ATLANTIC TESTING LABORATORIES

WBE certified company

Buffalo
5167 South Park Avenue
Hamburg, NY 14075
716-649-8110 (T)
atlantictesting.com

August 27, 2024

TYLin – Greeley and Hansen Water Solutions
77 Broadway Street – Suite 208
Buffalo, New York 14203

Attn: Edmund Aplerh-Doku, PE, DBIA, ENV SP
Program Manager
Email: edmund.aplerhdoku@tylin.com

Re: Subsurface Investigation and Geotechnical Evaluation
Proposed Sidney OLS Project
Sidney Street and Lark Street
Buffalo, New York
ATL Report No. BD161E-01-05-24

Edmund Aplerh-Doku:

Enclosed is one (1) electronic copy of the referenced report. ATL appreciates the opportunity to provide geotechnical services for your project.

Please note that upon completion of the subsurface investigation, the borings were backfilled with on-site soils and the surface was patched as appropriate. It is important that the backfilled borings be monitored for settlement or subsidence. This will be the responsibility of TYLin – Greeley and Hansen Water Solutions. ATL assumes no liability for loss or damage resulting from borehole settlement. The soil and bedrock samples obtained during this investigation will be retained for a period of six months and subsequently discarded, unless otherwise instructed.

Please contact our office should you have any questions or comments on this information, or if we may be of further service. We look forward to our continued association to obtain a successful completion of this project.

Sincerely,
ATLANTIC TESTING LABORATORIES, Limited

Thomas R. Seider, PE
Senior Engineer

TRS/sw

Enclosures

SUBSURFACE INVESTIGATION AND GEOTECHNICAL EVALUATION

PROPOSED SIDNEY OLS PROJECT
SIDNEY STREET AND LARK STREET
BUFFALO, NEW YORK

TYLIN – GREELEY AND HANSEN WATER SOLUTIONS

PREPARED FOR: **TYLin – Greeley and Hansen Water Solutions**
77 Broadway Street – Suite 208
Buffalo, New York, 14203

PREPARED BY: **Atlantic Testing Laboratories, Limited**
5167 South Park Avenue
Hamburg, New York, 14075

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TABLE OF CONTENTS

APPENDICES

SUBSURFACE INVESTIGATION
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BUFFALO, NEW YORK

TYLIN – GREELEY AND HANSEN WATER SOLUTIONS

1.0 INTRODUCTION

At the request of TYLin – Greeley and Hansen Water Solutions (TYLin), and in accordance with our proposal (ATL File No. BD998-1146-04-24, dated April 30, 2024), Atlantic Testing Laboratories, Limited (ATL) performed a subsurface investigation and geotechnical evaluation for the referenced project. The purpose of the investigation was to ascertain the general subsurface soil, bedrock, and groundwater conditions at the site, to evaluate the engineering significance of these findings, and to provide recommendations related to the design and construction of the proposed project.

2.0 SITE AND PROJECT DESCRIPTION

The proposed project is expected to include the following major components.

- Construction of an approximate 3.3 million gallon Offline Storage (OLS) Tank, within the vacant lots northwest of the Sidney Street and Lark Street intersection. This is expected to consist of an approximate 125 feet wide, 140 feet long, and 25 feet deep, cast-in-place concrete structure. The top of the tank will be about 20 feet below grade, or about elevation 615 feet, with the bottom of the tank about 45 feet below grade or about elevation 590 feet. Interior columns will be used to support the top of the tank.
- Installation of approximately 200 linear feet of 48-inch diameter, gravity flow, influent sewer piping, extending from Humboldt Parkway to the new OLS Tank. The piping will have an invert elevation near 616 feet.
- Installation of approximately 350 linear feet of 36-inch diameter, gravity flow, effluent sewer piping, extending from the new OLS Tank, towards the north along Lark Street, eventually connecting with an existing sewer line, through a drop-pipe manhole.
- The drop-pipe manhole at the north end of the new effluent sewer piping will consist of an approximate 60 feet deep structure. Several additional sewer manholes are planned within Sidney Street and Lark Street, that will extend from the surface to the new sewer piping.

- It is our understanding that micro-tunneling is being considered for installation of the sewer piping. Micro-tunneling is a trenchless construction method that uses a horizontal boring machine. The boring machine is pushed by hydraulic jacks from a launch shaft / pit. As the excavation is advanced, the spoils are removed, and piping is installed behind the boring machine.

The general limits of the proposed project are shown on **Figure 1 – Boring Location Plan**, which is included in **Appendix A**.

3.0 SUBSURFACE INVESTIGATION & SAMPLING METHODOLOGY

3.1 Boring Locations

Seven (7) boring locations, designated as TB-1 through TB-7, were selected by TYLin to provide general coverage of the proposed tank, sewer piping and manhole structures. ATL used Google Earth to establish the GPS northing and easting coordinates for each boring location, based on the plan provided by TYLin. A Trimble Model R8 GPS / GNSS Receiver was then used to locate the borings in the field and to determine the approximate ground surface elevations. The recorded coordinates at the boring locations, along with the approximate ground surface elevations are included in **Table 1**, within **Appendix B**. The approximate boring locations are shown on the Boring Location Plan in Appendix A.

3.2 Soil and Bedrock Borings

The borings were completed by ATL between June 12th and June 25th, 2024, using a Central Mine Equipment (CME) model 550X, all-terrain tire mounted drill rig. The borings were advanced through the overburden soil using hollow stem auger and split spoon soil sampling techniques. Soil sampling and standard penetration testing was performed continuously to a depth of 12 feet and in intervals of five feet or less for the remining depth of the overburden soils. The soil sampling and standard penetration testing was completed utilizing a 2-inch outside diameter split spoon sampler and automatic drop hammer, in accordance with ASTM D 1586.

All of the borings were advanced through the overburden soils until encountering auger refusal conditions at the top of apparent bedrock, at depths ranging from about 12 feet to 18 feet. Following auger refusal within borings TB-2, TB-4, and TB-6, the borings were advanced using rock coring methods, with an NQ size core barrel, to a depth of 80 feet each. Following auger refusal within boring TB-5, the boring was advanced using rock coring methods, with an HQ size core barrel, to a depth of 47.5 feet. The rock coring was completed in accordance with ASTM D 2113.

The collected soil samples were visually classified in the laboratory by a Geologist using the Burmister Soil Classification System. The split spoon sampler does not recover particles larger than 1⅜-inch in nominal dimension; therefore, the soil classifications may not be representative of the entire soil matrix. The recovered rock cores were also described, including characteristics such as color, rock type, core recovery and rock quality designation (RQD). The visual classifications and the standard penetration test results are presented on the **Subsurface Investigation Logs** included in **Appendix C**.

The boreholes that were not completed with observation wells were backfilled with on-site soils, and the surface was patched as appropriate. It is important that the backfilled borings be monitored for settlement or subsidence. This will be the responsibility of TYLin or others. ATL assumes no liability for loss or damage resulting from borehole settlement.

3.3 Groundwater Observation Wells

Following the completion of borings TB-3, TB-5, and TB-7, groundwater observation wells were installed. The observation wells consist of 2-inch diameter PVC machine slot well screen and riser pipe, with filter sand installed around the well screen.

The sand pack for observation well within boring TB-5 extends from the bottom of the boring at 47.5 feet, up to about 22.5 feet below the surface. A bentonite chip seal was installed above the sand pack up to about 15 feet. Accordingly, the sand pack at observation well TB-5 is sealed within the bedrock core hole.

The sand pack for observation well TB-3 extends from the bottom of the boring at 18 feet, up to about 6 feet below the surface. A bentonite chip seal was installed above the sand pack up to about 4 feet, sealing the sand pack within the indigenous soils. The sand pack for observation well TB-7 is mostly within fill soils, which extended to a depth of about 10 feet at that location.

A cement-bentonite grout and / or concrete was used to backfill the remainder of the bore holes above the bentonite seals, and flush-mount protective casings were installed at the surface. Additional details regarding the construction of the observation wells are shown on the **Monitoring Well Completion Records**, following boring logs TB-3, TB-5, and TB-7, in **Appendix C**.

4.0 GEOTECHNICAL LABORATORY ANALYSES

Select samples of the overburden fill soils and indigenous soils were tested in ATL's geotechnical laboratory for the following physical analyses.

- Laboratory Determination of Moisture Content of Soils (ASTM D 2216).
- Particle Size Distribution, both with and without Hydrometer Analyses (ASTM D 422).
- Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318).

The **Laboratory Test Results** for the soil samples are included in **Appendix D**, and are summarized in **Table 2**, within **Appendix B**.

In addition to the soil testing, eight (8) pieces of the recovered bedrock cores were tested by ATL for Unconfined Compressive Strength (ASTM D 7012, Method C). These results are also included in Appendix D, and are summarized in **Table 3**, within **Appendix B**.

5.0 SUBSURFACE CONDITIONS

The following description of subsurface conditions is based on the subsurface soil, bedrock, and groundwater conditions encountered during the subsurface investigation performed between June 12th and June 25th, 2024, along with a review of the laboratory test results. Actual subsurface conditions could vary across the project site in both the horizontal and vertical dimensions. More detailed subsurface descriptions are provided on the subsurface investigation logs in Appendix C.

5.1 Surface Conditions and Existing Fill Soils

Boring TB-1 was completed within Sidney Street, and encountered about six inches of asphalt pavement at the surface, which was underlain by about 4 inches of concrete. Borings TB-2, TB-3, and TB-4 were completed within the vacant lots northwest of the Sidney Street and Lark Street intersection, and encountered topsoil at the surface with a thickness ranging from about 2 to 4 inches. The remaining borings, TB-5, TB-6, and TB-7, were completed within the open lawn areas between the roadway curb and sidewalk. Topsoil was encountered at the surface of these locations, with a thickness ranging from about 2 to 6 inches.

Beneath the pavement or topsoil, man-placed fill type soils / materials were encountered, which extended to depths ranging from about 2 feet to 15.4 feet. The following table summarizes the approximate fill depths and apparent bottom of fill elevations encountered at the boring locations.

Approximate Fill Depths and Bottom of Fill Elevations

Boring	Approximate Surface Elevation (feet)	Fill Depth / Bottom of Fill Elevation (feet)
TB-1	634.1	6 / 628.4
TB-2	636.3	8 / 628.3
TB-3	635.1	4 / 631.1
TB-4	634.3	4 / 630.4
TB-5	634.3	4 / 630.3
TB-6	633.7	15.4 / 618.3 (extends to the top of bedrock)
TB-7	632.9	10 / 622.9

It should be expected that the fill thickness will vary between and away from the boring locations, and will be dependent on the original site topography prior to development. The fill soils will also extend to the bottom of the excavations made for any existing or former structure foundations or utilities.

The nature of the existing fill soils varied between the boring locations and with depth. However, it can generally be described a mixture of silt and clay with varying amounts of intermixed sand and gravel. Trace amounts of organics were often observed within the fill samples, along with trace amounts of concrete fragments, cinders, brick fragments, glass, and slag. Three samples of the exiting fill soils consisted predominately of concrete fragments with varying amounts of intermixed soils. These included: the 1 to 2 feet deep sample from boring TB-1; the 2 to 2.4 feet deep sample from TB-2; and the last sample collected from boring TB-7 at 15 to 15.4 feet.

Laboratory test results completed on samples of the existing fill soils are summarized in Table 2, within Appendix B, and confirm the visual soil descriptions. The Standard Penetration Test (SPT) “N” values obtained within fill soils ranged from 10 to 53, indicating the fill soils have “firm” to “very compact” relative density or a “stiff” to ‘hard” consistency.

5.2 Indigenous Soils

The indigenous soils consisted predominately of a medium plasticity clay and silt soil with trace amounts of sand and gravel. Near the bottom of the overburden soil stratum, the amount of intermixed sand and gravel often increased. The Standard Penetration Test (SPT) “N” values obtained within the indigenous soils ranged from 12 to 60, correlating to soils with a “stiff”, “very stiff”, and “hard” consistency. The lower SPT “N” values of 12 to 15 were encountered beneath a depth of about 10 to 12 feet. Laboratory test results completed on samples of the indigenous soils are summarized in Table 2, within Appendix B.

5.3 Bedrock

All seven borings were advanced through the overburden fill and indigenous soils until encountering auger refusal conditions at the top of apparent bedrock, at depths ranging from about 12 feet to 18 feet. Rock coring completed within borings TB-2, TB-4, TB-5, and TB-6, confirmed the auger refusal conditions consisted of bedrock. The following table summarizes the depth and elevation where the top of bedrock was encountered, as identified by rock coring (C) or auger refusal (AR).

