verdantas

July 31, 2025 Project No. 31874

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# Report Rev.1 of
# Geotechnical Subsurface Investigation
# Wastewater Treatment Plant Improvements
# Village of Oak Harbor, Ohio

Following is the report of the geotechnical subsurface investigation performed by Verdantas LLC, for the referenced project. This study was performed at the request of Jones & Henry Engineers, Ltd., on behalf of the Village of Oak Harbor. This investigation was performed in general accordance with VDT Proposal No. 31874.0001, dated January 13, 2025, and was authorized by you on the same day.

An original version of this report was provided on July 18, 2025. The report contained the results of our study, our engineering interpretation of the results with respect to the project characteristics, and our geotechnical-related recommendations for foundations, floor slabs and below-grade walls. This revised version incorporates specific design gross bearing pressures and bearing elevations for a few structures, which were provided subsequent to our previous report submittal.

Soil samples collected during this investigation will be stored at our laboratory for 90 days from the date of this report. The samples will be discarded after this time unless you request that they be saved or delivered to you.

Should you have any questions regarding this report or require additional information, please contact our office.

Sincerely,

**Verdantas, LLC.**

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CURTIS E. ROUPE
Reg # 59857
REGISTERED PROFESSIONAL ENGINEER

Cole Olson

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Staff Professional I

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# REPORT REV.1 OF
# GEOTECHNICAL SUBSURFACE INVESTIGATION
# WASTEWATER TREATMENT PLANT IMPROVEMENTS
# OAK HARBOR, OHIO

FOR

VILLAGE OF OAK HARBOR
OAK HARBOR, OHIO

SUBMITTED

JULY 31, 2025
VDT PROJECT NO. 31874

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# TABLE OF CONTENTS

# 1.0 INTRODUCTION

This geotechnical subsurface investigation report has been prepared for the of the additions to the existing wastewater treatment plant (WWTP) with a new precast concrete extended aeration plant along the south side of the existing WWTP located at 355 E water St, Oak Harbor, Ohio. The new wastewater treatment facility additions will include an Administration building, a Headworks facility, grit removal, a Pump station, splitter box, U.V. channel, sludge handling, clarifiers, and an oxidation ditch. The general area of the project is shown on the attached Site Location Map (Plate 1.0).

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures, presents the findings, discusses our evaluations and conclusions, and provides our design and construction recommendations for foundations, floor slabs and below-grade walls.

At the request of Jones & Henry Engineers, this investigation was performed for the Village of Oak Harbor. This investigation was performed in general accordance with VDT Proposal No. 31874.0001, dated January 13, 2025.

The purpose of this investigation was to evaluate the subsurface conditions and laboratory data relative to the design and construction of foundations, building slab and below-grade walls at the referenced site. This investigation included fifteen (15) test borings, field and laboratory soil testing, and a geotechnical engineering evaluation of the test results.

This report includes:

- A description of the subsurface soil-, rock-, and groundwater-conditions encountered in the borings.
- Design recommendations for foundations, floor slabs and below-grade walls related to the proposed improvements.

- Recommendations concerning soil-, rock-, and groundwater-related construction procedures such as site preparation, earthwork, foundation, building slabs and below-grade walls.

## 2.0 INVESTIGATIVE PROCEDURES

This subsurface investigation included fifteen (15) test borings, designated as B-1 through B-15, drilled by a subcontractor, TTL Associates, Inc., under VDT direction from March 17 to 24, 2025. Boring B-1 through B-4 were performed  near the Administration building; borings B-5 through B-7 was performed near the oxidation ditch; boring B-8 was performed near the grit removal; borings B-9 and B-10 were performed near the clarifier; boring B-11 was performed near the pump station and splitter box; boringB-12 was perform near the U.V. Channel; boring B-13 was performed near the headworks; boring B-14 was performed near the diversion chamber; and boring B-15 was performed near the sludge handling tank.

The test borings were located in the field by VDT and the ground surface elevations were provided with coordinates provided to locate the boring using a handheld GPS. Additionally, Latitude, Longitude, and ground surface elevations for all borings were surveyed by VDT via a hand-held GPS device. The accuracy from the handheld GPS device was generally found to be approximately 2 to 6 inches horizontal, and approximately 4 to 12 inches vertical.  The approximate locations of the test borings are shown on the Test Boring Location Plan (Plate 2.0).

The test borings were performed in general accordance with geotechnical investigative procedures outlined in ASTM Standard D 1586, ASTM D 1452, or ASTM D 6151. The test borings performed during this investigation were drilled with an ATV-mounted Diedrich D70 drilling rig, utilizing 3¼-inch inside diameter hollow-stem augers. The proposed boring were drilled as followed B1 through B8 to a depth of 30 feet, B9 and B10 to a depth of 35 feet, B11 to a depth of 50 feet, B12 to a depth of 40 feet, B13 to a depth of 60 feet, B14 to a depth of 45 feet and B15 to a depth of 30 feet below grade, or to refusal with a five foot rock core.

During auger advancement, soil samples from were generally collected at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter. Split-spoon (SS) samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Borings attached to this report. The samples were sealed in jars and shipped to our laboratory for further classification and testing.

Evaluations of soil strength/consistency considered SPT results corrected for 60 percent energy ratio (N60-values). The hammer/rod energy ratio for the ATV-mounted Diedrich D70 utilized for this investigation is 87.4 percent, based on calibration on June 11, 2024.

All of the recovered samples of the subsoils were visually or manually classified in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 and D 2488) and were tested in our laboratory for moisture content (ASTM D 2216). Dry density determinations were performed on 20 selected samples. Unconfined compressive strength tests by the constant rate of strain method (ASTM D 2166) were performed on selected rock-, soil-, and a Shelby tube- samples. Unconfined compressive strength estimates were obtained for the intact cohesive samples using a calibrated hand penetrometer. Likewise, unconsolidated-undrained (UU) triaxial compressive strength tests (ASTM D 2850) were performed on specimens from selected Shelby tube samples. A particle size analysis (ASTM D 6913 and D 7928) and an Atterberg limits test (ASTM D 4318) were performed on representative samples. A soil sample with detected organics was tested for Organic Content by Loss-on-Ignition method (ASTM D 2974). The test results are presented on the Logs of Test Borings, and Grain Size Distribution sheet attached to this report.

Soil and Rock conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as field logs of the encountered soils.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test borings made at specific locations. Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

# 3.0 PROPOSED CONSTRUCTION

This geotechnical subsurface investigation report has been prepared for the proposed construction of plant additions along the north side of the existing WWTP located at 355 E Water St, Oak Harbor, Ohio.

Based on provided plan, the structures are bearing at approximately 6 different elevations near (577, 571.5, 568, 561, 553, and 545.5. Additionally, it is to our understanding that fill depths from 1 to 6 feet will be required to achieve final site elevations.

Bearing pressures associated with the structures were assumed to be 3500 PSF at the time of preparing this report. Pavements are anticipated to consist of flexible (asphalt) sections and/or rigid (concrete) sections. Final grade is expected to approximate existing grades.

# 4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

## 4.1 General Site Conditions

The project area comprised of relatively flat grassland. The existing wastewater treatment plant lies South of the planned development. Residential buildings are present just north of the Site. Four concrete pads with masonry material noted as somewhat concentrated were encountered between borings B-7 and B-9 Masonry material was also noted as being present sporadically around the site. Existing fill materials were encountered in borings B-6, B-9, B-11, and B-15 to depths ranging from 1 to 3 feet. Traces of brick, gravel, and apparent slab material was noted in the existing fill.

## 4.2 General Site Geology

Published geologic maps from the Ohio Department of Natural Resources (ODNR) indicate that the project site is located on the Maumee Lake Plains Physiographic Region of Ohio. This region predominantly consists of Pleistocene-age silt, clay, and wave-planed clayey till over Silurian- and Devonian-age carbonate rocks and sandstone.

The lacustrine soil consists of predominantly silty clays and lean clays and may exhibit alternating thin layers of interbedded silts and clays known as varved. Varved soils are characteristic of lacustrine deposits, and the thin layering is typically attributed to seasonal or other cyclic variations of sedimentation in the lake waters. In addition, thin sand seams and partings may be encountered.

The glacial till, also referred to as moraine, was deposited by the advance and retreat of glacial ice. Due to the weight of the ice mass, the till deposits are moderately to highly over-consolidated, that is, the existing soil deposits have experienced a previous vertical stress significantly higher than the present effective vertical stress due to the remaining overlying soil strata in the profile. The till may contain cobbles and/or boulders in the till soil matrix. Additionally, seams of granular soil may be encountered within glacial tills. These granular seams may or may not be water bearing.

Bedrock in the project area is broadly mapped on the “Geologic Map of Ohio” as Silurian-age Ohio sedimentary rocks such as limestone and shale. The top of the rock is mapped at elevations ranging from 560 to 540 which is anticipated to be on the order of 20 to 40 feet below existing grades near ground surface.

The USDA Natural Resource Conservation Service (NRCS) Web Soil Survey indicates that soils in the project area are predominantly mapped as Nappanee silty clay loam (NpA) mapped on the northeast project extent. The Southwest portion of the site consisted of toledo silty clay (To and Tp) the Tp is known for flooded condition. The Nappanee silty clay loam soil consists of till derived from limestone and shale, formed on lake plains, and are considered poorly drained. The Toledo silty clay consists of clayey glaciolacustrine deposits soils made of glacial sediment, formed on lakebeds, and are considered very poorly drained.

## 4.3 General Soil and Bedrock Conditions

Based on the results of our field and laboratory tests, the subsoils encountered underlying the topsoil and existing fill materials generally consisted of native cohesive soils with varying strength and moisture characteristics. The cohesive soils exhibited predominantly stiff to very stiff consistency for the top 17 feet and have **trace amount of organics** transitioning to hard to very hard consistency until apparent bedrock was noted at 42 and 46 feet in the borings B-13 and B-11, respectively. This paragraph presents the general conditions of the subsurface profile, please refer to the attached boring logs for more detailed information at each boring location.. The native cohesive soil predominantly consists of lean clay with varying amounts of sand and gravel. The bedrock consisted of dolomite.

## 4.4 Groundwater Conditions

Groundwater was initially encountered during drilling operations in six (6) of the borings at depths ranging from approximately 6 to 43 feet below existing grade. Groundwater was observed upon completion of drilling in four of those borings at depths ranging from 5½ to 38 feet below existing grade. Groundwater was observed 7 days after drilling in two of the borings at depths ranging from 4½ to 6 feet below existing grade. It should be noted that all but two borings were drilled and backfilled within the same day and stabilized water levels may not have occurred over this limited time period. The depths at which groundwater was encountered in the borings are summarized in the following table.

Table 4.4. Groundwater Conditions

| Boring Number | Groundwater Initially Encountered During Drilling | Groundwater Observed Upon Completion of Drilling | Groundwater Observed 7 days after Drilling |
|---|---|---|---|
| | Depth (feet) | Depth (feet) | Depth (feet) |
| B-3 | 6 | - | - |
| B-10 | 30 | - | - |
| B-11 | 37.5 | 5.5 | 4.5 |
| B-12 | 37 | 38 | - |
| B-13 | 39.8 | 6.3 | 6.0 |
| B-14 | 43 | 16.4 | - |

Based on the limited data available, such as the soil characteristics and the groundwater conditions encountered in the borings, it is our opinion that the data indicates the “normal” groundwater level may be generally encountered at depths on the order of 4 to 6 feet below existing grades. That generally corresponds with the , standard high water level at elevation of 573.5 feet provided to us. It should be noted that groundwater elevations can fluctuate with seasonal and climatic influences. In particular, “perched” water may be encountered in fill materials or granular soils that are underlain by relatively impermeable native cohesive soils, or at the soil-bedrock interface. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this investigation.

# 5.0 DESIGN RECOMMENDATIONS

The following analyses and recommendations are based on our understanding of the proposed construction and upon the data obtained during our field exploration. If the project information or location as outlined is incorrect or should change significantly, a review of these recommendations should be made by Verdantas. These recommendations are subject to the satisfactory completion of the construction recommendations that follow.

## 5.1 Spread Foundations

The table below presents the calculated total settlements for both the originally anticipated gross bearing pressures from the structures and the allowable gross bearing pressures to limit the total settlement to 1-inch or less and differential settlement to ½ inch or less.

**Table 5.1 Summary of Structure Settlement and Bearing Pressure**

| Structure | Bearing Elevation | Gross Bearing Pressure (1) (psf) | Change in Pressure Contributing to Settlement (psf) | Total Settlement (2) (inches) |
|---|---|---|---|---|
| Garage Building Wall<br>As-Provided Pressure | 579 | 2,000 | 1,750 | <1 |
| Admin Building Wall<br>As-Provided Pressure | 577.5 | 2,200 | 1,810 | <1 |
| Sludge Handling Building Wall<br>As-Provided Pressure | 577.5 | 2,000 | 1,610 | <1 |
| Oxidation Ditch + Grit | 577 | 3,500 | 3,110 | 2¼ to 3¼ |
| Same as above.<br>Pressure Reduced for<br>1" Total Settlement | 577 | 1,040 | 650 | 1 |
| Oxidation Ditch(3)<br>As-Provided Pressure | 577 | 1,500(3) | 1,110(3) | 1(3) |
| Grit Tank(4)<br>As-Provided Pressure | 572.8 | 2,500(4) | 1,455(4) | 1(4) |

| Table 5.1 Summary of Structure Settlement and Bearing Pressure (Continued) | | | | |
|---|---|---|---|---|
| **Structure** | **Bearing Elevation** | **Gross Bearing Pressure (1) (psf)** | **Change in Pressure Contributing to Settlement (psf)** | **Total Settlement (2) (inches)** |
| RAS Tank + Splitter + Part of Headworks | 577 | 3500 | 3,110 | 1½ to 2¼ |
| Same as above.<br>Pressure Reduced for<br>1" Total Settlement | 577 | 1540 | 1150 | 1 |
| Headworks<br>As-Provide Pressure | 576.5 | 1500 | 1,110 | <1 |
| RAS Tank<br>As-Provided Pressure | 577 | 1000 | 610 | <1 |
| Part of Headworks + Part of U.V. | 571 | 3,675 | 2,630 | 1¼ to 1¾ |
| Same as above.<br>Pressure Reduced for<br>1" Total Settlement | 571 | 2,545 | 1,500 | 1 |
| Part of U.V. | 568 | 4,085 | 3,225 | 1½ to 2 |
| Same as above.<br>Pressure Reduced for<br>1" Total Settlement | 568 | 2,360 | 1,500 | 1 |
| Clarifier + Pump Station | 561 | 13,285 | 11,950 | 2 to 2¾ |
| Same as above.<br>Pressure Reduced for<br>1" Total Settlement | 561 | 3,835 | 2,500 | 1 |
| Same as above.<br>(Using Gross Bearing Pressure<br>Indicated for Preliminary Design.) | 561 | 3,500 | 2,165 | <1 |
| Diversion Chamber / Portions of Headworks | 553 | 9,175 | 7,300 | 1 to 1½ |
| Same as above.<br>(Using Gross Bearing Pressure<br>Indicated for Preliminary Design.) | 553 | 3,500 | 1,625 | <1 |
| Portions of Headworks | 545 | 4,800 | 2,420 | <1 |
| Same as above.<br>(Using Gross Bearing Pressure<br>Indicated for Preliminary Design.) | 545 | 3,500 | 1,120 | <1 |
| Grading Fill<br>(Average Across the Site) | 2 feet of fill<br>@ 580 | 260 | 260 | ½ |

(1) Gross bearing pressure requires the foundation, floor slab, and soil backfill overlying foundations to be included in structural load.
(2) Differential settlement on the order of half the total settlement.
(3) Over-excavate and Replace with Engineer Fill to Elevation 572
(4) Over-excavate and Replace with Engineer Fill to Elevation 571

In using a gross allowable bearing pressure, the weight of the footings, backfill over the footings, and floor slabs need to be included in the structural loads for dimensioning footings.

It was indicated that over-excavation and replacement to limit settlement to 1 inch would be the first option considered, where bearing pressures would otherwise result in more than 1 inch of settlement. Two structures (the Oxidation ditch and the Grit Tank) are indicated in Table 5.1 for over-excavation to limit settlement to 1 inch. Consideration may also be given to ground improvement methods, should they be more economical or beneficial to the schedule. Ground improvement methods are provided by proprietary contractors whom would provide design based on the geotechnical data in this report.

Where over-excavation is required, it should extend 12 inches wider for every 12 inches deep, centered along the foundation. The over-excavated areas should be backfilled with new granular engineered fill placed in controlled lifts and compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor). Alternatively, the over-excavated areas could be backfilled with flowable controlled-density fill having a minimum compressive strength of 300 pounds per square inch (psi).

All exterior footings and footings in unheated areas should be constructed at a minimum frost penetration depth of 3½ feet below finished exterior grades. Interior footings may bear at a convenient depth below the floor slab, provided they are supported on suitable native soils, properly placed and compacted new engineered fill, or lean concrete or flowable controlled-density fill. Spread footings should be at least 18 inches wide, and column (square) footings should be at least 30 inches square, regardless of sizing based on design loads and the allowable bearing pressure

Utilizing the above gross allowable bearing pressures that limit total settlement to 1 inch or less and proper foundation inspection techniques, the total settlement and differential settlement associated with the building or below-grade structures should not exceed 1 inch and ½ inch, respectively.

## 5.2 Seismic Considerations

We have reviewed seismic design parameters in accordance with the Ohio Building Code (OBC) criteria, which references ASCE 7-10. It should be noted that the OBC seismic site characterization is based on the upper 100 feet of the geologic profile and the borings performed for this investigation extended only to a maximum depth of soil was approximately 46 feet below existing grade. Therefore, we considered the soil conditions only within the explored depths in the borings performed for this investigation.

Using the $N_{ch}$-method, the average SPT N-value ($N_{ch}$) was calculated to be less than 37 blows per foot (bpf), which is indicative of a Site Class D "Stiff Soil Profile" designation in accordance with ASCE 7-10 Table 20.3-1 criteria. However, undrained shear strength ($S_u$) was calculated to be greater than 2000 psf, which implies for site class C "Stiff Soil profile". We recommend a Site Class D "Stiff Soil Profile" designation be utilized for this site.

## 5.3 Subgrades

### 5.3.1 Existing Subgrade

The subgrades that would result upon the satisfactory completion of the site preparation as described in Section 6.0 of this report are considered generally acceptable for support of the proposed pavements and floor slabs. Based on field and laboratory data developed during this investigation, the upper subgrade soils generally consist of native cohesive soils

The cohesive soils are considered fair to poor as subgrade materials because they have relatively low permeabilities and a high percentage of silt and clay particles, which makes them susceptible to moisture, frost penetration, and frost heave. Therefore, the cohesive soils will dictate floor slab and pavement design.

