

**Geophysical, Geotechnical and Environmental  
Investigation  
Assunpink Creek Restoration Project  
Trenton, New Jersey**

**Geotechnical Investigation Report**

Prepared for  
**U.S. Army Corps of Engineers  
Philadelphia District**

Under  
**Contract No. W912BU-10-D-0001  
Task Order: 0005**

Project Name  
**Geophysical/Geotechnical/Environmental Investigation  
Assunpink Creek Restoration Project  
Trenton, New Jersey**

January 2011

Prepared by



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**Geophysical, Geotechnical and  
Environmental Investigation  
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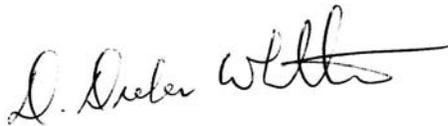
**Geotechnical Investigation Report**

Prepared for:  
US Army Corps of Engineers



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## 1. INTRODUCTION

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This report presents the results of the geotechnical investigation performed for the proposed Assunpink Creek Restoration Project. The site of the proposed creek restoration is within the lot located at the northeastern quadrant of the intersection of South Warren Street and Assunpink Street in Trenton, New Jersey. The project area for this investigation is a 500-foot section of the lower Assunpink Creek in downtown Trenton where the creek is contained within a buried box culvert known as the Broad Street Culvert. The investigation area is situated in an open grassy area adjacent to the State of New Jersey Department of Human Services (DHS) building

The purpose of the geotechnical investigation was to establish a general geotechnical characterization of the site. Specifically, the goals of the investigation were to establish the general soil profile and subsurface conditions across the site, identify potential geotechnical issues that may impact the proposed culvert demolition, creek realignment, and stream bank restoration, and evaluate the general slope stability of an open stream channel with laid-back stream banks.

The geotechnical investigation consisted of performing 9 test pit excavations on the site on September 16 and 17, 2010, examining the encountered soils and materials for engineering classification, and performing limited geotechnical laboratory testing on representative grab samples. The results of field and laboratory testing and recommendations regarding the planning and design of the proposed creek restoration are included in this report.

An environmental investigation was conducted simultaneously with the geotechnical investigation in order to characterize the environmental condition of the site soils. The environmental investigation included collection of grab soil samples from the test pits and chemical analyses of the site soils for parameters such as volatile organic compounds, semi-volatile organic compounds, metals, petroleum hydrocarbons, polychlorinated biphenyls (PCBs), herbicides, pesticides, and hazardous waste characterization analyses. The results of the environmental sample analyses indicate that the site soils at some of the test pit locations on the south side of the culvert have been impacted by contamination. The results of the environmental investigation are documented in our Environmental Investigation Report provided under separate cover.

A geophysical survey was conducted across the site in an effort to identify existing underground utility lines as well as foundations of historical mill structures that were formerly present on-site. The findings of the geophysical survey are presented in the geophysical subcontractor's report in Appendix D. Underground utilities identified during the geophysical survey are depicted on Figure 2.

## 2. SITE DESCRIPTION

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The site is located within the northeastern quadrant of the intersection of South Warren Street and Assunpink Street in downtown Trenton, New Jersey as shown on Figure 1 – Site Location Map. A pile-supported six-story state office building is situated in the northwestern corner of the site. A brick patio is present along the south and east sides of the building. Assunpink Creek, which flows from east to west, traverses the central portion of the site in a large concrete box culvert. The top slab of the western half of the culvert is exposed and a portion of the top slab has collapsed or has been removed. A chain link fence surrounds the site, and access gates are provided at the northeastern and southwestern corners of the site. The site cover beyond the exposed concrete culvert is predominantly grass and weeds. A crushed stone access road extends into the site from each of the gates.

The site topographic mapping indicates that the terrain slopes mildly toward the culvert from both sides of the creek. Average grades range from approximately 4H:1V (horizontal:vertical) to 7H:1V. Surface elevations range from a high at approximately elevation (EL.) 34 at street level in the southeastern corner to a low of approximately EL. 17 at the top of the exposed concrete box culvert near the west end of the site. Grated catch basins convey surface drainage via a pipe stub from the basins to the culvert. The culvert invert elevation ranges from about EL 7.8 to EL 7.0, from upstream to downstream, respectively.

Several underground utility lines including electric, steam, water, and communication lines traverse the site as shown on Figure 2-Test Pit Location Plan. The locations of some of these lines were identified during a Geophysical Utility Survey, as documented and discussed in the Geophysical subcontractor's report in Appendix D. Figure 2 also depicts the location of underground utility lines indicated on the base plan provided by the USACE.

### 3. PROPOSED CONSTRUCTION

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The proposed project was in the conceptual design phase at the time of this report and specific details regarding the creek restoration design have not yet been finalized. In general, the creek restoration concept includes demolition and removal of the box culvert and slight realignment of the creek channel to the south of the existing culvert alignment with a bottom channel width that could range from 25 to 45 feet. The invert of the stream channel would be established at, or slightly below, the current culvert invert elevation. The stream banks would be cut to a stable inclination, or otherwise stabilized by retention structures or slope reinforcement measures.

#### 4. SITE GEOLOGY

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The site is situated in the Piedmont Physiographic Province according to the New Jersey Department of Environmental Protection's i-Map NJ Geology, a web-based GIS application. The Piedmont is characterized by strongly folded and faulted metamorphic rock and residual soils derived from the in-situ decomposition of the parent bedrock. The surficial geologic mapping indicates the site is underlain by Quaternary-age alluvial deposits along the Assunpink Creek alignment. The alluvial deposits are described as sand, gravel, and silt with variable organic content deposited in modern floodplains and channels. Late Wisconsinan glaciofluvial deposits, described as sand, gravel and cobbles with minor silt content, are mapped within the northeastern quadrant of the site. The mapping indicates that the rock is Wissahickon schist and gneiss. The residual soils of the Wissahickon Formation typically consist of micaceous sand and silt, with subordinate percentages of clay. Differential weathering in the Wissahickon is common, and as a result, the rock surface is characterized by irregular profiles. The Wissahickon typically weathers into saprolite of variable thickness, underlain by weathered and then relatively sound (competent) bedrock.

## 5. SUBSURFACE EXPLORATION

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The subsurface conditions at the site were evaluated by excavating 9 test pits, designated as Test Pits TP-1 through TP-9. The test pit locations were initially selected by USACE and field located by O'Brien & Gere. The final test pit locations were surveyed by Taylor Wiseman & Taylor, a NJ Licensed Land Surveyor, and are indicated on Figure 2 – Test Pit Location Plan. The test pits were excavated by O'Brien & Gere Operations, LLC on September 16 and 17, 2010, using a CAT 315 track-mounted excavator. The test pits were excavated to depths ranging from 9 to 17 feet below existing surface grades. Soils excavated from the test pits were visually classified in general accordance with the Unified Soil Classification System (USCS) and a detailed test pit log was prepared for each test pit at the time of excavation. Ground surface elevations indicated on the test pit logs were determined by the surveyor. Laboratory soil classification tests were conducted on representative grab samples to confirm visual classifications, and the visual classifications were corrected accordingly.

During excavation of the test pits, the depth of soil strata changes, groundwater, and other materials/conditions encountered within the test pits were checked periodically using a tape measure. The ground surface elevation referenced on the test pit logs is the datum for depth measurements. In addition, the excavated materials were screened using a photo ionization detector (PID) to detect the presence of volatile gases, an indication of potential soil contamination. The PID readings are presented on the test pit logs. Test pit excavations were terminated due to excessive caving of excavation sidewalls or excavator refusal on bedrock, except at TP-01, TP-02 and TP-03. These three excavations were terminated at or near the depth where elevated photoionization detector (PID) readings/petroleum odors were observed. Following discussion of field observations, USACE directed O'Brien & Gere to terminate these test pits at the depth where field indications of impact were observed. The PID screening was also conducted to support the selection of grab samples for environmental analytical testing. The results of the environmental sampling and analysis are presented in an Environmental Investigation Report provided under separate cover.

The test pits were backfilled upon completion in compacted lifts using the excavator bucket in an effort to reduce the potential for settlement. The surface was rough-graded using the excavator bucket to match surrounding topography.

## 6. SUBSURFACE CONDITIONS

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The general soil profile is interpreted to be the result of predominantly cobble and boulder-sized rock fill placement within the old stream channel overlain by soil fill. In general, the majority of the test pits encountered predominantly granular fill soils consisting of silty sand to silty gravel extending approximately 8 to 10 feet below existing grades. The silt fines were generally non-plastic. The sandy fill materials transitioned into cobbles and boulders in a silty sand matrix in the majority of the test pits excavated along the south side of the culvert. Buried debris such as wood timbers, clay brick fragments, reinforcing bar, ceramic fragments, and some organic matter were mixed within the fill in generally low to moderate concentrations at some of the test pit locations. Small diameter tree limbs/trunks were encountered in Test Pits TP-3 and TP-5. Test Pits TP-8 and TP-9, which were excavated on the north side of the culvert, encountered approximately 7 feet of silty sand and gravel fill underlain by apparent native alluvial deposits consisting of sand and gravel with cobbles and occasional boulders. Excavator refusal on apparent bedrock was encountered in four of the 9 test pits at depths ranging from approximately 11 to 15 feet, corresponding to approximate EL 9 to EL 5.5.

Test Pit TP-7 was excavated adjacent to the southern culvert wall to investigate the presence of a footing below the culvert/culvert wall. An apparent concrete footing, extending approximately 18 inches laterally beyond the exterior wall face, was encountered approximately 12 feet below the ground surface (approx. EL 7.8). The culvert appears to be founded on bedrock, based on excavator refusal at approximately 13.5 feet. Four-inch diameter weep holes were observed on the interior culvert walls, about 2 feet above the culvert invert.

Groundwater measurements were taken during and upon completion of each test pit. The ground surface elevation referenced on the test pit logs is the datum for groundwater depth measurements. Groundwater was encountered in all nine of the test pits at depths ranging from approximately 8 feet (EL 10.5) to 14 feet (EL 11.8) after test pit completion. As the test pits were advanced below the groundwater table, groundwater intrusion into the test pit was rapid and often induced sidewall caving. The groundwater elevation within the fill materials adjacent to the culvert wall appears to be consistent with the elevation of the weep holes in the culvert wall. In addition, the presence of rock fill at depth appears to have resulted in entrapment of a large volume of groundwater within the voids of the rock fill, where present.

Individual Test Pit logs are included in Appendix A.

7. LABORATORY TESTING

Representative grab samples of the excavated soils were collected during test pit excavation and placed in jars for laboratory geotechnical analyses. The samples were delivered to GeoTesting Express, a USACE-validated geotechnical laboratory, in Boxborough, Massachusetts.

The soil samples were tested for moisture content, particle size distribution, and Atterberg limits. The test results were used to confirm the visual soil classifications, which were corrected on the logs as appropriate in accordance with the Unified Soil Classification System (USCS) and ASTM D2487. The laboratory test results are presented in the following table. The laboratory test reports are included in Appendix B.

Table 7.1: Summary of Soil Laboratory Testing

Boring No. Sample No.	Depth (ft)	% Finer # 200 Sieve	LL	PI	USCS Soil Classification	Water Content (%)
TP-1 S-1	2	26.1	NP	NP	Silty SAND (SM)	5.6
TP-1 S-2	3	21.2	NP	NP	Silty SAND with Gravel (SM)	3.5
TP-1 S-3	8	16.2	NP	NP	Silty GRAVEL with Sand (GM)	14
TP-1 S-4	12	20.0	NP	NP	Silty SAND with Gravel (SM)	11.6
TP-2 S-1	2	29.6	NP	NP	Silty SAND with Gravel (SM)	8.3
TP-2 S-2	4	27.1	NP	NP	Silty SAND with Gravel (SM)	15.0
TP-2 S-3	7.5	7.4	NP	NP	Poorly-Graded GRAVEL with Silt and Sand (GP-GM)	13.1
TP-3 S-1	2	30.6	NP	NP	Silty SAND (SM)	14.5
TP-3 S-2	7	12.5	NP	NP	Silty SAND with Gravel (SM)	10.8
TP-4 S-1	2	25.6	NP	NP	Silty SAND (SM)	4.4.
TP-4 S-2	4	12.8	NP	NP	Silty GRAVEL with Sand (GM)	10.8
TP-4 S-3	8	12.5	NP	NP	Silty SAND with Gravel (SM)	20.7
TP-5 S-1	2	38.5	NP	NP	Silty SAND (SM)	8.2
TP-5 S-2	4	19.4	NP	NP	Silty SAND with Gravel (SM)	10.1
TP-5 S-3	7	22.1	NP	NP	Silty SAND with Gravel (SM)	24.8
TP-6 S-1	2	35.7	NP	NP	Silty SAND with Gravel (SM)	4.8
TP-6 S-2	4	10.9	NP	NP	Poorly-Graded SAND with Silt (SP-SM)	7.1

Boring No. Sample No.	Depth (ft)	% Finer # 200 Sieve	LL	PI	USCS Soil Classification	Water Content (%)
TP-6 S-3	7	15.1	NP	NP	Silty SAND with Gravel (SM)	10.5
TP-6 S-4	10	21.0	NP	NP	Silty SAND with Gravel (SM)	14.8
TP-6 S-5	13	13.5	NP	NP	Silty GRAVEL with Sand (GM)	13.7
TP-7 S-1	2	32.1	42	15	Silty SAND with Gravel (SM)	12.0
TP-7 S-2	4	14.0	NP	NP	Silty SAND with Gravel (SM)	6.3
TP-7 S-3	6	22.3	NP	NP	Silty SAND with Gravel (SM)	11.4
TP-7 S-4	8	23.7	NP	NP	Silty SAND with Gravel (SM)	11.6
TP-8 S-1	3	27.6	NP	NP	Silty SAND (SM)	9.0
TP-8 S-2	10.5	4.2	NP	NP	Well-Graded GRAVEL with Sand (GW)	9.2
TP-8 S-3	9	3.3	NP	NP	Poorly-Graded GRAVEL with SAND (GP)	3.0
TP-9 S-1	2	23.6	NP	NP	Silty SAND with Gravel (SM)	6.1
TP-9 S-2	4	44.2	NP	NP	Silty SAND (SM)	13.4

Note: LL: Liquid Limit; PI: Plastic Index; NP: Non-plastic

## 8. CONCLUSIONS

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The proposed creek restoration project is considered to be feasible based on the results of this geotechnical investigation; however, the following geotechnical and environmental issues should be considered during design development. Additional geotechnical and environmental investigations and analyses may be warranted depending upon the final design approach selected for the creek restoration.

- The site soils consist of miscellaneous granular fill containing some deleterious materials, such as organic matter and wood debris, in low to moderate concentrations in some of the test pits. Tree limbs/trunks were encountered at depths of 7 to 8 feet in Test Pits TP-3 and TP-5. Where these materials are exposed during construction of the restored stream bank slopes, they should be removed.
- The site soils and groundwater appear to have been impacted by contamination. Groundwater was encountered at depths ranging from 8 to 14 feet below existing grades. A dewatering system will be needed to control water during culvert demolition and stream bank restoration.
- Temporary shoring of excavations could be required unless excavation side slopes can be cut to 2H:1V or flatter.

These and other geotechnical aspects of the project that should be considered during design development are presented in the following sections. Management of environmental issues as documented in our Environmental Investigation Report will require further planning.

## 9. PRELIMINARY GEOTECHNICAL CONSIDERATIONS

The following preliminary geotechnical considerations are intended to provide project planners and designers with generalized geotechnical information that may influence design development decisions. Additional geotechnical investigation and analysis may be warranted once the stream bank restoration plan has been established in greater detail. O'Brien & Gere should be given the opportunity to review the design at later stages to evaluate the need for additional investigation and analysis.

### 9.1. DEMOLITION OF CULVERT

Demolition of the concrete culvert is expected to require a control of water plan for management of both surface water (creek flow) and groundwater during demolition operations. Temporary diversion or bypass pumping of the creek flow will be required to enable demolition of the culvert in the dry. Dewatering of the soils adjacent to the culvert will be required to manage groundwater. The materials to be dewatered are expected to have a high permeability given the granular fill and natural soils that were encountered below the groundwater in most of the test pits. A series of dewatering wells or sumps will likely be required to drawdown the groundwater table below proposed excavations. Dewatering well installation should be accomplished using methods capable of penetrating obstructions such as cobbles and boulders and bedrock.

We anticipate that the culvert demolition will be accomplished using machine-mounted impact hammers and hand-operated jack hammers to break the concrete into manageable sizes. The culvert concrete is expected to contain significant reinforcing steel, which will make demolition tedious. If desired, the concrete can be crushed and screened on-site and reused as structural fill. It may also be feasible to use the demolished concrete for stream bank scour protection (riprap), if properly sized.

### 9.2. TEMPORARY EXCAVATIONS AND SLOPES

The exterior culvert walls will be exposed by excavating the adjacent backfill in preparation for culvert demolition. The excavations will encounter predominantly silty sands and gravel fill within the upper 8 feet below ground surface. Excavations below the current groundwater table will encounter cobble and boulder-laden fill in a wet silty sand matrix. Excavations will likely encounter some deleterious materials such as buried trees, wood, and organics. Highly permeable granular alluvial soils were encountered below the fill within test pits TP-8 and TP-9 on the north side of the culvert.

The slopes of temporary excavations or trenches should be configured in accordance with applicable OSHA excavation safety regulations. The site soils should be considered Type C soils for determination of maximum allowable temporary slopes, and groundwater should be maintained below the base of excavation/toe of slope to prevent seepage from developing on the slope face or into an open excavation. Where the vertical height of temporary excavation slopes exceeds 20 feet, the slope should be stabilized or configured in accordance with an engineered design.

Where site constraints, such as the existing State office building, prevent the slopes from being cut to 1½H:1V or flatter (for slopes up to 20 feet high), temporary excavation support systems will be required. It is recommended that temporary excavation support systems be designed by a New Jersey-licensed engineer retained by the specialty excavation support contractor. Excavation support systems such as driven sheet piles or driven soldier pile and lagging systems are not recommended given the presence of obstructions within the fill and shallow bedrock, which will prevent adequate penetration of the toe of the sheet or soldier pile. Soldier piles can likely be installed in pre-drilled, cased boreholes. Advancement of the borehole may require the use of a downhole percussion hammer to penetrate large boulders in the fill. Soldier pile systems will likely require bedrock socketing to develop adequate toe support given the presence of bedrock at the bottom of the creek channel. Tied-back excavation support systems may be feasible if tiebacks are anchored into the bedrock. This application will require investigation and testing of the bedrock to establish design bond strengths for the tie backs. Installation of tie backs could be difficult given the presence of obstructions and voids in the existing fill,

which may require permanently cased boreholes or pre-grouting and re-drilling to prevent grout loss around the tieback tendon.

**9.3. PERMANENT STREAM BANK SLOPES**

Given that the desired approach for the creek restoration includes establishment of an open, more natural stream channel, and re-alignment of the creek channel to its original location and width, the restored stream banks must be sloped at a stable inclination. Therefore, slope stability analyses were performed for a proposed typical section shown as Section A on Figure 2. The analyses were performed using the computer program *Slope/W* by GEO-SLOPE International, Ltd., which utilizes the method of slices and an iterative search procedure for locating the critical slip circle for the cross-section. The program utilizes the limit equilibrium theory of forces and moments to solve for the factor of safety of an earth slope. The Morgenstern-Price, Bishop, Ordinary, and Janbu methods of estimating slice forces were used in these analyses. The Factor of Safety results shown in Appendix C are based on the Morgenstern-Price method, which was selected because it satisfies the statics of both force and moment equilibrium in the method, while the other methods satisfy either force or moment equilibrium.

The cross-sectional geometry and soil strata are defined in the slope stability model along with soil strength and unit weight parameters for the individual soil strata as shown in Appendix C. Various methods are available for determining strength parameters including laboratory test results, in-situ testing, prior experience, and published information for similar soil types. The coarse-grained soils encountered in the test pits were considered to be relatively free-draining materials, are not easily tested in the laboratory, and were generally assigned strength parameters based on conservative published correlations with loose relative density and soil grain size. The soil parameters used in the slope stability analyses are provided in the table below:

Model Region No.	Stratum Represented	Unit Weight (pcf)	Friction Angle, °	Cohesion, c (psf)
1	Existing Fill: Silty SAND	120	31	0
2	Existing Fill: Silty GRAVEL	130	33	0
3	Bedrock	Not subject to slip plane penetration		

The configuration, loading, and geometry of the proposed slope are shown on the slope stability models in Appendix C. The analysis considered a 2H:1V slope with a crest at EL 28 and toe at EL 6, which is approximately the top of bedrock elevation and the base elevation of the existing culvert. A 200 psf (pounds per square foot) surcharge was applied at the top of the slope to represent vehicular traffic on the perimeter roads. The groundwater table was modeled based on the groundwater level observations in the test pits.

The results of the slope stability analysis indicates a factor of safety of approximately 1.4 for an excavated slope configured at 2H:1V. Considering that some form of stream bank armoring will be required to protect the slope from hydraulic forces, the slope was also analyzed with the same conditions as above with the addition of a small berm of riprap at the toe. The analysis indicates that the berm will improve the factor of safety to about 1.5.

In consideration of potential seepage developing on the slope face during construction, the stability of the 2H:1V slope with groundwater seepage emerging at the slope face at approximately EL 14 was analyzed. The analysis indicates that the seepage condition will reduce the factor of safety to 1.1. The Slope/W results for each of the three cases discussed above are presented in Appendix C.

It is recommended that permanent stream bank slopes be established at a maximum inclination of 2H:1V based on the results of the slope stability analysis. Where 2H:1V slopes cannot be accommodated due to site constraints, the use of engineered stabilization measures, such as reinforced slopes or structural toe walls, could

be considered. Where deleterious materials such as high concentrations of organics, wood, trees, etc. are encountered during slope construction, these materials should be removed and replaced with compacted structural fill. In addition, the potential exists for fine-grained fill soils to ravel into possible voids in the underlying cobble and boulder-laden fill. Fine-grained soils within the cobble/boulder fill may also migrate into the creek with creek level fluctuations. This potential for migration of soil fines may lead to ground loss or sinkhole formation on the slope. As such, it is recommended that a toe berm or outer slope shell constructed of free-draining soils graded to filter fine-grained soils and prevent their migration be placed against the face of the slope. The upper portions of the stream bank not subject to stream flow should be vegetated for erosion control.

It is recommended that permanent stream bank slopes be flattened as much as feasible to fit the site constraints, considering pedestrian use of the site and reduced potential for erosion problems. The incorporation of intermediate horizontal benches in the slope or tiered retaining walls could also be considered. The creek hydrology must also be considered in the design of any stream bank restoration project, as hydraulic forces can be significant.

#### 9.4. SITE EARTHWORK

Slope reconstruction, retaining wall construction, or other stream bank restoration alternatives may require placement of new fill to establish the desired slope configuration or proposed grades. Prior to placement of structural fill, the area to receive structural fill should be stripped of all vegetation, organic soils, and other deleterious materials or debris. The prepared subgrade should be observed by the geotechnical engineer prior to fill placement to confirm that the subgrade has been properly stripped and is sufficiently stable to receive structural fill. This observation may involve hand probing of the surface soils or proofrolling with a heavy roller or loaded dump truck, as practical depending on the site conditions at the time of construction. New fill placed on slopes should be keyed into existing soils and should be placed and compacted in thin, horizontal lifts compacted.

The on-site handling of contaminated soils, including their excavation and use as structural fill, may be ultimately dictated by environmental regulations. From The existing granular site soils, minus any deleterious material, meeting USCS classifications of SP, SW, SM, GP, GW, and GM, should be suitable for re-use as structural fill. Based on the results of the soil moisture content determination, the soils within the upper 4 to 5 feet should be within the working range of the optimum moisture for compaction. Deeper soils may require drying prior to compaction to bring the soil moisture within the working range of optimum for compaction. In general, maximum particle size for compacted structural fill should be limited to 6-inches. The deeper cobble and boulder fill is not considered suitable for compacted structural fill due to the large particle size. This material could potentially be used within the stream channel or to supplement bank armoring measures.

Imported material for structural fill should be low plasticity, granular soils meeting the USCS classifications of SP, SW, SM, GP, GW, and GM. Imported soil types other than those listed above should be considered unsuitable for use as structural fill.

#### 9.5. LATERAL EARTH PRESSURE

The stream restoration project may necessitate the use of retaining structures. Retaining walls should be designed for the lateral earth pressure imposed by the retained soils and any surcharge loads applied behind the wall. For the granular soils encountered on-site meeting USCS classifications of SP, SW, SM, GP, GW, and GM, and compacted in accordance with the recommendations above, it is recommended that active lateral earth pressures be computed based on an active earth pressure coefficient,  $K_a$ , of 0.33 for walls that will allow some minor translation at the top. For braced or rigid walls, the lateral earth pressure should be computed based on the at-rest earth pressure coefficient of 0.5. A passive earth pressure coefficient,  $K_p$ , of 3 may be used to compute passive earth pressures. An estimated unit weight of 120 pounds per cubic foot is recommended for the soil types listed above. These lateral earth pressure parameters can be applied as equivalent fluid pressure (EFP) by multiplying the appropriate earth pressure coefficient by the unit weight,  $\gamma$ . For example, the equivalent fluid pressure for the active earth pressure case would be  $EFP = K_a \times \gamma = 40$  pounds per square foot (psf). The above recommendations for lateral earth pressure parameters assume that the retaining wall backfill

is drained and the backfill is level. Inclined backfill slopes will result in a higher active earth pressure coefficient. For inclined backfill slopes at 2H:1V, we recommend an active earth pressure coefficient of 0.55.

Dewatering of the site will likely be required during construction of any retaining structure below the groundwater table. Retaining walls should be designed with adequate drainage to prevent the buildup of hydrostatic pressure from groundwater or infiltrating stormwater behind the wall.

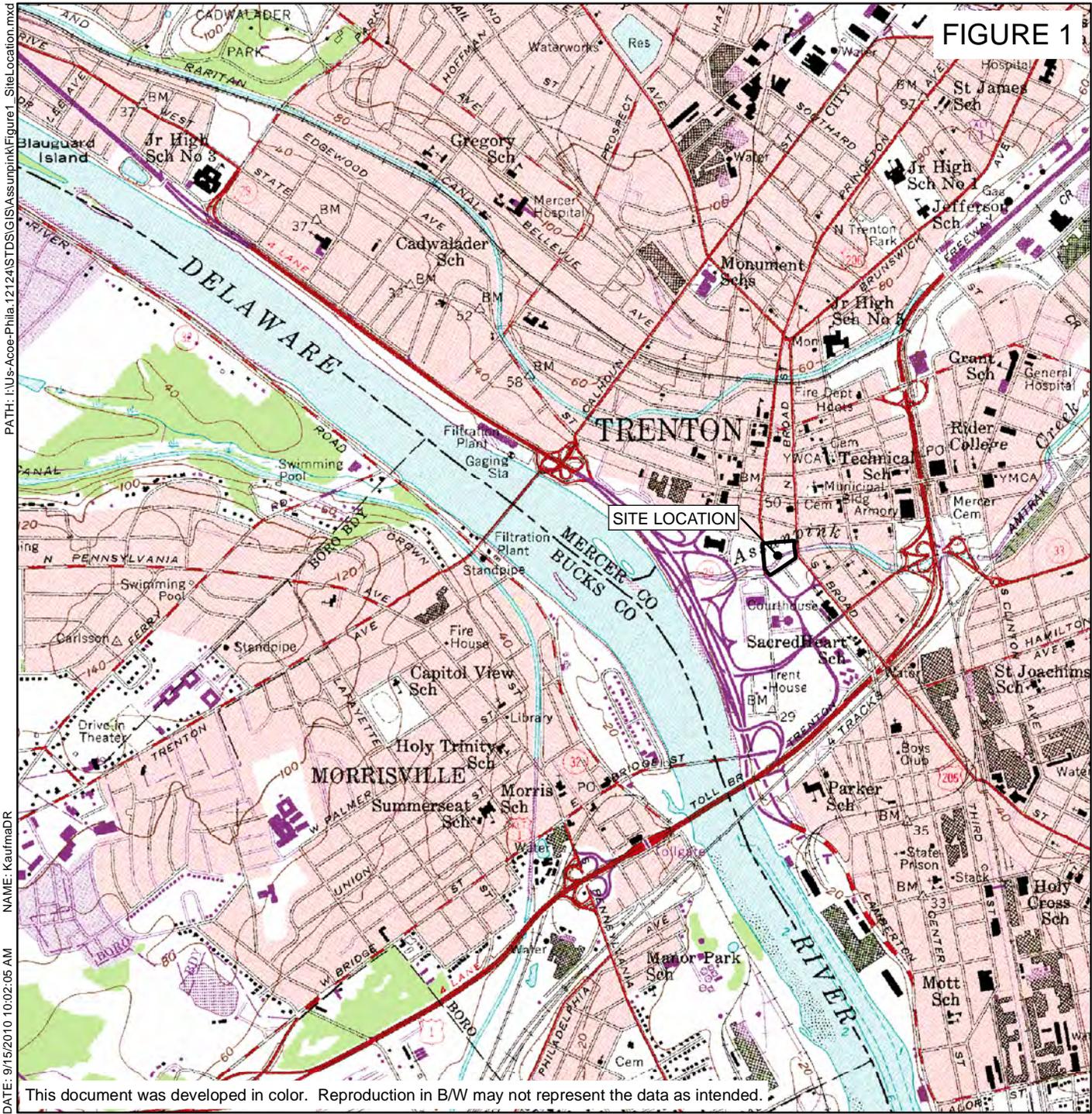
## 10. LIMITATIONS

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The analyses and recommendations contained in this report should be considered preliminary given that the specific design details of the project have not been finalized. In addition, the preliminary analyses and recommendations contained in this report are based on the data obtained from the test pits and our understanding of the proposed project. The test pits indicate soil and groundwater conditions only at specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between the test pit locations.

O'Brien & Gere should be given the opportunity to review the final creek restoration design to evaluate the need for additional geotechnical investigation and analysis and confirm that the design is consistent with our assumptions presented herein.



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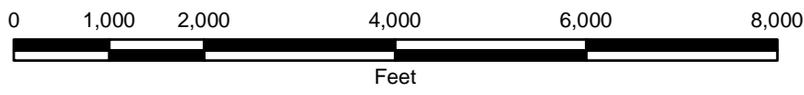
**FIGURE 1**

ADAPTED FROM: TRENTON WEST, NEW JERSEY USGS QUADRANGLE

**US ARMY CORPS OF ENGINEERS  
 ASSUNPINK CREEK RESTORATION  
 TRENTON, NEW JERSEY**



**SITE LOCATION**





# **APPENDIX A**

## **Test Pit Logs**



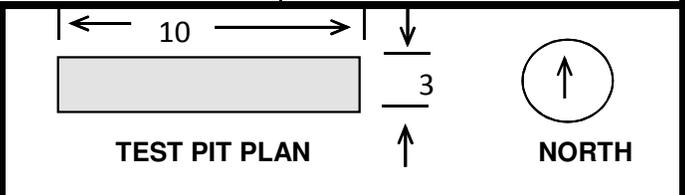
# TEST PIT LOG

TEST PIT NO. 01

PROJECT:	Assumpink Creek Restoration Project	JOB NO.:	46661
CLIENT:	USACE North Atlantic Division; Philadelphia District	GROUND ELEV.:	24.939 ft
CONTRACTOR:	O'Brien & Gere Operations, LLC	Location:	N 504226.315 E 417974.036
EQUIPMENT:	Cat 315 Trackhoe	DATUM:	NAVD 88 / NAD 83
OPERATOR:	Drew Baldwin	GROUND WATER DEPTH:	14'
INSPECTOR:	Stephen Scott	TIME STARTED:	1045
		DATE STARTED:	9/17/10
No. of Disturbed Samples:	7	TIME FINISHED:	1145
		DATE FINISHED:	9/17/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS
5	S-1	0.0	FILL: SILTY SAND (SM): m. brown, moist, dense, Silty SAND, some f-c gravel; Contains few cobbles, trace brick and concrete fragments	
		0.0	FILL: SILTY SAND with GRAVEL (SM): orange/brown, moist, m. dense f-c SAND with few f- gravel and some silt fines; Contains cobbles, brick and concrete fragments, occasional boulders	
	S-2	0.0	FILL: SILTY GRAVEL with SAND (GM): m. brown, moist, m. dense, f-c GRAVEL with some f-c sand, little silt fines; Contains cobbles, brick, and concrete. 1.5' x 1.5' x 1' sized concrete pieces with 1/2" diameter rebar; several 10' long, 1/2" to 1" diameter rebar	
		0.0	Rebar absent below 8'	
10	S-3	0.0		
		0.0		
		0.0		
15	S-4	0.0	FILL: SILTY SAND (SM): brown, moist, m. dense, Silty SAND with gravel; Contains brick and concrete fragments, cobbles and angular boulders	
		0.0		
		0.0		
		26.9	Test Pit terminated at 14' due to fuel oil odor, sheen on groundwater, and 26.9 ppm reading on PID at 14'	Sample collected at 12' for environmental analysis. Composite sample collected from 0-13.5' for environmental analysis. ▼ Groundwater entering test pit at 14'. Sample collected at 14' for environmental analysis.

