ATTACHMENT 1

GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

PROPOSED STEEL SELF-SUPPORTING TELECOMMUNICATION TOWER
655 BASSETT RD, WATERTOWN, CT 06795

Prepared For

North Atlantic Towers
1001 3RD Ave West, Suite 420
Bradenton, FL 34205

Prepared By

Berkshire Geo-Technologies
441 Main Rd – P.O. Box 61
Monterey, MA 01245

July 16, 2012

Christopher J. Tryon
Owner
Berkshire Geo-Technologies

July 16, 2012

North Atlantic Towers
C/O Dan Shriver
1001 3RD Ave West, Suite 420
Bradenton, FL 34205

Infinigy Engineering
C/O Kenneth Curley
11 Herbert Drive
Latham, New York 12110

Dear Mr. Curley

Berkshire Geo-Technologies has completed a geotechnical engineering report as per your request for the 655 Bassett Rd, Watertown, CT project. This report presents the findings of our subsurface exploration and provides geotechnical recommendations concerning earthwork and the design of foundations for the proposed tower and utility shelters.

In the following report, we include our understanding of the project, summary of the subsurface exploration and our design and construction recommendations.

We would like to thank you for the opportunity to work with you on this project. If you have any questions, please feel free to contact us.

Sincerely,

Christopher Tryon, Owner

Donald Chester, P.E.

Donald Chester, PE

STATE OF CONNECTICUT
DONALD A. CHESTER
No.23114
LICENSED
PROFESSIONAL ENGINEER

441 Main Road
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Monterey, MA 01245

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1.0 INTRODUCTION:

The Geotechnical Engineering Report has been completed for the proposed 150 foot steel self-supporting telecommunications tower and associated utility structures located at the 655 Bassett Rd, Watertown, CT site. A total of three borings were performed with shallow bedrock encountered in all three borings. Please refer to the appendices and exhibits for the field exploration and supporting documents.

The purpose of this Geotechnical Engineering Report is to provide Engineering Recommendations relative to the following:

- Subsurface Soil Conditions
- Foundation Design and Construction
- Groundwater Conditions
- Seismic Considerations
- Earthwork
- Slab Design and Construction

2.0 PROJECT INFORMATION

The project consists of the construction of a 150 foot steel self-supporting telecommunications tower and utility structures within the tower compound area. Access to the tower site will be provided by a proposed access road which will utilize an unimproved section of road and an existing wood road. The approximate existing ground elevation at the Tower Site is 833 feet. Please refer below for the project summary.

ITEM	DESCRIPTION
Site Layout	Figure A2, (Boring Location Diagram)
Tower	150 foot steel self-supporting
Steel Self-Supporting Tower: Maximum Allowable Settlement	Total Settlement less than 1 inch
Utility Building: Maximum Allowable Settlement	Total Settlement less than 1 inch Differential Settlement less than ½ inch
Grading	Approximate 4 to 6 foot cut to create shelf

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	Bassett Road, LAT: 41-39-26N / LONG: 73-08-11W, private property, approximately 1900 feet northwest of the Bassett Rd. entrance
Existing Improvements	N/A
Current Ground Cover	Wooded / Forest Floor
Existing Topography	Approximate 13% slope / Varies

The site is located on a residential parcel which contains no housing or buildings. The access road utilizes an existing old unimproved section of road (formerly Linkfield Rd.) and an existing wood road to proposed tower site. There are no wetland areas within the tower compound area.

3.0 SUBSURFACE INVESTIGATION AND CONDITIONS

3.1 Typical Profile

Based on the results of the boring and observations at the time of drilling, subsurface conditions on the tower site generally consisted of a thin layer of forest floor and subsoil underlain by glacial till.

DESCRIPTION	APPROXIMATE DEPTH TO BOTTOM OF STRATUM (FT)	CONSISTENCY / RELETIVE DENSITY
Glacial Till	2-3 feet	Dense

Based on the review of the "Bedrock Geological Map of Connecticut" (Woodbury Quadrangle), bedrock at the site likely consists of the Nonewaug Granite: white to pink, fine to very coarse grained Granite; parts are Pegmatitic.

After review of the core sample obtained from the site, the sample contained approximately 4.0' of incompetent schist (weathered). The remaining sample is comprised of a recrystallized quartzite with schistose layers and small fractures. The overall sample is very competent and chemically resistant.

