Geotechnical Engineering Report

Proposed Telecommunications Tower

T-Mobile Amtrak Madison (CTNH808A)

15 Orchard Park Road

Madison, Connecticut

December 21, 2009

Project No. J2095225

Prepared for:

All-Points Technology Corporation, P.C.
Killingworth, Connecticut

Prepared by:

Terracon Consultants, Inc.
Rocky Hill, Connecticut

Terracon

December 21, 2009

All-Points Technology Corporation, P.C.
3 Saddlebrook Drive
Killingworth, CT 06419

Attn: Mr. Scott Chasse, P.E., Principal
P: [860] 663 1697
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E: schasse@allpointstech.com

Re: Geotechnical Engineering Report
Proposed Telecommunications Tower
T-Mobile Amtrak Madison (CTNH808A)
15 Orchard Park Road
Madison, Connecticut
Terracon Project No. J2095225

Dear Mr. Chasse:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our Proposal for Geotechnical Engineering Services, dated November 30, 2009. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design of foundations for the proposed telecommunications tower and accompanying equipment cabinets.

In this report, we include our understanding of the project, a summary of the exploration program, and our design and construction recommendations. This report is subject to the General Comments in Section 5.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Stephen C. Lanne, P.E.
Senior Staff Geotechnical Engineer

Richard W.M. McLaren, P.E.
Senior Associate
Department Manager–Geotechnical Services

/ekc/J2095225
Attachment

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED TELECOMMUNICATIONS TOWER
T-MOBILE AMTRAK MADISON (CTNH808A)
15 ORCHARD PARK ROAD
MADISON, CONNECTICUT
Project No. J2095225
December 21, 2009

1.0 INTRODUCTION

A geotechnical engineering report has been completed for the proposed steel monopole telecommunications tower to be located near the southeast corner of the site at 15 Orchard Park Road in Madison, Connecticut. A single test boring was advanced to a depth of approximately 21 feet below existing ground surface about 6 feet southeast of the proposed tower center location. Two test probes were advanced near the southwest corner and central portion of the proposed fenced compound to depths of approximately 16.5 and 17 feet. Logs of the test boring and probes, along with a Topographic Vicinity Map (Figure 1) and an Exploration Location Diagram (Figure 2), are included in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- foundation design and construction
- seismic considerations
- slab design and construction

2.0 PROJECT INFORMATION

2.1 Project Description

The project consists of constructing a steel monopole telecommunications tower within a 40-foot by 45-foot fenced compound area. Equipment cabinets and various electrical appurtenances will be located within and near the compound area. The compound area slopes down to the east from around Elevation (El) 23 to 15 feet based on the elevation contours on the drawing entitled Site Plan, Sheet No. SP-1. A summary of the project is presented below:

ITEM	DESCRIPTION
Site layout	Appendix A, Exhibit A-2 (Figure 2), Exploration Location Diagram
Tower	Up to 160-foot high steel monopole
Steel monopole tower: Maximum dead load	35 kips (assumed)
Steel monopole tower: Maximum allowable settlement	1 inch
Equipment Pad: Maximum Loads	150 pounds/square foot (psf) (assumed)
Equipment Pad: Maximum allowable settlement	Total Settlement: 1 inch Differential Settlement: ½ inch
Grading	Based on the proposed tower elevation, we estimate that fills up to about 7 feet and cuts of about 2 feet will be required to level the compound area.
Cut and fill slopes	Permanent fill constructed earth slopes will be required on the north, east, and south sides of the site to level the compound area. We estimate finished slopes will be stable at 2H:1V (Horizontal to Vertical) max.
Retaining walls	If permanent slopes are not used to level the compound area, a retaining wall will be required.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	15 Orchard Park Road, Madison, Connecticut
Existing improvements	The site is bounded to the north and east by a wooded area and a wetland area (flagged by others). To the west and south are commercial buildings and associated paved parking areas.
Current ground cover	Fill within the proposed compound area
Existing topography	Moderate downward slope to the east from El 23 to 15 feet within the compound area.

The site is cleared and moderately sloped in the vicinity of the tower and compound area. Ground surface elevations at the exploration locations were based on the elevation contours shown on the drawing entitled Site Plan, Sheet No. SP-1. We consider our estimates of ground surface elevations to be accurate only to about one foot, or so.

3.0 SUBSURFACE EXPLORATIONS AND CONDITIONS

3.1 Typical Profile

Based on the results of the explorations and observations at the time of drilling, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency / Relative Density
Stratum 1	6 to 7	Fill, Poorly to Well-graded sand, trace gravel and silt, brown	Medium dense to dense
Stratum 2	15.5	Well-graded gravel with sand, trace silt, brown; to poorly-graded sand, trace gravel and silt, brown (Glaciofluvial Deposit)	Dense to very dense
Stratum 3	>21	Grey, hard, slightly weathered, medium grained Gneiss (Bedrock)	N/A

Conditions encountered at the individual exploration locations are indicated on the boring or probe logs in Appendix A of this report. Stratification boundaries on the boring log represent the approximate location of changes in soil types; *in situ*, the transition between materials may be gradual. Further details of the explorations can be found on the boring and probe logs.

