SUBSURFACE EXPLORATION REPORT

BERKLEY GROUP
JM ROBINSON MIDDLE SCHOOL TOWER SITE

BALLANTYNE COMMONS PARKWAY
CHARLOTTE, MECKLENBERG COUNTY, NORTH CAROLINA
S&ME JOB NO. 1261-12-059C

Prepared For:

AC&S

3 Marcus Drive
Greenville, South Carolina 29615

Berkley Group, LLC

10612-D Providence Road, PMB 742
Charlotte, North Carolina 28277

Prepared By:

S&ME

NC PE Firm License No. F-0176

November 2012

November 14, 2012

AC&S Engineering and Surveying, Inc.
3 Marcus Drive
Greenville, South Carolina 29615

Attention: Ms. Terry Aldrich, P.E.

Reference: **SUBSURFACE EXPLORATION REPORT**
Berkley Group – J.M. Robinson Middle School Tower Site
Ballantyne Commons Parkway
Charlotte, Mecklenberg County, North Carolina
S&ME Job No. 1261-12-059C

Ladies and Gentlemen:

S&ME, Inc. is pleased to submit this report of the subsurface exploration for the referenced project. The exploration was performed in accordance with our Proposal No. 12114 dated February 16, 2012. It was made to evaluate subsurface conditions in the tower area as they pertain to providing support for the new tower. This report presents a brief confirmation of our understanding of the project, the exploration results, and our geotechnical conclusions and recommendations regarding foundation support.

PROJECT DESCRIPTION

Based on preliminary drawings furnished by Ms. Terry Aldrich, P.E. a 175-foot tall monopole flag structure will be constructed at the referenced site. The maximum structural reactions at the base of the monopole, based on our previous experience in this area and this type of tower, are estimated as follows:

Downward Load:	10 to 30 kips
Horizontal Shear:	25 to 40 kips
Overturning Moment:	2500 to 4000 ft-kips

EXPLORATION

The field exploration included the performance of one soil test boring (B-1) and two additional offset borings near the center of the proposed tower. Please note that others provided the staked center. An access path was cleared (by others) though some brush and small trees prior to drilling. The borings were performed with a truck mounted drill rig using hollow stem auger techniques to advance the hole. Split-spoon samples and Standard Penetration Resistance values (N-values) were obtained at selected intervals in the boring in accordance with ASTM D-1586. The split spoon soil samples were transported to our laboratory where they were visually classified by the Geotechnical Engineer. The classification was estimated based on the Unified Soil Classification System (USCS).

A Site Location Plan (Figure 1), a Boring Location Plan (Figure 2) showing the approximate boring location, a Boring Log presenting the subsurface information obtained, and a brief description of the boring procedures are included in the Appendix. The ground surface elevation shown on the Boring Log is based on information furnished by AC&S Engineering and Surveying and should be considered approximate.

SITE CONDITIONS

REGIONAL GEOLOGY

The project site is in the Piedmont Physiographic Province of North Carolina. The Piedmont Physiographic Province is a relatively broad strip extending from central Alabama across Georgia and the Carolinas into Virginia. Rocks of the Piedmont occur in belts that are some of the oldest formations in the United States. The rock types are primarily metamorphic gneiss.

The major portion of the bedrock in the Piedmont is covered with a varying thickness of residual soil which has been derived by chemical decomposition and physical weathering of the underlying rock. Residual soils developed during the weathering of this bedrock consist predominately of clayey silts and sandy silts. The thickness of the residual soils can vary from only a few feet to in excess of 100 feet.

The boundary between the residual soil and the underlying bedrock is not sharply defined. Generally, a transition zone consisting of very hard soil to soft rock, appropriately classified as "partially weathered rock", is found. Within the transition zone, large boulders or lenses of relatively "fresh" rock which are generally much harder than the surrounding material often exist. The irregular bedrock surface is basically a consequence of differential weathering of the various minerals and joint patterns of the rock mass.

SURFACE FEATURES

The proposed tower site is located approximately 450 feet southeast of the intersection of 4 Mile Creek Road and Ballantyne Commons Parkway in Charlotte, Mecklenberg County, North Carolina. The new tower site will be about 100 feet north of I-485 and about 200 feet west of the track/practice field for the J.M. Robinson Middle School. The area was occupied by brush and small trees prior to clearing the access path to the boring location. The proposed tower lease area slopes downward from west to east with about 4 to 5 feet of topographic relief occurring across the proposed compound area.

SUBSURFACE CONDITIONS

The borings initially encountered a layer of topsoil that extended about 5 inches below the surface; however, portions of the topsoil were likely removed during the clearing work. Underlying the topsoil, residual soils common to the Mecklenberg County (Piedmont Physiographic Province) were encountered. The residual soils were comprised of silty sands (USCS symbol of SM) with traces of mica. The N-values recorded in the residual soils varied from 58 to 70 blows per foot indicating a very dense relative density.

