Jacobs

Process Air Compressor System for Low Level Nitrogen Removal

Geotechnical Memorandum for the Process Air Compressor Building

July 26, 2022

Greater New Haven Water Pollution Control Authority

CWF 2019-04

Process Air Compressor System for Low Level Nitrogen Removal

Project No:	E2X90000
Document Title:	Geotechnical Memorandum for the Process Air Compressor Building
Date:	July 26, 2022
Client Name:	Greater New Haven Water Pollution Control Authority
Client No:	CWF 2019-04
Project Manager:	Dan Lynch
Author:	Juan Parra
File Name:	GeotechnicalMemorandum.docx

Jacobs Engineering Group Inc.

120 St. James Avenue
5th Floor
Boston, MA 02116
United States
T +1.617.242.9222
F +1.617.242.9824
www.jacobs.com

Contents

1. Purpose

The purpose of this technical memorandum (TM) is to summarize the geotechnical subsurface investigation findings as well as the analyses, results, deep foundation design recommendations, and construction considerations for the proposed Process Air Compressor (PAC) building at the PAC System for Low-Level Nitrogen Removal project. This new building will replace the existing blowers and aeration piping system at the East Shore Water Pollution Abatement Facility (ESWPAF). The ESWPAF is operated by the Greater New Haven Water Pollution Control Authority (GNHWPCA) and is located in New Haven, Connecticut.

2. Site Description

The new PAC system will consist of a new PAC building next to the existing aeration basins as illustrated on Figure 1. The current topography at the PAC building footprint (38 feet by 96 feet) is relatively flat with an approximate grade elevation ranging between 10 to 12 feet NAVD88.

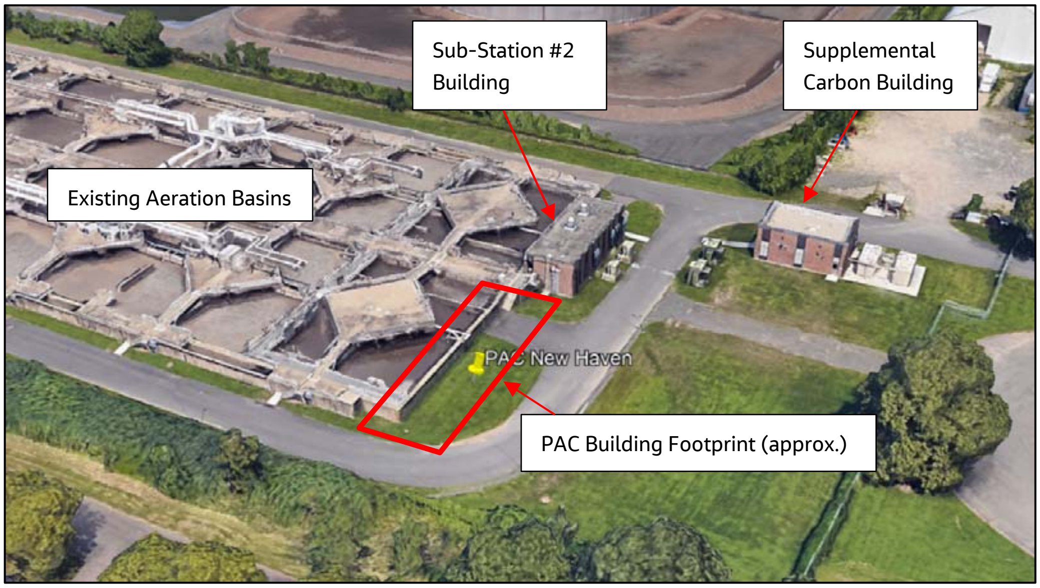


Figure 1. PAC Building Location

The PAC building floor elevation is planned to match the existing Sub-Station #2 building upper floor elevation equal to 18.38 feet. Raising the existing grade by adding fill directly over the existing ground to meet the proposed floor elevation is not recommended as this will impact the existing aeration basins east wall and the existing 84-inch reinforced concrete pipe (RCP) located at the north. These existing structures have not been designed for the effect of the additional fill load. Therefore, other options were explored by the design team to achieve the proposed building floor elevation. The selected option consists of a 4-foot-thick crawl space filled with lightweight cellular concrete fill designed to raise the building floor elevation from the existing grade to the planned floor elevation. The weight of the PAC building plus the filled crawl space and foundation slab will be supported by a deep foundation system. Another option included the design of an elevated slab, but the option was eliminated due to higher construction costs when compared to the selected option.

3. Subsurface Investigation

A geotechnical investigation was carried out by Freeman in June 2021 to further characterize the subsurface conditions at the project site. The investigation findings were used to evaluate the engineering properties of the subsurface soils and bedrock to develop foundation recommendations and construction considerations for the PAC building.

The Freeman Geotechnical Data Report (GDR), dated 08/13/2021, includes the findings of the recent (2021) and historical (2012 and 1972) subsurface investigations performed within and surrounding the PAC building footprint. This GDR is included in Attachment A of this TM. Table 1 below includes a summary of the subsurface investigations' general findings. The locations of these borings and available boring logs are shown in the Freeman GDR, Figure 2.

Table 1. Summary of the Subsurface Investigations

Boring (year) [1]	Ground Surface EL. (ft)	Boring Termination Depth (ft)	Boring Termination EL. (ft)	Glacial Till Top EL. (ft)	Weathered Rock Top EL. (ft)	Bedrock Top EL. (ft)
J-1 (2021)	11.5	47	-35.5	-32.5	Not identified	Not identified
J-1A (2021)	11.5	75	-63.5	-63.5	-48.5	-53.5
HA1 (2012)	11.1	32	-20.9	Not identified	Not identified	Not identified
B-1 (1972)	14	55.7	-41.7	-30	Not identified	Not identified
B-2 (1972)	12	45.7	-33.7	-32.5	Not identified	Not identified

4. Subsurface Conditions

The recent 2021 drilling program only intended one test boring, however, the drill string broke while driving the Standard Penetration Test (SPT) sampler from 45 to 47 feet below grade in Boring J-1. The borehole was abandoned and Boring J-1A (OW; observation well) was advanced as an offset about 3 feet south-southeast of Boring J-1. In addition, while removing J-1A casing, only 20 ft of casing (out of the 50 ft installed) were recovered. Based on this, the possibility of coarser materials such rock fragments and/or cobbles/boulders should be expected as part of the project site subsurface conditions.

In accordance with the depths shown in Table 1, the subsurface conditions at the project site include the following generalized stratums:

Stratum 1: Includes the Fill, Glaciofluvial Deposits, and the Glaciodeltaic Deposits.

- Fill: Dark gray/brown silty sand (SM), Standard Penetration Test (SPT) N-values ranging from 9 to 26 blows per foot (bpf), corresponding from loose to medium dense.
- Glaciofluvial Deposits: Gray-brown poorly graded sand (SP) and poorly graded sand with silt (SP-SM), SPT N-values ranging from 11 to 50 bpf, corresponding from medium dense to dense.
- Glaciodeltaic Deposits: Reddish-brown silt (ML)/clayey silt (CL-ML), with seams of elastic silt (MH), SPT N-values ranging from 3 to 10 bpf, corresponding from very loose to medium dense.

Stratum 2: The Glacial Till was encountered below the Glaciodeltaic Deposits and included reddish-brown SM, SPT N-values ranging from 14 to >100 bpf, corresponding from medium dense to very dense.

Stratum 3: The Weathered Rock was encountered below the Glacial Till and included reddish-brown silty gravel (GM), SPT N-values >100 bpf, corresponding to very dense. The thickness of this stratum was inferred based on the drilling effort required to penetrate it.

Stratum 4: Bedrock was encountered below the Weathered Rock and included reddish-brown Sandstone, medium to moderate hardness, slightly to moderately weathered, medium- to coarse-grained. Recoveries were 49 and 48 inches (out of two 60 inches cored) and RQDs were 46 and 24%, corresponding from poor to very poor.

5. Groundwater and Site 100-yr Flood Information

Groundwater generally was encountered 8 to 10 feet below the existing ground surface. Note that boring J-1A included the installation of an observation well which was monitored at approximately 7 and 21 days after the boring installation. Seasonal changes in groundwater elevations due to variations in precipitation, evaporation, and surface water runoff are possible. Therefore, for design, a groundwater elevation equal to 11.5 feet (0 feet depth) has been considered.

At the project site, a 100-year base flood elevation equal to 12 feet was determined based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for New Haven County, Connecticut, Panel 442 of 635, dated July 8, 2013.

6. Engineering Evaluation

A generalized subsurface profile was developed based on the subsurface conditions encountered in the borings. The generalized design subsurface profile is summarized in Table 2.

Table 2. Generalized Design Subsurface Profile

Stratum	Layer (Soil Type)	Top EL. (ft)	Bottom EL. (ft)	Thickness (ft)	SPT N-values
Stratum 1	Fill (SM)	11	4	7	6 - 9
	Glaciofluvial Deposits (SP)	4	-13	17	9 - 53
	Glaciodeltaic Deposits (ML)	-13	-34	21	3 - 11
Stratum 2	Glacial Till (SM)	-34	-49	15	47 to 100
Stratum 3	Weathered Rock (GM)	-49	-54	5	> 100
Stratum 4	Bedrock (Sandstone)	-54	-	-	-

6.1 Engineering Properties

The engineering properties of various stratums encountered at the project site are summarized in Table 3. Some of these engineering properties were directly measured from laboratory or in situ soil tests results whereas, other properties were interpreted based on published correlations or based on engineering judgment. Correlations of engineering properties of cohesive soils are generally made based on SPT N-values and index properties, i.e., liquid limits (LLs), plastic limits (PLs), and moisture content (w %). Correlations of cohesionless soils strength properties are generally based on N-values from SPTs. Refer to Attachment A for laboratory tests and results.

Table 3. Strength Engineering Properties

Stratum	Layer (Soil Type) [1]	Top EL. (ft)	SPT N_{60}^2	ɣ (pcf)	Phi' (deg)	S_u (psf)	q_u (psi)	K (pci)	E_{50}
Stratum 1	Fill (SM)	11	7	115	29	-	-	30	-
	Upper Glaciofluvial (SP)	4	40	130	34	-	-	100	-
	Lower Glaciofluvial (SP)	-4	12	120	31	-	-	45	-
	Upper Glaciodeltaic (ML)	-13	10	125	-	1200	-	-	0.007
	Lower Glaciodeltaic (ML)	-20	5	120	-	500	-	-	0.01
Stratum 2	Glacial Till (SM)	-34	> 50	135	35	-	-	140	-
Stratum 3	Weathered Rock (GM)	-49	> 50	140	37	-	-	160	-
Stratum 4	Bedrock (Sandstone)	-54	-	150	-	-	2495	-	-

Notes:

1. The Glaciofluvial and Glaciodeltaic Deposits layers were subdivided into upper and lower layer to better asses their soil relative density and/or consistency variability.
2. Per Freeman SPT Energy Testing Report, dated 07/19/2018, for the 2021 borings a hammer efficiency equal to 90% has been considered to estimate the corrected SPT N_{60}-values. The report is included in Attachment B.

6.2 Soil Corrosivity

According to AASHTO 2017 LRFD, the effect of corrosion and deterioration from environmental conditions shall be considered in the selection of the foundation type and in the determination of the required foundation cross-section. The following criteria should be considered as indicative of a potential corrosion situation:

- Resistivity less than 2,000 ohm-centimeters
- pH less than 5.5
- pH between 5.5 and 8.5 in soils with high organic content
- Sulfate concentrations greater than 1,000 parts per million
- Chloride content greater than 500 parts per million

Corrosivity tests were performed on soil samples obtained from boring J-1 within the Fill and Upper Glaciofluvial Deposits. These tests included pH, resistivity, and concentrations of chlorides and sulfates. Based on the results, the measured resistivity is indicative of a potential corrosion situation.

- Based on DIPRA 10-point soil evaluation, moderate to appreciable corrosion should be expected on ductile iron pipe and cast-iron pipe in contact with the ground and special corrosion protection measures should be adopted. In accordance with the Dipra Design Decision Model, V-Bio enhanced polyethylene encasement is recommended to mitigate the pipes corrosion.
- As discussed in Section 5, the micropile structural design considers a 3 millimeters reduction of steel thickness for corrosion allowance. Results from the corrosivity tests are presented in Attachment A and are summarized in Table 4.

Table 6. Summary of Corrosivity Test Results

Boring	Sample Depth (ft)	Water Content	Min. Resistivity (ohm-cm)	pH	Chlorides (ppm)	Sulfates (ppm)
J-1	0 to 9 (Composite Sample)	Moist	1,653	7.16	170	114

6.3 Frost Penetration Depth

The bottom of any foundation is recommended to be 42 inches below the finished grade in accordance with the following:

- According to Figure 2-1 of the Engineering Manual 1110-1-1905, Bearing Resistance of Soils (U.S. Army Corps of Engineers, 1992) the frost penetration depth at the project site is approximately 36 inches.
- According to the Connecticut State Building Code (2018), buildings and structures shall be protected from frost by using a minimum of 42 inches below finished grade.

6.4 Seismic Design Parameters

The seismic design parameters are in accordance with the mapped spectral accelerations and seismic site coefficients presented in 2015 IBC and based on the ATC Hazards by Location tool and the 2014 deaggregation of seismic hazard data found on the USGS Web site. The recommended seismic design parameters for this project are summarized in Table 5 and the USGS hazard reports are presented in Attachment C.

Table 6. Seismic Design Parameters

Parameter	Value
Coordinates	Latitude: 41.281978, Longitude: -72.901035
Risk category	III
Seismic design category	B
Site class	D (stiff soil)
Spectral acceleration for 0.2-sec period, Ss (g)	0.2
Spectral acceleration for 1.0-sec period, S_1 (g)	0.053
MCE_G peak ground acceleration, PGA	0.112
Site-modified peak ground acceleration, PGA_M	0.176
Site amplification factor at 0.2s (Fa)	1.6
Site amplification factor at 1.0s (Fv)	2.4
Magnitude of the design earthquake, MCE	5.59

Notes:

1. Design parameters are based on ATC Hazards by Location USGS tool using ASCE7-16. MCE is based on Dynamic Conterminous U.S. 2014 deaggregation of seismic hazard for a return period of 2475 years (2% in 50 years).

6.5 Liquefaction Potential

According to 2015 IBC, for structures assigned to seismic design category C, D, E, or F, a geotechnical evaluation of liquefaction potential shall be performed. Based on Table 5, the seismic design category for the project site is B. Nevertheless, Jacobs performed a liquefaction potential assessment considering the following:

- In general, three simultaneous conditions are required for liquefaction to occur: very loose to loose granular soils, saturated conditions, and rapid large strain cyclic loading, normally provided by earthquake motions.
- Although not predominant, there are lenses of saturated loose granular and soft fine-grained soils that may be susceptible to liquefaction.

The assessment of liquefaction potential was performed based on the Summary Report and supporting documentation in NCEER-97-0022, Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. The standard penetration tests (SPT) blow-counts and the methods proposed by Youd et al. (2001), Idriss & Boulanger (2008), and Seed et al. (2003) were considered. Based on the assessment, liquefaction potential is not a concern with a factor of safety greater than 1.1. Attachment C includes the liquefaction potential assessment.

7. Foundation Recommendations

The PAC building footprint is only 8 feet away from the existing aeration basins east wall and 5 feet away from the existing 84-inch reinforced concrete pipe (RCP) located at the north. The bottom of the existing aeration basins are supported on a 2-foot-thick mat bearing at elevation -5 feet and the existing 84-inch RCP is supported on stabilized subgrade at elevation -3 feet. Note that the bottom of the PAC building slab (2 feet thick) is planned between elevations 8 and 11 feet, which leaves 4 to 7 feet vertical clearance in between the bottom of the slab and the top of the 84-inch RCP. Considering these geometrical constraints, the use of shallow foundation to support the building is not considered feasible since the foundation will exert additional (likely excessive) pressure on the existing infrastructure and also cause additional settlement.

Based on the aforementioned and considering the presence of some loose/soft soils conditions within the depth of influence, a deep foundation system is recommended to support the PAC building. The deep foundation system will eliminate the excessive vertical and lateral loading acting at the aeration basins east wall and at the 84-inch RCP and will prevent detrimental total/differential settlements of existing infrastructure and the new building. The following deep foundation systems were evaluated for the PAC building.

- Driven Piles: Driven piles are deep foundation elements (i.e., precast concrete piles, steel H piles, steel pipe piles, etc.) driven into ground. Due to proximity to existing structures including, but not limited to, aeration basins, 84-inch RCP, Sub-Station #2 building, etc., driven piles are not recommended for this project. Driven piles installation induced vibrations may be detrimental to existing structures performance and could cause vibration-induced settlement. Additionally, the potential for presence of cobbles/boulders on this ground is expected to cause challenges for installation of this type of deep foundation.
- Micropiles: Micropiles are deep foundation elements that can be installed using smaller equipment and in all soil types and ground conditions with minimal vibrations. Micropiles can also be installed in the glacial till, weathered rock, and bedrock stratums, and could be drilled through obstructions, such as cobbles/boulders, if encountered. Therefore, this deep foundation system is recommended to support the PAC building.

7.1 Foundation loads

The loads used for the design of the micropiles are presented in Table 6. These loads represent the maximum micropile axial (including lightweight cellular concrete fill at the crawl space) and lateral loads applied to the micropile.

Table 7. Design Service Load on a Single Element

Load (kips)	Configuration	PAC Building
Maximum Micropile Axial Load	12 feet by 12 feet grid	206 (compression) [1] 0 (uplift)
Maximum Micropile Lateral Load		12.4

Notes:

1. A factor of safety for soil-grout bond strength equal to 2.5 has been considered in the design.

7.2 Micropiles Foundation

Micropiles will develop axial compression and uplift resistances from side friction on the bond zone. The bond zone is defined as the uncased length of the micropile that transfers the applied axial loads to the surrounding soil or rock. Methods for determination of axial geotechnical capacity as specified in the FHWA NHI-05-039

Micropile Design and Construction Reference Manual (2005) were followed in the design. The structural design was performed following the allowable stresses for materials used in deep foundation elements, Table 1810.3.2.6 of the 2015 IBC.

Lateral analyses were performed using LPILE 2019 software which computes the micropile deflection, shear, bending moment, and soil response with respect to depth in nonlinear soils. The behavior of a single micropile subjected to combined axial and lateral load, per Table 6, was modeled.

As shown in Figure 2, and in accordance with FHWA NHI-05-039 Micropile Design and Construction Reference Manual, dated 2005, Table 2-1, Micropile Type and Grouting Method sub-type A3 should be implemented.

The recommended micropile foundation for the PAC building consists of single grade-80 casing with 10.75-inch outside-diameter (OD) and 0.595-inch thickness, and grade-150 center thread bar of 1-3/8" diameter. The grout for the micropiles should have a compressive strength of minimum 4000 psi. Due corrosion potential, the micropiles structural design considers a 3-millimeter reduction in thickness for the steel casing. The bond zone is recommended to be 10-feet-long embedded in bedrock, to be confirmed on a single element axial compressive load test performed on a sacrificial micropile. Since all micropiles are terminated in bedrock, the vertical movement of the micropiles is expected to be subject to the elastic compression of the element.

A summary of results is presented in Table 7 and the micropile design calculations and results are provided in Attachment D.

Table 7: Design Recommendations for PAC Building Micropile Foundation

PAC Building	Micropile Foundation Design
Micropile type (See Figure 2)	A3
Micropiles maximum spacing	12 feet x 12 feet
Approximate micropile cut-off elevation	12.1 feet for centered micropiles 8.6 feet for wall micropiles
Estimated top of rock / Bottom of casing elevation	-54 feet
Rock socket length (bond zone)	10 feet
Estimated micropiles tip elevation	-64 feet
Drill hole	Minimum 11.25 inches
Micropile casing type	API N80 (fy = 80 ksi)
Micropile casing diameter and wall thickness	10.75-inch OD / 0.595-inch
Micropile center reinforcement	#11 bar
Estimated micropile elastic movement	0.25 inches

Table 2-1. Details of Micropile Classification Based on Type of Grouting (after Pearlman and Wolosick, 1992).

Micropile Type and Grouting Method	Sub-type	Drill Casing	Reinforcement	Grout
Type A Gravity grout only	A1	Temporary or unlined (open hole or auger)	None, single bar, cage, tube or structural section	Sand/cement mortar or neat cement grout tremied to base of hole (or casing), no excess pressure applied
	A2	Permanent, full length	Drill casing itself	
	A3	Permanent, upper shaft only	Drill casing in upper shaft, bar(s) or tube in lower shaft (may extend full length)	

Figure 2. FHWA NHI-05-039 Micropile Design and Construction Reference Manual, 2005

8. Construction Considerations

8.1 Site Preparation

In accordance with the Geotechnical Engineering and Environmental Report prepared by Haley & Aldrich (H&A) in September 2012, and provided in Attachment E, results of chemical testing at boring HA1 indicated the following:

- The existing fill soils, from existing grade elevation to about 5 feet depth, contain compounds at levels exceeding comparable Connecticut Department of Energy and Environmental Protection (CTDEEP) criteria, and therefore are considered “contaminated soil/fill”.
- The soil samples tested below 5 feet would be classified by CTDEEP as “clean fill” and are suitable for reuse on site around structures and in areas of general fill and backfill. This material also appears suitable for reuse as backfill above the pipe zone and above duct banks.
- Test results were also compared to Massachusetts Department of Environmental Protection (MADEP) landfill disposal criteria. The samples tested do not exceed MADEP landfill disposal criteria. Therefore, as stated in H&A report, the “contaminated soil/fill” should be taken off-site for disposal at a MADEP landfill.

Refer to H&A report for detailed chemical testing and results as well as soil reuse and disposal guidelines.

A sample in placed program and characterization is recommended to determine the levels and extents of the contamination and to determine an appropriate landfill. Excavated material that is determined not to be contaminated should be visually inspected to confirm suitability of the material for reuse. It is recommended to only reuse the sandy materials as backfill since the water content of the material will be easier to manage. Any soil containing greater than 15 percent silt and clay should have a liquid limit less than 40 and a plasticity index less than 20. All deleterious material should be removed from excavated material prior to placement as fill.

Most of subgrade soils are silty granular in texture and thus are susceptible to disturbance in the presence of moisture and construction traffic. Care should be exercised to maintain subgrade integrity when preparing areas for the placement of fill, excavation, and other earthwork. The exposed subgrade of non-micropile supported structures should be compacted as follow:

- Under pavement, floor slabs on grade, or granular fill, compact the upper 6 inches of the subgrade to a minimum of 95 percent relative compaction in accordance with ASTM D698.
- Under earthfill, compact the upper 6 inches of the subgrade to a minimum of 93 percent relative compaction in accordance with ASTM D698.

To mitigate risks regarding variable compaction/density of existing ground, the contractor should perform in-situ compaction testing in accordance with ASTM D1556 or ASTM D6938. Areas exhibiting pumping, determined unsuitable by the Engineer or Owner’s representative or that cannot be densified in-place, should be overexcavated and replaced with compacted granular fill.

8.2 Fill and Backfill

Gradation in general conformance with No. 6, or No. 67 coarse aggregate as specified in Connecticut Department of Transportation, Form 818, M.01.02, is recommended beneath the PAC Building (supported in micropiles). The granular fill should be placed in maximum 6-inch lifts and compacted, each lift, with two (2) passes by either a vibratory plate compactor or a power driven impact compactor. A minimum of 4-inch layer of granular fill should be installed. To address the expected frost penetration depth, it is recommended to install the edges of the slab to a depth equal to 42 inches below the finished grade.

For areas outside of structures and pavements, earthfill in agreement with the recommendations in Section 8.1 is recommended. Earthfill material should be compacted to at least 93 percent of the maximum dry density as determined by ASTM D698.

For the crawl space, lightweight cellular concrete fill is recommended to be installed in accordance with the following requirements.

Table 8. Lightweight Cellular Concrete Requirements

Property	Requirements	Test Method
Portland Cement	Type I/II	ASTM C150
Maximum / Minimum Dry Density	48.0 / 40.0 pounds per cubic foot	ASTM C796 (No oven drying)
Minimum Unconfined Compressive Strength @ 28 days curing	Minimum 120 pounds per square inch	ASTM C495
Internal Friction Angle	35 degrees (min.)	AASHTO T236 (ASTM D3080-72)
Frost Heave. Sample @ 250-hour exposure, 4.5-inch high x 4-inch dia.	< 0.5 in	British Road Research Laboratory, Lab Report LR 90, 1967, by Croney, Jacobs.
Freezing and Thawing Resistance	Relative Dynamic Modulus, RDM ≥ 80% at 300 cycles.	ASTM C666 Procedure B (Rapid freezing in air and thawing in water) modified per Bidwell Report dated April, 1975
Coefficient of permeability @ 2.0 pounds per square inch	$1x10^{-4}$ centimeter per second (min.)	
Water	Clean, potable water	ASTM C1602

8.3 Temporary Excavation Support Systems

The expected soils within excavation limits fall within the OSHA Type C category. As per the OSHA requirements, safe excavations within Type C soils must be cut flatter than 1.5H:1V to depths less than 20 feet. This project excavations are expected to be within 5-10 feet from the existing grade elevation. For excavations of 5 feet deep or slightly greater in areas with extensive underground utilities, the Contractor may choose to use shoring boxes with internal bracing.

8.4 Dewatering

The Contractor should be prepared to maintain groundwater to a minimum of 2 feet below the lowest point of any required excavation. The Contractor may require the use of surficial dewatering systems (such sump pumps) to control any surface water that may enter the excavation due to rainfall, surface runoff, etc.

The Contractor should comply with all federal, state, and local regulations for the disposal of water.

8.5 Micropile Installation

A micropile specialty subcontractor experienced with at least five years of construction and testing of micropiles and with experience similar to those encountered at the site is required. Key personnel, which includes the superintendent, driller(s), and project engineer/manager, should have at least 3 years of relevant experience. Micropiles should be installed under the direct supervision of a geotechnical engineer knowledgeable in the field of micropile foundations. A competent person is recommended to be on-site during micropile installation to establish if the required bond zone length has been achieved.

Obstructions, including but not limited to rock fragments, cobbles/boulders, and steel debris at J-1 and J-1A drilling locations (see Section 4) should be expected during installation of micropiles. Contractor should assess the impact of obstructions on micropile installation and take necessary measures to overcome the obstructions. If, during installation of a micropile, an obstruction is encountered that prevents the practical advancement of the micropile, the drilled hole should be abandoned and filled with grout. A new micropile should be installed at a location to be determined by the Engineer.

At least one compression load test should be performed to verify the adequacy of the micropile and the proposed construction procedures. The test micropile(s) should be loaded exceeding the ultimate micropile resistance (equal to 2.5 times the design axial load) and to failure. Production micropiles should not be installed until the test micropile(s) are successfully installed and load tested to meet the required acceptance criteria. The final micropiles bond length should be determined based on load test results. The test micropile should be equipped with strain gauges at the top and bottom of the bond zone to determine the distribution of stresses in the bond zone.

A minimum of 5 feet clearance between the northernmost row of micropiles and the existing 84-inch reinforced concrete pipe is recommended.

9. References

- FHWA NHI-05-039 Micropile Design and Construction Reference Manual, 2005
- AASHTO LRFD Bridge Design Specifications, 2017
- FHWA. 2005. Shallow Foundations, Geotechnical Engineering Circular No. 6
- FHWA. 2017. Geotechnical Site Characterization, Geotechnical Engineering Circular No. 5
- 2015 International Building Code
- ASCE 7-16, Minimum Design Loads for Buildings and Other Structures
- NCEER, 1997, "Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", Edited by Youd, T. L., Idriss, I. M., Technical Report No. NCEER-97-0022, December 31, 1997
- Supplemental Carbon Building Pile Plan, Wet Weather Capacity Improvements and Nitrogen Reduction – Phase 1, Greater New Haven Water Pollution Control Authority, New Haven , Connecticut, July 2017.
- Haley & Aldrich Geotechnical Engineering and Environmental Report, Wet Weather Capacity Improvements – Phase 1 East Shore Water Pollution Abatement Facility, New Haven, Connecticut, September 2012.
- Arcadis Submittal #02 61 50 – 001.B, Excavation Material Management and Disposal Plan, April 2014.
- Dipra, Advancements in Pipe Longevity: The Design Decision Model, May 2018

10. Limitations

This TM has been prepared in accordance with generally accepted engineering practices and it is intended for the exclusive use by the GNHWPCA for the construction of the PAC building at the ESWPAF in New Haven, CT. No other warranty, expressed or implied, is made.

Information contained in this TM is limited, based on data obtained from boring logs and laboratory testing that show subsurface conditions only at the specific location and time investigated, and only to the depth penetrated. Subsurface conditions and groundwater levels at other locations or depths may differ from conditions occurring at investigated locations. The passage of time may also result in changed conditions at these locations. If during construction, subsurface conditions are found to vary from those described in this TM, geotechnical recommendations should be reevaluated.

This TM includes both factual and interpreted information. Factual information is defined as objective data based on direct observations, such as boring logs and laboratory testing results. Interpreted information or geotechnical engineering interpretation is based on the engineering judgment, correlation, or extrapolation from factual information. No warranties, explicit or implied, are provided for interpreted information.

Attachment A

FREEMAN COMPANIES

LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Geotechnical Data Report
Process Air Facility
Greater New Haven Water Pollution Abatement Facility
New Haven, Connecticut

August 13, 2021

Prepared for:

Jacobs Engineering Group
100 Great Meadow Road
Suite 707
Wethersfield, Connecticut 06109

Jacobs Project No.: E2X90000

Prepared by:

Freeman Companies, LLC
36 John Street
Hartford, CT 06106

Freeman Project No.: 2021-0314

STATE OF CONNECTICUT
CHRISTOPHER J. TONZI
No. 21723
LICENSED
PROFESSIONAL ENGINEER

Christopher J. Tonzi, P.E.
Senior Geotechnical Engineer/Project Manager

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 INTRODUCTION

1.1 Summary

The Greater New Haven Water Pollution Control Authority is making improvements to their water pollution abatement facility, located in southeastern New Haven, along Connecticut Avenue.

Part of those improvements is the addition of a Process Air Facility, to be located near the existing aeration basins.

This report summarizes the subsurface geotechnical data collected during our subsurface exploration program.

1.2 Scope of Work

Freeman Companies conducted the following work:

- Engaged a subsurface exploration contractor to conduct one test boring at the site;
- Provided technical monitoring of the exploration;
- Arranged for a testing laboratory to conduct laboratory soil and rock tests; and
- Evaluated subsurface conditions and prepared this data report.

1.3 Authorization

The work was completed in accordance with our proposal dated February 21, 2019 and Field Service Agreement No. 148022180.

1.4 Elevation Datum

Elevations are in feet and reference NAVD88.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Description

The site is located at the east end of the WPCA aeration basins, west of Connecticut Avenue as shown on Figure 1, the Site Location Map.

Within the proposed building footprint, portions of the existing ground surface are covered by asphalt pavement, but the majority is covered by grass lawns. There are several buried utilities within the footprint including water lines and electrical conduits. The ground surface Elevation within the proposed footprint ranges from about 10 to 12 feet.

2.2 Project Description

The proposed building will have a footprint of approximately 3,000 square feet.

3.0 SUBSURFACE EXPLORATIONS

3.1 Recent Subsurface Explorations

Two test borings (J-1 and J-1A) were drilled by New England Boring Contractors of Glastonbury, Connecticut on June 22 and 23, 2021 to depths of 47 to 75 feet below existing ground surfaces.

The drilling program only intended one test boring, however, the drill string broke while driving the Standard Penetration Test (SPT) sampler from 45 to 47 feet below grade in Boring J-1. The borehole was abandoned and Boring J-1A (OW; observation well) was advanced as an offset about 3 feet south-southeast of Boring J-1.

Borings were advanced using 4-inch flush thread steel casing. SPTs were, in general, taken semi-continuously to 12 feet and then at 5-foot intervals thereafter. Boring J-1 terminated in the glacial till stratum. Boring J-1A (OW) terminated in bedrock, after two consecutive 5 foot long rock cores.

A groundwater monitoring well was installed in completed borehole J-1A (OW). The well was generally screened from about 5 to 15 feet below grade. Additional details about well construction are presented on the boring log.

Exploration locations were determined by taping from existing site features are considered approximate. A Freeman Companies' geotechnical engineer observed the drilling and prepared the field boring logs with soil descriptions based on visual observation of the samples. Test boring logs are included in Appendix A and locations are shown on Figure 2, the Subsurface Exploration Location Plan.

3.2 Previous Subsurface Explorations

Previous test borings, by others, were provided to Freeman by Jacobs Engineering Group. Nearby borings included B-1 and B-2, completed in January 1972 and HA-1 completed in May 2012 by General Borings of Prospect, Connecticut.

B-1 and B-2 were advanced to depths of 55 to 45 feet below grade, respectively and each appeared to terminate in the glacial till. HA-1 was advanced to a depth of 32 feet below grade and appeared to terminate in a sandy silt (Glaciodeltaic) stratum.

Test boring logs are presented in Appendix A and locations are shown on Figure 2, the Subsurface Exploration Location Plan.

3.3 Laboratory Testing

Laboratory testing included:

Soil:

- four (4) grain size analyses,
- three (3) Atterberg Limits,
- one (1) unconfined / unconsolidated triaxial test on soil,
- one (1) corrosivity series test (pH, resistivity, sulfates, and chlorides), and
- six (6) water content determinations.

<u>Bedrock:</u>

- Bulk density measurement; and
- one (1) unconfined compression test on bedrock.

Testing was completed by Geotesting Express, of Acton, Massachusetts. Results of laboratory testing are included in Appendix B and a summary of tests performed is presented as Table 1.

4.0 GEOTECHNICAL SUBSURFACE CONDITIONS

4.1 Geologic Setting

The United States Geologic Survey surficial geologic maps including, but not limited to, “Surficial Materials Map of Connecticut” dated 1992, indicates that subsurface conditions in the Greater New Haven area generally consist of artificial fill overlying sand over fines over glacial till.

4.2 Subsurface Conditions

Subsurface conditions encountered in the test borings were consistent with the published geology. Conditions are known only at the boring locations and may differ significantly around the site. A summary of subsurface data is presented in Table 2, attached. Note that the following interpretation was derived primarily using the conditions encountered in our recent test boring(s). Previous test borings, by others, that are considered relevant due to their proximity to this project, have been included as additional information.

Fill – Fill was encountered in the project area to a depth of about 6 feet. (We note that in nearby boring HA-1, the fill thickness was inferred by others to be almost 20 feet.) The fill material encountered included about 4 to 6 inches of topsoil overlying black, dark gray and dark brown gravelly silty sand [SM to SW]. Standard Penetration Test (SPT) N-values ranged from 9 to 26 blows per foot (bpf), corresponding from loose to medium dense.

Glaciofluvial Deposits – Glaciofluvial deposits were encountered below the fill to about 25 feet below grade (19 feet thick). The soils encountered in this stratum consisted of gray-brown sand with varying (and lesser) amounts of gravel and silt present [SP and SP-SM]. SPT N-values ranged from 11 to 50 bpf, corresponding from medium dense to dense.

Glaciodeltaic Deposits – Glaciodeltaic deposits were encountered below the glaciofluvial, down to about 44 feet below grade (19 feet thick). The soils encountered in this stratum consisted of reddish-brown silt with lesser amounts of fine sand and clay present [ML with occasional seams of MH and CL-ML]. SPT N-values ranged from 3 to 10 bpf, corresponding from very loose to medium dense.

Glacial Till – Glacial till was encountered below the glaciodeltaic, down to about 60 feet below grade (16 feet thick). The glacial till consisted of reddish-brown silty sand with varying amounts of gravel [SM]. SPT N-values ranged from 14 to >100 bpf, corresponding from medium dense to very dense. Refusal of the SPT sampler was noted in two of the three samples attempted in the glacial till.

Weathered Bedrock - Weathered bedrock was encountered below the glacial till down to about 65 feet below grade (5 feet thick). The thickness of this stratum was inferred based on the drilling effort required to penetrate it. Refusal of the SPT sampler was noted in the only sample attempted in the weathered bedrock.

Bedrock was encountered at about 65 feet below grade. Two, consecutive 5-foot long rock cores were taken in the bedrock. Reddish-brown sandstone was recovered in the cores: medium to moderate hardness, slightly to moderately weathered, medium- to coarse-grained. Recoveries were 49 and 48 inches (out of 60 inches cored) and RQDs were 46 and 24% (poor to very poor).

4.3 Groundwater

Groundwater was encountered in the boring approximately 8 to 10 feet below the existing ground surface during drilling. About 10 days after drilling and installation of the observation well, depth to groundwater was 8.3 feet. Plant personnel shared their belief that groundwater levels in that area are somewhat tidally influenced.

Groundwater level measurements in borings not designated as monitoring wells were made during or immediately following drilling and may not represent static conditions. Groundwater levels will fluctuate with season, precipitation, nearby construction activities, and other conditions.

5.0 LIMITATIONS

This report was prepared for the exclusive use of Jacobs Engineering Group, Inc. and the project design team. The recommendations provided herein are based on the project information provided at the time of this report and may require modification if there are any changes in the nature, design, or location of the project.

The data in this report are based on the subsurface explorations and laboratory testing. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise this report.

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

TABLES

2021-0314

Greater New Haven Water Pollution Abatement Facility - Blower Building

New Haven, Connecticut

Table 1

Laboratory Testing Performed

Boring No.	Sample Type & No.	Depth		Recovery (in)	SPT N / RQD %	SOIL TESTING					ROCK TESTING
		From (ft)	To (ft)			Sieve Analysis (ASTM D6913)	Atterberg Limits (ASTM D4318-05)	Moisture Content (ASTM D2216-05)	Unconsolidated-Undrained (UU)Triaxial (ASTM D2850)	Corrosivity - pH, Sulfates, Chlorides, and Resistivity (ASSHTO T288, T289, T290 & T291)	Unconfined Compressive Strength (ASTM D7012 Method C)
J-1	SS; S1	0	2	18	9					x (composite sample)	
J-1	SS; S2	2	4	20	21						
J-1	SS; S3	5	7	24	26						
J-1	SS; S4	7	9	18	47						
J-1	SS; S5	10	12	22	41	x		x			
J-1	SS; S7	20	22	10	11	x		x			
J-1	SS; S8	25	27	16	10	x	x	x			
J-1	Tube; U1	32	34	18	NA		x	x	X		
J-1	SS; S10	34	36	16	7						
J-1	SS; S11	40	42	24	3		x	x			
J-1A	SS; S2	50	52	10	> 100	x (composite sample)		x (composite sample)			
J-1A	SS; S3	55	57	10	> 100						
J-1A	Core Run; C1	65	70	49	46						X
J-1A	Core Run; C2	70	75	48	24						
					Total Assigned	4	3	6	1	1	1

Notes:

1. Corrosivity tests include: pH, Electrical Resistivity, Sulfates and Chloride
2. Composite samples were required in a few locations due to limited recoveries on samples.

2021-0314
Greater New Haven Water Pollution Abatement Facility - Blower Building
New Haven, Connecticut

Table 2
Subsurface Data

Boring No.	Ground Surface El. [1]	Depth (ft.)	Thickness (ft.)					Groundwater		Bedrock	
			Fill	Glaciofluvial Deposit	Glaciodeltaic Deposit	Glacial Till	Weathered Rock	Depth (ft.) [2]	Elevation	Depth (ft.)	Elevation
2021 Freeman											
J-1	11.5	47	6.0	19.0	19.0	>2 [3]	-- [3]	7.8	3.7	--	--
J-1A (OW) [2]	11.5	75	6.0	19.0	19.0	16.0	5.0	8.3	3.2	65	-53.5
2012 H&A											
HA-1	11.1	32	19.5	--	>12.5	--	--	12	-0.9	--	--
1972 General Borings											
B-1	14.0	55.7	11.0	11.5	19.5	>11.7	--	15	-1.0	--	--
B-2	12.0	45.7	ND [3]	ND	ND	ND	--	--	--	--	--

Notes:
1. Ground surface elevations are approximate and based upon available Google Map information.
2. Groundwater levels measured during drilling acitivities may not represent stabilized conditions in borings not designated observation wells (OW). Well reading taken on 7/13/2021.
3. ">" - Greater Than; "--" - Not Encountered; "ND" - Not Delineated

FIGURES

USGS QUADRANGLE MAPS
NEW HAVEN, CONNECTICUT
DATE 2021

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

SITE LOCATION MAP

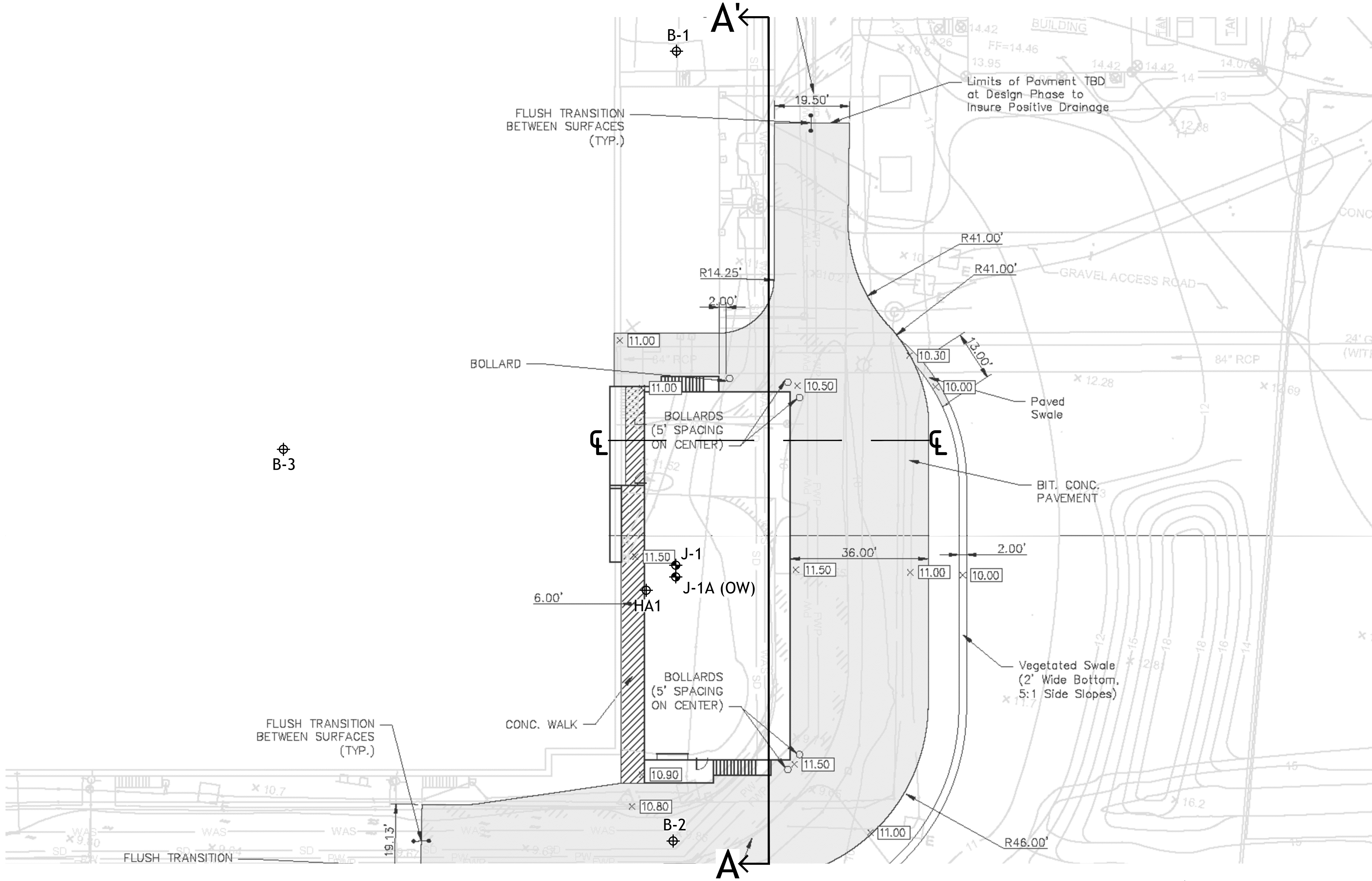
PROCESS AIR FACILITY
GREATER NEW HAVEN
WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

DRAFTED:	N.J.
CHECKED:	C.T.
APPROVED:	N.W.
SCALED:	1"=1000'
PROJECT NO.:	2021–0314
DATE:	06/28/2021

SHEET NO.

FIGURE 1

Freeman Companies, LLC . C:\Users\njohnson\AppData\Local\Temp\AcPublish_11440\Figure 1 – New Haven WPCA.dwg Jun 28, 2021–1:45pm Plotted By: njohnson



LEGEND:

⌖	J-1	RECENT TEST BORINGS (COMPLETED BY FREEMAN)
	OW	OBSERVATION WELL
⌖	B-1	PREVIOUS TEST BORINGS (COMPLETED BY OTHERS)

NOTES:

1. BASE PLAN PROVIDED BY JACOBS ENGINEERING GROUP
2. TEST BORING LOCATIONS WERE TAPED FROM EXISTING FEATURES AND ARE CONSIDERED APPROXIMATE
3. REFER TO FIGURE 3 (SUBSURFACE EXPLORATION PROFILE) FOR SECTION A-A'
4. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION

GRAPHIC SCALE

30 15 0 30

SCALE IN FEET

SUBSURFACE EXPLORATION LOCATION PLAN

PROCESS AIR FACILITY
GREATER NEW HAVEN WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

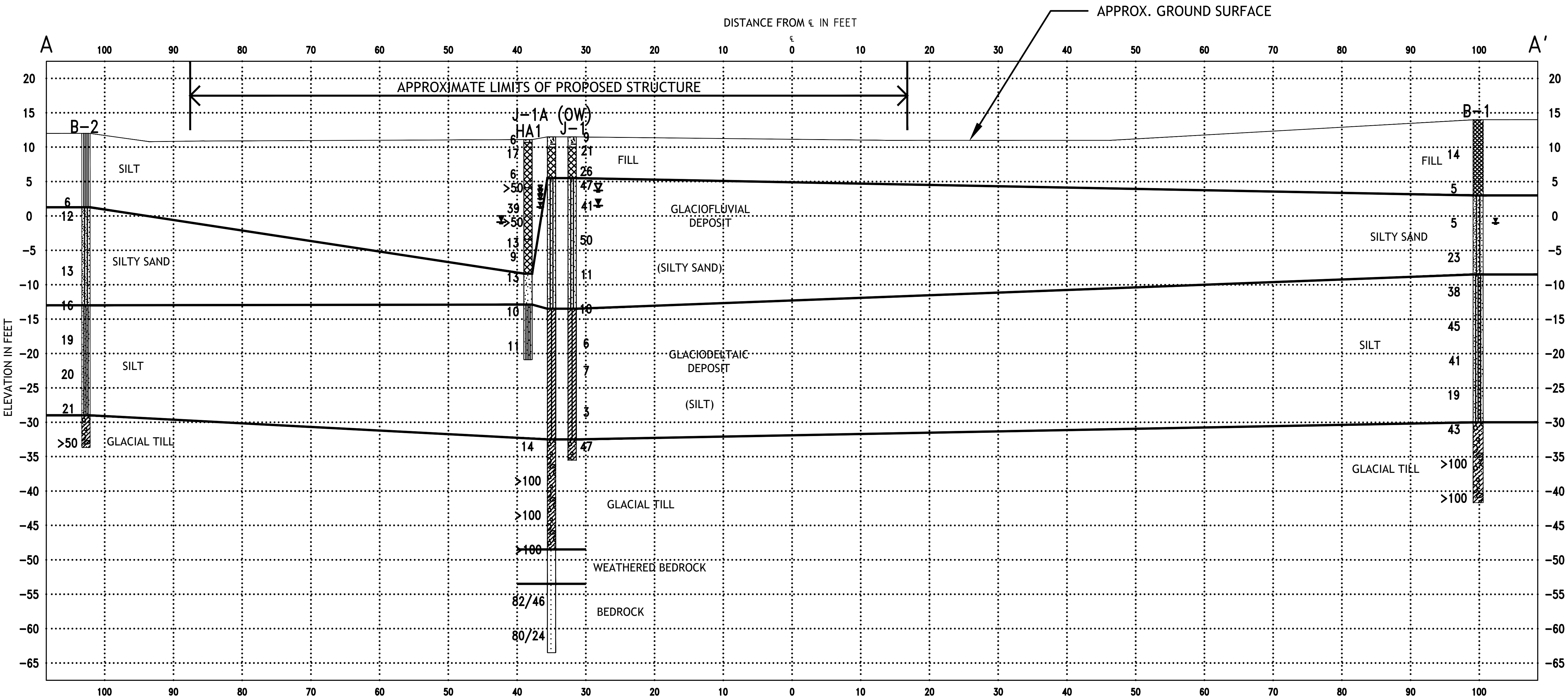
No.	Date	Description
–	–	–

REVISIONS

DRAWN:	N.J.
CHECKED:	A.M.M.
APPROVED:	C.T.
SCALE:	1"=30'
PROJECT NO.:	2021–0314
DATE:	07/26/2021

SHEET NO.

FIGURE 2



NOTE:
1. THE INTERPRETED STRATA BOUNDARIES INDICATED ARE KNOWN ONLY AT THE BORING LOCATIONS AND WILL VARY BETWEEN LOCATIONS

LEGEND

21	SPT N-VALUE
100/40	RECOVERY %/RQD %

SUBSURFACE EXPLORATION PROFILE

PROCESS AIR FACILITY
GREATER NEW HAVEN WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161

ELEVATE YOUR EXPECTATIONS

No.	Date	Description

REVISIONS

DRAWN:	N.J.
CHECKED:	A.M.M
APPROVED:	C.T.
SCALE:	1"=15'
PROJECT NO.:	2021-0314
DATE:	07/26/2021

SHEET NO.

FIGURE 3

APPENDIX A

TEST BORING LOGS

2021, 2012, 1972

Exploration Location

NORTHING: 266.45 **EASTING:** 390.87 **STATION:** **OFFSET:**
HORIZONTAL DATUM: **STATION CENTERLINE:**
VERTICAL DATUM: **ESTIMATED GROUND SURFACE ELEV. (FT):** 11.5
LOCATION: East of Aeration Basins

EXPLORATION
J-1
PAGE 1 of 2

Drilling Information

DATE START / END: 6/22/2021 - 6/22/2021 **TOTAL DEPTH (FT):** 47.0
CONTRACTOR: New England Boring **DRILLER:** R. Posa **LOGGED BY (Person):** N. Johnson
EQUIPMENT: Mobile B53 **EXPLORATION TYPE/METHOD:** 4.0-inch Casing
AUGER ID/OD: N/A / N/A **CASING ID/OD:** 4 in / N/A **CORE INFO:**
HAMMER TYPE: Automatic Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 7.80 6/23/2021 ▼ 10.00 6/22/2021
GENERAL NOTES: Used 4in Casing to 15ft, then switched to drilling mud

ABBREVIATIONS: ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample; U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	Sample Description & Classification	H_2O Depth	Remarks
			S1		0 to 2	24/18	3-4-5-5		TOPSOIL (Top 4 to 6") SILTY SAND WITH GRAVEL (SM); ~75% sand, ~20% fines, ~5% gravel; brown, With roots.		
10									**FILL at ~1.5 ft / ~El. 10.0 ft**		
			S2		2 to 4	24/20	4-11-10-13		SILTY SAND WITH GRAVEL (SM); ~70% sand, ~20% fines, ~10% gravel; blackish brown, Trace shells, Top 14in S2. SILTY SAND (SM); ~45% sand, ~45% fines, ~10% gravel; brownish black, With shells, Bottom 6in S2.		
	5		S3		5 to 7	24/24	6-7-19-24		WELL GRADED SAND WITH GRAVEL (SW); ~65% sand, ~25% gravel, ~10% fines; dark grayish brown, Top 18in S3.		
5									**GLACIOFLUVIAL at ~6 ft / ~El. 5.5 ft**		
			S4		7 to 9	24/18	24-22-25-30		POORLY GRADED SAND WITH GRAVEL (SP); ~80% sand, ~15% gravel, ~5% fines; damp grayish brown, Similar to above. Bottom 6in S3. POORLY GRADED SAND WITH GRAVEL (SP); ~85% sand, ~10% gravel, ~5% fines; moist, grayish brown.	▽ ▼	
0	10		S5		10 to 12	24/22	12-17-24-26		POORLY GRADED SAND WITH SILT (SP-SM); ~90% sand, ~9% fines, ~1% gravel; moist, grayish brown.		
-5	15		S6		15 to 17	24/14	18-26-24-24		POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; moist, brown.		
-10	20		S7		20 to 22	24/10	4-5-6-7		POORLY GRADED SAND (SP); ~92% sand, ~4% gravel, ~4% fines; grayish brown.		
									GLACIODELTAIC DEPOSITS at ~25 ft / ~El. -13.5		
-15	25		S8		25 to 27	24/16	6-4-6-7		SILT (ML); ~96% fines, ~4% sand, ~0% gravel; moist, reddish brown.		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: GNH WPCA - Process Air Facility
CITY/STATE: New Haven, Connecticut
PROJECT NUMBER: 2021-0314

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Exploration Location

NORTHING: 266.45 **EASTING:** 390.87 **STATION:** **OFFSET:**

HORIZONTAL DATUM: **STATION CENTERLINE:**

VERTICAL DATUM: **ESTIMATED GROUND SURFACE ELEV. (FT):** 11.5

LOCATION: East of Aeration Basins

EXPLORATION

J-1

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
-20			S9		30 to 32	24/24	4-3-3-5			SILT (ML); ~95% fines, ~5% sand, ~0% gravel; moist, reddish brown, Lenses of f sand.		
			U1		32 to 34	24				SILTY CLAY (CL-ML); reddish brown.		
-25	35		S10		34 to 36	24/16	WOH-3-4-6			SILT (ML); ~95% fines, ~5% sand, ~0% gravel; reddish brown.		
-30	40		S11		40 to 42	24/24	WOH-1-2-3			SILT (ML); ~95% fines, ~5% sand, ~0% gravel; reddish brown.		
										GLACIAL TILL at ~44 ft / ~El. -32.5 ft		
-35	45		S12		45 to 47	24/0	61-34-13-20			No Recovery		Grinding on rollerbit 44ft to 45ft
										Boring abandoned at 47ft due to broken Split Spoon		
-40	50											
-45	55											
-50	60											
-55	65											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: GNH WPCA - Process Air Facility
CITY/STATE: New Haven, Connecticut
PROJECT NUMBER: 2021-0314

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Exploration Location

NORTHING: ______ **EASTING:** ______ **STATION:** ______ **OFFSET:** ______
HORIZONTAL DATUM: ______ **STATION CENTERLINE:** ______
VERTICAL DATUM: ______ **ESTIMATED GROUND SURFACE ELEV. (FT):** 11.5
LOCATION: East of Aeration Basins

EXPLORATION

J-1A (OW)

PAGE 1 of 3

Drilling Information

DATE START / END: 6/22/2021 - 6/23/2021 **TOTAL DEPTH (FT):** 75.0
CONTRACTOR: New England Boring **DRILLER:** R. Posa **LOGGED BY (Person):** N. Johnson
EQUIPMENT: Mobile B53 **EXPLORATION TYPE/METHOD:** 4.0-inch Casing
AUGER ID/OD: N/A / N/A **CASING ID/OD:** 4 in / N/A **CORE INFO:** Type: NX
HAMMER TYPE: Automatic Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ∇8.30 7/13/21(OW) ▼10.20 6/23/2021 Measured immediately prior to well installation
GENERAL NOTES: Offset 3ft SSE from J-1. Initially used 4in Casing to 15ft, then switched to drilling mud (6/22/21). Flushed out drilling mud and drove casing to 50ft (6/23/21)

ABBREVIATIONS: ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample; U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	WELL CONSTRUCTION DETAILS
11.5–10.0	0–1.5									**FILL at ~1.5 ft / ~El. 10.0 ft**		Road Box; Sand (0.5'-2')
10.0–5.5	1.5–6									See J-1 for soil descriptions **GLACIOFLUVIAL at ~6 ft / ~El. 5.5 ft**		Bentonite Seal (2'-3'); PVC Riser (0.25'-5.25')
5.5–-13.5	6–25									See J-1 for soil descriptions **GLACIODELTAIC DEPOSITS at ~25 ft / ~El. -13.5 ft**	∇ 8.30; ▼ 10.20	Filter Sand (3'-15.25'); Slotted Pipe (5.25'-15.25'; Filter Sand (15.25-16.25'); Backfill
-13.5–	25–									See J-1 for soil descriptions		Backfill

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: GNH WPCA - Process Air Facility
CITY/STATE: New Haven, Connecticut
PROJECT NUMBER: 2021-0314

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Exploration Location

NORTHING: ______ **EASTING:** ______ **STATION:** ______ **OFFSET:** ______

HORIZONTAL DATUM: ______ **STATION CENTERLINE:** ______

VERTICAL DATUM: ______ **ESTIMATED GROUND SURFACE ELEV. (FT):** 11.5

LOCATION: East of Aeration Basins

EXPLORATION

J-1A (OW)

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
									See J-1 for soil descriptions		
-20											
	35										
-25											
	40										
-30									**GLACIAL TILL at ~44 ft / ~El. -32.5 ft**		
									Grinding on roller bit at 44ft		
	45		S1		45 to 47	24/0	4-4-10-18		No Recovery - gravel in tip of split spoon		Backfill
-35											
	50		S2		50 to 50.83	10/8	48-100/4"		SILTY SAND WITH GRAVEL (SM); ~60% sand, ~25% fines, ~15% gravel; reddish brown.		
-40											
	55		S3		55 to 56.33	16/10	36-24-76/4"		SILTY SAND WITH GRAVEL (SM); ~50% sand, ~25% gravel, ~25% fines; reddish brown, With quartz and weathered sandstone fragments.		
-45									**WEATHERED ROCK at ~60 ft / ~El. -48.5 ft**		
	60		S4		60 to 60.08	1/1	100/1"		SILTY GRAVEL WITH SAND (GM); ~65% gravel, ~25% fines, ~15% sand; reddish brown with dark gray, Weathered sandstone with residual soil.		
-50									**BEDROCK at ~65 ft / ~El. -53.5 ft**		
	65		C1		65 to 70	60/49	46		SANDSTONE, medium hard, moderately to slightly weathered, reddish brown with white, medium grained, medium to thickly bedded, (Dip ~0 to 50 deg.), highly to moderately fractured, with pocket of gneiss 65.8 ft. to 66.2 ft. and specks of quartz. Coring Times (min/ft): 2.5-3-3-3-2.75.		
-55											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: GNH WPCA - Process Air Facility
CITY/STATE: New Haven, Connecticut
PROJECT NUMBER: 2021-0314

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Exploration Location

NORTHING: ______ **EASTING:** ______ **STATION:** ______ **OFFSET:** ______
HORIZONTAL DATUM: ______ **STATION CENTERLINE:** ______
VERTICAL DATUM: ______ **ESTIMATED GROUND SURFACE ELEV. (FT):** 11.5
LOCATION: East of Aeration Basins

EXPLORATION

J-1A (OW)

PAGE 3 of 3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
-60	70		C2		70 to 75	60/48	24			SANDSTONE, medium to moderately hard, slightly weathered, reddish brown, coarse grained, medium to thickly bedded, (Dip ~0 to 20 deg.), moderately fractured, with 8-in pocket of fine grained sandstone/siltstone in middle of sample, specks of quartz. Coring Times (min/ft): 3-3-2-3-3.		Backfill
-65	75									End of Boring at 75 feet		
-70	80											
-75	85											
-80	90											
-85	95											
-90	100											
-95	105											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: GNH WPCA - Process Air Facility
CITY/STATE: New Haven, Connecticut
PROJECT NUMBER: 2021-0314

FREEMAN COMPANIES
LAND DEVELOPMENT · ENGINEERING DESIGN · CONSTRUCTION SERVICES

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Rock Core Data Sheet

Project No.	Project Description	Town	Location		Driller	Inspector	Engineer	Start Date	End Date
2021-0314	Blower Building - Greater New Haven Water Pollution Abatement Facility	New Haven, CT	East of Settling Tanks		R. Posa	N. Johnson	C. Tonzi	6/22/2021	6/23/2021

Boring No.	Sample No.	Sample Depth (ft.)	Rock Type	Color	Grain Size	Bedding	Fracturing	Weathering	Strength	Drill Rates (min/ft)					Pen. (in)	Rec. (in)	Rec. (%)	RQD (%)
J-1A	C1	65-70	Sandstone	Reddish Brown with White	Coarse Grained	Medium to Thickly Bedded	Highly to Moderately Fractured	Moderately to Slightly	Medium Hard	2.5	3	3	3	2.75	60	49	82%	46%
J-1A	C2	70-75	Sandstone	Reddish Brown	Coarse Grained	Medium to Thickly Bedded	Moderately Fractured	Slightly Weathered	Moderately Hard to Medium	3	3	2	3	3	60	48	80%	24%

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

NOTES:			
	J-1A C1: Pocket of Gneiss 65.8ft to 66.2ft, specks of Quartz	Casing Type/Size:	4in Driven Flush Steel Casing
	J-1A C2: 8-in pocket of fine grained sandstone/siltstone in middle of sample, specks of Quartz	Hammer Weight:	300
		Hammer Fall:	30
		Core Barrel Type:	NX

TEST BORING REPORT

HALEY & ALDRICH

Boring No. HA1

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT	File No.	37176-000
Client	CH2M HILL	Sheet No.	1 of 2
Contractor	General Borings, Inc.	Start	21 May 2012
		Finish	21 May 2012
		Driller	R. Posa
		H&A Rep.	S. Brousseau

	Casing	Sampler	Barrel
Type	HSA	S	-
Inside Diameter (in.)	3 1/4	1 3/8	-
Hammer Weight (lb)	-	140	-
Hammer Fall (in.)	-	30	-

Drilling Equipment and Procedures

Rig Make & Model: ATV-mounted Mobile Drill B53
Bit Type: Cutting Head
Drill Mud: None
Casing: -
Hoist/Hammer: Cat-Head Safety Hammer
PID Make & Model: None

Elevation 11.1 (est.)
Datum NAVD88
Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	1 2 4 4	S1 14	0.0 2.0	10.7 0.4		-TOPSOIL-
					SM	Loose brown silty medium to fine SAND, trace gravel, with few organics, no odor, dry
	5 7 10 13	S2 18	2.0 4.0		SM	Medium dense dark brown silty medium to fine SAND, trace gravel, with few organics and shells, no odor, dry
5	3 3 3 3	S3 14	5.0 7.0		SM	Similar to S2
	17 19 34 38	S4 16	7.0 9.0	4.1 7.0	SM	Very dense brown medium to fine SAND, little silt, with very few silty clay pockets, no odor, dry
10	13 17 22 27	S5 18	10.0 12.0		SM	Dense gray-brown medium to fine SAND, little silt, with very few organics and shells, no odor, moist
	19 24 29 32	S6 18	12.0 14.0		SM	Very dense gray-brown medium to fine SAND, little silt, trace gravel, no odor, wet
				-3.4 14.5		
15	4 5 8 9	S7 16	15.0 17.0		SM	Medium dense brown medium to fine SAND, little silt, with occasional silty clay seam, no odor, wet
	7 5 4 2	S8 14	17.0 19.0		SM	Loose brown medium to fine SAND, little silt, bottom 3 in. wood and gravel, no odor, wet
				-8.4 19.5		-FILL-
20						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/21/12	1145	0.0	10.0	14.0	12.0 ±

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 32.0
Rock Cored (ft) -
Samples 11S

Boring No. HA1

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA1
File No. 37176-000
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	3 5 8 11	S9 12	20.0 22.0		SP	Medium dense gray-brown medium to fine SAND, trace silt, no odor, wet Note: 2 ft running sands after sample retrieved
				-12.9 24.0		Note: Drill action indicates change at 24.0 ft
25	3 4 6 5	S10 14	25.0 27.0		ML	Stiff red-brown fine sandy SILT with interbedded clay laminae, no odor, wet
30	4 4 7 7	S11 20	30.0 32.0		ML	Stiff red-brown fine sandy SILT, interbedded with clay laminae and fine sand partings, no odor, wet -GLACIODELTAIC DEPOSITS-
				-20.9 32.0		Bottom of exploration at 32.0 ft Note: Borehole backfilled with drill cuttings upon completion

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA1

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

CLIENT: Camp, Dresser & McKee Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 2
HOLE NO. B-1
LINE
STATION N163610
OFFSET E558345

CONTRACTOR

FOREMAN-DRILLER J.D. C.E.