Approximate Depth and Elevation at Top of Bedrock		
Boring	Approximate Ground Surface Elevation (feet)	Depth / Elevation at Top of Bedrock (feet)
TB-1	634.1	16.5 / 617.6 (AR)
TB-2	636.3	18.0 / 618.3 (C)
TB-3	635.1	18.0 / 617.1 (AR)
TB-4	634.3	18.0 / 616.3 (C)
TB-5	634.3	17.5 / 616.8 (C)
TB-6	633.7	15.4 / 618.3 (C)
TB-7	632.9	12.0 / 620.9 (AR)

The bedrock cores recovered at depths shallower than about 58 feet consisted of grey, hard to very hard, sound, laminated to massively bedded, Limestone bedrock, with some fractures, along with varying amounts of chert. At depths deeper than about 58 feet, similar Limestone bedrock was encountered. However, the chert was not observed, and the bedrock hardness was described as medium hard to hard.

The percent recovery and the rock quality designation (RQD) value for each core run are summarized in **Table 3**, included within **Appendix B**. As shown, the core recoveries ranged from 89% to 100%. The RQD values ranged from 81% to 100%, indicating the rock mass quality is “good” to “excellent”.

Several pieces of the recovered rock cores were tested for Unconfined Compressive Strength. The results are included in Appendix D, and are also summarized in Table 3. The unconfined compressive strength of the rock cores tested, ranged from about 10,600 pounds per square inch (psi) to 13,900 psi.

During the bedrock coring process, water is introduced into the borings to cool the rock core bit and flush cuttings from the hole. The core water is typically returned to the surface. However, the driller noted the occasional loss of core water, which is noted on the boring logs and in Table 3. This could be an indication of some fractures / joints near these depths. The depths where core water loss occurred varied between boring locations. However, within borings TB-2, TB-4, and TB-5, water loss did occur at relatively similar depths, ranging from about 39 feet to 43 feet. Soil filled joints within the bedrock core were also observed within borings TB-4 and TB-6. These observations are noted on the boring logs, and in Table 3.

5.4 Groundwater

At the completion of overburden drilling at borings TB-1, TB-3, TB-4, and TB-7, no freestanding water was observed within bore holes. At the remaining locations TB-2, TB-5, and TB-6, water was measured at depths ranging from about 13 feet to 17 feet, or within one to two feet of the top of bedrock. In all cases, it is possible that the groundwater, where present, did not have adequate time to fully accumulate and stabilize in the borings, during the relatively short time period that had elapsed from the completion of drilling operations and the time of the measurements.

Following the completion of rock coring at borings TB-2, TB-4, TB-5, and TB-6, freestanding water was measured within the core holes at depths ranging from about 22 feet to 26 feet. Water was introduced into the borings to facilitate the rock coring. Accordingly, these measurements would typically not be considered to represent an actual groundwater condition. However, these water levels are near the water levels obtained from observation well TB-5, that was installed within the bedrock core hole.

Groundwater observation wells were installed within completed borings TB-3, TB-5, and TB-7. The well screen and sand pack at TB-3 and TB-7 are screened within the overburden soils The well screen and sand pack at TB-5 is sealed within the bedrock core hole. Water level measurements were obtained at the observation wells on three occasions, and are summarized in the following table.

Summary of Water Levels within Observation Wells			
Observation Well	Ground Surface Elevation (feet)	Date	Groundwater Depth / Elevation (feet)
TB-3 (overburden)	635.1	June 27, 2024	8.53 / 626.6
		July 11, 2024	7.65 / 627.5
		July 22, 2024	7.63 / 627.5
TB-5 (bedrock)	634.3	June 27, 2024	24.33 / 610.0
		July 11, 2024	23.95 / 610.4
		July 22, 2024	24.35 / 610.0
TB-7 (overburden)	632.9	June 27, 2024	no water present
		July 11, 2024	no water present
		July 22, 2024	no water present

Following the first and second water level readings at observation wells TB-3 and TB-5, approximately five gallons of water was removed from the well. This lowered the water level by about 8 to 9 feet within overburden well TB-3, but only about 0.2 feet to 0.4 feet within bedrock well TB-5. Supplemental water level readings indicate the water levels returned to near the same level.

The collected samples of fill soils and indigenous soils were described only as “moist”, not “moist to wet” or “wet”. The lack of, or limited amount of water following the completion of overburden drilling, the soil moisture descriptions, and the water level readings made within observation well TB-7, indicate an overburden groundwater condition was either not present, or exists near the top of bedrock. The one exception includes the water levels made within observation well TB-3, where water was present at depths of about 7.5 feet to 8.5 feet, suggesting a shallower zone of overburden groundwater exist at that location.

At all locations, there is a potential for perched groundwater to be encountered within zones of more permeable fill soils, which overlie less permeable clay and silt indigenous soils or bedrock. Perched groundwater conditions can be more prevalent following heavy or extended periods of precipitation and during seasonally wet periods. It should be expected that both perched and general groundwater within the overburden and bedrock will vary with location and with changes in soil conditions, precipitation and seasonal conditions. Consideration should be given to obtaining additional groundwater depth measurements within the observation wells to evaluate for seasonal fluctuations.

6.0 GEOTECHNICAL ENGINEERING DISCUSSION & RECOMMENDATIONS

6.1 General

The geotechnical engineering discussion and recommendations are based on the information provided by TYLin and the subsurface conditions outlined in this report. Based on the proposed OLS tank, manhole structures, and sewer piping, along with the subsurface conditions encountered, the following items should be considered with regard to design and construction of the project.

- OLS tank and manhole structure support, lateral earth pressures, and uplift resistance.
- Bedrock excavation and shoring requirements.
- Excavation dewatering.
- Protection of existing structures and utilities.

These considerations, along with associated recommendations are discussed in the following sections of this report.

6.2 OLS Tank and Manhole Structures

6.2.1 Bearing Capacity

The proposed OLS Tank and manhole structures will be bearing within the hard to very hard Limestone bedrock, which is considered suitable for supporting the proposed structures. The Limestone bedrock is adequate to support an allowable net bearing pressure increase in excess of 10 tons per square foot, which is more than adequate, considering construction of the tank and manhole structures are expected to result in minor to no net bearing pressure increases to the bedrock bearing grades. This is due to the volume of soil and bedrock that will be displaced by the tank and manhole structures. It may be desirable to level the bedrock bearing surface with Structural Fill or concrete fill (f'c at 28 days > 2,000 psi), prior to construction of the tank and manhole structures. Recommendations for Structural Fill are provided in Section 7.5 of this report.

6.2.2 Uplift Resistance

Design of the below grade structures should consider the presence of groundwater conditions and hydrostatic lateral and uplift pressures. An overburden groundwater condition appears to exist at depths ranging from about 7 feet (elevation 628 feet) in the area of boring TB-3, to within 1 to 2 feet of the top bedrock at the remaining boring locations. A bedrock groundwater condition exist near a depth of 24 feet (elevation 610 feet). However, it is recommended for design purposes that groundwater conditions be assumed to exist at the surface, to account for potentially variable groundwater conditions, and the possibility of surface water accumulation within the more granular soils / stone that will likely be used to backfill the structures.

A lip should be provided at the bottom of the structures in order to help mobilize the soil backfill weight against uplift. The weight of the soil column extending out at an angle of 20 degrees from vertical, above the bottom of the lip of the structure, can be added to the dead weight of the structure in computing the resistance to hydrostatic uplift. This only applies for the structures above any near vertical bedrock excavation sidewalls. For the portion of the structures within a near vertical bedrock excavation, the weight of the soil column extending out at an angle of 20 degrees from vertical, (up to the width of the excavation), above the bottom of the lip of the structure, can be added to the dead weight of the structure in computing the resistance to hydrostatic uplift. A submerged unit weight of 75 pounds per cubic foot can be used, where the tank and manhole backfill is Structural Fill, as described in section 7.5 of this report.

The use of rock anchors, grouted into pre-drilled holes into the Limestone bedrock, can be considered to provide additional uplift resistance. We recommend a minimum anchor (or dowel) hole diameter of 3 inches and a minimum bond length of 5 feet be used in the design of the anchors. The anchor hole should be over-bored approximately 1 foot, and the bond strength for the first upper 1 foot of rock be disregarded. Therefore, a rock anchor designed for 5 feet of bond strength length should be embedded a minimum of 7 feet into the bedrock.

It is general practice to develop a performance specification, with the desired capacity and locations, and then have a Specialty Contractor design the rock anchors. For preliminary planning purposes, an <u>ultimate bond strength</u> of 200 psi between the Limestone bedrock and the grout can be used for design of the rock anchors. Accordingly, a 3-inch diameter rock anchor with 5 feet of effective bond length in the Limestone bedrock would provide an <u>ultimate capacity</u> of about 113 kips.

The Post Tensioning Institute (PTI) - "Recommendations for Prestressed Rock and Soil Anchors" can be referenced with regard to providing design criteria and installation requirements for Rock Anchors. At least the first three anchors installed should be performance tested and all remaining rock anchors should be proof tested. Installation and testing of the rock anchors should be in accordance with NYSDOT Standard Specifications.

6.2.3 Earth Pressures

The design of the tank and manhole structure walls should be based on the lateral earth pressures caused by the load of backfill against the wall and the surcharge effects from any permanent or temporary adjacent loads. The depressed structure walls (restrained walls), should be designed to resist “at rest” lateral earth pressures generated by the earth backfill and any temporary or permanent surcharge loads, based on the following soil parameters. The lateral earth pressures can be computed using the following soil parameters where the wall backfill is a Structural Fill material.

<u>Recommended Soil Parameters for Below Grade Wall Design</u>

- Coefficient of At-Rest Lateral Earth Pressure – 0.47
- Coefficient of Active Lateral Earth Pressure – 0.31
- Angle of Internal Friction – 32 Degrees
- Moist Unit Weight of Soil – 140 pcf
- Submerged or Buoyant Unit Weight of Soil – 75 pcf
- Surcharge Load Lateral Coefficient – 0.50

The walls should also be designed to resist the hydrostatic pressures as well as the lateral earth pressures acting the walls. In this case, the lateral earth pressure should be computed based on a submerged soil unit weight below the design groundwater level. In addition, the floor or bottom slabs must be designed to resist potential hydrostatic uplift pressure acting on the floor and the structures should also be fully water proofed.

6.3 Sewer Lines

The effluent sewer piping will be situated within the Limestone bedrock, and could be installed using micro-tunneling methods, which appears to be a suitable option for the subsurface conditions encountered.

The influent sewer line invert elevation of 616 feet is expected to be near the interface between the overburden soils and the top of bedrock, which could present some issues with micro-tunneling methods of excavation due to the dissimilar materials. Accordingly, the use of traditional open cut trench methods might be a better option for the influent sewer piping installation. Excavation shoring considerations are provided in Section 7.3. Where open cut trench methods are used, the pipe manufacture recommendations for bedding stone thicknesses are expected to be adequate for piping bearing within the Limestone bedrock.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation Dewatering

As noted, an overburden groundwater condition appears to exist at depths ranging from about 7 feet in the area of boring TB-3, to within 1 to 2 feet of the top bedrock at the remaining boring locations. A bedrock groundwater condition exist near a depth of 24 feet (elevation 610 feet).

Accordingly, both overburden and bedrock excavation dewatering will be necessary. As noted, following the removal of about five gallons of water from bedrock observation well TB-5, the water level only dropped by about 0.2 feet to 0.4 feet. Fractures within the bedrock are expected to result in a relatively fast groundwater recovery rate. Where pumping is not adequate to dewater the excavation, it could become necessary to grout the bedrock fractures and / or implement alternative dewatering methods.

Excavation dewatering should be implemented as necessary to allow for construction to proceed in the dry. The amount of groundwater seepage can depend on the excavation location and depth, along with the soil / bedrock permeability, site drainage, and precipitation conditions at the time of construction.

Consideration should be given to obtaining additional groundwater depth measurements at the observation wells, to evaluate for seasonal fluctuations. Additional rock coring with packer testing should be considered to evaluate for fractures within the bedrock and where higher zones of groundwater infiltration can be expected. A groundwater drawdown test within the bedrock observation well can also be completed to help estimate the dewatering requirements. Both packer testing and drawdown testing should be completed by a dewatering contractor / consultant, experienced with bedrock dewatering methods.

Groundwater dewatering plans should include implementation of measures to control erosion, sedimentation, and the migration of soil fines. All dewatering activities should comply with New York State Department of Environmental Conservation (NYSDEC) stormwater discharge requirements and/or applicable federal and local regulations for construction.

