Construction Quality Assurance Report

Davidson County MSW Landfill
Phase 2 - Area 2 - Cell 1 Construction
Davidson County, North Carolina

Prepared for:

Davidson County Integrated Solid Waste Management Department
Thomasville, North Carolina

May 2014

Prepared by:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

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S+G Project No. DAVDCO-12-3

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May 2014

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Table of Contents

Page

1.0 OVERVIEW 1
2.0 PROJECT DESCRIPTION 1
2.1 General 1
2.2 Reference Documents 2
2.3 Design Modification 2
2.4 Project Participants 3
2.4.1 Owner 3
2.4.2 Engineer 3
2.4.3 Electrical Engineer 3
2.4.4 CQA Testing - Earthwork, Geosynthetics, & Construction Monitoring 3
2.4.5 Contractor 4
2.4.6 Geosynthetics Installer 4
2.4.7 Contractor's Surveyor 4
3.0 SUMMARY OF CONSTRUCTION ACTIVITIES 5
3.1 Site Preparation 5
3.2 Erosion and Sedimentation Control Measures 5
3.3 Excavation, Embankment, and Rock Removal 5
3.4 Soil Liner 6
3.5 Geosynthetic Clay Liner (GCL) 6
3.6 60 Mil HDPE Geomembrane 7
3.7 Leachate Collection System/Protective Cover 7
3.8 Leachate Pumps and Force Main 7
4.0 CQA PROGRAM 8
4.1 Scope of Services 8
5.0 EARTHWORK CQA 8
6.0 SOIL LINER CQA 9
7.0 GCL CQA 9
7.1 Material Approval 9
7.2 Manufacturer's Quality Control Submittals 10
7.3 Material Control Testing 10
8.0 60 MIL HDPE GEOMEMBRANE CQA 10
8.1 Material Approval 10
8.2 Manufacturer's Quality Control Certificates 10
8.3 Material Control Testing 10

8.4 Field Seam Control Tests....10
8.5 Field Seam Record Tests....11
9.0 LEACHATE MANAGEMENT SYSTEM CQA.... 11
9.1 Material Approval....11
9.2 Material Control Testing....12
9.3 Contractor CQC Testing....12
9.4 Leachate Pump Start-Up....13
10.0 GEOTEXTILE CQA.... 13
10.1 Material Approval....13
10.2 Manufacturer's Quality Control Submittals....13
10.3 Material Control Testing....13
11.0 DRAINAGE GEOCOMPOSITE CQA.... 13
11.1 Material Approval....13
11.2 Manufacturer's Quality Control Submittals....14
11.3 Material Control Testing....14
12.0 RECORD DRAWINGS.... 14
13.0 PROJECT CERTIFICATION 15

TABLES

Table 1 Summary of Material Control and Record Tests - Structural Fill
Table 2 Summary of Material Control and Record Tests - Soil Liner Test Fill
Table 3 Summary of Material Control and Record Tests - Soil Liner
Table 4 Summary of Material Control Tests - GCL
Table 5 Summary of Material Control Tests - HDPE Geomembrane
Table 6 Summary of Material Record Tests - HDPE Geomembrane Seams
Table 7 Summary of Material Control Tests - Geotextiles
Table 8 Summary of Material Control Tests - Drainage Geocomposite

APPENDICES

Appendix A Reference Document (Solid Waste Permit)
Appendix B Design Modification
Appendix C Photographic Log
Appendix D Subgrade Inspection and Piezometer Abandonment
Appendix E Rock Blasting Documentation
E1. Rock Blasting Plans
E2. Summary of Rock Blasting Activities
Appendix F CQA Meeting Minutes
Appendix G Earthwork CQA Data
G1. CQA Test Results - Control Tests
G2. CQA Test Results - Record Tests
Appendix H Soil Liner CQA Data
H1. CQA Test Results - Control Tests
H2. CQA Test Results - Record Tests
Appendix I Interface Shear Strength Test Data

Appendix J GCL CQA Data
J1. Manufacturer's Product Data Submittals and Quality Control Certificates
J2. Geosynthetics Inventory - GCL
J3. CQA Test Results - Material Control Tests
Appendix K Geomembrane CQA Data
K1. Manufacturer's Product Data Submittals and Quality Control Certificates
K2. Geosynthetics Inventory - HDPE Geomembrane
K3. CQA Test Results - Material Control Tests
K4. Installer Logs
Subgrade Acceptance
Field Trial Seam Log
Panel Placement Log
Seaming and Non Destructive Test Log
Repair Log
Destructive Test Log
Tensiometer Calibration Certificates
Panel Layout Drawing
Installer Field Photos
K5. CQA Test Results - Destructive Seam Testing (Laboratory)
Appendix L Leachate Management System CQA Data
L1. Manufacturer's Product Data Submittals and Quality Control Certificates
L2. CQA Test Results - Drainage Aggregate
L3. CQA Test Results - Protective Cover
L4. Leachate Force Main Pressure Test Documentation & Leachate Collection System Video Inspection
L5. Leachate Pump Start-Up Documentation
Appendix M Geotextile CQA Data
M1. Manufacturer's Product Data Submittals and Quality Control Certificates
M2. Geosynthetics Inventory - Geotextiles (Type GT-S; Type GT-C)
M3. CQA Test Results - Material Control Tests
Appendix N Drainage Geocomposite CQA Data
N1. Manufacturer's Product Data Submittals and Quality Control Certificates
N2. Geosynthetics Inventory - Drainage Geocomposite
N3. CQA Test Results - Material Control Tests
Appendix O Record Drawings

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1.0 OVERVIEW

This Construction Quality Assurance (CQA) Report has been prepared to document the CQA activities performed during the construction of Phase 2 - Area 2 - Cell 1 of the Davidson County Municipal Solid Waste (MSW) Landfill. The landfill facility is located on Old U.S. Highway 29 near Lexington, North Carolina and is owned and operated by Davidson County under State Solid Waste Permit No. 29-06. The most recent Permit to Operate was issued by the North Carolina Department of Environment and Natural Resources (NC DENR) Division of Waste Management (DWM) on August 27, 2013.

2.0 PROJECT DESCRIPTION

2.1 General

Area 2 - Cell 1 is approximately a 6.3 acre (lined) Subtitle D landfill unit designed by Smith Gardner, Inc. (S+G). The components of the constructed alternative liner system include the following components (top-down):

- a leachate collection system (LCS) consisting of:

  Base and Side Slopes (Cell 1A):
  - 24 inches of leachate collection media/protective cover (No. 78 stone);
  - a system of collection pipes and gravel columns; and
  - a cushion (Type GT-C) geotextile.

  Base Slopes (Cell 1B):
  - 12 inches of protective cover (soil);
  - a separator (Type GT-S) geotextile;
  - 12 inches of leachate collection media (No. 78 stone);
  - a system of collection pipes and gravel columns; and
  - a cushion (Type GT-C) geotextile.

  Side Slopes (Cell 1B):
  - 24 inches of protective cover (soil); and
  - a drainage geocomposite.

- a 60 mil textured HDPE geomembrane liner;
- a geosynthetic clay liner (GCL); and
- an 18-inch thick soil liner with a hydraulic conductivity of no more than 1×10^{-5} cm/sec.

Leachate generated from Cell 1 will be collected in a sump at the northwest end of the unit. From the sump, the leachate will be pumped via side-wall riser pumps and force main to an existing leachate storage tank located at the northeast end of the permitted landfill facility.

In addition to the liner and leachate management systems, the Cell 1 design also includes associated perimeter berms and erosion and sedimentation control measures. Also, part of the construction included the installation of cell divider berms in order to provide stormwater/leachate separation and, thus, reduce the quantity of leachate generated during initial operations.

2.2 Reference Documents

Cell 1 was constructed in accordance with the following documents with clarifications as described in **Section 2.3**.

Construction Documents - Davidson County MSW LF - Phase 2 - Area 2 - Cell 1:
Includes general and technical specifications, CQA manual, and contract addenda prepared by Smith Gardner, Inc. (S+G) and dated May, 2013 (Conformed - August, 2013).

Construction Drawings - Davidson County MSWLF - Phase 2 - Area 2 - Cell 1:
Includes construction drawings prepared by S+G and dated May, 2013 (Conformed - August, 2013).

Permit To Construct Application - Davidson County MSWLF - Phase 2 - Area 2:
Includes technical specifications, CQA manual, and permit drawings prepared by S+G as revised through April 2013 (Permit to Construct issued by NCDWM on August 27, 2013 (copy provided in **Appendix A**)).

Erosion and Sedimentation Control Plan - Davidson County MSWLF Phase 2 - Area 2 prepared by S+G dated May 2013. Letter of approval correspondence dated June 2013 from the Land Quality Section of the NC DENR Division of Energy, Mineral, and Land Resources.

2.3 Design Modification

One modification to the above documents for Cell 1 is listed below and provided in **Appendix B**.

1. Liner system tie-in with existing Area 1 (Approved February 28, 2014, DIN 20663 NCDWM, SWS, JM).

2.4 Project Participants

The following parties were involved in the construction and CQA of Cell 1:

2.4.1 Owner

Davidson County Integrated Solid Waste Management Department
1242 Old U.S. Highway 29
Thomasville, NC 27360
Phone: (336) 242-2284
Fax: (336) 249-7524

Contacts: Charlie Brushwood, Director
Steven Sink, Landfill Manager

2.4.2 Engineer

Smith Gardner, Inc. (S+G)
14 N. Boylan Ave.
Raleigh, NC 27603
Phone: (919) 828-0577
Fax: (919) 828-3899

Contacts: Pieter Scheer, P.E., Project Manager
John Fearrington, E.I., Project Engineer

2.4.3 Electrical Engineer

Herman Thio, P.E.
408 Livingstone Drive
Cary, NC 27513
Phone: (919) 612-4417
Contact: Herman Thio, P.E.

2.4.4 CQA Testing - Earthwork, Geosynthetics, & Construction Monitoring

Geotechnics (Soil Testing & Construction Monitoring)
2200 Westinghouse Blvd., Suite 103
Raleigh, NC 27604
Phone: (919) 876-0405
Fax: (919) 876-0460

Contacts: Mike Smith, Regional Manager
David Wright, Field Technician
Jacob Buda, Field Technician

Geotechnics (Laboratory Testing of Geosynthetics)
544 Braddock Ave.
East Pittsburgh, PA 15112
Phone: (412) 823-7600
Fax: (412) 823-8999

Contacts: Randy O'Rourke, President
J.P. Kline, P.E., Lab Director

2.4.5 Contractor

J.T. Russell & Sons, Inc. (JTR)
1721 US Highway 52 North
Albemarle, NC 28001
Phone: (336) 584-1745
Fax: (336) 584-0145

Contacts: Nathan Russell, Project Manager
Chuck Workman, Safety Coordinator
Spencer Walker, Site Superintendent

2.4.6 Geosynthetics Installer

Chesapeake Containment Systems, Inc. (CCS)
352 Earls Road
Middle River, MD 21220
Phone: (410) 335-5886
Fax: (443) 303-1682

Contact: Scott Perugia, Project Manager

2.4.7 Contractor's Surveyor

Wright & Fields Land Surveying
1340 Albemarle Road
Troy, NC 27371
Phone: (910) 572-2449

Contact: Tommy Fields, PLS

3.0 SUMMARY OF CONSTRUCTION ACTIVITIES

Major elements of the project are discussed below. Photos documenting the construction of Cell 1 can be found in **Appendix C**. Prior to JTR beginning work, a project Pre-Construction Meeting was held on September 25, 2013.

3.1 Site Preparation

Construction of Cell 1 began in October 2013 with the surveying/staking of the limits of construction and the initiation of site preparation activities by JTR including the abandonment of affected piezometers (see **Appendix D** for documentation.).

3.2 Erosion and Sedimentation Control Measures

The construction of erosion and sedimentation control measures took place in conjunction with project activities and under the approval issued by the Land Quality Section. Once areas reached final grade, the areas were vegetated in accordance with project requirements.

3.3 Excavation, Embankment, and Rock Removal

Excavation and stockpiling activities were performed while the affected wells and piezometers were abandoned. Excavated materials including unsuitable soils and structural fill were identified and separated. Topsoil and unsuitable soils were taken to the stockpile area located to the south of Cell 1 for later use by JTR or future use as daily/intermediate cover by the County. The soils within the Cell 1 footprint identified for use as structural fill were excavated and placed and compacted where needed. As anticipated, during excavation activities, some overexcavation and backfill due to the presence of unsuitable materials was required.

As anticipated, there were several areas where the removal of rock by blasting was required to achieve subgrade elevations. These areas included two locations along the western edge of Cell 1, one large area in the southeast corner of Cell 1, and one area in the northeast corner of Cell 1. Rock removal procedures were discussed and approved by the NC DENR prior to execution of all blasting activities (see **Appendix E**). Rock within the Cell 1 liner limits was removed to 4 feet below subgrade elevations.

Upon completion of blasting and upon completion of the Cell 1 subgrade and in accordance with the permit, Ms. Joan Smyth, P.G. visited and examined the site to identify any subgrade conditions that *may adversely affect the design, construction, or operation* of the unit. As documented in Ms. Smyth's report (**Appendix D**) no adverse conditions were observed.

An as-built drawing showing completed subgrade elevations is provided in **Appendix O**.

3.4 Soil Liner

Prior to the construction of the soil liner, a soil liner CQA meeting was held on October 29, 2010 in accordance with the requirements of the project CQA manual. A summary of this meeting can be found in **Appendix F**.

Prior to construction of the soil liner, two test fills (pads) were constructed on November 9, 2013 and November 14, 2013 western portion of Cell 1. Each test fill was constructed using the procedure described below and tested in accordance with the project specifications and CQA manual. All tests on the test fills met or exceeded project requirements. Once the test results for the test fills were obtained, construction of the soil liner was initiated.

For the placement and compaction of the compacted soil liner, JTR used the following general procedure:

1. JTR would first excavate the material from the borrow area and place the material in nominal 8 inch loose lifts.
2. The loose material was then processed using tracked equipment to break down clods as needed.
3. JTR then used a water tanker to add moisture, as needed, to the loose lift of soil liner.
4. Next a pad foot compactor was used to compact the liner.
5. Finally, each compacted lift was rolled with a smooth drum roller to seal the surface against moisture loss and to protect the lift from precipitation. Prior to the placement of subsequent lifts, the top of each lift was scarified to allow bonding of the lifts.

An as-built drawing showing completed soil liner elevations is provided in **Appendix O**.

3.5 Geosynthetic Clay Liner (GCL)

Prior to the installation of geosynthetics, a geosynthetics CQA meeting was held on January 9, 2014 in accordance with the requirements of the project CQA manual. A summary of this meeting can be found in **Appendix F**.

GCL placement by CCS began on February 28, 2014 at the southwest corner of Cell 1 and proceeded to the north and east following the parameters of the project specifications and standard industry practices.

3.6 60 Mil HDPE Geomembrane

The GCL installation was followed closely by placement of the 60 mil HDPE geomembrane to minimize the potential for damage to the GCL by hydration. In accordance with project requirements, textured HDPE geomembrane was placed over the GCL.

An as-built drawing showing the orientation of geomembrane panels as well as destructive sample and repair locations is provided in **Appendix O**.

3.7 Leachate Collection System/Protective Cover

As the 60 mil HDPE geomembrane installation was proceeding, placement of cushion (Type GT-C) geotextile (Cell 1A - Base and Side Slopes/Cells 1B Base Slopes) or drainage geocomposite (Cells 1B - Side Slopes) was begun. As these materials were placed, the overlying leachate collection media (No. 78 stone) and later protective cover was placed by JTR beginning at the southwest corner of Cell 1 and proceeded to the north and east. In order to protect the underlying geosynthetics from damage, trucks operated on at least 3 feet of material and low ground pressure dozers were used to push out the material. Only minor wrinkling of the geomembrane was observed during placement (as is typical) and good contact between the HDPE geomembrane and the underlying GCL was apparent.

Along with placement of leachate collection media/protective cover, JTR constructed the gravel columns/pipes across the base of Cell 1 along with the cell divider berm. In Cell 1B, where soil protective cover was used, the leachate collection media and gravel columns were covered with Type GT-S geotextile. The gravel columns were also covered with geosynthetic rain cover as additional protection. During landfill operations both the Type GT-S geotextile and geosynthetic rain cover will be removed from the gravel columns by operations personnel just ahead of waste placement.

The soils used for protective cover in Cell 1B were a silty sand (SM) or sandy silt (ML). The material was compacted by tracked equipment during placement sufficient to resist erosion but not overly compacted such that vegetation would be hindered.

3.8 Leachate Pumps and Force Main

As work on the Cell 1 liner system was being performed, JTR installed the leachate force main and electrical conduit along the perimeter berm.

Once the leachate sump area was completed, the leachate side risers and pumps along with the associated electrical items were installed and connected with the leachate force main. A pump start-up was performed as described in **Section 9.4**.

4.0 CQA PROGRAM

4.1 Scope of Services

In satisfying the requirements of the Project CQA Manual for Cell 1, the following activities were performed:

- Observation and documentation of construction of prepared subgrade, structural fill, soil liner, GCL, HDPE geomembrane, and leachate collection system (LCS).
- Field and/or laboratory testing of structural fill, soil liner, geosynthetics, and drainage aggregate.
- Review of submittals from the Contractor for conformance with project specification and CQA requirements.
- Review/preparation of record drawings.
- Preparation of the final CQA report.

5.0 EARTHWORK CQA

The criteria for construction of structural fill per the project specifications included the following:

Materials:	SP, SW, SM, SC, ML, or CL (ASTM D 2487) with no topsoil or other deleterious material and no stones or rocks in excess of one half the lift thickness as compacted;
Density:	Minimum 95% Maximum Standard Proctor Dry Density (ASTM D 698);
Moisture Content:	As necessary for compaction; and
Lift Thickness:	8-inch max. (6-inch max. for backfill in pipe trenches) (compacted).

The number and results of material control and record tests performed on the structural fill are summarized in **Table 1**. Other tests performed on an on-going basis during construction included a visual classification of soils (ASTM D 2488) and monitoring of loose lift thickness. Note that the number of tests required was based on an approximate quantity of 10,000 CY of material placed (in-place measure). The results of field and laboratory testing of structural fill can be found in **Appendix G**. An as-built drawing showing completed subgrade elevations is provided in **Appendix O**.

6.0 SOIL LINER CQA

The criteria for construction of soil liner per the project specifications included the following:

Materials:	Soil type as required to achieve the hydraulic conductivity criteria with no organics, debris, or other detrimental material;
Clod Size:	Max. ¾ inch (or less if required to achieve hydraulic conductivity);
Gradation:	Max. = ½ inch (finished soil liner surface) and Max. = 1½ inches (below finished soil liner surface);
Lift Thickness:	6-inch max. (compacted);
Density:	Minimum 95% Maximum Standard Proctor Dry Density (ASTM D 698);
Moisture Content:	$\geq$ optimum moisture content (ASTM D 698);
Hydraulic Conductivity:	$\leq 1 \times 10^{-5}$ cm/sec; and
Thickness:	18 inches min.

The number and results of material control and record tests performed on the soil liner are summarized in **Table 2 (Test Fill) and Table 3**. Note that the number of tests required was based on an approximate quantity of 15,300 CY of material placed (in-place measure). Other tests performed on an on-going basis during construction included a visual classification of soils (ASTM D 2488) and monitoring of clod size and loose lift thickness. The results of field and laboratory testing of the soil liner can be found in **Appendix H**. Final thickness of the soil liner was verified by Wright & Fields. An as-built of the soil liner can be found in **Appendix O**.

7.0 GCL CQA

7.1 Material Approval

S+G reviewed and approved the geosynthetic clay liner (GCL) product submittals provided by JTR. The selected material was Bentomat SDN as manufactured by CETCO Lining Technologies of Hoffman Estates, IL. Copies of selected product submittals for these products can be found in **Appendix J1**.

Note that, as part of the submittal information for all geosynthetics, interface shear strength testing was performed for the potential critical geosynthetic/soil or geosynthetic/geosynthetic interfaces within the liner systems. This testing was performed on representative material samples by Geotechnics of Pittsburgh, PA under

subcontract to JTR. A summary of this testing performed is provided in **Appendix I**. The results for each interface were found to meet or exceed project design requirements.

7.2 Manufacturer's Quality Control Submittals

S+G reviewed and approved CETCO's quality control certificates upon delivery to the site. Copies of these certificates can be found in **Appendix J1**.

7.3 Material Control Testing

The number and results of material control tests performed on the GCL are summarized in **Table 4**. Note that the number of tests required was based on a quantity of 308,850 SF (142 rolls/2 lots) of material received. A geosynthetics inventory log for the GCL can be found in **Appendix J2**. This log identifies the rolls which were sampled for material control testing. The results of material control testing of GCL can be found in **Appendix J3**.

8.0 60 MIL HDPE GEOMEMBRANE CQA

8.1 Material Approval

S+G reviewed and approved the 60 mil HDPE geomembrane product submittals provided by JTR. The selected material was Microspike textured 60 mil HDPE geomembrane as manufactured by Agru America, Inc. of Georgetown, SC. Copies of selected product submittals for these products can be found in **Appendix K1**.

8.2 Manufacturer's Quality Control Certificates

S+G reviewed and approved Agru America's quality control certificates upon delivery to the site. Copies of these certificates can be found in **Appendix K1**.

8.3 Material Control Testing

The number and results of material control tests performed on the 60 mil HDPE geomembrane is summarized in **Table 5**. Note that the number of tests required was based on a quantity of 360,065 SF (31 rolls/2 lots) of material received. A geosynthetics inventory log for HDPE geomembrane can be found in **Appendix K2**. This log identifies the rolls which were sampled for material control testing. The results of material control testing of HDPE geomembrane can be found in **Appendix K3**.

8.4 Field Seam Control Tests

The results of trial welds performed by CCS can be found in **Appendix K4**.

8.5 Field Seam Record Tests

Seaming forms (including the results of nondestructive testing) can be found in **Appendix K4**. The results of destructive CQC and CQA testing can be found in **Appendices K4 and K5**, respectively. A geomembrane repair report documenting all repairs of defects and destructive sample locations can be found in **Appendix K4**. Record testing of HDPE geomembrane seams is summarized in **Table 6**.

9.0 LEACHATE MANAGEMENT SYSTEM CQA

9.1 Material Approval

S+G reviewed and approved the leachate management system product submittals provided by JTR. The selected materials included the following:

Drainage Aggregate (No. 57 and No. 78 Stone)	Vulcan - Gold Hill Quarry (No. 78) JTR - Riley Quarry (Albemarle, NC) (No. 57 & 78) Martin Marietta - Thomasville Quarry (No. 57 & 78)
HDPE Pipe/Fittings:	Performance Pipe: 2" Diam. (DR 11) 6" and 18" Diam. (DR 17)
Valves: Swing Check Valve: Ball Valves:	 Ta Chen International: TC200 WOG (Stainless Steel) Asahi America & Hayward
Pumps: Side Risers (2): Sump Pump:	 GunnCo Sidesloper Model P2K 60-7 (5 HP) GunnCo Model P3K 100 (1 HP)
Flowmeter:	Seametrics EX-80 Series with FT400 Series Flow Computer
Geotextiles:	See **Section 10.0**
Drainage Geocomposite:	See **Section 11.0**
Geosynthetic Rain Cover:	Raven Dura Skrim 8 BV

Copies of selected product submittals for these products can be found in **Appendices L.**

9.2 Material Control Testing

Carbonate content testing of stone from JTR's Riley Quarry and Vulcan's Gold Hill Quarry was performed in accordance with ASTM D 3042. The results showed that the stone from these quarries had calcium carbonate contents of 1.5% and 3.3%, respectively (below the maximum allowable 15%). Stone from Martin Marietta's Thomasville Quarry is granitic and is, thus, calcium poor (as documented in prior CQA reports). Thus, carbonate content testing was not performed for this source.

The gradation of the No. 57 stone provided for use in the leachate collection system was evaluated in accordance with ASTM C 136 for the approximate 1,100 CY of material provided. A total of 2 gradation tests were performed on the No. 57 stone (exceeding the 1 test per 5,000 CY project requirement) and the results met project requirements.

The gradation and permeability of the No. 78 stone provided for use as leachate collection media/protective cover was evaluated in accordance with ASTM C 136 and ASTM D 2434, respectively, for the approximate 14,900 CY of material provided. A total of 3 gradation and 2 permeability tests were performed on the No. 78 stone (meeting the 1 test per 5,000 CY and 1 per 10,000 CY project requirements, respectively). All samples of No. 78 stone evaluated for gradation met project requirements. The permeability of the No. 78 stone was found to range between 4.1 cm/sec and 8.1 cm/sec, which exceeded the project requirement of 1 cm/sec.

Grain size analyses were performed for the soil used as protective cover in accordance with ASTM D 422 for the approximate 5,400 CY of material provided. A total of 2 gradation tests were performed on the soil (meeting the 1 test per 5,000 CY project requirement) and the results met project requirements. Compaction testing was performed on the protective cover soil placed on the flatter areas of Cell 1B (approximately 90,000 SF) and the required minimum compaction of 90% standard Proctor dry density was achieved. A total of 8 nuclear density tests were performed on the protective cover soil (meeting the 1 test per 40,000 SF).

The results of the CQA testing on No. 57 and No. 78M stone can be found in **Appendix L2**. Also, the results of the CQA testing on protective cover soil can be found in **Appendix L3**.

9.3 Contractor CQC Testing

Upon completion of construction of the leachate collection system, the piping system was flushed with water and inspected using a video camera by JetClean America, a subcontractor to JTR. Documentation of the pipe inspection can be found in **Appendix L4**.

During construction of the leachate force main, JTR performed a hydrostatic pressure test on the force main. The pressure testing was conducted in accordance with ASTM F 2164. Documentation of the successful test can be found in **Appendix L4**.

9.4 Leachate Pump Start-Up

Near completion of the project, JTR provided the services of the pump manufacturer, GunnCo Pump & Control, Inc., to perform start-up of the leachate pumps on April 22, 2014. Documentation of the pump start-up can be found in **Appendix L5**.

10.0 GEOTEXTILE CQA

10.1 Material Approval

S+G reviewed and approved the geotextile product submittals provided by JTR. The selected materials were SKAPS GE112 (Type GT-C geotextile) and SKAPS GT160 (Type GT-S geotextile) as manufactured by SKAPS Industries of Athens, Georgia. Copies of selected product submittals for this product can be found in **Appendix M1**.

10.2 Manufacturer's Quality Control Submittals

S+G reviewed and approved SKAPS' quality control certificates upon delivery to the site. Copies of these certificates can be found in **Appendix M1**.

10.3 Material Control Testing

The number and results of material control tests performed on the geotextiles is summarized in **Table 9**. Note that the number of tests required was based on a quantity of 309,600 SF (43 rolls/1 lot) of Type GT-C geotextile and 162,000 SF (12 rolls/1 lot) of Type GT-S geotextile material received. A geosynthetics inventory log for Type GT-C and Type GT-S geotextile can be found in **Appendix M2**. The results of material control testing of geotextiles can be found in **Appendix M3**.

11.0 DRAINAGE GEOCOMPOSITE CQA

11.1 Material Approval

S+G reviewed and approved the drainage geocomposite product submittals provided by JTR. The selected material was SKAPS Transnet 300-2-6 as manufactured by SKAPS Industries of Athens, Georgia. Copies of selected product submittals for this product can be found in **Appendix N1**.

11.2 Manufacturer's Quality Control Submittals

S+G reviewed and approved SKAPS' quality control certificates upon delivery to the site. Copies of these certificates can be found in **Appendix N1**.

11.3 Material Control Testing

The number and results of material control tests performed on the drainage geocomposite is summarized in **Table 9**. Note that the number of tests required was based on a quantity of 25,200 SF (9 rolls/1 lot) of material received. A geosynthetics inventory log for drainage geocomposite can be found in **Appendix N2**. The results of material control testing of drainage geocomposite can be found in **Appendix N3**.

12.0 RECORD DRAWINGS

The following record (as-built) drawings depicting the construction of Phase 2 - Area 2 - Cell 1 can be found in **Appendix O**:

- Subgrade Surface Verification (prepared by Wright & Fields);
- Top of Clay Surface Verification (prepared by Wright & Fields);
- HDPE Geomembrane Liner (prepared by Wright & Fields); and
- Top of Protective Cover/Gravel Verification* (prepared by Wright & Fields).

  *Drawing depicts thickness of No. 78 Stone in Cell 1A (2.0' min.) and Cell 1B (1.0 min).

13.0 PROJECT CERTIFICATION

Based on the observations and results of the CQA program documented herein, it is our professional opinion that the construction of Phase 2 - Area 2 - Cell 1 of the Davidson County MSW Landfill was completed in accordance with the following:

i. The Project CQA Manual;
ii. The conditions of the Permit to Construct Phase 2 - Area 2;
iii. The requirements of 15A NCAC 13B.1624; and
iv. Acceptable engineering practices.

SMITH GARDNER, INC.

NORTH CAROLINA PROFESSIONAL SEAL 021666 ENGINEER PIETER K. SCHEER

5/5/14

Pieter K. Scheer, P.E.
Project Manager

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SMITH+GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

TEL
919.828.0577

WEB
www.smithgardnerinc.com

May 5, 2014

Mr. John Murray, P.E.
Regional Engineer
NC DENR - Division of Waste Management
610 E. Center Ave.
Mooresville, NC 28115

RE: Davidson County MSW Landfill (Permit No. 29-06)
Phase 2 - Area 2 - Cell 1 Construction
Construction Quality Assurance (CQA) Report

Dear John:

On behalf of Davidson County, Smith Gardner, Inc. (S+G) would like to submit the enclosed construction quality assurance (CQA) report for the construction of the Phase 2 - Area 2 - Cell 1 municipal solid waste (MSW) landfill unit for your review.

As you are aware, the County is anxious to begin operations in Cell 1A as soon as possible as space in the existing Area 1 unit is becoming limited.

Should you have any questions or comments on this report, please contact me at your earliest convenience.

Sincerely,
SMITH GARDNER, INC.

Pieter K. Scheer, P.E.
Project Manager
pieter@smithgardnerinc.com

Enclosure

cc: Charlie Brushwood, Davidson County
Steven Sink, Davidson County
Ed Mussler, P.E., NCDWM
Hugh Jernigan, NCDWM

SMITH+GARDNER

App A - Reference Document.pdf

Shared by Pieter Scheer | 1.23 MB | Accessible until Jun 6, 2014

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Appendix B

Design Modification

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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SMITH+GARDNER

Design Modification No. 1

Approved, 2/28/14, DIN 20663
NCDWM, SWS, JM

Project:	Davidson County MSWLF - Phase 2 - Area 2 - Cell 1
Owner:	Davidson County Integrated Solid Waste Management Department 1242 Old U.S. Highway 29 Thomasville, NC 27360
Contractor:	J.T. Russell & Sons, Inc. ATTN: Nathan Russell 1721 U.S. Highway 52 North Albemarle, NC 28001

Regulatory Review Required (Y/N): Y

*If Yes, see below.

NOTE: Each modification described herein is a revision of a previously approved permit and/or design feature.

Reference(s):

Drawing L2, Detail 1 (Liner System Tie-In)

Description of Modification(s):

The liner system tie-in with existing Area 1 along the western berm of Area 2 will be as follows:

1. Repair existing geosynthetics as necessary.
2. Extend geosynthetic clay liner (GCL) over-top and beyond existing GCL by 1' (minimum). Add bentonite between panels.
3. Wedge-weld new 60-mil textured geomembrane to existing 60-mil HDPE textured geomembrane. If wedge-welding is not possible, extrusion weld the new geomembrane to the existing.
4. Heat bond the new Type GT-C geotextile to the existing Type GT-C geotextile.

Reason for Modification(s):

Based on the exposed condition of the existing liner system and the removal of the existing anchor trench for tie-in of the soil liner, the geosynthetics tie-in detail has been modified to simplify the installation.

Attachments:

Figure 1 - Revised Liner System Tie-In Detail

Comments:

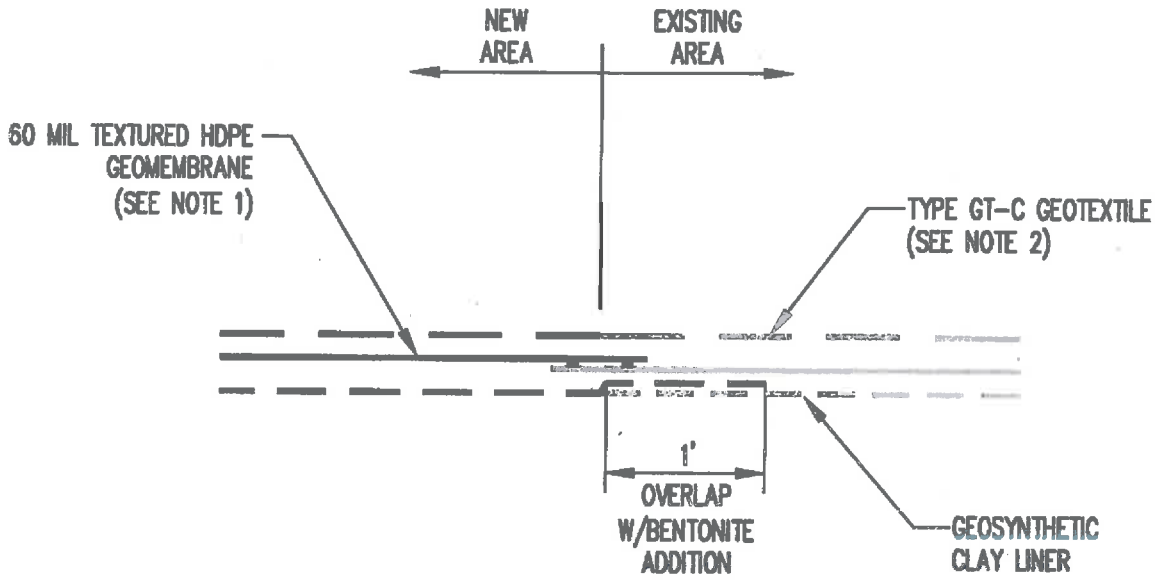
Regulatory Agency:	NC DENR - Divison of Waste Management ATTN: John Murray, P.E. john.murray@ncdenr.gov

Pieter K. Scheer, P.E.

Digitally signed by Pieter K. Scheer, P.E.
DN: cn=Pieter K. Scheer, P.E., o=Smith Gardner, Inc., ou, email=pieter@smithgardnerinc.com, c=US
Date: 2014.02.27 14:48:24 -05'00'

By:	Pieter K. Scheer, P.E.
Title:	Project Manager
Date:	February 27, 2014

Distribution: [X] Owner [X] Contractor [X] Field [X] File [X] Regulatory Agency



NOTES:

1. WEDGE WELD GEOMEMBRANE TO EXISTING. EXTRUSION WELD WHERE A WEDGE WELD CANNOT BE MADE.
2. HEAT BOND NEW TYPE GT-C GEOTEXTILE WITH EXISTING.
3. SOME LAYERS NOT SHOWN FOR CLARITY.

REVISED LINER SYSTEM TIE-IN

DETAIL 1
NOT TO SCALE FIG.1

NORTH CAROLINA PROFESSIONAL SEAL 021666 ENGINEER PIETER K. SCHEER
2/27/14

PREPARED FOR:

DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
REVISED LINER SYSTEM TIE-IN DETAIL

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	APPROVED:	SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:	FILE NAME:
K.C.B.	P.K.S.	N.T.S.	Feb 2014	DAVDCO-12-3	FIG. 1	DAVDCO-A0773

G:\CAD\Davidson\Davdco 12-3\sheets\DAVDCO-A0773.dwg - 2/27/2014 10:43 AM

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Appendix C

Photographic Log

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
1	10/18/13

Direction Photo Taken:

South

Description:

Existing conditions of Phase 2, Area 2, Cell 1. Operations previously used the area as a borrow source for daily and intermediate cover.

Photo No.	Date:
2	10/23/13

Direction Photo Taken:

Northwest

Description:

Overexcavation in the northwest corner of Cell 1A. Excavation removed all unsuitable and organic material and backfilled with structural fill.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
3	11/7/13

Direction Photo Taken:

Southwest

Description:

Rock drilling on the southern berm of Cell 1. Areas were drilled to remove rock 4-feet below subgrade.

Photo No.	Date:
4	11/12/13

Direction Photo Taken:

N/A

Description:

JTR representatives placing explosives in the drilled holes. Blasting documentation can be found in Appendix E.

This page intentionally left blank.

S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
5	11/18/13

Direction Photo Taken:

Southwest

Description:

Excavation and subgrade placement and compaction.

Photo No.	Date:
6	11/18/13

Direction Photo Taken:

North

Description:

Existing Area 1 liner exposed on the west berm of Area 2, Cell 1A.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
7	11/25/13

Direction Photo Taken:

South

Description:

Clay placement within Cell 1 limits. JTR spread the soil liner using a Catapillar D6 LGP with GPS. Moisture was added with an off road water truck before being compacted.

Photo No.	Date:
8	12/5/13

Direction Photo Taken:

Southwest

Description:

Compaction of soil liner

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
9	1/7/14

Direction Photo Taken:

N/A

Description:

Installation of drop inlet DI-34 and reinforced concrete pipe.

Photo No.	Date:
10	2/28/14

Direction Photo Taken:

Southwest

Description:

Finished soil liner grade and excavated anchor trench.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
11	2/28/14

Direction Photo Taken:

South

Description:

60-mil HDPE geomembrane deployed overtop GCL on the south slope of Cell 1. The GCL was covered within 24 hours of deployment by geomembrane.

Photo No.	Date:
12	3/1/14

Direction Photo Taken:

N/A

Description:

3 foot minimum GCL overlap with existing Area 1 GCL.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
13	3/1/14

Direction Photo Taken:

N/A

Description:

Tensiometer used by Chesapeake Containment Systems to test trial seams and field destructive samples. Installer logs can be found in **Appendix K**.

Photo No.	Date:
14	3/5/14

Direction Photo Taken:

N/A

Description:

Non-destructive testing of wedge weld geomembrane seams. The air channel was pressurized to 25 psi and held for 5 minutes, minimum allowable pressure drop of 3 psi. Installer logs can be found in **Appendix K**.

This page intentionally left blank.

S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
15	3/5/14

Direction Photo Taken:

N/A

Description:

Non-destructive testing of extrusion welded geomembrane seams using a vacuum box. Soapy water was applied to visually observe any air leaks.

Photo No.	Date:
16	3/6/14

Direction Photo Taken:

South

Description:

Geotextile (GT-C) deployment over HDPE geomembrane in Cell 1B.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County, North Carolina	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
17	3/27/14

Direction Photo Taken:

Southwest

Description:

Drainage aggregate (No. 78) was spread over Cell 1. Haul roads were created to allow off road dump trucks to bring stone into the cells.

Photo No.	Date:
18	4/6/14

Direction Photo Taken:

South

Description:

Geotextile (GT-S) placed over the drainage aggregate in Cell 1B.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County MSW Landfill	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
19	4/14/14

Direction Photo Taken:

Southeast

Description:

Placement of No. 57 stone above the Cell 1B leachate collection pipe.

Photo No.	Date:
20	4/18/14

Direction Photo Taken:

North

Description:

Construction of the Cell 1 temporary termination berm. Soil berm was covered by HDPE geomembrane rain flap.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County MSW Landfill	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
21	4/18/14

Direction Photo Taken:

Southeast

Description:

Area 2 leachate pumps. A pump test was completed on April 22, 2014.

Photo No.	Date:
22	4/22/14

Direction Photo Taken:

Northwest

Description:

Area 2 electrical and pump control panels

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County MSW Landfill	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
23	4/26/14

Direction Photo Taken:

Northwest

Description:

HDPE Geomembrane flap welded and rolled over Cell 1 temporary termination berm.

Photo No.	Date:
24	4/26/14

Direction Photo Taken:

East

Description:

Limit of Liner markers placed on the southern Cell 1 berm spaced every 100-ft.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County MSW Landfill	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
25	4/29/14

Direction Photo Taken:

Northwest

Description:

Geosynthetic rain cover overlaying No. 57 leachate collection stone in Cell 1B.

Photo No.	Date:
26	4/29/14

Direction Photo Taken:

Northeast

Description:

Landfill perimeter channel lined with turf reinforcement matting.

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S+G ENGINEERS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Davidson County MSW Landfill	Thomasville, North Carolina	DAVDCO-12-3

Photo No.	Date:
27	4/29/14

Direction Photo Taken:

Northwest

Description:

Overall panoramic site picture from the southeast with Cell 1B in the foreground.

Photo No.	Date:
28	4/29/14

Direction Photo Taken:

Northeast

Description:

Overall panoramic site picture from the southwest with Cell 1A in the foreground.

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Appendix D

Subgrade Inspection and Piezometer Abandonment

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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SMITH : GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

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919.828.0577

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www.smithgardnerinc.com

MEMORANDUM

Date:	April 21, 2014
To:	Pieter K. Scheer, P.E. Smith Gardner, Inc.
From:	Joan A. Smyth, P. G. Smith Gardner, Inc.
RE:	**Davidson County Phase 2 Area 2 Cell 1 Subgrade Certification**

As you know, on January 8, 2014, I visited the Davidson County Landfill for the purpose of inspecting the subgrade in the Phase 2 Area 2 Cell 1 portion of the site. This area had been previously brought to subgrade including some small rock areas that required blasting. Blasting was completed in December 2013 and a report summarizing blasting activities was submitted to NCDENR in March 2014. Upon completion of rock removal, a minimum four-feet of soil was placed between any remaining rock and the completed subgrade.

During the January 2014 site visit, I found the soil types were consistent with those encountered during drilling (primarily a mixture of silts and clays with some sand). The rock areas had not been identified during permitting, however these were isolated areas away from previously drilled piezometer locations. Based upon my observation, I hereby certify that the subgrade material, upon completion of subgrade construction, was materially consistent with the soil types found during the site investigation.

Joan A. Smyth

Joan A. Smyth, P.G.

4/21/14

NORTH CAROLINA LICENSED SEAL 1369 GEOLOGIST JOAN A. SMYTH

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SMITH+GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

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919.828.0577

WEB
www.smithgardnerinc.com

December 10, 2013

Mr. Brian Wootton
NCDENR Division of Waste Management
Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646

RE: Davidson County Landfill Piezometer Abandonment
Lined MSW Phase 2 Area 2
Permit No. 29-06

Dear Mr. Wootton:

Smith Gardner, Inc., (S+G) is pleased to present this letter report regarding piezometer abandonment at the Davidson County Lined MSW Landfill, Phase 2 Area 2 Expansion. Eight piezometers were abandoned in accordance with 15A NCAC 02C .0113 and the approved site Water Quality Monitoring Plan[1].

Piezometer Abandonment

Davidson County subcontracted HPC Land Services (HPC) out of Albemarle, North Carolina to abandon PZ-12, PZ-12D, PZ-35S, PZ-35D, PZ-58, PZ-59, PZ-62 and PZ-63 installed in the footprint of the future Phase 2 Area 2 MSW cell as part of the permit application groundwater investigation. Due to the piezometer locations within the future cell footprint proper abandonment included over-drilling and grouting to ensure pathways were not available for potential contaminant flow.

S+G and HPC personnel mobilized at the Davidson County facility November 4-6, 2013. Well abandonment procedure included removing the concrete pad, steel casing and the PVC screen and pipe. The steel casings and pad, where present, were removed by JTR personnel present on site for cell construction. Boreholes were over-drilled to well bottom elevations, using a 4.25" HSA auger. PVC pipe and screen were removed by inserting a pipe inside the PVC pipe and pulling the pipe with the drill rig.

Grout was force injected through a tremie pipe starting at the well bottoms and pumped to the approved subgrade elevation in one continuous operation. Due to subsurface conditions only PZ-59, PZ-62 and PZ-63 had boreholes that remained open following over-drilling; the other five piezometers were grouted through the augers. Each piezometer was grouted to the approximate future subgrade elevation to allow for future soil grading in certain areas. In areas of future fill, grout was emplaced to the current ground surface. Well pads, casing and pipe were disposed of properly.

[1] Water Quality Monitoring Plan; Phase 2 Areas 1 and 2, January 2013, Smith Gardner, Inc.

Well boring logs and abandonment records for monitoring wells and piezometers are provided as **Attachment A**. **Figure 1** shows the well abandonment locations.

If you have any questions regarding this well abandonment letter or require additional information, please contact us at (919) 828- 0577 or by email below.

Sincerely,
SMITH GARDNER, INC.

Madeline German, P.G.
Project Geologist
madeline@smithgardnerinc.com

Joan A. Smyth, P.G.
Senior Hydrogeologist
joan@smithgardnerinc.com

Attachments: Figure 1
Well construction and abandonment records

cc: Charlie Brushwood, Davidson County
Hugh Jernigan, NCDENR-WSRO
File

Figure

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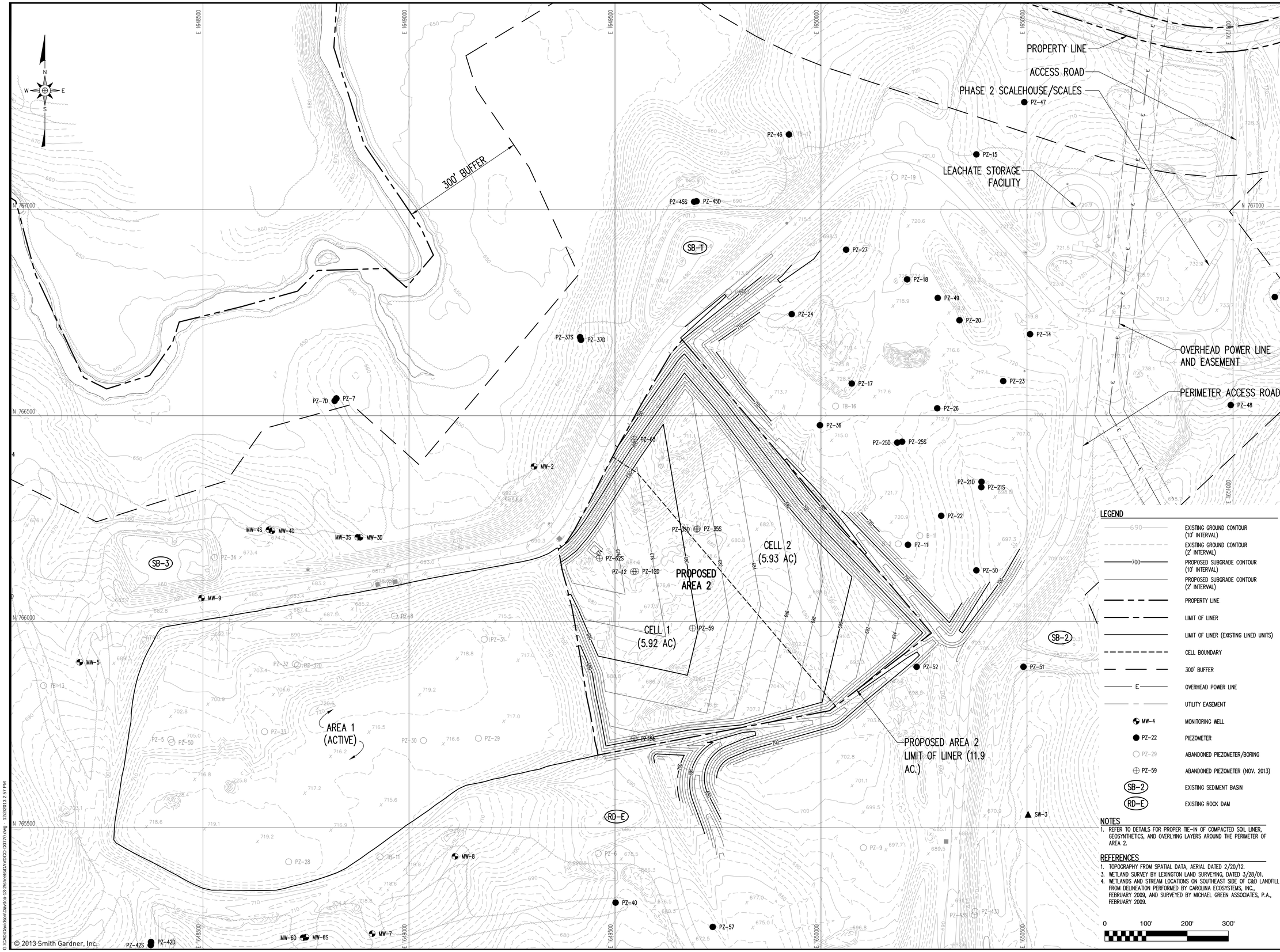

LEGEND

690	EXISTING GROUND CONTOUR (10' INTERVAL)
	EXISTING GROUND CONTOUR (2' INTERVAL)
700	PROPOSED SUBGRADE CONTOUR (10' INTERVAL)
	PROPOSED SUBGRADE CONTOUR (2' INTERVAL)
	PROPERTY LINE
	LIMIT OF LINER
	LIMIT OF LINER (EXISTING LINED UNITS)
	CELL BOUNDARY
	300' BUFFER
E	OVERHEAD POWER LINE
	UTILITY EASEMENT
MW-4	MONITORING WELL
PZ-22	PIEZOMETER
PZ-29	ABANDONED PIEZOMETER/BORING
PZ-59	ABANDONED PIEZOMETER (NOV. 2013)
SB-2	EXISTING SEDIMENT BASIN
RD-E	EXISTING ROCK DAM

NOTES

1. REFER TO DETAILS FOR PROPER TIE-IN OF COMPACTED SOIL LINER, GEOSYNTHETICS, AND OVERLYING LAYERS AROUND THE PERIMETER OF AREA 2.

REFERENCES

1. TOPOGRAPHY FROM SPATIAL DATA, AERIAL DATED 2/20/12.
3. WETLAND SURVEY BY LEXINGTON LAND SURVEYING, DATED 3/28/01.
4. WETLANDS AND STREAM LOCATIONS ON SOUTHEAST SIDE OF C&D LANDFILL FROM DELINEATION PERFORMED BY CAROLINA ECOSYSTEMS, INC., FEBRUARY 2009, AND SURVEYED BY MICHAEL GREEN ASSOCIATES, P.A., FEBRUARY 2009.

0 100' 200' 300'

© 2013 Smith Gardner, Inc.

C:\CAD\Davidson\Davdco-13-2\sheets\DAVDCO-D0770.dwg 12/2/2013 2:57 PM

PREPARED FOR:

DAVIDSON COUNTY MSW LANDFILL

PREPARED BY:

NC LIC. NO. C-0628 (ENGINEERING)
SMITH+ GARDNER ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

SEAL

SEAL

REV.	DATE	DESCRIPTION

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PROJECT TITLE:

DAVIDSON COUNTY PHASE 2 AREA 2 DESIGN HYDROGEOLOGIC STUDY

DRAWING TITLE:

PHASE 2 AREA 2 WELL ABANDONEMENT NOVEMBER 2013

DESIGNED: J.A.S.	PROJECT NO: DAVDCO-13-2
DRAWN: K.C.B.	SCALE: AS SHOWN
APPROVED:	DATE: DEC 2013
FILENAME: DAVDCO-D0770	
SHEET NUMBER:	DRAWING NUMBER: FIG. 1

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Attachment A

Well Abandonment Records

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G. N. Richardson & Associates, Inc.
14 North Boylan Avenue, Raleigh NC 27603
(919) 828-0577

FIELD BOREHOLE LOG

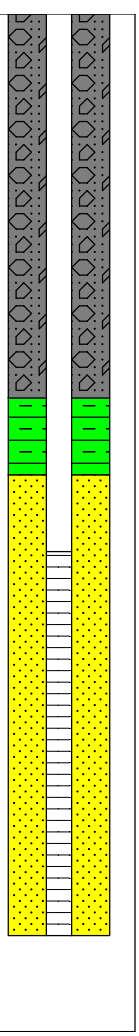
BOREHOLE NUMBER **PZ-12**

PROJECT NAME: **Davidson County - Phase 2**
LOACATION: **Lexington, NC**
DRILLING CO: **Engineering Tectonics, P.A.**
DRILLING METHOD: **HSA**
FIELD PARTY: **R. Barron**
GEOLOGIST: **P. May**
DATE BEGUN: **11/1/00** COMPLETED: **11/1/00**

TOTAL DEPTH: **25**
GROUND SURFACE ELEVATION: **680.48**
TOP OF CASING ELEVATION: **682.71**

STATIC WATER LEVEL (BLS)		
Depth (ft)	15.9	15.9
Time	10:00	10:30
Date	11/1/00	11/2/00

DEPTH	BLOW COUNT	SAMPLING METHOD	RECOVERY	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH	WELL INSTALLATION
0.0				HSA	SILTY SAND: Slightly moist gray, white, & tan mottled silty fine sand with iron.		0.0	
5.0	8-10-11	SS	12"				5.0	
10.0	8-7-7	SS	12"		CLAYEY SANDY SILT: Moist gray-white & rust mottled slightly clayey fine sandy silt, large quartz fragments.		10.0	
15.0	9-12-15	SS	14"		CLAYEY SAND: Wet tan & white & gray medium to coarse micaceous clayey sand (trace silt), quartz fragments, water at 15.0'.		15.0	
20.0	11-19-24	SS	12"		SAND: Wet white, brown, & gray mottled medium to coarse sand with quartz fragments.		20.0	
25.0	5-9-43	SS	12"		SILTY SAND: Wet gray & white silty fine sand with brown mottles. Boring terminated at 25'. Bottom of well set at 24'.		25.0	



G. N. Richardson & Associates, Inc.
14 North Boylan Avenue, Raleigh NC 27603
(919) 828-0577

FIELD BOREHOLE LOG

BOREHOLE NUMBER **PZ-12d** Page 1 of 1

PROJECT NAME: **Davidson County - Phase 2**
LOACATION: **Lexington, NC**
DRILLING CO: **Engineering Tectonics, P.A.**
DRILLING METHOD: **HSA**
FIELD PARTY: **R. Barron**
GEOLOGIST: **P. May**
DATE BEGUN: **11/17/00** COMPLETED: **11/20/00**

TOTAL DEPTH: **45**
GROUND SURFACE ELEVATION: **679.81**
TOP OF CASING ELEVATION: **682.56**

STATIC WATER LEVEL (BLS)		
Depth (ft)	16	16.1
Time	10:00	10:30
Date	11/20/00	11/21/00

DEPTH	BLOW COUNT	SAMPLING METHOD	RECOVERY	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH	WELL INSTALLATION
0.0				HSA	SILTY SAND: Slightly moist gray, white, & tan mottled silty fine sand with iron.		0.0	
6.0	8-10-11	SS	12"				6.0	
11.0	8-7-7	SS	12"		CLAYEY SANDY SILT: Moist gray-white & rust mottled slightly clayey fine sandy silt, large quartz fragments.		11.0	
16.0	9-12-15	SS	14"		CLAYEY SAND: Wet tan & white & gray medium to coarse micaceous clayey sand (trace silt), quartz fragments, water at 15.0'.		16.0	
21.0	11-19-24	SS	12"		SAND: Wet white, brown, & gray mottled medium to coarse sand with quartz fragments.		21.0	
26.0	5-9-43	SS	12"		SILTY SAND: Wet gray & white silty fine sand with brown mottles.		26.0	
31.0	26-50/6"	SS	10"		CLAYEY SILTY SAND: Wet dark gray & white salt & peppered clayey silty fine sand with iron streaks, some manganese, large (1mm) quartz grains at 31.5'.		31.0	
36.0	18-22-26	SS	14"		CLAYEY SAND: Wet brown medium to coarse clayey sand followed by gray & white salt & peppered fine silty sand/sandy silt with iron streaks and some quartz & manganese.		36.0	
41.0	23-36-45	SS	10"		SILTY SAND: Wet gray & white salt & peppered fine silty sand & partially weathered rock; large quartz grains; coarse sand. Boring terminated at 45'.		41.0	
45.0							45.0	

Richardson Smith Gardner & Assoc
14 North Boylan Avenue, Raleigh NC 27603
(919) 828-0577

FIELD BOREHOLE LOG

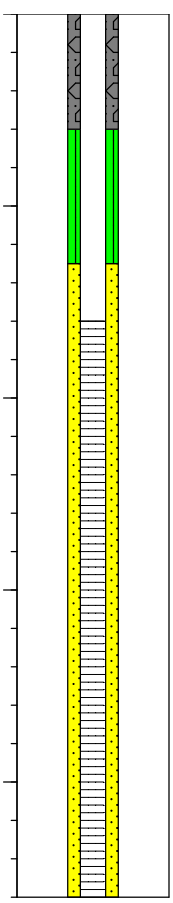
BOREHOLE NUMBER **PZ-35s** Page 1 of 1

PROJECT NAME: **Davidson County - Phase 2**
LOCATION: **Lexington, NC**
DRILLING CO: **Engineering Tectonics, P.A.**
DRILLING METHOD: **HSA**
FIELD PARTY: **R. Barron**
GEOLOGIST: **J. Smyth**
DATE BEGUN: **9/20/04** COMPLETED: **9/20/04**

TOTAL DEPTH: **23**
TOP OF CASING ELEV.: GROUND ELEV.:
NORTHING: **0** EASTING: **0**

STATIC WATER LEVEL (BLS)		
Depth (ft)	18	14.21
Time	3 pm	4:07
Date	9/20/04	10/12/04

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0				HSA	SILTY CLAY: Slightly moist granitic saprolitic silty clay. Sample has cast but no ribbon. Iron stained.		0.0	
	5,6,9	SS	18"					
5.0							5.0	
	3,3,4	SS	15"					
10.0							10.0	
	2,3,4	SS	16"					
15.0							15.0	
	3,6,9	SS	14"		SILTY CLAY: Wet granitici saprolitic silty clay with iron staining at a 60 degree angle. Boring terminated at 23 feet.			
20.0							20.0	



Richardson Smith Gardner & Assoc
14 North Boylan Avenue, Raleigh NC 27603
(919) 828-0577

FIELD BOREHOLE LOG

BOREHOLE NUMBER **PZ-35d**

PROJECT NAME: **Davidson County - Phase 2**
LOCATION: **Lexington, NC**
DRILLING CO: **Engineering Tectonics, P.A.**
DRILLING METHOD: **HSA**
FIELD PARTY: **R. Barron**
GEOLOGIST: **J. Smyth**
DATE BEGUN: **9/15/04** COMPLETED: **9/16/04**

TOTAL DEPTH: **73**
TOP OF CASING ELEV.: GROUND ELEV.:
NORTHING: **0** EASTING: **0**

STATIC WATER LEVEL (BLS)		
Depth (ft)		14.02
Time		4:10
Date		10/12/04

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0				HSA	SILTY CLAY: Slightly moist granitic saprolitic silty clay. Sample has cast but no ribbon. Iron stained.		0.0	
5.0	5,6,9	SS					5.0	
10.0	3,3,4	SS					10.0	
15.0	2,3,4	SS					15.0	
20.0	3,6,9	SS			SILTY CLAY: Wet granitici saprolitic silty clay with iron staining at a 60 degree angle.		20.0	
25.0	7,7,10	SS			SILTY CLAY: Wet granitic saprolitic silty clay.		25.0	
30.0	6,9,15	SS					30.0	
35.0	11,16,22	SS					35.0	
40.0	15,21,29	SS					40.0	

Richardson Smith Gardner & Assoc
14 North Boylan Avenue, Raleigh NC 27603
(919) 828-0577

FIELD BOREHOLE LOG

BOREHOLE NUMBER **PZ-35d**

PROJECT NAME: **Davidson County - Phase 2**
LOCATION: **Lexington, NC**
DRILLING CO: **Engineering Tectonics, P.A.**
DRILLING METHOD: **HSA**
FIELD PARTY: **R. Barron**
GEOLOGIST: **J. Smyth**
DATE BEGUN: **9/15/04** COMPLETED: **9/16/04**

TOTAL DEPTH: **73**
TOP OF CASING ELEV.: GROUND ELEV.:
NORTHING: **0** EASTING: **0**

STATIC WATER LEVEL (BLS)		
Depth (ft)		14.02
Time		4:10
Date		10/12/04

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
45.0							45.0	
	9,14,29	SS			SILTY CLAY: Wet granitic saprolitic silty clay to clayey silt. Iron and manganese staining. Could not take split spoons past 48' due to excessive water. BT @ 73 feet.			
50.0							50.0	
55.0							55.0	
60.0							60.0	
65.0							65.0	
70.0							70.0	

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FIELD BOREHOLE LOG

BOREHOLE NUMBER **PZ-58**

PROJECT NAME: **Davidson Co Phase 2 Landfill**
LOCATION: **Davidson County**
DRILLING CO: **Geologic Explorations**
DRILLING METHOD: **GP/AH**
FIELD PARTY: **John Burr**
GEOLOGIST: **Lindsay Quant**
DATE BEGUN: **11/11/10** COMPLETED: **11/11/10**

TOTAL DEPTH: **36**
TOP OF CASING ELEV. **697.4** GROUND ELEV.: **695.16**
NORTHING: **765715.824** EASTING: **1649546.003**

STATIC WATER LEVEL (BLS)		
Depth (ft)	25.85	
Time	4:35	
Date	11/15/10	

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0				GP/AH	SANDY SILT: Dry, red sandy silt.		0.0	
					CLAY: Dry red and orange clay.			
5.0		MC					5.0	
					SANDY CLAY: Dry red sandy clay and partially weathered rock (PWR). Trace silt and quartz rock fragments with the sandy clay between 10- 15 feet.			
10.0		MC					10.0	
15.0		MC			SAND: Dry white, red, brown coarse sand and gravel with trace clay. Sample contained manganese staining and partially weathered rock (PWR).		15.0	
20.0		MC			SANDY SILT: Dry white tan sandy silt with quartz fragments.		20.0	
					CLAY: Dry red brown clay.			
25.0		MC			SAND: Dry white and red coarse sand with quartz fragments and silty patches. Geoprobe refusal at 32 feet.		25.0	
30.0		MC					30.0	
35.0		MC			PWR: Dry to wet white to tan sandy partially weathered rock (PWR). No competent bedrock encountered. Boring terminated at 36 feet.		35.0	

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FIELD BOREHOLE LOG

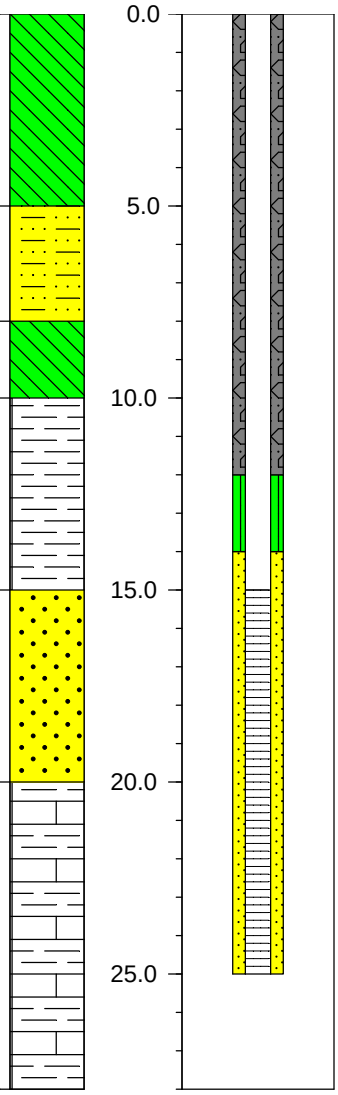
BOREHOLE NUMBER **PZ-59**

PROJECT NAME: **Davidson Co Phase 2 Landfill**
LOCATION: **Davidson County**
DRILLING CO: **Geologic Explorations**
DRILLING METHOD: **GP/AH**
FIELD PARTY: **John Burr**
GEOLOGIST: **Lindsay Quant**
DATE BEGUN: **11/11/10** COMPLETED: **11/11/10**

TOTAL DEPTH: **25**
TOP OF CASING ELEV. **691.34** GROUND ELEV.: **688.88**
NORTHING: **765984.48** EASTING: **1649687.842**

STATIC WATER LEVEL (BLS)		
Depth (ft)	19.32	
Time	4:45	
Date	11/15/10	

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0				GP/AH	CLAY: Dry red clay.		0.0	
5.0		MC			SANDY SILT: Dry red brown sandy silty with partially weathered rock (PWR).		5.0	
					CLAY: Moist to wet dark brown clay.			
10.0		MC			SILTY CLAY: Moist brown to red silty clay with PWR.		10.0	
15.0		MC			SAND: Moist white tan to gray sand with PWR.		15.0	
20.0		MC			PWR: Moist to wet sand with PWR. Very small sample recovered from 20 - 23 feet due to quartz fragement stuck in the sampler. Augers were very wet near bottom of the hole. Geoprobe refusal at 28 feet.		20.0	
25.0		MC					25.0	



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FIELD BOREHOLE LOG

BOREHOLE NUMBER **PZ-62**

PROJECT NAME: **Davidson Co Phase 2 Landfill**
LOCATION: **Davidson County**
DRILLING CO: **Geologic Explorations**
DRILLING METHOD: **GP/AH**
FIELD PARTY: **John Burr**
GEOLOGIST: **Lindsay Quant**
DATE BEGUN: **11/15/10** COMPLETED: **11/15/10**

TOTAL DEPTH: **25**
TOP OF CASING ELEV. **679.56** GROUND ELEV.: **676.76**
NORTHING: **766153.985** EASTING: **1649462.167**

STATIC WATER LEVEL (BLS)		
Depth (ft)	16.37	
Time	1:40 pm	
Date	12/22/10	

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0				GP/AH	SANDY SILT: Dry tan to gray sandy silt.		0.0	
					SILTY CLAY: Dry, brown red and gray silty clay with relict rock texture.			
5.0		MC			SILTY SAND: Moist brown, gray, and tan silty sand. Sand fraction coarsening iwith depth.		5.0	
10.0		MC					10.0	
15.0		MC					15.0	
20.0		MC			CLAYEY SILTY SAND: Wet gray clayey silty fine to medium sand.		20.0	
					SILTY SAND: Moist to wet silty fine to coarse sand and partially weathered rock (PWR). Boring terminated at 25 feet.			
25.0							25.0	

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FIELD BOREHOLE LOG

BOREHOLE NUMBER **PZ-63**

PROJECT NAME: **Davidson Co Phase 2 Landfill**
LOCATION: **Davidson County**
DRILLING CO: **Geologic Explorations**
DRILLING METHOD: **GP/AH**
FIELD PARTY: **John Burr**
GEOLOGIST: **Lindsay Quant**
DATE BEGUN: **11/11/10** COMPLETED: **11/23/10**

TOTAL DEPTH: **40**
TOP OF CASING ELEV.: **700.05** GROUND ELEV.: **697.20**
NORTHING: **766442.808** EASTING: **1649546.08**

STATIC WATER LEVEL (BLS)		
Depth (ft)	36.05	
Time	2:00	
Date	12/22/10	

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0				GP/AH	CLAYEY SILT: Moist brown red clayey silt and partially weathered rock (PWR).		0.0	
5.0		MC			CLAYEY SAND: Moist gray tan claeye fine sand with manganese sstaining.		5.0	
10.0		MC			SILT: Moist to wet silt with trace clay. 6-inch clay lens from 10 to 10.5 feet. Sample also contains partially weathered rock (PWR) with relict rock texture.		10.0	
15.0		MC			SILTY CLAY: Moist tan gray and black silty clay with partially weathered rock (PWR). Geoprobe refusal at 23 feet. Well initially set at 25 feet below grade.		15.0	
20.0		MC					20.0	
25.0					PWR: Moist to wet partially weatherred rock (PWR). Monitoring of well set at 25 indicated it was dry. Drillers removed well casing and advanced the borehole through a hard layer and then through layers of PWR. Boring terminated at 40 feet.		25.0	
30.0							30.0	
35.0							35.0	
40.0							40.0	

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-4-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name

Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County

Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: B35S

6b. Total well depth: 17 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): 7 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

6 BAGS PORTLAND 94# BAG
5# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Signature of Certified Well Contractor or Well Owner — Date: 11-16-13

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-5-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name — Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: PZ 59

6b. Total well depth: 20 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): 10 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

7 BAGS PORTLAND 94# BAG
5# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Jason Cain — 11-16-13

Signature of Certified Well Contractor or Well Owner — Date

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-6-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name

Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County

Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: P2 62

6b. Total well depth: 23 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): 13 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

8 BAGS PORTLAND 94# BAGS
7# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Jason Cain — 11-16-13

Signature of Certified Well Contractor or Well Owner — Date

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐Agricultural	☐Municipal/Public
☐Geothermal (Heating/Cooling Supply)	☐Residential Water Supply (single)
☐Industrial/Commercial	☐Residential Water Supply (shared)
☐Irrigation	
Non-Water Supply Well:	
☒Monitoring	☐Recovery
Injection Well:	
☐Aquifer Recharge	☐Groundwater Remediation
☐Aquifer Storage and Recovery	☐Salinity Barrier
☐Aquifer Test	☐Stormwater Drainage
☐Experimental Technology	☐Subsidence Control
☐Geothermal (Closed Loop)	☐Tracer
☐Geothermal (Heating/Cooling Return)	☐Other (explain under 7g)

4. Date well(s) abandoned: 11-4-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name — Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: P2 12

6b. Total well depth: 24 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): 14 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

8 BAGS PORTLAND 94# BAG
7# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4'/4 HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Jason Cain — 11-16-13

Signature of Certified Well Contractor or Well Owner — Date

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-6-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name — Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: P2 58

6b. Total well depth: 32 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): 22 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

11 BAGS PORTLAND 94# BAGS
10# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Jason Cain — 11-16-13

Signature of Certified Well Contractor or Well Owner — Date

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-5-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name

Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County

Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: P263

6b. Total well depth: ~~37~~ 40 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): ~~37~~ 30 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

14 BAGS PORTLAND 94# BAGS
15 # QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA. INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Jason Cain — Signature of Certified Well Contractor or Well Owner

11-16-13 — Date

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-5-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name

Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County

Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: P-12D

6b. Total well depth: 42 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): 32 (ft.)

6f. Inner casing/tubing length (if known): N/A (ft.)

6g. Screen length (if known): 10 (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

14 BAGS PORTLAND 94# BAGS
15# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Signature of Certified Well Contractor or Well Owner — Date: 11-16-13

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

10a. For All Wells: Submit this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

WELL ABANDONMENT RECORD

This form can be used for single or multiple wells

1. Well Contractor Information:

JASON CAIN

Well Contractor Name (or well owner personally abandoning well on his/her property)

3112-A

NC Well Contractor Certification Number

HPC LAND SERVICES

Company Name

2. Well Construction Permit #: _____

List all applicable well permits (i.e. County, State, Variance, Injection, etc.) if known

3. Well use (check well use):

Water Supply Well:	
☐ Agricultural	☐ Municipal/Public
☐ Geothermal (Heating/Cooling Supply)	☐ Residential Water Supply (single)
☐ Industrial/Commercial	☐ Residential Water Supply (shared)
☐ Irrigation	
Non-Water Supply Well:	
☒ Monitoring	☐ Recovery
Injection Well:	
☐ Aquifer Recharge	☐ Groundwater Remediation
☐ Aquifer Storage and Recovery	☐ Salinity Barrier
☐ Aquifer Test	☐ Stormwater Drainage
☐ Experimental Technology	☐ Subsidence Control
☐ Geothermal (Closed Loop)	☐ Tracer
☐ Geothermal (Heating/Cooling Return)	☐ Other (explain under 7g)

4. Date well(s) abandoned: 11-5-13

5a. Well location:

DAVIDSON CO. LANDFILL

Facility/Owner Name — Facility ID# (if applicable)

1242 OLD HWY 29, THOMASVILLE NC 27360

Physical Address, City, and Zip

DAVIDSON

County — Parcel Identification No. (PIN)

5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:
(if well field, one lat/long is sufficient)

_____ N _____ W

CONSTRUCTION DETAILS OF WELL(S) BEING ABANDONED

Attach well construction record(s) if available. For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

6a. Well ID#: PZ 35D

6b. Total well depth: 63 (ft.)

6c. Borehole diameter: 6 (in.) REAMED TO 8"

6d. Water level below ground surface: _____ (ft.)

6e. Outer casing length (if known): _____ (ft.)

6f. Inner casing/tubing length (if known): _____ (ft.)

6g. Screen length (if known): _____ (ft.)

For Internal Use ONLY:

WELL ABANDONMENT DETAILS

7a. Number of wells being abandoned: _____

For multiple injection or non-water supply wells ONLY with the same construction abandonment, you can submit one form.

7b. Approximate volume of water remaining in well(s): _____ (gal.)

FOR WATER SUPPLY WELLS ONLY:

7c. Type of disinfectant used: _____

7d. Amount of disinfectant used: _____

7e. Sealing materials used (check all that apply):

☒ Neat Cement Grout	☐ Bentonite Chips or Pellets
☐ Sand Cement Grout	☐ Dry Clay
☐ Concrete Grout	☐ Drill Cuttings
☐ Specialty Grout	☐ Gravel
☒ Bentonite Slurry	☐ Other (explain under 7g)

7f. For each material selected above, provide amount of materials used:

22 BAGS PORTLAND 94# BAGS
30# QUIK-GEL (BENTONITE)

7g. Provide a brief description of the abandonment procedure:

OVER DRILLED WELL & REMOVED WELL CASING THRU 4¼ HSA, INSERTED TREMIE TO BOTTOM OF BOREHOLE AND GROUTED, REMOVING AUGERS AS HOLE FILLED

8. Certification:

Signature of Certified Well Contractor or Well Owner — Date: 11-16-13

By signing this form, I hereby certify that the well(s) was (were) abandoned in accordance with 15A NCAC 02C .0100 or 2C .0200 Well Construction Standards and that a copy of this record has been provided to the well owner.

9. Site diagram or additional well details:
You may use the back of this page to provide additional well site details or well abandonment details. You may also attach additional pages if necessary.

SUBMITTAL INSTRUCTIONS

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Division of Water Resources, Information Processing Unit,
1617 Mail Service Center, Raleigh, NC 27699-1617

10b. For Injection Wells: In addition to sending the form to the address in 10a above, also submit one copy of this form within 30 days of completion of well abandonment to the following:

Division of Water Resources, Underground Injection Control Program,
1636 Mail Service Center, Raleigh, NC 27699-1636

10c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well abandonment to the county health department of the county where abandoned.

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Appendix E

Rock Blasting Documentation

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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North Carolina Department of Environment and Natural Resources
Division of Waste Management

Pat McCrory
Governor

Dexter R. Matthews
Director

John E. Skvarla, III
Secretary

SOLID WASTE SECTION

November 6, 2013

Sent Via E-mail - Charlie.Brushwood@DavidsonCountyNC.gov

Mr. Charlie Brushwood,
Davidson County Landfill
1242 Old Highway 29
Thomasville, NC 27360

Re: Authorization Approval for:
Rock Blasting Plan, proposed November 6, 2013
Davidson County MSWLF – Phase 2, Area 2, Cell 1
Davidson County, North Carolina
Permit No. 29-06; DIN 20106

Dear Mr. Brushwood:

The Solid Waste Section has completed a review of the *Blasting Plan for Davidson County Landfill* dated November 6, 2013 (DIN 20105) and submitted on behalf of Davidson County by Joan Smyth, P.G. of Smith Gardner, Inc. and JT Russell and Sons, Inc., regarding two (2) rock areas that extend above the proposed subgrade of Phase 2, Area 2, Cell 1.

The two (2) rock areas to be removed by blasting will consist of approximately 10,000 cubic yards and these rock areas are located at the northern and southern portions of the Area 2, Cell 1.

The Rock Blasting Plan is approved as described will be included in the list of the approved documents in the Permit to Operate. Please include the report, documenting the approved activity in the final CQA report as well as submitting the Blasting Report Results within 30 days of the activity.

Please note that further modifications to the construction of Area2, Cell 1 may require a permit modification fee.

The Division appreciates your efforts and cooperation in the matter. If you have any questions or would like to schedule a meeting to discuss this matter further, please contact me at (919) -707-8258.

Sincerely,

Brian Wootton

Brian Wootton
Hydrogeologist
Solid Waste Section

cc: Joan Smyth, P.G., Smyth Gardner
Ed Mussler, Solid Waste Section
John Murray, Solid Waste Section

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SMITH+GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

TEL
919.828.0577

WEB
www.smithgardnerinc.com

November 6, 2013

Mr. Brian Wootton, Hydrogeologist
NC DENR Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Davidson County Phase 2 MSW Landfill
Area 2 Cell 1Rock Blasting

Dear Mr. Wootton:

On behalf of Davidson County, Smith Gardner, Inc. (S+G) is presenting this plan for performing rock blasting to allow the construction of portions of Area 2 Cell 1. A detailed blasting plan from JT Russell and Sons, Inc. (JTR) is attached for your review.

As shown in the Figure located within the blasting plan there are two rock areas that extend above proposed subgrade. It is estimated that up to approximately 10,000 CY of rock will require removal for installation of this portion of the cell.

The blasting will be performed by JTR who is also the general contractor for the project. The drill hole pattern, charge weights, and delays were selected to minimize the amount of energy which may impact the underlying rock (i.e. peak particle velocities at blast monitoring locations are anticipated to be < 1 inch/sec.). Additionally, all blasting will be performed during daylight hours.

During the actual blasting, monitoring using a seismograph is proposed at three locations (two adjacent to Area 1 and one adjacent to the leachate tanks). These are the closest locations that may be affected by the blasting.

Documentation of blasting activities (including monitoring results) will be prepared by S+G and submitted to the Solid Waste Section within 30 days of the rock removal. This documentation, which will include observations of the excavation by S+G staff and an evaluation by a licensed geologist, will also be placed in the construction quality assurance (CQA) report for the project.

The blasting activities are scheduled to begin on Friday, November 8th. We appreciate your attention in this matter. Should you have any questions or require clarification or further information, please contact us at your earliest convenience.

Sincerely,
SMITH GARDNER, INC.

Joan A. Smyth, P.G.
Senior Hydrogeologist
joan@smithgardnerinc.com

Pieter K. Scheer, P.E.
Vice President, Senior Engineer
pieter@smithgardnerinc.com

Attachment

Cc: Charlie Brushwood – Davidson County

JT RUSSELL & SONS INC

BLASTING PLAN FOR DAVIDSON COUNTY LANDFILL

OWNER:

DAVIDSON COUNTY INTERGRATED SOLID WASTE FACILITY

CONTRACTOR:

J.T. Russell and Sons, Inc
1721 US Hwy 52 N
Albemarle, NC 28001

Table of Contents

Section Page

Scope of Blasting Project

Types of Blasting

Safety Procedure For Blasts

Blast Site Dimensions

Drill Pattern

Explosives Loading and Initiation

Ground Control

Flyrock Control Plan

Selection of Blasting Products and Methods

Monitoring, Blast Effects

Peak Particle Velocity Monitoring and Control

Blast Warning Signals

Environmental Concerns

Fire Prevention

Appendix A – Blasting Location

Appendix B – Example of Blasting Daily Log

Appendix C – Davidson County Blasting Permit Check List

1) SCOPE OF BLASTING PROJECT

Blasting will take at the Davidson County Landfill. J. T. Russell and Sons, Inc., plans to blast in Phase 2 Area 2 Cell 1. Only in the areas where the rock cannot be excavated by conventional means will blasting occur. JTR will work closely with the owner and engineer during the blast phase.

2) TYPES OF BLASTING

Primary type of blasting will be for excavation removal purposes. Blasting may also require blasting in storm drain trenches.

3) SAFETY PROCEDURE FOR BLASTS

All operations for transporting, handling, and loading explosives shall observe applicable industry standards and regulations as defined by the appropriate city, county, state, or federal governing agency. All blast events will be conducted in such a manner that complies with all safety cautions, procedures or regulations of the applicable city, county, state, or federal governing agency. This includes, but is not limited to: clearing the blast zone, guarding the blast area and vehicular or pedestrian traffic control. There will be no on-site, overnight storage of explosives.

4) BLAST SITE DIMENSIONS

The blast will consist from 50-200 holes covering approximately 2-3 acres. The depth of each borehole will be around 10 - 24 feet including sub drill. Estimated 10,000 CY of blasting to take place.

5) DRILL PATTERN

The proposed pattern is to drill 3” - 4”” diameter boreholes with a pattern of 5’x5’ or 10’x10’.

6) EXPLOSIVES LOADING AND INITIATION

a) It is proposed to use an Austin Ex-Gel for the main charge in each borehole, initiated with an appropriate detonating blasting cap. This cartridge weighs approximately 2.5 pounds per for16 inches of 2-inch borehole. Surface (non-electric) delays will be used to minimize the vibrations at adjacent structures. The blast delay intervals used will be

9ms, 17ms, 25ms, and 42ms. Each blast will be designed to have a max of 10-15 pounds of explosive per delay.

b) As one means to control ground movement, a minimum of 4' of inert stemming material will be loaded at the top of each borehole, beginning below the depth where competent rock was encountered. Stemming height will be determined by the discretion, experience and judgment of the blaster in charge, and site-specific conditions for each shot.

7) GROUND CONTROL

All blasts will be designed to prevent excessive movement of material from the blast zone. The blaster will include in his considerations such factors as rock type, geologic condition, borehole depth, charge weight and any other relevant, site specific conditions for each shot.

8) FLYROCK CONTROL PLAN

All shots will be carefully designed by the qualified blaster to control fly rock. All hole loading activity will be supervised by the qualified blaster. The qualified blaster will communicate with the driller to obtain geological information for each shot. JTR will haul and place soil over blast area for a protective cover from flyrock.

9) SELECTION OF BLASTING PRODUCTS AND METHODS

These blasting products were chosen because of many years of dependable use and positive results which are demonstrated by the:

- Quality, safety and reliability of the product
- Support offered by the manufacturer
- Availability
- Price

10) MONITORING BLAST EFFECTS

It is not expected that this type of rock will fracture in such a way as to cause any kind of ground displacement. Following each blast, the area will be examined for signs of ground cracking. Any indication of overbreak will be brought to the attention of the blaster and noted on the blast report. The shot pattern and/or loading will be adjusted to minimize or eliminate

overbreak. Vibration monitoring will be conducted at the structures located nearest the blasting. The closest blasting conducted to any occupied structure will be greater than 300 feet. The vibration levels produced by the blasting are estimated to be less than 1 inch per second PPV and 132 dBI at the closest location. The blasting will be monitored at the buildings closest to the blast. The blaster in charge will design each blast to minimize vibration and over pressure and to prevent fly rock.

11) PEAK PARTICLE VELOCITY MONITORING AND CONTROL

Each blast will be monitored by a licensed blaster or other person experienced in monitoring blasts using a seismograph machine. The seismograph will be placed at the "point of interest". In most cases, this will be next to the foundation of the closest building, power line foundation, utility or well. In all cases, both the sensor and seismograph will be protected from flyrock.

12) BLAST WARNING SIGNALS

Warning signals for each blast will be as follows:

- One long horn one minute before blast
- One long horn 10 seconds before blast
- One long horn for all clear after the blast

13) ENVIRONMENTAL CONCERNS

The Davidson County Fire Marshal will be notified prior to blasting.

14) FIRE PREVENTION

Following the required waiting period after each shot, the blast area will be inspected for any indication of fire or fire hazard. Particular attention will be paid to the vegetated areas outside of the right-of-way. Normally, the explosives vaporize at the instant of detonation and there is no fiber or other material left to smolder or be a source of

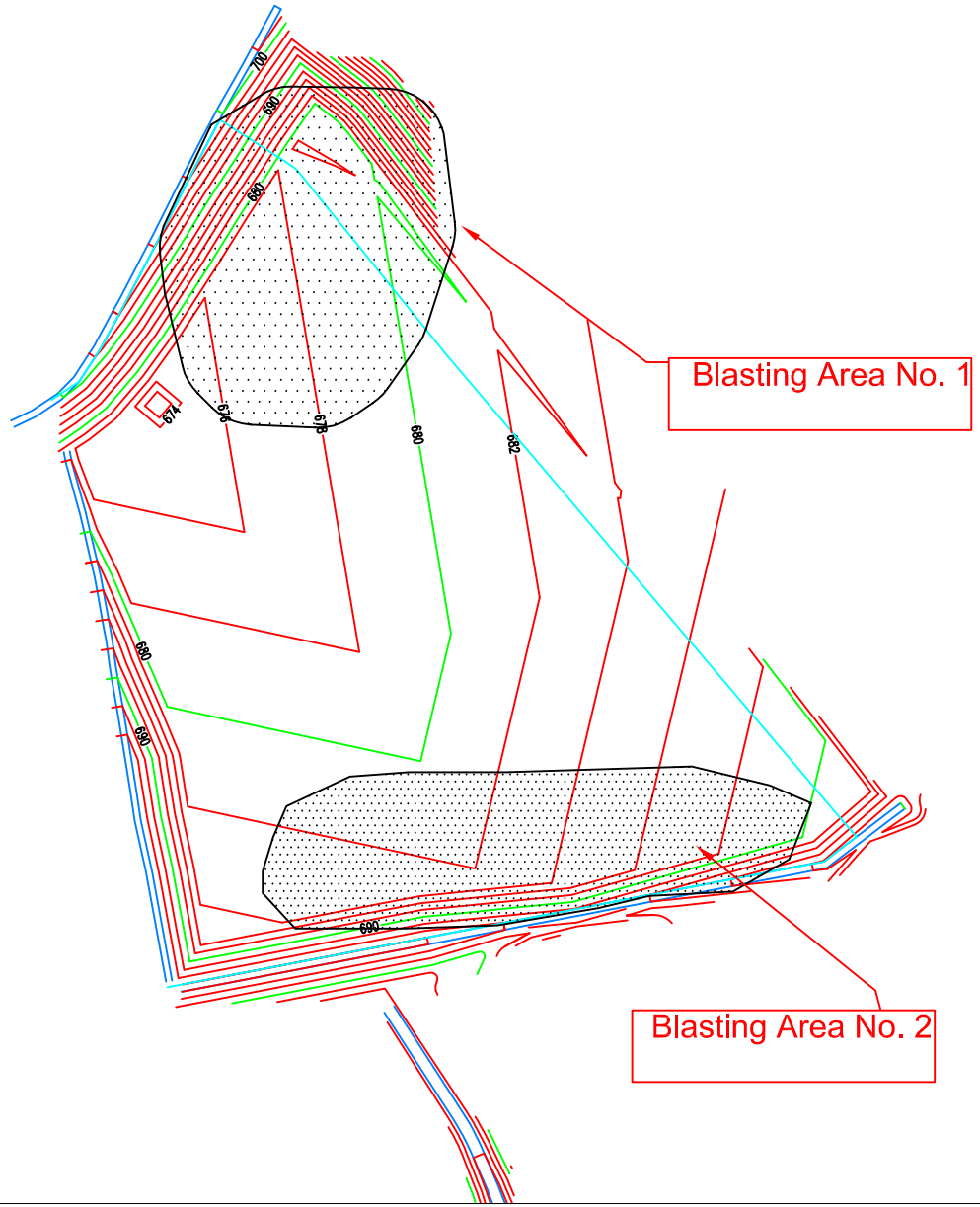
concern. Any plastic shock tube from the initiation system that remains after the blast will be picked up for proper disposal immediately after the blast.

The blasting operation will generally take place after the grading operation has graded the right-of-way to bare mineral soil. The blaster shall ensure that the initiating detonator is placed on bare mineral soil and that there is no vegetation within a 20-foot radius.

The initiating detonator will be a minimum of 400 feet from the nearest loaded hole.

Appendix A Locations and Typicals

SEE ATTACHED



Blasting in Phase 2 Area 2
Cell 1
JTR BLASTING PLAN -
DAVIDSON COUNTY

Appendix B

Example of Blasting Daily Log

JT Russell & Sons, Inc.
Blast Operations Report

1721 N Hwy 52
Albemarle NC 28001

Client _____
Blaster _____ License # _____
Date _____ Blast # _____ Time of Blast _____
Exact Site Location _____

Weather: Clouds _____ Humidity _____
Wind & Direction _____ Temperature _____
Distance, Direction, & Address of Nearest Structure to Blast Site: _____

How measured: Pace GPS Tape Map Laser Other
Drill log used: Yes No

Burden _____ ft Spacing _____ ft Subdrill _____ ft
# of Holes _____ Hole Dia. _____ in Depth(s) _____ ft
Avg. Stem _____ ft Type _____ Avg. Water Depth _____ ft

Shot cover used: Blasting Mat Backfill # of Decks: _____

Detonators Used:

Make and Type of Explosives Used:		Make	Length	Delay	# Used
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
TOTAL POUNDS IN SHOT:	lbs.				

Calculated Scaled Distance: SD = D ÷ √W = _____
W = max. lbs. / delay limit D= min. feet to nearest structure
Holes / Delay _____
Loaded "Max" lbs. / delay _____ lbs/delay

50 - (0-300')
55 - (301-5,000')
63 - (> 5001')

(1) Seismograph(s) Unit Number _____ Person Setting Up _____
(2) Seismograph(s) Unit Number _____ Person Setting Up _____
(3) Seismograph(s) Unit Number _____ Person Setting Up _____
Exact Location, Distance and Direction of Seismograph(s) from Blast Site:
1) _____
2) _____
3) _____

Seismic Readings (1) T V L Peak Overpressure _____ db
Seismic Readings (2) T V L Peak Overpressure _____ db
Seismic Readings (3) T V L Peak Overpressure _____ db
Frequency (1) _____ RPPV(1) _____ in/sec
Frequency (2) _____ RPPV(2) _____ in/sec
Frequency (3) _____ RPPV(3) _____ in/sec

Signature of Blaster _____

Attatch printout of seismograph(s) to this record.

Appendix C Davidson County Blasting Permit Check List

1) **See Attached Sketch in Blasting Plan Appendix A**

2) **Attached Blasting Plan**

3) **Hours of Blasting**

   Blasting will be performed during the hours of 9am and 5 pm

4) **Explosives WILL NOT be stored on site**

SMITH+GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

TEL
919.828.0577

WEB
www.smithgardnerinc.com

March 24, 2014

Mr. Brian Wootton, Hydrogeologist
NC DENR Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Davidson County Phase 2 MSW Landfill
Area 2 Cell 1Rock Blasting Summary

Dear Mr. Wootton:

On behalf of Davidson County and based on our earlier correspondence, Smith Gardner, Inc. (S+G) presents this letter to document rock blasting performed during construction of Phase 2 Area 2 Cell 1 of the County's municipal solid waste (MSW) landfill. A rock blasting plan was submitted November 6, 2013 and was approved by North Carolina Department of Environment and Natural Resources (NCDENR) that same day. This report documents the blasting events and provides vibration monitoring results as requested by the NCDENR.

Blasting Events

The blasting was performed by JT Russell and Sons, Inc. (JTR), who is the general contractor for the project. Personnel from S+G and Davidson County were also present during blasting procedures. Blasting was conducted during daylight hours on November 12, 15, and 22, 2013 and December 6, 13, and 18, 2013. The drill hole pattern, charge weights, and delays were selected to minimize the amount of energy which may impact the underlying rock. The planned peak particle velocities at blast monitoring locations were designed to be <1 inch/sec. **Figure 1** presents the blast locations.

Blasting procedures were executed in general accordance with the approved November 6, 2013 blasting plan and the blasting plan from JTR.

Blast Monitoring

During blasting, seismographs were used to monitor three locations (two adjacent to Area 1 and one adjacent to the leachate tanks) for each blast. Locations were selected based on closest proximity to the area that may be affected by the blasting. Measurements were collected for peak particle velocity, frequency, and sound level. **Table 1** presents the data retrieved from each seismograph during each blast event. In general, the peak velocities recorded were well below the generally accepted criterion of 1 in/sec. Only BML-2 on Blast 2B recorded velocities above 1in/sec. These velocities are attributed to the monitoring location residing only 71 feet from the blast. This area was near the edge of Phase 2 Area 1. Blast monitoring records are included in **Attachment 1** and **Figure 1** illustrates the blasting locations with their respective monitoring points.

It should be noted that after blasting, the anchor trench along the edge of Phase 2 Area 1 was uncovered to facilitate extending the liner system from Area 1 across Area 2 Cell 1. During construction, the liner system of Area 1 in the anchor trench was inspected for any indication of damage due to elevated blast velocities in this area. No abnormalities were noted, and the liner system for Phase 2 Area 2 Cell 1 was constructed.

Rock Removal Quantities

As you know, initial estimates projected removal of up to approximately 10,000 CY of rock to install Area 2 Cell 2. Calculations after blasting indicate approximately 18,309 CY of rock were removed during the 6 blasting events. Rock quantities removed from individual blast areas are summarized below:

- Blast area 1, 3 and 4 = ~8,422 CY removed;
- Blast area 2a = ~400 CY removed;
- Blast area 2B = ~98 CY removed; and
- Blast area 5 and 6 = ~9,389 CY removed.

Conclusion

The blasting that occurred in Area 2 Cell 1 generally met the rules and requirements of NCDENR. In the instances where a peak velocity of 1-inch/second was exceeded (at approximately 71 feet from the blast), no evidence of damage to the Area 1 liner system was noted. Based on the generally low velocities generated, no changes to the groundwater flow regime are expected and no modifications to the water quality monitoring plan are proposed at this time.

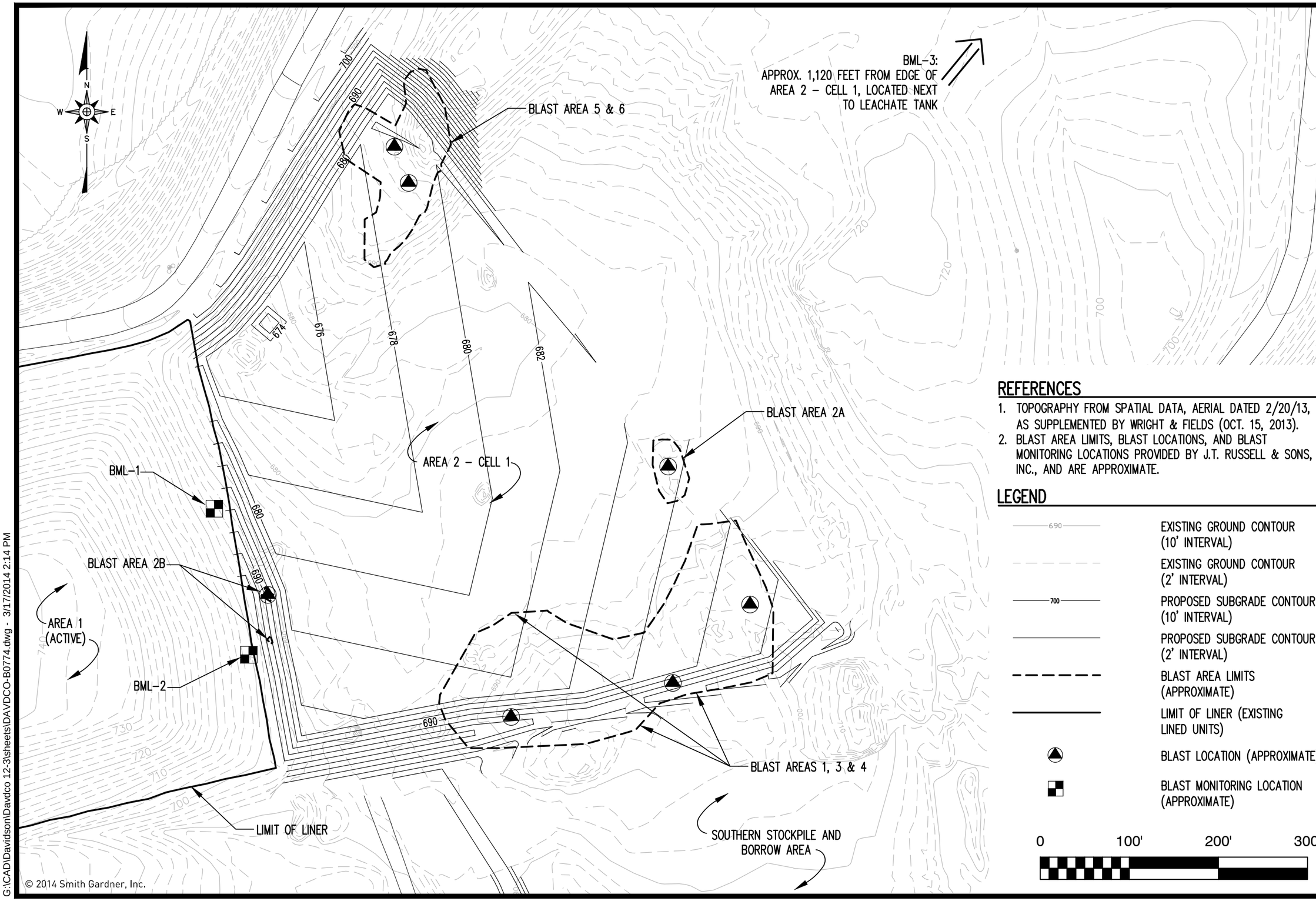
A copy of this blasting summary letter will also be included in the construction quality assurance (CQA) report for the project. Please contact us with any questions or concerns at (919) 828- 0577 or by email below.

Sincerely,
SMITH GARDNER, INC.

Joan A. Smyth, P.G.
Senior Hydrogeologist
joan@smithgardnerinc.com

Pieter K. Scheer, P.E.
Vice President, Senior Engineer
pieter@smithgardnerinc.com

Attachments: Figure1- Site Map with Blast Locations
Table 1 - Seismograph Data
Attachment 1- Blast Reports
cc: Charlie Brushwood - Davidson County



REFERENCES

1. TOPOGRAPHY FROM SPATIAL DATA, AERIAL DATED 2/20/13, AS SUPPLEMENTED BY WRIGHT & FIELDS (OCT. 15, 2013).
2. BLAST AREA LIMITS, BLAST LOCATIONS, AND BLAST MONITORING LOCATIONS PROVIDED BY J.T. RUSSELL & SONS, INC., AND ARE APPROXIMATE.

LEGEND

- 690 — EXISTING GROUND CONTOUR (10' INTERVAL)
- EXISTING GROUND CONTOUR (2' INTERVAL)
- 700 — PROPOSED SUBGRADE CONTOUR (10' INTERVAL)
- PROPOSED SUBGRADE CONTOUR (2' INTERVAL)
- BLAST AREA LIMITS (APPROXIMATE)
- LIMIT OF LINER (EXISTING LINED UNITS)
- BLAST LOCATION (APPROXIMATE)
- BLAST MONITORING LOCATION (APPROXIMATE)

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G:\CAD\Davidson\Davdco 12-3\sheets\DAVDCO-B0774.dwg - 3/17/2014 2:14 PM

PREPARED BY:

NC LIC. NO. C-0928 [ENGINEERING]
SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

PREPARED FOR:

DAVIDSON COUNTY MSW LANDFILL
PHASE 2 - AREA 2 - CELL 1
BLASTING LOCATIONS

FIGURE NO.	FIG. 1
FILENAME:	DAVDCO-B0774
SCALE:	AS SHOWN
PROJECT NO:	DAVDCO-12-3
APPROVED:	M.M.G.
DRAWN:	K.C.B.
DATE:	Mar 2014

SMITH+GARDNER

By: MG
Date: 2/21/2014

Table 1

Seismograph Data
Davidson County MSW Landfill
Phase 2 Area 1 Cell 1

		Distance (ft)	Tranverse	Vertical	Longitudinal	Acoustic (dbl)
Blast 1 11/12/13	BML1	411	0.093 in/s @ 26.3 Hz	0.123 in/s @ 27.8 Hz	0.075 in/s @ 25 Hz	122
	BML2	312	0.185 in/s @ 11.4 Hz	0.173 in/s @ 35.7 Hz	0.128 in/s @ 13.9 Hz	125
	BML3	1,415	N/T	N/T	N/T	N/A
Blast 2A 11/15/13	BML1	521	0.033 in/s @ 38.5 Hz	0.043 in/s @ 38.5 Hz	0.028 in/s @ 31.3 Hz	115
	BML2	561	0.33 in/s @ 41.7 Hz	0.045 in/s @ 38.5 Hz	0.028 in/s @ 35.7 Hz	113
	BML3	1,085	N/T	N/T	N/T	N/A
Blast 2B 11/15/13	BML1	154	0.328 in/s @ 14.7 Hz	0.518 in/s @ 25 Hz	0.233 in/s @ 16.7 Hz	131
	BML2	71	2.183 in/s @ 17.2 Hz	2.753 in/s @ 26.3 Hz	1.340 in/s @ 9.1 Hz	135
	BML3	1,578	N/T	N/T	N/T	N/A
Blast 3 11/22/13	BML1	556	0.033 in.s @ 16.7 Hz	0.060 in/s @ 33.3 Hz	0.048 in/s @ 29.4 Hz	123
	BML2	494	0.070 in/s @ 15.6 Hz	0.128 in/s @ 31.3 Hz	0.070 in/s @ 31.3 Hz	127
	BML3	1,280	N/T	N/T	N/T	N/A
Blast 4 12/6/13	BML1	618	N/T	N/T	N/T	N/A
	BML2	592	N/T	N/T	N/T	N/A
	BML3	1,160	0.025 in/s @ 31.3 Hz	0.020 in/s @ 45.5 Hz	0.023 in/s @ 35.7 Hz	114
Blast 5 12/13/13	BML1	457	0.073 in/s @ 8.8 Hz	0.055 in/s @ 16.1 Hz	0.098 in/s @ 5.7 Hz	124
	BML2	649	0.048 in/s @ 18.5 Hz	0.040 in/s @ 25 Hz	0.053 in/s @ 17.9 Hz	121
	BML3	1,091	0.020 in/s @ 10.4 Hz	0.013 in/s @ 25 Hz	0.008 in/s @ 7.5 Hz	111
Blast 6 12/18/13	BML1	485	0.035 in/s @ 16.1 Hz	0.038 in/s @ 13.2 Hz	0.053 in/s @ 5.5 Hz	140
	BML2	683	0.035 in/s @ 38.5 Hz	0.038 in/s @ 38.5 Hz	0.033 in/s @ 15.2 Hz	137
	BML3	1,087	N/T	N/T	N/T	N/A

Note:

BML = Blast Monitoring Location
N/T = No Movement Detected
N/A = Data Not Available
shading indicates velocity above 1in/s

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:12 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 1 - 11/12/2013 2:34 pm

John R. Fearrington
Staff Engineer

SMITH + GARDNER

14 N. Boylan Avenue
Raleigh, NC 27603

P (919) **828.0577 ext. 125**
F (919) **828.3899**

C (919) **980.0515**

www.smithgardnerinc.com

---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:39 PM
Subject: FW: Activity Report for 1 - 11/12/2013 2:34 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 1

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:10 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 1 - 11/12/2013 2:34 pm

Blast Date/Time	2013-11-12 14:34:00
Project	Davidson Landfill
Shot #	1

Lat	**Long**
35° 50' 53.800"	-80° 10' 54.900"

Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	11/12/2013	**Trigger Level**	0.030 in/s	**Tranverse**	0.093 in/s @ 26.3 Hz
Time	2:34 pm	**Calibration Date**	9/30/2013	**Vertical**	0.123 in/s @ 27.8 Hz
Distance	411 ft	**Direction from Blast**	NW	**Longitudinal**	0.075 in/s @ 25.0 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	122 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/12/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.185 in/s @ 11.4 Hz
Time	2:34 pm	**Calibration Date**	10/1/2013	**Vertical**	0.173 in/s @ 35.7 Hz
Distance	312 ft	**Direction from Blast**	W	**Longitudinal**	0.128 in/s @ 13.9 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	125 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/12/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	2:47 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,415 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 2A - 11/15/2013 3:04 pm

John R. Fearrington
Staff Engineer

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From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:34 PM
Subject: FW: Activity Report for 2A - 11/15/2013 3:04 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 2A

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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C (919) **815.9377**

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:05 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 2A - 11/15/2013 3:04 pm

Blast Date/Time	2013-11-15 15:04:00
Project	Davidson Landfill
Shot #	2A
Lat	**Long**
35° 50' 56.600"	-80° 10' 52.800"
Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	69
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Heig! ht< td class="hidden_border clear_background underline_box max_width_200 min_width_150" align="right">	
Stemming Type	Crushed Stone
Holes per Delay	3
Min Delay Period	8
Blaster Name	D MCGUIRT
Blaster License	

Blaster Comments	
Weather Type	Clear
Temperature	
Wind Speed	
Wind Direction	

N/A Shot Diagram

View Video

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.033 in/s @ 41.7 Hz
Time	3:04 pm	**Calibration Date**	10/1/2013	**Vertical**	0.045 in/s @ 38.5 Hz
Distance	561 ft	**Direction from Blast**	SW	**Longitudinal**	0.028 in/s @ 35.7 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	113 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.033 in/s @ 38.5 Hz
Time	3:04 pm	**Calibration Date**	9/30/2013	**Vertical**	0.043 in/s @ 38.5 Hz
Distance	521 ft	**Direction from Blast**	W	**Longitudinal**	0.028 in/s @ 31.3 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	115 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	4:18 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,085 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL

Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 2B - 11/15/2013 3:57 pm

John R. Fearrington
Staff Engineer

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C (919) **980.0515**

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:39 PM
Subject: FW: Activity Report for 2B - 11/15/2013 3:57 pm
To: John Fearrington <johnf@smithgardnerinc.com>
Cc: Joan Smyth <joan@smithgardnerinc.com>

No. 2B. Looks like this one was the only shot where readings exceeded 1 in/sec. The one monitor exceeded this significantly but was within very close proximity (71 feet per the provided data).

Pieter

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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C (919) **815.9377**

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:10 PM
To: pieter@smithgardnerinc.com
Subject: Activity Report for 2B - 11/15/2013 3:57 pm

Blast Date/Time	2013-11-15 15:57:00
Project	Davidson Landfill
Shot #	2B

Lat	**Long**
35° 50' 54.500"	-80° 10' 58.800"

Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	None
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1

Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear
Temperature	
Wind Speed	
Wind Direction	

N/A Shot Diagram

View Video

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.328 in/s @ 14.7 Hz
Time	3:57 pm	**Calibration Date**	9/30/2013	**Vertical**	0.518 in/s @ 25.0 Hz
Distance	154 ft	**Direction from Blast**	N	**Longitudinal**	0.233 in/s @ 16.7 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	131 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	2.183 in/s @ 17.2 Hz
Time	3:57 pm	**Calibration Date**	10/1/2013	**Vertical**	2.753 in/s @ 26.3 Hz
Distance	71 ft	**Direction from Blast**	S	**Longitudinal**	1.340 in/s @ 9.1 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	135 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	4:18 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,578 ft	**Direction from**	NE	**Longitudinal**	N/T

		Blast			
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 3 - 11/22/2013 4:58 pm

John R. Fearrington
Staff Engineer

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Raleigh, NC 27603

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:33 PM
Subject: FW: Activity Report for 3 - 11/22/2013 4:58 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 3

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:05 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 3 - 11/22/2013 4:58 pm

Blast Date/Time	2013-11-22 16:58:00
Project	Davidson Landfill
Shot #	3

Lat	**Long**
35° 50' 54.200"	-80° 10' 52.700"

Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	277
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Hei! ght	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	11/22/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.033 in/s @ 16.7 Hz
Time	4:58 pm	**Calibration Date**	9/30/2013	**Vertical**	0.060 in/s @ 33.3 Hz
Distance	556 ft	**Direction from Blast**	W	**Longitudinal**	0.048 in/s @ 29.4 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	123 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/22/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.070 in/s @ 15.6 Hz
Time	4:58 pm	**Calibration Date**	10/1/2013	**Vertical**	0.128 in/s @ 31.3 Hz
Distance	494 ft	**Direction from Blast**	W	**Longitudinal**	0.070 in/s @ 31.3 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	127 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/22/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	5:12 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,280 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 4 - 12/06/2013 2:06 pm

John R. Fearrington
Staff Engineer

SMITH + GARDNER

14 N. Boylan Avenue
Raleigh, NC 27603

P (919) **828.0577 ext. 125**
F (919) **828.3899**

C (919) **980.0515**

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 3:59 PM
Subject: FW: Activity Report for 4 - 12/06/2013 2:06 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 4

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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C (919) **815.9377**

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:00 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 4 - 12/06/2013 2:06 pm

Blast Date/Time	2013-12-06 14:06:00
Project	Davidson Landfill
Shot #	4

Lat	**Long**
35° 50' 55.080"	-80° 10' 51.660"

Shot Type	Construction
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	12/6/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.025 in/s @ 31.3 Hz
Time	2:06 pm	**Calibration Date**	3/12/2013	**Vertical**	0.020 in/s @ 45.5 Hz
Distance	1,160 ft	**Direction from Blast**	NE	**Longitudinal**	0.023 in/s @ 35.7 Hz
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	114 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/6/2013	**Trigger Level**	0.100 in/s	**Tranverse**	N/T
Time	4:57 pm	**Calibration Date**	9/30/2013	**Vertical**	N/T
Distance	618 ft	**Direction from Blast**	W	**Longitudinal**	N/T
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/6/2013	**Trigger Level**	0.100 in/s	**Tranverse**	N/T
Time	5:00 pm	**Calibration Date**	10/1/2013	**Vertical**	N/T
Distance	592 ft	**Direction from Blast**	W	**Longitudinal**	N/T
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 5 - 12/13/2013 5:27 pm

John R. Fearrington
Staff Engineer

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 3:59 PM
Subject: FW: Activity Report for 5 - 12/13/2013 5:27 pm
To: John Fearrington <johnf@smithgardnerinc.com>

FYI. Per my other email I'm hoping that we can get pdfs. However, please maintain these until we receive.

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:00 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 5 - 12/13/2013 5:27 pm

Blast Date/Time	2013-12-13 17:27:00
Project	Davidson Landfill
Shot #	5
Lat	**Long**
35° 50' 59.900"	-80° 10' 56.300"
Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	D MCGUIRT
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	12/13/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.020 in/s @ 10.4 Hz
Time	5:27 pm	**Calibration Date**	3/12/2013	**Vertical**	0.013 in/s @ 25.0 Hz
Distance	1,091 ft	**Direction from Blast**	NE	**Longitudinal**	0.008 in/s @ 7.5 Hz
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	111 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/13/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.048 in/s @ 18.5 Hz
Time	5:27 pm	**Calibration Date**	10/1/2013	**Vertical**	0.040 in/s @ 25.0 Hz
Distance	649 ft	**Direction from Blast**	S	**Longitudinal**	0.053 in/s @ 17.9 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	121 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/13/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.073 in/s @ 8.8 Hz
Time	5:27 pm	**Calibration Date**	9/30/2013	**Vertical**	0.055 in/s @ 16.1 Hz
Distance	457 ft	**Direction from Blast**	SW	**Longitudinal**	0.098 in/s @ 5.7 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	124 dBL

Operator VIBRA-TECH GSM	**Serial #**	9446		**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:14 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 6 - 12/18/2013 10:54 am

John R. Fearrington
Staff Engineer

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Raleigh, NC 27603

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 1:36 PM
Subject: FW: Activity Report for 6 - 12/18/2013 10:54 am
To: John Fearrington <johnf@smithgardnerinc.com>, Joan Smyth <joan@smithgardnerinc.com>
Cc: pieter@smithgardnerinc.com

John/Joan:

This is the report for the final blast at Davidson. I assume the other reports will be forthcoming.

Pieter

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

SMITH + GARDNER

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C (919) **815.9377**

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 1:35 PM
To: pieter@smithgardnerinc.com
Subject: Activity Report for 6 - 12/18/2013 10:54 am

Blast Date/Time	2013-12-18 10:54:00
Project	Davidson Landfill
Shot #	6
Lat	**Long**
35° 51' 0.300"	-80° 10' 56.500"
Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	

Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear
Temperature	
Wind Speed	
Wind Direction	

N/A Shot Diagram

View Video

Date	12/18/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.035 in/s @ 38.5 Hz
Time	10:54 am	**Calibration Date**	10/1/2013	**Vertical**	0.038 in/s @ 38.5 Hz
Distance	683 ft	**Direction from Blast**	S	**Longitudinal**	0.033 in/s @ 15.2 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	137 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/18/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.035 in/s @ 16.1 Hz
Time	10:54 am	**Calibration Date**	9/30/2013	**Vertical**	0.038 in/s @ 13.2 Hz
Distance	485 ft	**Direction from Blast**	SW	**Longitudinal**	0.053 in/s @ 5.5 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	140 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/18/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T

Time	11:07 am	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,087 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Appendix E

Rock Blasting Documentation

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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North Carolina Department of Environment and Natural Resources
Division of Waste Management

Pat McCrory
Governor

Dexter R. Matthews
Director

John E. Skvarla, III
Secretary

SOLID WASTE SECTION

November 6, 2013

Sent Via E-mail - Charlie.Brushwood@DavidsonCountyNC.gov

Mr. Charlie Brushwood,
Davidson County Landfill
1242 Old Highway 29
Thomasville, NC 27360

Re: Authorization Approval for:
Rock Blasting Plan, proposed November 6, 2013
Davidson County MSWLF – Phase 2, Area 2, Cell 1
Davidson County, North Carolina
Permit No. 29-06; DIN 20106

Dear Mr. Brushwood:

The Solid Waste Section has completed a review of the *Blasting Plan for Davidson County Landfill* dated November 6, 2013 (DIN 20105) and submitted on behalf of Davidson County by Joan Smyth, P.G. of Smith Gardner, Inc. and JT Russell and Sons, Inc., regarding two (2) rock areas that extend above the proposed subgrade of Phase 2, Area 2, Cell 1.

The two (2) rock areas to be removed by blasting will consist of approximately 10,000 cubic yards and these rock areas are located at the northern and southern portions of the Area 2, Cell 1.

The Rock Blasting Plan is approved as described will be included in the list of the approved documents in the Permit to Operate. Please include the report, documenting the approved activity in the final CQA report as well as submitting the Blasting Report Results within 30 days of the activity.

Please note that further modifications to the construction of Area2, Cell 1 may require a permit modification fee.

The Division appreciates your efforts and cooperation in the matter. If you have any questions or would like to schedule a meeting to discuss this matter further, please contact me at (919) -707-8258.

Sincerely,

Brian Wootton

Brian Wootton
Hydrogeologist
Solid Waste Section

cc: Joan Smyth, P.G., Smyth Gardner
Ed Mussler, Solid Waste Section
John Murray, Solid Waste Section

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SMITH+GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

TEL
919.828.0577

WEB
www.smithgardnerinc.com

November 6, 2013

Mr. Brian Wootton, Hydrogeologist
NC DENR Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Davidson County Phase 2 MSW Landfill
Area 2 Cell 1Rock Blasting

Dear Mr. Wootton:

On behalf of Davidson County, Smith Gardner, Inc. (S+G) is presenting this plan for performing rock blasting to allow the construction of portions of Area 2 Cell 1. A detailed blasting plan from JT Russell and Sons, Inc. (JTR) is attached for your review.

As shown in the Figure located within the blasting plan there are two rock areas that extend above proposed subgrade. It is estimated that up to approximately 10,000 CY of rock will require removal for installation of this portion of the cell.

The blasting will be performed by JTR who is also the general contractor for the project. The drill hole pattern, charge weights, and delays were selected to minimize the amount of energy which may impact the underlying rock (i.e. peak particle velocities at blast monitoring locations are anticipated to be < 1 inch/sec.). Additionally, all blasting will be performed during daylight hours.

During the actual blasting, monitoring using a seismograph is proposed at three locations (two adjacent to Area 1 and one adjacent to the leachate tanks). These are the closest locations that may be affected by the blasting.

Documentation of blasting activities (including monitoring results) will be prepared by S+G and submitted to the Solid Waste Section within 30 days of the rock removal. This documentation, which will include observations of the excavation by S+G staff and an evaluation by a licensed geologist, will also be placed in the construction quality assurance (CQA) report for the project.

The blasting activities are scheduled to begin on Friday, November 8th. We appreciate your attention in this matter. Should you have any questions or require clarification or further information, please contact us at your earliest convenience.

Sincerely,
SMITH GARDNER, INC.

Joan A. Smyth, P.G.
Senior Hydrogeologist
joan@smithgardnerinc.com

Pieter K. Scheer, P.E.
Vice President, Senior Engineer
pieter@smithgardnerinc.com

Attachment

Cc: Charlie Brushwood – Davidson County

JT RUSSELL & SONS INC

BLASTING PLAN FOR DAVIDSON COUNTY LANDFILL

OWNER:

DAVIDSON COUNTY INTERGRATED SOLID WASTE FACILITY

CONTRACTOR:

J.T. Russell and Sons, Inc
1721 US Hwy 52 N
Albemarle, NC 28001

Table of Contents

Section Page

Scope of Blasting Project

Types of Blasting

Safety Procedure For Blasts

Blast Site Dimensions

Drill Pattern

Explosives Loading and Initiation

Ground Control

Flyrock Control Plan

Selection of Blasting Products and Methods

Monitoring, Blast Effects

Peak Particle Velocity Monitoring and Control

Blast Warning Signals

Environmental Concerns

Fire Prevention

Appendix A – Blasting Location

Appendix B – Example of Blasting Daily Log

Appendix C – Davidson County Blasting Permit Check List

1) SCOPE OF BLASTING PROJECT

Blasting will take at the Davidson County Landfill. J. T. Russell and Sons, Inc., plans to blast in Phase 2 Area 2 Cell 1. Only in the areas where the rock cannot be excavated by conventional means will blasting occur. JTR will work closely with the owner and engineer during the blast phase.

2) TYPES OF BLASTING

Primary type of blasting will be for excavation removal purposes. Blasting may also require blasting in storm drain trenches.

3) SAFETY PROCEDURE FOR BLASTS

All operations for transporting, handling, and loading explosives shall observe applicable industry standards and regulations as defined by the appropriate city, county, state, or federal governing agency. All blast events will be conducted in such a manner that complies with all safety cautions, procedures or regulations of the applicable city, county, state, or federal governing agency. This includes, but is not limited to: clearing the blast zone, guarding the blast area and vehicular or pedestrian traffic control. There will be no on-site, overnight storage of explosives.

4) BLAST SITE DIMENSIONS

The blast will consist from 50-200 holes covering approximately 2-3 acres. The depth of each borehole will be around 10 - 24 feet including sub drill. Estimated 10,000 CY of blasting to take place.

5) DRILL PATTERN

The proposed pattern is to drill 3” - 4”” diameter boreholes with a pattern of 5’x5’ or 10’x10’.

6) EXPLOSIVES LOADING AND INITIATION

a) It is proposed to use an Austin Ex-Gel for the main charge in each borehole, initiated with an appropriate detonating blasting cap. This cartridge weighs approximately 2.5 pounds per for16 inches of 2-inch borehole. Surface (non-electric) delays will be used to minimize the vibrations at adjacent structures. The blast delay intervals used will be

9ms, 17ms, 25ms, and 42ms. Each blast will be designed to have a max of 10-15 pounds of explosive per delay.

b) As one means to control ground movement, a minimum of 4' of inert stemming material will be loaded at the top of each borehole, beginning below the depth where competent rock was encountered. Stemming height will be determined by the discretion, experience and judgment of the blaster in charge, and site-specific conditions for each shot.

7) GROUND CONTROL

All blasts will be designed to prevent excessive movement of material from the blast zone. The blaster will include in his considerations such factors as rock type, geologic condition, borehole depth, charge weight and any other relevant, site specific conditions for each shot.

8) FLYROCK CONTROL PLAN

All shots will be carefully designed by the qualified blaster to control fly rock. All hole loading activity will be supervised by the qualified blaster. The qualified blaster will communicate with the driller to obtain geological information for each shot. JTR will haul and place soil over blast area for a protective cover from flyrock.

9) SELECTION OF BLASTING PRODUCTS AND METHODS

These blasting products were chosen because of many years of dependable use and positive results which are demonstrated by the:

- Quality, safety and reliability of the product
- Support offered by the manufacturer
- Availability
- Price

10) MONITORING BLAST EFFECTS

It is not expected that this type of rock will fracture in such a way as to cause any kind of ground displacement. Following each blast, the area will be examined for signs of ground cracking. Any indication of overbreak will be brought to the attention of the blaster and noted on the blast report. The shot pattern and/or loading will be adjusted to minimize or eliminate

overbreak. Vibration monitoring will be conducted at the structures located nearest the blasting. The closest blasting conducted to any occupied structure will be greater than 300 feet. The vibration levels produced by the blasting are estimated to be less than 1 inch per second PPV and 132 dBI at the closest location. The blasting will be monitored at the buildings closest to the blast. The blaster in charge will design each blast to minimize vibration and over pressure and to prevent fly rock.

11) PEAK PARTICLE VELOCITY MONITORING AND CONTROL

Each blast will be monitored by a licensed blaster or other person experienced in monitoring blasts using a seismograph machine. The seismograph will be placed at the "point of interest". In most cases, this will be next to the foundation of the closest building, power line foundation, utility or well. In all cases, both the sensor and seismograph will be protected from flyrock.

12) BLAST WARNING SIGNALS

Warning signals for each blast will be as follows:

- One long horn one minute before blast
- One long horn 10 seconds before blast
- One long horn for all clear after the blast

13) ENVIRONMENTAL CONCERNS

The Davidson County Fire Marshal will be notified prior to blasting.

14) FIRE PREVENTION

Following the required waiting period after each shot, the blast area will be inspected for any indication of fire or fire hazard. Particular attention will be paid to the vegetated areas outside of the right-of-way. Normally, the explosives vaporize at the instant of detonation and there is no fiber or other material left to smolder or be a source of

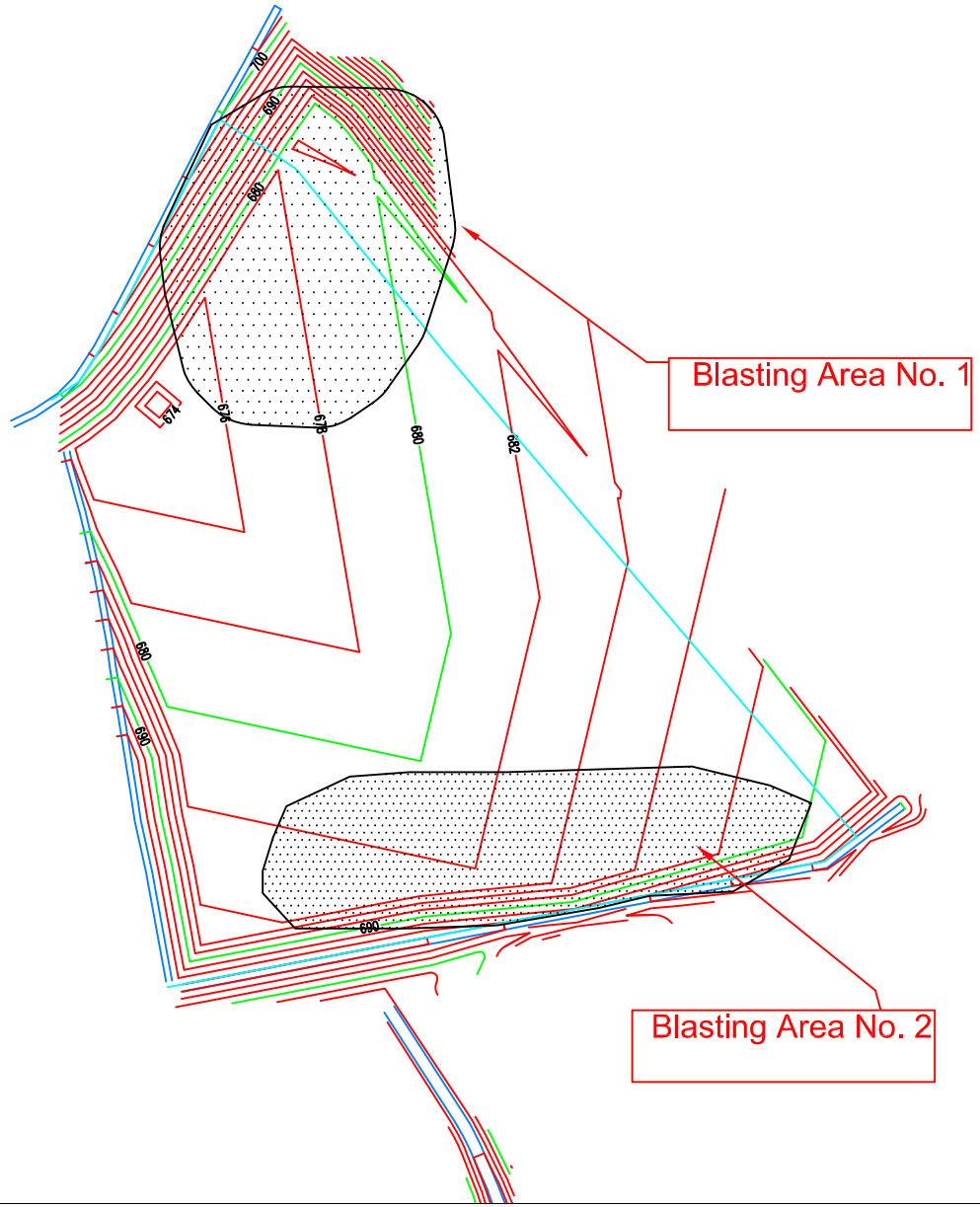
concern. Any plastic shock tube from the initiation system that remains after the blast will be picked up for proper disposal immediately after the blast.

The blasting operation will generally take place after the grading operation has graded the right-of-way to bare mineral soil. The blaster shall ensure that the initiating detonator is placed on bare mineral soil and that there is no vegetation within a 20-foot radius.

The initiating detonator will be a minimum of 400 feet from the nearest loaded hole.

Appendix A Locations and Typicals

SEE ATTACHED



Blasting in Phase 2 Area 2
Cell 1
JTR BLASTING PLAN -
DAVIDSON COUNTY

Appendix B

Example of Blasting Daily Log

JT Russell & Sons, Inc.
Blast Operations Report

1721 N Hwy 52
Albemarle NC 28001

Client _____
Blaster _____ License # _____
Date _____ Blast # _____ Time of Blast _____
Exact Site Location _____

Weather: Clouds _____ Humidity _____
Wind & Direction _____ Temperature _____
Distance, Direction, & Address of Nearest Structure to Blast Site: _____

How measured: Pace GPS Tape Map Laser Other
Drill log used: Yes No

Burden _____ ft Spacing _____ ft Subdrill _____ ft
# of Holes _____ Hole Dia. _____ in Depth(s) _____ ft
Avg. Stem _____ ft Type _____ Avg. Water Depth _____ ft

Shot cover used: Blasting Mat Backfill # of Decks: _____

Detonators Used:

Make and Type of Explosives Used:		Make	Length	Delay	# Used
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
	lbs.				
TOTAL POUNDS IN SHOT:	lbs.				

Calculated Scaled Distance: SD = D ÷ √W = _____
W = max. lbs. / delay limit D= min. feet to nearest structure
Holes / Delay _____
Loaded "Max" lbs. / delay _____ lbs/delay

50 - (0-300')
55 - (301-5,000')
63 - (> 5001')

(1) Seismograph(s) Unit Number _____ Person Setting Up _____
(2) Seismograph(s) Unit Number _____ Person Setting Up _____
(3) Seismograph(s) Unit Number _____ Person Setting Up _____
Exact Location, Distance and Direction of Seismograph(s) from Blast Site:
1) _____
2) _____
3) _____

Seismic Readings (1) T V L Peak Overpressure _____ db
Seismic Readings (2) T V L Peak Overpressure _____ db
Seismic Readings (3) T V L Peak Overpressure _____ db
Frequency (1) _____ RPPV(1) _____ in/sec
Frequency (2) _____ RPPV(2) _____ in/sec
Frequency (3) _____ RPPV(3) _____ in/sec

Signature of Blaster _____

Attatch printout of seismograph(s) to this record.

Appendix C Davidson County Blasting Permit Check List

1) **See Attached Sketch in Blasting Plan Appendix A**

2) **Attached Blasting Plan**

3) **Hours of Blasting**

   Blasting will be performed during the hours of 9am and 5 pm

4) **Explosives WILL NOT be stored on site**

SMITH+GARDNER
ENGINEERS

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March 24, 2014

Mr. Brian Wootton, Hydrogeologist
NC DENR Division of Waste Management
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Davidson County Phase 2 MSW Landfill
Area 2 Cell 1Rock Blasting Summary

Dear Mr. Wootton:

On behalf of Davidson County and based on our earlier correspondence, Smith Gardner, Inc. (S+G) presents this letter to document rock blasting performed during construction of Phase 2 Area 2 Cell 1 of the County's municipal solid waste (MSW) landfill. A rock blasting plan was submitted November 6, 2013 and was approved by North Carolina Department of Environment and Natural Resources (NCDENR) that same day. This report documents the blasting events and provides vibration monitoring results as requested by the NCDENR.

Blasting Events

The blasting was performed by JT Russell and Sons, Inc. (JTR), who is the general contractor for the project. Personnel from S+G and Davidson County were also present during blasting procedures. Blasting was conducted during daylight hours on November 12, 15, and 22, 2013 and December 6, 13, and 18, 2013. The drill hole pattern, charge weights, and delays were selected to minimize the amount of energy which may impact the underlying rock. The planned peak particle velocities at blast monitoring locations were designed to be <1 inch/sec. **Figure 1** presents the blast locations.

Blasting procedures were executed in general accordance with the approved November 6, 2013 blasting plan and the blasting plan from JTR.

Blast Monitoring

During blasting, seismographs were used to monitor three locations (two adjacent to Area 1 and one adjacent to the leachate tanks) for each blast. Locations were selected based on closest proximity to the area that may be affected by the blasting. Measurements were collected for peak particle velocity, frequency, and sound level. **Table 1** presents the data retrieved from each seismograph during each blast event. In general, the peak velocities recorded were well below the generally accepted criterion of 1 in/sec. Only BML-2 on Blast 2B recorded velocities above 1in/sec. These velocities are attributed to the monitoring location residing only 71 feet from the blast. This area was near the edge of Phase 2 Area 1. Blast monitoring records are included in **Attachment 1** and **Figure 1** illustrates the blasting locations with their respective monitoring points.

It should be noted that after blasting, the anchor trench along the edge of Phase 2 Area 1 was uncovered to facilitate extending the liner system from Area 1 across Area 2 Cell 1. During construction, the liner system of Area 1 in the anchor trench was inspected for any indication of damage due to elevated blast velocities in this area. No abnormalities were noted, and the liner system for Phase 2 Area 2 Cell 1 was constructed.

Rock Removal Quantities

As you know, initial estimates projected removal of up to approximately 10,000 CY of rock to install Area 2 Cell 2. Calculations after blasting indicate approximately 18,309 CY of rock were removed during the 6 blasting events. Rock quantities removed from individual blast areas are summarized below:

- Blast area 1, 3 and 4 = ~8,422 CY removed;
- Blast area 2a = ~400 CY removed;
- Blast area 2B = ~98 CY removed; and
- Blast area 5 and 6 = ~9,389 CY removed.

Conclusion

The blasting that occurred in Area 2 Cell 1 generally met the rules and requirements of NCDENR. In the instances where a peak velocity of 1-inch/second was exceeded (at approximately 71 feet from the blast), no evidence of damage to the Area 1 liner system was noted. Based on the generally low velocities generated, no changes to the groundwater flow regime are expected and no modifications to the water quality monitoring plan are proposed at this time.

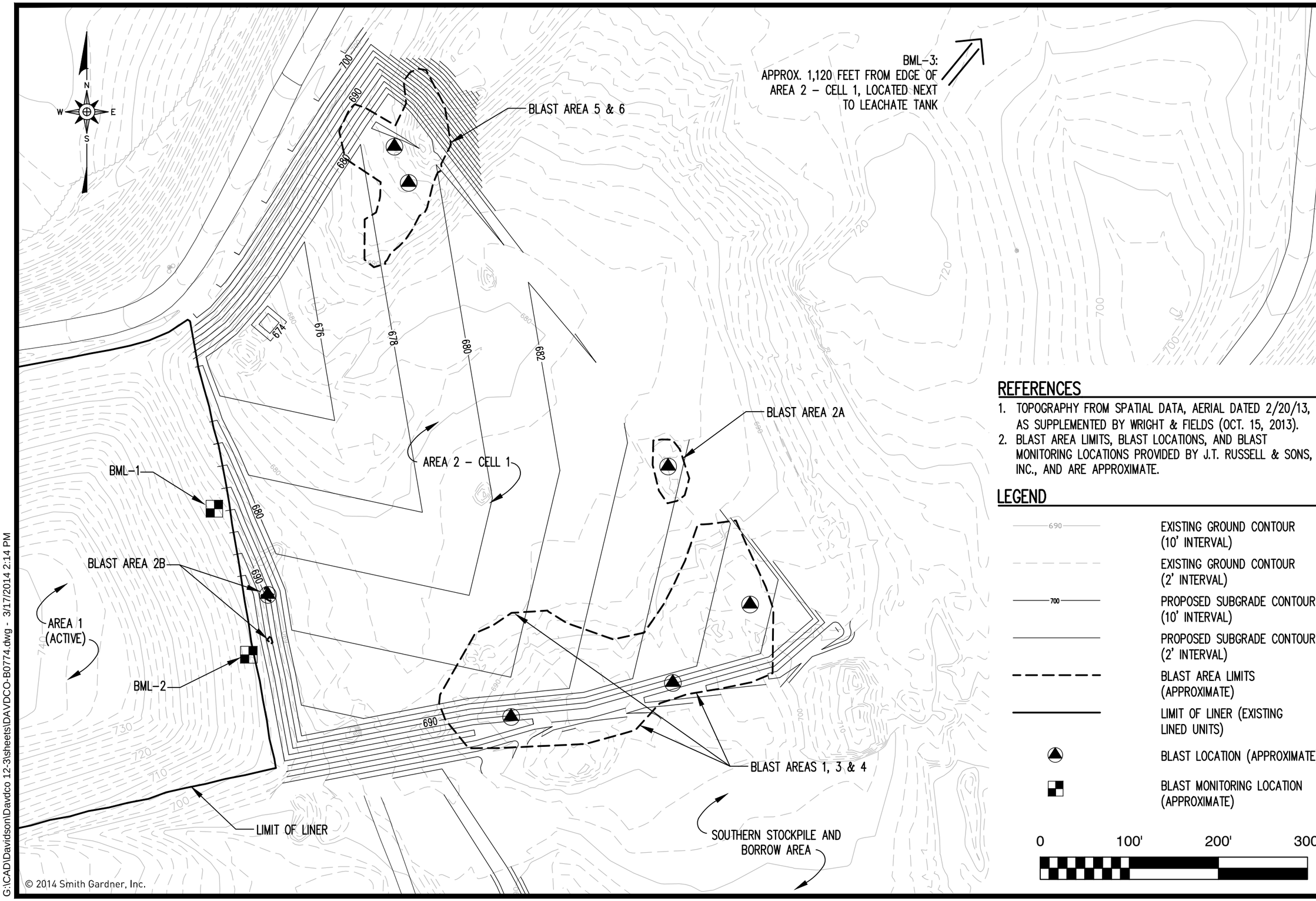
A copy of this blasting summary letter will also be included in the construction quality assurance (CQA) report for the project. Please contact us with any questions or concerns at (919) 828- 0577 or by email below.

Sincerely,
SMITH GARDNER, INC.

Joan A. Smyth, P.G.
Senior Hydrogeologist
joan@smithgardnerinc.com

Pieter K. Scheer, P.E.
Vice President, Senior Engineer
pieter@smithgardnerinc.com

Attachments: Figure1- Site Map with Blast Locations
Table 1 - Seismograph Data
Attachment 1- Blast Reports
cc: Charlie Brushwood - Davidson County



REFERENCES

1. TOPOGRAPHY FROM SPATIAL DATA, AERIAL DATED 2/20/13, AS SUPPLEMENTED BY WRIGHT & FIELDS (OCT. 15, 2013).
2. BLAST AREA LIMITS, BLAST LOCATIONS, AND BLAST MONITORING LOCATIONS PROVIDED BY J.T. RUSSELL & SONS, INC., AND ARE APPROXIMATE.

LEGEND

- 690 — EXISTING GROUND CONTOUR (10' INTERVAL)
- EXISTING GROUND CONTOUR (2' INTERVAL)
- 700 — PROPOSED SUBGRADE CONTOUR (10' INTERVAL)
- PROPOSED SUBGRADE CONTOUR (2' INTERVAL)
- BLAST AREA LIMITS (APPROXIMATE)
- LIMIT OF LINER (EXISTING LINED UNITS)
- BLAST LOCATION (APPROXIMATE)
- BLAST MONITORING LOCATION (APPROXIMATE)

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G:\CAD\Davidson\Davdco 12-3\sheets\DAVDCO-B0774.dwg - 3/17/2014 2:14 PM

PREPARED BY:

NC LIC. NO. C-0928 [ENGINEERING]
SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

PREPARED FOR:

DAVIDSON COUNTY MSW LANDFILL
PHASE 2 - AREA 2 - CELL 1
BLASTING LOCATIONS

FIGURE NO.	FIG. 1
FILENAME:	DAVDCO-B0774
SCALE:	AS SHOWN
PROJECT NO:	DAVDCO-12-3
APPROVED:	M.M.G.
DRAWN:	K.C.B.
DATE:	Mar 2014

SMITH+GARDNER

By: MG
Date: 2/21/2014

Table 1

Seismograph Data
Davidson County MSW Landfill
Phase 2 Area 1 Cell 1

		Distance (ft)	Tranverse	Vertical	Longitudinal	Acoustic (dbl)
Blast 1 11/12/13	BML1	411	0.093 in/s @ 26.3 Hz	0.123 in/s @ 27.8 Hz	0.075 in/s @ 25 Hz	122
	BML2	312	0.185 in/s @ 11.4 Hz	0.173 in/s @ 35.7 Hz	0.128 in/s @ 13.9 Hz	125
	BML3	1,415	N/T	N/T	N/T	N/A
Blast 2A 11/15/13	BML1	521	0.033 in/s @ 38.5 Hz	0.043 in/s @ 38.5 Hz	0.028 in/s @ 31.3 Hz	115
	BML2	561	0.33 in/s @ 41.7 Hz	0.045 in/s @ 38.5 Hz	0.028 in/s @ 35.7 Hz	113
	BML3	1,085	N/T	N/T	N/T	N/A
Blast 2B 11/15/13	BML1	154	0.328 in/s @ 14.7 Hz	0.518 in/s @ 25 Hz	0.233 in/s @ 16.7 Hz	131
	BML2	71	2.183 in/s @ 17.2 Hz	2.753 in/s @ 26.3 Hz	1.340 in/s @ 9.1 Hz	135
	BML3	1,578	N/T	N/T	N/T	N/A
Blast 3 11/22/13	BML1	556	0.033 in.s @ 16.7 Hz	0.060 in/s @ 33.3 Hz	0.048 in/s @ 29.4 Hz	123
	BML2	494	0.070 in/s @ 15.6 Hz	0.128 in/s @ 31.3 Hz	0.070 in/s @ 31.3 Hz	127
	BML3	1,280	N/T	N/T	N/T	N/A
Blast 4 12/6/13	BML1	618	N/T	N/T	N/T	N/A
	BML2	592	N/T	N/T	N/T	N/A
	BML3	1,160	0.025 in/s @ 31.3 Hz	0.020 in/s @ 45.5 Hz	0.023 in/s @ 35.7 Hz	114
Blast 5 12/13/13	BML1	457	0.073 in/s @ 8.8 Hz	0.055 in/s @ 16.1 Hz	0.098 in/s @ 5.7 Hz	124
	BML2	649	0.048 in/s @ 18.5 Hz	0.040 in/s @ 25 Hz	0.053 in/s @ 17.9 Hz	121
	BML3	1,091	0.020 in/s @ 10.4 Hz	0.013 in/s @ 25 Hz	0.008 in/s @ 7.5 Hz	111
Blast 6 12/18/13	BML1	485	0.035 in/s @ 16.1 Hz	0.038 in/s @ 13.2 Hz	0.053 in/s @ 5.5 Hz	140
	BML2	683	0.035 in/s @ 38.5 Hz	0.038 in/s @ 38.5 Hz	0.033 in/s @ 15.2 Hz	137
	BML3	1,087	N/T	N/T	N/T	N/A

Note:

BML = Blast Monitoring Location
N/T = No Movement Detected
N/A = Data Not Available
shading indicates velocity above 1in/s

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:12 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 1 - 11/12/2013 2:34 pm

John R. Fearrington
Staff Engineer

SMITH + GARDNER

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P (919) **828.0577 ext. 125**
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C (919) **980.0515**

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:39 PM
Subject: FW: Activity Report for 1 - 11/12/2013 2:34 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 1

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:10 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 1 - 11/12/2013 2:34 pm

Blast Date/Time	2013-11-12 14:34:00
Project	Davidson Landfill
Shot #	1

Lat	**Long**
35° 50' 53.800"	-80° 10' 54.900"

Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	11/12/2013	**Trigger Level**	0.030 in/s	**Tranverse**	0.093 in/s @ 26.3 Hz
Time	2:34 pm	**Calibration Date**	9/30/2013	**Vertical**	0.123 in/s @ 27.8 Hz
Distance	411 ft	**Direction from Blast**	NW	**Longitudinal**	0.075 in/s @ 25.0 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	122 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/12/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.185 in/s @ 11.4 Hz
Time	2:34 pm	**Calibration Date**	10/1/2013	**Vertical**	0.173 in/s @ 35.7 Hz
Distance	312 ft	**Direction from Blast**	W	**Longitudinal**	0.128 in/s @ 13.9 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	125 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/12/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	2:47 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,415 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 2A - 11/15/2013 3:04 pm

John R. Fearrington
Staff Engineer

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From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:34 PM
Subject: FW: Activity Report for 2A - 11/15/2013 3:04 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 2A

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:05 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 2A - 11/15/2013 3:04 pm

Blast Date/Time	2013-11-15 15:04:00
Project	Davidson Landfill
Shot #	2A
Lat	**Long**
35° 50' 56.600"	-80° 10' 52.800"
Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	69
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Heig! ht< td class="hidden_border clear_background underline_box max_width_200 min_width_150" align="right">	
Stemming Type	Crushed Stone
Holes per Delay	3
Min Delay Period	8
Blaster Name	D MCGUIRT
Blaster License	

Blaster Comments	
Weather Type	Clear
Temperature	
Wind Speed	
Wind Direction	

N/A Shot Diagram

View Video

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.033 in/s @ 41.7 Hz
Time	3:04 pm	**Calibration Date**	10/1/2013	**Vertical**	0.045 in/s @ 38.5 Hz
Distance	561 ft	**Direction from Blast**	SW	**Longitudinal**	0.028 in/s @ 35.7 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	113 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.033 in/s @ 38.5 Hz
Time	3:04 pm	**Calibration Date**	9/30/2013	**Vertical**	0.043 in/s @ 38.5 Hz
Distance	521 ft	**Direction from Blast**	W	**Longitudinal**	0.028 in/s @ 31.3 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	115 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	4:18 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,085 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL

Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 2B - 11/15/2013 3:57 pm

John R. Fearrington
Staff Engineer

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From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:39 PM
Subject: FW: Activity Report for 2B - 11/15/2013 3:57 pm
To: John Fearrington <johnf@smithgardnerinc.com>
Cc: Joan Smyth <joan@smithgardnerinc.com>

No. 2B. Looks like this one was the only shot where readings exceeded 1 in/sec. The one monitor exceeded this significantly but was within very close proximity (71 feet per the provided data).

Pieter

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:10 PM
To: pieter@smithgardnerinc.com
Subject: Activity Report for 2B - 11/15/2013 3:57 pm

Blast Date/Time	2013-11-15 15:57:00
Project	Davidson Landfill
Shot #	2B

Lat	**Long**
35° 50' 54.500"	-80° 10' 58.800"

Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	None
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1

Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear
Temperature	
Wind Speed	
Wind Direction	

N/A Shot Diagram

View Video

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.328 in/s @ 14.7 Hz
Time	3:57 pm	**Calibration Date**	9/30/2013	**Vertical**	0.518 in/s @ 25.0 Hz
Distance	154 ft	**Direction from Blast**	N	**Longitudinal**	0.233 in/s @ 16.7 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	131 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	2.183 in/s @ 17.2 Hz
Time	3:57 pm	**Calibration Date**	10/1/2013	**Vertical**	2.753 in/s @ 26.3 Hz
Distance	71 ft	**Direction from Blast**	S	**Longitudinal**	1.340 in/s @ 9.1 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	135 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/15/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	4:18 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,578 ft	**Direction from**	NE	**Longitudinal**	N/T

		Blast			
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 3 - 11/22/2013 4:58 pm

John R. Fearrington
Staff Engineer

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From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 4:33 PM
Subject: FW: Activity Report for 3 - 11/22/2013 4:58 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 3

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:05 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 3 - 11/22/2013 4:58 pm

Blast Date/Time	2013-11-22 16:58:00
Project	Davidson Landfill
Shot #	3

Lat	**Long**
35° 50' 54.200"	-80° 10' 52.700"

Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	277
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Hei! ght	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	11/22/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.033 in/s @ 16.7 Hz
Time	4:58 pm	**Calibration Date**	9/30/2013	**Vertical**	0.060 in/s @ 33.3 Hz
Distance	556 ft	**Direction from Blast**	W	**Longitudinal**	0.048 in/s @ 29.4 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	123 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/22/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.070 in/s @ 15.6 Hz
Time	4:58 pm	**Calibration Date**	10/1/2013	**Vertical**	0.128 in/s @ 31.3 Hz
Distance	494 ft	**Direction from Blast**	W	**Longitudinal**	0.070 in/s @ 31.3 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	127 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	11/22/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T
Time	5:12 pm	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,280 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 4 - 12/06/2013 2:06 pm

John R. Fearrington
Staff Engineer

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From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 3:59 PM
Subject: FW: Activity Report for 4 - 12/06/2013 2:06 pm
To: John Fearrington <johnf@smithgardnerinc.com>

No. 4

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Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:00 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 4 - 12/06/2013 2:06 pm

Blast Date/Time	2013-12-06 14:06:00
Project	Davidson Landfill
Shot #	4

Lat	**Long**
35° 50' 55.080"	-80° 10' 51.660"

Shot Type	Construction
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	12/6/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.025 in/s @ 31.3 Hz
Time	2:06 pm	**Calibration Date**	3/12/2013	**Vertical**	0.020 in/s @ 45.5 Hz
Distance	1,160 ft	**Direction from Blast**	NE	**Longitudinal**	0.023 in/s @ 35.7 Hz
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	114 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/6/2013	**Trigger Level**	0.100 in/s	**Tranverse**	N/T
Time	4:57 pm	**Calibration Date**	9/30/2013	**Vertical**	N/T
Distance	618 ft	**Direction from Blast**	W	**Longitudinal**	N/T
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/6/2013	**Trigger Level**	0.100 in/s	**Tranverse**	N/T
Time	5:00 pm	**Calibration Date**	10/1/2013	**Vertical**	N/T
Distance	592 ft	**Direction from Blast**	W	**Longitudinal**	N/T
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:13 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 5 - 12/13/2013 5:27 pm

John R. Fearrington
Staff Engineer

SMITH + GARDNER

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F (919) **828.3899**

C (919) **980.0515**

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 3:59 PM
Subject: FW: Activity Report for 5 - 12/13/2013 5:27 pm
To: John Fearrington <johnf@smithgardnerinc.com>

FYI. Per my other email I'm hoping that we can get pdfs. However, please maintain these until we receive.

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 4:00 PM

To: pieter@smithgardnerinc.com
Subject: Activity Report for 5 - 12/13/2013 5:27 pm

Blast Date/Time	2013-12-13 17:27:00
Project	Davidson Landfill
Shot #	5
Lat	**Long**
35° 50' 59.900"	-80° 10' 56.300"
Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	
Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	D MCGUIRT
Blaster Comments	
Weather Type	Clear

Temperature
Wind Speed
Wind Direction

N/A Shot Diagram
View Video

Date	12/13/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.020 in/s @ 10.4 Hz
Time	5:27 pm	**Calibration Date**	3/12/2013	**Vertical**	0.013 in/s @ 25.0 Hz
Distance	1,091 ft	**Direction from Blast**	NE	**Longitudinal**	0.008 in/s @ 7.5 Hz
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	111 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/13/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.048 in/s @ 18.5 Hz
Time	5:27 pm	**Calibration Date**	10/1/2013	**Vertical**	0.040 in/s @ 25.0 Hz
Distance	649 ft	**Direction from Blast**	S	**Longitudinal**	0.053 in/s @ 17.9 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	121 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/13/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.073 in/s @ 8.8 Hz
Time	5:27 pm	**Calibration Date**	9/30/2013	**Vertical**	0.055 in/s @ 16.1 Hz
Distance	457 ft	**Direction from Blast**	SW	**Longitudinal**	0.098 in/s @ 5.7 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	124 dBL

Operator VIBRA-TECH GSM	**Serial #**	9446		**Scaled Distance**	N/A ft/(lb^.5)

Joan Smyth

From: John Fearrington
Sent: Thursday, February 20, 2014 8:14 PM
To: Joan Smyth
Subject: Fwd: FW: Activity Report for 6 - 12/18/2013 10:54 am

John R. Fearrington
Staff Engineer

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---------- Forwarded message ----------
From: **Pieter Scheer** <pieter@smithgardnerinc.com>
Date: Mon, Jan 13, 2014 at 1:36 PM
Subject: FW: Activity Report for 6 - 12/18/2013 10:54 am
To: John Fearrington <johnf@smithgardnerinc.com>, Joan Smyth <joan@smithgardnerinc.com>
Cc: pieter@smithgardnerinc.com

John/Joan:

This is the report for the final blast at Davidson. I assume the other reports will be forthcoming.

Pieter

Pieter K. Scheer, P.E.
Vice President, Senior Engineer

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From: vtealerts@vibratechinc.com [mailto:vtealerts@vibratechinc.com]
Sent: Monday, January 13, 2014 1:35 PM
To: pieter@smithgardnerinc.com
Subject: Activity Report for 6 - 12/18/2013 10:54 am

Blast Date/Time	2013-12-18 10:54:00
Project	Davidson Landfill
Shot #	6
Lat	**Long**
35° 51' 0.300"	-80° 10' 56.500"
Shot Type	Construction Shot
Max Lbs/Delay	

Shot Cover	Mats
Average Water Depth	
# of Holes	
# of Rows	
Hole Diameter	
Hole Depth	
Hole Subdrill	
Space	
Burden	
Decks	
Stem Height!	

Stemming Type	Crushed Stone
Holes per Delay	1
Min Delay Period	8
Blaster Name	
Blaster License	
Blaster Comments	
Weather Type	Clear
Temperature	
Wind Speed	
Wind Direction	

N/A Shot Diagram

View Video

Date	12/18/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.035 in/s @ 38.5 Hz
Time	10:54 am	**Calibration Date**	10/1/2013	**Vertical**	0.038 in/s @ 38.5 Hz
Distance	683 ft	**Direction from Blast**	S	**Longitudinal**	0.033 in/s @ 15.2 Hz
Location	200' E of EW13 Gas Well	**GPS**	35° 50' 53.800", -80° 10' 58.700"	**Acoustic**	137 dBL
Operator	VIBRA-TECH GSM	**Serial #**	7262	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/18/2013	**Trigger Level**	0.020 in/s	**Tranverse**	0.035 in/s @ 16.1 Hz
Time	10:54 am	**Calibration Date**	9/30/2013	**Vertical**	0.038 in/s @ 13.2 Hz
Distance	485 ft	**Direction from Blast**	SW	**Longitudinal**	0.053 in/s @ 5.5 Hz
Location	190' E of EW12 Gas Well	**GPS**	35° 50' 56.000", -80° 10' 59.100"	**Acoustic**	140 dBL
Operator	VIBRA-TECH GSM	**Serial #**	9446	**Scaled Distance**	N/A ft/(lb^.5)

Date	12/18/2013	**Trigger Level**	0.020 in/s	**Tranverse**	N/T

Time	11:07 am	**Calibration Date**	3/12/2013	**Vertical**	N/T
Distance	1,087 ft	**Direction from Blast**	NE	**Longitudinal**	N/T
Location	Leachate Tank	**GPS**	35° 51' 5.000", -80° 10' 44.600"	**Acoustic**	N/A dBL
Operator	VIBRA-TECH GSM	**Serial #**	7685	**Scaled Distance**	N/A ft/(lb^.5)

Appendix F

CQA Meeting Minutes

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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MEMORANDUM

Date:	October 8, 2013
To:	Distribution and Meeting Attendees
From:	Pieter K. Scheer, P.E. Smith Gardner, Inc.
RE:	**Davidson County MSWLF – Phase 2 Area 2 Cell 1** **Pre-Construction Meeting Summary**

Attendees: See attached list.

Meeting Summary:

A pre-construction meeting was held Wednesday September 25th at the site to discuss the plans for the construction of Phase 2 Area 2 Cell 1 of the Davidson County Municipal Solid Waste (MSW) Landfill. The meeting began at 11:00 a.m. and the following items were discussed:

A. Tentative Construction Schedule/Milestones

The Notice to Proceed (NTP) was discussed. J.T. Russell & Sons (JTR) is currently working on obtaining the required performance and payment bonds. The NTP is anticipated by October 14th. Mr. Russell plans to issue a schedule once the NTP is issued. Work sequencing will be discussed and updated at regular construction meetings

B. Designation of Responsible Personnel

Davidson County (Owner)
Rex Buck, Public Works Director
Charlie Brushwood, Landfill Manager
Steven Sink, Landfill Supervisor

S+G (Design and CQA Engineer)
Pieter Scheer, Project Manager
John Fearrington, Staff Engineer
Soil Technician, Geotechnics

J.T. Russell & Sons (Contractor)
Nathan Russell, Project Manager
Spencer Walker, Site Superintendent
Chuck Workman, Safety Officer

NC DENR Division of Waste Mangement
John Murray, Permitting Engineer
Hugh Jernigan, Site Inspector

C. Field Decisions and Change Orders

Mr. Scheer noted the following:

- All design changes and/or change orders need to be approved in advance by the County and S+G.
- Conflicts between drawings and field conditions shall be brought to the attention of the County and S+G ASAP.
- If required, appropriate regulatory agencies will be notified of proposed changes.

D. Distribution of Contract Documents

Mr. Scheer provided copies to JTR and the County (Subsequent to the meeting, S+G also provided a CAD file of the plan view drawings to Tommy Fields - Contractor's surveyor). S+G will provide additional copies as needed.

E. Submittals

Mr. Scheer noted the following regarding submittals.

- Shop drawings should be submitted to S+G as outlined in the project specifications (Section 01300).
- It will be important to submit the intended geosynthetics products soon such that interface shear strength testing of liner components can proceed.

F. Record Documents

Mr. Scheer noted the following:

- S+G and Geotechnics will perform and document all quality assurance testing.
- S+G will maintain all test and sample information for preparation of the certification report.
- JTR is responsible for performing and documenting all quality control testing (including interface testing, geomembrane field seam testing, pressure testing of force main, and camera inspection of leachate collection piping) as well as all surveying.

G. Use of Site and Owner's Requirements

Mr. Scheer noted the following:

- Site access will be through the existing entrance.

- Water is available from hydrant near the entrance (meter required) or from creek.
- Coordinate with County (Charlie Brushwood) on use of site (location of storage areas and stockpiles).
- JTR will be responsible for returning disturbed areas of the site to at least their original condition and all waste materials must be removed.

Mr. Russell stated that JTR does not plan to have an on-site fuel tank.

H. Safety and First Aid Procedures

Safety was discussed. JTR has an internal safety program. Mr. Workman is JTR's safety officer. JTR conducts routine safety meetings and some employees have first aid and CPR certifications.

Mr. Brushwood noted that there is a defibrillator located in the scale house as well as a first aid kit. Also, Mr. Brushwood requested that JTR employees sign in at the scale house or maintain a list of employees on-site in case of the need to evacuate the site.

Smoking was discussed. No smoking is allowed in buildings and in the vicinity of the active landfill. JTR will designate areas where smoking is allowed.

Lightning hazards were discussed. JTR will use safe practices when lightning is in the area.

I. Security Procedures

Mr. Scheer noted the following:

- JTR is responsible for security when working after landfill hours and the gate must be locked.
- JTR is responsible for securing material and equipment on-site.

J. Pay Requests

Mr. Scheer noted the following:

- Pay requests should be submitted at/near the end of each month to S+G (Attn: Pieter Scheer) (1 original and 2 copies will be acceptable).

Mr. Scheer will forward approved pay requests to Mr. Brushwood.

K. Other Items

Mr. Scheer noted that coordination between S+G, the County, and JTR during the early stages of work will be very important.

Mr. Scheer noted that notification of S+G and the County is required prior to any overexcavation/backfill (if required) activities such that quantities can be agreed upon.

L. Next Meeting

Project meetings will be held monthly during active construction. The next meeting was set for Tuesday October 29th at 11 a.m.