ITEM	DESCRIPTION
MOH's Hardness Scale	**7**
RQD	**49.4%**

Conditions encountered at the boring location are indicated on the attached boring log. Stratification boundaries on the boring log represent the approximate location of changes in soil types; the transition between materials may be gradual. Further details can be found on the boring logs in Appendix A.

3.2 Groundwater

Groundwater was not encountered within the borings that were performed. Groundwater depths may fluctuate with the seasonal variations of rainfall amounts, runoff and other factors. The possibility of fluctuations in the groundwater levels should be considered during the design and construction.

4.0 DESIGN AND CONSTRUCTION RECOMMENDATIONS

4.1 Geotechnical Considerations

Based on the subsurface conditions encountered in the boring, we recommend the proposed Telecommunications tower be supported on either a monolithic mat or a pier and pad foundation bearing directly on the competent bedrock at a depth of at least 4 feet below the existing grade. Boulders that are encountered that will impede compaction efforts are to be removed and replaced with crushed stone. The utility structures should derive their support from the weathered bedrock or from compacted structural fill or minus ¾-inch crushed stone placed on the weathered bedrock. Design recommendations are presented in the following sections.

We recommend that the exposed subgrades be inspected after excavation and prior to the placement of concrete. We recommend the Engineer be retained to inspect all bearing material for the foundation subgrade soils.

4.2 Earthwork

Preparation of the site should include the removal of the existing vegetation and other unsuitable material. The subgrade should be proof rolled with a heavy non-vibratory roller. Any unsuitable subgrades should be removed and replaced with compacted structural fill or minus ¾-inch crushed stone. If required, structural fill may be used in the compound area to attain the final grade.

Fill material should meet the following properties:

FILL TYPE[1]	USCS CLASSIFICATION	ACCEPTABLE LOCATION FOR PLACEMENT
Structural Fill	GW[2]	All locations and elevations. Excavated glacial till may be selectively re-used as fill adjacent to and above the tower foundation and within the compound area, provided it is properly compacted and is free of organic material.
Common Fill	Varies	Excavated glacial till shall be used as common fill for minor site grading and fill slopes, provided it is properly compacted. Should not be used in the compound area due to the potential loads from utility structures

1. Compacted Structural fill should consist of approved materials that are free of organic material and debris. Frozen material should not be used. Fill should not be placed over a frozen subgrade.
2. If imported, material should meet CT DOT specifications. (Latest Edition)

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 material shall be tested for moisture content and compaction during placement. If the results do not meet the specified requirements, then the material should be reworked and retested. Continue until requirements are met.

4.2.2 Grading and Drainage

The compound area will be excavated approximately 4 to 6 feet to create a relatively level area. Grading shall be maintained to direct runoff away from the compound area. All slopes shall be a minimum of 3 foot horizontal to 1 foot vertical. All disturbed areas shall be seeded and mulched to prevent erosion until vegetation has been established. Other erosion control devices may be required to maintain erosion control during the construction phase.

4.2.3 Construction Considerations

Although the exposed subgrade is expected to be relatively stable upon excavation, unstable subgrade

conditions could develop during the construction phase, especially if the soils are wetted and are subject to heavy construction traffic. Should unstable conditions occur, site stabilization measures should be used. Construction traffic over the completed subgrade should be minimized to the greatest extent possible. The site should be graded to prevent ponding of runoff on the prepared subgrade. If the subgrade should become frozen, wet, or disturbed, the affected material should be removed and replaced with suitable material.

Temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stable and safe working conditions. The contractor is responsible for the design and methods of temporary excavations. All excavations shall conform to local, state and federal safety regulations.

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

4.3 FOUNDATION RECOMMENDATIONS

4.3.1 Design Recommendations – Tower Foundations

The tower may be supported be either a monolithic mat or a pier and pad foundation bearing directly on the competent bedrock at a depth of at least 4 feet below the existing grade. Approximately 4 feet of weathered rock shall be removed so the foundation will derive the support directly from the competent bedrock. The foundation shall be pinned and grouted to the competent bedrock conforming to an acceptable construction method. Design recommendations for both foundation systems are presented in the following paragraphs and tables.