Visual classification of the upper subgrade soils indicated the predominant cohesive subgrade soils may be generally classified as Lean Clay or Group A-6b and A-7-6 accordance with the Ohio Department of Transportation (ODOT) system of soil classification.

Pavement subgrade soils containing more than trace organics (more than nominally 5 percent) should be undercut at least 24 inches below top of subgrade/bottom of stone base elevation.

Based on the results of our fieldwork and laboratory testing, we did note debris in the upper 3 feet of the materials within the subgrade layer.

However, if cohesive existing fill materials are encountered, within vicinity of project site, containing trace or less debris and organics may remain as subgrade soils, provided they can be properly prepared as discussed in Section 6.0 of this report. If materials are encountered during construction that contain more than trace organics or debris, they should be evaluated at that time to determine the extent of removal that will be required.

At the time of this investigation, moisture content in the upper 4 feet of the existing cohesive subgrade soils ranged from 11 to 29 percent. These moisture contents are estimated to below to significantly above the expected optimum moisture content for these soils (estimated optimum moisture is 15 - 21 percent). Drying of the soils to achieve proper compaction of the subgrade, especially construction occurs during a particularly wet period should be anticipated. Additionally, subgrade modification may be required due to the presence of non-soil materials and varying consistency.

### 5.3.2 Modified Subgrade

Discussion is provided in Section 5.3.1 regarding modification of subgrade soils containing non-soil materials.

Where soils are dry of optimum, water should be uniformly mixed into the subgrade. Where soils are wet of optimum, lowering the moisture content by scarification and aeration (discing and exposure to sun and wind) may be required. However, this may not be feasible if construction occurs during wet seasonal conditions. Very moist to wet soils will "pump" under the operation of heavy equipment, resulting in deep rutting and perhaps rendering the operation of grading and paving equipment difficult or impossible.

Therefore, other methods of subgrade modification may be required in areas of high moisture content. Modification may be achieved by undercutting and replacement with granular subbase (possibly in combination with a geotextile separation layer or geogrid reinforcement), mixing stone into the subgrade, or treating the subgrade with lime or cement. However, due to the relatively small area of construction, the latest option most likely will not be feasible due to high mobilization cost of the equipment and varying depths of the structures. The method of subgrade modification should be determined at the time of construction (See Section 6.1, "Construction Recommendations - Site and Subgrade Preparation").

## 5.4 Floor Slabs

**Discussion is provided in Section 5.3.1 regarding modification of subgrade soils consisting of non-soil materials.**

It is recommended that all floor slabs be "floating", that is, fully ground supported and not structurally connected to walls or foundations. This is to reduce the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation. Such movements could be detrimental to slabs that are rigidly connected to the foundations. There may be certain areas where it will be difficult or impractical to make the slab floating. In such areas, it may be necessary to increase the slab thickness and reinforcement to prevent the foundation from cracking the slab and settling independently.

For properly prepared subgrade soils, a modulus of subgrade reaction (k) of 117 pounds per cubic inch (pci) may be used for floor slab design. It is recommended that the floor slab be supported on a minimum 6-inch layer of relatively clean granular material such as sand and gravel or crushed stone. This is to help distribute concentrated loads and provide more uniform subgrade support beneath the slab.

It is recommended that the supporting soil for floor slabs be free of any organic matter and contain trace or less construction debris, which might require over excavation of subgrade soils. If over-excavation for installation of foundations results in removal of all existing cohesive materials and replacement with new granular engineered fill at floor slab subgrade elevations, a k-value of 200 pci may be used for design.

### 5.5 Flexible (Asphalt) Pavement

**Discussion is provided in Section 5.3.1 regarding modification of subgrade soils consisting of non-soil materials.**

Based on the results of the laboratory testing and visual classifications, we recommend a subgrade CBR value of 3 percent for flexible pavement design for the Group A-7-6 or better soils. This CBR value is based on subgrade compacted to at least 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof rolling.

It should be noted that we are not privy to the design traffic loads or intended design life. The subgrade support recommendations indicated herein should be reviewed by the site engineer in conjunction with the design traffic criteria to determine the required pavement sections. In any case, we recommend the light-duty pavement cross-section consists of at least 3 inches of asphalt underlain by 6 inches of aggregate base for even the lightest-duty pavements based on our experience regarding environmental exposure and reasonable serviceability. For the same reason, we recommend the heavy-duty pavement cross-section consist of at least 4 inches of asphalt underlain by 8 inches of aggregate base.

All paving operations should conform to Ohio Department of Transportation (ODOT) specifications. The pavement and subgrade preparation procedures outlined in this report should result in a reasonably workable and satisfactory pavement. It should be recognized, however, that all flexible pavements need repairs or overlays from time to time as a result of progressive yielding under repeated traffic loads for a prolonged period of time, as well as exposure to weather conditions.

## 5.6 Rigid (Concrete) Pavement

**Discussion is provided in Section 5.3.1 regarding modification of subgrade soils consisting of non-soil materials.**

For properly prepared subgrade soils, a modulus of subgrade reaction (k) of 117 pounds per cubic inch (pci) may be used for rigid pavement design. A concrete pavement section is recommended in the loading-unloading areas, areas of repetitive turning, site exit and entrance aprons, and trash enclosure areas (including where the truck parks while servicing the container). This section should consist of a minimum of 6 inches of reinforced, air-entrained concrete with a minimum compressive strength of 3,500 pounds per square inch (psi) underlain by a minimum of 6 inches of a dense-graded aggregate base such as ODOT Item 304. The pavement section should be supported on subgrade compacted to at least 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof rolling.

## 5.7 Pavement Drainage

Based on the poorly-drained nature of the silty and clayey subgrade soils at the site, it is anticipated that surface water infiltration may collect in the aggregate base course. Without adequate drainage, water will remain in the base for extended periods of time, creating localized wet, soft pockets. The presence of these pockets will increase the likelihood that pavement distress (cracking, potholes, etc.) will develop. Drainage features may include grading the subgrade surface to slope downward to the outside edge of pavements and/or providing longitudinal edge drains connected to storm sewers or other outlets. A system of “finger drains” could also be installed near catch basins within the pavement areas to collect surface water, thus reducing the potential for freeze-thaw effects on the pavement.

## 5.8 Groundwater Control

Encountered groundwater conditions were previously discussed in Section 4.4. Based on the limited data available, such as the soil characteristics and the groundwater conditions encountered in the borings, it is our opinion that the “normal” groundwater level may be generally encountered at depths on the order of 6 feet or greater below existing grades at the project area. It should be noted that “perched” water may be encountered in granular soils that are underlain by relatively impermeable native cohesive soils, or at the soil-bedrock interface.

It is our experience that adequate control of groundwater seepage, “perched” water, or surface water run-off into shallow excavations should be achievable by minor dewatering systems, such as pumping from prepared sumps. Poorly graded sand and sandy silt seams were encountered in the subsurface profile, exhibiting higher permeability than the site's lean clay soils. Water seepage should be anticipated during excavation, particularly in deeper areas. Diligent dewatering may be required for deeper excavations that extend into these layers. Seepage pressures may also destabilize shallower subgrades, potentially requiring dewatering wells prior to excavation to maintain site stability. In the event excessive seepage is encountered during construction, Verdantas may be notified to evaluate whether other dewatering methods are required.

## 5.9 Permanent Drainage Considerations

Based on the design “normal” and high groundwater level of Elev. 573.5, up to approximately 0 to 28 feet of hydrostatic head may act against the base the proposed structures with the deepest structure bearing elevation indicated at Elev. 545.5± for the headworks. It is not anticipated that foundation drains will be utilized at this site. As such, consideration should be given to the buoyancy of the substructures, when operating empty, due to groundwater conditions. When considering buoyancy of each substructure, the weight of the structure, including the foundation system, can be used to resist uplift. In addition, a side wall ultimate friction factor of 0.30 may be utilized along the face of the vertical concrete walls to mobilize sliding resistance between the installed structure and the backfill, assuming interbedded granular and cohesive soils based on the encountered soil profile in the borings. An appropriate factor of safety should be considered in the design methodology when using the ultimate friction factor value of 0.30.

### 5.10 Below-Grade Walls

Below-grade structures are anticipated to extend approximately 0 to 35 feet below the current grades. Within these depths, subsoils are anticipated to consist of predominantly native cohesive soils with varying amount of sand. The cohesive materials were more predominant throughout the site, and dictate design compared to the other site materials.

Where existing structures, underground utilities, and embankments are located within a distance from the excavation equal to approximately twice the depth of the excavation, an adequate system of sheet piling, temporary post-and-panel, lateral bracing, trench boxes, or an alternate construction procedure may be required to prevent lateral movements that may cause settlement of these entities. Sheet piling may also be used in combination with laid-back slopes limited to the upper portion of the profile to avoid an excessively large, open excavation.

Design of sheet-pile walls or H-pile and lagging systems should be the responsibility of the contractor, since their installation and performance is integrally tied to the contractor’s means and methods of construction. In any case, applicable OSHA standards must be followed. It is the responsibility of the installation contractor to develop appropriate installation methods and equipment specifications prior to commencement of work, and to obtain the services of a qualified engineer to design or approve sloped or benched excavations and/or lateral bracing systems as required by OSHA criteria. In addition, OSHA requires that excavations with open-cut slopes higher than 20 feet or braced excavation support systems such as sheetpiling or cofferdams be reviewed and designed by a registered professional engineer.

For below-grade walls that are restrained from rotation and are considered rigid and non-yielding, lateral earth pressures should be assumed for “at-rest” conditions. An at-rest lateral earth pressure coefficient (ko) of 0.50 should be used along with a soil unit weight of 130 pounds per cubic foot (pcf) in determining the lateral pressure acting on the walls. For retaining structures or below-grade walls that are not restrained at the top of the wall (including temporary sheet piling for construction), an active lateral earth pressure coefficient (ka) of 0.33 may be used for design. Alternatively, equivalent fluid weights of 65 pcf and 45 pcf may be used for “at-rest” and active case designs, respectively. These values are based on the assumption that the existing predominately cohesive soils encountered in the subsurface profile will constitute the major portion of the backfill area and retained earth behind the walls.

For granular types of soil, if used for fill throughout the entire active or at-rest failure wedge, assuming that soils are meeting gradation characteristics of USCS soil types GW, GP, SW, or SP, the following parameters can be used for retaining structure design: $k_a$ may be taken as 0.25, ko may be taken as 0.40, and the soil unit weight may be assumed as 130 pcf, or alternatively, equivalent fluid weights of 65 pcf and 45 pcf may be used for the active and “at-rest” design cases, respectively.

A passive earth pressure coefficient ($k_p$) of 3.0 may be utilized for the portion of the wall that is below the excavation bottom. It should be noted that some wall movement or horizontal displacement is typically associated with active and passive earth pressure conditions. In particular, appreciable movements are needed to mobilize the full (theoretical) passive pressure of the soil. Specific bracing systems selected by the contractor may have variations of lateral earth pressure (and associated coefficients) that range between the active and passive cases.

Below the groundwater table, an effective unit weights should be utilized by reducing the total unit weights by the unit weight of water (62.4 pcf). Additionally, hydrostatic pressures should be considered below the groundwater level.

It should also be noted that the above earth pressures are based on a level backfill condition behind the retaining wall. In areas where appreciable sloping materials will be present behind the top of the wall, surcharge loading or equivalent higher earth pressure coefficients should be evaluated, based on the sloping material, backfill slope, and proximity to the wall. In general, 50 percent of the vertical surcharge load should be used for lateral loading in the design of the wall.

### 5.11 Corrosion Considerations

Testing was performed to evaluate potential soil corrosivity due to the planned below-grade utilities and structures (manholes). This testing was performed on bulk samples from Borings B-4 (BS-1), B-8 (BS-1) B-11 (ST-1). The corrosivity tests included resistivity, pH, moisture content, chloride content, and sulfate content. The results of the corrosivity tests are summarized in the following table.

| Boring ID | Moisture % | Sulfate (ppm) | Chloride (ppm) | PH | Resistivity (ohm-cm) |
|---|---|---|---|---|---|
| B-4 (BS-1) | 12 | 653.45 | 18.28 | 8.24 | 47400 |
| B-8 (BS-1) | 10 | 618.57 | 20.84 | 8.44 | 51700 |
| B-11(ST-1) | 17 | 172.94 | 48.97 | 8.34 | 3390 |

Research data published by The Ductile Iron Pipe Research Association (DIPRA) includes evaluation of soil resistivity based on soil box (laboratory test) values. Based on research data published by DIPRA, soil resistivity values greater than 3,000 ohm-cm are considered to be a negative factor contributing to potential for corrosion in underground ductile iron pipe (DIP), with resistivity values less than 1,500 ohm-cm being evident of high potential for corrosion in DIP requiring corrosion protection. The samples tested from this site that were saturated and tested in the laboratory via the soil box were all greater than 3,000 ohm-cm.. The results of the pH testing did not indicate negative factors contributing to potential for corrosion in underground DIP. Areas of poor drainage or continuously wet soils are considered to be a negative factor for DIP installation. Installation below the “normal” groundwater table, which is anticipated at elevation of 573.5 feet or greater below existing grades, would fall into the poor drainage/continuously wet soil category. Based on structure bottom elevation going as deep as 545, we expect these conditions could prevail for piping at this site. If underground ductile iron pipe is planned for this project, corrosion protection is recommended, or alternately, consideration should be given to other types of piping.

The pH of tested samples was found to range from 8.19 to 8.44. This range of pH is characterized as slightly alkaline soil reaction by the USDA Soil Conservation Service. Typically, soils with a pH between 5 and 9 are not considered to represent a significant corrosion risk to buried structural concrete or underground piping.

The chloride content for the tested samples was determined to range from 18 to 49 mg/kg (ppm) which is well below a threshold of 500 ppm typically considered for potential corrosion. The sulfate content for the tested samples was determined to range from 172 to 653 ppm. The American Concrete Institute (ACI) in “Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary” indicates that, for concrete in sulfate exposures, concentrations up to 1,500 ppm are considered only “moderate” sulfate exposure, for which Type II Portland cement may be used. All of the laboratory tested samples were below this threshold. Therefore, the properties of the soils are not anticipated to be restrictive to use of Type II Portland cement.

Based on the composite of the data from the tested samples, it is our opinion that the on-site soils do not represent a significant corrosion risk to buried structural concrete or underground piping, except DIP as noted above. We recommend that these data be reviewed by the pipe manufacturers, as the susceptibility to corrosion is a function of the type of pipe material.

## 5.12 Excavations and Slopes

The sides of temporary excavations for building foundations, below-grade structures, utility installations, and other construction should be adequately sloped to provide stable sides and safe working conditions. Otherwise, the excavation must be properly braced against lateral movements. In any case, applicable Occupational Safety and Health Administration (OSHA) safety standards must be followed.

It is the responsibility of the installation contractor to develop appropriate installation methods and equipment prior to commencement of work, and to obtain the services of a geotechnical engineer to design or approve sloped or benched excavations and/or lateral bracing systems as required by OSHA criteria. It should be noted that OSHA requires that excavations with open-cut slopes higher than 20 feet, or braced excavation support systems such as sheetpiling, be reviewed and designed by a registered professional engineer. Based on the test borings, it is likely that excavations will encounter a range of soil conditions that include the following OSHA designations:

- Type A soils (cohesive soils with unconfined compressive strengths of 3,000 pounds per square foot (psf) or greater),
- Type B soils (cohesive soils with unconfined compressive strengths greater than 1,000 psf but less than 3,000 psf), and
- Type C soils (cohesive soils with unconfined compressive strengths of 1,000 psf or less and granular soils).

For temporary excavations in Type A, B and C soils, side slopes must be no steeper than ¾ horizontal to 1 vertical (¾H:1V), 1H:1V, and 1½H:1V, respectively. For situations where a higher strength soil is underlain by a lower strength soil and the excavation extends into the lower strength soil, the slope of the entire excavation is governed by that required for the lower strength soil. In all cases, flatter slopes may be required if lower strength soils or adverse seepage conditions are encountered during construction.

When a portable trench box or sliding trench shield system is utilized, vertical side slopes may be used up to 18 inches below the top of the shield. The sides should then be sloped back from that point to the ground surface.

For permanent excavations and slopes, we recommend that grades be no steeper than 3H:1V without a more extensive geotechnical evaluation of the proposed construction plans and site conditions.

# 6.0 CONSTRUCTION RECOMMENDATIONS

## 6.1 Site and Subgrade Preparation

Prior to proceeding with construction operations, all topsoil, root mats, vegetation, and other deleterious non-soil materials should be removed from the proposed construction areas. Suitable topsoil may be stockpiled for later use in landscaped areas. It is important to note that topsoil thicknesses referenced in the borings may vary across the site. Typically, soils with more than 5 percent organics are not recommended as subgrade soils in structure and pavement areas, but dark colored soils having the appearance of topsoil with only trace “root hairs” of 5 percent or less may not necessarily require stripping. For these “transitional” soils, the actual moisture content and subgrade stability under proof-rolling operations is more critical than the color in determination of the amount of stripping or subgrade undercut. The actual amount of required stripping should be determined in the field by a geotechnical engineer or qualified representative.

Discussion is provided in Section 5.3.1 regarding modification of subgrade soils consisting of non-soil materials.

Upon completion of stripping and clearing, the areas intended to support floor slabs, new fill, and pavements should be carefully inspected by a geotechnical engineer. At that time, the engineer may require proof rolling for the on-site cohesive subgrade soils utilizing a 20- to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. Subgrade soils may consist of granular soils in some areas. Subgrade preparation in these areas may require proof rolling/compaction of the granular subgrades utilizing a smooth-drum roller. The roller or truck should make a minimum of two passes in each of two perpendicular directions covering the proposed development area, with additional passes as necessary to achieve required compaction and/or subgrade stabilization.

The purpose of proof rolling the cohesive subgrades is to locate any weak, soft, or excessively wet soils that may be present at the time of construction. The purpose of the proof rolling/compaction of the granular soils is to densify zones of loose materials that are encountered in the upper portion of the soil profile, thereby providing more uniform subgrade support. We recommend a roller with a minimum dead weight on the drums of 8 tons and traveling at speeds not exceeding approximately 4 feet per second (about 3 miles per hour). These operational criteria should provide sufficient dynamic compaction energy to alleviate loose soil conditions within the zone of influence for subgrade support.

Any unsuitable materials observed during the inspection and proof-rolling operations should be undercut and replaced with compacted fill or stabilized in place utilizing conventional remedial measures such as discing, aeration, and re-compaction. Once the site has been proof rolled, inspected, and stabilized, the proof-rolled or inspected subgrades should not be exposed to wet conditions. It should be recognized that during periods of wet weather, the silty/clayey soils that will be exposed at design subgrades will tend to pond water for short periods of time, with the potential to deteriorate the prepared subgrade.