**TEST PIT LOCATION AND NOTES:**

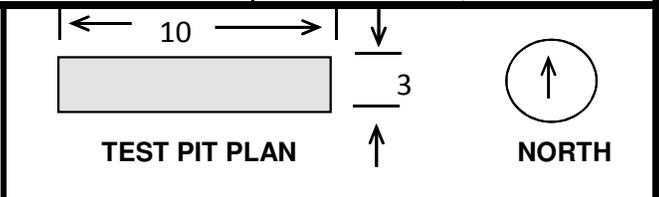




PROJECT:	Assunpink Creek Restoration Project	JOB NO.:	46661
CLIENT:	USACE North Atlantic Division; Philadelphia District	GROUND ELEV.:	22.176 ft
CONTRACTOR:	O'Brien & Gere Operations, LLC	Location:	N 504277.564 E 418048.884
EQUIPMENT:	Cat 315 Trackhoe	DATUM:	NAVD 88 / NAD 83
OPERATOR:	Drew Baldwin	GROUND WATER DEPTH:	11'
INSPECTOR:	Stephen Scott	TIME STARTED:	845
		DATE STARTED:	9/17/10
No. of Disturbed Samples:	6	TIME FINISHED:	930
		DATE FINISHED:	9/17/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS	
2	S-1	0.0	FILL: SILTY GRAVEL with SAND (GM): gray, moist, dense graded aggregate		
		0.0	FILL: SILTY SAND with GRAVEL (SM): dark brown, moist, m. dense Silty SAND with some f-c gravel		
4	S-2	0.0			
		0.0	FILL: SILTY SAND with GRAVEL (SM): grayish brown, moist, dense, Silty SAND with little f-c gravel; Contains cobbles, brick fragments, ceramic fragments		
6		0.0			
		0.0			
8	S-3	0.0	FILL: Poorly-graded GRAVEL with SILT and SAND (GP-GM): brown, moist, m. dense, poorly-graded GRAVEL with few silt and some sand; Contains cobbles, occasional boulders, brick fragments, and ceramics		Sample collected at 7' for environmental analysis.
		20.6			Sidewalls caving below 8.5'
10		0.0			Composite sample collected from 2-10.5' for environmental analysis
		18.9	Test Pit terminated at 11.5' due to fuel oil odor, floating product on groundwater, and a 20.6 ppm PID reading		▼Groundwater entering test pit at 11'; Sample collected at 11' for environmental analysis.

**TEST PIT LOCATION AND NOTES:**  
 Thin layer of black LNAPL observed on groundwater. Product is not continuous layer on the surface of groundwater, but rather sporadic globs. The LNAPL has a viscosity greater than water.

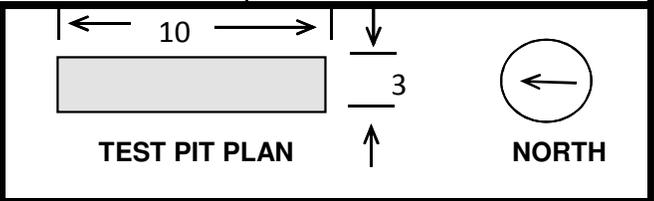




PROJECT:	Assunpink Creek Restoration Project	JOB NO.:	46661
CLIENT:	USACE North Atlantic Division; Philadelphia District	GROUND ELEV.:	21.248 ft
CONTRACTOR:	O'Brien & Gere Operations, LLC	Location:	N 504301.228 E 418101.025
EQUIPMENT:	Cat 315 Trackhoe	DATUM:	NAVD 88 / NAD 83
OPERATOR:	Drew Baldwin	GROUND WATER DEPTH:	8'
INSPECTOR:	Dreher Whetstone	TIME STARTED:	1630
		DATE STARTED:	9/16/10
No. of Disturbed Samples:	3	TIME FINISHED:	1700
		DATE FINISHED:	9/16/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS
2	S-1	0.0	FILL: SILTY GRAVEL with SAND (GM): gray, dry, dense graded aggregate	▼ Groundwater entering test pit at 8'. Trapped water below 8', filling hole; Sidewalls caving below 8' depth. Sample collected at 8' for environmental analysis.
		0.0	FILL: SILTY SAND (SM): dark brown, moist, m. dense, f-c SAND, some silt, trace gravel	
		0.0	FILL: SILTY SAND with GRAVEL (SM): tan/orange, moist, dense, f-c SAND, little silt, some f-c gravel; Contains brick fragments, little wood, few cobbles	
		0.0	FILL: SILTY SAND with GRAVEL (SM): brown, gray, moist, dense, f-c SAND with some gravel, little silt; Contains some cobbles, few small boulders some brick fragments	
6	S-2	0.0		
		0.0		
		0.0		
		0.0		
8		0.0		
		1.0	FILL: Cobbles and Boulders with wet Silty SAND matrix; Contains brick and small tree trunks. Sheen on groundwater and fuel oil odor.	
		1.0		
		1.0		
10		1.0		
		1.0		
12		0.0		
		0.0	Test Pit terminated at 12'.	

**TEST PIT LOCATION AND NOTES:**  
 A portion of TP-03 (8') and TP-04 (13') were composited for environmental analysis.

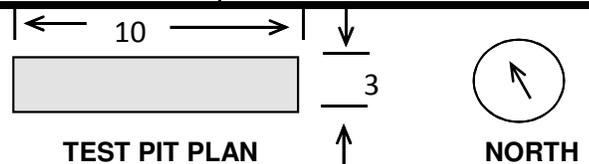


PROJECT:	Assunpink Creek Restoration Project	JOB NO.:	46661
CLIENT:	USACE North Atlantic Division; Philadelphia District	GROUND ELEV.:	20.489 ft
CONTRACTOR:	O'Brien & Gere Operations, LLC	Location:	N 504341.941 E 418106.224
EQUIPMENT:	Cat 315 Trackhoe	DATUM:	NAVD 88 / NAD 83
OPERATOR:	Drew Baldwin	GROUND WATER DEPTH:	8'
INSPECTOR:	Dreher Whetstone	TIME STARTED:	NR
		DATE STARTED:	9/16/10
No. of Disturbed Samples:	4	TIME FINISHED:	NR
		DATE FINISHED:	9/16/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS
5	S-1	0.0	FILL: SILTY SAND (SM): tan, orange, moist, dense, f- SAND, little silt, few f-c gravel and cobbles	Sidewalls relatively stable to 10'
		0.0		
		0.0		
5	S-2	0.0	FILL: SILTY GRAVEL with SAND (GM): dark gray, brown, moist, m. dense, f-c GRAVEL with some f-c sand, few silt fines; Contains cobbles and moderate concentration of bricks	▼ Groundwater entering test pit at 8'.
		0.0		
		0.0		
10	S-3	0.0	FILL: SILTY SAND with GRAVEL (SM): dark brown, moist, f-c SAND, some f-c gravel, little silt fines	Sample collected at 13' for environmental analysis.
		0.0	FILL: SILTY SAND (SM): black, wet, loose, Silty SAND with organics and roots	
		0.0	ROCK FILL: brown, black, wet, loose, mostly COBBLES with Silty SAND; Contains wood debris and brick fragments	
15		0.0	BEDROCK Test Pit terminated at 15'.	

**TEST PIT LOCATION AND NOTES:**

A portion of TP-03 (8') and TP-04 (13') were composited for environmental analysis.



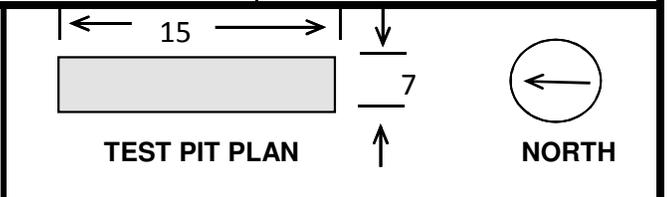




PROJECT:	Assunpink Creek Restoration Project	JOB NO.:	46661
CLIENT:	USACE North Atlantic Division; Philadelphia District	GROUND ELEV.:	25.869 ft
CONTRACTOR:	O'Brien & Gere Operations, LLC	Location:	N 504377.549 E 418213.284
EQUIPMENT:	Cat 315 Trackhoe	DATUM:	NAVD 88 / NAD 83
OPERATOR:	Drew Baldwin	GROUND WATER DEPTH:	14'
INSPECTOR:	Dreher Whetstone	TIME STARTED:	1130
		DATE STARTED:	9/16/10
No. of Disturbed Samples:	5	TIME FINISHED:	1220
		DATE FINISHED:	9/16/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS	
3	S-1	0.0	FILL: SILTY SAND with GRAVEL (SM): brown, orange, gray, moist, f-c SAND with little f-gravel and trace cobbles; Contains trace concrete and brick fragments	Datum for depth measurements is at ground surface elevation referenced above, at upper end of test pit.	
	S-2	0.0	FILL: Poorly-graded SAND with SILT (SP-SM): orange, moist, poorly-graded f-c SAND with few silt fines and trace f-gravel		
6	S-3	0.0	FILL: SILTY SAND with GRAVEL (SM): brown, gray, moist, f-c SAND with few f- gravel, little silt fines; Contains bricks, cobbles, and trace glass; Occasional boulders		Sample collected at 7' for environmental analysis.
9	S-4	0.0	ROCK FILL: wet, cobbles and boulders with Silty SAND with GRAVEL; Contains block stones of variable sizes		4" x 4" wood timber at north end of test pit.
12	S-5	0.0	ROCK FILL: wet, cobbles and boulders with Silty SAND with GRAVEL		▼Groundwater entering test pit at 14'. Water trapped in rock fill.
15		0.0			
18		0.0	Test Pit terminated at 17'		

**TEST PIT LOCATION AND NOTES:**  
A portion of TP-06 (7') and TP-07 (0-13.5') were composited for environmental analysis.

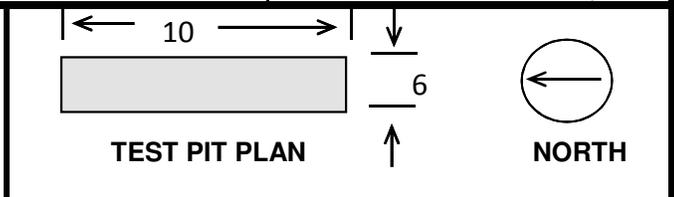




PROJECT:	Assunpink Creek Restoration Project	JOB NO.:	46661
CLIENT:	USACE North Atlantic Division; Philadelphia District	GROUND ELEV.:	19.804 ft
CONTRACTOR:	O'Brien & Gere Operations, LLC	Location:	N 504448.14 E 418261.479
EQUIPMENT:	Cat 315 Trackhoe	DATUM:	NAVD 88 / NAD 83
OPERATOR:	Drew Baldwin	GROUND WATER DEPTH:	8'
INSPECTOR:	Stephen Scott	TIME STARTED:	915
		DATE STARTED:	9/16/10
No. of Disturbed Samples:	6	TIME FINISHED:	1055
		DATE FINISHED:	9/16/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS
5	S-1	0.0	FILL: SILTY SAND with GRAVEL (SM): brown, light tan, moist, f-c SAND with little f- gravel, some silt fines, few 4-6" cobbles; Contains brick fragments and sub-rounded gravel	Top of culvert wall at 18" below surface.
		0.0	... With few 12-16" boulders ... 2" cast iron/steel pipe found at 3.5' (abandoned or debris)	
5	S-2	0.0	FILL: SILTY SAND with GRAVEL (SM): reddish orange, moist, f-c SAND with some rounded f-gravel, little silt fines; Contains trace brick fragments and few 4-6" rounded cobbles	▼Groundwater entering test pit at 8'. Water trapped in rock fill. Heavy groundwater flow from nest of boulders or old pipe.
	S-3	0.0	Large 24" boulder observed at 6-8'	
10	S-4	0.0	Same as above, except wet	4" core hole in wall of culvert (weep hole)
		0.0	Nest of cobbles and boulders observed at 9-10'	
15		0.0	FILL: SILTY GRAVEL (GM): brown, wet, f-c GRAVEL with some sand and cobbles, few boulders, little silt Concrete culvert footing (18" wide) observed at 12'	Sample collected at 13.5' for environmental analysis. Composite sample collected from 0-13.5' for environmental analysis.
		0.0	BEDROCK: Bedrock encountered at 13.5' Test Pit terminated at 13.5' at bedrock	

**TEST PIT LOCATION AND NOTES:**  
A portion of TP-06 (7') and TP-07 (0-13.5') were composited for environmental analysis.

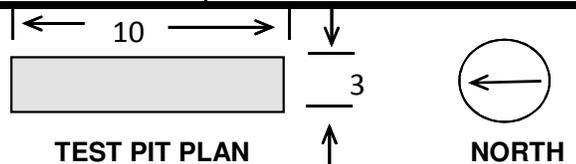


<b>PROJECT:</b> Assunpink Creek Restoration Project	<b>JOB NO.:</b> 46661
<b>CLIENT:</b> USACE North Atlantic Division; Philadelphia District	<b>GROUND ELEV.:</b> 19.909 ft
<b>CONTRACTOR:</b> O'Brien & Gere Operations, LLC	<b>Location:</b> N 504521.807 E 418247.684
<b>EQUIPMENT:</b> Cat 315 Trackhoe	<b>DATUM:</b> NAVD 88 / NAD 83
<b>OPERATOR:</b> Drew Baldwin	<b>GROUND WATER DEPTH:</b> 8'
<b>INSPECTOR:</b> Stephen Scott	<b>TIME STARTED:</b> 1415
	<b>DATE STARTED:</b> 9/17/10
<b>No. of Disturbed Samples:</b> 5	<b>TIME FINISHED:</b> 1500
	<b>DATE FINISHED:</b> 9/17/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS
		0.0	FILL: SILTY SAND with GRAVEL (SM): light brown, dry, m. dense, Silty SAND with gravel	
2		0.0		
	S-1	0.0	FILL: SILTY SAND with GRAVEL (SM): medium brown, moist, m. dense, f-c SAND with some silt, few f-gravel, and cobbles; Contains concrete, bricks, and occasional boulder	
4		0.0		Sample collected at 4' for environmental analysis.
		0.0		
6		0.0		Sidewalls collapsing below 6'.
		0.0		
8		0.0	SILTY SAND with GRAVEL (SM): brown, moist, m. dense to loose, Silty f-c SAND with f-c gravel; Contains rounded cobbles, boulders, appears native	▼ Groundwater entering test pit at 8'.
	S-3	0.0		
10		0.0	Poorly-graded GRAVEL with SAND (GP): dark brown, moist, poorly-graded GRAVEL with sand.	
	S-2	0.0		
		0.0	Well-graded GRAVEL with SAND (GW): brown, moist, well-graded GRAVEL with SAND	Composite sample collected from 0-11' for environmental analysis.
12		0.0	Test Pit terminated at 11'; Bedrock refusal	

**TEST PIT LOCATION AND NOTES:**

A portion of TP-08 (0-11') and TP-09 (0-9') were composited for environmental analysis.

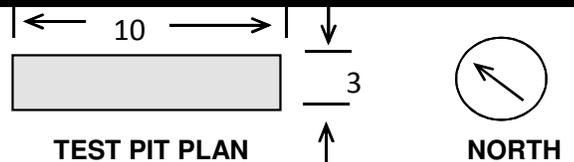


<b>PROJECT:</b> Assunpink Creek Restoration Project	<b>JOB NO.:</b> 46661
<b>CLIENT:</b> USACE North Atlantic Division; Philadelphia District	<b>GROUND ELEV.:</b> 21.556 ft
<b>CONTRACTOR:</b> O'Brien & Gere Operations, LLC	<b>Location:</b> N 504505.524 E 418173.118
<b>EQUIPMENT:</b> Cat 315 Trackhoe	<b>DATUM:</b> NAVD 88 / NAD 83
<b>OPERATOR:</b> Drew Baldwin	<b>GROUND WATER DEPTH:</b> 8'
<b>INSPECTOR:</b> Stephen Scott	<b>TIME STARTED:</b> 1320
	<b>DATE STARTED:</b> 9/17/10
<b>No. of Disturbed Samples:</b> 4	<b>TIME FINISHED:</b> 1355
	<b>DATE FINISHED:</b> 9/17/10

Depth Ft.	Geotech Sample #	PID Readings (ppm)	GEOLOGIC DESCRIPTION	REMARKS
2	S-1	0.0	FILL: SILTY SAND with GRAVEL (SM): light brown, dry, m. dense, Silty SAND with gravel	
4	S-2	0.0	FILL: SILTY SAND with GRAVEL (SM): medium brown, moist, m. dense, f-c SAND with little f-gravel, cobbles, and little silt fines; Contains concrete, bricks, and occasional boulders	
6		0.0	FILL: SILTY SAND (SM): dark brown, moist, f-c SAND, some silt fines, trace gravel	
8		0.0	SILTY SAND with GRAVEL (SM): brown, moist, m. dense to loose, Silty f-c SAND with f-c gravel; Contains rounded cobbles, boulders, appears native	Sample collected at 7' for environmental analysis; Sidewalls collapsing below 7'
10		0.0	Test Pit terminated at 9'. Sidewalls continuously collapsing, cannot achieve greater depth.	▼ Groundwater entering test pit at 8'. Composite sample collected from 0-9' for environmental analysis.
12		0.0		

**TEST PIT LOCATION AND NOTES:**

A portion of TP-08 (0-11') and TP-09 (0-9') were composited for environmental analysis.



## **APPENDIX B**

### **Laboratory Testing**



1145 Massachusetts Avenue  
Boxborough, MA 01719  
978 635 0424 Tel  
978 635 0266 Fax

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## **Geotechnical Test Report**

**10/6/2010**

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# **GTX-10261**

## **Assunpink Creek Restoration**

**Trenton, NJ**

**Client Project No.: 46661**

Prepared for:

**O'Brien & Gere Engineers**

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Client:	O'Brien & Gere Engineers		Project No:	GTX-10261
Project:	Assunpink Creek Restoration			
Location:	Trenton, NJ		Sample Type:	---
Boring ID:	---	Tested By:	jrl	
Sample ID:	---	Test Date:	10/06/10	Checked By: jdt
Depth :	---	Sample Id:	---	

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content,%
TP-1	#1	2 ft	Moist, brown silty sand	5.6
TP-1	#2	2 ft	Moist, dark brown silty sand with gravel	3.5
TP-1	#3	8 ft	Moist, dark brown silty gravel with sand	14
TP-1	#4	12 ft	Moist, brown silty sand with gravel	11.6

Notes: Temperature of Drying : 110° Celsius



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261
Project:	Assunpink Creek Restoration		Tested By:	cam
Location:	Trenton, NJ		Checked By:	jdt
Boring ID:	---	Sample Type:	---	
Sample ID:	---	Test Date:	10/06/10	
Depth :	---	Test Id:	191807	

**USCS Classification - ASTM D 2487-06**

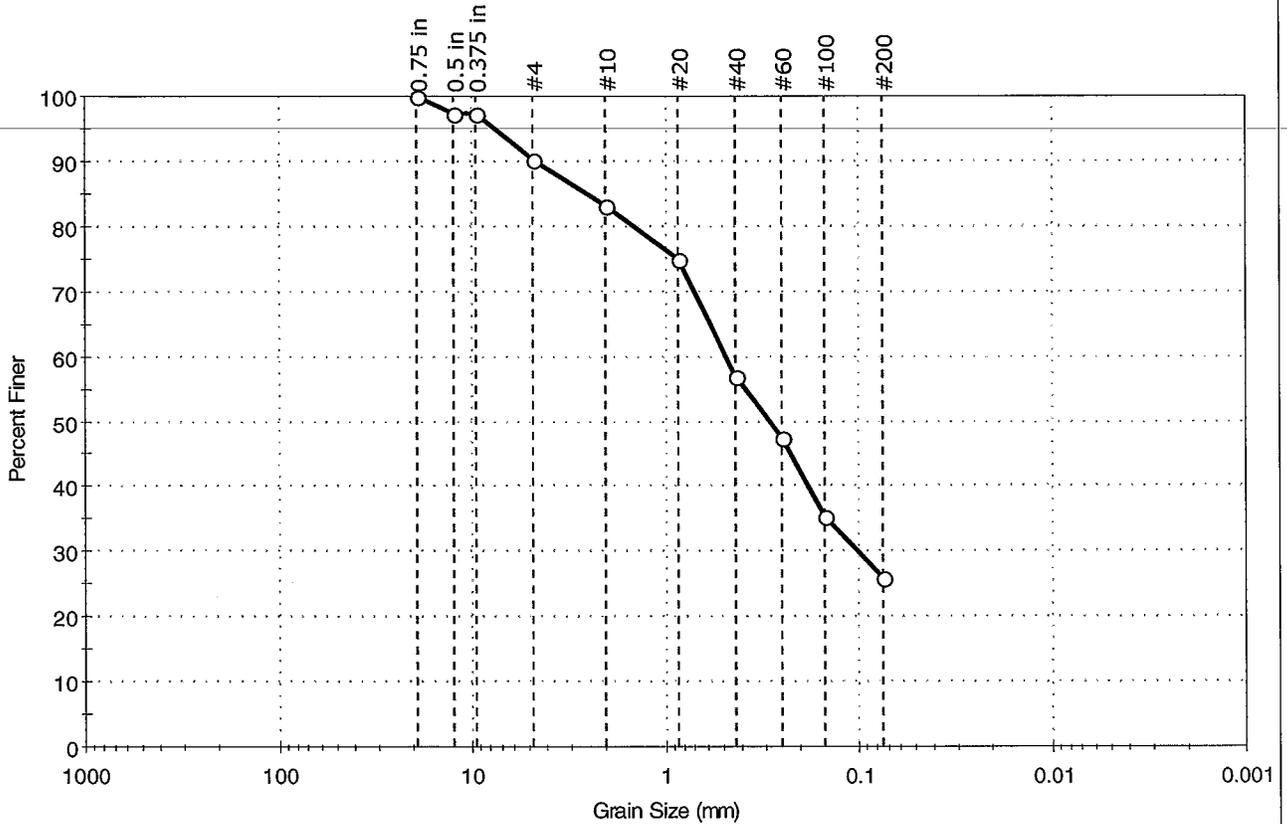
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-1	#1	2 ft	Silty sand	SM	9.7	64.2	26.1
TP-1	#2	2 ft	Silty sand with gravel	SM	37.4	41.4	21.2
TP-1	#3	8 ft	Silty gravel with sand	GM	48.0	35.8	16.2
TP-1	#4	12 ft	Silty sand with gravel	SM	22.4	57.6	20.0

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Location: Trenton, NJ	Project No: GTX-10261
Boring ID: TP-1	Sample Type: jar	Tested By: jbr	
Sample ID:#1	Test Date: 10/01/10	Checked By: jdt	
Depth : 2 ft	Test Id: 191832		
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
—	9.7	64.2	26.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	97		
0.375 in	9.50	97		
#4	4.75	90		
#10	2.00	83		
#20	0.85	75		
#40	0.42	57		
#60	0.25	47		
#100	0.15	35		
#200	0.075	26		

<b>Coefficients</b>	
D <sub>85</sub> = 2.4897 mm	D <sub>30</sub> = 0.1006 mm
D <sub>60</sub> = 0.4758 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.2878 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<b>Classification</b>	
<b>ASTM</b>	Silty sand (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

<b>Sample/Test Description</b>
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-1	Test Date:	10/06/10	Test Id:	191776
Sample ID:	#1	Test Comment:	---		
Depth :	2 ft	Sample Description:	Moist, brown silty sand		
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

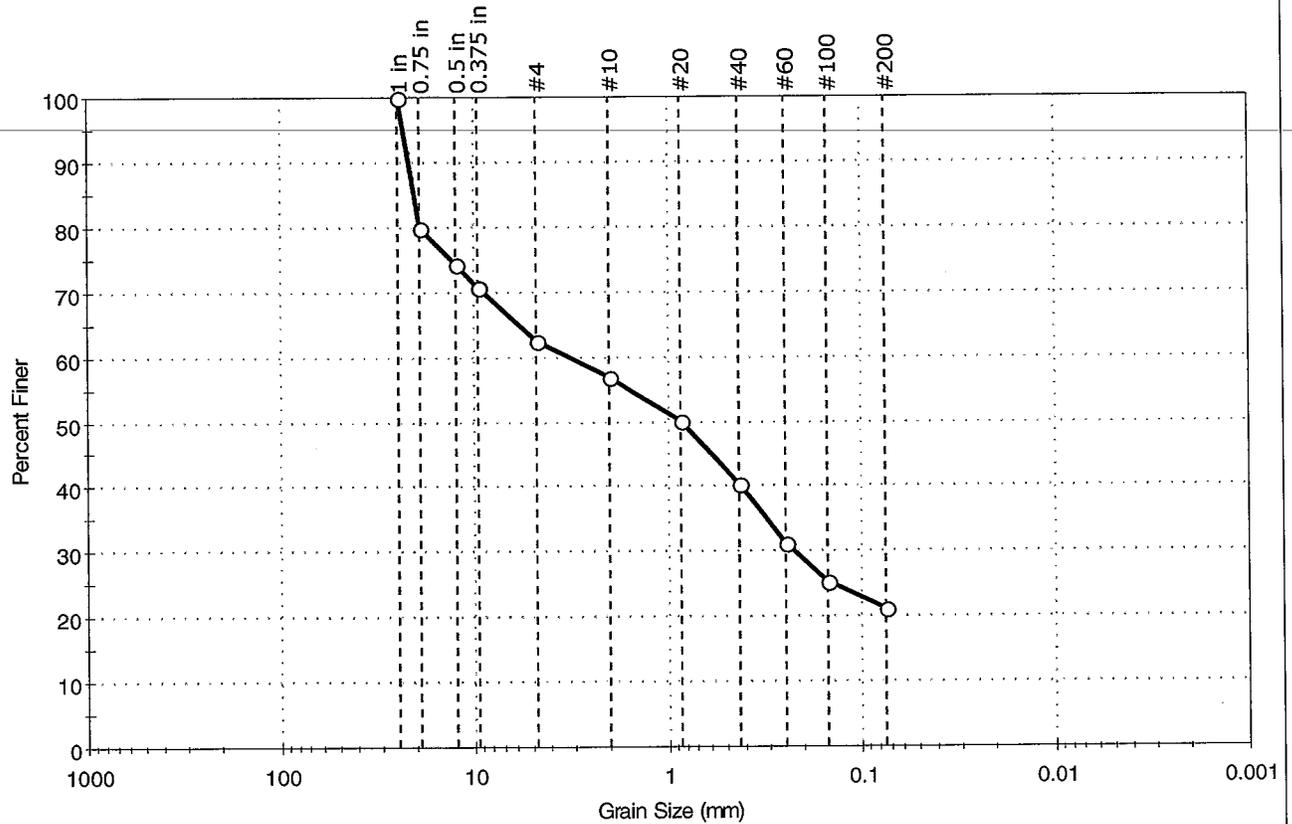
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#1	TP-1	2 ft	6	n/a	n/a	n/a	n/a	Silty sand (SM)

43% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-1	Sample Type: jar
Sample ID: #2	Test Date: 09/29/10	Tested By: jbr
Depth: 2 ft	Test Id: 191833	Checked By: jdt
Test Comment: ---	Sample Description: Moist, dark brown silty sand with gravel	Sample Comment: ---

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	37.4	41.4	21.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	80		
0.5 in	12.50	74		
0.375 in	9.50	71		
#4	4.75	63		
#10	2.00	57		
#20	0.85	50		
#40	0.42	41		
#60	0.25	31		
#100	0.15	25		
#200	0.075	21		

Coefficients	
D <sub>85</sub> = 20.3400 mm	D <sub>30</sub> = 0.2219 mm
D <sub>60</sub> = 3.2145 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.8327 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-1	Test Date:	10/06/10	Test Id:	191777
Sample ID:	#2	Test Comment:	---		
Depth :	2 ft	Sample Description:	Moist, dark brown silty sand with gravel		
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

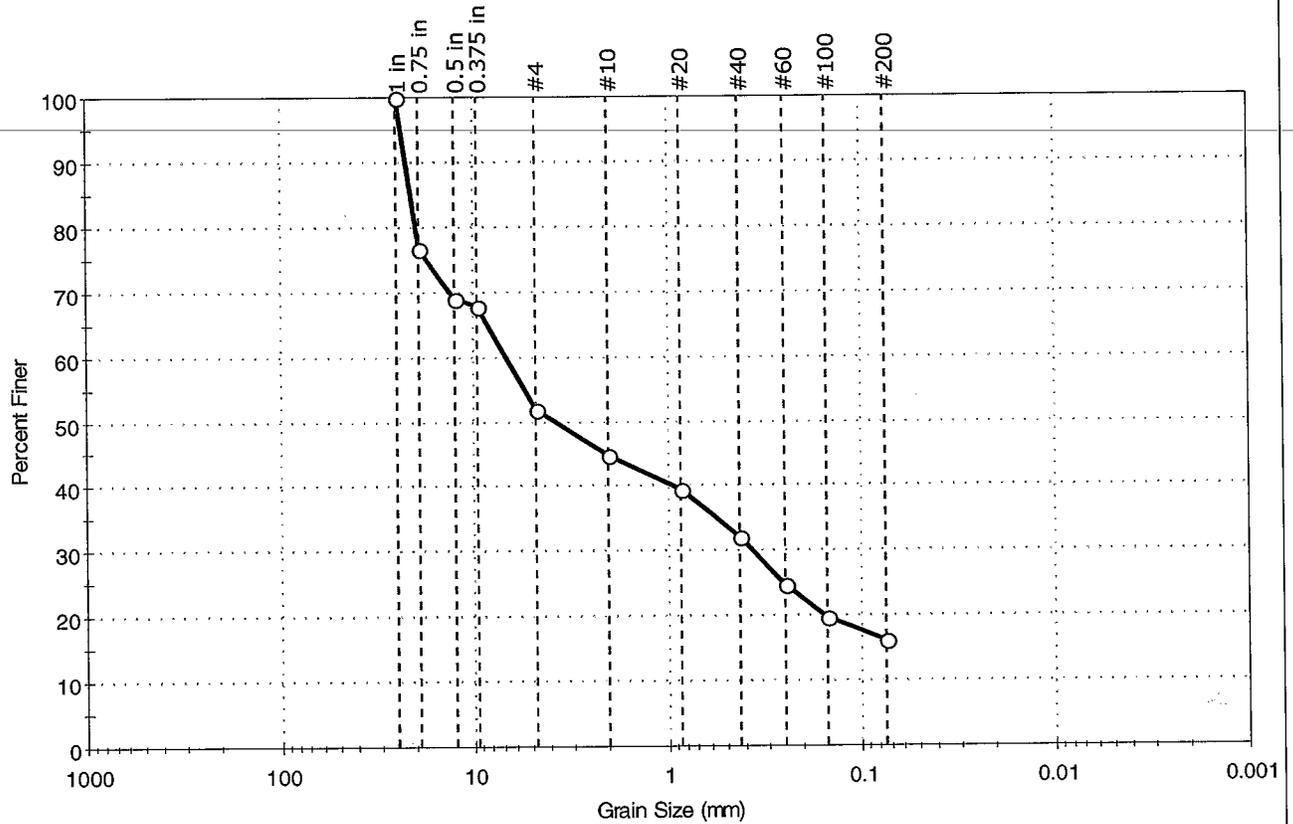
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#2	TP-1	2 ft	3	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

59% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jbr
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-1	Sample Type: jar
Sample ID: #3	Test Date: 09/29/10
Depth: 8 ft	Test Id: 191834
Test Comment: ---	
Sample Description: Moist, dark brown silty gravel with sand	
Sample Comment: ---	

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



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	48.0	35.8	16.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	77		
0.5 in	12.50	69		
0.375 in	9.50	68		
#4	4.75	52		
#10	2.00	45		
#20	0.85	39		
#40	0.42	32		
#60	0.25	25		
#100	0.15	20		
#200	0.075	16		

Coefficients	
D <sub>85</sub> = 20.9715 mm	D <sub>30</sub> = 0.3649 mm
D <sub>60</sub> = 6.7648 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 3.7206 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty gravel with sand (GM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	
Location: Trenton, NJ	
Boring ID: TP-1	Sample Type: jar
Sample ID: #3	Test Date: 10/06/10
Depth: 8 ft	Test Id: 191778
Test Comment: ---	Tested By: cam
Sample Description: Moist, dark brown silty gravel with sand	Checked By: jdt
Sample Comment: ---	