4.3.1.1 Mat/Pad Foundation

DESCRIPTION	VALUE
Net Allowable Bearing Pressure[1]	12,000 PSF
Minimum Depth of Underside of Mat / Pad	4 Feet
Minimum Embedment Below Finished Grade for Frost Protection	4 Feet
Approximate Total Settlement[2]	<1 Inch
Estimated Differential Settlement[2]	<1/2 Inch
Lateral Bearing Pressure - below natural grade	1200 lbs/ft
Passive Earth Pressure Coefficient, Kp[3]	3.0 (Ultimate)
Coefficient of Sliding Friction[4]	0.7 (Ultimate)

1. The Recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.
2. Foundation settlement will depend on the variations within the subsurface soil profile, the structure loading conditions, the embedment depth of the mat/pad, the thickness of the compacted fill, and the quality of the earthwork operations.
3. Passive earth pressure calculated with these parameters should be reduced by at least a factor of safety of 3, to reflect the amount of movement required to mobilize the passive resistance.
4. A factor of safety of at least 1.5 should be applied to the sliding resistance.

Uplift resistance for the spread footings may be computed as the sum of the weight of the foundation element and the weight of the soil overlaying the foundation. We recommend using a soil unit weight of

120 pounds per cubic foot (PCF) for engineered fill overlaying the footing as described in this section of this report. A unit weight of 150 pcf could be used for reinforced footing concrete. A factor of safety of 1.0 may be applied to calculations of dead load: a higher factor of safety may be appropriate for the loadings resisted by dead load.

4.3.2 Design Recommendations – Utility Structure Foundations

The proposed utility structure may be supported by shallow spread footings bearing on the weathered bedrock at a depth of at least 4 feet below the proposed grade or on compacted structural fill or minus ¾-inch crushed stone placed on the weathered bedrock after excavation to at least a depth of 4 feet below proposed grade. Alternatively for a lightly loaded utility structure, the structure 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 native glacial till deposit. Design recommendations for proposed structure are presented in the following paragraphs and tables.

4.3.2.1 Design Recommendations – Spread Footings

DESCRIPTION	VALUE
Net Allowable Bearing Pressure[1]	4000 PSF
Minimum Dimensions	12 inches width/diameter for strip footings or piers
Minimum Embedment Below Finished Grade for Frost Protection[2]	4 feet
Approximate Total Settlement[3]	<1 inch
Estimated Differential Settlement	<½ inch
Coefficient of Sliding Friction	0.35

1. The Recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. Use of footing drains will reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas.
3. Foundation settlement will depend on the variations within the subsurface soil profile, the structure loading conditions, the embedment depth of the mat/pad, the thickness of the compacted fill, and the quality of the earthwork operations.

4.3.2.2 Construction Considerations – Spread Footings

Concrete should be placed soon after excavating to reduce of soil disturbance. Should the soils at bearing level become wet, disturbed or frozen, the affected soil should be removed prior to placing concrete. The engineer should be retained to observe and test the soil foundation bearing materials.

If unsuitable material is encountered in the footing excavations, the excavation should extend deeper to suitable soils and the footings could bear directly on these soils at the lower level. The footings could also bear on properly compacted structural fill extending down to the suitable soils. Over excavation for the compacted structural fill placement below footings should extend laterally beyond the edges of the footings at least 8 inches per foot of over excavation depth below footing base elevation. The over excavation should then be backfilled up to the footing base elevation with well graded granular material placed in lifts of 8 inches or less in loose thickness and compacted to 95 percent of the modified proctor maximum dry density (ASTM D1557, Method C).

The contractor is required to maintain a stable subgrade during construction. The contractor should

prevent groundwater, if encountered, and surface water runoff from collecting in the excavation. Subgrade soils that become unstable because of water and or reworking by construction activity should be replaced with compacted structural fill or minus ¾ inch crushed stone, as necessary.

The foundation will be placed on the bedrock but during excavation portions of which may have elevated silt content. Soil with higher silt content will be sensitive to excess moisture and lose strength quickly during seasonally wet periods. Contractors experienced in earthwork construction in the area should be aware of the silty soil behavior and the effect that moisture and inclement weather can have on its workability. If a contractor bids construction knowing that earthwork must begin during the winter or wet months, the contractor should include a contingency in his bid to use off site suitable fill, and to remove and dispose of onsite soils that become unsuitable.

4.3.2.3 Design Recommendations – Slab-On-Grade

DESCRIPTION	VALUE
Slab Support (compacted structural fill)[1,2]	12 inch thick layer
Modulus of Subgrade Reaction	200 (psi/in)

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 2.5 feet of earth cover, thus reducing frost penetration.
2. Air entraining admixtures should be used for concrete exposed to freezing.