The results of the inspection and proof-rolling operations will be partially dependent on construction operations, the moisture content of the soil, and the weather conditions prevalent at the time. If pumping or rutting is encountered and difficulty is experienced in the operation of construction equipment, Verdantas should be notified in order to determine which method of subgrade modification may be best suited for the conditions encountered. Should such conditions be experienced, we may recommend that a small test area be used to determine the necessary depth of undercutting and stone replacement or other remedial action necessary to achieve a stable subgrade condition.

### 6.2 Fill

Construction excavations should not be left open any longer than necessary. As soon as a section of any below-grade structure or pipe installation is completed, the area should be backfilled to final grade. After the specified bedding material has been provided below and around the pipe, suitable excavated material may be used to backfill the trench, if located in non-structural and non-pavement areas. Fill required for backfill operations in non-structural and non-pavement areas may consist of any on-site soils that are free of organic matter, excessive moisture, debris, and rock or stone fragments larger than 3 inches.

In general, backfill material placed above the proposed structures or underground pipes should be compacted sufficiently to achieve stable backfill and avoid undesirable settlements. **Where underground utilities will be installed beneath pavement areas, future structure areas, or future pavement areas, the backfill material should be placed in uniform layers not more than 8 inches thick (loose measure) and compacted to 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor). Backfill placed in pavement areas should consist of dense-graded aggregate, such as ODOT Item 304 material. In order to achieve the desired compaction, the backfill material should be within 3 percent of the optimum moisture content.**

We emphasize the need for placing the fill in lifts and compacting each lift to the specified density, especially where the trench will be directly beneath roadway pavement. The installation contractor should not be allowed to push or end-dump several feet of backfill into the trench as a single layer or lift, because the lower portion of a thick lift will not achieve proper densification from compaction equipment operating at the surface of that lift. If backfill is not properly placed and compacted, undesirable trench backfill settlement may occur.

Material for engineered fill or backfill required to achieve design grades may consist of any non-organic soils having a maximum dry density as determined by the Standard Proctor (ASTM D 698) of 90 pounds per cubic foot (pcf) or greater. Depending on seasonal conditions, the on-site soils may be wet of optimum and may require scarification and aeration to achieve satisfactory compaction. If the construction schedule does not allow for scarification and aeration activities, it may be more practical or economical to utilize imported granular fill.

The contractor should be prepared to use a sheepsfoot roller to provide effective compaction of cohesive soils. Where granular soils are present or new engineered fill consists of granular material, a vibratory smooth- drum roller would provide effective compaction of these materials. In narrow utility excavations, the deeper profile on-site cohesive soils may be difficult to compact; therefore, a clean granular material may be required in these areas.

Scarified subgrade soils and all fill material should be within 3 percent of the optimum moisture content to facilitate compaction. Furthermore, fill material should not be frozen or placed on a frozen base. It is recommended that all earthwork and site preparation activities be conducted under adequate specifications and properly monitored in the field by a qualified geotechnical testing firm.

### 6.3 Construction (General)

Construction traffic and excavated material stockpiles should be kept away from the excavation a minimum distance equal to the full depth of the excavation. In all cases, pertinent OSHA requirements must be followed, and adequate protection for workers must be provided.

Where existing buildings or structures, including underground utilities, are located within a distance from the excavation equal to approximately twice its depth, an adequate system of sheet piling and/or lateral bracing may be required to prevent lateral movements that could cause settlement. Any retaining system proposed by the contractor should be reviewed by a registered professional engineer prior to approval for installation and use.

It is also suggested that a condition survey of any existing structures and transportation infrastructure located in the vicinity of the proposed structure locations and pipe alignments be completed. For general below-grade structure or pipe installation, we recommend the condition survey extend a distance from the proposed installation extents equal to the depth of the excavation, but not less than 50 feet. The condition survey should be extended to 100 feet from the pipe alignment and/or structure excavation footprint in areas where driving of sheetpiling, or compaction of granular material, will be performed for braced excavations. The condition survey should identify existing cracks and other forms of distress to the structures before the start of construction operations. This procedure will be helpful to evaluate possible effects the construction operations may have on nearby structures and to mitigate potential disputes with property owners.

## 7.0 QUALIFICATION OF RECOMMENDATIONS

Our evaluation of foundations, floor slabs and below-grade walls design and construction conditions has been based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe earthwork and foundation construction to confirm that the conditions anticipated in design are noted. Otherwise, Verdantas assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

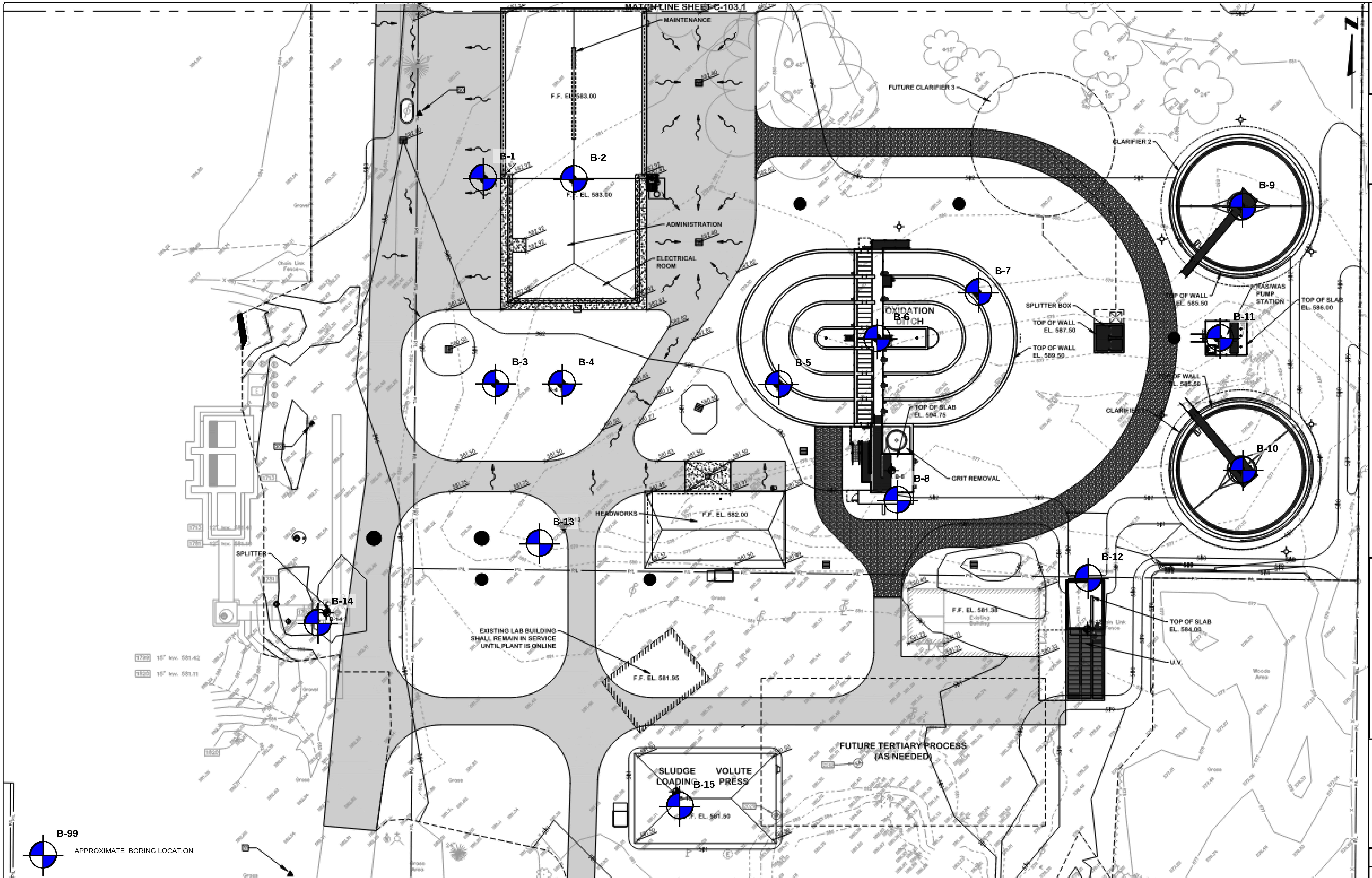
The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, a qualified geotechnical engineer should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report after on-site observations of the conditions.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. Verdantas is not responsible for the conclusions, opinions, or recommendations of others based on this data.

# PLATES

## PLATE 1.0 TEST BORING LOCAITON PLAN



**B-99**

APPROXIMATE BORING LOCATION

PREPARED FOR

**Village of Oak Harbor**
**Oak Harbor, Ohio**

DRAWN: CO / 07/2/25
REVISED: ---
PROJECT No: 31874

**PLATE 1.0**

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SOIL BORING
LOCATION PLAN

**VILLAGE OF OAK HARBOR, OHIO**
**WASTEWATER TREATMENT PLANT**

SCALE 1"=20'

THIS LINE SCALES 1" WHEN PLOTTED TO NOTED SCALE

TOL-8119002-BORINGS-C-4.2 SOIL BORING PLAN
2/27/2025 11:37 AM - BDRILL
2/27/2025 11:37 AM

# APPENDIX A

# LOGS OF TEST BORINGS

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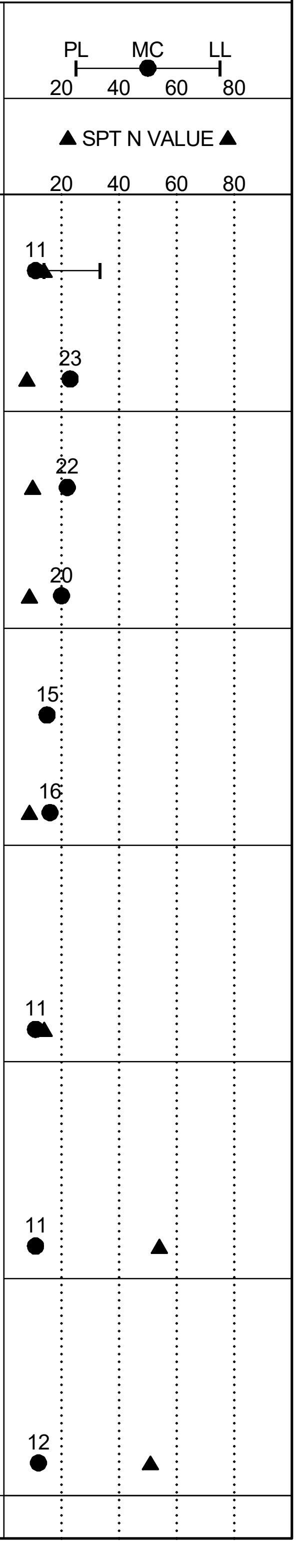
# BORING NUMBER B-1

PAGE 1 OF 1

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 581.5 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/21/25
**COMPLETED** 3/21/25
**AT TIME OF DRILLING** None
**LOGGED BY** TB
**CHECKED BY** CO
**AT END OF DRILLING** None
**NOTES**
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL / SPT N VALUE |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | TOPSOIL - 2 Inches 0.2' | | | | | | |
| 580 | | | Moist Stiff Brown SANDY LEAN CLAY w/Trace Gravel and Calcite Stain Seam (CL) 3.0' | SS 1 | 78 | 6-7-7 (14) | >4.5 | | 11 |
| | 5 | | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand and Trace Organics (CL)<br>LOI = 2.0% 6.5' | SS 2 | 100 | 2-3-5 (8) | 4.00 | | 23 |
| 575 | | | Moist Stiff Brown LEAN CLAY w/Sand, Trace Calcite Stain Seam, and Organics (CL)<br>LOI = 1.9% | SS 3 | 100 | 3-4-6 (10) | >4.5 | | 22 |
| | 10 | | @8': Gray/Brown, w/Trace Gravel and Iron Oxide Stain Seam | SS 4 | 100 | 2-3-6 (9) | 3.75 | | 20 |
| 570 | | | @11': w/Trace Organics<br>LOI = 3.7%<br>@12': Gray, w/Trace Shale Fragments | ST 1 | 100 | | 2.34 | 115 | 15 |
| | 15 | | | SS 5 | 100 | 2-4-5 (9) | 2.50 | | 16 |
| 565 | | | | | | | | | |
| | 20 | | | SS 6 | 100 | 3-5-9 (14) | >4.5 | | 11 |
| 560 | | | 23.0' | | | | | | |
| | 25 | | Moist Very Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 7 | 100 | 13-26-28 (54) | >4.5 | | 11 |
| 555 | | | | | | | | | |
| | 30 | | 30.0' | SS 8 | 89 | 17-21-30 (51) | 11.98 | 123 | 12 |
| | | | Bottom of hole at 30.0 feet. | | | | | | |



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# BORING NUMBER B-2

PAGE 1 OF 1

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 580.8 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/21/25

**COMPLETED** 3/21/25

**AT TIME OF DRILLING** None

**LOGGED BY** TB

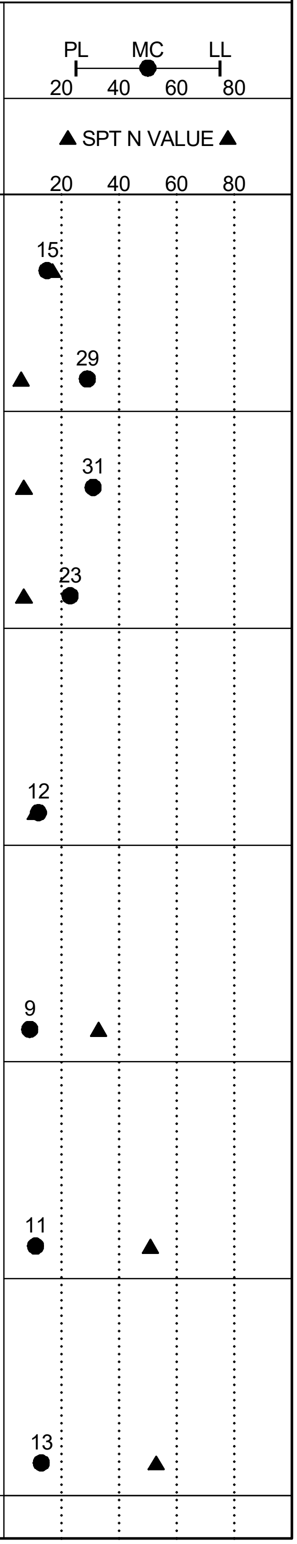
**CHECKED BY** CO

**AT END OF DRILLING** None

**NOTES**

**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 580 | 0 | TOPSOIL - 4 Inches<br>0.3' | | | | | |
| | | Moist Very Stiff Brown LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL)<br>3.0' | SS 1 | 78 | 5-8-9 (17) | >4.5 | |
| | 5 | Moist Medium Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL) | SS 2 | 89 | 2-2-4 (6) | 0.64 | 89 |
| 575 | | @6': Brown/Gray | SS 3 | 100 | 3-3-4 (7) | 2.25 | |
| | | @8': Brown, w/Trace Iron Oxide Stain Seam | SS 4 | 100 | 3-3-4 (7) | 2.75 | |
| 570 | 10 | 13.0' | | | | | |
| | 15 | Moist Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL), PH= 8.22 | SS 5 | 100 | 4-5-6 (11) | 2.50 | |
| 565 | | 17.0' | | | | | |
| | | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | |
| | 20 | | SS 6 | 100 | 7-14-19 (33) | >4.5 | |
| 560 | | | | | | | |
| | 25 | @23.5': Very Hard | SS 7 | 100 | 14-22-29 (51) | >4.5 | |
| 555 | | | | | | | |
| | 30 | 30.0' | SS 8 | 100 | 14-21-32 (53) | >4.5 | |
| | | Bottom of hole at 30.0 feet. | | | | | |



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# BORING NUMBER B-3

PAGE 1 OF 1

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 580.4 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/20/25

**COMPLETED** 3/20/25

∇ **AT TIME OF DRILLING** 6.0 ft / Elev 574.4 ft

**LOGGED BY** TB

**CHECKED BY** CO

**AT END OF DRILLING** None

**NOTES** Auger refusal encountered at 21.4 feet.

**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 580 | 0 | | TOPSOIL - 7 Inches<br>0.6' | | | | | | |
| | | | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 1 | 83 | 2-3-4 (7) | >4.5 | | 15 |
| | | | @3': w/Trace Organics<br>LOI = 2.4% | SS 2 | 100 | 3-3-3 (6) | 4.25 | | 23 |
| 575 | 5 | | | | | | | | |
| | | | ∇<br>@6': LOI = 2.2%<br>8.0' | SS 3 | 100 | 3-3-3 (6) | 1.00 | | 41 |
| | | | Moist Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL) | SS 4 | 100 | 3-5-8 (13) | >4.5 | | 22 |
| 570 | 10 | | | | | | | | |
| | | | @12': Gray | | | | | | |
| | | | | SS 5 | 100 | 2-4-6 (10) | 2.38 | 118 | 15 |
| 565 | 15 | | | | | | | | |
| | | | 17.5'<br>Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 6 | 100 | 8-18-26 (44) | >4.5 | | 9 |
| 560 | 20 | | 20.8' | | | | | | |
| | | | APPARENT BOULDER<br>21.4' | | | | | | |

Bottom of hole at 21.4 feet.

