GEOTECHNICAL INVESTIGATION

LATRINE IMPROVEMENTS
HICKORY RUN STATE PARK
WHITE HAVEN, PENNSYLVANIA

Prepared For:

SMP ARCHITECTS
1600 WALNUT STREET, #2
PHILADELPHIA, PENNSYLVANIA 18661

Prepared By:

GEO-SCIENCE ENGINEERING COMPANY, INC.
1252 MID VALLEY DRIVE
MID VALLEY INDUSTRIAL PARK
JESSUP, PENNSYLVANIA 18434

DECEMBER 2020

Geo-Science Engineering & Testing, LLC

December 16, 2020

SMP Architects
1600 Walnut Street, #2
Philadelphia, Pennsylvania 19460

Attention: Todd Woodward, AIA, LEED AP

Reference: Latrine Improvements
Hickory Run State Park
3614 PA-354
White Haven, Pennsylvania 18661
GSET Project No. 20030392

Dear Mr. Woodward

Enclosed is our report for the above referenced project. The report was based upon our discussions and your subsequent authorization. The report concludes the proposed structures can be constructed at this site.

Please review the details noted within the report at your convenience. Upon completion of the review, we will be available for a meeting to discuss the report and answer any questions that may have developed.

We are pleased to have been of service to you on this project. Should you have any questions please do not hesitate to contact us.

Sincerely,

Roger Knittle

Roger Knittle, E.I.T.
Staff Engineer

Wade

Wade Anundson, P.E.
Senior Geotechnical Engineer

P. Richard Scheller, P.E.
Sr. Vice President

PRS/WA/RCK
File: Y:\Projects\SMP Architects\20030392 - Hickory Run State Park

1252 Mid Valley Drive • Mid Valley Industrial Park • Jessup, PA 18434
Phone: 570-489-8717 • Fax: 570-489-8714 • www.geoscience.us

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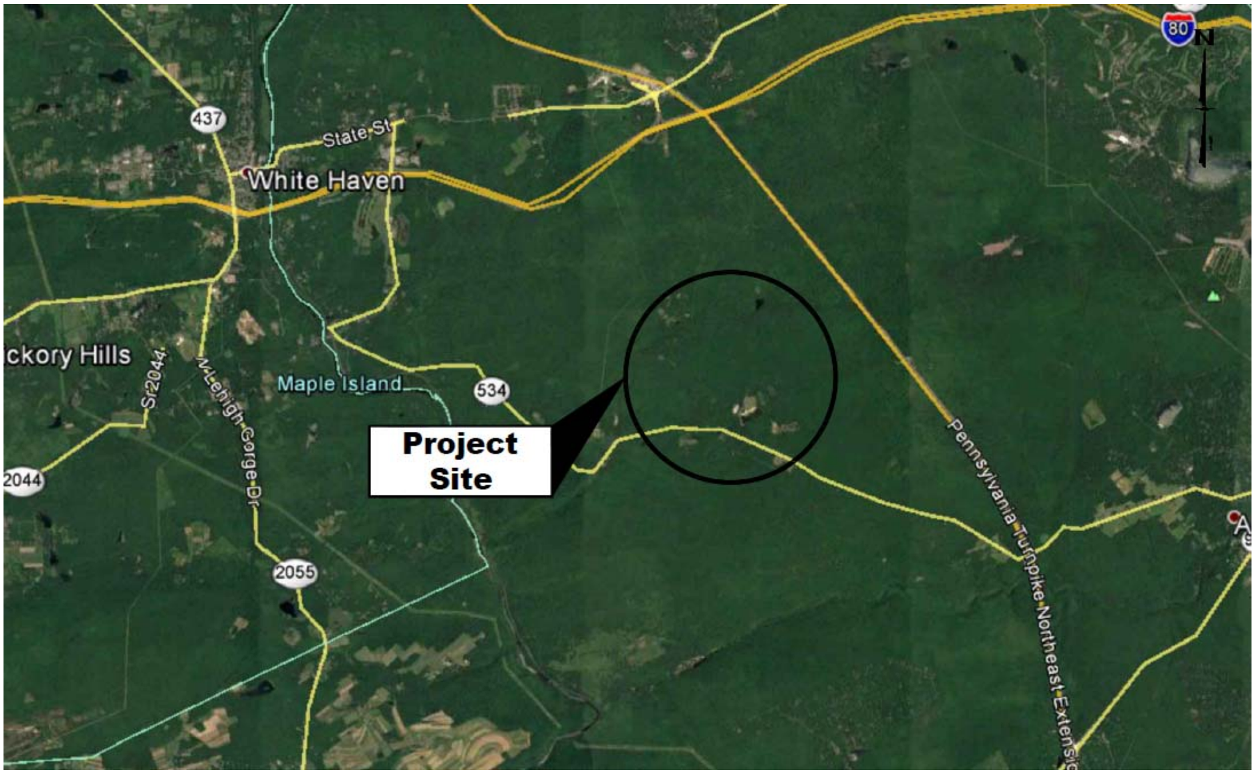
1.0 INTRODUCTION

1.1 GENERAL INTRODUCTION

The geotechnical investigation reported herein was performed at the request of Mr. Todd Woodward, AIA, LEED AP, SMP Architects, in connection with the design of four (4) single-story latrine buildings and associated parking located throughout Hickory Run State Park near White Haven, Carbon County Pennsylvania. A "Regional Location Plan" showing the general location of the project site is presented below.



Regional Location Plan – Figure 1

The purpose of this investigation was to review the subsurface conditions at the potential site of the proposed structures through the use of test borings, and infiltration test pits. The test borings and pits were placed to develop a general geotechnical understanding of the site. This study would develop geotechnical recommendations based upon the test borings drilled and attempt to identify any extraordinary or limiting geotechnical issues prior to construction. The foundation recommendations would be updated if necessary, as the project nears completion of design.

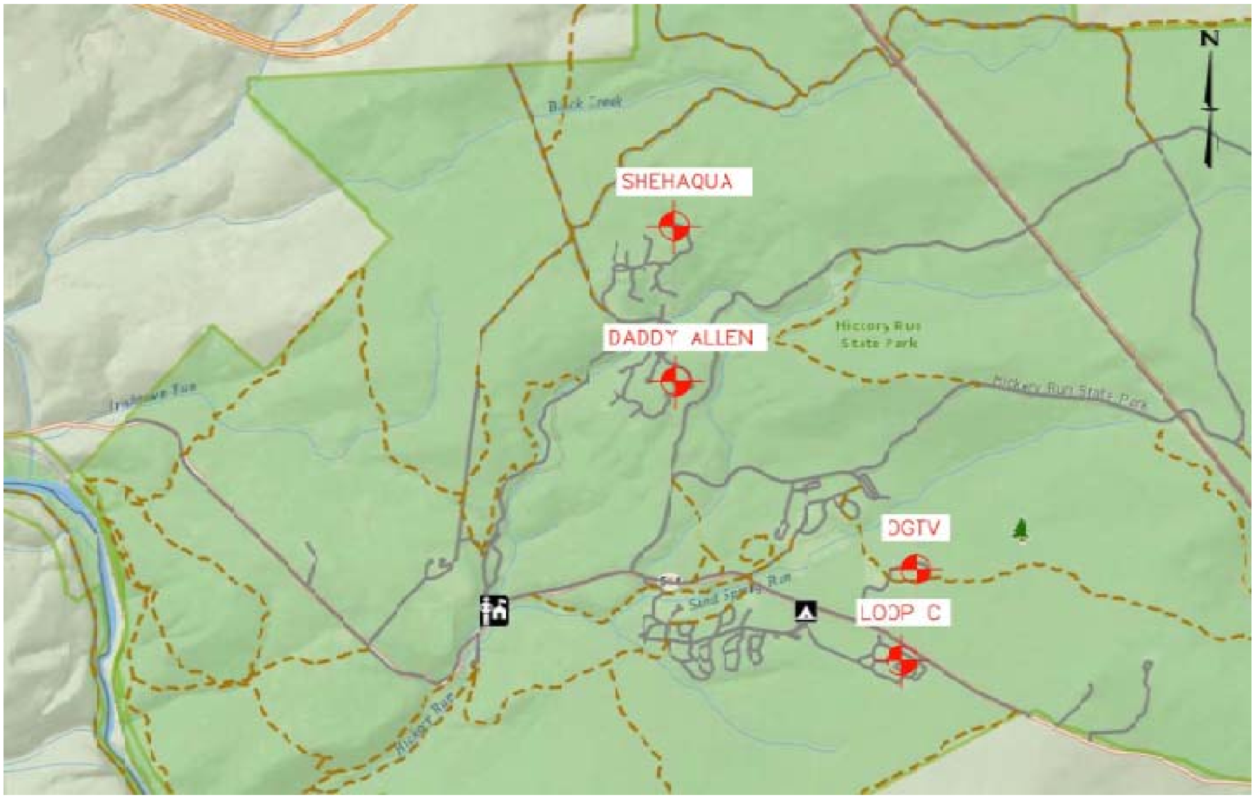
The scope of work included review and planning of the investigation with SMP Architects and Pennsylvania DCNR staff at the Hickory Run State Park, obtaining an independent test boring contractor, field infiltration testing, laboratory testing of representative samples, engineering analysis of the available geotechnical data, and the subsequent preparation of the enclosed report.

A description of the subsurface exploration program and logs of the test borings are included in Appendix B, together with the laboratory test program as may have been required to analyze the data.

Authorization to perform this study was issued by Mr. Mr. Todd Woodward, AIA, LEED AP.

1.2 PROJECT DESCRIPTION

Based upon the general data description provided by SMP Architects, the latrine buildings proposed will be single-story structures. A total of four (4) latrine buildings are to be constructed at sites located throughout Hickory Run State Park. It is our understanding that these are to be plumbed latrines without vaults. These sites are designated as the Shehaqua, Daddy Allen, OGTC, and Loop C sites. The approximate locations of these sites are shown in the following figure.



Overall Map of Sites – Figure 2

1.3 SITE CONDITIONS

The sites are located within Hickory Run State Park. Overall, the sites are covered with grasses, leaf litter, vegetation, and trees.

SITE PHOTOGRAPHS

Site Photo Near TP-9 – Figure 3

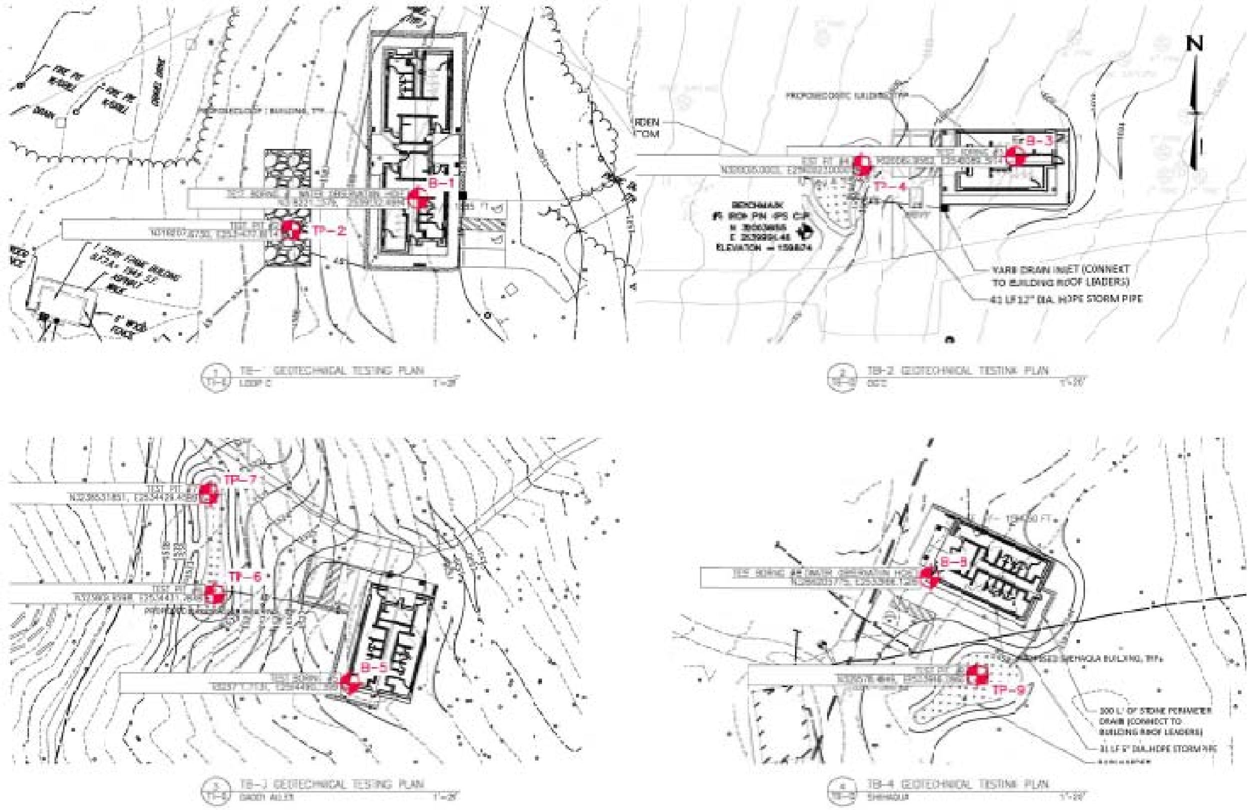
2.0 FIELD EXPLORATIONS

2.1 FIELD RECONNAISSANCE

A field reconnaissance was conducted at the project site at various times during November 2020.

2.2 DRILLING OPERATIONS

A total of four (4) test borings were drilled at the site along with five (5) infiltration test pits. The test borings and pits were completed by Pocono Test Borings, a drilling company under contract with Geo-Science Engineering & Testing, LLC (GSET). Drilling inspection was provided by GSET. Drilling for the borings was completed during November 2020. Staked boring locations were obtained by ESC Eng. & Surveying. The approximate location of each boring drilled is presented below on the Test Boring Location Plan.



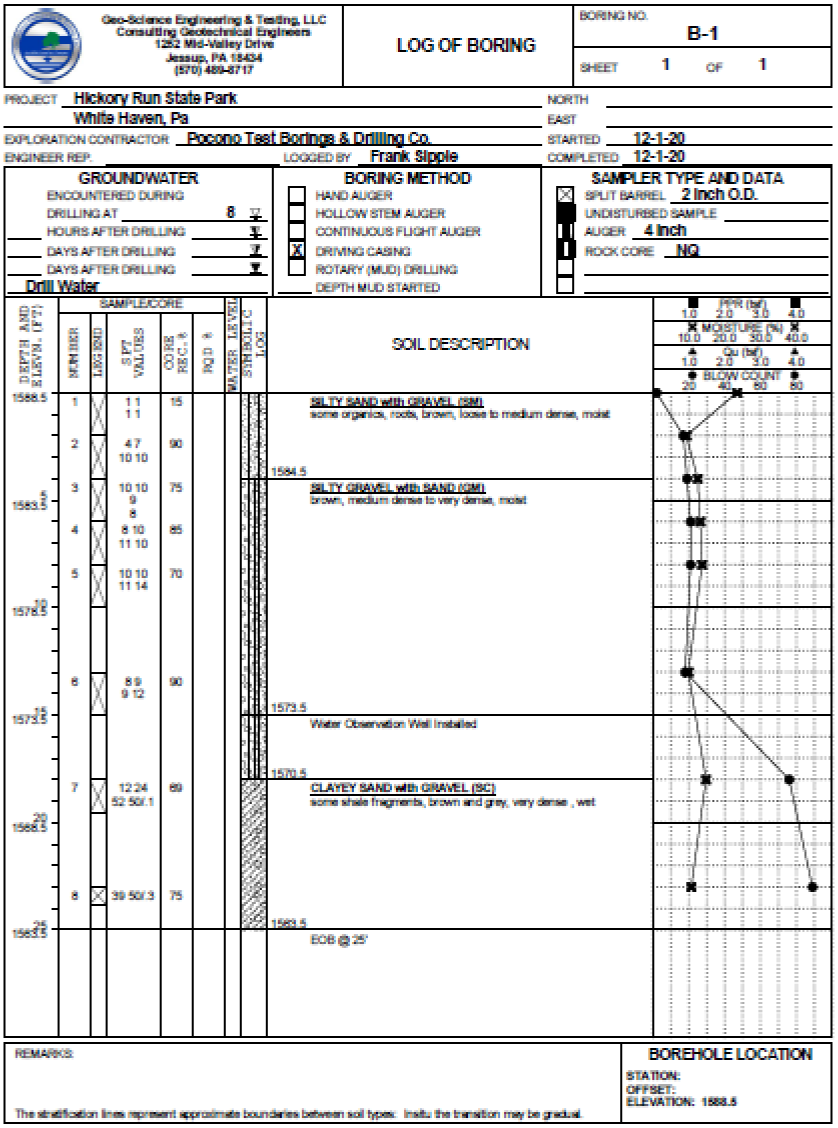
Test Boring Location Plan – Figure 4

A total of 100± lineal feet of drilling was completed during the subsurface exploration program. Results of the infiltration test pits are included in the report in Appendix C.

Each boring drilled was initially advanced through the soil overburden using a 4" wash boring until the design depth, top of boulders, or bedrock was encountered. Standard Penetration Tests (SPT's) were generally conducted at periodic intervals until refusal occurred due to the presence of cobbles and/or boulders as designated by less than or equal to (≥) 50 blows over six (6) inches of penetration or less. Upon successful penetration through cobbles and/or boulders, SPT's were resumed until bottom of the boring was achieved. At the conclusion of each boring, after the final water level reading was recorded, each core boring was backfilled with cuttings.

Drilling was generally conducted according to accepted protocols and standards. The SPT's were generally performed in accordance with ASTM Designation D 1586, "Standard Method for Penetration Test and Split-Barrel Sampling of Soils."

Detailed boring logs for each of the test borings were prepared by Geo-Science Engineering & Testing, LLC, and are presented in Appendix B. A typical log is shown below.



Geo-Science Engineering & Testing, LLC
Consulting Geotechnical Engineers
1262 Mid-Valley Drive
Jessup, PA 18434
(570) 489-8717

LOG OF BORING

BORING NO. B-1

SHEET 1 OF 1

PROJECT Hickory Run State Park
White Haven, Pa
NORTH
EAST
EXPLORATION CONTRACTOR Pocono Test Borings & Drilling Co.
STARTED 12-1-20
ENGINEER REP.
LOGGED BY Frank Sipple
COMPLETED 12-1-20

GROUNDWATER
ENCOUNTERED DURING
DRILLING AT 8
HOURS AFTER DRILLING
DAYS AFTER DRILLING
DAYS AFTER DRILLING
Drill Water

BORING METHOD
☐ HAND AUGER
☐ HOLLOW STEM AUGER
☐ CONTINUOUS FLIGHT AUGER
☒ DRIVING CASING
☐ ROTARY (MUD) DRILLING
DEPTH MUD STARTED

SAMPLER TYPE AND DATA
☒ SPLIT BARREL 2 Inch O.D.
UNDISTURBED SAMPLE
AUGER 4 Inch
ROCK CORE NQ

DEPTH AND ELEVN. (FT)	NUMBER	LEGEND	SPT VALUES	CORE REC. %	RQD %	WATER LEVEL	SYMBOLIC LOG	SOIL DESCRIPTION
1588.5	1	☒	1 1 1 1	15				**SILTY SAND with GRAVEL (SM)** some organics, roots, brown, loose to medium dense, moist
	2	☒	4 7 10 10	90				
								1584.5
	3	☒	10 10 9 8	75				**SILTY GRAVEL with SAND (GM)** brown, medium dense to very dense, moist
5 1583.5								
	4	☒	8 10 11 10	85				
	5	☒	10 10 11 14	70				
10 1578.5								
	6	☒	8 9 9 12	90				
								1573.5
15 1573.5								Water Observation Well Installed
								1570.5
	7	☒	12 24 52 50/.1	69				**CLAYEY SAND with GRAVEL (SC)** some shale fragments, brown and grey, very dense , wet
20 1568.5								
	8	☒	39 50/.3	75				
								1563.5
25 1563.5								EOB @ 25'

REMARKS:

The stratification lines represent approximate boundaries between soil types: Insitu the transition may be gradual.

BOREHOLE LOCATION
STATION:
OFFSET:
ELEVATION: 1588.5

Typical Test Boring Log (B-1) – Figure 5

Each boring log prepared includes the following items:

- The approximate depth, and description of materials encountered;
- The type and location of samples;
- The Standard Penetration Resistance obtained from SPT's conducted at the location of split barrel samples along with sample recovery measurements;
- The Unified Soil Classification System soil classification of samples by visual determination; and
- The percent recovery and rock quality designation (RQD) for each run of rock core and the RQD for each rock stratum encountered;
- The water levels in the boring upon completion of the test boring

Logs as prepared by the drilling contractor are presented in Appendix D. Logs of the test pits are included in Appendix C. of this report.

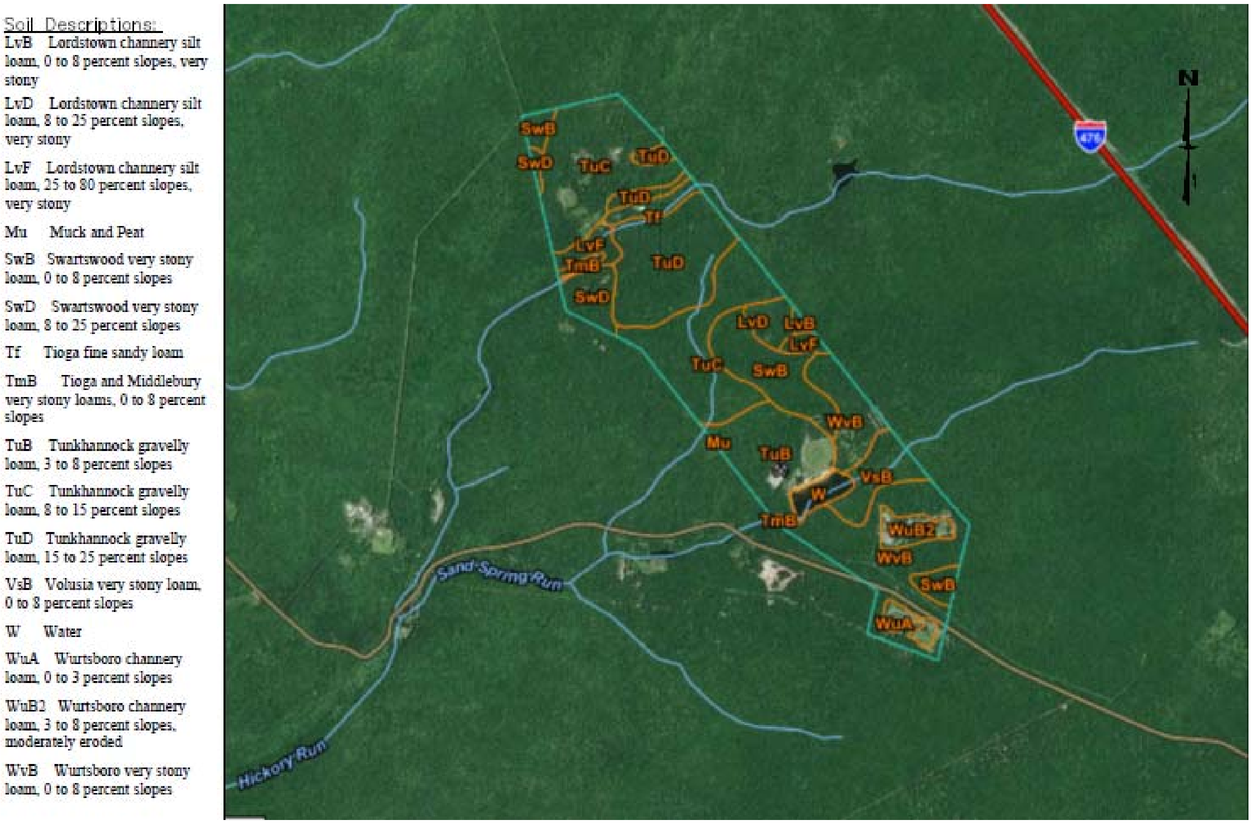
The following is a tabulation of the approximate test boring elevations.

Tabulation of Test Boring Elevations
Table 2.2.1

BORE HOLE #	SURFACE ELEVATION RELATIVE (FT)	DEPTH OF HOLE (FT)
B-1	1588.5±	25.0
B-3	1601.5±	25.0
B-5	1527.0±	25.0
B-8	1585.0±	25.0

2.3 NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

The NRCS, a department of the U.S. Department of Agricultural (formerly Soil Conservation Service) was authorized by the U.S. Congress to conduct a soil survey of the unconsolidated deposits for agricultural purposes across the United States. As part of their efforts, they also provided discussions of high-level basic engineering properties of the various deposits described.



Natural Resources Conservation Service Map – Figure 6

The NRCS Map classified the soils in the vicinity of the Shehaqua and Daddy Allen sites as Tunkhannock gravelly loam. The Tunkhannock series is a deep, well-drained glacial outwash deposit. It is generally coarse, but some parent rocks in this series can contribute to elevated clay contents within the soils.