7.2 Bedrock Excavation and Vibration Monitoring

The excavation of Limestone bedrock is expected to be necessary for the proposed OLS Tank, proposed manhole structures, and launch shafts / pits for the micro-tunneling equipment. The hard to very hard, and sound nature of the Limestone bedrock, its Chert content, and its relatively high RQD values indicates it will be necessary to loosen the bedrock prior to excavation, using hydraulic/pneumatic breakers (i.e. "hoe rams"), rock grinders or possibly through controlled drilling and blasting methods.

If blasting methods are permitted, they will need to be controlled and monitored to prevent uncontrolled rock heave and/or over-breakage of the bedrock subgrades that will support the OLS tank, manhole structures, and piping, as well as prevent potential detrimental impacts to existing adjacent structures and utilities. The Contractor should be required to prepare and submit a blasting operations plan. The plan should include all measures that will be employed to protect the public, workmen, and structures during blasting events. A schedule of blast events should also be established and coordinated with all appropriate parties. The plan should also include measures which will be used for monitoring blast vibrations, and to confirm that no damage has occurred to existing structures and utilities, and to subgrades for proposed tank and manhole structures.

For sensitive structures and structures in poor structural condition, it is generally recommended that the peak particle velocity (ppv) measured at the structure location not exceed 5 mm/sec (0.2 inches/sec). Higher ppv thresholds, in the range of 25 mm/sec (1 inch/sec) are generally considered acceptable for structures and utilities of sound condition.

The completion of pre-condition surveys should be considered of any nearby structures, documenting the existing conditions, damaged areas and defects. Such documentation should include photographs, video-taping, crack mapping, installation of "tell-tales", etc. This should also include documentation of doorway and window operation, and other features, which could be perceived as having been impacted or damaged.

Each blast event should be properly documented and monitored for vibration and over pressure by qualified personnel. Vibration monitoring for each blast event should be set up at the nearest structure/utility location, and at multiple locations, if appropriate. The vibrations should be limited to the thresholds stated above. In addition to the vibration monitoring the sound levels (over pressure) should not exceed 0.01 pounds per square inch (psi).

It should also be understood that quantity disputes for rock excavation can arise, as the result of bedrock heave and over-breakage from blasting. Accordingly, the construction contract should be clear that the rock excavation pay quantity is to be based on the depth of the in-situ undisturbed bedrock surface prior to blasting, along with the design bottom and side wall neat lines. Payment for additional rock excavation necessary due to heave and over-breakage beyond the trench width and bottom neat lines should not be allowed.

7.3 Excavation and Shoring

An open cut excavation could be used where there is sufficient room to cut back the excavation side slopes to safe and stable conditions, provided that any groundwater is depressed below the excavation bottom. The excavation sidewalls must be adequately sloped back in accordance with OSHA requirements as a minimum. The soil / bedrock conditions could vary away from the test boring locations. Accordingly, the Contractor should confirm the OSHA soil classification and excavation requirements at the time of construction based on actual soil, bedrock, and groundwater conditions present. The Contractor shall be solely responsible for all excavation safety, including the design of all excavation support systems.

Properly braced, or tied back shoring should be required at locations where existing structures, utilities, must be protected from potential detrimental soil movement as the result of soil relaxation/stress relief. It is noted that the use of cantilevered sheet piling (unbraced tight sheeting) or trench boxes will not be sufficient to prevent soil relaxation/stress relief (i.e. soil deformation) as excavations takes place. The use of rock anchors should be considered for excavations extending into the bedrock.

Excavation support systems should be designed by a registered Professional Engineer, who is experienced in the design of earth support systems. The design requirements at each location must consider the subsurface conditions, the potential for undercutting subgrades, utilities, structures, construction sequence, lateral earth pressures, hydrostatic conditions, and surcharge effects associated with excavation wall and bottom stability. In addition, driving sheet piles can cause detrimental damage to nearby structures, surface features, and underground utilities and must be considered during design and construction. Removal of excavation support systems should also be properly evaluated so as not to affect the integrity of the adjacent infrastructure.

7.4 Testing and Inspection

The final plans and project specifications should be reviewed by ATL, as the Geotechnical Engineer of Record, to verify that there has not been a misinterpretation of this report and/or ATL's understanding of the project.

The tank construction and manhole and sewer line installations should be continuously monitored by a Geotechnical Engineer to verify the stability and uniformity of the subgrades, to identify the presence of deleterious fill, and to ensure that adequate bearing capacity is obtained.

We recommend that ATL, as the Geotechnical Engineer of Record, be retained to perform inspections in accordance with the plans. An ATL geotechnical representative familiar with the findings and recommendations of this report will be able to assess the subsurface conditions encountered during construction, provide necessary remedial recommendations, and verify that adequate soil and bedrock conditions and bearing capacities are achieved.

7.5 Structural Fill

Structural Fill which is placed beneath the tank and manholes or used as excavation backfill should consist of a crushed ledge-rock, which is free of clay, organics and friable or deleterious particles. The material should comply with NYSDOT Standard Specifications, Item No. 304.12 - Type 2 Subbase. The Structural Fill should have the following gradation requirements.

Item 304.12 – Type 2 Subbase (crushed ledge-rock)	
Sieve Size Distribution	Percent Finer by Weight
2 inch ¼ inch no. 40 no. 200	100 25 to 60 5 to 40 0 to 10

The Structural Fill should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Placement of fill should not exceed a maximum loose lift thickness of 8 to 10 inches. The loose lift thickness should be reduced in conjunction with the compaction equipment used so that the required density is attained. The Structural Fill / Subbase Stone should have a moisture content within two percent of the optimum moisture content at the time of compaction.

8.0 LIMITATIONS

The subsurface investigation logs and this report in its entirety should be provided to the designers and contractors for information and interpretation. The subsurface investigation logs may not be representative of the entire sites subsurface condition, but only what was encountered at the individual test locations at the time of the investigation. The subsurface soil, bedrock, and groundwater conditions encountered at the time of construction may be different from those described on the subsurface investigation logs.

This report was prepared to present the findings of our subsurface investigation and engineering evaluation, and to outline concepts to be utilized in foundation design and construction. These concepts may require alterations to meet the specific design and economic considerations for this project.

Prepared by: Reviewed by:

Thomas R. Seider, PE
Senior Engineer

Brian T. Barnes, PE
Senior Engineer

TRS/BTB/sw

APPENDIX A

FIGURE

LEGEND:

B-1 Approximate Location and Designation of Test Boring

B-3 Approximate Location and Designation of Test Boring with Installed Groundwater Observation Well

NOTES:

1. Figure developed using Google Earth(TM) aerial photographs.

TYLin

Boring Location Plan

Date:	08/23/24
Project No:	BD161
Scale:	Not To Scale
Drawn by:	JDF

***Atlantic Testing Laboratories*, Limited**

Albany, NY · Binghamton, NY · Canton, NY · Elmira, NY · Plattsburgh, NY · Syracuse, NY · Rochester, NY · Utica, NY · Watertown, NY · Hamburg, NY · Poughkeepsie, NY

PROPOSED SIDNEY OLS PROJECT

SIDNEY STREET AND LARK STREET
BUFFALO, NEW YORK

FIGURE 1

APPENDIX B

TABLES

TABLE 1
Approximate Boring Locations and Ground Surface Elevations

Proposed Sidney OLS Project
Sidney Street and Lark Street
Buffalo, New York

Boring Number	Approximate Boring Locations GPS Coordinates		Approximate Ground Surface Elevation
	Latitude (Northing)	Longitude (Easting)	(feet)
TB-1	42° 54' 58.81"	78° 50' 33.41"	634.1
TB-2	42° 54' 59.88"	78° 50' 32.67"	636.3
TB-3	42° 54' 59.57"	78° 50' 31.99"	635.1
TB-4	42°54'59.2143"	78° 50' 31.35"	634.3
TB-5	42° 55' 00.36"	78° 50' 31.19"	634.3
TB-6	42° 55' 01.83"	78° 50' 31.17"	633.7
TB-7	42° 55' 02.99"	78° 50' 30.63"	632.9

Table 2
Summary of Geotechnical Laboratory Data - Soils

Proposed Sidney OLS Project
Sidney Street and Lark Street
Buffalo, New York

Boring Number	Sample Depth (ft. bgs)	Moisture Content (%)	Grain Size Distribution				Plastic / Liquid Limits		
			Gravel (%)	Sand (%)	Fines		Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)
					Silt (%)	Clay (%)			
Existing Fill Soils / Materials									
TB-2	4 to 8	16.7	0	2	40	58	not tested		
TB-3	2 to 6	18.2	0	4	36	60			
TB-5	0 to 4	17.2	2	13	31	54			
TB-6	6 to 8	15.2	0	1	41	58			
TB-6	10 to 12	17.7	0	4	96				
TB-7	6 to 8	21.3	0	11	89				
Indigenous Soils									
TB-1	8 to 12	16.1	0	1	99		16	33	17
TB-2	8 to 12	16.4	0	1	99		16	30	14
TB-4	8 to 12	16.8	0	1	99		15	30	15
TB-5	4 to 8	16.5	0	1	99		17	31	14

Note: ft. bgs = feet below ground surface.

Table 3
Summary of Geotechnical Laboratory Data - Bedrock

Proposed Sidney OLS Project
Sidney Street and Lark Street
Buffalo, New York

Boring Number	Core Run Number	Core Run Depth (ft. bgs)	Core Recovery (percent)	Core RQD (percent)	Core Unconfined Compressive Strength (psi)	Notes
TB-2	1	18 to 23	97	92		
	2	23 to 28	95	94		
	3	28 to 33	94	92		
	4	33 to 38	100	100		
	5	38 to 43	100	96		
	6	43 to 48	100	100		no core water return from 43' to 48'
	7	48 to 53	100	100		
	8	53 to 58	98	91		
	9	58 to 63	89	89		no core water return at 58'
	10	63 to 68	100	93		
	11	68 to 73	100	96		
	12	73 to 78	100	100		
	13	78 to 80	92	92		
TB-4	1	18 to 23	100	100		
	2	23 to 28	100	100	13,470	
	3	28 to 33	98	97		
	4	33 to 38	100	100		
	5	38 to 43	99	98		
	6	43 to 48	100	95		no core water return at 43'
	7	48 to 53	96	96	12,930	
	8	53 to 58	100	84		soil seams from 56.3' to 56.5'
	9	58 to 63	100	100	10,840	
	10	63 to 68	100	86		soil seam from 66.0' to 66.1'
	11	68 to 73	98	95		
	12	73 to 78	100	98	10,710	soil seams from 75.7' to 75.8'
	13	78 to 80	100	94		

Boring Number	Core Run Number	Core Run Depth (ft. bgs)	Core Recovery (percent)	Core RQD (percent)	Core Unconfined Compressive Strength (psi)	Notes
TB-5	1	17.5 to 18.8	96	96		
	2	18.8 to 23.8	100	94		
	3	23.8 to 28.8	98	97		
	4	28.8 to 33.8	100	100		
	5	33.8 to 38.8	99	99		
	6	38.8 to 43.8	100	94		no core water return at 39'
	7	43.8 to 47.5	100	100		
TB-6	1	15.4 to 18.4	100	100		
	2	18.4 to 23.4	91	91		
	3	23.4 to 28.4	100	100		no core water return at 27'
	4	28.4 to 33.4	96	96	13,880	
	5	33.4 to 38.4	100	100		
	6	38.4 to 43.4	100	100		
	7	43.4 to 48.4	97	97		
	8	48.4 to 53.4	95	88	10,980	
	9	53.4 to 58.4	98	81		
	10	58.4 to 63.4	100	95	10,610	soil seams from 62.3' to 62.5'
	11	63.4 to 68.4	97	96		
	12	68.4 to 73.4	99	97		
	13	73.4 to 78.4	98	93	11,890	
	14	78.4 to 80.0	96	86		

Notes:
1) ft. bgs = feet below ground surface.
2) RQD = Rock Quality Designation
3) psi = pounds per square inch
4) Blank space indicates testing was not completed for that sample.