Attachment: Attendee List

cc: Distribution:
Rex Buck, Davidson County
Charlie Brushwood, Davidson County
Steven Sink, Davidson County
Nathan Russell, J.T. Russell & Sons
Michelle Brown, LMC
John Fearrington, S+G
Mike Smith, Geotechnics
John Murray, NC DWM
Hugh Jernigan, NC DWM

PRE-CONSTRUCTION MEETING

ATTENDEES

NAME	COMPANY/AGENCY	PHONE	EMAIL
Pieter Scheer	Smith Gardner, Inc. (S+G)	(919) 828-0577 (office) (919) 815-9377 (cell)	pieter@smithgardnerinc.com
John Fearrington	S+G	(919) 828-0577 (office)	johnf@smithgardnerinc.com
Michelle Brown	LMC (Sub to J.T. Russell)	(916) 834-6532	Michellembrown@aol.com
Charlie Brushwood	Davidson County	(336) 240-0303 (cell)	
Steven Sink	Davidson County	(336) 240-0666 (cell)	
Ben Casselman	Lee Supply (Sub to J.T. Russell)	(803) 476-7348	bcasselman@leesupply.com
Chuck Workman	J.T. Russell & Sons, Inc.	(704) 982-2225	jtr@jtrussellandsons.com
Andre Stein	GUNNCO Pump & Control (Sub to J.T. Russell)	(404) 791-7587 (cell)	andre@gunnco.com
Scott Perugia	Chesapeake Containment Systems (Sub to J.T. Russell)	(410) 335-5886	sperugia@ccsliners.com
Mac Taylor	TEC Industrial, LLC. (Sub to J.T. Russell)	(276) 734-1804	MTaylor@Tecindustrial.biz
Kevin Varner	Wright & Fields Land Surveying (Sub to J.T. Russell)	(910) 572-2449	

NAME	COMPANY/AGENCY	PHONE	EMAIL
Thomas J. (Tommy) Fields	Wright & Fields Land Surveying (Sub to J.T. Russell)	(910) 572-2449 (office) (910) 995-4320 (cell)	Tfields1256@embarqmail.com
Nathan Russell	J.T. Russell & Sons, Inc.	(704) 982-2225 (office) (704) 986-2270 (fax) (704) 984-1650 (cell)	nathanrussell@jtrussellandsons.com
Rex Buck	Davidson County	(336) 242-2007	

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MEMORANDUM

Date:	November 12, 2013
To:	Distribution and Meeting Attendees
From:	Pieter K. Scheer, P.E. Smith Gardner, Inc.
RE:	**Davidson County MSWLF – Phase 2 Area 2 Cell 1** **Construction & Soil Liner Meeting Summary**

Attendees: See attached list.

Meeting Summary:

A construction meeting was held Tuesday October 29th at the site to discuss the construction of Phase 2 Area 2 Cell 1 of the Davidson County Municipal Solid Waste (MSW) Landfill. Also included was a discussion of the specification and construction quality assurance (CQA) requirements for the soil liner component of the liner system. The meeting began at 11:00 a.m. and was followed by a site walk through. During the meeting, the following items were discussed:

Current Progress:

Currently, J.T. Russell & Sons (JTR) is performing earthwork activities including overexcavation and backfill of the low (northwest) end of Cell 1 and excavation and structural fill placement in other areas. Mr. Scheer noted that overexcavation and backfill quantities will exceed the contract quantity as some unexpected wood waste (tree trunks and limbs) and organic material has been encountered below the subgrade and requires removal. Mr. Brushwood believed these materials likely were buried prior to the County taking ownership of the property. Measurements of the overexcavation are being made as the excavation progresses to determine a final quantity for payment.

In excavating to subgrade elevations, JTR has encountered rock in the north end of the project area, along the southern berm, and some smaller areas within the eastern side of the project area. JTR will continue to remove rippable material as feasible prior to drilling and blasting the remaining rock.

Planned Activities:

JTR reviewed their construction schedule (see **attached**).

In addition to continuing earthwork activities, well abandonment is planned for later this week. Madeline German, a geologist with S+G will observe this activity. Also later this week,

JTR plans to mobilize a rock drill to quantify the rock and to prepare for blasting. S+G and/or Geotechnics will observe this activity. The need for a blasting plan to obtain the required approvals was discussed.

JTR plans to begin the soil liner installation next week with the construction of a test fill around November 6th.

Submittals:

To date, submittals for HDPE Piping and electrical items have been submitted for review by S+G. The HDPE piping submittal has been approved. JTR anticipates submitting information on geosynthetic materials soon.

JTR will prepare a rock blasting submittal ASAP for approval by S+G and the NC DENR Division of Waste Management. Mr. Murray stated that Brian Wootton will review.

Other Items:

Interface shear strength testing was discussed. Cheasapeake Containment is set to have this work performed upon approval of the geosynthetic materials.

Soil Liner Meeting:

Mr. Scheer reviewed the requirements for the soil liner component of the liner system using the **attached** agenda.

Next Meeting

Subsequent to the meeting, the next meeting was re-scheduled for Wednesday November 20th at 11 a.m.

Attachment: Attendee List
JTR Construction Schedule
Soil Liner Meeting Agenda

cc: Distribution:

Rex Buck, Davidson County
Charlie Brushwood, Davidson County
Steven Sink, Davidson County
Nathan Russell, J.T. Russell & Sons
Spencer Walker, J.T. Russell & Sons
Michelle Brown, LMC
John Fearrington, S+G
Mike Smith, Geotechnics
David Wright, Geotechnics
John Murray, NC DWM
Hugh Jernigan, NC DWM

CONSTRUCTION MEETING
ATTENDEES

NAME	COMPANY/AGENCY	PHONE	EMAIL
Pieter Scheer	Smith Gardner, Inc. (S+G)	(919) 828-0577 (office) (919) 815-9377 (cell)	pieter@smithgardnerinc.com
Spencer Walker	J.T. Russell & Sons	(704) 985-2674 (cell)	swalker@jtrussellandsons.com
David Wright	Geotechnics	(910) 818-2459 (cell)	dwright@geotechnics.net
Chuck Workman	J.T. Russell & Sons	(919) 961-7933 (cell)	cworkman@jtrussellandsons.com
Michelle Brown	LMS/JTR	(916) 834-6532 (cell)	michellembrown@aol.com
John Murray	NC DENR DWM	(704) 235-2163	john.murray@ncdenr.gov
Steven Sink	Davidson County	(336) 240-0666 (cell)	
Charlie Brushwood	Davidson County	(336) 240-0303 (cell)	
Rex Buck	Davidson County	(336) 242-2007	
Nathan Russell	J.T. Russell & Sons	(704) 982-2225 (office) (704) 984-1650 (cell)	nathan@jtrussellandsons.com

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SOIL LINER MEETING
AGENDA

1. Review of Specification Requirements (Tech. Specification Section 02250)

Test Fill Construction:

- Tentative location/Timeframe
- Record survey of test fill subgrade (if in cell)
- Size: 20' x 50' Min.
- Depth: 3 - 6" compacted lifts
- Same materials and equipment to be used in main construction

Construction of Compacted Soil Liner (CSL):

- Confirmation of test fill must be complete before beginning
- Subgrade preparation and proof-roll
- Loose CSL placed in max. thickness of compaction feet (or penetration depth) (first lift placed thicker to avoid subgrade contamination - o.k.)
- Clod size: $\leq$ 3/4 inches (may require breakdown prior to compaction)
- Rock fragments: 1.5" below finished CSL surface; 0.5" in finished CSL surface
- Compaction Requirements: $\geq$ 95% Std. Proctor; $\geq$ optimum moisture content; k $\leq$ 1 x 10^{-5} cm/sec; 18" min. finished thickness (0.15 foot overbuild allowed)
- Protection of CSL from rain and desiccation (i.e. overbuild and smooth drum roll)
- Scarify surface prior to placement of subsequent lifts or prior to moisture addition if material is determined to be too dry
- Holes in CSL - patch with compacted CSL or sodium bentonite compacted and hydrated
- Surveying: Verify thickness and slope of CSL using survey grid (from surveyor)

2. Review of CQA Requirements (CQA Manual Section 4.0)

Performance of Control Tests on CSL material (Testing Underway)

Approval of CSL subgrade (visual and review of survey information)

CQA Testing:

- CQA testing in accordance with CQA Manual
- Timeframe for turnaround of CQA tests (typ. 2 to 3 days for preliminary hydraulic conductivity test results)

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MEMORANDUM

Date:	February 11, 2014
To:	Distribution and Meeting Attendees
From:	Pieter K. Scheer, P.E. Smith Gardner, Inc.
RE:	**Davidson County MSWLF – Phase 2 Area 2 Cell 1** **Construction Meeting Summary - January 9, 2014**

Attendees: See **attached** list.

Meeting Summary:

A construction meeting was held Thursday January 9th at the site to discuss the construction of Phase 2 Area 2 Cell 1 of the Davidson County Municipal Solid Waste (MSW) Landfill. The meeting began at 11:00 a.m. and was followed by a geosynthetics CQA meeting and a site walk through. During the meeting, the following items were discussed:

Current Progress:

Currently, J.T. Russell & Sons (JTR) is performing earthwork activities, including excavation of soil and rock, structural fill placement, and soil liner placement. Installation of the culverts and drop inlets has begun and is on-going. The delivery of geosynthetics is on-going and materials are being stacked and covered as needed for protection.

Three lifts of soil liner have been completed in the southern portion of the cell and two lifts of soil liner in the remaining area, except for the north end where excavation is still on-going. Passing hydraulic conductivity test results have been achieved.

Rainfall and cold conditions at the site over the past few weeks has slowed progress on the soil liner but work has continued with rock removal, earthwork activities, and culvert/drop inlet installation.

Planned Activities:

JTR will continue excavation of the northeast portion of the cell to bring the area to subgrade elevations. Soil liner work will continue as conditions allow. With good weather, the soil liner can be finished in approximately 2 weeks. The delivery of geosynthetics will continue and the delivery of HDPE pipe is anticipated soon. The geosynthetics subcontractor (Chesapeake Containment) is ready to mobilize as the soil liner nears completion.

Submittals:

JTR has provided the pumps and controls (GunnCo) submittal and S+G has forwarded to Herman Thio, P.E. for his review of electrical components.

Other Items:

JTR has provided quantities for both rock and overexcavation and backfill quantities. S+G is reviewing the data. Seismograph reports are being supplied by JTR for review.

An updated schedule was provided by JTR (**attached**) and was discussed.

The group discussed a potential contingency plan should weather conditions continue to postpone planned construction activities and should the available airspace become limited. In this event, Cell 1A would need to be completed (operational with sump/pumps in place) and certified as soon as possible. Further discussion is planned at the next construction meeting.

Geosynthetics CQA Meeting:

After the completion of the construction meeting a geosynthetics CQA meeting was conducted. Mr. Scheer reviewed specification and CQA requirements for the geosynthetic components based on the **attached** agenda.

Currently GCL, geomembrane, and geotextiles are being shipped and stored on site. Chesapeake requested that JTR store the Type GT-S and Type GT-C geotextiles separately. The drainage geocomposite has yet to be shipped to the site.

Wright & Fields will provide the as-built drawing for the geomembrane which will include the location of the following: (1) location and numbering of all panels/seams; (2) location of all repairs/patches; and (3) location of all destructive test locations.

Chesapeake noted intends to use a wedge welder for seaming geotextiles and drainage geocomposite as long as conditions allow.

The coordination of paint colors used for marking information on the liner system was discussed. Chesapeake plans to use orange or white and S+G/Wright & Fields will use different colors.

Next Meeting:

Subsequent to the meeting, the next construction meeting was re-scheduled for <u>Friday February 21st at 11 a.m.</u> due to anticipated weather conditions.

Attachments: Attendee List
JTR Construction Schedule (Updated)
Geosynthetics CQA Meeting - Agenda

cc: Distribution:

Rex Buck, Davidson County
Charlie Brushwood, Davidson County
Steven Sink, Davidson County
Nathan Russell, J.T. Russell & Sons
Spencer Walker, J.T. Russell & Sons
Michelle Brown, LMC
John Fearrington, S+G
Mike Smith, Geotechnics
Jacob Buda, Geotechnics
John Murray, NC DWM
Hugh Jernigan, NC DWM

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CONSTRUCTION MEETING
ATTENDEES

NAME	COMPANY/AGENCY	PHONE	EMAIL
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John Fearrington	Smith Gardner, Inc.	(919) 828-0577 (office) (919) 980-0515 (cell)	johnf@smithgardnerinc.com
Joan Smyth	S+G	(919) 828-0577	joan@smithgardnerinc.com
Rex Buck	Davidson County	(336) 242-2008	rex.buck@davidsoncountync.gov
Charlie Brushwood	Davidson County	(336) 240-0303 (cell)	charlie.brushwood@davidsoncountync.gov
Steven Sink	Davidson County	(336) 240-0666 (cell)	steven.sink@davidsoncountync.gov
Nathan Russell	J.T. Russell & Sons	(704) 982-2225 (office) (704) 984-1650 (cell)	nathan@jtrussellandsons.com
Spencer Walker	J.T. Russell & Sons	(704) 985-2674 (cell)	swalker@jtrussellandsons.com
Chuck Workman	J.T. Russell & Sons	(919) 961-7933 (cell)	cworkman@jtrussellandsons.com
Michelle Brown	LMC/JTR	(916) 834-6532 (cell)	michellembrown@aol.com
Scott Perugia	Chesapeake Containment Systems (CCS)	(410) 335-5886	sperugia@ccsliners.com
Ryan Clark	CCS	(410) 913-3390	rclark@ccsliners.com
David Wright	Geotechnics	(910) 818-2459 (cell)	dwright@geotechnics.net

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GEOSYNTHETICS CQA MEETING
AGENDA

1. Status of Approvals

Material	CQA Status
Soil Liner	• Placement on-going • Test Results successful to-date
Geosynthetic Clay Liner (GCL)	• CETCO Bentomat SDN passed material testing • 135 Rolls On-Site (1/9/14)
60 mil Textured HDPE Geomembrane	• Agru Microspike passed material testing • 31 Rolls On-Site (1/9/14)
Drainage Geocomposite	• SKAPS Transnet passed material testing • No Rolls On-Site (1/9/14)
Geotextiles	• Type GT-S and Type GT-C geotextiles (SKAPS) passed material testing • 24 Rolls On-Site (1/9/14)

2. **Anticipated Delivery Schedule:** On-Going

3. Review of Specification Requirements

<u>Geomembrane (Technical Specification Section 02775):</u>

- Installation in accordance with specifications and approved procedures.

- Chesapeake to provide the following:
  - Trial seam log
  - Panel/Seam log
  - Non-destructive testing (vacuum/air pressure tests) log
  - Destructive sampling log
  - Repair log

  Provide copies of the above forms to S+G at least weekly for review.

- <u>Record Information:</u>

  Per Paragraphs C.2.c. and D.8 of Section 02775, the following information is

required for the geomembrane:

CQC Documentation: Final logs as listed above.

As-Built Drawing:

(1) Location and numbering of all panels/seams;
(2) Location of all repairs/patches;
(3) Location of all destructive test locations; and
(4) Location of all pipe penetrations and other appurtenances (if applicable).

Survey information needs to be obtained/reviewed prior to placement of overlying materials.

GCL (Technical Specification Section 02776):

- Installation in accordance with specifications and approved installation procedures.
- Install GCL with dark side up (against 60 mil HDPE geomembrane) (white side down).
- 6" min. overlap on roll edges and 12" min. along roll ends with 0.25 lbs/LF bentonite (No bentonite is required on roll edges with "Supergroove" system.).
- No horizontal (end) seams on 3H:1V slopes (horizontal seams shall be kept to a minimum on all slopes $\geq$ 6H:1V).
- Shingle all GCL seams (upper panel over lower panel).
- Cover GCL with geomembrane in timely manner (especially when rain is forecast).

Drainage Geocomposite (Technical Specification Section 02712):

- Installation in accordance with specifications and approved installation procedures.
- 3" overlap of geonet drainage core on roll edges and 6" along roll ends. Ties every 5' along roll edges; every 12" along roll ends; every 6" in the anchor trench.
- Chesapeake plan for seaming geotextile component?: (Wedge Weld)

Geotextiles (Tech. Specification Section 02240):

- Installation in accordance with specifications and approved installation procedures.

- Chesapeake plan for seaming geotextiles?: (Wedge Weld)

4. Review of CQA Requirements (CQA Manual Sections 5.0 through 9.0)

Conformance Testing of Geosynthetics Materials:

- See Status of Approvals above.

Geomembrane:

- Marking on liner for panel identification, sampling, repairs, etc. (Chesapeake/S+G/Surveyor) (Chesapeake to use Orange and White)
- Field tensiometer provided by Chesapeake - should have recent calibration data
- Trial seam procedures in accordance with Section 5.3.5.1 (Chesapeake to document) (Note: minimum of four coupons (2 peel/2 shear))
- Non-Destructive Testing: Vacuum or air pressure testing to be done continuously by Chesapeake on all seams in accordance with Section 5.3.6.1
- Destructive Testing: Samples to be cut and tested at minimum one per 500 LF of weld in accordance with Section 5.3.6.2. (Chesapeake to document) (Note: minimum of six coupons (3 peel/3 shear)). Samples also to be sent to CQA laboratory (Geotechnics) (Typical 1 day turnaround on test results).
- Repairs and Verification: In accordance with Section 5.3.7

4. Review of Project Drawings

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Appendix G

Earthwork CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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STRUCTURAL FILL
CONTROL TEST SUMMARY

Project Name: Davidson County MSW Landfill - Phase 2 - Area 2 - Cell 1 Construction
Project Number: DAVDCO-12-3
Contractor: JT Russell & Sons

Grain Size Analysis (ASTM D 422) Test Results:

Test Number	+3" (%)	Pass #4 (%)	Pass #200 (%)	Gravel (%)	Sand (%)	Silt/Clay (%)	USCS Classification
SF-01	0.0	97.2	43.8	2.8	53.4	43.8	SC
SF-02	0.0	95.1	52.9	4.9	42.2	52.9	CL

Atterberg Limits (ASTM D 4318) Test Results:

Test Number	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Classification
SF-01	55	27	28	SC
SF-02	39	20	19	CL

Moisture-Density Relationship (ASTM D 698) Test Results:

Test Number	Optimum Water Content (%)	Maximum Dry Density (pcf)
SF-01	28.4	97.4
SF-02	15.8	111.5

Number of Tests Performed:

Grain Size Analysis:	2
Atterberg Limits:	2
Moisture Density Relationship:	2

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MOISTURE CONTENT

ASTM D 2216-10

Client	SMITH + GARDNER, INC.
Client Reference	DAVIDSON CO. LF
Project No.	2013-763-01

Lab ID	.001	.002	.003
Boring No.	NA	NA	NA
Depth (ft)	NA	NA	NA
Sample No.	SF-01	SF-02	CSL-01
Tare Number	307	312	398
Wt. of Tare & WS (gm)	662.29	637.85	582
Wt. of Tare & DS (gm)	523.02	565.58	445.37
Wt. of Tare (gm)	109.56	84.09	83.92
Wt. of Water (gm)	139.27	72.27	136.63
Wt. of DS (gm)	413.46	481.49	361.45
Water Content (%)	**33.7**	**15.0**	**37.8**

Notes : *NA*

Tested By *CTR* *Date* *10/24/13* *Checked By* GEM *Date* 11-12-13

DCN: CT-S1 DATE 6-30-98 REVISION: 2

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ATTERBERG LIMITS

ASTM D 4318-10

Client	SMITH & GARDNER	Boring No.	N/A
Client Reference	DAVIDSON CO. LF.	Depth (ft)	N/A
Project No.	2013-763-01	Sample No.	SF-01
Lab ID	2013-763-01-01	Soil Description	**LIGHT BROWN FAT CLAY**

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)

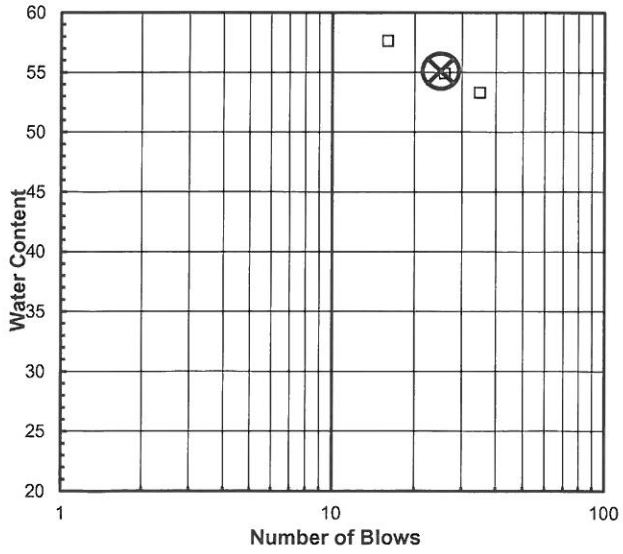
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	J	V	S	MULTIPOINT
Wt. of Tare & WS (gm)	28.37	29.44	28.15	
Wt. of Tare & DS (gm)	23.79	24.43	23.41	
Wt. of Tare (gm)	15.19	15.30	15.18	
Wt. of Water (gm)	4.6	5.0	4.7	
Wt. of DS (gm)	8.6	9.1	8.2	
Moisture Content (%)	**53.3**	**54.9**	**57.6**	
Number of Blows	**35**	**26**	**16**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	X-9	B	
Wt. of Tare & WS (gm)	22.52	23.91	
Wt. of Tare & DS (gm)	21.12	22.02	
Wt. of Tare (gm)	15.78	15.19	
Wt. of Water (gm)	1.4	1.9	
Wt. of DS (gm)	5.3	6.8	
Moisture Content (%)	**26.2**	**27.7**	**-1.5**

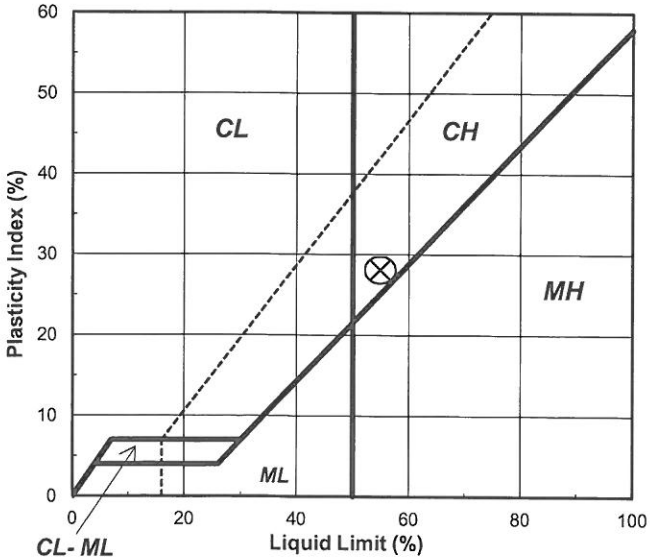
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**55**
Plastic Limit (%)	**27**
Plasticity Index (%)	**28**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



Tested By SS *Date* 10/28/13 *Checked By* MBS *Date* 10/29/13

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ATTERBERG LIMITS

ASTM D 4318-10

Client	SMITH & GARDNER	Boring No.	N/A
Client Reference	DAVIDSON CO. LF.	Depth (ft)	N/A
Project No.	2013-763-01	Sample No.	SF-02
Lab ID	2013-763-01-02	Soil Description	**RED/BROWN LEAN CLAY**

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)

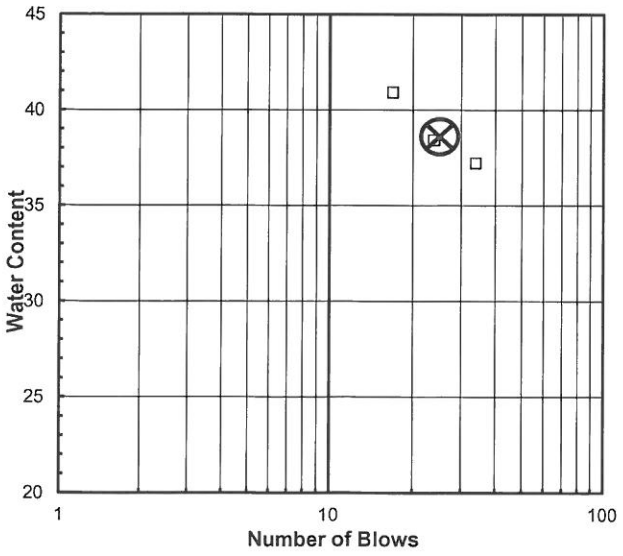
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	U	I	E	MULTIPOINT
Wt. of Tare & WS (gm)	34.15	33.19	37.95	
Wt. of Tare & DS (gm)	29.01	28.21	31.38	
Wt. of Tare (gm)	15.19	15.24	15.31	
Wt. of Water (gm)	5.1	5.0	6.6	
Wt. of DS (gm)	13.8	13.0	16.1	
Moisture Content (%)	**37.2**	**38.4**	**40.9**	
Number of Blows	**34**	**24**	**17**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	4M	2M	
Wt. of Tare & WS (gm)	24.40	24.82	
Wt. of Tare & DS (gm)	22.97	23.30	
Wt. of Tare (gm)	15.60	15.62	
Wt. of Water (gm)	1.4	1.5	
Wt. of DS (gm)	7.4	7.7	
Moisture Content (%)	**19.4**	**19.8**	**-0.4**

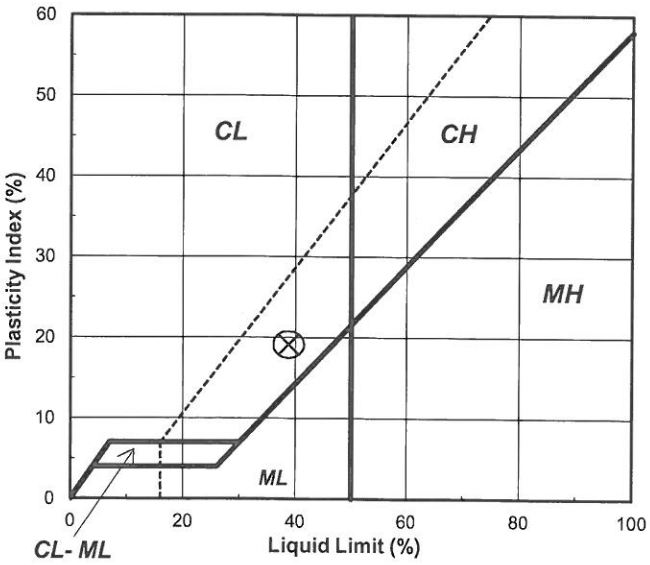
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**39**
Plastic Limit (%)	**20**
Plasticity Index (%)	**19**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By CG *Date* 10/24/13 *Checked By* MBS *Date* 10-29-13

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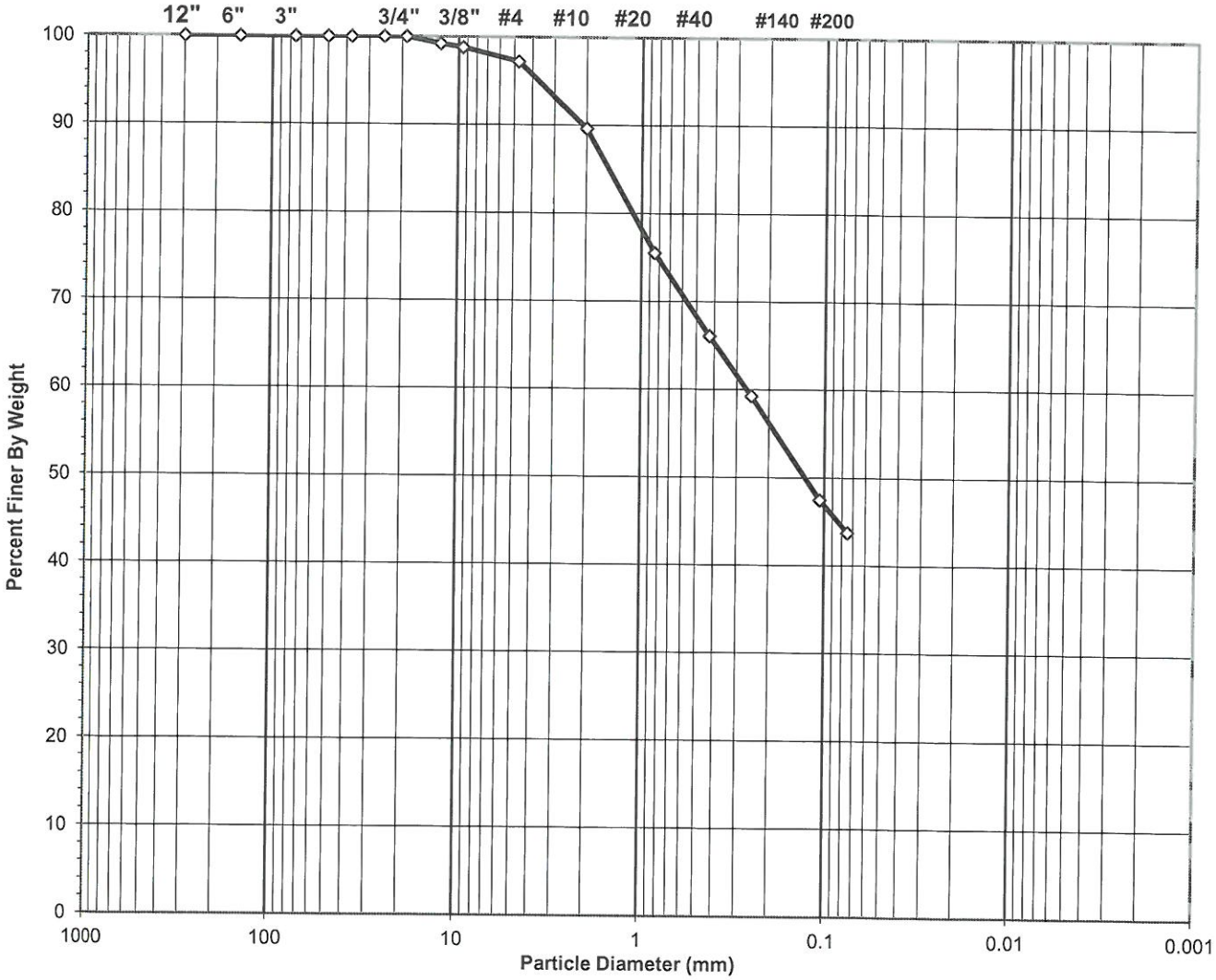
SIEVE ANALYSIS
ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-01
Lab ID	2013-763-01-01	Soil Color	**LT BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By SS Date 10/25/13 Checked By MBS Date 10-29-13

DCN: CT-S3C DATE: 6/25/08 REV: 10 R62 *SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-01-01 SIEVON REV 4 wHeader.XLS]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-01
Lab ID	2013-763-01-01	Soil Color	**LT BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	209	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	654.45	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	591.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	171.66	Weight of Tare (gm)	NA
Weight of Water (gm)	62.75	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	420.04	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**14.9**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	420.04
Dry Weight - 3/4" Sample (gm)	236.2	Weight of minus #200 material (gm)	183.80
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	236.24
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	3.22	0.8	0.8	99.2	**99.2**
3/8"	9.50	1.75	0.4	1.2	98.8	**98.8**
#4	4.75	6.67	1.6	2.8	97.2	**97.2**
#10	2.00	31.88	7.6	10.4	89.6	**89.6**
#20	0.850	59.30	14.1	24.5	75.5	**75.5**
#40	0.425	39.58	9.4	33.9	66.1	**66.1**
#60	0.250	28.61	6.8	40.7	59.3	**59.3**
#140	0.106	49.51	11.8	52.5	47.5	**47.5**
#200	0.075	15.72	3.7	56.2	43.8	**43.8**
Pan	-	183.80	43.8	100.0	-	-

Tested By SS Date 10/25/13 Checked By MBS Date 10-29-13

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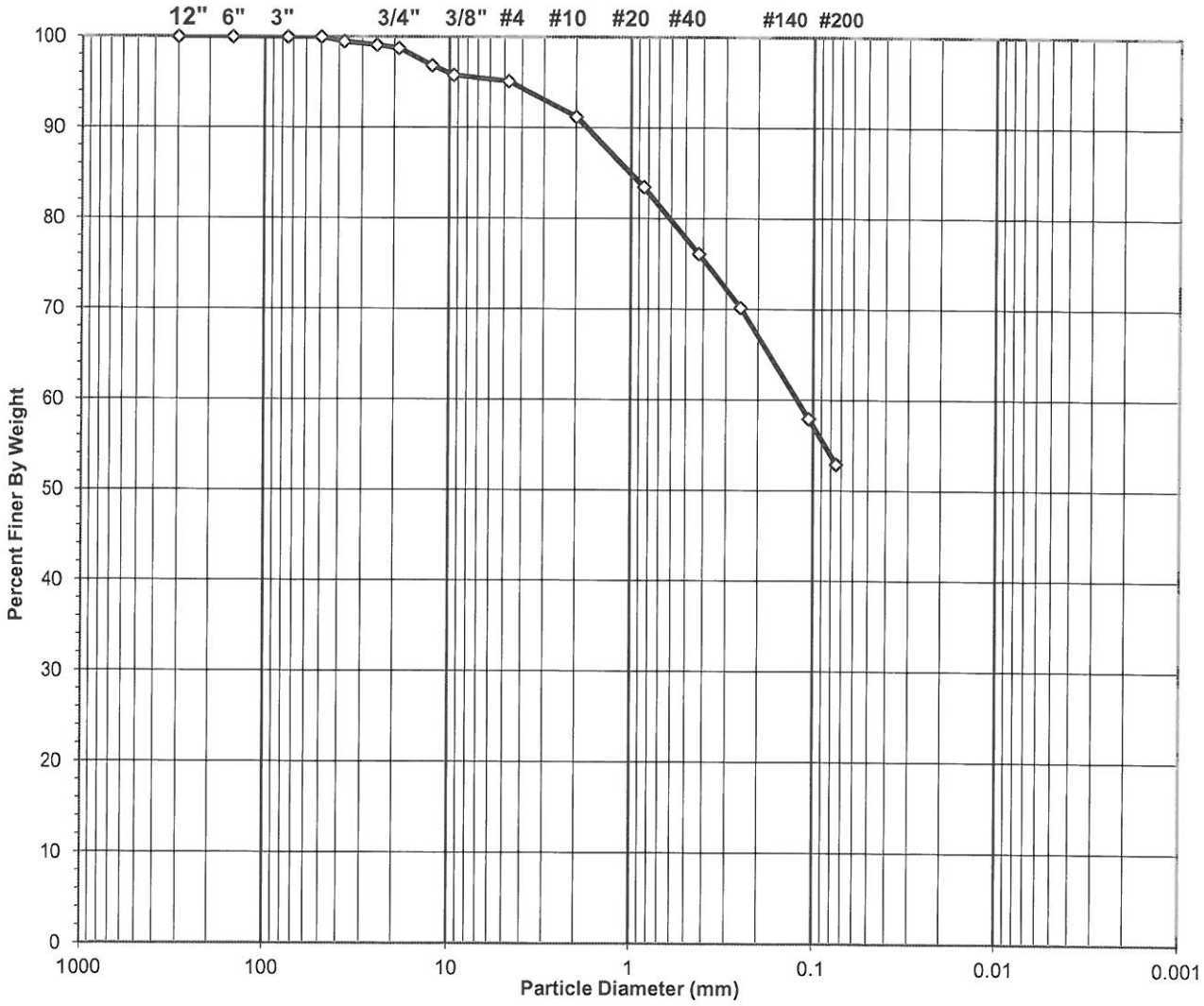
SIEVE ANALYSIS
ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-02
Lab ID	2013-763-01-02	Soil Color	**RED/BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***SANDY LEAN CLAY***

Tested By SS Date 10/21/13 Checked By MBS Date 10-29-13

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-02
Lab ID	2013-763-01-02	Soil Color	**RED/BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	167	Tare No.	311
Wgt.Tare + Wet Specimen (gm)	1388.42	Wgt.Tare + Wet Specimen (gm)	340.20
Wgt.Tare + Dry Specimen (gm)	1244.07	Wgt.Tare + Dry Specimen (gm)	333.76
Weight of Tare (gm)	238.85	Weight of Tare (gm)	84.28
Weight of Water (gm)	144.35	Weight of Water (gm)	6.44
Weight of Dry Soil (gm)	1005.22	Weight of Dry Soil (gm)	249.48
Moisture Content (%)	**14.4**	**Moisture Content (%)**	**2.6**

Wet Weight -3/4" Sample (gm)	19144	Weight of the Dry Specimen (gm)	1005.22
Dry Weight - 3/4" Sample (gm)	16740.1	Weight of minus #200 material (gm)	538.63
Wet Weight +3/4" Sample (gm)	215.55	Weight of plus #200 material (gm)	466.59
Dry Weight + 3/4" Sample (gm)	210.13		
Total Dry Weight Sample (gm)	16950.2	**J - Factor (Percent Finer than 3/4")**	**0.9876**

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	88.96		0.5	0.5	99.5	**99.5**
1"	25	65.95		0.4	0.9	99.1	**99.1**
3/4"	19	60.64		0.3	1.2	98.8	**98.8**
1/2"	12.5	19.25		1.9	1.9	98.1	**96.9**
3/8"	9.5	10.69		1.1	3.0	97.0	**95.8**
#4	4.75	7.14		0.7	3.7	96.3	**95.1**
#10	2	39.63		3.9	7.6	92.4	**91.2**
#20	0.85	78.80	(**)	7.8	15.5	84.5	**83.5**
#40	0.425	74.83		7.4	22.9	77.1	**76.1**
#60	0.25	60.51		6.0	28.9	71.1	**70.2**
#140	0.106	124.51		12.4	41.3	58.7	**58.0**
#200	0.075	51.23		5.1	46.4	53.6	**52.9**
Pan	-	538.63		53.6	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 SS Date 10/21/13 Checked By MBS Date 10-29-13

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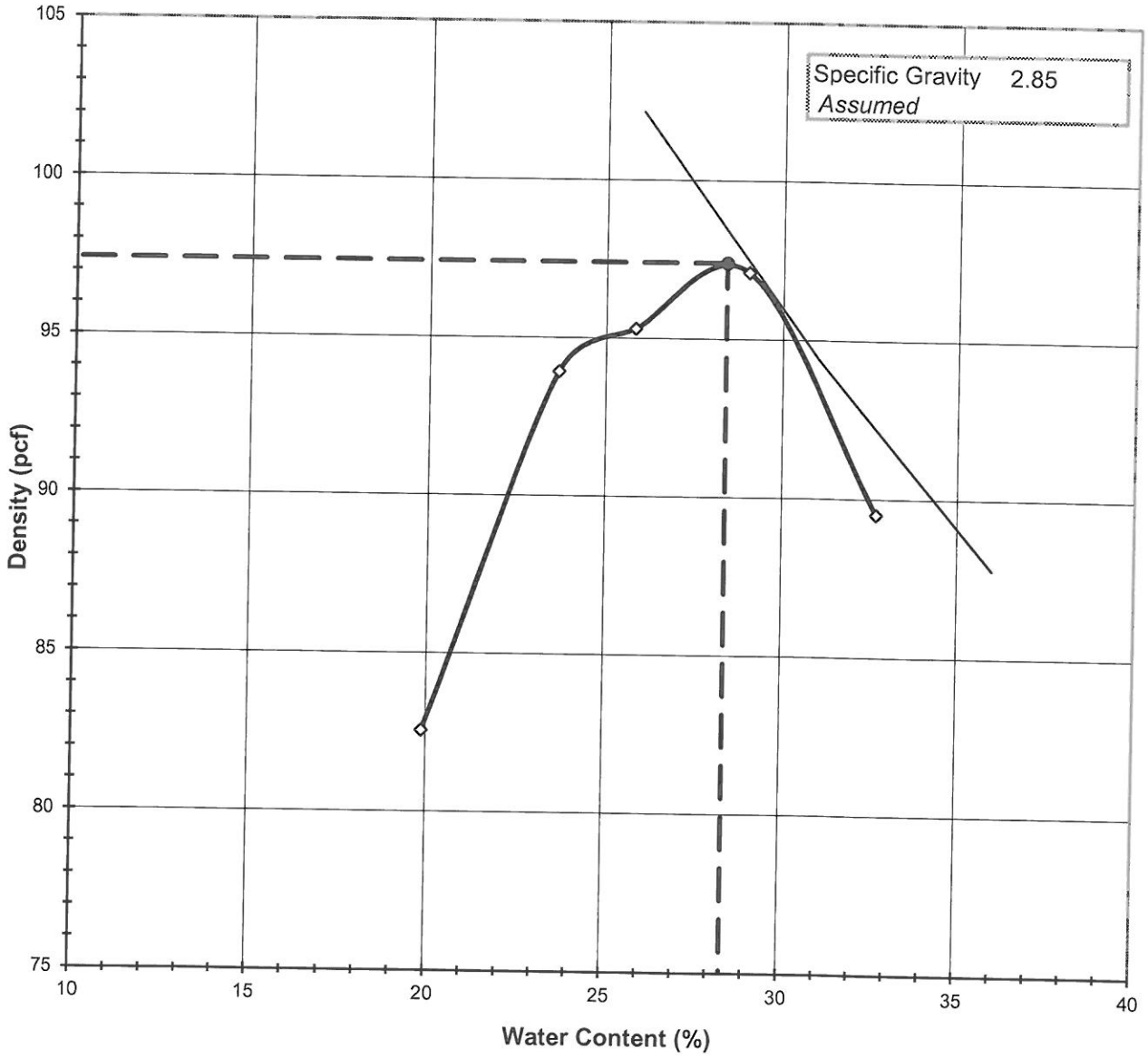
MOISTURE DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-01
Lab ID	2013-763-01-01	Test Method	**STANDARD**

Visual Description LIGHT BROWN CLAYEY SAND

Optimum Water Content **28.4**
Maximum Dry Density **97.4**



Tested By CTR *Date* 10/25/13 *Checked By* MKS *Date* 11-8-13

DCN:CT-S12 DATE:12/12/00 REV:3/06/15 [2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL IV]2013-763-01-01 Proctor wHeaders.xls]Sheet1

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MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-01
Lab ID	2013-763-01-01		

Visual Description LIGHT BROWN CLAYEY SAND

Total Weight of the Sample (gm)	17850
As Received Water Content(%)	NA
Assumed Specific Gravity	2.85
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		**STANDARD**
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	461
Mold diameter		4"
Weight of the Mold		4194
Volume of the Mold(cc)		937

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & WS (gm)	5681	5939	5995	6076	5978
Wt.of Mold (gm)	4194	4194	4194	4194	4194
Wt. of WS	1487	1745	1801	1882	1784
Mold Volume (cc)	937	937	937	937	937

Moisture Content / Density

Tare Number	304	368	300	398	311
Wt. of Tare & WS (gm)	648.98	545.17	586.83	294.20	297.55
Wt. of Tare & DS (gm)	559.68	462.05	489.06	246.87	244.98
Wt. of Tare (gm)	110.51	110.95	110.51	83.80	84.18
Wt. of Water (gm)	89.30	83.12	97.77	47.33	52.57
Wt. of DS (gm)	449.17	351.10	378.55	163.07	160.80

Wet Density (gm/cc)	1.59	1.86	1.92	2.01	1.90
Wet Density (pcf)	99.0	116.2	119.9	125.3	118.8
Moisture Content (%)	**19.9**	**23.7**	**25.8**	**29.0**	**32.7**
Dry Density (pcf)	**82.6**	**93.9**	**95.3**	**97.1**	**89.5**

Zero Air Voids

Moisture Content (%)	26.0	31.0	36.0
Dry Unit Weight (pcf)	102.1	94.4	87.8

Tested By *CTR* *Date* *10/25/13* *Checked By* *Date*

DCN:CT-S12 DATE:12/7/2010 REVISION:5 [2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL IV]2013-763-01-01 Proctor wHeaders.xls]Sheet1

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INTEGRITY IN TESTING

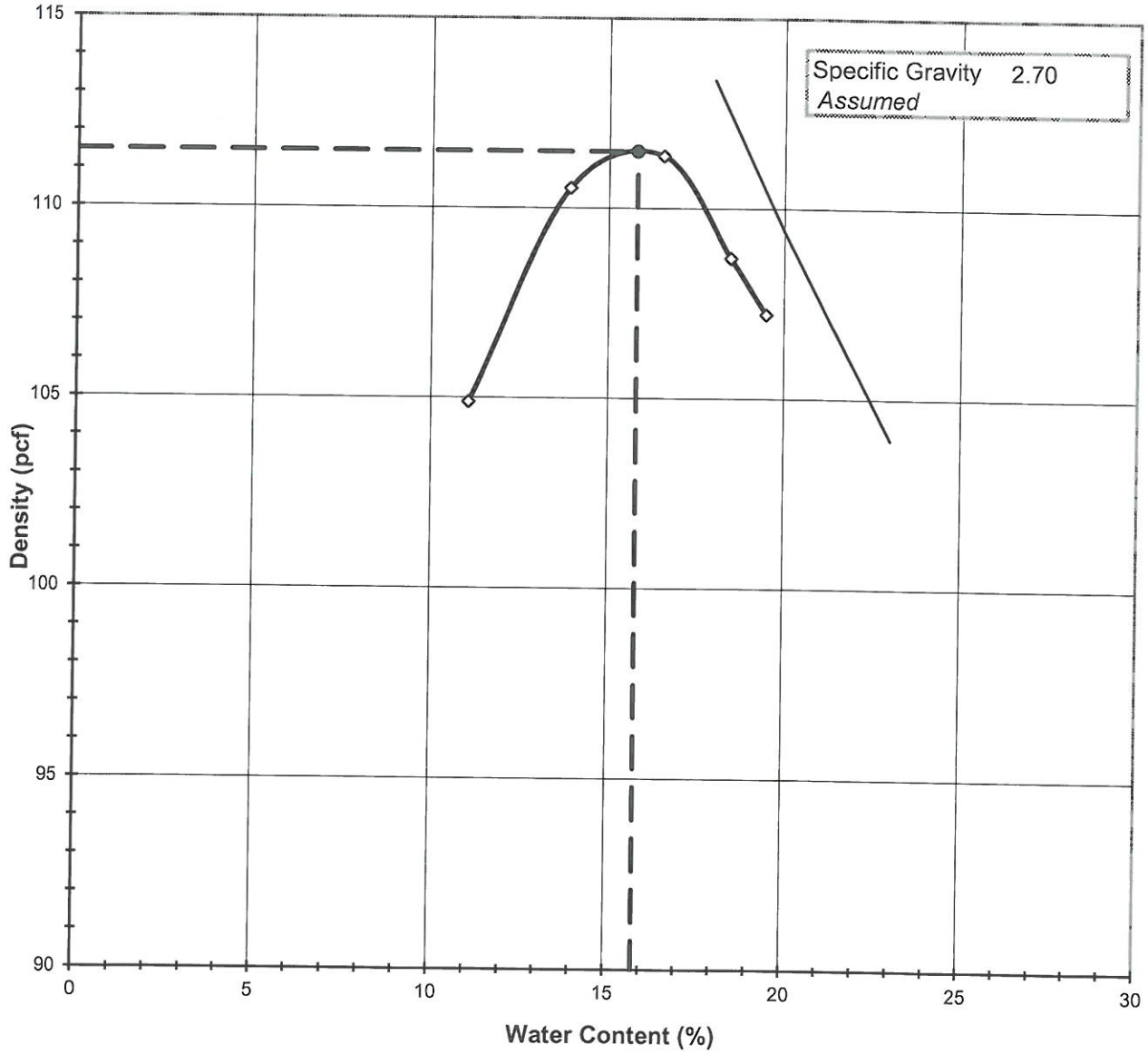
MOISTURE DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-02
Lab ID	2013-763-01-02	Test Method	**STANDARD**

Visual Description RED BROWN SANDY LEAN CLAY

Optimum Water Content **15.8**
Maximum Dry Density **111.5**



Tested By *CTR* *Date* *10/17/13* *Checked By* GEM *Date* 10-31-13

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INTEGRITY IN TESTING

MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	SF-02
Lab ID	2013-763-01-02		

Visual Description: RED BROWN SANDY LEAN CLAY

Total Weight of the Sample (gm)	19400
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	B

TestType		**STANDARD**
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	461
Mold diameter		4"
Weight of the Mold		4194
Volume of the Mold(cc)		937

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & WS (gm)	5944	6085	6144	6129	6119
Wt.of Mold (gm)	4194	4194	4194	4194	4194
Wt. of WS	1750	1891	1950	1935	1925
Mold Volume (cc)	937	937	937	937	937

Moisture Content / Density

Tare Number	818	307	820	825	822
Wt. of Tare & WS (gm)	508.90	666.93	589.20	422.90	366.00
Wt. of Tare & DS (gm)	471.96	598.87	524.51	378.34	328.86
Wt. of Tare (gm)	137.98	109.61	133.73	137.18	138.33
Wt. of Water (gm)	36.94	68.06	64.69	44.56	37.14
Wt. of DS (gm)	333.98	489.26	390.78	241.16	190.53

Wet Density (gm/cc)	1.87	2.02	2.08	2.06	2.05
Wet Density (pcf)	116.5	125.9	129.8	128.8	128.1
Moisture Content (%)	**11.1**	**13.9**	**16.6**	**18.5**	**19.5**
Dry Density (pcf)	**104.9**	**110.5**	**111.4**	**108.7**	**107.2**

Zero Air Voids

Moisture Content (%)	18.0	20.0	23.0
Dry Unit Weight (pcf)	113.4	109.4	103.9

Tested By CTR *Date* 10/17/13 *Checked By* GEM *Date* 10-31-13

DCN:CT-S12 DATE:12/2/2010 REVISION:5 2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL IV 2013-763-01-02 Proctor wHeaders.xls]Sheet1

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **FDR-01**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **10.23.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 815 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.	
SFND 1	S. Berm	Lift 1	6"	763-01-01	97.4	28.4	**120.4**	**24.2**	**96.9**	**99.5%**	**95.0%**	
SFND 2	S. Berm	Lift 2	6"	763-01-01	97.4	28.4	**119.7**	**26.4**	**94.7**	**97.2%**	**95.0%**	
SFND 3	S. Berm	Lift 3	6"	763-01-01	97.4	28.4	**118.2**	**23.9**	**95.4**	**97.9%**	**95.0%**	
SFND 4	S. Berm	Lift 4	6"	763-01-01	97.4	28.4	**119.1**	**24.8**	**95.4**	**98.0%**	**95.0%**	
SFND 5	S. Berm	Lift 5	6"	763-01-01	97.4	28.4	**117.2**	**26.2**	**92.9**	**95.3%**	**95.0%**	1Pt.-1
SFND 6	S. Berm	Lift 6	6"	763-01-01	97.4	28.4	**116.4**	**24.9**	**93.2**	**95.7%**	**95.0%**	DC-1

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	638	2405

Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **FDR-02**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **10.28-11.1.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 815 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.	
SFND	7	Sediment Pond	Lift 1	6"	763-01-02	111.5	15.8	**125.2**	**13.6**	**110.2**	**98.8%**	**95.0%**	
SFND	8	Sediment Pond	Lift 2	6"	763-01-02	111.5	15.8	**126.2**	**14.2**	**110.5**	**99.1%**	**95.0%**	DC-2
SFND	9	Sediment Pond	Lift 1	6"	763-01-02	111.5	15.8	**125.3**	**14.6**	**109.3**	**98.1%**	**95.0%**	1Pt.-2
SFND	10	Sediment Pond	Lift 2	6"	763-01-02	111.5	15.8	**124.6**	**13.5**	**109.8**	**98.5%**	**95.0%**	
SFND	11	S. Berm	Lift 7	6"	763-01-02	111.5	15.8	**125.2**	**12.3**	**111.5**	**100.0%**	**95.0%**	
SFND	12	S. Berm	Lift 8	6"	763-01-02	111.5	15.8	**121.6**	**13.6**	**107.0**	**96.0%**	**95.0%**	
SFND	13	S. Berm	Lift 9	6"	763-01-02	111.5	15.8	**122.5**	**14.4**	**107.1**	**96.0%**	**95.0%**	DC-3
SFND	14	S. Berm	Lift 10	6"	763-01-02	111.5	15.8	**121.8**	**12.9**	**107.9**	**96.8%**	**95.0%**	
SFND	15	S. Berm	Lift 11	6"	763-01-02	111.5	15.8	**125.5**	**14.8**	**109.3**	**98.0%**	**95.0%**	1Pt.-3
SFND	16	S. Berm	Lift 12	6"	763-01-02	111.5	15.8	**124.2**	**13.7**	**109.2**	**98.0%**	**95.0%**	
SFND	17	S. Berm	Lift 13	6"	763-01-01	97.4	28.4	**115.6**	**24.5**	**92.9**	**95.3%**	**95.0%**	DC-4
SFND	18	S. Berm	Lift 14	6"	763-01-01	97.4	28.4	**115.7**	**24.1**	**93.2**	**95.7%**	**95.0%**	
SFND	19	S. Berm	Lift 15	6"	763-01-01	97.4	28.4	**116.9**	**24.8**	**93.7**	**96.2%**	**95.0%**	1Pt.-4
SFND	20	S. Berm	Lift 16	6"	763-01-01	97.4	28.4	**113.7**	**22.7**	**92.7**	**95.1%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	647	2411

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Client: Smith & Gardner
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Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **FDR-03**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **11.12.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 815 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.	
SFND 21	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**123.4**	**12.9**	**109.3**	**98.0%**	**95.0%**	1-pt.05
SFND 22	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**121.8**	**13.8**	**107.0**	**96.0%**	**95.0%**	SFDC-05
SFND 23	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**125.7**	**14.1**	**110.2**	**98.8%**	**95.0%**	
SFND 24	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**126.2**	**13.9**	**110.8**	**99.4%**	**95.0%**	
SFND 25	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**124.9**	**12.4**	**111.1**	**99.7%**	**95.0%**	
SFND 26	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**124.8**	**14.8**	**108.7**	**97.5%**	**95.0%**	
SFND 27	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**126.6**	**15.1**	**110.0**	**98.6%**	**95.0%**	
SFND 28	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**124.2**	**13.5**	**109.4**	**98.1%**	**95.0%**	
SFND 29	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**124.8**	**16.7**	**106.9**	**95.9%**	**95.0%**	
SFND 30	Cell1 Floor	Lift 1	6"	763-01-02	111.5	15.8	**126.7**	**14.3**	**110.8**	**99.4%**	**95.0%**	
SFND 31	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**121.9**	**14.8**	**106.2**	**95.2%**	**95.0%**	1-pt.06
SFND 32	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**125.3**	**12.7**	**111.2**	**99.7%**	**95.0%**	SFDC-06
SFND 33	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**126.4**	**16.0**	**109.0**	**97.7%**	**95.0%**	
SFND 34	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**125.5**	**15.2**	**108.9**	**97.7%**	**95.0%**	
SFND 35	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**127.2**	**15.3**	**110.3**	**98.9%**	**95.0%**	
SFND 36	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**126.1**	**14.3**	**110.3**	**98.9%**	**95.0%**	
SFND 37	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**125.3**	**13.7**	**110.2**	**98.8%**	**95.0%**	
SFND 38	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**124.1**	**14.0**	**108.9**	**97.6%**	**95.0%**	
SFND 39	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**126.2**	**13.9**	**110.8**	**99.4%**	**95.0%**	
SFND 40	Cell1 Floor	Lift 2	6"	763-01-02	111.5	15.8	**124.9**	**12.7**	**110.8**	**99.4%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2354	631

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **FDR-04**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **12.6.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 815 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.	
SFND 41	South Berm	Lift 1	6"	763-01-02	111.5	15.8	**124.5**	**14.6**	**108.6**	**97.4%**	**95.0%**	1-pt.07
SFND 42	South Berm	Lift 2	6"	763-01-02	111.5	15.8	**126.8**	**14.9**	**110.4**	**99.0%**	**95.0%**	SFDC-07
SFND 43	South Berm	Lift 3	6"	763-01-02	111.5	15.8	**124.2**	**15.3**	**107.7**	**96.6%**	**95.0%**	
SFND 44	South Berm	Lift 4	6"	763-01-02	111.5	15.8	**125.2**	**15.9**	**108.0**	**96.9%**	**95.0%**	
SFND 45	South Berm	Lift 5	6"	763-01-02	111.5	15.8	**126.1**	**14.6**	**110.0**	**98.7%**	**95.0%**	
SFND 46	South Berm	Lift 6	6"	763-01-02	111.5	15.8	**125.8**	**16.2**	**108.3**	**97.1%**	**95.0%**	
SFND 47	South Berm	Lift 7	6"	763-01-02	111.5	15.8	**124.2**	**15.4**	**107.6**	**96.5%**	**95.0%**	
SFND 48	South Berm	Lift 8	6"	763-01-02	111.5	15.8	**126.5**	**15.8**	**109.2**	**98.0%**	**95.0%**	
SFND 49	South Berm	Lift 1	6"	763-01-02	111.5	15.8	**124.7**	**16.1**	**107.4**	**96.3%**	**95.0%**	
SFND 50	South Berm	Lift 2	6"	763-01-02	111.5	15.8	**125.6**	**14.6**	**109.6**	**98.3%**	**95.0%**	
SFND 51	South Berm	Lift 3	6"	763-01-02	111.5	15.8	**124.8**	**15.2**	**108.3**	**97.2%**	**95.0%**	1-pt.08
SFND 52	South Berm	Lift 4	6"	763-01-02	111.5	15.8	**126.8**	**16.2**	**109.1**	**97.9%**	**95.0%**	SFDC-08
SFND 53	South Berm	Lift 5	6"	763-01-02	111.5	15.8	**124.6**	**14.8**	**108.5**	**97.3%**	**95.0%**	
SFND 54	South Berm	Lift 6	6"	763-01-02	111.5	15.8	**125.7**	**17.0**	**107.4**	**96.4%**	**95.0%**	
SFND 55	South Berm	Lift 7	6"	763-01-02	111.5	15.8	**126.1**	**16.1**	**108.6**	**97.4%**	**95.0%**	
SFND 56	South Berm	Lift 8	6"	763-01-02	111.5	15.8	**128.2**	**15.8**	**110.7**	**99.3%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2388	638

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **FDR-05**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **12.12.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 815 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.	
SFND 57	South Berm	Lift 1	6"	763-01-02	111.5	15.8	**124.9**	**15.2**	**108.4**	**97.2%**	**95.0%**	1-pt.09
SFND 58	South Berm	Lift 2	6"	763-01-02	111.5	15.8	**126.5**	**15.0**	**110.0**	**98.7%**	**95.0%**	
SFND 59	South Berm	Lift 3	6"	763-01-02	111.5	15.8	**125.5**	**16.3**	**107.9**	**96.8%**	**95.0%**	
SFND 60	South Berm	Lift 4	6"	763-01-02	111.5	15.8	**126.8**	**14.7**	**110.5**	**99.1%**	**95.0%**	
SFND 61	South Berm	Lift 5	6"	763-01-02	111.5	15.8	**127.3**	**15.2**	**110.5**	**99.1%**	**95.0%**	SFDC-09
SFND 62	South Berm	Lift 6	6"	763-01-02	111.5	15.8	**125.2**	**16.5**	**107.5**	**96.4%**	**95.0%**	
SFND 63	South Berm	Lift 7	6"	763-01-02	111.5	15.8	**126.2**	**14.8**	**109.9**	**98.6%**	**95.0%**	
SFND 64	South Berm	Lift 8	6"	763-01-02	111.5	15.8	**127.0**	**16.1**	**109.4**	**98.1%**	**95.0%**	
SFND 65	South Berm	Lift 1	6"	763-01-02	111.5	15.8	**126.9**	**15.8**	**109.6**	**98.3%**	**95.0%**	
SFND 66	South Berm	Lift 2	6"	763-01-02	111.5	15.8	**126.5**	**16.2**	**108.9**	**97.6%**	**95.0%**	
SFND 67	South Berm	Lift 3	6"	763-01-02	111.5	15.8	**125.3**	**15.6**	**108.4**	**97.2%**	**95.0%**	1-pt.10
SFND 68	South Berm	Lift 4	6"	763-01-02	111.5	15.8	**127.5**	**15.1**	**110.8**	**99.3%**	**95.0%**	
SFND 69	South Berm	Lift 5	6"	763-01-02	111.5	15.8	**126.2**	**16.7**	**108.1**	**97.0%**	**95.0%**	
SFND 70	South Berm	Lift 6	6"	763-01-02	111.5	15.8	**125.8**	**15.3**	**109.1**	**97.9%**	**95.0%**	
SFND 71	South Berm	Lift 7	6"	763-01-02	111.5	15.8	**126.4**	**15.5**	**109.4**	**98.1%**	**95.0%**	SFDC-10
SFND 72	South Berm	Lift 8	6"	763-01-02	111.5	15.8	**125.3**	**16.4**	**107.6**	**96.5%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2392	640

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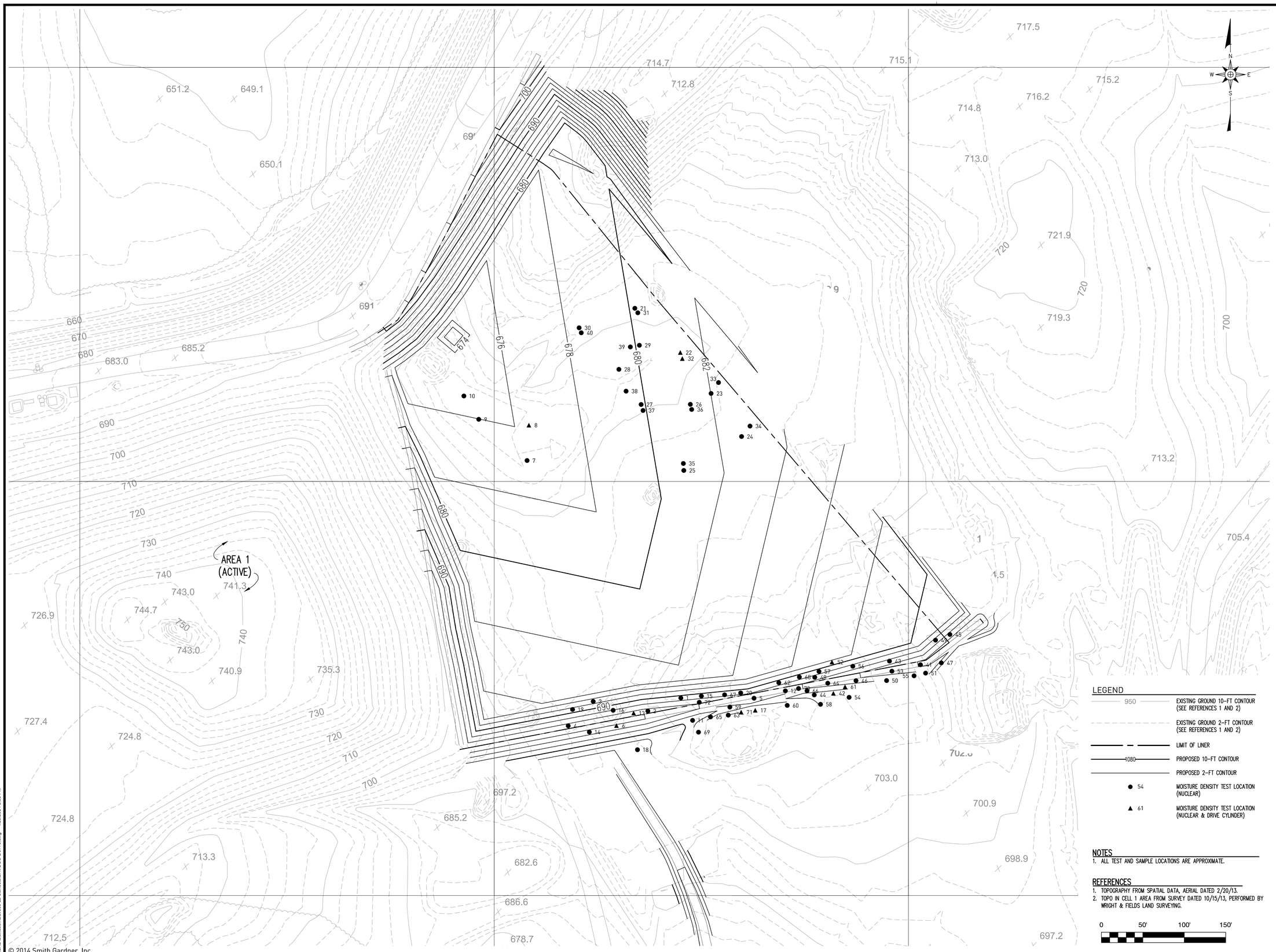

LEGEND

950	EXISTING GROUND 10-FT CONTOUR (SEE REFERENCES 1 AND 2)
	EXISTING GROUND 2-FT CONTOUR (SEE REFERENCES 1 AND 2)
	LIMIT OF LINER
1080	PROPOSED 10-FT CONTOUR
	PROPOSED 2-FT CONTOUR
● 54	MOISTURE DENSITY TEST LOCATION (NUCLEAR)
▲ 61	MOISTURE DENSITY TEST LOCATION (NUCLEAR & DRIVE CYLINDER)

NOTES

1. ALL TEST AND SAMPLE LOCATIONS ARE APPROXIMATE.

REFERENCES

1. TOPOGRAPHY FROM SPATIAL DATA, AERIAL DATED 2/20/13.
2. TOPO IN CELL 1 AREA FROM SURVEY DATED 10/15/13, PERFORMED BY WRIGHT & FIELDS LAND SURVEYING.

0 50' 100' 150'

PREPARED FOR:

DAVIDSON COUNTY INTEGRATED SOLID WASTE MANAGEMENT THOMASVILLE, NORTH CAROLINA

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+ GARDNER

ENGINEERS

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

SEAL

SEAL

REV.	DATE	DESCRIPTION

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PROJECT TITLE:

DAVIDSON COUNTY MSW LANDFILL PHASE 2 - AREA 2 - CELL 1

DRAWING TITLE:

STRUCTURAL FILL TEST LOCATIONS

DESIGNED: P.K.S.	PROJECT NO: DAVDCO 12-3
DRAWN: J.A.L.	SCALE: AS SHOWN
APPROVED:	DATE: APRIL 2014
FILENAME: DAVDCO-D0776	
SHEET NUMBER:	DRAWING NUMBER: **FIG. SF-1**

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Appendix H

Soil Liner CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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SOIL LINER
CONTROL TEST SUMMARY
BORROW SOILS

Project Name: Davidson County MSW Landfill - Phase 2 - Area 2 - Cell 1
Project Number: DAVDCO-12-3
Contractor: JT Russell & Sons

Grain Size Analysis (ASTM D 422) Test Results:

Test Number	+3" (%)	Pass #4 (%)	Pass #200 (%)	Gravel (%)	Sand (%)	Silt/Clay (%)	USCS Classification
CSL-01	0.0	94.9	67.3	5.1	27.6	67.3	CH
CSL-02	0.0	99.4	57.3	0.6	42.1	57.3	ML
PZ-9 (0-10)	0.0	100.0	61.4	0.0	38.6	61.4	CL
9	0.0	100.0	29.4	0.0	70.6	29.4	SM
10	0.0	98.3	59.8	1.7	38.5	59.8	MH
11	0.0	99.9	35.3	0.1	64.6	35.3	SM
TP-1	0.0	99.0	61.5	1.0	37.5	61.5	CL
TP-2	0.0	95.8	52.5	4.2	43.3	52.5	CL-ML
TP-3	0.0	99.9	58.0	0.1	41.9	58.0	ML
TP-4	0.0	91.8	47.4	8.2	44.4	47.4	SC
TP-5	0.0	95.6	44.3	4.4	51.3	44.3	SM

Atterberg Limits (ASTM D 4318) Test Results:

Test Number	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Classification
CSL-01	67	29	38	CH
CSL-02	48	28	20	ML
PZ-9 (0-10)	28	19	9	CL
9	46	34	12	SM
10	56	48	8	MH
11	27	24	3	SM
TP-1	44	25	19	CL
TP-2	27	20	7	CL-ML
TP-3	30	26	4	ML
TP-4	66	32	34	SC
TP-5	43	29	14	SM

Moisture-Density Relationship (ASTM D 698) Test Results:

Test Number	Optimum Moisture Content (%)	Maximum Dry Density (pcf)
CSL-01	30.0	91.9
CSL-02	18.5	106.4
PZ-9 (0-10)	13.5	120.7
9	22.5	99.4
10	19.3	107.8
11	15.3	105.3

Remolded Hydraulic Conductivity (ASTM D 5084) Test Results:

Test Number	Test Values: Dry Density (pcf)	Test Values: Moisture Content (%)	Reference Values ASTM D 698: Maximum Dry Density (pcf)	Reference Values ASTM D 698: Optimum Moisture Content (%)	Compaction (%)	Difference From Optimum Moisture (%)	Hydraulic Conductivity (cm/sec)	Pass/Fail	Comment
CSL-01	90.6	31.4	91.9	30.0	98.6	1.4	7.0E-09	PASS	
CSL-02	103.4	21.2	106.4	18.5	97.2	2.7	2.6E-08	PASS	
PZ-9 (0-10)	115.0	15.6	120.7	13.5	95.3	2.1	1.4E-07	PASS	
9	96.9	23.5	99.4	22.5	97.5	1.0	8.4E-09	PASS	
10	107.4	17.9	107.8	19.3	99.6	-1.4	2.3E-08	PASS	Run Dry
11	100.9	18.6	105.3	15.3	95.8	3.3	1.3E-06	PASS	

Minimum Hydraulic Conductivity (cm/sec): 7.0E-09
Maximum Hydraulic Conductivity (cm/sec): 1.3E-06
Average Hydraulic Conductivity (cm/sec): 2.5E-07

Number of Tests Performed:

Grain Size Analysis: 11
Atterberg Limits: 11
Moisture Density Relationship: 6
Remolded Hydraulic Conductivity: 6

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ATTERBERG LIMITS

ASTM D 4318-10

Client	SMITH & GARDNER	Boring No.	N/A
Client Reference	DAVIDSON CO. LF.	Depth (ft)	N/A
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03	Soil Description	**BROWN FAT CLAY**

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)

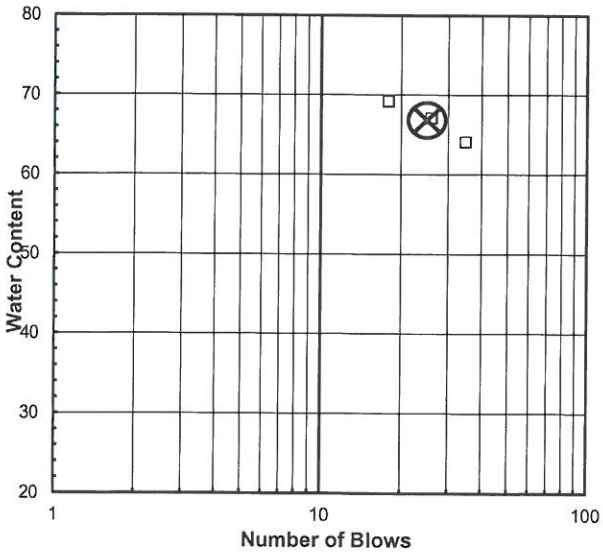
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	Q	Z-4	A-F	MULTIPOINT
Wt. of Tare & WS (gm)	31.05	33.09	34.85	
Wt. of Tare & DS (gm)	24.84	26.07	26.93	
Wt. of Tare (gm)	15.14	15.60	15.47	
Wt. of Water (gm)	6.2	7.0	7.9	
Wt. of DS (gm)	9.7	10.5	11.5	
Moisture Content (%)	**64.0**	**67.0**	**69.1**	
Number of Blows	**35**	**26**	**18**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	3	KP	
Wt. of Tare & WS (gm)	22.98	23.40	
Wt. of Tare & DS (gm)	21.31	21.61	
Wt. of Tare (gm)	15.44	15.50	
Wt. of Water (gm)	1.7	1.8	
Wt. of DS (gm)	5.9	6.1	
Moisture Content (%)	**28.4**	**29.3**	**-0.8**

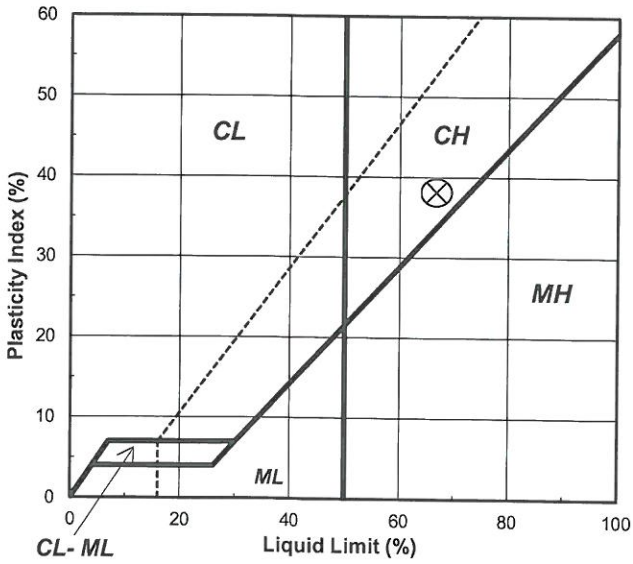
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**67**
Plastic Limit (%)	**29**
Plasticity Index (%)	**38**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



Tested By CG *Date* 10/24/13 *Checked By* MPS *Date* 10-28-13

page 1 of 1 **DCN:** CT-S4B **DATE:** 6/24/10 **REVISION:** 4

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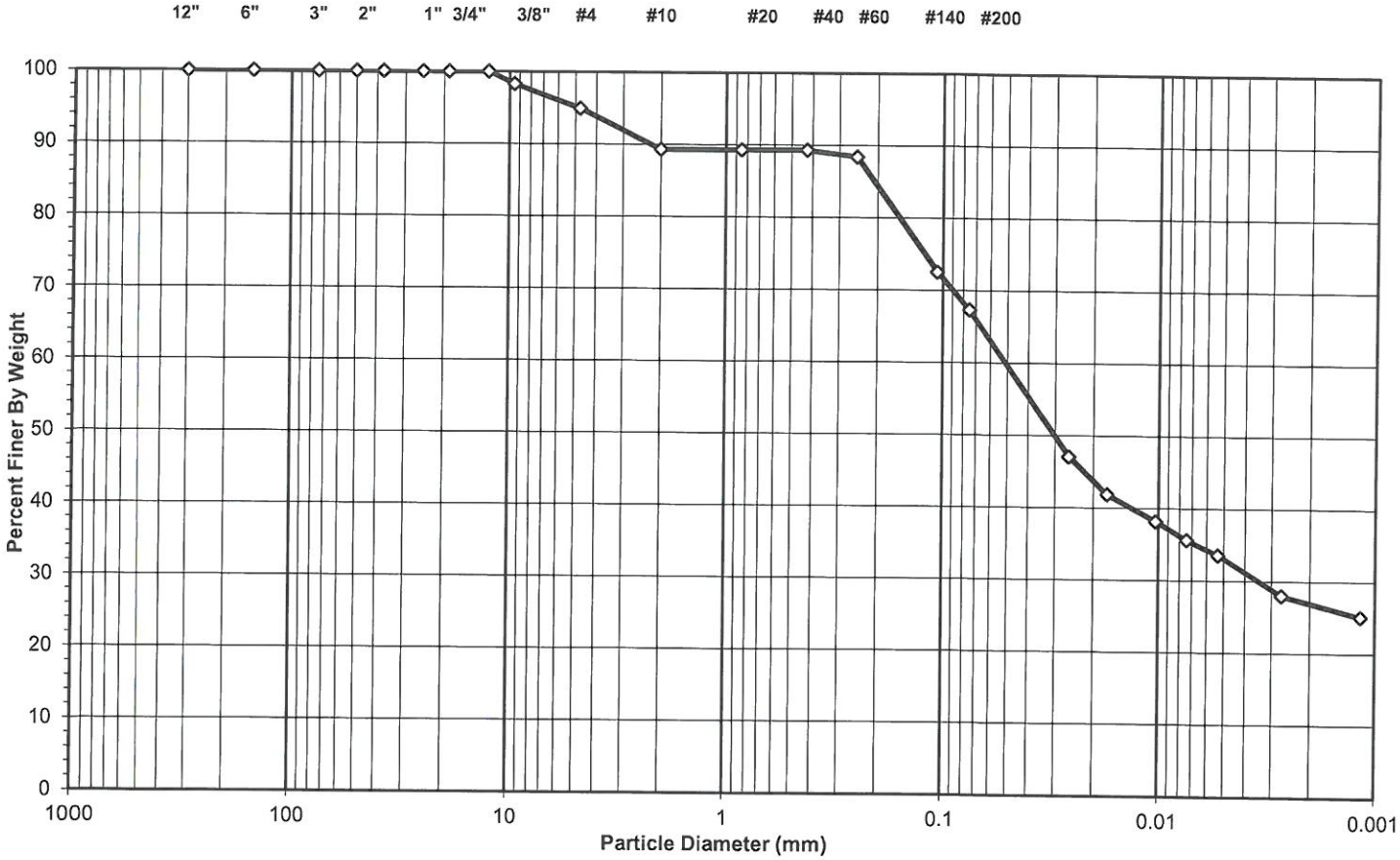
SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03	Soil Color	**BROWN**

	SIEVE ANALYSIS				HYDROMETER	
USCS	cobbles	gravel	sand		silt and clay fraction	
USDA	cobbles	gravel	sand		silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	5.08
#4 To #200	*Sand*	27.61
Finer Than #200	*Silt & Clay*	67.31

USCS Symbol ***CH, TESTED***

USCS Classification ***SANDY FAT CLAY***

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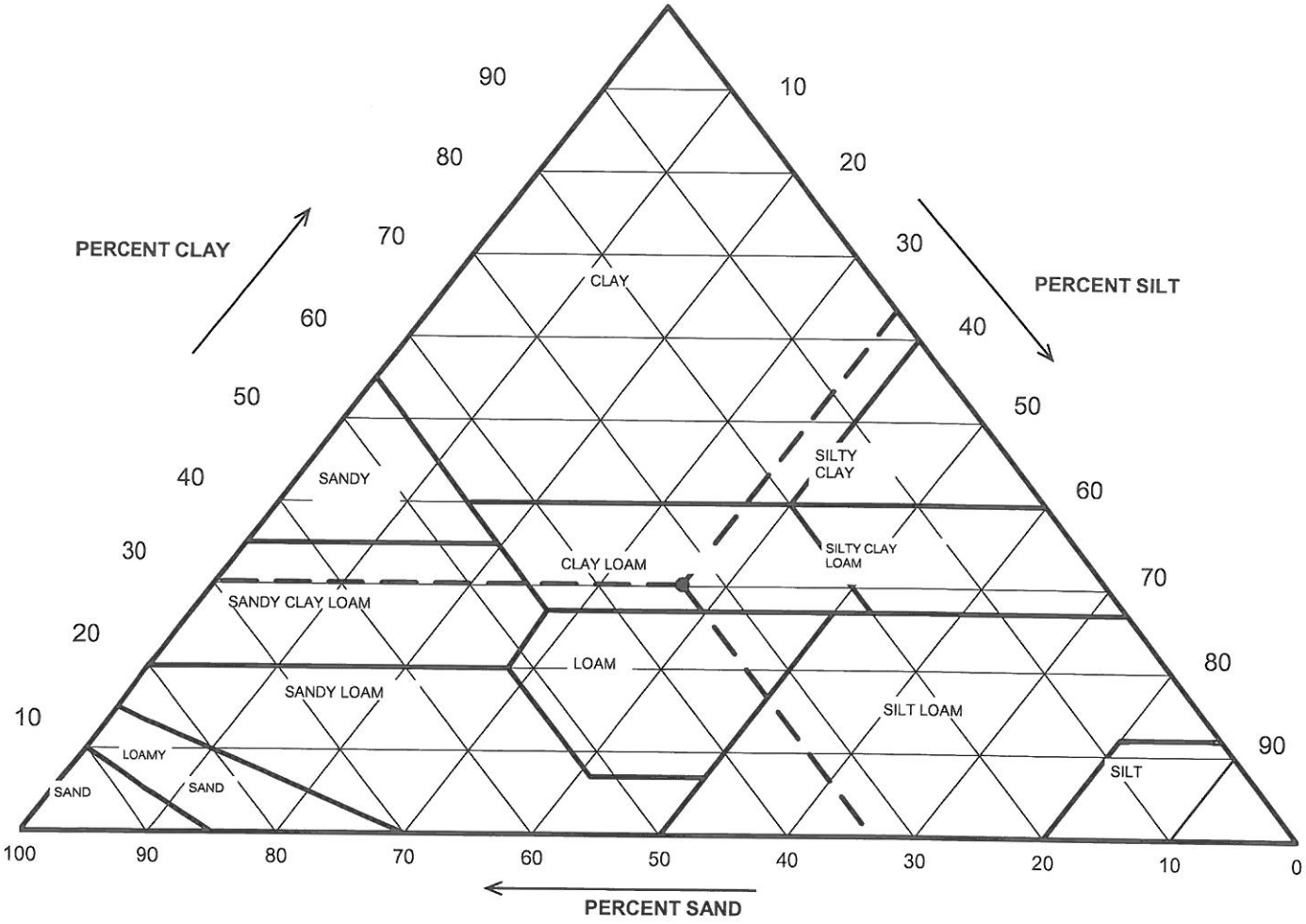
USDA CLASSIFICATION CHART

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	10.70	**0.00**
2	89.30	*Sand*	29.73	**33.29**
0.05	59.57	*Silt*	32.58	**36.48**
0.002	26.99	*Clay*	26.99	**30.22**

USDA Classification: ***CLAY LOAM***

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03	Soil Color	**BROWN**

Minus #10 for Hygroscopic Moisture Content		**Hydrometer Specimen Data**	
Tare No.	S-1	Air Dried - #10 Hydrometer Material (gm)	100.02
Wgt.Tare + Wet Soil (gm)	28.13	Corrected Dry Wt. of - #10 Material (gm)	85.05
Wgt.Tare + Dry Soil (gm)	26.25		
Weight of Tare (gm)	15.57	Weight of - #200 Material (gm)	64.11
Weight of Water (gm)	1.88	Weight of - #10 ; + #200 Material (gm)	20.94
Weight of Dry Soil (gm)	10.68		
Moisture Content (%)	**17.6**	**J-FACTOR (%FINER THAN #10)**	**0.8930**
Soil Specimen Data			
Tare No.	159		
Wgt.Tare + Air Dry Soil (gm)	770.17		
Weight of Tare (gm)	239.63		
Air Dried Wgt. Total Sample (gm)	530.54	Dry Weight of Material Retained on #10 (gm)	49.07
Total Dry Sample Weight (gm)	458.47	Corrected Dry Sample Wt - #10 (gm)	409.40

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"	12.5	0.00	0.0	0.0	100.0	**100.0**
3/8"	9.50	7.74	1.7	1.7	98.3	**98.3**
#4	4.75	15.55	3.4	5.1	94.9	**94.9**
#10	2.00	25.78	5.6	10.7	89.3	**89.3**
#20	0.85	0.00	0.0	0.0	100.0	**89.3**
#40	0.425	0.00	0.0	0.0	100.0	**89.3**
#60	0.250	0.84	1.0	1.0	99.0	**88.4**
#140	0.106	15.12	17.8	18.8	81.2	**72.5**
#200	0.075	4.98	5.9	24.6	75.4	**67.3**
Pan	-	64.11	75.4	100.0	-	**-**

Notes :

Tested By SS Date 10/19/13 Checked By MBS Date 11-8-13

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03	Soil Color	**BROWN**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	50.0	23.3	4.70	45.3	52.7	0.01293	0.0260	**47.1**
5	45.0	23.2	4.72	40.3	46.9	0.01294	0.0173	**41.9**
15	41.5	23.2	4.72	36.8	42.8	0.01294	0.0103	**38.2**
30	39.0	23.3	4.70	34.3	39.9	0.01293	0.0074	**35.7**
60	37.0	23.4	4.68	32.3	37.6	0.01291	0.0053	**33.6**
250	31.5	24.0	4.54	27.0	31.4	0.01282	0.0027	**28.0**
1440	29.0	22.8	4.81	24.2	28.2	0.01300	0.0012	**25.1**

Soil Specimen Data		Other Corrections	
Wgt. of Dry Material (gm)	85.05	Hygroscopic Moisture Factor	0.850
Weight of Deflocculant (gm)	5.0	a - Factor	0.99
		Percent Finer than # 10	89.30
		Specific Gravity	2.70 Assumed

Notes:

Tested By BW Date 10/21/13 Checked By MBS Date 11-8-13

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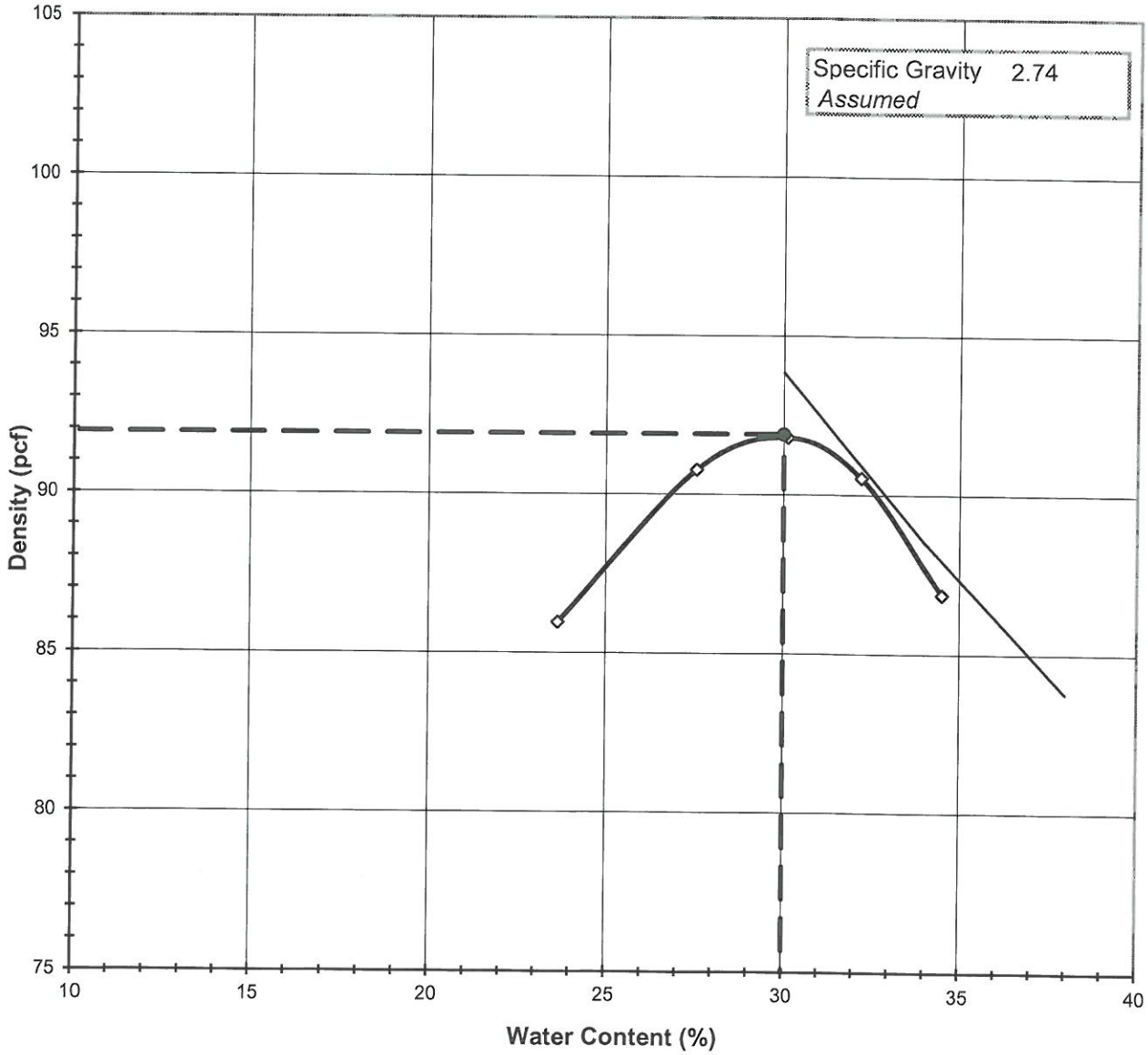
MOISTURE DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03	Test Method	**STANDARD**

Visual Description BROWN SANDY FAT CLAY

Optimum Water Content	**30.0**
Maximum Dry Density	**91.9**



Tested By CTR *Date* 10/25/13 *Checked By* CEM *Date* 10-28-13

DCN:CT-S12 DATE:12/21/11 REVISION:5 [2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL IV]2013-763-01-03 Proctor wHeaders.xls]Sheet1

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MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH & GARDNER	Boring No.	NA
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID	2013-763-01-03		

Visual Description BROWN SANDY FAT CLAY

Total Weight of the Sample (gm)	20900
As Received Water Content(%)	NA
Assumed Specific Gravity	2.74
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		**STANDARD**
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	461
Mold diameter		4"
Weight of the Mold		4194
Volume of the Mold(cc)		937

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & WS (gm)	5791	5933	5988	5992	5949
Wt.of Mold (gm)	4194	4194	4194	4194	4194
Wt. of WS	1597	1739	1794	1798	1755
Mold Volume (cc)	937	937	937	937	937

Moisture Content / Density

Tare Number	312	398	310	398	314
Wt. of Tare & WS (gm)	338.82	341.62	344.54	278.35	321.85
Wt. of Tare & DS (gm)	290.09	285.93	290.13	230.96	260.92
Wt. of Tare (gm)	84.07	83.81	109.51	83.81	84.32
Wt. of Water (gm)	48.73	55.69	54.41	47.39	60.93
Wt. of DS (gm)	206.02	202.12	180.62	147.15	176.60

Wet Density (gm/cc)	1.70	1.86	1.91	1.92	1.87
Wet Density (pcf)	106.3	115.8	119.4	119.7	116.8
Moisture Content (%)	**23.7**	**27.6**	**30.1**	**32.2**	**34.5**
Dry Density (pcf)	**86.0**	**90.8**	**91.8**	**90.5**	**86.9**

Zero Air Voids

Moisture Content (%)	30.0	34.0	38.0
Dry Unit Weight (pcf)	93.8	88.5	83.8

Tested By CTR *Date* 10/25/13 *Checked By* GJM *Date* 10-28-13

DCN:CT-S12 DATE:12/21/01 REVISION:5 2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\2013-763-01-03 Proctor wHeaders.xls]Sheet1

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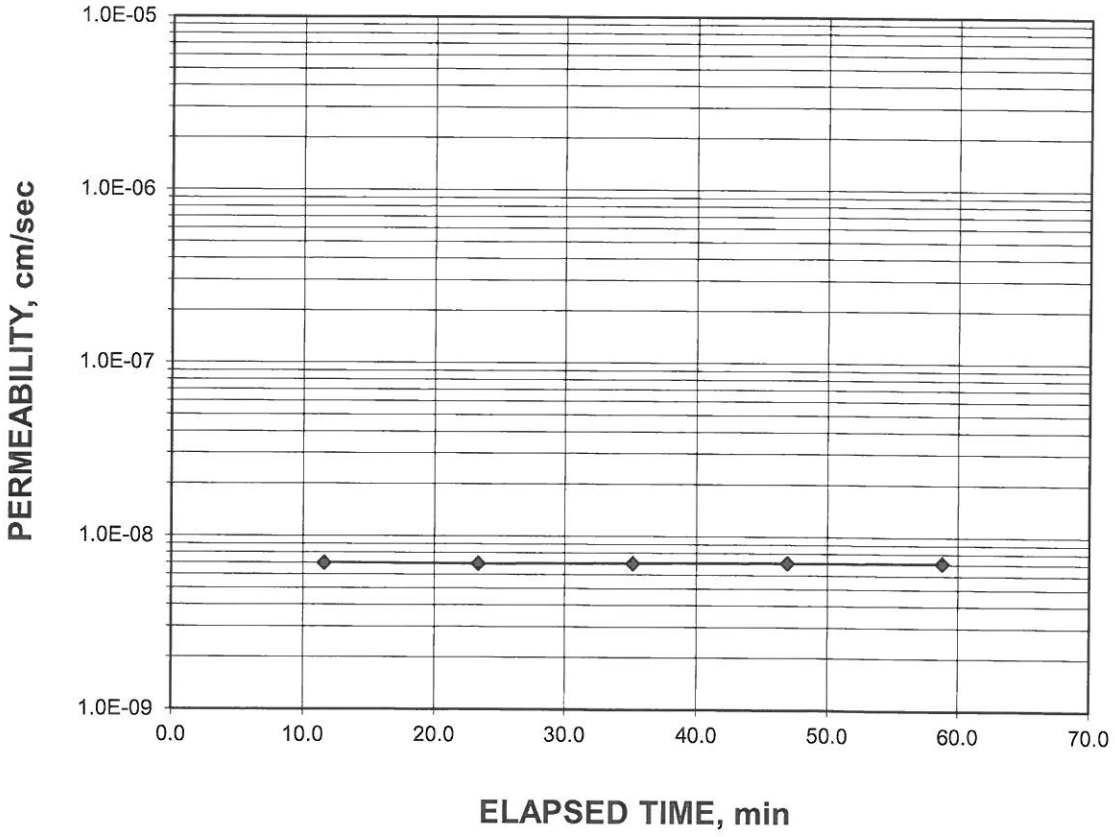
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	N/A
Client Project	DAVIDSON CO, LF.	Depth (ft.)	N/A
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID No.	2013-763-01-03		

Visual Description: BROWN SANDY FAT CLAY

AVERAGE PERMEABILITY = 7.0E-09 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.0E-11 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 11/9/13 Checked By: GEM Date: 11-14-13

DCN: CT-22A DATE: 2013-06-13 REVISION: 1 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-01-03 Permometer wHeader.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	N/A
Client Project	DAVIDSON CO, LF.	Depth (ft.)	N/A
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID No.	2013-763-01-03		

Specific Gravity	2.70	Assumed
Sample Condition		Remolded

Visual Description: BROWN SANDY FAT CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	810	816
Wt. of Tare & WS (gm.)	338.41	499.78
Wt. of Tare & DS (gm.)	285.11	406.26
Wt. of Tare (gm.)	115.46	137.76
Wt. of Water (gm.)	53.30	93.52
Wt. of DS (gm.)	169.65	268.50
Moisture Content (%)	**31.4**	**34.8**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2443.35	NA
Wt. of Tube (gm.)	1633.16	NA
Wt. of WS (calc.) (gm.)	810.19	831.23
Length 1 (in.)	4.009	4.017
Length 2 (in.)	4.009	4.015
Length 3 (in.)	4.009	4.037
Top Diameter (in.)	2.869	2.880
Middle Diameter (in.)	2.869	2.878
Bottom Diameter (in.)	2.869	2.879
Average Length (in.)	4.01	4.02
Average Area (in.^{2})	6.46	6.51
Sample Volume (cm^3)	424.71	429.17
Unit Wet Wt. (gm./ cm^3)	1.908	1.937
Unit Wet Wt. (pcf)	119.1	120.9
Unit Dry Wt. (pcf)	90.6	89.7
Unit Dry Wt. (gm./ cm^3)	1.452	1.437
Void Ratio, e	0.860	0.880
Porosity, n	0.462	0.468
Pore Volume (cm^3)	196.4	200.8
Total Wt. Of Sample After Test		835.13

Tested By: SFS Date: 11/9/13 Checked By: GEM Date: 11-19-13

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INTEGRITY IN TESTING

FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	N/A
Client Project	DAVIDSON CO, LF.	Depth (ft.)	N/A
Project No.	2013-763-01	Sample No.	CSL-01
Lab ID No.	2013-763-01-03		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	10.22
Back Pressure(psi)	40.0	Sample Area (cm^2), A	42.00
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	98	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 7.0E-09 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.0E-11 m/sec @ 20°C

DATE		TIME			ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
11/12/13	17	7	0	7.00	0.000	12.4	14.6	22.5	NA
11/12/13	17	18	36	18.60	11.600	12.3	14.4	22.5	7.0E-09
11/12/13	17	30	22	30.37	23.367	12.2	14.3	22.5	6.9E-09
11/12/13	17	42	11	42.18	35.183	12.1	14.2	22.5	7.0E-09
11/12/13	17	53	58	53.97	46.967	12.0	14.1	22.5	7.1E-09
11/12/13	18	5	48	5.80	58.800	11.9	13.9	22.5	7.1E-09

Tested By: SFS Date: 11/9/13 Checked By: GEM Date: 11-14-13

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MOISTURE CONTENT

ASTM D 2216-10

Client	SMITH + GARDNER, INC.
Client Reference	DAVIDSON CO. LF
Project No.	2013-763-02

Lab ID	.004
Boring No.	CSL-02
Depth (ft)	NA
Sample No.	BS-1
Tare Number	398
Wt. of Tare & WS (gm)	376.12
Wt. of Tare & DS (gm)	323.29
Wt. of Tare (gm)	83.9
Wt. of Water (gm)	52.83
Wt. of DS (gm)	239.39
Water Content (%)	**22.1**

Notes : *NA*

Tested By *CT* *Date* *11/21/13* *Checked By* *Date* *11/27*

DCN: CT-S1 DATE: 6-30-08 REVISION: 6 \\2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-02 WATCONT W Header.xls]Sheet1

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SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (2007)

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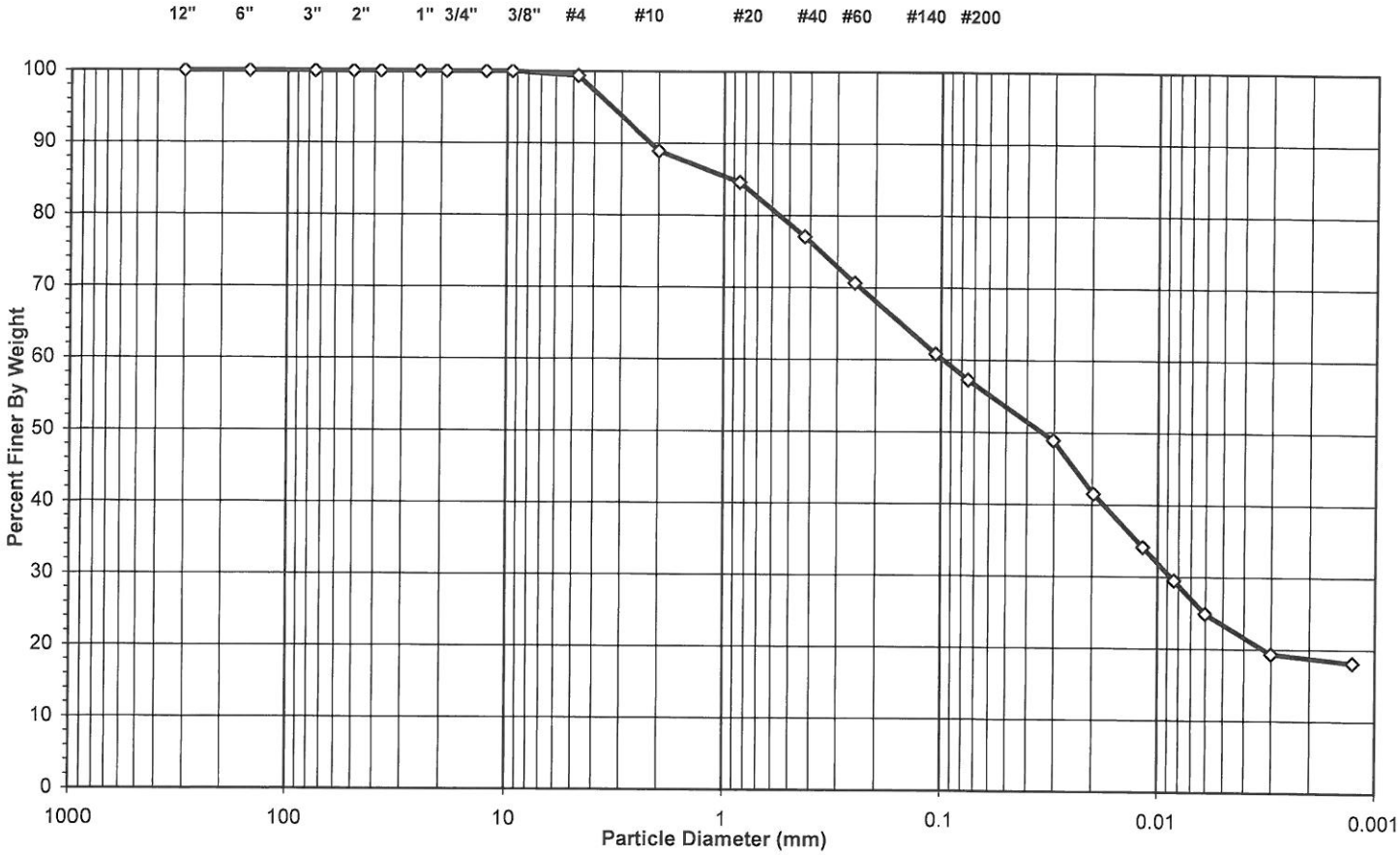
Client	SMITH & GARDNER, INC	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04	Soil Color	**ORANGE**

	SIEVE ANALYSIS				HYDROMETER	
USCS	cobbles	gravel	sand		silt and clay fraction	
USDA	cobbles	gravel	sand		silt	clay



USCS Summary

Sieve Sizes (mm)		Percentage
Greater Than #4	*Gravel*	0.61
#4 To #200	*Sand*	42.13
Finer Than #200	*Silt & Clay*	57.26

USCS Symbol *ML, TESTED*

USCS Classification *SANDY SILT*

DCN: CT-S3OR DATE: 2/28/03 REVISION: 15 *PROJECTS\2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-02-04 SIEVEHYD10 wHeader.xls]Sheet1*

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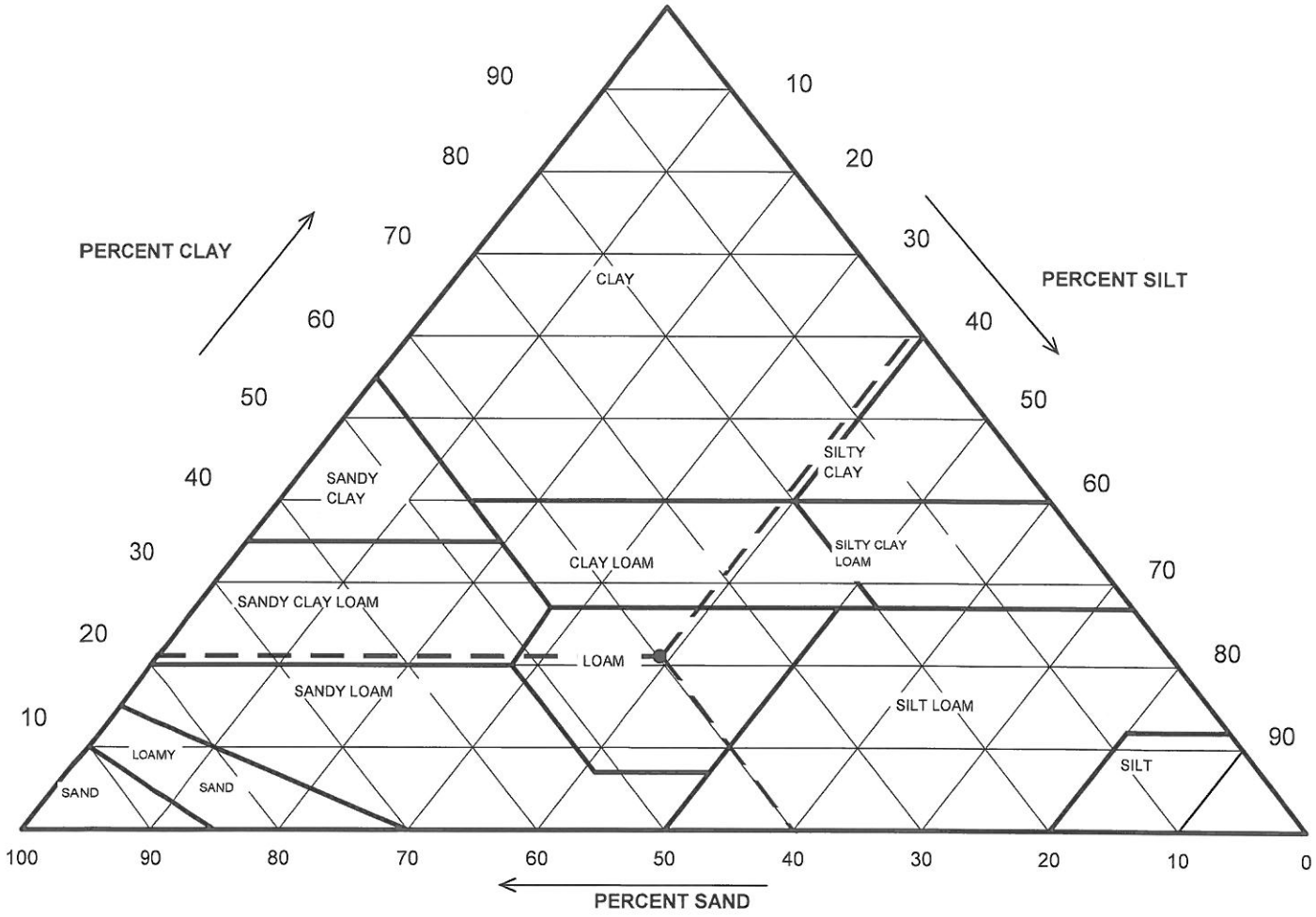
USDA CLASSIFICATION CHART

Client	SMITH & GARDNER, INC	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04	Soil Color	ORANGE



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	11.08	**0.00**
2	88.92	*Sand*	35.41	**39.83**
0.05	53.51	*Silt*	34.74	**39.07**
0.002	18.77	*Clay*	18.77	**21.11**

USDA Classification: ***LOAM***

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER, INC	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04	Soil Color	**ORANGE**

Minus #10 for Hygroscopic Moisture Content		**Hydrometer Specimen Data**	
Tare No.	B-2	Air Dried - #10 Hydrometer Material (gm)	50.00
Wgt.Tare + Wet Soil (gm)	33.50	Corrected Dry Wt. of - #10 Material (gm)	47.69
Wgt.Tare + Dry Soil (gm)	32.97		
Weight of Tare (gm)	22.03	Weight of - #200 Material (gm)	30.71
Weight of Water (gm)	0.53	Weight of - #10 ; + #200 Material (gm)	16.98
Weight of Dry Soil (gm)	10.94		
Moisture Content (%)	**4.8**	**J-FACTOR (%FINER THAN #10)**	**0.8892**
Soil Specimen Data			
Tare No.	156		
Wgt.Tare + Air Dry Soil (gm)	614.65		
Weight of Tare (gm)	238.01		
Air Dried Wgt. Total Sample (gm)	376.64	Dry Weight of Material Retained on #10 (gm)	40.01
Total Dry Sample Weight (gm)	361.09	Corrected Dry Sample Wt - #10 (gm)	321.08

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"	12.5	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	2.19	0.6	0.6	99.4	**99.4**
#10	2.00	37.82	10.5	11.1	88.9	**88.9**
#20	0.85	2.30	4.8	4.8	95.2	**84.6**
#40	0.425	4.05	8.5	13.3	86.7	**77.1**
#60	0.250	3.45	7.2	20.5	79.5	**70.6**
#140	0.106	5.27	11.1	31.6	68.4	**60.8**
#200	0.075	1.91	4.0	35.6	64.4	**57.3**
Pan	-	30.71	64.4	100.0	-	-

Notes :

Tested By CDS Date 11/18/13 Checked By MWS Date 11/27

DCN: CT-S3OR DATE: 2/20/08 REVISION: 3 *F:\2013 PROJECTS\2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-02-04 SIEVEHYD10 wHeader.xls]Sheet1*

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HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH & GARDNER, INC	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	NA
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04	Soil Color	**ORANGE**

Elapsed Time (min)	R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	31.0	24.1	4.52	26.5	55.0	0.01281	0.0303	**48.9**
5	27.0	24.1	4.52	22.5	46.7	0.01281	0.0197	**41.5**
15	23.0	24.1	4.52	18.5	38.4	0.01281	0.0117	**34.1**
30	20.5	24.1	4.52	16.0	33.2	0.01281	0.0084	**29.5**
60	18.0	24.1	4.52	13.5	28.0	0.01281	0.0060	**24.9**
250	15.0	24.1	4.52	10.5	21.8	0.01281	0.0030	**19.3**
1440	14.5	23.4	4.68	9.8	20.4	0.01291	0.0013	**18.1**

Soil Specimen Data		**Other Corrections**	
Wgt. of Dry Material (gm)	47.69	Hygroscopic Moisture Factor	0.954
Weight of Deflocculant (gm)	5.0		
		a - Factor	0.99
		Percent Finer than # 10	88.92
		Specific Gravity	2.70 Assumed

Notes:

Tested By CG Date 11/21/13 Checked By MMS Date 11/27

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ATTERBERG LIMITS

ASTM D 4318-10

Client	SMITH & GARDNER, INC	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	N/A
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04	Soil Description	**ORANGE SILT**

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)

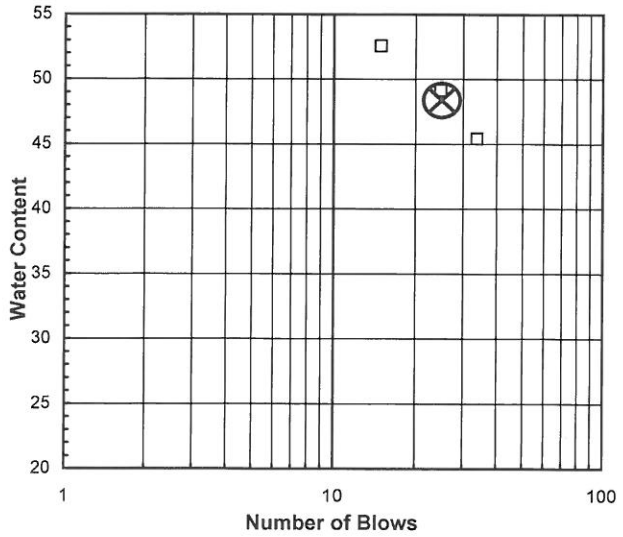
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	D-1	H	Y	MULTIPOINT
Wt. of Tare & WS (gm)	28.19	27.99	26.92	
Wt. of Tare & DS (gm)	24.16	23.76	23.03	
Wt. of Tare (gm)	15.27	15.14	15.62	
Wt. of Water (gm)	4.0	4.2	3.9	
Wt. of DS (gm)	8.9	8.6	7.4	
Moisture Content (%)	**45.3**	**49.1**	**52.5**	
Number of Blows	**34**	**25**	**15**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	B2	17	
Wt. of Tare & WS (gm)	22.36	22.77	
Wt. of Tare & DS (gm)	20.84	21.16	
Wt. of Tare (gm)	15.43	15.48	
Wt. of Water (gm)	1.5	1.6	
Wt. of DS (gm)	5.4	5.7	
Moisture Content (%)	**28.1**	**28.3**	**-0.2**

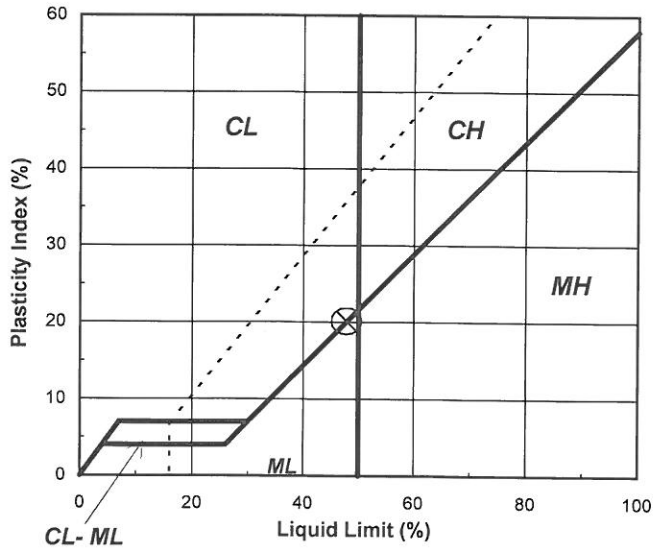
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**48**
Plastic Limit (%)	**28**
Plasticity Index (%)	**20**
USCS Symbol	**ML**

Flow Curve



Plasticity Chart



Tested By *BW* *Date* *11/19/13* *Checked By* *MWS* *Date* *11/27*

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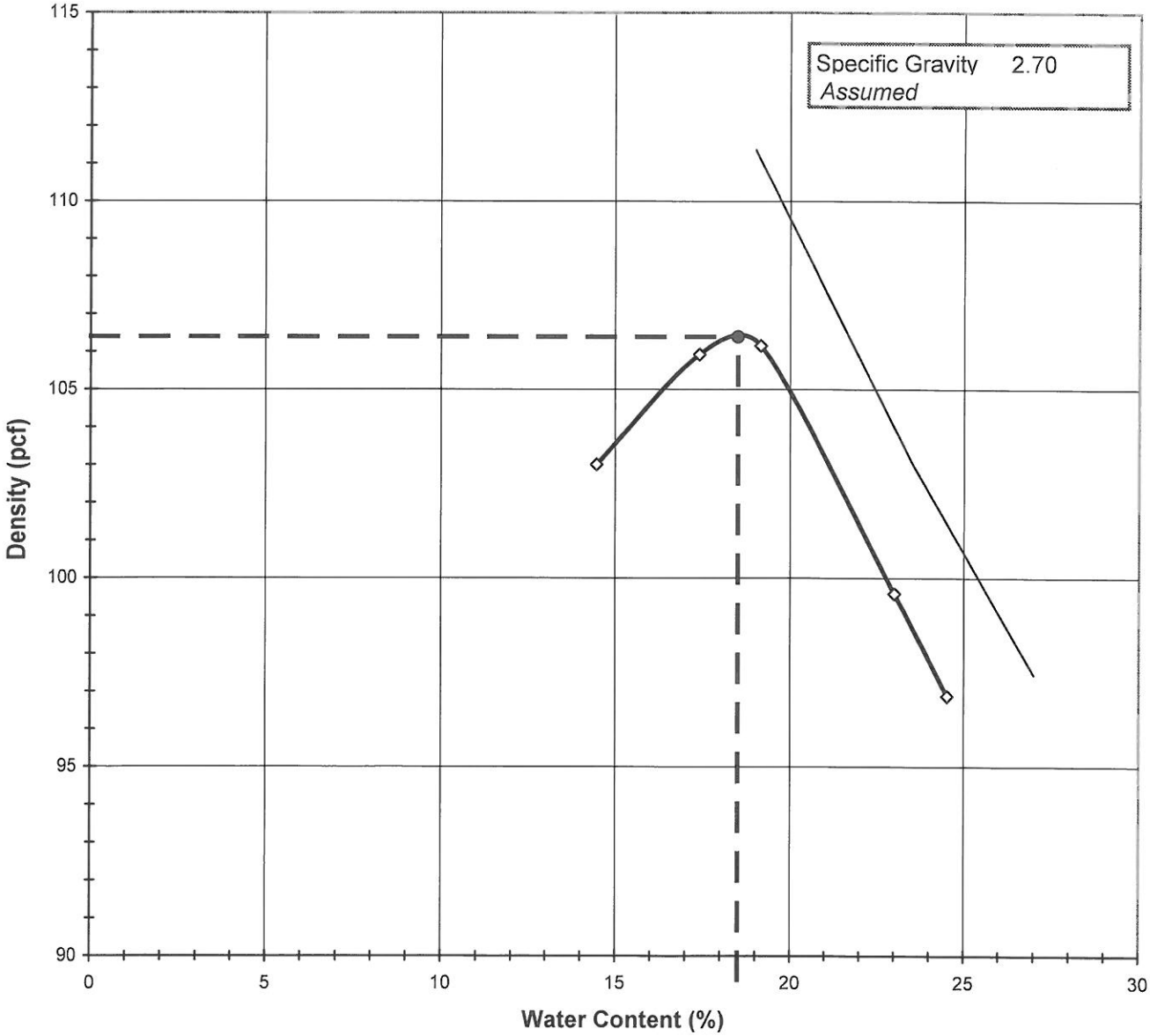
MOISTURE DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH + GARDNER, INC.	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	N/A
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04	Test Method	**STANDARD**

Visual Description ORANGE SANDY SILT

Optimum Water Content **18.5**
Maximum Dry Density **106.4**



Tested By CT *Date* 11/21/13 *Checked By* MPS *Date* 11/27

DCN:CT-S12 DATE:12/11/00 REVISION:5 S:\PROJECTS 2013-763 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1 [2013-763-02-04 Proctor wHeaders.XLS]Sheet1

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MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1

Client	SMITH + GARDNER, INC.	Boring No.	CSL-02
Client Reference	DAVIDSON CO. LF.	Depth (ft)	N/A
Project No.	2013-763-02	Sample No.	BS-1
Lab ID	2013-763-02-04		

Visual Description ORANGE SANDY SILT

Total Weight of the Sample (gm)	22450
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		**STANDARD**
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	461
Mold diameter		4"
Weight of the Mold		4189
Volume of the Mold(cc)		937

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & WS (gm)	5960	6057	6089	6029	6001
Wt.of Mold (gm)	4189	4189	4189	4189	4189
Wt. of WS	1771	1868	1900	1840	1812
Mold Volume (cc)	937	937	937	937	937

Moisture Content / Density

Tare Number	311	300	312	304	304
Wt. of Tare & WS (gm)	371.80	315.82	399.14	476.00	387.21
Wt. of Tare & DS (gm)	335.46	285.38	348.49	407.64	332.72
Wt. of Tare (gm)	84.21	110.49	84.08	110.48	110.53
Wt. of Water (gm)	36.34	30.44	50.65	68.36	54.49
Wt. of DS (gm)	251.25	174.89	264.41	297.16	222.19

Wet Density (gm/cc)	1.89	1.99	2.03	1.96	1.93
Wet Density (pcf)	117.9	124.4	126.5	122.5	120.6
Moisture Content (%)	**14.5**	**17.4**	**19.2**	**23.0**	**24.5**
Dry Density (pcf)	**103.0**	**105.9**	**106.2**	**99.6**	**96.9**

Zero Air Voids

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

Tested By CT *Date* 11/21/13 *Checked By* MMS *Date* 11/27

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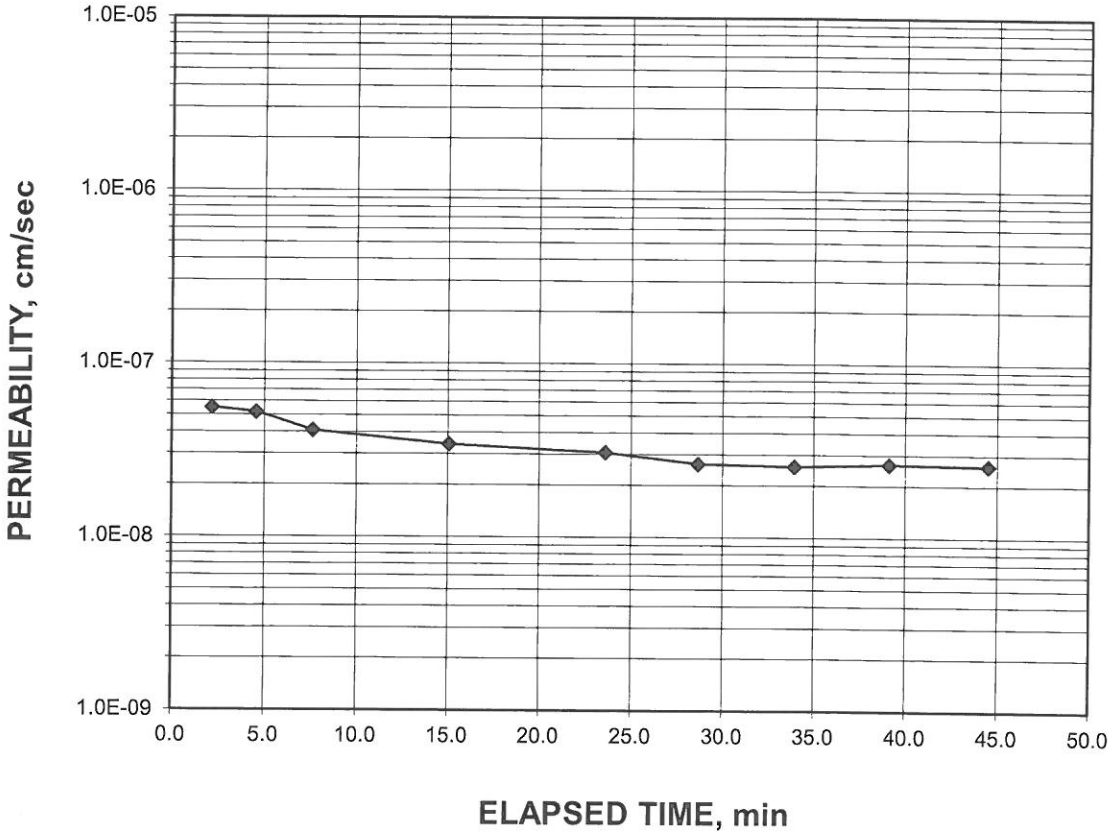
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	CSL-02
Client Project	DAVIDSON CO. LF.	Depth (ft.)	N/A
Project No.	2013-763-02	Sample No.	BS-1
Lab ID No.	2013-763-02-04		

Visual Description: ORANGE SANDY SILT

AVERAGE PERMEABILITY = 2.6E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 2.6E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 11/25/13 Checked By: EPM Date: 11-27-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	CSL-02
Client Project	DAVIDSON CO. LF.	Depth (ft.)	N/A
Project No.	2013-763-02	Sample No.	BS-1
Lab ID No.	2013-763-02-04		

Specific Gravity	2.70	Assumed
Sample Condition		Remolded

Visual Description: ORANGE SANDY SILT

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	819	A5
Wt. of Tare & WS (gm.)	335.54	557.89
Wt. of Tare & DS (gm.)	300.62	475.95
Wt. of Tare (gm.)	135.97	95.45
Wt. of Water (gm.)	34.92	81.94
Wt. of DS (gm.)	164.65	380.50
Moisture Content (%)	**21.2**	**21.5**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2485.81	NA
Wt. of Tube (gm.)	1633.16	NA
Wt. of WS (calc.) (gm.)	852.65	854.94
Length 1 (in.)	4.009	3.995
Length 2 (in.)	4.009	3.963
Length 3 (in.)	4.009	3.980
Top Diameter (in.)	2.869	2.851
Middle Diameter (in.)	2.869	2.865
Bottom Diameter (in.)	2.869	2.864
Average Length (in.)	4.01	3.98
Average Area (in.^{2})	6.46	6.42
Sample Volume (cm^3)	424.71	418.92
Unit Wet Wt. (gm./ cm^3)	2.008	2.041
Unit Wet Wt. (pcf)	125.3	127.4
Unit Dry Wt. (pcf)	103.4	104.8
Unit Dry Wt. (gm./ cm^3)	1.656	1.679
Void Ratio, e	0.630	0.608
Porosity, n	0.387	0.378
Pore Volume (cm^3)	164.2	158.4
Total Wt. Of Sample After Test		855.15

Tested By: SFS Date: 11/25/13 Checked By: GZM Date: 11-27-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	CSL-02
Client Project	DAVIDSON CO. LF.	Depth (ft.)	N/A
Project No.	2013-763-02	Sample No.	BS-1
Lab ID No.	2013-763-02-04		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	10.11
Back Pressure(psi)	40.0	Sample Area (cm^2), A	41.45
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	100	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 2.6E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 2.6E-10 m/sec @ 20°C

DATE	TIME				ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
11/26/13	15	26	51	26.85	0.000	8.5	9.7	23.3	NA
11/26/13	15	29	3	29.05	2.200	8.4	9.6	23.3	5.5E-08
11/26/13	15	31	25	31.42	4.567	8.3	9.4	23.3	5.2E-08
11/26/13	15	34	28	34.47	7.617	8.2	9.3	23.3	4.1E-08
11/26/13	15	41	55	41.92	15.067	8.0	9.0	23.3	3.4E-08
11/26/13	15	50	27	50.45	23.600	7.8	8.8	23.3	3.1E-08
11/26/13	15	55	30	55.50	28.650	7.7	8.7	23.3	2.7E-08
11/26/13	16	0	47	0.78	33.933	7.6	8.5	23.3	2.6E-08
11/26/13	16	5	59	5.98	39.133	7.5	8.4	23.3	2.7E-08
11/26/13	16	11	22	11.37	44.517	7.4	8.3	23.3	2.6E-08

Tested By: SFS Date: 11/25/13 Checked By: GAM Date: 11-27-13

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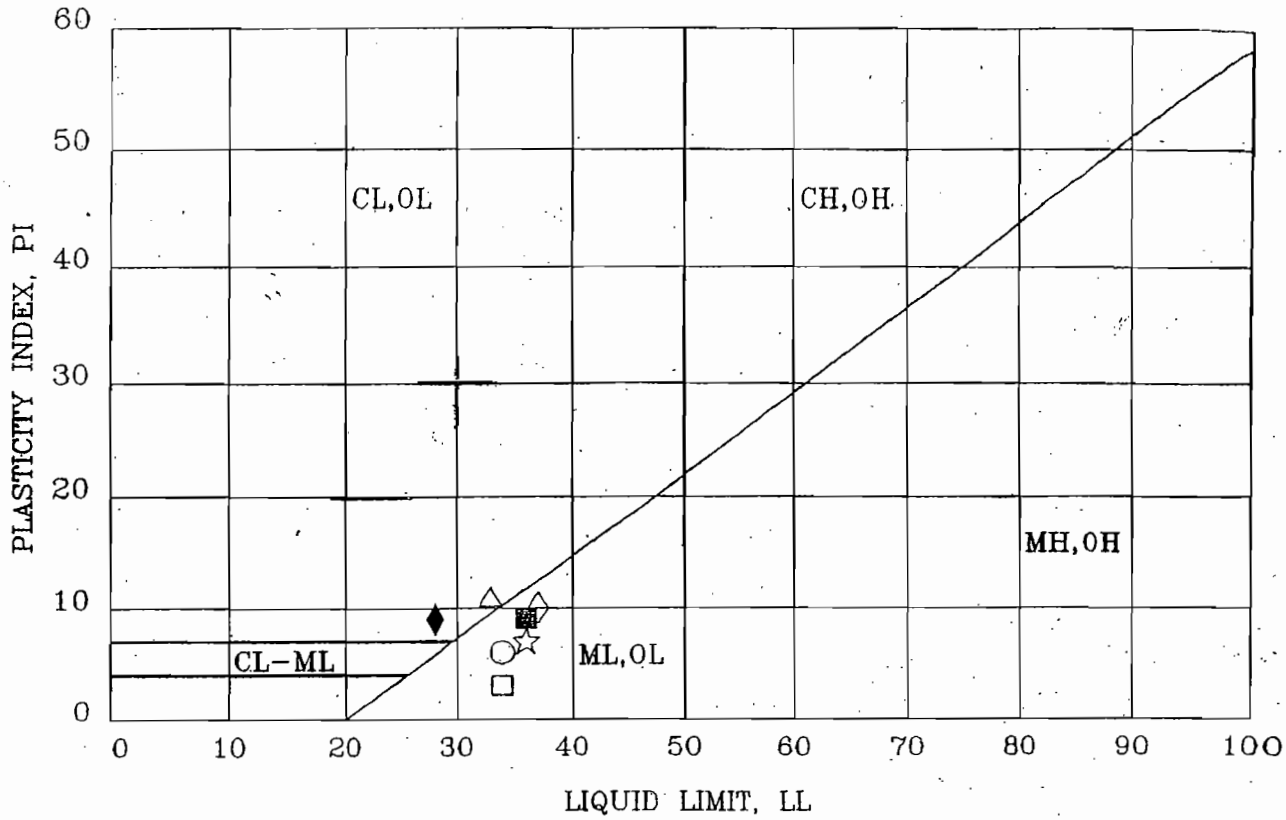
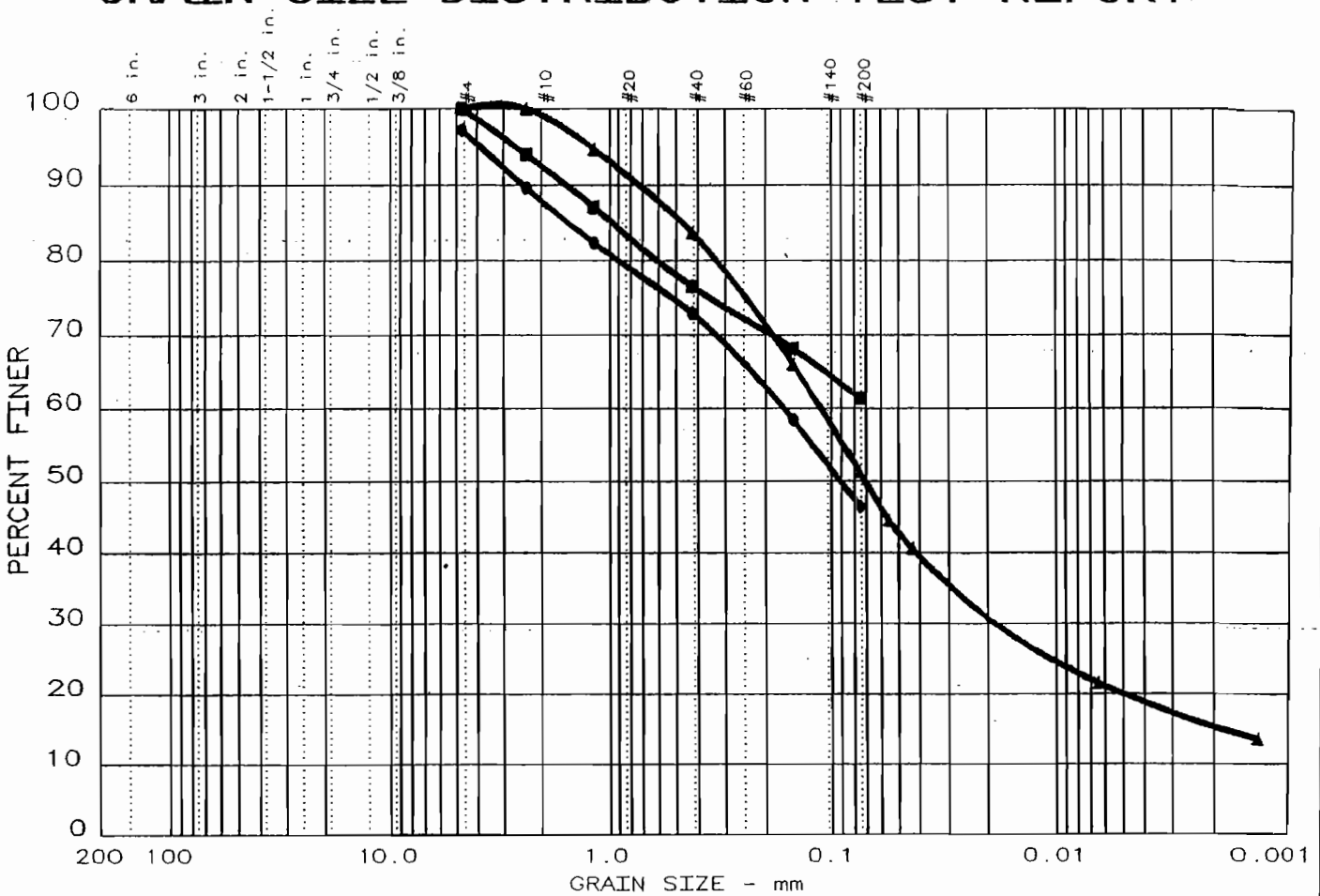


SYMBOL	SAMPLE	DEPTH (ft)	MC (%)	LL (%)	PL (%)	PI (%)	LI (-)	DESCRIPTION
○	PZ-1	20-21.5	17.3	34	28	6	-1.90	Gray Brown Clayey Silt-tr sand
□	PZ-2	20-21.5	9.2	34	31	3	-6.97	Brown Sandy Silt-tr clay
△	PZ-3 Bulk	0-10	16.7	33	22	11	-.46	Gray Coarse Sandy Clay
◇	PZ-4	5-6.5	26.3	37	27	10	-.04	Brown Gray Sandy Silt
☆	PZ-5 Bulk	0-10	20.8	36	29	7	-1.02	Brown Sandy Silt-tr clay ←
●	PZ-5	40-41.5	13.9	30	NP	NP	.46	Gray Silty Sand
■	PZ-6	10-11.5	28.2	36	27	9	.15	Tan Fine Sandy Silt
▲	PZ-7	15-16.5	10.6	21	NP	NP	.50	Brown Gray Silty Coarse Sand
◆	PZ-9 Bulk	0-10	16.1	28	19	9	-.28	Brown Sandy Clay ←

Remark :

Project No.00-793D	Davidson County Landfill PH II
Engineering Tectonics	PLASTICITY CHART Figure No.5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	10	0.0	2.8	50.7	46.5	
▲	11	0.0	0.0	48.7	31.2	20.1
■	12	0.0	0.0	38.6	61.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NP	NP	1.53	0.164	0.0912					
▲	NP	NP	0.468	0.111	0.0708	0.0186	0.0019			
■	28	9	0.966							

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Silty Sand	SM	A4(0.0)
▲ Tan Sandy Silt	ML	A4(0.0)
■ Brown Sandy Clay	CL	A4(3.2)

Project No.: 00-7930

Project: Davidson County Landfill Phase II

● Location: PZ-8(5-7')ST *

▲ Location: PZ-8(20-21.5')

■ Location: PZ-9(0-10')Bulk *

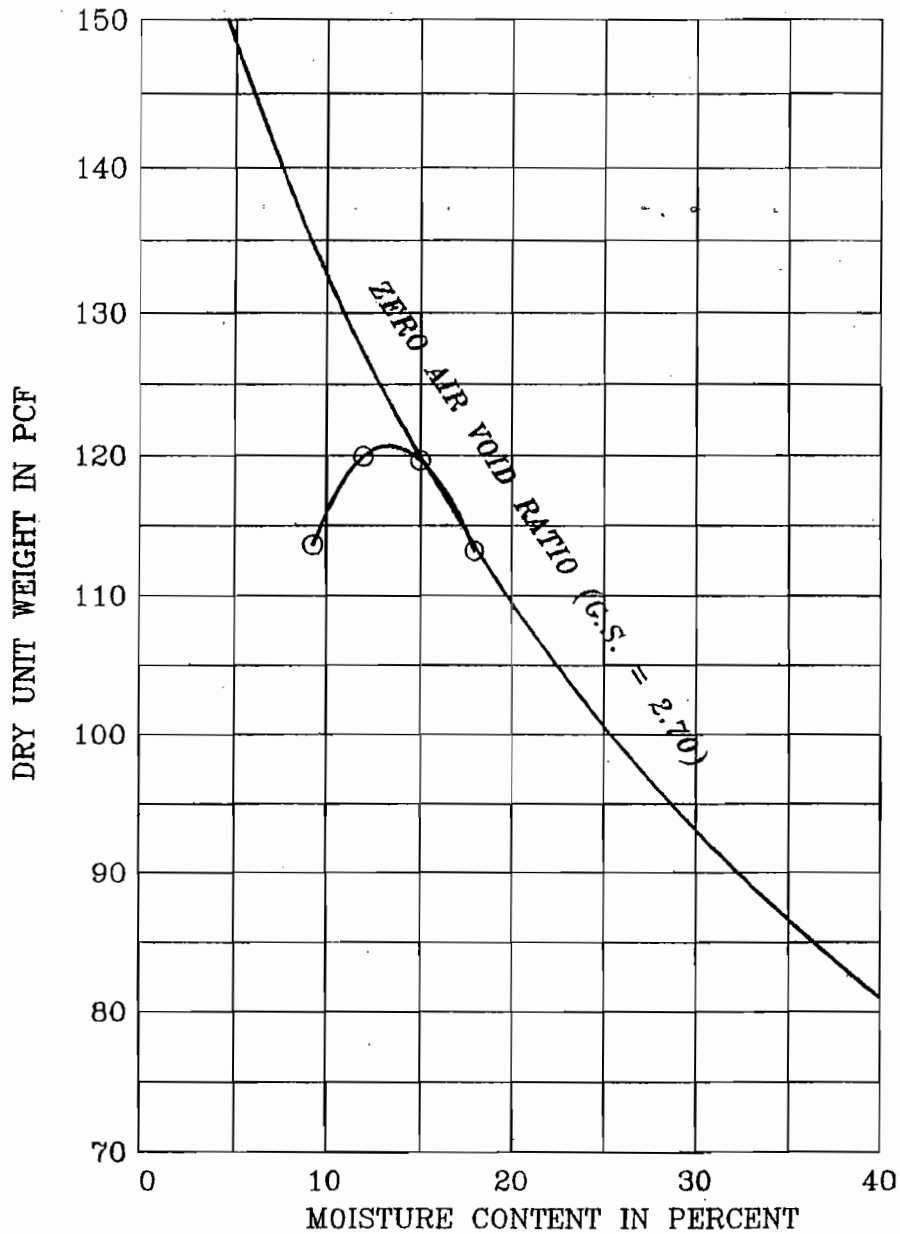
Date: 12-19-00

Remarks:

GRAIN SIZE DISTRIBUTION TEST REPORT

ENGINEERING TECTONICS

Fig. No.: 10



SYMBOL	SAMPLE LOCATION	DEPTH (ft)	DESCRIPTION	TEST METHOD	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)
O	PZ-9 Bulk	0-10	Brown Sandy Clay	D-698	13.5	120.7

Remark :

Project No.00-793D	Davidson County Landfill Phase II
Engineering Tectonics	COMPACTION TEST Figure No.3

ENGINEERING TECTONICS, P.A.
PERMEABILITY TEST REPORT
ASTM D5084

roject No. 00-793-B
mple No. PZ-9(BULK)

Project: Davidson Co. Landfill Phase II
Client: GNR

Test Summary

Permeability	1.42E-07	cm/sec
% Moisture	15.6%	%
Dry Density	115.0	pcf

Sample Information

Specimen Type:
Remolded X
Tube

Date Sampled
Location PZ-9
Lift No. Bulk (0-10')

Specimen Data

Length (in.):	4.60
Diameter (in.):	4.00
Area (sq.in.):	12.56
/olume (cu.in.):	57.78
Weight (grms.):	2017
Dry Weight (grms.):	1694
Dry Density (pcf):	115.0

Moisture Content Test Data

Wet Weight	98.63
Dry Weight	85.32
Tare Weight	0
% Moisture	15.6%

Test Data

Confining Pressure 10 psi

	H	Inflow (B)	Outflow (C)	B/C ratio	Q	k
60	8	2.00	2.00	1.00	2.00	1.42E-07
60	8	2.00	2.00	1.00	2.00	1.42E-07

Change In Time (minutes)
I: Driving Head (PSI)
low (B): Flow In (cubic centimeters)
low (C) :Flow Out (cubic centimeters)
: Flow (cubic centimeters)

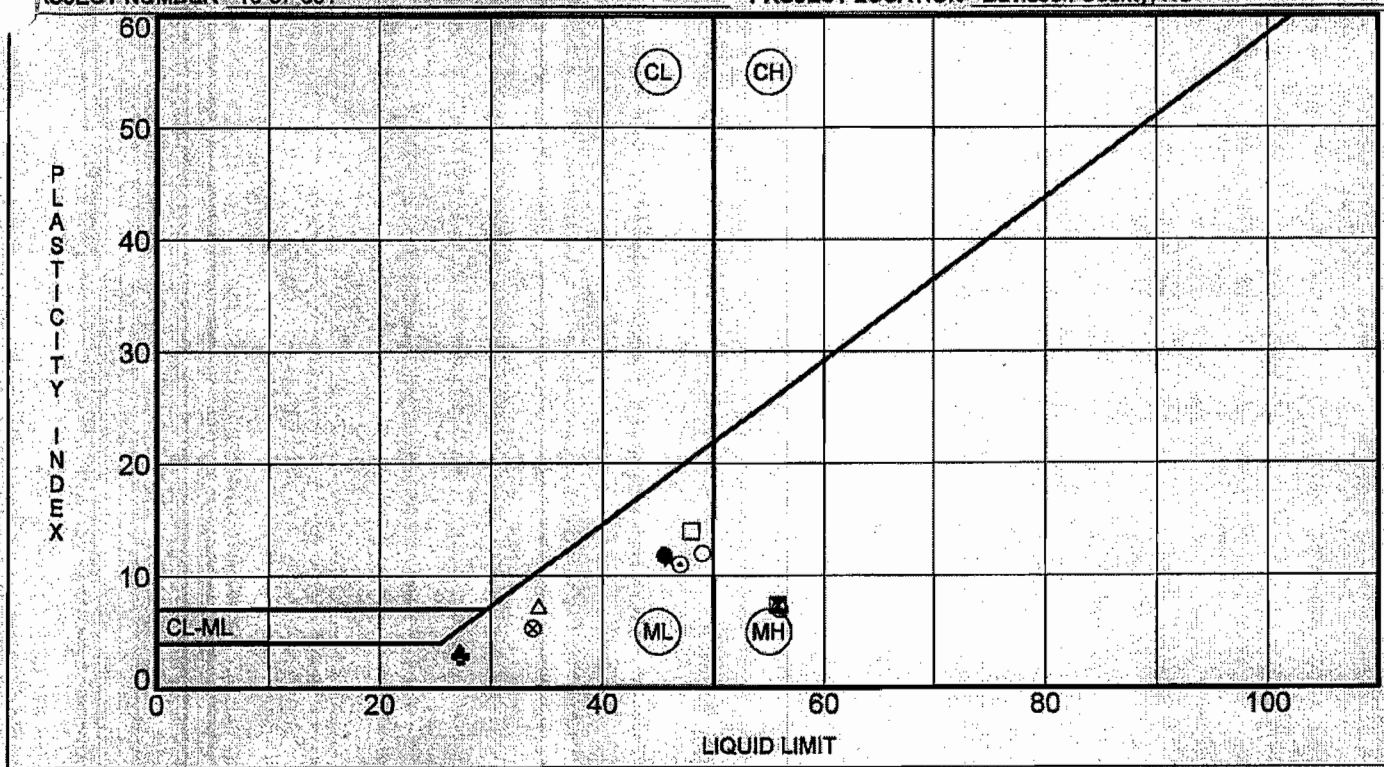
Permeability (k) 1.42E-07 cm/sec

ATTERBERG LIMITS' RESULTS

Engineering Tectonics, P.A.

CLIENT Richardson, Smith Gardner **PROJECT NAME** Davidson County Landfill

PROJECT NUMBER 10-07-661 **PROJECT LOCATION** Davidson County, NC



	Specimen Identification	LL	PL	PI	Fines	Classification
●	9	46	34	12	29	Red silty clayey sand
⊠	10	56	48	8	60	Brown sandy silt
▲	11	27	24	3	35	Gray silty clayey sand
★	T-1	46	35	12		
⊙	T-12	47	36	11		
✿	T-16	27	25	3		
○	T-18	49	37	12		
△	T-21	34	27	7		
⊗	T-23	34	29	6		
⊕	T-4	56	49	7		
□	T-8	48	34	14		

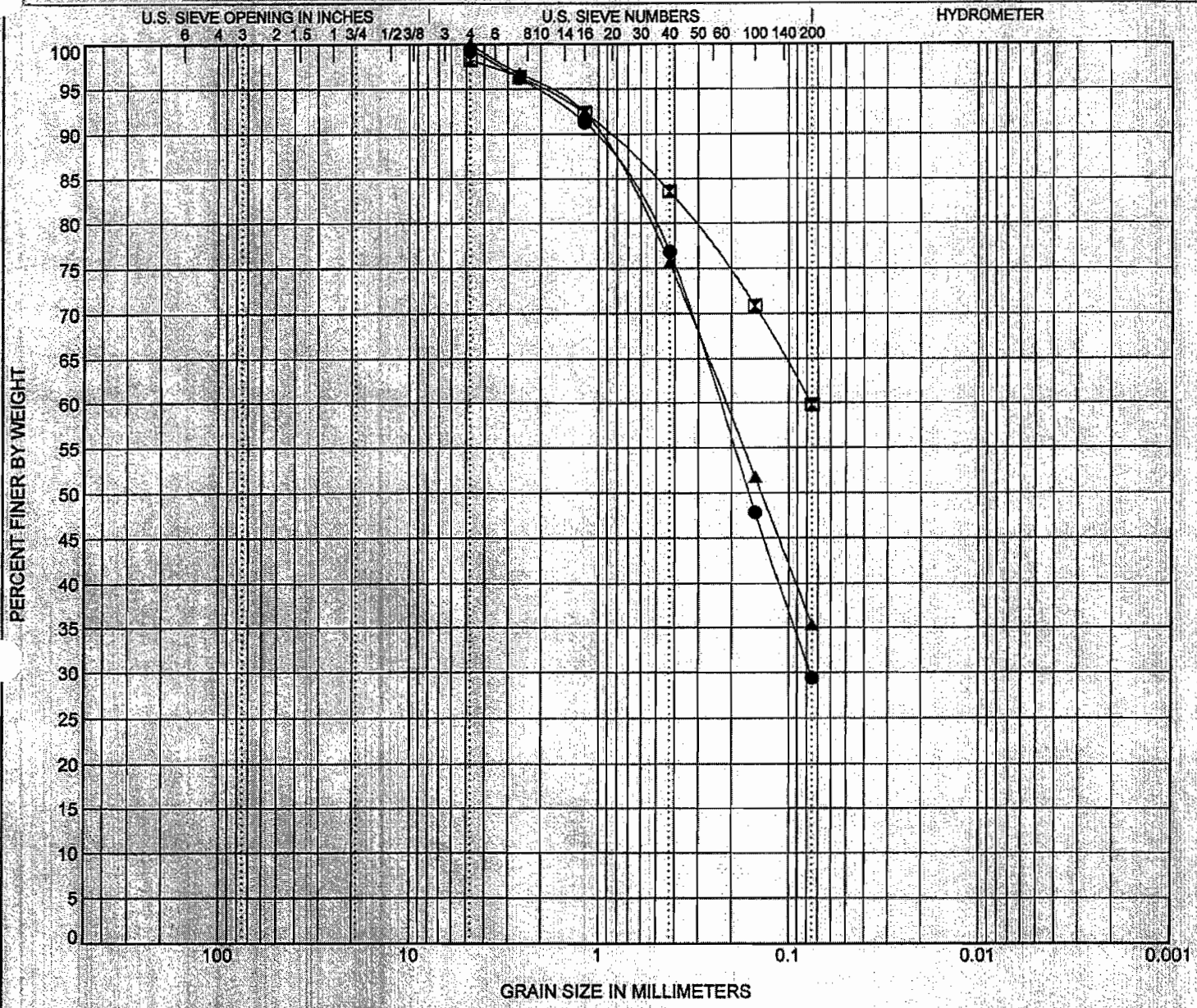
ATTERBERG LIMITS' US LAB.GDT - 3/28/08 13:17 - C:\PROGRAM FILES\GINT\PROJECTS\10-07-661.GPJ

GRAIN SIZE DISTRIBUTION

Engineering Tectonics, P.A.

CLIENT Richardson, Smith Gardner **PROJECT NAME** Davidson County Landfill

PROJECT NUMBER 10-07-661 **PROJECT LOCATION** Davidson County, NC

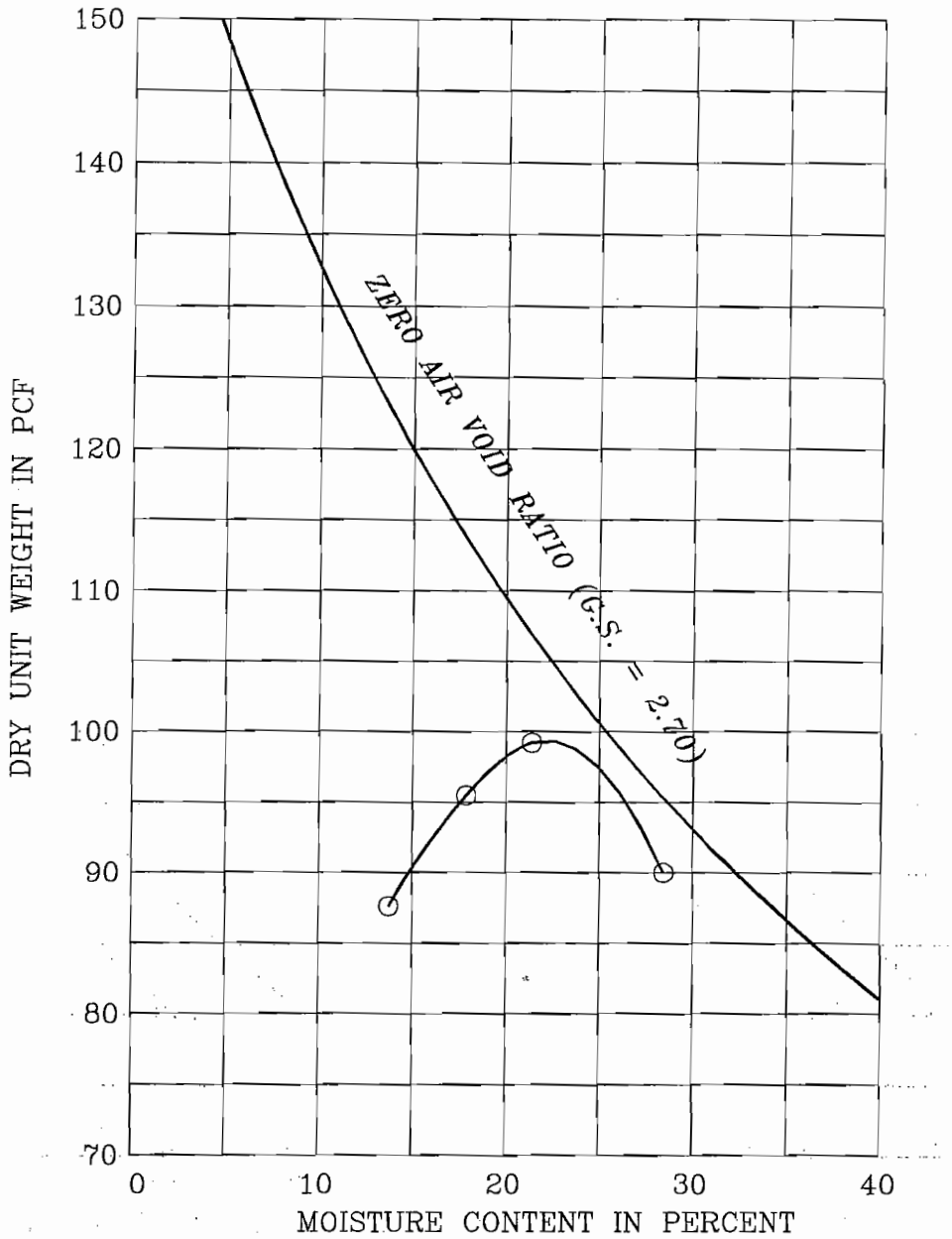


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	9	**Red silty clayey sand**	46	34	12		
⊠	10	**Brown sandy silt**	56	48	8		
▲	11	**Gray silty clayey sand**	27	24	3		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
	9	4.75	0.232	0.077			70.1	29.4	
⊠	10	4.75	0.076				38.5	59.8	
▲	11	4.75	0.215				64.6	35.3	

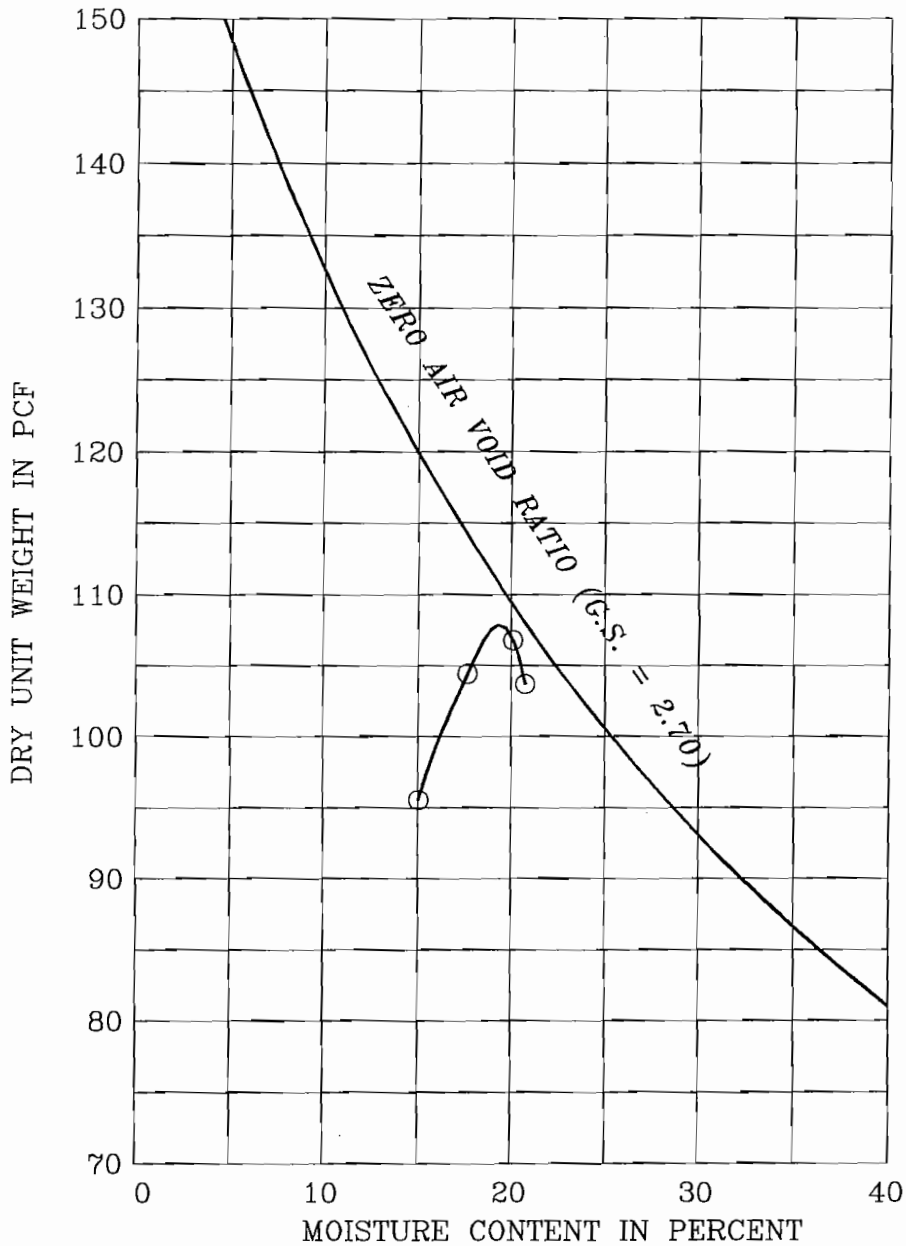
GRAIN SIZE - GINT.ST LAB.GDT - 1/16/08 10:31 - C:\PROGRAM FILES\GINT\PROJECTS\10-07-661.GPJ



SYMBOL	SAMPLE LOCATION	DEPTH (ft)	DESCRIPTION	TEST METHOD	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)
O	ON-SITE		RED SAND W/ CLAY	D-698	22.5	99.4

Remark :

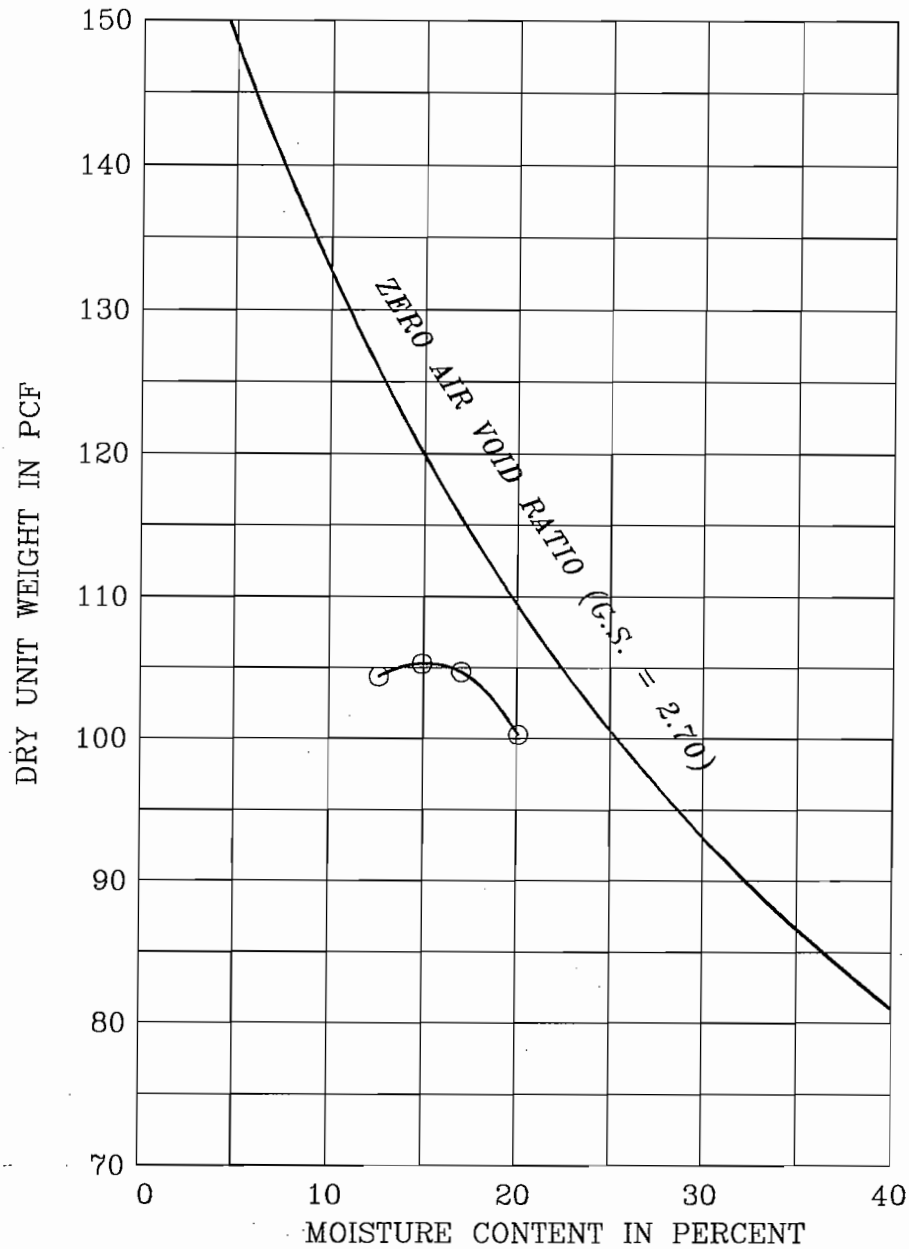
Project No.07-661B	DAVIDSON COUNTY LANDFILL
Engineering Tectonics	COMPACTION TEST Figure No.9



SYMBOL	SAMPLE LOCATION	DEPTH (ft)	DESCRIPTION	TEST METHOD	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)
O	ON-SITE		BROWN SAND W/ CLAY	D-698	19.3	107.8

Remark :

Project No.07-661B	DAVIDSON COUNTY LANDFILL
Engineering Tectonics	COMPACTION TEST Figure No.10



SYMBOL	SAMPLE LOCATION	DEPTH (ft)	DESCRIPTION	TEST METHOD	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)
O	ON-SITE		GREY SANDY CLAY	D-698	15.3	105.3

Remark :

Project No.07-661B	DAVIDSON COUNTY LANDFILL
Engineering Tectonics	COMPACTION TEST Figure No.11

c

ENGINEERING TECTONICS, P.A.
PERMEABILITY TEST REPORT
ASTM D5084

Project No. 10-07-583 Project: Davidson County Landfill
Sample No. 9 Client: Richardson, Smith, Gardner

Test Summary

Permeability	8.42E-09	cm/sec
% Moisture	23.5%	%
Dry Density	96.9	pcf
% Compaction	97.5	%

Sample Information

Specimen Type:
Remolded X
Tube

Date Sampled 8/22/2007
Location
Lift No.