The soils in the vicinity of the OGTC and Loop C sites classifies as Wurtsboro channery to very stony loam. This series is a glacial till deposit with medium drainage, mottles, stones, and a medium to coarse texture.

2.4 LABORATORY INVESTIGATIONS

Upon completion of the field explorations, the recovered soil samples were examined by our staff geotechnical engineer and a laboratory program was conducted to ascertain engineering characteristics of the subsurface materials encountered. All phases of the laboratory testing were conducted in general accordance with applicable ASTM specifications. Gradation analyses, Atterberg limits test, visual referrals, and natural moisture content were also performed. The results of these tests are noted in Appendix B and the table below. Descriptions of the soils follow general outlined procedures established by the Unified Soil Classification System and ASTM. The soils are more adequately described in the following sections.

Table 2.4.1
Summary of Laboratory Tests

Test Boring	Sample	Depth	Classification	-200	LL	PL	Natural Moisture
B-1	S-1	0-2	SM	19.4	-	NP	23.4
B-1	S-3	4-6	GM	28.9	-	NP	12.5
B-1	S-7	18-19.6	SC	15.9	35	23	14.8
B-3	S-2	2-4	SM	49.6	-	NP	10.6

2.4.1 Surface Covering

The site surface is covered by exposed soil, grass and undergrowth materials. The covering surfaces can vary up to 36 inches in thickness such as in B-3 where roots where encountered at 36 inches in depth. The thickness could easily vary between test boring locations.

2.4.2 Fills

Fills were not evident in the test borings. This does not mean there are no fills on the site. Fills are suspected where previous construction activities have occurred.

2.4.3 Native Soils

The native soil types are typically glacially derived, which contain varying percentages of clay, silt, sand and gravel. The native soils are silty sands with gravel, silty gravel with sand, clayey sand with gravel, and silty sand. The samples tested had approximately from 15.9% to 49.8% finer than the #200 sieve. Moisture contents for these strata vary between 3.5% and 27.8%. The majority of the samples indicated the wettest conditions were within 5 feet of the surface. The "N" values determined from the Standard Penetration Tests vary from medium dense to very dense. A significant number of cobbles and boulders were encountered within the native soils.

2.4.4 Groundwater

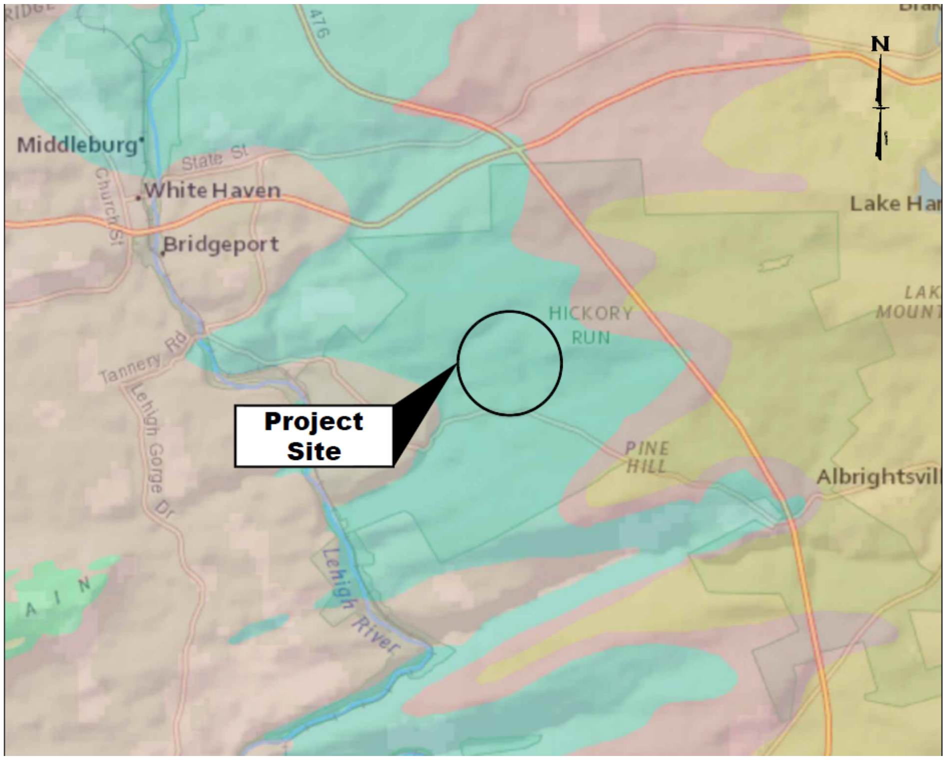
At the conclusion of drilling water levels within borings B-1, B-2, B-3, and B-4 were measured at 8 feet, 12 feet, 9 feet, and 8 feet below the ground surface. This water is most likely from the drilling process. A perched groundwater table was encountered 3± feet below the ground surface in TP-9. Groundwater observation wells 15 feet deep were installed in B-1 and B-8. Continued observation of these wells was beyond the scope of services.

Based upon past experience in the area, we would suspect that seepage into the site soils will occur especially after periods of precipitation and especially during the spring months. It is likely for perched groundwater pockets to develop in these soils. The glacial till soils have a significantly high propensity to support temporary perched water tables.

2.4.5 General Geology

Geologic Descriptions:

The Pocono Formation is composed of light- to olive-gray, fine- to medium-grained, crossbedded sandstone, siltstone, and conglomerate. It has some subordinate dark shale, siltstone, and very thin coaly horizons. Medial conglomerate, where present, is used to divide the formation into the Mount Carbon and Beckville Members. Conglomerate at the base is composed of abundant rounded, white quartz pebbles as large as 3 inches in diameter. Plant fossils are common. Because it contains resistant rock units, it tends to underlie ridges. It is equivalent to the Burgoon Sandstone of the Allegheny Plateau. It is up to 1,700 feet thick (Berg and others, 1980; Geyer and Wilshusen, 1982).



Geology Map – Figure 7

The general near-surface geologic unit under the site is the Pocono Formation. This formation is comprised of sandstone, siltstone, and conglomerate layers. Bedding are joints are well developed contributing to good surface drainage. The formation is generally difficult to excavate, highly resistant to weathering, and good for foundation stability.

2.4.6 Bedrock

Bedrock was not encountered in the test borings drilled at the site. All borings were terminated in the unconsolidated deposits.

3.0 CONCLUSIONS

From the results of this investigation, the following information has been preliminary concluded.

1. The soils at the site are medium dense to very dense glacial deposits. These soils contain in locations, significant amounts of cobbles and boulders.

2. The depth of the unconsolidated glacial soils begins either immediately below the surface covering or fills and extends at least 25 feet.

4. In general the wettest soil conditions are within 5 feet of the surface.

5. Perched water conditions should be anticipated to be encountered during excavation. This event is highly probable after precipitation events and during the period of November through May each year.

Based upon the information collected under this study, it is our opinion that a conventional shallow foundation system supported on a controlled engineered fill, where it may be required, or the native soils is our recommended foundation system.

The following section presents our recommendations based upon our field and laboratory findings.

4.0 GEOTECHNICAL RECOMMENDATIONS FOR SITE CONSTRUCTION AND BUILDNG PREP

The following recommendations are presented based upon the field and laboratory geotechnical data reported and contained herein. These recommendations should be revisited, if design conditions are modified from the assumptions noted herein.

4.1 SITE PREPARATION

4.1.1 Grubbing

All surface materials including asphalt, concrete, miscellaneous fills, grasses, topsoil, and/or scrub brush, etc. should be removed from within the proposed building limits to a distance of 7 feet outside the building limits and beneath any proposed new bituminous concrete pavement surface covering. It is estimated that this surface is approximately 6 inches to 36 inches in thickness. More or less could be encountered at other locations between test borings.

4.1.2 Utility Removal

Any utilities occupying the underground beneath the footprint plus 10 feet should be excavated and relocated outside the proposed building footprint. Any abandoned utility that remains should be cut, grouted closed and capped.

4.1.3 Existing Structures

From our literature search, previous structures are not reported to have existed on this site. If during any excavation remnant foundations are encountered, GSET, LLC should be contacted and the remnant structures should be completely removed from this site including all foundations and floor slabs. Additional exploratory efforts should be performed in this area to ensure all former structures are removed.

4.1.4 Undercutting/Cutting

From our test boring results and the grading on the proposed plans, it would appear major undercutting at this site will not be required. Loose zones or the presence of cobbles/boulders may be locally encountered and will need to be isolatedly undercut and replaced. A contingency should be established in the event some of these zones are encountered.

4.1.5 Proofrolling

With the site immediately adjacent to the existing structure, proofrolling with significant vibration equipment may induce settlements to the existing structure. The use of the large vibratory roller should be restricted in the zone from the existing building to 15' beyond the existing building. Smaller, automated rollers (±25,000 lbf) should be used in this zone.

At the direction of the project geotechnical engineer both the foundation base and floor slab subgrade will need to be proofrolled prior to the placement of any grade adjustment ill. Prior to proofrolling, the site may need to be dried to achieve the range of acceptable moistures to facilitate compaction. Proofrolling should be accomplished with a vibratory roller capable of developing a dynamic force of at least 65,000 lbf in addition to a static load of 10 tons. Please note the large roller should not be allowed within 15' of the existing structure. The roller should not exceed 1 mph.

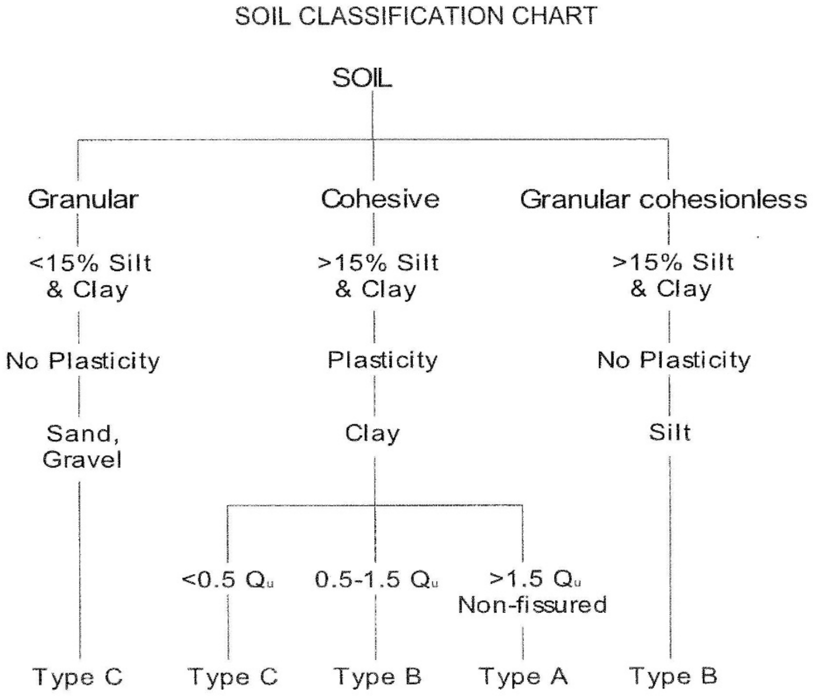
The area to be proofrolled should be completely traversed in both directions two (2) times minimum to identify any soft or weak areas. Those areas that have been identified as weak areas should be undercut to a stable strata and replaced with an engineered (load-bearing) fill. With the existing soils, no proofrolling should be accomplished without the presence of the geotechnical engineer. Once the proofroll program has been completed, the proofroll surface should be compacted to achieve a compaction level of 95% ASTM D1557. This will include all trench excavations for foundations. Upon completion of proofrolling, the site should be backfilled to grade with engineered (load-bearing) fill.

4.1.6 Benching

Where new fills are to be placed and where the existing ground surface is steeper than to 6H:1V benching of the new fills into the existing ground will be required. Benching and filling should begin at the lowest site location first. Each fill bench should be cut into the existing site materials 5 feet for every 4 feet of vertical height.

4.1.7 Temporary Excavation Slopes

The site soils should be classified as an OSHA Type B soil based upon the gradations and the following table.



Soil Classification Chart - Figure 6

Any excavation slope that will exist for a period less than 6 months is considered to be temporary. All temporary slopes are recommended to be constructed not less than 1.50H:1V or flatter depending on the response of the materials. The slopes should comply with all requirements of OSHA, other Federal, State and Local governing bodies. The Contractor should understand temporary slopes are his responsibility and should be continuously monitored to ensure stability. All sloughages, slips, etc. should be immediately repaired to protect the integrity of the slopes. All temporary slopes greater than 15 feet in vertical height should be analyzed for stability.

4.1.8 Permanent Slopes

It is recommended that all permanent earth slopes should be not steeper than 2.5H:1V. Rock slopes should not be steeper than 0.75H:1V. Where bedrock and soil exist in the same slope, the interface between soil and bedrock should be stepped back at least 5 feet from the crest of the rock slope. From our review it does not appear there will be any permanent slopes greater than 15 feet in vertical height at this project. Any finished slope greater than 15 feet should have a aslope stability analysis conducted.

Soil slopes in this area have a propensity to slump after heavy rainfalls and spring thaws. These slumps are weaknesses in the embankment due to excess water pressure build-up. This pressure build-up could be the result of sand seams, soil fracturing and other geologic anomalies. Cuts into these conditions can suddenly release the water and weakness planes can develop. Slumps where they occur should be immediately addressed. The slumps should be cleaned of the failed material and replaced with a PennDOT R6 RipRap. These repairs should be constructed rather quickly as the continued loss of soil from the embankment could result in significant instabilities to the embankment. These instabilities could create a general overall failure in the embankment.

The RipRap should be placed on a non-woven geotextile with an EOS of 70 and a fabric weight not less than 8 oz. /yd. Between the geotextile and the RipRap should be a minimum 6-inch layer of AASHTO type #57 stone. The RipRap thickness should not be less than 3 feet. A vertical drainage channel should be designed to allow seepage through the RipRap into a swale at the embankment toe. Upon completion of all permanent slopes, the slopes should be protected with an erosion control fabric and quick germinating long root grasses to minimize slope failures.

It is not recommended to allow site surface water to flow over the face of the embankment. It is recommended that a lined crest level swale be constructed to intercept this water and direct the water away from the slope. It is suggested the swale be constructed not closer than H/3 (H = embankment height) from the edge of the slope. This will minimize infiltration into the slope and cause slope failures.

4.1.9 Existing Site Soil

There are two types of glacial soils at the site, outwash and tills. Tills are created as the glacier advanced and outwash as the glacier retreated. The existing exposed site soils are glacial soils which classify as silty sand with gravels. Currently the glacial soils are moist. The soils with more than 30% finer than the #200 sieve are very moisture sensitive and frost susceptible. The glacial soils must meet several criteria to be acceptable as a structural fill for the building. Any miscellaneous materials encountered must first be removed. In addition, the oversize (+5") must be removed, and a minimum 95% ASTM D1557 (γ_d) density of 120 pcf will need to be achieved. The in-situ soil moistures indicate not all soils will be immediately useable and will likely be unusable during the period of November through May unless soil supplements are used.. Moisture conditioning to adjust the moisture values will be required. Typically, the existing site soils have not been used for structural fill due to their moisture sensitivity.

As we have noted, the soils with considerable fines are very moisture sensitive. The contractor should be advised any excessive movement over these soils generally result in weaving, rutting and site deterioration. This damage could ultimately result in increased site costs. All areas damaged by the contractor should be repaired immediately.

4.1.10 Site Grading

All site grading should be designed so that water flows away from the existing structure. Rain collection down leaders should not discharge directly adjacent to the building foundation especially with the site fills. All leaders should be connected into the site storm water system.

4.1.11 Earth Work Period

Earth work activities should be programmed to occur during the period when greatest drying potential can be achieved. That period is typically April through November. Earthwork efforts outside this increment can result in delays and increased construction costs. Winter construction may require the use of an off-site manufactured aggregate fill.

4.1.12 Unexposed Conditions

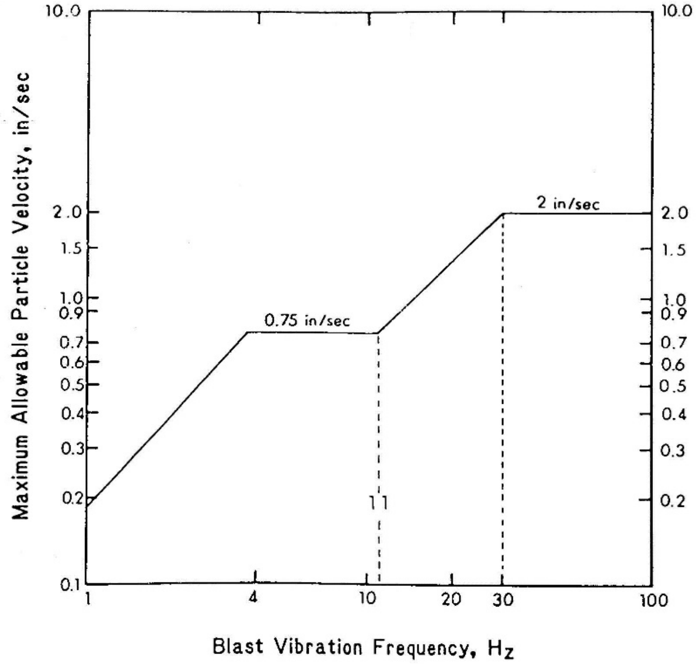
Due to the limited nature of geotechnical investigations and typical of construction at all sites, unexpected ground conditions could be encountered. If these conditions are encountered, they should be brought to the immediate attention of the geotechnical engineer, thoroughly investigated, removed, and replaced/repaired as required.

4.1.13 Rock Excavation

Rock excavation is not anticipated at this site. If boulders greater than 1 cubic yard are encountered in the excavation, these materials should be removed in their entirety from the excavation. As a specific definition, any material that is not capable of being ripped with a single tooth ripper mounted on a CAT D8N class tractor, is considered rock. In trench excavation, rock should be defined as any material that cannot be removed with a CAT Model 352 with a bucket volume of 1 cubic yard and a draw bar pull not less than 56,000 lbs.

4.1.14 Blasting

Blasting should not be necessary at this site. If blasting is performed, a blast plan should be submitted by a firm specializing in excavation with explosives. The plan should detail typical criteria such as spacing, burden delay change, weights, etc. The plan should be sealed by a registered engineer or geologist experienced with construction-related blasting. All blasts should be seismically monitored in accordance with all federal state and local criteria. Blast vibration should not exceed 1 in/sec at the site boundary. Total peak particle velocity should be in accordance with the criteria established by the USBM RI8506. Blasting mats should be placed over the area to be blasted to minimize fly rock exposure. Upon the completion of excavation, a geologist or geotechnical engineer should inspect the blasted surface to ensure **all** overshot material has been removed from the excavation.



OSM alternative blasting-level criteria. (Modified from Fig. B1, RI 8507, U.S. Bureau of Mines.)

Blast Vibration Frequency-Figure 7

4.1.15 Environmental Issues

Environmental engineering and any site environmental assessments were beyond the scope of our services.

5.0 FOUNDATION RECOMMENDATIONS

Based upon the results of the test borings, a conventional shallow foundation system is proposed for this project. The proposed footing system consists of continuous wall footings and individual column footings. All footings should bear either on engineered (load-bearing) fill, or 95% recompacted native site soils where determined to be suitable by the geotechnical engineer.

5.1 CONVENTIONAL FOUNDATION

The shallow foundation system should be proportioned for the total dead and sustained live loads so as to not exceed an average uniform net bearing value of 3,000 psf.

Continuous wall footings should have a minimum width of **2.0 feet** and individual column footings a minimum width of **3.0 feet**. The resultant of eccentrically loaded footings should be maintained within the middle third of the footings. Wall footings should have bötth top and bottom steel.

From our analysis, the estimated settlements should not exceed the maximum post construction settlement less than 1” total and ¾” ± differential movement.

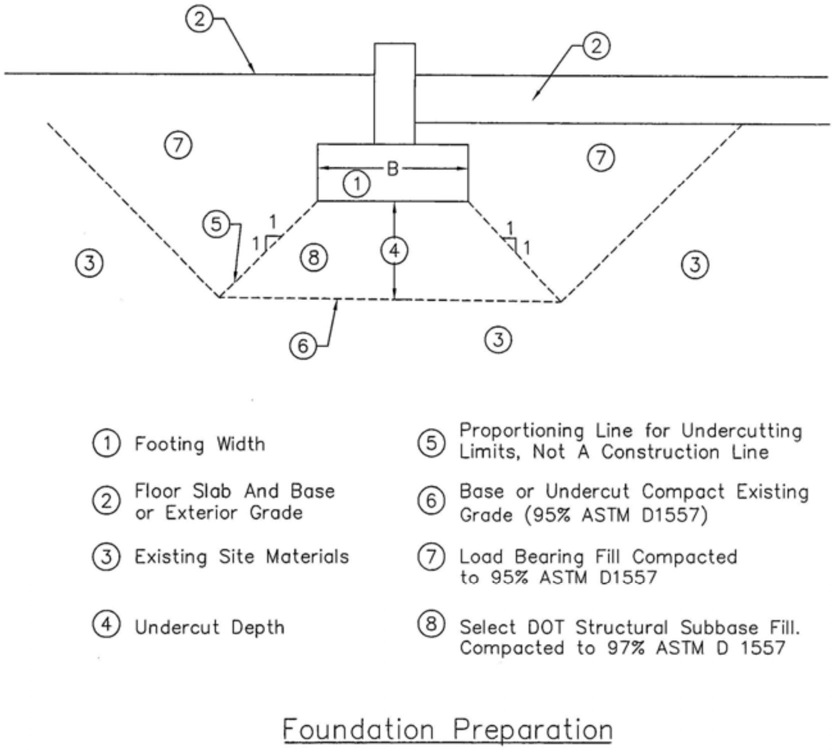
5.2 FOUNDATION MINIMUM DEPTH

All foundations exposed to freezing conditions should be placed at a minimum depth equal to 48 inches below the exposure surface. Interior heated space footings should be placed at a minimum depth of 24 inches below the top of the slab. It is unknown whether the interior space will be heated. If it is not, the interior footing should be placed as noted for exterior footings.

5.3 SHALLOW FOUNDATION CONSTRUCTION AND INSPECTION

All excavations should be thoroughly inspected and examined by a qualified Geotechnical Engineer or Geotechnical Technician to evaluate the quality of bearing materials. Any soft, loose, or otherwise detrimental possible materials encountered in the excavation should be removed and replaced with load-bearing fill depending on foundation bearing design conditions.

Where undercutting is required due to local conditions, the undercut beneath the foundations should generally be performed in accordance with the detail provided below.



Foundation Preparation - Figure 8

If a large boulder or a significant number of cobbles/boulders are encountered within the foundation excavation, the foundation bearing surface should be undercut at least one foot and replaced with an engineered, load bearing fill. Depending on how open the boulder/cobble surface is it may be necessary to separate the surface with a non-woven geofabric such as Mirafi HP 270 or equivalent. **It should be anticipated that some additional undercutting beneath areas of the foundation excavation will be required.** Conditions weakened by construction disturbances should be repaired or additionally undercut to a firm stratum. With the existing moisture and the type of soil it should be anticipated that overexcavation of soft wet areas may encountered.

It is highly recommended that excavations should not remain open for any length of time. Only sufficient excavation should be opened that can be successfully completed in one (1) day. Any foundation that remains open greater than one (1) day should have a 3" mud sill placed to protect the foundation bottom from disturbances. The mudsill can be ±3" in thickness of low strength fill concrete or flowable fill. The concrete strength should not exceed 1,000 psi.. Foundation concrete should be cast in forms. All concrete should be placed in accordance with the recommended practices of the American Concrete Institute.

5.12 SEISMOLOGY

Analysis of earthquake induced strong ground motion is a multi-discipline study of geology, soil mechanics, seismology, structural dynamics, mechanical vibration, probability, and statistics. It is an evolving science. Great research efforts are undertaken annually through the federal, state and private sectors to develop accurate methods of prediction, analysis, design and retrofit to lessen the impact of potentially catastrophic earthquakes. The seismic structural design portion of the IBC greatly simplifies the underlying science of strong ground motion and is incorporated into IBC. We have incorporated portions of the IBC here. The entire code and commentary should be consulted before proceeding with the design.

The Applied Technology Council (ATC), a nonprofit organization guided by representatives of the American Society of Civil Engineers, the National Council of Structural Engineers Association, and various state engineering associations, has developed an online tool to provide site-specific ground motion hazard information.

