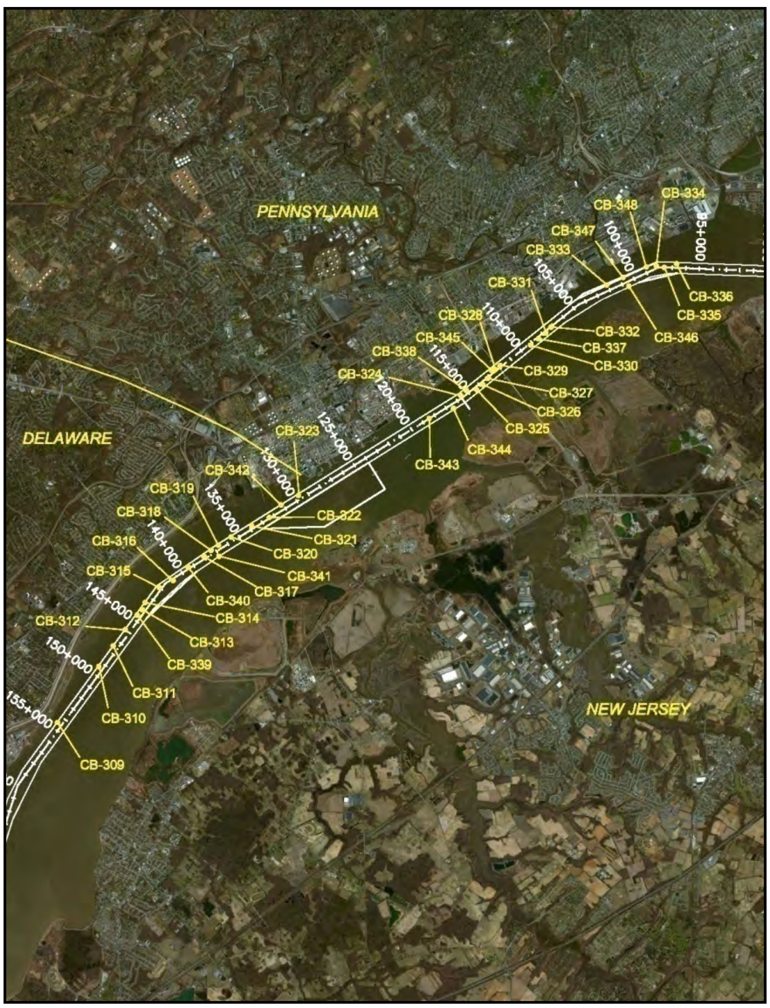
Philadelphia Regional Port Authority
U.S. Army Corps of Engineers – Philadelphia District

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Supplemental Geotechnical Subsurface Investigation

Reach B - Stations 95+000 To 155+000

July 2012



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LIST OF ABBREVIATIONS AND ACRONYMS

ASTM	–	American Society for Testing and Materials
GBA	–	Gahagan and Bryant Associates, Inc.
GPS	–	Global Positioning System
JBD	–	Jersey Boring and Drilling Company
L/B	–	Lift Boat
MLLW	–	Mean Lower Low Water
NOAA	–	National Oceanic and Atmospheric Administration
PRPA	–	Philadelphia Regional Port Authority
lb	–	Pounds
lb/ft^3	–	Pounds per Cubic Foot
psi	–	Pounds per Square Inch
RQD	–	Rock Quality Designation
RTK	–	Real-Time Kinematic
SPT	–	Standard Penetration Test
USACE	–	United States Army Corps of Engineers

1.0 INTRODUCTION

A geotechnical investigation of the northern section of the channel area designated as “Reach B” to be deepened within the Delaware River federal shipping channel for the authorized Delaware River Main Channel Deepening Project (Deepening Project) was performed. This report provides the description, procedure, and results of this effort. The location of Reach B within the Delaware River is shown in Figure 1 (Appendix A).

1.1 Purpose

This investigation was performed to supplement existing information with additional data on the type, nature, and characteristics of subaqueous materials as well as the vertical and horizontal extents and conditions of these materials as they exist in locations within the northern section of Reach B of the Deepening Project.

Furthermore, this investigation provides geotechnical information that will further define the type of material that may be encountered during the deepening of Reach B of the Delaware River Main Channel from existing grade to a depth of - 45 feet Mean Lower Low Water (MLLW) plus one foot of allowable pay over-depth (-46 feet MLLW) in non-rock areas and 45 feet plus two feet of pay over-depth (-47 feet MLLW) in the bedrock areas.

This report presents the results of boring and coring operations and sampling results to assist in analyzing the depth, composition, and quality of the soil and bedrock that must be removed as part of the Deepening Project contract. Section 2 of this report contains the procedures and equipment used to obtain soil and rock borings. The boring sediment and rock core tests performed are described in Section 3. Summaries of results are discussed in Section 4. Appendix A contains report figures; Appendix B contains the boring and coring logs; Appendix C lists the laboratory test results; and Appendix D presents photographs of borings and rock cores.

1.2 Project Location

The area for this investigation is shown on Figure 2 and extends from Station 95+000 to 155+000, approximately 9.9 nautical miles from the Tinicum Range, near Philadelphia, Pennsylvania to the Bellevue Range in northern Delaware.

This portion of the channel is 800 feet wide (with the exception of channel bends) and is bordered by New Jersey to the east and Delaware and Pennsylvania to the west.

1.3 Project Organization

The supplemental geotechnical investigation was requested and sponsored by the United States Army Corps of Engineers (USACE) Philadelphia District and the Philadelphia Regional Port Authority (PRPA). Sampling activities were conducted on the lift boat *L/B Vision* provided by Northstar Marine, Inc. The drilling contractor for the project was Jersey Boring and Drilling Company (JBD); oversight (quality assurance) for the drilling operation was provided by a professional geologist from AEON Geosciences, Inc. Engineering and surveying for the project was accomplished by Gahagan and Bryant Associates, Inc. (GBA). Laboratory testing of samples was conducted by GeoTesting Express, Inc. (GeoTesting). Figure 3 depicts the project organization chart.

2.0 PROCEDURE & EQUIPMENT

During the week of November 20, 2011, the drilling equipment and staff were mobilized to the USACE Fort Mifflin, Philadelphia field office. The drilling began on November 28, 2011 and was completed on December 29, 2011. Locations of the 40 borings are displayed on Figures 4 and 5 and are detailed in Table 1.

Borings were completed at an average rate of two per day by JBD, utilizing a CME-55 track mounted drilling rig aboard the *L/B Vision* lift boat (equipment details are discussed in Section 2.2).

Positioning at the coring locations was accomplished using a Trimble series real-time kinematic global positioning system (RTK GPS), resulting in positioning accuracies of less than one meter (3.28 feet). Water depths were measured with RTK GPS and a graduated lead line inside the boring casing; all depth measurements were corrected to MLLW. After positioning over the target coordinates, the boring sampling was conducted.

2.1 Coring & Drilling Procedure

GBA provided a licensed surveyor to locate the lift boat and drill rig within 10 feet of the proposed boring locations using a RTK GPS. Once the *L/B Vision* was on location, the spuds were lowered to the mudline and final positioning adjustments were made. After the drilling hole was located on top of the proposed position, the boat was lifted out of the water using hydraulic methods. Once the lift boat was stabilized, the surveyor established the bottom elevation and horizontal position of each boring using RTK GPS and a leadline in accordance with the USACE Engineer's Manual EM 1110-2-1003. Elevations were converted to MLLW based on real-time tides from National Oceanic and Atmospheric Administration (NOAA) and recorded on each log and in the project field book for presentation on the final boring logs. Upon satisfactory setup and positioning, JBD lowered six-inch diameter steel casing into the river bottom in 5 to 10 foot long flush threaded sections.

2.1.1 SPT Drilling

Six-inch diameter flush threaded drive casing was advanced to the target depth at each location using a percussion hammer. A (tri-cone) roller bit using water or a bentonite-based drilling mud was used to evacuate soil sediment from inside the advanced casing. If the initial setting of the casing penetrated more than one foot a split spoon sample using a standard 2-inch diameter and 24-inch length split-spoon was attempted. Once the casing was set, split-spoon sampling began using a larger 3-inch outer diameter by 24-inch length split-spoon sampler. The larger sampler was advanced below the drive casing to the target sampling depth using a 140-pound safety drive hammer in accordance with ASTM D 3550 and ASTM D1586. Drive casing was then advanced to the next desired sampling depth, and the procedure was repeated.

Sampling in overburden material was continuous using standard penetration test methods. Soil samples were taken by driving the sampling spoon 2 feet into the material at the bottom of the hole. The sample spoon was driven with the force of the hammer under a free fall of 30 inches. The number of blows applied in each 6-inch increment were counted and recorded until one of the following conditions occurred:

a. A total of 50 blows had been applied and advancement was less than 2 inches.

b. There was no observed advance of the sampler during the application of 20 successive blows of the hammer.

c. The sampler was advanced the 24 inches without the limiting blow counts occurring as described in a and b.

If the Standard Penetration Testing (SPT) drive sampler was advancing, even in excess of 50 blows per 2 inches and suspected to be in rock, it was an indication that the rock was rippable and/or highly weathered and/or decomposed. Since this rock material may be potentially removable using standard dredging techniques, the driller continued advancing the SPT drive sampler and obtained samples of the material penetrated.

Soil samples were photographed (Appendix D) before extraction from the split spoon sampler. After photographing the samples, soil samples were removed from the split spoon and placed in labeled sample jars. Separate jars were used when distinct soil types or physical property differences were encountered. Multiple samples collected from the same boring hole were labeled with alphabetical designations indicating depth within the boring (i.e., A was the shallowest sample, B and C etc. were deeper in the boring). Soil borings were visually classified and recorded on boring logs in accordance with *Description and Identification of Soils - Visual Manual Procedure* (ASTM D 2488). Boring logs are in Appendix B.

2.1.2 Rock Core Drilling

Upon split-spoon refusal during SPT at 12 locations (Table 1), HQ-Core drilling was used to complete the boring to its required depth in accordance with ASTM D 2113. When bedrock was encountered at the bottom of the boring within two feet of the planned depth, a minimum 5-foot run into the bedrock was performed to identify the rock material, its physical condition, and to define the elevation of the top of bedrock. HQ-Core drilling was performed in 5-foot sampling intervals; when soft or broken rock was encountered, the sampling interval was reduced to 2 feet in order to reduce and/or keep core loss and core disturbance to the minimum.

Rock cores were visually classified and recorded on boring logs in accordance with *Standard Guides for Using Rock-Mass Classification Systems for Engineering Purposes* (ASTM D 5878), *Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core* (ASTM D 6032), Kulander, et al., 1990 and Blackmer, 2005. Rock core boring logs are displayed in Appendix B.

Upon collection of rock core samples, the cores were arranged neatly in partitioned boxes in the same sequence of drilling. The depths of the top and bottom of the core and noticeable gaps in the core recoveries were marked by labeled wooden spacer blocks. Spacers were also placed in the core boxes to immobilize the cores and keep them in the correct positions. Photographs were taken of rock core samples and are shown in Appendix D.

Upon completion of sampling at each boring location, holes were backfilled with bentonite slurry to the proposed dredging elevation. The remaining borehole was backfilled to the original mudline with soil cuttings.

2.2 Equipment

2.2.1 Vessel

As previously noted, lift boat *L/B Vision* was used to conduct drilling for the 40 sample locations. The *L/B Vision* was provided by Northstar Marine, Inc. The *L/B Vision* is a 70 foot lift boat equipped with 3 hydraulically-driven 95-foot legs. The lift boat was used to raise the boat and drilling rig above the water surface to eliminate stress and potential breakage on the drilling equipment during sampling. A drill hole was located approximately 15 feet from the bow in the middle of the deck to accommodate drilling activities.

2.2.2 Boring Rig

A CME-55 track mounted drilling rig, provided by JBD, was employed to collect SPT and rock coring samples. The CME-55 was equipped with 6-inch diameter flush threaded casing, a 140-pound safety drive hammer, standard 2-inch diameter split-spoons, 3-inch split-spoon samplers, and HQ-Core equipment for rock drilling.

2.2.3 Survey Equipment

The survey equipment consisted of a Trimble RTK GPS system. A Trimble R5 receiver and antenna was used for positioning and elevation measurements. Horizontal and vertical accuracies of less than 1 meter were achieved by integrating internet-available Virtual Reference Station data into the Trimble software program. Vertical accuracies were checked twice daily by comparing measured elevations at the boring locations with real-time data from NOAA tide gages located nearby on the Delaware River.

2.3 Sampling Locations

USACE and GBA reviewed all previous boring, coring, vibracoring, and test pit information that was performed within the area of investigation with the primary purpose to obtain additional borings to determine composition, thickness, density, and depth of sediment levels and top of bedrock elevations of the of the in-place materials.

Sampling locations were selected to provide:

- Additional information in locations in which attempts to advance vibracores in the most recent investigation that was completed by the USACE in 2010 indicated the presence of dense subsurface conditions and possibly bedrock in the proposed channel deepening area and
- Supplement existing geotechnical information to provide additional information to further refine the type, nature, and characteristics of subaqueous materials and the extent and conditions of the various materials as they exist to the depths and the locations in the proposed channel deepening template.

Forty drilling locations were selected by applying the above selection process coupled with a detailed review and analysis of the United States Army Corps of Engineers 2010 multi-beam hydrographic surveys, which depicted areas to be deepened to below -46 or -47 MLLW. Locations of the 40 borings are displayed on Figures 4 and 5 are detailed in Table 1 on the following page.

Table 1 – Sampling Locations

Core Designation	Date	Northing (NJ NAD83, U.S. Survey Feet)	Easting (NJ NAD83, U.S. Survey Feet)	Top of Mudline Elevation (ft MLLW)
CB-309	12/21/11	337406.54	214661.02	-42.65
CB-310	12/20/11	341557.50	217712.27	-42.97
CB-311	12/20/11	343074.42	218775.52	-44.60
CB-312	12/16/11	344290.15	219681.85	-43.16
CB-313	12/16/11	345761.17	220933.97	-43.90
CB-314	12/15/11	346296.37	221121.77	-42.24
CB-315	12/15/11	347406.04	222190.31	-44.01
CB-316	12/14/11	347936.40	223208.66	-42.23
CB-317[1]	12/14/11	349718.01	225483.80	-44.54
CB-318	12/13/11	350168.93	226021.72	-42.30
CB-319	12/13/11	350557.41	226549.61	-41.44
CB-320	12/12/11	351152.11	227479.95	-43.99
CB-321	12/12/11	351993.07	229011.82	-45.56
CB-322[1]	12/9/11	352594.55	230312.94	-44.88
CB-323	12/9/11	354237.68	232463.35	-44.96
CB-324[1]	12/8/11	361632.21	244474.08	-45.78
CB-325	12/7/11	362091.72	245618.51	-44.49
CB-326	12/6/11	362445.44	246106.95	-44.25
CB-327	12/6/11	362901.54	246441.85	-42.40
CB-328	12/5/11	363556.33	247005.64	-45.17
CB-329	12/2/11	363862.52	247376.10	-43.73
CB-330	12/2/11	365371.45	249618.06	-45.64
CB-331[1]	12/1/11	366269.20	250754.02	-49.03
CB-332	12/1/11	366703.25	251134.06	-45.21
CB-333[1]	11/30/11	369835.71	255254.75	-40.30
CB-334[1]	11/30/11	371229.13	258921.28	-45.20
CB-335	11/29/11	371128.32	259504.32	-47.86
CB-336	11/28/11	371400.17	260417.11	-42.01
CB-337[1]	12/19/11	365830.48	250220.09	-42.92
CB-338[1]	12/19/11	362028.42	244862.93	-45.59
CB-339	12/21/11	345369.33	220548.26	-44.64
CB-340[1]	12/22/11	348931.78	224311.85	-43.20
CB-341	12/22/11	349723.36	226595.32	-43.98
CB-342	12/23/11	353532.01	231173.54	-46.52
CB-343[1]	12/29/11	359936.30	242127.68	-44.99
CB-344[1]	12/29/11	360679.36	243927.60	-46.42
CB-345	12/28/11	363529.76	246721.96	-42.99
CB-346	12/28/11	369742.29	256885.08	-47.72

Core Designation	Date	Northing (NJ NAD83, U.S. Survey Feet)	Easting (NJ NAD83, U.S. Survey Feet)	Top of Mudline Elevation (ft MLLW)
CB-347	12/27/11	370387.30	256467.40	-43.40
CB-348[1]	12/27/11	371156.56	258176.72	-44.10

[1] – denotes rock coring locations

The processed hydrographic survey data was used to create a digital terrain model. The modeled surface was compared to a hypothetical dredging template to provide a difference plot. The difference plot is created by comparing "z" elevations from the two models in the same "x" and "y" position. These differences provide a new "z" value now associated with the "x" and "y"; however the "z" value is no longer an elevation, it is now a thickness (material above the template). The depicted depth of material to be dredged is color coded to display increments of dredging in plan view (ex. Red indicated 0 to 1 ft of dredging, etc). The difference plots with the locations are provided in Appendix A, Figures 4 and 5.

3.0 LABORATORY PROCEDURES & TESTS

Selected soil and rock samples were subjected to laboratory testing. The samples were delivered to GeoTesting Express, a USACE validated geotechnical laboratory, in Boxborough, Massachusetts. Testing was performed on soil and rock materials that will be removed during the dredging and rock removal operations or in close proximity to the dredging level. Table 2 details the testing that was performed by GeoTesting.

Table 2 – Laboratory Testing

Laboratory Test	Number of Tests	ASTM Method
Moisture Content	58	D 2216-05
Grain Size Analysis	44	D 422-63(reapproved 2002)
Grain Size Analysis w/ Hydrometer	14	D 422-63(reapproved 2002)
Atterberg Limits	12	D 4318-05
Splitting Tensile Test (Brazilian)	10	D 3967
Unconfined Compression Strength of Rock	9	D 7012 Method C
Elastic Moduli of Rock in Uniaxial Compression	4	D 70121 Method D

4.0 LABORATORY RESULTS

Results of laboratory analyses and a generalized description of subsurface conditions are presented below. Laboratory reports from GeoTesting are located in Appendix C.

4.1 SPT Samples

Fifty-eight soil samples from 34 boring locations were submitted for moisture content and grain size analyses. Twelve samples were submitted for Atterberg limits. Detailed soil test results are shown in Tables 3 and 4. The test results are summarized below:

- The soil samples were predominantly sand and gravel.
- Silt and clay fractions greater than 50% were found in 9 of the soil samples.

- The highest percentages of silt and clay were detected at CB-341 (89% from 0 to 6 feet), CB-342 (83% at 0 to 2 feet), and CB-347 (average of 97% from 0 to 8 feet).
- Liquid limits ranged from 24 to 85, plastic limits ranged from 16 to 35, and plasticity index values ranged from 7 to 51.
- Sample classifications varied from fat clay to well-graded gravel with silt and sand.

Table 3 – Grain Size Analysis Results

Boring #	Sample ID	Depth in Boring (ft)	Elevation (ft MLLW)	Moist. Content	% Cobble	% Gravel	% Sand	% Silt/Clay
CB-309	S-1	0-2	-42.65 to -44.65	10.1	0	53.4	35.7	10.9
	S-2	3-5	-45.65 to -47.65	19.2	0	0	41.4	58.6
CB-310	S-1	0-2	-42.97 to -44.97	9.3	0	51	41.9	7.1
	S-2	4-6	-46.97 to -48.97	21.4	0	2.4	53.6	44
CB-311	S-1	0-2	-44.6 to -46.6	7.5	0	62.7	32.8	4.5
	S-2	3-5	-47.6 to -49.6	16.8	0	10.4	86.1	3.5
CB-312	S-1	0-2	-43.16 to -45.16	10.5	0	41.7	47.1	11.2
	S-2	3-5	-46.16 to -48.16	7.8	0	81.9	16.8	1.3
CB-313	S-1	0-2	-43.9 to -45.9	7.8	0	69.6	27.9	2.5
	S-2	4-6	-47.9 to -49.9	6.5	0	72.5	24.2	3.3
CB-314	S-3	5-7	-47.24 to -49.24	7.3	0	69.4	27.6	3
CB-315	S-1	0-2	-44.01 to -46.01	6.3	0	63	30.9	6.1
	S-2	4.0-5.4	-48.01 to -49.41	4.4	0	77.5	21.7	0.8
CB-316	S-1	0-2	-42.23 to -44.23	8.6	0	57.1	36.8	6.1
	S-2	3.0-4.5	-45.23 to -46.73	13.5	0	13.4	85.4	1.2
	S-3	5-7	-47.23 to -49.23	9.7	0	50.4	43.8	5.8
CB-317	S-1A	0-1	-44.54 to -45.54	9.9	0	7.8	78.1	14.1
	S-1B	1-2	-45.54 to -46.54	14.2	0	1.6	74.8	23.6
CB-318	S-1	0-2	-42.3 to -44.3	9.1	0	50.7	41.7	7.6
	S-2	3-5	-45.3 to -47.3	3.8	0	70.8	27.8	1.4
	S-3B	6.5-7.0	-48.8 to -49.3	26.7	0	0	33.8	66.2
CB-319	S-1	0-2	-41.44 to -43.44	7.6	0	54	39.7	6.3
	S-2	3-5	-44.44 to -46.44	5.7	0	65	32.6	2.4
	S-3B	5-7	-46.44 to -48.44	23.5	0	8.6	81.9	9.5
CB-320	S-1A	2.0-2.5	-45.99 to -46.49	25.6	0	0	97.7	2.3
	S-1B	2.5-3.0	-46.49 to -46.99	5.1	0	45.1	53.8	1.1
CB-322	S-1	2-4	-46.88 to -48.88	12.3	0	35.3	47.6	17.1

Boring #	Sample ID	Depth in Boring (ft)	Elevation (ft MLLW)	Moist. Content	% Cobble	% Gravel	% Sand	% Silt/Clay
CB-323	S-1	2-3.5	-48.88 to -50.38	4.5	0	71.3	27.9	0.8
	S-2	4.0-5.5	-48.88 to -50.38	4.7	0	68.4	30.7	0.9
CB-325	S-1	4-6	-48.94 to -50.94	4.8	0	56	43.5	0.5
CB-327	S-2	5-7	-47.4 to -49.4	17.6	0	1.1	48.8	50.1
	S-3	7-9	-49.4 to -51.4	5.5	0	49.5	41.9	8.6
CB-328	S-2	5-7	-50.17 to -52.17	22.7	0	1	67.7	31.3
CB-329	S-1	3-5	-46.73 to -48.73	5.4	0	61.8	36.6	1.6
	S-2	5-7	-48.73 to -50.73	24.8	0	0.1	60.8	39.1
CB-330	S-1	3-5	-48.64 to -50.64	12.8	0	17.4	61.2	21.4
CB-332	S-1	3-5	-48.21 to -50.21	13.8	0	16	71.4	12.6
CB-333	S-1	0-1	-40.3 to -41.3	18.2	0	19.2	75.7	5.1
CB-334	S-1	1-3	-46.2 to -48.2	11.2	0	2.4	71.5	26.1
CB-335	S-1	4-6	-51.86 to -53.86	10.9	0	42.1	47.4	10.5
CB-336	S-2	4-6	-46.01 to -48.01	22	0	1.6	55.7	42.7
CB-338	S-1	0-2	-45.59 to -47.59	6.7	0	64.9	29.1	6
CB-339	S-1	1-3	-45.64 to -47.64	6	0	67.5	29.1	3.4
	S-2	3-5	-47.64 to -49.64	5.4	0	74.9	23.9	1.2
CB-340	S-1	0-1	-43.2 to -44.2	8.3	0	47.3	45.2	7.5
	S-2	3-5	-46.2 to -48.2	33.9	0	0	61.9	38.1
CB-341	S-1	0-6	-43.98 to -49.98	92.6	0	0	10.9	89.1
CB-342	S-1	0-2	-46.52 to -48.52	57.4	0	0	17.4	82.6
	S-2	4-6	-50.52 to -52.52	21.7	0	1.4	35.1	63.5
CB-344	S-1	0-2	-46.42 to -48.42	8.5	0	54.4	34.6	11
	S-2	3-4	-49.42 to -50.42	10.2	0	66.6	32.9	0.5
CB-345	S-2	3-4	-45.99 to -46.99	10.1	0	2.7	84.2	13.1
CB-346	S-1	1-4	-48.72 to -51.72	62.1	0	3.2	28.7	68.1
	S-2	4-6	-51.72 to -53.72	46.3	0	12.2	38.3	49.5
CB-347	S-1	0-3	-43.4 to -46.4	88.9	0	0	2.8	97.2
	S-3	6-8	--49.4 to -51.4	86.6	0	0	3.1	96.9
CB-348	S-1	0-2	-44.1 to -46.1	6.9	0	46.8	45.5	7.7
	S-2	3.0-4.2	-47.1 to -48.3	20.4	0	4.6	78.1	17.3

Table 4 – Atterberg Limits Results

Boring #	Sample ID	Depth in Boring (ft)	Elevation (ft MLLW)	Moist. Content	LL	PL	PI	LI	USCS Soil Classification
CB-309	S-2	3-5	-45.65 to -47.65	19.2	44	16	28	0	CL
CB-310	S-2	4-6	-46.97 to -48.97	21.4	58	19	39	0	SC
CB-327	S-2	5-7	-47.4 to -49.4	17.6	-	-	-	-	ML
CB-336	S-2	4-6	-46.01 to -48.01	22.0	39	23	16	0	SC
CB-338	S-1	0-2	-45.59 to -47.59	6.7	-	-	-	-	GW-GM
CB-341	S-1	0-6	-43.98 to -49.98	92.6	67	35	32	2	MH
CB-342	S-1	0-2	-46.52 to -48.52	57.4	72	29	43	1	CH
	S-2	4-6	-50.52 to -52.52	21.7	24	17	7	1	CL
CB-346	S-1	1-4	-48.72 to -52.72	62.1	73	29	44	1	CH
	S-2	4-6	-52.72 to -54.72	46.3	69	27	42	0	SC
CB-347	S-1	0-3	-43.4 to -46.4	88.9	85	34	51	1	CH
	S-3	6-8	-49.4 to -51.4	86.6	80	34	46	1	CH

LL = Liquid Limit *PI = Plasticity Index* *USCS = Unified Soil Classification System*
PL = Plastic Limit *LI = Liquidity Index*

4.2 Rock Cores

Rock Quality Designation (RQD) was determined for the 21 rock core sample runs recovered. RQD is calculated by dividing the sum of the total length of recovered intact and sound pieces of rock core 4 inches or greater in length by the total length of the core run. RQD is expressed as a percentage for each rock core sample run. Table 5 provides the ratings that were applied to describe the rock samples.

Table 5 – Rock Quality Designation (RQD)

RQD	Rating
0 – 25%	Very Poor
25 – 50%	Poor
50 – 75%	Fair
75 – 90%	Good
90 – 100%	Excellent

Table 6 lists the results of rock coring data at the 12 boring locations. The following observations were made:

- The predominant rock type was micaceous gneiss and mafic gneiss that was observed to be vertically non-foliated and horizontally foliated. Gneissic schist was predominant at CB-348. Definitions of micaceous, mafic, gneiss, and schist are located in Appendix E (Glossary of Terms).

- Core recoveries varied from 16% to 100% for individual runs and averaged 85% for all rock boring locations.
- RQDs were variable between locations, ranging from very poor to excellent, with an average RQD of 46%.
- The core recovery and RQD results were of higher competency than expected for the seven borings where saprolitic bedrock was encountered.
- Where the bedrock was decomposed to a soil state, SPT samples were gathered and many were included in the soils testing program to approximate the type of dredged material the bedrock would produce.

Table 6 – Rock Coring Data

Boring #	Depth in Boring (ft)	Elevation (ft MLLW)	Predominant Rock Type	Recovery (%)	RQD (%)[1]
CB-317	5-10	-49.5 to -54.5	Gneiss	64	14/very poor
	10-15	-54.5 to -59.5	Gneiss	98	78/good
CB-322	5-10	-49.9 to -54.9	Mafic Gneiss	100	52/fair
	10-15	-54.9 to -59.9	Mafic Gneiss	100	80/good
CB-324	1-6	-46.8 to -52.8	Mafic Gneiss	100	28/poor
CB-331	4-9	-53.0 to -58.0	Gneiss	88	76/good
CB-333	1-6	-41.3 to -46.3	Gneiss	100	33/poor
	6-9	-46.3 to -49.3	Gneiss	100	62/fair
CB-334	9-14	-54.2 to -59.2	Mafic Gneiss	16	0/very poor
CB-337	0.8-5	-43.7 to -47.9	Gneiss	100	72/fair
	5-10	-47.9 to -52.9	Gneiss	100	16/very poor
	10-15	-52.9 to -57.9	Gneiss	100	16/very poor
CB-338	5-10	-50.6 to -55.6	Gneiss	100	66/fair
	10-15	-55.6 to -60.6	Gneiss	100	98/excellent
CB-340	12.5-16	-55.7 to -59.2	Mafic Gneiss	16	0/very poor
CB-343	5-10	-50.0 to -55.0	Mafic Gneiss	68	54/fair
	10-15	-55.0 to -60.0	Mafic Gneiss	96	74/fair
CB-344	6-11	-52.4 to -57.4	Mafic Gneiss	96	66/fair
	11-16	-57.4 to -62.4	Mafic Gneiss	100	72/fair
CB-348	5-10	-49.1 to -54.1	Gneissic Schist	80	0/very poor
	10-13	-54.1 to -57.1	Gneissic Schist	70	17/very poor

Table 7 lists the nine samples that were submitted for bulk density and unconfined compressive strength testing. The results are summarized below.

- Bulk density values for rock core samples showed little variability, ranging from 164 pounds per cubic foot (lb/ft^3) to 183 lb/ft^3.
- Unconfined compressive strengths were more variable with strengths from 3,896 psi to 40,474 psi.
- Intact material failure of rock samples was observed in 6 of 9 samples; discontinuity failures were observed in 4 of 9 samples.
- Six of 9 samples did not meet side straightness tolerances per *Standard Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerances* (ASTM D 4543). This was most likely due to the core barrel-torquing induced by the high current velocities in the river.

Table 7 – Unconfined Compressive Strength Test Results

Boring #	Depth in Boring (ft)	Elevation (ftMLLW)	Bulk Density (lb/ft^3)	Unconfined Compressive Strength (psi)	Failure Type[1]	Conformance with ASTM D 4543
CB-317	11.54-11.97	-56.1 to -56.5	165	27,528	1	No[2]
CB-322	6.36-6.79	-51.2 to -51.7	183	40,474	1	Yes
CB-324	4.35-4.78	-50.1 to -50.6	173	8,563	2	No[2]
CB-333	3.57-4.00	-43.9 to -44.3	164	12,770	2	No[2]
	7.85-8.28	-48.2 to -48.6	164	14,113	1	No[2]
CB-337	1.02-1.45	-43.9 to -44.4	164	3,896	1 & 2	No[2]
	10.46-10.89	-53.4 to -53.8	166	16,883	1	No[2]
CB-343	5.92-6.35	-50.9 to -51.3	169	13,043	1	Yes
CB-344	7.79-8.22	-54.2 to 54.6	171	10,686	2	Yes

[1] Failure type: 1 = intact material failure, 2 = discontinuity failure

[2] The as-received core did not meet side straightness tolerances per ASTM D 4543 - Standard Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerances

Four samples were submitted for compressive strength and elastic moduli analyses (Table 8). The following observations were noted:

- Compressive strengths varied from 9,725 psi to 18,374 psi. Various stress ranges were tested on each sample.
- Young's Modulus values ranged from 1,130,000 psi to 10,000,000 psi and Poisson's Ratio values ranged from 0.15 to 0.46.

Table 8 – Elastic Moduli of Rock in Uniaxial Compression Test Results

Boring #	Depth in Boring (ft)	Elevation (ft MLLW)	Peak Compressive Strength (psi)	Stress Range (psi)	Young's Modulus (psi)	Poisson's Ratio
CB-331	5.75-6.18	-54.8 to -55.2	18,374	0-6,000	4,500,000	0.21
				6,000-12,000	5,700,000	0.46
				12,000-18,000	4,400,000	-
CB-337	2.9-3.33	-45.8 to -46.3	9,725	0-2,000	1,130,000	0.26
				2,000-4,000	1,590,000	0.43
				4,000-6,000	2,230,000	-
				6,000-8,000	2,700,000	-
CB-337	4.44-4.87	-47.4 to -47.8	13,816	0-3,000	1,940,000	0.15
				3,000-6,000	2,780,000	0.27
				6,000-9,000	3,310,000	0.46
				9,000-12,000	3,150,000	-
CB-338	9.47-9.9	-55.1 to -55.5	17,382	0-5,000	10,000,000	0.18
				5,000-10,000	9,280,000	0.21
				10,000-15,000	8,000,000	0.25

Ten samples were submitted for failure load and splitting tensile strength analyses (Table 9). The following observations were noted:

- Failure loads ranged from 4,441 pounds (lb) to 7,409 lb.
- Splitting tensile strengths ranged from 968 pounds per square inch (psi) to 1,620 psi.

Table 9 – Splitting Tensile Test Results

Boring #	Depth in Boring (ft)	Elevation (ft MLLW)	Thickness (in)			Diameter (inch)	Failure Load (lb)	Splitting Tensile Strength (psi)
CB-317	11.43-11.53	-56.0 to -56.1	1.2	1.2	1.2	2.49	7,409	1,620
CB-322	5.52-5.62	-50.4 to -50.5	1.1	1.2	1.2	2.47	6,544	1,400
CB-324	5.17-5.27	-50.9 to -51.0	1.2	1.2	1.2	2.49	4,984	1,100
CB-331	5.64-5.74	-54.7 to -54.8	1.2	1.2	1.2	2.49	4,441	968
CB-333	1.62-1.72	-41.9 to -42.0	1.2	1.2	1.2	2.49	5,507	1,220
	6.67-6.77	-47.0 to -47.1	1.2	1.2	1.2	2.49	6,204	1,330
CB-337	3.91-4.01	-46.8 to -46.9	1.2	1.2	1.2	2.46	4,610	1,020
CB-338	10.25-10.35	-55.8 to -55.9	1.2	1.2	1.2	2.49	7,213	1,520
CB-343	8.71-8.81	-53.7 to -53.8	1.2	1.2	1.2	2.47	4,891	1,040
CB-344	8.62-8.72	-55.0 to -55.1	1.2	1.2	1.2	2.47	4,623	1,010

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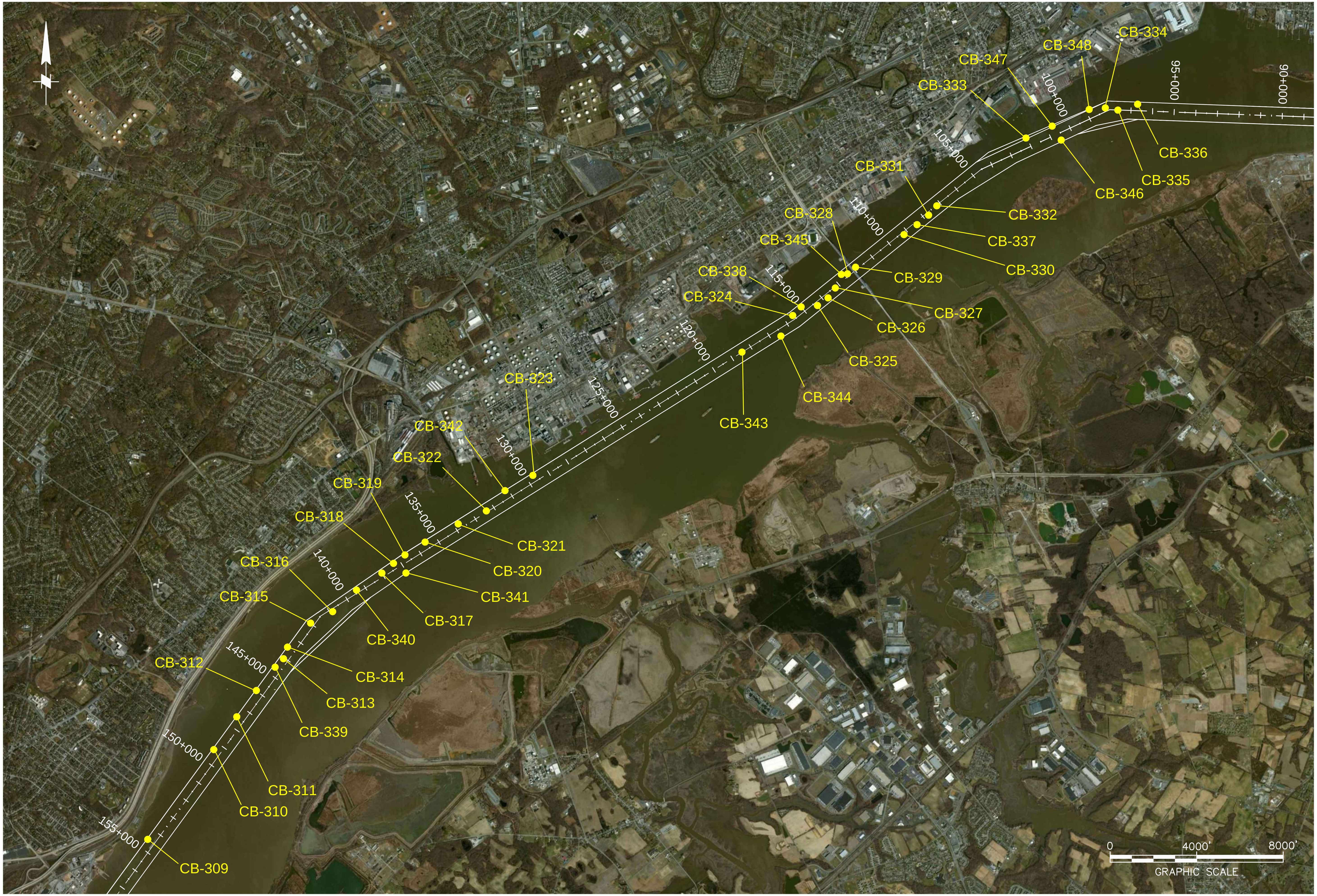
APPENDIX A

Figures

FIGURE 1: SITE VICINITY FOR SUPPLEMENTAL GEOTECHNICAL SUBSURFACE INVESTIGATION



Mark	Description	Date	Appr.	Mark	Description	Date	Appr.

Designed by: SCS
Dwn by: ECC
Ckd by: SCS
Reviewed by: --
Submitted by: --
Date: APRIL 2012
Rev.
Drawing Name : GEO_BORINGS
Scale: AS SHOWN
Plot scale: 1 = 1

PHILADELPHIA REGIONAL PORT AUTHORITY

GBA ENGINEERS ★ SURVEYORS
9008 Yellow Brick Rd.
Unit O
Baltimore, MD 21237
Phone (410) 682-5595

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

FIG 2: 2011 GEOTECHNICAL BORINGS

SEAL

FIG 2
A-2

P:\Delaware_River\2008_616_PRPA_45ft_Deepening\dwg\2001Geotechnical_Borings_Figure2.dwg

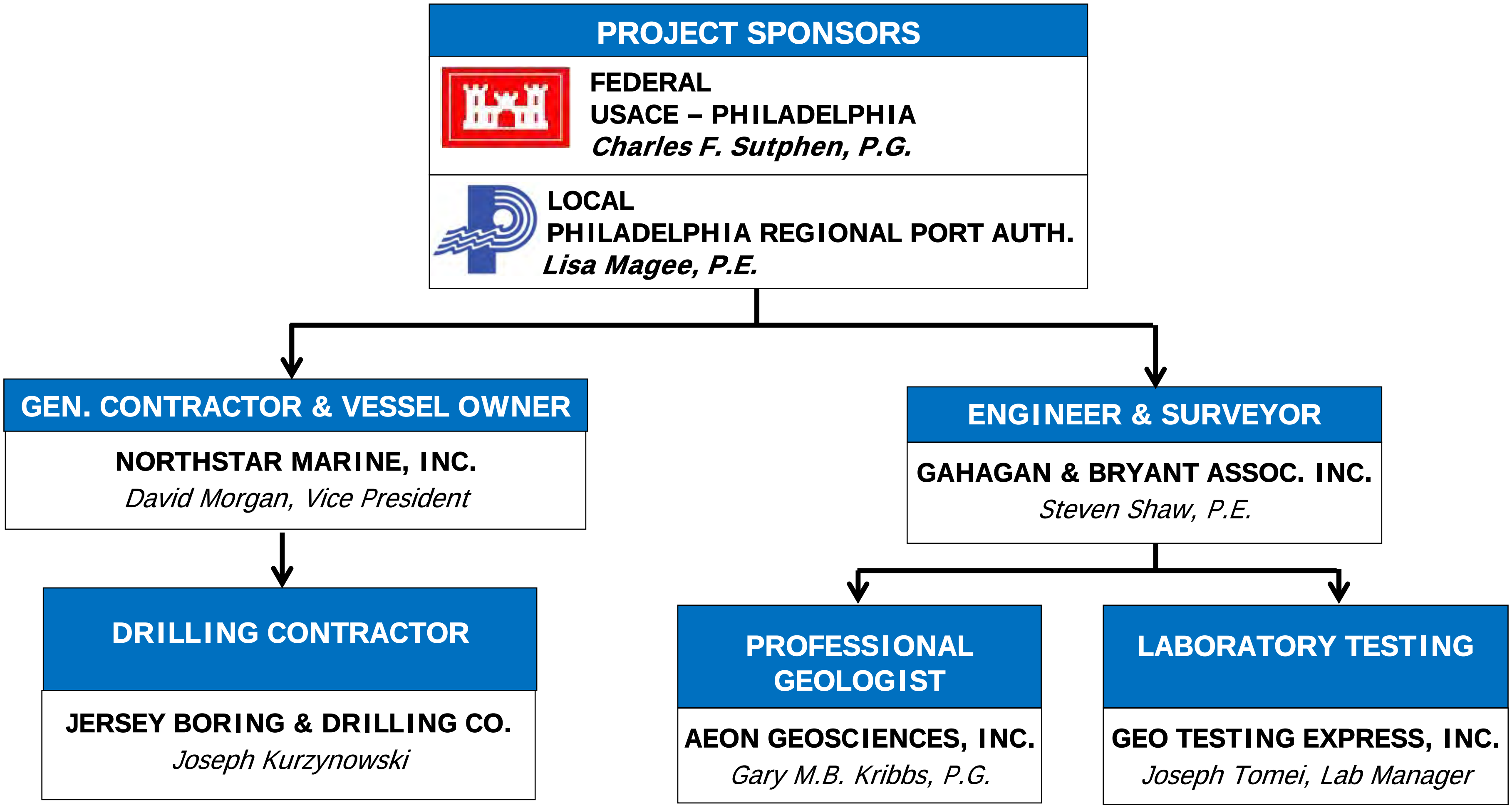
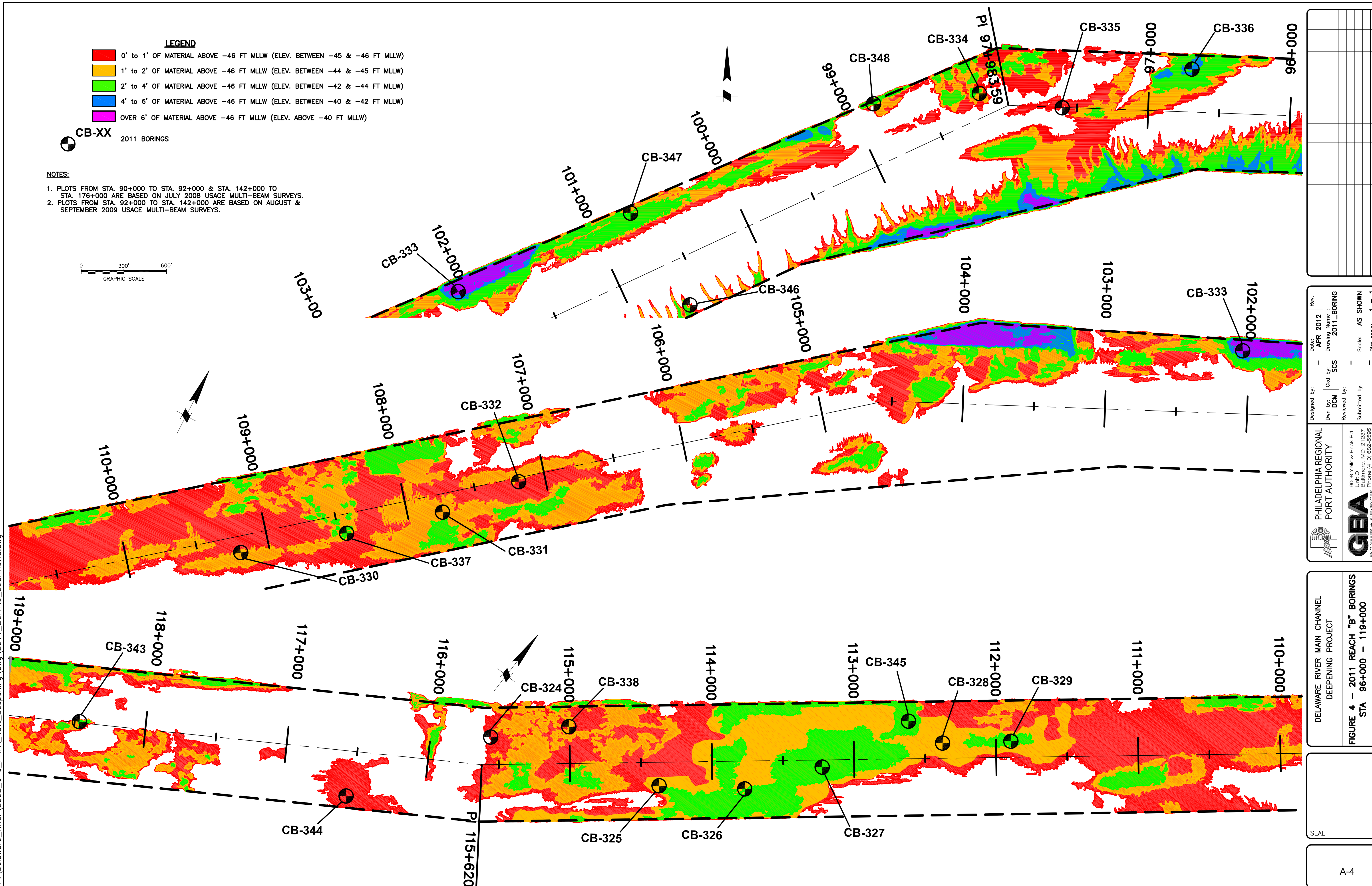


Figure 3

Reach B Supplemental Geotechnical Subsurface Investigation Organization Chart


LEGEND
0' to 1' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -45 & -46 FT MLLW)
1' to 2' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -44 & -45 FT MLLW)
2' to 4' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -42 & -44 FT MLLW)
4' to 6' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -40 & -42 FT MLLW)
OVER 6' OF MATERIAL ABOVE -46 FT MLLW (ELEV. ABOVE -40 FT MLLW)
CB-XX 2011 BORINGS
NOTES:
1. PLOTS FROM STA. 90+000 TO STA. 92+000 & STA. 142+000 TO STA. 176+000 ARE BASED ON JULY 2008 USACE MULTI-BEAM SURVEYS.
2. PLOTS FROM STA. 92+000 TO STA. 142+000 ARE BASED ON AUGUST & SEPTEMBER 2009 USACE MULTI-BEAM SURVEYS.
0 300' 600'
GRAPHIC SCALE
CB-333
CB-347
CB-348
CB-334
CB-335
CB-336
CB-346
PI 97+983.59
96+000
97+000
99+000
100+000
101+000
102+000
103+00
CB-332
CB-330
CB-337
CB-331
CB-333
102+000
103+000
104+000
105+000
106+000
107+000
108+000
109+000
110+000
CB-343
CB-344
CB-324
CB-338
CB-325
CB-326
CB-327
CB-345
CB-328
CB-329
PI 115+620.
110+000
111+000
112+000
113+000
114+000
115+000
116+000
117+000
118+000
119+000
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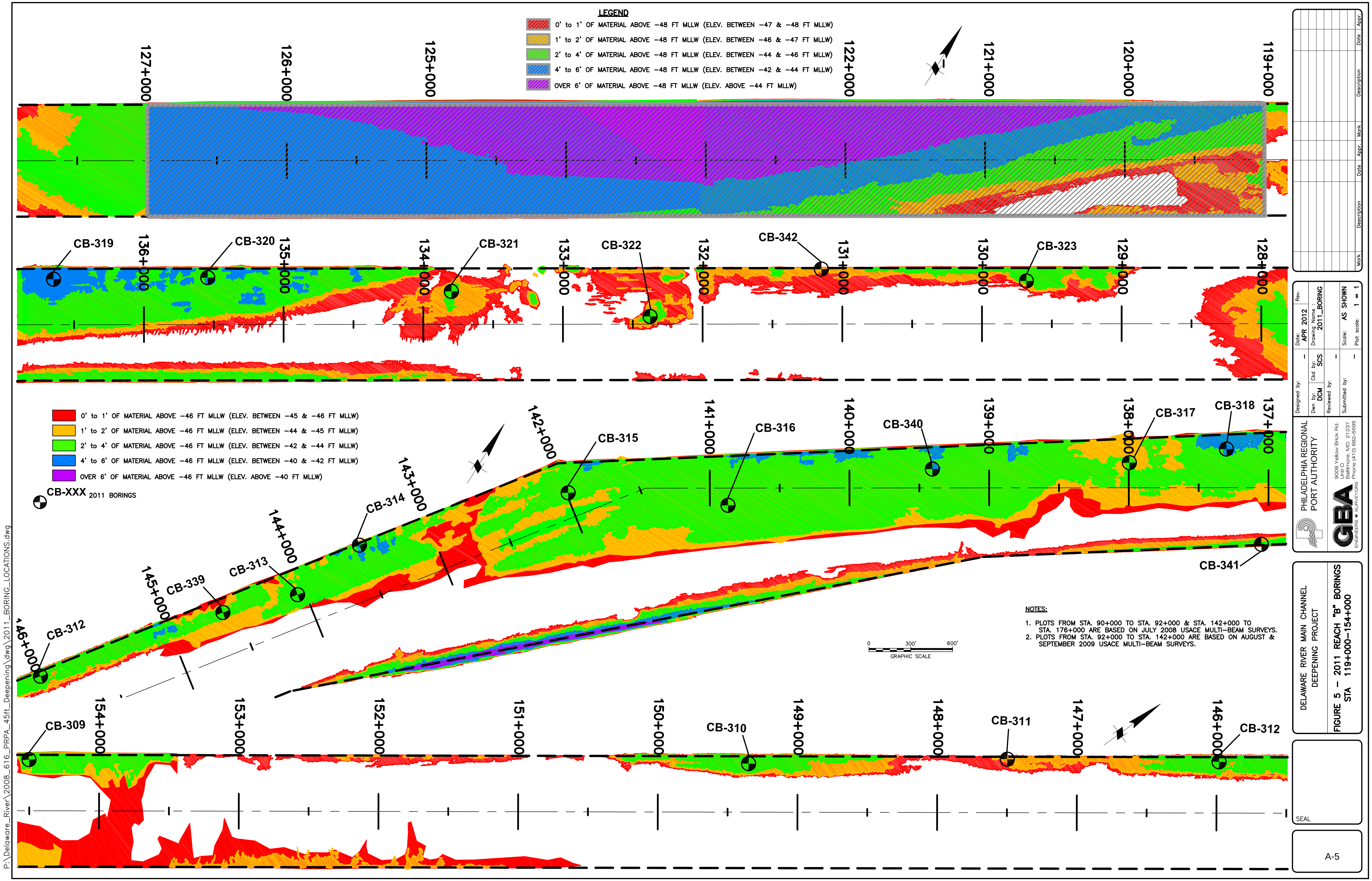
Designed by: -
Dwn by: DCM
Ckd by: SCS
Reviewed by: -
Submitted by: -
Date: APR 2012
Drawing Name: 2011_BORING
Scale: AS SHOWN
Plot scale: 1 = 1
Rev.
Mark Description Date Appr.
PHILADELPHIA REGIONAL PORT AUTHORITY
GBA ENGINEERS ★ SURVEYORS
9008 Yellow Brick Rd. Unit O Baltimore, MD 21237 Phone (410) 682-5595
DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT
FIGURE 4 - 2011 REACH "B" BORINGS STA 96+000 - 119+000
SEAL
A-4


LEGEND
0' to 1' OF MATERIAL ABOVE -48 FT MLLW (ELEV. BETWEEN -47 & -48 FT MLLW)
1' to 2' OF MATERIAL ABOVE -48 FT MLLW (ELEV. BETWEEN -46 & -47 FT MLLW)
2' to 4' OF MATERIAL ABOVE -48 FT MLLW (ELEV. BETWEEN -44 & -46 FT MLLW)
4' to 6' OF MATERIAL ABOVE -48 FT MLLW (ELEV. BETWEEN -42 & -44 FT MLLW)
OVER 6' OF MATERIAL ABOVE -48 FT MLLW (ELEV. ABOVE -44 FT MLLW)
127+000
126+000
125+000
122+000
121+000
120+000
119+000
CB-319
136+000
CB-320
135+000
134+000
CB-321
133+000
CB-322
132+000
CB-342
131+000
130+000
CB-323
129+000
128+000
0' to 1' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -45 & -46 FT MLLW)
1' to 2' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -44 & -45 FT MLLW)
2' to 4' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -42 & -44 FT MLLW)
4' to 6' OF MATERIAL ABOVE -46 FT MLLW (ELEV. BETWEEN -40 & -42 FT MLLW)
OVER 6' OF MATERIAL ABOVE -46 FT MLLW (ELEV. ABOVE -40 FT MLLW)
CB-XXX 2011 BORINGS
142+000
CB-315
141+000
CB-316
140+000
CB-340
139+000
138+000
CB-317
CB-318
137+000
143+000
CB-314
144+000
CB-313
CB-339
145+000
CB-312
146+000
CB-341
NOTES:
1. PLOTS FROM STA. 90+000 TO STA. 92+000 & STA. 142+000 TO STA. 176+000 ARE BASED ON JULY 2008 USACE MULTI-BEAM SURVEYS.
2. PLOTS FROM STA. 92+000 TO STA. 142+000 ARE BASED ON AUGUST & SEPTEMBER 2009 USACE MULTI-BEAM SURVEYS.
0
300'
600'
GRAPHIC SCALE
CB-309
154+000
153+000
152+000
151+000
150+000
CB-310
149+000
148+000
CB-311
147+000
146+000
CB-312
Mark
Description
Date
Appr.
Mark
Description
Date
Appr.
Rev.
Date: APR 2012
Drawing Name: 2011_BORING
Scale: AS SHOWN
Plot scale: 1 = 1
Designed by: -
Dwn by: DCM
Ckd by: SCS
Reviewed by: -
Submitted by: -
PHILADELPHIA REGIONAL PORT AUTHORITY
GBA
ENGINEERS ★ SURVEYORS
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DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT
FIGURE 5 - 2011 REACH "B" BORINGS STA 119+000-154+000
SEAL
A-5
P:\Delaware_River\2008_616_PRPA_45ft_Deepening\dwg\2011_BORING_LOCATIONS.dwg

APPENDIX B

Boring & Rock Coring Logs

Grain Size, Rock Lithology, and Abbreviations

Soils Color variations not shown
Gravel

Gravel and Sand
Or Sand and Gravel

Sand

Silt

Mixtures of Sand, Silt and Clay

Silt and Clay

Silt and Clay Varved

Glauconitic (Clayey) Sand

White/Black Granitic Gneiss

White/Gray/Black Mafic Gneiss

Blue/Black/Purple Mafic Gneiss
(Wilmington Complex)

Green/Black Mafic or Dioritic
Gneiss

Greenish Black Mafic Gneissic
Schist

USCS Soil Classification Abbreviations

GW – well-graded gravel
GP – poorly graded gravel
GM – silty gravel
GC – clayey gravel
SW – well-graded sand
SP – poorly graded sand
SM – silty sand
SC – clayey sand
CL – lean clay
ML – silt
OL – organic clay or silt
CH – fat clay
MH – elastic silt
OH – organic clay or silt
PT – peat

Abbreviations

CS – Compressive Strength
EM PR - Elastic Modulus: Poisson’s Ratio
EM YM - Elastic Modulus: Young’s Modulus
FL – Failure Load
FS – Failure Strength
RQD – Rock Quality Designation
REC – Recovery
STS – Splitting Tensile Strength
WOC – Weight of Casing
WOH – Weight of Hammer
WOR – Weight of Rod

Hole No. CB- 309

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT
Delaware River Deepening Project Reach B

2. LOCATION (*Coordinates or Station*
337406.536 214661.022

3. DRILLING AGENCY
Jersey Boring and Drilling

4. HOLE NO. (*As shown on drawing title and title number*) CB-309

5. NAME OF DRILLER Joseph Kurzynowski

6. DIRECTION OF HOLE
X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN 13' plus

8. DEPTH DRILLED INTO ROCK N/A

9. TOTAL DEPTH OF HOLE 13'

10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.

11. DATUM FOR ELEVATION SHOWN (*TBM or MSL*) -42.65 MLLW

12. MANUFACTURERS DESIGNATION OF DRILL CME-55

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 6 | DISTURBED Yes | UNDISTURBED

14. TOTAL NUMBER CORE BOXES N/A

15. ELEVATION GROUND WATER N/A

16. DATE HOLE | STARTED 11/28/11 11:00 | COMPLETED 15:00

17. ELEVATION TOP OF HOLE -42.65 feet MLLW

18. TOTAL CORE RECOVERY FOR BORING N/A

19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G.