Specimen Data

Length (in.):	4.60
Diameter (in.):	4.00
Area (sq.in.):	12.56
Volume (cu.in.):	57.78
Wet Weight (grms.):	1815
Dry Weight (grms.):	1469.406
Dry Density (pcf):	96.9

Moisture Content Test Data

Wet Weight	57.35
Dry Weight	46.43
Tare Weight	0
% Moisture	23.5%

Test Data Confining Pressure 20 psi

T	H	Inflow (B)	Outflow (C)	B/C ratio	Q	k
15	27	0.09	0.11	0.82	0.10	8.42E-09

T: Change In Time (minutes)
H: Driving Head (PSI)
Inflow (B): Flow In (cubic centimeters)
Inflow (C) :Flow Out (cubic centimeters)
Q: Flow (cubic centimeters)

Permeability (k) 8.42E-09 cm/sec

ENGINEERING TECTONICS, P.A.
PERMEABILITY TEST REPORT
ASTM D5084

Project No. 10-07-583 Project: Davidson County Landfill
Sample No. 10 Client: Richardson, Smith, Gardner

Test Summary

Permeability	2.27E-08	cm/sec
% Moisture	17.9%	%
Dry Density	107.4	pcf
% Compaction	99.6	%

Sample Information

Specimen Type:
Remolded X
Tube

Date Sampled 8/22/2007
Location
Lift No.

Specimen Data

Length (in.):	4.60
Diameter (in.):	4.00
Area (sq.in.):	12.56
Volume (cu.in.):	57.78
Wet Weight (grms.):	1920
Dry Weight (grms.):	1629.15
Dry Density (pcf):	107.4

Moisture Content Test Data

Wet Weight	58.95
Dry Weight	50.02
Tare Weight	0
% Moisture	17.9%

Test Data Confining Pressure 20 psi

T	H	Inflow (B)	Outflow (C)	B/C ratio	Q	k
15	27	0.26	0.28	0.93	0.27	2.27E-08

T: Change In Time (minutes)
H: Driving Head (PSI)
Inflow (B): Flow In (cubic centimeters)
Inflow (C) :Flow Out (cubic centimeters)
Q: Flow (cubic centimeters)

Permeability (k) 2.27E-08 cm/sec

ENGINEERING TECTONICS, P.A.
PERMEABILITY TEST REPORT
ASTM D5084

Project No. 10-07-583
Sample No. 11

Project: Davidson County Landfill
Client: Richardson, Smith, Gardner

Test Summary

Permeability	1.30E-06	cm/sec
% Moisture	18.6%	%
Dry Density	100.9	pcf
% Compaction	95.9	%

Sample Information

Specimen Type:
Remolded X
Tube

Date Sampled 8/22/2007
Location
Lift No.

Specimen Data

Length (in.):	4.60
Diameter (in.):	4.00
Area (sq.in.):	12.56
Volume (cu.in.):	57.78
Wet Weight (grms.):	1815
Dry Weight (grms.):	1530.798
Dry Density (pcf):	100.9

Moisture Content Test Data

Wet Weight	55.05
Dry Weight	46.43
Tare Weight	0
% Moisture	18.6%

Test Data

Confining Pressure 20 psi

T	H	Inflow (B)	Outflow (C)	B/C ratio	Q	k
15	27	15.47	15.45	1.00	15.46	1.30E-06

Permeability (k) 1.30E-06 cm/sec

T: Change In Time (minutes)
Driving Head (PSI)
Inflow (B): Flow In (cubic centimeters)
Inflow (C) :Flow Out (cubic centimeters)
Q: Flow (cubic centimeters)

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ATTERBERG LIMITS

ASTM D 4318-05 / AASHTO T89 (SOP - S4A)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-1
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-01	Soil Description	**ORANGE LEAN CLAY**

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)

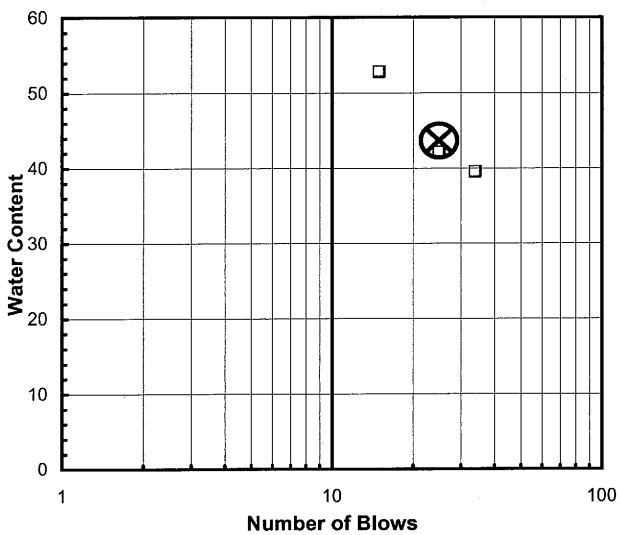
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	A	E	I	**MULTIPOINT**
Wt. of Tare & WS (gm)	25.78	27.41	26.65	
Wt. of Tare & DS (gm)	22.13	23.82	23.41	
Wt. of Tare (gm)	15.21	15.29	15.21	
Wt. of Water (gm)	3.7	3.6	3.2	
Wt. of DS (gm)	6.9	8.5	8.2	
Moisture Content (%)	**52.7**	**42.1**	**39.5**	
Number of Blows	**15**	**25**	**34**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	O	U	
Wt. of Tare & WS (gm)	21.46	21.44	
Wt. of Tare & DS (gm)	20.19	20.19	
Wt. of Tare (gm)	15.18	15.15	
Wt. of Water (gm)	1.3	1.3	
Wt. of DS (gm)	5.0	5.0	
Moisture Content (%)	**25.3**	**24.8**	**0.5**

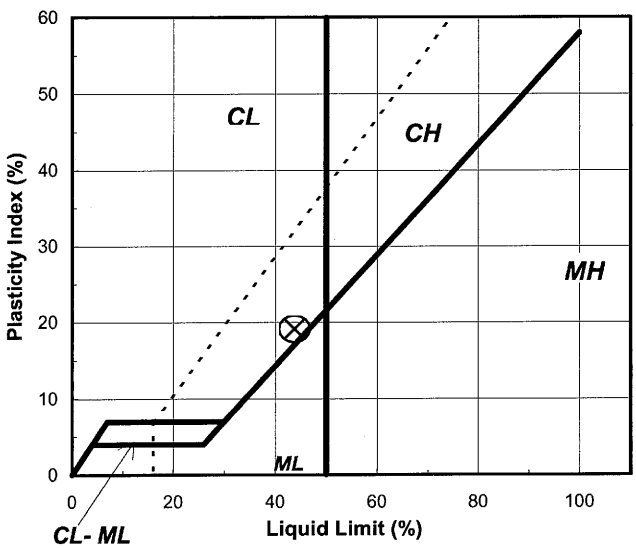
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**44**
Plastic Limit (%)	**25**
Plasticity Index (%)	**19**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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ATTERBERG LIMITS

ASTM D 4318-05 / AASHTO T89 (SOP - S4A)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-2
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-02	Soil Description	**GRAY SILTY CLAY**

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)

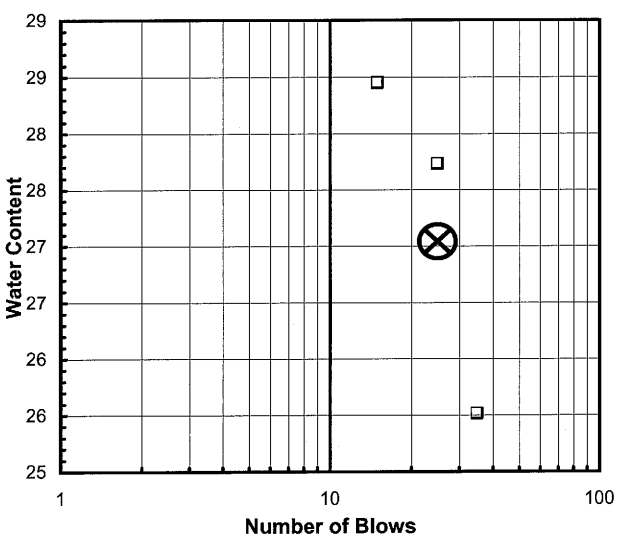
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	G	Y	B	M U L T I P O I N T
Wt. of Tare & WS (gm)	28.58	28.56	27.36	
Wt. of Tare & DS (gm)	25.57	25.74	24.88	
Wt. of Tare (gm)	14.99	15.57	15.16	
Wt. of Water (gm)	3.0	2.8	2.5	
Wt. of DS (gm)	10.6	10.2	9.7	
Moisture Content (%)	**28.4**	**27.7**	**25.5**	
Number of Blows	**15**	**25**	**35**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	T	W	
Wt. of Tare & WS (gm)	22.02	21.75	
Wt. of Tare & DS (gm)	20.87	20.62	
Wt. of Tare (gm)	15.17	15.11	
Wt. of Water (gm)	1.2	1.1	
Wt. of DS (gm)	5.7	5.5	
Moisture Content (%)	**20.2**	**20.5**	**-0.3**

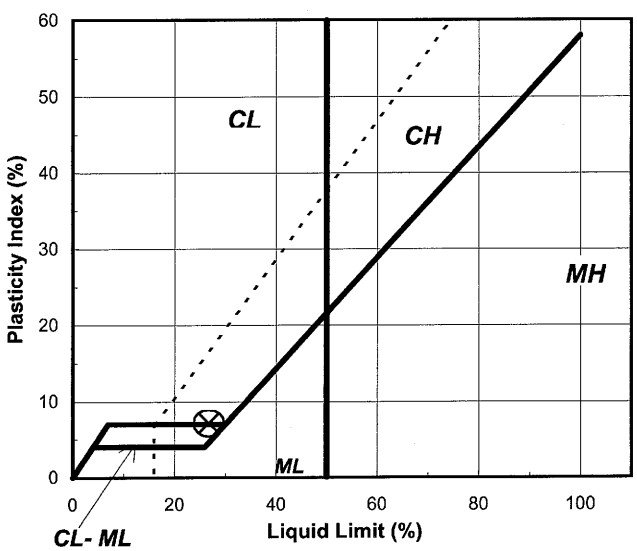
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**27**
Plastic Limit (%)	**20**
Plasticity Index (%)	**7**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



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ATTERBERG LIMITS

ASTM D 4318-05 / AASHTO T89 (SOP - S4A)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-3
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-39-10
Lab ID	2010-642-01-03	Soil Description	**TAN GRAY SILT**

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)

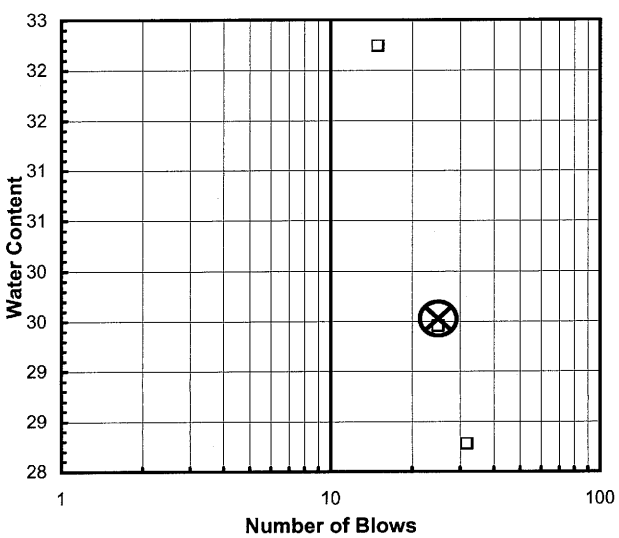
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	C	N	R	MULTIPOINT
Wt. of Tare & WS (gm)	28.10	29.94	26.20	
Wt. of Tare & DS (gm)	24.96	26.60	23.76	
Wt. of Tare (gm)	15.22	15.26	15.13	
Wt. of Water (gm)	3.1	3.3	2.4	
Wt. of DS (gm)	9.7	11.3	8.6	
Moisture Content (%)	**32.2**	**29.5**	**28.3**	
Number of Blows	**15**	**25**	**32**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	P	K	
Wt. of Tare & WS (gm)	22.06	21.48	
Wt. of Tare & DS (gm)	20.64	20.20	
Wt. of Tare (gm)	15.17	15.19	
Wt. of Water (gm)	1.4	1.3	
Wt. of DS (gm)	5.5	5.0	
Moisture Content (%)	**26.0**	**25.5**	**0.4**

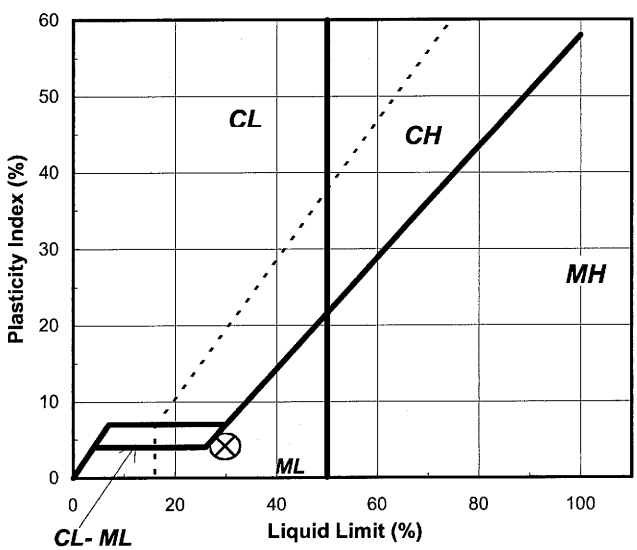
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**30**
Plastic Limit (%)	**26**
Plasticity Index (%)	**4**
USCS Symbol	**ML**

Flow Curve



Plasticity Chart



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ATTERBERG LIMITS

ASTM D 4318-05 / AASHTO T89 (SOP - S4A)

Client	R.S.G. & ASSOCIATES	Boring No.	TP-4
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-641-01	Sample No.	3-9-10
Lab ID	2010-642-01-04	Soil Description	**BROWN FAT CLAY**

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)

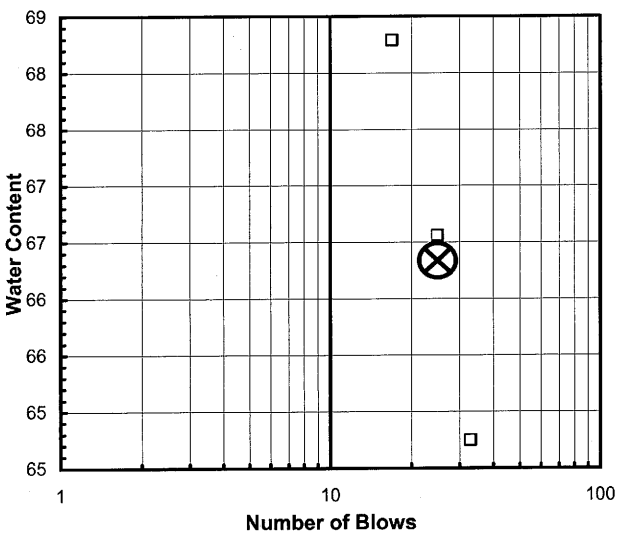
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	A-P	K-A	A-K	MULTIPOINT
Wt. of Tare & WS (gm)	25.27	25.20	26.06	
Wt. of Tare & DS (gm)	21.33	21.32	21.91	
Wt. of Tare (gm)	15.56	15.49	15.50	
Wt. of Water (gm)	3.9	3.9	4.2	
Wt. of DS (gm)	5.8	5.8	6.4	
Moisture Content (%)	**68.3**	**66.6**	**64.7**	
Number of Blows	**17**	**25**	**33**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	A-Q	A-I	
Wt. of Tare & WS (gm)	21.65	21.47	
Wt. of Tare & DS (gm)	20.16	20.02	
Wt. of Tare (gm)	15.48	15.43	
Wt. of Water (gm)	1.5	1.5	
Wt. of DS (gm)	4.7	4.6	
Moisture Content (%)	**31.8**	**31.6**	**0.2**

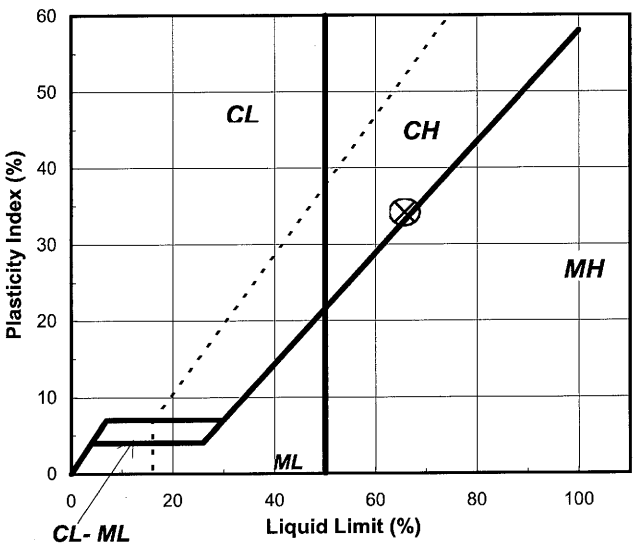
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**66**
Plastic Limit (%)	**32**
Plasticity Index (%)	**34**
USCS Symbol	**CH**

Flow Curve



Plasticity Chart



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ATTERBERG LIMITS

ASTM D 4318-05 / AASHTO T89 (SOP - S4A)

Client	R.S.G. & ASSOCIATES	Boring No.	TP-5
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-641-01	Sample No.	3-9-10
Lab ID	2010-642-01-05	Soil Description	**LIGHT BROWN SILT**

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)

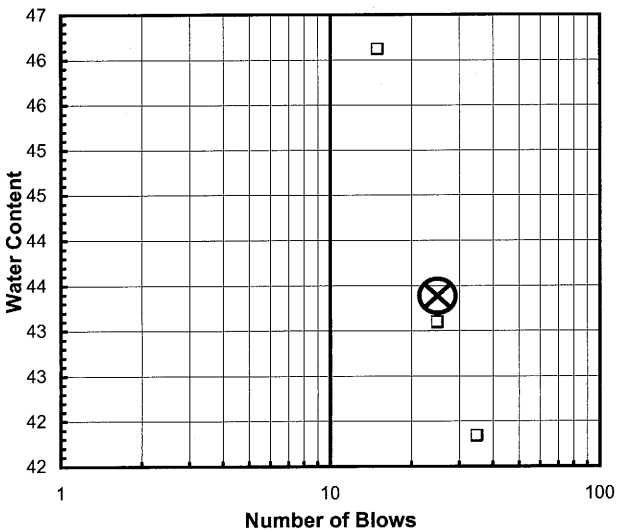
Liquid Limit Test	**1**	**2**	**3**	
Tare Number	C	N	R	M U L T I P O I N T
Wt. of Tare & WS (gm)	26.69	28.21	27.81	
Wt. of Tare & DS (gm)	23.07	24.31	24.07	
Wt. of Tare (gm)	15.22	15.26	15.13	
Wt. of Water (gm)	3.6	3.9	3.7	
Wt. of DS (gm)	7.9	9.1	8.9	
Moisture Content (%)	**46.1**	**43.1**	**41.8**	
Number of Blows	**15**	**25**	**35**	

Plastic Limit Test	**1**	**2**	**Range**
Tare Number	P	K	
Wt. of Tare & WS (gm)	21.53	21.40	
Wt. of Tare & DS (gm)	20.09	20.00	
Wt. of Tare (gm)	15.18	15.20	
Wt. of Water (gm)	1.4	1.4	
Wt. of DS (gm)	4.9	4.8	
Moisture Content (%)	**29.3**	**29.2**	**0.2**

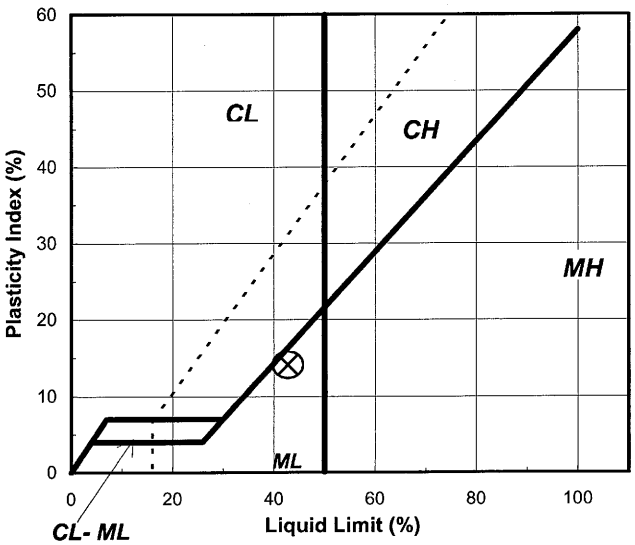
Note: The acceptable range of the two Moisture contents is ± 2.6

Test Results	
Liquid Limit (%)	**43**
Plastic Limit (%)	**29**
Plasticity Index (%)	**14**
USCS Symbol	**ML**

Flow Curve



Plasticity Chart



Tested By SD *Date* 3/16/2010 *Checked By* GTM *Date* 3-22-10

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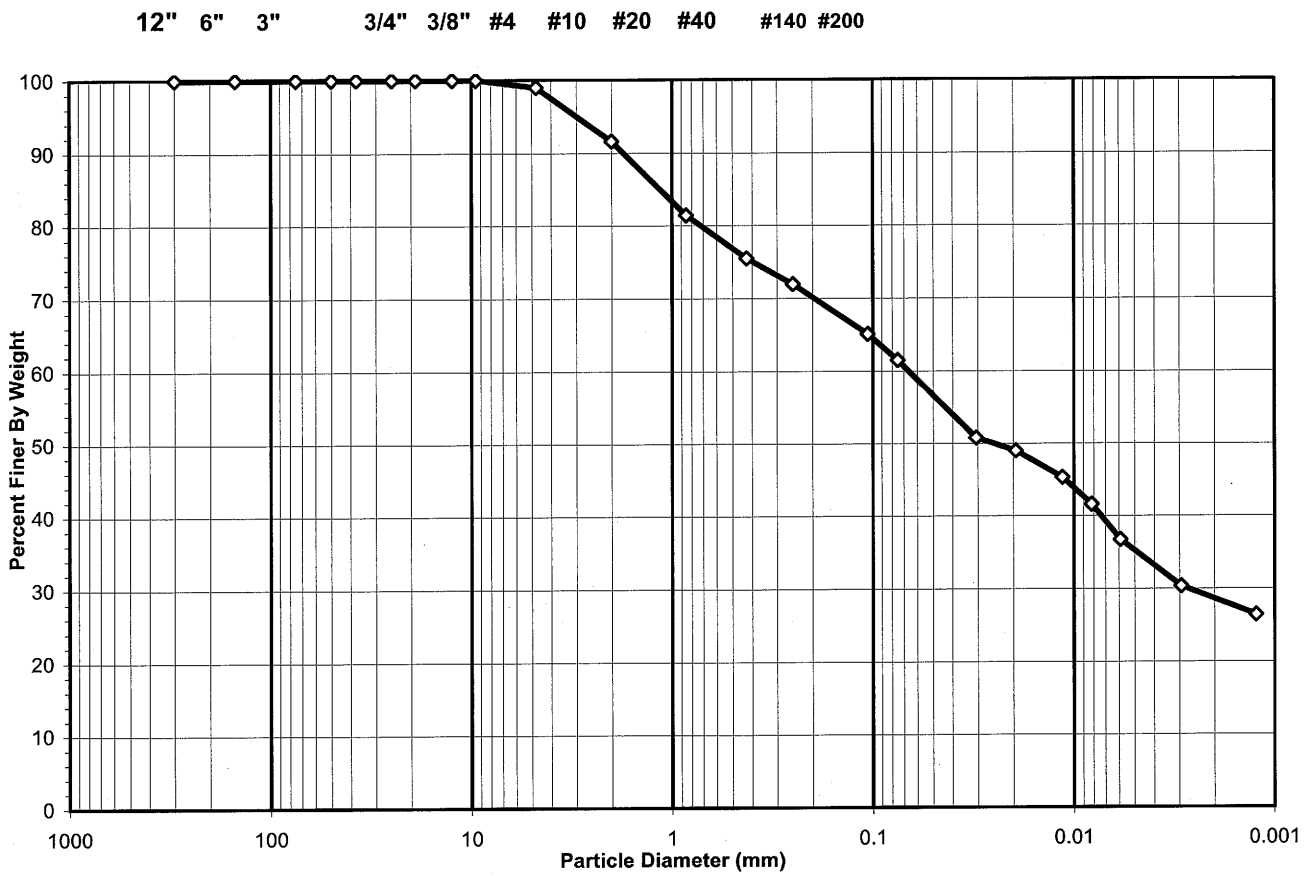
SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-1
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-01	Soil Color	**ORANGE**

	SIEVE ANALYSIS					HYDROMETER
USCS	cobbles	gravel	sand			silt and clay fraction
USDA	cobbles	gravel	sand		silt	clay



USCS Summary		
Sieve Sizes (mm)		**Percentage**
Greater Than #4	*Gravel*	1.00
#4 To #200	*Sand*	37.52
Finer Than #200	*Silt & Clay*	61.48

USCS Symbol ***CL, TESTED***

USCS Classification ***SANDY LEAN CLAY***

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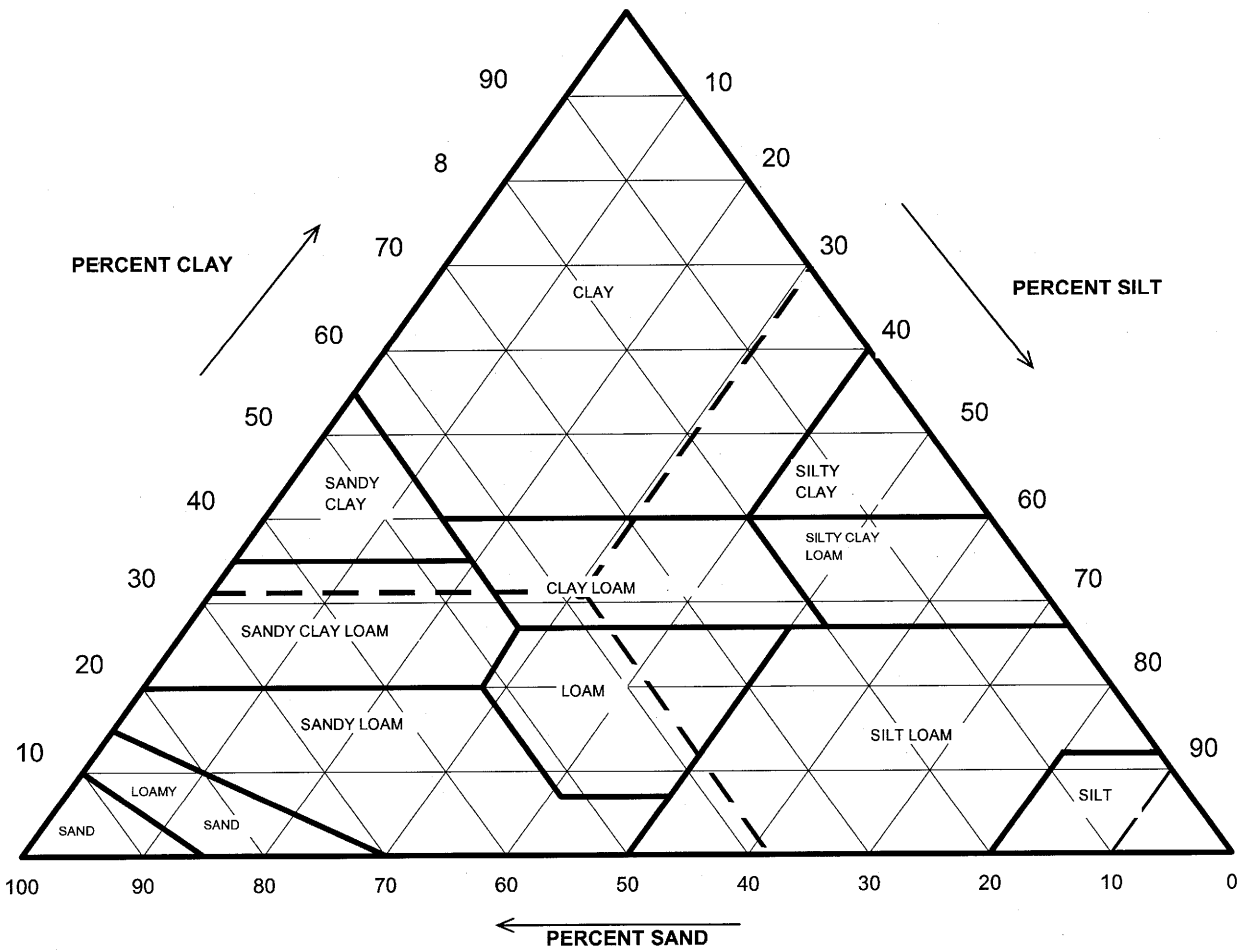
USDA CLASSIFICATION CHART

Client	R.S.G.& ASSOCIATES	Boring No.	TP-1
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-01	Soil Color	ORANGE



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	8.41	**0.00**
2	91.59	*Sand*	34.95	**38.15**
0.05	56.65	*Silt*	28.02	**30.59**
0.002	28.63	*Clay*	28.63	**31.25**

USDA Classification: ***CLAY LOAM***

 DCN: CT-S3P DATE:06/12/09 REVISION:9 \\Server\data drive\2010 PROJECTS\2010-642 RSG DAVIDSON\[2010-642-01-01 #10 Split Hydro rev 9.xls]Sheet1

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WASH SIEVE ANALYSIS #10 SPLIT

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-1
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-01	Soil Color	**ORANGE**

Moisture Content/sieve +10 Material		Moisture Content for Hydrometer Portion	
Tare No.	214	Tare No.	E-2
Wgt.Tare + Wet Soil (gm)	561.27	Wgt.Tare + Wet Soil (gm)	39.44
Wgt.Tare + Dry Soil (gm)	497.83	Wgt.Tare + Dry Soil (gm)	39.15
Weight of Tare (gm)	171.27	Weight of Tare (gm)	15.65
Weight of Water (gm)	63.44	Weight of Water (gm)	0.29
Weight of Dry Soil (gm)	326.56	Weight of Dry Soil (gm)	23.50
Moisture Content (%)	**19.4**	**Moisture Content (%)**	**1.2**

Soil Specimen Data			
Wet Weight +#10 Material (gm)	390.00	Weight of the Dry Sample (gm)	375.95
Dry Weight +#10 Material(gm)	326.6	Weight of minus #200 material (gm)	33.15
Wet Weight Hydro. Material.(gm)	50.00	Weight of plus #200 material (gm)	342.80
Dry Weight Hydro. Material (gm)	49.39		
Total Dry Weight Sample (gm)	375.95	**J-FACTOR (%FINER THAN #10)**	**0.9159**

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	3.28	1.00	1.00	99.00	**99.00**
#10	2.00	24.17	7.40	8.41	91.59	**91.59**
#20	0.85	5.49	11.12	11.12	88.88	**81.41**
#40	0.425	3.19	6.46	17.57	82.43	**75.50**
#60	0.250	1.91	3.87	21.44	78.56	**71.96**
#140	0.106	3.71	7.51	28.95	71.05	**65.07**
#200	0.075	1.94	3.93	32.88	67.12	**61.48**
Pan	-	33.15	67.12	100.00	-	-

Notes :

Tested By SD Date 3/19/2010 Checked By GEM Date 3-19-10

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HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-1
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-01	Soil Color	**ORANGE**

Elapsed Time (min)		R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	34.0	34.0	21.5	6.34	27.7	55.4	0.01321	0.0306	**50.8**
5		33.0	21.5	6.34	26.7	53.4	0.01321	0.0195	**49.0**
15		31.0	21.5	6.34	24.7	49.4	0.01321	0.0114	**45.3**
30		29.0	21.5	6.34	22.7	45.4	0.01321	0.0082	**41.6**
60		26.0	22.0	6.00	20.0	40.1	0.01313	0.0059	**36.7**
250		22.0	22.8	5.46	16.5	33.2	0.01300	0.0029	**30.4**
1440		20.0	22.6	5.60	14.4	28.9	0.01303	0.0012	**26.4**

Soil Specimen Data		**Other Corrections**	
Tare + Dry Material (gm)	49.39	a - Factor	0.99
Weight of Tare (gm)	0		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 10	91.59
Weight of Dry Material (gm)	49.39		
		Specific Gravity	2.7 Assumed

Note:

Tested By JBD Date 3/16/2010 Checked By GZM Date 3-19-10

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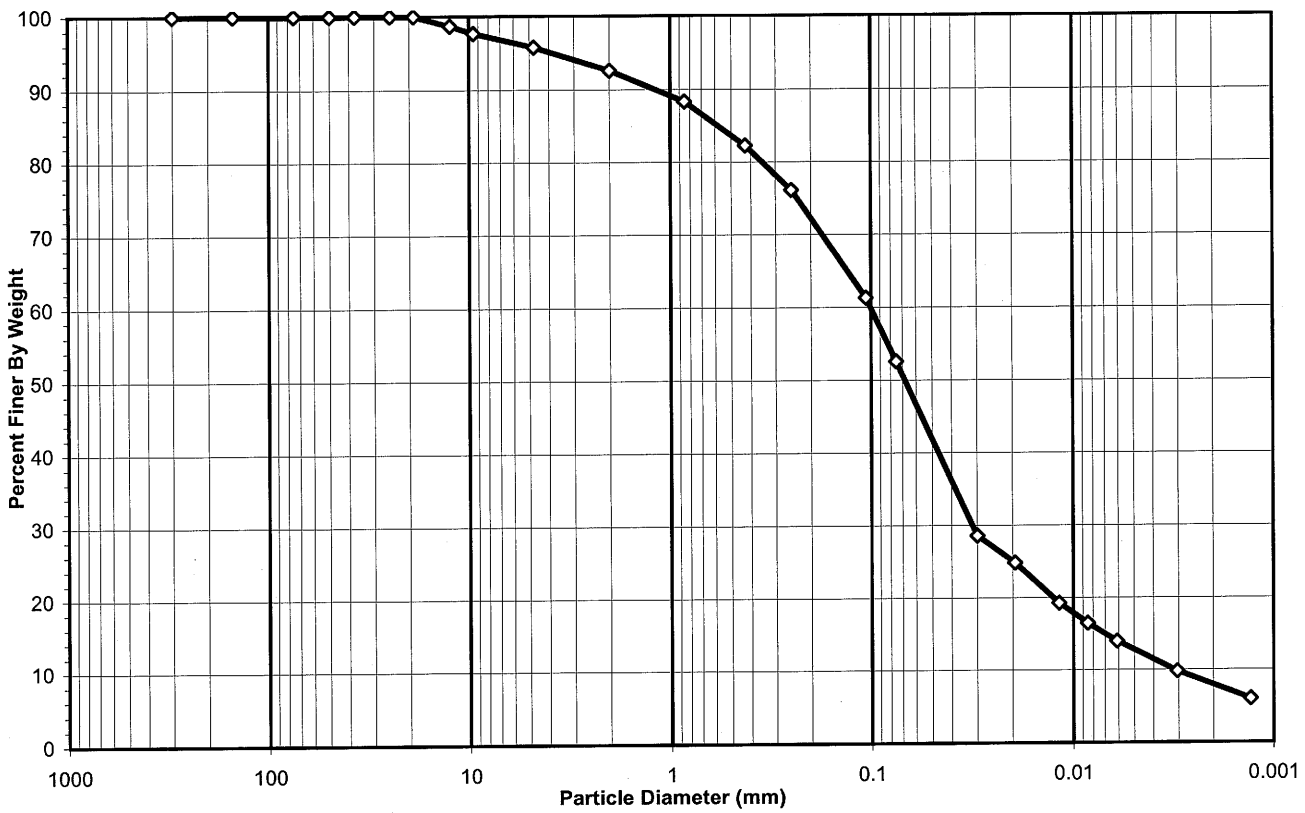
SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-2
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-02	Soil Color	**GRAY**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay

12" 6" 3" 3/4" 3/8" #4 #10 #20 #40 #140 #200



USCS Summary

Sieve Sizes (mm)		Percentage
Greater Than #4	*Gravel*	4.20
#4 To #200	*Sand*	43.29
Finer Than #200	*Silt & Clay*	52.51

USCS Symbol ***CL-ML, TESTED***

USCS Classification ***SANDY SILTY CLAY***

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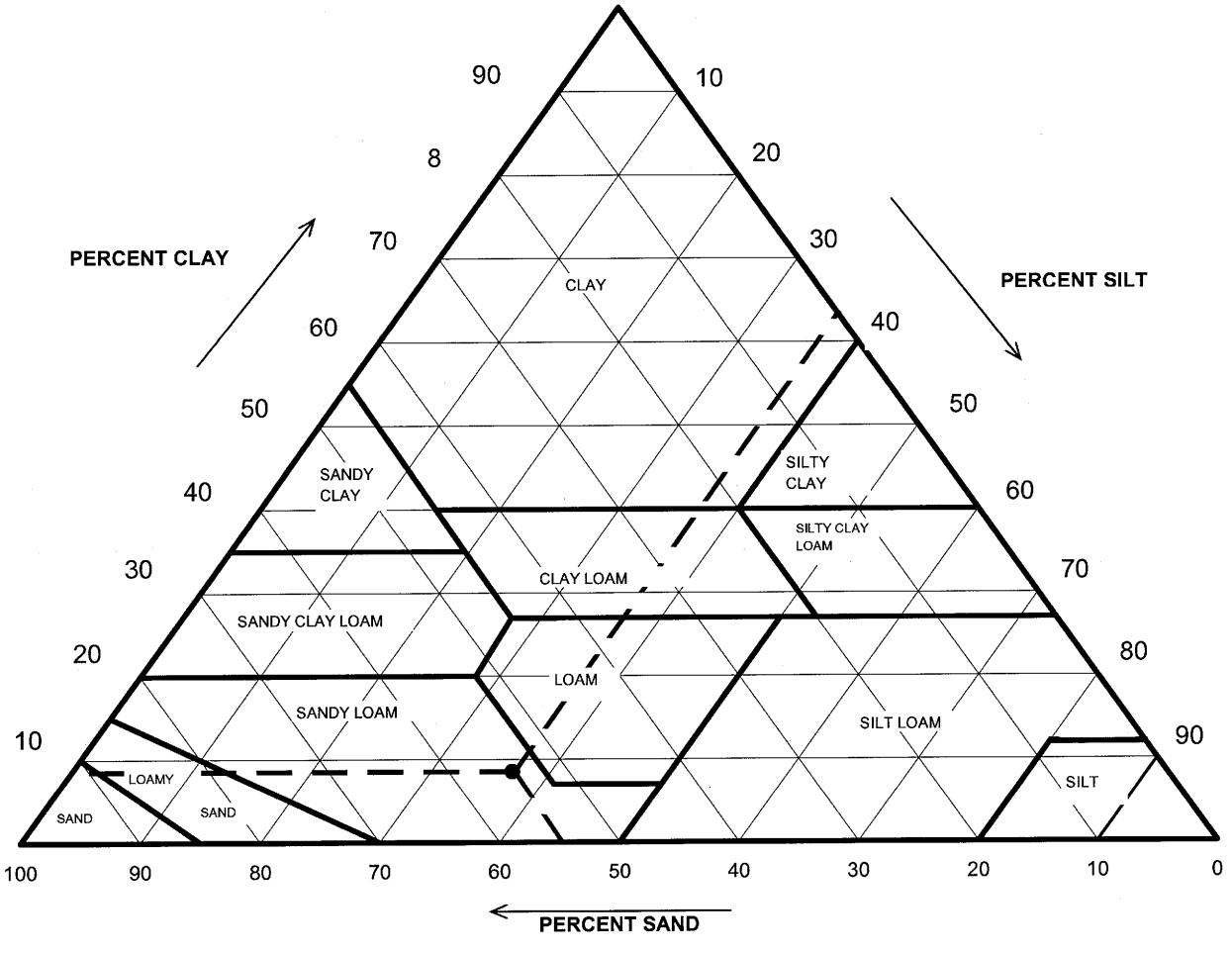
USDA CLASSIFICATION CHART

Client	R.S.G.& ASSOCIATES	Boring No.	TP-2
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-02	Soil Color	GRAY



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	7.42	**0.00**
2	92.58	*Sand*	50.62	**54.68**
0.05	41.96	*Silt*	34.05	**36.77**
0.002	7.92	*Clay*	7.92	**8.55**

USDA Classification: ***SANDY LOAM***

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WASH SIEVE ANALYSIS #10 SPLIT

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-2
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-02	Soil Color	**GRAY**

Moisture Content/sieve +10 Material		Moisture Content for Hydrometer Portion	
Tare No.	215	Tare No.	C-2
Wgt.Tare + Wet Soil (gm)	533.15	Wgt.Tare + Wet Soil (gm)	58.16
Wgt.Tare + Dry Soil (gm)	482.98	Wgt.Tare + Dry Soil (gm)	57.49
Weight of Tare (gm)	172.29	Weight of Tare (gm)	15.66
Weight of Water (gm)	50.17	Weight of Water (gm)	0.67
Weight of Dry Soil (gm)	310.69	Weight of Dry Soil (gm)	41.83
Moisture Content (%)	**16.1**	**Moisture Content (%)**	**1.6**

Soil Specimen Data			
Wet Weight +#10 Material (gm)	360.86	Weight of the Dry Sample (gm)	409.11
Dry Weight +#10 Material(gm)	310.7	Weight of minus #200 material (gm)	55.82
Wet Weight Hydro. Material.(gm)	100.00	Weight of plus #200 material (gm)	353.29
Dry Weight Hydro. Material (gm)	98.42		
Total Dry Weight Sample (gm)	409.11	**J-FACTOR (%FINER THAN #10)**	**0.9258**

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	4.14	1.33	1.33	98.67	**98.67**
3/8"	9.50	3.14	1.01	2.34	97.66	**97.66**
#4	4.75	5.76	1.85	4.20	95.80	**95.80**
#10	2.00	10.01	3.22	7.42	92.58	**92.58**
#20	0.85	4.51	4.58	4.58	95.42	**88.34**
#40	0.425	6.48	6.58	11.17	88.83	**82.24**
#60	0.250	6.50	6.60	17.77	82.23	**76.13**
#140	0.106	15.75	16.00	33.77	66.23	**61.31**
#200	0.075	9.36	9.51	43.28	56.72	**52.51**
Pan	-	55.82	56.72	100.00	-	-

Notes :

Tested By DAW Date 3/19/2010 Checked By GEM Date 3-22-10

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HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-2
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-02	Soil Color	**GRAY**

Elapsed Time (min)		R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	37.0	37.0	21.5	6.34	30.7	30.8	0.01321	0.0299	**28.6**
5		33.0	21.5	6.34	26.7	26.8	0.01321	0.0195	**24.8**
15		27.0	21.5	6.34	20.7	20.8	0.01321	0.0117	**19.2**
30		24.0	21.5	6.34	17.7	17.8	0.01321	0.0085	**16.4**
60		21.0	22.0	6.00	15.0	15.1	0.01313	0.0061	**14.0**
250		16.0	22.8	5.46	10.5	10.6	0.01300	0.0030	**9.8**
1440		12.0	22.6	5.60	6.4	6.4	0.01303	0.0013	**6.0**

Soil Specimen Data		**Other Corrections**	
Tare + Dry Material (gm)	98.42	a - Factor	0.99
Weight of Tare (gm)	0		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 10	92.58
Weight of Dry Material (gm)	98.42		
		Specific Gravity	2.7 Assumed

Note:

Tested By JBD Date 3/18/2010 Checked By GEM Date 3-22-10

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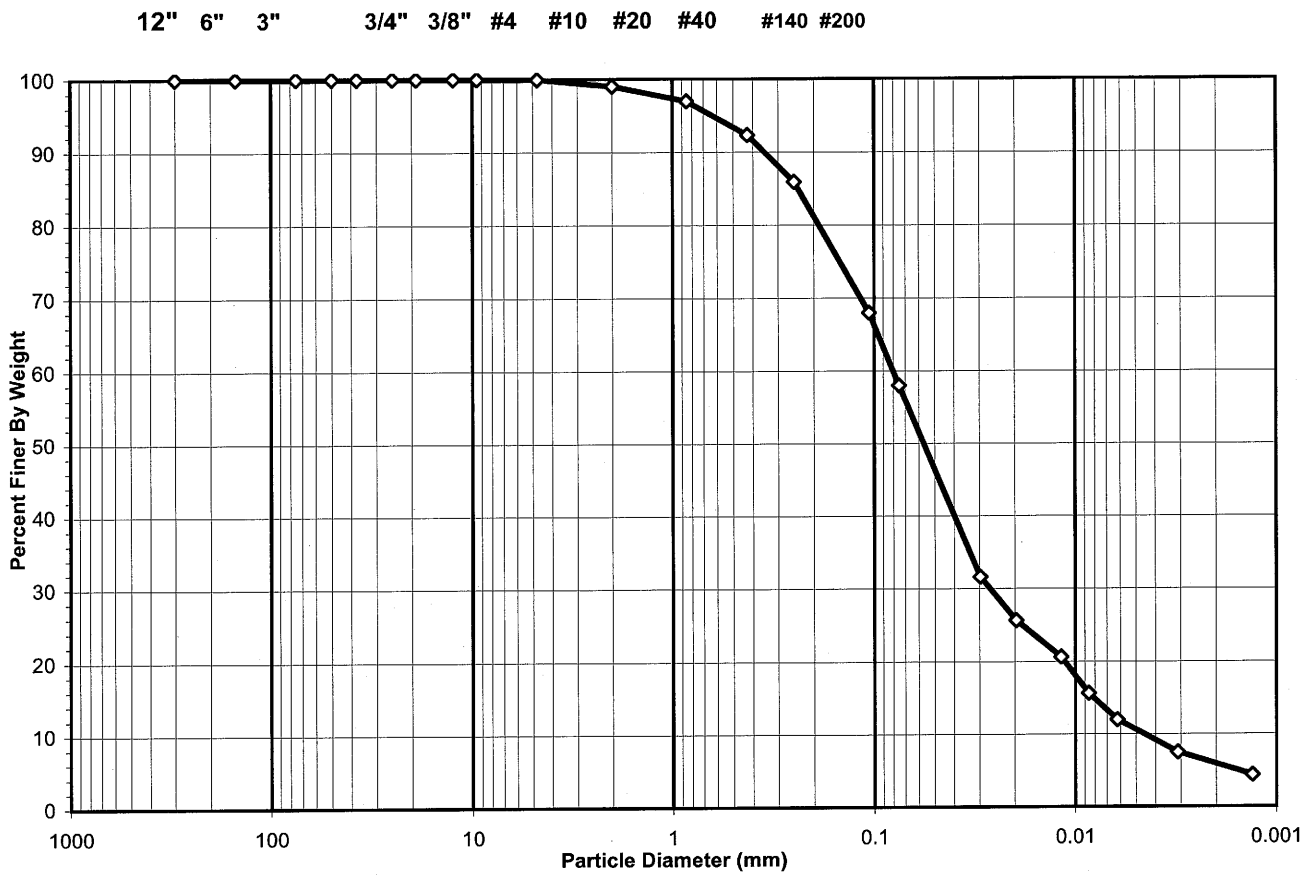
SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-3
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-03	Soil Color	**TAN GRAY**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	0.06
#4 To #200	*Sand*	41.96
Finer Than #200	*Silt & Clay*	57.98

USCS Symbol ***ML, TESTED***

USCS Classification ***SANDY SILT***

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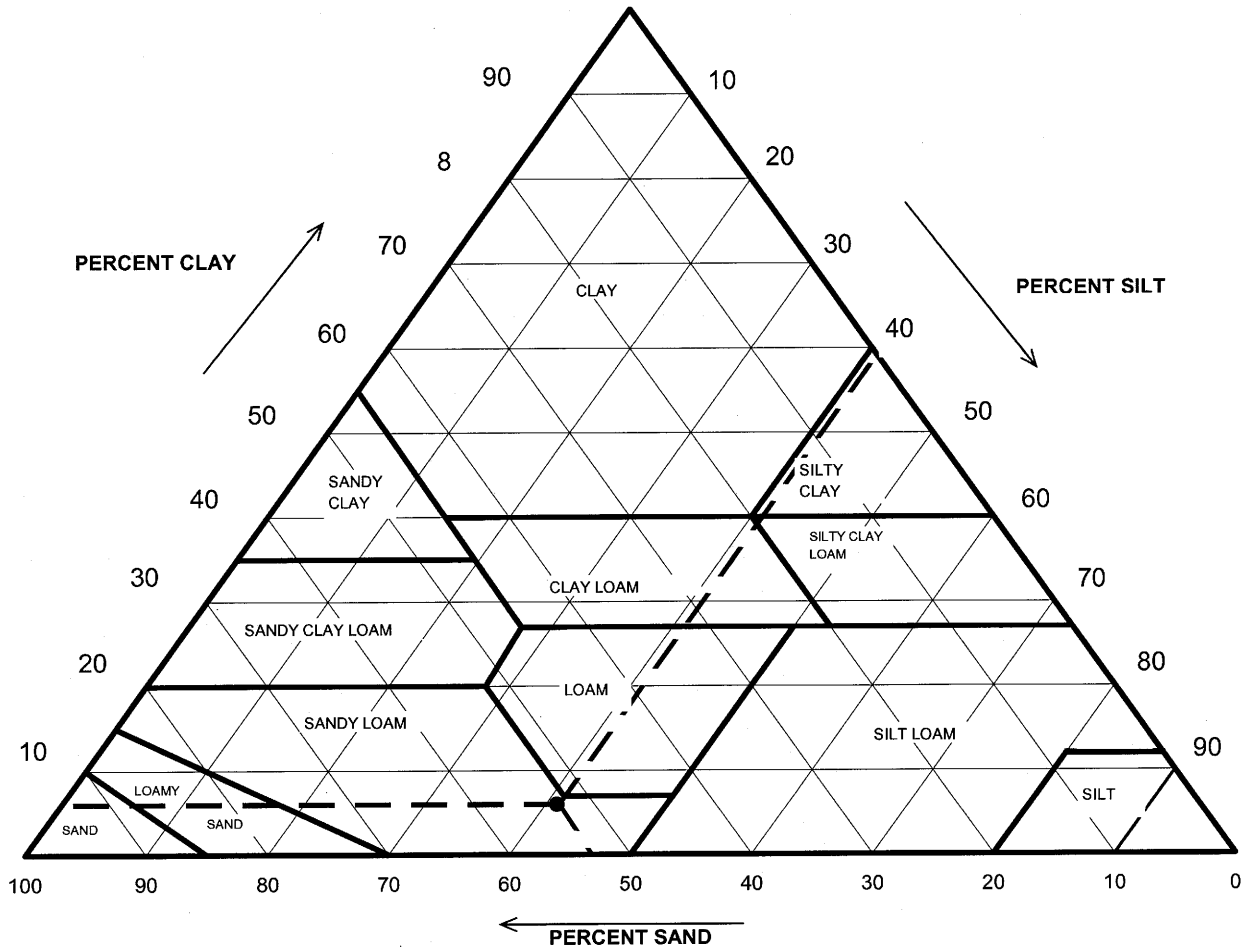
USDA CLASSIFICATION CHART

Client	R.S.G.& ASSOCIATES	Boring No.	TP-3
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-03	Soil Color	TAN GRAY



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	0.97	**0.00**
2	99.03	*Sand*	52.56	**53.08**
0.05	46.46	*Silt*	40.54	**40.94**
0.002	5.93	*Clay*	5.93	**5.99**

USDA Classification: ***SANDY LOAM***

 DCN: CT-S3P DATE:06/12/09 REVISION:9 \\Server\data drive\2010 PROJECTS\2010-642 RSG DAVIDSON\[2010-642-01-03 #10 Split Hydro rev 9.xls]Sheet1

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WASH SIEVE ANALYSIS #10 SPLIT

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-3
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-03	Soil Color	**TAN GRAY**

Moisture Content/sieve +10 Material		Moisture Content for Hydrometer Portion	
Tare No.	216	Tare No.	B-1
Wgt.Tare + Wet Soil (gm)	497.17	Wgt.Tare + Wet Soil (gm)	53.08
Wgt.Tare + Dry Soil (gm)	458.21	Wgt.Tare + Dry Soil (gm)	52.43
Weight of Tare (gm)	170.71	Weight of Tare (gm)	15.83
Weight of Water (gm)	38.96	Weight of Water (gm)	0.65
Weight of Dry Soil (gm)	287.50	Weight of Dry Soil (gm)	36.60
Moisture Content (%)	**13.6**	**Moisture Content (%)**	**1.8**

Soil Specimen Data			
Wet Weight +#10 Material (gm)	326.46	Weight of the Dry Sample (gm)	385.75
Dry Weight +#10 Material(gm)	287.5	Weight of minus #200 material (gm)	57.53
Wet Weight Hydro. Material.(gm)	99.99	Weight of plus #200 material (gm)	328.22
Dry Weight Hydro. Material (gm)	98.25		
Total Dry Weight Sample (gm)	385.75	**J-FACTOR (%FINER THAN #10)**	**0.9903**

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.17	0.06	0.06	99.94	**99.94**
#10	2.00	2.63	0.91	0.97	99.03	**99.03**
#20	0.85	2.06	2.10	2.10	97.90	**96.95**
#40	0.425	4.62	4.70	6.80	93.20	**92.29**
#60	0.250	6.34	6.45	13.25	86.75	**85.90**
#140	0.106	17.78	18.10	31.35	68.65	**67.98**
#200	0.075	9.92	10.10	41.45	58.55	**57.98**
Pan	-	57.53	58.55	100.00	-	-

Notes :

Tested By SD Date 3/19/2010 Checked By GM Date 3-19-10

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HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-3
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-03	Soil Color	**TAN GRAY**

Elapsed Time (min)		R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	38.0	38.0	21.5	6.34	31.7	31.9	0.01321	0.0296	**31.6**
5		32.0	21.5	6.34	25.7	25.9	0.01321	0.0196	**25.6**
15		27.0	21.5	6.34	20.7	20.8	0.01321	0.0117	**20.6**
30		22.0	21.5	6.34	15.7	15.8	0.01321	0.0086	**15.6**
60		18.0	22.0	6.00	12.0	12.1	0.01313	0.0062	**12.0**
250		13.0	22.8	5.46	7.5	7.6	0.01300	0.0031	**7.5**
1440		10.0	22.6	5.60	4.4	4.4	0.01303	0.0013	**4.4**

Soil Specimen Data		**Other Corrections**	
Tare + Dry Material (gm)	98.25	a - Factor	0.99
Weight of Tare (gm)	0		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 10	99.03
Weight of Dry Material (gm)	98.25		
		Specific Gravity	2.7 Assumed

Note:

Tested By JBD Date 3/16/2010 Checked By Gem Date 3-19-10

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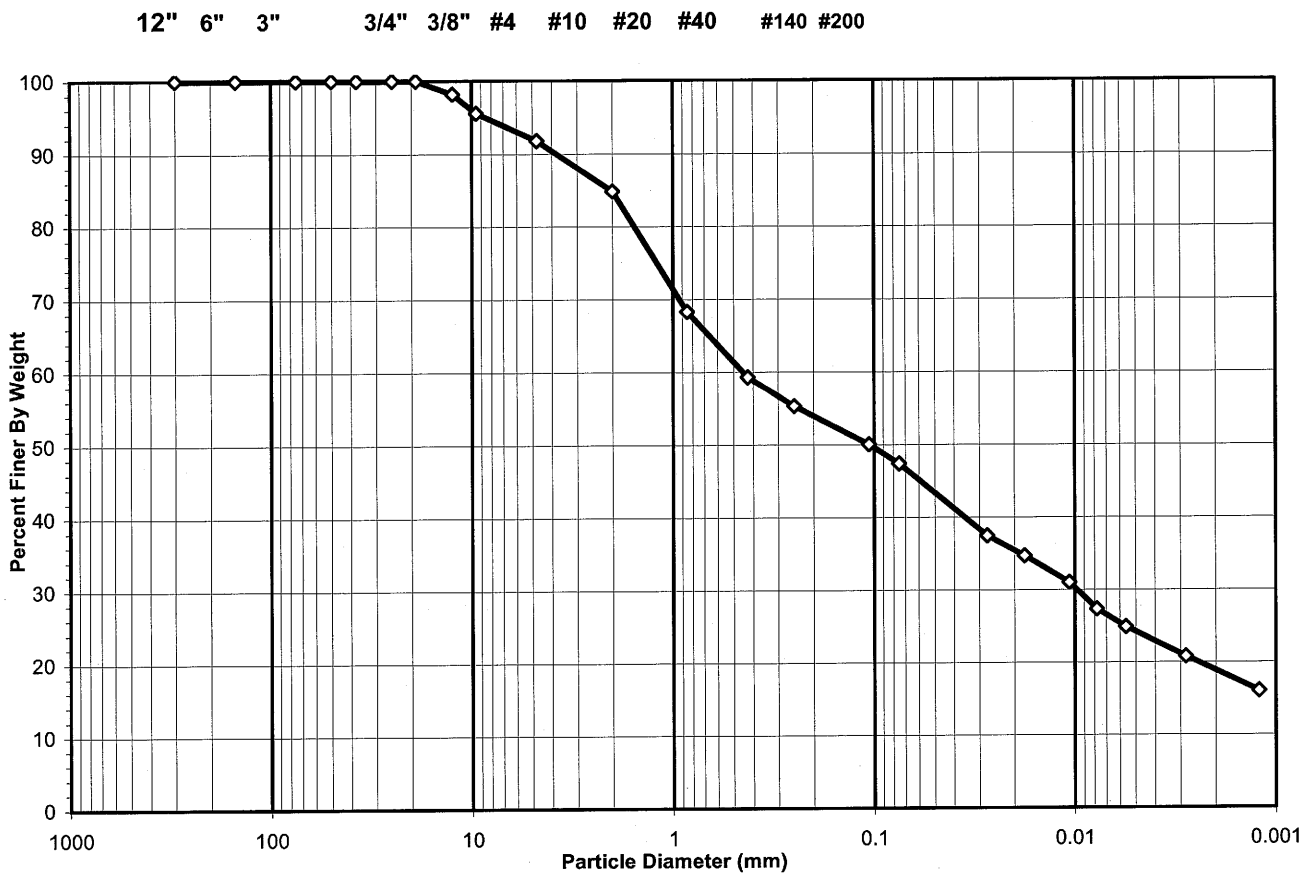
SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-4
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-04	Soil Color	**BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



USCS Summary

Sieve Sizes (mm)		Percentage
Greater Than #4	*Gravel*	8.21
#4 To #200	*Sand*	44.41
Finer Than #200	*Silt & Clay*	47.38

USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

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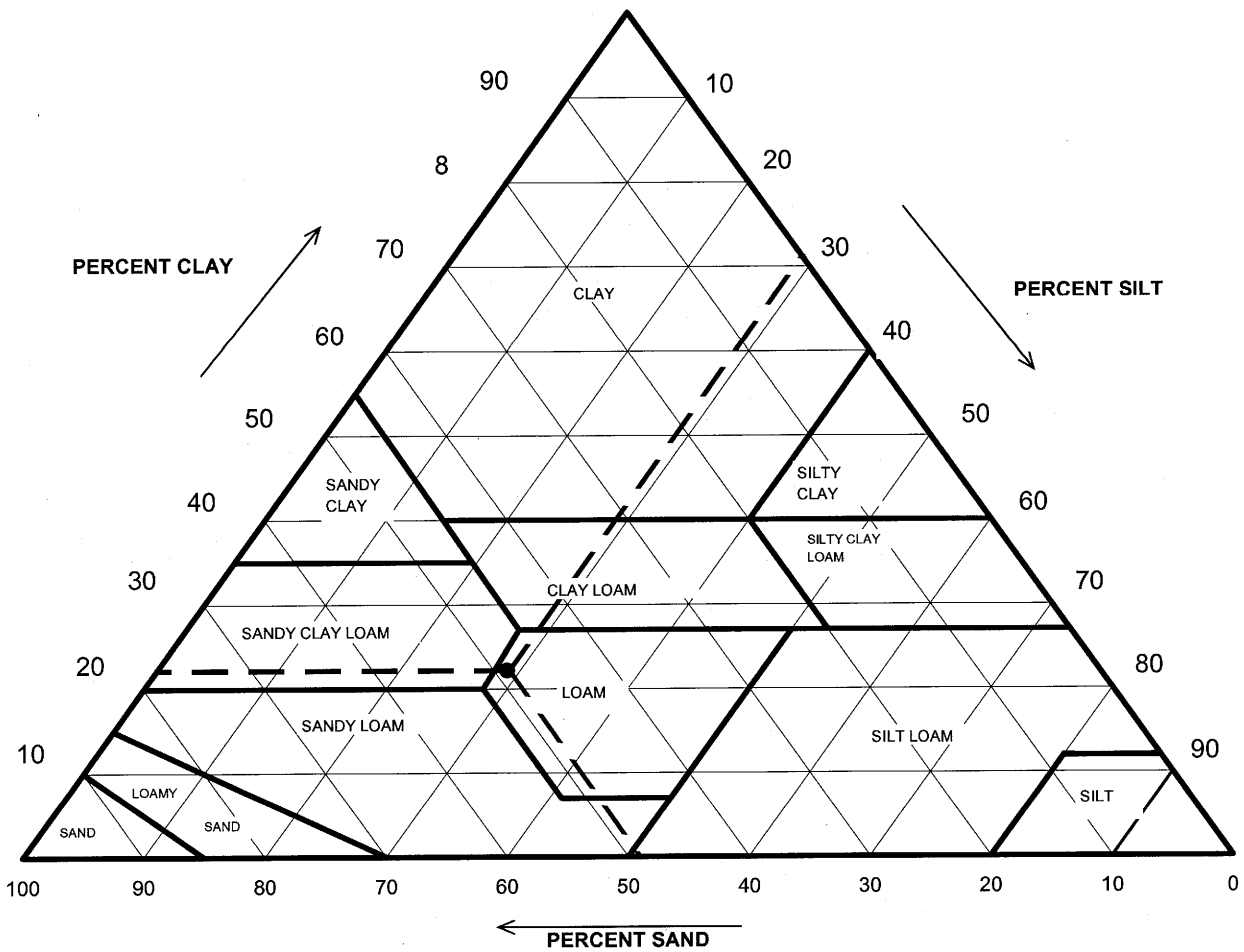
USDA CLASSIFICATION CHART

Client	R.S.G.& ASSOCIATES	Boring No.	TP-4
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-04	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	15.15	**0.00**
2	84.85	*Sand*	41.46	**48.86**
0.05	43.39	*Silt*	24.55	**28.93**
0.002	18.84	*Clay*	18.84	**22.20**

USDA Classification: ***LOAM***

 DCN: CT-S3P DATE:06/12/09 REVISION:9 \\Server\data drive\2010 PROJECTS\2010-642 RSG DAVIDSON\[2010-642-01-04 #10 Split Hydro rev 9.xls]Sheet1

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WASH SIEVE ANALYSIS #10 SPLIT

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-4
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-04	Soil Color	**BROWN**

Moisture Content/sieve +10 Material		Moisture Content for Hydrometer Portion	
Tare No.	212	Tare No.	R-1
Wgt.Tare + Wet Soil (gm)	498.22	Wgt.Tare + Wet Soil (gm)	42.76
Wgt.Tare + Dry Soil (gm)	421.22	Wgt.Tare + Dry Soil (gm)	40.38
Weight of Tare (gm)	171.49	Weight of Tare (gm)	15.76
Weight of Water (gm)	77.00	Weight of Water (gm)	2.38
Weight of Dry Soil (gm)	249.73	Weight of Dry Soil (gm)	24.62
Moisture Content (%)	**30.8**	**Moisture Content (%)**	**9.7**

Soil Specimen Data			
Wet Weight +#10 Material (gm)	326.73	Weight of the Dry Sample (gm)	340.92
Dry Weight +#10 Material(gm)	249.7	Weight of minus #200 material (gm)	50.92
Wet Weight Hydro. Material.(gm)	100.00	Weight of plus #200 material (gm)	290.00
Dry Weight Hydro. Material (gm)	91.19		
Total Dry Weight Sample (gm)	340.92	**J-FACTOR (%FINER THAN #10)**	**0.8485**

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	4.51	1.81	1.81	98.19	**98.19**
3/8"	9.50	6.52	2.61	4.42	95.58	**95.58**
#4	4.75	9.48	3.80	8.21	91.79	**91.79**
#10	2.00	17.33	6.94	15.15	84.85	**84.85**
#20	0.85	17.81	19.53	19.53	80.47	**68.28**
#40	0.425	9.66	10.59	30.13	69.87	**59.29**
#60	0.250	4.28	4.69	34.82	65.18	**55.30**
#140	0.106	5.68	6.23	41.05	58.95	**50.02**
#200	0.075	2.84	3.11	44.16	55.84	**47.38**
Pan	-	50.92	55.84	100.00	-	-

Notes :

Tested By SD Date 3/19/2010 Checked By GEM Date 3-19-10

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HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-4
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-04	Soil Color	**BROWN**

Elapsed Time (min)		R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	47.0	47.0	21.5	6.34	40.7	44.1	0.01321	0.0274	**37.5**
5		44.0	21.5	6.34	37.7	40.9	0.01321	0.0178	**34.7**
15		40.0	21.5	6.34	33.7	36.5	0.01321	0.0106	**31.0**
30		36.0	21.5	6.34	29.7	32.2	0.01321	0.0078	**27.3**
60		33.0	22.0	6.00	27.0	29.3	0.01313	0.0056	**24.9**
250		28.0	22.8	5.46	22.5	24.5	0.01300	0.0028	**20.8**
1440		23.0	22.6	5.60	17.4	18.9	0.01303	0.0012	**16.0**

Soil Specimen Data		**Other Corrections**	
Tare + Dry Material (gm)	91.19	a - Factor	0.99
Weight of Tare (gm)	0		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 10	84.85
Weight of Dry Material (gm)	91.19		
		Specific Gravity	2.7 Assumed

Note:

Tested By JBD Date 3/16/2010 Checked By GEM Date 3-19-10

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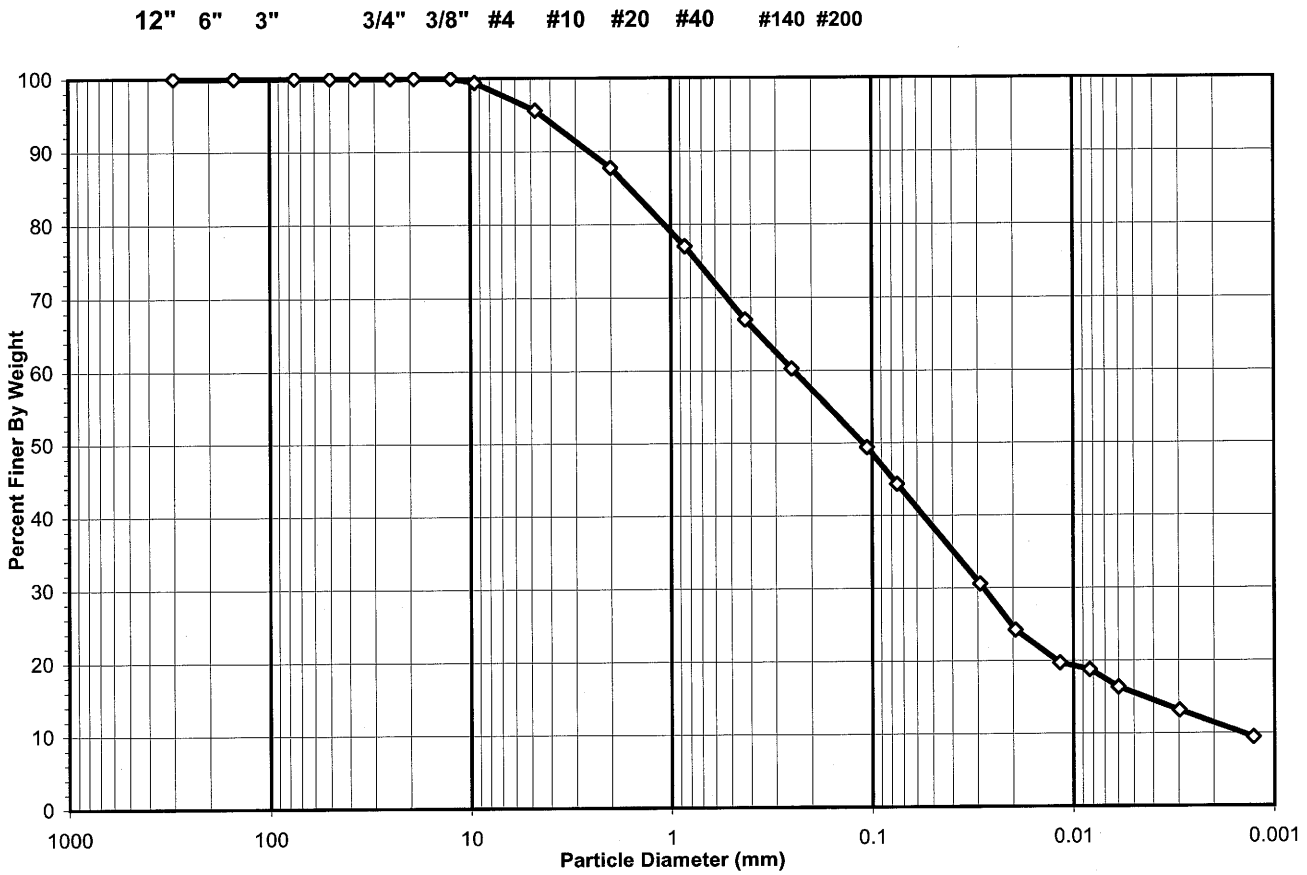
SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-5
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-05	Soil Color	**LIGHT BROWN**

	SIEVE ANALYSIS			HYDROMETER	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



Sieve Sizes (mm)	USCS Summary	Percentage
Greater Than #4	*Gravel*	4.40
#4 To #200	*Sand*	51.29
Finer Than #200	*Silt & Clay*	44.30

USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND***

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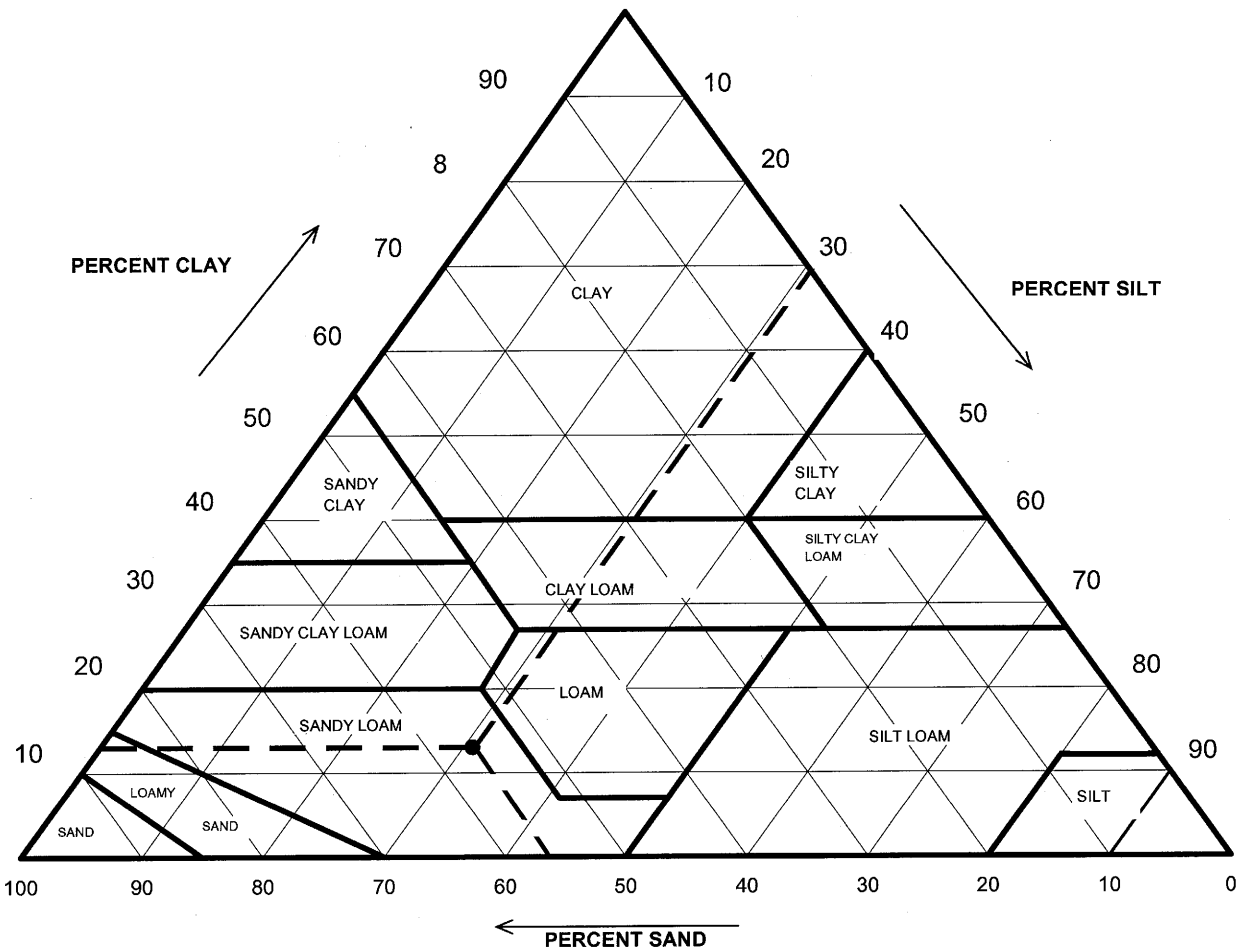
USDA CLASSIFICATION CHART

Client	R.S.G.& ASSOCIATES	Boring No.	TP-5
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-05	Soil Color	LIGHT BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	12.31	**0.00**
2	87.69	*Sand*	49.29	**56.21**
0.05	38.40	*Silt*	26.95	**30.74**
0.002	11.45	*Clay*	11.45	**13.06**

USDA Classification: ***SANDY LOAM***

 DCN: CT-S3P DATE:06/12/09 REVISION:9 \\Server\data drive\2010 PROJECTS\2010-642 RSG DAVIDSON\[2010-642-01-05 #10 Split Hydro rev 9.xls]Sheet1

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WASH SIEVE ANALYSIS #10 SPLIT

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-5
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-05	Soil Color	**LIGHT BROWN**

Moisture Content/sieve +10 Material		Moisture Content for Hydrometer Portion	
Tare No.	202	Tare No.	S-1
Wgt.Tare + Wet Soil (gm)	518.49	Wgt.Tare + Wet Soil (gm)	54.72
Wgt.Tare + Dry Soil (gm)	458.43	Wgt.Tare + Dry Soil (gm)	53.02
Weight of Tare (gm)	197.33	Weight of Tare (gm)	15.59
Weight of Water (gm)	60.06	Weight of Water (gm)	1.70
Weight of Dry Soil (gm)	261.10	Weight of Dry Soil (gm)	37.43
Moisture Content (%)	**23.0**	**Moisture Content (%)**	**4.5**

Soil Specimen Data			
Wet Weight +#10 Material (gm)	321.16	Weight of the Dry Sample (gm)	356.77
Dry Weight +#10 Material(gm)	261.1	Weight of minus #200 material (gm)	48.33
Wet Weight Hydro. Material.(gm)	100.02	Weight of plus #200 material (gm)	308.44
Dry Weight Hydro. Material (gm)	95.67		
Total Dry Weight Sample (gm)	356.77	**J-FACTOR (%FINER THAN #10)**	**0.8769**

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	1.51	0.58	0.58	99.42	**99.42**
#4	4.75	9.99	3.83	4.40	95.60	**95.60**
#10	2.00	20.64	7.91	12.31	87.69	**87.69**
#20	0.85	11.64	12.17	12.17	87.83	**77.02**
#40	0.425	10.94	11.43	23.60	76.40	**66.99**
#60	0.250	7.34	7.67	31.27	68.73	**60.27**
#140	0.106	11.88	12.42	43.69	56.31	**49.38**
#200	0.075	5.54	5.79	49.48	50.52	**44.30**
Pan	-	48.33	50.52	100.00	-	-

Notes :

Tested By DAW Date 3/19/2010 Checked By GEM Date 3-22-10

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HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	R.S.G.& ASSOCIATES	Boring No.	TP-5
Client Reference	DAVIDSON CO. BORROW STUDY	Depth (ft)	NA
Project No.	2010-642-01	Sample No.	3-9-10
Lab ID	2010-642-01-05	Soil Color	**LIGHT BROWN**

Elapsed Time (min)		R Measured	Temp. (°C)	Composite Correction	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	40.0	40.0	21.5	6.34	33.7	34.8	0.01321	0.0291	**30.5**
5		33.0	21.5	6.34	26.7	27.6	0.01321	0.0195	**24.2**
15		28.0	21.5	6.34	21.7	22.4	0.01321	0.0117	**19.7**
30		27.0	21.5	6.34	20.7	21.4	0.01321	0.0083	**18.7**
60		24.0	22.0	6.00	18.0	18.6	0.01313	0.0060	**16.3**
250		20.0	22.8	5.46	14.5	15.0	0.01300	0.0030	**13.2**
1440		16.0	22.6	5.60	10.4	10.8	0.01303	0.0013	**9.4**

Soil Specimen Data		**Other Corrections**	
Tare + Dry Material (gm)	95.67	a - Factor	0.99
Weight of Tare (gm)	0		
Weight of Deflocculant (gm)	5.0	Percent Finer than # 10	87.69
Weight of Dry Material (gm)	95.67		
		Specific Gravity	2.7 Assumed

Note:

Tested By JBD Date 3/18/2010 Checked By GEM Date 3-22-10

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **CSLDR-01**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **11.9.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory 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.	
CLND 01	Test Pad 1	Lift 1	6"	763-01-03	91.9	30.0	**119.7**	**33.9**	**89.4**	**97.3%**	**95.0%**	CSLDC-01
CLND 2	Test Pad 1	Lift 1	6"	763-01-03	91.9	30.0	**119.5**	**34.1**	**89.1**	**97.0%**	**95.0%**	
CLND 3	Test Pad 1	Lift 1	6"	763-01-03	91.9	30.0	**121.2**	**36.2**	**89.0**	**96.8%**	**95.0%**	
CLND 4	Test Pad 1	Lift 1	6"	763-01-03	91.9	30.0	**120.4**	**33.8**	**90.0**	**97.9%**	**95.0%**	
CLND 5	Test Pad 1	Lift 2	6"	763-01-03	91.9	30.0	**120.4**	**34.7**	**89.4**	**97.3%**	**95.0%**	CSLDC-02
CLND 6	Test Pad 1	Lift 2	6"	763-01-03	91.9	30.0	**119.2**	**35.8**	**87.8**	**95.5%**	**95.0%**	
CLND 7	Test Pad 1	Lift 2	6"	763-01-03	91.9	30.0	**121.2**	**34.4**	**90.2**	**98.1%**	**95.0%**	
CLND 8	Test Pad 1	Lift 2	6"	763-01-03	91.9	30.0	**120.7**	**35.2**	**89.3**	**97.1%**	**95.0%**	
CLND 9	Test Pad 1	Lift 3	6"	763-01-03	91.9	30.0	**118.5**	**34.1**	**88.4**	**96.2%**	**95.0%**	CSLDC-03
CLND 10	Test Pad 1	Lift 3	6"	763-01-03	91.9	30.0	**120.5**	**32.9**	**90.7**	**98.7%**	**95.0%**	
CLND 11	Test Pad 1	Lift 3	6"	763-01-03	91.9	30.0	**119.6**	**32.7**	**90.1**	**98.1%**	**95.0%**	
CLND 12	Test Pad 1	Lift 3	6"	763-01-03	91.9	30.0	**118.5**	**33.5**	**88.8**	**96.6%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2365	638

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **CSLDR-02**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **11.14.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory 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.	
CLND 13	Test Pad 2	Lift 1	6"	763-02-04	106.4	18.5	**126.2**	**23.6**	**102.1**	**96.0%**	**95.0%**	CSLDC-04
CLND 14	Test Pad 2	Lift 1	6"	763-02-04	106.4	18.5	**125.8**	**24.1**	**101.4**	**95.3%**	**95.0%**	
CLND 15	Test Pad 2	Lift 1	6"	763-02-04	106.4	18.5	**125.2**	**23.8**	**101.1**	**95.0%**	**95.0%**	
CLND 16	Test Pad 2	Lift 1	6"	763-02-04	106.4	18.5	**124.8**	**22.1**	**102.2**	**96.1%**	**95.0%**	
CLND 17	Test Pad 2	Lift 2	6"	763-02-04	106.4	18.5	**126.2**	**23.2**	**102.4**	**96.3%**	**95.0%**	CSLDC-05
CLND 18	Test Pad 2	Lift 2	6"	763-02-04	106.4	18.5	**125.2**	**20.9**	**103.6**	**97.3%**	**95.0%**	
CLND 19	Test Pad 2	Lift 2	6"	763-02-04	106.4	18.5	**124.3**	**22.7**	**101.3**	**95.2%**	**95.0%**	
CLND 20	Test Pad 2	Lift 2	6"	763-02-04	106.4	18.5	**127.2**	**24.6**	**102.1**	**95.9%**	**95.0%**	
CLND 21	Test Pad 2	Lift 3	6"	763-02-04	106.4	18.5	**125.1**	**23.7**	**101.1**	**95.0%**	**95.0%**	CSLDC-06
CLND 22	Test Pad 2	Lift 3	6"	763-02-04	106.4	18.5	**126.8**	**25.2**	**101.3**	**95.2%**	**95.0%**	
CLND 23	Test Pad 2	Lift 3	6"	763-02-04	106.4	18.5	**124.7**	**23.4**	**101.1**	**95.0%**	**95.0%**	
CLND 24	Test Pad 2	Lift 3	6"	763-02-04	106.4	18.5	**124.9**	**21.8**	**102.5**	**96.4%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2337	628

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **CSLDR-03**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **11.25.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory 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.	
CLND 25	A-2	Lift 1	6"	763-01-03	91.9	30.0	**118.6**	**32.1**	**89.8**	**97.7%**	**95.0%**	
CLND 26	A-3	Lift 1	6"	763-01-03	91.9	30.0	**117.5**	**33.4**	**88.1**	**95.8%**	**95.0%**	CSLDC-07
CLND 27	A-4	Lift 1	6"	763-01-03	91.9	30.0	**116.9**	**32.8**	**88.0**	**95.8%**	**95.0%**	
CLND 28	A-5	Lift 1	6"	763-01-03	91.9	30.0	**117.8**	**33.6**	**88.2**	**95.9%**	**95.0%**	
CLND 29	B-2	Lift 1	6"	763-01-03	91.9	30.0	**119.3**	**34.1**	**89.0**	**96.8%**	**95.0%**	
CLND 30	B-3	Lift 1	6"	763-01-03	91.9	30.0	**116.9**	**33.5**	**87.6**	**95.3%**	**95.0%**	
CLND 31	B-4	Lift 1	6"	763-01-03	91.9	30.0	**118.3**	**32.7**	**89.1**	**97.0%**	**95.0%**	
CLND 32	B-5	Lift 1	6"	763-01-03	91.9	30.0	**120.6**	**33.6**	**90.3**	**98.2%**	**95.0%**	
CLND 33	C-2	Lift 1	6"	763-01-03	91.9	30.0	**120.2**	**34.3**	**89.5**	**97.4%**	**95.0%**	
CLND 34	C-3	Lift 1	6"	763-01-03	91.9	30.0	**117.7**	**35.2**	**87.1**	**94.7%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2330	621

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **CSLDR-04**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **12.6.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory 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.	
CLND 35	A-2	Lift 2	6"	763-01-03	91.9	30.0	**117.3**	**32.1**	**88.8**	**96.6%**	**95.0%**	
CLND 36	A-3	Lift 2	6"	763-01-03	91.9	30.0	**118.3**	**34.5**	**88.0**	**95.7%**	**95.0%**	ST-01-02
CLND 37	A-4	Lift 2	6"	763-01-03	91.9	30.0	**116.8**	**33.8**	**87.3**	**95.0%**	**95.0%**	CSLDC-08
CLND 38	A-5	Lift 2	6"	763-01-03	91.9	30.0	**120.3**	**35.8**	**88.6**	**96.4%**	**95.0%**	
CLND 39	B-2	Lift 2	6"	763-01-03	91.9	30.0	**119.1**	**36.2**	**87.4**	**95.2%**	**95.0%**	
CLND 40	B-3	Lift 2	6"	763-01-03	91.9	30.0	**117.4**	**34.5**	**87.3**	**95.0%**	**95.0%**	
CLND 41	B-4	Lift 2	6"	763-01-03	91.9	30.0	**118.0**	**34.1**	**88.0**	**95.7%**	**95.0%**	
CLND 42	B-5	Lift 2	6"	763-01-03	91.9	30.0	**118.6**	**33.7**	**88.7**	**96.5%**	**95.0%**	ST-02-02
CLND 43	C-2	Lift 2	6"	763-01-03	91.9	30.0	**117.7**	**34.2**	**87.7**	**95.4%**	**95.0%**	
CLND 44	C-3	Lift 2	6"	763-01-03	91.9	30.0	**119.5**	**35.6**	**88.1**	**95.9%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2386	636

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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Field Density Test Report

Report Number : **CSLDR-05**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **12.19.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory 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.	
CLND 57	C-4	Lift 1	6"	763-02-04	106.4	18.5	**124.2**	**20.3**	**103.2**	**97.0%**	**95.0%**	ST-05-01
CLND 58	C-5	Lift 1	6"	763-02-04	106.4	18.5	**126.5**	**22.1**	**103.6**	**97.4%**	**95.0%**	
CLND 59	D-2	Lift 1	6"	763-02-04	106.4	18.5	**123.4**	**21.6**	**101.5**	**95.4%**	**95.0%**	
CLND 60	D-3	Lift 1	6"	763-02-04	106.4	18.5	**125.2**	**22.1**	**102.5**	**96.4%**	**95.0%**	ST-04-01
CLND 61	D-4	Lift 1	6"	763-02-04	106.4	18.5	**126.1**	**20.4**	**104.7**	**98.4%**	**95.0%**	
CLND 62	D-5	Lift 1	6"	763-02-04	106.4	18.5	**124.2**	**22.8**	**101.1**	**95.1%**	**95.0%**	
CLND 63	D-6	Lift 1	6"	763-02-04	106.4	18.5	**125.1**	**23.1**	**101.6**	**95.5%**	**95.0%**	ST-06-01
CLND 64	E-2	Lift 1	6"	763-02-04	106.4	18.5	**126.3**	**23.5**	**102.3**	**96.1%**	**95.0%**	ST-03-01
CLND 65	E-3	Lift 1	6"	763-02-04	106.4	18.5	**122.4**	**20.4**	**101.7**	**95.5%**	**95.0%**	
CLND 66	E-4	Lift 1	6"	763-02-04	106.4	18.5	**124.2**	**22.4**	**101.5**	**95.4%**	**95.0%**	
CLND 67	F-2	Lift 1	6"	763-02-04	106.4	18.5	**123.7**	**21.3**	**102.0**	**95.8%**	**95.0%**	
CLND 68	F-3	Lift 1	6"	763-02-04	106.4	18.5	**126.8**	**21.9**	**104.0**	**97.8%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2402	649

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **CSLDR-06**	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) : **12.21.13**	Reviewed By :	Date :

Contractor : J.T. Russell	Borrow Source : Onsite fill

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory 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.	
CLND 69	C-2	Lift 2	6"	763-02-04	106.4	18.5	**125.2**	**23.1**	**101.7**	**95.6%**	**95.0%**	
CLND 70	C-3	Lift 2	6"	763-02-04	106.4	18.5	**126.7**	**22.4**	**103.5**	**97.3%**	**95.0%**	
CLND 71	C-4	Lift 2	6"	763-02-04	106.4	18.5	**125.3**	**22.6**	**102.2**	**96.1%**	**95.0%**	
CLND 72	C-5	Lift 2	6"	763-02-04	106.4	18.5	**124.8**	**21.7**	**102.5**	**96.4%**	**95.0%**	ST-05-02
CLND 73	D-2	Lift 2	6"	763-02-04	106.4	18.5	**126.0**	**23.4**	**102.1**	**96.0%**	**95.0%**	ST-03-02
CLND 74	D-3	Lift 2	6"	763-02-04	106.4	18.5	**124.6**	**22.5**	**101.7**	**95.6%**	**95.0%**	
CLND 75	D-4	Lift 2	6"	763-02-04	106.4	18.5	**124.8**	**23.1**	**101.4**	**95.3%**	**95.0%**	
CLND 76	D-5	Lift 2	6"	763-02-04	106.4	18.5	**125.3**	**20.9**	**103.6**	**97.4%**	**95.0%**	ST-06-02
CLND 77	D-6	Lift 2	6"	763-02-04	106.4	18.5	**124.9**	**22.4**	**102.0**	**95.9%**	**95.0%**	
CLND 78	E-2	Lift 2	6"	763-02-04	106.4	18.5	**126.2**	**21.6**	**103.8**	**97.5%**	**95.0%**	
CLND 79	E-3	Lift 2	6"	763-02-04	106.4	18.5	**127.1**	**22.7**	**103.6**	**97.4%**	**95.0%**	
CLND 80	E-4	Lift 2	6"	763-02-04	106.4	18.5	**126.4**	**21.3**	**104.2**	**97.9%**	**95.0%**	ST-04-02
CLND 81	F-2	Lift 2	6"	763-02-04	106.4	18.5	**125.5**	**22.5**	**102.4**	**96.3%**	**95.0%**	
CLND 82	F-3	Lift 2	6"	763-02-04	106.4	18.5	**126.0**	**23.4**	**102.1**	**96.0%**	**95.0%**	
CLND 83	A-2	Lift 3	6"	763-02-04	106.4	18.5	**124.8**	**22.8**	**101.6**	**95.5%**	**95.0%**	
CLND 84	A-3	Lift 3	6"	763-02-04	106.4	18.5	**126.2**	**20.5**	**104.7**	**98.4%**	**95.0%**	
CLND 85	A-4	Lift 3	6"	763-02-04	106.4	18.5	**124.3**	**21.7**	**102.1**	**96.0%**	**95.0%**	
CLND 86	A-5	Lift 3	6"	763-02-04	106.4	18.5	**125.1**	**23.4**	**101.4**	**95.3%**	**95.0%**	ST-01-03
CLND 87	B-2	Lift 3	6"	763-02-04	106.4	18.5	**125.1**	**22.8**	**101.9**	**95.7%**	**95.0%**	
CLND 88	B-3	Lift 3	6"	763-02-04	106.4	18.5	**126.3**	**23.6**	**102.2**	**96.0%**	**95.0%**	ST-02-03
CLND 89	B-4	Lift 3	6"	763-02-04	106.4	18.5	**124.4**	**22.4**	**101.6**	**95.5%**	**95.0%**	
CLND 90	B-6	Lift 3	6"	763-02-04	106.4	18.5	**123.7**	**21.8**	**101.6**	**95.5%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2404	651

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2014-625

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INTEGRITY IN TESTING

Field Density Test Report

Report Number : **CSLDR-07**	Geotechnics Representative : Jacob R Buda	Page : 1 of 1
Date (s) : **2.6.-2.7.14**	Reviewed By : JRB	Date : 2.17.14

Contractor : J.T. Russell	Borrow Source : Onsite Excavation

Compaction Equipment : CAT 563 SP Sheepsfoot vibratory compactor, CAT 815 Sheepsfoot Roller, CAT Smoothdrum Roller

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.	
CLND - 91	C-7	Lift 1	6"	763-02-04	106.4	18.5	**124.6**	**20.1**	**103.7**	**97.5%**	**95.0%**	ST-07-01
CLND - 92	C-8	Lift 1	6"	763-02-04	106.4	18.5	**123.5**	**21.4**	**101.7**	**95.6%**	**95.0%**	
CLND - 93	B-8	Lift 1	6"	763-02-04	106.4	18.5	**122.8**	**19.3**	**102.9**	**96.7%**	**95.0%**	
CLND - 94	C-7	Lift 2	6"	763-02-04	106.4	18.5	**123.8**	**20.7**	**102.6**	**96.4%**	**95.0%**	
CLND - 95	C-8	Lift 2	6"	763-02-04	106.4	18.5	**127.1**	**21.4**	**104.7**	**98.4%**	**95.0%**	ST-07-02
CLND - 96	B-8	Lift 2	6"	763-02-04	106.4	18.5	**123.1**	**21.4**	**101.4**	**95.3%**	**95.0%**	
CLND - 97	F-2	Lift 3	6"	763-02-04	106.4	18.5	**123.9**	**22.5**	**101.1**	**95.1%**	**95.0%**	ST-03-03
CLND - 98	E-2	Lift 3	6"	763-02-04	106.4	18.5	**123.8**	**21.3**	**102.1**	**95.9%**	**95.0%**	
CLND - 99	D-2	Lift 3	6"	763-02-04	106.4	18.5	**124.4**	**23.0**	**101.1**	**95.1%**	**95.0%**	
CLND - 100	E-3	Lift 3	6"	763-01-03	91.9	30.0	**116.3**	**31.1**	**88.7**	**96.5%**	**95.0%**	
CLND - 101	D-3	Lift 3	6"	763-01-03	91.9	30.0	**115.9**	**32.3**	**87.6**	**95.3%**	**95.0%**	
CLND - 102	D-4	Lift 3	6"	763-01-03	91.9	30.0	**116.1**	**32.2**	**87.8**	**95.6%**	**95.0%**	ST-04-03
CLND - 103	E-4	Lift 3	6"	763-01-03	91.9	30.0	**118.3**	**35.4**	**87.4**	**95.1%**	**95.0%**	ST-05-03
CLND - 104	D-5	Lift 3	6"	763-01-03	91.9	30.0	**119.5**	**35.6**	**88.1**	**95.9%**	**95.0%**	
CLND - 105	C-6	Lift 3	6"	763-01-03	91.9	30.0	**117.4**	**33.1**	**88.2**	**96.0%**	**95.0%**	ST-06-03
CLND - 106	C-6	Lift 3	6"	763-01-03	91.9	30.0	**116.2**	**32.5**	**87.7**	**95.4%**	**95.0%**	
CLND - 107	C-7	Lift 3	6"	763-02-04	106.4	18.5	**124.7**	**21.4**	**102.7**	**96.5%**	**95.0%**	
CLND - 108	C-7	Lift 3	6"	763-02-04	106.4	18.5	**123.6**	**22.1**	**101.2**	**95.1%**	**95.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
32387	3440	696	2279

Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2014-625

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Field Density Test Report

Report Number :	**CSLDR-08**	Geotechnics Representative :	Jacob R Buda	Page :	1 of 1
Date (s) :	**2.20.14**	Reviewed By :	JB3	Date :	3.2.14

Contractor :	J.T. Russell	Borrow Source :	Onsite Excavation

Compaction Equipment :	CAT 563 SP Sheepsfoot vibratory compactor, CAT 815 Sheepsfoot Roller, CAT Smoothdrum Roller

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.	
CLND - 109	D-3	Lift 4	6"	763-02-04	106.4	18.5	**123.8**	**21.0**	**102.3**	**96.2%**	**95.0%**	
CLND - 110	E-3	Lift 4	6"	763-02-04	106.4	18.5	**125.3**	**20.9**	**103.6**	**97.4%**	**95.0%**	
CLND - 111	E-4	Lift 4	6"	763-01-03	91.9	30.0	**121.3**	**33.2**	**91.1**	**99.1%**	**95.0%**	ST-04-03 RW
CLND - 112	D-4	Lift 4	6"	763-01-03	91.9	30.0	**120.4**	**32.1**	**91.1**	**99.2%**	**95.0%**	
CLND - 113	B-4	Lift 4	6"	763-02-04	106.4	18.5	**124.2**	**21.3**	**102.4**	**96.2%**	**95.0%**	ST-01-04 RW
CLND - 114	B-3	Lift 4	6"	763-02-04	106.4	18.5	**124.9**	**21.3**	**103.0**	**96.8%**	**95.0%**	
CLND - 115	B-2	Lift 4	6"	763-02-04	106.4	18.5	**125.9**	**23.6**	**101.9**	**95.7%**	**95.0%**	ST-02-04 RW

Gauge Number	Gauge Model	Density Count	Moisture Count
33577	3430	584	1965

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Client: Smith Gardner, Inc.
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2014-625

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Field Density Test Report

Report Number :	**CSLDR-09**	Geotechnics Representative :	Jacob R Buda	Page :	1 of 1
Date (s) :	**2.24.-2.25.14**	Reviewed By :	JRB	Date :	3.18.14

Contractor :	J.T. Russell	Borrow Source :	Onsite Excavation

Compaction Equipment :	CAT 563 SP Sheepsfoot vibratory compactor, CAT 815 Sheepsfoot Roller, CAT Smoothdrum Roller

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.	
CLND - 116	A-6	Lift 1	6"	763-02-04	106.4	18.5	**131.6**	**21.1**	**108.7**	**102.1%**	**95.0%**	
CLND - 117	A-7	Lift 1	6"	763-02-04	106.4	18.5	**131.8**	**21.6**	**108.4**	**101.9%**	**95.0%**	
CLND - 118	A-6	Lift 2	6"	763-02-04	106.4	18.5	**128.4**	**22.0**	**105.2**	**98.9%**	**95.0%**	
CLND - 119	A-7	Lift 2	6"	763-02-04	106.4	18.5	**126.9**	**21.7**	**104.3**	**98.0%**	**95.0%**	
CLND - 120	A-6	Lift 3	6"	763-02-04	106.4	18.5	**131.6**	**21.1**	**108.7**	**102.1%**	**95.0%**	
CLND - 121	A-7	Lift 3	6"	763-02-04	106.4	18.5	**127.1**	**25.4**	**101.4**	**95.3%**	**95.0%**	ST-07-03

Gauge Number	Gauge Model	Density Count	Moisture Count
33577	3430	590	1941

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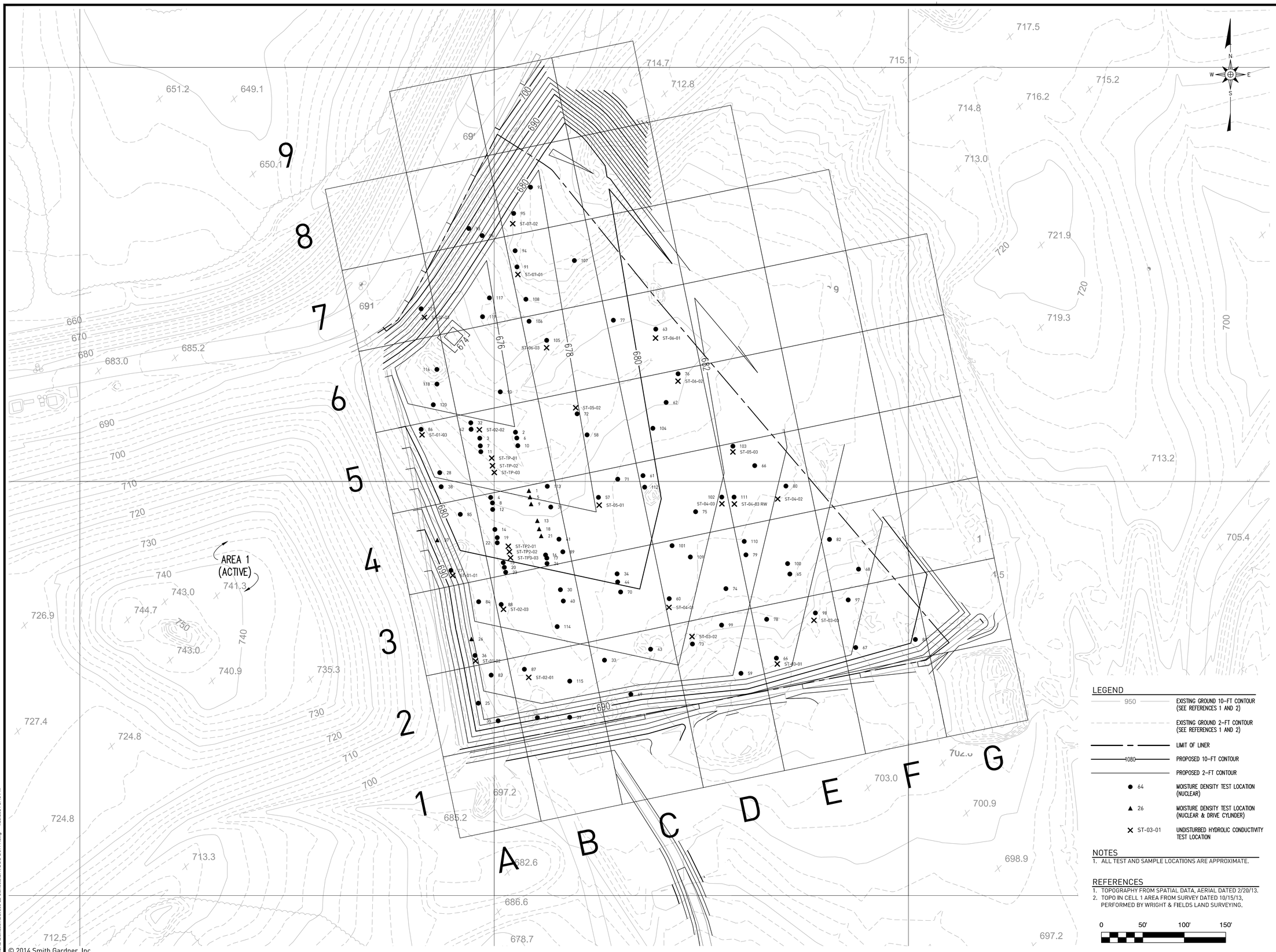

LEGEND

950	EXISTING GROUND 10–FT CONTOUR (SEE REFERENCES 1 AND 2)
	EXISTING GROUND 2–FT CONTOUR (SEE REFERENCES 1 AND 2)
	LIMIT OF LINER
1080	PROPOSED 10–FT CONTOUR
	PROPOSED 2–FT CONTOUR
● 64	MOISTURE DENSITY TEST LOCATION (NUCLEAR)
▲ 26	MOISTURE DENSITY TEST LOCATION (NUCLEAR & DRIVE CYLINDER)
✕ ST-03-01	UNDISTURBED HYDROLIC CONDUCTIVITY TEST LOCATION

NOTES

1. ALL TEST AND SAMPLE LOCATIONS ARE APPROXIMATE.

REFERENCES

1. TOPOGRAPHY FROM SPATIAL DATA, AERIAL DATED 2/20/13.
2. TOPO IN CELL 1 AREA FROM SURVEY DATED 10/15/13, PERFORMED BY WRIGHT & FIELDS LAND SURVEYING.

0 50' 100' 150'

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PREPARED FOR:

DAVIDSON COUNTY INTEGRATED SOLID WASTE MANAGEMENT THOMASVILLE, NORTH CAROLINA

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+ GARDNER

ENGINEERS

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

SEAL

SEAL

REV.	DATE	DESCRIPTION

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PROJECT TITLE:

DAVIDSON COUNTY MSW LANDFILL PHASE 2 - AREA 2 - CELL 1

DRAWING TITLE:

SOIL LINER TEST LOCATIONS

DESIGNED: P.K.S.	PROJECT NO: DAVDCO 12-3
DRAWN: J.A.L.	SCALE: AS SHOWN
APPROVED:	DATE: APRIL 2014
FILENAME: DAVDCO-D0777	
SHEET NUMBER:	DRAWING NUMBER: **FIG. SL-1**

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

Report Number : **CSLDC-01**
Date (s) : 11.9.13

Drive Cylinder - ASTM D 2937

Test Information			
Test Number :	DC-01	DC-02	DC-03
Nuclear Test Number :	CLND-	CLND-	CLND-
Location:	TESTPAD 1	TESTPAD 1	TESTPAD 1
Depth (ft):	LIFT 1	LIFT 2	LIFT 3
Date :	11.9.13	11.9.13	11.9.13
Mold			
Cylinder ID	1	1	1
Weight of Cylinder (lbs.)	1.06	1.06	1.06
Volume of Cylinder (ft^3)	0.033	0.033	0.033
Specimen			
Wt. of Cylinder & WS (lbs.)	4.99	5.03	4.96
Wt. of Cylinder (lbs.)	1.06	1.06	1.06
Wt. of WS	3.93	3.97	3.90
Cylinder Volume (ft^3)	0.033	0.033	0.033
Moisture / Density			
Tare Number	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	442.47	390.98	376.98
Wt. of Tare & DS (gm)	358.30	318.60	308.20
Wt. of Tare (gm)	110.00	110.00	110.00
Wt. of Water (gm)	84.17	72.38	68.78
Wt. of DS (gm)	248.30	208.60	198.20
Wet Density (pcf):	119.1	120.3	118.2
Moisture Content (%):	**33.9**	**34.7**	**34.7**
Dry Density (pcf):	**88.9**	**89.3**	**87.7**

Geotechnics Representative : David Wright

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

geotechnics
INTEGRITY IN TESTING

Report Number :	**CSLDR-01**
Date (s) :	11.9.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Brown Sandy Fat Clay

Test Information

Test Number :	1pt.-01
Location:	CSLND-01
Depth (ft):	LIFT 1
Date :	11.9.13

Mold

Weight of Mold (lbs.)	9.32
Volume OF Mold (ft^3)	0.033

Specimen

Weight of Mold & WS (lbs)	13.27
Weight of Mold (lbs)	9.32
Weight of WS (lbs)	3.95
Volume OF Mold (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	452.70
Wt. of Tare & DS (gm)	371.40
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	81.30
Wt. of DS (gm)	261.40
Wet Density (pcf)	119.7
Moisture Content %	**31.1**
Dry Density (pcf)	**91.3**

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

geotechnics
INTEGRITY IN TESTING

Report Number :	**CSLDC-02**
Date (s) :	11.14.13

Drive Cylinder - ASTM D 2937

Test Information			
Test Number :	DC-04	DC-05	DC-06
Nuclear Test Number :	CLND-13	CLND-17	CLND-21
Location:	TESTPAD 2	TESTPAD 2	TESTPAD 2
Depth (ft):	LIFT 1	LIFT 2	LIFT 3
Date :	11.14.13	11.14.13	11.14.13
Mold			
Cylinder ID	1	1	1
Weight of Cylinder (lbs.)	1.06	1.06	1.06
Volume of Cylinder (ft^3)	0.033	0.033	0.033
Specimen			
Wt. of Cylinder & WS (lbs.)	5.21	5.22	5.18
Wt. of Cylinder (lbs.)	1.06	1.06	1.06
Wt. of WS	4.15	4.16	4.12
Cylinder Volume (ft^3)	0.033	0.033	0.033
Moisture / Density			
Tare Number	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	282.05	322.90	346.90
Wt. of Tare & DS (gm)	249.20	282.80	301.50
Wt. of Tare (gm)	110.00	110.00	110.00
Wt. of Water (gm)	32.85	40.10	45.40
Wt. of DS (gm)	139.20	172.80	191.50
Wet Density (pcf):	125.8	126.1	124.8
Moisture Content (%):	**23.6**	**23.2**	**23.7**
Dry Density (pcf):	**101.7**	**102.3**	**100.9**

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

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INTEGRITY IN TESTING

Report Number :	**CSLDR-02**
Date (s) :	11.14.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Brown Sandy Fat Clay

Test Information

Test Number :	1pt.-02
Location:	CSLND-14
Depth (ft):	LIFT 1
Date :	11.14.13

Mold

Weight of Mold (lbs.)	9.32
Volume OF Mold (ft^3)	0.033

Specimen

Weight of Mold & WS (lbs)	13.44
Weight of Mold (lbs)	9.32
Weight of WS (lbs)	4.12
Volume OF Mold (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	343.50
Wt. of Tare & DS (gm)	308.20
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	35.30
Wt. of DS (gm)	198.20
Wet Density (pcf)	124.8
Moisture Content %	**17.8**
Dry Density (pcf)	**106.0**

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

geotechnics
INTEGRITY IN TESTING

Report Number :	**CSLDC-03**
Date (s) :	11.25.13

Drive Cylinder - ASTM D 2937

Test Information

Test Number :	DC-07
Nuclear Test Number :	CLND-26
Location:	A-3
Depth (ft):	LIFT 1
Date :	11.25.13

Mold

Cylinder ID	1
Weight of Cylinder (lbs.)	1.06
Volume of Cylinder (ft^3)	0.033

Specimen

Wt. of Cylinder & WS (lbs.)	4.92
Wt. of Cylinder (lbs.)	1.06
Wt. of WS	3.86
Cylinder Volume (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	293.40
Wt. of Tare & DS (gm)	247.50
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	45.90
Wt. of DS (gm)	137.50
Wet Density (pcf):	117.0
Moisture Content (%):	**33.4**
Dry Density (pcf):	**87.7**

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

Geotechnics
INTEGRITY IN TESTING

Report Number :	**CSLDR-02**
Date (s) :	11.25.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Brown Sandy Fat Clay

Test Information

Test Number :	1pt.-03
Location:	CSLND-14
Depth (ft):	LIFT 1
Date :	11.25.13

Mold

Weight of Mold (lbs.)	9.32
Volume OF Mold (ft^3)	0.033

Specimen

Weight of Mold & WS (lbs)	13.27
Weight of Mold (lbs)	9.32
Weight of WS (lbs)	3.95
Volume OF Mold (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	315.50
Wt. of Tare & DS (gm)	268.30
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	47.20
Wt. of DS (gm)	158.30
Wet Density (pcf)	119.7
Moisture Content %	**29.8**
Dry Density (pcf)	**92.2**

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Client:	Smith & Gardner
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Project Number :	2013-763

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INTEGRITY IN TESTING

Report Number :	**CSLDC-04**
Date (s) :	12.6.13

Drive Cylinder - ASTM D 2937

Test Information

Test Number :	DC-08
Nuclear Test Number :	CLND-37
Location:	A-4
Depth (ft):	LIFT 2
Date :	12.6.13

Mold

Cylinder ID	1
Weight of Cylinder (lbs.)	1.06
Volume of Cylinder (ft^3)	0.033

Specimen

Wt. of Cylinder & WS (lbs.)	4.92
Wt. of Cylinder (lbs.)	1.06
Wt. of WS	3.86
Cylinder Volume (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	370.60
Wt. of Tare & DS (gm)	304.30
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	66.30
Wt. of DS (gm)	194.30
Wet Density (pcf):	117.0
Moisture Content (%):	**34.1**
Dry Density (pcf):	**87.2**

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

Report Number :	**CSLDR-04**
Date (s) :	12.6.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Brown Sandy Fat Clay

Test Information

Test Number :	1pt.-03
Location:	CSLND-39
Depth (ft):	LIFT 2
Date :	12.6.13

Mold

Weight of Mold (lbs.)	9.32
Volume OF Mold (ft^3)	0.033

Specimen

Weight of Mold & WS (lbs)	13.21
Weight of Mold (lbs)	9.32
Weight of WS (lbs)	3.89
Volume OF Mold (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	388.30
Wt. of Tare & DS (gm)	328.30
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	60.00
Wt. of DS (gm)	218.30
Wet Density (pcf)	117.9
Moisture Content %	**27.5**
Dry Density (pcf)	**92.5**

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Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

Geotechnics
INTEGRITY IN TESTING

Report Number :	**CSLDC-05**
Date (s) :	12.19.13

Drive Cylinder - ASTM D 2937

Test Information				
Test Number :	DC-09	DC-10	DC-11	DC-12
Nuclear Test Number :	CLND-57	CLND-60	CLND-63	CLND-64
Location:	C-4	D-3	D-6	E-2
Depth (ft):	LIFT 1	LIFT 1	LIFT 1	LIFT 1
Date :	12.19.13	12.19.13	12.19.13	12.19.13
Mold				
Cylinder ID	1	1	1	1
Weight of Cylinder (lbs.)	1.06	1.06	1.06	1.06
Volume of Cylinder (ft^3)	0.033	0.033	0.033	0.033
Specimen				
Wt. of Cylinder & WS (lbs.)	5.17	5.18	5.16	5.20
Wt. of Cylinder (lbs.)	1.06	1.06	1.06	1.06
Wt. of WS	4.11	4.12	4.10	4.14
Cylinder Volume (ft^3)	0.033	0.033	0.033	0.033
Moisture / Density				
Tare Number	DW-01	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	370.70	351.20	398.70	485.60
Wt. of Tare & DS (gm)	326.70	307.50	344.10	414.60
Wt. of Tare (gm)	110.00	110.00	110.00	110.00
Wt. of Water (gm)	44.00	43.70	54.60	71.00
Wt. of DS (gm)	216.70	197.50	234.10	304.60
Wet Density (pcf):	124.5	124.8	124.2	125.5
Moisture Content (%):	**20.3**	**22.1**	**23.3**	**23.3**
Dry Density (pcf):	**103.5**	**102.2**	**100.7**	**101.7**

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

Report Number : **CSLDR-05**
Date (s) : 12.19.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Reddish Brown Sandy Clay

Test Information			
Test Number :	1pt.-04	1pt.-05	1pt.-06
Location:	CSLND-57	CSLND-60	CSLND-63
Depth (ft):	LIFT 2	LIFT 2	LIFT 2
Date :	12.19.13	12.19.13	12.19.13
Mold			
Weight of Mold (lbs.)	9.32	9.32	9.32
Volume OF Mold (ft^3)	0.033	0.033	0.033
Specimen			
Weight of Mold & WS (lbs)	13.42	13.39	13.53
Weight of Mold (lbs)	9.32	9.32	9.32
Weight of WS (lbs)	4.1	4.07	4.21
Volume OF Mold (ft^3)	0.033	0.033	0.033
Moisture / Density			
Tare Number	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	427.90	476.80	416.80
Wt. of Tare & DS (gm)	383.10	422.70	367.60
Wt. of Tare (gm)	110.00	110.00	110.00
Wt. of Water (gm)	44.80	54.10	49.20
Wt. of DS (gm)	273.10	312.70	257.60
Wet Density (pcf)	124.2	123.3	127.6
Moisture Content %	**16.4**	**17.3**	**19.1**
Dry Density (pcf)	**106.7**	**105.1**	**107.1**

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

Geotechnics
INTEGRITY IN TESTING

Report Number :	**CSLDR-05**
Date (s) :	12.19.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Reddish Brown Sandy Clay

Test Information

Test Number :	1pt.-07
Location:	CSLND-64
Depth (ft):	LIFT 2
Date :	12.19.13

Mold

Weight of Mold (lbs.)	9.32
Volume OF Mold (ft^3)	0.033

Specimen

Weight of Mold & WS (lbs)	13.5
Weight of Mold (lbs)	9.32
Weight of WS (lbs)	4.18
Volume OF Mold (ft^3)	0.033

Moisture / Density

Tare Number	DW-01
Wt. of Tare & WS (gm)	542.70
Wt. of Tare & DS (gm)	469.10
Wt. of Tare (gm)	110.00
Wt. of Water (gm)	73.60
Wt. of DS (gm)	359.10
Wet Density (pcf)	126.7
Moisture Content %	**20.5**
Dry Density (pcf)	**105.1**

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

Report Number : **CSLDC-06**
Date (s) : 12.21.13

Drive Cylinder - ASTM D 2937

Test Information				
Test Number :	DC-13	DC-14	DC-15	DC-16
Nuclear Test Number :	CLND-72	CLND-73	CLND-76	CLND-80
Location:	C-5	D-2	D-6	E-4
Depth (ft):	LIFT 2	LIFT 2	LIFT 2	LIFT 2
Date :	12.21.13	12.21.13	12.21.13	12.21.13
Mold				
Cylinder ID	1	1	1	1
Weight of Cylinder (lbs.)	1.06	1.06	1.06	1.06
Volume of Cylinder (ft^3)	0.033	0.033	0.033	0.033
Specimen				
Wt. of Cylinder & WS (lbs.)	5.19	5.19	5.20	5.24
Wt. of Cylinder (lbs.)	1.06	1.06	1.06	1.06
Wt. of WS	4.13	4.13	4.14	4.18
Cylinder Volume (ft^3)	0.033	0.033	0.033	0.033
Moisture / Density				
Tare Number	DW-01	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	346.80	333.50	366.30	347.80
Wt. of Tare & DS (gm)	304.30	290.10	321.30	304.60
Wt. of Tare (gm)	110.00	110.00	110.00	110.00
Wt. of Water (gm)	42.50	43.40	45.00	43.20
Wt. of DS (gm)	194.30	180.10	211.30	194.60
Wet Density (pcf):	125.2	125.2	125.5	126.7
Moisture Content (%):	**21.9**	**24.1**	**21.3**	**22.2**
Dry Density (pcf):	**102.7**	**100.8**	**103.4**	**103.7**

Geotechnics Representative : David Wright

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

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INTEGRITY IN TESTING

Report Number :	**CSLDC-06**
Date (s) :	12.21.13

Drive Cylinder - ASTM D 2937

Test Information		
Test Number :	DC-17	DC-18
Nuclear Test Number :	CLND-86	CLND-88
Location:	A-5	B-3
Depth (ft):	LIFT 3	LIFT 3
Date :	12.21.13	12.21.13
Mold		
Cylinder ID	1	1
Weight of Cylinder (lbs.)	1.06	1.06
Volume of Cylinder (ft^3)	0.033	0.033
Specimen		
Wt. of Cylinder & WS (lbs.)	5.18	5.22
Wt. of Cylinder (lbs.)	1.06	1.06
Wt. of WS	4.12	4.16
Cylinder Volume (ft^3)	0.033	0.033
Moisture / Density		
Tare Number	DW-01	DW-01
Wt. of Tare & WS (gm)	395.80	341.80
Wt. of Tare & DS (gm)	341.40	296.70
Wt. of Tare (gm)	110.00	110.00
Wt. of Water (gm)	54.40	45.10
Wt. of DS (gm)	231.40	186.70
Wet Density (pcf):	124.8	126.1
Moisture Content (%):	**23.5**	**24.2**
Dry Density (pcf):	**101.1**	**101.5**

Geotechnics Representative : David Wright MWS

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Client:	Smith & Gardner
Project Name :	Davidson County Phase 2 Cell 1
Project Number :	2013-763

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INTEGRITY IN TESTING

Report Number :	**CSLDR-06**
Date (s) :	12.21.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Reddish Brown Sandy Clay

Test Information			
Test Number :	1pt.-08	1pt.-09	1pt.-10
Location:	CSLND-72	CSLND-73	CSLND-76
Depth (ft):	LIFT 2	LIFT 2	LIFT 2
Date :	12.21.13	12.21.13	12.21.13
Mold			
Weight of Mold (lbs.)	9.32	9.32	9.32
Volume OF Mold (ft^3)	0.033	0.033	0.033
Specimen			
Weight of Mold & WS (lbs)	13.54	13.42	13.48
Weight of Mold (lbs)	9.32	9.32	9.32
Weight of WS (lbs)	4.22	4.1	4.16
Volume OF Mold (ft^3)	0.033	0.033	0.033
Moisture / Density			
Tare Number	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	373.60	307.80	435.20
Wt. of Tare & DS (gm)	330.80	277.80	385.10
Wt. of Tare (gm)	110.00	110.00	110.00
Wt. of Water (gm)	42.80	30.00	50.10
Wt. of DS (gm)	220.80	167.80	275.10
Wet Density (pcf)	127.9	124.2	126.1
Moisture Content %	**19.4**	**17.9**	**18.2**
Dry Density (pcf)	**107.1**	**105.4**	**106.6**

Geotechnics Represenative : David Wright MPS

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2013-763

Report Number : **CSLDR-06**
Date (s) : 12.21.13

ONE POINT PROCTOR - Method for Soil Identification

Visual Descrpiton : Reddish Brown Sandy Clay

Test Information			
Test Number :	1pt.-11	1pt.-12	1pt.-13
Location:	CSLND-80	CSLND-86	CSLND-88
Depth (ft):	LIFT 2	LIFT 3	LIFT 3
Date :	12.21.13	12.21.13	12.21.13
Mold			
Weight of Mold (lbs.)	9.32	9.32	9.32
Volume OF Mold (ft^3)	0.033	0.033	0.033
Specimen			
Weight of Mold & WS (lbs)	13.54	13.33	13.5
Weight of Mold (lbs)	9.32	9.32	9.32
Weight of WS (lbs)	4.22	4.01	4.18
Volume OF Mold (ft^3)	0.033	0.033	0.033
Moisture / Density			
Tare Number	DW-01	DW-01	DW-01
Wt. of Tare & WS (gm)	295.60	361.80	457.28
Wt. of Tare & DS (gm)	264.30	328.40	396.30
Wt. of Tare (gm)	110.00	110.00	110.00
Wt. of Water (gm)	31.30	33.40	60.98
Wt. of DS (gm)	154.30	218.40	286.30
Wet Density (pcf)	127.9	121.5	126.7
Moisture Content %	**20.3**	**15.3**	**21.3**
Dry Density (pcf)	**106.3**	**105.4**	**104.4**

Geotechnics Represenative : David Wright

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SOIL LINER
RECORD TEST SUMMARY
TEST FILL

Project Name: Davidson County MSW Landfill - Phase 2 - Area 2 - Cell 1
Project Number: DAVDCO-12-3
Contractor: JT Russell & Sons

Undisturbed Hydraulic Conductivity (ASTM D 5084) Test Results:

Test Number	In-Situ Values Dry Density* (pcf)	In-Situ Values Moisture Content* (%)	Reference Values ASTM D 698 Maximum Dry Density (pcf)	Reference Values ASTM D 698 Optimum Moisture Content (%)	Compaction (%)	Difference From Optimum Moisture (%)	Hydraulic Conductivity (cm/sec)	Pass/Fail	Comment
ST-TP-01	88.9	33.9	91.9	30.0	97	3.9	4.2E-08	PASS	
ST-TP-02	89.3	34.7	91.9	30.0	97	4.7	7.1E-08	PASS	
ST-TP-03	87.7	34.7	91.9	30.0	95	4.7	5.7E-08	PASS	
ST-TP2-01	101.7	23.6	106.4	18.5	96	5.1	5.3E-07	PASS	
ST-TP2-02	102.3	23.2	106.4	18.5	96	4.7	1.2E-07	PASS	
ST-TP2-03	100.9	23.7	106.4	18.5	95	5.2	4.9E-07	PASS	

* Drive Cylinder Results

Minimum Hydraulic Conductivity (cm/sec): 4.2E-08
Maximum Hydraulic Conductivity (cm/sec): 5.3E-07
Average Hydraulic Conductivity (cm/sec): 2.2E-07

Number of Tests Performed:

Undisturbed Hydraulic Conductivity: 6

SOIL LINER
RECORD TEST SUMMARY
GENERAL FILL (UNDISTURBED HYDRAULIC CONDUCTIVITY TEST RESULTS)

Project Name: Davidson County MSW Landfill - Phase 2 - Area 2 - Cell 1
Project Number: DAVDCO-12-3
Contractor: JT Russell & Sons

Undisturbed Hydraulic Conductivity (ASTM D 5084) Test Results:

Test Number	Hydraulic Conductivity (cm/sec)	Pass/Fail	Comment
ST-01-01	1.9E-07	Pass	
ST-01-02	9.8E-08	Pass	
ST-01-03	1.0E-06	Pass	
ST-02-01	1.0E-07	Pass	
ST-02-02	9.2E-08	Pass	
ST-02-03	7.7E-08	Pass	
ST-03-01	7.1E-07	Pass	
ST-03-02	6.5E-08	Pass	
ST-03-03	7.6E-07	Pass	
ST-04-01	5.7E-07	Pass	
ST-04-02	1.1E-07	Pass	
ST-04-03	1.1E-05	Fail	This area re-worked and re-tested
ST-04-03 RW	1.1E-07	Pass	Re-worked test for ST-04-03
ST-05-01	7.6E-08	Pass	
ST-05-02	3.9E-06	Pass	
ST-05-03	3.9E-07	Pass	
ST-06-01	3.9E-07	Pass	
ST-06-02	4.4E-06	Pass	
ST-06-03	2.5E-08	Pass	
ST-07-01	1.4E-07	Pass	
ST-07-02	1.6E-08	Pass	
ST-07-03	6.3E-08	Pass	

Minimum Hydraulic Conductivity (cm/sec): 1.6E-08
Maximum Hydraulic Conductivity (cm/sec): 4.4E-06 (Passing Tests)
Average Hydraulic Conductivity (cm/sec): 6.3E-07 (Passing Tests)

Number of Tests Performed:

Undisturbed Hydraulic Conductivity: 21 (Passing Tests)

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INTEGRITY IN TESTING

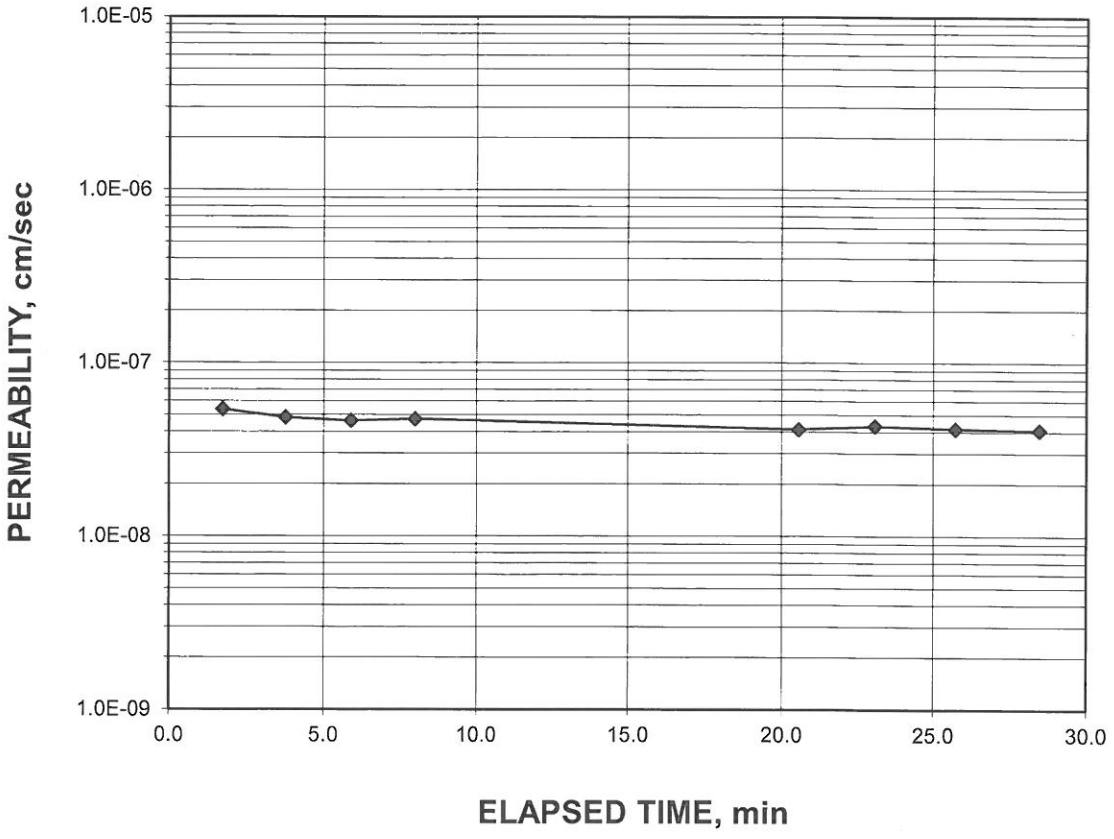
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-02	Sample No.	ST-TP-01
Lab ID No.	2013-763-02-01		

Visual Description: BROWN SANDY CLAY WITH ROCK FRAGMENTS

AVERAGE PERMEABILITY = 4.2E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 4.2E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 11/12/13 Checked By: GLM Date: 11-14-13

DCN: CT-22A DATE: 2013-06-05 REVISION: 0 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-02-01 Permometer wHeader.xls]Sheet1

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INTEGRITY IN TESTING

FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-02	Sample No.	ST-TP-01
Lab ID No.	2013-763-02-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY WITH ROCK FRAGMENTS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	820	B-1
Wt. of Tare & WS (gm.)	311.37	389.91
Wt. of Tare & DS (gm.)	270.68	321.31
Wt. of Tare (gm.)	131.44	96.18
Wt. of Water (gm.)	40.69	68.60
Wt. of DS (gm.)	139.24	225.13
Moisture Content (%)	**29.2**	**30.5**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	604.84	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	604.84	610.68
Length 1 (in.)	2.989	2.966
Length 2 (in.)	2.992	2.953
Length 3 (in.)	3.008	2.963
Top Diameter (in.)	2.850	2.856
Middle Diameter (in.)	2.848	2.853
Bottom Diameter (in.)	2.839	2.849
Average Length (in.)	3.00	2.96
Average Area (in.^{2})	6.36	6.39
Sample Volume (cm^3)	312.28	310.09
Unit Wet Wt. (gm./ cm^3)	1.937	1.969
Unit Wet Wt. (pcf)	120.9	122.9
Unit Dry Wt. (pcf)	93.6	94.2
Unit Dry Wt. (gm./ cm^3)	1.499	1.509
Void Ratio, e	0.801	0.789
Porosity, n	0.445	0.441
Pore Volume (cm^3)	138.9	136.7
Total Wt. Of Sample After Test		610.74

Tested By: SFS Date: 11/12/13 Checked By: GM Date: 11-14-13

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PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-02	Sample No.	ST-TP-01
Lab ID No.	2013-763-02-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.52
Back Pressure(psi)	40.0	Sample Area (cm^2), A	41.23
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	95	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 4.2E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 4.2E-10 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
11/13/13	10	1	54	1.90	0.000	8.3	12.7	22.4	NA
11/13/13	10	3	40	3.67	1.767	8.2	12.5	22.4	5.4E-08
11/13/13	10	5	40	5.67	3.767	8.1	12.3	22.4	4.8E-08
11/13/13	10	7	47	7.78	5.883	8.0	12.2	22.4	4.6E-08
11/13/13	10	9	53	9.88	7.983	7.9	12.0	22.4	4.7E-08
11/13/13	10	22	28	22.47	20.567	7.4	11.1	22.4	4.1E-08
11/13/13	10	24	59	24.98	23.083	7.3	10.9	22.4	4.3E-08
11/13/13	10	27	38	27.63	25.733	7.2	10.8	22.4	4.2E-08
11/13/13	10	30	23	30.38	28.483	7.1	10.6	22.4	4.1E-08

Tested By: SFS Date: 11/12/13 Checked By: GAM Date: 11-14-13

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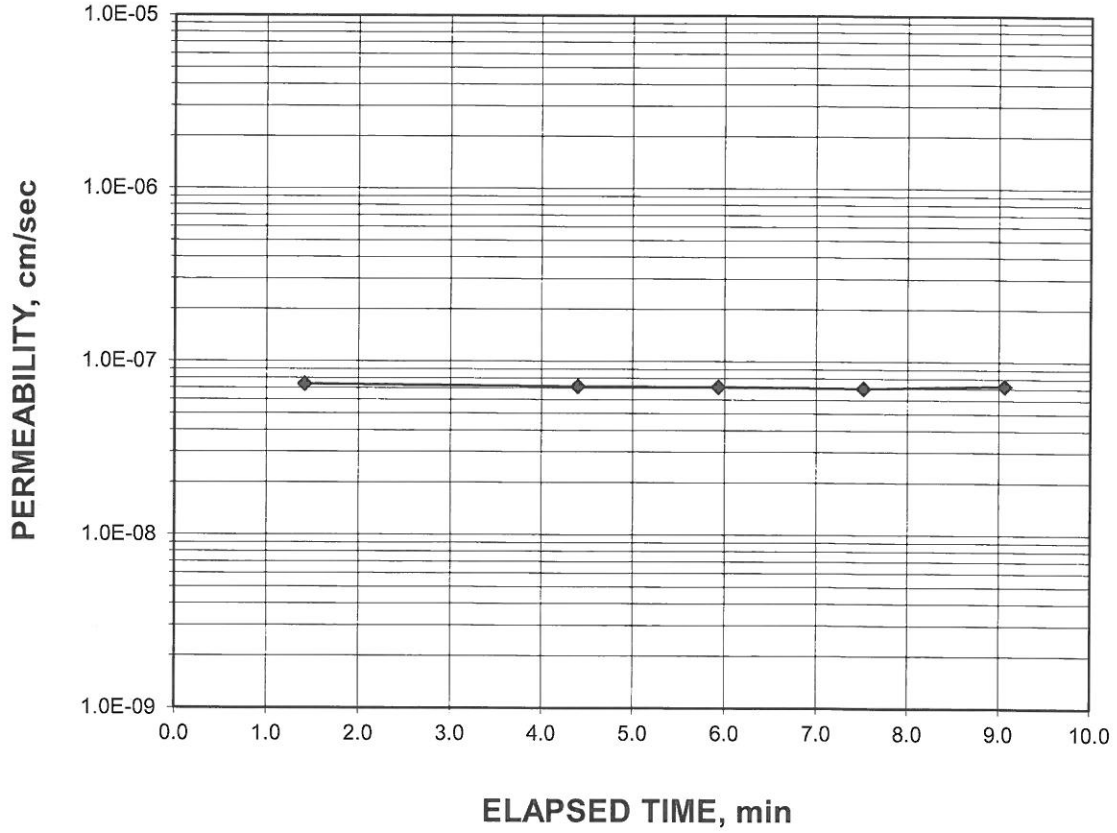
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-02	Sample No.	ST-TP-02
Lab ID No.	2013-763-02-02		

Visual Description: BROWN SANDY CLAY WITH ROCK FRAGMENTS

AVERAGE PERMEABILITY = 7.1E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.1E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 11/12/13 Checked By: GAM Date: 11-14-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-02	Sample No.	ST-TP-02
Lab ID No.	2013-763-02-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY WITH ROCK FRAGMENTS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	819	Y-11
Wt. of Tare & WS (gm.)	327.04	347.73
Wt. of Tare & DS (gm.)	281.22	284.65
Wt. of Tare (gm.)	135.86	93.53
Wt. of Water (gm.)	45.82	63.08
Wt. of DS (gm.)	145.36	191.12
Moisture Content (%)	**31.5**	**33.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	618.79	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	618.79	625.77
Length 1 (in.)	3.155	3.103
Length 2 (in.)	3.155	3.082
Length 3 (in.)	3.140	3.111
Top Diameter (in.)	2.843	2.834
Middle Diameter (in.)	2.849	2.842
Bottom Diameter (in.)	2.847	2.828
Average Length (in.)	3.15	3.10
Average Area (in.^{2})	6.36	6.31
Sample Volume (cm^3)	328.45	320.46
Unit Wet Wt. (gm./ cm^3)	1.884	1.953
Unit Wet Wt. (pcf)	117.6	121.9
Unit Dry Wt. (pcf)	89.4	91.6
Unit Dry Wt. (gm./ cm^3)	1.432	1.468
Void Ratio, e	0.885	0.839
Porosity, n	0.469	0.456
Pore Volume (cm^3)	154.2	146.2
Total Wt. Of Sample After Test		624.10

Tested By: SFS Date: 11/12/13 Checked By: GAM Date: 11-14-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-02	Sample No.	ST-TP-02
Lab ID No.	2013-763-02-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.87
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.72
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 7.1E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.1E-10 m/sec @ 20°C

DATE		TIME			ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
11/13/13	11	13	17	13.28	0.000	8.0	11.6	22.7	NA
11/13/13	11	14	42	14.70	1.417	7.9	11.4	22.7	7.4E-08
11/13/13	11	17	41	17.68	4.400	7.7	11.1	22.7	7.2E-08
11/13/13	11	19	13	19.22	5.933	7.6	11.0	22.7	7.1E-08
11/13/13	11	20	48	20.80	7.517	7.5	10.8	22.7	7.0E-08
11/13/13	11	22	21	22.35	9.067	7.4	10.6	22.7	7.3E-08

Tested By: SFS Date: 11/12/13 Checked By: GEM Date: 11-14-13

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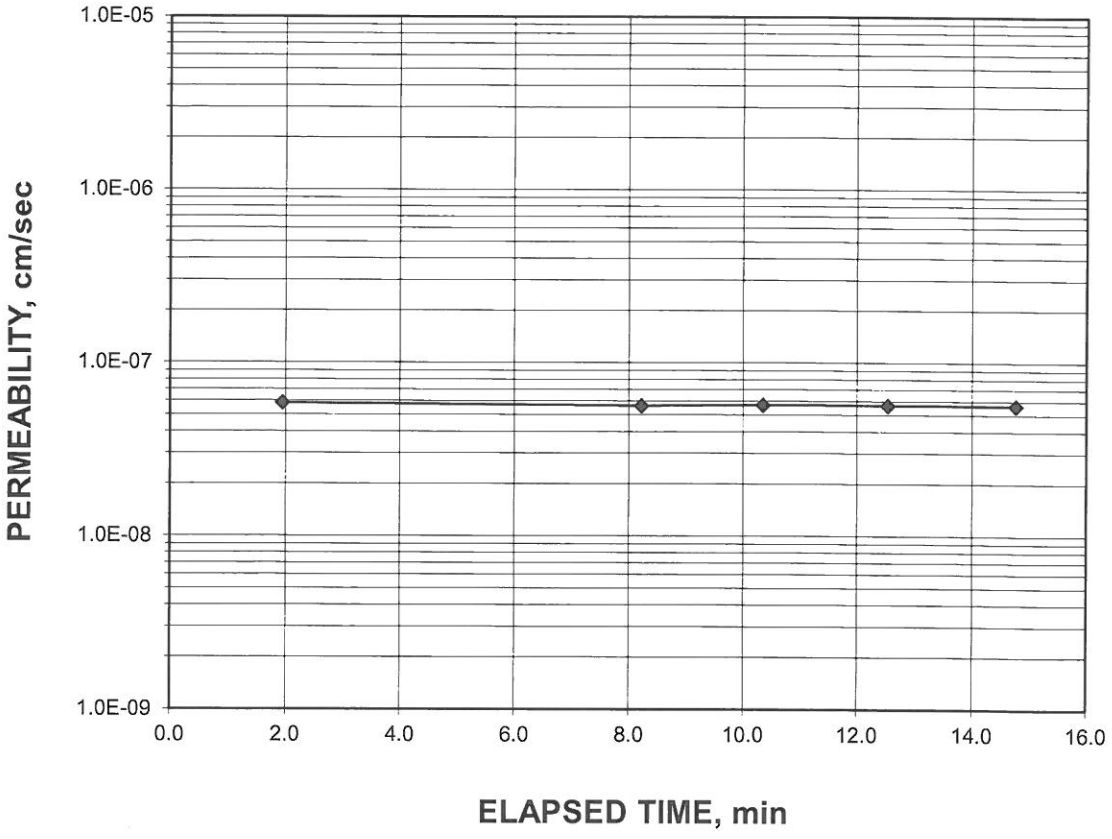
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-02	Sample No.	ST-TP-03
Lab ID No.	2013-763-02-03		

Visual Description: BROWN SANDY CLAY WITH ROCK FRAGMENTS

AVERAGE PERMEABILITY = 5.7E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 5.7E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 11/12/13 Checked By: GAM Date: 11-14-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-02	Sample No.	ST-TP-03
Lab ID No.	2013-763-02-03		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY WITH ROCK FRAGMENTS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	827	A-5
Wt. of Tare & WS (gm.)	337.01	394.25
Wt. of Tare & DS (gm.)	292.54	323.27
Wt. of Tare (gm.)	139.05	95.64
Wt. of Water (gm.)	44.47	70.98
Wt. of DS (gm.)	153.49	227.63
Moisture Content (%)	**29.0**	**31.2**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	582.51	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	582.51	592.49
Length 1 (in.)	2.933	2.870
Length 2 (in.)	2.932	2.927
Length 3 (in.)	2.941	2.905
Top Diameter (in.)	2.825	2.834
Middle Diameter (in.)	2.823	2.823
Bottom Diameter (in.)	2.832	2.826
Average Length (in.)	2.94	2.90
Average Area (in.^{2})	6.28	6.28
Sample Volume (cm^3)	301.85	298.50
Unit Wet Wt. (gm./ cm^3)	1.930	1.985
Unit Wet Wt. (pcf)	120.5	123.9
Unit Dry Wt. (pcf)	93.4	94.4
Unit Dry Wt. (gm./ cm^3)	1.496	1.513
Void Ratio, e	0.804	0.784
Porosity, n	0.446	0.440
Pore Volume (cm^3)	134.6	131.2
Total Wt. Of Sample After Test		589.70

Tested By: SFS Date: 11/12/13 Checked By: GEM Date: 11-14-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	TEST PAD
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-02	Sample No.	ST-TP-03
Lab ID No.	2013-763-02-03		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.37
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.51
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	100	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 5.7E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 5.7E-10 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
11/13/13	10	2	50	2.83	0.000	7.1	10.8	22.4	NA
11/13/13	10	4	47	4.78	1.950	7.0	10.6	22.4	5.8E-08
11/13/13	10	11	3	11.05	8.217	6.7	10.1	22.4	5.6E-08
11/13/13	10	13	11	13.18	10.350	6.6	9.9	22.4	5.7E-08
11/13/13	10	15	22	15.37	12.533	6.5	9.7	22.4	5.7E-08
11/13/13	10	17	36	17.60	14.767	6.4	9.6	22.4	5.7E-08

Tested By: SFS Date: 11/12/13 Checked By: GM Date: 11-14-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

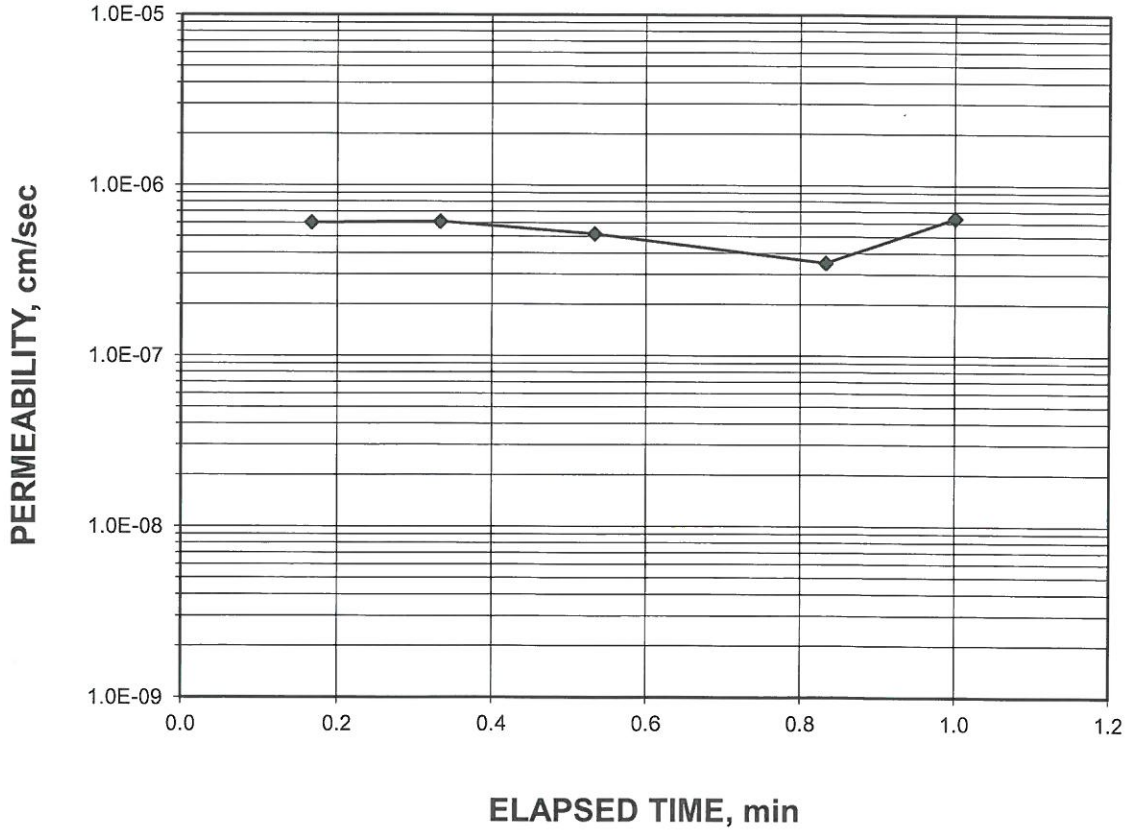
ASTM D 5084-10

Client	SMITH + GARNER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-03	Sample No.	ST-TP2-L1
Lab ID No.	2013-763-03-01-422		

Visual Description: LIGHT BROWN CLAY

AVERAGE PERMEABILITY = 5.3E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 5.3E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

ASTM D 5084-10

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Client	SMITH + GARNER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-03	Sample No.	ST-TP2-L1
Lab ID No.	2013-763-03-01-422		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: LIGHT BROWN CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	808	810
Wt. of Tare & WS (gm.)	351.55	415.13
Wt. of Tare & DS (gm.)	285.77	337.31
Wt. of Tare (gm.)	104.35	114.89
Wt. of Water (gm.)	65.78	77.82
Wt. of DS (gm.)	181.42	222.42
Moisture Content (%)	**36.3**	**35.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	540.41	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	540.41	535.37
Length 1 (in.)	2.885	2.850
Length 2 (in.)	2.877	2.863
Length 3 (in.)	2.905	2.833
Top Diameter (in.)	2.861	2.818
Middle Diameter (in.)	2.859	2.830
Bottom Diameter (in.)	2.855	2.840
Average Length (in.)	2.89	2.85
Average Area (in.^{2})	6.42	6.29
Sample Volume (cm^3)	303.78	293.50
Unit Wet Wt. (gm./ cm^3)	1.779	1.824
Unit Wet Wt. (pcf)	111.0	113.9
Unit Dry Wt. (pcf)	81.5	84.4
Unit Dry Wt. (gm./ cm^3)	1.306	1.351
Void Ratio, e	1.068	0.998
Porosity, n	0.516	0.500
Pore Volume (cm^3)	156.9	146.6
Total Wt. Of Sample After Test		536.84

Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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INTEGRITY IN TESTING

FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARNER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-03	Sample No.	ST-TP2-L1
Lab ID No.	2013-763-03-01-422		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	60.0	Sample Length (cm), L	7.24
Back Pressure(psi)	50.0	Sample Area (cm^2), A	40.56
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	99	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 5.3E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 5.3E-09 m/sec @ 20°C

DATE (mm/dd/yy)	TIME (hr)	(min)	(sec)	(min)	ELAPSED TIME t (min)	PIPETTE READI NG R_p (cm)	INCREMENT GRADIENT i (cm/cm)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
11/20/13	14	34	29	34.48	0.000	7.6	11.9	23.5	NA
11/20/13	14	34	39	34.65	0.167	7.5	11.7	23.5	6.0E-07
11/20/13	14	34	49	34.82	0.333	7.4	11.6	23.5	6.1E-07
11/20/13	14	35	1	35.02	0.533	7.3	11.4	23.5	5.2E-07
11/20/13	14	35	19	35.32	0.833	7.2	11.2	23.5	3.5E-07
11/20/13	14	35	29	35.48	1.000	7.1	11.0	23.5	6.4E-07

Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

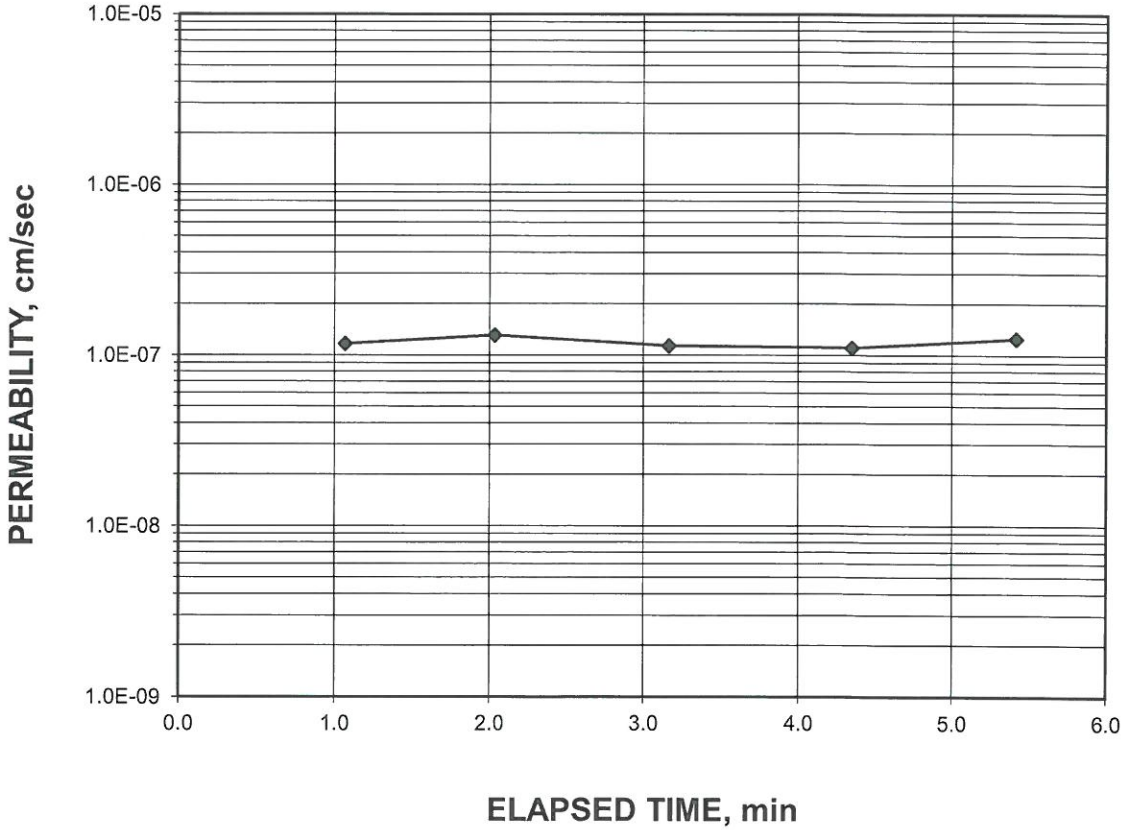
ASTM D 5084-10

Client	SMITH + GARDENER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-03	Sample No.	ST-TP2-L2
Lab ID No.	2013-763-03-02-422		

Visual Description: LIGHT BROWN CLAY

AVERAGE PERMEABILITY = 1.2E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.2E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

ASTM D 5084-10

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Client	SMITH + GARDENER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-03	Sample No.	ST-TP2-L2
Lab ID No.	2013-763-03-02-422		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: LIGHT BROWN CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	810	814
Wt. of Tare & WS (gm.)	318.46	396.99
Wt. of Tare & DS (gm.)	268.26	322.77
Wt. of Tare (gm.)	114.87	111.11
Wt. of Water (gm.)	50.20	74.22
Wt. of DS (gm.)	153.39	211.66
Moisture Content (%)	**32.7**	**35.1**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	649.32	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	649.32	660.76
Length 1 (in.)	3.359	3.345
Length 2 (in.)	3.332	3.329
Length 3 (in.)	3.365	3.312
Top Diameter (in.)	2.869	2.863
Middle Diameter (in.)	2.864	2.850
Bottom Diameter (in.)	2.860	2.862
Average Length (in.)	3.35	3.33
Average Area (in.^{2})	6.44	6.42
Sample Volume (cm^3)	353.95	350.02
Unit Wet Wt. (gm./ cm^3)	1.834	1.888
Unit Wet Wt. (pcf)	114.5	117.8
Unit Dry Wt. (pcf)	86.3	87.2
Unit Dry Wt. (gm./ cm^3)	1.382	1.398
Void Ratio, e	0.953	0.932
Porosity, n	0.488	0.482
Pore Volume (cm^3)	172.8	168.8
Total Wt. Of Sample After Test		662.35

Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDENER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-03	Sample No.	ST-TP2-L2
Lab ID No.	2013-763-03-02-422		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	60.0	Sample Length (cm), L	8.45
Back Pressure(psi)	50.0	Sample Area (cm^2), A	41.40
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 1.2E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.2E-09 m/sec @ 20°C

DATE (mm/dd/yy)	TIME (hr)	(min)	(sec)	(min)	ELAPSED TIME t (min)	PIPETTE READI NG R_p (cm)	INCREMENT GRADIENT i (cm/cm)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
11/20/13	14	15	45	15.75	0.000	7.1	9.4	23.5	NA
11/20/13	14	16	49	16.82	1.067	7.0	9.3	23.5	1.2E-07
11/20/13	14	17	47	17.78	2.033	6.9	9.1	23.5	1.3E-07
11/20/13	14	18	55	18.92	3.167	6.8	9.0	23.5	1.1E-07
11/20/13	14	20	6	20.10	4.350	6.7	8.8	23.5	1.1E-07
11/20/13	14	21	10	21.17	5.417	6.6	8.7	23.5	1.3E-07

Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

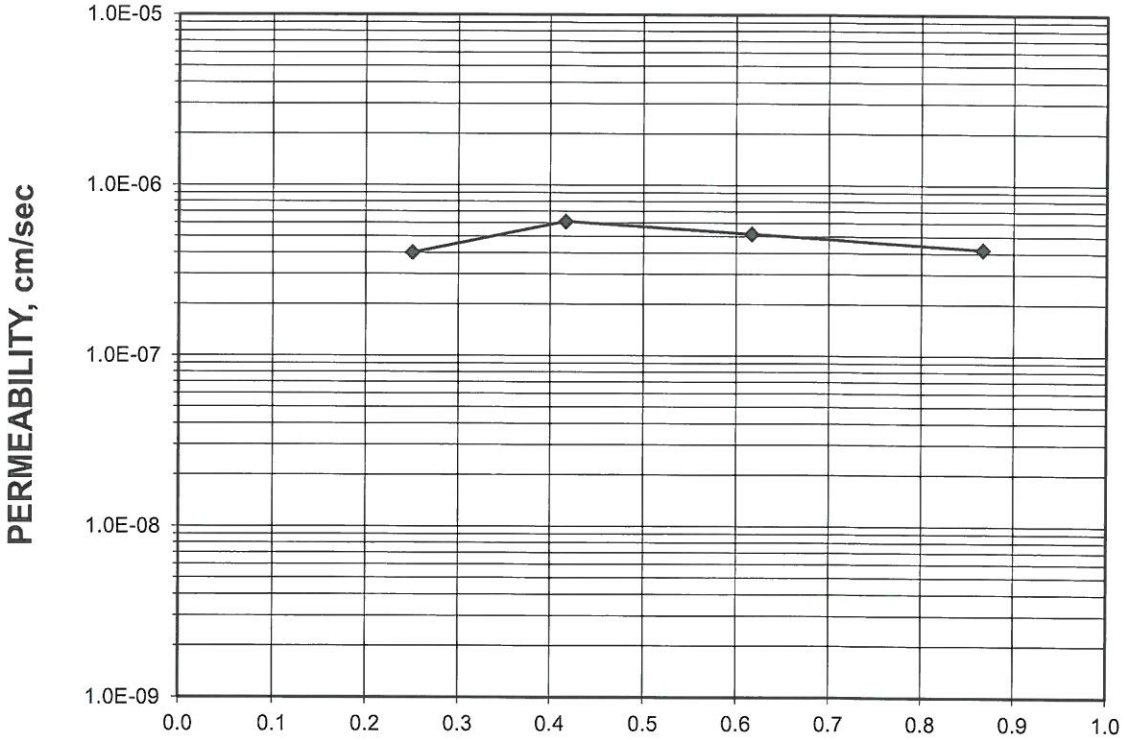
ASTM D 5084-10

Client	SMITH + GARDNER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT3
Project No.	2013-763-03	Sample No.	ST-TP2-L3
Lab ID No.	2013-763-03-03-422		

Visual Description: LIGHT BROWN SANDY CLAY

AVERAGE PERMEABILITY = 4.9E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 4.9E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT3
Project No.	2013-763-03	Sample No.	ST-TP2-L3
Lab ID No.	2013-763-03-03-422		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: LIGHT BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	814	Z-12
Wt. of Tare & WS (gm.)	304.18	410.87
Wt. of Tare & DS (gm.)	265.80	354.04
Wt. of Tare (gm.)	111.11	89.64
Wt. of Water (gm.)	38.38	56.83
Wt. of DS (gm.)	154.69	264.40
Moisture Content (%)	**24.8**	**21.5**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	653.18	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	653.18	635.82
Length 1 (in.)	3.258	3.380
Length 2 (in.)	3.255	3.415
Length 3 (in.)	3.228	3.372
Top Diameter (in.)	2.840	3.023
Middle Diameter (in.)	2.828	3.049
Bottom Diameter (in.)	2.842	3.048
Average Length (in.)	3.25	3.39
Average Area (in.^{2})	6.32	7.26
Sample Volume (cm^3)	336.27	403.10
Unit Wet Wt. (gm./ cm^3)	1.942	1.577
Unit Wet Wt. (pcf)	121.2	98.5
Unit Dry Wt. (pcf)	97.1	81.0
Unit Dry Wt. (gm./ cm^3)	1.556	1.298
Void Ratio, e	0.735	1.080
Porosity, n	0.424	0.519
Pore Volume (cm^3)	142.4	209.3
Total Wt. Of Sample After Test		637.49

Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC	Boring No.	TEST PAD 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT3
Project No.	2013-763-03	Sample No.	ST-TP2-L3
Lab ID No.	2013-763-03-03-422		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	60.0	Sample Length (cm), L	8.61
Back Pressure(psi)	50.0	Sample Area (cm^2), A	46.83
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	95	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 4.9E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 4.9E-09 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
11/20/13	14	0	35	0.58	0.000	7.8	10.3	23.5	NA
11/20/13	14	0	50	0.83	0.250	7.7	10.2	23.5	4.0E-07
11/20/13	14	1	0	1.00	0.417	7.6	10.0	23.5	6.1E-07
11/20/13	14	1	12	1.20	0.617	7.5	9.9	23.5	5.2E-07
11/20/13	14	1	27	1.45	0.867	7.4	9.7	23.5	4.2E-07

Tested By: BW Date: 11/19/13 Checked By: MBS Date: 11-21-13

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

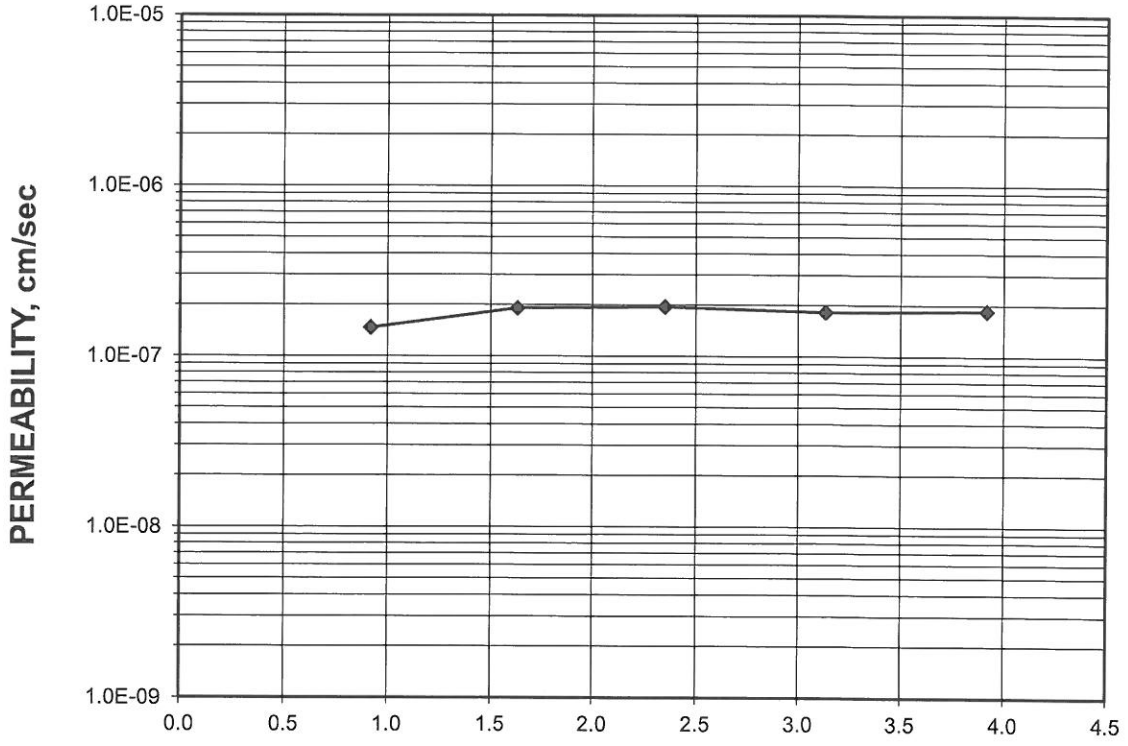
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-04	Sample No.	ST-01-01
Lab ID No.	2013-763-04-01		

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: SFS Date: 12/03/13 Checked By: MBS Date: 12-5-13

DCN: CT-22A DATE: 12-13-2013 REVISION: 5 GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-04-01 Permometer wHeader.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-04	Sample No.	ST-01-01
Lab ID No.	2013-763-04-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	818	B-1
Wt. of Tare & WS (gm.)	340.78	412.34
Wt. of Tare & DS (gm.)	295.21	337.6
Wt. of Tare (gm.)	136.76	95.71
Wt. of Water (gm.)	45.57	74.74
Wt. of DS (gm.)	158.45	241.89
Moisture Content (%)	**28.8**	**30.9**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	620.52	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	620.52	630.83
Length 1 (in.)	3.068	3.033
Length 2 (in.)	3.066	3.037
Length 3 (in.)	3.071	3.025
Top Diameter (in.)	2.831	2.833
Middle Diameter (in.)	2.812	2.845
Bottom Diameter (in.)	2.845	2.851
Average Length (in.)	3.07	3.03
Average Area (in.^{2})	6.29	6.35
Sample Volume (cm^3)	316.13	315.37
Unit Wet Wt. (gm./ cm^3)	1.963	2.000
Unit Wet Wt. (pcf)	122.5	124.9
Unit Dry Wt. (pcf)	95.2	95.4
Unit Dry Wt. (gm./ cm^3)	1.524	1.528
Void Ratio, e	0.771	0.767
Porosity, n	0.435	0.434
Pore Volume (cm^3)	137.6	136.9
Total Wt. Of Sample After Test		623.06

Tested By: SFS Date: 12/03/13 Checked By: MBS Date: 12-5-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-04	Sample No.	ST-01-01
Lab ID No.	2013-763-04-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.70
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.96
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

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

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
12/04/13	9	28	1	28.02	0.000	6.4	9.2	21.9	NA
12/04/13	9	28	56	28.93	0.917	6.3	9.0	21.9	1.5E-07
12/04/13	9	29	39	29.65	1.633	6.2	8.8	21.9	1.9E-07
12/04/13	9	30	22	30.37	2.350	6.1	8.6	21.9	2.0E-07
12/04/13	9	31	9	31.15	3.133	6.0	8.5	21.9	1.8E-07
12/04/13	9	31	56	31.93	3.917	5.9	8.3	21.9	1.9E-07

Tested By: SFS Date: 12/03/13 Checked By: MBS Date: 12-5-13

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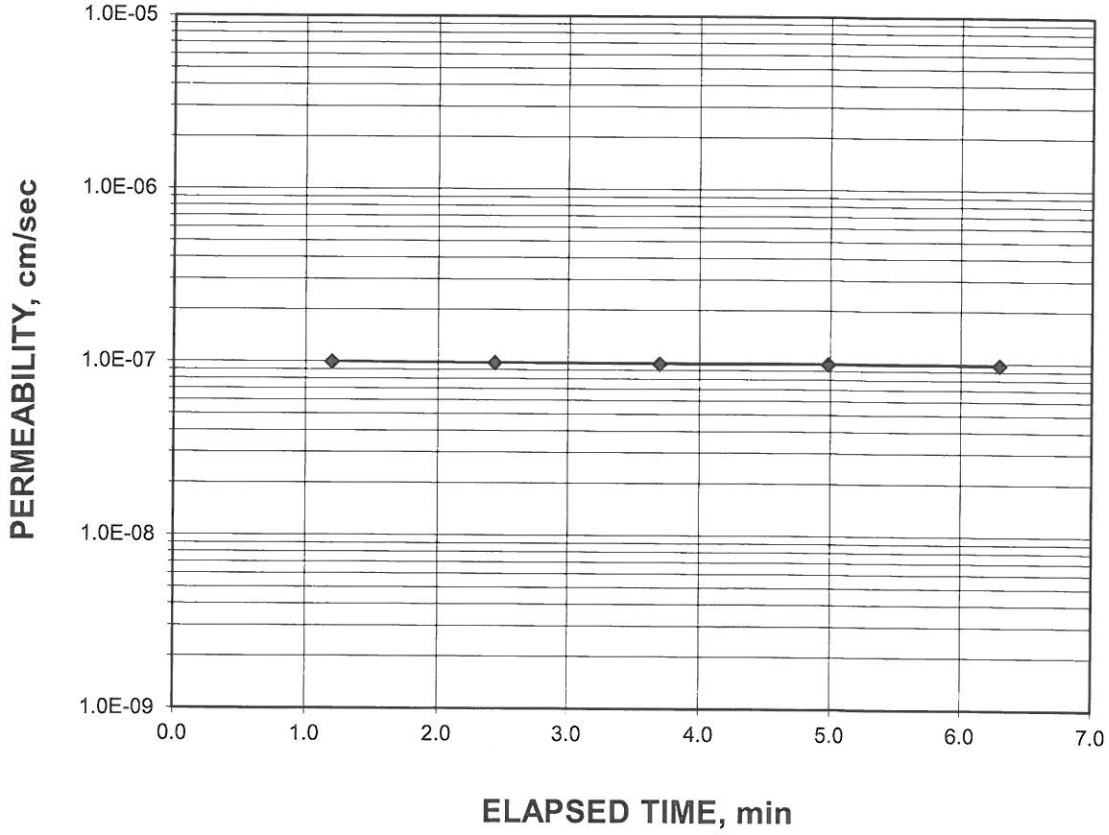
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE-1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-05	Sample No.	ST-01-02
Lab ID No.	2013-763-05-01		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 9.8E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 9.8E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 12/16/13 Checked By: GM Date: 12-18-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE-1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-05	Sample No.	ST-01-02
Lab ID No.	2013-763-05-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	B-1	806
Wt. of Tare & WS (gm.)	308.36	400.15
Wt. of Tare & DS (gm.)	259.96	328.79
Wt. of Tare (gm.)	95.73	100.4
Wt. of Water (gm.)	48.40	71.36
Wt. of DS (gm.)	164.23	228.39
Moisture Content (%)	**29.5**	**31.2**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	568.74	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	568.74	576.53
Length 1 (in.)	2.863	2.802
Length 2 (in.)	2.859	2.804
Length 3 (in.)	2.860	2.821
Top Diameter (in.)	2.809	2.792
Middle Diameter (in.)	2.800	2.802
Bottom Diameter (in.)	2.817	2.787
Average Length (in.)	2.86	2.81
Average Area (in.^{2})	6.20	6.13
Sample Volume (cm^3)	290.44	282.16
Unit Wet Wt. (gm./ cm^3)	1.958	2.043
Unit Wet Wt. (pcf)	122.2	127.5
Unit Dry Wt. (pcf)	94.4	97.2
Unit Dry Wt. (gm./ cm^3)	1.512	1.557
Void Ratio, e	0.785	0.734
Porosity, n	0.440	0.423
Pore Volume (cm^3)	127.7	119.5
Total Wt. Of Sample After Test		566.46

Tested By: SFS Date: 12/16/13 Checked By: GDM Date: 12-18-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE-1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-05	Sample No.	ST-01-02
Lab ID No.	2013-763-05-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.13
Back Pressure(psi)	40.0	Sample Area (cm^2), A	39.55
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	100	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 9.8E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 9.8E-10 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
12/16/13	19	25	2	25.03	0.000	6.8	10.6	22.1	NA
12/16/13	19	26	14	26.23	1.200	6.7	10.4	22.1	1.0E-07
12/16/13	19	27	28	27.47	2.433	6.6	10.3	22.1	9.9E-08
12/16/13	19	28	44	28.73	3.700	6.5	10.1	22.1	9.8E-08
12/16/13	19	30	1	30.02	4.983	6.4	9.9	22.1	9.8E-08
12/16/13	19	31	20	31.33	6.300	6.3	9.7	22.1	9.8E-08

Tested By: SFS Date: 12/16/13 Checked By: GM Date 12-18-13

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INTEGRITY IN TESTING

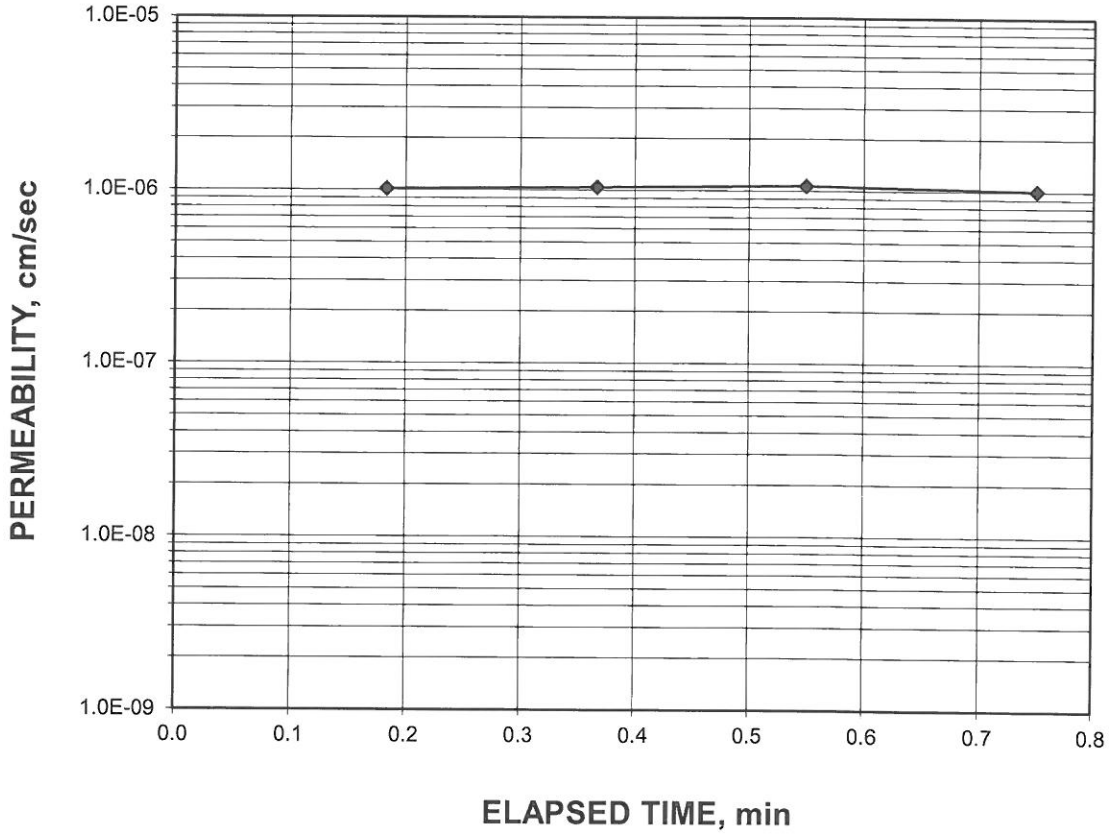
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-06	Sample No.	ST-01-03
Lab ID No.	2013-763-06-03		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 1.0E-06 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.0E-08 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-06	Sample No.	ST-01-03
Lab ID No.	2013-763-06-03		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	813	B-1
Wt. of Tare & WS (gm.)	311.95	323.13
Wt. of Tare & DS (gm.)	273.99	273.73
Wt. of Tare (gm.)	113.05	95.71
Wt. of Water (gm.)	37.96	49.40
Wt. of DS (gm.)	160.94	178.02
Moisture Content (%)	**23.6**	**27.7**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	614.22	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	614.22	634.91
Length 1 (in.)	2.953	2.947
Length 2 (in.)	2.950	2.931
Length 3 (in.)	2.973	2.943
Top Diameter (in.)	2.809	2.846
Middle Diameter (in.)	2.801	2.845
Bottom Diameter (in.)	2.800	2.843
Average Length (in.)	2.96	2.94
Average Area (in.^{2})	6.17	6.36
Sample Volume (cm^3)	299.25	306.23
Unit Wet Wt. (gm./ cm^3)	2.053	2.073
Unit Wet Wt. (pcf)	128.1	129.4
Unit Dry Wt. (pcf)	103.7	101.3
Unit Dry Wt. (gm./ cm^3)	1.661	1.623
Void Ratio, e	0.626	0.664
Porosity, n	0.385	0.399
Pore Volume (cm^3)	115.2	122.2
Total Wt. Of Sample After Test		622.67

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A1
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-06	Sample No.	ST-01-03
Lab ID No.	2013-763-06-03		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.47
Back Pressure(psi)	40.0	Sample Area (cm^2), A	41.00
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	95	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 1.0E-06 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.0E-08 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	10	9	0	9.00	0.000	9.0	13.8	20.3	NA
1/3/14	10	9	11	9.18	0.183	8.8	13.5	20.3	1.0E-06
1/3/14	10	9	22	9.37	0.367	8.6	13.1	20.3	1.0E-06
1/3/14	10	9	33	9.55	0.550	8.4	12.8	20.3	1.1E-06
1/3/14	10	9	45	9.75	0.750	8.2	12.4	20.3	1.0E-06

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

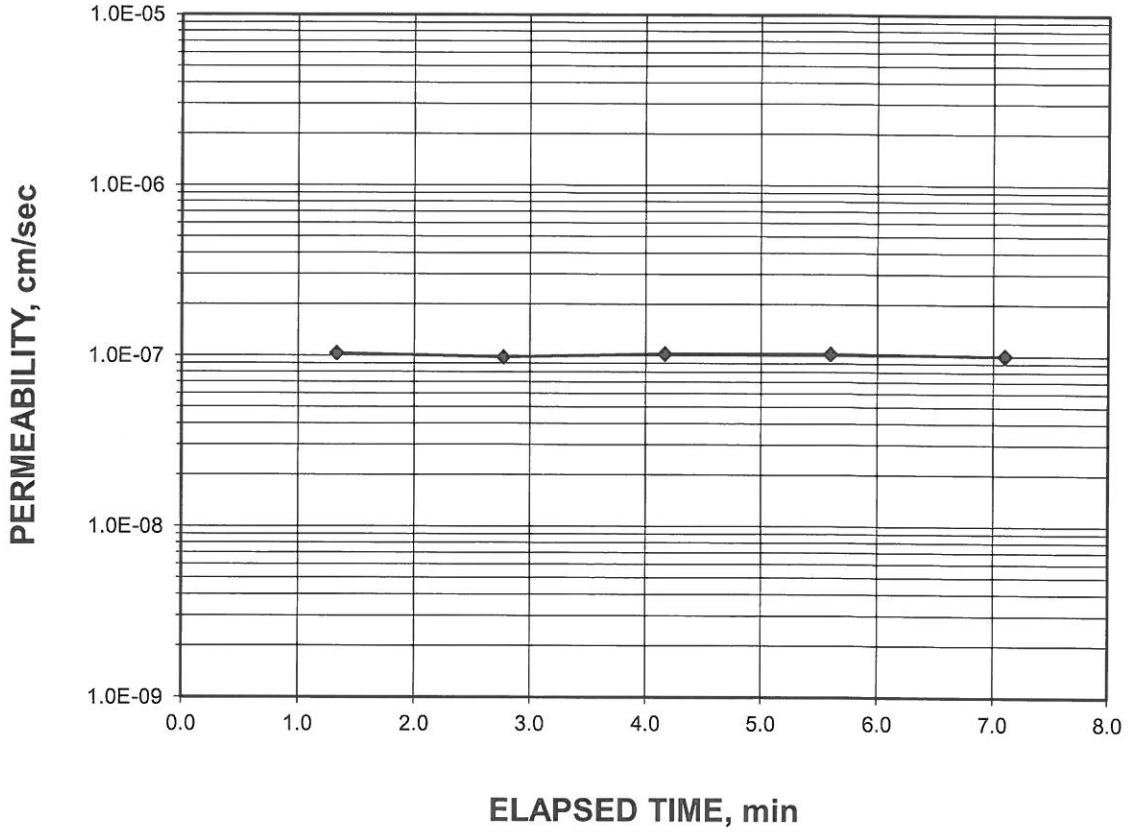
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-04	Sample No.	ST-02-01
Lab ID No.	2013-763-04-02		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 1.0E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.0E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 12/03/13 Checked By: MRS Date: 12-5-13

DCN: CT-22A DATE: 2013-7-18 REVISION: 5 GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-04-02 Permometer wHeader.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-04	Sample No.	ST-02-01
Lab ID No.	2013-763-04-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	B-1	A-5
Wt. of Tare & WS (gm.)	283.16	363.39
Wt. of Tare & DS (gm.)	246.90	308.99
Wt. of Tare (gm.)	95.69	95.58
Wt. of Water (gm.)	36.26	54.40
Wt. of DS (gm.)	151.21	213.41
Moisture Content (%)	**24.0**	**25.5**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	560.55	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	560.55	567.38
Length 1 (in.)	2.666	2.629
Length 2 (in.)	2.664	2.643
Length 3 (in.)	2.678	2.647
Top Diameter (in.)	2.824	2.845
Middle Diameter (in.)	2.826	2.844
Bottom Diameter (in.)	2.836	2.844
Average Length (in.)	2.67	2.64
Average Area (in.^{2})	6.28	6.35
Sample Volume (cm^3)	274.89	274.85
Unit Wet Wt. (gm./ cm^3)	2.039	2.064
Unit Wet Wt. (pcf)	127.3	128.9
Unit Dry Wt. (pcf)	102.7	102.7
Unit Dry Wt. (gm./ cm^3)	1.645	1.645
Void Ratio, e	0.642	0.641
Porosity, n	0.391	0.391
Pore Volume (cm^3)	107.4	107.4
Total Wt. Of Sample After Test		565.28

Tested By: SFS Date: 12/03/13 Checked By: MBS Date: 12-5-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-04	Sample No.	ST-02-01
Lab ID No.	2013-763-04-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	6.70
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.99
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 1.0E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.0E-09 m/sec @ 20°C

DATE		TIME			ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
12/04/13	10	50	12	50.20	0.000	5.6	9.0	22.0	NA
12/04/13	10	51	32	51.53	1.333	5.5	8.8	22.0	1.0E-07
12/04/13	10	52	58	52.97	2.767	5.4	8.6	22.0	9.8E-08
12/04/13	10	54	22	54.37	4.167	5.3	8.4	22.0	1.0E-07
12/04/13	10	55	48	55.80	5.600	5.2	8.2	22.0	1.0E-07
12/04/13	10	57	18	57.30	7.100	5.1	8.0	22.0	1.0E-07

Tested By: SFS Date: 12/03/13 Checked By: MBS Date: 12-5-13

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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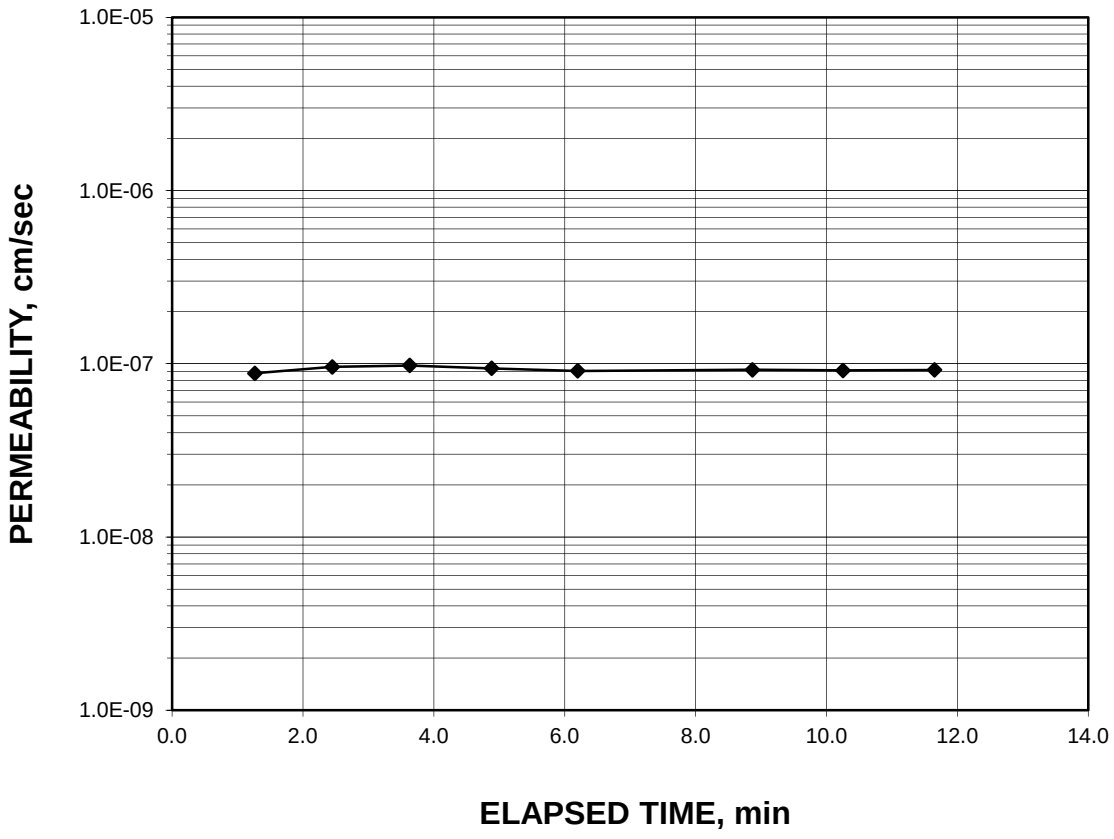
Client	SMITH + GARDNER, INC.	Boring No.	ACRE-2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-05	Sample No.	ST-02-02
Lab ID No.	2013-763-05-02		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 9.2E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 9.2E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 12/19/13 Checked By: GEM Date: 1/13/14

DCN: CT-22A DATE: 2-6-2013 REVISION: 5 TITLE: GARDNER DAVIDSON CO. LF - CELL 1\[2013-763-05-02 Permometer NO Header fixed acre lift.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE-2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-05	Sample No.	ST-02-02
Lab ID No.	2013-763-05-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	Y-11	800
Wt. of Tare & WS (gm.)	286.84	396.37
Wt. of Tare & DS (gm.)	244.91	331.02
Wt. of Tare (gm.)	93.56	103.78
Wt. of Water (gm.)	41.93	65.35
Wt. of DS (gm.)	151.35	227.24
Moisture Content (%)	**27.7**	**28.8**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	568.07	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	568.07	572.76
Length 1 (in.)	2.861	2.816
Length 2 (in.)	2.860	2.784
Length 3 (in.)	2.870	2.786
Top Diameter (in.)	2.826	2.798
Middle Diameter (in.)	2.831	2.816
Bottom Diameter (in.)	2.806	2.824
Average Length (in.)	2.86	2.80
Average Area (in.^{2})	6.25	6.21
Sample Volume (cm^3)	293.31	284.62
Unit Wet Wt. (gm./ cm^3)	1.937	2.012
Unit Wet Wt. (pcf)	120.9	125.6
Unit Dry Wt. (pcf)	94.7	97.6
Unit Dry Wt. (gm./ cm^3)	1.517	1.563
Void Ratio, e	0.780	0.728
Porosity, n	0.438	0.421
Pore Volume (cm^3)	128.6	119.9
Total Wt. Of Sample After Test		565.67

Tested By: SFS Date: 12/19/13 Checked By: GEM Date: 1/13/14

DCN: CT-22A DATE: 1-10-2013 REVISION: 5 DAVIDSON CO. LF - CELL 1\[2013-763-05-02 Permometer NO Header fixed acre lift.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE-2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-05	Sample No.	ST-02-02
Lab ID No.	2013-763-05-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.10
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.09
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	98	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 9.2E-08 cm/sec @ 20°C

AVERAGE PERMEABILITY = 9.2E-10 m/sec @ 20°C

DATE		TIME			ELAPSED TIME **t**	PIPETTE READI NG **R_p**	INCREMENT GRADIENT **i**	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
12/20/13	15	45	0	45.00	0.000	7.0	11.0	22.8	NA
12/20/13	15	46	16	46.27	1.267	6.9	10.9	22.8	8.8E-08
12/20/13	15	47	27	47.45	2.450	6.8	10.7	22.8	9.6E-08
12/20/13	15	48	38	48.63	3.633	6.7	10.5	22.8	9.8E-08
12/20/13	15	49	53	49.88	4.883	6.6	10.3	22.8	9.4E-08
12/20/13	15	51	12	51.20	6.200	6.5	10.1	22.8	9.1E-08
12/20/13	15	53	52	53.87	8.867	6.3	9.7	22.8	9.2E-08
12/20/13	15	55	15	55.25	10.250	6.2	9.6	22.8	9.1E-08
12/20/13	15	56	39	56.65	11.650	6.1	9.4	22.8	9.2E-08

Tested By: SFS Date: 12/19/13 Checked By: GEM Date: 1/13/14

DCN: CT-22A DATE: 12-10-2013 REVISION: 5 DAVIDSON CO. LF - CELL 1\[2013-763-05-02 Permometer NO Header fixed acre lift.xls]Sheet1

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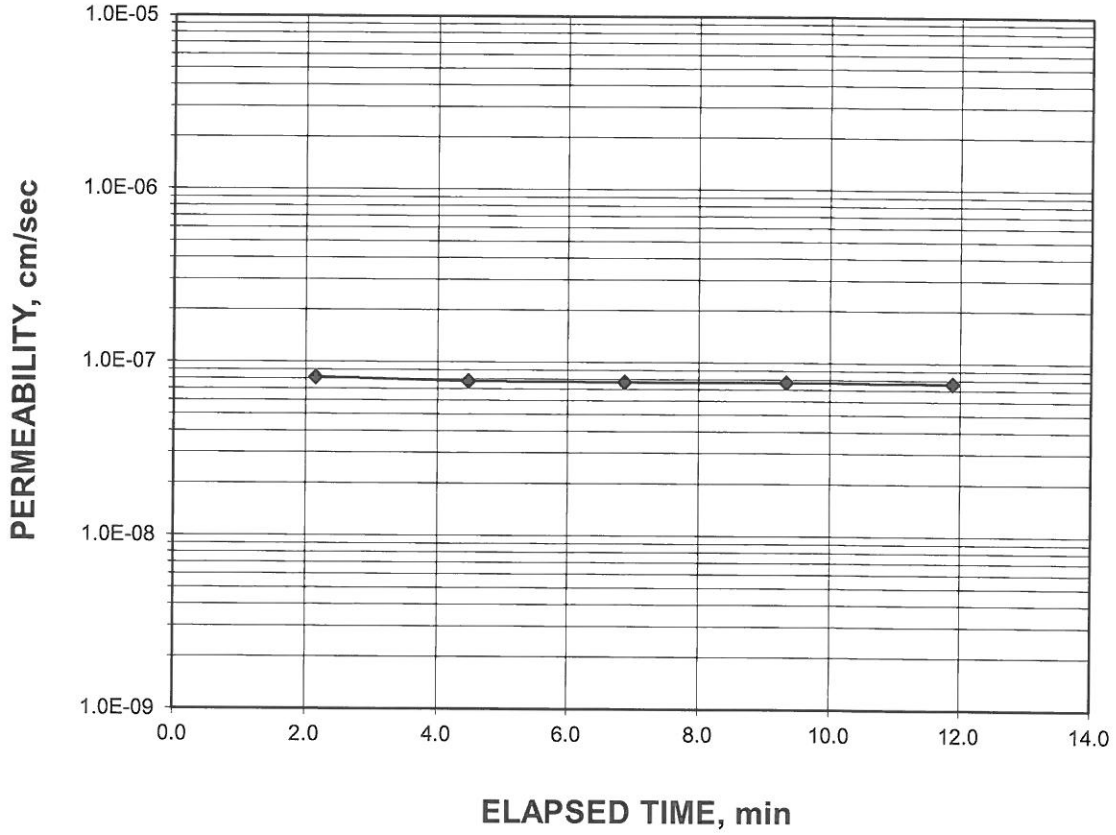
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-06	Sample No.	ST-02-03
Lab ID No.	2013-763-06-04		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 7.7E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.7E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-06	Sample No.	ST-02-03
Lab ID No.	2013-763-06-04		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	A-5	804
Wt. of Tare & WS (gm.)	295.15	319.56
Wt. of Tare & DS (gm.)	236.16	266.77
Wt. of Tare (gm.)	95.70	105.4
Wt. of Water (gm.)	58.99	52.79
Wt. of DS (gm.)	140.46	161.37
Moisture Content (%)	**42.0**	**32.7**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	557.38	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	557.38	520.94
Length 1 (in.)	2.779	2.775
Length 2 (in.)	2.784	2.767
Length 3 (in.)	2.793	2.754
Top Diameter (in.)	2.841	2.841
Middle Diameter (in.)	2.847	2.834
Bottom Diameter (in.)	2.844	2.837
Average Length (in.)	2.79	2.77
Average Area (in.^{2})	6.35	6.32
Sample Volume (cm^3)	289.95	286.52
Unit Wet Wt. (gm./ cm^3)	1.922	1.818
Unit Wet Wt. (pcf)	120.0	113.5
Unit Dry Wt. (pcf)	84.5	85.5
Unit Dry Wt. (gm./ cm^3)	1.354	1.370
Void Ratio, e	0.994	0.971
Porosity, n	0.499	0.493
Pore Volume (cm^3)	144.6	141.1
Total Wt. Of Sample After Test		560.37

Tested By: SFS Date: 1/2/14 Checked By: GAW Date: 1-6-14

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PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A2
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2013-763-06	Sample No.	ST-02-03
Lab ID No.	2013-763-06-04		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.02
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.79
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	96	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 7.7E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.7E-10 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	10	53	0	53.00	0.000	9.0	14.7	20.4	NA
1/3/14	10	55	9	55.15	2.150	8.8	14.3	20.4	8.2E-08
1/3/14	10	57	28	57.47	4.467	8.6	13.9	20.4	7.8E-08
1/3/14	10	59	52	59.87	6.867	8.4	13.6	20.4	7.7E-08
1/3/14	11	2	20	2.33	9.333	8.2	13.2	20.4	7.7E-08
1/3/14	11	4	53	4.88	11.883	8.0	12.8	20.4	7.7E-08

Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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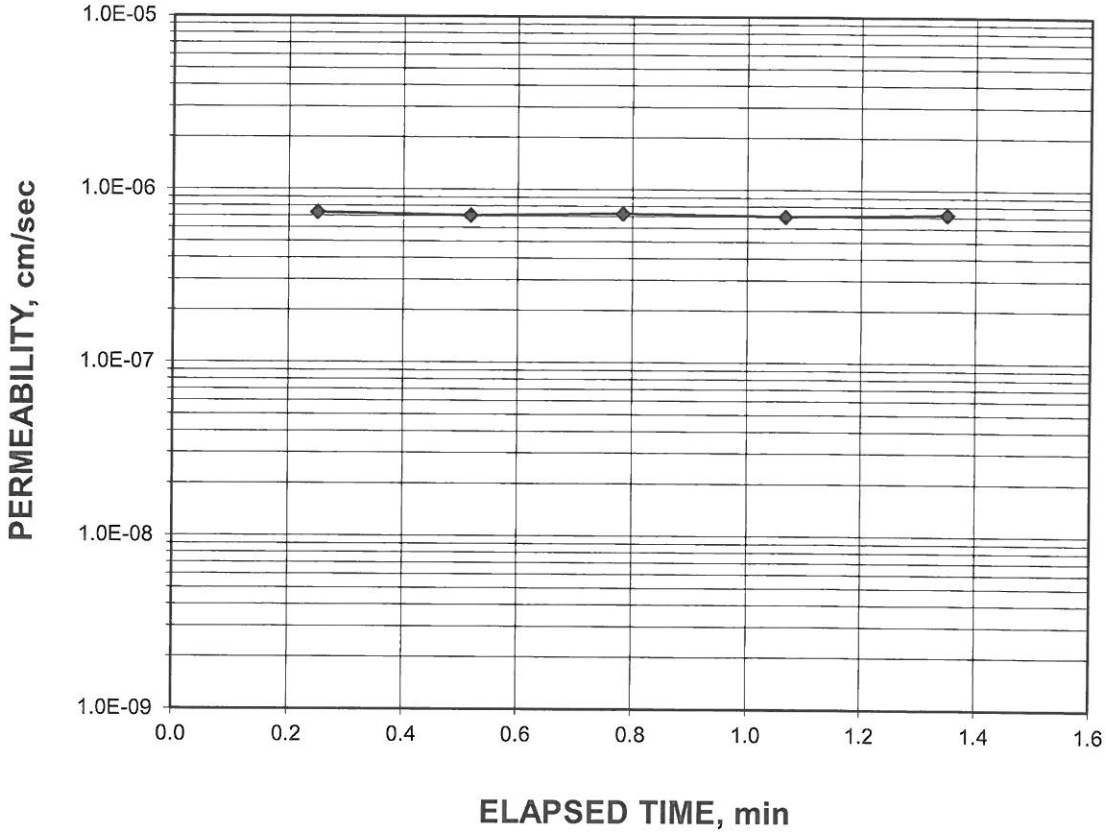
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-03-01
Lab ID No.	2013-763-06-05		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 7.1E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.1E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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INTEGRITY IN TESTING

FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-03-01
Lab ID No.	2013-763-06-05		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	Y-11	A-5
Wt. of Tare & WS (gm.)	340.78	351.6
Wt. of Tare & DS (gm.)	298.77	303.12
Wt. of Tare (gm.)	93.56	95.63
Wt. of Water (gm.)	42.01	48.48
Wt. of DS (gm.)	205.21	207.49
Moisture Content (%)	**20.5**	**23.4**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	591.60	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	591.60	605.81
Length 1 (in.)	2.877	2.868
Length 2 (in.)	2.903	2.9
Length 3 (in.)	2.873	2.881
Top Diameter (in.)	2.825	2.842
Middle Diameter (in.)	2.829	2.825
Bottom Diameter (in.)	2.827	2.835
Average Length (in.)	2.88	2.88
Average Area (in.^{2})	6.28	6.31
Sample Volume (cm^3)	296.68	298.01
Unit Wet Wt. (gm./ cm^3)	1.994	2.033
Unit Wet Wt. (pcf)	124.5	126.9
Unit Dry Wt. (pcf)	103.3	102.9
Unit Dry Wt. (gm./ cm^3)	1.655	1.648
Void Ratio, e	0.631	0.639
Porosity, n	0.387	0.390
Pore Volume (cm^3)	114.8	116.1
Total Wt. Of Sample After Test		609.39

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-03-01
Lab ID No.	2013-763-06-05		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.32
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.70
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	95	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 7.1E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.1E-09 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	10	30	56	30.93	0.000	9.0	14.1	20.3	NA
1/3/14	10	31	11	31.18	0.250	8.8	13.7	20.3	7.3E-07
1/3/14	10	31	27	31.45	0.517	8.6	13.4	20.3	7.1E-07
1/3/14	10	31	43	31.72	0.783	8.4	13.0	20.3	7.3E-07
1/3/14	10	32	0	32.00	1.067	8.2	12.7	20.3	7.0E-07
1/3/14	10	32	17	32.28	1.350	8.0	12.3	20.3	7.2E-07

Tested By: SFS Date: 1/2/14 Checked By: GJM Date: 1-6-14

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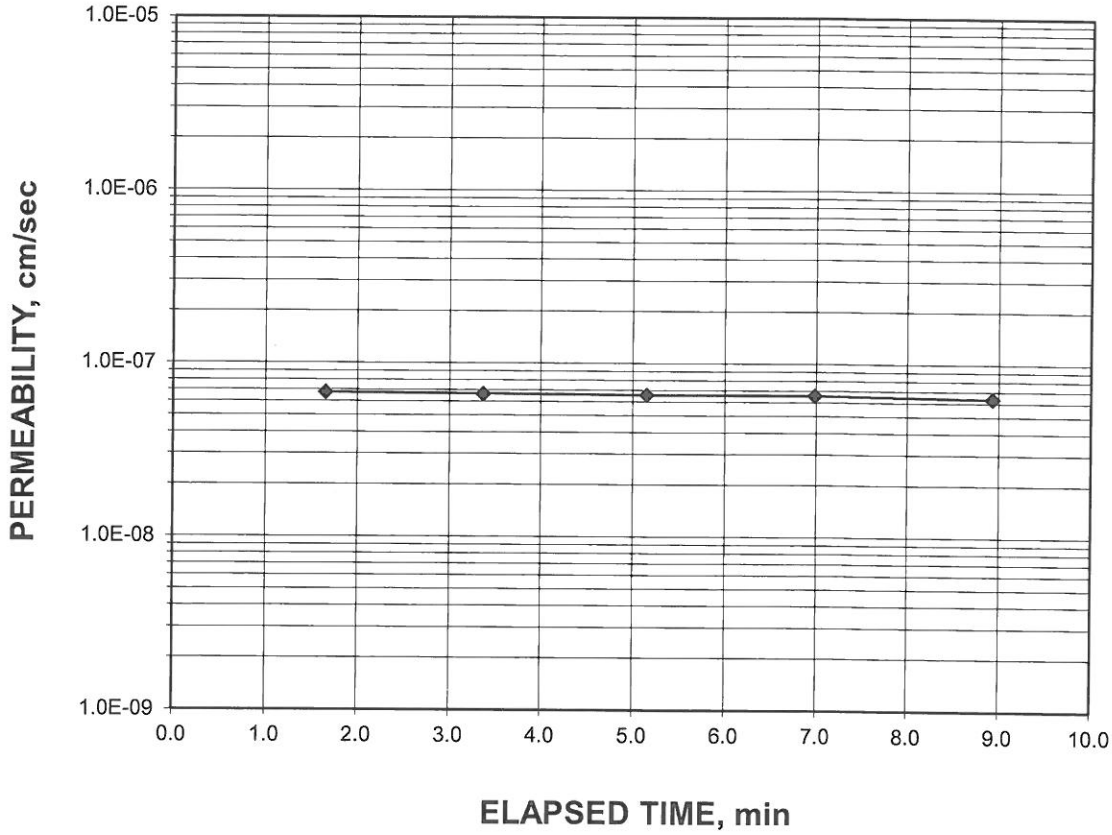
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-03-02
Lab ID No.	2013-763-06-06		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 6.5E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 6.5E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-03-02
Lab ID No.	2013-763-06-06		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	814	Y-11
Wt. of Tare & WS (gm.)	246.77	334.98
Wt. of Tare & DS (gm.)	228.58	293.09
Wt. of Tare (gm.)	111.13	93.52
Wt. of Water (gm.)	18.19	41.89
Wt. of DS (gm.)	117.45	199.57
Moisture Content (%)	**15.5**	**21.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	379.44	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	379.44	397.52
Length 1 (in.)	1.780	1.782
Length 2 (in.)	1.749	1.732
Length 3 (in.)	1.773	1.753
Top Diameter (in.)	2.850	2.857
Middle Diameter (in.)	2.834	2.841
Bottom Diameter (in.)	2.841	2.803
Average Length (in.)	1.77	1.76
Average Area (in.^{2})	6.34	6.31
Sample Volume (cm^3)	183.68	181.44
Unit Wet Wt. (gm./ cm^3)	2.066	2.191
Unit Wet Wt. (pcf)	129.0	136.8
Unit Dry Wt. (pcf)	111.7	113.0
Unit Dry Wt. (gm./ cm^3)	1.789	1.811
Void Ratio, e	0.509	0.491
Porosity, n	0.337	0.329
Pore Volume (cm^3)	62.0	59.8
Total Wt. Of Sample After Test		387.01

Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-03-02
Lab ID No.	2013-763-06-06		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	4.46
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.69
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 6.5E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 6.5E-10 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	11	39	54	39.90	0.000	9.0	23.1	20.5	NA
1/3/14	11	41	33	41.55	1.650	8.8	22.6	20.5	6.7E-08
1/3/14	11	43	16	43.27	3.367	8.6	22.0	20.5	6.7E-08
1/3/14	11	45	3	45.05	5.150	8.4	21.4	20.5	6.6E-08
1/3/14	11	46	53	46.88	6.983	8.2	20.8	20.5	6.6E-08
1/3/14	11	48	50	48.83	8.933	8.0	20.2	20.5	6.4E-08

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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PERMEABILITY TEST

ASTM D 5084-03

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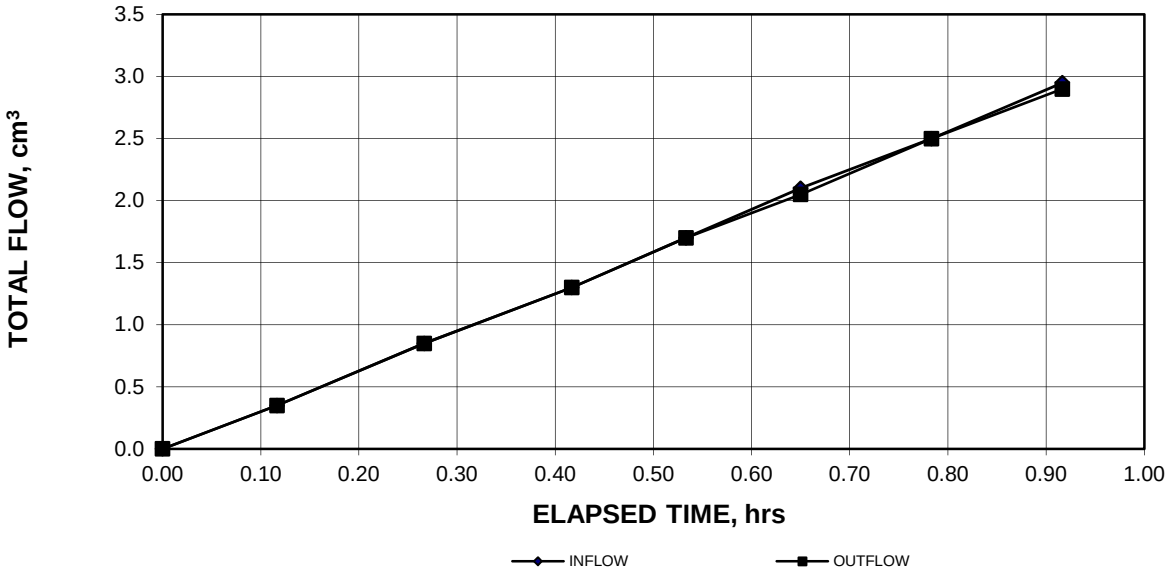
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-03-03
Lab ID No.	2014-625-02-01		

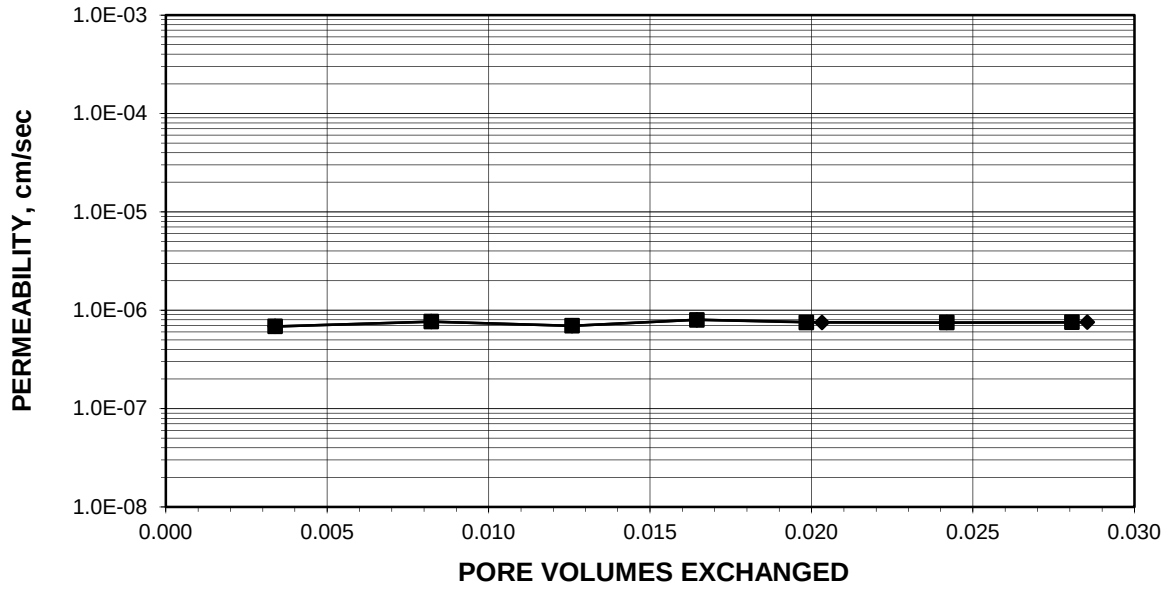
AVERAGE PERMEABILITY = 7.6E-07 cm/sec @ 20°C

AVERAGE PERMEABILITY = 7.6E-09 m/sec @ 20°C

TOTAL FLOW vs. ELAPSED TIME



PORE VOLUMES EXCHANGED vs. PERMEABILITY



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PERMEABILITY TEST

ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-03-03
Lab ID No.	2014-625-02-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	307	826
Wt. of Tare & WS (gm.)	380.46	411.15
Wt. of Tare & DS (gm.)	326.27	347.74
Wt. of Tare (gm.)	109.82	138.13
Wt. of Water (gm.)	54.19	63.41
Wt. of DS (gm.)	216.45	209.61
Moisture Content (%)	**25.0**	**30.3**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	465.18	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	465.18	484.58
Length 1 (in.)	2.363	2.223
Length 2 (in.)	2.391	2.380
Length 3 (in.)	2.379	2.301
Top Diameter (in.)	2.832	2.863
Middle Diameter (in.)	2.839	2.846
Bottom Diameter (in.)	2.843	2.851
Average Length (in.)	2.38	2.30
Average Area (in.^{2})	6.33	6.39
Sample Volume (cm^3)	246.47	241.14
Unit Wet Wt. (gm./ cm^3)	1.89	2.01
Unit Wet Wt. (pcf)	117.8	125.4
Unit Dry Wt. (pcf)	94.2	96.3
Unit Dry Wt. (gm./ cm^3)	1.51	1.54
Void Ratio, e	0.79	0.75
Porosity, n	0.44	0.43
Pore Volume (cm^3)	108.7	103.4
Total Wgt. Of Sample After Test		472.21

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

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PERMEABILITY TEST

ASTM D 5084-03

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 3
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-03-03
Lab ID No.	2014-625-02-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	39.0	Sample Length (cm), L	5.85
Bottom Cap (psi)	41.0	Sample Diameter (cm)	7.25
Cell (psi)	50.0	Sample Area (cm^2), A	41.25
Total Pressure Head (cm)	140.6	Inflow Burette Area (cm^2), a-in	0.892
Hydraulic Gradient	24.05	Outflow Burette Area (cm^2), a-out	0.905
		B Parameter (%)	98

AVERAGE PERMEABILITY = 7.6E-07 cm/sec @ 20°C

AVERAGE PERMEABILITY = 7.6E-09 m/sec @ 20°C

DATE (mm/dd/yy)	TIME (hr)	TIME (min)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	TOTAL HEAD h (cm)	FLOW (0 flow) (1 stop)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
2/10/14	15	3	0.00	0.0	0.0	161.2	0	22.9	NA
2/10/14	15	10	0.12	0.4	0.3	160.4	0	22.9	6.9E-07
2/10/14	15	19	0.27	0.9	0.8	159.3	0	22.9	7.7E-07
2/10/14	15	28	0.42	1.3	1.3	158.3	0	22.9	6.9E-07
2/10/14	15	35	0.53	1.7	1.7	157.4	0	22.9	8.0E-07
2/10/14	15	42	0.65	2.1	2.1	156.6	0	22.9	7.5E-07
2/10/14	15	50	0.78	2.5	2.5	155.7	0	22.9	7.5E-07
2/10/14	15	58	0.92	3.0	2.9	154.7	1	22.9	7.6E-07

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

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FLEXIBLE WALL PERMEABILITY TEST

PERMOMETER METHOD

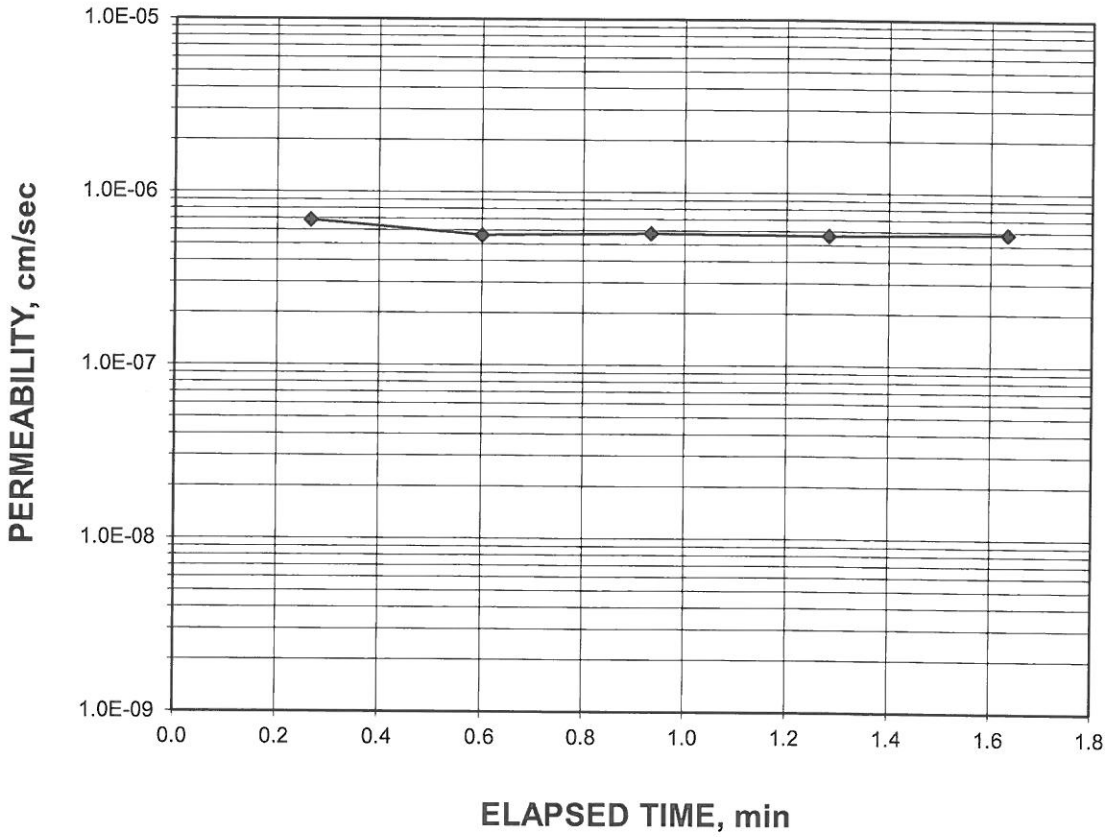
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-04-01
Lab ID No.	2013-763-06-07		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 5.7E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 5.7E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-04-01
Lab ID No.	2013-763-06-07		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	812	812
Wt. of Tare & WS (gm.)	342.84	341.57
Wt. of Tare & DS (gm.)	301.47	297.73
Wt. of Tare (gm.)	106.88	106.87
Wt. of Water (gm.)	41.37	43.84
Wt. of DS (gm.)	194.59	190.86
Moisture Content (%)	**21.3**	**23.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	596.64	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	596.64	605.05
Length 1 (in.)	2.855	2.862
Length 2 (in.)	2.841	2.851
Length 3 (in.)	2.857	2.848
Top Diameter (in.)	2.829	2.82
Middle Diameter (in.)	2.830	2.825
Bottom Diameter (in.)	2.836	2.824
Average Length (in.)	2.85	2.85
Average Area (in.^{2})	6.30	6.26
Sample Volume (cm^3)	294.22	292.70
Unit Wet Wt. (gm./ cm^3)	2.028	2.067
Unit Wet Wt. (pcf)	126.6	129.0
Unit Dry Wt. (pcf)	104.4	104.9
Unit Dry Wt. (gm./ cm^3)	1.672	1.681
Void Ratio, e	0.615	0.606
Porosity, n	0.381	0.377
Pore Volume (cm^3)	112.0	110.5
Total Wt. Of Sample After Test		607.35

Tested By: SFS Date: 1/2/14 Checked By: GPM Date: 1-6-14

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PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-04-01
Lab ID No.	2013-763-06-07		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.25
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.38
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	95	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 5.7E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 5.7E-09 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	11	12	56	12.93	0.000	9.0	14.2	20.4	NA
1/3/14	11	13	12	13.20	0.267	8.8	13.9	20.4	6.9E-07
1/3/14	11	13	32	13.53	0.600	8.6	13.5	20.4	5.6E-07
1/3/14	11	13	52	13.87	0.933	8.4	13.2	20.4	5.8E-07
1/3/14	11	14	13	14.22	1.283	8.2	12.8	20.4	5.7E-07
1/3/14	11	14	34	14.57	1.633	8.0	12.4	20.4	5.8E-07

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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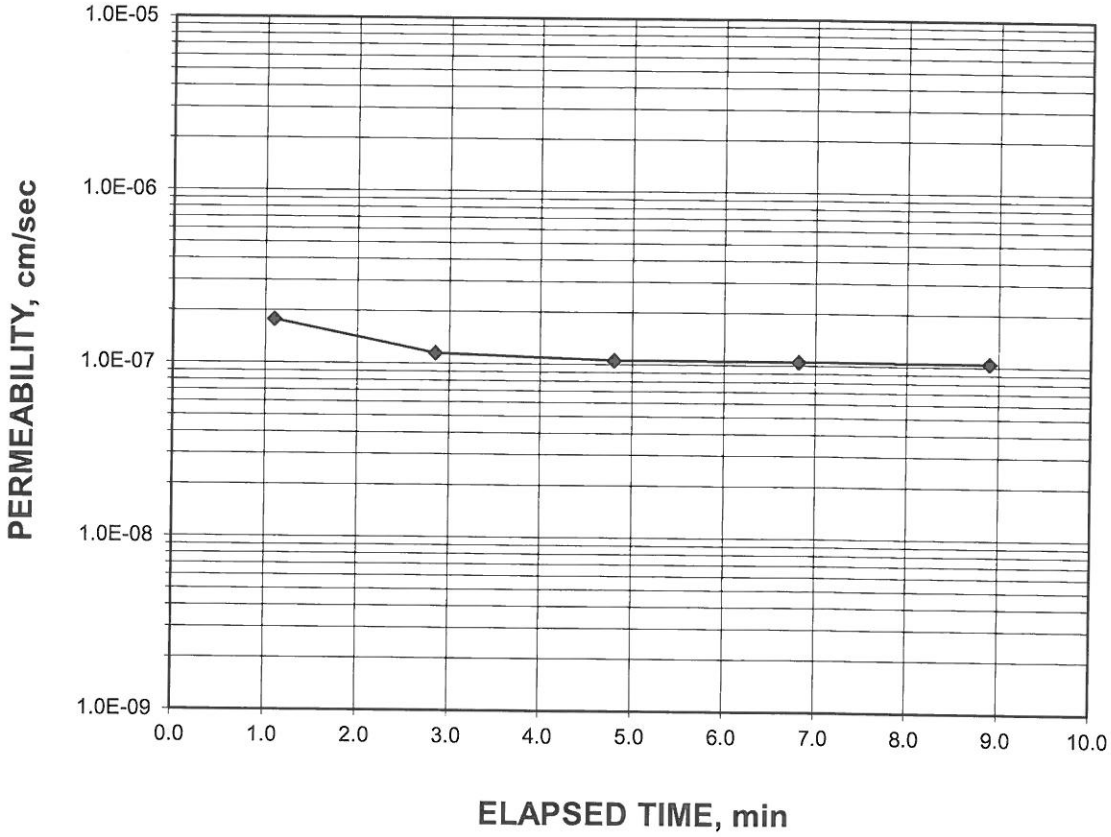
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-04-02
Lab ID No.	2013-763-06-08		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 1.1E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.1E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GPM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-04-02
Lab ID No.	2013-763-06-08		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	808	810
Wt. of Tare & WS (gm.)	290.51	379.5
Wt. of Tare & DS (gm.)	255.97	331.42
Wt. of Tare (gm.)	104.34	114.54
Wt. of Water (gm.)	34.54	48.08
Wt. of DS (gm.)	151.63	216.88
Moisture Content (%)	**22.8**	**22.2**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	638.87	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	638.87	635.69
Length 1 (in.)	3.072	3.053
Length 2 (in.)	3.090	3.016
Length 3 (in.)	3.078	3.032
Top Diameter (in.)	2.842	2.814
Middle Diameter (in.)	2.846	2.807
Bottom Diameter (in.)	2.851	2.835
Average Length (in.)	3.08	3.03
Average Area (in.^{2})	6.36	6.24
Sample Volume (cm^3)	321.15	310.20
Unit Wet Wt. (gm./ cm^3)	1.989	2.049
Unit Wet Wt. (pcf)	124.2	127.9
Unit Dry Wt. (pcf)	101.1	104.7
Unit Dry Wt. (gm./ cm^3)	1.620	1.677
Void Ratio, e	0.666	0.610
Porosity, n	0.400	0.379
Pore Volume (cm^3)	128.4	117.5
Total Wt. Of Sample After Test		652.39

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-04-02
Lab ID No.	2013-763-06-08		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.71
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.26
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 1.1E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.1E-09 m/sec @ 20°C

DATE	TIME				ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	9	46	38	46.63	0.000	9.0	13.4	20.2	NA
1/3/14	9	47	44	47.73	1.100	8.8	13.1	20.2	1.8E-07
1/3/14	9	49	29	49.48	2.850	8.6	12.7	20.2	1.1E-07
1/3/14	9	51	26	51.43	4.800	8.4	12.4	20.2	1.1E-07
1/3/14	9	53	27	53.45	6.817	8.2	12.0	20.2	1.1E-07
1/3/14	9	55	32	55.53	8.900	8.0	11.7	20.2	1.0E-07

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PERMEABILITY TEST

ASTM D 5084-03

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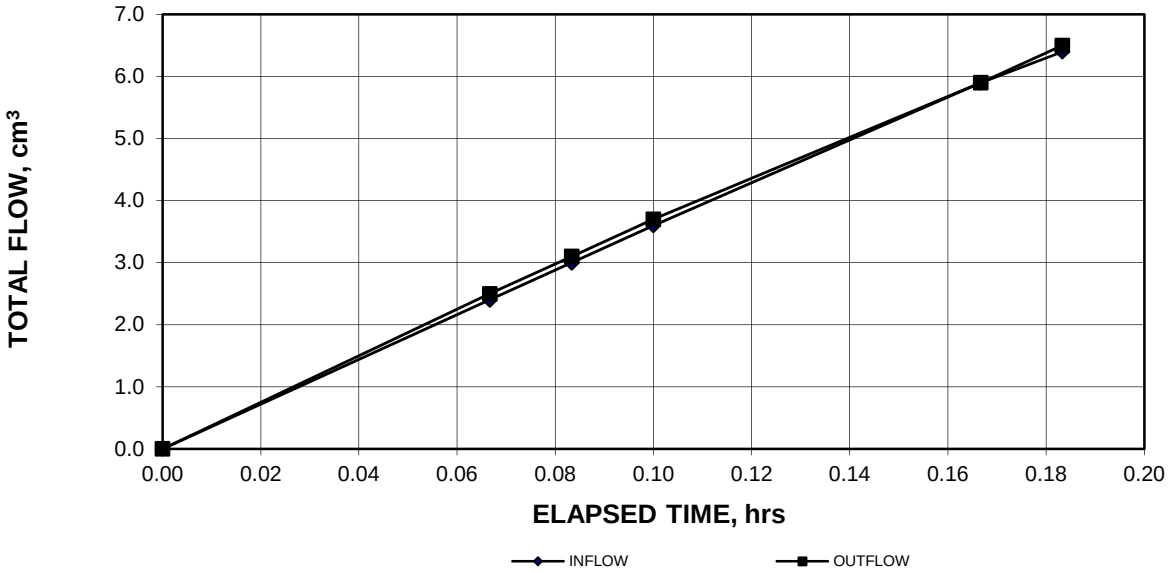
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-04-03
Lab ID No.	2014-625-02-02		

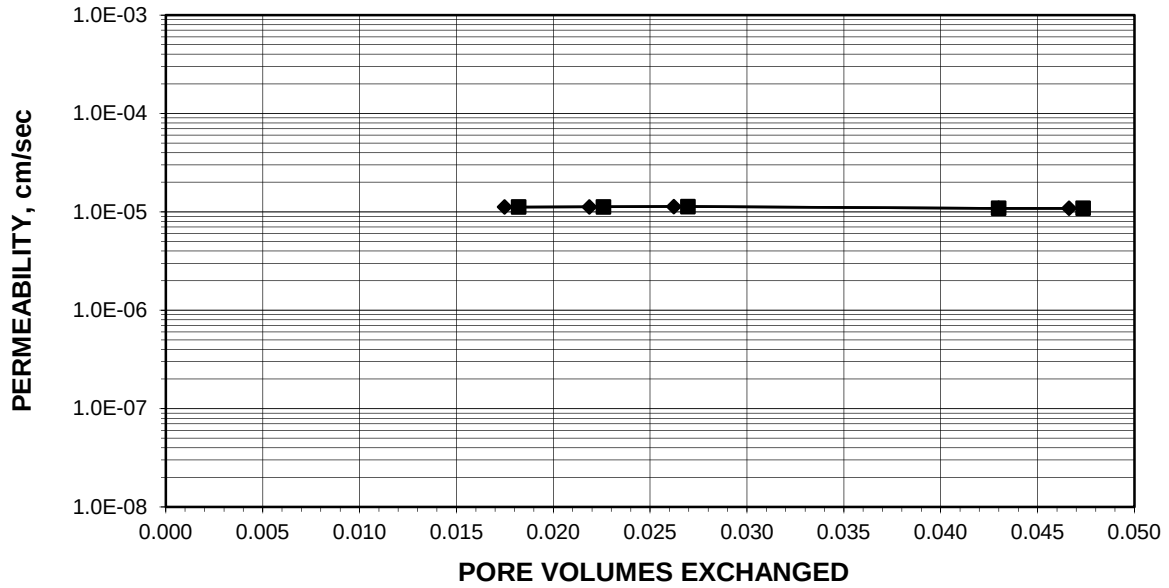
AVERAGE PERMEABILITY = 1.1E-05 cm/sec @ 20°C

AVERAGE PERMEABILITY = 1.1E-07 m/sec @ 20°C

TOTAL FLOW vs. ELAPSED TIME



PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

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PERMEABILITY TEST

ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-04-03
Lab ID No.	2014-625-02-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	303	825
Wt. of Tare & WS (gm.)	345.89	448.18
Wt. of Tare & DS (gm.)	291.67	374.52
Wt. of Tare (gm.)	110.51	137.27
Wt. of Water (gm.)	54.22	73.66
Wt. of DS (gm.)	181.16	237.25
Moisture Content (%)	**29.9**	**31.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	538.66	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	538.66	543.30
Length 1 (in.)	2.851	2.820
Length 2 (in.)	2.834	2.790
Length 3 (in.)	2.841	2.814
Top Diameter (in.)	2.843	2.842
Middle Diameter (in.)	2.837	2.839
Bottom Diameter (in.)	2.824	2.829
Average Length (in.)	2.84	2.81
Average Area (in.^{2})	6.31	6.32
Sample Volume (cm^3)	293.91	290.81
Unit Wet Wt. (gm./ cm^3)	1.83	1.87
Unit Wet Wt. (pcf)	114.4	116.6
Unit Dry Wt. (pcf)	88.0	89.0
Unit Dry Wt. (gm./ cm^3)	1.41	1.43
Void Ratio, e	0.91	0.89
Porosity, n	0.48	0.47
Pore Volume (cm^3)	140.4	137.3
Total Wgt. Of Sample After Test		551.39

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

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INPUT BURETTE NO. AND CONDITIONS

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-04-03
Lab ID No.	2014-625-02-02		

Pressure Heads (Constant)

Top Cap (psi)	39.0
Bottom Cap (psi)	41.0
Cell (psi)	50.0
Total Pressure Head (cm)	140.6

INFLOW (HEADWATER) BURETTE

BURETTE No.	R 396
BURETTE FACTOR	1
INFLOW AREA (cm^2), a-in	0.880
VOLUME CORR. FACTOR	1.074
SLOPE	1.108
INTERCEPT	65.2

OUTFLOW (HEADWATER) BURETTE

BURETTE No.	R 397
BURETTE FACTOR	1
OUTFLOW AREA (cm^2), a-out	0.865
VOLUME CORR. FACTOR	1.002
SLOPE	1.112
INTERCEPT	65.2
B Parameter (%)	97

Permeabilty Ratio	DATE (mm/dd/yy)	TIME (hr)	TIME (min)	INFLOW G396 (div.)	OUTFLOW G397 (div.)	FLOW (0 flow) (1 stop)	TEMP. (^oC)	FLOW RATIO
	2/10/14	14	55	9.70	15.40	0	22.9	
1.0	2/10/14	14	59	12.10	12.90	0	22.9	NA
1.0	2/10/14	15	0	12.70	12.30	0	22.9	NA
1.0	2/10/14	15	1	13.30	11.70	0	22.9	0.973
1.0	2/10/14	15	5	15.60	9.50	0	22.9	1.029
1.0	2/10/14	15	6	16.10	8.90	1	22.9	1.000

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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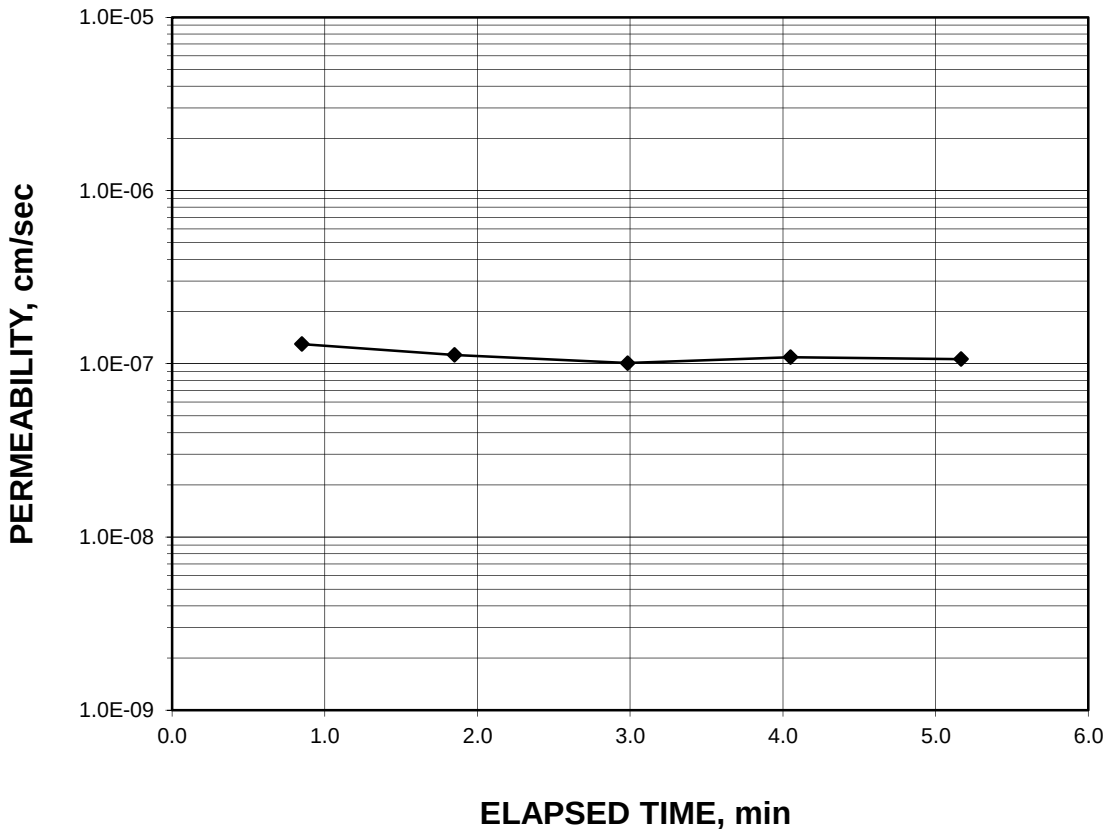
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-03	Sample No.	ST-04-03 RW
Lab ID No.	2014-625-03-01		

Visual Description: ORANGE SILTY CLAY

AVERAGE PERMEABILITY = 1.1E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.1E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 2/22/14 Checked By: GEM Date: 2/25/14

DCN: CT-22A DATE: 2-10-2014 REVISION: 25 TEMPLATE: SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-03-01 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-03	Sample No.	ST-04-03 RW
Lab ID No.	2014-625-03-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	Y-11	Z-12
Wt. of Tare & WS (gm.)	294.43	340.78
Wt. of Tare & DS (gm.)	245.35	276.19
Wt. of Tare (gm.)	93.46	90
Wt. of Water (gm.)	49.08	64.59
Wt. of DS (gm.)	151.89	186.19
Moisture Content (%)	**32.3**	**34.7**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	531.99	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	531.99	541.55
Length 1 (in.)	2.717	2.700
Length 2 (in.)	2.732	2.691
Length 3 (in.)	2.758	2.707
Top Diameter (in.)	2.830	2.816
Middle Diameter (in.)	2.825	2.836
Bottom Diameter (in.)	2.838	2.857
Average Length (in.)	2.74	2.70
Average Area (in.^{2})	6.29	6.32
Sample Volume (cm^3)	282.19	279.49
Unit Wet Wt. (gm./ cm^3)	1.885	1.938
Unit Wet Wt. (pcf)	117.7	121.0
Unit Dry Wt. (pcf)	88.9	89.8
Unit Dry Wt. (gm./ cm^3)	1.425	1.439
Void Ratio, e	0.895	0.877
Porosity, n	0.472	0.467
Pore Volume (cm^3)	133.3	130.6
Total Wt. Of Sample After Test		534.62

Tested By: SFS Date: 2/22/14 Checked By: GEM Date: 2/25/14

DCN: CT-22A DATE: 2/20/2014 REVISION: 6 G:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-03-01 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 4
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-03	Sample No.	ST-04-03 RW
Lab ID No.	2014-625-03-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	6.86
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.76
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	98	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 1.1E-07 cm/sec @ 20°C

AVERAGE PERMEABILITY = 1.1E-09 m/sec @ 20°C

DATE		TIME			ELAPSED TIME **t**	PIPETTE READI NG **R_p**	INCREMENT GRADIENT **i**	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
2/24/14	8	18	45	18.75	0.000	6.7	10.9	23.3	NA
2/24/14	8	19	36	19.60	0.850	6.6	10.7	23.3	1.3E-07
2/24/14	8	20	36	20.60	1.850	6.5	10.5	23.3	1.1E-07
2/24/14	8	21	44	21.73	2.983	6.4	10.3	23.3	1.0E-07
2/24/14	8	22	48	22.80	4.050	6.3	10.1	23.3	1.1E-07
2/24/14	8	23	55	23.92	5.167	6.2	9.9	23.3	1.1E-07

Tested By: SFS Date: 2/22/14 Checked By: GEM Date: 2/25/14

DCN: CT-22A DATE: 2/22/2011 REVISION: 6 G:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-03-01 Permometer Jan 14.xls]Sheet1

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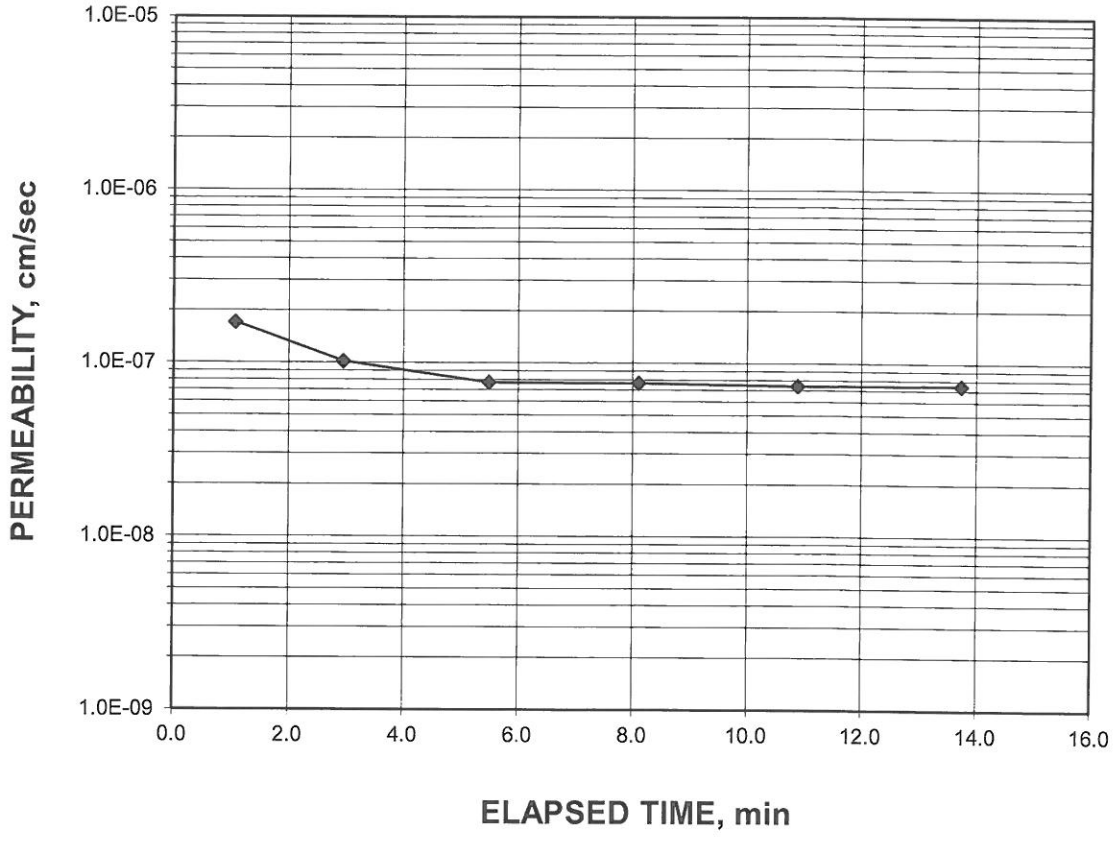
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-05-01
Lab ID No.	2013-763-06-09		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 7.6E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.6E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-05-01
Lab ID No.	2013-763-06-09		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	803	Z-12
Wt. of Tare & WS (gm.)	303.85	333.53
Wt. of Tare & DS (gm.)	273.86	294.02
Wt. of Tare (gm.)	104.32	89.74
Wt. of Water (gm.)	29.99	39.51
Wt. of DS (gm.)	169.54	204.28
Moisture Content (%)	**17.7**	**19.3**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	645.99	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	645.99	655.06
Length 1 (in.)	2.928	2.921
Length 2 (in.)	2.908	2.93
Length 3 (in.)	2.938	2.924
Top Diameter (in.)	2.830	2.858
Middle Diameter (in.)	2.830	2.834
Bottom Diameter (in.)	2.827	2.845
Average Length (in.)	2.92	2.93
Average Area (in.^{2})	6.29	6.36
Sample Volume (cm^3)	301.25	304.85
Unit Wet Wt. (gm./ cm^3)	2.144	2.149
Unit Wet Wt. (pcf)	133.9	134.1
Unit Dry Wt. (pcf)	113.7	112.4
Unit Dry Wt. (gm./ cm^3)	1.822	1.801
Void Ratio, e	0.482	0.500
Porosity, n	0.325	0.333
Pore Volume (cm^3)	98.0	101.6
Total Wt. Of Sample After Test		655.47

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-05-01
Lab ID No.	2013-763-06-09		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.43
Back Pressure(psi)	40.0	Sample Area (cm^2), A	41.03
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	95	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

AVERAGE PERMEABILITY = 7.6E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 7.6E-10 m/sec @ 20°C

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	9	11	11	11.18	0.000	9.0	13.9	20.2	NA
1/3/14	9	12	16	12.27	1.083	8.8	13.5	20.2	1.7E-07
1/3/14	9	14	8	14.13	2.950	8.6	13.2	20.2	1.0E-07
1/3/14	9	16	40	16.67	5.483	8.4	12.8	20.2	7.7E-08
1/3/14	9	19	17	19.28	8.100	8.2	12.5	20.2	7.7E-08
1/3/14	9	22	4	22.07	10.883	8.0	12.1	20.2	7.4E-08
1/3/14	9	24	55	24.92	13.733	7.8	11.8	20.2	7.5E-08

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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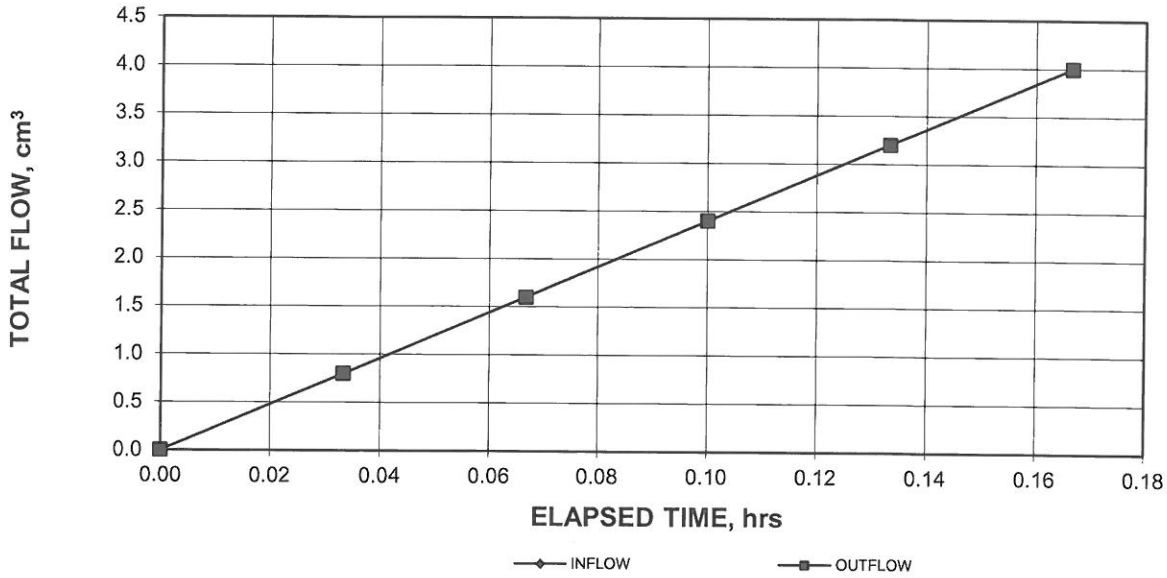
PERMEABILITY TEST

ASTM D 5084-03

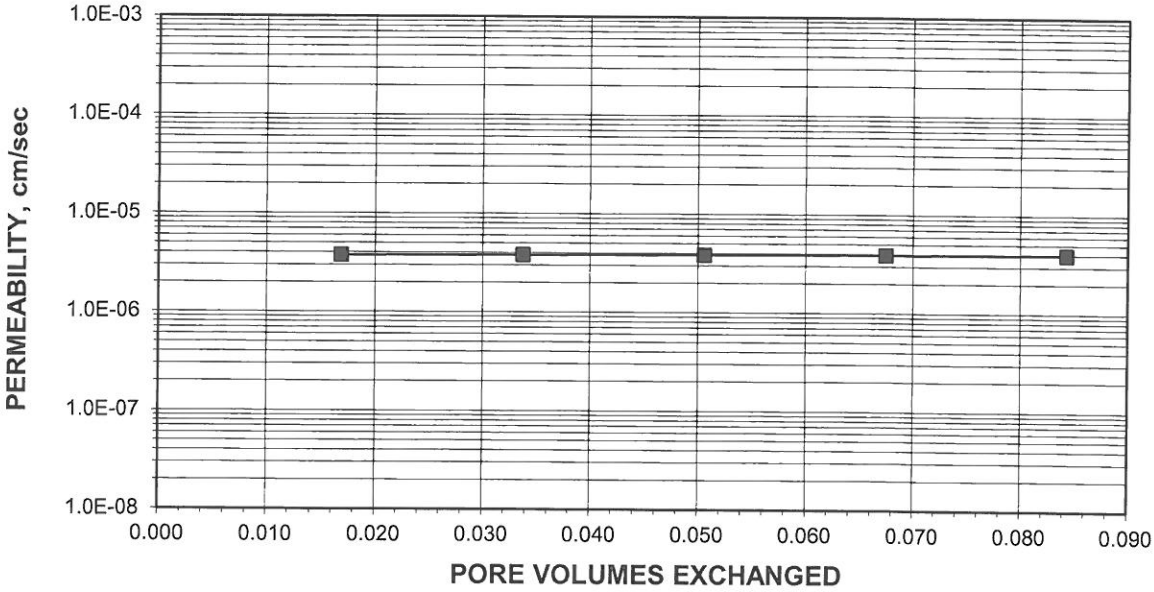
Client	SMITH + GARDNER, INC.	Boring No.	A5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-05-02
Lab ID No.	2013-763-06-10		

AVERAGE PERMEABILITY = 3.9E-06 cm/sec @ 20°C
AVERAGE PERMEABILITY = 3.9E-08 m/sec @ 20°C

TOTAL FLOW vs. ELAPSED TIME



PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-05-02
Lab ID No.	2013-763-06-10		

Specific Gravity 2.70 Assumed

Sample Condition Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	807	821
Wt. of Tare & WS (gm.)	306.08	394.15
Wt. of Tare & DS (gm.)	271.23	344.27
Wt. of Tare (gm.)	105.37	138.98
Wt. of Water (gm.)	34.85	49.88
Wt. of DS (gm.)	165.86	205.29
Moisture Content (%)	**21.0**	**24.3**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	246.80	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	246.80	253.50
Length 1 (in.)	1.185	1.167
Length 2 (in.)	1.200	1.196
Length 3 (in.)	1.180	1.162
Top Diameter (in.)	2.830	2.851
Middle Diameter (in.)	2.830	2.845
Bottom Diameter (in.)	2.820	2.859
Average Length (in.)	1.19	1.18
Average Area (in.^{2})	6.28	6.39
Sample Volume (cm^3)	122.20	122.98
Unit Wet Wt. (gm./ cm^3)	2.02	2.06
Unit Wet Wt. (pcf)	126.1	128.7
Unit Dry Wt. (pcf)	104.2	103.5
Unit Dry Wt. (gm./ cm^3)	1.67	1.66
Void Ratio, e	0.62	0.63
Porosity, n	0.38	0.39
Pore Volume (cm^3)	46.7	47.4
Total Wgt. Of Sample After Test		255.30

Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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PERMEABILITY TEST

ASTM D 5084-03

Client	SMITH + GARDNER, INC.	Boring No.	A5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-05-02
Lab ID No.	2013-763-06-10		

Pressure Heads (Constant)

Top Cap (psi)	38.5
Bottom Cap (psi)	40.0
Cell (psi)	50.0
Total Pressure Head (cm)	105.5
Hydraulic Gradient	35.33

Final Sample Dimensions

Sample Length (cm), L	2.98
Sample Diameter (cm)	7.24
Sample Area (cm^2), A	41.21
Inflow Burette Area (cm^2), a-in	0.971
Outflow Burette Area (cm^2), a-out	0.976
B Parameter (%)	96

AVERAGE PERMEABILITY = 3.9E-06 cm/sec @ 20°C

AVERAGE PERMEABILITY = 3.9E-08 m/sec @ 20°C

DATE (mm/dd/yy)	TIME (hr)	TIME (min)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	TOTAL HEAD h (cm)	FLOW (0 flow) (1 stop)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
1/3/14	14	33	0.00	0.0	0.0	126.8	0	20.8	NA
1/3/14	14	35	0.03	0.8	0.8	125.1	0	20.8	3.8E-06
1/3/14	14	37	0.07	1.6	1.6	123.5	0	20.8	3.8E-06
1/3/14	14	39	0.10	2.4	2.4	121.9	0	20.8	3.9E-06
1/3/14	14	41	0.13	3.2	3.2	120.2	0	20.8	3.9E-06
1/3/14	14	43	0.17	4.0	4.0	118.6	1	20.8	4.0E-06

Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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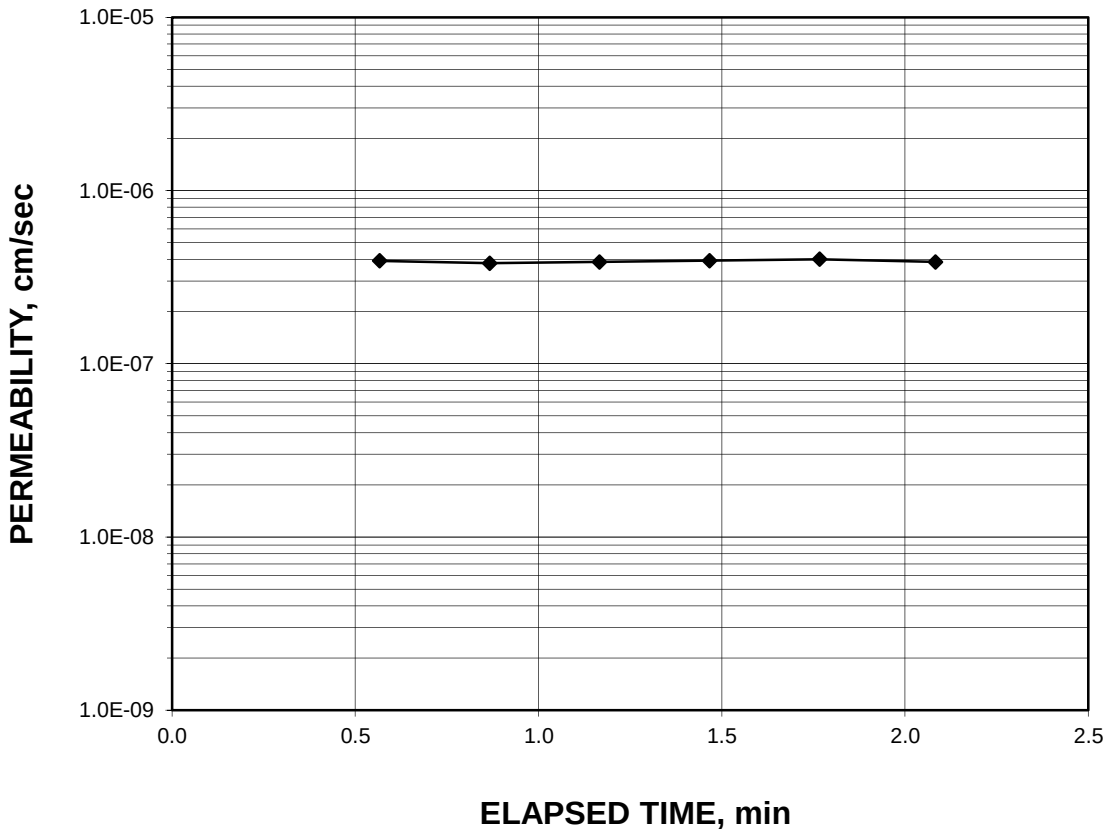
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-05-03
Lab ID No.	2014-625-02-03		

Visual Description: 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: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2-10-2014 REVISION: 25 TEMPLATE: SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-02-03 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-05-03
Lab ID No.	2014-625-02-03		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	305	Z-12
Wt. of Tare & WS (gm.)	245.11	358.07
Wt. of Tare & DS (gm.)	203.58	292.41
Wt. of Tare (gm.)	84.61	90.01
Wt. of Water (gm.)	41.53	65.66
Wt. of DS (gm.)	118.97	202.40
Moisture Content (%)	**34.9**	**32.4**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	557.84	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	557.84	547.64
Length 1 (in.)	2.873	2.879
Length 2 (in.)	2.905	2.813
Length 3 (in.)	2.863	2.811
Top Diameter (in.)	2.853	2.847
Middle Diameter (in.)	2.858	2.840
Bottom Diameter (in.)	2.844	2.845
Average Length (in.)	2.88	2.83
Average Area (in.^{2})	6.39	6.35
Sample Volume (cm^3)	301.46	295.05
Unit Wet Wt. (gm./ cm^3)	1.850	1.856
Unit Wet Wt. (pcf)	115.5	115.9
Unit Dry Wt. (pcf)	85.6	87.5
Unit Dry Wt. (gm./ cm^3)	1.372	1.401
Void Ratio, e	0.968	0.927
Porosity, n	0.492	0.481
Pore Volume (cm^3)	148.3	141.9
Total Wt. Of Sample After Test		560.18

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/20/2014 REVISION: 6 H:\2-PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-02-03 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 5
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-05-03
Lab ID No.	2014-625-02-03		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.20
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.98
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

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

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

DATE		TIME			ELAPSED TIME **t**	PIPETTE READI NG **R_p**	INCREMENT GRADIENT **i**	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
2/10/14	14	17	53	17.88	0.000	7.0	10.9	23.0	NA
2/10/14	14	18	27	18.45	0.567	6.8	10.5	23.0	3.9E-07
2/10/14	14	18	45	18.75	0.867	6.7	10.3	23.0	3.8E-07
2/10/14	14	19	3	19.05	1.167	6.6	10.2	23.0	3.9E-07
2/10/14	14	19	21	19.35	1.467	6.5	10.0	23.0	3.9E-07
2/10/14	14	19	39	19.65	1.767	6.4	9.8	23.0	4.0E-07
2/10/14	14	19	58	19.97	2.083	6.3	9.6	23.0	3.9E-07

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/20/2014 REVISION: 6 G:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-02-03 Permometer Jan 14.xls]Sheet1

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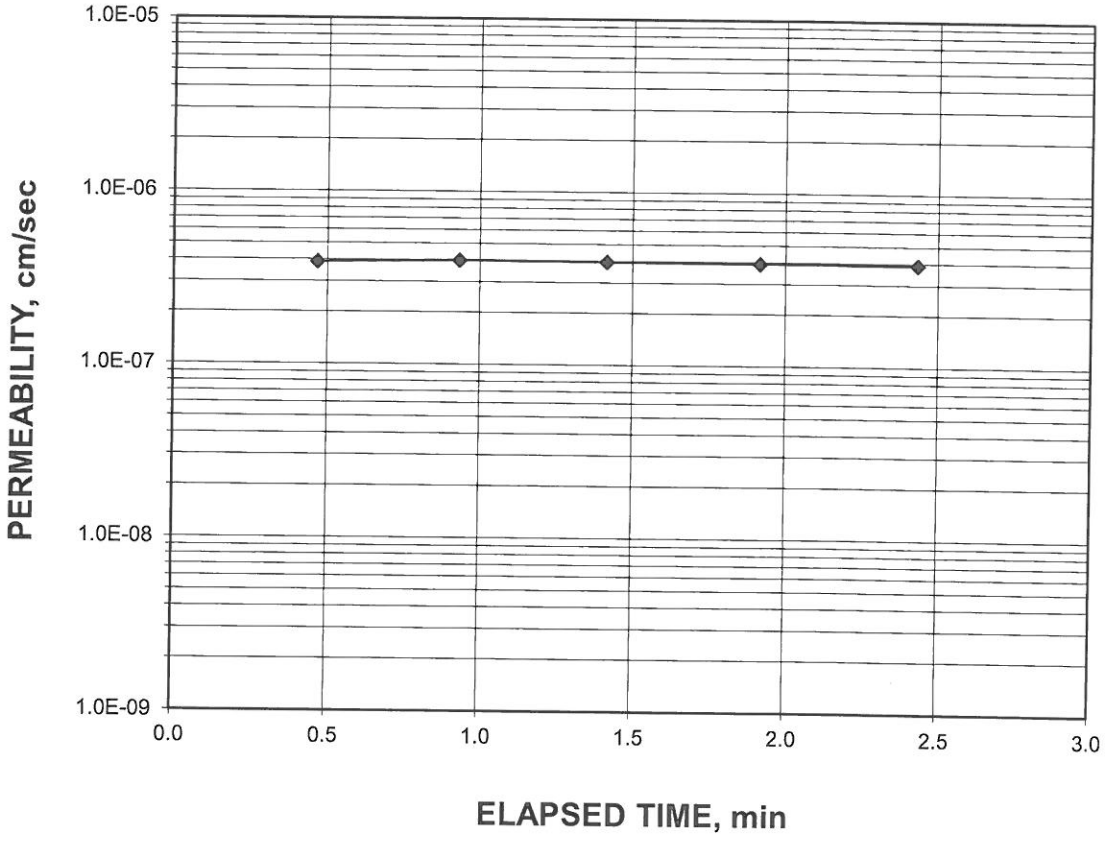
FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-06-01
Lab ID No.	2013-763-06-11		

Visual Description: BROWN 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: 1/2/14 Checked By: GDM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-06-01
Lab ID No.	2013-763-06-11		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	804	802
Wt. of Tare & WS (gm.)	309.33	375.28
Wt. of Tare & DS (gm.)	276.75	328.2
Wt. of Tare (gm.)	105.44	104.09
Wt. of Water (gm.)	32.58	47.08
Wt. of DS (gm.)	171.31	224.11
Moisture Content (%)	**19.0**	**21.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	618.60	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	618.60	628.94
Length 1 (in.)	3.001	2.926
Length 2 (in.)	2.981	2.935
Length 3 (in.)	2.982	2.925
Top Diameter (in.)	2.836	2.83
Middle Diameter (in.)	2.835	2.845
Bottom Diameter (in.)	2.825	2.849
Average Length (in.)	2.99	2.93
Average Area (in.^{2})	6.30	6.34
Sample Volume (cm^3)	308.43	304.30
Unit Wet Wt. (gm./ cm^3)	2.006	2.067
Unit Wet Wt. (pcf)	125.2	129.0
Unit Dry Wt. (pcf)	105.2	106.6
Unit Dry Wt. (gm./ cm^3)	1.685	1.708
Void Ratio, e	0.602	0.581
Porosity, n	0.376	0.367
Pore Volume (cm^3)	115.9	111.8
Total Wt. Of Sample After Test		636.83

Tested By: SFS Date: 1/2/14 Checked By: GM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2013-763-06	Sample No.	ST-06-01
Lab ID No.	2013-763-06-11		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.44
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.91
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	96	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

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

DATE			TIME		ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
1/3/14	8	46	6	46.10	0.000	9.2	14.2	20.2	NA
1/3/14	8	46	34	46.57	0.467	9.0	13.9	20.2	3.9E-07
1/3/14	8	47	2	47.03	0.933	8.8	13.5	20.2	4.0E-07
1/3/14	8	47	31	47.52	1.417	8.6	13.2	20.2	4.0E-07
1/3/14	8	48	1	48.02	1.917	8.4	12.8	20.2	3.9E-07
1/3/14	8	48	32	48.53	2.433	8.2	12.5	20.2	3.9E-07

Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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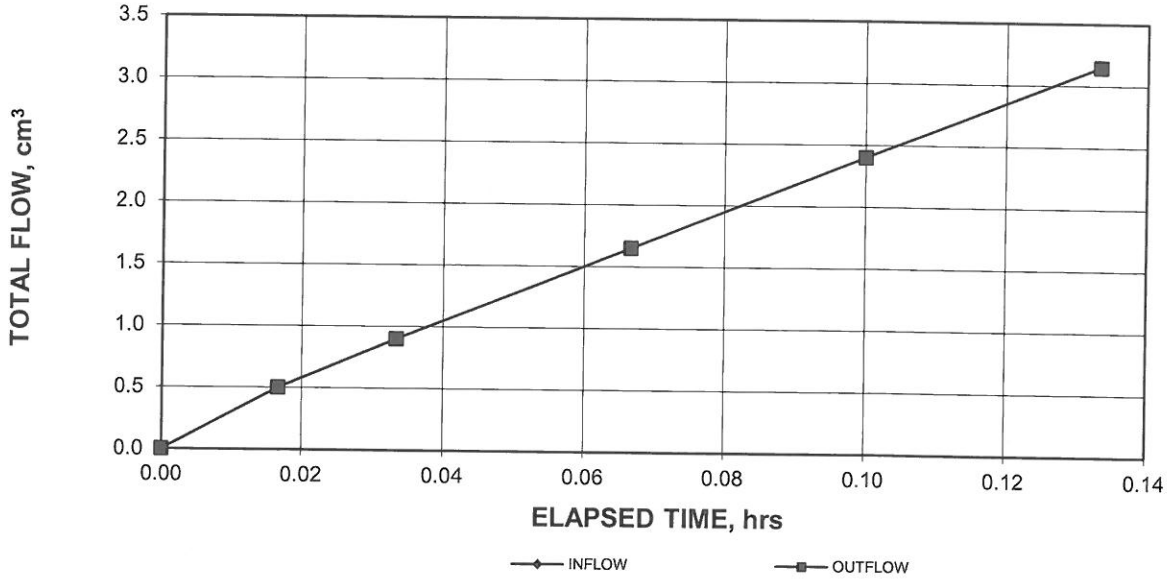
PERMEABILITY TEST

ASTM D 5084-03

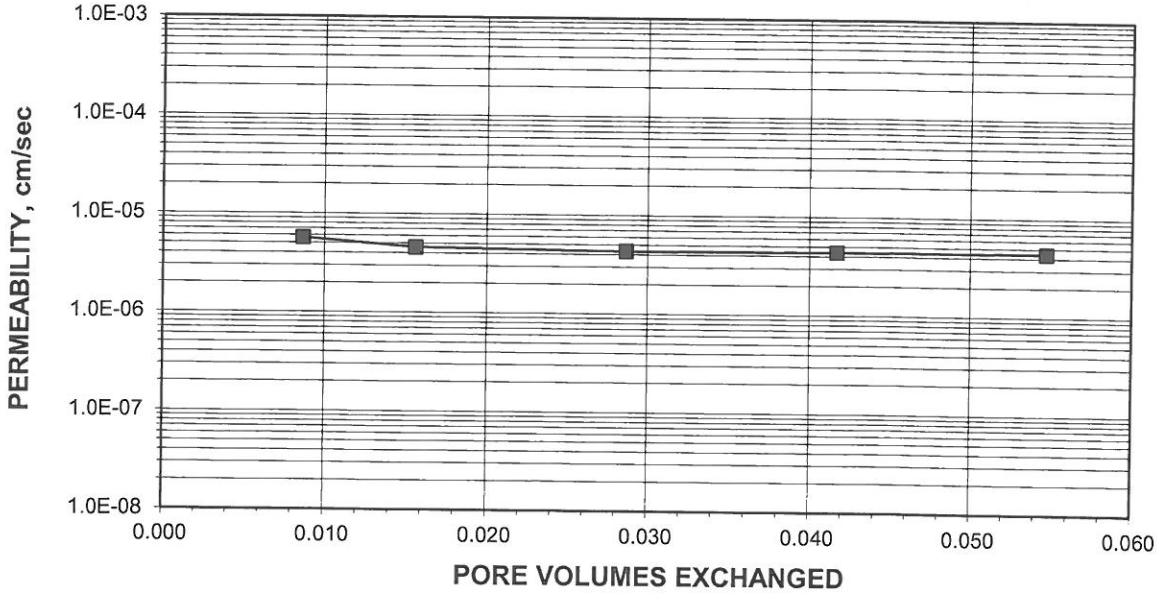
Client	SMITH + GARDNER, INC.	Boring No.	A6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-06-02
Lab ID No.	2013-763-06-12		

AVERAGE PERMEABILITY = 4.4E-06 cm/sec @ 20°C
AVERAGE PERMEABILITY = 4.4E-08 m/sec @ 20°C

TOTAL FLOW vs. ELAPSED TIME



PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 1/2/14 Checked By: GPM Date: 1-6-14

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PERMEABILITY TEST

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	A6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-06-02
Lab ID No.	2013-763-06-12		

Specific Gravity 2.70 Assumed

Sample Condition Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	811	808
Wt. of Tare & WS (gm.)	314.56	379.78
Wt. of Tare & DS (gm.)	282.87	331.47
Wt. of Tare (gm.)	107.17	104.32
Wt. of Water (gm.)	31.69	48.31
Wt. of DS (gm.)	175.70	227.15
Moisture Content (%)	**18.0**	**21.3**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	291.19	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	291.19	299.16
Length 1 (in.)	1.441	1.448
Length 2 (in.)	1.454	1.455
Length 3 (in.)	1.459	1.390
Top Diameter (in.)	2.842	2.843
Middle Diameter (in.)	2.836	2.845
Bottom Diameter (in.)	2.837	2.843
Average Length (in.)	1.45	1.43
Average Area (in.^{2})	6.33	6.35
Sample Volume (cm^3)	150.48	148.93
Unit Wet Wt. (gm./ cm^3)	1.94	2.01
Unit Wet Wt. (pcf)	120.8	125.4
Unit Dry Wt. (pcf)	102.3	103.4
Unit Dry Wt. (gm./ cm^3)	1.64	1.66
Void Ratio, e	0.65	0.63
Porosity, n	0.39	0.39
Pore Volume (cm^3)	59.1	57.6
Total Wgt. Of Sample After Test		302.84

Tested By: SFS Date: 1/2/14 Checked By: GEM Date: 1-6-14

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PERMEABILITY TEST

ASTM D 5084-03

Client	SMITH + GARDNER, INC.	Boring No.	A6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2013-763-06	Sample No.	ST-06-02
Lab ID No.	2013-763-06-12		

Pressure Heads (Constant)

Top Cap (psi)	38.5
Bottom Cap (psi)	40.0
Cell (psi)	50.0
Total Pressure Head (cm)	105.5
Hydraulic Gradient	29.01

Final Sample Dimensions

Sample Length (cm), L	3.63
Sample Diameter (cm)	7.22
Sample Area (cm^2), A	40.97
Inflow Burette Area (cm^2), a-in	0.897
Outflow Burette Area (cm^2), a-out	0.894
B Parameter (%)	95

AVERAGE PERMEABILITY = 4.4E-06 cm/sec @ 20°C

AVERAGE PERMEABILITY = 4.4E-08 m/sec @ 20°C

DATE (mm/dd/yy)	TIME (hr)	TIME (min)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	TOTAL HEAD h (cm)	FLOW (0 flow) (1 stop)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
1/3/14	13	31	0.00	0.0	0.0	128.9	0	20.7	NA
1/3/14	13	32	0.02	0.5	0.5	127.8	0	20.7	5.7E-06
1/3/14	13	33	0.03	0.9	0.9	126.9	0	20.7	4.6E-06
1/3/14	13	35	0.07	1.7	1.7	125.2	0	20.7	4.3E-06
1/3/14	13	37	0.10	2.4	2.4	123.5	0	20.7	4.4E-06
1/3/14	13	39	0.13	3.2	3.2	121.9	1	20.7	4.4E-06

Tested By: SFS Date: 1/2/14 Checked By: GAM Date: 1-6-14

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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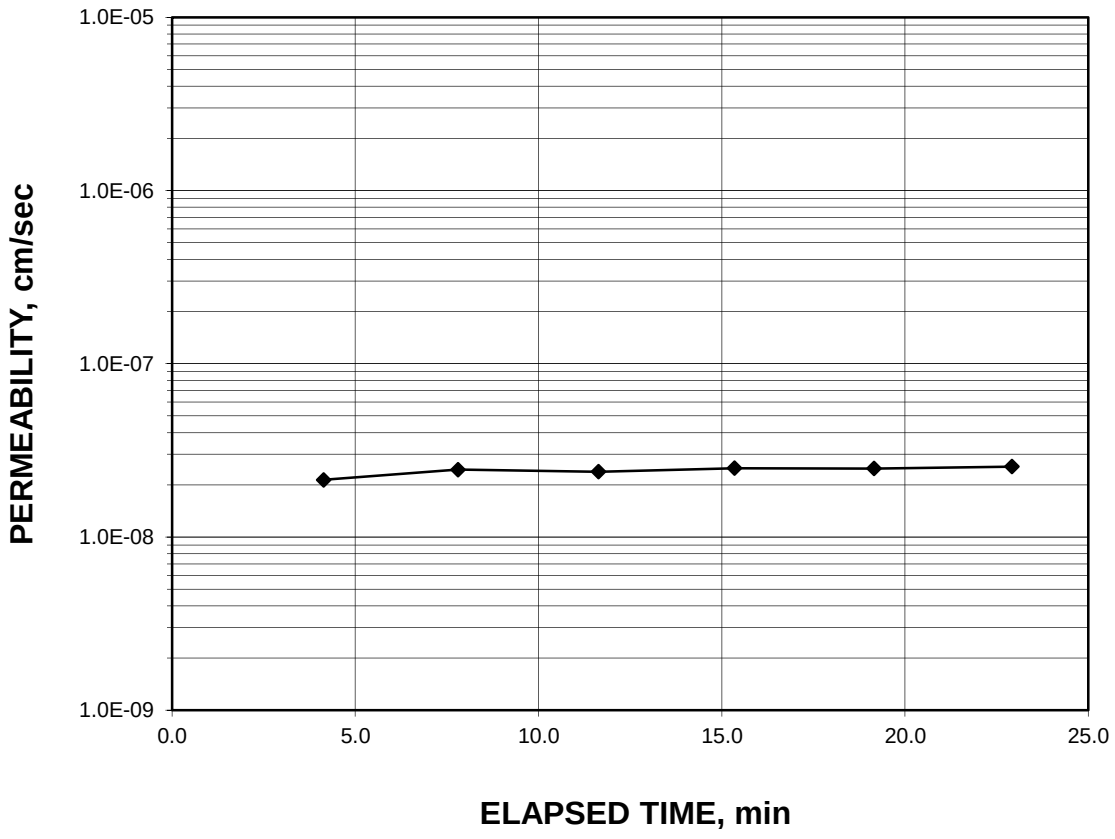
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-06-03
Lab ID No.	2014-625-02-04		

Visual Description: ORANGE SANDY CLAY

AVERAGE PERMEABILITY = 2.5E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 2.5E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2-10-14 REVISION: 25 TEPROJECTS\2014\SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-02-04 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-06-03
Lab ID No.	2014-625-02-04		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	318	A-5
Wt. of Tare & WS (gm.)	305.08	299.36
Wt. of Tare & DS (gm.)	251.71	245.04
Wt. of Tare (gm.)	87.35	95.7
Wt. of Water (gm.)	53.37	54.32
Wt. of DS (gm.)	164.36	149.34
Moisture Content (%)	**32.5**	**36.4**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	462.43	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	462.43	476.05
Length 1 (in.)	2.418	2.392
Length 2 (in.)	2.392	2.357
Length 3 (in.)	2.423	2.373
Top Diameter (in.)	2.832	2.848
Middle Diameter (in.)	2.847	2.841
Bottom Diameter (in.)	2.835	2.833
Average Length (in.)	2.41	2.37
Average Area (in.^{2})	6.33	6.34
Sample Volume (cm^3)	249.93	246.55
Unit Wet Wt. (gm./ cm^3)	1.850	1.931
Unit Wet Wt. (pcf)	115.5	120.5
Unit Dry Wt. (pcf)	87.2	88.4
Unit Dry Wt. (gm./ cm^3)	1.397	1.416
Void Ratio, e	0.933	0.907
Porosity, n	0.483	0.476
Pore Volume (cm^3)	120.6	117.3
Total Wt. Of Sample After Test		463.84

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/20/2014 REVISION: 6 H:\2-PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-02-04 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 6
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-02	Sample No.	ST-06-03
Lab ID No.	2014-625-02-04		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	6.03
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.89
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	99	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 2.5E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 2.5E-10 m/sec @ 20°C

DATE		TIME			ELAPSED TIME t	PIPETTE READI NG R_p	INCREMENT GRADIENT i	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
2/10/14	13	47	58	47.97	0.000	7.3	13.6	22.9	NA
2/10/14	13	52	6	52.10	4.133	7.2	13.4	22.9	2.1E-08
2/10/14	13	55	46	55.77	7.800	7.1	13.2	22.9	2.4E-08
2/10/14	13	59	36	59.60	11.633	7.0	13.0	22.9	2.4E-08
2/10/14	14	3	19	3.32	15.350	6.9	12.8	22.9	2.5E-08
2/10/14	14	7	7	7.12	19.150	6.8	12.6	22.9	2.5E-08
2/10/14	14	10	53	10.88	22.917	6.7	12.3	22.9	2.5E-08

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/2/2011 REVISION: 6 G:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-02-04 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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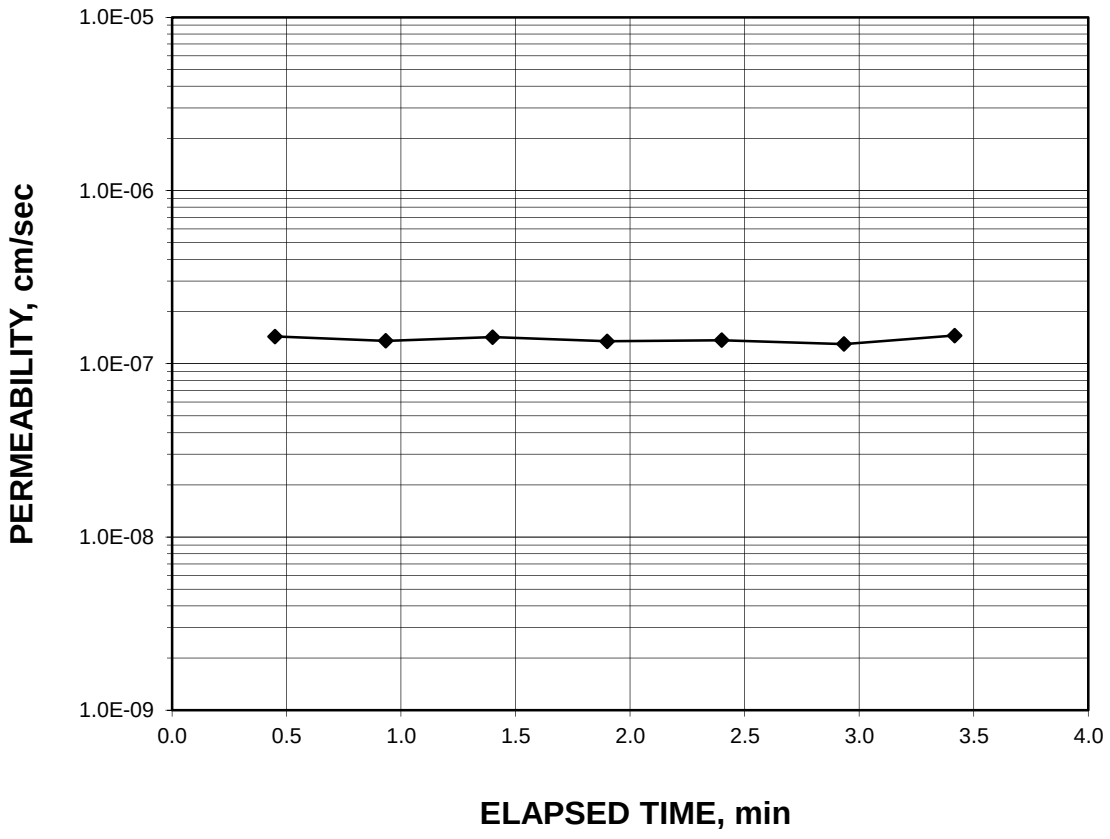
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2014-625-01	Sample No.	ST-07-01
Lab ID No.	2014-625-01-01		

Visual Description: ORANGE SANDY CLAY

AVERAGE PERMEABILITY = 1.4E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.4E-09 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2-10-2014 REVISION: 25 TEMPLATE: SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-01-01 Permometer Jan 14.xls]Sheet1

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ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2014-625-01	Sample No.	ST-07-01
Lab ID No.	2014-625-01-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	300	822
Wt. of Tare & WS (gm.)	353.13	384.57
Wt. of Tare & DS (gm.)	316.62	329.15
Wt. of Tare (gm.)	110.48	138.34
Wt. of Water (gm.)	36.51	55.42
Wt. of DS (gm.)	206.14	190.81
Moisture Content (%)	**17.7**	**29.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	414.63	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	414.63	454.55
Length 1 (in.)	2.031	2.049
Length 2 (in.)	2.072	1.989
Length 3 (in.)	2.091	2.019
Top Diameter (in.)	2.814	2.827
Middle Diameter (in.)	2.819	2.822
Bottom Diameter (in.)	2.814	2.824
Average Length (in.)	2.06	2.02
Average Area (in.^{2})	6.23	6.27
Sample Volume (cm^3)	210.67	207.28
Unit Wet Wt. (gm./ cm^3)	1.968	2.193
Unit Wet Wt. (pcf)	122.9	136.9
Unit Dry Wt. (pcf)	104.4	106.1
Unit Dry Wt. (gm./ cm^3)	1.672	1.699
Void Ratio, e	0.615	0.589
Porosity, n	0.381	0.371
Pore Volume (cm^3)	80.2	76.8
Total Wt. Of Sample After Test		413.73

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/10/2014 REVISION: 6 G:\2PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-01-01 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 1
Project No.	2014-625-01	Sample No.	ST-07-01
Lab ID No.	2014-625-01-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	5.13
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.42
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	99	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 1.4E-07 cm/sec @ 20°C

AVERAGE PERMEABILITY = 1.4E-09 m/sec @ 20°C

DATE		TIME			ELAPSED TIME **t**	PIPETTE READI NG **R_p**	INCREMENT GRADIENT **i**	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
2/10/14	13	48	18	48.30	0.000	8.4	18.8	22.9	NA
2/10/14	13	48	45	48.75	0.450	8.3	18.6	22.9	1.4E-07
2/10/14	13	49	14	49.23	0.933	8.2	18.3	22.9	1.4E-07
2/10/14	13	49	42	49.70	1.400	8.1	18.1	22.9	1.4E-07
2/10/14	13	50	12	50.20	1.900	8.0	17.8	22.9	1.3E-07
2/10/14	13	50	42	50.70	2.400	7.9	17.6	22.9	1.4E-07
2/10/14	13	51	14	51.23	2.933	7.8	17.3	22.9	1.3E-07
2/10/14	13	51	43	51.72	3.417	7.7	17.1	22.9	1.5E-07

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/28/2011 REVISION: 6 G:\PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-01-01 Permometer Jan 14.xls]Sheet1

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PERMOMETER METHOD
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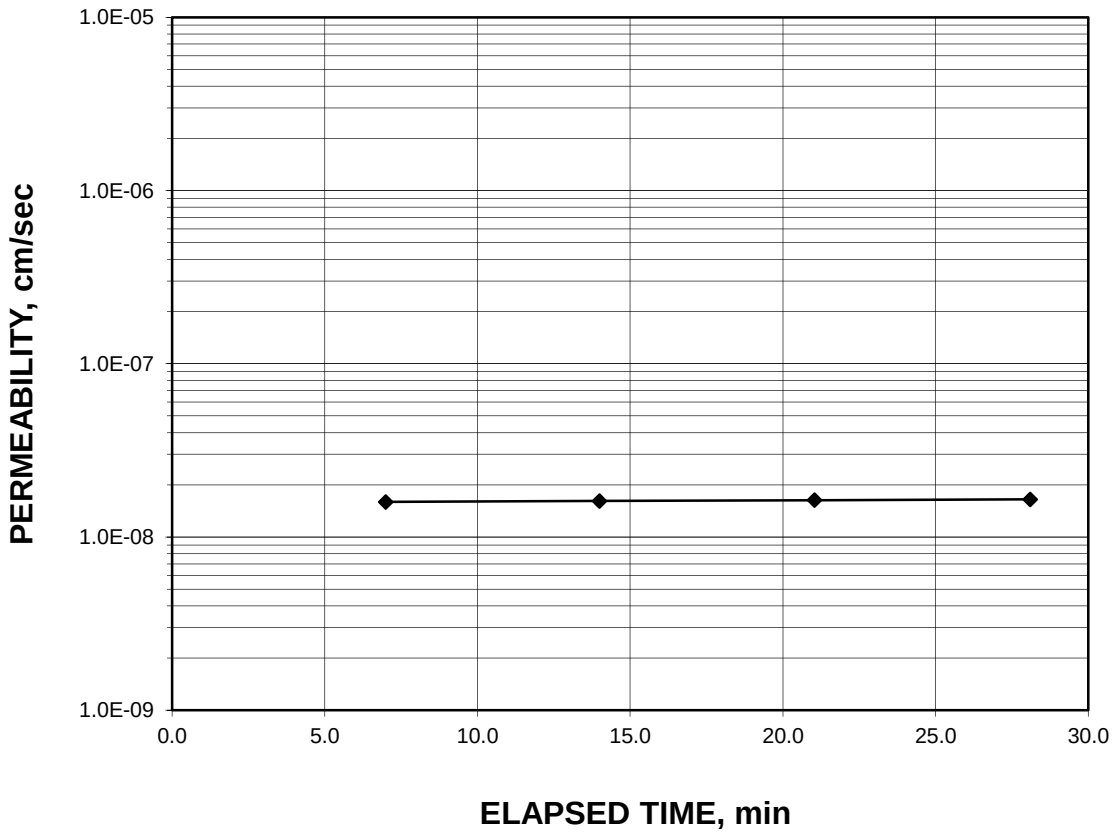
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2014-625-01	Sample No.	ST-07-02
Lab ID No.	2014-625-01-02		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 1.6E-08 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.6E-10 m/sec @ 20°C

PERMEABILITY vs. TIME



Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2-10-2014 REVISION: 25 TEMPLATE: SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-01-02 Permometer Jan 14.xls]Sheet1

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PERMOMETER METHOD
ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2014-625-01	Sample No.	ST-07-02
Lab ID No.	2014-625-01-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	368	815
Wt. of Tare & WS (gm.)	411.44	524.01
Wt. of Tare & DS (gm.)	362.51	458.99
Wt. of Tare (gm.)	110.93	137.22
Wt. of Water (gm.)	48.93	65.02
Wt. of DS (gm.)	251.58	321.77
Moisture Content (%)	**19.4**	**20.2**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	719.17	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	719.17	723.73
Length 1 (in.)	3.292	3.266
Length 2 (in.)	3.319	3.246
Length 3 (in.)	3.313	3.300
Top Diameter (in.)	2.847	2.838
Middle Diameter (in.)	2.838	2.830
Bottom Diameter (in.)	2.847	2.828
Average Length (in.)	3.31	3.27
Average Area (in.^{2})	6.35	6.30
Sample Volume (cm^3)	344.36	337.61
Unit Wet Wt. (gm./ cm^3)	2.088	2.144
Unit Wet Wt. (pcf)	130.4	133.8
Unit Dry Wt. (pcf)	109.1	111.3
Unit Dry Wt. (gm./ cm^3)	1.748	1.783
Void Ratio, e	0.544	0.514
Porosity, n	0.352	0.340
Pore Volume (cm^3)	121.4	114.6
Total Wt. Of Sample After Test		722.42

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/20/2014 REVISION: 6 H:\2-PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-01-02 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 2
Project No.	2014-625-01	Sample No.	ST-07-02
Lab ID No.	2014-625-01-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	8.31
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.64
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	99	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1

AVERAGE PERMEABILITY = 1.6E-08 cm/sec @ 20°C

AVERAGE PERMEABILITY = 1.6E-10 m/sec @ 20°C

DATE		TIME			ELAPSED TIME **t**	PIPETTE READI NG **R_p**	INCREMENT GRADIENT **i**	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
2/10/14	14	17	30	17.50	0.000	7.9	10.8	23.0	NA
2/10/14	14	24	30	24.50	7.000	7.8	10.7	23.0	1.6E-08
2/10/14	14	31	30	31.50	14.000	7.7	10.5	23.0	1.6E-08
2/10/14	14	38	32	38.53	21.033	7.6	10.4	23.0	1.6E-08
2/10/14	14	45	36	45.60	28.100	7.5	10.2	23.0	1.6E-08

Tested By: SFS Date: 2/8/14 Checked By: GEM Date: 2/11/14

DCN: CT-22A DATE: 2/12/2014 REVISION: 6 G:\PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-01-02 Permometer Jan 14.xls]Sheet1

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FLEXIBLE WALL PERMEABILITY TEST
PERMOMETER METHOD
ASTM D 5084-10

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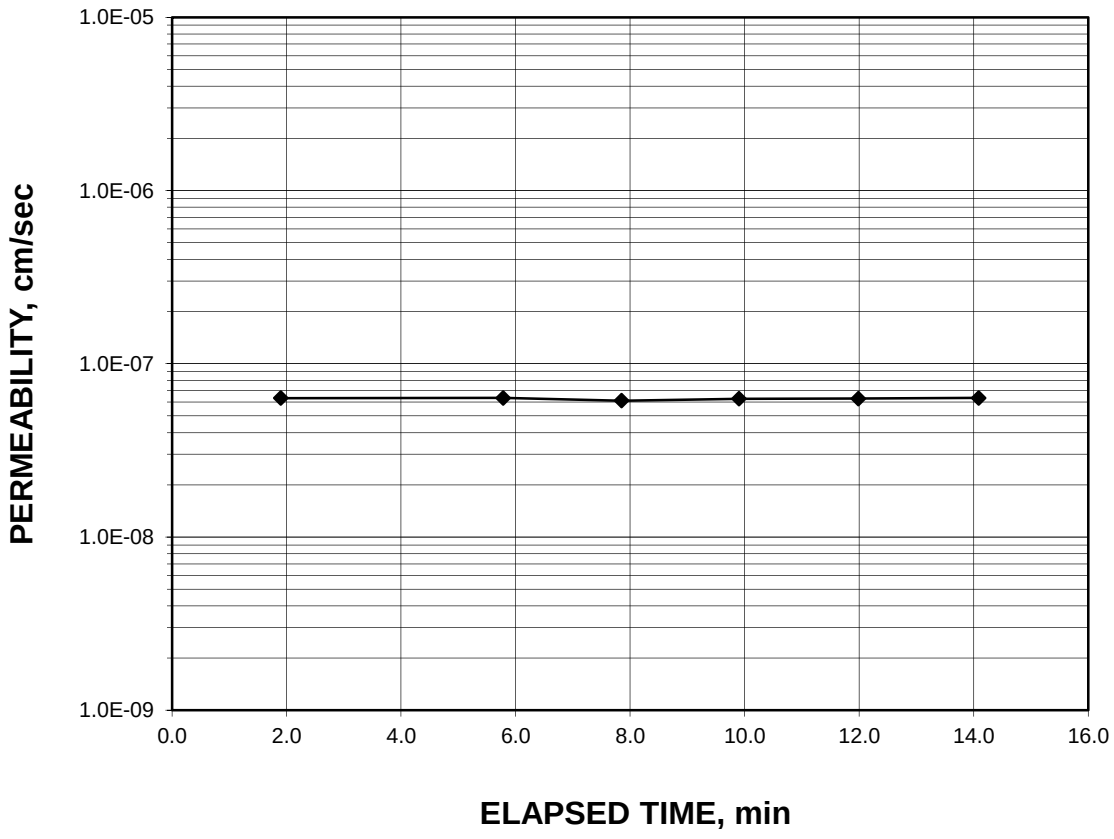
Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-05	Sample No.	ST-07-03
Lab ID No.	2014-625-05-01		

Visual Description: ORANGE SANDY CLAY WITH GRAVEL

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

PERMEABILITY vs. TIME



Tested By: SFS Date: 2/26/14 Checked By: GEM Date: 2/28/14

DCN: CT-22A DATE: 2-10-2014 REVISION: 25 TEMPLATE: SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-05-01 Permometer Jan 14.xls]Sheet1

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PERMOMETER METHOD
ASTM D 5084-10

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Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-05	Sample No.	ST-07-03
Lab ID No.	2014-625-05-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: ORANGE SANDY CLAY WITH GRAVEL

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	A-5	Y-11
Wt. of Tare & WS (gm.)	331.25	412.73
Wt. of Tare & DS (gm.)	287.79	350.97
Wt. of Tare (gm.)	95.63	93.44
Wt. of Water (gm.)	43.46	61.76
Wt. of DS (gm.)	192.16	257.53
Moisture Content (%)	**22.6**	**24.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	644.73	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	644.73	651.91
Length 1 (in.)	3.131	3.105
Length 2 (in.)	3.124	3.095
Length 3 (in.)	3.138	3.105
Top Diameter (in.)	2.829	2.853
Middle Diameter (in.)	2.841	2.834
Bottom Diameter (in.)	2.832	2.824
Average Length (in.)	3.13	3.10
Average Area (in.^{2})	6.31	6.32
Sample Volume (cm^3)	323.65	321.30
Unit Wet Wt. (gm./ cm^3)	1.992	2.029
Unit Wet Wt. (pcf)	124.3	126.7
Unit Dry Wt. (pcf)	101.4	102.2
Unit Dry Wt. (gm./ cm^3)	1.625	1.637
Void Ratio, e	0.662	0.650
Porosity, n	0.398	0.394
Pore Volume (cm^3)	128.9	126.6
Total Wt. Of Sample After Test		648.52

Tested By: SFS Date: 2/26/14 Checked By: GEM Date: 2/28/14

DCN: CT-22A DATE: 2/20/2014 REVISION: 6 G:\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-05-01 Permometer Jan 14.xls]Sheet1

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PERMOMETER METHOD

ASTM D 5084-10

Client	SMITH + GARDNER, INC.	Boring No.	ACRE 7
Client Project	DAVIDSON CO. LF.	Depth (ft.)	LIFT 3
Project No.	2014-625-05	Sample No.	ST-07-03
Lab ID No.	2014-625-05-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	7.88
Back Pressure(psi)	40.0	Sample Area (cm^2), A	40.78
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm^2), a_p	0.03142
Response (%)	97	Annulus Area (cm^2), a_a	0.76712
		Equilibrium Level (cm), R_{eq}	1.1

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

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

DATE		TIME			ELAPSED TIME **t**	PIPETTE READI NG **R_p**	INCREMENT GRADIENT **i**	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	(min)	(cm)	(cm/cm)	(°C)	(cm/sec)
2/27/14	8	29	1	29.02	0.000	7.3	10.3	21.9	NA
2/27/14	8	30	55	30.92	1.900	7.2	10.1	21.9	6.3E-08
2/27/14	8	34	48	34.80	5.783	7.0	9.8	21.9	6.4E-08
2/27/14	8	36	52	36.87	7.850	6.9	9.6	21.9	6.1E-08
2/27/14	8	38	55	38.92	9.900	6.8	9.4	21.9	6.3E-08
2/27/14	8	41	0	41.00	11.983	6.7	9.3	21.9	6.3E-08
2/27/14	8	43	6	43.10	14.083	6.6	9.1	21.9	6.4E-08

Tested By: SFS Date: 2/26/14 Checked By: GEM Date: 2/28/14

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Appendix I

Interface Shear Strength Test Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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Table 1: Summary of Interface Shear Strength Test Data

Interface	Peak Shear Strength Envelope Determined by Direct Shear Testing[1]	Peak Shear Stress @ (Normal Load)	Required Shear Stress @ (Normal Load)	Comment
1. GCL vs. Soil Liner	ϕ = 24.3°	138 psf (200 psf)	100 psf (200 psf)	Exceeds Requirement
	a = 321 psf	1,418 psf (2,000 psf)	750 psf (2,000 psf)	Exceeds Requirement
		2,376 psf (4,000 psf)	1,500 psf (4,000 psf)	Exceeds Requirement
		3,775 psf (8,000 psf)	3,500 psf (8,000 psf)	Exceeds Requirement
2. 60 mil THDPE vs. GCL	ϕ = 25.7°	127 psf (200 psf)	100 psf (200 psf)	Exceeds Requirement
	a = 0 psf	937 psf (2,000 psf)	750 psf (2,000 psf)	Exceeds Requirement
		1,671 psf (4,000 psf)	1,500 psf (4,000 psf)	Exceeds Requirement
		3,989 psf (8,000 psf)	3,500 psf (8,000 psf)	Exceeds Requirement
3. Type GT-C Geotextile vs. 60 mil THDPE	ϕ = 31.5°	171 psf (200 psf)	100 psf (200 psf)	Exceeds Requirement
	a = 190 psf	1,473 psf (2,000 psf)	750 psf (2,000 psf)	Exceeds Requirement
		2,833 psf (4,000 psf)	1,500 psf (4,000 psf)	Exceeds Requirement
		4,989 psf (8,000 psf)	3,500 psf (8,000 psf)	Exceeds Requirement
4. Drainage Geocomposite vs. 60 mil THDPE	ϕ = 26.7°	163 psf (200 psf)	100 psf (200 psf)	Exceeds Requirement
	a = 226 psf	1,377 psf (2,000 psf)	750 psf (2,000 psf)	Exceeds Requirement
		2,339 psf (4,000 psf)	1,500 psf (4,000 psf)	Exceeds Requirement
		4,168 psf (8,000 psf)	3,500 psf (8,000 psf)	Exceeds Requirement
5. Protective Cover vs. Drainage Geocomposite	ϕ = 31.7°	146 psf (200 psf)	100 psf (200 psf)	Exceeds Requirement
	a = 0 psf	1,355 psf (2,000 psf)	750 psf (2,000 psf)	Exceeds Requirement
		2,142 psf (4,000 psf)	1,500 psf (4,000 psf)	Exceeds Requirement
		5,072 psf (8,000 psf)	3,500 psf (8,000 psf)	Exceeds Requirement
6. Protective Cover vs. Type GT-S Geotextile	ϕ =30.4°	137 psf (200 psf)	100 psf (200 psf)	Exceeds Requirement
	a = 0 psf	1,112 psf (2,000 psf)	750 psf (2,000 psf)	Exceeds Requirement
		2,264 psf (4,000 psf)	1,500 psf (4,000 psf)	Exceeds Requirement
		4,753 psf (8,000 psf)	3,500 psf (8,000 psf)	Exceeds Requirement

Notes:

1. Tests performed by Geotechnics, Pittsburgh, PA. Peak shear strength envelope based on best-fit line over the normal stresses evaluated.

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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

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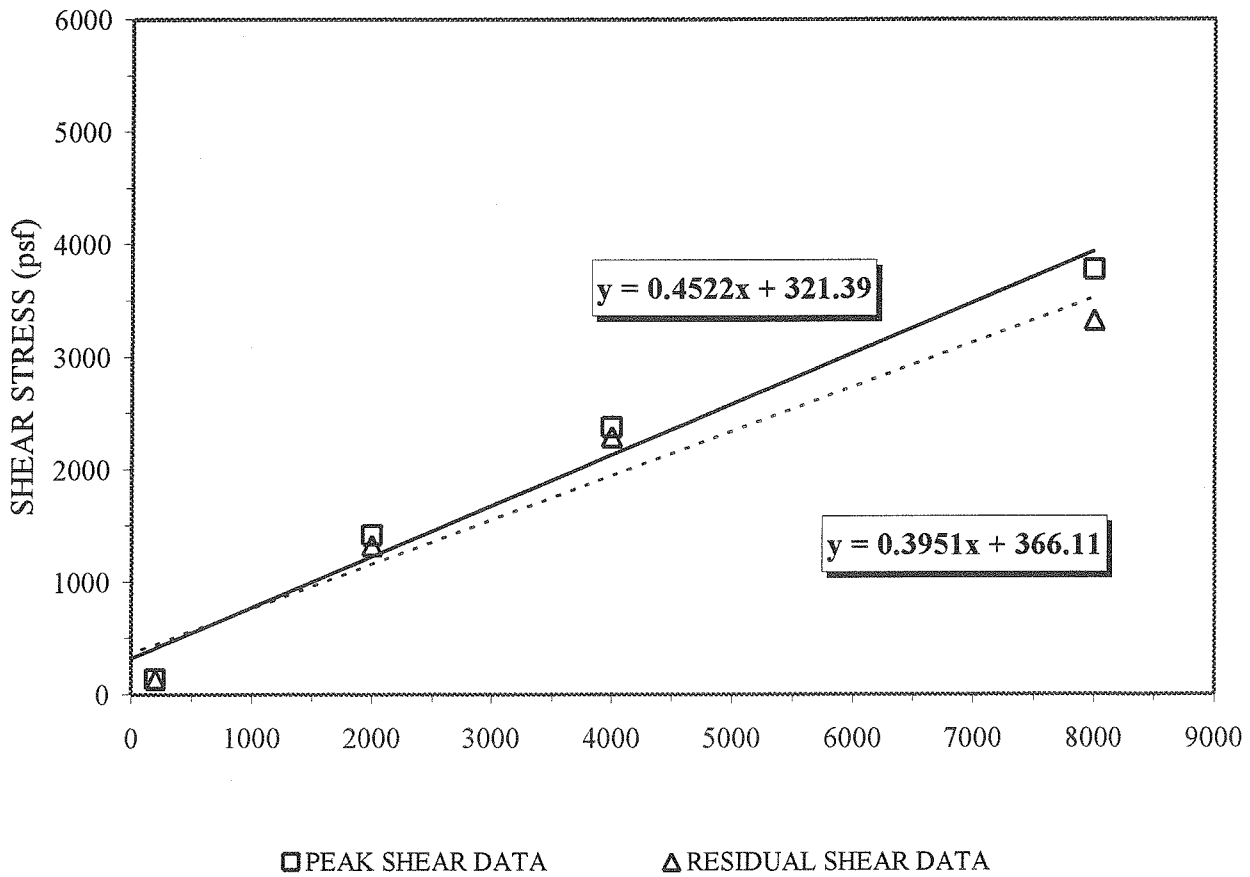
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: Soil Liner Sample CSL-01 (2013-763-01-03)

INTERFACE : **Soil @ 87.3 pcf & 32 % M.C.**
vs. GCL (White Side)

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = **24.3**	Φ = **21.6**
COEFFICIENT OF FRICTION :	= **0.452**	= **0.395**
ADHESION [Calculated] (psf):	a = **321**	a = **366**

NOTES:
1.) Soil placement based upon 95% maximum dry density & a moisture content of +2% of optimum.
2.) The interface was loaded, inundated with water & Hydrated under test load for 24 hours prior to shearing.
3.) The peak friction angle was calculated using linear regression on the four data points.
4.) The residual friction angle was calculated using linear regression on the end of test values.



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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

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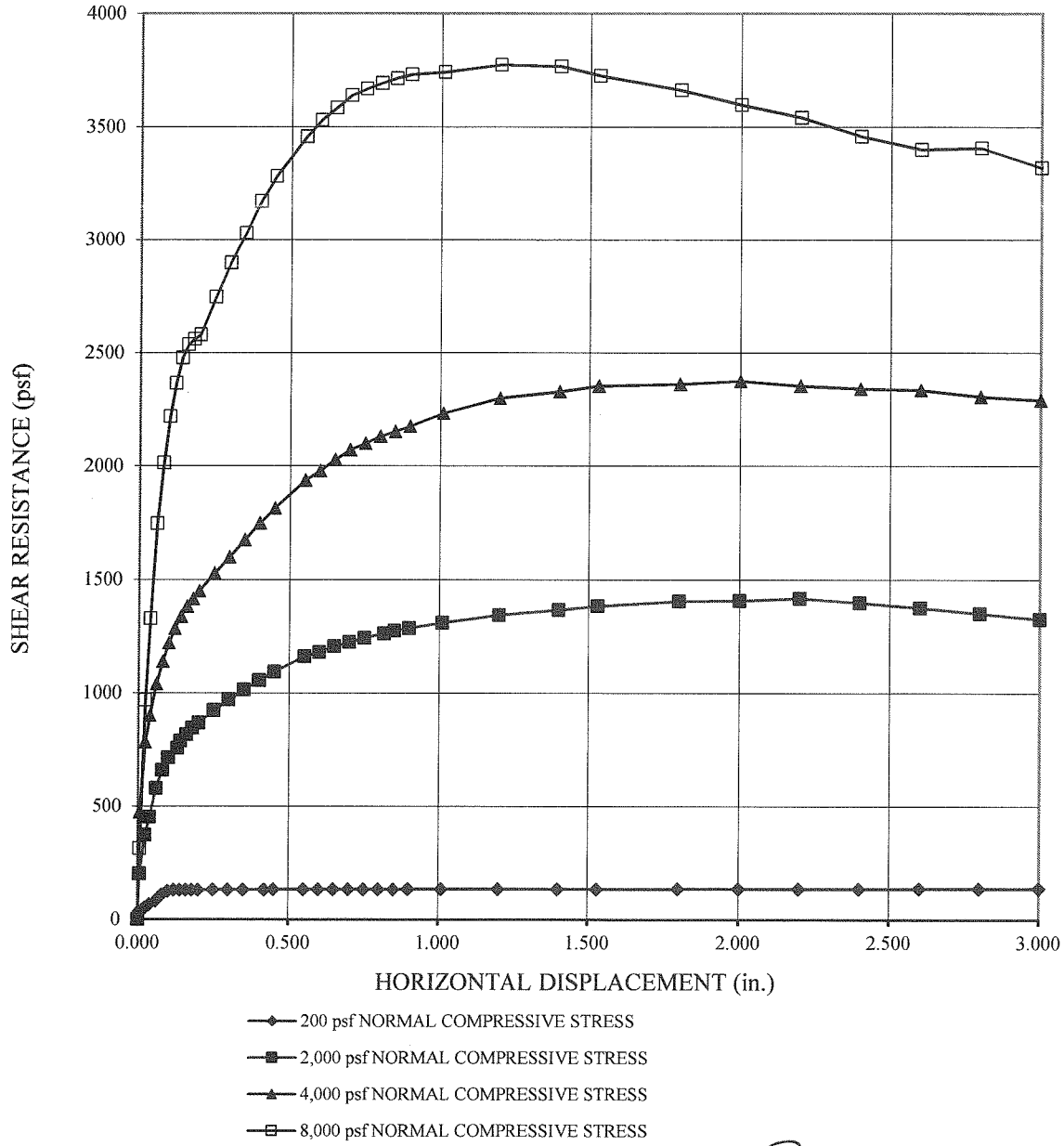
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: Soil Liner Sample CSL-01 (2013-763-01-03)

INTERFACE : **Soil @ 87.3 pcf & 32 % M.C.**
vs. GCL (White Side)

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: Soil Liner Sample CSL-01 (2013-763-01-03)
CETCO Bentomat SDN, Roll # 297 (L13140-01-01)

INTERFACE : **Soil @ 87.3 pcf & 32 % M.C.**
vs. GCL (White Side)

STRAIN RATE (in/min) : 0.04 DIRECT SHEAR UNIT: Durham Geo
PLACEMENT CONDITION: Inundated NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	2000		NORMAL LOAD (psf)	4000		NORMAL LOAD (psf)	8000	
PEAK SHEAR STRESS (psf)	1418		PEAK SHEAR STRESS (psf)	2376		PEAK SHEAR STRESS (psf)	3775	
RESIDUAL SHEAR (psf)	1326		RESIDUAL SHEAR (psf)	2291		RESIDUAL SHEAR (psf)	3320	
HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	202	202	0.005	474	474	0.005	313	313
0.023	373	373	0.023	786	786	0.023	970	970
0.038	451	451	0.038	903	903	0.038	1329	1329
0.060	580	580	0.060	1041	1041	0.060	1747	1747
0.080	661	661	0.080	1139	1139	0.080	2014	2014
0.100	716	716	0.100	1221	1221	0.100	2219	2219
0.130	759	759	0.120	1285	1285	0.120	2366	2366
0.140	791	791	0.140	1338	1338	0.140	2478	2478
0.160	818	818	0.160	1383	1383	0.160	2537	2537
0.180	847	847	0.180	1415	1415	0.180	2561	2561
0.200	870	870	0.200	1451	1451	0.200	2581	2581
0.250	925	925	0.250	1528	1528	0.250	2746	2746
0.300	972	972	0.300	1599	1599	0.300	2898	2898
0.350	1015	1015	0.350	1676	1676	0.350	3031	3031
0.400	1057	1057	0.400	1750	1750	0.400	3172	3172
0.450	1095	1095	0.450	1815	1815	0.450	3283	3283
0.550	1161	1161	0.550	1937	1937	0.550	3458	3458
0.600	1180	1180	0.600	1979	1979	0.600	3531	3531
0.650	1206	1206	0.650	2028	2028	0.650	3585	3585
0.700	1225	1225	0.700	2071	2071	0.700	3640	3640
0.750	1243	1243	0.750	2100	2100	0.750	3670	3670
0.816	1263	1263	0.800	2131	2131	0.800	3695	3695
0.850	1275	1275	0.850	2153	2153	0.850	3716	3716
0.900	1287	1287	0.900	2175	2175	0.900	3733	3733
1.010	1310	1310	1.010	2233	2233	1.010	3743	3743
1.200	1345	1345	1.200	2301	2301	1.200	3775	3775
1.400	1367	1367	1.400	2330	2330	1.400	3768	3768
1.530	1384	1384	1.530	2354	2354	1.530	3727	3727
1.800	1405	1405	1.800	2362	2362	1.800	3663	3663
2.000	1407	1407	2.000	2376	2376	2.000	3599	3599
2.200	1418	1418	2.200	2355	2355	2.200	3542	3542
2.400	1398	1398	2.400	2343	2343	2.400	3458	3458
2.600	1376	1376	2.600	2336	2336	2.600	3400	3400
2.800	1351	1351	2.800	2307	2307	2.800	3407	3407
3.000	1326	1326	3.000	2291	2291	3.000	3320	3320

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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

geotechnics
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: Soil Liner Sample CSL-01 (2013-763-01-03)
CETCO Bentomat SDN, Roll # 297 (L13140-01-01)

INTERFACE : **Soil @ 87.3 pcf & 32 % M.C. vs. GCL (White Side)**

STRAIN RATE (in/min) : 0.04
PLACEMENT CONDITION: Inundated
DIRECT SHEAR UNIT: Durham Geo
NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	200
PEAK SHEAR STRESS (psf)	138
RESIDUAL SHEAR (psf)	138

HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0
0.005	37	37
0.023	50	50
0.038	66	66
0.060	81	81
0.080	109	109
0.100	126	126
0.120	130	130
0.140	131	131
0.160	131	131
0.180	131	131
0.200	131	131
0.250	131	131
0.300	132	132
0.350	132	132
0.420	132	132
0.450	133	133
0.550	133	133
0.600	133	133
0.650	133	133
0.700	133	133
0.750	133	133
0.800	134	134
0.850	134	134
0.900	134	134
1.010	134	134
1.200	134	134
1.400	135	135
1.530	135	135
1.800	135	135
2.000	135	135
2.200	136	136
2.400	136	136
2.600	138	138
2.800	138	138
3.000	138	138

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DATE : 11-23-13

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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

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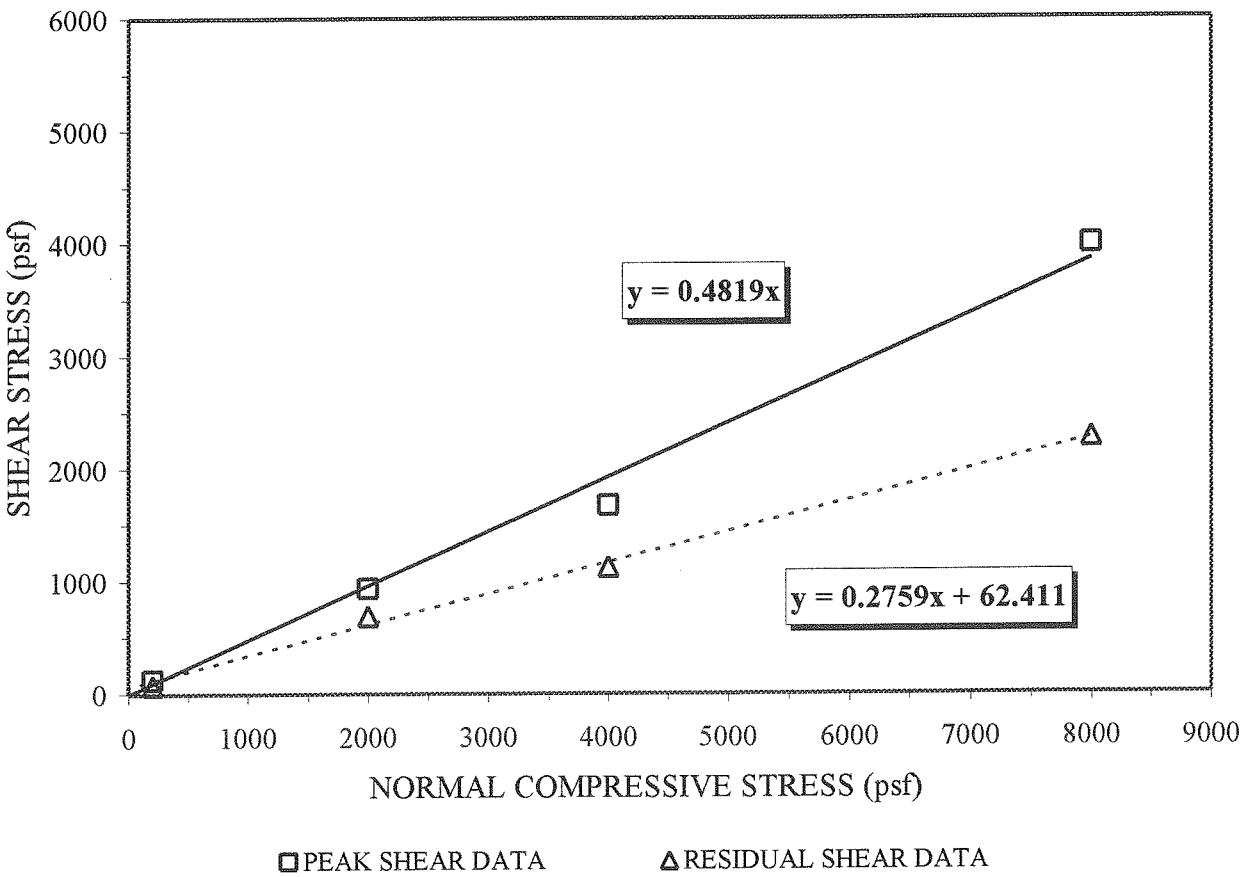
INTEGRITY IN TESTING

CLIENT : Chesapeake Containments Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: CETCO Bentomat SDN, Roll # 297 (L13140-01-01)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **GCL (Dark Side)**
vs. Agru 60 mil HDPE Microspike (Bottom Side)

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = 25.7	Φ = 15.4
COEFFICIENT OF FRICTION :	= 0.482	= 0.276
ADHESION [Calculated] (psf):	a = 0	a = 62

NOTES:
1.) The interface was loaded, inundated with water & hydrated under test load for 24 hours prior to shearing.
2.) The peak friction angle was calculated using linear regression on the four data points.
3.) The residual friction angle was calculated using linear regression on the end of test values.



