

**GEOTECHNICAL INVESTIGATION REPORT
WTJX PUBLIC TV FACILITY
SUBBASE, ST THOMAS, USVI
(VTE22-01.1109)**

Prepared for

The Virgin Islands Public Broadcasting System
P.O. Box 808
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Attention: Ms. Tanya-Marie Singh

Submitted By



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May 30, 2022

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Attention: Ms. Tanya-Marie Singh

**Subject: GEOTECHNICAL INVESTIGATION, WTJX PUBLIC TV FACILITY, SUBBASE,
ST THOMAS, USVI (VTE22-01.1109)**

Dear Ms. Singh:

VITEST Engineers is pleased to submit this geotechnical engineering report for the proposed reconstruction of the WTJX facility on St Thomas, in the US Virgin Islands.

The proposed project will include the demolition of the existing buildings and the construction of a new building complex with parking and driveways and a stormwater system. Based upon the findings of the investigation, we believe that the site can be made suitable for the support of the facility. The attached report provides details on the subsurface conditions, evaluation of the site suitability and recommendations for foundation support of the buildings.

We appreciate the opportunity to provide our services on this project and trust that the data and recommendations are clear and understandable. Should there be any questions on the report content or if we can be of further assistance, please call.

Very truly yours,

VITEST Engineers

Improving the Quality of Island Life

Donald S. Law

Donald S. Law, P.E., MBA

President

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Introduction

VITEST Engineers has completed a subsurface soil investigation at the location of the existing WTJX facility in Subbase on St Thomas. This facility was severely damaged during the hurricanes of 2017. The existing buildings will be demolished, and new structures will be designed and constructed to meet current needs and design code. This report presents the scope of work performed and the findings of the investigation. We also present our evaluation of the site conditions and recommendations for the foundation design of the proposed structures.

Project Description

The existing facility is located at Parcel 158 and 158-a on Haypiece Hill in Subbase on St Thomas. The ground elevations where the buildings are located varies from +318 feet MSL to +280 feet MSL. Two buildings on the site are separated by a retaining wall that is about 8 feet high. The existing parking and driveways are paved with concrete and asphalt.

The proposed facility will include a new TV Studio and Control Room. There will be a reconstructed Antenna area and a garage and storage building. The existing entrance and parking area will be reconfigured. Specific details on the structure were not available at the time of this report. However, we anticipate that the buildings will be steel frame and concrete construction. The foundations are expected to be moderately to heavily loaded.

Purpose and Scope

The purpose of performing this investigation was to explore the subsurface soil and ground water table conditions beneath the site to evaluate the suitability of the subsurface conditions for the support of the proposed buildings and to develop geotechnical engineering recommendations for the design of foundations and site development. In order to accomplish this task, we drilled and sampled five (5) Standard Penetration Test (SPT) borings below the prevailing grade adjacent to the existing building. The approximate location of the boring is identified on the Location Plan on Sheet 1. The soils encountered in the boring is presented in the form of Soil Profiles on Sheet 2. Samples were obtained from the borings and returned to our laboratory on St Croix for classification by a geotechnical engineer. Infiltration rates were measured in a

borehole in the lower elevation of the site where the stormwater system may be located. The information obtained during our field investigations and laboratory analyses was used to develop recommendations for the design of the proposed foundation systems and stormwater system.

Subsurface Exploration

Drilling Methods - The Standard Penetration Test borings were sampled in general accordance with the procedures of ASTM D-1586 using the open-hole rotary drilling method. The borehole advancement was achieved using 3-1/4 inch diameter hollow stem augers with a rock cutting bit. Soil samples and corresponding SPT penetration resistance (N-values) were obtained throughout the profile using a split-barrel sampler driven by a 140-pound hammer, falling 30 inches. The soil samples recovered from the borings were visually examined in the field with representative samples sealed in airtight containers and transported to our laboratory.

Laboratory Inspection and Testing

The soil samples were classified in accordance with the Unified Soil Classification System (USCS), ASTM D-2288. The laboratory testing included the determination of the natural moisture content in accordance with ASTM D-2216 and the percent passing the No 200 sieve ASTM D-1140. The results and the classification of the soils samples are indicated in the soil profiles in Sheet 1 attached to the report. The soil descriptions and the symbols used in the USCS system are shown on the Legend on Sheet 2.