SITE CLASS DEFINITIONS – FIGURE 9

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 FEET		
		Soil Shear wave velocity, V_S (ft/s)	Standard penetration resistance, N	Soil undrained shear strength, S_U (psf)
A	Hard Rock	$V_S > 5,000$	N/A	N/A
B	Rock	$2,000 < V_S \leq 5,000$	N/A	N/A
C	Very dense soil and soft rock	$1,200 < V_S \leq 2,500$	N>50	$S_U \geq 2,000$
D	Stiff soil profile	$600 \leq V_S \leq 1,200$	15≤N≤50	$1,000 \leq S_U \leq 2,000$
E	Soft soil profile	$V_S < 600$	N<15	$S_U < 1,000$
E	--	Any profile with more than 10 feet of soil having the following characteristics: 1. Plasticity index PI >20. 2. Moisture content w≥40% and 3. Undrained shear strength $S_U < 500$ psf		
F	--	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly sensitive clays (H>10 feet of peat and/or highly organic clay where H = thickness of soil) 3. Very high plasticity clays (H>25 feet with plasticity index PI>75) 4. Very thick soft/medium stiff clays (H>120 feet)		

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPA, N/A = Not Applicable

For this site, the ranking for ground movement established by IBC indicates the site classification is “D”.

The seismic coefficients for this site are as follows:

S_s – 0.139	S_{ms} – 0.222	S_{ds} – 0.148
S_1 – 0.045	S_{m1} – 0.108	S_{d1} – 0.072

The site design category is estimated to be “B”

5.13 SOIL CORROSIVITY

The conditions promoting corrosion include:

- Low resistivity of ground;
- High concentration of chlorides and sulfides in ground or groundwater;
- Too low or too high hydrogen potential (pH) of ground or groundwater;
- High saturation conditions; and
- Stray currents

The factors above collectively define ground corrosion potential (or aggressively of the ground). Examples of aggressive soils and factors that may increase corrosion potential include:

- *Acidic Soils*: These soils include soils with a high level of soluble iron and are characterized with low hydrogen potential (i.e., pH<5).
- *Sodic Soils*: These are alkaline soils (i.e., pH>9) with components favoring corrosion and are common in arid environments. Low precipitation and intense evaporation case soluble salts (e.g., sodium, chloride, and sulfates) to be transported from the bedrock to shallow layers.
- *Calcareous Soils*: These are alkaline soils (7 < pH < 9) with large concentrations of sodium, calcium, calcium-magnesium carbonates and sulfates. Examples of these soils include those derived from calcite, dolomite, and gypsum.
- *Organic Soils*: These soils have unusually high-water content (e.g., peats, mucks, and cinders) and may contain humic acid.
- *Materials of Industrial Origin*: These industrial waste “soils” can have pH values that vary significantly and extend along the whole pH scale. Examples of industrial waste soils are slag, fly ash, fills with construction debris, mine tailings, and acid mine waste.

- *Electrical Currents*: Corrosion may be induced in nail bars (or other metallic parts) when stray electrical currents are applied repeatedly. Stray currents can derive from power sources such as electric rail systems, electrical transmissions systems, and welding operations, and is particularly damaging in a marine environment. However, when the sources are located more than about 30 to 60 m (100 to 200 feet) from the nail bars, the potential of stray current corrosion is minimal (Elias, 2000).
- *Other Environmental Factors:* The corrosion potential of granular soils tends to increase slightly when they are in the 60 to 80 percent of the degree of saturation range. In regions where de-icing salts are used, the top 2.5 m (7.5 feet) of soil behind a soil nail wall should be assumed to contain a higher concentration of chlorides.

Tests listed in Table 6.13(a) are used to classify the corrosion potential of the ground.

Table 5.13.1

Test	Units	Strong Corrosion Potential/Aggressive	Mild to no Corrosion Potential/Non-Aggressive	ASTM Standard	AASHTO Test Method
pH	-	<4.5,>10	5.5<pH<10	G51	T 289-91
Resistivity	ohm-cm	<2,000	Greater than 5,000	G57	T 288-91
Sulfates	ppm(1)	>200	Less than 200	D516	T 280-91
Chlorides	ppm	>100	Less than 100	D512	T 291-91
Stray Current	-	Present	-	-	-

Note: (1) ppm = parts per million.

Table 5.13.2
Corrosion Laboratory Testing Results

Test	Result
pH	8.2
Resistivity	805,680 ohm-cm
Sulfates	>200 mg/kg
Chlorides	<28 mg/kg

The tests indicate the soil possesses a strong corrosion potential because of the elevated sulfate levels. Type II concrete is necessary to protect against the high level of sulfates in the soil.

6.0 FLOOR SLABS

Based upon the alternatives and review of the test borings for the conventional foundation system, the floor slab is recommended to bear at grade. Please note the existing soils are classified as an F2-F3 soil which denoted a frost susceptible condition especially with unheated floor space. This could result in the potential for heaving of the floor slabs in the unheated spaces. For frost heave to occur we also need to have a surface water condition. From the data, the water table appears to be below the depth that would potentially feed the soils moisture to develop frost heave. Based upon the F3 risk it is recommended the frost susceptible soils should be removed and replaced with a non-susceptible soil (Aggregate with not more than 15% finer than a No. 200 mesh sieve such as Penn DOT Type 2A)

Prior to the placement of engineered fill to grade for the floor slabs. The floor slab area should be proofrolled in accordance with Section 5.1.5 Proofrolling. A subgrade modulus **(k_s)** moduli of **120 psi/in** can be used for the design of the floor slab. Immediately prior to floor slab construction, the entire subgrade should be densified and recompacted. Any soft areas which develop should be undercut and replaced with a load bearing fill.

After the subgrade is prepared it is recommended that a well graded 6" granular base course be placed including a 15-mil vapor barrier, taped and sealed. The base course should consist of gravel or crushed stone equivalent to an AASHTO No. 57 coarse aggregate. The vapor barrier should be placed in accordance with current recommended guidelines of ACI.

The maximum joint spacing for concrete to reduce the amount of floor slab cracking should not exceed 3xT in feet, where T is slab thickness in inches (not greater than 15 feet in width). However, it should be noted that even at this spacing slab cracking has developed.

With the advent of more environmentally compliant low VOC glues, we have encountered a number of instances where the glues have not adhered to the concrete floor substrate. Vapor emissions from concrete can occur for a length time (more than 1 year) after placement. Additionally, moisture in the capillary zone before concrete floor slab placement can eventually through thermal diffusion move upwards through the slab affecting the glue. We have encountered much less incidents where permeability reduction agents such as Barrier One have been added to the concrete or where a penetrating water sealer has been added to the surface of the concrete.

For concrete moisture transmission testing, both calcium chloride tests and relative humidity tests should be conducted.

7.0 RETAINING WALLS

7.1 EARTH PRESSURE COEFFICIENTS

If retaining walls are required for this project, the following recommendations are presented based upon the test borings drilled. Retaining walls designed for active earth pressure should be calculated based upon the Rankine stress relationship, where the earth pressure coefficients are defined below.

TABLE NO. 7.1.1
EARTH PRESSURE COEFFICIENTS

COEFFICIENT	EXISTING GLACIAL MATERIALS	2A Fill
Ø	32	34
C psf	0	0
Y_T pcf	125	145
δ̊	20	22

7.2 COEFFICIENT OF LATERAL SLIDING FRICTION

Lateral resistance for site retaining walls that are not braced by other structural elements should be developed through a combination of friction and passive pressure. A coefficient of friction **(f) of 0.34** is recommended for friction between the wall foundation and soil bearing materials.

7.3 ACTIVE/PASSIVE EARTH PRESSURE

Active and passive pressure against the imbedded portions or retaining walls and foundations may be computed from the Rankine relationship, where load-bearing fill is being placed against the walls and foundations or the foundations are poured directly against their excavations. The passive pressure for the upper four (4) feet of the wall should be neglected.

1. Active Soil $k_a = \tan^2 (45 - Ø/2)$ (1)
2. Passive Soil $k_p = \tan^2 (45 + Ø/2)$ (2)

7.4 AT REST RETAINING WALLS

Structural retaining walls which are restrained from deflection should be designed for the condition of at-rest lateral earth pressure (k_0). These earth pressures should be calculated assuming the following relationship.

$$k_0 = 1\text{-}\sin \emptyset \qquad (3)$$

The walls should be additionally designed to resist the uniform lateral pressure equal to 0.75 of any expected live loads at the top of the backfill. These retaining walls should also be provided with a suitable moisture proof covering to preclude moisture infiltration. If the walls cannot be adequately drained, they should be designed for full hydrostatic pressure and water proofed.

Foundation bearing for the retaining walls shall be prepared in accordance with foundation preparation guidelines noted for wall footings.

7.6 RETAINING WALL DRAINAGE

Behind all walls a vertical drainage blanket should be constructed. The blanket should be a minimum of one foot in thickness. The drainage material should be consistent with the grading characteristics of PennDOT Type 57 Stone. Separating the drainage stone from the adjacent soils should be a geotextile drainage filter having the minimum characteristics of Mirafi 180N.

For k_a/k_p conditions, a minimum of four-inch weep holes should be placed six inches above the retained grade at 8 feet on centers. The weep holes should be backed with a screen to resist drainage aggregate movement. For k_o conditions, the vertical drainage blanket should be connected into a foundation drain.

8.0 ENGINEERED (LOAD-BEARING) FILL

Any engineered (load-bearing) fill required to raise a portion of the site to the design grade, including parking lots, engineered (load-bearing) fill required as backfill behind retaining walls, and if necessary engineered (load-bearing) fill utilized for the support of spread and/or wall footings where undercutting of soft or loose soils might be necessary should be placed and compacted in accordance with the following recommendations. In addition, all engineered (load-bearing) fill should extend outside the perimeter of the building 5 feet.

8.1 FILL MATERIALS

In order for the existing undercut site fills to be suitable for engineered fills at this site, they must meet several criteria. The oversized (+5 in) material will need to be removed. Excessive amounts of and detrimental materials, coal, cinders, ash, wood, paper, and plastic will need to be removed. Any contaminated soil should be legally wasted. The fill materials will need to be able to achieve a 95% compacted dry density (ASTM D1557) of at least 120 pcf. The excavated soil materials may be required to be moisture adjusted to ±2% of the optimum value determined in ASTM D1557 prior to use. Soils meeting these criteria can be stockpiled for reuse. All sandy silts (ML) soils should be considered unacceptable. All stockpiles should be protected from adverse conditions. Where the lack of protection is attributed to the stockpile moisture unsuitability, the contractor should be required to replace the unsuitable materials in the stockpile on a yd./yd. basis. If off-site borrow is required, the borrow materials should meet the criteria for PennDOT 2A structural fill or the off specification material colloquially known as 3a modified meeting the following gradation range:

Size (in.)	Size (mm.)	Min % Passing	Max % Passing
2.5	63.5	100	100
2.0	50.8	90	100
1.5	30.1	50	85
¾	19.1	40	70
3/8	9.52	30	50
No. 4	4.75	20	40
No. 8	2.38	15	30
No. 16	1.19	10	25
No. 200	0.074	0	5

It is possible for alternate borrow material to be used providing it is acceptable to the geotechnical engineer. No asphalt recycled materials should be allowed beneath the structure. Any recycled material proposed for use, should be reviewed with the geotechnical engineer prior to its use.

The existing, native soils are frost susceptible and should not be used as structural fill beneath building in the zone of subgrade to -4 feet below subgrade. Below that depth they would be suitable provided they meet the above criteria. Within the building from -4 feet to subgrade, non-frost susceptible soils should be used such as Penn DOT Type 2A. (<15% Finer than a No. 200 mesh sieve)

8.2 COMPACTION REQUIREMENTS

8.2.1 Foundations and Floor Slabs

All engineered (load-bearing) fill beneath foundations and floor slabs should be placed in approximately horizontal lifts not exceeding a loose thickness of 10 inches for heavy compaction equipment, 4 inches with mechanical hand methods. All fill placed beneath floor slabs, foundations and any other surface cartways (parking lots) where structural capacity needs to be achieved shall be compacted to at least 95% of the maximum modified density achieved in ASTM D1557, latest edition. The moisture content of all engineered (load-bearing) fill should be maintained within ± 2% of the optimum values as determined in ASTM D1557, latest edition. Structural filling within the building area should be suspended when moisture contents extend beyond these limits. Wetting or drying may be necessary to achieve this requirement.

8.2.2 Utility Trenches

Once the protective fill is placed over the pipes as required (sand, gravel, etc.) utility trench backfill shall be placed in horizontal lifts not to exceed 6" in thickness and compacted to a density not less than 95% of ASTM D1557 with moisture content variation not greater than ±2% of the optimum values. As an alternate, flowable fill can be used to backfill the trenches. From 3 feet to the surface compaction levels should increase to 97% of ASTM D1557.

8.3 FILL INSPECTION

Observations, inspections and testing services are considered an extension of our geotechnical services for consistency and understanding of the geotechnical report and how the recommendations were developed. It is considered the observation, inspections and testing of site soils is an extension of our geotechnical contract. With the technical nature of this project, it is highly recommended that all site excavations, engineered (load-bearing) fill construction or specialized geotechnical contracting be performed under the observation of GSET, LLC. Our engineer will observe and document the construction and make appropriate field tests, as necessary, to determine that acceptable fill materials are being used and that the construction is being performed in accordance with the plans, specifications, and good construction practices. Based upon past experience, the most effective fill inspection is obtained by the continuous presence of our qualified inspector while fill construction is in progress.

8.4 TESTING AND OBSERVATION FREQUENCY

All fills placed at the site should be placed under the continuous observation of a geotechnical engineering firm whose engineering technician reports directly to a registered geotechnical engineer. As a minimum testing frequency, the following is recommended. It should be noted the actual engineering technician should determine the frequency of testing.

Mass Fill:	Every lift. Not less than one (1) test/day. Not less than one (1) test for each 5000 ft^2 of fill placed. At least one (1) initial proctor test should be performed with the corresponding gradation. A check gradation should be performed for each 1000 tons of fill used at the site.
Backfill:	Every lift. Not less than one (1) test/day. One (1) test each 50 lineal feet of backfill placed. At least one (1) initial proctor should be performed with its corresponding gradation and one (1) proposed alternate material. During construction, at least one (1) check gradation should be performed for each 500 tons of material used.

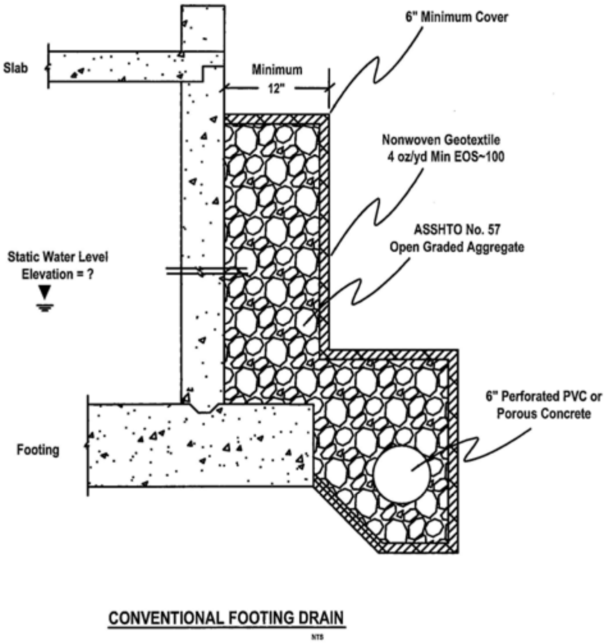
8.5 INFILTRATION/PLANTING ZONE

Planting zone or landscaping spaces immediately adjacent to the proposed structure should not be used for infiltration. The existing soils are sensitive to water. Water infiltration into this zone could increase the potential for developing frost heave and potential foundation settlement. It is highly recommended that this zone not be used for any water infiltration.

9.0 GROUNDWATER CONTROL

9.1 PERIMETER DRAIN

Some areas within the development area have shown that perched and/or temporary water tables exist at the site. Therefore, we are recommending each structure be provided with a permanent drainage system. The subdrain pipe component should be a minimum of 6 inches in diameter. The perimeter drain should be located at the base of the footing. See ketch below. The drain pipe should be surrounded by a drainage course consisting of coarse aggregate material and should be wrapped in a non-woven, needle-punched geotextile (Mirafi 160N or equal). Minimum overlap between adjacent sheets of geotextile should be 18 inches, or in accordance with the manufacturer's recommendations. The drainage pipe should be drained to a suitable gravity outfall which is not subject to storm water surcharge during periods of precipitation, or pumped. All below grade walls should be provided with a suitable moisture-proof covering to preclude moisture infiltration. All below grade occupied space areas should be water proofed.



Footing Drain Detail – Figure 10

9.2 UNDERSLAB DRAINAGE

Based upon the results of the test borings. We do not recommend the installation of a subfloor drainage system beneath the finish floor.

9.3 EXCAVATION DEWATERING

Based upon the test borings, a major excavation dewatering program is not anticipated. However, depending on the time of year perched and/or temporary water tables can develop and significantly discharge water into an excavation. These groundwater seepage will need to be expected. Uncontrolled seepage will cause softening in the impacted soils. If groundwater is encountered the Contractor is advised that he should immediately address the water condition and will need to maintain a dry excavation.

9.4 DOWNSPOUTS

It is recommended that downspouts should not discharge roof water directly adjacent to the building. Downspouts should be connected to the site storm drainage system and discharged to the retention basin by gravity.

10.0 PAVEMENTS

Review of the topographic plan indicates that it may be necessary to both cut and fill the parking area to bring the site to grade. See Section 9 for load-bearing fill discussion and Section 5 – proofrolling prior to fill placement

It should be noted that the on-site soils within the depths anticipated for cut were both above and below the optimum values which indicate the soil materials will require to be moisture adjusted prior to use. Prior to construction, an additional series of tests should be conducted to determine the in-situ moisture conditions of the on-site soils for placement.

We suggest a pavement thicknesses as follows based upon a CBR=5%. These suggested pavement thickness should not be incorporated into the design without discussion with the Civil Engineer.

Asphalt

Structure	**Structural Coefficient**	**Light Duty**	**Heavy Duty**
Subbase	0.1	6"	9"
Asphalt Base	0.4	3.0"	5"
Asphalt Wearing	0.44	1.5	1.5
Geofabric (1)			1 Layer

(1) The geofabric should be equivalent to a Mirafi 270HP or equivalent.

11.0 LIMITATIONS

This preliminary report has been prepared to aid in the evaluation of the site for design of Latrine Buildings at Hickory Run State Park. It is considered that recommendations have been provided to serve as a partial basis for decision making. Additional investigations may be necessary.

Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions between test locations will be materially different from those encountered at the specific testing locations. In addition, soil and groundwater conditions may become altered by construction activities and the passage of time. These possibilities should be considered by the designers and contractors.

Any reports prepared by Consultant are for general geotechnical information purposes only and are intended for the exclusive use of the Client for the Project and the scope of services defined in the agreement for professional services between Client and Consultant for the Project. No 3rd Party reliance is permitted or provided for this report.

Client acknowledges that further design and engineering services are necessary to establish a basis for design engineering, cost and quantity estimating, and construction work for the Project, including but not limited to excavation, foundations, pavement, dewatering, removal of unsuitable materials, or related aspects of engineering and construction. Accordingly, Client shall not rely on these reports to prepare bids or estimates for design engineering and construction work. A more fully developed scope of investigation, analysis and consultation will be required for further design and engineering and quantity estimation purposes.

These analyses and recommendations are, of necessity, based on the information made available to us at the time of the actual writing of the report as well as site conditions, surface and subsurface within only the depths investigated and existing at the time of the exploratory pits in relations both to the areal extent of the site and to the investigate depth are representative of conditions across the site. If subsurface conditions are encountered which differ from those reported herein, this office should be notified immediately so that the analyses and recommendations can be reviewed and/or revised as necessary. It is also required that:

(1) Geo-Science Engineering, & Testing, LLC be present at the site during the construction phase to verify installation according to approved plans and specifications. This is particularly important during excavation placement, compaction of fill material.

(2) This report consists of a set of engineering opinions developed for use in interpretation of the generalized geotechnical conditions exposed at this site. This report is not considered to be a specification nor shall this report be used as a specification.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted principles and practices. This warranty is in lieu of all other warranties either implied or expressed. Geo-Science Engineering & Testing, LLC assumes no responsibility for interpretations made by others based on work or recommendations made by Geo-Science Engineering & Testing, LLC. By receiving this report and using it in any manner, the client or any other person accepts that no individual is personally liable whether in tort, contract for breach of statutory duty or otherwise.

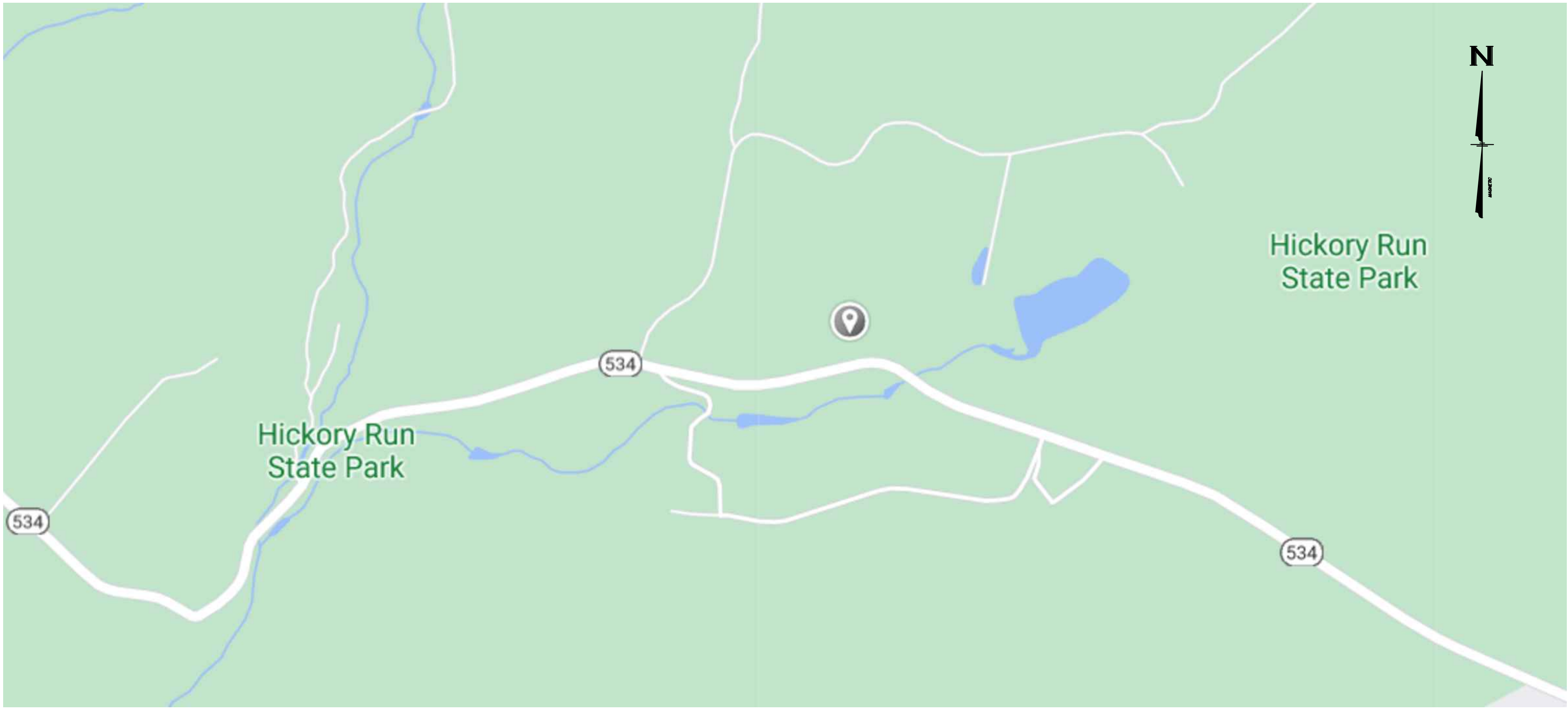
The report contained herein is proprietary and was prepared exclusively to aid the design process. The report is copyrighted.

12.0 DISCLAIMER

All available data contained in this report concerning subsurface materials or conditions, whether based upon soundings, test pits, or otherwise, has been obtained by the retained Geotechnical Consultant for his own use in designing this project. Its accuracy or completeness is not guaranteed by the Geotechnical Consultant, and **IS NOT PART OF THE CONTRACT PLANS OR SPECIFICATIONS. CONTRACTORS MUST ASSUME ALL RISKS AS THEY MAY RELATE TO THIS GEOTECHNICAL REPORT** for this project and shall not be entitled to rely on any subsurface information obtained from the retained Geotechnical Consultant and contained in this report. Contractors shall therefore make their own investigation of existing subsurface conditions, and if they do not do so, neither the Geotechnical Consultant nor Owner will be responsible in any way for the consequences.