APPENDIX C

SUBSURFACE INVESTIGATION LOGS

DATE:
START 6/12/2024
FINISH 6/12/2024
SHEET 1 OF 1

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. TB-1
SURF. ELEV 634.1'
G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS
PROJ. NO.: BD161
LOCATION: SIDNEY STREET, BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	X	X			ASPHALT / CONCRETE	Driller noted approximately
		4	4		---	Brown-Gray DEBRIS (concrete); some Silt & Clay;	6" of Asphalt and 4" of
	2	4	8			little cmf Sand; little cf Gravel (moist, low plasticity) FILL	Concrete at the surface
		11	11		19	Brown-Gray SILT & CLAY; some cf Gravel;	
5	3	9	11			some cmf Sand (moist, low plasticity) FILL	
		16	20		27	Similar Soils; trace Debris (concrete)	
	4	19	19			Brown CLAY & SILT; little cf Gravel; little cmf Sand	
		25	31		44	(moist, medium plasticity)	
	5	8	11			Similar Soils; trace f Sand; no Gravel	
10		14	14		25		
	6	7	9			Similar Soils	
		10	13		19		
15							REF = Sample Spoon
	7	3	5			Similar Soils; little cf Gravel; little cmf Sand	Refusal
		50/0.4			REF		
						Boring Complete at 16.5' with Auger Refusal	No Free Standing Water encountered at boring completion
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW
CLASSIFIED BY: Geologist
DRILLER: R. STEINER
DRILL RIG TYPE : CME 550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 6/14/2024
FINISH 6/18/2024
SHEET 1 OF 3

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. TB-2
SURF. ELEV 636.3'
G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS
LOCATION: SIDNEY / LARK STREETS, BUFFALO, NY
PROJ. NO.: BD161

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	4	7			TOPSOIL	Driller noted approximately
		10	18		17	Brown SILT & CLAY; some cmf Sand; little cf Gravel;	2" of Topsoil at the
	2	50/0.4			REF	trace Organics (roots); trace Debris (concrete, brick,	surface
						cinders) (moist, low plasticity) FILL	REF = Sample Spoon
5	3	8	10			Gray DEBRIS (concrete, cinders); some cmf Sand;	Refusal
		15	20		25	some f Gravel; trace Clayey Silt; trace Organics (roots)	
	4	25	25			(moist, non-plastic) FILL	
		28	31		53	Brown CLAY & SILT; trace mf Sand; trace Organics	
	5	7	13			(roots) (moist, medium plasticity) FILL	
10		19	24		32	Similar Soils; trace Debris (cinders,	
	6	6	10			spark plug)	
		14	15		24	Brown CLAY & SILT; trace f Sand	
						(moist, medium plasticity)	
						Similar Soils	
15							
	7	3	4			Similar Soils; trace f Gravel	
		5	7		9		
							NQ '2' Size Rock Core
						Gray LIMESTONE Rock; hard to very hard; sound;	Run #1: 18.0' - 23.0'
20						thinly bedded to thickly bedded; some fractures;	REC = 97%
						contains chert	RQD = 92%
						Similar Rock; laminated to thickly bedded	Run #2: 23.0' - 28.0'
25							REC = 95%
							RQD = 94%
						Similar Rock	Run #3: 28.0' - 33.0'
30							REC = 94%
							RQD = 92%
						Similar Rock; thickly bedded to massively bedded	Run #4: 33.0' - 38.0'
35							REC = 100%
							RQD = 100%
						Similar Rock; laminated to massively bedded	Run #5: 38.0' - 43.0'
40							REC = 100%

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: R. STEINER

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			
START	6/14/2024		HOLE NO. TB-2
FINISH	6/18/2024	**Atlantic Testing Laboratories, Limited**	SURF. ELEV 636.3'
SHEET	2 OF 3	**Subsurface Log**	G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS   LOCATION: SIDNEY / LARK STREETS
PROJ. NO.: BD161   BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40							RQD = 96%
						Similar Rock; massively bedded	Run #6: 43.0' - 48.0'
45							REC = 100%
							RQD = 100%
						Note: No core water return from 43' to 48'	
						Similar Rock	Run #7: 48.0' - 53.0'
50							REC = 100%
							RQD = 100%
						Similar Rock; laminated to thickly bedded	Run #8: 53.0' - 58.0'
55							REC = 98%
							RQD = 91%
						Note: No core water return at 58'	
						Grey LIMESTONE Rock; medium hard; sound;	Run #9: 58.0' - 63.0'
60						bedded to thickly bedded; some fractures;	REC = 89%
						some vugs	RQD = 89%
						Similar Rock; laminated to thickly bedded; no vugs	Run #10: 63.0' - 68.0'
65							REC = 100%
							RQD = 93%
						Similar Rock; laminated to massively bedded	Run #11: 68.0' - 73.0'
70							REC = 100%
							RQD = 96%
						Similar Rock; bedded to massively bedded	Run #12: 73.0' - 78.0'
75							REC = 100%
							RQD = 100%
							Run #13: 78.0' - 80.0'
						Similar Rock; thickly bedded	REC = 92%
80							RQD = 92%

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist
DRILLER: R. STEINER   DRILL RIG TYPE : CME-550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			HOLE NO. TB-2
START 6/14/2024	**Atlantic Testing Laboratories, Limited**		SURF. ELEV 636.3'
FINISH 6/18/2024			
SHEET 3 OF 3	**Subsurface Log**		G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS — LOCATION: SIDNEY / LARK STREETS
PROJ. NO.: BD161 — BUFFALO, NY

DEPTH FT.		SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N		SOIL OR ROCK CLASSIFICATION	NOTES
80								Boring Complete at 80.0'	Free Standing Water recorded at 16' at completion of overburden drillng.
85									Free Standing Water recorded at 26' at completion of rock coring
90									No core water return from 43' to 48'
									No core water return at 58'
95									
100									
105									
110									
115									
120									

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: R. STEINER — DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION: ASTM D-1586 USING HOLLOW STEM AUGERS

DATE: START 6/12/2024 FINISH 6/12/2024 SHEET 1 OF 1	**Atlantic Testing Laboratories, Limited** **Subsurface Log**	HOLE NO. TB-3 SURF. ELEV 635.1' G.W. DEPTH See Notes

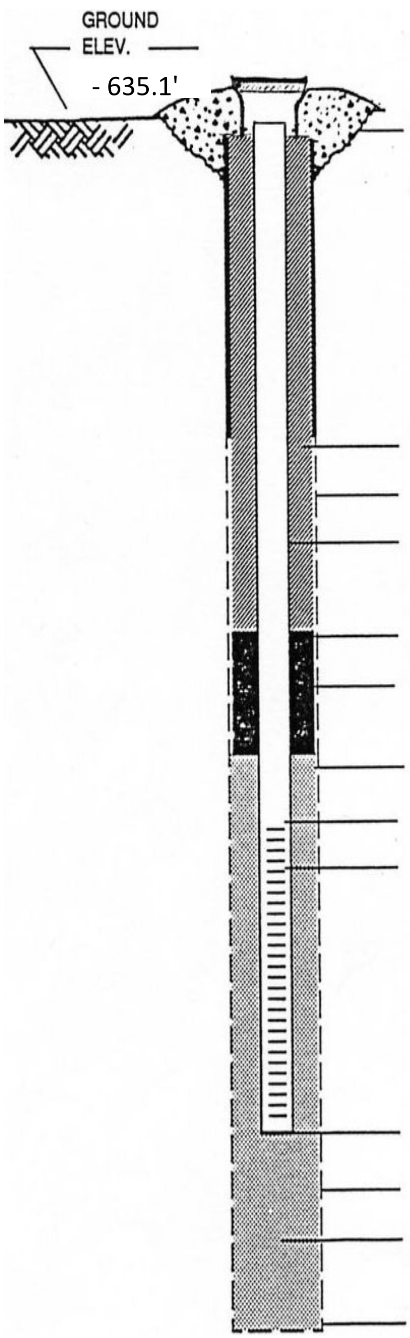
PROJECT: PROPOSED BSA - SIDNEY OLS
PROJ. NO.: BD161
LOCATION: SIDNEY / LARK STREETS
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	8	5			TOPSOIL	Driller noted approximately
		6	9		11	Gray cf GRAVEL; some Silt & Clay; little cmf Sand;	2" of Topsoil at the
	2	6	10			trace Organics (roots; grass); trace Debris (glass)	surface
		12	15		22	(moist, low plasticity) FILL	
5	3	6	8			Brown CLAY & SILT; trace cmf Sand; trace Organics	
		12	16		20	(roots) (moist, medium plasticity) FILL	
	4	21	25			Brown CLAY & SILT; trace cmf Sand; trace f Gravel	
		31	34		56	(moist, medium plasticity)	
	5	8	14			Similar Soils	S-5: Poor Recovery
10		19	21		33	Similar Soils; no Gravel	
	6	6	10			Similar Soils	
		12	15		22		
15							
	7	1	5			Similar Soils; trace f Gravel	
		9	8		14		
						Boring Complete at 18.0' with Auger Refusal	No Free Standing Water encountered at boring completion 2" PVC Observation well installed within completed boring
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist
DRILLER: R. STEINER DRILL RIG TYPE : CME 550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

WELL NUMBER: TB-3	
PROJECT: BSA - SIDNEY OLS	**DRILLING METHOD:** ASTM D-1586 USING HSA
PROJECT NUMBER: BD161	**GEOLOGIST:** N/A
DRILLER: R. Steiner	**INSTALLATION DATE(S):** 6-12-24



TYPE OF SURFACE SEAL:	CONCRETE
TYPE OF BACKFILL:	GROUT
BOREHOLE DIAMETER:	±8"
I.D. OF RISER PIPE:	2.0"
TYPE OF RISER PIPE:	PVC
DEPTH OF SEAL:	4.0'
TYPE OF SEAL:	BENTONITE CHIPS
DEPTH OF SAND PACK:	6.0'
DEPTH OF TOP OF SCREEN:	7.8'
TYPE OF SCREEN:	PVC
SLOT SIZE X LENGTH:	.010"x10'
I.D. OF SCREEN:	2.0"
TYPE OF SAND PACK:	'0' FILTER SAND
DEPTH BOTTOM OF SCREEN:	17.8'
DEPTH BOTTOM OF SAND PACK:	18.0'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	N/A
ELEVATION/ DEPTH OF HOLE:	18.0'

DATE:			
START	6/12/2024	HOLE NO.	TB-4
FINISH	6/14/2024	SURF. ELEV	634.3'
SHEET	1 OF 3	G.W. DEPTH	See Notes

Atlantic Testing Laboratories, Limited
Subsurface Log

PROJECT: PROPOSED BSA - SIDNEY OLS
LOCATION: SIDNEY / LARK STREETS, BUFFALO, NY
PROJ. NO.: BD161

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	3	7			TOPSOIL	Driller noted approximately
		6	5		13	Brown-Gray CLAY & SILT; trace f Gravel; trace cmf Sand	4" of Topsoil at the
	2	6	9			trace Organics (grass, roots); trace Debris (plastic,	surface
		11	12		20	cinders, brick) (moist, medium plasticity) FILL	
5	3	5	9			Brown CLAY & SILT; trace cmf Sand; trace f Gravel	
		13	18		22	(moist, medium plasticity)	
	4	24	27			Similar Soils	
		33	35		60		
	5	5	11			Similar Soils; trace f Sand; no Gravel	
10		13	17		24		
	6	5	8			Similar Soils	
		9	14		17		
15							
	7	2	5			Similar Soils; some cmf Sand; little cf Gravel	
		9	10		14		
							NQ '2' Size Rock Core
						Gray LIMESTONE Rock; hard to very hard; sound; thickly bedded; some fractures; contains chert	Run #1: 18.0' - 23.0' REC = 100% RQD = 100%
20							
						Similar Rock; laminated to thickly bedded	Run #2: 23.0' - 28.0' REC = 100% RQD = 100%
25							
						Similar Rock	Run #3: 28.0' - 33.0' REC = 98% RQD = 97%
30							
						Similar Rock; bedded to massively bedded	Run #4: 33.0' - 38.0' REC = 100% RQD = 100%
35							
						Similar Rock	Run #5: 38.0' - 43.0' REC = 99%
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW
CLASSIFIED BY: Geologist
DRILLER: R. STEINER
DRILL RIG TYPE : CME 550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE START 6/12/2024 FINISH 6/14/2024 SHEET 2 OF 3	**Atlantic Testing Laboratories, Limited** **Subsurface Log**	HOLE NO. TB-4 SURF. ELEV 634.3' G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS LOCATION: SIDNEY / LARK STREETS
PROJ. NO.: BD161 BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40							RQD = 98%
45						Similar Rock; laminated to massively bedded Note: No core water return at 43'	Run #6: 43.0' - 48.0' REC = 100% RQD = 95%
50						Similar Rock; massively bedded	Run #7: 48.0' - 53.0' REC = 96% RQD = 96%
55						Similar Rock; laminated to thickly bedded; contains soil seams from 56.3' to 56.5'	Run #8: 53.0' - 58.0' REC = 100% RQD = 84%
60						Grey LIMESTONE Rock; medium hard to hard; sound; thickly bedded to massively bedded; some fractures; some vugs	Run #9: 58.0' - 63.0' REC = 100% RQD = 100%
65						Similar Rock; contains soil seams from 66.0' to 66.1'	Run #10: 63.0' - 68.0' REC = 100% RQD = 86%
70						Similar Rock; medium hard to very hard; thinly bedded to massively bedded	Run #11: 68.0' - 73.0' REC = 98% RQD = 95%
75						Similar Rock; medium hard; laminated to thickly bedded; contains soil seams from 75.7' to 75.8'	Run #12: 73.0' - 78.0' REC = 100% RQD = 98%
80						Similar Rock; medium hard to hard; thinly bedded to bedded	Run #13: 78.0' - 80' REC = 100% RQD = 94%