A layer of partially weathered rock (PWR) was initially encountered by the boring at a depth of about 4.5 feet below the surface and continued to a depth of about 6 feet. PWR was encountered again at 9 feet below the surface and continued to the refusal depth of the boring. Partially weathered rock is defined as a transitional material between very hard soil and rock which has a Standard Penetration Resistance value of at least 50 blows per 6 inches. This material often contains boulders and layers of relatively fresh rock.

Refusal to auger advancement was encountered by the initial boring at 14 feet below the existing ground surface. The offset borings, after penetrating similar materials as the initial boring, encountered refusal material at 13 and 12 feet below the surface. Refusal is a designation applied to any material having a resistance in excess of the penetrating capacity of the drilling equipment. Refusal, thus indicated, may result from weathered rock, boulders, rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the characteristics and continuity of the materials below the level of refusal. Based on our experience, these refusal levels are most probably due to massive rock.

Subsurface water was not encountered by the borings. However, wet conditions were observed below 12 feet, possibly indicating “perched” water conditions. It should be noted the subsurface water level will fluctuate during the year, due to such things as precipitation, seasonal variations and construction activity in the area.

The above description of subsurface conditions is relatively brief and general. For more detailed information, the individual Boring Log contained in the Appendix may be consulted.

CONCLUSIONS AND RECOMMENDATIONS

Based on the boring data revealing high to very high consistency soils and relatively shallow refusal depths, it is our opinion a shallow mat should be used to support the tower. The following presents our conclusions and recommendations regarding this type of foundation system. Please note that difficult excavation due to the partially weathered rock should be expected.

TOWER FOUNDATION DESIGN

The mat foundation should bear at a minimum depth of 4 feet below existing grade in evaluated and approved residual soils or partially weathered rock and be designed for a maximum net allowable bearing pressure of 5000 psf. For the mat to resist the overturning moment, the weight of the concrete and any soil vertically above the foundation can be used. In addition, a friction factor of 0.45 between the soil and the concrete, a passive lateral earth pressure coefficient (K_p) equal to 2.8 and a soil unit weight of 100 pcf may be used in design for resistance of lateral loads and the overturning moment. To develop these lateral values, the concrete should be placed neat against the excavation sides.

CONSTRUCTION CONSIDERATIONS

Excavation

The boring data indicates excavation to the expected foundation bottom level will primarily extend through high consistency residual soils and near and into partially weathered rock. The following presents our comments regarding excavation of these various materials based on our experience.

High Consistency Residual Soils - These materials can usually be excavated by a heavy tracked excavator.

Partially Weathered Rock - Based on the exploration and our past experience with other sites in Mecklenberg County, partially weathered rock could be encountered within the mat excavation. Partially weathered rock typically contains boulders and rock lenses. The partially weathered rock will require the use of a heavy tracked excavator equipped with a ramhoe along with the possibility of some light blasting or hand excavation using pneumatic tools where boulders or rock lenses are present.

As can be seen by this exploration and our experience with similar sites in the area, rock in a weathered, boulder and massive form varies erratically in location and depth in the Piedmont Physiographic Province, of which Mecklenberg County is a part. Therefore, there is always a potential these materials could be encountered at shallower depths near the boring locations.

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for site safety. This information is provided only as a service and under no circumstances should we be assumed to be responsible for construction site safety.

Dewatering

For the installation of the shallow mat foundation, we do not expect subsurface water will be encountered. However, the wet conditions observed below 12 feet in the boring may be due to "perched" water. If this water is encountered during excavation, it should be removed during excavation. This can typically be accomplished by pumping from sumps.

Mat Foundation Evaluation

The excavated subgrade for the mat should be evaluated by a representative of the Geotechnical Engineer prior to concrete placement. This evaluation should include probing, shallow hand auger borings and dynamic cone penetrometer testing to help verify (1) suitable residual materials directly underlie the mat foundation and (2) the need for any undercutting. If undercutting is required, the undercut volume should be backfilled with lean concrete or compacted washed stone (size No. 57).

Fill Placement and Compaction

Backfill placed above the mat foundation should consist of soil free of deleterious materials and be compacted in relatively thin lifts (8 inches, loose measure). A degree of compaction corresponding to at least 95 percent of the soil's maximum dry density, as compared to a laboratory standard Proctor compaction test (ASTM D-698), should be achieved. Fill placement should be monitored by a qualified Materials Technician working under the direction of the Geotechnical Engineer. In addition to this visual evaluation, the Technician should perform a sufficient amount of in-place field density tests to confirm the required degree of compaction is being attained.