INSPECTOR Om Mehta

PROJECT NAME East Shore Water Pollution
LOCATION Abatement Project
New Haven, Conn.

GROUND WATER OBSERVATIONS
AT 15.0' FT. AFTER 0 HOURS
AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	NOM. 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 1/19 - 1/19/72
DATE FIN.
SURFACE ELEV. 14.0
GROUND WATER ELEV. -1.0

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	ss	18"	15	6.5'	2	4	10		moist medium		1) Brown fine-coarse sand, little silt with gray clay, trace sand, trace shell.
10		2	ss	18"	14"	11.5'	1	3	2		wet loose	11.0'	2) Dark gray clay and silt, red-brown fine-coarse sand, little silt in tip of split spoon.
15		3	ss	18"	13"	16.5'	1	2	3		"		3) Brown fine-medium sand, trace coarse sand, little silt.
20		4	ss	18"	16	21.5'	7	12	11		wet medium	22.5'	4) S me as #3 with red-brown fine-medium sand, trace coarse sand, little silt in tip of split spoon.
25		5	ss	18"	13"	26.5'	16	16	22		wet dense		5) Red-brown very fine sand, trace silt.
30		6	ss	18	16"	31.5'	12	20	25		"		6) Red-brown silt.
35		7	"	"	13	36.5'	11	11	30		"		7) Same as #6.
		8	ss	18"	16"	41.5'	5	7	12		wet medium		8) Red-brown silt, little very fine sand.

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT: Camp. Dresser & McKee Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 2 OF 2

HOLE NO. B-1

LINE

CONTRACTOR

PROJECT NAME East Shore Water Pollution

FOREMAN-DRILLER J.D. C.E.

LOCATION Abatement Project New Haven, Conn.

STATION N163610

INSPECTOR Om Mehta

OFFSET E558345

GROUND WATER OBSERVATIONS

AT 15.0 FT. AFTER 0 HOURS

AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	NOM. 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 1/19 - 1/19/72

DATE FIN.

SURFACE ELEV. 14.0

GROUND WATER ELEV. -1.0

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
												44.0'	
5		9	ss	18"	12"	46.5'	12	15	28		wet dense		9) Red-brown fine-coarse sand, trace fine-medium gravel, little silt.
0'		10	ss	18"	13"	51.5'	25	37	76		wet very dense		10) Red-brown fine-medium sand, trace coarse sand, trace fine gravel, little silt.
5		11	"	8"	6"	55.67'	75	100/2"			"	55.67' EOB	11) Same as #10. Refusal on split spoon at 55.67'.

END OF BO ING 55.67' Soil

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT: Camp, Dresser & McKee, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 2

HOLE NO. B-2

LINE

CONTRACTOR

PROJECT NAME East Shore Water Pollution Abatement Project

FOREMAN-DRILLER L.C. R.D.

LOCATION New Haven, Conn.

STATION N163410

OFFSET E558375

INSPECTOR Om Mehta

GROUND WATER OBSERVATIONS

AT ___ FT. AFTER ___ HOURS

AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	WI	SS	
SIZE I.D.	NOM. 2"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 2/26 - 2/28/72

DATE FIN.

SURFACE ELEV. 12.0

GROUND WATER ELEV. –

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. / MOIST	STRATA CHANGE DEPTH / ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
	2	1	UB	24"	24"	2.0'	Press				saturated		1) Black silt - Fine sand at bottom of UB sample.
	14												
	9												
	4												
	3												
5	3	2		24"	12	8.0'	Press						2) Gray silt. UB Sample
	9												
	9												
	9										sat		1) Top 9" - brown organic silt.
10	11	1	ss	18"	18	11.5'	3	3	3		loose		Bottom 9 - brown fine sand, trace silt.
	18												
	29										wet		
	38	2	ss	18"	14	14.5'	6	6	6		medium		2) Brown fine sand, trace silt.
	36												
	38												
15	52												
	54												
	54												
	60										wet		3) Grey-brown fine-medium sand,
	65	3	"	"	11	21.5'	5	6	7		medium		trace silt.
20	46												
	68												
	70												
	62										moist		4) Red-brown silt, trace very
	60	4	"	"	14	26.5'	5	6	10		medium		fine sand.
25	50												
	62												
	77												
	85										moist		5) Same as #4.
	88	5			13	31.5'	6	9	10		medium		
30	52												
	70												
	89												
	100	6	"	"	18	36.5'	7	9	11		moist		6) Red-brown silt, some very
35	95										medium		fine sand.
	78												7) Red-brown silt, some very
	90												fine sand changing to red-brown
	96												fine-medium silty sand, trace
	94										moist		~~medium gravel.~~
	90	7	"		18"	41.5'	6	9	12		medium		medium gravel.

TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE

EARTH BORING ______ FT.

ROCK CORING ______ FT.

CLIENT: Camp, Dresser & McKee, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 2 OF 2

HOLE NO. B-2

CONTRACTOR

PROJECT NAME East Shore Water Pollution

LINE

FOREMAN-DRILLER L.C. R. D.

LOCATION Abatement Project New Haven, Conn.

STATION N163410

INSPECTOR Om Mehta

OFFSET E558375

GROUND WATER OBSERVATIONS

AT ___ FT. AFTER ___ HOURS

AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	WI	SS	
SIZE I.D.	2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 2/26 - 2/26/72

DATE FIN.

SURFACE ELEV. 12.0

GROUND WATER ELEV. -

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
	88											41.0'	
	99												
	125												
	150												
5	200	8	SS	8"		45.67'	29	50/2	50/0"		wet very dense	45.67' EOB	8) Red-brown fine-coarse sand, fine-medium gravel, trace silt, decomposed sandstone in spoon tip.
10													Refusal on spoon at 45.67'.
													END OF BORING 45.67' Soil
15													2UB
20													
25													
30													
35													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE

EARTH BORING ___ FT.

ROCK CORING ___ FT.

APPENDIX B

RESULTS OF LABORATORY TESTING

Client:	Freeman Companies, LLC				
Project:	Greater New Haven WPCA Blower Bldg				
Location:	New Haven, CT			Project No:	GTX-313887
Boring ID:	---	Sample Type:	---	Tested By:	ckg
Sample ID:	---	Test Date:	07/01/21	Checked By:	bfs
Depth :	---	Test Id:	623227		

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
J-1	S5	10-12	Moist, dark gray sand with silt	11.1
J-1	S7	20-22	Moist, dark brown sand	23.2
J-1	S8	25-27	Moist, red silt	27.6
J-1	U1	32-34	Moist, reddish brown silty clay	22.8
J-1	S11	40-42	Moist, red silt	24.9
J-1A (OW)	S2 & S3 (Comp. Sample)	50-57	Moist, reddish brown silty sand with gravel	11.6

Notes: Temperature of Drying : 110º Celsius

printed 7/16/2021 1:18:50 PM

Client:	Freeman Companies, LLC
Project Name:	Greater New Haven WPCA Blower Bldg
Project Location:	New Haven, CT
GTX #:	313887
Test Date:	07/14/21
Tested By:	htk
Checked By:	bfs

pH by AASHTO T 289

Boring ID	Sample ID	Depth, ft	Description	pH
J-1	S1-S4 (Comp. Sample)	0-9	Moist, brown clayey sand	7.16

Client:	Freeman Companies, LLC
Project Name:	Greater New Haven WPCA Blower Bldg
Project Location:	New Haven. CT
GTX #:	313887
Test Date:	07/14/21
Tested By:	htk
Checked By:	bfs

Minimum Laboratory Soil Resistivity by AASHTO T 288

Boring ID	Sample ID	Depth, ft	Sample Description	Minimum Soil Resistivity, ohm-cm
J-1	S1-S4 (Comp. Sample)	0-9	Moist, brown clayey sand	1,653

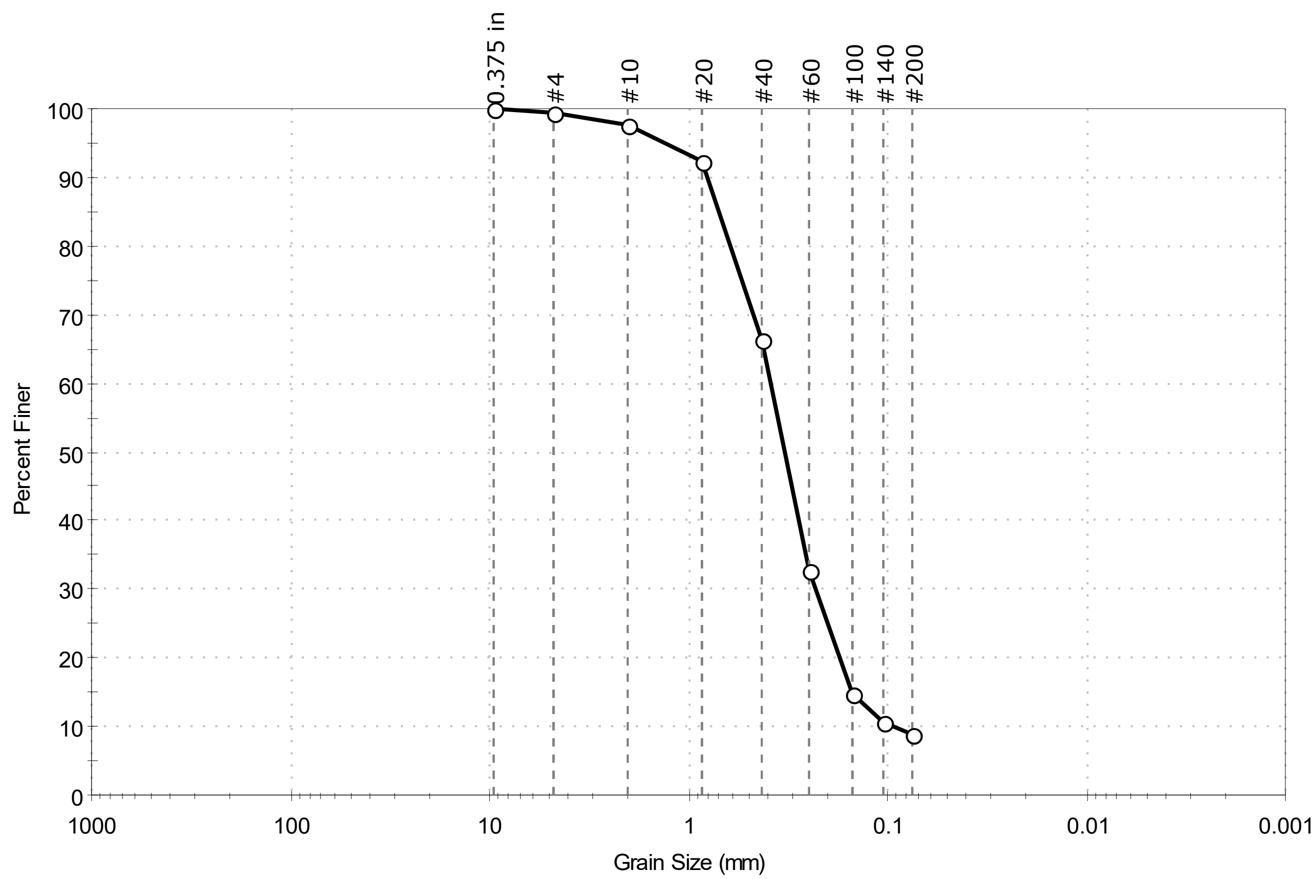
Comments: Test Equipment: Nilsson Model 400 Soil Resistance Meter, MC Miller Soil Box
Test conducted in standard laboratory atmosphere: 68-73 F

GeoTesting EXPRESS

Client:	Freeman Companies, LLC		
Project:	Greater New Haven WPCA Blower Bldg		
Location:	New Haven, CT	Project No:	GTX-313887
Boring ID: J-1	Sample Type: jar	Tested By:	ckg
Sample ID: S5	Test Date: 07/07/21	Checked By:	bfs
Depth : 10-12	Test Id: 623218		

Test Comment: ---
Visual Description: Moist, dark gray sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.7	90.6	8.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	98		
#20	0.85	92		
#40	0.42	66		
#60	0.25	33		
#100	0.15	15		
#140	0.11	11		
#200	0.075	8.7		

Coefficients

D_{85} =0.6993 mm D_{30} =0.2318 mm
D_{60} =0.3843 mm D_{15} =0.1507 mm
D_{50} =0.3284 mm D_{10} =0.0935 mm
C_u =4.110 C_c =1.495

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

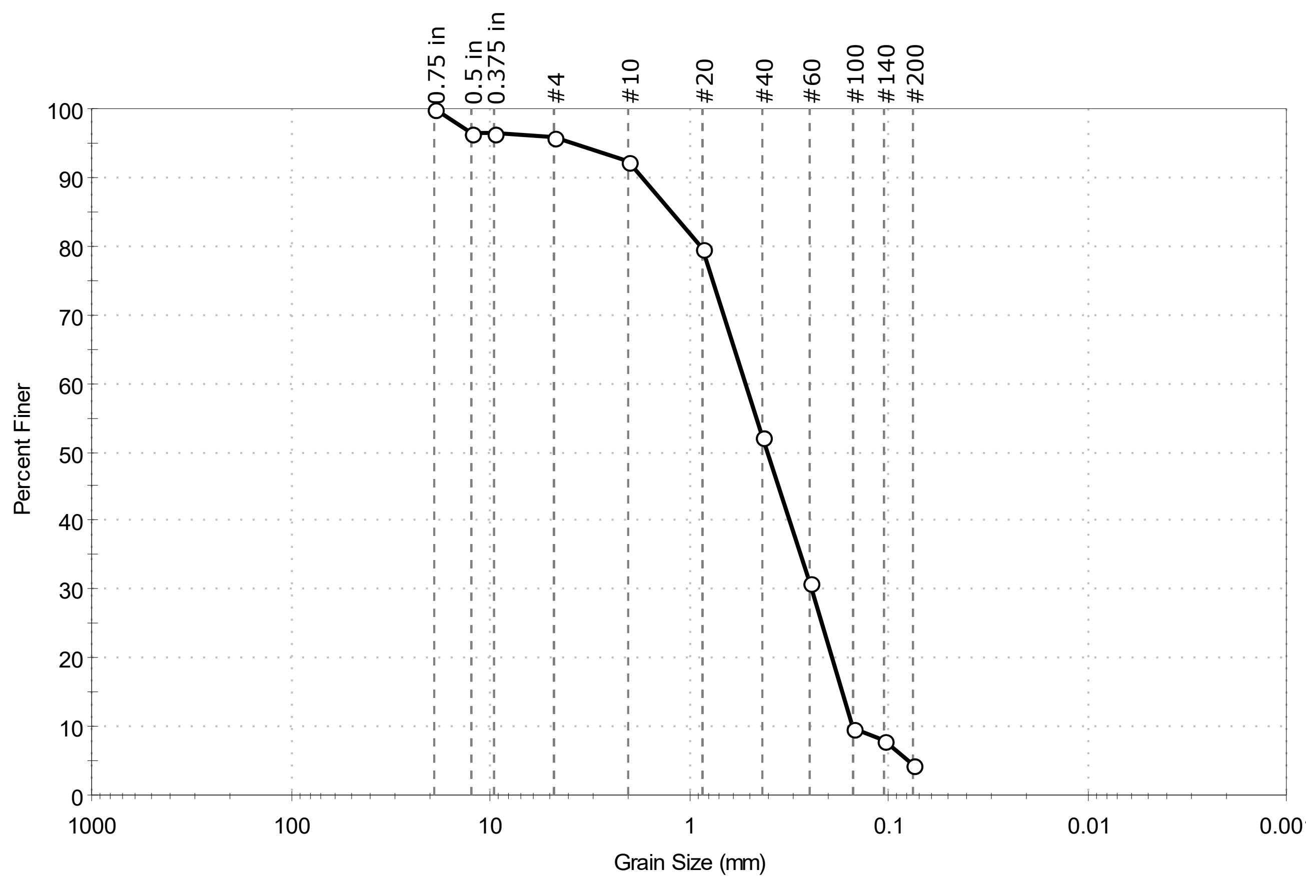
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

printed 7/16/2021 1:13:52 PM

Client:	Freeman Companies, LLC		
Project:	Greater New Haven WPCA Blower Bldg		
Location:	New Haven, CT	Project No:	GTX-313887
Boring ID: J-1	Sample Type: jar	Tested By:	ckg
Sample ID: S7	Test Date: 07/13/21	Checked By:	bfs
Depth : 20-22	Test Id: 623219		
Test Comment:	---		
Visual Description:	Moist, dark brown sand		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	4.2	91.4	4.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	96		
#4	4.75	96		
#10	2.00	92		
#20	0.85	80		
#40	0.42	52		
#60	0.25	31		
#100	0.15	10		
#140	0.11	8		
#200	0.075	4.4		

Coefficients

D_{85} =1.2223 mm D_{30} =0.2444 mm

D_{60} =0.5186 mm D_{15} =0.1704 mm

D_{50} =0.4029 mm D_{10} =0.1511 mm

C_u =3.432 C_c =0.762

Classification

ASTM Poorly graded SAND (SP)

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

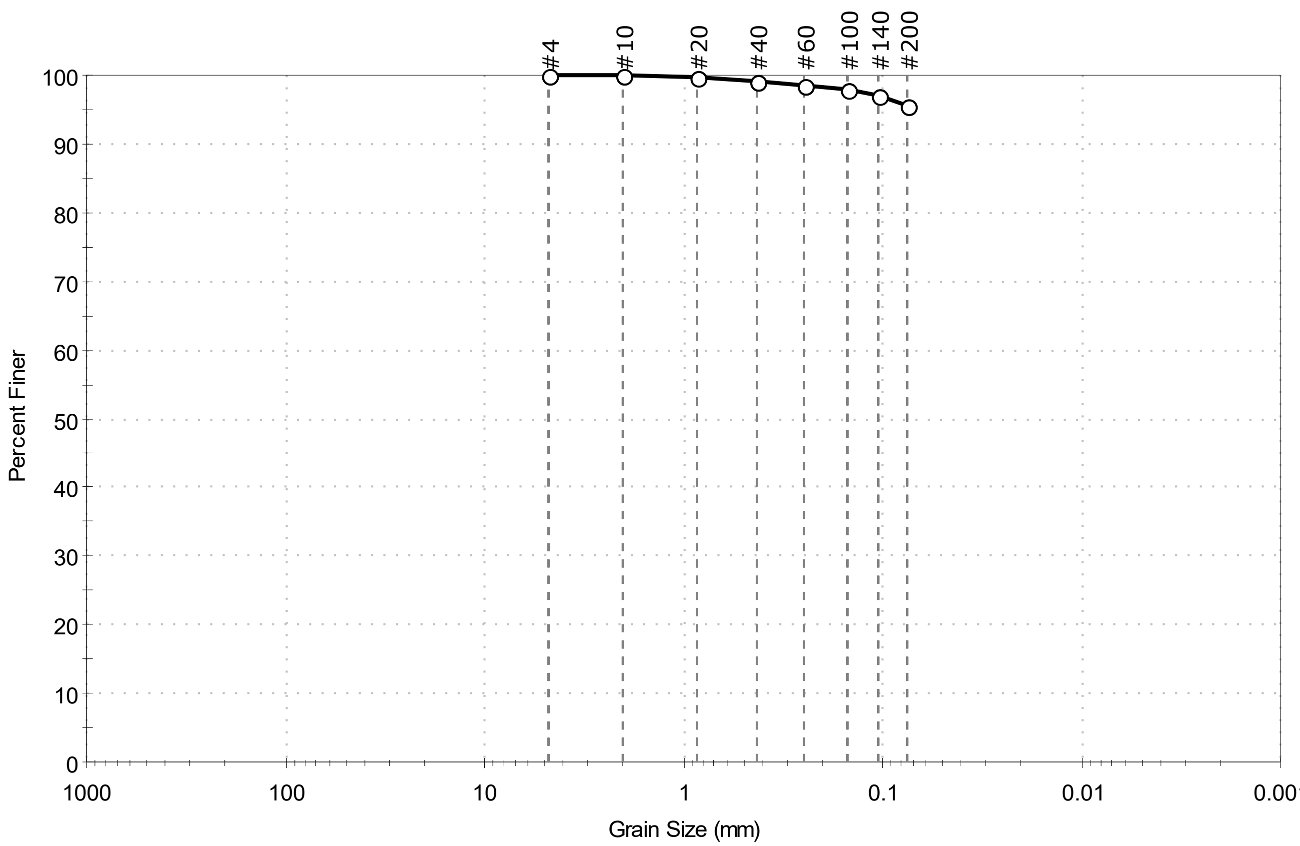
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 7/16/2021 1:13:54 PM

Client:	Freeman Companies, LLC		
Project:	Greater New Haven WPCA Blower Bldg		
Location:	New Haven, CT	Project No:	GTX-313887
Boring ID: J-1	Sample Type: jar	Tested By:	ckg
Sample ID: S8	Test Date: 07/06/21	Checked By:	bfs
Depth : 25-27	Test Id: 623220		
Test Comment:	---		
Visual Description:	Moist, red silt		
Sample Comment:	---		

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	4.3	95.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	99		
#100	0.15	98		
#140	0.11	97		
#200	0.075	96		

Coefficients

D_{85} =N/A D_{30} =N/A

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

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

C_u =N/A C_c =N/A

Classification

ASTM SILT (ML)

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

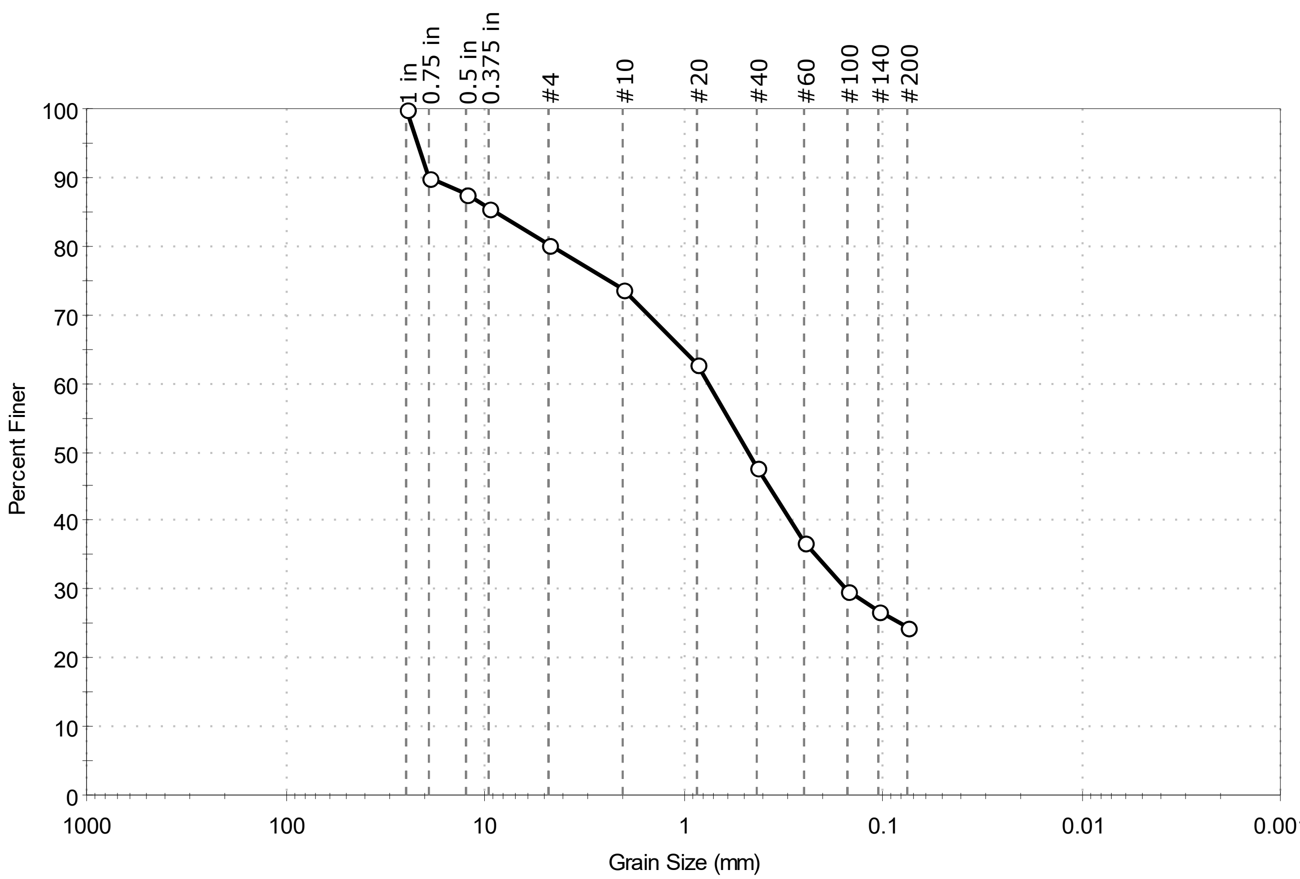
printed 7/16/2021 1:13:57 PM

Client:	Freeman Companies, LLC		
Project:	Greater New Haven WPCA Blower Bldg		
Location:	New Haven, CT	Project No:	GTX-313887

Boring ID:	J-1A (OW)	Sample Type:	jar	Tested By:	ckg
Sample ID:	S2 & S3 (Comp. Sample)	Test Date:	07/07/21	Checked By:	bfs
Depth :	50-57	Test Id:	623221		

Test Comment: ---
Visual Description: Moist, reddish brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	19.7	55.9	24.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	90		
0.5 in	12.50	87		
0.375 in	9.50	86		
#4	4.75	80		
#10	2.00	74		
#20	0.85	63		
#40	0.42	48		
#60	0.25	37		
#100	0.15	30		
#140	0.11	27		
#200	0.075	24		

Coefficients

D_{85} =8.7713 mm | D_{30} =0.1533 mm
D_{60} =0.7465 mm | D_{15} =N/A
D_{50} =0.4688 mm | D_{10} =N/A
C_u =N/A | C_c =N/A

Classification

ASTM N/A

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

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 7/16/2021 1:14:00 PM

GeoTesting EXPRESS

Client:	Freeman Companies, LLC		
Project:	Greater New Haven WPCA Blower Bldg		
Location:	New Haven, CT	Project No:	GTX-313887

Boring ID:	J-1	Sample Type:	jar	Tested By:	cam
Sample ID:	S8	Test Date:	07/01/21	Checked By:	bfs
Depth :	25-27	Test Id:	623215		

Test Comment: ---
Visual Description: Moist, red silt
Sample Comment: ---

Atterberg Limits - ASTM D4318

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S8	J-1	25-27	28	n/a	n/a	n/a	n/a	SILT (ML)

1% Retained on #40 Sieve
Dry Strength: LOW
Dilatancy: RAPID
Toughness: LOW
The sample was determined to be Non-Plastic

printed 7/16/2021 1:10:58 PM

Client:	Freeman Companies, LLC				
Project:	Greater New Haven WPCA Blower Bldg				
Location:	New Haven, CT			Project No:	GTX-313887
Boring ID:	J-1	Sample Type:	jar	Tested By:	cam
Sample ID:	S11	Test Date:	07/02/21	Checked By:	bfs
Depth :	40-42	Test Id:	623217		
Test Comment:	---				
Visual Description:	Moist, red silt				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

Sample Determined to be non-plastic

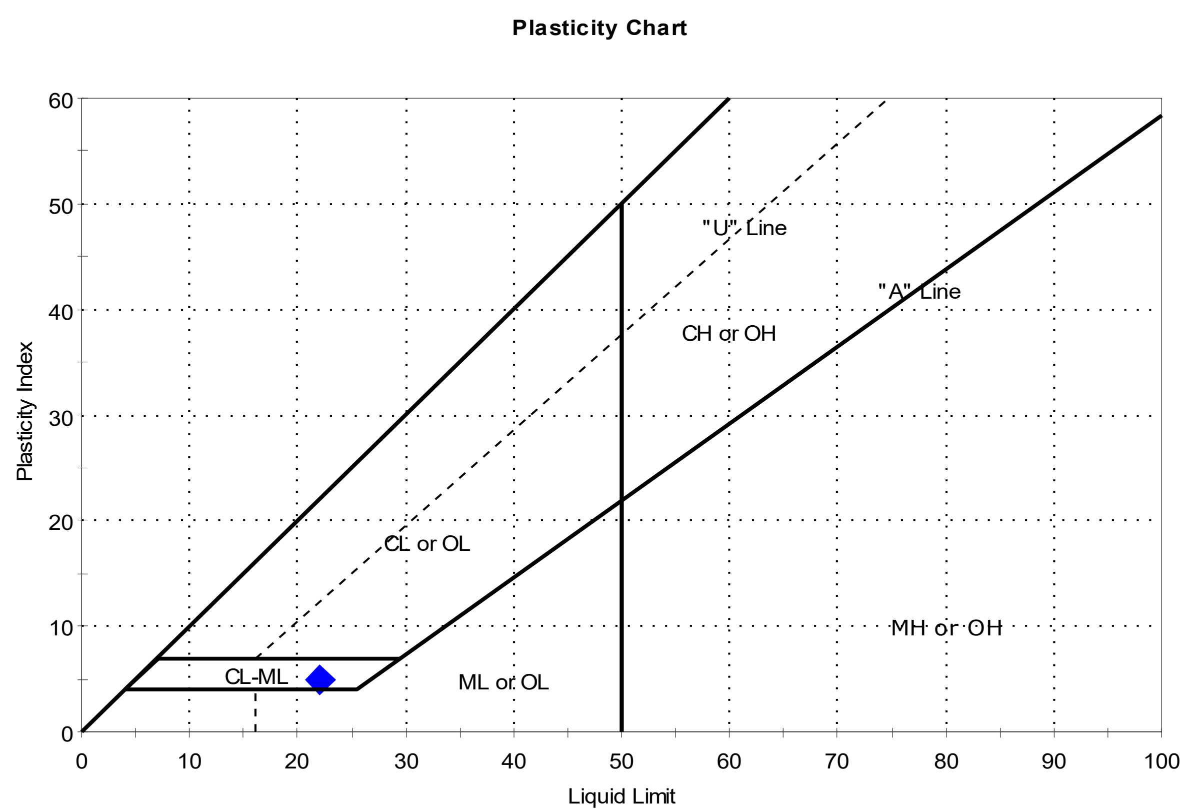
Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S11	J-1	40-42	25	n/a	n/a	n/a	n/a	

Dry Strength: LOW
Dilatancy: RAPID
Toughness: LOW
The sample was determined to be Non-Plastic

printed 7/16/2021 1:10:59 PM

Client: Freeman Companies, LLC			
Project: Greater New Haven WPCA Blower Bldg			
Location: New Haven, CT		Project No:	GTX-313887
Boring ID: J-1	Sample Type: tube	Tested By:	cam
Sample ID: U1	Test Date: 07/07/21	Checked By:	bfs
Depth : 32-34	Test Id: 623216		
Test Comment: ---			
Visual Description: Moist, reddish brown silty clay			
Sample Comment: ---			

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	U1	J-1	32-34	23	22	17	5	1.2	

Sample Prepared using the WET method

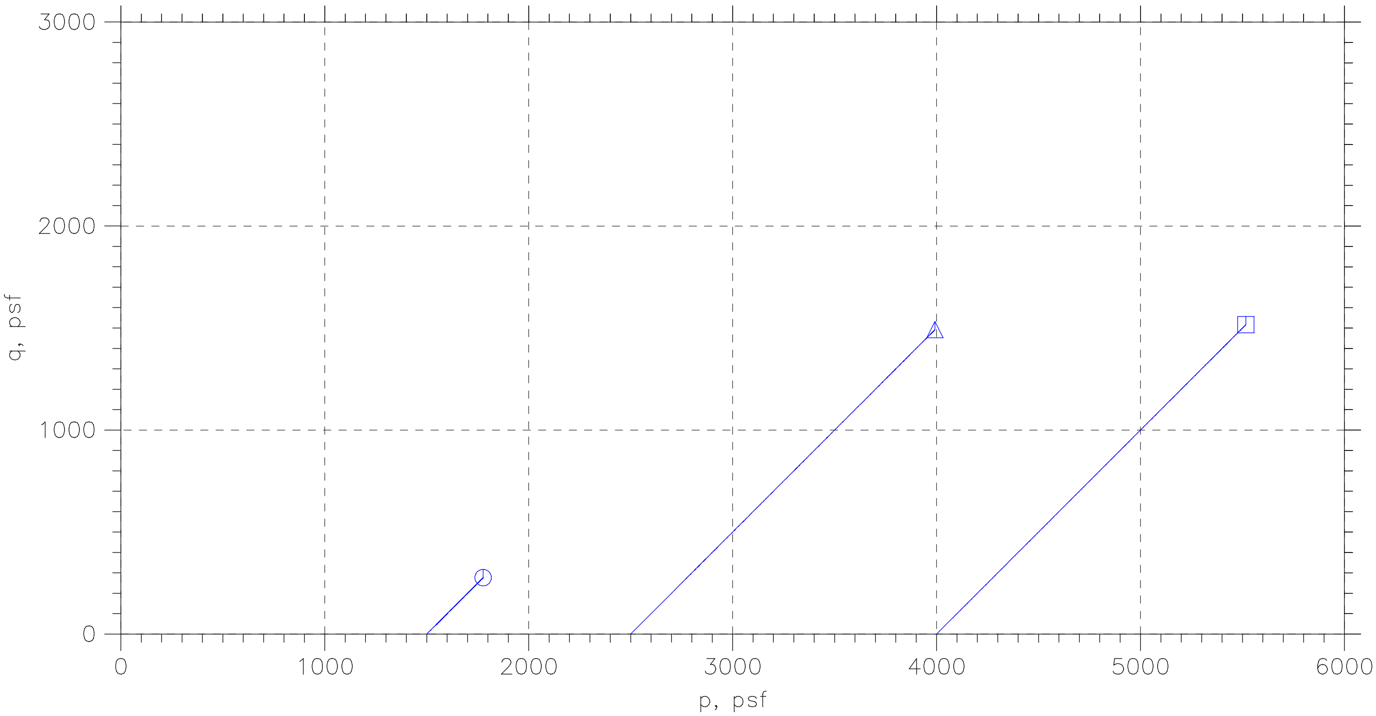
Dry Strength: LOW

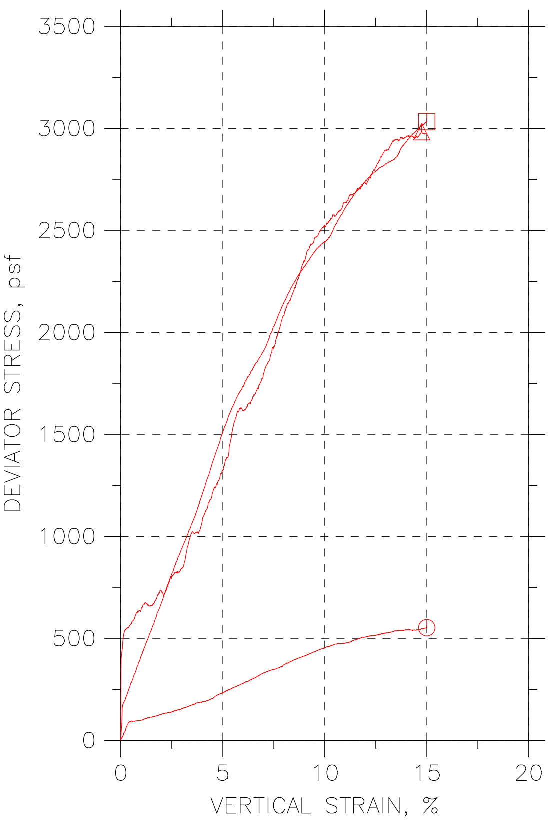
Dilatancy: RAPID

Toughness: LOW

printed 7/16/2021 1:11:00 PM

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D2850





Symbol	○	△	□	
Sample No.	U1	U1	U1	
Test No.	UU-1-1	UU-1-2	UU-1-3	
Depth	32-34	32--34	32-34	
Tested by	trm	trm	trm	
Test Date	7/6/21	7/6/21	7/6/21	
Checked by	anm	anm	anm	
Check Date	7/16/21	7/16/21	7/16/21	
Diameter, in	2.78	2.85	2.87	
Height, in	6	5.85	6.1	
Water Content, %	22.8	20.9	20.5	
Dry Density, pcf	102.2	106.1	106.4	
Saturation, %	94.9	96.0	94.6	
Void Ratio	0.649	0.588	0.584	
Confining Stress, psf	1500	2500	4000	
Undrained Strength, psf	276.3	1492	1517	
Max. Dev. Stress, psf	552.7	2984	3033	
Strain at Failure, %	15	14.7	15	
Strain Rate, %/min	1	1	1	
Estimated Specific Gravity	2.7	2.7	2.7	
Liquid Limit	22	22	22	
Plastic Limit	17	17	17	
Plasticity Index	5	5	5	

GeoTesting EXPRESS

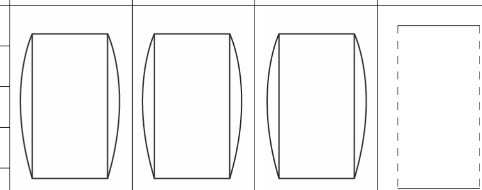
Project: Greater New Haven WCPA

Location: New Haven, CT

Project No.: GTX-313887

Boring No.: J-1

Sample Type: intact



Description: Moist, reddish brown clay

Remarks: System F

Phase calculations based on start and end of test.

Fri, 16-JUL-2021 13:59:03

PO Box 572455 / Salt Lake City UT 84157-2455 / USA
TEL +1 801 262 2448 · FAX +1 801 262 9870 · www.TEi-TS.com

GEOTESTING EXPRESS INCORPORATED
125 NAGOG PARK
ACTON MA 01720-3451
USA

Analysis No.	TS-A2109686
Report Date	08 July 2021
Date Sampled	30 June 2021
Date Received	02 July 2021
Where Sampled	Acton, MA USA
Sampled By	Client

This is to attest that we have examined: Soil: Project: Greater New Haven WPCA Blower Building; Site Location: New Haven, CT; Job Number: GTX-313887

When examined to the applicable requirements of:

AASHTO T-291-18	"Standard Method of Test for Determining Water-Soluble Chloride Ion Content in Soil" Method B
AASHTO T-290-20	"Standard Method of Test for Determining Water-Soluble Sulfate Ion Content in Soil"

Results:

AASHTO T 291 – Chloride Method B

Sample		Results		Detection Limit
		ppm (mg/kg)	%[1]	
Composite Sample		170.	0.0170	10.
S1-S4	J-1 / 0-9			

NOTE: [1]Percent by weight after drying and prepared as per the Standard.

AASHTO T-290 - Sulfate (soluble)

Sample		Results		Detection Limit
		ppm (mg/kg)	%[1]	
Composite Sample		114.	0.0114	10.
S1-S4	J-1 / 0-9			

NOTE: [1]Percent by weight after drying and prepared as per the Standard.

END OF ANALYSIS

USEPA Laboratory ID UT00930

Merrill Gee P.E. – Engineer in Charge

Client:	Freeman Companies, LLC			
Project:	Greater New Haven WPCA Blower Bldg			
Location:	New Haven, CT		Project No:	GTX-313887
Boring ID: J-1A (OW)	Sample Type:	cylinder	Tested By:	ckg
Sample ID: C1	Test Date:	07/08/21	Checked By:	smd
Depth : 65-70	Test Id:	623214		
Test Comment:	---			
Visual Description:	See photograph(s)			
Sample Comment:	---			

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
J-1A (OW)	C1	65-70 ft	151	2495	1	No	2,*

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

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

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

1: Best effort end preparation. See Tolerance report for details.
2: The as-received core did not meet the ASTM side straightness tolerance due to irregularities in the sample as cored.
3: Specimen L/D < 2.
4: The as-received core did not meet the ASTM minimum diameter tolerance of 1.875 inches.
5: Specimen diameter is less than 10 times maximum particle size.
6: Specimen diameter is less than 6 times maximum particle size.

*Because the indicated tested specimens did not meet the ASTM D4543 standard tolerances, the results reported here may differ from those for a test specimen within tolerances.

printed 7/12/2021 9:49:04 AM

Client:	Freeman Companies, LLC	Test Date:	7/2/2021
Project Name:	Greater New Haven WPCA Blower Bldg	Tested By:	cmh
Project Location:	New Haven, CT	Checked By:	smd
GTX #:	313887		
Boring ID:	J-1A (OW)		
Sample ID:	C1		
Depth:	65-70 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.59	4.59	4.59
Specimen Diameter, in:	1.88	1.89	1.89
Specimen Mass, g:	508.84		
Bulk Density, lb/ft^3	151		
Length to Diameter Ratio:	2.4		

Minimum Diameter Tolerence Met? YES

Length to Diameter Ratio Tolerance Met? YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

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

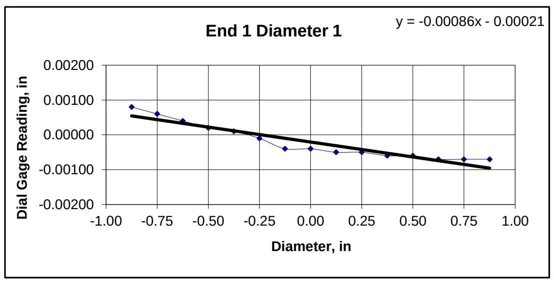
Difference between max and min readings, in:
0° = 0.00150 90° = 0.00040

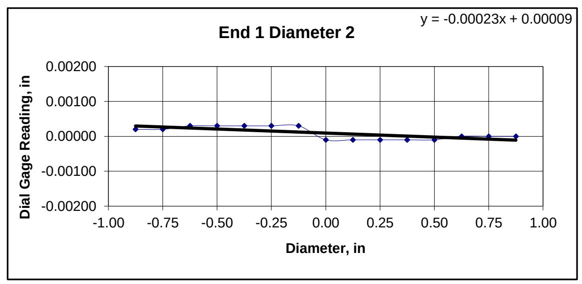
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	-0.00020	-0.00030	-0.00030	-0.00060
Diameter 2, in (rotated 90°)	-0.00050	-0.00050	-0.00040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

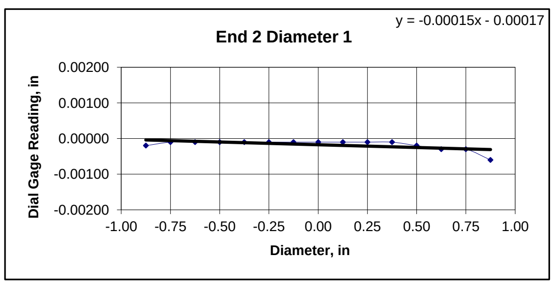
Difference between max and min readings, in:
0° = 0.0005 90° = 0.0004

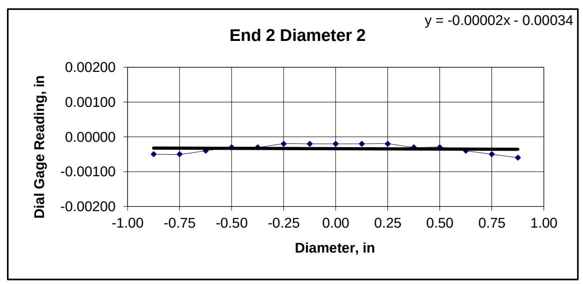
Maximum difference must be < 0.0020 in. Difference = ± 0.00075

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00086
Angle of Best Fit Line:	0.04911
End 2:	
Slope of Best Fit Line	0.00015
Angle of Best Fit Line:	0.00884
Maximum Angular Difference:	0.04027

Parallelism Tolerance Met? NO
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00023
Angle of Best Fit Line:	0.01326
End 2:	
Slope of Best Fit Line	0.00002
Angle of Best Fit Line:	0.00115
Maximum Angular Difference:	0.01211

Parallelism Tolerance Met? NO
Spherically Seated

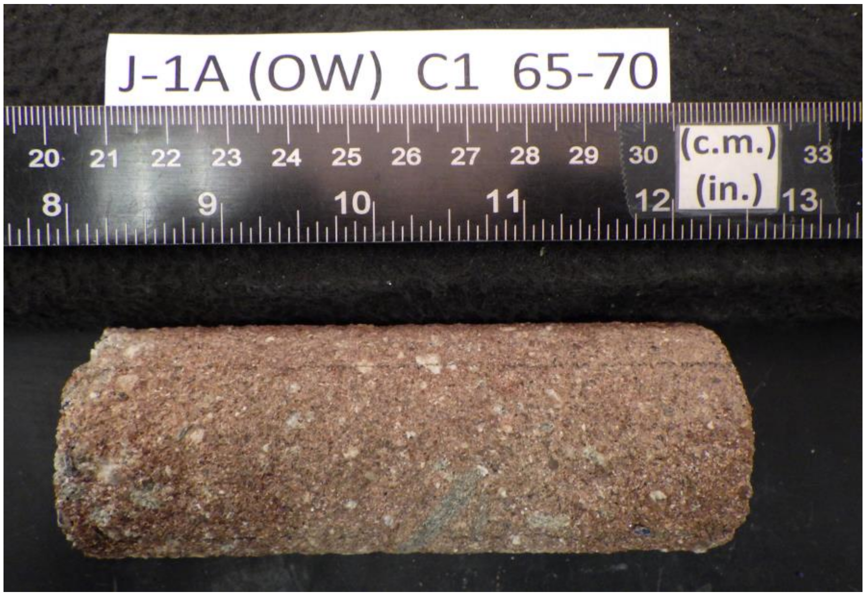
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00150	1.885	0.00080	0.046	YES
Diameter 2, in (rotated 90°)	0.00040	1.885	0.00021	0.012	YES
END 2					
Diameter 1, in	0.00050	1.885	0.00027	0.015	YES
Diameter 2, in (rotated 90°)	0.00040	1.885	0.00021	0.012	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Freeman Companies, LLC
Project Name:	Greater New Haven WPCA Blower Bldg
Project Location:	New Haven, CT
GTX #:	313887
Test Date:	7/2/2021
Tested By:	cmh
Checked By:	smd
Boring ID:	J-1A (OW)
Sample ID:	C1
Depth, ft:	65-70



After cutting and grinding

After break

Attachment B

GZA
Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

35 Nutmeg Drive
Suite 325
Trumbull, CT 06611
T: 203.380.8188
F: 203.375.1529
www.gza.com

July 19, 2018
Project No. 02.0173791.00

Mr. Tom Garside
New England Boring Contractors
40 Fordway Street
Derry, New Hampshire 03038

Re: SPT Energy Testing – Mobile B-53 Drill Rig No. D-26
Newburgh, Maine

Dear Mr. Garside,

This report summarizes the results of the dynamic energy measurements performed on the All-Terrain Vehicle Mounted Mobile B-53 Drill Rig No. D-26, equipped with a Northeast Geotechnical customized automatic hammer at the above referenced address on July 3, 2018. The tests were conducted by Rayan Shamas of GZA using a Pile Driving Analyzer®, Model PAX manufactured by Pile Dynamics, Inc. The measurements were performed in accordance with ASTM D4633-16 using the force velocity method (EFV).

Energy Measurement Program

The purpose of the energy measurement program was to ascertain the energy imparted during Standard Penetration Tests on one drill rig. The Standard Penetration test is conducted by driving a 1-3/8 inch I.D. split-spoon sampler (normally) 24 inches into the ground with a 140 lb. hammer falling 30 inches. The nominal driving energy of such a system is 4200 in.-lbs., or 350 ft.-lbs. However, actual energy output varies due to inefficiencies arising from the method of lifting and dropping the weight, as well as energy losses along the drill rods connecting the hammer to the sampler. Typical SPT results assume that the hammer is operating at 60 percent efficiency, that is, that the energy per blow imparted by the hammer is 0.60 x 350 ft. lbs., or 210 ft.-lbs. This is based on the average results found when conducting SPT tests with safety hammers, where a rope-and-cathead are used to lift the hammer, which falls when the driller allows the rope to go slack.

On July 3, 2018, the drilling contractor, New England Boring Contractors used a 140 lb. automatic hammer to perform the standard penetration testing. The automatic hammer is operated using a hydraulically powered chain drive which lifts the 140-lb. weight and releases it at the 30 inch drop height inside a closed steel cylinder. SPT data obtained when using any type of hammer should therefore be corrected based on the actual energy per blow, which allows traditional correlations between N-values and soil properties to be valid.

Drilling Equipment Details

The test boring was made by New England Boring Contractors using an All-Terrain Vehicle Mounted Mobile B-53 Drill Rig. A hollow-stem auger was used to provide an open hole from which Standard Penetration Tests could be performed for the samples. The Standard Penetration Tests were performed with a Northeast Geotechnical 140-pound customized automatic hammer. The hammer was physically linked to the top of the NWJ drill rods. Photographs of the drill rig can be found in Appendix C.

Dynamic Energy Testing Equipment Details

The energy measurements were made using an instrumented 24-inch-long section of NWJ drill rod. Two piezoresistive accelerometers and two foil strain gages were mounted on the outside of the drill rod. Data was collected and stored using Pile Driving Analyzer®, model PAX. All the testing equipment was manufactured by Pile Dynamics, Inc., Cleveland, Ohio. Equipment calibration certificates can be found in Appendix D.

Energy Measurement Test Results

Sample S2 (13-15 ft.), the automatic hammer had an average energy transfer ratio of 87.8% based on readings made immediately below the hammer. Energy transfer ratios ranged from 85.7% to 90.9%, with a standard deviation of 1.5%. The average hammer blow rate was 42 blows per minute. The energy transfer ratio for the SPT sample was averaged and reported for 22 impacts during the middle foot of the test which relates to the observed N-value.

Sample S3 (15-17 ft.), the automatic hammer had an average energy transfer ratio of 88.1% based on readings made immediately below the hammer. Energy transfer ratios ranged from 84.9% to 91.1%, with a standard deviation of 1.5%. The average hammer blow rate was 42 blows per minute. The energy transfer ratio for the SPT sample was averaged and reported for 22 impacts during the middle foot of the test which relates to the observed N-value.

Sample S4 (17-19 ft.), the automatic hammer had an average energy transfer ratio of 90.7% based on readings made immediately below the hammer. Energy transfer ratios ranged from 86.0% to 102.9%, with a standard deviation of 3.2%. The average hammer blow rate was 51 blows per minute. The energy transfer ratio for the SPT sample was averaged and reported for 27 impacts during the middle foot of the test which relates to the observed N-value.

Sample S5 (19-21 ft.), the automatic hammer had an average energy transfer ratio of 95.0% based on readings made immediately below the hammer. Energy transfer ratios ranged from 92.0% to 96.9%, with a standard deviation of 1.2%. The average hammer blow rate was 57 blows per minute. The energy transfer ratio for the SPT sample was averaged and reported for 18 impacts during the middle foot of the test which relates to the observed N-value.

Sample S6 (21-23 ft.), the automatic hammer had an average energy transfer ratio of 97.8% based on readings made immediately below the hammer. Energy transfer ratios ranged from 95.7% to 99.4%, with a standard deviation of 1.0%. The average hammer blow rate was 57 blows per minute. The energy transfer ratio for the SPT sample was averaged and reported for 18 impacts during the middle foot of the test which relates to the observed N-value.

The results are summarized in Table 1 and the full test results are provided in Appendix A. Test boring B-3 was logged by a representative from GZA. The log can be found in Appendix B.

Summary

For the Mobile B-53 Drill Rig No. D-26 the average energy transfer to the top of the NWJ drill string for the five SPT's ranged from 87.8% to 97.8%, using a 140-pound Northeast Geotechnical customized automatic hammer operated at 42 to 57 blows per minute.

Please contact the undersigned if you have any questions regarding the test findings.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Richard Higginbotham
Engineer II

Jon J. Jagello
Senior Project Manager

Bradford W. Roberts, P.E.
Senior Principal

Attachments: Table 1
Appendix A - Test Results
Appendix B - Field Boring Log B-3

Appendix A – Test Results

Table 1 - Summary of Energy Measurements - Newburgh, ME

Drill Rig	Test Date	Type of Test Hammer Type	Sample No.	Sample Depth (feet) top bottom	SPT Blows per 6"				N-Value (middle ft.)	Distance to bottom of sampler from center of instrumented rod (feet)	Rated Energy (ft.-kips)	Average Transferred Energy (ft.-kips.)	Average Transfer Efficiency (%)	Average Hammer Blow Rate (blows/min.)
Truck Mounted Mobile B-53 Rig No. D-26	7/3/2018	Northeast Geotech. 140 lb. Automatic	S2	13 15	6	12	10	8	22	18.0	0.350	0.307	87.8	41.8
		Northeast Geotech. 140 lb. Automatic	S3	15 17	8	10	12	11	22	19.0	0.350	0.308	88.1	41.8
		Northeast Geotech. 140 lb. Automatic	S4	17 19	16	14	13	19	27	23.0	0.350	0.317	90.7	50.7
		Northeast Geotech. 140 lb. Automatic	S5	19 21	10	9	9	10	18	24.0	0.350	0.332	95.0	56.5
		Northeast Geotech. 140 lb. Automatic	S6	21 23	10	9	9	11	18	26.0	0.350	0.342	97.8	56.5

Notes: (1) Driller Name: Brad Enos - New England Boring Contractors
(2) Averaged only for impacts during the middle one ft. of the test which relates to the observed N-Value.