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist
DRILLER: R. STEINER DRILL RIG TYPE : CME-550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			
START	6/12/2024		HOLE NO. TB-4
FINISH	6/14/2024	**Atlantic Testing Laboratories, Limited**	SURF. ELEV 634.3'
SHEET	3 OF 3	**Subsurface Log**	G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS — LOCATION: SIDNEY / LARK STREETS, BUFFALO, NY
PROJ. NO.: BD161

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
80						Boring Complete at 80.0'	No Free Standing Water encountered at completion of overburden drilling. Free Standing Water recorded at 14' on 6/13/24 at 0800, with augers at 18'. Free Standing Water recorded at 23' at completion of rock coring No core water return at 43'
85							
90							
95							
100							
105							
110							
115							
120							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: R. STEINER — DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION: ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:	
START	6/19/2024
FINISH	6/20/2024
SHEET	1 OF 2

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO.	TB-5
SURF. ELEV	634.3'
G.W. DEPTH	See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS
PROJ. NO.: BD161
LOCATION: LARK STREET
BUFFALO, NY

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	2	5			TOPSOIL	Driller noted approximately
		5	5		10	Brown CLAY & SILT; some Debris (concrete, brick,	2" of Topsoil at the
	2	6	10			glass, cinders); trace cmf Sand; trace f Gravel; trace	surface
		12	15		22	Organics (roots, glass) (moist, low plasticity) FILL	
5	3	7	9			Brown CLAY & SILT; trace f Sand	
		15	22		24	(moist, medium plasticity)	
	4	25	27			Similar Soils	
		32	32		59		
	5	6	9			Similar Soils; trace cmf Sand; trace f Gravel	
10		12	15		21		
	6	2	5			Similar Soils; no Gravel	
		7	10		12		
15							
	7	2	5			Similar Soils; some cf Gravel; little cmf Sand	
		7	31		12		NQ '2' Size Rock Core
						Gray LIMESTONE Rock; hard to very hard; sound;	Run #1: 17.5' - 18.8'
20						thickly bedded; some fractures; contains chert	REC = 96%
						Similar Rock; thinly bedded to thickly bedded	RQD = 96%
							Run #2: 18.8' - 23.8'
							REC = 100%
							RQD =94%
25						Similar Rock; laminated to thickly bedded	Run #3: 23.8' - 28.8'
							REC = 98%
							RQD = 97%
30						Similar Rock; bedded to thickly bedded	Run #4: 28.8' - 33.8'
							REC = 100%
							RQD = 100%
35						Similar Rock; bedded to massively bedded	Run #5: 33.8' - 38.8'
							REC = 99%
							RQD = 99%
40						Note: No core water return at 39'	

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: R. STEINER

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE START 6/19/2024 FINISH 6/20/2024 SHEET 2 OF 2	**Atlantic Testing Laboratories, Limited** **Subsurface Log**	HOLE NO. TB-5 SURF. ELEV 634.3' G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS
PROJ. NO.: BD161
LOCATION: LARK STREET
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40						Similar Rock; laminated to thickly bedded	Run #6: 38.8' - 43.8' REC = 100% RQD = 94%
45						Similar Rock; bedded to thickly bedded	Run #7: 43.8' - 47.5' REC = 100% RQD = 100%
50						Boring Complete at 47.5'	Free Standing Water recorded at 17' on 6/19/2024, with augers at 17.5' Free Standing Water recorded at 22' at completion of rock coring No core water return at 39' 2" PVC Observation well installed within completed boring
55							
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

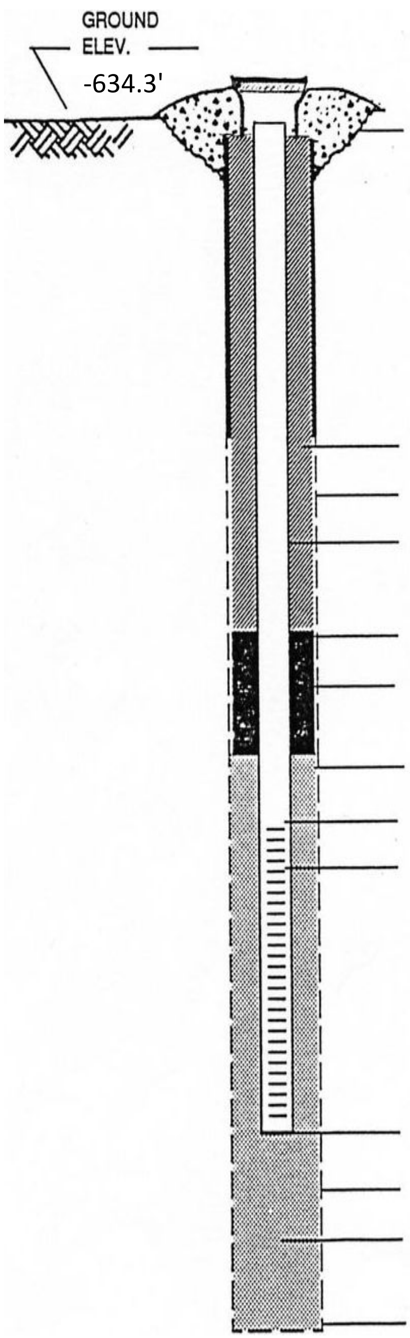
DRILLER: R. STEINER

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

WELL NUMBER: TB-5	
PROJECT: BSA - SIDNEY OLS	**DRILLING METHOD:** ASTM D-1586 USING HSA
PROJECT NUMBER: BD161	**GEOLOGIST:** N/A
DRILLER: R. Steiner	**INSTALLATION DATE(S):** 6-20-24



TYPE OF SURFACE SEAL:	CONCRETE
TYPE OF BACKFILL:	GROUT
BOREHOLE DIAMETER:	±8"/3.8"
I.D. OF RISER PIPE:	2.0"
TYPE OF RISER PIPE:	PVC
DEPTH OF SEAL:	15.0'
TYPE OF SEAL:	BENTONITE CHIPS
DEPTH OF SAND PACK:	22.5'
DEPTH OF TOP OF SCREEN:	37.5'
TYPE OF SCREEN:	PVC
SLOT SIZE X LENGTH:	.010"x10'
I.D. OF SCREEN:	2.0"
TYPE OF SAND PACK:	'0' FILTER SAND
DEPTH BOTTOM OF SCREEN:	47.5'
DEPTH BOTTOM OF SAND PACK:	47.5'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	N/A
ELEVATION/ DEPTH OF HOLE:	47.5'

DATE:			
START	6/21/2024	**Atlantic Testing Laboratories, Limited**	HOLE NO. TB-6
FINISH	6/25/2024	**Subsurface Log**	SURF. ELEV 633.7'
SHEET	1 OF 3		G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS — LOCATION: LARK STREET
PROJ. NO.: BD161 — BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N
	1	2	3		
		7	3		10
	2	1	4		
		10	5		14
5	3	9	10		
		15	20		25
	4	20	22		
		25	29		47
	5	11	14		
10		17	24		31
	6	6	6		
		9	14		15
15					
	7	50/0.4			REF
20					
25					
30					
35					
40					

SOIL OR ROCK CLASSIFICATION

- TOPSOIL
- Brown Clayey SILT; some cmf Sand; trace f Gravel; trace Organics (roots); trace Debris (concrete, cinders, slag) (moist, slight plasticity) FILL
- Brown-Gray SILT & CLAY; some cmf Sand; little cf Gravel; trace Organics (roots); trace Debris (concrete, slag) (moist, low plasticity) FILL
- Brown CLAY & SILT; trace f Sand (moist, medium plasticity) FILL
- Similar Soils
- Brown Clayey SILT; some f Gravel; some cmf Sand; trace Organics (roots); trace Debris (brick, concrete) (moist, slight plasticity) FILL
- Brown CLAY & SILT; trace mf Sand; trace Organics (roots) (moist, medium plasticity) FILL
- Gray DEBRIS (concrete); some cf Gravel (moist, non-plastic) FILL
- Gray LIMESTONE Rock; hard to very hard; sound; laminated to thickly bedded; some fractures; contains chert
- Similar Rock; bedded to thickly bedded
- Similar Rock; laminated to thickly bedded
- Note: No core water return at 27'
- Similar Rock; bedded to thickly bedded
- Similar Rock; laminated to thickly bedded

NOTES

Driller noted approximately 6" of Topsoil at the surface

REF = Sample Spoon Refusal
NQ '2' Size Rock Core

Run #1: 15.4' - 18.4
REC = 100%
RQD = 100%

Run #2: 18.4' - 23.4'
REC = 91%
RQD = 91%

Run #3: 23.4' - 28.4'
REC = 100%
RQD = 100%

Run #4: 28.4' - 33.4'
REC = 96%
RQD = 96%

Run #5: 33.4' - 38.4'
REC = 100%
RQD = 100%

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: R. STEINER — DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		Atlantic Testing Laboratories, Limited	HOLE NO.	TB-6
START	6/21/2024	Subsurface Log	SURF. ELEV	633.7'
FINISH	6/25/2024		G.W. DEPTH	See Notes
SHEET	2 OF 3			

PROJECT: PROPOSED BSA - SIDNEY OLS | LOCATION: LARK STREET
PROJ. NO.: BD161 | BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40						Similar Rock	Run #6: 38.4' - 43.4' REC = 100% RQD = 100%
45						Similar Rock; massively bedded	Run #7: 43.4' - 48.4' REC = 97% RQD = 97%
50						Similar Rock; laminated to thickly bedded	Run #8: 48.4' - 53.4' REC = 95% RQD = 88%
55						Similar Rock; weathered to sound; some vugs	Run #9: 53.4' - 58.4' REC = 98% RQD = 81%
60						Gray LIMESTONE Rock; medium hard to hard; sound; laminated to massively bedded; contains soil seam from 62.3' to 62.5'; some fractures	Run #10: 58.4' - 63.4' REC = 100% RQD = 95%
65						Similar Rock; laminated to thickly bedded	Run #11: 63.4' - 68.4' REC = 97% RQD = 96%
70						Similar Rock; thinly bedded to massively bedded	Run #12: 68.4' - 73.4' REC = 99% RQD = 97%
75						Similar Rock	Run #13: 73.4' - 78.4' REC = 98% RQD = 93%
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist

DRILLER: R. STEINER   DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE		**Atlantic Testing Laboratories, Limited**	HOLE NO. TB-6
START	6/21/2024		SURF. ELEV 633.7'
FINISH	6/25/2024	**Subsurface Log**	G.W. DEPTH See Notes
SHEET	3 OF 3		

PROJECT: PROPOSED BSA - SIDNEY OLS — LOCATION: LARK STREET

PROJ. NO.: BD161 — BUFFALO, NY

DEPTH FT.		SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N		SOIL OR ROCK CLASSIFICATION	NOTES
80								Similar Rock; thinly bedded to bedded	Run #14: 78.4' - 80.0' REC = 96% RQD = 86%
								Boring Complete at 80'	Free Standing Water recorded at 13.4' at completion of overburden drilling. Free Standing Water recorded at 24' at completion of rock coring No core water return at 27'
85									
90									
95									
100									
105									
110									
115									
120									

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: R. STEINER — DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION: ASTM D-1586 USING HOLLOW STEM AUGERS

DATE: START 6/25/2024 FINISH 6/25/2024 SHEET 1 OF 1	**Atlantic Testing Laboratories, Limited** **Subsurface Log**	HOLE NO. TB-7 SURF. ELEV 632.9' G.W. DEPTH See Notes