On December 4, 2009, *in-situ* soil resistivity testing was completed by a Terracon field engineer. Resistivity testing was performed in general accordance with ASTM G57 by the Wenner Four Probe Method using a Megger DET5/4R Digital Earth Tester. Two resistivity lines were completed with electrodes spaced at approximately 5, 10, 20, 30, and 40 feet; however, because of site constraints, Line 2 was extended to only 30 feet. The location and orientation of resistivity lines are shown on Figure 2. The resistivity test results are tabulated below:

	Resistivity (ohm-cm)	
Electrode Spacing (ft)	**Line 1**	**Line 2**
5	897,180	590,780
10	635,780	308,505
20	283,420	203,375
30	357,340	143,050
40	144,010	-

3.2 Groundwater

Groundwater was encountered in each exploration at a depth of about 8 feet below the existing ground surface. However, fluctuations in groundwater level may occur because of seasonal variations in the amount of rainfall, runoff and other factors. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Based on our review of the subsurface conditions at the site, we believe it is feasible to design an adequate foundation system for support of the proposed tower.

We understand that you would prefer to use a drilled shaft foundation for support of the tower because of the site configuration. The following sections of the report are based on the use of a drilled shaft foundation. If at a later date you wish to consider a shallow foundation, such as a monolithic mat or a pier and pad foundation, we can provide alternate recommendations.

The compound area is currently underlain by about 6 to 7 feet of granular fill, which was observed to be medium dense to dense, based on the blows counts in the test boring. Provided the surface of the existing fill is thoroughly compacted after excavation or prior to placing additional fill, the proposed equipment cabinets and other ancillary structures may be supported by a slab-on-grade underlain by a minimum 12-inch thickness of compacted structural fill or minus ¾-inch crushed stone placed on the existing fill.

A permanent fill constructed earth slope will be required north, east and south of the proposed compound area in order to level the site. If an earth slope is not used because of encroachment on the adjacent wetlands, or any other reason, a retaining wall will be required to support the fill. We estimate that the slope or retaining wall will be constructed early on in the project in order to level the compound area. The design of the retaining wall, if used, should consider the earth pressures acting on the wall, as discussed in Section 4.4 of this report, construction surcharges, and handling of surface water run-off.

We recommend that the exposed subgrades be thoroughly evaluated prior to fill placement. We recommend that the geotechnical engineer be retained to evaluate the bearing material for the foundation subgrade soils. Subsurface conditions in the explorations have been reviewed and evaluated with respect to the proposed construction plans known to us at this time.

4.2 Earthwork

Prior to placing fill, topsoil and any otherwise unsuitable materials should be removed. The subgrade should be proofrolled with a large roller compactor. Unstable subgrades should be removed and replaced with compacted structural fill or minus ¾-inch crushed stone, as necessary. Structural fill may then be placed within the compound area to attain the required grade.

Fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Structural Fill	GW [2]	All locations and elevations. The existing fill and native glaciofluvial deposit, if excavated, may be selectively re-used as structural fill, provided they meet the gradation requirements in Note 2, below.
Common fill	Varies [3]	Common fill may be used for site grading to within 12 inches of finished grade. Common fill should not be used under settlement sensitive structures. The existing fill and native glaciofluvial deposit, if excavated, may be re-used as common fill provided they are free of organics and can be adequately compacted.

1. Compacted structural fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used. Fill should not be placed on a frozen subgrade.
2. Imported structural fill should meet the following gradation:

Percent Passing by Weight

Sieve Size	Structural Fill
6”	100
3”	70 – 100
2”	(100)*
¾”	45 – 95
No. 4	30 – 90
No. 10	25 – 80
No. 40	10 – 50
No. 200	0 - 12

* Maximum 2-inch particle size within 12 inches of the underside of footings or slabs

3. Common fill should have a maximum particle size of 6 inches and no more than 25 percent by weight passing the US No. 200 sieve.

4.2.1 Compaction Requirements

ITEM	DESCRIPTION
Fill Lift Thickness	8 inches or less in loose thickness
Compaction Requirements [1]	95% maximum modified Proctor dry density (ASTM D1557, Method C)
Moisture Content – Granular Material	Workable moisture levels

1. We recommend that structural fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.

4.2.2 Grading and Drainage

The compound area currently slopes downward to the east with a total elevation change of about 8 feet. We understand that you will place fill over the existing slope, grading the compound area to be level with the current grade at the southwest corner of the site. A permanent earth slope or retaining wall will be required to support the fill.

Provision should be made in the design of the slope or retaining wall and the compound area to collect and divert stormwater run-off away from the slope or retaining wall.

4.2.3 Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, wet, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted.

As a minimum, temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations, as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, State and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of foundations.

4.3 Foundation Recommendations

4.3.1 Tower Foundations

It is our understanding that you would prefer to use a drilled shaft foundation system. Design recommendations are presented in the following paragraphs and tables.