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# BORING NUMBER B-3-1

PAGE 1 OF 1

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 580.4 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/20/25
**COMPLETED** 3/20/25
▽ **AT TIME OF DRILLING** 6.0 ft / Elev 574.4 ft
**LOGGED BY** TB
**CHECKED BY** CO
**AT END OF DRILLING** None
**NOTES** Boring offset 5.0 feet SW of B-3.
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 / ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 580 | 0 | TOPSOIL - 7 Inches | | | | | | |
| | 0.6' | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL)<br>@3': w/Trace Organics<br>LOI = 2.4% | | | | | | |
| 575 | 5 | ▽ | | | | | | |
| | 8.0' | Moist Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL) | | | | | | |
| 570 | 10 | | | | | | | |
| | | @12': Gray | | | | | | |
| 565 | 15 | | | | | | | |
| | 17.5' | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| 560 | 20 | | | | | | | |
| | | @23.5': Very Hard | SS 1 | 89 | 15-23-28 (51) | >4.5 | | 11 ● ▲ |
| 555 | 25 | | | | | | | |
| | 30.0' | | SS 2 | 89 | 13-18-25 (43) | >4.5 | | 14 ● ▲ |
| | 30 | Bottom of hole at 30.0 feet. | | | | | | |

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# BORING NUMBER B-4

PAGE 1 OF 1

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 579.7 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/20/25

**COMPLETED** 3/20/25

**AT TIME OF DRILLING** None

**LOGGED BY** TB

**CHECKED BY** CO

**AT END OF DRILLING** None

**NOTES** A bulk sample was taken from auger cuttings from 20-30 feet.

**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL ● MC LL (20 40 60 80) / ▲ SPT N VALUE ▲ (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | TOPSOIL - 3 Inches<br>0.3' | | | | | | |
| | | | Moist Medium Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 1 | 83 | 3-3-4 (7) | 2.75 | | ● 19 ▲ |
| 575 | 5 | | | SS 2 | 100 | 2-3-4 (7) | 3.75 | | ● 25 ▲ |
| | | | | SS 3 | 100 | 3-3-3 (6) | 1.00 | | ● 29 ▲ |
| 570 | 10 | | @8': Gray/Brown, w/Trace Organics<br>LOI = 4.6%<br>UU Triaxial: C = 9.9 psi | ST 1 | 96 | | UU | 102 | ● 22 |
| | | | @11.3': Gray | SS 4 | 100 | 2-3-3 (6) | 2.25 | | ● 17 ▲ |
| 565 | 15 | | | SS 5 | 100 | 2-4-4 (8) | 3.50 | | ● 16 ▲ |
| | | | 17.0'<br>Moist Very Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL), PH = 8.24 | | | | | | |
| 560 | 20 | | | SS 6 | 100 | 11-26-38 (64) | >4.5 | | ● 7 ▲ |
| 555 | 25 | | @23.5': Hard | SS 7 | 100 | 10-18-25 (43) | 2.97 | 122 | ● 12 ▲ |
| 550 | 30 | | 30.0' | SS 8 | 94 | 13-18-26 (44) | >4.5 | | ● 14 ▲ |
| | | | Bottom of hole at 30.0 feet. | | | | | | |

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# BORING NUMBER B-5

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 578.7 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/20/25
**COMPLETED** 3/20/25
**AT TIME OF DRILLING** None
**LOGGED BY** TB
**CHECKED BY** CO
**AT END OF DRILLING** None
**NOTES**
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL ├ MC ● ┤ LL 20 40 60 80 / ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | TOPSOIL - 2 Inches 0.2' | | | | | | |
| | | | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand and Trace Gravel (CL) | SS 1 | 22 | 1-3-5 (8) | 2.50 | | ▲ ● 28 |
| 575 | | | @3': Brown/Gray | | | | | | |
| | | | 4.5' | SS 2 | 100 | 2-2-4 (6) | 3.75<br>3.00 | | ▲ ● 26<br>● 15 |
| | 5 | | Moist Medium Stiff Brown/Gray SANDY LEAN CLAY w/Trace Gravel, Iron Oxide Stain Seam, and Organics (CL) LOI = 1.0% 6.0' | | | | | | |
| | | | Moist Medium Stiff Gray LEAN CLAY w/Sand (CL) | SS 3 | 100 | 3-3-4 (7) | 3.25 | | ▲ ● 24 |
| 570 | | | @8': w/Trace Gravel | | | | | | |
| | 10 | | | SS 4 | 100 | 2-3-5 (8) | 1.92 | 116 | ▲ ● 15 |
| 565 | 15 | | | SS 5 | 100 | 3-3-5 (8) | 4.00 | | ▲ ● 16 |
| | | | 17.0' | | | | | | |
| | | | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| 560 | 20 | | | SS 6 | 100 | 19-20-21 (41) | >4.5 | | ● 11 ▲ |
| 555 | 25 | | @23.5': Very Hard | SS 7 | 100 | 13-23-29 (52) | 13.61 | 123 | ● 11 ▲ |
| | | | 27.0' | | | | | | |
| | | | Moist Very Stiff Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| 550 | 30 | | 30.0' | SS 8 | 100 | 7-10-16 (26) | >4.5 | | ● 14 ▲ |
| | | | Bottom of hole at 30.0 feet. | | | | | | |

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# BORING NUMBER B-6

PAGE 1 OF 1

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 578.5 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/20/25

**COMPLETED** 3/20/25

**AT TIME OF DRILLING** None

**LOGGED BY** TB

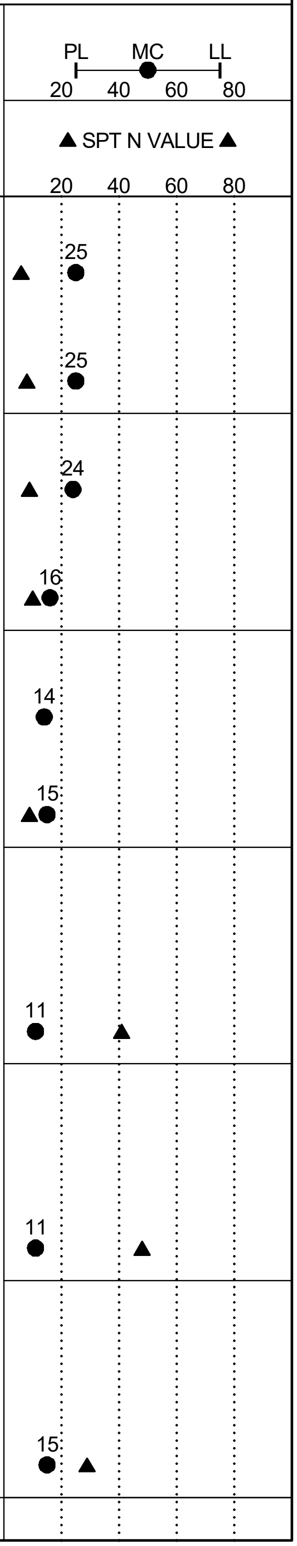
**CHECKED BY** CO

**AT END OF DRILLING** None

**NOTES**

**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | TOPSOIL - 4 Inches 0.3' | | | | | | |
| | | | BRICK - 7 Inches 0.9' | SS 1 | 78 | 2-2-4 (6) | 2.75 | | 25 |
| | | | FILL - Moist Medium Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Brick Fragments 3.0' | | | | | | |
| 575 | 5 | | Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) 6.0' | SS 2 | 100 | 1-3-5 (8) | 3.50 | | 25 |
| | | | Moist Stiff Gray LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)<br>LOI = 1.0% | SS 3 | 100 | 3-4-5 (9) | 1.60 | 95 | 24 |
| 570 | 10 | | | SS 4 | 100 | 4-4-6 (10) | 4.00 | | 16 |
| | | | @11': Brown/Gray, w/Trace Organics<br>LOI = 2.4% | ST 1 | 100 | | 3.67 | 119 | 14 |
| 565 | 15 | | @13.5': Gray 17.0' | SS 5 | 100 | 4-4-5 (9) | 4.25 | | 15 |
| 560 | 20 | | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL), PH=8.27 | SS 6 | 100 | 15-20-21 (41) | >4.5 | | 11 |
| 555 | 25 | | 27.0' | SS 7 | 100 | 14-21-27 (48) | 9.21 | 119 | 11 |
| 550 | 30 | | Moist Very Stiff Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) 30.0' | SS 8 | 100 | 7-12-17 (29) | >4.5 | | 15 |
| | | | Bottom of hole at 30.0 feet. | | | | | | |



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# BORING NUMBER B-7

PAGE 1 OF 1

| | | | |
|---|---|---|---|
| **CLIENT** | Jones and Henry | **PROJECT NAME** | Oak Harbor WWTP |
| **PROJECT NUMBER** | 31874 | **PROJECT LOCATION** | Oak Harbor, OH |
| **DRILLING CONTRACTOR** | TTL Engineering Services, LLC TB MB | **RIG NO.** | D70 |
| | | **GROUND ELEVATION** | 578.9 ft |
| **DRILLING METHOD** | 3-1/4 in. HSA | **GROUND WATER LEVELS:** | |
| **DATE STARTED** | 3/19/25 | **COMPLETED** | 3/19/25 |
| **LOGGED BY** | TB | **CHECKED BY** | CO |
| **AT TIME OF DRILLING** | None | **AT END OF DRILLING** | None |
| **0hrs AFTER DRILLING** | Borehole Sealed with Cement Bentonite Grout | | |

**NOTES** A bulk sample was taken from auger cuttings from 20-30 feet.

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 / ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | TOPSOIL - 6 Inches 0.5' | | | | | | |
| | | | Moist Loose Brown CLAYEY SAND (SC) 3.0' | SS 1 | 83 | 2-3-4 (7) | NP | | 15 |
| 575 | 5 | | Moist Stiff Gray/Brown LEAN CLAY w/Sand (CL) | SS 2 | 100 | 3-5-8 (13) | >4.5 | | 24 |
| | | | @6': Brown/Gray, w/Trace Sand and Organics<br>LOI = 4.1% | SS 3 | 100 | 3-4-6 (10) | >4.5 | | 23 |
| 570 | 10 | | @8': Gray | SS 4 | 100 | 4-6-8 (14) | 3.75 | | 14 |
| 565 | 15 | | 16.5' | SS 5 | 100 | 4-6-7 (13) | 3.51 | 114 | 15 |
| 560 | 20 | | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 6 | 100 | 17-18-24 (42) | >4.5 | | 11 |
| 555 | 25 | | 28.5' | SS 7 | 89 | 12-21-26 (47) | >4.5 | | 11 |
| 550 | 30 | | Moist Very Stiff Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) 30.0' | SS 8 | 100 | 9-12-17 (29) | >4.5 | | 15 |
| | | | Bottom of hole at 30.0 feet. | | | | | | |

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# BORING NUMBER B-8

PAGE 1 OF 1

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 577.2 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/19/25

**COMPLETED** 3/19/25

**AT TIME OF DRILLING** None

**LOGGED BY** TB

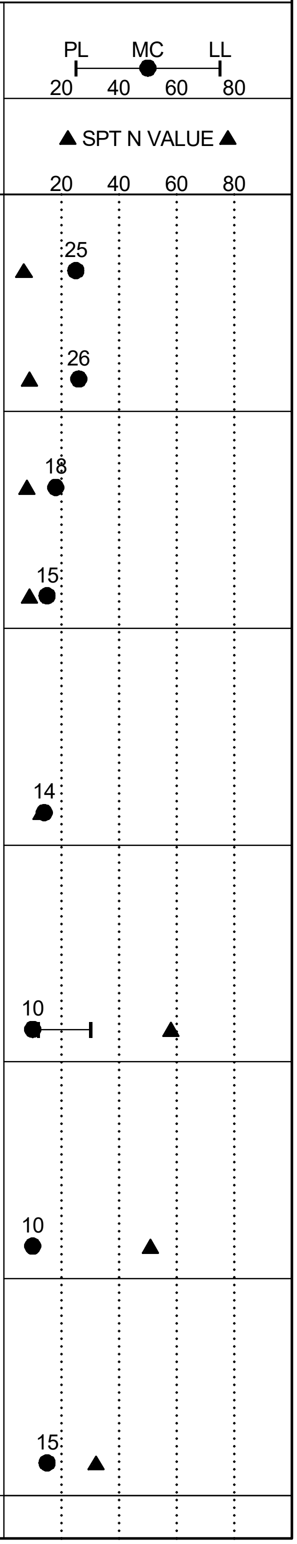
**CHECKED BY** CO

**AT END OF DRILLING** None

**NOTES** A bulk sample was taken from auger cuttings from 20-30 feet.

**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL |
|---|---|---|---|---|---|---|---|---|
| | 0 | TOPSOIL - 2 Inches<br>0.2' | | | | | | |
| 575 | | Moist Medium Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL)<br>3.0' | SS 1 | 83 | 1-3-4 (7) | 3.25 | | 25 |
| | 5 | Moist Stiff Gray/Brown LEAN CLAY w/Sand and Trace Gravel (CL)<br>6.5' | SS 2 | 100 | 2-4-5 (9) | 3.75 | | 26 |
| 570 | | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand and Trace Gravel (CL)<br>8.0' | SS 3 | 100 | 3-4-4 (8) | 3.50 | | 18 |
| | 10 | Moist Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | SS 4 | 100 | 3-4-5 (9) | 3.50 | | 15 |
| 565 | | | | | | | | |
| | 15 | 16.0' | SS 5 | 100 | 4-4-9 (13) | 4.00 | | 14 |
| 560 | | Moist Very Hard Gray SANDY LEAN CLAY w/Trace Gravel and Calcite Stain Seam (CL), PH=8.44 | | | | | | |
| | 20 | | SS 6 | 89 | 20-25-33 (58) | >4.5 | | 10 |
| 555 | | | | | | | | |
| | 25 | | SS 7 | 100 | 14-22-29 (51) | >4.5 | | 10 |
| 550 | | @27': Hard | | | | | | |
| | 30 | 30.0' | SS 8 | 100 | 7-12-20 (32) | 4.53 | 116 | 15 |
| | | Bottom of hole at 30.0 feet. | | | | | | |



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# BORING NUMBER B-9

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 579.7 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/18/25
**COMPLETED** 3/18/25
**AT TIME OF DRILLING** None
**LOGGED BY** TB
**CHECKED BY** CO
**AT END OF DRILLING** None
**NOTES** A bulk sample was taken from auger cuttings from 20-30 feet.
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL / MC / LL (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|
| | 0 | TOPSOIL - 9 Inches 0.8' | | | | | | |
| | | CRUSHED STONE - 2 Inches 0.9' | SS 1 | 83 | 2-2-3 (5) | NP | | 22 |
| | | FILL - Moist Loose Brown CLAYEY SAND w/Trace Gravel, Brick, and Slag Fragments 2.5' | | | | | | |
| 575 | 5 | Moist Stiff Brown LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL) | SS 2 | 83 | 3-5-7 (12) | 4.25 | | 24 |
| | | @6': Gray/Brown. w/Trace Calcite Stain Seam | SS 3 | 100 | 4-5-6 (11) | 4.25 | | 21 |
| 570 | 10 | @8': w/Trace Organics<br>LOI = 4.2% | ST 1 | 100 | | 2.66 | 107 | 19 |
| | | @11': Brown/Gray | | | | | | |
| 565 | 15 | | SS 4 | 100 | 3-5-7 (12) | 4.00 | | 15 |
| | | 18.0' | | | | | | |
| 560 | 20 | Moist Very Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL), PH=8.39 | SS 5 | 100 | 17-29-30 (59) | 12.00 | 125 | 8 |
| 555 | 25 | @23.5': Hard | SS 6 | 100 | 9-19-26 (45) | >4.5 | | 11 |
| 550 | 30 | | SS 7 | 89 | 12-19-25 (44) | >4.5 | | 14 |

▲ SPT N VALUE ▲

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# BORING NUMBER B-9

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL<br>20 40 60 80<br>▲ SPT N VALUE ▲<br>20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 545 | 35 | ▨ | 35.0' | SS<br>8 | 100 | 20-25-22<br>(47) | >4.5 | | 8<br>● ▲ |
| | | | Bottom of hole at 35.0 feet. | | | | | | |

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# BORING NUMBER B-10

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 576.4 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/19/25
**COMPLETED** 3/19/25
▽ **AT TIME OF DRILLING** 30.0 ft / Elev 546.4 ft
**LOGGED BY** TB
**CHECKED BY** CO
**AT END OF DRILLING** None
**NOTES**
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 / ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| | 0 | TOPSOIL - 8 Inches | | | | | | |
| 575 | | 0.7'<br>Moist Stiff Brown LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 1 | 83 | 2-3-6 (9) | 4.50 | | 25 |
| | 5 | | SS 2 | 100 | 5-6-9 (15) | >4.5 | | 21 |
| 570 | | @6.5': Brown/Gray, w/Trace Iron Oxide Stain Seam | SS 3 | 100 | 5-6-9 (15) | >4.5 | | 19 |
| | 10 | 7.4'<br>Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | SS 4 | 100 | 3-4-4 (8) | 2.36 | 114 | 16 |
| 565 | | 13.0'<br>Moist Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | | | | | | |
| | 15 | | SS 5 | 100 | 2-4-8 (12) | >4.5 | | 12 |
| 560 | | 17.0'<br>Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| | 20 | | SS 6 | 100 | 12-18-28 (46) | >4.5 | | 11 |
| 555 | | @23.5': Very Hard | | | | | | |
| | 25 | | SS 7 | 94 | 15-22-31 (53) | >4.5 | | 12 |
| 550 | | | | | | | | |
| | 30 ▽ | | SS 8 | 89 | 20-22-32 (54) | >4.5 | | 10 |

*(Continued Next Page)*

# BORING NUMBER B-10

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80<br>▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 545 | | ▨ | @32': Hard | | | | | | |
| | 35 | ▨ | 35.0' | SS<br>9 | 100 | 19-22-24<br>(46) | >4.5 | | 10 ● ▲ |
| | | | Bottom of hole at 35.0 feet. | | | | | | |

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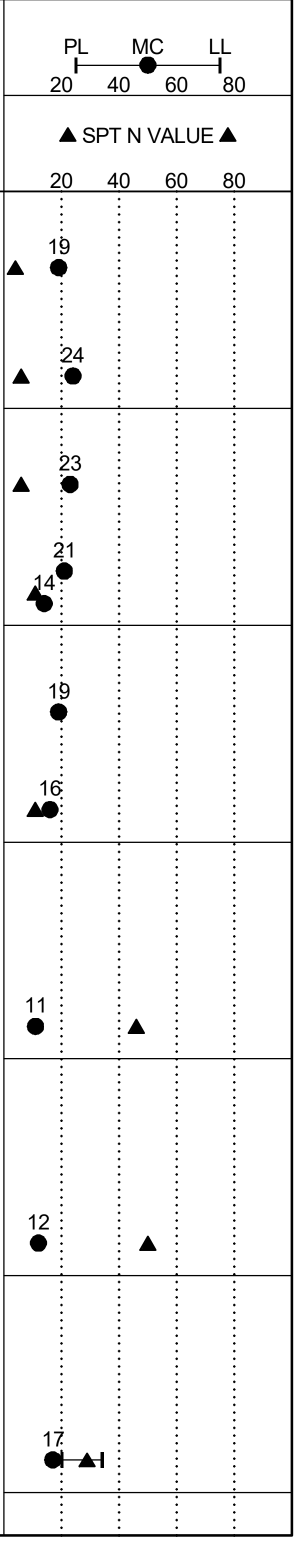
# BORING NUMBER B-11