Project Name: ***SPT Energy Testing***
Location: Newburgh, Maine
Date: 7/3/2018
Drill Rig: Mobile B-53, Rig No. D-26
Hammer Type: Northeast Geotech. Custom Automatic
Hammer Rated Energy: 350 ft.-lbs
Drilling Contractor: New England Boring Contractors
Driller Name: Brad Enos
Sample No./Sample Depth: S2 , 13'-15', N=6-12-10-8
Test Type: Top Instrumented Rod
Length From Gages To Tip of Spoon: 18 feet
Rod Type: NWJ
Casing/Auger: Auger

Blows Per 6 Inches	Blow Number	Transferred Energy (ft.-kips)	Transferred Energy Efficiency (percent)	Hammer Blow Count Rate (BPM)
6	1	0.304	86.9	5.9
	2	0.305	87.1	41.9
	3	0.305	87.1	41.9
	4	0.304	86.9	41.6
	5	0.300	85.7	41.9
	6	0.307	87.7	41.6
12	7	0.302	86.3	41.9
	8	0.307	87.7	41.6
	9	0.309	88.3	41.8
	10	0.312	89.1	41.8
	11	0.308	88.0	41.6
	12	0.303	86.6	42.1
	13	0.318	90.9	41.5
	14	0.316	90.3	41.9
	15	0.315	90.0	41.6
	16	0.309	88.3	41.9
	17	0.314	89.7	41.7
	18	0.307	87.7	42.1
10	19	0.308	88.0	41.7
	20	0.309	88.3	41.7
	21	0.301	86.0	42
	22	0.303	86.6	41.6
	23	0.300	85.7	42
	24	0.303	86.6	41.6
	25	0.303	86.6	42
	26	0.307	87.7	41.5
	27	0.302	86.3	42
	28	0.301	86.0	41.8
8	29	0.299	85.4	41.7
	30	0.305	87.1	41.8
	31	0.306	87.4	41.8
	32	0.302	86.3	42
	33	0.303	86.6	41.6
	34	0.301	86.0	41.9
	35	0.304	86.9	41.7
	36	0.307	87.7	41.7
	average (middle foot)	**0.307**	**87.8**	**41.8**
	standard dev. (middle foot)	**0.005**	**1.513**	
	C.O.V. (middle foot)	**0.017**	**0.017**	
	maximum (middle foot)	**0.318**	**90.9**	
	minimum (middle foot)	**0.300**	**85.7**	

N E BORING SPT CAL (NEWBURGH, ME) - S-2 (13-15)
OP: RS

MOBILE B-53 (D-26)
Date: 03-July-2018

AR: 1.43 in²
LE: 18.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.35

BPM: Blows/Minute
EMX: Maximum Energy
ETR: Energy Transfer Ratio - Rated
FMX: Maximum Force
DMX: Maximum Displacement
VMX: Maximum Velocity
AMX: Maximum Acceleration
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	
1	5.9	0.304	86.8	37	2.20	17.7	1,932	2.13	1.037
2	41.9	0.305	87.2	37	1.39	16.6	2,215	1.39	1.004
3	41.9	0.305	87.1	37	1.14	16.2	2,212	1.14	1.007
4	41.6	0.304	86.8	38	1.14	15.8	2,056	1.14	1.034
5	41.9	0.300	85.7	38	1.36	16.6	2,069	1.36	1.002
6	41.6	0.307	87.6	39	1.27	16.5	2,116	1.27	1.023
7	41.9	0.302	86.2	38	1.32	16.3	2,058	1.32	1.040
8	41.6	0.307	87.7	39	1.24	16.5	2,138	1.24	1.024
9	41.8	0.309	88.3	39	0.99	15.6	2,044	0.99	1.019
10	41.8	0.312	89.0	38	0.90	14.4	2,033	0.90	1.043
11	41.6	0.308	88.1	40	0.67	14.6	2,115	0.67	1.063
12	42.1	0.303	86.5	39	0.67	14.5	2,129	0.66	1.045
13	41.5	0.318	90.7	39	0.69	14.6	2,087	0.68	1.049
14	41.9	0.316	90.2	39	0.67	14.7	2,135	0.66	1.040
15	41.6	0.315	90.0	39	0.71	14.9	2,288	0.71	1.041
16	41.9	0.309	88.1	40	0.62	14.6	2,223	0.62	1.060
17	41.7	0.314	89.7	40	0.72	14.6	2,261	0.72	1.068
18	42.1	0.307	87.6	40	0.73	15.1	2,348	0.72	1.055
19	41.7	0.308	88.0	40	0.79	15.6	2,274	0.79	1.061
20	41.7	0.309	88.3	39	0.81	14.9	2,054	0.81	1.072
21	42.0	0.301	86.0	39	0.83	14.8	2,077	0.82	1.057
22	41.6	0.303	86.5	39	0.82	15.1	2,107	0.81	1.057
23	42.0	0.300	85.8	39	0.81	15.4	2,183	0.81	1.058
24	41.6	0.303	86.7	40	0.86	15.5	2,103	0.86	1.066
25	42.0	0.303	86.5	39	0.97	15.5	2,051	0.97	1.049
26	41.5	0.307	87.6	40	1.09	15.7	2,098	1.09	1.054
27	42.0	0.302	86.4	39	1.06	15.3	2,029	1.06	1.059
28	41.8	0.301	85.9	40	0.95	15.5	2,065	0.95	1.055
29	41.7	0.299	85.5	39	1.01	15.4	2,109	1.01	1.045
30	41.8	0.305	87.2	39	0.94	15.8	2,091	0.94	1.057
31	41.8	0.306	87.4	40	0.92	15.8	2,140	0.92	1.060
32	42.0	0.302	86.3	39	0.84	15.3	2,134	0.83	1.055
33	41.6	0.303	86.6	38	1.01	15.6	2,136	1.00	1.018
34	41.9	0.301	85.9	38	0.99	15.7	2,139	0.99	1.024
35	41.7	0.304	86.8	38	1.04	15.7	2,159	1.04	1.017
36	41.7	0.307	87.7	39	1.06	15.5	2,199	1.06	1.035
Average	40.8	0.306	87.4	39	0.98	15.5	2,128	0.97	1.043

Total number of blows analyzed: 36

BL# Sensors

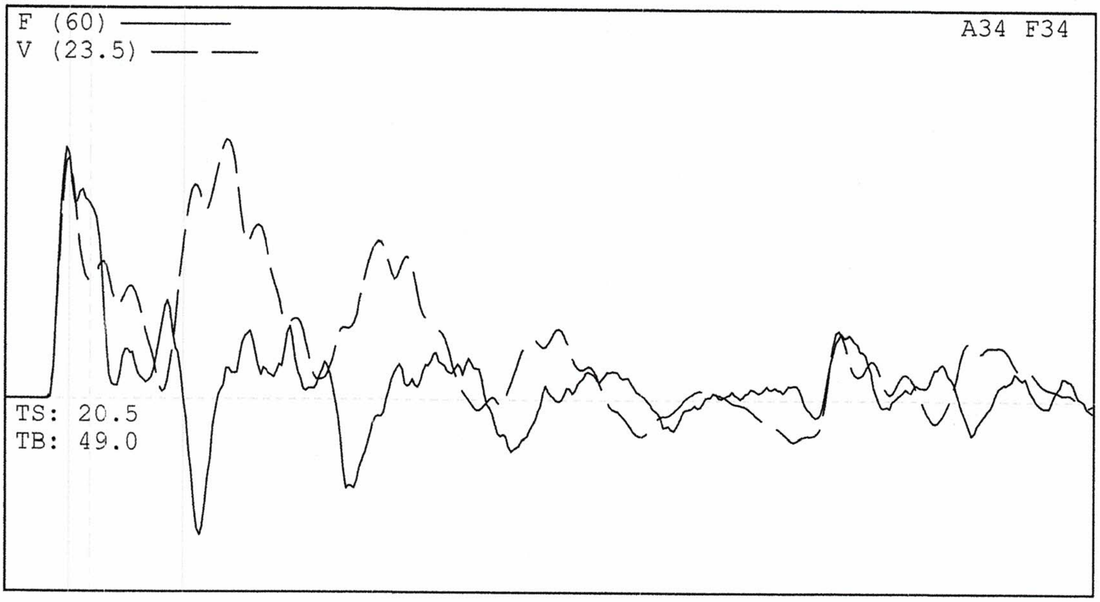
1-36 F3: [117-NWJ-1] 223.5 (1.00); F4: [117-NWJ-2] 223.7 (1.00); A3: [K4800] 340.0 (1.00);
A4: [K4161] 378.0 (1.00)

Time Summary

Drive 50 seconds 10:18 AM - 10:19 AM BN 1 - 36

GZA GeoEnvironmental Inc. Pile Driving Analyzer ®

N E BORING SPT CAL (NEWBURGH, ME) S-2 (13-15)



Project Information

PROJECT: N E BORING SPT CAL (NEWBURGH, ME)
PILE NAME: S-2 (13-15)
DESCR: MOBILE B-53 (D-26)
OPERATOR: RS
FILE: B-3 (13-15).W01
7/3/2018 10:19:00 AM
Blow Number 9

Pile Properties

LE	18.00 ft
AR	1.43 in^2
EM	30000 ksi
SP	0.492 k/ft3
WS	16807.9 f/s
EA/C	2.6 ksec/ft
2L/C	2.15 ms
JC	0.35 []
LP	13.00 ft

Quantity Results

CSI	27.7 ksi
CSX	27.0 ksi
CSB	8.8 ksi
RX7	8 kips
RX8	8 kips
RX9	8 kips
EMX	0.309 k-ft
BPM	41.8 bpm
ETR	88.3 (%)

Sensors

F3: [117-NWJ-1] 223.45 (1)
F4: [117-NWJ-2] 223.7 (1)
A3: [K4800] 340 mv/5000g's (1)
A4: [K4161] 378 mv/5000g's (1)
CLIP: OK

Version 2016.125

Project Name: *SPT Energy Testing*
Location: Newburgh, Maine
Date: 7/3/2018
Drill Rig: Mobile B-53, Rig No. D-26
Hammer Type: Northeast Geotech. Custom Automatic
Hammer Rated Energy: 350 ft.-lbs
Drilling Contractor: New England Boring Contractors
Driller Name: Brad Enos
Sample No./Sample Depth: S3 , 15'-17', N=8-10-12-11
Test Type: Top Instrumented Rod
Length From Gages To Tip of Spoon: 19 feet
Rod Type: NWJ
Casing/Auger: Auger

Blows Per 6 Inches	Blow Number	Transferred Energy (ft.-kips)	Transferred Energy Efficiency (percent)	Hammer Blow Count Rate (BPM)
8	1	0.310	88.6	1.9
	2	0.311	88.9	41.7
	3	0.311	88.9	41.7
	4	0.313	89.4	41.4
	5	0.308	88.0	41.8
	6	0.309	88.3	41.6
	7	0.307	87.7	41.7
	8	0.308	88.0	41.4
10	9	0.306	87.4	41.8
	10	0.306	87.4	41.7
	11	0.309	88.3	41.5
	12	0.319	91.1	41.7
	13	0.318	90.9	41.6
	14	0.307	87.7	41.7
	15	0.312	89.1	41.4
	16	0.302	86.3	42
	17	0.311	88.9	41.3
	18	0.304	86.9	42
12	19	0.307	87.7	41.6
	20	0.309	88.3	41.5
	21	0.304	86.9	41.8
	22	0.307	87.7	41.6
	23	0.305	87.1	41.7
	24	0.311	88.9	41.5
	25	0.317	90.6	41.5
	26	0.297	84.9	44
	27	0.309	88.3	41.8
	28	0.307	87.7	42.6
	29	0.309	88.3	41.8
	30	0.307	87.7	42.2
11	31	0.308	88.0	42.2
	32	0.301	86.0	42.4
	33	0.314	89.7	42
	34	0.311	88.9	42.2
	35	0.318	90.9	42.1
	36	0.314	89.7	42.1
	37	0.310	88.6	42.2
	38	0.313	89.4	42
	39	0.311	88.9	42.2
	40	0.315	90.0	41.9
	41	0.312	89.1	42.3
	average (middle foot)	**0.308**	**88.1**	**41.8**
	standard dev. (middle foot)	**0.005**	**1.461**	
	C.O.V. (middle foot)	**0.017**	**0.017**	
	maximum (middle foot)	**0.319**	**91.1**	
	minimum (middle foot)	**0.297**	**84.9**	

N E BORING SPT CAL (NEWBURGH, ME) - S-3 (15-17) MOBILE B-53 (D-26)
OP: RS Date: 03-July-2018

AR: 1.43 in^2 SP: 0.492 k/ft^3
LE: 19.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.35

BPM: Blows/Minute
EMX: Maximum Energy
ETR: Energy Transfer Ratio - Rated
FMX: Maximum Force
DMX: Maximum Displacement
VMX: Maximum Velocity
AMX: Maximum Acceleration
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	
1	1.9	0.310	88.5	39	1.72	16.8	2,104	1.71	1.018
2	41.7	0.311	89.0	39	1.18	16.1	2,133	1.18	1.000
3	41.7	0.311	89.0	38	1.26	16.6	2,132	1.26	0.970
4	41.4	0.313	89.4	39	1.21	16.6	2,169	1.21	1.011
5	41.8	0.308	88.0	39	1.23	16.4	2,096	1.21	0.997
6	41.6	0.309	88.4	39	1.10	16.1	2,109	1.10	0.997
7	41.7	0.307	87.7	38	1.15	15.7	2,136	1.15	0.974
8	41.4	0.308	88.0	39	0.98	15.5	2,091	0.98	0.991
9	41.8	0.306	87.5	37	1.17	14.5	2,052	1.17	0.973
10	41.7	0.306	87.3	38	1.03	14.7	2,208	1.03	0.974
11	41.5	0.309	88.2	37	0.71	14.7	2,143	0.71	0.972
12	41.7	0.319	91.1	38	0.78	14.8	2,107	0.78	0.980
13	41.6	0.318	90.9	37	0.81	14.7	2,092	0.81	0.972
14	41.7	0.307	87.7	36	0.64	15.2	1,955	0.64	0.956
15	41.4	0.312	89.1	37	0.84	16.0	2,083	0.84	0.937
16	42.0	0.302	86.4	37	0.98	16.2	2,074	0.98	0.963
17	41.3	0.311	88.9	39	1.07	16.7	2,112	1.07	0.961
18	42.0	0.304	86.8	37	0.89	15.6	2,030	0.89	1.000
19	41.6	0.307	87.7	38	0.92	16.0	2,093	0.92	1.025
20	41.5	0.309	88.3	38	0.95	15.3	2,111	0.95	0.963
21	41.8	0.304	86.9	38	0.96	15.9	2,147	0.96	0.983
22	41.6	0.307	87.8	38	0.91	15.8	2,220	0.91	0.981
23	41.7	0.305	87.0	37	0.89	15.6	2,123	0.89	0.987
24	41.5	0.311	88.8	38	0.95	15.3	2,247	0.95	0.987
25	41.5	0.317	90.4	38	0.88	15.1	2,242	0.88	0.987
26	44.0	0.297	85.0	36	0.89	14.5	2,137	0.89	0.968
27	41.8	0.309	88.3	36	0.78	14.4	2,048	0.78	0.986
28	42.6	0.307	87.6	36	0.81	14.4	2,089	0.81	0.919
29	41.8	0.309	88.2	35	0.66	14.6	1,970	0.66	0.970
30	42.2	0.307	87.7	36	0.75	14.5	2,126	0.75	0.961
31	42.2	0.308	88.1	35	0.85	15.1	2,047	0.85	0.938
32	42.4	0.301	85.9	35	0.86	15.2	2,150	0.86	0.952
33	42.0	0.314	89.8	37	0.85	15.3	2,200	0.85	0.940
34	42.2	0.311	89.0	36	0.88	14.9	2,136	0.88	0.980
35	42.1	0.318	90.7	37	0.95	15.2	2,192	0.95	0.976
36	42.1	0.314	89.6	36	0.96	15.5	2,112	0.96	0.956
37	42.2	0.310	88.7	36	0.94	15.3	2,132	0.94	0.955
38	42.0	0.313	89.4	35	1.02	15.4	2,002	1.02	0.988
39	42.2	0.311	88.9	36	1.02	15.3	2,092	1.02	0.958
40	41.9	0.315	90.0	37	0.87	15.1	2,151	0.87	0.950
41	42.3	0.312	89.2	36	0.85	14.8	2,139	0.85	0.949
42	42.1	0.318	90.9	36	0.94	14.6	2,206	0.94	0.953
43	42.3	0.312	89.3	35	0.81	14.3	2,122	0.81	0.958
Average	41.0	0.310	88.5	37	0.95	15.4	2,118	0.95	0.972

Total number of blows analyzed: 43

N E BORING SPT CAL (NEWBURGH, ME) - S-3 (15-17)
OP: RS

MOBILE B-53 (D-26)
Date: 03-July-2018

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	

BL# Sensors

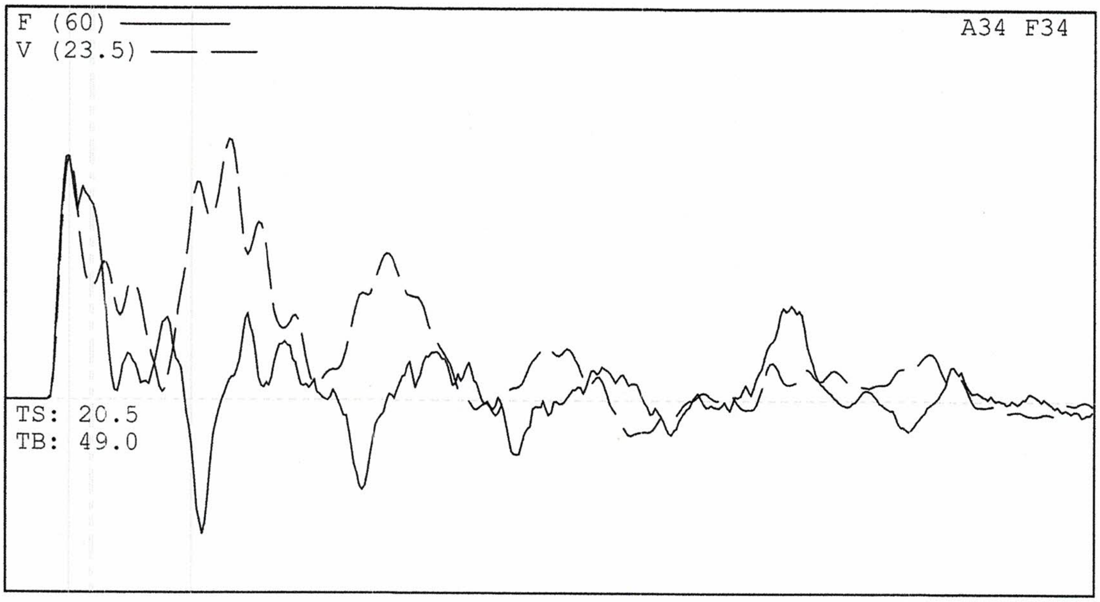
1-43 F3: [117-NWJ-1] 223.5 (1.00); F4: [117-NWJ-2] 223.7 (1.00); A3: [K4800] 340.0 (1.00); A4: [K4161] 378.0 (1.00)

Time Summary

Drive 1 minute 0 second 10:26 AM - 10:27 AM BN 1 - 43

GZA GeoEnvironmental Inc. — Pile Driving Analyzer ®

N E BORING SPT CAL (NEWBURGH, ME) — C-3 (15-17)



Project Information
PROJECT: N E BORING SPT CAL (NEWBURGH, ME)
PILE NAME: C-3 (15-17)
DESCR: MOBILE B-53 (D-26)
OPERATOR: RS
FILE: B-3 (15-17).W01
7/3/2018 10:27:14 AM
Blow Number 18

Pile Properties

LE	19.00	ft
AR	1.43	in^2
EM	30000	ksi
SP	0.492	k/ft3
WS	16807.9	f/s
EA/C	2.6	ksec/ft
2L/C	2.29	ms
JC	0.35	[]
LP	15.00	ft

Quantity Results

CSI	26.6	ksi
CSX	26.0	ksi
CSB	8.7	ksi
RX7	6	kips
RX8	6	kips
RX9	6	kips
EMX	0.304	k-ft
BPM	42.0	bpm
ETR	86.8	(%)

Sensors
F3: [117-NWJ-1] 223.45 (1)
F4: [117-NWJ-2] 223.7 (1)
A3: [K4800] 340 mv/5000g's (1)
A4: [K4161] 378 mv/5000g's (1)
CLIP: OK

Version 2016.125

Project Name: *SPT Energy Testing*
Location: Newburgh, Maine
Date: 7/3/2018
Drill Rig: Mobile B-53, Rig No. D-26
Hammer Type: Northeast Geotech. Custom Automatic
Hammer Rated Energy: 350 ft.-lbs
Drilling Contractor: New England Boring Contractors
Driller Name: Brad Enos
Sample No./Sample Depth: S4 , 17'-19', N=16-14-13-19
Test Type: Top Instrumented Rod
Length From Gages To Tip of Spoon: 23 feet
Rod Type: NWJ
Casing/Auger: Auger

Blows Per 6 Inches	Blow Number	Transferred Energy (ft.-kips)	Transferred Energy Efficiency (percent)	Hammer Blow Count Rate (BPM)
16	1	0.320	91.4	52.9
	2	0.317	90.6	8.8
	3	0.315	90.0	42.0
	4	0.319	91.1	41.9
	5	0.322	92.0	42.6
	6	0.310	88.6	44.0
	7	0.307	87.7	43.3
	8	0.302	86.3	42.9
	9	0.312	89.1	42.5
	10	0.311	88.9	42.8
	11	0.309	88.3	42.7
	12	0.286	81.7	46.7
	13	0.294	84.0	43.1
	14	0.291	83.1	44.8
	15	0.302	86.3	43.3
	16	0.296	84.6	43.9
14	17	0.301	86.0	8.1
	18	0.339	96.9	8.0
	19	0.360	102.9	34.4
	20	0.308	88.0	59.5
	21	0.315	90.0	54.0
	22	0.315	90.0	54.7
	23	0.315	90.0	54.3
	24	0.317	90.6	54.4
	25	0.312	89.1	54.7
	26	0.317	90.6	54.3
	27	0.316	90.3	54.5
	28	0.315	90.0	54.2
	29	0.314	89.7	54.7
	30	0.309	88.3	54.4
13	31	0.308	88.0	54.8
	32	0.310	88.6	54.1
	33	0.309	88.3	54.6
	34	0.310	88.6	54.4
	35	0.315	90.0	54.4
	36	0.314	89.7	54.9
	37	0.320	91.4	53.7
	38	0.327	93.4	54.6
	39	0.326	93.1	54.5
	40	0.321	91.7	57.2
	41	0.317	90.6	55.8
	42	0.320	91.4	55.5
	43	0.321	91.7	55.9
	44	0.317	90.6	56.0
	45	0.317	90.6	55.9
	46	0.325	92.9	55.3
	47	0.314	89.7	56.6
	48	0.322	92.0	55.2
	49	0.318	90.9	56.4
	50	0.322	92.0	55.5

Blows Per 6 Inches	Blow Number	Transferred Energy (ft.-kips)	Transferred Energy Efficiency (percent)	Hammer Blow Count Rate (BPM)
19	51	0.312	89.1	56.7
	52	0.316	90.3	55.6
	53	0.313	89.4	30.6
	54	---	---	---
	55	---	---	---
	56	---	---	---
	57	---	---	---
	58	---	---	---
	59	---	---	---
	60	---	---	---
	61	---	---	---
	62	---	---	---
	average (middle foot)	**0.317**	**90.7**	**50.7**
	standard dev. (middle foot)	**0.011**	**3.203**	
	C.O.V. (middle foot)	**0.035**	**0.035**	
	maximum (middle foot)	**0.360**	**102.9**	
	minimum (middle foot)	**0.301**	**86.0**	

N E BORING SPT CAL (NEWBURGH, ME) - S-4 (17-19)
OP: RS

MOBILE B-53 (D-26)
Date: 03-July-2018

AR: 1.43 in²
LE: 23.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.35

BPM: Blows/Minute
EMX: Maximum Energy
ETR: Energy Transfer Ratio - Rated
FMX: Maximum Force
DMX: Maximum Displacement

VMX: Maximum Velocity
AMX: Maximum Acceleration
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	
1	52.9	0.320	91.4	38	2.71	18.8	1,824	2.71	1.046
2	8.8	0.317	90.4	38	1.44	17.0	2,034	1.43	1.040
3	42.0	0.315	90.0	38	1.14	16.6	1,968	1.14	1.055
4	41.9	0.319	91.1	39	0.82	14.6	2,148	0.82	1.026
5	42.6	0.322	91.9	39	0.97	14.8	2,137	0.97	1.014
6	44.0	0.310	88.6	38	0.99	14.7	1,989	0.99	1.018
7	43.3	0.307	87.7	38	1.08	15.1	1,919	1.08	1.043
8	42.9	0.302	86.4	37	0.94	15.2	1,887	0.94	1.031
9	42.5	0.312	89.0	39	1.01	15.8	2,031	1.01	1.049
10	42.8	0.311	89.0	38	0.96	15.3	2,066	0.96	1.028
11	42.7	0.309	88.4	38	0.81	14.5	2,113	0.81	1.004
12	46.7	0.286	81.6	36	0.85	13.7	1,902	0.85	1.034
13	43.1	0.294	84.0	36	0.68	13.8	2,000	0.68	1.018
14	44.8	0.291	83.1	37	0.81	14.0	1,953	0.81	1.037
15	43.3	0.302	86.2	37	0.92	14.0	1,882	0.92	1.043
16	43.9	0.296	84.4	37	0.92	14.0	1,941	0.92	1.042
17	8.1	0.301	86.1	38	0.90	14.3	1,980	0.90	1.047
18	8.0	0.339	96.9	40	1.14	15.4	2,138	1.14	1.035
19	34.4	0.360	102.8	41	0.97	15.1	2,124	0.97	1.061
20	59.5	0.308	88.1	38	0.76	14.3	2,054	0.74	0.991
21	54.0	0.315	90.1	39	0.91	14.7	2,133	0.91	1.004
22	54.7	0.315	89.9	39	1.14	16.0	2,070	1.12	1.039
23	54.3	0.315	90.0	39	0.98	15.9	2,172	0.95	1.001
24	54.4	0.317	90.5	39	0.98	15.3	2,220	0.96	1.008
25	54.7	0.312	89.1	38	0.96	15.1	2,088	0.94	1.016
26	54.3	0.317	90.5	39	1.04	15.5	2,226	1.03	1.030
27	54.5	0.316	90.3	39	1.04	15.4	2,089	1.02	1.002
28	54.2	0.315	89.9	39	0.93	15.1	2,022	0.92	1.003
29	54.7	0.314	89.7	39	1.00	15.2	1,992	0.97	1.041
30	54.4	0.309	88.4	38	1.02	14.8	1,991	1.00	1.021
31	54.8	0.308	87.9	38	0.92	14.8	1,940	0.90	1.017
32	54.1	0.310	88.6	38	1.01	14.7	1,975	1.01	1.008
33	54.6	0.309	88.4	38	1.02	15.2	1,989	1.00	1.039
34	54.4	0.310	88.7	39	1.05	15.4	2,006	1.04	1.035
35	54.4	0.315	90.0	39	0.96	15.3	2,044	0.94	1.031
36	54.9	0.314	89.6	38	0.73	14.6	2,067	0.73	1.021
37	53.7	0.320	91.4	39	0.75	14.6	2,025	0.75	1.033
38	54.6	0.327	93.3	38	0.91	14.6	2,038	0.91	0.986
39	54.5	0.326	93.2	39	1.01	14.8	2,158	1.01	0.998
40	57.2	0.321	91.6	39	1.23	15.5	2,244	1.22	0.982
41	55.8	0.317	90.6	39	1.07	15.0	2,204	1.07	1.003
42	55.5	0.320	91.3	39	1.03	15.0	2,269	1.02	0.985
43	55.9	0.321	91.8	39	1.17	15.5	2,137	1.16	1.014
44	56.0	0.317	90.7	39	1.05	15.7	2,263	1.04	0.989
45	55.9	0.317	90.5	39	0.99	15.1	2,161	0.98	1.016

N E BORING SPT CAL (NEWBURGH, ME) - S-4 (17-19)
OP: RS

MOBILE B-53 (D-26)
Date: 03-July-2018

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	
46	55.3	0.325	92.7	40	1.08	15.6	2,190	1.08	1.024
47	56.6	0.314	89.8	39	1.01	15.0	2,305	1.01	0.971
48	55.2	0.322	92.1	39	1.09	15.1	2,200	1.09	0.974
49	56.4	0.318	90.8	39	1.06	15.0	2,099	1.05	1.020
50	55.5	0.322	92.1	39	1.12	15.4	2,237	1.12	0.982
51	56.7	0.312	89.2	38	1.05	15.4	2,122	1.05	0.997
52	55.6	0.316	90.2	39	1.19	14.7	2,062	1.19	0.977
53	30.6	0.313	89.4	38	1.20	14.7	2,077	1.20	0.993
Average	48.5	0.314	89.8	38	1.03	15.1	2,074	1.02	1.017

Total number of blows analyzed: 53

BL# Sensors

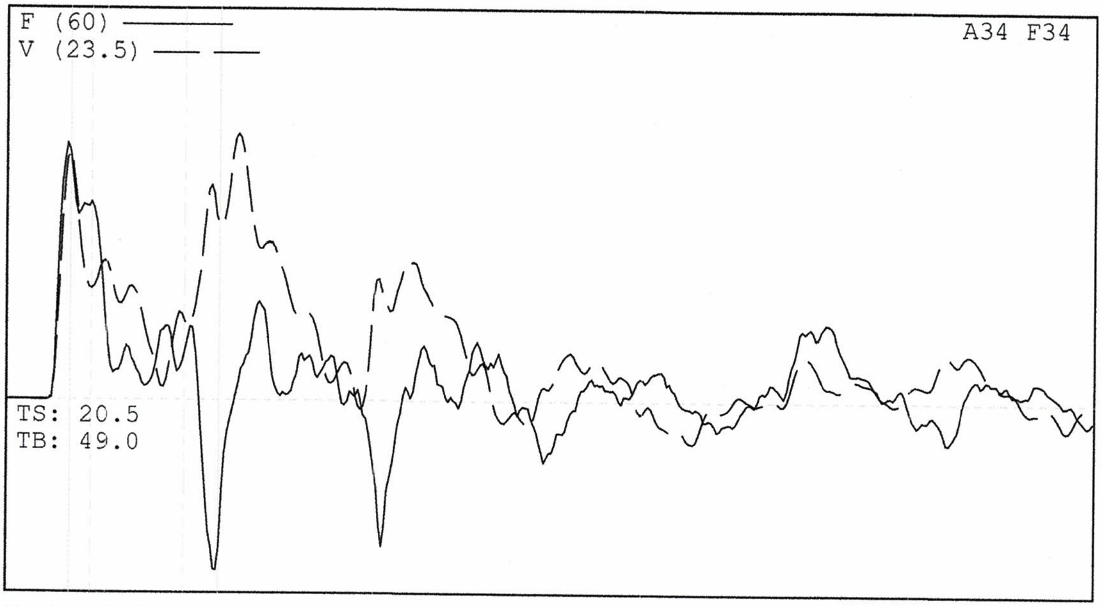
1-53 F3: [117-NWJ-1] 223.5 (1.00); F4: [117-NWJ-2] 223.7 (1.00); A3: [K4800] 340.0 (1.00);
A4: [K4161] 378.0 (1.00)

Time Summary

Drive 1 minute 20 seconds 10:32 AM - 10:33 AM BN 1 - 53

GZA GeoEnvironmental Inc. — Pile Driving Analyzer ®

N E BORING SPT CAL (NEWBURGH, ME) — S-4 (17-19)



Project Information

PROJECT: N E BORING SPT CAL (NEWBURGH, ME)
PILE NAME: S-4 (17-19)
DESCR: MOBILE B-53 (D-26)
OPERATOR: RS
FILE: B-3 (17-19).W01
7/3/2018 10:33:15 AM
Blow Number 23

Pile Properties

LE	23.00	ft
AR	1.43	in^2
EM	30000	ksi
SP	0.492	k/ft3
WS	16807.9	f/s
EA/C	2.6	ksec/ft
2L/C	2.78	ms
JC	0.35	[]
LP	17.00	ft

Quantity Results

CSI	27.5	ksi
CSX	27.4	ksi
CSB	5.6	ksi
RX7	8	kips
RX8	8	kips
RX9	8	kips
EMX	0.315	k-ft
BPM	54.3	bpm
ETR	90.0	(%)

Sensors

F3: [117-NWJ-1] 223.45 (1)
F4: [117-NWJ-2] 223.7 (1)
A3: [K4800] 340 mv/5000g's (1)
A4: [K4161] 378 mv/5000g's (1)
CLIP: OK

Version 2016.125

Project Name: *SPT Energy Testing*
Location: Newburgh, Maine
Date: 7/3/2018
Drill Rig: Mobile B-53, Rig No. D-26
Hammer Type: Northeast Geotech. Custom Automatic
Hammer Rated Energy: 350 ft.-lbs
Drilling Contractor: New England Boring Contractors
Driller Name: Brad Enos
Sample No./Sample Depth: S5 , 19'-21', N=10-9-9-10
Test Type: Top Instrumented Rod
Length From Gages To Tip of Spoon: 24 feet
Rod Type: NWJ
Casing/Auger: Auger

Blows Per 6 Inches	Blow Number	Transferred Energy (ft.-kips)	Transferred Energy Efficiency (percent)	Hammer Blow Count Rate (BPM)
10	1	0.335	95.7	58.9
	2	0.327	93.4	57.8
	3	0.329	94.0	56.7
	4	0.337	96.3	55.7
	5	0.333	95.1	57.3
	6	0.333	95.1	56.8
	7	0.330	94.3	56.6
	8	0.324	92.6	56.5
	9	0.325	92.9	56.7
	10	0.322	92.0	56.7
9	11	0.322	92.0	56.9
	12	0.329	94.0	55.8
	13	0.334	95.4	56.3
	14	0.334	95.4	56.5
	15	0.337	96.3	55.8
	16	0.331	94.6	57.3
	17	0.331	94.6	55.9
	18	0.333	95.1	56.3
	19	0.333	95.1	56.3
9	20	0.335	95.7	56.2
	21	0.337	96.3	56.5
	22	0.334	95.4	56.3
	23	0.333	95.1	56.8
	24	0.339	96.9	56.1
	25	0.335	95.7	57
	26	0.325	92.9	57.5
	27	0.331	94.6	55.9
	28	0.330	94.3	56.8
10	29	0.331	94.6	57.2
	30	0.312	89.1	58.1
	31	0.316	90.3	56.7
	32	0.307	87.7	57.1
	33	0.319	91.1	55.1
	34	0.318	90.9	57.2
	35	0.313	89.4	56.9
	36	0.314	89.7	57.4
	37	0.314	89.7	56.6
	38	0.307	87.7	57.4
	average (middle foot)	**0.332**	**95.0**	**56.5**
	standard dev. (middle foot)	**0.004**	**1.189**	
	C.O.V. (middle foot)	**0.013**	**0.013**	
	maximum (middle foot)	**0.339**	**96.9**	
	minimum (middle foot)	**0.322**	**92.0**	

GZA GeoEnvironmental Inc.
Case Method & iCAP® Results

Page 1
PDIPLOT2 2017.2.58.3 - Printed 12-July-2018

N E BORING SPT CAL (NEWBURGH, ME) - S-5 (19-21)
OP: RS

MOBILE B-53 (D-26)
Date: 03-July-2018

AR: 1.43 in²
LE: 24.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.35

BPM: Blows/Minute
EMX: Maximum Energy
ETR: Energy Transfer Ratio - Rated
FMX: Maximum Force
DMX: Maximum Displacement

VMX: Maximum Velocity
AMX: Maximum Acceleration
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	
1	58.9	0.335	95.6	37	1.73	16.1	1,898	1.73	1.028
2	57.8	0.327	93.5	38	1.07	15.2	2,123	1.07	1.014
3	56.7	0.329	94.1	38	1.07	14.9	2,238	1.07	1.002
4	55.7	0.337	96.2	39	1.14	15.0	2,159	1.14	1.032
5	57.3	0.333	95.2	39	1.07	14.7	2,293	1.07	1.042
6	56.8	0.333	95.0	39	0.96	14.8	2,200	0.96	1.028
7	56.6	0.330	94.3	39	0.97	14.7	2,134	0.97	1.031
8	56.5	0.324	92.6	39	0.91	14.6	2,217	0.91	1.036
9	56.7	0.325	92.7	39	0.94	14.7	2,063	0.94	1.025
10	56.7	0.322	92.1	38	0.99	14.6	1,994	0.99	1.031
11	56.9	0.322	91.9	39	1.00	14.6	2,099	1.00	1.036
12	55.8	0.329	94.0	39	1.19	14.9	2,104	1.19	1.000
13	56.3	0.334	95.4	40	1.34	15.4	2,148	1.34	1.007
14	56.5	0.334	95.4	39	1.26	15.8	2,090	1.26	1.017
15	55.8	0.337	96.2	38	1.41	15.9	2,159	1.41	1.014
16	57.3	0.331	94.6	39	1.32	15.9	2,080	1.32	1.031
17	55.9	0.331	94.7	39	1.23	15.6	2,167	1.23	1.006
18	56.3	0.333	95.0	39	1.04	15.2	2,137	1.03	1.030
19	56.3	0.333	95.1	38	0.93	15.3	2,120	0.92	1.023
20	56.2	0.335	95.8	39	1.23	15.3	2,230	1.23	1.007
21	56.5	0.337	96.2	39	1.17	15.1	2,184	1.17	0.993
22	56.3	0.334	95.4	39	1.13	14.9	2,174	1.13	0.992
23	56.8	0.333	95.3	38	1.14	15.4	2,239	1.14	0.999
24	56.1	0.339	96.9	38	1.17	15.6	2,195	1.17	1.006
25	57.0	0.335	95.8	39	1.20	15.3	2,180	1.20	1.000
26	57.5	0.325	92.8	38	1.12	15.0	2,175	1.12	0.999
27	55.9	0.331	94.7	37	1.17	15.6	2,198	1.17	1.009
28	56.8	0.330	94.2	37	0.99	15.1	2,292	0.99	0.996
29	57.2	0.331	94.7	38	1.07	15.0	2,299	1.06	1.009
30	58.1	0.312	89.0	36	0.91	14.7	1,958	0.91	1.006
31	56.7	0.316	90.3	37	0.97	15.3	2,276	0.97	0.982
32	57.1	0.307	87.8	36	0.86	14.4	2,279	0.85	0.975
33	55.1	0.319	91.2	37	0.92	15.0	2,507	0.92	0.930
34	57.2	0.318	91.0	37	1.02	15.2	2,372	1.02	0.963
35	56.9	0.313	89.5	38	0.84	14.9	2,442	0.84	0.941
36	57.4	0.314	89.7	37	1.03	14.9	2,443	1.03	0.934
37	56.6	0.314	89.6	37	1.03	14.7	2,409	1.03	0.922
38	57.4	0.307	87.8	37	1.00	14.7	2,346	1.00	0.958
39	56.0	0.317	90.7	38	0.97	15.1	2,408	0.96	0.957
40	57.4	0.310	88.5	37	1.31	14.9	2,407	1.31	0.927
Average	56.7	0.326	93.3	38	1.10	15.1	2,211	1.09	0.998

Total number of blows analyzed: 40

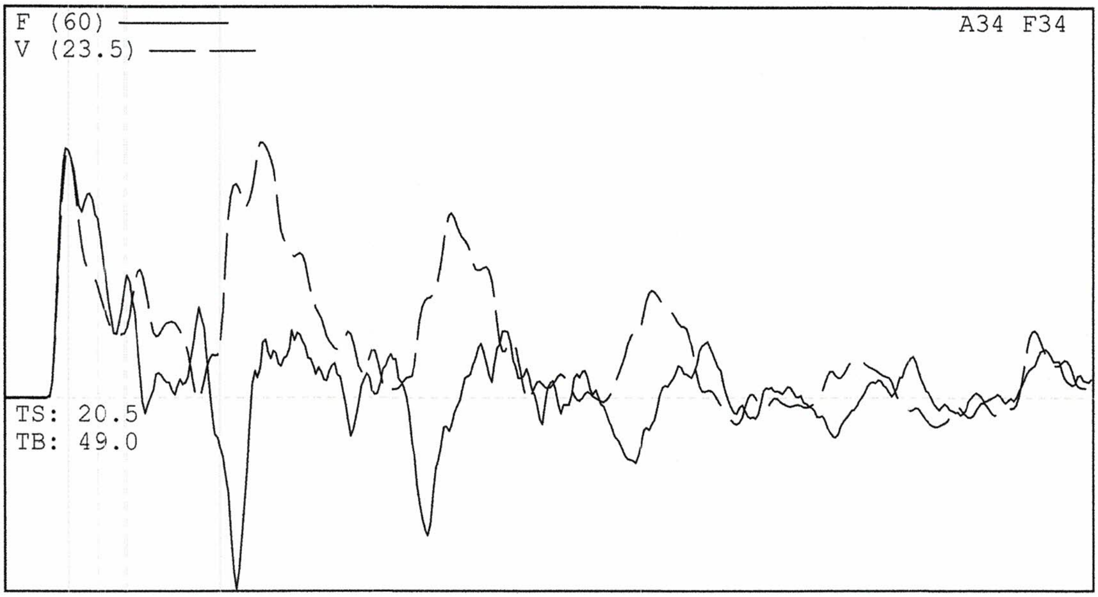
BL# Sensors

1-40 F3: [117-NWJ-1] 223.5 (1.00); F4: [117-NWJ-2] 223.7 (1.00); A3: [K4800] 340.0 (1.00);
A4: [K4161] 378.0 (1.00)

Time Summary

Drive 41 seconds 10:47 AM - 10:48 AM BN 1 - 40

N E BORING SPT CAL (NEWBURGH, ME) S-5 (19-21)



Project Information
PROJECT: N E BORING SPT CAL (NEWBURGH, M
PILE NAME: S-5 (19-21)
DESCR: MOBILE B-53 (D-26)
OPERATOR: RS
FILE: B-3 (19-21).W01
7/3/2018 10:47:46 AM
Blow Number 23

Pile Properties

LE	24.00	ft
AR	1.43	in^2
EM	30000	ksi
SP	0.492	k/ft3
WS	16807.9	f/s
EA/C	2.6	ksec/ft
2L/C	2.87	ms
JC	0.35	[]
LP	19.00	ft

Quantity Results

CSI	27.2	ksi
CSX	26.8	ksi
CSB	10.5	ksi
RX7	6	kips
RX8	6	kips
RX9	6	kips
EMX	0.333	k-ft
BPM	56.8	bpm
ETR	95.3	(%)

Sensors
F3: [117-NWJ-1] 223.45 (1)
F4: [117-NWJ-2] 223.7 (1)
A3: [K4800] 340 mv/5000g's (1)
A4: [K4161] 378 mv/5000g's (1)
CLIP: OK

Version 2016.125

Project Name: ***SPT Energy Testing***
Location: Newburgh, Maine
Date: 7/3/2018
Drill Rig: Mobile B-53, Rig No. D-26
Hammer Type: Northeast Geotech. Custom Automatic
Hammer Rated Energy: 350 ft.-lbs
Drilling Contractor: New England Boring Contractors
Driller Name: Brad Enos
Sample No./Sample Depth: S6 , 21'-23', N=10-9-9-11
Test Type: Top Instrumented Rod
Length From Gages To Tip of Spoon: 26 feet
Rod Type: NWJ
Casing/Auger: Auger

Blows Per 6 Inches	Blow Number	Transferred Energy (ft.-kips)	Transferred Energy Efficiency (percent)	Hammer Blow Count Rate (BPM)
10	1	0.336	96.0	55.9
	2	0.329	94.0	2.3
	3	0.327	93.4	56.2
	4	0.331	94.6	56.4
	5	0.334	95.4	56.6
	6	0.332	94.9	56.2
	7	0.339	96.9	56.0
	8	0.337	96.3	56.5
	9	0.334	95.4	57.3
	10	0.341	97.4	55.9
9	11	0.336	96.0	56.6
	12	0.342	97.7	56.3
	13	0.344	98.3	56.5
	14	0.342	97.7	56.7
	15	0.348	99.4	56.3
	16	0.346	98.9	56.4
	17	0.338	96.6	56.8
	18	0.338	96.6	56.7
	19	0.345	98.6	55.9
9	20	0.335	95.7	57.3
	21	0.345	98.6	56.3
	22	0.342	97.7	56.5
	23	0.344	98.3	56.4
	24	0.346	98.9	56.6
	25	0.344	98.3	56.7
	26	0.341	97.4	56.4
	27	0.341	97.4	56.7
	28	0.342	97.7	56.6
11	29	0.338	96.6	56.7
	30	0.335	95.7	56.6
	31	0.341	97.4	56.5
	32	0.339	96.9	56.5
	33	0.335	95.7	56.9
	34	0.330	94.3	56.8
	35	0.333	95.1	56.8
	36	0.335	95.7	56.5
	37	0.331	94.6	57.0
	38	0.333	95.1	57.2
	39	0.334	95.4	56.8
	average (middle foot)	**0.342**	**97.8**	**56.5**
	standard dev. (middle foot)	**0.004**	**1.020**	
	C.O.V. (middle foot)	**0.010**	**0.010**	
	maximum (middle foot)	**0.348**	**99.4**	
	minimum (middle foot)	**0.335**	**95.7**	

N E BORING SPT CAL (NEWBURGH, ME) - S-6 (21-23)
OP: RS

MOBILE B-53 (D-26)
Date: 03-July-2018

AR: 1.43 in²
LE: 26.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.35

BPM: Blows/Minute
EMX: Maximum Energy
ETR: Energy Transfer Ratio - Rated
FMX: Maximum Force
DMX: Maximum Displacement
VMX: Maximum Velocity
AMX: Maximum Acceleration
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BPM	EMX	ETR	FMX	DMX	VMX	AMX	DFN	FVP
	bpm	k-ft	(%)	kips	in	f/s	g's	in	
1	1.9	0.323	92.3	36	2.04	16.8	1,571	2.04	1.066
2	55.9	0.336	95.9	37	1.38	15.8	2,047	1.38	1.032
3	2.3	0.329	93.9	37	1.32	15.5	2,148	1.32	1.020
4	56.2	0.327	93.4	36	1.01	14.8	1,961	1.01	1.016
5	56.4	0.331	94.7	37	1.28	15.3	2,170	1.28	0.988
6	56.6	0.334	95.4	37	1.40	15.1	2,359	1.40	0.986
7	56.2	0.332	94.9	37	1.25	15.3	2,226	1.25	0.996
8	56.0	0.339	97.0	38	1.22	15.7	2,385	1.22	0.967
9	56.5	0.337	96.2	38	1.17	15.3	2,259	1.17	0.984
10	57.3	0.334	95.5	39	1.29	15.3	2,438	1.29	0.960
11	55.9	0.341	97.4	38	1.43	15.5	2,388	1.43	0.975
12	56.6	0.336	96.1	37	1.40	15.3	2,293	1.40	0.985
13	56.3	0.342	97.6	39	1.38	15.4	2,411	1.38	0.972
14	56.5	0.344	98.4	39	1.36	15.4	2,420	1.36	0.991
15	56.7	0.342	97.8	38	1.40	15.3	2,434	1.40	0.981
16	56.3	0.348	99.5	39	1.45	15.5	2,424	1.44	0.988
17	56.4	0.346	98.8	39	1.33	15.6	2,475	1.33	0.989
18	56.8	0.338	96.6	39	1.32	15.1	2,397	1.32	0.964
19	56.7	0.338	96.5	38	1.26	15.1	2,335	1.26	0.992
20	55.9	0.345	98.6	40	1.42	15.6	2,472	1.42	0.963
21	57.3	0.335	95.8	39	1.33	15.1	2,380	1.33	0.964
22	56.3	0.345	98.4	40	1.42	15.6	2,408	1.42	0.981
23	56.5	0.342	97.8	40	1.39	15.5	2,489	1.39	1.000
24	56.4	0.344	98.4	40	1.39	15.6	2,504	1.39	0.961
25	56.6	0.346	98.9	40	1.40	15.7	2,497	1.40	0.966
26	56.7	0.344	98.2	40	1.29	15.6	2,529	1.29	1.002
27	56.4	0.341	97.4	40	1.27	15.4	2,468	1.27	1.005
28	56.7	0.341	97.5	39	1.21	15.4	2,440	1.21	0.990
29	56.6	0.342	97.6	39	1.13	15.6	2,386	1.13	0.966
30	56.7	0.338	96.7	39	1.10	15.3	2,411	1.10	0.972
31	56.6	0.335	95.8	38	1.05	15.0	2,360	1.05	0.979
32	56.5	0.341	97.6	38	1.17	15.3	2,389	1.17	0.975
33	56.5	0.339	96.7	38	1.07	15.5	2,329	1.07	0.973
34	56.9	0.335	95.6	38	1.03	15.0	2,191	1.03	0.978
35	56.8	0.330	94.4	37	0.93	14.9	2,268	0.93	0.972
36	56.8	0.333	95.2	37	1.08	15.2	2,356	1.08	0.965
37	56.5	0.335	95.7	37	1.02	15.4	2,350	1.02	0.959
38	57.0	0.331	94.4	38	1.11	15.2	2,372	1.11	0.967
39	57.2	0.333	95.2	38	1.07	15.5	2,329	1.07	0.963
40	56.8	0.334	95.4	39	1.18	15.6	2,443	1.18	0.967
Average	53.8	0.338	96.5	38	1.27	15.4	2,338	1.27	0.983

Total number of blows analyzed: 40

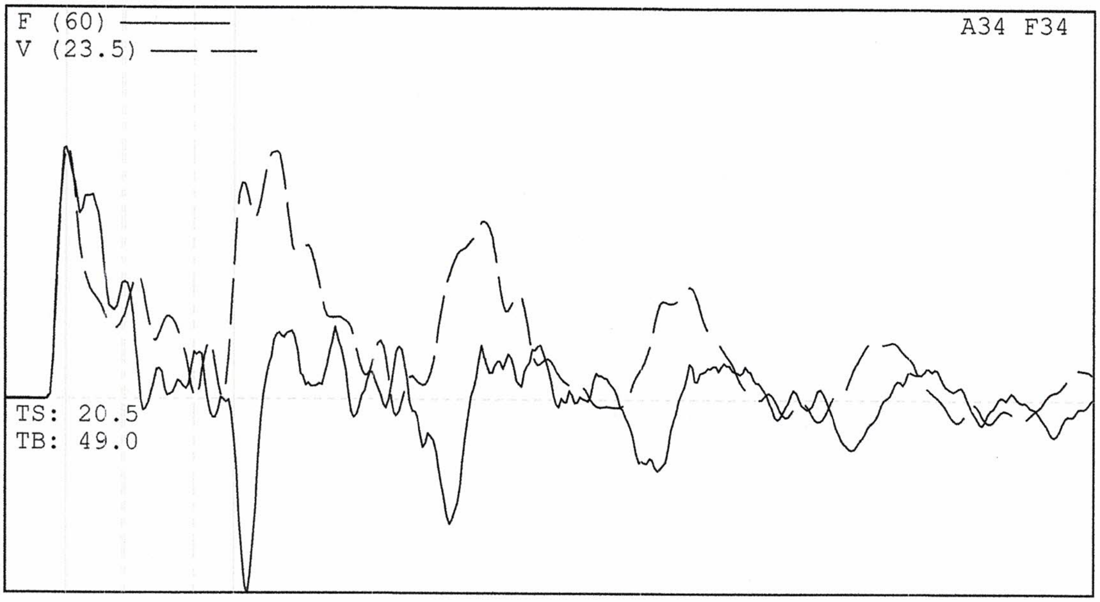
BL# Sensors

1-40 F3: [117-NWJ-1] 223.5 (1.00); F4: [117-NWJ-2] 223.7 (1.00); A3: [K4800] 340.0 (1.00);
A4: [K4161] 378.0 (1.00)

Time Summary

Drive 1 minute 6 seconds 10:51 AM - 10:52 AM BN 1 - 40

N E BORING SPT CAL (NEWBURGH, ME) C-6 (21-23)



Project Information

PROJECT: N E BORING SPT CAL (NEWBURGH, M
PILE NAME: C-6 (21-23)
DESCR: MOBILE B-53 (D-26)
OPERATOR: RS
FILE: B-3 (21-23).W01
7/3/2018 10:52:21 AM
Blow Number 19

Pile Properties

LE	26.00	ft
AR	1.43	in^2
EM	30000	ksi
SP	0.492	k/ft3
WS	16807.9	f/s
EA/C	2.6	ksec/ft
2L/C	3.14	ms
JC	0.35	[]
LP	21.00	ft

Quantity Results

CSI	27.4	ksi
CSX	26.9	ksi
CSB	12.1	ksi
RX7	10	kips
RX8	10	kips
RX9	10	kips
EMX	0.338	k-ft
BPM	56.7	bpm
ETR	96.5	(%)

Sensors

F3: [117-NWJ-1] 223.45 (1)
F4: [117-NWJ-2] 223.7 (1)
A3: [K4800] 340 mv/5000g's (1)
A4: [K4161] 378 mv/5000g's (1)
CLIP: OK

Version 2016.125

Appendix B – Field Boring Log

TEST BORING LOG

GZA GeoEnvironmental, Inc.
Engineers and Scientists

SPT Energy Measurements
Newburgh, ME

EXPLORATION NO.: B-3
SHEET: 1 of 1
PROJECT NO: 02.0173791.00
REVIEWED BY: J. Jagello

Logged By: R. Shamas
Drilling Co.: New England Boring Contractors
Foreman: Brad

Type of Rig: ATV
Rig Model: Mobile B-53
Drilling Method: HSA

Boring Location:
Ground Surface Elev. (ft.):
Final Boring Depth (ft.): 23
Date Start - Finish: 7/3/2018 - 7/3/2018

H. Datum:
V. Datum:

Hammer Type: Automatic Hammer
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3-1/4

Sampler Type: SS
Sampler O.D. (in.): 2.0
Sampler Length (in.): 24
Core Barrel Size: N/A

Groundwater Depth (ft.)			
Date	Time	Water Depth	Stab. Time

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description and Identification (Modified Burmister Procedure)	Remark	Field Test Data	Depth (ft.)	STRATUM Description	Elev. (ft.)
10		SS-1	10-12			15 10 9 8	19	SS-1 : Medium dense, brown, medium to coarse SAND, some Gravel					
		SS-2	13-15	24	12	6 12 10 8	22	SS-2 : Medium dense, brown, medium to coarse SAND, some Gravel					
15		SS-3	15-17	24	13	8 10 12 11	22	SS-3 : Medium dense, brown, fine to coarse SAND, some Gravel					
		SS-4	17-19	24	11	16 14 13 19	27	SS-4 : Medium dense, fine to coarse SAND, some Gravel, trace Silt					
20		SS-5	19-21	24	11	10 9 9 10	18	SS-5 : Medium dense, brown, medium to coarse SAND, some Gravel					
		SS-6	21-23	24	8	10 9 9 11	18	SS-6 : Medium dense, brown, medium to coarse SAND, some Gravel					
								End of exploration at 23 feet below grade.					

REMARKS

Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual.

Exploration No.: B-3

Attachment C

Seismic Site Classification based on Table 3.10.3.1-1 Site Class Definitions of AASHTO LRFD

Boring ID: J-1 and J-1A (offset of J-1)
Drilled Date: 6/22/2021
Surface Elevation (ft): 11.5

Layer No.	Soil / Rock	Average SPT N-Value	UCS (ksi)	Average Thickness (ft)	di/Ni
1	SM	9		2	0.222
2	SM	21		3	0.143
3	SM/SP	26		2	0.077
4	SP	47		3	0.064
5	SP	41		5	0.122
6	SP	50		5	0.100
7	SP	11		5	0.455
8	SP	10		5	0.500
9	ML	6		4	0.667
10	CL-ML/ML	7		6	0.857
11	ML	3		5	1.667
12	SM	30		5	0.167
13	SM	80		5	0.063
14	SM	80		5	0.063
15	GM	100		40	0.400
16	Rock				
			Total =	100	5.564
Average SPT N-value:		**18**			
Site Class:		**D**			

Boring ID: HA1
Drilled Date: 5/21/2012
Surface Elevation (ft): 11.1

Not representative of the actual soil conditions below depth 32 ft.