APPENDIX A

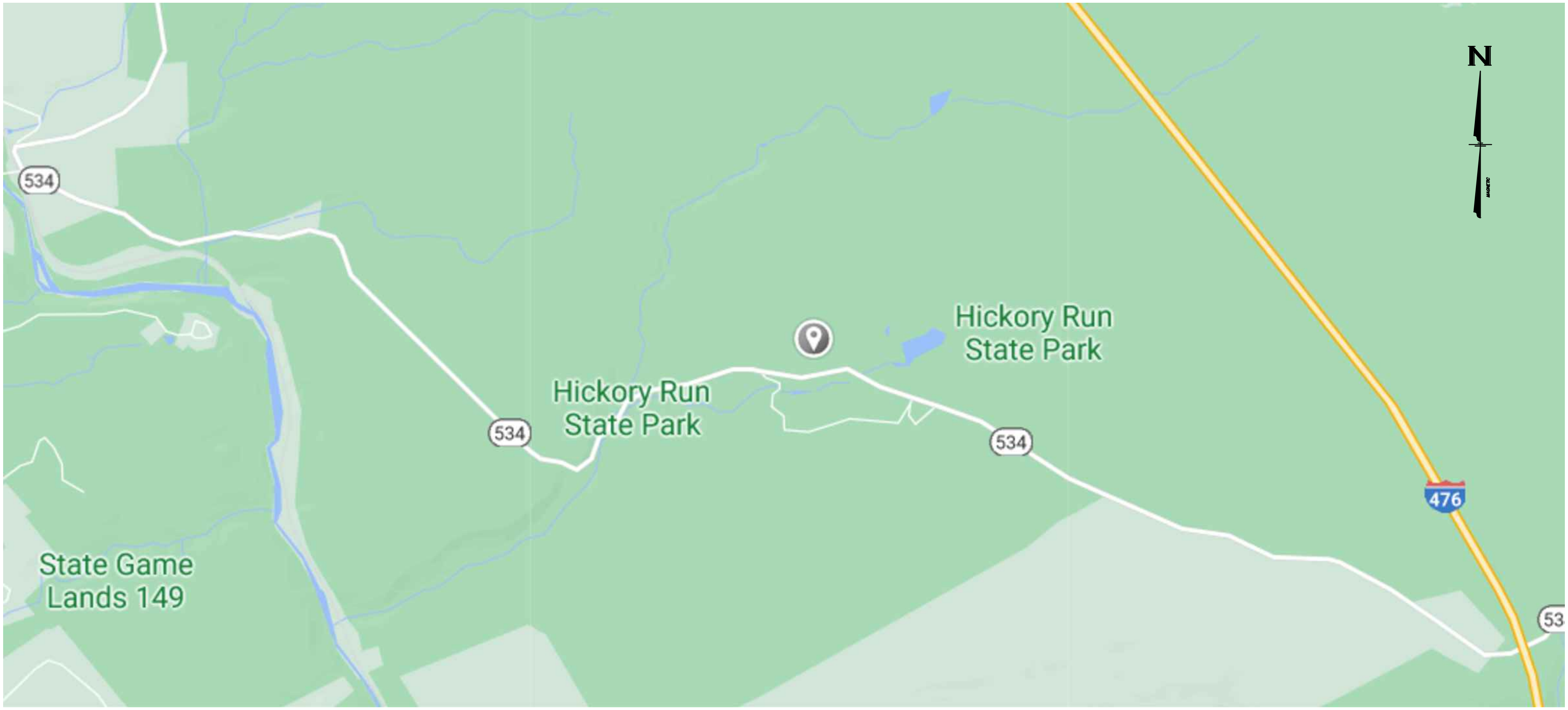
Plates



HICKORY RUN STATE PARK
WHITE HAVEN, PA

GEO–SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489–8717

SHEET NO.
A-1



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WHITE HAVEN, PA

GEO–SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489–8717

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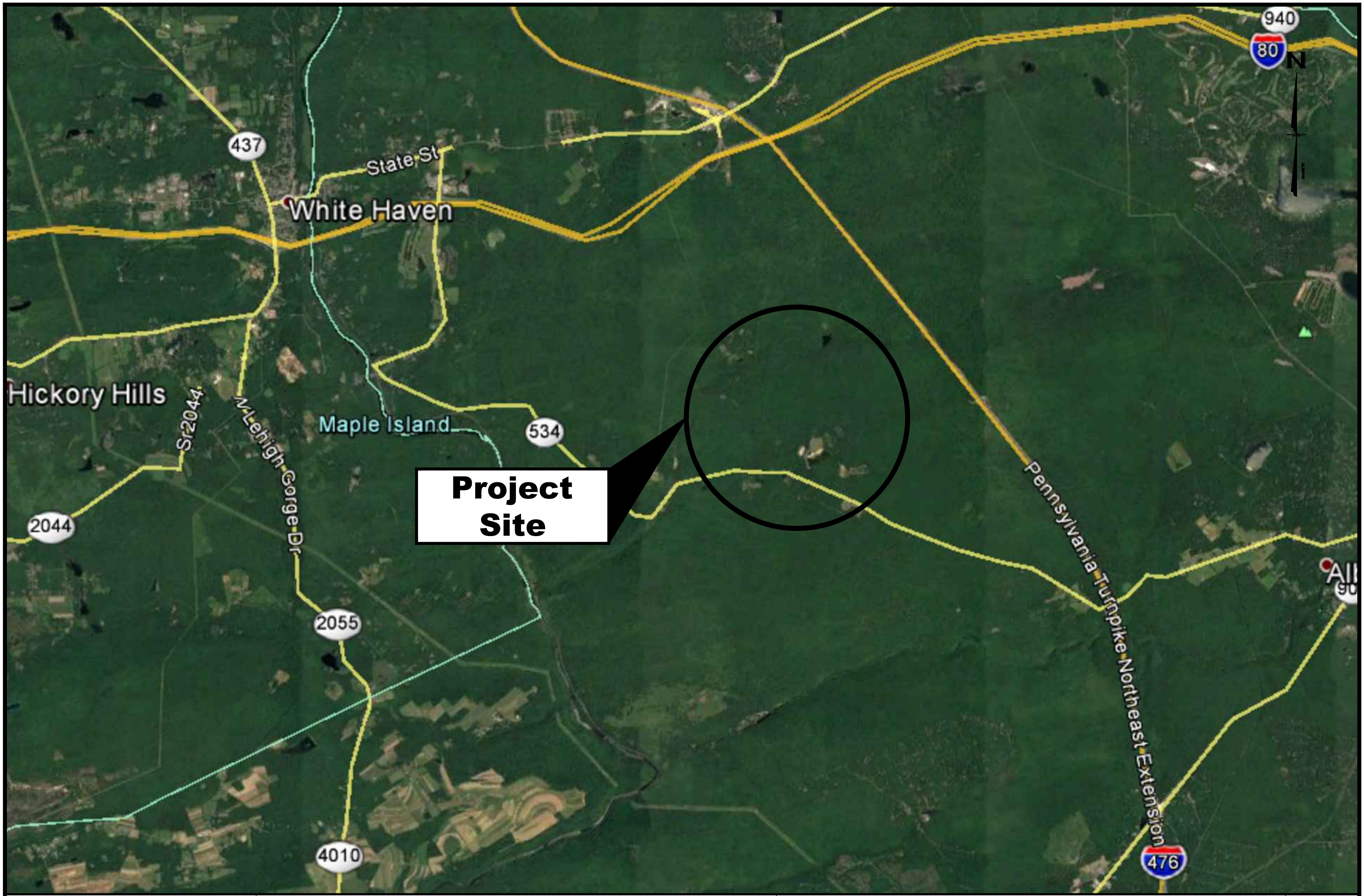


AERIAL MAP

SCALE: NTS

HICKORY RUN STATE PARK
SR 534
WHITE HAVEN, CARBON COUNTY, PENNSYLVANIA

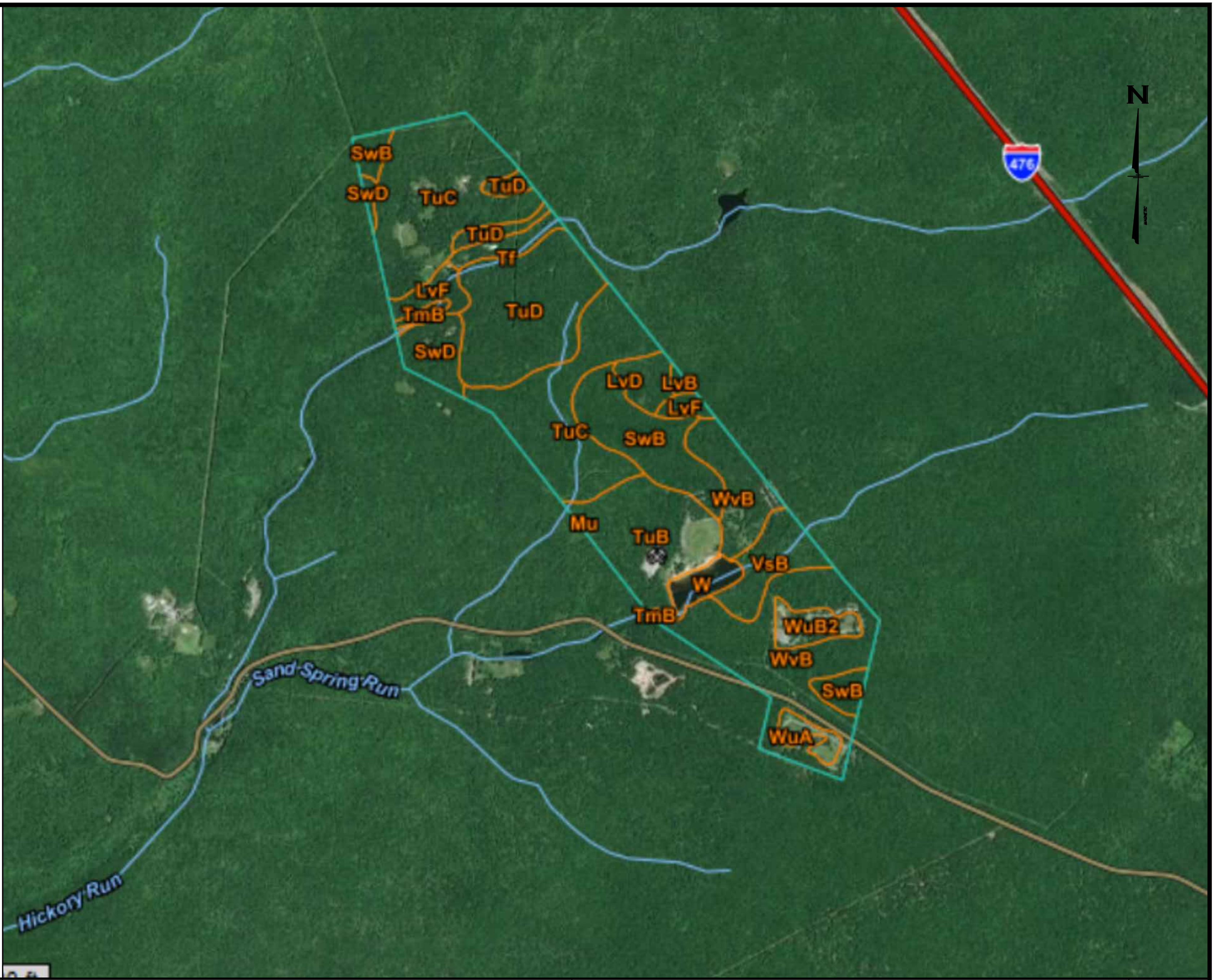
GEO-SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489-8717

SHEET NO.
A-3

DATE 12/02/2020
PROJECT #20030392

Soil Descriptions:

LvB	Lordstown channery silt loam, 0 to 8 percent slopes, very stony
LvD	Lordstown channery silt loam, 8 to 25 percent slopes, very stony
LvF	Lordstown channery silt loam, 25 to 80 percent slopes, very stony
Mu	Muck and Peat
SwB	Swartswood very stony loam, 0 to 8 percent slopes
SwD	Swartswood very stony loam, 8 to 25 percent slopes
Tf	Tioga fine sandy loam
TmB	Tioga and Middlebury very stony loams, 0 to 8 percent slopes
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes
TuC	Tunkhannock gravelly loam, 8 to 15 percent slopes
TuD	Tunkhannock gravelly loam, 15 to 25 percent slopes
VsB	Volusia very stony loam, 0 to 8 percent slopes
W	Water
WuA	Wurtsboro channery loam, 0 to 3 percent slopes
WuB2	Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded
WvB	Wurtsboro very stony loam, 0 to 8 percent slopes



SOILS MAP

SCALE: NTS

HICKORY RUN STATE PARK
SR 534
WHITE HAVEN, CARBON COUNTY, PENNSYLVANIA

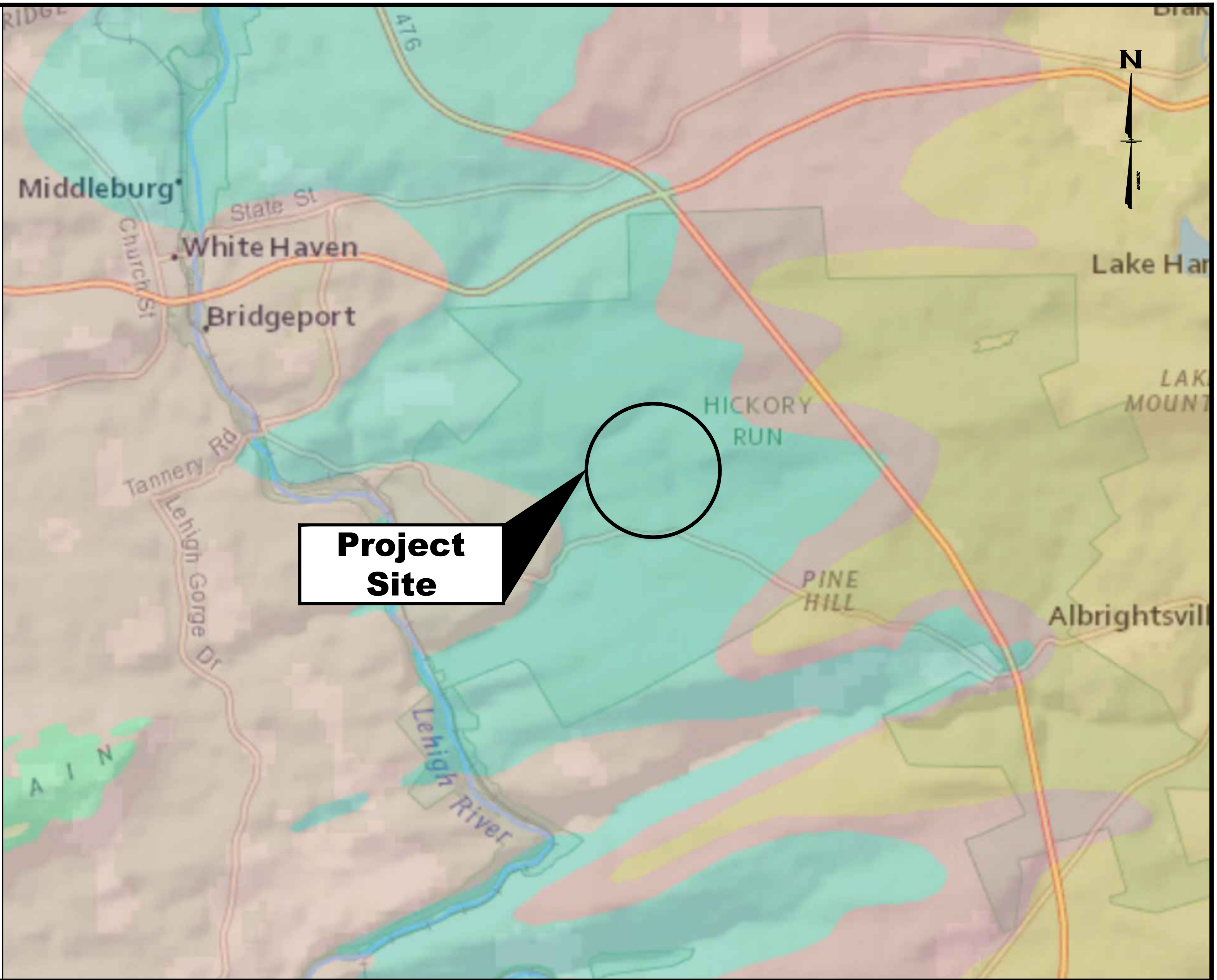
GEO–SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489–8717

SHEET NO.
A-4

DATE 12/02/2020
PROJECT #20030392

Geologic Descriptions:

The Pocono Formation is composed of light- to olive-gray, fine- to medium-grained, crossbedded sandstone, siltstone, and conglomerate. It has some subordinate dark shale, siltstone, and very thin coaly horizons. Medial conglomerate, where present, is used to divide the formation into the Mount Carbon and Beckville Members. Conglomerate at the base is composed of abundant rounded, white quartz pebbles as large as 3 inches in diameter. Plant fossils are common. Because it contains resistant rock units, it tends to underlie ridges. It is equivalent to the Burgoon Sandstone of the Allegheny Plateau. It is up to 1,700 feet thick (Berg and others, 1980; Geyer and Wilshusen, 1982).



GEOLOGIC MAP

SCALE: NTS

HICKORY RUN STATE PARK
SR 534
WHITE HAVEN, CARBON COUNTY, PENNSYLVANIA

GEO–SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489–8717

SHEET NO.
A-5

DATE 12/02/2020
PROJECT #20030392

APPENDIX B

Field and Laboratory Test Data

FIELD EXPLORATORY PROCEDURES

BORINGS

Any soil boring is simply a process of advancing a hole in the ground by some means and obtaining samples of soil at stated intervals or at changes of stratum. In the usual procedure involving the Standard Penetration Test, the hole is advanced by augering or by use of rotary drills with various types of bits cutting the soil. The hole is cleaned with flight augers or with water being pumped to remove the cuttings. When a sample is desired, a split-spoon sampler of standard dimensions is lowered to the bottom of the hole, seated a distance of 6", and then driven an additional 12 inches to 18 inches into the soil with a standard weight dropping a standard distance. The number of blows required to drive the spoon the final foot or the middle 12 inches is called the N value. As specified by the American Society for Test and Materials. ASTM Designation D1586-84, the number of blows the standard weight required to seat the sampler 6" as well as the number of blows required to drive the sampler the final foot (middle 12 inches) (two 6" increments) are recorded on the boring log.

Equipment consists of a split-spoon sampler having a 2" outside diameter and 1-3/8" inside diameter, and a weight of 140 pounds which is allowed to free fall a distance of 30". Tables have been prepared by various authorities giving relationships between N values and bearing capacities of both clay and sand.

Usually the zone most heavily stressed by the average footing is within the top 10' to 20' of soil. Therefore, in all borings we have performed the Standard Penetration Test continuously to a depth of 12 feet and at a distance between SPR Tests not-to-exceed 3 feet thereafter. Beyond 50 feet, the interval becomes 10 feet to the depth of boring. After each Standard Penetration Test has been made at the various depths, the split-spoon sampler is brought to the surface and a visual description of the soil found in the sampler is recorded by the driller on the boring log. Each sample is then placed in a container to be returned to the laboratory for verification of the visual soil description, groundwater observations are made upon the completion of the boring a minimum of 24 hours after completion of each boring. In the case of cohesionless soil, the position of the groundwater table is most critical, since a high water table decreases bearing capacity and increases settlement potential. The test boring logs attached in this appendix are the copies of the logs as presented by the test drilling company. No engineering correction or alteration is provided.

TEST PITS

Test pits are methods employed to visually examine the matrix and structure of the near surface soils. The test pits are excavated by a small hydraulic excavator to refusal or the general depth limits of the machine. At each 2 foot interval, field tests are performed to identify the relative density of the soils. The tests most commonly performed are either field density or penetrometer. Samples of the respective material changes are obtained for laboratory evaluation and the exposed soils in the side walls of the excavation are logged for further review.

GENERAL NOTES

The "standard" penetration resistance is an indication of the density of cohesionless soils and of the strength of cohesive soils.

RELATIVE DENSITY OF SOIL THAT IS PRIMARILY SAND

Number of blows	Relative Density [1]
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
Over 51	Very Dense

CONSISTENCY OF SOIL THAT IS PRIMARILY SILT OR CLAY

Number of Blows	Consistency [1]
0 - 2	Very soft
3 - 4	Soft
5 - 8	Medium
9 - 15	Stiff
16 - 30	Very stiff
Over 31	Hard

While individual test boring records are considered to be representative of subsurface conditions at the respective boring locations on the dates shown, it is not warranted that they are representative of subsurface conditions at other locations and times.

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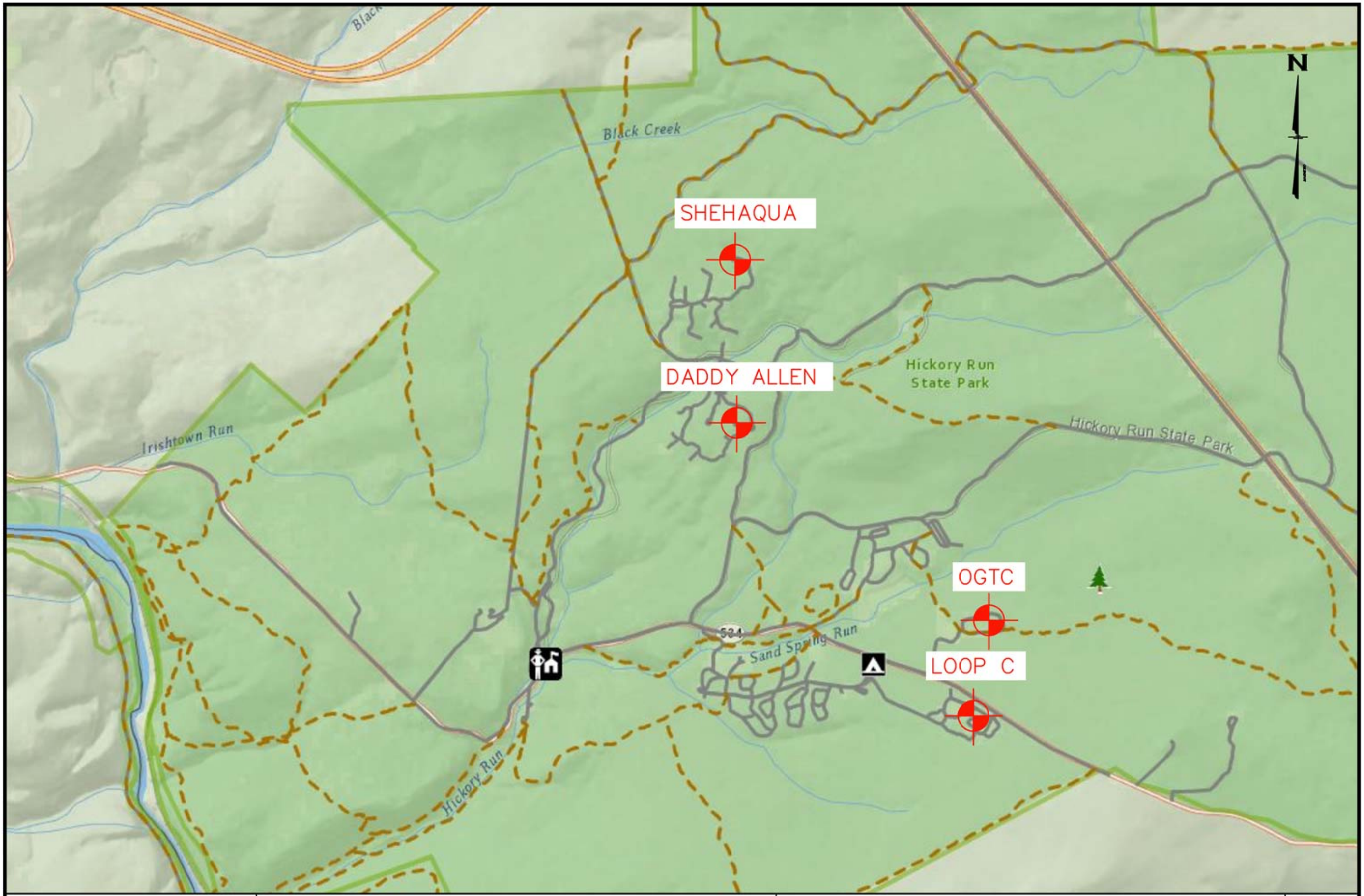
[1] SOIL MECHANICS in ENGINEERING PRACTICE by Karl Terzaghi and Ralph B. Peck.