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 577.4 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/18/25 **COMPLETED** 3/24/25
▽ **AT TIME OF DRILLING** 37.5 ft / Elev 539.9 ft
**LOGGED BY** TB **CHECKED BY** CO
▼ **AT END OF DRILLING** 5.5 ft / Elev 571.9 ft
**NOTES** Auger refusal encountered at 46.0 feet and 4.0 feet of rock cored.
▼ **144hrs AFTER DRILLING** 4.5 ft / Elev 572.9 ft



| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
|  | 0 |  | TOPSOIL - 2 Inches 0.2' |  |  |  |  |  |  |
| 575 |  |  | FILL - Moist Very Loose Brown/Orange BRICK FRAGMENTS w/Sand 2.5' | SS 1 | 11 | 3-3-1 (4) | NP |  | 19 |
|  | 5 |  | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)<br>▼ LOI = 4.1%<br>▼ | SS 2 | 89 | 2-3-3 (6) | 3.50 |  | 24 |
| 570 |  |  | @6': Brown/Gray 8.0' | SS 3 | 100 | 2-3-3 (6) | 1.50 |  | 23 |
|  | 10 |  | Moist Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)<br>LOI = 3.0%<br>@8.8': Gray | SS 4 | 100 | 3-5-6 (11) | 3.50<br>3.50 |  | 21<br>14 |
| 565 |  |  | @11': Brown/Gray, w/Trace Organics<br>LOI = 3.7% | ST 1 | 19 |  | 1.22 | 100 | 19 |
|  | 15 |  | 16.0' | SS 5 | 100 | 2-4-7 (11) | 3.25 |  | 16 |
| 560 |  |  | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) |  |  |  |  |  |  |
|  | 20 |  |  | SS 6 | 89 | 19-21-25 (46) | 12.94 | 121 | 11 |
| 555 |  |  |  |  |  |  |  |  |  |
|  | 25 |  | 27.0' | SS 7 | 100 | 12-21-29 (50) | >4.5 |  | 12 |
| 550 |  |  | Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL), PH=8.34 |  |  |  |  |  |  |
|  | 30 |  |  | SS 8 | 100 | 7-12-17 (29) | 5.00 | 110 | 17 |

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# BORING NUMBER B-11

PAGE 2 OF 2

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80<br>▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 545 | | | 32.0'<br>Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| | 35 | | | SS<br>9 | 100 | 17-21-22<br>(43) | >4.5 | | 9<br>● ▲ |
| 540 | | | ▽ 37.5'<br>Moist Very Hard Gray SANDY LEAN CLAY w/Dolomite Fragments (CL) | | | | | | |
| | 40 | | | SS<br>10 | 100 | 35-50/4" | >4.5 | | 9<br>● >>▲ |
| 535 | | | | | | | | | |
| | 45 | | | SS<br>11 | 88 | 25-32-50/5" | >4.5 | | 10<br>● >>▲ |
| | | | 46.0'<br>DOLOMITE<br>@47.3': Qu = 9389 psi | RC<br>1 | 40 | | | | |
| 530 | | | | | | | | | |
| | 50 | | 50.0' | | | | | | |
| | | | Bottom of hole at 50.0 feet. | | | | | | |

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# BORING NUMBER B-12

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 577.4 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/19/25
**COMPLETED** 3/19/25
▽ **AT TIME OF DRILLING** 37.0 ft / Elev 540.4 ft
**LOGGED BY** TB
**CHECKED BY** CO
▼ **AT END OF DRILLING** 38.0 ft / Elev 539.4 ft
**NOTES** Split spoon refusal encountered at 39.3 feet.
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL (20 40 60 80) ▲ SPT N VALUE ▲ (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|
| | 0 | TOPSOIL - 8 Inches | | | | | | |
| 575 | 0.7' | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)<br>LOI = 3.3% | SS 1 | 83 | 2-3-4 (7) | 3.50 | | 24 |
| | 3.0' / 5 | Moist Stiff Brown LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL) | SS 2 | 100 | 2-4-5 (9) | 4.25 | | 26 |
| 570 | 6.5' | Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL) | SS 3 | 100 | 3-3-5 (8) | >4.5 | | 22 |
| | 8.0' / 10 | Moist Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | SS 4 | 100 | 3-4-6 (10) | 3.25 | | 16 |
| 565 | | @11': w/Trace Organics<br>LOI = 1.9% | ST 1 | 100 | | 2.66 | 116 | 14 |
| | 15 | | SS 5 | 100 | 3-4-5 (9) | 4.00 | | 15 |
| 560 | 16.0' | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL), PH=8.34 | | | | | | |
| | 20 | | SS 6 | 89 | 9-20-25 (45) | >4.5 | | 11 |
| 555 | | | | | | | | |
| | 25 | | SS 7 | 100 | 14-22-25 (47) | 14.76 | 121 | 11 |
| 550 | | | | | | | | |
| | 30 | @29': Very Hard | SS 8 | 100 | 7-20-37 (57) | >4.5 | | 7 |

(Continued Next Page)

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# BORING NUMBER B-12

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL (20 40 60 80)<br>▲ SPT N VALUE ▲ (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|---|
| 545 | | ▨ | @32.5': Hard | | | | | | |
| | | ▨ | | SS<br>9 | 89 | 14-20-22<br>(42) | >4.5 | | 9 ●<br>▲ |
| | 35 | ▨ | | | | | | | |
| 540 | | ▨ | ▽ 37.0' | | | | | | |
| | | ▨ | Moist Very Hard Gray SANDY LEAN CLAY w/Dolomite Fragments (CL) ▼ | | | | | | |
| | | ▨ | 39.3' | SS<br>10 | 89 | 38-50/3" | >4.5 | | 8 ●<br>>>▲ |

Bottom of hole at 39.3 feet.

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# BORING NUMBER B-13

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 578.9 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/17/25

**COMPLETED** 3/24/25

▽ **AT TIME OF DRILLING** 39.8 ft / Elev 539.1 ft

**LOGGED BY** TB

**CHECKED BY** CO

▼ **AT END OF DRILLING** 6.3 ft / Elev 572.6 ft

**NOTES** Auger refusal encountered at 43.4 feet and 6.9 feet of rock cored.

▼ **168hrs AFTER DRILLING** 6.0 ft / Elev 572.9 ft

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 / ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | TOPSOIL - 8 Inches | | | | | | |
| | | | 0.7' | | | | | | |
| | | | Moist Soft Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)<br>LOI = 4.1% | SS 1 | 89 | 1-2-2 (4) | 1.75 | | 25 |
| 575 | | | 3.0' | | | | | | |
| | 5 | | Moist Medium Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL) | SS 2 | 100 | 2-3-5 (8) | 2.50 | | 26 |
| | | | ▼ 6.5' | | | | | | |
| | | | Moist Stiff Gray/Brown LEAN CLAY w/Sand and Trace Gravel (CL) | SS 3 | 100 | 2-4-5 (9) | 3.00 | | 31 |
| 570 | | | 9.0' | | | | | | |
| | 10 | | Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | SS 4 | 100 | 2-2-4 (6) | 0.73 | 106 | 20 |
| 565 | 15 | | | SS 5 | 100 | 3-3-5 (8) | 2.75 | | 16 |
| | | | 17.0' | ST 1 | 100 | | 4.73 | 120 | 9 |
| | | | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| 560 | 20 | | | SS 6 | 94 | 15-17-25 (42) | >4.5 | | 11 |
| 555 | 25 | | | SS 7 | 100 | 16-21-25 (46) | >4.5 | | 12 |
| 550 | 30 | | | SS 8 | 89 | 12-19-26 (45) | >4.5 | | 16 |

(Continued Next Page)

# BORING NUMBER B-13

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80<br>▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 545 | 35 | ▨ | 32.0'<br>Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | SS 9 | 100 | 7-9-13 (22) | 2.19 | 119 | 14 ● ▲ |
| 540 | 40 |  | 38.0'<br>Moist Very Dense Gray SILTY SAND w/Dolomite Fragments (SM) | SS 10 | 78 | 15-20-32 (52) | NP |  | 13 ● ▲ |
|  |  |  | 39.4' ▽<br>Moist Very Hard Gray SANDY LEAN CLAY w/Dolomite Fragments (CL) |  |  |  | >4.5 |  | 12 ● |
|  |  |  | 41.0'<br>WEATHERED DOLOMITE |  |  |  |  |  |  |
| 535 | 45 |  | 43.4'<br>DOLOMITE<br>@44.5': Qu = 9911 psi | RC 1 | 83 |  |  |  |  |
| 530 | 50 |  | 48.4'<br>DOLOMITE<br>@48.7': Qu = 8936 psi<br>50.3' | RC 2 | 48 |  |  |  |  |

Bottom of hole at 50.3 feet.

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# BORING NUMBER B-14

PAGE 1 OF 2

**CLIENT** Jones and Henry

**PROJECT NAME** Oak Harbor WWTP

**PROJECT NUMBER** 31874

**PROJECT LOCATION** Oak Harbor, OH

**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB

**RIG NO.** D70

**GROUND ELEVATION** 582.4 ft

**DRILLING METHOD** 3-1/4 in. HSA

**GROUND WATER LEVELS:**

**DATE STARTED** 3/24/25

**COMPLETED** 3/24/25

▽ **AT TIME OF DRILLING** 43.0 ft / Elev 539.4 ft

**LOGGED BY** TB

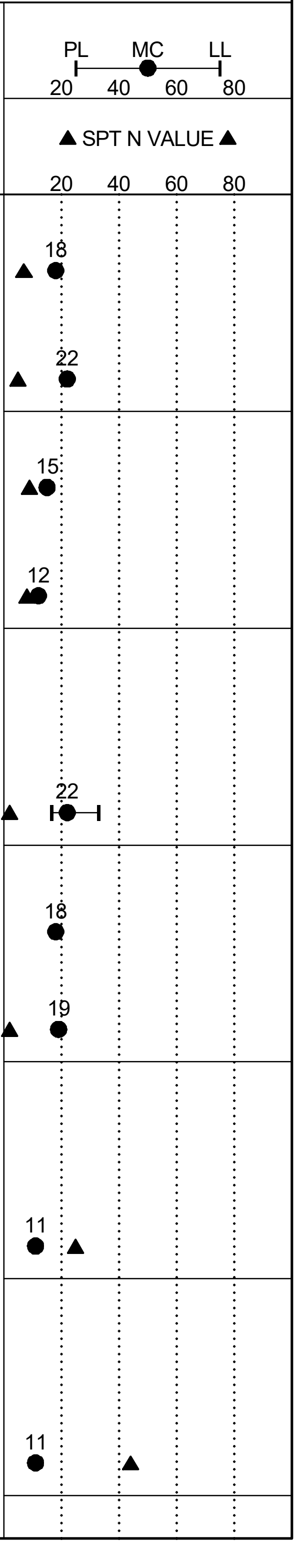
**CHECKED BY** CO

▼ **AT END OF DRILLING** 16.4 ft / Elev 566.0 ft

**NOTES** A bulk sample was taken from auger cuttings from 20-30 feet.

**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| | 0 | TOPSOIL - 7 Inches<br>0.6' | | | | | |
| 580 | | Moist Medium Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)<br>LOI = 3.3% | SS 1 | 89 | 3-3-4 (7) | 3.50 | |
| | 5 | @3': Gray, w/Trace Calcite Stain Seam<br>6.0' | SS 2 | 100 | 3-2-3 (5) | 2.75 | |
| 575 | | Moist Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)<br>8.0' | SS 3 | 100 | 3-4-5 (9) | 2.75 | |
| | 10 | Moist Medium Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL)<br>12.0' | SS 4 | 100 | 2-3-5 (8) | 3.00 | |
| 570 | 15 | Moist Very Soft Gray SANDY LEAN CLAY w/Trace Gravel (CL) | SS 5 | 100 | 1-1-1 (2) | 1.75 | |
| 565 | | ▼ @16': Brown/Gray, w/Trace Organics<br>LOI = 2.0%<br>UU Triaxial: C = 9.0 psi | ST 1 | 67 | | UU | 110 |
| | 20 | @18.5': Gray<br>23.0' | SS 6 | 100 | 1-1-1 (2) | 0.75 | |
| 560 | 25 | Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL), PH=8.19<br>28.5' | SS 7 | 100 | 6-11-14 (25) | >4.5 | |
| 555 | 30 | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | SS 8 | 100 | 9-21-23 (44) | 12.17 | 117 |



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# BORING NUMBER B-14

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH

| ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|---|
| 550 | | | | | | | | | |
| | | | 33.5' | | | | | | |
| | 35 | | Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) | SS<br>9 | 100 | 8-11-17<br>(28) | >4.5 | | 17 ● ▲ |
| | | | 36.0' | | | | | | |
| 545 | | | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL) | | | | | | |
| | 40 | | | SS<br>10 | 89 | 13-17-19<br>(36) | >4.5 | | 8 ● ▲ |
| 540 | | | | | | | | | |
| | | | ▽ 43.0' | | | | | | |
| | 45 | | Moist Very Dense Gray SILTY SAND w/Dolomite Fragments (SM)<br>45.0' | SS<br>11 | 80 | 50/5" | NP | | 10 ● >>▲ |
| | | | Bottom of hole at 45.0 feet. | | | | | | |

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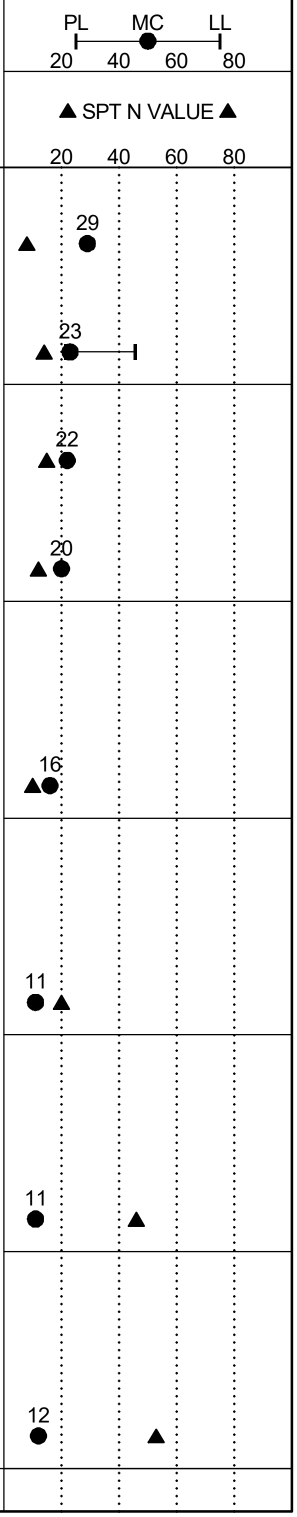
# BORING NUMBER B-15

PAGE 1 OF 1

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH
**DRILLING CONTRACTOR** TTL Engineering Services, LLC TB MB
**RIG NO.** D70
**GROUND ELEVATION** 581.2 ft
**DRILLING METHOD** 3-1/4 in. HSA
**GROUND WATER LEVELS:**
**DATE STARTED** 3/21/25
**COMPLETED** 3/21/25
**AT TIME OF DRILLING** None
**LOGGED BY** TB
**CHECKED BY** CO
**AT END OF DRILLING** None
**NOTES** A bulk sample was taken from auger cuttings from 20-30 feet.
**0hrs AFTER DRILLING** Borehole Sealed with Cement Bentonite Grout

| ELEVATION (ft) | DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | UNCONF. COMP. STR. (tsf) | DRY UNIT WT. (pcf) | PL MC LL |
|---|---|---|---|---|---|---|---|---|
|  | 0 | TOPSOIL - 3 Inches<br>0.3' |  |  |  |  |  |  |
| 580 |  | FILL - Moist Medium Stiff Black/Gray/Brown GRAVELLY LEAN CLAY w/Trace Organics<br>1.0' | SS 1 | 83 | 3-4-4 (8) | 3.75 |  | 29 |
|  | 5 | Moist Medium Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL)<br>3.0' | SS 2 | 100 | 3-6-8 (14) | >4.5 |  | 23 |
| 575 |  | Moist Stiff Brown LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL) | SS 3 | 100 | 5-6-9 (15) | 4.00 |  | 22 |
|  | 10 | @8.5': Gray/Brown | SS 4 | 100 | 3-5-7 (12) | >4.5 |  | 20 |
| 570 |  | @12.5': Gray |  |  |  |  |  |  |
| 565 | 15 |  | SS 5 | 100 | 3-4-6 (10) | 1.76 | 116 | 16 |
| 560 | 20 | @19': Very Stiff<br>23.0' | SS 6 | 100 | 3-6-14 (20) | >4.5 |  | 11 |
| 555 | 25 | Moist Hard Gray LEAN CLAY w/Sand, Trace Gravel, and Calcite Stain Seam (CL), PH=8.31 | SS 7 | 100 | 11-20-26 (46) | >4.5 |  | 11 |
|  | 30 | @28.5': Very Hard<br>30.0' | SS 8 | 94 | 15-21-32 (53) | 9.21 | 117 | 12 |
|  |  | Bottom of hole at 30.0 feet. |  |  |  |  |  |  |

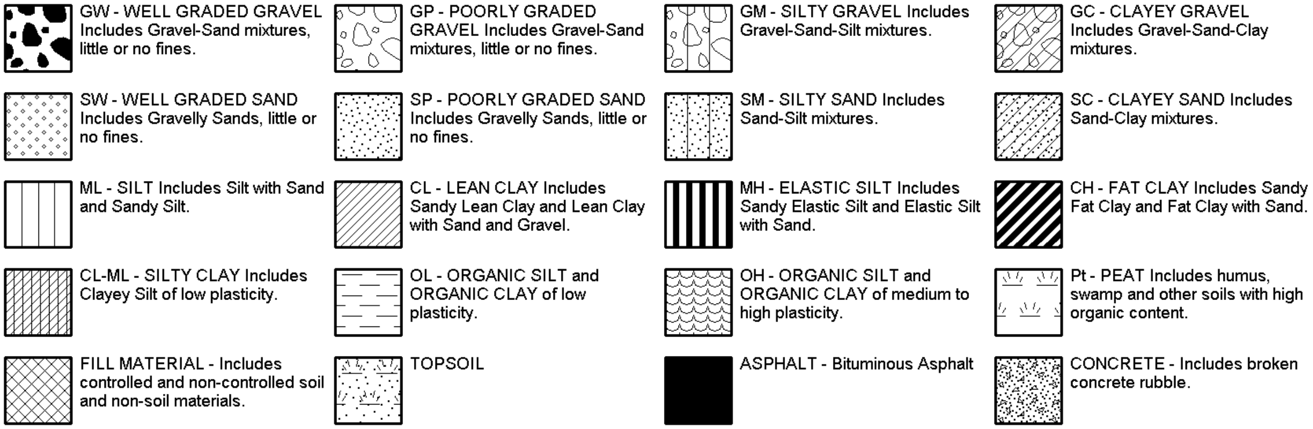


# APPENDIX B

# LEGEND KEY

# LEGEND KEY

## Unified Soil Classification System Soil Symbols



GW - WELL GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.

GP - POORLY GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.

GM - SILTY GRAVEL Includes Gravel-Sand-Silt mixtures.

GC - CLAYEY GRAVEL Includes Gravel-Sand-Clay mixtures.

SW - WELL GRADED SAND Includes Gravelly Sands, little or no fines.

SP - POORLY GRADED SAND Includes Gravelly Sands, little or no fines.

SM - SILTY SAND Includes Sand-Silt mixtures.

SC - CLAYEY SAND Includes Sand-Clay mixtures.

ML - SILT Includes Silt with Sand and Sandy Silt.

CL - LEAN CLAY Includes Sandy Lean Clay and Lean Clay with Sand and Gravel.

MH - ELASTIC SILT Includes Sandy Elastic Silt and Elastic Silt with Sand.

CH - FAT CLAY Includes Sandy Fat Clay and Fat Clay with Sand.