Layer No.	Soil / Rock	Average SPT N-Value	UCS (ksi)	Average Thickness (ft)	di/Ni
1		6		2	0.333
2		17		3	0.176
3		6		2	0.333
4		53		3	0.057
5		39		2	0.051
6		53		3	0.057
7		13		2	0.154
8		9		3	0.333
9		13		5	0.385
10		10		5	0.500
11		11		70	6.364
			Total =	100	8.743
Average SPT N-value:		**11**			
Site Class:		**E**			

ATC Hazards by Location

Search Information

Coordinates: 41.281978, -72.901035

Elevation: 10 ft

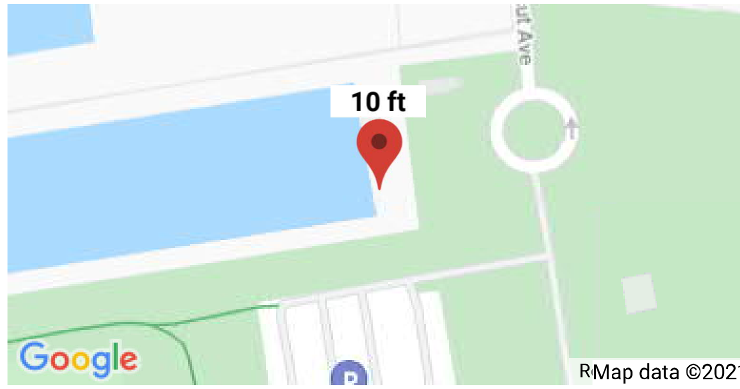
Timestamp: 2021-09-13T15:49:23.776Z

Hazard Type: Seismic

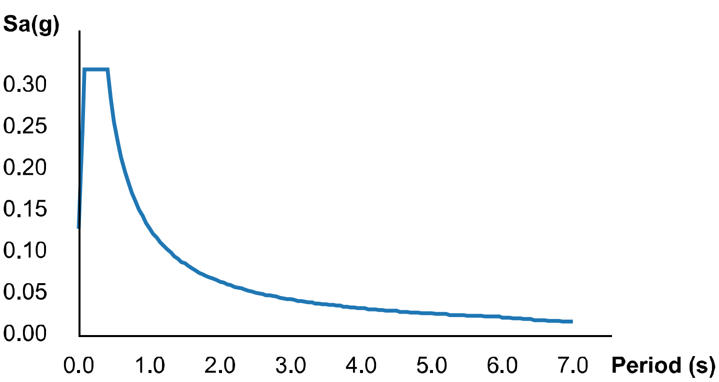
Reference Document: ASCE7-16

Risk Category: III

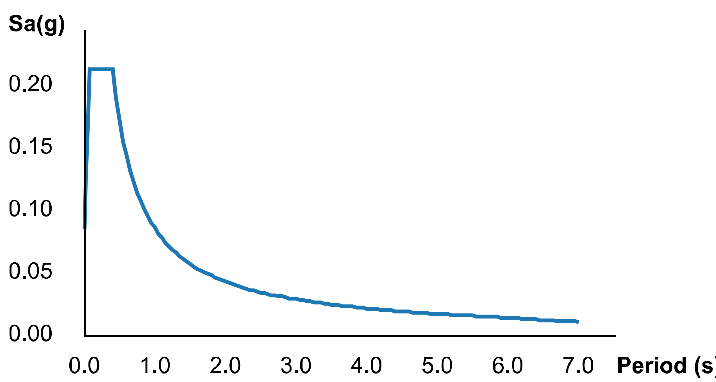
Site Class: D



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.2	MCE_R ground motion (period=0.2s)
S_1	0.053	MCE_R ground motion (period=1.0s)
S_{MS}	0.32	Site-modified spectral acceleration value
S_{M1}	0.128	Site-modified spectral acceleration value
S_{DS}	0.213	Numeric seismic design value at 0.2s SA
S_{D1}	0.086	Numeric seismic design value at 1.0s SA

▾Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.943	Coefficient of risk (0.2s)

CR_1	0.927	Coefficient of risk (1.0s)
PGA	0.112	MCE_G peak ground acceleration
F_{PGA}	1.577	Site amplification factor at PGA
PGA_M	0.176	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	0.2	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.212	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.053	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.058	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Latitude

Decimal degrees

41.281978

Longitude

Decimal degrees, negative values for western longitudes

-72.901035

Site Class

760 m/s (B/C boundary)

Spectral Period

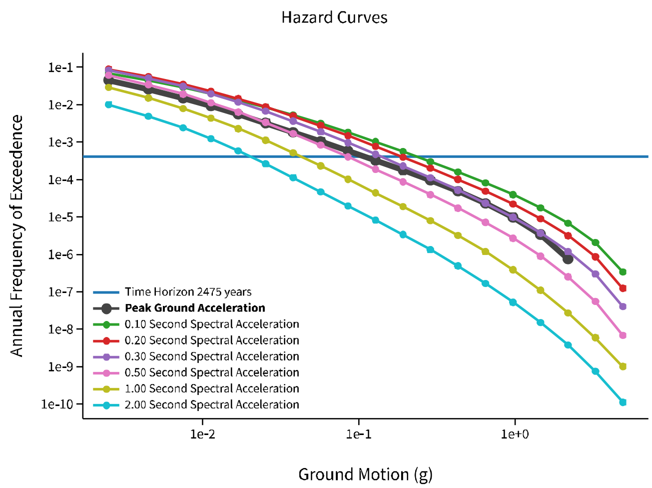
Peak Ground Acceleration

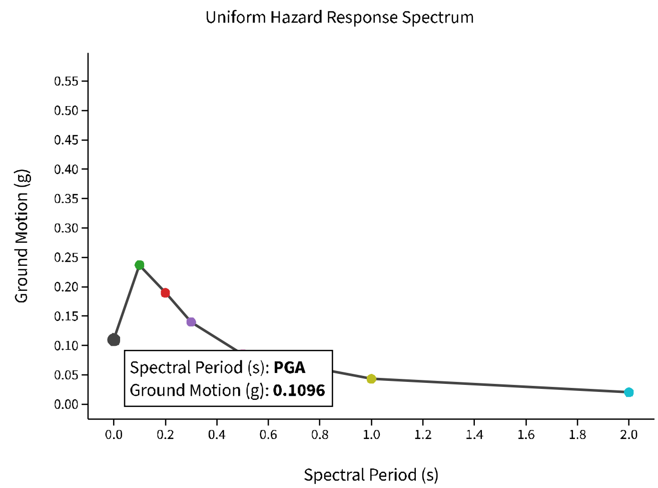
Time Horizon

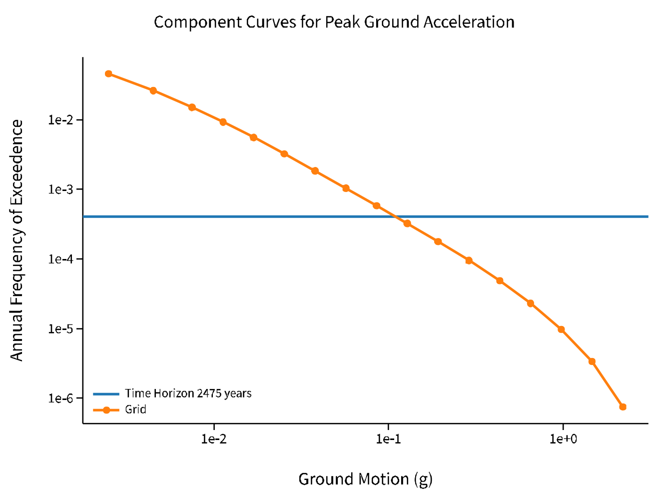
Return period in years

2475

Hazard Curve





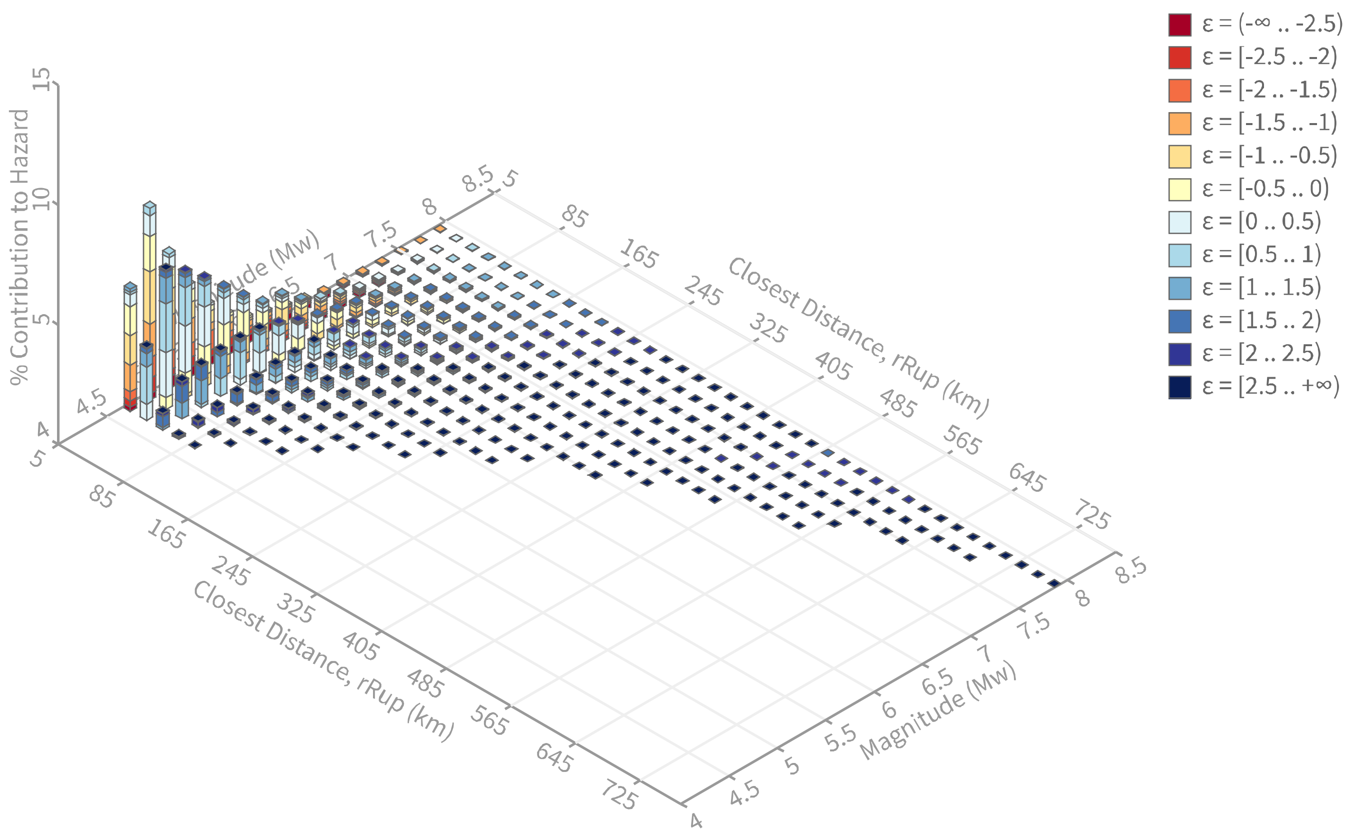


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.10958548 g

Recovered targets

Return period: 2472.3996 yrs
Exceedance rate: 0.00040446536 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 1.56 %

Mean (over all sources)

m: 5.59
r: 44.36 km
ε_0: -0.07 σ

Mode (largest m-r bin)

m: 4.9
r: 12.87 km
ε_0: -0.88 σ
Contribution: 7.99 %

Mode (largest m-r-ε_0 bin)

m: 4.9
r: 13.53 km
ε_0: -0.76 σ
Contribution: 2.17 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
USGS Adaptive Smoothing Zone 2 (opt)	Grid							26.94
PointSourceFinite: -72.901, 41.529		27.36	5.38	-0.04	72.901°W	41.529°N	0.00	3.47
PointSourceFinite: -72.901, 41.439		17.89	5.24	-0.63	72.901°W	41.439°N	0.00	3.24
PointSourceFinite: -72.901, 41.349		8.90	5.15	-1.72	72.901°W	41.349°N	0.00	2.39
PointSourceFinite: -72.901, 41.484		22.61	5.30	-0.29	72.901°W	41.484°N	0.00	2.15
PointSourceFinite: -72.901, 41.574		32.10	5.45	0.15	72.901°W	41.574°N	0.00	2.01
PointSourceFinite: -72.901, 41.394		13.26	5.19	-1.10	72.901°W	41.394°N	0.00	1.96
PointSourceFinite: -72.901, 41.664		41.52	5.61	0.42	72.901°W	41.664°N	0.00	1.53
PointSourceFinite: -72.901, 41.619		36.82	5.53	0.31	72.901°W	41.619°N	0.00	1.50
PointSourceFinite: -72.901, 41.709		46.21	5.69	0.52	72.901°W	41.709°N	0.00	1.11
PointSourceFinite: -72.901, 41.754		50.88	5.77	0.59	72.901°W	41.754°N	0.00	1.01
SSCn Adaptive Smoothing Zone 4 (opt)	Grid							26.12
PointSourceFinite: -72.901, 41.529		27.36	5.38	-0.04	72.901°W	41.529°N	0.00	3.47
PointSourceFinite: -72.901, 41.439		17.89	5.24	-0.63	72.901°W	41.439°N	0.00	3.24
PointSourceFinite: -72.901, 41.349		8.90	5.15	-1.72	72.901°W	41.349°N	0.00	2.39
PointSourceFinite: -72.901, 41.484		22.61	5.30	-0.29	72.901°W	41.484°N	0.00	2.15
PointSourceFinite: -72.901, 41.574		32.10	5.45	0.15	72.901°W	41.574°N	0.00	2.01
PointSourceFinite: -72.901, 41.394		13.26	5.19	-1.10	72.901°W	41.394°N	0.00	1.96
PointSourceFinite: -72.901, 41.664		41.52	5.61	0.42	72.901°W	41.664°N	0.00	1.53
PointSourceFinite: -72.901, 41.619		36.82	5.53	0.31	72.901°W	41.619°N	0.00	1.50
PointSourceFinite: -72.901, 41.709		46.21	5.69	0.52	72.901°W	41.709°N	0.00	1.11
PointSourceFinite: -72.901, 41.754		50.88	5.77	0.59	72.901°W	41.754°N	0.00	1.01
USGS Fixed Smoothing Zone 2 (opt)	Grid							22.57
PointSourceFinite: -72.901, 41.529		27.36	5.38	-0.04	72.901°W	41.529°N	0.00	2.46
PointSourceFinite: -72.901, 41.439		17.89	5.24	-0.63	72.901°W	41.439°N	0.00	2.41
PointSourceFinite: -72.901, 41.349		8.90	5.15	-1.72	72.901°W	41.349°N	0.00	1.87
PointSourceFinite: -72.901, 41.574		32.10	5.45	0.15	72.901°W	41.574°N	0.00	1.66
PointSourceFinite: -72.901, 41.484		22.61	5.30	-0.29	72.901°W	41.484°N	0.00	1.62
PointSourceFinite: -72.901, 41.394		13.26	5.19	-1.10	72.901°W	41.394°N	0.00	1.54
PointSourceFinite: -72.901, 41.664		41.52	5.61	0.42	72.901°W	41.664°N	0.00	1.18
PointSourceFinite: -72.901, 41.619		36.82	5.53	0.31	72.901°W	41.619°N	0.00	1.08
SSCn Fixed Smoothing Zone 4 (opt)	Grid							21.20
PointSourceFinite: -72.901, 41.529		27.36	5.38	-0.04	72.901°W	41.529°N	0.00	2.46
PointSourceFinite: -72.901, 41.439		17.89	5.24	-0.63	72.901°W	41.439°N	0.00	2.41
PointSourceFinite: -72.901, 41.349		8.90	5.15	-1.72	72.901°W	41.349°N	0.00	1.87
PointSourceFinite: -72.901, 41.574		32.10	5.45	0.15	72.901°W	41.574°N	0.00	1.66
PointSourceFinite: -72.901, 41.484		22.61	5.30	-0.29	72.901°W	41.484°N	0.00	1.62
PointSourceFinite: -72.901, 41.394		13.26	5.19	-1.10	72.901°W	41.394°N	0.00	1.54
PointSourceFinite: -72.901, 41.664		41.52	5.61	0.42	72.901°W	41.664°N	0.00	1.18
PointSourceFinite: -72.901, 41.619		36.82	5.53	0.31	72.901°W	41.619°N	0.00	1.08
SSCn Fixed Smoothing Zone 7 (opt)	Grid							1.32

SPT-BASED LIQUEFACTION ANALYSIS

Project:	PAC
Structure:	Process Air Facility
Site Location:	New Haven, CT

References:
(1) Youd et al. (2001). "Liquefaction Resistance fo Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils". J. of Geotech. And Geoenv. Eng., 124.
(2) Idriss, I. M. and Boulanger R. W. (2008). " Soil Liquefaction during Earthquaks", Earthquake Engineering Research Institute, MNO-12
(3) Seed et al. (2003). "Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework", 26th Annual Geotechnical Spring Seminar.
(4) Ishihara, K., and Yoshimine, M., (1992). "Evaluation of settlements in sand deposits following liquefaction during earthquakes", Soils and Foundations 32(1), 173–88.
(5) Zhang et al. (2002). "Estimating liquefaction-induced ground settlements from CPT for level ground" Can. Geotech. J. 39, 1168–1180

Design Parameters:	
Boring Number:	J-1, J-1A
Ground Surface Elevation (ft):	11.5
Depth to Groundwater During Field Exploration (ft):	8
Design Groundwater Depth (ft):	2
SPT Hammer Energy Ratio (ER): {Enter as a percent} ***See Note 4 & Table 1.***	80
Standard Sampler? {Yes or No}	NO
Liner Used in Sampler? {Yes or No}	NO
Peak Horizontal Ground Acceleration (a_{max}/g):	0.176
Design Earthquake Magnitude (M):	5.59

Table 1: Range of Hammer Energy Ratios

Equipment:	Range[1]	Recommended Value[2]
Safety Hammer	42% - 72%	60%
Donut Hammer	30% - 60%	50%
Automatic-Trip Donut-Type Hammer	48% - 78%	80%

1) after recommendations by NCEER, 1997
2) for good-quality equipment and procedures conforming to ASTM D-1686.

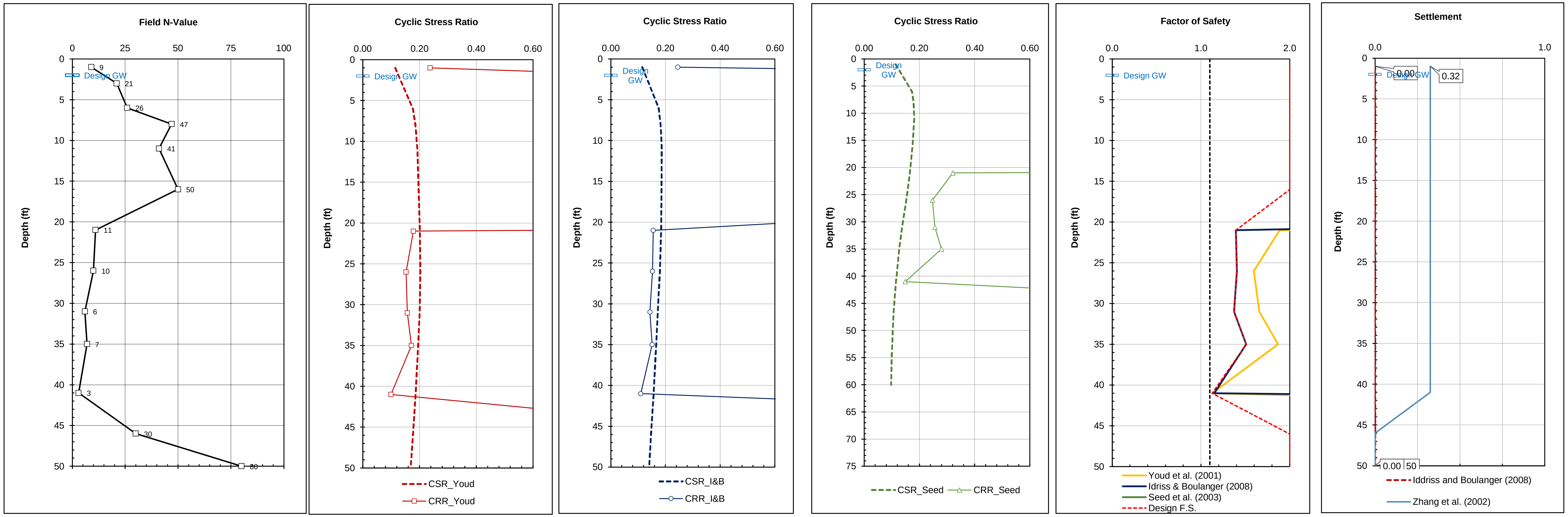
Depth (ft)	Layer Thickness (ft)	Soil Type	Total Unit Weight (pcf)	Field SPT N-value	Estimated Fines (%)	Plasticity Index
1	2	SM	115	9	20	0
3	3	SM	115	21	20	0
6	2	SP	115	26	20	0
8	3	SP	130	47	4	0
11	5	SP	130	41	4	0
16	5	SP	130	50	4	0
21	5	SP	120	11	4	0
26	5	SP	120	10	4	0
31	4	ML	125	6	95	0
35	6	ML	125	7	95	0
41	5	ML	120	3	95	0
46	5	SM	135	30	25	0
50	5	SM	135	80	25	0
55	5	SM	135	80	25	0
60	5	GM	135	100	25	0

Depth (ft)	Youd et al. (2001) Cyclic Stress Ratio	Cyclic Resistance Ratio	Factor of Safety	Factor of Safety	Idriss & Boulanger (2008) Cyclic Stress Ratio	Cyclic Resistance Ratio	Factor of Safety	Factor of Safety	Seed et al. (2003) Cyclic Stress Ratio	Cyclic Resistance Ratio	Factor of Safety	Factor of Safety
1	0.11	0.24	4.41	2.00	0.11	0.25	3.52	2.00	0.11	5.91	101.57	2.00
3	0.14	1.96	30.00	2.00	0.14	4.40	52.23	2.00	0.14	24.20	344.32	2.00
6	0.18	3.08	36.99	2.00	0.18	4.40	41.39	2.00	0.17	13.63	154.24	2.00
8	0.19	18.38	210.48	2.00	0.18	4.40	39.78	2.00	0.18	119.32	1303.50	2.00
11	0.19	9.76	107.89	2.00	0.19	2.75	24.32	2.00	0.18	37.25	402.38	2.00
16	0.20	22.66	244.88	2.00	0.19	2.79	24.76	2.00	0.18	76.45	853.69	2.00
21	0.20	0.18	1.89	1.89	0.18	0.16	1.39	1.39	0.17	0.32	3.80	2.00
26	0.20	0.15	1.60	1.60	0.18	0.15	1.40	1.40	0.15	0.25	3.18	2.00
31	0.20	0.16	1.66	1.66	0.17	0.14	1.37	1.37	0.14	0.26	3.65	2.00
35	0.19	0.17	1.87	1.87	0.17	0.15	1.51	1.51	0.13	0.28	4.32	2.00
41	0.19	0.10	1.13	1.13	0.16	0.11	1.15	1.15	0.12	0.15	2.52	2.00
46	0.18	1.58	19.05	2.00	0.15	3.90	43.70	2.00	0.11	2.08	37.84	2.00
50	0.17	103.72	1305.87	2.00	0.14	3.48	40.95	2.00	0.10	401.40	7598.28	2.00
55	0.16	77.19	1029.61	2.00	0.13	4.21	52.54	2.00	0.10	248.71	4876.91	2.00
60	0.15	156.43	2216.13	2.00	0.12	4.25	56.25	2.00	0.10	1202.29	24124.37	2.00
	0.22	0.04	0.43	0.43	0.22	0.06	0.47	0.47	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52
	0.22	0.04	0.43	0.43	0.22	0.06	0.44	0.44	0.22	0.06	0.52	0.52

Depth (ft)	F.S. Statistics FS. Standard Deviation	FS. Average	COV	FS. Settlement	Iddriss and Boulanger (2008) Settlement (in)	Zhang et al. (2002) Settlement (in)
1	0.00	2.00	0.00	2.00	0.00	0.32
3	0.00	2.00	0.00	2.00	0.00	0.32
6	0.00	2.00	0.00	2.00	0.00	0.32
8	0.00	2.00	0.00	2.00	0.00	0.32
11	0.00	2.00	0.00	2.00	0.00	0.32
16	0.00	2.00	0.00	2.00	0.00	0.32
21	0.32	1.76	0.18	1.39	0.00	0.32
26	0.30	1.67	0.18	1.40	0.00	0.32
31	0.31	1.68	0.19	1.37	0.00	0.32
35	0.25	1.79	0.14	1.51	0.00	0.32
41	0.50	1.43	0.35	1.13	0.00	0.32
46	0.00	2.00	0.00	2.00	0.00	0.00
50	0.00	2.00	0.00	2.00	0.00	0.00
55	0.00	2.00	0.00	2.00	0.00	0.00
60	0.00	2.00	0.00	2.00	0.00	0.00
	0.04	0.47	0.09	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
	0.05	0.46	0.10	0.43	0.00	0.00
			9%			

SPT-BASED LIQUEFACTION ANALYSIS

Project:	PAC
Structure:	Process Air Facility
Site Location:	New Haven, CT



Attachment D

Micropile Design

based on FHWA-NHI-05-039 (2005) Micropile Design and Construction

New Haven PACS WTP with Crawl Space

Calculation by: JP Checked by: Em. C Date: 9-3-2021

Units

$psf := \frac{lbf}{ft^2}$ $pci := \frac{lbf}{in^3}$ $pcf := \frac{lbf}{ft^3}$ $ksi := 1000psi$ $kips := 1000lbf$ $kPa := 1000Pa$

Structural Inputs

$P_{design} := 206kips$	Design load of micropiles
$d_{drillhole} := 11.25in$	Drillhole diameter
$d_{casing} := (10.75 - 0.236)in$	Outside diameter of casing, 3 mm of corrosion correction
$t_{casing} := (0.595 - 0.118)in$	Thickness of casing, 3 mm of corrosion correction
$EL_{casing} := -54ft$	Top elevation of the bond zone, which is also the bottom elevation of the casing.
$d_{bar} := 1.41in$	Diameter of reinforcing bar, #11 threaded bar
$F_{y\_casing} := 80ksi$	Yield strength of casing (Max. Fy allowable for IBC is 32 ksi, therefore max Fy_casing is 80 ksi)
$F_{y\_bar} := 150ksi$	Minimum Yield strength of reinforcing bar
$f'_c := 4ksi$	Compressive strength of concrete

Juan: Lets use 10 ft as cut-off elevation (instead of 11 ft)

Soil Inputs

$GSE := 10ft$	Ground surface elevation (approx. from boring)
$GWE := 10ft$	Ground water elevation
$FS_{soil} := 2.5$	Factor of safety for soil-grout bond strength

Very Dense SM/GM - Glacial Till	-49	0.01
Weathered Bedrock	-54	0.01
Bedrock	-104	1000

See Table 5-2 on last page for ultimate bond strength values

Structural Design

Cross sectional areas of micropile components

$A_{bar} := \frac{\pi}{4} \cdot d_{bar}^{2}$ $\qquad A_{bar} = 1.56 \cdot in^2$

$A_{casing} := \frac{\pi}{4} \cdot \left[d_{casing}^{2} - \left(d_{casing} - 2 \cdot t_{casing}\right)^2 \right]$ $\qquad A_{casing} = 15.04 \cdot in^2$

$A_{conc} := \frac{\pi}{4} d_{drillhole}^{2}$ $\qquad A_{conc} = 99.4 \cdot in^2$

$A_{conc\_bar} := A_{conc} - A_{bar}$ $\qquad A_{conc\_bar} = 97.84 \cdot in^2$

$A_{conc\_casing} := \frac{\pi}{4} d_{casing}^{2} - A_{casing} - A_{bar}$ $\qquad A_{conc\_casing} = 70.22 \cdot in^2$

Allowable capacities for upper cased section

$F_y := \min\left(F_{y\_casing}, F_{y\_bar}\right)$

Allowable tension (2015 IBC Table 1810.3.2.6)

$P_{t\_allow} := 0.6 \cdot F_{y\_bar} \cdot A_{bar} + 0.6 \cdot F_{y\_casing} A_{casing}$ $\qquad P_{t\_allow} = 862.49 \cdot kips$

Allowable compression (2015 IBC Table 1810.3.2.6)

$P_{c\_allow} := \left(0.4 \cdot f'_c \cdot A_{conc\_casing}\right) + 0.5 \cdot F_y A_{bar} + 0.4 \cdot F_y \cdot A_{casing}$ $\qquad P_{c\_allow} = 656.1 \cdot kips$

Allowable capacities for lower uncased section

Assume

$P_{transfer} := 0 kips$

$P_{tcase\_allow} := 0.6 \cdot F_y \cdot A_{bar} + P_{transfer}$ $\qquad P_{tcase\_allow} = 74.95 \cdot kips$

$P_{ccase\_allow} := 0.4 \cdot f'_c \cdot A_{conc\_bar} + \min\left(0.5 \cdot F_y, 32 ksi\right) \cdot A_{bar} + P_{transfer}$ $\qquad P_{ccase\_allow} = 206.51 \cdot kips$

Geotechnical Design

$d_{layer} := EL_{casing} - EL_{layer\_bottom}$

$d_{pos_i} := \text{if}\left(d_{layer_i} > 0, 1, 0\right)$

$layer1 := \text{match}\left(1, d_{pos}\right)_0$ $\qquad n := layer1 .. \text{last}\left(d_{layer}\right)$

$t_{bearing_n} := d_{layer_n} - d_{layer_{n-1}}$ $\qquad t_{bearing} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 50 \end{pmatrix} ft$

Allowable Load Transfer

$$ALT := \frac{\alpha_{ultimate}}{FS_{soil}} \cdot \pi \cdot d_{drillhole}$$

$$\alpha_{ultimate} = \begin{pmatrix} 1.5 \times 10^{-3} \\ 1.5 \times 10^{-3} \\ 1.5 \times 10^{-3} \\ 145.0 \end{pmatrix} \cdot psi$$

$$ALT = \begin{pmatrix} 2.46 \times 10^{-4} \\ 2.46 \times 10^{-4} \\ 2.46 \times 10^{-4} \\ 24.61 \end{pmatrix} \cdot \frac{kips}{ft}$$

Required bond length

$$P_i := \sum_{ii=0}^{i} \left(ALT_{ii} \cdot t_{bearing_{ii}}\right)$$

$$P_{index_i} := if\left(P_i > P_{design}, 1, 0\right)$$

$$bearing := match\left(1, P_{index}\right)_0$$

$$P = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1.23 \times 10^{3} \end{pmatrix} \cdot kips$$

$$k := 0 .. bearing$$

$$L_{geotech\_min} := \begin{cases} \dfrac{P_{design}}{ALT_{layer1}} & \text{if } match\left(1, P_{index}\right)_0 = layer1 \\ \displaystyle\sum_{l=0}^{bearing-1} t_{bearing_l} + \dfrac{P_{design} - \displaystyle\sum_{m=0}^{bearing-1} \left(ALT_m \cdot t_{bearing_m}\right)}{ALT_{bearing}} & \end{cases}$$

$$ALT_{layer1} = 24.61 \cdot \frac{ki}{f}$$

$$L_{geotech\_min} = 8.4 \cdot ft$$

$$L_{plunge} := 0ft$$

$$P_{transfer\_check} := ALT_{layer1} \cdot L_{plunge}$$

$$P_{transfer\_check} = 0 \cdot kips$$

$$L_{casing} := GSE - EL_{casing}$$

$$L_{casing} = 64\,ft$$

$$L_{total} := L_{casing} - L_{plunge} + L_{geotech\_min}$$

$$L_{total} = 72.37\,ft$$

Table 5-3. Summary of Typical α_{bond} (Grout-to-Ground Bond) Values for Micropile Design.

Soil / Rock Description	Grout-to-Ground Bond Ultimate Strengths, kPa (psi)			
	Type A	Type B	Type C	Type D
Silt & Clay (some sand) (soft, medium plastic)	35-70 (5-10)	35-95 (5-14)	50-120 (5-17.5)	50-145 (5-21)
Silt & Clay (some sand) (stiff, dense to very dense)	50-120 (5-17.5)	70-190 (10-27.5)	95-190 (14-27.5)	95-190 (14-27.5)
Sand (some silt) (fine, loose-medium dense)	70-145 (10-21)	70-190 (10-27.5)	95-190 (14-27.5)	95- 240 (14-35)
Sand (some silt, gravel) (fine-coarse, med.-very dense)	95-215 (14-31)	120-360 (17.5-52)	145-360 (21-52)	145-385 (21-56)
Gravel (some sand) (medium-very dense)	95-265 (14-38.5)	120-360 (17.5-52)	145-360 (21-52)	145-385 (21-56)
Glacial Till (silt, sand, gravel) (medium-very dense, cemented)	95-190 (14-27.5)	95-310 (14-45)	120-310 (17.5-45)	120-335 (17.5-48.5)
Soft Shales (fresh-moderate fracturing, little to no weathering)	205-550 (30-80)	N/A	N/A	N/A
Slates and Hard Shales (fresh-moderate fracturing, little to no weathering)	515-1,380 (75-200)	N/A	N/A	N/A
Limestone (fresh-moderate fracturing, little to no weathering)	1,035-2,070 (150-300)	N/A	N/A	N/A
Sandstone (fresh-moderate fracturing, little to no weathering)	520-1,725 (75.5-250)	N/A	N/A	N/A
Granite and Basalt (fresh-moderate fracturing, little to no weathering)	1,380-4,200 (200-609)	N/A	N/A	N/A

Type A: Gravity grout only
Type B: Pressure grouted through the casing during casing withdrawal
Type C: Primary grout placed under gravity head, then one phase of secondary "global" pressure grouting
Type D: Primary grout placed under gravity head, then one or more phases of secondary "global" pressure grouting

Table 4-5. Dimensions and Yield Strength of Common Micropile Pipe Types and Sizes.

API N-80 Pipe – Common Sizes					
Casing OD Wall(1), mm (in.)	139.7 (5.500)	139.7 (5.500)	177.8 (7.000)	177.8 (7)	244.5 (9.625)
Wall Thickness(1), mm (in.)	9.17 (0.361)	10.5 (0.415)	12.6 (0.498)	18.5 (0.73)	12.0 (0.472)
Area(2), mm^2 ($in.^2$)	3760 (5.83)	4280 (6.63)	6560 (10.2)	9280 (14.4)	8760 (13.6)
Yield Strength(3), kN (kip)	2,070 (466)	2,360 (530)	3,620 (814)	5,120 (1,151)	4,830 (1,086)
ASTM A519, A106 Pipe – Common Sizes(5)					
Casing OD Wall(1), mm (in.)	139.7 (5.50)	168.3 (6.625)	203.2 (8.00)	273.1 (10.75)	-
Wall Thickness(1), mm (in.)	12.7 (0.50)	12.7 (0.50)	12.7 (0.50)	16 (0.625)	-
Area(2), mm^2 ($in.^2$)	5,067 (7.85)	6,208 (9.62)	7,600 (11.8)	12,850 (19.9)	-
Yield Strength(3), kN (kip)	1,270 (286)	1,540 (346)	1,890 (425)	3,190 (717)	-

Notes: (1)Casing outside diameter (OD) and wall thickness (t) are nominal dimensions.
(2)Steel area is calculated as $A_s = (\pi/4) \times (OD^2 - ID^2)$.
(3)Nominal yield stress for API N-80 steel is F_y = 552 MPa (80 ksi).
(4)Nominal yield stress for ASTM A519 & A106 steel is F_y = 241 MPa (36 ksi).
(5)Other pipe sizes are manufactured but may not be readily available. Check for availability through suppliers.

Juan: Use FS = 2.5 when only axial test on sacrificial pile
is performed. If using FS =2.0 then axial test on sacrificial
+ proof test on 5% of production piles should be performed

```
================================================================================

                    LPile for Windows, Version 2019-11.009

                 Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
                          © 1985-2019 by Ensoft, Inc.
                              All Rights Reserved

================================================================================

This copy of LPile is being used by:

Jacobs Engineering
Virginia

Serial Number of Security Device: 419704768

This copy of LPile is licensed for exclusive use by:

CH2M Hill Inc., Global License,

Use of this program by any entity other than CH2M Hill Inc., Global License,
is a violation of the software license agreement.

--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\\ORION\Groups2\Geotechnical\Shared_Projects\New Haven\Process Air Compressor
Project\2021 Design\Analysis\3. Micropile\Lateral Analysis\12x12 grid, new\

Name of input data file:
Micropile Analysis_freepilehead.lp11d

Name of output report file:
Micropile Analysis_freepilehead.lp11o

Name of plot output file:
Micropile Analysis_freepilehead.lp11p

Name of runtime message file:
Micropile Analysis_freepilehead.lp11r



--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------
```

Date: September 5, 2021   Time: 9:27:15

Problem Title

Project Name: New Haven PACS

Job Number: E2X90000

Client: GNHWPCA

Engineer: Jacobs

Description: Micropile Lateral Analysis

Program Options and Settings

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	500
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)

- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Input of side resistance moment along pile not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 2
Total length of pile = 70.000 ft
Depth of ground surface below top of pile = 0.0000 ft

Pile diameters used for p-y curve computations are defined using 4 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	10.5140
2	60.000	10.5140
3	60.000	10.5140
4	70.000	10.5140

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a drilled shaft with permanent casing
Length of section = 60.000000 ft
Casing outside diameter = 10.514000 in

```
   Shear capacity of section                            =      0.0000 lbs

Pile Section No. 2:

   Section 2 is a round drilled shaft, bored pile, or CIDH pile
   Length of section                                    =   10.000000 ft
   Shaft Diameter                                       =   10.514000 in
   Shear capacity of section                            =      0.0000 lbs



--------------------------------------------------------------------------------
                       Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                      =       0.000 degrees
                                                        =       0.000 radians

Pile Batter Angle                                       =       0.000 degrees
                                                        =       0.000 radians


--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 8 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer            =      0.0000 ft
   Distance from top of pile to bottom of layer         =    7.000000 ft
   Effective unit weight at top of layer                =   52.600000 pcf
   Effective unit weight at bottom of layer             =   52.600000 pcf
   Friction angle at top of layer                       =   29.000000 deg.
   Friction angle at bottom of layer                    =   29.000000 deg.
   Subgrade k at top of layer                           =   30.000000 pci
   Subgrade k at bottom of layer                        =   30.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer            =    7.000000 ft
   Distance from top of pile to bottom of layer         =   15.000000 ft
   Effective unit weight at top of layer                =   67.600000 pcf
   Effective unit weight at bottom of layer             =   67.600000 pcf
   Friction angle at top of layer                       =   34.000000 deg.
   Friction angle at bottom of layer                    =   34.000000 deg.
   Subgrade k at top of layer                           =  100.000000 pci
   Subgrade k at bottom of layer                        =  100.000000 pci
```

```
Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    15.000000 ft
   Distance from top of pile to bottom of layer       =    24.000000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Friction angle at top of layer                     =    31.000000 deg.
   Friction angle at bottom of layer                  =    31.000000 deg.
   Subgrade k at top of layer                         =    45.000000 pci
   Subgrade k at bottom of layer                      =    45.000000 pci


Layer 4 is stiff clay without free water

   Distance from top of pile to top of layer          =    24.000000 ft
   Distance from top of pile to bottom of layer       =    31.000000 ft
   Effective unit weight at top of layer              =    62.600000 pcf
   Effective unit weight at bottom of layer           =    62.600000 pcf
   Undrained cohesion at top of layer                 =        1200. psf
   Undrained cohesion at bottom of layer              =        1200. psf
   Epsilon-50 at top of layer                         =     0.007000
   Epsilon-50 at bottom of layer                      =     0.007000


Layer 5 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer          =    31.000000 ft
   Distance from top of pile to bottom of layer       =    45.000000 ft
   Effective unit weight at top of layer              =    57.600000 pcf
   Effective unit weight at bottom of layer           =    57.600000 pcf
   Undrained cohesion at top of layer                 =   500.000000 psf
   Undrained cohesion at bottom of layer              =   500.000000 psf
   Epsilon-50 at top of layer                         =     0.010000
   Epsilon-50 at bottom of layer                      =     0.010000


Layer 6 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer          =    45.000000 ft
   Distance from top of pile to bottom of layer       =    60.000000 ft
   Effective unit weight at top of layer              =    72.600000 pcf
   Effective unit weight at bottom of layer           =    72.600000 pcf
   Friction angle at top of layer                     =    35.000000 deg.
   Friction angle at bottom of layer                  =    35.000000 deg.
   Subgrade k at top of layer                         =   140.000000 pci
   Subgrade k at bottom of layer                      =   140.000000 pci


Layer 7 is sand, p-y criteria by Reese et al., 1974
```

Distance from top of pile to top of layer = 60.000000 ft
Distance from top of pile to bottom of layer = 65.000000 ft
Effective unit weight at top of layer = 77.600000 pcf
Effective unit weight at bottom of layer = 77.600000 pcf
Friction angle at top of layer = 37.000000 deg.
Friction angle at bottom of layer = 37.000000 deg.
Subgrade k at top of layer = 160.000000 pci
Subgrade k at bottom of layer = 160.000000 pci

Layer 8 is weak rock, p-y criteria by Reese, 1997

Distance from top of pile to top of layer = 65.000000 ft
Distance from top of pile to bottom of layer = 100.000000 ft
Effective unit weight at top of layer = 87.600000 pcf
Effective unit weight at bottom of layer = 87.600000 pcf
Uniaxial compressive strength at top of layer = 500.000000 psi
Uniaxial compressive strength at bottom of layer = 500.000000 psi
Initial modulus of rock at top of layer = 80000. psi
Initial modulus of rock at bottom of layer = 80000. psi
RQD of rock at top of layer = 35.000000 %
RQD of rock at bottom of layer = 35.000000 %
k rm of rock at top of layer = 0.0005000
k rm of rock at bottom of layer = 0.0005000

(Depth of the lowest soil layer extends 30.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Cohesion psf	Angle of Friction deg.	Uniaxial qu psi	RQD %	E50 or krm	kpy pci	Rock Mass Modulus psi
1	Sand	0.00	52.6000	--	29.0000	--	--	--	30.0000	--
	(Reese, et al.)	7.0000	52.6000	--	29.0000	--	--	--	30.0000	--
2	Sand	7.0000	67.6000	--	34.0000	--	--	--	100.0000	--
	(Reese, et al.)	15.0000	67.6000	--	34.0000	--	--	--	100.0000	--

```
  3           Sand              15.0000      57.6000       --          31.0000
 --          --           --          45.0000       --
         (Reese, et al.)       24.0000      57.6000       --          31.0000
 --          --           --          45.0000       --
  4         Stiff Clay         24.0000      62.6000       1200.       --
 --          --          0.00700       --            --
         w/o Free Water        31.0000      62.6000       1200.       --
 --          --          0.00700       --            --
  5           Soft             31.0000      57.6000    500.0000       --
 --          --          0.01000       --            --
              Clay             45.0000      57.6000    500.0000       --
 --          --          0.01000       --            --
  6           Sand             45.0000      72.6000       --          35.0000
 --          --           --         140.0000       --
         (Reese, et al.)       60.0000      72.6000       --          35.0000
 --          --           --         140.0000       --
  7           Sand             60.0000      77.6000       --          37.0000
 --          --           --         160.0000       --
         (Reese, et al.)       65.0000      77.6000       --          37.0000
 --          --           --         160.0000       --
  8           Weak             65.0000      87.6000       --          --
500.0000      35.0000     5.00E-04       --           80000.
              Rock            100.0000      87.6000       --          --
500.0000      35.0000     5.00E-04       --           80000.
```

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

```
Load    Load        Condition              Condition           Axial Thrust
Compute Top y    Run Analysis
 No.    Type           1                       2                 Force, lbs
vs. Pile Length
-----   ----   --------------------   ----------------------   ----------------
---------------    ------------
   1     2     V =       12400. lbs   S =       0.0000 in/in          206000.
    No               Yes
```

V = shear force applied normal to pile axis
M = bending moment applied to pile head

```
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.



--------------------------------------------------------------------------------
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 2

Pile Section No. 1:
-------------------

Dimensions and Properties of Drilled Shaft (Bored Pile) with Permanent Casing:
------------------------------------------------------------------------------

Length of Section                                      =    60.000000 ft
Outer Diameter of Casing                               =    10.514000 in
Concrete Cover Thickness Inside Casing                 =     4.070000 in
Casing Wall Thickness                                  =     0.477000 in
Moment of Inertia of Steel Casing                      =   189.832167 in^4
Yield Stress of Casing                                 =       80000. psi
Elastic Modulus of Casing                              =    29000000. psi
Number of Reinforcing Bars                             =            1 bar
Area of Single Reinforcing Bar                         =     1.577711 sq. in.
Edge-to-Edge Bar Spacing                               =    -1.417323 in
Maximum Concrete Aggregate Size                        =    0.0010000 in
Ratio of Bar Spacing to Aggregate Size                 =     -1417.32
Offset of Center of Rebar Cage from Center of Pile     =       0.0000 in
Yield Stress of Reinforcing Bars                       =      150000. psi
Modulus of Elasticity of Reinforcing Bars              =    29000000. psi
Gross Area of Pile                                     =    86.821209 sq. in.
Area of Concrete                                       =    70.202655 sq. in.
Cross-sectional Area of Steel Casing                   =    15.040843 sq. in.
Area of All Steel (Casing and Bars)                    =    16.618554 sq. in.
Area Ratio of All Steel to Gross Area of Pile          =        19.14 percent

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As    =     1678.613 kips
Tensile Load for Cracking of Concrete                  =      -84.799 kips
Nominal Axial Tensile Capacity                         =    -1439.924 kips
```

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.417323	1.577711	0.00000	0.00000

NOTE: The positions of the above rebars were computed by LPile

Concrete Properties:

Compressive Strength of Concrete	=	4000. psi
Modulus of Elasticity of Concrete	=	3604997. psi
Modulus of Rupture of Concrete	=	-474.341649 psi
Compression Strain at Peak Stress	=	0.001886
Tensile Strain at Fracture of Concrete	=	-0.0001154
Maximum Coarse Aggregate Size	=	0.0010000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	206.000

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 206.000 kips

Bending Bending Bending Depth to Max Comp Max Tens

Curvature rad/in.	Moment in-kip	Stiffness kip-in2	N Axis in	Max Conc Strain in/in	Max Steel Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Max Casing Stress ksi	Run Msg
0.00000125	8.7487443	6998995.	222.6039235	0.0002783	0.0002651	1.0928457	7.9035996	8.0674866	
0.00000250	17.4974819	6998993.	113.9316344	0.0002848	0.0002585	1.1163306	7.9284582	8.2562322	
0.00000375	26.2462060	6998988.	77.7080592	0.0002914	0.0002520	1.1397273	7.9533735	8.4450345	
0.00000500	34.9949097	6998982.	59.5966625	0.0002980	0.0002454	1.1630357	7.9783455	8.6338934	
0.00000625	43.7435865	6998974.	48.7301372	0.0003046	0.0002389	1.1862556	8.0033742	8.8228091	
0.00000750	52.4922295	6998964.	41.4860476	0.0003111	0.0002323	1.2093871	8.0284595	9.0117814	
0.00000875	61.2408320	6998952.	36.3119212	0.0003177	0.0002257	1.2324300	8.0536016	9.2008104	
0.00001000	69.9893872	6998939.	32.4315219	0.0003243	0.0002192	1.2553842	8.0788003	9.3898961	
0.00001125	78.7378884	6998923.	29.4136073	0.0003309	0.0002126	1.2782497	8.1040557	9.5790384	
0.00001250	87.4863287	6998906.	26.9994320	0.0003375	0.0002061	1.3010263	8.1293677	9.7682375	
0.00001375	96.2347015	6998887.	25.0243397	0.0003441	0.0001995	1.3237140	8.1547365	9.9574932	
0.00001500	104.9830000	6998867.	23.3785599	0.0003507	0.0001930	1.3463127	8.1801619	10.1468056	
0.00001625	113.7312175	6998844.	21.9860972	0.0003573	0.0001864	1.3688223	8.2056440	10.3361747	
0.00001750	122.4793471	6998820.	20.7926694	0.0003639	0.0001799	1.3912428	8.2311828	10.5256005	
0.00001875	131.2273822	6998794.	19.7584696	0.0003705	0.0001733	1.4135739	8.2567783	10.7150830	
0.00002000	139.9753159	6998766.	18.8536425	0.0003771	0.0001668	1.4358157	8.2824305	10.9046221	
0.00002125	148.7231416	6998736.	18.0553576	0.0003837	0.0001603	1.4579681	8.3081394	11.0942179	
0.00002250	157.4708525	6998705.	17.3458580	0.0003903	0.0001537	1.4800309	8.3339048	11.2838703	
0.00002375	166.2184418	6998671.	16.7111248	0.0003969	0.0001472	1.5020042	8.3597270	11.4735795	
0.00002500	174.9659026	6998636.	16.1399431	0.0004035	0.0001406	1.5238877	8.3856059	11.6633454	
0.00002625	183.7132284	6998599.	15.6232342	0.0004101	0.0001341	1.5456815	8.4115416	11.8531681	
0.00002750	192.4604123	6998560.	15.1535699	0.0004167	0.0001276	1.5673854	8.4375339	12.0430474	

0.00002875	201.2074476	6998520.	14.7248139	0.0004233	0.0001211
1.5889993	8.4635829	12.2329833			
0.00003000	209.9543274	6998478.	14.3318528	0.0004300	0.0001145
1.6105232	8.4896886	12.4229760			
0.00003125	218.7010452	6998433.	13.9703912	0.0004366	0.0001080
1.6319570	8.5158511	12.6130254			
0.00003250	227.4475940	6998388.	13.6367944	0.0004432	0.0001015
1.6533006	8.5420702	12.8031315			
0.00003375	236.1939672	6998340.	13.3279665	0.0004498	0.00009497
1.6745538	8.5683460	12.9932943			
0.00003500	244.9401580	6998290.	13.0412535	0.0004564	0.00008845
1.6957167	8.5946785	13.1835138			
0.00003625	253.6861596	6998239.	12.7743679	0.0004631	0.00008194
1.7167891	8.6210677	13.3737900			
0.00003750	262.4319652	6998186.	12.5253267	0.0004697	0.00007542
1.7377709	8.6475137	13.5641229			
0.00003875	271.1775681	6998131.	12.2924032	0.0004763	0.00006891
1.7586621	8.6740163	13.7545125			
0.00004000	279.9229616	6998074.	12.0740862	0.0004830	0.00006240
1.7794626	8.7005757	13.9449589			
0.00004125	288.6681389	6998015.	11.8690481	0.0004896	0.00005590
1.8001722	8.7271917	14.1354619			
0.00004250	297.4130932	6997955.	11.6761170	0.0004962	0.00004939
1.8207910	8.7538645	14.3260217			
0.00004375	306.1578177	6997893.	11.4942552	0.0005029	0.00004289
1.8413187	8.7805940	14.5166382			
0.00004500	314.9023057	6997829.	11.3225403	0.0005095	0.00003638
1.8617554	8.8073803	14.7073114			
0.00004625	323.6465504	6997763.	11.1601497	0.0005162	0.00002988
1.8821009	8.8342232	14.8980413			
0.00004750	332.3905452	6997696.	11.0063470	0.0005228	0.00002339
1.9023552	8.8611229	15.0888280			
0.00004875	341.1342831	6997626.	10.8604719	0.0005294	0.00001689
1.9225181	8.8880793	15.2796713			
0.00005125	358.6209614	6997482.	10.5901836	0.0005427	0.00000390
1.9625696	8.9421623	15.6615283			
0.00005375	376.1065313	6997331.	10.3451840	0.0005561	-0.00000907
2.0022548	8.9964723	16.0436122			
0.00005625	393.5909388	6997172.	10.1221013	0.0005694	-0.00002204
2.0415728	9.0510093	16.4259231			
0.00005875	411.0741029	6997006.	9.9181375	0.0005827	-0.00003501
2.0805230	9.1057730	16.8084608			
0.00006125	428.5554400	6996824.	9.7309489	0.0005960	-0.00004796
2.1191043	9.1607590	17.1912208			
0.00006375	446.0336417	6996606.	9.5585561	0.0006094	-0.00006091
2.1573149	9.2159562	17.5741919			
0.00006625	463.5072169	6996335.	9.3992771	0.0006227	-0.00007385
2.1951529	9.2713515	17.9573612			
0.00006875	480.9746983	6995996.	9.2516746	0.0006361	-0.00008678
2.2326162	9.3269314	18.3407150			
0.00007125	498.4347441	6995575.	9.1145133	0.0006494	-0.00009971

2.2697032	9.3826830	18.7242406			
0.00007375	515.8861470	6995066.	8.9867258	0.0006628	-0.0001126
2.3064121	9.4385945	19.1079260			
0.00007625	530.0577278	6951577.	8.8534534	0.0006751	-0.0001266
2.3398402	9.4638482	19.4609537 C			
0.00007875	546.5693452	6940563.	8.7381809	0.0006881	-0.0001398
2.3749662	9.5108847	19.8357641 C			
0.00008125	562.9807071	6928993.	8.6296094	0.0007012	-0.0001531
2.4096313	9.5569959	20.2096493 C			
0.00008375	579.2985056	6916997.	8.5271566	0.0007141	-0.0001664
2.4438422	9.6022251	20.5826524 C			
0.00008625	595.5298712	6904694.	8.4303118	0.0007271	-0.0001797
2.4776064	9.6466257	20.9548270 C			
0.00008875	611.6822206	6892194.	8.3386258	0.0007401	-0.0001931
2.5109320	9.6902612	21.3262364 C			
0.00009125	627.7631216	6879596.	8.2517021	0.0007530	-0.0002064
2.5438277	9.7332044	21.6969536 C			
0.00009375	643.7603308	6866777.	8.1690878	0.0007659	-0.0002198
2.5762785	9.7752599	22.0667830 C			
0.00009625	659.6949517	6853974.	8.0905386	0.0007787	-0.0002333
2.6083091	9.8166831	22.4359801 C			
0.00009875	675.5763520	6841280.	8.0157861	0.0007916	-0.0002467
2.6399312	9.8575893	22.8046604 C			
0.0001013	691.4054915	6828696.	7.9445498	0.0008044	-0.0002602
2.6711466	9.8979810	23.1728260 C			
0.0001038	707.1649510	6816048.	7.8764796	0.0008172	-0.0002736
2.7019326	9.9375692	23.5401882 C			
0.0001063	722.8892497	6803664.	7.8115158	0.0008300	-0.0002871
2.7323332	9.9768591	23.9072519 C			
0.0001088	738.5627657	6791382.	7.7493650	0.0008427	-0.0003007
2.7623290	10.0156008	24.2737677 C			
0.0001113	754.1893323	6779230.	7.6898480	0.0008555	-0.0003142
2.7919243	10.0538276	24.6397684 C			
0.0001138	769.7866758	6767355.	7.6328782	0.0008682	-0.0003277
2.8211435	10.0918274	25.0055421 C			
0.0001163	785.3289199	6755518.	7.5781559	0.0008810	-0.0003413
2.8499513	10.1291431	25.3706318 C			
0.0001188	800.8534349	6744029.	7.5257235	0.0008937	-0.0003549
2.8783989	10.1664102	25.7356729 C			
0.0001213	816.3243688	6732572.	7.4752555	0.0009064	-0.0003684
2.9064372	10.2029816	26.1000182 C			
0.0001238	831.7794751	6721450.	7.4268197	0.0009191	-0.0003820
2.9341186	10.2395283	26.4643389 C			
0.0001263	847.1915577	6710428.	7.3801548	0.0009317	-0.0003956
2.9614050	10.2755357	26.8281201 C			
0.0001288	862.5807244	6699656.	7.3352578	0.0009444	-0.0004093
2.9883254	10.3113774	27.1917358 C			
0.0001313	877.9457153	6689110.	7.2920173	0.0009571	-0.0004229
3.0148775	10.3470143	27.5551467 C			
0.0001338	893.2724364	6678672.	7.2502691	0.0009697	-0.0004365
3.0410419	10.3821693	27.9180756 C			

```
 0.0001363   908.5921278     6668566.     7.2100857     0.0009824    -0.0004502
3.0668634    10.4174539    28.2811342 C
 0.0001388   923.8690317     6658516.     7.1711994     0.0009950    -0.0004638
3.0922902    10.4521314    28.6435856 C
 0.0001413   939.1297246     6648706.     7.1336749     0.0010076    -0.0004775
3.1173615    10.4867481    29.0059763 C
 0.0001438   954.3833251     6639188.     7.0974861     0.0010203    -0.0004911
3.1420904    10.5214923    29.3684945 C
 0.0001463   969.5891266     6629669.     7.0623559     0.0010329    -0.0005048
3.1664174    10.5554788    29.7302548 C
 0.0001488   984.7871757     6620418.     7.0284325     0.0010455    -0.0005185
3.1904018    10.5895771    30.0921271 C
 0.0001588         1045.     6585190.     6.9031505     0.0010959    -0.0005732
3.2827607    10.7247146    31.5383604 C
 0.0001688         1106.     6552505.     6.7923326     0.0011462    -0.0006280
3.3694185    10.8579722    32.9827138 C
 0.0001788         1166.     6522100.     6.6936413     0.0011965    -0.0006829
3.4504223    10.9898165    34.4256539 C
 0.0001888         1226.     6493754.     6.6052411     0.0012467    -0.0007378
3.5258138    11.1207508    35.8676840 C
 0.0001988         1285.     6467280.     6.5256720     0.0012970    -0.0007927
3.5956285    11.2513135    37.3093425 C
 0.0002088         1345.     6442512.     6.4537594     0.0013472    -0.0008476
3.6598951    11.3820762    38.7512010 C
 0.0002188         1404.     6419147.     6.3883628     0.0013975    -0.0009025
3.7185891    11.5124655    40.1926862 C
 0.0002288         1463.     6397130.     6.3287556     0.0014477    -0.0009574
3.7717444    11.6433306    41.6346470 C
 0.0002388         1522.     6376321.     6.2742486     0.0014980    -0.0010122
3.8193637    11.7749355    43.0773477 C
 0.0002488         1581.     6356544.     6.2241738     0.0015483    -0.0010671
3.8614282    11.9068993    44.5204073 C
 0.0002588         1640.     6337746.     6.1781094     0.0015986    -0.0011219
3.8979497    12.0399130    45.9645168 C
 0.0002688         1698.     6319828.     6.1356168     0.0016489    -0.0011767
3.9289176    12.1740475    47.4097471 C
 0.0002788         1757.     6302644.     6.0962357     0.0016993    -0.0012315
3.9543092    12.3086878    48.8554832 C
 0.0002888         1815.     6286230.     6.0598159     0.0017498    -0.0012861
3.9741356    12.4452775    50.3031688 C
 0.0002988         1873.     6270424.     6.0259222     0.0018002    -0.0013408
3.9883650    12.5826382    51.7516252 C
 0.0003088         1931.     6255189.     5.9943499     0.0018508    -0.0013954
3.9969897    12.7211253    53.2012081 C
 0.0003188         1989.     6240523.     5.9649740     0.0019013    -0.0014500
3.9999968    12.8616036    54.6527822 C
 0.0003288         2047.     6226362.     5.9375759     0.0019520    -0.0015045
3.9995181    13.0039012    56.1061756 C
 0.0003388         2105.     6212587.     5.9118391     0.0020026    -0.0015590
3.9999227    13.1466241    57.5599943 C
 0.0003488         2162.     6199242.     5.8877794     0.0020534    -0.0016134
```

```
  3.9993453    13.2913828    59.0158488 C
   0.0003588         2219.      6186276.     5.8652633     0.0021042    -0.0016677
  3.9991633    13.4382459    60.4738078 C
   0.0003688         2277.      6173635.     5.8441744     0.0021550    -0.0017220
  3.9994554    13.5873124    61.9339700 C
   0.0003788         2334.      6161265.     5.8243260     0.0022060    -0.0017762
  3.9996030    13.7377721    63.3955255 C
   0.0003888         2390.      6149162.     5.8056343     0.0022569    -0.0018304
  3.9996507    13.8897599    64.8586091 C
   0.0003988         2447.      6137344.     5.7880633     0.0023080    -0.0018845
  3.9996157    14.0438670    66.3238120 C
   0.0004088         2504.      6125806.     5.7715253     0.0023591    -0.0019385
  3.9994859    14.2000269    67.7910677 C
   0.0004188         2560.      6114543.     5.7559401     0.0024103    -0.0019924
  3.9992216    14.3581652    69.2603018 C
   0.0004288         2617.      6103552.     5.7412345     0.0024616    -0.0020463
  3.9987549    14.5182016    70.7314340 C
   0.0004388         2673.      6092825.     5.7273230     0.0025129    -0.0021002
  3.9987977    14.6798112    72.2041394 C
   0.0004488         2729.      6082333.     5.7140975     0.0025642    -0.0021540
  3.9999568    14.8422813    73.6777053 C
   0.0004588         2786.      6072098.     5.7015775     0.0026156    -0.0022077
  3.9996242    15.0064646    75.1529844 C
   0.0004688         2842.      6062122.     5.6897084     0.0026671    -0.0022614
  3.9988189    15.1722355    76.6298511 C
   0.0004788         2898.      6052405.     5.6784428     0.0027186    -0.0023150
  3.9994534    15.3395014    78.1082128 C
   0.0004888         2953.      6042919.     5.6677501     0.0027701    -0.0023686
  3.9997322    15.5083532    79.5881604 C
   0.0004988         3008.      6032054.     5.6581595     0.0028220    -0.0024219
  3.9986714    15.6869433    80.0000000 CY
   0.0005088         3062.      6018129.     5.6502549     0.0028746    -0.0024744
  3.9999982    15.8848426    80.0000000 CY
   0.0005188         3113.      6000222.     5.6443757     0.0029280    -0.0025261
  3.9994653    16.1086334    80.0000000 CY
   0.0005288         3161.      5977868.     5.6406981     0.0029825    -0.0025768
  3.9978821    16.3627710    80.0000000 CY
   0.0005388         3206.      5951025.     5.6392532     0.0030381    -0.0026263
  3.9999022    16.6496575    80.0000000 CY
   0.0005488         3249.      5920524.     5.6397303     0.0030948    -0.0026748
  3.9988543    16.9662915    80.0000000 CY
   0.0006088         3463.      5689161.     5.6598080     0.0034454    -0.0029550
  3.9999097    19.1758236    80.0000000 CY
   0.0006688         3601.      5384226.     5.6686064     0.0037909    -0.0032404
  3.9990558    21.2364644    80.0000000 CY
   0.0007288         3692.      5066550.     5.6683832     0.0041308    -0.0035312
  3.9997211    23.1370873    80.0000000 CY


-------------------------------------------------------------------------------
  Summary of Results for Nominal Moment Capacity for Section 1
```

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	206.000	3175.038	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.75).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318,
or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor	Nominal Ax. Thrust kips	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	206.000000	3175.	133.900000	2064.	6222330.
1	0.75	206.000000	3175.	154.500000	2381.	6151121.
1	0.90	206.000000	3175.	185.400000	2858.	6059359.