Evaluation of Subsurface Conditions

USDA SCS Soil Survey – The soils in the vicinity of Haypiece Hill were mapped by the USDA Soil Conservation Service and published in the Natural Resources Conservation Service (NRCS) Reports. This survey reports that the soil type across the property is Southgate-Rock Outcrop 20-40% slopes (SrE). A brief description of these soils is presented below.

Southgate-Rock Outcrop 20-40% slopes (SrE): This component is on summits and side slopes of volcanic hills and mountains. The Southgate profile is comprised of brown gravelly loam followed by weathered and unweathered igneous bedrock in the upper 60 inches. The natural drainage class is well drained. The

permeability is moderate. The depth to seasonal high water table is more than 6 feet. Shrink-swell potential is low, and the soil is extremely stony. It is in Hydrologic Soil Group D.

Soil Stratigraphy - The surface material in the areas explored is 4 to 6 inches of concrete. Below the surface cover, the soil is a yellowish brown rock. It is medium dense to dense in the upper 4 feet and very dense below this depth. Drilling rates in the very dense material is less than 1 inch in 30 minutes. A more detailed description of the soils encountered is presented on Sheet 2. Please note that although the boring logs indicate distinct strata breaks, the actual transition between the soil layers may be gradual.

The SPT blow counts (N-values) were recorded during drilling. These values provide a measure of the relative density of the subsurface soils. The N-values range from 26 to more than 50 blows for less than 6 inches of penetration. The blowcounts are presented adjacent to the soil profiles on Sheet 2. In the upper 4 feet of the profile, the soils are in a medium dense to dense conditions. The underlying soils are in a very dense condition throughout the depth of exploration.

Groundwater Conditions - The ground water table was not encountered in the boreholes at the time of the drilling. The water table elevation is influenced by on-site soils, nearby drainage features, rainfall conditions, relief points, site improvements, etc. The groundwater table will typically attain its highest level near the end of the rainy season. Based upon the soil types encountered, the antecedent rainfall and the measured water levels, we anticipate that the seasonal high-water table (SHWT) will remain more than 25 feet below the land surface.

Engineering Evaluations and Recommendations

General Discussion – The soil profile across the site disclosed a dense to very dense rock formation. The upper profile weathered rock that is very dense. Due to the solid nature of the rock, it may be difficult to cut or excavate the material by conventional means. We believe that hydraulic jack hammers attached to large excavators will be needed to excavate footings or to change the grades at the site. No additional subgrade compaction will be needed for footings embedded in the rock. Following adequate subgrade

preparation, the proposed building may be supported on a shallow foundation. Recommendations for site preparation and foundation design are presented in the following subsections.

Earthwork Considerations

Clearing and Grubbing - The construction area should be cleared to remove all existing buildings, pavement, vegetation, rocks, construction debris, and other unsuitable materials buried under the ground surface. These operations should be completed to a minimum of 5 feet beyond the building perimeters. The depth of grubbing and stripping should be determined in the field based on visual observations and proper judgement. The spoil generated during these operations should be removed from the site and disposed of as directed by the owner.

Site Grading - The final grading plan of the site should allow for positive drainage away from the foundations. During construction, the area should be graded to direct surface runoff away from the structures and temporary excavations.

Excavation - Temporary side slopes of excavations may stand near vertical for short periods. Side slopes of excavations greater than 10 feet should be laid back at 2 Horizontal to 1 Vertical or flatter. Side walls of excavation deeper than 10 feet should be protected by a method designed by a registered engineer. The contractor should follow all recent OSHA safety requirements for excavation.

Suitable Fill - All fill required for site grading and backfilling should be comprised of clean, gravel-silt-sand mixtures containing less than 20 percent passing the U.S. No. 200 Sieve and meeting the AASHTO requirements for fill. The fill should be free of topsoil, roots, organic material, rocks larger than 2 inches, debris, trash, or other objectionable material that may be compressible, degradable or which cannot be compacted properly.

The material encountered in the borings are not considered suitable for re-use as structural backfill. This material will be excavated in large boulders that will have to be crushed and processed to make it suitable for use as fill .

Fill Placement and Compaction - The fill should be placed in relatively level lifts, dried or wetted as needed, and then compacted to a minimum density of 95 percent of the Modified Proctor Maximum dry density (ASTM D-1557) unless otherwise specified. The lifts should not exceed 12 inches in loose thickness if compaction is performed by a heavy vibratory roller and 6 inches if an approved hand-operated compaction plate is used. Vibratory rollers should not be used in a vibratory mode within 75 feet of any existing structures without vibration monitoring.