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Brown-Gray SAND & GRAVEL	30-36		A-1-a (0)
-43.65	1		trace to little clay at base			N/A
				36-12	S-1	
-44.65	2				0-2'	
				--	25%	Casing running and re-seated
				--	0.5'	Between 2-3'
-45.65	3		Orange/Gray interbedded SANDY		S-2	
			CLAY (varved) 7.5 YR 4/6	10-10	3-5'	A-7-6 (16)
	4				REC	CL
-46.65				12-26	80%	
			2" gray gravelly clay lens		1.6'	
-47.65	5		Red /Gray		S-3	
			Varved SAND and SILTY CLAY	17-22	5-7'	
-48.65	6		10YR 3/3 / 7.5 YR 4/6		REC	
					95%	
				27-32	1.9'	
-49.65	7				S-4	
				10-12	7-9'	
	8				REC	
-50.65			Increasing frequency of		1.7'	
			Sand varves with depth	17-26	85%	
-51.65	9				S-5	
				17-32	9-11'	
-52.65	10				REC	
				48-59	1.3'	
			Brown SAND lens medium		65%	
-53.65	11					
			Red CLAY with gray & olive	10-12	S-6	
-54.65	12		mottling		11-13'	
				17-18	REC	
					1.9'	
-55.65	13				95%	
			Bottom of Boring 13'			

SPT Boring Only

ENG FORM 1836
MAR 71
PREVIOUS EDITIONS ARE OBSOLETE
PROJECT DRDP-RB
HOLE NO. CB- 309

Hole No. CB- 310

DRILLING LOG	DIVISION Philadelphia	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 341557.499 217712.271	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.97 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-310	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 — DISTURBED: Yes — UNDISTURBED:
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/20/11 12:00 — COMPLETED 14:30
	17. ELEVATION TOP OF HOLE -42.97 MLLW
7. THICKNESS OF OVERBURDEN 12'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary MB Kribbs P.G.
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
					S-1	A-1-a (0)
					0-2'	N/A
-43.97	1		**SAND with rounded gravel**		REC	140# safety hammer
			with variable composition		65%	Seated casing into sediment
-44.97	2		Apparent small boulders		1.3'	4' feet after relocating
				--		Because of Flowing sand
				--		Using a bentonite drilling mud
-45.97	3			--		
				--		
	4			--	S-2	
-46.97				5-5	4-6'	
					REC	A-7-6 (15)
-47.97	5		Gray clayey **SAND**		55%	SC
			with rock fragments and silt	11-11	1.1'	
-48.97	6					
			Upper 1' Orange oxidized glauconitic	11-12	S-3	
			SAND		6-8'	
-49.97	7				REC	
				17-18	80%	
	8		Green Glauconitic SAND		1.6'	
-50.97				8-10	S-4	
					8-10'	
-51.97	9			12-14	REC	
					90%	
-52.97	10				1.8'	
				18-27	S-5	
					10-12'	
-53.97	11				REC	
				41-45	100%	
-54.97	12				2.0'	
			Bottom of Boring 12'			
	13					
	14					
	15					

SPT Boring Only

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB- 310

Hole No. CB-311

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 343074.422 218775.523	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.6
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-311	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 6 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/20/11 8:30 — COMPLETED 10:55
	17. ELEVATION TOP OF HOLE -44.6 MLLW
7. THICKNESS OF OVERBURDEN 13' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M. B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 13'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				4-4	S-1 *	
-45.6	1				0-2	
				8-9	REC	A-1-a (0)
-46.6	2				30%	GW
			Gray/Brown	---	0.6'	
			GRAVEL and SAND			
-47.6	3		trace silt		S-2	
				8-22	3-5'	A-1-b (0)
-48.6	4				REC	SP
				23-18	55%	
					1.1	
-49.6	5				S-3	
				22-26	5-7'	
-50.6	6				REC	
					80%	
				31-32	1.6'	
-51.6	7				S-4	
				16-47	7-9'	
-52.6	8				REC	
					55%	
-53.6	9			24-35	1.1'	
			Gray/Green/Red		S-5	
			GRAVEL and SAND	32-28	9-11'	
-54.6	10		trace silt and clay		REC	
				22-50	80%	
					1.6	
-55.6	11				S-6	
				17-11	11-13'	
-56.6	12				REC	
					100%	
				12-12	2.0'	
-57.6	13					
			Bottom of Boring 13'			

SPT Boring Only

Hole No. CB-312

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT "2" or 3" SPT 140# Safety hammer
2. LOCATION (Coordinates or Station) 344290.147 219681.848	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) -43.16 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. (As shown on drawing title and title number) CB-312	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/16/11 7:30 — COMPLETED 11:30
	17. ELEVATION TOP OF HOLE -43.16 MLLW
7. THICKNESS OF OVERBURDEN 11' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 11'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Brown GRAVEL and SAND	24-15	S-1 *	A-1-a (0)
-44.16	1		Trace silt		0-2	N/A
				8-20	REC	
-45.16	2				40%	
			Gray/Brown	---	0.8'	
			GRAVEL and SAND			
-46.16	3		trace silt		S-2	
				32-100	3-5'	A-1-a (0)
-47.16	4				REC	GP
				--	30%	
					0.6	
-48.16	5				S-3	
				5-10	5-7'	
-49.16	6		Gray/Green		REC	
			SAND and Silt		55%	
			Trace clay	57-47	1.1'	
-50.16	7				S-4	
				54-75	7-9'	
-51.16	8				REC	
					70%	
-52.16	9			95-67	1.4'	
			Gray/Brown/Green/Red		S-5	
			GRAVEL and SAND	22-42	9-11'	
-53.16	10		trace silt and clay			
				68-100/0.5	100%	
-54.16	11					
			Bottom of Boring 11'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-312
MAR 71

Hole No. CB-313

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1
1. PROJECT Delaware River Deepening Project Reach B		10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer	
2. LOCATION *(Coordinates or Station* 345761.166 220933.974		11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -43.9 MLLW	
3. DRILLING AGENCY Jersey Boring and Drilling Company		12. MANUFACTURERS DESIGNATION OF DRILL CME-55	
4. HOLE NO. *(As shown on drawing title and title number)*	CB-313	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5	DISTURBED Yes / UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski		14. TOTAL NUMBER CORE BOXES N/A	
		15. ELEVATION GROUND WATER N/A	
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.		16. DATE HOLE	STARTED 12/16/11 7:30 / COMPLETED 11:30
		17. ELEVATION TOP OF HOLE -43.9 MLLW	
7. THICKNESS OF OVERBURDEN 12' plus		18. TOTAL CORE RECOVERY FOR BORING N/A	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.	
9. TOTAL DEPTH OF HOLE 12'			

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				45-46	S-1 *	
-44.9	1				0-2	A-1-a (0)
				27-20	REC	GP
-45.9	2				35%	
			Gray/Brown	---	0.7'	
			GRAVEL with Cobbles			
-46.9	3		Some sand, trace silt and clay			

-47.9	4				S-2	
				38-56	4-6'	A-1-a (0)
					REC	GP
-48.9	5				35%	
				24-27	0.7	
-49.9	6				S-3	
					6-8	
				24-20	REC	
-50.9	7				100%	
				19-24	2.0'	
-51.9	8		Dark Gray **SILTY CLAY** 10 YR 3/2		S-4	
					8-10'	
-52.9	9		Gray Medium Grained **SAND**	11-15	REC	
					55%	
			Reddish Gray **SILTY CLAY** 10 YR 3/1	19-21	1.1'	
-53.9	10				S-5	
				10-54	10-12'	
			Gray/Brown		REC	
-54.9	11		**GRAVEL and SAND**		70%	
			trace sand, silt and clay	30-32	1.4'	
-55.9	12					
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 MAR 71	PREVIOUS EDITIONS ARE OBSOLETE.	PROJECT DRDP-RB	HOLE NO. CB-313

Hole No. CB-314

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 346296.374 221121.766	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.24 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-314	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 / DISTURBED Yes / UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE / STARTED 12/15/11 12:00 / COMPLETED 14:30
	17. ELEVATION TOP OF HOLE -42.24MLLW
7. THICKNESS OF OVERBURDEN 12' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				65-25	S-1 *	
-43.24	1				0-2	
				83-100/0.4	REC	
-44.24	2				45%	
			Gray/Brown	---	0.9'	
			Well graded GRAVEL and SAND			
-45.24	3		trace silt and clay		S-2	
				8-73	3-5	
-46.24	4		Large Cobble		REC	
				--	0%	
					0.0	
-47.24	5					
				42-45		
-48.24	6				S-3	
					5-7	A-1-a (0)
			Large Cobble	52-60	REC	GW
-49.24	7				65%	
				---	1.3	
-50.24	8		Gray Well Rounded Well graded		S-4	
			Variable Color and composition	15-13	8-10'	
-51.24	9		**GRAVEL and SAND**		REC	
			Coarse to medium		100%	
				31-50/0.0	2.0'	
-52.24	10		Occasional cobble		S-5	
				35-60	10-12'	
					REC	
-53.24	11				75%	
				80-32	1.5'	
-54.24	12					
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-314

MAR 71

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 347406.041 222190.313	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.01 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-315	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 / DISTURBED Yes / UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
	15. ELEVATION GROUND WATER N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	16. DATE HOLE STARTED 12/15/11 12:00 COMPLETED 14:30
	17. ELEVATION TOP OF HOLE -44.01 MLLW
7. THICKNESS OF OVERBURDEN 12' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Gray/Brown	45-33	S-1 *	A-1-a (0)
-45.0	1		**GRAVEL and SAND**		0-2	N/A
			Little sand, trace silt	37-39	REC	
-46.0	2				60%	
				---	1.2'	
-47.0	3		Well rounded Well graded		S-2	
			Varible Color and Composition	---	4-5.4	A-1-a (0)
-48.0	4		**GRAVEL and SAND**		REC	GW
				8-26	55%	
					1.1	
-49.0	5					
				100/0.4		
-50.0	6				S-3	
					6-8'	
				6-22	REC	
-51.0	7				60	
				---	1.2	
-52.0	8		Brown **SILTY CLAY**	34-28	S-4	
					8-10'	
-53.0	9			4-7	REC	
					100%	
			Gray **SILTY CLAY**	8-9	2.0'	
-54.0	10		No varving present		S-5	
				7-8	10-12'	
					REC	
-55.0	11				65%	
				13-15	1.3'	
-56.0	12					
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-315
MAR 71

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT
Delaware River Deepening Project Reach B

2. LOCATION (*Coordinates or Station*
347936.4 223208.657

3. DRILLING AGENCY
Jersey Boring and Drilling Company

4. HOLE NO. (*As shown on drawing title and title number)* CB-316

5. NAME OF DRILLER
Joseph Kurzynowski

6. DIRECTION OF HOLE
X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN 13' plus

8. DEPTH DRILLED INTO ROCK N/A

9. TOTAL DEPTH OF HOLE 13'

10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer

11. DATUM FOR ELEVATION SHOWN (*TBM or MSL)* -42.23 MLLW

12. MANUFACTURERS DESIGNATION OF DRILL CME-55

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 6 | DISTURBED Yes | UNDISTURBED

14. TOTAL NUMBER CORE BOXES N/A

15. ELEVATION GROUND WATER N/A

16. DATE HOLE | STARTED 12/14/11 12:20 | COMPLETED 14:45

17. ELEVATION TOP OF HOLE -42.23 MLLW

18. TOTAL CORE RECOVERY FOR BORING N/A

19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				19-19	S-1 *	Casing running during spooning
-43.23	1		Brown		0-2	A-1-a (0)
			Poorly sorted **GRAVEL and SAND**	43-42	REC	N/A
-44.23	2		trace silt		55%	Casing embedded 3'
				---	1.1'	
-45.22	3				S-2	
			Gray **SAND** well graded	12-24	3-5'	Casing running during spooning
-46.23	4				REC	
					45%	
			Gray Well Rounded Well graded	100/0.25	0.9'	A-1-b (0)
-47.23	5		**GRAVE**L with Sand			SP
			Large cobble or small boulder	85-147		Drove again to 5'
-48.23	6				S-3	
					5-7'	A-1-a (0)
				35-27	REC	N/A
-49.22	7		Increasing sand with depth		70%	
				25-15	1.4	
-50.23	8				S-4	
					7-9'	
-51.23	9		Orange **SILT**	18-12	REC	
					80%	
			Brown **SAND**	18-20	1.6'	
-52.23	10		with well rounded gravel		S-5	
					9-11'	
				21-28	REC	
-53.23	11		Greenish Gray Silty Clay		100%	
				38-28	2.0'	
-54.23	12		**Brown SAND**		S-6*	
			with well rounded gravel	33-35	11-13'	
					100%	
-55.2	13		Greenish Gray Silty Clay layer		2.0'	
			Bottom of Boring 13'			
	14					
	15					

SPT Boring Only

Hole No. CB-317

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 349718.009 225483.799	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.54MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-317	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: Yes — UNDISTURBED:
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/14/11 07:30 — COMPLETED 11:00
	17. ELEVATION TOP OF HOLE -44.54 MLLW
7. THICKNESS OF OVERBURDEN 5.0	18. TOTAL CORE RECOVERY FOR BORING 81% =8.1'
8. DEPTH DRILLED INTO ROCK 10'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs. P.G.
9. TOTAL DEPTH OF HOLE 15'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) *d*	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				43-44	S-1a	Difficulty seating casing
					0-0.8	A-1-b (0)
-45.54	1	1	Brown medium **SAND** trace silt/clay			
				30-45	S-1b	A-2-4 (0)
-46.54	2	2			1-2	
			Orange fine SAND little silt	----		
-47.54	3	3				
			Green/Black	100/0.25		
-48.54	4	4	SAND and Rock Fragments			
			Decomposed Saprolitic bedrock			
-49.54	5	Horiz. MB 5				
		Horiz. NF-Stnd			R-1	
-50.54	6	Horiz. NF-Stnd 6		REC	5-10'	
		Broken to 7.4		64%		
		Ang- NF-Stnd		3.2'		
-51.54	7	Horiz. NF-Stnd 7		RQD		
		7.4	Green/Black Quartz Dioritic **GNEISS**,	14%		
-52.54	8	Horiz. NF 7.7 8		0.7'		Horizontal fracturing
		Horiz. MB	Massive mostly			Heavy iron staining into rock matrix
		Horiz. MB 8.3				Sericitic iron staining
-53.54	9	Horiz. NF-Stnd 9				
		Broken zone				
-54.54	10	Broken zone 10	40^0 gneissic foliation			
		Horiz. NF-Stnd	is very faint within the fabric			
		Horiz. NF 10.			R-2	
-55.54	11	Broken zone 11		REC	10-15'	Horizontal fracturing
		ST-1		98%		**FL-7409 lb ST-1620 psi**
-56.54	12	Horiz. NF-Stn 12		4.9'		Heavy iron staining into rock matrix
		Horiz. MB 12.		RQD		Sericitic iron staining
-57.54		**CS-2.1**		78%		**CS-27,528 psi**
	13	13		3.9'		
-58.54	14	Horiz. MB 14				
			Bottom of Boring 15'			
-59.54	15	15				

SPT Boring

Rock Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-317

MAR 71

Hole No. CB-318

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 350168.926 226021.725	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.3 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-318	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/13/11 12:00 — COMPLETED 13:30
	17. ELEVATION TOP OF HOLE -42.3 MLLW
7. THICKNESS OF OVERBURDEN 12' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				22-60	S-1 *	Casing embedded 2'
-43.3	1		Brown well graded		0-2	A-1-a (0)
			GRAVEL and SAND	37-38	REC	Casing running during spooning
-44.3	2				100%	
				---	2.0'	
-45.3	3				S-2	
				9-83	3-5'	Casing running during spooning
-46.3	4				REC	A-1-a (0)
					70%	GW
			Gray **GRAVEL** and **SAND**	86-35	1.4'	
-47.3	5		trace clay			Drove again to 5'
				19-9		
-48.3	6				S-3	
					5-7'	
				8-9	REC	A-4 (0)
-49.44	7		Gray **SANDY SILT**		60%	N/A
			10YR 2/2	9-12	1.2	Drove again to 7'
-50.44	8				S-4	
			Gray Medium- **SAND**	12-19	7-9'	
-51.3	9				REC	
			Gray **SANDY SILT**		70%	
				12-14	1.4'	
-52.3	10					
					S-5	
			Gray **SANDY SILT** varved	---	10-12'	
-53.3	11				REC	
			Very sticky and suction at bottom	15-16	2.5%	
-54.3	12				0.05	
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-318

Hole No. CB-319

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 350557.41 226549.614	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -41.44 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-319	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 6 · DISTURBED Yes · UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE · STARTED 12/13/11 7:45 · COMPLETED 10:30
	17. ELEVATION TOP OF HOLE -41.44 MLLW
7. THICKNESS OF OVERBURDEN 14' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 14'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				WOR-WOR	S-1 *	Casing embedded 2'
-42.44	1				1-3'	N/A
				48-80	REC	
-43.44	2				70%	
				36-14	1.4'	
			Brown			Casing running during spooning
-44.44	3		**GRAVEL and SAND**		S-2	
			Trace silt	16-30	3-5'	A-1-a (0)
-45.44	4		Slightly Micaceous with depth		REC	GW
					40%	
				22-23	0.8	
-46.44	5					
				15-18		
-47.44	6				S-3	
					5-7'	
				15-22	REC	A-3 (0)
-48.44	7		Gray fine **SAND**		50%	N/A
			Well graded	—	1.0	Drove again to 8'
-49.44	8				S-4	
				5-8	8-10'	
					REC	
					100%	
			Medium-fine **SAND**	10-13	2.0	
-51.44	10		Mottled Well graded			
					S-5	
				7-8	10-12'	
-52.44	11				REC	
			Gray	9-7	100%	
-53.44	12		**SILTY CLAY** varved		2.0	
			(10YR 3/3)		S-6	
-54.44	13		Very sticky	7-8	12-14'	
					REC	
			Orange/Gray Medium **SAND**	9-14	100%	
-55.44	14		Little mica		2.0	
			Bottom of Boring 14'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-319
MAR 71

Hole No. CB-320

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT: Delaware River Deepening Project Reach B
2. LOCATION (Coordinates or Station: 351152.109 227479.95
3. DRILLING AGENCY: Jersey Boring and Drilling Company
4. HOLE NO. (As shown on drawing title and title number): CB-320
5. NAME OF DRILLER: Joseph Kurzynowski
6. DIRECTION OF HOLE: X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15' plus
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 15'
10. SIZE AND TYPE OF BIT "2" or 3" SPT 140# Safety hammer
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): -43.99 MLLW
12. MANUFACTURERS DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: 6 | DISTURBED: Yes | UNDISTURBED:
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 12/12/11 13:30 | COMPLETED 15:30
17. ELEVATION TOP OF HOLE: -43.99 MLLW
18. TOTAL CORE RECOVERY FOR BORING: N/A
19. SIGNATURE OF INSPECTOR: Gary M.B. Kribbs P.G.

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Gray Quartz SAND			Casing embedded 2'
-44.99	1					
-45.99	2				S-1 *	A-3 (0)
				15-100/0.4'	2-3.5'	SP
			Gray and mixed color		REC	Casing running during spooning
-46.99	3		pea sized **GRAVEL and SAND**		60%	A-1-a (0)
			Loose and running		0.9'	SW
-47.99	4				S-2	
					4-6'	
				53-63	REC	Drove again to 5'
-48.99	5				72.5%	
				16-27	1.45'	
-49.99	6		Gray		S-3	
			SILT and CLAY		6-8'	
			(10YR 2/2)	63-37	REC	
-50.99	7				50%	
				16-20	1.0	
-51.99	8				S-4	
					8-10'	
				28-27	REC	
-52.99	9	9.5	Gray Quartz SAND		55%	
			10 YR 2/3		1.1'	
-53.99	10			6-10	S-5	
					10-12'	
				12-18	REC	
-54.99	11				100%	
			Gray	7-10	2.0	
-55.99	12		**SILT** some clay		S-6	
			(10YR 2/2)		12-14'	
-56.99	13			16-18	REC	
					100%	
			Gray Medium-Fine **SAND**	14-32	2.0	
-57.99	14		Well graded		S-7	
					14-15.25	
			Bottom of Boring 15'	100/0.25'	100%	
-58.99	15				1.25'	

SPT Boring Only

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT DRDP-RB | HOLE NO. CB-320

Hole No. CB-321

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1
1. PROJECT Delaware River Deepening Project Reach B		10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer	
2. LOCATION (Coordinates or Station) 351993.07 229011.816		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) -45.56 MLLW	
3. DRILLING AGENCY Jersey Boring and Drilling Company		12. MANUFACTURERS DESIGNATION OF DRILL CME-55	
4. HOLE NO. (As shown on drawing title and title number)	CB-321	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 7	DISTURBED Yes / UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski		14. TOTAL NUMBER CORE BOXES N/A	
		15. ELEVATION GROUND WATER N/A	
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.		16. DATE HOLE STARTED 12/5/11 12:30	COMPLETED 15:30
		17. ELEVATION TOP OF HOLE -45.56 MLLW	
7. THICKNESS OF OVERBURDEN 9.5'		18. TOTAL CORE RECOVERY FOR BORING N/A	
8. DEPTH DRILLED INTO ROCK 5.5' Saprolite		19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.	
9. TOTAL DEPTH OF HOLE 15'			

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				21-50	S-1 *	Casing embedded 4'
-46.56	1		SAND and GRAVEL	Inside	0.1.5'	
			Very loose & running		REC	
-47.56	2				0%	
-48.56	3					
-49.56	4				S-2	
					4-6'	Casing running during spooning
				53-63	REC	Drove again to 5'
-50.56	5				72.5%	
			Gray and mixed color medium -fine	16-27	1.45'	
-51.56	6		Quartz SAND and GRAVEL		S-3	
			trace silt-occ. cobble		6-8'	
				63-37	REC	
-52.56	7				50%	
				16-20	1.0	
-53.56	8				S-4	
					8-10'	
				28-27	REC	
-54.56	9	9.5			55%	
					1.1'	
-55.56	10			6-10	S-5	
					10-12'	
				12-18	REC	
-56.56	11		Green		100%	
			Micaceous -chlorite **SAPROLITE**	7-10	2.0	
-57.56	12		(Micaceous Medium-Fine SAND and SILT)		S-6	
			(10G 6/2)		12-14'	
-58.56	13			16-18	REC	
					100%	
				14-32	2.0	
-59.56	14				S-7	
					14-15.25	
			Bottom of Boring 15'	100/0.25'	100%	
-60.56	15				1.25'	

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB- 321

MAR 71

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer, HX Diam.
2. LOCATION *(Coordinates or Station* 352594.553 230312.94	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.88 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-322	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: Yes — UNDISTURBED:
	14. TOTAL NUMBER CORE BOXES 1
5. NAME OF DRILLER Joseph Kurzynowski	15. ELEVATION GROUND WATER N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	16. DATE HOLE — STARTED 12/9/11 11:45 — COMPLETED 13:30
	17. ELEVATION TOP OF HOLE -44.88 MLLW
7. THICKNESS OF OVERBURDEN 5'	18. TOTAL CORE RECOVERY FOR BORING 100% =10'
8. DEPTH DRILLED INTO ROCK 10'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs. P.G.
9. TOTAL DEPTH OF HOLE 15'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
-45.88	1					
-46.88	2				S-1*	
			Gray **GRAVEL** and coarse **SAND**	35-12	REC	A-1-b (0)
					50%	N/A
-47.88	3			24	1.0	
		3.5		100/0.4	2-4	
-48.88	4		Gray/Brown Mottled **Sandy SILT** (saprolitic)			
-49.88	5					
		ST-2		REC	R-1	FL-6544 lb, STS-1400 psi
-50.88	6			100%	5-10'	
				4.5'		
-51.88	7	CS-2.1	Blue /Black/Purple **Mafic GNEISS**	RQD		CS- 40,474 psi
		20° NF	(Wilmington Complex)	52%		
		25° NF		2.6'		
-52.88	8					
			Very Limited Natural Fracturing			
-53.88	9	85° NF				
		Joint extend				
-54.88	10	85° NF				
				REC	R-2	
-55.88	11	Broken zone No recovered core		92%	10-15'	
				4.6'		
-56.88	12			RQD		
				80%		
				4.0'		
-57.88	13					
-58.88	14					
-59.88	15		Bottom of Boring 15'			

SPT Boring

Rock Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-322
MAR 71

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT "2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 354237.675 232463.349	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.96 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-323	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 4 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/9/11 7:45 — COMPLETED 10:30
	17. ELEVATION TOP OF HOLE -44.96 MLLW
7. THICKNESS OF OVERBURDEN 10'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 10'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
						Casing embedded 2'
-45.96	1					
-46.96	2		Multi-colored variable composition		S-1 *	
			Angular to subrounded	10-22	2-3.5'	A-1-a (0)
			GRAVEL some sand		REC	GW
-47.96	3				100%	
				100/0.5'	1.5'	
-48.96	4				S-2	
				14-29	4-5.5'	A-1-a (0)
					REC	GW
-49.96	5				93%	
				100/0.4'	1.4'	
-50.96	6				S-3	
				2-8	6-8'	
					REC	
-51.96	7				75%	
		7.5	White/Gray well graded Quartz **SAND**	11-12	1.5'	
-52.96	8		Varved Gray clayey **SILT**		S-4	
					8-10'	
-53.96			White/Gray well graded Quartz	2-9	REC	
	9		Fine to Coarse **SAND**	10-12	90%	
		9.5			1.8'	
-54.96	10		Varved Gray clayey **SILT** sand at base			
			Bottom of Boring 10'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-323
MAR 71

Hole No. CB-324

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 361632.209 244474.082	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -45.77 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-324	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: Yes — UNDISTURBED:
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/8/11 12:00 — COMPLETED 14:30
	17. ELEVATION TOP OF HOLE -45.77 MLLW
7. THICKNESS OF OVERBURDEN 1'	18. TOTAL CORE RECOVERY FOR BORING 100% =5'
8. DEPTH DRILLED INTO ROCK 5'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs. P.G.
9. TOTAL DEPTH OF HOLE 6'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Gray/Brown Sand			
-46.77	1					
		Horiz. NF				
-47.77	2	Horiz. + 42° NF		REC	R-1	
		Horiz. NF	White/Black **Mafic GNEISS**	100%	1-6'	
		Horiz. NF	42^0 gneissic foliation	5'		
-48.77	3			RQD		
		Horiz. + 42° NF	Horizontal and vertical	28%		
-49.77	4		Natural fracturing	1.4'		
		CS-3.1				CS-8,563 psi
		Horiz. NF	4.2 to 5' gneissic foliation showing			
-50.77	5	Broken zone	flowage/migmatization			
		ST-3				FL-4,984 lbs STS-1,100 psi
-51.77	6					
			Bottom of Boring 6'			
-						

Rock Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-324
MAR 71

Hole No. CB-325

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 362091.716 245618.512	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.49 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-325	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 3 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/7/11 12:30 — COMPLETED 15:30
	17. ELEVATION TOP OF HOLE -44.49 MLLW
7. THICKNESS OF OVERBURDEN 8'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 8'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
						Casing embedded 3'
-45.49	1					
						Spoon pulled casing up &
-46.49	2				S-1 *	Collapsed the hole
			Multi-colored		4-6'	A-1-a (0)
			GRAVEL and SAND		REC	GW
-47.49	3				62.5%	
-48.49	4					
			Moderately well sorted	27-36		
-49.49	5					
				50-53	S-2	
-50.49	6				6-8'	
				27-36	REC	
					62.5%	
-51.49	7				1.25'	Casing running
				27-33		
-52.49	8					
			Bottom of Boring 8'			
	9					

SPT Boring Only

ENG FORM 1836 MAR 71	PREVIOUS EDITIONS ARE OBSOLETE.	PROJECT DRDP-RB	HOLE NO. CB-325

Hole No. CB-326

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140 # Safety Hammer 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.25 MLLW
2. LOCATION *(Coordinates or Station* 362445.436 246106.953	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
3. DRILLING AGENCY Jersey Boring and Drilling Company	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 2 — DISTURBED Yes — UNDISTURBED
4. HOLE NO. *(As shown on drawing title and title number)* CB-326	14. TOTAL NUMBER CORE BOXES N.A
5. NAME OF DRILLER Joseph Kurzynowski	15. ELEVATION GROUND WATER N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	16. DATE HOLE — STARTED 12/6/11 11:00 — COMPLETED 13:00 17. ELEVATION TOP OF HOLE -44.25 MLLW
7. THICKNESS OF OVERBURDEN 6'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 6'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
						Casing running
-45.25	1					
			Gray			Casing dropped
-46.25	2		**GRAVEL and SAND**			Reset L/B Deck 2 feet
				27-31	S-1	
					2-4'	
-47.25	3				REC	Current picking up
				36-37	0%	Rods are slapping the casing hard
-48.25	4				0.0'	
				48-50	S-2	
					4-6'	
-49.25	5				REC	Called hole for Safety- Rods
				45-75	0%	Torquing from tide-wind vibrations
-50.25	6			Refusal		Lost spoon tide-wind vibrations
			Bottom of Boring 6'			
	7					
	8					
	9					
	10					
	11					

SPT Boring Only

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-326

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT 140 # Safety Hammer
2. LOCATION *(Coordinates or Station* 362901.539 246441.847	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.4 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-327	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 4 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N.A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/6/11 7:45 — COMPLETED 10:00
	17. ELEVATION TOP OF HOLE -42.4 MLLW
7. THICKNESS OF OVERBURDEN 10.5'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 10.5'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Very loose			Casing embedded into sediment
-43.4	1		Casing 3 feet.			Due to strong river current
			Loose gravel and sand in wash			
-44.4	2					
					S-1	
-45.4	3				3-5'	
			Gray	12-27	REC	
-46.4	4		**GRAVEL and SAND**		0%	
				36-41	0.0'	
					S-2	
-47.4	5				5-7'	
				12-26	REC	
-48.4	6		Reddish Gray		40%	**A-4 (0)**
			Micaceous Sandy SILT with	19-28	0.8'	**ML**
			rock fragments and gravel		S-3	**Non-plastic**
-49.4	7				7-9'	
			Brown/Gray	37-53	REC	**A-1-a (0)**
-50.4	8		**GRAVEL and SAND**		100%	**N/A**
					2'	
			Grading down to	54-53	S-4	
-51.4	9		Medium grained **SAND**		9-11'	
			With gravel and rock fragments	63-67	REC	
-52.4	10				100%	
				100/0.5	2'	
-53.4	11		Bottom of Boring 10.5'			
	12					
	13					
	14					
	15					

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-327
MAR 71

Hole No. CB-328

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 363556.332 247005.644	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -45.17 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-328	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 3 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
	15. ELEVATION GROUND WATER N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	16. DATE HOLE — STARTED 12/5/11 12:30 — COMPLETED 15:30
	17. ELEVATION TOP OF HOLE -45.17 MLLW
7. THICKNESS OF OVERBURDEN 5'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK 4' Saprolite	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 9'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
						Casing embedded 2'
-46.2	1					
-47.2	2				S-1 *	
			Gray medium -fine	2-57	2-4'	
			Quartz SAND and GRAVEL	50/0.3	REC	
-48.2	3		trace silt-occ. cobble		0%	casing punched through
						3.5 and drove easily to 5'
-49.2	4					
-50.2	5					
			Orange/Brown	7-8	S-2	
-51.2	6		Oxidized **SAPROLITE**		5-7'	A-2-4 (0)
			(breaks down to)	12-22	REC	N/A
			Micaceous Fine Quartz Gravel and SAND		62.5%	
-52.2	7				1.25'	
			7.5'		S-3	
-53.2	8		Black/Green	24-37	7-9'	
			Micaceous-biotite-chlorite **SAPROLITE**		REC	
			(Micaceous Medium-Fine SAND and SILT)	59-70	100%	
-54.2	9				2.0	
			Bottom of Boring 9'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-328
MAR 71

Hole No. CB-329

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1
1. PROJECT Delaware River Deepening Project Reach B		10. SIZE AND TYPE OF BIT 2" or 3" SPT 140 # Safety Hammer 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -43.73 MLLW	
2. LOCATION *(Coordinates or Station* 363862.516 247376.101		12. MANUFACTURERS DESIGNATION OF DRILL CME-55	
3. DRILLING AGENCY Jersey Boring and Drilling Company		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 4	DISTURBED Yes / UNDISTURBED
4. HOLE NO. *(As shown on drawing title and title number)*	CB-329	14. TOTAL NUMBER CORE BOXES N.A	
5. NAME OF DRILLER Joseph Kurzynowski		15. ELEVATION GROUND WATER N/A	
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.		16. DATE HOLE	STARTED 12/2//11 11:30 / COMPLETED 14:30
		17. ELEVATION TOP OF HOLE -43.73 MLLW	
7. THICKNESS OF OVERBURDEN	6'	18. TOTAL CORE RECOVERY FOR BORING N/A	
8. DEPTH DRILLED INTO ROCK	5' Saprolite	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.	
9. TOTAL DEPTH OF HOLE	11'		

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Very soft-loose			Casing embedded into sediment
-44.73	1		Casing sank to 3 feet.			Due to strong river current
			Loose gravel and sand in wash			Casing running down hole
-45.73	2					
-46.73	3					
			Gray	100/0.5	S-1	
-47.73	4		**GRAVEL and SAND** trace silt		3-5'	**A-1-a (0)**
			(gravel is variable composition and running		REC	**GW**
			Into the casing)		45%	
-48.73	5			25-12	0.9'	
					S-2	
-49.73	6				5-7'	
				12-7	REC	
			Yellow/Brown Micaceous		25%	**A-4 (0)**
-50.73	7		**Oxidized SAPROLITE**		0.5'	**N/A**
			(Micaceous Fine Silty SAND)	7-14	S-3	
-51.73	8				7-9'	
					REC	
			Green/Black Micaceous Schist	20-18	60%	
-52.73	9		**SAPROLITE**		1.2'	
			(Micaceous Medium SAND and SILT)	12-14	S-4	
-53.73	10				9-11'	
				18-20	REC	
					100%	
-54.73	11				2'	
			Bottom of Boring 11'			

SPT Boring Only

Hole No. CB-330

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 365371.453 249618.06	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -45.64 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-330	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 3 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N.A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/2//11 8:30 — COMPLETED 10:30
	17. ELEVATION TOP OF HOLE -45.64 MLLW
7. THICKNESS OF OVERBURDEN 12'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
						Casing embedded into sediment
			Very soft/loose			Due to strong river current
-46.64	1		Casing sank to 3 feet.			Casing running down hole
			Loose **sand and gravel** in wash			
-47.64	2					
-48.64	3					
			Gray medium to fine grained	39-37	S-1	**A-2-4 (0)**
-49.64	4		**SAND** little gravel, silt		3-5'	**N/A**
				17-16	REC	Casing running with spoon
					45%	Spoon trapped
-50.64	5				0.9'	
-51.64	6					
			Casing clean out			Casing running as driving
			wash consistent with samples above and below			
-52.64	7					
-53.64	8					
				19-11	S-2	
			Gray medium to fine grained		8-10'	
-54.64	9		**SAND** trace gravel, silt	14-17	REC	Casing running with spoon
					60%	
-55.64	10				1.2'	
				10-20	S-3	
					10-12'	Casing running with spoon
-56.64	11		Gray medium to fine grained		REC	
			SAND little silt, varving	12-12	90%	
-57.64	12				1.8'	
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-330
MAR 71

Hole No. CB-331

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT 140# Safety hammer
2. LOCATION (*Coordinates or Station* 366269.202 250754.018	11. DATUM FOR ELEVATION SHOWN (*TBM or MSL)* -49.03 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. (*As shown on drawing title and title number)* CB-331	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
	15. ELEVATION GROUND WATER N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	16. DATE HOLE — STARTED 12/1/11 11:30 — COMPLETED 13:30
	17. ELEVATION TOP OF HOLE -49.03 MLLW
7. THICKNESS OF OVERBURDEN 4'	18. TOTAL CORE RECOVERY FOR BORING 100% =5'
8. DEPTH DRILLED INTO ROCK 5'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs. P.G.
9. TOTAL DEPTH OF HOLE 9'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
					S-1	S-1 w/ 2" spoon
				15/4'	0-4'	
-50.03	1		Gray/Brown Sand and silt	No REC		WOC = casing sinking under own weight
			Trace gravel			
-51.03	2					
-52.03	3					
						Firmer near rock, but no recovery
-53.03	4					
-54.03	5	Peg-52^0	5-5.2' Quartz pegmatite zone dip-52^0	REC	R-1	
		Horiz. NF		88% .	4-9'	FL-4,441 lbs, STS-968 psi
-55.03	6	ST-4 EM		4.4'		EM- YM 4.5m-5.7m
		Horiz. MB	Gray/Black Granitic GNEISS, mica rich	RQD		EM PR 0.21-0.46
			90^0 gneissic foliation	76%		
-56.03	7		Visible amphibole content	3.8'		
			(Chester Park Gneiss)			
-57.03	8	Horiz. MB				
-58.03	9					
			Bottom of Boring 9'			

SPT Boring

Rock Coring

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-331

Hole No. CB-332

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 3" SPT
2. LOCATION (Coordinates or Station 366703.247 251134.065	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) -45.21 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. (As shown on drawing title and title number) CB-332	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: Yes — UNDISTURBED:
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 11/30//11 13:30 — COMPLETED 15:30
	17. ELEVATION TOP OF HOLE -45.21 MLLW
7. THICKNESS OF OVERBURDEN 9'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK 0	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 9'	

ELEVATION a	DEPTH b	LEGEND c General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF	CLASSIFICATION OF MATERIALS (Description) d	SPT or % CORE RECOVERY & RQD e	BOX OR SAMPLE # or Run # f	REMARKS g (Weathering, staining water loss drilling penetration rates, drilling issues and testing results)
						Difficulty seating casing
						Mud line 56.3
-46.21	1	1				
-47.21	2	2	Gray medium grained quartz **SAND** & rounded Gravel			
-48.21	3	3		REC	S-1	
				60%	3-5'	A-1-b (0)
-49.21	4	4		1.2'		N/A
-50.21	5	5		REC	S-2	
				100%	5-7'	
-51.21	6	6		2'		
		6.5				
		6.9	Gray **GRAVEL** w/fine sand and silt			
-52.21	7	7		REC		
			Few angular rock fragments near top	0.05%	S-3	
-53.21	8	8	Grading to	0.1'	7-9'	
			Gray and Brown Rounded GRAVEL			
-54.21	9	9				
			Bottom of Boring 9'			
		10				
		11				
		12				
		13				
		14				
		15				

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-332
MAR 71

Hole No. CB-333

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 369835.708 255254.754	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -40.3 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-333	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: Yes — UNDISTURBED:
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 11/30//11 13:30 — COMPLETED 16:30
	17. ELEVATION TOP OF HOLE -40.3 MLLW
7. THICKNESS OF OVERBURDEN 1.0	18. TOTAL CORE RECOVERY FOR BORING 100% =8'
8. DEPTH DRILLED INTO ROCK 8'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 9'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				26	S-1	Difficulty seating casing
			Brown fine **SAND** & rounded Gravel	38/.4	0-0.8	**A-3 (0)**
-41.3	1	Horiz. NF 1 ST-5		REC	88%	N/A
		Horiz. NF		100%	R-1	FS-5,507 lbs, STS-1,220 psi
-42.3	2	Horiz. NF 2	Gray/Black Granitic **GNEISS**, mica rich	5'	1-6'	
		10^0 NF	40^0 gneissic foliation	RQD		Horizontal fracturing
		45^0 NF	@ x 2.5' 2" pegmatitic layer	33%		Heavy iron staining into rock matrix
-43.3	3	Horiz. NF-Stained 3		1.65'		
		Horiz. NF-Stained CS-				
-44.3	4	Horiz. NF-Stained 5.1 4				CS-12,770 psi
-45.3	5	Horiz. NF- 5	@ x5' 4" pegmatitic layer			
-46.34	6	6				
		Horiz. NF-Stained ST-6			R-2	FL-6,204 lbs, STS 1,330 psi
		CS- 6.1		REC	6-9'	CS- 14,113 psi
-47.34	7	7		100% .		
		Horiz. NF-Stained	Gray/Black Granitic **GNEISS**, mica rich	3'		
-48.3	8	8	40^0 gneissic foliation still present ,but fading	RQD		Horizontal fracturing
		Horiz. NF Stained		62%		Heavy iron staining into rock matrix
		Fe - Stained		1.85'		
-49.3	9	9				
		10	Bottom of Boring 9'			
		11				
		12				
		13				
		14				
		15				

SPT Boring

Rock Coring

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-333

Hole No. CB-334

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" & 3" spoon and/or HX core
2. LOCATION *(Coordinates or Station* 371229.126 258921.279	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -45.2 feet MLLW
3. DRILLING AGENCY Jersey Boring and Drilling	12. MANUFACTURERS DESIGNATION OF DRILL CME-55 Track
4. HOLE NO. *(As shown on drawing title and title number)* CB-334	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 1 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 11/30/11 8:30 — COMPLETED 11/30/11 12:00
	17. ELEVATION TOP OF HOLE -45.2 feet MLLW
7. THICKNESS OF OVERBURDEN 6'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK 8' Saprolite-Severely weathered	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 14'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Quartz Coarse SAND with variable composition Angular to subrounded Trace fines	38-38 37-50/0.3	S-1 1-3' REC 30% 0.6'	A-2-4 (0) N/A 140# safety hammer Seated casing into sediment 2' feet
-46.2	1					
-47.2	2					
-48.2	3					
			Light Gray **GRAVEL** **Micaceous SAND** Oxidized Chester Park Gneiss	15-18 25-38 50/0.5	S-2 3-5' REC 55% 1.1 S-3 5-5.5'	6 to 7' reseated casing and drove
-49.2	4					
-50.2	5					
-51.2	6					
			Green-Gray-White **Saprolite** (Micaceous silt and sand) (Chester Park Gneiss) remnant structure present		REC 27% 0.4 S-4 7-9' 100% 2.0'	Additional foot Too Dense to spoon Roller bit to 7-9'
-52.2	7					
-53.2	8					
-54.2	9					
			Gray /Black **Mafic GNEISS** Massive no foliation Severely weathered to decomposed	REC 16% 0.8' RQD 0%	R-1 9-14'	
-55.2	10					
-56.2	11					
-57.2	12					
-58.2	13					
-59.2	14					
			Bottom of boring 14 feet			

SPT Boring

Roller Bit

Rock Coring

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-334

Hole No. CB- 335

DRILLING LOG	DIVISION Philadelphia	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 371128.321 259504.316	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -47.86 feet MLLW
3. DRILLING AGENCY Jersey Boring and Drilling	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-335	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 4 — DISTURBED: Yes — UNDISTURBED:
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 11/29/11 10:30 — COMPLETED 14:40
	17. ELEVATION TOP OF HOLE -47.86 feet MLLW
7. THICKNESS OF OVERBURDEN 7'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK 5' Saprolite	19. SIGNATURE OF INSPECTOR Gary M. B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
						140# safety hammer
						Seated casing into sediment
-48.86	1		**Gravel**			4' feet after relocating due
			with variable composition			to boulder
-49.86	2		Apparent small boulders			And bad current effects
-50.86	3					
	4					
-51.86				33-38	S-1	
					4-6'	
-52.86	5		Light Gray fine Quartz		55%	A-1-1 (0)
			GRAVEL and SAND trace clay	24-17	1.1'	N/A
-53.86	6				S-2	
				17-19	6-8'	
					50%	
-54.86	7				1.0'	
			Black-White	18-20		
	8		Micaceous silt and sand			
-55.86			**Saprolite**	27-38	S-3	
			remnant structure present		8-10'	
-56.86	9		Variable attitude	45-50/0.35	100%	
					2.0'	
-57.86	10				S-4	
				20-27	10-12'	Casing running down with spoon
					75%	
-58.86	11				1.5'	
				32-53/0.5		
-59.86	12					Boring called at 12 feet
			Bottom of Boring 12'			
	13					
	14					
	15					

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT DRDP-RB | HOLE NO. CB- 335

MAR 71

DRILLING LOG

DRILLING LOG	DIVISION Philadelphia	INSTALLATION Philadelphia District	SHEET 1 OF 1

- 1. PROJECT Delaware River Deepening Project Reach B
- 2. LOCATION *(Coordinates or Station* 371400.168 260417.107
- 3. DRILLING AGENCY Jersey Boring and Drilling
- 4. HOLE NO. *(As shown on drawing title and title number)* CB-336
- 5. NAME OF DRILLER Joseph Kurzynowski
- 6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED _______________ DEG. FROM VERT.
- 7. THICKNESS OF OVERBURDEN 8.5'
- 8. DEPTH DRILLED INTO ROCK 6.5' Saprolite
- 9. TOTAL DEPTH OF HOLE 15'
- 10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
- 11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.0 feet MLLW
- 12. MANUFACTURERS DESIGNATION OF DRILL CME-55
- 13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 | DISTURBED Yes | UNDISTURBED
- 14. TOTAL NUMBER CORE BOXES N/A
- 15. ELEVATION GROUND WATER N/A
- 16. DATE HOLE STARTED 11/28/11 11:00 COMPLETED 15:00
- 17. ELEVATION TOP OF HOLE -42.0 feet MLLW
- 18. TOTAL CORE RECOVERY FOR BORING N/A
- 19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G.

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
-42.0						
						Seated casing into sediment
-43.0	1		**Quartz Gravel**			2' feet
			with variable composition			
-44.0	2		Angular to subrounded			
			Trace fines	15-12	S-1	140# safety hammer
					2-4'	
-45.0	3				REC	
				12-18	30%	
	4				0.6'	
-46.0				7-8		
					S-2	
-47.0	5			8-9	4-6'	
					REC	
-48.0	6				40%	6 to 7' reseated casing and drove
			Light Gray		0.8'	Additional foot
			Micaceous Clayey SAND			A-6 (4)
-49.0	7		Grading into white sand at base			
			saprolitic	2-5		
	8				S-3	
-50.0			Green-Gray-White	13-11	7-9'	
			Micaceous silt and sand		REC	
-51.0	9		**Saprolite**	15-16	100%	
			remnant structure present	100%	2.0'	
-52.0	10		40^0 foliation	2.0'		
				18-25	S-4	Casing running down with spoon
					9-11'	
-53.0	11				REC	
					100%	
-54.0	12				2.0'	
-55.0	13			22-56	S-5	
			40^0 foliation increasing		13-15'	
-56.0	14		Prominences with depth		REC	
				61-80	90%	
			Bottom of Boring 15'		1.8'	
-57.0	15					

SPT Boring Only

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB- 336

Hole No. CB-337

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 365830.476 250220.093	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.92 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-337	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 1 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/19/11 7:30 — COMPLETED 11:30
	17. ELEVATION TOP OF HOLE -42.92 MLLW
7. THICKNESS OF OVERBURDEN 0.8	18. TOTAL CORE RECOVERY FOR BORING 100% =14.2'
8. DEPTH DRILLED INTO ROCK 14.2'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 15'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			GRAVEL & Rock Fragments	50/0.25	S-1	Difficulty seating casing
					0-0.8	
-43.92	1	CS-7.1		REC	R-1	CS-3,896 psi
-44.92	2	Horiz. NF		100%	0.8 -5'	Horizontal fracturing
		Horiz. NF		4.2'		Heavy iron staining into rock
		EM		RQD		Matrix-ground mass
-45.92	3	Horiz. NF		72%		EM YM-1.13m-1.59m
		Horiz. NF	Gray/Black Granitic **GNEISS**, mica rich	3.0'		EM PR-0.26-0.43
-46.92	4	ST-	Vertical to 85^0 gneissic foliation			FL-4,610 lbs, STS-1,020 psi
		EM				EM YM-1.94m, 2.78m, 3.31m
-47.92	5	NF-foliation				EM PR-0.15, 0.27,0.46
		NF-foliation				
-48.92	6	NF-foliation				
		NF-foliation			R-2	
		Horiz. NF		REC	5-10'	
-49.92	7	Horiz. NF		100% .		
		Horiz. NF	Change in foliation	5'		
-50.92	8	Horiz. NF-Stnd		RQD		
				16%		
		Horiz. NF		0.8'		
-51.92	9	Horiz. NF				
-52.92	10	Horiz. NF				
		Horiz. NF-Stnd CS-7.2				
		Horiz. NF-Stnd	Gray/Black Granitic **GNEISS**, mica rich		R-3	CS-16,883 psi
-53.92	11		45 to 60^0 gneissic foliation	REC	10-15'	
		Horiz. NF		100% .		
-54.92	12	Horiz. MB		5'		
		Horiz. NF		RQD		
		Horiz. NF		16%		
-55.92	13	Horiz. NF		0.8'		
		Horiz. MB				
-56.92	14	45 foliation				
			Bottom of Boring 15'			
-57.92	15					

SPT Boring

Rock Coring

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. — PROJECT DRDP-RB — HOLE NO. CB-337

Hole No. CB-338

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 362028.422 244862.934	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -45.59 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-338	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 1 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1 15. ELEVATION GROUND WATER N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	16. DATE HOLE — STARTED 12/19/11 7:30 — COMPLETED 11:30 17. ELEVATION TOP OF HOLE -45.59 MLLW
7. THICKNESS OF OVERBURDEN 0.8	18. TOTAL CORE RECOVERY FOR BORING 100% =14.2'
8. DEPTH DRILLED INTO ROCK 14.2'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 15'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			SILT and SAND	32-50/0.2	S-1	A-1-a (0)
			with black wood fragments		0-0.8	GW-GM Non plastic
-46.59	1	1	Gray/Black Granitic **GNEISS**, mica rich			
						Reseating casing to 2'
-47.59	2	2	Coring very soft			Too hard to spoon
					Tricone	Too soft to core
			Roller bit to firmer material	REC	2-5'	Roller bit
-48.59	3	3	(Decomposed bedrock)	0%		
-49.59	4	4	wash is salt & pepper			
			SAND and Micaceous SILT			
			@5' solid			
-50.59	5	5				
			Hard intact rock			
-51.59	6	6	Gray/Black Granitic **GNEISS**, mica rich			
		Horiz. NF-Stnd			R-1	
		6.8	6.8 to 7.5 magmatic	REC	5-10'	
-52.59	7	7		100% .		
		Horiz. NF-Stnd		5'		
		7.5				
-53.59	8	8		RQD		
		Horiz. NF Stnd		66%		
		8.2 Fe - Stnd	72^{0} foliation	3.3'		
-54.59	9	9	with 2 vertical joints Fe Stained			
		Horiz. NF				
-55.59	10	Horiz. NF EM 10				EM YM-10.0m, 9.288m, 8.0m
		Horiz. NF	Migmatitic zone very tight fracture			EM PR 0.18, 0.21,0.25
		ST-			R-2	CS- 7,213 psi
-56.59	11	45^{0} NF 11	Gray/Black Granitic **GNEISS**, mica rich	REC	10-15'	
		Horiz. NF-Stnd 11.5		100% .		
-57.59	12	Horiz. NF-Stnd 12	70^{0} gneissic foliation	5'		
		Horiz. NF-Stnd		RQD		
				98%		
-58.59	13	13		4.9'		
		Horiz. NF-				
-59.59	14	14	Migmatitic zone very contorted			
			Thick Quartz lens			
			Bottom of Boring 15'			
-60.59	15	15				

SPT Boring

Roller Bit

Rock Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-338

MAR 71

Hole No. CB-339

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT "2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 345369.326 220548.259	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.64 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-339	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/21/11 11:30 — COMPLETED 14:45
	17. ELEVATION TOP OF HOLE -44.64 MLLW
7. THICKNESS OF OVERBURDEN 12' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				WOC	S-1 *	Casing running during spooning
-45.64	1		Brown/Gray		0-2	
			GRAVEL and SAND	36-58	REC	**A-1-a (0)**
-46.64	2				55%	**GW**
				22-36	1.1'	
-47.64	3				S-2	
				44-45	3-5'	**A-1-a (0)**
-48.64	4				REC	**GW**
					45%	
				100/0.35	0.9'	
-49.64	5					

-50.64	6				S-3	
					5-7'	
			Gray **SILTY CLAY** (organic odor)	7-9	REC	
-51.64	7		10 YR 3/2		90%	
			Trace gravel	15-14	1.8	
-52.64	8				S-4	
					7-9'	
-53.64	9		Gray med-grained **SAND** trace rock fragments	14-16	REC	
					90%	
				18-19	1.8'	
-54.64	10		Gray Micaceous **SILT**		S-5	
			Gray med-grained **SAND** trace rock fragments		9-11'	
				10-12	REC	
-55.64	11				100%	
			Gray micaceous **SILT**	15-16	2.0'	
-56.64	12					
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-339

MAR 71

Hole No. CB-340

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer HX Diam.
2. LOCATION (Coordinates or Station 348931.782 224311.851	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) -43.2 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. (As shown on drawing title and title number) CB-340	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 6 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/22/11 8:30 — COMPLETED 12:30
	17. ELEVATION TOP OF HOLE -43.2 MLLW
7. THICKNESS OF OVERBURDEN 12.5'	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK 3.5' Saprolitic Bedrock	19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G
9. TOTAL DEPTH OF HOLE 16	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				22-32		A-1-a (0)
			Brown SAND and GRAVEL		S-1 *	N/A
-44.2	1	1			0-2'	
				9-10	REC	
-45.2	2	2			50%	
				---	1.0	
-46.2	3	3				
				10-18	S-2	A-4 (0)
-48.6	4	4			3-5'	
			Black/Green	33-34	REC	
			Mafic gneiss **SAPROLITE**		62.5%	
-49.6	5	5	(Micaceous Medium-Fine SAND and SILT)		1.25'	
			Oxidized minor Fe staining	54-62	S-3	
-50.6	6	6			5-7'	
				47-52	REC	
					90%	
-51.6	7	7			1.8	
					S-4	
-52.6	8	8			7-9'	
					REC	
				35-50	90%	
-53.6	9	9		24	1.8	
		Spoon Ref.		100/0.25	S-5	
	10	10			9-10'	
				----	REC	
			Black/Green		20%	
	11	11	**Mafic Gneiss SAPROLITE**	27-42	0.4	
			(Micaceous Medium-Fine SAND and SILT)		S-6	
	12	12		100/0.4	11-12.5	
					60%	
					1.2	
	13	13	Green/Black	REC	R-1	
			Mafic (Gabbroic) **GNEISS**	16%	12.5-16.0	
	14	14	Very Decomposed	0.55'		
				RQD		
	15		Bottom of Boring 16'	0.0%		
	16	15				

SPT Boring

Rock Coring

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-340

Hole No. CB-341

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT
Delaware River Deepening Project Reach B

2. LOCATION (Coordinates or Station
349723.356 226595.317

3. DRILLING AGENCY
Jersey Boring and Drilling Company

4. HOLE NO. (As shown on drawing title and title number) CB-341

5. NAME OF DRILLER
Joseph Kurzynowski

6. DIRECTION OF HOLE
X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN 15' plus

8. DEPTH DRILLED INTO ROCK N/A

9. TOTAL DEPTH OF HOLE 15'

10. SIZE AND TYPE OF BIT "2" or 3" SPT 140# Safety hammer

11. DATUM FOR ELEVATION SHOWN (TBM or MSL) -43.98 MLLW

12. MANUFACTURERS DESIGNATION OF DRILL CME-55

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 | DISTURBED Yes | UNDISTURBED

14. TOTAL NUMBER CORE BOXES N/A

15. ELEVATION GROUND WATER N/A

16. DATE HOLE | STARTED 12/22/11 12:00 | COMPLETED 15:30

17. ELEVATION TOP OF HOLE -43.98 MLLW

18. TOTAL CORE RECOVERY FOR BORING N/A

19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
					S-1 *	
				WOR	0-6'	Casing embedded 2'
-44.98	1				REC	
					100%	**A-7-5 (37)**
-45.98	2				2.0'	**MH**
						Casing running during spooning
-46.98	3				S-2	
					6-8'	
-47.98	4				REC	
					100%	
					2.0	Drove again to 5'
-48.98	5					
-49.98	6		Gray		S-3	
			SILT and CLAY	WOR	8-10'	
			(10YR 3/3)		REC	
-50.98	7				100%	
			Small lens of peat and sand		2.0	
-51.98	8				S-4	
				WOR	10-12'	
					REC	
-52.98	9				100%	
					2.0'	
-53.98	10					
				WOR		
-54.98	11					
-55.98	12					
-56.98	13		Slightly firmer	WOH		
-57.98	14					
			Bottom of Boring 15'			
-58.98	15					

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT DRDP-RB | HOLE NO. CB-341
MAR 71

Hole No. CB-342

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT: Delaware River Deepening Project Reach B
2. LOCATION (*Coordinates or Station*: 353532.007 231173.542
3. DRILLING AGENCY: Jersey Boring and Drilling Company
4. HOLE NO. (*As shown on drawing title and title number*): CB-342
5. NAME OF DRILLER: Joseph Kurzynowski
6. DIRECTION OF HOLE: X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 12'
8. DEPTH DRILLED INTO ROCK: N/A
9. TOTAL DEPTH OF HOLE: 12'
10. SIZE AND TYPE OF BIT "2" or 3" SPT 140# Safety hammer
11. DATUM FOR ELEVATION SHOWN (*TBM or MSL)*: -46.52 MLLW
12. MANUFACTURERS DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: 5 | DISTURBED: Yes | UNDISTURBED:
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 12/23/11 8:00 | COMPLETED 10:30
17. ELEVATION TOP OF HOLE: -46.52 MLLW
18. TOTAL CORE RECOVERY FOR BORING: N/A
19. SIGNATURE OF INSPECTOR: Gary M.B Kribbs P.G

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
					S-1 *	
				WOR	0-3'	**A-7-6 (41)**
-47.52	1				REC	**CH (fat clay)**
			Gray		100%	
-48.52	2		Interbedded **SAND and SILTY CLAY**		2.0'	
			(10YR 3/1)			
-49.52	3				S-2	
			Gray	--	4-6'	
-50.52	4		**SILTY CLAY**		REC	
			(10YR 3/1)	WOR	100%	
					2.0	
-51.52	5					
			Gray/Red **SAND with CLAY**	9-12		**A-4 (2)**
-52.52	6		and rounded gravel (5YR 4/2)		S-3	**CL (fat clay)**
				13-40	8-10'	Casing running during spooning
					REC	
-53.52	7				100%	
				54-60	2.0	
-54.52	8		Cross bedding pattern in spoon		S-4	
				31-42	10-12'	
			Gray medium **SAND with gravel**		REC	
-55.52	9			38-59	100%	
			Coarser with depth		2.0'	
-56.52	10					
				55-60		
-57.52	11					
			Gray **Sand and CLAY** ½ to 1" units	23-19		
-58.52	12		(10YR 3/3)			
			Bottom of Boring 12'			
-59.0						

SPT Boring Only

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT DRDP-RB | HOLE NO. CB-342

Hole No. CB-343

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 359936.304 242127.677	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.99 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-343	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 2 | DISTURBED Yes | UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ____________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE STARTED 12/29/11 11:45 COMPLETED 14:00
	17. ELEVATION TOP OF HOLE -44.99 MLLW
7. THICKNESS OF OVERBURDEN 5'	18. TOTAL CORE RECOVERY FOR BORING 81% =8.1'
8. DEPTH DRILLED INTO ROCK 10'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 15'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				WOH	S-1	
					0-2'	
-45.99	1		Gray/Brown GRAVEL		REC	
			Trace silt	1-1	0%	
-46.99	2				0.0'	
				--	S-2	
-47.99	3					
			Gray/Black	32-100	3-5'	
-48.99	4		Decomposed-Saprolite		40%	
			Mafic GNEISS	112-50/0.2	0.8	
-49.99	5					
-50.99	6	CS-9.1		REC	R-1	CS-13,043 psi
		Horiz NF		68%	5-10'	
-51.99	7			3.4'		
				RQD		
		Horiz NF		54%		
-52.99	8			0.7'		
			Gray/Black **Mafic GNEISS**			
		ST-	Vertical gneissic foliation			FL-4,891 lbs, STS-1,040 psi
-53.99	9					
		Horiz MB				
-54.99	10		Pyrite inclusions @ 5 and 8'			
				REC	R-2	
-55.99	11			96%	10-15'	
				4.7'		
-56.99	12			RQD		
				74%		
			Fe Staining on 45° jointing	3.77'		
-57.99	13					
		Horiz MB				
-58.99	14					
		Horiz NF				
		45° NF	Bottom of Boring 15'			
-59.99	15					

SPT Boring

Rock Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-343

MAR 71

Hole No. CB-344

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT 140# Safety hammer, HX Diam.
2. LOCATION *(Coordinates or Station* 360679.356 243927.602	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -46.42 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-344	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 2 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/29/11 7:45 — COMPLETED 10:30
	17. ELEVATION TOP OF HOLE -46.42 MLLW
7. THICKNESS OF OVERBURDEN 6'	18. TOTAL CORE RECOVERY FOR BORING 98% =9.8'
8. DEPTH DRILLED INTO ROCK 10'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 16'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				21-43	S-1	
					0-2'	A-1-a (0)
-47.42	1		Gray/Brown **GRAVEL and SAND**		REC	N/A
			Trace silt	46-52/0.25	40%	
-48.42	2				0.8'	
				--	S-2	
-49.42	3					
			Gray /Red	7-31	3-5'	
-50.42	4		**GRAVEL and SAND**		40%	
			With clay and silt	100/0.2	0.8	A-1-a (0)
						N/A
-51.42	5			----		
-52.42	6					
				REC	R-1	
-53.42	7	Horiz NF		96%	6-11'	
		Horiz NF	Gray/Black **Mafic GNEISS**	4.8'		
		ST-10	Horizontal to 68° gneissic foliation	RQD		FL 4,623 lbs, STS 1,010 psi
-54.42	8			66%		
		Horiz NF CS-10.1		3.3'		CS-10, 686 psi
-55.42	9					
		25° NF				
-56.42	10					
		30° NF				
				REC	R-2	
-57.42	11			100%	11-16'	
				5.0'		
-58.42	12			RQD		
				72%		
				3.6'		
-59.42	13					
-60.42	14					
		30° NF-F				
-61.42	15	Horiz NF-F				
-62.42	16		Bottom of Boring 16'			

SPT
Boring

Rock
Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-344
MAR 71

Hole No. CB-345

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 363529.764 246721.964	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -42.99 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-345	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______________ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/28/11 8:00 — COMPLETED 11:45
	17. ELEVATION TOP OF HOLE -42.99 MLLW
7. THICKNESS OF OVERBURDEN 12' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				130/0.5	S-1 *	
-43.99	1		Brown Gray		0-2	
			Coarse GRAVEL	--	REC	Casing running during spooning
-44.99	2		Little sand		100%	
				---	0.4'	
-45.99	3				S-2	
			Brown Medium **SAND**	45-120	3-4'	
-46.99	4				REC	**A-1-b (0)**
					55%	**N/A**
			Gray Coarse **SAND**	---	1.1'	
-47.99	5		Little gravel	REC	R-1	
			Boulder	0.0	5-6'	
-48.99	6				S-3	
				27-40	6-8'	
					REC	
-49.99	7				0%	
				22-15	0.0	
-50.99	8				S-4	
				8-35	8-10'	
-51.99	9		Gray poorly sorted **SAND**		REC	
			With Rock Fragments		70%	
				47-69	1.7'	
-52.99	10					
					S-5	
			Brown **SAND**	13-22	10-12'	
-53.99	11		With Rock Fragments		REC	
				36-40	100%	
-54.99	12				2.0	
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-345
MAR 71

Hole No. CB-346

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer
2. LOCATION *(Coordinates or Station* 369742.29 256885.08	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -47.72 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-346	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/28/11 12:15 — COMPLETED 16:15
	17. ELEVATION TOP OF HOLE -47.72 MLLW
7. THICKNESS OF OVERBURDEN 12' plus	18. TOTAL CORE RECOVERY FOR BORING N/A
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G
9. TOTAL DEPTH OF HOLE 12'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
			Pea Gravel veneer		S-1 *	
				WOR	1-4'	Casing embedded 2'
-48.72	1				REC	
				--	40%	**A-7-6 (35)**
-49.72	2		Gray		0.8'	**CH (fat clay)**
			SILTY CLAY and fine SAND	--		
			(10YR 3/3)			Casing running during spooning
-50.72	3				S-2	
				---	4-6'	**A-7-6 (21)**
-51.72	4				REC	**SC**
					100%	
				WOR	1.8'	Drove again to 5'
-52.72	5					
-53.72	6				S-3	
					8-10'	
					REC	
-54.72	7			WOR	100%	
					2.0	
-55.72	8		Gray Pea **Gravel** zone with silty clay matrix		S-4	
					10-12'	
				WOH	REC	
-56.72	9				100%	
			Gray		2.0'	
-57.72	10		**SILTY CLAY and fine SAND**			
			(10YR 3/3)			
				WOH		
-58.72	11					
-59.72	12					
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT DRDP-RB HOLE NO. CB-346

Hole No. CB-347

DRILLING LOG	DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1
1. PROJECT Delaware River Deepening Project Reach B		10. SIZE AND TYPE OF BIT *2" or 3" SPT 140# Safety hammer	
2. LOCATION (Coordinates or Station) 370387.295 256467.395		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) -43.4 MLLW	
3. DRILLING AGENCY Jersey Boring and Drilling Company		12. MANUFACTURERS DESIGNATION OF DRILL CME-55	
4. HOLE NO. (As shown on drawing title and title number)	CB-347	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 5	DISTURBED Yes / UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
		16. DATE HOLE	STARTED 12/28/11 12:15 / COMPLETED 16:15
7. THICKNESS OF OVERBURDEN	12' plus	17. ELEVATION TOP OF HOLE -43.4 MLLW	
8. DEPTH DRILLED INTO ROCK	N/A	18. TOTAL CORE RECOVERY FOR BORING N/A	
9. TOTAL DEPTH OF HOLE	12'	19. SIGNATURE OF INSPECTOR Gary M.B Kribbs P.G	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
					S-1 *	
				WOR	0-3'	Casing embedded 2'
-44.4	1				REC	**A-7-5 (67)**
					55%	**CH (fat clay)**
-45.4	2		Gray		1.1'	
			SILTY CLAY			
			(10YR 3/3)			Casing running during spooning
-46.4	3				S-2	
				---	3-6'	**A-7-5 (60)**
-47.4	4				REC	**CH (fat clay)**
					100%	
				WOR	2.0	Drove again to 5'
-48.4	5					
-49.4	6				S-3	
					6-8'	
					REC	
-50.4	7			WOR	100%	
					2.0	
-51.4	8		Gray		S-4	
			SILTY CLAY		8-10'	
			(10YR 3/3)	WOR	REC	
-52.4	9				100%	
					2.0'	
-53.4	10				S-5	
					10-12'	
				WOR	REC	
-54.4	11				100%	
					2.0'	
-55.4	12					
			Bottom of Boring 12'			

SPT Boring Only

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-347
MAR 71

Hole No. CB-348

DRILLING LOG	INSTALLATION Philadelphia District	SHEET 1 OF 1

1. PROJECT Delaware River Deepening Project Reach B	10. SIZE AND TYPE OF BIT 2" or 3" SPT or HX Diamond Bit.
2. LOCATION *(Coordinates or Station* 371156.556 258176.725	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)* -44.1 MLLW
3. DRILLING AGENCY Jersey Boring and Drilling Company	12. MANUFACTURERS DESIGNATION OF DRILL CME-55
4. HOLE NO. *(As shown on drawing title and title number)* CB-348	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 2 — DISTURBED Yes — UNDISTURBED
5. NAME OF DRILLER Joseph Kurzynowski	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE X VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
	16. DATE HOLE — STARTED 12/19/11 7:30 — COMPLETED 11:30
	17. ELEVATION TOP OF HOLE -44.1 MLLW
7. THICKNESS OF OVERBURDEN 5'	18. TOTAL CORE RECOVERY FOR BORING 79% =6.3''
8. DEPTH DRILLED INTO ROCK 8'	19. SIGNATURE OF INSPECTOR Gary M.B. Kribbs P.G.
9. TOTAL DEPTH OF HOLE 13'	

ELEVATION a	DEPTH b	General Sample Condition Rock: fracture or joint angle Mechanical Break = MB, Natural Fracture = NF LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SPT or Core % REC & RQD e	BOX OR SAMPLE # or Run # depth % Rec f	(Weathering, staining water loss drilling penetration rates, drilling issues and testing results) REMARKS g
				14-18	S-1	Difficulty seating casing
					0-2'	**A-1-a (0)**
-45.1	1				REC	**N/A**
			Black/Gray	8-12	55%	
-46.1	2		**SAPROLITE**		1.1	
			Breaks down to Sand & Gravel	34-91		Horizontal fracturing
			45^0 residual foliation			Heavy iron staining into rock
-47.1	3				S-2	matrix-ground mass
			(Breaks down to Silty Gravel and Sand)	50/0.2	3-4.2'	A-2-4 (0)
-48.1	4				92%	N/A
			Quartz zone with Pyrite and Biotite			
-49.1	5					
		Horiz NF-F	Very Micaceous			
-50.1	6	(F = foliation)	Quartz zone			
		45° NF-F	Very Micaceous		R-1	
		45° NF-F	Black Micaceous **Gneissic SCHIST**	REC	5-10'	
-51.1	7		(Biotite)	80%		
		90° NF		4'		
-52.1	8			RQD		
				0.0%		
				0.0'		
-53.1	9		46°foliation			
-54.1	10			REC		
		30° NF-F		77% .		
		30° NF-F		2.3'	R-2	
-55.1	11	45° NF-F 450		RQD	10-13'	
				17%		
-56.1	12			0.5'		
			20° foliation			Core barrel and casing slapping
		Horiz NF	12-12.25' pyrite crystals			Due to tide current. Called hole
-57.1	13					
			Bottom of Boring 13'			

SPT Boring

Roller Bit

Rock Coring

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT DRDP-RB HOLE NO. CB-348
MAR 71