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

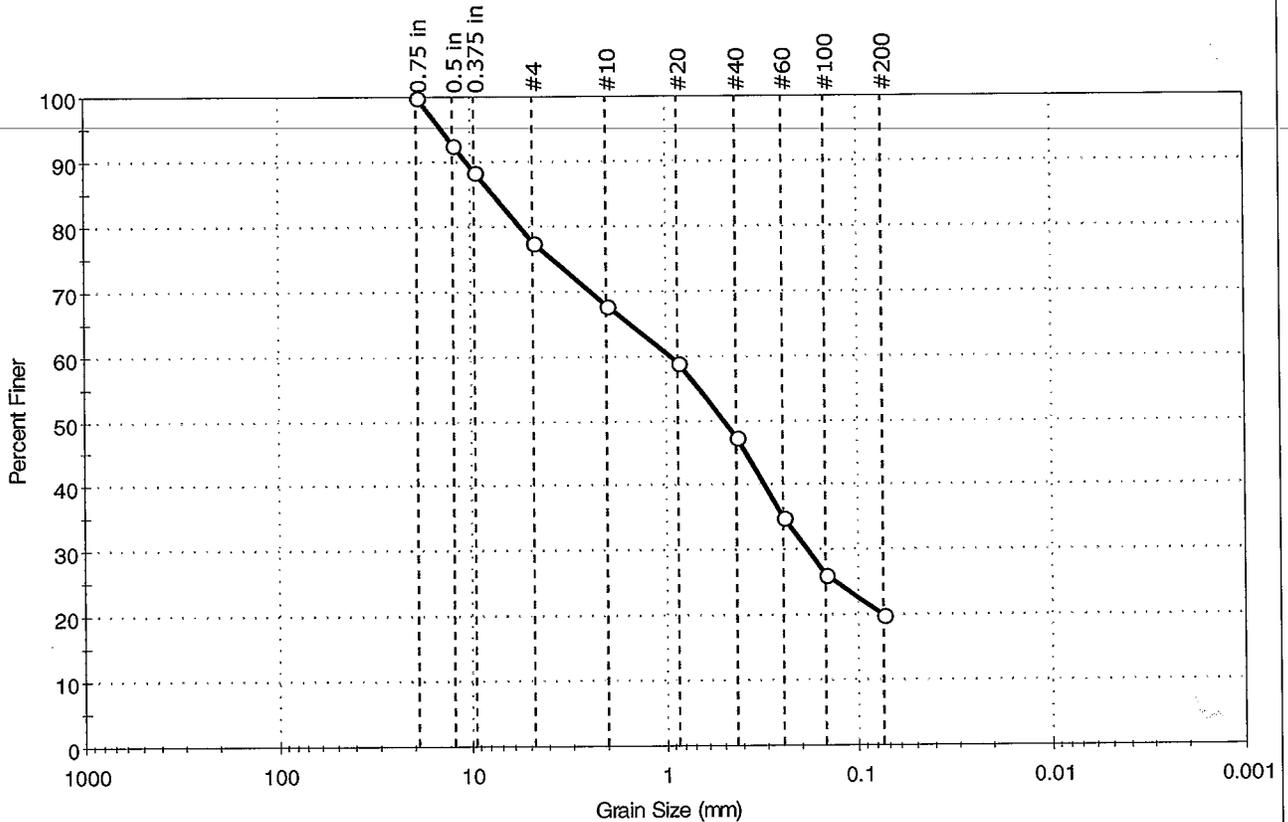
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#3	TP-1	8 ft	14	n/a	n/a	n/a	n/a	Silty gravel with sand (GM)

68% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-1	Sample Type: jar
Sample ID: #4	Test Date: 09/29/10	Checked By: jdt
Depth: 12 ft	Test Id: 191835	Tested By: jbr
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
---	22.4	57.6	20.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	93		
0.375 in	9.50	89		
#4	4.75	78		
#10	2.00	68		
#20	0.85	59		
#40	0.42	48		
#60	0.25	35		
#100	0.15	26		
#200	0.075	20		

Coefficients	
D <sub>85</sub> = 7.5498 mm	D <sub>30</sub> = 0.1866 mm
D <sub>60</sub> = 0.9383 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.4921 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID:	TP-1	Sample Type: jar
Sample ID:	#4	Test Date: 10/06/10
Depth:	12 ft	Test Id: 191779
Test Comment:	---	
Sample Description:	Moist, brown silty sand with gravel	
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
*	#4	TP-1	12 ft	12	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

52% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID: ---	Sample Type: ---	Tested By: jrl
Sample ID:---	Test Date: 10/06/10	Checked By: jdt
Depth : ---	Sample Id: ---	

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content,%
TP-2	#1	2 ft	Moist, brown silty sand with gravel	8.3
TP-2	#2	4 ft	Moist, dark brown silty sand with gravel	15
TP-2	#3	7.5 ft	Moist, dark brown gravel with silt and sand	13.1

Notes: Temperature of Drying : 110° Celsius



Client: O'Brien & Gere Engineers	Project No: GTX-10261	
Project: Assunpink Creek Restoration		
Location: Trenton, NJ		
Boring ID: ---	Sample Type: ---	Tested By: cam
Sample ID:---	Test Date: 10/06/10	Checked By: jdt
Depth : ---	Test Id: 191810	

**USCS Classification - ASTM D 2487-06**

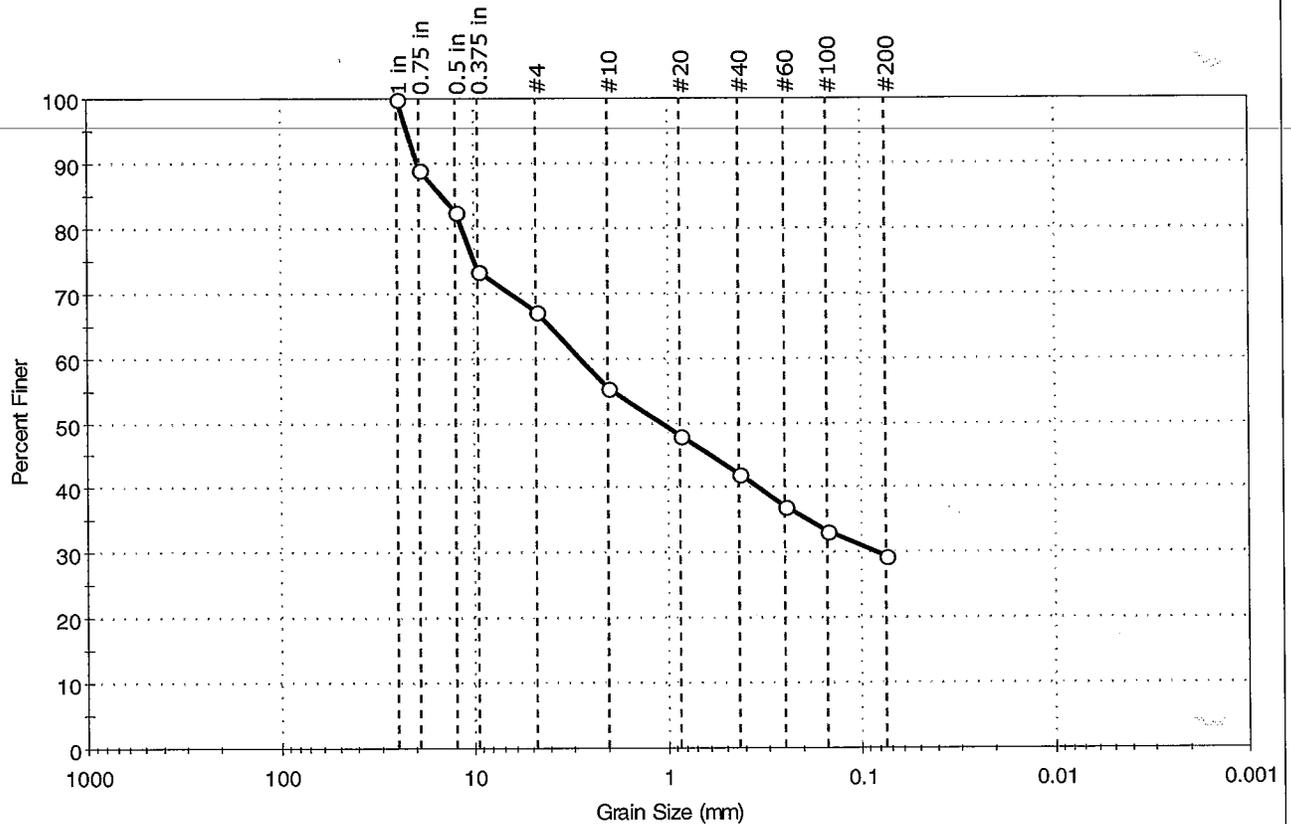
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-2	#1	2 ft	Silty sand with gravel	SM	32.9	37.5	29.6
TP-2	#2	4 ft	Silty sand with gravel	SM	28.9	44.0	27.1
TP-2	#3	7.5 ft	Poorly graded gravel with silt and sand	GP-GM	57.9	34.7	7.4

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-2	Sample Type: jar
Sample ID: #1	Depth: 2 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist, brown silty sand with gravel	Test Id: 191836
Checked By: jbr	Checked By: jdt	

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



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	32.9	37.5	29.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	89		
0.5 in	12.50	83		
0.375 in	9.50	73		
#4	4.75	67		
#10	2.00	55		
#20	0.85	48		
#40	0.42	42		
#60	0.25	37		
#100	0.15	33		
#200	0.075	30		

Coefficients	
D <sub>85</sub> = 14.6842 mm	D <sub>30</sub> = 0.0806 mm
D <sub>60</sub> = 2.7995 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 1.0509 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
<b>ASTM</b>	Silty sand with gravel (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD



Client: O'Brien & Gere Engineers	Project No: GTX-10261	
Project: Assunpink Creek Restoration		
Location: Trenton, NJ		
Boring ID: TP-2	Sample Type: jar	Tested By: cam
Sample ID: #1	Test Date: 10/06/10	Checked By: jdt
Depth: 2 ft	Test Id: 191780	
Test Comment: ---		
Sample Description: Moist, brown silty sand with gravel		
Sample Comment: ---		

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

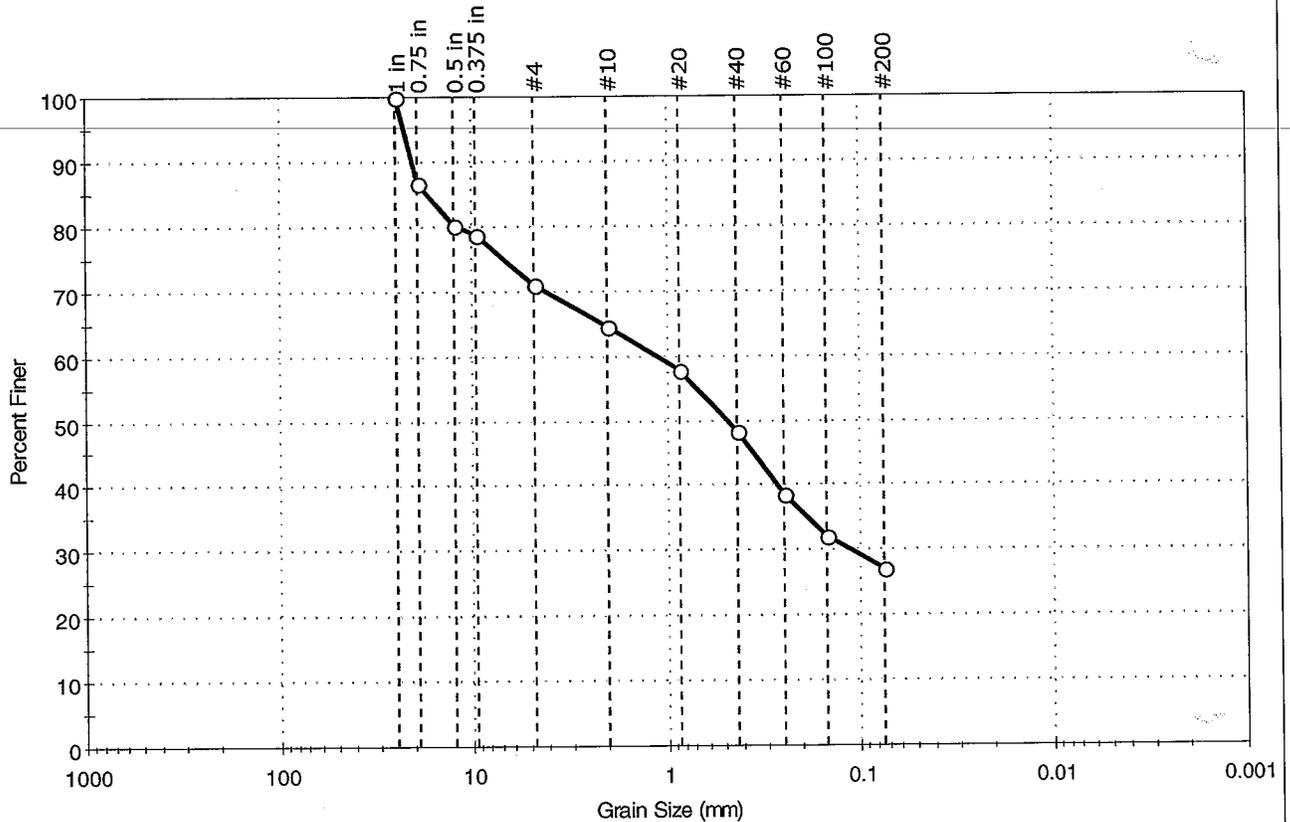
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#1	TP-2	2 ft	8	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

58% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	jbr	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-2	Test Date:	09/29/10	Test Id:	191837
Sample ID:	#2	Test Comment: ---			
Depth:	4 ft	Sample Description: Moist, dark brown silty sand with gravel			
Sample Comment: ---					

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	28.9	44.0	27.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	87		
0.5 in	12.50	80		
0.375 in	9.50	79		
#4	4.75	71		
#10	2.00	65		
#20	0.85	58		
#40	0.42	48		
#60	0.25	39		
#100	0.15	32		
#200	0.075	27		

<b>Coefficients</b>	
D <sub>85</sub> = 16.8960 mm	D <sub>30</sub> = 0.1117 mm
D <sub>60</sub> = 1.1045 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.4819 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<b>Classification</b>	
<b>ASTM</b>	Silty sand with gravel (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

<b>Sample/Test Description</b>	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-2	Test Date:	10/06/10	Test Id:	191781
Sample ID:	#2	Test Comment:	---		
Depth :	4 ft	Sample Description:	Moist, dark brown silty sand with gravel		
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

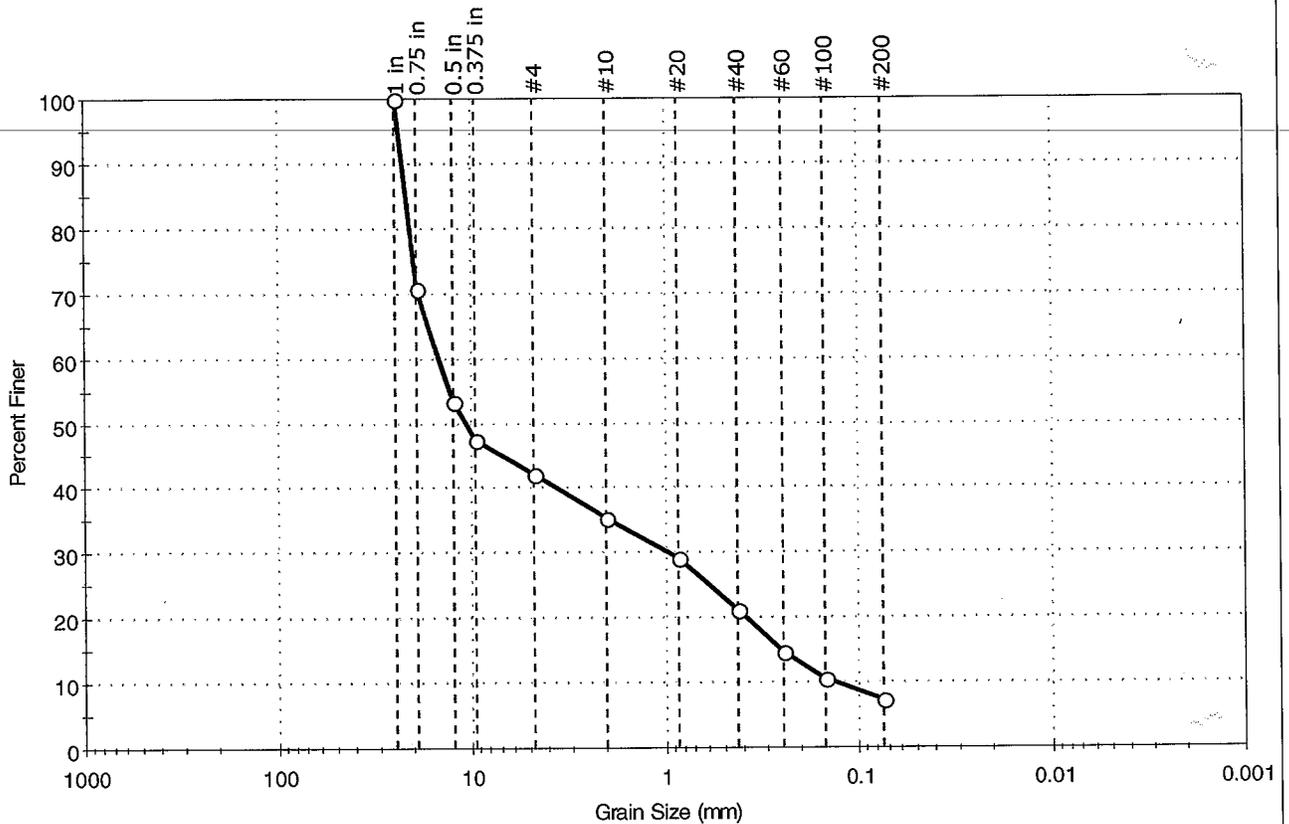
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#2	TP-2	4 ft	15	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

52% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-2	Sample Type: jar
Sample ID: #3	Test Date: 09/29/10	Tested By: jbr
Depth: 7.5 ft	Test Id: 191838	Checked By: jdt
Test Comment: ---	Sample Description: Moist, dark brown gravel with silt and sand	Sample Comment: ---

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	57.9	34.7	7.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	71		
0.5 in	12.50	53		
0.375 in	9.50	47		
#4	4.75	42		
#10	2.00	35		
#20	0.85	29		
#40	0.42	21		
#60	0.25	15		
#100	0.15	11		
#200	0.075	7		

Coefficients	
D <sub>85</sub> = 21.7260 mm	D <sub>30</sub> = 0.9631 mm
D <sub>60</sub> = 14.6605 mm	D <sub>15</sub> = 0.2538 mm
D <sub>50</sub> = 10.6919 mm	D <sub>10</sub> = 0.1333 mm
C <sub>u</sub> = 109.981	C <sub>c</sub> = 0.475

Classification	
ASTM	Poorly graded gravel with silt and sand (GP-GM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



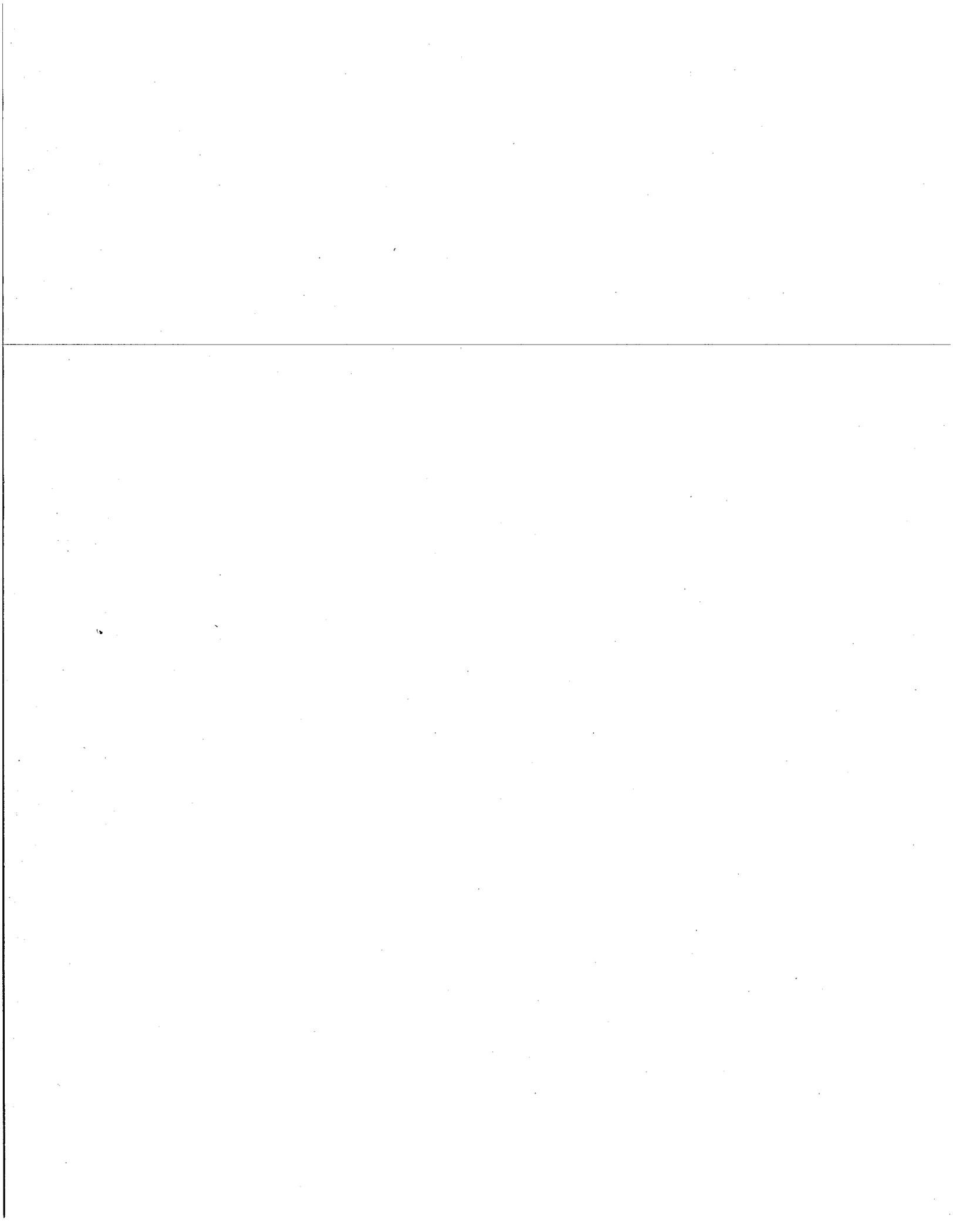
Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-2	Test Date:	10/06/10	Test Id:	191782
Sample ID:	#3	Test Comment:	---		
Depth :	7.5 ft	Sample Description:	Moist, dark brown 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
*	#3	TP-2	7.5 ft	13	n/a	n/a	n/a	n/a	Poorly graded gravel with silt and sand (GP-GM)

79% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilentancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client: O'Brien & Gere Engineers	Project No: GTX-10261		
Project: Assunpink Creek Restoration	Tested By: cam		
Location: Trenton, NJ	Checked By: jdt		
Boring ID: ---	Sample Type: ---	Test Date: 10/06/10	Test Id: 191812
Sample ID: ---			
Depth : ---			

**USCS Classification - ASTM D 2487-06**

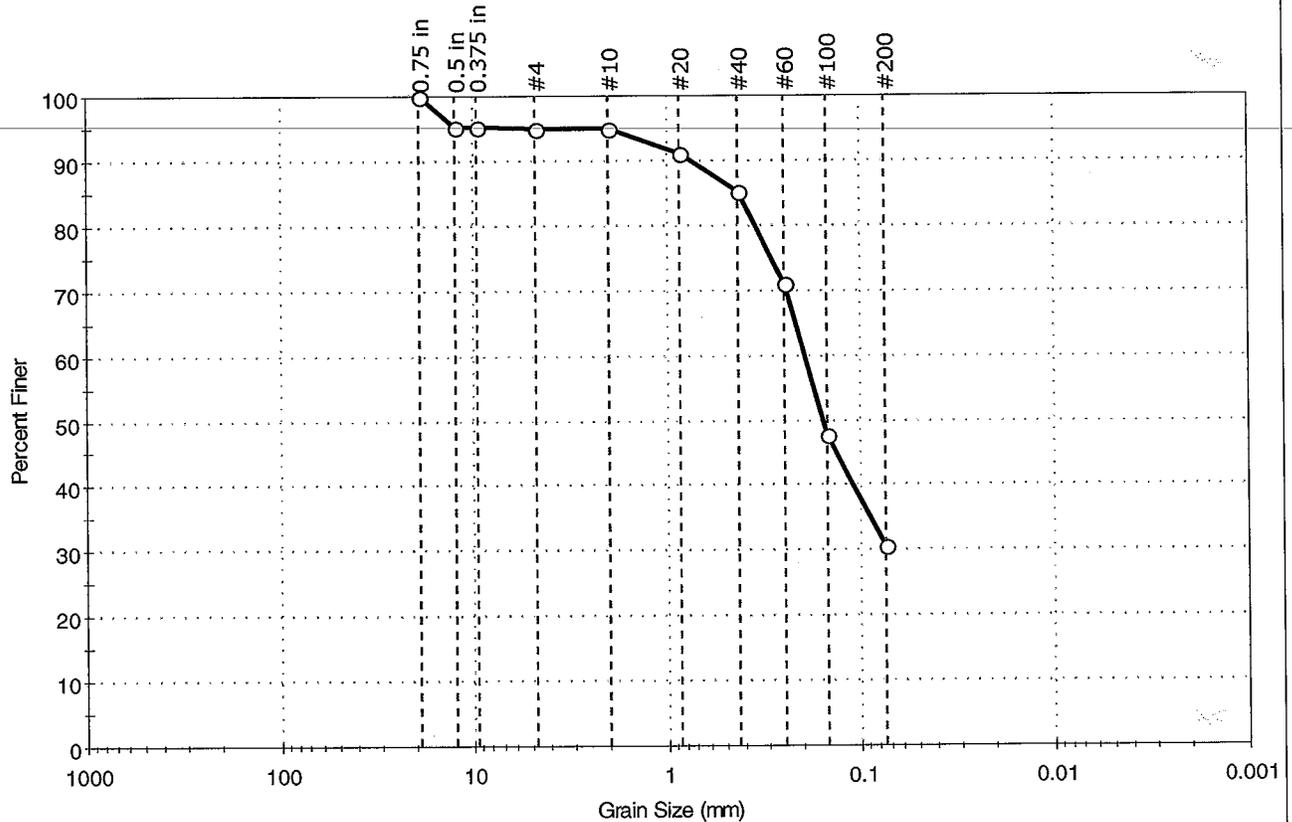
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-3	S-1	2 ft	Silty sand	SM	5.0	64.4	30.6
TP-3	S-2	7 ft	Silty sand with gravel	SM	37.2	50.3	12.5

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
Atterbeg Limits performed by ASTM 4318, results enclosed



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	jbr	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-3	Test Date:	09/29/10	Test Id:	191839
Sample ID:	S-1	Test Comment:	---		
Depth:	2 ft	Sample Description:	Moist, black silty sand		
		Sample Comment:	---		

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	5.0	64.4	30.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	95		
0.375 in	9.50	95		
#4	4.75	95		
#10	2.00	95		
#20	0.85	91		
#40	0.42	85		
#60	0.25	71		
#100	0.15	48		
#200	0.075	31		

Coefficients	
D <sub>85</sub> = 0.4195 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.1962 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.1573 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand (SM)
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description
Sand/Gravel Particle Shape : <b>ROUNDED</b>
Sand/Gravel Hardness : <b>HARD</b>



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-3	Test Date:	10/06/10	Test Id:	191783
Sample ID:	S-1	Depth :	2 ft	Test Comment:	---
Sample Description:	Moist, black silty sand				
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

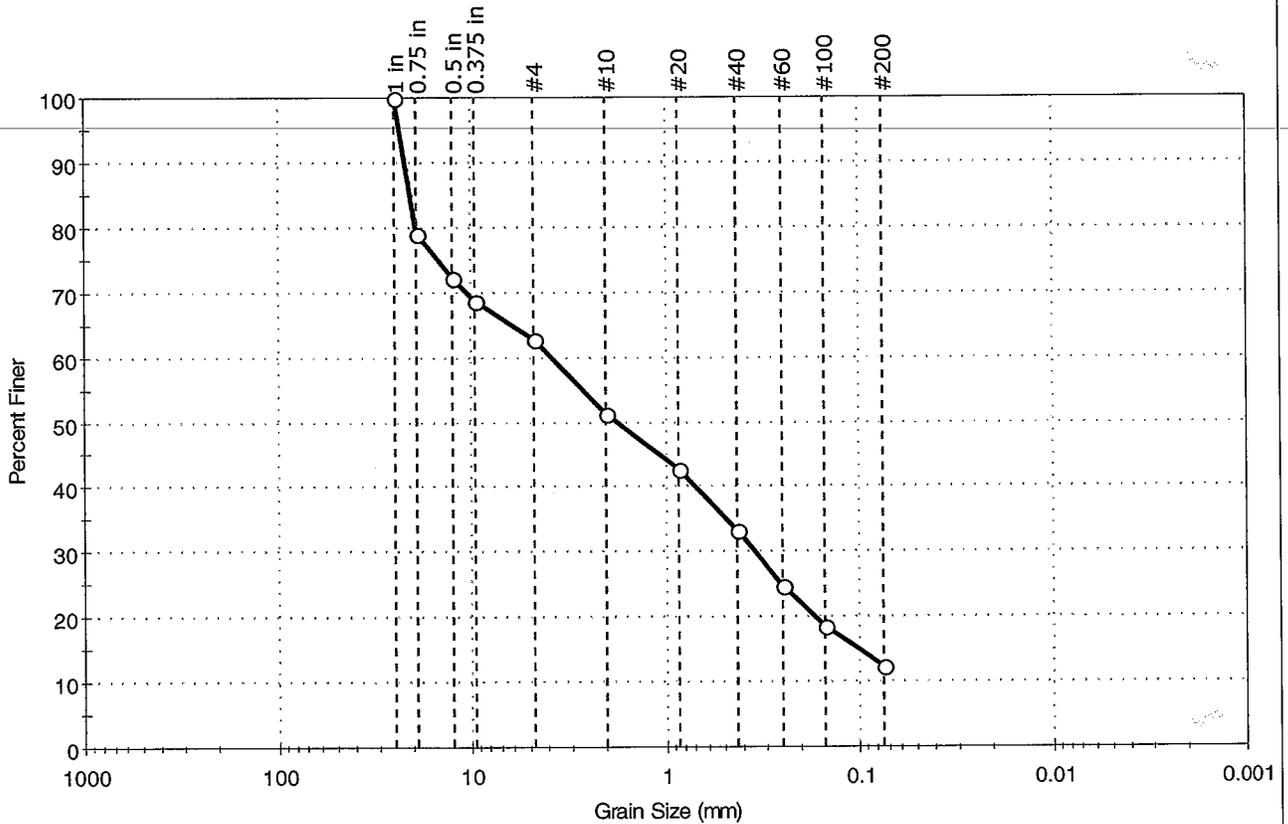
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	TP-3	2 ft	15	n/a	n/a	n/a	n/a	Silty sand (SM)

15% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-3	Sample Type: jar
Sample ID: S-2	Depth: 7 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist, dark brown silty sand with gravel	Tested By: jbr
Sample Comment: ---		Checked By: jdt
		Test Id: 191840

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	37.2	50.3	12.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	79		
0.5 in	12.50	72		
0.375 in	9.50	69		
#4	4.75	63		
#10	2.00	51		
#20	0.85	43		
#40	0.42	33		
#60	0.25	25		
#100	0.15	18		
#200	0.075	12		

Coefficients	
D <sub>85</sub> = 20.5433 mm	D <sub>30</sub> = 0.3465 mm
D <sub>60</sub> = 3.8471 mm	D <sub>15</sub> = 0.1005 mm
D <sub>50</sub> = 1.7422 mm	D <sub>10</sub> = 0.0564 mm
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
<b>ASTM</b>	Silty sand with gravel (SM)
<b>AASHTO</b>	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