4.3.1.1 Design Recommendations – Drilled Shaft

DESCRIPTION	VALUE
Net Allowable Bearing Capacity	
Bedrock (> 15 feet)	15 ksf [1]
Ultimate Side Friction	
Fill (3.5 to 6 feet)	0.5 ksf [2]
Glaciofluvial Deposit (6 to 15 feet)	1.2 ksf
Bedrock (>15 feet)	4 ksf
Coefficient Lateral Subgrade Reaction	
Fill (0 to 6 feet)	20 (z/D) kcf [3]
Glaciofluvial Deposit (6 to 15 feet)	50 (z/D) kcf
Bedrock (> 15 feet)	80 (z/D) kcf
Angle of Internal Friction	
Fill (0 to 6 feet)	32 degrees
Glaciofluvial Deposit (6 to 15 feet)	36 degrees
Estimated In-situ Soil Unit Weight	
Fill (0 to 6 feet)	120 pcf
Glaciofluvial Deposit (6 to 15 feet)	125 pcf
Bedrock (> 15 feet)	150 pcf
Approximate Groundwater Depth	8 feet (12/4/2009)
Concrete minimum 28-day unconfined compressive strength	4,000 psi
Minimum drilled shaft diameter	Diameter of monopole base
Allowable deflection at top of shaft	0.5 inch

1. The allowable end bearing pressure assumes that loose rock pieces and soil have been removed from the base of the shaft excavation and that the shaft has been extended at least 3 feet into the bedrock.
2. Contribution to shaft capacity from soil above a depth of 3.5 feet should be ignored. The uplift capacity of the shaft will be based on side friction and the dead weight of the shaft.
3. z is depth below the ground surface and D is diameter of shaft, both in feet.

We anticipate that the design length of the shaft will be primarily dependent on the embedment/lateral capacity required to resist live loading, such as the combination of wind and ice loads. Based on the relatively shallow depth to bedrock, we estimate a minimum socket depth into bedrock of 3 feet will be required to achieve the design lateral capacity. The drilled shaft will be designed to resist tension loads. Therefore reinforcing steel should be installed throughout the entire length of the shaft. Technical specifications should be prepared that require material and installation detail submittals, proof of experience in drilled shaft installation, concrete placement methods, and hole stabilization methods.

4.3.1.2 Construction Considerations – Drilled Shaft

The drilled shaft should be aligned vertically. The drilling method or combination of methods selected by the contractor should be submitted for review by the geotechnical engineer, prior to mobilization of drilling equipment. A rock socket will likely be required to construct the shaft. The contractor should take these aspects into account in his proposed drilling method(s).

The groundwater table was encountered at a depth of about 8 feet below existing ground surface. To maintain the integrity of the shaft walls during drilling, a bentonite slurry or other suitable drilling fluid may be required. A section of temporary casing and a positive head of water or drilling mud, above the static groundwater level, may be required to reduce the likelihood of caving of the side walls of the shaft hole. Concrete should be placed by tremie methods.

4.3.2 Equipment Cabinet Foundations

The proposed equipment cabinets may be supported on a slab-on-grade underlain by at least a 12-inch thickness of compacted structural fill or minus ¾-inch crushed stone placed on the existing fill or structural fill placed on the existing fill, the surface of which should be thoroughly compacted and clear of organic matter. Design recommendations for the proposed slab-on-grade are presented in the following paragraphs.

4.3.2.1 Design Recommendations – Slab-on-Grade

DESCRIPTION	VALUE
Slab support (compacted structural fill or minus ¾-inch crushed stone)	12-inch thick layer
Modulus of subgrade reaction	200 pounds per square inch per in (psi/in)
Minimum embedment below finished grade for frost protection [1,2]	3.5 feet
Approximate total settlement [3]	<1 inch
Estimated differential settlement	<½ inch
Coefficient of sliding friction	0.5

1. Consideration should be given to using dense insulation boards (Dow Styrofoam Highload, or similar) under and adjacent to lightly loaded slabs-on-grade, to provide the equivalent of 3.5 feet of earth cover, thus reducing frost penetration.
2. Air entraining admixtures should be used for concrete exposed to freezing.
3. Settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the thickness of compacted fill, and the quality of the earthwork operations.