APPENDIX C

Laboratory Test Results

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: ---	Sample Type: ---	Tested By:	jek
Sample ID:---	Test Date: 02/14/12	Checked By:	njh
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
CB-309	S-1	0-2 ft	Moist, yellowish brown gravel with silt and sand	10.1
CB-309	S-2	3-5 ft	Moist, yellowish brown sandy clay	19.2
CB-310	S-1	0-2 ft	Moist, brown gravel with silt and sand	9.3
CB-310	S-2	4-6 ft	Moist, mottled yellowish brown and gray clayey sand	21.4
CB-311	S-1	0-2 ft	Moist, dark grayish brown gravel with sand	7.5
CB-311	S-2	3-5 ft	Moist, brown sand	16.8
CB-312	S-1	0-2 ft	Moist, brown sand with silt and gravel	10.5
CB-312	S-2	3-5 ft	Moist, brown gravel with sand	7.8
CB-313	S-1	0-2 ft	Moist, brown gravel with sand	7.8
CB-313	S-2	4-6 ft	Moist, grayish brown gravel with sand	6.5

Notes: Temperature of Drying : 110° Celsius

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GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: ---	Sample Type: ---	Tested By:	jek
Sample ID:---	Test Date: 02/14/12	Checked By:	njh
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
CB-314	S-3	5-7 ft	Moist, brown gravel with sand	7.3
CB-315	S-1	0-2 ft	Moist, dark grayish brown gravel with silt and sand	6.3
CB-315	S-2	4.0-5.4 ft	Moist, grayish brown gravel with sand	4.4
CB-316	S-1	0-2 ft	Moist, brown gravel with silt and sand	8.6
CB-316	S-2	3.0-4.5 ft	Moist, brown sand	13.5
CB-316	S-3	5-7 ft	Moist, brown gravel with silt and sand	9.7
CB-317	S-1A	0-1 ft	Moist, grayish brown silty sand	9.9
CB-317	S-1B	1-2 ft	Moist, dark yellowish brown silty sand	14.2
CB-318	S-1	0-2 ft	Moist, brown gravel with silt and sand	9.1
CB-318	S-2	3-5 ft	Moist, brown gravel with sand	3.8

Notes: Temperature of Drying : 110º Celsius

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: ---	Sample Type: ---	Tested By:	jek
Sample ID:---	Test Date: 02/14/12	Checked By:	njh
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
CB-318	S-3B	6.5-7.0 ft	Moist, grayish brown sandy silt	26.7
CB-319	S-1	0-2 ft	Moist, brown gravel with silt and sand	7.6
CB-319	S-2	3-5 ft	Moist, brown gravel with sand	5.7
CB-319	S-3B	5-7 ft	Moist, dark brown sand with silt	23.5
CB-320	S-1A	2.0-2.5 ft	Moist, brown sand	25.6
CB-320	S-1B	2.5-3.0 ft	Moist, brown sand with gravel	5.1
CB-322	S-1	2-4 ft	Moist, brown silty sand with gravel	12.3
CB-323	S-1	2-3.5 ft	Moist, brown gravel with sand	4.5
CB-323	S-2	4.0-5.5 ft	Moist, brown gravel with sand	4.7
CB-325	S-1	4-6 ft	Moist, brown gravel with sand	4.8

Notes: Temperature of Drying : 110° Celsius

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Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: ---	Sample Type: ---	Tested By:	jek
Sample ID:---	Test Date: 02/14/12	Checked By:	njh
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
CB-327	S-2	5-7 ft	Moist, grayish brown sandy silt	17.6
CB-327	S-3	7-9 ft	Moist, brown gravel with silt and sand	5.5
CB-328	S-2	5-7 ft	Moist, dark yellowish brown silty sand	22.7
CB-329	S-1	3-5 ft	Moist, brown gravel with sand	5.4
CB-329	S-2	5-7 ft	Moist, brown silty sand	24.8
CB-330	S-1	3-5 ft	Moist, grayish brown silty sand with gravel	12.8
CB-332	S-1	3-5 ft	Moist, brown silty sand with gravel	13.8
CB-333	S-1	0-1 ft	Moist, brown sand with silt and gravel	18.2
CB-334	S-1	1-3 ft	Moist, dark brown silty sand	11.2
CB-335	S-1	4-6 ft	Moist, dark grayish brown sand with silt and gravel	10.9

Notes: Temperature of Drying : 110º Celsius

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GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: ---	Sample Type: ---	Tested By:	jek
Sample ID:---	Test Date: 02/14/12	Checked By:	njh
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
CB-336	S-2	4-6 ft	Moist, brownish yellow clayey sand	22
CB-338	S-1	0-2 ft	Moist, dark grayish brown gravel with silt and sand	6.7
CB-339	S-1	1-3 ft	Moist, brown gravel with sand	6
CB-339	S-2	3-5 ft	Moist, brown gravel with sand	5.4
CB-340	S-1	0-1 ft	Moist, dark yellowish brown gravel with silt and sand	8.3
CB-340	S-2	3-5 ft	Moist, brown silty sand	33.9
CB-341	S-1	0-6 ft	Wet, gray silt	92.6
CB-342	S-1	0-2 ft	Moist, gray clay with sand	57.4
CB-342	S-2	4-6 ft	Moist, brown sandy clay	21.7
CB-344	S-1	0-2 ft	Moist, gray gravel with silt and sand	8.5

Notes: Temperature of Drying : 110° Celsius

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: ---	Sample Type: ---	Tested By:	jek
Sample ID:---	Test Date: 02/14/12	Checked By:	njh
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
CB-344	S-2	3-4 ft	Moist, dark grayish brown gravel with sand	10.2
CB-345	S-2	3-4 ft	Moist, brown silty sand	10.1
CB-346	S-1	1-4 ft	Moist, dark gray sandy clay	62.1
CB-346	S-2	4-6 ft	Moist, dark greenish gray clayey sand	46.3
CB-347	S-1	0-3 ft	Wet, dark gray clay	88.9
CB-347	S-3	6-8 ft	Wet, gray clay	86.6
CB-348	S-1	0-2 ft	Moist, grayish brown gravel with silt and sand	6.9
CB-348	S-2	3.0-4.2 ft	Moist, dark gray silty sand	20.4

Notes: Temperature of Drying : 110° Celsius

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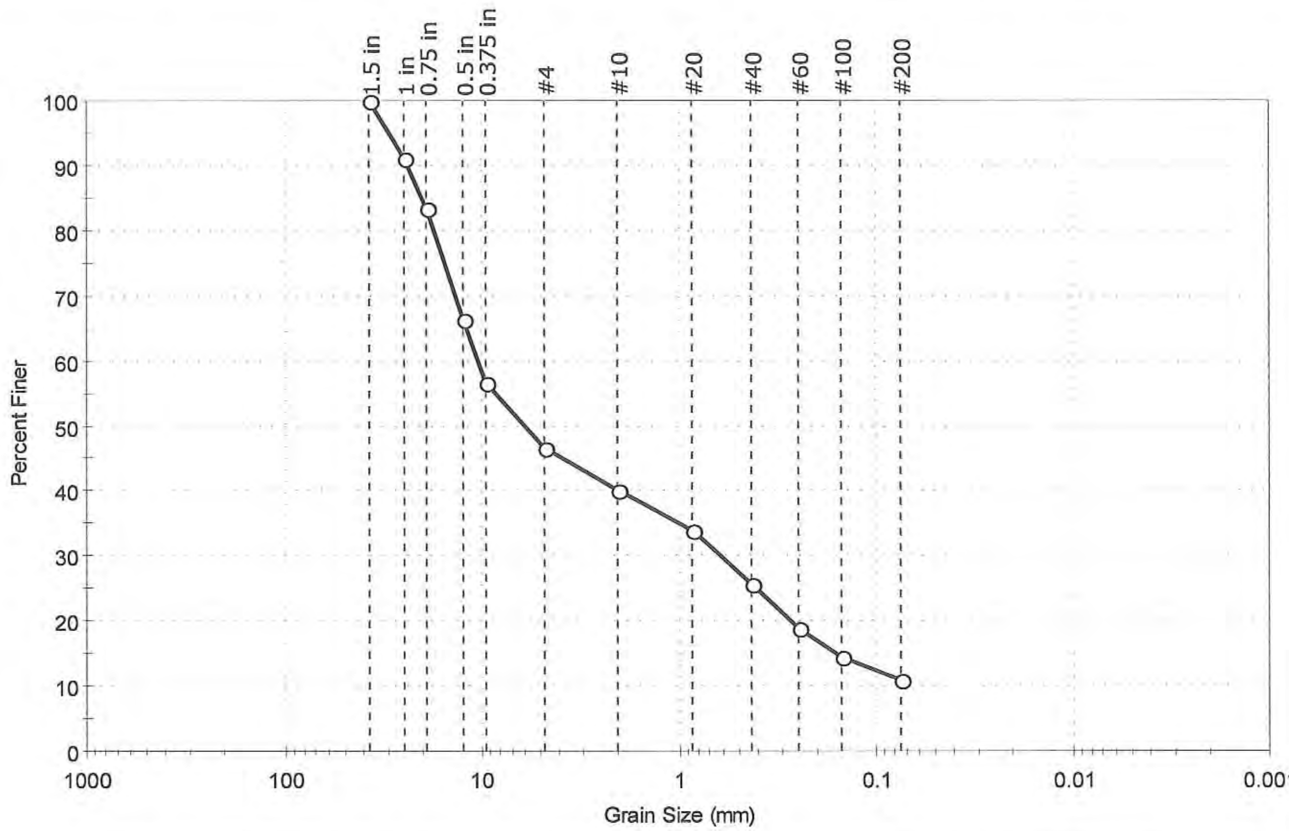
Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-309	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228767		
Test Comment: ---			
Sample Description: Moist, yellowish brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	53.4	35.7	10.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	91		
0.75 in	19.00	84		
0.5 in	12.50	66		
0.375 in	9.50	57		
#4	4.75	47		
#10	2.00	40		
#20	0.85	34		
#40	0.42	26		
#60	0.25	19		
#100	0.15	14		
#200	0.075	11		

Coefficients

D_{85} =20.0053 mm | D_{30} =0.6117 mm
D_{60} =10.4760 mm | D_{15} =0.1607 mm
D_{50} =6.0025 mm | D_{10} =0.0621 mm
C_u =168.696 | C_c =0.575

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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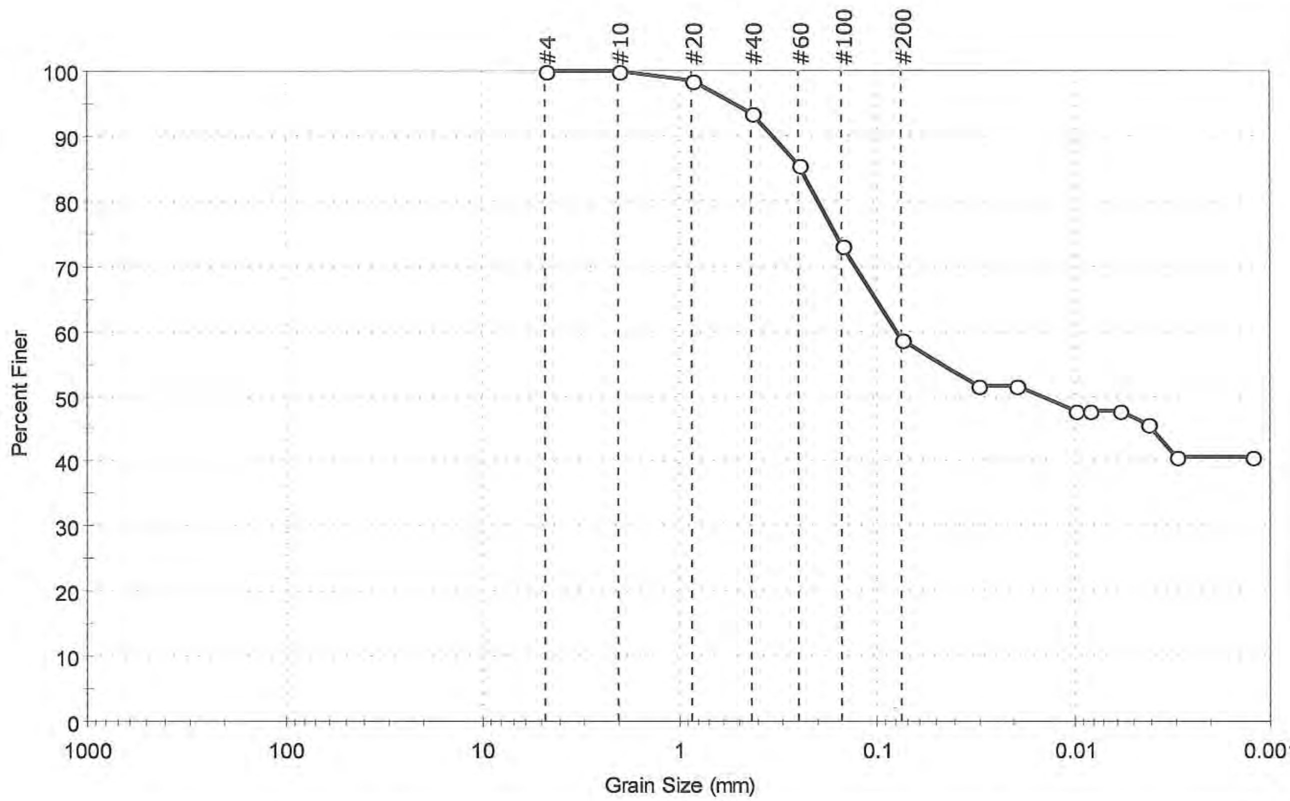
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-309	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/06/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228809		
Test Comment:	---		
Sample Description:	Moist, yellowish brown sandy clay		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	41.4	58.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	93		
#60	0.25	86		
#100	0.15	73		
#200	0.075	59		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0314	52		
---	0.0198	52		
---	0.0099	48		
---	0.0083	48		
---	0.0058	48		
---	0.0041	46		
---	0.0030	41		
---	0.0012	41		

Coefficients

D_{85} =0.2436 mm — D_{30} =N/A

D_{60} =0.0800 mm — D_{15} =N/A

D_{50} =0.0146 mm — D_{10} =N/A

C_u =N/A — C_c =N/A

Classification

ASTM Sandy lean clay (CL)

AASHTO Clayey Soils (A-7-6 (16))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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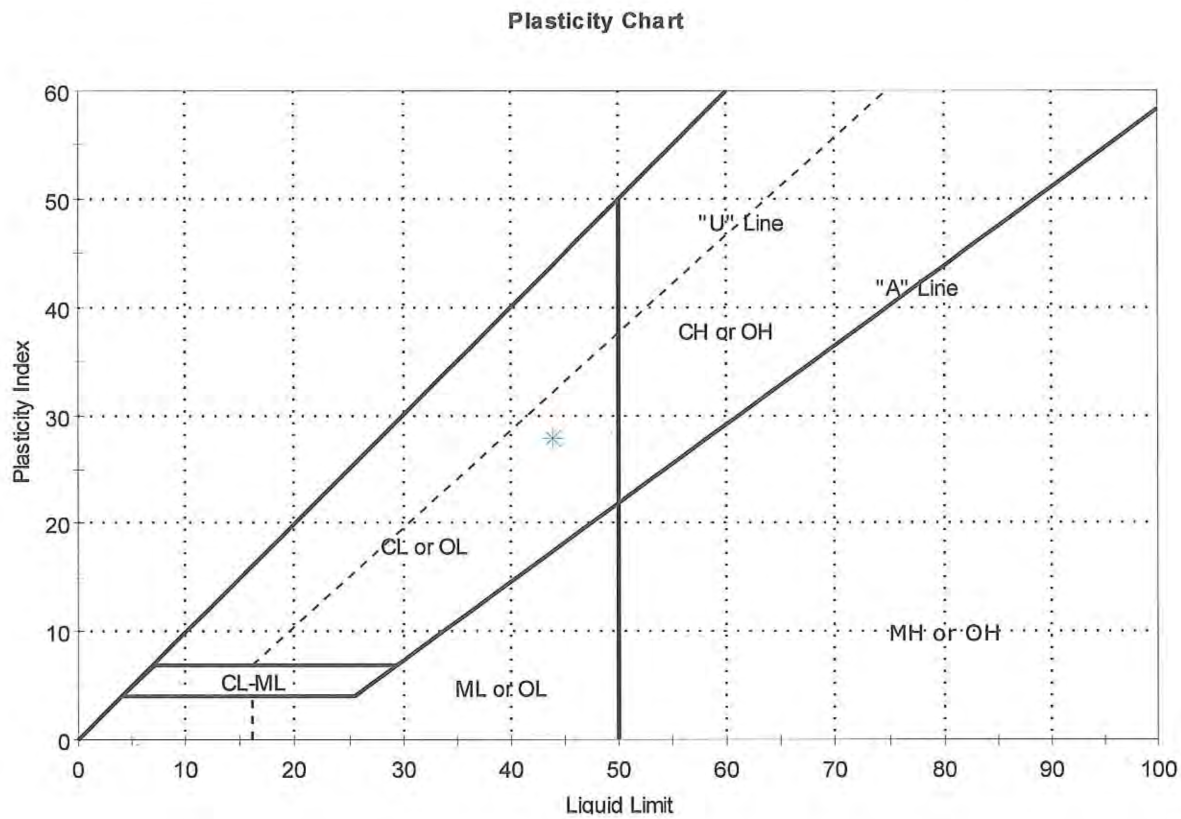
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-309	Sample Type: jar	Tested By:	cam
Sample ID:S-2	Test Date: 02/08/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228827		
Test Comment:	---		
Sample Description:	Moist, yellowish brown sandy clay		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	CB-309	3-5 ft	19	44	16	28	0	Sandy lean clay (CL)

Sample Prepared using the WET method

7% Retained on #40 Sieve

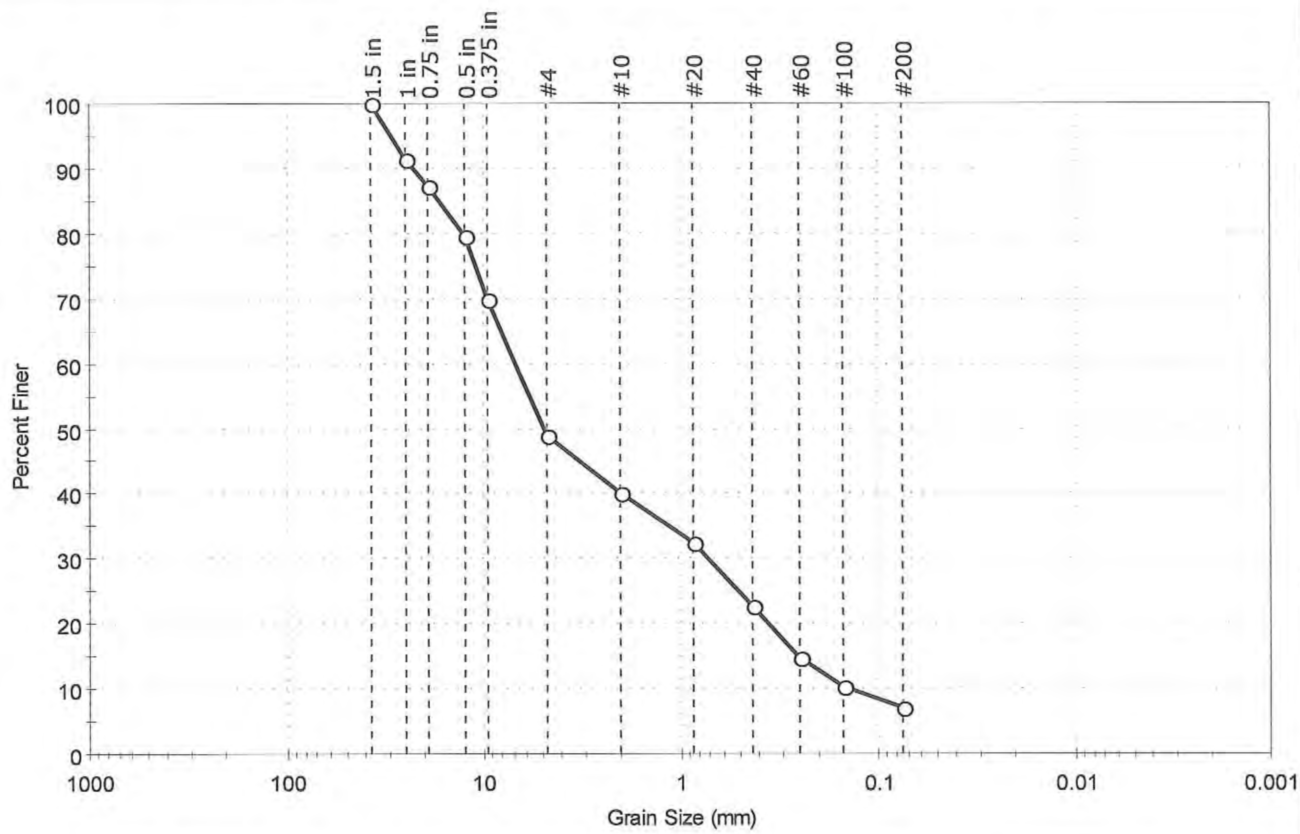
Dry Strength: VERY HIGH

Dilentancy: SLOW

Toughness: LOW

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-310	Sample Type: jar	Tested By:	jbr
Sample ID: S-1	Test Date: 02/03/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228768		
Test Comment: ---			
Sample Description: Moist, brown gravel with silt and sand			
Sample Comment: Sample contains broken glass			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	51.0	41.9	7.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	92		
0.75 in	19.00	87		
0.5 in	12.50	80		
0.375 in	9.50	70		
#4	4.75	49		
#10	2.00	40		
#20	0.85	32		
#40	0.42	23		
#60	0.25	15		
#100	0.15	10		
#200	0.075	7		

Coefficients

D_{85} =16.7505 mm　　D_{30} =0.7157 mm
D_{60} =6.8454 mm　　D_{15} =0.2557 mm
D_{50} =4.9061 mm　　D_{10} =0.1427 mm
C_u =47.971　　C_c =0.524

Classification

ASTM　N/A

AASHTO　Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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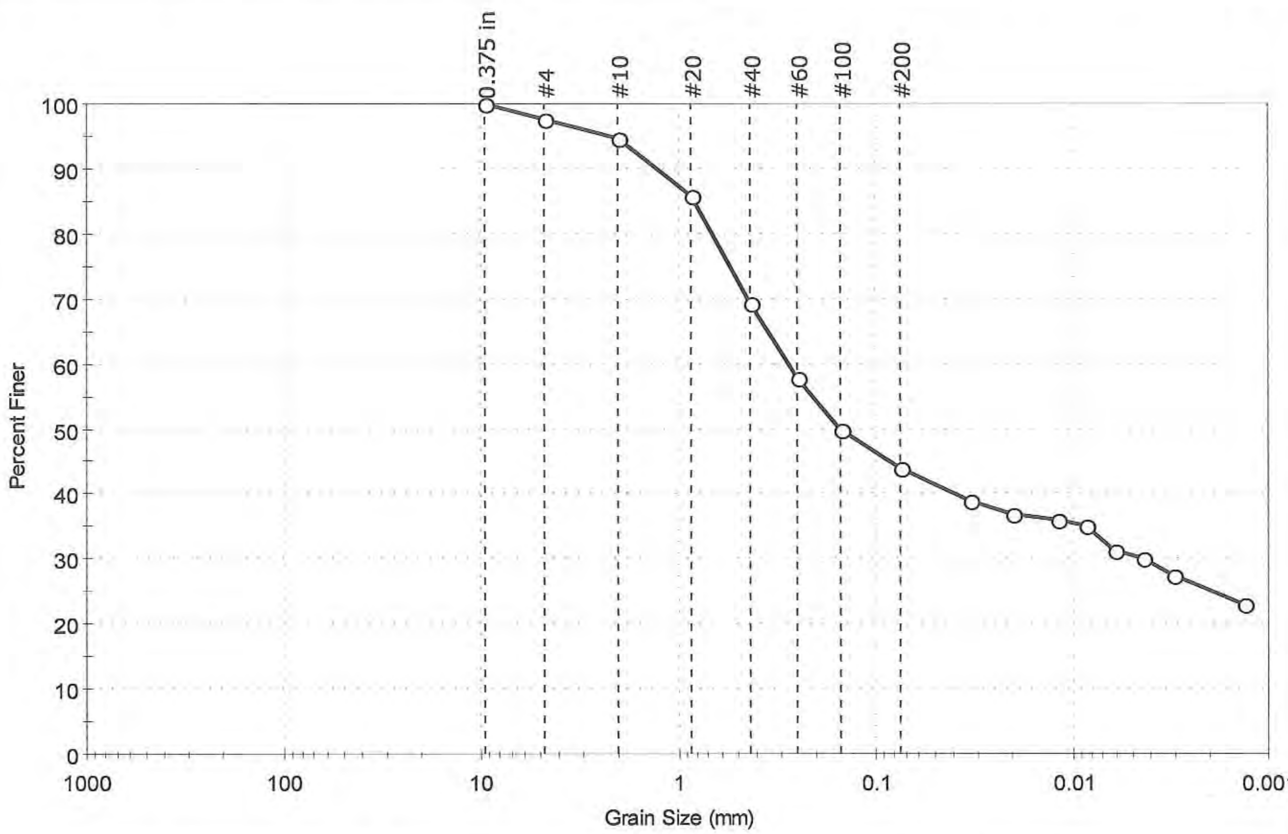
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-310	Sample Type: jar	Tested By:	jbr
Sample ID: S-2	Test Date: 02/07/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228810		
Test Comment: ---			
Sample Description: Moist, mottled yellowish brown and gray clayey sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	53.6	44.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	95		
#20	0.85	86		
#40	0.42	69		
#60	0.25	58		
#100	0.15	50		
#200	0.075	44		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0337	39		
---	0.0202	37		
---	0.0120	36		
---	0.0086	35		
---	0.0061	31		
---	0.0043	30		
---	0.0031	27		
---	0.0013	23		

Coefficients

D_{85} =0.8212 mm — D_{30} =0.0042 mm

D_{60} =0.2775 mm — D_{15} =N/A

D_{50} =0.1505 mm — D_{10} =N/A

C_u =N/A — C_c =N/A

Classification

ASTM Clayey sand (SC)

AASHTO Clayey Soils (A-7-6 (15))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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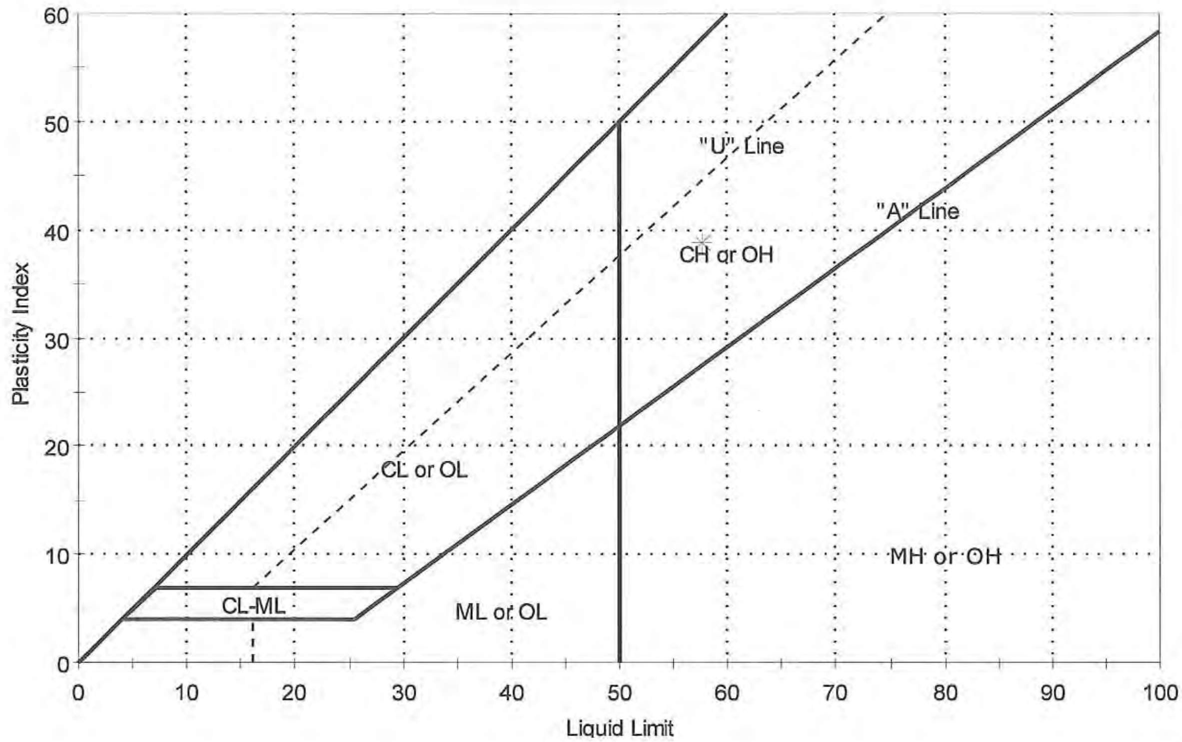
Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-310	Sample Type: jar	Tested By:	cam
Sample ID:S-2	Test Date: 02/07/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228828		
Test Comment: ---			
Sample Description: Moist, mottled yellowish brown and gray clayey sand			
Sample Comment: ---			

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	CB-310	4-6 ft	21	58	19	39	0	Clayey sand (SC)

Sample Prepared using the WET method

31% Retained on #40 Sieve

Dry Strength: VERY HIGH

Dilentancy: SLOW

Toughness: LOW

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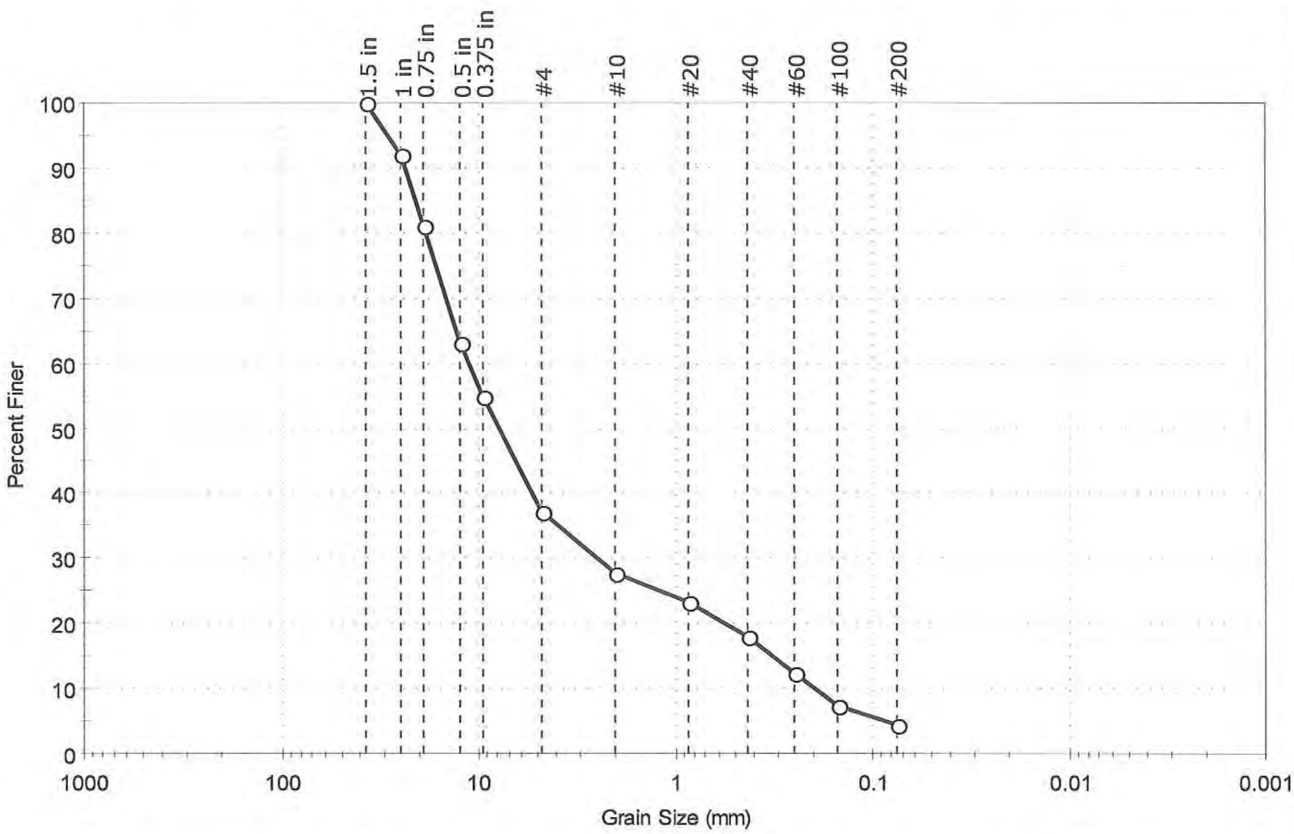
Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-311	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/08/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228769		
Test Comment: ---			
Sample Description: Moist, dark grayish brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	62.7	32.8	4.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	92		
0.75 in	19.00	81		
0.5 in	12.50	63		
0.375 in	9.50	55		
#4	4.75	37		
#10	2.00	28		
#20	0.85	23		
#40	0.42	18		
#60	0.25	12		
#100	0.15	7		
#200	0.075	5		

Coefficients

D_{85} =20.9230 mm D_{30} =2.4659 mm
D_{60} =11.2403 mm D_{15} =0.3209 mm
D_{50} =7.8487 mm D_{10} =0.1977 mm
C_u =56.855 C_c =2.736

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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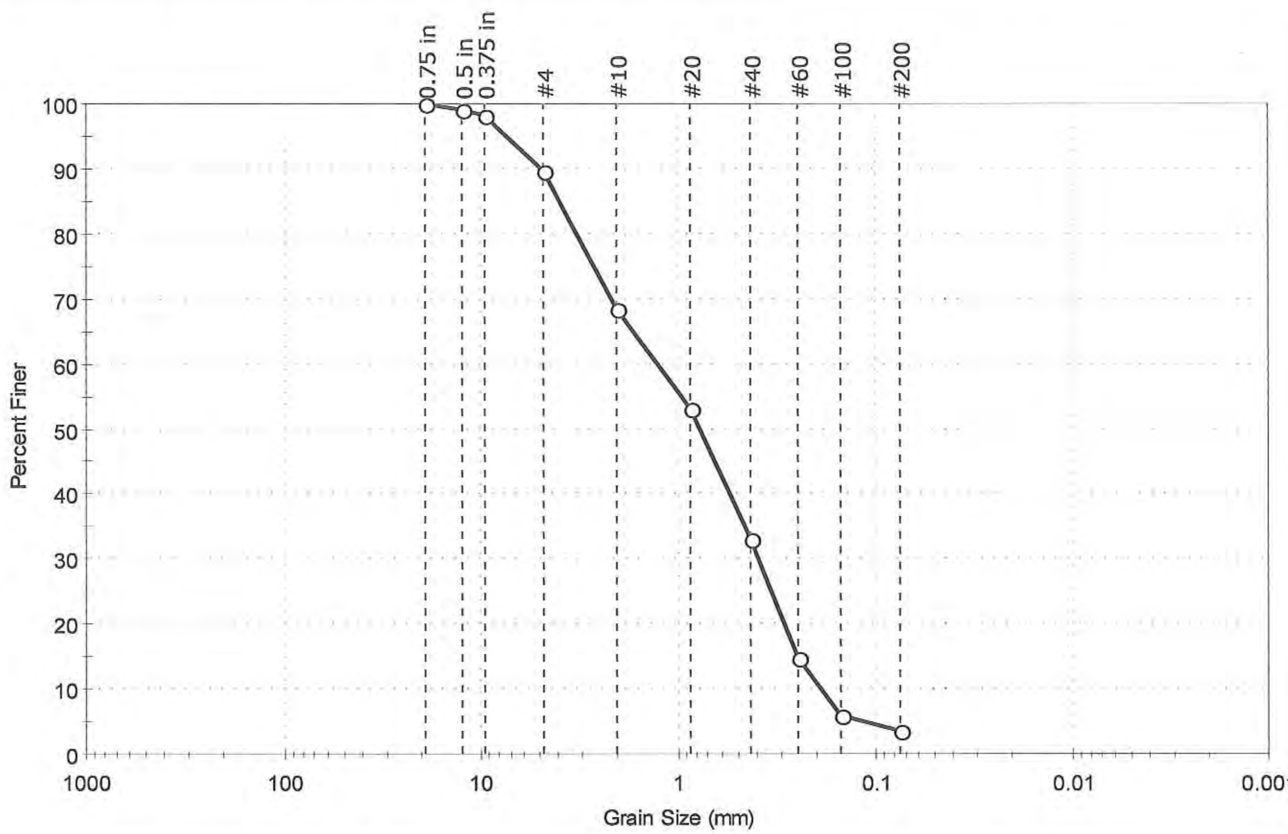
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-311	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/02/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228770		
Test Comment: ---			
Sample Description: Moist, brown sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	10.4	86.1	3.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	99		
0.375 in	9.50	98		
#4	4.75	90		
#10	2.00	68		
#20	0.85	53		
#40	0.42	33		
#60	0.25	15		
#100	0.15	6		
#200	0.075	4		

Coefficients

D_{85} =3.9383 mm　　D_{30} =0.3878 mm

D_{60} =1.2464 mm　　D_{15} =0.2514 mm

D_{50} =0.7603 mm　　D_{10} =0.1890 mm

C_u =6.595　　C_c =0.638

Classification

ASTM　Poorly graded sand (SP)

AASHTO　Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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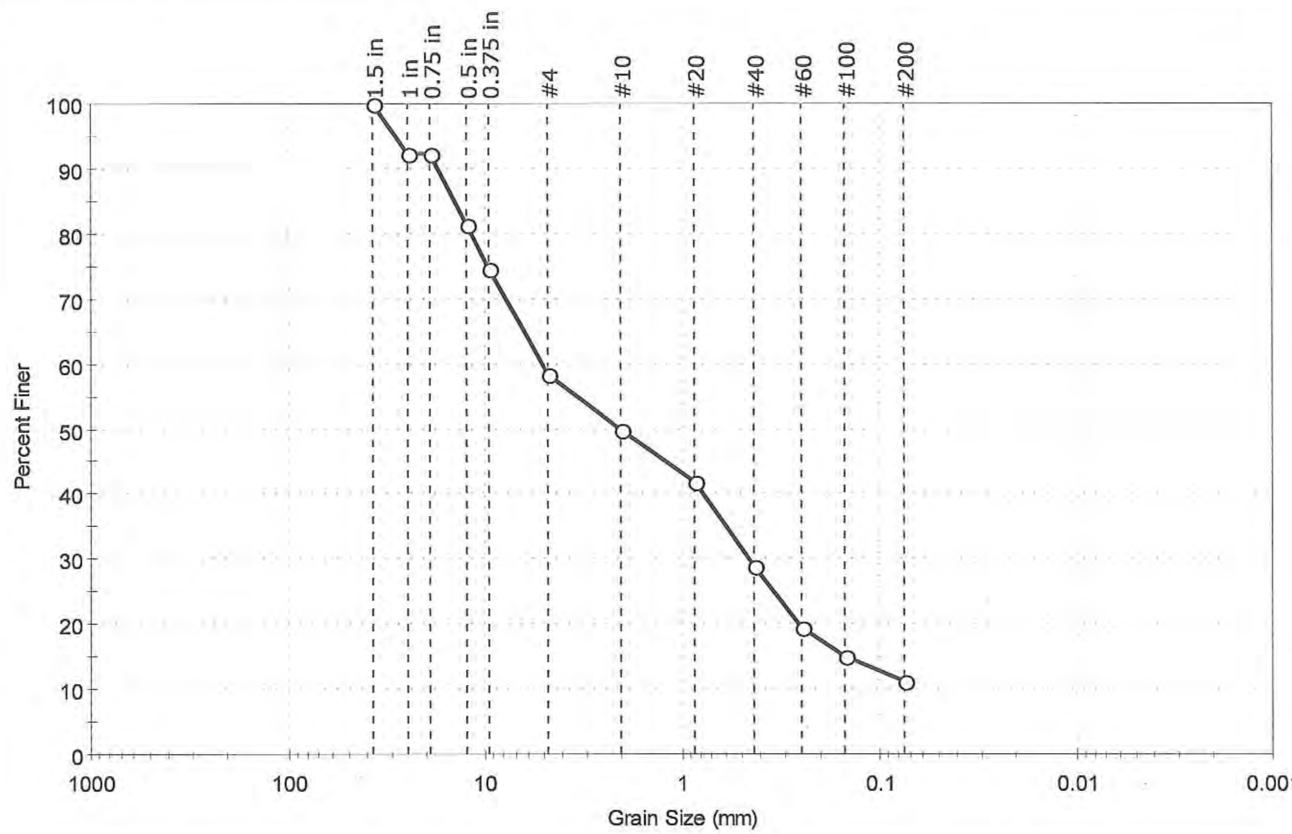
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-312	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228771		
Test Comment:	---		
Sample Description:	Moist, brown sand with silt and gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	41.7	47.1	11.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	92		
0.75 in	19.00	92		
0.5 in	12.50	81		
0.375 in	9.50	75		
#4	4.75	58		
#10	2.00	50		
#20	0.85	42		
#40	0.42	29		
#60	0.25	19		
#100	0.15	15		
#200	0.075	11		

Coefficients

D_{85} =14.3942 mm D_{30} =0.4509 mm

D_{60} =5.1059 mm D_{15} =0.1506 mm

D_{50} =2.0239 mm D_{10} =0.0600 mm

C_u =85.098 C_c =0.664

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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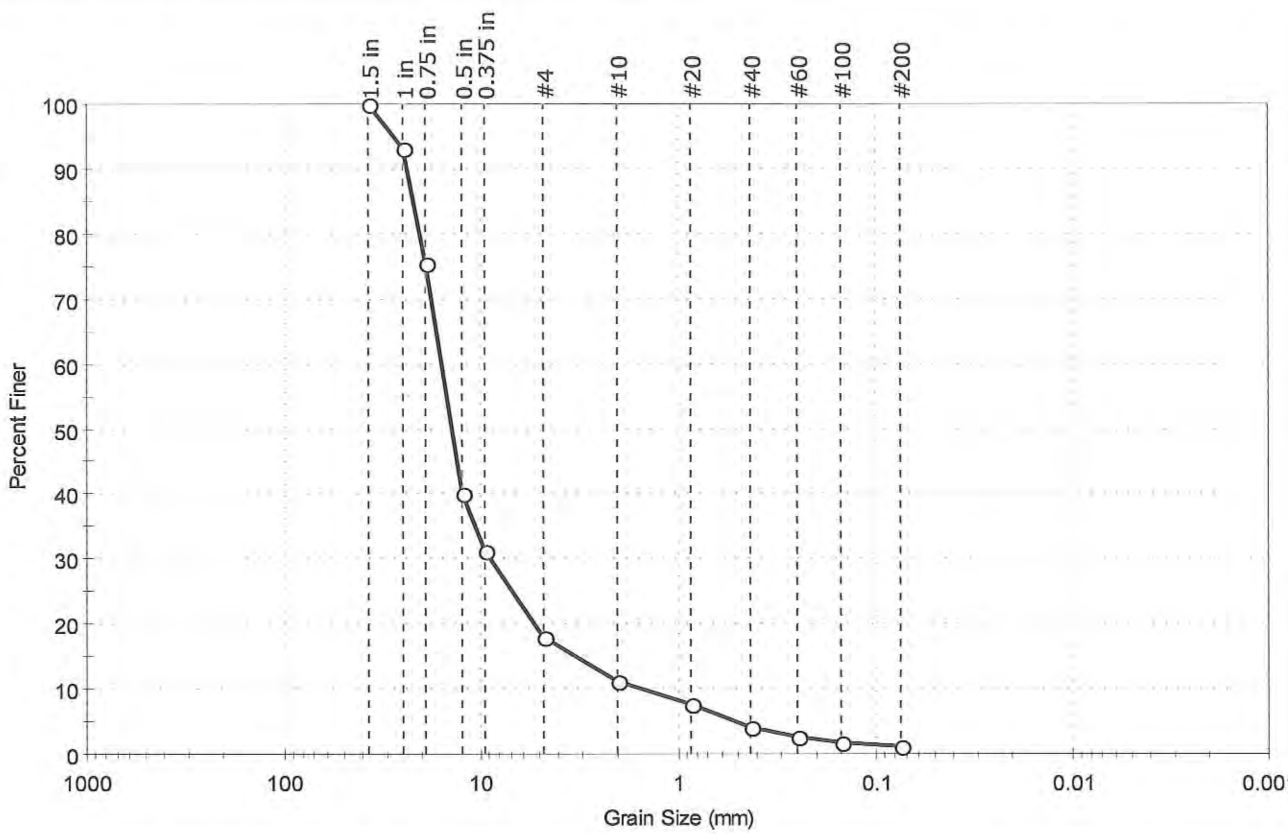
Client:	Gahagan & Bryant Associates				
Project:	Delaware River Channel Deepening Reach B				
Location:	---			Project No:	GTX-11510
Boring ID:	CB-312	Sample Type:	jar	Tested By:	jbr
Sample ID:	S-2	Test Date:	02/06/12	Checked By:	njh
Depth :	3-5 ft	Test Id:	228772		
Test Comment:	---				
Sample Description:	Moist, brown gravel with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	81.9	16.8	1.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	93		
0.75 in	19.00	75		
0.5 in	12.50	40		
0.375 in	9.50	31		
#4	4.75	18		
#10	2.00	11		
#20	0.85	8		
#40	0.42	4		
#60	0.25	3		
#100	0.15	2		
#200	0.075	1		

Coefficients

D_{85} =22.0183 mm	D_{30} =8.9453 mm
D_{60} =15.8307 mm	D_{15} =3.1915 mm
D_{50} =14.0598 mm	D_{10} =1.4791 mm
C_u =10.703	C_c =3.417

Classification

ASTM Poorly graded gravel with sand (GP)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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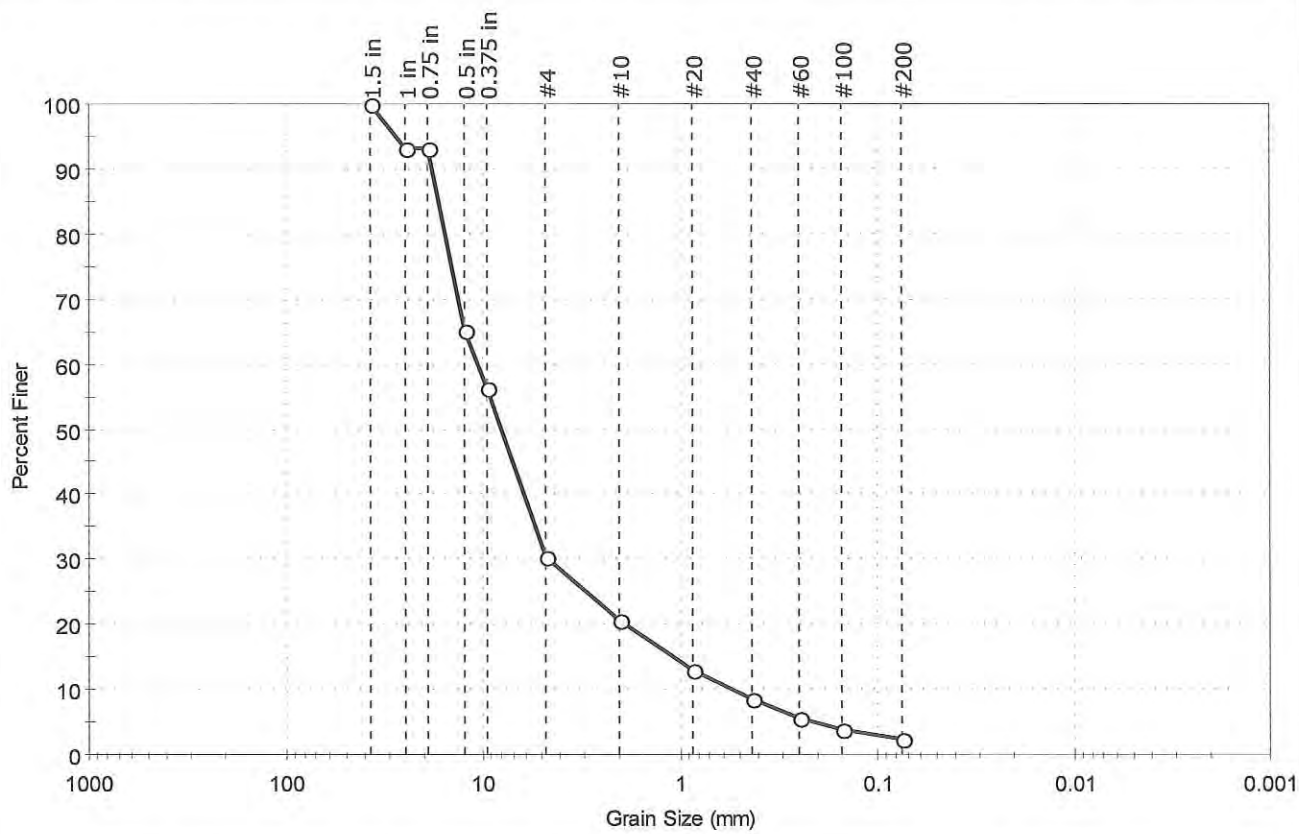
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates
Project: Delaware River Channel Deepening Reach B
Location: --- Project No: GTX-11510
Boring ID: CB-313 Sample Type: jar Tested By: jbr
Sample ID:S-1 Test Date: 02/02/12 Checked By: njh
Depth : 0-2 ft Test Id: 228773
Test Comment: ---
Sample Description: Moist, brown gravel with sand
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	69.6	27.9	2.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	93		
0.75 in	19.00	93		
0.5 in	12.50	65		
0.375 in	9.50	56		
#4	4.75	30		
#10	2.00	21		
#20	0.85	13		
#40	0.42	9		
#60	0.25	6		
#100	0.15	4		
#200	0.075	2		

Coefficients

D_{85} =16.7977 mm D_{30} =4.5943 mm
D_{60} =10.6378 mm D_{15} =1.0719 mm
D_{50} =8.0197 mm D_{10} =0.5275 mm
C_u =20.166 C_c =3.762

Classification

ASTM Poorly graded gravel with sand (GP)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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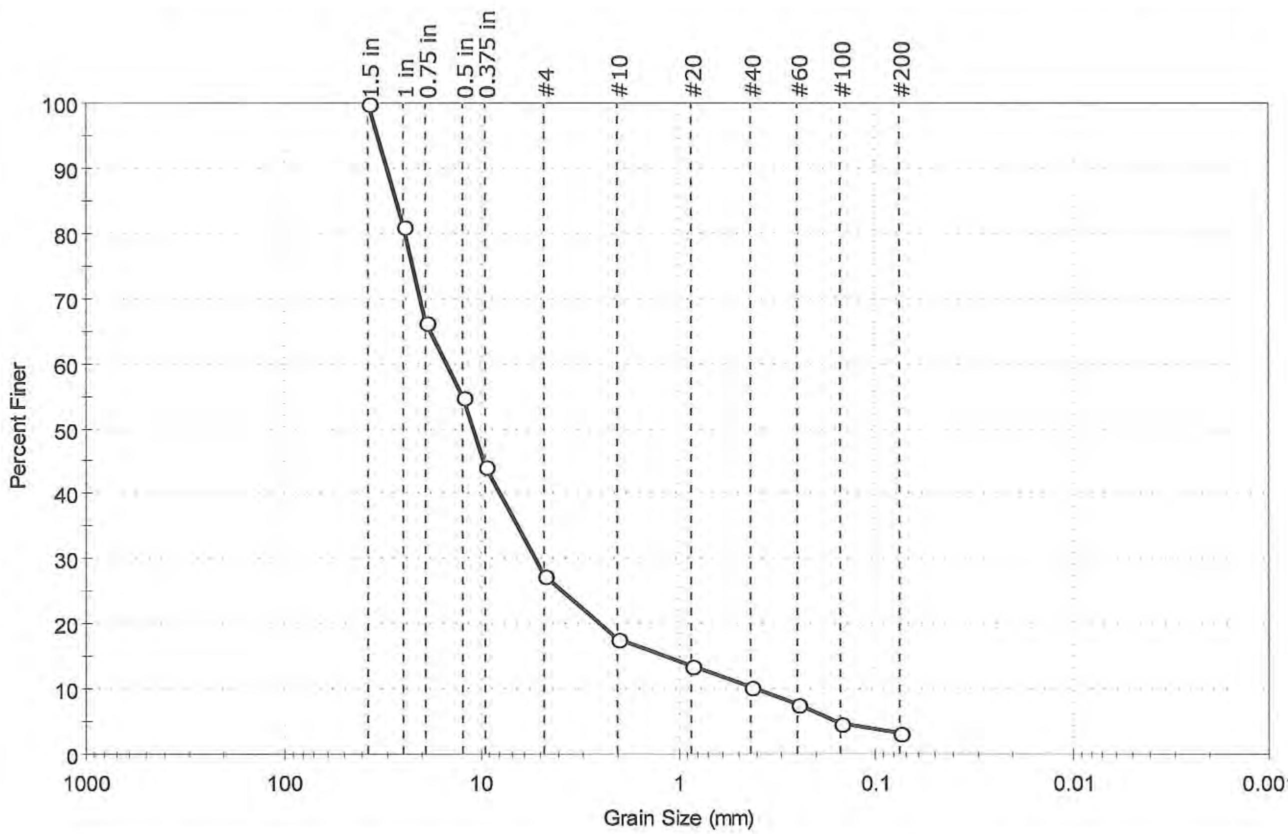
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-313	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/09/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228774		
Test Comment: ---			
Sample Description: Moist, grayish brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	72.5	24.2	3.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	81		
0.75 in	19.00	66		
0.5 in	12.50	55		
0.375 in	9.50	44		
#4	4.75	28		
#10	2.00	18		
#20	0.85	14		
#40	0.42	10		
#60	0.25	8		
#100	0.15	5		
#200	0.075	3		

Coefficients

D_{85} =27.1972 mm D_{30} =5.2539 mm

D_{60} =15.0712 mm D_{15} =1.1298 mm

D_{50} =11.0136 mm D_{10} =0.3953 mm

C_u =38.126 C_c =4.633

Classification

ASTM Poorly graded gravel with sand (GP)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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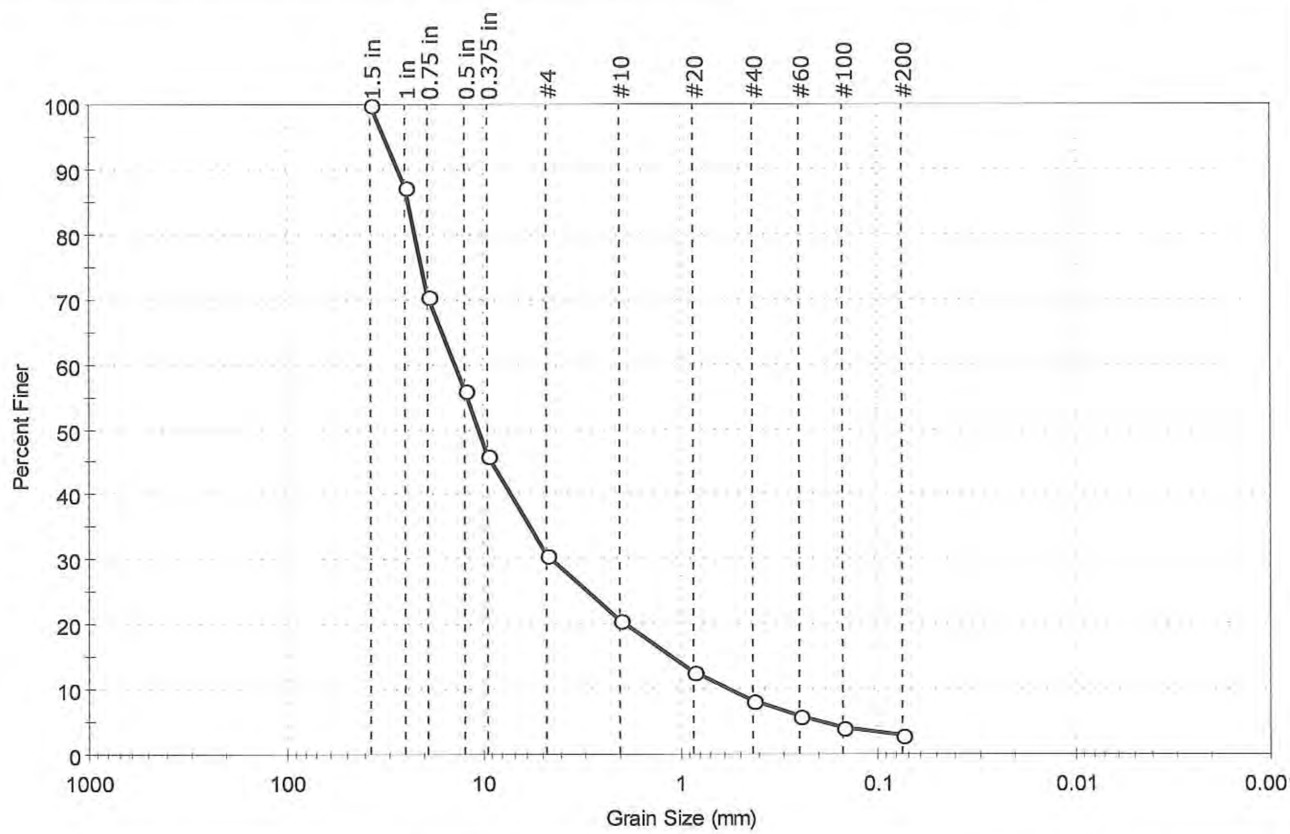
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-314	Sample Type: jar	Tested By:	jbr
Sample ID:S-3	Test Date: 02/06/12	Checked By:	njh
Depth : 5-7 ft	Test Id: 228775		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: Sample contains broken glass			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	69.4	27.6	3.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	87		
0.75 in	19.00	71		
0.5 in	12.50	56		
0.375 in	9.50	46		
#4	4.75	31		
#10	2.00	21		
#20	0.85	13		
#40	0.42	8		
#60	0.25	6		
#100	0.15	4		
#200	0.075	3		

Coefficients

D_{85} =24.0578 mm — D_{30} =4.5124 mm

D_{60} =13.9870 mm — D_{15} =1.0830 mm

D_{50} =10.5929 mm — D_{10} =0.5610 mm

C_u =24.932 — C_c =2.595

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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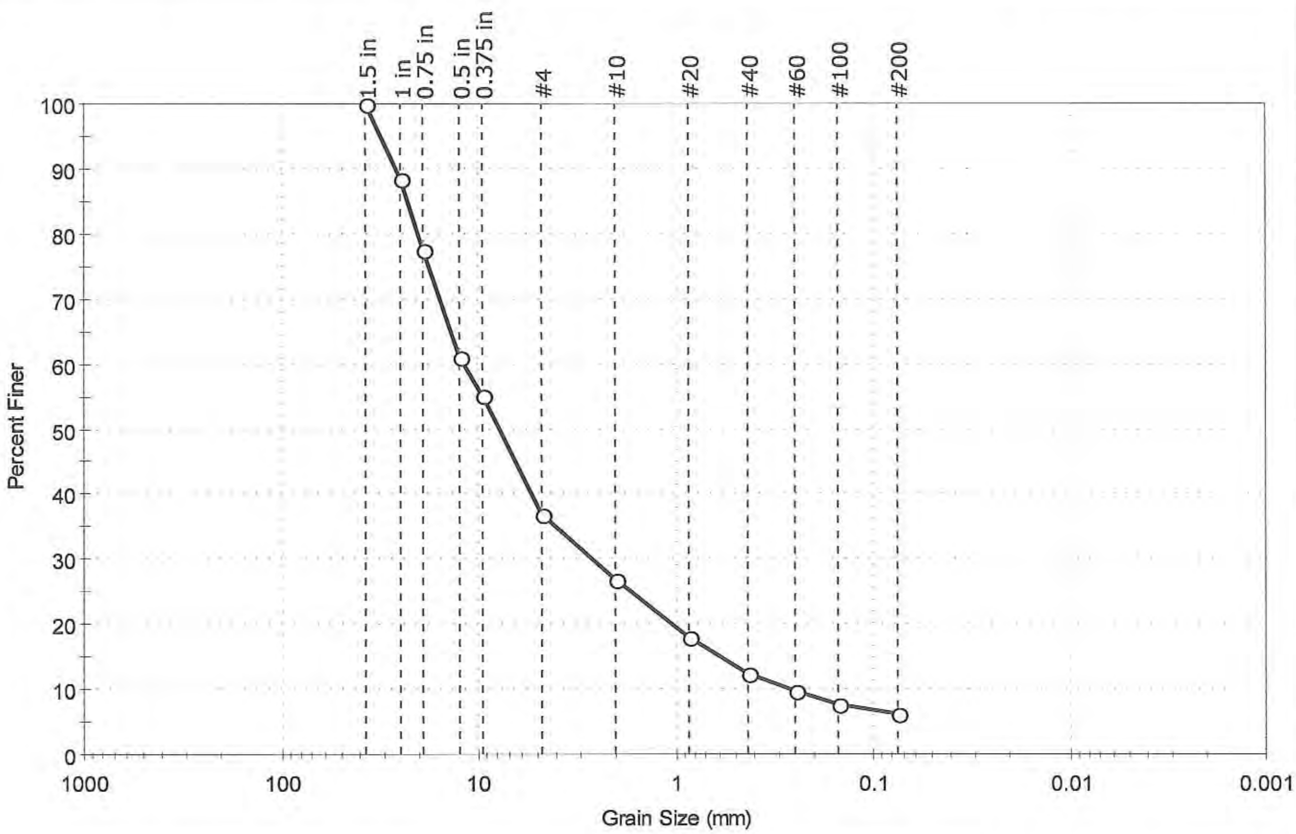
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-315	Sample Type: jar	Tested By:	jbr
Sample ID: S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228776		
Test Comment: ---			
Sample Description: Moist, dark grayish brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	63.0	30.9	6.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	89		
0.75 in	19.00	78		
0.5 in	12.50	61		
0.375 in	9.50	55		
#4	4.75	37		
#10	2.00	27		
#20	0.85	18		
#40	0.42	13		
#60	0.25	10		
#100	0.15	8		
#200	0.075	6		

Coefficients

D_{85} =22.8595 mm D_{30} =2.6187 mm
D_{60} =11.9033 mm D_{15} =0.5787 mm
D_{50} =7.7875 mm D_{10} =0.2687 mm
C_u =44.300 C_c =2.144

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

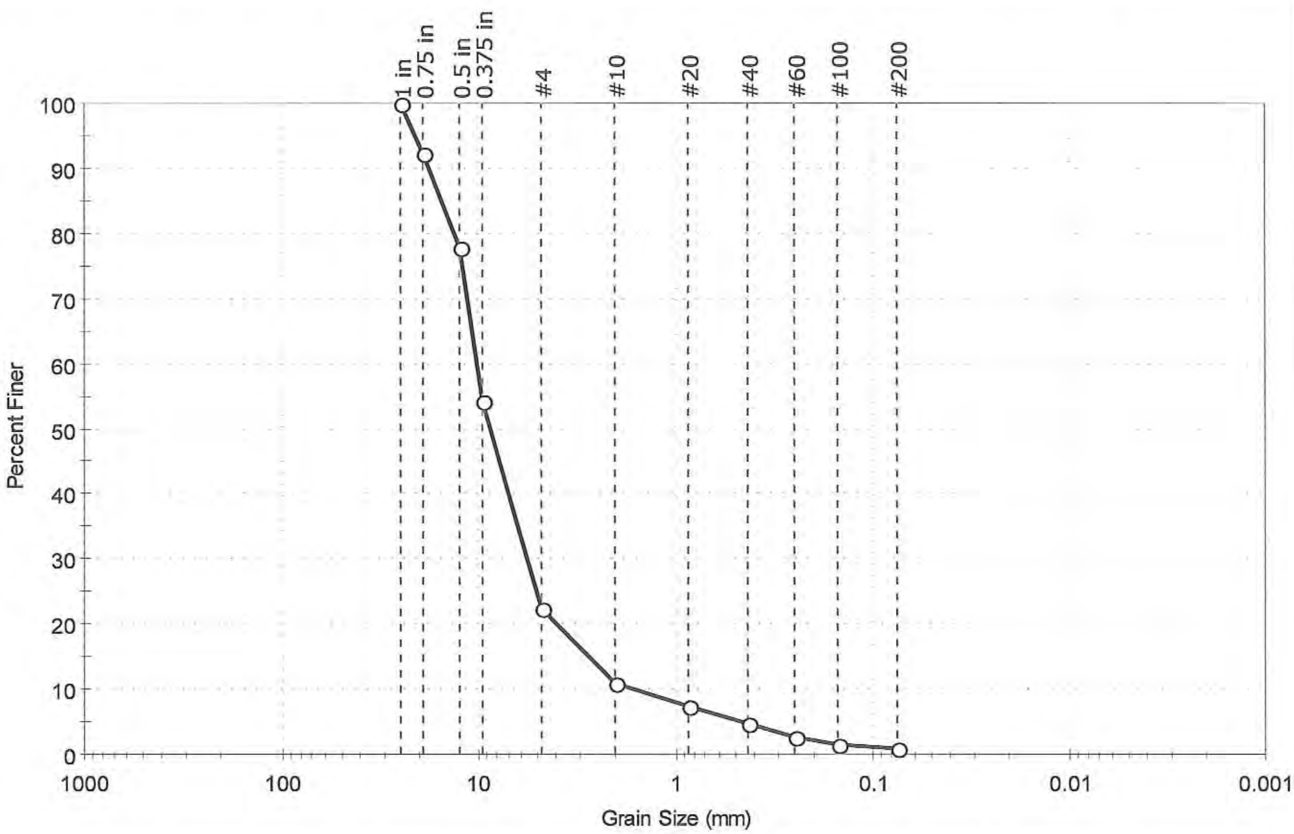
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:03:47 AM