Sufficient earthwork monitoring and a sufficient number of in-place density tests should be performed to evaluate fill placement and compaction operations and to confirm that the required compaction is being achieved

Foundation Support

Foundation Loading Conditions - The structural data was not available for this report. However, foundations are expected to be moderately to heavily loaded.

Subgrade Improvement – Based upon the soil conditions encountered in the borings, the excavation for footings will be in weathered rock. Once the bottom elevations are achieved, no other preparation is needed in this material. In areas where silty gravel is encountered, we recommend that this material be compacted and tested to at least 12 inches below the bottom of the footings.

Shallow Foundation - Provided that the subgrade is prepared as recommended, the footings may be designed using a net allowable bearing pressure of 4500 pounds per square foot (psf) or less. The minimum embedment depth of these footings should be 16 inches as measured from the bottom of the footing to the lowest adjacent finished grade. Footing widths shall not be less than 2 feet for strip footings and 3 feet for spread footings.

Slab-on-Grade – Floor slabs may be supported directly on prepared subgrade. The slabs should be adequately reinforced and should be placed on a vapor barrier at least 6 mils thick. The vapor barrier should

be overlapped and sealed where they are joined. A modulus of subgrade reaction of 300 pounds per cubic inch may be used on designing slabs on the weathered rock.

Seismic Considerations - Since the Island of St Croix is subjected to occasional earthquake forces, the building should be designed to account for lateral earthquake forces. Liquefaction of the subgrade soils is a concern for buildings foundations in earthquake zones. Liquefaction is the seismic phenomenon where loose, saturated granular soil behave like a fluid when subject to high intensity ground shaking. However, liquefaction is a concern when the foundation soils are predominantly loose sand deposits with shallow water table. The soils encountered within the depth of the borings are primarily dense weathered rock and is not considered liquefiable soils. The groundwater table at the subject site is expected to remain deeper than 25 feet. As a result, we anticipate that the liquefaction potential is low to nil.

The site class was evaluated using the Standard Penetration Test N-Values and the site class definitions of the International Building Code (IBC) and the National Earthquake Hazard Reduction Program (NEHRP). Based upon the consistency of the soil profile and material encountered, we estimate that the site can be categorized as Site Class B.

The earthquake spectral response of the site was evaluated using the ASCE 7 Hazard Tool. The property is identified as being in risk category IV with Site Class B. The seismic design parameters for the site may be taken as shown on the table below.

SEISMIC DESIGN PARAMETERS

Site Coefficient	Site Amplification Factor	Spectral response	Design spectral response
$S_s=1.22$	$F_a=0.9$	$S_{MS}=0.86$	$S_{DS}=0.58$
$S_1=0.38$	$F_v=0.8$	$S_{M1}=0.27$	$S_{D1}=0.18$
Peak Ground Acceleration PGA – 0.41			
Long-period transition period T_L - 12 sec			

Foundation Settlement – Provided that the foundation is designed and constructed as recommended, we estimate that the maximum static settlement of the structures will be less than 1 inch. Differential Settlement

is expected to be ½ inch or less. We anticipate the settlement will be complete soon after the roof loads are applied.

Lateral Earth Pressures: Retaining walls and walls of basement levels of the structure will support backfilled soils. These walls and other retaining walls should be designed to support the lateral earth pressures exerted by the compacted soils. The lateral earth pressures are presented as equivalent fluid unit weights in pounds per square foot (psf) per foot of depth (pcf). The backfill soils are assumed to have a moist unit weight of 125 pcf and an internal friction angle of 34 degrees.

For the design of rigid walls that are not free to rotate, we recommend that the "at rest" earth pressure be calculated using an equivalent fluid pressure of 55 pounds per cubic foot (pcf) above the water table. Where retaining walls are free to rotate at the top, the "active" earth pressure should be calculated using an equivalent fluid pressure of 35 pcf above the water table. In each of these designs, the equivalent fluid pressures assume free-draining conditions and that a drainage system with an appropriate outfall will be included behind the walls to prevent the build-up of hydrostatic forces.

In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed basement/retaining wall footing will surcharge the proposed retaining structure. If a uniform surcharge is applied to the top of the walls, this will produce an additional lateral pressure along the wall equal to about 1/3 the vertical contact pressure.