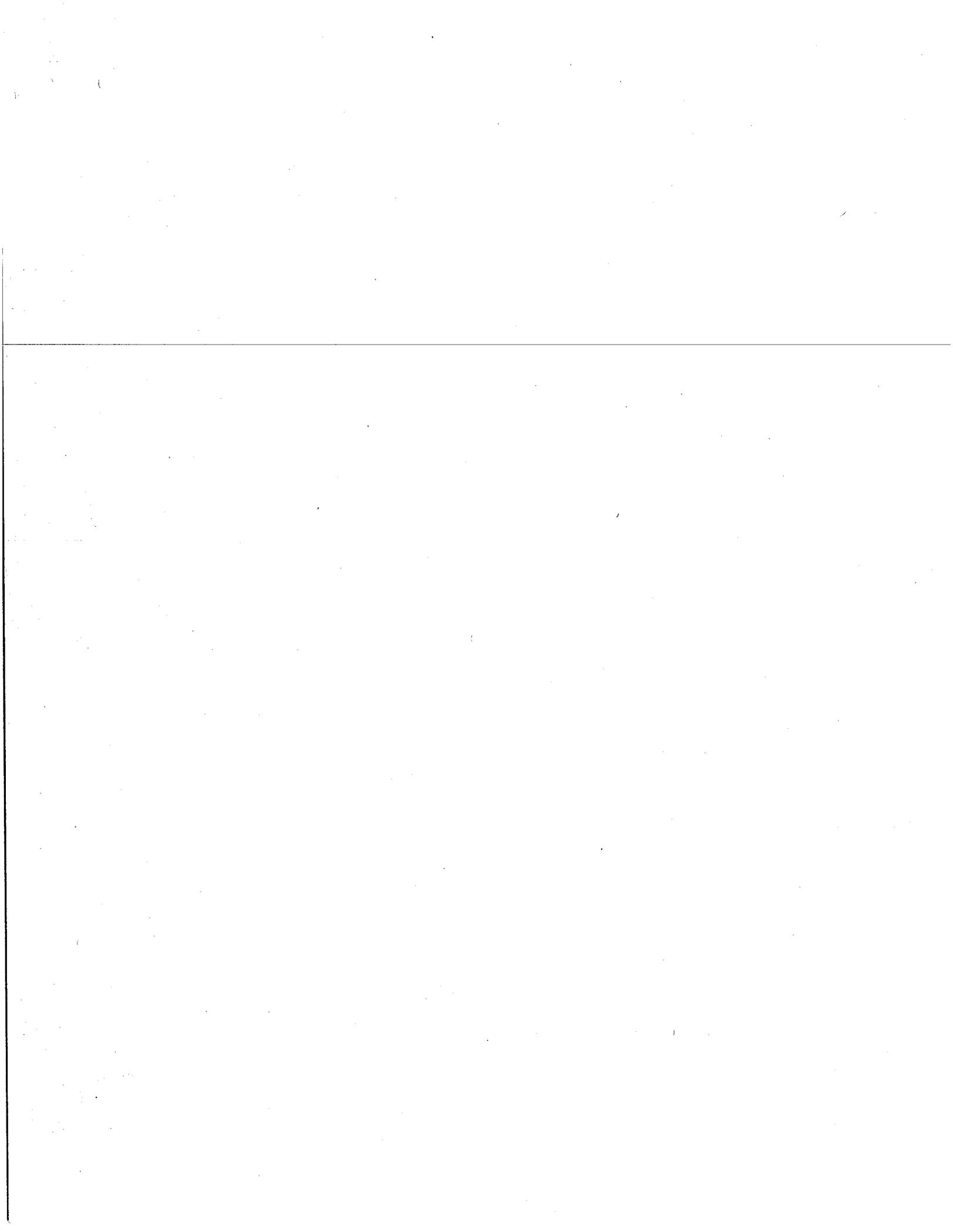
Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration				
Location:	Trenton, NJ				
Boring ID:	TP-3	Sample Type:	jar	Tested By:	cam
Sample ID:	S-2	Test Date:	10/06/10	Checked By:	jdt
Depth :	7 ft	Test Id:	191784		
Test Comment:	---				
Sample Description:	Moist, dark brown silty sand with gravel				
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	TP-3	7 ft	11	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

67% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilentancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID: ---	Sample Type: ---	Tested By: jrl
Sample ID: ---	Test Date: 10/06/10	Checked By: jdt
Depth : ---	Sample Id: ---	

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content, %
TP-4	S-1	2 ft	Moist, light brown silty sand	4.4
TP-4	S-2	4 ft	Moist, very dark grayish brown silty gravel with sand	10.8
TP-4	S-3	8 ft	Moist, dark brown silty sand with gravel	20.7

Notes: Temperature of Drying : 110° Celsius



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261
Project:	Assunpink Creek Restoration			
Location:	Trenton, NJ		Boring ID:	---
	Sample Type:	---	Tested By:	cam
	Sample ID:	---	Test Date:	10/06/10
	Depth :	---	Checked By:	jdt
			Test Id:	191815

**USCS Classification - ASTM D 2487-06**

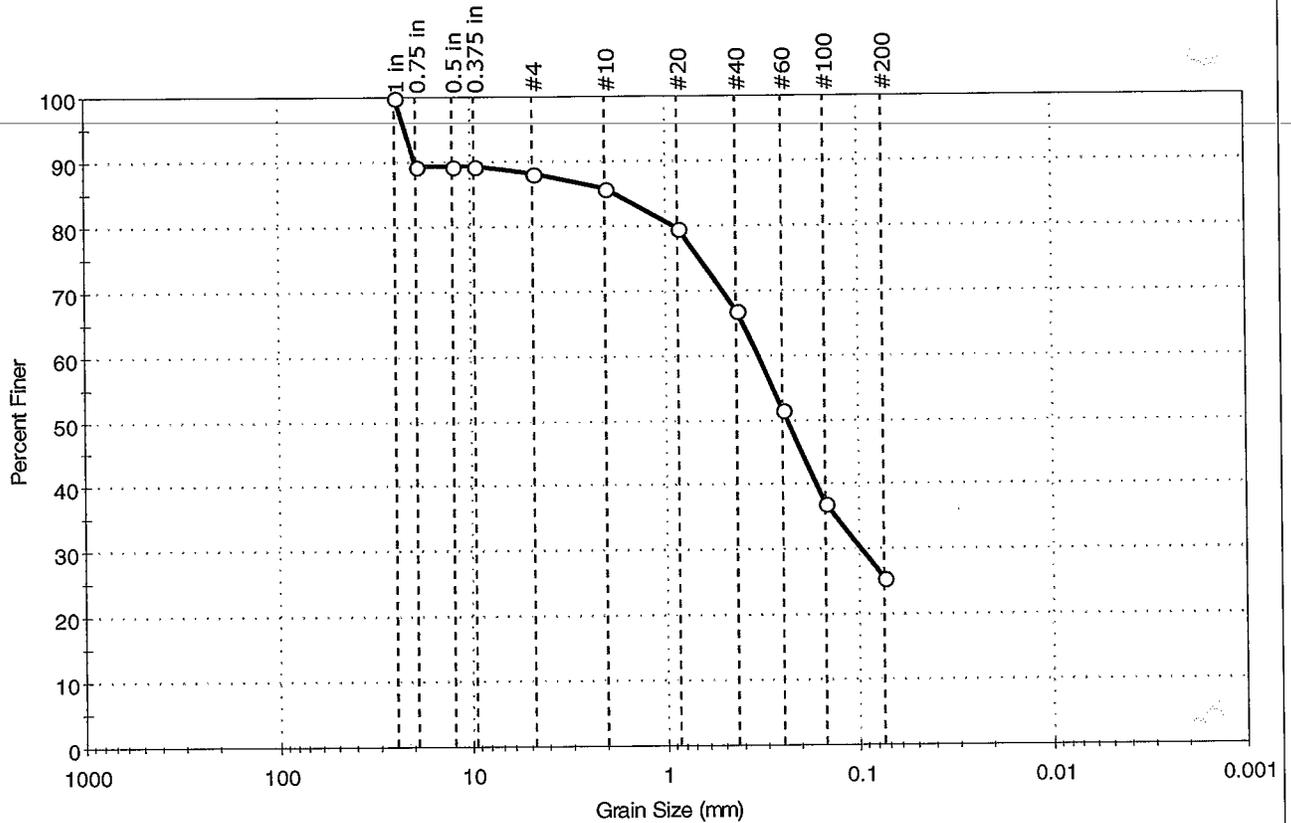
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-4	S-1	2 ft	Silty sand	SM	11.6	62.8	25.6
TP-4	S-2	4 ft	Silty gravel with sand	GM	46.7	40.5	12.8
TP-4	S-3	8 ft	Silty sand with gravel	SM	42.9	44.6	12.5

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-4	Sample Type: jar
Sample ID: S-1	Depth: 2 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist, light brown silty sand	Tested By: jbr
Sample Comment: ---		Checked By: jdt
		Test Id: 191841

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	11.6	62.8	25.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	89		
0.5 in	12.50	89		
0.375 in	9.50	89		
#4	4.75	88		
#10	2.00	86		
#20	0.85	80		
#40	0.42	67		
#60	0.25	52		
#100	0.15	37		
#200	0.075	26		

Coefficients	
D <sub>85</sub> = 1.7877 mm	D <sub>30</sub> = 0.0977 mm
D <sub>60</sub> = 0.3335 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.2363 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand (SM)
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration				
Location:	Trenton, NJ	Sample Type:	jar	Tested By:	cam
Boring ID:	TP-4	Test Date:	10/06/10	Checked By:	jdt
Sample ID:	S-1	Test Id:	191785		
Depth :	2 ft				
Test Comment:	---				
Sample Description:	Moist, light brown silty sand				
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

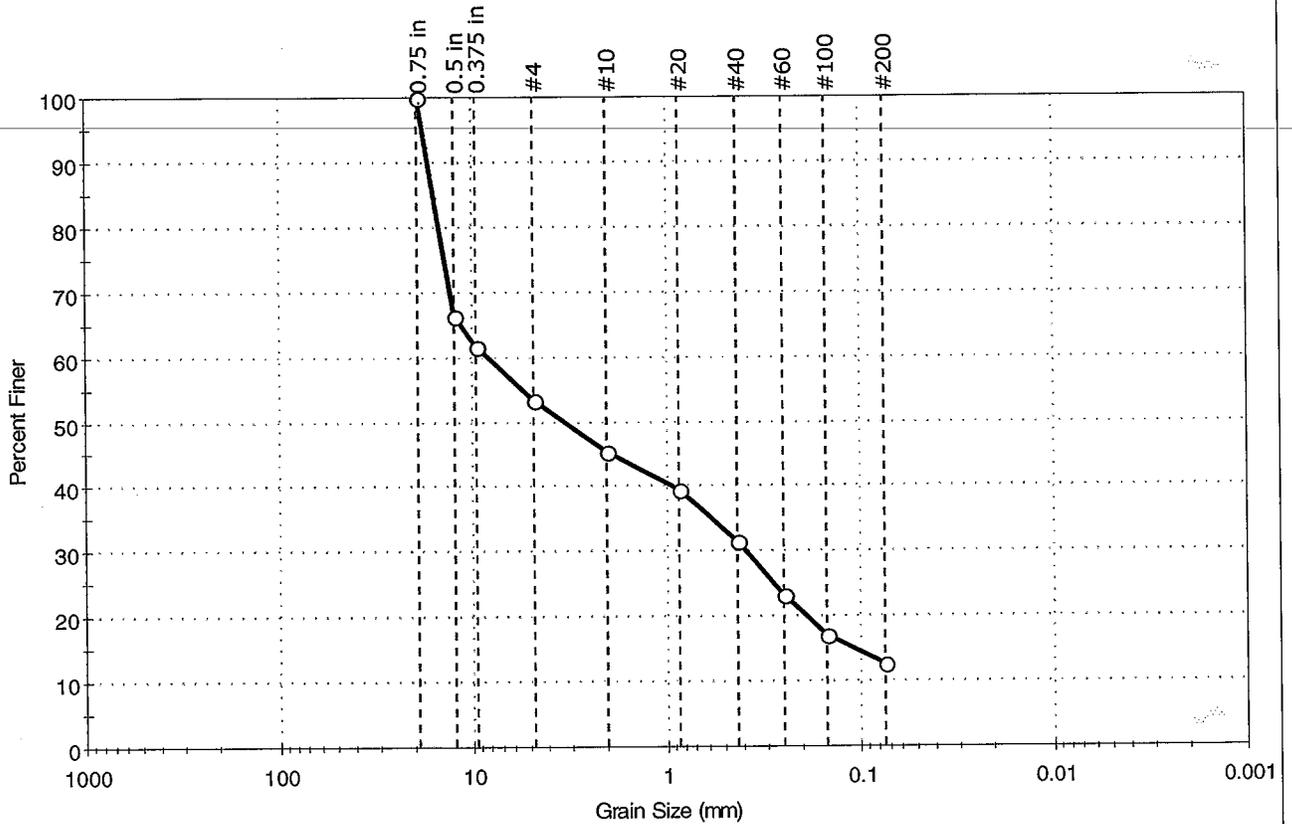
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	TP-4	2 ft	4	n/a	n/a	n/a	n/a	Silty sand (SM)

33% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-4	Sample Type: jar
Sample ID: S-2	Depth: 4 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist, very dark grayish brown silty gravel with sand	Tested By: jbr
Sample Comment: ---		Checked By: jdt
		Test Id: 191842

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	46.7	40.5	12.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	66		
0.375 in	9.50	62		
#4	4.75	53		
#10	2.00	45		
#20	0.85	39		
#40	0.42	32		
#60	0.25	23		
#100	0.15	17		
#200	0.075	13		

Coefficients	
D <sub>85</sub> = 15.7552 mm	D <sub>30</sub> = 0.3835 mm
D <sub>60</sub> = 8.2367 mm	D <sub>15</sub> = 0.1074 mm
D <sub>50</sub> = 3.2900 mm	D <sub>10</sub> = 0.0469 mm
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty gravel with sand (GM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-4	Sample Type:	jar
Sample ID:	S-2	Test Date:	10/06/10
Depth:	4 ft	Test Id:	191786
Test Comment:	---		
Sample Description:	Moist, very dark grayish brown silty gravel with sand		
Sample Comment:	---		

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

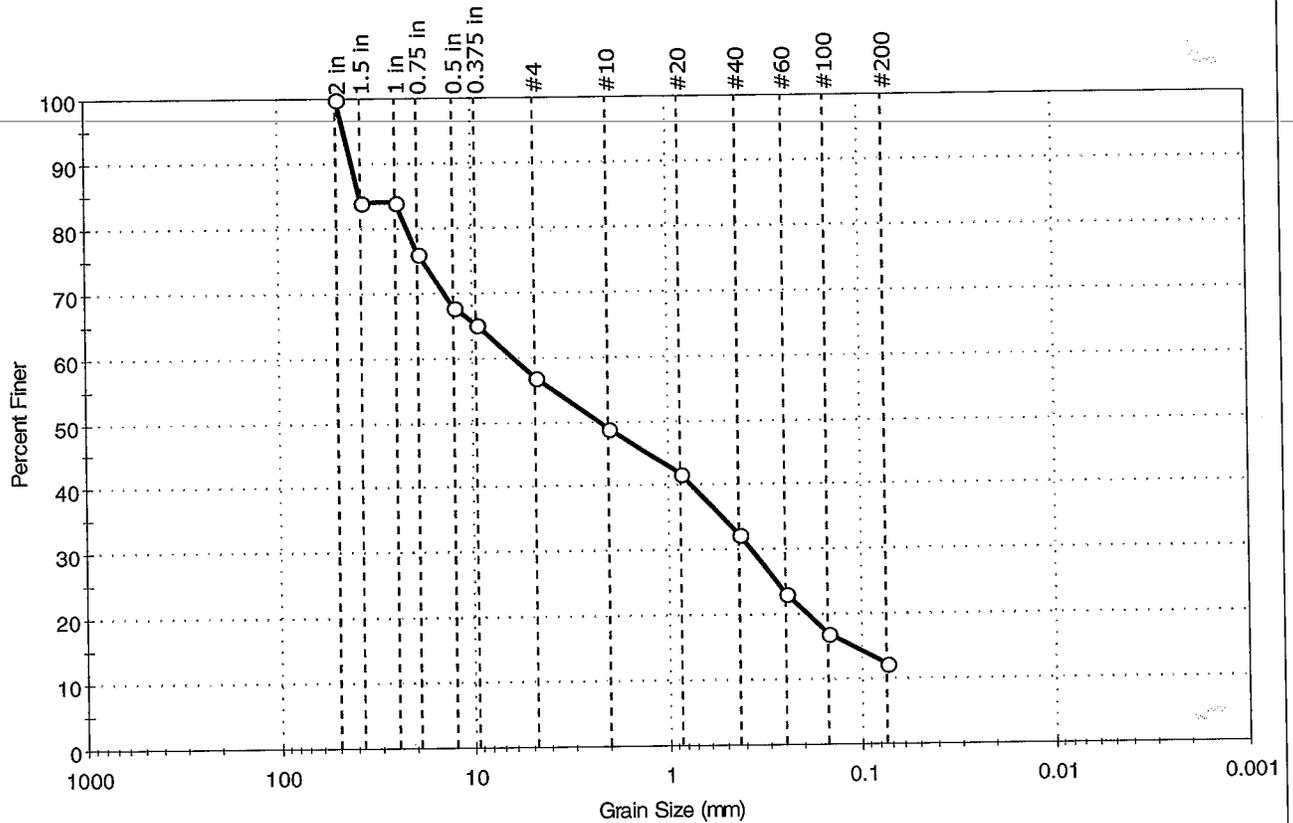
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	TP-4	4 ft	11	n/a	n/a	n/a	n/a	Silty gravel with sand (GM)

68% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-4	Sample Type: jar
Sample ID: S-3	Depth: 8 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist, dark brown silty sand with gravel	Tested By: jbr
Sample Comment: ---		Checked By: jdt
		Test Id: 191843

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	42.9	44.6	12.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	84		
1 in	25.00	84		
0.75 in	19.00	76		
0.5 in	12.50	68		
0.375 in	9.50	65		
#4	4.75	57		
#10	2.00	49		
#20	0.85	42		
#40	0.42	32		
#60	0.25	23		
#100	0.15	17		
#200	0.075	12		

Coefficients	
D <sub>85</sub> = 38.1706 mm	D <sub>30</sub> = 0.3687 mm
D <sub>60</sub> = 6.0980 mm	D <sub>15</sub> = 0.1090 mm
D <sub>50</sub> = 2.2136 mm	D <sub>10</sub> = 0.0519 mm
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



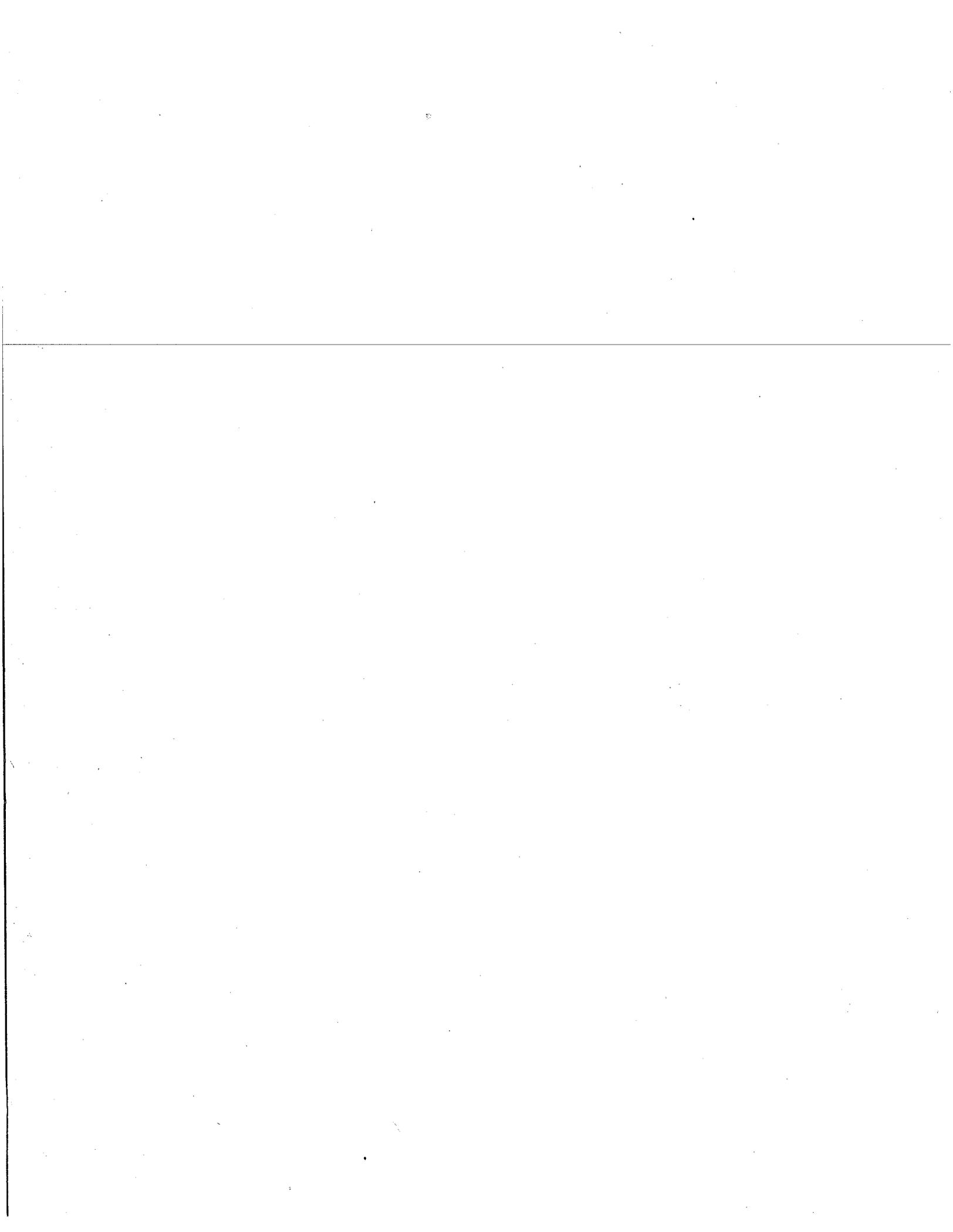
Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-4	Sample Type:	jar
Sample ID:	S-3	Test Date:	10/06/10
Depth:	8 ft	Test Id:	191787
Test Comment:	---		
Sample Description:	Moist, dark brown silty sand with gravel		
Sample 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-3	TP-4	8 ft	21	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

68% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	
Location: Trenton, NJ	
Boring ID: ---	Sample Type: ---
Sample ID: ---	Test Date: 10/06/10
Depth: ---	Sample Id: ---
	Tested By: jrl
	Checked By: jdt

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content, %
TP-5	S-1	2 ft	Moist, brown silty sand	8.2
TP-5	S-2	4 ft	Moist, brown silty sand with gravel	10.1
TP-5	S-3	7 ft	Moist, dark brown silty sand with gravel	24.8

Notes: Temperature of Drying : 110° Celsius



Client: O'Brien & Gere Engineers	Project: Assumpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: ---	Sample Type: ---
Sample ID: ---	Test Date: 10/06/10	Tested By: cam
Depth : ---	Test Id: 191818	Checked By: jdt

**USCS Classification - ASTM D 2487-06**

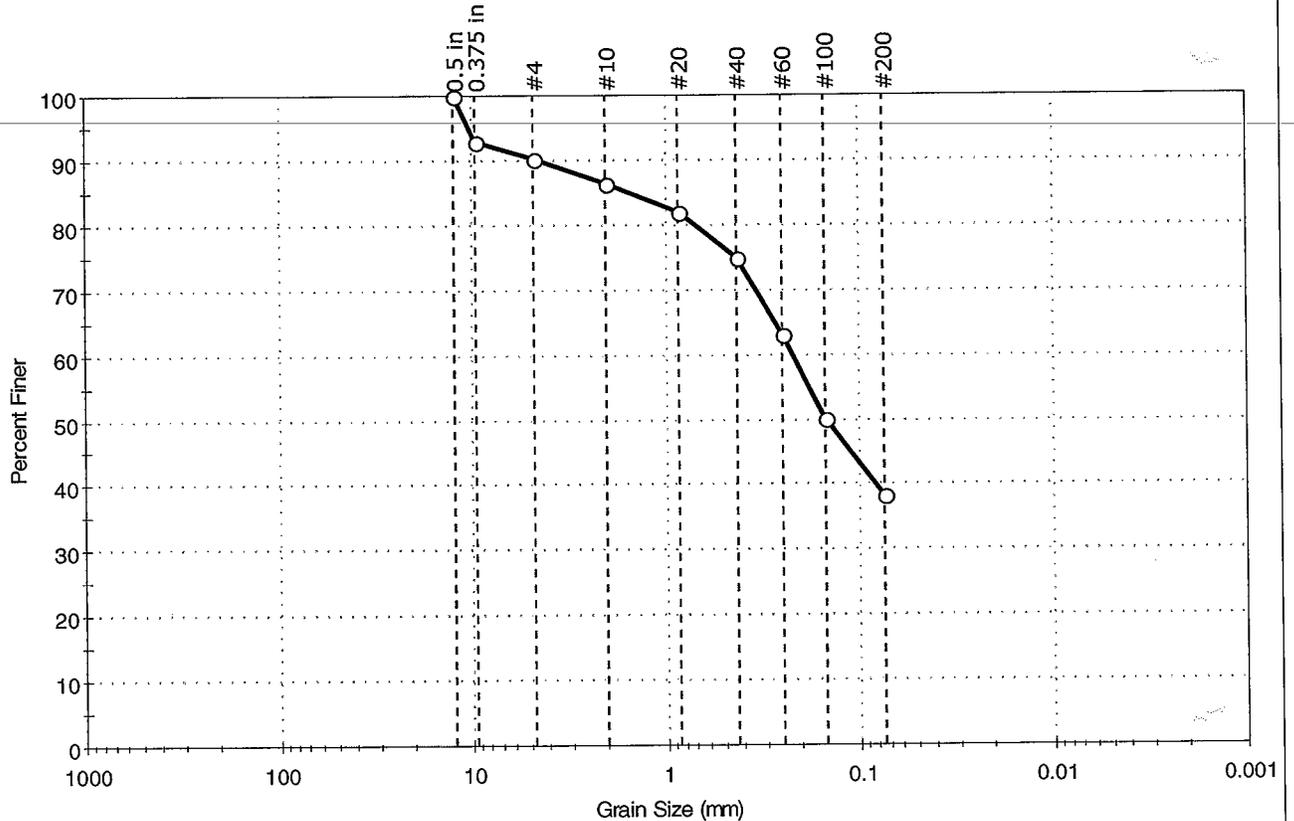
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-5	S-1	2 ft	Silty sand	SM	9.6	51.9	38.5
TP-5	S-2	4 ft	Silty sand with gravel	SM	16.1	64.5	19.4
TP-5	S-3	7 ft	Silty sand with gravel	SM	28.5	49.4	22.1

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterberg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	
Location: Trenton, NJ	
Boring ID: TP-5	Sample Type: jar
Sample ID: S-1	Test Date: 09/29/10
Depth: 2 ft	Test Id: 191844
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
—	9.6	51.9	38.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	93		
#4	4.75	90		
#10	2.00	86		
#20	0.85	82		
#40	0.42	75		
#60	0.25	63		
#100	0.15	50		
#200	0.075	38		

<b>Coefficients</b>	
D <sub>85</sub> = 1.5457 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.2220 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.1498 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<b>Classification</b>	
<b>ASTM</b>	Silty sand (SM)
<b>AASHTO</b>	Silty Soils (A-4 (0))

<b>Sample/Test Description</b>
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD



Client: O'Brien & Gere Engineers	Project: Assumpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-5	Sample Type: jar
Sample ID: S-1	Test Date: 10/06/10	Tested By: cam
Depth: 2 ft	Test Id: 191788	Checked By: jdt
Test Comment: ---	Sample Description: Moist, brown silty sand	Sample Comment: ---

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

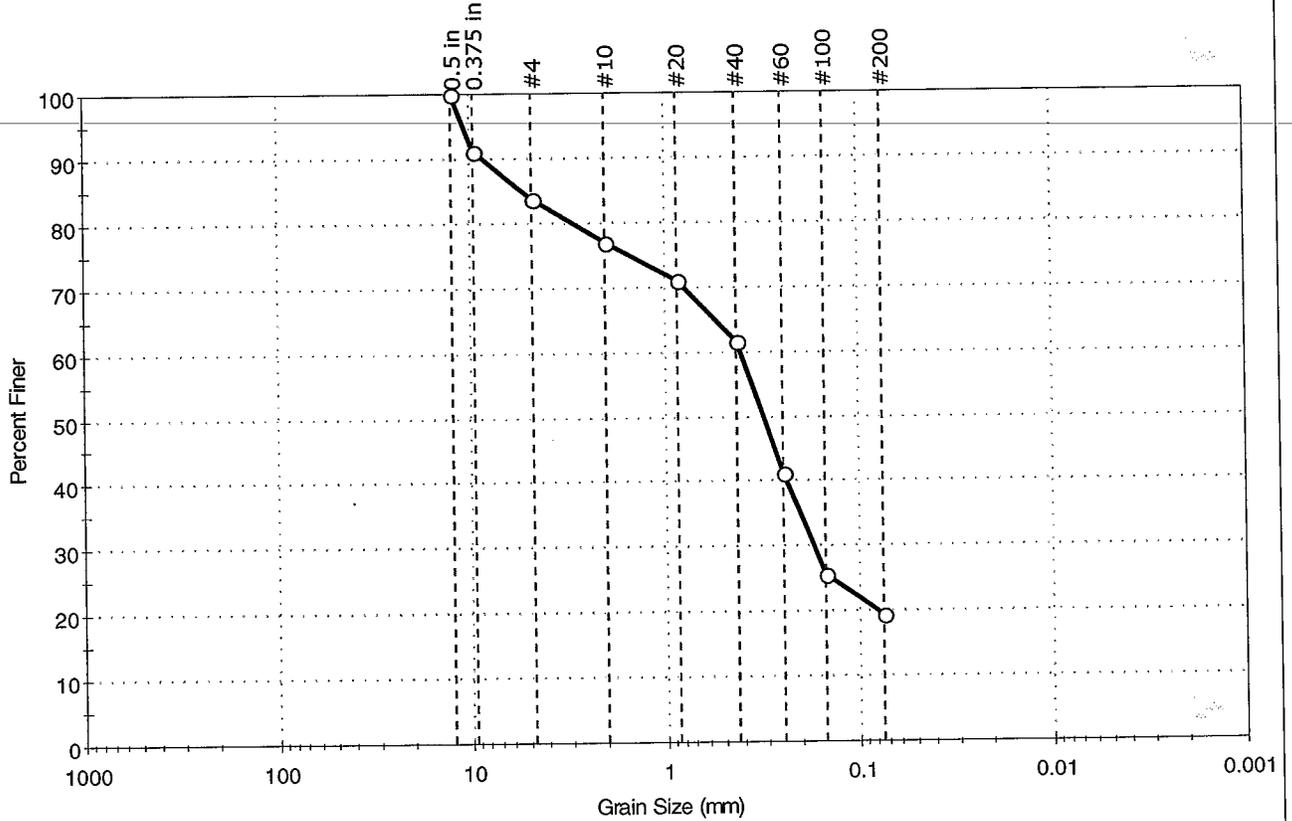
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	TP-5	2 ft	8	n/a	n/a	n/a	n/a	Silty sand (SM)

25% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jbr
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-5	Sample Type: jar
Sample ID: S-2	Test Date: 09/29/10
Depth: 4 ft	Test Id: 191845
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
—	16.1	64.5	19.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	91		
#4	4.75	84		
#10	2.00	77		
#20	0.85	71		
#40	0.42	62		
#60	0.25	41		
#100	0.15	26		
#200	0.075	19		

Coefficients	
D <sub>85</sub> = 5.3055 mm	D <sub>30</sub> = 0.1725 mm
D <sub>60</sub> = 0.4070 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.3131 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID:	TP-5	Sample Type: jar
Sample ID:	S-2	Test Date: 10/06/10
Depth:	4 ft	Test Id: 191789
Test Comment:	---	
Sample Description:	Moist, brown silty sand with gravel	
Sample Comment:	---	

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

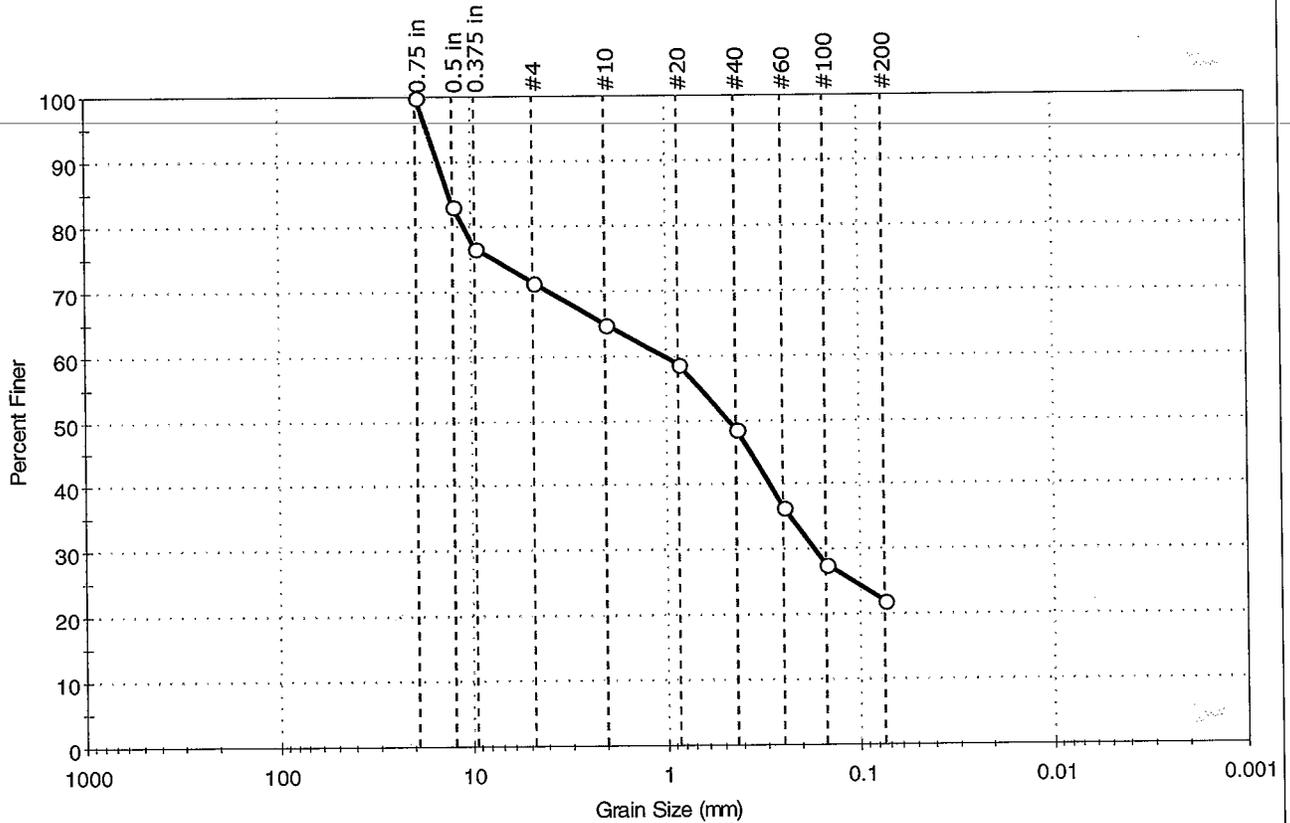
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	TP-5	4 ft	10	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

38% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-5	Sample Type: jar
Sample ID: S-3	Depth: 7 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist, dark brown silty sand with gravel	Tested By: jbr
Sample Comment: ---		Checked By: jdt
		Test Id: 191846

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	28.5	49.4	22.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	83		
0.375 in	9.50	77		
#4	4.75	71		
#10	2.00	65		
#20	0.85	59		
#40	0.42	49		
#60	0.25	37		
#100	0.15	28		
#200	0.075	22		

Coefficients	
D <sub>85</sub> = 13.1042 mm	D <sub>30</sub> = 0.1701 mm
D <sub>60</sub> = 1.0080 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.4682 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-5	Sample Type:	jar
Sample ID:	S-3	Test Date:	10/06/10
Depth:	7 ft	Tested By:	cam
		Checked By:	jdt
		Test Id:	191790
Test Comment:	---		
Sample Description:	Moist, dark brown silty sand with gravel		
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-3	TP-5	7 ft	25	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

51% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client:	O'Brien & Gere Engineers		Project No:	GTX-10261
Project:	Assunpink Creek Restoration			
Location:	Trenton, NJ			
Boring ID:	---	Sample Type:	---	Tested By: jrl
Sample ID:	---	Test Date:	10/06/10	Checked By: jdt
Depth :	---	Sample Id:	---	

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content, %
TP-6	S-1	2 ft	Moist, dark brown silty sand with gravel	4.8
TP-6	S-2	4 ft	Moist, yellowish brown sand with silt	7.1
TP-6	S-3	7 ft	Moist, brown silty sand with gravel	10.5
TP-6	S-4	10 ft	Moisty dark brown silty sand with gravel	14.8
TP-6	S-5	13 ft	Moist dark brown silty gravel with sand	13.7

Notes: Temperature of Drying : 110° Celsius



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	
Location: Trenton, NJ	
Boring ID: ---	Sample Type: ---
Sample ID:---	Test Date: 10/06/10
Depth : ---	Test Id: 191889
	Tested By: cam
	Checked By: jdt

**USCS Classification - ASTM D 2487-06**

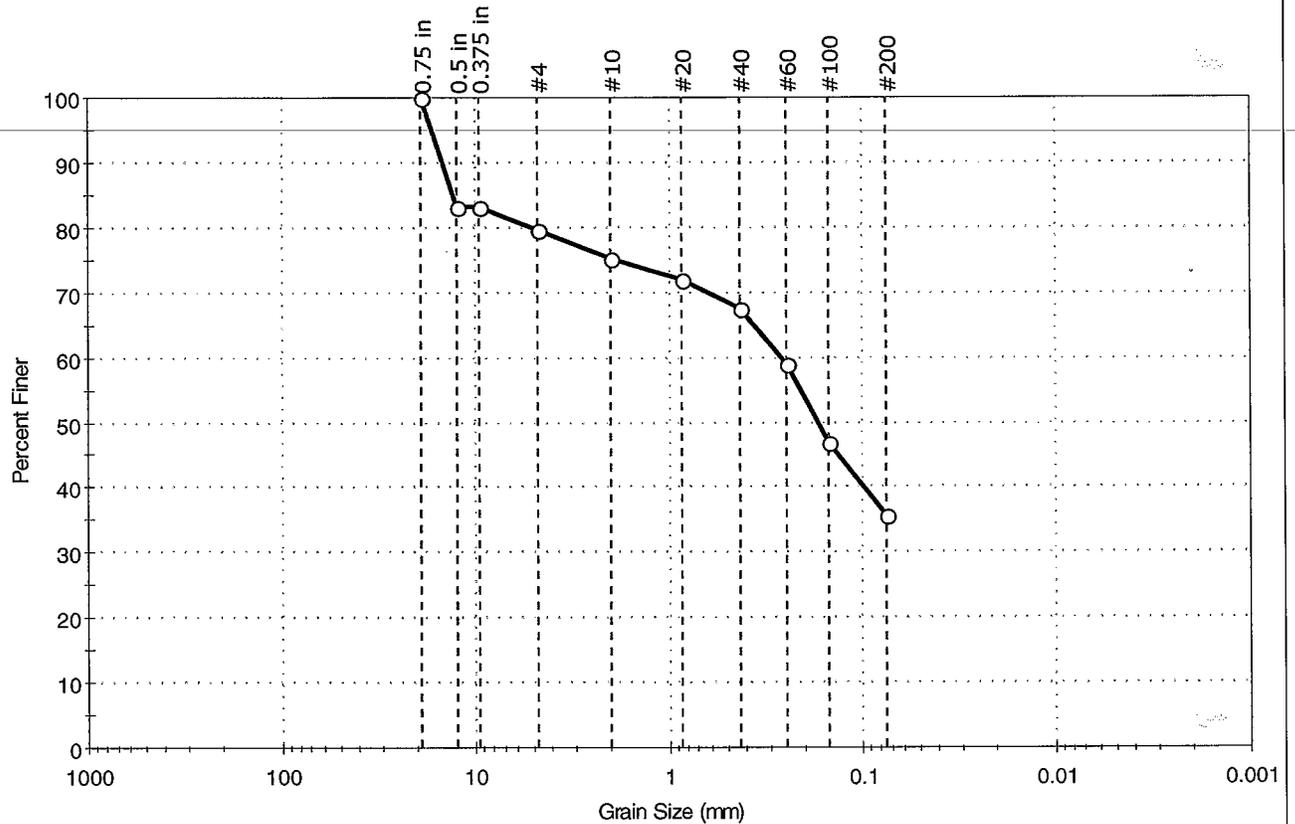
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-6	S-1	2 ft	Silty sand with gravel	SM	20.3	44.0	35.7
TP-6	S-2	4 ft	Poorly graded sand with silt	SP-SM	6.4	82.7	10.9
TP-6	S-3	7 ft	Silty sand with gravel	SM	37.1	47.8	15.1
TP-6	S-4	10 ft	Silty sand with gravel	SM	22.3	56.7	21.0
TP-6	S-5	13 ft	Silty gravel with sand	GM	44.2	42.3	13.5

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-6	Sample Type: jar
Sample ID: S-1	Test Date: 09/29/10	Tested By: jbr
Depth: 2 ft	Test Id: 191847	Checked By: jdt
Test Comment: ---	Sample Description: Moist, dark brown silty sand with gravel	Sample Comment: ---

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	20.3	44.0	35.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	83		
0.375 in	9.50	83		
#4	4.75	80		
#10	2.00	75		
#20	0.85	72		
#40	0.42	68		
#60	0.25	59		
#100	0.15	47		
#200	0.075	36		

Coefficients	
D <sub>85</sub> = 13.0943 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.2676 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.1719 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Silty Soils (A-4 (0))

Sample/Test Description	
Sand/Gravel Particle Shape	: ROUNDED
Sand/Gravel Hardness	: HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-6	Test Date:	10/06/10	Test Id:	191791
Sample ID:	S-1	Depth :	2 ft	Test Comment:	---
Sample Description:	Moist, dark brown silty sand with gravel				
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

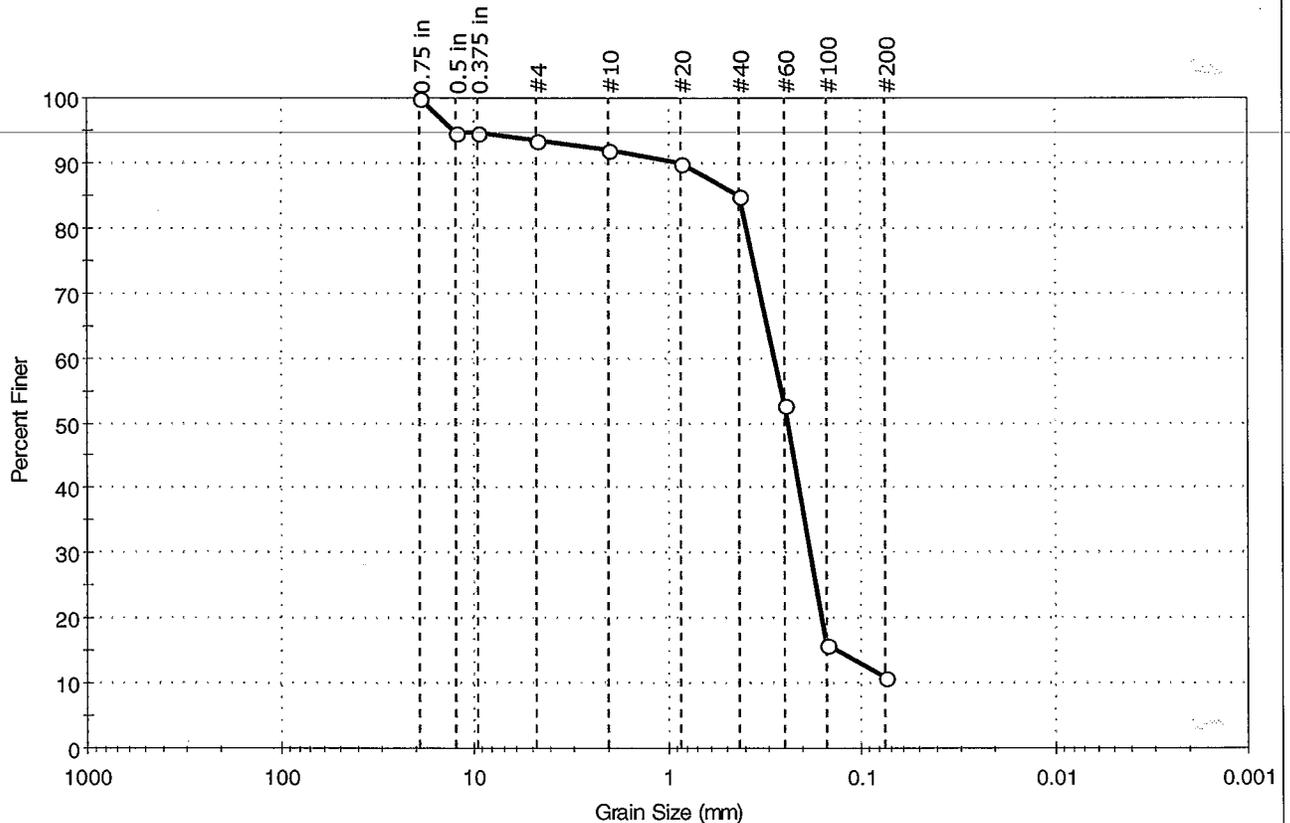
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	TP-6	2 ft	5	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

32% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jbr
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-6	Sample Type: jar
Sample ID: S-2	Test Date: 10/01/10
Depth: 4 ft	Test Id: 191848
Test Comment: ---	
Sample Description: Moist, yellowish brown sand with silt	
Sample Comment: ---	

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	6.4	82.7	10.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	95		
0.375 in	9.50	95		
#4	4.75	94		
#10	2.00	92		
#20	0.85	90		
#40	0.42	85		
#60	0.25	53		
#100	0.15	16		
#200	0.075	11		

**Coefficients**

D <sub>85</sub> = 0.4350 mm	D <sub>30</sub> = 0.1824 mm
D <sub>60</sub> = 0.2821 mm	D <sub>15</sub> = 0.1319 mm
D <sub>50</sub> = 0.2409 mm	D <sub>10</sub> = 0.0665 mm
C <sub>u</sub> = 4.242	C <sub>c</sub> = 1.773

**Classification**

**ASTM** Poorly graded sand with silt (SP-SM)

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

**Sample/Test Description**

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261			
Project:	Assunpink Creek Restoration						
Location:	Trenton, NJ	Boring ID:	TP-6	Sample Type:	jar	Tested By:	cam
		Sample ID:	S-2	Test Date:	09/30/10	Checked By:	jdt
		Depth :	4 ft	Test Id:	191792		
Test Comment:	---						
Sample Description:	Moist, yellowish brown sand with silt						
Sample Comment:	---						

## Atterberg Limits - ASTM D 4318-05

### Sample Determined to be non-plastic

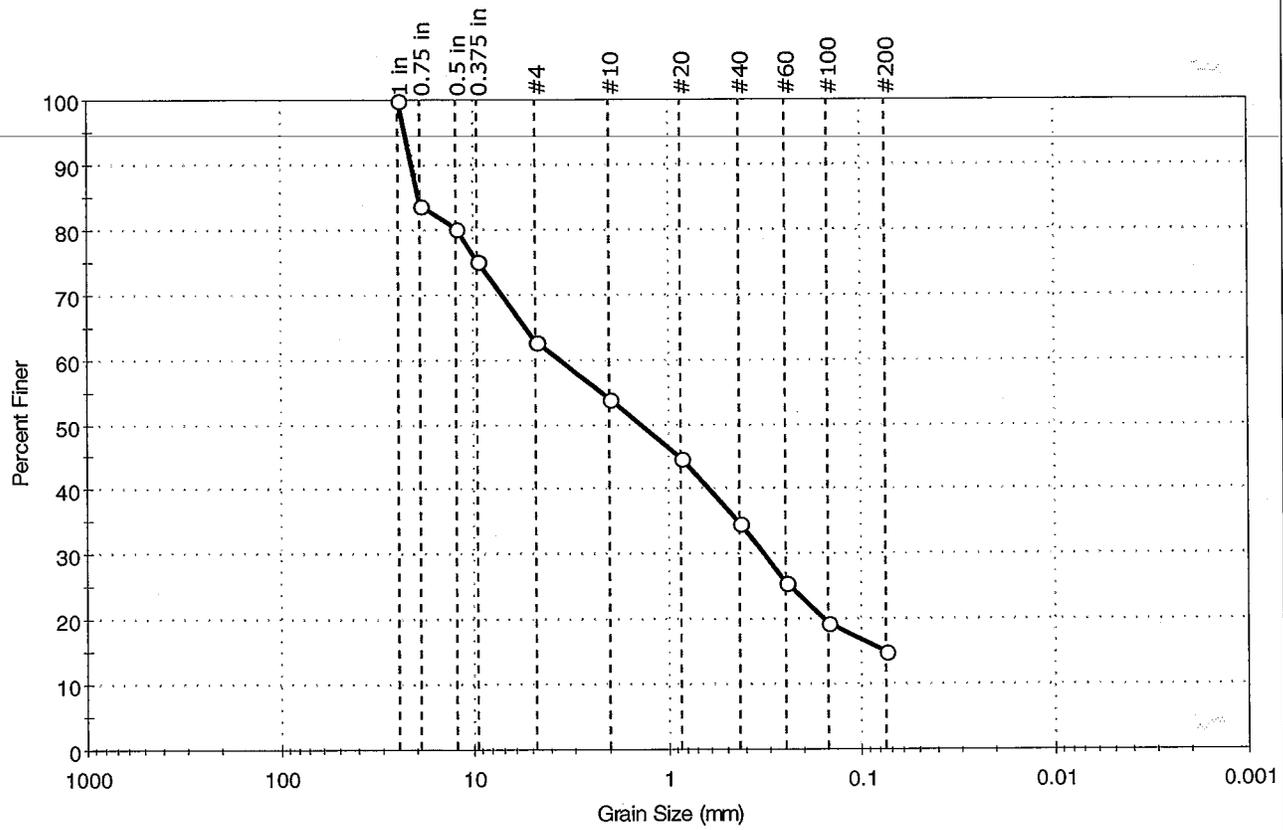
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	TP-6	4 ft	7	n/a	n/a	n/a	n/a	Poorly graded sand with silt (SP-SM)

15% Retained on #40 Sieve  
 Dry Strength: MEDIUM  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jbr
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-6	Sample Type: jar
Sample ID: S-3	Test Date: 09/29/10
Depth: 7 ft	Test Id: 191849
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
—	37.1	47.8	15.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	84		
0.5 in	12.50	80		
0.375 in	9.50	75		
#4	4.75	63		
#10	2.00	54		
#20	0.85	45		
#40	0.42	35		
#60	0.25	26		
#100	0.15	20		
#200	0.075	15		

**Coefficients**

D <sub>85</sub> = 19.3716 mm	D <sub>30</sub> = 0.3207 mm
D <sub>60</sub> = 3.5842 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 1.3719 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

**Classification**

**ASTM** Silty sand with gravel (SM)

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

**Sample/Test Description**

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration				
Location:	Trenton, NJ	Sample Type:	jar	Tested By:	cam
Boring ID:	TP-6	Test Date:	10/06/10	Checked By:	jdt
Sample ID:	S-3	Test Id:	191793		
Depth :	7 ft				
Test Comment:	---				
Sample Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

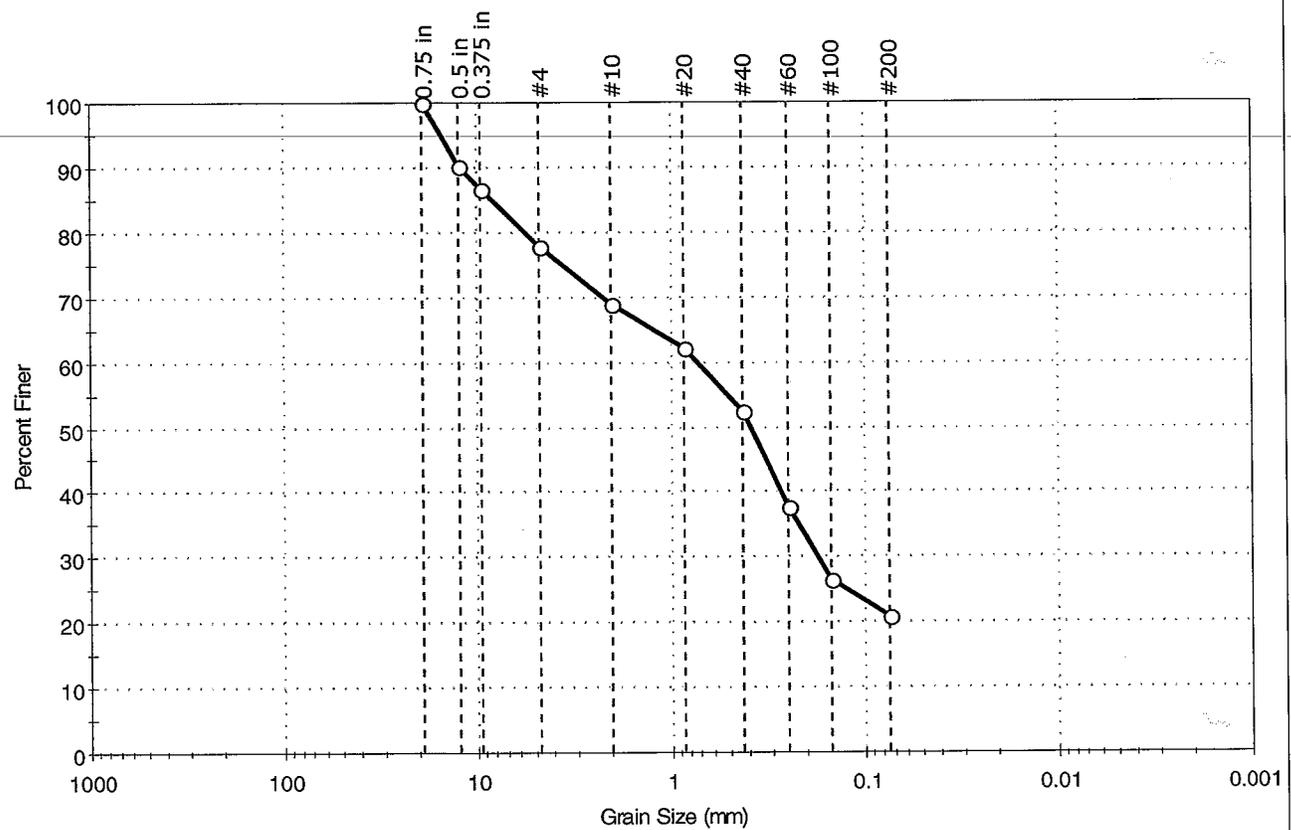
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-3	TP-6	7 ft	11	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

65% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-6	Sample Type: jar
Sample ID: S-4	Depth: 10 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moisty dark brown silty sand with gravel	Test Id: 191850
Checked By: jdt	Tested By: jbr	Sample Comment: ---

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	22.3	56.7	21.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	90		
0.375 in	9.50	87		
#4	4.75	78		
#10	2.00	69		
#20	0.85	62		
#40	0.42	53		
#60	0.25	38		
#100	0.15	27		
#200	0.075	21		

Coefficients	
D <sub>85</sub> = 8.3008 mm	D <sub>30</sub> = 0.1756 mm
D <sub>60</sub> = 0.7225 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.3880 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
<b>ASTM</b>	Silty sand with gravel (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-6	Sample Type:	jar
Sample ID:	S-4	Test Date:	10/06/10
Depth :	10 ft	Test Id:	191794
Test Comment:	---		
Sample Description:	Moisty dark brown silty sand with gravel		
Sample Comment:	---		

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

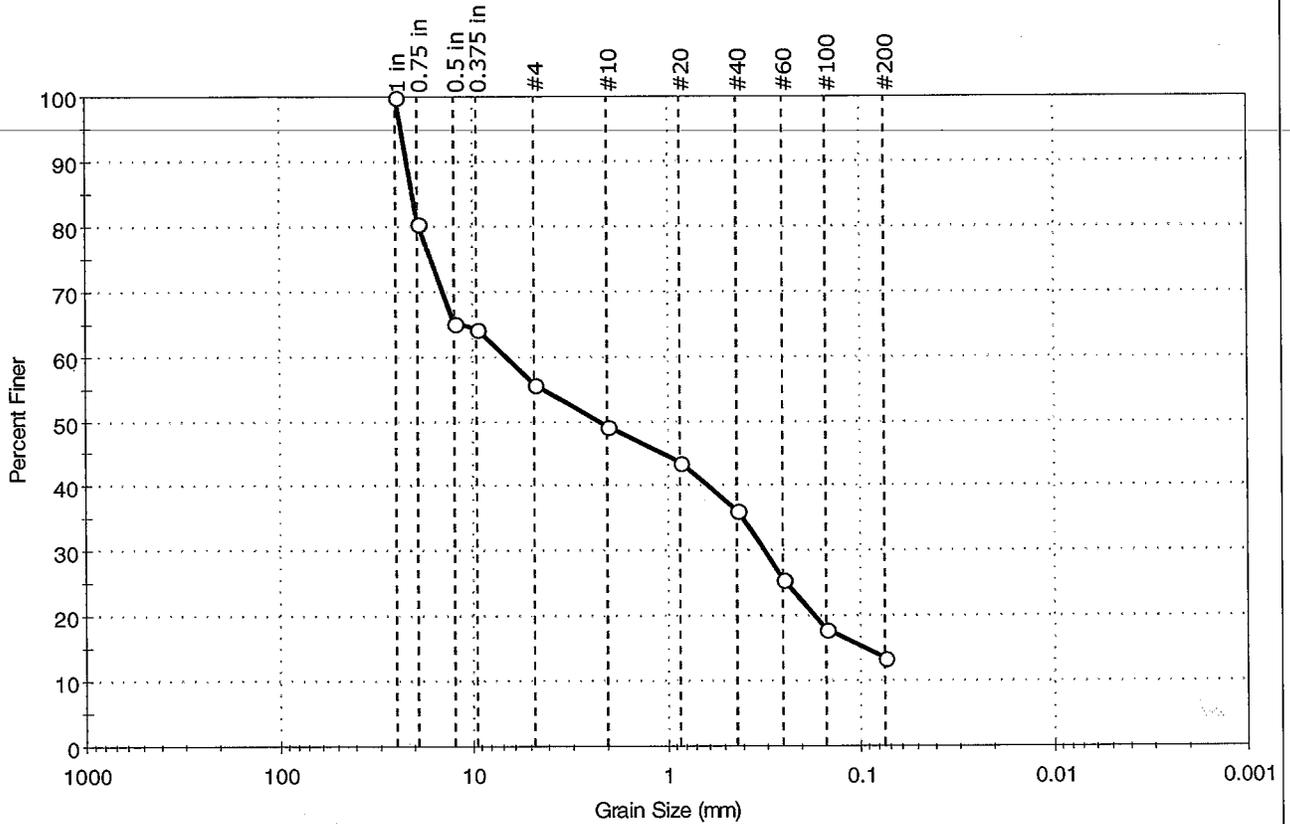
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-4	TP-6	10 ft	15	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

47% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-6	Sample Type: jar
Sample ID: S-5	Test Date: 09/29/10	Tested By: jbr
Depth: 13 ft	Test Id: 191890	Checked By: jdt
Test Comment: ---	Sample Description: Moist dark brown silty gravel with sand	Sample Comment: ---

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	44.2	42.3	13.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	81		
0.5 in	12.50	65		
0.375 in	9.50	64		
#4	4.75	56		
#10	2.00	49		
#20	0.85	44		
#40	0.42	36		
#60	0.25	26		
#100	0.15	18		
#200	0.075	14		

Coefficients	
D <sub>85</sub> = 20.2050 mm	D <sub>30</sub> = 0.3104 mm
D <sub>60</sub> = 6.6806 mm	D <sub>15</sub> = 0.0944 mm
D <sub>50</sub> = 2.2044 mm	D <sub>10</sub> = 0.0435 mm
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty gravel with sand (GM)
AASHTO	Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-6	Sample Type:	jar
Sample ID:	S-5	Test Date:	10/06/10
Depth :	13 ft	Test Id:	191888
Test Comment:	---		
Sample Description:	Moist dark brown silty gravel with 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-5	TP-6	13 ft	14	n/a	n/a	n/a	n/a	Silty gravel with sand (GM)

64% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jrl
Location: Trenton, NJ	Checked By: jdt
Boring ID: ---	Sample Type: ---
Sample ID: ---	Test Date: 10/06/10
Depth : ---	Sample Id: ---

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content, %
TP-7	S-1	2 ft	Moist, dark brown silty sand with gravel	12
TP-7	S-2	4 ft	Moist, brown silty sand with gravel	6.3
TP-7	S-3	6 ft	Moist, dark brown silty sand with gravel	11.4
TP-7	S-4	8 ft	Moist dark brown silty sand with gravel	11.6

Notes: Temperature of Drying : 110° Celsius



Client: O'Brien & Gere Engineers	Project: Assumpink Creek Restoration	Location: Trenton, NJ	Project No: GTX-10261
Boring ID: ---	Sample Type: ---	Tested By: cam	
Sample ID:---	Test Date: 10/06/10	Checked By: jdt	
Depth : ---	Test Id: 191826		

**USCS Classification - ASTM D 2487-06**

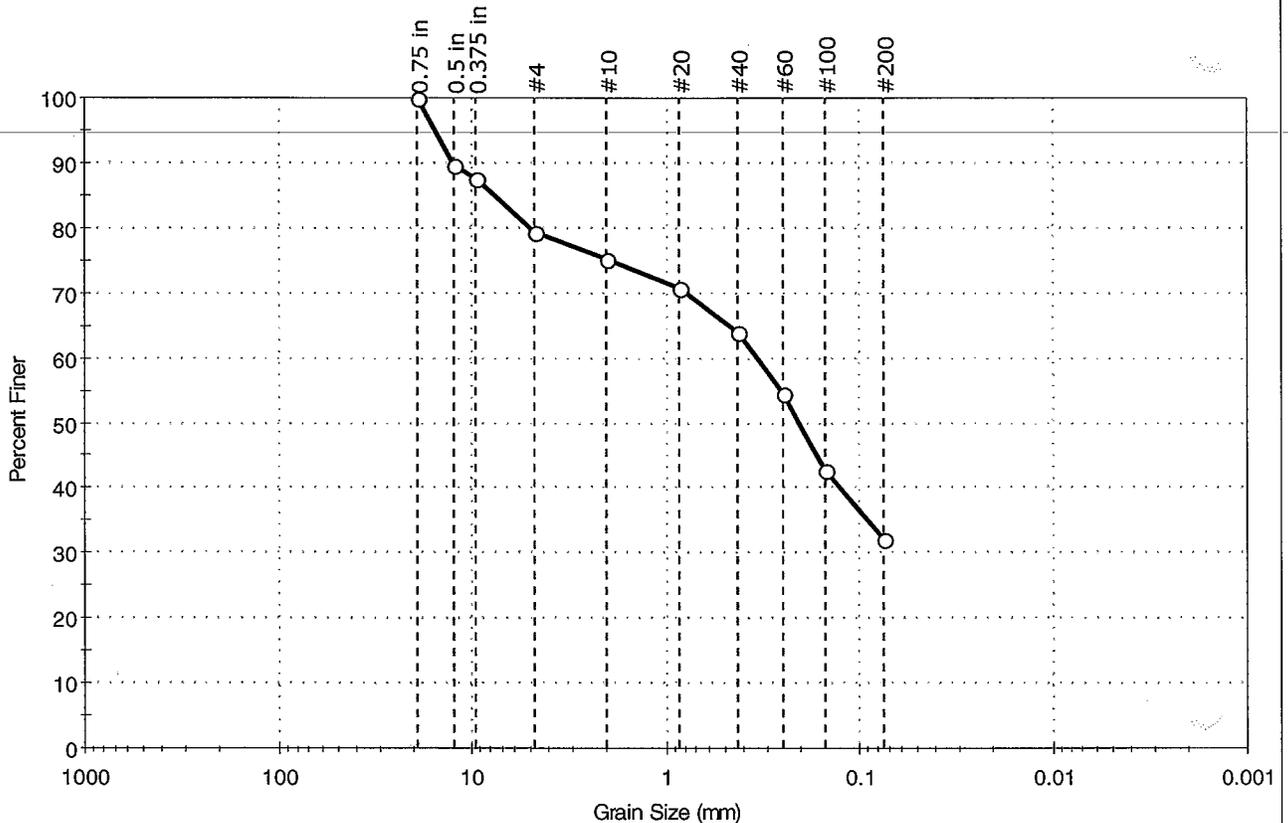
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-7	S-1	2 ft	Silty sand with gravel	SM	20.6	47.3	32.1
TP-7	S-2	4 ft	Silty sand with gravel	SM	32.7	53.3	14.0
TP-7	S-3	6 ft	Silty sand with gravel	SM	24.2	53.5	22.3
TP-7	S-4	8 ft	Silty sand with gravel	SM	22.1	54.2	23.7

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	
Location: Trenton, NJ	
Boring ID: TP-7	Sample Type: jar
Sample ID: S-1	Test Date: 09/29/10
Depth: 2 ft	Test ID: 191851
Test Comment: ---	Tested By: jbr
Sample Description: Moist, dark brown silty sand with gravel	Checked By: jdt
Sample Comment: ---	

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	20.6	47.3	32.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	90		
0.375 in	9.50	88		
#4	4.75	79		
#10	2.00	75		
#20	0.85	71		
#40	0.42	64		
#60	0.25	55		
#100	0.15	43		
#200	0.075	32		

Coefficients	
D <sub>85</sub> = 7.6169 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.3383 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.2053 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