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-315	Sample Type: jar	Tested By:	jbr
Sample ID: S-2	Test Date: 02/06/12	Checked By:	njh
Depth : 4.0-5.4 ft	Test Id: 228777		
Test Comment:	---		
Sample Description:	Moist, grayish brown gravel with sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	77.5	21.7	0.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	92		
0.5 in	12.50	78		
0.375 in	9.50	54		
#4	4.75	22		
#10	2.00	11		
#20	0.85	7		
#40	0.42	5		
#60	0.25	3		
#100	0.15	1		
#200	0.075	1		

Coefficients

D_{85} = 15.3482 mm	D_{30} = 5.5950 mm
D_{60} = 10.1509 mm	D_{15} = 2.7298 mm
D_{50} = 8.6516 mm	D_{10} = 1.6348 mm
C_u = 6.209	C_c = 1.886

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

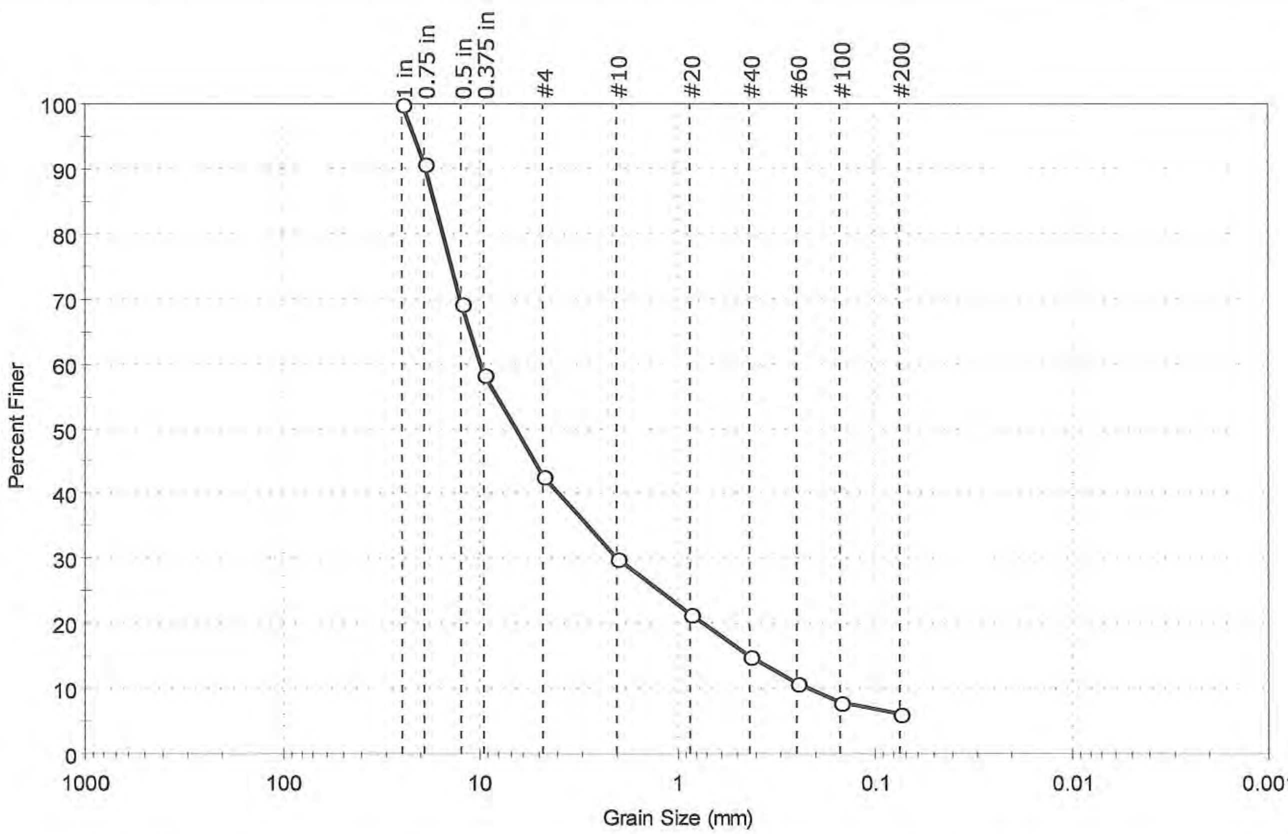
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:04:22 AM

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-316	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228778		
Test Comment: ---			
Sample Description: Moist, brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	57.1	36.8	6.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	91		
0.5 in	12.50	69		
0.375 in	9.50	58		
#4	4.75	43		
#10	2.00	30		
#20	0.85	22		
#40	0.42	15		
#60	0.25	11		
#100	0.15	8		
#200	0.075	6		

Coefficients

D_{85} =16.9747 mm D_{30} =1.9607 mm

D_{60} =9.8865 mm D_{15} =0.4284 mm

D_{50} =6.5369 mm D_{10} =0.2151 mm

C_u =45.962 C_c =1.808

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

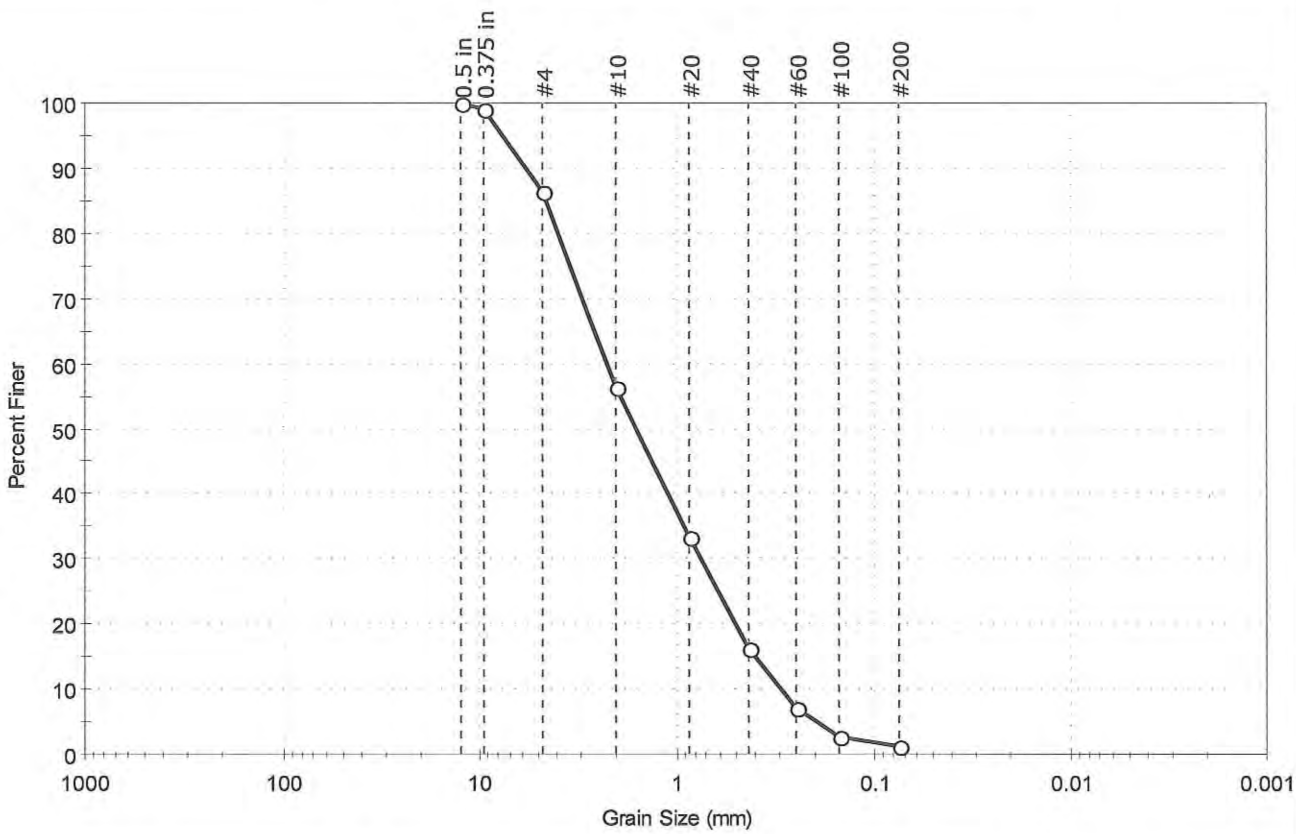
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:04:54 AM

Client:	Gahagan & Bryant Associates
Project:	Delaware River Channel Deepening Reach B
Location:	---
Project No:	GTX-11510
Boring ID:	CB-316
Sample ID:	S-2
Depth :	3.0-4.5 ft
Sample Type:	jar
Test Date:	02/09/12
Test Id:	228736
Tested By:	jbr
Checked By:	njh
Test Comment:	---
Sample Description:	Moist, brown sand
Sample Comment:	---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	13.4	85.4	1.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	99		
#4	4.75	87		
#10	2.00	56		
#20	0.85	33		
#40	0.42	16		
#60	0.25	7		
#100	0.15	3		
#200	0.075	1		

Coefficients

D_{85} =4.5438 mm D_{30} =0.7405 mm

D_{60} =2.2197 mm D_{15} =0.3975 mm

D_{50} =1.5771 mm D_{10} =0.2978 mm

C_u =7.454 C_c =0.830

Classification

ASTM Poorly graded sand (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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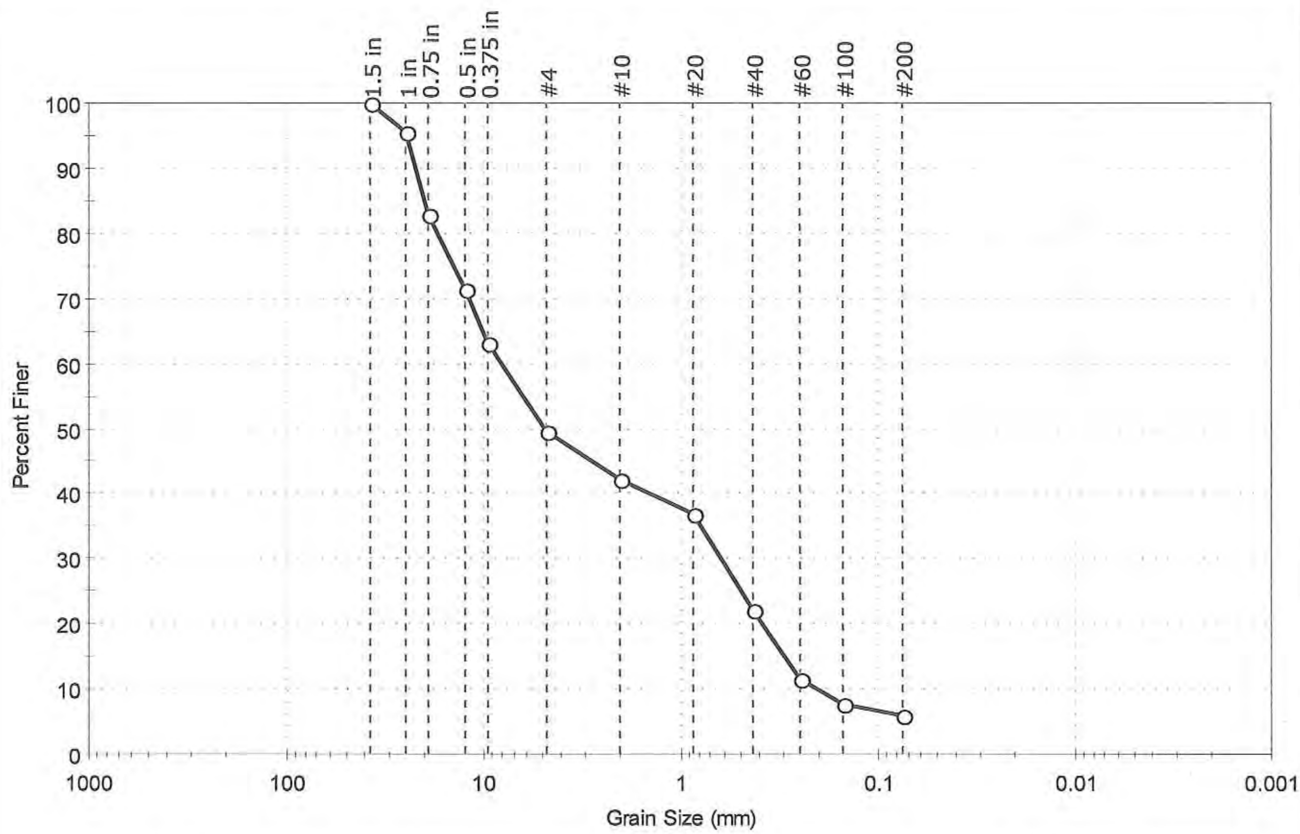
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-316	Sample Type: jar	Tested By:	jbr
Sample ID:S-3	Test Date: 02/06/12	Checked By:	njh
Depth : 5-7 ft	Test Id: 228737		
Test Comment: ---			
Sample Description: Moist, brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	50.4	43.8	5.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	96		
0.75 in	19.00	83		
0.5 in	12.50	71		
0.375 in	9.50	63		
#4	4.75	50		
#10	2.00	42		
#20	0.85	37		
#40	0.42	22		
#60	0.25	11		
#100	0.15	8		
#200	0.075	6		

Coefficients

D_{85} =19.8579 mm	D_{30} =0.6160 mm
D_{60} =8.0560 mm	D_{15} =0.2989 mm
D_{50} =4.8655 mm	D_{10} =0.2046 mm
C_u =39.374	C_c =0.230

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

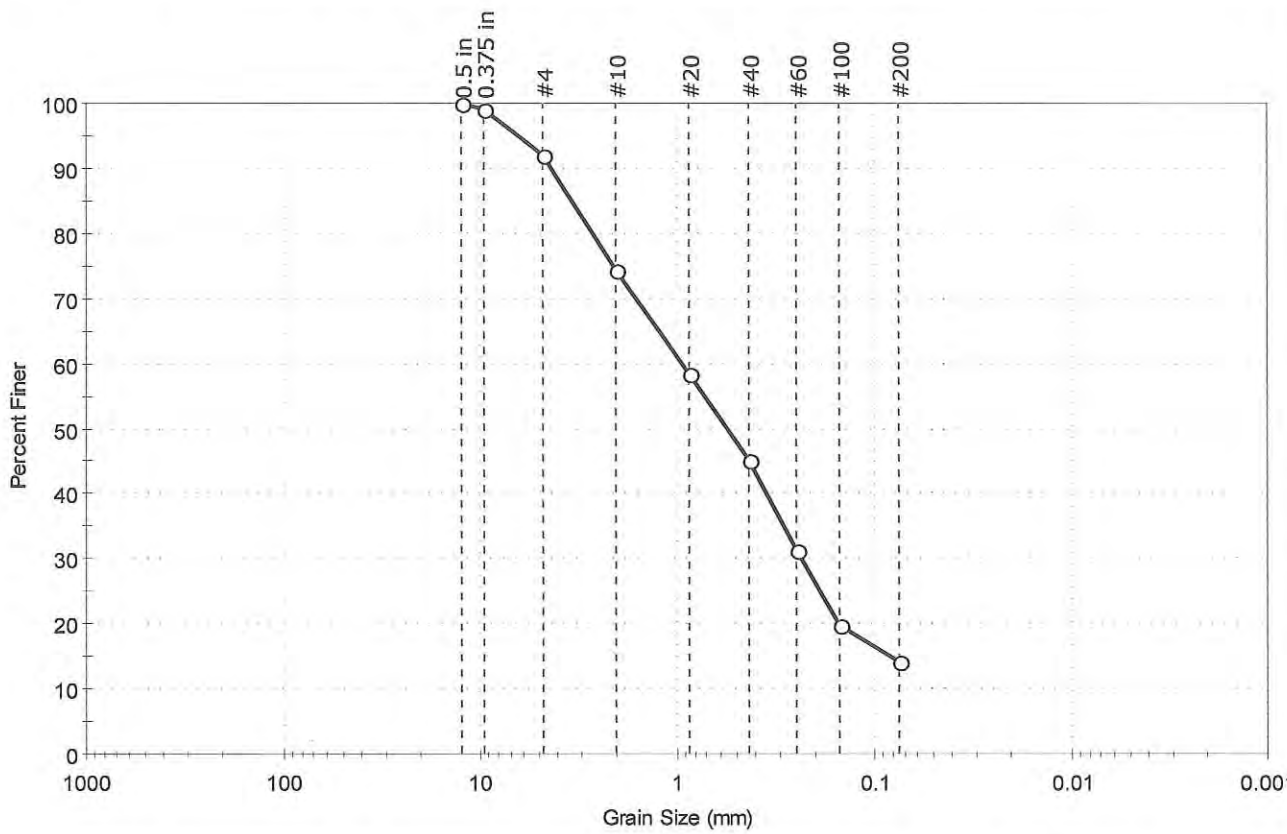
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:06:41 AM

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-317	Sample Type: jar	Tested By:	jbr
Sample ID:S-1A	Test Date: 02/06/12	Checked By:	njh
Depth : 0-1 ft	Test Id: 228738		
Test Comment: ---			
Sample Description: Moist, grayish brown silty sand			
Sample Comment: Sample contains broken glass			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	7.8	78.1	14.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	99		
#4	4.75	92		
#10	2.00	74		
#20	0.85	58		
#40	0.42	45		
#60	0.25	31		
#100	0.15	20		
#200	0.075	14		

Coefficients

D_{85} =3.3639 mm D_{30} =0.2372 mm
D_{60} =0.9278 mm D_{15} =0.0839 mm
D_{50} =0.5468 mm D_{10} =0.0457 mm
C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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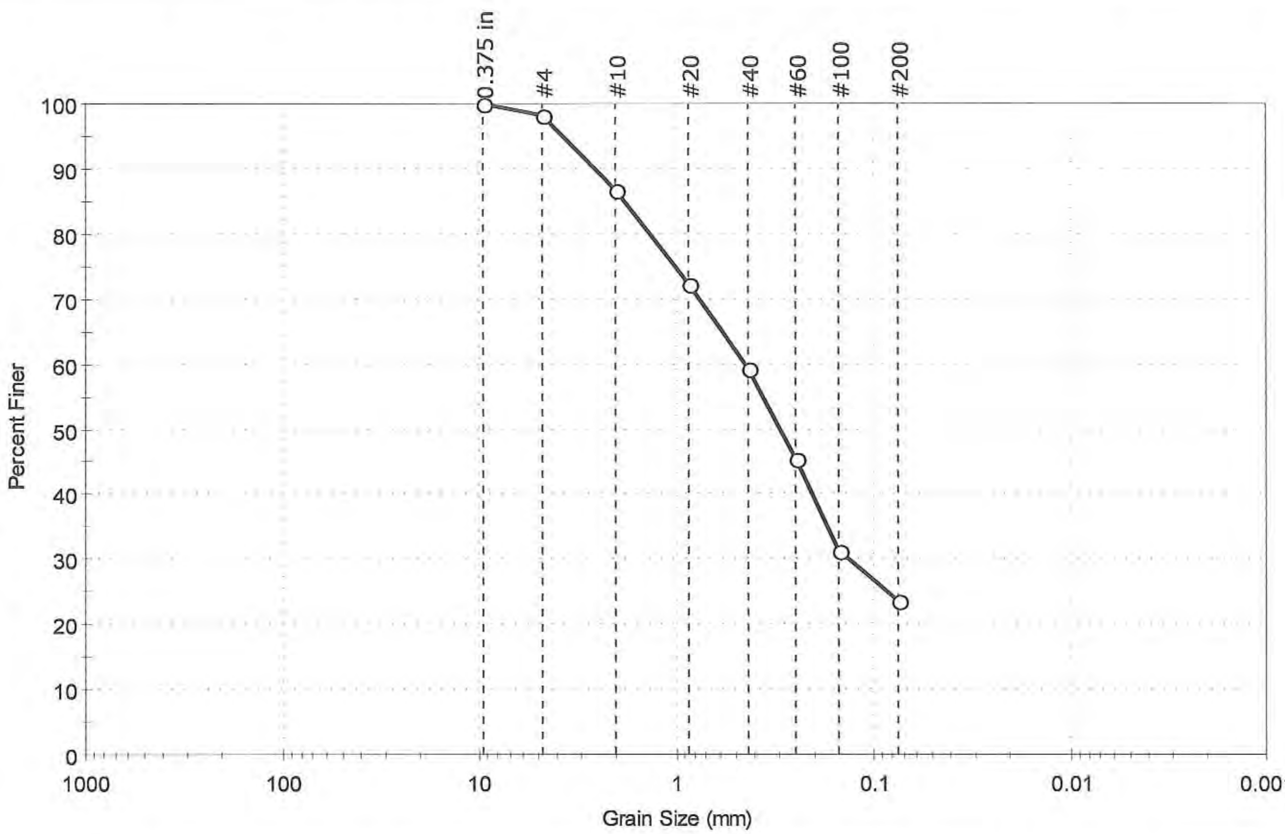
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-317	Sample Type: jar	Tested By:	jbr
Sample ID:S-1B	Test Date: 02/06/12	Checked By:	njh
Depth : 1-2 ft	Test Id: 228739		
Test Comment:	---		
Sample Description:	Moist, dark yellowish brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	74.8	23.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	87		
#20	0.85	72		
#40	0.42	59		
#60	0.25	45		
#100	0.15	31		
#200	0.075	24		

Coefficients

D_{85} =1.8087 mm	D_{30} =0.1325 mm
D_{60} =0.4426 mm	D_{15} =N/A
D_{50} =0.2990 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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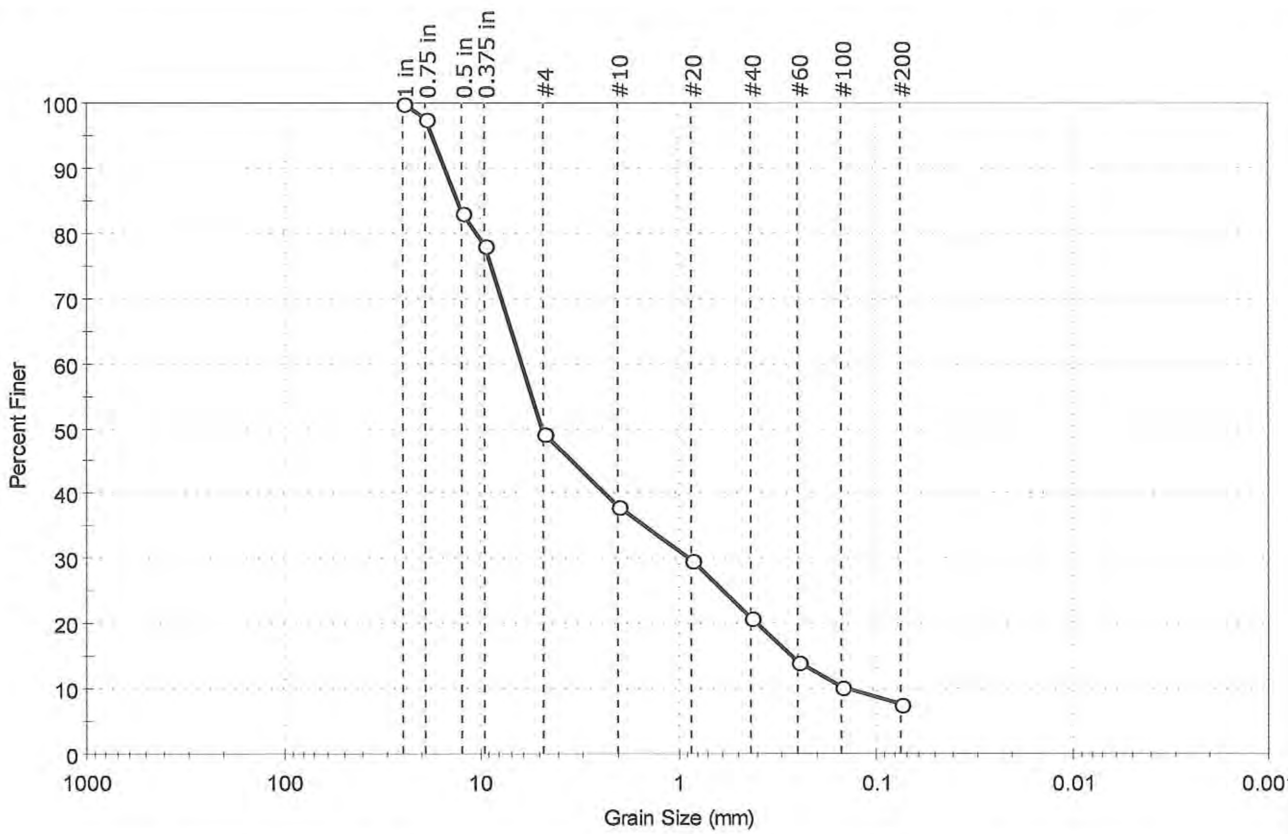
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-318	Sample Type: jar	Tested By:	jbr
Sample ID: S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228740		
Test Comment: ---			
Sample Description: Moist, brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	50.7	41.7	7.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	98		
0.5 in	12.50	83		
0.375 in	9.50	78		
#4	4.75	49		
#10	2.00	38		
#20	0.85	30		
#40	0.42	21		
#60	0.25	14		
#100	0.15	10		
#200	0.075	8		

Coefficients

D_{85} =13.1851 mm	D_{30} =0.8613 mm
D_{60} =6.1502 mm	D_{15} =0.2645 mm
D_{50} =4.8326 mm	D_{10} =0.1366 mm
C_u =45.023	C_c =0.883

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

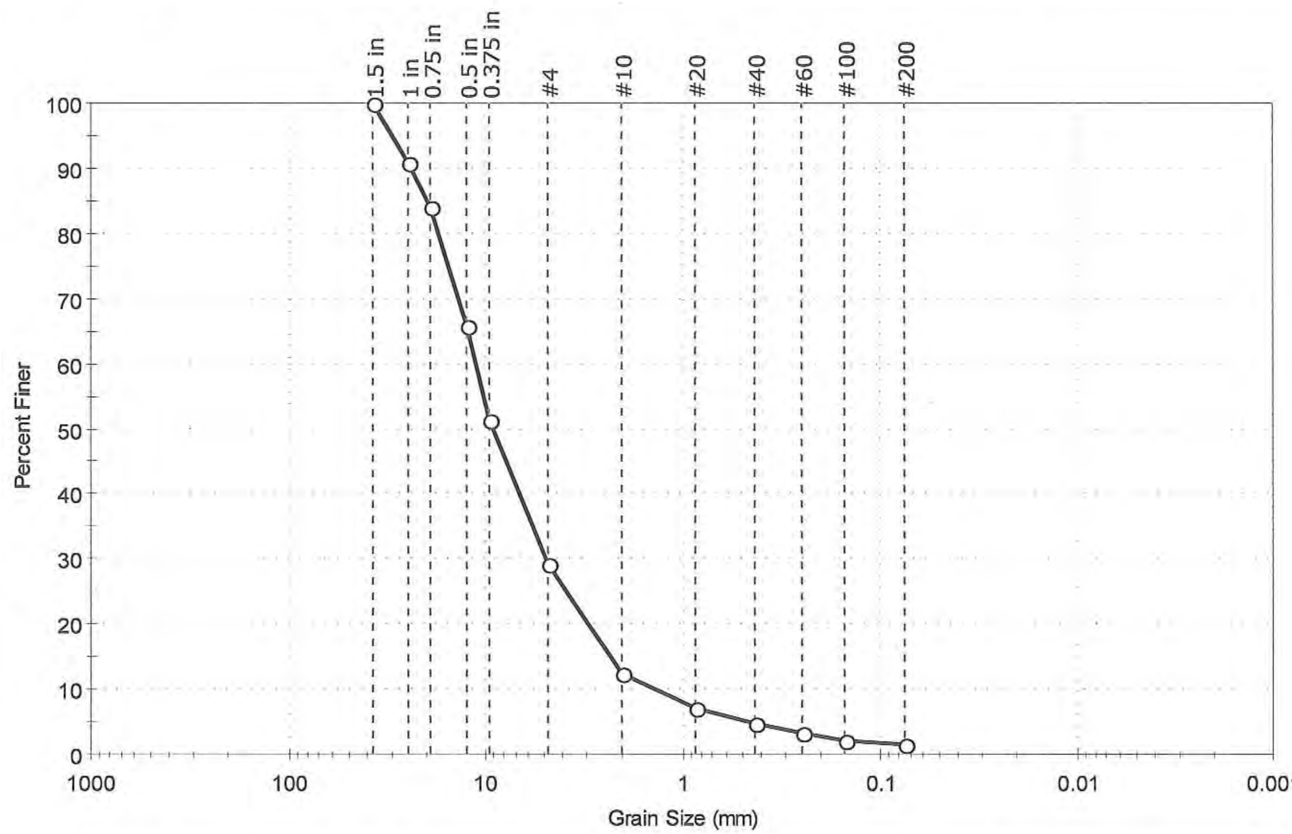
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:08:45 AM

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-318	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/07/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228741		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	70.8	27.8	1.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	91		
0.75 in	19.00	84		
0.5 in	12.50	66		
0.375 in	9.50	51		
#4	4.75	29		
#10	2.00	12		
#20	0.85	7		
#40	0.42	5		
#60	0.25	3		
#100	0.15	2		
#200	0.075	1		

Coefficients

D_{85} =19.6259 mm | D_{30} =4.8731 mm

D_{60} =11.2100 mm | D_{15} =2.2853 mm

D_{50} =9.1163 mm | D_{10} =1.3632 mm

C_u =8.223 | C_c =1.554

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

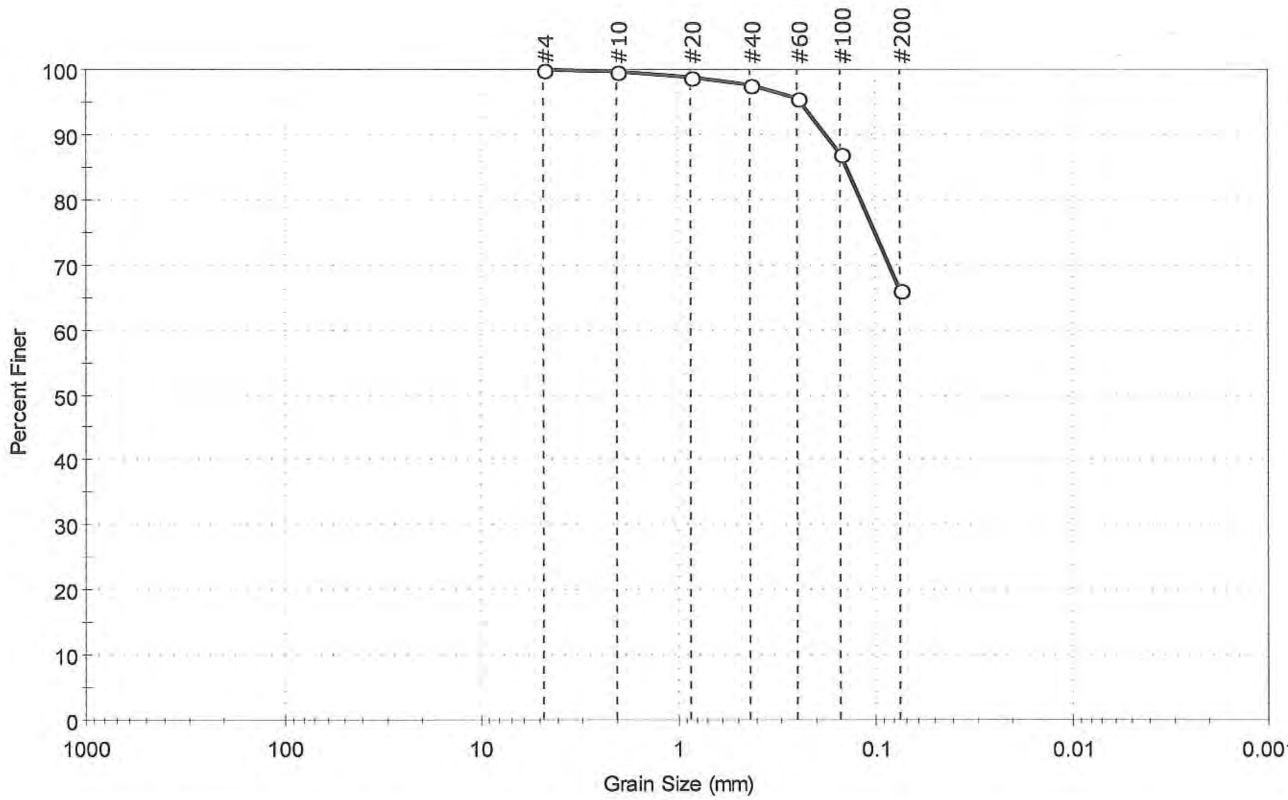
Sand/Gravel Hardness : HARD

printed 2/14/2012 10:09:22 AM

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates				
Project:	Delaware River Channel Deepening Reach B				
Location:	---			Project No:	GTX-11510
Boring ID:	CB-318	Sample Type:	jar	Tested By:	jbr
Sample ID:	S-3B	Test Date:	02/09/12	Checked By:	njh
Depth :	6.5-7.0 ft	Test Id:	228742		
Test Comment:	---				
Sample Description:	Moist, grayish brown sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	33.8	66.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	95		
#100	0.15	87		
#200	0.075	66		

Coefficients

D_{85} =0.1398 mm | D_{30} =N/A
D_{60} =N/A | D_{15} =N/A
D_{50} =N/A | D_{10} =N/A
C_u =N/A | C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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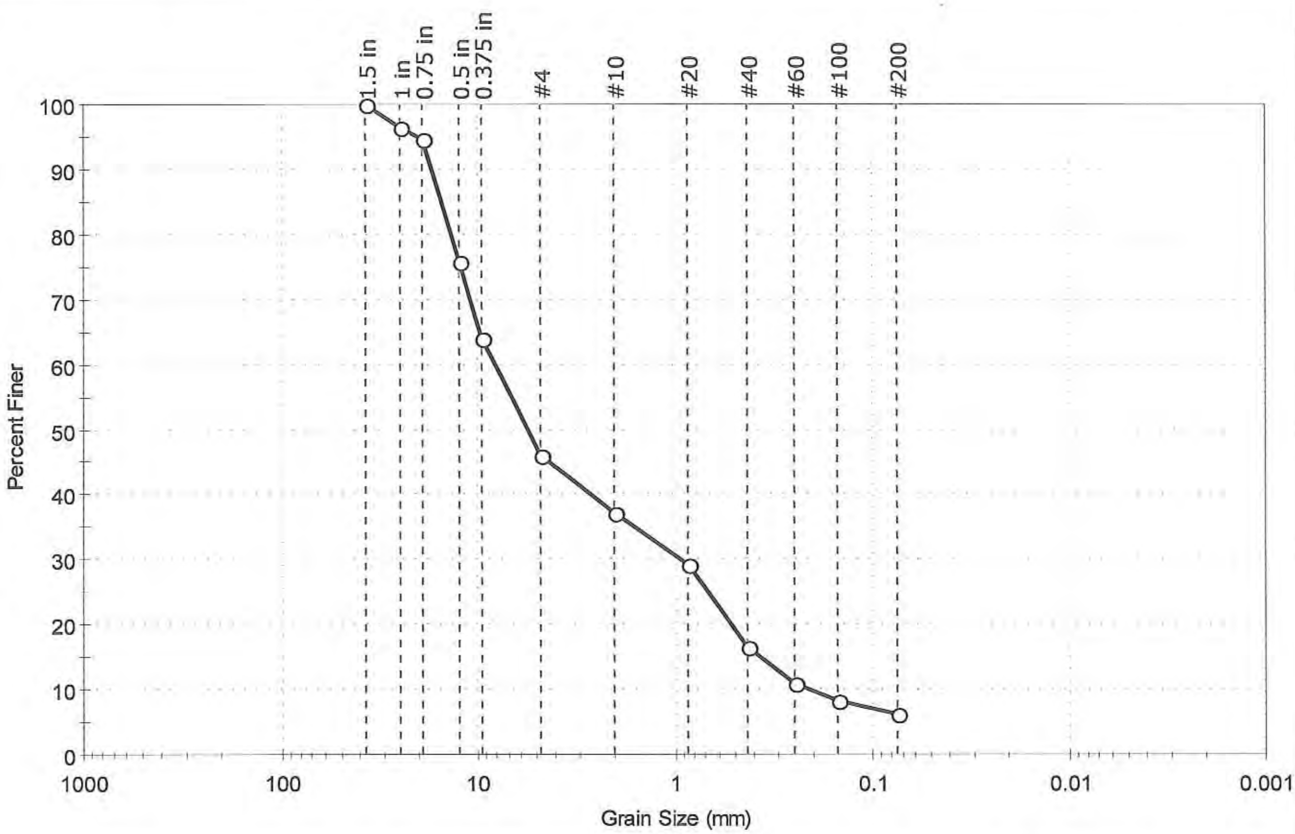
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-319	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/07/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228743		
Test Comment: ---			
Sample Description: Moist, brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	54.0	39.7	6.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	97		
0.75 in	19.00	95		
0.5 in	12.50	76		
0.375 in	9.50	64		
#4	4.75	46		
#10	2.00	37		
#20	0.85	29		
#40	0.42	17		
#60	0.25	11		
#100	0.15	8		
#200	0.075	6		

Coefficients

D_{85} =15.3516 mm	D_{30} =0.9310 mm
D_{60} =8.1279 mm	D_{15} =0.3664 mm
D_{50} =5.5519 mm	D_{10} =0.2065 mm
C_u =39.360	C_c =0.516

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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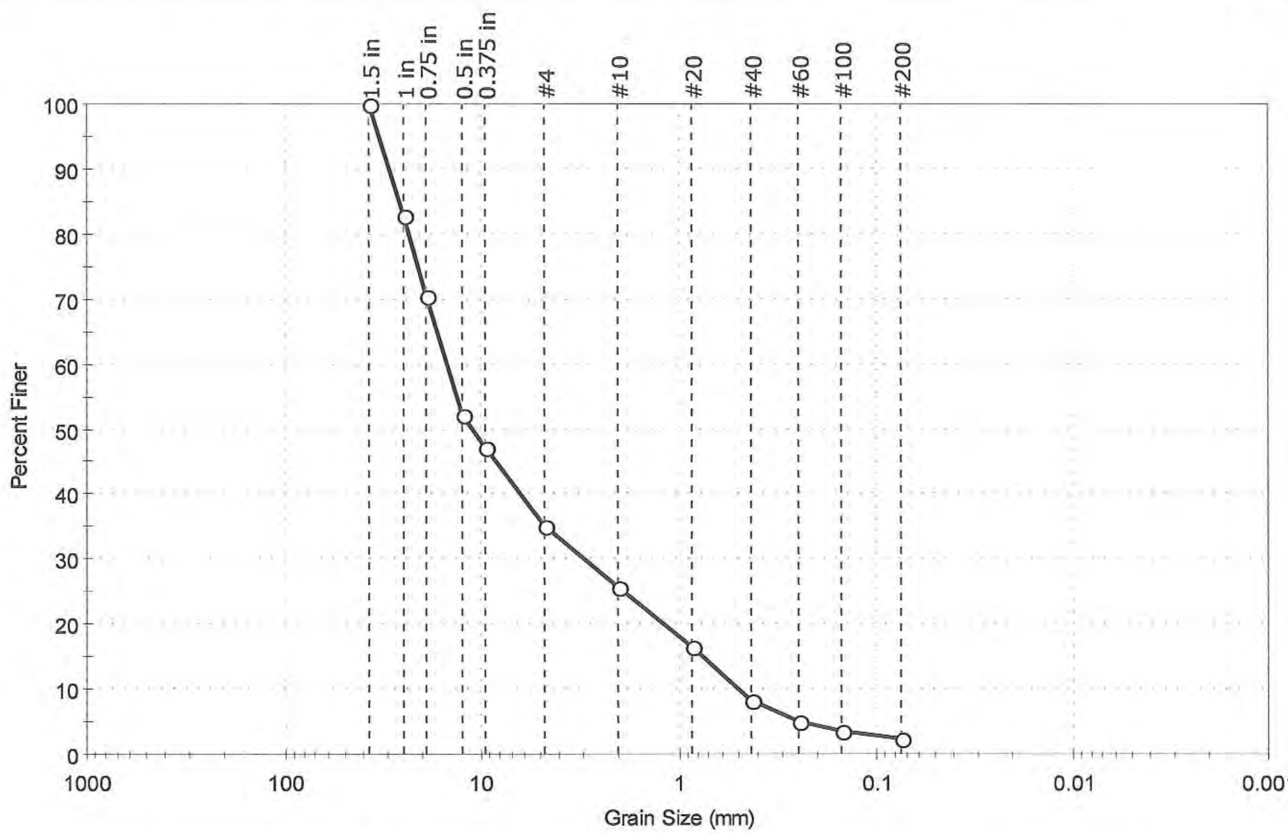
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-319	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/08/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228744		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: Sample contains broken glass			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	65.0	32.6	2.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	83		
0.75 in	19.00	70		
0.5 in	12.50	52		
0.375 in	9.50	47		
#4	4.75	35		
#10	2.00	26		
#20	0.85	16		
#40	0.42	8		
#60	0.25	5		
#100	0.15	3		
#200	0.075	2		

Coefficients

D_{85} =26.2413 mm — D_{30} =2.9753 mm

D_{60} =14.9345 mm — D_{15} =0.7532 mm

D_{50} =11.0402 mm — D_{10} =0.4950 mm

C_u =30.171 — C_c =1.197

Classification

ASTM — Well-graded gravel with sand (GW)

AASHTO — Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

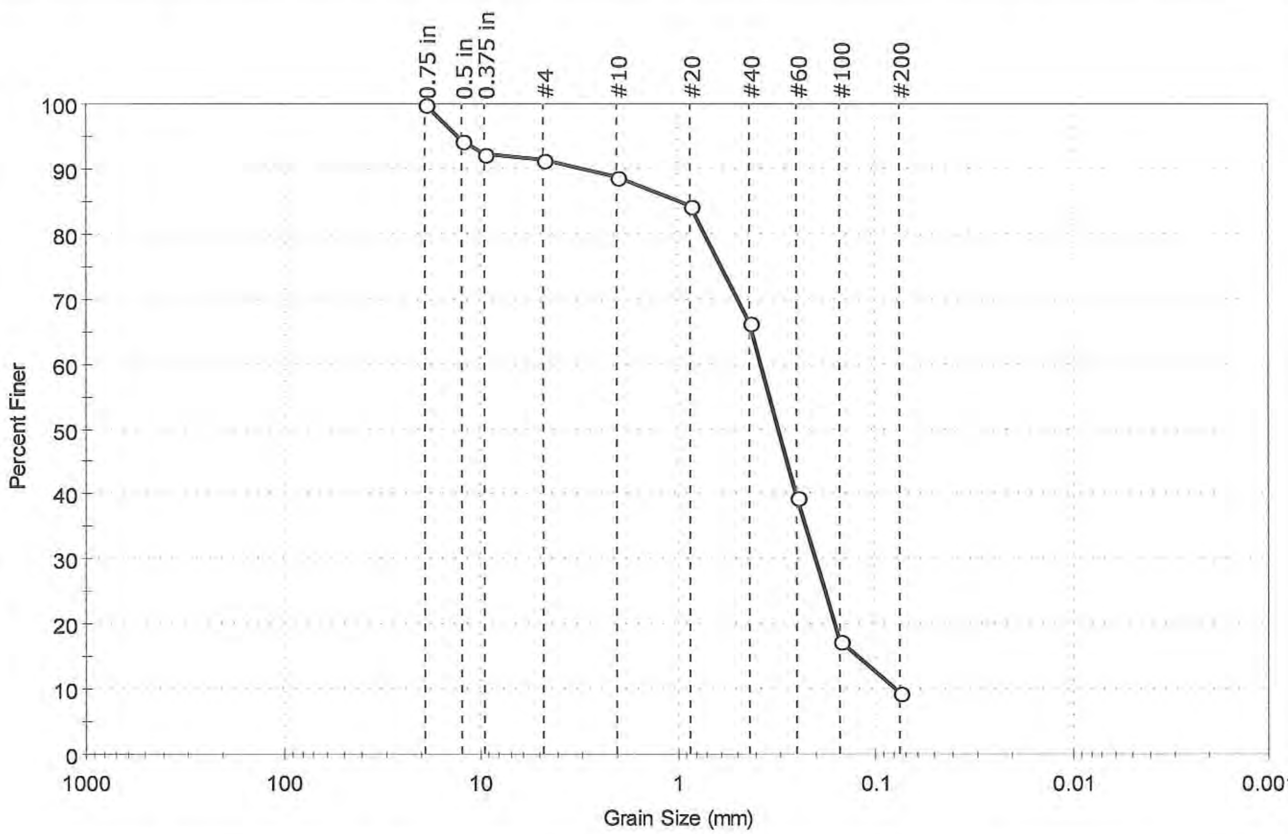
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:18:27 AM

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-319	Sample Type: jar	Tested By:	jbr
Sample ID:S-3B	Test Date: 02/06/12	Checked By:	njh
Depth : 5-7 ft	Test Id: 228745		
Test Comment: ---			
Sample Description: Moist, dark brown sand with silt			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	8.6	81.9	9.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	94		
0.375 in	9.50	92		
#4	4.75	91		
#10	2.00	89		
#20	0.85	84		
#40	0.42	66		
#60	0.25	40		
#100	0.15	17		
#200	0.075	10		

Coefficients

D_{85} =0.9390 mm
D_{30} =0.2003 mm
D_{60} =0.3744 mm
D_{15} =0.1217 mm
D_{50} =0.3069 mm
D_{10} =0.0783 mm
C_u =4.782
C_c =1.369

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

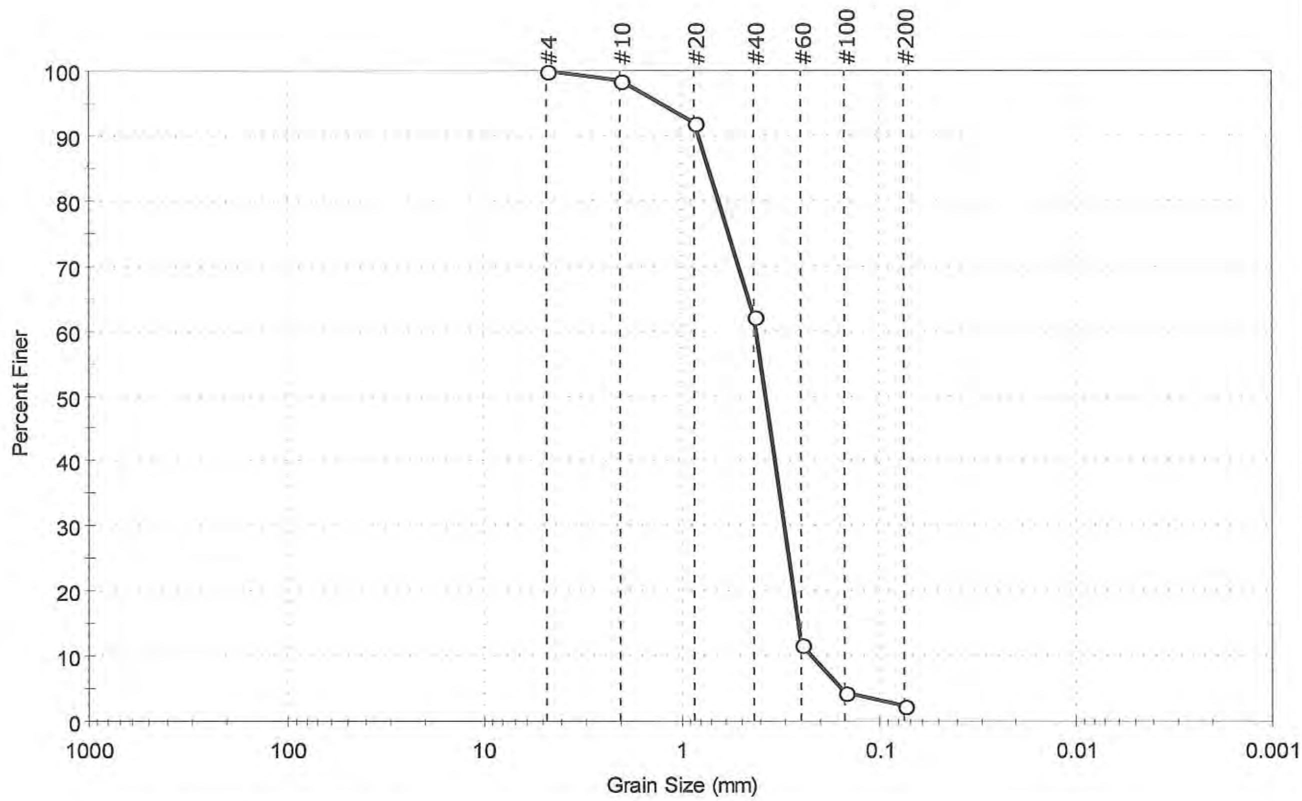
Sand/Gravel Hardness : HARD

printed 2/14/2012 10:19:02 AM

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-320	Sample Type: jar	Tested By:	jbr
Sample ID:S-1A	Test Date: 02/09/12	Checked By:	njh
Depth : 2.0-2.5 ft	Test Id: 228746		
Test Comment:	---		
Sample Description:	Moist, brown sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	—	97.7	2.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	92		
#40	0.42	62		
#60	0.25	12		
#100	0.15	4		
#200	0.075	2		

Coefficients

D_{85} =0.7231 mm	D_{30} =0.3028 mm
D_{60} =0.4157 mm	D_{15} =0.2584 mm
D_{50} =0.3740 mm	D_{10} =0.2203 mm
C_u =1.887	C_c =1.001

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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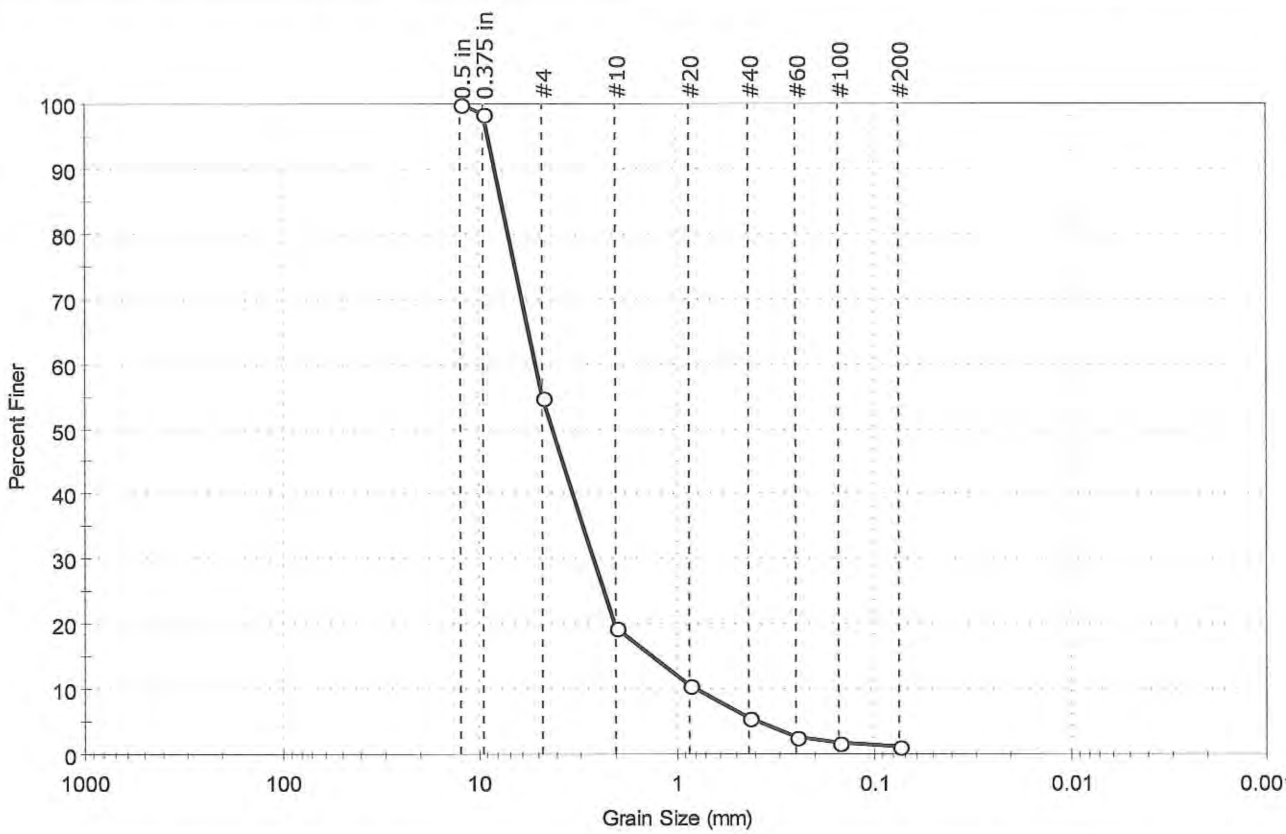
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-320	Sample Type: jar	Tested By:	jbr
Sample ID:S-1B	Test Date: 02/06/12	Checked By:	njh
Depth : 2.5-3.0 ft	Test Id: 228747		
Test Comment:	---		
Sample Description:	Moist, brown sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	45.1	53.8	1.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	99		
#4	4.75	55		
#10	2.00	19		
#20	0.85	11		
#40	0.42	6		
#60	0.25	3		
#100	0.15	2		
#200	0.075	1		

Coefficients

D_{85} =7.6531 mm D_{30} =2.5863 mm

D_{60} =5.1520 mm D_{15} =1.2880 mm

D_{50} =4.2171 mm D_{10} =0.7668 mm

C_u =6.719 C_c =1.693

Classification

ASTM Well-graded sand with gravel (SW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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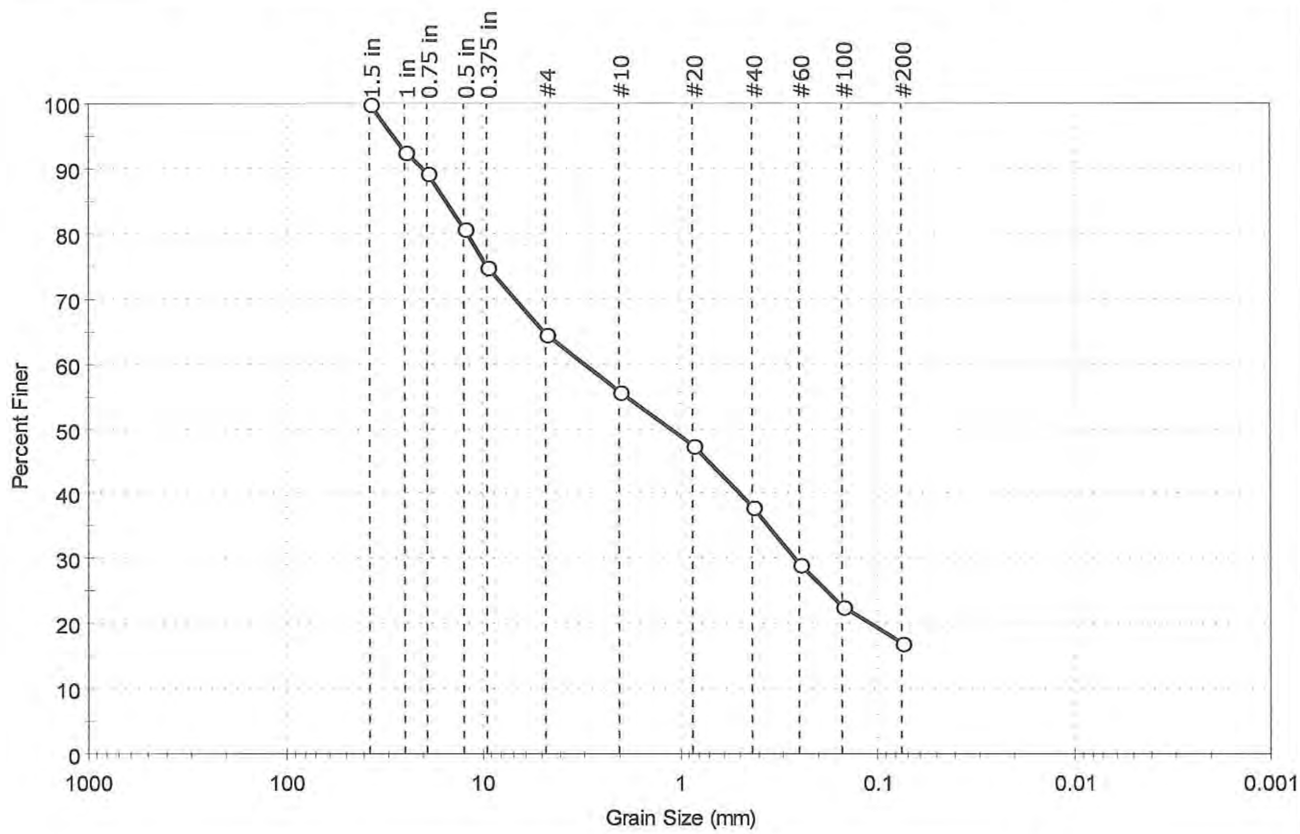
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-322	Sample Type: jar	Tested By:	jbr
Sample ID: S-1	Test Date: 02/08/12	Checked By:	njh
Depth : 2-4 ft	Test Id: 228748		
Test Comment: ---			
Sample Description: Moist, brown silty sand with gravel			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	35.3	47.6	17.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	92		
0.75 in	19.00	89		
0.5 in	12.50	81		
0.375 in	9.50	75		
#4	4.75	65		
#10	2.00	56		
#20	0.85	47		
#40	0.42	38		
#60	0.25	29		
#100	0.15	23		
#200	0.075	17		

Coefficients

D_{85} =15.3094 mm D_{30} =0.2600 mm
D_{60} =3.0296 mm D_{15} =N/A
D_{50} =1.1183 mm D_{10} =N/A
C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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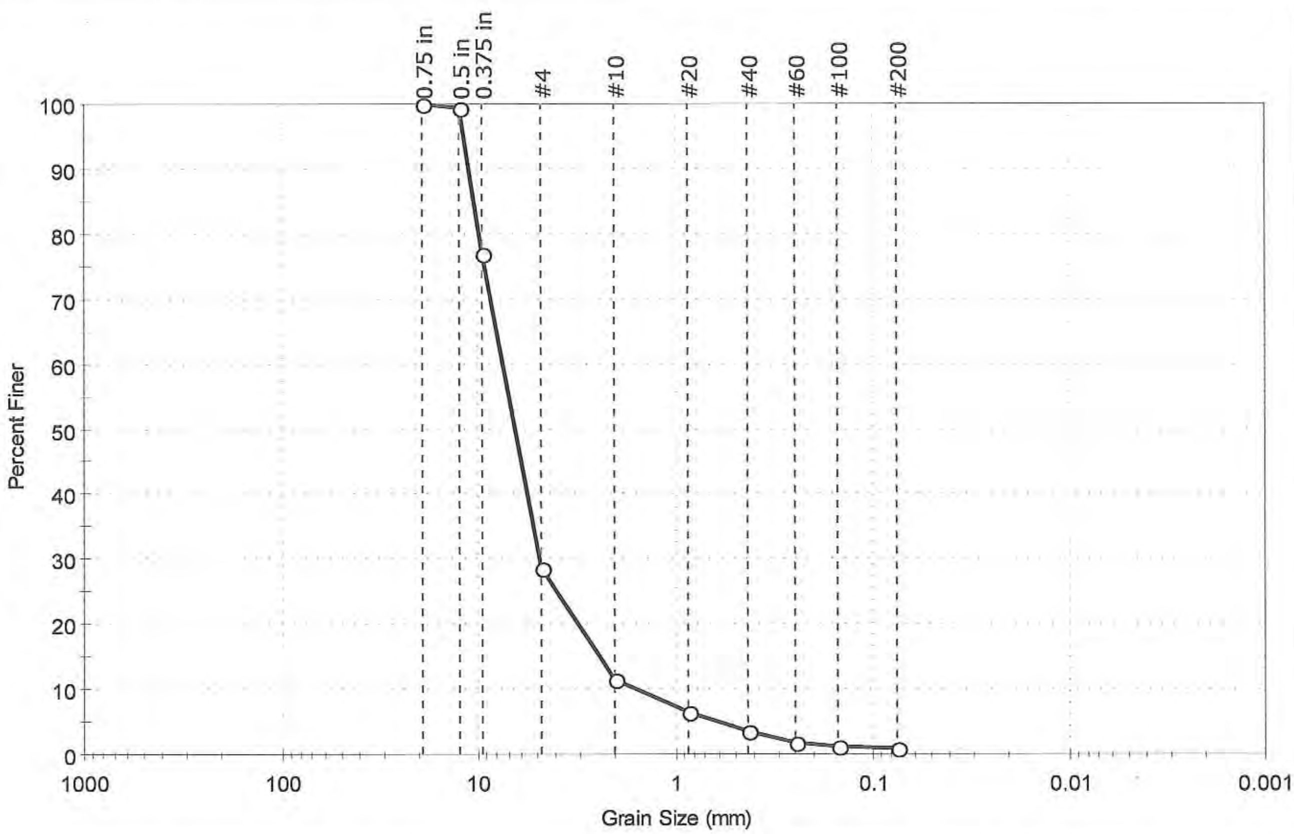
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-323	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/08/12	Checked By:	njh
Depth : 2-3.5 ft	Test Id: 228749		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	71.3	27.9	0.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	99		
0.375 in	9.50	77		
#4	4.75	29		
#10	2.00	12		
#20	0.85	6		
#40	0.42	4		
#60	0.25	2		
#100	0.15	1		
#200	0.075	1		

Coefficients

D_{85} =10.4747 mm D_{30} =4.8391 mm

D_{60} =7.4392 mm D_{15} =2.3755 mm

D_{50} =6.4457 mm D_{10} =1.5334 mm

C_u =4.851 C_c =2.053

Classification

ASTM   Well-graded gravel with sand (GW)