Lateral Resistance: Lateral forces applied to footings may be resisted by the passive pressure mobilized on the buried face of the footing and by friction along the base of the footings. The passive pressure produced by compacted backfill can be taken as that equivalent to the pressure exerted by a fluid weighing 445 pcf. A coefficient of friction of 0.42 may be used for calculating the frictional resistance along the base of cast-in-place concrete footings. Additional lateral resistance may be realized by designing the footings with a "key" at the base and mobilizing the passive resistance along the vertical face of the key. The values presented presume that the footings are surrounded by well-compacted, suitable soil with a moist unit weight

of approximately 125 pcf and that the footings can withstand small movements on the order of 1/4 inch. A factor of safety of at least 1.5 is also recommended in the design.

Uplift Resistance - Uplift resistance for the foundation will be provided by the dead loads applied on the foundation and the weight of the foundation. Additional uplift resistance, if needed, can be realized by increasing the width of the foundation, the embedment depth or by anchoring the foundation. A minimum factor of safety of 1.5 should be used against uplift.

Elevator Pits and Cisterns: The elevator pits and cisterns will be embedded in the rock layer encountered. The excavation and replacement procedures recommended earlier in this report will apply to the foundation of these structures.

The walls of the elevator pits or cisterns should be waterproofed using industry standards and methods. The elevator pits should also be designed to resist uplift. We recommend that the base slab of the pit be extended beyond the perimeter walls to assist in uplift resistance. The uplift resistance can be calculated as described earlier in this report.

Pavement Support

General Requirements: The pavement area should be cleared, grubbed, graded as needed to provide positive drainage. The pavement subgrade soils should provide adequate subsurface drainage to protect the pavement over time. The groundwater table is not expected to affect the pavement at this site. Fill soils required to raise site grades should meet the requirements as recommended in the Earthwork Activities section of this report.

Recommended Pavement Section: Following adequate site preparation, the pavement section may be a flexible, a semi-flexible, or a rigid pavement section. The proposed pavement will be subjected to lightly loaded vehicles.

Pavement Subgrade: In order to promote proper drainage for the pavement section, we recommend that there be sufficient granular material with a maximum of 15 percent passing the US no 200 sieve. This material should have a maximum liquid limit of 35 and Plasticity Index less than 12. The California Bearing Ratio (CBR) of the subgrade shall not be less than 20. The subgrade material should be compacted to a minimum of 95 percent of the soils maximum modified proctor value as determined by ASTM D-1557.

Flexible Pavement Section.

Sub-base Course: The subbase material in the flexible pavement section shall have a minimum strength equivalent to a California Bearing Ratio (CBR) of 30. The material shall have a maximum of 15 percent passing the US No 200 sieve, a liquid limit of not more than 25 and Plasticity of 5 or less. We recommend a minimum thickness of 6 inches, compacted to a minimum of 95 percent of the maximum modified proctor value. The compacted material shall be firm and unyielding.

Base Course: An approved aggregate base course is recommended for the pavement. The base material should be compacted to a 98 percent of the maximum modified proctor value and should have a minimum California Bearing Ratio (CBR) of 100. The minimum thickness of the base should be 6 inches. Alternative materials may be used provided that it meets the specifications for base course and that the thickness, strength, and compaction are considered in the pavement design.

Surface Course: We recommend a Hot Mix Asphalt for the wearing surface of the pavement. The mix design selected for the HMA should be stable, weather-resistant, wear-resistant, waterproof, and non-slippery. We recommend a minimum thickness of 1-1/2 inches of compacted pavement. We further recommend a minimum of 2 inches of wearing surface along the driveway where the vehicles will be stacked for entering and exiting. The surface smoothness shall have a maximum deviation of 1/4 inch.

The minimum thicknesses provided here will result in a Structural Number of 2.7. The actual pavement section should be designed for the actual equivalent 18 kip single axle load anticipated over the life of the pavement.

Rigid Pavement Section

A rigid pavement section may also be used for this application. The subgrade preparation recommendations above will also apply to this pavement section. The subgrade should be firm and unyielding and well-drained. The Concrete used in a rigid pavement section should have a 28 day strength of 3000 psi. A minimum of 6 inches of concrete is recommended for the normal vehicle access areas. A minimum of eight inches of concrete is recommended for heavy traffic areas. The concrete pavement should be designed with adequate longitudinal and transverse reinforcement and expansion joints. The approach slab of the dumpster areas should be designed to withstand the stopping and turning forces produced by the disposal vehicle.

Stormwater Management Facilities.