4.3.2.4 Construction Considerations – Slab-On-Grade

Site grading is generally accomplished early in the construction phase. As the construction phase continues, the subgrade may be disturbed by foundation excavations, construction traffic, rainfall, etc. As a result, the slab on subgrade may not be suitable for placement of structural fill or minus ¾ inch crushed stone and corrective actions will be required.

We recommend the area underlying the slabs be rough graded and then thoroughly proof-rolled with a vibratory roller or heavy plate compactor prior to the final grading and placement of a minimum 12 inch thickness of structural fill. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and 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.

4.4 Seismic Considerations

DESCRIPTION	VALUE
Code Used	2012 International Building Code (IBC)[1]
Site Class	C[2]
Maximum Considered Earthquake Ground Motions (5 percent damping)	0.100g (SDS) 0.034g (SD1)
Liquefaction Potential In Event of an Earthquake	Not Susceptible

1. In general accordance with section 1613
2. The 2012 International Building Code (IBC) requires a 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 boring performed for this report extended to a maximum 31 feet. However, we expect soil and rock as dense as encountered above a depth of 31 feet to exist to a depth of at least 100 feet.

5.0 GENERAL COMMENTS

Berkshire Geo-Technologies 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. Berkshire Geo-Technologies also should be retained to provide observation and testing services during grading, excavations, foundations construction and other

earth-relate construction phases of the project.

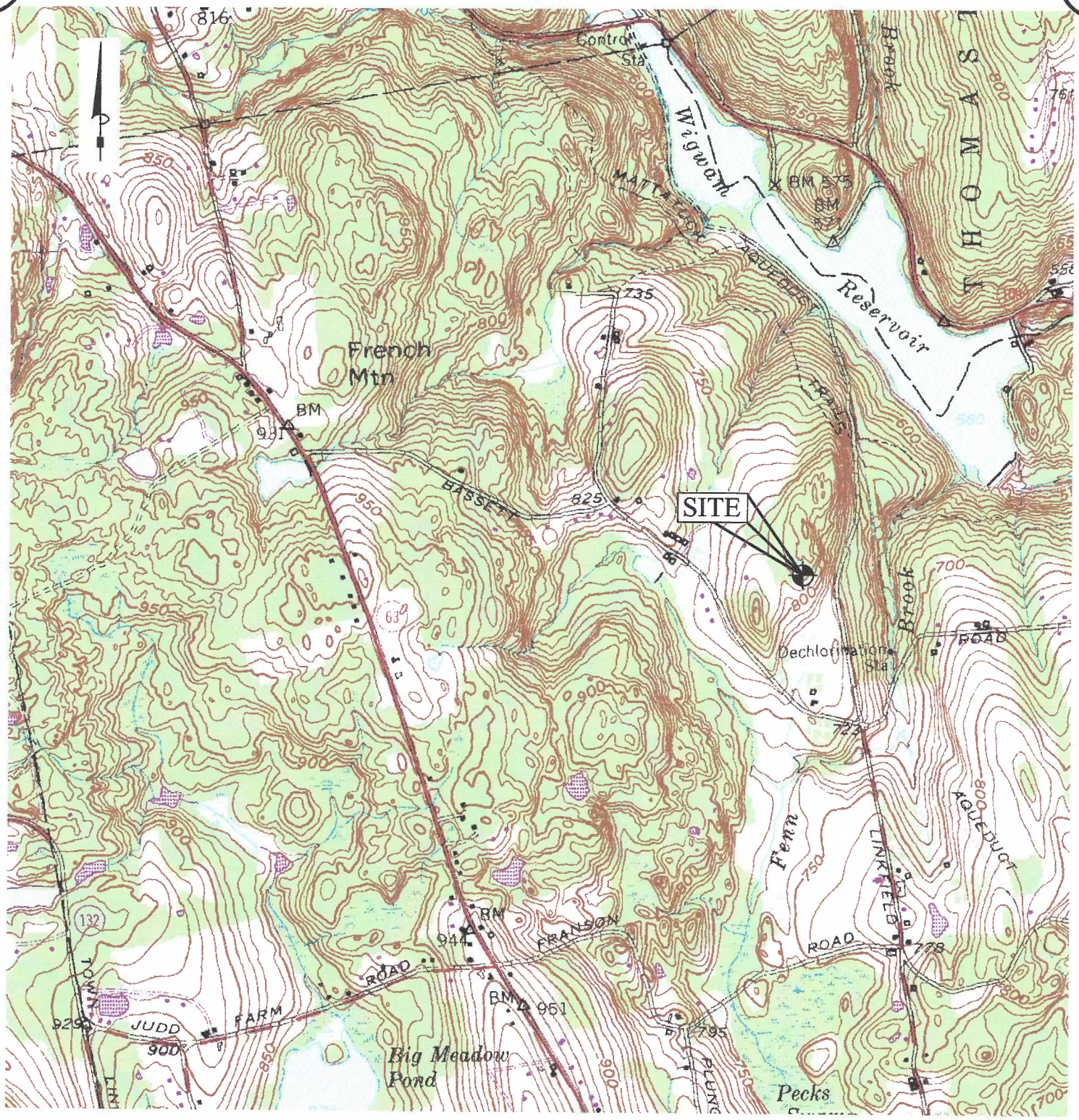
The analysis and recommendations presented in this report are based upon the data obtained from the explorations preformed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between explorations, across the site, or due to the modifying effects of weather. The nature and extent of such variations man 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 anomalies within the test area. Resistivity results will also fluctuate depending on 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, express or implied, are intended or made. Site safety, excavation support, and dewatering requirement 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 Berkshire Geo-technologies reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A