CL-ML - SILTY CLAY Includes Clayey Silt of low plasticity.

OL - ORGANIC SILT and ORGANIC CLAY of low plasticity.

OH - ORGANIC SILT and ORGANIC CLAY of medium to high plasticity.

Pt - PEAT Includes humus, swamp and other soils with high organic content.

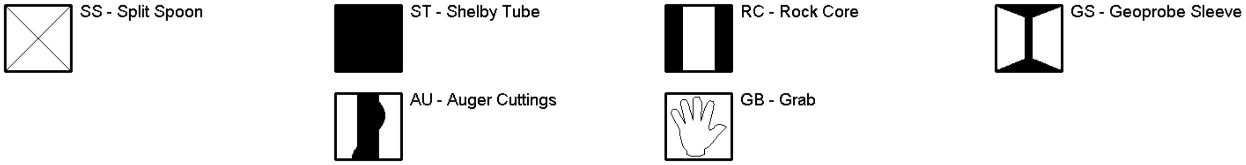
FILL MATERIAL - Includes controlled and non-controlled soil and non-soil materials.

TOPSOIL

ASPHALT - Bituminous Asphalt

CONCRETE - Includes broken concrete rubble.

## Sample Symbols



SS - Split Spoon

ST - Shelby Tube

RC - Rock Core

GS - Geoprobe Sleeve

AU - Auger Cuttings

GB - Grab

Notes:

1. Exploratory borings were drilled on March 17, 2025, to March 24, 2025, using hollow stem augers.
2. These logs are subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.
3. The borings were located in the field by VDT via a hand-held GPS device in accordance with a boring plan provided by Jones & Henry.
4. Latitude, Longitude, and ground surface elevation for all borings were surveyed by VDT via a hand-held GPS device. The accuracy from the handheld GPS device was generally found to be approximately 2 to 6 inches horizontal, and approximately 4 to 12 inches vertical.
5. Unconfined Compressive Strength:
   NP = Non-Plastic

# APPENDIX C

# LABORATORY TEST DATA

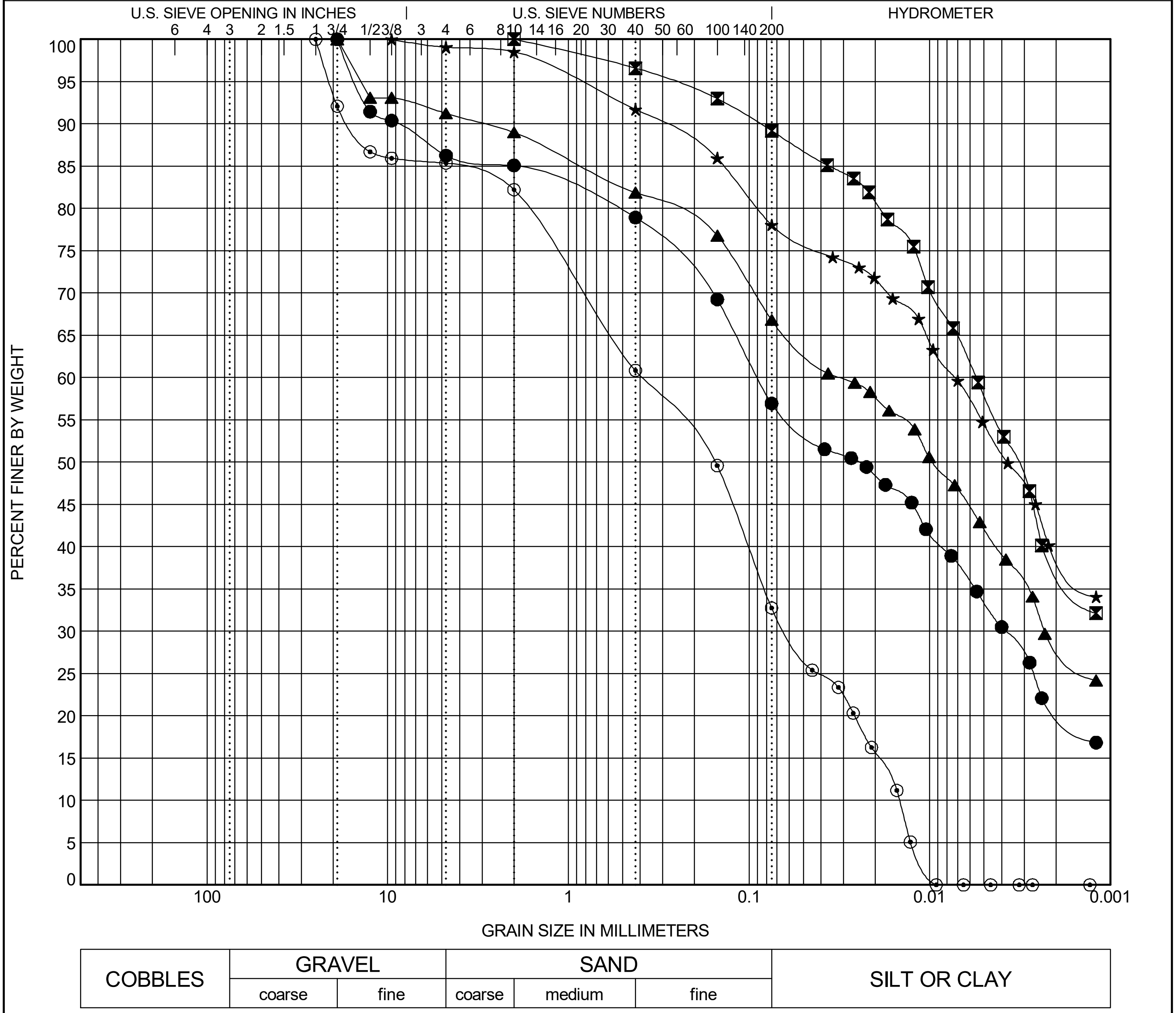
| Boring | Sample | Interval | SPT N | N60 | Water Content (%) | LOI (%) | Dry Density (pcf) | UCS (psf) | Gravel >4.75 | CSand >2.00 | MSand >.425 | FSand >.075 | Silt >.005 | Clay | Liquid Limit | Plastic Limit | PI | USCS Class | OHDOT Class | OHDOT Group | Total Density (pcf) | SPT Blows | PH | sulfate (ppm) | chlorides (ppm) | Restivity Ohm-cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | SS-1 | 1.0 - 2.5 | 14 | 20.44 | 10.8 |  |  | >4.5 | 14 | 1 | 6 | 22 | 23 | 33 | 33 | 14 | 19 | CL | A-6b | 8 |  | 6-7-7 |  |  |  |  |
| B-1 | SS-2 | 3.5 - 5.0 | 8 | 11.68 | 23.2 | 2.04 |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-5 |  |  |  |  |
| B-1 | SS-3 | 6.0 - 7.5 | 10 | 14.6 | 21.6 | 1.94 |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-6 |  |  |  |  |
| B-1 | SS-4 | 8.5 - 10.0 | 9 | 13.14 | 20.2 |  |  | 7500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-6 |  |  |  |  |
| B-1 | ST-1 | 11.0 - 13.0 |  |  | 15.4 | 3.7 | 115.1 | 4682 |  |  |  |  |  |  |  |  |  |  |  |  | 132.9 |  |  |  |  |  |
| B-1 | SS-5 | 13.5 - 15.0 | 9 | 13.14 | 15.9 |  |  | 5000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-5 |  |  |  |  |
| B-1 | SS-6 | 18.5 - 20.0 | 14 | 20.44 | 11.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-9 |  |  |  |  |
| B-1 | SS-7 | 23.5 - 25.0 | 54 | 78.84 | 10.5 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 13-26-28 |  |  |  |  |
| B-1 | SS-8 | 28.5 - 30.0 | 51 | 74.46 | 12.4 |  | 122.8 | 23970 |  |  |  |  |  |  |  |  |  |  |  |  | 138 | 17-21-30 |  |  |  |  |
| B-2 | SS-1 | 1.0 - 2.5 | 17 | 24.82 | 14.7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 5-8-9 |  |  |  |  |
| B-2 | SS-2 | 3.5 - 5.0 | 6 | 8.76 | 28.5 |  | 88.5 | 1275 |  |  |  |  |  |  |  |  |  |  |  |  | 113.8 | 2-2-4 |  |  |  |  |
| B-2 | SS-3 | 6.0 - 7.5 | 7 | 10.22 | 31.2 |  |  | 4500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-4 |  |  |  |  |
| B-2 | SS-4 | 8.5 - 10.0 | 7 | 10.22 | 22.7 |  |  | 5500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-4 |  |  |  |  |
| B-2 | SS-5 | 13.5 - 15.0 | 11 | 16.06 | 12.4 |  |  | 5000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4-5-6 |  |  |  |  |
| B-2 | SS-6 | 18.5 - 20.0 | 33 | 48.18 | 9.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 7-14-19 |  |  |  |  |
| B-2 | SS-7 | 23.5 - 25.0 | 51 | 74.46 | 11.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 14-22-29 | 8.22 |  |  |  |
| B-2 | SS-8 | 28.5 - 30.0 | 53 | 77.38 | 13.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 14-21-32 |  |  |  |  |
| B-3 | SS-1 | 1.0 - 2.5 | 7 | 10.22 | 14.9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-4 |  |  |  |  |
| B-3 | SS-2 | 3.5 - 5.0 | 6 | 8.76 | 22.5 | 2.36 |  | 8500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-3 |  |  |  |  |
| B-3 | SS-3 | 6.0 - 7.5 | 6 | 8.76 | 41 | 2.2 |  | 2000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-3 |  |  |  |  |
| B-3 | SS-4 | 8.5 - 10.0 | 13 | 18.98 | 22.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-8 |  |  |  |  |
| B-3 | SS-5 | 13.5 - 15.0 | 10 | 14.6 | 14.9 |  | 117.6 | 4756 |  |  |  |  |  |  |  |  |  |  |  |  | 135.1 | 2-4-6 |  |  |  |  |
| B-3 | SS-6 | 18.5 - 20.0 | 44 | 64.24 | 8.7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 8-18-26 |  |  |  |  |
| B-3-1 | SS-1 | 23.5 - 25.0 | 51 | 74.46 | 11 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 15-23-28 |  |  |  |  |
| B-3-1 | SS-2 | 28.5 - 30.0 | 43 | 62.78 | 14.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 13-18-25 |  |  |  |  |
| B-4 | SS-1 | 1.0 - 2.5 | 7 | 10.22 | 19 |  |  | 5500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-4 |  |  |  |  |
| B-4 | SS-2 | 3.5 - 5.0 | 7 | 10.22 | 24.8 |  |  | 7500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-4 |  |  |  |  |
| B-4 | SS-3 | 6.0 - 7.5 | 6 | 8.76 | 29.4 |  |  | 2000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-3 |  |  |  |  |
| B-4 | ST-1 | 8.0 - 10.0 |  |  | 21.9 | 4.59 | 101.9 | UU |  |  |  |  |  |  |  |  |  |  |  |  | 124.2 |  |  |  |  |  |
| B-4 | SS-4 | 11.0 - 12.5 | 6 | 8.76 | 17.3 |  |  | 4500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-3 |  |  |  |  |
| B-4 | SS-5 | 13.5 - 15.0 | 8 | 11.68 | 16.1 |  |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-4 |  |  |  |  |
| B-4 | SS-6 | 18.5 - 20.0 | 64 | 93.44 | 7.4 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 11-26-38 |  |  |  |  |
| B-4 | SS-7 | 23.5 - 25.0 | 43 | 62.78 | 11.7 |  | 122 | 5939 |  |  |  |  |  |  |  |  |  |  |  |  | 136.3 | 10-18-25 | 8.24 | 1966.5 | 18.28 | 47400 |
| B-4 | SS-8 | 28.5 - 30.0 | 44 | 64.24 | 13.9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 13-18-26 |  |  |  |  |
| B-5 | SS-1 | 1.0 - 2.5 | 8 | 11.68 | 28 |  |  | 5000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 1-3-5 |  |  |  |  |
| B-5 | SS-2 | 3.5 - 5.0 | 6 | 8.76 |  | 1.01 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-2-4 |  |  |  |  |
| B-5 | - | 4.0 - |  |  | 26.2 |  |  | 7500 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-5 | - | 4.8 - |  |  | 15.3 |  |  | 6000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-5 | SS-3 | 6.0 - 7.5 | 7 | 10.22 | 24.2 |  |  | 6500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-4 |  |  |  |  |
| B-5 | SS-4 | 8.5 - 10.0 | 8 | 11.68 | 14.6 |  | 115.8 | 3848 |  |  |  |  |  |  |  |  |  |  |  |  | 132.7 | 2-3-5 |  |  |  |  |
| B-5 | SS-5 | 13.5 - 15.0 | 8 | 11.68 | 15.9 |  |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-5 |  |  |  |  |
| B-5 | SS-6 | 18.5 - 20.0 | 41 | 59.86 | 10.9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 19-20-21 |  |  |  |  |
| B-5 | SS-7 | 23.5 - 25.0 | 52 | 75.92 | 10.5 |  | 123.3 | 27223 |  |  |  |  |  |  |  |  |  |  |  |  | 136.3 | 13-23-29 |  |  |  |  |
| B-5 | SS-8 | 28.5 - 30.0 | 26 | 37.96 | 14 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 7-10-16 |  |  |  |  |
| B-6 | SS-1 | 1.0 - 2.5 | 6 | 8.76 | 25.3 |  |  | 5500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-2-4 |  |  |  |  |
| B-6 | SS-2 | 3.5 - 5.0 | 8 | 11.68 | 24.5 |  |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 1-3-5 |  |  |  |  |
| B-6 | SS-3 | 6.0 - 7.5 | 9 | 13.14 | 23.7 | 1.01 | 94.9 | 3209 |  |  |  |  |  |  |  |  |  |  |  |  | 117.4 | 3-4-5 |  |  |  |  |
| B-6 | SS-4 | 8.5 - 10.0 | 10 | 14.6 | 15.6 |  |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4-4-6 |  |  |  |  |
| B-6 | ST-1 | 11.0 - 13.0 |  | 0 | 14.3 | 2.43 | 118.9 | 7335 |  |  |  |  |  |  |  |  |  |  |  |  | 135.9 |  |  |  |  |  |
| B-6 | SS-5 | 13.5 - 15.0 | 9 | 13.14 | 15.1 |  |  | 8500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4-4-5 |  |  |  |  |
| B-6 | SS-6 | 18.5 - 20.0 | 41 | 59.86 | 11.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 15-20-21 |  |  |  |  |
| B-6 | SS-7 | 23.5 - 25.0 | 48 | 70.08 | 11.3 |  | 118.6 | 18421 |  |  |  |  |  |  |  |  |  |  |  |  | 132 | 14-21-27 | 8.27 |  |  |  |
| B-6 | SS-8 | 28.5 - 30.0 | 29 | 42.34 | 14.6 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 7-12-17 |  |  |  |  |
| B-7 | SS-1 | 1.0 - 2.5 | 7 | 10.22 | 14.5 |  |  | NP |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-4 |  |  |  |  |
| B-7 | SS-2 | 3.5 - 5.0 | 13 | 18.98 | 24.2 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-8 |  |  |  |  |
| B-7 | SS-3 | 6.0 - 7.5 | 10 | 14.6 | 23.1 | 4.05 |  | >4.5 | 0 | 0 | 3 | 7 | 31 | 58 | 47 | 20 | 27 | CL | A-7-6 | 16 |  | 3-4-6 |  |  |  |  |
| B-7 | SS-4 | 8.5 - 10.0 | 14 | 20.44 | 14.4 |  |  | 7500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4-6-8 |  |  |  |  |
| B-7 | SS-5 | 13.5 - 15.0 | 13 | 18.98 | 14.5 |  | 113.7 | 7013 |  |  |  |  |  |  |  |  |  |  |  |  | 130.2 | 4-6-7 |  |  |  |  |
| B-7 | SS-6 | 18.5 - 20.0 | 42 | 61.32 | 11.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 17-18-24 |  |  |  |  |
| B-7 | SS-7 | 23.5 - 25.0 | 47 | 68.62 | 11.4 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 12-21-26 |  |  |  |  |
| B-7 | SS-8 | 28.5 - 30.0 | 29 | 42.34 | 15.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 9-12-17 |  |  |  |  |
| B-8 | SS-1 | 1.0 - 2.5 | 7 | 10.22 | 25.2 |  |  | 6500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 1-3-4 |  |  |  |  |
| B-8 | SS-2 | 3.5 - 5.0 | 9 | 13.14 | 25.9 |  |  | 7500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-5 |  |  |  |  |
| B-8 | SS-3 | 6.0 - 7.5 | 8 | 11.68 | 18.1 |  |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-4 |  |  |  |  |
| B-8 | SS-4 | 8.5 - 10.0 | 9 | 13.14 | 15 |  |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-5 |  |  |  |  |
| B-8 | SS-5 | 13.5 - 15.0 | 13 | 18.98 | 13.9 |  |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4-4-9 |  |  |  |  |
| B-8 | SS-6 | 18.5 - 20.0 | 58 | 84.68 | 9.6 |  |  | >4.5 | 9 | 2 | 7 | 15 | 25 | 42 | 30 | 12 | 18 | CL | A-6b | 10 |  | 20-25-33 |  |  |  |  |
| B-8 | SS-7 | 23.5 - 25.0 | 51 | 74.46 | 10.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 14-22-29 | 8.44 | 1855.7 | 20.84 | 51700 |
| B-8 | SS-8 | 28.5 - 30.0 | 32 | 46.72 | 14.9 |  | 115.8 | 9052 |  |  |  |  |  |  |  |  |  |  |  |  | 133.1 | 7-12-20 |  |  |  |  |
| B-9 | SS-1 | 1.0 - 2.5 | 5 | 7.3 | 22 |  |  | NP |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-2-3 |  |  |  |  |
| B-9 | SS-2 | 3.5 - 5.0 | 12 | 17.52 | 23.6 |  |  | 8500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-7 |  |  |  |  |
| B-9 | SS-3 | 6.0 - 7.5 | 11 | 16.06 | 21.1 |  |  | 8500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4-5-6 |  |  |  |  |
| B-9 | ST-1 | 8.0 - 10.0 |  |  | 18.8 | 4.24 | 107.3 | 5323 |  |  |  |  |  |  |  |  |  |  |  |  | 127.5 |  |  |  |  |  |
| B-9 | SS-4 | 13.5 - 15.0 | 12 | 17.52 | 15.4 |  |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-7 |  |  |  |  |
| B-9 | SS-5 | 18.5 - 20.0 | 59 | 86.14 | 8.3 |  | 125 | 24000 |  |  |  |  |  |  |  |  |  |  |  |  | 135.3 | 17-29-30 |  |  |  |  |
| B-9 | SS-6 | 23.5 - 25.0 | 45 | 65.7 | 10.7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 9-19-26 | 8.39 |  |  |  |
| B-9 | SS-7 | 28.5 - 30.0 | 44 | 64.24 | 14 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 12-19-25 |  |  |  |  |
| B-9 | SS-8 | 33.5 - 35.0 | 47 | 68.62 | 8.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 20-25-22 |  |  |  |  |
| B-10 | SS-1 | 1.0 - 2.5 | 9 | 13.14 | 24.5 |  |  | 9000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-6 |  |  |  |  |
| B-10 | SS-2 | 3.5 - 5.0 | 15 | 21.9 | 20.7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 5-6-9 |  |  |  |  |
| B-10 | SS-3 | 6.0 - 7.5 | 15 | 21.9 | 18.7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 5-6-9 |  |  |  |  |
| B-10 | SS-4 | 8.5 - 10.0 | 8 | 11.68 | 16.3 |  | 114.1 | 4717 |  |  |  |  |  |  |  |  |  |  |  |  | 132.8 | 3-4-4 |  |  |  |  |
| B-10 | SS-5 | 13.5 - 15.0 | 12 | 17.52 | 12.5 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-8 |  |  |  |  |
| B-10 | SS-6 | 18.5 - 20.0 | 46 | 67.16 | 10.9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 12-18-28 |  |  |  |  |
| B-10 | SS-7 | 23.5 - 25.0 | 53 | 77.38 | 11.6 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 15-22-31 |  |  |  |  |
| B-10 | SS-8 | 28.5 - 30.0 | 54 | 78.84 | 9.5 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 20-22-32 |  |  |  |  |
| B-10 | SS-9 | 33.5 - 35.0 | 46 | 67.16 | 10.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 19-22-24 |  |  |  |  |
| B-11 | SS-1 | 1.0 - 2.5 | 4 | 5.84 | 18.6 |  |  | NP |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-1 |  |  |  |  |
| B-11 | SS-2 | 3.5 - 5.0 | 6 | 8.76 | 23.9 | 4.09 |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-3 |  |  |  |  |
| B-11 | SS-3 | 6.0 - 7.5 | 6 | 8.76 | 22.7 |  |  | 3000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-3 |  |  |  |  |
| B-11 | SS-4 | 8.5 - 10.0 | 11 | 16.06 |  | 3.04 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-6 |  |  |  |  |
| B-11 | - | 8.8 - |  |  | 21.1 |  |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-11 | - | 9.5 - |  |  | 14.3 |  |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-11 | ST-1 | 11.0 - 13.0 |  |  | 18.5 | 3.66 | 100.3 | 2447 |  |  |  |  |  |  |  |  |  |  |  |  | 118.8 |  |  |  |  |  |
| B-11 | SS-5 | 13.5 - 15.0 | 11 | 16.06 | 15.7 |  |  | 6500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-7 |  |  |  |  |
| B-11 | SS-6 | 18.5 - 20.0 | 46 | 67.16 | 10.7 |  | 121.2 | 25878 |  |  |  |  |  |  |  |  |  |  |  |  | 134.2 | 19-21-25 |  |  |  |  |
| B-11 | SS-7 | 23.5 - 25.0 | 50 | 73 | 12 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 12-21-29 | 8.34 | 520.5 | 48.97 | 3390 |
| B-11 | SS-8 | 28.5 - 30.0 | 29 | 42.34 | 16.8 |  | 110 | 10002 | 1 | 1 | 7 | 14 | 24 | 54 | 34 | 20 | 14 | CL | A-6a | 10 | 128.5 | 7-12-17 |  |  |  |  |
| B-11 | SS-9 | 33.5 - 35.0 | 43 | 62.78 | 9.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 17-21-22 |  |  |  |  |
| B-11 | SS-10 | 38.5 - 39.3 |  |  | 9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 35-50/4" |  |  |  |  |
| B-11 | SS-11 | 43.5 - 44.9 | 82 | 119.72 | 9.8 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 25-32-50/5" |  |  |  |  |
| B-11 | RC-1 | 46.0 - 50.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