AASHTO   Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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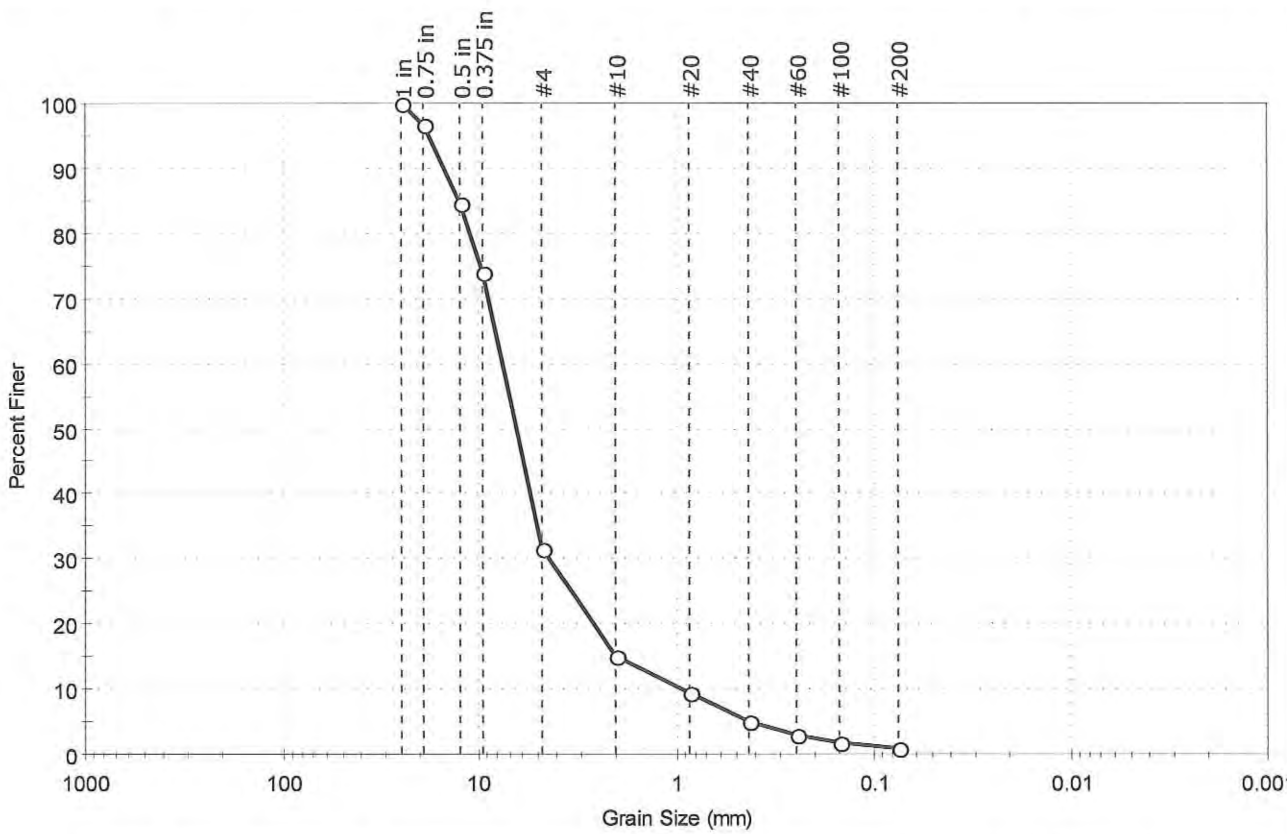
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-323	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/07/12	Checked By:	njh
Depth : 4.0-5.5 ft	Test Id: 228750		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: Sample contains broken glass			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	68.4	30.7	0.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	97		
0.5 in	12.50	85		
0.375 in	9.50	74		
#4	4.75	32		
#10	2.00	15		
#20	0.85	9		
#40	0.42	5		
#60	0.25	3		
#100	0.15	2		
#200	0.075	1		

Coefficients

D_{85} =12.5985 mm D_{30} =4.3603 mm

D_{60} =7.5474 mm D_{15} =1.9891 mm

D_{50} =6.4103 mm D_{10} =0.9431 mm

C_u =8.003 C_c =2.671

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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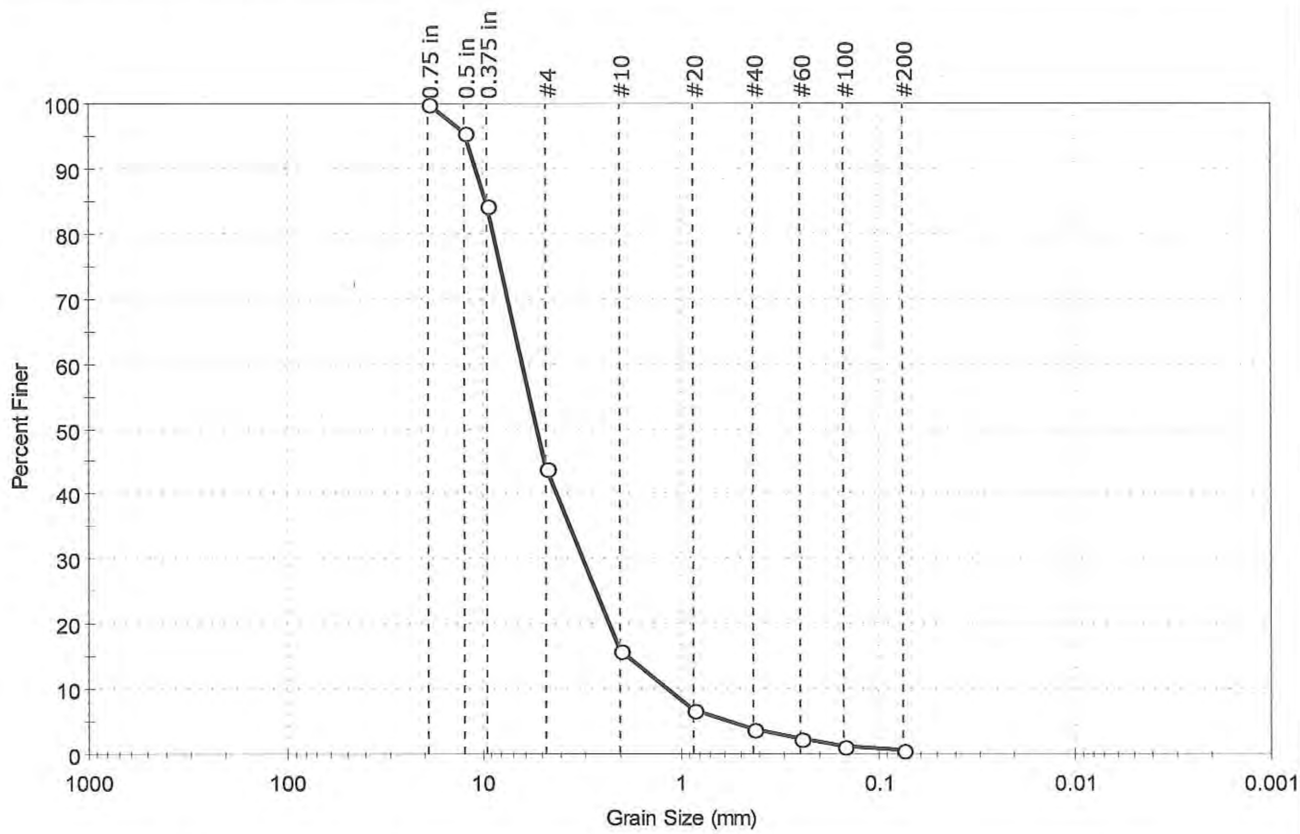
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-325	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/07/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228751		
Test Comment:	---		
Sample Description:	Moist, brown gravel with sand		
Sample Comment:	Sample contains broken glass		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	56.0	43.5	0.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	84		
#4	4.75	44		
#10	2.00	16		
#20	0.85	7		
#40	0.42	4		
#60	0.25	2		
#100	0.15	1		
#200	0.075	0		

Coefficients

D_{85} =9.6730 mm D_{30} =3.0920 mm
D_{60} =6.2568 mm D_{15} =1.8530 mm
D_{50} =5.2669 mm D_{10} =1.1434 mm
C_u =5.472 C_c =1.336

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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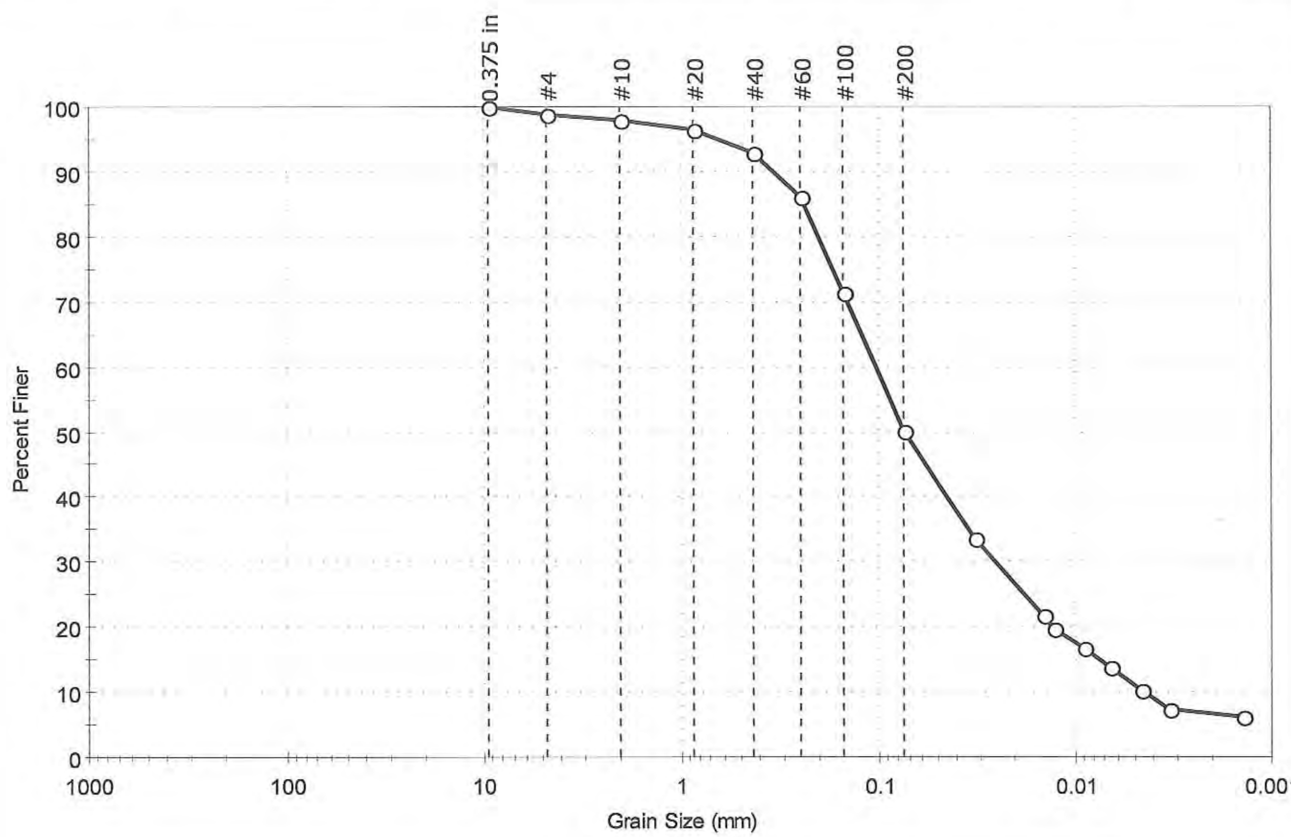
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-327	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/08/12	Checked By:	njh
Depth : 5-7 ft	Test Id: 228760		
Test Comment: ---			
Sample Description: Moist, grayish brown sandy silt			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.1	48.8	50.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	98		
#20	0.85	97		
#40	0.42	93		
#60	0.25	86		
#100	0.15	71		
#200	0.075	50		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0324	34		
---	0.0145	22		
---	0.0129	20		
---	0.0091	17		
---	0.0066	14		
---	0.0046	10		
---	0.0033	7		
---	0.0014	6		

Coefficients

D_{85} =0.2406 mm D_{30} =0.0254 mm

D_{60} =0.1036 mm D_{15} =0.0074 mm

D_{50} =0.0749 mm D_{10} =0.0045 mm

C_u =N/A C_c =N/A

Classification

ASTM Sandy silt (ML)

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

printed 2/14/2012 10:25:23 AM

Client:	Gahagan & Bryant Associates			
Project:	Delaware River Channel Deepening Reach B			
Location:	---		Project No:	GTX-11510
Boring ID: CB-327		Sample Type: jar	Tested By:	cam
Sample ID:S-2		Test Date: 02/06/12	Checked By:	njh
Depth : 5-7 ft		Test Id: 228764		
Test Comment:	---			
Sample Description:	Moist, grayish brown sandy silt			
Sample Comment:	---			

Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	CB-327	5-7 ft	18	n/a	n/a	n/a	n/a	Sandy silt (ML)

7% Retained on #40 Sieve

Dry Strength: LOW

Dilentancy: RAPID

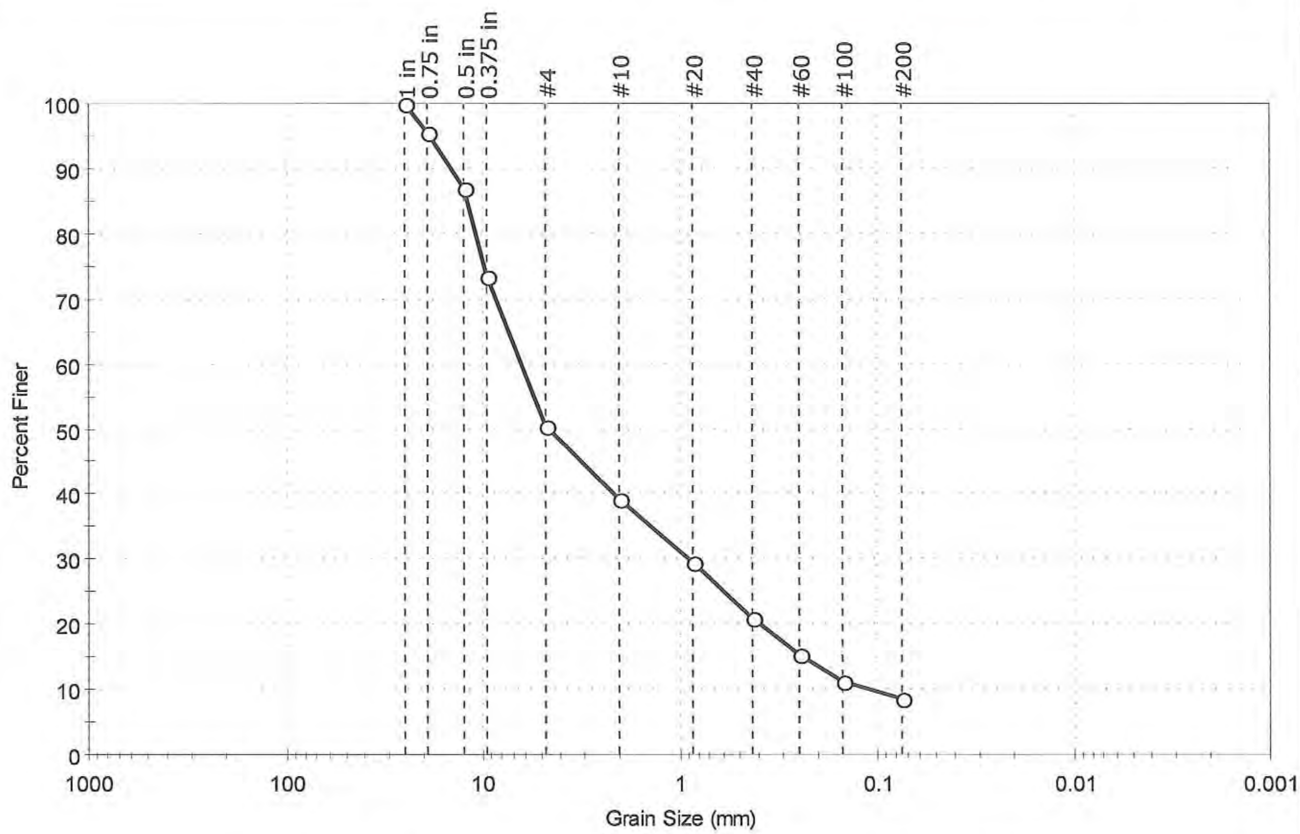
Toughness: n/a

The sample was determined to be Non-Plastic

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-327	Sample Type: jar	Tested By:	jbr
Sample ID:S-3	Test Date: 02/08/12	Checked By:	njh
Depth : 7-9 ft	Test Id: 228752		
Test Comment: ---			
Sample Description: Moist, brown gravel with silt and sand			
Sample Comment: Sample contains broken glass			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	49.5	41.9	8.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	96		
0.5 in	12.50	87		
0.375 in	9.50	73		
#4	4.75	51		
#10	2.00	39		
#20	0.85	29		
#40	0.42	21		
#60	0.25	15		
#100	0.15	11		
#200	0.075	9		

Coefficients

D_{85} =12.0210 mm　D_{30} =0.8891 mm

D_{60} =6.3314 mm　D_{15} =0.2364 mm

D_{50} =4.5488 mm　D_{10} =0.1069 mm

C_u =59.227　C_c =1.168

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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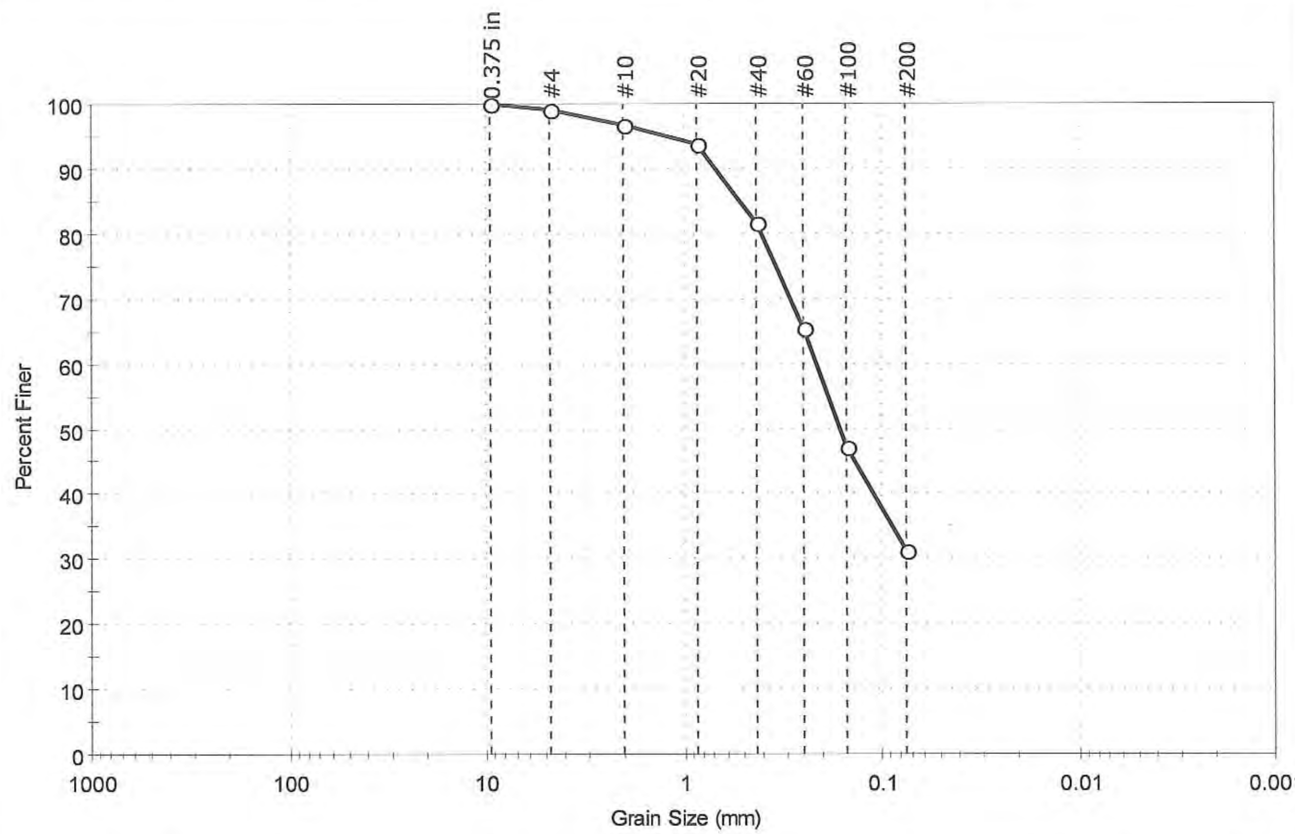
Client:	Gahagan & Bryant Associates
Project:	Delaware River Channel Deepening Reach B
Location:	---
Project No:	GTX-11510
Boring ID:	CB-328
Sample ID:	S-2
Depth :	5-7 ft
Sample Type:	jar
Test Date:	02/09/12
Test Id:	228753
Tested By:	jbr
Checked By:	njh
Test Comment:	---
Sample Description:	Moist, dark yellowish brown silty sand
Sample Comment:	---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.0	67.7	31.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	97		
#20	0.85	94		
#40	0.42	82		
#60	0.25	65		
#100	0.15	47		
#200	0.075	31		

Coefficients

D_{85} = 0.5121 mm | D_{30} = N/A
D_{60} = 0.2147 mm | D_{15} = N/A
D_{50} = 0.1624 mm | D_{10} = N/A
C_u = N/A | C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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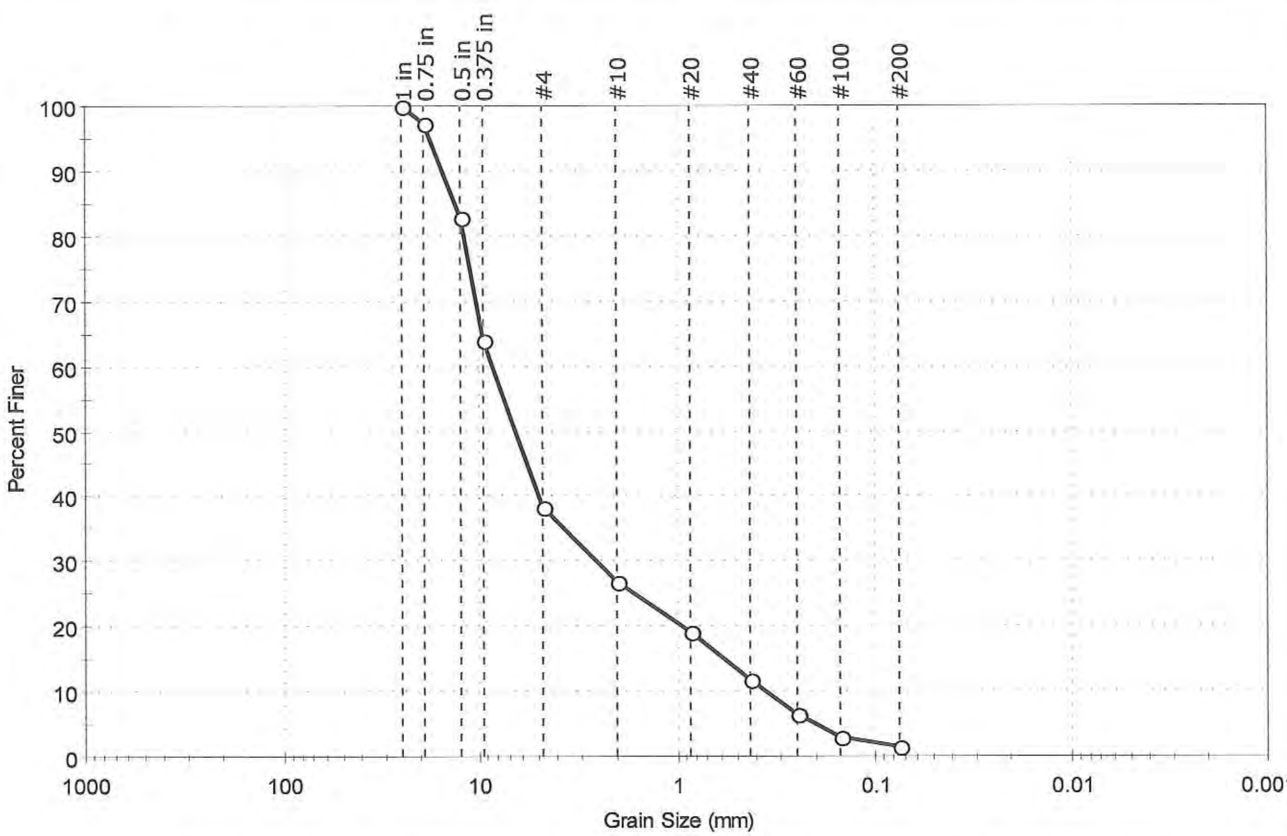
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-329	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/08/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228754		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	61.8	36.6	1.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	97		
0.5 in	12.50	83		
0.375 in	9.50	64		
#4	4.75	38		
#10	2.00	27		
#20	0.85	19		
#40	0.42	12		
#60	0.25	6		
#100	0.15	3		
#200	0.075	2		

Coefficients

D_{85} =13.3319 mm	D_{30} =2.5589 mm
D_{60} =8.5390 mm	D_{15} =0.5672 mm
D_{50} =6.5247 mm	D_{10} =0.3535 mm
C_u =24.156	C_c =2.169

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

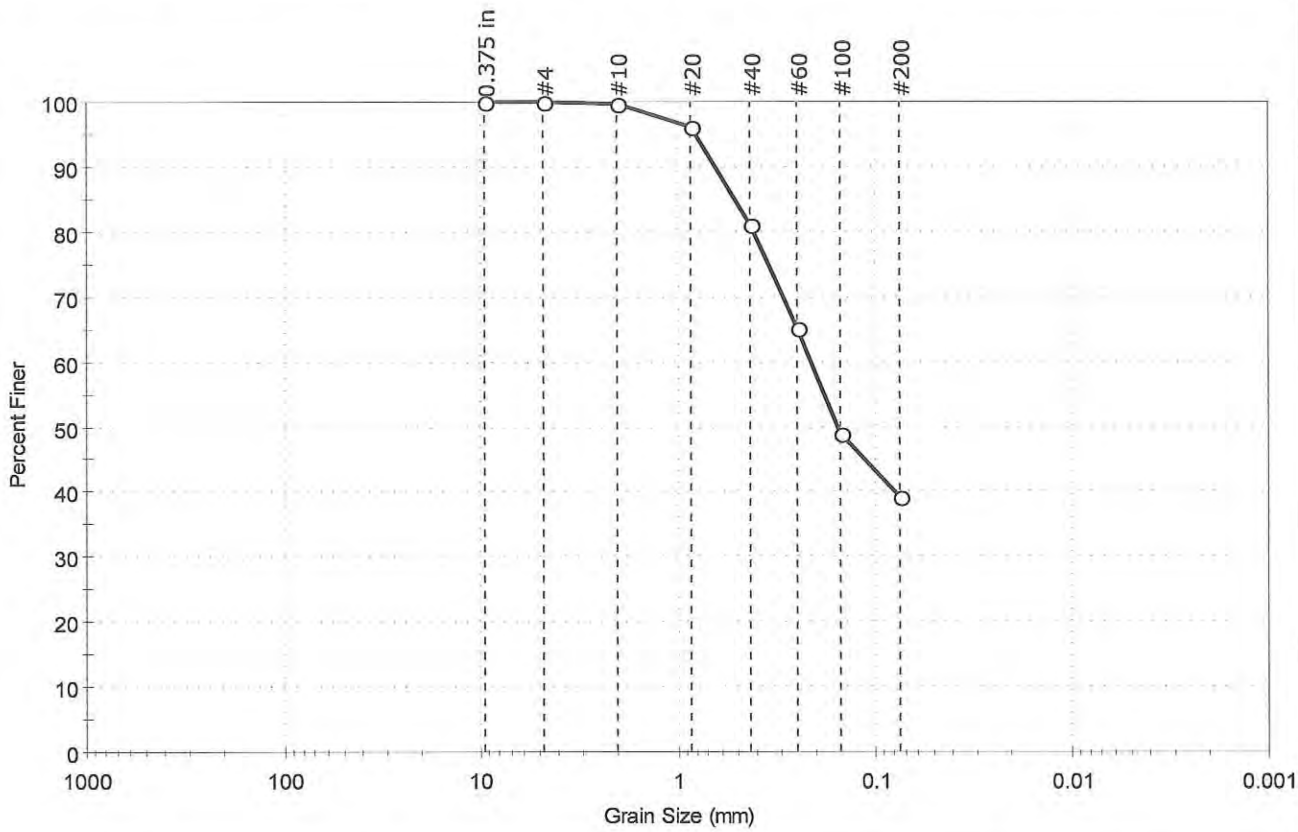
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:46:15 AM

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-329	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/09/12	Checked By:	njh
Depth : 5-7 ft	Test Id: 228755		
Test Comment:	---		
Sample Description:	Moist, brown silty sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	60.8	39.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	96		
#40	0.42	81		
#60	0.25	65		
#100	0.15	49		
#200	0.075	39		

Coefficients

D_{85} =0.5090 mm | D_{30} =N/A

D_{60} =0.2126 mm | D_{15} =N/A

D_{50} =0.1552 mm | D_{10} =N/A

C_u =N/A | C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

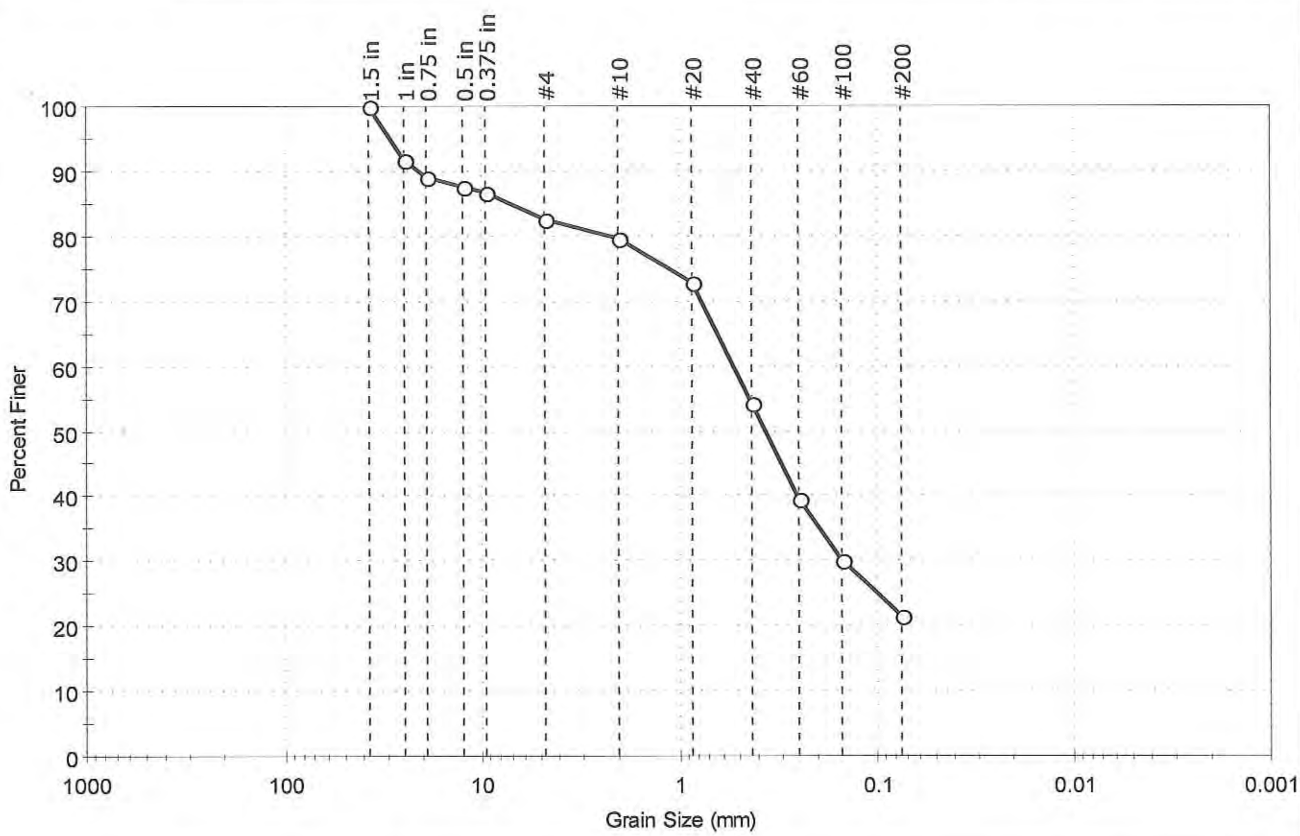
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

printed 2/14/2012 10:46:53 AM

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-330	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228756		
Test Comment:	---		
Sample Description:	Moist, grayish brown silty sand with gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	17.4	61.2	21.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	92		
0.75 in	19.00	89		
0.5 in	12.50	88		
0.375 in	9.50	87		
#4	4.75	83		
#10	2.00	80		
#20	0.85	73		
#40	0.42	54		
#60	0.25	40		
#100	0.15	30		
#200	0.075	21		

Coefficients

D_{85} =7.1126 mm | D_{30} =0.1488 mm

D_{60} =0.5281 mm | D_{15} =N/A

D_{50} =0.3651 mm | D_{10} =N/A

C_u =N/A | C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

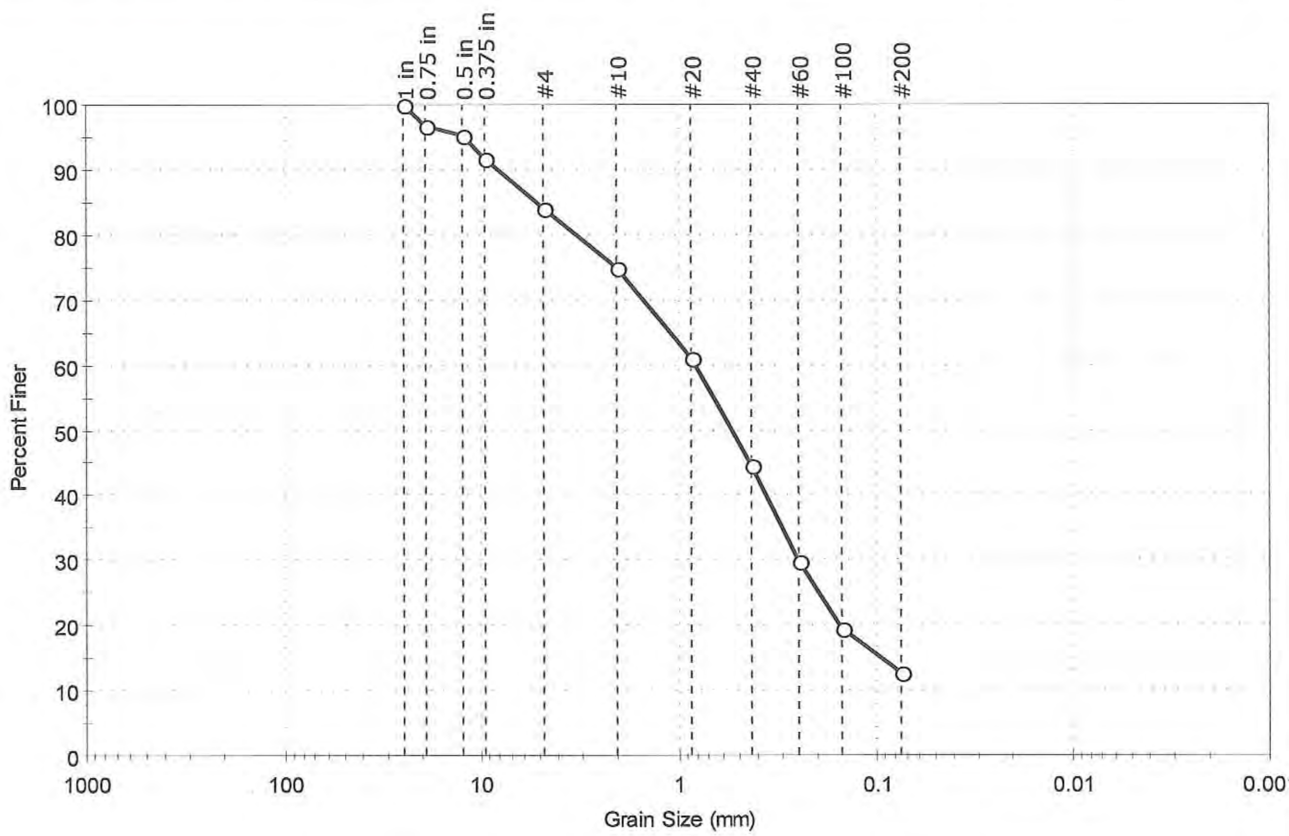
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-332	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/07/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228757		
Test Comment: ---			
Sample Description: Moist, brown silty sand with gravel			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	16.0	71.4	12.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	97		
0.5 in	12.50	95		
0.375 in	9.50	92		
#4	4.75	84		
#10	2.00	75		
#20	0.85	61		
#40	0.42	44		
#60	0.25	30		
#100	0.15	20		
#200	0.075	13		

Coefficients

D_{85} =5.2121 mm　　D_{30} =0.2525 mm

D_{60} =0.8119 mm　　D_{15} =0.0954 mm

D_{50} =0.5357 mm　　D_{10} =0.0582 mm

C_u =N/A　　C_c =N/A

Classification

ASTM　N/A

AASHTO　Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

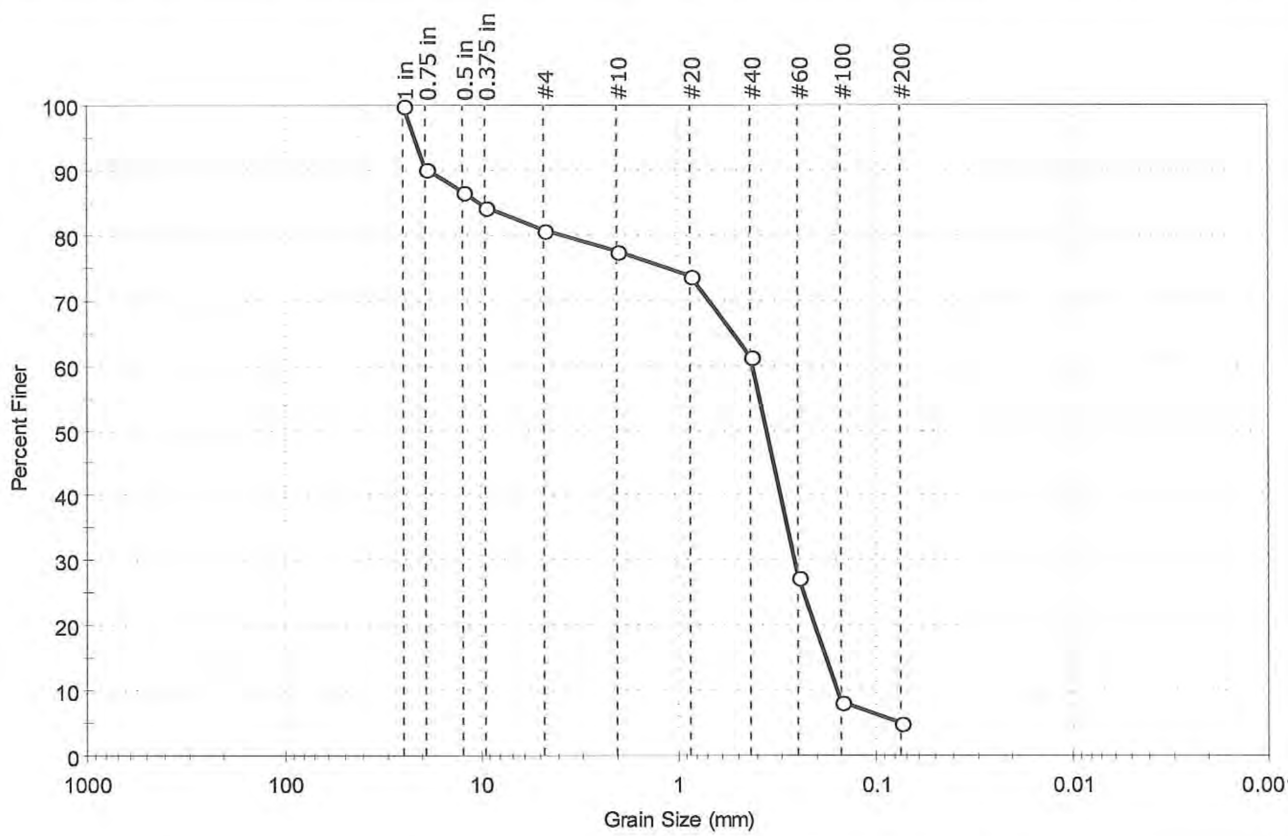
Sand/Gravel Hardness : HARD

printed 2/14/2012 10:48:32 AM

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-333	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/03/12	Checked By:	njh
Depth : 0-1 ft	Test Id: 228758		
Test Comment: ---			
Sample Description: Moist, brown sand with silt and gravel			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	19.2	75.7	5.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	90		
0.5 in	12.50	87		
0.375 in	9.50	84		
#4	4.75	81		
#10	2.00	78		
#20	0.85	74		
#40	0.42	61		
#60	0.25	27		
#100	0.15	8		
#200	0.075	5		

Coefficients

D_{85} =10.1705 mm D_{30} =0.2607 mm
D_{60} =0.4158 mm D_{15} =0.1801 mm
D_{50} =0.3559 mm D_{10} =0.1576 mm
C_u =2.638 C_c =1.037

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (0))

Sample/Test Description

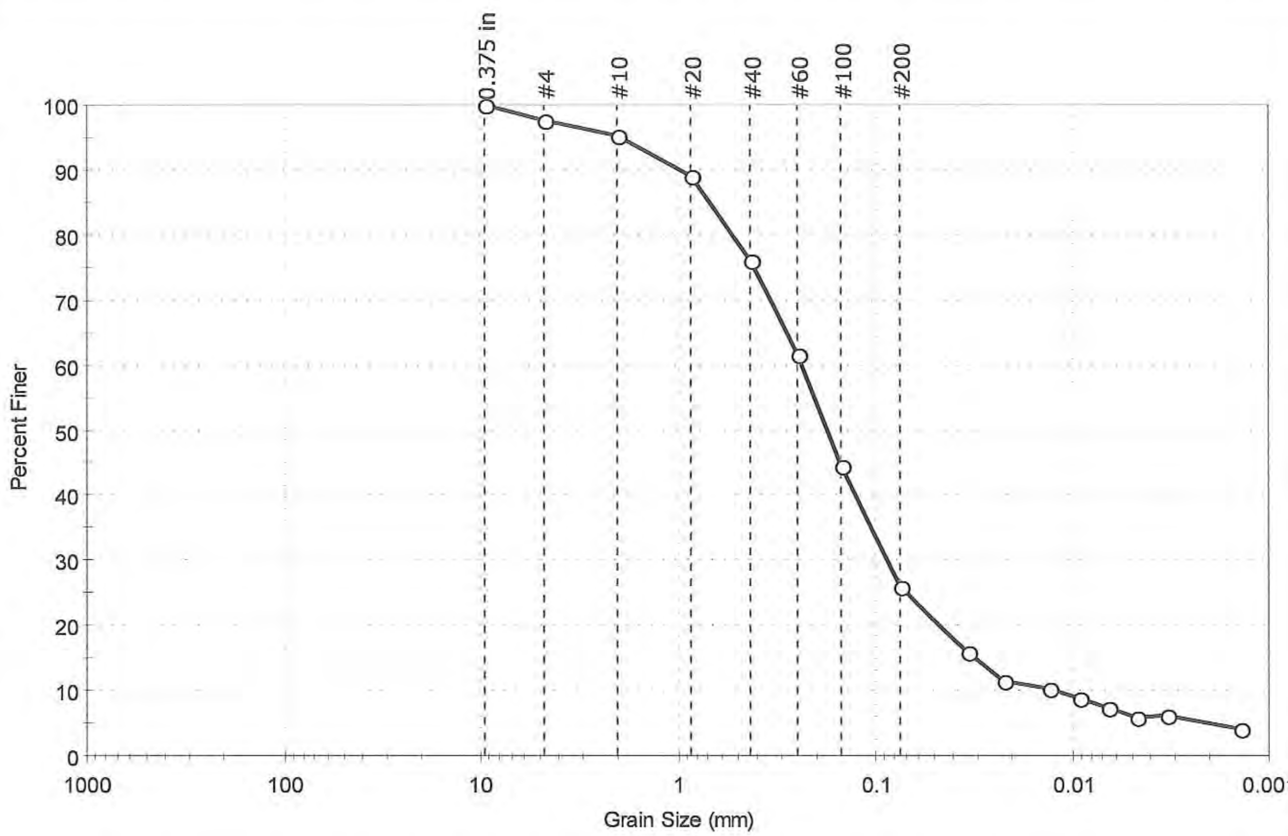
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 10:49:12 AM

Client:	Gahagan & Bryant Associates			
Project:	Delaware River Channel Deepening Reach B			
Location:	---		Project No:	GTX-11510
Boring ID: CB-334		Sample Type: jar	Tested By:	jbr
Sample ID:S-1		Test Date: 02/02/12	Checked By:	njh
Depth : 1-3 ft		Test Id: 228761		
Test Comment:	---			
Sample Description:	Moist, dark brown silty sand			
Sample Comment:	---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	71.5	26.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	95		
#20	0.85	89		
#40	0.42	76		
#60	0.25	62		
#100	0.15	45		
#200	0.075	26		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0344	16		
---	0.0220	12		
---	0.0130	10		
---	0.0092	9		
---	0.0065	7		
---	0.0047	6		
---	0.0033	6		
---	0.0014	4		

Coefficients

D_{85} =0.6820 mm　　D_{30} =0.0869 mm

D_{60} =0.2389 mm　　D_{15} =0.0314 mm

D_{50} =0.1768 mm　　D_{10} =0.0124 mm

C_u =N/A　　C_c =N/A

Classification

ASTM　N/A

AASHTO　Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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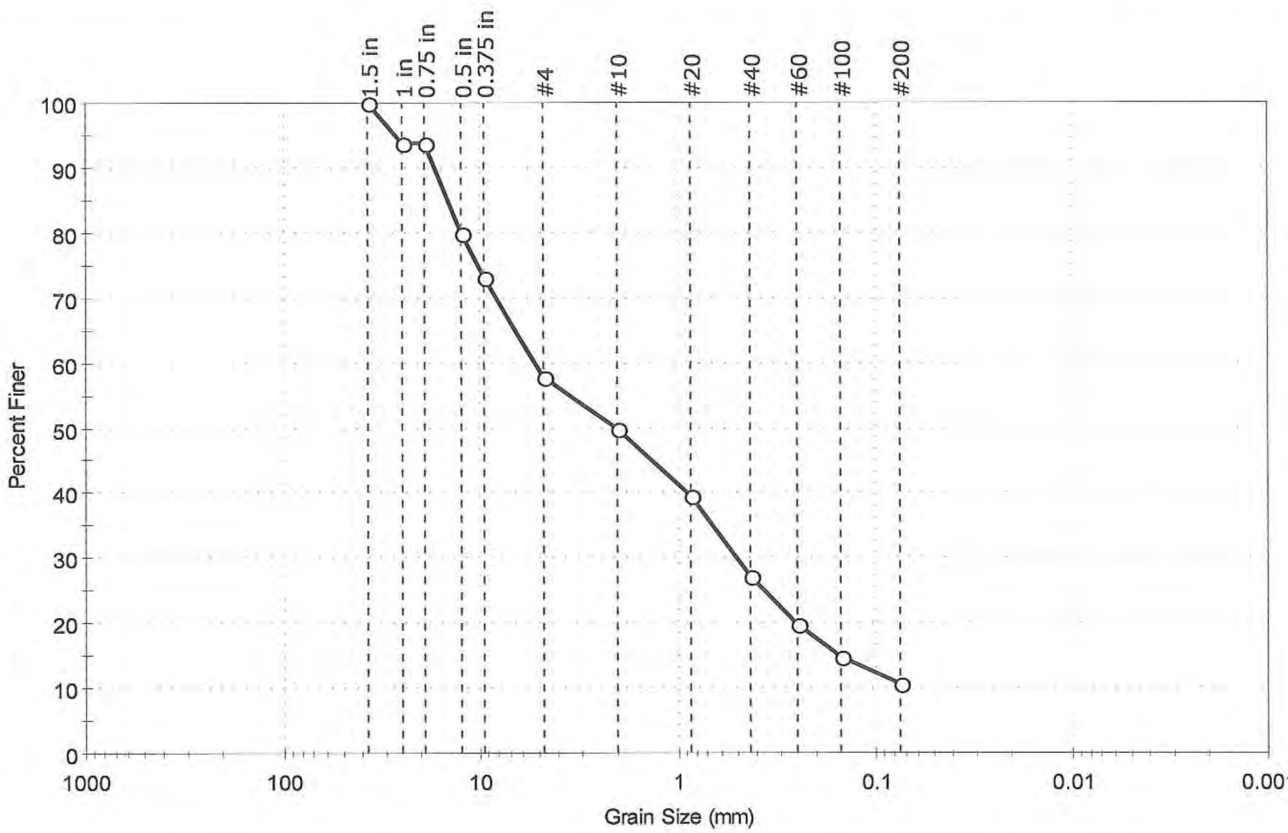
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-335	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/03/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228759		
Test Comment:	---		
Sample Description:	Moist, dark grayish brown sand with silt and gravel		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	42.1	47.4	10.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	94		
0.75 in	19.00	94		
0.5 in	12.50	80		
0.375 in	9.50	73		
#4	4.75	58		
#10	2.00	50		
#20	0.85	39		
#40	0.42	27		
#60	0.25	20		
#100	0.15	15		
#200	0.075	11		

Coefficients

D_{85} =14.5791 mm D_{30} =0.4974 mm

D_{60} =5.2085 mm D_{15} =0.1552 mm

D_{50} =2.0581 mm D_{10} =0.0687 mm

C_u =75.815 C_c =0.691

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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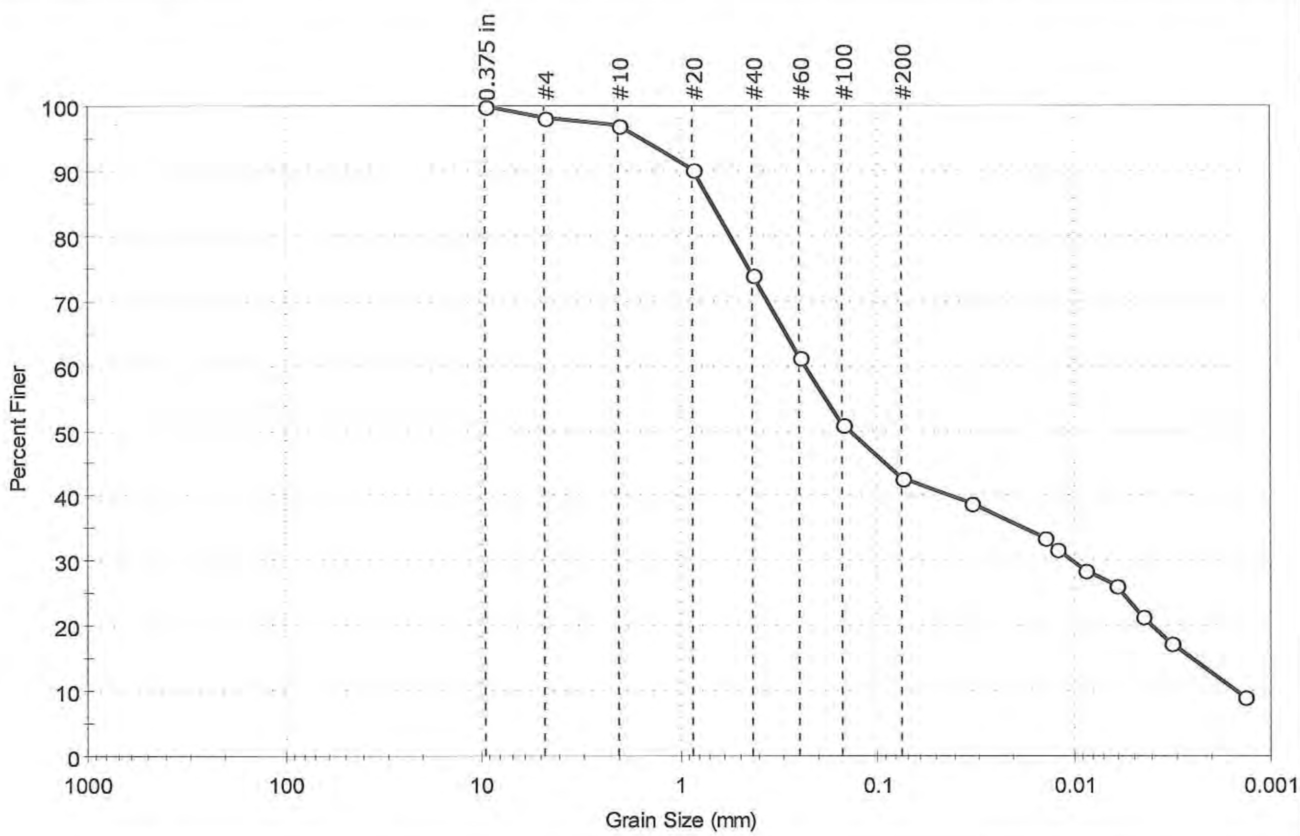
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-336	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/02/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228762		
Test Comment:	---		
Sample Description:	Moist, brownish yellow clayey sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	55.7	42.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	97		
#20	0.85	90		
#40	0.42	74		
#60	0.25	61		
#100	0.15	51		
#200	0.075	43		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0337	39		
---	0.0142	34		
---	0.0122	32		
---	0.0087	28		
---	0.0062	26		
---	0.0044	22		
---	0.0032	17		
---	0.0014	9		

Coefficients

D_{85} =0.6791 mm D_{30} =0.0101 mm

D_{60} =0.2334 mm D_{15} =0.0025 mm

D_{50} =0.1391 mm D_{10} =0.0015 mm

C_u =N/A C_c =N/A

Classification

ASTM Clayey sand (SC)

AASHTO Clayey Soils (A-6 (4))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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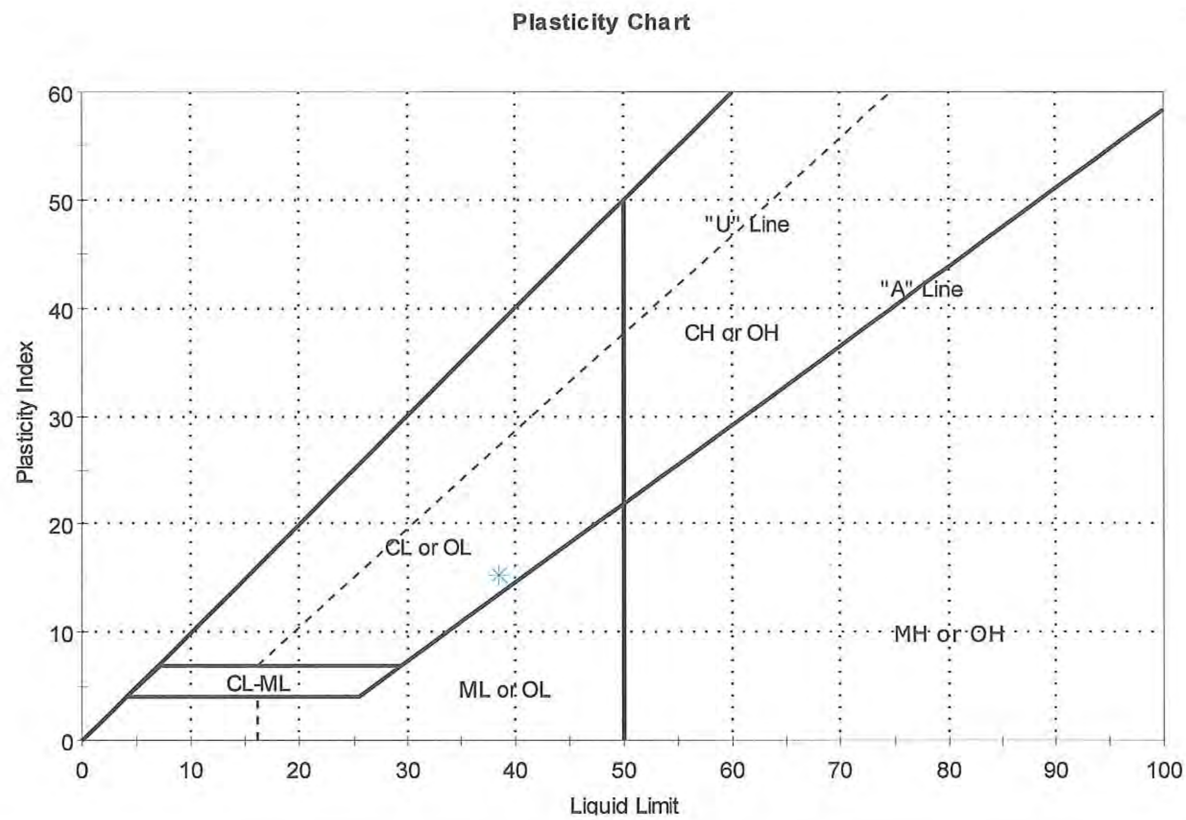
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates				
Project:	Delaware River Channel Deepening Reach B				
Location:	---			Project No:	GTX-11510
Boring ID: CB-336		Sample Type:	jar	Tested By:	cam
Sample ID:S-2		Test Date:	02/07/12	Checked By:	njh
Depth :	4-6 ft	Test Id:	228765		
Test Comment:	---				
Sample Description:	Moist, brownish yellow clayey sand				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	CB-336	4-6 ft	22	39	23	16	0	Clayey sand (SC)

Sample Prepared using the WET method

26% Retained on #40 Sieve

Dry Strength: HIGH

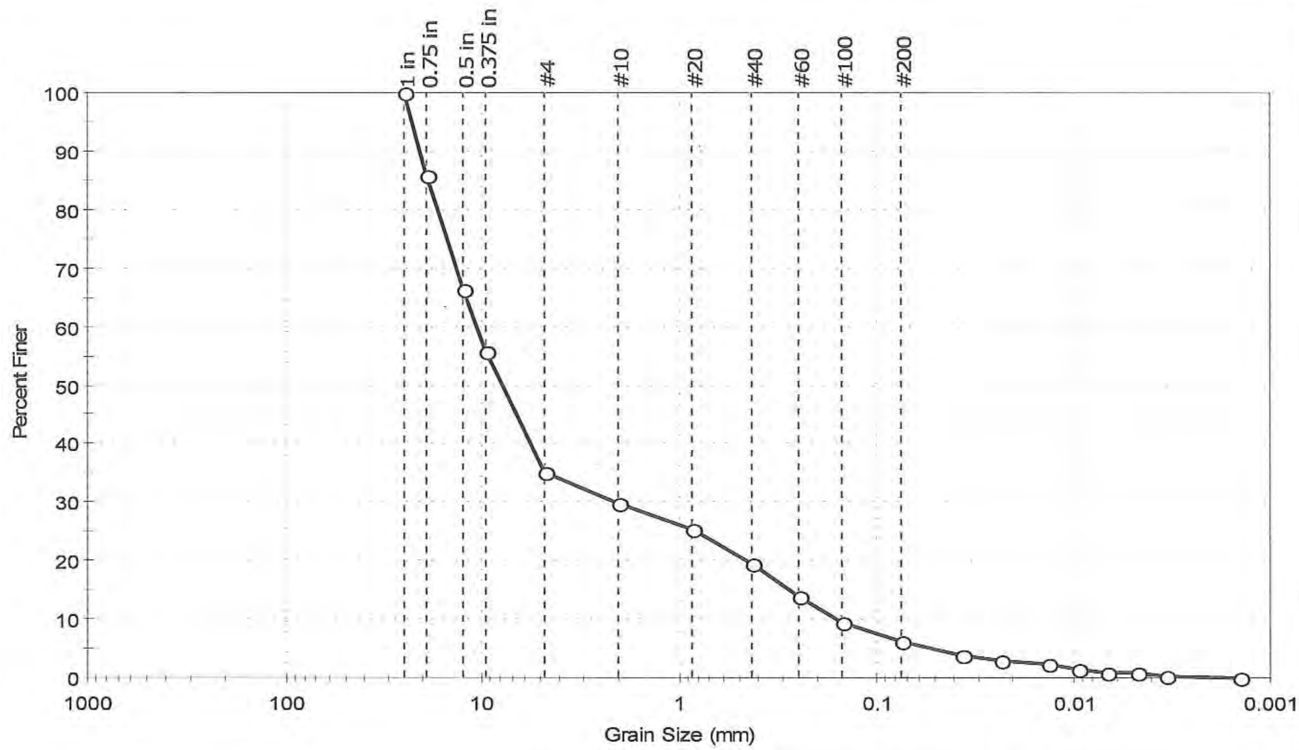
Dilentancy: SLOW

Toughness: LOW

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-338	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/02/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228763		
Test Comment: ---			
Sample Description: Moist, dark grayish brown gravel with silt and sand			
Sample Comment: ----			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	64.9	29.1	6.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	86		
0.5 in	12.50	66		
0.375 in	9.50	56		
#4	4.75	35		
#10	2.00	30		
#20	0.85	25		
#40	0.42	19		
#60	0.25	14		
#100	0.15	9		
#200	0.075	6		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0368	4		
---	0.0233	3		
---	0.0134	2		
---	0.0095	2		
---	0.0067	1		
---	0.0048	1		
---	0.0034	0		
---	0.0014	0		

Coefficients

D_{85} =18.6787 mm	D_{30} =2.0203 mm
D_{60} =10.5982 mm	D_{15} =0.2767 mm
D_{50} =7.8265 mm	D_{10} =0.1600 mm
C_u =66.239	C_c =2.407

Classification

ASTM Well-graded gravel with silt and sand (GW-GM)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates				
Project:	Delaware River Channel Deepening Reach B				
Location:	---			Project No:	GTX-11510
Boring ID:	CB-338	Sample Type:	jar	Tested By:	cam
Sample ID:	S-1	Test Date:	02/02/12	Checked By:	njh
Depth :	0-2 ft	Test Id:	228766		
Test Comment:	---				
Sample Description:	Moist, dark grayish brown gravel with silt and sand				
Sample Comment:	----				

Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	CB-338	0-2 ft	7	n/a	n/a	n/a	n/a	Well-graded gravel with silt and sand (GW-GM)