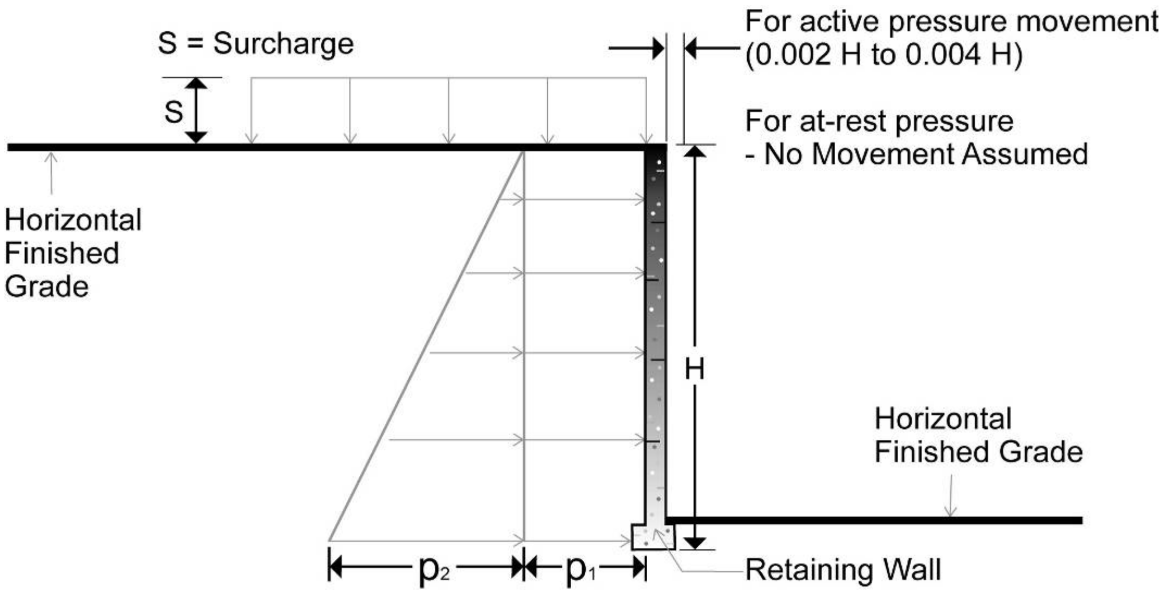
4.3.2.2 Construction Considerations – Slab-on-Grade

On most tower sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed by foundation excavations, construction traffic, rainfall, etc. As a result, the slab subgrade may not be suitable for placement of structural fill or minus ¾-inch crushed stone, and corrective action will be required.

We recommend the area underlying the slabs be rough graded and then thoroughly proofrolled with a vibratory roller or heavy plate compactor prior to final grading and placement of structural fill or minus ¾-inch crushed stone. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas previously filled or backfilled. Areas where unsuitable or unstable conditions are located should be repaired by removing and replacing the affected material with properly compacted structural fill or minus ¾-inch crushed stone, as necessary.

4.4 Lateral Earth Pressures

Retaining walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Conditions	Earth Pressure Coefficient	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (K_a)	0.33	40	(0.33)S	(40)H
At-Rest (K_o)	0.46	55	(0.46)S	(55)H
Passive (K_p)	3.0	360	---	---

Applicable conditions to the above parameters include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 H to 0.004 H, where H is wall height.
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance.
- Uniform area surcharge behind the wall, where S is surcharge pressure in psf.
- Other surcharge loads should be considered where they are located within a horizontal distance behind the wall equal to 1.5 times the height of the wall.
- Surcharge stresses due to point loads, line loads, and those of limited extent, such as compaction equipment, should be evaluated using elastic theory.
- To account for the effect of compaction equipment on the wall during construction, the lateral pressure should not be less than 200 psf, distributed uniformly over the height of the wall.
- Retained soil total unit weight up to 120 pcf.
- Backfill compacted to 95 percent of modified Proctor maximum dry density, except within 4 feet of back of wall, which should be compacted to 92 percent of modified Proctor maximum dry density with hand operated equipment. Heavy

equipment should not operate within a distance closer than the exposed height of retaining walls.

- Loading from heavy compaction equipment is not included.
- No hydrostatic pressures acting on wall; surcharge due to water pressure may be neglected only if an effective drain is incorporated into the design.
- No dynamic loading.
- No safety factor included in soil parameters; lateral pressures based on the above parameters are cumulative for computing overall safety factors.
- Passive pressure should be ignored in frost zone.

Backfill placed against the retaining wall should consist of granular soils. For the earth pressure values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.5 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To control hydrostatic pressure behind the wall, we recommend that a drain be installed at the wall foundation with a collection pipe leading to a reliable discharge. A swale should be constructed in the retained soil behind the retaining wall to direct surface run-off away from the wall.

Seismic forces are additive and may be calculated based on 11h psf/foot, distributed as an inverse triangle for active conditions and as a uniform pressure for “at-rest” conditions. In this case, ‘h’ is equal to the exposed height of the wall, i.e. above the permanent ground level in front of the wall.