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section = 10.000000 ft
Shaft Diameter = 10.514000 in
Concrete Cover Thickness (to edge of long. rebar) = 4.500000 in

```
Number of Reinforcing Bars                              =           1 bar
Yield Stress of Reinforcing Bars                        =     150000. psi
Modulus of Elasticity of Reinforcing Bars               =   29000000. psi
Gross Area of Shaft                                     =   86.821209 sq. in.
Total Area of Reinforcing Steel                         =    1.577711 sq. in.
Area Ratio of Steel Reinforcement                       =        1.82 percent
Edge-to-Edge Bar Spacing                                =   -1.417323 in
Maximum Concrete Aggregate Size                         =   0.0010000 in
Ratio of Bar Spacing to Aggregate Size                  =    -1417.32
Offset of Center of Rebar Cage from Center of Pile      =      0.0000 in

Axial Structural Capacities:
----------------------------

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As    =     526.485 kips
Tensile Load for Cracking of Concrete                   =     -40.732 kips
Nominal Axial Tensile Capacity                          =    -236.657 kips


Reinforcing Bar Dimensions and Positions Used in Computations:

     Bar          Bar Diam.      Bar Area         X              Y
    Number         inches        sq. in.        inches         inches
  ----------     ----------     ----------     ----------     ----------
      1           1.417323       1.577711       0.00000        0.00000


NOTE: The positions of the above rebars were computed by LPile


Concrete Properties:
--------------------

Compressive Strength of Concrete                        =       4000. psi
Modulus of Elasticity of Concrete                       =    3604997. psi
Modulus of Rupture of Concrete                          = -474.341649 psi
Compression Strain at Peak Stress                       =    0.001886
Tensile Strain at Fracture of Concrete                  =  -0.0001154
Maximum Coarse Aggregate Size                           =   0.0010000 in


Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

   Number     Axial Thrust Force
                   kips
   ------     ------------------
      1             206.000


Definitions of Run Messages and Notes:
--------------------------------------
```

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 206.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in	Max Conc Stress ksi	Max Steel Stress ksi	Run Msg
0.00000125	2.1975408	1758033.	474.7080471	0.0005934	0.0005802	2.1206124	17.0423741	
0.00000250	4.3950454	1758018.	239.9868116	0.0006000	0.0005737	2.1395082	17.0674586	
0.00000375	6.5924778	1757994.	161.7483055	0.0006066	0.0005671	2.1583292	17.0927503	
0.00000500	8.7898017	1757960.	122.6304819	0.0006132	0.0005606	2.1770749	17.1182493	
0.00000625	10.9869811	1757917.	99.1609314	0.0006198	0.0005540	2.1957451	17.1439556	
0.00000750	13.1839798	1757864.	83.5155174	0.0006264	0.0005475	2.2143395	17.1698692	
0.00000875	15.3807616	1757801.	72.3410386	0.0006330	0.0005410	2.2328577	17.1959901	
0.00001000	17.5772904	1757729.	63.9608945	0.0006396	0.0005345	2.2512994	17.2223183	
0.00001125	19.7735301	1757647.	57.4436401	0.0006462	0.0005280	2.2696643	17.2488539	
0.00001250	21.9694444	1757556.	52.2304087	0.0006529	0.0005215	2.2879521	17.2755968	
0.00001375	24.1649971	1757454.	47.9655576	0.0006595	0.0005150	2.3061625	17.3025471	
0.00001500	26.3601522	1757343.	44.4119919	0.0006662	0.0005085	2.3242952	17.3297049	
0.00001625	28.5548733	1757223.	41.4055689	0.0006728	0.0005020	2.3423498	17.3570701	

0.00001750 30.7491244 1757093. 38.8290437 0.0006795 0.0004955
2.3603261 17.3846428
0.00001875 32.9428691 1756953. 36.5964369 0.0006862 0.0004890
2.3782237 17.4124231
0.00002000 35.1360713 1756804. 34.6432638 0.0006929 0.0004826
2.3960423 17.4404109
0.00002125 37.3286948 1756644. 32.9202127 0.0006996 0.0004761
2.4137816 17.4686063
0.00002250 39.5207031 1756476. 31.3889300 0.0007063 0.0004697
2.4314412 17.4970094
0.00002375 41.7120602 1756297. 30.0191366 0.0007130 0.0004632
2.4490210 17.5256203
0.00002500 43.9027297 1756109. 28.7866091 0.0007197 0.0004568
2.4665204 17.5544389
0.00002625 46.0926753 1755911. 27.6717381 0.0007264 0.0004504
2.4839393 17.5834653
0.00002750 48.2818607 1755704. 26.6584798 0.0007331 0.0004440
2.5012774 17.6126997
0.00002875 50.4702496 1755487. 25.7335803 0.0007398 0.0004376
2.5185342 17.6421420
0.00003000 52.6578056 1755260. 24.8859948 0.0007466 0.0004312
2.5357095 17.6717923
0.00003125 54.8444924 1755024. 24.1064458 0.0007533 0.0004248
2.5528029 17.7016507
0.00003250 57.0302735 1754778. 23.3870830 0.0007601 0.0004184
2.5698142 17.7317172
0.00003375 59.2151125 1754522. 22.7212190 0.0007668 0.0004120
2.5867431 17.7619920
0.00003500 61.3989731 1754256. 22.1031220 0.0007736 0.0004056
2.6035891 17.7924751
0.00003625 63.5818187 1753981. 21.5278506 0.0007804 0.0003993
2.6203520 17.8231666
0.00003750 65.7636148 1753696. 20.9911224 0.0007872 0.0003929
2.6370315 17.8540655
0.00003875 67.9443210 1753402. 20.4892073 0.0007940 0.0003865
2.6536272 17.8851740
0.00004000 70.1239028 1753098. 20.0188418 0.0008008 0.0003802
2.6701389 17.9164912
0.00004125 72.3023235 1752784. 19.5771578 0.0008076 0.0003739
2.6865663 17.9480172
0.00004250 74.4795467 1752460. 19.1616247 0.0008144 0.0003675
2.7029089 17.9797520
0.00004375 76.6555356 1752127. 18.7700010 0.0008212 0.0003612
2.7191665 18.0116957
0.00004500 78.8302536 1751783. 18.4002943 0.0008280 0.0003549
2.7353388 18.0438484
0.00004625 81.0036641 1751431. 18.0507277 0.0008348 0.0003486
2.7514254 18.0762103
0.00004750 83.1757303 1751068. 17.7197113 0.0008417 0.0003423
2.7674260 18.1087815
0.00004875 85.3464156 1750696. 17.4058181 0.0008485 0.0003360

2.7833403	18.1415619				
0.00005125	89.6834961	1749922.	16.8243903	0.0008623	0.0003234
2.8149088	18.2077514				
0.00005375	94.0146111	1749109.	16.2975869	0.0008760	0.0003109
2.8461282	18.2747797				
0.00005625	98.3394653	1748257.	15.8181253	0.0008898	0.0002984
2.8769959	18.3426478				
0.00005875	102.6577632	1747366.	15.3799625	0.0009036	0.0002859
2.9075095	18.4113568				
0.00006125	106.9692083	1746436.	14.9780421	0.0009174	0.0002734
2.9376662	18.4809077				
0.00006375	111.2735037	1745467.	14.6081009	0.0009313	0.0002610
2.9674635	18.5513017				
0.00006625	115.5703517	1744458.	14.2665192	0.0009452	0.0002486
2.9968987	18.6225399				
0.00006875	119.8594539	1743410.	13.9502038	0.0009591	0.0002362
3.0259694	18.6946237				
0.00007125	124.1405112	1742323.	13.6564959	0.0009730	0.0002239
3.0546728	18.7675542				
0.00007375	128.4132237	1741196.	13.3830970	0.0009870	0.0002116
3.0830063	18.8413329				
0.00007625	132.6772906	1740030.	13.1280100	0.0010010	0.0001993
3.1109672	18.9159612				
0.00007875	136.9324104	1738824.	12.8894917	0.0010150	0.0001871
3.1385530	18.9914404				
0.00008125	141.1782807	1737579.	12.6660132	0.0010291	0.0001749
3.1657610	19.0677721				
0.00008375	145.4145980	1736294.	12.4562283	0.0010432	0.0001627
3.1925886	19.1449578				
0.00008625	149.6410582	1734969.	12.2589470	0.0010573	0.0001505
3.2190329	19.2229992				
0.00008875	153.8573561	1733604.	12.0731132	0.0010715	0.0001384
3.2450915	19.3018979				
0.00009125	158.0631853	1732199.	11.8977867	0.0010857	0.0001263
3.2707615	19.3816556				
0.00009375	162.2582386	1730755.	11.7321275	0.0010999	0.0001142
3.2960403	19.4622741				
0.00009625	166.4422076	1729270.	11.5753831	0.0011141	0.0001022
3.3209252	19.5437551				
0.00009875	170.6147829	1727745.	11.4268770	0.0011284	0.00009015
3.3454135	19.6261007				
0.0001013	174.7756540	1726179.	11.2859995	0.0011427	0.00007816
3.3695024	19.7093127				
0.0001038	178.9245090	1724574.	11.1522000	0.0011570	0.00006621
3.3931891	19.7933931				
0.0001063	183.0610349	1722927.	11.0249794	0.0011714	0.00005429
3.4164710	19.8783440				
0.0001088	187.1849175	1721241.	10.9038848	0.0011858	0.00004240
3.4393453	19.9641674				
0.0001113	191.2958413	1719513.	10.7885037	0.0012002	0.00003054
3.4618091	20.0508656				

0.0001138	195.3934895	1717745.	10.6784602	0.0012147	0.00001871	3.4838598	20.1384408
0.0001163	199.4775438	1715936.	10.5734105	0.0012292	0.00000691	3.5054944	20.2268952
0.0001188	203.5476847	1714086.	10.4730400	0.0012437	-0.00000486	3.5267102	20.3162313
0.0001213	207.6034307	1712193.	10.3770589	0.0012582	-0.00001660	3.5475041	20.4064479
0.0001238	211.6440032	1710255.	10.2851991	0.0012728	-0.00002831	3.5678729	20.4975375
0.0001263	215.6684612	1708265.	10.1972126	0.0012874	-0.00003999	3.5878131	20.5894885
0.0001288	219.6758045	1706220.	10.1128702	0.0013020	-0.00005165	3.6073212	20.6822878
0.0001313	223.6650094	1704114.	10.0319599	0.0013167	-0.00006327	3.6263937	20.7759209
0.0001338	227.6350718	1701944.	9.9542857	0.0013314	-0.00007486	3.6450270	20.8703737
0.0001363	231.5850844	1699707.	9.8796661	0.0013461	-0.00008643	3.6632180	20.9656335
0.0001388	235.5140936	1697399.	9.8079326	0.0013609	-0.00009797	3.6809633	21.0616865
0.0001413	239.4211515	1695017.	9.7389285	0.0013756	-0.0001095	3.6982597	21.1585181
0.0001438	240.3651931	1672106.	9.6555205	0.0013880	-0.0001234	3.7123332	21.1852980 C
0.0001463	243.5997124	1665639.	9.5880635	0.0014023	-0.0001354	3.7281928	21.2676360 C
0.0001488	246.7667918	1658936.	9.5227357	0.0014165	-0.0001475	3.7435806	21.3493777 C
0.0001588	258.6238473	1629127.	9.2796740	0.0014731	-0.0001959	3.8002985	21.6656330 C
0.0001688	269.3668300	1596248.	9.0626337	0.0015293	-0.0002449	3.8495497	21.9682580 C
0.0001788	279.1108216	1561459.	8.8675278	0.0015851	-0.0002943	3.8915457	22.2587003 C
0.0001888	287.9377695	1525498.	8.6910143	0.0016404	-0.0003441	3.9264584	22.5377475 C
0.0001988	295.9334461	1488973.	8.5305030	0.0016954	-0.0003942	3.9544529	22.8066572 C
0.0002088	303.2023257	1452466.	8.3841229	0.0017502	-0.0004446	3.9756871	23.0680139 C
0.0002188	309.8079999	1416265.	8.2501550	0.0018047	-0.0004952	3.9902663	23.3232079 C
0.0002288	315.7581736	1380364.	8.1268226	0.0018590	-0.0005461	3.9982649	23.5712544 C
0.0002388	321.1446488	1345108.	8.0133033	0.0019132	-0.0005970	3.9998701	23.8157149 C
0.0002488	325.9770192	1310460.	7.9086597	0.0019673	-0.0006481	3.9998754	24.0583590 C
0.0002588	330.2869401	1276471.	7.8120619	0.0020214	-0.0006991		

3.9997627	24.3006804 C				
0.0002688	334.1270312	1243263.	7.7227549	0.0020755	-0.0007501
3.9994205	24.5438021 C				
0.0002788	337.5057230	1210783.	7.6397167	0.0021296	-0.0008012
3.9999620	24.7858014 C				
0.0002888	340.4929781	1179196.	7.5625215	0.0021837	-0.0008522
3.9994869	25.0285654 C				
0.0002988	343.1561205	1148640.	7.4908361	0.0022379	-0.0009032
3.9998963	25.2742909 C				
0.0003088	345.5154220	1119078.	7.4240071	0.0022922	-0.0009540
3.9999634	25.5219215 C				
0.0003188	347.5569994	1090375.	7.3612652	0.0023464	-0.0010049
3.9992510	25.7685730 C				
0.0003288	349.4002342	1062814.	7.3030050	0.0024009	-0.0010556
3.9994965	26.0215613 C				
0.0003388	350.9607702	1036047.	7.2478065	0.0024552	-0.0011064
3.9996050	26.2708351 C				
0.0003488	352.3752694	1010395.	7.1965281	0.0025098	-0.0011570
3.9996291	26.5277416 C				
0.0003588	353.5514342	985509.	7.1477343	0.0025642	-0.0012076
3.9995583	26.7807544 C				
0.0003688	354.6181084	961676.	7.1023673	0.0026190	-0.0012580
3.9993899	27.0421132 C				
0.0003788	355.4826662	938568.	7.0590050	0.0026736	-0.0013086
3.9990533	27.2991783 C				
0.0003888	356.2425537	916380.	7.0183863	0.0027284	-0.0013589
3.9986748	27.5620233 C				
0.0003988	356.8843675	895008.	6.9800820	0.0027833	-0.0014091
3.9999788	27.8280729 C				
0.0004088	357.3765300	874316.	6.9434525	0.0028381	-0.0014595
3.9997439	28.0917590 C				
0.0004188	357.7993305	854446.	6.9091084	0.0028932	-0.0015095
3.9991358	28.3619533 C				
0.0004288	358.1323513	835294.	6.8765260	0.0029483	-0.0015596
3.9991571	28.6341323 C				
0.0004388	358.3396613	816729.	6.8452219	0.0030033	-0.0016097
3.9998065	28.9036782 C				
0.0004488	358.4924637	798869.	6.8157520	0.0030586	-0.0016596
3.9989313	29.1789365 C				
0.0004588	358.5963634	781681.	6.7879648	0.0031140	-0.0017093
3.9999944	29.4594898 C				
0.0004688	358.5963634	765006.	6.7610900	0.0031693	-0.0017592
3.9994029	29.7363294 C				
0.0004788	358.5963634	749026.	6.7354414	0.0032246	-0.0018090
3.9986131	30.0146059 C				
0.0004888	358.5963634	733701.	6.7112363	0.0032801	-0.0018586
3.9995812	30.2984654 C				
0.0004988	358.5963634	718990.	6.6883044	0.0033358	-0.0019081
3.9977256	30.5867021 C				
0.0005088	358.5963634	704858.	6.6662342	0.0033914	-0.0019576
3.9995817	30.8743512 C				

0.0005188	358.5963634	691270.	6.6448358	0.0034470	-0.0020071	3.9980221	31.1593052 C
0.0005288	358.5963634	678196.	6.6245648	0.0035027	-0.0020565	3.9993781	31.4491363 C
0.0005388	358.5963634	665608.	6.6052640	0.0035586	-0.0021058	3.9995887	31.7423685 C
0.0005488	358.5963634	653479.	6.5869860	0.0036146	-0.0021549	3.9988932	32.0406807 C
0.0006088	358.5963634	589070.	6.5317589	0.0039762	-0.0024242	3.9969249	34.5690258 C

Summary of Results for Nominal Moment Capacity for Section 2

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	206.000	358.327	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.75).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318,
or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor	Nominal Ax. Thrust kips	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	206.000000	358.327075	133.900000	232.912599	1698927.
1	0.75	206.000000	358.327075	154.500000	268.745306	1598150.

1 0.90 206.000000 358.327075 185.400000 322.494367
1335431.

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.00	0.00	N.A.	No	0.00	12385.
2	7.0000	6.0201	Yes	No	12385.	130087.
3	15.0000	15.2921	Yes	No	142473.	263720.
4	24.0000	46.1507	No	No	406192.	66174.
5	31.0000	122.7005	No	No	472366.	55327.
6	45.0000	21.1800	No	No	527693.	1857765.
7	60.0000	36.2829	Yes	No	2385458.	1062757.
8	65.0000	65.0000	No	Yes	N.A.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 12400.0 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 206000.0 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Deflect. Bending Shear Slope Total Bending Soil
Res. Soil Spr. Distrib.
X y Moment Force S Stress Stiffness p
Es*H Lat. Load

feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/inch	lb/inch	lb/inch
0.00	0.2893	-702557.	12400.	0.00	0.00	6.82E+09	0.00	0.00	0.00
0.7000	0.2857	-597648.	12313.	-8.01E-04	0.00	6.82E+09	-20.7236	609.3583	0.00
1.4000	0.2759	-492928.	12052.	-0.00146	0.00	7.00E+09	-41.4570	1262.	0.00
2.1000	0.2611	-390109.	11639.	-0.00199	0.00	7.00E+09	-56.9180	1831.	0.00
2.8000	0.2423	-290495.	11112.	-0.00240	0.00	7.00E+09	-68.4271	2372.	0.00
3.5000	0.2207	-195107.	10498.	-0.00269	0.00	7.00E+09	-77.7850	2961.	0.00
4.2000	0.1971	-104801.	9769.	-0.00287	0.00	7.00E+09	-95.7938	4083.	0.00
4.9000	0.1724	-21038.	8885.	-0.00295	0.00	7.00E+09	-114.7479	5591.	0.00
5.6000	0.1475	54673.	7845.	-0.00293	0.00	7.00E+09	-132.8126	7563.	0.00
6.3000	0.1232	120899.	6668.	-0.00282	0.00	7.00E+09	-147.5434	10062.	0.00
7.0000	0.1001	176464.	5431.	-0.00265	0.00	7.00E+09	-146.9581	12338.	0.00
7.7000	0.07871	221292.	3989.	-0.00241	0.00	7.00E+09	-196.2860	20948.	0.00
8.4000	0.05960	251811.	2309.	-0.00212	0.00	7.00E+09	-203.7124	28710.	0.00
9.1000	0.04303	267433.	607.3232	-0.00181	0.00	7.00E+09	-201.4504	39322.	0.00
9.8000	0.02916	268285.	-1031.	-0.00149	0.00	7.00E+09	-188.6319	54337.	0.00
10.5000	0.01799	255270.	-2515.	-0.00118	0.00	7.00E+09	-164.6153	76851.	0.00
11.2000	0.00940	230110.	-3737.	-8.85E-04	0.00	7.00E+09	-126.3185	112896.	0.00
11.9000	0.00312	195559.	-4455.	-6.30E-04	0.00	7.00E+09	-44.6204	119952.	0.00
12.6000	-0.00118	157453.	-4567.	-4.18E-04	0.00	7.00E+09	17.8069	127008.	0.00
13.3000	-0.00389	120276.	-4231.	-2.51E-04	0.00	7.00E+09	62.1271	134064.	0.00
14.0000	-0.00540	87234.	-3590.	-1.27E-04	0.00	7.00E+09	90.6369	141120.	0.00
14.7000	-0.00602	60405.	-2763.	-3.79E-05	0.00	7.00E+09	106.1572	148176.	0.00
15.4000	-0.00603	40942.	-2107.	2.29E-05	0.00	7.00E+09	50.1616	69854.	0.00
16.1000	-0.00563	24933.	-1690.	6.24E-05	0.00	7.00E+09			

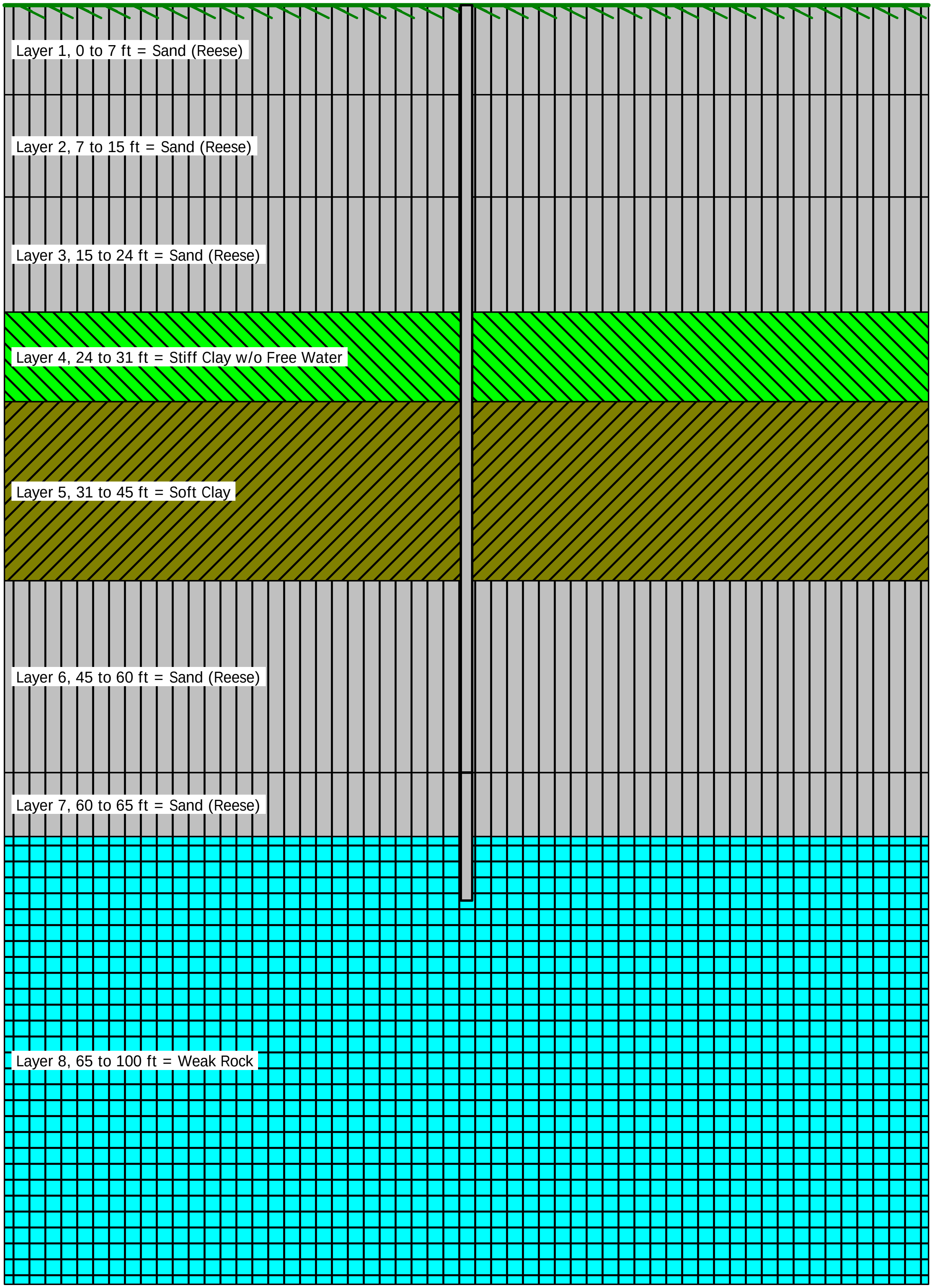
							48.9745	73030.	0.00
16.8000	-0.00498	12327.	-1295.	8.48E-05	0.00	7.00E+09	45.2056	76205.	0.00
17.5000	-0.00421	2886.	-937.9076	9.39E-05	0.00	7.00E+09	39.7708	79380.	0.00
18.2000	-0.00341	-3754.	-630.3193	9.34E-05	0.00	7.00E+09	33.4645	82555.	0.00
18.9000	-0.00264	-8026.	-376.6327	8.63E-05	0.00	7.00E+09	26.9371	85730.	0.00
19.6000	-0.00195	-10381.	-176.6111	7.53E-05	0.00	7.00E+09	20.6872	88906.	0.00
20.3000	-0.00137	-11254.	-26.4446	6.23E-05	0.00	7.00E+09	15.0668	92081.	0.00
21.0000	-9.08E-04	-11041.	80.0723	4.89E-05	0.00	7.00E+09	10.2944	95256.	0.00
21.7000	-5.52E-04	-10078.	150.4974	3.63E-05	0.00	7.00E+09	6.4735	98431.	0.00
22.4000	-2.99E-04	-8638.	192.8604	2.50E-05	0.00	7.00E+09	3.6129	101606.	0.00
23.1000	-1.32E-04	-6925.	214.9511	1.57E-05	0.00	7.00E+09	1.6468	104782.	0.00
23.8000	-3.52E-05	-5081.	223.7649	8.48E-06	0.00	7.00E+09	0.4518	107957.	0.00
24.5000	1.05E-05	-3195.	210.4731	3.52E-06	0.00	7.00E+09	-3.6165	2895867.	0.00
25.2000	2.39E-05	-1557.	160.6418	6.65E-07	0.00	7.00E+09	-8.2481	2895867.	0.00
25.9000	2.17E-05	-498.1643	94.6331	-5.68E-07	0.00	7.00E+09	-7.4682	2895867.	0.00
26.6000	1.44E-05	34.7749	42.4471	-8.46E-07	0.00	7.00E+09	-4.9570	2895867.	0.00
27.3000	7.44E-06	217.8768	10.8481	-6.95E-07	0.00	7.00E+09	-2.5666	2895867.	0.00
28.0000	2.71E-06	219.4276	-3.8520	-4.32E-07	0.00	7.00E+09	-0.9334	2895867.	0.00
28.7000	1.82E-07	154.6597	-8.0366	-2.08E-07	0.00	7.00E+09	-0.06290	2895867.	0.00
29.4000	-7.83E-07	85.1321	-7.1664	-6.39E-08	0.00	7.00E+09	0.2701	2895867.	0.00
30.1000	-8.91E-07	34.4859	-4.7416	7.88E-09	0.00	7.00E+09	0.3072	2895867.	0.00
30.8000	-6.51E-07	5.4456	-2.5084	3.18E-08	0.00	7.00E+09	0.2245	2895867.	0.00
31.5000	-3.56E-07	-7.7660	-0.8939	3.04E-08	0.00	7.00E+09	0.1599	3770261.	0.00
32.2000	-1.40E-07	-9.6779	0.04105	2.00E-08	0.00	7.00E+09	0.06270	3770261.	0.00
32.9000	-2.07E-08	-7.1456	0.3433	9.88E-09	0.00	7.00E+09	0.00928	3770261.	0.00
33.6000	2.63E-08	-3.9438	0.3327	3.23E-09	0.00	7.00E+09	-0.01181	3770261.	0.00

34.3000	3.35E-08	-1.5674	0.2199	-8.02E-11	0.00	7.00E+09	-0.01506	3770261.	0.00
35.0000	2.50E-08	-0.2501	0.1095	-1.17E-09	0.00	7.00E+09	-0.01121	3770261.	0.00
35.7000	1.39E-08	0.2770	0.03631	-1.15E-09	0.00	7.00E+09	-0.00623	3770261.	0.00
36.4000	5.57E-09	0.3640	-3.42E-04	-7.70E-10	0.00	7.00E+09	-0.00250	3770261.	0.00
37.1000	9.37E-10	0.2739	-0.01261	-3.87E-10	0.00	7.00E+09	-4.21E-04	3770261.	0.00
37.8000	-9.36E-10	0.1535	-0.01261	-1.31E-10	0.00	7.00E+09	4.20E-04	3770261.	0.00
38.5000	-1.26E-09	0.06244	-0.00847	-1.25E-12	0.00	7.00E+09	5.66E-04	3770261.	0.00
39.2000	-9.57E-10	0.01118	-0.00429	4.29E-11	0.00	7.00E+09	4.29E-04	3770261.	0.00
39.9000	-5.40E-10	-0.00980	-0.00147	4.38E-11	0.00	7.00E+09	2.42E-04	3770261.	0.00
40.6000	-2.22E-10	-0.01367	-3.46E-05	2.97E-11	0.00	7.00E+09	9.95E-05	3770261.	0.00
41.3000	-4.15E-11	-0.01049	4.62E-04	1.52E-11	0.00	7.00E+09	1.86E-05	3770261.	0.00
42.0000	3.31E-11	-0.00597	4.77E-04	5.29E-12	0.00	7.00E+09	-1.48E-05	3770261.	0.00
42.7000	4.74E-11	-0.00249	3.26E-04	0.00	0.00	7.00E+09	-2.13E-05	3770261.	0.00
43.4000	3.67E-11	-5.01E-04	1.67E-04	-1.57E-12	0.00	7.00E+09	-1.65E-05	3770261.	0.00
44.1000	2.10E-11	3.22E-04	5.80E-05	-1.68E-12	0.00	7.00E+09	-9.42E-06	3770261.	0.00
44.8000	8.49E-12	4.80E-04	2.44E-06	-1.20E-12	0.00	7.00E+09	-3.81E-06	3770261.	0.00
45.5000	0.00	3.67E-04	-1.38E-05	0.00	0.00	7.00E+09	-6.29E-08	642096.	0.00
46.2000	-3.14E-12	2.50E-04	-1.31E-05	0.00	0.00	7.00E+09	2.44E-07	651974.	0.00
46.9000	-4.58E-12	1.49E-04	-1.05E-05	0.00	0.00	7.00E+09	3.61E-07	661853.	0.00
47.6000	-4.52E-12	7.34E-05	-7.49E-06	0.00	0.00	7.00E+09	3.61E-07	671731.	0.00
48.3000	-3.72E-12	2.30E-05	-4.71E-06	0.00	0.00	7.00E+09	3.02E-07	681610.	0.00
49.0000	-2.68E-12	-6.07E-06	-2.51E-06	0.00	0.00	7.00E+09	2.21E-07	691488.	0.00
49.7000	-1.71E-12	-1.96E-05	-9.83E-07	0.00	0.00	7.00E+09	1.43E-07	701366.	0.00
50.4000	0.00	-2.30E-05	-4.92E-08	0.00	0.00	7.00E+09	7.94E-08	711245.	0.00
51.1000	0.00	-2.07E-05	4.27E-07	0.00	0.00	7.00E+09	3.39E-08	721123.	0.00
51.8000	0.00	-1.60E-05	5.91E-07	0.00	0.00	7.00E+09			

5.19E-09	731002.	0.00				
52.5000	0.00	-1.09E-05	5.70E-07	0.00	0.00	7.00E+09
-1.01E-08	740880.	0.00				
53.2000	0.00	-6.44E-06	4.61E-07	0.00	0.00	7.00E+09
-1.60E-08	750758.	0.00				
53.9000	0.00	-3.13E-06	3.26E-07	0.00	0.00	7.00E+09
-1.61E-08	760637.	0.00				
54.6000	0.00	-9.54E-07	2.02E-07	0.00	0.00	7.00E+09
-1.34E-08	770515.	0.00				
55.3000	0.00	2.80E-07	1.05E-07	0.00	0.00	7.00E+09
-9.68E-09	780394.	0.00				
56.0000	0.00	8.32E-07	3.89E-08	0.00	0.00	7.00E+09
-6.14E-09	790272.	0.00				
56.7000	0.00	9.49E-07	-7.39E-10	0.00	0.00	7.00E+09
-3.31E-09	800150.	0.00				
57.4000	0.00	8.30E-07	-2.02E-08	0.00	0.00	7.00E+09
-1.33E-09	810029.	0.00				
58.1000	0.00	6.16E-07	-2.62E-08	0.00	0.00	7.00E+09
-1.12E-10	819907.	0.00				
58.8000	0.00	3.93E-07	-2.45E-08	0.00	0.00	7.00E+09
5.17E-10	829786.	0.00				
59.5000	0.00	2.06E-07	-1.91E-08	0.00	0.00	7.00E+09
7.65E-10	839664.	0.00				
60.2000	0.00	7.21E-08	-1.21E-08	0.00	0.00	1.76E+09
9.23E-10	970906.	0.00				
60.9000	0.00	2.89E-09	-5.51E-09	0.00	0.00	1.76E+09
6.35E-10	982195.	0.00				
61.6000	0.00	-2.15E-08	-1.47E-09	0.00	0.00	1.76E+09
3.27E-10	993485.	0.00				
62.3000	0.00	-2.28E-08	3.82E-10	0.00	0.00	1.76E+09
1.14E-10	1004774.	0.00				
63.0000	0.00	-1.57E-08	8.95E-10	0.00	0.00	1.76E+09
7.71E-12	1016064.	0.00				
63.7000	0.00	-7.96E-09	8.24E-10	0.00	0.00	1.76E+09
-2.44E-11	1027354.	0.00				
64.4000	0.00	-1.88E-09	6.48E-10	0.00	0.00	1.76E+09
-1.77E-11	1038643.	0.00				
65.1000	0.00	2.96E-09	1.32E-10	0.00	0.00	1.76E+09
-1.05E-10	7.74E+07	0.00				
65.8000	0.00	3.66E-10	-1.78E-10	0.00	0.00	1.76E+09
3.11E-11	1.49E+08	0.00				
66.5000	0.00	-3.21E-11	-2.21E-11	0.00	0.00	1.76E+09
6.00E-12	2.21E+08	0.00				
67.2000	0.00	-6.05E-12	1.92E-12	0.00	0.00	1.76E+09
0.00	2.92E+08	0.00				
67.9000	0.00	0.00	0.00	0.00	0.00	1.76E+09
0.00	3.36E+08	0.00				
68.6000	0.00	0.00	0.00	0.00	0.00	1.76E+09
0.00	3.36E+08	0.00				
69.3000	0.00	0.00	0.00	0.00	0.00	1.76E+09
0.00	3.36E+08	0.00				

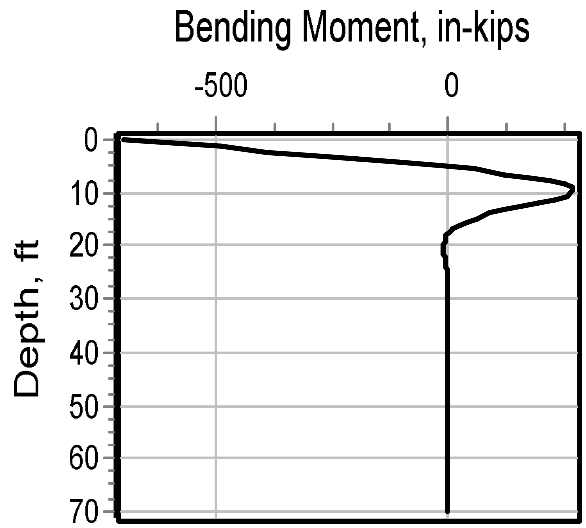
```
   70.0000       0.00       0.00       0.00       0.00       0.00   1.76E+09
0.00   1.68E+08       0.00

* This analysis computed pile response using nonlinear moment-curvature rela-
  tionships. Values of total stress due to combined axial and bending stresses
  are computed only for elastic sections only and do not equal the actual
  stresses in concrete and steel. Stresses in concrete and steel may be inter-
  polated from the output for nonlinear bending properties relative to the
  magnitude of bending moment developed in the pile.


Output Summary for Load Case No. 1:

Pile-head deflection             =     0.28930975 inches
Computed slope at pile head      =       0.000000 radians
Maximum bending moment           =       -702557. inch-lbs
Maximum shear force              =         12400. lbs
Depth of maximum bending moment  =       0.000000 feet below pile head
Depth of maximum shear force     =       0.000000 feet below pile head
Number of iterations             =             11
Number of zero deflection points =             14


--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians


Load Load                Load                Axial    Pile-head  Pile-head  Max
Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation    in
Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians      lbs
     in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  V, lb     12400.   S, rad        0.00    206000.     0.2893       0.00
12400.   -702557.


Maximum pile-head deflection = 0.2893097549 inches
Maximum pile-head rotation   = 0.0000000000 radians = 0.000000 deg.
```

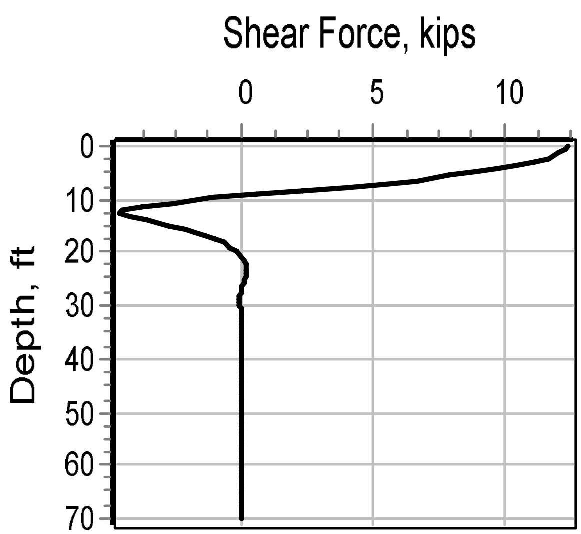
The analysis ended normally.

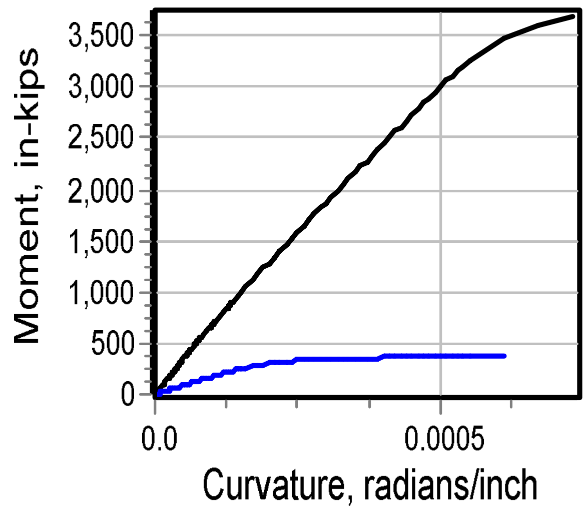


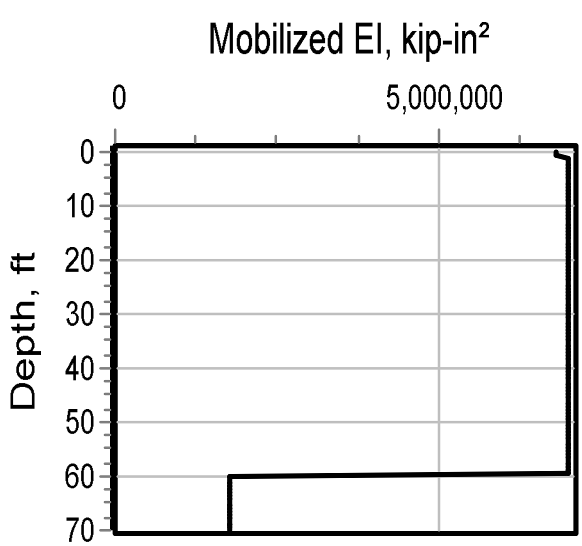
Layer 1, 0 to 7 ft = Sand (Reese)
Layer 2, 7 to 15 ft = Sand (Reese)
Layer 3, 15 to 24 ft = Sand (Reese)
Layer 4, 24 to 31 ft = Stiff Clay w/o Free Water
Layer 5, 31 to 45 ft = Soft Clay
Layer 6, 45 to 60 ft = Sand (Reese)
Layer 7, 60 to 65 ft = Sand (Reese)
Layer 8, 65 to 100 ft = Weak Rock

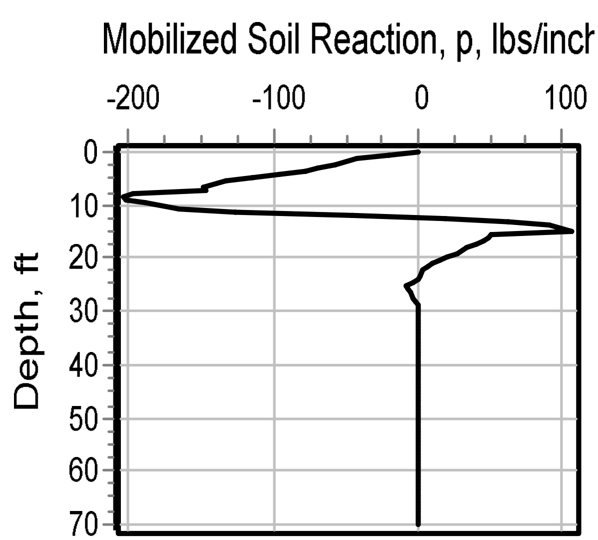

Deflection, inches
0
0.1
0.2
Depth, ft
0
10
20
30
40
50
60
70


Bending Moment, in-kips
-500
0
Depth, ft
0
10
20
30
40
50
60
70


Shear Force, kips
0
5
10
Depth, ft
0
10
20
30
40
50
60
70


Moment, in-kips
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0.0
0.0005
Curvature, radians/inch


Mobilized EI, kip-in²
0
5,000,000
Depth, ft
0
10
20
30
40
50
60
70


Mobilized Soil Reaction, p, lbs/inch
-200
-100
0
100
Depth, ft
0
10
20
30
40
50
60
70

Attachment E

GEOTECHNICAL ENGINEERING AND ENVIRONMENTAL REPORT WET WEATHER CAPACITY IMPROVMENETS – PHASE 1 EAST SHORE WATER POLLUTION ABATEMENT FACILITY NEW HAVEN, CONNECTICUT

by

Haley & Aldrich, Inc.
Rocky Hill, Connecticut

for

CH2M Hill
Wethersfield, Connecticut

File No. 37176-000
4 September 2012

HALEY & ALDRICH

Haley & Aldrich, Inc.
100 Corporate Place
Suite 105
Rocky Hill, CT 06067

Tel: 860.282.9400
Fax: 860.721.0612
HaleyAldrich.com

HALEY & ALDRICH

Revised 4 September 2012
22 June 2012
File No. 37176-000

CH2M HILL
119 Cherry Hill Road Suite 300
Parsippany, NJ 07054

Attention: Mr. Eric Muir, P.E.

Subject: Geotechnical Engineering and Environmental Report
Wet Weather Capacity Improvements and Nitrogen Reduction – Phase 1
East Shore Water Pollution Abatement Facility
Greater New Haven Water Pollution Control Authority (GNHWPCA)
New Haven, Connecticut

Refer to set of drawing named *"407000_WWCI and Nitrogen Reduction Record Drawings"*

Ladies and Gentlemen:

This report presents the results of our geotechnical engineering studies for the proposed Wet Weather Capacity Improvements at the East Shore Water Pollution Abatement Facility in New Haven, Connecticut. Our work was performed in accordance with our Agreement dated 8 March 2012.

In summary, we recommend structures be supported on spread footings on natural glaciodeltaic sand, or compacted granular fill after over-excavation of unsuitable fill and organic soils, or on the existing fill after improvement with aggregate piers, or on timber piles. Utility pipes may be soil-supported on 1 ft of compacted granular fill. Premium geotechnical costs will be associated with over-excavation of fill, aggregate piers or timber piles, and dewatering.

The existing fill at the proposed methanol building, odor control facilities area, and storage tank is environmentally-impacted. Some portions of the natural soils are also environmentally-impacted while other portions are not. Additional environmental testing may be necessary, depending on the proposed disposal location. There will be premium costs associated with disposal of environmentally-impacted soils if off-site disposal is planned.

Detailed geotechnical design recommendations are included in Section 5, environmental evaluation in Section 6, and construction considerations are in Section 7. Please call if you have any questions or require additional information.

Sincerely yours,
HALEY & ALDRICH, INC.

Chris G. Harriman, L.E.P.
Vice President

Thomas W. Nolan, P.E.
Vice President

Enclosures

G:\37176_GNHWPCA Elec Infrastructure\000\Deliverables\Final Report\2012-0904-HAI GNHWPCA ESWTP-F.doc

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 General

This report presents geotechnical engineering recommendations for foundation design and construction for the Wet Weather Capacity Improvements and Nitrogen Reduction – Phase 1 at the East Shore Water Pollution Abatement Facility in New Haven, Connecticut. The project locus is shown on Figure 1. The project owner is GNHWPCA of New Haven, Connecticut. The design engineer is CH2M Hill, Wethersfield, Connecticut.

1.2 Purpose and Scope

This investigation was undertaken to obtain information on subsurface conditions and to provide geotechnical and environmental recommendations.

The scope of our geotechnical engineering services included:

- review existing subsurface information
- plan and monitor a subsurface exploration program
- perform geotechnical engineering analysis and make recommendations for foundation type, design and construction
- prepare the geotechnical engineering sections of this report.

The environmental component of our work scope, which was integrated with our geotechnical services, included:

- plan and monitor a soil pre-characterization (chemical testing) program to assess options for on-site reuse and off-site disposition of excavated soils
- perform chemical testing on representative soil samples
- prepare the environmental section of this report.

1.3 Elevation Datum

Elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD88).

1.4 Limitations

This report has been prepared for specific application to the project. In the event that changes in the nature, design, or location of structures are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing. The analyses and recommendations submitted in this report are based in part upon data obtained from referenced explorations. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

The planned construction will be supported on or in the soil or rock at the site and below-grade structures will be close to or penetrate the design groundwater level for the project. Any recommendations presented in this report for foundation and floor drainage, moisture protection and waterproofing address only the conventional geotechnical engineering related aspects of design and construction and are not intended to provide an environment that would prohibit infestation of mold or other biological pollutants. Our work scope did not include the development of criteria or procedures to minimize the risk of mold or other biological pollutant infestations in or near any structure.

This report is prepared for the exclusive use of the project team in connection with the environmental and geotechnical aspects of the project.

2. PROPOSED CONSTRUCTION

The project consists of several new structures and utilities at the East Shore Water Pollution Abatement Facility (ESWPAF) as shown on Figure 2. Proposed construction includes:

- Methanol Storage Building

Closest one to our proposed Process Air Compresor

- Electric Building
- Standby Emergency Power Generators
- Distribution Conduits
- Odor Control Scrubber Pad
- Sludge Storage Tank
- Buffering (sound wall or soil berm)

Details of proposed structures are provided on the Structure Summary Sheets in Appendix D.

3. EXISTING STRUCTURES

There are several structures at the plant near the proposed construction including:

- Administration Building (Headworks)
- Gravity Thickeners and Sludge Storage Tank
- Inlet Works
- Primary Clarifiers
- Odor Control Scrubbers
- Aeration Basins
- Chlorine Contact Tanks
- Yard Piping

We reviewed drawings associated with previous additions and upgrades at the ESWPAF, including:

- "Sewage Disposal Project for East Shore District, Contract No. 2 Settling and Digestion Tanks – Control Chamber" drawings prepared by the City of New Haven Connecticut Bureau of Engineering, dated March 1949.
- "East Shore Water Pollution Abatement Project, Contract No. 1 Wastewater Treatment Plant" drawings prepared by Camp Dresser & McKee, dated July 1975.
- "Boulevard-East Street Water Pollution Abatement Project, East Shore S.T.P. Modifications" drawings prepared by CE Maguire, Inc., dated November 1985.
- "Odor Control Improvements, East Shore Water Pollution Abatement Facility" drawings prepared by CH2M HILL, dated November 1996.

General information about the structures that are near the proposed upgrades is discussed on the Structure Summary Sheets in Appendix D.

4. FIELD AND LABORATORY INVESTIGATIONS

4.1 Site Conditions

Locations of the proposed structures are shown on Figure 2. Site conditions consist of wastewater treatment plant structures surrounded by paved and gravel surfaces, grass and landscaped areas. There are woods and wetlands to the east of the primary settling tanks. Ground surface elevations range from approximately El. 12 at the proposed storage tank, approximately El. 14 near the proposed odor control, emergency generators, and electric building, and approximately El. 11 to 12 at the proposed methanol building.

Beyond the eastern fence line of the main plant, grade slopes down to a wetland area at approximately El. 6 and is relatively level at El. 6 to 7 in the area of the proposed buffer, which is planned further east of the fence line.

4.2 Recent Test Borings

The test boring program consisting of eight borings (HA-1 through HA-7 and HA-9) which were drilled between 18 and 21 May 2012 by General Borings, Inc., of Prospect, Connecticut. Boring HA-8 was not performed at the request of GNHWPCA. The borings were advanced using hollow stem augers to depths of 21.7 to 42 ft below ground surface. Standard penetration tests were performed at maximum 5 ft intervals. Six of the borings were terminated at refusal on bedrock at 21.7 to 42 ft below ground surface. Test boring locations are shown on Figure 2 and logs are presented in Appendix A.

4.3 Previous Test Borings

Test borings and test pits were performed for previous projects at the site in 1972. Test boring locations are shown on Figure 2 and the logs are presented in Appendix A.

4.4 Subsurface Conditions

Subsurface conditions consist of fill, organic deposits, and glacial deltaic sand and silt over sandstone bedrock at a depth of about 18 to 55 ft. Soils encountered are described below in order of increasing depth below ground surface. Strata thicknesses are summarized on Table I.

Strata Thickness (ft)	Generalized Description
3.5 to 19.5	FILL - Loose to dense brown, dark brown, gray brown, silty SAND with varying amounts of gravel, coal, asphalt, slag, and brick fragments. Portions of the fill consist of soft gray SILT with varying amounts of clay, organics and shells.
2 to 5	ORGANIC DEPOSITS – Very soft to soft brown and black interbedded SILT and CLAY with organics or medium dense brown medium to fine SAND little silt with organics. An approximately 1 ft thick layer of stiff brown fibrous PEAT was encountered at 13 ft at HA-2.

13 to 45	GLACIODELTAIC SAND AND SILT – Medium dense brown medium to fine SAND, little silt, trace gravel with zones of fine sandy SILT, trace clay.
---	SANDSTONE BEDROCK – The upper few feet of bedrock is weathered in some areas.

Detailed soil and rock conditions are included on the test boring and test pit logs in Appendix A.

4.5 Groundwater Conditions

Groundwater level in the borings generally ranged from about El. 10.2 to -4.0, about 5 to 20 ft below the ground surface. Groundwater levels at test borings are summarized in Table I. An observation well was installed at HA-5. The installation report and water level data are included in Appendix B. Water levels are expected to be higher in the spring and during times of above normal precipitation. Groundwater levels will fluctuate with season, precipitation, and nearby construction activity.

We understand the 100 year flood is El. 10.

4.6 Corrosion Testing

SJB Services of Henrietta, New York and Complete Environmental Testing of Stratford, Connecticut, tested for corrosivity parameters in soil samples collected from borings. Three composite samples were submitted for testing. Testing parameters included DIPRA analyses (pH, electrical resistivity, reactive sulfide, and redox), water soluble sulfates (EPA 300), and chloride ion (EPA 300). Test results are provided in Appendix C.

5. GEOTECHNICAL ENGINEERING RECOMMENDATIONS

Our recommendations for foundation design and construction are presented for each proposed structure in Appendix D. The basis for the recommendation is a maximum allowable total settlement of the new structures of 1 in., and maximum allowable differential settlement between the new and existing structures of ½ in.

The existing fill and organic soils are not suitable to support the structures on spread footings or mat foundations. Accordingly, we recommend the structures be supported on spread footings bearing on natural sand deposits or on compacted granular fill after overexcavation of unsuitable fill and organic soil. To avoid overexcavation, the existing soils could be improved with aggregate piers or foundations could be supported on driven timber piles.

Assuming the overexcavated soils can be reused on site, we anticipate overexcavation and replacement with compacted granular fill will be the least expensive option where the thickness of unsuitable material is 10 ft or less. Where the thickness of unsuitable material is greater than 10 ft, we believe timber piles or footings on aggregate pier improved soil will be least expensive. If soils will be disposed of off-site, there will be premium costs because they are typically environmentally impacted, and this will make the timber pile or aggregate pier options more cost effective at shallower overexcavation depths. Also, if the timber piles or Aggregate Piers are planned in certain areas, they will be more cost effective in the other areas due to the economy of scale and spreading out of the mobilization costs.

5.1 Foundation Type

Based on discussions with CH2M Hill, we understand that excess excavated soil will need to be disposed of offsite. Accordingly, we anticipate the following foundation types for the various structures:

- Methanol Storage Building – Timber piles or Aggregate Piers

Closest one to our proposed Process Air Compresor

- Electric Building – Timber piles or Aggregate Piers
- Standby Emergency Power Generators – Timber piles or Aggregate Piers
- Odor Control Structure– Timber piles or Aggregate Piers
- Sludge Storage Tank – Spread footings or mat.

5.2 Spread Footing or Mat Foundations

Refer to the Structure Summary Sheets in Appendix D for specific design recommendations. General recommendations follow.

- Allowable footing bearing pressures may be increased by 1/3 for transient loading conditions.
- Design for a minimum footing width of 18 in.
- Remove unsuitable material below footings and replace with compacted granular fill to the limits shown on Figure 4.

- Design footings to bear a minimum 3.5 ft below proposed exterior grade, for frost protection.

- Locate footings to bear below a 2H:1V slope from the bottom of new or existing utility pipes, pits, or other planned localized excavations.

- Where practical, locate new footings to bear at the same level as existing adjacent footings.

- Where new footings will be at a higher level than existing footings to remain, locate new footings below a 2H:1V zone extending upward from existing footings.

- Where new footings are planned at a level lower than existing footings, locate new footings above a 2H:1V zone extending downward from existing footings or provide excavation support or underpinning of existing footings.

5.3 Aggregate Piers

Aggregate Piers are installed by a specialty contractor by vibrating or driving a probe into the soil to the desired depth of improvement, then compacting processed aggregate within the hole in lifts using the probe. The final product is a dense aggregate pier, surrounded by densified soil. The specialty contractor will perform the actual design, which will be confirmed with a load test during construction. Another variety of Aggregate Pier consists of using augers and a beveled tamper, but this system does not appear feasible here due to the high groundwater level.

Installation of aggregate piers will generate ground vibrations. The ground improvement specification should limit maximum allowable peak particle velocities generated at adjacent structures and utilities, and vibrations should be monitored during construction.

5.4 Piles

Driven timber piles are another option. Design criteria are as follows:

- Compression Capacity:
  Total = 25 tons
  Downdrag = 5 tons
  Net = 20 tons

- Uplift Capacity: 10 kips soil resistance (structural engineer to check connection and tensile strength of the wood)

- Lateral Capacity: 1.2 kip, free head, ¼ in. deflection.

  The group lateral pile capacity is as follows: $P_T = (n)(P_i)C_r$

  P_T = Total Lateral Capacity of Cap
  n = Number of Piles in Cap
  P_i = Lateral Capacity of Individual Pile
  Cr = Group Capacity Reduction Factor (see below)

Number of Piles in Cap	Group Capacity Reduction Factor	
	Perpendicular to Long Dimension of Pile Cap	Parallel to Long Dimension of Pile Cap
2	1.0	0.72
3	0.81	0.81
4	0.72	0.72
5	0.66	0.66
6	0.72	0.63
7	0.66	0.60
8	0.65	0.60

Spacing: Minimum center-to-center pile spacing = 30 in.

If possible, the piles should be located at least 5 ft away from existing active pipes (that are in good condition) to reduce risk of damaging the utility during pile driving. If that is not possible or it is concluded that the risk of damage to the pipe is high because of its condition, drilled piles can be used close to the existing pipes. Assume 6.625 in. dia. drilled piles with a capacity of 40 tons (could go higher if there is a pile load test) with 5 ft long rock socket.

5.5 Hydrostatic Uplift

Tanks should be designed to resist hydrostatic uplift pressure when the tank is empty (such as may be the condition during maintenance). Uplift resistance may be provided by the following:

- Dead weight of the structure
- The weight of soil above the projection of the mat foundation
- Tiedown anchors
- The uplift capacity of the piles.

5.5.1 Seismic Site Class

The seismic design criteria are provided in Appendix D.

5.5.2 Floor Slabs

Floor slab recommendations for individual structures are provided in Appendix D. General recommendations are as follows:

- Backfill excavations below slabs-on-grade, such as those for foundations and utilities, with compacted granular fill.
- Existing topsoil, fill, and organic deposits should be removed below proposed slabs-on-grade (practically, much of it will be removed during the footing overexcavation). For Aggregate Pier option, overexcavation will not be required provided the aggregate piers are designed to support the slab. For structural slabs (such as would be used for the Pile Foundation option), overexcavation will not be required.

5.6 Corrosion

The laboratory test results indicate that the soils at HA-2 are corrosive to buried steel. The corrosive soils consist of the existing fill. Sulfate concentrations are relatively low, thus the exposure to sulfate attack on concrete is mild, and Type I cement may be used in the concrete.

5.7 Backfill Materials

5.7.1 Compacted Granular Fill

Compacted granular fill is recommended to backfill below foundation, and slabs, and against tank walls.

Granular fill should be placed in maximum 12-in. thick lifts and compacted to at least 95 percent of the maximum dry density determined by ASTM D1557. In confined areas, use maximum 6-in. thick lifts. Compaction equipment in confined areas may consist of hand-guided vibratory equipment or mechanical tampers.

Granular fill should consist of primarily of sand and gravel, and shall be free of organic material, environmentally-impacted material, snow, ice, frozen soil, or other unsuitable material, and be well-graded within the following limits:

U.S. Standard Sieve Size	Percent Finer by Weight
6 in. *	100
No. 4	30-80
No. 40	10-50
No. 200	0-8

* use a maximum 3-in. size for fill placed within 6 in. of concrete slabs or footings

5.7.2 Common Fill

Common fill may be used for raising grades below pavement and sidewalk sections and landscaped areas. Common fill should consist of mineral soil, free of clay, organic soils, deleterious material, and particles larger than 10 in. in size, which can be spread and compacted.

5.7.3 Crushed Stone

Crushed stone may be used as a bearing pad for foundation below groundwater level. It should consist of No. 6 crushed stone (3/4-in. size) in accordance with Connecticut Department of Transportation Form 816, M.01.01. Crushed stone should be separated from surrounding soil using a geotextile filter.

5.7.4 Geotextile Filter

A filtration-type geotextile is recommended between crushed stone and surrounding soil. It should consist of Mirafi Construction Products 140N, ConTech C46NW, Propex Geotex 401, or equivalent.

5.8 Compaction

Recommended compaction requirements are as follow:

Location	Minimum Compaction Requirements
Beneath and around footings, under slabs	95%
Parking, roadways and sidewalks	92% up to 3 ft below finished grade 95% in the upper 3 ft
Landscaped areas	90%

Minimum compaction requirements refer to percentages of the maximum dry density determined in accordance with ASTM D1557C.

5.9 Use of On-Site Excavated soil

Excavations will be in existing fill, organic soils and glacial deltaic sand. The majority of the fill and organic soils will only be suitable for reuse as common fill, and even then will be difficult to compact when wet. Although they may not meet the specification, the more granular portions of the existing fill and the glacial deltaic sand may be used as compacted granular fill. Most of this more granular soil will be generated at the sludge handling facility. Some segregation will be required to separate the soils that are suitable from those that are not.

Excess soil which cannot be re-used onsite will be disposed off site at approved disposal facilities, most likely a landfill. See Section 6.3.2 for environmental comments relative to re-use of soils.

5.10 Site Settlement

Some site settlement will occur from grade raise fill from consolidation of the fill and organic soils. We don't think this will be a concern because the only proposed grade raise is beneath the structures, where the fill and organics will be overexcavated or improved with aggregate piers, thus will not settle appreciably. If onsite filling is planned, such as to dispose of excess unsuitable soil, settlement of the proposed fill area should be reviewed.

5.11 Utilities

Locations of new utilities are not known at the time of this report. We anticipate that underground utilities may be supported with ordinary bedding materials, with an additional 12 in. of compacted granular fill beneath utilities greater than 24 in. in dia. Portions of the on-site fill are corrosive to buried steel.

6. ENVIRONMENTAL CONSIDERATIONS

Haley & Aldrich performed a soil pre-characterization (chemical testing) program to assess options for on-site reuse and off-site disposition of excavated soils.

6.1 Laboratory Testing

Ten composite soil samples (8 Fill and 2 Fill/Natural) were collected from borings HA-1, HA-2, HA-3, HA-4, HA-5, and HA-6/HA-7 and submitted to Complete Environmental Testing, Stratford, Connecticut (a Connecticut state-certified laboratory) for laboratory chemical testing. Each soil sample was analyzed for the following as applicable:

- RCRA 8 metals (and TCLP as necessary);
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082;
- Connecticut Extractable Total Petroleum Hydrocarbons (CT ETPH);
- Volatile Organic Compounds (VOCs) by EPA Method 8260/5035;
- Semi-volatile Organic Compounds (SVOCs) by EPA Method 8270; and
- Waste characteristic parameters (by Method SW 846) Reactive Sulfide and Cyanide, Flashpoint, and pH.

The results of the soil testing are summarized on Table II. The table typically only includes those compounds detected in at least one sample. Copies of the laboratory reports and chain-of-custody documentation for this soil testing are provided in Appendix E.

See section 6.3.2

6.2 Results of Chemical Testing

Results of chemical testing indicate that some Fill and Fill/Natural soils (i.e., HA1-S1, HA2-S2, HA5-S1 and HA5-S2) contain compounds at levels exceeding comparable Connecticut Department of Energy and Environmental Protection (CTDEEP) Pollutant Mobility Criteria (PMC) for areas with groundwater classified as "GB" (GB PMC) by the CTDEEP and exceed the CTDEEP Industrial / Commercial Direct Exposure Criteria. Refer to Table II. Other areas tested did not contain contaminants at concentrations exceeding comparable CTDEEP criteria.

Soil sample test results were also compared to Massachusetts Department of Environmental Protection (MADEP) landfill disposal criteria. The samples tested do not exceed MADEP landfill disposal criteria. In addition, the samples did not exceed typical asphalt batching facility limits. However, much of the excavated soil will not be geotechnically suitable for use in an asphalt mix (organics, shells, etc.) and may be rejected by asphalt batching facilities.

6.3 Recommendations

6.3.1 Permitting

State and local permits may be required in the event that certain activities occur on-site as follows:

- In the event excavated soils are stockpiled (whether on-site or off-site), a CTDEEP General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer) may be required.

- Municipalities may require special permits for proposed construction activities. Some municipalities require special permits for stockpiling and/or earthwork activities (e.g., Special Permit by the City of West Haven).

- If significant amounts of solid waste are encountered, it may be necessary to obtain a Disruption Permit from the CTDEEP for managing and disposing of solid waste (e.g., some types of buried demolition debris).

- If construction dewatering activities include the discharge of contaminated groundwater, such as the contaminated groundwater identified in HA5/OW, and/or storm water, then a CTDEEP General Permit will be required. Assuming that contaminated dewatering effluent is directed to the on-site wastewater treatment facility, then a "General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer" would be required.

6.3.2 Soil Reuse and Disposal Options

The soil samples tested from HA-1 below 5 ft, HA-2 above 5 ft, and HA6/7 would be classified buy CTDEEP as "clean fill." Clean fill is suitable for reuse on site without restriction provided the material meets the geotechnical requirements for granular fill.

The remaining soil samples tested detected contaminants above natural background conditions and would be classified by CTDEEP as either "polluted soil/fill" (those samples collected from HA-3 and HA-4) or "contaminated soil/fill" (those collected from HA-1 (above 5 ft), HA-2 (below 5 ft), and HA-5).

<u>Polluted Soil/Fill</u>

Test results indicate that the "polluted soil/fill" that will be excavated meet CTDEEP criteria for on-site beneficial reuse.

Applicable CTDEEP guidelines for on-site polluted soil reuse include the following:

- A map showing the location and depth of soil placement is maintained by the GNHWPCA;

- Soil is not placed below the water table; and

- Soil is not placed in an area subject to erosion.

Alternatively, this material could be used to create the site buffering "berm" on the eastern side of the property. Details for this option are discussed in Appendix D.

Contaminated Soil/Fill

We recommend that "contaminated soils" be taken off-site for disposal at a MADEP landfill. Alternatively, the property owner could decide to reuse this material on-site to backfill excavations made for foundations up to within 4 ft of landscaped areas and 2 ft of paved areas. CTDEEP guidelines for on-site polluted soil reuse outlined above would also apply.

6.3.3 Additional Chemical Testing

Chemical testing to date has been conducted to characterize soils for possible disposal at a MADEP-permitted landfill, for planning and budgeting purposes. Due to typical landfill volume testing requirements, additional soil testing will be required if off-site disposal is planned.

7. CONSTRUCTION CONSIDERATIONS

7.1 General

This section provides comments related to foundation construction, earthwork, and other geotechnical aspects of the project. It will aid those responsible for the preparation of contract plans and specifications and those involved with construction monitoring. Contractors must evaluate potential construction problems on the basis of their own knowledge and experience in the area and on the basis of similar localities, taking into account their own proposed construction methods and procedures.

7.2 Excavation Support and Dewatering

Conventional heavy construction equipment appears practical for excavation of overburden soils. Excavation geometry should conform to OSHA excavation regulations contained in 29 CFR Part 1926, latest revision. Temporary dewatered soil slopes no greater than 1.5H:1V appear appropriate, but should be confirmed during construction based on conditions at the time of excavation. Temporary excavation support will be required to support existing utilities, and possibly to maintain space for construction and plant operations. We anticipate temporary steel sheet piling will typically be the choice. Open cuts may be considered in some areas.

Groundwater will be encountered for deeper excavations and where overexcavation is planned. We believe dewatering may be accomplished by pumping from sumps and drainage trenches. Storm water runoff should be directed away from excavations, and pumped away if it accumulates in the excavation. An initial lift of crushed stone surrounded by a geotextile filter may be used for backfilling below groundwater level.

7.3 Protection and Monitoring of Existing Structures

Existing structures and utilities within 50 ft (aggregate pier or pile option) of the proposed construction should be monitored for horizontal and vertical movement. The excavation support system should also be monitored. Monitoring points should be spaced at 25 ft. Existing structures and utilities should be monitored for vibrations when installing aggregate piers or driving piles within 50 ft.

The existing utilities that are close to or below the footprint of the proposed structures will need to be accurately located before installing Aggregate Piers or piles.

7.4 Construction Monitoring

The foundation recommendations contained in this report are based on the known and predictable behavior of a properly engineered and constructed foundation. It is recommended that personnel qualified by training and experience provide monitoring during the foundation phases of the work. This monitoring program should include:

- overexcavation of unsuitable soils
- placement and compaction of granular fill
- preparation of bearing surfaces for foundations and slabs

- installation of aggregate piers or timber piles
- installation of excavation support systems and underpinning
- installation of dewatering systems
- Instrumentation data review.