80% Retained on #40 Sieve

Dry Strength: NONE

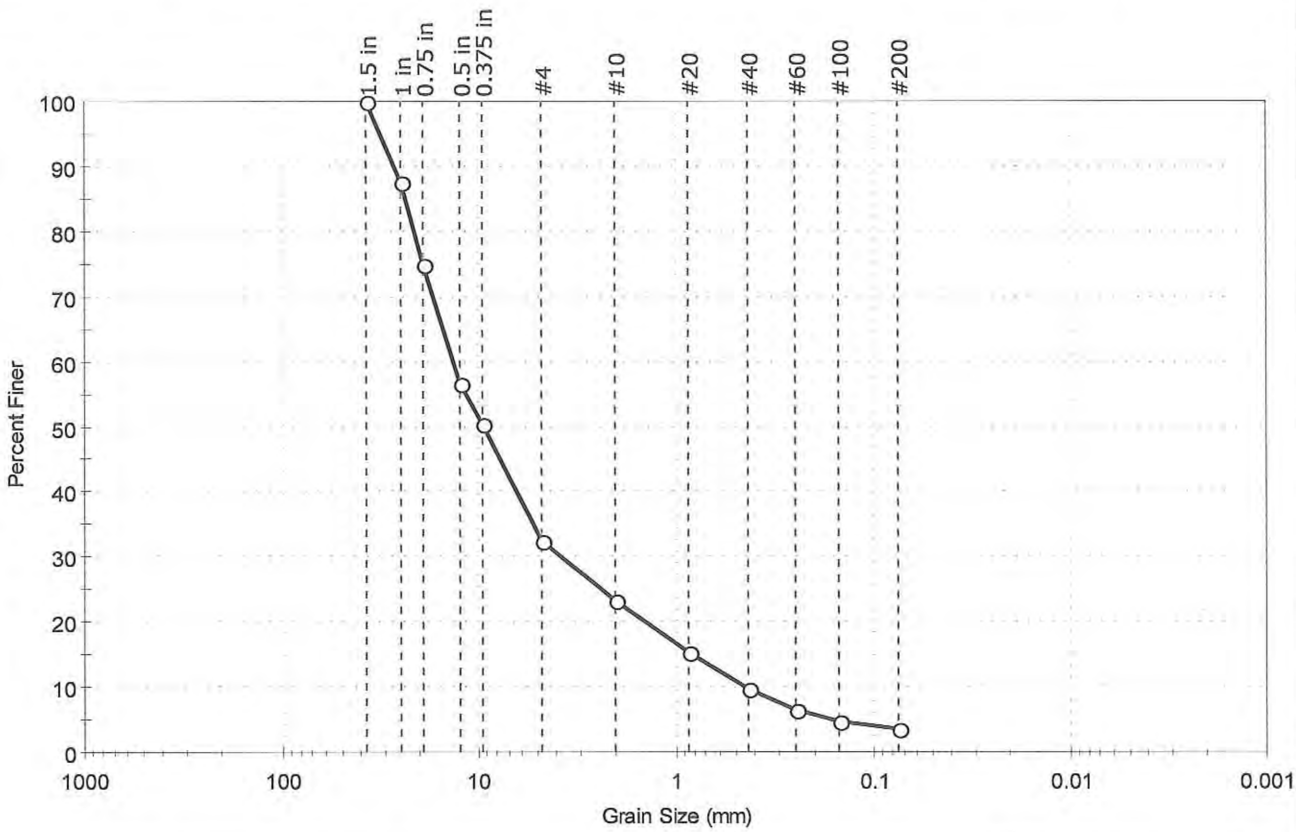
Dilentancy: RAPID

Toughness: n/a

The sample was determined to be Non-Plastic

Client:	Gahagan & Bryant Associates			
Project:	Delaware River Channel Deepening Reach B			
Location:	---		Project No:	GTX-11510
Boring ID: CB-339		Sample Type: jar	Tested By:	jbr
Sample ID:S-1		Test Date: 02/02/12	Checked By:	njh
Depth : 1-3 ft		Test Id: 228779		
Test Comment:	---			
Sample Description:	Moist, brown gravel with sand			
Sample Comment:	---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	67.5	29.1	3.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	88		
0.75 in	19.00	75		
0.5 in	12.50	57		
0.375 in	9.50	50		
#4	4.75	32		
#10	2.00	23		
#20	0.85	15		
#40	0.42	10		
#60	0.25	7		
#100	0.15	5		
#200	0.075	3		

Coefficients

D_{85} =23.5847 mm D_{30} =3.7696 mm
D_{60} =13.4804 mm D_{15} =0.8143 mm
D_{50} =9.3563 mm D_{10} =0.4456 mm
C_u =30.252 C_c =2.366

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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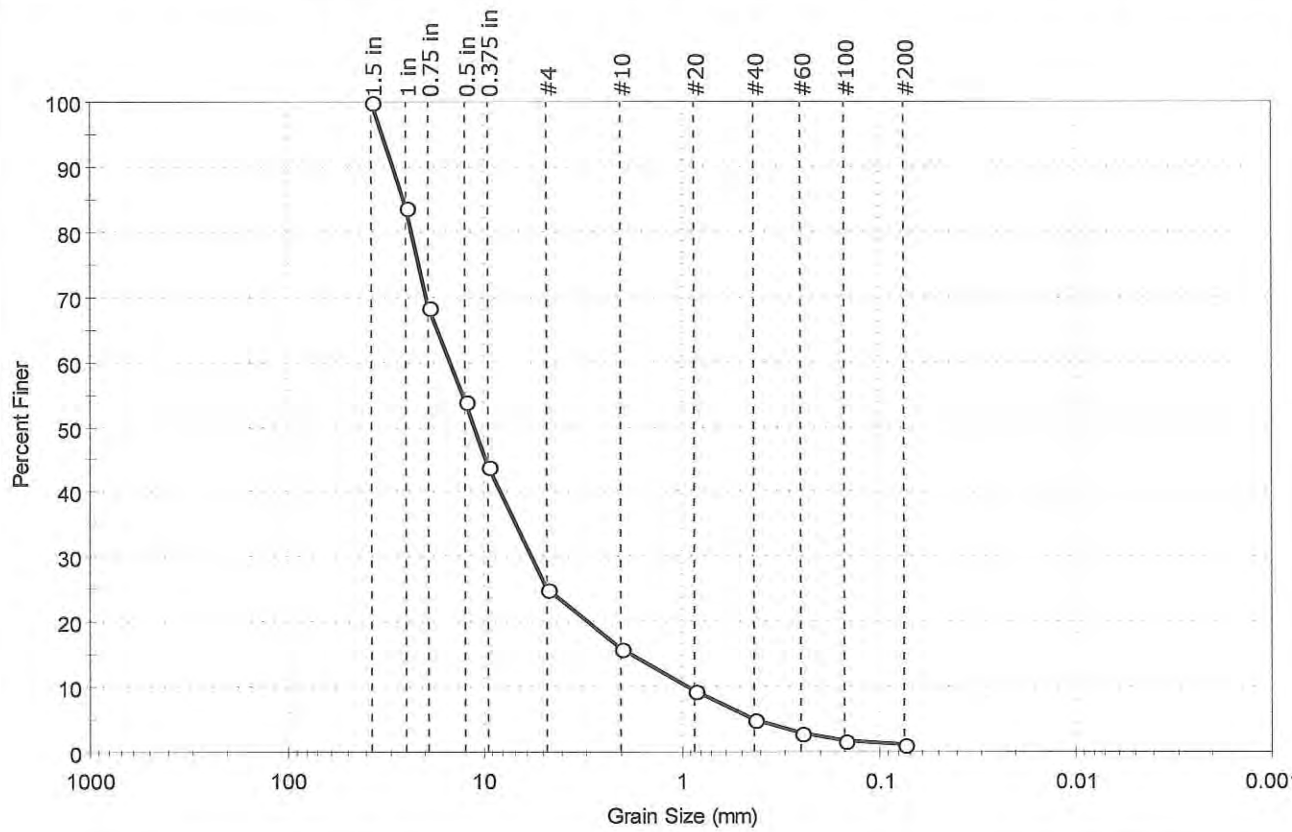
Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-339	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/02/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228780		
Test Comment: ---			
Sample Description: Moist, brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	74.9	23.9	1.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	84		
0.75 in	19.00	68		
0.5 in	12.50	54		
0.375 in	9.50	44		
#4	4.75	25		
#10	2.00	16		
#20	0.85	10		
#40	0.42	5		
#60	0.25	3		
#100	0.15	2		
#200	0.075	1		

Coefficients

D_{85} =25.8164 mm D_{30} =5.6830 mm

D_{60} =14.8878 mm D_{15} =1.7498 mm

D_{50} =11.2111 mm D_{10} =0.9005 mm

C_u =16.533 C_c =2.409

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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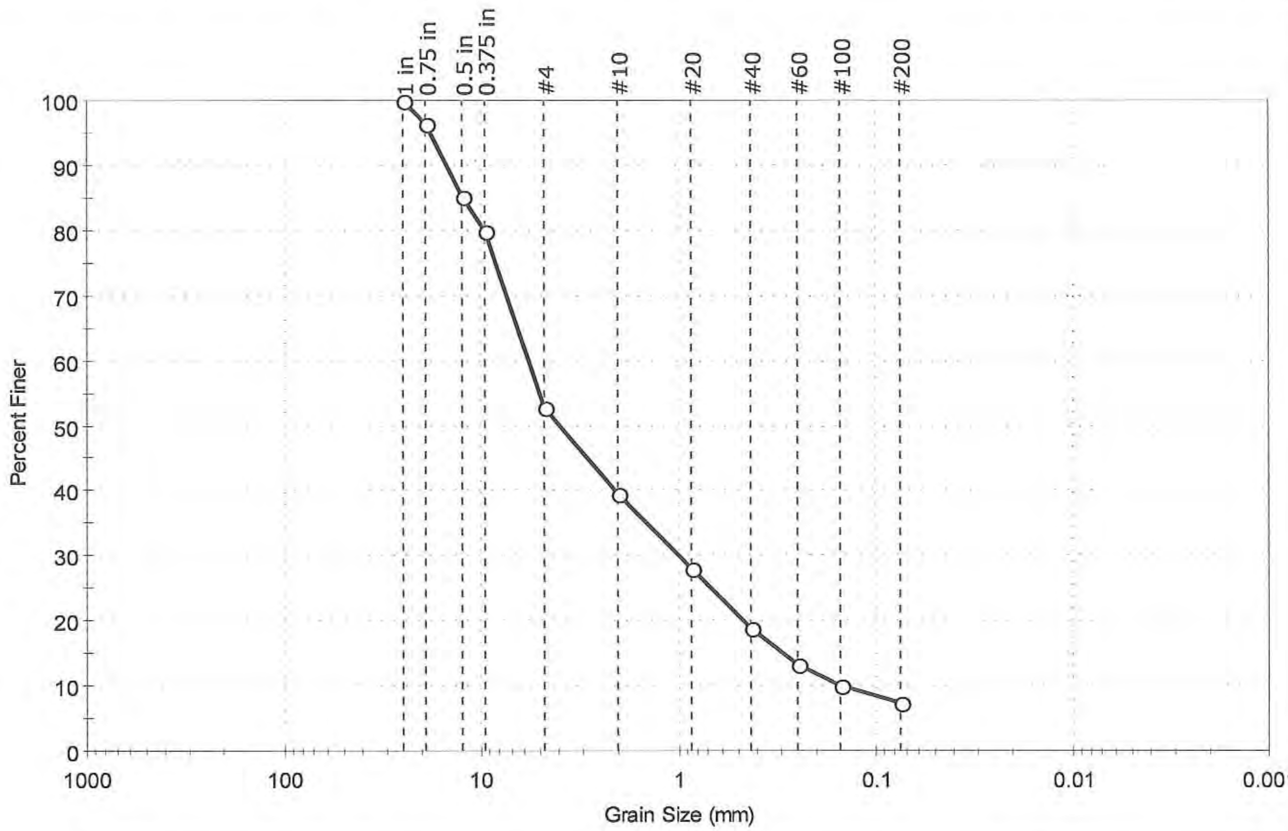
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-340	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-1 ft	Test Id: 228781		
Test Comment: ---			
Sample Description: Moist, dark yellowish brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	47.3	45.2	7.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	97		
0.5 in	12.50	85		
0.375 in	9.50	80		
#4	4.75	53		
#10	2.00	40		
#20	0.85	28		
#40	0.42	19		
#60	0.25	13		
#100	0.15	10		
#200	0.075	7		

Coefficients

D_{85} =12.2910 mm D_{30} =0.9827 mm

D_{60} =5.7249 mm D_{15} =0.2944 mm

D_{50} =3.9802 mm D_{10} =0.1490 mm

C_u =38.422 C_c =1.132

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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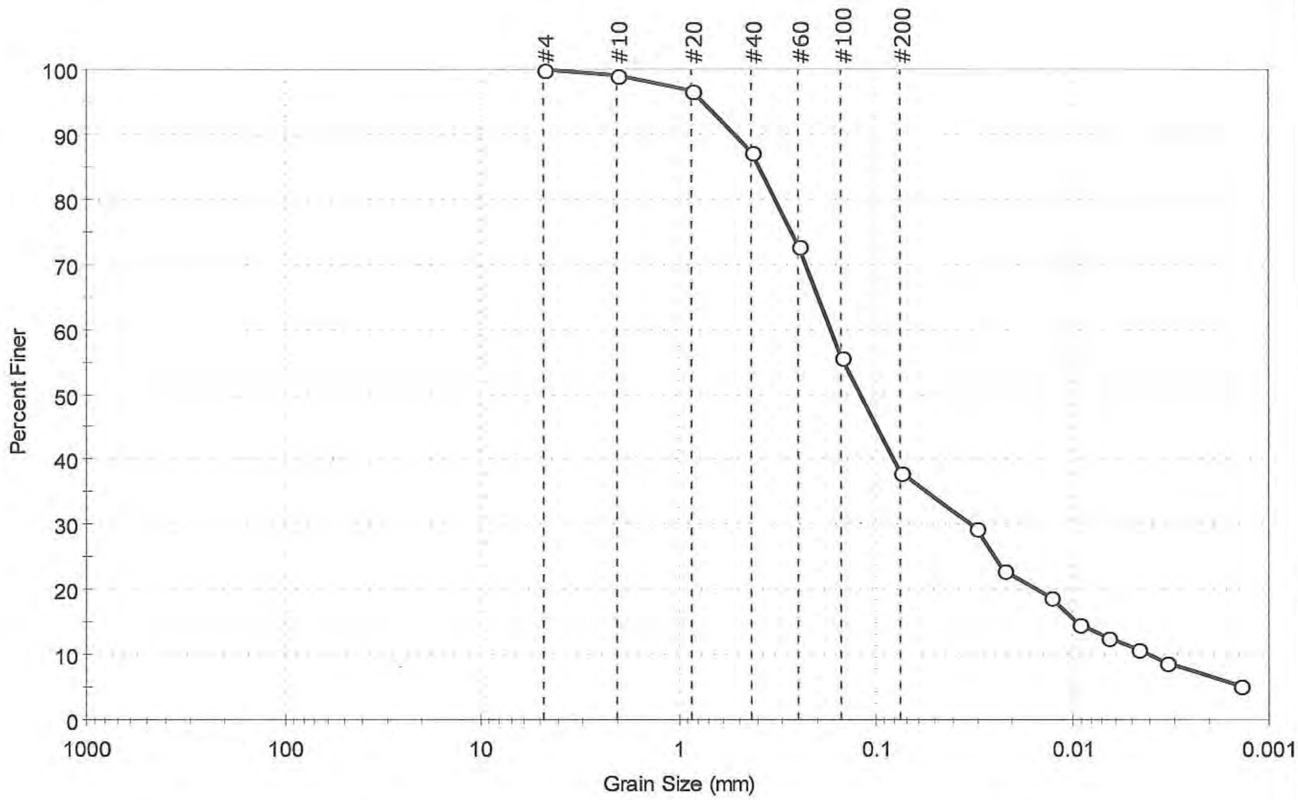
Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-340	Sample Type: jar	Tested By:	jbr
Sample ID: S-2	Test Date: 02/03/12	Checked By:	njh
Depth : 3-5 ft	Test Id: 228782		
Test Comment: ---			
Sample Description: Moist, brown silty sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	61.9	38.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	97		
#40	0.42	87		
#60	0.25	73		
#100	0.15	56		
#200	0.075	38		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0314	29		
---	0.0223	23		
---	0.0129	19		
---	0.0092	15		
---	0.0065	13		
---	0.0046	11		
---	0.0033	9		
---	0.0014	5		

Coefficients

D_{85} =0.3920 mm D_{30} =0.0335 mm
D_{60} =0.1705 mm D_{15} =0.0093 mm
D_{50} =0.1197 mm D_{10} =0.0039 mm
C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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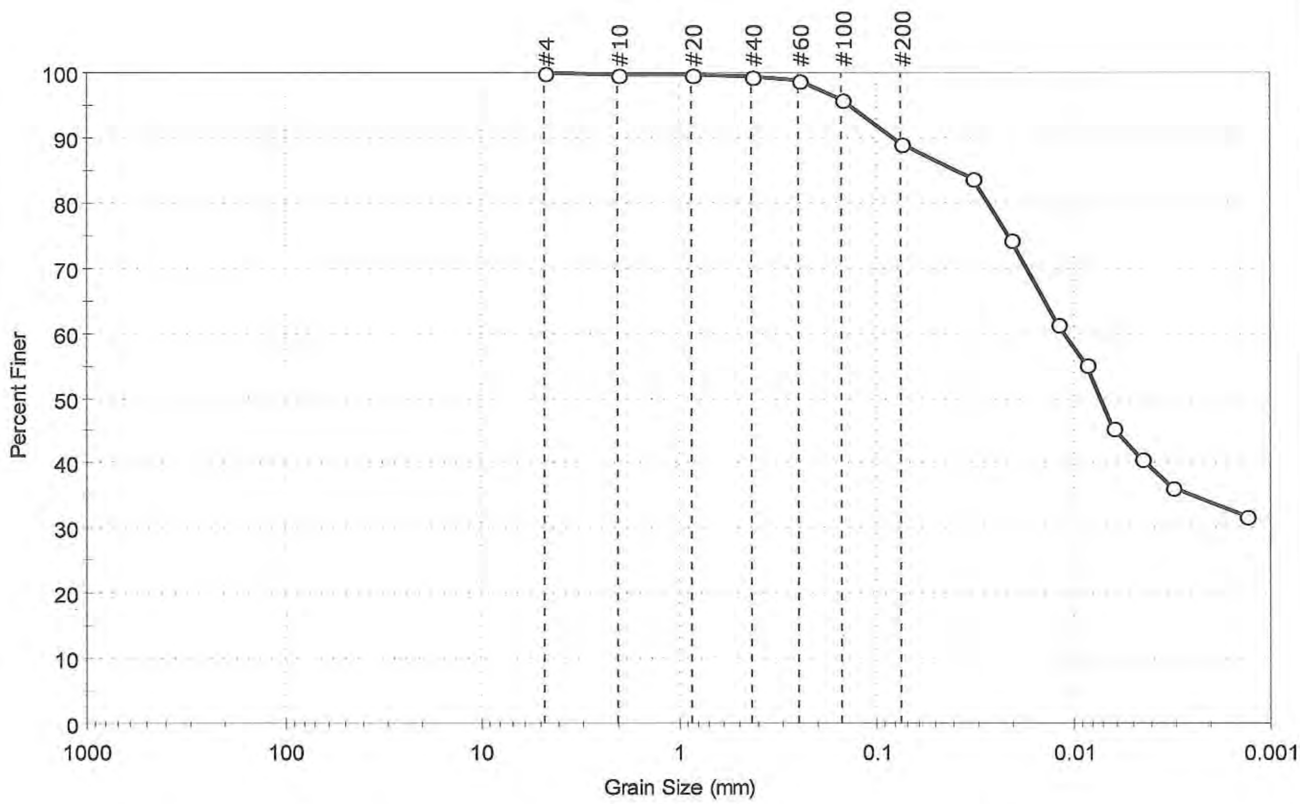
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-341	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/07/12	Checked By:	njh
Depth : 0-6 ft	Test Id: 228811		
Test Comment:	---		
Sample Description:	Wet, gray silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	10.9	89.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	99		
#100	0.15	96		
#200	0.075	89		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0326	84		
---	0.0205	74		
---	0.0118	61		
---	0.0087	55		
---	0.0062	45		
---	0.0045	41		
---	0.0032	36		
---	0.0013	32		

Coefficients

D_{85} =0.0392 mm	D_{30} =N/A
D_{60} =0.0110 mm	D_{15} =N/A
D_{50} =0.0073 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM elastic silt (MH)

AASHTO Clayey Soils (A-7-5 (37))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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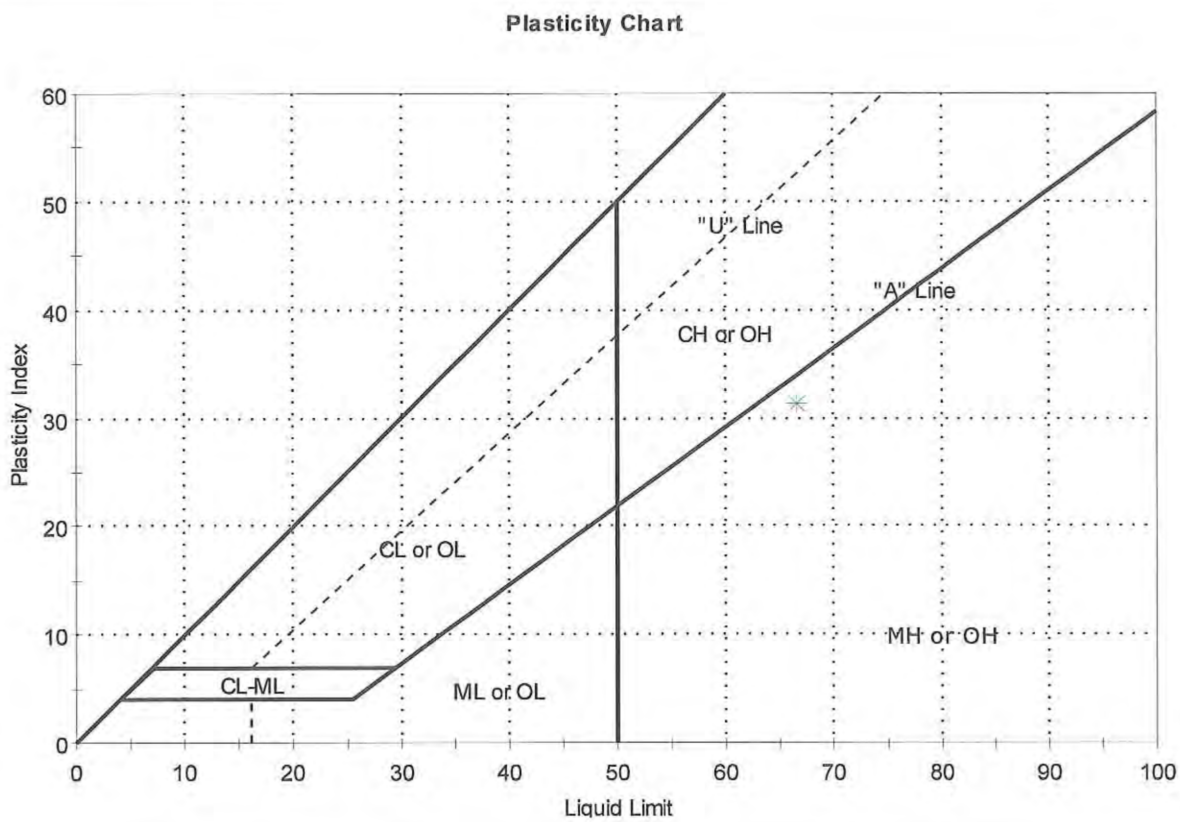
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-341	Sample Type: jar	Tested By:	cam
Sample ID:S-1	Test Date: 02/08/12	Checked By:	njh
Depth : 0-6 ft	Test Id: 228829		
Test Comment:	---		
Sample Description:	Wet, gray silt		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	CB-341	0-6 ft	93	67	35	32	2	elastic silt (MH)

Sample Prepared using the WET method

1% Retained on #40 Sieve

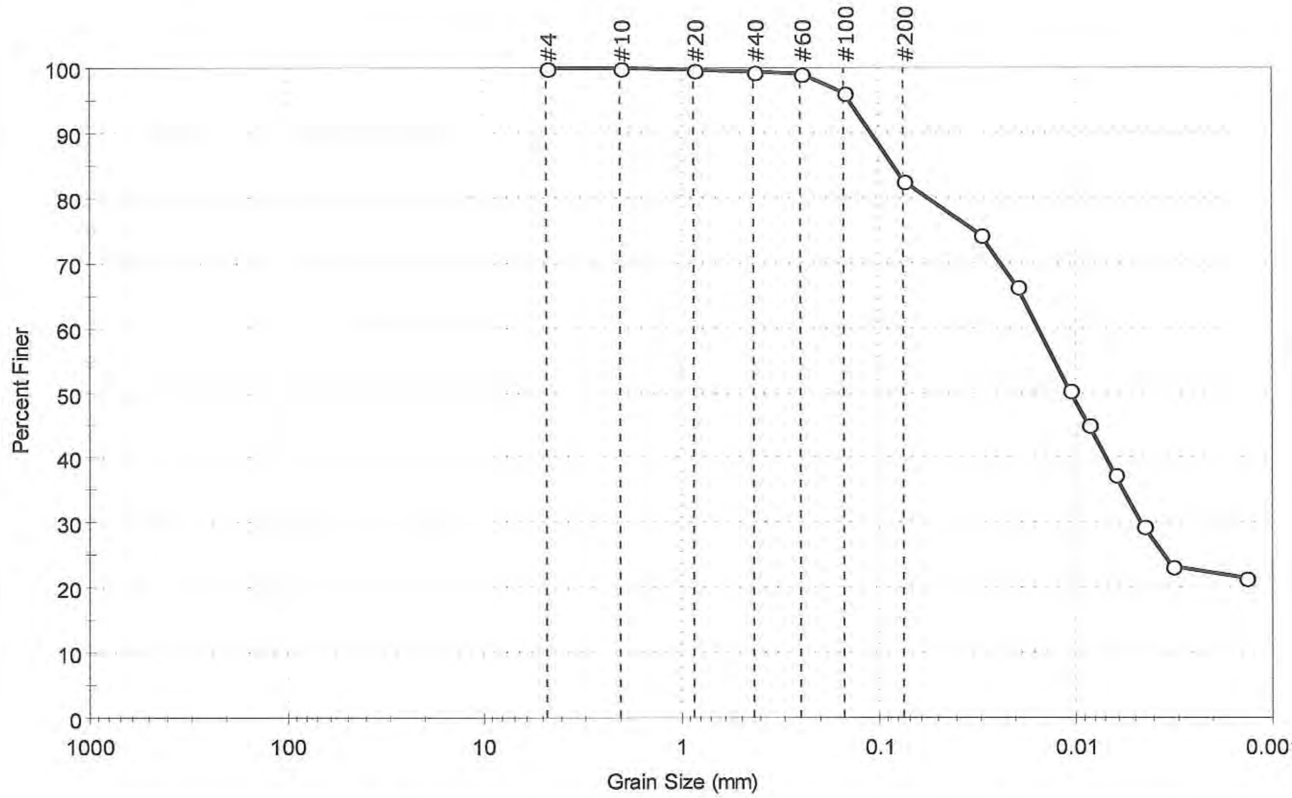
Dry Strength: VERY HIGH

Dilentancy: SLOW

Toughness: LOW

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-342	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/08/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228813		
Test Comment:	---		
Sample Description:	Moist, gray clay with sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	17.4	82.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	96		
#200	0.075	83		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0305	74		
---	0.0195	66		
---	0.0106	51		
---	0.0085	45		
---	0.0063	37		
---	0.0045	30		
---	0.0032	23		
---	0.0013	21		

Coefficients

D_{85} =0.0849 mm | D_{30} =0.0046 mm
D_{60} =0.0152 mm | D_{15} =N/A
D_{50} =0.0104 mm | D_{10} =N/A
C_u =N/A | C_c =N/A

Classification

ASTM fat clay with sand (CH)

AASHTO Clayey Soils (A-7-6 (44))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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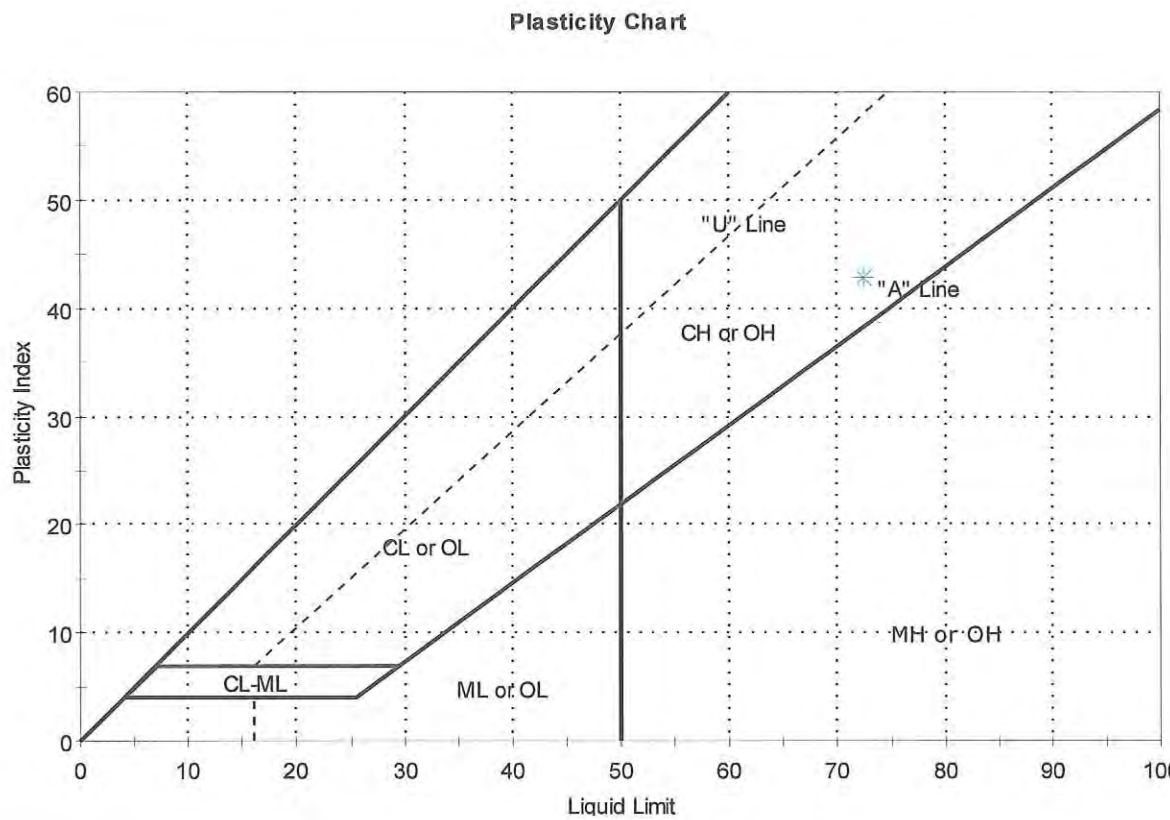
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-342	Sample Type: jar	Tested By:	cam
Sample ID:S-1	Test Date: 02/07/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228831		
Test Comment:	---		
Sample Description:	Moist, gray clay with sand		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	CB-342	0-2 ft	57	72	29	43	1	fat clay with sand (CH)

Sample Prepared using the WET method

0% Retained on #40 Sieve

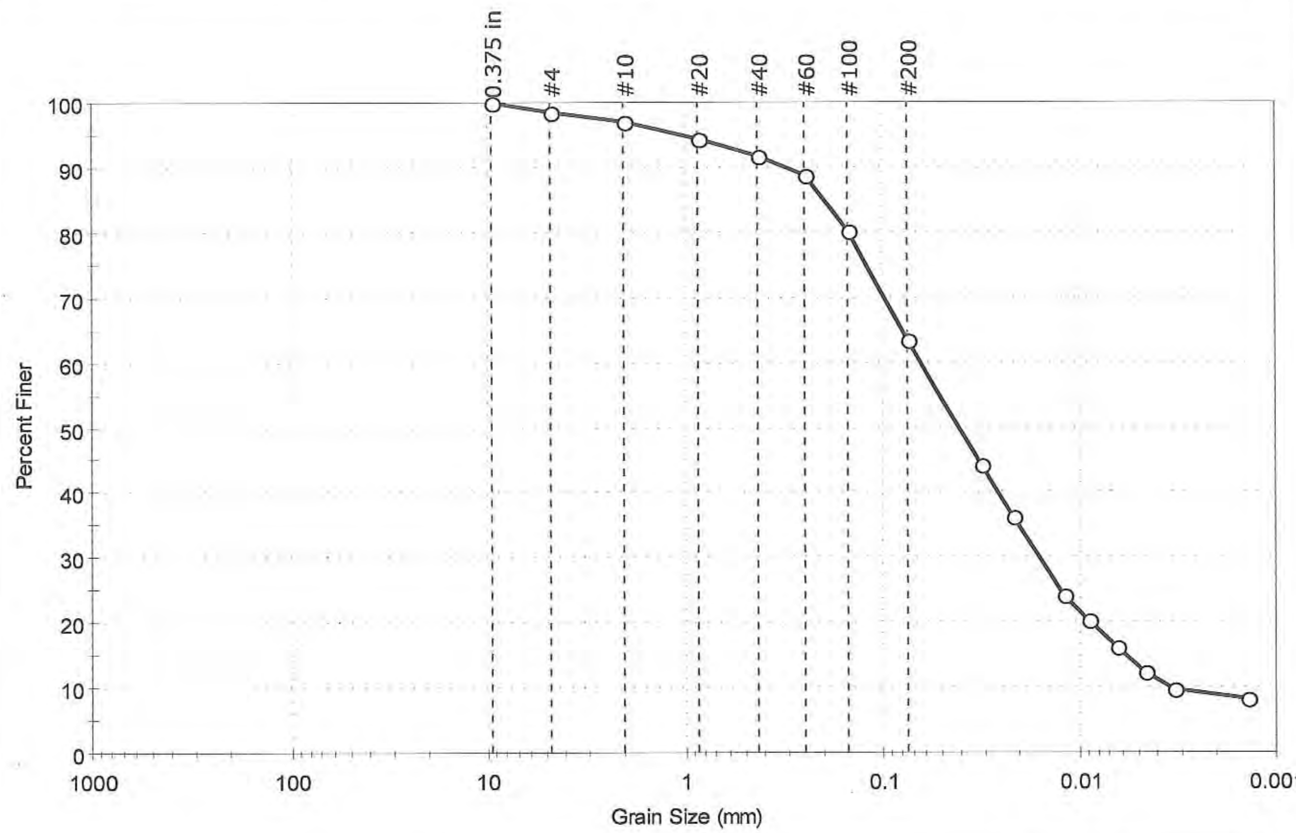
Dry Strength: VERY HIGH

Dilentancy: SLOW

Toughness: LOW

Client:	Gahagan & Bryant Associates
Project:	Delaware River Channel Deepening Reach B
Location:	---
Project No:	GTX-11510
Boring ID:	CB-342
Sample ID:	S-2
Depth :	4-6 ft
Sample Type:	jar
Test Date:	02/08/12
Test Id:	228812
Tested By:	jbr
Checked By:	njh
Test Comment:	---
Sample Description:	Moist, brown sandy clay
Sample Comment:	---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.4	35.1	63.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	97		
#20	0.85	94		
#40	0.42	92		
#60	0.25	89		
#100	0.15	80		
#200	0.075	64		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0318	44		
---	0.0215	36		
---	0.0118	24		
---	0.0091	20		
---	0.0064	16		
---	0.0046	12		
---	0.0033	10		
---	0.0014	8		

Coefficients

D_{85} =0.2001 mm | D_{30} =0.0158 mm
D_{60} =0.0640 mm | D_{15} =0.0058 mm
D_{50} =0.0411 mm | D_{10} =0.0034 mm
C_u =N/A | C_c =N/A

Classification

ASTM Sandy lean clay (CL)

AASHTO Silty Soils (A-4 (2))

Sample/Test Description

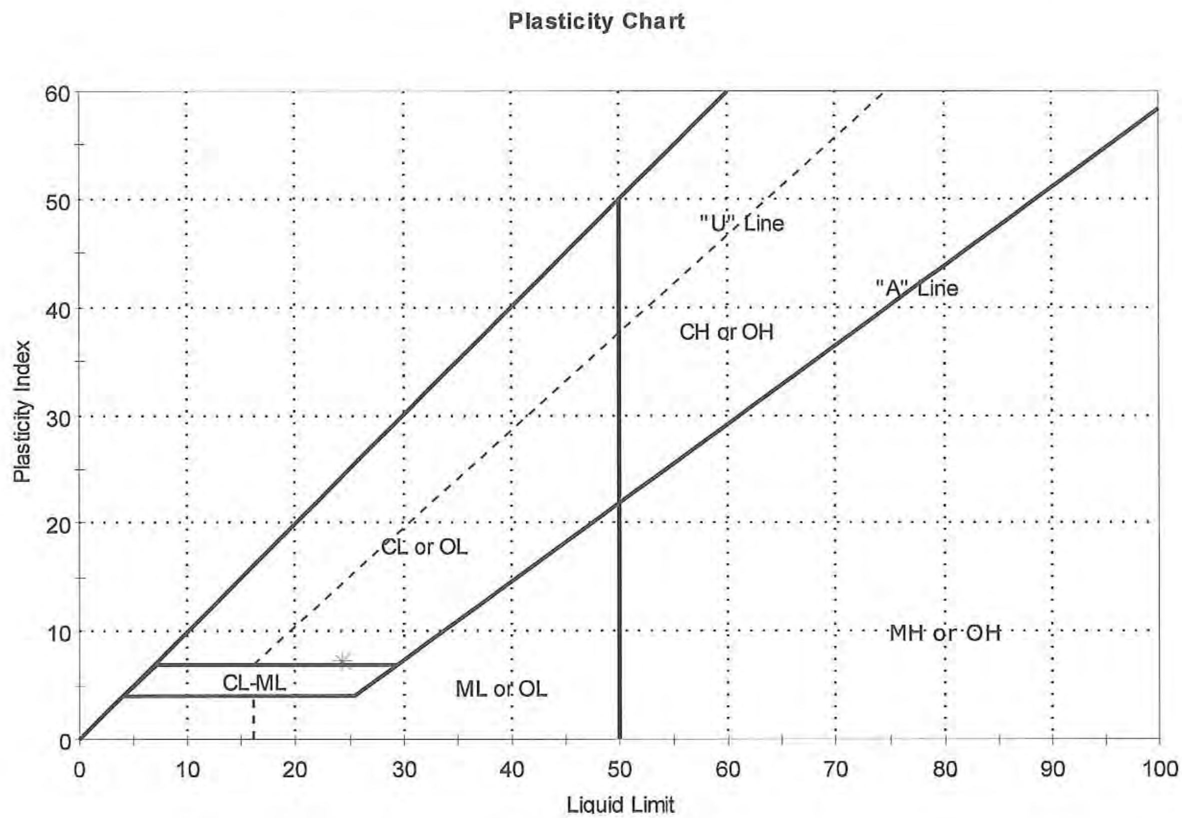
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-342	Sample Type: jar	Tested By:	cam
Sample ID:S-2	Test Date: 02/07/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228830		
Test Comment:	---		
Sample Description:	Moist, brown sandy clay		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	CB-342	4-6 ft	22	24	17	7	1	Sandy lean clay (CL)

Sample Prepared using the WET method

8% Retained on #40 Sieve

Dry Strength: HIGH

Dilentancy: SLOW

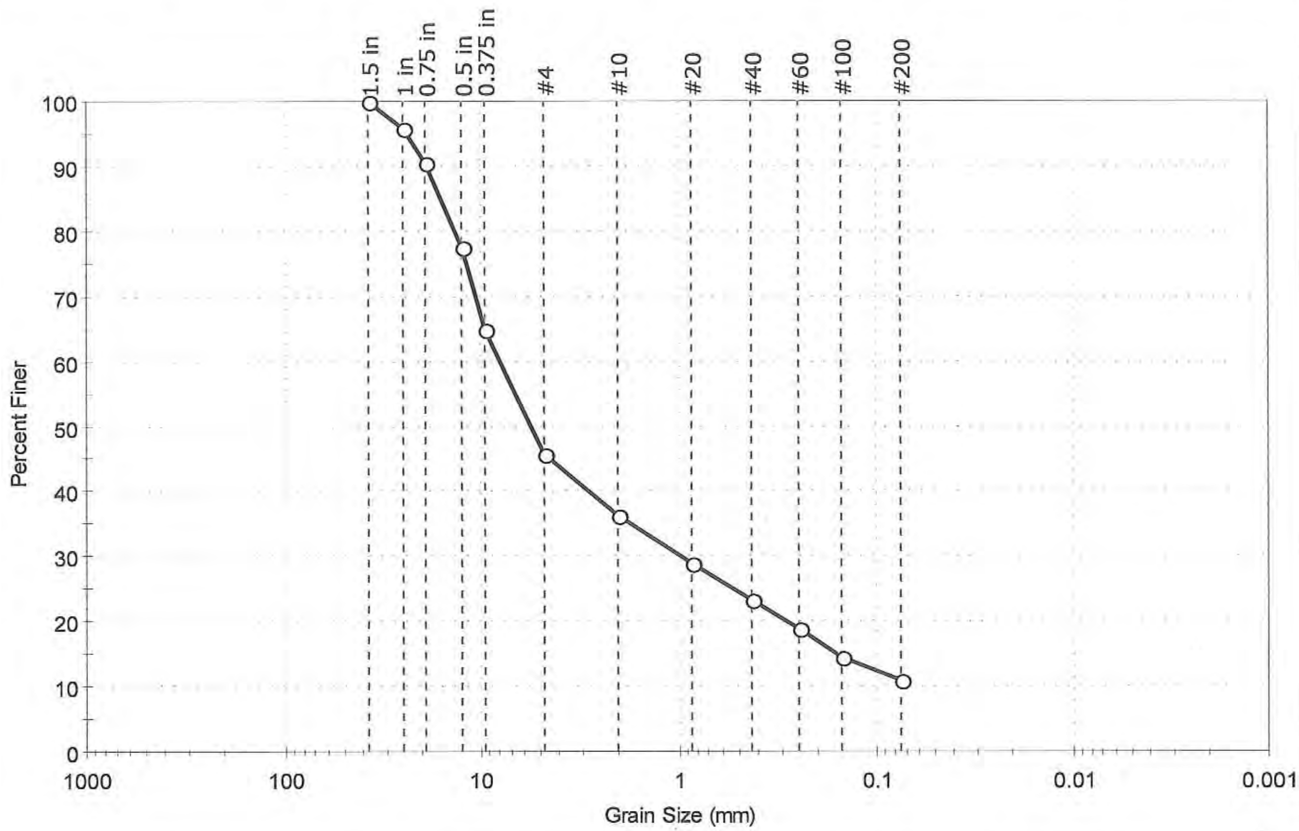
Toughness: LOW

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-344	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/03/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228783		

Test Comment: ---
Sample Description: Moist, gray gravel with silt and sand
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	54.4	34.6	11.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	96		
0.75 in	19.00	91		
0.5 in	12.50	78		
0.375 in	9.50	65		
#4	4.75	46		
#10	2.00	36		
#20	0.85	29		
#40	0.42	23		
#60	0.25	19		
#100	0.15	14		
#200	0.075	11		

Coefficients

D_{85} =15.8689 mm D_{30} =0.9535 mm
D_{60} =7.9378 mm D_{15} =0.1614 mm
D_{50} =5.5575 mm D_{10} =0.0604 mm
C_u =131.421 C_c =1.896

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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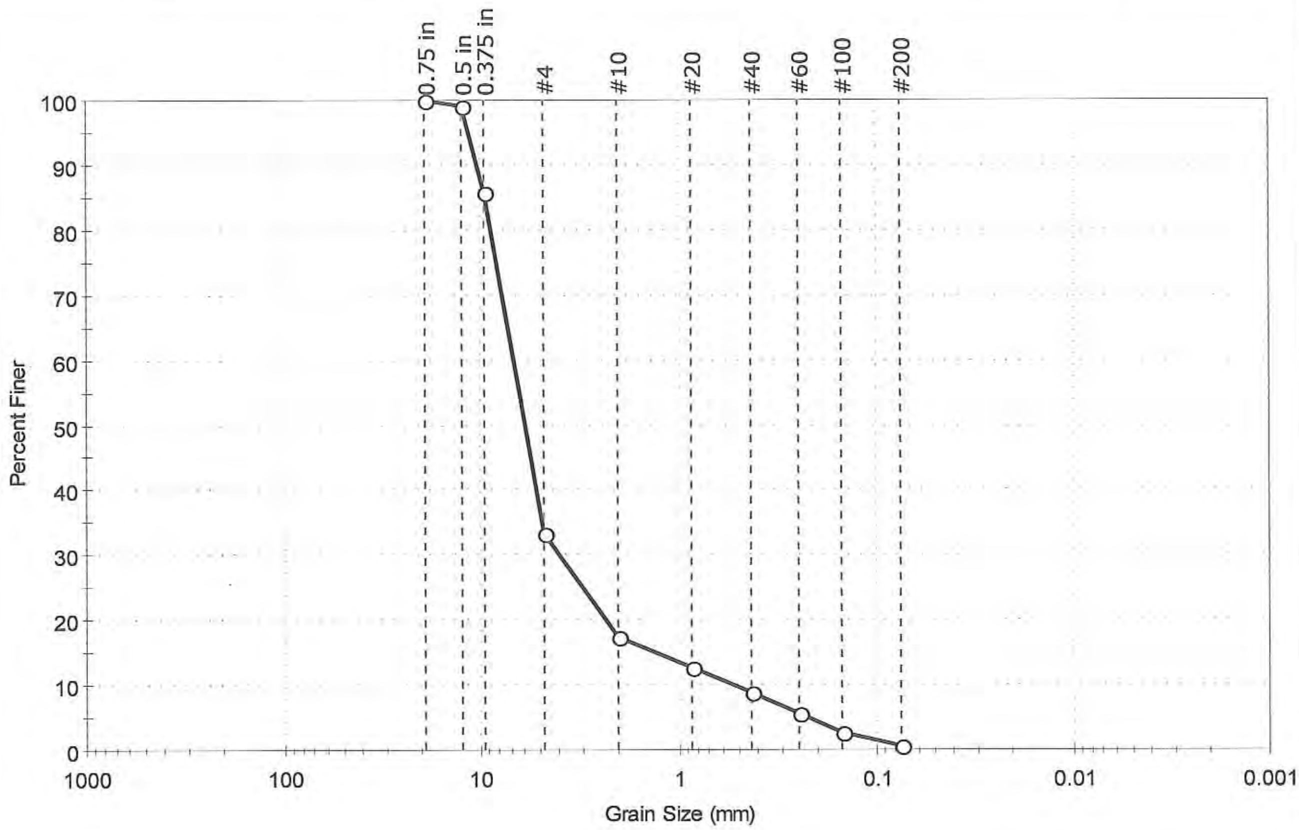
Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-344	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/09/12	Checked By:	njh
Depth : 3-4 ft	Test Id: 228784		
Test Comment: ---			
Sample Description: Moist, dark grayish brown gravel with sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	66.6	32.9	0.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	99		
0.375 in	9.50	86		
#4	4.75	33		
#10	2.00	17		
#20	0.85	13		
#40	0.42	9		
#60	0.25	6		
#100	0.15	3		
#200	0.075	1		

Coefficients

D_{85} =9.4120 mm | D_{30} =3.9526 mm
D_{60} =6.7569 mm | D_{15} =1.2946 mm
D_{50} =5.9179 mm | D_{10} =0.5258 mm
C_u =12.851 | C_c =4.397

Classification

ASTM Poorly graded gravel with sand (GP)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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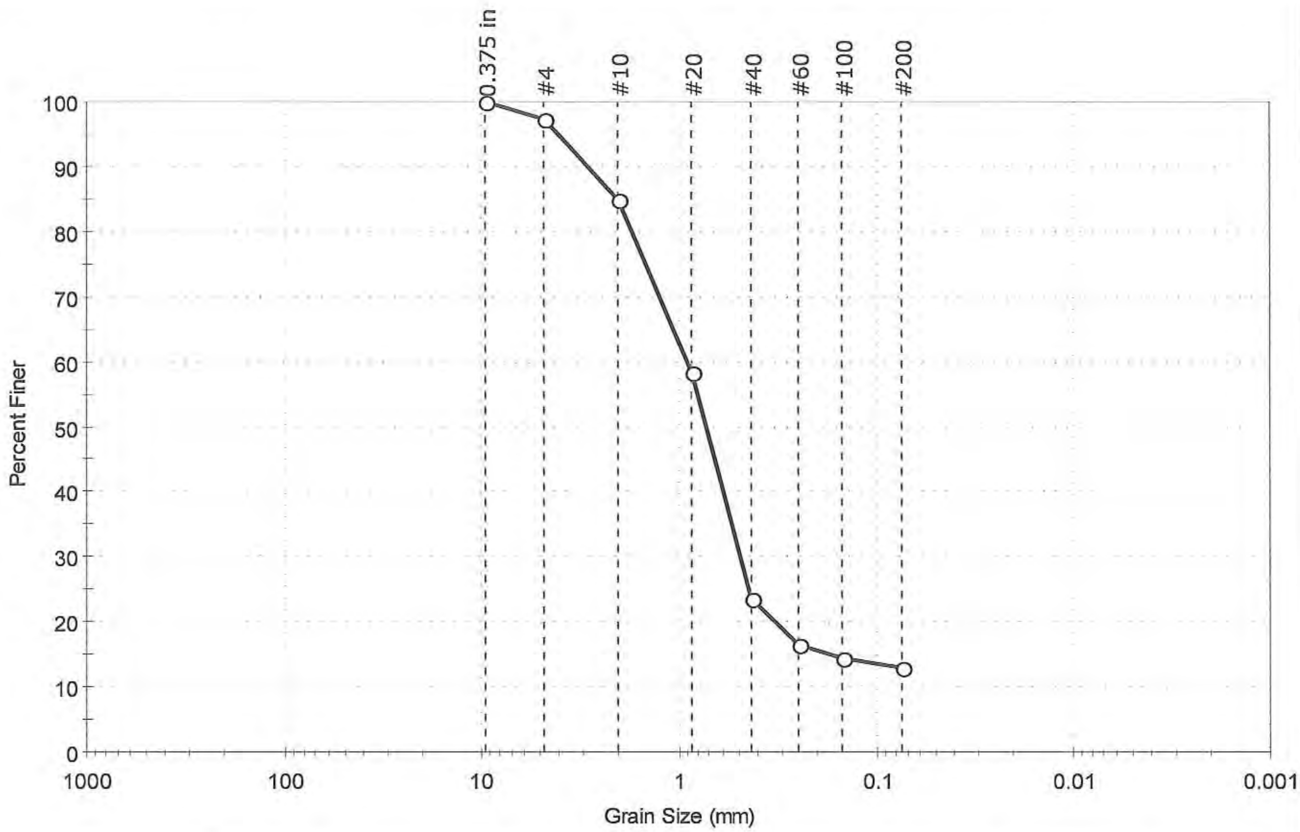
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-345	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/02/12	Checked By:	njh
Depth : 3-4 ft	Test Id: 228785		
Test Comment:	---		
Sample Description:	Moist, brown silty sand		
Sample Comment:	Sample contains broken glass		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.7	84.2	13.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	85		
#20	0.85	58		
#40	0.42	23		
#60	0.25	16		
#100	0.15	14		
#200	0.075	13		

Coefficients

D_{85} =2.0165 mm D_{30} =0.4836 mm
D_{60} =0.8940 mm D_{15} =0.1769 mm
D_{50} =0.7190 mm D_{10} =0.0138 mm
C_u =N/A C_c =N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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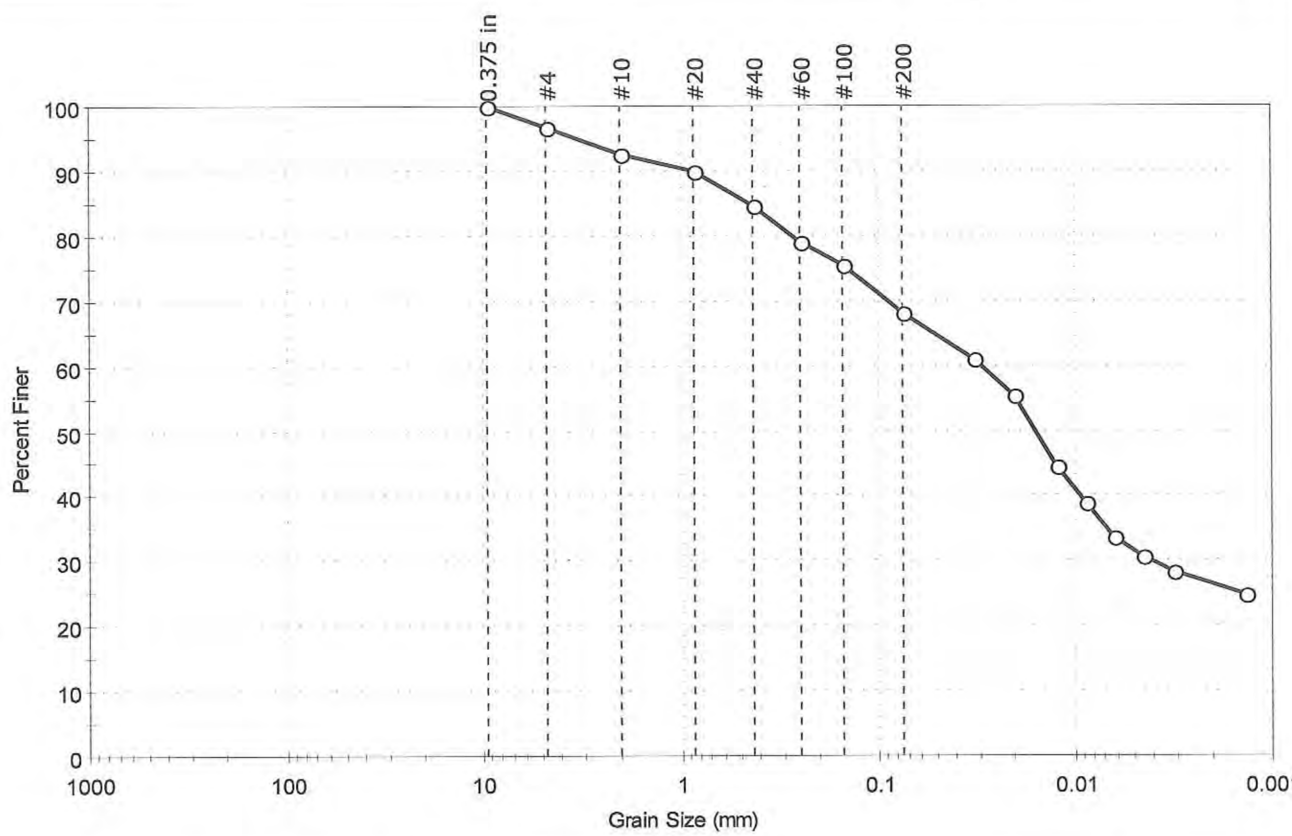
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-346	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/02/12	Checked By:	njh
Depth : 1-4 ft	Test Id: 228814		
Test Comment:	---		
Sample Description:	Moist, dark gray sandy clay		
Sample Comment:	---		

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.2	28.7	68.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	93		
#20	0.85	90		
#40	0.42	85		
#60	0.25	79		
#100	0.15	75		
#200	0.075	68		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0328	61		
---	0.0202	55		
---	0.0123	44		
---	0.0088	39		
---	0.0063	33		
---	0.0045	31		
---	0.0032	28		
---	0.0013	25		

Coefficients

D_{85} =0.4485 mm D_{30} =0.0040 mm
D_{60} =0.0302 mm D_{15} =N/A
D_{50} =0.0158 mm D_{10} =N/A
C_u =N/A C_c =N/A

Classification

ASTM Sandy fat clay (CH)

AASHTO Clayey Soils (A-7-6 (35))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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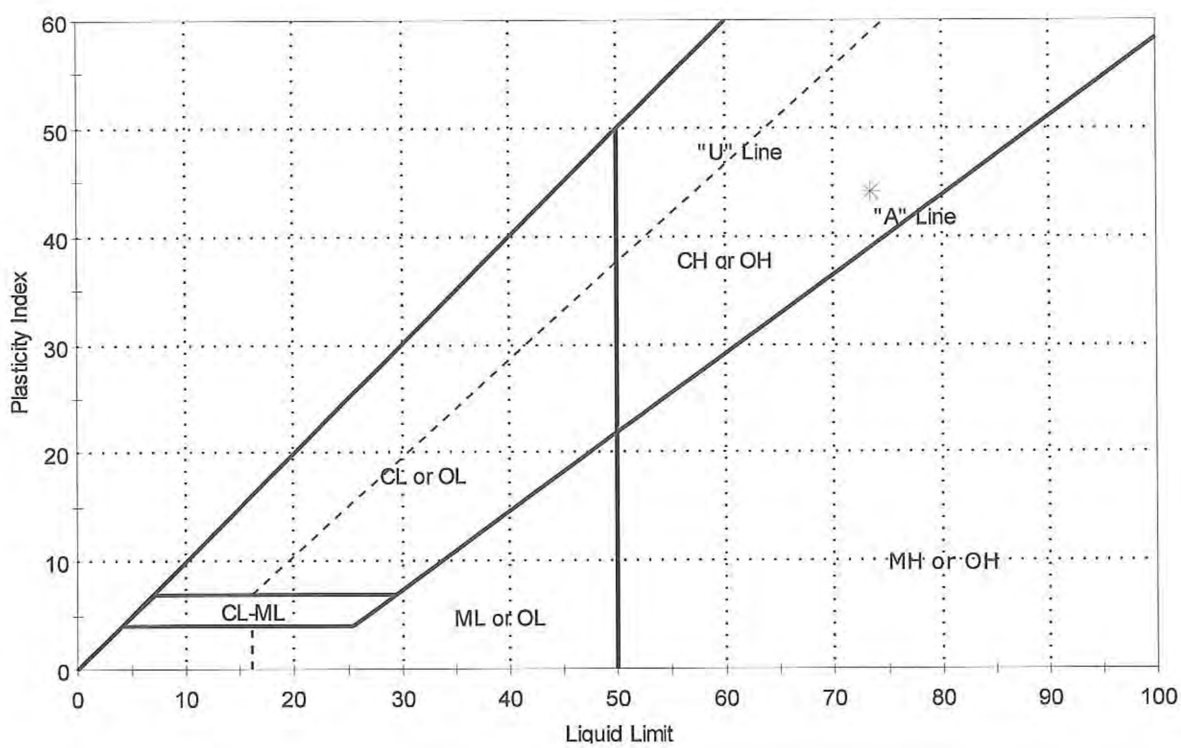
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates
Project:	Delaware River Channel Deepening Reach B
Location:	---
Project No:	GTX-11510
Boring ID:	CB-346
Sample Type:	jar
Tested By:	cam
Sample ID:	S-1
Test Date:	02/07/12
Checked By:	njh
Depth :	1-4 ft
Test Id:	228832
Test Comment:	---
Sample Description:	Moist, dark gray sandy clay
Sample Comment:	---

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	CB-346	1-4 ft	62	73	29	44	1	Sandy fat clay (CH)

Sample Prepared using the WET method

15% Retained on #40 Sieve

Dry Strength: VERY HIGH

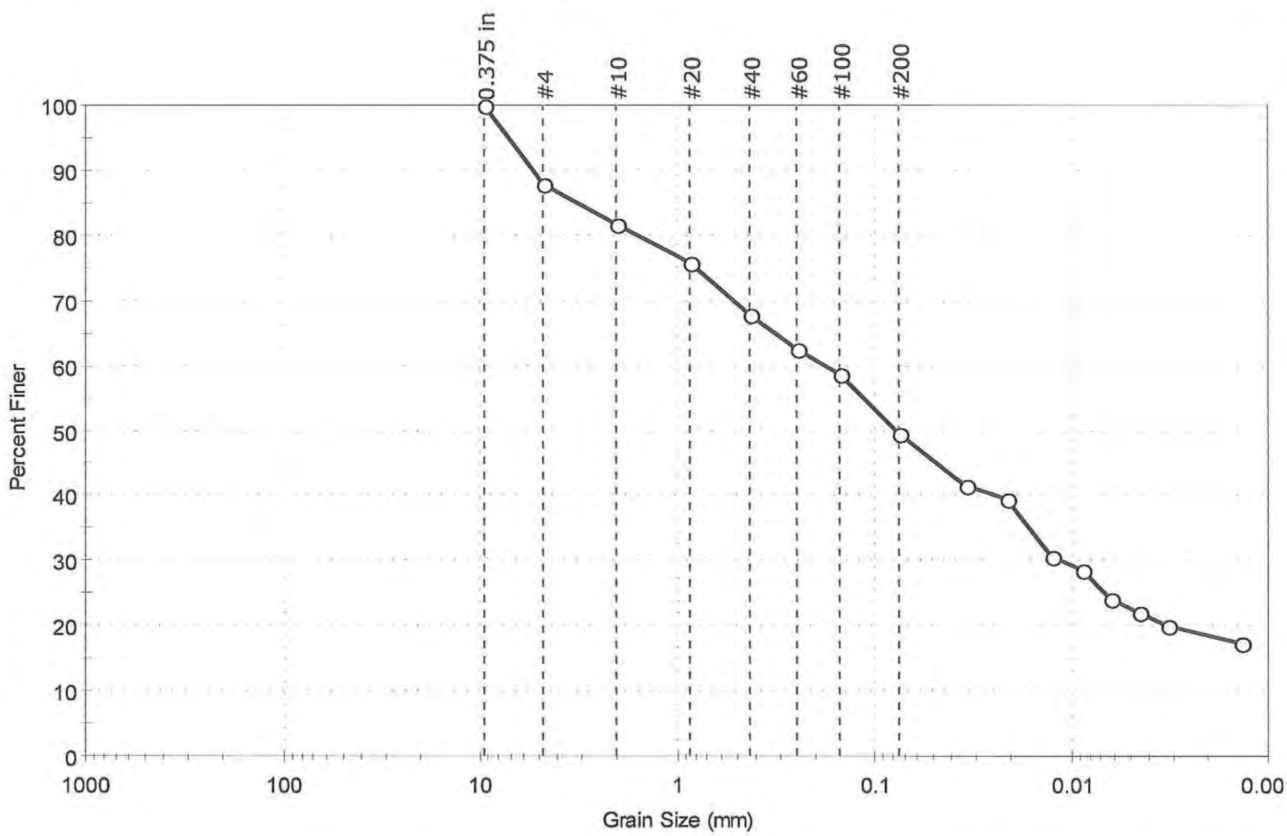
Dilentancy: SLOW

Toughness: LOW

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-346	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/02/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228815		
Test Comment: ---			
Sample Description: Moist, dark greenish gray clayey sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	12.2	38.3	49.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	88		
#10	2.00	82		
#20	0.85	76		
#40	0.42	68		
#60	0.25	63		
#100	0.15	59		
#200	0.075	50		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0342	42		
---	0.0213	39		
---	0.0125	31		
---	0.0088	29		
---	0.0063	24		
---	0.0045	22		
---	0.0032	20		
---	0.0014	17		

Coefficients

D_{85} =3.1917 mm	D_{30} =0.0110 mm
D_{60} =0.1775 mm	D_{15} =N/A
D_{50} =0.0776 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM Clayey sand (SC)

AASHTO Clayey Soils (A-7-6 (21))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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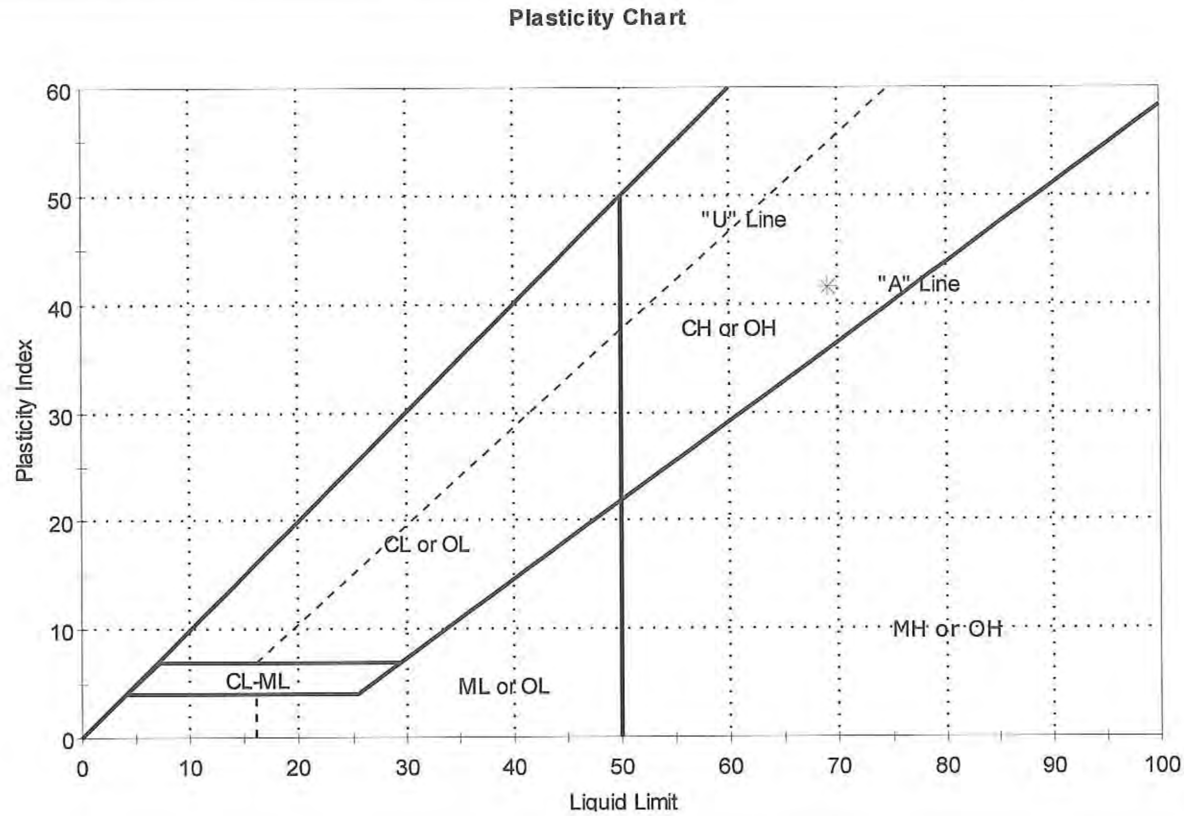
GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-346	Sample Type: jar	Tested By:	cam
Sample ID:S-2	Test Date: 02/06/12	Checked By:	njh
Depth : 4-6 ft	Test Id: 228833		
Test Comment:	---		
Sample Description:	Moist, dark greenish gray clayey sand		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	CB-346	4-6 ft	46	69	27	42	0	Clayey sand (SC)