| Boring | Sample | Interval | SPT N | N60 | Water Content (%) | LOI (%) | Dry Density (pcf) | UCS (psf) | Gravel >4.75 | CSand >2.00 | MSand >.425 | FSand >.075 | Silt >.005 | Clay | Liquid Limit | Plastic Limit | PI | USCS Class | OHDOT Class | OHDOT Group | Total Density (pcf) | SPT Blows | PH | sulfate (ppm) | chlorides (ppm) | Restivity Ohm-cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-12 | SS-1 | 1.0 - 2.5 | 7 | 10.22 | 24.1 | 3.32 |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-4 |  |  |  |  |
| B-12 | SS-2 | 3.5 - 5.0 | 9 | 13.14 | 26.4 |  |  | 8500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-5 |  |  |  |  |
| B-12 | SS-3 | 6.0 - 7.5 | 8 | 11.68 | 22.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-5 |  |  |  |  |
| B-12 | SS-4 | 8.5 - 10.0 | 10 | 14.6 | 15.6 |  |  | 6500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-6 |  |  |  |  |
| B-12 | ST-1 | 11.0 - 13.0 |  |  | 14.4 | 1.91 | 116.4 | 5321 |  |  |  |  |  |  |  |  |  |  |  |  | 133.1 |  |  |  |  |  |
| B-12 | SS-5 | 13.5 - 15.0 | 9 | 13.14 | 15.3 |  |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-5 |  |  |  |  |
| B-12 | SS-6 | 18.5 - 20.0 | 45 | 65.7 | 10.8 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 9-20-25 |  |  |  |  |
| B-12 | SS-7 | 23.5 - 25.0 | 47 | 68.62 | 11.2 |  | 120.6 | 29523 |  |  |  |  |  |  |  |  |  |  |  |  | 134.1 | 14-22-25 | 8.34 |  |  |  |
| B-12 | SS-8 | 28.5 - 30.0 | 57 | 83.22 | 7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 7-20-37 |  |  |  |  |
| B-12 | SS-9 | 33.5 - 35.0 | 42 | 61.32 | 9.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 14-20-22 |  |  |  |  |
| B-12 | SS-10 | 38.5 - 39.3 |  |  | 8.1 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 38-50/3" |  |  |  |  |
| B-13 | SS-1 | 1.0 - 2.5 | 4 | 5.84 | 25.1 | 4.11 |  | 3500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 1-2-2 |  |  |  |  |
| B-13 | SS-2 | 3.5 - 5.0 | 8 | 11.68 | 25.5 |  |  | 5000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-5 |  |  |  |  |
| B-13 | SS-3 | 6.0 - 7.5 | 9 | 13.14 | 31.3 |  |  | 6000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-4-5 |  |  |  |  |
| B-13 | SS-4 | 8.5 - 10.0 | 6 | 8.76 | 20.3 |  | 106.3 | 1469 |  |  |  |  |  |  |  |  |  |  |  |  | 127.9 | 2-2-4 |  |  |  |  |
| B-13 | SS-5 | 13.5 - 15.0 | 8 | 11.68 | 16.1 |  |  | 5500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-5 |  |  |  |  |
| B-13 | ST-1 | 16.0 - 17.2 |  |  | 9.2 |  | 120.3 | 9453 |  |  |  |  |  |  |  |  |  |  |  |  | 131.4 |  |  |  |  |  |
| B-13 | SS-6 | 18.5 - 20.0 | 42 | 61.32 | 11.5 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 15-17-25 |  |  |  |  |
| B-13 | SS-7 | 23.5 - 25.0 | 46 | 67.16 | 11.9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 16-21-25 |  |  |  |  |
| B-13 | SS-8 | 28.5 - 30.0 | 45 | 65.7 | 15.9 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 12-19-26 |  |  |  |  |
| B-13 | SS-9 | 33.5 - 35.0 | 22 | 32.12 | 14.2 |  | 118.6 | 4379 |  |  |  |  |  |  |  |  |  |  |  |  | 135.5 | 7-9-13 |  |  |  |  |
| B-13 | SS-10 | 38.5 - 40.0 | 52 | 75.92 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 15-20-32 |  |  |  |  |
| B-13 | - | 39.0 - |  |  | 12.9 |  |  | NP | 15 | 3 | 21 | 28 | 33 | 0 | NP | NP | NP | SM | A-2-4 | 0 |  |  |  |  |  |  |
| B-13 | - | 39.8 - |  |  | 12.3 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-13 | RC-1 | 43.4 - 48.4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-13 | RC-2 | 48.4 - 50.3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B-14 | SS-1 | 1.0 - 2.5 | 7 | 10.22 | 18.4 | 3.3 |  | 7000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-3-4 |  |  |  |  |
| B-14 | SS-2 | 3.5 - 5.0 | 5 | 7.3 | 21.8 |  |  | 5500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-2-3 |  |  |  |  |
| B-14 | SS-3 | 6.0 - 7.5 | 9 | 13.14 | 15.2 |  |  | 5500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-5 |  |  |  |  |
| B-14 | SS-4 | 8.5 - 10.0 | 8 | 11.68 | 11.9 |  |  | 6000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2-3-5 |  |  |  |  |
| B-14 | SS-5 | 13.5 - 15.0 | 2 | 2.92 | 21.6 |  |  | 3500 | 2 | 2 | 6 | 22 | 26 | 43 | 33 | 16 | 17 | CL | A-6b | 10 |  | 1-1-1 |  |  |  |  |
| B-14 | ST-1 | 16.0 - 18.0 |  |  | 17.9 | 1.98 | 110 | UU |  |  |  |  |  |  |  |  |  |  |  |  | 129.7 |  |  |  |  |  |
| B-14 | SS-6 | 18.5 - 20.0 | 2 | 2.92 | 18.9 |  |  | 1500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 1-1-1 |  |  |  |  |
| B-14 | SS-7 | 23.5 - 25.0 | 25 | 36.5 | 11.4 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 6-11-14 | 8.19 |  |  |  |
| B-14 | SS-8 | 28.5 - 30.0 | 44 | 64.24 | 11.1 |  | 117.1 | 24334 |  |  |  |  |  |  |  |  |  |  |  |  | 130 | 9-21-23 |  |  |  |  |
| B-14 | SS-9 | 33.5 - 35.0 | 28 | 40.88 | 16.7 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 8-11-17 |  |  |  |  |
| B-14 | SS-10 | 38.5 - 40.0 | 36 | 52.56 | 7.8 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 13-17-19 |  |  |  |  |
| B-14 | SS-11 | 43.5 - 43.9 |  |  | 9.9 |  |  | NP |  |  |  |  |  |  |  |  |  |  |  |  |  | 50/5" |  |  |  |  |
| B-15 | SS-1 | 1.0 - 2.5 | 8 | 11.68 | 28.6 |  |  | 7500 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-4-4 |  |  |  |  |
| B-15 | SS-2 | 3.5 - 5.0 | 14 | 20.44 | 23.3 |  |  | >4.5 | 0 | 0 | 4 | 11 | 27 | 58 | 46 | 21 | 25 | CL | A-7-6 | 15 |  | 3-6-8 |  |  |  |  |
| B-15 | SS-3 | 6.0 - 7.5 | 15 | 21.9 | 22.1 |  |  | 8000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 5-6-9 |  |  |  |  |
| B-15 | SS-4 | 8.5 - 10.0 | 12 | 17.52 | 20 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-5-7 |  |  |  |  |
| B-15 | SS-5 | 13.5 - 15.0 | 10 | 14.6 | 15.9 |  | 115.6 | 3514 |  |  |  |  |  |  |  |  |  |  |  |  | 134 | 3-4-6 |  |  |  |  |
| B-15 | SS-6 | 18.5 - 20.0 | 20 | 29.2 | 11.2 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3-6-14 |  |  |  |  |
| B-15 | SS-7 | 23.5 - 25.0 | 46 | 67.16 | 11.4 |  |  | >4.5 |  |  |  |  |  |  |  |  |  |  |  |  |  | 11-20-26 | 8.31 |  |  |  |
| B-15 | SS-8 | 28.5 - 30.0 | 53 | 77.38 | 11.8 |  | 116.5 | 18421 |  |  |  |  |  |  |  |  |  |  |  |  | 130.3 | 15-21-32 |  |  |  |  |

Verdantas, LLC.
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

# GRAIN SIZE DISTRIBUTION

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH



| | Specimen Identification | | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | **B-1** | **1.0** | **SANDY LEAN CLAY (CL)** | **33** | **14** | **19** | | |
| ☒ | **B-7** | **6.0** | **LEAN CLAY (CL)** | **47** | **20** | **27** | | |
| ▲ | **B-8** | **18.5** | **SANDY LEAN CLAY (CL)** | **30** | **12** | **18** | | |
| ★ | **B-11** | **28.5** | **LEAN CLAY with SAND (CL)** | **34** | **20** | **14** | | |
| ⊙ | **B-13** | **39.0** | **SILTY SAND (SM)** | **NP** | **NP** | **NP** | **0.7** | **26.7** |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | **B-1** | **1.0** | **19** | **0.089** | **0.004** | | **13.7** | **29.3** | **23.5** | **33.4** |
| ☒ | **B-7** | **6.0** | **2** | **0.006** | | | **0.0** | **10.8** | **31.3** | **57.9** |
| ▲ | **B-8** | **18.5** | **19** | **0.031** | **0.002** | | **8.8** | **24.4** | **24.7** | **42.1** |
| ★ | **B-11** | **28.5** | **9.5** | **0.007** | | | **0.9** | **21.0** | **23.6** | **54.5** |
| ⊙ | **B-13** | **39.0** | **25** | **0.393** | **0.062** | **0.015** | **14.6** | **52.6** | **32.8** | **0.0** |

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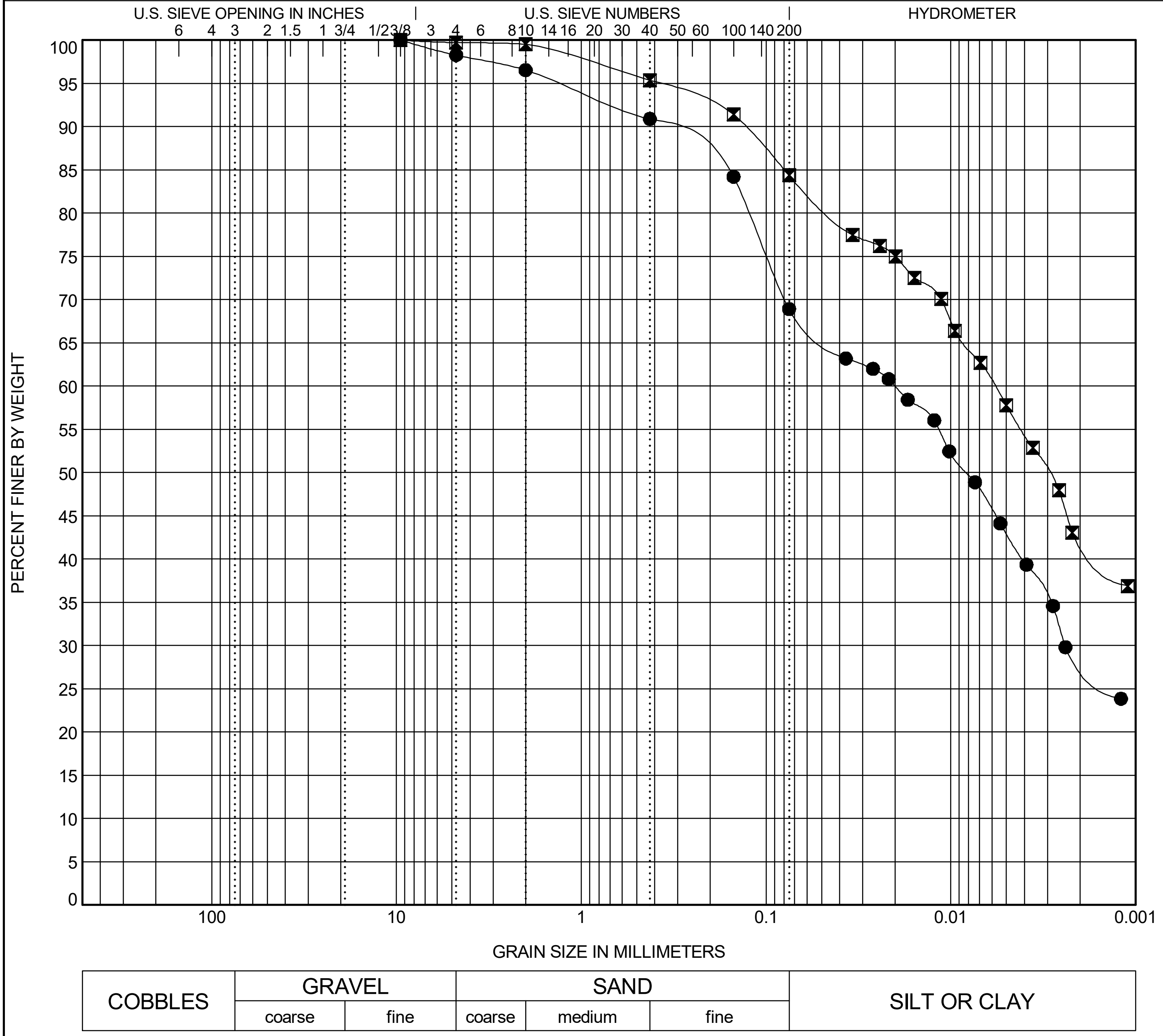
# GRAIN SIZE DISTRIBUTION

**CLIENT** Jones and Henry
**PROJECT NAME** Oak Harbor WWTP
**PROJECT NUMBER** 31874
**PROJECT LOCATION** Oak Harbor, OH



| Specimen Identification | | USCS Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● **B-14** | **13.5** | **SANDY LEAN CLAY (CL)** | **33** | **16** | **17** | | |
| ☒ **B-15** | **3.5** | **LEAN CLAY with SAND (CL)** | **46** | **21** | **25** | | |

| Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|
| ● **B-14** | **13.5** | **9.5** | **0.02** | **0.002** | | **1.7** | **29.4** | **25.9** | **43.0** |
| ☒ **B-15** | **3.5** | **9.5** | **0.006** | | | **0.3** | **15.4** | **26.6** | **57.8** |

## UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS IN TRIAXIAL COMPRESSION (ASTM D 2850)

Project: Oak Harbor WWTP
Client: Jones & Henry
Sample ID: B-14 ST-1
Project No.: 31874

Date: 4/3/2025
File: 31874B-14ST-1
Depth: 16.0 - 18.0'
Specimen ID: "C" (17.0 - 17.5 Feet)

## SAMPLE PROPERTIES

Visual Description: Brown/Gray Sandy LEAN CLAY w/ Trace Gravel, and Organics (CL)

Diameter: 2.88 in.
Area: 6.514 in^2
Length: 6.08 in.
Initial Void Ratio: 0.56
Chamber Pressure: 14 psi