4.5 Seismic Considerations

DESCRIPTION	VALUE
Code Used	Connecticut State Building Code (CBC) [1]
Site Class	C [2]
Maximum considered earthquake ground motions (5 percent damping)	0.080g (1.0 second spectral response acceleration)
	0..268g (0.2 second spectral response acceleration)
Liquefaction potential in event of an earthquake	Not susceptible

1. The CBC incorporates the Seismic Design Category approach from the 2003 International Building Code.
2. The CBC requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100 foot soil profile determination; the borings performed for this report extended to a maximum depth of 21 feet. However, the encountered bedrock will extend to a depth of 100 feet.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the explorations performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between explorations, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

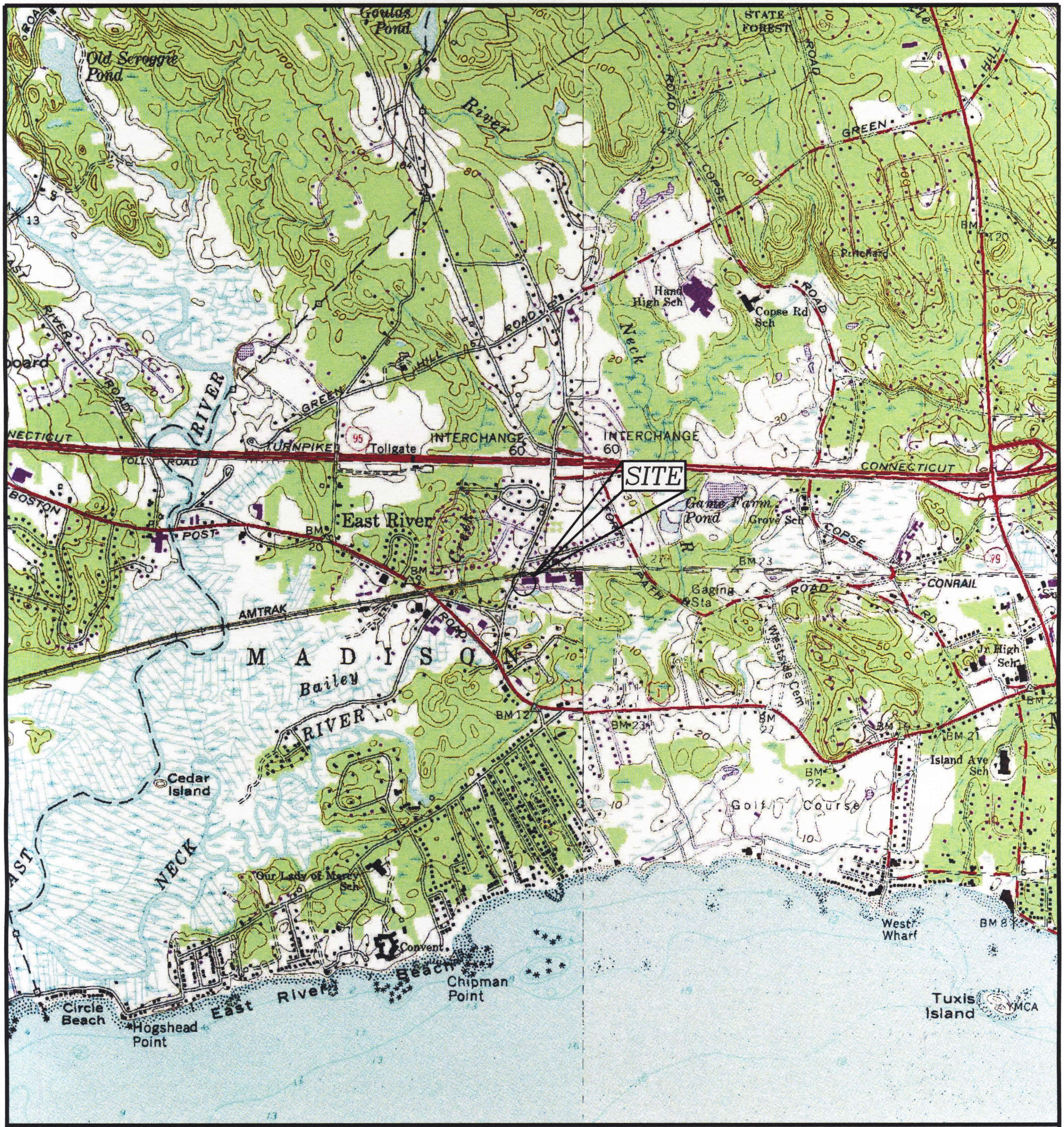
Resistivity testing may be influenced by the presence of boulders or other anomalies within the test area. Resistivity results will also fluctuate depending on the degree of compaction, moisture content, soil constituent solubility, and temperature. Field resistivity values may vary depending upon season, precipitation, and other conditions, which may be different from those at the time of testing.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION



SCALE: 1:24 000

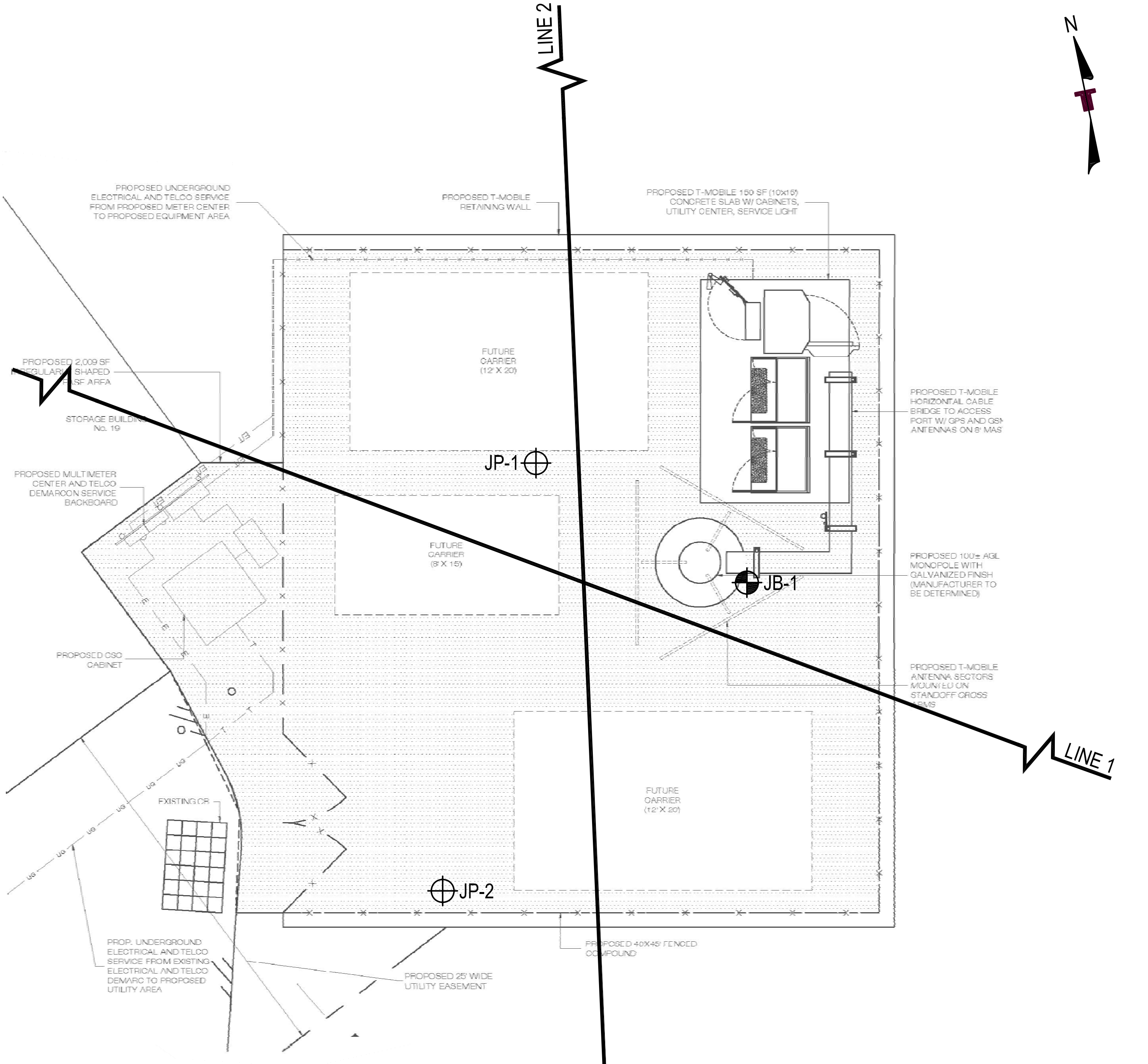
1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Project Mngr: SCL	Project No. J2095225	**Terracon** Consulting Engineers and Scientists	TOPOGRAPHIC VICINITY MAP	FIG. No.
Drawn By: BJS	Quadrangle: GUILFORD, CONNECTICUT - 1984		T-MOBILE AMTRAK MADISON TOWER	1
Checked By: SCL	File No. J2095225	201 Hammer Mill Road Rocky Hill, Connecticut 06067	15 ORCHARD PARK ROAD	
Approved By: RWM	Date: DECEMBER 2009	PH. (860)721-1900 FAX.(860)721-1939	MADISON, CONNECTICUT	



10 0 5 10

SCALE IN FEET

LEGEND

JB-1 TEST BORING LOCATION

JP-1 TEST PROBE LOCATION (TYP)

LINE 1 RESISTIVITY TEST LOCATION (TYP)

NOTES:

1. THIS DIAGRAM WAS PREPARED FROM A PLAY BY ALL-POINTS TECHNOLOGY CORPORATION, P.C. OF KILLINGWORTH, CONNECTICUT, PROJECT NAME: CT-255T-340, SHEET No. SP-2, TITLED: "COMPOUND PLAN & TOWER ELEVATION REV. 3" DATED: 7/27/2009.

2. THE EXPLORATIONS SHOWN AS JB-1 AND JP-1 THROUGH JP-2 WERE ADVANCED ON DECEMBER 4, 2009 UNDER THE DIRECTION OF TERRACON WITH EQUIPMENT OWNED AND OPERATED BY NEW ENGLAND BORING CONTRACTORS, INC. OF GLASTONBURY, CONNECTICUT.