Sample Prepared using the WET method

32% Retained on #40 Sieve

Dry Strength: VERY HIGH

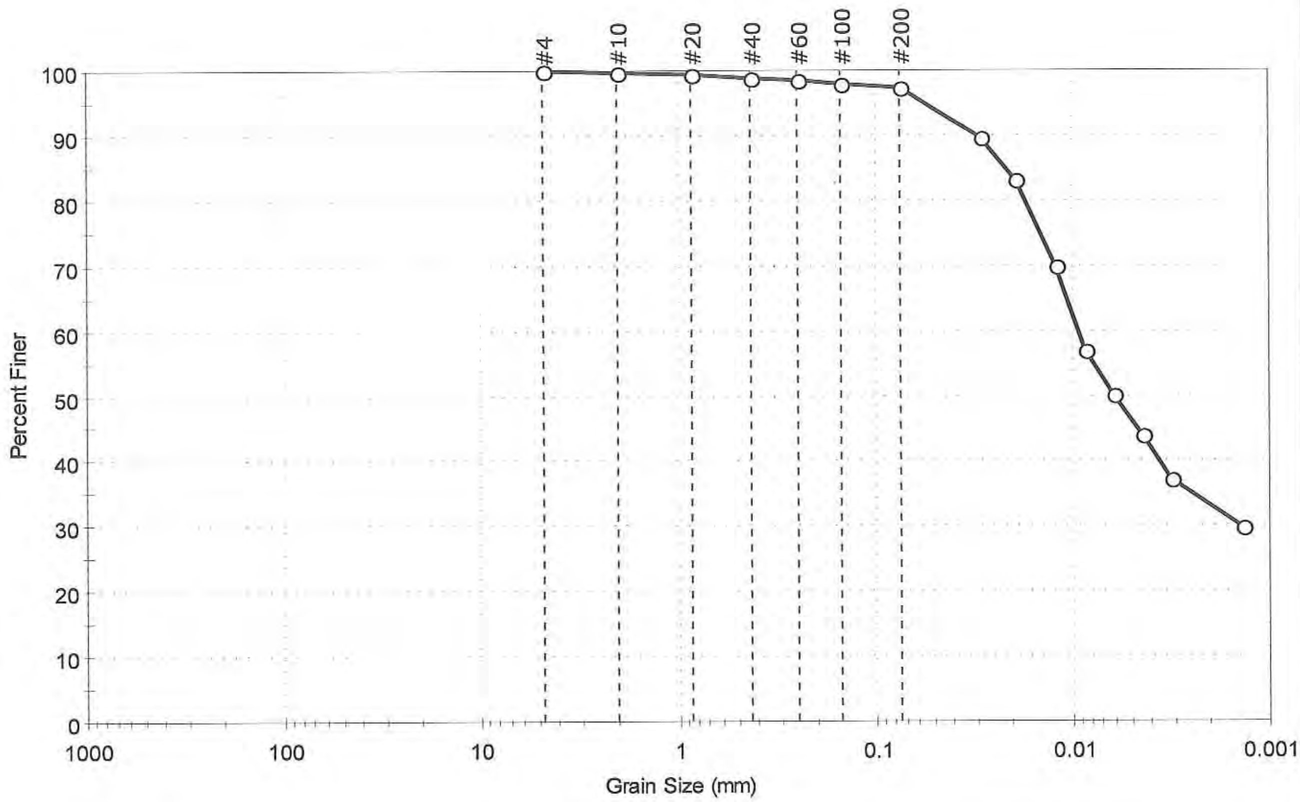
Dilentancy: SLOW

Toughness: LOW

GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-347	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/07/12	Checked By:	njh
Depth : 0-3 ft	Test Id: 228816		
Test Comment: ---			
Sample Description: Wet, dark gray clay			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	2.8	97.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	98		
#100	0.15	98		
#200	0.075	97		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0290	90		
---	0.0193	83		
---	0.0119	70		
---	0.0086	57		
---	0.0062	50		
---	0.0044	44		
---	0.0032	37		
---	0.0014	30		

Coefficients

D_{85} =0.0215 mm D_{30} =0.0014 mm
D_{60} =0.0093 mm D_{15} =N/A
D_{50} =0.0061 mm D_{10} =N/A
C_u =N/A C_c =N/A

Classification

ASTM fat clay (CH)

AASHTO Clayey Soils (A-7-5 (67))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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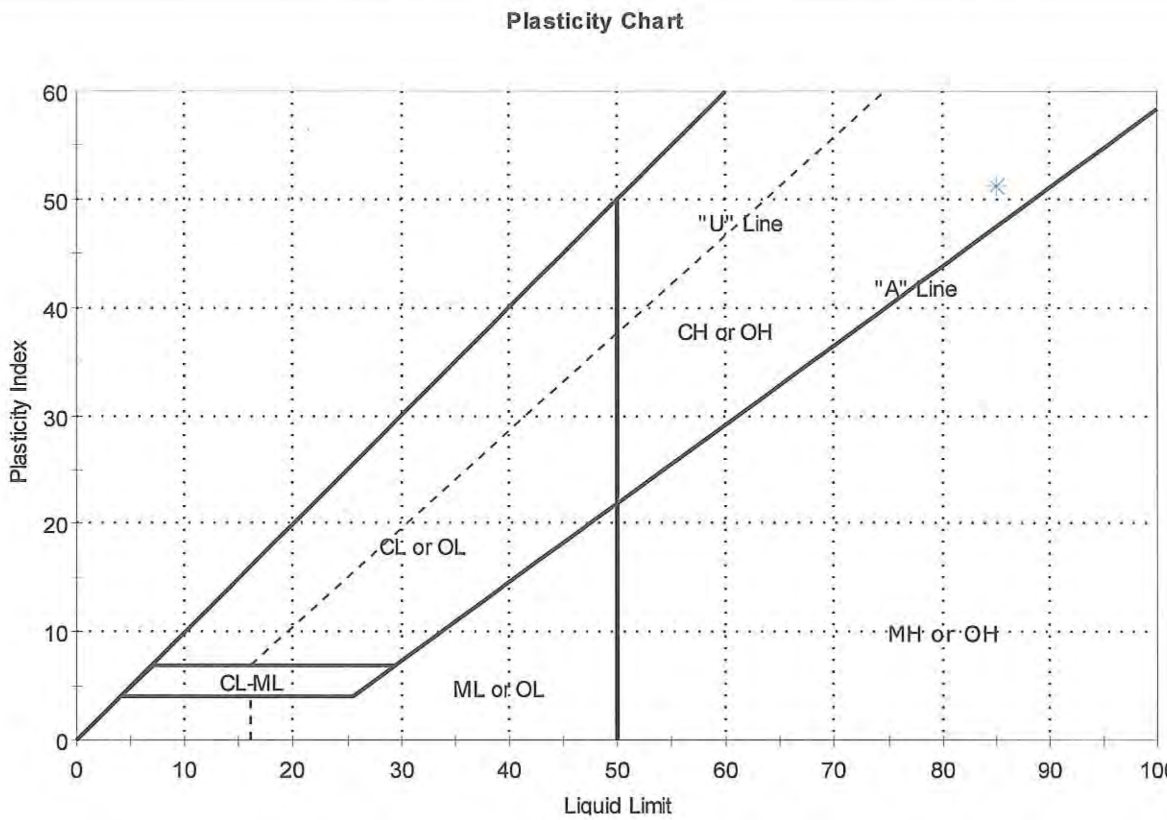
Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-347	Sample Type: jar	Tested By:	cam
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-3 ft	Test Id: 228834		
Test Comment:	---		
Sample Description:	Wet, dark gray clay		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	CB-347	0-3 ft	89	85	34	51	1	fat clay (CH)

Sample Prepared using the WET method

1% Retained on #40 Sieve

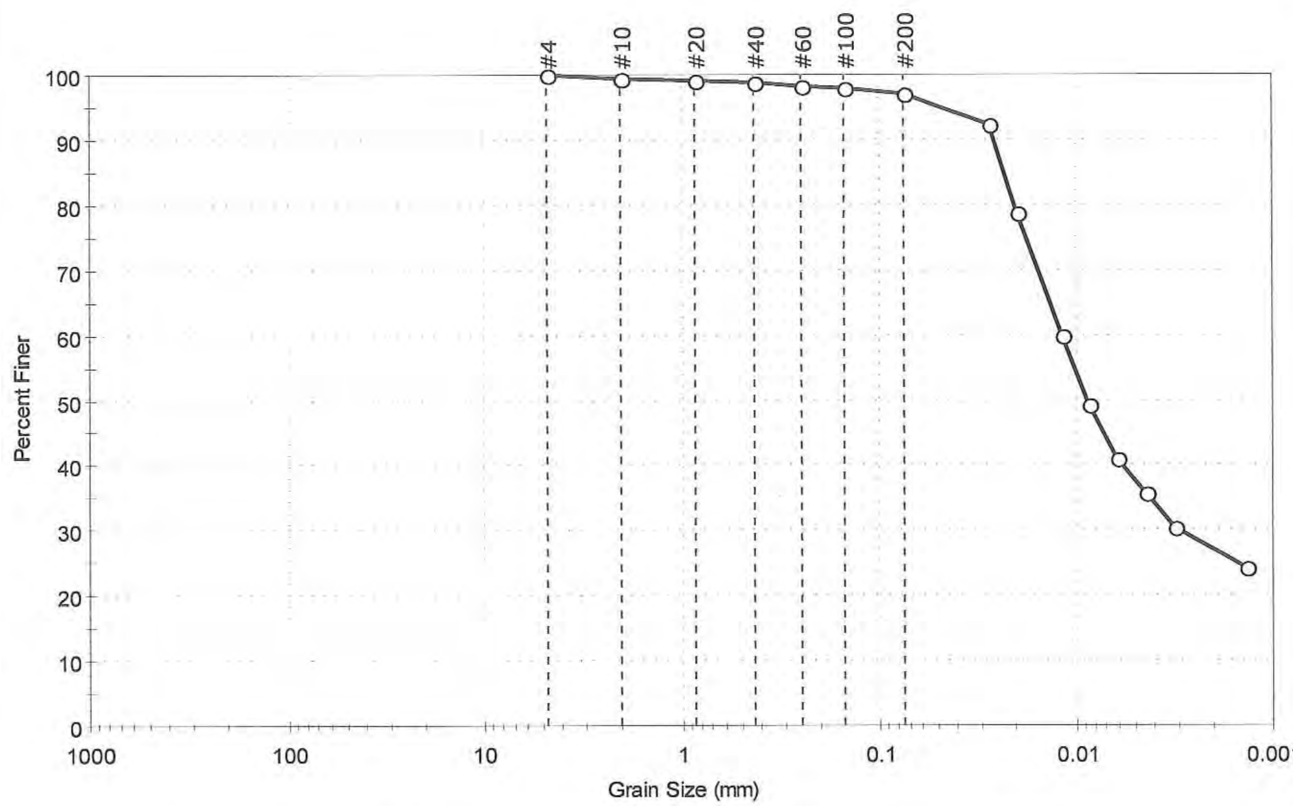
Dry Strength: VERY HIGH

Dilentancy: SLOW

Toughness: LOW

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-347	Sample Type: jar	Tested By:	jbr
Sample ID: S-3	Test Date: 02/06/12	Checked By:	njh
Depth : 6-8 ft	Test Id: 228817		
Test Comment: ---			
Sample Description: Wet, gray clay			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	3.1	96.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	99		
#40	0.42	99		
#60	0.25	98		
#100	0.15	98		
#200	0.075	97		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0279	92		
---	0.0198	79		
---	0.0117	60		
---	0.0085	49		
---	0.0062	41		
---	0.0044	36		
---	0.0031	31		
---	0.0014	24		

Coefficients

D_{85} =0.0231 mm D_{30} =0.0029 mm

D_{60} =0.0117 mm D_{15} =N/A

D_{50} =0.0087 mm D_{10} =N/A

C_u =N/A C_c =N/A

Classification

ASTM fat clay (CH)

AASHTO Clayey Soils (A-7-5 (60))

Sample/Test Description

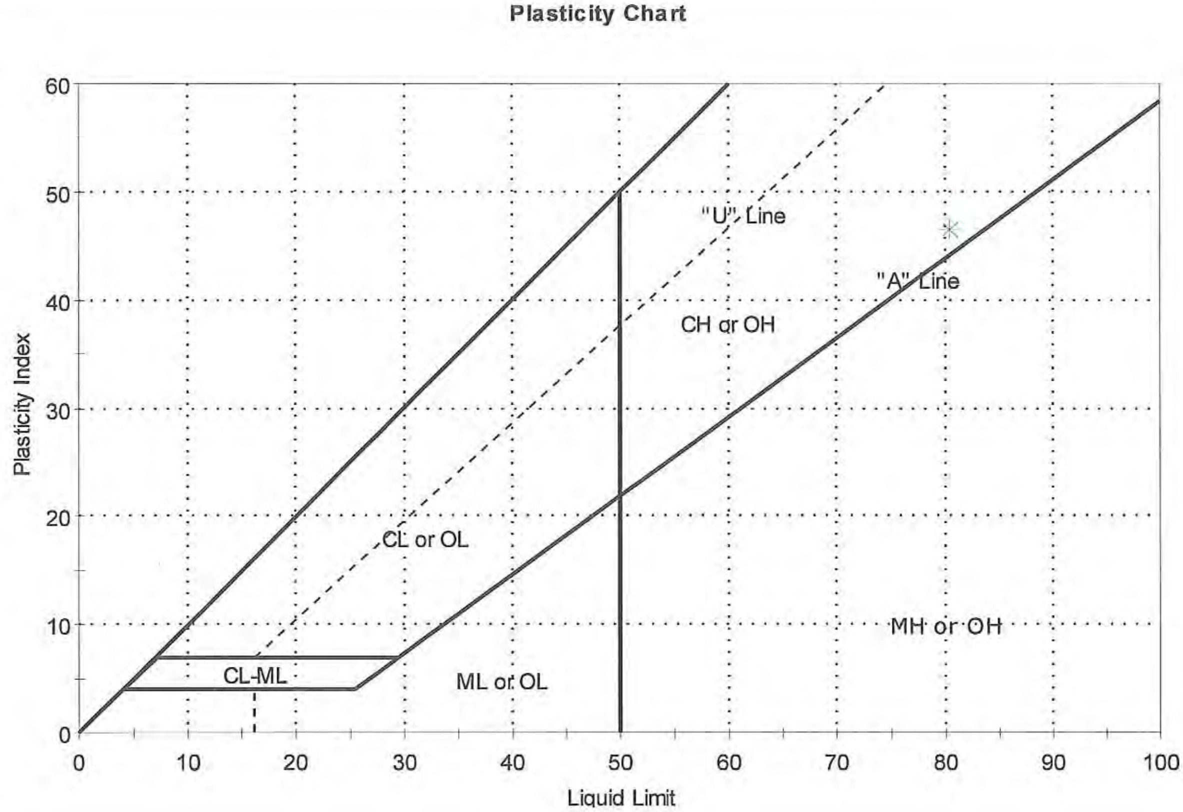
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates		
Project:	Delaware River Channel Deepening Reach B		
Location:	---	Project No:	GTX-11510
Boring ID: CB-347	Sample Type: jar	Tested By:	cam
Sample ID:S-3	Test Date: 02/07/12	Checked By:	njh
Depth : 6-8 ft	Test Id: 228835		
Test Comment:	---		
Sample Description:	Wet, gray clay		
Sample Comment:	---		

Atterberg Limits - ASTM D 4318-05



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-3	CB-347	6-8 ft	87	80	34	46	1	fat clay (CH)

Sample Prepared using the WET method

1% Retained on #40 Sieve

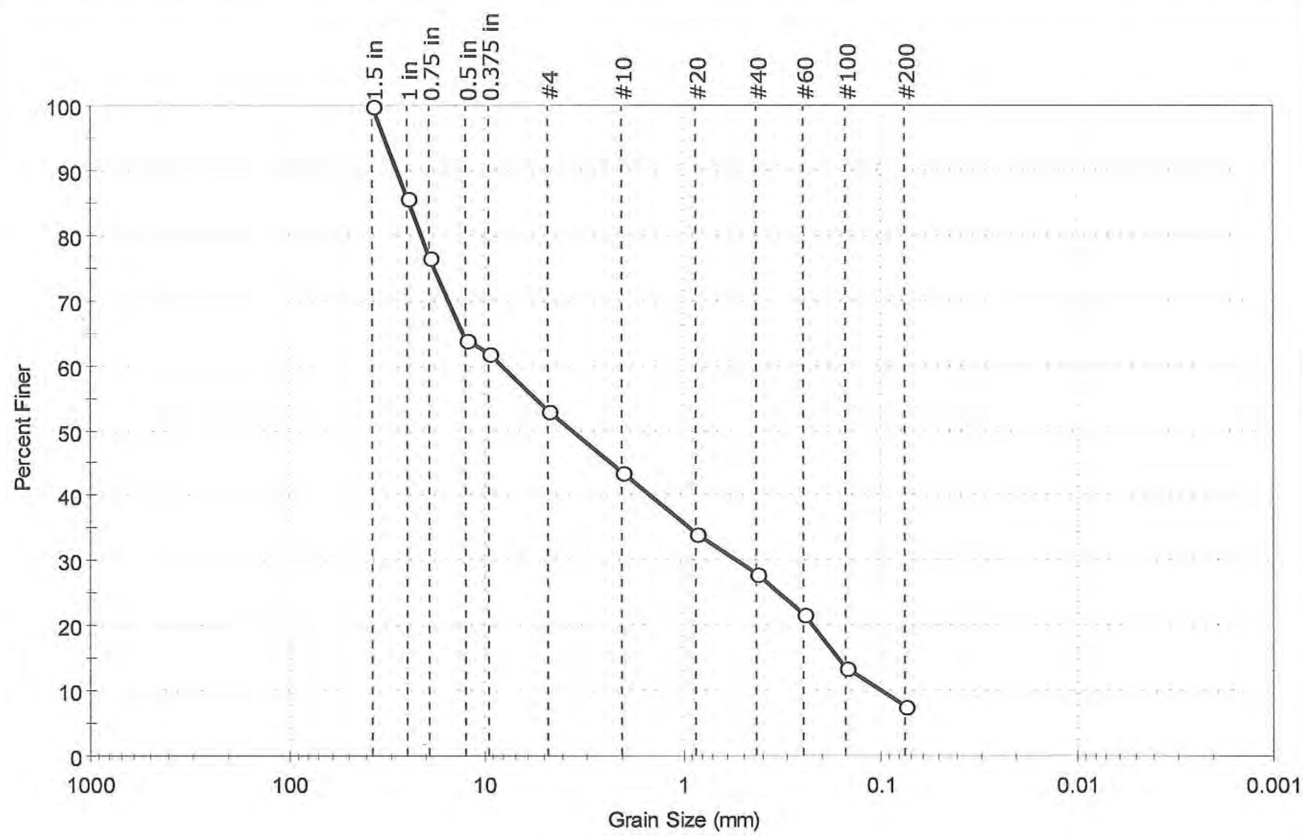
Dry Strength: MEDIUM

Dilentancy: SLOW

Toughness: LOW

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-348	Sample Type: jar	Tested By:	jbr
Sample ID:S-1	Test Date: 02/06/12	Checked By:	njh
Depth : 0-2 ft	Test Id: 228786		
Test Comment: ---			
Sample Description: Moist, grayish brown gravel with silt and sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	46.8	45.5	7.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	86		
0.75 in	19.00	77		
0.5 in	12.50	64		
0.375 in	9.50	62		
#4	4.75	53		
#10	2.00	44		
#20	0.85	34		
#40	0.42	28		
#60	0.25	22		
#100	0.15	14		
#200	0.075	8		

Coefficients

D_{85} =24.4008 mm D_{30} =0.5266 mm

D_{60} =8.1289 mm D_{15} =0.1632 mm

D_{50} =3.5395 mm D_{10} =0.0983 mm

C_u =82.695 C_c =0.347

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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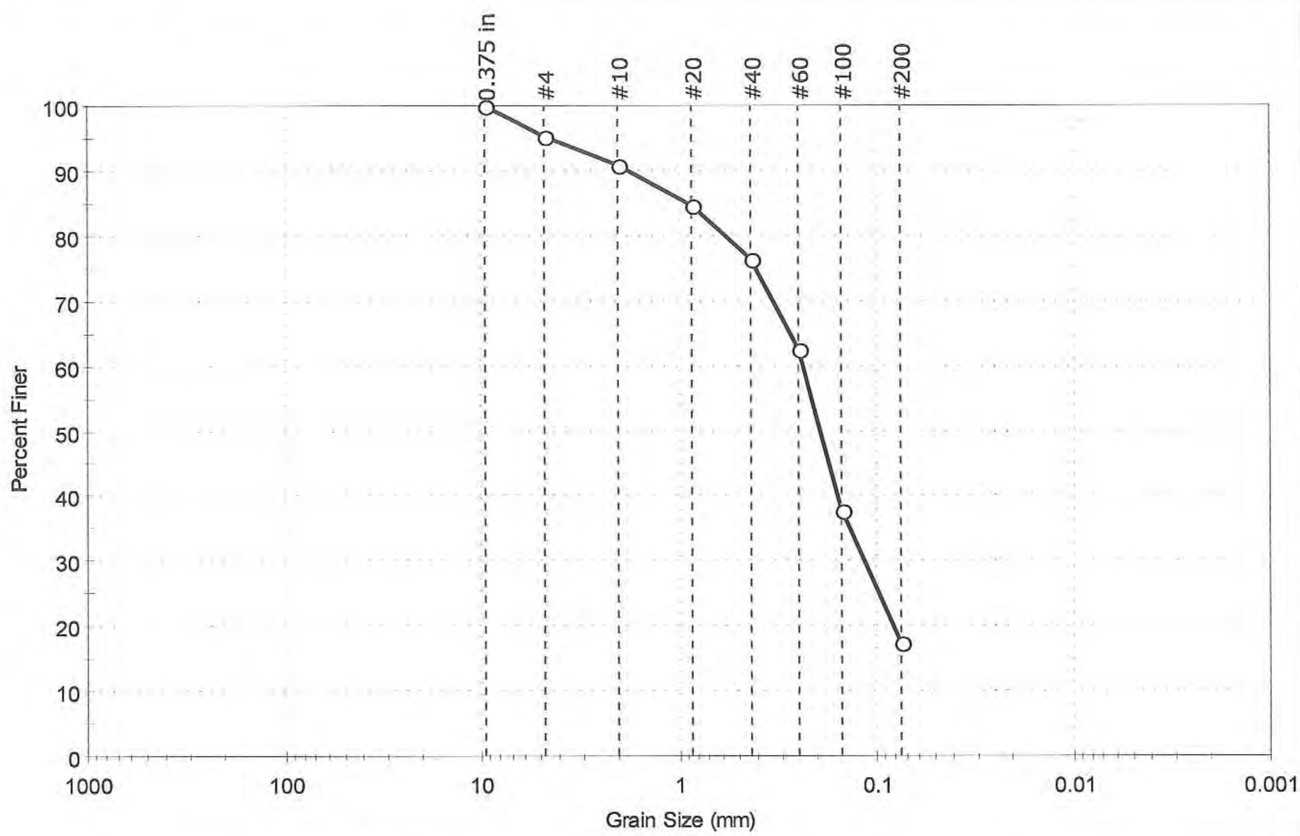
GeoTesting EXPRESS

Client: Gahagan & Bryant Associates			
Project: Delaware River Channel Deepening Reach B			
Location: ---		Project No:	GTX-11510
Boring ID: CB-348	Sample Type: jar	Tested By:	jbr
Sample ID:S-2	Test Date: 02/02/12	Checked By:	njh
Depth : 3.0-4.2 ft	Test Id: 228787		
Test Comment: ---			
Sample Description: Moist, dark gray silty sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	4.6	78.1	17.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	95		
#10	2.00	91		
#20	0.85	85		
#40	0.42	76		
#60	0.25	63		
#100	0.15	38		
#200	0.075	17		

Coefficients

D_{85} =0.9030 mm　　D_{30} =0.1152 mm
D_{60} =0.2366 mm　　D_{15} =N/A
D_{50} =0.1926 mm　　D_{10} =N/A
C_u =N/A　　C_c =N/A

Classification

ASTM　N/A

AASHTO　Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/14/2012 11:21:44 AM

Client:	Gahagan Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/22/12
Tested By:	bfm
Checked By:	mpd
Sample Type:	Core
Sample Description:	---
Strain Rate:	2.5%/min.

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D 3967

Boring ID	Sample ID	Depth, ft.	Test No.	Thickness (L), in.			Diameter (D), in.	Failure Load (P), lb.	Splitting Tensile Strength, psi
CB-317	---	11.43-11.53	ST-1	1.17	1.17	1.17	2.49	7,409	1,620
CB-322	---	5.52-5.62	ST-2	1.12	1.24	1.24	2.47	6,544	1,400
CB-324	---	5.17-5.27	ST-3	1.16	1.16	1.17	2.49	4,984	1,100
CB-331	---	5.64-5.74	ST-4	1.17	1.18	1.18	2.49	4,441	968
CB-333	---	1.62-1.72	ST-5	1.16	1.16	1.16	2.49	5,507	1,220
CB-333	---	6.67-6.77	ST-6	1.18	1.19	1.20	2.49	6,204	1,330
CB-337	---	3.91-4.01	ST-7	1.17	1.17	1.16	2.46	4,610	1,020
CB-338	---	10.25-10.35	ST-8	1.22	1.22	1.21	2.49	7,213	1,520
CB-343	---	8.71-8.81	ST-9	1.20	1.21	1.22	2.47	4,891	1,040
CB-344	---	8.62-8.72	ST-10	1.18	1.18	1.18	2.47	4,623	1,010

Client:	Gahagan Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510

Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D 3967

CB-317

11.43-11.53 ft

ST-1

Intact material failure

L/D: 0.5

CB-322

5.52-5.62 ft

ST-2

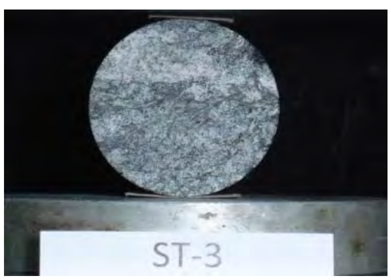
Intact material failure

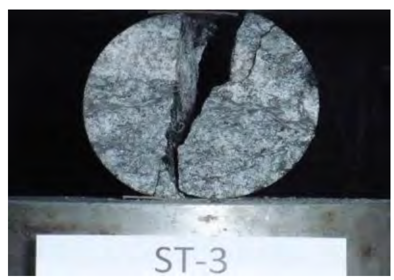
L/D: 0.5

CB-324

5.17-5.27 ft

ST-3





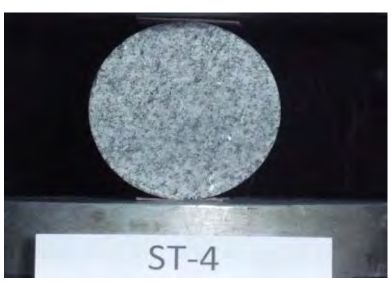
Intact material failure

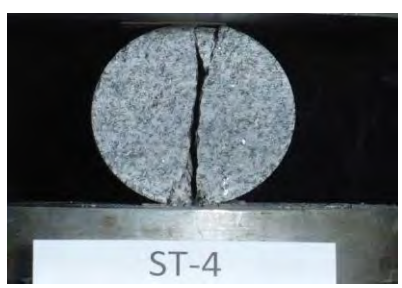
L/D: 0.5

CB-331

5.64-5.74 ft

ST-4





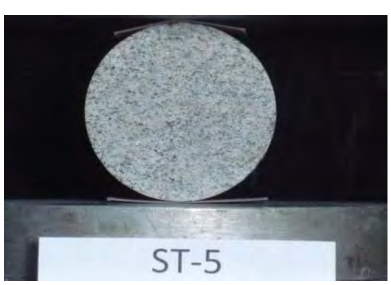
Intact material failure

L/D: 0.5

CB-333

1.62-1.72 ft

ST-5



Intact material failure

L/D: 0.5

GeoTesting EXPRESS

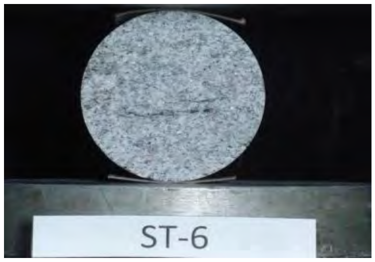
Client:	Gahagan Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510

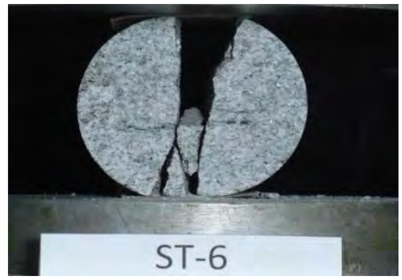
Splitting Tensile Strength of Intact Rock Core Specimens by ASTM D 3967

CB-333

6.67-6.77 ft

ST-6





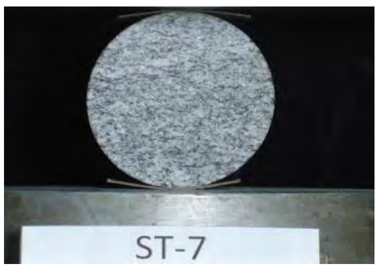
Intact material failure

L/D: 0.5

CB-337

3.91-4.01 ft

ST-7



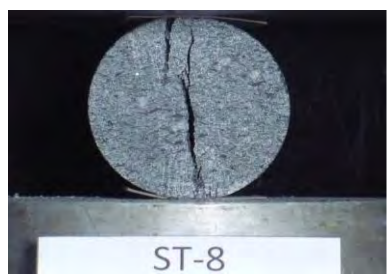
Intact material failure

L/D: 0.5

CB-338

10.25-10.35 ft

ST-8



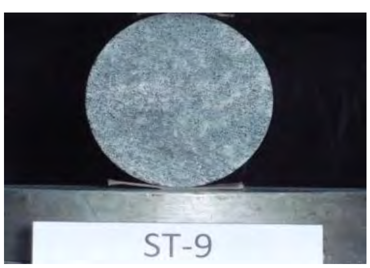
Intact material failure

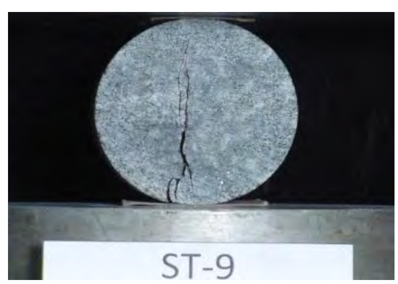
L/D: 0.5

CB-343

8.71-8.81 ft

ST-9





Intact material failure

L/D: 0.5

CB-344

8.62-8.72 ft

ST-10

Intact material failure

L/D: 0.5

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D 7012 Method C

Boring ID	Sample ID	Depth, ft	Bulk Density, lb/ft^3	Compressive Strength, psi	Failure Type	In conformance with ASTM D 4543
CB-317	---	11.54-11.97	165	27,528	1	NO *
CB-322	---	6.36-6.79	183	40,474	1	YES
CB-324	---	4.35-4.78	173	8,563	2	NO *
CB-333	---	3.57-4.00	164	12,770	2	NO *
CB-333	---	7.85-8.28	164	14,113	1	NO *
CB-337	---	1.02-1.45	164	3,896	1 & 2	NO *
CB-337	---	10.46-10.89	166	16,883	1	NO *
CB-343	---	5.92-6.35	169	13,043	1	YES
CB-344	---	7.79-8.22	171	10,686	2	YES

Notes:

Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure (See attached photographs)

* The as-received core did not meet the ASTM side straightness tolerance.

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-317		
Sample ID:	---		
Depth:	11.54-11.97 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.13	5.13	5.13
Specimen Diameter, in:	2.49	2.50	2.50
Specimen Mass, g:	1089.74		
Bulk Density, lb/ft^3	165		
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **NO**

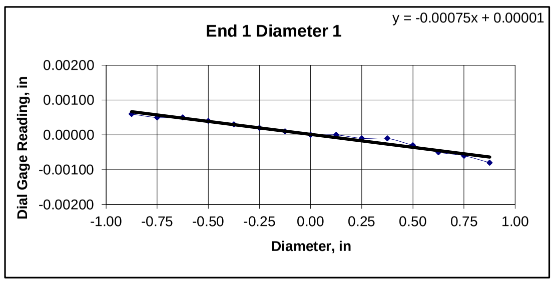
END FLATNESS AND PARALLELISM (Procedure FP1)

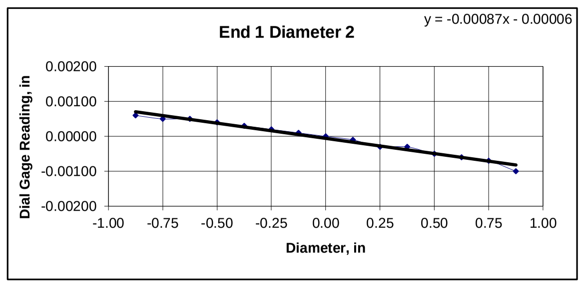
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00060	0.00050	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00010	-0.00030	-0.00050	-0.00060	-0.00080
Diameter 2, in (rotated 90^o)	0.00060	0.00050	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	-0.00010	-0.00030	-0.00030	-0.00050	-0.00060	-0.00070	-0.00100

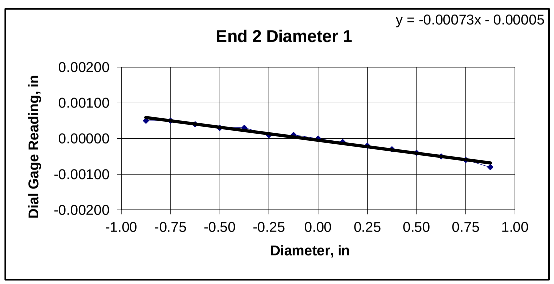
Difference between max and min readings, in:
0° = 0.00140 90° = 0.00160

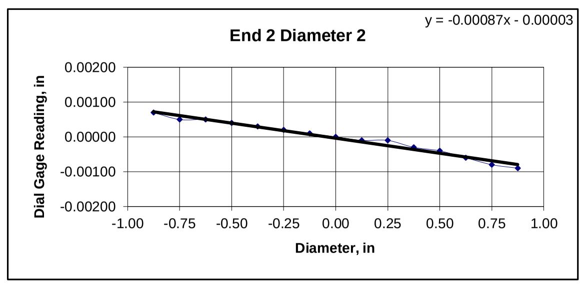
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00050	0.00050	0.00040	0.00030	0.00030	0.00010	0.00010	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050	-0.00060	-0.00080
Diameter 2, in (rotated 90^o)	0.00070	0.00050	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	-0.00010	-0.00010	-0.00030	-0.00040	-0.00060	-0.00080	-0.00090

Difference between max and min readings, in:
0° = 0.0013 90° = 0.0016
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00080
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line -0.00075
Angle of Best Fit Line: -0.04297

End 2:
Slope of Best Fit Line -0.00073
Angle of Best Fit Line: -0.04183

Maximum Angular Difference: 0.00115

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line -0.00087
Angle of Best Fit Line: -0.04985

End 2:
Slope of Best Fit Line -0.00087
Angle of Best Fit Line: -0.04985

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00140	2.495	0.00056	0.032	YES
Diameter 2, in (rotated 90^o)	0.00160	2.495	0.00064	0.037	YES
END 2					
Diameter 1, in	0.00130	2.495	0.00052	0.030	YES
Diameter 2, in (rotated 90^o)	0.00160	2.495	0.00064	0.037	YES

Maximum angle of departure must be $\leq$ 0.25°
Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/23/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-317
Sample ID:	---
Depth, ft:	11.54-11.97

After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-322		
Sample ID:	---		
Depth:	6.36-6.79 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.13	5.13	5.13
Specimen Diameter, in:	2.49	2.49	2.49
Specimen Mass, g:	1201.87		
Bulk Density, lb/ft^3	183		
Length to Diameter Ratio:	2.1		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **YES**

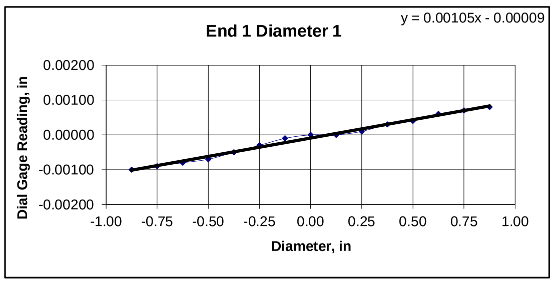
END FLATNESS AND PARALLELISM (Procedure FP1)

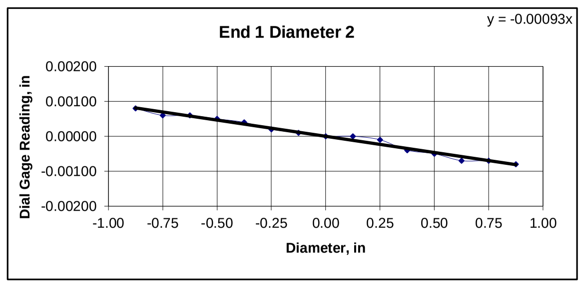
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00100	-0.00090	-0.00080	-0.00070	-0.00050	-0.00030	-0.00010	0.00000	0.00000	0.00010	0.00030	0.00040	0.00060	0.00070	0.00080
Diameter 2, in (rotated 90°)	0.00080	0.00060	0.00060	0.00050	0.00040	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00040	-0.00050	-0.00070	-0.00070	-0.00080

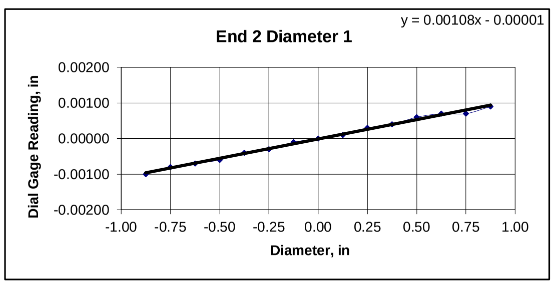
Difference between max and min readings, in:
0° = 0.00180 90° = 0.00160

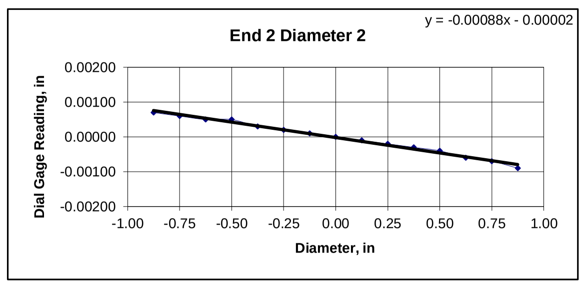
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00100	-0.00080	-0.00070	-0.00060	-0.00040	-0.00030	-0.00010	0.00000	0.00010	0.00030	0.00040	0.00060	0.00070	0.00070	0.00090
Diameter 2, in (rotated 90°)	0.00070	0.00060	0.00050	0.00050	0.00030	0.00020	0.00010	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00060	-0.00070	-0.00090

Difference between max and min readings, in:
0° = 0.0019 90° = 0.0016
Maximum difference must be < 0.0020 in. Difference = ± 0.00095
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00105
Angle of Best Fit Line: 0.06016

End 2:
Slope of Best Fit Line 0.00108
Angle of Best Fit Line: 0.06188

Maximum Angular Difference: 0.00172

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line -0.00093
Angle of Best Fit Line: -0.05329

End 2:
Slope of Best Fit Line -0.00088
Angle of Best Fit Line: -0.05042

Maximum Angular Difference: 0.00286

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1)

(Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00180	2.490	0.00072	0.041	YES
Diameter 2, in (rotated 90°)	0.00160	2.490	0.00064	0.037	YES
END 2					
Diameter 1, in	0.00190	2.490	0.00076	0.044	YES
Diameter 2, in (rotated 90°)	0.00160	2.490	0.00064	0.037	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/23/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-322
Sample ID:	---
Depth, ft:	6.36-6.79

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-324		
Sample ID:	---		
Depth:	4.35-4.78 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.08	5.08	5.08
Specimen Diameter, in:	2.48	2.49	2.49
Specimen Mass, g:	1124.39		
Bulk Density, lb/ft^3	173		
Length to Diameter Ratio:	2.0	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? NO

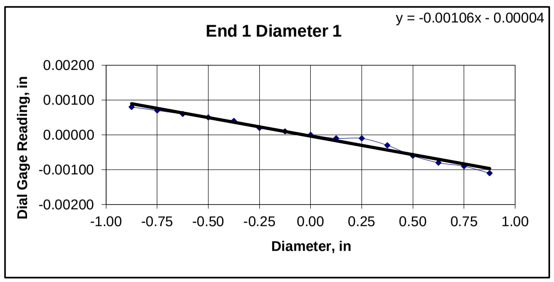
END FLATNESS AND PARALLELISM (Procedure FP1)

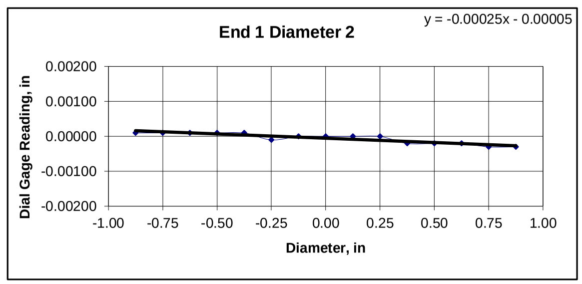
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00080	0.00070	0.00060	0.00050	0.00040	0.00020	0.00010	0.00000	-0.00010	-0.00010	-0.00030	-0.00060	-0.00080	-0.00090	-0.00110
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00020	-0.00020	-0.00030	-0.00030

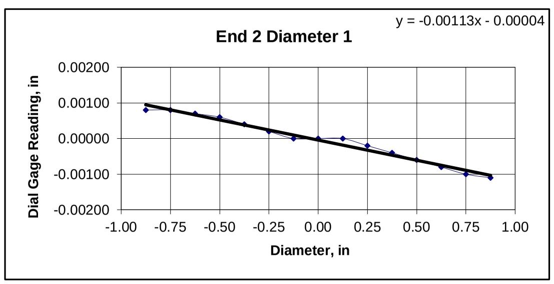
Difference between max and min readings, in:
0° = 0.00190 90° = 0.00040

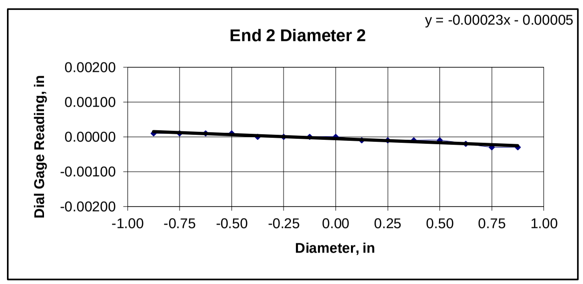
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00080	0.00080	0.00070	0.00060	0.00040	0.00020	0.00000	0.00000	0.00000	-0.00020	-0.00040	-0.00060	-0.00080	-0.00100	-0.00110
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010	-0.00020	-0.00030	-0.00030

Difference between max and min readings, in:
0° = 0.0019 90° = 0.0004
Maximum difference must be < 0.0020 in. Difference = ± 0.00095
Flatness Tolerance Met? YES









DIAMETER 1

End 1:	Slope of Best Fit Line	-0.00106
	Angle of Best Fit Line:	-0.06073
End 2:	Slope of Best Fit Line	-0.00113
	Angle of Best Fit Line:	-0.06474
Maximum Angular Difference:		0.00401

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	-0.00025
	Angle of Best Fit Line:	-0.01432
End 2:	Slope of Best Fit Line	-0.00023
	Angle of Best Fit Line:	-0.01318
Maximum Angular Difference:		0.00115

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00190	2.485	0.00076	0.044	YES
Diameter 2, in (rotated 90°)	0.00040	2.485	0.00016	0.009	YES
END 2					
Diameter 1, in	0.00190	2.485	0.00076	0.044	YES
Diameter 2, in (rotated 90°)	0.00040	2.485	0.00016	0.009	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-324
Sample ID:	---
Depth, ft:	4.35-4.78

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-333		
Sample ID:	---		
Depth:	3.57-4.00 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.09	5.09	5.09
Specimen Diameter, in:	2.49	2.49	2.49
Specimen Mass, g:	1071.3		
Bulk Density, lb/ft^3	164		
Length to Diameter Ratio:	2.0	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? NO

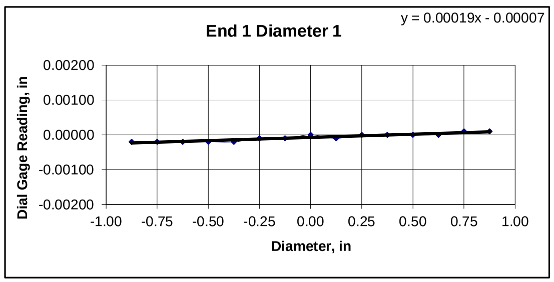
END FLATNESS AND PARALLELISM (Procedure FP1)

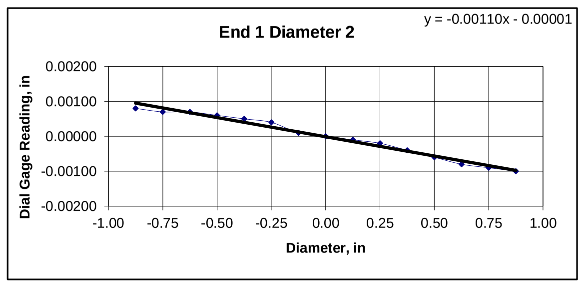
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00010	-0.00010	0.00000	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010
Diameter 2, in (rotated 90°)	0.00080	0.00070	0.00070	0.00060	0.00050	0.00040	0.00010	0.00000	-0.00010	-0.00020	-0.00040	-0.00060	-0.00080	-0.00090	-0.00100

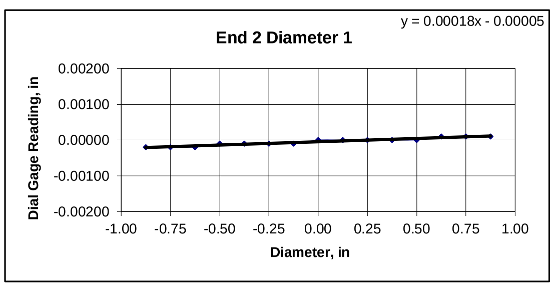
Difference between max and min readings, in:
0° = 0.00030 90° = 0.00180

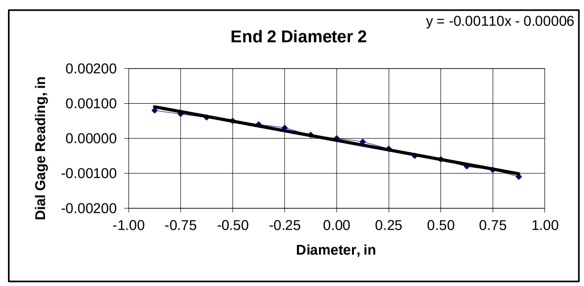
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010
Diameter 2, in (rotated 90°)	0.00080	0.00070	0.00060	0.00050	0.00040	0.00030	0.00010	0.00000	-0.00010	-0.00030	-0.00050	-0.00060	-0.00080	-0.00090	-0.00110

Difference between max and min readings, in:
0° = 0.0003 90° = 0.0019
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00095
Flatness Tolerance Met? YES









DIAMETER 1

End 1:	Slope of Best Fit Line	0.00019
	Angle of Best Fit Line:	0.01089
End 2:	Slope of Best Fit Line	0.00018
	Angle of Best Fit Line:	0.01031
Maximum Angular Difference:		0.00057

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	-0.00110
	Angle of Best Fit Line:	-0.06303
End 2:	Slope of Best Fit Line	-0.00110
	Angle of Best Fit Line:	-0.06303
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00030	2.490	0.00012	0.007	YES
Diameter 2, in (rotated 90°)	0.00180	2.490	0.00072	0.041	YES
END 2					
Diameter 1, in	0.00030	2.490	0.00012	0.007	YES
Diameter 2, in (rotated 90°)	0.00190	2.490	0.00076	0.044	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-333
Sample ID:	---
Depth, ft:	3.57-4.00

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-333		
Sample ID:	---		
Depth:	7.85-8.28 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.07	5.06	5.07
Specimen Diameter, in:	2.49	2.50	2.50
Specimen Mass, g:	1067.42		
Bulk Density, lb/ft^3	164		
Length to Diameter Ratio:	2.0		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? **NO**

END FLATNESS AND PARALLELISM (Procedure FP1)

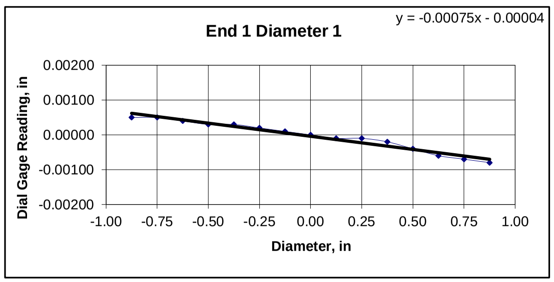
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00050	0.00050	0.00040	0.00030	0.00030	0.00020	0.00010	0.00000	-0.00010	-0.00010	-0.00020	-0.00040	-0.00060	-0.00070	-0.00080
Diameter 2, in (rotated 90°)	0.00090	0.00090	0.00080	0.00070	0.00050	0.00020	0.00010	0.00000	0.00000	-0.00020	-0.00050	-0.00070	-0.00070	-0.00090	-0.00100

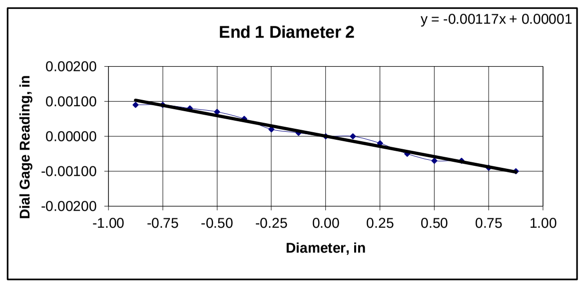
Difference between max and min readings, in:
0° = 0.00130 90° = 0.00190

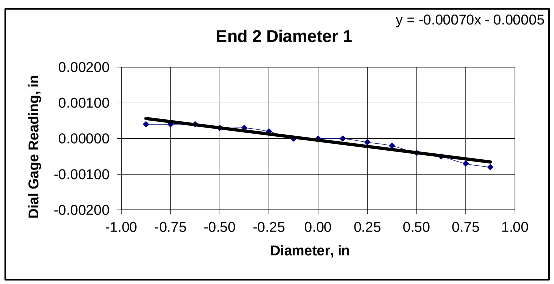
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00040	0.00040	0.00040	0.00030	0.00030	0.00020	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00040	-0.00050	-0.00070	-0.00080
Diameter 2, in (rotated 90°)	0.00090	0.00090	0.00070	0.00070	0.00050	0.00030	0.00010	0.00000	0.00000	-0.00020	-0.00040	-0.00060	-0.00070	-0.00080	-0.00100

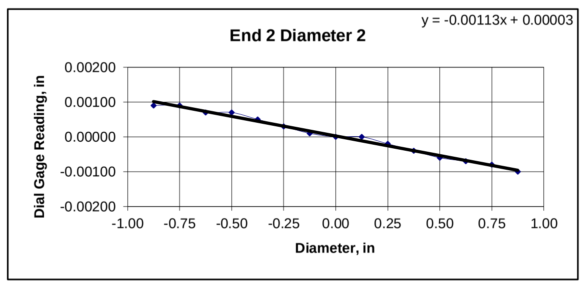
Difference between max and min readings, in:
0° = 0.0012 90° = 0.0019

Maximum difference must be < 0.0020 in. Difference = ± 0.00095
Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	Slope of Best Fit Line	-0.00075
	Angle of Best Fit Line:	-0.04297
End 2:	Slope of Best Fit Line	-0.00070
	Angle of Best Fit Line:	-0.04011
Maximum Angular Difference:		0.00286

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	-0.00117
	Angle of Best Fit Line:	-0.06704
End 2:	Slope of Best Fit Line	-0.00113
	Angle of Best Fit Line:	-0.06474
Maximum Angular Difference:		0.00229

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00130	2.495	0.00052	0.030	YES
Diameter 2, in (rotated 90°)	0.00190	2.495	0.00076	0.044	YES
END 2					
Diameter 1, in	0.00120	2.495	0.00048	0.028	YES
Diameter 2, in (rotated 90°)	0.00190	2.495	0.00076	0.044	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-333
Sample ID:	---
Depth, ft:	7.85-8.28

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-337		
Sample ID:	---		
Depth:	1.02-1.45 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.07	5.07	5.07
Specimen Diameter, in:	2.39	2.44	2.42
Specimen Mass, g:	1002.61		
Bulk Density, lb/ft^3	164		
Length to Diameter Ratio:	2.1		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **NO**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00080	0.00080	0.00060	0.00060	0.00040	0.00030	0.00010	0.00000	-0.00010	-0.00020	-0.00030	-0.00050	-0.00070	-0.00070	-0.00090
Diameter 2, in (rotated 90°)	-0.00100	-0.00090	-0.00080	-0.00070	-0.00060	-0.00030	-0.00010	0.00000	0.00000	0.00010	0.00030	0.00050	0.00060	0.00070	0.00080

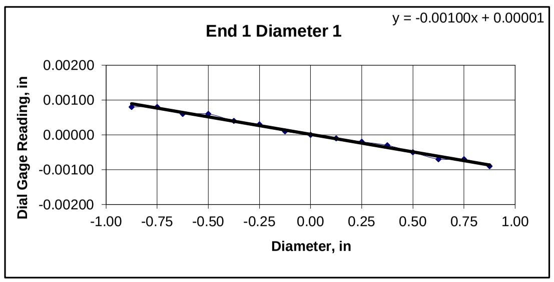
Difference between max and min readings, in:
0° = 0.00170 90° = 0.00180

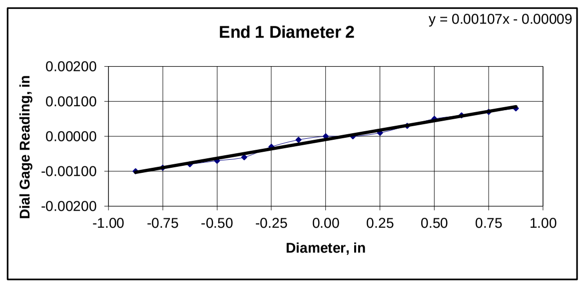
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00070	0.00060	0.00060	0.00050	0.00040	0.00040	0.00010	0.00000	-0.00010	-0.00030	-0.00050	-0.00060	-0.00080	-0.00090	-0.00100
Diameter 2, in (rotated 90°)	-0.00100	-0.00090	-0.00080	-0.00070	-0.00060	-0.00030	-0.00020	0.00000	0.00010	0.00010	0.00020	0.00040	0.00060	0.00070	0.00090

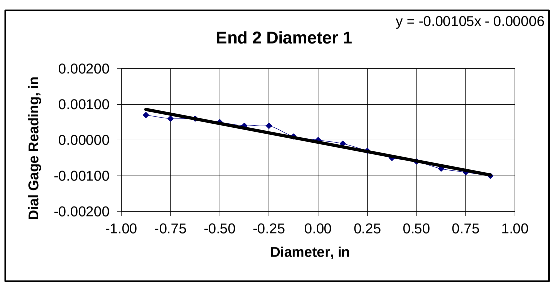
Difference between max and min readings, in:
0° = 0.0017 90° = 0.0019

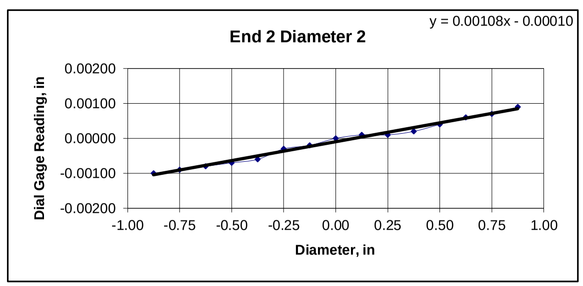
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00095

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	Slope of Best Fit Line	-0.00100
	Angle of Best Fit Line:	-0.05730
End 2:	Slope of Best Fit Line	-0.00105
	Angle of Best Fit Line:	-0.06016
Maximum Angular Difference:		0.00286

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	0.00107
	Angle of Best Fit Line:	0.06131
End 2:	Slope of Best Fit Line	0.00108
	Angle of Best Fit Line:	0.06188
Maximum Angular Difference:		0.00057

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00170	2.415	0.00070	0.040	YES
Diameter 2, in (rotated 90°)	0.00180	2.415	0.00075	0.043	YES
END 2					
Diameter 1, in	0.00170	2.415	0.00070	0.040	YES
Diameter 2, in (rotated 90°)	0.00190	2.415	0.00079	0.045	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-337
Sample ID:	---
Depth, ft:	1.02-1.45

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-337		
Sample ID:	---		
Depth:	10.46-10.89 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.11	5.11	5.11
Specimen Diameter, in:	2.50	2.50	2.50
Specimen Mass, g:	1093.46		
Bulk Density, lb/ft^3	166		
Length to Diameter Ratio:	2.0		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **NO**

END FLATNESS AND PARALLELISM (Procedure FP1)

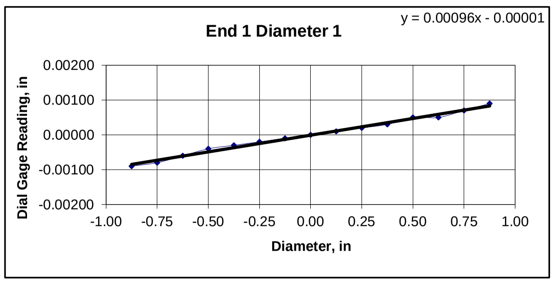
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00080	-0.00060	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00050	0.00050	0.00070	0.00090
Diameter 2, in (rotated 90°)	-0.00100	-0.00080	-0.00070	-0.00050	-0.00040	-0.00030	-0.00010	0.00000	0.00010	0.00020	0.00020	0.00030	0.00040	0.00040	0.00040

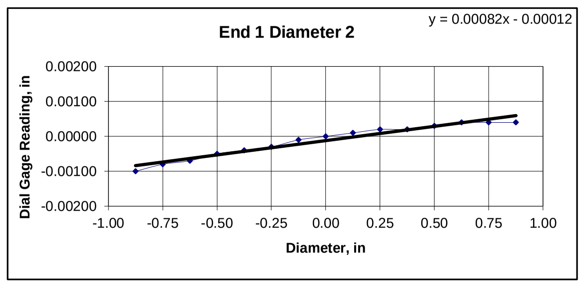
Difference between max and min readings, in:
0° = 0.00180 90° = 0.00140

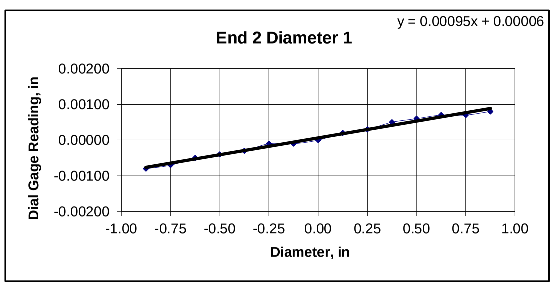
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00080	-0.00070	-0.00050	-0.00040	-0.00030	-0.00010	-0.00010	0.00000	0.00020	0.00030	0.00050	0.00060	0.00070	0.00070	0.00080
Diameter 2, in (rotated 90°)	-0.00080	-0.00080	-0.00070	-0.00060	-0.00050	-0.00030	-0.00010	0.00000	0.00000	0.00020	0.00030	0.00030	0.00040	0.00050	0.00070

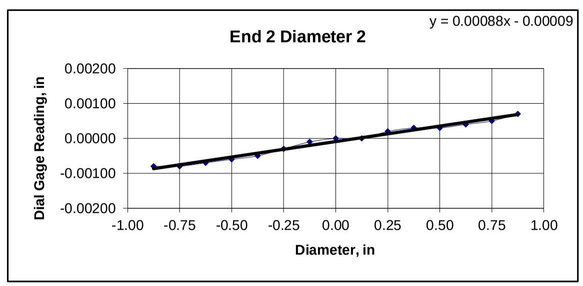
Difference between max and min readings, in:
0° = 0.0016 90° = 0.0015
Maximum difference must be < 0.0020 in. Difference = ± 0.00090

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	Slope of Best Fit Line	0.00096
	Angle of Best Fit Line:	0.05500
End 2:	Slope of Best Fit Line	0.00095
	Angle of Best Fit Line:	0.05443
Maximum Angular Difference:		0.00057

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	0.00082
	Angle of Best Fit Line:	0.04698
End 2:	Slope of Best Fit Line	0.00088
	Angle of Best Fit Line:	0.05042
Maximum Angular Difference:		0.00344

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00180	2.500	0.00072	0.041	YES
Diameter 2, in (rotated 90°)	0.00140	2.500	0.00056	0.032	YES
END 2					
Diameter 1, in	0.00160	2.500	0.00064	0.037	YES
Diameter 2, in (rotated 90°)	0.00150	2.500	0.00060	0.034	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-337
Sample ID:	---
Depth, ft:	10.46-10.89

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-343		
Sample ID:	---		
Depth:	5.92-6.35 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.11	5.11	5.11
Specimen Diameter, in:	2.46	2.47	2.47
Specimen Mass, g:	1084.02		
Bulk Density, lb/ft^3	169		
Length to Diameter Ratio:	2.1		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00090	-0.00080	-0.00060	-0.00040	-0.00030	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00070	0.00080
Diameter 2, in (rotated 90°)	-0.00080	-0.00070	-0.00060	-0.00050	-0.00030	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00020	0.00040	0.00050	0.00060	0.00080

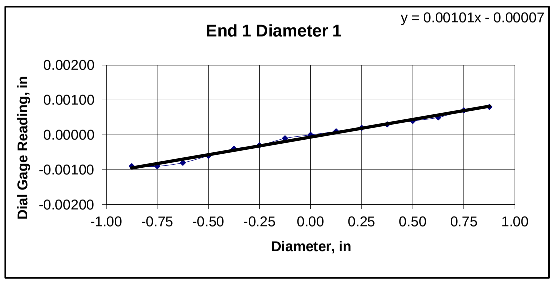
Difference between max and min readings, in:
0° = 0.00170 90° = 0.00160