Initial Dry Unit Weight of Sample: 110.2 pcf
Initial Moisture Content: 17.9 %
Specific Gravity (assumed): 2.75
Initial Degree of Saturation: 88 %
Proving Ring Number: 1155-12-13322

## STRESS-STRAIN DATA

| Speciman Deformation (in) | Vertical Strain | Proving Ring Reading | Piston Load (lbs) | Corrected Area (in^2) | Deviator Stress (psi) |
|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 6.514 | 0.0 |
| 0.010 | 0.002 | 4.0 | 2.7 | 6.525 | 0.4 |
| 0.020 | 0.003 | 7.5 | 5.1 | 6.536 | 0.8 |
| 0.030 | 0.005 | 10.0 | 6.9 | 6.547 | 1.0 |
| 0.040 | 0.007 | 12.5 | 8.6 | 6.558 | 1.3 |
| 0.050 | 0.008 | 17.0 | 11.7 | 6.568 | 1.8 |
| 0.075 | 0.012 | 24.5 | 16.8 | 6.596 | 2.5 |
| 0.100 | 0.016 | 33.5 | 23.0 | 6.623 | 3.5 |
| 0.125 | 0.021 | 43.5 | 29.8 | 6.651 | 4.5 |
| 0.150 | 0.025 | 53.5 | 36.7 | 6.679 | 5.5 |
| 0.175 | 0.029 | 63.0 | 43.2 | 6.707 | 6.4 |
| 0.200 | 0.033 | 73.5 | 50.4 | 6.736 | 7.5 |
| 0.250 | 0.041 | 90.0 | 61.7 | 6.794 | 9.1 |
| 0.300 | 0.049 | 105.5 | 72.4 | 6.853 | 10.6 |
| 0.350 | 0.058 | 120.5 | 82.7 | 6.912 | 12.0 |
| 0.400 | 0.066 | 131.0 | 89.9 | 6.973 | 12.9 |
| 0.450 | 0.074 | 141.5 | 97.1 | 7.035 | 13.8 |
| 0.500 | 0.082 | 150.5 | 103.2 | 7.098 | 14.5 |
| 0.550 | 0.090 | 159.0 | 109.1 | 7.162 | 15.2 |
| 0.600 | 0.099 | 166.0 | 113.9 | 7.228 | 15.8 |
| 0.650 | 0.107 | 173.0 | 118.7 | 7.294 | 16.3 |
| 0.700 | 0.115 | 180.5 | 123.8 | 7.362 | 16.8 |
| 0.750 | 0.123 | 185.5 | 127.3 | 7.431 | 17.1 |
| 0.800 | 0.132 | 191.0 | 131.0 | 7.501 | 17.5 |
| 0.850 | 0.140 | 195.5 | 134.1 | 7.573 | 17.7 |
| 0.900 | 0.148 | 200.5 | 137.5 | 7.646 | 18.0 |
| 0.912 | 0.150 | 201.5 | 138.2 | 7.664 | 18.0 |
| | | | | | |
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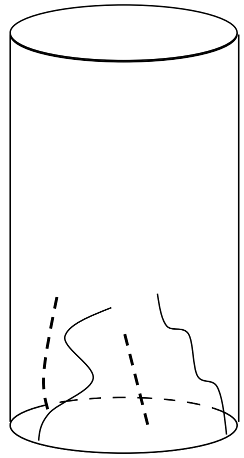


Sketch of Tested Specimen

## RESULTS

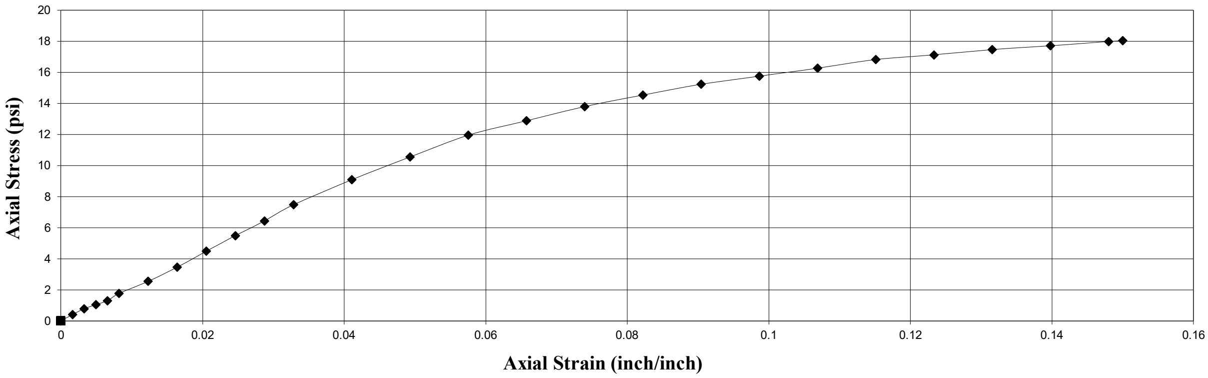
Maximum Deviator Stress 18.0 psi

# Unconsolidated - Undrained Triaxial Shear Strength Test

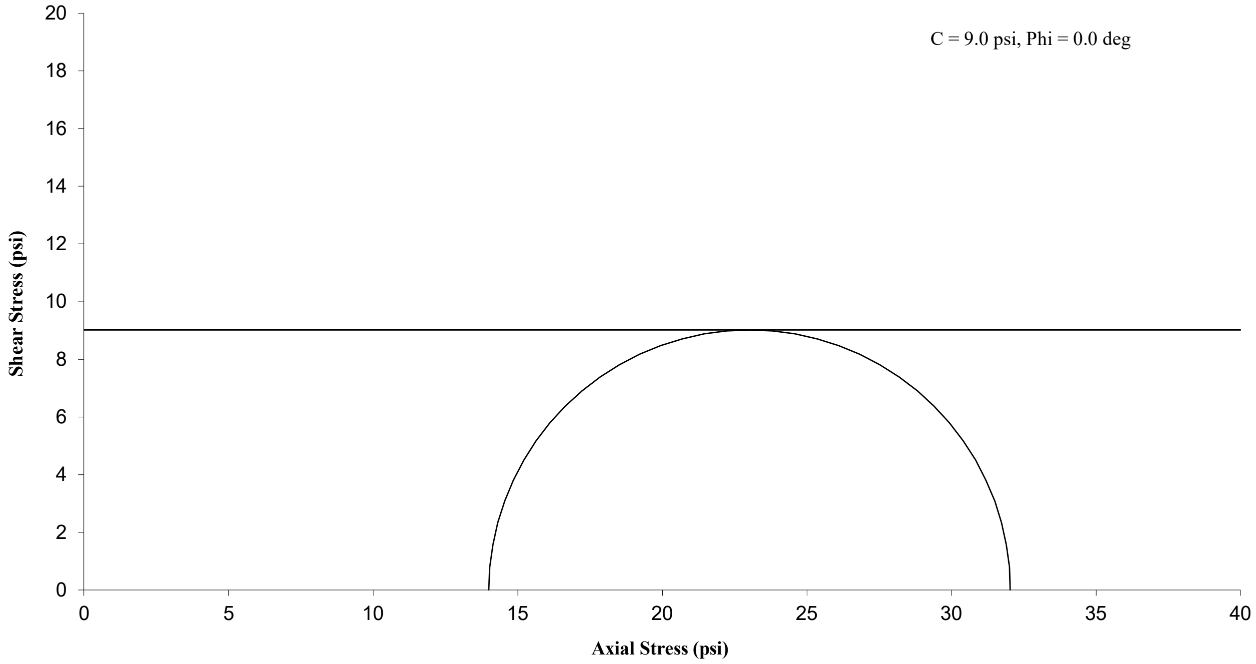
ASTM D 2850

| General Sample Data | | Triaxial Specimen Data | | | |
|---|---|---|---|---|---|
| Project No.: | 31874 | Symbol | ◆ | ■ | ● |
| Project: | Oak Harbor WWTP | Init. Specimen Height (in.) | 6.08 | - | - |
| Sample ID: | B-14 ST-1 | Init. Specimen Diameter (in.) | 2.88 | - | - |
| Sample Interval: | 16.0 - 18.0' | Init. Moisture Content* (%) | 17.9 | - | - |
| Soil Description: | Brown/Gray Sandy LEAN CLAY w/ Trace Gravel, and Organics (CL) | Init. Dry Unit Weight (pcf) | 110.2 | - | - |
| Liquid Limit: | 33 | Init. Void Ratio | 0.56 | - | - |
| Plastic Limit: | 16 | Init. Degree of Saturation (%) | 88 | - | - |
| Plasticity Index: | 17 | Minor Principal Stress (psi) | 14.0 | - | - |
| Specific Gravity: | 2.75 (Assumed) | Deviator Stress at Failure (psi) | 18.0 | - | - |
| Rate of Strain: | 0.03 Inches per Minute | Major Principal Stress (psi) | 32.0 | - | - |
| Failure Criteria: | Peak Deviator Stress or Deviator Stress at 15% Axial Strain | Axial Strain at Failure (%) | 15.0 | - | - |

## Stress/Strain



## Mohr Circle Plot



# UNCONSOLIDATED, UNDRAINED COMPRESSIVE STRENGTH OF COHESIVE SOILS IN TRIAXIAL COMPRESSION (ASTM D 2850)

Project: Oak Harbor WWTP
Client: Jones & Henry
Sample ID: B-4 ST-1
Project No.: 31874

Date: 4/3/2025
File: 31874B-4ST-1
Depth: 8.0 - 10.0'
Specimen ID: "A" (8.0 - 8.5 Feet)

## SAMPLE PROPERTIES

Visual Description: Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)

Diameter: 2.88 in.
Area: 6.514 in^2
Length: 5.40 in.
Initial Void Ratio: 0.68
Chamber Pressure: 7 psi

Initial Dry Unit Weight of Sample: 102.1 pcf
Initial Moisture Content: 21.9 %
Specific Gravity (assumed): 2.75
Initial Degree of Saturation: 88 %
Proving Ring Number: 1155-12-13322

## STRESS-STRAIN DATA

| Speciman Deformation (in) | Vertical Strain | Proving Ring Reading | Piston Load (lbs) | Corrected Area (in^2) | Deviator Stress (psi) |
|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 6.514 | 0.0 |
| 0.010 | 0.002 | 11.0 | 7.5 | 6.526 | 1.2 |
| 0.020 | 0.004 | 20.0 | 13.7 | 6.539 | 2.1 |
| 0.030 | 0.006 | 28.0 | 19.2 | 6.551 | 2.9 |
| 0.040 | 0.007 | 36.5 | 25.0 | 6.563 | 3.8 |
| 0.050 | 0.009 | 44.5 | 30.5 | 6.575 | 4.6 |
| 0.075 | 0.014 | 62.5 | 42.9 | 6.606 | 6.5 |
| 0.100 | 0.019 | 79.5 | 54.5 | 6.637 | 8.2 |
| 0.125 | 0.023 | 99.0 | 67.9 | 6.669 | 10.2 |
| 0.150 | 0.028 | 112.5 | 77.2 | 6.701 | 11.5 |
| 0.175 | 0.032 | 129.0 | 88.5 | 6.733 | 13.1 |
| 0.200 | 0.037 | 146.0 | 100.2 | 6.765 | 14.8 |
| 0.250 | 0.046 | 169.5 | 116.3 | 6.831 | 17.0 |
| 0.300 | 0.056 | 184.5 | 126.6 | 6.898 | 18.3 |
| 0.350 | 0.065 | 193.5 | 132.7 | 6.966 | 19.1 |
| 0.400 | 0.074 | 202.5 | 138.9 | 7.036 | 19.7 |
| 0.450 | 0.083 | 204.5 | 140.3 | 7.107 | 19.7 |
| 0.500 | 0.093 | 205.0 | 140.6 | 7.179 | 19.6 |
| 0.550 | 0.102 | 205.5 | 141.0 | 7.253 | 19.4 |
| 0.553 | 0.102 | 205.5 | 141.0 | 7.258 | 19.4 |
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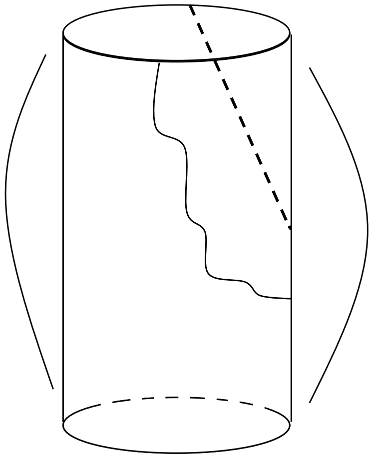


Sketch of Tested Specimen

## RESULTS

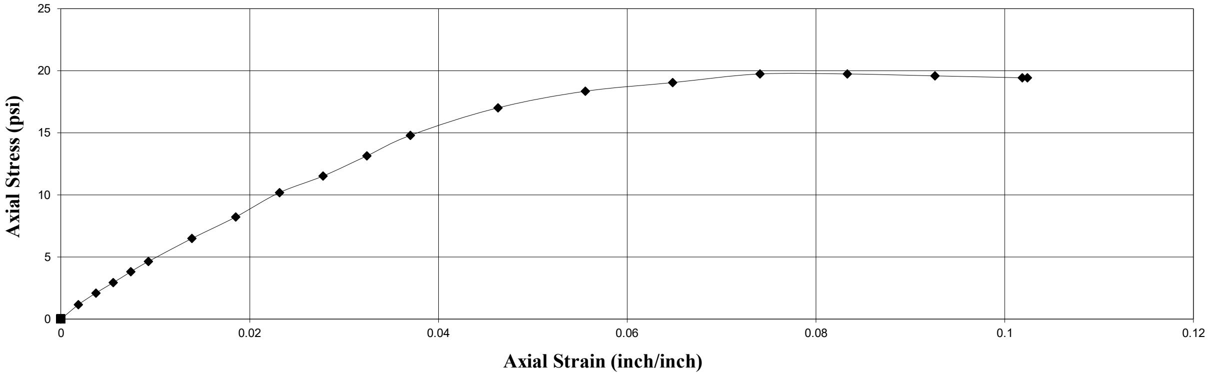
Maximum Deviator Stress 19.7 psi

## Unconsolidated - Undrained Triaxial Shear Strength Test

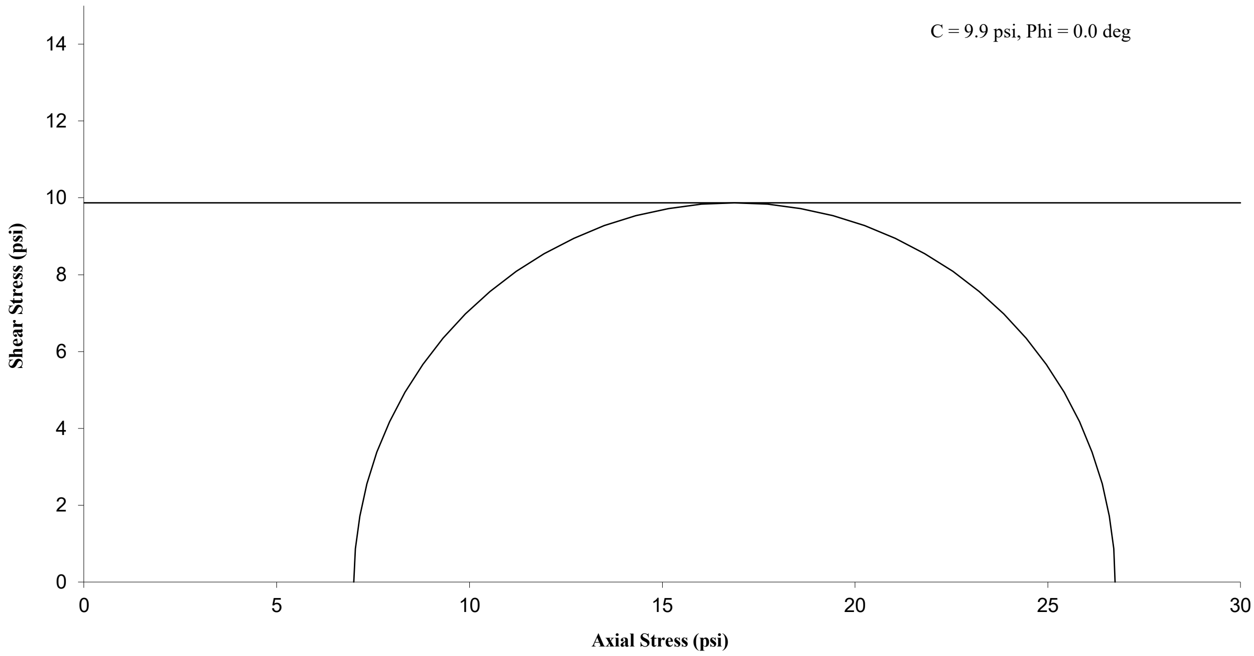
ASTM D 2850

| General Sample Data | | Triaxial Specimen Data | | | |
|---|---|---|---|---|---|
| Project No.: | 31874 | Symbol | ◆ | ■ | ● |
| Project: | Oak Harbor WWTP | Init. Specimen Height (in.) | 5.40 | - | - |
| Sample ID: | B-4 ST-1 | Init. Specimen Diameter (in.) | 2.88 | - | - |
| Sample Interval: | 8.0 - 10.0' | Init. Moisture Content* (%) | 21.9 | - | - |
| Soil Description: | Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL) | Init. Dry Unit Weight (pcf) | 102.1 | - | - |
| Liquid Limit: | 47 | Init. Void Ratio | 0.68 | - | - |
| Plastic Limit: | 20 | Init. Degree of Saturation (%) | 88 | - | - |
| Plasticity Index: | 27 | Minor Principal Stress (psi) | 7.0 | - | - |
| Specific Gravity: | 2.75 (Assumed) | Deviator Stress at Failure (psi) | 19.7 | - | - |
| Rate of Strain: | 0.03 Inches per Minute | Major Principal Stress (psi) | 26.7 | - | - |
| Failure Criteria: | Peak Deviator Stress or Deviator Stress at 15% Axial Strain | Axial Strain at Failure (%) | 7.4 | - | - |

### Stress/Strain



### Mohr Circle Plot



# CORE PHOTO LOG – BORING B-11

| | | |
|---|---|---|
| Project: Village of Oak Harbor WWTP | Core Run | Depth (feet) |
| Project Location: Oak Harbor, Ohio | RC-1 | 46 to 50 |
| VDT Project No.: 31874 | | |
| Core Date: March 18, 2025 | | |

# CORE PHOTO LOG – BORING B-13

Project: Village of Oak Harbor
Project Location: Oak Harbor, Ohio
CT Project No.: 31874
Core Date: March 17, 2025

| Core Run | Depth (feet) |
|---|---|
| RC-1 | 43.4 to 48.4 |
| RC-2 | 48.4 to 50.3 |

**Begin RC-1**

**End RC-1 / Begin RC-2**

**End RC-2**