TABLE I
SUMMARY OF SUBSURFACE EXPLORATIONS
WET WEATHER CAPACITY IMPROVEMENTS - PHASE I
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

BORING NO.		APPROXIMATE GROUND SURFACE ELEVATION	TOTAL DEPTH (FT)	THICKNESS OF STRATA (FT)						TOP OF NATURAL SAND (FT)		WATER LEVEL (FT)		TOP OF PROBABLE BEDROCK (FT)	
				BITUMINOUS CONCRETE	TOPSOIL	FILL	ORGANIC DEPOSITS	GLACIODELTAIC DEPOSITS	WEATHERED BEDROCK	DEPTH	ELEVATION	DEPTH	ELEVATION	DEPTH	ELEVATION
RECENT BORINGS															
HA1		11.1	32.0	--	0.4	19.1	--	> 12.5	--	19.5	-8.4	12.0	-0.9	--	--
HA2	R	14.2	39.1	--	--	8.0	5.0	26.1	--	13.0	1.2	4.0	10.2	38.0	-23.8
HA3	R	16.0	42.0	--	--	8.0	5.0	29.0	--	13.0	3.0	6.0	10.0	42.0	-26.0
HA4		15.5	27.0	--	--	19.5	--	> 7.5	--	19.5	-4.0	20.0	-4.5	--	--
HA5-OW	R	12.1	24.0	0.5	--	9.5	--	14.5	--	10.0	2.1	10.1	2.0	24.0	-11.9
HA6	R	6.0	21.7	--	1.5	3.5	--	13.0	3.7	5.0	1.0	4.5	1.5	18.0	-12.0
HA7	R	7.0	21.9	--	1.5	3.5	--	13.0	3.9	5.0	2.0	3.4	3.6	18.0	-11.0
HA8		BORING NOT PERFORMED													
HA9	R	13.4	27.5	--	0.6	13.9	--	13.0	--	14.5	-1.1	12.0	1.4	27.5	-14.1
PREVIOUS BORINGS															
B1	R	12.9	55.7	--	--	11.0	--	44.7	--	11.0	1.9	15.0	-2.1	55.7	-42.7
B2	R	10.9	45.7	--	--	10.0	0.8	44.9	--	10.8	0.1	--	--	45.7	-34.7
B27	C	5.7	33.0	--	--	6.0	--	19.0	--	6.0	-0.3	4.0	1.7	25.0	-19.3
B38	R	16.5	31.0	--	--	14.0	--	17.0	--	14.0	2.5	14.0	2.5	31.0	-14.5
B39	R	21.1	39.0	--	--	15.0	2.0	22.0	--	17.0	4.1	15.0	6.1	39.0	-17.9
B40	R	21.4	36.5	--	--	11.0	2.0	23.5	--	13.0	8.4	13.0	8.4	36.5	-15.1
B41	C	21.9	45.5	--	--	19.0	--	26.5	--	19.0	2.9	18.0	3.9	40.5	-18.6
B42	C	18.9	57.0	--	--	18.0	--	39.0	--	18.0	0.9	18.0	0.9	47.0	-28.1
PREVIOUS TEST PITS															
TP1		4.9	7.0	--	--	3.5	--	> 3.5	--	3.5	1.4	0.5	0.5	--	--
TP10		13.6	10.0	--	--	> 10	--	--	--	--	--	3.5	0.5	--	--
TP12		17.9	10.0	--	--	> 10	--	--	--	--	--	9.0	0.5	--	--
TP14		12.9	10.0	--	--	> 10	--	--	--	--	--	8.0	0.5	--	--
TP16		12.4	10.0	--	--	8.0	> 2	--	--	--	--	--	--	--	--

NOTES:

1. ">" indicates greater than
   "<" indicates less than
   OW indicates observation well
   (R) indicates boring terminated upon auger or split spoon refusal
   (C) indicates rock core was obtained at boring
3. Elevations are in feet and reference NAVD 88 Datum. Elevations on previous logs were converted from NGVD to NAVD by subtracting 1.1 ft.
4. Elevations of explorations were estimated from topographic contours on Figure 2.
5. Groundwater levels were measured shortly after drilling and may not represent stabilized groundwater levels except at HA5-OW.
6. Refer to test boring logs for detailed soil and rock descriptions.

TABLE II
SUMMARY OF LABORATORY ANALYTICAL DATA FOR SOIL
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY UPGRADES
NEW HAVEN, CONNECTICUT

"contaminated" based on section 6.3.2

"clean" based on section 6.3.2

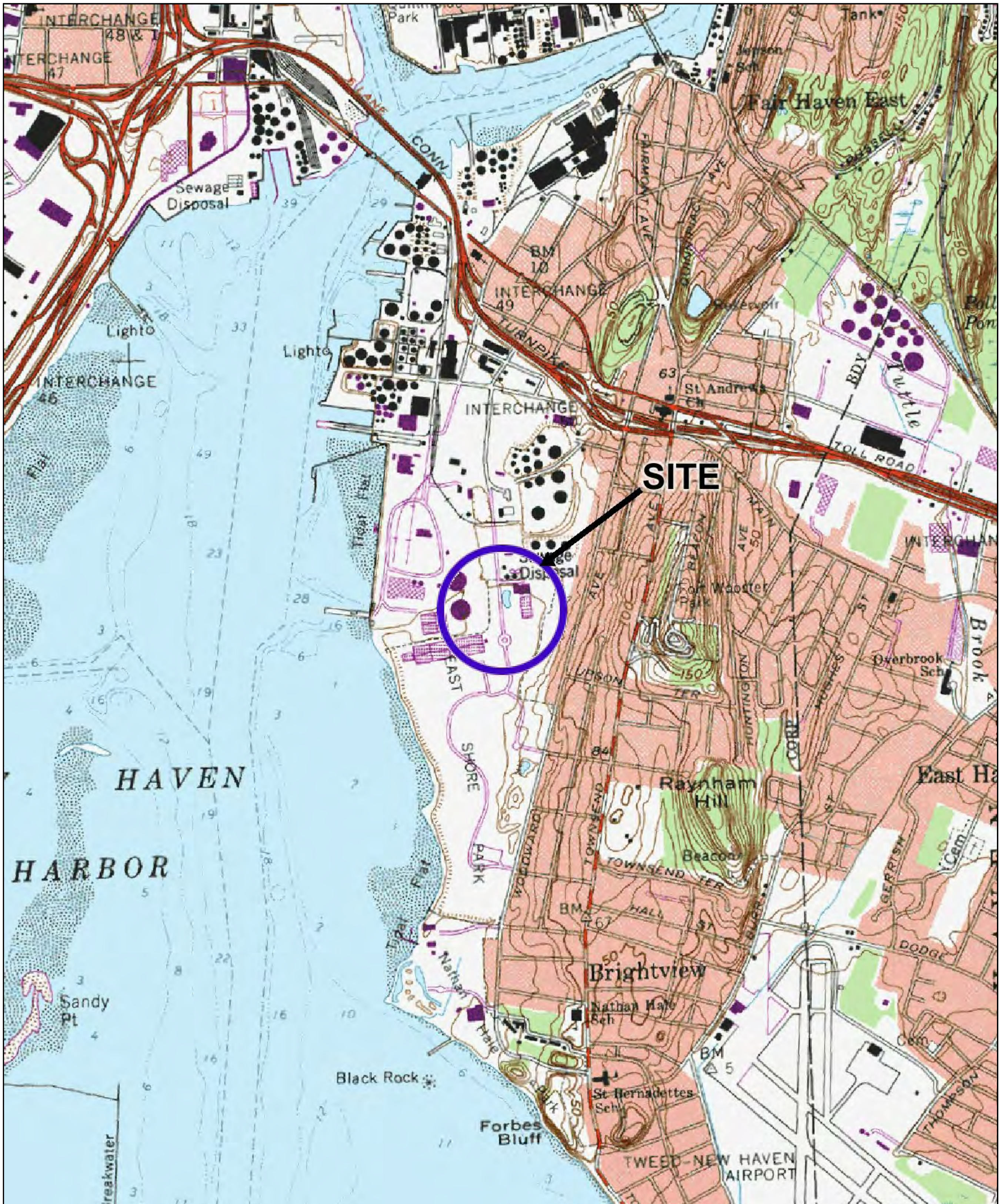
PARAMETER	CTDEP RSRs		Massachusetts Landfill Criteria		Asphalt Batching Limits	Sample ID:	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft	HA5-S2 5-10ft	HA617-S1 0-5ft
	Industrial / Commercial Direct Exposure Criteria	GB Pollutant Mobility Criteria	Lined Landfill	Unlined Landfill		Sample Date:	5/21/2012	5/21/2012	5/18/2012	5/18/2012	5/18/2012	5/18/2012	5/21/2012	5/18/2012	5/18/2012	5/21/2012
						Lab ID:	AF03615	AF03616	AF03617	AF03618	AF03619	AF03620	AF03621	AF03622	AF03623	AF03598
						Soil Type:	FILL	FILL	FILL	FILL/NATURAL	FILL	FILL/NATURAL	FILL	FILL	FILL	FILL
						Soil Depth:	0 to 5	5 to 19	0 to 5	5 to 14	0 to 5	5 to 12	0 to 19	0 to 5	5 to 10	0 to 5
Volatile Organics (mg/kg)																
Napthalene	-	56	-	-	-		ND(0.005)	ND(0.004)	ND(0.004)	0.13	ND(0.005)	ND(0.005)	ND(0.005)	0.0093	ND(0.004)	ND(0.004)
SUM	-	-	10	4	500		--	--	--	0.13	--	--	--	0.0093	--	--
SUM Total Chlorinated	-	-	-	-	5											
Semivolatile Organics (mg/kg)																
Acenaphthene	2500	84	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	1.7	ND(0.353)	ND(0.435)	ND(0.334)	ND(0.33)	ND(0.338)	ND(0.341)
Acenaphthylene	2500	84	-	-	-		0.43	ND(0.341)	ND(0.327)	0.56	ND(0.353)	ND(0.435)	ND(0.334)	0.8	0.57	ND(0.341)
Aniline	-	-	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	ND(0.455)	ND(0.353)	ND(0.435)	ND(0.334)	ND(0.33)	ND(0.338)	ND(0.341)
Anthracene	2500	400	-	-	-		0.37	ND(0.341)	ND(0.327)	2.2	ND(0.353)	ND(0.435)	ND(0.334)	1.1	1	ND(0.341)
Benzo(a)anthracene	7.8	1	-	-	-		**1.1**	ND(0.341)	ND(0.327)	**2.7**	0.38	ND(0.435)	0.47	**3.1**	**2**	ND(0.341)
Benzo(a)pyrene	1	1	-	-	-		**1.3**	ND(0.341)	ND(0.327)	**2.3**	ND(0.353)	ND(0.435)	ND(0.334)	**2.6**	**1.6**	ND(0.341)
Benzo(b)fluoranthene	7.8	1	-	-	-		**1.4**	ND(0.341)	ND(0.327)	**2.8**	0.48	0.5	0.5	**4.3**	**2.1**	ND(0.341)
Benzo(ghi)perylene	2500	42	-	-	-		0.5	ND(0.341)	ND(0.327)	1.7	0.38	ND(0.435)	ND(0.334)	0.86	0.38	ND(0.341)
Benzo(k)fluoranthene	78	1	-	-	-		0.65	ND(0.341)	ND(0.327)	**1.2**	ND(0.353)	ND(0.435)	ND(0.334)	**1.5**	0.84	ND(0.341)
Carbazole	290	1	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	0.84	ND(0.353)	ND(0.435)	ND(0.334)	0.34	ND(0.338)	ND(0.341)
Chrysene	780	1	-	-	-		**1.3**	ND(0.341)	ND(0.327)	**2.4**	ND(0.353)	ND(0.435)	0.41	**2.3**	**1.6**	ND(0.341)
Di-n-butylphthalate	2500	140	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	ND(0.455)	ND(0.353)	ND(0.435)	ND(0.334)	ND(0.33)	ND(0.338)	ND(0.341)
Di-n-octylphthalate	2500	20	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	ND(0.455)	ND(0.353)	ND(0.435)	ND(0.334)	ND(0.33)	ND(0.338)	ND(0.341)
Dibenzo(a,h)anthracene	1	1	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	0.47	ND(0.353)	ND(0.435)	ND(0.334)	ND(0.33)	ND(0.338)	ND(0.341)
Dibenzofuran	2500	5.6	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	1.4	ND(0.353)	ND(0.435)	ND(0.334)	0.48	0.4	ND(0.341)
Fluoranthene	2500	56	-	-	-		2	ND(0.341)	ND(0.327)	5.4	0.59	0.56	1	5.2	3.5	ND(0.341)
Fluorene	2500	56	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	2.3	ND(0.353)	ND(0.435)	ND(0.334)	0.68	1	ND(0.341)
Indeno(1,2,3-cd)Pyrene	7.8	1	-	-	-		0.51	ND(0.341)	ND(0.327)	**1.5**	ND(0.353)	ND(0.435)	ND(0.334)	0.85	0.35	ND(0.341)
Naphthalene	2500	56	-	-	-		ND(0.358)	ND(0.341)	ND(0.327)	2.2	ND(0.353)	ND(0.435)	ND(0.334)	0.78	0.61	ND(0.341)
Phenanthrene	2500	40	-	-	-		0.66	ND(0.341)	ND(0.327)	6.7	0.42	ND(0.435)	0.5	3.6	4.6	ND(0.341)
Pyrene	2500	40	-	-	-		1.7	ND(0.341)	ND(0.327)	3.8	0.51	0.53	0.75	4.4	3.5	ND(0.341)
SUM		-	100	100			11.92	--	--	42.17	2.76	1.59	3.63	32.89	24.05	--
Polychlorinated Biphenyls (mg/kg)																
SUM	-	-	2	2	1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Metals (mg/kg)																
Lead	1000	-	2000	-	1000		200	9.7	8.6	57	94	68	21	30	31	14
Selenium	10000	-	-	-	-		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND(1.5)
Cadmium	1000	-	80	-	30		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND(1)
Chromium	100	-	1000	-	500		21	11	12	46	50	42	15	12	19	10
Arsenic	10	-	40	-	30		4.7	ND	2.4	8.1	2.8	8.4	2.5	2.7	2.9	1.6
Barium	140000	-	-	-	-		55	18	24	58	44	60	46	32	43	34
Silver	10000	-	-	-	-		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	610	-	10	-	10		0.55	ND	ND	0.86	ND	0.94	ND	ND	ND	ND(0.3)
TCLP Lead (mg/l)	-	0.15	5	5	5		**0.33**	--	--	--	--	--	--	--	--	--
Extractable Petroleum Hydrocarbons (CTETPH) (mg/kg)	2500	2500	5000	2500	60000		ND(60)	ND(57)	ND(55)	ND(76)	280	ND(73)	ND(56)	890	240	ND(57)
Waste Characterization Parameters																
pH	-	-	2.5 to 12	2.5 to 12	2 to 12.5		7.28	7.06	8.37	8.07	7.69	8.08	8.12	8.5	8.23	5.42
Cyanide, Reactive (mg/kg)	-	-	250	250	NR		ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)
Sulfide, Reactive (mg/kg)	-	-	500	500	NR		ND(20)	ND(20)	ND(20)	ND(20)	ND(20)	ND(20)	ND(20)	ND(20)	ND(20)	ND(20)
Ignitability (degree F)	-	-	NI	NI	NI		>200	>200	>200	>200	>200	>200	>200	>200	>200	>200

NOTES:
1. This table typically includes only those compounds detected on the dates indicated.
2. RSR criteria are listed in the same units as the analyte test result reported.
3. NI means not ignitable. NR means not reactive.
4. ND(0.01) means that the compound was not detected above laboratory detection limit. The number in parentheses is the detection limit.
5. - means not applicable or not analyzed.
6. mg/kg means milligrams per kilogram (ppm), mg/l means milligrams per liter.
7. Orange and bolded cells indicate concentration exceeds CT RSR Industrial / Commercial Direct Exposure Critiria (I/C DEC). I/C DEC takes precedence over GB PMC.
8. Blue and bolded cells indicate concentration exceeds CT RSR GB PMC.
9. Red and bolded cells indicate concentrtion exceeds MA Landfill criteria. This takes precedence over I/C DEC.

TABLE III
SUMMARY OF LABORATORY ANALYTICAL DATA FOR GROUNDWATER
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY UPGRADES
NEW HAVEN, CONNECTICUT

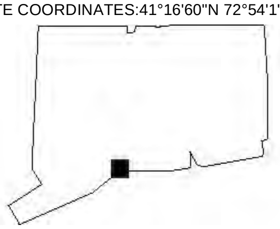
PARAMETER	CTDEP RSRs			Groundwater Remediation Wastewater Directly to Surface Water (A area) [7]	Groundwater Remediation Wastewater to a Sanitary Sewer [8]	Sample ID: HA5-OW Sample Date: 5/21/2012 Lab ID: AF03604
	Groundwater Protection	Industrial / Commericial Volatilization Criteria	Surface Water Protection			
Volatile Organics (ug/l)						
1,2,4-Trimethylbenzene	350	-	-	-	-	15
Naphthalene	280	-	-	-	-	4.2
SUM	-	-	-	10	5000	19.2
Total Chlorinated	-	-	-	-	1000	ND
Semivolatile Organics (ug/l)						
Benzo(a)anthracene	0.06	-	0.3		-	0.48
Benzo(a)pyrene	0.2	-	0.3		-	0.38
Benzo(b)fluoranthene	0.08	-	0.3		-	0.44
Indeno(1,2,3-cd)Pyrene	0.2	-	-		-	0.31
Naphthalene	280	-	24	-	-	2.2
Phenanthrene	200	-	0.077		-	0.54
SUM	-	-	-	5	500	3.87
Total PAHs	-	-	-	-	500	3.87
Polychlorinated Biphenyls (ug/l)						
SUM	-	-	-	0.1	1	ND
Total Metals (ug/l)						
Arsenic	50	-	4	0.021	100	ND(4)
Barium	1000	-	-	-	5000	660
Cadmium	5	-	6	10	100	ND(5)
Chromium	50	-	110	342	1000	ND(50)
Lead	15	-	13	9.8	100	97
Mercury	2	-	0.4	1	5	ND(0.4)
Selenium	50	-	50	40	1000	ND(10)
Silver	36	-	12	5	100	ND(12)
Extractable Petroleum Hydrocarbons (CTETPH) (ug/l)	500	-	-	5000	100000	ND(0.1)
Waste Characterization Parameters						
pH	-	-	-	-	-	

NOTES:
1. This table typically includes only those compounds detected on the dates indicated.
2. RSR criteria are listed in the same units as the analyte test result reported.
3. NI means not ignitable.
4. ND(0.01) means that the compound was not detected above laboratory detection limit.
   The number in parentheses is the detection limit.
5. - means not applicable or not analyzed.
6. ug/l means micrograms per liter (ppb).
7. General Permit limit for VOCs is for a surface wate classification as A, for total PAHs is 5 ug/l, and for metals dilution factor 10:1.
8. General Permit limit for total PAHs is 500 ug/l.



SITE COORDINATES:41°16'60"N 72°54'1"W

N
W E
S



U.S.G.S. QUADRANGLE: NEW HAVEN, CT

HALEY & ALDRICH

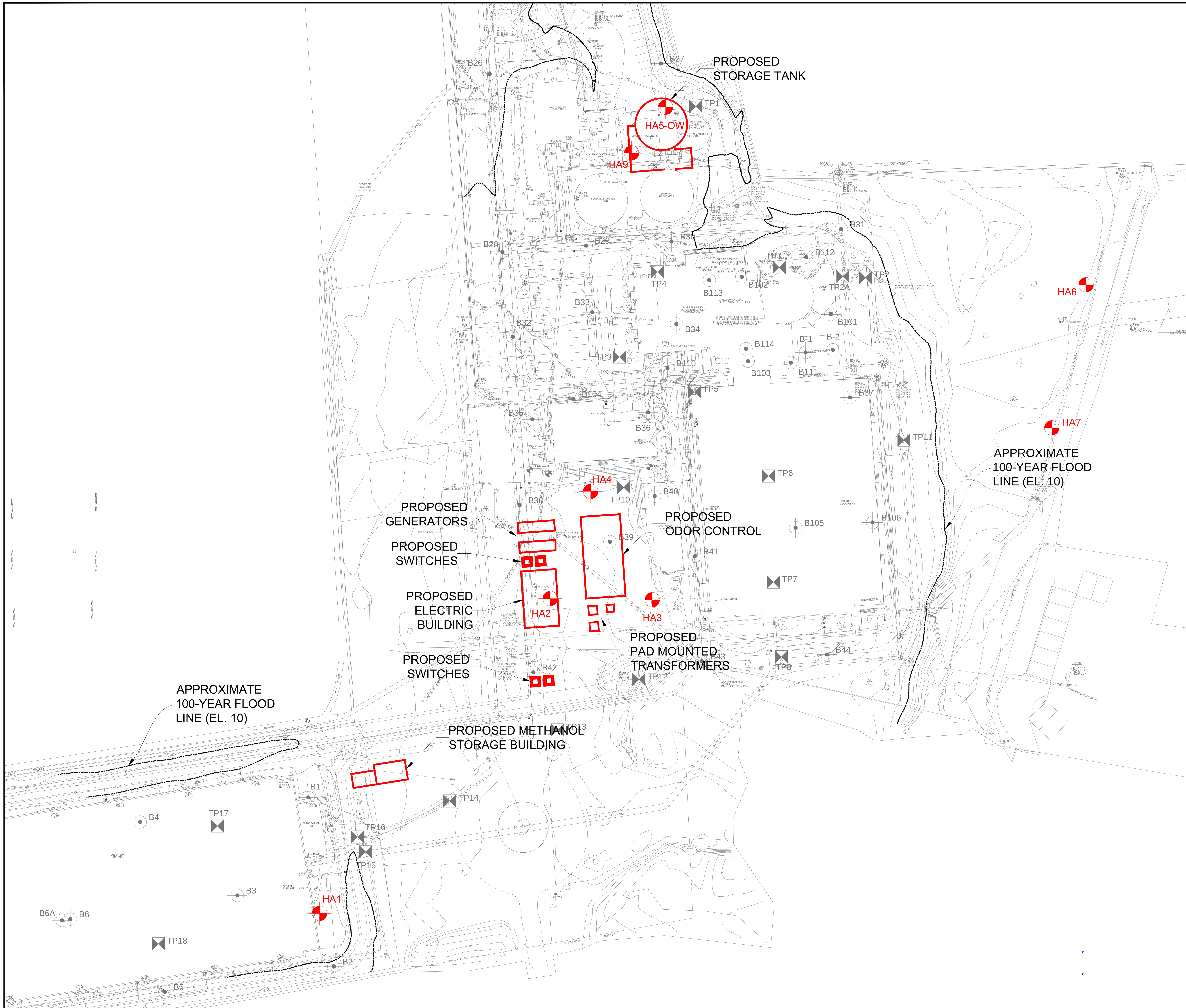
EAST SHORE WATER POLLUTION ABATEMENT FACILITY UPGRADES
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
NEW HAVEN, CONNECTICUT

PROJECT LOCUS

SCALE: 1:24,000
JUNE 2012

FIGURE 1

37176-000 1.PDF



LEGEND

HA6 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORINGS PERFORMED FOR HALEY & ALDRICH BY GENERAL BORINGS, INC. BETWEEN 18 AND 21 MAY 2012.

B37 — DESIGNATION AND APPROXIMATE LOCATION OF PREVIOUS TEST BORINGS.

TP11 — DESIGNATION AND APPROXIMATE LOCATION OF PREVIOUS TEST PITS.

NOTES:

1. BASE PLAN IS DRAWING "GNHWPCA_SURVEY.DWG" PROVIDED BY CH2M HILL ON 2 MAY 2012.
2. LOCATIONS OF PREVIOUS BORINGS ARE BASED ON DRAWING C-3 "CONTRACT NO. 1 WASTEWATER TREATMENT PLANT, BORING PLAN" PREPARED BY CAMP DRESSER & MCKEE, INC. DATED JULY 1975.
3. PROPOSED STRUCTURE LOCATIONS BASED ON DRAWING "05-C-XGAN1_407000-06-15-12" PREPARED BY CH2M HILL RECEIVED ON 19 JUNE 2012.

HALEY & ALDRICH

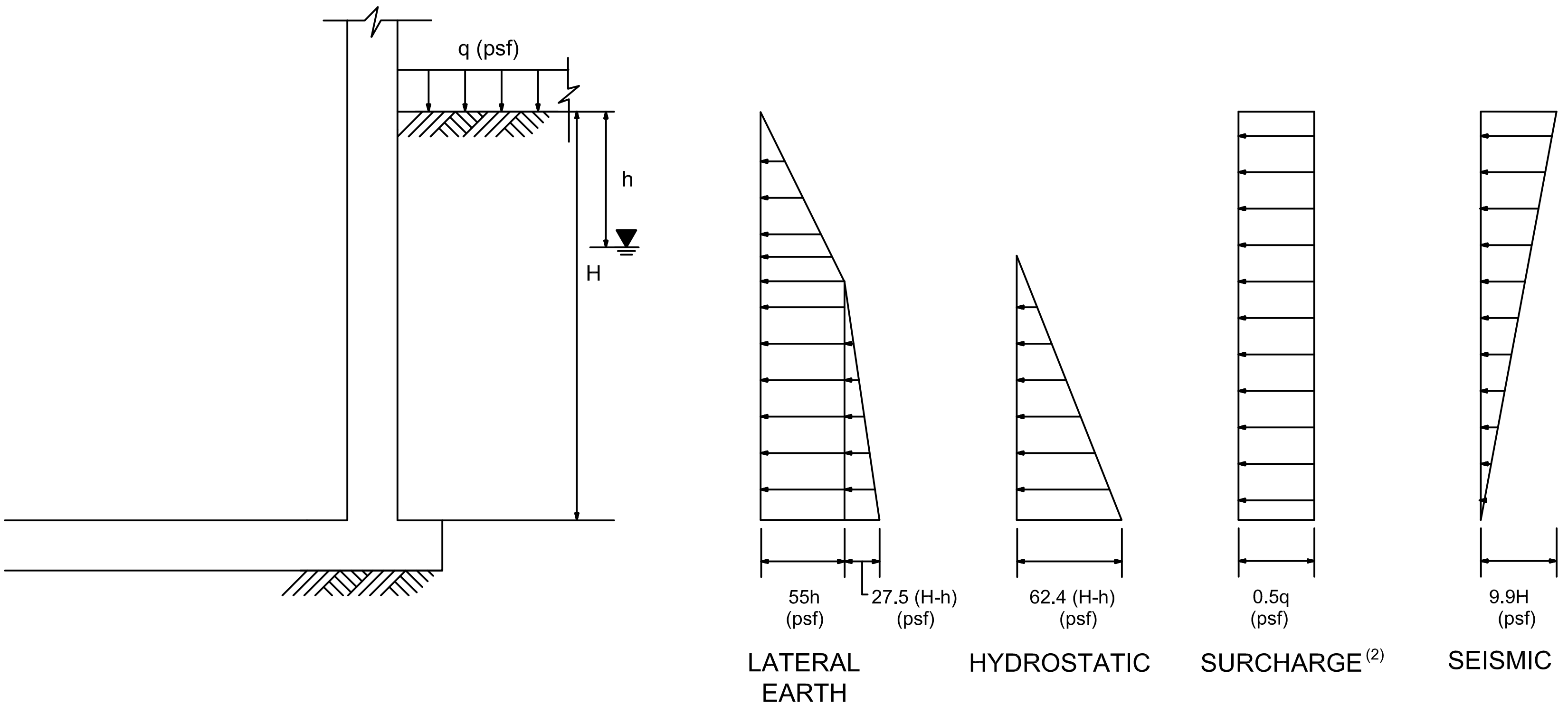
WET WEATHER CAPACITY IMPROVEMENTS - PHASE I
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
AUGUST 2012

FIGURE 2

G:\37176_GNHWPCA ELEC INFRASTRUCTURE\000\CAD\37176-000-0004 BLP.DWG



NOTES:

1. IT IS ASSUMED THAT RETAINING WALLS ARE BRACED AT THE TOP AND NOT FREE TO ROTATE.

2. SURCHARGE LATERAL PRESSURE FROM TRAFFIC MAY BE IGNORED BELOW THE UPPER 15 FT OF THE WALL.

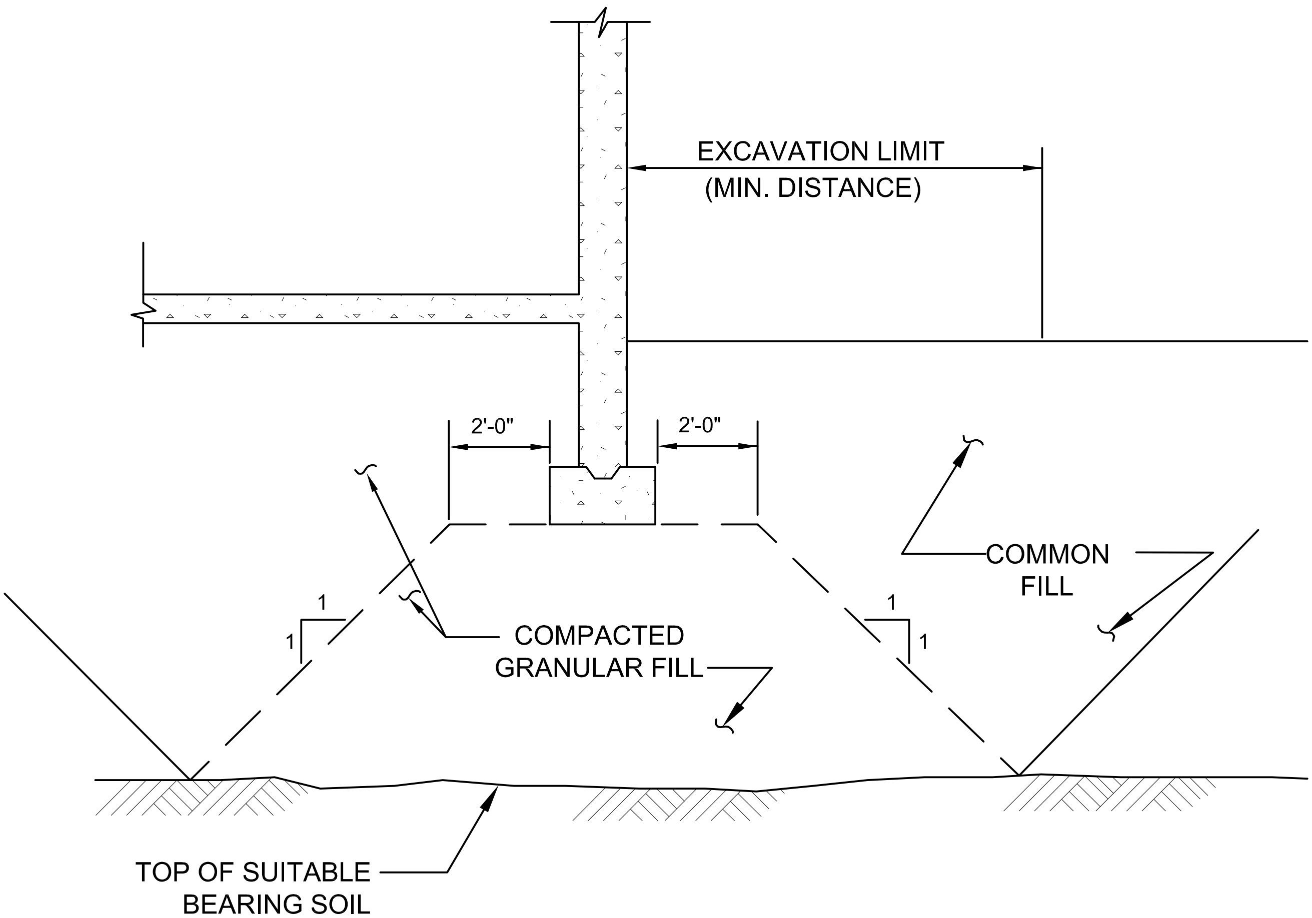
HALEY & ALDRICH

WET WEATHER CAPACITY EXPANSION PROJECT
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
NEW HAVEN, CONNECTICUT

AT REST
LATERAL PRESSURES
FOR BELOW-GRADE WALLS

SCALE: NOT TO SCALE
JUNE 2012

FIGURE 3



TYPICAL DETAIL

HALEY & ALDRICH

WET WEATHER CAPACITY EXPANSION PROJECT
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
NEW HAVEN, CONNECTICUT

RECOMMENDED
LIMITS OF COMPACTED
GRANULAR FILL

SCALE: NOT TO SCALE
JUNE 2012

FIGURE 4

G:\37176_GNHWPCA ELEC INFRASTRUCTURE\000\CAD\FIGURE 3_37176-000- GRANFILL.DWG

APPENDIX A

Test Boring Logs

APPENDIX A
(Part 1 of 2)

Recent Boring Logs

HALEY & ALDRICH — TEST BORING REPORT

Boring No. HA1

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT	File No.	37176-000
Client	CH2M HILL	Sheet No.	1 of 2
Contractor	General Borings, Inc.	Start	21 May 2012
		Finish	21 May 2012
		Driller	R. Posa
		H&A Rep.	S. Brousseau

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: ATV-mounted Mobile Drill B53
Inside Diameter (in.)	3 1/4	1 3/8	-	Bit Type: Cutting Head; Drill Mud: None
Hammer Weight (lb)	-	140	-	Casing: - ; Hoist/Hammer: Cat-Head Safety Hammer
Hammer Fall (in.)	-	30	-	PID Make & Model: None

Elevation 11.1 (est.)
Datum NAVD88
Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	1 2 4 4	S1 14	0.0 2.0	10.7 0.4		-TOPSOIL-
					SM	Loose brown silty medium to fine SAND, trace gravel, with few organics, no odor, dry
	5 7 10 13	S2 18	2.0 4.0		SM	Medium dense dark brown silty medium to fine SAND, trace gravel, with few organics and shells, no odor, dry
5	3 3 3 3	S3 14	5.0 7.0		SM	Similar to S2
	17 19 34 38	S4 16	7.0 9.0	4.1 7.0	SM	Very dense brown medium to fine SAND, little silt, with very few silty clay pockets, no odor, dry
10	13 17 22 27	S5 18	10.0 12.0		SM	Dense gray-brown medium to fine SAND, little silt, with very few organics and shells, no odor, moist
	19 24 29 32	S6 18	12.0 14.0		SM	Very dense gray-brown medium to fine SAND, little silt, trace gravel, no odor, wet
15	4 5 8 9	S7 16	15.0 17.0	-3.4 14.5	SM	Medium dense brown medium to fine SAND, little silt, with occasional silty clay seam, no odor, wet
	7 5 4 2	S8 14	17.0 19.0		SM	Loose brown medium to fine SAND, little silt, bottom 3 in. wood and gravel, no odor, wet
				-8.4 19.5		-FILL-
20						

I dont see index lab testing results in the logs. Also, geotechnical lab testing reports are not included in the report.

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/21/12	1145	0.0	10.0	14.0	12.0 ±

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 32.0
Rock Cored (ft) -
Samples 11S
Boring No. HA1

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HARICOMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	3 5 8 11	S9 12	20.0 22.0		SP	Medium dense gray-brown medium to fine SAND, trace silt, no odor, wet Note: 2 ft running sands after sample retrieved
				-12.9 24.0		Note: Drill action indicates change at 24.0 ft
25	3 4 6 5	S10 14	25.0 27.0		ML	Stiff red-brown fine sandy SILT with interbedded clay laminae, no odor, wet
30	4 4 7 7	S11 20	30.0 32.0		ML	Stiff red-brown fine sandy SILT, interbedded with clay laminae and fine sand partings, no odor, wet -GLACIODELTAIC DEPOSITS-
				-20.9 32.0		Bottom of exploration at 32.0 ft Note: Borehole backfilled with drill cuttings upon completion

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

HALEY & ALDRICH

Boring No. HA2

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT	File No.	37176-000
Client	CH2M HILL	Sheet No.	1 of 2
Contractor	General Borings, Inc.	Start	18 May 2012
		Finish	18 May 2012
		Driller	T. McGovern
		H&A Rep.	S. Brousseau
		Elevation	14.2 (est.)
		Datum	NAVD88
		Location	See Plan

	Casing	Sampler	Barrel
Type	HSA	S	-
Inside Diameter (in.)	3 1/4	1 3/8	-
Hammer Weight (lb)	-	140	-
Hammer Fall (in.)	-	30	-

Drilling Equipment and Procedures

- Rig Make & Model: Truck mounted Mobile Drill B53
- Bit Type: Cutting Head
- Drill Mud: None
- Casing: -
- Hoist/Hammer: Cat-Head Safety Hammer
- PID Make & Model: None

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	8 11 12 15	S1 18	0.0 2.0		SM	Medium dense brown medium to fine SAND, little silt, trace gravel, with very few coal fragments, no odor, dry
	16 18 11 12	S2 16	2.0 4.0		SM	Medium dense brown SAND, little silt, trace gray clay, with few shell fragments, no odor, dry
	3 2 2 4	S3 4	4.0 6.0	10.2 4.0	ML	Soft gray SILT, trace medium to fine SAND, trace fine gravel, few organics, organic odor, wet
5	2 1 2 3	S4 10	6.0 8.0		ML	Similar to S3 -FILL-
	4 1 1 1	S5 24	8.0 10.0	6.2 8.0	ML/CL	Very soft interbedded SILT and CLAY, with few organics, no odor, wet
10	1 1 2 4	S6 24	10.0 12.0		ML/CL	Similar to S5, except soft (bottom 4 in. fibrous peat)
	3 5 8 9	S7 15	12.0 14.0		PT	Medium dense dark brown fibrous PEAT -ORGANIC DEPOSITS-
				1.2 13.0	SM	Medium dense brown medium to fine SAND, little silt, with common organics, no odor, wet
15	5 13 20 22	S8 8	15.0 17.0		SM	Medium dense brown medium to fine SAND, little silt, no odor, wet
20						-GLACIODELTAIC DEPOSITS-

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/18/12	1130	0.0	4.0	8.0	4.0 ±

Sample ID

- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram

Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (ft)	39.1
Rock Cored (ft)	-
Samples	13S

Boring No. HA2

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA2
File No. 37176-000
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	3 2 1 3	S9 22	20.0 22.0		SP	Very loose brown medium to fine SAND, trace silt, no odor, wet
25	14 22 20 28	S10 18	25.0 27.0	-10.8 25.0	SM	Dense red-brown silty fine SAND, no odor, wet
30	2 4 6 5	S11 20	30.0 32.0		ML/CL	Medium stiff interbedded SILT and CLAY laminae, no odor, wet
35	1 5 9 9	S12 24	35.0 37.0		ML/CL	Similar to S11
				-21.3 35.5	SP	Medium dense red-brown medium to fine SAND, trace silt, no odor, wet
				-23.8 38.0		Note: Drill action indicates change at 38.0 ft
	100/1"	S13 1	39.0 39.1	-24.9 39.1		Note: HSA refusal at 39.1 ft Weathered sandstone -GLACIODELTAIC DEPOSITS- Bottom of exploration at 39.1 ft Note: Borehole backfilled with drill cuttings upon completion

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA2

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA3

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT
Client	CH2M HILL
Contractor	General Borings, Inc.

File No.	37176-000
Sheet No.	1 of 2
Start	18 May 2012
Finish	18 May 2012
Driller	R. Posa
H&A Rep.	S. Brousseau
Elevation	16.0 (est.)
Datum	NAVD88
Location	See Plan

	Casing	Sampler	Barrel
Type	HSA	S	-
Inside Diameter (in.)	3 1/4	1 3/8	-
Hammer Weight (lb)	-	140	-
Hammer Fall (in.)	-	30	-

Drilling Equipment and Procedures

Rig Make & Model: ATV-mounted Mobile Drill B53
Bit Type: Cutting Head
Drill Mud: None
Casing: -
Hoist/Hammer: Cat-Head Safety Hammer
PID Make & Model: None

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	2 8 6 4	S1 12	0.0 2.0		SM	Medium dense brown to gray-brown silty medium to fine SAND, with gray clay layer, few asphalt fragments, no odor, dry
	11 18 12 11	S2 17	2.0 4.0		SM	Dense dark brown silty medium to fine SAND, trace gravel, with few organics and asphalt fragments, organic odor, dry
	3 5 7 8	S3 10	4.0 6.0		SM	Medium dense red-brown SAND, little silt, trace gravel, with few shell fragments, no odor, dry
5	7 6 3 3	S4 14	6.0 8.0		SM	Similar to S3, except loose, wet
				8.0 8.0		-FILL-
10	1 1 2 2	S5 24	10.0 12.0		ML/CL	Soft gray black interbedded SILT and CLAY, with few organics, no odor, wet
				3.0 13.0		-ORGANIC DEPOSITS-
						Note: Drill action indicates change at 13.0 ft
15	4 5 7 8	S6 12	15.0 17.0		SP-SM	Medium dense medium to fine SAND, little silt, no odor, wet
20						-GLACIODELTAIC DEPOSITS-

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/18/12	1200	0.0	4.0	8.0	6.0 ±

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	42.0
Rock Cored (ft)	-
Samples	11S

Boring No. HA3

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY& ALDRICH

TEST BORING REPORT

Boring No. HA3
File No. 37176-000
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	4 6 6 7	S7 20	20.0 22.0		SP	Medium dense brown medium to fine SAND, trace silt, no odor, wet
25	4 13 15 21	S8 20	25.0 27.0		SP	Medium dense brown medium to fine SAND, trace silt, trace gravel, no odor, wet Note: 2 ft running sands after sample recovered, washed out
						Note: Wash out 3 ft running sands before sampling at 30.0 ft
30	28 31 33 37	S9 18	30.0 32.0		SM	Very dense red-brown silty fine SAND, no odor, wet
35	10 11 14 21	S10 14	35.0 37.0		SM	Medium dense red-brown silty SAND, trace gravel (probable weathered sandstone), no odor, moist
40	100/1"	S11 0	40.0 40.0			No recovery Note: HSA refusal at 42.0 ft -GLACIODELTAIC DEPOSITS-
				-26.0 42.0		Bottom of exploration at 42.0 ft Note: Borehole backfilled with drill cuttings upon completion

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA3

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA4

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT	File No.	37176-000
Client	CH2M HILL	Sheet No.	1 of 2
Contractor	General Borings, Inc.	Start	21 May 2012
		Finish	21 May 2012
		Driller	R. Posa
		H&A Rep.	S. Brousseau
		Elevation	15.5 (est.)
		Datum	NAVD88
		Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: ATV-mounted Mobile Drill B53
Inside Diameter (in.)	3 1/4	1 3/8	-	Bit Type: Cutting Head; Drill Mud: None
Hammer Weight (lb)	-	140	-	Casing: -
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Cat-Head Safety Hammer; PID Make & Model: None

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	22 24 15 11	S1 7	0.0 2.0		SM	Dense brown medium to fine SAND, little silt, trace gravel, with few asphalt fragments, no odor, dry
	10 9 7 7	S2 10	2.0 4.0		SM	Similar to S1, except medium dense
				11.0 4.5		
5	5 7 8 8	S3 18	5.0 7.0		SM	Medium dense dark brown silty fine SAND, trace fine gravel, with few silty clay pockets, few fragments of coal and shells, few organics, organic odor, dry
	10 14 15 18	S4 24	7.0 9.0		SM	Similar to S3
10	7 12 38 44	S5 10	10.0 12.0		SM	Similar to S4, except very dense, with few cobble/boulder fragments
	18 19 12 11	S6 20	12.0 14.0		SM	Similar to S3, except dense
				1.0 14.5		
15	19 22 25 19	S7 15	15.0 17.0		SM	Dense brown silty medium to fine SAND, trace fine gravel, trace ash, few organics, organic odor, dry
	29 58 37 39	S8 18	17.0 19.0		SM	Very dense brown silty medium to fine SAND, trace gravel, with few silty clay pockets and organics, few fragments of coal, no odor, dry
				-4.0 19.5		-FILL-
20						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/21/12	0945	0.0	20.0	22.0	20.0 ±

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary
- Overburden (ft) 27.0
- Rock Cored (ft) -
- Samples 10S

Boring No. HA4

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	5 7 10 12	S9 14	20.0 22.0		SP	Medium dense brown to gray-brown medium to fine SAND, trace silt, no odor, wet
25	4 8 13 43	S10 22	25.0 27.0		SM	Medium dense brown medium to fine SAND, little silt, no odor, wet -GLACIODELTAIC DEPOSITS-
				-11.5 27.0		Bottom of exploration at 27.0 ft Note: Borehole backfilled with drill cuttings upon completion

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA5-OW

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT	File No.	37176-000
Client	CH2M HILL	Sheet No.	1 of 2
Contractor	General Borings, Inc.	Start	18 May 2012
		Finish	18 May 2012
		Driller	T. McGovern
		H&A Rep.	S. Brousseau
		Elevation	12.1 (est.)
		Datum	NAVD88
		Location	See Plan

	Casing	Sampler	Barrel
Type	HSA	S	-
Inside Diameter (in.)	3 1/4	1 3/8	-
Hammer Weight (lb)	-	140	-
Hammer Fall (in.)	-	30	-

Drilling Equipment and Procedures

Rig Make & Model: Truck mounted Mobile Drill B53
Bit Type: Cutting Head
Drill Mud: None
Casing: -
Hoist/Hammer: Cat-Head Safety Hammer
PID Make & Model: None

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0					11.6 0.5		-BITUMINOUS CONCRETE-
	8 16 11 7	S1 18	1.0 3.0			SM	Medium dense dark brown silty medium to fine SAND, trace fine gravel, with few slag fragments, organic odor, dry
	7 4 4 5	S2 12	3.0 5.0			SM	Similar to S1, except loose
5	58 31 18 10	S3 18	5.0 7.0			SM	Dense brown to dark brown silty medium to fine SAND, trace gravel, with few brick fragments and 3 in. asphalt layer at 5.2 ft, organic odor, dry
	38 100/3"	S4 10	7.0 7.9			SM	Very dense brown silty medium to fine SAND, trace gravel, with few brick fragments, no odor, dry
	6 3 9 20	S5 6	8.0 10.0			SM	Medium dense brown silty medium to fine SAND, with few organics, organic odor, moist
					2.1		-FILL-
10	10 14 15 19	S6 14	10.0 12.0		10.0	SP	Medium dense red-brown medium to fine SAND, trace silt, no odor, wet
15	3 7 12 11	S7 16	15.0 17.0			SP	Medium dense red-brown SAND, trace silt, trace fine gravel, no odor, wet
					-6.9		-GLACIODELTAIC DEPOSITS-
					19.0		Note: Drill action indicates change at 19.0 ft
20							

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/18/12	0945	0.0	8.0	12.0	10.0 ±
5/18/12	1645	7.0	well at 20.0 ft		10.05
5/21/12	1030	70	20	20	14.8

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	24.0
Rock Cored (ft)	-
Samples	8S

Boring No. HA5-OW

Field Tests:
Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

HALEY & ALDRICH

Boring No. HA5-OW
File No. 37176-000
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	8 16 18 14	S8 12	20.0 22.0			SM	Dense red-brown silty medium to fine SAND, trace gravel (probable weathered sandstone in spoon tip), no odor, wet
							-GLACIODELTAIC DEPOSITS-
					-11.9 24.0		Note: HSA refusal at 24.0 ft
							Bottom of exploration at 24.0 ft
							Note: Groundwater observation well installed in completed borehole. See "Observation Well Installation Report "HA5-OW"" for details

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA5-OW

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA6

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT	File No.	37176-000
Client	CH2M HILL	Sheet No.	1 of 2
Contractor	General Borings, Inc.	Start	21 May 2012
		Finish	21 May 2012
		Driller	R. Posa
		H&A Rep.	S. Brousseau
		Elevation	6.0 (est.)
		Datum	NAVD88
		Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: ATV-mounted Mobile Drill B53
Inside Diameter (in.)	3 1/4	1 3/8	-	Bit Type: Cutting Head; Drill Mud: None
Hammer Weight (lb)	-	140	-	Casing: -
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Cat-Head Safety Hammer; PID Make & Model: None

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	2 2 3 4	S1 20	0.0 2.0			-TOPSOIL-
				4.5 1.5	SM	Loose brown silty medium to fine SAND, trace gravel, with few roots, no odor, dry
	4 4 4 5	S2 18	2.0 4.0		SM	Loose brown medium to fine SAND, little silt, with few organics, no odor, dry
						-POSSIBLE FILL-
5	4 7 7 7	S3 14	5.0 7.0	1.0 5.0	SM	Medium dense gray-brown fine SAND, little silt, no odor, wet
	5 6 8 8	S4 18	7.0 9.0		SP	Medium dense brown medium to fine SAND, trace silt, no odor, wet
10	3 4 4 5	S5 20	10.0 12.0		SP	Similar to S4, except loose
15	3 5 16 35	S6 16	15.0 17.0		SM	Similar to S4, except with trace gravel
						-GLACIODELTAIC DEPOSITS-
				-12.0 18.0		Note: Drill action indicates change at 18.0 ft
20						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/21/12	1630	0.0	5.0	7.0	4.5 ±

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 21.8
Rock Cored (ft) -
Samples 7S

Boring No. HA6

Field Tests:
Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	54 23 34 50/4"	S7 12	20.0 21.9			Weathered sandstone Note: Sampler refusal at 21.9 ft
				-15.9 21.9		-WEATHERED BEDROCK- Bottom of exploration at 21.9 ft Note: Borehole backfilled with drill cuttings upon completion

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA7

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT
Client	CH2M HILL
Contractor	General Borings, Inc.
File No.	37176-000
Sheet No.	1 of 2
Start	21 May 2012
Finish	21 May 2012
Driller	R. Posa
H&A Rep.	S. Brousseau
Elevation	7.0 (est.)
Datum	NAVD88
Location	See Plan

	Casing	Sampler	Barrel
Type	HSA	S	-
Inside Diameter (in.)	3 1/4	1 3/8	-
Hammer Weight (lb)	-	140	-
Hammer Fall (in.)	-	30	-

Drilling Equipment and Procedures

Rig Make & Model: ATV-mounted Mobile Drill B53
Bit Type: Cutting Head
Drill Mud: None
Casing: -
Hoist/Hammer: Cat-Head Safety Hammer
PID Make & Model: None

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0	10 2 2 4	S1 20	0.0 2.0			-TOPSOIL-
				5.5 1.5	SM	Loose brown medium to fine SAND, little silt, with few organics, no odor, dry
	5 8 10 11	S2 18	2.0 4.0		SM	Similar to S1 (below 1.5 ft)
						-POSSIBLE FILL-
5	5 6 6 8	S3 18	5.0 7.0	2.0 5.0	SP	Medium dense gray-brown medium to fine SAND, trace silt, no odor, wet
	6 6 8 9	S4 20	7.0 9.0		SP	Similar to S3
10	2 4 5 5	S5 20	10.0 12.0		SP	Similar to S4, except loose
15	2 5 4 6	S6 16	15.0 17.0		SP	Similar to S5
						-GLACIODELTAIC DEPOSITS-
				-11.0 18.0		Note: Drill action indicates change in stratum at 18 ft
20						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/21/12	1530	0.0	5.0	7.0	4.5 ±
5/21/12	1700	1.5	open hole		3.4

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 21.8
Rock Cored (ft) -
Samples 7S

Boring No. HA7

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA7
File No. 37176-000
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	11 41 11 50	S7 14	20.0 21.7		SM	Very dense red-brown silty medium to fine SAND, trace gravel (probable weathered bedrock), no odor, moist
				-15.0 22.0		Bottom of exploration at 22 ft Note: Borehole backfilled with drill cuttings upon completion

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA7

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA9

Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF, New Haven, CT
Client	CH2M HILL
Contractor	General Borings, Inc.

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: ATV-mounted Mobile Drill B53
Inside Diameter (in.)	3 1/4	1 3/8	-	Bit Type: Cutting Head; Drill Mud: None
Hammer Weight (lb)	-	140	-	Casing: -
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Cat-Head Safety Hammer; PID Make & Model: None

File No. 37176-000
Sheet No. 1 of 2
Start 18 May 2012
Finish 18 May 2012
Driller R. Posa
H&A Rep. S. Brousseau
Elevation 13.4 (est.)
Datum NAVD88
Location See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0						-TOPSOIL-
	1 3 5 9	S1 16	0.0 2.0	12.8 0.6	SM	Loose brown silty medium to fine SAND, trace gravel, no odor, dry
	8 10 12 15	S2 18	2.0 4.0	11.4 2.0	SM	Medium dense dark brown silty medium to fine SAND, trace gravel, with few slag and brick fragments, slight creosote odor, dry
5	7 10 10 13	S3 18	5.0 7.0		SM	Medium dense dark brown silty medium to fine SAND, trace gravel, with few slag fragments, organic odor, dry
	12 13 12 13	S4 15	7.0 9.0		SM	Similar to S3
				5.4 8.0	SM	Medium dense brown medium to fine SAND, little silt, no odor, dry
10	10 12 13 13	S5 15	10.0 12.0		SM	Medium brown to red-brown silty medium to fine SAND, trace gravel, no odor, moist
	9 8 11 13	S6 20	12.0 14.0		SM	Medium dense brown medium to fine SAND, little silt, trace gravel, organic odor, wet
						-FILL-
15	14 16 19 21	S7 24	15.0 17.0	-1.1 14.5	SP	Medium dense gray-brown medium to fine SAND, trace silt, no odor, dry
20						-GLACIODELTAIC DEPOSITS-

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
5/18/12	0930	0.0	10.0	14.0	12.0 ±
5/18/12	1030	1.0	27.5	27.5	14.8

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 27.5
Rock Cored (ft) -
Samples 9S

Boring No. HA9

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA9
File No. 37176-000
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
20	18 19 22 24	S8 18	20.0 22.0		SP	Similar to S7, except dense, red-brown
				-7.6 21.0	SM	Dense red-brown silty medium to fine SAND, trace fine gravel, no odor, wet
25	24 100/5"	S9 8	25.0 25.9		SM	Dense red-brown silty medium to fine SAND, trace gravel, no odor, wet
						Note: HSA refusal at 27.5 ft
						-GLACIODELTAIC DEPOSITS-
				-14.1 27.5		Bottom of exploration at 27.5 ft
						Note: Borehole backfilled with drill cuttings upon completion

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA9

H&A-TEST BORING-07-1 HA-LIB07-1.GLB HA-TB+CORE+WELL-07-1.GDT \\HAR\COMMON\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\2012-0524 37176-000TB GINT 8.GPJ 31 Aug 12

APPENDIX A
(Part 2 of 2)

Previous Boring and Test Pit Logs

CLIENT: Camp, Dresser & McKee Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 2

HOLE NO. B-1

LINE

CONTRACTOR

FOREMAN-DRILLER J.D. C.E.

INSPECTOR Om Mehta

PROJECT NAME East Shore Water Pollution

LOCATION Abatement Project

New Haven, Conn.

STATION N163610

OFFSET E558345

GROUND WATER OBSERVATIONS

AT 15.0' FT. AFTER 0 HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	NOM. 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 1/19 - 1/19/72

DATE FIN.

SURFACE ELEV. 14.0

GROUND WATER ELEV. -1.0

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. / MOIST	STRATA CHANGE DEPTH / ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	ss	18"	15"	6.5'	2	4	10		moist medium		1) Brown fine-coarse sand, little silt with gray clay, trace sand, trace shell.
10		2	ss	18"	14"	11.5'	1	3	2		wet loose	11.0'	2) Dark gray clay and silt, red-brown fine-coarse sand, little silt in tip of split spoon.
15		3	ss	18"	13"	16.5'	1	2	3				3) Brown fine-medium sand, trace coarse sand, little silt.
20		4	ss	18"	16	21.5'	7	12	11		wet medium	22.5'	4) S me as #3 with red-brown fine-medium sand, trace coarse sand, little silt in tip of split spoon.
25		5	ss	18"	13"	26.5'	16	16	22		wet dense		5) Red-brown very fine sand, trace silt.
30		6	ss	18	16"	31.5'	12	20	25		"		6) Red-brown silt.
35		7	"	"	13	3[illegible].5'	11	11	30		"		7) Same as #6.
		8	ss	18"	16"	41.5'	5	7	12		wet medium		8) Red-brown silt, little very fine sand.

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ________ FT.
ROCK CORING ________ FT.

CLIENT: Camp. Dresser & McKee Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 2 OF 2

HOLE NO. B-1

CONTRACTOR

PROJECT NAME East Shore Water Pollution

LINE

FOREMAN-DRILLER J.D. C.E.

LOCATION Abatement Project New Haven, Conn.

STATION N163610

INSPECTOR Om Mehta

OFFSET E558345

GROUND WATER OBSERVATIONS

AT 15.0' FT. AFTER 0 HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	NOM. 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START

DATE FIN. 1/19 - 1/19/72

SURFACE ELEV. 14.0

GROUND WATER ELEV. -1.0

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
												44.0'	
5		9	ss	18"	12"	46.5'	12	15	28		wet dense		9) Red-brown fine-coarse sand, trace fine-medium gravel, little silt.
0'		10	ss	18"	13"	51.5'	25	37	76		wet very dense		10) Red-brown fine-medium sand, trace coarse sand, trace fine gravel, little silt.
5		11		8"	6"	55.67'	75	100/2"			"	55.67' EOB	11) Same as #10. Refusal on split spoon at 55.67'.

END OF BO ING 55.67' Soil

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

CLIENT: Camp, Dresser & McKee, Inc.	**General Borings, Inc.** P. O. BOX 7135 PROSPECT, CONN. 06712
CONTRACTOR	PROJECT NAME East Shore Water Pollution Abatement Project
FOREMAN-DRILLER L.C. R.D.	LOCATION New Haven, Conn.
INSPECTOR Om Mehta	

SHEET 1 OF 2
HOLE NO. B-2
LINE
STATION N163410
OFFSET E558375
DATE START 2/26 - DATE FIN. 2/28/72
SURFACE ELEV. 12.0
GROUND WATER ELEV. –

GROUND WATER OBSERVATIONS
AT ___ FT. AFTER ___ HOURS
AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	WI	SS	
SIZE I.D.	NOM. 2"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. / MOIST	STRATA CHANGE DEPTH / ELEV.
	2	1	UB	24"	24	2.0'	Press				saturated	
	14											
	9											
	4											
5	3											
	3	2		24"	12	8.0'	Press					
	9											
	9											
	9											
10	11	1	ss	18"	18	11.5'	3	3	3		sat loose	
	13											
	29											
	38	2	ss	18"	14	14.5'	6	6	6		wet medium	
	36											
15	36											
	52											
	54											
	54											
	60											
20	65	3	"	"	11	21.5'	5	6	7		wet medium	
	46											
	68											
	70											
	62											
25	60	4	"	"	14	26.5'	5	6	10		moist medium	
	50											
	62											
	77											
	85											
30	88	5			13	31.5'	6	9	10		moist medium	
	52											
	70											
	89											
	100											
35	95	6		"	18	36.5'	7	9	11		moist medium	
	73											
	90											
	96											
	94											
	90	7	"		18	41.5'	6	9	12		moist medium	

FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.

1) Black silt - Fine sand at bottom of UB sample.

2) Gray silt. UB Sample

1) Top 9" - brown organic silt. Bottom 9" - brown fine sand, trace silt.

2) Brown fine sand, trace silt.

3) Gray-brown fine-medium sand, trace silt.

4) Red-brown silt, trace very fine sand.

5) Same as #4.

6) Red-brown silt, some very fine sand.

7) Red-brown silt, some very fine sand changing to red-brown fine-medium silty sand, trace medium gravel.

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING _____ FT.
ROCK CORING _____ FT.

CLIENT: Camp, Dresser & McKee, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 2 OF 2

HOLE NO. B-2

LINE

CONTRACTOR

PROJECT NAME East Shore Water Pollution

LOCATION Abatement Project New Haven, Conn.

FOREMAN-DRILLER L.C. R. D.

STATION N163410

INSPECTOR Om Mehta

OFFSET E558375

GROUND WATER OBSERVATIONS

AT ___ FT. AFTER ___ HOURS

AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	WI	SS	
SIZE I.D.	2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 2/28

DATE FIN. 2/28/72

SURFACE ELEV. 12.0

GROUND WATER ELEV. –

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
	88											41.0'	
	99												
	125												
	150												
5	200	8	SS	8"		45.67'	29	50/2"	50/0"		wet very dense	45.67' EOB	8) Red-brown fine-coarse sand, fine-medium gravel, trace silt, decomposed sandstone in spoon tip.
10													Refusal on spoon at 45.67'.
													END OF BORING 45.67' Soil
15													2UB
20													
25													
30													
35													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE

EARTH BORING ______ FT.

ROCK CORING ______ FT.

CLIENT: Camp, Dresser & McKee Inc.	General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712	SHEET 1 OF 1 HOLE NO. [illegible]-10
CONTRACTOR	PROJECT NAME East Shore Water Pollution	LINE
FOREMAN-DRILLER J.D. C.E.	LOCATION Abatement Project New Haven, Conn.	STATION N163520
INSPECTOR Om Mehta		OFFSET E557755

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	
AT 13.0' FT. AFTER 0 HOURS	TYPE	HA	SS		DATE START [illegible]
AT ___ FT. AFTER ___ HOURS	SIZE I.D.	NOM. 2"	1 3/8"		DATE FIN. [illegible]
	HAMMER WT.		140 lbs.	BIT	SURFACE ELEV. 14.8
	HAMMER FALL		30		GROUND WATER ELEV. 1.8

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	ss	18	18	6.5'	3	4	3		moist loose		1) Gray fine-medium sand, trace coarse sand, little silt, trace seashells.
10		2	"	"	18	11.5'	2	1	2		"		2) Black fine-medium sand, trace coarse sand, little silt, trace vegetation, trace fine gravel.
15		3			18	16.5'	1	2	4		"		3) Same as #2.
20		4		"	6"	21.5'	18	21	61		wet very dense		4) Red-brown fine-coarse sand, trace silt, trace fine gravel.
25		5		"	13"	26.5'	23	37	60		"		5) Red-brown fine-medium sand, trace coarse sand, little silt.
30		6			18"	31.5'	58	67	47		"		6) Same as #5, trace medium gravel.
		7		6"	6"	33.0'	100/6"					33.0' EOB	7) Red-brown decomposed sandstone, trace gray decomposed rock. Refusal on split spoon at 33.0'
35													END OF BORING 33.0' Soil

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

CLIENT Camp, Dresser & McKee Inc

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 1
HOLE NO. B-38
LINE

CONTRACTOR

PROJECT NAME East Shore Water Pollution

FOREMAN-DRILLER W.C. C.C.