PROJECT: PROPOSED BSA - SIDNEY OLS   LOCATION: LARK STREET
PROJ. NO.: BD161   BUFFALO, NY

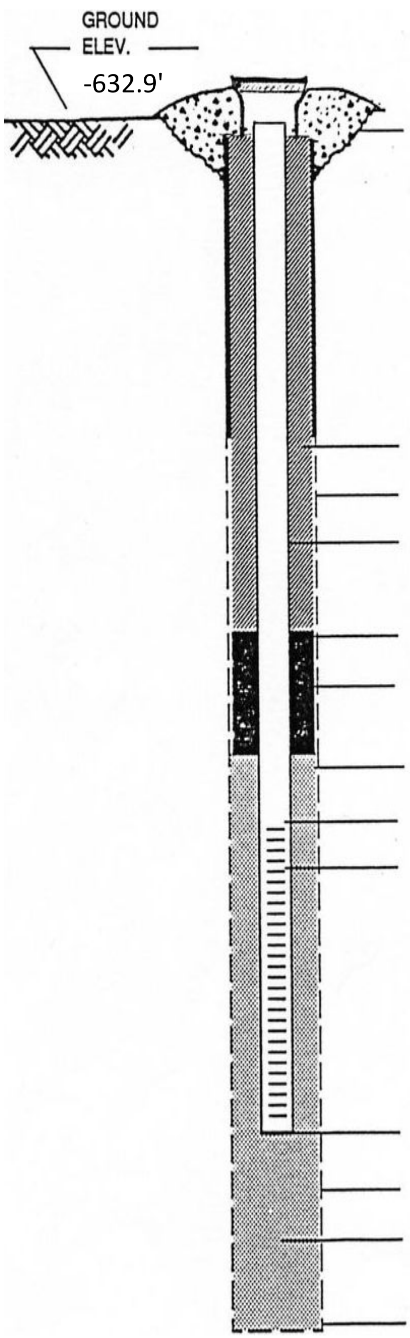
DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	4	15			TOPSOIL	Driller noted approximately 4" of Topsoil at the surface
		16	11		31	Gray SILT & CLAY; little cmf Sand; little f Gravel; trace Organics (roots, grass); trace Debris (glass, cinders, brick) (moist, low plasticity) FILL	
	2	9	13				
		15	16		28		
5	3	6	7			Similar Soils	
		5	8		12	Similar Soils; Brown-Gray; trace f Gravel; trace Debris (brick, masonary debris)	
	4	8	8				
		9	9		17	Brown-Gray CLAY & SILT; little mf Sand; trace Organics (roots) (moist, medium plasticity) FILL	
	5	3	6				
10		10	15		16	Similar Soils; no Organics	
	6	3	15			Brown SILT & CLAY; some cf Gravel; little cmf Sand (moist, low plasticity)	
		18	21		33		
						Boring Complete at 12.0' with Auger Refusal	No Free Standing Water encountered at boring completion
15							
							2" PVC Observation well installed within completed boring
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist
DRILLER: R. STEINER   DRILL RIG TYPE : CME 550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

WELL NUMBER: TB-7

PROJECT: BSA - SIDNEY OLS	**DRILLING METHOD:** ASTM D-1586 USING HSA
PROJECT NUMBER: BD161	**GEOLOGIST:** N/A
DRILLER: R. Steiner	**INSTALLATION DATE(S):** 6-25-24



TYPE OF SURFACE SEAL:	CONCRETE
TYPE OF BACKFILL:	GROUT
BOREHOLE DIAMETER:	±8"
I.D. OF RISER PIPE:	2.0"
TYPE OF RISER PIPE:	PVC
DEPTH OF SEAL:	2.0'
TYPE OF SEAL:	BENTONITE CHIPS
DEPTH OF SAND PACK:	4.0'
DEPTH OF TOP OF SCREEN:	7.0'
TYPE OF SCREEN:	PVC
SLOT SIZE X LENGTH:	.010"x5'
I.D. OF SCREEN:	2.0"
TYPE OF SAND PACK:	'0' FILTER SAND
DEPTH BOTTOM OF SCREEN:	12.0'
DEPTH BOTTOM OF SAND PACK:	12.0'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	N/A
ELEVATION/ DEPTH OF HOLE:	12.0'

APPENDIX D

LABORATORY TEST RESULTS

ATLANTIC TESTING LABORATORIES

WBE certified company

PROJECT INFORMATION

Client: TY Lin - Greeley & Hansen Water Solutions
Project: Buffalo Sewer Authority - Sidney OLS

ATL Report No.: BD161SL-01-08-24
Report Date: August 22, 2024
Date Received: July 19, 2024

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D 7012, Method C

Core ID	Depth (ft)	Diameter (in)	Length (in)	Load Rate (lbs/sec)	Total Load (lbs)	Area (in^2)	Compressive Strength (psi)	Calculated Density (pcf)
TB-4	23.0-23.8	1.98	4.58	400	41490	3.08	13,470	164.7
TB-4	48.7-49.3	1.98	4.54	400	39800	3.08	12,930	166.5
TB-4	59.5-60.2	1.98	4.56	400	33390	3.08	10,840	157.9
TB-4	73.0-73.7	1.98	4.57	400	32980	3.08	10,710	170.2
TB-6	32.4-33.0	1.98	4.13	400	42730	3.08	13,880	164.1
TB-6	49.3-50.0	1.98	4.57	400	33820	3.08	10,980	166.1
TB-6	58.5-59.1	1.98	4.55	400	32680	3.08	10,610	160.9
TB-6	74.2-75.1	1.98	4.54	400	36620	3.08	11,890	161.5

Reviewed By: _______________ Date: 8/22/2024

ATLANTIC TESTING LABORATORIES

WBE certified company

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS
ASTM D 2216

PROJECT INFORMATION

Client:	TY-Lin - Greeley & Hansen Water Solutions	**ATL Report No.:**	BD161SL-01-08-24
Project:	Buffalo Sewer Authority - Sidney OLS	**Report Date:**	August 22, 2024
		Date Received:	July 19, 2024

TEST DATA

Boring No.	Sample No.	Depth (ft)	Moisture Content (%)
TB-1	S-5&6 [1]	8-12	16.1
TB-2	S-3&4 [1]	4-8	16.7
TB-2	S-5&6	8-12	16.4
TB-3	S-2&3 [1]	2-6	18.2
TB-4	S-5&6 [1]	8-12	16.8
TB-5	S-1&2 [1]	0-4	17.2
TB-5	S-3&4 [1]	4-8	16.5
TB-6	S-4 [1]	6-8	15.2
TB-6	S-6 [1]	10-12	17.7
TB-7	S-4 [1]	6-8	21.3

REMARKS

1 The drying temperature was 110°C ±5°C.
2 No material was excluded from the test sample.

Reviewed By: ______________________ Date: 8/22/2024

ATLANTIC TESTING LABORATORIES

WBE certified company

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOIL
ASTM D 4318

PROJECT INFORMATION

Client:	Ty-Lin Greeley & Hansen Water Solutions	**ATL Report No.:**	BD161SL-01-08-24
Project:	Buffalo Sewer Authority - Sidney OLS	**Report Date:**	August 22, 2024
		Date Received:	July 19, 2024

TEST DATA

Boring No.	Sample No.	LL	PL	PI
TB-1	S-5 & S-6	33	16	17
TB-2	S-5 & S-6	30	16	14
TB-4	S-5 & S-6	30	15	15
TB-5	S-3 & S-4	31	17	14

SAMPLE INFORMATION

Boring No.	Sample No.	Maximum Grain Size (mm)	Estimated Amount of Sample Retained on No. 40 Sieve (%)	As Received Moisture Content (%)
TB-1	S-5 & S-6	0.4	1	16.1
TB-2	S-5 & S-6	0.4	1	16.4
TB-4	S-5 & S-6	0.4	1	16.8
TB-5	S-3 & S-4	0.2	0	16.5

PREPARATION INFORMATION

Boring No.	Sample No.	Preparation	Method of Removing Oversized Material
TB-1	S-5 & S-6	Air Dry	Pulverizing and Screening
TB-2	S-5 & S-6	Air Dry	Pulverizing and Screening
TB-4	S-5 & S-6	Air Dry	Pulverizing and Screening
TB-5	S-3 & S-4	Air Dry	Pulverizing and Screening

EQUIPMENT INFORMATION

Liquid Limit Procedure:	Multipoint - Method A	X	Single Point - Method B	
Liquid Limit Apparatus:	Manual	X	Motor Driven	
Liquid Limit Grooving Tool Material:	Plastic		Metal	X
Liquid Limit Grooving Tool Shape:	Flat	X	Curved (AASHTO Only)	
Plastic Limit:	Hand Rolled	X	Mechanical Rolling Device	

REMARKS

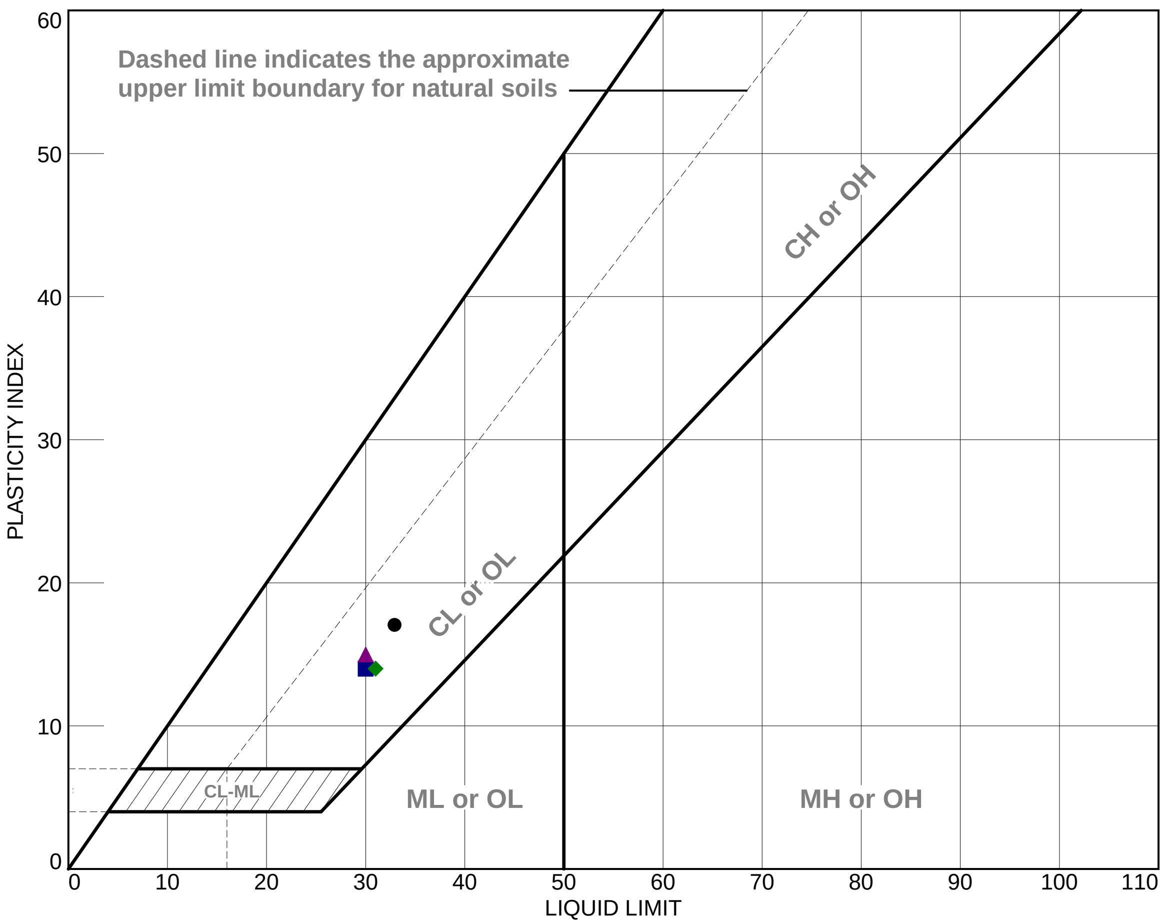
1 The drying temperature was 110° ± 5° C

Reviewed By: ______________________ Date: 8/22/2024

ATLANTIC TESTING LABORATORIES

WBE certified company

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	TB-1	S-5 & S-6	8.0'-12.0'	16.1	16	33	17	
■	TB-2	S-5 & S-6	8.0'-12.0'	16.4	16	30	14	CL
▲	TB-4	S-5 & S-6	8.0'-12.0'		15	30	15	
◆	TB-5	S-3 & S-4	4.0'-8.0'		17	31	14	CL

ATLANTIC TESTING LABORATORIES, LIMITED
Buffalo, New York

Client: TY-Lin Greeley & Hansen Water Solutions
Project: Buffalo Sewer Authority - Sidney OLS