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INTERFACE FRICTION TEST RESULTS
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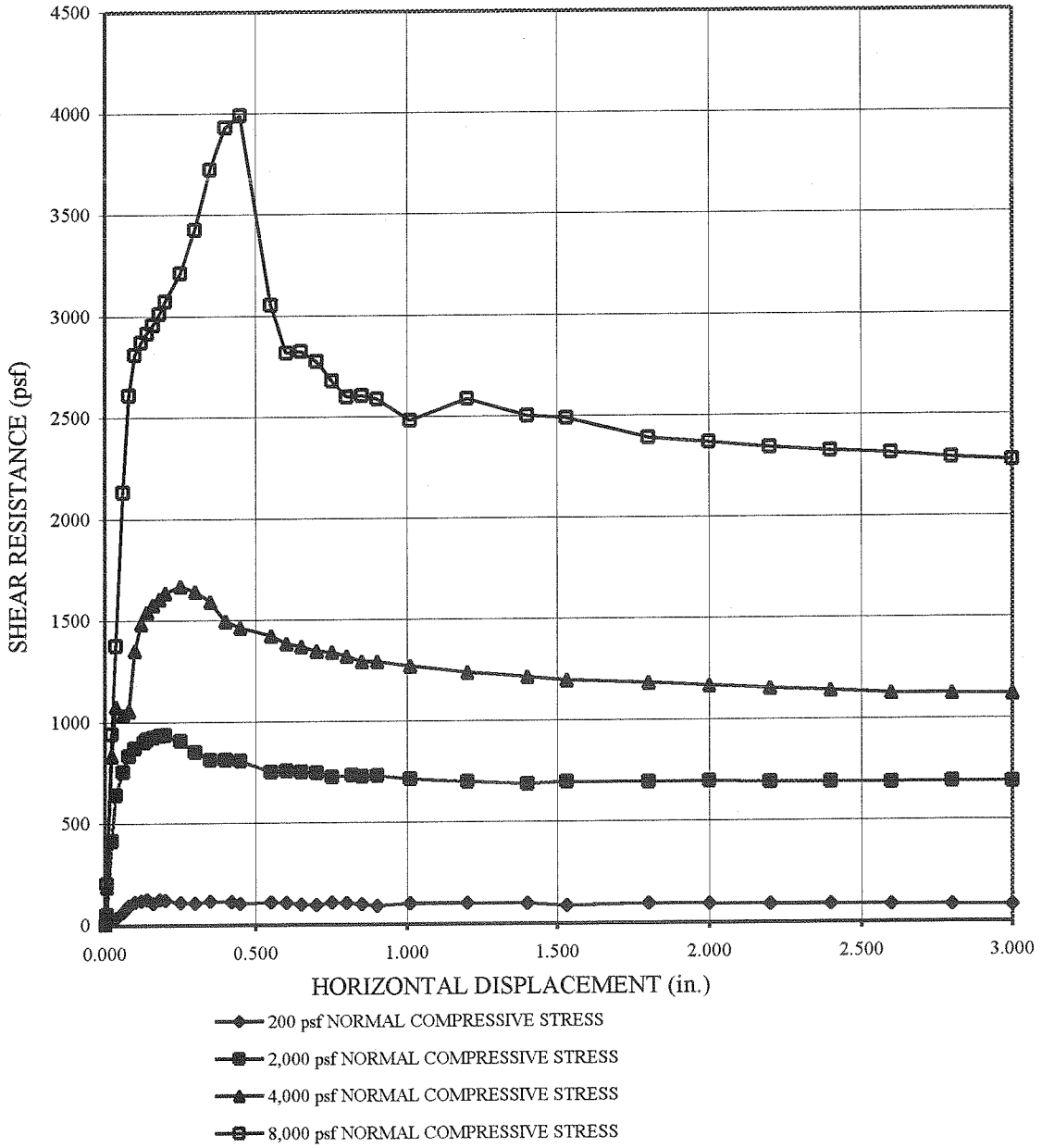
INTEGRITY IN TESTING

CLIENT : Chesapeake Containments Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: CETCO Bentomat SDN, Roll # 297 (L13140-01-01)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **GCL (Dark Side)**
vs. Agru 60 mil HDPE Microspike (Bottom Side)

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containments Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: CETCO Bentomat SDN, Roll # 297 (L13140-01-01)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **GCL (Dark Side)**
vs. Agru 60 mil HDPE Microspike (Bottom Side)

STRAIN RATE (in/min) : 0.04 DIRECT SHEAR UNIT: Durham Geo
PLACEMENT CONDITION: Inundated NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	2000		NORMAL LOAD (psf)	4000		NORMAL LOAD (psf)	8000	
PEAK SHEAR STRESS (psf)	937		PEAK SHEAR STRESS (psf)	1671		PEAK SHEAR STRESS (psf)	3989	
RESIDUAL SHEAR (psf)	690		RESIDUAL SHEAR (psf)	1122		RESIDUAL SHEAR (psf)	2274	
ASPERITY (mils)	34		ASPERITY (mils)	32		ASPERITY (mils)	35	
HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	52	52	0.005	192	192	0.005	204	204
0.023	416	416	0.023	836	836	0.023	944	944
0.038	641	641	0.038	1078	1078	0.038	1377	1377
0.060	755	755	0.060	1037	1037	0.060	2135	2135
0.080	835	835	0.080	1059	1059	0.080	2611	2611
0.100	874	874	0.100	1355	1355	0.100	2812	2812
0.130	902	902	0.120	1485	1485	0.120	2872	2872
0.140	917	917	0.140	1545	1545	0.140	2918	2918
0.160	926	926	0.160	1581	1581	0.160	2957	2957
0.180	934	934	0.180	1610	1610	0.180	3013	3013
0.200	937	937	0.200	1639	1639	0.200	3075	3075
0.250	910	910	0.250	1671	1671	0.250	3213	3213
0.300	853	853	0.300	1645	1645	0.300	3427	3427
0.350	816	816	0.350	1594	1594	0.350	3724	3724
0.400	815	815	0.400	1499	1499	0.400	3931	3931
0.450	808	808	0.450	1467	1467	0.450	3989	3989
0.550	754	754	0.550	1425	1425	0.550	3056	3056
0.600	759	759	0.600	1386	1386	0.600	2818	2818
0.650	754	754	0.650	1371	1371	0.650	2825	2825
0.700	749	749	0.700	1350	1350	0.700	2775	2775
0.750	727	727	0.750	1342	1342	0.750	2680	2680
0.816	735	735	0.800	1323	1323	0.800	2600	2600
0.850	730	730	0.850	1297	1297	0.850	2605	2605
0.900	732	732	0.900	1296	1296	0.900	2589	2589
1.010	714	714	1.010	1272	1272	1.010	2484	2484
1.200	701	701	1.200	1240	1240	1.200	2589	2589
1.400	690	690	1.400	1218	1218	1.400	2503	2503
1.530	699	699	1.530	1200	1200	1.530	2491	2491
1.800	696	696	1.800	1184	1184	1.800	2391	2391
2.000	697	697	2.000	1169	1169	2.000	2370	2370
2.200	692	692	2.200	1155	1155	2.200	2343	2343
2.400	693	693	2.400	1144	1144	2.400	2325	2325
2.600	689	689	2.600	1130	1130	2.600	2312	2312
2.800	692	692	2.800	1126	1126	2.800	2289	2289
3.000	690	690	3.000	1122	1122	3.000	2274	2274

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INTERFACE FRICTION TEST RESULTS
ASTM D 6243

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containments Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: CETCO Bentomat SDN, Roll # 297 (L13140-01-01)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **GCL (Dark Side)**
vs. Agru 60 mil HDPE Microspike (Bottom Side)

STRAIN RATE (in/min) : 0.04
PLACEMENT CONDITION: Inundated

DIRECT SHEAR UNIT: Durham Geo
NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	200
PEAK SHEAR STRESS (psf)	127
RESIDUAL SHEAR (psf)	82
ASPERITY (mils)	36

HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0
0.005	15	15
0.023	26	26
0.038	36	36
0.060	65	65
0.080	96	96
0.100	113	113
0.120	121	121
0.140	125	125
0.160	107	107
0.180	127	127
0.200	122	122
0.250	112	112
0.300	107	107
0.350	118	118
0.420	113	113
0.450	106	106
0.550	112	112
0.600	107	107
0.650	101	101
0.700	96	96
0.750	108	108
0.800	105	105
0.850	99	99
0.900	92	92
1.010	103	103
1.200	102	102
1.400	99	99
1.530	89	89
1.800	96	96
2.000	94	94
2.200	92	92
2.400	91	91
2.600	89	89
2.800	86	86
3.000	82	82

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L13140-01

DATE : 11-27-13
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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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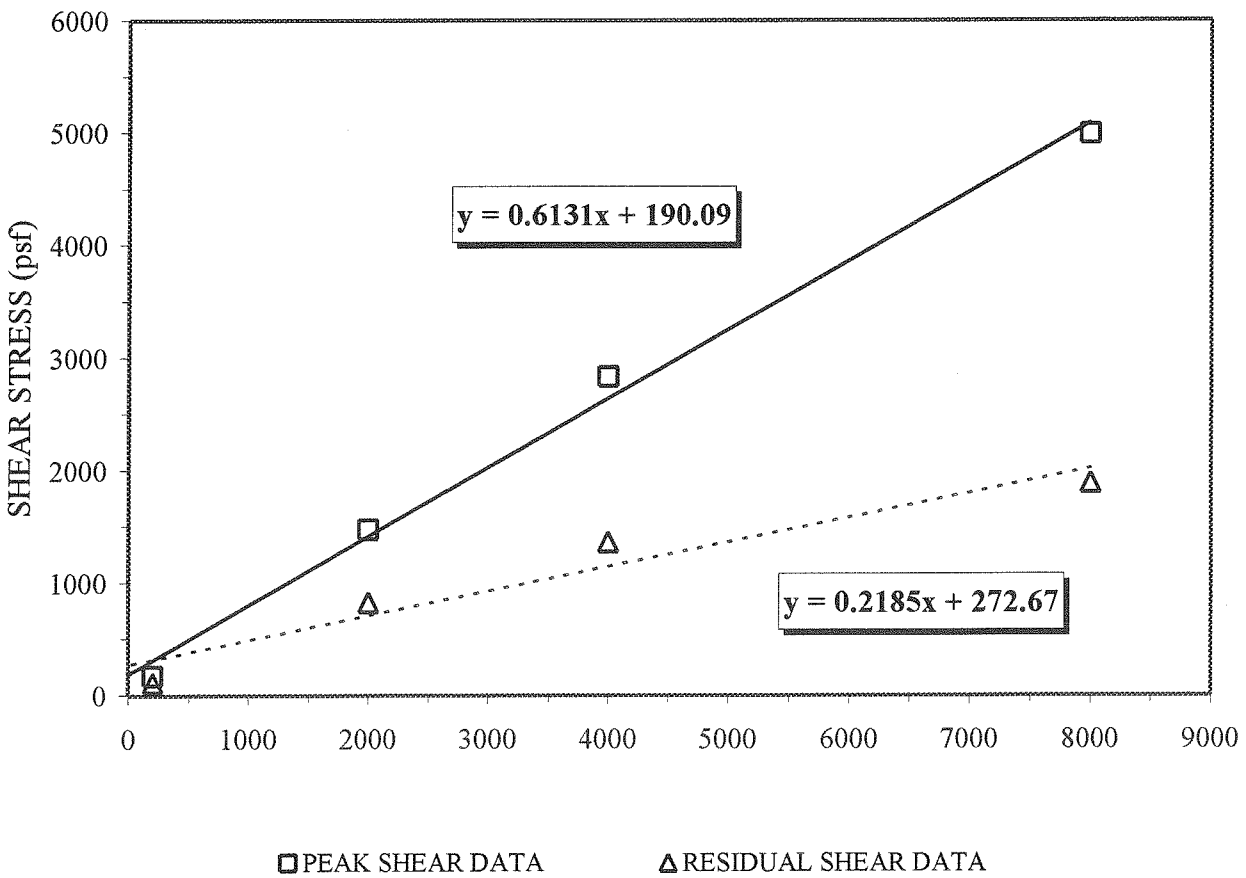
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson Co. MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: SKAPS GE-112 Geotextile, Roll # 31937.03 (L13140-01-03)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geotextile**
vs. Agru 60 mil HDPE Microspike (Top Side)

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = **31.5**	Φ = **12.3**
COEFFICIENT OF FRICTION :	= **0.613**	= **0.219**
ADHESION [Calculated] (psf):	a = **190**	a = **273**

NOTES:
1.) The interface was placed under test load, inundated with water & seated for 1 hour prior to shearing.
2.) The peak friction angle was calculated using linear regression on the four data points.
3.) The residual friction angle was calculated using linear regression on the end of test values.



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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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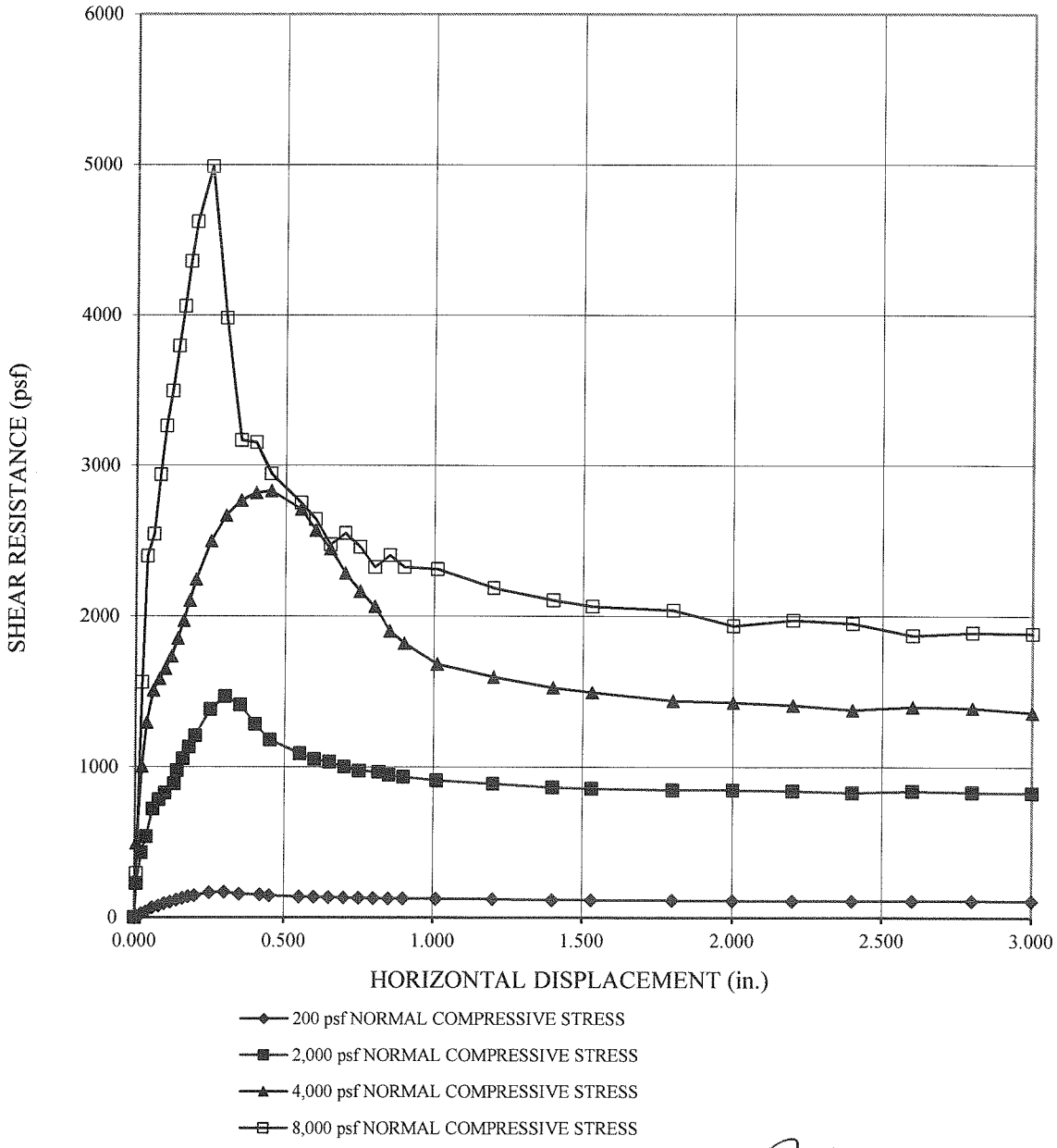
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson Co. MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: SKAPS GE-112 Geotextile, Roll # 31937.03 (L13140-01-03)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geotextile**
vs. Agru 60 mil HDPE Microspike (Top Side)

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

geotechnics
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson Co. MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: SKAPS GE-112 Geotextile, Roll # 31937.03 (L13140-01-03)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geotextile**
vs. Agru 60 mil HDPE Microspike (Top Side)

STRAIN RATE (in/min) : 0.20 DIRECT SHEAR UNIT: Durham Geo
PLACEMENT CONDITION: Inundated NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	2000		NORMAL LOAD (psf)	4000		NORMAL LOAD (psf)	8000	
PEAK SHEAR STRESS (psf)	1473		PEAK SHEAR STRESS (psf)	2833		PEAK SHEAR STRESS (psf)	4989	
RESIDUAL SHEAR (psf)	829		RESIDUAL SHEAR (psf)	1364		RESIDUAL SHEAR (psf)	1887	
ASPERITY (mils)	28		ASPERITY (mils)	27		ASPERITY (mils)	25	
HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	227	227	0.005	495	495	0.005	295	295
0.023	432	432	0.023	1007	1007	0.023	1564	1564
0.038	539	539	0.038	1298	1298	0.038	2400	2400
0.060	723	723	0.060	1511	1511	0.060	2545	2545
0.080	784	784	0.080	1589	1589	0.080	2939	2939
0.100	829	829	0.100	1655	1655	0.100	3263	3263
0.130	891	891	0.120	1737	1737	0.120	3496	3496
0.140	979	979	0.140	1855	1855	0.140	3795	3795
0.160	1058	1058	0.160	1973	1973	0.160	4060	4060
0.180	1135	1135	0.180	2105	2105	0.180	4358	4358
0.200	1210	1210	0.200	2246	2246	0.200	4623	4623
0.250	1386	1386	0.250	2500	2500	0.250	4989	4989
0.300	1473	1473	0.300	2670	2670	0.300	3982	3982
0.350	1414	1414	0.350	2770	2770	0.350	3169	3169
0.400	1286	1286	0.400	2820	2820	0.400	3154	3154
0.450	1182	1182	0.450	2833	2833	0.450	2946	2946
0.550	1091	1091	0.550	2710	2710	0.550	2752	2752
0.600	1053	1053	0.600	2571	2571	0.600	2643	2643
0.650	1037	1037	0.650	2447	2447	0.650	2477	2477
0.700	1003	1003	0.700	2286	2286	0.700	2552	2552
0.750	978	978	0.750	2167	2167	0.750	2459	2459
0.816	970	970	0.800	2066	2066	0.800	2326	2326
0.850	950	950	0.850	1904	1904	0.850	2405	2405
0.900	936	936	0.900	1823	1823	0.900	2326	2326
1.010	911	911	1.010	1685	1685	1.010	2312	2312
1.200	891	891	1.200	1601	1601	1.200	2188	2188
1.400	867	867	1.400	1529	1529	1.400	2108	2108
1.530	859	859	1.530	1498	1498	1.530	2066	2066
1.800	848	848	1.800	1443	1443	1.800	2041	2041
2.000	849	849	2.000	1431	1431	2.000	1937	1937
2.200	843	843	2.200	1412	1412	2.200	1975	1975
2.400	832	832	2.400	1381	1381	2.400	1954	1954
2.600	840	840	2.600	1402	1402	2.600	1873	1873
2.800	834	834	2.800	1394	1394	2.800	1893	1893
3.000	829	829	3.000	1364	1364	3.000	1887	1887

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson Co. MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: SKAPS GE-112 Geotextile, Roll # 31937.03 (L13140-01-03)
Agru 60 mil HDPE Microspike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geotextile**
vs. Agru 60 mil HDPE Microspike (Top Side)

STRAIN RATE (in/min) : 0.20
PLACEMENT CONDITION: Inundated
DIRECT SHEAR UNIT: Durham Geo
NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	200
NORMAL LOAD (psi)	1.4
PEAK SHEAR STRESS (psf)	171
RESIDUAL SHEAR (psf)	113
ASPERITY (mils)	27

HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0
0.005	13	13
0.023	26	26
0.038	38	38
0.060	67	67
0.080	80	80
0.100	96	96
0.120	106	106
0.140	119	119
0.160	131	131
0.180	141	141
0.200	149	149
0.250	167	167
0.300	171	171
0.350	159	159
0.420	154	154
0.450	150	150
0.550	142	142
0.600	139	139
0.650	136	136
0.700	135	135
0.750	132	132
0.800	130	130
0.850	128	128
0.900	128	128
1.010	127	127
1.200	124	124
1.400	119	119
1.530	119	119
1.800	117	117
2.000	115	115
2.200	114	114
2.400	113	113
2.600	112	112
2.800	113	113
3.000	113	113

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DATE : 11-23-13

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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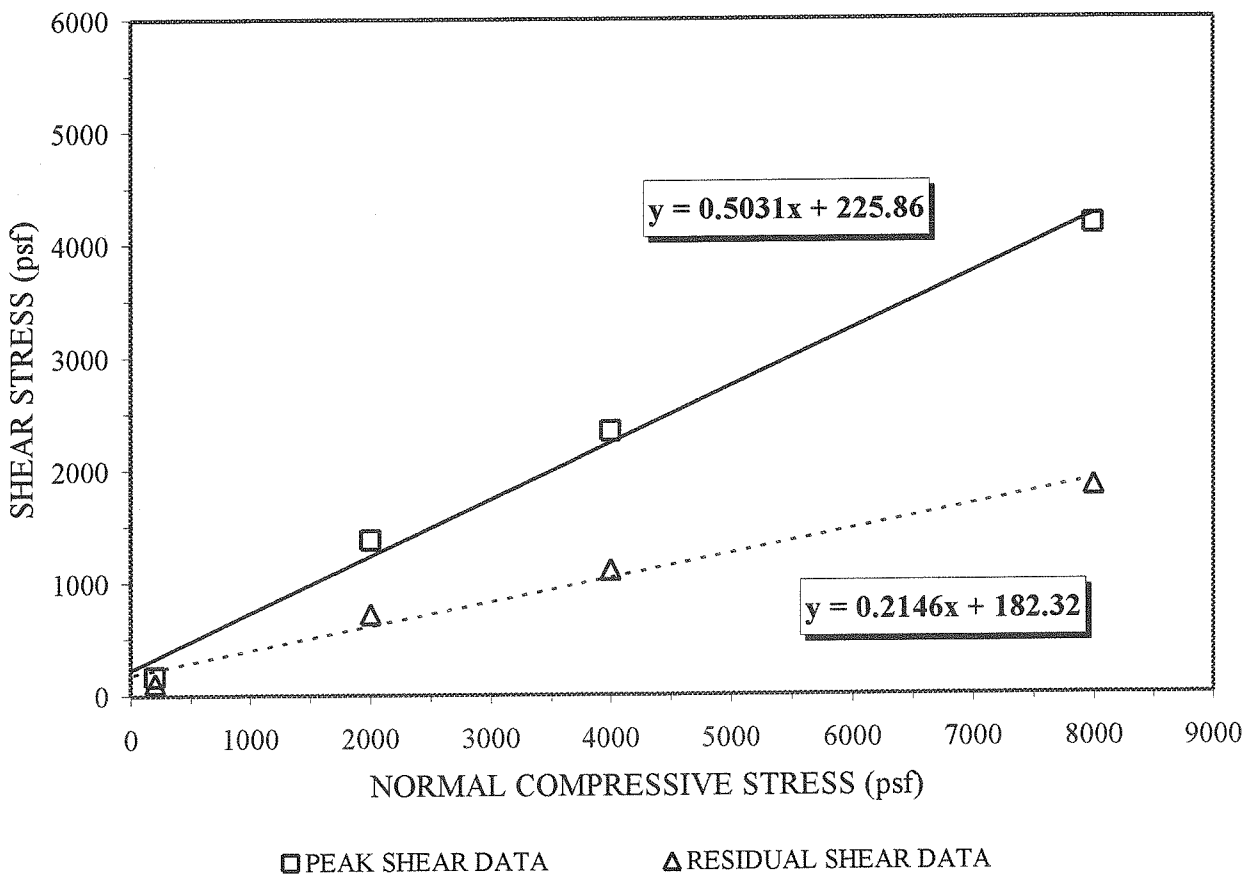
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: SKAPS TN 330-2-6 Geocomposite, Roll # 56671010003 (L13140-01-04)
Agru 60 mil HDPE Micropsike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geocomposite**
vs. Agru 60 mil HDPE Microspike (Top Side)

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = 26.7	Φ = 12.1
COEFFICIENT OF FRICTION :	= 0.503	= 0.214
ADHESION [Calculated] (psf):	a = 226	a = 184

NOTES:
1.) The interface was placed under test load, inundated with water & seated for 1 hour prior to shearing.
2.) The peak friction angle was calculated using linear regression on the four data points.
3.) The residual friction angle was calculated using linear regression on the end of test values.



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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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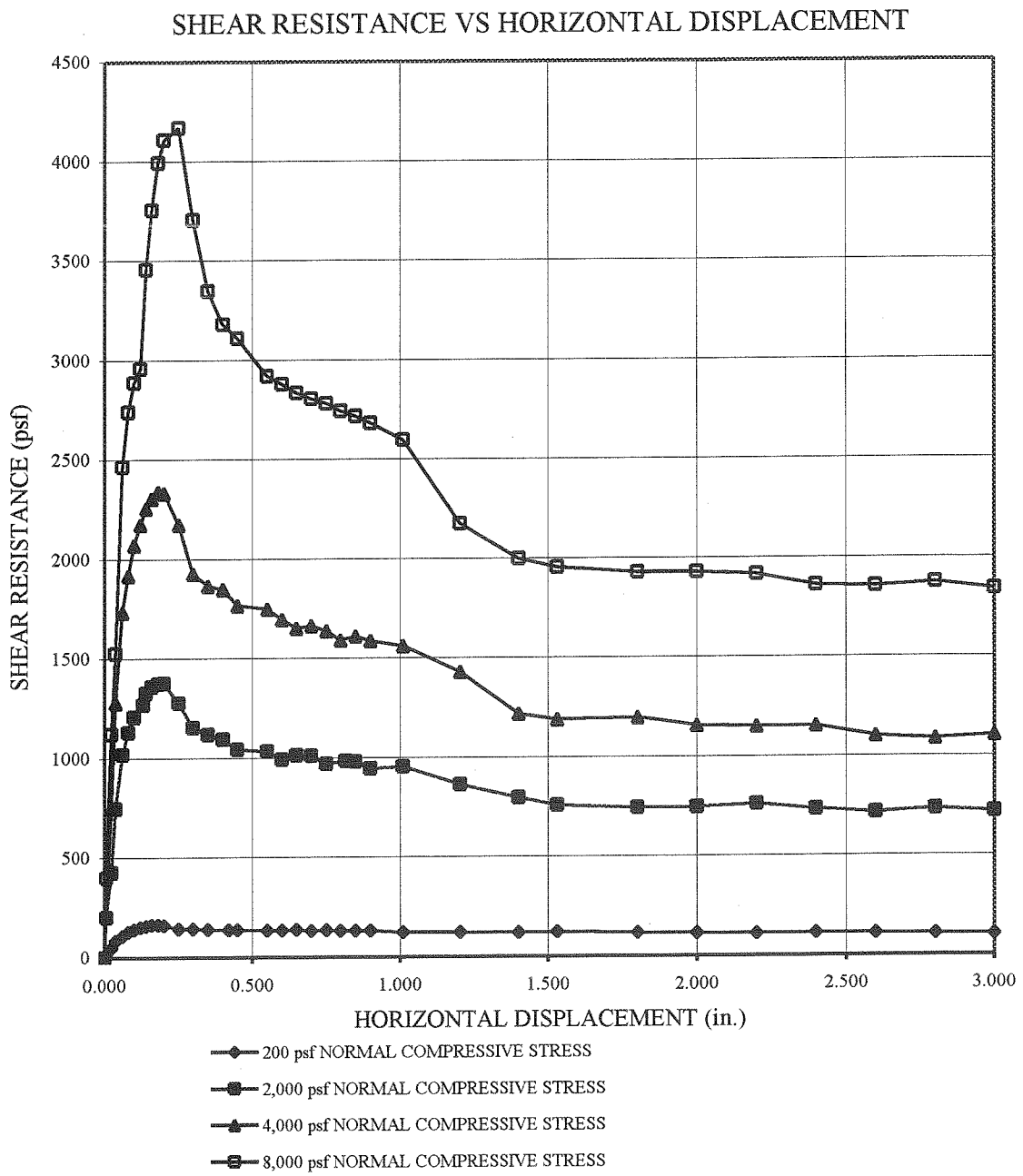
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: SKAPS TN 330-2-6 Geocomposite, Roll # 56671010003 (L13140-01-04)
Agru 60 mil HDPE Micropsike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geocomposite**
vs. Agru 60 mil HDPE Microspike (Top Side)



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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: SKAPS TN 330-2-6 Geocomposite, Roll # 56671010003 (L13140-01-04)
Agru 60 mil HDPE Micropsike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geocomposite**
vs. Agru 60 mil HDPE Microspike (Top Side)

STRAIN RATE (in/min) : 0.20 DIRECT SHEAR UNIT: Durham Geo
PLACEMENT CONDITION: Inundated NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	2000	NORMAL LOAD (psf)	4000	NORMAL LOAD (psf)	8000
PEAK SHEAR STRESS (psf)	1377	PEAK SHEAR STRESS (psf)	2339	PEAK SHEAR STRESS (psf)	4168
RESIDUAL SHEAR (psf)	722	RESIDUAL SHEAR (psf)	1106	RESIDUAL SHEAR (psf)	1842
ASPERITY (mils)	27	ASPERITY (mils)	28	ASPERITY (mils)	27

HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	201	201	0.005	215	215	0.005	403	403
0.023	429	429	0.023	755	755	0.023	1123	1123
0.038	749	749	0.038	1280	1280	0.038	1527	1527
0.060	1021	1021	0.060	1735	1735	0.060	2466	2466
0.080	1133	1133	0.080	1920	1920	0.080	2742	2742
0.100	1208	1208	0.100	2073	2073	0.100	2887	2887
0.130	1270	1270	0.120	2176	2176	0.120	2959	2959
0.140	1327	1327	0.140	2257	2257	0.140	3456	3456
0.160	1361	1361	0.160	2307	2307	0.160	3755	3755
0.180	1374	1374	0.180	2339	2339	0.180	3993	3993
0.200	1377	1377	0.200	2335	2335	0.200	4108	4108
0.250	1278	1278	0.250	2174	2174	0.250	4168	4168
0.300	1154	1154	0.300	1930	1930	0.300	3705	3705
0.350	1120	1120	0.350	1868	1868	0.350	3347	3347
0.400	1095	1095	0.400	1851	1851	0.400	3181	3181
0.450	1043	1043	0.450	1769	1769	0.450	3110	3110
0.550	1035	1035	0.550	1750	1750	0.550	2919	2919
0.600	994	994	0.600	1696	1696	0.600	2879	2879
0.650	1013	1013	0.650	1654	1654	0.650	2836	2836
0.700	1011	1011	0.700	1666	1666	0.700	2805	2805
0.750	970	970	0.750	1639	1639	0.750	2783	2783
0.816	986	986	0.800	1592	1592	0.800	2745	2745
0.850	983	983	0.850	1613	1613	0.850	2717	2717
0.900	947	947	0.900	1588	1588	0.900	2683	2683
1.010	956	956	1.010	1564	1564	1.010	2598	2598
1.200	865	865	1.200	1432	1432	1.200	2176	2176
1.400	797	797	1.400	1219	1219	1.400	2000	2000
1.530	760	760	1.530	1191	1191	1.530	1956	1956
1.800	745	745	1.800	1200	1200	1.800	1929	1929
2.000	748	748	2.000	1159	1159	2.000	1930	1930
2.200	762	762	2.200	1152	1152	2.200	1918	1918
2.400	737	737	2.400	1155	1155	2.400	1862	1862
2.600	718	718	2.600	1103	1103	2.600	1856	1856
2.800	736	736	2.800	1088	1088	2.800	1873	1873
3.000	722	722	3.000	1106	1106	3.000	1842	1842

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: SKAPS TN 330-2-6 Geocomposite, Roll # 56671010003 (L13140-01-04)
Agru 60 mil HDPE Micropsike, Roll # 443564-11 (L13140-01-02)

INTERFACE : **Geocomposite**
vs. Agru 60 mil HDPE Microspike (Top Side)

STRAIN RATE (in/min) : 0.20
PLACEMENT CONDITION: Inundated

DIRECT SHEAR UNIT: Durham Geo
NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	200
PEAK SHEAR STRESS (psf)	163
RESIDUAL SHEAR (psf)	107
ASPERITY (mils)	28

HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0
0.005	20	20
0.023	51	51
0.038	84	84
0.060	110	110
0.080	128	128
0.100	141	141
0.120	152	152
0.140	159	159
0.160	163	163
0.180	163	163
0.200	160	160
0.250	145	145
0.300	143	143
0.350	142	142
0.420	137	137
0.450	138	138
0.550	134	134
0.600	136	136
0.650	136	136
0.700	132	132
0.750	136	136
0.800	133	133
0.850	131	131
0.900	133	133
1.010	124	124
1.200	124	124
1.400	119	119
1.530	123	123
1.800	118	118
2.000	113	113
2.200	110	110
2.400	115	115
2.600	111	111
2.800	109	109
3.000	107	107

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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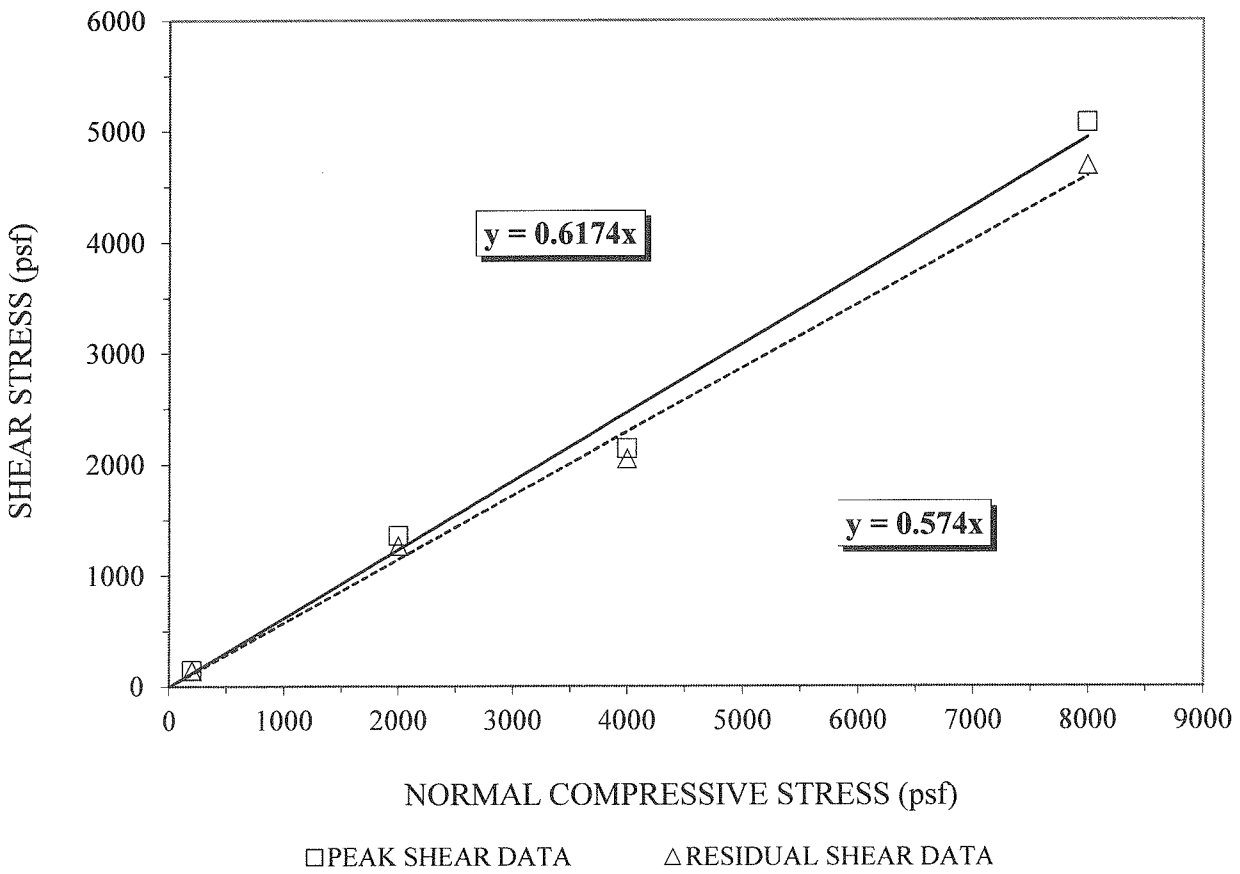
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: Protective Cover (L13140-01-06)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C.**
vs. Geocomposite

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = 31.7	Φ = 29.9
COEFFICIENT OF FRICTION :	= 0.617	= 0.574
ADHESION [Calculated] (psf):	a = 0	a = 0

NOTES:
1.) Soil was lightly compacted at the as-received moisture content.
2.) The interface was loaded, inundated with water and seated for 1 hour prior to shearing.
3.) The peak friction angle was calculated using linear regression on the four data points.
4.) The residual friction angle was calculated using linear regression on the end of test values.



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INTERFACE FRICTION TEST RESULTS
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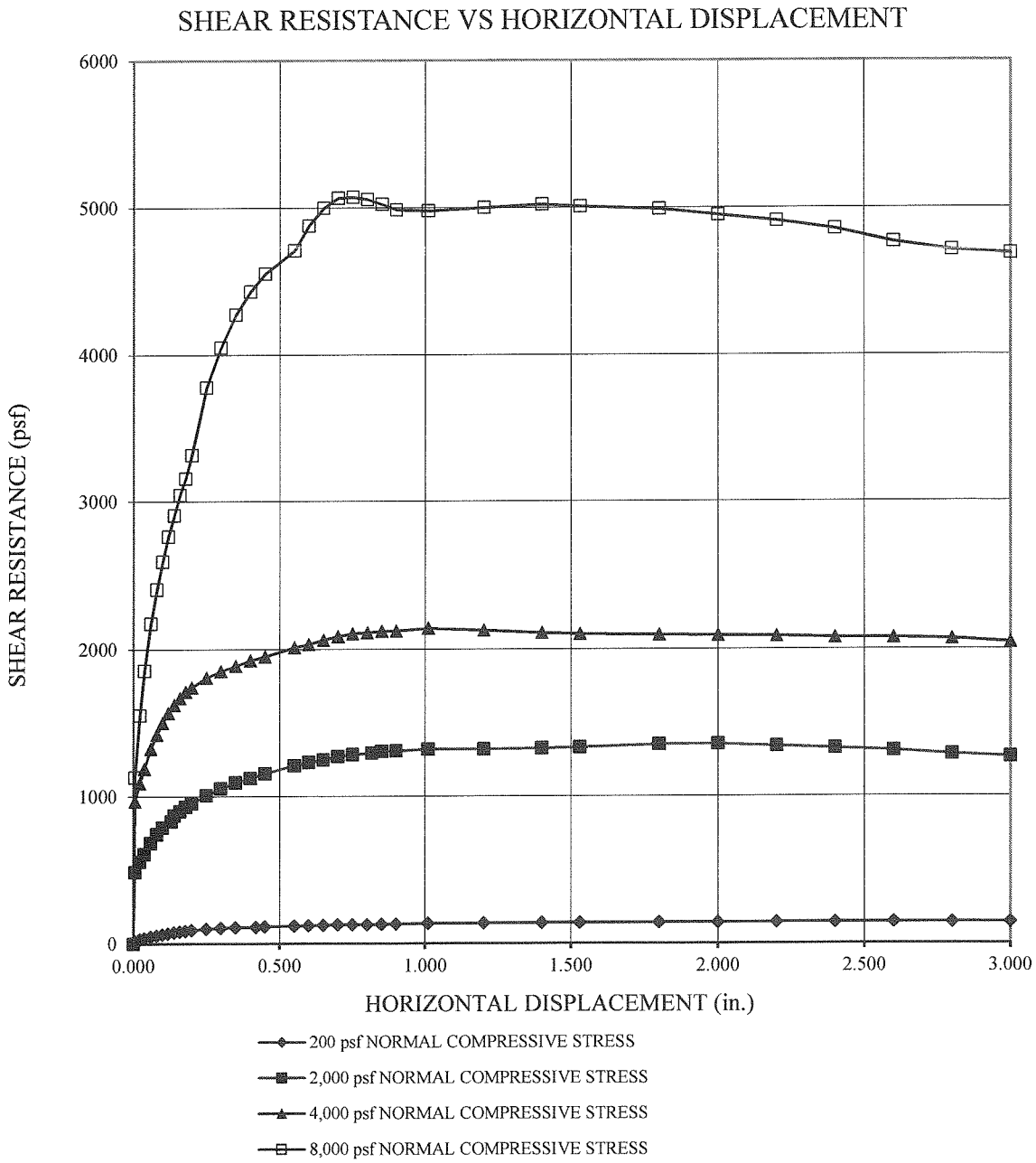
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: Protective Cover (L13140-01-06)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C.**
vs. Geocomposite



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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: Protective Cover (L13140-01-06)
SKAPS TN 330-2-6 Geocomposite, Roll # 56671010003 (L13140-01-04)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C.**
vs. Geocomposite

STRAIN RATE (in/min) : 0.04 DIRECT SHEAR UNIT: Durham Geo
PLACEMENT CONDITION: Inundated NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	2000		NORMAL LOAD (psf)	4000		NORMAL LOAD (psf)	8000	
PEAK SHEAR STRESS (psf)	1355		PEAK SHEAR STRESS (psf)	2142		PEAK SHEAR STRESS (psf)	5072	
RESIDUAL SHEAR (psf)	1267		RESIDUAL SHEAR (psf)	2047		RESIDUAL SHEAR (psf)	4686	
HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	487	487	0.005	970	970	0.005	1130	1130
0.023	558	558	0.023	1091	1091	0.023	1552	1552
0.038	611	611	0.038	1190	1190	0.038	1857	1857
0.060	686	686	0.060	1326	1326	0.060	2177	2177
0.080	745	745	0.080	1421	1421	0.080	2407	2407
0.100	790	790	0.100	1502	1502	0.100	2594	2594
0.130	831	831	0.120	1569	1569	0.120	2764	2764
0.140	870	870	0.140	1625	1625	0.140	2907	2907
0.160	900	900	0.160	1670	1670	0.160	3045	3045
0.180	929	929	0.180	1712	1712	0.180	3157	3157
0.200	954	954	0.200	1743	1743	0.200	3317	3317
0.250	1008	1008	0.250	1810	1810	0.250	3777	3777
0.300	1055	1055	0.300	1853	1853	0.300	4051	4051
0.350	1095	1095	0.350	1889	1889	0.350	4274	4274
0.400	1125	1125	0.400	1925	1925	0.400	4431	4431
0.450	1157	1157	0.450	1952	1952	0.450	4552	4552
0.550	1209	1209	0.550	2012	2012	0.550	4710	4710
0.600	1231	1231	0.600	2035	2035	0.600	4876	4876
0.650	1250	1250	0.650	2064	2064	0.650	4998	4998
0.700	1270	1270	0.700	2087	2087	0.700	5067	5067
0.750	1284	1284	0.750	2107	2107	0.750	5072	5072
0.816	1295	1295	0.800	2113	2113	0.800	5056	5056
0.850	1306	1306	0.850	2123	2123	0.850	5022	5022
0.900	1309	1309	0.900	2126	2126	0.900	4986	4986
1.010	1320	1320	1.010	2142	2142	1.010	4977	4977
1.200	1320	1320	1.200	2130	2130	1.200	5000	5000
1.400	1326	1326	1.400	2112	2112	1.400	5020	5020
1.530	1332	1332	1.530	2104	2104	1.530	5007	5007
1.800	1351	1351	1.800	2098	2098	1.800	4990	4990
2.000	1355	1355	2.000	2093	2093	2.000	4948	4948
2.200	1340	1340	2.200	2089	2089	2.200	4908	4908
2.400	1327	1327	2.400	2080	2080	2.400	4854	4854
2.600	1311	1311	2.600	2077	2077	2.600	4764	4764
2.800	1285	1285	2.800	2070	2070	2.800	4709	4709
3.000	1267	1267	3.000	2047	2047	3.000	4686	4686

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: Protective Cover (L13140-01-06)
SKAPS TN 330-2-6 Geocomposite, Roll # 56671010003 (L13140-01-04)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C. vs. Geocomposite**

STRAIN RATE (in/min) : 0.04
PLACEMENT CONDITION: Inundated
DIRECT SHEAR UNIT: Durham Geo
NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	200
PEAK SHEAR STRESS (psf)	146
RESIDUAL SHEAR (psf)	144

HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0
0.005	17	17
0.023	31	31
0.038	39	39
0.060	49	49
0.080	56	56
0.100	64	64
0.120	71	71
0.140	77	77
0.160	83	83
0.180	88	88
0.200	92	92
0.250	101	101
0.300	107	107
0.350	111	111
0.420	114	114
0.450	116	116
0.550	121	121
0.600	123	123
0.650	126	126
0.700	128	128
0.750	128	128
0.800	130	130
0.850	131	131
0.900	133	133
1.010	136	136
1.200	139	139
1.400	141	141
1.530	141	141
1.800	142	142
2.000	143	143
2.200	144	144
2.400	145	145
2.600	146	146
2.800	144	144
3.000	144	144

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

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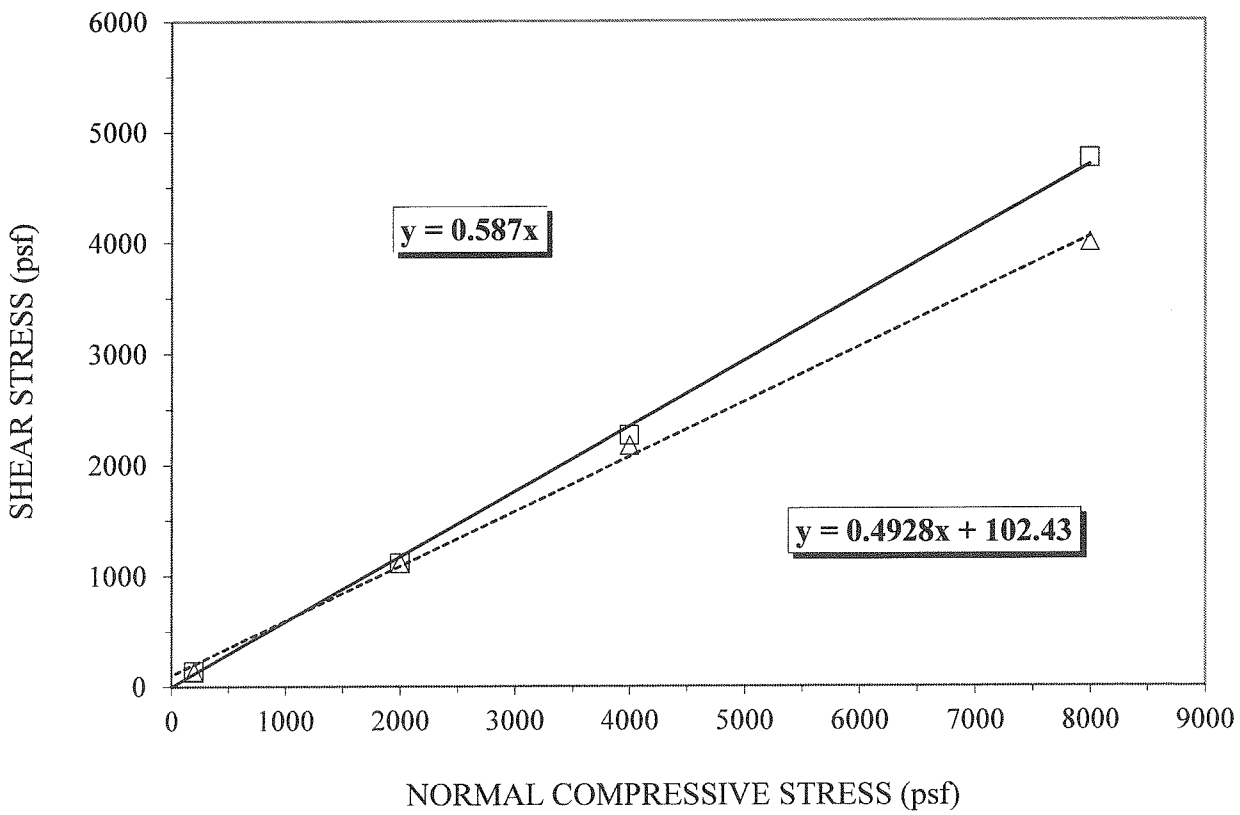
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: Protective Cover (L13140-01-06)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C. vs. Geotextile**

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = 30.4	Φ = 26.2
COEFFICIENT OF FRICTION :	= 0.587	= 0.493
ADHESION [Calculated] (psf):	a = 0	a = 102

NOTES:
1.) Soil was lightly compacted at the as-received moisture content.
2.) The interface was loaded, inundated with water and seated for 1 hour prior to shearing.
3.) The peak friction angle was calculated using linear regression on the four data points.
4.) The residual friction angle was calculated using linear regression on the end of test values.



□PEAK SHEAR DATA △RESIDUAL SHEAR DATA

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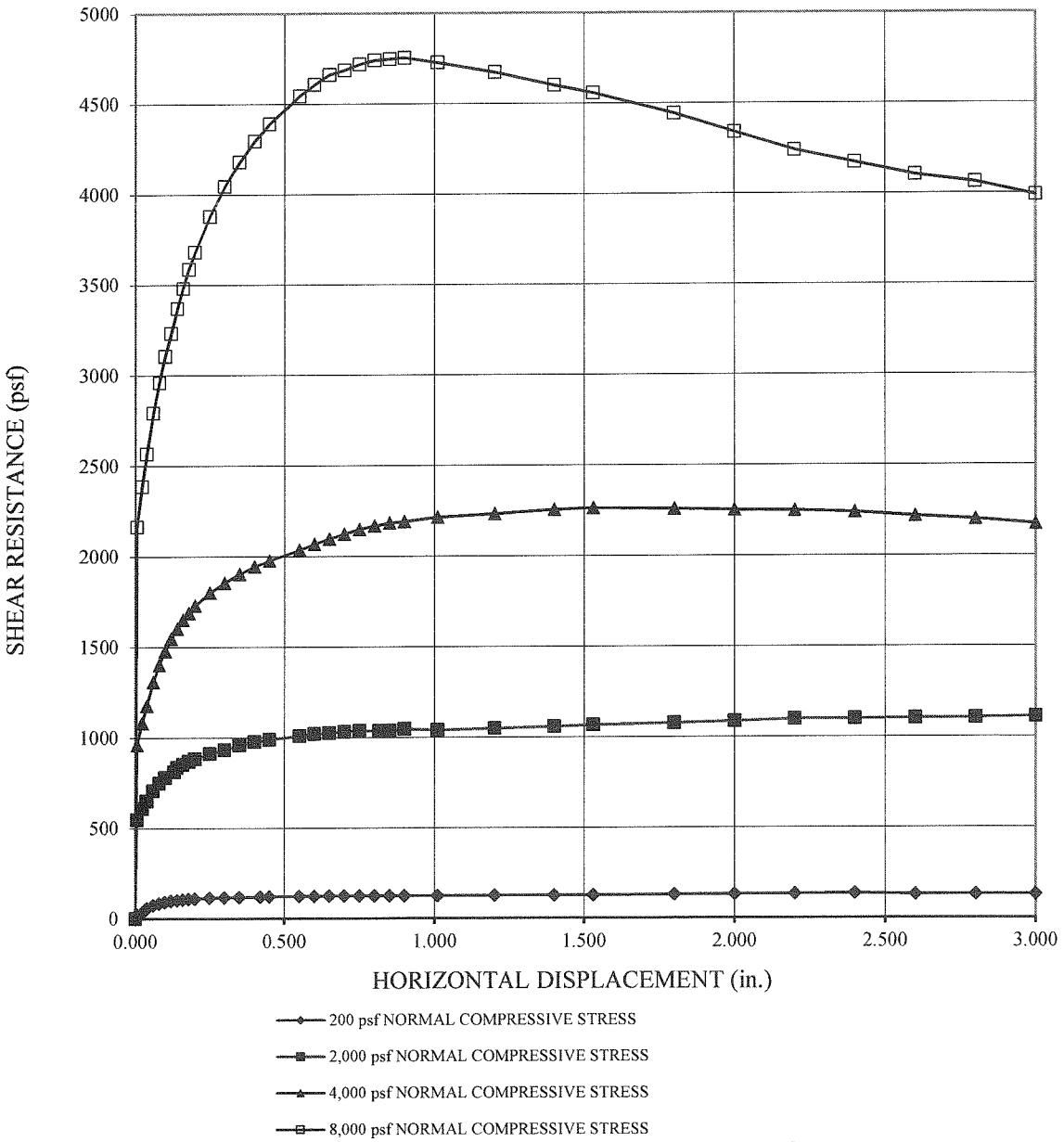
INTERFACE FRICTION TEST RESULTS
ASTM D 5321

geotechnics
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.: Protective Cover (L13140-01-06)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C.**
vs. Geotextile

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

geotechnics
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: Protective Cover (L13140-01-06)
Skaps GE-160 Geotextile, Roll # 319371.02 (L13140-01-06)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C.**
vs. Geotextile

STRAIN RATE (in/min) : 0.04 DIRECT SHEAR UNIT: Durham Geo
PLACEMENT CONDITION: Inundated NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	2000		NORMAL LOAD (psf)	4000		NORMAL LOAD (psf)	8000	
PEAK SHEAR STRESS (psf)	1112		PEAK SHEAR STRESS (psf)	2264		PEAK SHEAR STRESS (psf)	4753	
RESIDUAL SHEAR (psf)	1112		RESIDUAL SHEAR (psf)	2174		RESIDUAL SHEAR (psf)	3990	
HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.005	549	549	0.005	962	962	0.005	2165	2165
0.023	610	610	0.023	1082	1082	0.023	2388	2388
0.038	652	652	0.038	1177	1177	0.038	2568	2568
0.060	709	709	0.060	1309	1309	0.060	2793	2793
0.080	750	750	0.080	1402	1402	0.080	2959	2959
0.100	782	782	0.100	1479	1479	0.100	3106	3106
0.130	812	812	0.120	1547	1547	0.120	3233	3233
0.140	837	837	0.140	1603	1603	0.140	3368	3368
0.160	854	854	0.160	1651	1651	0.160	3480	3480
0.180	870	870	0.180	1689	1689	0.180	3587	3587
0.200	885	885	0.200	1729	1729	0.200	3683	3683
0.250	913	913	0.250	1801	1801	0.250	3880	3880
0.300	935	935	0.300	1854	1854	0.300	4046	4046
0.350	960	960	0.350	1903	1903	0.350	4181	4181
0.400	978	978	0.400	1943	1943	0.400	4295	4295
0.450	990	990	0.450	1977	1977	0.450	4391	4391
0.550	1009	1009	0.550	2036	2036	0.550	4544	4544
0.600	1021	1021	0.600	2069	2069	0.600	4606	4606
0.650	1027	1027	0.650	2096	2096	0.650	4661	4661
0.700	1033	1033	0.700	2122	2122	0.700	4685	4685
0.750	1038	1038	0.750	2149	2149	0.750	4719	4719
0.816	1036	1036	0.800	2167	2167	0.800	4739	4739
0.850	1037	1037	0.850	2184	2184	0.850	4747	4747
0.900	1047	1047	0.900	2192	2192	0.900	4753	4753
1.010	1041	1041	1.010	2214	2214	1.010	4726	4726
1.200	1049	1049	1.200	2232	2232	1.200	4673	4673
1.400	1059	1059	1.400	2256	2256	1.400	4600	4600
1.530	1068	1068	1.530	2264	2264	1.530	4557	4557
1.800	1078	1078	1.800	2259	2259	1.800	4443	4443
2.000	1087	1087	2.000	2252	2252	2.000	4340	4340
2.200	1098	1098	2.200	2250	2250	2.200	4240	4240
2.400	1101	1101	2.400	2239	2239	2.400	4173	4173
2.600	1103	1103	2.600	2218	2218	2.600	4103	4103
2.800	1105	1105	2.800	2200	2200	2.800	4062	4062
3.000	1112	1112	3.000	2174	2174	3.000	3990	3990

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INTERFACE FRICTION TEST RESULTS
ASTM D 5321

geotechnics
INTEGRITY IN TESTING

CLIENT : Chesapeake Containment Systems, Inc.
CLIENT PROJECT : Davidson County MSWLF Phase 2 - Area 2 - Cell 1
PROJECT NO. : L13140-01
LAB I. D. NO.S: Protective Cover (L13140-01-06)
Skaps GE-160 Geotextile, Roll # 319371.02 (L13140-01-06)

INTERFACE : **Soil @ 97.6 pcf & 13.9 % M.C. vs. Geotextile**

STRAIN RATE (in/min) : 0.04
PLACEMENT CONDITION: Inundated
DIRECT SHEAR UNIT: Durham Geo
NORMAL LOAD: Bladder System

NORMAL LOAD (psf)	200
PEAK SHEAR STRESS (psf)	137
RESIDUAL SHEAR (psf)	131

HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0
0.005	24	24
0.023	30	30
0.038	56	56
0.060	74	74
0.080	84	84
0.100	93	93
0.120	99	99
0.140	103	103
0.160	106	106
0.180	109	109
0.200	111	111
0.250	115	115
0.300	118	118
0.350	120	120
0.420	121	121
0.450	122	122
0.550	123	123
0.600	124	124
0.650	125	125
0.700	125	125
0.750	125	125
0.800	126	126
0.850	126	126
0.900	126	126
1.010	126	126
1.200	126	126
1.400	127	127
1.530	128	128
1.800	130	130
2.000	131	131
2.200	133	133
2.400	137	137
2.600	131	131
2.800	131	131
3.000	131	131

APPROVED BY : L13140-01
DATE : 12-18-13 12/18/2013

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Appendix J

GCL CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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GEOSYNTHETIC CLAY LINER
MANUFACTURING QUALITY ASSURANCE DATA PACKAGE

PROJECT NAME: Davidson Co LF
CUSTOMER P.O.: 13-156
ORDER NUMBER: 000299512
PREPARED FOR: Cheasapeake Containment Systems

CONTENTS:

- Product Certifications
- GCL Order packing list and MQA tracking form
- GCL manufacturing quality control test data
- Bentonite clay certification
- Raw material test results

PREPARED BY: Roger B. Wilkerson
Quality Assurance Coordinator
CETCO
P.O. Box 428
92 Hwy. 37
Lovell, WY 82431
Telephone: 800-322-1149 ext. 413
E-Mail: rwilke@cetco.com

PRODUCT CERTIFICATIONS

PROJECT NAME: Davidson Co LF
CUSTOMER P.O.: 13-156
ORDER NUMBERS: 000299512
PREPARED FOR: Cheasapeake Containment Systems

The GCL manufactured for the above-referenced order number(s) is certified to meet the values listed in the tables below:

GCL PROPERTY SPECIFICATIONS FOR BENTOMAT SDN

Test Method	Test Method Property	Test Frequency	Certified Value
ASTM D 5891	Bentonite Fluid Loss	1 per 50 Tons	18 ml Max
ASTM D 5993	Bentonite Mass/Area	40,000 sq ft (4000 sq m)	0.75 lb /sq ft Min
ASTM D 5890	Bentonite Swell Index	1 per 50 Tons	24 ml/2g Min
ASTM D 6768	GCL Grab Strength	200,000 sq ft (20,000 sq m)	30 lbs/in typ, 25 lbs/in MARV
ASTM D 6243	GCL Hydrated Internal Shear Strength	Periodic	500 psf typ @ 200 psf normal load
ASTM D 5887	GCL Hydraulic Conductivity	Weekly	5.0E-9 cm/s Max
ASTM D 5887	GCL Index Flux	Weekly	1.0E-8 m3/m2/s Max
ASTM D 6496	GCL Peel Strength	40,000 sq ft (4000 sq m)	3.0 lbs/in Min

SPECIALLY REQUESTED CERTIFIED PROPERTIES FOR THIS ORDER OF BENTOMAT SDN

Test Method	Test Method Property	Requested Frequency	Requested Value	Requested Conditions
ASTM D 5887	GCL Hydraulic Conductivity	1/270,000 sqft	5.0E-9 cm/s Max	Standard
ASTM D 6768	GCL Grab Strength	Standard	30 lbs/in	Standard
ASTM D 6496	GCL Peel Strength	Standard	5.3 lbs/in	Standard

Bentonite property tests are performed at a bentonite processing facility before shipment to CETCO's production facility. All tensile testing is in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

NEEDLE DETECTION AND REMOVAL PROCEDURE

CETCO hereby affirms that all Bentomat® geosynthetic clay liner material manufactured for this project is continually passed under a magnet for needle removal and then screened with a metal detection device. CETCO certifies Bentomat® to be essentially free of broken needles and fragments of needles that would negatively effect the performance of the final product.

Roger B. Wilkerson
Quality Assurance Coordinator

GCL PACKING LIST AND MQA TRACKING FORM

Listing of finished and raw materials used to produce certification package number 000299512

GCL								Geotextiles				Clay
LO-BENTOMAT SDN								N/W-WHITE			LO-N/W-BLK-DNLW-2.7	LO-CG 50
Order	**GCL Lot #**	**GCL Roll #**	**Length**	**Width**	**weight**	**sq ft**	**Roll # Tested**	**Cap Lot #**	**Cap Roll #**	**Roll # Tested**	**Base Roll #**	**Clay Lot #**
000299512	201345LO	254	150	14.5	2890	2175	254	2023105626			600040483	110613C
000299512	201345LO	255	150	14.5	2890	2175	254	2023105626			600040483	110613C
000299512	201345LO	256	150	14.5	2910	2175	254	2023105626			600040483	110613C
000299512	201345LO	257	150	14.5	2860	2175	254	2023105626			600040483	110613C
000299512	201345LO	258	150	14.5	2850	2175	254	2023105626			600040483	110613C
000299512	201345LO	259	150	14.5	2900	2175	254	2023105626			600040483	110613C
000299512	201345LO	260	150	14.5	2900	2175	254	2023105626			600040483	110613C
000299512	201345LO	261	150	14.5	2920	2175	254	2023105669			600040483	110613C
000299512	201345LO	262	150	14.5	2920	2175	254	2023105669			600040483	110613C
000299512	201345LO	263	150	14.5	2950	2175	254	2023105669			600040483	110613C
000299512	201345LO	264	150	14.5	2940	2175	254	2023105669			600040483	110613C
000299512	201345LO	265	150	14.5	2945	2175	254	2023105669			600040484	110613C
000299512	201345LO	266	150	14.5	2935	2175	254	2023105669			600040484	110613C
000299512	201345LO	267	150	14.5	2970	2175	254	2023105669			600040484	110613C
000299512	201345LO	268	150	14.5	2900	2175	254	2023105680			600040484	110613D
000299512	201345LO	269	150	14.5	2940	2175	254	2023105680			600040484	110613D
000299512	201345LO	270	150	14.5	2945	2175	254	2023105680			600040484	110613D
000299512	201345LO	271	150	14.5	2945	2175	254	2023105680			600040484	110613D
000299512	201345LO	272	150	14.5	2975	2175	272	2023105680			600040484	110613D
000299512	201345LO	273	150	14.5	2915	2175	272	2023105680			600040484	110613D
000299512	201345LO	274	150	14.5	2930	2175	272	2023105680			600040484	110613D
000299512	201345LO	275	150	14.5	2915	2175	272	2023105680			600040484	110613D
000299512	201345LO	276	150	14.5	2925	2175	272	2023105634			600040484	110613D
000299512	201345LO	277	150	14.5	2900	2175	272	2023105634			600040484	110613D
000299512	201345LO	278	150	14.5	2885	2175	272	2023105634			600040453	110613D
000299512	201345LO	279	150	14.5	2875	2175	272	2023105634			600040453	110613D
000299512	201345LO	280	150	14.5	2880	2175	272	2023105634			600040453	110613D
000299512	201345LO	281	150	14.5	2880	2175	272	2023105665			600040453	110613D
000299512	201345LO	282	150	14.5	2845	2175	272	2023105665			600040453	110613D
000299512	201345LO	283	150	14.5	2840	2175	272	2023105665			600040453	110613D

Order	GCL Lot #	GCL Roll #	Length	Width	weight	sq ft	Roll # Tested	Cap Lot #	Cap Roll #	Roll # Tested	Base Roll #	Clay Lot #
000299512	201345LO	284	150	14.5	2860	2175	272	2023105665			600040453	110613D
000299512	201345LO	285	150	14.5	2825	2175	272	2023105665			600040453	110613D
000299512	201345LO	286	150	14.5	2880	2175	272	2023105665			600040453	110613D
000299512	201345LO	287	150	14.5	2875	2175	272	2023105665			600040453	110613D
000299512	201345LO	288	150	14.5	2865	2175	272	2023105665			600040453	110613D
000299512	201345LO	289	150	14.5	2905	2175	272	2023105542			600040453	110613D
000299512	201345LO	290	150	14.5	2905	2175	290	2023105542			600040453	110613D
000299512	201345LO	291	150	14.5	2920	2175	290	2023105542			600040453	110613D
000299512	201345LO	292	150	14.5	2870	2175	290	2023105542			600040453	110613D
000299512	201345LO	293	150	14.5	2910	2175	290	2023105542			600040485	110613D
000299512	201345LO	294	150	14.5	2900	2175	290	2023105542			600040485	110613D
000299512	201345LO	295	150	14.5	2950	2175	290	2023105542			600040485	110613D
000299512	201345LO	296	150	14.5	2930	2175	290	2023105551			600040485	110613D
000299512	201345LO	297	150	14.5	2985	2175	290	2023105551			600040485	110613D
000299512	201345LO	298	150	14.5	2950	2175	290	2023105551			600040485	110613D
000299512	201345LO	299	150	14.5	2945	2175	290	2023105551			600040485	110613D
000299512	201345LO	300	150	14.5	2905	2175	290	2023105551			600040485	110613D
000299512	201345LO	301	150	14.5	2935	2175	290	2023105551			600040485	110613D
000299512	201345LO	302	150	14.5	2905	2175	290	2023105551			600040485	110613D
000299512	201345LO	303	150	14.5	2965	2175	290	2023105551			600040485	110613D
000299512	201345LO	304	150	14.5	2965	2175	290	2023105550			600040485	110613D
000299512	201345LO	305	150	14.5	2930	2175	290	2023105550			600040485	110613D
000299512	201345LO	306	150	14.5	2890	2175	290	2023105550			600040454	110613D
000299512	201345LO	307	150	14.5	2915	2175	290	2023105550			600040454	110613D
000299512	201345LO	308	150	14.5	2925	2175	308	2023105550			600040454	110613D
000299512	201345LO	309	150	14.5	2905	2175	308	2023105550			600040454	110613D
000299512	201345LO	310	150	14.5	2885	2175	308	2023105550			600040454	110613D
000299512	201345LO	311	150	14.5	2900	2175	308	2023105546			600040454	110613D
000299512	201345LO	312	150	14.5	2875	2175	308	2023105546			600040454	110613D
000299512	201345LO	313	150	14.5	2885	2175	308	2023105546			600040454	110613D
000299512	201345LO	314	150	14.5	2895	2175	308	2023105546			600040454	110613E
000299512	201345LO	315	150	14.5	2905	2175	308	2023105546			600040454	110613E
000299512	201345LO	316	150	14.5	2875	2175	308	2023105546			600040454	110613E
000299512	201345LO	317	150	14.5	2875	2175	308	2023105546			600040454	110613E
000299512	201345LO	318	150	14.5	2905	2175	308	2023105546			600040454	110613E
000299512	201345LO	319	150	14.5	2890	2175	308	2023105544			600040454	110613E
000299512	201345LO	320	150	14.5	2875	2175	308	2023105544			600040454	110613E
000299512	201345LO	321	150	14.5	2870	2175	308	2023105544			600040452	110613E

000299512	201345LO	322	150	14.5	2860	2175	308	2023105544			600040452	110613E
Order	**GCL Lot #**	**GCL Roll #**	**Length**	**Width**	**weight**	**sq ft**	**Roll # Tested**	**Cap Lot #**	**Cap Roll #**	**Roll # Tested**	**Base Roll #**	**Clay Lot #**
000299512	201345LO	323	150	14.5	2855	2175	308	2023105544			600040452	110613E
000299512	201345LO	324	150	14.5	2815	2175	308	2023105544			600040452	110613E
000299512	201345LO	325	150	14.5	2830	2175	308	2023105544			600040452	110613E
000299512	201345LO	326	150	14.5	2880	2175	326	2023105666			600040452	110613E
000299512	201345LO	327	150	14.5	2830	2175	326	2023105666			600040452	110613E
000299512	201345LO	328	150	14.5	2850	2175	326	2023105666			600040452	110613E
000299512	201345LO	329	150	14.5	2850	2175	326	2023105666			600040452	110613E
000299512	201345LO	330	150	14.5	2860	2175	326	2023105666			600040452	110613E
000299512	201345LO	331	150	14.5	2820	2175	326	2023105666			600040452	110613E
000299512	201345LO	332	150	14.5	2830	2175	326	2023105666			600040452	110613E
000299512	201345LO	333	150	14.5	2815	2175	326	2023105666			600040452	110613E
000299512	201345LO	334	150	14.5	2820	2175	326	2023105534			600040452	110613E
000299512	201345LO	335	150	14.5	2820	2175	326	2023105534			600040452	110613E
000299512	201345LO	336	150	14.5	2810	2175	326	2023105534			600040455	110613E
000299512	201345LO	337	150	14.5	2860	2175	326	2023105534			600040455	110613E
000299512	201345LO	338	150	14.5	2800	2175	326	2023105534			600040455	110613E
000299512	201345LO	339	150	14.5	2795	2175	326	2023105545			600040455	110613E
000299512	201345LO	340	150	14.5	2835	2175	326	2023105545			600040455	110613E
000299512	201345LO	341	150	14.5	2780	2175	326	2023105545			600040455	110613E
000299512	201345LO	342	150	14.5	2825	2175	326	2023105545			600040455	110613E
000299512	201345LO	345	280	14.5	2710	2175	326	2023105545			600040455	110613E
000299512	201346LO	346	150	14.5	2855	2175	346	2023105545			600040455	110613E
000299512	201346LO	347	150	14.5	2835	2175	346	2023105667			600040455	110613E
000299512	201346LO	348	150	14.5	2790	2175	346	2023105667			600040455	110613E
000299512	201346LO	349	150	14.5	2840	2175	346	2023105667			600040455	110613E
000299512	201346LO	350	150	14.5	2845	2175	346	2023105667			600040455	110613E
000299512	201346LO	351	150	14.5	2835	2175	346	2023105667			600040455	110613E
000299512	201346LO	352	150	14.5	2860	2175	346	2023105667			600040455	110613E
000299512	201346LO	353	150	14.5	2810	2175	346	2023105529			600040455	110613E
000299512	201346LO	354	150	14.5	2885	2175	346	2023105529			600040455	110613E
000299512	201346LO	355	150	14.5	2785	2175	346	2023105529			600040455	110613E
000299512	201346LO	356	150	14.5	2840	2175	346	2023105529			600040455	110613F
000299512	201346LO	357	150	14.5	2835	2175	346	2023105529			600040455	110613F
000299512	201346LO	358	150	14.5	2820	2175	346	2023105529			600040455	110613F
000299512	201346LO	359	150	14.5	2840	2175	346	2023105529			600040455	110613F
000299512	201346LO	360	150	14.5	2880	2175	346	2023105675			111113ANW1	110613F
000299512	201346LO	361	150	14.5	2850	2175	346	2023105675			111113ANW1	110613F

000299512	201346LO	362	150	14.5	2830	2175	346	2023105675			111113ANW1	110613F
000299512	201346LO	363	150	14.5	2870	2175	346	2023105675			111113ANW1	110613F
Order	**GCL Lot #**	**GCL Roll #**	**Length**	**Width**	**weight**	**sq ft**	**Roll # Tested**	**Cap Lot #**	**Cap Roll #**	**Roll # Tested**	**Base Roll #**	**Clay Lot #**
000299512	201346LO	364	150	14.5	2860	2175	364	2023105675			111113ANW1	110613F
000299512	201346LO	365	150	14.5	2840	2175	364	2023105675			111113ANW1	110613F
000299512	201346LO	366	150	14.5	2865	2175	364	2023105675			111113ANW1	110613F
000299512	201346LO	367	150	14.5	2860	2175	364	2023105675			111113ANW1	110613F
000299512	201346LO	368	150	14.5	2845	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	369	150	14.5	2850	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	370	150	14.5	2845	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	371	150	14.5	2845	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	372	150	14.5	2845	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	373	150	14.5	2865	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	374	150	14.5	2930	2175	364	2023105679			111113ANW1	110613F
000299512	201346LO	375	150	14.5	2880	2175	364	2023105678			111113ANW1	110613F
000299512	201346LO	376	150	14.5	2900	2175	364	2023105678			2022360428	110613F
000299512	201346LO	377	150	14.5	2910	2175	364	2023105678			2022360428	110613F
000299512	201346LO	378	150	14.5	2890	2175	364	2023105678			2022360428	110613F
000299512	201346LO	379	150	14.5	2875	2175	364	2023105678			2022360428	110613F
000299512	201346LO	380	150	14.5	2885	2175	364	2023105678			2022360428	110613F
000299512	201346LO	381	150	14.5	2855	2175	364	2023105678			2022360428	110613F
000299512	201346LO	382	150	14.5	2865	2175	382	2023118687			2022360428	110613F
000299512	201346LO	383	150	14.5	2845	2175	382	2023118687			2022360428	110613F
000299512	201346LO	384	150	14.5	2825	2175	382	2023118687			2022360428	110613F
000299512	201346LO	385	150	14.5	2860	2175	382	2023118687			2022360428	110613F
000299512	201346LO	386	150	14.5	2830	2175	382	2023118687			2022360428	110613F
000299512	201346LO	387	150	14.5	2850	2175	382	2023118687			2022360428	110613F
000299512	201346LO	388	150	14.5	2840	2175	382	2023118687			2022360428	110613F
000299512	201346LO	389	150	14.5	2825	2175	382	2023118687			2022360428	110613F
000299512	201346LO	390	150	14.5	2840	2175	382	2023118697			2022360428	110613F
000299512	201346LO	391	150	14.5	2805	2175	382	2023118697			2022360428	110613F
000299512	201346LO	392	150	14.5	2840	2175	382	2023118697			2022360430	110613F
000299512	201346LO	393	150	14.5	2800	2175	382	2023118697			2022360430	110613F
000299512	201346LO	394	150	14.5	2860	2175	382	2023118697			2022360430	110613F
000299512	201346LO	395	150	14.5	2845	2175	382	2023118697			2022360430	110613F
000299512	201346LO	396	150	14.5	2820	2175	382	2023118697			2022360430	110613F
000299512	201346LO	397	150	14.5	2810	2175	382	2023118697			2022360430	110613F
					Total sq ft:	**308850**	Total Number of Rolls Certified: **142**					

GCL MANUFACTURING QUALITY CONTROL TEST DATA

The following rolls in GCL certification package number 000299512 have been tested in our production facility lab.

Product	Lot # Tested	Roll # Tested	Mass Area	Grab Strength	Peel Strength 6496
		ASTM Test Method:	D 5993	D 6768	D 6496
		Required Value:	0.75 lb /sq ft Min	30 lbs/in MARV	5.3 lbs/in Min
LO-BENTOMAT SDN	201345LO	254	0.90	110.6	9.6
LO-BENTOMAT SDN	201345LO	272	0.92	110.6	8.9
LO-BENTOMAT SDN	201345LO	290	0.89	47.6	7.8
LO-BENTOMAT SDN	201345LO	308	0.91	47.6	8.6
LO-BENTOMAT SDN	201345LO	326	0.90	47.6	10.6
LO-BENTOMAT SDN	201346LO	346	0.91	43.7	11.4
LO-BENTOMAT SDN	201346LO	364	0.94	43.7	10.2
LO-BENTOMAT SDN	201346LO	382	0.97	43.7	9.8

modified ASTM D 4632 using 4 inch grips.

BENTONITE CLAY CERTIFICATION

The Bentonite Clay used to produce package 000299512

has been tested by American Colloid Company and yielded the following test results.

Clay Lot #	Moist	Swell	Fluid Loss
ASTM Test Method:	D 2216	D 5890	D 5891
Required Value:	12% Max	24 ml/2g Min	18 ml Max
110613C	8.80	27.00	13.00
110613D	8.00	30.00	13.00
110613F	8.70	27.00	17.60

GEOTEXTILE TEST RESULTS FROM MATERIAL SUPPLIERS

The GCL in certification package number 000299512 was manufactured with geotextiles which were tested with the following results.

BASE GEOTEXTILE

Material	Roll Number	Mass Area oz/yd2	Grab Strength lbs
PT-NWBLACK	111113ANW1	3.9	117.2
PPX 311	2022360428	3.9	100.7
PPX 311	2022360430	3.9	100.7
SPS-NWB-311	600040452	3.6	111.0
SPS-NWB-311	600040453	3.6	111.0
SPS-NWB-311	600040454	3.5	112.0
SPS-NWB-311	600040455	3.5	112.0
SPS-NWB-65	600040483	6.2	208.0
SPS-NWB-65	600040484	6.2	208.0
SPS-NWB-65	600040485	6.6	255.0

COVER GEOTEXTILE

Material	Roll Number	Mass Area oz/yd2	Grab Strength lbs
PPX 650	2023105529	6.5	145.1
PPX 650	2023105534	6.7	147.0
PPX 650	2023105542	6.5	142.8
PPX 650	2023105544	6.5	140.8
PPX 650	2023105545	6.5	140.8
PPX 650	2023105546	6.5	140.8
PPX 650	2023105550	6.4	161.0
PPX 650	2023105551	6.4	161.0
PPX 650	2023105626	6.7	142.8
PPX 650	2023105634	6.4	155.7
PPX 650	2023105665	6.4	137.1
PPX 650	2023105666	6.4	137.1
PPX 650	2023105667	6.4	137.1
PPX 650	2023105669	6.3	145.8
PPX 650	2023105675	6.6	150.3
PPX 650	2023105678	6.7	148.8
PPX 650	2023105679	6.7	148.8
PPX 650	2023105680	6.7	148.8
PPX 650	2023118687	6.8	146.9
PPX 650	2023118697	6.1	134.0

Certifications from our suppliers are on file at our production facility.

An '*' or 'PT' indicates supplier certifications were unavailable prior to shipping so testing was performed at a CETCO lab.

November 18, 2013

Mail To:	**Bill To:**
Mr. Marat Goldenberg, P.E. **CETCO** 2870 Forbs Avenue Hoffman Estates, IL 60192 email: marat.goldenberg@cetco.com	**<= Same**

Dear Mr. Goldenberg

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Davidson County Landfill**
TRI Job Reference Number:	E2373-99-09
Material(s) Tested:	Two Bentomat SDN GCL(s)
Test(s) Requested:	Index Flux (ASTM D 5887)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

John M. Allen, P.E.
Division Director

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

GCL TEST RESULTS

TRI Client: CETCO
Project: Davidson County Landfill

Material: Bentomat DN GCL
TRI Log #: E2373-99-09

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.	PROJ. SPEC.
Index Flux (ASTM D 5887)													
Sample Identification: 254	Lot: 201345LO												
Index Flux ($m^3/m^2/sec$)	3.6E-09										**3.6E-09**		
Hydraulic Conductivity (cm/sec)	3.6E-09										**3.6E-09**		5.0E-09
Index Flux (ASTM D 5887)													
Sample Identification: 378	Lot: 201346LO												
Index Flux ($m^3/m^2/sec$)	3.3E-09										**3.3E-09**		
Hydraulic Conductivity (cm/sec)	2.8E-09										**2.8E-09**		5.0E-09

MD Machine Direction TD Transverse Direction NA Not Available

The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

GEOSYNTHETICS INVENTORY LOG
GEOSYNTHETIC CLAY LINER (GCL)

Project Name: Davidson County Phase 2, Area 2 Construction
Project Number: DAVDCO-12-3
Contractor: JT Russel & Sons, Inc. Storage Area:
Geosynthetics Installer: Chesapeake Containment Inventory Monitor(s): D. Wright/J. Buda

Geosynthetic Material Type: Geosynthetic Clay Liner (GCL)
Geosynthetic Product Identification: CETCO Bentomat SDN

Material		Material Dimensions		MQC Information?	CQA Conformance Sample No.	Remarks
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)			
254	201345LO	150	14.5	Y	Y	
255	201345LO	150	14.5	Y		
256	201345LO	150	14.5	Y		
257	201345LO	150	14.5	Y		
258	201345LO	150	14.5	Y		
259	201345LO	150	14.5	Y		
260	201345LO	150	14.5	Y		
261	201345LO	150	14.5	Y		
262	201345LO	150	14.5	Y		
263	201345LO	150	14.5	Y		
264	201345LO	150	14.5	Y		
265	201345LO	150	14.5	Y		
266	201345LO	150	14.5	Y		
267	201345LO	150	14.5	Y		
268	201345LO	150	14.5	Y		
269	201345LO	150	14.5	Y		
270	201345LO	150	14.5	Y		
271	201345LO	150	14.5	Y		
272	201345LO	150	14.5	Y		
273	201345LO	150	14.5	Y		
274	201345LO	150	14.5	Y		
275	201345LO	150	14.5	Y		
276	201345LO	150	14.5	Y		
277	201345LO	150	14.5	Y		
278	201345LO	150	14.5	Y		
279	201345LO	150	14.5	Y		
280	201345LO	150	14.5	Y		
281	201345LO	150	14.5	Y		
282	201345LO	150	14.5	Y		
283	201345LO	150	14.5	Y		
284	201345LO	150	14.5	Y		
285	201345LO	150	14.5	Y		
286	201345LO	150	14.5	Y		
287	201345LO	150	14.5	Y		

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
288	201345LO	150	14.5	Y		
289	201345LO	150	14.5	Y		
290	201345LO	150	14.5	Y		
291	201345LO	150	14.5	Y		
292	201345LO	150	14.5	Y		
293	201345LO	150	14.5	Y		
294	201345LO	150	14.5	Y		
295	201345LO	150	14.5	Y		
296	201345LO	150	14.5	Y		
297	201345LO	150	14.5	Y		
298	201345LO	150	14.5	Y		
299	201345LO	150	14.5	Y	Y	
300	201345LO	150	14.5	Y		
301	201345LO	150	14.5	Y		
302	201345LO	150	14.5	Y		
303	201345LO	150	14.5	Y		
304	201345LO	150	14.5	Y		
305	201345LO	150	14.5	Y		
306	201345LO	150	14.5	Y		
307	201345LO	150	14.5	Y		
308	201345LO	150	14.5	Y		
309	201345LO	150	14.5	Y		
310	201345LO	150	14.5	Y		
311	201345LO	150	14.5	Y		
312	201345LO	150	14.5	Y		
313	201345LO	150	14.5	Y		
314	201345LO	150	14.5	Y		
315	201345LO	150	14.5	Y		
316	201345LO	150	14.5	Y		
317	201345LO	150	14.5	Y		
318	201345LO	150	14.5	Y		
319	201345LO	150	14.5	Y		
320	201345LO	150	14.5	Y		
321	201345LO	150	14.5	Y		
322	201345LO	150	14.5	Y		
323	201345LO	150	14.5	Y		
324	201345LO	150	14.5	Y		
325	201345LO	150	14.5	Y		
326	201345LO	150	14.5	Y		
327	201345LO	150	14.5	Y		
328	201345LO	150	14.5	Y		
329	201345LO	150	14.5	Y		
330	201345LO	150	14.5	Y		
331	201345LO	150	14.5	Y		
332	201345LO	150	14.5	Y		
333	201345LO	150	14.5	Y		

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
334	201345LO	150	14.5	Y		
335	201345LO	150	14.5	Y		
336	201345LO	150	14.5	Y		
337	201345LO	150	14.5	Y		
338	201345LO	150	14.5	Y		
339	201345LO	150	14.5	Y		
340	201345LO	150	14.5	Y		
341	201345LO	150	14.5	Y		
342	201345LO	150	14.5	Y		
345	201345LO	150	14.5	Y		
346	201346LO	150	14.5	Y	Y	
347	201346LO	150	14.5	Y		
348	201346LO	150	14.5	Y		
349	201346LO	150	14.5	Y		
350	201346LO	150	14.5	Y		
351	201346LO	150	14.5	Y		
352	201346LO	150	14.5	Y		
353	201346LO	150	14.5	Y		
354	201346LO	150	14.5	Y		
355	201346LO	150	14.5	Y		
356	201346LO	150	14.5	Y		
357	201346LO	150	14.5	Y		
358	201346LO	150	14.5	Y		
359	201346LO	150	14.5	Y		
360	201346LO	150	14.5	Y		
361	201346LO	150	14.5	Y		
362	201346LO	150	14.5	Y		
363	201346LO	150	14.5	Y		
364	201346LO	150	14.5	Y		
365	201346LO	150	14.5	Y		
366	201346LO	150	14.5	Y		
367	201346LO	150	14.5	Y		
368	201346LO	150	14.5	Y		
369	201346LO	150	14.5	Y		
370	201346LO	150	14.5	Y		
371	201346LO	150	14.5	Y		
372	201346LO	150	14.5	Y		
373	201346LO	150	14.5	Y		
374	201346LO	150	14.5	Y		
375	201346LO	150	14.5	Y		
376	201346LO	150	14.5	Y		
377	201346LO	150	14.5	Y		
378	201346LO	150	14.5	Y		
379	201346LO	150	14.5	Y		
380	201346LO	150	14.5	Y		
381	201346LO	150	14.5	Y		

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
382	201346LO	150	14.5	Y		
383	201346LO	150	14.5	Y		
384	201346LO	150	14.5	Y		
385	201346LO	150	14.5	Y		
386	201346LO	150	14.5	Y		
387	201346LO	150	14.5	Y		
388	201346LO	150	14.5	Y		
389	201346LO	150	14.5	Y		
390	201346LO	150	14.5	Y		
391	201346LO	150	14.5	Y	Y	
392	201346LO	150	14.5	Y		
393	201346LO	150	14.5	Y		
394	201346LO	150	14.5	Y		
395	201346LO	150	14.5	Y		
396	201346LO	150	14.5	Y		
397	201346LO	150	14.5	Y		

Totals:

Total Rolls:	142
Total Lots:	2
Total SF:	308,850

CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-04
LAB ID NO.: L13139-04-01
MATERIAL: CETCO BENTOMAT SDN
ROLL NO: 254

	SPECIMEN	TOTAL WT. AS REC'D grams	TOTAL WT. DRY grams	TOTAL WT. AS REC'D psf	TOTAL WT. DRY psf	WT. BACKING psf (1)	AS REC'D Bent Cont psf	DRY Bent Cont psf	MOISTURE CONTENT %	Bent Cont 12% m.c. psf
BENTONITE CONTENT ASTM D3776 & ASTM D5993	1	64.5	50.4	1.28	1.00	0.070	1.21	0.93	30	1.04
	2	69.7	54.6	1.38	1.08	0.070	1.31	1.01	29	1.13
	3	73.0	57.2	1.45	1.13	0.070	1.38	1.06	30	1.19
	4	53.0	41.0	1.05	0.81	0.070	0.98	0.74	32	0.83
	5	68.1	54.1	1.35	1.07	0.070	1.28	1.00	28	1.12
							AVERAGE:	**0.95**	**30**	**1.06**

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVG	STD
PEEL STRENGTH	D 6496	MD-lbs/in	12.2	13.2	17.8	12.4	14.5	**14.0**	2.05

* NOTES:1) Weight of carrier (geotextile) provided by CETCO spec. info: .

CHECKED BY: RO DATE: 12/11/13

\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVIDSON COUNTY MSWLF\[L13139-04-03 BENTOMAT SDN DAVIDSON COUNT L13139-04-01 12/11/13

CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-04
LAB ID NO.: L13139-04-02
MATERIAL: CETCO BENTOMAT SDN
ROLL NO: 299

	SPECIMEN	TOTAL WT. AS REC'D grams	TOTAL WT. DRY grams	TOTAL WT. AS REC'D psf	TOTAL WT. DRY psf	WT. BACKING psf (1)	AS REC'D Bent Cont psf	DRY Bent Cont psf	MOISTURE CONTENT %	Bent Cont 12% m.c. psf
BENTONITE CONTENT ASTM D3776 & ASTM D5993	1	58.7	46.8	1.16	0.93	0.070	1.09	0.86	27	0.96
	2	52.6	41.8	1.04	0.83	0.070	0.97	0.76	28	0.85
	3	52.0	41.4	1.03	0.82	0.070	0.96	0.75	28	0.84
	4	51.4	41.0	1.02	0.81	0.070	0.95	0.74	28	0.83
	5	54.7	42.8	1.08	0.85	0.070	1.01	0.78	30	0.87
							AVERAGE:	**0.78**	**28**	**0.87**

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVG	STD
PEEL STRENGTH	D 6496	MD-lbs/in	9.4	11.4	10.7	13.3	10.1	**11.0**	1.34

* NOTES:1) Weight of carrier (geotextile) provided by CETCO spec. info: .

CHECKED BY: RO DATE: 12/11/13

\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVIDSON COUNTY MSWLF\[L13139-04-03 BENTOMAT SDN DAVIDSON COUNT L13139-04-02 12/11/13

CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-04
LAB ID NO.: L13139-04-03
MATERIAL: CETCO BENTOMAT SDN
ROLL NO: 346

	SPECIMEN	TOTAL WT. AS REC'D grams	TOTAL WT. DRY grams	TOTAL WT. AS REC'D psf	TOTAL WT. DRY psf	WT. BACKING psf (1)	AS REC'D Bent Cont psf	DRY Bent Cont psf	MOISTURE CONTENT %	Bent Cont 12% m.c. psf
BENTONITE CONTENT ASTM D3776 & ASTM D5993	1	63.2	50.6	1.25	1.00	0.070	1.18	0.93	27	1.05
	2	48.6	38.5	0.96	0.76	0.070	0.89	0.69	29	0.78
	3	60.2	47.6	1.19	0.94	0.070	1.12	0.87	29	0.98
	4	58.7	46.9	1.16	0.93	0.070	1.09	0.86	27	0.96
	5	64.8	51.3	1.29	1.02	0.070	1.22	0.95	28	1.06
							AVERAGE:	**0.86**	**28**	**0.97**

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVG	STD
PEEL STRENGTH	D 6496	MD-lbs/in	14.0	15.3	11.7	14.8	14.1	**14.0**	1.22

* NOTES:1) Weight of carrier (geotextile) provided by CETCO spec. info: .

CHECKED BY: RO DATE: 12/11/13

\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVIDSON COUNTY MSWLF\[L13139-04-03 BENTOMAT SDN DAVIDSON COUNT L13139-04-03 12/11/13

CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-04
LAB ID NO.: L13139-04-04
MATERIAL: CETCO BENTOMAT SDN
ROLL NO: 391

	SPECIMEN	TOTAL WT. AS REC'D grams	TOTAL WT. DRY grams	TOTAL WT. AS REC'D psf	TOTAL WT. DRY psf	WT. BACKING psf (1)	AS REC'D Bent Cont psf	DRY Bent Cont psf	MOISTURE CONTENT %	Bent Cont 12% m.c. psf
BENTONITE CONTENT ASTM D3776 & ASTM D5993	1	75.2	59.9	1.49	1.19	0.070	1.42	1.12	27	1.25
	2	60.6	48.3	1.20	0.96	0.070	1.13	0.89	27	0.99
	3	66.0	51.8	1.31	1.03	0.070	1.24	0.96	29	1.07
	4	72.8	58.1	1.44	1.15	0.070	1.37	1.08	27	1.21
	5	67.7	54.0	1.34	1.07	0.070	1.27	1.00	27	1.12
							AVERAGE:	**1.01**	**28**	**1.13**

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVG	STD
PEEL STRENGTH	D 6496	MD-lbs/in	11.6	10.8	13.2	10.0	10.0	**11.1**	1.21

* NOTES:1) Weight of carrier (geotextile) provided by CETCO spec. info: .

CHECKED BY: RO DATE: 12/11/13

\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVIDSON COUNTY MSWLF\[L13139-04-03 BENTOMAT SDN DAVIDSON COUNT L13139-04-04 12/11/13

GCL INDEX FLUX & PERMEABILITY TEST

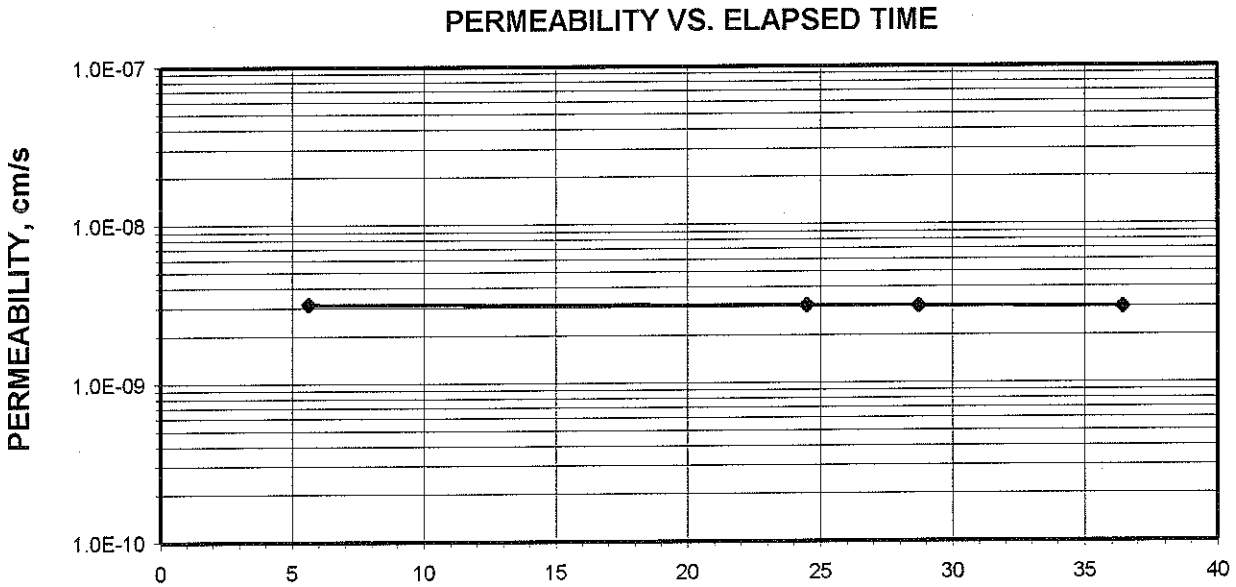
ASTM D 5887
(SOP-G52)

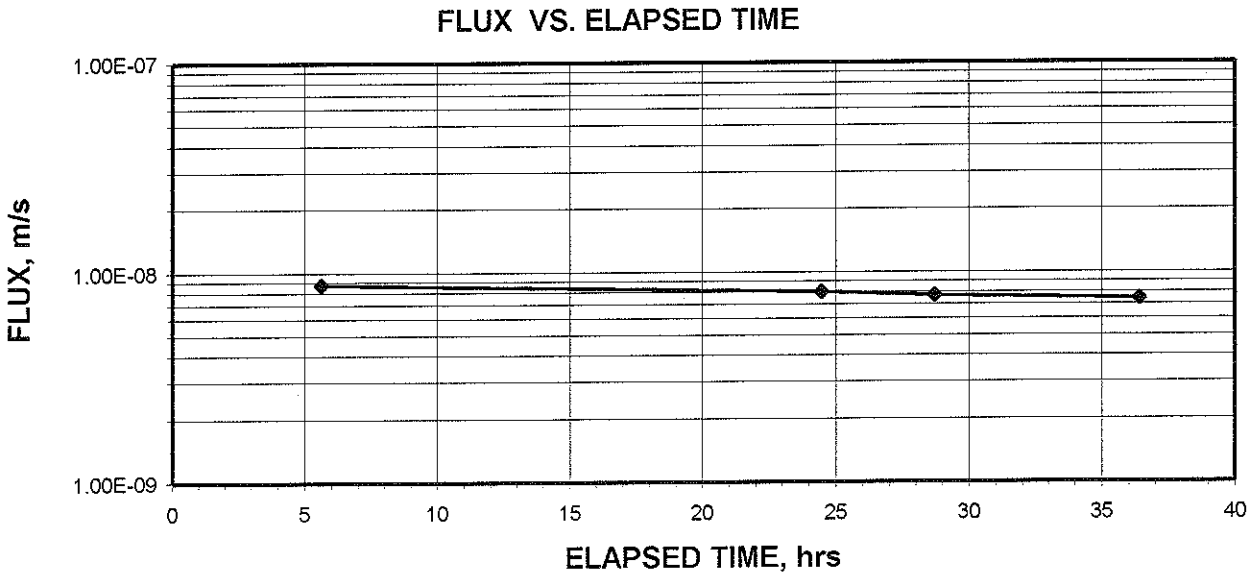
geotechnics
INTEGRITY IN TESTING

Lab ID No.	L13139-04-01	Material	CETCO BENTOMAT SDN
Client	SMITH GARDNER, INC.	Roll I.D.:	254
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Lot No.:	NA
		Sample No.	NA
Project No.	L13139-04		

AVERAGE FLUX = 7.76E-09 m/s

AVERAGE PERMEABILITY = 3.05E-09 cm/s @ 20°C





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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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INTEGRITY IN TESTING

Lab ID No.	L13139-04-01	Tested by: JO	Date: 12/12/13
Client	SMITH GARDNER, INC.		
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Checked by: BF	Date: 12-20-13
Project No.	L13139-04		
Material	CETCO BENTOMAT SDN		
Roll I.D.:	254		
Lot No.:	NA		
Sample No.	NA		

Permeant: DEAIRED, DEIONIZED WATER

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	85	93
Wt. of Tare & GCL[2] (gm.)	94.70	99.81
Wt. of Tare & Dry GCL [2] (gm.)	77.67	43.23
Wt. of Tare (gm.)	11.56	11.57
Wt. of Water (gm.)	17.03	56.58
Wt. of Dry GCL (gm.) [2]	66.11	31.66
GCL Moisture Content (%)	**25.8**	**178.7**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of GCL (gm.) [2]	38.57	85.48 (Calculated)
Clay Component Thickness 1 (in.) [1]	0.143	0.246
Clay Component Thickness 2 (in.) [1]	0.142	0.244
Clay Component Thickness 3 (in.) [1]	0.140	0.243
Average Clay Component Thickness (in.)	na	0.244
Average Clay Component Thickness (mm)	na	**6.206**
Specimen Dia. (in)	4.000	4.000
Specimen Area (in.^{2})	12.57	12.57
Specimen Area (m^2)	0.00811	0.00811
Mass/Unit Area of GCL(gm./m^2) [2]	4,756	10,540
Mass/Unit Area of GCL(psf) [2]	0.97	2.16
Mass/Unit Area of Dry GCL(gm./m^2) [2]	3,782	
Mass/Unit Area of Dry GCL(psf) [2]	0.77	

*NOTES: 1) Direct visual measurement of exposed clay at specimen perimeter.
2) Includes weight of the textile carriers.

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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INTEGRITY IN TESTING

Lab ID No.	L13139-04-01
Client	SMITH GARDNER, INC.
Client Project	DAVIDSON COUNTY MSWLF
Project No.	PHASE 2 - AREA 2 - CELL 1
Material	CETCO BENTOMAT SDN
Roll I.D.:	254
Sample No.	NA

Pressure Heads (Constant)

Top Cap (psi)	75.0
Bottom Cap (psi)	77.0
Cell (psi)	80.0
Total Head (cm)	140.6

Final Sample Dimensions

Sample Length (cm), L	0.621
Sample Diameter (cm)	10.16
Sample Area (cm^2), A	**78.50**
Inflow Burette Area (cm^2), a-in	0.856
Outflow Burette Area (cm^2), a-out	0.855

AVERAGE FLUX = 7.76E-09 m/s
AVERAGE PERMEABILITY = 3.05E-09 cm/s @ 20oC

DATE (m-d-y)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	RATIO ΔIN/ΔOUT (3 readings)	TOTAL HEAD h (cm)	TEMP. (°C)	INCREMENTAL FLUX @ 20°C (m/sec)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
12/18/13	0.0	0.0	0.0	NA	168.7	20.1	NA	NA
12/18/13	5.6	1.4	1.4	NA	165.5	21.0	8.79E-09	3.18E-09
12/19/13	24.5	5.7	5.7	1.00	155.5	20.2	8.07E-09	3.10E-09
12/19/13	28.7	6.7	6.6	1.01	153.3	20.6	7.73E-09	3.05E-09
12/19/13	36.4	8.3	8.2	1.04	149.5	20.7	7.47E-09	3.00E-09

Checked By: BF Date: 12-20-13

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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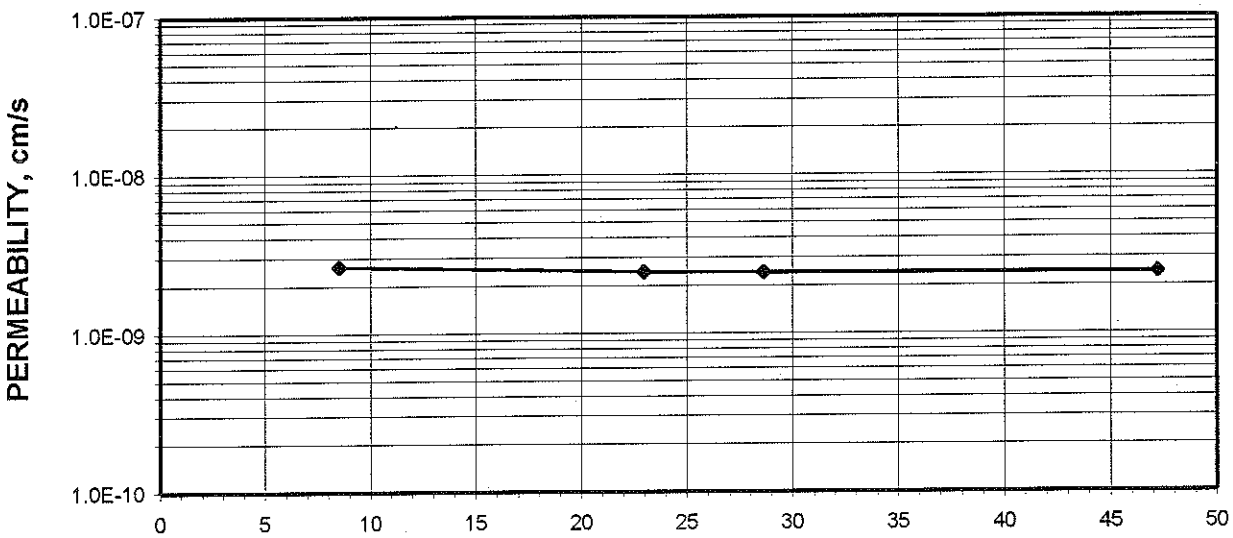
INTEGRITY IN TESTING

Lab ID No.	L13139-04-02	Material	CETCO BENTOMAT SDN
Client	SMITH GARDNER, INC.	Roll I.D.:	299
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Lot No.:	NA
		Sample No.	NA
Project No.	L13139-04		

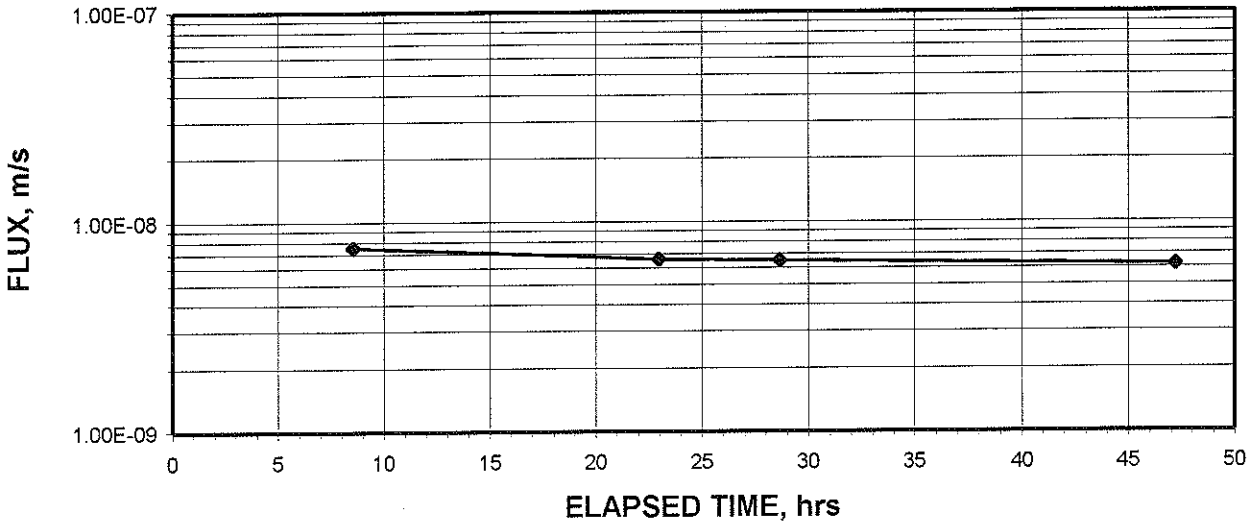
AVERAGE FLUX = 6.45E-09 m/s

AVERAGE PERMEABILITY = 2.43E-09 cm/s @ 20°C

PERMEABILITY VS. ELAPSED TIME



FLUX VS. ELAPSED TIME



Checked By: BF Date: 12-20-13

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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INTEGRITY IN TESTING

Lab ID No.	L13139-04-02	Tested by: JO	Date: 12/12/13
Client	SMITH GARDNER, INC.		
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Checked by: BF	Date: 12-20-13
Project No.	L13139-04		
Material	CETCO BENTOMAT SDN		
Roll I.D.:	299		
Lot No.:	NA		
Sample No.	NA		

Permeant: DEAIRED, DEIONIZED WATER

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	78	67
Wt. of Tare & GCL[2] (gm.)	91.75	87.43
Wt. of Tare & Dry GCL [2] (gm.)	75.87	44.20
Wt. of Tare (gm.)	11.50	11.77
Wt. of Water (gm.)	15.88	43.23
Wt. of Dry GCL (gm.) [2]	64.37	32.43
GCL Moisture Content (%)	**24.7**	**133.3**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of GCL (gm.) [2]	39.60	74.11 (Calculated)
Clay Component Thickness 1 (in.) [1]	0.143	0.237
Clay Component Thickness 2 (in.) [1]	0.139	0.235
Clay Component Thickness 3 (in.) [1]	0.137	0.231
Average Clay Component Thickness (in.)	na	0.234
Average Clay Component Thickness (mm)	na	**5.952**
Specimen Dia. (in)	4.000	4.000
Specimen Area (in.^{2})	12.57	12.57
Specimen Area (m^2)	0.00811	0.00811
Mass/Unit Area of GCL(gm./m^2) [2]	4,883	9,138
Mass/Unit Area of GCL(psf) [2]	1.00	1.87
Mass/Unit Area of Dry GCL(gm./m^2) [2]	3,917	
Mass/Unit Area of Dry GCL(psf) [2]	0.80	

*NOTES: 1) Direct visual measurement of exposed clay at specimen perimeter.
2) Includes weight of the textile carriers.

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
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INTEGRITY IN TESTING

Lab ID No.	L13139-04-02
Client	SMITH GARDNER, INC.
Client Project	DAVIDSON COUNTY MSWLF
Project No.	PHASE 2 - AREA 2 - CELL 1
Material	CETCO BENTOMAT SDN
Roll I.D.:	299
Sample No.	NA

Pressure Heads (Constant)

Top Cap (psi)	75.0
Bottom Cap (psi)	77.0
Cell (psi)	80.0
Total Head (cm)	140.6

Final Sample Dimensions

Sample Length (cm), L	0.595
Sample Diameter (cm)	10.16
Sample Area (cm^2), A	**78.50**
Inflow Burette Area (cm^2), a-in	0.874
Outflow Burette Area (cm^2), a-out	0.853

AVERAGE FLUX = 6.45E-09 m/s
AVERAGE PERMEABILITY = 2.43E-09 cm/s @ 20oC

DATE (m-d-y)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	RATIO ΔIN/ΔOUT (3 readings)	TOTAL HEAD h (cm)	TEMP. (°C)	INCREMENTAL FLUX @ 20°C (m/sec)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
12/17/13	0.0	0.0	0.0	NA	168.6	20.3	NA	NA
12/17/13	8.5	1.9	1.8	NA	164.3	21.0	7.58E-09	2.65E-09
12/18/13	23.0	4.7	4.4	1.06	158.1	20.1	6.61E-09	2.44E-09
12/18/13	28.7	5.8	5.4	1.08	155.6	21.0	6.54E-09	2.43E-09
12/19/13	47.2	9.1	8.6	1.05	148.1	20.2	6.19E-09	2.42E-09

Checked By: BF Date: 12-20-13

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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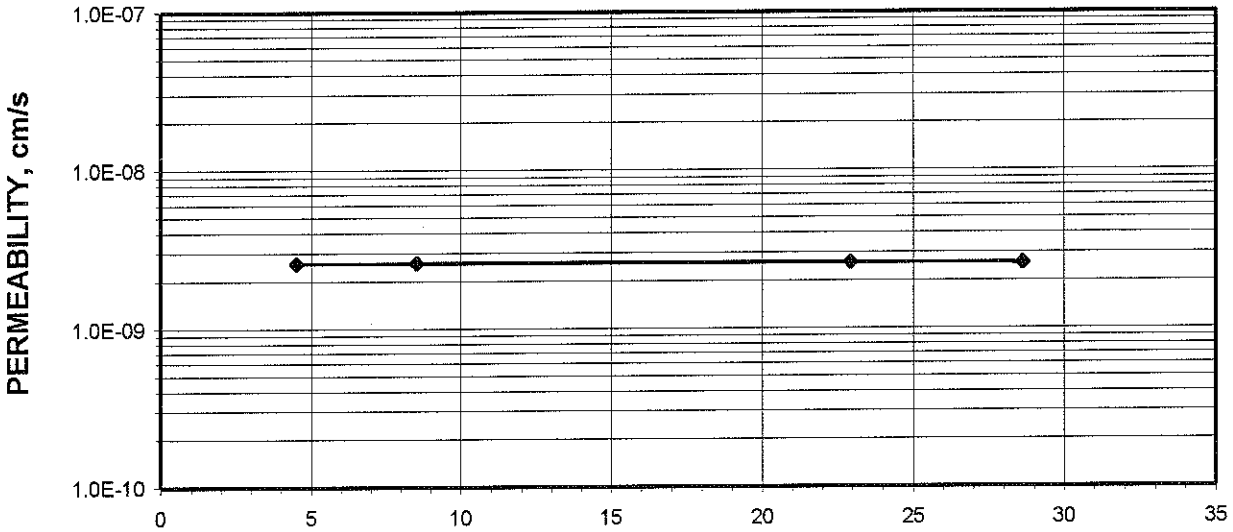
INTEGRITY IN TESTING

Lab ID No.	L13139-04-03	Material	CETCO BENTOMAT SDN
Client	SMITH GARDNER, INC.	Roll I.D.:	346
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Lot No.:	NA
		Sample No.	NA
Project No.	L13139-04		

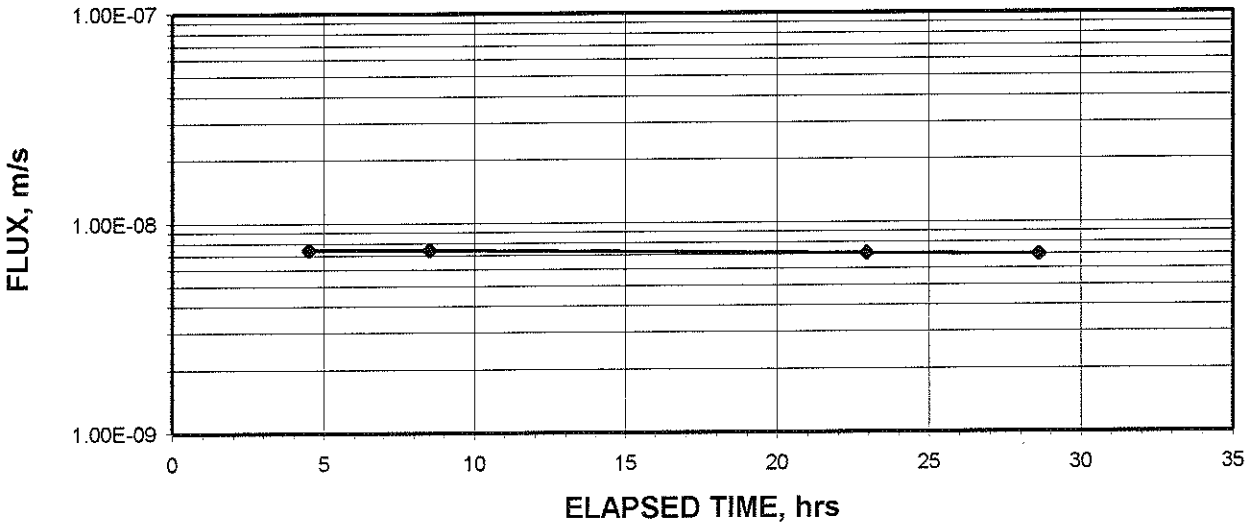
AVERAGE FLUX = 7.20E-09 m/s

AVERAGE PERMEABILITY = 2.61E-09 cm/s @ 20°C

PERMEABILITY VS. ELAPSED TIME



FLUX VS. ELAPSED TIME



Checked By: BF Date: 12-20-13

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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INTEGRITY IN TESTING

Lab ID No.	L13139-04-03	Tested by: JO	Date: 12/12/13
Client	SMITH GARDNER, INC.		
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Checked by: BF	Date: 12-20-13
Project No.	L13139-04		
Material	CETCO BENTOMAT SDN		
Roll I.D.:	346		
Lot No.:	NA		
Sample No.	NA		

Permeant: DEAIRED, DEIONIZED WATER

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	94	73
Wt. of Tare & GCL[2] (gm.)	80.20	92.86
Wt. of Tare & Dry GCL [2] (gm.)	66.15	47.70
Wt. of Tare (gm.)	11.62	11.69
Wt. of Water (gm.)	14.05	45.16
Wt. of Dry GCL (gm.) [2]	54.53	36.01
GCL Moisture Content (%)	**25.8**	**125.4**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of GCL (gm.) [2]	44.10	79.04 (Calculated)
Clay Component Thickness 1 (in.) [1]	0.144	0.236
Clay Component Thickness 2 (in.) [1]	0.143	0.233
Clay Component Thickness 3 (in.) [1]	0.141	0.231
Average Clay Component Thickness (in.)	na	0.233
Average Clay Component Thickness (mm)	na	**5.927**
Specimen Dia. (in)	4.000	4.000
Specimen Area (in.^{2})	12.57	12.57
Specimen Area (m^2)	0.00811	0.00811
Mass/Unit Area of GCL(gm./m^2) [2]	5,438	9,746
Mass/Unit Area of GCL(psf) [2]	1.11	2.00
Mass/Unit Area of Dry GCL(gm./m^2) [2]	4,324	
Mass/Unit Area of Dry GCL(psf) [2]	0.89	

*NOTES: 1) Direct visual measurement of exposed clay at specimen perimeter.
2) Includes weight of the textile carriers.

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

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INTEGRITY IN TESTING

Lab ID No.	L13139-04-03
Client	SMITH GARDNER, INC.
Client Project	DAVIDSON COUNTY MSWLF
Project No.	PHASE 2 - AREA 2 - CELL 1
Material	CETCO BENTOMAT SDN
Roll I.D.:	346
Sample No.	NA

Pressure Heads (Constant)

Top Cap (psi)	75.0
Bottom Cap (psi)	77.0
Cell (psi)	80.0
Total Head (cm)	140.6

Final Sample Dimensions

Sample Length (cm), L	0.593
Sample Diameter (cm)	10.16
Sample Area (cm^2), A	**78.50**
Inflow Burette Area (cm^2), a-in	0.871
Outflow Burette Area (cm^2), a-out	0.863

AVERAGE FLUX = 7.20E-09 m/s
AVERAGE PERMEABILITY = 2.61E-09 cm/s @ 20oC

DATE (m-d-y)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	RATIO ΔIN/ΔOUT (3 readings)	TOTAL HEAD h (cm)	TEMP. (°C)	INCREMENTAL FLUX @ 20°C (m/sec)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
12/17/13	0.0	0.0	0.0	NA	168.8	20.3	NA	NA
12/17/13	4.5	0.9	1.0	NA	166.6	20.9	7.47E-09	2.59E-09
12/17/13	8.5	1.8	1.8	1.00	164.6	21.0	7.49E-09	2.62E-09
12/18/13	22.9	4.7	4.7	1.03	157.9	20.1	7.12E-09	2.62E-09
12/18/13	28.6	5.9	5.8	1.01	155.3	21.0	7.00E-09	2.59E-09

Checked By: BF Date: 12-20-13

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GCL INDEX FLUX & PERMEABILITY TEST

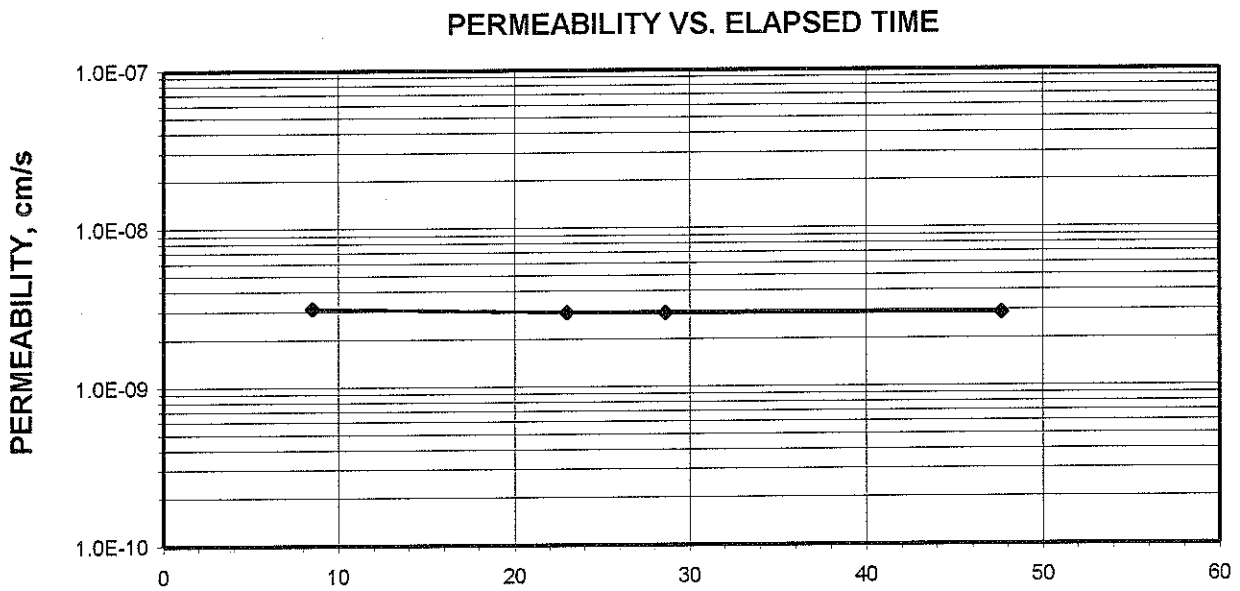
ASTM D 5887
(SOP-G52)

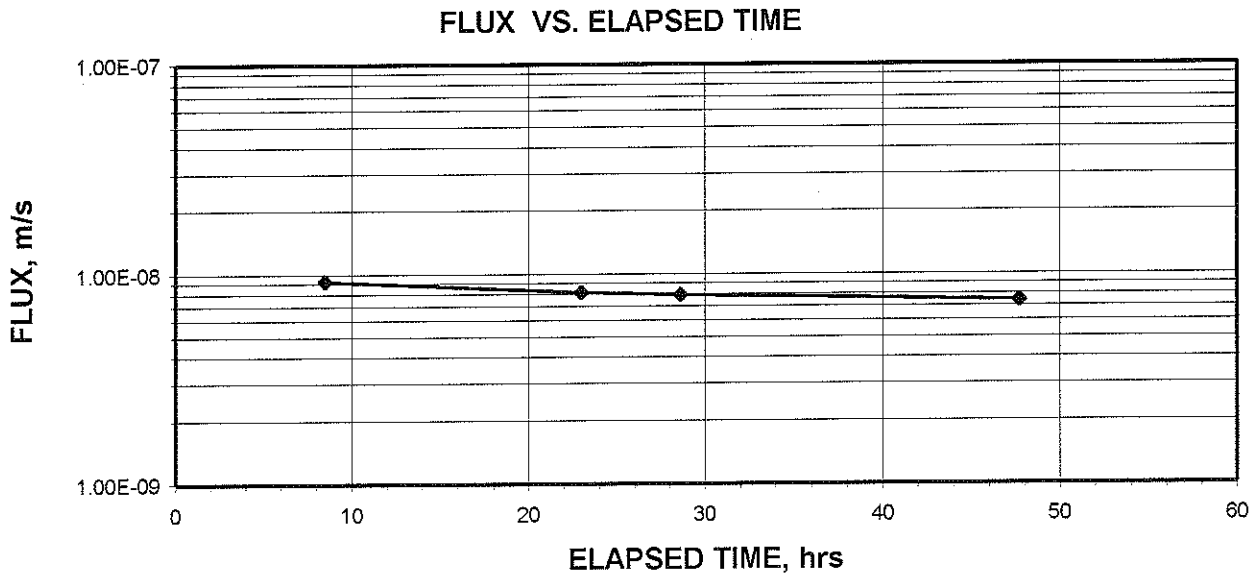
geotechnics
INTEGRITY IN TESTING

Lab ID No.	L13139-04-04	Material	CETCO BENTOMAT SDN
Client	SMITH GARDNER, INC.	Roll I.D.:	391
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Lot No.:	NA
		Sample No.	NA
Project No.	L13139-04		

AVERAGE FLUX = 7.88E-09 m/s

AVERAGE PERMEABILITY = 2.92E-09 cm/s @ 20°C





Checked By: BF Date: 12-20-13

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

geotechnics
INTEGRITY IN TESTING

Lab ID No.	L13139-04-04	Tested by: JO	Date: 12/12/13
Client	SMITH GARDNER, INC.		
Client Project	DAVIDSON COUNTY MSWLF PHASE 2 - AREA 2 - CELL 1	Checked by: BF	Date: 12-20-13
Project No.	L13139-04		
Material	CETCO BENTOMAT SDN		
Roll I.D.:	391		
Lot No.:	NA		
Sample No.	NA		

Permeant: DEAIRED, DEIONIZED WATER

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	90	73
Wt. of Tare & GCL[2] (gm.)	96.32	91.58
Wt. of Tare & Dry GCL [2] (gm.)	79.06	48.40
Wt. of Tare (gm.)	11.66	11.71
Wt. of Water (gm.)	17.26	43.18
Wt. of Dry GCL (gm.) [2]	67.40	36.69
GCL Moisture Content (%)	**25.6**	**117.7**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of GCL (gm.) [2]	46.25	80.15 (Calculated)
Clay Component Thickness 1 (in.) [1]	0.146	0.234
Clay Component Thickness 2 (in.) [1]	0.144	0.232
Clay Component Thickness 3 (in.) [1]	0.141	0.229
Average Clay Component Thickness (in.)	na	0.232
Average Clay Component Thickness (mm)	na	**5.884**
Specimen Dia. (in)	4.000	4.000
Specimen Area (in.^{2})	12.57	12.57
Specimen Area (m^2)	0.00811	0.00811
Mass/Unit Area of GCL(gm./m^2) [2]	5,703	9,883
Mass/Unit Area of GCL(psf) [2]	1.17	2.02
Mass/Unit Area of Dry GCL(gm./m^2) [2]	4,540	
Mass/Unit Area of Dry GCL(psf) [2]	0.93	

*NOTES: 1) Direct visual measurement of exposed clay at specimen perimeter.
2) Includes weight of the textile carriers.

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887
(SOP-G52)

geotechnics
INTEGRITY IN TESTING

Lab ID No.	L13139-04-04
Client	SMITH GARDNER, INC.
Client Project	DAVIDSON COUNTY MSWLF
Project No.	PHASE 2 - AREA 2 - CELL 1
Material	CETCO BENTOMAT SDN
Roll I.D.:	391
Sample No.	NA

Pressure Heads (Constant)

Top Cap (psi)	75.0
Bottom Cap (psi)	77.0
Cell (psi)	80.0
Total Head (cm)	140.6

Final Sample Dimensions

Sample Length (cm), L	0.588
Sample Diameter (cm)	10.16
Sample Area (cm^2), A	**78.50**
Inflow Burette Area (cm^2), a-in	0.825
Outflow Burette Area (cm^2), a-out	0.860

AVERAGE FLUX = 7.88E-09 m/s
AVERAGE PERMEABILITY = 2.92E-09 cm/s @ 20oC

DATE (m-d-y)	ELAPSED TIME t (hr)	TOTAL INFLOW (cm^3)	TOTAL OUTFLOW (cm^3)	RATIO ΔIN/ΔOUT (3 readings)	TOTAL HEAD h (cm)	TEMP. (°C)	INCREMENTAL FLUX @ 20°C (m/sec)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
12/17/13	0.0	0.0	0.0	NA	168.6	20.3	NA	NA
12/17/13	8.5	2.3	2.2	NA	163.4	21.0	9.26E-09	3.14E-09
12/18/13	23.0	5.7	5.5	1.03	155.6	20.1	8.19E-09	2.96E-09
12/18/13	28.6	6.9	6.8	1.01	152.6	21.0	7.96E-09	2.91E-09
12/19/13	47.7	11.1	10.7	1.04	143.2	20.2	7.48E-09	2.90E-09

Checked By: BF Date: 12-20-13

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Appendix K

Geomembrane CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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cust:	Chesapeake Containment Systems	doc	23782
PO#:	13-155 Davidson Cty LF		
Dest:	Thomasville, NC		

31 rolls 60 HD micro (505)

English Dimensions

WE wrap & send to Geotechnics using Smith&Gard's UPS GROUND 6476W9 >> "DAVDCO-12-3" in reference

roll #	wid	len	area	check weld rod qty (if ordered)				wgt		resin lot #
G13F476080	23	505	11,615.0	60HD	micro	31tot	1	3520	1ft conf	H8232876
G13F477081	23	505	11,615.0	60HD	micro	31tot	2	3520		H8232876
G13F477082	23	505	11,615.0	60HD	micro	31tot	3	3525		H8232876
G13F477083	23	505	11,615.0	60HD	micro	31tot	4	3532		H8232876
G13F477084	23	505	11,615.0	60HD	micro	31tot	5	3516		H8232876
G13F477085	23	505	11,615.0	60HD	micro	31tot	6	3532		H8232876
G13F477086	23	505	11,615.0	60HD	micro	31tot	7	3529		H8232876
G13F477087	23	505	11,615.0	60HD	micro	31tot	8	3528		H8232876
G13F477088	23	505	11,615.0	60HD	micro	31tot	9	3530	1ft conf	H8232876
G13F477089	23	505	11,615.0	60HD	micro	31tot	10	3523		H8232876
G13F477090	23	505	11,615.0	60HD	micro	31tot	11	3523		H8232876
G13F477091	23	505	11,615.0	60HD	micro	31tot	12	3528		H8232876
G13F477092	23	505	11,615.0	60HD	micro	31tot	13	3528		H8232876
G13F477093	23	505	11,615.0	60HD	micro	31tot	14	3531		H8232876
G13F477094	23	505	11,615.0	60HD	micro	31tot	15	3529		H8232876
G13F481001	23	505	11,615.0	60HD	micro	31tot	16	3541		H8232876
G13F481002	23	505	11,615.0	60HD	micro	31tot	17	3511		H8232876
G13F481003	23	505	11,615.0	60HD	micro	31tot	18	3488	1ft conf	H8232876
G13F481004	23	505	11,615.0	60HD	micro	31tot	19	3485		H8232876
G13F481005	23	505	11,615.0	60HD	micro	31tot	20	3485		H8232859
G13F481006	23	505	11,615.0	60HD	micro	31tot	21	3487		H8232859
G13F481007	23	505	11,615.0	60HD	micro	31tot	22	3476		H8232859
G13F481008	23	505	11,615.0	60HD	micro	31tot	23	3472		H8232859
G13F481009	23	505	11,615.0	60HD	micro	31tot	24	3471		H8232859
G13F481010	23	505	11,615.0	60HD	micro	31tot	25	3468		H8232859
G13F481011	23	505	11,615.0	60HD	micro	31tot	26	3469	1ft conf	H8232859
G13F481012	23	505	11,615.0	60HD	micro	31tot	27	3467		H8232859
G13F481013	23	505	11,615.0	60HD	micro	31tot	28	3483		H8232859
G13F482014	23	505	11,615.0	60HD	micro	31tot	29			H8232859
G13F482015	23	505	11,615.0	60HD	micro	31tot	30			H8232859
G13F482016	23	505	11,615.0	60HD	micro	31tot	31			H8232859

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ROLL # G13F476080 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.36** mm	**53** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.59** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**28** mil
		Bottom			**35** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.31**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**152** ppi	**2540** psi
		TD	**29** N/mm	**164** ppi	**2734** psi
	Average Strength @ Break	MD	**36** N/mm	**205** ppi	**3420** psi
		TD	**33** N/mm	**186** ppi	**3106** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**470.0**
		TD		%	**573.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**226.8** N	**51.0** lbs
		TD		**209.1** N	**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**360.3** N	**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**564.9** N	**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/23/2013**
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ROLL # G13F477081 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.40** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.60** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.47** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**26** mil
		Bottom			**35** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.28**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**152** ppi	**2540** psi
		TD	**29** N/mm	**164** ppi	**2734** psi
	Average Strength @ Break	MD	**36** N/mm	**205** ppi	**3420** psi
		TD	**33** N/mm	**186** ppi	**3106** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**470.0**
		TD		%	**573.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**226.8** N	**51.0** lbs
		TD		**209.1** N	**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**360.3** N	**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**564.9** N	**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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ROLL # G13F477082 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.35** mm	**53** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.60** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**25** mil
		Bottom		**36** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.28**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**152** ppi	**2540** psi
		TD	**29** N/mm	**164** ppi	**2734** psi
	Average Strength @ Break	MD	**36** N/mm	**205** ppi	**3420** psi
		TD	**33** N/mm	**186** ppi	**3106** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**470.0**
		TD		%	**573.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**226.8** N		**51.0** lbs
		TD	**209.1** N		**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**360.3** N		**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**564.9** N		**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F477083 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.40** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.57** mm	**62** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**25** mil
		Bottom			**36** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.32**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**153** ppi	**2549** psi
		TD	**29** N/mm	**167** ppi	**2783** psi
	Average Strength @ Break	MD	**38** N/mm	**217** ppi	**3624** psi
		TD	**34** N/mm	**197** ppi	**3277** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**471.0**
		TD		%	**587.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**226.8** N	**51.0** lbs
		TD		**209.1** N	**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**360.3** N	**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**564.9** N	**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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ROLL # G13F477084 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.41** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.61** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.49** mm	**59** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**25** mil
		Bottom		**35** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.32**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**153** ppi	**2549** psi
		TD	**29** N/mm	**167** ppi	**2783** psi
	Average Strength @ Break	MD	**38** N/mm	**217** ppi	**3624** psi
		TD	**34** N/mm	**197** ppi	**3277** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD	%	**21.0**	
		TD	%	**15.0**	
	Average Elongation @Break	MD	%	**471.0**	
		TD	%	**587.0**	
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change		%	**-0.42**	
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**226.8** N	**51.0** lbs	
		TD	**209.1** N	**47.0** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**360.3** N	**81.0** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**564.9** N	**127.0** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

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ROLL # G13F477085 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.58** mm	**62** mil	Length	**153.926** m	**505** feet
	AVE	**1.47** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**27** mil
		Bottom			**35** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.32**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**153** ppi	**2549** psi
		TD	**29** N/mm	**167** ppi	**2783** psi
	Average Strength @ Break	MD	**38** N/mm	**217** ppi	**3624** psi
		TD	**34** N/mm	**197** ppi	**3277** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**471.0**
		TD		%	**587.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**226.8** N	**51.0** lbs
		TD		**209.1** N	**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**360.3** N	**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**564.9** N	**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/24/2013**
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ROLL # G13F477086 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.55** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**26** mil
		Bottom			**33** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.28**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**153** ppi	**2549** psi
		TD	**29** N/mm	**167** ppi	**2783** psi
	Average Strength @ Break	MD	**38** N/mm	**217** ppi	**3624** psi
		TD	**34** N/mm	**197** ppi	**3277** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**471.0**
		TD		%	**587.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**226.8** N	**51.0** lbs
		TD		**209.1** N	**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**360.3** N	**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**564.9** N	**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/24/2013**
Signature
Quality Control Department

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quality certificate

ROLL # G13F477087 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.38** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.52** mm	**60** mil	Length	**153.926** m	**505** feet
	AVE	**1.46** mm	**57** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**26** mil
		Bottom			**34** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.28**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**153** ppi	**2549** psi
		TD	**29** N/mm	**167** ppi	**2783** psi
	Average Strength @ Break	MD	**38** N/mm	**217** ppi	**3624** psi
		TD	**34** N/mm	**197** ppi	**3277** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**21.0**
		TD		%	**15.0**
	Average Elongation @Break	MD		%	**471.0**
		TD		%	**587.0**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**226.8** N	**51.0** lbs
		TD		**209.1** N	**47.0** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**360.3** N	**81.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**564.9** N	**127.0** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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ROLL # G13F477088 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.37** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.60** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.49** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**25** mil
		Bottom			**34** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.38**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**26** N/mm	**151** ppi	**2520** psi
		TD	**27** N/mm	**153** ppi	**2553** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3602** psi
		TD	**31** N/mm	**176** ppi	**2935** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**18.3**
		TD		%	**14.8**
	Average Elongation @Break	MD		%	**457.8**
		TD		%	**573.6**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**212.6** N	**47.8** lbs
		TD		**192.2** N	**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**373.8** N	**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**558.7** N	**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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ROLL # G13F477089 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.33** mm	**52** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.61** mm	**64** mil	Length	**153.926** m	**505** feet
	AVE	**1.47** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**26** mil
		Bottom		**34** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.38**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**26** N/mm	**151** ppi	**2520** psi
		TD	**27** N/mm	**153** ppi	**2553** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3602** psi
		TD	**31** N/mm	**176** ppi	**2935** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**18.3**
		TD		%	**14.8**
	Average Elongation @Break	MD		%	**457.8**
		TD		%	**573.6**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N	**47.8** lbs	
		TD	**192.2** N	**43.2** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N	**84.0** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N	**125.6** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

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ROLL # G13F477090 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.37** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.58** mm	**62** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**27** mil
		Bottom			**35** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.38**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**26** N/mm	**151** ppi	**2520** psi
		TD	**27** N/mm	**153** ppi	**2553** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3602** psi
		TD	**31** N/mm	**176** ppi	**2935** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**18.3**
		TD		%	**14.8**
	Average Elongation @Break	MD		%	**457.8**
		TD		%	**573.6**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**212.6** N	**47.8** lbs
		TD		**192.2** N	**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**373.8** N	**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**558.7** N	**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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ROLL # G13F477091 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.61** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.49** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**26** mil
		Bottom		**33** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.35**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**26** N/mm	**151** ppi	**2520** psi
		TD	**27** N/mm	**153** ppi	**2553** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3602** psi
		TD	**31** N/mm	**176** ppi	**2935** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**18.3**
		TD		%	**14.8**
	Average Elongation @Break	MD		%	**457.8**
		TD		%	**573.6**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N	**47.8** lbs	
		TD	**192.2** N	**43.2** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N	**84.0** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N	**125.6** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

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ROLL # G13F477092 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.38** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.59** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**26** mil
		Bottom		**34** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.35**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**26** N/mm	**151** ppi	**2520** psi
		TD	**27** N/mm	**153** ppi	**2553** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3602** psi
		TD	**31** N/mm	**176** ppi	**2935** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**18.3**
		TD		%	**14.8**
	Average Elongation @Break	MD		%	**457.8**
		TD		%	**573.6**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N	**47.8** lbs	
		TD	**192.2** N	**43.2** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N	**84.0** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N	**125.6** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

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ROLL # G13F477093 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.43** mm	**56** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.60** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.50** mm	**59** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**26** mil
		Bottom		**34** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.37**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**140** ppi	**2330** psi	
		TD	**27** N/mm	**155** ppi	**2584** psi	
	Average Strength @ Break	MD	**35** N/mm	**200** ppi	**3329** psi	
		TD	**32** N/mm	**184** ppi	**3064** psi	
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD			%	**17.8**
		TD			%	**14.2**
	Average Elongation @Break	MD			%	**448.6**
		TD			%	**576.9**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change				%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**212.6** N	**47.8** lbs	
		TD		**192.2** N	**43.2** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**373.8** N	**84.0** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**558.7** N	**125.6** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**		
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**		

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ROLL # G13F477094 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.46** mm	**57** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.60** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.52** mm	**60** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**34** mil
		Bottom			**36** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.37**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**140** ppi	**2330** psi
		TD	**27** N/mm	**155** ppi	**2584** psi
	Average Strength @ Break	MD	**35** N/mm	**200** ppi	**3329** psi
		TD	**32** N/mm	**184** ppi	**3064** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.8**
		TD		%	**14.2**
	Average Elongation @Break	MD		%	**448.6**
		TD		%	**576.9**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481001 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.41** mm	**56** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.59** mm	**63** mil	Length	**153.926** m	**505** feet
	AVE	**1.50** mm	**59** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**212** minutes
Asperity ASTM D7466	Average	Top			**26** mil
		Bottom			**34** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.33**
Carbon Black Content ASTM D4218	Range			%	**2.37**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**140** ppi	**2330** psi
		TD	**27** N/mm	**155** ppi	**2584** psi
	Average Strength @ Break	MD	**35** N/mm	**200** ppi	**3329** psi
		TD	**32** N/mm	**184** ppi	**3064** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.8**
		TD		%	**14.2**
	Average Elongation @Break	MD		%	**448.6**
		TD		%	**576.9**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481002 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.40** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.58** mm	**62** mil	Length	**153.926** m	**505** feet
	AVE	**1.50** mm	**59** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**34** mil
		Bottom		**35** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.44**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**140** ppi	**2330** psi
		TD	**27** N/mm	**155** ppi	**2584** psi
	Average Strength @ Break	MD	**35** N/mm	**200** ppi	**3329** psi
		TD	**32** N/mm	**184** ppi	**3064** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.8**
		TD		%	**14.2**
	Average Elongation @Break	MD		%	**448.6**
		TD		%	**576.9**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481003 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.38** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.55** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.47** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**26** mil
		Bottom		**33** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.44**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**140** ppi	**2330** psi
		TD	**27** N/mm	**155** ppi	**2584** psi
	Average Strength @ Break	MD	**35** N/mm	**200** ppi	**3329** psi
		TD	**32** N/mm	**184** ppi	**3064** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.8**
		TD		%	**14.2**
	Average Elongation @Break	MD		%	**448.6**
		TD		%	**576.9**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.42**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481004 **LOT #** H8232876 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.54** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.47** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**212** minutes
Asperity ASTM D7466	Average	Top		**25** mil
		Bottom		**33** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.33**
Carbon Black Content ASTM D4218	Range		%	**2.30**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**157** ppi	**2615** psi
		TD	**30** N/mm	**173** ppi	**2880** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3593** psi
		TD	**34** N/mm	**192** ppi	**3199** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD	%	**17.3**	
		TD	%	**14.6**	
	Average Elongation @Break	MD	%	**455.0**	
		TD	%	**562.4**	
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change		%	**-0.42**	
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N	**47.8** lbs	
		TD	**192.2** N	**43.2** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N	**84.0** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N	**125.6** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

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ROLL # G13F481005 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.33** mm	**52** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.54** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.44** mm	**57** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**27** mil
		Bottom			**34** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.30**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**157** ppi	**2615** psi
		TD	**30** N/mm	**173** ppi	**2880** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3593** psi
		TD	**34** N/mm	**192** ppi	**3199** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.3**
		TD		%	**14.6**
	Average Elongation @Break	MD		%	**455.0**
		TD		%	**562.4**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481006 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.40** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.53** mm	**60** mil	Length	**153.926** m	**505** feet
	AVE	**1.44** mm	**57** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**26** mil
		Bottom			**34** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.30**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**157** ppi	**2615** psi
		TD	**30** N/mm	**173** ppi	**2880** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3593** psi
		TD	**34** N/mm	**192** ppi	**3199** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.3**
		TD		%	**14.6**
	Average Elongation @Break	MD		%	**455.0**
		TD		%	**562.4**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481007 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.37** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.56** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.45** mm	**57** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**23** mil
		Bottom			**28** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.30**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**157** ppi	**2615** psi
		TD	**30** N/mm	**173** ppi	**2880** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3593** psi
		TD	**34** N/mm	**192** ppi	**3199** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.3**
		TD		%	**14.6**
	Average Elongation @Break	MD		%	**455.0**
		TD		%	**562.4**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481008 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.54** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.46** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**22** mil
		Bottom			**33** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.30**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**27** N/mm	**157** ppi	**2615** psi
		TD	**30** N/mm	**173** ppi	**2880** psi
	Average Strength @ Break	MD	**38** N/mm	**216** ppi	**3593** psi
		TD	**34** N/mm	**192** ppi	**3199** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**17.3**
		TD		%	**14.6**
	Average Elongation @Break	MD		%	**455.0**
		TD		%	**562.4**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**212.6** N		**47.8** lbs
		TD	**192.2** N		**43.2** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**373.8** N		**84.0** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**558.7** N		**125.6** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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ROLL # G13F481009 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.32** mm	**52** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.55** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.46** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**191** minutes
Asperity ASTM D7466	Average	Top		**27** mil
		Bottom		**36** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.28**
Carbon Black Content ASTM D4218	Range		%	**2.36**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**26** N/mm	**146** ppi	**2427** psi
	Average Strength @ Break	MD	**39** N/mm	**223** ppi	**3713** psi
		TD	**30** N/mm	**173** ppi	**2891** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**23.8**
		TD		%	**16.1**
	Average Elongation @Break	MD		%	**483.5**
		TD		%	**578.5**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**213.1** N		**47.9** lbs
		TD	**190.8** N		**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**392.8** N		**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**575.6** N		**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

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Destination Thomasville, NC

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ROLL # G13F481010 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.38** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.51** mm	**59** mil	Length	**153.926** m	**505** feet
	AVE	**1.45** mm	**57** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**26** mil
		Bottom			**34** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.36**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**26** N/mm	**146** ppi	**2427** psi
	Average Strength @ Break	MD	**39** N/mm	**223** ppi	**3713** psi
		TD	**30** N/mm	**173** ppi	**2891** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**23.8**
		TD		%	**16.1**
	Average Elongation @Break	MD		%	**483.5**
		TD		%	**578.5**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**213.1** N	**47.9** lbs
		TD		**190.8** N	**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**392.8** N	**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**575.6** N	**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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Destination Thomasville, NC

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ROLL # G13F481011 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.37** mm	**54** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.53** mm	**60** mil	Length	**153.926** m	**505** feet
	AVE	**1.47** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**191** minutes
Asperity ASTM D7466	Average	Top		**29** mil
		Bottom		**33** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.28**
Carbon Black Content ASTM D4218	Range		%	**2.36**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**26** N/mm	**146** ppi	**2427** psi
	Average Strength @ Break	MD	**39** N/mm	**223** ppi	**3713** psi
		TD	**30** N/mm	**173** ppi	**2891** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**23.8**
		TD		%	**16.1**
	Average Elongation @Break	MD		%	**483.5**
		TD		%	**578.5**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**213.1** N		**47.9** lbs
		TD	**190.8** N		**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**392.8** N		**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**575.6** N		**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

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ROLL # G13F481012 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.41** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.52** mm	**60** mil	Length	**153.926** m	**505** feet
	AVE	**1.46** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**28** mil
		Bottom			**35** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.28**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**26** N/mm	**146** ppi	**2427** psi
	Average Strength @ Break	MD	**39** N/mm	**223** ppi	**3713** psi
		TD	**30** N/mm	**173** ppi	**2891** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**23.8**
		TD		%	**16.1**
	Average Elongation @Break	MD		%	**483.5**
		TD		%	**578.5**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**213.1** N	**47.9** lbs
		TD		**190.8** N	**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**392.8** N	**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**575.6** N	**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

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ROLL # G13F481013 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.42** mm	**56** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.53** mm	**60** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**191** minutes
Asperity ASTM D7466	Average	Top		**32** mil
		Bottom		**35** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.28**
Carbon Black Content ASTM D4218	Range		%	**2.28**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**26** N/mm	**146** ppi	**2427** psi
	Average Strength @ Break	MD	**39** N/mm	**223** ppi	**3713** psi
		TD	**30** N/mm	**173** ppi	**2891** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**23.8**
		TD		%	**16.1**
	Average Elongation @Break	MD		%	**483.5**
		TD		%	**578.5**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**213.1** N		**47.9** lbs
		TD	**190.8** N		**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**392.8** N		**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**575.6** N		**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/25/2013**
Signature
Quality Control Department

agru america
quality control dept.

quality certificate

ROLL # G13F482014 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.40** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.57** mm	**62** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**191** minutes
Asperity ASTM D7466	Average	Top		**28** mil
		Bottom		**35** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.28**
Carbon Black Content ASTM D4218	Range		%	**2.33**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**25** N/mm	**143** ppi	**2381** psi
	Average Strength @ Break	MD	**36** N/mm	**208** ppi	**3472** psi
		TD	**31** N/mm	**179** ppi	**2984** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**20.1**
		TD		%	**16.2**
	Average Elongation @Break	MD		%	**460.1**
		TD		%	**563.8**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**213.1** N		**47.9** lbs
		TD	**190.8** N		**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**392.8** N		**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**575.6** N		**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs		**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs		**ONGOING**

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/26/2013**
Signature
Quality Control Department

agru america
quality control dept.

quality certificate

ROLL # G13F482015 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.54** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.49** mm	**59** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895				**191** minutes
Asperity ASTM D7466	Average	Top		**30** mil
		Bottom		**35** mil
Specific Gravity ASTM D792	Average	Density	g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min			**.28**
Carbon Black Content ASTM D4218	Range		%	**2.33**
Carbon Black Dispersion ASTM D5596	Category			**10 in Category 1**

Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**25** N/mm	**143** ppi	**2381** psi
	Average Strength @ Break	MD	**36** N/mm	**208** ppi	**3472** psi
		TD	**31** N/mm	**179** ppi	**2984** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD	%	**20.1**	
		TD	%	**16.2**	
	Average Elongation @Break	MD	%	**460.1**	
		TD	%	**563.8**	
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change		%	**-0.58**	
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD	**213.1** N	**47.9** lbs	
		TD	**190.8** N	**42.9** lbs	
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load		**392.8** N	**88.3** lbs	
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load		**575.6** N	**129.4** lbs	
ESCR ASTM D1693	Minumum Hrs w/o Failures		1500 Hrs	**CERTIFIED**	
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%		300 Hrs	**ONGOING**	

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/26/2013**
Signature
Quality Control Department

agru america
quality control dept.

quality certificate

ROLL # G13F482016 **LOT #** H8232859 **LINER TYPE** MICROSPIKE HD 60

		METRIC	ENGLISH		METRIC	ENGLISH
Thickness Measurement ASTM D5994 (Modified)	MIN	**1.39** mm	**55** mil	Thickness	**1.52 mm**	**60 mil**
	MAX	**1.56** mm	**61** mil	Length	**153.926** m	**505** feet
	AVE	**1.48** mm	**58** mil	Width	**7.01** m	**23** feet

OIT(Standard) ASTM D 3895					**191** minutes
Asperity ASTM D7466	Average	Top			**30** mil
		Bottom			**36** mil
Specific Gravity ASTM D792	Average	Density		g/cc	**.944**
MFI ASTM D1238 COND. E Grade **K307**	Melt Flow Index 190C/2160 g - g/10 min				**.28**
Carbon Black Content ASTM D4218	Range			%	**2.33**
Carbon Black Dispersion ASTM D5596	Category				**10 in Category 1**
Tensile Strength ASTM D6693 (2 inches / minute)	Average Strength @ Yield	MD	**24** N/mm	**136** ppi	**2264** psi
		TD	**25** N/mm	**143** ppi	**2381** psi
	Average Strength @ Break	MD	**36** N/mm	**208** ppi	**3472** psi
		TD	**31** N/mm	**179** ppi	**2984** psi
Tensile Elongation ASTM D6693 (2 inches / minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	MD		%	**20.1**
		TD		%	**16.2**
	Average Elongation @Break	MD		%	**460.1**
		TD		%	**563.8**
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional Change			%	**-0.58**
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	MD		**213.1** N	**47.9** lbs
		TD		**190.8** N	**42.9** lbs
Puncture Resistance FTMS 101 Method 2065 Modified	Average Peak Load			**392.8** N	**88.3** lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load			**575.6** N	**129.4** lbs
ESCR ASTM D1693	Minumum Hrs w/o Failures			1500 Hrs	**CERTIFIED**
Notched Constant Tensile Load ASTM D5397	Pass/Fail @ 30%			300 Hrs	**ONGOING**

Customer Chesapeake Containment Systems
PO 13-155 Davidson Cty LF
Destination Thomasville, NC

Date **11/26/2013**
Signature
Quality Control Department

CoA Date: 11/07/2013

Certificate of Analysis

Shipped To: AGRU AMERICA INC:GEORGETOWN
500 GARRISON RD
GEORGETOWN SC 29440
USA

Recipient: PALMER
Fax:

Delivery #: 88747400
PO #: 007844
Weight: 183700 LB
Ship Date: 11/07/2013
Package: BULK
Mode: Hopper Car
Car #: PSPX002448
Seal No: 316553

Product:
MARLEX POLYETHYLENE K307 BULK

Lot Number: H8232876

Property	Test Method	Value	Unit
Melt Index	ASTM D1238	0.33	g/10mi
HLMI Flow Rate	ASTM D1238	25	g/10mi
Density	D1505 or D4883	0.938	g/cm3
Pellet Count	P02.08.03	24	pel/g
Production Date		10/10/2013	

The data set forth herein have been carefully compiled by Chevron Phillips Chemical Company LP (CPChem).
However, there is no warranty of any kind, either expressed or implied, applicable to its use, and the user assumes all risk and liability in connection therewith.

Troy Griffin
Quality Systems Coordinator

For CoA questions contact Customer Service Representative at +1-832-813-4806

CoA Date: 11/07/2013

Certificate of Analysis

Shipped To: AGRU AMERICA INC:GEORGETOWN
500 GARRISON RD
GEORGETOWN SC 29440
USA

Recipient: PALMER
Fax:

Delivery #: 88747716
PO #: 007844
Weight: 180100 LB
Ship Date: 11/07/2013
Package: BULK
Mode: Hopper Car
Car #: PSPX006938
Seal No: 313694

Product:
MARLEX POLYETHYLENE K307 BULK

Lot Number: H8232859

Property	Test Method	Value	Unit
Melt Index	ASTM D1238	0.28	g/10mi
HLMI Flow Rate	ASTM D1238	21	g/10mi
Density	D1505 or D4883	0.936	g/cm3
Pellet Count	P02.08.03	27	pel/g
Production Date		10/07/2013	

The data set forth herein have been carefully compiled by Chevron Phillips Chemical Company LP (CPChem).
However, there is no warranty of any kind, either expressed or implied, applicable to its use, and the user assumes all risk and liability in connection therewith.

Troy Griffin
Quality Systems Coordinator

For CoA questions contact Customer Service Representative at +1-832-813-4806

Lili Cui, Ph.D., Geomembrane Technical Service & Applications Development
Room 154 PTC ■ Bartlesville, OK 74004■
918-661-1897 ■ cuil@cpchem.com ■ Fax: 918-662-2220 ■ www.cpchem.com

June 8, 2012

Grant Palmer
Agru America
500 Garrison Road
Georgetown, SC 29440

Dear Grant:

This letter is to report the final results of oven-aging and UV-aging tests (according to GRI-GM13 and GRI-GM17) on Agru America sheet samples that you provided to us in 2011. These tests were performed by CPChem's Materials Evaluation Laboratory in Bartlesville, OK. The tests were completed April 2012.

The GRI-GM13 (HDPE) and GRI-GM17 (LLDPE) durability tests were done according to the following procedures.

Test	Exposure	Method
HP-OIT	150 °C, 500 psi oxygen	D5885
Oven Aging	90 days, 85 °C	D5721
UV Aging	1600 UV hrs (Conditions were 20 hours UVA-340 at 75 °C followed by 4 hrs dark with condensation at 60 °C. Irradiance was 0.72 W/m^2 at 340 nm.)	D7238

Oven-Aging Results

Sample	Initial HP-OIT (min)	HP-OIT Value after Oven Aging (min)	% HP-OIT Retained	GRI-GM13 or GRI-GM17 % Retained Requirement
40 mil LLDPE Roll # 346550-11 from Marlex® 7104 Polyethylene Lot # CBC810430	659	572	**87**	60
60 mil HDPE Roll # 447108-11 from Marlex® K307 Polyethylene Lot # 71-1-1104	1136	994	**88**	80

UV-Aging Results

Sample	Initial HP-OIT (min)	HP-OIT Value after UV Aging (min)	% HP-OIT Retained	GRI-GM13 or GRI-GM17 % Retained Requirement
40 mil LLDPE Roll # 346550-11 from Marlex® 7104 Polyethylene Lot # CBC810430	659	449	**68**	35
60 mil HDPE Roll # 447108-11 from Marlex® K307 Polyethylene Lot # 71-1-1104	1136	924	**81**	50

According to these test results, the durability requirements are met.

If you have any questions, please call me at 918-661-1897.

Sincerely,

Lili Cui, Ph.D.
Geomembrane Technical Service & Applications Development

Any technical advice, recommendations, results, or analysis ("Information") contained herein, including, without limitation, Information as it may relate to the selection of a specific product ("Product") for your use and application, is given ***without warranty or guarantee*** *and is accepted at your sole risk. It is imperative that you test the Information (and Product, if applicable) to determine to your own satisfaction whether the Information (and Product, if applicable) are suitable for your intended use and application.* ***You expressly assume, and release Chevron Phillips Chemical Company, from all risk and liability, whether based in contract, tort or otherwise, in connection with the use of, or results obtained from, such Information (and Product, if applicable).***

Lili Cui, Polyethylene Tech Service and Applications Development
Room 154 PTC ■ Bartlesville, OK 74003■
918-977- 4685 ■ cuill@cpchem.com ■ Fax: 918-977-7599 ■ www.cpchem.com

July 10, 2013

Grant Palmer
Agru America
500 Garrison Road
Georgetown, SC 29440

Dear Grant:

Per your request for this information, there has been no change to the additive formulation specifications of Marlex® 7104 and Marlex® K307 polyethylene resins since GRI-GM13 and GRI-GM17 oven- and UV-aging testing was performed on Agru America sheet from these resins in December 2012.

If you have any questions, please call me at 918-977-4685.

Sincerely,

Lili Cui

Lili Cui, Ph.D.
Polyethylene Tech Service and Applications Development

Any technical advice, recommendations, results, or analysis ("Information") contained herein, including, without limitation, Information as it may relate to the selection of a specific product ("Product") for your use and application, is given ***without warranty or guarantee*** *and is accepted at your sole risk. It is imperative that you test the Information (and Product, if applicable) to determine to your own satisfaction whether the Information (and Product, if applicable) are suitable for your intended use and application.* ***You expressly assume, and release Chevron Phillips Chemical Company, from all risk and liability, whether based in contract, tort or otherwise, in connection with the use of, or results obtained from, such Information (and Product, if applicable).***

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GEOSYNTHETICS INVENTORY LOG
60-MIL HDPE GEOMEMBRANE (TEXTURED)

Project Name: Davidson County Phase 2, Area 2 Construction
Project Number: DAVDCO-12-3
Contractor: JT Russel & Sons, Inc. Storage Area:
Geosynthetics Installer: Chesapeake Containment Inventory Monitor(s): D. Wright/J. Buda

Geosynthetic Material Type: 60-Mil LLDPE Geomembrane (Textured)
Geosynthetic Product Identification: AGRU 60-mil Microspike

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
G13F476080	H8232876	505	23	Y	Y	
G13F476081	H8232876	505	23	Y		
G13F476082	H8232876	505	23	Y		
G13F476083	H8232876	505	23	Y		
G13F476084	H8232876	505	23	Y		
G13F476085	H8232876	505	23	Y		
G13F476086	H8232876	505	23	Y		
G13F476087	H8232876	505	23	Y		
G13F476088	H8232876	505	23	Y	Y	
G13F476089	H8232876	505	23	Y		
G13F476090	H8232876	505	23	Y		
G13F476091	H8232876	505	23	Y		
G13F476092	H8232876	505	23	Y		
G13F476093	H8232876	505	23	Y		
G13F476094	H8232876	505	23	Y		
G13F481001	H8232876	505	23	Y		
G13F481002	H8232876	505	23	Y		
G13F481003	H8232876	505	23	Y	Y	
G13F481004	H8232876	505	23	Y		
G13F481005	H8232859	505	23	Y		
G13F481006	H8232859	505	23	Y		
G13F481007	H8232859	505	23	Y		
G13F481008	H8232859	505	23	Y		
G13F481009	H8232859	505	23	Y		
G13F481010	H8232859	505	23	Y		
G13F481011	H8232859	505	23	Y	Y	
G13F481012	H8232859	505	23	Y		
G13F481013	H8232859	505	23	Y		
G13F481014	H8232859	505	23	Y		
G13F481015	H8232859	505	23	Y		
G13F481016	H8232859	505	23	Y		

Totals:

Total Rolls: 31
Total Lots: 2
Total SF: 360,065

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-02
LAB ID NO.: L13139-02-01
MATERIAL: 60 MIL HDPE MICROSPIKE
ROLL NO: G13F476080

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVE	STD
THICKNESS	D 5994	mils	56.6	57.7	59.9	60.1	60.2		
			58.7	59.1	60.1	60.0	59.7	**59.2**	1.15
DENSITY	D 1505	g/cc	0.9448	0.9446	0.9443			**0.9445**	0.0002
CARBON BLACK CONTENT	D 1603	%	2.22	2.20				**2.21**	0.008
CARBON BLACK DISPERSION	D 5596	CATEGORY	1	1	2	1	1		
			2	1	1	1	1		
TEAR RESISTANCE	D 1004	MD-lbs	58.6	56.3	56.4	54.6	53.9		
			52.9	54.8	51.7	56.0	51.8	**54.7**	2.09
		CD-lbs	52.9	54.2	51.3	52.4	52.7		
			61.0	52.7	53.7	57.4	59.4	**54.8**	3.14
TENSILE PROPERTIES	D 6693								
STRENGTH AT YIELD		MD-ppi	126	131	133	144	139	**135**	6.55
		CD-ppi	165	149	163	150	154	**156**	6.61
STRENGTH AT BREAK		MD-ppi	208	187	172	212	189	**194**	14.61
		CD-ppi	165	185	168	170	155	**168**	9.54
ELONGATION AT YIELD		MD%	20.1	19.1	20.2	19.1	19.1	**19.5**	0.52
Lo = 1.3"		CD%	14.7	15.2	12.8	14.7	15.2	**14.5**	0.89
ELONGATION AT BREAK		MD%	449	483	478	476	408	**459**	28.02
Lo = 2.0"		CD%	509	619	554	574	518	**555**	39.86

CHECKED BY: J-O DATE: 12-4-13

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-02
LAB ID NO.: L13139-02-02
MATERIAL: 60 MIL HDPE MICROSPIKE
ROLL NO: G13F477088

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVE	STD
THICKNESS	D 5994	mils	58.9	59.2	59.7	60.2	60.2		
			60.0	60.0	59.1	59.2	59.8	**59.6**	0.46
DENSITY	D 1505	g/cc	0.9439	0.9439	0.9438			**0.9439**	0.0001
CARBON BLACK CONTENT	D 1603	%	2.40	2.41				**2.40**	0.005
CARBON BLACK DISPERSION	D 5596	CATEGORY	1	1	1	1	1		
			1	1	1	1	1		
TEAR RESISTANCE	D 1004	MD-lbs	51.7	52.4	57.2	50.4	56.1		
			56.1	51.1	50.0	55.9	51.3	**53.2**	2.63
		CD-lbs	54.4	54.1	54.1	54.2	54.7		
			61.5	61.9	53.0	60.4	53.8	**56.2**	3.35
TENSILE PROPERTIES	D 6693								
STRENGTH AT YIELD		MD-ppi	123	130	133	129	130	**129**	3.14
		CD-ppi	134	137	146	153	140	**142**	6.63
STRENGTH AT BREAK		MD-ppi	196	203	225	172	164	**192**	21.93
		CD-ppi	177	164	146	172	164	**164**	10.64
ELONGATION AT YIELD		MD%	21.8	20.4	21.0	21.5	19.4	**20.8**	0.85
Lo = 1.3"		CD%	15.4	16.0	14.9	14.1	15.7	**15.2**	0.67
ELONGATION AT BREAK		MD%	500	502	476	456	469	**481**	17.86
Lo = 2.0"		CD%	589	556	477	564	569	**551**	38.57

CHECKED BY: J-O DATE: 12-4-13

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-02
LAB ID NO.: L13139-02-03
MATERIAL: 60 MIL HDPE MICROSPIKE
ROLL NO: G13F481003

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVE	STD
THICKNESS	D 5994	mils	58.7	58.9	59.2	59.0	60.1		
			60.0	59.2	59.0	58.4	58.9	**59.1**	0.51
DENSITY	D 1505	g/cc	0.9444	0.9441	0.9441			**0.9442**	0.0002
CARBON BLACK CONTENT	D 1603	%	2.20	2.22				**2.21**	0.009
CARBON BLACK DISPERSION	D 5596	CATEGORY	1	1	1	1	1		
			1	1	1	1	1		
TEAR RESISTANCE	D 1004	MD-lbs	51.8	51.8	54.4	51.1	50.7		
			59.2	52.2	49.9	53.8	56.0	**53.1**	2.68
		CD-lbs	54.1	49.6	56.3	49.2	49.9		
			58.9	58.4	54.4	50.6	60.7	**54.2**	4.05
TENSILE PROPERTIES	D 6693								
STRENGTH AT YIELD		MD-ppi	131	129	132	126	125	**129**	2.46
		CD-ppi	142	138	133	147	136	**139**	4.88
STRENGTH AT BREAK		MD-ppi	166	176	206	166	203	**183**	17.82
		CD-ppi	167	170	176	182	178	**175**	5.71
ELONGATION AT YIELD		MD%	19.6	19.1	20.9	18.4	22.2	**20.0**	1.35
Lo = 1.3"		CD%	13.8	14.1	15.2	13.8	15.2	**14.4**	0.65
ELONGATION AT BREAK		MD%	424	478	435	477	472	**457**	22.97
Lo = 2.0"		CD%	554	564	602	591	593	**581**	18.45

CHECKED BY: J.O DATE: 12-4-13

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-02
LAB ID NO.: L13139-02-04
MATERIAL: 60 MIL HDPE MICROSPIKE
ROLL NO: G13F481011

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVE	STD
THICKNESS	D 5994	mils	59.2	59.0	60.1	60.0	57.7		
			58.1	58.6	59.0	59.7	59.9	**59.1**	0.78
DENSITY	D 1505	g/cc	0.9441	0.9438	0.9436			**0.9438**	0.0002
CARBON BLACK CONTENT	D 1603	%	2.32	2.36				**2.34**	0.021
CARBON BLACK DISPERSION	D 5596	CATEGORY	1	1	1	1	1		
			1	1	1	1	1		
TEAR RESISTANCE	D 1004	MD-lbs	56.9	60.6	60.1	50.6	51.2		
			20.2	53.3	55.4	52.5	56.6	**51.7**	11.01
		CD-lbs	49.6	56.7	49.2	58.7	53.8		
			52.7	53.7	50.6	53.9	52.2	**53.1**	2.84
TENSILE PROPERTIES	D 6693								
STRENGTH AT YIELD		MD-ppi	124	136	135	130	142	**133**	6.09
		CD-ppi	152	138	149	144	136	**144**	6.47
STRENGTH AT BREAK		MD-ppi	170	180	222	186	236	**199**	25.74
		CD-ppi	172	168	176	190	165	**174**	8.65
ELONGATION AT YIELD		MD%	21.2	18.9	21.4	18.7	22.3	**20.5**	1.44
Lo = 1.3"		CD%	13.3	14.2	13.6	16.4	15.6	**14.6**	1.19
ELONGATION AT BREAK		MD%	443	503	447	485	415	**459**	31.46
Lo = 2.0"		CD%	587	601	597	638	585	**602**	19.16

CHECKED BY: J-O DATE: 12-4-13

\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVIDSON COUNTY MSWLF\[L13139-02-04 HDPE MICROS L13139-02-04 12/4/13

CHESAPEAKE
CONTAINMENT SYSTEMS, INC.