LOCATION Abatement Project New Haven, Conn.

STATION N163955

INSPECTOR Om Mehta

OFFSET E558595

GROUND WATER OBSERVATIONS

AT 14.0' FT. AFTER One-Half HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	2"	1 3/8	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START
DATE FIN. 2/1 - 2/1/72
SURFACE ELEV. 17.6
GROUND WATER ELEV. 3.6

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	SS	18	18	6.5'	10	12	11		wet medium		1) Brown medium-coarse sand, some shells, trace fine gravel, trace silt.
10		2			18	11.5'	5	7	3		wet loose		2) Gray-brown fine-medium sand, some silt, trace shells.
15		3			18	16.5'	7	8	8		wet loose		3) Brown fine-medium sand, little silt, trace fine gravel.
20		4			18	21.5'	11	16	15		wet medium		4) Brown fine-coarse sand, trace silt.
25		5	"	18"	14"	26.5'	11	12	25		"		5) Same as #4.
30		6		12"	12"	31.0'	137/12"				wet very dense	31.0' EOB	6) Red-brown very fine sand and silt. Refusal at 31.0'
													END OF BORING 31.0' Soil
35													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ______ FT.
ROCK CORING ______ FT.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

CLIENT: Camp, Dresser & McKee Inc.

SHEET 1 OF 1
HOLE NO. B-39

CONTRACTOR

PROJECT NAME: East Shore Water Pollution

LINE

LOCATION: Abatement Project New Haven, Conn.

FOREMAN-DRILLER: L.C.

STATION: N163910

INSPECTOR: Om Mehta

OFFSET: E558695

GROUND WATER OBSERVATIONS
AT 15.0' FT. AFTER 0 HOURS
AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	Nom. 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START
DATE FIN. 1/26 - 1/26/72
SURFACE ELEV. 22.2
GROUND WATER ELEV. 7.2

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	SS	18"	14"	6.5'	1	5	7		wet medium		1) Brown fine-medium sand, some silt, trace shells.
10		2	"	"	14"	11.5'	1	1	3		wet loose		2) Gray fine-medium sand, some silt, little seashells.
15		3	"	"	18"	16.5'	3	7	5		moist medium		3) Brown fine sand, some silt, little black fine silty sand, trace of vegetation.
20		4	"	"	18"	21.5'	4	13	12		moist medium		4) Brown fine-medium sand, some silt.
25		5	"	"	18"	26.5'	6	12	13		wet medium		5) Same as above.
30		6	"	"	18"	31.5'	16	18	33		wet very dense	31.0'	6) Brown fine-medium sand changing to fine-coarse sand and fine-medium gravel.
35		7	"	"	16"	36.5'	13	17	27		wet dense	36.0'	7) Red-brown fine-coarse sand and fine-medium gravel changing to red-brown very fine sandy silt.
			SS	0"	0"	39.0'	50/0"				very dense	39.0' EOB	Refusal on split spoon at 39.0'. END OF BORING 39.0' Soil

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE 39.0'
EARTH BORING 39.0' FT.
ROCK CORING ____ FT.

CLIENT: Camp, Dresser & McKee Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 1 OF 1
HOLE NO. B-40

CONTRACTOR

PROJECT NAME East Shore Water Pollution

LOCATION Abatement Project
New Haven, Conn.

LINE

FOREMAN-DRILLER L.C.

STATION N163965

INSPECTOR Om Mehta

OFFSET E558750

GROUND WATER OBSERVATIONS
AT 13.0' FT. AFTER 0 HOURS
AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	NOM 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 1/26 – DATE FIN. 1/26/72
SURFACE ELEV. 22.5
GROUND WATER ELEV. 9.5

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	SS	18"	16"	6.5'	1	3	4		wet loose		1) Gray fine-medium sand and silt, shells.
10		2	"	"	18"	11.5'	1	1	1		moist very soft	11.0'	2) Gray clayey silt changing to black fine silty sand.
15		3		"	18"	16.5'	6	10	12		wet medium		3) Brown fine-medium sand, some silt, trace coarse gravel.
20		4	"	"	10"	21.5'	8	14	12		wet medium		4) Brown fine-coarse sand, some silt, trace fine-medium gravel.
25		5	"	"	16"	26.5'	35	40	34		wet hard		5) Red-brown silt, trace very fine sand, trace of coarse gravel.
30		6	"	"	18"	31.5'	5	6	12		wet very stiff		6) Red-brown silt, trace very fine sand, trace medium gravel.
35		7	"	"	12"	36.5'	4	5	100		wet hard	36.5' EOB	7) Red-brown silt, trace very fine sand, red sandstone in tip of spoon. Refusal on spoon at 36.5'. END OF BORING 36.5' Soil

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

CLIENT: Camp, Dresser & McKee Inc.	SHEET 1 OF 2
CONTRACTOR	HOLE NO. B-41
FOREMAN-DRILLER J.D. C.E.	LINE
INSPECTOR Om Mehta	STATION N163895
PROJECT NAME East Shore Water Pollution Abatement Project	OFFSET E558795
LOCATION New Haven, Conn.	

GROUND WATER OBSERVATIONS

AT 13.[illegible] FT. AFTER 0 HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	AXM
SIZE I.D.	NOM. 2½"	1 3/8"	1 1/8"
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	Carbide

DATE START ____

DATE FIN. 1/25 - 1/26/72

SURFACE ELEV. 23.0

GROUND WATER ELEV. 5.0

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5		1	ss	18"	6"	6.5'	2	3	3		moist loose		1) Brown fine-coarse sand, some silt, trace fine gravel.
10		2	"	"	12"	11.5'	14	16	15		wet dense	13.0'	2) Brown fine-medium sand, trace coarse sand, trace fine gravel, little silt.
15		3	"	"	18"	16.5'	overdrove 1/12"		1		wet loose	19.0'	3) Gray sandy silt.
20		4	"	"	18"	21.5'	9	7	9		wet medium		4) Brown fine-medium sand, trace silt.
25		5	"	"	18"	26.5'	8	10	13		"		5) Same as #4.
30		6	"	"	12"	31.5'	9	8	17		"	34.0'	6) Red-brown fine-coarse sand, trace fine gravel, little silt.
35		7	"	"	6"	36.5'	31	50	28		wet very dense		7) Red-brown sandy silt.
		8	"	"	3"	40.5'	14	50/[illegible]			"		8) Red-brown fine-coarse sand, trace fine gravel, little silt.

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE

EARTH BORING ______ FT.

ROCK CORING ______ FT.

CLIENT Camp, Dresser & McKee Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 2 OF 2

HOLE NO. B-41

CONTRACTOR

PROJECT NAME East Shore Water Pollution Abatement Project

LINE

FOREMAN-DRILLER J.D. C.E.

LOCATION New Haven, Conn.

STATION N163895

INSPECTOR Om Mehta

OFFSET E558795

GROUND WATER OBSERVATIONS

AT 18.0' FT. AFTER 0 HOURS

AT ____ FT. AFTER ____ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	AX M
SIZE I.D.	NOM. 2½"	1 3/8"	1 1/8"
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30	Carbide

DATE START

DATE FIN. 1/25 - 1/26/72

SURFACE ELEV. 23.0

GROUND WATER ELEV. 5.0

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
		1	C	60	6"	45.54				1		40.54' Run #1	Refusal on spoon.
										1			
										1			Run #1 Cored 40.54'-45.54'. Recovered 6" white-red sandstone.
										2			
										2			
5												45.54' EOB	END OF BORING 45.54' 40.54' Soil 5.0' Rock
10													
15													
20													
25													
30													
35													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST

PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ____ FT.
ROCK CORING ____ FT.

General Borings, Inc.
P. O. BOX 7135 PROSPECT, CONN. 06712

CLIENT: Camp, Dresser & McKee Inc.
CONTRACTOR
FOREMAN-DRILLER L.C.
INSPECTOR Om Mehta

PROJECT NAME East Shore Water Pollution
LOCATION Abatement Project New Haven, Conn.

SHEET 1 OF 2
HOLE NO. B-42
LINE
STATION N163755
OFFSET E558605

GROUND WATER OBSERVATIONS
AT 13.0' FT. AFTER 0 HOURS
AT ___ FT. AFTER ___ HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	
SIZE I.D.	Nom. 2½"	1 3/8"	
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30"	

DATE START 1/24
DATE FIN. 1/25/72
SURFACE ELEV. 20.0
GROUND WATER ELEV. 0.5

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
													First Attempt - No Recovery
5			cs	18"	0"	6.5'	6	5	22				
		1	ss	18"	12"	8.0'	25	26	12		moist dense	6.5' 7.0' 7.75'	1) Brown fine-medium sand and gravel, bric-a-brac fill changing to gray fine-medium sand, some silt changing to gray silty clay.
10		2	"	"	18"	11.5'	4	3	3		moist medium		2) Gray clayey silt changing to silty clay.
15		3	"	"	18"	16.5'	1	1	2		moist soft	18.0'	3) Gray clayey silt.
20		4	"	18"	18"	21.5'	3	7	9		wet medium		4) Brown fine-medium sand.
25		5	"	"	18"	26.5'	4	13	20		wet dense	28.0'	5) Brown fine-coarse sand, trace of fine-medium gravel.
30		6	"	"	18"	31.5'	10	18	22		wet dense		6) Red-brown very fine silty sand.
35		7	"	"	18"	36.5'	5	8	13		wet medium		7) Same as above.
		8	"	"	18"	41.5'	4	7	9		wet medium		8) Red-brown very fine silty sand, little clay.

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ___ FT.
ROCK CORING ___ FT.

CLIENT: Camp, Dresser & McKee, Inc.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CONN. 06712

SHEET 2 OF 2
HOLE NO. B-42

CONTRACTOR

PROJECT NAME East Shore Water Pollution
LOCATION Abatement Project
New Haven, Conn.

LINE

FOREMAN-DRILLER L.C.

STATION N163755

INSPECTOR Om Mehta

OFFSET E558605

GROUND WATER OBSERVATIONS
AT 18.0' FT. AFTER 0 HOURS
AT 19.5 FT. AFTER 26 HOURS

	CASING	SAMPLER	CORE BAR.
TYPE	HA	SS	AX
SIZE I.D.	2½"	1 3/8"	1 1/8"
HAMMER WT.		140 lbs.	BIT Carbide
HAMMER FALL		30"	

DATE START
DATE FIN. 1/24 - 1/25/72
SURFACE ELEV. 20.0
GROUND WATER ELEV. 0.5

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO.	TYPE	PEN	REC.	DEPTH @ BOT.	BLOWS PER 6" ON SAMPLER (FORCE ON TUBE) 0-6	6-12	12-18	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
45 / 5		9	ss	18"	16"	46.5'	6	12	10				9) Brown fine-medium sand, little fine-medium gravel, trace silt.
												47.0'	Refusal on auger at 47.0'.
										2			
50 / 10										2		Run#1	Run#1 Cored rock 47.0'-52.0'. (5.0') Recovered 9" red sandstone.
										2½			
										2			
	Run	1	C	60"	9"	52.0'				2		52.0'	
										2			
55 / 15										1½		Run#2	Run 2 Cored rock 52.0' - 57.0'. (5.0') Recovered 1" red sandstone.
										2			
										2½			
	Run	2	C	60"	1"	57.0'				2		57.0'	
60 / 20												EOB	END OF BORING 57.0' 47.0' Soil 10.0' Rock
25													
30													
35													

TYPE OF SAMPLES:
D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON
UB=UNDISTURBED BALL CHECK VT=VANE TEST
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%

TOTAL FOOTAGE
EARTH BORING ________ FT.
ROCK CORING ________ FT.

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS

TEST PIT REPORT

TEST PIT NO. TP1

PROJECT: EAST SHORE SEWER TREATMENT PLANT, New Haven Ct.

CLIENT: CAMP, DRESSER & McKEE

CONTRACTOR: GENERAL BORINGS

EQUIPMENT USED: 3/8 cu. yd. DYNAHOE

FILE NO. 2849

LOCATION: See Plan N164425 E558800

ELEVATION: 6±

EXPLORATION DATE: 24 Feb 72

INSPECTOR: D. Andrews

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
				Red and black silty fine SAND, little ash, trace roots, coarse sand and glass (FILL)	Strong sewage odor
	1.0			Dark brown SILT, trace fine sand (slightly organic) (FILL)	
2	1.5			Olive brown fine sandy SILT (FILL)	
4	3.5			Light brown fine SAND, little silt	Excessive caving at 4'
6	4.5			Light red-gray medium to fine SAND, trace fine gravel.	
8	7.0			Bottom of Exploration at 7.0 ft. due to excessive caving	
10					
12					

GROUNDWATER

DATE	TIME	DEPTH FT.
2-24-72	0	0.5

Note: Ice on surface

NOT ENCOUNTERED

PIT DIMENSIONS

8 (L) · 4 (W) · 7 (D) 224 Cu. Ft.

BOULDERS

8" to 18" DIAM. No. --- Vol. --- Cu. Ft.

Over 18" DIAM. No. --- Vol. --- Cu. Ft.

SUMMARY

DEPTH 7

JAR SAMPLES ---

BAG SAMPLES ---

GROUNDWATER 0.5 ft.

TEST PIT NO. TP1

H & A FORM MAR. 71

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS

TEST PIT REPORT

TEST PIT NO. TP10

PROJECT: EAST SHORE SEWER TREATMENT PLANT, New Haven Ct.

CLIENT: CAMP, DRESSER & McKEE

CONTRACTOR: GENERAL BORINGS

EQUIPMENT USED: 3/8 cu. yd. DYNAHOE

FILE NO. 2849

LOCATION: See Plan N163975 E558715

ELEVATION: 14.7

EXPLORATION DATE: 24 Feb 72

INSPECTOR: D. Andrews

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
	0.1			Black SLUDGE (FILL)	
2	2.5			Light brown coarse to fine SAND (FILL)	
	3.5			Red brown fine SAND little silt, trace coarse to medium sand and gravel (FILL)	Water seeping in at 3.5 ft.
4	6.0			Mottled gray organic silty coarse to fine SAND with shells in layers and pockets of reeds (FILL)	
6, 8	10.0			Dark gray to black ORGANIC SILT, trace little fine sand in lenses, trace shells and pockets of reeds (FILL)	
10, 12				Bottom of Exploration at 10.0 ft.	

GROUNDWATER

DATE	TIME	DEPTH FT.
2-24-72	---	3.5
2-25-72	15	3.5
NOT ENCOUNTERED		

PIT DIMENSIONS

10 (L) · 3 (W) · 10 (D) 300 Cu. Ft.

BOULDERS

8" to 18" DIAM. No. --- Vol. --- Cu. Ft.

Over 18" DIAM. No. --- Vol. --- Cu. Ft.

SUMMARY

DEPTH 10.0

JAR SAMPLES ---

BAG SAMPLES ---

GROUNDWATER 3.5

TEST PIT NO. TP10

H & A FORM MAR. 71 2

HALEY & ALDRICH, INC. CONSULTING SOIL ENGINEERS	TEST PIT REPORT	TEST PIT NO. TP12

PROJECT: EAST SHORE SEWER TREATMENT PLANT, New Haven Ct.

CLIENT: CAMP, DRESSER & McKEE

CONTRACTOR: GENERAL BORINGS

EQUIPMENT USED: 3/8 cu. yd. DYNAHOE

FILE NO. 2849

LOCATION: See Plan N163740 E558730

ELEVATION: 19+

EXPLORATION DATE: 24 Feb 72

INSPECTOR: D. Andrews

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
2, 4				Brown mottled silty fine SAND, little reinforced concrete blocks, trace curbstones, wood ties, plastic, pipe, brick and reeds. Trace gravel, few cobbles and boulders (FILL)	One piece of concrete 6' x 2' x 3' Rubble materials=25%
6, 8	6.0			Light gray brown medium to fine SAND, trace shells and coarse sand, pockets and balls of organic silt (FILL)	
	9.0			Dark gray organic silty coarse to fine SAND, many shells (FILL)	
10, 12	10.0			Bottom of Exploration at 10.0 ft.	

GROUNDWATER

DATE	TIME*	DEPTH FT.
2-24-72	---	9.0
NOT ENCOUNTERED	*	HRS. AFTER COMPL.

PIT DIMENSIONS

12 (L) x 4 (W) x 10 (D) = 480 Cu. Ft.

BOULDERS

8" to 18" DIAM No. 4 Vol. 2 Cu. Ft.

Over 18" DIAM No. 3 Vol. 40 Cu. Ft.

SUMMARY

DEPTH 10.0

JAR SAMPLES ---

BAG SAMPLES ---

GROUNDWATER 9.0

TEST PIT NO TP12

H & A FORM MAR. 71

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS

TEST PIT REPORT

TEST PIT NO. TP14

PROJECT: EAST SHORE SEWER TREATMENT PLANT, New Haven Ct.

CLIENT: CAMP, DRESSER & McKEE

CONTRACTOR: GENERAL BORINGS

EQUIPMENT USED: 3/8 cu. yd. DYNAHOE

FILE NO. 2849

LOCATION: See Plan N163605 E558510

ELEVATION: 14+

EXPLORATION DATE: 25 Feb 72

INSPECTOR: D. Andrews

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
				Mottled brown fine SAND, little gravel, trace silt and coarse to medium sand; few cobbles, trace brick, tile and concrete (slightly organic) (FILL)	
2					
	3.0			Black ORGANIC SILT, trace reeds and shells (FILL)	
	3.5				
4				Light gray fine SAND, little organic silt (pockets) with reeds and shells (FILL)	
	5.5			Gray medium to fine SAND, little organic silt, trace reeds, shells and gravel (organic silt also in pockets) (FILL)	
6					
8					
	9.0			Black to gray ORGANIC SILT, trace reeds and fine sand (FILL)	
10	10.0			Bottom of Exploration at 10.0 ft.	
12					

GROUNDWATER

DATE	TIME	DEPTH FT.
2-25-72	---	8.0

NOT ENCOUNTERED

PIT DIMENSIONS

10 (L) · 3.5 (W) · 10 (D) 350 Cu. Ft.

BOULDERS

8" to 18" DIAM No. --- Vol. --- Cu. Ft.

Over 18" DIAM No. --- Vol. --- Cu. Ft.

SUMMARY

DEPTH 10

JAR SAMPLES ---

BAG SAMPLES ---

GROUNDWATER 8.0

TEST PIT NO. TP14

H & A FORM MAR. 71

HALEY & ALDRICH, INC.
CONSULTING SOIL ENGINEERS

TEST PIT REPORT

TEST PIT NO. TP16

PROJECT: EAST SHORE SEWER TREATMENT PLANT, New Haven Ct.

CLIENT: CAMP, DRESSER & McKEE

CONTRACTOR: GENERAL BORINGS

EQUIPMENT USED: 3/8 cu. yd. DYNAHOE

FILE NO. 2849

LOCATION: See Plan N163565 E558400

ELEVATION: 13.5±

EXPLORATION DATE: 25 Feb 72

INSPECTOR: D. Andrews

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
	1.0			Brown silty fine SAND, trace brick, glass, concrete and slag (FILL)	
2	3.5			Gray mottled ORGANIC SILT, little coarse to fine sand; trace brick, concrete and gravel (FILL)	
4, 6	8.0			Black and gray fine sandy ORGANIC SILT, trace reeds and shells, trace fine sand in lenses (FILL)	
8	10.0			Dark gray and black ORGANIC SILT, trace reeds and shell fragments intermixed with fine sand (FILL?)	May be natural
10, 12				Bottom of Exploration at 10.0 ft.	

GROUNDWATER

DATE	TIME	DEPTH FT.

NOT ENCOUNTERED X

PIT DIMENSIONS

10 (L) . 3 (W) . 10 (D) 300 Cu. Ft.

BOULDERS

8" to 18" DIAM: No. --- Vol. --- Cu. Ft.

Over 18" DIAM: No. --- Vol. --- Cu. Ft.

SUMMARY

DEPTH 10

JAR SAMPLES ---

BAG SAMPLES ---

GROUNDWATER ---

TEST PIT NO. TP16

H & A FORM MAR. 71 2

APPENDIX B

Ground Water Observation Well Installation Report and Data

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA5-OW
Boring No. HA5-OW

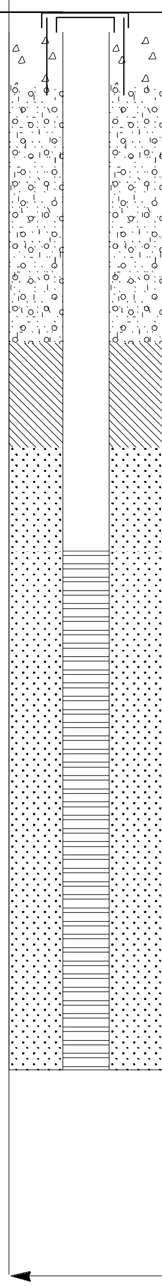
Project	Wet Weather Capacity Improvements - Ph.I GNHWPCA ESWPAF
Location	New Haven, CT
Client	CH2M HILL
Contractor	General Borings, Inc.
Driller	T. McGovern
Initial Water Level (depth bgs)	10.0 ± ft

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No.	37176-000
Date Installed	18 May 2012
H&A Rep.	S. Brousseau
Location	See Plan
Ground El.	12.1 (est.)
Datum	NAVD88

SOIL/ROCK CONDITIONS	DEPTH (ft.)	WELL DEPTH (ft.)	ELEVATION (ft.)
		0.0	12.1
BITUMINOUS CONCRETE	0.5	1.0	11.1
FILL		6.0	6.1
		8.0	4.1
	10.0	10.0	2.1
		20.0	-7.9
GLACIODELTAIC DEPOSITS	24.0		



WELL CONSTRUCTION DETAILS

Type of protective cover	Bolted
Depth of Roadway Box below ground surface	0.0 ft
Depth of top of riser below ground surface	0.37 ft
Type of protective casing	Roadway Box
Length	0.7 ft
Inside diameter	6.0 in.
Depth of bottom of Roadway Box	0.7 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	10.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0 ft	1.0 ft
Bentonite	6.0 ft	2.0 ft
	-	-

Diameter of borehole	8 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	10.0 ft
Depth to bottom of well screen	20.0 ft
Bottom of silt trap	n/a
Depth of bottom of borehole	24.0 ft

COMMENTS:

GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\37176_GNHWPCA ELEC INFRASTRUCTURE\000\DATABASES\RECOVERED\2012-0524 37176-000TB GINT 8.GPJ Sep 4, 12

HALEY & ALDRICH

GROUNDWATER MONITORING REPORT

OW/PZ NUMBER

HA5-OW

Page 1 **of** 1

PROJECT	East Shore Water Pollution Abatement Facility Upgrades	**H&A FILE NO.**	37176-000
LOCATION	New Haven, Connecticut	**PROJECT MGR.**	T. Nolan
CLIENT	CH2M HILL	**FIELD REP.**	S. Brousseau
CONTRACTOR	General Borings, Inc.	**DATE**	18 May 2012

ELEVATION OF REFERENCE POINT 12.1

DESCRIPTION OF REFERENCE POINT ☐ **PVC** ☐ **Roadway / Casing** ☑ **Ground Surface** ☐ **Other:**

Date	Time	Elapsed Time (days)	Depth to Water from Reference Point	Elevation of Water	Remarks	Read By
18-May-12	09:45	0	10.0	2.1		SB
18-May-12	16:45	0.3	10.1	2.0		SB
21-May-12	16:30	3	14.8	-2.7		SB

Form #3170

APPENDIX C

Geotechnical Laboratory Test Results

Rochester Office
535 Summit Point Drive
Henrietta, NY 14467

LABORATORY D.I.P.R.A. TESTS

Project: GNHWPCA Electrical Infrastructure

Project Number: RT-12-040

Town /City: N/A

Date: 06-14-2012

Client: Haley & Aldrich

Technician: William Gilmore

Summary of Laboratory Analysis Soil

Lab ID:	Location:	Resistivity (Ohm-cm)	Redox (mv)	PH	Sulfides (+,T,-)	% Moisture Content (wet, moist, dry)	TOTAL POINTS
		Points	*Points*	*Points*	*Points*	*Points*	
12-351	HA-2 Depth = 4' – 14'	*1,600*	*-4.9*	*6.72*	*-*	*Moist (9.5%)*	**14**
		8	*5*	*0*	*0*	*1*	
12-352	HA-5 Depth = 10' – 17'	*7,000*	*2.9*	*7.45*	*-*	*Wet (18.7%)*	**6**
		0	*4*	*0*	*0*	*2*	
12-353	HA-9 Depth = 2' – 9'	*9,800*	*-8.4*	*7.82*	*-*	*Moist (8.5%)*	**6**
		0	*5*	*0*	*0*	*1*	

Per the Ductile Iron Pipe Research Association (DIPRA), point totals 10 or greater should be considered for Cathodic Protection.

COMPLETE ENVIRONMENTAL TESTING, INC.

80 Lupes Drive
Stratford, CT 06615

Tel: (203) 377-9984
Fax: (203) 377-9952
e-mail: cet1@cetlabs.com

Client: Ms. Jen Buchanon
Haley & Aldrich
100 Corporate Place, Suite 105
Rocky Hill, CT 06067-1803

Analytical Report

CET # 12060097

Report Date: June 11, 2012
Client Project: GNHWPCA Electrical Infrastructure
Client Project #: 37176-000

Connecticut Laboratory Certification PH 0116
Massachusetts Laboratory Certification M-CT903
Rhode Island Certification 199

New York Certification 11982
Florida Laboratory Certification E871064

SAMPLE SUMMARY:

This report contains analytical data associated with the following samples only:

CETID	Client Sample ID	Matrix	Collection Date	Collection Time	Receipt Date
AF04675	HA-2	Soil	5/18/2012		06/05/2012
AF04676	HA-5	Soil	5/18/2012		06/05/2012
AF04677	HA-9	Soil	5/18/2012		06/05/2012

Sample temperature upon receipt was 1.3 degrees C

ANALYSIS:

Chloride [EPA 300.0] Units: mg/kg

Client ID	HA-2	HA-5	HA-9
CET ID	AF04675	AF04676	AF04677
Date Analyzed	6/7/2012	6/7/2012	6/7/2012
Chloride	8.4	14	ND < 5.0

Sulfate [EPA 300.0] Units: mg/kg

Client ID	HA-2	HA-5	HA-9
CET ID	AF04675	AF04676	AF04677
Date Analyzed	6/8/2012	6/7/2012	6/8/2012
Sulfate	320	17	110

Questions related to this report should be directed to David Ditta, Timothy Fusco, or Robert Blake at 203-377-9984.

Sincerely,

David Ditta
Laboratory Director

Report Comments:
1. ND is None Detected at the specified detection limit.
2. All analyses were performed in house unless a Reference Laboratory is listed.
3. Samples will be disposed of 30 days after the report date.
4. Sample Result Flags:
   E - The result is estimated, above the calibration range.
   H - The surrogate recovery is above the control limits.
   L - The surrogate recovery is below the control limits.
   B - The compound was detected in the laboratory blank.
   P - The Relative Percent Difference (RPD) of dual column analyses exceeds 40%.
   D - The RPD between the sample and the sample duplicate is high. Sample homogeneity may be a problem.
5. All results met standard operating procedures unless indicated by a data qualifier next to a sample result, or a narration in the QC report.

12060097

HALEY & ALDRICH
Haley & Aldrich, Inc.
800 Connecticut Blvd.,
Suite 100
East Hartford, CT 06108-7303
Phone 860-282-9400
Fax 860-282-9500

CHAIN OF CUSTODY RECORD

1 of 1

H&A FILE NO.	37176-000	LABORATORY	CET	DELIVERY DATE	5/30/12
PROJECT NAME	GNHWPCA Electrical Infrastructure	ADDRESS	80 Lupes Drive, Stratford, CT 06615	TURNAROUND TIME	**Normal**
H&A CONTACT	Jen Buchanon jbuchanon@Haleyaldrich.com	CONTACT	Tim or Dave	PROJECT MANAGER	Tom Nolan

Sample No.	Date	Time	Depth (feet)	Type (Soil)	Analysis Requested: 1 Chloride	2 Water Sulble Sulfate In Soil	3	4	5	6	Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)
HA-2	5/18/12	--	4-14	Soil	X	X					1	Please run all samples for the following:
HA-5	5/18/12	--	10-17	Soil	X	X					1	
HA-9	5/18/12	--	2-9	Soil	X	X					1	
	--	--										Chloride (Standard Methods 4500 / EPA 300.0)
	--	--										Water Soluble Sulfate in Soil (Std Method 4500 / EPA 300.0)
	--	--										
	--	--										
	--	--										
	--	--										
	--	--										

Sampled and Relinquished by	Received by
Sign [illegible]	Sign [illegible]
Print Sean Carr	Print Robert Perlamen
Firm Haley & Aldrich, Inc.	Firm CET
Date 5/30/2012 Time 1320	Date 6-5-12 Time 1335
Relinquished by	**Received by**
Sign [illegible]	Sign [illegible]
Print Robert Perlamen	Print
Firm	Firm
Date 6-5-12 Time 1525	Date 6/5/12 Time 1525
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID

	1	2	3	4	5	6
VOA Vial						
Amber Glass						
Plastic Bottle						
Preservative						
Volume						

SOLID

	1	2	3	4	5	6
VOA Vial						
Amber Glass						
Clear Glass	2 oz	2 oz	2 oz	2 oz		
Preservative	A	A	A	A		
Volume						

PRESERVATION KEY

A Sample chilled C NaOH E H_2SO_4 G Methanol
B Sample filtered D HNO_3 F HCL H Sodium Bisulfate

Sampling Comments

Adhere to CT PMC and RDEC.
Use CTDEP RCPs.

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

1.30

Form #3204

APPENDIX D

Structure Summary Sheets

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: METHANOL BUILDING

1. Applicable Subsurface Explorations:

Recent Test Boring: HA-1
Previous Test Borings: B1, TP14, TP16

Note the proposed location of the methanol tank was moved after HA-1was drilled, thus the boring is not very close to the proposed structure.

2. Subsurface Conditions:

Stratum	Range in Thickness (ft.)	Average Top of Stratum Elevation (ft.) (NAVD)
Fill	11	12
Organic Deposits	--	--
Glaciodeltaic Deposits	44.7	2.0
Sandstone/Siltstone	---	-42.8.

Approximate Groundwater Elevation: 5.0 (NAVD)

3. Proposed Structure Design Features:

The methanol building will consist of a one-story brick and block structure located to the east of the existing aeration tanks. The east half of the footprint will have a lowest floor at El. 14.67, which is about 2 ft above existing ground. The west half of the structure will have a lowest floor at El. 10.67, about 1.4 ft below ground and will contain a 10,000 gallon storage tank.

- Approximate Structure Loads:

Building walls:	3,700 lbs per ft.
Building slab:	less than 500 psf
Storage tank pad:	500 to 1,000 psf

- Existing Nearby Structures:
  - The existing aeration tanks are located approximately 70 ft west. The tanks are supported on a 2 ft thick mat bearing at El. -5.

- Existing Nearby Utilities:
  - A utility pole to the northwest and a transformer pad to the southwest as shown on Figure 2.

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: METHANOL BUILDING

1. Foundation Design Recommendations:

- Foundation Type:

  Footings bearing on compacted granular fill after overexcavation of unsuitable soil. Timber piles or footings bearing on aggregate piers installed through the fill are also feasible, and may be more economical because piles or aggregate piers are recommended for other structures.

- Allowable Bearing Capacity: 2 tsf (for footings bearing on natural sand or compacted granular fill placed over natural sand or on aggregate piers).

- Estimated timber pile length: 45 ft.

- Seismic Design:

  For the design earthquake, seismically-induced settlement of the underlying soils will be less than 1 in.

  In accordance with the 2009 Supplement to the State of Connecticut Building Code, the seismic soil design criteria are as follows:

  $S_s = 0.243$
  $S_1 = 0.062$
  Site Class: D

2. Construction Considerations:

- Underpinning and Temporary Excavation Support: The utility pole to the northwest and the transformer to the southwest will need to be temporarily supported for overexcavation option.

- Dewatering: We anticipate that dewatering can be accomplished using sumps.

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: ELECTRIC BUILDING

1. Applicable Subsurface Explorations:

   Recent Test Boring: HA-2
   Previous Test Boring: B-42

2. Subsurface Conditions:

Stratum	Range in Thickness (ft.)	Average Top of Stratum Elevation (ft.) (NAVD)
Fill	8 to 16.9*	14.2
Organic Deposits	0 to 5.0*	6.2
Glaciodeltaic Deposits	29.0	1.6
Sandstone/Siltstone	---	-38.7

* Difficult to distinguish the fill from the organic deposit in the previous boring.

Approximate Groundwater Elevation: 10 (NAVD)

3. Proposed Structure Design Features:

   The electric building will be a one-story brick and block structure with floor El. 14.64. Switchgear pads are planned, two to the north and two to the south of the building.

   - Approximate Structure Loads:
     Building walls: 4,400 lbs per ft.
     Building slab: less than 500 psf
     Storage tank pad: 500 to 1,000 psf

   - Existing Nearby Utilities:

     – An existing 66-in. dia. RCP pipe with invert at approximately El. 1 will be about 10 ft south of the building as shown on Figure 2.

     – An abandoned 48-in. dia. RCP pipe is located about 15 ft west of the northwest corner of the proposed electric building.

4. Foundation Design Recommendations:

   - Foundation Type:

STRUCTURE: ELECTRIC BUILDING

Timber piles or footings bearing on existing fill after improving with aggregate piers. Footings bearing on compacted granular fill after overexcavation of unsuitable soil is also feasible but we believe that will cost more. More information is needed on the switchgear pads, which if settlement tolerable may be able to be supported on a 2 to 3 ft thickness of compacted granular fill over the existing fill.

- Allowable Bearing Capacity: 2 tsf (for footings bearing on aggregate piers or on natural sand or compacted granular fill placed over natural sand).
- Estimated timber pile length: 40 ft.
- Seismic Design:

  For the design earthquake, seismically-induced settlement of the underlying soils will be less than 1 in.

  In accordance with the 2009 Supplement to the State of Connecticut Building Code, the seismic soil design criteria are as follows:

  $S_s = 0.243$
  $S_1 = 0.062$
  Site Class: D

5. Construction Considerations:

- Underpinning and Temporary Excavation Support: None for the pile or aggregate pier option.
- Dewatering: None for the pile or aggregate pier option. We anticipate that dewatering can be accomplished using sumps for overexcavation option.
- Special Considerations:
  - Assuming piles and aggregate piers are at least 10 ft away from the 66 in. dia. pipe, we don't believe special construction techniques are warranted.

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: ODOR CONTROL

1. Applicable Subsurface Explorations:

   Recent Test Boring: HA-3, HA-4
   Previous Test Borings: B39, B40

2. Subsurface Conditions:

Stratum	Range in Thickness (ft.)	Average Top of Stratum Elevation (ft.) (NAVD)
Fill	18 to 19.5	15.5
Organic Deposits	0 to 5	--
Glaciodeltaic Deposits	24 to 26	3.0
Sandstone/Siltstone	---	-15.8

   Approximate Groundwater Elevation: 10 (NAVD)

3. Proposed Structure Design Features:

   The odor control facility will consist of a slab at El. 14.64 supporting three 12-ft dia., 26-ft tall Biotowers, three 10-ft dia. 15-ft tall carbon polishing vessels, associated utilities, and overhead ducts.

   - Approximate Structure Loads:
     Building walls: 5,900 lbs per ft.
     Slab: 500 to 1,000 psf

   - Existing Nearby Structures:

     – Concrete Scrubber Pad about 40 ft to the east

   - Existing Nearby Utilities:

     – The 42 in. dia. RCP (IE -4.1) crosses the footprint. This pipe will remain active for several years after the building is complete.

4. Foundation Design Recommendations:

   - Foundation Type:

STRUCTURE: ODOR CONTROL

Piles or footings bearing on existing fill after improving with aggregate piers. Footings bearing on compacted granular fill after overexcavation of unsuitable soil is also feasible but we believe that will cost more. More information is needed on the exterior pads, which if settlement tolerable may be able to be supported on a 2 to 3 ft thickness of compacted granular fill over the existing fill.

- Allowable Bearing Capacity: 2 tsf (for footings bearing on aggregate piers or on natural sand or compacted granular fill placed over natural sand).

- Estimated timber pile length: 30 to 40, average 35 ft.

- Seismic Design:

  For the design earthquake, seismically-induced settlement of the underlying soils will be less than 1 in.

  In accordance with the 2009 Supplement to the State of Connecticut Building Code, the seismic soil design criteria are as follows:

  S_s = 0.243
  S_1 = 0.062
  Site Class: D

5. Construction Considerations:

- Underpinning and Temporary Excavation Support: None for pile of aggregate pier option.

- Dewatering: None for aggregate pier option. We anticipate that dewatering can be accomplished using sumps for overexcavation option.

- Special Considerations:

  – Protection of the 42 in. dia. pipe during installation of aggregate piers. Special design for aggregate piers or alternate method of soil improvement local to the pipe may be needed.

  – Protection of the 42 in. dia. pipe during installation of piles. Driven piles should be located at least 5 ft away from existing active pipes (that are in good condition) to reduce risk of damaging the utility during pile driving. If that is not possible or it is concluded that the risk of damage to the pipe is high

STRUCTURE: ODOR CONTROL

because of its condition, drilled piles can be used close to the existing pipes. Assume 6.625 in. dia. drilled piles with a capacity of 40 tons (could go higher if there is a pile load test) with 5 ft long rock socket.

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: GENERATORS

1. Applicable Subsurface Explorations:

   Recent Test Boring: HA-2
   Previous Test Borings: B38

2. Subsurface Conditions:

Stratum	Range in Thickness (ft.)	Average Top of Stratum Elevation (ft.) (NAVD)
Fill	8.0 to 15.0	15
Organic Deposits	0 to 5	--
Glaciodeltaic Deposits	21.0 to 29.0	1.1
Sandstone/Siltstone	---	-14.5

   Approximate Groundwater Elevation: 10 (NAVD)

3. Proposed Structure Design Features:

   The standby emergency power generators will be an at-grade structure with a floor at El. 14.64. The generator and a fuel tank will be supported by a steel-frame on a concrete pad.

   - Structure Load: Approx. 50,000 lbs. each.
   - Existing Nearby Structures:
   - Existing Nearby Utilities:
     - The 42 in. dia. RCP (IE -4.1) crosses the footprints of the pads.
     - The abandoned 48 in. RCP crosses the footprints of the pads.

4. Foundation Design Recommendations:

   - Foundation Type:

     Piles or footings bearing on existing fill after improving with aggregate piers. We recommend considering shifting the generators to the west so that they are not over the 42 in. dia. RCP which is to remain in service.

STRUCTURE: GENERATORS

Footings bearing on compacted granular fill after overexcavation of unsuitable soil are also feasible but we believe that will cost more. More information is needed on the generator pads, which if settlement tolerable may be able to be supported on a 2 to 3 ft thickness of compacted granular fill over the existing fill. This would have some inherent risk because if the 42 in. dia. RCP were to fail, the generator foundation would likely be compromised.

- Allowable Bearing Capacity: 2 tsf (for footings bearing on aggregate piers or on natural sand or compacted granular fill placed over natural sand).

- Estimated timber pile length: 35 ft.

- Seismic Design:

  For the design earthquake, seismically-induced settlement of the underlying soils will be less than 1 in.

  In accordance with the 2009 Supplement to the State of Connecticut Building Code, the seismic soil design criteria are as follows:

  S_s = 0.243
  S_1 = 0.062
  Site Class: D

5. Construction Considerations:

- Underpinning and Temporary Excavation Support: None for pile or aggregate pier option.

- Dewatering: None for aggregate pier option. We anticipate that dewatering can be accomplished using sumps for overexcavation option.

- Special Considerations:

  If it is not possible to relocate the generators away from the 42 in. dia. RCP, the following applies:

  - Protection of the 42 in. dia. pipe during installation of aggregate piers. Special design for aggregate piers or alternate method of soil improvement local to the pipe may be needed.

STRUCTURE: GENERATORS

- Protection of the 42 in. dia. pipe during installation of piles. Driven piles should be located at least 5 ft away from existing active pipes (that are in good condition) to reduce risk of damaging the utility during pile driving. If that is not possible or it is concluded that the risk of damage to the pipe is high because of its condition, drilled piles can be used close to the existing pipes. Assume 6.625 in. dia. drilled piles with a capacity of 40 tons (could go higher if there is a pile load test) with 5 ft long rock socket.

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: SLUDGE HANDLING FACILITY

1. Applicable Subsurface Explorations:

Recent Test Boring: HA5-OW, HA9
Previous Test Borings: B27, TP1

2. Subsurface Conditions:

Stratum	Range in Thickness (ft.)	Average Top of Stratum Elevation (ft.) (NAVD)
Fill	6.0 to 14.5	13
Glaciodeltaic Deposits	13.0 to 19.0	5
Sandstone/Siltstone	---	-15.1

Approximate Groundwater Elevation: 2.0 (NAVD)

3. Proposed Structure Design Features:

The new storage tank is planned at the location of the off-line gravity thickeners, which will be demolished and removed. The proposed structure will abut the north side of the on-line gravity thickener and storage tank. The proposed storage tank will be about 65 ft dia., with the bottom at El. -4.73 at the perimeter (approximately 18 ft below ground surface) and about 6 ft deeper at its conical center. A basement / pump room area with floor El. -4.73 is planned adjacent to the west and south sides of the tank, connecting to the existing pump room of the on-line gravity thickeners, which we understand has a floor at approximately the same elevation.

Once the new storage tank in on line, the existing storage tank will be converted to a gravity thickener. Once this gravity thickener is on line, the existing gravity thickener tank will be converted to a duel use gravity thickener/sludge storage tank. Once this is on line, the new sludge storage tank will be used as a receiving tank for truck imported sludge.

- Structure Design Load: unknown

- Existing Nearby Structures:

  - The proposed Sludge Handling Facility will abut the north side on-line gravity thickener structure, which consists of two tanks with an underground pump room between them. In the original design (1949), the digester tanks and pump room appear to have been supported on a 1 ft thick mat, but in the renovated/converted design (1975), the mat was thickened by about 5 ft at the now storage and thickener tanks and by 1 ft at the pump room. The tank mats bear at approximately El. -6.64 (NAVD) around the perimeter and slope down to about El. -18 at the center. A tunnel connects the pump room to the Maintenance Building to the northwest.

- Existing Nearby Utilities:
  - There are at-grade equipment pads to the west of the proposed Sludge Handling Facility
  - There is a 15-in. dia. RCP storm line along the north and east sides of the Sludge Handling Facility
  - Several other utilities are within the footprint as shown on Figure 2.

4. Foundation Design Recommendations:

- Foundation Type:
  - Mat bearing on the natural glaciodeltaic deposits or compacted granular fill over the natural glaciodeltaic deposits.
  - Waterproof design and construction in pump room.
  - Hydrostatic pressure considerations for pump room and empty tanks, including the refurbishing
  - Design for a groundwater level at El. 10 (100-year flood elevation)
- Allowable Bearing Capacity: 2 tsf
- Seismic Design:

  For the design earthquake, seismically-induced settlement of the underlying soils will be less than 1 in.

  In accordance with the 2009 Supplement to the State of Connecticut Building Code, the seismic soil design criteria are as follows:

  S_s = 0.243
  S_1 = 0.062
  Site Class: D

STRUCTURE: SLUDGE HANDLING FACILITY

5. Construction Considerations:

- Underpinning and Temporary Excavation Support: Open cut or temporary steel sheet piles.

  - Temporary excavation support or relocating the 15-in. dia. RCP storm sewer.
  - Temporary excavation support of the concrete pads west of the proposed structure.

- Dewatering: We anticipate that dewatering can be accomplished using deep sumps. Several sumps will be needed to dewater the permeable sand.

- Special Considerations:

GEOTECHNICAL ENGINEERING SUMMARY
GREATER NEW HAVEN WATER POLLUTION CONTROL AUTHORITY
EAST SHORE WATER POLLUTION ABATEMENT FACILITY
NEW HAVEN, CONNECTICUT

STRUCTURE: SITE BUFFERING

1. Applicable Subsurface Explorations:

Recent Test Boring: HA6, HA7
Access to the southern portion of this area was not possible because it could not be accessed from the GNHWPCA property through the woods, brush and wetland, and GNHWPCA did not want us to access through the neighbors property.

2. Subsurface Conditions:

Stratum	Range in Thickness (ft.)	Average Top of Stratum Elevation (ft.) (NAVD)
Fill	5.0	5.0
Glaciodeltaic Deposits	13.0	1.5
Sandstone/Siltstone	---	-11.5

Approximate Groundwater Elevation: 1.5 to 3.6 (NAVD)

3. Proposed Structure Design Features:

A soil berm, screening wall, or sound barrier is being considered.

- Structure Design Load: unknown
- Existing Nearby Structures:
  - An existing 43 by 68 in. box culvert storm sewer parallels or may lie beneath the planned location of the buffer near the east property line.

4. Foundation Design Recommendations:

- Foundation Type:

  1. Soil Berm – The berm may be constructed on common fill. This may be a location considered for disposing/reuse of onsite excess excavated soil. Environmental exposure consideration may include some clean cover soil and a liner and infiltrating water collection system below the berm (routed to the sanitary line).
  2. Screening Wall or Sound Barrier – Typically these structures are supported on concrete piers, which appear feasible at the site. The piers should be embedded within the natural glaciodeltaic sand.

STRUCTURE: SITE BUFFERING

- Allowable Bearing Capacity: 2 tsf

- Seismic Design:

  For the design earthquake, seismically-induced settlement of the underlying soils will be less than 1 in.

  In accordance with the 2009 Supplement to the State of Connecticut Building Code, the seismic soil design criteria are as follows:

  S_s = 0.243
  S_1 = 0.062
  Site Class: D

5. Construction Considerations:

- Temporary Excavation Support: Open cuts appear feasible.

- Dewatering: We anticipate that dewatering can be accomplished using sumps, and a layer of crushed stone at the bottom of the screening wall piers.

- Special Considerations:

  - Protection of box culvert.

APPENDIX E

Environmental Laboratory Analytical Data Reports and Chain of Custody Documentation

COMPLETE ENVIRONMENTAL TESTING, INC.

80 Lupes Drive
Stratford, CT 06615

Tel: (203) 377-9984
Fax: (203) 377-9952
e-mail: cet1@cetlabs.com

Client: Ms. Jen Buchanon
Haley & Aldrich
100 Corporate Place, Suite 105
Rocky Hill, CT 06067-1803

Analytical Report

CET # 12050544

Report Date: May 30, 2012
Client Project: GNHWPCA
Client Project #: 37176-000

Connecticut Laboratory Certification PH 0116
Massachusetts Laboratory Certification M-CT903
Rhode Island Certification 199

New York Certification 11982
Florida Laboratory Certification E871064

SAMPLE SUMMARY:

This report contains analytical data associated with the following samples only:

CETID	Client Sample ID	Matrix	Collection Date	Collection Time	Receipt Date
AF03598	HA617-S1 0-5ft	Soil	5/21/2012	17:00	05/22/2012

Sample temperature upon receipt was 1.1 degrees C

PREP ANALYSIS:

Acid Digestion [EPA 3050B]

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012

Accelerated Solvent Ext. SVOC [EPA 3545A]

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012

Accelerated Solvent Ext.- PCBs [EPA 3545A]

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012

Ultrasonic Extraction-ETPH [EPA 3550C]

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012

ANALYSIS:

Total Mercury [EPA 7471B] Units: mg/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012
Total Mercury	ND < 0.30

Flash Point (Ignitability) [EPA 1010] Units: Degrees F

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012
Flash Point (Ignitability)	>200

pH [EPA 9045C] Units: S.U.

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/23/2012
pH	5.42

Reactivity (Cyanide) [SW 846 CH.7] Units: mg/kg

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/30/2012
Reactivity (Cyanide)	ND < 5.0

Reactivity (Sulfide) [SW 846 CH.7] Units: mg/kg

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/30/2012
Reactivity (Sulfide)	ND < 20

Total Solids [EPA 160.3 mo] Units: percent

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/30/2012
Total Solids	88

Total Metals [EPA 6010C] Units: mg/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/24/2012
Dilution	1.0
Lead	14
Selenium	ND < 1.5
Cadmium	ND < 1.0
Chromium	10
Arsenic	1.6
Barium	34
Silver	ND < 2.5

EPA 8082 PCBs [EPA 8082A] Units: mg/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/25/2012
Dilution	1.0
PCB-1016	ND < 0.29
PCB-1221	ND < 0.29
PCB-1232	ND < 0.29
PCB-1242	ND < 0.29
PCB-1248	ND < 0.29
PCB-1254	ND < 0.29
PCB-1260	ND < 0.29
PCB-1268	ND < 0.29
TCMX (Surr 1) 50-150	71
DCB (Surr 2) 50-150	64

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/26/2012
Dilution	1.0
Pyridine	ND < 114
n-Nitroso-dimethylamine	ND < 341
bis(2-Chloroethyl)ether	ND < 341
Phenol	ND < 341
Aniline	ND < 341
2-Chlorophenol	ND < 341
1,3-Dichlorobenzene	ND < 341
1,4-Dichlorobenzene	ND < 341
Benzyl Alcohol	ND < 341
1,2-Dichlorobenzene	ND < 341
bis(2-chloroisopropyl)ether	ND < 341
Hexachloroethane	ND < 341
N-Nitroso-di-n-propylamine	ND < 341
2-Methyl Phenol	ND < 341
3+4 Methyl Phenol	ND < 341
Nitrobenzene	ND < 341
Isophorone	ND < 341
2-Nitrophenol	ND < 341
2,4-Dimethylphenol	ND < 341
bis(2-Chloroethoxy)methane	ND < 341
Benzoic Acid	ND < 341
2,4-Dichlorophenol	ND < 341
1,2,4-Trichlorobenzene	ND < 341
Naphthalene	ND < 341
2,6-Dichlorophenol	ND < 341
4-Chloroaniline	ND < 341
1,2,4,5 Tetrachlorobenzene	ND < 341
Hexachlorobutadiene	ND < 341
4-Chloro-3-methylphenol	ND < 341
2-Methyl Naphthalene	ND < 341
Hexachlorocyclopentadiene	ND < 341

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
2,4,6-Trichlorophenol	ND < 341
2,4,5-Trichlorophenol	ND < 341
2-Chloronaphthalene	ND < 341
2-Nitroaniline	ND < 341
Acenaphthylene	ND < 341
Dimethylphthalate	ND < 341
2,6-Dinitrotoluene	ND < 341
4-Nitroaniline	ND < 341
Acenaphthene	ND < 341
2,4-Dinitrophenol	ND < 341
2,4-Dinitrotoluene	ND < 341
4-Nitrophenol	ND < 341
Dibenzofuran	ND < 341
2,3,4,6-Tetrachlorophenol	ND < 341
Fluorene	ND < 341
4-Chlorophenyl-phenylether	ND < 341
Diethylphthalate	ND < 341
3-Nitroaniline	ND < 341
4,6-Dinitro-2-methylphenol	ND < 341
n-Nitrosodiphenylamine	ND < 341
1,2-Diphenylhydrazine	ND < 341
4-Bromophenyl-phenylether	ND < 341
Hexachlorobenzene	ND < 341
Pentachlorophenol	ND < 341
Phenanthrene	ND < 341
Anthracene	ND < 341
Carbazole	ND < 341
Di-n-butylphthalate	ND < 341
Pentachloronitrobenzene	ND < 341
Fluoranthene	ND < 341
Pyrene	ND < 341
Butylbenzylphthalate	ND < 341
3,3-Dichlorobenzidine	ND < 341
Benzo[a]anthracene	ND < 341
Chrysene	ND < 341
bis(2-Ethylhexyl)phthalate	ND < 341
Di-n-octylphthalate	ND < 341
Benzo[b]fluoranthene	ND < 341
Benzo[k]fluoranthene	ND < 341
Benzo[a]pyrene	ND < 341
Indeno[1,2,3-cd]pyrene	ND < 341
Dibenz[a,h]anthracene	ND < 341
Benzo[g,h,i]perylene	ND < 341
2-Fluorophenol (Surr) 30-130	57.1
Phenol-d6(Surr) 30-130	65.5
Nitrobenzene-d5(Surr) 30-130	55.8
2-Fluorobiphenyl (Surr) 30-130	68.4
2,4,6-Tribromophenol (Surr) 30-130	84.2
Terphenyl-d14 (Surr) 30-130	74.6

Conn. Extractable TPH [CT DEP] Units: mg/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/25/2012
Dilution	1.0
ETPH	ND < 57
Octacosane (surr) 50-150	106

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
CET ID	AF03598
Date Analyzed	5/27/2012
Dilution	1.3
Dichlorodifluoromethane	ND < 11
Chloromethane	ND < 8.0
Vinyl Chloride	ND < 4.0
Bromomethane	ND < 8.0
Chloroethane	ND < 8.0
Acetone	ND < 110
Acrylonitrile	ND < 6.0
Trichlorofluoromethane	ND < 30
Trichlorotrifluoroethane	ND < 30
1,1-Dichloroethene	ND < 4.0
Methylene Chloride	ND < 37
Carbon Disulfide	ND < 8.0
Methyl-t-Butyl Ether (MTBE)	ND < 4.0
trans-1,2-Dichloroethene	ND < 4.0
1,1-Dichloroethane	ND < 4.0
2-Butanone (MEK)	ND < 19
2,2-Dichloropropane	ND < 4.0
cis-1,2-Dichloroethene	ND < 4.0
Chloroform	ND < 4.0
Tetrahydrofuran	ND < 19
1,1,1-Trichloroethane	ND < 4.0
Carbon Tetrachloride	ND < 4.0
1,1-Dichloropropene	ND < 4.0
Benzene	ND < 4.0
1,2-Dichloroethane	ND < 4.0
Methyl Isobutyl Ketone	ND < 19
Trichloroethene	ND < 4.0
1,2-Dichloropropane	ND < 4.0
Dibromomethane	ND < 4.0
Bromodichloromethane	ND < 4.0
2-Hexanone	ND < 19
cis-1,3-Dichloropropene	ND < 4.0
Toluene	ND < 4.0
trans-1,3-Dichloropropene	ND < 4.0
1,1,2-Trichloroethane	ND < 4.0
Tetrachloroethene	ND < 4.0
1,3-Dichloropropane	ND < 4.0
Dibromochloromethane	ND < 4.0
1,2-Dibromoethane	ND < 4.0

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA617-S1 0-5ft
trans-1,4-Dichloro-2-Butene	ND < 19
Chlorobenzene	ND < 4.0
1,1,1,2-Tetrachloroethane	ND < 4.0
Ethylbenzene	ND < 4.0
m+p Xylenes	ND < 4.0
o-Xylene	ND < 4.0
Styrene	ND < 4.0
Bromoform	ND < 4.0
Isopropylbenzene	ND < 4.0
1,1,2,2-Tetrachloroethane	ND < 4.0
Bromobenzene	ND < 4.0
1,2,3-Trichloropropane	ND < 4.0
n-Propylbenzene	ND < 4.0
2-Chlorotoluene	ND < 4.0
4-Chlorotoluene	ND < 4.0
1,3,5-Trimethylbenzene	ND < 4.0
tert-Butylbenzene	ND < 4.0
1,2,4-Trimethylbenzene	ND < 4.0
sec-Butylbenzene	ND < 4.0
1,3-Dichlorobenzene	ND < 4.0
4-Isopropyltoluene	ND < 4.0
1,4-Dichlorobenzene	ND < 4.0
1,2-Dichlorobenzene	ND < 4.0
n-Butylbenzene	ND < 4.0
1,2-Dibromo-3-Chloropropane	ND < 4.0
1,2,4-Trichlorobenzene	ND < 4.0
Hexachlorobutadiene	ND < 4.0
Naphthalene	ND < 4.0
1,2,3-Trichlorobenzene	ND < 4.0
1,2 Dichloroethane-d4 (SURR) 70-130	126
toluene-d8 (SURR) 70-130	100
4-bromofluorobenzene (SURR) 70-130	96.4

Questions related to this report should be directed to David Ditta, Timothy Fusco, or Robert Blake at 203-377-9984.

Sincerely,

David Ditta
Laboratory Director

Report Comments:

1. ND is None Detected at the specified detection limit.
2. All analyses were performed in house unless a Reference Laboratory is listed.
3. Samples will be disposed of 30 days after the report date.
4. Sample Result Flags:
   E - The result is estimated, above the calibration range.
   H - The surrogate recovery is above the control limits.
   L - The surrogate recovery is below the control limits.
   B - The compound was detected in the laboratory blank.
   P - The Relative Percent Difference (RPD) of dual column analyses exceeds 40%.
   D - The RPD between the sample and the sample duplicate is high. Sample homogeneity may be a problem.
5. All results met standard operating procedures unless indicated by a data qualifier next to a sample result, or a narration in the QC report.

The EPA has removed reactivity as a method. Therefore, we cannot certify Reactivity results.

HALEY & ALDRICH
Haley & Aldrich, Inc.
800 Connecticut Blvd.,
Suite 100
East Hartford, CT 06108-7303
Phone 860-282-9400
Fax 860-282-9500

12050544

CHAIN OF CUSTODY RECORD

1 of 1

H&A FILE NO.	37176-000	LABORATORY	CET	DELIVERY DATE	22 MAY 2012
PROJECT NAME	GNHWPCA	ADDRESS	Stratford, CT	TURNAROUND TIME	Normal
H&A CONTACT	Jen Buchanon 860-290-3134	CONTACT	Dave Ditta	PROJECT MANAGER	Chris Harriman

Sample No.	Date	Time	Depth (feet)	Type (Soil)	1 VOCs by 8260	2 SVOCs by 8270	3 PCBs by 8082	4 TPH by CTETPH Method	5 RCRA 8 Metals	6 pH, flashpoint, reactive CN, reactive sulfide						Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)
HA6/7-S1	21 MAY 2012	1700	0-5'	Soil	X	X	X	X	X	X						5	
				Soil													
				Soil													
				Soil													
				Soil													
				Soil													
				Soil													
				Soil													
				Soil													

Sampled and Relinquished by
Sign [signature]
Print Steve Brousseau
Firm Haley & Aldrich, Inc.
Date 22MAY12 Time

Received by
Sign [signature]
Print CET
Firm
Date 5/22/12 Time 1205

Relinquished by
Sign [signature]
Print CET
Firm
Date 5/22/12 Time 1600

Received by
Sign [signature]
Print
Firm
Date 5/22/12 Time 1600

Relinquished by
Sign
Print
Firm
Date Time

Received by
Sign
Print
Firm
Date Time

LIQUID

	1	2	3	4	5	6					
VOA Vial											
Amber Glass											
Plastic Bottle											
Preservative											
Volume											

SOLID

	1	2	3	4	5	6					
VOA Vial	X										
Amber Glass											
Clear Glass		X	X	X	X	X					
Preservative	AGH	A	A	A	AD	A					
Volume	40 ml	8oz	8oz	8oz	0.25L	8oz					

PRESERVATION KEY

A Sample chilled C NaOH E H_2SO_4 G Methanol
B Sample filtered D HNO_3 F HCL H Sodium Bisulfate

Sampling Comments

Adhere to CT PMC and RDEC.
Use CTDEP RCPs.

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

2.1p 1.1

Form #3204

COMPLETE ENVIRONMENTAL TESTING, INC.