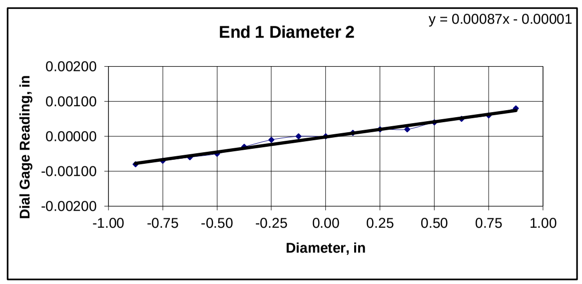
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00090	-0.00080	-0.00060	-0.00050	-0.00030	-0.00010	0.00000	0.00010	0.00010	0.00020	0.00050	0.00060	0.00080	0.00090
Diameter 2, in (rotated 90°)	-0.00080	-0.00080	-0.00060	-0.00050	-0.00040	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00050	0.00060	0.00060

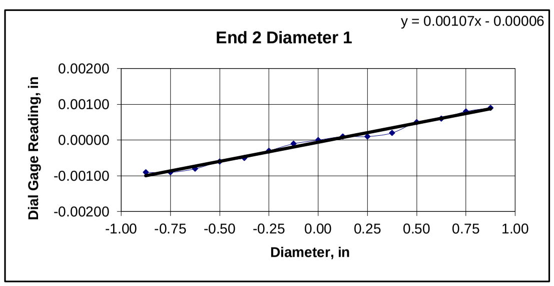
Difference between max and min readings, in:
0° = 0.0018 90° = 0.0014

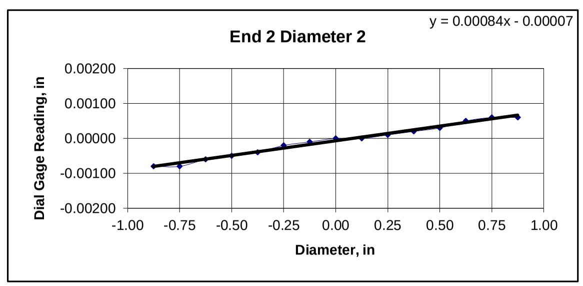
Maximum difference must be < 0.0020 in. Difference = ± 0.00090

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00101
Angle of Best Fit Line: 0.05787

End 2:
Slope of Best Fit Line 0.00107
Angle of Best Fit Line: 0.06131

Maximum Angular Difference: 0.00344

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00087
Angle of Best Fit Line: 0.04985

End 2:
Slope of Best Fit Line 0.00084
Angle of Best Fit Line: 0.04813

Maximum Angular Difference: 0.00172

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1)

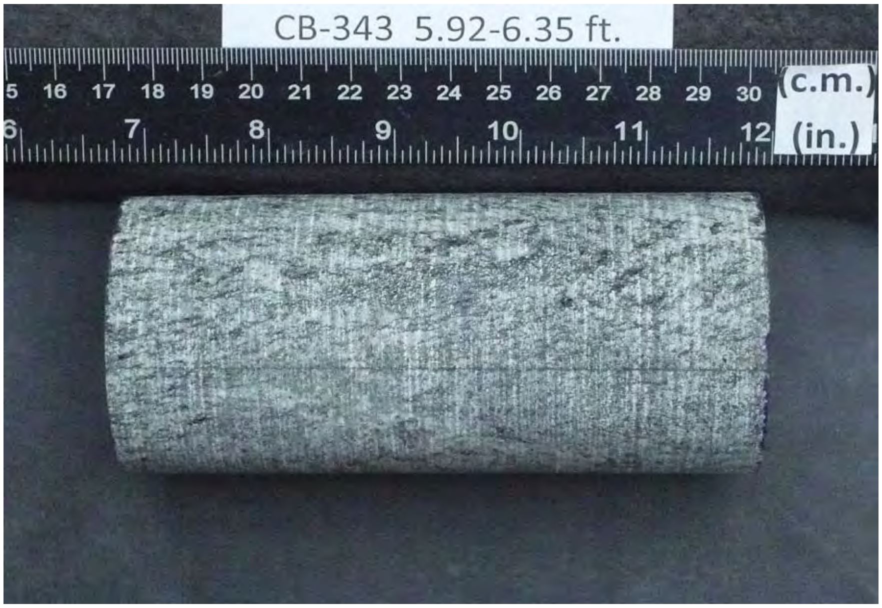
(Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00170	2.465	0.00069	0.040	YES
Diameter 2, in (rotated 90°)	0.00160	2.465	0.00065	0.037	YES
END 2					
Diameter 1, in	0.00180	2.465	0.00073	0.042	YES
Diameter 2, in (rotated 90°)	0.00140	2.465	0.00057	0.033	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-343
Sample ID:	---
Depth, ft:	5.92-6.35



After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates	Test Date:	2/22/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-344		
Sample ID:	---		
Depth:	7.79-8.22 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.10	5.10	5.10
Specimen Diameter, in:	2.47	2.47	2.47
Specimen Mass, g:	1097.44		
Bulk Density, lb/ft^3	171		
Length to Diameter Ratio:	2.1		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **YES**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00060	0.00060	0.00050	0.00040	0.00030	0.00020	0.00020	0.00000	-0.00010	-0.00020	-0.00030	-0.00050	-0.00070	-0.00080	-0.00100
Diameter 2, in (rotated 90°)	-0.00080	-0.00080	-0.00060	-0.00050	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00030	0.00040	0.00040	0.00060	0.00070	0.00080

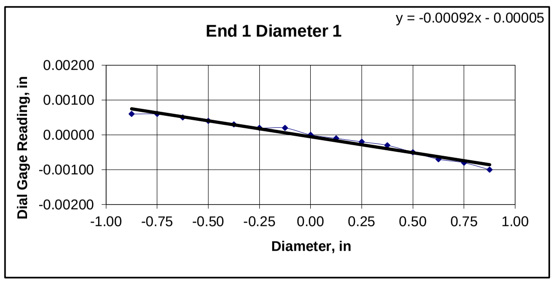
Difference between max and min readings, in:
0° = 0.00160 90° = 0.00160

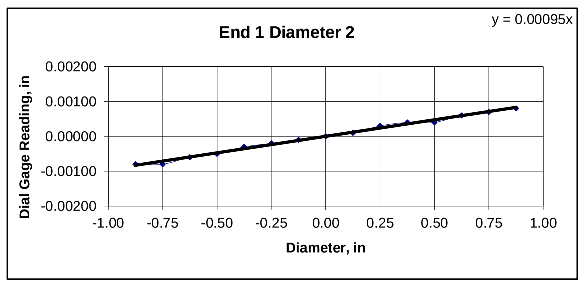
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00070	0.00060	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	-0.00020	-0.00040	-0.00050	-0.00070	-0.00080	-0.00100
Diameter 2, in (rotated 90°)	-0.00100	-0.00080	-0.00070	-0.00060	-0.00030	-0.00030	-0.00010	0.00000	0.00010	0.00030	0.00040	0.00040	0.00050	0.00060	0.00070

Difference between max and min readings, in:
0° = 0.0017 90° = 0.0017

Maximum difference must be < 0.0020 in. Difference = ± 0.00085

Flatness Tolerance Met? **YES**





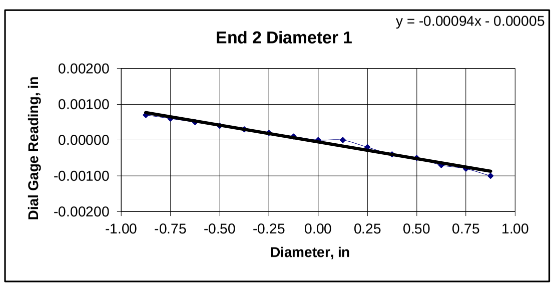
DIAMETER 1

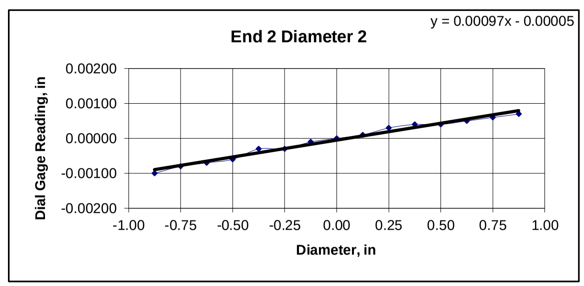
End 1:
Slope of Best Fit Line -0.00092
Angle of Best Fit Line: -0.05271

End 2:
Slope of Best Fit Line -0.00094
Angle of Best Fit Line: -0.05386

Maximum Angular Difference: 0.00115

Parallelism Tolerance Met? **YES**
Spherically Seated





DIAMETER 2

End 1:
Slope of Best Fit Line 0.00095
Angle of Best Fit Line: 0.05443

End 2:
Slope of Best Fit Line 0.00097
Angle of Best Fit Line: 0.05558

Maximum Angular Difference: 0.00115

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00160	2.470	0.00065	0.037	YES
Diameter 2, in (rotated 90°)	0.00160	2.470	0.00065	0.037	YES
END 2					
Diameter 1, in	0.00170	2.470	0.00069	0.039	YES
Diameter 2, in (rotated 90°)	0.00170	2.470	0.00069	0.039	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/24/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-344
Sample ID:	---
Depth, ft:	7.79-8.22

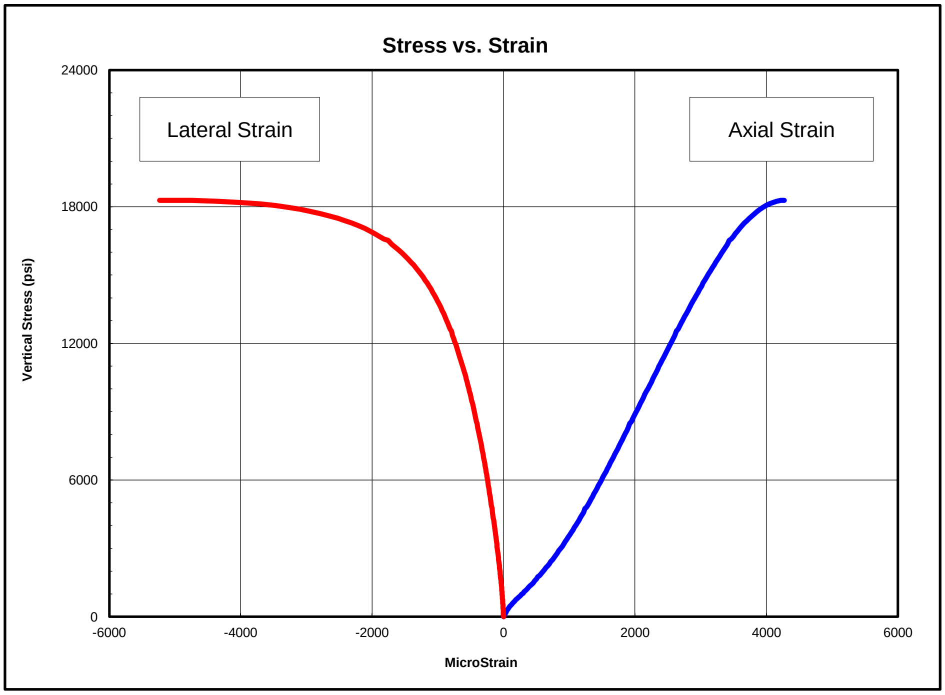
After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-331
Sample ID:	---
Depth, ft:	5.75-6.18
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D 7012 - Method D



Peak Compressive Stress: 18,374 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
0-6000	4,500,000	0.21
6000-12000	5,700,000	0.46
12000-18000	4,400,000	---

Notes: Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Gahagan & Bryant Associates	Test Date:	2/17/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-331		
Sample ID:	---		
Depth:	5.75-6.18 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.10	5.11	5.11
Specimen Diameter, in:	2.48	2.49	2.49
Specimen Mass, g:	1076.49		
Bulk Density, lb/ft^3	165		
Length to Diameter Ratio:	2.1		

Length to Diameter Ratio Tolerance Met? YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00090	-0.00080	-0.00070	-0.00050	-0.00020	0.00000	0.00000	0.00010	0.00030	0.00040	0.00060	0.00070	0.00080	0.00090
Diameter 2, in (rotated 90°)	0.00060	0.00050	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00050	-0.00060

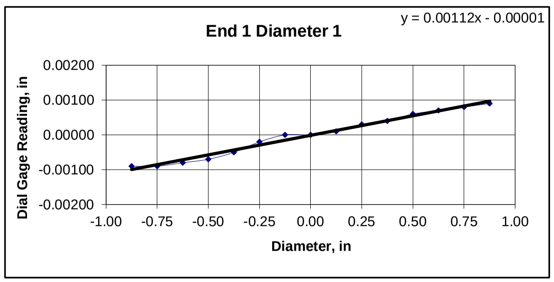
Difference between max and min readings, in:
0° = 0.00180 90° = 0.00120

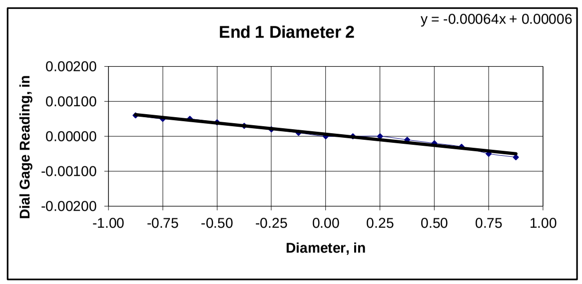
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00100	-0.00100	-0.00090	-0.00060	-0.00040	-0.00020	-0.00010	0.00000	0.00010	0.00030	0.00040	0.00060	0.00070	0.00080	0.00090
Diameter 2, in (rotated 90°)	0.00040	0.00040	0.00040	0.00040	0.00030	0.00020	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00050	-0.00060	-0.00080

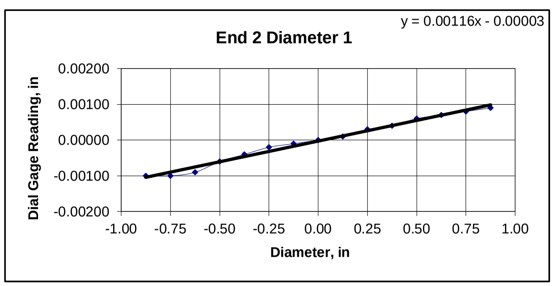
Difference between max and min readings, in:
0° = 0.0019 90° = 0.0012

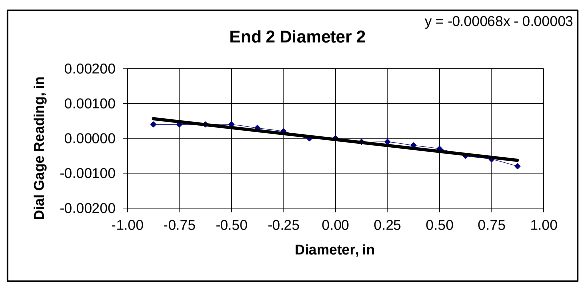
Maximum difference must be < 0.0020 in. Difference = ± 0.00095

Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00112
Angle of Best Fit Line: 0.06417

End 2:
Slope of Best Fit Line 0.00116
Angle of Best Fit Line: 0.06646

Maximum Angular Difference: 0.00229

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line -0.00064
Angle of Best Fit Line: -0.03667

End 2:
Slope of Best Fit Line -0.00068
Angle of Best Fit Line: -0.03896

Maximum Angular Difference: 0.00229

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1)

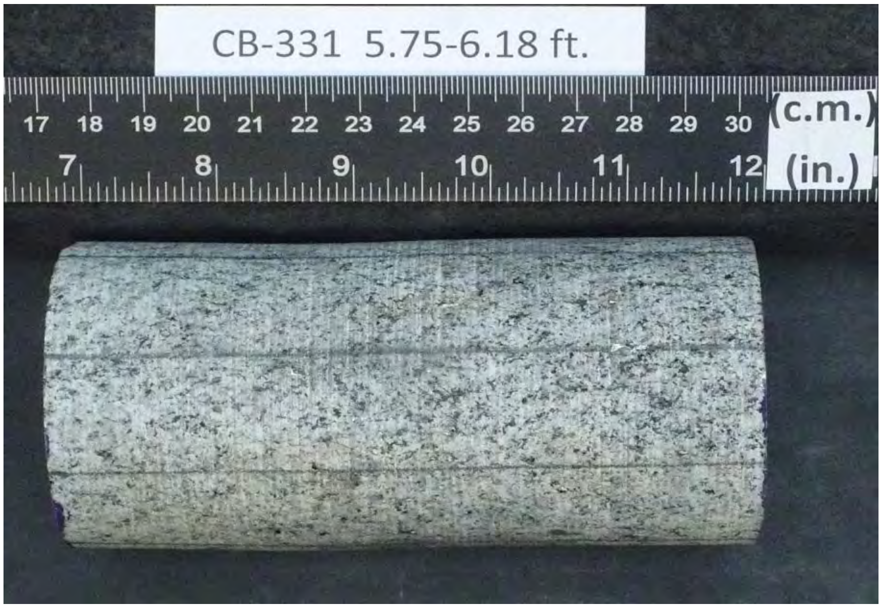
(Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00180	2.485	0.00072	0.042	YES
Diameter 2, in (rotated 90°)	0.00120	2.485	0.00048	0.028	YES
END 2					
Diameter 1, in	0.00190	2.485	0.00076	0.044	YES
Diameter 2, in (rotated 90°)	0.00120	2.485	0.00048	0.028	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-331
Sample ID:	---
Depth, ft:	5.75-6.18

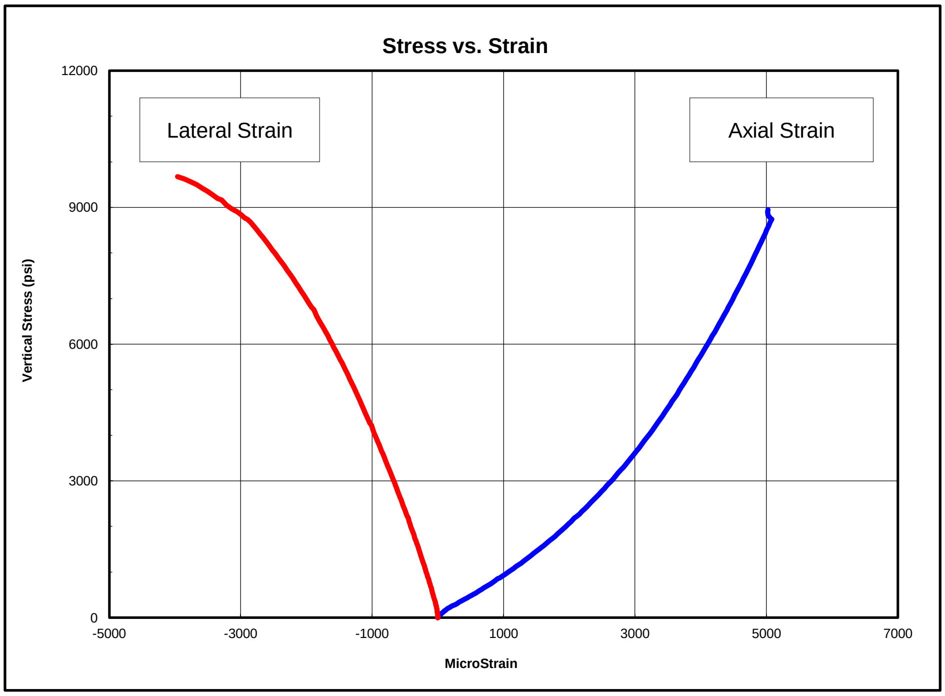


After cutting and grinding

After break

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-337
Sample ID:	---
Depth, ft:	2.90-3.33
Sample Type:	rock core
Sample Description:	See photographs Intact material failure and discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D 7012 - Method D



Peak Compressive Stress: 9,725 psi

The graph above does not include all data up to the peak stress value. The strain gauges failed before the peak stress value was recorded.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
0-2000	1,130,000	0.26
2000-4000	1,590,000	0.43
4000-6000	2,230,000	---
6000-8000	2,700,000	---

Notes: Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Gahagan & Bryant Associates	Test Date:	2/17/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-337		
Sample ID:	---		
Depth:	2.90-3.33 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.07	5.07	5.07
Specimen Diameter, in:	2.40	2.44	2.42
Specimen Mass, g:	1003.94		
Bulk Density, lb/ft^3	164		
Length to Diameter Ratio:	2.1		

Length to Diameter Ratio Tolerance Met? **YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? **NO**

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00080	-0.00070	-0.00060	-0.00040	-0.00020	0.00000	0.00000	0.00020	0.00040	0.00050	0.00070	0.00080	0.00080	0.00090
Diameter 2, in (rotated 90°)	-0.00060	-0.00060	-0.00050	-0.00030	-0.00030	-0.00020	-0.00010	0.00000	0.00010	0.00030	0.00030	0.00040	0.00050	0.00060	0.00080

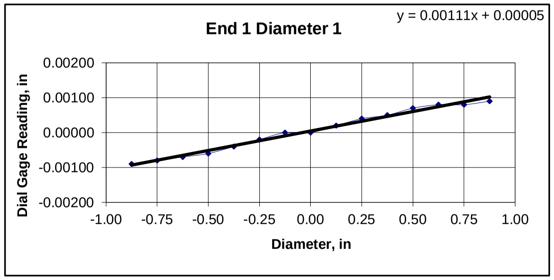
Difference between max and min readings, in:
0° = 0.00180 90° = 0.00140

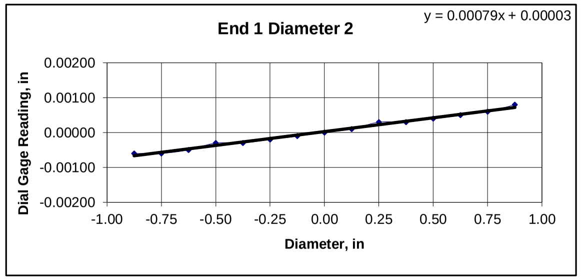
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00100	-0.00090	-0.00080	-0.00070	-0.00040	-0.00030	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00040	0.00070	0.00080	0.00090
Diameter 2, in (rotated 90°)	-0.00080	-0.00080	-0.00060	-0.00050	-0.00040	-0.00020	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00050

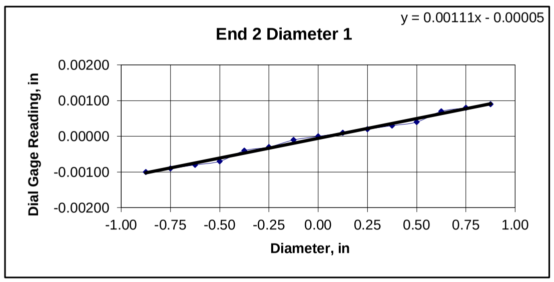
Difference between max and min readings, in:
0° = 0.0019 90° = 0.0013

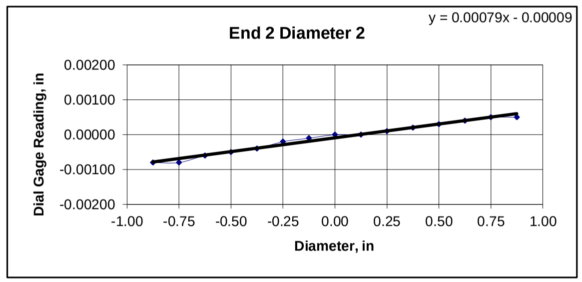
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00095

Flatness Tolerance Met? **YES**









DIAMETER 1

End 1:	Slope of Best Fit Line	0.00111
	Angle of Best Fit Line:	0.06360
End 2:	Slope of Best Fit Line	0.00111
	Angle of Best Fit Line:	0.06360
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	0.00079
	Angle of Best Fit Line:	0.04526
End 2:	Slope of Best Fit Line	0.00079
	Angle of Best Fit Line:	0.04526
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? **YES**
Spherically Seated

PERPENDICULARITY (Procedure P1)

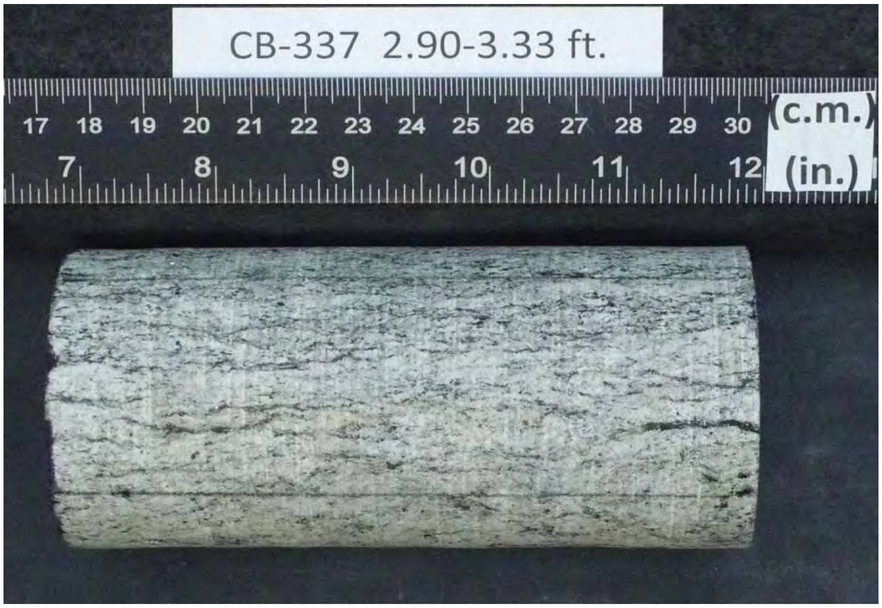
(Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00180	2.420	0.00074	0.043	YES
Diameter 2, in (rotated 90°)	0.00140	2.420	0.00058	0.033	YES
END 2					
Diameter 1, in	0.00190	2.420	0.00079	0.045	YES
Diameter 2, in (rotated 90°)	0.00130	2.420	0.00054	0.031	YES

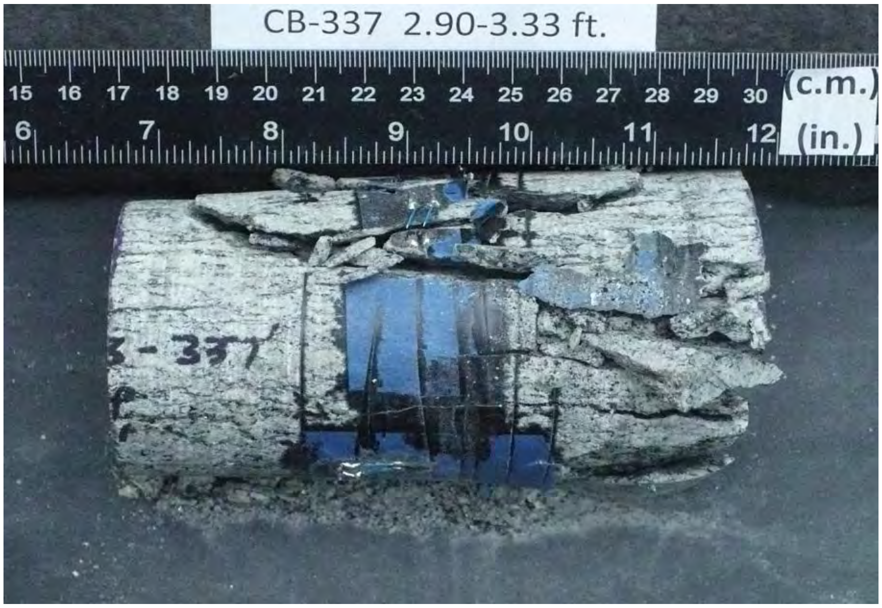
Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? **YES**

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-337
Sample ID:	---
Depth, ft:	2.90-3.33



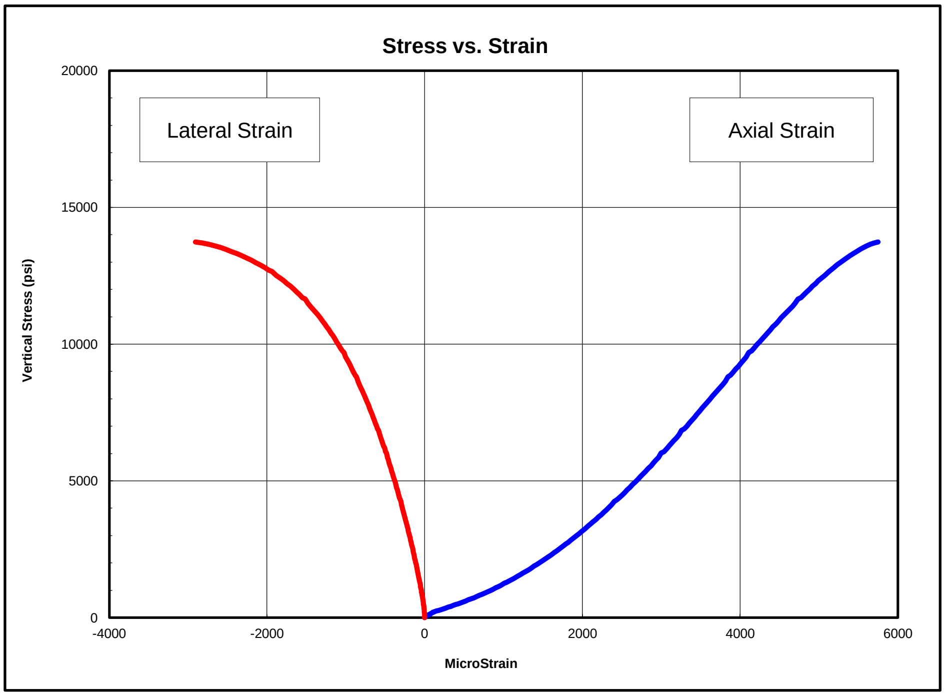
After cutting and grinding



After break

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-337
Sample ID:	---
Depth, ft:	4.44-4.87
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D 7012 - Method D



Peak Compressive Stress: 13,816 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
0-3000	1,940,000	0.15
3000-6000	2,780,000	0.27
6000-9000	3,310,000	0.46
9000-12000	3,150,000	---

Notes: Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Gahagan & Bryant Associates	Test Date:	2/17/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-337		
Sample ID:	---		
Depth:	4.44-4.87 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.00	5.01	5.01
Specimen Diameter, in:	2.45	2.48	2.47
Specimen Mass, g:	1039.78		
Bulk Density, lb/ft^3	165		
Length to Diameter Ratio:	2.0	**Length to Diameter Ratio Tolerance Met?**	**YES**

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? NO

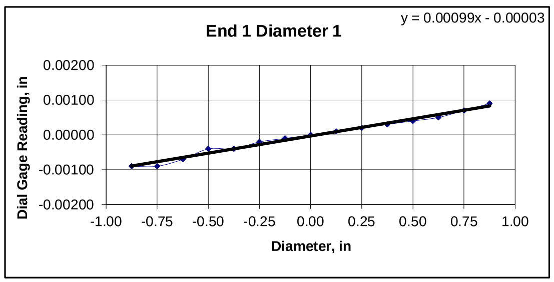
END FLATNESS AND PARALLELISM (Procedure FP1)

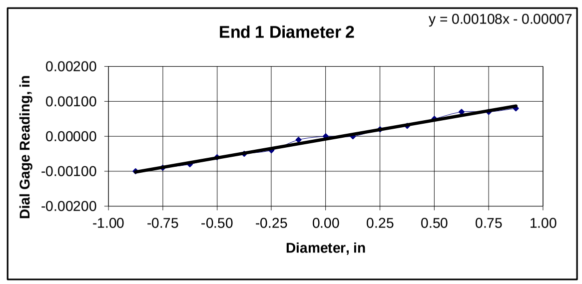
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00090	-0.00070	-0.00040	-0.00040	-0.00020	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00040	0.00050	0.00070	0.00090
Diameter 2, in (rotated 90°)	-0.00100	-0.00090	-0.00080	-0.00060	-0.00050	-0.00040	-0.00010	0.00000	0.00000	0.00020	0.00030	0.00050	0.00070	0.00070	0.00080

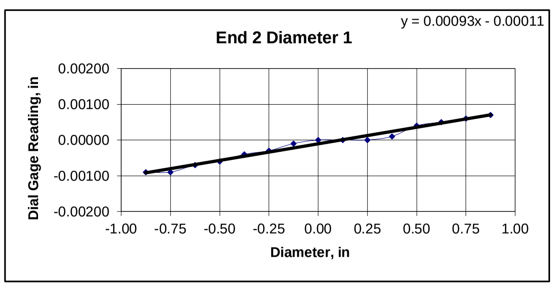
Difference between max and min readings, in:
0° = 0.00180 90° = 0.00180

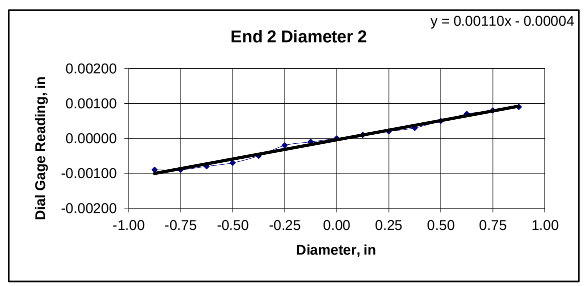
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00090	-0.00090	-0.00070	-0.00060	-0.00040	-0.00030	-0.00010	0.00000	0.00000	0.00000	0.00010	0.00040	0.00050	0.00060	0.00070
Diameter 2, in (rotated 90°)	-0.00090	-0.00090	-0.00080	-0.00070	-0.00050	-0.00020	-0.00010	0.00000	0.00010	0.00020	0.00030	0.00050	0.00070	0.00080	0.00090

Difference between max and min readings, in:
0° = 0.0016 90° = 0.0018
Maximum difference must be < 0.0020 in. Difference = ± 0.00090
Flatness Tolerance Met? YES









DIAMETER 1

End 1:	Slope of Best Fit Line	0.00099
	Angle of Best Fit Line:	0.05672
End 2:	Slope of Best Fit Line	0.00093
	Angle of Best Fit Line:	0.05329
Maximum Angular Difference:		0.00344

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	0.00108
	Angle of Best Fit Line:	0.06188
End 2:	Slope of Best Fit Line	0.00110
	Angle of Best Fit Line:	0.06303
Maximum Angular Difference:		0.00115

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00180	2.465	0.00073	0.042	YES
Diameter 2, in (rotated 90°)	0.00180	2.465	0.00073	0.042	YES
END 2					
Diameter 1, in	0.00160	2.465	0.00065	0.037	YES
Diameter 2, in (rotated 90°)	0.00180	2.465	0.00073	0.042	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

GeoTesting EXPRESS

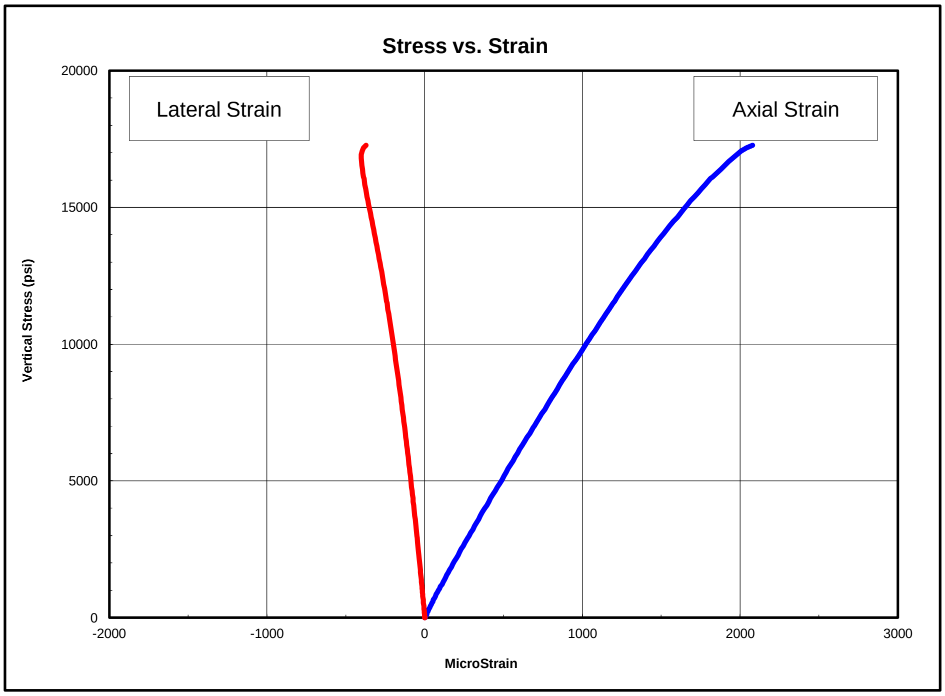
Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-337
Sample ID:	---
Depth, ft:	4.44-4.87

After cutting and grinding

After break

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-338
Sample ID:	---
Depth, ft:	9.47-9.90
Sample Type:	rock core
Sample Description:	See photographs Discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D 7012 - Method D



Peak Compressive Stress: 17,382 psi

The graph above does not include all data up to the peak stress value. The strain gauges failed before the peak stress value was recorded.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
0-5000	10,000,000	0.18
5000-10000	9,280,000	0.21
10000-15000	8,000,000	0.25

Notes: Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Gahagan & Bryant Associates	Test Date:	2/17/2012
Project Name:	Delaware River Channel Deepening Reach B	Tested By:	daa
Project Location:	---	Checked By:	mpd
GTX #:	11510		
Boring ID:	CB-338		
Sample ID:	---		
Depth:	9.47-9.90 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D 4543-04

BULK DENSITY

	1	2	Average
Specimen Length, in:	5.04	5.04	5.04
Specimen Diameter, in:	2.49	2.49	2.49
Specimen Mass, g:	1104.94		
Bulk Density, lb/ft^3	171		
Length to Diameter Ratio:	2.0		

Length to Diameter Ratio Tolerance Met? YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030	-0.00030
Diameter 2, in (rotated 90^o)	0.00080	0.00060	0.00060	0.00060	0.00040	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00030	-0.00050	-0.00070	-0.00090	-0.00100

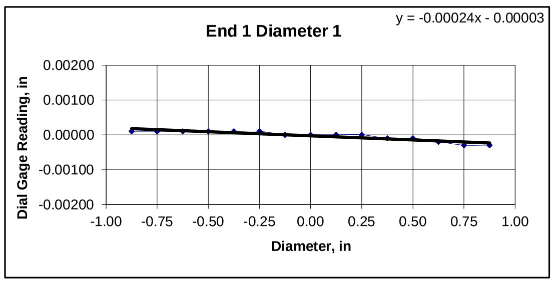
Difference between max and min readings, in:
0° = 0.00040 90° = 0.00180

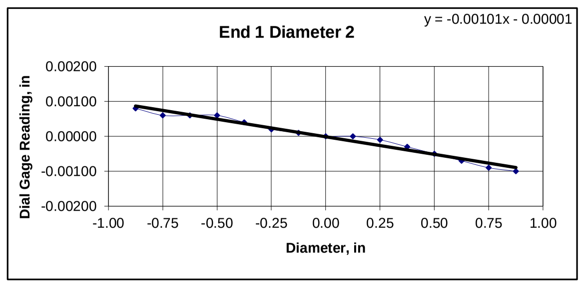
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00010	0.00020	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040
Diameter 2, in (rotated 90^o)	0.00080	0.00060	0.00060	0.00050	0.00040	0.00020	0.00010	0.00000	-0.00010	-0.00020	-0.00040	-0.00050	-0.00060	-0.00080	-0.00100

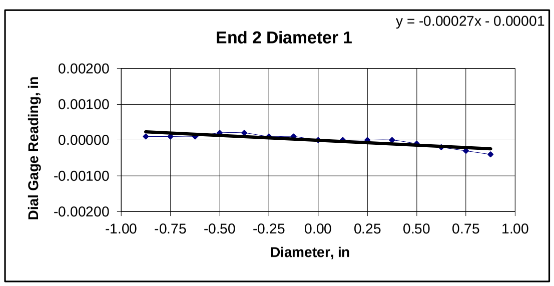
Difference between max and min readings, in:
0° = 0.0006 90° = 0.0018

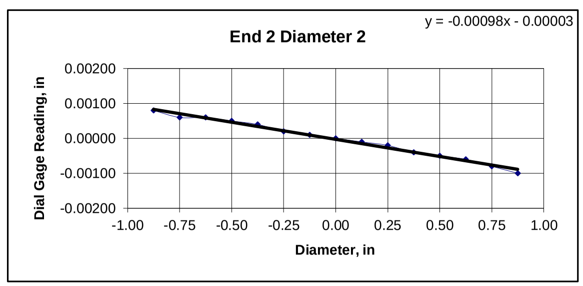
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00090

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	Slope of Best Fit Line	-0.00024
	Angle of Best Fit Line:	-0.01375
End 2:	Slope of Best Fit Line	-0.00027
	Angle of Best Fit Line:	-0.01547
Maximum Angular Difference:		0.00172

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	-0.00101
	Angle of Best Fit Line:	-0.05787
End 2:	Slope of Best Fit Line	-0.00098
	Angle of Best Fit Line:	-0.05615
Maximum Angular Difference:		0.00172

Parallelism Tolerance Met? YES
Spherically Seated

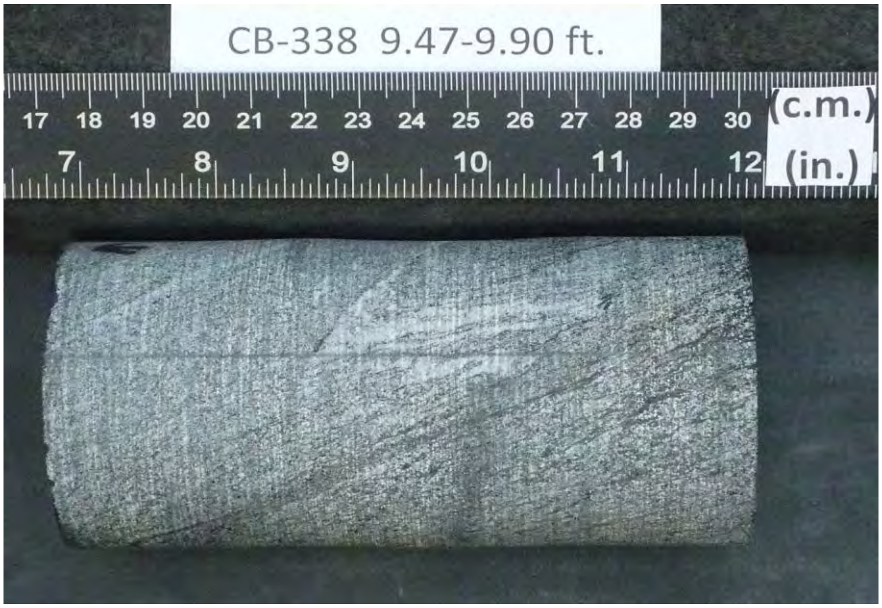
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00040	2.490	0.00016	0.009	YES
Diameter 2, in (rotated 90^o)	0.00180	2.490	0.00072	0.041	YES
END 2					
Diameter 1, in	0.00060	2.490	0.00024	0.014	YES
Diameter 2, in (rotated 90^o)	0.00180	2.490	0.00072	0.041	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Gahagan & Bryant Associates
Project Name:	Delaware River Channel Deepening Reach B
Project Location:	---
GTX #:	11510
Test Date:	02/21/12
Tested By:	daa
Checked By:	mpd
Boring ID:	CB-338
Sample ID:	---
Depth, ft:	9.47-9.90



After cutting and grinding

After break

APPENDIX D

Photographs

CB-317

Coordinates: N 349718.009, E 225483.799

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 15 feet

Surface Elevation -44.54 feet MLLW

Rock Elevation -49.54 feet MLLW

CB-317

Boring Penetration 15 ft

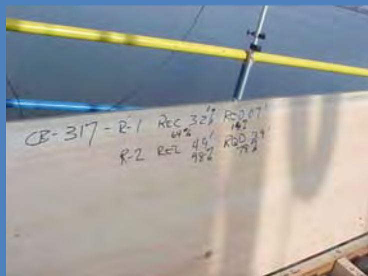
Depths descend from left to right

CB-317

Boring Penetration 15 feet.

R-1 (5-10 ft): Recovery 64% at 3.2 ft, RQD 14% at 0.7 ft

Depths descend from left to right

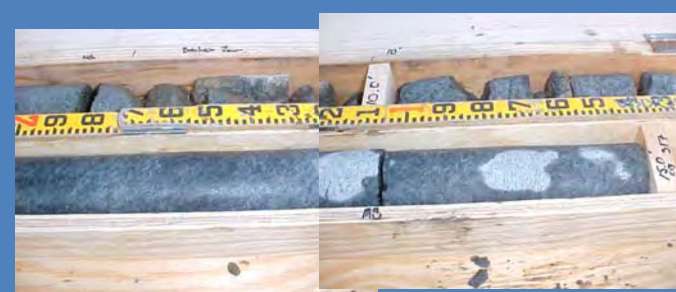


CB-317

Boring Penetration 15 feet

R-2 (10 -15 ft): Recovery 98% at 4.9 ft, RQD 78% at 3.9 ft

Depths descend from left to right



CB-322

Coordinates: N 371128.321, E 259504.316

New Jersey State Plane NAD83, U.S. Survey Feet

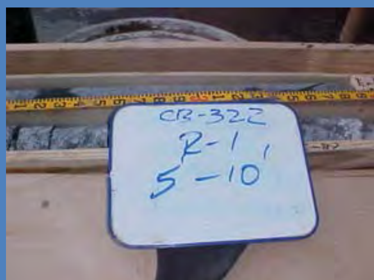
Total Depth 15 feet

Surface Elevation -44.88 feet MLLW

Rock Elevation -49.88 feet MLLW

CB-322

Boring Penetration 15 feet



R-1 (5-10 ft): Recovery 100% at 5 ft, RQD 52% at 2.6ft

Depths descend from left to right

CB-322

Boring Penetration 15 feet

R-2 (10-15 ft): Recovery 92% at 4.6 ft, RQD 80% at 4.0 ft

Depths descend from left to right

CB-324

Coordinates: N 361632.209, E 244474.082

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 6 feet

Surface Elevation -45.77 feet MLLW

Rock Elevation -46.77 feet MLLW

CB-324

Boring Penetration 6 feet

R-1 (1-6 ft): Recovery 100% at 5 ft, RQD 28% at1.4 ft

Depths descend from left to right

CB-331

Coordinates: N 366269.202, E 250754.018

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 9 feet

Surface Elevation -49.03 feet MLLW

Rock Elevation -53.03 feet MLLW

CB-331

Boring Penetration 9 feet.

(no soil samples recovered)

R-1 (4-9 ft): Recovery 88% at 4.4 ft,

RQD 76% at 3.8 ft

Depths descend from left to right

CB-333

Coordinates: N 369835.708, E 255254.754

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 9 feet

Surface Elevation -40.3 feet MLLW

Rock Elevation -41.3 feet MLLW

CB-333

Boring Penetration 9 feet

S-1 (0-0.8 ft) 88% recovery

Depths descend from left to right

Enlargement of 0 to 0.6 feet

CB-333

Boring Penetration 9 feet

R-1 (1-6 ft): 100% recovery, 33% RQD

Depths descend from left to right

CB-333

Boring Penetration 9 feet

R-2 (6-9 ft): Recovery 100%, 62% RQD

Depths descend from left to right

CB-334

Coordinates: N 371229.126, E 258921.279

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 14 feet

Surface Elevation -45.2 feet MLLW

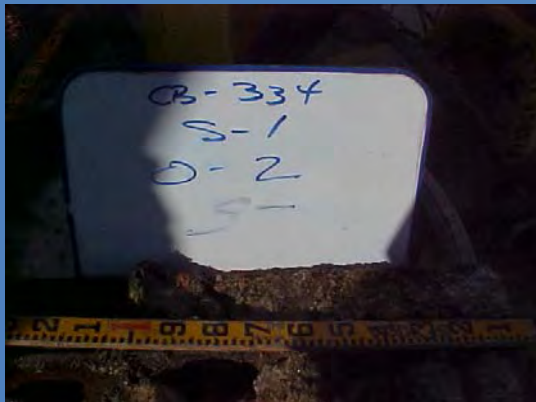
Rock Elevation -54.2 feet MLLW

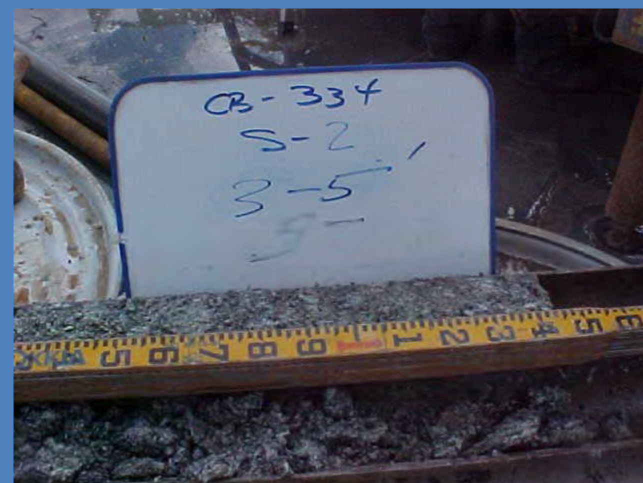
CB-334

Boring Penetration 14 feet

S-1 (0-2 ft) 30% Recovery; S-2 (3-5 ft) 55% Recovery

Depths descend from left to right





Enlarged S-1 Sample

Enlarged S-2 sample of Saprolite

CB-334

Boring Penetration 14 feet

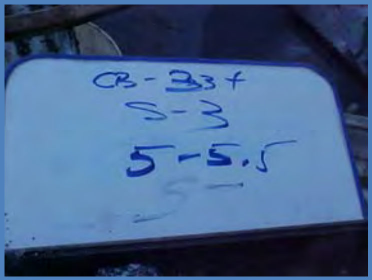
S-3 (5-5.5 ft): Saprolite between 5.5-9 ft

Too soft to drill & too hard to Spoon

Core attempted and Very Poor Recovery

R-1 (9-14 ft): 16% recovery, 0% RQD

Depths descend from left to right



CB-337

Coordinates: N 365830.476, E 250220.093

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 15 feet

Surface Elevation -42.92 feet MLLW

Rock Elevation -43.72 feet MLLW

CB-337

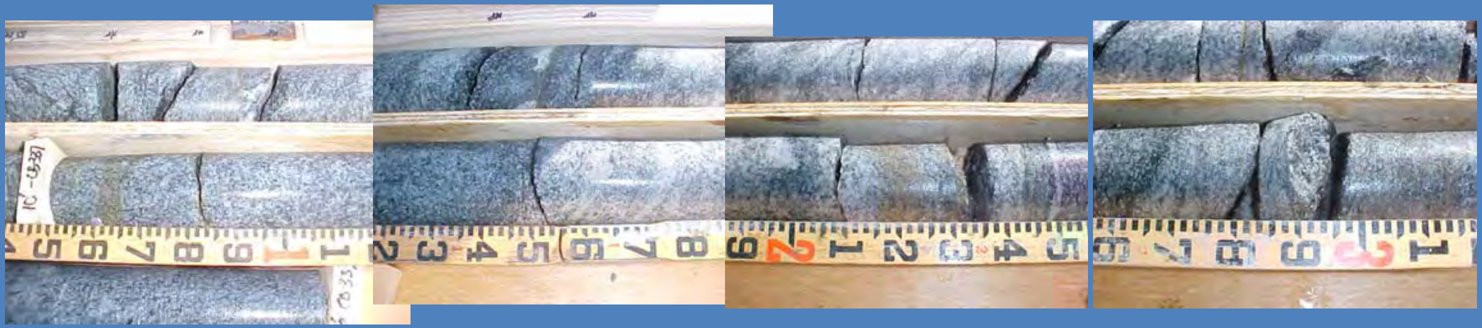
R-1 (0.8 to 5 ft): 100% Recovery, 72% RQD

R-2 (5 -10 ft): 100 % Recovery, 16% RQD

Depths descend from left to right

CB-337

R-3 (10-15 ft): 100% Recovery, 16% RQD



Depths descend from left to right

CB-338

Coordinates: N 365828.422, E 244862.934

New Jersey State Plane NAD83, U.S. Survey Feet

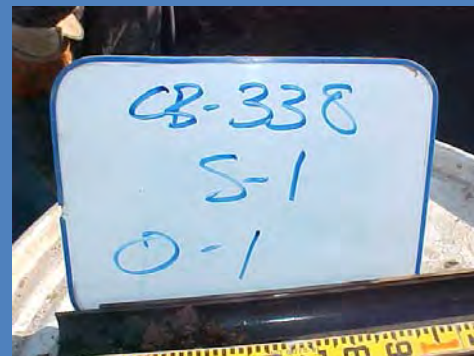
Total Depth 15 feet

Surface Elevation -45.59 feet MLLW

Rock Elevation -46.59 feet MLLW

CB-338
Poor coring Saprolite and very dense 2-5 ft
Depths descend from left to right

S-1 (0-1 ft) 71% Recovery

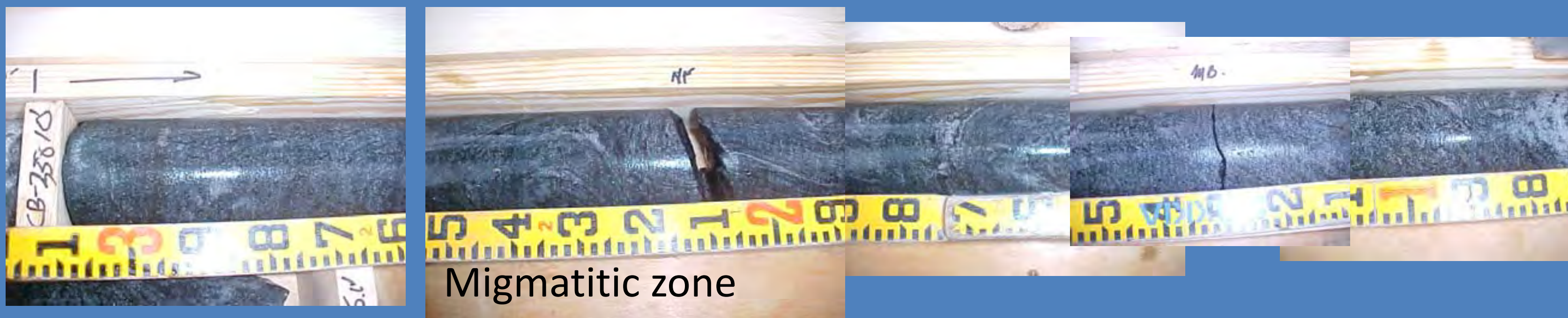


R-1 (1-2 ft): 100% Recovery, 72% RQD

R-2 (5-10 ft): 100% Recovery, 66% RQD. R-2 is bottom core

CB-338

R-3 (10-15 ft): 100% Recovery, 98% RQD



Depths descend from left to right

CB-340

Coordinates: N 348931.782, E 224311.851

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 16 feet

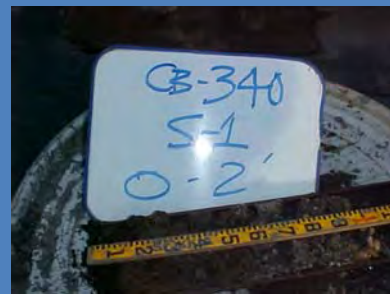
Surface Elevation -43.2 feet MLLW

Rock Elevation -55.7 feet MLLW

CB-340

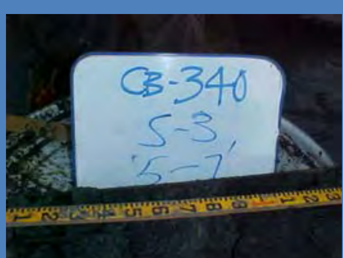
Depths descend from left to right

S-1 (0-2 ft) 50% Recovery



S-2 (3-5 ft) 62.5% Recovery

S-3 (5-7 ft) 90% Recovery, Mafic Gneiss Saprolite



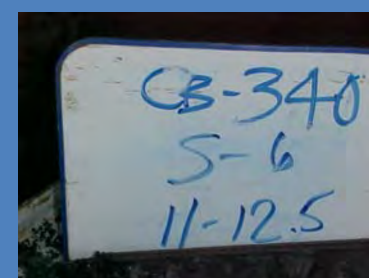
CB-340

Depths descend from left to right

S-4 (7-9 ft) 90% recovery

S-5 (9-10 ft) 20% recovery

Mafic Gneiss Saprolite



S-6 (11-12.5 ft) 60% recovery

CB-343

Coordinates: N 359936.304, E 242127.677

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 15 feet

Surface Elevation -44.99 feet MLLW

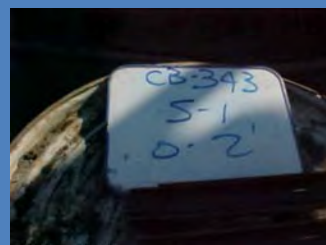
Rock Elevation -49.99 feet MLLW

CB-343

S-1 (0-2 ft) 0% recovery

Depths descend from

left to right



S-2 (3-5 ft) 40% recovery

CB-343

R-1 (5-10 ft): 68% recovery, 54% RQD

Depths descend from left to right

Mafic Gneiss

CB-343

R-2 (10-15 ft): 96% recovery, 74% RQD

Depths descend from left to right

R-2 is the bottom core in each photograph

Mafic Gneiss

CB-344

Coordinates: N 360679.356, E 243927.602

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 16 feet

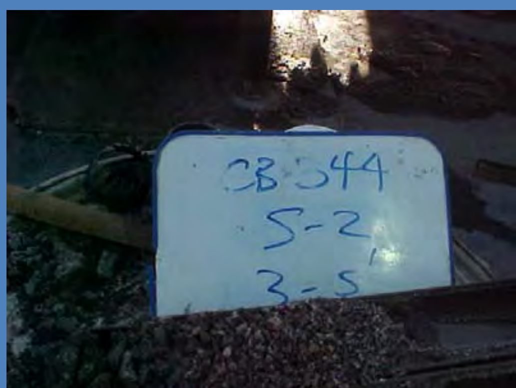
Surface Elevation -46.42 feet MLLW

Rock Elevation -52.42 feet MLLW

CB-344

Depths descend from left to right

S-1 (0-2 ft) 40% recovery



S-2 (3-5 ft) 40% recovery

CB-344

R-1 (6-11 ft): 96% recovery, 66% RQD

Depths descend from left to right

R-1 is bottom core in each photograph

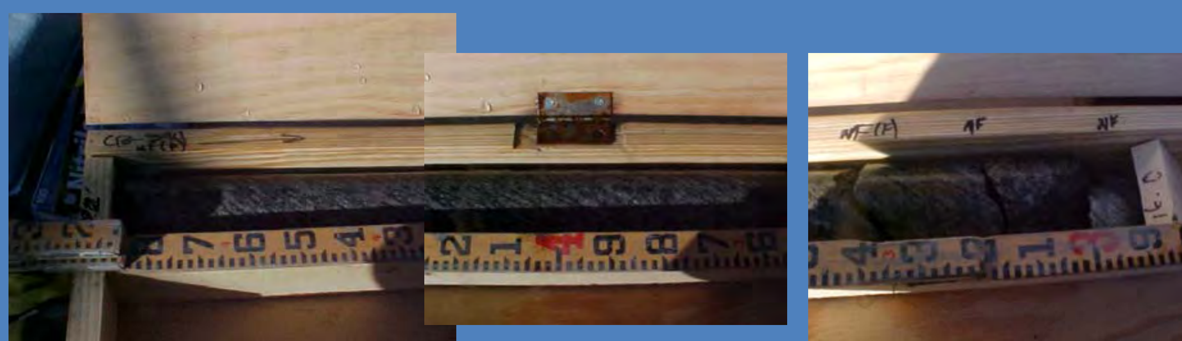
R-1 continued

CB-344

R-2 (11-16 ft): 100% recovery, 72% RQD

Depths descend from left to right

R-2 is bottom core in each photograph



CB-348

Coordinates: N 371156.556, E 258176.725

New Jersey State Plane NAD83, U.S. Survey Feet

Total Depth 13 feet

Surface Elevation -44.1 feet MLLW

Rock Elevation -49.1 feet MLLW

CB-348
Depths descend from left to right

S-1 (0-2 ft) 55% recovery

S-2 (3-4.2 ft) 92% recovery

CB-348

R-1 (5-10 ft): 80% recovery, 0% RQD

Depths descend from left to right

CB-348

R-2 (10-13 ft): 77% recovery, 17% RQD

Depths descend from left to right

Pyrite zone

Pyrite crystals are paralleling the foliation at a depth of 12-12.25 ft

APPENDIX E

Glossary of Terms

Compressive Strength – capacity of material to withstand axially directed pushing forces; calculated by dividing the maximum load by the original cross-sectional area of a sample.

Gneiss – common and widely distributed type of rock formed by high-grade regional metamorphic processes from pre-existing formations originally comprised of igneous or sedimentary rocks.

Liquidity Index – used for scaling the natural water content of a soil sample relative to liquid limit and plastic limit. Calculated as a ratio of difference between natural water content (W), plastic limit (PL), and liquid limit (LL): liquidity index = (W-PL)/(LL-PL).

Liquid Limit - water content at which a soil changes from plastic to liquid behavior.

Mafic –a silicate mineral or rock rich in magnesium and iron that is dark in color. Common mafic rocks include basalt, dolerite and gabbro.

Micaceous – a rock or mineral containing mica.

Plasticity Index - the difference between liquid limit and plastic limit; the range of water contents where a soil sample exhibits plastic properties.

Plastic Limit - defined as the moisture content at which a soil sample will retain its shape (during rolling) to a diameter of 3 millimeters.

Schist – medium-grade metamorphic rocks consisting of minerals such as micas, chlorite, talc, hornblende and graphite.

Splitting Tensile Strength – the method of determining the tensile strength of rock using a cylinder which splits across the vertical diameter. Tensile strength is the maximum strength that a material can withstand while being stretched or pulled before significant contraction occurs.

Unconfined Compressive Strength – the measurement of the shearing resistance of cohesive soils and rocks. Unconfined compressive strength is defined at the compressive strength at which an unconfined cylindrical specimen of soil will fail in a single compression test.

Young's Modulus (Elastic Deformation) - elastic material deforms under stress but returns to its original size and shape when the stress is released; there is no permanent deformation. Some elastic strain, like in a rubber band, can be large, but in rocks it is usually small enough to be considered infinitesimal. In materials science and geology, it is necessary to know the strain and what stress produced it. The two versions are equivalent; the only difference is which side the constant is written on. The constant E is called Young's Modulus. Because strain is dimensionless, Young's Modulus has the units of pressure or stress, i.e. psi or pascals (1 psi = 6895 pascals).

Physical Meaning of Young's Modulus - If strain = 1, stress = E. It follows that Young's Modulus can be considered the theoretical stress it would take to produce 100 percent stretching or compression. In reality, most rocks fracture or flow when deformation exceeds a few percent, that is, at stresses a few percent of Young's Modulus.

The seismic P- and S-wave velocities in rocks are proportional to the square root of E. These values may be helpful when designing a blasting plan for the sections of the channel that may require blasting. For most crystalline rocks, E ranges from 50-150 Gpa, averaging about 100. Using 100 Gpa as an average, and consider one bar (100,000 pa) of stress, the result is $10^5 = 10^{11}$ Strain, or Strain = 10^{-6}. Thus, rocks typically deform elastically by 10^{-6} per bar of stress.

Poisson's ratio is the ratio of transverse contraction strain to longitudinal extension strain in the direction of stretching force. Tensile deformation is considered positive and compressive deformation is considered negative in engineering considerations. Poisson's ratio varies in natural rock from between 0.1 to 0.5. One example of the use Poisson’s ratio is in the analysis of the propagation of an energy wave generated by an earthquake. This wave moves through solid rock and is, therefore, somewhat subjected to rock properties. The speed of propagation, or wave velocity, is dependent upon the Poisson's ratio of the rock. As rock type changes, wave velocity also changes as a function of rock properties.

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