Davidson County

Closeout Submittal

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1. Compliance Letter

2. SUBGRADE ACCEPTANCE

3. QC Documentation

4. Tensiometer Certs

5. Installation Record Drawing

6. Job Photos

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CHESAPEAKE
CONTAINMENT SYSTEMS, INC.

March 25, 2014

J.T. Russell and Sons, Inc.
1721 US Highway 52 N
Albemarle, NC 28001

Project: Davidson County MSWLF Phase 2 Area 2 Cell 1

Attn: Nathan Russell

Chesapeake Containment Systems is pleased to present the attached record documentation for the Davidson County MSWLF Phase 2 Area 2 Cell 1 project.

We certify that the enclosed information is a compilation of our documentation for the project and that the installation was performed in accordance with the project specifications.

We further certify that all subgrade surface (surface quality only) was accepted by Chesapeake Containment Systems, Inc. prior to installation of Geosynthetics.

Included in this package are record copies of our field Quality Control, Installation records, and tensiometer certifications.

If you should require any additional information please do not hesitate to contact our office.

Thank you

Chesapeake Containment Systems, Inc.

Scott Perugia

Scott Perugia

352 Earls Road, Middle River, MD 21220 | 410.335.5886 Phone | 1.888.50.LINER (54637) Toll-Free | 443.303.1682 eFax | www.ccsliners.com

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CHESAPEAKE
CONTAINMENT SYSTEMS, INC.

SUBGRADE SURFACE ACCEPTANCE

Project Name: Davidson County Customer: J.T. Russell and Sons, Inc.

Project Number: I13-124 Date: 03-19-14

Location: Thomasville, NC Partial: _____ Final: ✔

This document only applies to the acceptability of surface conditions for installation of geosynthetic products. Chesapeake Containment Systems, Inc. does not accept responsibility for weather damage, compaction, elevation or moisture content, subsurface conditions, nor for the surface condition maintenance during deployment. Structural integrity of the subgrade and maintenance of these conditions are the responsibility of the Owner or Earthwork Contractor.

For Chesapeake Containment Systems, Inc.

Scott Perugia

Scott Perugia-Project Estimator

For Contractor/Owner/Inspector:

_____

_____

Acceptance Number: Final

Area Accepted: All Subgrade

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CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Field Trial Seam Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, Nc

Material: HDPE

60 mil Thickness

Project Seam Requirements

	Fusion:		Extrusion:
Peel:	90	Peel:	78
Shear:	120	Shear:	120

Sample #	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
				Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN / OUT					Shear (ppi)							
								1	2	3	4	5	1	2	3	4	5			
1	2/28/2014	16:00		15	DG	860/5		124 125	124 130	121 127			196	196	188			Pass	ED	S/S
2	2/28/2014	16:05		15	DG	860/5		134 130	131 131	129 128			195	196	196			Pass	ED	T/T
3	2/28/2014	15:56		11	HR	860/5		131 127	129 116	141 123			175	180	181			Pass	ED	S/S
4	2/28/2014	16:24		11	HR	860/5		123 137	109 106	112 121			191	188	189			Pass	ED	T/T
5	2/28/2014	17:20		10	FH	860/5		130 123	127 130	126 132			187	193	189			Pass	ED	S/S
6	2/28/2014	16:03		12	EA	860/5		125 123	124 126	122 125			190	193	191			Pass	ED	S/S
7	2/28/2014	16:10		12	EA	860/5		121 125	121 123	124 120			187	193	194			Pass	ED	T/T
8	3/1/2014	14:30		15	DG	860/5		132 127	136 128	134 132			194	191	195			Pass	ED	S/S
9	3/1/2014	14:29		15	DG	860/5		134 143	144 140	140 145			221	220	207			Pass	ED	T/T
10	3/1/2014	14:25		15	DG	860/5		144 129	156 167	150 153			230	238	238			Pass	ED	S/T
11	3/1/2014	14:31		11	HR	860/5		141 135	142 134	143 132			223	225	219			Pass	ED	S/S
12	3/1/2014	14:33		11	HR	860/5		145 139	147 121	152 137			173	178	180			Pass	ED	T/T

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Field Trial Seam Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, Nc

Material: HDPE

60 mil Thickness

Project Seam Requirements

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Shear:	120	Shear:	120

Sample #	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
				Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN / OUT					Shear (ppi)							
								1	2	3	4	5	1	2	3	4	5			
13	3/1/2014	14:30		10	FH	860/5		126 123	132 117	121 109			156	172	179			Pass	ED	S/S
14	3/1/2014	14:26		10	DG	860/5		125 134	126 126	129 124			175	173	171			Pass	ED	T/T
15	3/1/2014	17:58		33	DG	860/5		123 134	121 132	124 124			176	175	170			Pass	ED	S/T
16	3/1/2014	18:04		11	HR	860/5		130 131	125 128	130 121			173	176	175			Pass	ED	T/T
17	3/1/2014	18:09		11	HR	860/5		129 125	124 130	121 125			176	173	171			Pass	ED	S/S
18	3/1/2014	18:02		33	FH	860/5		126 127	123 127	127 122			181	177	176			Pass	ED	T/T
19	3/1/2014	18:06		33	FH	860/5		121 129	123 128	131 122			178	181	176			Pass	ED	S/S
20	3/1/2014	18:01		15	DG	860/5		125 134	123 127	124 122			181	178	183			Pass	ED	T/T
21	3/1/2014	18:04		15	DG	860/5		126 132	123 126	129 122			180	179	175			Pass	ED	T/T
22	3/2/2014	10:30		15	DG	860/5		140 132	156 134	130 131			207	207	209			Pass	ED	S/S
23	3/2/2014	10:35		15	DG	860/5		148 134	136 123	146 129			220	209	223			Pass	ED	T/T
24	3/2/2014	10:37		15	DG	860/5		126 132	131 126	133 128			195	196	200			Pass	ED	S/T

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Field Trial Seam Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, Nc

Material: HDPE

60 mil Thickness

Project Seam Requirements

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Shear:	120	Shear:	120

Sample #	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
				Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN / OUT					Shear (ppi)							
								1	2	3	4	5	1	2	3	4	5			
25	3/2/2014	10:55		33	FH	860/5		127 126	122 126	122 128			182	180	180			Pass	ED	S/S
26	3/2/2014	10:57		33	FH	860/5		126 136	136 129	124 126			156	168	173			Pass	ED	T/T
27	3/2/2014	15:38		11	HR	860/5		131 170	139 167	124 167			170	159	177			Pass	ED	S/S
28	3/2/2014	15:38		11	HR	860/5		141 141	136 143	119 138			169	171	170			Pass	ED	T/T
29	3/2/2014	19:05		11	HR	860/5		125 127	131 132	120 130			185	187	190			Pass	ED	T/T
30	3/2/2014	19:10		11	HR	860/5		132 130	113 126	130 123			185	186	194			Pass	ED	S/S
31	3/2/2014	19:08		33	FH	860/5		123 128	128 127	126 129			185	190	194			Pass	ED	S/S
32	3/2/2014	19:00		33	FH	860/5		126 120	117 112	123 124			160	163	149			Pass	ED	T/T
33	3/2/2014	19:05		15	DG	860/5		116 122	118 123	111 122			168	169	173			Pass	ED	S/S
34	3/2/2014	7:05		15	DG	860/5		125 128	122 126	126 121			166	169	149			Pass	ED	T/T
35	3/2/2014	19:10		15	DG	860/5		111 113	121 1191	114 120			161	153	151			Pass	ED	S/T
36	3/2/2014	22:03		11	HR	860/5		114 113	116 116	114 117			176	177	174			Pass	ED	S/S
37	3/2/2014	22:05		11	HR	860/5		106 114	119 119	112 114			176	170	160			Pass	ED	T/T

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Field Trial Seam Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, Nc

Material: HDPE

60 mil Thickness

Project Seam Requirements

	Fusion:		Extrusion:
Peel:	90	Peel:	78
Shear:	120	Shear:	120

Sample #	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
				Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN / OUT					Shear (ppi)							
								1	2	3	4	5	1	2	3	4	5			
38	3/2/2014	22:07		11	HR	860/5		121	123	120			154	148	165			Pass	ED	S/T
								101	121	114										
39	3/2/2014	22:11		15	DG	860/5		141	106	125			180	177	176			Pass	ED	S/S
								128	114	127										
40	3/2/2014	22:13		15	DG	860/5		116	117	116			154	164	154			Pass	ED	T/T
								113	121	119										
41	3/2/2014	8:07		15	DG	860/5		119	106	125			159	165	165			Pass	ED	S/T
								118	114	127										
42	3/2/2014	8:11		33	FH	860/5		117	117	116			146	149	166			Pass	ED	S/S
								100	115	115										
43	3/2/2014	8:31		33	FH	860/5		119	123	120			159	163	167			Pass	ED	T/T
								116	124	119										
44	3/2/2014	22:09		33	FH	860/5		122	101	110			168	162	157			Pass	ED	S/T
								125	106	113										
45	3/4/2014	8:07		6	EA		550/500	116	120	123			169	173	170			Pass	ED	T/T
46	3/4/2014	8:13		23	ER		550/500	132	135	129			151	156	155			Pass	ED	T/T
47	3/4/2014	8:09		3	MG		550/500	114	116	118			164	168	152			Pass	ED	T/T
48	3/4/2014	13:12		23	ER		550/500	123	139	126			147	150	149			Pass	ED	T/T
49	3/4/2014	13:06		3	MG		550/500	135	130	137			174	176	178			Pass	ED	T/T
50	3/4/2014	13:21		6	EA		550/500	110	121	119			176	165	174			Pass	ED	T/T
51	3/5/2014	7:48		3	MG		550/500	124	127	131			176	170	160			Pass	ED	T/T

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Field Trial Seam Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, Nc

Material: HDPE

60 mil Thickness

Project Seam Requirements

Fusion:		Extrusion:	
Peel:	90	Peel:	78
Shear:	120	Shear:	120

Sample #	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
				Machine	Operator	Temp/ Speed °F/fpm (or %max)	Barrel/ Preheat °F/°F	Peel (ppi) IN / OUT					Shear (ppi)							
								1	2	3	4	5	1	2	3	4	5			
52	3/5/2014	7:52		23	ER		550/500	131	130	127			180	178	176			Pass	ED	T/T
53	3/5/2014	8:00		6	EA		550/500	126	132	133			154	164	154			Pass	ED	T/T
54	3/5/2014	1:01		3	MG		550/500	134	127	125			176	182	180			Pass	ED	T/T
55	3/5/2014	12:56		6	EA		550/500	124	131	129			171	171	170			Pass	ED	T/T
56	3/5/2014	12:55		23	ER		550/500	126	129	131			172	170	165			Pass	ED	T/T

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CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Panel Placement Log

Project No.: I13-124
Project Name: Davidson Co LF
Project Start Date: 02/28/14
Project Location: Thomasville, Nc

Material: HDPE

Thickness: 60 mil

Date Deployed	Panel No.	Time Deployed	Panel Location	Roll No.	Width (FT)	Length (FT)	Area (SQ FT)
28-Feb	1	16:05	S Slope	1004	22.5	52	1170
28-Feb	2	16:10	S Slope	1004	22.5	53	1192.5
28-Feb	3	16:21	S Slope	1004	22.5	53	1192.5
28-Feb	4	16:25	S Slope	1004	22.5	53	1192.5
28-Feb	5	16:27	S Slope	1004	22.5	54	1215
28-Feb	6	16:29	S Slope	1004	22.5	55	1237.5
28-Feb	7	16:31	S Slope	1004	22.5	56	1260
28-Feb	8	16:35	S Slope	1004	22.5	56	1260
28-Feb	9	16:40	S Slope	1004	22.5	22	495
28-Feb	10	16:37	S Slope	7084	22.5	35	787.5
28-Feb	11	16:41	S Slope	7084	22.5	60	1350
28-Feb	12	16:44	S Slope	7084	22.5	60	1350
28-Feb	13	16:47	S Slope	7084	22.5	60	1350
28-Feb	14	16:51	S Slope	7084	22.5	60	1350
28-Feb	15	16:54	S Slope	7084	22.5	60	1350
28-Feb	16	16:57	S Slope	7084	22.5	60	1350
28-Feb	17	17:01	S Slope	7084	22.5	61	1372.5
28-Feb	18	17:16	W Slope	7089	22.5	36	810
28-Feb	19	17:29	W Slope	7089	22.5	24	540
28-Feb	20	17:32	S Slope	7089	22.5	32	720
28-Feb	21	17:34	S Slope	7089	22.5	19	427.5
28-Feb	22	18:00	S Slope	7089	22.5	62	1395
28-Feb	23	18:05	S Slope	7089	22.5	62	1395
28-Feb	24	18:09	S Slope	7089	22.5	63	1417.5
28-Feb	25	18:12	S Slope	7089	22.5	64	1440
28-Feb	26	18:14	S Slope	7089	22.5	65	1462.5
28-Feb	27	18:17	S Slope	7089	22.5	25	562.5
28-Feb	28	18:23	S Slope	2016	22.5	40	900
28-Feb	29	18:28	S Slope	2016	22.5	65	1462.5
28-Feb	30	18:31	S Slope	2016	22.5	65	1462.5

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Panel Placement Log

Project No.: I13-124
Project Name: Davidson Co LF
Project Start Date: 02/28/14
Project Location: Thomasville, Nc

Material: HDPE

Thickness: 60 mil

Date Deployed	Panel No.	Time Deployed	Panel Location	Roll No.	Width (FT)	Length (FT)	Area (SQ FT)
28-Feb	31	18:25	S Slope	2016	22.5	60	1350
28-Feb	32	18:39	S Slope	2016	10	32	320
1-Mar	33	14:18	FLOOR	2018	22.5	507	11407.5
1-Mar	34	14:25	FLOOR	7082	22.5	90	2025
1-Mar	35	15:00	FLOOR	7082	22.5	422	9495
1-Mar	36	15:09	FLOOR	7088	22.5	170	3825
1-Mar	37	15:15	FLOOR	7088	22.5	324	7290
1-Mar	38	15:20	FLOOR	1003	22.5	238	5355
1-Mar	39	15:30	FLOOR	1003	22.5	247	5557.5
1-Mar	40	15:43	FLOOR	7085	22.5	302	6795
1-Mar	41	16:10	FLOOR	7085	22.5	193	4342.5
1-Mar	42	16:12	FLOOR	2015	22.5	337	7582.5
1-Mar	43	16:30	FLOOR	2015	22.5	156	3510
1-Mar	44	16:40	FLOOR	1001	22.5	367	8257.5
1-Mar	45	17:10	FLOOR	1001	22.5	123	2767.5
1-Mar	46	17:16	FLOOR	1013	22.5	383	8617.5
1-Mar	47	17:30	FLOOR	1013	22.5	114	2565
1-Mar	48	17:45	FLOOR	6080	22.5	379	8527.5
1-Mar	49	18:05	FLOOR	6080	22.5	108	2430
1-Mar	50	18:15	FLOOR	1008	22.5	374	8415
1-Mar	51	18:25	FLOOR	1008	22.5	127	2857.5
1-Mar	52	6:31	FLOOR	1012	22.5	344	7740
1-Mar	53	19:24	FLOOR	1012	22.5	135	3037.5
1-Mar	54	19:30	FLOOR	2014	22.5	323	7267.5
1-Mar	55	19:45	FLOOR	2014	22.5	177	3982.5
1-Mar	56	19:55	FLOOR	7086	22.5	265	5962.5
2-Mar	57	10:40	N Slope	1009	22.5	141	3172.5
2-Mar	58	10:45	N Slope	1009	22.5	125	2812.5
2-Mar	59	10:55	N Slope	1009	22.5	112	2520
2-Mar	60	10:58	N Slope	7087	22.5	59	1327.5

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Panel Placement Log

Project No.: I13-124
Project Name: Davidson Co LF
Project Start Date: 02/28/14
Project Location: Thomasville, Nc

Material: HDPE

Thickness: 60 mil

Date Deployed	Panel No.	Time Deployed	Panel Location	Roll No.	Width (FT)	Length (FT)	Area (SQ FT)
2-Mar	61	11:01	N Slope	7087	22.5	41	922.5
2-Mar	62	11:06	N Slope	1009	22.5	18	405
2-Mar	63	11:07	N Slope	1009	5	13	65
2-Mar	64	11:15	N Slope	1011	22.5	163	3667.5
2-Mar	65	11:30	N Slope	1011	22.5	75	1687.5
2-Mar	66	11:39	N Slope	1011	22.5	75	1687.5
2-Mar	67	11:43	N Slope	1011	22.5	75	1687.5
2-Mar	68	12:00	N Slope	7081	22.5	75	1687.5
2-Mar	69	12:05	N Slope	7081	22.5	76	1710
2-Mar	70	12:10	N Slope	7081	22.5	77	1732.5
2-Mar	71	12:15	N Slope	7081	22.5	78	1755
2-Mar	72	12:17	N Slope	7081	22.5	79	1777.5
2-Mar	73	12:33	N Slope	7081	22.5	40	900
2-Mar	74	12:36	N Slope	7081	22.5	40	900
2-Mar	75	18:05	E Floor	1010	22.5	424	9540
2-Mar	76	18:10	E Floor	1010	22.5	71	1597.5
2-Mar	77	18:13	E Floor	7091	22.5	341	7672.5
2-Mar	78	18:20	E Floor	7091	22.5	147	3307.5
2-Mar	79	18:25	E Floor	7083	22.5	250	5625
2-Mar	80	18:34	E Floor	7083	22.5	242	5445
2-Mar	81	18:41	E Floor	7090	22.5	144	3240
2-Mar	82	19:22	E Floor	7090	22.5	191	4297.5
2-Mar	83	19:27	E Floor	1007	22.5	35	787.5
2-Mar	84	20:01	E Floor	1007	22.5	370	8325
2-Mar	85	20:01	E Floor	7092	22.5	114	2565
2-Mar	86	20:04	E Floor	7092	22.5	108	2430
2-Mar	87	20:10	E Floor	7092	22.5	100	2250
2-Mar	88	20:19	E Floor	1007	22.5	84	1890
2-Mar	89	20:26	E Floor	7089	22.5	179	4027.5
2-Mar	90	20:31	E Floor	7086	22.5	169	3802.5

Panel Placement Log

Project No.: I13-124
Project Name: Davidson Co LF
Project Start Date: 02/28/14
Project Location: Thomasville, Nc

Material: HDPE

Thickness: 60 mil

Date Deployed	Panel No.	Time Deployed	Panel Location	Roll No.	Width (FT)	Length (FT)	Area (SQ FT)
2-Mar	91	20:41	E Floor	7086	22.5	106	2385
2-Mar	92	20:43	E Floor	7086	22.5	21	472.5
2-Mar	93	20:45	E Floor	2016	22.5	33	742.5
2-Mar	94	20:47	E Floor	2016	22.5	92	2070
2-Mar	95	21:15	E Floor	1008	22.5	86	1935
2-Mar	96	21:13	E Floor	1008	22.5	17	382.5
2-Mar	97	21:16	E Floor	1008	22.5	42	945
2-Mar	98	21:18	E Floor	1008	22.5	32	720
2-Mar	99	21:22	E Floor	1006	22.5	10	225

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
2/28/14	1/2	16:21	DG	15	860	5	SOS	EOS	0+52	30	30	14:13	14:18	JR	4-Mar
2/28/14	2/3	16:34	DG	15	860	5	SOS	EOS	0+53	30	30	14:13	14:18	JR	4-Mar
2/28/14	3/4	16:42	DG	15	860	5	SOS	EOS	0+53	30	30	14:05	14:10	JR	4-Mar
2/28/14	4/5	17:00	DG	15	860	5	SOS	EOS	0+53	30	30	14:02	14:07	JR	4-Mar
2/28/14	5/6	16:10	HR	11	860	5	SOS	EOS	0+54	30	30	13:55	14:00	JR	4-Mar
2/28/14	6/7	16:52	HR	11	860	5	SOS	EOS	0+55	30	30	13:55	14:00	JR	4-Mar
2/28/14	7/8	17:06	HR	11	860	5	SOS	EOS	0+56	30	30	13:48	13:53	JR	4-Mar
2/28/14	8/10	17:36	HR	11	860	5	SOS	EOS	0+35	30	30	13:41	13:46	JR	4-Mar
2/28/14	8/9	17:53	HR	11	860	5	SOS	EOS	0+22	30	30	13:41	13:46	JR	4-Mar
2/28/14	9/10	17:23	HR	11	860	5	SOS	EOS	0+22	30	30	13:40	13:45	JR	4-Mar
2/28/14	10/11	17:53	HR	11	860	5	SOS	EOS	0+35	30	30	13:38	13:43	JR	4-Mar
2/28/14	9/11	17:48	HR	11	860	5	SOS	EOS	0+22	30	30	13:40	13:45	JR	4-Mar
2/28/14	11/12	18:05	HR	11	860	5	SOS	EOS	0+60	30	30	13:30	13:35	JR	4-Mar
2/28/14	12/13	18:19	HR	11	860	5	SOS	EOS	0+60	30	30	1:30	1:35	JR	4-Mar
2/28/14	13/14	17:26	FH	10	860	5	SOS	EOS	0+60	30	30	12:11	12:16	JR	4-Mar
2/28/14	14/15	17:11	FH	10	860	5	SOS	EOS	0+60	30	30	12:04	12:09	JR	4-Mar
2/28/14	15/16	17:56	FH	10	860	5	SOS	EOS	0+60	30	30	12:01	12:06	JR	4-Mar
2/28/14	16/17	18:07	FH	10	860	5	SOS	0+44	0+44	30	30	11:55	12:00	JR	4-Mar
2/28/14	16/17	18:15	FH	10	860	5	0+44	EOS	0+18	30	29	11:18	11:23	JR	4-Mar
2/28/14	18/19	17:20	DG	15	860	5	SOS	EOS	0+25	30	29	14:25	14:30	JR	4-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
2/28/14	19/21	17:52	DG	15	860	5	SOS	EOS	0+20	30	30	14:27	14:32	JR	4-Mar
2/28/14	20/21	17:47	DG	15	860	5	SOS	EOS	0+18	30	30	14:29	14:34	JR	4-Mar
2/28/14	1/20	17:36	DG	15	860	5	SOS	EOS	0+45	30	30	14:18	14:23	JR	4-Mar
2/28/14	18/20	18:01	DG	15	860	5	SOS	EOS	0+25	30	30	14:18	14:23	JR	4-Mar
2/28/14	19/20	17:56	DG	15	860	5	SOS	EOS	0+09	30	30	14:21	14:26	JR	4-Mar
2/28/14	17/22	18:21	FH	10	860	5	SOS	EOS	0+62	30	30	11:18	11:23	VT	4-Mar
2/28/14	22/23	18:40	FH	10	860	5	SOS	EOS	0+62	30	30	11:44	11:49	VT	4-Mar
2/28/14	23/24	18:11	DG	15	860	5	SOS	EOS	0+63	30	30	11:41	11:46	VT	4-Mar
2/28/14	24/25	18:25	DG	15	860	5	SOS	EOS	0+63	30	29	11:35	11:40	VT	4-Mar
2/28/14	25/26	18:42	DG	15	860	5	SOS	EOS	0+65	30	30	11:32	11:37	VT	4-Mar
2/28/14	26/27	19:10	DG	15	860	5	SOS	EOS	0+25	30	30	11:29	11:34	VT	4-Mar
2/28/14	26/28	19:02	DG	15	860	5	SOS	EOS	0+40	30	30	11:24	11:29	VT	4-Mar
2/28/14	27/28	18:39	HR	11	860	5	SOS	EOS	0+22	30	30	11:16	11:21	VT	4-Mar
2/28/14	27/29	18:51	HR	11	860	5	SOS	EOS	0+40	30	30	10:18	10:23	VT	4-Mar
2/28/14	28/29	18:47	HR	11	860	5	SOS	EOS	0+25	30	30	11:20	11:25	VT	4-Mar
2/28/14	29/32	19:14	HR	11	860	5	SOS	EOS	0+32	30	30	11:12	11:17	VT	4-Mar
2/28/14	29/31	19:20	HR	11	860	5	SOS	EOS	0+34	30	30	11:04	11:09	VT	4-Mar
2/28/14	31/32	19:00	HR	11	860	5	SOS	EOS	0+28	30	30	11:11	11:16	VT	4-Mar
2/28/14	30/31	19:05	HR	11	860	5	SOS	0+42	0+42	30	30	10:56	11:01	VT	4-Mar
2/28/14	30/31	19:14	HR	11	860	5	0+42	EOS	0+24	31	30	11:02	11:07	VT	4-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

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Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/1/14	18/33	14:52	DG	15	860	5	SOS	EOS	0+43	30	30	14:22	14:27	VT	4-Mar
3/1/14	1/33	15:00	DG	15	860	5	SOS	EOS	0+19	30	30	14:12	14:17	VT	4-Mar
3/1/14	2/33	15:04	DG	15	860	5	SOS	EOS	0+22	30	30	14:08	14:13	VT	4-Mar
3/1/14	3/33	15:08	DG	15	860	5	SOS	EOS	0+22	30	30	14:05	14:10	VT	4-Mar
3/1/14	4/33	15:11	DG	15	860	5	SOS	EOS	0+22	30	30	14:02	14:07	VT	4-Mar
3/1/14	5/33	15:15	DG	15	860	5	SOS	EOS	0+22	30	30	13:56	14:01	VT	4-Mar
3/1/14	6/33	15:18	DG	15	860	5	SOS	EOS	0+22	30	30	13:53	13:58	VT	4-Mar
3/1/14	7/33	15:21	DG	15	860	5	SOS	EOS	0+22	30	30	13:48	13:53	VT	4-Mar
3/1/14	8/33	15:25	DG	15	860	5	SOS	EOS	0+22	30	30	13:47	13:52	VT	4-Mar
3/1/14	10/33	15:28	DG	15	860	5	SOS	EOS	0+22	30	30	13:33	13:38	VT	4-Mar
3/1/14	11/33	15:31	DG	15	860	5	SOS	EOS	0+22	30	30	13:30	13:35	VT	4-Mar
3/1/14	12/33	15:34	DG	15	860	5	SOS	EOS	0+22	30	30	12:14	12:19	VT	4-Mar
3/1/14	13/33	15:38	DG	15	860	5	SOS	EOS	0+22	30	30	12:11	12:16	VT	4-Mar
3/1/14	14/33	15:42	DG	15	860	5	SOS	EOS	0+22	30	30	12:08	12:13	VT	4-Mar
3/1/14	15/33	15:45	DG	15	860	5	SOS	EOS	0+22	30	30	12:03	12:08	VT	4-Mar
3/1/14	16/33	15:49	DG	15	860	5	SOS	EOS	0+22	30	30	11:54	11:59	JR	4-Mar
3/1/14	17/33	15:51	DG	15	860	5	SOS	EOS	0+22	30	30	11:48	11:53	JR	4-Mar
3/1/14	22/33	15:56	DG	15	860	5	SOS	EOS	0+22	30	30	11:43	11:48	JR	4-Mar
3/1/14	23/33	16:00	DG	15	860	5	SOS	EOS	0+22	30	30	11:42	11:47	JR	4-Mar
3/1/14	24/33	16:03	DG	15	860	5	SOS	EOS	0+22	30	30	11:35	11:40	JR	4-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

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Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/1/14	25/33	16:06	DG	15	860	5	SOS	EOS	0+22	30	30	11:33	11:38	JR	4-Mar
3/1/14	26/33	16:10	DG	15	860	5	SOS	EOS	0+06	30	30	11:28	11:33	JR	4-Mar
3/1/14	26/34	16:11	DG	15	860	5	SOS	EOS	0+16	30	30	11:28	11:33	JR	4-Mar
3/1/14	27/34	16:13	DG	15	860	5	SOS	EOS	0+22	30	30	11:22	11:27	JR	4-Mar
3/1/14	29/34	16:16	DG	15	860	5	SOS	EOS	0+22	30	30	11:05	11:10	JR	4-Mar
3/1/14	31/34	16:20	DG	15	860	5	SOS	EOS	0+11	30	30	10:55	11:00	JR	4-Mar
3/1/14	30/34	16:22	DG	15	860	5	SOS	EOS	0+22	30	30	10:55	11:00	JR	4-Mar
3/1/14	33/36	15:35	HR	11	860	5	SOS	EOS	1+70	30	30	14:45	14:50	VT	4-Mar
3/1/14	33/35	15:56	HR	11	860	5	SOS	EOS	3+37	30	30	16:28	16:33	VT	4-Mar
3/1/14	34/35	16:54	HR	11	860	5	SOS	EOS	0+65	31	30	14:45	14:50	VT	4-Mar
3/1/14	33/34	14:51	HR	11	860	5	SOS	EOS	0+22	30	30	11:20	11:25	VT	4-Mar
3/1/14	35/36	15:17	HR	11	860	5	SOS	EOS	0+22	30	30	16:28	16:33	JR	4-Mar
3/1/14	36/37	15:35	FH	10	860	5	SOS	EOS	1+70	30	30	14:53	14:58	JR	4-Mar
3/1/14	35/37	15:55	FH	10	860	5	SOS	0+71	0+71	30	30	16:28	16:33	JR	4-Mar
3/1/14	35/37	15:55	FH	10	860	5	0+71	EOS	0+83	30	30	16:38	16:43	JR	4-Mar
3/1/14	35/38	16:17	FH	10	860	5	SOS	EOS	2+45	30	30	16:38	16:43	JR	4-Mar
3/1/14	37/38	15:25	FH	10	860	5	SOS	EOS	0+22	30	30	16:39	16:44	JR	4-Mar
3/1/14	37/40	16:02	EA	12	860	5	SOS	EOS	3+00	30	30	14:58	15:03	JR	4-Mar
3/1/14	37/39	16:44	EA	12	860	5	SOS	EOS	0+21	30	30	16:51	16:56	JR	4-Mar
3/1/14	38/39	16:47	EA	12	860	5	SOS	EOS	2+32	30	30	16:50	16:55	JR	4-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

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Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/1/14	39/40	15:56	EA	12	860	5	SOS	EOS	0+22	30	30	16:52	16:57	JR	4-Mar
3/1/14	40/41	16:41	DG	15	860	5	SOS	EOS	1+92	30	30	15:07	15:12	JR	4-Mar
3/1/14	40/42	17:15	DG	15	860	5	SOS	EOS	1+12	30	30	16:57	17:02	JR	4-Mar
3/1/14	39/42	17:30	DG	15	860	5	SOS	EOS	2+41	30	30	16:52	16:57	JR	4-Mar
3/1/14	41/42	16:35	DG	15	860	5	SOS	EOS	0+22	30	30	7:20	7:25	JR	4-Mar
3/1/14	41/44	5:16	HR	11	860	5	SOS	EOS	1+93	30	30	15:12	15:17	JR	4-Mar
3/1/14	42/44	17:53	HR	11	860	5	SOS	EOS	1+78	30	30	16:57	17:02	JR	4-Mar
3/1/14	42/43	18:30	HR	11	860	5	SOS	EOS	1+63	30	30	7:00	7:05	JR	4-Mar
3/1/14	43/44	17:20	FH	33	860	5	SOS	EOS	0+22	30	30	7:02	7:07	JR	4-Mar
3/1/14	44/45	17:40	FH	33	860	5	SOS	0+08	0+08	30	30	15:26	15:31	JR	4-Mar
3/1/14	44/45	17:44	FH	33	860	5	0+08	0+23	0+15	30	30	15:27	15:32	JR	4-Mar
3/1/14	44/45	17:49	FH	33	860	5	0+23	0+53	0+30	30	30	15:28	15:33	JR	4-Mar
3/1/14	44/45	17:58	FH	33	860	5	0+53	EOS	0+72	30	30	7:59	8:04	JR	4-Mar
3/1/14	44/46	18:16	FH	33	860	5	SOS	EOS	2+40	30	30	7:54	7:59	JR	4-Mar
3/1/14	43/46	19:25	FH	33	860	5	SOS	EOS	1+50	30	30	7:07	7:12	JR	4-Mar
3/1/14	45/46	17:32	FH	33	860	5	SOS	EOS	0+22	30	30	7:55	8:00	JR	4-Mar
3/1/14	45/48	17:09	EA	12	860	5	SOS	0+58	0+58	30	30	3:42	3:47	JR	4-Mar
3/1/14	45/48	17:21	EA	12	860	5	0+58	EOS	0+65	30	30	8:04	8:09	JR	4-Mar
3/1/14	46/48	17:36	EA	12	860	5	SOS	EOS	2+56	30	30	8:04	8:09	JR	4-Mar
3/1/14	46/47	18:29	EA	12	860	5	SOS	EOS	1+20	30	30	7:11	7:16	JR	4-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
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Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/1/14	47/48	17:45	EA	12	860	5	SOS	0+11	0+11	30	30	7:10	7:15	JR	4-Mar
3/1/14	47/48	17:47	EA	12	860	5	0+11	EOS	0+11	30	30	7:10	7:15	JR	4-Mar
3/1/14	48/49	18:12	DG	15	860	5	SOS	EOS	1+08	30	30	3:55	4:00	JR	4-Mar
3/1/14	48/50	18:45	DG	15	860	5	SOS	EOS	2+70	30	29	8:09	8:14	JR	4-Mar
3/1/14	47/50	19:50	DG	15	860	5	SOS	EOS	1+08	30	30	7:11	7:16	JR	4-Mar
3/1/14	49/50	18:14	DG	15	860	5	SOS	EOS	0+22	30	30	8:08	8:13	JR	4-Mar
3/1/14	49/52	19:17	HR	11	860	5	SOS	EOS	1+08	30	30	3:55	4:00	JR	4-Mar
3/1/14	50/52	19:40	HR	11	860	5	SOS	EOS	2+38	30	30	8:09	8:14	JR	4-Mar
3/1/14	50/51	19:59	HR	11	860	5	SOS	EOS	1+25	30	30	8:09	8:14	JR	4-Mar
3/1/14	51/52	19:07	HR	11	860	5	SOS	EOS	0+22	30	30	8:27	8:32	JR	4-Mar
3/1/14	52/53	20:21	EA	12	860	5	SOS	EOS	1+35	30	30	4:06	4:11	JR	4-Mar
3/1/14	52/54	20:33	EA	12	860	5	SOS	1+44	1+44	30	30	8:15	8:20	JR	4-Mar
3/1/14	52/54	20:42	EA	12	860	5	1+44	EOS	0+65	30	30	8:30	8:35	JR	4-Mar
3/1/14	51/54	21:11	EA	12	860	5	SOS	EOS	1+21	30	30	8:27	8:32	JR	4-Mar
3/1/14	53/54	19:50	EA	12	860	5	SOS	EOS	0+22	30	30	8:16	8:21	JR	4-Mar
3/1/14	53/56	20:22	FH	33	860	5	SOS	EOS	1+35	31	30	4:09	4:14	JR	4-Mar
3/1/14	54/56	20:54	FH	33	860	5	SOS	EOS	1+32	30	30	4:09	4:14	JR	4-Mar
3/1/14	54/55	21:20	FH	33	860	5	SOS	EOS	1+83	30	29	8:16	8:21	JR	4-Mar
3/1/14	55/56	20:40	DG	15	860	5	SOS	EOS	0+22	30	30	8:39	8:44	JR	4-Mar
3/2/14	57/58	10:44	DG	15	860	5	SOS	EOS	1+33	30	30	10:16	10:21	VT	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

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WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	58/59	10:56	HR	11	860	5	SOS	0+45	0+45	30	30	10:12	10:17	VT	5-Mar
3/2/14	58/59	10:56	HR	15	860	5	0+45	EOS	0+72	30	30	10:14	10:19	VT	5-Mar
3/2/14	59/60	11:29	DG	15	860	5	SOS	EOS	0+24	30	30	10:48	10:53	VT	5-Mar
3/2/14	59/61	11:34	DG	15	860	5	SOS	EOS	0+32	30	30	11:42	11:47	VT	5-Mar
3/2/14	59/62	11:39	DG	15	860	5	SOS	EOS	0+32	30	30	10:38	10:43	VT	5-Mar
3/2/14	59/63	11:44	DG	15	860	5	SOS	EOS	0+09	30	30	10:22	10:27	VT	5-Mar
3/2/14	60/61	11:05	FH	33	860	5	SOS	EOS	0+53	30	30	10:41	10:46	VT	5-Mar
3/2/14	61/62	11:09	DG	15	860	5	SOS	EOS	0+29	30	30	10:53	10:58	VT	5-Mar
3/2/14	62/63	11:14	DG	15	860	5	SOS	EOS	0+07	30	30	10:25	10:30	VT	5-Mar
3/2/14	57/64	11:29	HR	11	860	5	SOS	EOS	1+50	30	29	10:08	10:13	VT	5-Mar
3/2/14	64/65	11:35	FH	33	860	5	SOS	EOS	0+75	30	30	9:06	9:11	VT	5-Mar
3/2/14	65/66	11:52	FH	33	860	5	SOS	EOS	0+75	30	30	9:10	9:15	VT	5-Mar
3/2/14	66/67	12:03	HR	33	860	5	SOS	EOS	0+76	30	30	9:15	9:20	VT	5-Mar
3/2/14	67/68	12:10	FH	33	860	5	SOS	EOS	0+76	30	30	9:17	9:22	VT	5-Mar
3/2/14	68/69	12:25	FH	33	860	5	SOS	EOS	0+77	30	30	9:20	9:25	VT	5-Mar
3/2/14	69/70	12:22	HR	11	860	5	SOS	EOS	0+78	30	30	9:28	9:33	VT	5-Mar
3/2/14	70/71	12:39	HR	11	860	5	SOS	EOS	0+78	30	30	9:31	9:36	VT	5-Mar
3/2/14	71/72	12:20	DG	15	860	5	SOS	EOS	0+79	30	30	9:36	9:41	VT	5-Mar
3/2/14	72/73	12:39	DG	15	860	5	SOS	EOS	0+40	30	30	9:55	10:00	VT	5-Mar
3/2/14	72/74	12:47	DG	15	860	5	SOS	EOS	0+40	30	30	9:42	9:47	VT	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	73/74	12:36	DG	15	860	5	SOS	EOS	0+11	30	30	9:54	9:59	VT	5-Mar
3/2/14	56/75	18:10	DG	15	860	5	SOS	EOS	2+61	30	30	9:23	9:28	VT	5-Mar
3/2/14	55/75	18:58	DG	15	860	5	SOS	EOS	1+70	30	30	8:39	8:44	VT	5-Mar
3/2/14	75/77	18:11	HR	11	860	5	SOS	EOS	3+41	30	30	9:44	9:49	VT	5-Mar
3/2/14	75/76	19:25	HR	11	860	5	SOS	EOS	0+75	31	30	8:47	8:52	VT	5-Mar
3/2/14	76/77	18:15	FH	33	860	5	SOS	EOS	0+22	30	30	8:49	8:54	VT	5-Mar
3/2/14	77/79	18:25	FH	33	860	5	SOS	1+20	1+20	30	30	9:42	9:47	JR	5-Mar
3/2/14	77/79	18:55	FH	33	860	5	1+35	EOS	1+15	30	30	9:42	9:47	JR	5-Mar
3/2/14	77/78	19:12	FH	33	860	5	SOS	EOS	0+90	30	30	9:07	9:12	JR	5-Mar
3/2/14	76/78	19:24	FH	33	860	5	SOS	EOS	0+62	30	30	8:49	8:54	JR	5-Mar
3/2/14	78/79	18:40	EA	12	860	5	SOS	EOS	0+22	30	30	9:10	9:15	JR	5-Mar
3/2/14	79/81	18:56	EA	12	860	5	SOS	1+25	1+25	30	30	9:53	9:58	JR	5-Mar
3/2/14	79/81	19:20	EA	12	860	5	1+25	EOS	0+19	30	30	10:28	10:33	JR	5-Mar
3/2/14	79/80	19:43	EA	12	860	5	SOS	EOS	1+04	30	30	10:20	10:25	JR	5-Mar
3/2/14	78/80	20:03	EA	12	860	5	SOS	EOS	1+41	30	30	9:10	9:15	JR	5-Mar
3/2/14	80/81	18:50	EA	12	860	5	SOS	EOS	0+22	30	30	10:29	10:34	JR	5-Mar
3/2/14	81/82	19:34	HR	11	860	5	SOS	EOS	1+44	30	29	10:00	10:05	JR	5-Mar
3/2/14	80/82	20:00	HR	11	860	5	SOS	EOS	1+99	30	29	10:35	10:40	JR	5-Mar
3/2/14	80/83	20:36	HR	11	860	5	SOS	EOS	0+39	30	30	8:54	8:59	JR	5-Mar
3/2/14	82/83	19:45	FH	33	860	5	SOS	EOS	0+22	30	30	9:00	9:05	JR	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	82/84	19:42	DG	15	860	5	SOS	EOS	3+44	30	30	10:12	10:17	JR	5-Mar
3/2/14	83/84	20:56	DG	15	860	5	SOS	EOS	0+30	30	30	9:00	9:05	JR	5-Mar
3/2/14	60/84	20:49	HR	11	860	5	SOS	EOS	0+22	30	30	10:40	10:45	JR	5-Mar
3/2/14	61/84	20:52	HR	11	860	5	SOS	EOS	0+22	30	30	10:34	10:39	JR	5-Mar
3/2/14	62/84	20:56	HR	11	860	5	SOS	EOS	0+22	30	30	10:26	10:31	JR	5-Mar
3/2/14	63/84	21:00	HR	11	860	5	SOS	EOS	0+06	30	30	10:33	10:38	JR	5-Mar
3/2/14	59/84	21:03	HR	11	860	5	SOS	EOS	0+30	30	30	10:20	10:25	JR	5-Mar
3/2/14	58/84	21:10	HR	11	860	5	SOS	EOS	0+30	30	30	10:13	10:18	JR	5-Mar
3/2/14	57/84	21:15	HR	11	860	5	SOS	EOS	0+30	30	30	10:02	10:07	JR	5-Mar
3/2/14	64/84	21:22	HR	11	860	5	SOS	0+10	0+10	30	30	10:10	10:15	JR	5-Mar
3/2/14	64/84	21:24	HR	11	860	5	0+10	EOS	0+20	30	29	10:10	10:15	JR	5-Mar
3/2/14	84/90	22:48	DG	15	860	5	SOS	EOS	0+10	30	30	8:10	8:15	VT	5-Mar
3/2/14	84/91	22:57	DG	15	860	5	SOS	EOS	0+30	30	30	7:46	7:51	VT	5-Mar
3/2/14	84/92	23:05	DG	15	860	5	SOS	EOS	0+30	30	30	7:42	7:47	VT	5-Mar
3/2/14	84/95	23:09	DG	15	860	5	SOS	EOS	0+30	30	30	7:27	7:32	VT	5-Mar
3/2/14	84/96	23:15	DG	15	860	5	SOS	EOS	0+30	30	30	7:20	7:25	VT	5-Mar
3/2/14	84/98	23:21	DG	15	860	5	SOS	EOS	0+39	30	30	7:11	7:16	VT	5-Mar
3/2/14	84/99	23:26	DG	15	860	5	SOS	EOS	0+09	30	30	7:06	7:11	VT	5-Mar
3/2/14	64/85	23:25	FH	33	860	5	SOS	EOS	0+11	30	30	8:44	8:49	VT	5-Mar
3/2/14	64/86	23:20	FH	33	860	5	SOS	EOS	0+22	30	30	8:43	8:48	VT	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	64/87	23:15	FH	33	860	5	SOS	EOS	0+22	30	30	8:41	8:46	VT	5-Mar
3/2/14	64/89	23:05	FH	33	860	5	SOS	EOS	0+22	30	30	8:36	8:41	VT	5-Mar
3/2/14	64/90	23:00	FH	33	860	5	SOS	EOS	0+14	30	30	8:29	8:34	VT	5-Mar
3/2/14	85/86	20:06	FH	33	860	5	SOS	EOS	1+94	30	30	8:59	9:04	VT	5-Mar
3/2/14	86/87	20:30	EA	12	860	5	SOS	EOS	1+00	30	30	8:50	8:55	VT	5-Mar
3/2/14	86/88	21:15	EA	12	860	5	SOS	EOS	0+86	30	30	9:00	9:05	VT	5-Mar
3/2/14	87/88	20:21	EA	12	860	5	SOS	EOS	0+22	30	30	9:00	9:05	VT	5-Mar
3/2/14	87/89	20:46	FH	33	860	5	SOS	EOS	1+00	30	30	8:38	8:43	VT	5-Mar
3/2/14	88/89	21:25	FH	33	860	5	SOS	EOS	0+82	30	30	9:04	9:09	VT	5-Mar
3/2/14	89/90	21:07	EA	33	860	5	SOS	EOS	1+76	30	30	8:19	8:24	VT	5-Mar
3/2/14	90/91	21:27	FH	33	860	5	SOS	0+75	0+75	30	29	8:12	8:17	VT	5-Mar
3/2/14	90/91	21:45	FH	33	860	5	0+75	EOS	0+42	31	30	8:10	8:15	VT	5-Mar
3/2/14	90/93	21:55	FH	33	860	5	SOS	EOS	0+44	30	30	8:05	8:10	VT	5-Mar
3/2/14	91/92	22:10	EA	12	860	5	SOS	EOS	0+32	30	30	7:55	8:00	VT	5-Mar
3/2/14	91/94	22:18	EA	12	860	5	SOS	EOS	0+65	30	30	7:56	8:01	VT	5-Mar
3/2/14	93/94	22:31	EA	12	860	5	SOS	EOS	0+28	30	30	8:02	8:07	VT	5-Mar
3/2/14	91/93	21:06	DG	15	860	5	SOS	EOS	0+22	30	30	8:01	8:06	VT	5-Mar
3/2/14	92/94	21:00	DG	15	860	5	SOS	EOS	0+22	30	30	7:45	7:50	VT	5-Mar
3/2/14	92/95	21:25	DG	15	860	5	SOS	EOS	0+10	30	30	7:43	7:48	VT	5-Mar
3/2/14	94/95	21:27	DG	15	860	5	SOS	EOS	0+75	30	30	7:46	7:51	VT	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	95/96	22:15	DG	15	860	5	SOS	EOS	0+28	30	30	7:40	7:45	VT	5-Mar
3/2/14	95/97	22:21	DG	15	860	5	SOS	EOS	0+45	30	30	7:40	7:45	VT	5-Mar
3/2/14	96/97	22:10	DG	15	860	5	SOS	EOS	0+22	30	30	7:23	7:28	VT	5-Mar
3/2/14	96/98	22:02	FH	33	860	5	SOS	EOS	0+06	30	29	7:21	7:26	VT	5-Mar
3/2/14	97/98	22:04	FH	33	860	5	SOS	EOS	0+38	30	30	7:22	7:27	VT	5-Mar
3/2/14	98/99	22:35	FH	33	860	5	SOS	EOS	0+20	30	30	7:10	7:15	VT	5-Mar
3/2/14	65/85	22:51	HR	11	860	5	SOS	EOS	0+22	30	30	9:07	9:12	VT	5-Mar
3/2/14	66/85	22:46	HR	11	860	5	SOS	EOS	0+22	30	30	9:11	9:16	VT	5-Mar
3/2/14	67/85	22:42	HR	11	860	5	SOS	EOS	0+22	30	30	9:16	9:21	VT	5-Mar
3/2/14	68/85	22:39	HR	11	860	5	SOS	EOS	0+22	30	30	9:18	9:23	VT	5-Mar
3/2/14	69/85	22:34	HR	11	860	5	SOS	EOS	0+22	30	30	9:21	9:26	VT	5-Mar
3/2/14	70/85	22:28	HR	11	860	5	SOS	EOS	0+22	30	30	9:30	9:35	VT	5-Mar
3/2/14	71/85	22:23	HR	11	860	5	SOS	EOS	0+22	30	30	9:33	9:38	VT	5-Mar
3/2/14	72/85	22:18	HR	11	860	5	SOS	EOS	0+22	30	30	9:40	9:45	VT	5-Mar
3/2/14	74/85	22:15	HR	11	860	5	SOS	EOS	0+11	30	30	9:48	9:53	VT	5-Mar
3/2/14	60/TI	23:27	HR	11	860	5	SOS	0+24	0+24	30	30	12:23	12:28	VT	5-Mar
3/2/14	60/TI	23:33	HR	11	860	5	0+24	0+36	0+12	30	29	11:11	11:16	VT	5-Mar
3/2/14	60/TI	23:35	HR	11	860	5	0+36	0+50	0+14	30	30	11:01	11:06	VT	5-Mar
3/2/14	60/TI	23:37	HR	11	860	5	0+50	EOS	0+10	30	30	11:00	11:05	VT	5-Mar
3/2/14	84/TI	23:40	HR	11	860	5	SOS	EOS	0+22	30	30	10:10	10:15	VT	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	82/TI	23:44	HR	11	860	5	SOS	EOS	0+22	30	30	10:12	10:17	VT	5-Mar
3/2/14	81/TI	23:46	HR	11	860	5	SOS	0+11	0+11	30	30	10:00	10:05	VT	5-Mar
3/2/14	81/TI	23:48	HR	11	860	5	0+11	EOS	0+11	30	30	9:53	9:58	VT	5-Mar
3/2/14	79/TI	23:50	HR	11	860	5	SOS	0+11	0+11	30	30	9:47	9:52	VT	5-Mar
3/2/14	79/TI	23:52	HR	11	860	5	0+11	EOS	0+11	30	30	9:45	9:50	VT	5-Mar
3/2/14	77/TI	23:54	HR	11	860	5	SOS	0+11	0+11	30	30	9:42	9:47	VT	5-Mar
3/2/14	77/TI	23:56	HR	11	860	5	0+11	EOS	0+11	30	30	9:40	9:45	VT	5-Mar
3/2/14	75/TI	23:58	HR	11	860	5	SOS	0+11	0+11	30	30	9:35	9:40	VT	5-Mar
3/2/14	75/TI	12:00	HR	11	860	5	0+11	EOS	0+11	30	30	9:22	9:27	VT	5-Mar
3/2/14	56/TI	14:48	DG	15	860	5	SOS	0+11	0+11	30	29	9:22	9:27	VT	5-Mar
3/2/14	56/TI	14:50	DG	15	860	5	0+11	EOS	0+11	30	30	16:11	16:16	JT	5-Mar
3/2/14	53/TI	14:52	DG	15	860	5	SOS	0+11	0+11	30	30	16:08	16:13	JT	5-Mar
3/2/14	53/TI	14:54	DG	15	860	5	0+11	EOS	0+11	30	30	16:08	16:13	JT	5-Mar
3/2/14	52/TI	14:56	DG	15	860	5	SOS	0+11	0+11	30	30	16:10	16:15	JT	5-Mar
3/2/14	52/TI	14:58	DG	15	860	5	0+11	0+16	0+05	30	30	16:10	16:15	JT	5-Mar
3/2/14	52/TI	15:00	DG	15	860	5	0+16	EOS	0+08	30	30	15:52	15:57	JT	5-Mar
3/2/14	49/TI	15:04	DG	15	860	5	SOS	0+11	0+11	30	30	15:50	15:55	JT	5-Mar
3/2/14	49/TI	15:06	DG	15	860	5	0+11	EOS	0+11	30	30	15:40	15:45	JT	5-Mar
3/2/14	48/TI	15:08	DG	15	860	5	SOS	0+11	0+11	30	30	15:36	15:41	JT	5-Mar
3/2/14	48/TI	15:10	DG	15	860	5	0+11	EOS	0+22	30	30	15:30	15:35	JT	5-Mar

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Seaming and Non Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

Thickness : 60 mil

WELD DATE	SEAM # (P#/P#)	WELD TIME	TECH ID	Machine ID	Machine Temp	Machine Speed or Preheat	Start Point	End Point	Seam Length (Feet)	Air Pressure Test					
										PSI		Time		Tech	Date
										Start	Finish	Start	Finish		
3/2/14	45/TI	15:12	DG	15	860	5	SOS	0+11	0+11	30	30	15:15	15:20	JT	5-Mar
3/2/14	45/TI	15:14	DG	15	860	5	0+11	EOS	0+11	30	30	15:15	15:20	JT	5-Mar
3/2/14	44/TI	15:16	DG	15	860	5	SOS	0+11	0+11	30	29	15:10	15:15	JT	5-Mar
3/2/14	44/TI	15:18	DG	15	860	5	0+11	EOS	0+11	30	30	15:10	15:15	JT	5-Mar
3/2/14	41/TI	15:20	DG	15	860	5	SOS	0+11	0+11	30	30	15:00	15:05	JT	5-Mar
3/2/14	41/TI	15:22	DG	15	860	5	0+11	EOS	0+22	30	30	15:00	15:05	JT	5-Mar
3/2/14	40/TI	15:24	DG	15	860	5	SOS	0+11	0+11	30	30	14:52	14:57	JT	5-Mar
3/2/14	40/TI	15:26	DG	15	860	5	0+11	EOS	0+11	30	30	14:52	14:57	JT	5-Mar
3/2/14	37/TI	15:28	DG	15	860	5	SOS	0+11	0+11	30	30	14:45	14:50	JT	5-Mar
3/2/14	37/TI	15:30	DG	15	860	5	0+11	EOS	0+11	30	30	14:44	14:49	JT	5-Mar
3/2/14	36/TI	15:32	DG	15	860	5	SOS	0+11	0+11	30	30	14:36	14:41	JT	5-Mar
3/2/14	36/TI	15:34	DG	15	860	5	0+11	EOS	0+11	30	30	14:34	14:39	JT	5-Mar
3/2/14	33/TI	15:36	DG	15	860	5	SOS	0+11	0+11	30	30	14:20	14:25	JT	5-Mar
3/2/14	33/TI	15:38	DG	15	860	5	0+11	EOS	0+11	30	30	14:19	14:24	JT	5-Mar
3/2/14	18/TI	15:40	DG	15	860	5	SOS	0+11	0+11	30	30	14:13	14:18	JT	5-Mar
3/2/14	18/TI	15:42	DG	15	860	5	0+11	EOS	0+11	30	30	14:12	14:17	JT	5-Mar
3/2/14	19/TI	15:44	DG	15	860	5	SOS	0+10	0+10	30	29	14:06	14:11	JT	5-Mar
3/2/14	19/TI	15:46	DG	15	860	5	0+10	0+15	0+05	30	30	14:01	14:06	JT	5-Mar
3/2/14	19/TI	15:48	DG	15	860	5	0+15	EOS	0+08	30	29	14:01	14:06	JT	5-Mar

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CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124
Project Name: Davidson Co LF
Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE
Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
1	AT	P19/21/TI	3/4/2014	15:00	Patch	2x4	23	ER	Pass	3/5/2014	JR
2	BO	P19/TI 5' F AT	3/4/2014	15:15	Patch	2X2	23	ER	Pass	3/5/2014	JR
3	BO	P19/TI 10' F AT	3/4/2014	15:16	Patch	2X2	23	ER	Pass	3/5/2014	JR
4	AT	P18/19/TI	3/4/2014	15:21	Patch	2X2	23	ER	Pass	3/5/2014	JR
5	AT	P18/TI 12' F P19	3/4/2014	15:45	Patch	2X2	23	ER	Pass	3/5/2014	JR
6	AT	P18/33/TI	3/4/2014	15:45	Patch	2X2	23	ER	Pass	3/5/2014	JR
7	AT	P33/TI 13" F P18	3/4/2014	16:17	Patch	2X2	23	ER	Pass	3/5/2014	JR
8	AT	P19/20/21	3/4/2014	15:07	Patch	2X2	23	ER	Pass	3/5/2014	JR
9	AT	P18/19/20	3/4/2014	15:05	Patch	2X2	23	ER	Pass	3/5/2014	JR
10	AT	P1/18/20/33	3/4/2014	15:00	Patch	3X6	23	ER	Pass	3/5/2014	JR
11	AT	P1/2/33	3/4/2014	14:39	Patch	2X2	23	ER	Pass	3/5/2014	JR
12	DS-3	P1/20 6' F AT	3/4/2014	14:41	DS	2X4	23	ER	Pass	3/5/2014	JR
13	AT	P2/3/33	3/4/2014	14:53	Patch	2X2	23	ER	Pass	3/5/2014	JR
14	AT	P3/4/33	3/4/2014	14:29	Patch	2X2	23	ER	Pass	3/5/2014	JR
15	AT	P4/5/33	3/4/2014	16:12	Patch	2X2	23	ER	Pass	3/5/2014	JR
16	AT	P5/6/33	3/4/2014	16:08	Patch	2X2	23	ER	Pass	3/5/2014	JR
17	DS-1	P5/6 20' F AT	3/4/2014	15:52	DS	2X4	23	ER	Pass	3/5/2014	JR
18	AT	P6/7/33	3/4/2014	18:06	Patch	2X2	23	ER	Pass	3/5/2014	JR
19	AT	P7/8/33	3/4/2014	16:04	Patch	2X2	23	ER	Pass	3/5/2014	JR
20	DS-2	P8/10/33	3/4/2014	15:48	DS	2X4	23	ER	Pass	3/5/2014	JR
21	AT	P8/9/10	3/4/2014	15:23	Patch	2X2	23	ER	Pass	3/5/2014	JR
22	AT	P9/10/11	3/4/2014	15:10	Patch	2X2	23	ER	Pass	3/5/2014	JR
23	AT	P10/11/33	3/4/2014	15:16	Patch	2X2	23	ER	Pass	3/5/2014	JR
24	AT	P11/12/33	3/4/2014	15:14	Patch	2X2	23	ER	Pass	3/5/2014	JR
25	AT	P12/13/33	3/4/2014	15:08	Patch	2X2	23	ER	Pass	3/5/2014	JR
26	AT	P13/14/33	3/4/2014	15:05	Patch	2X2	23	ER	Pass	3/5/2014	JR
27	AT	P14/15/33	3/4/2014	2:52	Patch	2X2	23	ER	Pass	3/5/2014	JR
28	AT	P15/16/33	3/4/2014	2:54	Patch	2X2	23	ER	Pass	3/5/2014	JR
29	DS-5	P16/33 3' F P17	3/4/2014	14:52	DS	2X4	23	ER	Pass	3/5/2014	JR
30	AT	P16/17/33	3/4/2014	14:35	Patch	2X2	23	ER	Pass	3/5/2014	JR

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124

Project Name: Davidson Co LF

Date: 2/28/2014

Project Location: Thomasville, NC

Material: HDPE

Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
31	BO	P16/17 38' F AT	3/4/2014	14:03	Patch	2X2	23	ER	Pass	3/5/2014	JR
32	AT	P17/22/33	3/4/2014	14:06	Patch	2X2	23	ER	Pass	3/5/2014	JR
33	AT	P22/23/33	3/4/2014	14:00	Patch	2X2	23	ER	Pass	3/5/2014	JR
34	DS-4	P22/23 34' F AT	3/4/2014	14:10	DS	2X4	23	ER	Pass	3/5/2014	JR
35	AT	P23/24/33	3/4/2014	13:57	Patch	2X2	23	ER	Pass	3/5/2014	JR
36	AT	P24/25/33	3/4/2014	13:51	Patch	2X2	12	EA	Pass	3/5/2014	JR
37	AT	P25/26/33	3/4/2014	13:47	Patch	2X2	12	EA	Pass	3/5/2014	JR
38	AT	P26/33/34	3/4/2014	13:50	Patch	2X2	12	EA	Pass	3/5/2014	JR
39	AT	P26/27/34	3/4/2014	12:00	Patch	2X2	12	EA	Pass	3/5/2014	JR
40	AT	P26/27/28	3/4/2014	12:10	Patch	2X2	12	EA	Pass	3/5/2014	JR
41	AT	P27/28/29	3/4/2014	23:55	Patch	2X2	12	EA	Pass	3/5/2014	JR
42	BO	P28/29/AT	3/4/2014	14:00	Patch	2X2	12	EA	Pass	3/5/2014	JR
43	AT	P29/31/32	3/4/2014	23:49	Patch	2X2	12	EA	Pass	3/5/2014	JR
44	AT	P27/29/34	3/5/2014	23:41	Patch	2X2	12	EA	Pass	3/5/2014	JR
45	AT	P29/31/34	3/4/2014	23:30	Patch	2X2	12	EA	Pass	3/5/2014	JR
46	AT	P30/31/34	3/4/2014	23:35	Patch	2X2	12	EA	Pass	3/5/2014	JR
47	AT	P30/31 40' F AT	3/4/2014	23:45	Patch	2X2	12	EA	Pass	3/5/2014	JR
48	AT	P33/34/35	3/5/2014	8:20	Patch	2X2	12	EA	Pass	3/6/2014	JR
49	DS-6	P33/35 82' F P34	3/5/2014	8:15	DS	2X4	12	EA	Pass	3/6/2014	JR
50	AT	P35/37/38	3/5/2014	8:08	Patch	2X2	12	EA	Pass	3/6/2014	JR
51	AT	P37/38/39	3/5/2014	8:06	Patch	2X2	12	EA	Pass	3/6/2014	JR
52	AT	P37/39/40	3/5/2014	8:04	Patch	2X2	12	EA	Pass	3/6/2014	JR
53	DS-7	P35/37 46' F P38	3/5/2014	8:00	Patch	2X2	12	EA	Pass	3/6/2014	JR
54	BO	P35/37 80' F38	3/5/2014	4:55	Patch	2X2	12	EA	Pass	3/6/2014	JR
55	AT	P35/36/37	3/5/2014	4:40	Patch	2X2	12	EA	Pass	3/6/2014	JR
56	AT	P33/35/36	3/5/2014	4:44	Patch	2X2	12	EA	Pass	3/6/2014	JR
57	DS-8	P37/40 157' F AT	3/5/2014	4:46	DS	2X4	12	EA	Pass	3/6/2014	JR
58	AT	P33/36/TI	3/4/2014	4:20	Patch	2X2	23	ER	Pass	3/5/2014	JR
59	AT	P36/TI 13' F P33	3/4/2014	4:25	Patch	2X2	23	ER	Pass	3/5/2014	JR
60	AT	P36/37/TI	3/4/2014	4:32	Patch	2X2	23	ER	Pass	3/5/2014	JR

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124
Project Name: Davidson Co LF
Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE
Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
61	AT	P37/TI 13' F P36	3/4/2014	4:38	Patch	2X2	23	ER	Pass	3/5/2014	JR
62	AT	P37/40/TI	3/4/2014	4:43	Patch	2X2	23	ER	Pass	3/5/2014	JR
63	AT	P40/TI 13' F P37	3/4/2014	4:50	Patch	2X2	23	ER	Pass	3/5/2014	JR
64	AT	P40/41/TI	3/4/2014	4:54	Patch	2X2	23	ER	Pass	3/5/2014	JR
65	AT	P41/TI 13' F P40	3/4/2014	5:06	Patch	2X2	23	ER	Pass	3/5/2014	JR
66	AT	P41/44/TI	3/5/2014	7:53	Patch	2X2	23	ER	Pass	3/6/2014	JR
67	AT	P44/TI 14' F P41	3/5/2014	8:00	Patch	2X2	23	ER	Pass	3/6/2014	JR
68	AT	P44/45/TI	3/5/2014	8:05	Patch	2X2	23	ER	Pass	3/6/2014	JR
69	AT	P45/TI 13' F P44	3/5/2014	8:10	Patch	2X2	23	ER	Pass	3/6/2014	JR
70	AT	P45/48/TI	3/5/2014	8:12	Patch	2X2	23	ER	Pass	3/6/2014	JR
71	AT	P48/TI 13' F P45	3/5/2014	9:16	Patch	2X2	23	ER	Pass	3/6/2014	JR
72	DS-12	P48/49 1' F TI	3/5/2014	9:30	DS	2X4	23	ER	Pass	3/6/2014	JR
73	AT	P49/TI 13' F P48	3/5/2014	9:35	Patch	2X2	23	ER	Pass	3/6/2014	JR
74	AT	P49/52/TI	3/5/2014	9:42	Patch	2X2	23	ER	Pass	3/6/2014	JR
75	BO	P52/TI 8' F P49	3/5/2014	9:52	Patch	2X2	23	ER	Pass	3/6/2014	JR
76	BO	P52/TI 12' F P49	3/5/2014	9:57	Patch	2X2	23	ER	Pass	3/6/2014	JR
77	AT	P52/53/TI	3/5/2014	10:04	Patch	2X2	23	ER	Pass	3/6/2014	JR
78	BO	P44/45 17' F TI	3/4/2014	8:15	Patch	2X2	12	EA	Pass	3/6/2014	JR
79	BO	P44/45 22' F TI	3/4/2014	8:24	Patch	2X2	12	EA	Pass	3/6/2014	JR
80	DS-10	P44/45 43' F TI	3/4/2014	8:42	DS	2X4	12	EA	Pass	3/6/2014	JR
81	BO	P44/45 55' F TI	3/4/2014	10:56	Patch	2X2	12	EA	Pass	3/6/2014	JR
82	DS-9	P41/44 45' F AT	3/4/2014	10:52	DS	2X4	12	EA	Pass	3/6/2014	JR
83	AT	P44/45/46	3/4/2014	11:00	Patch	2X2	12	EA	Pass	3/6/2014	JR
84	AT	P41/42/44	3/4/2014	9:08	Patch	2X2	12	EA	Pass	3/6/2014	JR
85	AT	P40/41/42	3/4/2014	8:58	Patch	2X2	12	EA	Pass	3/6/2014	JR
86	AT	P39/40/42	3/4/2014	9:12	Patch	2X2	12	EA	Pass	3/6/2014	JR
87	AT	P42/43/44	3/4/2014	8:25	Patch	2X2	12	EA	Pass	3/6/2014	JR
88	AT	P43/44/46	3/4/2014	8:33	Patch	2X2	12	EA	Pass	3/6/2014	JR
89	DS-13	P47/50 95' F P48	3/4/2014	10:29	DS	2X4	12	EA	Pass	3/6/2014	JR
90	DD	P50 110' F P52 2' F P51	3/4/2014	10:31	Patch	2X2	12	EA	Pass	3/6/2014	JR

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124

Project Name: Davidson Co LF

Date: 2/28/2014

Project Location: Thomasville, NC

Material: HDPE

Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
91	DS-14	P50/51 115' F P52	3/4/2014	10:46	DS	2X4	12	EA	Pass	3/6/2014	JR
92	DS-15	P51/54 110' F P52	3/4/2014	10:53	DS	2X4	12	EA	Pass	3/6/2014	JR
93	AT	P47/48/50	3/5/2014	8:23	Patch	2X2	12	EA	Pass	3/6/2014	JR
94	BO	P47/48 17' F P50	3/5/2014	8:20	Patch	2X2	12	EA	Pass	3/6/2014	JR
95	AT	P46/47/48	3/5/2014	8:18	Patch	2X2	12	EA	Pass	3/6/2014	JR
96	AT	P50/51/52	3/5/2014	10:23	Patch	2X2	12	EA	Pass	3/6/2014	JR
97	DD	P46 29' F P45 9' F P48	3/5/2014	10:20	Patch	2X2	12	EA	Pass	3/6/2014	JR
98	DD	P46 20' F P45 9' F P48	3/5/2014	14:10	Patch	2X2	12	EA	Pass	3/6/2014	JR
99	DD	P46 15' F P45 11' F P48	3/5/2014	14:11	Patch	2X2	12	EA	Pass	3/6/2014	JR
100	DD	P46 15' F P45 9' F P48	3/5/2014	14:13	Patch	2X2	12	EA	Pass	3/6/2014	JR
101	DD	P46 5' F P45 11' F P48	3/5/2014	14:15	Patch	2X2	12	EA	Pass	3/6/2014	JR
102	DD	P46 5' F P45 9' F P48	3/5/2014	14:16	Patch	2X2	12	EA	Pass	3/6/2014	JR
103	AT	P45/46/48	3/5/2014	2:18	Patch	2X2	12	EA	Pass	3/6/2014	VT
104	AT	P48/49/50	3/5/2014	14:22	Patch	2X2	12	EA	Pass	3/6/2014	VT
105	AT	P49/50/52	3/5/2014	14:25	Patch	2X2	12	EA	Pass	3/6/2014	VT
106	BO	P45/48 55' F TI	3/5/2014	14:28	Patch	2X2	12	EA	Pass	3/6/2014	VT
107	DS-11	P45/48 20' F TI	3/5/2014	14:32	DS	2X4	12	EA	Pass	3/6/2014	VT
108	AT	P53/TI 13' F P52	3/5/2014	10:58	Patch	2X2	23	ER	Pass	3/6/2014	VT
109	AT	P53/56/TI	3/5/2014	11:01	Patch	2X2	23	ER	Pass	3/6/2014	VT
110	AT	P56/TI/13' F P53	3/5/2014	11:03	Patch	2X2	23	ER	Pass	3/6/2014	VT
111	AT	P56/75/TI	3/5/2014	11:14	Patch	2X2	23	ER	Pass	3/6/2014	VT
112	AT	P53/54/56	3/5/2014	9:15	Patch	2X2	12	EA	Pass	3/6/2014	VT
113	AT	P52/53/54	3/5/2014	9:48	Patch	2X2	12	EA	Pass	3/6/2014	VT
114	BO	P52/54 140' F P53	3/5/2014	10:45	Patch	2X2	12	EA	Pass	3/6/2014	VT
115	AT	P54/55/56	3/5/2014	10:06	Patch	2X2	12	EA	Pass	3/6/2014	VT
116	BO	P55/56/75	3/5/2014	11:11	Patch	2X2	12	EA	Pass	3/6/2014	VT
117	AT	P51/52/54	3/5/2014	10:20	Patch	2X2	12	EA	Pass	3/6/2014	VT
118	AT	P75/76/77	3/5/2014	11:05	Patch	2X2	12	EA	Pass	3/6/2014	VT
119	AT	P76/77/78	3/5/2014	11:08	Patch	2X2	12	EA	Pass	3/6/2014	VT
120	AT	P77/78/79	3/5/2014	11:15	Patch	2X2	12	EA	Pass	3/6/2014	VT

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124
Project Name: Davidson Co LF
Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE
Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
121	AT	P78/79/80	3/5/2014	11:18	Patch	2X4	12	EA	Pass	3/6/2014	VT
122	CAP	P77/79 125' F TI	3/5/2014	12:05	C	2X10	12	EA	Pass	3/6/2014	VT
123	AT	P79/80/81	3/5/2014	11:42	Patch	2X2	12	EA	Pass	3/6/2014	VT
124	BO	P79/81 125' F TI	3/5/2014	11:50	Patch	2X2	12	EA	Pass	3/6/2014	VT
125	AT	P80/81/82	3/5/2014	11:45	Patch	2X2	12	EA	Pass	3/6/2014	VT
126	AT	P75/TI 13' F P56	3/5/2014	11:15	Patch	2X2	23	ER	Pass	3/6/2014	VT
127	AT	P75/77/TI	3/5/2014	11:17	Patch	2X2	23	ER	Pass	3/6/2014	VT
128	AT	P77/TI 13' F P75	3/5/2014	11:19	Patch	2X2	23	ER	Pass	3/6/2014	VT
129	AT	P77/79/TI	3/5/2014	11:21	Patch	2X2	23	ER	Pass	3/6/2014	VT
130	AT	P79/TI 14' F P77	3/5/2014	11:27	Patch	2X2	23	ER	Pass	3/6/2014	VT
131	AT	P79/81/TI	3/5/2014	11:30	Patch	2X2	23	ER	Pass	3/6/2014	VT
132	AT	P81/TI 13' F P79	3/5/2014	11:40	Patch	2X2	23	ER	Pass	3/6/2014	VT
133	AT	P82/TI 0'-13' F P81	3/5/2014	11:49	Patch	2X13	23	ER	Pass	3/6/2014	VT
134	AT	P82/84/TI	3/5/2014	12:02	Patch	2X2	23	ER	Pass	3/6/2014	VT
135	AT	P60/84/TI	3/4/2014	9:26	Patch	2X2	3	MG	Pass	3/5/2014	VT
136	AT	P60/61/84	3/4/2014	9:30	Patch	2X2	3	MG	Pass	3/5/2014	VT
137	AT	P61/62/84	3/4/2014	9:35	Patch	2X2	3	MG	Pass	3/5/2014	VT
138	AT	P62/63/84	3/4/2014	9:41	Patch	2X2	3	MG	Pass	3/5/2014	VT
139	AT	P59/63/84	3/4/2014	9:45	Patch	2X2	3	MG	Pass	3/5/2014	VT
140	AT	P58/59/84	3/4/2014	9:49	Patch	2X2	3	MG	Pass	3/5/2014	VT
141	AT	P57/58/84	3/4/2014	9:51	Patch	2X2	3	MG	Pass	3/5/2014	VT
142	AT	P57/64/84	3/4/2014	9:56	Patch	2X2	3	MG	Pass	3/5/2014	VT
143	BO	P64/84 6' F P57	3/4/2014	9:59	Patch	2X2	3	MG	Pass	3/5/2014	VT
144	AT	P64/84/90	3/4/2014	10:03	Patch	2X2	3	MG	Pass	3/5/2014	VT
145	AT	P84/90/91	3/4/2014	10:08	Patch	2X2	3	MG	Pass	3/5/2014	VT
146	AT	P84/91/92	3/4/2014	10:13	Patch	2X2	3	MG	Pass	3/5/2014	VT
147	AT	P84/92/95	3/4/2014	10:19	Patch	2X2	3	MG	Pass	3/5/2014	VT
148	AT	P84/95/96	3/4/2014	10:32	Patch	2X2	3	MG	Pass	3/5/2014	VT
149	AT	P84/96/98	3/4/2014	10:41	Patch	2X2	3	MG	Pass	3/5/2014	VT
150	AT	P84/98/99	3/4/2014	10:48	Patch	2X2	3	MG	Pass	3/5/2014	VT

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124
Project Name: Davidson Co LF
Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE
Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
151	AT	P82/83/84	3/4/2014	11:28	Patch	2X2	12	EA	Pass	3/5/2014	VT
152	AT	P80/82/83	3/4/2014	11:23	Patch	2X2	12	EA	Pass	3/5/2014	VT
153	DS-23	P80/82 3' F P83	3/4/2014	11:25	DS	2X4	12	EA	Pass	3/5/2014	VT
154	DS-22	P78/80 60' FP79	3/4/2014	11:34	DS	2X4	12	EA	Pass	3/5/2014	VT
155	DS-21	P77/79 20' F P78	3/4/2014	11:41	DS	2X4	12	EA	Pass	3/5/2014	VT
156	DS-20	P75/77 170' F TI	3/4/2014	11:55	DS	2X4	12	EA	Pass	3/5/2014	VT
157	DS-19	P56/75 98' F TI	3/5/2014	13:27	DS	2X2	12	EA	Pass	3/5/2014	VT
158	BO	P58/59 51' F AT	3/5/2014	11:07	Patch	2X2	3	MG	Pass	3/6/2014	VT
159	AT	P59/62/63	3/5/2014	11:00	Patch	2X2	3	MG	Pass	3/6/2014	VT
160	AT	P59/61/62	3/5/2014	11:09	Patch	2X2	3	MG	Pass	3/6/2014	VT
161	AT	P59/60/61	3/5/2014	11:16	Patch	2X2	3	MG	Pass	3/6/2014	VT
162	BO	P60/TI/AT	3/5/2014	11:24	Patch	4X5	3	MG	Pass	3/6/2014	VT
163	DS-16	P60/TI 18' F AT	3/5/2014	11:31	DS	2X4	3	MG	Pass	3/6/2014	VT
164	BO	P60/TI 23' F AT	3/5/2014	11:38	Patch	2X2	3	MG	Pass	3/6/2014	VT
165	BO	P60/TI 40' F AT	3/5/2014	11:44	Patch	2X2	3	MG	Pass	3/6/2014	VT
166	MD	EX 42' F AT 2' F P60	3/5/2014	11:50	Patch	2X2	3	MG	Pass	3/6/2014	VT
167	BO	P60/TI 55' F AT	3/5/2014	16:43	Patch	2X2	3	MG	Pass	3/6/2014	VT
168	DS-28	P79/TI 2' F P81	3/5/2014	16:49	DS	2X4	3	MG	Pass	3/6/2014	VT
169	DS-24	P58/84 2' FP59	3/5/2014	16:57	DS	2X4	3	MG	Pass	3/6/2014	VT
170	DS-17	P57/64 30' F P84	3/5/2014	9:12	DS	2X4	3	MG	Pass	3/6/2014	VT
171	AT	P64/89/90	3/5/2014	9:17	Patch	2X2	3	MG	Pass	3/6/2014	VT
172	AT	P64/87/89	3/5/2014	9:20	Patch	2X2	3	MG	Pass	3/6/2014	VT
173	AT	P64/86/87	3/5/2014	9:25	Patch	2X2	3	MG	Pass	3/6/2014	VT
174	AT	P64/85/86	3/5/2014	9:31	Patch	2X2	3	MG	Pass	3/6/2014	VT
175	AT	P64/65/85	3/5/2014	9:37	Patch	2X2	3	MG	Pass	3/6/2014	VT
176	AT	P65/66/85	3/5/2014	9:49	Patch	2X2	3	MG	Pass	3/6/2014	VT
177	AT	P66/67/85	3/5/2014	9:54	Patch	2X2	3	MG	Pass	3/6/2014	VT
178	DS-27	P85/86 55' F P64	3/5/2014	2:00	DS	2X2	3	MG	Pass	3/6/2014	VT
179	AT	P86/87/88	3/5/2014	10:07	Patch	2X2	3	MG	Pass	3/6/2014	VT
180	AT	P87/88/89	3/5/2014	10:13	Patch	2X2	3	MG	Pass	3/6/2014	VT

CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Repair Log

Project No.: I13-124
Project Name: Davidson Co LF
Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE
Thickness: 60 mil

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Test		Vac Test Tech
		Seam #							P/F	Date	
181	DS-26	P87/89 2' F P88	3/5/2014	10:26	DS	2X2	3	MG	Pass	3/6/2014	VT
182	BO	P90/91 40' F P93	3/5/2014	10:40	Patch	2X2	3	MG	Pass	3/6/2014	VT
183	AT	P91/92/94	3/5/2014	8:31	Patch	2X2	3	MG	Pass	3/6/2014	VT
184	DS-25	P91/92 2' F P84	3/5/2014	8:38	DS	2X4	3	MG	Pass	3/6/2014	VT
185	AT	P92/94/95	3/5/2014	8:44	Patch	2X2	3	MG	Pass	3/6/2014	VT
186	AT	P95/96/97	3/5/2014	8:52	Patch	2X2	3	MG	Pass	3/6/2014	VT
187	AT	P96/97/98	3/5/2014	8:58	Patch	2X2	3	MG	Pass	3/6/2014	VT
188	AT	P91/93/94	3/5/2014	13:55	Patch	2X2	3	MG	Pass	3/6/2014	VT
189	AT	P90/91/93	3/5/2014	2:05	Patch	2X2	3	MG	Pass	3/6/2014	VT
190	AT	P67/68/85	3/5/2014	14:19	Patch	2X2	3	MG	Pass	3/6/2014	VT
191	AT	P68/69/85	3/5/2014	14:22	Patch	2X2	3	MG	Pass	3/6/2014	VT
192	AT	P69/70/85	3/5/2014	14:29	Patch	2X2	3	MG	Pass	3/6/2014	VT
193	AT	P70/71/85	3/5/2014	14:33	Patch	2X2	3	MG	Pass	3/6/2014	VT
194	AT	P71/72/85	3/5/2014	14:39	Patch	2X2	3	MG	Pass	3/6/2014	VT
195	AT	P72/74/85	3/5/2014	14:43	Patch	2X2	3	MG	Pass	3/6/2014	VT
196	AT	P72/73/74	3/5/2014	14:48	Patch	2X2	3	MG	Pass	3/6/2014	VT
197	DS-18	P68/69 15' F AT	3/5/2014	14:55	Patch	2X2	3	MG	Pass	3/6/2014	VT
198	BO	P57/58/AT	3/5/2014	14:59	Patch	2X2	3	MG	Pass	3/6/2014	VT
199	BO	P57/64/AT	3/5/2014	15:04	Patch	2X2	3	MG	Pass	3/6/2014	VT
200	BO	P58/59/AT	3/5/2014	15:09	Patch	2X2	3	MG	Pass	3/6/2014	VT

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CHESAPEAKE CONTAINMENT SYSTEMS, INC.

Geomembrane Seam Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

60 Mil Thickness

Project Seam Requirements

	Fusion:		Extrusion:
Peel:	90	Peel:	78
Shear:	120	Shear:	120

DT#	Location	Date Removed	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
			Machine	Operator	Temp/ Speed ºF/fpm	Temp/ Preheat ºF/ºF	Peel (ppi) IN / OUT					Shear (ppi)							
							1	2	3	4	5	1	2	3	4	5			
1	P5/6 24' F AT	3/4/2014	11	HR	860/4.5		106	106	121	123	122						Pass	EG	
							123	116	131	121	125	154	148	159	166	172			
2	P8/10 @ P33	3/4/2014	11	HR	860/4.5		108	109	116	113	116						Pass	EG	
							118	104	109	104	110	180	178	176	165	160			
3	P1/20 6' F AT	3/4/2014	15	DG	860/4.5		114	113	122	130	108						Pass	EG	
							113	115	109	119	118	154	164	154	148	164			
4	P22/23 30' F AT	3/4/2014	10	FH	860/4.5		106	119	119	117	121						Pass	EG	
							114	119	109	116	120	159	165	165	159	160			
5	P16/33 5' F P17	3/4/2014	15	DG	860/4.5		106	119	134	131	134						Pass	EG	
							114	108	113	121	119	146	149	166	175	169			
6	P33/35 240' F P36	3/4/2014	11	HR	860/4.5		119	115	115	106	125						Pass	EG	
							120	122	120	114	127	151	156	155	167	165			
7	P35/37 130' F P36	3/4/2014	10	FH	860/4.5		114	116	114	117	116						Pass	EG	
							113	116	117	115	115	164	168	152	148	175			
8	P37/40 160' F EXT	3/4/2014	12	EA	860/4.5		106	119	112	121	120						Pass	EG	
							114	119	114	123	119	147	150	149	178	176			
9	P41/44 70' F EXT	3/4/2014	11	HR	860/4.5		121	123	120	120	122						Pass	EG	
							101	121	114	121	124	174	176	178	164	154			
10	P44/45 55' F EXT	3/4/2014	33	FH	860/4.5		141	106	125	120	123						Pass	EG	
							128	114	127	121	119	176	177	174	165	173			

Geomembrane Seam Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

60 Mil Thickness

Project Seam Requirements

Fusion:		Extrusion:	
Peel:	90	Peel:	78
Shear:	120	Shear:	120

DT#	Location	Date Removed	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
			Machine	Operator	Temp/ Speed ºF/fpm	Temp/ Preheat ºF/ºF	Peel (ppi) IN / OUT					Shear (ppi)							
							1	2	3	4	5	1	2	3	4	5			
11	P45/48 20' F EXT	3/4/2014	12	EA	860/4.5		116	117	116	119	120						Pass	EG	
							113	121	119	117	120	176	170	160	149	179			
12	P48/49 @ EXT	3/4/2014	15	DG	860/4.5		119	106	125	106	113						Pass	EG	
							118	114	127	116	125	154	148	165	174	172			
13	P47/50 95' F P48	3/4/2014	15	DG	860/4.5		117	117	116	109	119						Pass	EG	
							100	115	115	104	113	180	177	176	165	160			
14	P50/51 95' F P52	3/4/2014	11	HR	860/4.5		119	123	120	118	125						Pass	EG	
							116	124	119	121	123	154	164	154	148	164			
15	P51/54 115' F P52	3/4/2014	12	EA	860/4.5		122	101	110	113	106						Pass	EG	
							125	106	113	103	90	159	165	165	178	171			
16	P60/TI 18' F R162	3/4/2014	11	HR	860/4.5		116	120	123	129	108						Pass	EG	
							110	121	119	119	118	146	149	166	175	169			
17	P57/64 30' F P84	3/4/2014	11	HR	860/4.5		132	135	129	134	121						Pass	EG	
							135	130	137	139	127	159	163	167	170	164			
18	P68/69 15' F AT	3/4/2014	33	FH	860/4.5		114	116	118	116	116						Pass	EG	
							123	139	126	125	126	168	162	157	158	179			
19	P56/75 90' F EXT	3/4/2014	15	DG	860/4.5		125	119	124	131	129						Pass	EG	
							141	133	137	133	129	169	173	170	179	172			
20	P75/77 120' F EXT	3/4/2014	11	HR	860/4.5		108	119	120	118	114						Pass	EG	
							118	117	120	120	113	151	156	155	167	174			

Geomembrane Seam Destructive Test Log

Project No.: I13-124
Project Name: Davidson Co LF
Start Date: 2/28/2014
Project Location: Thomasville, NC

Material: HDPE

60 Mil Thickness

Project Seam Requirements

	Fusion:		Extrusion:
Peel:	90	Peel:	78
Shear:	120	Shear:	120

DT#	Location	Date Removed	Welder ID		Wedge	Extruder	Seam Strength										Pass Fail	Tech ID	Remarks
			Machine	Operator	Temp/ Speed ºF/fpm	Temp/ Preheat ºF/ºF	Peel (ppi) IN / OUT					Shear (ppi)							
							1	2	3	4	5	1	2	3	4	5			
21	P77/79 125' F EXT	3/4/2014	33	FH	860/4.5		120	106	113	108	106						Pass	EG	
							131	116	125	111	114	164	168	152	148	175			
22	P78/80 60' F P79	3/4/2014	12	EA	860/4.5		116	109	119	107	106						Pass	EG	
							105	104	113	109	114	147	150	149	178	176			
23	P80/82 6' F P83	3/4/2014	11	HR	860/4.5		122	123	122	119	119						Pass	EG	
							106	121	125	123	120	174	176	178	164	154			
24	P58/84 2' F P59	3/4/2014	11	HR	860/4.5		109	113	106	110	114						Pass	EG	
							114	103	90	120	113	176	165	174	165	180			
25	P91/92 2' F P84	3/4/2014	12	EA	860/4.5		111	129	108	108	106						Pass	EG	
							114	119	118	111	114	176	170	160	149	179			
26	P87/89 2' F P88	3/4/2014	33	FH	860/4.5		107	118	114	118	121						Pass	EG	
							109	119	116	118	120	180	178	176	165	160			
27	P85/86 40' F P64	3/4/2014	33	FH	860/4.5		116	108	106	124	141						Pass	EG	
							113	116	119	123	125	154	164	154	148	164			
28	P79/TI 2' F P81	3/4/2014	15	DG	860/4.5		106	119	119	117	121						Pass	EG	
							114	119	109	116	120	176	182	180	179	183			

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Legends

DEFECT CODE			
BO-	Burn Out	SI-	Soil Surface
CR-	Crease	DD-	Deployment Damage
DS-	Destructive Test Number	MD-	Material Damage
EE-	Earthwork Equipment Damage	WR-	Wrinkle
FM-	Fishmouth	WS-	Welder Restart
FT-	Pressure Test Cut	FD-	Factory Defect
T-	Joint	AT-	Air Test

REPAIR TYPE	
C-	Cap Strip
P-	Patches
B-	Extrudate Bead
GB-	Grind & Bead
BT-	Boot

NOTATIONS	
SOS or 0'	Beginning of Seam
EOS	End of Seam
--	To an Area
>	From an Area
NOAT	No AT

TEST RESULTS	
P-	Pass
F-	Fail

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T3

Demtech Services, Inc.

Placerville, California, USA

CALIBRATION CERTIFICATE

Customer Name: **Chesapeake Contanment Systems**

Tensiometer Model: Pro-Tester T-0100

Device Calibrated: S-Type load cell

Range: 0 - 750 lbs. Tension

Model No: M2405-750#

Serial No: **239492**

Calibration Apparatus:

Reference load cell (S/N 204781)

A/D Module Model No: T-029

A/D Module Serial No: **3409239492**

Channel No: N/A

Dead Weight:		Reference Cell:	
W1	2	R1	2
W2	152	R2	152
W3	302	R3	302

Indicator reading with no load: 0

Offset **2.352174** Scale: **5.142937**

Applied Force lbs.	Cell Response:	Deviation Error:
2	2	0.00
52	52	0.00
102	102	0.00
152	152	0.00
202	202	0.00
252	252	0.00
302	302	0.00

Total Deviation Error (%): 0.00%

Temperature at time of calibration: 73 degrees F

Exitation Voltage: 5 V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

Calibration Technician: JF

Date: 08/09/13

T3

Demtech Services, Inc.

Placerville, California, USA

CALIBRATION CERTIFICATE

Chesapeake Containment Systems

Tensiometer Model: Pro-Tester T-0100

Device Calibrated: S-Type load cell

Range: 0 - 750 lbs. Tension

Model No: M2405-750#

Serial No: **263941**

Calibration Apparatus: Pro-Cal unit, model TC-0100/A

A/D Module Model No: T-029

A/D Module Serial No: **2111263941**

Channel No: N/A

Dead Weight:		Reference Cell:	
W1	2	R1	2
W2	152	R2	152
W3	302	R3	302

Indicator reading with no load: 0

Offset **4.961887** Scale: **5.030009**

Applied Force lbs.	Cell Response:	Deviation Error:
2	2	0.00
52	52	0.00
102	102	0.00
152	152	0.00
202	202	0.00
252	252	0.00
302	302	0.00

Total Deviation Error (%): 0.00%

Temperature at time of calibration: 73 degrees F

Exitation Voltage: 5 V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

JF

Date: 08/09/13

Demtech Services, Inc.

Placerville, California, USA

T4

CALIBRATION CERTIFICATE

Chesapeake Containment Systems

Tensiometer Model: Pro-Tester T-0100

Device Calibrated: S-Type load cell

Range: 0 - 750 lbs. Tension

Model No: M2405-750#

Serial No: **667571**

Calibration Apparatus: Pro-Cal unit, model TC-0100/A

A/D Module Model No: T-029

A/D Module Serial No: **2911667571**

Channel No: N/A

Dead Weight:

W1	2
W2	152
W3	302

Reference Cell:

R1	2
R2	152
R3	302

Indicator reading with no load: 0

Offset **2.491389** Scale: **3.176252**

Applied Force lbs.	Cell Response:	Deviation Error:
2	2	0.00
52	52	0.00
102	102	0.00
152	152	0.00
202	202	0.00
252	252	0.00
302	302	0.00

Total Deviation Error (%): 0.00%

Temperature at time of calibration: 73 degrees F

Exitation Voltage: 5 V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

TD

Date: 09/04/13

T4

Demtech Services, Inc.

Placerville, California, USA

CALIBRATION CERTIFICATE

Chesapeake Containment Systems

Tensiometer Model: Pro-Tester T-0100

Device Calibrated: S-Type load cell

Range: 0 - 750 lbs. Tension

Model No: M2405-750#

Serial No: **682277**

Calibration Apparatus: Pro-Cal unit, model TC-0100/A

A/D Module Model No: T-029

A/D Module Serial No: **3712682277**

Channel No: N/A

Dead Weight:		Reference Cell:	
W1	2	R1	2
W2	152	R2	152
W3	302	R3	302

Indicator reading with no load: 0

Offset: **6.529324** Scale: **3.194836**

Applied Force lbs.	Cell Response:	Deviation Error:
2	2	0.00
52	52	0.00
102	102	0.00
152	152	0.00
202	202	0.00
252	252	0.00
302	302	0.00

Total Deviation Error (%): 0.00%

Temperature at time of calibration: 73 degrees F

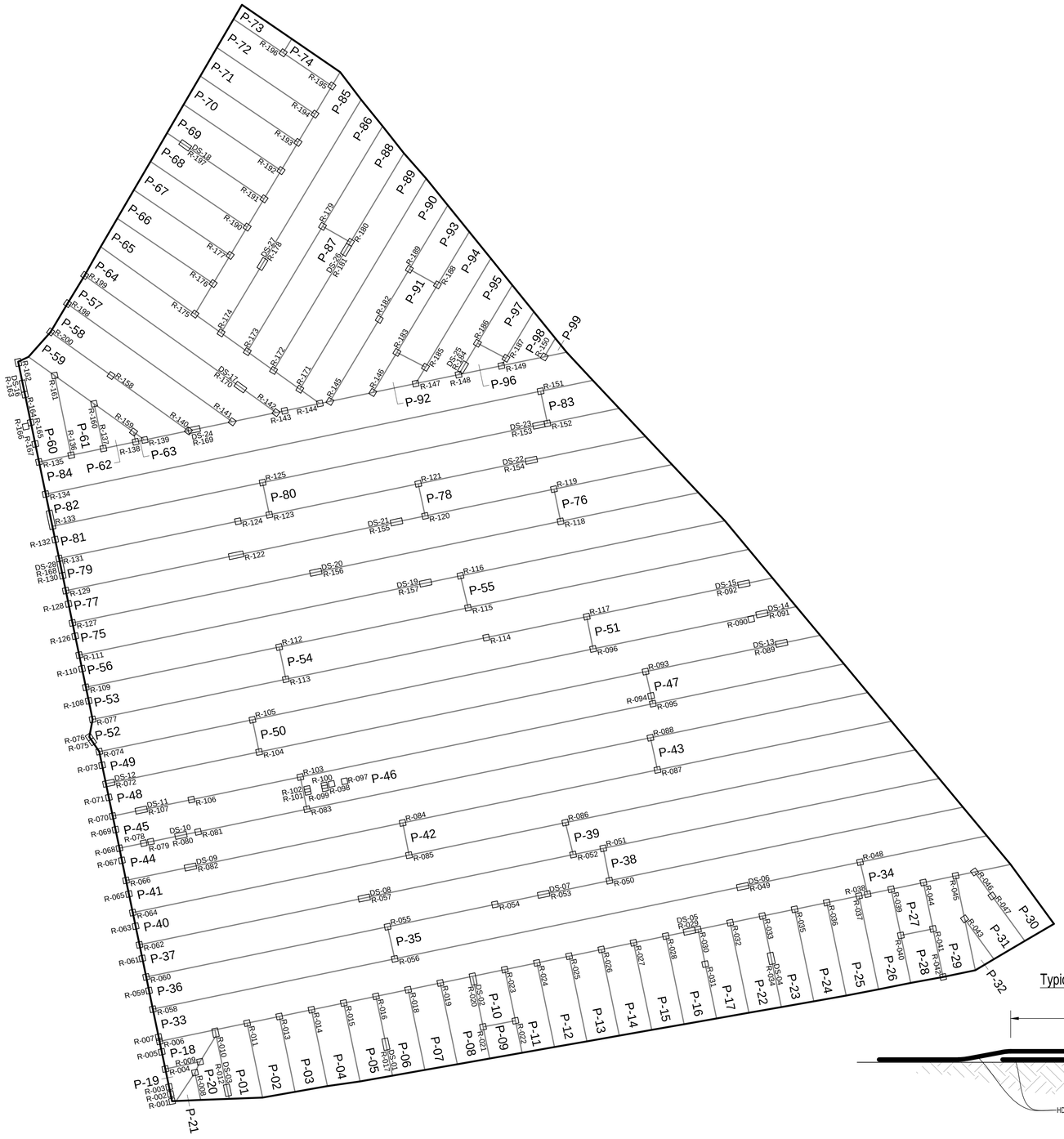
Exitation Voltage: 5 V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

TD

Date: 09/04/13



LEGEND

———	PANEL BOUNDARY
———	PANEL
P-00	PANEL NUMBER
□R-00	REPAIR LOCATION
▭DS-00 R-00	DESTRUCT LOCATION

NOTE:

RECORD LAYOUT DRAWING IS FOR GENERAL ORIENTATION ONLY. INFORMATION DOCUMENTED AND SUBMITTED AS FINAL RECORD COPY OF INSTALLATION. THIS IS NOT A SURVEYED DRAWING.

NORTH

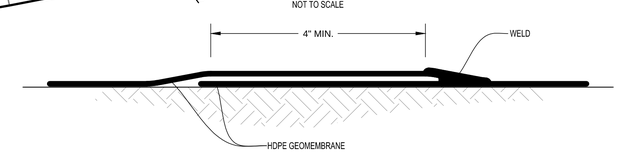
RECORD LAYOUT DRAWING

40' 0 40' 80' 120'

SCALE : 1" = 40'

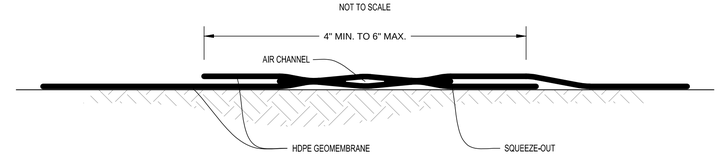
Typical Extrusion Weld

NOT TO SCALE



Typical Hot Wedge Double Track Fusion Weld

NOT TO SCALE



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Middle River, MD 21220

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CHESAPEAKE CONTAINMENT SYSTEMS, INC.
www.ccsliners.com

ENGINEER SEAL

RECORD LAYOUT DRAWING PLAN

DAVIDSON COUNTY MSW LANDFILL
PHASE 2 - AREA 2 - CELL 1
THOMASVILLE, NORTH CAROLINA

SCALE	DATE
1" = 40'	03/25/2014
CCS JOB NUMBER	SHEET NUMBER
I13-085	01 OF 01

DRAWING NUMBER

R-01

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-01
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-1

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	116.3	BRK	<10
2	115.0	BRK	<10
3	141.1	BRK	<10
4	120.0	BRK	<10
5	126.5	BRK	<10
AVERAGE	**123.8**		
STD. DEV.	10.66		
INSIDE TRACK (WELD "B")			
1	135.2	BRK	<10
2	140.3	BRK	<10
3	143.9	BRK	<10
4	137.9	BRK	<10
5	145.2	BRK	<10
AVERAGE	**140.5**		
STD. DEV.	4.14		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	190.0	SE1
2	187.2	SE1
3	189.4	SE1
4	186.7	SE1
5	188.7	SE1
AVERAGE	**188.4**	
STD. DEV.	1.41	

CHECKED BY: __GEM__ DATE: _3/7/14__

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-01 3/7/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-02
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-2

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	130.9	BRK	<10
2	118.4	BRK	<10
3	124.9	BRK	<10
4	120.1	BRK	<10
5	122.0	BRK	<10
AVERAGE	**123.3**		
STD. DEV.	4.91		
INSIDE TRACK (WELD "B")			
1	133.6	BRK	<10
2	142.8	BRK	<10
3	142.8	BRK	<10
4	147.2	BRK	<10
5	144.8	BRK	<10
AVERAGE	**142.2**		
STD. DEV.	5.16		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	188.0	SE1
2	186.7	SE1
3	188.6	SE1
4	185.9	SE1
5	188.2	SE1
AVERAGE	**187.5**	
STD. DEV.	1.13	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-02 3/7/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-03
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-3

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	128.3	BRK	<10
2	126.7	BRK	<10
3	127.4	BRK	<10
4	121.9	BRK	<10
5	129.7	BRK	<10
AVERAGE	**126.8**		
STD. DEV.	2.96		
INSIDE TRACK (WELD "B")			
1	123.7	BRK	<10
2	121.6	BRK	<10
3	125.9	BRK	<10
4	132.0	BRK	<10
5	133.5	BRK	<10
AVERAGE	**127.3**		
STD. DEV.	5.19		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	182.0	SE1
2	192.1	SE1
3	187.8	SE1
4	183.4	SE1
5	190.2	SE1
AVERAGE	**187.1**	
STD. DEV.	4.32	

CHECKED BY: __GEM__ DATE: _3/7/14__

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-03 3/7/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-04
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-4

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	131.3	BRK	<10
2	128.2	BRK	<10
3	127.4	BRK	<10
4	139.3	BRK	<10
5	142.3	BRK	<10
AVERAGE	**133.7**		
STD. DEV.	6.73		
INSIDE TRACK (WELD "B")			
1	142.3	BRK	<10
2	140.9	BRK	<10
3	139.2	BRK	<10
4	132.1	BRK	<10
5	143.4	BRK	<10
AVERAGE	**139.6**		
STD. DEV.	4.47		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	192.8	SE1
2	194.8	SE1
3	189.2	SE1
4	192.3	SE1
5	194.2	SE1
AVERAGE	**192.7**	
STD. DEV.	2.18	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-04 3/7/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-05
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-5

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	142.9	BRK	<10
2	138.9	BRK	<10
3	145.6	BRK	<10
4	140.0	BRK	<10
5	145.5	BRK	<10
AVERAGE	**142.6**		
STD. DEV.	3.08		
INSIDE TRACK (WELD "B")			
1	124.5	BRK	<10
2	122.6	BRK	<10
3	122.4	BRK	<10
4	123.1	BRK	<10
5	127.2	BRK	<10
AVERAGE	**124.0**		
STD. DEV.	1.99		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	174.9	SE1
2	180.3	SE1
3	172.9	SE1
4	173.6	SE1
5	173.0	SE1
AVERAGE	**174.9**	
STD. DEV.	3.10	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-05 3/7/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-06
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-6

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	112.7	BRK	<10
2	121.2	BRK	<10
3	131.6	BRK	<10
4	122.8	BRK	<10
5	118.4	BRK	<10
AVERAGE	**121.3**		
STD. DEV.	6.90		
INSIDE TRACK (WELD "B")			
1	143.2	BRK	<10
2	142.9	BRK	<10
3	143.7	BRK	<10
4	146.3	BRK	<10
5	147.7	BRK	<10
AVERAGE	**144.8**		
STD. DEV.	2.12		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	193.0	SE1
2	191.6	SE1
3	190.5	SE1
4	189.2	SE1
5	187.2	SE1
AVERAGE	**190.3**	
STD. DEV.	2.23	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-06 3/7/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-07
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-7

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	130.5	BRK	<10
2	136.6	BRK	<10
3	137.4	BRK	<10
4	135.0	BRK	<10
5	138.0	BRK	<10
AVERAGE	**135.5**		
STD. DEV.	3.01		
INSIDE TRACK (WELD "B")			
1	129.1	BRK	<10
2	124.2	BRK	<10
3	127.1	BRK	<10
4	132.9	BRK	<10
5	137.4	SE1	<10
AVERAGE	**130.1**		
STD. DEV.	5.15		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	194.7	SE1
2	192.7	SE1
3	193.3	SE1
4	192.5	SE1
5	197.7	SE1
AVERAGE	**194.2**	
STD. DEV.	2.15	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-07 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-08
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-8

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	127.9	BRK	<10
2	127.2	BRK	<10
3	124.3	BRK	<10
4	121.8	BRK	<10
5	126.3	BRK	<10
AVERAGE	**125.5**		
STD. DEV.	2.47		
INSIDE TRACK (WELD "B")			
1	142.8	BRK	<10
2	134.8	BRK	<10
3	141.2	BRK	<10
4	137.9	BRK	<10
5	137.3	BRK	<10
AVERAGE	**138.8**		
STD. DEV.	3.19		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	194.3	SE1
2	192.2	SE1
3	195.7	SE1
4	189.9	SE1
5	190.7	SE1
AVERAGE	**192.6**	
STD. DEV.	2.43	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-08 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-09
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-9

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	131.3	BRK	<10
2	123.1	BRK	<10
3	116.8	BRK	<10
4	121.3	BRK	<10
5	113.9	BRK	<10
AVERAGE	**121.3**		
STD. DEV.	6.68		
INSIDE TRACK (WELD "B")			
1	136.8	BRK	<10
2	142.8	BRK	<10
3	129.0	BRK	<10
4	139.9	BRK	<10
5	131.7	BRK	<10
AVERAGE	**136.0**		
STD. DEV.	5.69		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	187.2	BRK
2	188.7	SE1
3	188.5	SE1
4	190.1	SE1
5	182.8	SE1
AVERAGE	**187.5**	
STD. DEV.	2.80	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-(2014-625-06-09 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-10
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-10

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	138.2	BRK	<10
2	132.7	BRK	<10
3	116.7	BRK	<10
4	118.8	BRK	<10
5	112.9	BRK	<10
AVERAGE	**123.9**		
STD. DEV.	10.96		
INSIDE TRACK (WELD "B")			
1	140.7	BRK	<10
2	138.2	BRK	<10
3	125.9	BRK	<10
4	138.6	BRK	<10
5	137.5	BRK	<10
AVERAGE	**136.2**		
STD. DEV.	5.87		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	195.4	BRK
2	194.0	BRK
3	190.4	BRK
4	193.4	BRK
5	191.8	BRK
AVERAGE	**193.0**	
STD. DEV.	1.94	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-10 3/10/14

PEEL AND SHEAR TEST RESULTS
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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-11
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-11

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	131.8	SE1	<10
2	137.4	SE1	<10
3	132.4	SE1	<10
4	125.6	SE1	<10
5	135.2	SE1	<10
AVERAGE	**132.5**		
STD. DEV.	4.46		
INSIDE TRACK (WELD "B")			
1	138.3	SE1	<10
2	141.7	SE1	<10
3	148.4	SE1	<10
4	150.9	SE1	<10
5	136.0	SE1	<10
AVERAGE	**143.1**		
STD. DEV.	6.41		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	196.1	BRK
2	195.4	BRK
3	196.9	BRK
4	196.3	BRK
5	178.5	BRK
AVERAGE	**192.6**	
STD. DEV.	7.92	

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C:\My Documents\EXCEL\Templates\[HDP&S-DFusion.xls]Sheet1

T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-11 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-12
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-12

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	125.0	SE1	<10
2	132.3	SE1	<10
3	125.5	SE1	<10
4	130.8	SE1	<10
5	149.5	SE1	<10
AVERAGE	**132.6**		
STD. DEV.	9.96		
INSIDE TRACK (WELD "B")			
1	120.4	SE1	<10
2	131.1	SE1	<10
3	129.0	SE1	<10
4	125.3	SE1	<10
5	133.6	SE1	<10
AVERAGE	**127.9**		
STD. DEV.	5.17		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	189.6	BRK
2	192.4	BRK
3	194.9	BRK
4	193.4	BRK
5	190.5	BRK
AVERAGE	**192.2**	
STD. DEV.	2.15	

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C:\My Documents\EXCEL\Templates\[HDP&S-DFusion.xls]Sheet1

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-13
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-13

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	145.2	SE1	<10
2	153.5	SE1	<10
3	148.1	SE1	<10
4	149.5	SE1	<10
5	131.8	SE1	<10
AVERAGE	**145.6**		
STD. DEV.	8.28		
INSIDE TRACK (WELD "B")			
1	128.9	SE1	<10
2	125.9	SE1	<10
3	124.1	SE1	<10
4	115.9	SE1	<10
5	129.9	SE1	<10
AVERAGE	**124.9**		
STD. DEV.	5.56		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	182.4	BRK
2	181.4	BRK
3	177.8	BRK
4	175.4	BRK
5	164.7	BRK
AVERAGE	**176.3**	
STD. DEV.	7.09	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-13 3/12/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-14
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-14

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	140.1	SE1	<10
2	117.9	SE1	<10
3	123.3	SE1	<10
4	126.2	SE1	<10
5	119.0	SE1	<10
AVERAGE	**125.3**		
STD. DEV.	8.92		
INSIDE TRACK (WELD "B")			
1	154.8	SE1	<10
2	147.3	SE1	<10
3	131.5	SE1	<10
4	139.6	SE1	<10
5	130.8	SE1	<10
AVERAGE	**140.8**		
STD. DEV.	10.32		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	188.4	BRK
2	196.0	BRK
3	190.9	BRK
4	193.8	BRK
5	189.8	BRK
AVERAGE	**191.8**	
STD. DEV.	3.08	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-14 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-15
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-15

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	124.1	SE1	<10
2	133.2	SE1	<10
3	123.9	SE1	<10
4	125.5	SE1	<10
5	130.5	SE1	<10
AVERAGE	**127.4**		
STD. DEV.	4.18		
INSIDE TRACK (WELD "B")			
1	132.9	SE1	<10
2	134.9	SE1	<10
3	147.0	SE1	<10
4	135.1	SE1	<10
5	136.2	SE1	<10
AVERAGE	**137.2**		
STD. DEV.	5.60		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	189.0	BRK
2	190.5	BRK
3	220.7	BRK
4	190.2	BRK
5	193.5	BRK
AVERAGE	**196.8**	
STD. DEV.	13.47	

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C:\My Documents\EXCEL\Templates\[HDP&S-DFusion.xls]Sheet1

T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-15 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-16
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-16

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	158.1	SE1	<10
2	146.1	SE1	<10
3	128.3	SE1	<10
4	137.1	SE1	<10
5	134.9	SE1	<10
AVERAGE	**140.9**		
STD. DEV.	11.53		
INSIDE TRACK (WELD "B")			
1	135.9	SE1	<10
2	137.2	SE1	<10
3	126.6	SE1	<10
4	126.8	SE1	<10
5	134.6	SE1	<10
AVERAGE	**132.2**		
STD. DEV.	5.12		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	195.9	BRK
2	193.8	BRK
3	196.9	BRK
4	197.8	BRK
5	190.1	BRK
AVERAGE	**194.9**	
STD. DEV.	3.07	

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C:\My Documents\EXCEL\Templates\[HDP&S-DFusion.xls]Sheet1

T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-16 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-17
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-17

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	121.8	SE1	<10
2	130.7	SE1	<10
3	143.5	SE1	<10
4	129.4	SE1	<10
5	131.5	SE1	<10
AVERAGE	**131.4**		
STD. DEV.	7.80		
INSIDE TRACK (WELD "B")			
1	137.8	SE1	<10
2	144.2	SE1	<10
3	133.2	SE1	<10
4	142.6	SE1	<10
5	129.8	SE1	<10
AVERAGE	**137.5**		
STD. DEV.	6.10		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	183.8	BRK
2	186.0	BRK
3	183.5	BRK
4	185.7	BRK
5	183.1	BRK
AVERAGE	**184.4**	
STD. DEV.	1.33	

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C:\My Documents\EXCEL\Templates\[HDP&S-DFusion.xls]Sheet1

T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-17 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-18
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-18

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	134.7	SE1	<10
2	117.9	SE1	<10
3	122.1	SE1	<10
4	125.1	SE1	<10
5	127.6	SE1	<10
AVERAGE	**125.5**		
STD. DEV.	6.30		
INSIDE TRACK (WELD "B")			
1	137.5	SE1	<10
2	138.9	SE1	<10
3	139.6	SE1	<10
4	135.1	SE1	<10
5	140.5	SE1	<10
AVERAGE	**138.3**		
STD. DEV.	2.11		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	194.3	BRK
2	194.7	BRK
3	196.5	BRK
4	192.6	BRK
5	191.2	BRK
AVERAGE	**193.9**	
STD. DEV.	2.03	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-18 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-19
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-19

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	145.2	SE1	<10
2	124.1	SE1	<10
3	147.9	SE1	<10
4	143.1	SE1	<10
5	132.3	SE1	<10
AVERAGE	**138.5**		
STD. DEV.	10.00		
INSIDE TRACK (WELD "B")			
1	130.3	SE1	<10
2	134.9	SE1	<10
3	135.3	SE1	<10
4	132.2	SE1	<10
5	123.1	SE1	<10
AVERAGE	**131.2**		
STD. DEV.	4.95		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	198.1	BRK
2	190.8	BRK
3	193.6	BRK
4	192.5	BRK
5	193.3	BRK
AVERAGE	**193.7**	
STD. DEV.	2.71	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-: 2014-625-06-19 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
geotechnical & geosynthetic testing

CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-20
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-20

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	129.1	SE1	<10
2	123.6	SE1	<10
3	134.0	SE1	<10
4	121.2	SE1	<10
5	127.5	SE1	<10
AVERAGE	**127.1**		
STD. DEV.	4.97		
INSIDE TRACK (WELD "B")			
1	141.9	SE1	<10
2	144.2	SE1	<10
3	140.3	SE1	<10
4	143.6	SE1	<10
5	132.1	SE1	<10
AVERAGE	**140.4**		
STD. DEV.	4.89		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	187.3	BRK
2	183.6	BRK
3	189.8	BRK
4	187.8	BRK
5	190.1	BRK
AVERAGE	**187.7**	
STD. DEV.	2.61	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-2 2014-625-06-20 3/10/14

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

geotechnics
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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-21
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-21

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	128.2	SE1	<10
2	130.7	SE1	<10
3	126.9	SE1	<10
4	128.5	SE1	<10
5	126.4	SE1	<10
AVERAGE	**128.1**		
STD. DEV.	1.68		
INSIDE TRACK (WELD "B")			
1	139.8	SE1	<10
2	124.1	SE1	<10
3	132.6	SE1	<10
4	127.4	SE1	<10
5	135.3	SE1	<10
AVERAGE	**131.8**		
STD. DEV.	6.24		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	195.2	BRK
2	192.7	BRK
3	185.6	BRK
4	190.9	BRK
5	192.5	BRK
AVERAGE	**191.4**	
STD. DEV.	3.58	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-22
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-22

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	122.8	SE1	<10
2	124.1	SE1	<10
3	121.4	SE1	<10
4	132.6	SE1	<10
5	143.4	SE1	<10
AVERAGE	**128.9**		
STD. DEV.	9.23		
INSIDE TRACK (WELD "B")			
1	146.2	SE1	<10
2	131.4	SE1	<10
3	143.6	SE1	<10
4	130.8	SE1	<10
5	134.1	SE1	<10
AVERAGE	**137.2**		
STD. DEV.	7.18		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	187.6	BRK
2	189.6	BRK
3	189.4	BRK
4	188.9	BRK
5	179.5	BRK
AVERAGE	**187.0**	
STD. DEV.	4.26	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-23
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-23

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	123.6	SE1	<10
2	124.6	SE1	<10
3	129.3	SE1	<10
4	124.3	SE1	<10
5	125.0	SE1	<10
AVERAGE	**125.4**		
STD. DEV.	2.26		
INSIDE TRACK (WELD "B")			
1	133.0	SE1	<10
2	141.4	SE1	<10
3	136.3	SE1	<10
4	135.7	SE1	<10
5	140.6	SE1	<10
AVERAGE	**137.4**		
STD. DEV.	3.52		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	188.7	BRK
2	188.2	BRK
3	185.1	BRK
4	187.8	BRK
5	188.4	BRK
AVERAGE	**187.6**	
STD. DEV.	1.46	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-24
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-24

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	107.9	SE1	<10
2	126.2	SE1	<10
3	112.8	SE1	<10
4	113.5	SE1	<10
5	118.7	SE1	<10
AVERAGE	**115.8**		
STD. DEV.	6.95		
INSIDE TRACK (WELD "B")			
1	124.2	SE1	<10
2	134.1	SE1	<10
3	126.8	SE1	<10
4	120.7	SE1	<10
5	118.5	SE1	<10
AVERAGE	**124.9**		
STD. DEV.	6.07		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	173.7	BRK
2	171.3	BRK
3	149.5	BRK
4	175.4	BRK
5	177.4	BRK
AVERAGE	**169.5**	
STD. DEV.	11.38	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-25
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-25

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	125.5	SE1	<10
2	122.3	SE1	<10
3	122.9	SE1	<10
4	124.3	SE1	<10
5	116.6	SE1	<10
AVERAGE	**122.3**		
STD. DEV.	3.43		
INSIDE TRACK (WELD "B")			
1	129.1	SE1	<10
2	124.5	SE1	<10
3	125.3	SE1	<10
4	124.5	SE1	<10
5	121.6	SE1	<10
AVERAGE	**125.0**		
STD. DEV.	2.69		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	185.1	BRK
2	187.8	BRK
3	186.7	BRK
4	189.7	BRK
5	188.9	BRK
AVERAGE	**187.6**	
STD. DEV.	1.82	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-26
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-26

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	124.0	SE1	<10
2	122.4	SE1	<10
3	121.2	SE1	<10
4	120.8	SE1	<10
5	124.1	SE1	<10
AVERAGE	**122.5**		
STD. DEV.	1.53		
INSIDE TRACK (WELD "B")			
1	131.5	SE1	<10
2	130.4	SE1	<10
3	131.6	SE1	<10
4	125.3	SE1	<10
5	126.9	SE1	<10
AVERAGE	**129.1**		
STD. DEV.	2.87		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	180.0	BRK
2	179.6	BRK
3	176.8	BRK
4	184.5	BRK
5	179.9	BRK
AVERAGE	**180.2**	
STD. DEV.	2.76	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-27
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-27

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	132.5	SE1	<10
2	121.5	SE1	<10
3	129.8	SE1	<10
4	118.3	SE1	<10
5	125.7	SE1	<10
AVERAGE	**125.6**		
STD. DEV.	5.82		
INSIDE TRACK (WELD "B")			
1	135.6	SE1	<10
2	135.7	SE1	<10
3	134.6	SE1	<10
4	135.3	SE1	<10
5	132.2	SE1	<10
AVERAGE	**134.7**		
STD. DEV.	1.45		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	186.9	BRK
2	182.3	BRK
3	187.7	BRK
4	188.1	BRK
5	186.0	BRK
AVERAGE	**186.2**	
STD. DEV.	2.32	

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PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392 & 4437 w/NSF 54

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CLIENT: SMITH + GARDNER
CLIENT PROJECT: DAVIDSON CO. LF

CLIENT PROJ. NO.: NA
PROJECT NO.: 2014-625-06
LAB ID NO.: 2014-625-06-28
MATERIAL: 60-MIL HDPE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-28

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	130.1	SE1	<10
2	135.6	SE1	<10
3	126.6	SE1	<10
4	133.7	SE1	<10
5	128.0	SE1	<10
AVERAGE	**130.8**		
STD. DEV.	3.79		
INSIDE TRACK (WELD "B")			
1	137.3	SE1	<10
2	147.0	SE1	<10
3	149.0	SE1	<10
4	164.6	SE1	<10
5	161.3	SE1	<10
AVERAGE	**151.8**		
STD. DEV.	11.13		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	172.9	BRK
2	204.0	BRK
3	188.6	BRK
4	205.8	BRK
5	174.8	BRK
AVERAGE	**189.2**	
STD. DEV.	15.56	

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T:\2014 PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-06-2 2014-625-06-28 3/10/14

Appendix L

Leachate Management System CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

PerformancePipe.com

DRISCOPLEX® 4000 [DIPS] / 4100 [IPS]

HDPE PIPE DATA SHEET

DriscoPlex® 4000/4100 Pipe meets or exceeds:

ASTM F714 (4" and larger) AWWA C906 NSF/ANSI 61
ASTM D3035 (up to 3") AWWA C901 NSF/ANSI 61
ASTM D3350, cell classification PE445574C
PPI TR-4 designation PE4710
NSF/ANSI 14 – Available upon request

DriscoPlex® 4000/4100 Pipe for:

Potable Water, Raw Water, Sanitary Sewer,
Reclaimed Water, Storm Drain, Treated Sewage, etc.
Iron Pipe Size OD (IPS) ¾" to 54",
Ductile Iron Pipe Size OD (DIPS) 4" to 42"
40' and 50' Joints / Solid Black / Color Striping Available
500' coils available in sizes through 6"

NOMINAL PIPE PROPERTIES [1]	UNIT	TEST METHOD	VALUE PE4710
Density	gms / cm^3	ASTM D1505	0.960 (black)
Melt Index (MI) Condition 190°C / 2.16kg	gms / 10 minutes	ASTM D1238	0.08
Hydrostatic Design Basis 73° F (23° C)	psi	ASTM D2837	1600
Hydrostatic Design Basis 140° F (60° C)	psi	ASTM D2837	1000
Color: UV Stabilizer [C]	---	ASTM D3350	Min 2% Carbon Black
NOMINAL MATERIAL PROPERTIES [1] [2]	**UNIT**	**TEST METHOD**	**VALUE PE4710**
Flexural Modulus 2% Secant – 16:1 span: depth. 0.5 in / min.	psi	ASTM D790	>120,000
Tensile Strength at Yield	psi	ASTM D638 Type IV	>3500
Elongation at Break 2 in / min., Type IV Bar	%	ASTM D638	>800
Elastic Modulus	psi	ASTM D638	>175,000
Hardness	Shore D	ASTM D2240	62
PENT	hrs	ASTM F1473	>500
Vicat Softening Temperature	°F	ASTM D1525	256
Brittleness Temperature	°F	ASTM D746	< -103
Thermal Expansion	in / in / °F	ASTM D696	1.0×10^{-4}

1. This is not a product specification and does not guarantee or establish specific minimum or maximum values or manufacturing tolerance for material or piping products to be supplied.
2. Values obtained from tests of specimens taken from piping product may vary from these typical values.

When Performance Matters Rely on Performance Pipe

Bulletin: PP101 / January 2011
© 2009 Chevron Phillips Chemical Company LP

Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7348

This data sheet provides typical properties for Performance Pipe piping products. Before using this product, the user is advised and cautioned to make their own determination and assessment of the safety and suitability of the product for the specific use in question and is further advised against relying on the information contained herein as it may relate to any specific use or application. It is the ultimate responsibility of the user to ensure that the product is suited and the information is application to the user's specific application. Chevron Phillips Chemical Company LP does not make, and expressly disclaims, all warranties, including warranties of merchantability or fitness for a particular purpose, regardless of whether oral or written, express or implied, allegedly arising from any usage of any trade or from any course of dealing in connection with the use of information contained herein or the product itself. The user expressly assumes all risk and liability, whether based in contract, tort or otherwise, in connection with the use of the information contained herein or the product itself. Further, information contained herein is given without reference to any intellectual property issues, as well as federal, state or local laws which may be encountered in the use thereof. Such questions should be investigated by the user. The data sheet may change periodically. Visit www.Performance Pipe.com for the most current data sheet.

PERFORMANCE PIPE
A DIVISION OF CHEVRON PHILLIPS CHEMICAL COMPANY LP

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Revised 06-28-2013

IPS Size and Dimension Data

PE4710 (PE3408)

DriscoPlex® Municipal, Industrial & Energy Series

Pressure Ratings are calculated using 0.63 design factor for HDS at 73°F as listed in PPI TR-4 for PE 4710 materials. HDPE can accomodate up to 1.5 times the pipe pressure rating for a recurring surge and up to 2.0 times the pipe pressure rating for an occasional surge. Temperature, Chemical, and Environmental use considerations may require use of additional design factors.

Pressure Rating		317 psi DR 7.3			250 psi DR 9.0			200 psi DR 11.0			160 psi DR 13.5			
Nominal Pipe Size	IPS OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Nominal Pipe Size
1 1/4"	1.660	0.227	1.179	0.45	0.184	1.270	0.37	0.151	1.340	0.31	0.123	1.399	0.26	1 1/4"
1 1/2"	1.900	0.260	1.349	0.59	0.211	1.453	0.49	0.173	1.533	0.41	0.141	1.601	0.34	1 1/2"
2"	2.375	0.325	1.686	0.92	0.264	1.815	0.77	0.216	1.917	0.64	0.176	2.002	0.53	2"
3"	3.500	0.479	2.485	1.99	0.389	2.675	1.66	0.318	2.826	1.39	0.259	2.951	1.16	3"
4"	4.500	0.616	3.194	3.29	0.500	3.440	2.75	0.409	3.633	2.31	0.333	3.794	1.92	4"
6"	6.625	0.908	4.700	7.12	0.736	5.065	5.96	0.602	5.349	5.00	0.491	5.584	4.15	6"
8"	8.625	1.182	6.119	12.07	0.958	6.594	10.11	0.784	6.963	8.47	0.639	7.270	7.04	8"
10"	10.750	1.473	7.627	18.75	1.194	8.219	15.70	0.977	8.679	13.16	0.796	9.062	10.93	10"
12"	12.750	1.747	9.046	26.38	1.417	9.746	22.08	1.159	10.293	18.51	0.944	10.749	15.38	12"
14"	14.000	1.918	9.934	31.81	1.556	10.701	26.63	1.273	11.301	22.32	1.037	11.802	18.54	14"
16"	16.000	2.192	11.353	41.55	1.778	12.231	34.78	1.455	12.915	29.15	1.185	13.488	24.22	16"
18"	18.000	2.466	12.772	52.58	2.000	13.760	44.02	1.636	14.532	36.89	1.333	15.174	30.65	18"
20"	20.000	2.740	14.191	64.91	2.222	15.289	54.34	1.818	16.146	45.54	1.481	16.860	37.84	20"
22"	22.000	3.014	15.610	78.55	2.444	16.819	65.75	2.000	17.760	55.10	1.630	18.544	45.79	22"
24"	24.000	3.288	17.029	93.48	2.667	18.346	78.25	2.182	19.374	65.58	1.778	20.231	54.49	24"
26"	26.000				2.889	19.875	91.84	2.364	20.988	76.96	1.926	21.917	63.95	26"
28"	28.000				3.111	21.405	106.51	2.545	22.605	89.26	2.074	23.603	74.17	28"
30"	30.000				3.333	22.934	122.27	2.727	24.219	102.47	2.222	25.289	85.14	30"
32"	32.000				3.556	24.462	139.12	2.909	25.833	116.58	2.370	26.976	96.87	32"
34"	34.000				3.778	25.991	157.05	3.091	27.447	131.61	2.519	28.660	109.36	34"
36"	36.000				4.000	27.520	176.07	3.273	29.061	147.55	2.667	30.346	122.60	36"
42"	42.000							3.818	33.906	200.84	3.111	35.405	166.88	42"
48"	48.000													48"
54"	54.000													54"

This size and dimension chart is intended for reference purposes. It should not be used in place of the advice from a licensed Professional Engineer. Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter is calculated using IPS OD and Minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimension and tolerances in the applicable pipe manufacturing specification.

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Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Revised 06/28/2013

IPS Size and Dimension Data

PE4710 (PE3408)

DriscoPlex® Municipal, Industrial & Energy Series

Pressure Ratings are calculated using 0.63 design factor for HDS at 73°F as listed in PPI TR-4 for PE 4710 materials. HDPE can accomodate up to 1.5 times the pipe pressure rating for a recurring surge and up to 2.0 times the pipe pressure rating for an occasional surge. Temperature, Chemical, and Environmental use considerations may require use of additional design factors.

Pressure Rating		125 psi DR 17.0			100 psi DR 21.0			80 psi DR 26.0			63 psi DR 32.5			
Nominal Pipe Size	IPS OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Nominal Pipe Size
1 1/4"	1.660													1 1/4"
1 1/2"	1.900													1 1/2"
2"	2.375	0.140	2.078	0.43										2"
3"	3.500	0.206	3.063	0.94										3"
4"	4.500	0.265	3.938	1.55	0.214	4.046	1.27							4"
6"	6.625	0.390	5.798	3.36	0.315	5.957	2.75	0.255	6.084	2.24	0.204	6.193	1.81	6"
8"	8.625	0.507	7.550	5.69	0.411	7.754	4.66	0.332	7.921	3.80	0.265	8.063	3.07	8"
10"	10.750	0.632	9.410	8.83	0.512	9.665	7.24	0.413	9.874	5.91	0.331	10.048	4.77	10"
12"	12.750	0.750	11.160	12.43	0.607	11.463	10.19	0.490	11.711	8.31	0.392	11.919	6.71	12"
14"	14.000	0.824	12.253	14.98	0.667	12.586	12.28	0.538	12.859	10.02	0.431	13.086	8.09	14"
16"	16.000	0.941	14.005	19.57	0.762	14.385	16.04	0.615	14.696	13.09	0.492	14.957	10.56	16"
18"	18.000	1.059	15.755	24.77	0.857	16.183	20.30	0.692	16.533	16.57	0.554	16.826	13.37	18"
20"	20.000	1.176	17.507	30.58	0.952	17.982	25.07	0.769	18.370	20.45	0.615	18.696	16.50	20"
22"	22.000	1.294	19.257	37.00	1.048	19.778	30.33	0.846	20.206	24.75	0.677	20.565	19.97	22"
24"	24.000	1.412	21.007	44.03	1.143	21.577	36.10	0.923	22.043	29.45	0.738	22.435	23.76	24"
26"	26.000	1.529	22.759	51.67	1.238	23.375	42.36	1.000	23.880	34.57	0.800	24.304	27.89	26"
28"	28.000	1.647	24.508	59.93	1.333	25.174	49.13	1.077	25.717	40.09	0.862	26.173	32.34	28"
30"	30.000	1.765	26.258	68.80	1.429	26.971	56.40	1.154	27.554	46.02	0.923	28.043	37.13	30"
32"	32.000	1.882	28.010	78.28	1.524	28.769	64.17	1.231	29.390	52.36	0.985	29.912	42.24	32"
34"	34.000	2.000	29.760	88.37	1.619	30.568	72.44	1.308	31.227	59.11	1.046	31.782	47.69	34"
36"	36.000	2.118	31.510	99.07	1.714	32.366	81.21	1.385	33.064	66.27	1.108	33.651	53.46	36"
42"	42.000	2.471	36.761	134.84	2.000	37.760	110.54	1.615	38.576	90.20	1.292	39.261	72.77	42"
48"	48.000	2.824	42.013	176.12	2.286	43.154	144.38	1.846	44.086	117.81	1.477	44.869	95.05	48"
54"	54.000	3.176	47.266	222.90	2.571	48.549	182.73	2.077	49.597	149.10	1.662	50.477	120.29	54"

This size and dimension chart is intended for reference purposes. It should not be used in place of the advice from a licensed Professional Engineer. Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter is calculated using IPS OD and Minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimension and tolerances in the applicable pipe manufacturing specification.

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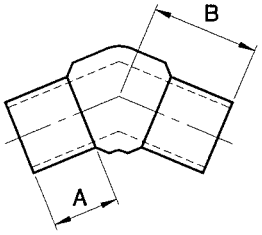

Butt 45° Elbows

PRODUCED TO ASTM D2513 & D3261 AND AWWA C901-02 & 906-99

Butt 45 Degree Ells	DR/Wall	Dimensions A x B (in)	Package Quantity	Package Weight (lbs.)	Box Quantity	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
2" IPS	DR 7	2.45 x 3.20	20	20.0	20					*M020*L45D*
	DR 9			18.6						
	DR 11			15.2						
	DR 17			13.0						
3" IPS	DR 7	3.10 x 5.38	4	11.4	4					*M030*L45D*
	DR 9			10.8					x	
	DR 11 / 11.5			9.0		x[2]		x		
	DR 13.5									
	DR 17									
4" IPS	DR 7	3.00 x 5.38	4	15.1	4					*M040*L45D*
	DR 9								x	
	DR 11 / 11.5	3.00 x 4.93		9.4		x[2]		x		
	DR 13.5					x				
	DR 17									
6" IPS	DR 7	4.25 x 7.12	2	20.4	2					*M060*L45D*
	DR 9								x	
	DR 11 / 11.5	4.00 x 6.38		13.3		x[2]	x	x		
	DR 13.5					x				
	DR 17									
8" IPS	DR 7	6.00 x 10.00	1	22.7	1					*M080*L45D*
	DR 9								x	
	DR 11			17.0		x		x		
	DR 13.5			16.3		x				
	DR 17									

[1] - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.
[2] - CSA only DR11 is approved (not 11.5)
x - Indicates certification/approval for application at additional charge.
- Drawing No. CU70B257

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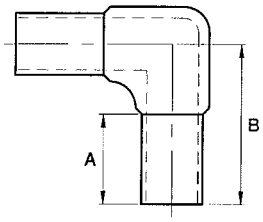

Butt 90° Elbow

PRODUCED TO ASTM D2513 & D3261 and AWWA C901-02 & C906-99

Butt 90 Degree Ells	DR/Wall	Dimensions A x B (in)	Package Quantity	Package Weight (lbs.)	Box-Quantity	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
1/2" CTS	0.090 wall	1.69 x 1.79	10	0.4	100					*M.50*L90D*
3/4" CTS	0.090 wall	1.72 x 2.94	10	0.8	50					*M.75*L90D*
1" CTS	0.102 wall	1.69 x 2.94	10	0.9	50					*M010*L90D*
	0.125 wall									
3/4" IPS	DR 11	1.72 x 2.94	10	0.9	50	x				*M.75*L90D*
1" IPS	DR 9	1.72 x 3.06	10	1.3	50		x			*M010*L90D*
	DR 11					x				
1 1/4" IPS	DR 9	2.50 x 3.88	10	3.2	20					*M1.25*L90D*
	DR 10	3.13 x 4.50				x				
	DR 11					x				
1 1/2" IPS	DR 9	3.00 x 4.50	10	5.0	10					*M1.50*L90D*
	DR 11					x				
2" IPS	DR 7	2.88 x 5.06	10	10.8	10					*M020*L90D*
	DR 9			9.3					x	
	DR 11			7.6		x	x	x		
	DR 17			7.6						
3" IPS	DR 7	3.00 x 6.00	4	11.7	4					*M030*L90D*
	DR 9								x	
	DR 11 / 11.5	3.00 x 5.63		7.3		x[2]	x	x		
	DR 13.5					x				
	DR 17									
4" IPS	DR 7	3.00 x 6.00	4	16.2	4					*M040*L90D*
	DR 9								x	
	DR 11 / 11.5	3.00 x 6.75		16.3		x[2]	x	x		
	DR 13.5					x				
	DR 17									
6" IPS	DR 7	4.25 x 8.63	2	27.2	2					*M060*L90D*
	DR 9			26.8					x	
	DR 11 / 11.5	4.00 x 8.25		17.3		x[2]	x	x		
	DR 13.5			16.6		x				
	DR 17									
8" IPS	DR 7	6.00 x 11.81	1	26.5						*M080*L90D*
	DR 9								x	
	DR 11			20.2		x		x		
	DR 13.5					x				
	DR 17									

[1] - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.
[2] - CSA only DR11 is approved (not 11.5)
x - Indicates certification/approval for appropriate application at additional charge.
- Drawing No. CU70B247 for 1/2" CTS thru 1" IPS & CU70B255 for 1-1/4" IPS thru 8" IPS

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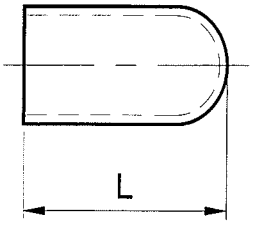

BUTT END CAP

PRODUCED TO ASTM D2513 and D3261 and AWWA C901-02 & C906-99

Butt End Cap	DR/Wall	Dimension L (in)	Package Quantity	Package Weight (lbs.)	Box Quantity	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
1/2" CTS	0.090 wall	2.00	10	0.2	200	x				*M.50*CPST*
3/4" CTS	0.090 wall	2.30	10	0.2	100					*M.75*CPST*
1" CTS	0.102 wall	2.30	10	0.3	100					*M010*CPST*
	0.125 wall									
1/2" IPS	DR 9.3	2.20	10	0.2	100					*M.50*CPST*
3/4" IPS	DR 11	2.30	10	0.3		x				*M.75*CPST*
1" IPS	DR 9	2.40	10	0.5	50					*M010*CPST*
	DR 11					x	x			
1 1/4" IPS	DR 9	3.31	10	1.2	50					*M1.25*CPST*
	DR 10	3.94				x				
	DR 11					x				
1 1/2" IPS	DR 11	3.70	10	1.3	50	x				*M1.50*CPST*
2" IPS	DR 7	4.25	10	3.2	40					*M020*CPST*
	DR 9			2.6			x		x	
	DR 11					x		x		
	DR 17									
3" IPS	DR 7	4.80	10	10.0	10					*M030*CPST*
	DR 9			8.1					x	
	DR 11 / 11.5	3.94		5.6		x[2]	x	x		
	DR 13.5					x				
	DR 17									
4" IPS	DR 7	8.50	10	23.7	10					*M040*CPST*
	DR 9								x	
	DR 11 / 11.5	4.25		9.0		x[2]	x	x		
	DR 13.5					x				
	DR 17									
6" IPS	DR 7	9.88	6	27.9	6					*M060*CPST*
	DR 9								x	
	DR 11 / 11.5	5.20	5	14.1	5	x[2]	x	x		
	DR 13.5					x				
	DR 17									
8" IPS	DR 7	5.00	1	5.6						*M080*CPST*
	DR 9								x	
	DR 11			4.3		x		x		
	DR 13.5					x				
	DR 17									

[1] - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.
2 - CSA only DR11 is approved (not 11.5)
x - Indicates certification/approval for application or test at additional charge.
- Drawing Nos. CU70B248 for 1/2" CTS thru 1" IPS
- Drawing Nos. CU70B258 for 1-1/4" thru 8" IPS

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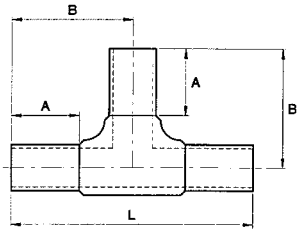

BUTT TEE

PRODUCED TO ASTM D2513 & D3261 and AWWA C901-02 & C906-99

Molded Butt Tee	DR/Wall	Dimensions A x B x L (in)	Package Quantity	Package Weight (lbs.)	Box Quantity	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
1/2" CTS	0.090 wall	1.69 x 2.83 x 5.65	10	0.6	100	x				*M.50*TSTR*
3/4" CTS	0.090 wall	1.72 x 2.94 x 5.88	10	1.1	50					*M.75*TSTR*
1" CTS	0.102 wall	1.72 x 2.94 x 5.88	10	1.3	50					*M010*TSTR*
	0.125 wall				50					
1/2" IPS	DR 9.3	1.72 x 2.94 x 5.88	10	.8	50					*M.50*TSTR*
3/4" IPS	DR 11	1.72 x 2.94 x 5.88	10	1.2	50	x				*M.75*TSTR*
1" IPS	DR 9	1.72 x 3.06 x 6.12	10	1.8	50					*M010*TSTR*
	DR 11				50	x				
1 1/4" IPS	DR 9	2.50 x 3.90 x 7.80	10	4.4	10					*M1.25*TSTR*
	DR 10	2.75 x 4.53 x 9.25	10	5.2	10	x				
	DR 11				10	x				
1 1/2" IPS	DR 11	3.02 x 4.62 x 9.24	10	6.6	10	x	x			*M1.50*TSTR*
	DR 9				10					
2" IPS	DR 7	2.88 x 5.125 x 10.25	10	14.0	10					*M020*TSTR*
	DR 9		10	11.8	10				x	
	DR 11		10	10.0	10	x	x	x		
	DR 17		10	10.0	10					
3" IPS	DR 7	3.00 x 6.06 x 12.13	4	15.3	4					*M030*TSTR*
	DR 9		4	14.9	4				x	
	DR 11 /	3.00 x 5.72 x 11.44	4	10.4	4	x[2]	x	x		
	DR 13.5				4	x				
	DR 17				4					
4" IPS	DR 7	3.00 x 6.22 x 12.44	4	23.0	4					*M040*TSTR*
	DR 9		4	22.0	4				x	
	DR 11 /	3.00 x 6.75 x 13.50	4	21.0	4	x[2]	x	x		
	DR 13.5		4	20.0	4	x				
	DR 17		4	19.9	4					
6" IPS	DR 7	4.25 x 8.63 x 17.25	1	16.7	1					*M060*TSTR*
	DR 9				1				x	
	DR 11 /	4.06 x 8.31 x 16.62	1	11.6	1	x[2]	x	x		
	DR 13.5				1	x				
	DR 17				1					
8" IPS	DR 7	6.00 x 12.09 x 24.18	1	37.6	1					*M080*TSTR*
	DR 9		1	36.6	1				x	
	DR 11		1	27.5	1	x		x		
	DR 13.5		1	26.3	1	x				
	DR 17				1					

[1] - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.
[2] - CSA only DR11 is approved (not 11.5)
x - Indicates certification/approval for application or test at additional charge.
- Drawing No. CU70B246 for 1/2" CTS thru 1" IPS & CU70B256 for 1-1/4" IPS thru 8" IPS

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Material: HDPE - PE4710/3608/100

REVISION HISTORY			
REV	DESCRIPTION	DATE	DESIGNER
1	VALID - ORIGINAL DWG	05/19/11	
2	EDIT L COLUMN	07/27/11	
3	EDIT T-2 DIMENSIONS	09/02/11	Matthew
5	UPDATE TOLERANCE ON SUBMITTAL SHEET	3/6/2013	JEREMY GARZA
6	CORRECT EDITS	5/16/2013	JEREMY GARZA

Wall Thickness and Hub Height (2" - 16")																					
	SDR's																				
	7		9		11		13.5		15.5		17		19		21		26		32.5		
Size	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2
2	0.339	0.450	0.264	0.400	0.216	0.402	0.176	0.402	0.153	0.402	0.138	0.402	0.125	0.402	0.113	0.402	0.091	0.402	0.073	0.402
3	0.500	0.600	0.389	0.598	0.319	0.598	0.259	0.598	0.226	0.598	0.205	0.598	0.184	0.598	0.167	0.598	0.135	0.598	0.108	0.598
4	0.642	1.000	0.500	0.800	0.409	0.800	0.333	0.800	0.290	0.800	0.264	0.800	0.237	0.800	0.214	0.800	0.173	0.800	0.138	0.800
6	0.945	1.200	0.736	0.920	0.602	0.799	0.491	0.799	0.427	0.799	0.390	0.799	0.349	0.799	0.315	0.799	0.255	0.799	0.204	0.799
8	1.232	1.598	0.958	1.200	0.783	0.799	0.639	0.799	0.556	0.799	0.508	0.799	0.454	0.799	0.411	0.799	0.332	0.799	0.265	0.799
10	1.535	1.900	1.194	1.490	0.976	1.299	0.796	1.299	0.694	1.299	0.634	0.902	0.566	0.902	0.512	0.902	0.413	0.902	0.331	0.902
12	1.823	2.299	1.417	1.770	1.159	1.500	0.944	1.500	0.823	1.500	0.752	1.000	0.671	1.000	0.607	1.000	0.490	1.000	0.392	1.000
14	2.000	2.598	1.556	1.950	1.272	1.701	1.037	1.701	0.903	1.701	0.823	1.098	0.737	1.098	0.667	1.098	0.538	1.098	0.431	1.098
16	2.287	3.000	1.778	2.220	1.453	1.902	1.185	1.902	1.032	1.902	0.941	1.201	0.842	1.201	0.762	1.201	0.615	1.201	0.492	1.201

Wall Thickness and Hub Height (18" - 63")																					
	SDR's																				
	7		9		11		13.5		15.5		17		19		21		26		32.5		
Size	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2	T-1	T-2
18	2.571	3.858	2.000	2.500	1.636	2.100	1.333	2.100	1.161	2.100	1.059	1.400	0.947	1.250	0.857	1.250	0.692	1.250	0.554	1.250
20	2.857	3.630	2.222	3.490	1.819	2.300	1.481	2.300	1.290	2.300	1.177	1.500	1.053	1.390	0.952	1.390	0.769	1.390	0.615	1.390
22	3.143	3.920	2.444	3.920	2.000	2.500	1.630	2.500	1.419	2.500	1.295	1.600	1.158	1.520	1.048	1.520	0.846	1.520	0.677	1.520
24	3.429	4.360	2.667	4.360	2.181	2.900	1.778	2.900	1.548	2.900	1.413	1.800	1.263	1.667	1.143	1.667	0.923	1.667	0.738	1.667
26	3.714	4.643	2.889	4.643	2.364	2.955	1.926	2.955	1.677	2.955	1.529	2.955	1.368	1.711	1.238	1.711	1.000	1.711	0.800	1.711
28			3.111	5.000	2.545	3.182	2.074	3.182	1.806	3.182	1.647	3.182	1.474	1.842	1.333	1.842	1.077	1.842	0.862	1.842
30			3.333	5.357	2.727	3.409	2.222	3.409	1.935	3.409	1.765	3.409	1.579	1.974	1.429	1.974	1.154	1.974	0.923	1.974
32			3.556	5.714	2.909	3.636	2.370	3.636	2.065	3.636	1.882	3.636	1.684	2.105	1.524	2.105	1.231	2.105	0.985	2.105
34			3.778	6.071	3.091	3.864	2.519	3.864	2.194	3.864	2.000	3.864	1.789	2.237	1.619	2.237	1.308	2.237	1.046	2.237
36			4.000	6.429	3.273	4.091	2.667	4.091	2.323	4.091	2.118	4.091	1.895	2.368	1.714	2.368	1.385	2.368	1.108	2.368
42					3.818	4.773	3.111	4.773	2.710	4.773	2.471	4.773	2.211	2.763	2.000	2.763	1.615	2.763	1.292	2.763
48					4.364	5.455	3.556	5.455	3.097	5.455	2.824	5.455	2.526	3.158	2.286	3.158	1.846	3.158	1.477	3.158
54															2.571	3.553	2.077	3.553	1.662	3.553
63															3.000	4.145	2.423	4.145	1.938	4.145

Flange Adapter Dimensions					
Size	Type	OD-1	OD-2	L	R
2	IPS	2.375	4.000	5.984	0.354
3	IPS	3.500	5.000	5.984	0.354
4	IPS	4.500	6.598	5.984	0.433
6	IPS	6.625	8.500	7.992	0.433
8	IPS	8.625	10.598	9.016	0.433
10	IPS	10.750	12.799	11.000	0.433
12	IPS	12.750	15.252	11.000	0.433
14	IPS	14.000	17.500	11.000	0.433
16	IPS	16.000	20.000	12.000	0.433
18	IPS	18.000	21.098	12.000	0.500
20	IPS	20.000	23.500	12.000	0.500
22	IPS	22.000	25.600	12.000	0.500
24	IPS	24.000	27.900	14.000	0.500
26	IPS	26.000	29.750	14.000	0.500
28	IPS	28.000	32.000	14.000	0.500
30	IPS	30.000	34.000	14.000	0.500
32	IPS	32.000	36.125	14.000	0.500
34	IPS	34.000	38.125	14.000	0.500
36	IPS	36.000	40.500	14.000*	0.500
42	IPS	42.000	47.125	21.000	0.500
48	IPS	48.000	53.500	21.000	0.500
54	IPS	54.000	59.625	21.000	0.500
63	IPS	63.000	66.790	21.000	0.500

*Length is 16.500" for 36" SDR9 only.

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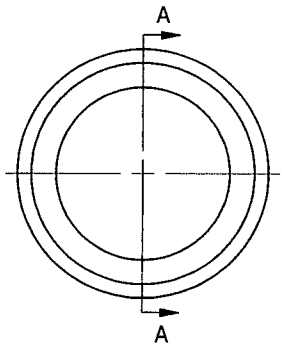
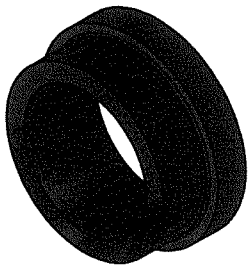
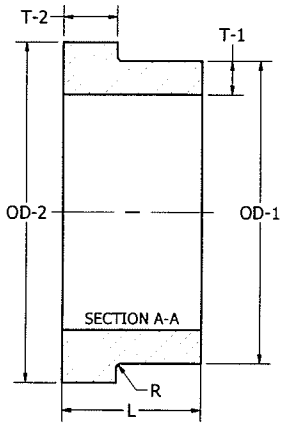






Notes

HIGH DENSITY POLYETHYLENE PIPE FITTINGS MANUFACTURED BY IMPROVED PIPING PRODUCTS (IPP) MEET DIMENSIONS, TOLERANCES AND REQUIREMENTS OF ASTM D3261, AWWA C906 AND NSF 61 STANDARD, AS APPROPRIATE. SPECIFICATIONS NOT STATED IN THESE STANDARDS FOLLOW IMPROVED PIPING PRODUCTS STANDARD SPECIFICATIONS."

DRAWN	Matt Graff	5/19/2011
ENG	Ellis Clark	3/20/2013
QA	Teresa Matias	3/20/2013

IMPROVED PIPING PRODUCTS, INC.

TITLE: IPS Flange Adapter Submittal

UNLESS OTHERWISE NOTED, ALL DIMENSIONS IN INCHES OR METRIC

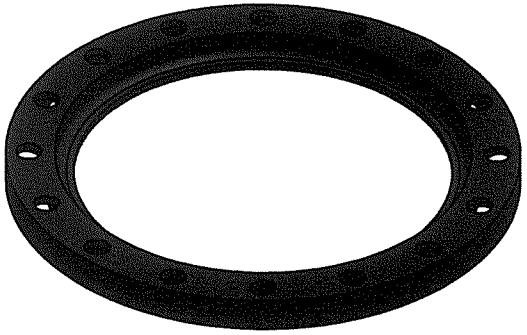
SIZE	PART NO	SALES NO
C	FA SUBMITTAL - IPS	

SCALE | MAT'L: HDPE - PE4710/3608/100 | WEIGHT | SHEET 1 OF 1

Material: Ductile Iron, ASTM A536, 65/45/12

REVISION HISTORY			
REV	DESCRIPTION	DATE	DESIGNER
1	VALID	07/29/11	
2	ADD 42" SDR11	09/07/11	Matt Graff
3	ADD 20", 22", 24 SDR7	10/14/11	Matt Graff
4	EDIT SDR COUMN	06/28/12	Matt Graff
5	EDIT PER PHYSICAL FLANGE	05/20/13	Don Peterson

Dimensions										
Pipe Diameter (in)	SDR	O.D.	T	I.D.	Bolt Count	Bolt Hole Size (H)	Bolt Hole Circle (BC)	R	Weight (lbs)	Operating Pressure (psi)
1/2"	7	3.500	0.500	0.900	4	0.625	2.380	0.130	1.0	267
3/4"	7	3.880	0.500	1.110	4	0.625	2.750	0.130	1.0	267
1"	7	4.250	0.560	1.380	4	0.625	3.130	0.130	1.0	267
1 1/4"	7	4.630	0.630	1.720	4	0.625	3.500	0.190	1.4	267
1 1/2"	7	5.000	0.690	1.970	4	0.625	3.880	0.250	1.7	267
2"	7	6.000	0.750	2.460	4	0.750	4.750	0.310	2.2	267
2"	11	6.000	0.500	2.630	4	0.750	4.750	0.200	1.5	160
2 1/2"	7	7.000	0.880	2.970	4	0.750	5.500	0.310	4.0	267
3"	7	7.500	0.940	3.600	4	0.750	6.000	0.400	3.5	267
3"	11	7.500	0.530	3.750	4	0.750	6.000	0.280	2.5	160
4"	7	9.000	0.940	4.600	8	0.750	7.500	0.400	5.0	267
4"	11	9.000	0.550	4.750	8	0.750	7.500	0.280	3.5	160
5"	7	10.000	0.940	5.690	8	0.875	8.500	0.440	6.0	267
6"	7	11.000	1.000	6.750	8	0.875	9.500	0.400	7.5	267
6"	11	11.000	0.630	6.880	8	0.875	9.500	0.280	4.5	160
8"	7	13.500	1.120	8.750	8	0.875	11.750	0.400	11.0	267
8"	11	13.500	0.850	8.880	8	0.875	11.750	0.280	8.0	160
10"	7	16.000	1.190	10.920	12	1.000	14.250	0.400	17.0	267
10"	11	16.000	0.980	11.000	12	1.000	14.250	0.310	12.0	160
12"	7	19.000	1.500	12.920	12	1.000	17.000	0.400	22.0	267
12"	11	19.000	1.250	13.130	12	1.000	17.000	0.280	20.0	160
14"	7	21.000	1.630	14.180	12	1.125	18.750	0.400	37.0	267
14"	11	21.000	1.380	14.380	12	1.125	18.750	0.310	30.0	160
16"	7	23.500	1.880	16.190	16	1.125	21.250	0.400	52.5	267
16"	11	23.500	1.650	16.380	16	1.125	21.250	0.350	40.0	160
18"	7	25.000	1.900	18.200	16	1.250	22.750	0.400	56.0	267
18"	11	25.000	1.670	18.380	16	1.250	22.750	0.350	41.0	160
20"	7	27.500	2.125	20.375	20	1.250	25.000	0.310	66.5	267
20"	11	27.500	1.810	20.380	20	1.250	25.000	0.400	53.0	160
22"	7	29.500	2.300	22.375	20	1.375	27.250	0.310	87.0	267
22"	11	29.500	2.000	22.380	20	1.380	27.250	0.370	65.0	160



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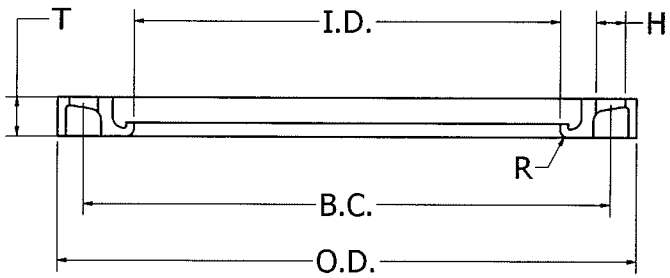


NOTES

Improved Piping Products' backing ring and blinds mate with AWWA C207, ANSI B16.5 and ANSI B16.47, as appropriate. Specificatiions not stated in these standards follow internal specifications

DRAWN Matt Graff	7/29/2011
ENG Ellis Clark	5/21/2013
QA Teresa Matias	6/14/2013
VPOP	

IMPROVED PIPING PRODUCTS, INC.