Reuse of Excavated Soils as Backfill

The residual soils will be suitable for reuse as backfill. However, some adjustment to the moisture content may be needed during backfilling. It should be noted the moisture content of the surface soils will vary significantly, depending on weather conditions prior to and during construction. Accordingly, drying or wetting could be required to achieve compaction.

The partially weathered rock will also be suitable for use as structural fill. However, this material is typically excavated in the form of blocks, requiring heavy compaction equipment to suitably pulverize these blocks into soil size particles (about 32 to 4 inches in diameter). Because of the local excavation and back filling, this may not be practical. Boulders and rock pieces could be excavated within the residual soils or partially weathered rock. Rock pieces larger than four inches in diameter should not be placed in the backfill.

LIMITATIONS OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations in this report are based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of variations near the borings will not become evident until construction. If variations appear evident, then we will re-evaluate the recommendations of this report.

In the event that any changes in the nature, design, or location of the tower are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing.

CLOSURE

We appreciate the opportunity to work with AC&S and the Berkley Group, LLC by providing the geotechnical engineering services for this project. Should any questions arise regarding information presented in this report or when we may be of further assistance, please do not hesitate to contact us.

Sincerely,
S&ME, Inc.

NC PE Firm License No. F-0176

11-14-12

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Important Information About Your Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Scope of Geotechnical Services

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project. Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

APPENDIX

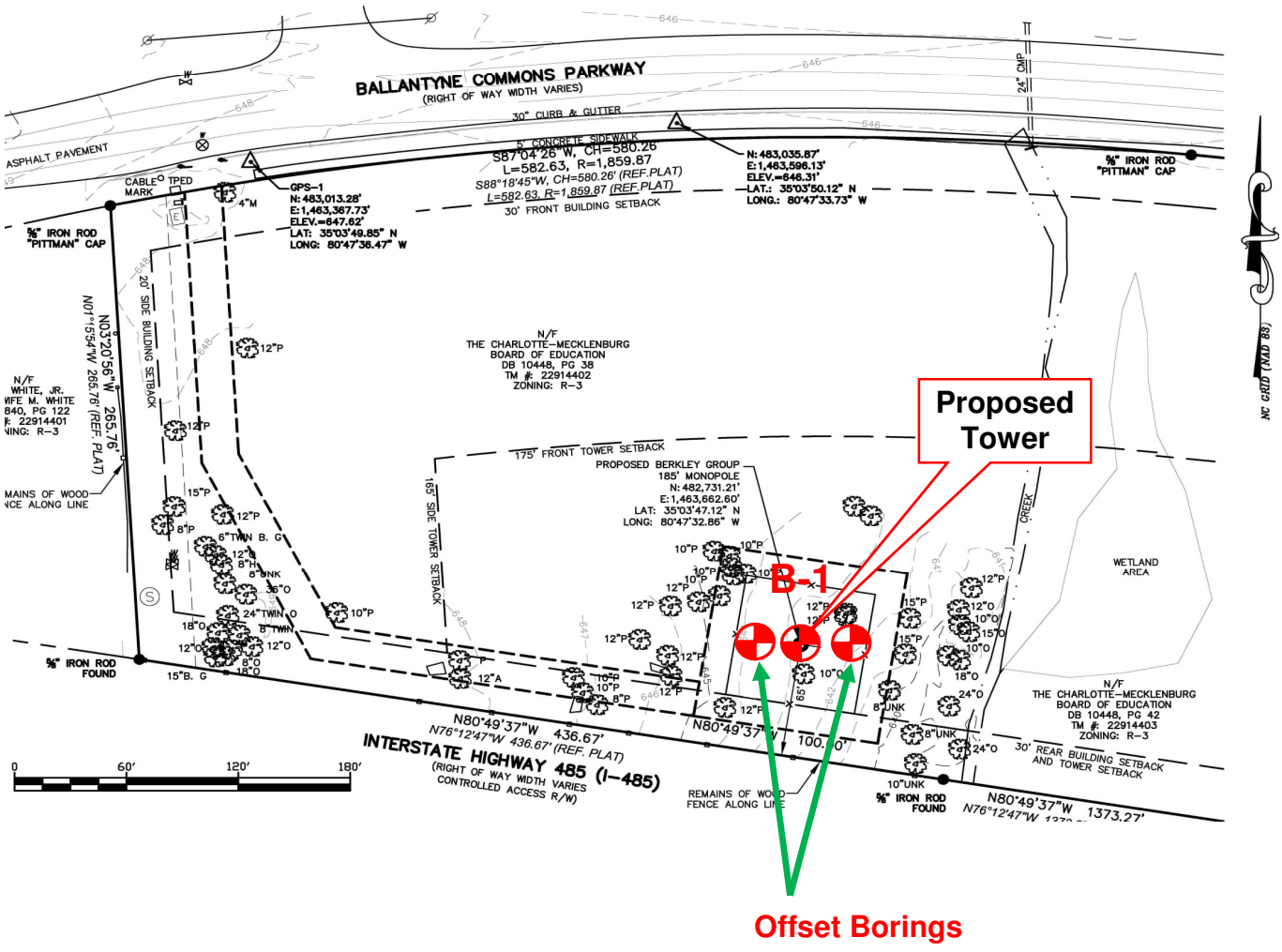
N

SCALE:	None
CHECKED:	WB
DRAWN:	DAS
DATE:	11/13/12

S&ME

SITE LOCATION PLAN
Berkley Group - J.M. Robinson MS
Charlotte, North Carolina
1261-12-059C