Project No.: BD-161 **Figure**

ATLANTIC TESTING LABORATORIES

WBE certified company

Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS

Report No.: BD161SL-01-08-24

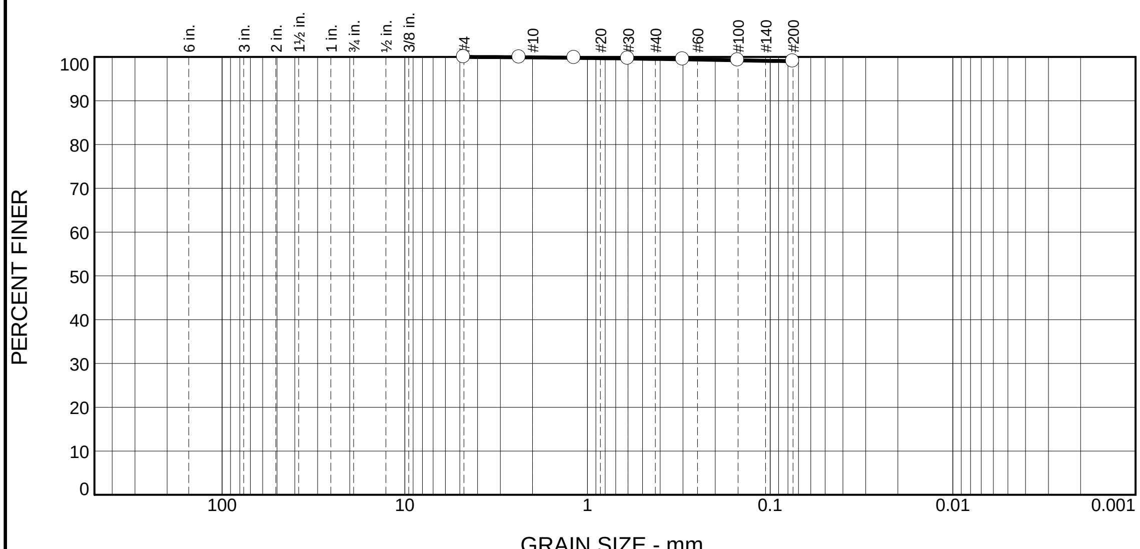
Client: TY-Lin Greeley & Hansen Water Solutions

Date: 8-13-24

Sample No: S-5 & S-6 **Source of Sample:** TB-1

Location: in-place

Elev./Depth: 8.0'-12.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	1	99	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#8	100		
#16	100		
#30	100		
#50	99		
#100	99		
#200	99		

Soil Description

Brown CLAY & SILT; trace f Sand

Atterberg Limits

PL= 16 LL= 33 PI= 17

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 16.1 %

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED

Figure

Reviewed by: P.Gregorczyk

Date: 8-22-2024

ATLANTIC TESTING LABORATORIES

WBE certified company

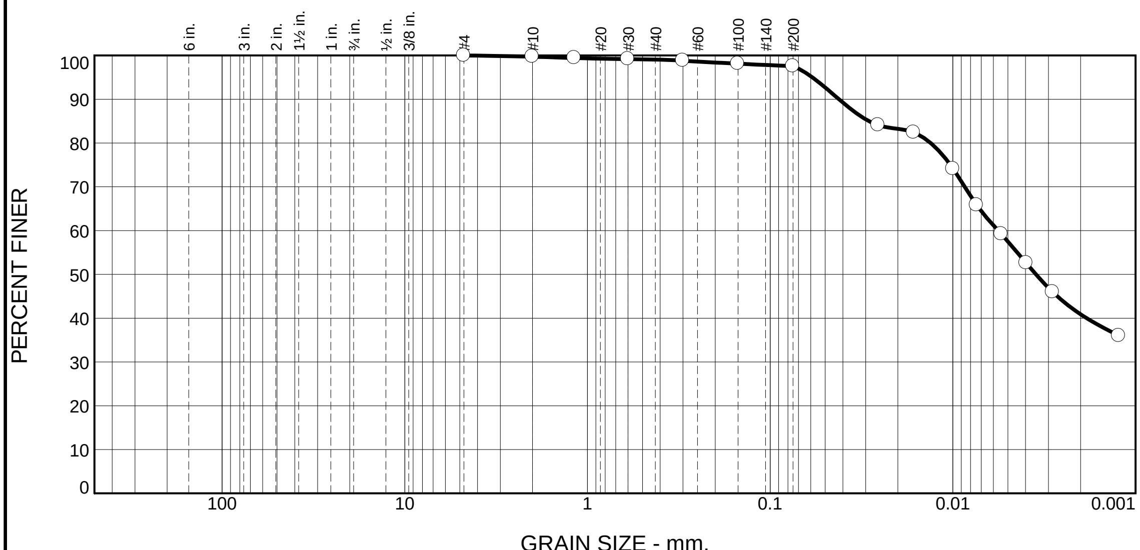
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-15-24

Sample No: S-3 & S-4 **Source of Sample:** TB-2

Location: in-place **Elev./Depth:** 4.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	1	40	58

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#10	100		
#16	99		
#30	99		
#50	99		
#100	98		
#200	98		

Soil Description

Brown CLAY & SILT; trace mf Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0288 D_{60}= 0.0056 D_{50}= 0.0035
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 16.7 %

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED **Figure**

Reviewed by: P.Gregorczyk Date: 8-22-2024

ATLANTIC TESTING LABORATORIES

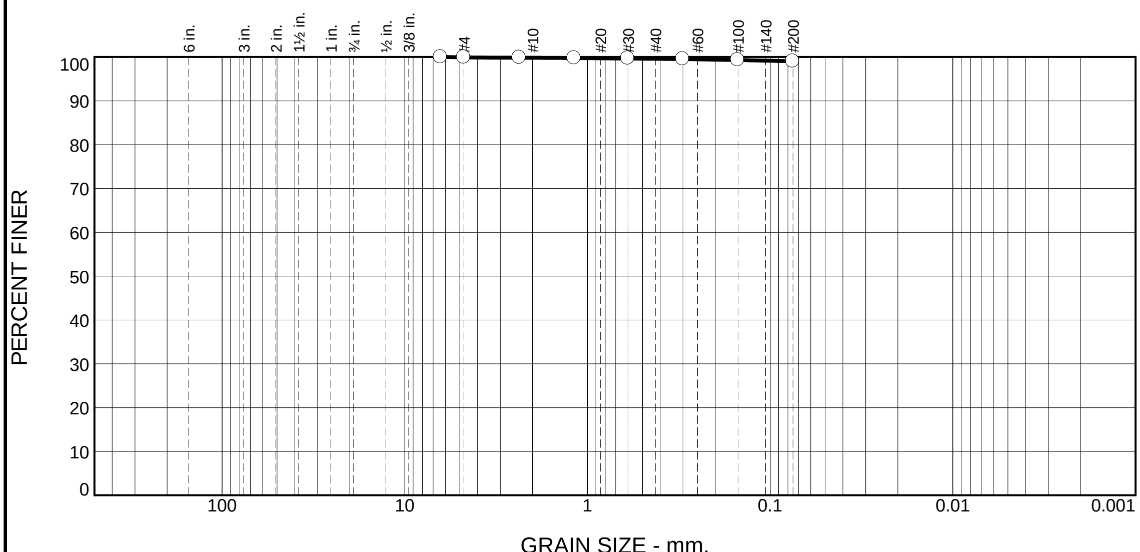
WBE certified company

Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-13-24

Sample No: S-5 & S-6 **Source of Sample:** TB-2
Location: in-place **Elev./Depth:** 8.0'-12.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	1	99	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.25	100		
#4	100		
#8	100		
#16	100		
#30	100		
#50	100		
#100	99		
#200	99		

Soil Description

Brown CLAY & SILT; trace f Sand

Atterberg Limits

PL= 16 LL= 30 PI= 14

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

moisture content = 16.4 %

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED **Figure**

Reviewed by: P.Gregorczyk Date: 8-22-2024

ATLANTIC TESTING LABORATORIES

WBE certified company

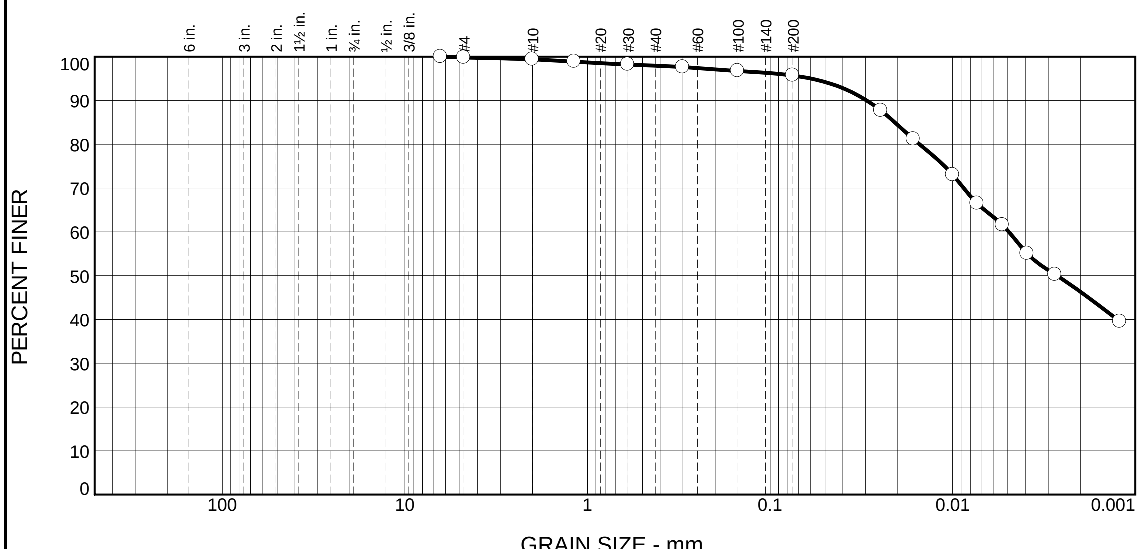
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-15-23

Sample No: S-2 & S-3 **Source of Sample:** TB-3

Location: in-place **Elev./Depth:** 2.0'-6.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	1	2	36	60

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.25	100		
#4	100		
#10	99		
#16	99		
#30	98		
#50	98		
#100	97		
#200	96		

Soil Description

Brown CLAY & SILT; trace cmf Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0207 D_{60}= 0.0049 D_{50}= 0.0027

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 18.2 %

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED

Figure

Reviewed by: P.Gregorczyk

Date: 8-22-2024

ATLANTIC TESTING LABORATORIES

WBE certified company

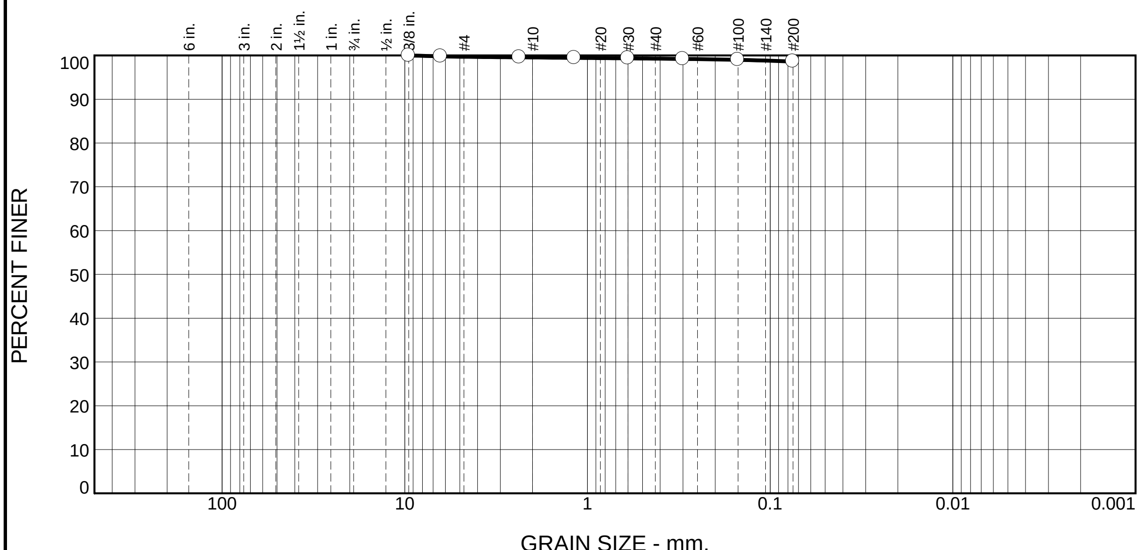
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-13-24

Sample No: S-5 & S-6 **Source of Sample:** TB-4

Location: in-place **Elev./Depth:** 8.0'-12.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	0	99	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.375	100		
.25	100		
#8	100		
#16	99		
#30	99		
#50	99		
#100	99		
#200	99		

Soil Description

Brown CLAY & SILT; trace m Sand

Atterberg Limits

PL= 15 LL= 30 PI= 15

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 16.8 %

* (no specification provided)