TITLE: BUP-SDR Convoluted Flange / Backup Ring Submittal Sheet

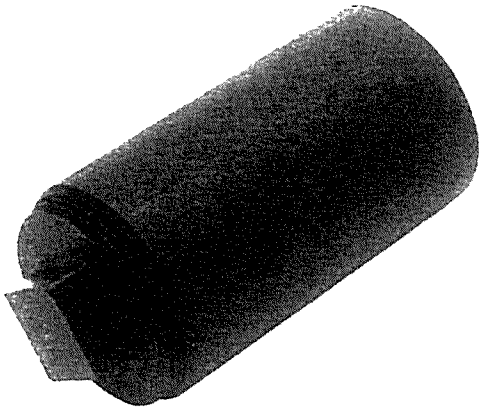
UNLESS OTHERWISE NOTED, ALL DIMENSIONS IN INCHES

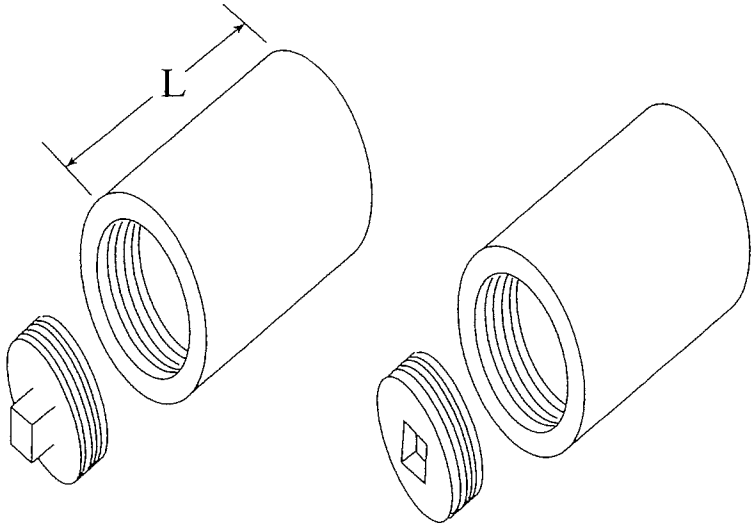
SIZE: C | PART NO: BUP-SDR submittal | SALES NO:

SCALE | REV 2 | SHEET 1 OF 2

Ongoing engineering design efforts may affect the technical information listed in our publications.

IPS Fittings Clean Outs





IPS Fittings Clean Outs

Nominal Size(in)	Pipe OD(in)	DR	Part #	Dimensions L (in)	Weight Lbs.	Shipping Method
2	2.375	11	ISFFCO0211IPS	6	1	UPS
3	3.5	11	ISFFCO0311IPS	6	1.5	UPS
4	4.5	11	ISFFCO0411IPS	6	2	UPS
6	6.625	11	ISFFCO0611IPS	6	3	UPS
8	8.625	11	ISFFCO0811IPS	6	5	UPS
10	10.75	11	ISFFCO1011IPS	6	8	UPS
12	12.75	11	ISFFCO1211IPS	6	11	UPS

****Fittings rated for gravity service only**
****Male boss standard - female boss available upon request**

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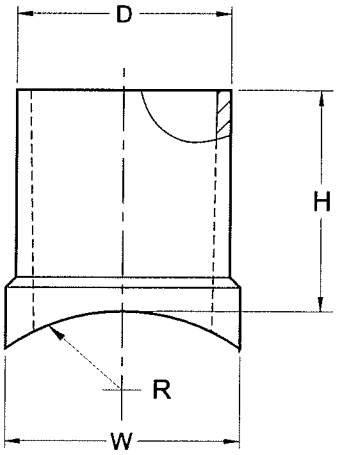
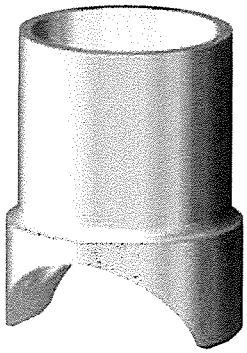
Saddle Fittings: Round Base Branch Saddles





Fittings are standard sizes.

Call for availability of other sizes and dimensions.

ROUND BASE BRANCH SADDLES DIMENSIONS

Nominal Outlet Size	H	W	D	L
2" IPS Butt	3.00	2.63	2.37	*
3" IPS Butt	4.00	3.88	3.50	*
4" IPS Butt	4.00	4.80	4.50	*
6" IPS Butt	5.13	6.81	6.62	*
8" IPS Butt	7.97	9.00	8.62	*
12" IPS Butt	9.47	13.35	12.75	*

(PE2406/PE2708) IPS × IPS ROUND BASE BRANCH SADDLES

Outlet Size	Main Size	SDR	Part Number	Pack. Qty.	Wt.	CSA	IAPMO
2" IPS	2" IPS	DR 11	6920344	30	0.23	-	-
2" IPS	3" IPS	DR 11	6920330	30	0.21	-	-
2" IPS	4" IPS	DR 11	6920342	30	0.20	-	-
2" IPS	6" IPS	DR 11	6920337	30	0.26	-	-
2" IPS	8" IPS	DR 11	6920407	30	0.26	-	-
2" IPS	10" IPS	DR 11	6921046	30	0.25	-	-
2" IPS	12" IPS	DR 11	6920689	30	0.26	-	-
3" IPS	3" IPS	DR 11	6920398	18	0.94	-	-
3" IPS	4" IPS	DR 11	692040320000	18	0.55	-	-
3" IPS	6" IPS	DR 11	692060320000	18	0.70	-	-
3" IPS	8" IPS	DR 11	call	-	-	-	-
3" IPS	10" IPS	DR 11	call	-	-	-	-
3" IPS	12" IPS	DR 11	6930912	18	0.62	-	-
4" IPS	4" IPS	DR 11	6920343	10	1.20	-	-
4" IPS	6" IPS	DR 11	692060420000	10	1.06	-	-
4" IPS	8" IPS	DR 11	6920211	10	1.88	-	-
4" IPS	10" IPS	DR 11	call	-	-	-	-
4" IPS	12" IPS	DR 11	6920690	10	1.00	-	-
6" IPS	8" IPS	DR 11 / 11.5	10000301	5	1.88	-	-
6" IPS	10" IPS	DR 11	call	-	-	-	-
6" IPS	12" IPS	DR 11	6920913	5	2.90	-	-

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Saddle Fittings: Round Base Branch Saddles

(PE3408/PE4710) IPS × IPS ROUND BASE BRANCH SADDLES

Outlet Size	Main Size	SDR	Part Number	Pack. Qty.	Wt.	AWWA
2" IPS	2" IPS	DR 11	10004876	30	0.27	YES
2" IPS	3" IPS	DR 11	10005086	30	0.27	YES
2" IPS	4" IPS	DR 17	10005096	30	0.19	YES
2" IPS	4" IPS	DR 11	10005094	30	0.25	YES
2" IPS	6" IPS	DR 11	10005102	30	0.21	YES
2" IPS	6" IPS	DR 9.3	10004880	30	0.21	YES
2" IPS	8" IPS	DR 11	10005108	30	0.20	YES
2" IPS	8" IPS	DR 9.3	10005110	30	0.23	YES
2" IPS	10" IPS	DR 11	10005025	30	0.20	YES
2" IPS	12" IPS	DR 11	10005037	30	0.20	YES
2" IPS	14" IPS	DR 11	10005045	30	0.19	YES
2" IPS	16" IPS	DR 11	10005054	30	0.21	YES
2" IPS	18" IPS	DR 11	10005064	30	0.21	YES
2" IPS	18" IPS	DR 9.3	10005065	30	0.21	YES

(PE3408/PE4710) IPS × IPS ROUND BASE BRANCH SADDLES

Outlet Size	Main Size	SDR	Part Number	Pack. Qty.	Wt.	AWWA
2" IPS	20" IPS	DR 11	call	-	-	-
2" IPS	22" IPS	DR 11	call	-	-	-
2" IPS	24" IPS	DR 11	10005079	30	0.20	YES
2" IPS	30" IPS	DR 11	call	-	-	-
2" IPS	36" IPS	DR 11	call	-	-	-
2" IPS	42" IPS	DR 11	call	-	-	-
2" IPS	48" IPS	DR 11	call	-	-	-
3" IPS	4" IPS	DR 11	10004878	10	0.54	YES
3" IPS	6" IPS	DR 11	10005103	10	0.65	YES
3" IPS	8" IPS	DR 11	10005111	18	0.53	YES
3" IPS	10" IPS	DR 17	10005028	10	0.67	YES
3" IPS	10" IPS	DR 11	10005027	10	0.65	YES
3" IPS	12" IPS	DR 17	10005040	10	0.67	YES
3" IPS	12" IPS	DR 11	10005039	18	0.66	YES
3" IPS	14" IPS	DR 11	10005046	10	0.69	YES
3" IPS	16" IPS	DR 11	10005055	10	0.70	YES
3" IPS	18" IPS	DR 11	10005066	10	0.60	YES
3" IPS	20" IPS	DR 11	10005073	10	0.70	YES
3" IPS	22" IPS	DR 11	call	-	-	-
3" IPS	24" IPS	DR 11	10005080	10	0.70	YES
3" IPS	30" IPS	DR 11	call	-	-	-
3" IPS	36" IPS	DR 9.3	call	-	-	-
3" IPS	42" IPS	DR 11	call	-	-	-
3" IPS	48" IPS	DR 11	call	-	-	-
4" IPS	4" IPS	DR 9.3	10004879	10	0.85	YES
4" IPS	6" IPS	DR 11	10005104	10	0.95	YES
4" IPS	8" IPS	DR 11	10005112	10	0.90	YES
4" IPS	8" IPS	DR 17	10005113	10	0.96	YES
4" IPS	10" IPS	DR 11	10005029	10	0.88	YES
4" IPS	12" IPS	DR 11	10005041	10	1.27	YES

COUPLINGS

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

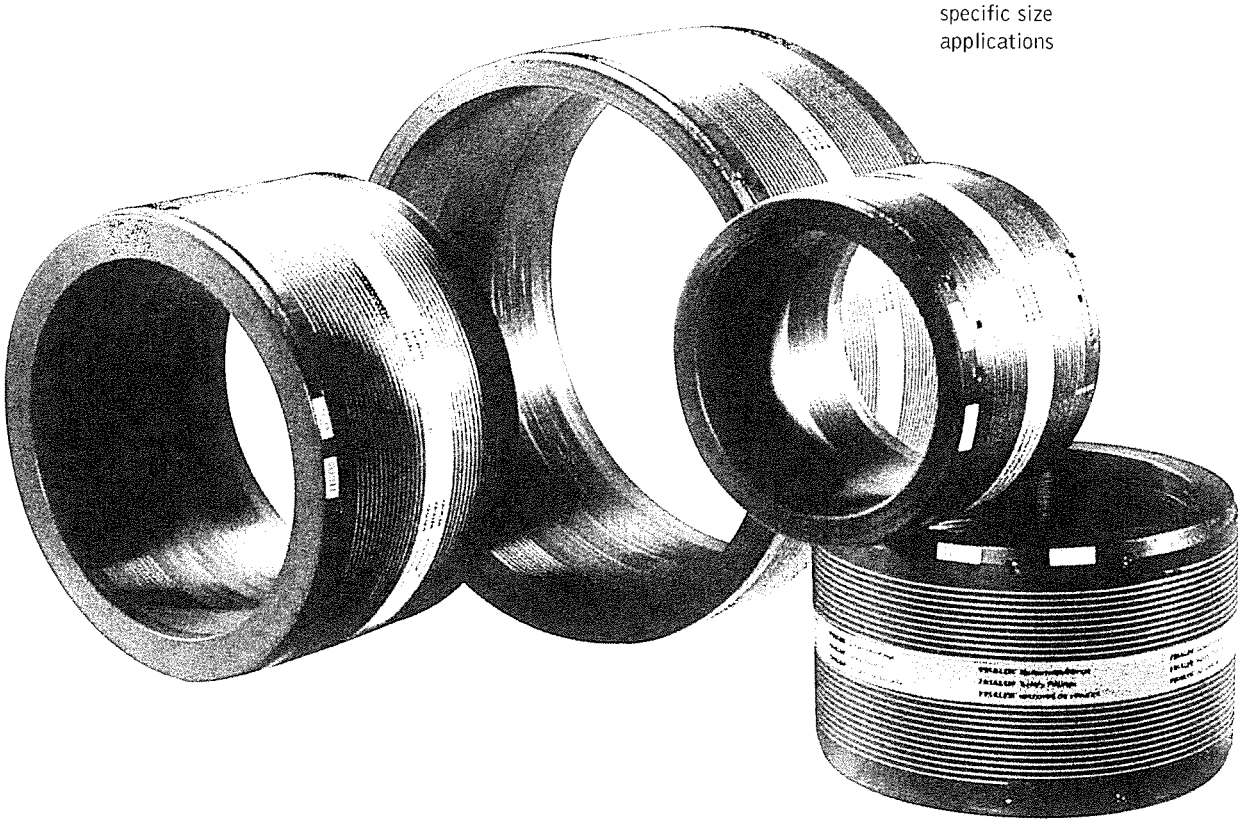
1/2" CTS through 28" IPS

Our Couplings and Fittings deliver flexibility and reliability.
No one offers a wider range of coupling sizes and every FRIATEC fitting is ASTM approved.

Short Designation	MBI/UBI...OD
Field of Application	Connections of PE Pipes 2406/2708 and 3408/4710
Range of Application	Gas up to 125 psi and water up to 200 psi

For higher pressure ranges, contact IPEX at 800-463-9572

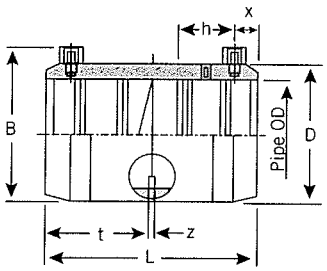
see pg 5 for specific size applications



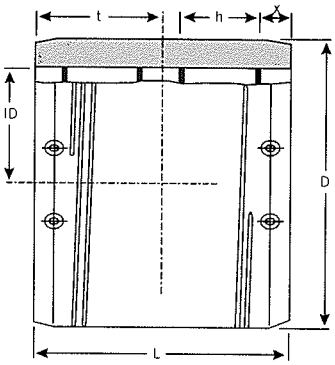
Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

1/2" CTS through 28" IPS cont'd

1/2" - 6"



8" - 28"



Nominal OD CTS	Pipe SDR	Product Code	ID min	ID max	D	B	L	t	z	h	x	Fusion Time/Sec @ 73°F	Cooling Time/Min */**/***
1/2"	11	128031	0.622	0.634	1.102	1.732	2.283	1.142	0.079	0.591	0.23	27	05/08/10
1"	11	128027	1.122	1.134	1.654	2.244	3.071	1.535	0.079	0.787	0.31	28	05/08/10

Nominal OD IPS	Pipe SDR	Product Code	ID min	ID max	D	B	L	t	z	h	x	Fusion Time/Sec @ 73°F	Cooling Time/Min */**/***
3/4"	11	128026	1.047	1.059	1.575	2.165	2.598	1.260	0.079	0.728	0.27	28	05/08/10
1"	11	128024	1.311	1.323	1.850	2.460	3.071	1.496	0.079	0.787	0.31	28	05/08/10
1-1/4"	11	128025	1.654	1.679	2.244	2.835	3.346	1.634	0.079	0.945	0.39	34	10/15/25
1-1/2"	11	128033	1.902	1.917	2.480	3.130	3.858	1.870	0.079	1.060	0.46	34	10/15/25
→ 2"	11	128028	2.374	2.390	3.142	3.657	4.449	2.205	0.079	1.205	0.51	54	10/15/25
3"	11	128029	3.496	3.516	4.606	4.980	5.472	2.717	0.079	1.417	0.59	100	10/30/40
† 4"	11	128030	4.492	4.516	5.827	6.173	6.260	3.110	0.079	1.689	0.67	151	10/30/40
† 6"	11	128032	6.610	6.634	8.543	8.740	7.992	3.976	0.079	2.295	0.79	440	20/60/75
◗† 8" monofilar	11	128060	8.626	8.665	11.029	-	9.448	4.724	-	2.953	1.063	540	20/60/75
◗† 8" bifilar	11	128023	8.626	8.665	11.022	-	9.448	4.724	-	2.953	1.063	554 ea side	20/60/75
◗† 10"	11	128061	10.748	10.787	13.975	-	11.811	5.275	-	3.149	1.063	500 ea side	30/75/100
◗† 12"	11	128062	12.748	12.787	15.746	-	11.219	5.610	-	2.679	1.142	550 ea side	30/75/100
◗† 14"	11	128064	13.976	14.016	17.716	-	11.811	5.905	-	3.500	1.260	580 ea side	30/75/100
◗† 16"	11	128063	15.969	16.008	19.685	-	12.598	6.299	-	3.748	1.260	870/730 ea side	45/95/120
◗† 18"	11	128065	17.969	18.008	22.047	-	13.386	6.693	-	3.346	1.260	870/870 ea side	45/95/120
† 20"	11	128176	19.961	20.016	24.803	-	14.173	7.086	-	3.622	1.260	870/720 ea side	45/95/120
22"	17	128066	21.961	22.016	24.803	-	14.566	7.283	-	3.291	1.260	870/720 ea side	45/95/120
24"	13.5	128067	24.000	24.039	27.952	-	15.748	7.874	-	4.095	1.420	870/850 ea side	45/95/120
28"	17	128068	27.992	28.031	31.496	-	15.748	7.874	-	6.062	1.614	850/850 ea side	60/80/120

FRIATEC Safety Fittings can be fused to all PE pipes SDR range 9.33 through 17.6.

- * Pipe can be moved after indicated cooling time (handling)
- ** Pipe can be pressurized after indicated cooling time (pressure <90 psi)
- *** Pipe can be pressurized after indicated cooling time (pressure >90 psi)
- † FM 200 psi, Short Designation: MBI...OD
- ◗ NSF approved

IPEX

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Xirtec 140™
PVC PROCESS PIPING SYSTEM

PVC SCHEDULE 80 IPS SOLVENT WELD PLAIN END/BELLED END PRESSURE PIPE

LETTER OF COMPLIANCE

Scope:

This letter of compliance covers IPEX Inc. requirements for ¼" through 24" (6mm – 600 mm) PVC **Schedule 80** Solvent Weld Plain End/Belled End Pressure Pipe made to Iron Pipe Sizes (IPS). These products meet or exceed performance standards set by the American National Standards Institute (ANSI), the American Society of Testing and Materials (ASTM), CSA International (CSA) and NSF International (NSF).

Material:

Rigid PVC Poly(Vinyl Chloride) used in the manufacturing of IPEX Inc. **Schedule 80** Solvent Weld Plain End/Belled End Pressure Pipe complies with the material requirements of ASTM D 1784, *Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds*, having a cell classification of 12454 or 14333-D. The compound is listed with NSF for potable water service.

Extruded Pipe:

Extruded **Schedule 80** Solvent Weld Plain End/Belled End Pressure Pipes conforms to the following standards:

ANSI/NSF 61 *"Drinking Water System Components – Health Effects"*

ASTM D 1785 *"Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120"*

CSA B137.3 *"Rigid Poly(Vinyl Chloride) (PVC) Pipe for Pressure Applications."*

Markings:

Schedule 80 Solvent Weld Plain End/Belled End Pressure Pipes are marked as prescribed in the above applicable standards to indicate size of the pipe, material designation, compliance to standard, and manufacturer's name or trademark.

Color Coding:

Schedule 80 Solvent Weld Plain End/Belled End Pressure Pipe is color-coded grey.

Yours truly,

Frank Yorio
Senior Vice President, Operations

Issue Date: 2007-07-20

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

DIMENSIONS, WEIGHTS & PRESSURE RATINGS FOR PVC & CPVC PIPE

U.S. UNITS

SCHEDULE (DR) SDR	Nominal pipe size (inches)	Outside dia. (inches)	Max. working pressure (PSI at 73°F)	Min. wall thickness (inches)	Average inside dia. (inches)	Weight of pipe (lbs./ft.) plain end CPVC	Weight of pipe (lbs./ft.) plain end PVC
SCHD 80 (DR 4.5)	1/4	.540	1130	.119	.302	-	.10
SCHD 80 (DR 5.4)	3/8	.675	920	.126	.423	-	.14
SCHD 40 (DR 8)	1/2	.840	600	.109	.602	.18	.17
SCHD 80 (DR 6)			850	.147	.526	.23	.21
SDR 21			200	.080	.660		.13
SCHD 40 (DR 10)	3/4	1.050	480	.113	.804	.24	.22
SCHD 80 (DR 7)			690	.154	.722	.31	.28
SDR 21			200	.060	.870		.13
SCHD 40 (DR 10)	1	1.315	450	.133	1.029	.35	.33
SCHD 80 (DR 8)			630	.179	.936	.45	.41
SDR 21			200	.080	1.135		.21
SCHD 40 (DR 12)	1 1/4	1.660	370	.141	1.360	.48	.44
SCHD 80 (DR 9)			520	.191	1.255	.62	.57
SDR 21			200	.080	1.480		.27
SCHD 40 (DR 13)	1 1/2	1.900	330	.145	1.590	.57	.52
SCHD 80 (DR 10)			470	.200	1.476	.76	.69
SDR 21			200	.090	1.700		.35
SDR 26			160	.080	1.720		.32
SCHD 40 (DR 16)	2	2.375	280	.154	2.047	.77	.70
SCHD 80 (DR 11)			400	.218	1.913	1.05	.96
SDR 21			200	.113	2.129		.54
SDR 26			160	.091	2.173		.45
SCHD 40 (DR 14)	2 1/2	2.875	300	.203	2.445	1.21	1.11
SCHD 80 (DR 11)			420	.276	2.290	1.60	1.46
SDR 21			200	.137	2.581		.78
SDR 26			160	.110	2.635		.64
SCHD 40 (DR 16)	3	3.500	260	.216	3.042	1.58	1.45
SCHD 80 (DR 12)			370	.300	2.864	2.14	1.96
SDR 21			200	.167	3.146		1.14
SDR 26			160	.135	3.210		.94
SDR 32.5			125	.108	3.264		.77
SDR 41			100	.085	3.310		.63
SCHD 40 (DR 19)	4	4.500	220	.237	3.998	2.25	2.07
SCHD 80 (DR 13)			320	.337	3.786	3.12	2.87
SDR 21			200	.214	4.046		1.88
SDR 26			160	.173	4.133		1.54
SDR 32.5			125	.138	4.204		1.25
SDR 41			100	.110	4.260		1.02
SCHD 40 (DR 22)	5	5.563	190	.258	5.016	3.06	2.81
SCHD 80 (DR 15)			290	.375	4.768	4.34	4.02
SDR 21			200	.265	5.001		2.88
SDR 26			160	.214	5.107		2.35
SDR 32.5			125	.171	5.199		1.89
SDR 41			100	.136	5.271		1.53
SCHD 40 (DR 24)	6	6.625	180	.280	6.031	3.97	3.65
SCHD 80 (DR 16)			280	.432	5.709	5.96	5.48
SDR 21			200	.315	5.955		4.09
SDR 26			160	.255	6.084		3.33
SDR 32.5			125	.204	6.193		2.69
SDR 41			100	.161	6.281		2.15

METRIC

Nominal pipe size (mm)	Outside dia. (mm)	Max. working pressure (kPa at 23°C)	Min. wall thickness (mm)	Average inside dia. (mm)	Weight of pipe (kg/m) plain end CPVC	Weight of pipe (kg/m) plain end PVC
6	13.7	7 790	3.02	7.67	-	.150
10	17.1	6 340	3.20	10.74	-	.210
12	21.3	4 140	2.76	15.26	.268	.253
		5 860	3.72	13.34	.342	.313
		1 380	2.02	16.74		.193
20	26.70	3 300	2.86	20.46	.357	.327
		4 760	3.90	18.38	.461	.417
		1 380	2.02	22.14		.194
25	33.40	3 100	3.38	26.14	.520	.491
		4 340	4.54	23.78	.670	.610
		1 380	2.02	28.84		.313
32	42.15	2 550	3.56	34.53	.714	.655
		3 590	4.84	31.87	.923	.848
		1 380	2.02	37.59		.402
40	48.25	2 280	3.68	40.37	.848	.774
		3 240	5.08	37.49	1.131	1.026
		1 380	2.28	43.17		.521
		1 100	2.02	43.69		.476
50	60.35	1 930	3.90	52.03	1.146	1.042
		2 760	5.54	48.61	1.563	1.429
		1 380	2.86	54.11		.80[illegible]
		1 100	2.30	55.23		.670
65	73.00	2 070	5.16	62.08	1.801	1.652
		2 900	7.00	58.16	2.381	2.173
		1 380	3.48	65.54		1.161
		1 100	2.78	66.92		.952
75	88.90	1 790	5.48	77.28	2.351	2.158
		2 550	7.62	72.74	3.185	2.917
		1 380	4.24	79.92		1.697
		1 100	3.42	81.54		1.399
		860	2.74	82.90		1.146
		690	2.16	84.08		.938
100	114.30	1 520	6.02	101.58	3.349	3.081
		2 210	8.56	96.16	4.643	4.271
		1 380	5.44	102.76		2.798
		1 100	4.38	105.00		2.292
		860	3.50	106.78		1.860
		690	2.78	108.22		1.518
125	141.30	1 310	6.54	127.42	4.554	4.182
		2 000	9.52	121.12	6.459	5.982
		1 380	6.72	127.04		4.286
		1 100	5.44	129.74		3.497
		860	4.34	132.08		2.813
		690	3.44	133.90		2.277
150	168.30	1 240	7.10	153.22	5.908	5.432
		1 930	10.96	145.04	8.870	8.155
		1 380	8.02	151.28		6.087
		1 100	6.48	154.56		4.956
		860	5.18	157.32		4.003
		690	4.12	159.56		3.200

A. Manufacturer's Product Specification: Schedule 80 PVC

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Scope

This specification sheet covers the manufacturer's requirements for Xirtec®140 PVC Schedule 80 pipe fittings as manufactured by IPEX. These fittings meet or exceed the standards set by the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF) International, Standards 14/61.

PVC Materials

Rigid Xirtec®140 PVC (Polyvinyl Chloride) used in the manufacture of Schedule 80 fittings is of Type I, Grade 1 compound (cell classification 12454) as stated in ASTM D1784. Raw material used in molding shall contain the specified amounts of color pigment, stabilizers, and other additives approved by NSF International.

Dimensions

Physical dimensions and tolerances of Xirtec®140 PVC Schedule 80 IPS fittings as manufactured by IPEX meet the requirements of ASTM Standard Specification D2467 for socket-type fittings and ASTM D2464 for threaded fittings. Threaded fittings have Taper Pipe Threads in accordance with ANSI/ASME B1.20.1. Flanged fittings have nominal dimensions in accordance with ANSI/ASME B16.5.

Marking

Xirtec®140 PVC Schedule 80 fittings are marked as prescribed in ASTM D2467 and D2464 to indicate the manufacturer's name and trademark, material designation, the NSF mark, size of fitting, and ASTM designation D2467 (socket) or D2464 (threaded).

Sample Specification

All Schedule 80 socket fittings shall conform to ASTM D2467. All Schedule 80 threaded fittings shall conform to ASTM D2464. All 150 Class flanges shall conform to ANSI/ASME B16.5. All pipe, fittings, and valves shall be compatible Xirtec®140 compound and produced by one manufacturer; as supplied by IPEX.

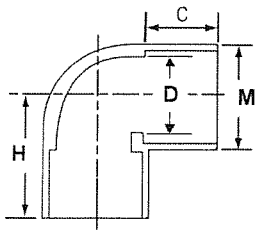
Notes

All dimensions are in inches unless otherwise specified. Dimensions are subject to change without notice. Contact the factory for clarifications.

MEMBER
IAPD
INTERNATIONAL ASSOCIATION OF PLASTICS DISTRIBUTORS

90° Elbows

Schedule 80
90° ELBOWS
Soc x Soc



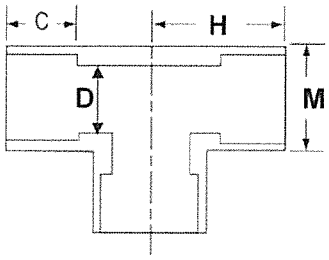
Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Nom. Pipe Size	Xirtec Univ. Part No.	Xirtec IPEX Part No.	Corzan Univ. Part No.	Corzan IPEX Part No.	CRITICAL DIMENSIONS C	D	H	M	Wt.(lbs)
1/4 x 1/4	806002	036179	9806002	057192	0.655	0.302	1.000	0.845	0.031
3/8 x 3/8	806003	036180	9806003	059193	0.780	0.423	1.250	1.000	0.040
1/2 x 1/2	806005	036181	9806005	059194	0.890	0.524	1.445	1.215	0.086
3/4 x 3/4	806007	036182	9806007	059195	1.020	0.722	1.685	1.470	0.115
1 x 1	806010	036183	9806010	059196	1.145	0.936	1.940	1.760	0.187
1-1/4 x 1-1/4	809012	036184	9806012	059197	1.270	1.255	2.160	2.145	0.289
1-1/2 x 1-1/2	806015	036185	9806015	059198	1.400	1.476	2.400	2.385	0.348
2 x 2	806020	036186	9806020	059199	1.525	1.913	2.805	2.955	0.617
2-1/2 x 2-1/2	806025	036187	9806025	059200	1.775	2.290	3.300	3.580	1.054
3 x 3	806030	036188	9806030	059201	1.935	2.864	3.745	4.230	1.523
4 x 4	806040	036189	9806040	059202	2.265	3.786	4.625	5.345	2.619
6 x 6	806060	036191	9806060	059203	3.025	5.709	6.650	7.615	7.295
8 x 8	806080	036192	9806080	059204	4.125	7.565	8.600	9.775	14.733
10 x 10	806100	036864	9806100	059085	5.500	9.493	11.315	10.780	28.740
12 x 12	806120	036865	9806120	059086	6.500	11.294	13.385	14.200	43.901

TEES

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Schedule 80
TEE
Soc x Soc x Soc



Nom. Pipe Size	Xirtec		Corzan		CRITICAL DIMENSIONS				
	Univ. Part No.	IPEX Part No.	Univ. Part No.	IPEX Part No.	C	D	H	M	Wt.(lbs)
1/4 x 1/4 x 1/4	801002	036768	9801002	059479	0.655	0.302	0.970	0.845	0.040
3/8 x 3/8 x 3/8	801003	036769	9801003	059480	0.780	0.423	1.250	0.985	0.060
1/2 x 1/2 x 1/2	801005	036770	9801005	059481	0.895	0.526	1.405	1.240	0.115
3/4 x 3/4 x 3/4	801007	036771	9801007	059482	1.015	0.722	1.595	1.415	0.159
1 x 1 x 1	801010	036772	9801010	059483	1.145	0.936	1.845	1.750	0.251
1-1/4 x 1-1/4 x 1-1/4	801012	036773	9801012	059484	1.270	1.255	2.155	2.350	0.381
1-1/2 x 1-1/2 x 1-1/2	801015	036774	9801015	059485	1.395	1.476	2.410	2.405	0.498
2 x 2 x 2	801020	036775	9801020	059486	1.520	1.913	2.800	2.895	0.882
2-1/2 x 2-1/2 x 2-1/2	801025	036776	9801025	059487	1.775	2.290	3.280	3.570	1.380
3 x 3 x 3	801030	036777	9801030	059488	1.900	2.864	3.720	4.200	2.046
4 x 4 x 4	801040	036778	9801040	059489	2.270	3.786	4.595	5.280	3.684
6 x 6 x 6	801060	036780	9801060	059490	3.030	5.709	6.530	7.575	9.555
8 x 8 x 8	801080	036781	9801080	059491	4.130	7.565	8.625	9.810	19.041
10 x 10 x 10	801100	036866	9801100	059062	5.500	9.493	11.250	12.000	35.400
12 x 12 x 12	801120	036876	9801120	059084	6.500	11.294	13.385	14.200	54.450

Manufacturer's Product Specification: Schedule 40

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Scope

This specification sheet covers the manufacturer's requirements for Xirtec®140 PVC Schedule 40 pipe fittings as manufactured by IPEX. These fittings meet or exceed the standards set by the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF) International, Standards 14/61.

PVC Materials

Rigid Xirtec®140 PVC (Polyvinyl Chloride) used in the manufacture of Schedule 40 fittings is of Type I, Grade 1 compound (cell classification 12454) as stated in ASTM D1784. Raw material used in molding shall contain the specified amounts of color pigment, stabilizers, and other additives approved by NSF International.

Dimensions

Physical dimensions and tolerances of Xirtec®140 PVC Schedule 40 IPS fittings as manufactured by IPEX meet the requirements of ASTM Standard Specification D2466. Threaded fittings have Taper Pipe Threads in accordance with ANSI/ASME B1.20.1.

Marking

Xirtec®140 PVC Schedule 40 fittings are marked as prescribed in ASTM D2466 to indicate the manufacturer's name and trademark, material designation, the NSF mark, size of fitting, and ASTM designation.

Sample Specification

All Schedule 40 socket fittings shall conform to ASTM D2466. All pipe, fittings, and valves shall be compatible Xirtec®140 compound and produced by one manufacturer; as supplied by IPEX.

Notes

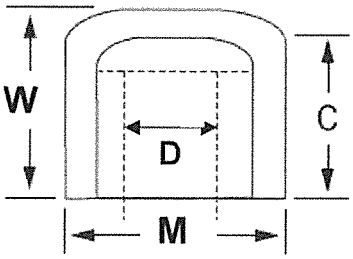
All dimensions are in inches unless otherwise specified. Dimensions are subject to change without notice. Contact the factory for clarifications.

*Corzan is a trademark of The BF Goodrich Company and is registered or under application in various countries of the world.

Caps

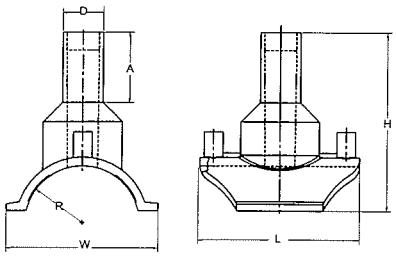
Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Schedule 40
CAPS
Soc Cap

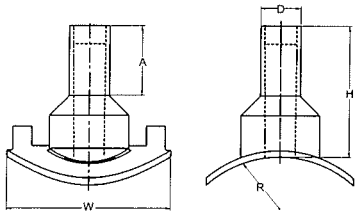


Nom. Pipe Size	White		Gray		CRITICAL DIMENSIONS				
	Univ. Part No.	IPEX Part No.	Univ. Part No.	IPEX Part No.	C	D	M	W	Wt.(lbs)
3/8	447003	035406	447003G	035590	0.865	0.473	0.880	1.000	0.010
1/2	447005	035407	447005G	035017	0.900	0.602	1.100	1.300	0.031
1	447007	035408	447007G	035018	1.035	0.804	1.320	1.455	0.040
1-1/4	447010	035409	447010G	035019	1.135	1.029	1.640	1.495	0.071
1-1/2	447012	035410	447012G	035020	1.240	1.360	2.000	1.615	0.090
2	447015	035411	447015G	035021	1.370	1.590	2.250	1.745	0.130
2-1/2	447020	035412	447020G	035022	1.535	2.047	2.725	2.125	0.185
2	447025	035413	447025G	035023	1.785	2.445	3.380	2.500	0.330
3	447030	035414	447030G	035024	1.910	3.042	3.995	2.590	0.527
4	447040	035415	447040G	035025	2.240	3.998	5.065	3.200	0.770
5	447050	035416	447050G	035026	4.060	5.016	6.110	4.425	1.400
6	447060	035417	447060G	035027	3.050	6.031	7.365	4.815	2.030
8	447080	035418	447080G	035028	4.075	7.941	9.370	5.745	3.788

Electrofusion Fittings: Branch Saddles



2" IPS to 6" DIPS



8" IPS to12" DIPS

Branch Saddle w/1¼" Outlet

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Charleroi, PA
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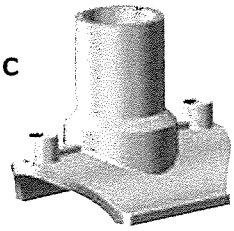

BRANCH SADDLE DIMENSIONS: 2" OUTLET					
Nominal Base Size	A	D	H	W	L
2" IPS	3.28	2.37	6.65	3.59	6.62
3" IPS	3.28	2.37	6.65	4.60	6.62
4" IPS/DIPS	3.28	2.37	7.27	6.26	6.62
6" IPS/DIPS	3.28	2.37	8.43	8.68	6.62
8" IPS/DIPS	3.28	2.37	5.29	6.75	*
10" IPS/DIPS	3.28	2.37	5.56	6.75	*
12" IPS/DIPS	3.28	2.37	5.73	6.75	*

(PE3408/PE4710) ELECTROFUSION BRANCH SADDLES (full pressure)							
Outlet Size	Main Size	Pin Type	Clamp Type	Part Number	Pack. Qty.	Wt.	AWWA
1¼" IPS	2" IPS	4.7 R	B	10004521	40	0.81	YES
1¼" IPS	3" IPS	4.7 R	C	10004523		0.26	YES
1¼" IPS	4" IPS/DIPS	4.7 R	D/L	10004531		1.09	YES
1½" IPS	2" IPS	4.7 R	B	call	-	-	-
1½" IPS	3" IPS	4.7 R	C	call	-	-	-
1½" IPS	4" IPS/DIPS	4.7 R	D/L	call	-	-	-
2" IPS	2" IPS	4.7 R	B	10003536	30	0.90	YES
2" IPS	3" IPS	4.7 R	C	10004525	30	0.96	YES
2" IPS	4" IPS/DIPS	4.7 R	D/L	10003547	30	0.90	YES
2" IPS	6" IPS/DIPS	4.7 R	E/M	10004543	30	2.00	YES
2" IPS	8" IPS	4.7 R	H	10007711	30	1.16	YES
2" IPS	8" DIPS	4.7 S	H	10004508	30	1.16	YES
2" IPS	10" IPS	4.7 S	H	10004660	30	1.22	YES
2" IPS	10" DIPS	4.7 S	H	10004516	30	1.33	YES
2" IPS	12" IPS	4.7 S	H	10003560	30	1.33	YES
2" IPS	12" DIPS	4.7 S	H	10004512	30	1.22	YES

Call for availability of other sizes and dimensions.
4.7R = 4.7 Pin with Resistor
4.7S = 4.7 Solid Pin

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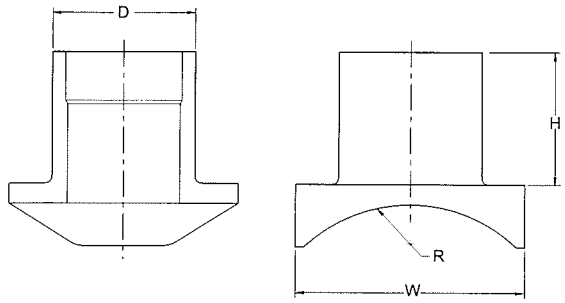
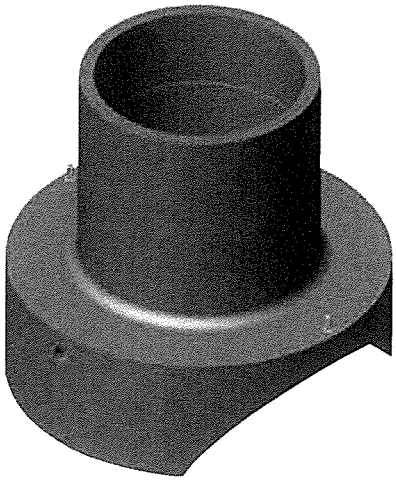
Electrofusion Fittings: Branch Saddles

NOTE: These have a restricted pressure rating limited to 50 psi.



Branch Saddle Drawing 4: w/6" & 8" Butt Outlet



Call for availability of other sizes and dimensions.
4.7R = 4.7 Pin with Resistor
4.7S = 4.7 Solid Pin

BRANCH SADDLE DIMENSIONS: 6" & 8" BUTT OUTLET

Nominal Base Size	A	D	H	W	L
6" IPS DR 17	*	6.62	6.00	10.60	*
8" IPS DR 11	*	8.62	6.00	10.60	*

(PE3408/PE4710) ELECTROFUSION BRANCH SADDLES

Outlet Size	Main Size	Pin Type	Clamp Type	Part Number	Pack. Qty.	Wt.	AWWA
4" IPS	Multi-Base 8"-10"	3 Pin Resistor	J	5750808	1	2.90	-
6" IPS	10" IPS	4.7 S	K	10009202	1	5.60	-
6" IPS	12" IPS	4.7 S	K	10009203	1	5.60	-
6" IPS	14" IPS	4.7 S	K	10009105	1	5.60	-
6" IPS	16" IPS	4.7 S	K	10009106	1	5.07	-
6" IPS	18" IPS	4.7 S	K	10009107	1	5.99	-
6" IPS	20" IPS	4.7 S	K	10009108	1	4.99	-
6" IPS	22" IPS	4.7 S	K	10009136	1	5.62	-
6" IPS	24" IPS	4.7 S	K	10009109	1	5.62	-
6" IPS	30" IPS	4.7 S	K	10009110	1	5.60	-
6" IPS	32" IPS	4.7 S	K	5758416	1	5.78	-
6" IPS	36" IPS	4.7 S	K	10009113	1	5.50	-
6" IPS	42" IPS	4.7 S	K	10009114	1	5.36	-
6" IPS	48" IPS	4.7 S	K	10009115	1	5.30	-
8" IPS	10" IPS	4.7 S	K	10009200	1	8.75	-
8" IPS	12" IPS	4.7 S	K	10009201	1	7.94	-
8" IPS	14" IPS	4.7 S	K	10009093	1	7.83	-
8" IPS	16" IPS	4.7 S	K	10009094	1	8.00	-
8" IPS	18" IPS	4.7 S	K	10009095	1	7.27	-
8" IPS	20" IPS	4.7 S	K	10009096	1	7.89	-
8" IPS	22" IPS	4.7 S	K	10009138	1	7.89	-
8" IPS	24" IPS	4.7 S	K	10009097	1	7.55	-
8" IPS	26" IPS	4.7 S	K	10009132	1	7.98	-
8" IPS	30" IPS	4.7 S	K	10009098	1	7.98	-
8" IPS	32" IPS	4.7 S	K	10009099	1	7.89	-
8" IPS	36" IPS	4.7 S	K	10009101	1	8.15	-
8" IPS	42" IPS	4.7 S	K	10009102	1	8.37	-
8" IPS	48" IPS	4.7 S	K	10009103	1	8.63	-

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Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Part Name: Male thread HDPE Transition Fitting
Series 710 Carbon Steel, T304, T316, Stainless Steel

Threaded Transitions

The POLY-CAM Threaded Transition Adaptors is a multi-level mechanical transition fitting, protected under patent number 5,211,429, which is hydraulically compressed unto the polyethylene or pipe quality copolymer material.

Design

The relaxation creates a seal to prevent leakage. Under pressure, the internal pressure within the pipe increases the sealing surface area on the barb. Under zero internal pressure, the compression strain and tensional strain created by the compression of the multi-level barbs is greater then the stress created by relaxation and/or thero expansion and contraction. As the internal pressure increases the joining of the polyethylene or copolymer and the coupling increases.

Sizes range from .5" to 12" NPT. All National Pipe Threads are made to ANSI/ASME B1.20-1983 R 1992.

System Performance

The transition fitting is designed to handle the pressure rating of the HDPE pipe with a 2:1 safety factor at 73.40 degrees Fahrenheit with a minimum 50 year design life.

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Quality Assurance

The transition fitting shall be manufactured by Poly-Cam, Inc. Poly-Cam, Inc. shall provide quality assurance with regards to proper installation, compatibility, performance, and acceptance. Transition joint meets or exceeds the requirements of ASTM D2513 Category 3. Upon request Poly-cam can install a stainless steel insert to meet ASTM 2513 Category 1. All Fittings meet ARRA requirements. Manufactured in the United States.

Installation

HDPE pipe end: Install transition fitting so as to comply with the pipe manufacturer's recommended procedures. All field welds shall be accomplished in accordance with Plastic Pipe Institute's welding procedure for butt fusion.

Threaded Fitting: When installing the transition fitting one should always use pipe joint sealant or Teflon tape. Always use strap wrenches. **Do not use pipe wrench. Always use 2 wrenches when connecting, Over tighten may cause ovality or damage. Always pressure test for leaks before backfilling.** Backfill and compact carefully around transition and service line to prevent ground shifts which could damage the valve and/or transition fitting.

Material

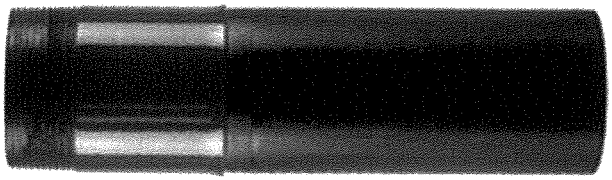
The POLY-CAM Threaded Transition is manufactured of Carbon Steel (A53 or A106 grade) Type 304 or Type 316 (ASTM A249 or ASTM A269) and or ERW pipe (ASTM SA-312) and incorporated with the transition manufactured of HDPE (cell class 345454c) or pipe quality Copolymer material. (pe3408, pe3608 and pe4710). All pipe meets ASTM 3035 and ASTM 714. It complies AWWA C-901, C906 and NSF 61. All certification will be submitted upon request.

The **epoxy coating** (IF 194T Red Iron Oxide) is fusion bonded to the metal. It has approvals NSF 61, FDA 175.300, AWWA C116-01,C213-01, UL 262 and FM 1120/1130
The carbon steel epoxy POLY-CAM threaded transition fitting complies with AWWA and NSF 61 material requirements.

Warranty

Warranty period is one year after date of substantial completion of installation.

Series 710
Transition with Male NPT

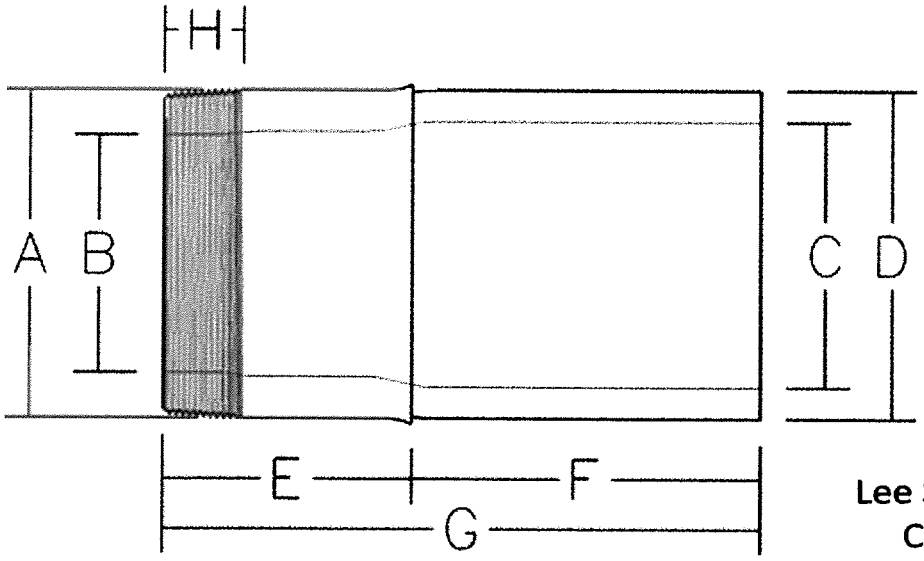


POLY-CAM Male Threaded Transition Adaptors (710 Series) is a multi-level mechanical transition fitting, patent number 5,211,429. The POLY-CAM Threaded Transition is manufactured to the following;

- Carbon Steel Epoxy Coated, 304 and 316 Stainless Steel
- Other steel materials can be made depending on availability.
- Sizes range from .5 to 12" NPT
- Meets ANSI/ASME B1.20-1983 R 1992
- All materials comply with AWWA and NSF 61 Meets ASTM 2513 Category 3. Upon request Poly-cam can install a stainless steel insert to meet ASTM 2513 Category 1

SDR 7 | SDR 9 | SDR 11 | SDR 17

NOMINAL SIZE INCHES	COUPLING O.D. "A"	PRESSED SDR11 PE PIPE I.D. "B"	EXPOSED SDR11 PE PIPE I.D. "C"	EXPOSED PE PIPE O.D. "D"	COUPLING LENGTH "E"	EXPOSED PE PIPE LENGTH "F"	OVERALL LENGTH "G"	THREAD LENGTH "H"
0.5	1.000	~0.625	0.67	0.840	1.6	6.4	8	0.64
0.75	1.250	~0.79	0.84	1.050	1.8	6.2	8	0.7
1	1.315	~0.84	1.05	0.315	2	6	8	0.99
1.25	1.660	~1.06	1.34	1.660	2.6	5.4	8	1.01
1.5	1.900	~1.28	1.53	19.000	2.6	5.4	8	1.03
2	2.375	~1.64	1.92	2.375	3	5	8	1.06
2.5	2.875	~1.99	2.31	2.875	3.5	4.5	8	1.25
3	3.500	~2.42	2.83	3.500	4	4	8	1.26
4	4.500	~3.23	3.63	4.500	4	8	12	1.48
5	5.563	~4.0	4.49	5.563	5	7	12	1.5
6	6.625	~4.8	5.35	6.625	5	8	13	1.56
8	8.625	~6.3	6.96	8.625	7	8	15	1.75
10	10.750	~7.9	8.68	10.750	8	8	16	1.85
12	12.750	~9.5	10.29	12.750	9	9	18	2.27



Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

11/00 ® Registered Trademark Poly-Cam, Inc. - US Patent # 5,211,429

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Lee Supply Co., Inc
Charleroi, PA
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Series 735
Transition for PVC/HDPE

Fitting Description

General – The transition fitting is constructed out of PVC material, stainless steel insert, and high density polyethylene (HDPE) pipe. The PVC and HDPE materials are joined together by hydraulically pressing the HDPE pipe into the PVC coupling. The PVC coupling portion of the transition fitting is machined with our multi-level patented barb system that provides a leak free radial compressed joint. The high density polyethylene portion of the transition fitting is cut to a specific length and is pressed into the PVC coupling. A stainless steel insert is installed to lock the PVC coupling and HDPE pipe together thus forming a leak-proof join that is stronger than the HDPE pipe.

Dimensions

See Poly-Cam, Inc. product dimension sheet provided separately.

System Performance

The transition fitting is designed to handle the pressure rating of the HDPE pipe with a 2:1 safety factor at 73.40 degrees Fahrenheit with a minimum 50 year design life.

Quality Assurance

The transition fitting shall be manufactured by Poly-Cam, Inc. Poly-Cam, Inc. shall provide quality assurance with regards to proper installation, compatibility, performance, and acceptance. Transition joint meets or exceeds the requirements of ASTM D2513 Category 1. All Fittings meet ARRA requirements. Manufactured in USA.

Warranty

Warranty period is one year after date of substantial completion of installation.

Materials Specifications

PVC coupling – The PVC coupling is manufactured out of PVC round bar and PVC hollow bar. This material is a rigid, unfilled, general-purpose-grade Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454, per ASTM D1784. (Callout Designation S-PVC0111 per ASTM D6263).

High Density Polyethylene – HDPE pipe conforming to ASTM D-3350 with minimum cell classification values of 345464C, and shall conform to ASTM F714. Density shall be no less than 0.955 gms/ccm as referenced in ASTM D1505, with melt index no greater than 0.15 gms/10 minutes when tested in accordance with ASTM D 1238. Tensile Strength at yield –tensile shall be 3,200 to less than 3,500 psi as referenced in ASTM D638, and ESCR-Environmental Stress Crack Resistance shall be in excess of 5,000 hours with zero failures when tested in accordance with ASTM D 1693-Condition C.

Stainless Steel insert – The insert is manufacture out of 304 stainless steel tubing (ASTM A249 or ASTM A269) and or ERW pipe (ASTM SA-312).

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Installation

HDPE Pipe End

Install transition fitting so as to comply with the pipe manufacturer's recommended procedures. All field welds shall be accomplished in accordance with Plastic Pipe Institute's welding procedure for butt fusion.

PVC coupling

Install the PVC coupling so as to comply with the pipe manufacturer's recommended procedures for solvent cement.

Multi-Purpose Clear Cement is a medium bodied, medium set multi-purpose cement designed for use on PVC, CPVC and ABS pipe and fittings: Schedule 40 & 80, Types I & II, up to 6 inches. For potable water, pressure pipe, gas, and conduit, drain waste and vent pipe. Flows freely and provides a thick layer of cement on the pipe and loose fitting joints. Apply at temperatures 40°F to 100°F. Meets ASTM D-2564.

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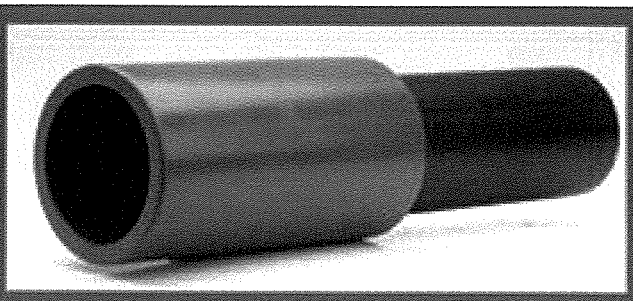
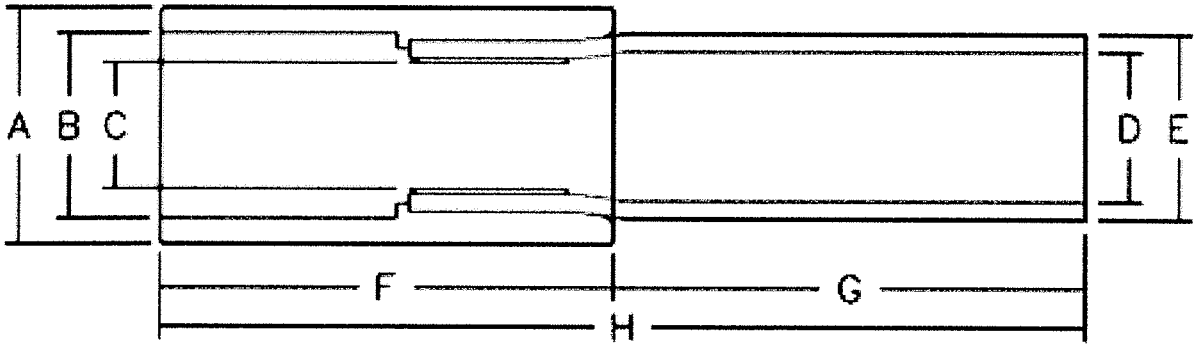
Series 735
Transition for PVC/HDPE



Nominal Size	PVC O.D. "A"	PVC I.D. "B"	Est. I.D. Pressed SDR 9 "C"	Est. I.D. Pressed SDR 11 "C"	HDPE I.D. SDR 9 "D"	HDPE I.D. SDR 11 "D"	HDPE O.D. "E"	PVC Length "F"	Exposed HDPE Length "G"	Total Length "H"
0.75	1.525	1.05	0.65	0.68	0.807	0.851	1.05	2.5	~7	~9.5
1	1.785	1.305	0.81	0.86	1.003	1.051	1.315	3	~6.25	~9.25
1.25	2.375	1.65	1.08	1.15	1.27	1.34	1.66	4.5	~5.75	~10.25
1.5	2.375	1.91	1.15	1.26	1.453	1.533	1.9	4.5	~5.75	~10.25
→ 2	3.025	2.375	1.54	1.64	1.815	1.917	2.375	5.75	~5.5	~11.25
3	4	3.5	2.48	2.63	2.675	2.836	3.5	6.5	~4.5	~11
4	5.625	4.5	3.17	3.36	3.44	3.633	4.5	6.5	~8.5	~15

Stainless Steel ID Insert Standard - PVC ID Insert Available



Fully pressure rated • Standard SDR sizes 7,9,11
Manufactured to ASTM D—2513-96a, D1599, D1598
11/00 ® Registered Trademark Poly-Cam, Inc. - US Patent # 5,211,429

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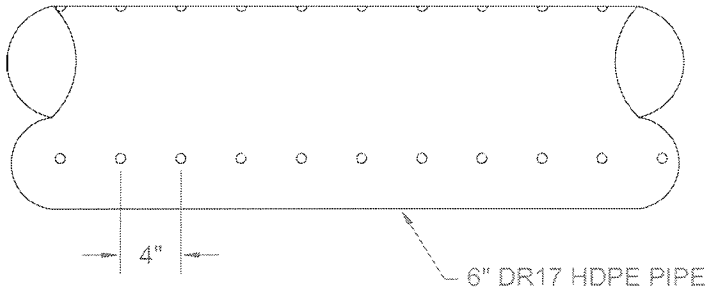

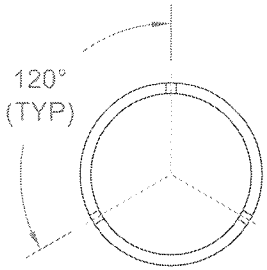

PERFORATION PATTERN
1/2" HOLES
3 ROWS
4" CENTERS
NON STAGGERED

6" DR17 HDPE PERF PIPE

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LEE SUPPLY CO. INC.

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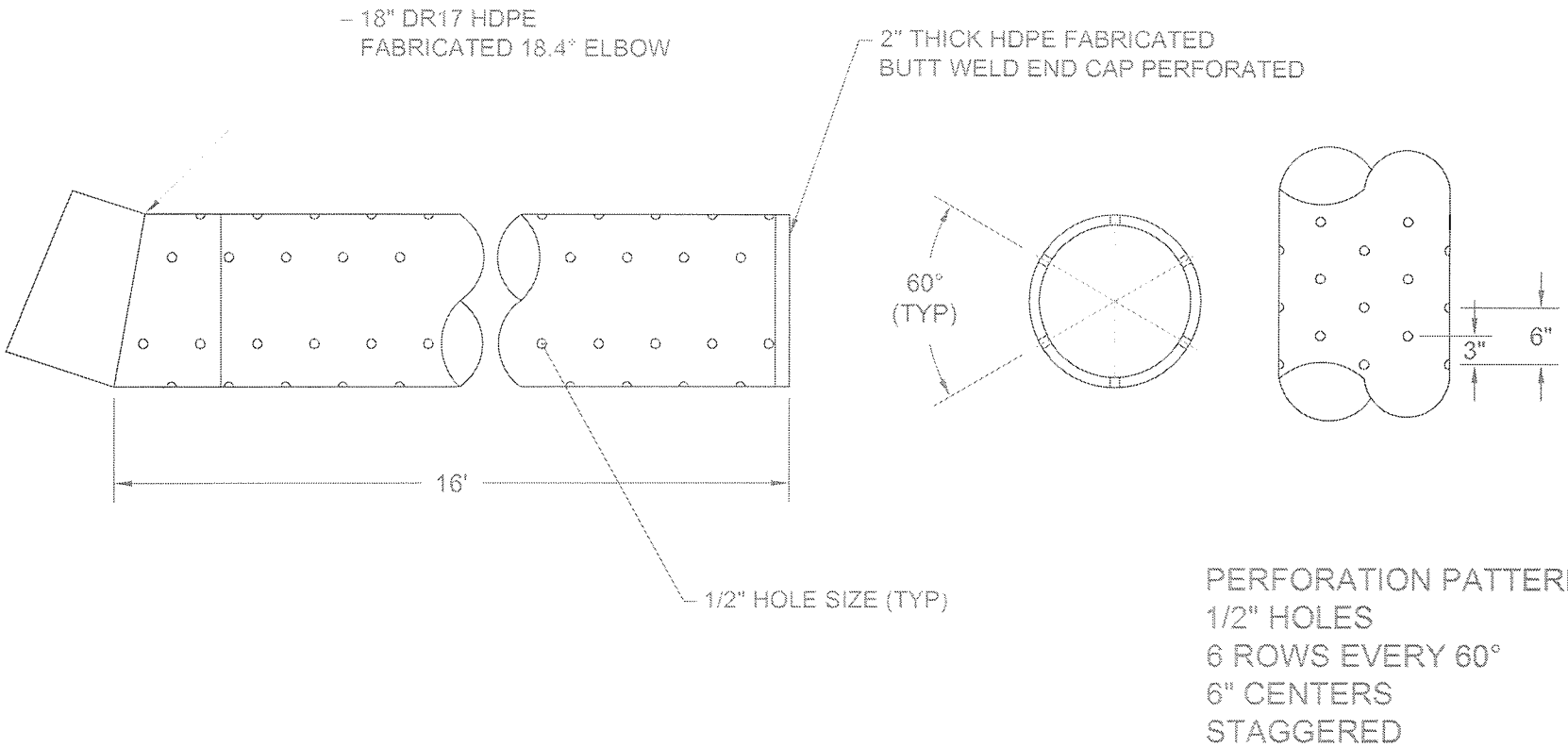
DATE:	SEPTEMBER 19,2013
APPROVED BY:	
REVISIONS:	



PERFORATION PATTERN
1/2" HOLES
6 ROWS EVERY 60°
6" CENTERS
STAGGERED

18" DR17 HDPE 18.4° SLOPE RISER

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DATE:	SEPTEMBER 19,2013
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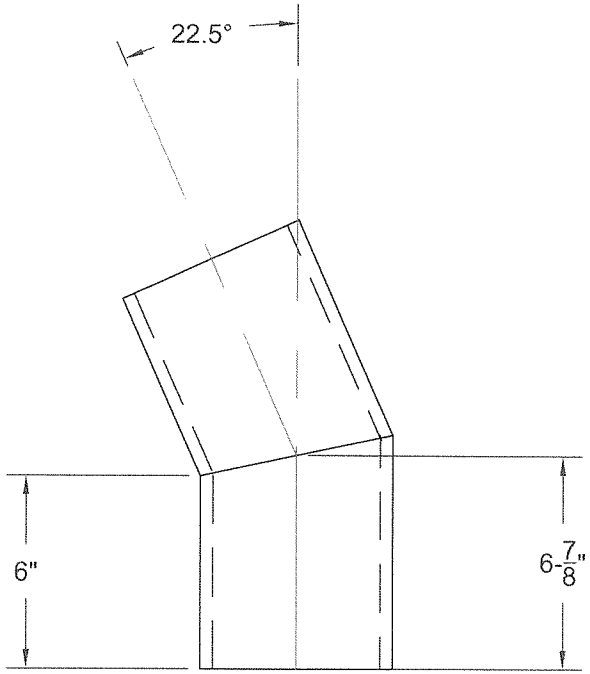
REVISIONS:	



6 IN HDPE DR 17 22.5°

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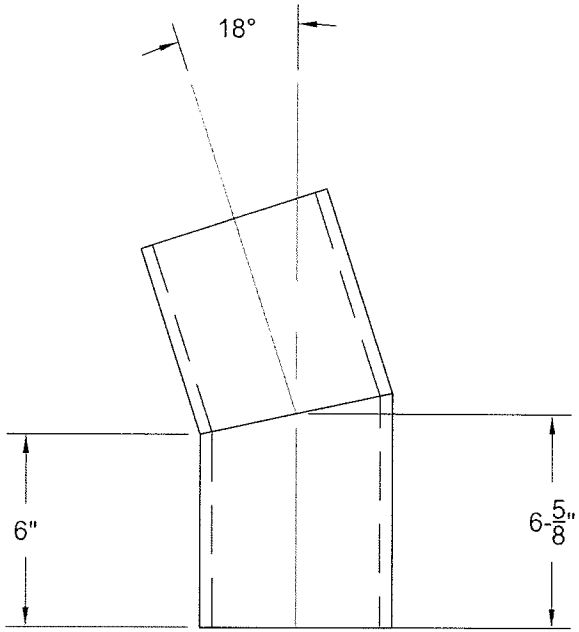

6 IN HDPE DR17 18°

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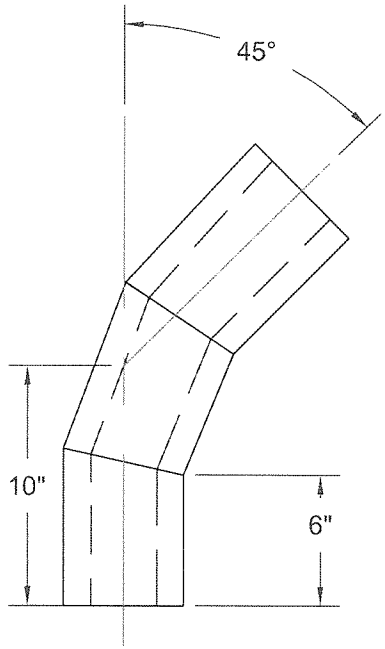
*ALL FABRICATIONS WILL BE BASED ON APPROVED DRAWINGS.

LEE SUPPLY CO. INC.

1-800-353-3747

CUSTOMER:	
DRAWN BY:	MATTHEW
DATE:	JULY 18,2013
APPROVED BY:	
REVISIONS:	



6" HDPE DR17 45°

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LEE SUPPLY CO. INC.

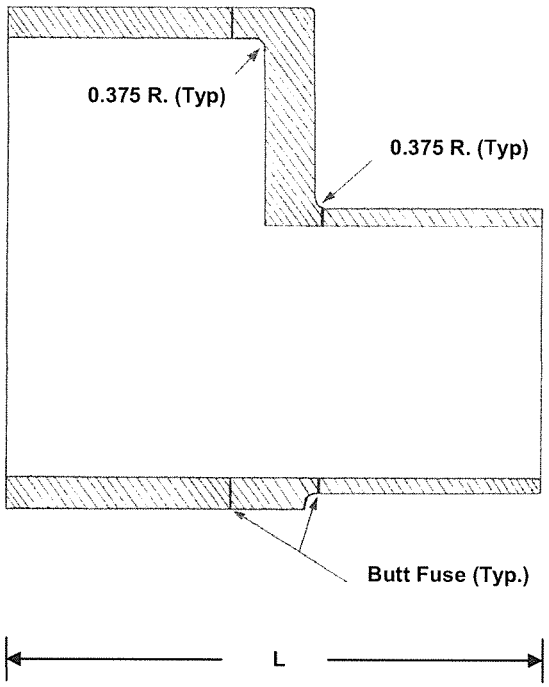
1-800-353-3747

CUSTOMER:	
DRAWN BY:	MATTHEW
DATE:	MAY 16,2012
APPROVED BY:	
REVISIONS:	

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

IPS Fabricated IPS X IPS Ecc. Reducer

Not Pressure Rated
(Dimensions in Inches)

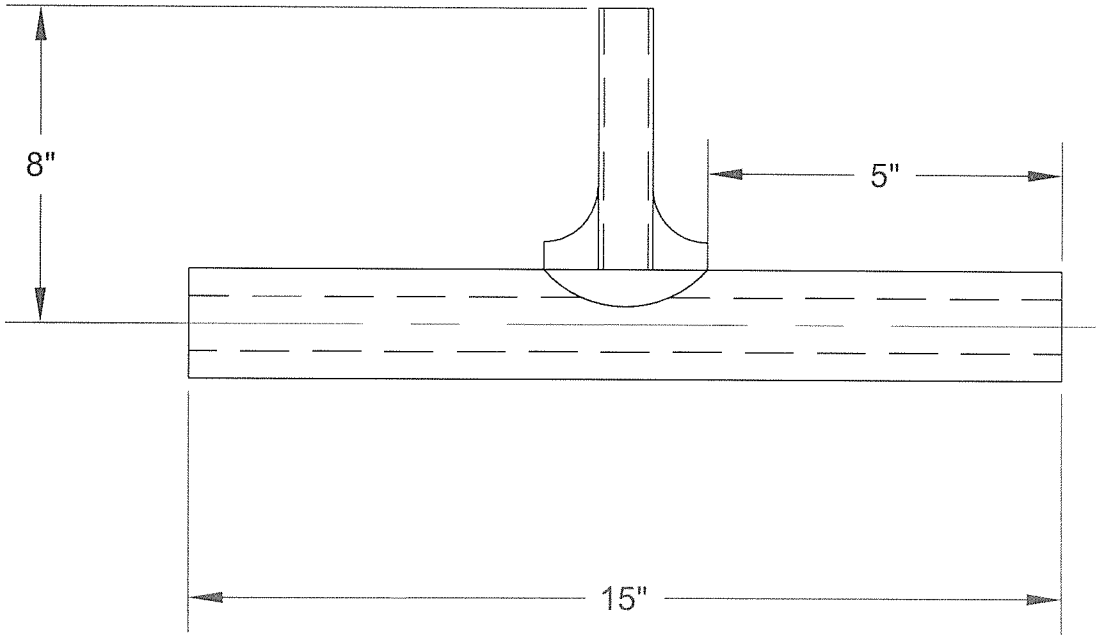


Nom. IPS Size	L (in)	DR	Weight (lbs)
8"IPS X 6"IPS	17.00	11/11	10
10"IPS X 8"IPS	17.00	9/9	15
12"IPS X 10"IPS	17.00	9/9	24
16"IPS X 12"IPS	20.00	9/9	72

PLEASE NOTE !! - SPECIFICATIONS

Dimensions and appearance are subject to change without notice due to design, production modifications or other various factors affecting production. Dimensions are approximate. Angle tolerance for fabricated elbows is +/- 2 degrees. All fittings are subject to Infinity Plastics "Standard Terms and Conditions." A copy of this drawing must accompany all purchase orders for this fitting. All other dimensions are to tolerances of +/- 1.0"

HDPE Fabricated Fittings supplied by Infinity Plastics are designed to meet AWWA C901/C906 fitting requirements and are manufactured from PPI and NSF listed resins in accordance with the material specifications listed in ASTM D3350 with a cell classification of 345464C. Suitable for butt welding to pipe manufactured to ASTM D2513, D3035, F714 with similar resins. NOTE: Fabricated HDPE (PE 4710) fittings are available through Infinity Plastics upon request.



2" X1" HDPE DR11 BRANCH SADDLE TEE

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LEE SUPPLY CO. INC.

1-800-353-3747

CUSTOMER:	
DRAWN BY:	MATTHEW
DATE:	FEBRUARY 22,2011
APPROVED BY:	
REVISIONS:	

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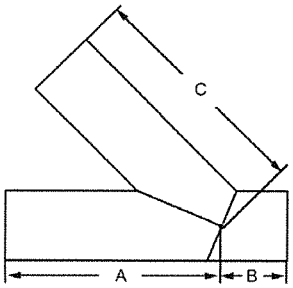

IPS Fabricated 45° Lateral Wye Unreinforced

(Dimensions in Inches)

IPS Size	A	B	C	SDR		Weight (lbs)
2"	18.0	6.0	14.0	7 9 11		3 2 2
3"	18.0	7.0	14.0	7 9 11		7 6 5
4"	22.0	7.0	22.0	7 9 11		16 14 12
6"	28.0	7.0	28.0	7 9 11		42 33 30
8"	30.0	8.0	30.0	7 9 11		74 59 51
10"	31.0	8.0	31.0	7 9 11 17		119 98 79 55
12"	33.0	11.0	33.0	7 9 11 17		181 148 124 84
14"	42.0	11.0	42.0	7 9 11 17		271 217 181 123
16"	44.0	13.0	44.0	7 9 11 17		383 311 258 174
18"	57.0	14.0	57.0	7 9 11 17		605 493 415 280

• IPS 45° Lateral Wyes Continued Next Page •

Other sizes and DR's not listed are available - Call For Quick Quote

Sizes 24" and smaller meet AWWA C906 fitting requirements, sizes 26" and larger are quoted per fitting.

WPR represents the long term hydrostatic pressure capacity of the fabricated wye with a 1.5:1 safety factor. To achieve a 2:1 safety factor like that of the straight pipe the WPR will be reduced.

HDPE Fabricated Fittings supplied by Infinity Plastics are designed to meet AWWA C901/C906 fitting requirements and are manufactured from PPI and NSF listed resins in accordance with the material specifications listed in ASTM D3350 with a cell classification of 345464C. Suitable for butt welding to pipe manufactured to ASTM D2513, D3035, F714 with similar resins.

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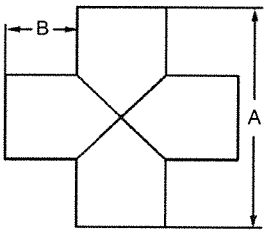


Fabricated Line Cross - IPS

(Dimensions in Inches)

IPS Size	A	B	SDR	WPR (psi)	Weight (lbs)
2"	9.0	3.3	11	160	2
3"	10.3	3.4	11	160	3
4"	16.5	6.0	7 9 11	200 160 128	10 8 7
6"	18.6	6.0	7 9 11	200 160 128	22 18 16
8"	24.6	8.0	7 9 11	200 160 128	50 41 34
10"	26.8	8.0	7 9 11 17	200 160 128 80	83 67 55 38
12"	28.8	8.0	7 9 11 17	200 160 128 80	123 99 84 56
14"	32.0	9.0	7 9 11 17	200 160 128 80	165 132 109 74
16"	34.0	9.0	7 9 11 17	200 160 128 80	236 1192 159 107
18"	38.0	10.0	7 9 11 17	200 160 128 80	328 267 224 152

• IPS Line Cross Continued Next Page •

Other sizes and DR's not listed are available - Call For Quick Quote

Sizes 24" and smaller meet AWWA C906 fitting requirements, sizes 26" and larger are quoted per fitting.

WPR represents the long term hydrostatic pressure capacity of the fabricated cross with a 1.5:1 safety factor. To achieve a 2:1 safety factor like that of the straight pipe the WPR will be reduced.

HDPE Fabricated Fittings supplied by Infinity Plastics are designed to meet AWWA C901/C906 fitting requirements and are manufactured from PPI and NSF listed resins in accordance with the material specifications listed in ASTM D3350 with a cell classification of 345464C. Suitable for butt welding to pipe manufactured to ASTM D2513, D3035, F714 with similar resins.

Range of Products
Physical Properties and Specifications

Lee Supply Co., Inc
Charleroi, PA
1-800-353-3747

Physical properties			Polystone®				
Property	Units	ASTM Test	G (HDPE)	P (Polypropylene) Homopolymer	P (Polypropylene) Copolymer	P (Polypropylene) Rochling Grey Homopolymer	P (Polypropylene) Rochling Grey Copolymer
Density	gm/cm³	D792	.95	.91	.91	.91	.91
Tensile strength at yield 73°F	psi	D638	3000	4700	3700	4700	3700
IZOD impact strength 73°F	ft. lb./in.	D256	3.1	1.0	8.0	1.0	8.0
Hardness 73°F	Shore	D785	67	72	68	72	68
Coefficient of linear thermal expansion	in./in./°F	D696	5-6.5 x 10^{-5}	5-6.5 x 10^{-5}	5-6.5 x 10^{-5}	5-6.5 x 10^{-5}	5-6.5 x 10^{-5}
Continuous service temperature in air (max)	°F	–	180	180	180	239	230

Polystone® G (HDPE)
Polystone® P (Polypropylene)

Sheets, extruded
1/16"- 1-1/2" x 48" x 96"
1/16"- 1-1/2" x 48" x 120"
1/16"- 1-1/2" x 60" x 120"
Sheets up to 120" wide available upon request

Sheets, pressed
1-3/4" - 4" x 48" x 96"
1-3/4" - 4" x 48" x 120"
1-3/4" - 4" x 96" x 240"
Sheets up to 8" thick available upon request

Rods
8mm (.31") - 350mm (13.78")

Welding Rods
3mm (.118") - 5mm (.197") diameter

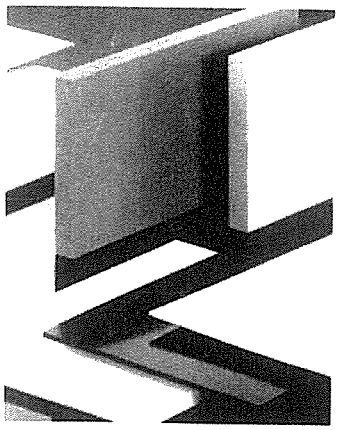
Specifications and Approvals

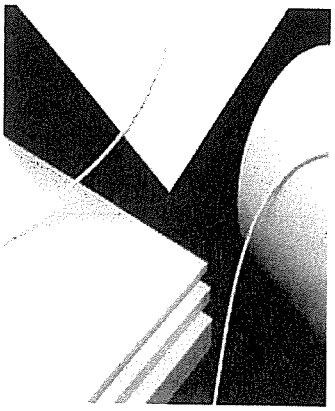
Polystone® G (HDPE)

ASTM	D-1248	Polyethylene plastics molding and extrusion materials
FDA	Natural, and colors if requested	FDA Regulation Title 21 CFR 177.1520 Approved for direct contact with meat and poultry
Federal	L-P-390C	Plastic, molding and extrusion, polyethylene and copolymers
Military	MIL-P-23536 MIL-P-21922	Plastic sheets, virgin and borated polyethylene Plastic rods and tubes polyethylene

Polystone® P (Polypropylene)

ASTM	D-4101	Propylene plastis injection and extrusion materials
FDA/USDA	Natural, and colors if requested	FDA Regulation Title 21 CFR 177.1520 Approved for direct contact with meat and poultry
Federal	L-P-394C	Plastic molding material (propylene plastics)
UL Rating	UL94 HB	If UL94-V0 is required, Polystone® P Flame Retardant is manufactured from approved materials





The information listed herein is stated to the best of our knowledge and is intended to provide a general guideline for Polystone® and its uses. The values given are based on laboratory testing backed with global industry experience. All properties in this brochure have performed equal or better in laboratory testing. However, the data should not be considered as guaranteed specific properties. Suggested applications are provided for information only and are not specific recommendations.

Polystone® G (HDPE)
Polystone® P (Polypropylene)

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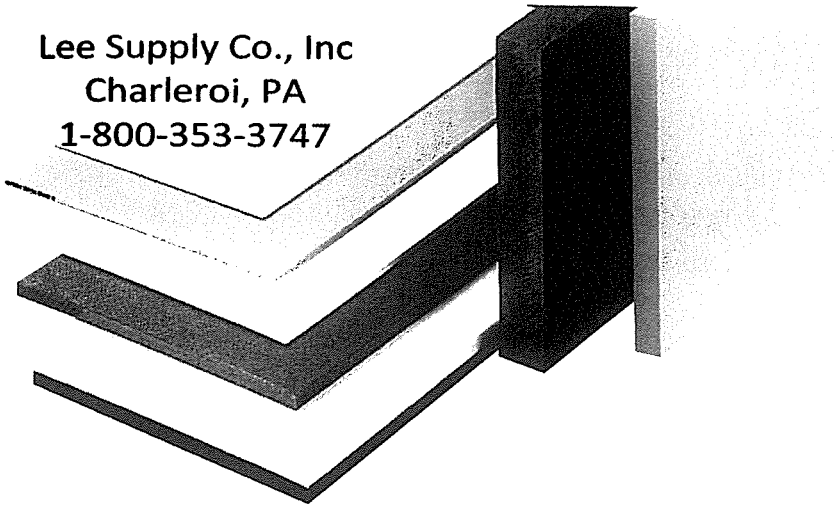
Charleroi, PA
1-800-353-3747



Polystone® G and P sheets are extruded with exceptionally close tolerances and, since they are always stress-relieved, you can be assured of the flatness. Our unique in-line trimming process produces a clean, square cut that does not require re-trimming.

Polystone® G:
- Outstanding impact resistance
- Easily fabricated and welded
- Operating temperature up to 180° F (82° C)
- FDA and USDA accepted
- Resistant to most acids and solvents

Polystone® P:
- Exceptional chemical resistance
- Easily fabricated, welded and formed
- Operating temperature up to 180° F (82° C), and up to 239° F (115° C) with heat stabilizers
- High impact resistance
- FDA and USDA accepted

Polystone® G Selection Table	Material Description	Standard Color
Natural	Standard high-density polyethylene, FDA/USDA accepted	Opaque white
Colors	Available in standard and custom colors	Assorted
Cut-Rite	Food preparation cutting boards, textured both sides	Natural and assorted
Play-Tec	Designed for playground structures, textured both sides, U.V. stabilized	Assorted solid and co-extruded
Marine-Tec	Designed for boat builders with a unique texture on both sides, U.V. stabilized	Assorted marine colors
Marine-Tec lite	Special foamed core reduces weight by as much as 20%	Assorted marine colors
Polystone	Bathroom partitions, textured both sides (available in HDPE or PP)	Assorted solid and granite
Pipe Grade	Special grade for the HDPE pipe market, U.V. stabilized	Black

Polystone® P Selection Table	Material Description	Standard Color
Natural Homopolymer	Standard polypropylene, FDA/USDA accepted	Opaque white
Natural Copolymer	Higher impact strength, especially in cold temperatures as low as −40° F	White
Colors	Available in standard and custom colors	Assorted
White	Designed for the semiconductor industry, with protective masking	Bright white
Rächling Grey	Operating temperature is increased up to 239°F	Grey-Tan
Flame Retardant	Manufactured from UL-94 V0 approved materials	White
Polystone	Bathroom partitions, textured both sides (available in HDPE or PP)	Assorted solid and granite
Foamlite	Extruded foam sheet with closed pores, textured scratch-resistant surface	Assorted

All grades are available in homopolymer and copolymer

4” Submersible Motors High Thrust

Application

These motors are built for dependable operation in 4” diameter or larger water wells.

Basic Features

- Corrosion-resistant construction
- Stainless steel splined shaft
- Hermetically-sealed windings
- StatorShield™ resin system
- Filter check valve
- Water lubrication
- Kingsbury-type thrust bearing
- Pressure-equalizing diaphragm
- Sand fighting slinger
- Built-in lightning arrestors (single-phase)
- New lead assembly
- Franklin-manufactured control boxes available for single-phase motors
- UL 778 recognized (North American voltages)
- CSA certified
- ANSI/NSF 61 certified
- Industry standard NEMA mounting dimensions

Special Options

- **316 SS Construction**
  Special construction option for corrosive applications, including acids, low pH and seawater.
- **Sand Fighter™ Construction**
  Special construction option for sandy water wells. Motors include Sand Fighter sealing system with silicon carbide mechanical shaft seal and are warranted against sand entry failure.
- **Coalbed Methane Construction**
  Special construction option for coalbed methane wells. Includes Sand Fighter sealing system, reinforced diaphragm housing to resist damage from bottom tagging and protective filter to shield diaphragm from debris.
- **Oil Stripper Construction**
  Special construction option for secondary oil recovery wells where there is a mixture of oil and water. They are also suitable for geothermal and other water well applications where high temperatures and/or high pH conditions exist. Three-phase Oil Stripper motors are equipped with Subtrol™ heat sensor for use with SubMonitor™ protection devices.

4" Submersible Motors High Thrust

4-Inch High Thrust Motor Specifications

Hz	Ph	Hp Range	kW Range	Poles	RPM	Max. Ambient Temp.	Duty Rating
60	1	1.5 - 5	1.1 - 3.7	2	3450	86 °F / 30 °C	Continuous at 0.25 ft/sec flow past motor
50	1	1.5 - 5	1.1 - 3.7	2	2875	86 °F / 30 °C	Continuous at 0.25 ft/sec flow past motor
60	3	1.5 - 10	1.1 - 7.5	2	3450	86 °F / 30 °C	Continuous at 0.25 ft/sec flow past motor
50	3	1.5 - 10	1.1 - 7.5	2	2875	86 °F / 30 °C	Continuous at 0.25 ft/sec flow past motor

NOTE: Not all ratings available in all construction options.

4-Inch High Thrust Construction Materials

	Construction Type		
Component	Standard Water Well	Coalbed Methane	Sand Fighter™
Top Castings	303 SS	303 SS	303 SS
Bottom Castings	303 SS Over Iron, Painted Cast Iron	303 SS Over Iron, Painted Cast Iron	303 SS Over Iron, Painted Cast Iron
Stator Shell	301 SS	301 SS	301 SS
Stator Ends	Low Carbon Steel	Low Carbon Steel	Low Carbon Steel
Shaft Extension	17-4 SS	17-4 SS	17-4 SS
Fasteners	300 Series SS	300 Series SS	300 Series SS
Seal Cover	Acetal	Sintered Bronze	Sintered Bronze
Seal	Nitrile Rubber Lip	Sand Fighter™ SiC/ SiC Mech Seal	Sand Fighter SiC/ SiC Mech Seal
Diaphragm	Nitrile Rubber	Nitrile Rubber	Nitrile Rubber
Diaphragm Cup	316 SS	316 SS	316 SS
Diaphragm Spring	316 SS	316 SS	316 SS
Diaphragm Cover	Gray Iron	Gray Iron	304 SS
Slinger	Nitrile Rubber	Nitrile Rubber	Nitrile Rubber
Lead Wire (or Cable)	XLPE*	XLPE*	XLPE*
Lead Potting	Epoxy	Epoxy	Epoxy
Lead Screws / Clamp	316 SS	316 SS	316 SS
Filter	Delrin & Polyester	Delrin & Polyester	Delrin & Polyester

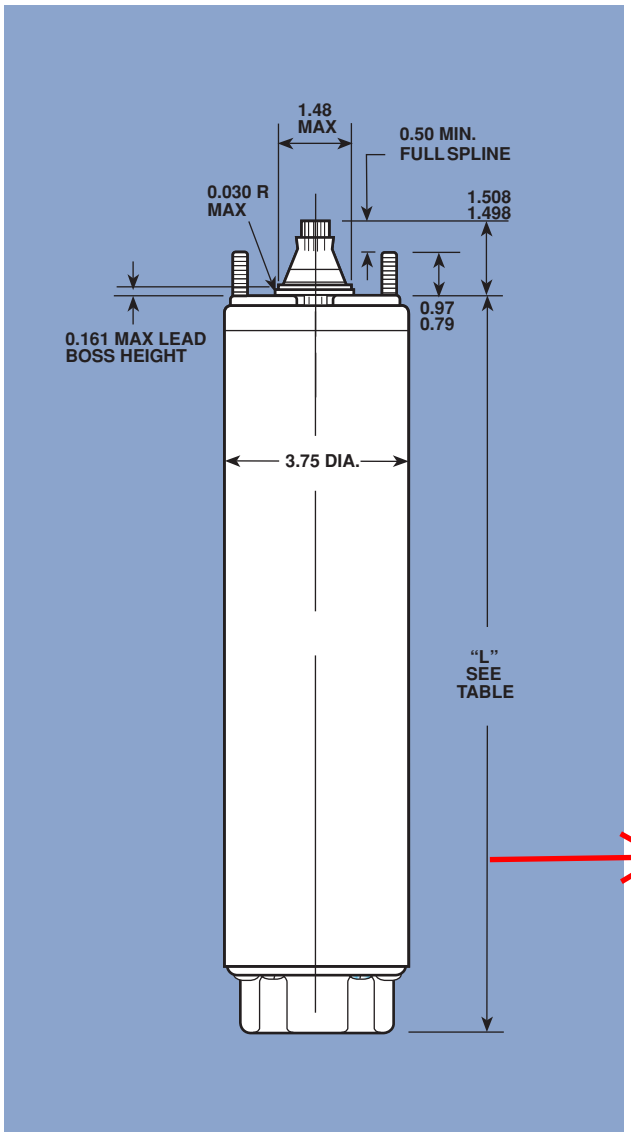
	Construction Type	
Component	Chemical (316 STNLS)	Oil Stripper
Top Casting	316 SS	316 SS
Bottom Casting	316 SS	316 SS
Stator Shell	316 SS	316 SS
Stator Ends	316 SS	316 SS
Shaft Extension	17-4 SS	17-4 SS
Fasteners	316 SS	316 SS
Seal Cover	316 SS	316 SS
Seal	Sand Fighter SiC Mech Seal	Sand Fighter Viton®
Diaphragm	Nitrile Rubber	Viton®
Diaphragm Cup	316 SS	316 SS
Diaphragm Spring	316 SS	316 SS
Diaphragm Cover	316 SS	316 SS
Slinger	Nitrile Rubber	Viton®
Lead Wire (or Cable)	XLPE*	XLPE*
Lead Potting	Epoxy	Epoxy
Lead Screws / Clamp	316 SS	316 SS
Filter	316 SS Plug	316 SS Plug

* Removable type, factory-installed in 60 Hz and dual frequency rated water well motors. Consult catalog for additional leads.

Specifications subject to change without notice. Contact Franklin Electric if current material types are required for bid specifications.

Viton® is a registered trademark of DuPont Dow Elastomers.

4-Inch High Thrust Dimensions and Weights



Single-Phase Motors*

HP	KW	"L" (inches)	SHIPPING WEIGHT LBS	SHIPPING WEIGHT KG	MOTOR CARTON SIZE (in inches)
1.5	1.1	19.12	35	15.9	6 x 6 x 23
2	1.5	20.62	43	19.5	6 x 6 x 25
3	2.2	23.20	56	25.4	6 x 6 x 28
5	3.7	29.20	71	32.2	6 x 6 x 34

Single-Phase Motors - Oil Stripper

HP	KW	"L" (inches)	SHIPPING WEIGHT LBS	SHIPPING WEIGHT KG	MOTOR CARTON SIZE (in inches)
2	1.5	22.87	46	20.9	6 x 6 x 28
3	2.2	23.20	56	25.4	6 x 6 x 34
5	3.7	29.20	71	32.2	6 x 6 x 37

Three-Phase Motors*

HP	KW	"L" (inches)	SHIPPING WEIGHT LBS	SHIPPING WEIGHT KG	MOTOR CARTON SIZE (in inches)
1.5	1.1	18.00	37	16.8	6 x 6 x 23
2	1.5	19.12	44	20.0	6 x 6 x 23
3	2.2	20.20	44	20.0	6 x 6 x 25
4	3.0	23.20	56	25.4	6 x 6 x 28
5	3.7	23.20	56	25.4	6 x 6 x 28
5.5	4.0	25.68	63	28.6	6 x 6 x 28
7.5	5.5	29.20	71	32.2	6 x 6 x 34
10	7.5	32.20	77	34.9	6 x 6 x 34

Three-Phase Motors - Oil Stripper

HP	KW	"L" (inches)	SHIPPING WEIGHT LBS	SHIPPING WEIGHT KG	MOTOR CARTON SIZE (in inches)
2	1.5	21.37	42	19.1	6 x 6 x 25
3	2.2	20.20	44	20.0	6 x 6 x 28
5	3.7	25.68	63	28.6	6 x 6 x 34
7.5	5.5	29.20	71	32.2	6 x 6 x 37

* Represents standard and Sand Fighter™ construction models. Consult factory for Coalbed Methane and 316 SS weights and dimensions.

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* **DIRECT INDICATION OF PROCESS, SET POINT & RESET POINT**
* **LARGE BACKLIT DISPLAY**
* **10 AMP SPDT CONTACTS**
* **24 VDC POWER FOR 2 WIRE TRANSMITTERS**
* C UL US LISTED 51JB
  INDUSTRIAL CONTROL EQUIPMENT

GENERAL:

Control of pumps, motors, solenoids, etc. is provided via DEVAR'S Model 332 Alarm/ Controller. This highly accurate, multi-purpose instrument provides a digital readout of the measured variable (0/100% or in engineering units), contains two separate alarm set and reset trip adjustments, has a highly rated 10 amp S.P.D.T. relay output plus simplicity of adjustment. The set and reset trip points are read directly via the digital display.

ALARM ACTION:

Used as a simple alarm the 332 monitors a single voltage or current input signal and compares it to the trip point setting. When the input signal reaches this trip setting an alarm is initiated by action of the internal relay. This action is set in the fail safe mode, (relay normally energized, de-energizes on alarm or on loss of power).

Two independent output channels (S.P.D.T.) are provided, both rated at 10 amps. Each channel may be set to alarm as a high (signal increasing) or low (signal decreasing) alarm via internal DIP switch settings.

Upon exceeding the preset trip point, a bright red L.E.D. indicates channel A or B in alarm. At the same time the back-lit digital display begins to flash further alerting the observer to the alarm condition. The flashing display may be disabled.

A special feature of the 332 allows the user to set not only the trip point, but also the reset point (many alarm devices limit the user to a fixed 1-2% internal reset "deadband" setting). The 332's set and reset points may be set at any point between -5% and 105% of the calibrated input range. This feature allows use of the 332 as a simple on/off controller.

SPECIFICATIONS:

INPUT:

-1	0/5mA (Ri=200 OHMS)	-6	0/5 VDC (Ri>10 MEG)
-2	1/5mA (Ri=200 OHMS)	-7	0/1 mA (Ri=1K OHMS)
-3	4/20 mA (Ri=50 OHMS)	-8	0/1 VDC (Ri>10 MEG)
-4	10/50 mA (Ri=20 OHMS)	-9	1/5 VDC (Ri>10 MEG)
-5	0/10 VDC (Ri>10 MEG)	-X	OTHER

OUTPUT:
TWO INDEPENDENTLY SETABLE
SPDT, EPOXY SEALED RELAYS

CONTACT RATING:
10 AMPS, 240 VAC RESISTIVE, 1 PHASE
8 AMPS, 24 VDC RESISTIVE
1/3 HP, 120 VAC (7.2 full load amps)
1/2 HP, 240 VAC (4.9 full load amps)
MECHANICAL : 20 MILLION OPERATIONS
ELECTRICAL : 100,000 OPERATIONS, 8 AMPS, 240 VAC RES.
MAX SWITCHED POWER: 200 W DC, 2000 VA AC

DISPLAY TYPE:
7 SEGMENT 3.5 DIGIT BACK LIT LCD,
RED DIGITS ON BLACK BACKGROUND
CHARACTER HEIGHT: 0.5 IN
RANGE DISPLAY: -1999 TO +1999

INDICATION:
INPUT: 0 TO 100% STANDARD
SET POINT: -5 TO 105%
RESET POINTS: -5 TO 105%
NON-STD RANGE BETWEEN +/-1999 COUNTS
FLASHES WHEN IN ALARM

POWER:
115 VAC, 50/60 HZ, 6 VA
OPTION E71: 230 VAC, 50/60 HZ, 6 VA
OPTION E92: 24/28 VDC, 90 mA (nonisolated)

PERFORMANCE:
REPEATABILITY: 0.1% SPAN
RESOLUTION TRIP ADJUST: 0.1% SPAN
DISPLAY ACCURACY: +/-2 COUNTS
OPERATING TEMP. ALARM: -10 TO +70ºC
OPERATING TEMP DISPLAY: 0 TO 60ºC
STORAGE TEMPERATURE: -20 TO 80ºC
TEMPERATURE EFFECT: .018%/ºC MAX

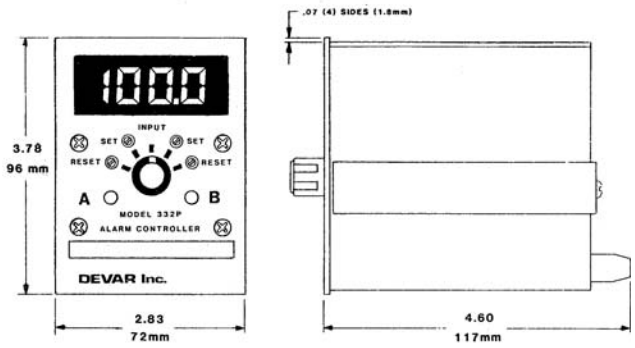
ENCLOSURE:
PANEL MOUNT- SPECIFY 332-P
WALL MOUNT- SPECIFY 332-W
GRAY BAKED ENAMEL OVER ZINC PLATED STEEL

WEIGHT:
2.3 LBS.

OPTIONS:
-E30 Single Channel
-R Reverse relay action (resets on loss of power)
-N4 NEMA 4X Enclosure (332 W only)

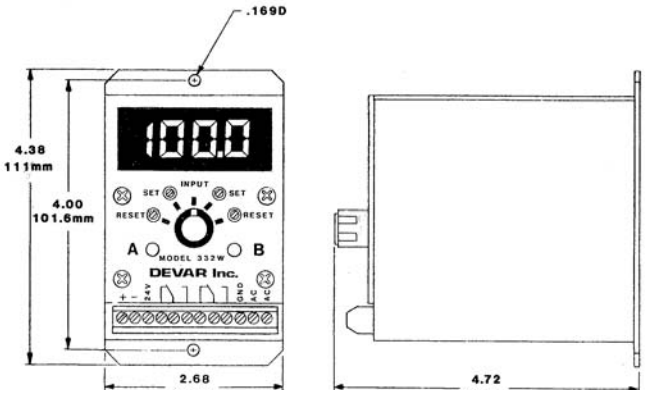
APPLICATION NOTE: ON-OFF CONTROL
Level control in a tank may be provided by the 332. Example: Set the 332 for "LOW" alarm action (via internal DIP switch). Adjust the low set trip point to 50% and the reset trip point to 75%.What will happen? The 332 will monitor the calibrated input signal, readable via the digital display. When this signal drops below 50%, the channel "A" contact will (change state), activating a pump motor, valve etc. to enable filling of the tank.
As the level increases it is monitored by reading the display, however no output action occurs until the signal reaches the 75% reset point. Upon reaching this setting the relay will once again reset to its original state. Note: The channel "B" contact may be used as an alarm or to control a second device.

BULLETIN 332
990026-0001 04/04

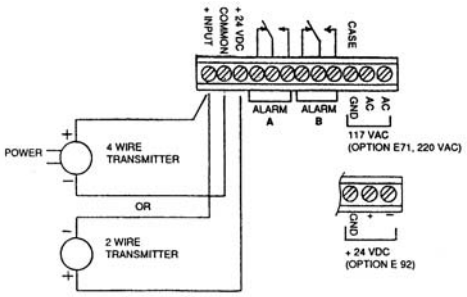


PANEL CUTOUT
3.67 (93.2mm) X 2.71 (68.6 mm)
TOLERANCE ±.015 (± .38mm)

GENERAL DIMENSIONS 332P



GENERAL DIMENSIONS 332W



FIELD WIRING

DEVAR Inc.
706 Bostwick Ave., Bridgeport, CT 06605-2396
TEL: 203-368-6751, TOLL FREE: 1-800-566-6822
FAX: 203-368-3747 e-mail: info@devarinc.com
http://www.devarinc.com

Series 700 Submersible Pressure Transducer

The Series 700 pressure transducer uses piezoresistive pressure cell sensing technology with a 316 stainless steel diaphragm. The housing is 316 stainless steel with Teflon wetted materials. Cable is a heavy duty polyurethane jacketed and shielded with polyethylene breather tube. Conductors are 22 AWG.

Signal is 4-20mA provided by a 24 volt powered control loop.

Standard pressure range for leachate cell pump applications is 0-5 psi with 0-10 psi available. Higher ranges are available for storage tank applications.

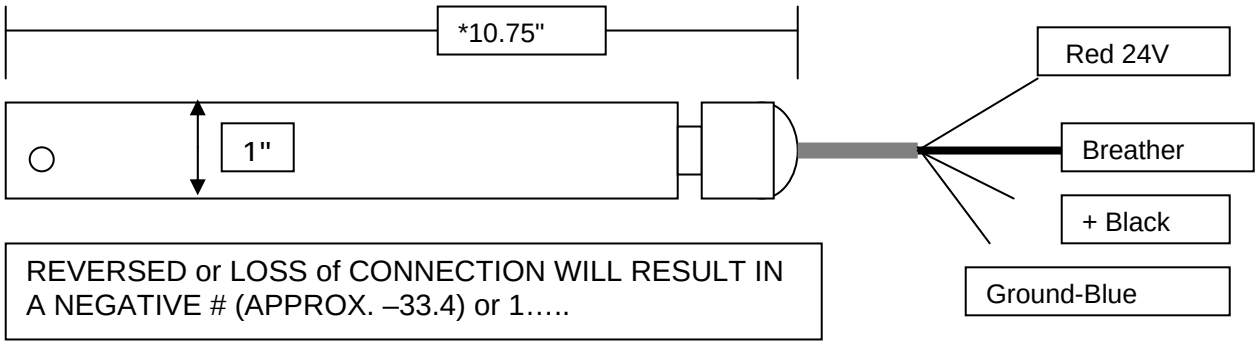
Accuracy is +/- 1.00 % of full range (for 0-5 psi accuracy is +/-1.4" minimum).

Rated burst pressure is 2X pressure range (10 psi minimum).

The standard Sidesloper unit is provided with an internal surge suppressor with more than 10,000 amperes peak surge. Protectors are multi-stage design, with a solid state section that intercepts the leading edge of the surge in a nanosecond. The second stage of the design contains a gas discharge tube which crowbars up to 20,000 ampere currents to ground. The tube remains in the crowbar start until the surge has passed, then rests to normal operation automatically.

Approvals are available for FM, CSA, and UL for Class 1, Div 1, Groups A, B, & C, and Class II, Div 1, group E, F, & G, and Class III, Div 1 hazardous locations. Hazardous location approvals are accomplished using approved electrical barrier.

A permanent bellows breather device mounted in the control panel allows the device to "breath" and prevents moisture from entering and condensing in the vent tube of the cable. This device replaces desiccant tubes which require periodic replacement.



Esterline
Pressure Systems

Submersible Level Transducer

KPSI™ Transducers | Series 700

FEATURES

- Custom Level Ranges up to 700 ft (210 m) H_2O
- Accuracy to ±0.05% FS Available
- Analog Outputs of 4-20 mA or VDC
- Welded 316 SS or Titanium Construction
- Optional Lifetime Lightning Protection
- Optional Temperature Measurement Output
- Custom Cable Lengths

APPLICATIONS

- Well Monitoring
- Level Control
- Oceanographic Research
- Lift Stations
- Ground Water Monitoring
- Surface Water Monitoring
- Slug Tests
- Pump Control
- Soil Remediation

The Series 700 family of submersible hydrostatic level transducers is specifically designed to meet the rigorous environments encountered in liquid level measurement and control. They can be configured to perform to specifications under most adverse, reactive conditions.

All KPSI Transducers utilize a highly accurate pressure sensor assembly specifically designed for hostile fluids and gases. The assembly is integrated with supporting electronics in a durable waterproof housing constructed of 316 stainless steel or titanium. The attached electrical cable is custom manufactured to Pressure Systems' specifications and includes Kevlar® members to prevent errors due to cable elongation, and a unique water block feature that self-seals in the event of accidental cuts to the cable. Each transducer is shipped with our latest SuperDry™ Vent Filter that prevents moisture from entering the vent tube for at least one year without maintenance, even in the most humid environments.

These units are designed for installation in a Class I, Division 1, Groups A, B, C, and D, Class II, Division 1, Groups E, F and G, Class III, Division 1 hazardous location when connected to appropriate apparatus such as those manufactured by R. G. Stahl, Inc., and others. KPSI transducers are type approved by the American Bureau of Shipping (ABS) and are UL, CUL, and FM approved and have a IP 68 and NEMA 6P housing protection rating. The Series 700 is CE compliant to EN 61000-6-4:2001 and EN 61000-6-2:2001. All KPSI Transducer calibrations are traceable to the National Institute of Standards and Technology (NIST).

GUNNCO PUMP & CONTROLS, Inc.
515 Industrial Way
Cumming, GA 30040

Series 700 Specifications

Specifications subject to change without notice.

Parameter	735[1]	730[1]	720	710	700	Units	Comments
LEVEL RANGES							
Full Scale Level Ranges[2]	5 thru 700 (1.5 thru 210)		2.3 thru 700 (0.70 thru 210)			ft H_20 (m H_20)	for vented gage reference
	N/A	35 thru 700 (10 thru 210)	10 thru 700 (3 thru 210)			ft H_20 (m H_20)	for sealed gage reference
	N/A	35 thru 700 (10 thru 210)				ft H_20 (m H_20)	for absolute reference
Proof Pressure	1.5					x FS	
Burst Pressure	2.0					x FS	
STATIC PERFORMANCE							
Static Accuracy[3]	±0.05	±0.10	±0.25	±0.50	±1.00	%FSO	BFSL method
Resolution	Infinitesimal						
ENVIRONMENTAL							
Wetted Materials	316 SS or Titanium; Delrin®; polyurethane or Viton®						Delrin® and Viton® are registered trademarks of DuPont.
Compensated Temp Range	0 to 50					ºC	
Thermal Error[4]	±0.05[5]					%FSO/ ºC	worst case over compensated temperature range
Operating Temp Range	-20 to 60 0 to 50					ºC ºC	when using polyurethane cable when using ETFE cable[11]
Protection Rating	IP 68, NEMA 6P						
ELECTRICAL							
Excitation	9 – 30 [12] 2.5 - 10					VDC	for mA, VDC
Input Current	20 3.5					mA max	for mA output for VDC output
Output[10]	4 - 20 0 - 5					mA VDC	options available[6]
Zero Offset	±0.20[8] < 0.25					mA VDC	for mA output for VDC output
Output Impedance	See Loop Resistance diagram on page 7 20					ohm	for mA output for VDC output
Insulation Resistance	100					mega ohm	at 50 VDC
Circuit Protection	Polarity, surge/shorted output						

Specifications subject to change without notice.

Parameter	735[1]	730[1]	720	710	700	Units	Comments
PHYSICAL							
Approximate Weight	0.44 (198) 0.05 (79)					lbs (g) lbs/ft (g/m)	transducer cable
Cable Jacket Material Pull Strength Number of Conductors Conductor Size	 Polyurethane (std) ETFE[9] (opt) 200 (90) 4 22					 lbs (kg) AWG	 Tefzel®, Teflon® and Kevlar® are registered trademarks of DuPont.
Cable Seal	Molded Polyurethane Viton® Gland						for polyurethane cable for ETFE cable
TEMPERATURE OUTPUT OPTION (NOT INTRINSIC SAFETY APPROVED)							
Temperature Range	-20 to 60					ºC	available for 4-20mA output versions only
Output Signal[10]	4-20					mA	
Temperature Measurement Accuracy	±4					ºC	
LIGHTNING PROTECTION (OPTIONAL)[13]							
Life Expectancy	> 1000 operations						
Peak Clamping Voltage	36 volts						
Response Time	< 10 nsecs						

Notes:

1 For ranges > 230 ft (70 m) H_2O, output is 4-20 mA only.
2 Intermediate level ranges are available.
3 Static accuracy includes the combined errors due to nonlinearity, hysteresis and nonrepeatability on a Best Fit Straight Line (BFSL) basis, at 25ºC per ISA S51.1.
4 Thermal error is the maximum allowable deviation from the Best Fit Straight Line due to a change in temperature, per ISA S51.1.
5 For ranges < 12 ft (4 m) H_2O, maximum thermal error is ±0.1% FSO/ºC.
6 Custom VDC output levels can be provided up to 2.5 VDC less than the excitation supply voltage. Contact Customer Service for VDC output availability.
8 For ranges <= 5 ft (1 m) H_2O, zero offset is ±0.25 mA.
9 ETFE is a fluoropolymer (Teflon® derivative) material, Tefzel® or equivalent
10 For ranges < 5 ft (1.5 m) H_2O, only 4-20 mA output is available.
11 -20ºC to 50ºC for level ranges <= 100 ft (70m) H_2O when using ETFE cable.
12 Intrinsic safety limits excitation to 28V.
13 The power supply needs to be limited to 150 mA to avoid lock up of the gas tube after a suppression event.

FT400-Series

FLOW COMPUTER INSTRUCTIONS

- **FT415**
- **FT420**

FT400-SERIES FLOW COMPUTER INSTRUCTIONS

ISO 9001:2000 CERTIFIED

SeaMetrics

The Leader in Flow Meter Value

GENERAL INFORMATION

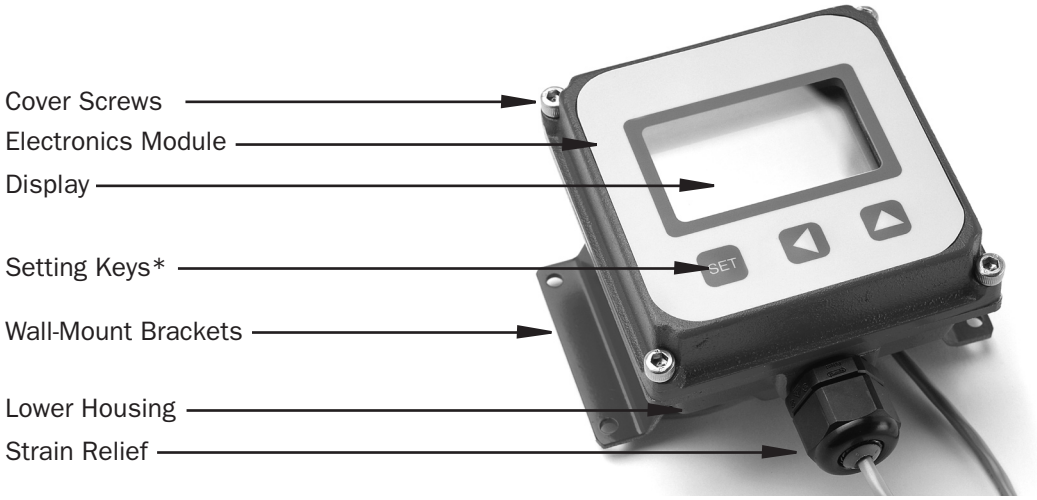
The FT400-Series flow computers are microcontroller-based indicator/transmitters that display flow rate and total and provide output signals. The FT415 is battery-powered and provides a scalable pulse output. The FT420 is powered by external DC voltage and has both pulse and 4-20 mA analog outputs. The FT420 is a “two-wire” or “loop-powered” device, meaning that the 4-20 mA output signal doubles as its power supply.

The addition of a dual-relay output board FT420 only allows for certain applications requiring contact output isolation (e.g., certain metering pumps and water treatment controls). Dual solid state relays provide exactly the same pulse output as the standard unit, and each can signal one external device. A non-resettable total is also available. The FT420 can be ordered in a plastic enclosure with a 115 Vac power supply for use with mechanical meters, or with a built-in 115 Vac/12-24 Vdc dual power supply for magmeters.

Both the FT415 and the FT420 can be factory-mounted on the meter (-M) or remotely wall mounted with the brackets provided (-W). The FT420 is also available as a panel mount (-P) with an open back for easy installation in the user’s own electrical enclosure. Most FT400’s can be converted from wall-to-meter or meter-to-wall mount configurations after installation if needed.

Housings for the -W and -M models are rugged cast aluminum, potted and gasketed for maximum environmental protection. A membrane keypad allows settings to be changed without removing the cover. (Password protection, a standard feature, can be used to prevent settings from being changed.)

FEATURES



*Includes password protection for tamper prevention when needed

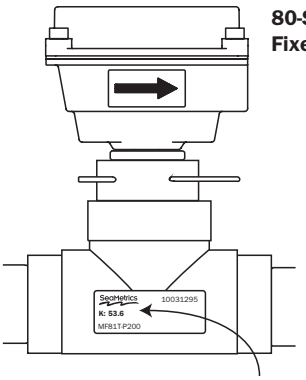
SPECIFICATIONS*		FT415	FT420
Power		Lithium "C", 3.6 Vdc, replaceable, 3-5 year life	12-30 Vdc, 4mA (4-20 mA when loop-powered)
Display	**Rate**	6-digit autorange, 1/2" character height	6-digit autorange, 1/2" character height
	Total	8-digit, 5/16" character height	8-digit, 5/16" character height
Outputs	**Current Sinking**	Scaled Pulse output (0.1 sec duration 6.1 Hz max) or High Alarm output or Low Alarm output	
		Sensor pass-through Pulse output (unscaled)	
	Analog	None	4-20 mA loop; 24-30 Vdc
Pulse Output Range		0.1 - 9999999.9 units/pulse	0.1 - 9999999.9 units/pulse
Input		Micropower GMR Sensor (square wave)	5V pulse or contact closure
Input Range		1.0 - 150 pulses/second	1.0 - 1,500 pulses/second
K-Factor Range		.001 - 99999.999	.001 - 99999.999
Flow Alarm Output Range		.01 - 999999.99	.01 - 999999.99
Operating Temperature		-30˚ to 65˚ C (-22˚ to 148˚ F)	-30˚ to 65˚ C (-22˚ to 148˚ F)
Environmental		NEMA 4X, IP66	NEMA 4X, IP66
EMC		CE EN 61000	CE EN 61000

**Specifications subject to change • Please consult our website for current data (www.seametrics.com).*

K-FACTOR

At a minimum, every FT400-Series flow computer must be programmed with the "K-factor". (This is the number of pulses that the meter produces per gallon of flow.) If you wish the FT400 to read in units other than gallons, see below.

The K-factor on any SeaMetrics flow sensor fitting or in-line meter can be found on the model-serial label. The line reading K = xxxx gives the desired number. For depth-adjustable sensors (101,201,115,215 models), look in the instruction manual under your pipe size. For EX meters, use the calculator on our website.



80-Series Fixed Depth Meter

Find Your K-Factor Here

READING IN OTHER UNITS

Changing Volume Units. The default K-factor units are pulses per gallon. To read your total in metric or other units instead, the standard K-factor must be converted to the desired volume units. For example, to read in pulses per liter, the K-factor must be multiplied by the applicable number shown below.

NOTE: Both rate & total will read in whatever units you choose.

To Convert K to:	Multiply by:
Liters	.26418
Cubic Meters	264.18
Fluid Ounces	.0078
Cubic Feet	7.48

Changing Time Units: To read your rate in liters per second (for example), convert the K-factor volume units as shown above and change the time units to Seconds, using the Set Time Unit instructions at right.

Set K. Begin by pressing the SET key once. The prompt SET K should appear on the display. The digit to the far right will be blinking. Use the up arrow key to reach your desired value. Then press the left arrow key to move to the next digit. Repeat the process until the entire number is entered. (Note that the decimal is fixed at three places. If you only have two decimal places for your K-factor, enter a zero for the third digit.) Press SET to advance. (**Note:** If unable to set K-factor, the unit is "locked" to prevent tampering. Please contact your Distributor for assistance.)

Set P/Flow Alarm. FT420 only. At this screen you may select between pulse output (P) or flow alarm (A) functions. If the pulse output and flow alarm features are not being used, this step can be skipped. The P (pulse output) setting does not affect anything if it is not being used.

Set P is the default that appears on a new FT400-Series. On an FT400 that has been previously set up with flow alarm function, an A will appear on this screen. To move between P and A screens, firmly press all three keys for 5-10 seconds, then use the up arrow to scroll through the three options: P, AL HI (high flow alarm) and AL LO (low flow alarm).

Set P. From this screen, follow the same process as for Set K to enter the desired pulse rate. This is the number of gallons (or whatever units are programmed) between pulses. (**Note:** Using the pulse output function disables the high and low flow alarm functions.) (6.1 Hz max output)

Set Flow Alarm. From the A screen, use the up arrow key to choose either AL HI or AL LO and then press the SET key to set the alarm rate. Use the up arrow and left arrow as above to reach the desired digits. (**Note:** Using the flow alarm function disables the pulse output function.)

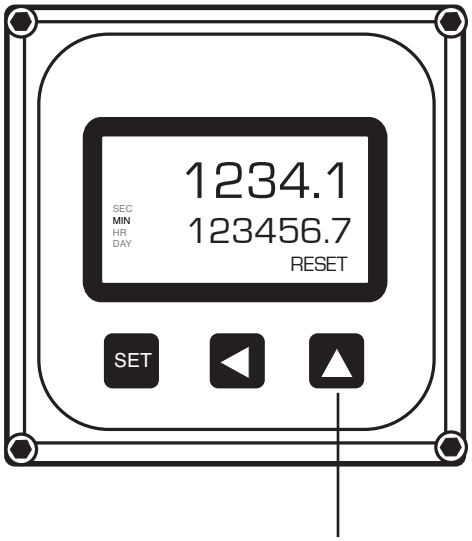
Set 20 mA (FT420 Only). Press the SET key to advance to SET 20, to set the flow rate, in volume units per time unit, at which 20 mA is desired. Use the up arrow key to reach your desired value. Then press the left arrow key to move to the next digit. Repeat the process until the entire number is entered. The processor will automatically scale the 4-20 mA loop accordingly, with 4 mA at zero flow.

Set Decimal Point. Press the SET key again for the D prompt. Pressing the up arrow key switches among no decimal place, one decimal place and two decimal places.

Set Time Unit. When the SET key is pressed again, a blinking time unit appears. Press the up arrow key to select SEC (seconds), MIN (minutes), HR (hours) or DAY (days) (for example, gal/min, or gal/hr).

To return to normal operation after entering settings, press SET again. When the unit is connected to an operating flow sensor, the rate (larger digits) and total (smaller digits) indicator numbers should appear in the display.

Resettable/Non-Resettable Totalizer. Unless the unit has been ordered with the non-reset option, a RESET prompt is visible in the lower right corner above the up arrow key, when the display is in use. Press the up arrow key at any time to reset the totalizer to zero. (**Note:** If you need to reset a unit that has been ordered with a non-resettable totalizer, contact your distributor.)



This key resets total to zero when in normal run mode.

CAUTION: Do not touch up Arrow button unless you intend to RESET Total to Zero. TOTAL IS NOT RECOVERABLE.

Operation of 4-20 mA Output (FT420 Only). If the 4-20 mA output is in use and is correctly connected, the signal should vary between 4 mA and 20 mA in proportion to the flow, with the top flow rate set by the user (see Settings, page 8). At no time should the signal drop below 4 mA. A reading between 0 and 4 mA indicates a fault of some type, typically in the loop power supply or the connections (see Troubleshooting, back page). In the rare instance that the 4-20 signal fluctuates excessively ("paints") it may need to be damped by additional averaging. Contact Seametrics for information on how to increase filtering.

Operation of the Pulse Output. If the pulse output is being used (either standard electronic or relay-type), it should pulse for 0.1 second every time the set number of gallons has been totalized. If a pulse-responsive metering pump is properly connected to this output, it should stroke periodically. If this does not occur, see Troubleshooting, back page.

FT415 Battery Change. The expected average life of the battery ranges between 3-5 years depending on the frequency of the input. The battery is easily pulled and replaced. When the battery is removed, all of the settings will be retained.

CAUTION: During a battery change, the totalizer will reset to a previous total, which represents the last auto-backup (auto backups occur at approximately 4 minute intervals). If it is necessary to save the exact current total at the time of the battery change, save before removing the battery as follows:

1) Simultaneously press the SET and up arrow keys
2) Press SET again
3) Again simultaneously press the SET and up arrow keys

Problem	Probable Cause	Try...
Display blank	No power to the unit	Check for minimum 12 Vdc at power terminals
	Short in sensor circuit	Disconnect sensor, see if display returns (zero flow rate)
	Battery dead or loose (FT415 only)	Wiggle battery, replace if over three years old
Display missing segments	Damaged display module	Contact distributor for return/replacement
Display reading meaningless characters	Unit's microcontroller crashed	Disconnect and reconnect power, if problem repeats, contact distributor for return/replacement
	Battery nearly dead	Replace battery if over three years old
Display reads normally, flow rate incorrect	Wrong K-factor or time base entered	Enter correct K-factor from meter, fitting, or manual
Display reads normally, incorrect pulse output	Wrong pulse output setting	Use "Set P" to correct pulse output setting
	Polarity reversed on pulse output terminals	Reverse leads
Display reads normally, but no (or incorrect) 4-20 mA output (FT420 only)	Wrong 20 mA setting	Use "Set 20" to correct target top flow rate
	Inadequate loop power supply voltage	Check voltage (For 4-20 mA applications, 24 Vdc recommended)
	Polarity incorrect in 4-20 mA loop circuit	Compare to Connections diagram
Display reads zero when there is flow	Flow sensor failed	Consult flow sensor manual for how to test
	Break in flow sensor circuit	Check for continuity with multimeter
	Flow sensor not battery-compatible	Check flow sensor model number for "micropower option"
Display reads flow rate when there is none	Long flow sensor wire, running parallel to power wires	Reroute wire or change to shielded wire
	Flow sensor malfunction	See flow sensor manual to check
	Flow "jitter" (oscillating slosh) reads as flow	Consult factory for "anti-jitter" setting

SeaMetrics

SeaMetrics Incorporated • 19026 72nd Avenue South • Kent, Washington 98032 • USA
(P) 253.872.0284 • (F) 253.872.0285 • 1.800.975.8153 • www.seametrics.com

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EX80-SERIES
Insertion Electromagnetic Flow Sensor

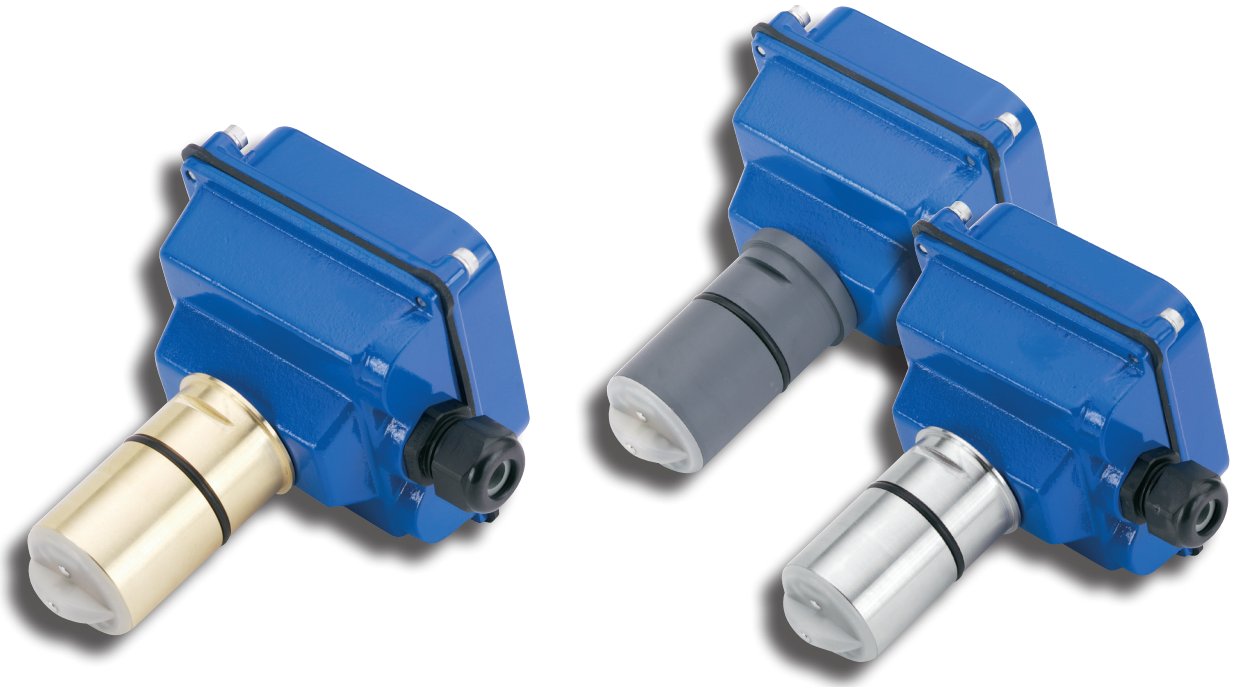
ISO 9001:2008 CERTIFIED COMPANY

APPLICATIONS

- Conductive fluids
- Small pipe applications (1”-12”)
- Industrial processes
- Chemical metering pumps
- Fertigation

FEATURES

- No moving parts
- Economical
- Durable
- Easy to install
- Easy to maintain



GENERAL INFORMATION

EX80-Series insertion electromagnetic flowmeters are designed for use with conductive liquids in 1 to 12” pipe. A choice of materials (stainless steel, brass, and PVC) allows the meter to adapt to a range of temperature, pressure, and corrosive environments.

The EX80 is highly suitable for difficult applications with changing viscosities and pulsating flows, such as air-driven diaphragm pumps. With no moving parts, these meters can be used in “dirty” applications where debris would foul a mechanical meter. Like all magmeters, when used in chemical injection applications, these meters should be installed upstream of the chemical line (or far enough downstream to allow complete mixing of fluids before the meter).

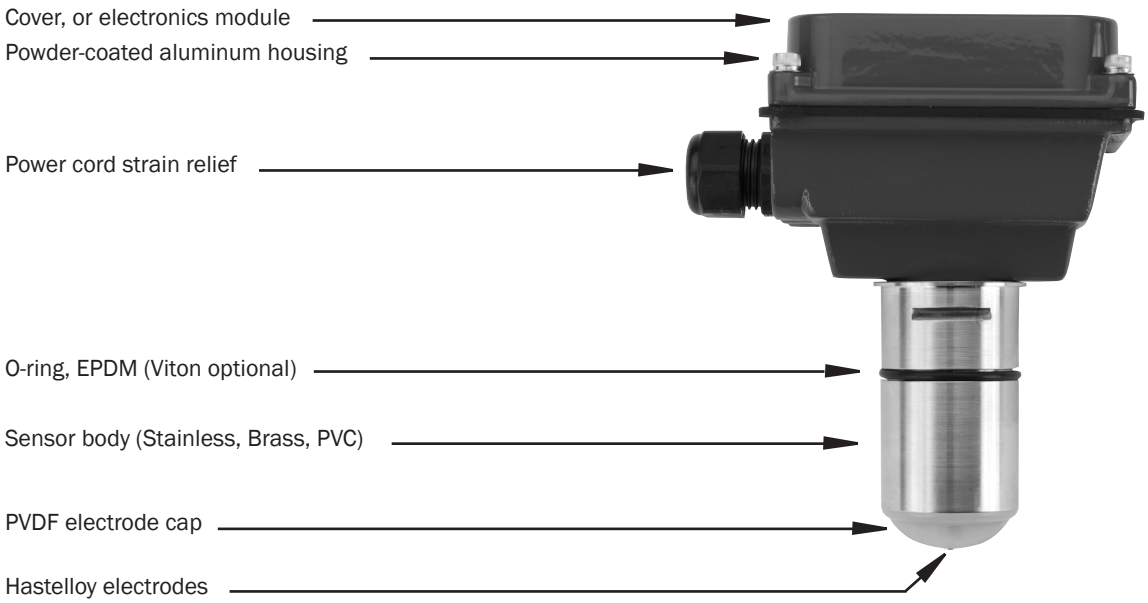
Designed for modularity and versatility, the EX80-Series has a current-sinking pulse output that can be combined with the appropriate transmitter or indicator for the application. For analog output and display of rate and total, an FT420 can be used. Blind analog output is provided by the A055. The PD10 can be used to divide the pulse for pacing chemical metering pumps and the DL76 (data logger) is also compatible. Modules can be wall- or meter- mounted. If the EX80 meter is used with a programmable controller, the output signal can be fed direct, with no other conditioning required.

EX80-Series fixed depth insertion meters require special fittings. Factory installation in the fitting ensures correct depth placement in the pipe. The EX80-Series meter can be ordered in a full power model when a source of electricity is available, or in a low power model that can run on an external battery with solar panel.

Reverse flow output and immersibility are optional.

EX80-SERIES
Insertion Electromagnetic Flow Sensor

FEATURES

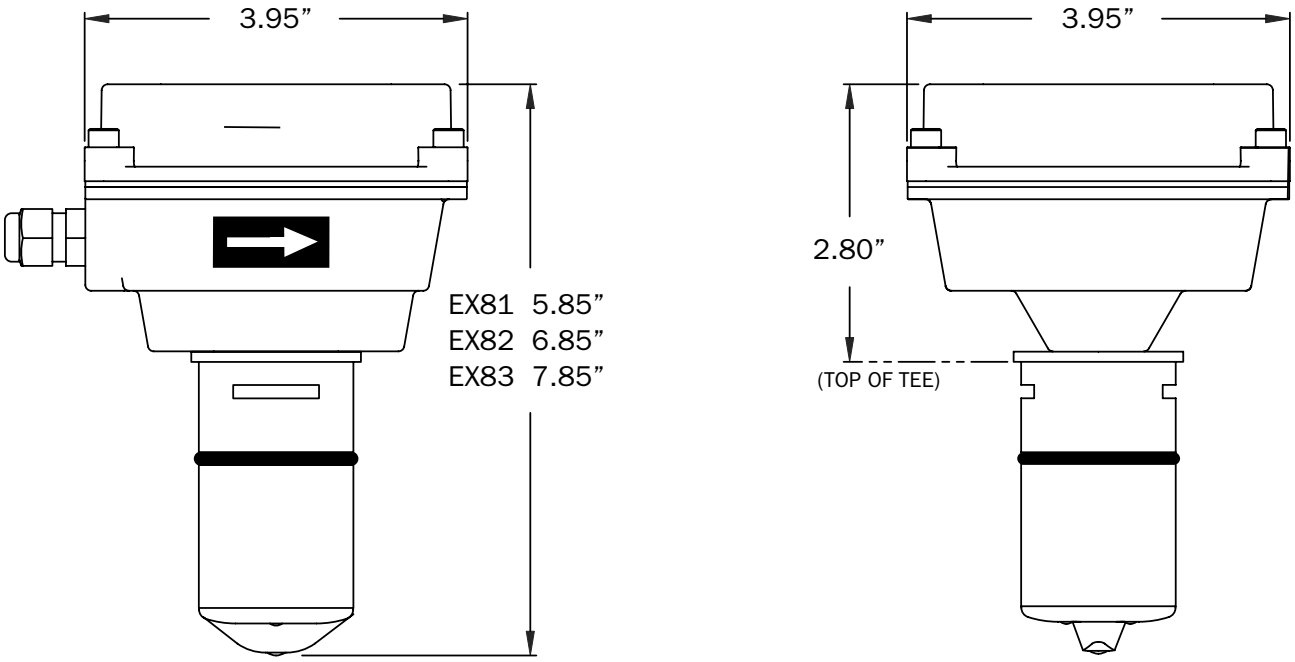


SPECIFICATIONS*

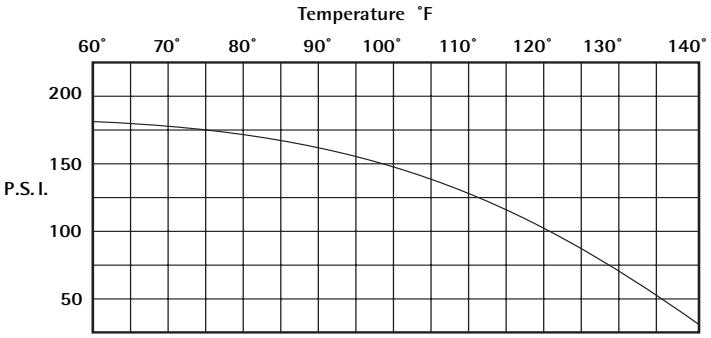
Pipe Size		1” to 12”
Materials	**Mechanical**	316 SS/Brass/PVC
	Electrodes	Hastelloy
	Housing	Cast powder-coated aluminum
	Electrode Cap	PVDF (Kynar)
	O-Ring	EPDM standard (Viton optional)
Power	**Full Power**	12 - 25 Vdc, 250 mA
	Low Power	12 - 25 Vdc, 40 mA average with 250 mA peaks
Flow Rate		0.28 - 20 ft/sec (0.08 - 6.09 m/sec)
Temperature	**Ambient Temp**	0˚ to 160˚ F (-17˚ to 72˚ C)
	Fluid Temp : Brass/SS	32˚ to 200˚ F (0˚ to 93˚ C)
	Fluid Temp: PVC	32˚ to 130˚ F (0˚ to 55˚ C) @ 0 psi
Pressure	**Brass/SS**	200 psi (13.8 bar)
	PVC	150 psi (10 bar) @ 75˚ F
Minimum Conductivity		20 microSiemens/cm
Calibration Accuracy		+/- 1% of full scale
Output		Square wave pulse, opto isolated, 550 Hz @ 20 ft/sec
Empty Pipe Detection		Software, defaults to zero flow
Regulatory		CE Mark (Stainless Steel, Brass and Standard Power Only)

**Specifications subject to change • Please consult our website for current data (www.seametrics.com).*

DIMENSIONS



PRESSURE VS. TEMPERATURE (PVC)



FLOW RANGE (in GPM)

Nominal Pipe Size	1”	1-1/2”	2”	3”	4”	6”	8”	10”	12”
Min	.69	1.5	2.7	6.2	11	25	43	68	99
Max	49	110	196	440	783	1760	3130	4900	7050

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EX80-SERIES
Insertion Electromagnetic Flow Sensor

EX80-COMPATIBLE FITTINGS

Variety of Fittings

	Tee	Saddle	Weld/Braze	Sweat Tee
Bronze	1-4"	3-4"	3-12"	1-4"
PVC	1-2"	3-8"	x	x
Stainless Steel	1-2"	x	3-12"	x
Carbon Steel	1-2"	x	3-12"	x
Ductile Iron	x	3-12"	x	x

HOW TO ORDER

MODEL

1” - 3” pipe = **EX81**
4” - 10” pipe = **EX82**
12” pipe = **EX83**

MATERIAL

PVC = **P**
Brass = **B**
316 Stainless = **S**

OPTIONS

Reverse flow output = **-15**
*Immersible = **-40**
Low power = **-50**
Viton O-ring = **-125**

*Consult factory for suitable applications

FITTINGS

Select from chart above (Fitting Type and Material)

ACCESSORIES

Rate and Total Indicator = **FT420**
Blind 4-20 mA Converter = **AO55**
Data Logger = **DL76**
Pulse Divider = **PD10**
Extra Cable (specify length) = **31010**
Power Converter, Plug-In, 115 Vac, 24 Vdc = **PC3**
Dual Power Supply, 115 Vac, 12/24 Vdc = **PC42**
Solar Panel Kit, 5 Watt = **RSP5**

CONTACT YOUR SUPPLIER

GunnCo Pump & Control, Inc

Model P3K 100

1 HP, 1/115V

GENERAL DATA

MAX. FLOW: GPM (L/min)	89 GPM (337 L/min)
MAX. HEAD: ft (m)	49.5' (15.1 m)
MAX. SUBMERSION DEPTH: ft (m)	65' (20m) or limited to length of power cord, Consult factory for deeper depths
PUMP TYPE	TOP DISCHARGE, DEWATERING
SOLID SIZE: in (mm)	1/4" (6.3 mm)
STRAINER OPENING	0.25" (6.35 mm)
PUMP DOWN WATER LEVEL: in (mm)	2.25" (57 mm)
IMPELLER DIAMETER: in (mm)	4.33" (110 mm)
DISCHARGE SIZE	2" NPT-MALE
PUMP WEIGHT, without cable: lbs (kg)	54 lbs (24.5 kg)
SHIPPING WEIGHT: lbs (kg)	68 lbs (31 kg)

CONSTRUCTION/MATERIAL DATA

MECHANICAL SEAL - UPPER	CARBON/CERAMIC
MECHANICAL SEAL - LOWER	SILICON CARBIDE/SILICON CARBIDE
OUTER CASING	304 SS
MOTOR CASING	304 SS
PUMP VOLUTE	CAST IRON
IMPELLER- MULTI VANE	CAST IRON
STRAINER	304 SS
BOTTOM PLATE	CAST IRON
LIPSEAL & O-RINGS	BUNA-N
ROTOR SHAFT	304 SS
EXTERNAL HARDWARE	304 SS
QTY. OIL IN SEAL CHAMBER	3.7 U.S. FL. OZ. (110 C.C.)
BALL BEARING: PERM. LUBE. UPPER	6203
BALL BEARING: PERM. LUBE. LOWER	6304

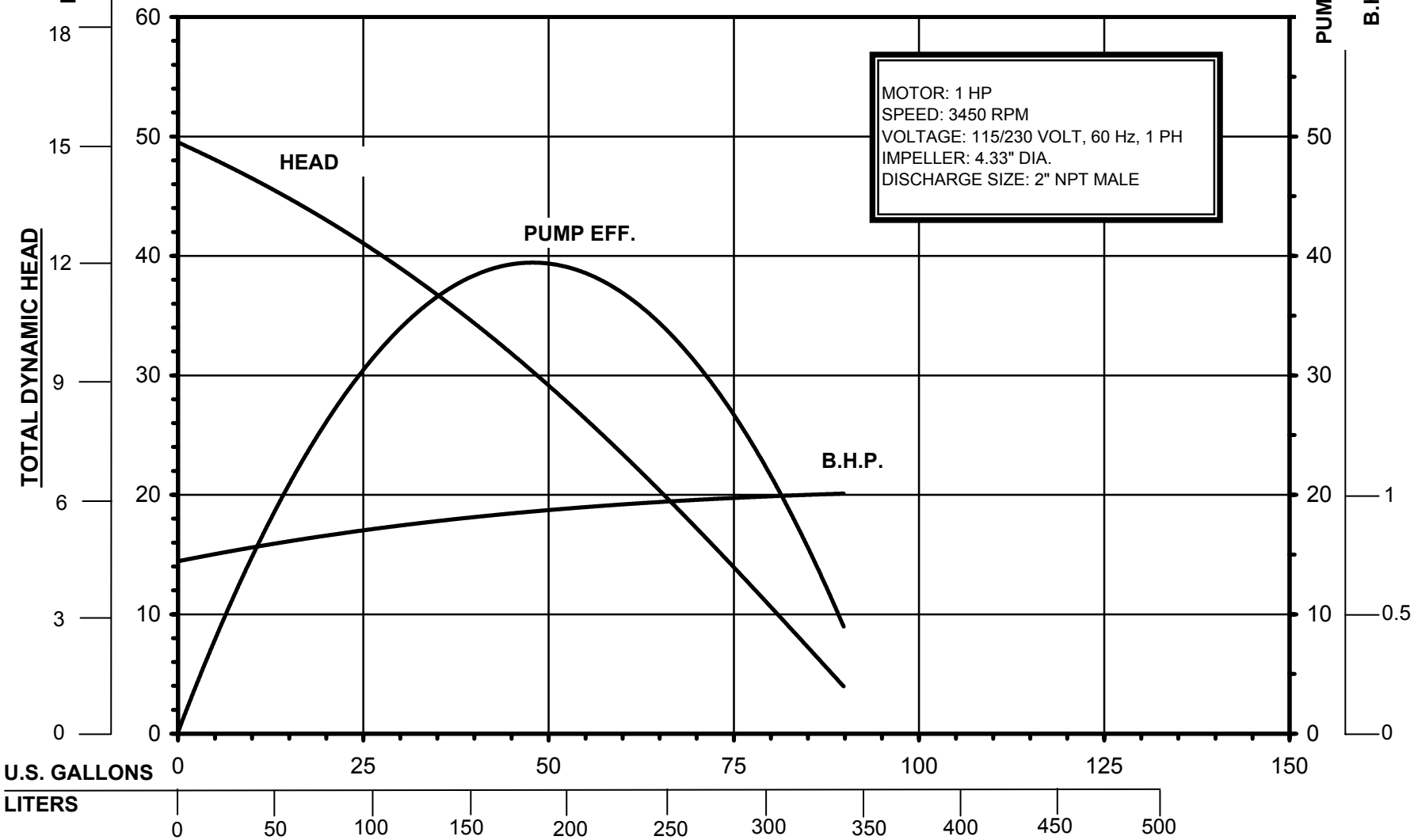
ELECTRICAL /MOTOR DATA

MOTOR: TYPE, RATING HP	SUBMERSIBLE, 1 (CONTINUOUS DUTY)	
MOTOR RPM	3450	
MOTOR INSULATION CLASS	F	
MOTOR SERVICE FACTOR	1.1	
VOLTAGE[1] - 1 PH, 60 Hz	115V	230V
CURRENT F.L.A.	14	7
LOCKED ROTOR CURRENT (LRA)	65	32.5
MOTOR PROTECTION	THERMAL & AMP. OVERLOAD	
POWER CORD: GAGE; LENGTH	A.W.G. 14/3; 50' (15.2 m), STOW	
MAXIMUM LIQUID TEMPERATURE	104°F (40°C)	

1- Available in other voltages (and in 50 Hz).

GunnCo Pump & Control, Inc.

GunnCo Pump and Control, Inc
Model P3K 100



2/17/2006 supersedes priors

FLOW RATE PER MINUTE

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

GunnCo Pump & Control, Inc.

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High Density Polyethylene

TYPICAL PROPERTIES

HDPE CHARACTERISTICS
TYPICAL PROPERTIES
CHEMICAL RESISTANCE CHART
SIZE AND DIMENSION CHARTS BY APPLICATION
CALCULATION PROGRAMS

HIGH DENSITY POLYETHYLENE PIPE
Typical Physical Properties***

Property	Specification	Unit	Nominal Value
Material Designation	PPI / ASTM		PE 3408
Material Classification	ASTM D-1248		III C 5 P34
Cell Classification	ASTM D3350-99		345464C
-Density (3)	ASTM D-1505	gm/cm3	0.955
-Melt Index (4)	ASTM D-1238 (216 kg/190iC)	gm/10 min.	0.11*
-Flex Modulus (5)	ASTM D-790	psi	135,000
-Tensile Strength (4)	ASTM D-638	psi	3,200
PENT (6)	ASTM F-1473	Hours	>100
-HDB @73i F (4)	ASTM D-2837	psi	1,600
-HDB @ 140 Deg F	ASTM D-2837	psi	800
-U-V Stabilizer (C)	ASTM D-1603	% C	2.5
Hardness	ASTM D-2240	Shore "D"	65
Compressive Strength (yield)	ASTM D-695	psi	1,600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D-638 (2"/min.)	psi	3,200
Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type IV Spec.)	ASTM D-638	psi	5,000
Elongation @ Break	ASTM D-638	%, minimum	750
Modulus of Elasticity	ASTM D-638	psi	130,000
PENT (6)	ASTM F-1473	Hours	>100
(Cond. A, B, C: Mold. Slab)	ASTM D-1693	Fo, Hours	>5,000

(Compressed Ring - pipe)	ASTM F-1248	Fo, Hours	>3,500
Slow Crack Growth	Battelle Method	Days to Failure	>64
Impact Strength (IZOD) (.125Ó Thick)	ASTM D-256 (Method A)	In-lb / in notch	42
Linear Thermal Expansion Coef.	ASTM D-696	in / in/iF	1.2x10-4
Thermal Conductivity	ASTM D-177	BTU-in/ft2/ hrs/ degreesF	2.7
Brittleness Temp.	ASTM D-746	degrees F	< -180
Vicat Soft. Temp.	ASTM D-1525	degrees F	257
Heat Fusion Cond.	ASTM D-1525	@ psi degrees F	75 @ 400

*** This list of typical physical properties is intended for basic characterization of the material and does not represent specific determinations of specifications. The physical properties values reported herein were determined on compression molded specimens prepared in accordance with Procedure C of ASTM D 1928 and may differ from specimens taken from pipe.
** Tests were discontinued because no failures and no indication of stress crackinitiation.
* Average Melt Index value with a standard deviation of 0.01

This document reports accurate and reliable information to the best of our knowledge but our suggestions and recommendations cannot be guaranteed because the conditions of the use are beyond our control. The user of such information assumes all risk connected with the use thereof. Chevron Phillips Chemical Co. and its subsidiaries assume no responsibility for the use of information presented herein and hereby expressly disclaims all liability in regards to such use.

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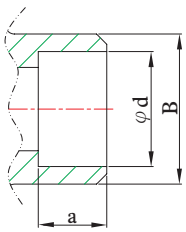
TC-CK
TC-CKS

200 WOG SWING CHECK VALVE, THREADED/S.W.

DESIGN FEATURES:

- Swing Type
- Body: ASTM A351 Gr.CF8M
- Disc: ASTM A351 Gr.CF8M
- Packing: PTFE.
- Working Pressure: 200 psi
- End Connections: Threaded End
- TEST STANDARD:API 598

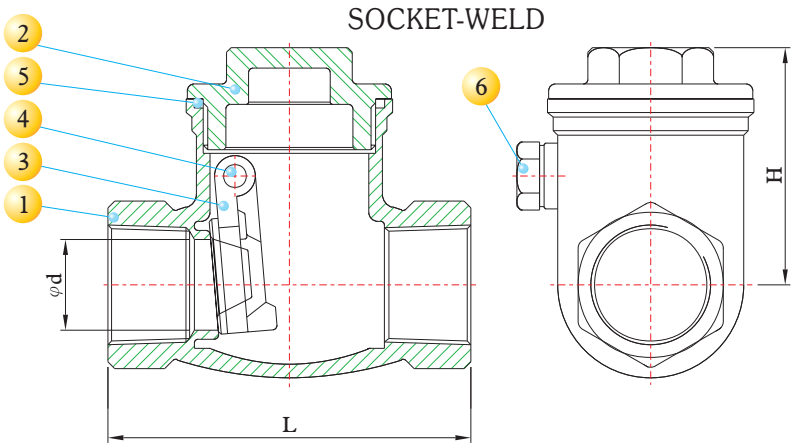
Threaded Type:
ANSI B1.20.1 (NPT)
DIN 259/DIN 2999
ISO 228
BSP
PT



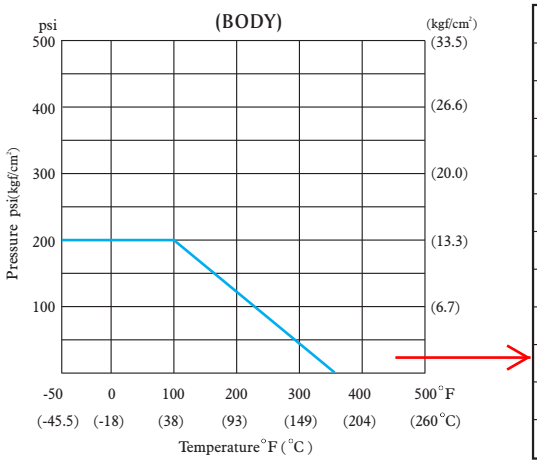
MATERIALS LIST

NO.	PART NAME	MATERIAL	Q'TY
1	BODY	ASTM A351 Gr.CF8M	1
2	CAP	ASTM A351 Gr.CF8M	1
3	DISC	ASTM A351 Gr.CF8M	1
4	HINGE PIN	SS316	1
5	GASKET	PTFE	1
6	PLUG	SS316	1

SOCKET-WELD



PRESSURE TEMPERATURE RATINGS



DIMENSIONS

SIZE		d		L		H		a		d		B		Cv	Weight	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	Factor	Kg	Lb
1/4"	8	0.39	10	2.56	65.0	1.77	45	0.39	10	0.55	14.1	0.9	22.8	3.0	0.33	0.73
3/8"	10	0.47	12	2.56	65.0	1.77	45	0.39	10	0.69	17. 6	0.9	22.8	4.0	0.35	0.77
1/2"	15	0.59	15	2.60	66.0	1.81	46	0.39	10	0.85	21.7	1.06	26.8	6.5	0.30	0.66
3/4"	20	0.79	20	3.19	81.0	2.13	54	0.51	13	1.07	27.1	1.36	34.6	15.0	0.48	1.06
1"	25	0.98	25	3.58	91.0	2.36	60	0.51	13	1.33	33.8	1.56	39.5	28.0	0.75	1.65
1 1/4"	32	1.26	32	4.19	106.5	2.83	72	0.51	13	1.68	42.6	1.93	49.0	45.0	1.15	2.53
1 1/2"	40	1.57	40	4.76	121.0	2.95	75	0.51	13	1.92	48.7	2.20	55.8	65.0	1.54	3.39
2"	50	1.97	50	5.59	142.0	3.23	82	0.63	16	2.41	61.1	2.68	68.0	120.0	2.54	5.59
2 1/2"	65	2.56	65	6.26	159.0	3.54	90	0.63	16	2.91	73.8	3.46	88.0	190.0	3.80	8.37
3"	80	3.15	80	7.48	190.0	4.09	104	0.63	16	3.54	89.8	4.13	105. 0	280.0	5.90	13.00

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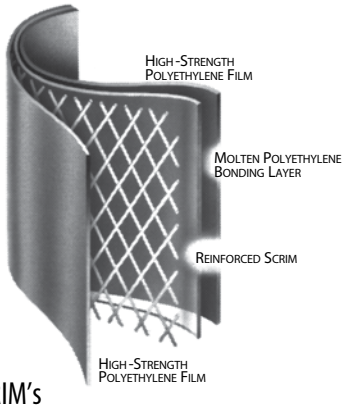
DURA•SKRIM® 8BV & 12BV

Meets GRI-GM22 Standard Specification

RAVEN ENGINEERED FILMS

Product Description



DURA•SKRIM® 8BV and 12BV consist of two sheets of high-strength virgin polyethylene film laminated together with a third layer of molten polyethylene. The black outer layers contain carbon black to enhance outdoor life. A heavy scrim reinforcement placed between these plies greatly enhances tear resistance and increases service life. DURA•SKRIM's heavy-duty diamond reinforcement responds to tears immediately by surrounding and stopping the tear.

Product Use

DURA•SKRIM 8BV and 12BV are used in more demanding applications requiring high tear resistance. They are designed to withstand longer term outdoor applications requiring up to 5 years of exposure or more depending upon geographical location.

DURA•SKRIM 8BV and 12BV are designed to meet the requirements of the Geosynthetics Research Institute; GRI-GM22 Standard Specification.

Size & Packaging

DURA•SKRIM 8BV and 12BV are available in a variety of widths and panels up to 100,000 square feet. All panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time-saving installation.

Temporary Rain Shed Cover

Product	Part #
DURA•SKRIM	R8BV
DURA•SKRIM	R12BV

APPLICATIONS

- Daily Landfill Covers
- Interim Landfill Covers
- Temporary Rainshed Covers
- Remediation Covers or Liners
- Cargo Coverings
- Outdoor Covers

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DURA•SKRIM® 8BV & 12BV

ISO 9001:2008 CERTIFIED MANAGEMENT SYSTEM

Meets GRI-GM22 Standard Specification

		DURA•SKRIM 8BV		DURA•SKRIM 12BV	
PROPERTIES	**TEST METHOD**	Imperial	Metric	Imperial	Metric
Appearance		Black/Black		Black/Black	
Thickness, Nominal		8 mil	0.20 mm	12 mil	0.30 mm
Weight		38 lbs/MSF 5.5 oz./yd^2	185 g/m^2	58 lbs/MSF 8.4 oz./yd^2	283 g/m^2
Construction		Extrusion laminated with scrim reinforcement			
1" Tensile Strength	ASTM D7003	70 lbf/in	122 N/cm	75 lbf/in	131 N/cm
Elongation at Film Break	ASTM D7003	550 %	550 %	600 %	600 %
Elongation at Scrim Break	ASTM D7003	16 %	16 %	18 %	18 %
Grab Tensile	ASTM D7004	80 lbf	356 N	100 lbf	445 N
***Tongue Tear**	ASTM D5884	30 lbf	133 N	40 lbf	178 N
CBR Puncture Resistance	ASTM D6241	200 lbf	890 N	270 lbf	1201 N
Mullen Burst	ASTM D751	75 psi	517 kPa	100 psi	689 kPa
UV Resistance (10,000 HR)	ASTM D882 / GRI-GM16	>90% retained / no cracking		>90% retained / no cracking	
High Pressure OIT		>1000 min.		>1000 min.	
Maximum Use Temperature		180°F	82°C	180°F	82°C
Minimum Use Temperature		-70°F	-57°C	-70°F	-57°C
WVTR	ASTM E96 Procedure B	0.271 grains/(100in^2·day)	0.274 g/(m^2·day)	0.159 grains/(100in^2·day)	0.161 g/(m^2·day)
Perm	ASTM E96 Procedure B	0.039 Perms grains/(ft^2·hr·in Hg)	0.026 Perms g/(24hr·m^2·mm Hg)	0.023 Perms grains/(ft^2·hr·in Hg)	0.015 Perms g/(24hr·m^2·mm Hg)

*Tests are an average of MD and TD directions.

DURA♦SKRIM® 8BV and 12BV are both four-layer reinforced extrusion laminates. The outer layers consist of a high-strength polyethylene film containing carbon black and UV and thermal stabilizers.