SITE LOCATION MAP

PREPARED FOR

NORTH ATLANTIC TOWERS

655 BASSETT ROAD, WATERTOWN, CT

Berkshire Geo-Technologies
Engineering – Field & Laboratory Testing

DESIGNED BY:	CJT
CHECKED BY:	DC
APPROVED BY:	CJT
DATE:	07/16/12
SCALE:	1"=1,500'

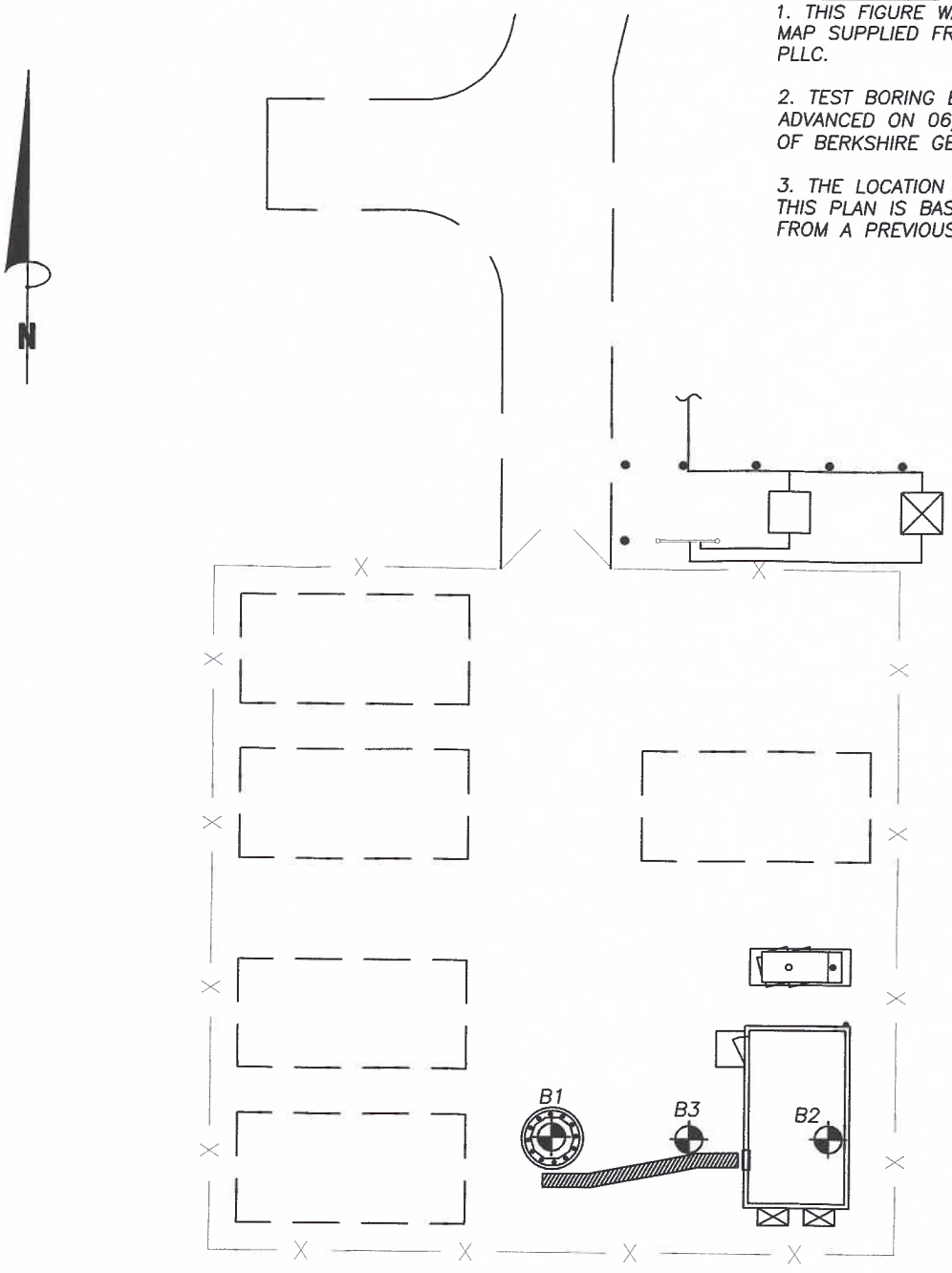
FIGURE

A-1

GENERAL NOTES:
1. THIS FIGURE WAS PREPARED FROM A BASE MAP SUPPLIED FROM INFINIGY ENGINEERING, PLLC.

2. TEST BORING B-1, B-2 & B-3 WERE ADVANCED ON 06/12/12 UNDER THE DIRECTION OF BERKSHIRE GEO-TECHNOLOGIES.

3. THE LOCATION OF THE BORING SHOWN ON THIS PLAN IS BASED ON FIELD MEASUREMENTS FROM A PREVIOUS SITE LAYOUT.



LEGEND

APPROXIMATE LOCATION OF BORING

BORING LOCATION PLAN

PREPARED FOR

NORTH ATLANTIC TOWERS

655 BASSETT ROAD, WATERTOWN, CT

Berkshire Geo-Technologies
Engineering – Field & Laboratory Testing

DESIGNED BY:	CJT
CHECKED BY:	DC
APPROVED BY:	CJT
DATE:	07/14/12
SCALE:	1"=20'

FIGURE

A-2

(603) 437-1610 **New Hampshire Boring, Inc.** **Fax: (603) 437-0034**
P.O. Box 165
Derry, NH 03038
E-Mail: nhb@nhboring

Boring # B-1 **Project**: Berkshire Geotech Cell Tower Site CT1140 **Project #** 106933

Project Address: 655 Bassett Road **City:** Watertown **State:** CT **Zip:**