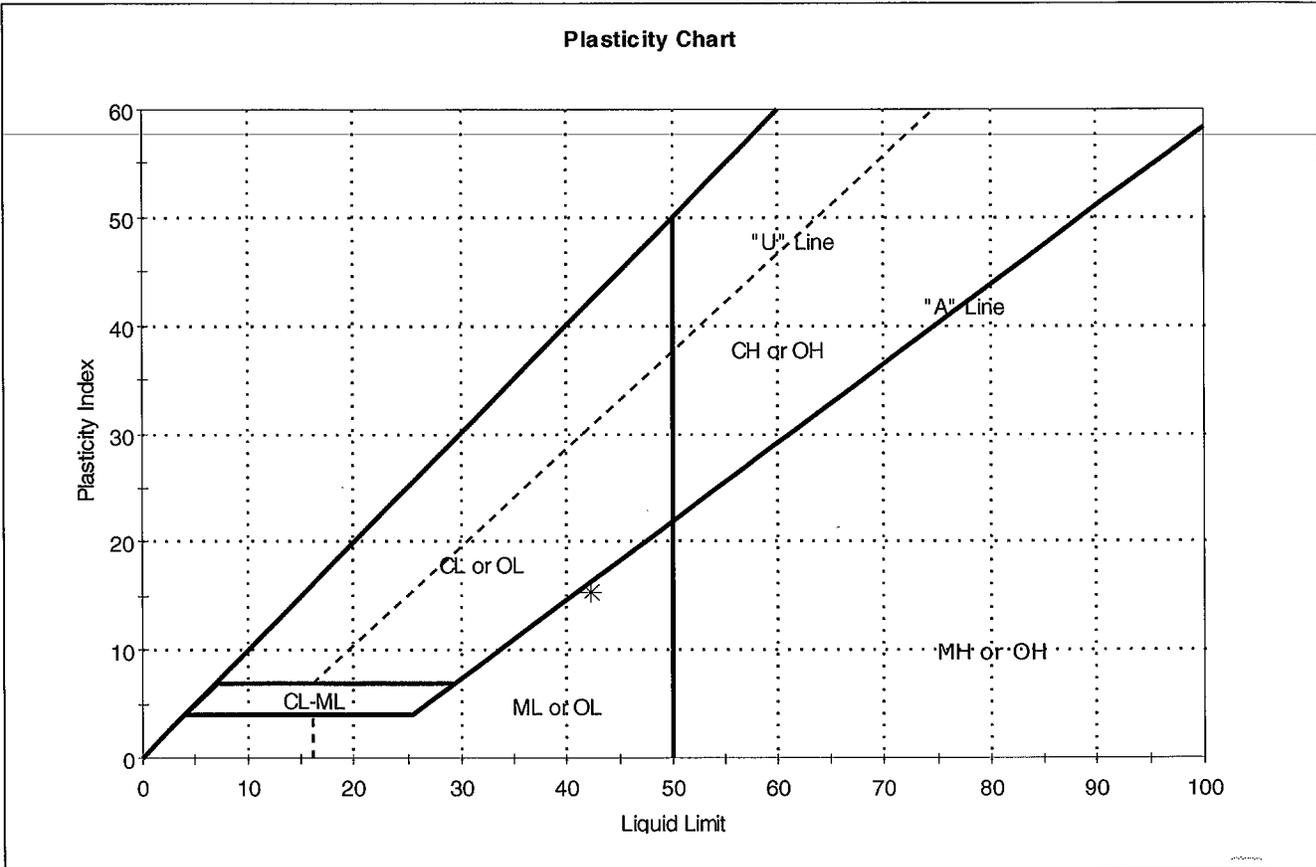
Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Clayey Gravel and Sand (A-2-7 (2))

Sample/Test Description	
Sand/Gravel Particle Shape	: ROUNDED
Sand/Gravel Hardness	: HARD



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: cam
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-7	Sample Type: jar
Sample ID: S-1	Test Date: 10/04/10
Depth: 2 ft	Test Id: 191795
Test Comment: ---	
Sample Description: Moist, dark brown silty sand with gravel	
Sample Comment: ---	

## Atterberg Limits - ASTM D 4318-05



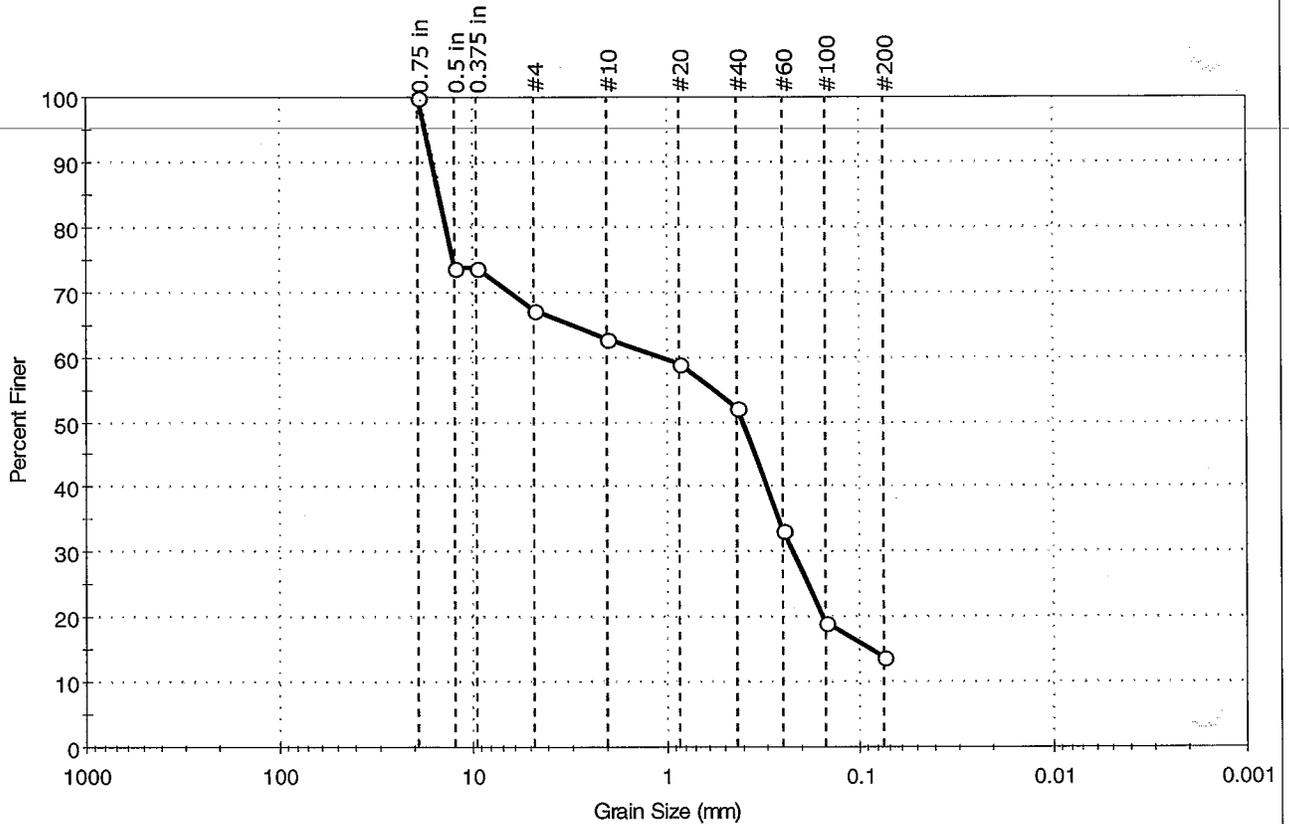
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-1	TP-7	2 ft	12	42	27	15	-1	Silty sand with gravel (SM)

Sample Prepared using the WET method  
 36% Retained on #40 Sieve  
 Dry Strength: HIGH  
 Dilatancy: SLOW  
 Toughness: LOW



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-7	Sample Type: jar
Sample ID: S-2	Test Date: 09/29/10	Tested By: jbr
Depth: 4 ft	Test Id: 191852	Checked By: jdt
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
—	32.7	53.3	14.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	74		
0.375 in	9.50	74		
#4	4.75	67		
#10	2.00	63		
#20	0.85	59		
#40	0.42	52		
#60	0.25	33		
#100	0.15	19		
#200	0.075	14		

Coefficients	
D <sub>85</sub> = 14.9767 mm	D <sub>30</sub> = 0.2217 mm
D <sub>60</sub> = 1.0946 mm	D <sub>15</sub> = 0.0860 mm
D <sub>50</sub> = 0.4007 mm	D <sub>10</sub> = 0.0435 mm
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No =
Boring ID:	TP-7	Sample Type: jar
Sample ID:	S-2	Test Date: 10/06/10
Depth:	4 ft	Test Id: 191796
Test Comment:	---	
Sample Description:	Moist, brown silty sand with gravel	
Sample Comment:	---	

## Atterberg Limits - ASTM D 4318-05

<p><b>Sample Determined to be non-plastic</b></p>
---

Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	
*	S-2	TP-7	4 ft	6	n/a	n/a	n/a	n/a	Silty sand

48% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID:	TP-7	Sample Type: jar
Sample ID:	S-2	Test Date: 10/06/10
Depth:	4 ft	Test Id: 191796
Test Comment:	---	
Sample Description:	Moist, brown silty sand with gravel	
Sample Comment:	---	

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

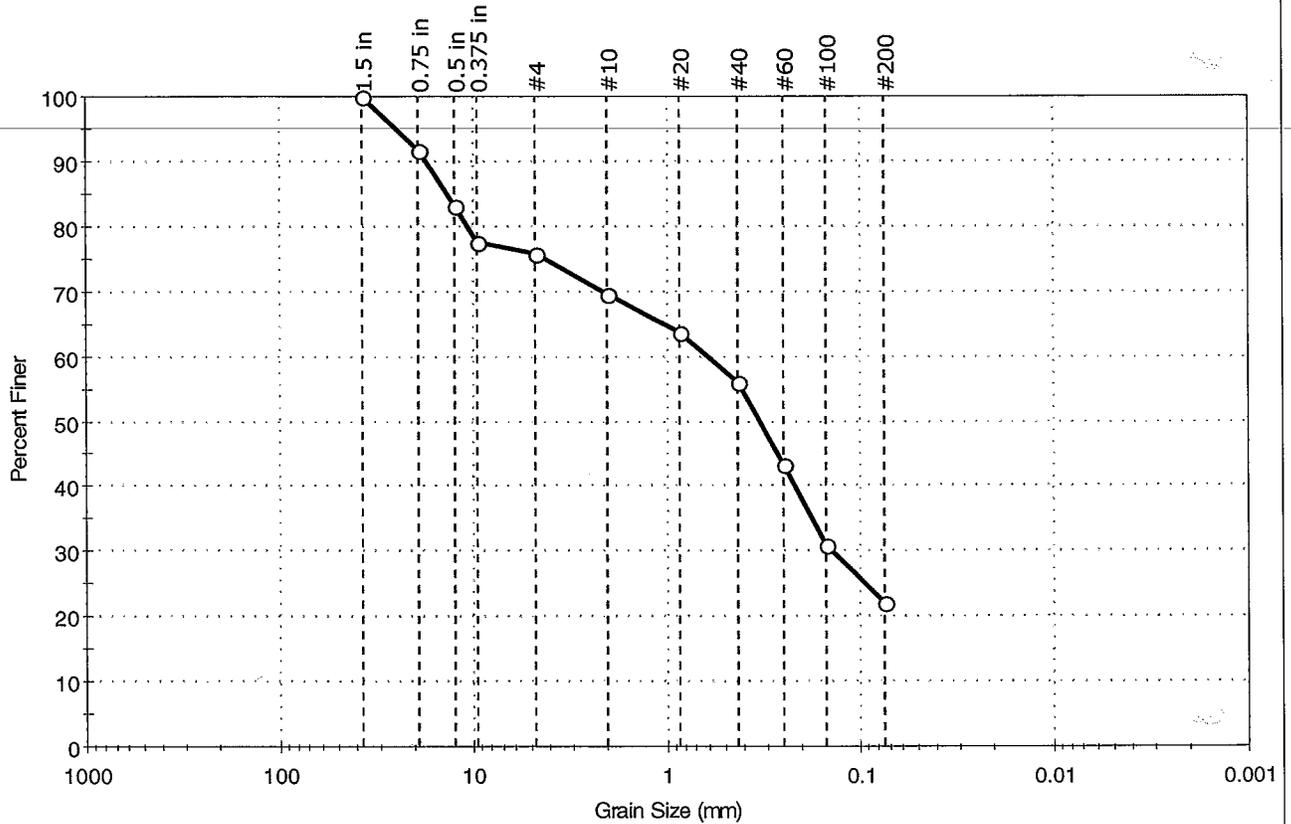
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-2	TP-7	4 ft	6	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

48% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-7	Sample Type: jar
Sample ID: S-3	Depth: 6 ft	Test Date: 09/29/10
Test Comment: ---	Test Id: 191853	Tested By: jbr
Sample Description: Moist, dark brown silty sand with gravel	Checked By: jdt	
Sample Comment: ---		

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



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	24.2	53.5	22.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
0.75 in	19.00	92		
0.5 in	12.50	83		
0.375 in	9.50	78		
#4	4.75	76		
#10	2.00	69		
#20	0.85	64		
#40	0.42	56		
#60	0.25	43		
#100	0.15	31		
#200	0.075	22		

Coefficients	
D <sub>85</sub> = 13.5981 mm	D <sub>30</sub> = 0.1392 mm
D <sub>60</sub> = 0.6010 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.3301 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
<b>ASTM</b>	Silty sand with gravel (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration				
Location:	Trenton, NJ				
Boring ID:	TP-7	Sample Type:	jar	Tested By:	cam
Sample ID:	S-3	Test Date:	10/06/10	Checked By:	jdt
Depth :	6 ft	Test Id:	191797		
Test Comment:	---				
Sample Description:	Moist, dark brown silty sand with gravel				
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

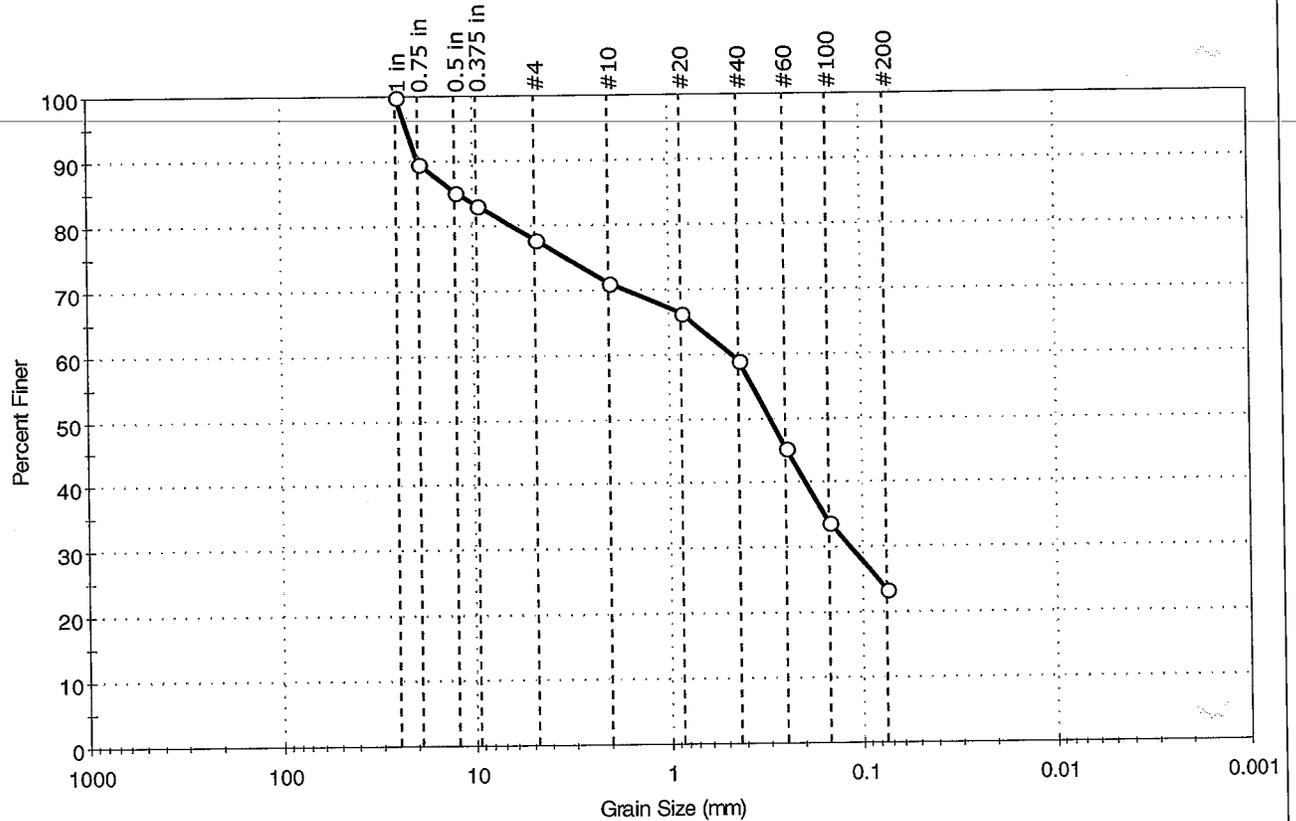
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	S-3	TP-7	6 ft	11	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

44% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assumpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-7	Sample Type: jar
Sample ID: S-4	Depth: 8 ft	Test Date: 09/29/10
Test Comment: ---	Sample Description: Moist dark brown silty sand with gravel	Tested By: jbr
Sample Comment: ---		Checked By: jdt
		Test Id: 191854

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	22.1	54.2	23.7

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	85		
0.375 in	9.50	83		
#4	4.75	78		
#10	2.00	71		
#20	0.85	66		
#40	0.42	59		
#60	0.25	46		
#100	0.15	34		
#200	0.075	24		

Coefficients	
D <sub>85</sub> = 12.1897 mm	D <sub>30</sub> = 0.1151 mm
D <sub>60</sub> = 0.4727 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.2989 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand with gravel (SM)
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description
Sand/Gravel Particle Shape : ROUNDED
Sand/Gravel Hardness : HARD



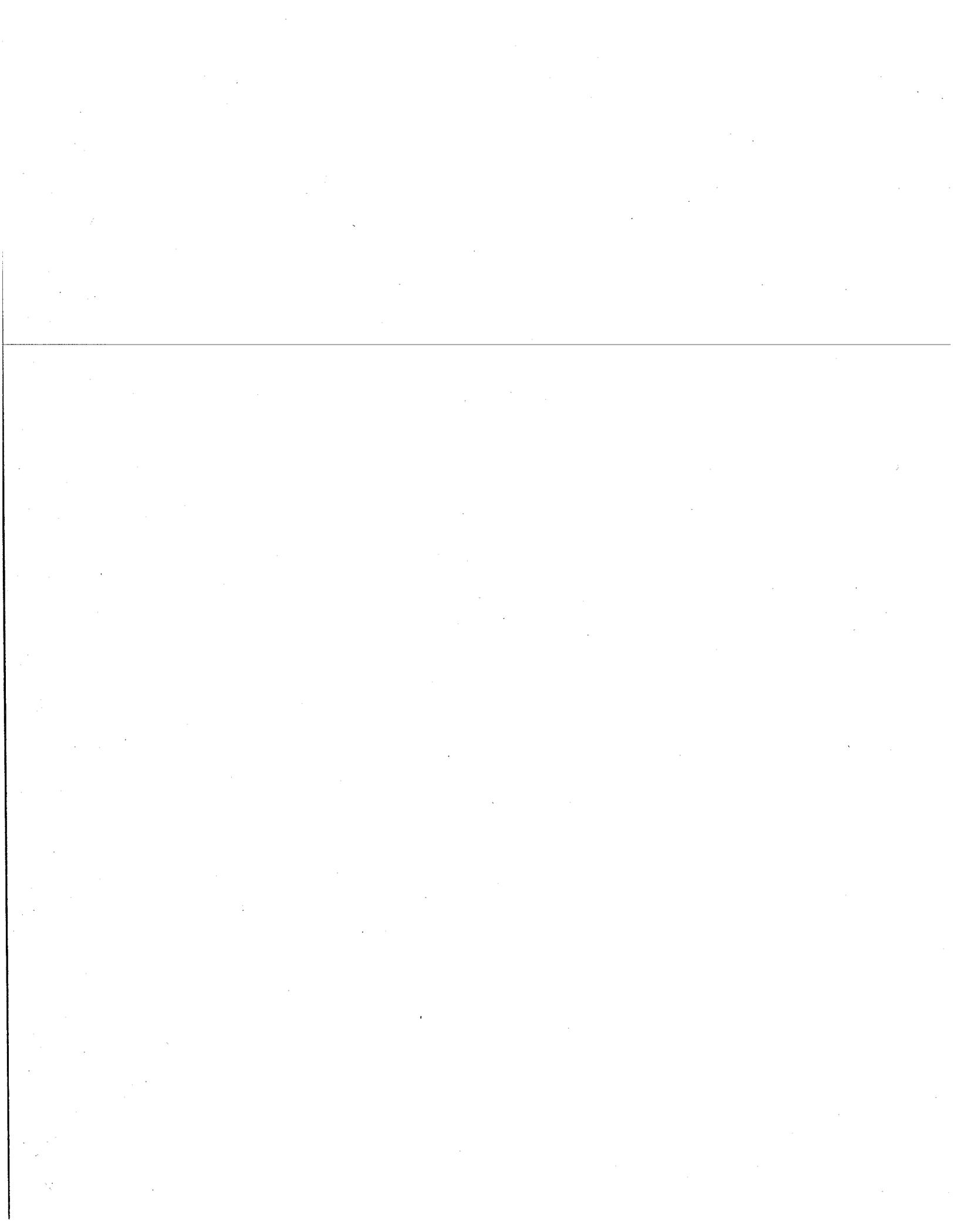
Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID:	TP-7	Sample Type: jar
Sample ID:	S-4	Test Date: 10/06/10
Depth:	8 ft	Test Id: 191798
Test Comment:	---	
Sample Description:	Moist dark brown silty sand with gravel	
Sample Comment:	---	

## 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-4	TP-7	8 ft	12	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

41% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client: O'Brien & Gere Engineers	Project No: GTX-10261	
Project: Assunpink Creek Restoration		
Location: Trenton, NJ		
Boring ID: ---	Sample Type: ---	Tested By: jrl
Sample ID: ---	Test Date: 10/06/10	Checked By: jdt
Depth : ---	Sample Id: ---	

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content, %
TP-8	#1	3 ft	Moist, dark brown silty sand	9
TP-8	#2	10.5 ft	Moist, brown gravel with sand	9.2
TP-8	#3	9 ft	Moist, dark brown gravel with sand	3

Notes: Temperature of Drying : 110° Celsius



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	---	Checked By:	jdt
Boring ID:	---	Test Date:	10/06/10	Test Id:	191829
Sample ID:	---				
Depth :	---				

**USCS Classification - ASTM D 2487-06**

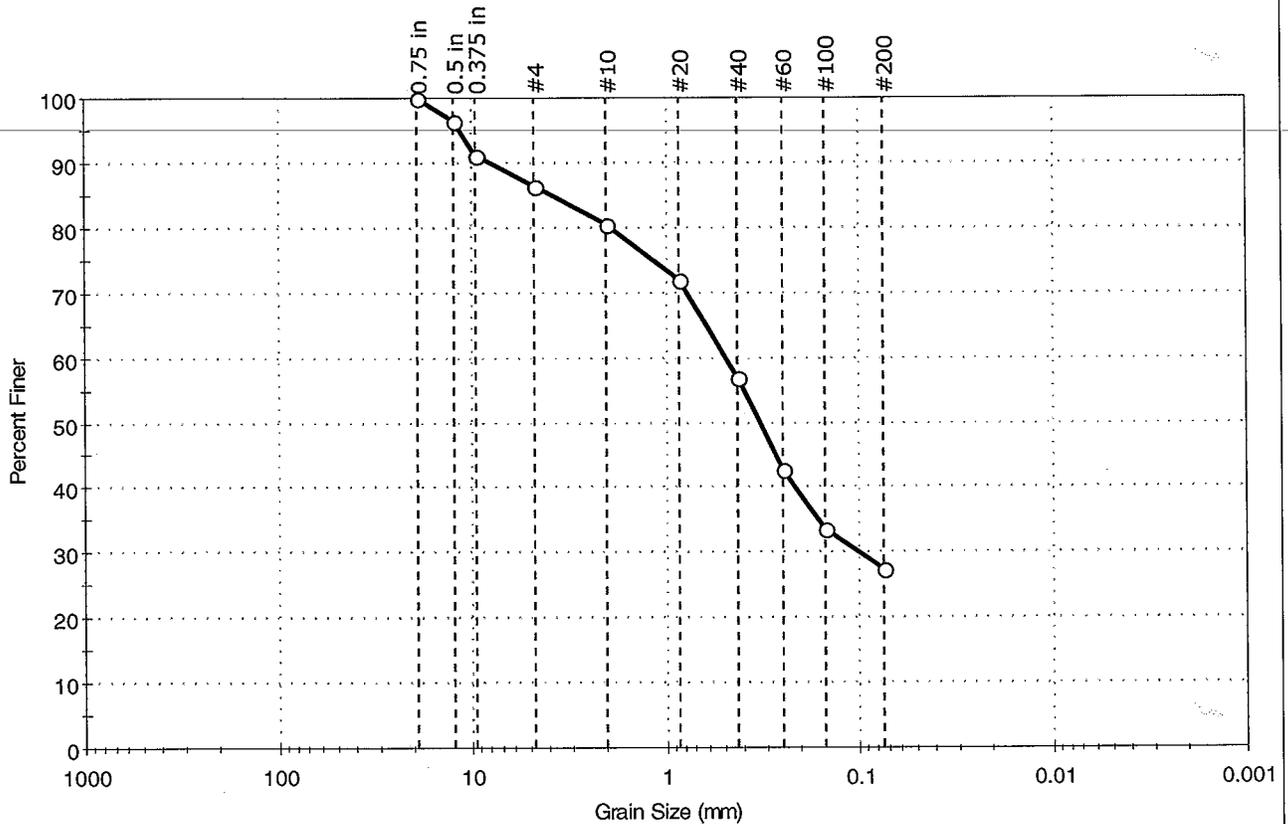
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-8	#1	3 ft	Silty sand	SM	13.6	58.8	27.6
TP-8	#2	10.5 ft	Well-graded gravel with sand	GW	63.2	32.6	4.2
TP-8	#3	9 ft	Poorly graded gravel with sand	GP	78.2	18.5	3.3

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Location: Trenton, NJ	Project No: GTX-10261
Boring ID: TP-8	Sample Type: jar	Tested By: jbr	
Sample ID:#1	Test Date: 09/29/10	Checked By: jdt	
Depth : 3 ft	Test Id: 191855		
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
—	13.6	58.8	27.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	97		
0.375 in	9.50	91		
#4	4.75	86		
#10	2.00	81		
#20	0.85	72		
#40	0.42	57		
#60	0.25	43		
#100	0.15	34		
#200	0.075	28		

<u>Coefficients</u>	
D <sub>85</sub> = 3.8518 mm	D <sub>30</sub> = 0.0990 mm
D <sub>60</sub> = 0.4919 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.3288 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<u>Classification</u>	
<b>ASTM</b>	Silty sand (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

<u>Sample/Test Description</u>	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-8	Sample Type:	jar
Sample ID:	#1	Test Date:	10/06/10
Depth :	3 ft	Test Id:	191799
Test Comment:	---		
Sample Description:	Moist, dark brown silty sand		
Sample Comment:	---		

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

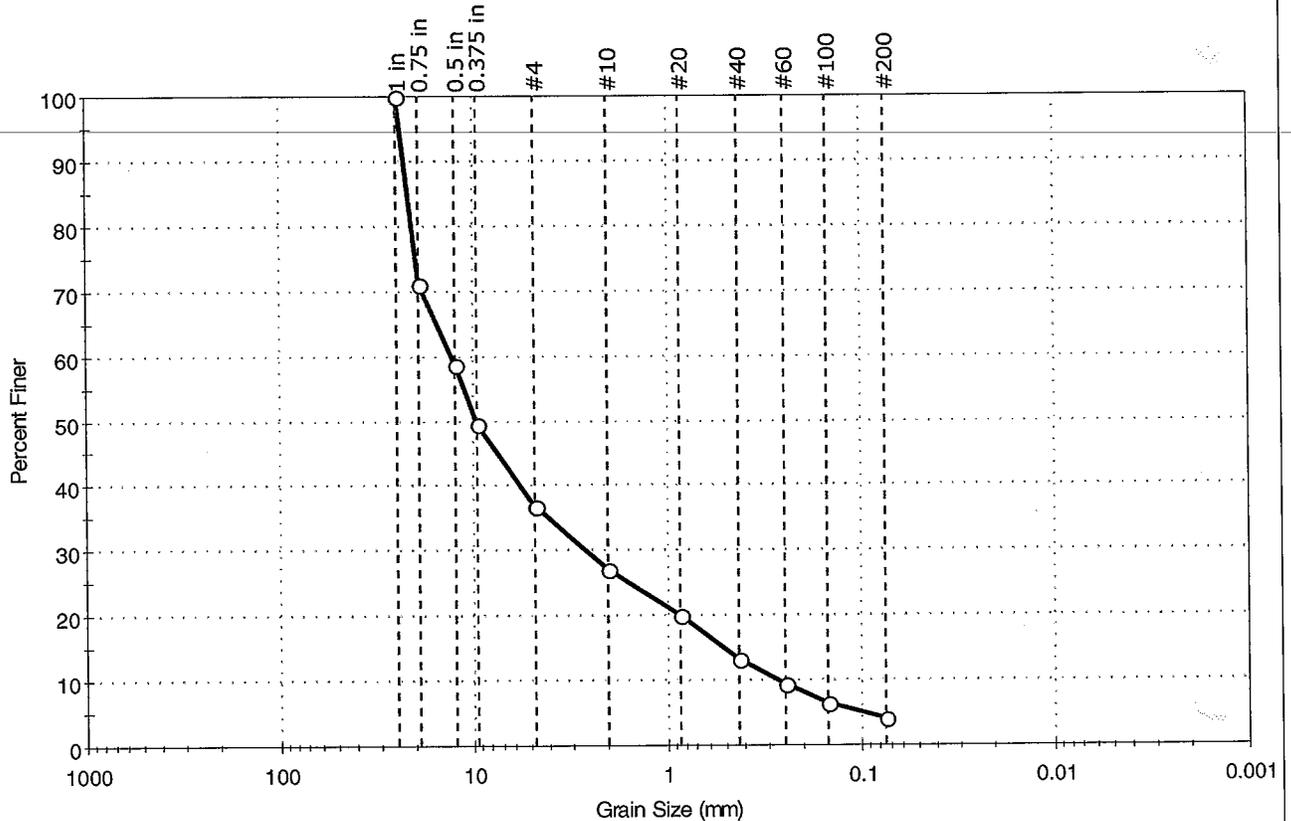
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#1	TP-8	3 ft	9	n/a	n/a	n/a	n/a	Silty sand (SM)

43% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jbr
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-8	Sample Type: jar
Sample ID:#2	Test Date: 09/29/10
Depth : 10.5 ft	Test Id: 191856
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
—	63.2	32.6	4.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	71		
0.5 in	12.50	59		
0.375 in	9.50	50		
#4	4.75	37		
#10	2.00	27		
#20	0.85	20		
#40	0.42	13		
#60	0.25	9		
#100	0.15	7		
#200	0.075	4		

Coefficients	
D <sub>85</sub> = 21.6753 mm	D <sub>30</sub> = 2.5747 mm
D <sub>60</sub> = 13.0547 mm	D <sub>15</sub> = 0.5000 mm
D <sub>50</sub> = 9.6001 mm	D <sub>10</sub> = 0.2715 mm
C <sub>u</sub> = 48.084	C <sub>c</sub> = 1.870

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



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-8	Test Date:	10/06/10	Test Id:	191800
Sample ID:	#2	Test Comment: ---			
Depth :	10.5 ft	Sample Description: Moist, brown gravel with sand			
Sample Comment: ---					

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

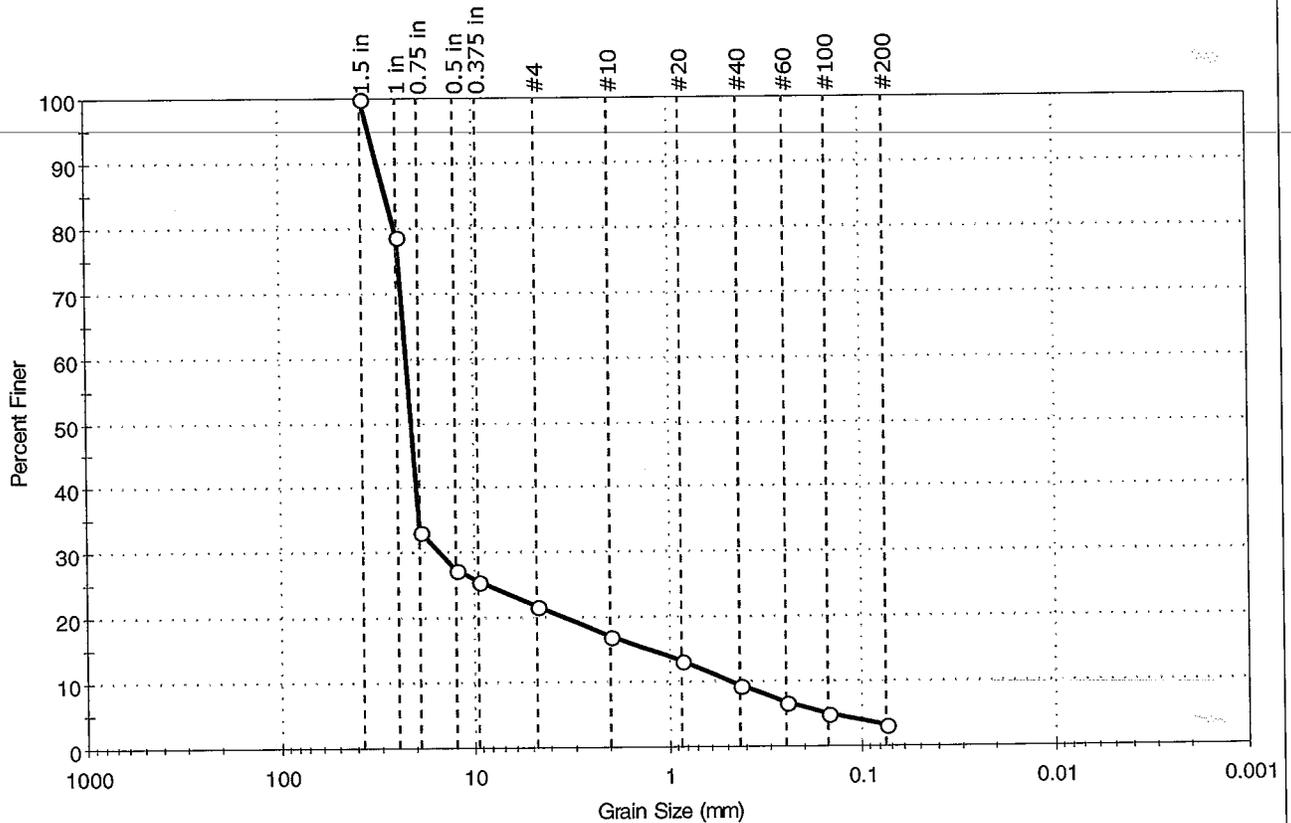
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#2	TP-8	10.5 ft	9	n/a	n/a	n/a	n/a	Well-graded gravel with sand (GW)

87% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilentancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jbr
Location: Trenton, NJ	Checked By: jdt
Boring ID: TP-8	Sample Type: jar
Sample ID: #3	Test Date: 09/29/10
Depth: 9 ft	Test Id: 191857
Test Comment: ---	
Sample Description: Moist, dark brown gravel with sand	
Sample Comment: ---	

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



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	78.2	18.5	3.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	79		
0.75 in	19.00	33		
0.5 in	12.50	27		
0.375 in	9.50	26		
#4	4.75	22		
#10	2.00	17		
#20	0.85	13		
#40	0.42	9		
#60	0.25	7		
#100	0.15	5		
#200	0.075	3		

Coefficients	
D <sub>85</sub> = 28.1612 mm	D <sub>30</sub> = 15.0194 mm
D <sub>60</sub> = 22.3283 mm	D <sub>15</sub> = 1.2412 mm
D <sub>50</sub> = 21.0232 mm	D <sub>10</sub> = 0.4804 mm
C <sub>u</sub> = 46.479	C <sub>c</sub> = 21.030

Classification	
<u>ASTM</u>	Poorly graded gravel with sand (GP)
<u>AASHTO</u>	Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description	
Sand/Gravel Particle Shape : ROUNDED	
Sand/Gravel Hardness : HARD	



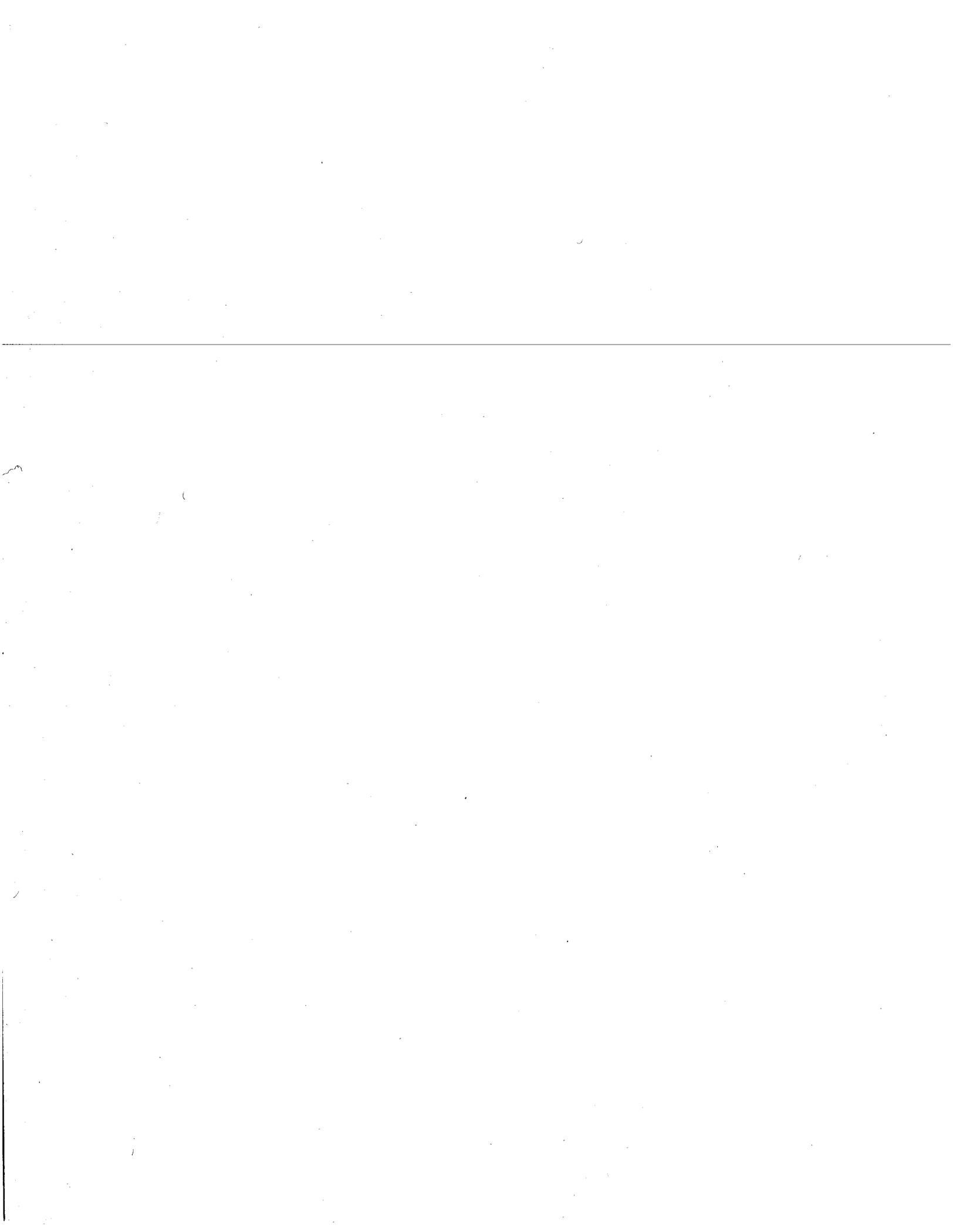
Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID:	TP-8	Sample Type: jar
Sample ID:	#3	Test Date: 10/06/10
Depth:	9 ft	Test Id: 191801
Test Comment:	---	
Sample Description:	Moist, dark brown gravel with sand	
Sample Comment:	---	

## 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
*	#3	TP-8	9 ft	3	n/a	n/a	n/a	n/a	Poorly graded gravel with sand (GP)

91% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic





Client: O'Brien & Gere Engineers	Project No: GTX-10261
Project: Assunpink Creek Restoration	Tested By: jrl
Location: Trenton, NJ	Checked By: jdt
Boring ID: ---	Sample Type: ---
Sample ID: ---	Test Date: 10/06/10
Depth : ---	Sample Id: ---

**Moisture Content of Soil - ASTM D 2216-05**

Boring ID	Sample ID	Depth	Description	Moisture Content, %
TP-9	#1	2 ft	Moist, dark brown silty sand with gravel	6.1
TP-9	#2	4 ft	Moist, dark brown silty sand	13.4

Notes: Temperature of Drying : 110° Celsius



Client:	O'Brien & Gere Engineers	
Project:	Assunpink Creek Restoration	
Location:	Trenton, NJ	Project No: GTX-10261
Boring ID:	---	Sample Type: ---
Sample ID:	---	Test Date: 10/06/10
Depth :	---	Test Id: 191831
		Tested By: cam
		Checked By: jdt

**USCS Classification - ASTM D 2487-06**

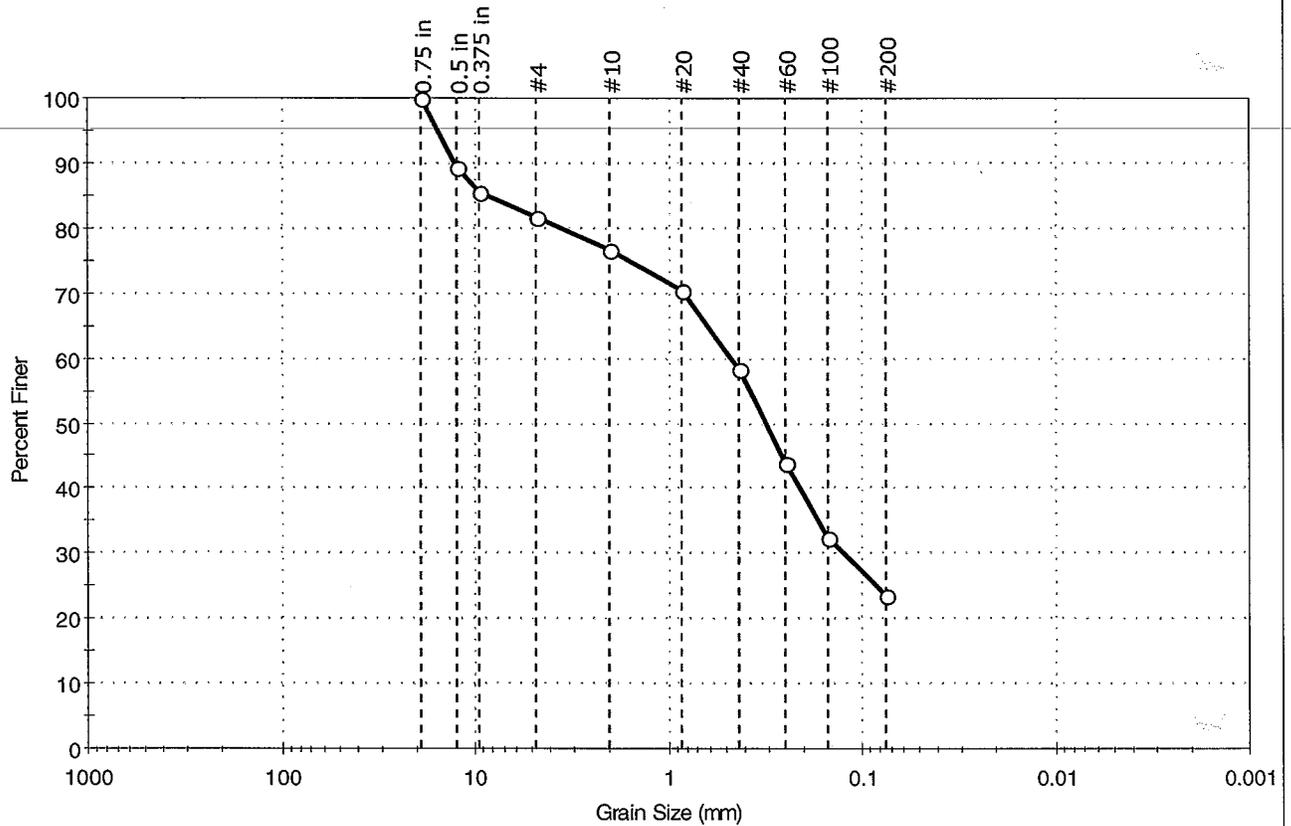
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
TP-9	#1	2 ft	Silty sand with gravel	SM	18.3	58.1	23.6
TP-9	#2	4 ft	Silty sand	SM	6.2	49.6	44.2

Remarks: Grain Size analysis performed by ASTM D422, results enclosed  
 Atterbeg Limits performed by ASTM 4318, results enclosed



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Project No: GTX-10261
Location: Trenton, NJ	Boring ID: TP-9	Sample Type: jar
Sample ID:#1	Test Date: 10/01/10	Tested By: jbr
Depth : 2 ft	Test Id: 191858	Checked By: jdt
Test Comment: ---		
Sample Description: Moist, dark brown silty sand with gravel		
Sample Comment: ---		

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



%Cobble	%Gravel	%Sand	%Silt & Clay Size
—	18.3	58.1	23.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	89		
0.375 in	9.50	85		
#4	4.75	82		
#10	2.00	77		
#20	0.85	71		
#40	0.42	58		
#60	0.25	44		
#100	0.15	32		
#200	0.075	24		

<b>Coefficients</b>	
D <sub>85</sub> = 8.7935 mm	D <sub>30</sub> = 0.1239 mm
D <sub>60</sub> = 0.4656 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.3118 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

<b>Classification</b>	
<b>ASTM</b>	Silty sand with gravel (SM)
<b>AASHTO</b>	Silty Gravel and Sand (A-2-4 (0))

<b>Sample/Test Description</b>
Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD



Client:	O'Brien & Gere Engineers		Project No:	GTX-10261	
Project:	Assunpink Creek Restoration		Tested By:	cam	
Location:	Trenton, NJ	Sample Type:	jar	Checked By:	jdt
Boring ID:	TP-9	Test Date:	10/06/10	Test Id:	191802
Sample ID:	#1				
Depth :	2 ft				
Test Comment:	---				
Sample Description:	Moist, dark brown silty sand with gravel				
Sample Comment:	---				

## Atterberg Limits - ASTM D 4318-05

Sample Determined to be non-plastic

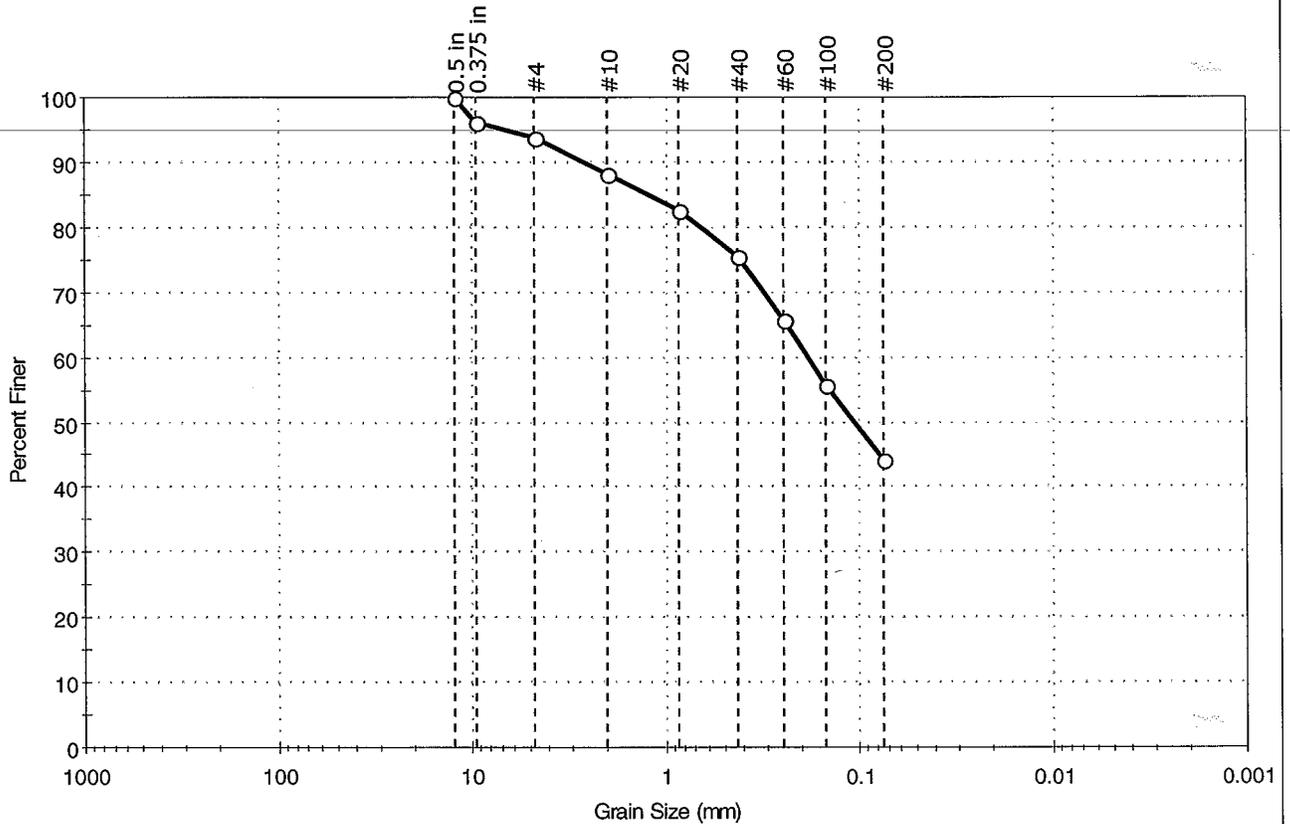
Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#1	TP-9	2 ft	6	n/a	n/a	n/a	n/a	Silty sand with gravel (SM)

42% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



Client: O'Brien & Gere Engineers	Project: Assunpink Creek Restoration	Location: Trenton, NJ	Project No: GTX-10261
Boring ID: TP-9	Sample Type: jar	Tested By: jbr	Sample ID:#2
Depth : 4 ft	Test Date: 09/29/10	Checked By: jdt	Test Id: 191859
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
---	6.2	49.6	44.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	96		
#4	4.75	94		
#10	2.00	88		
#20	0.85	83		
#40	0.42	75		
#60	0.25	66		
#100	0.15	56		
#200	0.075	44		

Coefficients	
D <sub>85</sub> = 1.2061 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.1872 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.1066 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

Classification	
ASTM	Silty sand (SM)
AASHTO	Silty Soils (A-4 (0))

Sample/Test Description	
Sand/Gravel Particle Shape :	ANGULAR
Sand/Gravel Hardness :	HARD



Client:	O'Brien & Gere Engineers		
Project:	Assunpink Creek Restoration		
Location:	Trenton, NJ	Project No:	GTX-10261
Boring ID:	TP-9	Sample Type:	jar
Sample ID:	#2	Test Date:	10/06/10
Depth :	4 ft	Test Id:	191803
Test Comment:	---		
Sample Description:	Moist, dark brown silty sand		
Sample Comment:	---		

## Atterberg Limits - ASTM D 4318-05

<p><b>Sample Determined to be non-plastic</b></p>
---

Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	#2	TP-9	4 ft	13	n/a	n/a	n/a	n/a	Silty sand (SM)

25% Retained on #40 Sieve  
 Dry Strength: NONE  
 Dilatancy: RAPID  
 Toughness: n/a  
 The sample was determined to be Non-Plastic



**SOIL CHAIN OF CUSTODY & TEST REQUEST**

006 7599

**CLIENT**

Company: O'Brien & Gere  
Address: Bentwood Campus, 301 E. Germantown Pike, 3<sup>rd</sup> Floor  
City, State, Zip: E. Norriton, PA 19401  
Contact: Dreher Whetstone  
Phone: 484.804.7236

E-mail: Dreher.Whetstone@obg.com  
Fax: 215-628-9953

**PROJECT**

Project Name: Assunpink Creek Restoration  
Address: 222 S. Warren St  
City, State, Zip: Trenton, NJ  
Client Project #: 46661  
On-site Contact: E-mail:  
Phone: Fax:

**GeoTesting Express, Inc.**  
1145 Massachusetts Avenue  
Boxborough, MA 01719  
800 434 1062 Toll Free  
978 635 0266 Fax

2662 Halcomb Bridge Road, Suite 310  
Alpharetta, GA 30022  
770 645 6575 Tel  
770 645 6570 Fax

www.geotesting.com

**INVOICE (complete if different from client)**

Company:  
Address:  
City, State, Zip:  
Contact:  
Phone:

Purchase Order #:  
Shipped By: DDW  
Date Shipped: 9/24/10  
Mode of Shipment: FedEx  
Requested Turnaround: Standard

Send Results To:  CLIENT OFFICE  PROJECT OFFICE  
Send Results Via:  E-MAIL  FAX  VERBAL  HARD COPY

**GENERAL**

GTX Sales Order #:  
Date Shipped: 9/24/10  
Requested Turnaround: Standard

SOIL *please include boring # and depth if known	Sample ID	Specify Test Conditions (Undisturbed or Remolded, Density and moisture, Test Normal Loads, Test Confining Stresses, etc.):										Other:						
		Aterberg Limits (ASTM D 4318)	California Bearing Ratio (ASTM D 1883) *specify conditions below	USCS - Classification (ASTM D 2487)	Density (ASTM D 2937)	Direct Shear (ASTM D 3080) *specify conditions below	Direct Simple Shear (ASTM D 6528) *specify conditions below	Electrical Resistivity (ASTM G 57) Sieve Only / Sieve & Hydrometer please circle one	Incremental Consolidation (ASTM D 2435) please circle one	Moisture Content (ASTM D 2216)	Organic Content (ASTM D 2974)	Permeability/ Hydraulic Conductivity (Fixed Wall - ASTM D 2434) (Flexible Wall - ASTM D 5084) please circle one	Ph (ASTM D 4972) please circle one	Proctor Compaction (Standard - ASTM D 698) (Modified - ASTM D 1557) please circle one	Specific Gravity (ASTM D 854)	Trialaxial Shear (UU - ASTM D 2850) (CU - ASTM D 4767) (CD - US COE EM1110) *specify conditions below please circle one	Unconfined Compression (ASTM D 2166)	Other:
	1	TP-1 (#1) @ 2'	X					X		X								
	2	TP-1 (#2) @ 2'	X					X		X								
	3	TP-1 (#3) @ 8'	X					X		X								
	4	TP-1 (#4) @ 12'	X					X		X								
	5	TP-2 (#1) @ 2'	X					X		X								
	6	TP-2 (#2) @ 4'	X					X		X								
	7	TP-2 (#3) @ 7.5'	X					X		X								

**AUTHORIZE BY SIGNING AND DATING:**

**SIGNATURE:** *[Signature]* **DATE:** 9/24/10

**PRINT NAME: DREHER WHETSTONE**

**Received By:** *[Signature]* **DATE:** 9/24/10  
**TIME:** 11:45am

**Received By:** *[Signature]* **DATE:** 9/24/10  
**TIME:** 11:00

Incoming Sample Inspection Performed

Adverse conditions: \_\_\_\_\_

**Relinquished By:** *[Signature]* **DATE:** 9/24/10  
**TIME:** 11:00

**Relinquished By:** *[Signature]* **DATE:** 9/24/10  
**TIME:** 11:00

**SOIL CHAIN OF CUSTODY & TEST REQUEST**

**CLIENT**

Company: O'Brien & Gere  
Address: Bentwood Campus, 301 E. Germantown Pike, 3<sup>rd</sup> Floor  
City, State, Zip: E. Norriton, PA 19401  
E-mail: Dreher.Whetstone@obg.com  
Phone: 484.804.7236

**PROJECT**

Project Name: Assunpink Creek Restoration  
Address: 222 S. Warren St  
City, State, Zip: Trenton, NJ  
Client Project #: 46661  
On-site Contact:  
E-mail:  
Phone:

**Geotesting Express, Inc.**  
1145 Massachusetts Avenue  
Boxborough, MA 01719  
800 434 1062 Toll Free  
978 635 0266 Fax

2662 Holcomb Bridge Road, Suite 310  
Alpharetta, GA 30022  
770 645 6575 Tel  
770 645 6570 Fax  
www.geotesting.com

**INVOICE (complete if different from client)**

Company:  
Address:  
City, State, Zip:  
Contact:  
Phone:

**GENERAL**

Purchase Order #:  
Shipped By: DDW  
Date Shipped: 9/24/10  
Mode of Shipment: FedEx  
Requested Turnaround: Standard  
Send Results To:  CLIENT OFFICE  PROJECT OFFICE  
Send Results Via:  E-MAIL  FAX  VERBAL  HARD COPY

SOIL	Sample ID	*please include boring # and depth if known																		
		Aterberg Limits (ASTM D 4318)	California Bearing Ratio (ASTM D 1883) *specify conditions below	USCS - Classification (ASTM D 2487)	Density (ASTM D 2937)	Direct Shear (ASTM D 3080) *specify conditions below	Direct Simple Shear (ASTM D 6528) *specify conditions below	Electrical Resistivity (ASTM G 57)	Grain Size (ASTM D 422) Sieve Only / Sieve & Hydrometer please circle one	Incremental Consolidation (ASTM D 2435)	Moisture Content (ASTM D 2216)	Organic Content (ASTM D 2974)	Permeability (Fixed Wall - ASTM D 2434) (Flexible Wall - ASTM D 5084) please circle one	Ph (ASTM D 4972)	Proctor Compaction (Standard - ASTM D 698) (Modified - ASTM D 1557) please circle one	Specific Gravity (ASTM D 854)	Triaxial Shear (UU - ASTM D 2850) (CU - ASTM D 4767) (CD - US COE EM1110) *specify conditions below please circle one	Unconfined Compression (ASTM D 2166)	Other:	Other:
	1	X		X			X			X										
	2	X		X			X			X										
	3	X		X			X			X										
	4	X		X			X			X										
	5	X		X			X			X										
	6	X		X			X			X										
	7	X		X			X			X										

Specify Test Conditions (Undisturbed or Remolded, Density and moisture, Test Normal Loads, Test Confining Stresses, etc.):

**AUTHORIZE BY SIGNING AND DATING:**

**SIGNATURE:** *[Signature]* **PRINT NAME: DREHER WHETSTONE** **DATE: 9/24/10**

Incoming Sample Inspection Performed   
Adverse conditions: \_\_\_\_\_

**Relinquished By:** *[Signature]* **DATE: 9/28/10**  
**TIME: 11W**

**Relinquished By:** *[Signature]* **DATE: 9/24/10**  
**TIME: 11W**

**SOIL CHAIN OF CUSTODY & TEST REQUEST**

**CLIENT**

Company: O'Brien & Gere  
Address: Bentwood Campus, 301 E. Germantown Pike, 3<sup>rd</sup> Floor  
City, State, Zip: E. Norriton, PA 19401  
E-mail: Dreher.Whetstone@obg.com  
Phone: 484.804.7236

**PROJECT**

Project Name: Assumpink Creek Restoration  
Address: 222 S. Warren St.  
City, State, Zip: Trenton, NJ  
E-mail:  
Phone:

**Geotesting Express, Inc.**  
1145 Massachusetts Avenue  
Boxborough, MA 01719  
800 434 1062 Toll Free  
978 635 0266 Fax

2662 Holcomb Bridge Road, Suite 310  
Alpharetta, GA 30022  
770 645 6575 Tel  
770 645 6570 Fax  
www.geotesting.com

**INVOICE (complete if different from client)**

Company:  
Address:  
City, State, Zip:  
Contact:  
Phone:

**GENERAL**

Purchase Order #: GTX Sales Order #:  
Shipped By: DDW Date Shipped: 9/24/10  
Mode of Shipment: FedEx Requested Turnaround: Standard  
Send Results To:  CLIENT OFFICE  PROJECT OFFICE  
Send Results Via:  E-MAIL  FAX  VERBAL  HARD COPY

SOIL	Sample ID	*specify conditions below										Other:															
		Aterberg Limits (ASTM D 4318)	California Bearing Ratio (ASTM D 1883)	*specify conditions below	USCS - Classification (ASTM D 2487)	Density (ASTM D 2937)	Direct Shear (ASTM D 3080)	*specify conditions below	Direct Simple Shear (ASTM D 6528)	*specify conditions below	Electrical Resistivity (ASTM G 57)	Grain Size (ASTM D 422)	Sieve Only / Sieve & Hydrometer	Incremental Consolidation (ASTM D 2435)	Moisture Content (ASTM D 2216)	Organic Content (ASTM D 2974)	Permeability / Hydraulic Conductivity (Fixed Wall - ASTM D 2434) (Flexible Wall - ASTM D 5084)	Ph (ASTM D 4972)	Proctor Compaction (Standard - ASTM D 698) (Modified - ASTM D 1557)	Specific Gravity (ASTM D 854)	Triaxial Shear (UU - ASTM D 2850) (CU - ASTM D 4767) (CD - US COE EM1110) *specify conditions below	Unconfined Compression (ASTM D 2166)	Other:	Other:			
	1	TP-5 (S-3) @ 7'	x		x						x																
	2	TP-6 (S-1) @ 2'	x		x						x																
	3	TP-6 (S-2) @ 4'	x		x						x																
	4	TP-6 (S-3) @ 7'	x		x						x																
	5	TP-6 (S-4) @ 10'	x		x						x																
	6	TP-7 (S-1) @ 2'	x		x						x																
	7	TP-7 (S-2) @ 4'	x		x						x																

Specify Test Conditions (Undisturbed or Remolded, Density and moisture, Test Normal Loads, Test Confining Stresses, etc.):

**AUTHORIZE BY SIGNING AND DATING**

SIGNATURE: *[Signature]* PRINT NAME: DREHER WHETSTONE DATE: 9/24/10

Incoming Sample Inspection Performed   
Adverse conditions: \_\_\_\_\_

Relinquished By: *[Signature]* DATE: 9/24/10  
TIME: 11:45 am

Relinquished By: *[Signature]* DATE: 9/28/10  
TIME: 11:00



## WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

## Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$	T	temperature
B	pore pressure parameter for $\Delta\sigma_3$	t	time
CIU	isotropically consolidated undrained triaxial test	U, UC	unconfined compression test
CR	compression ratio for one dimensional consolidation	UU, Q	unconsolidated undrained triaxial test
$C_c$	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$	$u_a$	pore gas pressure
$C_u$	coefficient of uniformity, $D_{60}/D_{10}$	$u_e$	excess pore water pressure
$C_c$	compression index for one dimensional consolidation	$u, u_w$	pore water pressure
$C_a$	coefficient of secondary compression	V	total volume
$c_v$	coefficient of consolidation	$V_g$	volume of gas
c	cohesion intercept for total stresses	$V_s$	volume of solids
$c'$	cohesion intercept for effective stresses	$V_v$	volume of voids
D	diameter of specimen	$V_w$	volume of water
$D_{10}$	diameter at which 10% of soil is finer	$V_o$	initial volume
$D_{15}$	diameter at which 15% of soil is finer	v	velocity
$D_{30}$	diameter at which 30% of soil is finer	W	total weight
$D_{50}$	diameter at which 50% of soil is finer	$W_s$	weight of solids
$D_{60}$	diameter at which 60% of soil is finer	$W_w$	weight of water
$D_{85}$	diameter at which 85% of soil is finer	w	water content
$d_{50}$	displacement for 50% consolidation	$w_c$	water content at consolidation
$d_{90}$	displacement for 90% consolidation	$w_f$	final water content
$d_{100}$	displacement for 100% consolidation	$w_l$	liquid limit
E	Young's modulus	$w_n$	natural water content
e	void ratio	$w_p$	plastic limit
$e_c$	void ratio after consolidation	$w_s$	shrinkage limit
$e_o$	initial void ratio	$w_o, w_i$	initial water content
G	shear modulus	$\alpha$	slope of $q_f$ versus $p_f$
$G_s$	specific gravity of soil particles	$\alpha'$	slope of $q_f$ versus $p_f'$
H	height of specimen	$\gamma_t$	total unit weight
PI	plasticity index	$\gamma_d$	dry unit weight
i	gradient	$\gamma_s$	unit weight of solids
$K_o$	lateral stress ratio for one dimensional strain	$\gamma_w$	unit weight of water
k	permeability	$\epsilon$	strain
LI	Liquidity Index	$\epsilon_{vol}$	volume strain
$m_v$	coefficient of volume change	$\epsilon_h, \epsilon_v$	horizontal strain, vertical strain
n	porosity	$\mu$	Poisson's ratio, also viscosity
PI	plasticity index	$\sigma$	normal stress
$P_c$	preconsolidation pressure	$\sigma'$	effective normal stress
p	$(\sigma_1 + \sigma_3) / 2, (\sigma_v + \sigma_h) / 2$	$\sigma_c, \sigma'_c$	consolidation stress in isotropic stress system
$p'$	$(\sigma'_1 + \sigma'_3) / 2, (\sigma'_v + \sigma'_h) / 2$	$\sigma_h, \sigma'_h$	horizontal normal stress
$p'_c$	$p'$ at consolidation	$\sigma_v, \sigma'_v$	vertical normal stress
Q	quantity of flow	$\sigma_1$	major principal stress
q	$(\sigma_1 - \sigma_3) / 2$	$\sigma_2$	intermediate principal stress
$q_f$	q at failure	$\sigma_3$	minor principal stress
$q_o, q_i$	initial q	$\tau$	shear stress
$q_c$	q at consolidation	$\phi$	friction angle based on total stresses
S	degree of saturation	$\phi'$	friction angle based on effective stresses
SL	shrinkage limit	$\phi'_r$	residual friction angle
$s_u$	undrained shear strength	$\phi_{ult}$	$\phi$ for ultimate strength
T	time factor for consolidation		