FIGURE NO.
1



Legend

- Approximate Soil Test Boring Location

SCALE: As Noted	S&ME	**BORING LOCATION PLAN** Berkley Group - J.M. Robinson MS Charlotte, North Carolina	FIGURE NO.
CHECKED: WB			
DRAWN: DAS			2
DATE: 11/13/12		1261-12-059C	

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)


Fill


Asphalt


Concrete


Topsoil


Gravel


Sand


Silt


Clay


Organic


Silty Sand


Clayey Sand


Sandy Silt


Clayey Silt


Sandy Clay


Silty Clay


Partially Weathered Rock


Cored Rock

WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination of Boring
▼ = Water Level Taken After 24 Hours
◄ = Loss of Drilling Water
HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

SAMPLER TYPES

(Shown in Samples Column)


Shelby Tube


Split Spoon


Rock Core


No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

PROJECT: **Berkley Group - J.M. Robinson MS Tower Site**
Charlotte, North Carolina
S&ME Project No. 1261-12-059C

BORING LOG B-1

DATE DRILLED: **11/12/12**	ELEVATION: **643.0** Feet	NOTES: **Boring offset 10 foot west of staked location - redrilled and encountered refusal at 13 feet. Boring offset a second time 10 feet east of staked location and encountered refusal at 12 feet.**
DRILLING METHOD: **2¼" H.S.A.**	BORING DEPTH: **14.0** Feet	
LOGGED BY: **D. Swoap**	WATER LEVEL: **Not Encountered @ TOB**	
DRILLER: **Metro Drill**	DRILL RIG: **Acker-Sentry**	
HAMMER TYPE: ☒ **Gravity** ☐ **Automatic** ☐ **Other**	NORTHING:	EASTING:

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA 1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
	TOPSOIL : 5 inches								
	RESIDUUM - SILTY SAND (SM) : very dense, brown, fine to course, trace mica		1		21	26	32		58
			2		37	32	50/ 5"		50/ 5"
5	**PARTIALLY WEATHERED ROCK - SILTY SAND (SM)** : very dense, gray-brown, fine to coarse	638.0							
	SILTY SAND (SM) : very dense, brown, fine to coarse, trace mica		3		31	36	34		70
			4		32	50/ 3"			50/ 3"
10	**PARTIALLY WEATHERED ROCK - SILTY SAND (SM)** : very dense, gray-brown, fine to coarse, some rock fragments, trace mica, wet below 12 feet	633.0							
			5		50/ 1"				50/ 1"
	AUGER REFUSAL AT 14 FEET								

STANDARD PENETRATION TEST DATA (blows/ft): 10 20 30 60 80

BORING LOG 6112059C JM ROBINSON (1 BORING).GPJ S&ME.GDT 11/14/12

NOTES:

1. ***THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.***
2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

REFERENCE:

S&ME
S&ME, Inc.
Greenville, SC 864.232.8987
Spartanburg, SC 864.574.2360

FIELD TESTING PROCEDURES

SOIL TEST BORINGS

All borings and sampling were conducted in accordance with ASTM D-1586-99 test method. Initially, the borings were advanced by either mechanically augering or wash boring through the overburden soils. When necessary, a heavy drilling fluid is used below the water table to stabilize the sides and bottom of the borehole. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel or split-spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated as the "Standard Penetration Resistance" or N-value. The penetration resistance, when properly evaluated, can be correlated to consistency, relative density, strength and compressibility of the sampled soils.

WATER LEVEL READINGS

Water level readings are normally taken in conjunction with borings and are recorded on the Boring Logs following termination of drilling (designated by ▽) and at a period of 24 hours following termination of drilling (designated by ▼). These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. The groundwater table may be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should also be expected with variations in surface run-off, evaporation, construction activity and other factors.

Occasionally the boreholes sides will cave, preventing the water level readings from being obtained or trapping drilling water above the cave-in zone. In these instances, the hole cave-in depth (designated by HC) is measured and recorded on the Boring Logs. Water level readings taken during the field operations do not provide information on the long-term fluctuations of the water table. When this information is required, piezometers are installed to prevent the boreholes from caving.