Date Start: 06-12-12 **Date End:** 06-12-12 **Location:** See Plan

Casing: HSA	**Sampler:**	**Casing:** 4-1/4" ID	**Sampler:**
Type:	S/S	Size:	1-3/8 in. I.D.
Hammer:	140 lbs.	Fall:	30 in.

GROUNDWATER OBSERVATION

Date: 4/26/12	**Depth:** 8'	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6"	S/C	SAMPLE DESCRIPTION
-						6"	TOPSOIL
-	S-1	0'-2'	24"	12"	1-2-2-3		Dry, loose, brown, FINE SAND, trace coarse sand, trace inorganic silt, trace roots.
-	S-2	2' – 3'6"	18"	14"	2-33-80		Dry, very dense, brown, FINE SAND AND INORGANIC SILT, some weathered stone.
2'6"							
-						3'6"	Top of BEDROCK
-							Roller bit 3'8" to 5'8" and began coring.
-							
-							
5'0"	C-1	5'8" – 10'3"	50"	6"	2-2.5-4-4		
-					2.25		
-							
-							
-							
7'6"							
-							
-							
-							
-							
10'0"	C-2	10'3" – 15'3"	60"		2-2.5-2.75		
-					3.5-3.5		
-							
-							
-							
12'6"							
-							
-							
-							
-						15'3"	
15'0"							Bottom of Exploration = 15'3"
-							

Drillers. Walter Hoeckele **Helper:** Dan Strickland **Inspector:** Chris

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

FIGURE A3

(603) 437-1610 | **New Hampshire Boring, Inc.** | Fax: (603) 437-0034
P.O. Box 165
Derry, NH 03038
E-Mail: nhb@nhboring