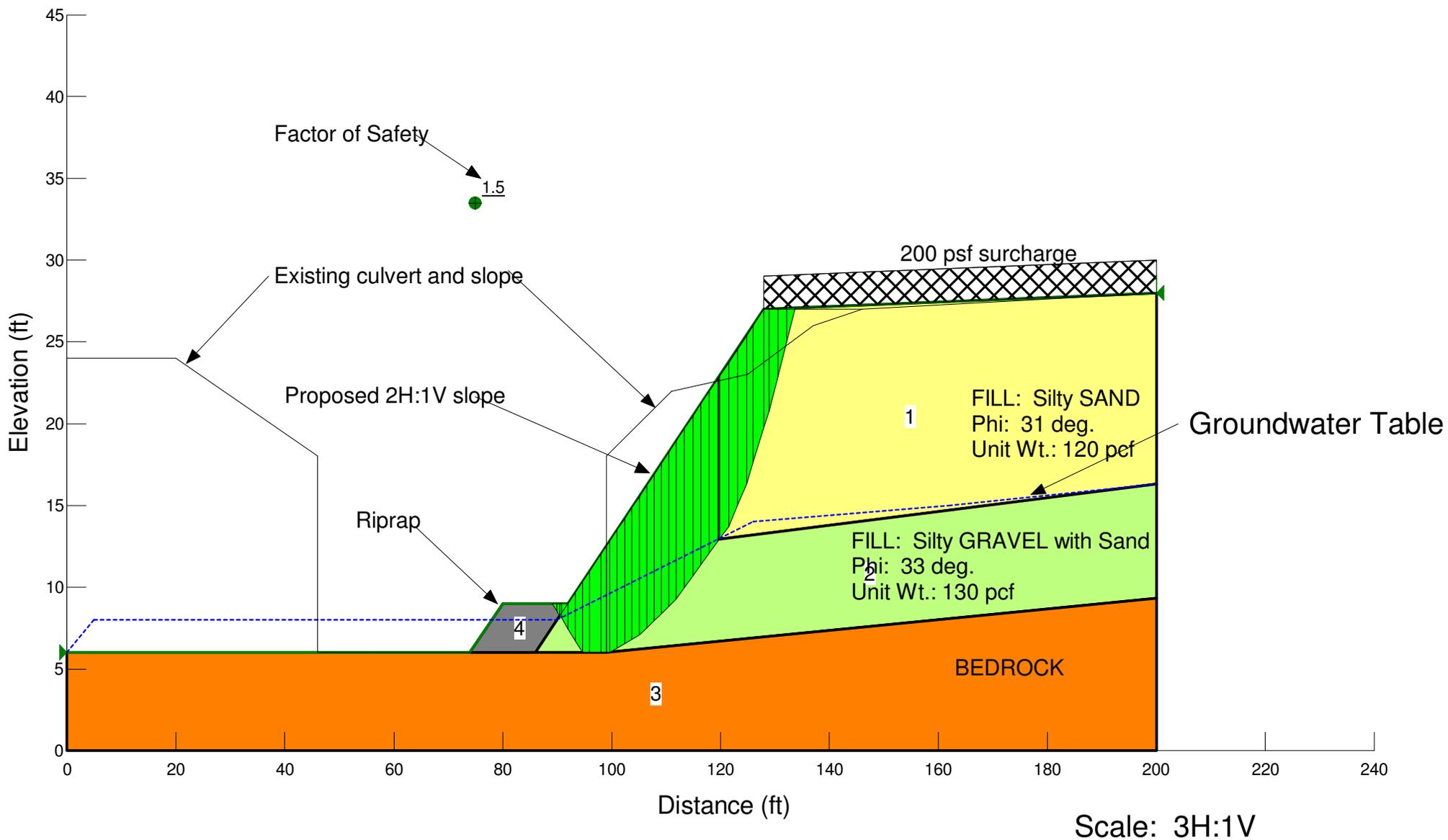
## **APPENDIX C**

### **Slope Stability Analyses**

# ASSUNPINK CREEK RESTORATION

## Slope Stability Model of Proposed 2H:1V Side Slope with Riprap Toe

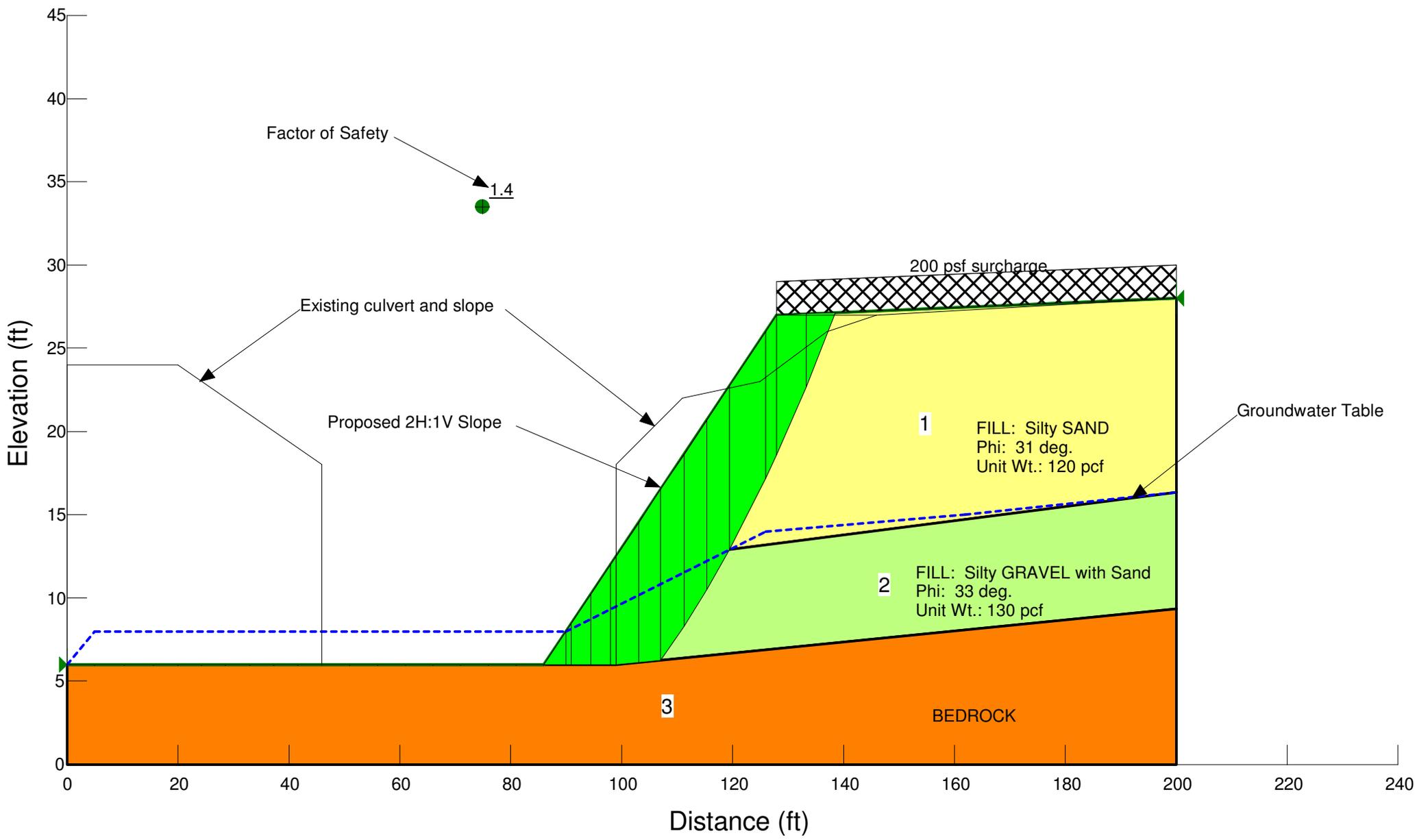
### Section A



# ASSUNPINK CREEK RESTORATION

## Slope Stability Model of Proposed 2H:1V Side Slope

### Section A

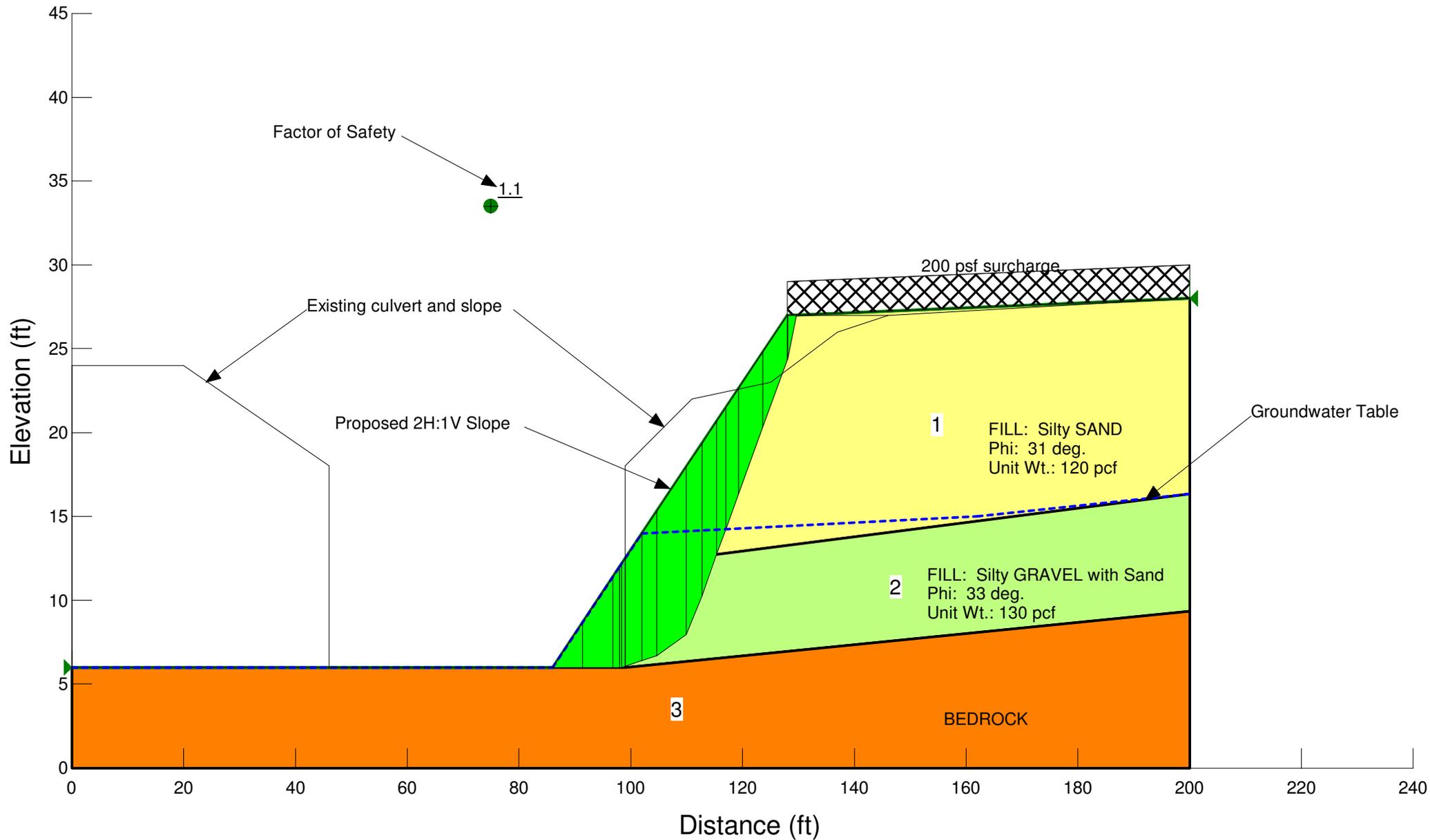


SCALE: 3H:1V

# ASSUNPINK CREEK RESTORATION

## Slope Stability Model of Proposed 2H:1V Side Slope

### Section A



SCALE: 3H:1V

## **APPENDIX D**

### **Geophysical Investigation Report**



**Final Report  
Geophysical Survey  
Underground Structure and Utility Detection/Delineation  
Assunpink Creek Restoration Site  
Trenton, NJ  
Enviroscan Project Number 081013**

**Prepared for: O'Brien & Gere Engineers, Inc.  
Prepared By: Enviroscan, Inc.  
October 12, 2010**





October 12, 2010

Mr. Dreher Whetstone  
**O'Brien & Gere Engineers, Inc.**  
Bentwood Campus  
301 E. Germantown Pike – 3<sup>rd</sup> Floor  
E. Norriton, PA 19401

**RE:** Geophysical Survey  
Underground Structure and Utility Detection/Delineation  
Assunpink Creek Restoration Site  
Trenton, NJ  
Enviroscan Project Number 081013

Dear Mr. Whetstone:

Pursuant to our proposal dated August, 9, 2010, Enviroscan, Inc. has completed a geophysical survey of the above-referenced site. The purpose of the survey was to detect and delineate underground utilities and suspected underground metal and non-metal structures. Fieldwork was completed on September 8, 2010. The methods and results of the survey are described below.

## Methods

### Metallic Structure Delineation

In order to provide detection of large subsurface metallic targets while minimizing interference from surficial debris and structures, Enviroscan performed an electromagnetic (EM) survey using a Geonics, Ltd. EM-61 MK2 instrument.

### **EM-61 MK2**

Enviroscan performed mapping of subsurface metallic masses using a Geonics EM-61 MK2 instrument. The EM-61 MK2 uses a one-meter by ½-meter coil to transmit 150 electromagnetic pulses per second into the ground at each measurement station. A second transmitter coil is used to narrowly focus the pulses, making the instrument relatively insensitive to overhead and/or nearby sources of electromagnetic interference such as buildings, fences, power lines, surficial debris, and atmospheric electromagnetic activity. During the off-time



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between transmitted pulses, a receiver coil measures the decay of transient electrical currents induced by the transmitted pulses. The decay is characterized by recording the re-radiated field at several different delays or time gates following shut-off of the applied field. Electrical currents in moderately conductive earth materials (e.g. electrolytic soils) dissipate rapidly, leaving the more prolonged currents due to buried metallic objects. The EM-61 MK2 measures the surficial electrical potential due to the prolonged subsurface currents, providing a digital read-out of the relative metallic content of the subsurface.

To complete the EM-61 MK2 survey, a system of profiles (at approximately 5-foot intervals) was surveyed by hand-towing the EM-61 MK2. Data were collected at a rate of 4 readings per second (for an average station spacing of approximately 1 foot). Location control was maintained using a Topcon GMS-110 GPS receiver. The GPS positions were collected with real-time differential correction, using Coast Guard radio beacon in Sandy Hook, NJ. The resulting differential GPS (DGPS) positions have an accuracy of better than 2 feet. GPS and EM data were fed simultaneously to a Juniper System Allegro data logger running "Trackmaker" software that displayed data coverage in real time to ensure complete site coverage. The data coverage is depicted on Figure 1 as small yellow dots.

Results of the EM-61 MK2 survey are depicted as contours of the individual EM-61 MK2 station measurements in Figure 2. The EM-61 MK2 records four measurements spaced by time (time gates) after the initial transmit pulse. The first three gates are read from the bottom coil, which is closest to the ground surface. Gate 1 reads responses from metal targets of all depth and size within the range and sensitivity of the instrument. Gate 2 filters out the smallest targets. Gate 3 reads responses from large targets. Gate 4 is a reading from a second (top) coil, spaced above the bottom coil, which is coincident in time with the Gate 3 reading from the bottom coil. The differential response is the difference between the top coil and Gate 3 bottom coil readings. The differential response depicts mainly large targets at positive numbers and surface metal (above the coils, such as metal roofs above the unit) as negative numbers. The differential response is best suited for displaying possible utilities and structures. Figure 2 displays the differential response.

### **Non-Metallic Structure Delineation**

The non-metallic structure survey was performed in an effort to delineate the footprint of several historic mill buildings located on the south side of the Assunpink Creek culvert. This portion of the survey was performed utilizing a ground penetrating radar (GPR) system.

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GPR systems produce cross-sectional images of subsurface features and layers by continuously emitting pulses of radar-frequency energy from a scanning antenna as it is towed along a survey profile. The radar pulses are reflected by interfaces between materials with differing dielectric properties. The reflections return to the antenna and are displayed on a video monitor as a continuous cross section in real time. Since the electrical properties of metal are distinctly different from soil and backfill materials, metallic pipes and other structures commonly produce dramatic and characteristic reflections. Fiberglass, plastic, concrete, and terra-cotta pipes and structures also produce recognizable, but less dramatic reflections. Scanning was performed using a GSSI SIR-2000 GPR controller with an internal hard drive and a color display and a high-frequency, 400 megaHertz (MHz) antenna or transducer.

The GPR system was tested on-site to determine its site-specific depth of signal penetration. Testing was performed by scanning profiles perpendicular to known utilities; specifically, the 2-inch water line and the north-south-trending steam and electric lines on the east side of the survey area, to determine if a known target could be imaged. None of these utilities could be imaged, indicating that the signal penetration depth was less than two feet. Scanning across the areas where the historic buildings were thought to be also indicated little to no GPR signal penetration. In addition, GPR was utilized in select areas of the site to determine if any areas of acceptable signal penetration existed. None were found; therefore, the GPR survey was halted at that point. The cause of the poor GPR signal penetration is most likely highly conductive soils or backfill underneath the survey area.

### **Utility Detection**

The utility survey was completed using standard and/or routinely accepted practices of the geophysical industry. The results of the utility mapping survey are depicted in Figure 1. The equipment utilized for this survey included:

- a Fisher TW-6 electromagnetic (EM) pipe and cable locator/tracer;
- a Fisher FX-3 magnetic (MAG) locator;
- a Radiodetection C.A.T. and Genny pipe and cable locator/tracer;
- a Radiodetection RD8000 Multi-Frequency pipe and cable tracer; and

The principles of these techniques are detailed below.

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## ***TW-6***

In order to detect and trace underground utilities, Enviroscan employed a Fisher TW-6 pipe and cable locator and tracer. In pipe and cable search mode, the TW-6 is essentially a deep-sensing metal detector that detects any highly electrically conductive materials (e.g. metals) by creating an electromagnetic field with a transmitting coil. A receiving coil at a fixed separation from the transmitter measures the field strength. As the instrument is swept along the ground surface, subsurface metallic bodies distort the transmitted field. The change in field strength/orientation is sensed by the receiver, setting off an audible alarm and/or causing deflection of an analog meter. The TW-6 can nominally detect a 2-inch metal pipe to a depth of 8 feet and a 10-inch metal pipe to a depth of 14 feet.

In pipe and cable tracing mode, the TW-6 transmitter can be coupled directly (conductively) to exposed portions of a metallic pipe, cable, or wire or inductively to a subsurface metallic utility with known location and orientation. The transmitter remains stationary and energizes or excites the metallic utility to be traced with an 81.92-kilohertz signal that can be traced at the ground surface using the mobile TW-6 receiver wand or probe.

## ***C.A.T. and Genny***

The survey areas were also scanned with a Radiodetection C.A.T. and Genny pipe and cable locator and tracer. In Power mode, the C.A.T. detects the 50 to 60 Hertz (Hz) electromagnetic field generated by live power cables and other metallic utilities to which a live line is grounded. In Radio mode, the C.A.T. detects buried conductors (cables or metallic pipes) as they conduct and re-transmit commercial broadcast radio energy. In Genny mode, the C.A.T. detects signal generated by the Genny transmitter. The Genny transmitter can be coupled directly (conductively) to exposed portions of a metallic pipe, cable, or wire or inductively to a subsurface metallic utility with known location and orientation.

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### ***RD8000***

Utility tracing was also conducted using a Radiodetection RD8000 digital cable and pipe tracer. Similar to the TW-6 and C.A.T./Genny, the transmitter can be directly coupled to exposed portions of a metallic pipe, cable, or wire or indirectly (inductively) to a subsurface metallic utility of known location/orientation. The transmitter remains stationary and energizes the metallic utility at a frequency selected by the operator (512 Hz, 8 kHz, 33 kHz, or 65 kHz), which is received at the ground surface by the digital locator. When the transmitter is directly coupled to the metallic utility, the digital receiver can also calculate the depth of the utility to an accuracy of  $\pm 10\%$  of the actual depth of the utility. Please note the close proximity to bends in the traced line or poor signal strength can result in erroneous depth estimations.

## **Results**

The results of the utility trace and the processed EM-61 MK2 response contours are depicted on Figure 2. The yellow- to red- to pink-colored contours represent increasing response to subsurface metal. The color green represents no response or no metal. Figure 2 displays four areas (outlined in black dashed polygons) of anomalously high EM response in the northern portion of the survey area. These anomalies are not associated with any surface object or utility, and likely result from large concentrations of metal in the subsurface. Further geotechnical investigations should include these anomalies to determine the source object or material.

Note that one small area within the fenced portion of the survey area was not accessible (see cross-hatched polygon) due to a steep-sloped area in which footing was treacherous. Also note that the southeastern border of the survey area could not be scanned with the EM-61 MK2 due to the close proximity of the security fence and roadside guardrail, which would result in instrument saturation rendering the data uninterpretable.

The utility survey results are overlain on the EM-61 MK2 survey results. Enviroscan first traced the locations of all evident utilities with visible valves, meters, or service connections within or adjacent to the survey area. These visible utilities were energized and traced using the Radiodetection RD8000 equipment.

The survey areas were then scanned to locate non-evident utilities. Non-evident electric lines were scanned for using the C.A.T. in Power mode. Searches for other non-evident utilities were conducted using the TW-6, C.A.T. in Radio mode.

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Utility traces in all areas were marked in the field as the survey progressed using semi-permanent marking paint. Locations of these markings were digitally recorded using a Topcon GMS-110 GPS system. The GPS positions were collected with real-time differential correction, using Coast Guard radio beacon in Sandy Hook, NJ. The resulting DGPS positions have a nominal accuracy of better than 2 feet (+/-).

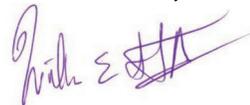
## Limitations

The geophysical survey described above was completed using standard and/or routinely accepted practices of the geophysical industry and equipment representing the best available technology. Enviroscan does not accept responsibility for survey limitations due to inherent technological limitations or site-specific conditions. However, we make every effort to identify and notify the client of such limitations or conditions. In particular, please note that the EM-61 can nominally detect a drum-size metal target to a depth of 12 to 15 feet.

Enviroscan has appreciated this opportunity to work with you. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

**Enviroscan, Inc.**



William E. Steinhart III, M.Sc., P.G.  
Senior Project Manager

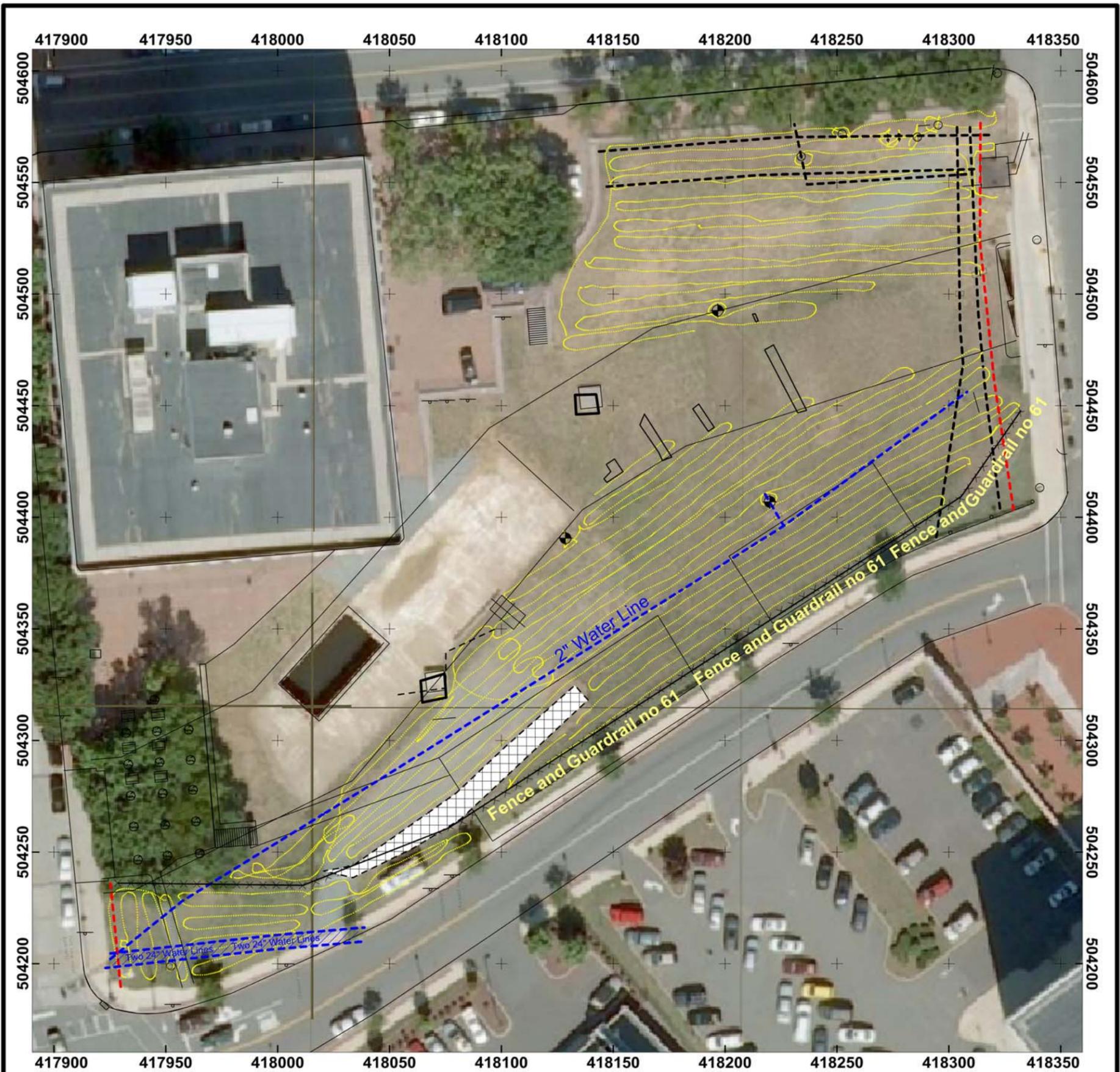
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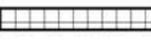
**Enviroscan, Inc.**

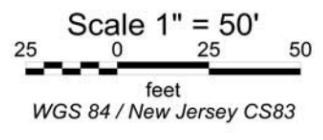


Felicia Kegel Bechtel, M.Sc., P.G.  
President

enc.: Figure 1: EM-61 Survey Data Coverage  
Figure 2: EM-61 Differential Response Contours



-  EM-61 Survey Station
-  Inaccessible Area
-  Steam Line
-  Water Line
-  Electric Line
-  EM-61 Anomaly
-  Fence
-  Manhole Cover



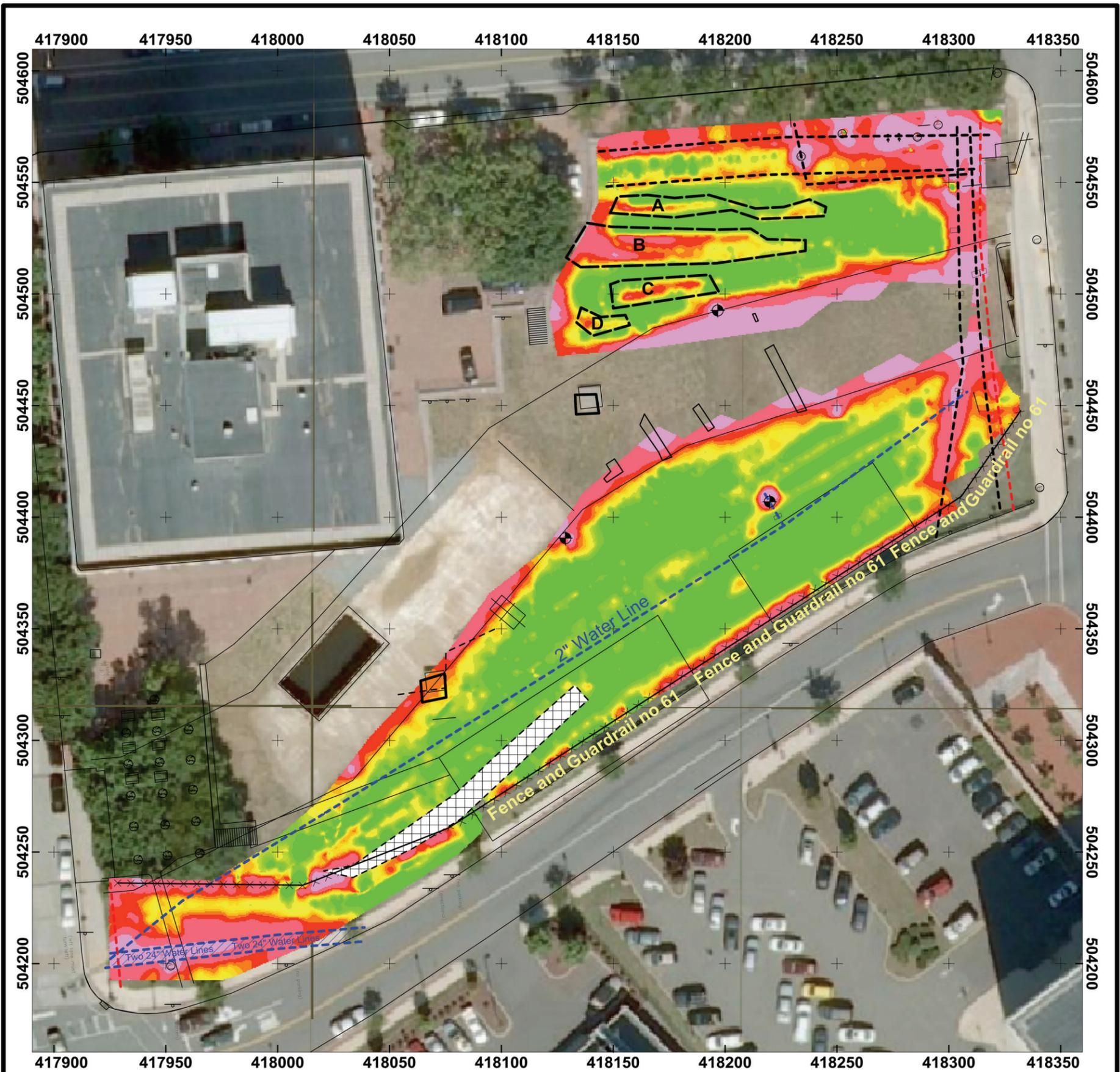
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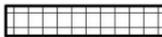
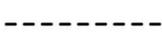
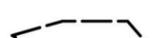
Coordinates in New Jersey State Plane Grid, NAD-83 Datum.

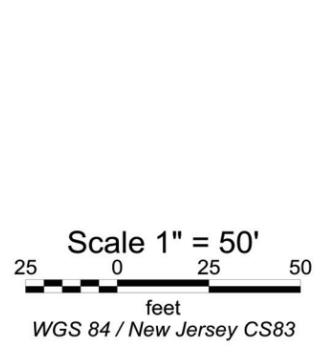
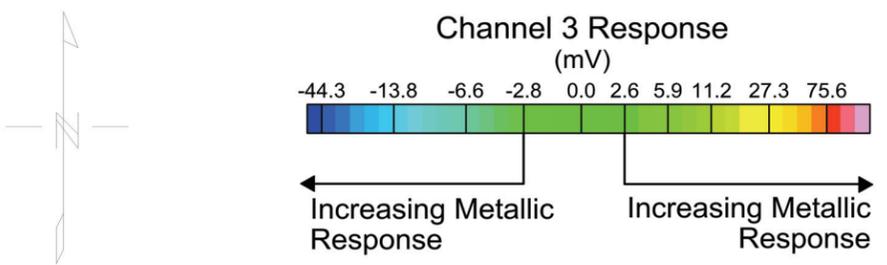
Data collected with Geonics EM-61MK2 instrument.

Basemap features from client-supplied file, DGPS survey by Enviroscan, Inc., and Google Earth.

Prepared By:  <b>Enviroscan, Inc.</b> 1051 Columbia Ave. Lancaster PA 17603 717-396-8922 www.enviroscan.com	Title: <h3 style="margin: 0;">EM-61 Survey Data Coverage</h3>	Project Location: Assunpink Creek Project Trenton, NJ	Figure: <h1 style="margin: 0; text-align: center;">1</h1>												
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Project Number</td> <td style="width: 50%;">Revision/Issue</td> </tr> <tr> <td style="text-align: center;">081013</td> <td style="text-align: center;">10/12/10</td> </tr> <tr> <td style="font-size: x-small;">Original Scale</td> <td style="font-size: x-small;">Survey Ending Date</td> </tr> <tr> <td style="text-align: center;">1" = 50'</td> <td style="text-align: center;">09/08/10</td> </tr> </table>	Project Number	Revision/Issue	081013	10/12/10	Original Scale	Survey Ending Date	1" = 50'	09/08/10	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Drawn by:</td> <td style="width: 50%;">Approved by:</td> </tr> <tr> <td style="text-align: center;">WES</td> <td style="text-align: center;">FKB</td> </tr> </table>	Drawn by:	Approved by:	WES	FKB
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-  Inaccessible Area
-  Steam Line
-  Water Line
-  Electric Line
-  EM-61 Anomaly
-  Fence
-  Manhole Cover



Notes:

Coordinates in New Jersey State Plane Grid, NAD-83 Datum.

Data collected with Geonics EM-61MK2 instrument.

Basemap features from client supplied file, DGPS survey by Enviroscan, Inc., and Google Earth.

Prepared By:   <b>Enviroscan, Inc.</b> 1051 Columbia Ave. Lancaster PA 17603 717-396-8922 www.enviroscan.com	Title:  <b>EM-61 Differential Response Contours and Utility Trace Results</b>	Project Location:  <b>Assunpink Creek Project Trenton, NJ</b>	Figure:  <span style="font-size: 2em; font-weight: bold;">2</span>												
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