DURA♦SKRIM® 8BV and 12BV are reinforced with a minimum of a 1000 denier scrim laid in a diagonal pattern spaced 3/8" apart with an additional machine direction scrim every 3" across the width.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.RavenEFD.com

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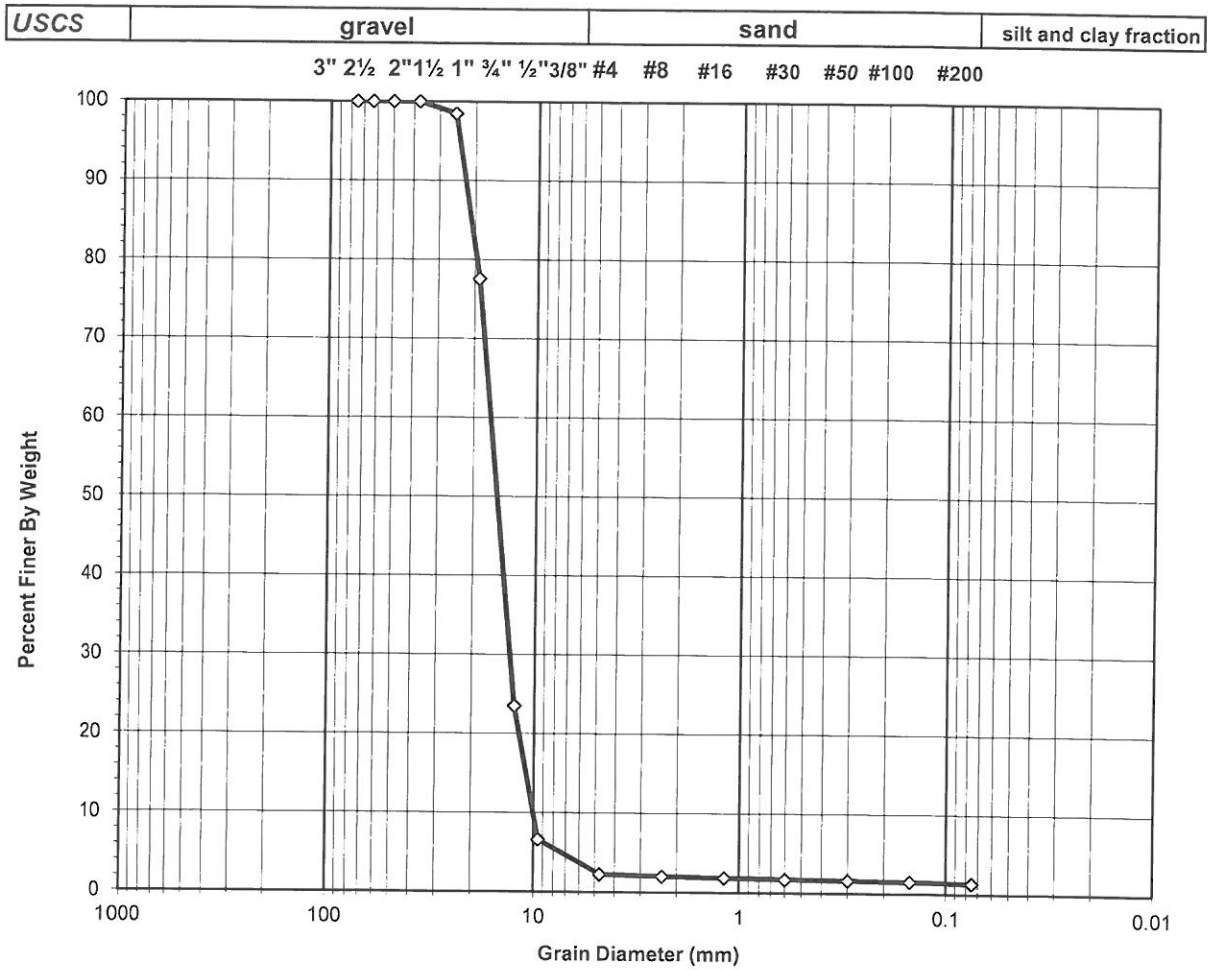
WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-04 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	JTR STONE
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2013-763-06	Sample No.	JTR 1"
Lab ID	2013-763-06-01		

Color **GRAY**



USCS Symbol:	*gp, ASSUMED*	D60 =	16.58		
Fineness Modulus:	*7.05*	D30 =	13.14	CC =	1.04
		D10 =	10.04	CU =	1.65

USCS Classification: ***POORLY GRADED GRAVEL***

Tested By SS Date 1/8/14 Checked By GM Date 1-8-14

DCN: CT-S42A DATE: 03/28/07 REVISION: 13 *SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-06-01 C136pan wHeader.xls]Sheet1*

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WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-04 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	JTR STONE
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2013-763-06	Sample No.	JTR 1"
Lab ID	2013-763-06-01		
		Color	GRAY

Tare No.	A-21	Wt. of Dry Specimen (gm)	13590.10
Wt. Tare + DS.(Pre-Wash)	14074.50	Wt. of +#200 Specimen(gm)	13403.39
Wt.Tare + Dry,Washed specimen	13929.80	Wt. of -#200 Specimen(gm)	167.71
Wt Tare	484.40		
Wt. Dry,Washed specimen	13445.40		

Total Wt. Retained After Sieving 13426.40

% Difference Wt. Dry,Washed specimen vs Total Wt. Retained After Sieving 0.1
Note: % Difference must not be more than 0.3

Sieve	Sieve Opening (mm)	Weight Retained (gm.)	Percent Retained	Accumulated Percent Retained	**Percent Finer**
3"	75	0.00	0	0	100
2 1/2"	63	0.00	0	0	100
2"	50	0.00	0	0	100
1 1/2"	37.50	0.00	0	0	100
1"	25.00	203.78	1	1	99
3/4"	19.00	2842.66	21	22	78
1/2"	12.50	7346.60	54	76	24
3/8"	9.50	2298.04	17	93	7
#4	4.75	587.20	4	98	2
#8	2.36	32.79	0	98	2
#16	1.18	24.04	0	98	2
#30	0.60	18.51	0	98	2
#50	0.30	13.57	0	98	2
#100	0.15	16.65	0	98	2
#200	0.075	19.55	0.1	98.6	1.4
Pan	-	23.01	0	99	-

Tested By SS Date 1/8/14 Checked By GM Date 1-8-14

DCN: CT-S42A DATE: 08/28/07 REVISION: 13 SMITH + GARDNER - DAVIDSON CO. LF - CELL 1\[2013-763-06-01 C136pan wHeader.xls]Sheet1

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CARBONATE CONTENT

ASTM D 3042-09

Client:	SMITH + GARDNER, INC.	Boring No.:	JT RUSSELL
Client Reference:	DAVIDSON CO LF	Depth (ft):	NA
Project No.:	2014-625-07	Sample No.:	NO. 57
Lab ID:	2014-625-07-03		

Visual Description: GRAY STONE

Washed and Dried Specimen (+ #200 Material), Total % Carbonate only

Tare No.	58
Weight of Tare (g)	198.99
Weight of Washed, Dry Sample & Tare Before Acid Wash (g)	916.21
Weight of Washed, Dry Sample & Tare After Acid Wash (g)	905.48
Weight of Dry Sample Before Acid Wash (g)	717.22
Weight of Dry Sample After Acid Wash (g)	706.49

Carbonate Content 1.5%

Tested By KBL Date 4/7/14 Checked By KC Date 4/9/14

DCN: CT-S47 DATE :5/1/13 REVISION: 2

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WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-13 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	M. MARIETTA
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2014-625-07	Sample No.	NO. 57
Lab ID	2014-625-07-02		
		Color	**GRAY GRAVEL**

Tare No.	B-39	Wt. of Dry Specimen (gm)	10261.36
Wt. Tare + DS.(Pre-Wash)	10810.46	Wt. of +#200 Specimen(gm)	10162.51
Wt.Tare + Dry,Washed specimen	10741.10	Wt. of -#200 Specimen(gm)	90.13
Wt Tare	549.10		
Wt. Dry,Washed specimen	10192.00		
		Total Wt. Retained After Sieving	10183.28

% Difference Wt. Dry,Washed specimen vs Total Wt. Retained After Sieving 0.1

Note: % Difference must not be more than 0.3

Sieve	Sieve Opening (mm)	Weight Retained (g)	Percent Retained	Accumulated Percent Retained	**Percent Finer**
6"	150	0.00	0	0	100
4"	100	0.00	0	0	100
3"	75	0.00	0	0	100
2 1/2"	63	0.00	0	0	100
2"	50	0.00	0	0	100
1 1/2"	37.50	0.00	0	0	100
1"	25.00	158.40	2	2	98
3/4"	19.00	1819.30	18	19	81
1/2"	12.50	4489.10	44	63	37
3/8"	9.50	2334.84	23	86	14
#4	4.75	1211.13	12	98	2
#8	2.36	93.59	1	98	2
#16	1.18	15.60	0	99	1
#30	0.60	7.83	0	99	1
#50	0.30	20.89	0	99	1
#100	0.15	10.16	0	99	1
#200	0.075	1.67	0.0	99.0	1.0
Pan	-	20.77	0	99	-

Tested By	SS	Date	4/11/14	Checked By	GEM	Date	4/22/14

DCN: CT-S42A4 DATE: 4/12/13 REVISION: 1
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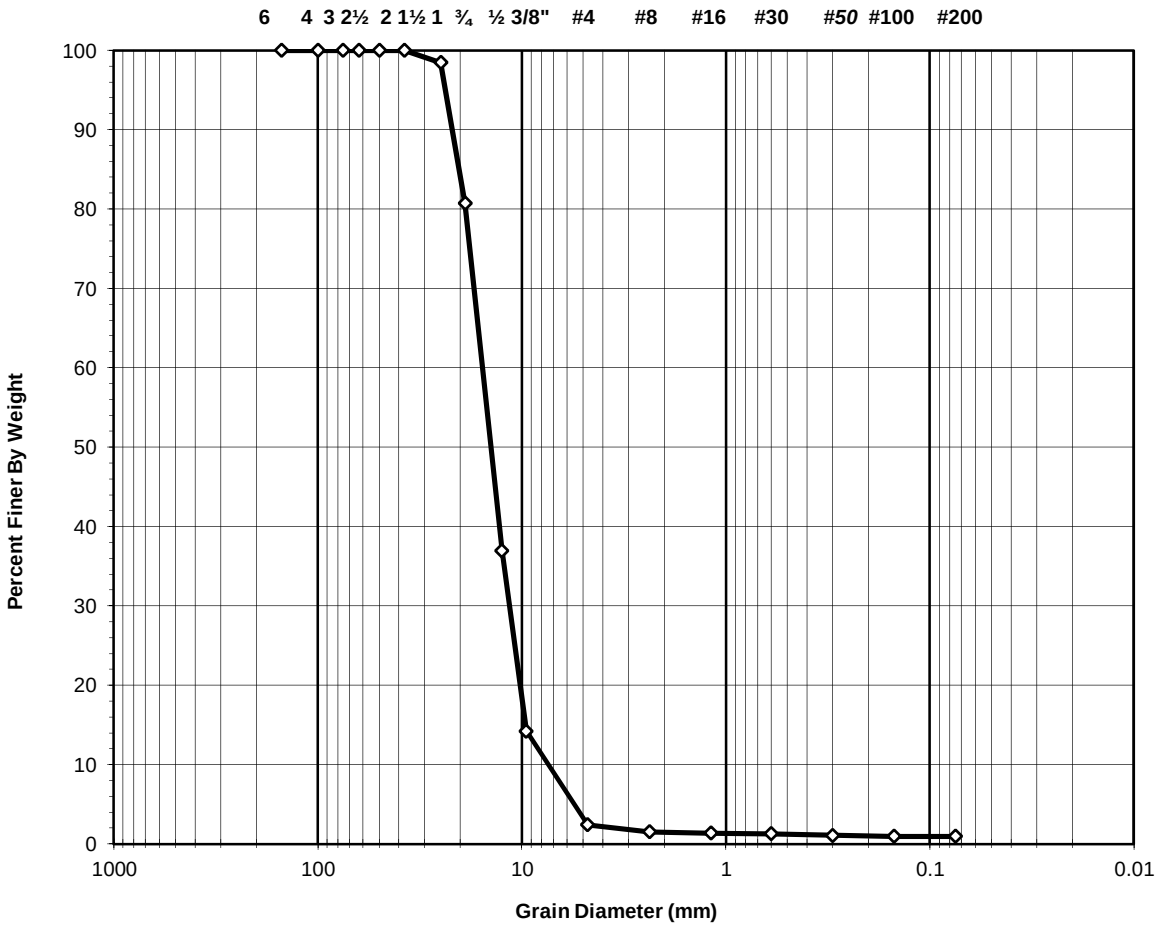
WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-13 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	M. MARIETTA
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2014-625-07	Sample No.	NO. 57
Lab ID	2014-625-07-02		
		Color	**GRAY GRAVEL**

USCS	**gravel**	**sand**	**silt and clay fraction**



USCS Symbol: ***gp, ASSUMED***

Fineness Modulus: ***6.96***

D60 =	15.58		
D30 =	11.49	CC =	1.14
D10 =	7.41	CU =	2.10

USCS Classification: ***POORLY GRADED GRAVEL***

Tested By SS Date 4/11/14 Checked By Date

DCN: CT-S42A4 DATE: 2/12/2013 REVISION: 6 *2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-07-02 C136pan (2).xls]Sheet1*

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WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-13 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	M. MARIETTA
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2014-625-07	Sample No.	NO. 78
Lab ID	2014-625-07-01		
		Color	**GRAY**

Tare No.	A-21	Wt. of Dry Specimen (gm)	7914.12
Wt. Tare + DS.(Pre-Wash)	8398.92	Wt. of +#200 Specimen(gm)	7653.07
Wt.Tare + Dry,Washed specimen	8153.10	Wt. of -#200 Specimen(gm)	256.09
Wt Tare	484.80		
Wt. Dry,Washed specimen	7668.30		
		Total Wt. Retained After Sieving	7663.34

% Difference Wt. Dry,Washed specimen vs Total Wt. Retained After Sieving 0.1

Note: % Difference must not be more than 0.3

Sieve	Sieve Opening (mm)	Weight Retained (g)	Percent Retained	Accumulated Percent Retained	**Percent Finer**
6"	150	0.00	0	0	100
4"	100	0.00	0	0	100
3"	75	0.00	0	0	100
2 1/2"	63	0.00	0	0	100
2"	50	0.00	0	0	100
1 1/2"	37.50	0.00	0	0	100
1"	25.00	0.00	0	0	100
3/4"	19.00	0.00	0	0	100
1/2"	12.50	20.80	0	0	100
3/8"	9.50	278.89	4	4	96
#4	4.75	5122.24	65	69	31
#8	2.36	1558.91	20	88	12
#16	1.18	349.26	4	93	7
#30	0.60	139.42	2	94	6
#50	0.30	74.14	1	95	5
#100	0.15	55.60	1	96	4
#200	0.075	53.81	0.7	96.7	3.3
Pan	-	10.27	0	97	-

Tested By	SS	Date	4/11/14	Checked By	GEM	Date	4/15/14

DCN: CT-S42A4 DATE: 4/12/13 REVISION: 1
C136pan.xls

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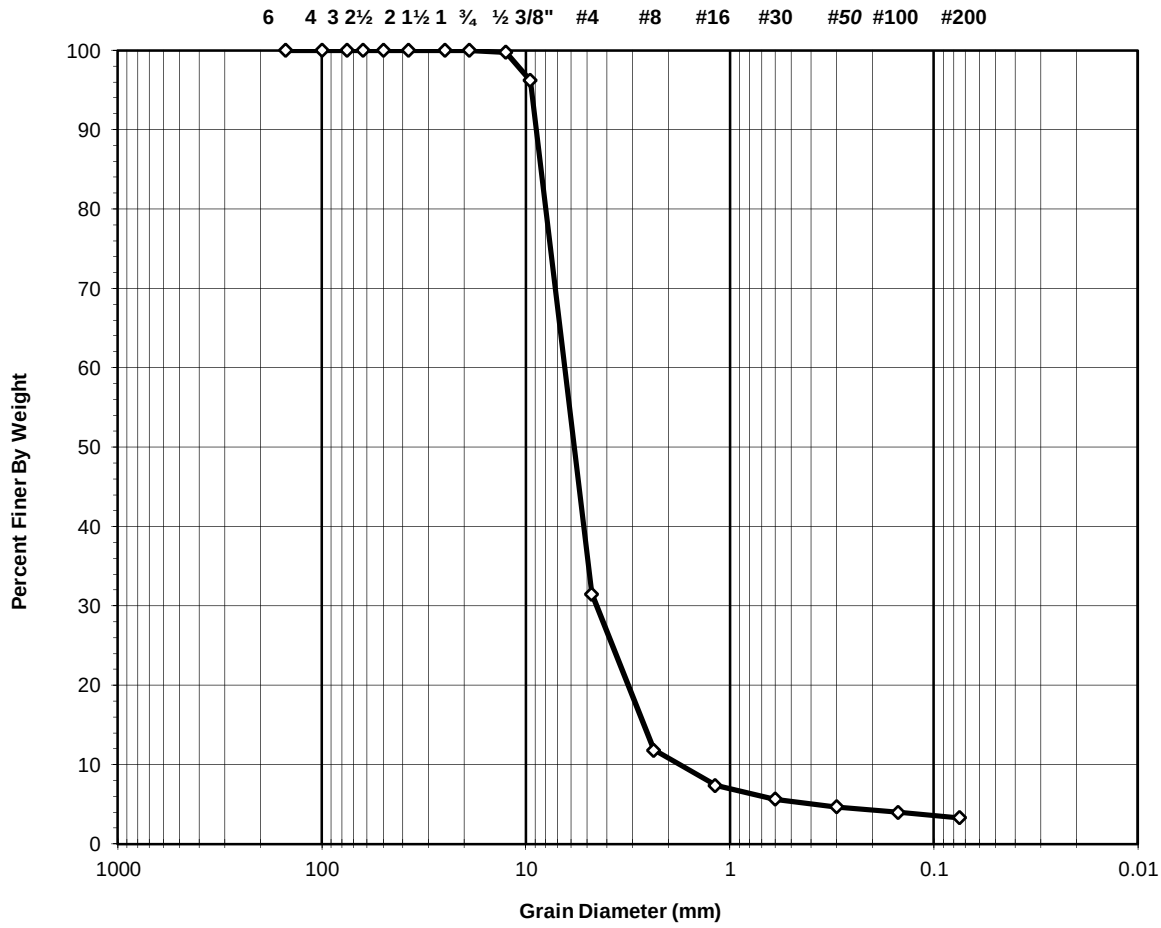
WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-13 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	M. MARIETTA
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2014-625-07	Sample No.	NO. 78
Lab ID	2014-625-07-01		
		Color	**GRAY**

USCS	**gravel**	**sand**	**silt and clay fraction**



USCS Symbol: ***gp, ASSUMED***

Fineness Modulus: ***5.39***

D60 =	6.45		
D30 =	4.51	CC =	1.77
D10 =	1.78	CU =	3.62

USCS Classification: ***POORLY GRADED GRAVEL WITH SAND***

Tested By	SS	Date	4/11/14	Checked By	Date

DCN: CT-S42A4 DATE: 12/14/2012 REVISION: 1 T:\2014\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-07-01 C136pan (2).xls]Sheet1

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RIGID WALL CONSTANT HEAD PERMEABILITY

ASTM D 2434-68 (SOP-S35) Modified

Client	SMITH & GARDNER, INC.	Boring No.	M MARETTA
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2014-625-07	Sample No.	NO. 78
Lab ID	2014-625-07-01	Visual	GRAY CRUSHED STONE

Unit Weight

Wt. of Wet Material (gm)	12232
Average Length (in)	12.2
Permeameter Diameter (in)	7.5
Sample Volume (cc)	8861.2
Unit Dry Weight (gm/cc)	1.35
Unit Dry Weight (pcf)	84.5

Water Content

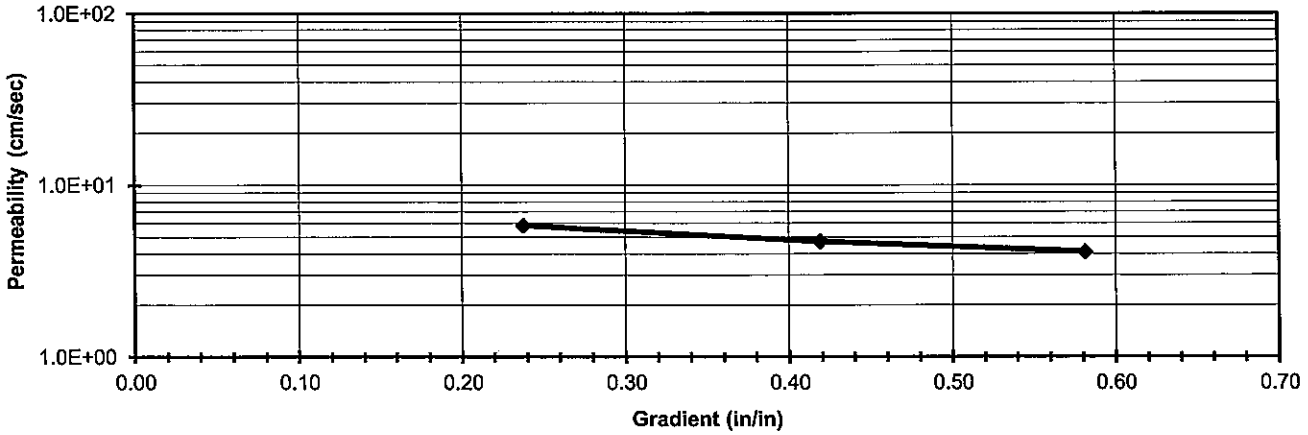
Tare Number	7
Wt. of Tare & Wet Mat.(gm)	626.29
Wt. of Tare & Dry Mat.(gm)	616.10
Wt. of Tare (gm)	74.68
Wt. Water (gm)	10.19
Wt. of Dry Material (gm)	541.42

	Test 1	Test 2	Test 3
Piezometer Spacing (in)	***8***	***8***	***8***
Temperature (° C)	*24.6*	*24.6*	*24.6*
Temp. Correction Factor	*0.8972*	*0.8972*	*0.8972*

Water Content (%) ***1.9*** *(Measured)*

Load (psf) ***NA***

Test No.	Replicate No.	Head (in)	Gradient (in/in)	Elapsed Time (sec)	Collection Tube (divisions)	Collected Volume (cc)	Permeability 20° C (cm/s)	Average Permeability (cm/s)
1	1	1.90	0.24	32.5	10	14441	5.9E+00	
1	2	1.90	0.24	32.6	10	14441	5.9E+00	**5.9E+00**
1	3	1.90	0.24	32.9	10	14441	5.8E+00	
2	1	3.35	0.42	22.9	10	14441	4.7E+00	
2	2	3.35	0.42	23.2	10	14441	4.7E+00	**4.7E+00**
2	3	3.35	0.42	22.8	10	14441	4.8E+00	
3	1	4.65	0.58	19.0	10	14441	4.1E+00	
3	2	4.65	0.58	19.2	10	14441	4.1E+00	**4.1E+00**
3	3	4.65	0.58	19.0	10	14441	4.1E+00	



Tested By JP Date 04/07/14 Checked By D B Date 4/8/14

 DCN: CT-S35 DATE: 2/26/10 REVISION: 7 *C:\Users\Dave\Documents\excel\PROJECTS 2014\[2014-625-07-01.xls]Sheet1*

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WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-04 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	STOCKPILE
Client Reference	DAVIDSON CO. LF.	Depth(ft.)	NA
Project No.	2014-625-05	Sample No.	VULCAN NO. 78
Lab ID	2014-625-05-02		
		Color	**GRAY**

Tare No.	A-21	Wt. of Dry Specimen (gm)	3276.50
Wt. Tare + DS.(Pre-Wash)	3761.00	Wt. of +#200 Specimen(gm)	3273.54
Wt.Tare + Dry,Washed specimen	3750.80	Wt. of -#200 Specimen(gm)	10.57
Wt Tare	484.50		
Wt. Dry,Washed specimen	3266.30		
		Total Wt. Retained After Sieving	3273.91

% Difference Wt. Dry,Washed specimen vs Total Wt. Retained After Sieving -0.2
Note: % Difference must not be more than 0.3

Sieve	Sieve Opening (mm)	Weight Retained (gm.)	Percent Retained	Accumulated Percent Retained	**Percent Finer**
3"	75	0.00	0	0	100
2 1/2"	63	0.00	0	0	100
2"	50	0.00	0	0	100
1 1/2"	37.50	0.00	0	0	100
1"	25.00	0.00	0	0	100
3/4"	19.00	0.00	0	0	100
1/2"	12.50	0.00	0	0	100
3/8"	9.50	166.63	5	5	95
#4	4.75	2021.15	62	67	33
#8	2.36	1028.13	31	98	2
#16	1.18	39.14	1	99	1
#30	0.60	13.34	0	100	0
#50	0.30	2.64	0	100	0
#100	0.15	1.46	0	100	0
#200	0.075	1.05	0.0	99.9	0.1
Pan	-	0.37	0	100	-

Tested By BW Date 2/28/14 Checked By GEM Date 2/28/14

DCN: CT-S42A DATE 07/20/09 REVISION 12 *2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-05-02 C136pan.xls]Sheet1*

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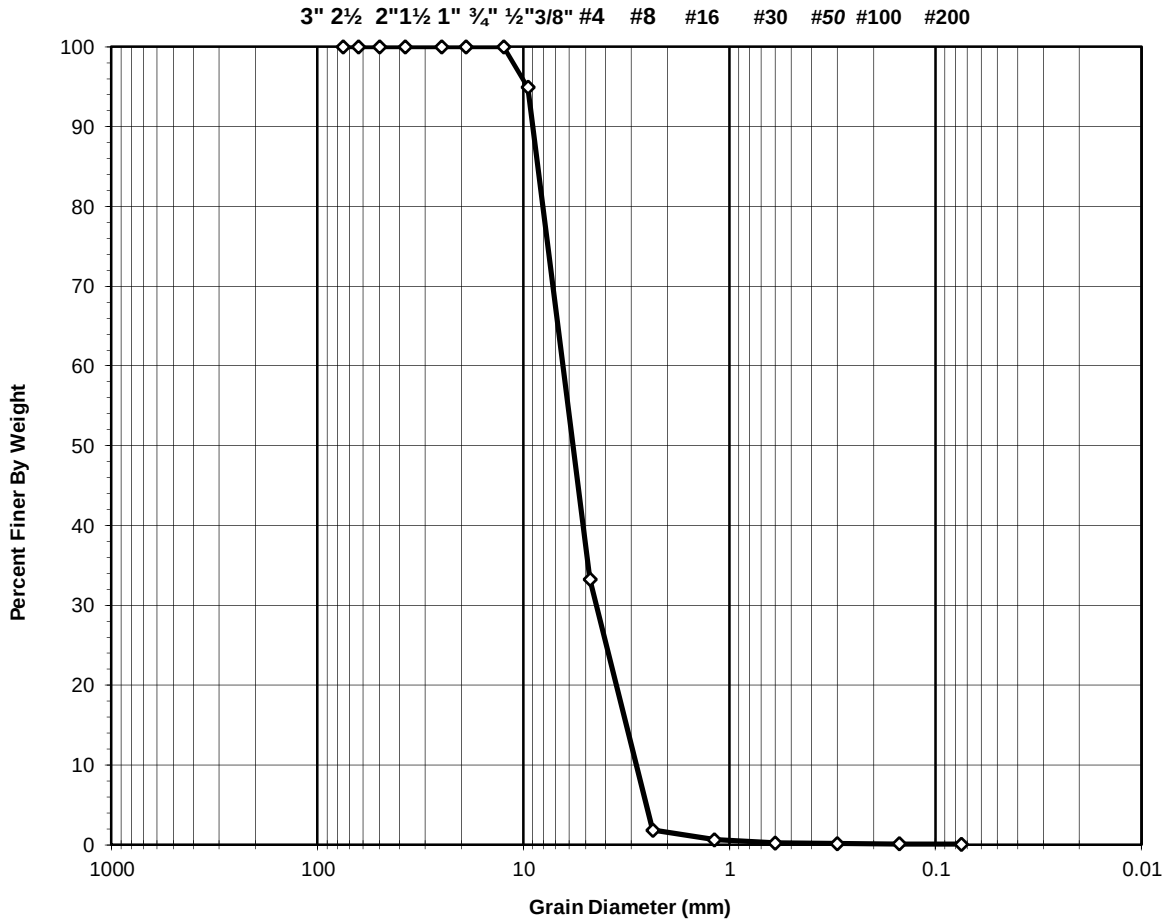
WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-04 / C136-06

Client	SMITH + GARDNER, INC.	Boring No.	STOCKPILE
Client Reference	DAVIDSON CO. LF.	Depth(ft.)	NA
Project No.	2014-625-05	Sample No.	VULCAN NO. 78
Lab ID	2014-625-05-02		
		Color	**GRAY**

USCS	gravel	sand	silt and clay fraction



USCS Symbol: ***gp, ASSUMED***

Fineness Modulus: ***5.69***

D60 =	6.42		
D30 =	4.42	CC =	1.08
D10 =	2.83	CU =	2.27

USCS Classification: ***POORLY GRADED GRAVEL WITH SAND***

Tested By	BW	Date	2/28/14	Checked By	GEM	Date	2/28/14

DCN: CT-S42A DATE 07/20/09 REVISION 12 *[2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-05-02 C136pan.xls]Sheet1*

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INTEGRITY IN TESTING

RIGID WALL CONSTANT HEAD PERMEABILITY

ASTM D 2434-68 (SOP-S35) Modified

Client	SMITH, GARDNER, INC.	Boring No.	STOCKPILE
Client Reference	DAVIDSON CO. LF	Depth(ft.)	NA
Project No.	2014-625-08	Sample No.	VULCAN NO. 78
Lab ID	2014-625-08-01	Visual	DARK GRAY STONE

Unit Weight

Wt. of Wet Material (gm)	12937
Average Length (in)	11.5
Permeameter Diameter (in)	7.5
Sample Volume (cc)	8340.0
Unit Dry Weight (gm/cc)	1.54
Unit Dry Weight (pcf)	96.1

Water Content

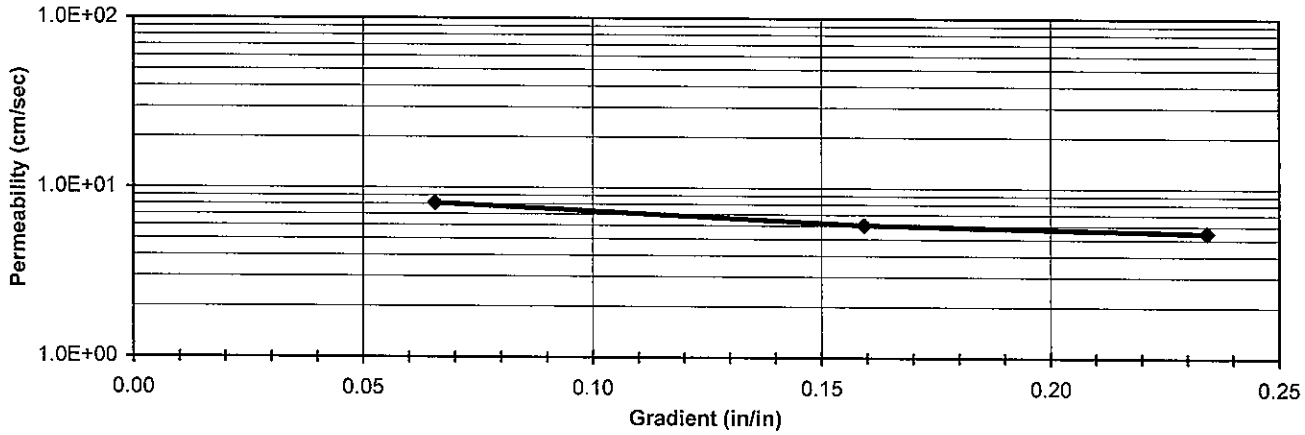
Tare Number	1741
Wt. of Tare & Wet Mat.(gm)	467.69
Wt. of Tare & Dry Mat.(gm)	464.99
Wt. of Tare (gm)	83.09
Wt. Water (gm)	2.70
Wt. of Dry Material (gm)	381.90

	Test 1	Test 2	Test 3
Piezometer Spacing (in)	*8*	*8*	*8*
Temperature (° C)	*22.6*	*23.2*	*23.6*
Temp. Correction Factor	*0.9399*	*0.9267*	*0.9182*

Water Content (%) ***0.7*** *(Measured)*

Load (psf) ***NA***

Test No.	Replicate No.	Head (in)	Gradient (in/in)	Elapsed Time (sec)	Collection Tube (divisions)	Collected Volume (cc)	Permeability 20° C (cm/s)	Average Permeability (cm/s)
1	1	0.52	0.07	89.5	10	14441	8.1E+00	
1	2	0.52	0.07	89.3	10	14441	8.1E+00	**8.1E+00**
1	3	0.52	0.07	89.4	10	14441	8.1E+00	
2	1	1.28	0.16	48.5	10	14441	6.1E+00	
2	2	1.28	0.16	48.6	10	14441	6.1E+00	**6.1E+00**
2	3	1.28	0.16	48.7	10	14441	6.0E+00	
3	1	1.88	0.23	36.1	10	14441	5.5E+00	
3	2	1.88	0.23	36.1	10	14441	5.5E+00	**5.5E+00**
3	3	1.88	0.23	36.2	10	14441	5.5E+00	



Tested By PC Date 4/28/14 Checked By hc Date 4-28-14

DCN: CT-S35 DATE: 8/27/10 REVISION: 0 G:\GEOTECHNICAL PROJECTS\SMITH GARDNER\2014-625-08 DAVIDSON CO LF\PERMS\[2014-625-08-01 Perm.xls]Sheet1

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CARBONATE CONTENT
ASTM D 3042-09

Client:	Smith, Gardner, Inc.	Boring No.:	STOCKPILE
Client Reference:	DAVIDSON CO. LF	Depth (ft):	NA
Project No.:	2014-625-08	Sample No.:	VULCAN No. 78
Lab ID:	2014-625-08-01		

Visual Description: DARK GRAY STONE

Washed and Dried Specimen (+ #200 Material), Total % Carbonate only

Tare No.	975
Weight of Tare (g)	97.29
Weight of Washed, Dry Sample & Tare Before Acid Wash (g)	821.05
Weight of Washed, Dry Sample & Tare After Acid Wash (g)	797.10
Weight of Dry Sample Before Acid Wash (g)	723.76
Weight of Dry Sample After Acid Wash (g)	699.81

Carbonate Content 3.3%

Tested By KBL Date 4/29/14 Checked By KC Date 5/1/14

DCN: CT-S47 DATE :5/1/13 REVISION: 2

CARBONT.xls

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WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-13 / C136-06

Client	SMITH + GARDNER,INC.	Boring No.	CELL 1
Client Reference	DAVIDSON CO.LF	Depth(ft.)	NA
Project No.	2014-625-09	Sample No.	78-01
Lab ID	2014-625-09-02		
		Color	**GRAY**

Tare No.	167	Wt. of Dry Specimen (gm)	2127.25
Wt. Tare + DS.(Pre-Wash)	2366.23	Wt. of +#200 Specimen(gm)	2096.59
Wt.Tare + Dry,Washed specimen	2339.87	Wt. of -#200 Specimen(gm)	26.98
Wt Tare	238.98		
Wt. Dry,Washed specimen	2100.89		
		Total Wt. Retained After Sieving	2097.21

% Difference Wt. Dry,Washed specimen vs Total Wt. Retained After Sieving 0.2

Note: % Difference must not be more than 0.3

Sieve	Sieve Opening (mm)	Weight Retained (g)	Percent Retained	Accumulated Percent Retained	**Percent Finer**
6"	150	0.00	0	0	100
4"	100	0.00	0	0	100
3"	75	0.00	0	0	100
2 1/2"	63	0.00	0	0	100
2"	50	0.00	0	0	100
1 1/2"	37.50	0.00	0	0	100
1"	25.00	0.00	0	0	100
3/4"	19.00	0.00	0	0	100
1/2"	12.50	4.09	0	0	100
3/8"	9.50	189.64	9	9	91
#4	4.75	1256.16	59	68	32
#8	2.36	588.59	28	96	4
#16	1.18	44.72	2	98	2
#30	0.60	4.13	0	98	2
#50	0.30	3.69	0	98	2
#100	0.15	2.78	0	98	2
#200	0.075	2.79	0.1	98.6	1.4
Pan	-	0.62	0	99	-

Tested By	SS	Date	4/28/14	Checked By	GEM	Date	4/28/14

DCN: CT-S42A4 DATE: 4/12/13 REVISION: 1

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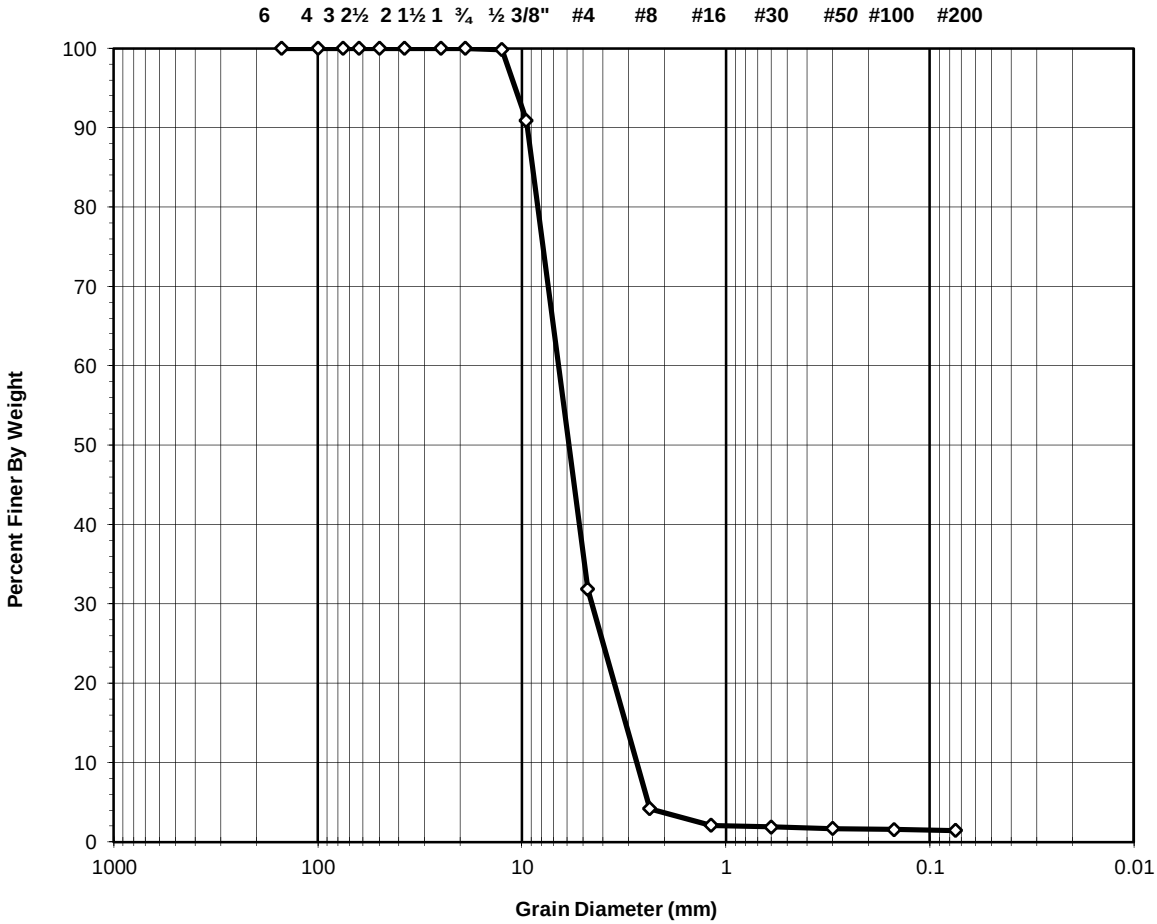
WASH SIEVE ANALYSIS OF AGGREGATES
ASTM C117-13 / C136-06

Client	SMITH + GARDNER,INC.	Boring No.	CELL 1
Client Reference	DAVIDSON CO.LF	Depth(ft.)	NA
Project No.	2014-625-09	Sample No.	78-01
Lab ID	2014-625-09-02		
		Color	**GRAY**

USCS	**gravel**	**sand**	**silt and clay fraction**



USCS Symbol: ***gp, ASSUMED***

Fineness Modulus: ***5.66***

D60 =	6.61		
D30 =	4.53	CC =	1.14
D10 =	2.73	CU =	2.42

USCS Classification: ***POORLY GRADED GRAVEL WITH SAND***

Tested By SS Date 4/28/14 Checked By Date

DCN: CT-S42A4 DATE: 12/12/13 REVISION: 4 T:\2014\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[2014-625-09-02 C136pan (2).xls]Sheet1

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Client: Smith & Gardner
Project Name : Davidson County Phase 2 Cell 1
Project Number : 2014-625

Field Density Test Report

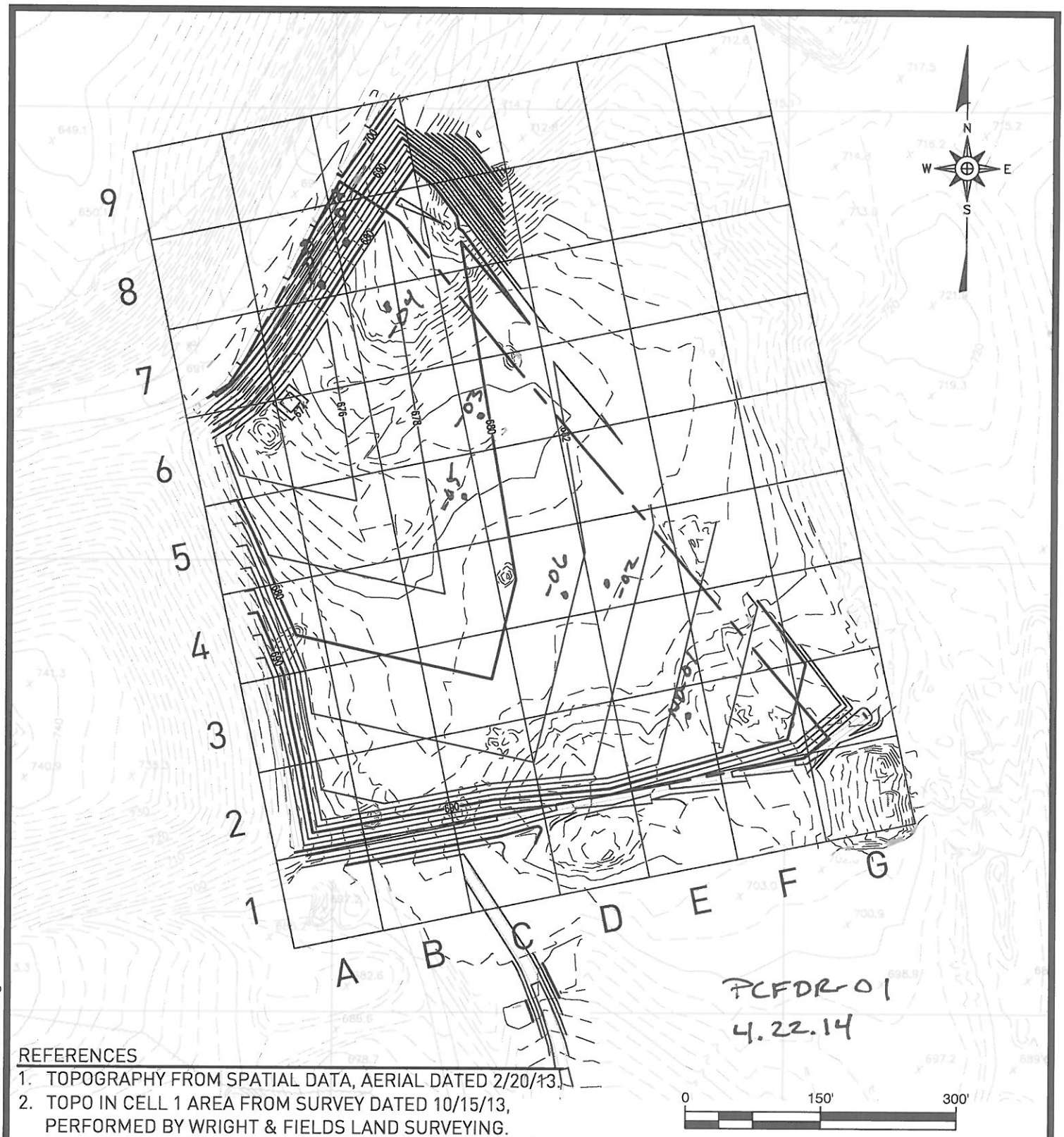
Report Number :	**PCFDR-01**	Geotechnics Representative :	Jacob R Buda	Page :	1 of 1
Date (s) :	**4.22.14**	Reviewed By :	JRB	Date :	4.29.14

Contractor :	J.T. Russell	Borrow Source :	Onsite Excavation

Compaction Equipment :	NA

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.	
PCND - 01	E-2	LIFT 1	6"	625-07-04	123.7	13.5	**136.6**	**16.9**	**116.9**	**94.5%**	**90.0%**	
PCND - 02	E-4	LIFT 1	6"	625-07-04	123.7	13.5	**135.8**	**20.8**	**112.4**	**90.9%**	**90.0%**	
PCND - 03	D-6	LIFT 1	6"	625-09-01	111.1	15.0	**126.0**	**19.6**	**105.4**	**94.8%**	**90.0%**	
PCND - 04	C-7	LIFT 1	6"	625-07-04	123.7	13.5	**136.7**	**17.5**	**116.3**	**94.1%**	**90.0%**	
PCND - 05	C-5	LIFT 1	6"	625-09-01	111.1	15.0	**133.4**	**23.2**	**108.3**	**97.5%**	**90.0%**	
PCND - 06	D-4	LIFT 1	6"	625-07-04	123.7	13.5	**135.6**	**18.2**	**114.7**	**92.7%**	**90.0%**	
PCND - 07	C-8	LIFT 1	6"	625-09-01	111.1	15.0	**122.8**	**15.1**	**106.7**	**96.0%**	**90.0%**	
PCND - 08	B-8	LIFT 1	6"	625-09-01	111.1	15.0	**125.6**	**18.2**	**106.3**	**95.6%**	**90.0%**	

Gauge Number	Gauge Model	Density Count	Moisture Count
33577	3430	584	1965



REFERENCES

1. TOPOGRAPHY FROM SPATIAL DATA, AERIAL DATED 2/20/13.
2. TOPO IN CELL 1 AREA FROM SURVEY DATED 10/15/13, PERFORMED BY WRIGHT & FIELDS LAND SURVEYING.

PREPARED FOR:

DAVIDSON COUNTY MSW LANDFILL
PHASE 2 AREA 2 - CELL 1
FIELD GRID

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	APPROVED:	SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:	FILE NAME:
J.A.L.		AS SHOWN	Nov 2013	DAVDCO 11-3	1	DAVDCO-A0766

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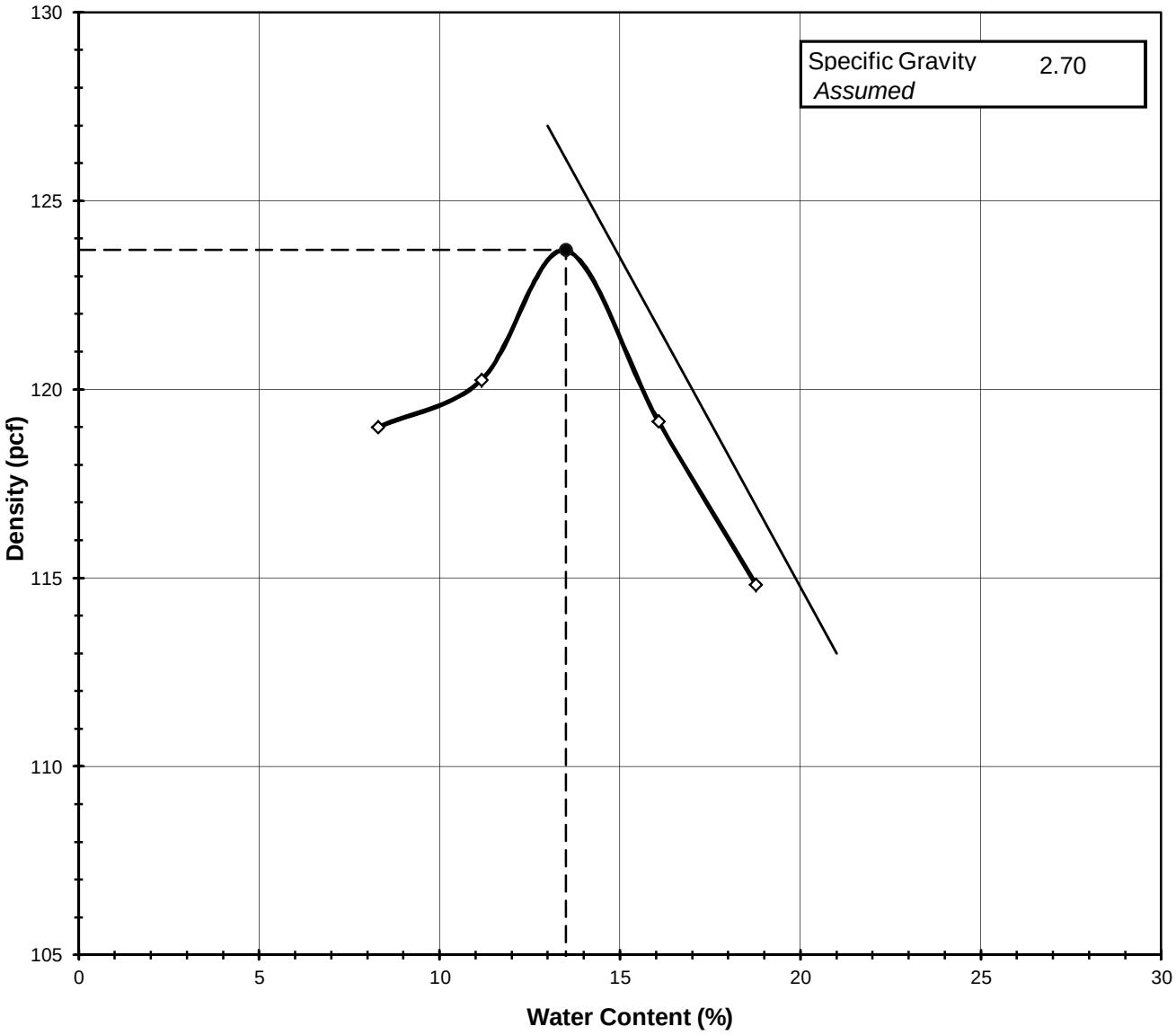
MOISTURE DENSITY RELATIONSHIP

ASTM D698-12

Client:	SMITH + GARDNER, INC.	Boring No.:	ON SITE BORROW
Client Reference:	DAVIDSON CO. LF	Depth (ft):	N/A
Project No.:	2014-625-07	Sample No.:	PC-01
Lab ID:	2014-625-07-04	Test Method	**STANDARD**

Visual Description: GRAY SANDY SILT

Optimum Water Content	**13.5**
Maximum Dry Density	**123.7**



Tested By *BW* *Date* *4/15/14* *Checked By* *GEM* *Date* 4/21/14

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MOISTURE - DENSITY RELATIONSHIP

ASTM D698-12

Client:	SMITH + GARDNER, INC.	Boring No.:	ON SITE BORROW
Client Reference:	DAVIDSON CO. LF	Depth (ft):	N/A
Project No.:	2014-625-07	Sample No.:	PC-01
Lab ID:	2014-625-07-04		

Visual Description: GRAY SANDY SILT

Total Weight of the Sample (g)	22150
As Received Water Content (%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	1
Percent Retained on 3/8"	1
Percent Retained on #4	0
Oversize Material	Not included
Procedure Used	A

Test Type		**STANDARD**
Rammer Weight (lb)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	461
Mold diameter		4"
Weight of the Mold (g)		4184
Volume of the Mold (cm^3)		937

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & Wet Sample (g)	6120	6192	6293	6261	6233
Wt.of Mold (g)	4184	4184	4184	4184	4184
Wt. of Wet Sample (g)	1936	2008	2109	2077	2049
Mold Volume (cm^3)	937	937	937	937	937

Moisture Content / Density

Tare Number	317	311	368	300	308
Wt. of Tare & Wet Sample (g)	439.80	403.90	497.50	572.10	650.50
Wt. of Tare & Dry Sample (g)	412.50	371.80	451.50	508.20	561.60
Wt. of Tare (g)	83.70	84.30	111.00	110.60	88.10
Wt. of Water (g)	27.30	32.10	46.00	63.90	88.90
Wt. of Dry Sample (g)	328.80	287.50	340.50	397.60	473.50

Wet Density (g/cm^3)	2.07	2.14	2.25	2.22	2.19
Wet Density (pcf)	128.9	133.7	140.4	138.3	136.4
Moisture Content (%)	**8.3**	**11.2**	**13.5**	**16.1**	**18.8**
Dry Density (pcf)	**119.0**	**120.2**	**123.7**	**119.1**	**114.8**

Zero Air Voids

Moisture Content (%)	13.0	17.0	21.0
Dry Unit Weight (pcf)	127.0	120.0	113.0

Tested By *BW* *Date* *4/15/14* *Checked By* *GEM* *Date* 4/21/14

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH + GARDNER, INC.	Boring No.	ON SITE BORROW
Client Reference	DAVIDSON CO. LF	Depth (ft)	NA
Project No.	2014-625-07	Sample No.	PC-01
Lab ID	2014-625-07-04	Soil Color	**LIGHT BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	165	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	927.84	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	845.76	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	236.93	Weight of Tare (gm)	NA
Weight of Water (gm)	82.08	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	608.83	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**13.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	608.83
Dry Weight - 3/4" Sample (gm)	383.2	Weight of minus #200 material (gm)	210.45
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	398.38
Dry Weight + 3/4" Sample (gm)	15.23		
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	15.23	2.5	2.5	97.5	**97.5**
1/2"	12.50	0.00	0.0	2.5	97.5	**97.5**
3/8"	9.50	3.33	0.5	3.0	97.0	**97.0**
#4	4.75	13.26	2.2	5.2	94.8	**94.8**
#10	2.00	38.50	6.3	11.6	88.4	**88.4**
#20	0.850	75.57	12.4	24.0	76.0	**76.0**
#40	0.425	72.62	11.9	35.9	64.1	**64.1**
#60	0.250	52.56	8.6	44.5	55.5	**55.5**
#140	0.106	93.00	15.3	59.8	40.2	**40.2**
#200	0.075	34.31	5.6	65.4	34.6	**34.6**
Pan	-	210.45	34.6	100.0	-	**-**

Tested By SS Date 4/11/14 Checked By GEM Date 4/11/14

DCN: CT-S3C DATE 6-25-98 REVISION 2 *PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[20114-625-07-04 SIEVON REV 4.xls]Sheet1*

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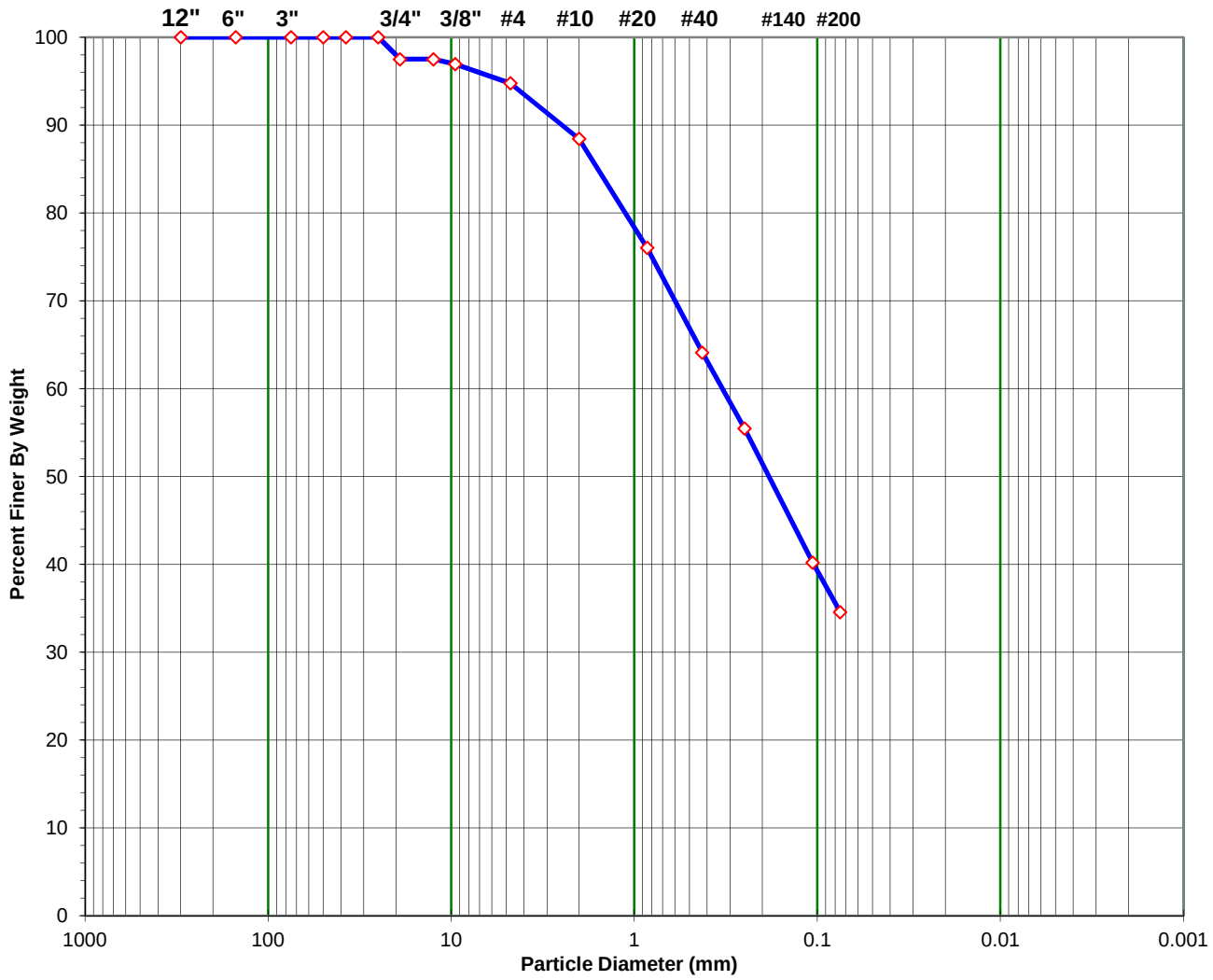
SIEVE ANALYSIS
ASTM D 422-63 (2007)

Client	SMITH + GARDNER, INC.	Boring No.	ON SITE BORROW
Client Reference	DAVIDSON CO. LF	Depth (ft)	NA
Project No.	2014-625-07	Sample No.	PC-01
Lab ID	2014-625-07-04	Soil Color	**LIGHT BROWN**

	SIEVE ANALYSIS		***HYDROMETER***
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***sm, ASSUMED***

USCS Classification SILTY SAND

Tested By	SS	Date	4/11/14	Checked By	GEM	Date	4/11/14

DCN: CT-S3C DATE 6-25-98 REVISION 2 *PROJECTS\2014-625 SMITH + GARDNER - DAVIDSON CO. LF\[20114-625-07-04 SIEVON REV 4.xls]Sheet1*

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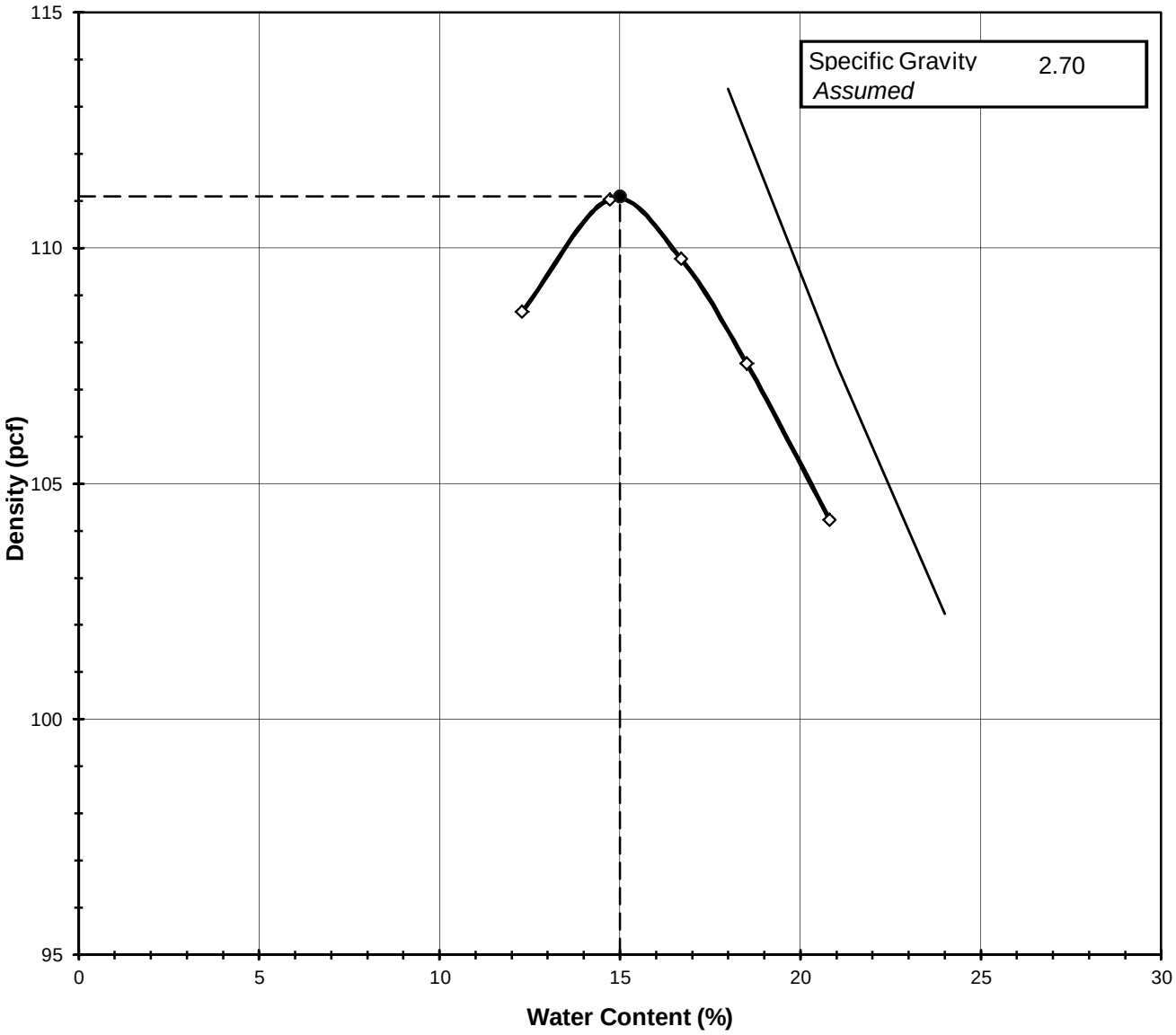
MOISTURE DENSITY RELATIONSHIP

ASTM D698-12

Client:	SMITH + GARDNER, INC.	Boring No.:	CELL 1
Client Reference:	DAVIDSON CO. LF	Depth (ft):	NA
Project No.:	2014-625-09	Sample No.:	PC-02
Lab ID:	2014-625-09-01	Test Method	**STANDARD**

Visual Description: RED CLAYEY SILT

Optimum Water Content	**15.0**
Maximum Dry Density	**111.1**



Tested By *BW* *Date* *4/25/14* *Checked By* *GEM* *Date* 4/29/14

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MOISTURE - DENSITY RELATIONSHIP

ASTM D698-12

Client:	SMITH + GARDNER, INC.	Boring No.:	CELL 1
Client Reference:	DAVIDSON CO. LF	Depth (ft):	NA
Project No.:	2014-625-09	Sample No.:	PC-02
Lab ID:	2014-625-09-01		

Visual Description: RED CLAYEY SILT

Total Weight of the Sample (g)	17750
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

Test Type		**STANDARD**
Rammer Weight (lb)		5.5
Rammer Drop (in)		12
Rammer Type		MECHANICAL
Machine ID	R	174
Mold ID	R	461
Mold diameter		4"
Weight of the Mold (g)		4184
Volume of the Mold (cm^3)		937

Mold / Specimen

Point No.	**1**	**2**	**3**	**4**	**5**
Wt. of Mold & Wet Sample (g)	6017	6097	6108	6099	6076
Wt.of Mold (g)	4184	4184	4184	4184	4184
Wt. of Wet Sample (g)	1833	1913	1924	1915	1892
Mold Volume (cm^3)	937	937	937	937	937

Moisture Content / Density

Tare Number	813	811	812	806	803
Wt. of Tare & Wet Sample (g)	399.20	460.30	530.80	446.10	386.10
Wt. of Tare & Dry Sample (g)	367.70	415.02	470.17	392.16	337.69
Wt. of Tare (g)	111.40	107.40	107.00	100.80	105.10
Wt. of Water (g)	31.50	45.28	60.63	53.94	48.41
Wt. of Dry Sample (g)	256.30	307.62	363.17	291.36	232.59

Wet Density (g/cm^3)	1.96	2.04	2.05	2.04	2.02
Wet Density (pcf)	122.0	127.4	128.1	127.5	125.9
Moisture Content (%)	**12.3**	**14.7**	**16.7**	**18.5**	**20.8**
Dry Density (pcf)	**108.6**	**111.0**	**109.8**	**107.5**	**104.2**

Zero Air Voids

Moisture Content (%)	18.0	21.0	24.0
Dry Unit Weight (pcf)	113.4	107.5	102.2

Tested By *BW* *Date* *4/25/14* *Checked By* *GEM* *Date* 4/29/14

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WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	SMITH + GARDNER, INC.	Boring No.	CELL 1
Client Reference	DAVIDSON CO. LF	Depth (ft)	NA
Project No.	2014-625-09	Sample No.	PC-02
Lab ID	2014-625-09-01	Soil Color	**RED**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	841	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	660.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	599.16	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	259.39	Weight of Tare (gm)	NA
Weight of Water (gm)	61.54	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	339.77	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**18.1**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	339.77
Dry Weight - 3/4" Sample (gm)	155.3	Weight of minus #200 material (gm)	184.47
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	155.30
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	3.03	0.9	0.9	99.1	**99.1**
#10	2.00	21.81	6.4	7.3	92.7	**92.7**
#20	0.850	46.45	13.7	21.0	79.0	**79.0**
#40	0.425	22.35	6.6	27.6	72.4	**72.4**
#60	0.250	12.50	3.7	31.2	68.8	**68.8**
#140	0.106	34.80	10.2	41.5	58.5	**58.5**
#200	0.075	14.36	4.2	45.7	54.3	**54.3**
Pan	-	184.47	54.3	100.0	-	**-**

Tested By SS Date 4/28/14 Checked By GEM Date 4/28/14

DCN: CT-S3C DATE 6-25-98 REVISION: 2 *T:\2014 PROJECTS\2014-641 DUNCKLEE DUNHAM UMICORE\[2014-641-05-01 SIVON.xls]Sheet1*

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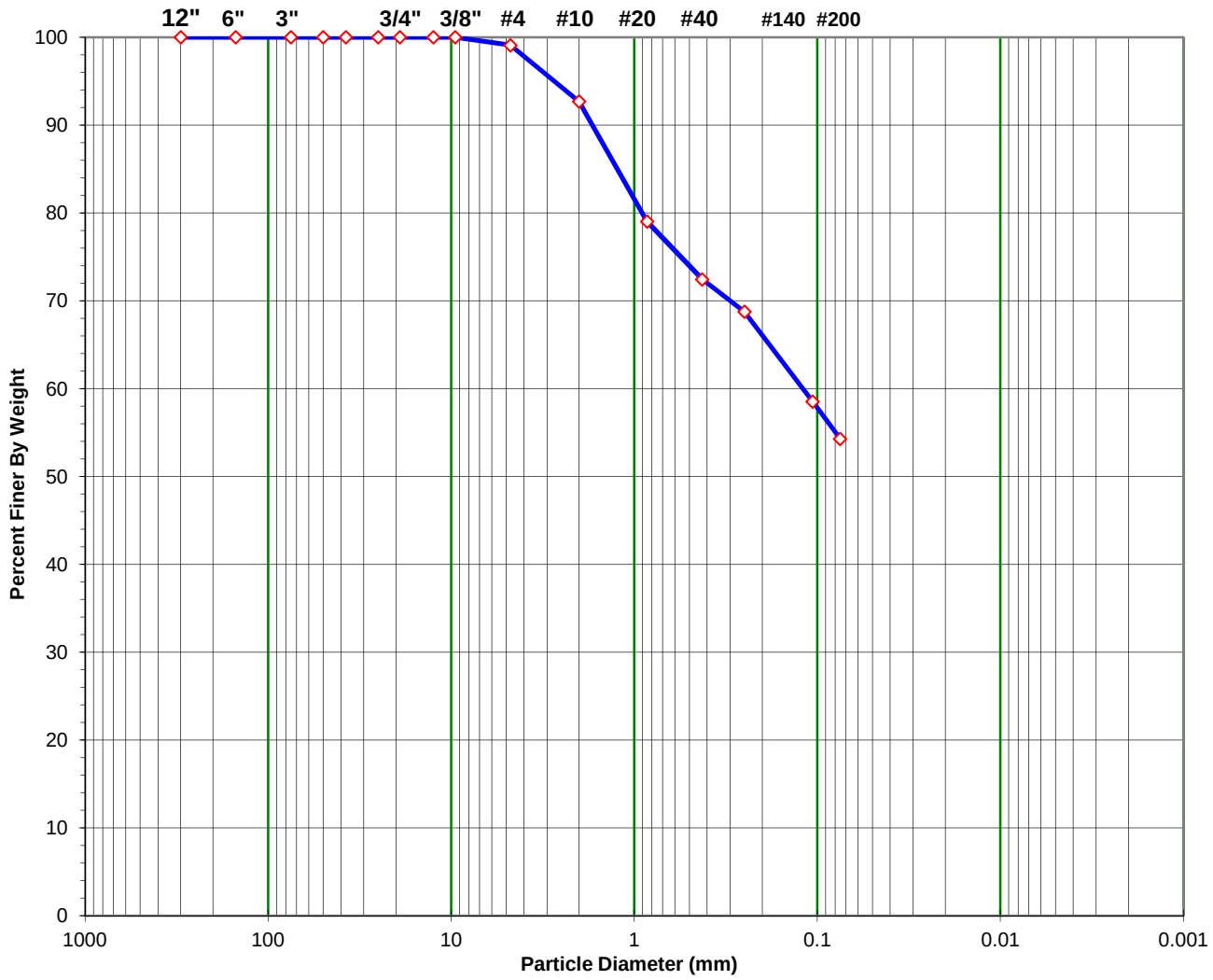
SIEVE ANALYSIS
ASTM D 422-63 (2007)

Client	SMITH + GARDNER, INC.	Boring No.	CELL 1
Client Reference	DAVIDSON CO. LF	Depth (ft)	NA
Project No.	2014-625-09	Sample No.	PC-02
Lab ID	2014-625-09-01	Soil Color	**RED**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***ml, ASSUMED***

USCS Classification SANDY SILT

Tested By	SS	Date	4/28/14	Checked By	GEM	Date	4/28/14

 DCN: CT-S3C DATE 6-25-98 REVISION: 2 *T:\2014 PROJECTS\2014-641 DUNCKLEE DUNHAM UMICORE\[2014-641-05-01 SIVON.xls]Sheet1*

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SMITH+GARDNER

Hydrostatic Pressure Test Documentation

Test Procedure: ASTM F 2164

Date: 3.20.14

Project: Davidson Co. MSW LF Phase 2 - Area 2 - Cell 1

Contractor: JT Russell & Sons

Test Observed by: Jacob R. Buda - Geotechnics

Pipeline Description*: 2.0" HDPE (DR11) Forcemain and associated valves and fittings

(Material, Thickness, Pressure Rating, Etc.)

Section Tested: From: Existing Tee / Isolation Valve Box Assembly

To: Cell 1 Side Raiser

Test Section: Diam. (D) (in): 2.0 Length (L) (ft): ~ 50

Test Start Time: 3/20/14 11:28 AM

Pressure Test Results (See Notes 1 and 2):

Time	Tt	Pt	Pc	% Pressure Drop
0	10	45.0	45.0	0.0%
10	10	45.0	45.0	0.0%
20	11	45.0	45.2	0.5%
30	11	45.0	45.2	0.5%
40	12	44.9	45.3	0.7%
50	12	44.9	45.3	0.7%
60	12	44.9	45.3	0.7%

Notes:

1. Per ASTM F 2164, pressurize pipe for 4 hours, reduce pressure by 10 psi, and then begin the 1 hour test period.
2. Per ASTM F 2164, a passing test is indicated by no visual leakage and the test pressure remaining steady (within 5% of the pressure at the start of the test) for the 1 hour test period.

Test Result (Pass/Fail): Pass

Leak Location (if Fail): NA

Notes: Pipe was pressurized to 45 psi and held for one hour with no pressure loss.

Calculations:

Pressure Correction: $$Pc = \frac{(Pt + 14.7)(Tt + 273)}{(Ti + 273)} - 14.7$$

% Pressure Drop: $$\frac{Pc - Pi}{Pc} \times 100\%$$

where:

T_t = Temperature in °C at time "t"
T_i = Initial temperature in °C
P_t = Test pressure in psig at time "t"
P_i = Initial test pressure in psig =
P_c = Pressure in psig corrected for temperature (Tt) at time "t"
t = Time in minutes from start of the test

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JT Russell and Sons, Inc.
Davidson County Landfill
Phase 2 - Area 2 - Cell 1
New LCS Piping Video Inspections

Work Performed
April 2014

Conducted By:
Jetclean America
800-226-8013

JETCLEAN AMERICA

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REPORT

DATE : 4/24/2014
TO : Nathan Russell – J.T. Russell & Sons
FROM : Ralph Calistri (jetcleanamerica@yahoo.com)
SUBJECT : 2014 Davidson County LF - Phase 2 - Area 2 - Cell 1 - New LCS Piping

Jetclean America was mobilized to the Davidson County Landfill on 4/17/2014 to provide explosion-proof video-inspection services on the new Phase 2 - Area 2 - Cell 1 leachate collection piping. Included with this report are the applicable video-inspection logs and the DVD format inspection footage for complete detailed reference.

Explosion-Proof Video-Inspection:
The new Phase 2 - Area 2 - Cell 1 leachate collection piping was video-inspected in entirety using certified explosion-proof equipment (see included CCTV Survey List, Pipe Graphic Reports, and DVD's). All areas of the new LCS piping visible through the inspection camera appear to be in good working order, with no specific defects noted. As the reports and videos document, in some sections of the piping the inspection camera was submerged under liquid which may obscure visibility. In any areas where video quality was obscured, the fact that the inspection camera's forward progress was not restricted in any way would support the contention that those areas of the leachate collection system are also in good working order.

Please call with questions or concerns at 800-226-8013.

Regards,

Ralph Calistri

Ralph Calistri – Jetclean America

JETCLEAN AMERICA

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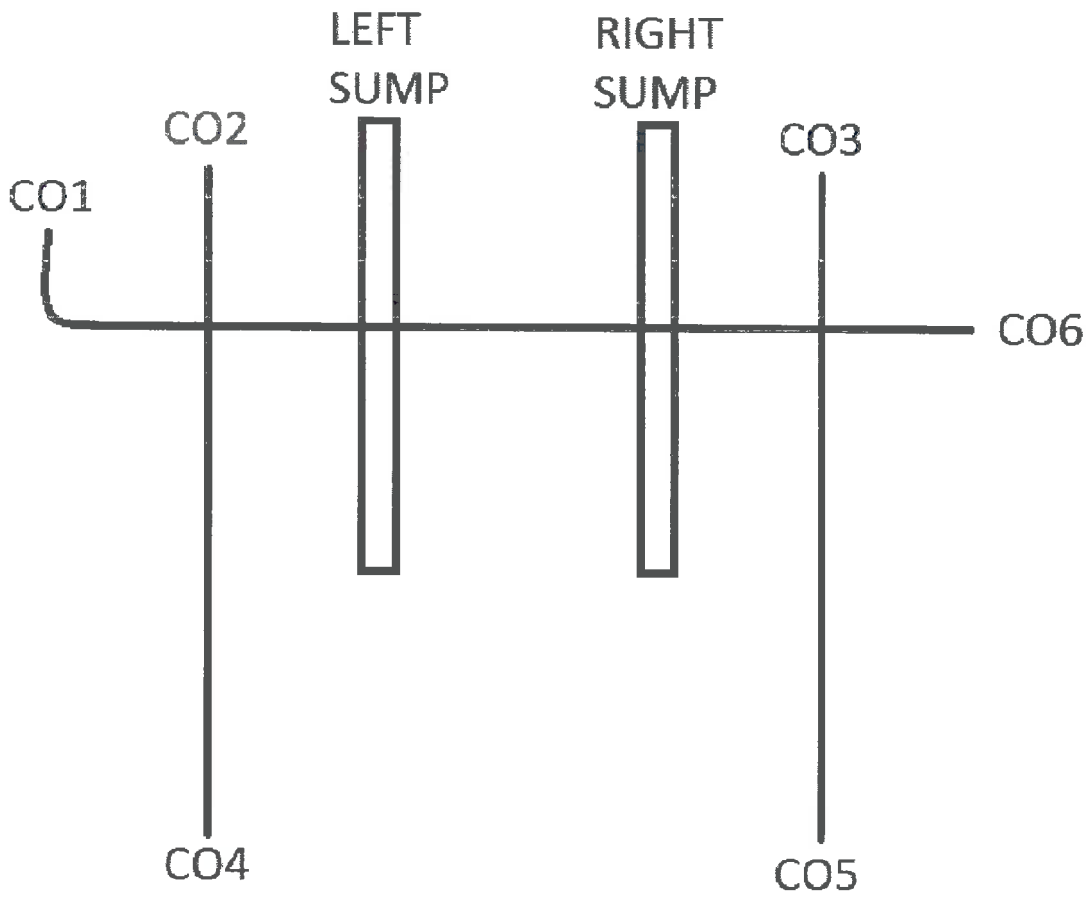
DAVIDSON COUNTY LANDFILL
PHASE 2 - AREA 2 - CELL 1
(2014 JT RUSSELL AND SONS)
(NOT DRAWN TO SCALE)



CCTV Surveys List for JT RUSSELL

Number of surveys in this list is 8 as of Thursday, April 17, 2014 Unit of measure: ft

Setup	Date	Street	Start MH	Finish MH	Dir	Size inch	Pre Clean	Vid Cassette	Scheduled Length	Surveyed Length
1	4/17/2014	DAVIDSON COUNTY LANDFILL	CO 1	CO 1A	U	6	N	1		130.5
2	4/17/2014	DAVIDSON COUNTY LANDFILL	CO 2	CO 2A	U	6	N	1		379.0
3	4/17/2014	DAVIDSON COUNTY LANDFILL	CO 3	CO 3A	U	6	N	1		341.3
4	4/17/2014	DAVIDSON COUNTY LANDFILL	CO 4	CO 4A	D	6	N	1		303.0
5	4/17/2014	DAVIDSON COUNTY LANDFILL	CO 5	CO 5A	D	6	N	1		277.2
6	4/17/2014	DAVIDSON COUNTY LANDFILL	CO 6	CO 6A	D	6	N	1		206.9
7	4/17/2014	DAVIDSON COUNTY LANDFILL	SUMP LEFT	SUMP LEFTA	D	18	N	1		87.1
8	4/17/2014	DAVIDSON COUNTY LANDFILL	SUMP RIGHT	SUMP RIGHTA	D	18	N	1		87.7

Total Scheduled Length 0.0

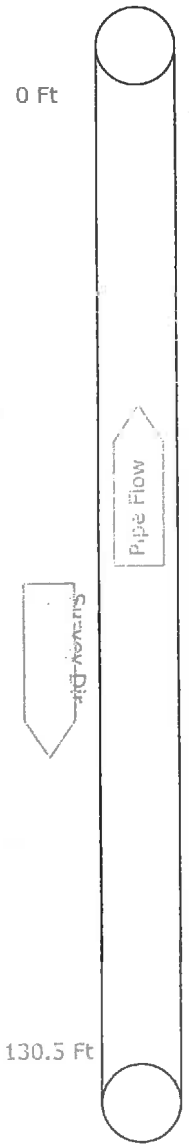
Total Length Surveyed 1,812.7

Pipe Graphic Report of PLR CO 1A X for JT RUSSELL

Work Order		**Contract**		**Video** 1	**Setup** 1
Facility		**Operator** DAVID		**Van Ref** NC-2	**Surveyed On** 04/17/2014
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From** CO 1	**Depth** ft
Shape	Circular	**Size** 6 **by**	ins	**To** CO 1A	**Depth** ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Upstream	
Lining		**Year laid** 2014		**Pre-clean** N **Last cleaned**	

General note	Structural Service Constructional
Location note	Hydralic



0.0 Ft Manhole/Node [CO 1]
Water level 0

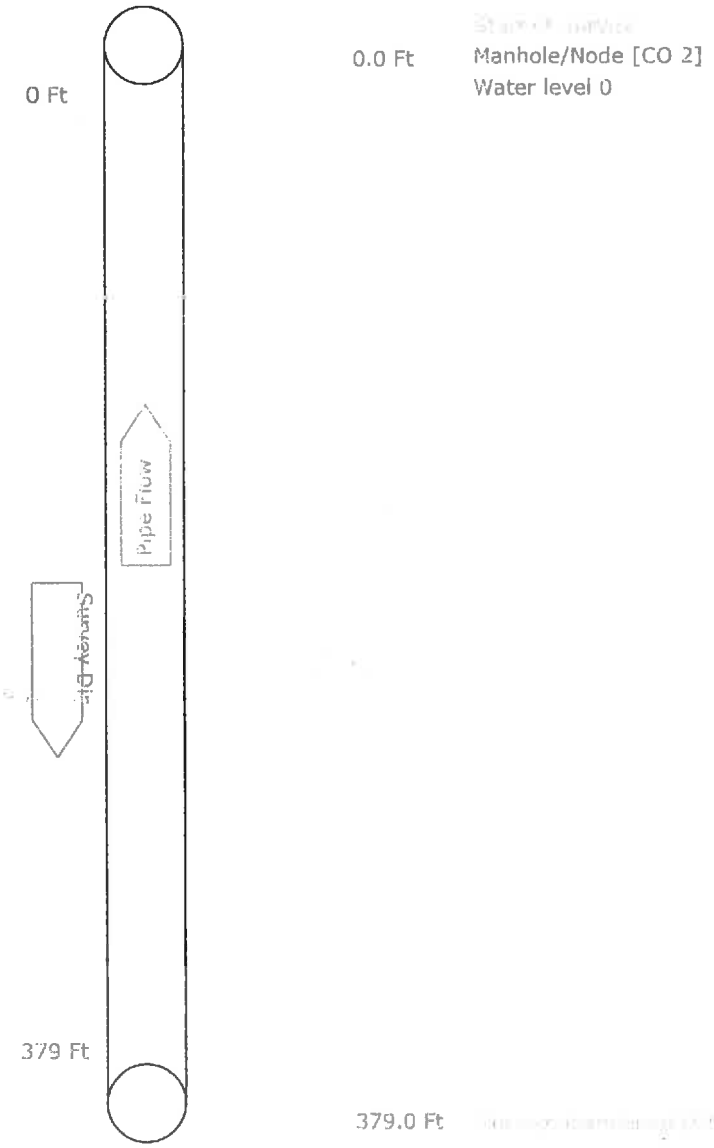
130.5 Ft

Pipe Graphic Report of PLR CO 2A X **for** JT RUSSELL

Work Order		**Contract**		**Video** 1	**Setup** 2
Facility		**Operator** DAVID	**Van Ref** NC-2	**Surveyed On**	04/17/2014
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From** CO 2	**Depth** Ft
Shape	Circular	**Size** 6 **by**	ins	**To** CO 2A	**Depth** Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Upstream	
Lining		**Year laid** 2014		**Pre-clean** N	**Last cleaned**

General note	Structural	Service	Constructional
Location note		Hydralic	

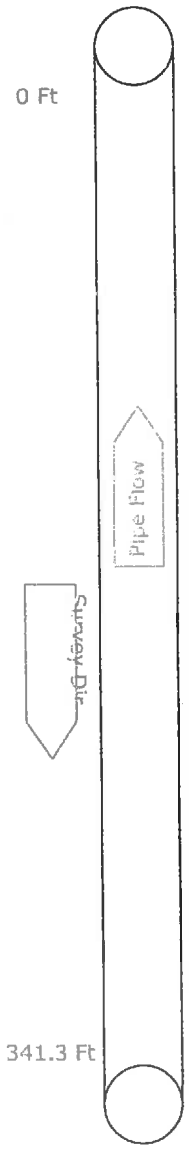


Pipe Graphic Report of PLR CO 3A X **for** JT RUSSELL

Work Order		**Contract**	**Video**	1	**Setup** 3
Facility		**Operator** DAVID	**Van Ref**	NC-2	**Surveyed On** 04/17/2014
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From** CO 3	**Depth** Ft
Shape	Circular	**Size** 6 **by**	ins	**To** CO 3A	**Depth** Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Upstream	
Lining		**Year laid** 2014		**Pre-clean** N **Last cleaned**	

General note	Structural Service Constructional
Location note	Hydralic



0.0 Ft Manhole/Node [CO 3]
Water level 0

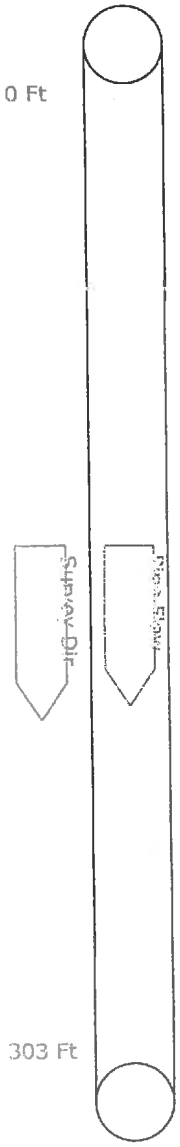
341.3 Ft

Pipe Graphic Report of PLR CO 4 X for JT RUSSELL

Work Order		**Contract**		**Video** 1	**Setup** 4
Facility		**Operator** DAVID		**Van Ref** NC-2	**Surveyed On** 04/17/2014
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From** CO 4	**Depth** Ft
Shape	Circular	**Size** 6 **by**	ins	**To** CO 4A	**Depth** Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Downstream	
Lining		**Year laid** 2014		**Pre-clean** N **Last cleaned**	

General note	Structural Service Constructional
Location note	Hydralic



0.0 Ft Manhole/Node [CO 4]
Water level 0

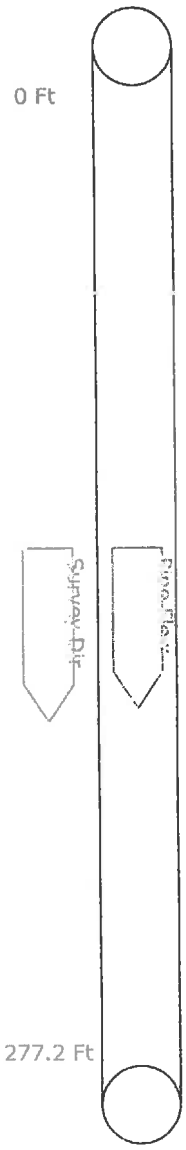
303.0 Ft

Pipe Graphic Report of PLR CO 5 X for JT RUSSELL

Work Order		**Contract**		**Video** 1	**Setup** 5
Facility		**Operator** DAVID	**Van Ref** NC-2	**Surveyed On** 04/17/2014	
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From** CO 5	**Depth** Ft
Shape	Circular	**Size** 6	**by** ins	**To** CO 5A	**Depth** Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Downstream	
Lining		**Year laid** 2014		**Pre-clean** N	**Last cleaned**

General note	Structural Service Constructional
Location note	Hydralic



0 Ft

0.0 Ft Manhole/Node [CO 5]
Water level 0

277.2 Ft

277.2 Ft

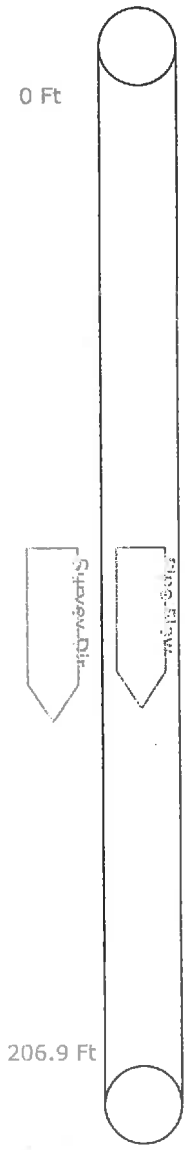
Pipe Graphic Report of PLR CO 6 X **for** JT RUSSELL

Work Order		**Contract**	**Video** 1	**Setup**	6
Facility		**Operator** DAVID	**Van Ref** NC-2	**Surveyed On**	04/17/2014

Street Name	DAVIDSON COUNTY LANDFILL	**City**	
Location type	Near environmentally sensitive area		
Surface			
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry

Pipe Use	Foul Water	**Schedule length**	Ft	**From** CO 6	**Depth** Ft
Shape	Circular	**Size** 6 **by**	ins	**To** CO 6A	**Depth** Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Downstream	
Lining		**Year laid** 2014		**Pre-clean** N	**Last cleaned**

General note		Structural	Service	Constructional
Location note			Hydralic



0.0 Ft Manhole/Node [CO 6]
Water level 0

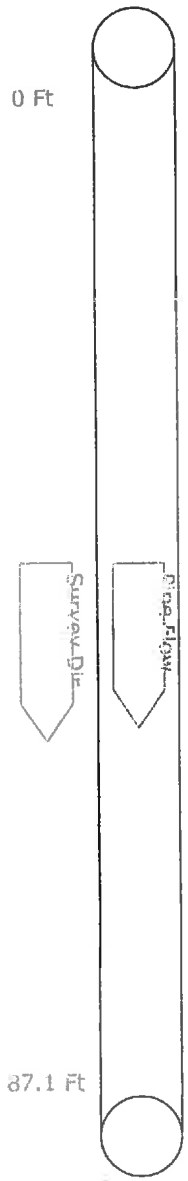
206.9 Ft

Pipe Graphic Report of PLR SUMP LEFT X **for** JT RUSSELL

Work Order		**Contract**	**Video**	1	**Setup** 7
Facility		**Operator** DAVID	**Van Ref**	NC-2	**Surveyed On** 04/17/2014
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From** SUMP LEFT	**Depth** Ft
Shape	Circular	**Size** 18 **by**	ins	**To** SUMP LEFTA	**Depth** Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction** Downstream	
Lining		**Year laid** 2014		**Pre-clean** N **Last cleaned**	

General note	Structural Service Constructional
Location note	Hydralic



0.0 Ft Manhole/Node [SUMP LEFT]
Water level 0

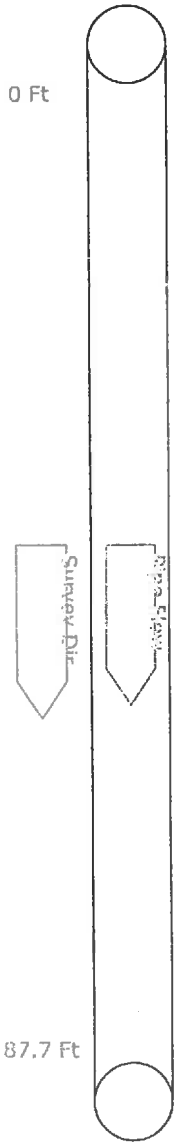
87.1 Ft

Pipe Graphic Report of PLR SUMP RIGHT X for JT RUSSELL

Work Order		**Contract**	**Video**	1	**Setup** 8
Facility		**Operator** DAVID	**Van Ref**	NC-2	**Surveyed On** 04/17/2014
Street Name	DAVIDSON COUNTY LANDFILL	**City**			
Location type	Near environmentally sensitive area				
Surface					
Survey purpose	Pre-acceptance - normally new sewers for adoption or pri	**Weather**	Dry		

Pipe Use	Foul Water	**Schedule length**	Ft	**From**	SUMP RIGHT	**Depth**	Ft
Shape	Circular	**Size** 18	**by** ins	**To**	SUMP RIGHTA	**Depth**	Ft
Material	Polyethylene - High density	**Joint spacing**	Ft	**Direction**	Downstream		
Lining		**Year laid**	2014	**Pre-clean**	N	**Last cleaned**	

General note	Structural	Service	Constructional
Location note		Hydralic	



0.0 Ft Manhole/Node [SUMP RIGHT]
Water level 0

87.7 Ft

SMITH+GARDNER

System Identification: **Area 2 Sideriser Pumps**

Project:	Davidson County MSW Landfill Phase 2 - Area 2 - Cell 1 Thomasville, North Carolina
Owner: PRESENT? (Y/N)	Davidson County Integrated Solid Waste Management Depart. ATTN: Charlie Brushwood 1242 Old U.S. Highway 29 Thomasville, North Carolina
General Contractor: PRESENT? (Y/N)	J.T. Russell & Sons, Inc. ATTN: Nathan Russell 1721 U.S. Highway 52 North Albemarle, NC 28001

SYSTEM STARTUP (PASS/FAIL):	Pass

Electrical Contractor: PRESENT? (Y/**N**)	TEC Industrial, LLC ATTN: Mac Taylor Spencer, VA 24165
Manufacturer: PRESENT? (**Y**/N)	GunnCo Pump & Control, Inc. ATTN: Andre Steyn/Clint - Technician 125-E Enterprise Drive Cumming, GA 30040

Reference(s): *(Details, Shop Drawings, Manufacturer's Literature)*

Submittal No. 17 - Sideslope Riser Leahcate Pumps and Controls, Dated 1/8/14, Approved 1/8/14

Pump Information:

Model No.	GunnCo Sideslope P2K60.7				Quantity:	2			
Rated Capacity:	50	GPM	@	150	FT	211	GPM	@	0 FT
Rated HP:	5		Voltage:	480		Phase:	3		

Note: 2.31 FT = 1 PSI

Test Information:

#1 - Test Capacity:	61	GPM	@	48	PSI	92	GPM	@	67 PSI	Both Pumps On
		AMPS	@		VOLTS		AMPS	@	VOLTS	
#2 - Test Capacity:	62	GPM	@	47	PSI		GPM	@	PSI	
		AMPS	@		VOLTS		AMPS	@	VOLTS	

Certified Pump Curve Fit: Yes (Y/N; Does actual meet rated capacity?)

Operating Cycle:					
P1 ON:	18 INCHES	OFF:	12 INCHES (Above Sensor)
P2 ON:	24	OFF:	12
High Level ON:	36	OFF:	34.5

System Operations (Check):

Valves:	✔	HOA Switch:	✔	Flow Meter:	✔	Surge Protector:	✔
Gauges:	✔	Run Lights:	✔	Phase Monitor:	✔	Enclosure:	✔
O&M Manuals:	✔	Hour Meter:	✔	Alarms:	✔	Inner Door:	✔
Warranty:	To Be Provided	As-Builts:	✔	Level Controls:	✔	Leak Test(s):	N/A

Comments:

Level in sump at start-up (55.6 inches - Pump #1; 55.1 inches - Pump # 2)

CQA Engineer Approval:

By:		**By:**	**Pieter K. Scheer, P.E.**
Title:		**Title:**	**Project Manager**
Date:		**Date:**	**April 22, 2014**

Distribution:

X	Owner	X	Contractor		Field	X	File	X	Regulatory Agency

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Appendix M

Geotextile CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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SKAPS Industries (Nonwoven Division)
335, Athena Drive
Athens, GA 30601 (U.S.A.)
Phone (706) 354-3700 Fax (706) 354-3737
E-mail: info@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

November 12, 2013
Chesapeake Containment Systems, Inc.
352 Earls Road
Middle River, MD 21220
Ref : JT Russel and Sons Inc
PO : 13-154

Dear Sir/Madam:

This is to certify that SKAPS GE160 is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GE160 resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GE160 conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Weight	ASTM D 5261	oz/sy (g/m^2)	6.00 (203)
Thickness*	ASTM D 5199	mils (mm)	85 (2.16)
Grab Tensile	ASTM D 4632	lbs (kN)	160 (0.71)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	65 (0.29)
Puncture Resistance	ASTM D 4833	lbs (kN)	95 (0.42)
Mullen Burst Strength	ASTM D 3786	psi (kPa)	330 (2275)
Permittivity*	ASTM D 4491	sec^{-1}	1.63
Permeability*	ASTM D 4491	cm/sec	0.48
Water Flow*	ASTM D 4491	gpm/ft^2(l/min/m^2)	125 (5093)
AOS*	ASTM D 4751	US Sieve (mm)	70 (0.21)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:

* At the time of manufacturing. Handling may change these properties.

PALAK PATEL
QUALITY CONTROL MANAGER

Product : GE160-180

ROLL #	WEIGHT	THICKNESS	MD TENSILE	MD ELONG	XMD TENSILE	XMD ELONG	MD TRAP	XMD TRAP	PUNCTURE	MULLEN	AOS	WATER FLOW	PERMEABILITY	PERMITTIVITY
ASTM METHOD	D5261	D5199	D4632	D4632	D4632	D4632	D4533	D4533	D4833	D3786	D4751	D4491	D4491	D4491
UNITS	oz/sq yd	(mils)	lbs.	%	lbs	%	lbs.	lbs	lbs.	psi	US Sieve	gpm/ft^2	cm/sec	sec^{-1}
TARGET	6.00	85	160	50	160	50	65	65	95	330	70	125	0.48	1.63
319371.01	6.56	111	166	72	177	85	78	85	99	336	70	134	0.50	1.79
319371.02	6.56	111	166	72	177	85	78	85	99	336	70	134	0.50	1.79
319371.03	6.56	111	166	72	177	85	78	85	99	336	70	134	0.50	1.79
319371.04	6.56	111	166	72	177	85	78	85	99	336	70	134	0.50	1.79
319371.05	6.29	109	161	68	173	79	78	85	99	336	70	134	0.50	1.79
319371.06	6.29	109	161	68	173	79	78	85	99	336	70	134	0.50	1.79
319371.07	6.29	109	161	68	173	79	78	85	99	336	70	134	0.50	1.79
319371.08	6.29	109	161	68	173	79	78	85	99	336	70	134	0.50	1.79
319371.09	6.29	109	161	68	173	79	78	85	99	336	70	134	0.50	1.79
319371.10	6.42	112	169	75	180	81	73	81	96	331	70	134	0.50	1.79
319371.11	6.42	112	169	75	180	81	73	81	96	331	70	134	0.50	1.79
319371.12	6.42	112	169	75	180	81	73	81	96	331	70	134	0.50	1.79

* All value are MARV.

SKAPS Industries (Nonwoven Division)
335, Athena Drive
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Phone (706) 354-3700 Fax (706) 354-3737
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Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

November 12, 2013
Chesapeake Containment Systems, Inc.
352 Earls Road
Middle River, MD 21220
Ref : JT Russel and Sons Inc
PO : 13-154

Dear Sir/Madam:

This is to certify that SKAPS GE112 is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GE112 resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GE112 conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Weight	ASTM D 5261	oz/sy (g/m^2)	12.00 (407)
Thickness*	ASTM D 5199	mils (mm)	120 (3.05)
Grab Tensile	ASTM D 4632	lbs (kN)	330 (1.47)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	125 (0.56)
Puncture Resistance	ASTM D 4833	lbs (kN)	190 (0.85)
Mullen Burst Strength	ASTM D 3786	psi (kPa)	625 (4309)
Permittivity*	ASTM D 4491	sec^{-1}	0.90
Permeability*	ASTM D 4491	cm/sec	0.30
Water Flow*	ASTM D 4491	gpm/ft^2(l/min/m^2)	70 (2852)
AOS*	ASTM D 4751	US Sieve (mm)	100 (0.15)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

PALAK PATEL
QUALITY CONTROL MANAGER

Product : GE112-180

ROLL #	WEIGHT	THICKNESS	MD TENSILE	MD ELONG	XMD TENSILE	XMD ELONG	MD TRAP	XMD TRAP	PUNCTURE	MULLEN	AOS	WATER FLOW	PERMEABILITY	PERMITTIVITY
ASTM METHOD	D5261	D5199	D4632	D4632	D4632	D4632	D4533	D4533	D4833	D3786	D4751	D4491	D4491	D4491
UNITS	oz/sq yd	(mils)	lbs.	%	lbs	%	lbs.	lbs	lbs.	psi	US Sieve	gpm/ft^2	cm/sec	sec^{-1}
TARGET	12.00	120	330	50	330	50	125	125	190	625	100	70	0.30	0.90
31937.01	12.48	131	343	77	358	90	137	152	200	631	100	73	0.33	0.98
31937.02	12.48	131	343	77	358	90	137	152	200	631	100	73	0.33	0.98
31937.03	12.48	131	343	77	358	90	137	152	200	631	100	73	0.33	0.98
31937.04	12.48	131	343	77	358	90	137	152	200	631	100	73	0.33	0.98
31937.05	12.24	124	336	75	354	84	137	152	200	631	100	73	0.33	0.98
31937.06	12.24	124	336	75	354	84	137	152	200	631	100	73	0.33	0.98
31937.07	12.24	124	336	75	354	84	137	152	200	631	100	73	0.33	0.98
31937.08	12.24	124	336	75	354	84	137	152	200	631	100	73	0.33	0.98
31937.09	12.24	124	336	75	354	84	137	152	200	631	100	73	0.33	0.98
31937.10	12.66	135	345	80	363	86	131	146	194	626	100	73	0.33	0.98
31937.11	12.66	135	345	80	363	86	131	146	194	626	100	73	0.33	0.98
31937.12	12.66	135	345	80	363	86	131	146	194	626	100	73	0.33	0.98
31937.13	12.66	135	345	80	363	86	131	146	194	626	100	73	0.33	0.98
31937.14	12.66	135	345	80	363	86	131	146	194	626	100	73	0.33	0.98
31937.15	12.37	120	339	71	350	80	131	146	194	626	100	73	0.33	0.98
31937.16	12.37	120	339	71	350	80	131	146	194	626	100	73	0.33	0.98
31937.17	12.37	120	339	71	350	80	131	146	194	626	100	73	0.33	0.98
31937.18	12.37	120	339	71	350	80	131	146	194	626	100	73	0.33	0.98
31937.19	12.37	120	339	71	350	80	131	146	194	626	100	73	0.33	0.98
31937.20	12.53	128	341	76	360	89	140	155	197	634	100	73	0.33	0.98
31937.21	12.53	128	341	76	360	89	140	155	197	634	100	73	0.33	0.98
31937.22	12.53	128	341	76	360	89	140	155	197	634	100	73	0.33	0.98
31937.23	12.53	128	341	76	360	89	140	155	197	634	100	73	0.33	0.98
31937.24	12.53	128	341	76	360	89	140	155	197	634	100	73	0.33	0.98
31937.25	12.21	125	337	74	356	83	140	155	197	634	100	73	0.33	0.98
31937.26	12.21	125	337	74	356	83	140	155	197	634	100	73	0.33	0.98
31937.27	12.21	125	337	74	356	83	140	155	197	634	100	73	0.33	0.98

*All values are MARV.

Product : GE112-180

ROLL #	WEIGHT	THICKNESS	MD TENSILE	MD ELONG	XMD TENSILE	XMD ELONG	MD TRAP	XMD TRAP	PUNCTURE	MULLEN	AOS	WATER FLOW	PERMEABILITY	PERMITTIVITY
ASTM METHOD	D5261	D5199	D4632	D4632	D4632	D4632	D4533	D4533	D4833	D3786	D4751	D4491	D4491	D4491
UNITS	oz/sq yd	(mils)	lbs.	%	lbs	%	lbs.	lbs	lbs.	psi	US Sieve	gpm/ft^2	cm/sec	sec^{-1}
TARGET	12.00	120	330	50	330	50	125	125	190	625	100	70	0.30	0.90
31937.28	12.21	125	337	74	356	83	140	155	197	634	100	73	0.33	0.98
31937.29	12.21	125	337	74	356	83	140	155	197	634	100	73	0.33	0.98
31937.30	12.68	132	344	79	365	87	134	149	190	629	100	73	0.33	0.98
31937.31	12.68	132	344	79	365	87	134	149	190	629	100	73	0.33	0.98
31937.32	12.68	132	344	79	365	87	134	149	190	629	100	73	0.33	0.98
31937.33	12.68	132	344	79	365	87	134	149	190	629	100	73	0.33	0.98
31937.34	12.68	132	344	79	365	87	134	149	190	629	100	73	0.33	0.98
31937.35	12.29	121	335	70	352	81	134	149	190	629	100	73	0.33	0.98
31937.36	12.29	121	335	70	352	81	134	149	190	629	100	73	0.33	0.98
31937.37	12.29	121	335	70	352	81	134	149	190	629	100	73	0.33	0.98
31937.38	12.29	121	335	70	352	81	134	149	190	629	100	73	0.33	0.98
31937.39	12.29	121	335	70	352	81	134	149	190	629	100	73	0.33	0.98
31937.40	12.47	130	340	75	361	85	136	151	199	632	100	73	0.33	0.98
31937.41	12.47	130	340	75	361	85	136	151	199	632	100	73	0.33	0.98
31937.42	12.47	130	340	75	361	85	136	151	199	632	100	73	0.33	0.98
31937.43	12.47	130	340	75	361	85	136	151	199	632	100	73	0.33	0.98

*All values are MARV.

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GEOSYNTHETICS INVENTORY LOG
TYPE GT-S GEOTEXTILE

Project Name: Davidson County Phase 2, Area 2 Construction
Project Number: DAVDCO-12-3
Contractor: JT Russel & Sons, Inc.
Storage Area:
Geosynthetics Installer: Chesapeake Containment
Inventory Monitor(s): D. Wright/J. Buda

Geosynthetic Material Type: Type GT-S Geotextile
Geosynthetic Product Identification: SKAPS GT160

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
319371.01	319371	900	15	Y		
319371.02	319371	900	15	Y	Y	
319371.03	319371	900	15	Y		
319371.04	319371	900	15	Y		
319371.05	319371	900	15	Y		
319371.06	319371	900	15	Y		
319371.07	319371	900	15	Y		
319371.08	319371	900	15	Y		
319371.09	319371	900	15	Y		
319371.10	319371	900	15	Y	Y	
319371.11	319371	900	15	Y		
319371.12	319371	900	15	Y		

Totals:

Total Rolls: 12
Total Lots: 1
Total SF: 162,000

GEOSYNTHETICS INVENTORY LOG
TYPE GT-C GEOTEXTILE

Project Name: Davidson County Phase 2, Area 2 Construction
Project Number: DAVDCO-12-3
Contractor: JT Russel & Sons, Inc. Storage Area:
Geosynthetics Installer: Chesapeake Containment Inventory Monitor(s): D. Wright/J. Buda

Geosynthetic Material Type: Type GT-C Geotextile
Geosynthetic Product Identification: SKAPS GE112

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
31937.01	31937	480	15	Y		
31937.02	31937	480	15	Y		
31937.03	31937	480	15	Y	Y	
31937.04	31937	480	15	Y		
31937.05	31937	480	15	Y		
31937.06	31937	480	15	Y		
31937.07	31937	480	15	Y		
31937.08	31937	480	15	Y		
31937.09	31937	480	15	Y		
31937.10	31937	480	15	Y		
31937.11	31937	480	15	Y		
31937.12	31937	480	15	Y		
31937.13	31937	480	15	Y		
31937.14	31937	480	15	Y		
31937.15	31937	480	15	Y		
31937.16	31937	480	15	Y		
31937.17	31937	480	15	Y		
31937.18	31937	480	15	Y	Y	
31937.19	31937	480	15	Y		
31937.20	31937	480	15	Y		
31937.21	31937	480	15	Y		
31937.22	31937	480	15	Y		
31937.23	31937	480	15	Y		
31937.24	31937	480	15	Y		
31937.25	31937	480	15	Y		
31937.26	31937	480	15	Y		
31937.27	31937	480	15	Y		
31937.28	31937	480	15	Y		
31937.29	31937	480	15	Y		
31937.30	31937	480	15	Y		
31937.31	31937	480	15	Y		
31937.32	31937	480	15	Y		
31937.33	31937	480	15	Y		
31937.34	31937	480	15	Y		

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
31937.35	31937	480	15	Y	Y	
31937.36	31937	480	15	Y		
31937.37	31937	480	15	Y		
31937.38	31937	480	15	Y		
31937.39	31937	480	15	Y		
31937.40	31937	480	15	Y		
31937.41	31937	480	15	Y		
31937.42	31937	480	15	Y		
31937.43	31937	480	15	Y	Y	

Totals:

Total Rolls:	43
Total Lots:	1
Total SF:	309,600

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-01
MATERIAL: SKAPS GE-160 NONWOVEN GEOTEXTILE
ROLL NO: 319371.02

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
GRAB STRENGTH	D 4632	MD-lbs	207.7	187.3	196.4	214.5	190.1	200.1	192.7	186.8	213.0	184.7	**197.3**	**10.49**
		CD-lbs	228.0	225.2	228.0	220.6	231.7	255.7	232.2	262.0	218.6	221.7	**232.4**	**14.74**
GRAB ELONGATION	D 4632	MD-%	93.3	96.7	100.0	93.3	90.0	96.7	93.3	90.0	93.3	90.0	**93.7**	**3.14**
		CD-%	130.0	136.7	130.0	126.7	130.0	130.0	126.7	136.7	126.7	130.0	**130.3**	**3.48**
TRAPEZOIDAL TEAR	D 4533	MD-lbs	102.7	98.6	82.7	117.9	103.9	97.4	94.6	124.9	103.6	102.2	**102.9**	**11.12**
		CD-lbs	138.9	100.9	129.0	122.0	134.6	138.7	156.6	147.0	150.1	154.7	**137.3**	**16.04**
CBR PUNCTURE	D 6241	lbs	510.0	575.0	562.0	501.0	522.0	537.0	528.0	533.0	531.0	525.0	**532.4**	**20.94**
A.O.S.	D 4751	mm	0.207	0.187	0.206	0.177	0.186						**0.193**	
								AVERAGE AOS, US STD.SIEVE SIZE =					**#70**	

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APPARENT OPENING SIZE
ASTM D 4751

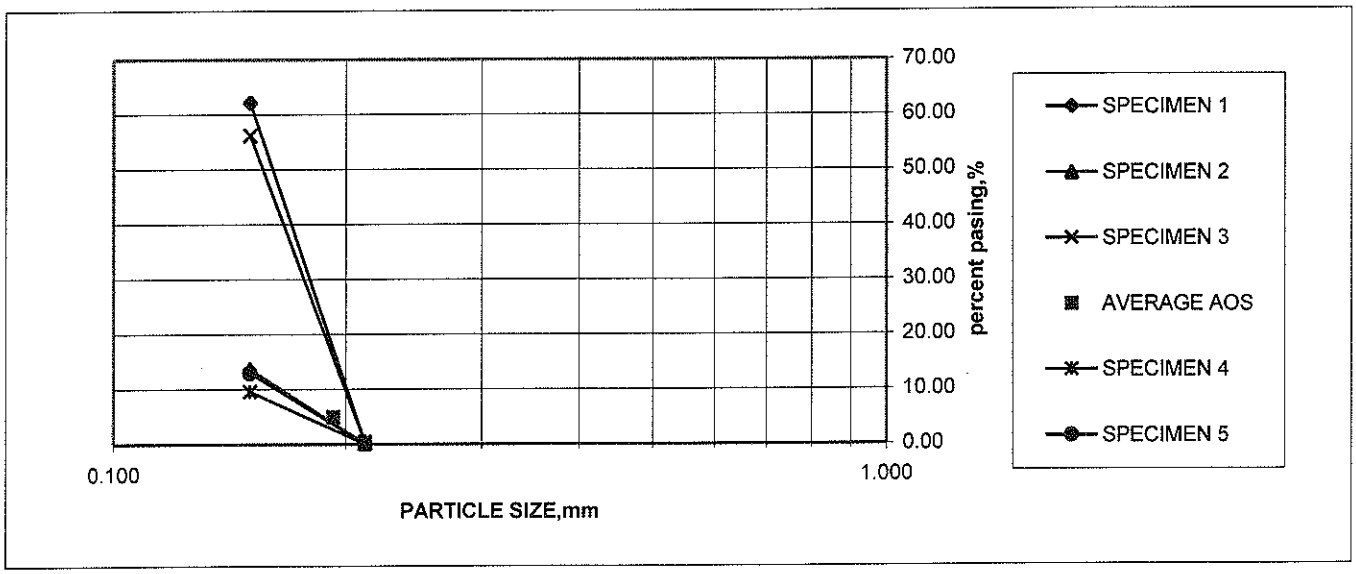
geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
MATERIAL: SKAPS GE-160 NONWOVEN GEOTEXTILE

PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-01
ROLL NO: 319371.02

US STD. SIEVE SIZE	SIEVE OPENING (mm)	WT. FRAME & GEOTEXTILE & BEADS (gm)	WT. FRAME & GEOTEXTILE (gm)	WT. BEADS (gm)	WT. PAN & BEADS (gm)	WT. PAN (gm)	WT. BEADS PASSING (gm)	PERCENT PASSING (%)	AOS @ 5% PASSING (mm)
SPECIMEN 1									
#100	0.150	1157.94	1107.94	50.00	414.40	383.32	31.08	62.16	
#70	0.212	1158.08	1108.08	50.00	383.52	383.32	0.20	0.40	**0.207**
SPECIMEN 2									
#100	0.150	816.44	766.44	50.00	538.34	531.51	6.83	13.66	
#70	0.212	816.60	766.60	50.00	531.56	531.51	0.05	0.10	**0.187**
SPECIMEN 3									
#100	0.150	822.06	772.06	50.00	555.05	526.95	28.10	56.20	
#70	0.212	822.20	772.20	50.00	527.19	526.95	0.24	0.48	**0.206**
SPECIMEN 4									
#100	0.150	811.74	761.74	50.00	529.90	525.10	4.80	9.60	
#70	0.212	812.08	762.08	50.00	525.13	525.10	0.03	0.06	**0.177**
SPECIMEN 5									
#100	0.150	820.46	770.46	50.00	533.42	526.93	6.49	12.98	
#70	0.212	820.92	770.92	50.00	527.00	526.93	0.07	0.14	**0.186**

AVERAGE AOS @ 5% PASSING, mm 0.193
AVERAGE AOS, US STD. SIEVE SIZE **#70**



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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-02
MATERIAL: SKAPS GE-160 NONWOVEN GEOTEXTILE
ROLL NO: 319371.10

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
GRAB STRENGTH	D 4632	MD-lbs	183.7	189.3	223.0	199.6	221.9	218.4	226.2	217.3	195.4	212.4	**208.7**	**14.59**
		CD-lbs	210.9	192.6	250.7	255.2	203.4	239.6	263.2	218.7	225.0	180.1	**223.9**	**27.90**
GRAB ELONGATION	D 4632	MD-%	96.7	103.3	100.0	106.7	103.3	106.7	110.0	100.0	96.7	96.7	**102.0**	**4.52**
		CD-%	140.0	126.7	130.0	130.0	120.0	123.3	133.3	126.7	130.0	120.0	**128.0**	**5.81**
TRAPEZOIDAL TEAR	D 4533	MD-lbs	105.1	134.4	111.7	106.6	126.0	114.8	102.2	110.9	125.2	99.6	**113.7**	**10.87**
		CD-lbs	112.6	118.0	136.6	150.9	112.8	141.9	118.9	146.6	149.1	107.9	**129.5**	**16.17**
CBR PUNCTURE	D 6241	lbs	557.0	519.0	593.0	622.0	571.0	589.0	625.0	641.0	531.0	553.0	**580.1**	**39.01**
A.O.S.	D 4751	mm	0.205	0.200	0.185	0.197	0.195						**0.197**	
								AVERAGE AOS, US STD.SIEVE SIZE =					**#70**	

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APPARENT OPENING SIZE
ASTM D 4751

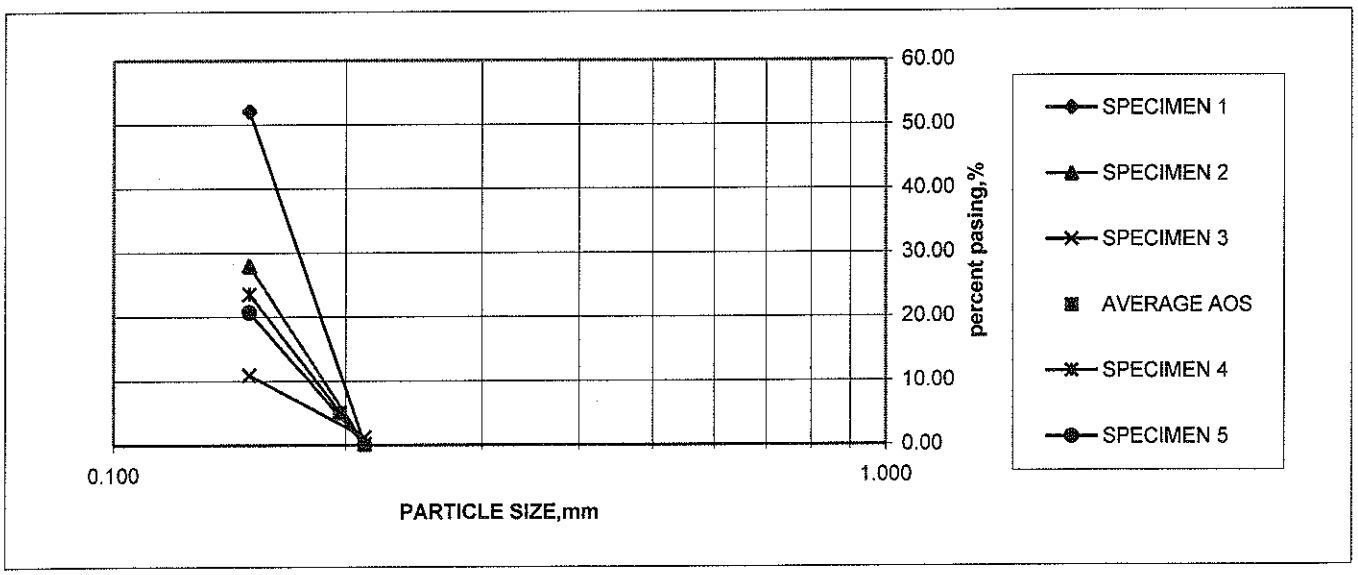
geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
MATERIAL: SKAPS GE-160 NONWOVEN GEOTEXTILE

PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-02
ROLL NO: 319371.10

US STD. SIEVE SIZE	SIEVE OPENING (mm)	WT. FRAME & GEOTEXTILE & BEADS (gm)	WT. FRAME & GEOTEXTILE (gm)	WT. BEADS (gm)	WT. PAN & BEADS (gm)	WT. PAN (gm)	WT. BEADS PASSING (gm)	PERCENT PASSING (%)	AOS @ 5% PASSING (mm)
SPECIMEN 1									
#100	0.150	1158.10	1108.10	50.00	409.35	383.32	26.03	52.06	
#70	0.212	1158.60	1108.60	50.00	383.45	383.32	0.13	0.26	
									0.205
SPECIMEN 2									
#100	0.150	816.24	766.24	50.00	545.53	531.51	14.02	28.04	
#70	0.212	816.60	766.60	50.00	531.58	531.51	0.07	0.14	
									0.200
SPECIMEN 3									
#100	0.150	823.50	773.50	50.00	532.41	526.95	5.46	10.92	
#70	0.212	823.92	773.92	50.00	527.55	526.95	0.60	1.20	
									0.185
SPECIMEN 4									
#100	0.150	810.68	760.68	50.00	536.89	525.10	11.79	23.58	
#70	0.212	810.86	760.86	50.00	525.18	525.10	0.08	0.16	
									0.197
SPECIMEN 5									
#100	0.150	820.44	770.44	50.00	537.27	526.93	10.34	20.68	
#70	0.212	820.90	770.90	50.00	526.96	526.93	0.03	0.06	
									0.195

AVERAGE AOS @ 5% PASSING, mm 0.197
AVERAGE AOS, US STD. SIEVE SIZE **#70**



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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-03
MATERIAL: SKAPS GE-112 NONWOVEN GEOTEXTILE
ROLL NO: 31937.03

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
MASS/UNIT AREA	D 5261	oz/sy	11.73	13.74	13.30	13.17	13.63	12.52	12.66	12.07	11.77	11.60	**12.62**	**0.769**
GRAB STRENGTH	D 4632	MD-lbs	304.0	323.2	338.0	297.2	328.9	359.1	359.0	383.0	387.1	320.7	**340.0**	**29.50**
		CD-lbs	407.0	404.2	448.2	494.2	495.2	459.2	460.3	394.2	399.2	329.6	**429.1**	**48.96**
GRAB ELONGATION	D 4632	MD-%	100.0	100.0	103.3	96.7	106.7	103.3	103.3	106.7	110.0	113.3	**104.3**	**4.73**
		CD-%	126.7	130.0	123.3	126.7	123.3	126.7	130.0	136.7	130.0	126.7	**128.0**	**3.71**
TRAPEZOIDAL TEAR	D 4533	MD-lbs	187.4	192.7	194.4	212.2	161.9	189.1	169.2	174.2	186.9	145.9	**181.4**	**17.92**
		CD-lbs	252.0	253.3	275.2	281.9	269.1	230.8	241.1	254.7	250.1	224.9	**253.3**	**17.39**
CBR PUNCTURE	D 6241	lbs	913.0	1104.0	965.0	834.0	958.0	1029.0	1036.0	1055.0	1103.0	1075.0	**1007.2**	**83.55**

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-04
MATERIAL: SKAPS GE-112 NONWOVEN GEOTEXTILE
ROLL NO: 31937.18

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
MASS/UNIT AREA	D 5261	oz/sy	11.77	12.17	12.37	12.97	12.34	12.00	11.47	12.12	11.82	13.26	**12.23**	**0.516**
GRAB STRENGTH	D 4632	MD-lbs	310.6	341.7	348.9	314.0	310.7	298.9	323.4	344.2	318.7	341.9	**325.3**	**16.61**
		CD-lbs	337.2	443.2	447.6	456.2	464.2	403.2	426.0	399.1	473.2	360.9	**421.1**	**43.00**
GRAB ELONGATION	D 4632	MD-%	116.7	96.7	93.3	96.7	96.7	100.0	96.7	96.7	96.7	100.0	**99.0**	**6.16**
		CD-%	126.7	130.0	133.3	126.7	123.3	123.3	120.0	123.3	130.0	120.0	**125.7**	**4.23**
TRAPEZOIDAL TEAR	D 4533	MD-lbs	190.0	194.8	169.0	194.0	191.6	174.9	192.0	188.8	173.4	171.6	**184.0**	**9.86**
		CD-lbs	197.6	252.2	213.3	217.7	222.2	271.1	253.3	272.0	217.1	207.4	**232.4**	**25.79**
CBR PUNCTURE	D 6241	lbs	902.0	935.0	1003.0	967.0	1059.0	990.0	889.0	962.0	863.0	979.0	**954.9**	**55.81**

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-05
MATERIAL: SKAPS GE-112 NONWOVEN GEOTEXTILE
ROLL NO: 31937.35

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
MASS/UNIT AREA	D 5261	oz/sy	12.67	12.72	13.36	13.02	11.60	12.07	12.62	12.16	11.94	12.72	**12.49**	**0.505**
GRAB STRENGTH	D 4632	MD-lbs	270.6	342.2	381.6	355.2	304.7	322.6	361.2	315.6	309.2	343.2	**330.6**	**30.75**
		CD-lbs	396.1	392.2	429.2	441.1	448.2	495.0	466.0	449.2	419.6	399.9	**433.7**	**31.31**
GRAB ELONGATION	D 4632	MD-%	90.0	96.7	96.7	100.0	106.7	103.3	106.7	100.0	103.3	106.7	**101.0**	**5.17**
		CD-%	130.0	130.0	130.0	126.7	130.0	133.3	133.3	126.7	130.0	133.3	**130.3**	**2.33**
TRAPEZOIDAL TEAR	D 4533	MD-lbs	171.2	199.0	191.9	208.6	178.0	174.0	170.6	163.0	186.7	176.9	**182.0**	**13.53**
		CD-lbs	189.0	206.0	265.6	250.9	260.7	287.2	289.1	282.2	280.1	244.7	**255.6**	**32.54**
CBR PUNCTURE	D 6241	lbs	944.0	1202.0	1057.0	1126.0	1111.0	1152.0	1009.0	1054.0	1145.0	1250.0	**1105.0**	**86.47**

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-01
LAB ID NO.: L13139-01-06
MATERIAL: SKAPS GE-112 NONWOVEN GEOTEXTILE
ROLL NO: 31937.43

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
MASS/UNIT AREA	D 5261	oz/sy	11.30	12.74	12.74	12.47	12.44	10.20	12.80	13.66	13.16	13.39	**12.49**	**0.975**
GRAB STRENGTH	D 4632	MD-lbs	358.8	379.2	368.2	337.2	314.9	324.4	332.2	386.2	357.6	297.2	**345.6**	**27.55**
		CD-lbs	328.6	340.9	466.2	487.2	446.0	411.7	409.2	446.9	437.7	349.9	**412.4**	**52.44**
GRAB ELONGATION	D 4632	MD-%	100.0	106.7	100.0	96.7	103.3	100.0	100.0	103.3	96.7	93.3	**100.0**	**3.65**
		CD-%	116.7	120.0	126.7	130.0	130.0	126.7	130.0	123.3	130.0	130.0	**126.3**	**4.58**
TRAPEZOIDAL TEAR	D 4533	MD-lbs	184.0	185.7	190.4	182.4	168.2	187.3	160.1	150.6	187.6	161.3	**175.8**	**13.58**
		CD-lbs	192.8	237.3	194.9	212.5	207.4	250.0	244.0	213.6	177.2	227.7	**215.7**	**22.61**
CBR PUNCTURE	D 6241	lbs	1160.0	1172.0	1207.0	1149.0	995.0	1149.0	1105.0	1134.0	1119.0	1079.0	**1126.9**	**55.50**

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Appendix N

Drainage Geocomposite CQA Data

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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November 25, 2013
Chesapeake Containment Systems, Inc.
352 Earls Road
Middle River, MD, 21220

Ref. : Davidson County MSW Landfill, NC
Customer P.O. # 13-154
Product : TN 300-2-6

We certify that the TN 300-2-6 drainage geocomposite, meets the project requirements as stated in the specifications. The properties listed in this section are:

Property	Test Method	Unit	Required Value	Qualifier
Geonet[3]				
Thickness	ASTM D 5199	mil	250	Minimum
Carbon Black	ASTM D 4218	%	2.0 - 3.0	Range
Melt Flow	ASTM D 1238[2]	g/10 min	1.0	Maximum
Density	ASTM D 1505	g/cm^2	0.94	Minimum
Composite				
Ply Adhesion (Min)	ASTM D 7005	lb/in	1.0	MARV[5]
Ply Adhesion (Avg)	ASTM D 7005	lb/in	2.0	MARV
Transmissivity[1]	ASTM D 4716	m^2/sec	5.0×10^{-4}	MARV
Geotextile[3 & 4]				
Fabric Weight	ASTM D 5261	oz/yd^2	6.0	MARV
Grab Strength	ASTM D 4632	lbs	160	MARV
Grab Elongation	ASTM D 4632	%	50	MARV
CBR Puncture	ASTM D 6241	lbs	410	MARV
Permittivity	ASTM D 4491	sec^{-1}	1.00	MARV
AOS	ASTM D 4751	US Sieve	70	MaxARV
UV Resistance	ASTM D 4355	%/hrs	70/500	MARV

Notes:

1 Transmissivity measured using water at 21 $\pm$ 2 ^{o}C (70 $\pm$ 4 ^{o}F) with a gradient of 0.1 and a confining pressure of 15000 psf between soil and textured HDPE geomembrane after 100 hours.

2 Condition 190/2.16

3 Geotextile and Geonet properties are prior to lamination.

4 Geotextile data is provided by the supplier.

5 MARV is statistically defined as mean minus two standard deviations and it is the value which is exceeded by 97.5% of all the test data.

Sincerely,

Nilay Patel

Nilay Patel
QA Manager

APPROVED 5 QA

571 Industrial Parkway, Commerce, GA 30529 Ph : 706-336-7000 Fax : 706-336-7007 Email : info@skaps.com

Product : **TN 300-2-6**
Project : **Davidson County MSW Landfill, NC**

We, the Geocomposite Manufacturer, hereby certify the following for the material delivered to the above referenced project :

Roll	Geocomposite Roll Number	Geonet Roll Number	Geotextile Roll Number		Ply Adhesion (lb/in)		Geocomposite Transmissivity (m^2/sec)
			Side A	Side B	Minimum	Average	
1	56671010001	56671010001 - N	5667.002	5667.001	2.68	4.70	6.71×10^{-4}
2	56671010002	56671010002 - N	5667.002	5667.001			
3	56671010003	56671010003 - N	5667.002	5667.001			
4	56671010004	56671010004 - N	5667.002	5667.001			
5	56671010005	56671010005 - N	5667.002	5667.001			
6	56671010006	56671010006 - N	5667.002	5667.001			

571 Industrial Parkway, Commerce, GA 30529 Ph : 706-336-7000 Fax : 706-336-7007 Email : info@skaps.com

Product : **TN 300-2-6**
Project : **Davidson County MSW Landfill, NC**

We, the Geonet Manufacturer, hereby certify the following for the material sent to the above referenced project :

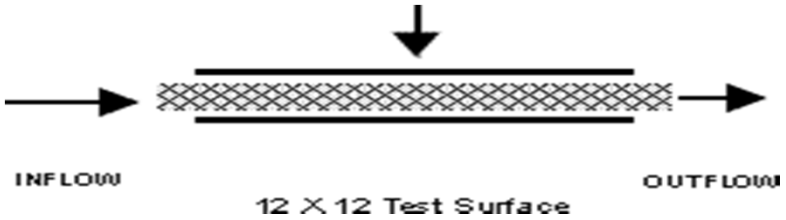
Geonet Roll Number	Resin Lot Number	Geonet Density (gm/cc)	Thickness (mils)	Carbon Black (%)	Transmissivity (m^2/sec)
56671010001 - N	SHPX 463738	0.9546	296	2.63	
56671010002 - N	SHPX 463738	0.9546			
56671010003 - N	SHPX 463738	0.9546			
56671010004 - N	SHPX 463738	0.9546			
56671010005 - N	SHPX 463738	0.9546			
56671010006 - N	SHPX 463738	0.9546			

571 Industrial Parkway, Commerce, GA 30529 Ph : 706-336-7000 Fax : 706-336-7007 Email : info@skaps.com

ASTM D 4716

Client:	Chesapeake Containment Systems, Inc.	**Job #**	5667
Project:	Davidson County MSW Landfill, NC		
Product:	TN 300-2-6		

Test Configuration:



Test Information:

Boundary Conditions:	Soil Geocomposite Textured HDPE Geomembrane	**Normal Load:**	15000
		Gradient:	0.1
		Seating Time:	100 hours
		Flow Direction:	MD

Test Results:

Roll No.	Pressure, psf	Gradient	Transmissivity, m^2/sec
			100 hours
56671010001	15000	0.1	6.71×10^{-4}

571 Industrial Parkway, Commerce, GA 30529 Ph : 706-336-7000 Fax : 706-336-7007 Email : info@skaps.com

POLYETHYLENE RESIN CERTIFICATION

Customer Name : Chesapeake Containment Systems, Inc.
Project Name : Davidson County MSW Landfill, NC
Geocomposite Manufacturer : SKAPS Industries
Geocomposite Production Plant : Commerce, GA
Geocomposite Brand Name : TN 300-2-6

We, the Geonet Manufacturer, hereby certify the following for the material delivered to the above referenced project:

Resin Supplier	Resin Production Plant	Resin Brand Name	Resin Lot Number	Property	Test Method	Units	Resin Supplier Value	Tested Value*
Chevron Phillips Chemical Company	Chevron, TX	HDPE	SHPX 463738	Density	ASTM D1505	gm / cc	0.9487	0.9495
				Melt flow Index	ASTM D1238[(a)]	gm / 10 min	0.33	0.36

(a) Condition 190/2.16
* Data from SKAPS Quality Control

571 Industrial Parkway, Commerce, GA 30529 Ph : 706-336-7000 Fax : 706-336-7007 Email : info@skaps.com

Product : **TN 300-2-6**
Project : **Davidson County MSW Landfill, NC**

We, the Geocomposite Manufacturer, hereby certify the following for the material delivered to the above referenced project :

GEOCOMP ROLL#	FABRIC ROLL#	WEIGHT oz/sq yd	MD TENSILE lbs.	MD ELONG %	XMD TENSILE lbs.	XMD ELONG %	CBR PUNCTURE lbs.	AOS us sieve	PERM-ITY sec^{-1}
56671010001	5667.002	6.51	165	75	178	77	485	70	1.77
	5667.001	6.51	165	75	178	77	485	70	1.77

571 Industrial Parkway, Commerce, GA 30529 Ph : 706-336-7000 Fax : 706-336-7007 Email : info@skaps.com

GEOSYNTHETICS INVENTORY LOG
DRAINAGE GEOCOMPOSITE

Project Name: Davidson County Phase 2, Area 2 Construction
Project Number: DAVDCO-12-3
Contractor: JT Russel & Sons, Inc. Storage Area:
Geosynthetics Installer: Chesapeake Containment Inventory Monitor(s): D. Wright/J. Buda

Geosynthetic Material Type: Drainage Geocomposite
Geosynthetic Product Identification: SKAPS TRANSNET 300-2-6

Material		Material Dimensions		MQC	CQA	
Roll No.	Batch/Lot No.	Length (Feet)	Width (Feet)	Information?	Conformance Sample No.	Remarks
56671010001	SHPX 463738	14	200	Y		
56671010002	SHPX 463738	14	200	Y		
56671010003	SHPX 463738	14	200	Y	Y	
56671010004	SHPX 463738	14	200	Y		
56671010005	SHPX 463738	14	200	Y		
56671010006	SHPX 463738	14	200	Y		
56671010007	SHPX 463738	14	200	Y		
56671010008	SHPX 463738	14	200	Y		
56671010009	SHPX 463738	14	200	Y		

Totals:

Total Rolls: 9
Total Lots: 1
Total SF: 25,200

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CONFORMANCE TEST RESULTS

geotechnics
INTEGRITY IN TESTING

CLIENT: SMITH GARDNER, INC.
CLIENT PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 - AREA 2 - CELL 1
PROJECT NO.: L13139-03
LAB ID NO.: L13139-03-01
MATERIAL: SKAPS TN 300-2-6 GEOCOMPOSITE
ROLL NO: 56671010003

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVE	STD
Geonet									
THICKNESS	D 5199	inches	0.3122	0.3110	0.3133	0.3187	0.3096		
			0.3146	0.3101	0.3162	0.3150	0.3177	**0.3138**	0.0030
DENSITY	D 1505	g/cc	0.9531	0.9529	0.9528			**0.9529**	0.0001
Geocomposite									
PLY ADHESION	D 7005								
	SIDE "A"	MD-lb/in	6.7	6.4	6.8	4.6	6.3	**6.14**	0.810
	SIDE"B"	MD-lb/in	2.7	5.4	4.1	2.4	3.9	**3.69**	1.063

CHECKED BY: J-O DATE: 12-5-13

\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVID L13139-03-01 12/5/13

TRANSMISSIVITY TEST RESULTS
ASTM D 4716

geotechnics
INTEGRITY IN TESTING

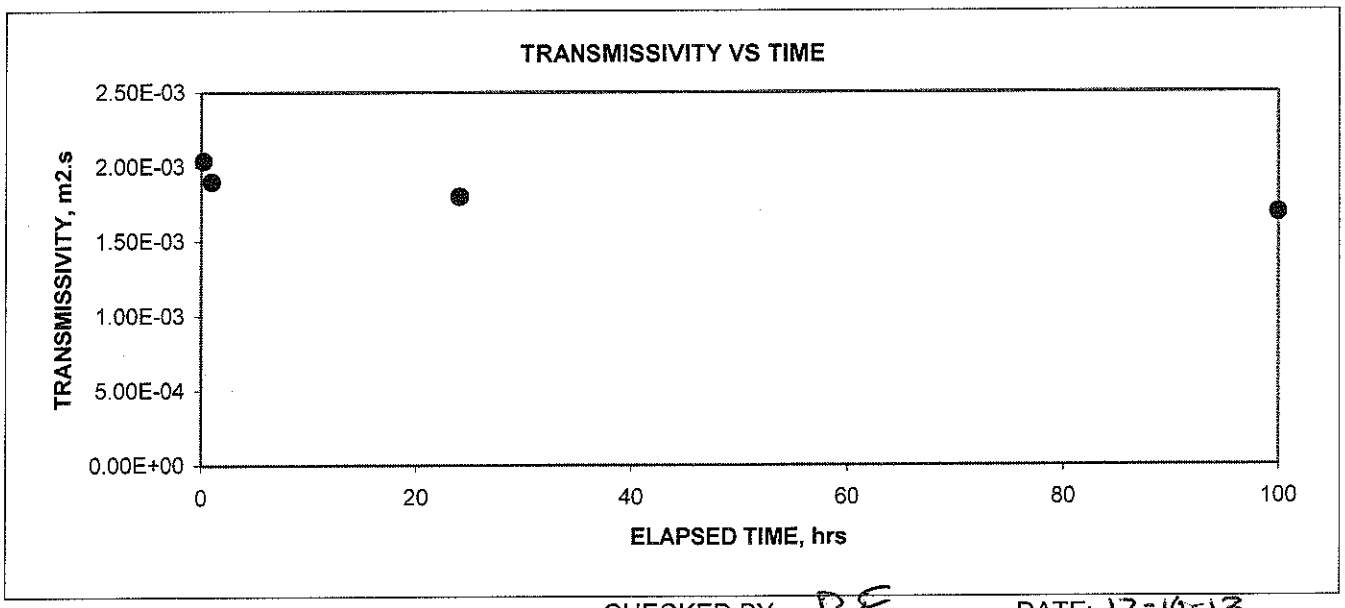
CLIENT: SMITH GARDNER, INC.
PROJECT: DAVIDSON COUNTY MSWLF
PHASE 2 AREA 2 - CELL 1
MATERIAL: SKAPS TN 300-2-6 GEOCOMPOSITE

PROJECT NO.: L13139-03
LAB I.D. NO.: L13139-03-01
ROLL NO.: 56671010003
REPLICATE NO.: 1 of 1

TEST SECTION: SAND
GEOCOMPOSITE-MD
60 MIL HDPE MICROSPIKE

15,000 psf NORMAL COMPRESSIVE STRESS

ELAPSED TIME (hrs)	MANOMETERS RES. (in)	MANOMETERS WEIR (in)	HYDR. GRAD.	COLLECTION DATA VOLUME (ml)	COLLECTION DATA TIME (sec.)	WATER TEMP °C	AVERAGE FLOW RATE (l/s-m)	AVERAGE FLOW RATE (gpm/ft)	CALCULATED TRANSMISSIVITY (m2/sec)
0.25	1.90	0.70	0.10	945 945 945	15 15 15	19.4	2.04E-01	0.986	2.04E-03
1	1.90	0.70	0.10	880 880 880	15 15 15	19.4	1.90E-01	0.918	1.90E-03
24	1.90	0.70	0.10	830 830 830	15 15 15	19.2	1.80E-01	0.870	1.80E-03
100	1.90	0.70	0.10	780 780 780	15 15 15	19.3	1.69E-01	0.816	1.69E-03



CHECKED BY: BF DATE: 12-10-13

C:\My Documents\EXCEL\Templates\[Trans100hr1Load1Grad.xls]Sheet1
\\GEOSERVER\Data Drive\Synthetics\2013 SYNTHETICS\139 - SMITH GARDNER - DAVIDSON COUNTY MSWLF\[L13139-03-01 TRANS DAVIDSON L13139-03-01 12/10/13

Appendix O

Record Drawings

Construction Quality Assurance Report
Phase 2, Area 2, Cell 1 Construction
Davidson County MSW Landfill

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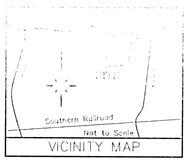


NCGS Grid North
by Local Established
Monuments

Topographic As-Built Survey for :

DAVIDSON COUNTY
INTEGRATED SOLID WASTE MANAGEMENT

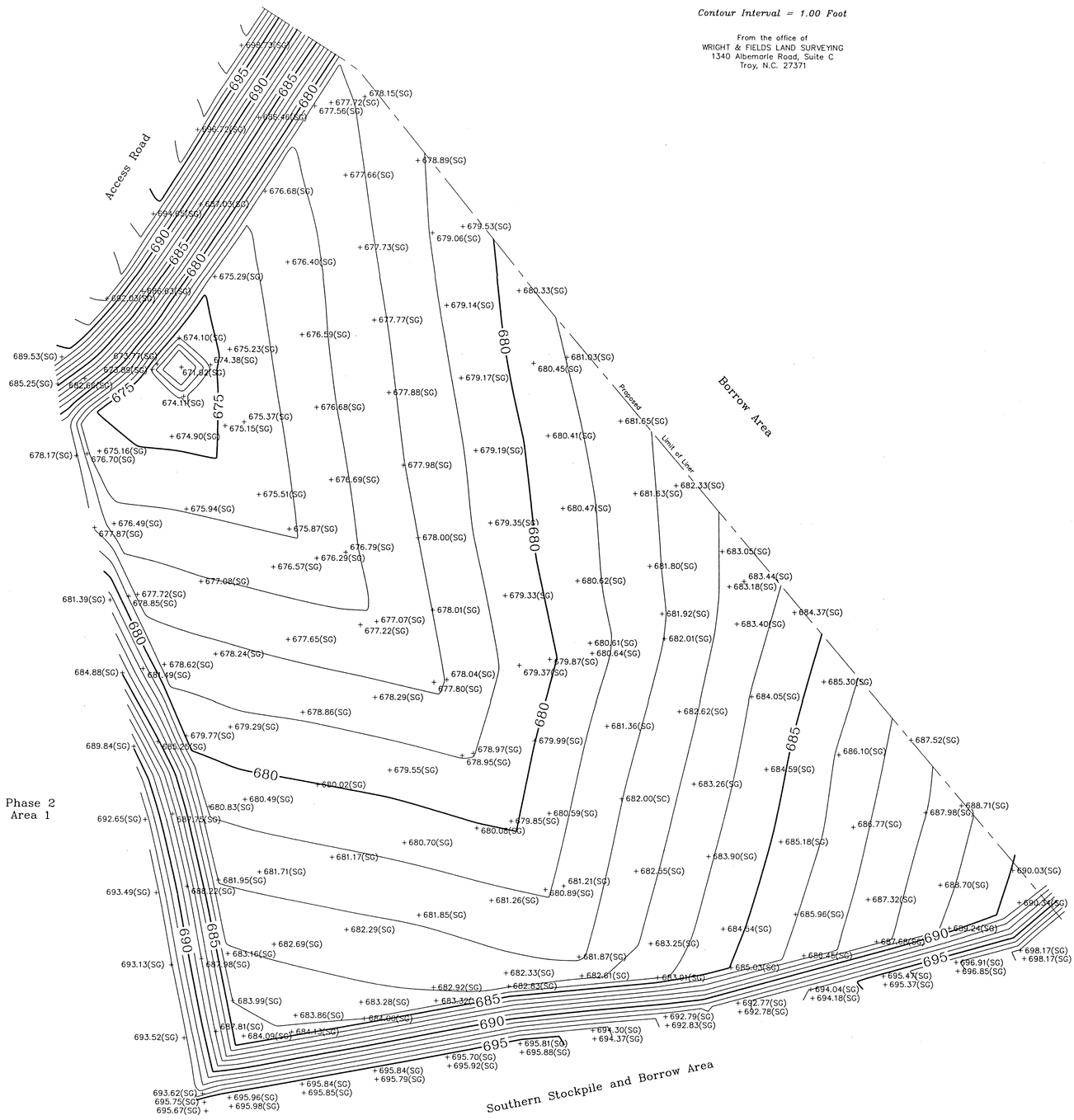
Top of Subgrade Surface Verification for Cell No. 1 of Phase 2, Area 2 at the Davidson County MSW Landfill Site

Thomasville Township, Davidson County, North Carolina
Deed Reference Book 639 Page 473, Book 643 Page 395, and Book 1342 Page 1782.
Surveyed by Thomas J. Fields, PLS-2906, in January and February 2014.
REVISED & UPDATED on April 30th, 2014

40 0 40
Scale is in Feet
1" = 40'

Contour Interval = 1.00 Foot

From the office of
WRIGHT & FIELDS LAND SURVEYING
1340 Albemarle Road, Suite C
Troy, N.C. 27371



NORTH CAROLINA
DAVIDSON COUNTY

I, Thomas J. Fields, certify that this plat was drawn from an actual field survey done by me and is in all respects correct to the best of my knowledge and belief. Surface elevations shown on this plat represent measurements made of the finished SUBGRADE surface at the construction site of Cell 1, Area 2. Witness my original signature and official stamp this the 30th day of April 2014.

Thomas J. Fields
SURVEYOR PLS-2906

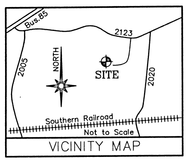
No horizontal control within 2000 feet.

NORTH CAROLINA PROFESSIONAL SEAL L-2906 LAND SURVEYOR THOMAS JEFFREY FIELDS

LEGEND

Elevation at Existing Contours	690
Spot Elevations at Subgrade	+690.05(SG)
One Foot Contour Interval (minor contours)	
Five Foot Contour Interval (major contours)	

Job No. 2013-94



VICINITY MAP

NCGS Grid North
by Local Established
Monuments

Topographic As-Built Survey for :

DAVIDSON COUNTY
INTEGRATED SOLID WASTE MANAGEMENT

Top of Clay Surface Verification for Cell No. 1 of Phase 2, Area 2 at the Davidson County MSW Landfill Site

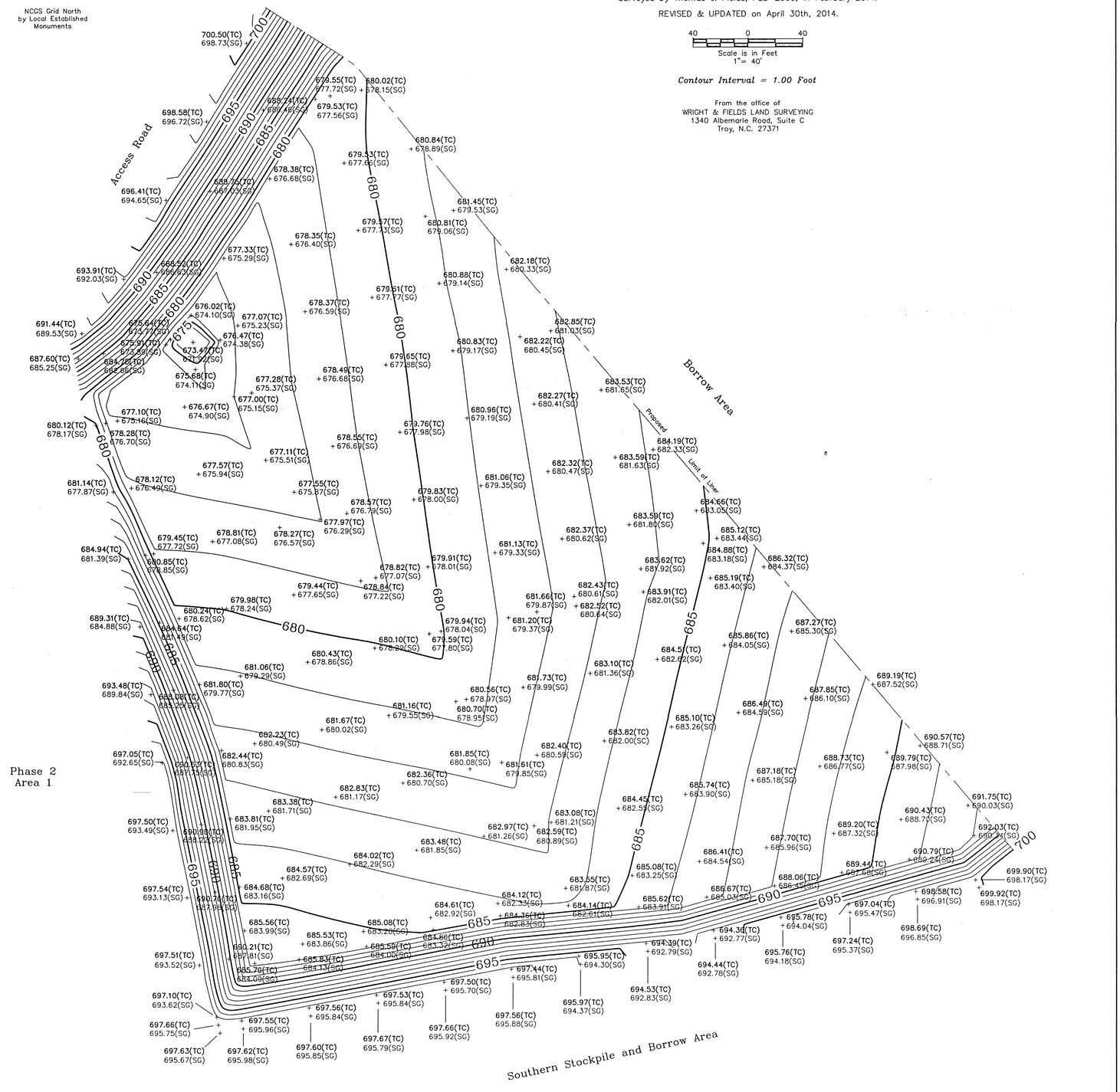
Thomasville Township, Davidson County, North Carolina
Deed Reference Book 639 Page 473, Book 643 Page 395, and Book 1342 Page 1782.
Surveyed by Thomas J. Fields, PLS-2906, in February 2014.

REVISED & UPDATED on April 30th, 2014.

40 0 40
Scale is in Feet
1"= 40'

Contour Interval = 1.00 Foot

From the office of
WRIGHT & FIELDS LAND SURVEYING
1340 Albemarle Road, Suite C
Troy, N.C. 27371



NORTH CAROLINA
DAVIDSON COUNTY

I, Thomas J. Fields, certify that this plat was drawn from an actual field survey done by me and is in all respects correct to the best of my knowledge and belief. Surface elevations shown on this plat represent measurements made of the finished TOP OF CLAY surface at the construction site of Cell 1, Area 2. Witness my original signature and official stamp this the 30th day of April 2014.

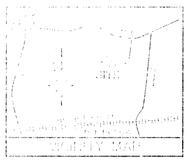
Thomas J. Fields
SURVEYOR PLS-2906

NORTH CAROLINA PROFESSIONAL SEAL L-2003 LAND SURVEYOR THOMAS JEFFREY FIELDS

No horizontal control within 2000 feet.

LEGEND

Elevation at Existing Contours	690
Spot Elevations at Clay Surface	+681.55(TC)
Spot Elevations at Subgrade	+679.55(SG)
One Foot Contour Interval (minor contours)	
Five Foot Contour Interval (major contours)	



Topographic As-Built Survey for :

DAVIDSON COUNTY
INTEGRATED SOLID WASTE MANAGEMENT

Top of Soil and Cover Verification for Cell No. 1 of Phase 2, Area 2 at the Davidson County MSW Landfill Site

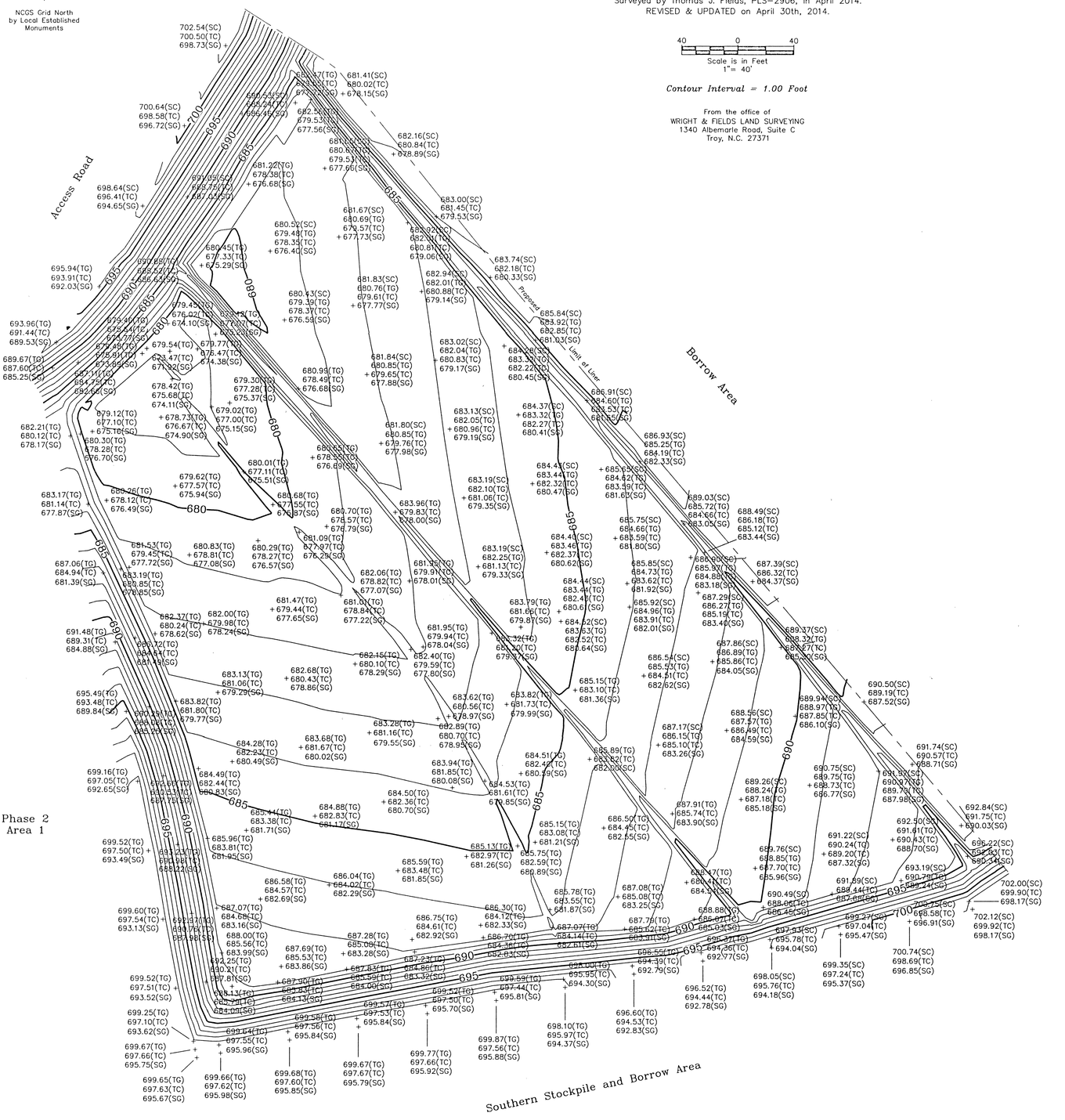
Thomasville Township, Davidson County, North Carolina
Deed Reference Book 639 Page 473, Book 643 Page 395, and Book 1342 Page 1782.
Surveyed by Thomas J. Fields, PLS-2906, in April 2014.
REVISED & UPDATED on April 30th, 2014.

40 0 40
Scale is in Feet
1" = 40'

Contour Interval = 1.00 Foot

From the office of
WRIGHT & FIELDS LAND SURVEYING
1340 Albemarle Road, Suite C
Troy, N.C. 27371

NCGS Grid North
by Local Established
Monuments



LEGEND

Existing Contours	690
Spot Elevations at Soil Cover Surface	•694.55(SC)
Spot Elevations at Gravel Surface	•693.55(TG)
Spot Elevations at Clay Surface	•691.55(TC)
Spot Elevations at Subgrade	•690.05(SG)
One Foot Contour Interval (minor contours)	
Five Foot Contour Interval (major contours)	

NORTH CAROLINA
DAVIDSON COUNTY

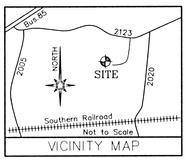
I, Thomas J. Fields, certify that this plat was drawn from an actual field survey done by me and is in all respects correct to the best of my knowledge and belief. Surface elevations shown on this plat represent measurements made of the finished TOP OF GRAVEL and TOP OF SOIL COVER surface at the construction site of Cell 1, Area 2. Witness my original signature and official stamp this the 30th day of April 2014.

Thomas J. Fields
SURVEYOR PLS-2906

NORTH CAROLINA PROFESSIONAL SEAL L-2906 LAND SURVEYOR THOMAS JEFFREY FIELDS

No horizontal control within 2000 feet.

Job No. 2013-94



VICINITY MAP

As-Built Survey for :

DAVIDSON COUNTY
INTEGRATED SOLID WASTE MANAGEMENT

HDPE Geomembrane Liner As-Built for Cell 1 of Phase 2, Area 2 at the Davidson County MSW Landfill Site

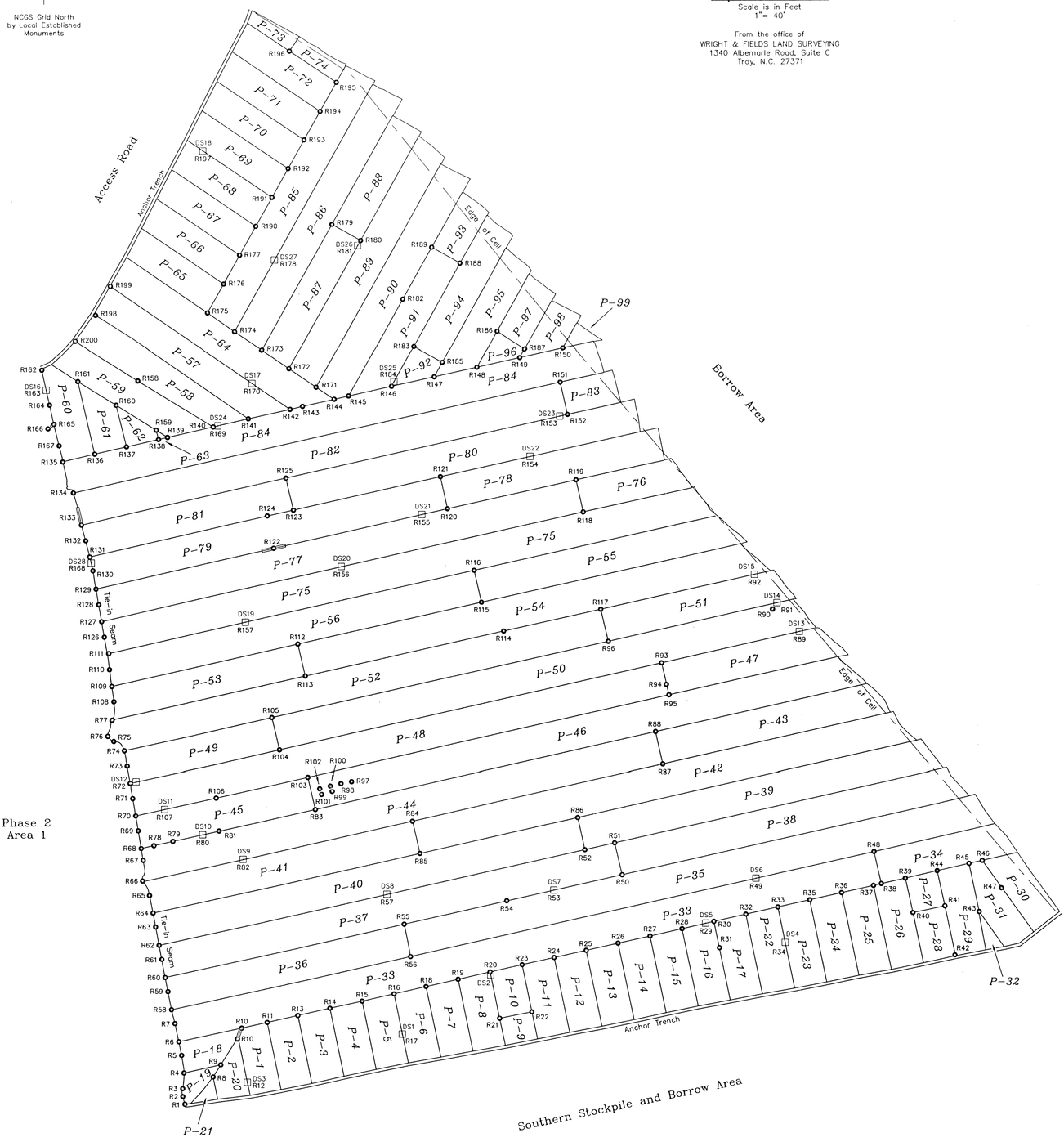
Thomasville Township, Davidson County, North Carolina
Deed Reference Book 639 Page 473, Book 643 Page 395, and Book 1342 Page 1782.
Surveyed by Thomas J. Fields, PLS-2906, in March 2014.

REVISED & UPDATED on April 30th, 2014.

40 0 40
Scale is in Feet
1" = 40'

From the office of
WRIGHT & FIELDS LAND SURVEYING
1340 Albemarle Road, Suite C
Troy, N.C. 27371

NCGS Grid North
by Local Established
Monuments



NORTH CAROLINA
DAVIDSON COUNTY

I, Thomas J. Fields, certify that this plat was drawn from an actual field survey done by me and is in all respects correct to the best of my knowledge and belief. This plat was prepared for engineering and verification purposes only and is not intended for recordation, conveyance, or sale. Witness my original signature and official stamp this the 30th day of April 2014.

Thomas J. Fields
SURVEYOR PLS-2906

No horizontal control within 2000 feet.

NORTH CAROLINA PROFESSIONAL SEAL L-2906 LAND SURVEYOR THOMAS JEFFREY FIELDS

HDPE Geomembrane Area
2D Surface Area = 279,573.8 Sq.Ft.
3D Surface Area = 281,318.4 Sq.Ft.

Legend

P-39 ..... denotes Panel Numbers
DS10 ..... denotes Destruct Numbers
R20 ..... denotes Repair Numbers
⊡ ..... denotes Destruct Symbols
● ..... denotes Repair Symbols

Job No. 2013-94