Coefficient of Permeability: A field permeability test was conducted in the lower elevation of the site in the area of the proposed pavement. The method used was an uncased hole at 4.5 feet below the ground surface. The test hole was filled with water and allowed to saturate. After a period of saturation, the time for the level in the borehole to fall 3 inches and 6 inches was measured. Using a formula associated with the test configuration, the coefficient of permeability was determined to be 24 feet/day in the weathered rock.

Pond Design: The stormwater system can take the form of open dry or wet bottom ponds, exfiltration systems, ditches, swales, or other approved systems. The system selected will be dependent upon the soil and groundwater table conditions, the stormwater runoff, the space available and the DPNR requirements.

The system should be designed to hold and treat the pollution abatement volume and attenuate to the design storm. The outfall from the control structure should not exceed the pre-development discharge rate from the site. An appropriate positive outfall is required. If a positive outfall is not available, the system should be designed to hold the 100 year flood runoff.

On-site sewage disposal system

Infiltration Rate. A percolation test was conducted in the lower elevation of the site. A falling head, uncased hole test was conducted. Once the borehole was saturated, it was filled and the time for the water to infiltrate several inches was measured. A percolation rate of 0.03 minutes per inch was measured in the weathered rock.

Loading rate. Based upon the percolation rate measured, we recommend the loading rate for sizing drainfield for the on-site sewage disposal system be taken as 0.8 gallons per day per square foot of area (gpd/ft²) for a bed configuration and 1.2 gpd/ft² for a trench design.

Limitations

This report was prepared in accordance with commonly accepted geotechnical engineering practices for the exclusive use of our client only for the subject project. No other warranty, expressed or implied, is made. The analyses and recommendations presented herein were based on the results of our subsurface exploration, available information about the subject site and the proposed site improvements. In addition, the exploration does not address deep geological activity. If significant changes in the final site grades, locations, or foundation loads other than those described herein, or if subsurface conditions different from those encountered in the borings become evident prior to, or during, site preparation or construction, VITEST Engineers should be immediately notified so that we may review and, if necessary, modify our analyses and recommendations.