BORING LOCATION PLAN

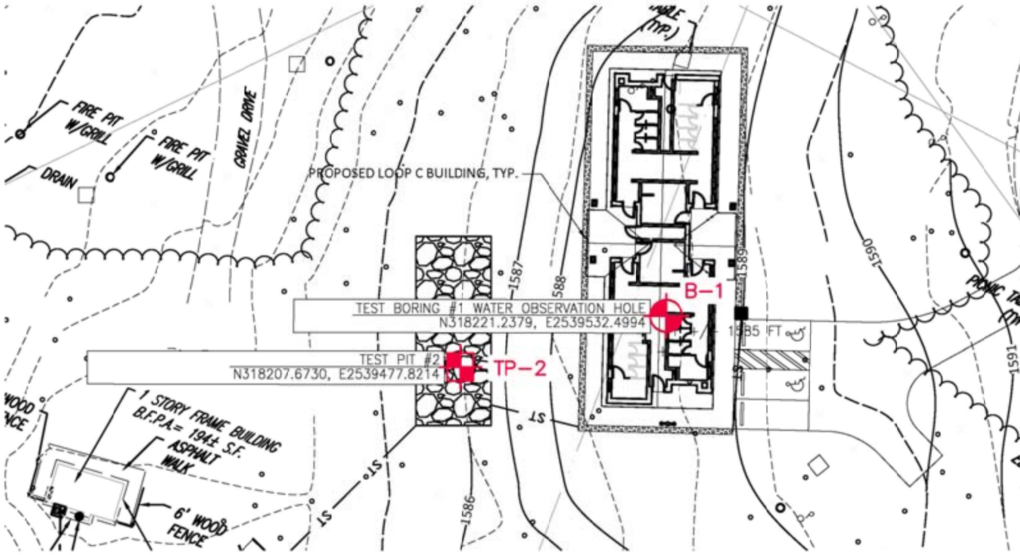
SCALE: NTS

HICKORY RUN STATE PARK
S.R.534
WHITE HAVEN, CARBON COUNTY, PENNSYLVANIA

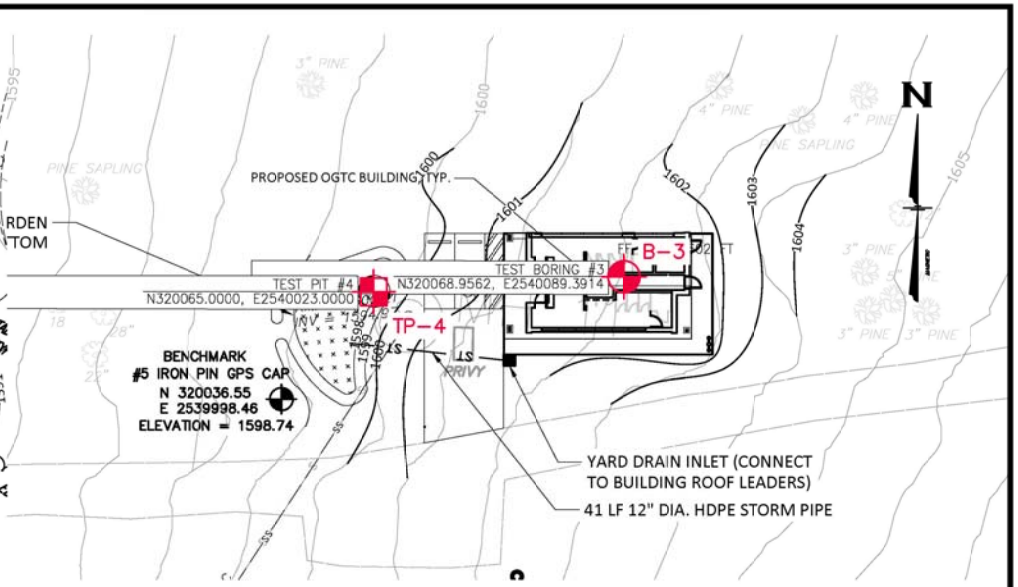
GEO–SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489–8717

SHEET NO.
B-3

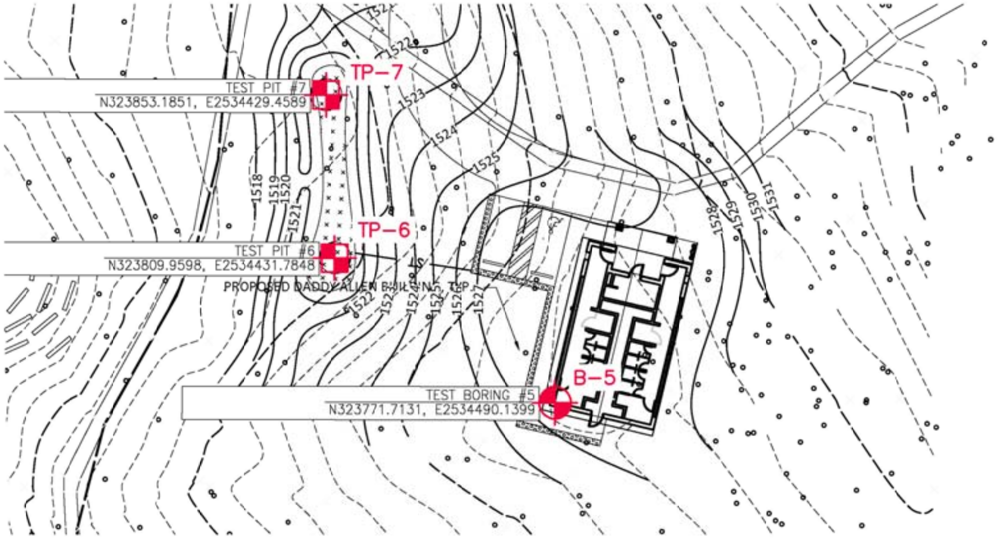
DATE 12/03/2020
PROJECT #20030392



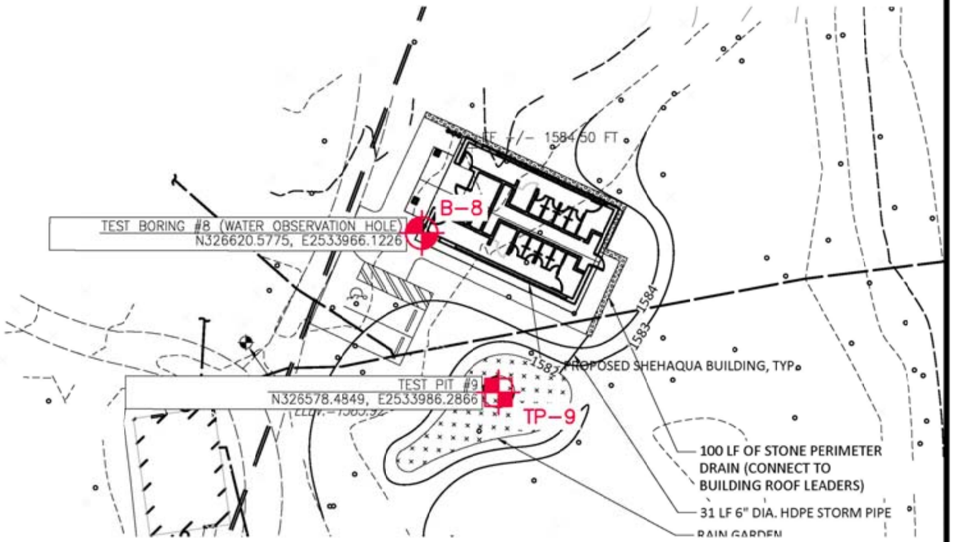
1 TB-0 TB-1 GEOTECHNICAL TESTING PLAN
LOOP C 1'=20'



2 TB-0 TB-2 GEOTECHNICAL TESTING PLAN
OGTC 1'=20'



3 TB-0 TB-3 GEOTECHNICAL TESTING PLAN
DADDY ALLEN 1'=20'



4 TB-0 TB-4 GEOTECHNICAL TESTING PLAN
SHEHAQUA 1'=20'

BORING LOCATION PLAN

SCALE: NTS

HICKORY RUN STATE PARK
S.R. 534
WHITE HAVEN, LUZERNE COUNTY, PENNSYLVANIA

GEO-SCIENCE ENGINEERING & TESTING, LLC
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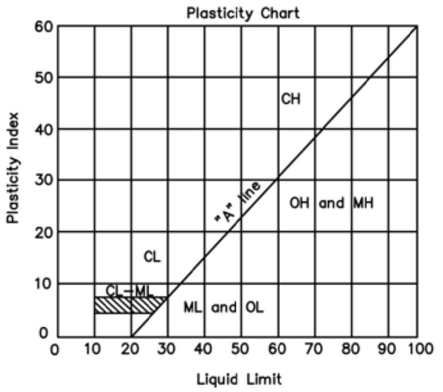
1252 mid valley drive
jessup, pa. 18434
(570) 489-8717

SHEET NO.
B-4

DATE 12/03/2020
PROJECT #20030392

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria			
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fine (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:	Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent Borderline cases requiring dual symbols^b	$C_u=\frac{D_{60}}{D_{10}}$ greater than 4; $C_c=\frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines			Not meeting all gradation requirements for GW	
		Gravels with Fines (Appreciable amount of fines)	GM^a	d	Silty gravels, gravel-sand-silt mixtures			Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u					
			GC		Clayey gravels, gravel-sand-clay mixtures			Atterberg limits below "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines			$C_u=\frac{D_{60}}{D_{10}}$ greater than 6; $C_c=\frac{(D_{30})^2}{D_{10} X D_{60}}$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines			Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM^a	d	Silty sands, sand-silt mixtures			Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u					
			SC		Clayey sands, sand-clay mixtures			Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	 Plasticity Chart			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
			OL		Organic silts and organic silty clays of low plasticity				
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts				
			CH		Inorganic clays of high plasticity, fat clays				
			OH		Organic clays of medium to high plasticity, organic silts				
	Highly organic soils		Pt		Peat and other highly organic soils				

KEY TO SOIL SYMBOLS AND TERMS

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

TERMS DESCRIBING CONSISTENCY OR CONDITION

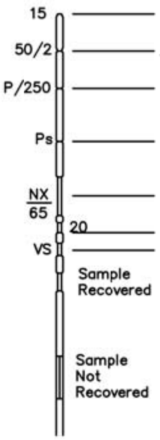
COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to relative density[1] as determined by laboratory tests or standard penetration resistance tests.

Descriptive Term	Relative Density
Very loose	0 to 15%
Loose	15 to 35%
Medium dense	35 to 65%
Dense	65 to 85%
Very dense	85 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings of by unconfined compression tests.

Descriptive Term	Unconfined Compression Strength, tons/sq.ft.
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

TEST AND SAMPLE IDENTIFICATION



15 – The number of blows (15) of a 140-pound hammer falling 30 inches used to drive a 2" O.D. split-barrel sampler for the last 12 inches of penetration.
50/2 – Number of blows (50) used to drive the split-barrel a certain number of inches (2).
P – Thin-wall tube sample.
P250 – Thin-wall tube pushed hydraulically, using a certain pressure (250 psi) to push the last 6 inches.
C_1 – Dennison or Pitcher-Type – core-barrel sample.
Ps – Piston sample.
A – Auger sample
BX – Rock cored with BX core barrel, which obtains a 1-5/8" diameter core.
NX – Rock cored with NX core barrel, which obtains a 2-1/8" diameter core.
65% – Percentage (65) of rock core recovered.
20% – Rock Quality Designation (RQD)
VS – Vane Shear Test.

Laboratory Test Performed:

C – Consolidation and specific gravity tests.
D – Maximum and minimum density.
DS – Direct Shear test.
G – Specific gravity test.
K – Permeability test
M – Mechanical (sieve or hydrometer) analysis
T – Triaxial compression test
U – Unconfined compression test.
W – Unit weight and Natural moisture content.
X – Special test performed – see Laboratory test results.

GEO-SCIENCE ENGINEERING & TESTING, LLC
Consulting Engineers
1252 mid valley drive
jessup, pa. 18434
(570) 489-8717

SHEET NO.
B-5

Geo-Science Engineering & Testing, LLC
Consulting Geotechnical Engineers
1252 Mid-Valley Drive
Jessup, PA 18434
(570) 489-8717

LOG OF BORING

BORING NO. **B-1**
SHEET **1** OF **1**

PROJECT **Hickory Run State Park**
White Haven, Pa
EXPLORATION CONTRACTOR **Pocono Test Borings & Drilling Co.**
ENGINEER REP.
LOGGED BY **Frank Sipple**
NORTH
EAST
STARTED **12-1-20**
COMPLETED **12-1-20**

GROUNDWATER

ENCOUNTERED DURING
DRILLING AT **8** ▽
____ HOURS AFTER DRILLING ____ ▼
____ DAYS AFTER DRILLING ____ ▼
____ DAYS AFTER DRILLING ____ ▼
Drill Water

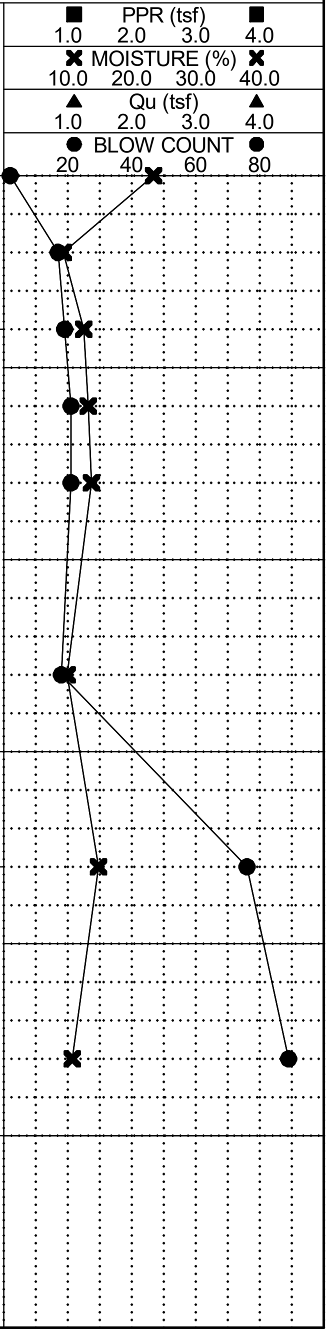
BORING METHOD

☐ HAND AUGER
☐ HOLLOW STEM AUGER
☐ CONTINUOUS FLIGHT AUGER
☒ DRIVING CASING
☐ ROTARY (MUD) DRILLING
____ DEPTH MUD STARTED

SAMPLER TYPE AND DATA

☒ SPLIT BARREL **2 Inch O.D.**
■ UNDISTURBED SAMPLE
▐ AUGER **4 Inch**
▌ ROCK CORE **NQ**
☐
☐

DEPTH AND ELEVN. (FT)	SAMPLE/CORE NUMBER	LEGEND	SPT VALUES	CORE REC. %	RQD %	WATER LEVEL	SYMBOLIC LOG	SOIL DESCRIPTION
1588.5	1	☒	1 1 1 1	15				**SILTY SAND with GRAVEL (SM)** some organics, roots, brown, loose to medium dense, moist
	2	☒	4 7 10 10	90				
								1584.5
5 1583.5	3	☒	10 10 9 8	75				**SILTY GRAVEL with SAND (GM)** brown, medium dense to very dense, moist
	4	☒	8 10 11 10	85				
	5	☒	10 10 11 14	70				
10 1578.5								
	6	☒	8 9 9 12	90				
15 1573.5								1573.5 Water Observation Well Installed
								1570.5
	7	☒	12 24 52 50/.1	69				**CLAYEY SAND with GRAVEL (SC)** some shale fragments, brown and grey, very dense , wet
20 1568.5								
	8	☒	39 50/.3	75				
25 1563.5								1563.5 EOB @ 25'



REMARKS:

The stratification lines represent approximate boundaries between soil types: Insitu the transition may be gradual.

BOREHOLE LOCATION

STATION:
OFFSET:
ELEVATION: 1588.5

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Consulting Geotechnical Engineers
1252 Mid-Valley Drive
Jessup, PA 18434
(570) 489-8717

LOG OF BORING

BORING NO. **B-3**
SHEET **1** OF **1**

PROJECT **Hickory Run State Park**
White Haven, Pa
NORTH
EAST
EXPLORATION CONTRACTOR **Pocono Test Borings & Drilling Co.**
STARTED **12-1-20**
ENGINEER REP.
LOGGED BY **Frank Sipple**
COMPLETED **12-1-20**

GROUNDWATER

ENCOUNTERED DURING
DRILLING AT **12** ▽
HOURS AFTER DRILLING ▼
DAYS AFTER DRILLING ▼
DAYS AFTER DRILLING ▼
Drill Water

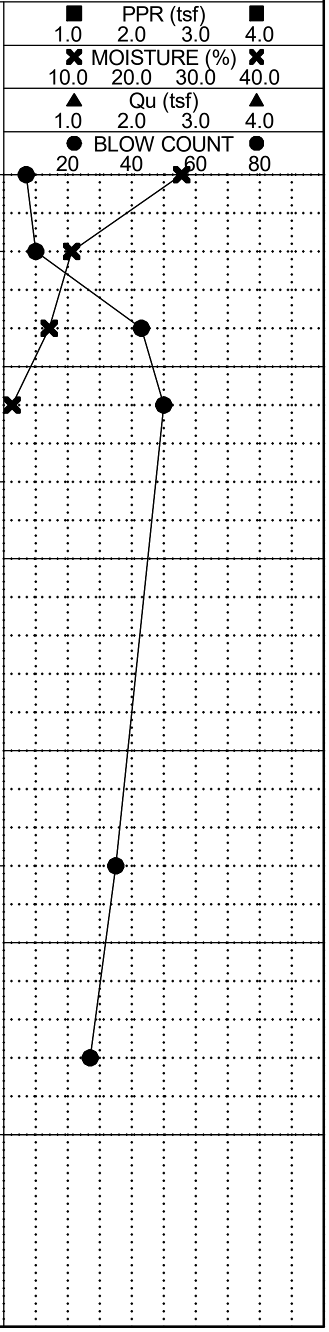
BORING METHOD

☐ HAND AUGER
☐ HOLLOW STEM AUGER
☐ CONTINUOUS FLIGHT AUGER
☒ DRIVING CASING
☐ ROTARY (MUD) DRILLING
DEPTH MUD STARTED

SAMPLER TYPE AND DATA

☒ SPLIT BARREL **2 Inch O.D.**
■ UNDISTURBED SAMPLE
▮ AUGER **4 Inch**
▯ ROCK CORE **NQ**
☐
☐

DEPTH AND ELEVN. (FT)	SAMPLE/CORE NUMBER	LEGEND	SPT VALUES	CORE REC. %	RQD %	WATER LEVEL	SYMBOLIC LOG	SOIL DESCRIPTION
1601.5	1		1 1 6 13	20				**SILTY SAND with GRAVEL (SM)** red brown, loose, moist
	2		9 1 9 24	25				1599.5 **SILTY SAND (SM)** brown, medium dense to very dense, moist
5 1596.5	3		18 24 19 20	55				
	4		50/.3	67				
	R-1				54			1593.5 **BOULDERS** nested
10 1591.5								
	R-2				36			
15 1586.5								
	5		28 16 19 16	35				1583.5 **SILTY SAND (SM)** brown, medium dense, moist
20 1581.5								
	6		11 15 12 22	50				
25 1576.5								1576.5 EOB @ 25'



REMARKS:

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BOREHOLE LOCATION

STATION:
OFFSET:
ELEVATION: 1601.5

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Consulting Geotechnical Engineers
1252 Mid-Valley Drive
Jessup, PA 18434
(570) 489-8717

LOG OF BORING

BORING NO. **B-5**

SHEET **1** OF **1**

PROJECT **Hickory Run State Park**
White Haven, Pa
EXPLORATION CONTRACTOR **Pocono Test Borings & Drilling Co.**
ENGINEER REP. ______ LOGGED BY **Frank Sipple**

NORTH **N 5**
EAST **E 0**
STARTED **12-2-20**
COMPLETED **12-2-20**

GROUNDWATER

ENCOUNTERED DURING
DRILLING AT **9** ∇
_____ HOURS AFTER DRILLING ______ ▼
_____ DAYS AFTER DRILLING ______ ▼
_____ DAYS AFTER DRILLING ______ ▼
Drill Water

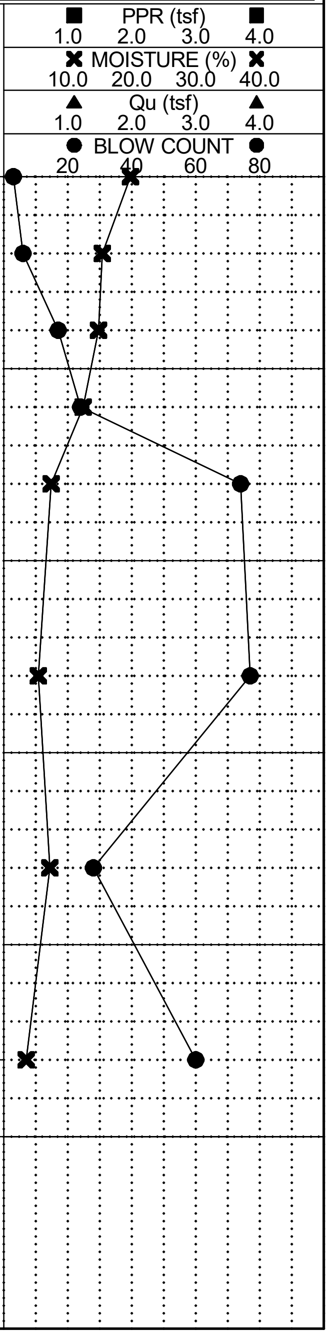
BORING METHOD

☐ HAND AUGER
☐ HOLLOW STEM AUGER
☐ CONTINUOUS FLIGHT AUGER
☒ DRIVING CASING
☐ ROTARY (MUD) DRILLING
_____ DEPTH MUD STARTED

SAMPLER TYPE AND DATA

☒ SPLIT BARREL **2 Inch O.D.**
■ UNDISTURBED SAMPLE ______
▮ AUGER **4 Inch**
▯ ROCK CORE **NQ**
☐ ______
☐ ______

DEPTH AND ELEVN. (FT)	SAMPLE/CORE NUMBER	LEGEND	SPT VALUES	CORE REC. %	RQD %	WATER LEVEL	SYMBOLIC LOG	SOIL DESCRIPTION
1527.0	1	☒	1 2 1 4	45				**SILTY SAND with GRAVEL (SM)** some cobbles, red brown, loose to very dense, moist
	2	☒	3 3 2 3	40				
5 1522.0	3	☒	4 8 9 14	50				
	4	☒	10 13 11 20	35				
	5	☒	24 50/.2	71				
10 1517.0								
	6	☒	21 27 50/.2	83				
15 1512.0								
	7	☒	18 14 14 17	40				
20 1507.0								
								1504.0
	8	☒	30 32 28 31	25				**SILTY SAND (SM)** some rock fragments, red brown, very dense, moist
25 1502.0								1502.0 EOB @ 25'



REMARKS:

The stratification lines represent approximate boundaries between soil types: Insitu the transition may be gradual.

BOREHOLE LOCATION
STATION:
OFFSET:
ELEVATION: 1527

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Consulting Geotechnical Engineers
1252 Mid-Valley Drive
Jessup, PA 18434
(570) 489-8717

LOG OF BORING

BORING NO. **B-8**

SHEET **1** OF **1**

PROJECT **Hickory Run State Park**
White Haven, Pa

NORTH

EAST

EXPLORATION CONTRACTOR **Pocono Test Borings & Drilling Co.**

STARTED **12-2-20**

ENGINEER REP.

LOGGED BY **Frank Sipple**

COMPLETED **12-2-20**

GROUNDWATER

ENCOUNTERED DURING
DRILLING AT 8 ▽
HOURS AFTER DRILLING ▼
DAYS AFTER DRILLING ▼
DAYS AFTER DRILLING ▼
Drill Water

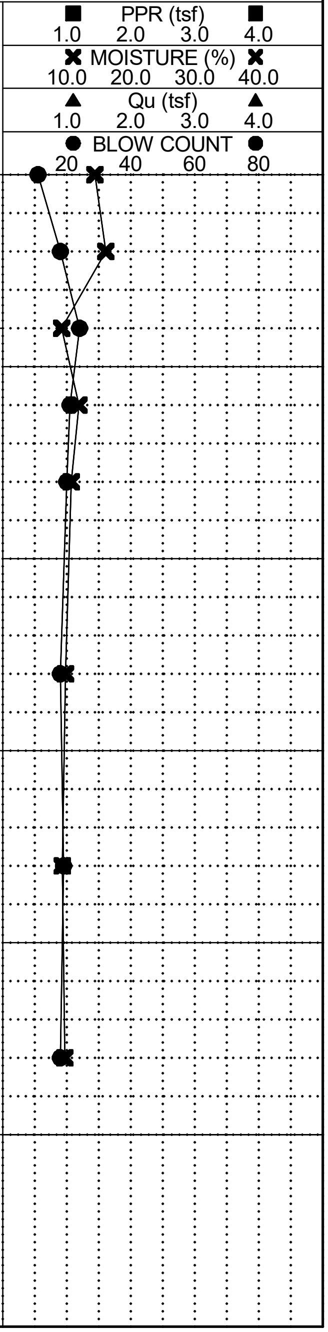
BORING METHOD

☐ HAND AUGER
☐ HOLLOW STEM AUGER
☐ CONTINUOUS FLIGHT AUGER
☒ DRIVING CASING
☐ ROTARY (MUD) DRILLING
DEPTH MUD STARTED

SAMPLER TYPE AND DATA

☒ SPLIT BARREL **2 Inch O.D.**
■ UNDISTURBED SAMPLE
▌ AUGER **4 Inch**
▐ ROCK CORE **NQ**
☐
☐

DEPTH AND ELEVN. (FT)	SAMPLE/CORE NUMBER	LEGEND	SPT VALUES	CORE REC. %	RQD %	WATER LEVEL	SYMBOLIC LOG	SOIL DESCRIPTION
1585.0	1	☒	2 3 8 8	75				**SILTY SAND with GRAVEL (SM)** brown, medium dense, moist
	2	☒	8 8 10 11	65				
								1581.0
	3	☒	14 12 12 13	75				**SILTY SAND (SM)** red brown, medium dense, moist
5 1580.0								
	4	☒	10 13 8 15	45				
	5	☒	4 10 10 12	70				
10 1575.0								
	6	☒	8 9 9 10	70				
								1570.0
15 1570.0								Water Observation Well Installed
	7	☒	5 9 10 13	100				
20 1565.0								
	8	☒	8 9 9 9	90				
								1560.0
25 1560.0								EOB @ 25'



REMARKS:

The stratification lines represent approximate boundaries between soil types: Insitu the transition may be gradual.