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Figure

Reviewed by: P.Gregorczyk Date: 8-22-2024

ATLANTIC TESTING LABORATORIES

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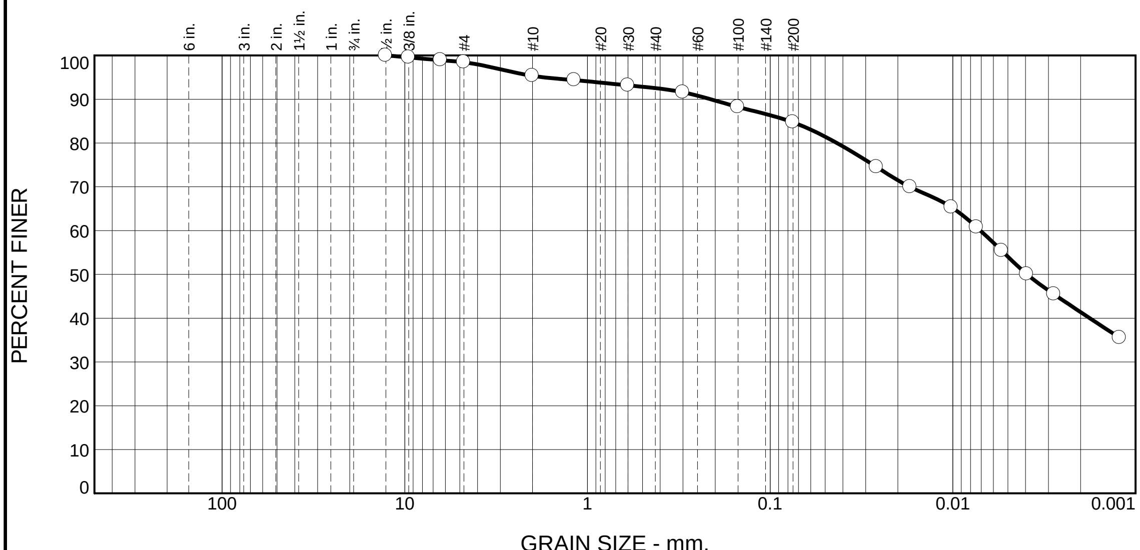
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-15-24

Sample No: S-1 & S-2 **Source of Sample:** TB-5

Location: in-place **Elev./Depth:** 0.0'-4.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	2	3	2	8	31	54

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.5	100		
.375	100		
.25	99		
#4	98		
#10	95		
#16	94		
#30	93		
#50	92		
#100	88		
#200	85		

Soil Description

Brown CLAY & SILT; trace cmf Sand; trace f Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0783 D_{60}= 0.0071 D_{50}= 0.0039

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 17.2 %

* (no specification provided)

Figure

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Reviewed by: P.Gregorczyk Date: 8-22-2024

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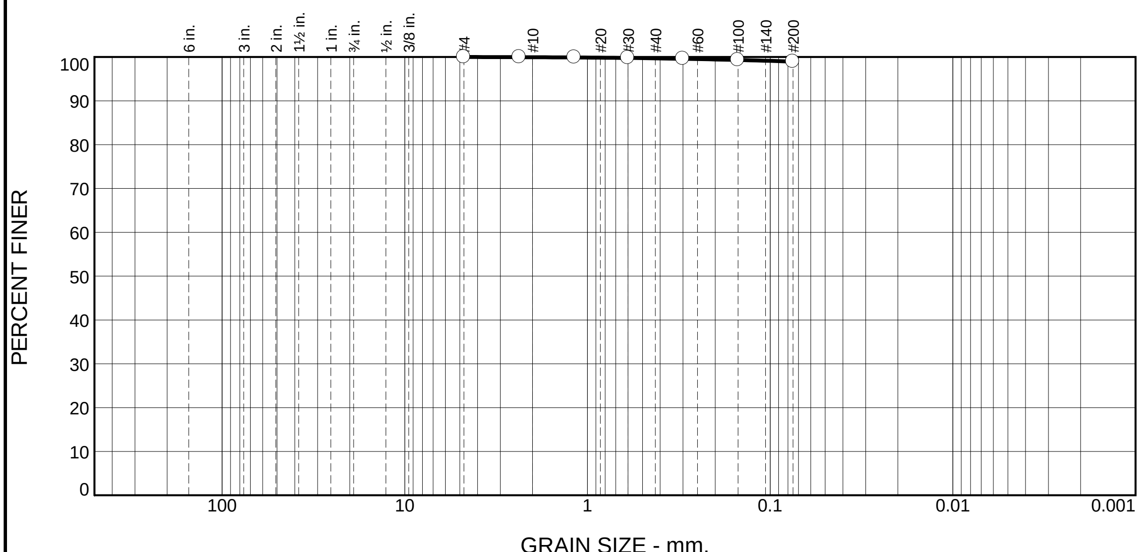
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-13-24

Sample No: S-3 & S-4 **Source of Sample:** TB-5

Location: in-place **Elev./Depth:** 4.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	1	99	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#8	100		
#16	100		
#30	100		
#50	100		
#100	99		
#200	99		

Soil Description

Brown CLAY & SILT; trace f Sand

Atterberg Limits

PL= 17 LL= 31 PI= 14

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 16.5 %

* (no specification provided)

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Figure

Reviewed by: P.Gregorczyk

Date: 8-22-2024

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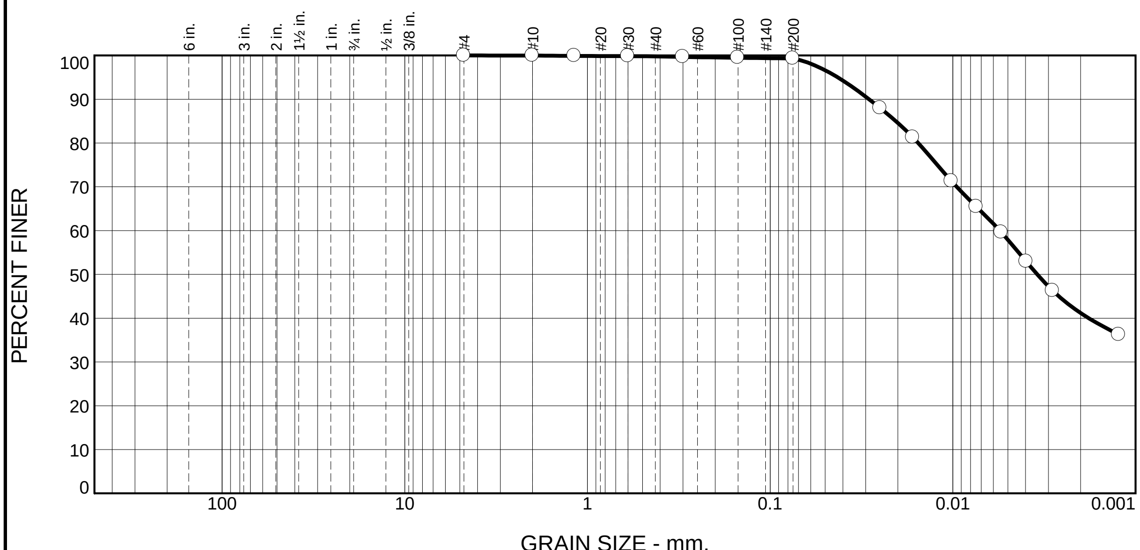
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-15-24

Sample No: S-4 **Source of Sample:** TB-6

Location: in-place **Elev./Depth:** 6.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	0	1	41	58

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#10	100		
#16	100		
#30	100		
#50	100		
#100	99		
#200	99		

Soil Description

Brown CLAY & SILT; trace f Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0205 D_{60}= 0.0055 D_{50}= 0.0035
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 15.2 %

* (no specification provided)

ATLANTIC TESTING LABORATORIES, LIMITED **Figure**

Reviewed by: P.Gregorczyk Date: 8-22-2024

ATLANTIC TESTING LABORATORIES

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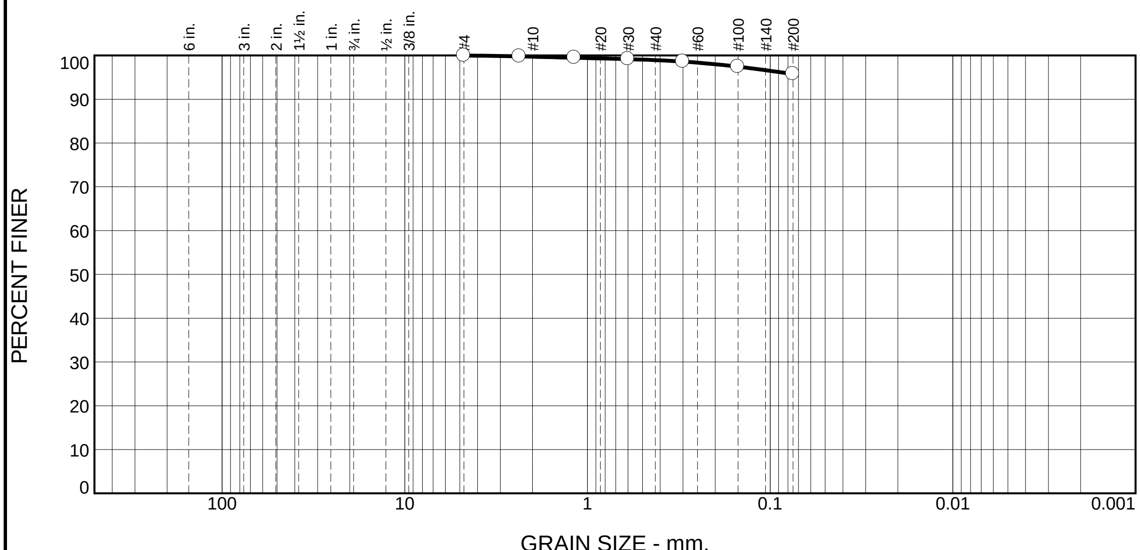
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-13-24

Sample No: S-6 **Source of Sample:** TB-6

Location: in-place **Elev./Depth:** 10.0'-12.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	3	96	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
#4	100		
#8	100		
#16	99		
#30	99		
#50	99		
#100	97		
#200	96		

Soil Description

Brown CLAY & SILT; trace mf Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 17.7 %

* (no specification provided)

Figure

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Reviewed by: P.Gregorczyk

Date: 8-22-2024

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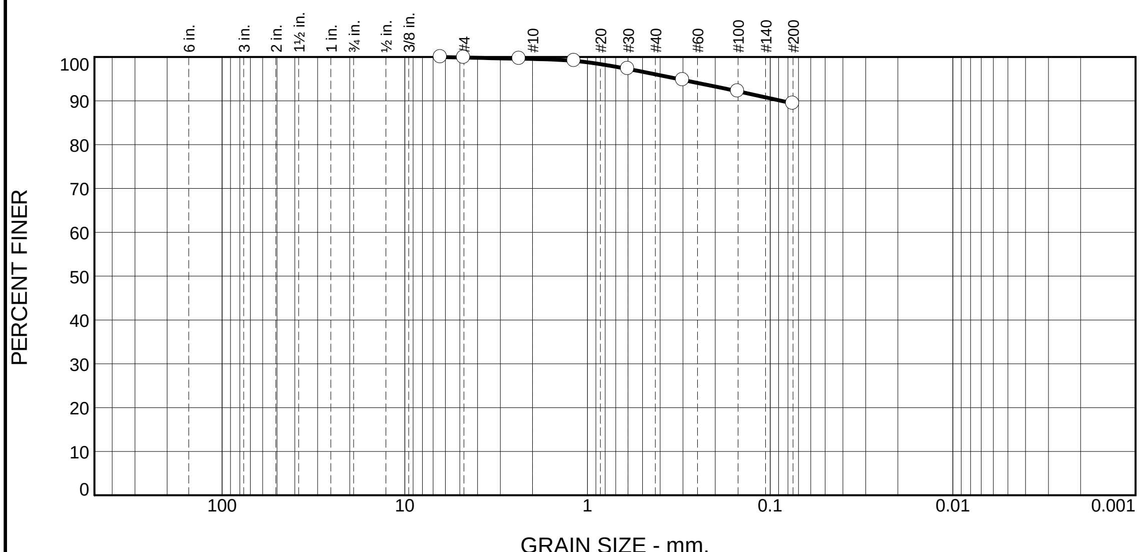
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Sidney OLS **Report No.:** BD161SL-01-08-24

Client: TY-Lin Greeley & Hansen Water Solutions **Date:** 8-13-24

Sample No: S-4 **Source of Sample:** TB-7

Location: in-place **Elev./Depth:** 6.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	4	7	89	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.25	100		
#4	100		
#8	100		
#16	99		
#30	97		
#50	95		
#100	92		
#200	89		

Soil Description

Brown-Grey SILT & CLAY; little mf Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 21.3 %

* (no specification provided)

Figure

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Reviewed by: P.Gregorczyk

Date: 8-22-2024