3. RESISTIVITY TESTING WAS PERFORMED ON DECEMBER 4, 2009 BY A TERRACON FIELD ENGINEER.

4. THE APPROXIMATE LOCATIONS OF THE EXPLORATIONS AND RESISTIVITY TESTS WERE TAPED FROM SITE FEATURES. THE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

5. USE OF THIS DIAGRAM IS LIMITED TO THE ILLUSTRATION OF THE APPROXIMATE LOCATIONS OF THE EXPLORATIONS, RESISTIVITY TESTS, AND OTHER PERTINENT SITE FEATURES. ANY OTHER USE OF THIS DIAGRAM WITHOUT PERMISSION FROM TERRACON IS PROHIBITED.

Project Mngr: SCL	Project No. J2095225	Terracon	EXPLORATION LOCATION DIAGRAM
Drawn By: BJS	Scale: 1" = 10'	Consulting Engineers and Scientists	T-MOBILE AMTRAK MADISON TOWER
Checked By: SCL	File No. J2095225	201 Hammer Mill Road Rocky Hill, Connecticut 06067	15 ORCHARD PARK ROAD
Approved By: RWM	Date: DECEMBER 2009	PH. (860)721-1900 FAX.(860)721-1939	MADISON, CONNECTICUT

FIG. No.

2

LOG OF BORING No. JB-1

CLIENT: **All Points Technology Corporation**	
SITE: **15 Orchard Park, Madison, CT**	PROJECT: **T-Mobile Amtrak Madison Tower**

Approx. Surface Elev.: 20 ft

Depth (ft)	Elev.	DESCRIPTION	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - Blows per 6"	WATER CONTENT, %	pH	UNCONFINED STRENGTH, psf	OTHER TESTS
0–6	14	**FILL**, **POORLY GRADED SAND**, trace gravel and silt, medium dense to dense. **(FILL)**		1	SS	12	9-8 9-12				
				2	SS	14	10-10 18-19				
			GW	3	SS	18	20-27 33-29				
6–14	6	**WELL GRADED GRAVEL**, with sand, trace silt, brown, dense.	GW	4	SS	12	10-16 26-21				
14–15.5	4.5	**POORLY GRADED SAND**, trace gravel and silt, brown, dense. **(GLACIOFLUVIAL DEPOSIT)**	SP	5	SS	5	50				min/ft
15.5–21	-1	Hard, slightly weathered, gray, medium grained, GNEISS. RQD = 100% **(BEDROCK)**		1	C						2:15 1:45 1:45 1:00 1:45

BORING TERMINATED AT 21.0 ft

The stratification lines represent the approximate boundary lines between soil and rock types; in situ, the transition may be gradual.

3 1/4" ID HSA, 2" OD SS, 140h

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 8	
WL		
WL	While Drilling	

Terracon

BORING STARTED	12-4-09		
BORING COMPLETED	12-4-09		
RIG	Mobile B-53	FOREMAN	JL
LOGGED	DY	JOB #	J2095225

LOG OF PROBE No. JP-1

CLIENT
All Points Technology Corporation

SITE **15 Orchard Park**
Madison, CT

PROJECT
T-Mobile Amtrak Madison Tower

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 20 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - Blows per 6"	TESTS: WATER CONTENT, %	TESTS: pH	TESTS: UNCONFINED STRENGTH, psf	TESTS: OTHER TESTS
	FILL, **WELL GRADED SAND**, trace gravel and silt, brown. **(FILL)** 7 — 13	5									
	POORLY GRADED SAND, with gravel, trace silt, brown. **(GLACIOFLUVIAL DEPOSIT)** 16.5 — 3.5	10 15	SP								
	PROBE REFUSAL AT 16.5 ft on probable bedrock										

The stratification lines represent the approximate boundary lines between soil and rock types; in situ, the transition may be gradual.

4" dia, SSA

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 8	▼
WL	▼	▼
WL	After 2 minutes	

Terracon

PROBE STARTED	12-4-09
PROBE COMPLETED	12-4-09
RIG Mobile B-53	FOREMAN JL
LOGGED DY	JOB # J2095225

LOG OF PROBE No. JP-2

CLIENT **All Points Technology Corporation**	
SITE **15 Orchard Park Madison, CT**	PROJECT **T-Mobile Amtrak Madison Tower**

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 21 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - Blows per 6"	TESTS: WATER CONTENT, %	TESTS: pH	TESTS: UNCONFINED STRENGTH, psf	TESTS: OTHER TESTS
	FILL, **WELL GRADED SAND**, trace gravel, and silt, brown **(FILL)** 6 … 15	5									
	POORLY GRADED SAND, with gravel, trace silt, brown. **(GLACIOFLUVIAL DEPOSIT)** 17 … 4	10 15	SP								
	PROBE REFUSAL AT 17.0 ft on probable bedrock										

The stratification lines represent the approximate boundary lines between soil and rock types; in situ, the transition may be gradual.