BOREHOLE LOCATION

STATION:
OFFSET:
ELEVATION: 1585

LABORATORY PROCEDURES

Upon completion of the test borings, the samples are returned to the laboratory for appropriate examination and testing.

The samples are recorded and visually examined and classified. Representative samples are then selected for basic geotechnical properties tests such as:

Moisture Content
Gradation Analysis
Specific Gravity
Atterberg Limits

These tests are then performed in accordance with the appropriate ASTM designation for the laboratory test required. The index tests are then used to correlate the engineering properties based upon known performance history or published data.

If, from the review, more sophisticated testing is required such as compressibility or strength tests, the samples are then prepared accordingly.

MOISTURE CONTENT AND REFERRAL

PROJECT: Hickory Run State Park **Project: 20030392**

LOCATION: White Haven, PA **Date: 12-9-20**

BORE HOLE NO.	**SAMPLE NO.**	**DEPTH** (feet)	**VISUAL IDENTIFICATION**	**MOISTURE CONTENT (%)**
B-1	1	0-2'	SILTY SAND w/GRAVEL (SM)	23.4
	2	2-4'	Refer to B-1, S-1	9.3
	3	4-6'	SILTY GRAVEL with SAND (GM)	12.5
	4	6-8'	Refer to B-1, S-3	13.2
	5	8-10'	Refer to B-1, S-3	13.7
	6	13-15'	Refer to B-1, S-3	9.9
	7	18-19.6'	CLAYEY SAND w/GRAVEL (SC)	14.8
	8	23-23.8'	Refer to B-1, S-7	10.7
B-3	1	0-2'	Refer to B-1, S-1	27.8
	2	2-4'	SILTY SAND (SM)	10.6
	3	4-6'	Refer to B-3, S-2	7.1
	4	6-6.3'	Rock Fragments	1.3
	5	18-20'	Refer to B-3, S-2	12.7
	6	23-25'	Refer to B-3, S-2	10.5

MOISTURE CONTENT AND REFERRAL

PROJECT: Hickory Run State Park **Project: 20030392**

LOCATION: White Haven, PA **Date: 12-9-20**

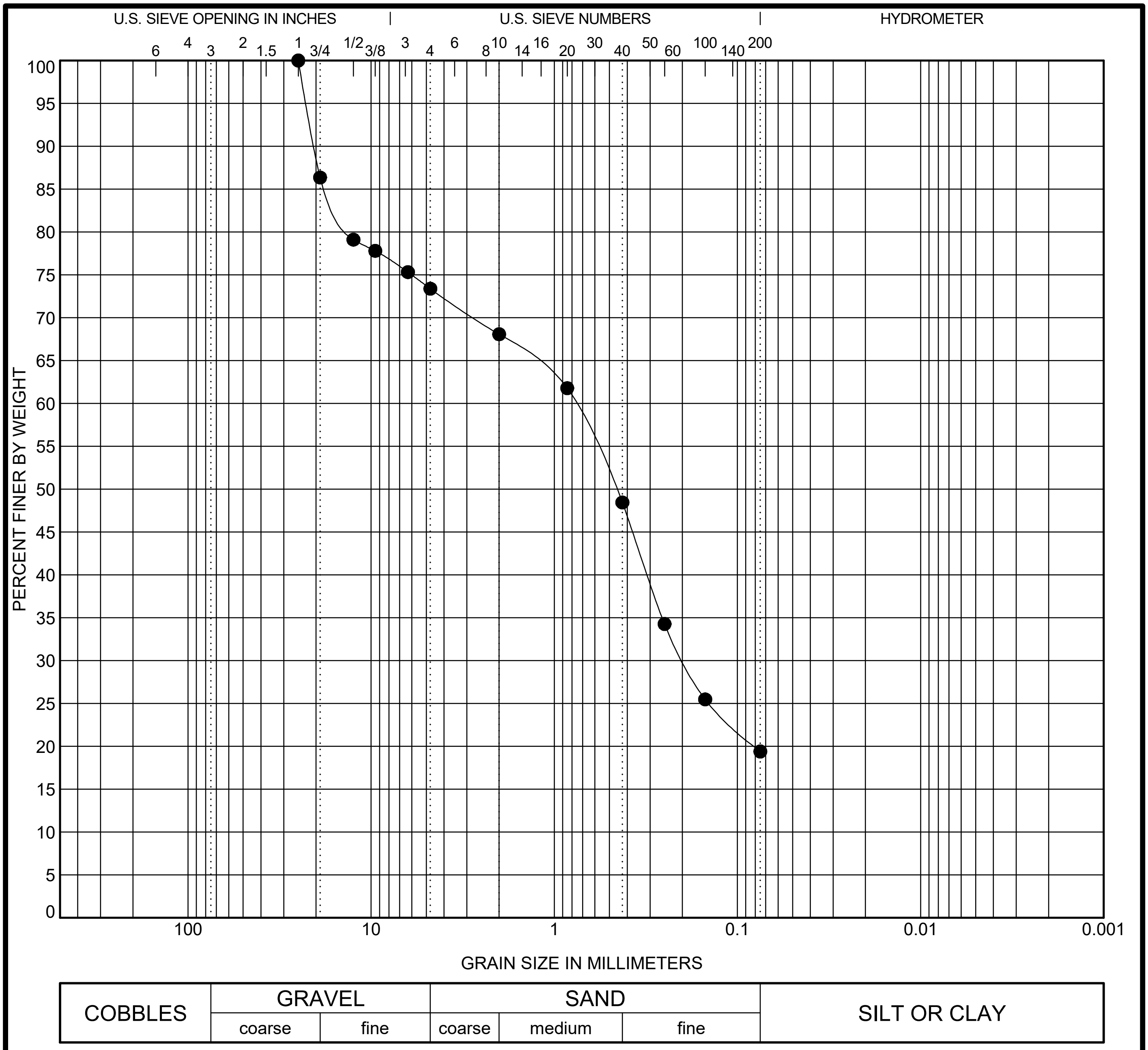
BORE HOLE NO.	**SAMPLE NO.**	**DEPTH** (feet)	**VISUAL IDENTIFICATION**	**MOISTURE CONTENT (%)**
B-5	1	0-2'	Refer to B-1, S-3	19.8
	2	2-4'	Refer to B-1, S-3	15.4
	3	4-6'	Refer to B-1, S-3, redox with some organics	14.8
	4	6-8'	Refer to B-1, S-3, redox with some organics	12.4
	5	8-8.7'		7.4
	6	13-14.2'	Refer to B-1, S-3	5.4
	7	18-20'	Refer to B-1, S-3	7.2
	8	23-25'	Rock Fragments	3.5
B-8	1	0-2'	Refer to B-1, S-1	14.4
	2	2-4'	Refer to B-1, S-1	16.1
	3	4-6'	Refer to B-3, S-2	9.2
	4	6-8'	Refer to B-3, S-2	11.9
	5	8-10'	Refer to B-3, S-2	10.7
	6	13-15'	Refer to B-3, S-2	9.8
	7	18-20'	Refer to B-3, S-2	9.3

MOISTURE CONTENT AND REFERRAL

PROJECT: Hickory Run State Park **Project: 20030392**

LOCATION: White Haven, PA **Date: 12-9-20**

BORE HOLE NO.	SAMPLE NO.	DEPTH (feet)	VISUAL IDENTIFICATION	MOISTURE CONTENT (%)
B-8	8	23-25	Refer to B-3, S-2	9.7



Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-1 S-1	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	% Fines
● B-1 S-1	25	0.775	0.195		26.6	54.0	19.4

GSE_GRAIN_SIZE 20030392.GPJ LAB_STANDARD.GDT 12/4/20

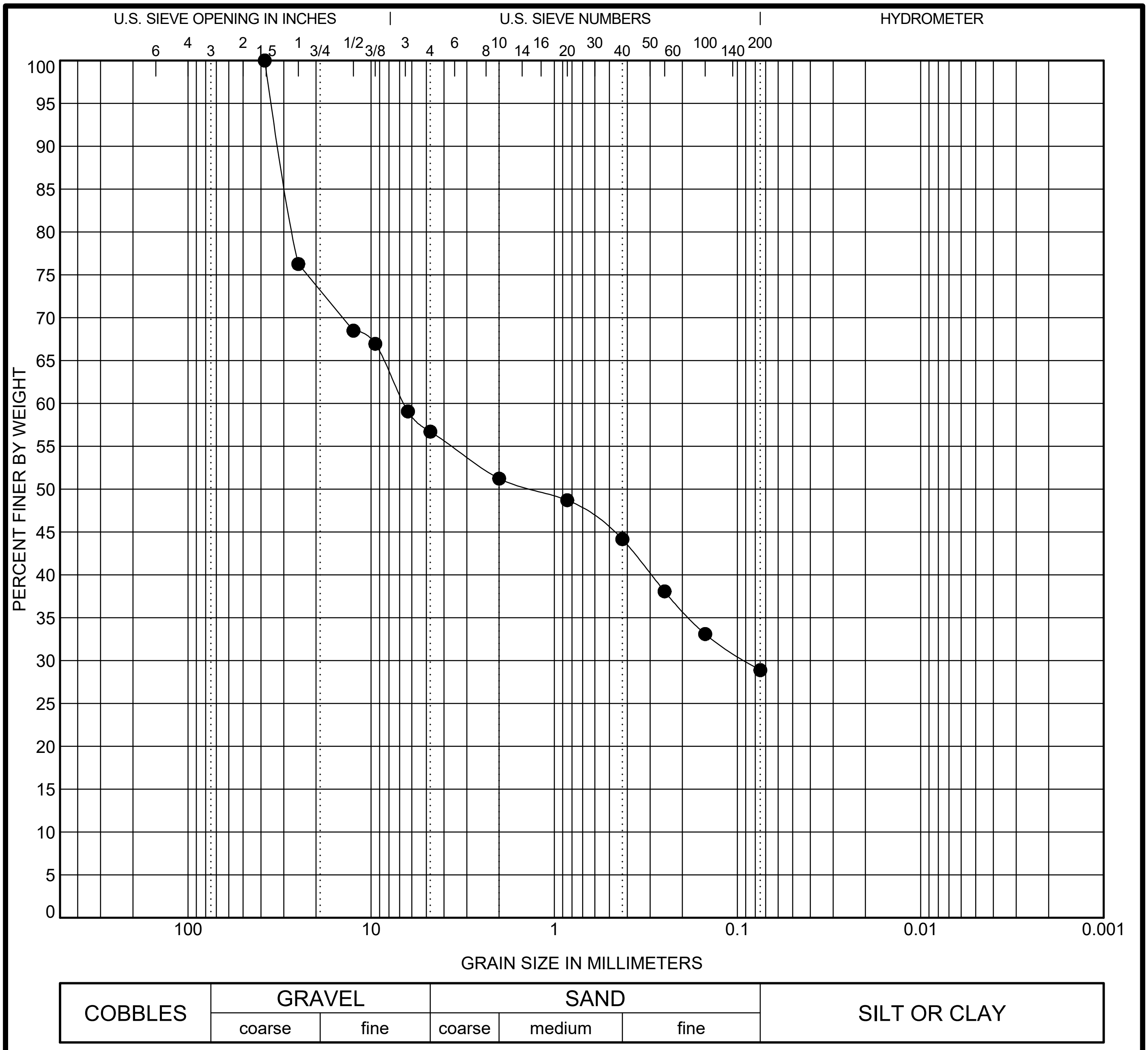
Geo-Science Engineering
& Testing, LLC
1252 Mid-Valley Drive
Jessup, PA 18434
Telephone: (570) 489-8717

GRAIN SIZE DISTRIBUTION

Project: Hickory Run State Park

Location: White Haven, pa

Number: 20030392



Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-1 S-3	SILTY GRAVEL with SAND(GM)	NP	NP	NP		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	% Fines
● B-1 S-3	38.1	6.615	0.09		43.3	27.8	28.9

Geo-Science Engineering
& Testing, LLC
1252 Mid-Valley Drive
Jessup, PA 18434
Telephone: (570) 489-8717

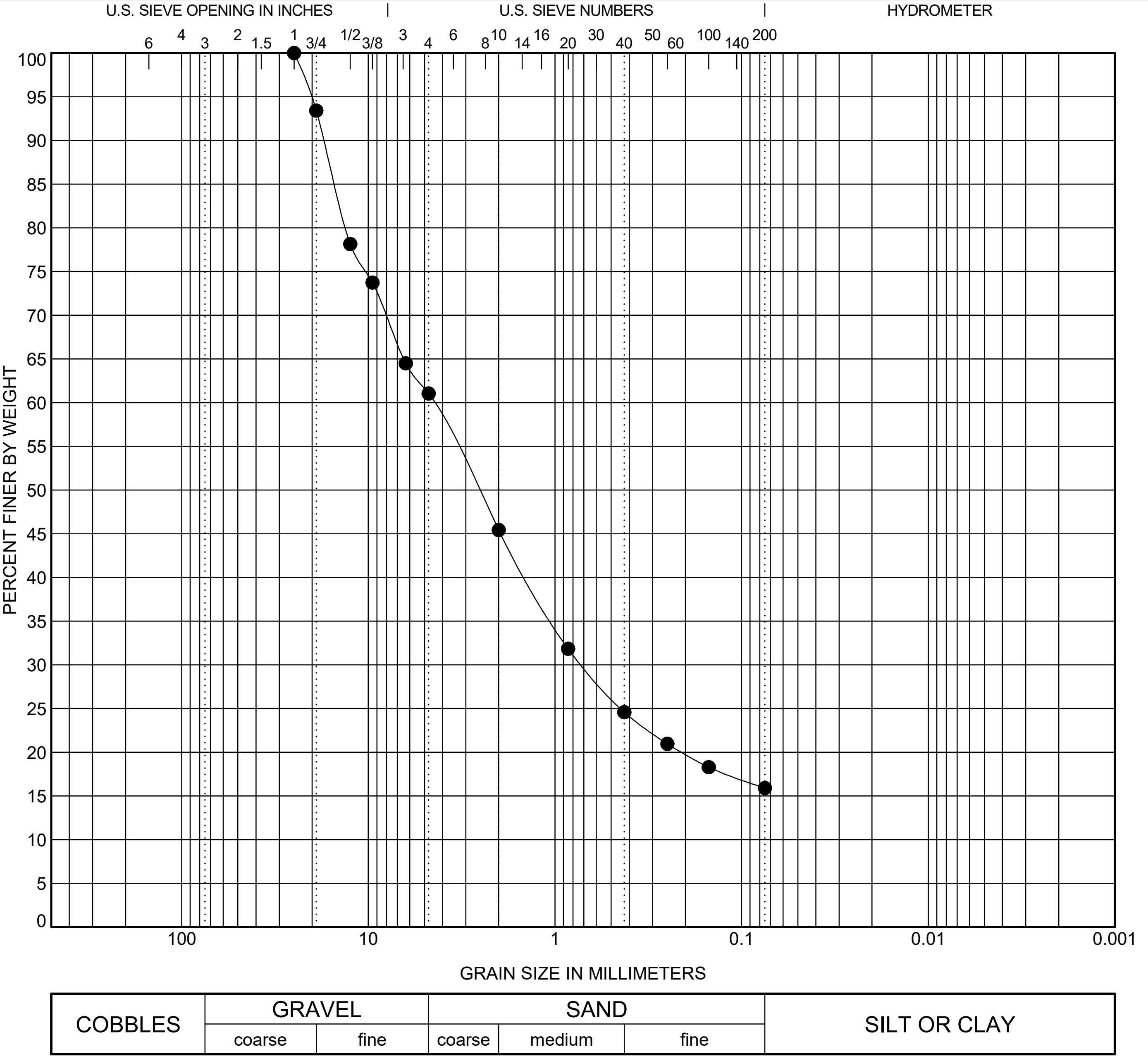
GRAIN SIZE DISTRIBUTION

Project: Hickory Run State Park

Location: White Haven, pa

Number: 20030392

GSE GRAIN SIZE 20030392.GPJ LAB STANDARD.GDT 12/4/20



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-1	S-7	CLAYEY SAND with GRAVEL(SC)	35	23	12		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% Fines
●	B-1	S-7	25	4.484	0.713		39.0	45.1	15.9

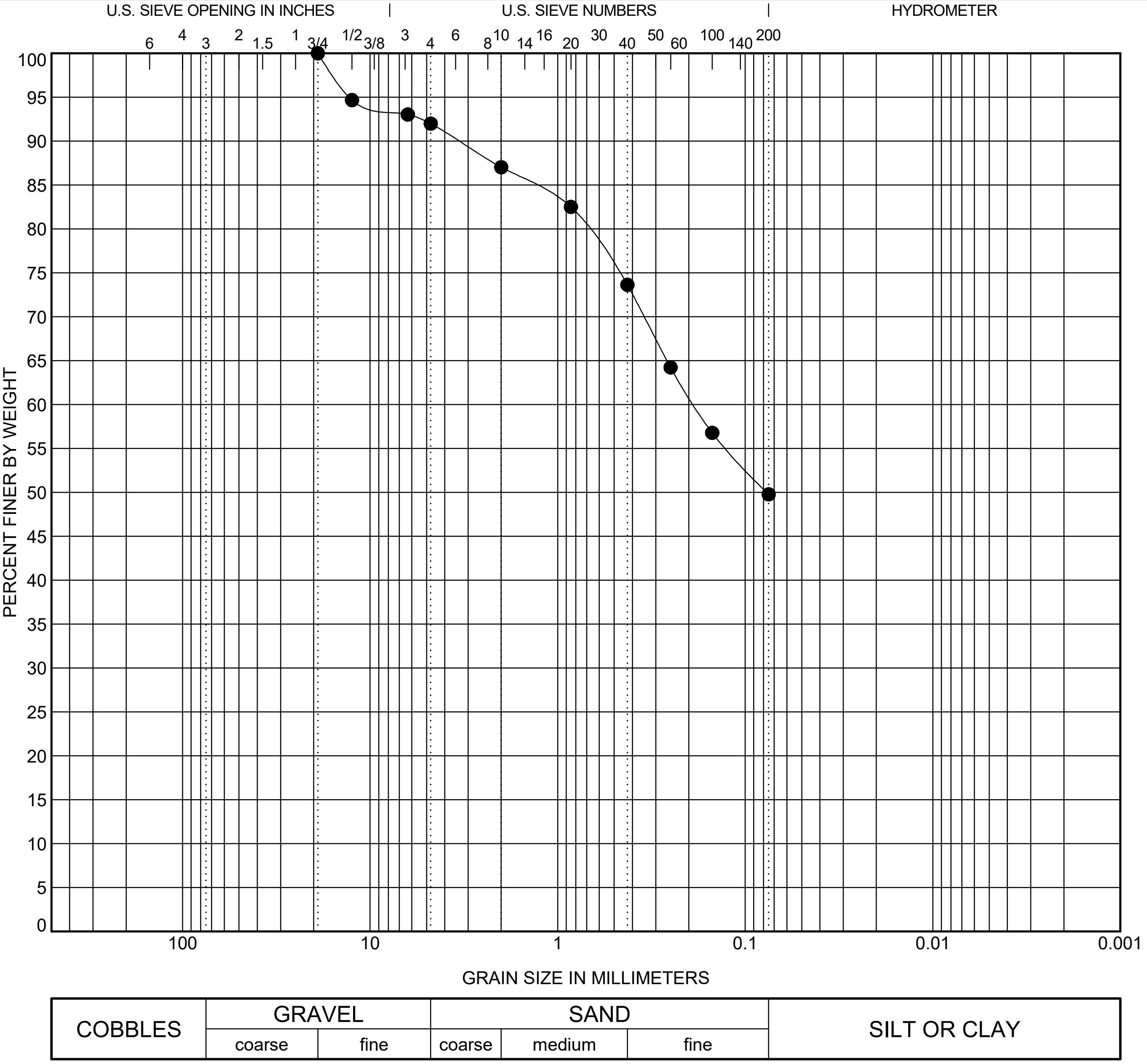
Geo-Science Engineering
& Testing, LLC
1252 Mid-Valley Drive
Jessup, PA 18434
Telephone: (570) 489-8717

GRAIN SIZE DISTRIBUTION

Project: Hickory Run State Park

Location: White Haven, pa

Number: 20030392



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-3	S-2	SILTY SAND(SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	% Fines
●	B-3	S-2	19	0.187			8.0	42.2	49.8

Geo-Science Engineering
& Testing, LLC
1252 Mid-Valley Drive
Jessup, PA 18434
Telephone: (570) 489-8717

GRAIN SIZE DISTRIBUTION

Project: Hickory Run State Park

Location: White Haven, pa

Number: 20030392

GSE GRAIN SIZE 20030392.GPJ LAB STANDARD.GDT 12/4/20

Hickory Run State Park
GSET Project No. 20030087

Corrosion Suite LABORATORY REPORT

Material Tested:	SPT Soil Jar
Date:	December 4, 2020
Sample Identification	B-5, S-2/3

Chlorides (ppm)	<28
Sulfates (ppm)	>200
pH	8.2
Resistivity (ohm/cm)	805,680

APPENDIX C

Infiltration Report

Geo-Science Engineering & Testing, LLC

December 15, 2020

SMP Architects
1600 Walnut Street, #2
Philadelphia, Pennsylvania 19460

Attention: Todd Woodward, AIA, LEED AP

Reference: Latrine Improvements Stormwater Infiltration Summary
Hickory Run State Park
White Haven, Pennsylvania 18661
GSET Project Number: 20030392

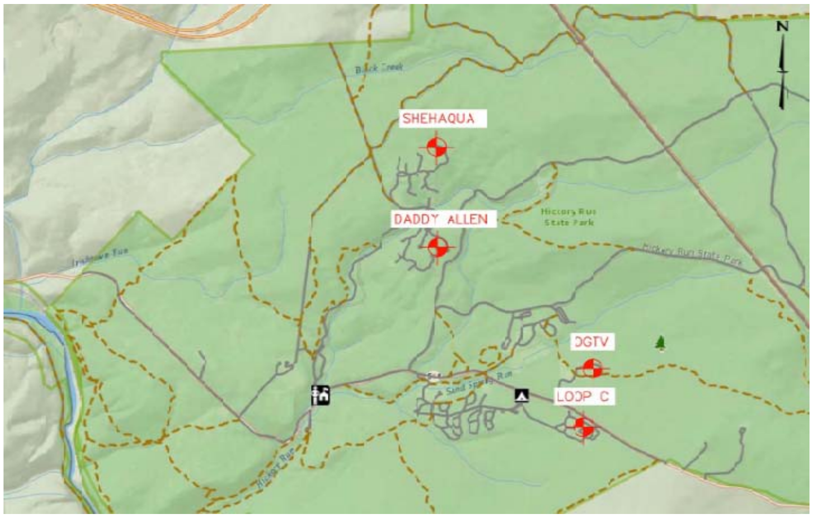
Mr. Woodward,

Geo-Science Engineering & Testing, LLC. (GSET) has completed a site evaluation for stormwater infiltration facilities for Latrine Improvements at the Hickory Run State Park in White Haven, Pennsylvania. All testing was conducted in general accordance with the Pennsylvania Department of Environmental Protection (PADEP)'s *Pennsylvania Stormwater Best Management Practices Manual , Appendix C – Site Evaluation and Soil Testing– December 2006* ("BMP Manual") specifications.

1.0 Project Site Conditions

The purpose of this evaluation was to determine feasibility for stormwater infiltration facilities in support of four, single-story Latrine Buildings and associated parking located throughout the Hickory Run State Park.

These sites are designated as the Shehaqua, Daddy Allen, OGTC, and Loop C sites. The approximate locations of these sites are shown in the following figure.



Currently, the dominant land use is that of walking/hiking trails, camping sites and natural setting. Visual inspection of the area also indicates manicured grasses, scrub grasses including upland habitat and mature canopy.

2.0 Testing Methods

In November 2020, five (5) test pits were excavated to evaluate and determine the suitability of the soils for stormwater infiltration. The test pit locations and depths were provided by Meliora in the Project RFP and the locations were subsequently field marked by ESC Design. The location plan is attached to this report.