80 Lupes Drive
Stratford, CT 06615

Tel: (203) 377-9984
Fax: (203) 377-9952
e-mail: cet1@cetlabs.com

Client: Ms. Jen Buchanon
Haley & Aldrich
100 Corporate Place, Suite 105
Rocky Hill, CT 06067-1803

Analytical Report

CET # 12050553

Report Date: May 30, 2012
Client Project: GNHWPCA
Client Project #: 37176-000

Connecticut Laboratory Certification PH 0116
Massachusetts Laboratory Certification M-CT903
Rhode Island Certification 199

New York Certification 11982
Florida Laboratory Certification E871064

SAMPLE SUMMARY:

This report contains analytical data associated with the following samples only:

CETID	Client Sample ID	Matrix	Collection Date	Collection Time	Receipt Date
AF03615	HA1-S1 0-5ft	Soil	5/21/2012	11:00	05/22/2012
AF03616	HA1-S2 5-19ft	Soil	5/21/2012	11:30	05/22/2012
AF03617	HA2-S1 0-5ft	Soil	5/18/2012	11:30	05/22/2012
AF03618	HA2-S2 5-14ft	Soil	5/18/2012	12:30	05/22/2012
AF03619	HA3-S1 0-5ft	Soil	5/18/2012	11:45	05/22/2012
AF03620	HA3-S2 5-12ft	Soil	5/18/2012	12:45	05/22/2012
AF03621	HA4-S1 0-19ft	Soil	5/21/2012	9:00	05/22/2012
AF03622	HA5-S1 0-5ft	Soil	5/18/2012	9:00	05/22/2012
AF03623	HA5-S2 5-10ft	Soil	5/18/2012	9:30	05/22/2012

Sample temperature upon receipt was 1.1 degrees C

PREP ANALYSIS:

Acid Digestion [EPA 3050B]

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Acid Digestion [EPA 3050B]

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Acid Digestion [EPA 3050B]

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/24/2012

Accelerated Solvent Ext. SVOC [EPA 3545A]

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Accelerated Solvent Ext. SVOC [EPA 3545A]

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Accelerated Solvent Ext. SVOC [EPA 3545A]

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/24/2012

Accelerated Solvent Ext.- PCBs [EPA 3545A]

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Accelerated Solvent Ext.- PCBs [EPA 3545A]

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Accelerated Solvent Ext.- PCBs [EPA 3545A]

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/24/2012

Ultrasonic Extraction-ETPH [EPA 3550C]

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Ultrasonic Extraction-ETPH [EPA 3550C]

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012

Ultrasonic Extraction-ETPH [EPA 3550C]

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/24/2012

ANALYSIS:

Mercury Dup Result [EPA 7471B] Units: mg/kg (Dry Wt)

Client ID	HA1-S1 0-5ft
CET ID	AF03615
Date Analyzed	5/25/2012
Mercury Dup Result	0.43

Total Mercury [EPA 7471B] Units: mg/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/25/2012	5/25/2012	5/25/2012	5/25/2012
Total Mercury	0.55	ND < 0.30	ND < 0.30	0.86

Total Mercury [EPA 7471B] Units: mg/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/25/2012	5/25/2012	5/25/2012	5/25/2012
Total Mercury	ND < 0.30	0.94	ND < 0.30	ND < 0.30

Total Mercury [EPA 7471B] Units: mg/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/25/2012
Total Mercury	ND < 0.30

Flash Point (Ignitability) [EPA 1010] Units: Degrees F

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012
Flash Point (Ignitability)	>200	>200	>200	>200

Flash Point (Ignitability) [EPA 1010] Units: Degrees F

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012
Flash Point (Ignitability)	>200	>200	>200	>200

Flash Point (Ignitability) [EPA 1010] Units: Degrees F

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/24/2012
Flash Point (Ignitability)	>200

pH [EPA 9045C] Units: S.U.

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/23/2012	5/23/2012	5/23/2012	5/23/2012
pH	7.28	7.06	8.37	8.07

pH [EPA 9045C] Units: S.U.

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/23/2012	5/23/2012	5/23/2012	5/23/2012
pH	7.69	8.08	8.12	8.50

pH [EPA 9045C] Units: S.U.

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/23/2012
pH	8.23

Reactivity (Cyanide) [SW 846 CH.7] Units: mg/kg

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/30/2012	5/30/2012	5/30/2012	5/30/2012
Reactivity (Cyanide)	ND < 5.0	ND < 5.0	ND < 5.0	ND < 5.0

Reactivity (Cyanide) [SW 846 CH.7] Units: mg/kg

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/30/2012	5/30/2012	5/30/2012	5/30/2012
Reactivity (Cyanide)	ND < 5.0	ND < 5.0	ND < 5.0	ND < 5.0

Reactivity (Cyanide) [SW 846 CH.7] Units: mg/kg

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/30/2012
Reactivity (Cyanide)	ND < 5.0

Reactivity (Sulfide) [SW 846 CH.7] Units: mg/kg

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/30/2012	5/30/2012	5/30/2012	5/30/2012
Reactivity (Sulfide)	ND < 20	ND < 20	ND < 20	ND < 20

Reactivity (Sulfide) [SW 846 CH.7] Units: mg/kg

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/30/2012	5/30/2012	5/30/2012	5/30/2012
Reactivity (Sulfide)	ND < 20	ND < 20	ND < 20	ND < 20

Reactivity (Sulfide) [SW 846 CH.7] Units: mg/kg

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/30/2012
Reactivity (Sulfide)	ND < 20

Total Solids [EPA 160.3 mo] Units: percent

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/30/2012	5/30/2012	5/30/2012	5/30/2012
Total Solids	84	88	92	66

Total Solids [EPA 160.3 mo] Units: percent

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/30/2012	5/30/2012	5/30/2012	5/30/2012
Total Solids	85	69	90	91

Total Solids [EPA 160.3 mo] Units: percent

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/30/2012
Total Solids	89

Total Metals [EPA 6010C] Units: mg/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012
Dilution	1.0	1.0	1.0	1.0
Lead	200	9.7	8.6	57
Selenium	ND < 1.5	ND < 1.5	ND < 1.5	ND < 2.0
Cadmium	ND < 1.0	ND < 1.0	ND < 1.0	ND < 1.0
Chromium	21	11	12	46
Arsenic	4.7	ND < 1.5	2.4	8.1
Barium	55	18	24	58
Silver	ND < 2.5	ND < 2.5	ND < 2.5	ND < 3.5

Total Metals [EPA 6010C] Units: mg/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/24/2012	5/24/2012	5/24/2012	5/24/2012
Dilution	1.0	1.0	1.0	1.0
Lead	94	68	21	30
Selenium	ND < 1.5	ND < 1.5	ND < 1.5	ND < 1.5
Cadmium	ND < 1.0	ND < 1.0	ND < 1.0	ND < 1.0
Chromium	50	42	15	12
Arsenic	2.8	8.4	2.5	2.7
Barium	44	60	46	32
Silver	ND < 2.5	ND < 3.0	ND < 2.5	ND < 2.5

Total Metals [EPA 6010C] Units: mg/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/24/2012
Dilution	1.0
Lead	31
Selenium	ND < 1.5
Cadmium	ND < 1.0
Chromium	19
Arsenic	2.9
Barium	43
Silver	ND < 2.5

EPA 8082 PCBs [EPA 8082A] Units: mg/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/25/2012	5/25/2012	5/25/2012	5/25/2012
Dilution	1.0	1.0	1.0	1.0
PCB-1016	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1221	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1232	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1242	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1248	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1254	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1260	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
PCB-1268	ND < 0.30	ND < 0.29	ND < 0.28	ND < 0.38
TCMX (Surr 1) 50-150	73	76	79	83
DCB (Surr 2) 50-150	60	67	68	68

EPA 8082 PCBs [EPA 8082A] Units: mg/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/25/2012	5/26/2012	5/26/2012	5/26/2012
Dilution	1.0	1.0	1.0	1.0
PCB-1016	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1221	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1232	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1242	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1248	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1254	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1260	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
PCB-1268	ND < 0.30	ND < 0.37	ND < 0.28	ND < 0.28
TCMX (Surr 1) 50-150	79	81	83	71
DCB (Surr 2) 50-150	60	65	67	80

EPA 8082 PCBs [EPA 8082A] Units: mg/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/26/2012
Dilution	1.0
PCB-1016	ND < 0.29
PCB-1221	ND < 0.29
PCB-1232	ND < 0.29
PCB-1242	ND < 0.29
PCB-1248	ND < 0.29
PCB-1254	ND < 0.29
PCB-1260	ND < 0.29
PCB-1268	ND < 0.29
TCMX (Surr 1) 50-150	77
DCB (Surr 2) 50-150	69

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/26/2012	5/26/2012	5/29/2012	5/25/2012
Dilution	1.0	1.0	1.0	1.0
Pyridine	ND < 120	ND < 114	ND < 109	ND < 152
n-Nitroso-dimethylamine	ND < 358	ND < 341	ND < 327	ND < 455
bis(2-Chloroethyl)ether	ND < 358	ND < 341	ND < 327	ND < 455
Phenol	ND < 358	ND < 341	ND < 327	ND < 455
Aniline	ND < 358	ND < 341	ND < 327	ND < 455
2-Chlorophenol	ND < 358	ND < 341	ND < 327	ND < 455
1,3-Dichlorobenzene	ND < 358	ND < 341	ND < 327	ND < 455
1,4-Dichlorobenzene	ND < 358	ND < 341	ND < 327	ND < 455
Benzyl Alcohol	ND < 358	ND < 341	ND < 327	ND < 455
1,2-Dichlorobenzene	ND < 358	ND < 341	ND < 327	ND < 455
bis(2-chloroisopropyl)ether	ND < 358	ND < 341	ND < 327	ND < 455
Hexachloroethane	ND < 358	ND < 341	ND < 327	ND < 455
N-Nitroso-di-n-propylamine	ND < 358	ND < 341	ND < 327	ND < 455
2-Methyl Phenol	ND < 358	ND < 341	ND < 327	ND < 455
3+4 Methyl Phenol	ND < 358	ND < 341	ND < 327	ND < 455
Nitrobenzene	ND < 358	ND < 341	ND < 327	ND < 455
Isophorone	ND < 358	ND < 341	ND < 327	ND < 455
2-Nitrophenol	ND < 358	ND < 341	ND < 327	ND < 455
2,4-Dimethylphenol	ND < 358	ND < 341	ND < 327	ND < 455
bis(2-Chloroethoxy)methane	ND < 358	ND < 341	ND < 327	ND < 455
Benzoic Acid	ND < 358	ND < 341	ND < 327	ND < 455
2,4-Dichlorophenol	ND < 358	ND < 341	ND < 327	ND < 455
1,2,4-Trichlorobenzene	ND < 358	ND < 341	ND < 327	ND < 455
Naphthalene	ND < 358	ND < 341	ND < 327	2200
2,6-Dichlorophenol	ND < 358	ND < 341	ND < 327	ND < 455
4-Chloroaniline	ND < 358	ND < 341	ND < 327	ND < 455
1,2,4,5 Tetrachlorobenzene	ND < 358	ND < 341	ND < 327	ND < 455
Hexachlorobutadiene	ND < 358	ND < 341	ND < 327	ND < 455
4-Chloro-3-methylphenol	ND < 358	ND < 341	ND < 327	ND < 455
2-Methyl Naphthalene	ND < 358	ND < 341	ND < 327	ND < 455
Hexachlorocyclopentadiene	ND < 358	ND < 341	ND < 327	ND < 455
2,4,6-Trichlorophenol	ND < 358	ND < 341	ND < 327	ND < 455
2,4,5-Trichlorophenol	ND < 358	ND < 341	ND < 327	ND < 455
2-Chloronaphthalene	ND < 358	ND < 341	ND < 327	ND < 455
2-Nitroaniline	ND < 358	ND < 341	ND < 327	ND < 455
Acenaphthylene	430	ND < 341	ND < 327	ND < 455
Dimethylphthalate	ND < 358	ND < 341	ND < 327	560
2,6-Dinitrotoluene	ND < 358	ND < 341	ND < 327	ND < 455
4-Nitroaniline	ND < 358	ND < 341	ND < 327	ND < 455
Acenaphthene	ND < 358	ND < 341	ND < 327	ND < 455
2,4-Dinitrophenol	ND < 358	ND < 341	ND < 327	1700
2,4-Dinitrotoluene	ND < 358	ND < 341	ND < 327	ND < 455
4-Nitrophenol	ND < 358	ND < 341	ND < 327	ND < 455
Dibenzofuran	ND < 358	ND < 341	ND < 327	ND < 455
2,3,4,6-Tetrachlorophenol	ND < 358	ND < 341	ND < 327	1400
Fluorene	ND < 358	ND < 341	ND < 327	ND < 455
4-Chlorophenyl-phenylether	ND < 358	ND < 341	ND < 327	2300
Diethylphthalate	ND < 358	ND < 341	ND < 327	ND < 455
3-Nitroaniline	ND < 358	ND < 341	ND < 327	ND < 455
4,6-Dinitro-2-methylphenol	ND < 358	ND < 341	ND < 327	ND < 455

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
n-Nitrosodiphenylamine	ND < 358	ND < 341	ND < 327	ND < 455
1,2-Diphenylhydrazine	ND < 358	ND < 341	ND < 327	ND < 455
4-Bromophenyl-phenylether	ND < 358	ND < 341	ND < 327	ND < 455
Hexachlorobenzene	ND < 358	ND < 341	ND < 327	ND < 455
Pentachlorophenol	ND < 358	ND < 341	ND < 327	ND < 455
Phenanthrene	660	ND < 341	ND < 327	6700
Anthracene	370	ND < 341	ND < 327	2200
Carbazole	ND < 358	ND < 341	ND < 327	840
Di-n-butylphthalate	ND < 358	ND < 341	ND < 327	ND < 455
Pentachloronitrobenzene	ND < 358	ND < 341	ND < 327	ND < 455
Fluoranthene	2000	ND < 341	ND < 327	5400
Pyrene	1700	ND < 341	ND < 327	3800
Butylbenzylphthalate	ND < 358	ND < 341	ND < 327	ND < 455
3,3-Dichlorobenzidine	ND < 358	ND < 341	ND < 327	ND < 455
Benzo[a]anthracene	1100	ND < 341	ND < 327	2700
Chrysene	1300	ND < 341	ND < 327	2400
bis(2-Ethylhexyl)phthalate	ND < 358	ND < 341	ND < 327	ND < 455
Di-n-octylphthalate	ND < 358	ND < 341	ND < 327	ND < 455
Benzo[b]fluoranthene	1400	ND < 341	ND < 327	2800
Benzo[k]fluoranthene	650	ND < 341	ND < 327	1200
Benzo[a]pyrene	1300	ND < 341	ND < 327	2300
Indeno[1,2,3-cd]pyrene	510	ND < 341	ND < 327	1500
Dibenz[a,h]anthracene	ND < 358	ND < 341	ND < 327	470
Benzo[g,h,i]perylene	500	ND < 341	ND < 327	1700
2-Fluorophenol (Surr) 30-130	50.7	59.8	51.5	54.6
Phenol-d6(Surr) 30-130	66.9	63.8	65.8	62.1
Nitrobenzene-d5(Surr) 30-130	59.9	56.4	58.7	56.2
2-Fluorobiphenyl (Surr) 30-130	71.7	65.8	71.9	66
2,4,6-Tribromophenol (Surr) 30-130	81.7	77.4	80.5	80.6
Terphenyl-d14 (Surr) 30-130	68.9	69.9	72.6	79.3

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/25/2012	5/25/2012	5/25/2012	5/25/2012
Dilution	1.0	1.0	1.0	1.0
Pyridine	ND < 118	ND < 145	ND < 112	ND < 110
n-Nitroso-dimethylamine	ND < 353	ND < 435	ND < 334	ND < 330
bis(2-Chloroethyl)ether	ND < 353	ND < 435	ND < 334	ND < 330
Phenol	ND < 353	ND < 435	ND < 334	ND < 330
Aniline	ND < 353	ND < 435	ND < 334	ND < 330
2-Chlorophenol	ND < 353	ND < 435	ND < 334	ND < 330
1,3-Dichlorobenzene	ND < 353	ND < 435	ND < 334	ND < 330
1,4-Dichlorobenzene	ND < 353	ND < 435	ND < 334	ND < 330
Benzyl Alcohol	ND < 353	ND < 435	ND < 334	ND < 330
1,2-Dichlorobenzene	ND < 353	ND < 435	ND < 334	ND < 330
bis(2-chloroisopropyl)ether	ND < 353	ND < 435	ND < 334	ND < 330
Hexachloroethane	ND < 353	ND < 435	ND < 334	ND < 330
N-Nitroso-di-n-propylamine	ND < 353	ND < 435	ND < 334	ND < 330
2-Methyl Phenol	ND < 353	ND < 435	ND < 334	ND < 330

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
3+4 Methyl Phenol	ND < 353	ND < 435	ND < 334	ND < 330
Nitrobenzene	ND < 353	ND < 435	ND < 334	ND < 330
Isophorone	ND < 353	ND < 435	ND < 334	ND < 330
2-Nitrophenol	ND < 353	ND < 435	ND < 334	ND < 330
2,4-Dimethylphenol	ND < 353	ND < 435	ND < 334	ND < 330
bis(2-Chloroethoxy)methane	ND < 353	ND < 435	ND < 334	ND < 330
Benzoic Acid	ND < 353	ND < 435	ND < 334	ND < 330
2,4-Dichlorophenol	ND < 353	ND < 435	ND < 334	ND < 330
1,2,4-Trichlorobenzene	ND < 353	ND < 435	ND < 334	ND < 330
Naphthalene	ND < 353	ND < 435	ND < 334	ND < 330
2,6-Dichlorophenol	ND < 353	ND < 435	ND < 334	780
4-Chloroaniline	ND < 353	ND < 435	ND < 334	ND < 330
1,2,4,5 Tetrachlorobenzene	ND < 353	ND < 435	ND < 334	ND < 330
Hexachlorobutadiene	ND < 353	ND < 435	ND < 334	ND < 330
4-Chloro-3-methylphenol	ND < 353	ND < 435	ND < 334	ND < 330
2-Methyl Naphthalene	ND < 353	ND < 435	ND < 334	ND < 330
Hexachlorocyclopentadiene	ND < 353	ND < 435	ND < 334	ND < 330
2,4,6-Trichlorophenol	ND < 353	ND < 435	ND < 334	ND < 330
2,4,5-Trichlorophenol	ND < 353	ND < 435	ND < 334	ND < 330
2-Chloronaphthalene	ND < 353	ND < 435	ND < 334	ND < 330
2-Nitroaniline	ND < 353	ND < 435	ND < 334	ND < 330
Acenaphthylene	ND < 353	ND < 435	ND < 334	ND < 330
Dimethylphthalate	ND < 353	ND < 435	ND < 334	800
2,6-Dinitrotoluene	ND < 353	ND < 435	ND < 334	ND < 330
4-Nitroaniline	ND < 353	ND < 435	ND < 334	ND < 330
Acenaphthene	ND < 353	ND < 435	ND < 334	ND < 330
2,4-Dinitrophenol	ND < 353	ND < 435	ND < 334	ND < 330
2,4-Dinitrotoluene	ND < 353	ND < 435	ND < 334	ND < 330
4-Nitrophenol	ND < 353	ND < 435	ND < 334	ND < 330
Dibenzofuran	ND < 353	ND < 435	ND < 334	ND < 330
2,3,4,6-Tetrachlorophenol	ND < 353	ND < 435	ND < 334	480
Fluorene	ND < 353	ND < 435	ND < 334	ND < 330
4-Chlorophenyl-phenylether	ND < 353	ND < 435	ND < 334	680
Diethylphthalate	ND < 353	ND < 435	ND < 334	ND < 330
3-Nitroaniline	ND < 353	ND < 435	ND < 334	ND < 330
4,6-Dinitro-2-methylphenol	ND < 353	ND < 435	ND < 334	ND < 330
n-Nitrosodiphenylamine	ND < 353	ND < 435	ND < 334	ND < 330
1,2-Diphenylhydrazine	ND < 353	ND < 435	ND < 334	ND < 330
4-Bromophenyl-phenylether	ND < 353	ND < 435	ND < 334	ND < 330
Hexachlorobenzene	ND < 353	ND < 435	ND < 334	ND < 330
Pentachlorophenol	ND < 353	ND < 435	ND < 334	ND < 330
Phenanthrene	420	ND < 435	ND < 334	ND < 330
Anthracene	ND < 353	ND < 435	500	3600
Carbazole	ND < 353	ND < 435	ND < 334	1100
Di-n-butylphthalate	ND < 353	ND < 435	ND < 334	340
Pentachloronitrobenzene	ND < 353	ND < 435	ND < 334	ND < 330
Fluoranthene	590	560	ND < 334	ND < 330
Pyrene	510	530	1000	5200
Butylbenzylphthalate	ND < 353	ND < 435	750	4400
3,3-Dichlorobenzidine	ND < 353	ND < 435	ND < 334	ND < 330
Benzo[a]anthracene	380	ND < 435	ND < 334	ND < 330
Chrysene	ND < 353	ND < 435	470	3100
bis(2-Ethylhexyl)phthalate	ND < 353	ND < 435	410	2300

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
Di-n-octylphthalate	ND < 353	ND < 435	ND < 334	ND < 330
Benzo[b]fluoranthene	480	500	500	4300
Benzo[k]fluoranthene	ND < 353	ND < 435	ND < 334	1500
Benzo[a]pyrene	ND < 353	ND < 435	390	2600
Indeno[1,2,3-cd]pyrene	ND < 353	ND < 435	ND < 334	850
Dibenz[a,h]anthracene	ND < 353	ND < 435	ND < 334	ND < 330
Benzo[g,h,i]perylene	380	ND < 435	ND < 334	860
2-Fluorophenol (Surr) 30-130	60.4	66.5	57.2	66.9
Phenol-d6(Surr) 30-130	66.9	75.9	63.7	71.4
Nitrobenzene-d5(Surr) 30-130	71.4	70.4	63.8	75.1
2-Fluorobiphenyl (Surr) 30-130	76.8	79.3	72.1	79.7
2,4,6-Tribromophenol (Surr) 30-130	80.1	99.5	75.2	81.1
Terphenyl-d14 (Surr) 30-130	77.2	93.8	75.1	72.5

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/25/2012
Dilution	1.0
Pyridine	ND < 113
n-Nitroso-dimethylamine	ND < 338
bis(2-Chloroethyl)ether	ND < 338
Phenol	ND < 338
Aniline	ND < 338
2-Chlorophenol	ND < 338
1,3-Dichlorobenzene	ND < 338
1,4-Dichlorobenzene	ND < 338
Benzyl Alcohol	ND < 338
1,2-Dichlorobenzene	ND < 338
bis(2-chloroisopropyl)ether	ND < 338
Hexachloroethane	ND < 338
N-Nitroso-di-n-propylamine	ND < 338
2-Methyl Phenol	ND < 338
3+4 Methyl Phenol	ND < 338
Nitrobenzene	ND < 338
Isophorone	ND < 338
2-Nitrophenol	ND < 338
2,4-Dimethylphenol	ND < 338
bis(2-Chloroethoxy)methane	ND < 338
Benzoic Acid	ND < 338
2,4-Dichlorophenol	ND < 338
1,2,4-Trichlorobenzene	ND < 338
Naphthalene	360
2,6-Dichlorophenol	ND < 338
4-Chloroaniline	ND < 338
1,2,4,5 Tetrachlorobenzene	ND < 338
Hexachlorobutadiene	ND < 338
4-Chloro-3-methylphenol	ND < 338
2-Methyl Naphthalene	ND < 338
Hexachlorocyclopentadiene	ND < 338

Semi-Volatile Organics [EPA 8270D] Units: ug/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
2,4,6-Trichlorophenol	ND < 338
2,4,5-Trichlorophenol	ND < 338
2-Chloronaphthalene	ND < 338
2-Nitroaniline	ND < 338
Acenaphthylene	420
Dimethylphthalate	ND < 338
2,6-Dinitrotoluene	ND < 338
4-Nitroaniline	ND < 338
Acenaphthene	ND < 338
2,4-Dinitrophenol	ND < 338
2,4-Dinitrotoluene	ND < 338
4-Nitrophenol	ND < 338
Dibenzofuran	ND < 338
2,3,4,6-Tetrachlorophenol	ND < 338
Fluorene	770
4-Chlorophenyl-phenylether	ND < 338
Diethylphthalate	ND < 338
3-Nitroaniline	ND < 338
4,6-Dinitro-2-methylphenol	ND < 338
n-Nitrosodiphenylamine	ND < 338
1,2-Diphenylhydrazine	ND < 338
4-Bromophenyl-phenylether	ND < 338
Hexachlorobenzene	ND < 338
Pentachlorophenol	ND < 338
Phenanthrene	3400
Anthracene	840
Carbazole	ND < 338
Di-n-butylphthalate	ND < 338
Pentachloronitrobenzene	ND < 338
Fluoranthene	2900
Pyrene	2800
Butylbenzylphthalate	ND < 338
3,3-Dichlorobenzidine	ND < 338
Benzo[a]anthracene	1500
Chrysene	1200
bis(2-Ethylhexyl)phthalate	ND < 338
Di-n-octylphthalate	ND < 338
Benzo[b]fluoranthene	1600
Benzo[k]fluoranthene	620
Benzo[a]pyrene	1200
Indeno[1,2,3-cd]pyrene	340
Dibenz[a,h]anthracene	ND < 338
Benzo[g,h,i]perylene	350
2-Fluorophenol (Surr) 30-130	63.8
Phenol-d6(Surr) 30-130	68.3
Nitrobenzene-d5(Surr) 30-130	69.6
2-Fluorobiphenyl (Surr) 30-130	78
2,4,6-Tribromophenol (Surr) 30-130	78.2
Terphenyl-d14 (Surr) 30-130	72.3

Semi-Vol. Dup Result [EPA 8270D] Units: ug/kg

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/25/2012
Dilution	1.0
Pyridine	ND < 113
n-Nitroso-dimethylamine	ND < 338
bis(2-Chloroethyl)ether	ND < 338
Phenol	ND < 338
Aniline	ND < 338
2-Chlorophenol	ND < 338
1,3-Dichlorobenzene	ND < 338
1,4-Dichlorobenzene	ND < 338
Benzyl Alcohol	ND < 338
1,2-Dichlorobenzene	ND < 338
bis(2-chloroisopropyl)ether	ND < 338
Hexachloroethane	ND < 338
N-Nitroso-di-n-propylamine	ND < 338
2-Methyl Phenol	ND < 338
3+4 Methyl Phenol	ND < 338
Nitrobenzene	ND < 338
Isophorone	ND < 338
2-Nitrophenol	ND < 338
2,4-Dimethylphenol	ND < 338
bis(2-Chloroethoxy)methane	ND < 338
Benzoic Acid	ND < 338
2,4-Dichlorophenol	ND < 338
1,2,4-Trichlorobenzene	ND < 338
Naphthalene	610
2,6-Dichlorophenol	ND < 338
4-Chloroaniline	ND < 338
1,2,4,5 Tetrachlorobenzene	ND < 338
Hexachlorobutadiene	ND < 338
4-Chloro-3-methylphenol	ND < 338
2-Methyl Naphthalene	ND < 338
Hexachlorocyclopentadiene	ND < 338
2,4,6-Trichlorophenol	ND < 338
2,4,5-Trichlorophenol	ND < 338
2-Chloronaphthalene	ND < 338
2-Nitroaniline	ND < 338
Acenaphthylene	570
Dimethylphthalate	ND < 338
2,6-Dinitrotoluene	ND < 338
4-Nitroaniline	ND < 338
Acenaphthene	ND < 338
2,4-Dinitrophenol	ND < 338
2,4-Dinitrotoluene	ND < 338
4-Nitrophenol	ND < 338
Dibenzofuran	400
2,3,4,6-Tetrachlorophenol	ND < 338
Fluorene	1000
4-Chlorophenyl-phenylether	ND < 338
Diethylphthalate	ND < 338
3-Nitroaniline	ND < 338
4,6-Dinitro-2-methylphenol	ND < 338

Semi-Vol. Dup Result [EPA 8270D] Units: ug/kg

Client ID	HA5-S2 5-10ft
n-Nitrosodiphenylamine	ND < 338
1,2-Diphenylhydrazine	ND < 338
4-Bromophenyl-phenylether	ND < 338
Hexachlorobenzene	ND < 338
Pentachlorophenol	ND < 338
Phenanthrene	4600
Anthracene	1000
Carbazole	ND < 338
Di-n-butylphthalate	ND < 338
Pentachloronitrobenzene	ND < 338
Fluoranthene	3500
Pyrene	3500
Butylbenzylphthalate	ND < 338
3,3-Dichlorobenzidine	ND < 338
Benzo[a]anthracene	2000
Chrysene	1600
bis(2-Ethylhexyl)phthalate	ND < 338
Di-n-octylphthalate	ND < 338
Benzo[b]fluoranthene	2100
Benzo[k]fluoranthene	840
Benzo[a]pyrene	1600
Indeno[1,2,3-cd]pyrene	350
Dibenz[a,h]anthracene	ND < 338
Benzo[g,h,i]perylene	380
2-Fluorophenol (Surr) 30-130	57.4
Phenol-d6(Surr) 30-130	64
Nitrobenzene-d5(Surr) 30-130	63.6
2-Fluorobiphenyl (Surr) 30-130	73.3
2,4,6-Tribromophenol (Surr) 30-130	75.4
Terphenyl-d14 (Surr) 30-130	71

Conn. Extractable TPH [CT DEP] Units: mg/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/25/2012	5/25/2012	5/25/2012	5/25/2012
Dilution	1.0	1.0	1.0	1.0
ETPH	ND < 60	ND < 57	ND < 55	ND < 76
Octacosane (surr) 50-150	109	104	106	112

Conn. Extractable TPH [CT DEP] Units: mg/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/25/2012	5/25/2012	5/25/2012	5/25/2012
Dilution	1.0	1.0	1.0	1.0
ETPH	280*	ND < 73	ND < 56	890*
Octacosane (surr) 50-150	108	102	111	103

*C_{18} – C_{36} May be PNA related/Motor Oil range

Conn. Extractable TPH [CT DEP] Units: mg/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/25/2012
Dilution	1.0
ETPH	240*
Octacosane (surr) 50-150	104

*$C_{18} - C_{36}$ May be PNA related/Motor Oil range

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
CET ID	AF03615	AF03616	AF03617	AF03618
Date Analyzed	5/27/2012	5/27/2012	5/27/2012	5/27/2012
Dilution	1.4	1.2	1.3	1.4
Dichlorodifluoromethane	ND < 13	ND < 11	ND < 11	ND < 17
Chloromethane	ND < 9.0	ND < 7.0	ND < 8.0	ND < 11
Vinyl Chloride	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Bromomethane	ND < 9.0	ND < 7.0	ND < 8.0	ND < 11
Chloroethane	ND < 9.0	ND < 7.0	ND < 8.0	ND < 11
Acetone	ND < 130	ND < 100	ND < 110	ND < 160
Acrylonitrile	ND < 7.0	ND < 6.0	ND < 6.0	ND < 9.0
Trichlorofluoromethane	ND < 34	ND < 28	ND < 29	ND < 44
Trichlorotrifluoroethane	ND < 34	ND < 28	ND < 29	ND < 44
1,1-Dichloroethene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Methylene Chloride	ND < 43	ND < 35	ND < 36	ND < 54
Carbon Disulfide	ND < 9.0	ND < 7.0	ND < 8.0	ND < 11
Methyl-t-Butyl Ether (MTBE)	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
trans-1,2-Dichloroethene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,1-Dichloroethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
2-Butanone (MEK)	ND < 22	ND < 18	ND < 18	ND < 27
2,2-Dichloropropane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
cis-1,2-Dichloroethene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Chloroform	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Tetrahydrofuran	ND < 22	ND < 18	ND < 18	ND < 27
1,1,1-Trichloroethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Carbon Tetrachloride	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,1-Dichloropropene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Benzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2-Dichloroethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Methyl Isobutyl Ketone	ND < 22	ND < 18	ND < 18	ND < 27
Trichloroethene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2-Dichloropropane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Dibromomethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Bromodichloromethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
2-Hexanone	ND < 22	ND < 18	ND < 18	ND < 27
cis-1,3-Dichloropropene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Toluene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
trans-1,3-Dichloropropene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,1,2-Trichloroethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Tetrachloroethene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,3-Dichloropropane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Dibromochloromethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA1-S1 0-5ft	HA1-S2 5-19ft	HA2-S1 0-5ft	HA2-S2 5-14ft
1,2-Dibromoethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
trans-1,4-Dichloro-2-Butene	ND < 22	ND < 18	ND < 18	ND < 27
Chlorobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,1,1,2-Tetrachloroethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Ethylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
m+p Xylenes	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
o-Xylene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Styrene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Bromoform	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Isopropylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,1,2,2-Tetrachloroethane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Bromobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2,3-Trichloropropane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
n-Propylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
2-Chlorotoluene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
4-Chlorotoluene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,3,5-Trimethylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
tert-Butylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2,4-Trimethylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
sec-Butylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,3-Dichlorobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
4-Isopropyltoluene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,4-Dichlorobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2-Dichlorobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
n-Butylbenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2-Dibromo-3-Chloropropane	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2,4-Trichlorobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Hexachlorobutadiene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
Naphthalene	ND < 5.0	ND < 4.0	ND < 4.0	130
1,2,3-Trichlorobenzene	ND < 5.0	ND < 4.0	ND < 4.0	ND < 6.0
1,2 Dichloroethane-d4 (SURR) 70-130	129	132 H	132 H	129
toluene-d8 (SURR) 70-130	100	101	100	99.8
4-bromofluorobenzene (SURR) 70-130	85.3	93.9	87.7	94.7

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
CET ID	AF03619	AF03620	AF03621	AF03622
Date Analyzed	5/27/2012	5/27/2012	5/27/2012	5/27/2012
Dilution	1.4	1.2	1.5	1.4
Dichlorodifluoromethane	ND < 13	ND < 14	ND < 13	ND < 12
Chloromethane	ND < 9.0	ND < 9.0	ND < 9.0	ND < 8.0
Vinyl Chloride	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Bromomethane	ND < 9.0	ND < 9.0	ND < 9.0	ND < 8.0
Chloroethane	ND < 9.0	ND < 9.0	ND < 9.0	ND < 8.0
Acetone	ND < 130	ND < 130	ND < 120	ND < 120
Acrylonitrile	ND < 7.0	ND < 7.0	ND < 7.0	ND < 7.0
Trichlorofluoromethane	ND < 34	ND < 35	ND < 33	ND < 31
Trichlorotrifluoroethane	ND < 34	ND < 35	ND < 33	ND < 31
1,1-Dichloroethene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Methylene Chloride	ND < 42	ND < 44	ND < 41	ND < 39

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
Carbon Disulfide	ND < 9.0	ND < 9.0	ND < 9.0	ND < 8.0
Methyl-t-Butyl Ether (MTBE)	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
trans-1,2-Dichloroethene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,1-Dichloroethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
2-Butanone (MEK)	ND < 21	ND < 22	ND < 21	ND < 20
2,2-Dichloropropane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
cis-1,2-Dichloroethene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Chloroform	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Tetrahydrofuran	ND < 21	ND < 22	ND < 21	ND < 20
1,1,1-Trichloroethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Carbon Tetrachloride	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,1-Dichloropropene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Benzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2-Dichloroethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Methyl Isobutyl Ketone	ND < 21	ND < 22	ND < 21	ND < 20
Trichloroethene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2-Dichloropropane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Dibromomethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Bromodichloromethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
2-Hexanone	ND < 21	ND < 22	ND < 21	ND < 20
cis-1,3-Dichloropropene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Toluene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
trans-1,3-Dichloropropene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,1,2-Trichloroethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Tetrachloroethene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,3-Dichloropropane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Dibromochloromethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2-Dibromoethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
trans-1,4-Dichloro-2-Butene	ND < 21	ND < 22	ND < 21	ND < 20
Chlorobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,1,1,2-Tetrachloroethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Ethylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
m+p Xylenes	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
o-Xylene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Styrene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Bromoform	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Isopropylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,1,2,2-Tetrachloroethane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Bromobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2,3-Trichloropropane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
n-Propylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
2-Chlorotoluene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
4-Chlorotoluene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,3,5-Trimethylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
tert-Butylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2,4-Trimethylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
sec-Butylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,3-Dichlorobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
4-Isopropyltoluene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,4-Dichlorobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2-Dichlorobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA3-S1 0-5ft	HA3-S2 5-12ft	HA4-S1 0-19ft	HA5-S1 0-5ft
n-Butylbenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2-Dibromo-3-Chloropropane	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2,4-Trichlorobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Hexachlorobutadiene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
Naphthalene	ND < 5.0	ND < 5.0	ND < 5.0	9.3
1,2,3-Trichlorobenzene	ND < 5.0	ND < 5.0	ND < 5.0	ND < 4.0
1,2 Dichloroethane-d4 (SURR) 70-130	129	126	129	130
toluene-d8 (SURR) 70-130	100	100	100	99.7
4-bromofluorobenzene (SURR) 70-130	94	94.8	93.8	91.4

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
CET ID	AF03623
Date Analyzed	5/28/2012
Dilution	1.3
Dichlorodifluoromethane	ND < 12
Chloromethane	ND < 8.0
Vinyl Chloride	ND < 4.0
Bromomethane	ND < 8.0
Chloroethane	ND < 8.0
Acetone	ND < 110
Acrylonitrile	ND < 6.0
Trichlorofluoromethane	ND < 30
Trichlorotrifluoroethane	ND < 30
1,1-Dichloroethene	ND < 4.0
Methylene Chloride	ND < 37
Carbon Disulfide	ND < 8.0
Methyl-t-Butyl Ether (MTBE)	ND < 4.0
trans-1,2-Dichloroethene	ND < 4.0
1,1-Dichloroethane	ND < 4.0
2-Butanone (MEK)	ND < 19
2,2-Dichloropropane	ND < 4.0
cis-1,2-Dichloroethene	ND < 4.0
Chloroform	ND < 4.0
Tetrahydrofuran	ND < 19
1,1,1-Trichloroethane	ND < 4.0
Carbon Tetrachloride	ND < 4.0
1,1-Dichloropropene	ND < 4.0
Benzene	ND < 4.0
1,2-Dichloroethane	ND < 4.0
Methyl Isobutyl Ketone	ND < 19
Trichloroethene	ND < 4.0
1,2-Dichloropropane	ND < 4.0
Dibromomethane	ND < 4.0
Bromodichloromethane	ND < 4.0
2-Hexanone	ND < 19
cis-1,3-Dichloropropene	ND < 4.0
Toluene	ND < 4.0
trans-1,3-Dichloropropene	ND < 4.0
1,1,2-Trichloroethane	ND < 4.0

Volatile Organics [EPA 8260C] Units: ug/kg (Dry Wt)

Client ID	HA5-S2 5-10ft
Tetrachloroethene	ND < 4.0
1,3-Dichloropropane	ND < 4.0
Dibromochloromethane	ND < 4.0
1,2-Dibromoethane	ND < 4.0
trans-1,4-Dichloro-2-Butene	ND < 19
Chlorobenzene	ND < 4.0
1,1,1,2-Tetrachloroethane	ND < 4.0
Ethylbenzene	ND < 4.0
m+p Xylenes	ND < 4.0
o-Xylene	ND < 4.0
Styrene	ND < 4.0
Bromoform	ND < 4.0
Isopropylbenzene	ND < 4.0
1,1,2,2-Tetrachloroethane	ND < 4.0
Bromobenzene	ND < 4.0
1,2,3-Trichloropropane	ND < 4.0
n-Propylbenzene	ND < 4.0
2-Chlorotoluene	ND < 4.0
4-Chlorotoluene	ND < 4.0
1,3,5-Trimethylbenzene	ND < 4.0
tert-Butylbenzene	ND < 4.0
1,2,4-Trimethylbenzene	ND < 4.0
sec-Butylbenzene	ND < 4.0
1,3-Dichlorobenzene	ND < 4.0
4-Isopropyltoluene	ND < 4.0
1,4-Dichlorobenzene	ND < 4.0
1,2-Dichlorobenzene	ND < 4.0
n-Butylbenzene	ND < 4.0
1,2-Dibromo-3-Chloropropane	ND < 4.0
1,2,4-Trichlorobenzene	ND < 4.0
Hexachlorobutadiene	ND < 4.0
Naphthalene	ND < 4.0
1,2,3-Trichlorobenzene	ND < 4.0
1,2 Dichloroethane-d4 (SURR) 70-130	135 H
toluene-d8 (SURR) 70-130	99.7
4-bromofluorobenzene (SURR) 70-130	92.3

Questions related to this report should be directed to David Ditta, Timothy Fusco, or Robert Blake at 203-377-9984.

Sincerely,

David Ditta
Laboratory Director

HALEY & ALDRICH
Haley & Aldrich, Inc.
800 Connecticut Blvd.,
Suite 100
East Hartford, CT 06108-7303

CHAIN OF CUSTODY RECORD

12050553

Phone 860-282-9400
Fax 860-282-9500

1 of 2

H&A FILE NO.	37176-000	LABORATORY	CET
PROJECT NAME	GNHWPCA	ADDRESS	Stratford, CT
H&A CONTACT	Jen Buchanon 860-290-3134	CONTACT	Dave Ditta

DELIVERY DATE: 22 MAY 2012
TURNAROUND TIME: Normal
PROJECT MANAGER: Chris Harriman

Analysis Requested

Sample No.	Date	Time	Depth (feet)	Type (Soil)	1 VOCs by 8260	2 SVOCs by 8270	3 PCBs by 8082	4 TPH by CTETPH Method	5 RCRA 8 Metals	6 pH, flashpoint, reactive CN, reactive sulfide	Number of Containers
HA1-S1	21 MAY 2012	1100	0-5'	Soil	X	X	X	X	X	X	5
HA1-S2	21 MAY 2012	1130	5-19'	Soil	X	X	X	X	X	X	5
HA2-S1	18 MAY 2012	1130	0-5'	Soil	X	X	X	X	X	X	5
HA2-S2	18 MAY 2012	1230	5-14'	Soil	X	X	X	X	X	X	5
HA3-S1	18 MAY 2012	1145	0-5'	Soil	X	X	X	X	X	X	5
HA3-S2	18 MAY 2012	1245	5-12'	Soil	X	X	X	X	X	X	5
HA4-S1	21 MAY 2012	0900	0-19'	Soil	X	X	X	X	X	X	5
HA5-S1	18 MAY 2012	0900	0-5'	Soil	X	X	X	X	X	X	5
HA5-S2	18 MAY 2012	0930	5-10'	Soil	X	X	X	X	X	X	5

Comments (special instructions, precautions, additional method numbers, etc.)
freezer @ CET. 5/30/12 10:30

Sampled and Relinquished by
Sign: [signature]
Print: Steve Brousseau
Firm: Haley & Aldrich, Inc.
Date: 22 MAY 2012 Time

Received by
Sign: [signature]
Print: CET
Firm
Date: 5/22/12 Time: 1:22

Relinquished by
Sign: [signature]
Print
Firm
Date Time

Received by
Sign: [signature]
Print
Firm
Date: 5/30/12 Time: 1600

Relinquished by
Sign
Print
Firm
Date Time

Received by
Sign
Print
Firm
Date Time

LIQUID

VOA Vial						
Amber Glass						
Plastic Bottle						
Preservative						
Volume						

SOLID

VOA Vial	X					
Amber Glass		X	X	X	X	X
Clear Glass						
Preservative	AGH	A	A	A	AD	A
Volume	40 ml	8oz	8oz	8oz	0.25L	8oz

Sampling Comments
Adhere to CT PMC and RDEC.
Use CTDEP RCPs.

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

PRESERVATION KEY

A Sample chilled
B Sample filtered
C NaOH
D HNO_3
E H_2SO_4
F HCL
G Methanol
H Sodium Bisulfate

Form #3204

2.1°C

COMPLETE ENVIRONMENTAL TESTING, INC.

80 Lupes Drive
Stratford, CT 06615

Tel: (203) 377-9984
Fax: (203) 377-9952
e-mail: cet1@cetlabs.com

Client: Ms. Jen Buchanon
Haley & Aldrich
100 Corporate Place, Suite 105
Rocky Hill, CT 06067-1803

Analytical Report

CET # 12060003

Report Date: June 5, 2012
Client Project: GNHWPCA
Client Project #: 37176-000

Connecticut Laboratory Certification PH 0116
Massachusetts Laboratory Certification M-CT903
Rhode Island Certification 199

New York Certification 11982
Florida Laboratory Certification E871064

SAMPLE SUMMARY:

This report contains analytical data associated with the following samples only:

CETID	Client Sample ID	Matrix	Collection Date	Collection Time	Receipt Date
AF04368	HA1-S1 0-5ft	Soil	5/21/2012	11:00	05/22/2012

Sample temperature upon receipt was 1.1 degrees C

PREP ANALYSIS:

TCLP, Metals [EPA 1311]

Client ID	HA1-S1 0-5ft
CET ID	AF04368
Date Analyzed	6/2/2012

ANALYSIS:

TCLP Metals [EPA 6020A] Units: mg/l

Client ID	HA1-S1 0-5ft
CET ID	AF04368
Date Analyzed	6/4/2012
Dilution	1.0
Lead	0.33

Questions related to this report should be directed to David Ditta, Timothy Fusco, or Robert Blake at 203-377-9984.

Sincerely,

David Ditta
Laboratory Director

Report Comments:
1. ND is None Detected at the specified detection limit.
2. All analyses were performed in house unless a Reference Laboratory is listed.
3. Samples will be disposed of 30 days after the report date.
4. Sample Result Flags:
   E - The result is estimated, above the calibration range.
   H - The surrogate recovery is above the control limits.
   L - The surrogate recovery is below the control limits.
   B - The compound was detected in the laboratory blank.
   P - The Relative Percent Difference (RPD) of dual column analyses exceeds 40%.
   D - The RPD between the sample and the sample duplicate is high. Sample homogeneity may be a problem.
5. All results met standard operating procedures unless indicated by a data qualifier next to a sample result, or a narration in the QC report.

Main Identity 12060003

From: "Dave Ditta" <dditta1@cetlabs.com>
To: <jbakos@cetlabs.com>
Sent: Thursday, May 31, 2012 3:43 PM
Attach: 12050553.pdf
Subject: FW: cet# 12050553

From: Buchanon, Jennifer N. [mailto:JBuchanon@haleyaldrich.com]
Sent: Thursday, May 31, 2012 1:50 PM
To: CET1
Subject: FW: cet# 12050553

Please run TCLP Lead for Sample ID: HA1-S1 0-5ft

From: cetreports [mailto:cetreports@cetlabs.com]
Sent: Wednesday, May 30, 2012 4:33 PM
To: Buchanon, Jennifer N.
Subject: cet# 12050553

CET
COMPLETE ENVIRONMENTAL TESTING, INC.

Please do not reply to this e-mail. This e-mail address is not monitored. If you need assistance please contact the lab at (203) 377-9984 or e-mail cet1@cetlabs.com

HALEY & ALDRICH
Haley & Aldrich, Inc.
800 Connecticut Blvd.,
Suite 100
East Hartford, CT 06108-7303
Phone 860-282-9400
Fax 860-282-9500

20S553 12060003

CHAIN OF CUSTODY RECORD

1 of 2

H&A FILE NO.	37176-000	LABORATORY	CET	DELIVERY DATE	22 MAY 2012
PROJECT NAME	GNHWPCA	ADDRESS	Stratford, CT	TURNAROUND TIME	Normal
H&A CONTACT	Jen Buchanon 860-290-3134	CONTACT	Dave Ditta	PROJECT MANAGER	Chris Harriman

Analysis Requested

Sample No.	Date	Time	Depth (feet)	Type (Soil)	1 VOCs by 8260	2 SVOCs by 8270	3 PCBs by 8082	4 TPH by CTETPH Method	5 RCRA 8 Metals	6 pH, flashpoint, reactive CN, reactive sulfide	Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)
HA1-S1	21 MAY 2012	1100	0-5'	Soil	X	X	X	X	X	X	5	
HA1-S2	21 MAY 2012	1130	5-19'	Soil	X	X	X	X	X	X	5	Keeper @ CET. 5/22/12 10:30
HA2-S1	18 MAY 2012	1130	0-5'	Soil	X	X	X	X	X	X	5	
HA2-S2	18 MAY 2012	1230	5-18'	Soil	X	X	X	X	X	X	5	
HA3-S1	18 MAY 2012	1145	0-5'	Soil	X	X	X	X	X	X	5	
HA3-S2	18 MAY 2012	1245	5-12'	Soil	X	X	X	X	X	X	5	
HA4-S1	21 MAY 2012	0900	0-19'	Soil	X	X	X	X	X	X	5	
HA5-S1	18 MAY 2012	0900	0-5'	Soil	X	X	X	X	X	X	5	
HA5-S2	18 MAY 2012	0930	5-10'	Soil	X	X	X	X	X	X	5	

Sampled and Relinquished by	Received by
Sign [signature]	Sign [signature]
Print Steve Brousseau	Print CET
Firm Haley & Aldrich, Inc.	Firm
Date 22 MAY 2012 Time	Date 5/22/12 Time 1120
Relinquished by	**Received by**
Sign [signature]	Sign [signature]
Print	Print
Firm	Firm
Date Time	Date 5/22/12 Time 1600
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID

VOA Vial						
Amber Glass						
Plastic Bottle						
Preservative						
Volume						

SOLID

	1	2	3	4	5	6
VOA Vial	X					
Amber Glass						
Clear Glass		X	X	X	X	X
Preservative	AGH	A	A	A	AD	A
Volume	40 ml	8oz	8oz	8oz	0.25L	8oz

Sampling Comments

Adhere to CT PMC and RDEC.
Use CTDEP RCPs.

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

PRESERVATION KEY

A Sample chilled
B Sample filtered
C NaOH
D HNO_3
E H_2SO_4
F HCL
G Methanol
H Sodium Bisulfate

Form #3204

2 mp 1.1 g

COMPLETE ENVIRONMENTAL TESTING, INC.

80 Lupes Drive
Stratford, CT 06615

Tel: (203) 377-9984
Fax: (203) 377-9952
e-mail: cet1@cetlabs.com

Client: Ms. Jen Buchanon
Haley & Aldrich
100 Corporate Place, Suite 105
Rocky Hill, CT 06067-1803

Analytical Report

CET # 12050547

Report Date: May 30, 2012
Client Project: GNHWPCA
Client Project #: 37176-000

Connecticut Laboratory Certification PH 0116
Massachusetts Laboratory Certification M-CT903
Rhode Island Certification 199

New York Certification 11982
Florida Laboratory Certification E871064

SAMPLE SUMMARY:

This report contains analytical data associated with the following samples only:

CETID	Client Sample ID	Matrix	Collection Date	Collection Time	Receipt Date
AF03604	HA5-OW	Water	5/21/2012	18:30	05/22/2012

Sample temperature upon receipt was 1.1 degrees C

PREP ANALYSIS:

Acid Digestion of Waters [EPA 3005A]

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/25/2012

Liquid-Liquid Extraction EPH [EPA 3510C]

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/24/2012

Liquid-Liquid Extraction SVOCs [EPA 3510C]

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/25/2012

ANALYSIS:

Total Mercury [EPA 7470A] Units: mg/l

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/29/2012
Total Mercury	ND < 0.0004

Total Metals [EPA 200.7] Units: mg/l

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/25/2012
Dilution	1.0
Lead	0.097
Selenium	ND < 0.01
Cadmium	ND < 0.005
Chromium	ND < 0.05
Arsenic	ND < 0.004
Barium	0.66
Silver	ND < 0.012

Semi-Volatile Organics [EPA 8270D] Units: ug/l

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/29/2012
Dilution	1.0
Pyridine	ND < 4.0
n-Nitroso-dimethylamine	ND < 20
bis(2-Chloroethyl)ether	ND < 10
Phenol	ND < 20
Aniline	ND < 20
2-Chlorophenol	ND < 20
1,3-Dichlorobenzene	ND < 5.0
1,4-Dichlorobenzene	ND < 5.0
Benzyl Alcohol	ND < 20
1,2-Dichlorobenzene	ND < 5.0
bis(2-chloroisopropyl)ether	ND < 10
Hexachloroethane	ND < 3.0
N-Nitroso-di-n-propylamine	ND < 10
2-Methyl Phenol	ND < 20
3+4 Methyl Phenol	ND < 20
Nitrobenzene	ND < 20
Isophorone	ND < 20
2-Nitrophenol	ND < 20
2,4-Dimethylphenol	ND < 20
bis(2-Chloroethoxy)methane	ND < 20
Benzoic Acid	ND < 20
2,4-Dichlorophenol	ND < 20
1,2,4-Trichlorobenzene	ND < 5.0
Naphthalene	2.2
2,6-Dichlorophenol	ND < 20
4-Chloroaniline	ND < 20
1,2,4,5 Tetrachlorobenzene	ND < 20
Hexachlorobutadiene	ND < 20
4-Chloro-3-methylphenol	ND < 20
2-Methyl Naphthalene	ND < 1.0
Hexachlorocyclopentadiene	ND < 20
2,4,6-Trichlorophenol	ND < 20
2,4,5-Trichlorophenol	ND < 20
2-Chloronaphthalene	ND < 20
2-Nitroaniline	ND < 20
Acenaphthylene	ND < 0.30
Dimethylphthalate	ND < 20
2,6-Dinitrotoluene	ND < 75
4-Nitroaniline	ND < 20
Acenaphthene	ND < 1.0
2,4-Dinitrophenol	ND < 20
2,4-Dinitrotoluene	ND < 75
4-Nitrophenol	ND < 75
Dibenzofuran	ND < 1.0
2,3,4,6-Tetrachlorophenol	ND < 20
Fluorene	ND < 1.0
4-Chlorophenyl-phenylether	ND < 20
Diethylphthalate	ND < 20
3-Nitroaniline	ND < 20
4,6-Dinitro-2-methylphenol	ND < 20

Semi-Volatile Organics [EPA 8270D] Units: ug/l

Client ID	HA5-OW
n-Nitrosodiphenylamine	ND < 20
1,2-Diphenylhydrazine	ND < 20
4-Bromophenyl-phenylether	ND < 20
Hexachlorobenzene	ND < 0.077
Pentachlorophenol	ND < 1.0
Phenanthrene	0.54
Anthracene	ND < 1.0
Carbazole	ND < 1.0
Di-n-butylphthalate	ND < 20
Pentachloronitrobenzene	ND < 20
Fluoranthene	ND < 1.0
Pyrene	ND < 1.0
Butylbenzylphthalate	ND < 20
3,3-Dichlorobenzidine	ND < 75
Benzo[a]anthracene	0.48
Chrysene	ND < 1.0
bis(2-Ethylhexyl)phthalate	ND < 2.0
Di-n-octylphthalate	ND < 20
Benzo[b]fluoranthene	0.44
Benzo[k]fluoranthene	ND < 0.30
Benzo[a]pyrene	0.38
Indeno[1,2,3-cd]pyrene	0.31
Dibenz[a,h]anthracene	ND < 0.20
Benzo[g,h,i]perylene	ND < 1.0
2-Fluorophenol (Surr) 15-110	21
Phenol-d6(Surr) -	14
Nitrobenzene-d5(Surr) 30-130	44
2-Fluorobiphenyl (Surr) 30-130	44
2,4,6-Tribromophenol (Surr) 15-110	120 H
Terphenyl-d14 (Surr) 30-130	130

Conn. Extractable TPH [CT DEP] Units: mg/l

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/24/2012
Dilution	1.0
ETPH	ND < 0.10
Octacosane (surr) 50-150	84

Volatile Organics [EPA 8260C] Units: ug/l

Client ID	HA5-OW
CET ID	AF03604
Date Analyzed	5/23/2012
Dilution	1.0
Dichlorodifluoromethane	ND < 10
Chloromethane	ND < 2.7
Vinyl Chloride	ND < 1.6
Bromomethane	ND < 5.0
Chloroethane	ND < 5.0
Acetone	ND < 50
Acrylonitrile	ND < 0.50
Trichlorofluoromethane	ND < 25
Trichlorotrifluoroethane	ND < 25
1,1-Dichloroethene	ND < 1.0
Methylene Chloride	ND < 5.0
Carbon Disulfide	ND < 5.0
Methyl-t-Butyl Ether (MTBE)	ND < 5.0
trans-1,2-Dichloroethene	ND < 1.0
1,1-Dichloroethane	ND < 1.0
2-Butanone (MEK)	ND < 25
2,2-Dichloropropane	ND < 1.0
cis-1,2-Dichloroethene	ND < 1.0
Chloroform	ND < 1.0
Tetrahydrofuran	ND < 5.0
1,1,1-Trichloroethane	ND < 1.0
Carbon Tetrachloride	ND < 1.0
1,1-Dichloropropene	ND < 1.0
Benzene	ND < 1.0
1,2-Dichloroethane	ND < 1.0
Methyl Isobutyl Ketone	ND < 25
Trichloroethene	ND < 1.0
1,2-Dichloropropane	ND < 1.0
Dibromomethane	ND < 1.0
Bromodichloromethane	ND < 0.50
2-Hexanone	ND < 25
cis-1,3-Dichloropropene	ND < 0.50
Toluene	ND < 1.0
trans-1,3-Dichloropropene	ND < 0.50
1,1,2-Trichloroethane	ND < 1.0
Tetrachloroethene	ND < 1.0
1,3-Dichloropropane	ND < 0.50
Dibromochloromethane	ND < 0.50
1,2-Dibromoethane	ND < 0.50
trans-1,4-Dichloro-2-Butene	ND < 10
Chlorobenzene	ND < 1.0
1,1,1,2-Tetrachloroethane	ND < 1.0
Ethylbenzene	ND < 1.0
m+p Xylenes	ND < 1.0
o-Xylene	ND < 1.0
Styrene	ND < 1.0
Bromoform	ND < 1.0
Isopropylbenzene	ND < 1.0
1,1,2,2-Tetrachloroethane	ND < 0.50
Bromobenzene	ND < 1.0

Volatile Organics [EPA 8260C] Units: ug/l

Client ID	HA5-OW
1,2,3-Trichloropropane	ND < 1.0
n-Propylbenzene	ND < 1.0
2-Chlorotoluene	ND < 1.0
4-Chlorotoluene	ND < 1.0
1,3,5-Trimethylbenzene	ND < 1.0
tert-Butylbenzene	ND < 1.0
1,2,4-Trimethylbenzene	15
sec-Butylbenzene	ND < 1.0
1,3-Dichlorobenzene	ND < 1.0
4-Isopropyltoluene	ND < 1.0
1,4-Dichlorobenzene	ND < 1.0
1,2-Dichlorobenzene	ND < 1.0
n-Butylbenzene	ND < 1.0
1,2-Dibromo-3-Chloropropane	ND < 1.0
1,2,4-Trichlorobenzene	ND < 1.0
Hexachlorobutadiene	ND < 0.45
Naphthalene	4.2
1,2,3-Trichlorobenzene	ND < 1.0
1,2 Dichloroethane-d4 (SURR) 70-130	100
toluene-d8 (SURR) 70-130	100
4-bromofluorobenzene (SURR) 70-130	107

Questions related to this report should be directed to David Ditta, Timothy Fusco, or Robert Blake at 203-377-9984.

Sincerely,

David Ditta
Laboratory Director

Report Comments:
1. ND is None Detected at the specified detection limit.
2. All analyses were performed in house unless a Reference Laboratory is listed.
3. Samples will be disposed of 30 days after the report date.
4. Sample Result Flags:
   E - The result is estimated, above the calibration range.
   H - The surrogate recovery is above the control limits.
   L - The surrogate recovery is below the control limits.
   B - The compound was detected in the laboratory blank.
   P - The Relative Percent Difference (RPD) of dual column analyses exceeds 40%.
   D - The RPD between the sample and the sample duplicate is high. Sample homogeneity may be a problem.
5. All results met standard operating procedures unless indicated by a data qualifier next to a sample result, or a narration in the QC report.

HALEY & ALDRICH
Haley & Aldrich, Inc.
800 Connecticut Blvd.,
Suite 100
East Hartford, CT 06108-7303
Phone 860-282-9400
Fax 860-282-9500

CHAIN OF CUSTODY RECORD

12050547

1 of 1

H&A FILE NO.	37176-000	LABORATORY	CET	DELIVERY DATE	22 MAY 2012
PROJECT NAME	GNHWPCA	ADDRESS	Stratford, CT	TURNAROUND TIME	Normal
H&A CONTACT	Jen Buchanon 860-290-3134	CONTACT	Dave Ditta	PROJECT MANAGER	Chris Harriman

Sample No.	Date	Time	Depth (feet)	Type (Soil)	1 VOCs by 8260	2 SVOCs by 8270	3 TPH by CTETPH	4 RCRA 8 Metals	5	6	Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)
HA5-OW	21 MAY 2012	1830	NA	Water	X	X	X	X			5	

Sampled and Relinquished by	Received by
Sign [signature]	Sign RBlda I
Print Steve Brousseau	Print CET
Firm Haley & Aldrich, Inc.	Firm
Date 22 MAY 2012 Time	Date 5/22/12 Time 1205
Relinquished by	**Received by**
Sign RBldaI	Sign [signature]
Print CET	Print
Firm	Firm
Date 5/22/12 Time 1605	Date 5/22/12 Time 1610
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID

	1	2	3	4	5	6
VOA Vial	X					
Amber Glass		X	X			
Plastic Bottle				X		
Preservative	AF	A	A	AD		
Volume	250 ml	1L	1L	250 ml		

SOLID

	1	2	3	4	5	6
VOA Vial	X					
Amber Glass						
Clear Glass		X	X	X	X	X
Preservative		A	A	A	A	A
Volume	40 ml	8oz	8oz	8oz	8oz	8oz

PRESERVATION KEY

A Sample chilled C NaOH E H_2SO_4 G Methanol
B Sample filtered D HNO_3 F HCL H Sodium Bisulfate

Sampling Comments

Adhere to CT PMC and RDEC.
Use CTDEP RCPs.

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

Temp 4.1

Form #3204