4" dia, SSA

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 8	▼
WL	▼	▼
WL	After 2 minutes	

Terracon

PROBE STARTED	12-4-09		
PROBE COMPLETED	12-4-09		
RIG	Mobile B-53	FOREMAN	JL
LOGGED	DY	JOB #	J2095225

Field Exploration Description

The proposed tower compound was cleared and grass covered. The tower center had already been staked in the field by others.

Terracon monitored the advancement of one test boring (JB-1) and two test probes (JP-1 and JP-2) adjacent to the proposed tower compound area on December 4, 2009. The explorations were advanced using a Mobile B-53 truck-mounted rotary drill rig, owned and operated by New England Boring Contractors Inc. of Glastonbury, Connecticut. JB-1 was advanced using 3¼-inch I.D. continuous flight hollow-stem augers (HSA) to a depth of about 15.5 feet below existing grade and terminated upon refusal on the gneiss bedrock. Bedrock was then cored to a depth of 21 feet with an NQ2-sized core barrel.

In the split-barrel sampling procedure utilized in JB-1, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler typically the middle 12 inches of the total 24-inch penetration by means of a 140-pound safety hammer with a free fall of 30 inches is the Standard Penetration Test (SPT) resistance value "N". This "N" value is used to estimate the *in-situ* relative density of cohesionless soils and consistency of cohesive soils.

The soil samples were placed in labeled glass jars and taken, along with the rock core in a wooden core box, to our Rocky Hill (Hartford), Connecticut office for further review by a Terracon geotechnical engineer. Information provided on the boring log attached to this report includes soil and rock descriptions, relative density and/or consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The boring was backfilled with auger cuttings prior to the drill crew leaving the site.

JP-1 and JP-2 were advanced with 4-inch diameter solid stem augers (SSA) to further evaluate the subsurface conditions at the site. The probes were terminated upon refusal at depths of approximately 16.5 to 17 feet. The probes were backfilled with auger cuttings prior to the drill crew leaving the site.

Field logs of the boring and probes were prepared by a Terracon field engineer. These logs included visual classifications of the materials encountered during drilling as well as interpretation by our field engineer of the subsurface conditions between samples. Final boring logs included with this report represent further interpretation by the geotechnical engineer of the field logs and incorporate, where appropriate, modifications based on laboratory classification of the samples.

The approximate exploration locations, which are shown on Figure 2, were measured by taping from existing features in the field and by estimating right angles. The ground elevations at the exploration locations were estimated by interpolating between contour elevations of existing grade shown on the plans provided. Ground surface elevations rounded to the nearest foot are shown on the individual boring and probe logs in Appendix A. The locations and elevations of the explorations should be considered accurate only to the degree implied by the method used to define them.

APPENDIX B

LABORATORY TESTING

Laboratory Testing

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System (USCS). USCS symbols are also shown. A brief description of the USCS is attached to this report. Classification was by visual/manual procedures.

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-$^3/_8$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the “Standard Penetration” or “N-value”.

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Ring Sampler (RS) Blows/Ft.	Relative Density
0 – 3	0-6	Very Loose
4 – 9	7-18	Loose
10 – 29	19-58	Medium Dense
30 – 49	59-98	Dense
50+	99+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

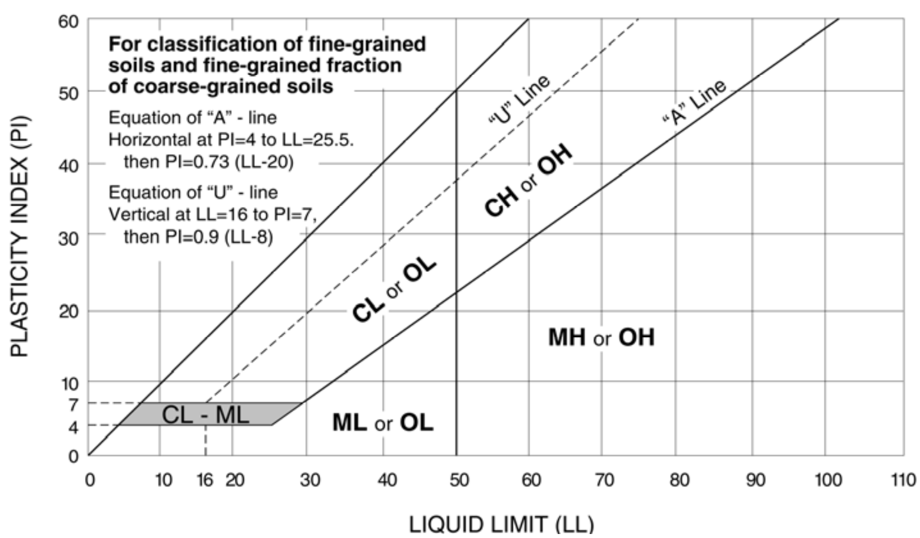
PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay
[E] $Cu = D_{60}/D_{10} \qquad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] $PI \geq 4$ and plots on or above "A" line.
[O] $PI < 4$ or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



GENERAL NOTES
Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock[a]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD)[b]		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.