The soils were evaluated to determine if the soils have limitations that would affect the design, installation, and function of stormwater infiltration structures. Soil limitations are considered to be features such as a seasonal high water table, perched water table, restrictive soil horizons, massive bedrock, and fractured or open-jointed bedrock. The proposed infiltration sites are evaluated to determine feasibility and conformance to the BMP manual based on soil morphology. The BMP manual recommends maintaining a two (2) foot separation from the bottom of the proposed infiltration structure and a soil limitation.

Upon documentation of conditions feasible for stormwater infiltration, infiltration tests are performed at the depth of the proposed infiltration structure. For this project, double ring infiltrometers were utilized for testing and are strongly preferred to percolation tests by PADEP for large basins because they discount the exfiltration of water from the sides of percolation holes and provide a much more accurate assessment of potential permeability. All infiltration tests should be performed within ±1' of the design depth.

3.0 Results and Recommendations

Refer to the Test Location Plan, which shows the location of the test pits and infiltration testing. GSET completed a soil morphologic evaluation within each test pit, noting indications, if encountered, to the depth of redoximorphic features and soil horizons restrictive to infiltration based on soil morphology. Our findings are detailed in the Table 1, below.

Test Pit	**Ex. Elev.**	**Test Elev.**	**Test Depth**	**Test Pit Depth**	**Limiting Zone**	**Field Infiltration Rate A (in/hr.)**	**Field Infiltration Rate B (in/hr.)**	**Field Infiltration Rate Avg. (in/hr.)**
TP-2	1586	1581	5	7		0.61	0.57	0.59
TP-4	1598	1593	5	7		0.89	0.98	0.94
TP-6	1521	1516	5	7		2.89	2.99	2.94
TP-7	1521	1516	5	7		2.58	2.52	2.55
TP-9	1582	1577	-	-	Water @ 3' - Gleyed	-	-	-

The infiltration values expressed in the table above represent actual field measurements, therefore it is recommended that a factor of safety of two (2) be applied to these rates. We also recommend performing post-construction infiltration testing in order to confirm your design parameters.

We appreciate the opportunity to work with you on this project and should you have any questions or require additional information please do not hesitate to contact our office.

Respectfully Submitted,
Geo-Science Engineering Co., Inc

Jeremy C. Wint
SR Soil Scientist

LOG OF TEST PIT TP-2

Date Excavated: 11/23/20

Logged by: MA

Equipment: Bobcat Mini Excavator

Surface Elevation(ft): 1586.0

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	HAND PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
		Root mat - O - Black Silty Sand					
		SILTY SAND with GRAVEL (SM) brown - loose, moist					
		SILTY GRAVEL with SAND (GM) - brown, medium dense to dense, moist					
5		Infiltration Test Elevation					
		EOP @ 7'					

Geo-Science Engineering & Testing, LLC
1252 Mid Valley Drive
Jessup, PA 18434
Phone: 570-489-8717 Fax:

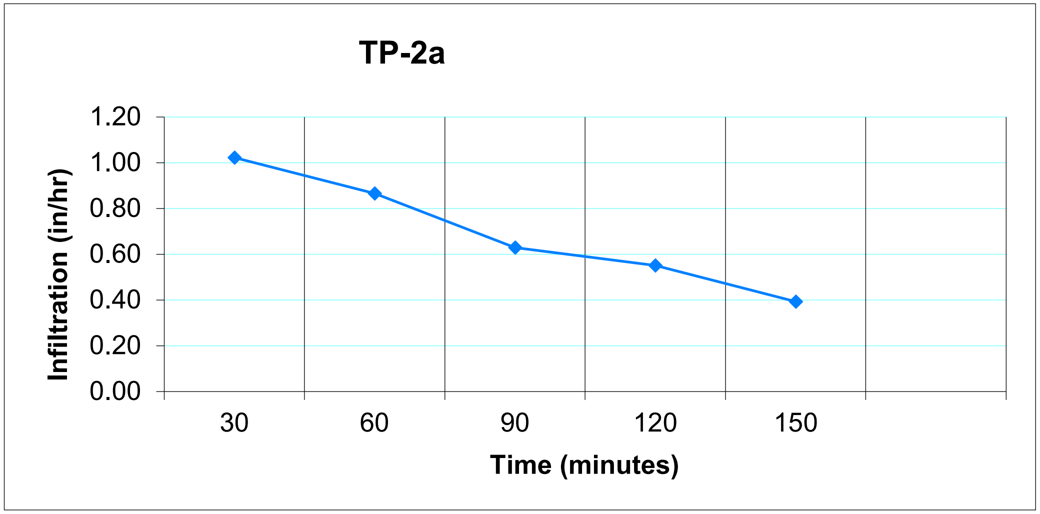
Hickory Run State Park
White Haven, PA

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-2a

Surface Elevation = 1586
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	13	0.51	1.02
60	11	0.43	0.87
90	8	0.31	0.63
120	7	0.28	0.55
150	5	0.20	0.39



Average of last 4 = **0.61 in/hr**

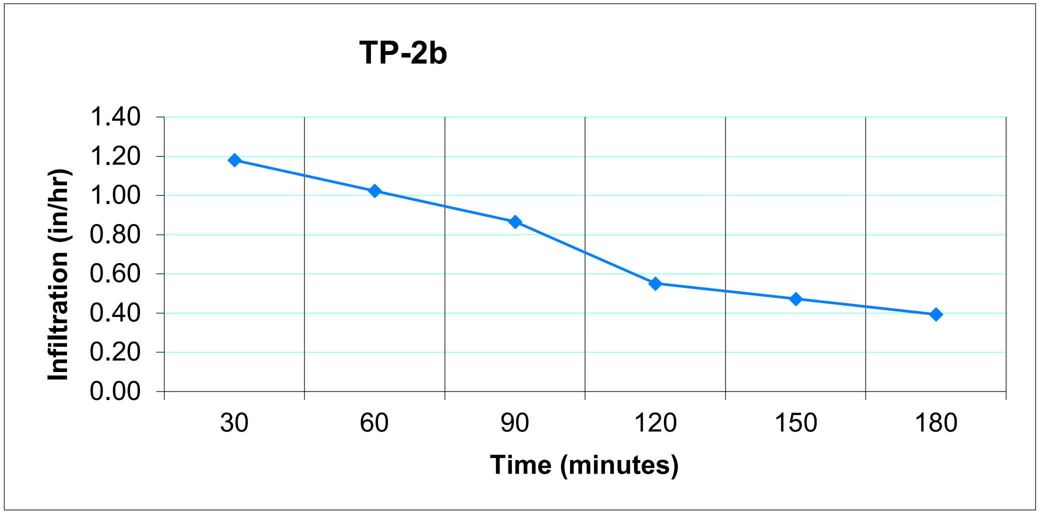
Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-2b

Surface Elevation = 1586
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	15	0.59	1.18
60	13	0.51	1.02
90	11	0.43	0.87
120	7	0.28	0.55
150	6	0.24	0.47
180	5	0.20	0.39



Average of last 4 = **0.57 in/hr**

Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

LOG OF TEST PIT TP-4

Date Excavated: 11/23/20

Logged by: MA

Equipment: Bobcat Mini Excavator

Surface Elevation(ft): 1598.0

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	HAND PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
		Root mat - O - Black Silty Sand					
		SILTY SAND - brown -medium dense, moist					
		SILTY GRAVEL with SAND (GM) - red brown, dense, moist					
5		Infiltration Test Elevation					
		Cobbles/Nested					
		EOP @ 7'					

Geo-Science Engineering & Testing, LLC
1252 Mid Valley Drive
Jessup, PA 18434
Phone: 570-489-8717 Fax:

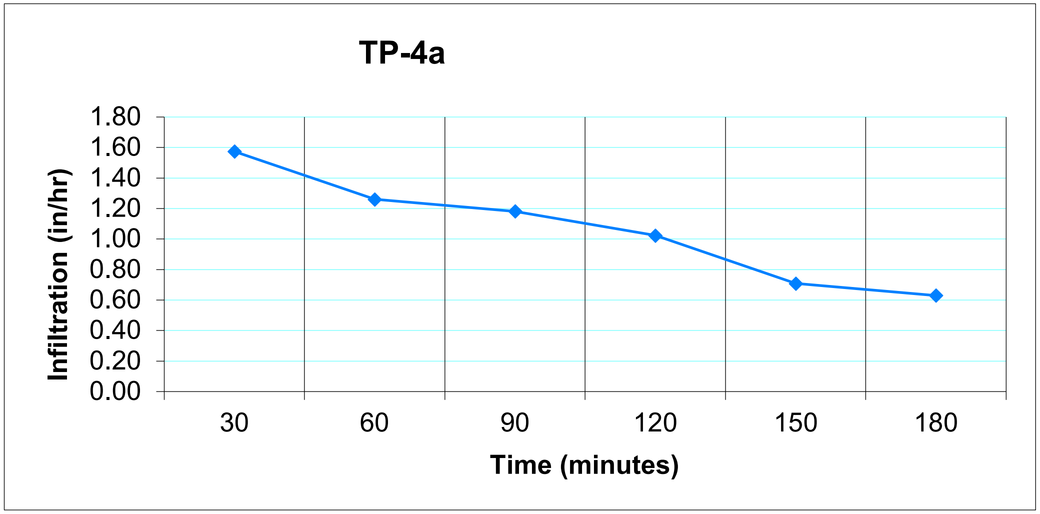
Hickory Run State Park
White Haven, PA

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-4a

Surface Elevation = 1598
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	20	0.79	1.57
60	16	0.63	1.26
90	15	0.59	1.18
120	13	0.51	1.02
150	9	0.35	0.71
180	8	0.31	0.63



Average of last 4 = **0.89 in/hr**

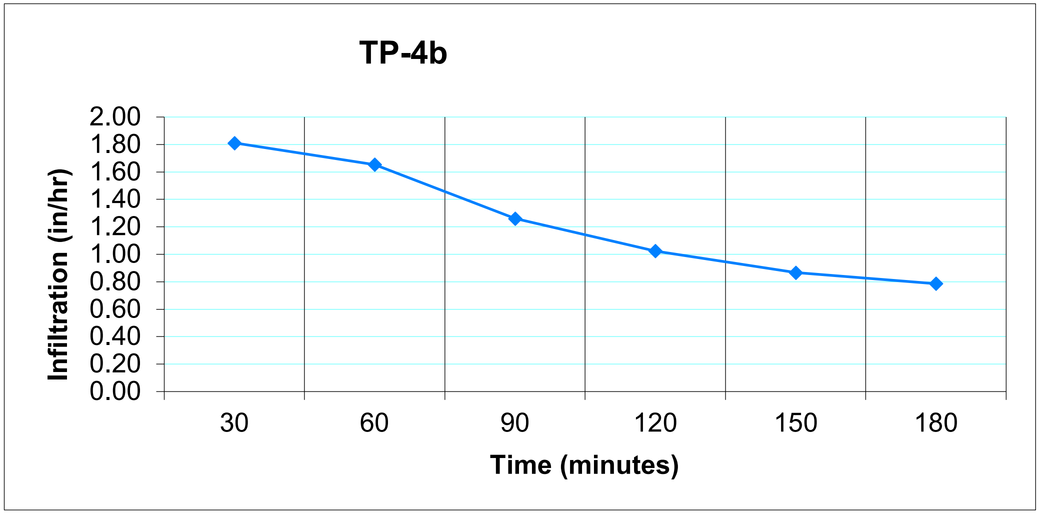
Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-4b

Surface Elevation = 1598
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	23	0.91	1.81
60	21	0.83	1.65
90	16	0.63	1.26
120	13	0.51	1.02
150	11	0.43	0.87
180	10	0.39	0.79



Average of last 4 = **0.98 in/hr**

Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

LOG OF TEST PIT TP-6

Date Excavated: 11/24/20

Logged by: MA

Equipment: Bobcat Mini Excavator

Surface Elevation(ft): 1521.0

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	HAND PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
		Root mat - O - Black Silty Sand					
		SILTY SAND with GRAVEL (SM) - brown, medium dense, moist					
		SILTY GRAVEL with SAND (GM) brown, dense, moist					
5		Infiltration Test Elevation					
		EOP @ 7'					

Geo-Science Engineering & Testing, LLC
1252 Mid Valley Drive
Jessup, PA 18434
Phone: 570-489-8717 Fax:

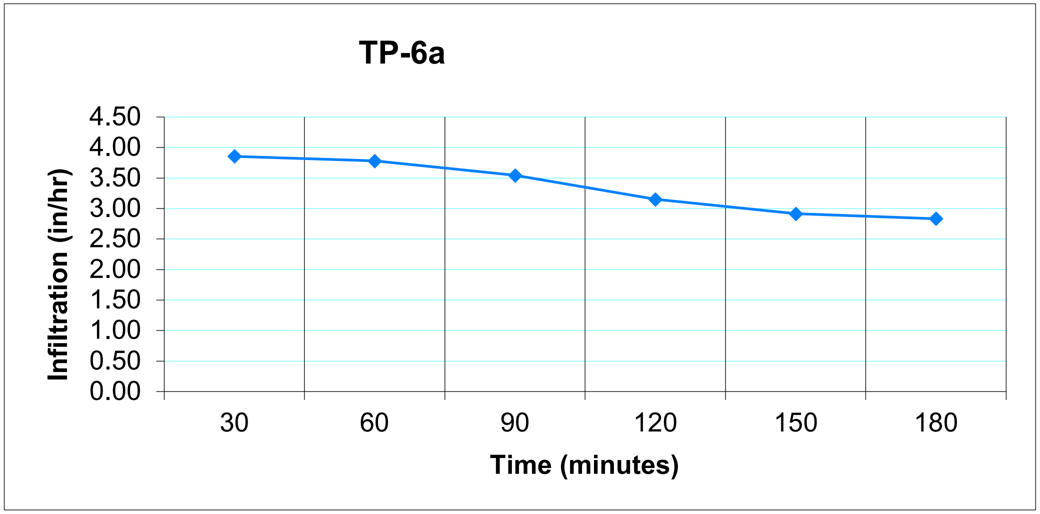
Hickory Run State Park
White Haven, PA

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-6a

Surface Elevation = 1521
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time	Reading		
(min)	(mm)	(inches)	(in/hr)
30	49	1.93	3.86
60	48	1.89	3.78
90	45	1.77	3.54
120	40	1.57	3.15
150	37	1.46	2.91
180	36	1.42	2.83
210	34	1.34	2.68



Average of last 4 = **2.89 in/hr**

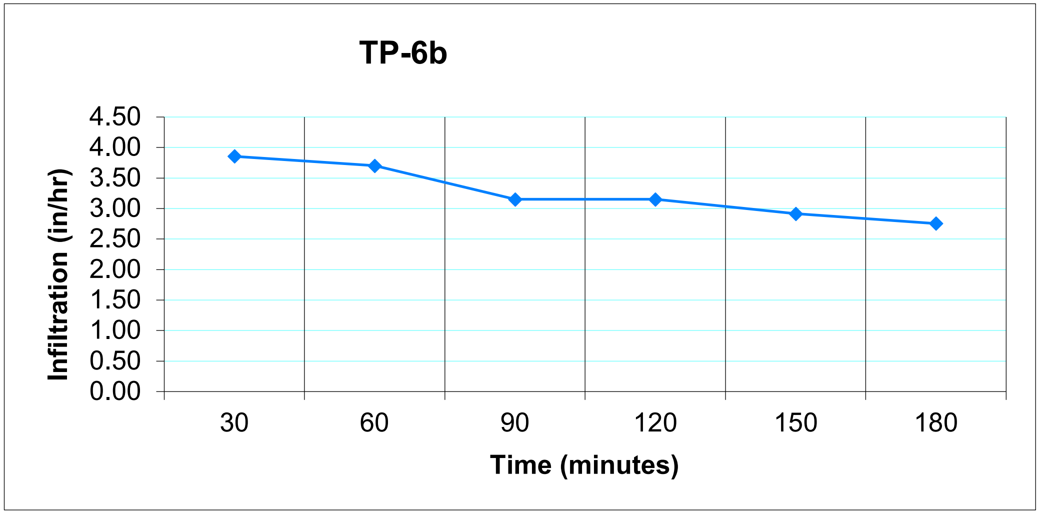
Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-6b

Surface Elevation = 1521
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	49	1.93	3.86
60	47	1.85	3.70
90	40	1.57	3.15
120	40	1.57	3.15
150	37	1.46	2.91
180	35	1.38	2.76



Average of last 4 = **2.99 in/hr**

Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

LOG OF TEST PIT TP-7

Date Excavated: 11/24/20

Logged by: MA

Equipment: Bobcat Mini Excavator

Surface Elevation(ft): 1521.0

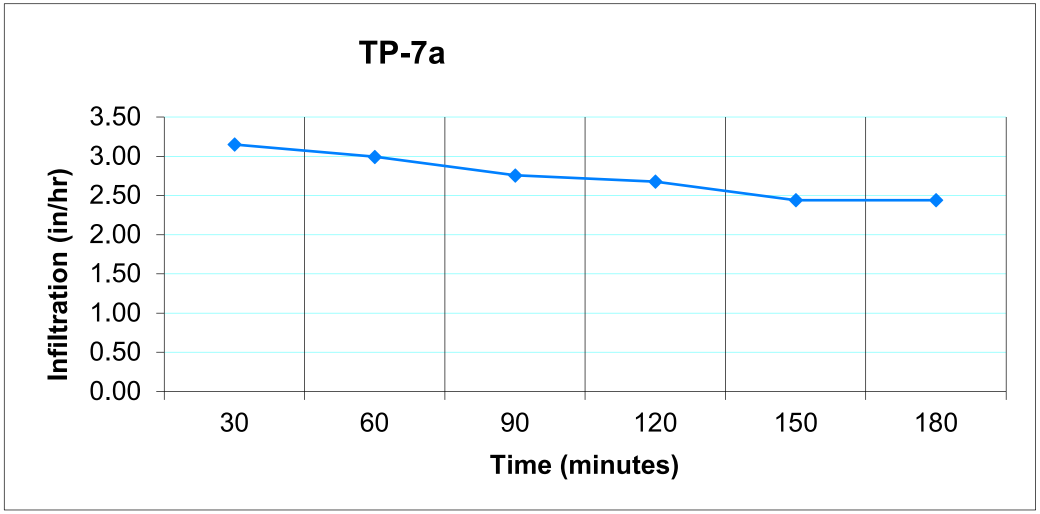
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	HAND PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
		Root mat - O - Black Silty Sand					
		SILTY SAND (SM) - brown, medium dense, moist					
		SILTY GRAVEL with SAND (GM) - red brown, medium dense to dense, moist					
5		Infiltration Test Elevation					
		EOP @ 7'					

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-7a

Surface Elevation = 1521
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	40	1.57	3.15
60	38	1.50	2.99
90	35	1.38	2.76
120	34	1.34	2.68
150	31	1.22	2.44
180	31	1.22	2.44



Average of last 4 = **2.58 in/hr**

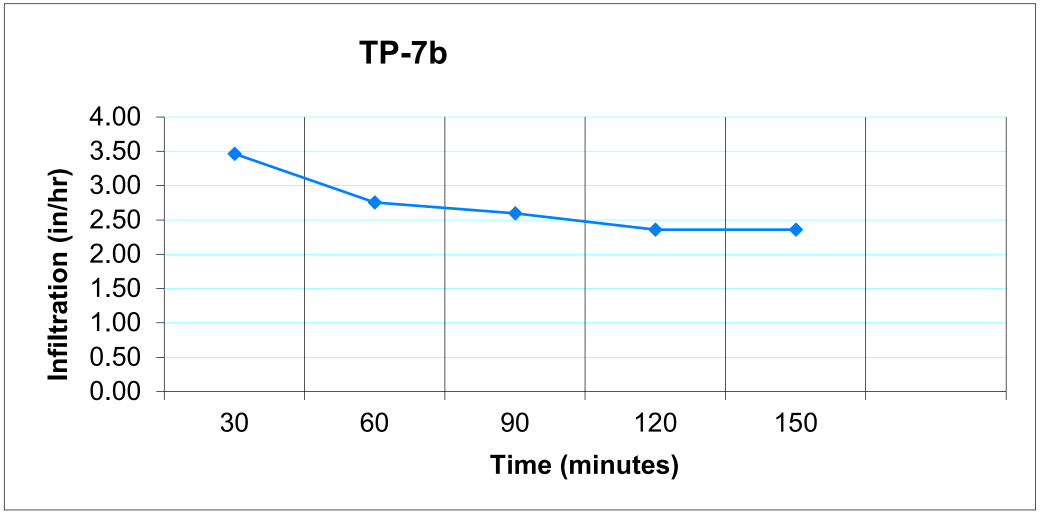
Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

INFILTRATION TEST REPORT

Project Name: Hickory Run State Park
Project #: 20030392
Date: 11/24/2020
Location: TP-7b

Surface Elevation = 1521
Depth of Test = 5.0 feet
Testing Equipment = Double Ring Infiltrometer

Time (min)	Reading (mm)	(inches)	(in/hr)
30	44	1.73	3.46
60	35	1.38	2.76
90	33	1.30	2.60
120	30	1.18	2.36
150	30	1.18	2.36



Average of last 4 = **2.52 in/hr**

Reference: Pennsylvania Stormwater Best Management Practices Manual, Appendix C
Infiltration rates represent actual field measurements. It is reccomended that a factor of safety of two (2) be applied to this rate.