Boring # B-2 **Project:** Berkshire Geotech Cell Tower Site CT1140 **Project #** 106933

Project Address: 655 Bassett Road **City:** Watertown **State:** CT **Zip:**

Date Start: 06-12-12 **Date End:** 06-12-12 **Location:** See Plan

Casing: HSA	**Sampler:**	**Casing:** 4-1/4" ID	**Sampler:**
Type:	S/S	Size:	1-3/8 in. I.D.
Hammer:	140 lbs.	Fall:	30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**
4/26/12	8'		

DP	S./#	DEPTH	PEN	REC	BLOWS/6"	S/C	SAMPLE DESCRIPTION
-						6"	TOPSOIL
-	S-1	6" – 1'7"	12"	4"	1-3		Dry, loose, brown, FINE SAND AND INORGANIC SILT,
-						2	trace coarse sand and weathered stone.
-	S-2	1'7" – 2'	5"	1"	54		WEATHERED STONE
2'6"							Bottom of Exploration = 2'
-							
-							
-							
-							
5'0"							
-							
-							
-							
-							
7'6"							
-							
-							
-							
-							
10'0"							
-							
-							
-							
-							
12'6"							
-							
-							
-							
-							
15'0"							
-							

Drillers. Walter Hoeckele **Helper:** Dan Strickland **Inspector:** Chris

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

FIGURE A4

(603) 437-1610 | **New Hampshire Boring, Inc.** | Fax: (603) 437-0034
P.O. Box 165
Derry, NH 03038
E-Mail: nhb@nhboring

Boring # B-3 **Project:** Berkshire Geotech Cell Tower Site CT1140 **Project #** 106933

Project Address: 655 Bassett Road **City:** Watertown **State:** CT **Zip:**

Date Start: 06-12-12 **Date End:** 06-12-12 **Location:** See Plan

Casing: HSA	**Sampler:**	**Casing:** 4-1/4" ID	**Sampler:**
Type:	S/S	Size:	1-3/8 in. I.D.
Hammer:	140 lbs.	Fall:	30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 4/26/12	**Depth:** 8'	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6"	S/C	SAMPLE DESCRIPTION
-	S-1	0' – 2'	24"	12"	1-2-2-3		Moist, loose, brown, FINE SAND AND INORGANIC SILT, trace fine gravel, trace roots.
-							
-						2'3"	
-	S-2	2' – 2'3"	3"	1"	78/3"		Moist, loose, brown, FINE SAND AND INORGANIC SILT, trace fine gravel, trace roots.
2'6"							
-							Bottom of Exploration = 2'3"
-							
-							
-							
5'0"							
-							
-							
-							
-							
7'6"							
-							
-							
-							
-							
10'0"							
-							
-							
-							
-							
12'6"							
-							
-							
-							
-							
15'0"							
-							

Drillers. Walter Hoeckele **Helper:** Dan Strickland **Inspector:** Chris

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

FIGURE A5

Field Investigation Description

Berkshire Geo-Technologies monitored the advancement of three test borings (B-1, B-2, & B-3) within the proposed tower compound area on June 12, 2012. The exploration was advanced using a Mobil track-mounted rotary drill rig, owned and operated by New Hampshire Boring, Inc., New Hampshire. The boring was advanced using 2¼-inch I.D. hollow-stem auger drilling methods to a maximum depth of about 2-3 feet below existing grade and rock coring to 15 feet.

In the split-barrel sampling procedure, 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 in 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 samples were placed in labeled glass jars and taken to our Monterey (MA) laboratory for further review, possible testing, and classification. Information provided on the boring log attached to this report includes soil descriptions, relative density and/or consistency evaluation, boring depth, sampling intervals, and groundwater conditions. The boring was backfilled with auger cuttings prior to the drill crew leaving the site.

The field log of the boring was prepared by a New Hampshire Boring, Inc. driller. The log included visual classification of the materials encountered during drilling as well as interpretation by our field engineer of the subsurface conditions between samples.

The approximate exploration location, which is shown in Figure A-2, was measured by taping from existing features in the field and by estimating right angles. The ground surface elevations at the exploration locations were taken from the site plan that you provided. The ground surface elevation rounded to the nearest foot in shown on the individual boring logs in Appendix A. The location and elevation of the exploration should be considered accurate only to the degree implied by the method used to define it.

APPENDIX B

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] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 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 ≥ 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 ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 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.