APPENDIX A



APPROXIMATE BORING LOCATION

GEOTECHNICAL INVESTIGATION
 WTJX PUBLIC TV FACILITY
 SUBBASE, ST THOMAS, USVI

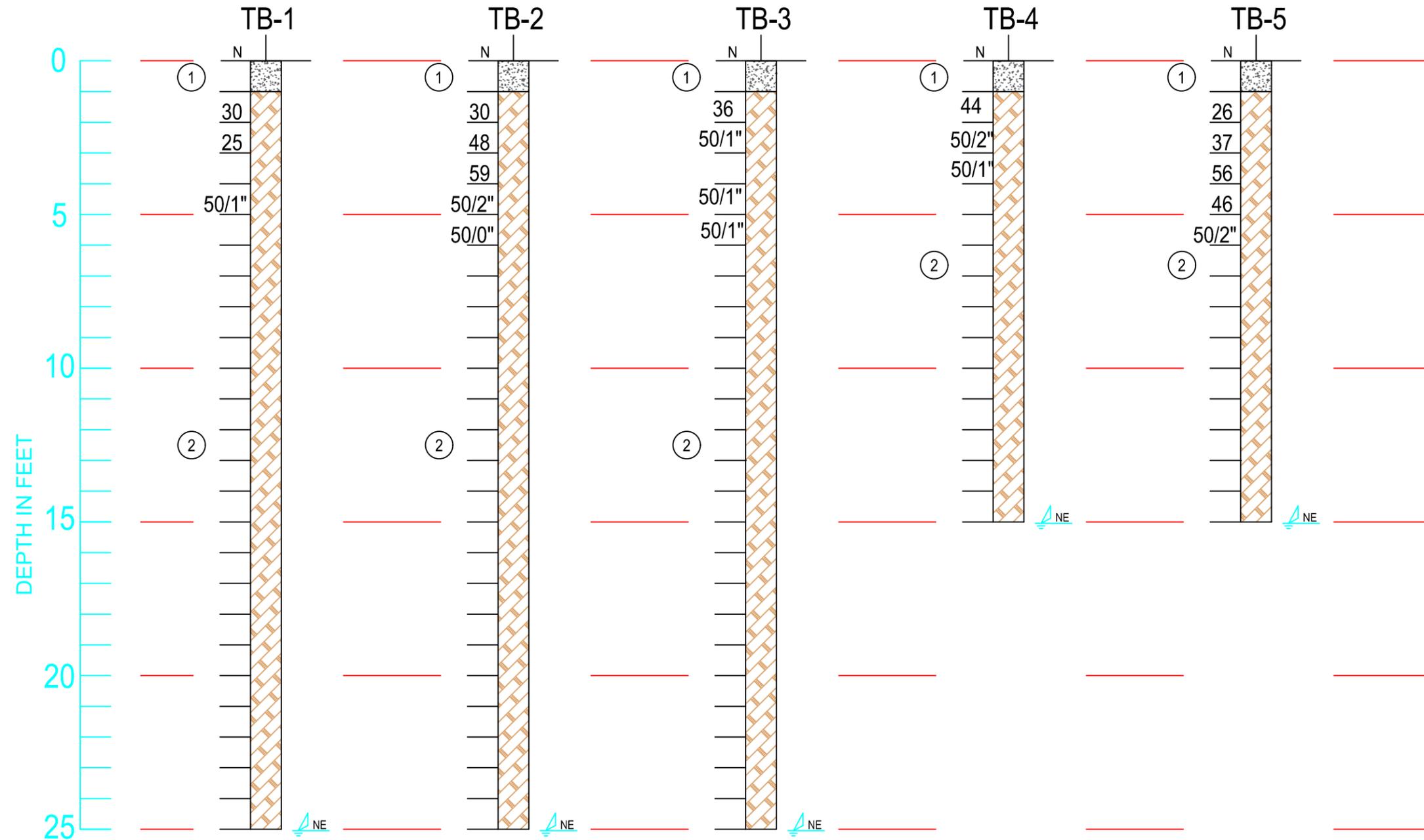


VITEST Engineers

*Civil & Geotechnical Engineering,
 Materials Testing & Environmental Services*

Scale:	NTS	Approved By:	DSL
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SOIL PROFILES



LEGEND

- ① 4" CONCRETE W/WIRE MESH AND GRAVEL BASE (CONC.)
- ② YELLOWISH- BROWN WEATHERED ROCK (ROCK)

- GROUNDWATER TABLE NOT ENCOUNTERED
- N N-VALUE (BLOW COUNTS PER FOOT)
- W NATURAL MOISTURE CONTENT IN PERCENT
- 200 PERCENT PASSING THE NO. 200 SIEVE

TB-1 APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (More than 50 % larger than #200 sieve)	GRAVEL AND GRAVELLY SOILS (More than 50% of coarse fraction retained on #40 sieve)	CLEAN GRAVELS (Little or no Fines)	GW Well-graded gravels, gravel-sand mixtures, little to no fines
		GRAVELS WITH FINES (Appreciable amount of fines)	GP Poorly graded gravels, gravel-sand mixtures, Little to no Fines
		SAND AND SANDY SOILS (More than 50% of coarse fraction Passing #4 sieve)	GM Silty gravels, gravel-sand-silt mixtures
		SANDS WITH FINES (Appreciable amount of fines)	GC Clayey gravels, gravel-sand-clay mixtures
	SANDS WITH FINES (Appreciable amount of fines)	CLEAN SANDS (Little or no Fines)	SW Well-graded sands, gravelly sands, little to no fines
		SANDS WITH FINES (Appreciable amount of fines)	SP Poorly graded sands, gravelly sands little to no fines
		SANDS WITH FINES (Appreciable amount of fines)	SM Silty sand, sand-silt mixtures
		SANDS WITH FINES (Appreciable amount of fines)	SC Clayey sands sand-clay mixtures
FINE GRAINED SOILS (More than 50 % Smaller than #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sand or clayey silts with slight plasticity	
		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	
		OH Organic Clays of medium to high Plasticity	
HIGHLY ORGANIC SOILS		PT Peat, Humus, Swamp soils with high organic contents	

RELATIVE DENSITY vs N-Value

COHESIONLESS SOILS	
DENSITY	N-value (bpf)
Very Loose	0 to 5
Loose	5 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	over 50

CONSISTENCY vs N-Value

COHESIVE SOILS	
Consistency	N-Value (bpf)
Very Soft	0 to 2
Soft	2 to 4
Medium Stiff	4 to 8
Stiff	8 to 15
Very Stiff	15 to 30
Hard	Over 30

SITE CLASS

Site Class	Soil Profile	N (bpf)
A	Hard Rock	
B	Rock	
C	Very Dense Soil and Soft Rock	>50
D	Stiff Soil Profile	15-50
E	Soft Soil Profile	<15
F	Requires Further Site Evaluation	