LOG OF TEST PIT TP-9

Date Excavated: 11/24/20

Logged by: MA

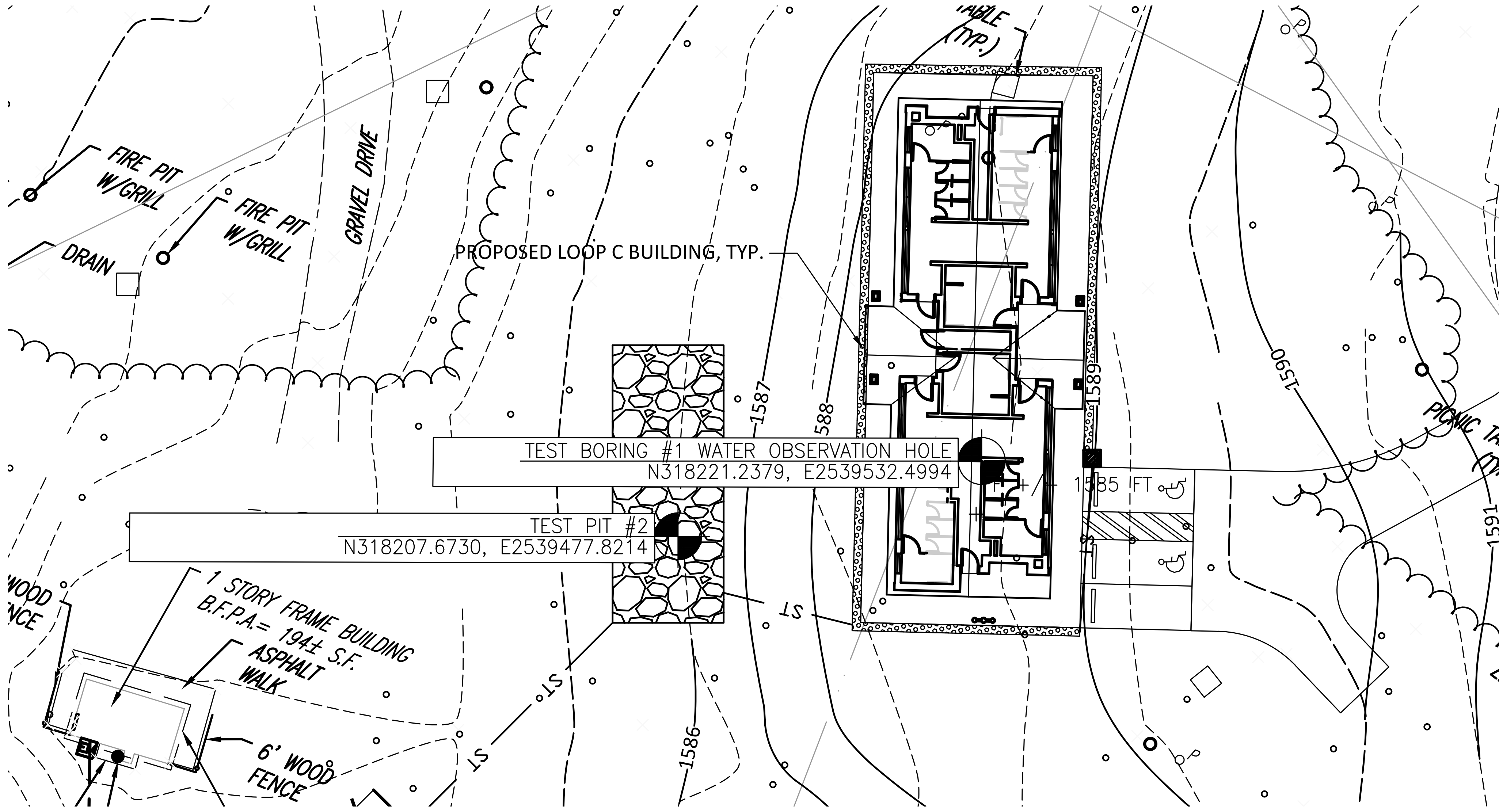
Equipment: Bobcat Mini Excavator

Surface Elevation(ft): 1582.0

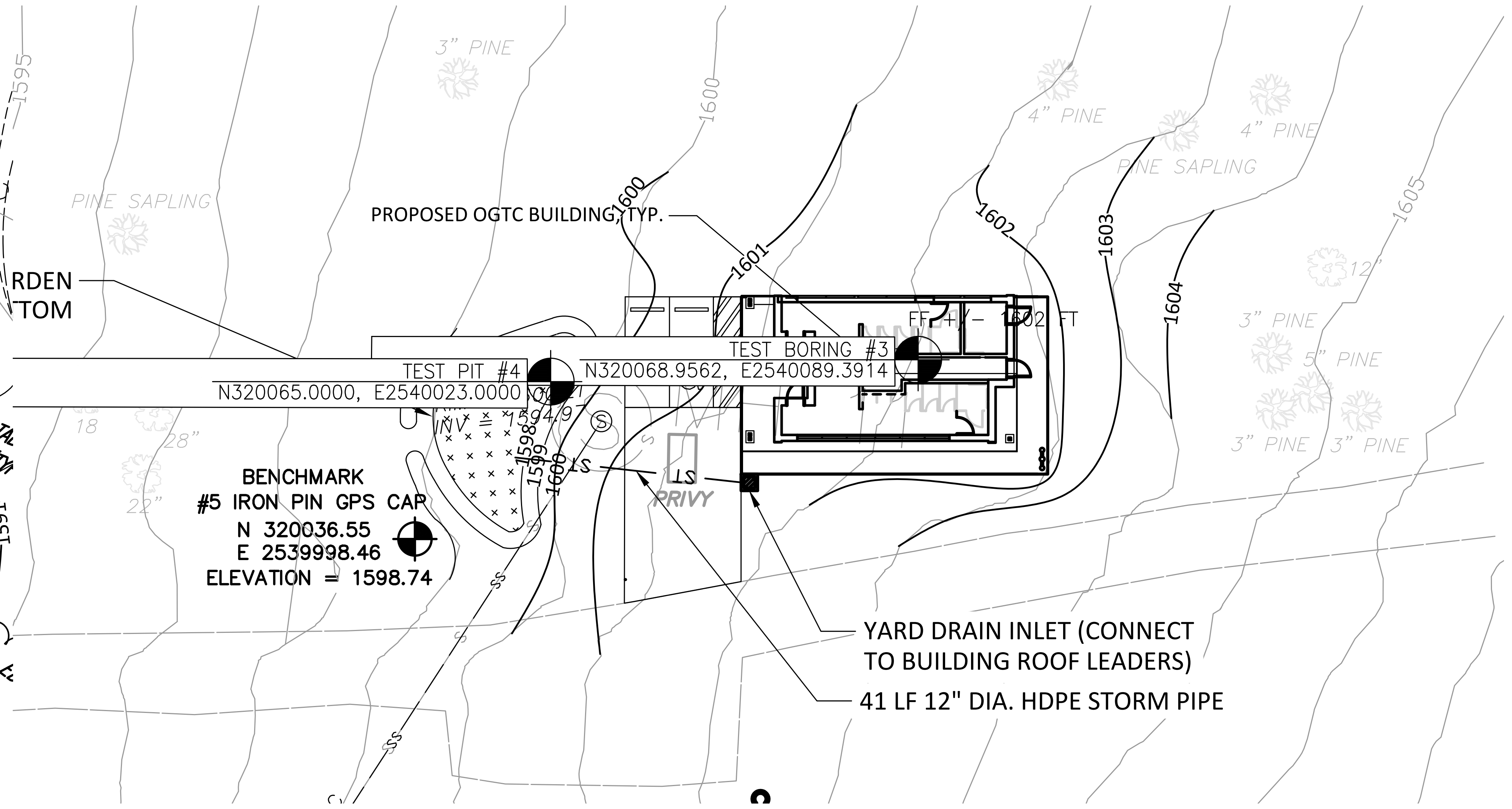
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	HAND PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
		Root mat - O - Black Silty Sand					
		SILTY SAND (SM) - grey (gleyed)					
		Water EOP @ 3'					
5							

Geo-Science Engineering & Testing, LLC
1252 Mid Valley Drive
Jessup, PA 18434
Phone: 570-489-8717 Fax:

Hickory Run State Park
White Haven, PA

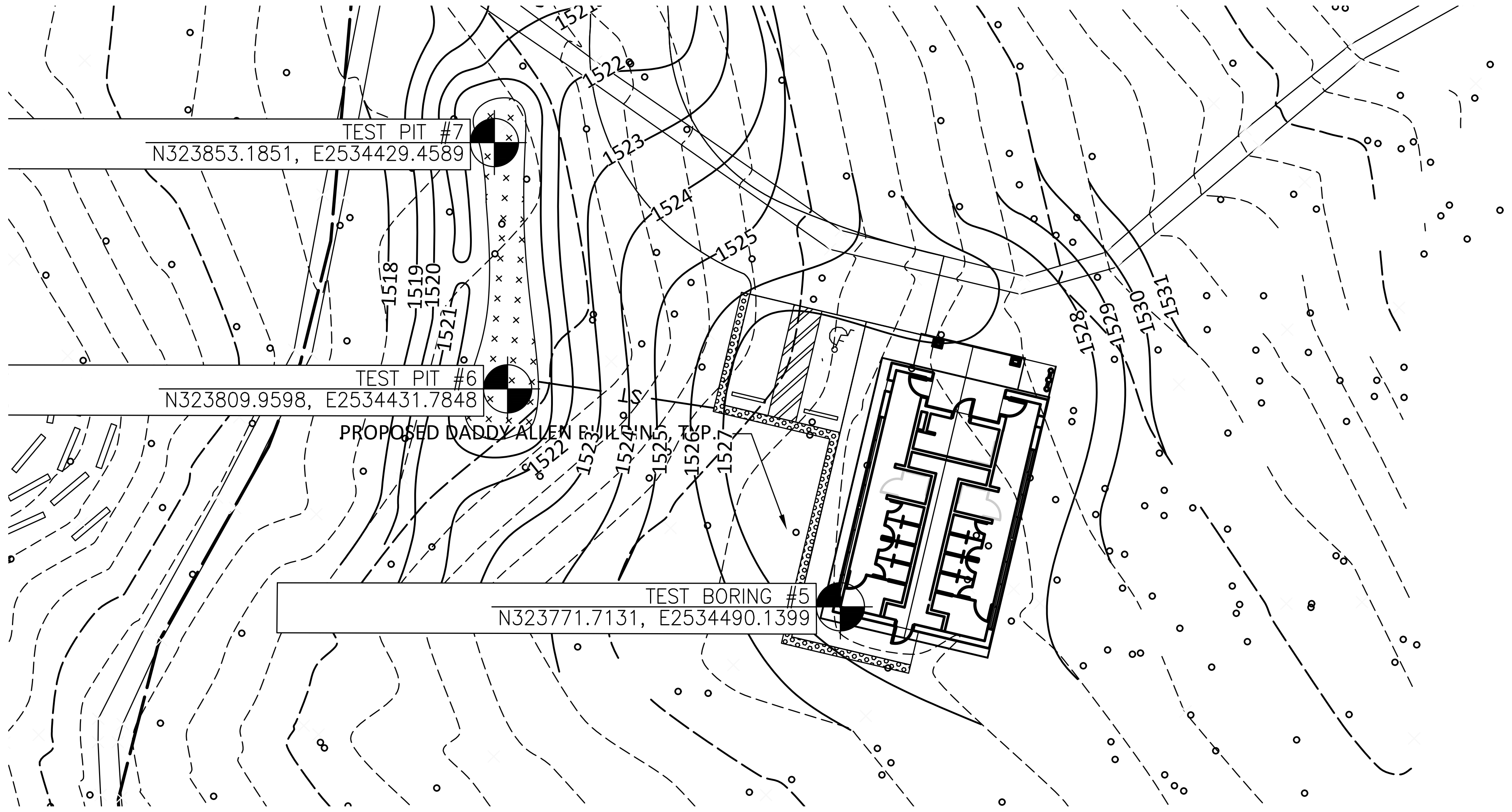


1 TB-0 TB–1 GEOTECHNICAL TESTING PLAN
LOOP C 1"=20'

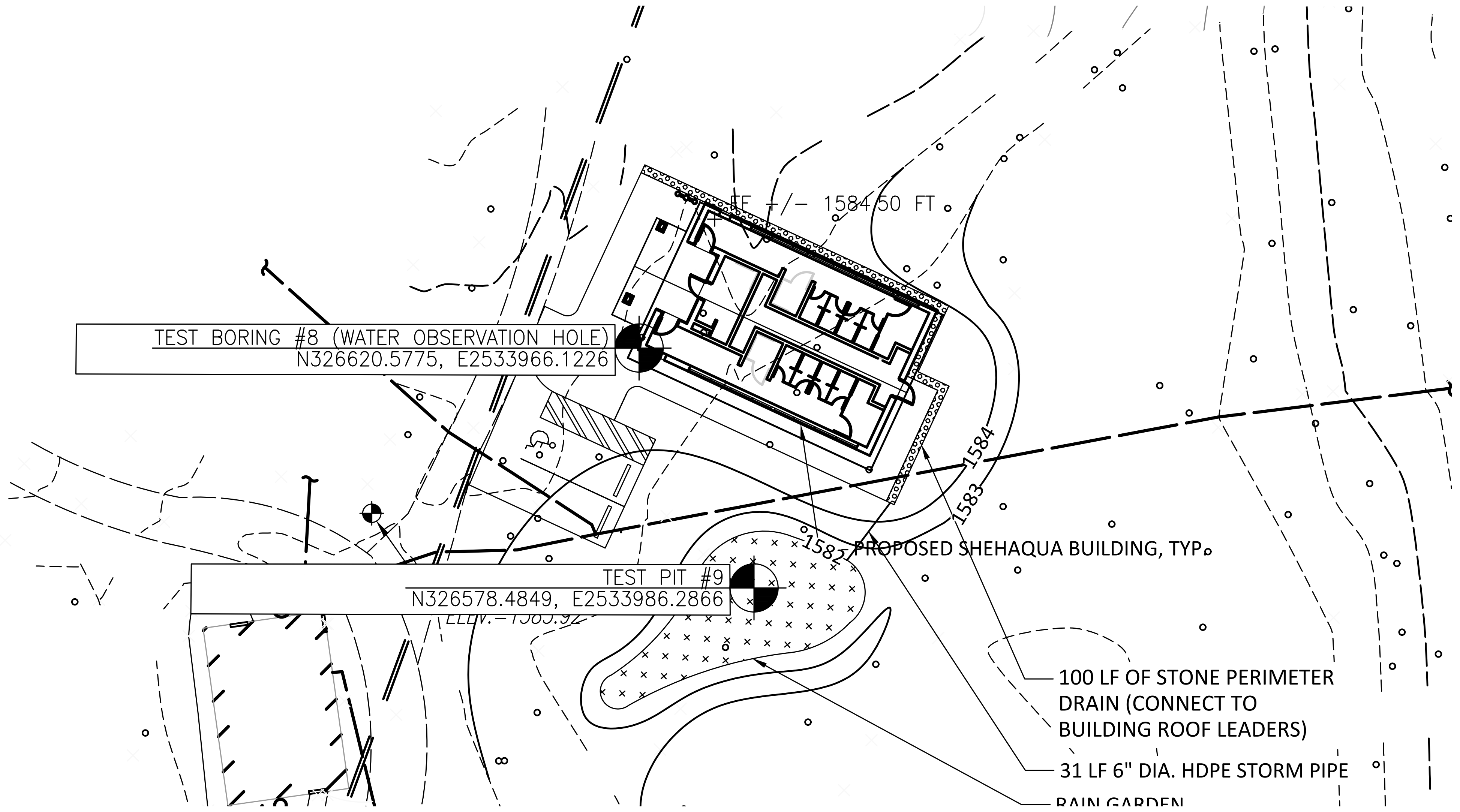


2 TB-0 TB–2 GEOTECHNICAL TESTING PLAN
OGTC 1"=20'

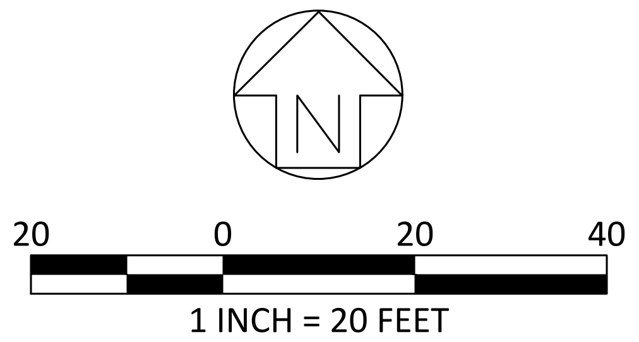
NOTES:
1. ALL TEST BORINGS SHALL BE CARRIED TO THE DEPTHS LISTED IN THE SCHEDULE, EXCEPT WHERE ROCK IS ENCOUNTERED PRIOR THERETO, IN WHICH CASE, CORING SHALL EXTEND (5) FEET INTO THE ROCK, WHETHER OR NOT THE FINAL DEPTH IS MORE OR LESS THAN THE DEPTH LISTED IN THE SCHEDULE, EXCEPT THAT CERTAIN BORINGS SHALL BE CARRIED TO THE CONTRACT DEPTH REGARDLESS OF THE MATERIALS ENCOUNTERED.
2. ALL INFILTRATION TESTS SHALL BE DOUBLE-RING INFILTROMETER TESTS AND PERFORMED TO THE DEPTHS SPECIFIED IN THE SCHEDULE. TESTING REQUIREMENTS SHALL FOLLOW PA STORMWATER BMP MANUAL AND KIDDER TOWNSHIP CODE CHAPTER 148.



3 TB-0 TB–3 GEOTECHNICAL TESTING PLAN
DADDY ALLEN 1"=20'



4 TB-0 TB–4 GEOTECHNICAL TESTING PLAN
SHEHAQUA 1"=20'



TEST SCHEDULE

TEST NUMBER	TEST	SURFACE ELEVATION	CONTRACT DEPTHS	ACTUAL DEPTHS
1	STANDARD BORING		25.00 Ft	
2	TEST PIT		7.00 Ft	
3	STANDARD BORING		25.00 Ft	
4	TEST PIT		7.00 Ft	
5	STANDARD BORING		25.00 Ft	
6	TEST PIT		7.00 Ft	
7	TEST PIT		7.00 Ft	
8	STANDARD BORING		25.00 Ft	
9	TEST PIT		7.00 Ft	

SCHEDULE OF CONTRACT QUANTITIES

No. Holes	Earth Drilling	Rock Coring	Total Footage
4 Std. Borings	100 Lin. Ft.	0 Lin. Ft.	100 Lin. Ft.

No of Soil Test Pits:	5 each
No of Soil Infilitration Tests:	10 each

TB-0, 10/20/2020 11:30:25

259 MORGAN STREET, PHOENIXVILLE, PA 19460
(610) 933-0123
melioradesign.com

RECORD REVISIONS

SEAL

SIGNATURE DATE

SMP ARCHITECTS
1600 WALNUT STREET, SECOND FLOOR
PHILADELPHIA, PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF GENERAL SERVICES
HARRISBURG, PENNSYLVANIA

D.G.S. PROJECT No.
C–114–0006 PHASE 1

VERIFY SCALE
BAR IS ONE (1) INCH LONG ON ORIGINAL DRAWING:
0 ▬ 1
IF BAR IS NOT ONE (1) INCH LONG, ADJUST SCALE ACCORDINGLY

HICKORY RUN STATE PARK
LATRINE IMPROVEMENTS
DEPT of CONSERVATION AND NATURAL RESOURCES
WHITE HAVEN, CARBON COUNTY, PA

TEST BORING LOCATION PLAN AND SCHEDULE – SHEET 1

CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS. VARIANCE FROM CONTRACT DOCUMENTS NOT PERMITTED WITHOUT PROFESSIONAL & BUREAU OF CONSTRUCTION APPROVAL.

DRAWN BY: M DIMONTE
DATE: 10/30/2020
DRAWING No.: TB–0 of XX
CHECKED BY: J ADAMS
SCALE: AS NOTED

FILE PATH: J:\2020\20027 – Hickory Run State Park\CAD\Sheet Files\20027 – GEOTECHNICAL TESTING PLAN.dwg PLOTTED BY: James Adams
LAST SAVED: 2020.10.20 11:21 AM PLOTTED: 2020.10.20 11:30 AM

APPENDIX D

Driller's Boring Logs

POCONO TEST BORINGS & DRILLING CO., INC.

TEST BORING LOG

BORING NO.: 1
SHEET NO. 1 OF: 1
STATION:
OFFSET:
ELEVATION:
DATE START: 12-1-20
DATE FINISH: 12-1-20
DRILLER: F SIPPLE
INSPECTOR:

PROJECT HICKORY RUN STATE PARK
CLIENT GEO SCIENCE
LOCATION HICKORY RUN STATE PARK

GROUND WATER

DATE	TIME	DEPTH	CASING
12-1-20	OHR	8.0	0
DRILL WATER			

	CAS.	SAMP.	CORE	TUBE
TYPE	HW	SS	/	/
DIA.	4"	2"	/	/
WT.	300	140	/	/
FALL	24"	30"	/	/

DEPTH FEET (M)	CASING BLOWS	SAMPLE NO.	BLOWS ON SAMPLE SPOON	SAMPLE RECOVERY	IDENTIFICATION	REMARKS
2.0		1	1 1 1 1	0.3	BR SANDY SILT W/ GRAVEL (WET)	Was Bore Hole Grouted? ☐ YES ☒ NO If Yes, What Type Of Grout Was Used? ______ How Many Bags? ______
4.0		2	4 7 10 10	1.8	BR SILTY SAND W/GRAVEL (MOIST)	
6.0			10 10 9 8	1.5	SAME	OBSERVATION WELL INSTALLED AT 15.0'
8.0		4	8 10 11 10	1.7	SAME	
10		5	10 10 11 14	1.4	SAME	
13						
15		6	8 9 9 12	1.8	SAME	
18						
19.6		7	12 24 52 50/0.1	1.1	BR SILTY SAND W/ SHALE, GRAVEL (TILL) (WET)	
23						
23.8		8	39 50/0.3	0.6	SAME	
					ROLLER BIT TO 25.0 BOTM OF BORING 25.0	

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POCONO TEST BORINGS & DRILLING CO., INC.

TEST BORING LOG

BORING NO.: 3
SHEET NO. 1 OF: 1
STATION:
OFFSET:
ELEVATION:
DATE START: 12-1-20
DATE FINISH: 12-1-20
DRILLER: F Semple
INSPECTOR:

PROJECT Hickory Run State Park
CLIENT GCD Schnabel Eng
LOCATION Hickory Run State Park

GROUND WATER

DATE	TIME	DEPTH	CASING
12-1-20	8AM	12.0	0
DRILL	WATER		

	CAS.	SAMP.	CORE	TUBE
TYPE	HW	S-S	NQ	/
DIA.	4"	2"	2"	
WT.	300	140		
FALL	24"	30"		

DEPTH FEET (M)	CASING BLOWS	SAMPLE NO.	BLOWS ON SAMPLE SPOON	SAMPLE RECOVERY	IDENTIFICATION	REMARKS
2.0		1	1 1 6 13	0.4	BR SILT (MOIST)	**Was Bore Hole Grouted?** ☐ YES ☐ NO **If Yes, What Type Of Grout Was Used?** ______ **How Many Bags?** ______
4.0		2	9 7 9 24	0.5	RED BR SANDY SILT W/ GRAVEL (TILL) (MOIST)	
6.0		3	18 24 19 20	1.1	SAME	
6.3		4	50/0.3	0.2	RK FRAGMENTS ROLLER BIT REFUSAL @ 8.0'	
8.0						
13		R 1		2.7	SANDSTONE CONGLOMERATE RQD 24%	
18		R 2		1.8	SAME BOULDER'S	
20		5	28 16 19 16	0.7	RED BR SILTY SAND W/ GRAVEL (TILL)	
23						
25		6	11 15 12 22	1.0	SAME	BOTTOM OF BORING 25

POCONO TEST BORINGS & DRILLING CO., INC.

TEST BORING LOG

BORING NO.: 5
SHEET NO. 1 OF: 1
STATION:
OFFSET:
ELEVATION:
DATE START: 12-2-20
DATE FINISH: 12-2-20
DRILLER: F SIPPLE
INSPECTOR:

PROJECT HICKORY RUN STATE PARK
CLIENT GEO SCIENCE
LOCATION HICKORY RUN STATE PARK

GROUND WATER

DATE	TIME	DEPTH	CASING
12-2-20	OIN	9.0	0
DRILL	WATER		

	CAS.	SAMP.	CORE	TUBE
TYPE	HW	S-S	/	/
DIA.	4"	2"	/	/
WT.	300	140	/	/
FALL	24"	30"	/	/

DEPTH FEET (M)	CASING BLOWS	SAMPLE NO.	BLOWS ON SAMPLE SPOON	SAMPLE RECOVERY	IDENTIFICATION
2.0		1	1 2 1 4	0.9	BR SANDY SILT W/ GRAVEL (MOIST)
4.0		2	3 3 2 3	0.8	SAME
6.0		3	4 8 9 14	1.0	BR SILTY SAND W/ GRAVEL (MOIST)
8.0		4	10 13 11 20	0.7	SAME
8.7		5	24 50/0.2	0.5	SAME
13					COBBLES
14.2		6	21 27 50/0.2	1.0	SAME
18					
20		7	18 14 14 17	0.8	SAME
23					
25		8	30 32 28 31	0.5	BR SAND & GRAVEL
					BOTTOM OF BORING 25.0

REMARKS

Was Bore Hole Grouted?
☐ ~~YES~~ ☐ NO

If Yes, What Type Of Grout Was Used? ________

How Many Bags? ________

POCONO TEST BORINGS & DRILLING CO., INC.

TEST BORING LOG

BORING NO.: 8
SHEET NO. 1 OF: 1
STATION:
OFFSET:
ELEVATION:
DATE START: 12-2-20
DATE FINISH: 12-2-20
DRILLER: F Sipple
INSPECTOR:

PROJECT Hickory Run State Park
CLIENT GCD Source
LOCATION Hickory Run State Park

GROUND WATER

DATE	TIME	DEPTH	CASING
12-2-20	0 hr	8.0	0
DRILL WATER			

	CAS.	SAMP.	CORE	TUBE
TYPE	HW	SS		
DIA.	4"	2"	/	/
WT.	300	140		
FALL	24"	30"		

DEPTH FEET (M)	CASING BLOWS	SAMPLE NO.	BLOWS ON SAMPLE SPOON	SAMPLE RECOVERY	IDENTIFICATION
2.0		1	2 3 8 8	1.5	BR SILTY SND w/ GRAVEL
4.0		2	8 8 10 11	1.3	SAME
6.0		3	14 12 12 13	1.5	SAME
8.0		4	10 13 8 15	0.9	RED BR SANDY SILT w/ GRAVEL
10		5	4 10 10 12	1.4	SAME
13					
15		6	8 9 9 10	1.4	SAME
18					
20		7	5 9 10 13	2.0	SAME
23					
25		8	8 9 9 9	1.8	SAME

Botm of Boring 25.0'

REMARKS

Was Bore Hole Grouted?
☐ YES ☒ NO

If Yes, What Type Of Grout Was Used? ______

How Many Bags? ______

OBSERVATION WELL INSTALLED

D-4

APPENDIX E

Important Information About Your Geotechnical Report

IMPORTANT INFORMATION
ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor.

The following recommendations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation, physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult Geo-Science Engineering Co., Inc. to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless Geo-Science Engineering Co., Inc. indicates otherwise, *this geotechnical engineering report should not be used;*

$ When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;

$ When the size or configuration of the proposed structure is altered;

$ When the location or orientation of the proposed structure is modified;

$ When there is a change of ownership, or

$ For application to an adjacent site.

Geo-Science Engineering & Testing LLC. cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with this office to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The Geo-Science Engineering & Testing, LLC should be kept apprised of any such events and should be consulted to determine if additional test are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geo-Science Engineering & Testing, LLC's reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposed indicated by the client. The information contained herein is proprietary and cannot be duplicated or copied, or in any manner reproduced without the express written permission of Geo-Science Engineering & Testing, LLC. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with Geo-Science Engineering & Testing, LLC. No person should apply this report for any purpose other than that originally contemplated without first conferring with Geo-Science Engineering & Testing, LLC.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professions to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

The boring logs contained within this report are reproductions of the boring contractor's submitted field logs. The report was developed based upon Geo-Science Engineering & Testing, LLC 's interpretation of these logs in conjunction with laboratory tests and other field data. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgement and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' responsibilities begin and end. Their use helps all parties involved reorganize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Geo-Science Engineering Co., Inc. will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Consulting with this office to discuss other techniques which can be employed to mitigate risk.