

January 17, 2014

New Par dba Verizon Wireless  
7575 Commerce Court  
Lewis Center, Ohio 43035

Attention: Real Estate

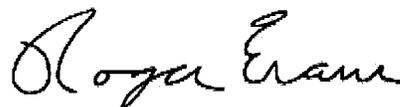
Reference: Subsurface Investigation  
Site Name/Site Number – McCutcheon/CLMB-247  
3690 Stygler Road  
Gahanna, Franklin County, Ohio  
CTL Project No. 13050218COL

CTL Engineering, Inc. has completed the subsurface investigation for the above referenced project. A PDF copy of this report is being submitted.

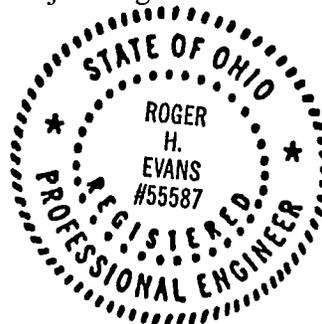
Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office.

Respectfully Submitted

CTL ENGINEERING, INC.



Roger Evans, P.E.  
Project Engineer



# **SUBSURFACE INVESTIGATION**

**SUBSURFACE INVESTIGATION  
SITE NAME/NUMBER-MCCUTCHEON/CLMB-247  
3690 STYGLER ROAD  
GAHANNA, FRANKLIN COUNTY, OHIO  
CTL PROJECT NO. 13050218COL**

**PREPARED FOR:**

**NEW PAR DBA VERIZON WIRELESS  
7575 COMMERCE COURT  
LEWIS CENTER, OHIO 43035**

**PREPARED BY:**

**CTL ENGINEERING, INC.  
2860 FISHER ROAD  
COLUMBUS, OHIO 43204  
(614) 276-8123 phone  
(614) 276-6377 fax**

**January 17, 2013**



## TABLE OF CONTENTS

	<u>PAGE</u>
EXECUTIVE SUMMARY	1
I. LOCATION AND STRUCTURE DATA	2
II. SUBSURFACE INVESTIGATION	2
III. FINDINGS	2
A. Visual Observations	2
B. Subsurface Conditions	2
IV. ANALYSIS AND RECOMMENDATIONS	3
A. Equipment Shelter	3
1. Site Preparation	3
2. Foundation Support	4
B. Tower	5
V. CHANGED CONDITIONS	6
VI. TESTING AND OBSERVATION	6
VII. CLOSING	6
APPENDIX A	TEST BORING RECORD
APPENDIX B	BORING LOCATION PLAN/SOIL PROFILE SHEET



## **EXECUTIVE SUMMARY**

The site is considered suitable for the construction of the proposed stealth monopole/pine tree communications tower and equipment shelter. The tower may be constructed onto a drilled pier foundation system constructed into the native soils. The proposed shelter may be supported on shallow foundations constructed into the native soils.

No groundwater is anticipated during the excavation and construction of shallow foundations. However, groundwater should be anticipated during excavation and construction of the drilled pier, at and below a depth of about 13 feet.

## **I. LOCATION AND STRUCTURE DATA**

The project site, identified as McCutcheon-CLMB-247, is located at 3690 Stygler Road in Franklin County, Gahanna, Ohio. The site is intended for the design and construction of a new Verizon stealth monopole/pine tree communications tower with an overall height of 125 feet (tower height = 120' + lightning rod = 5'), and a 12 foot by 26 foot equipment shelter.

## **II. SUBSURFACE INVESTIGATION**

One (1) soil test boring, designated as B-1, was drilled to a depth of 40.0 feet at the approximate location shown on the enclosed Plan/Soil Profile sheet.

The test boring was performed using a truck mounted drill rig, utilizing continuous flight augers (CFA), on January 9, 2014. Standard penetration tests were conducted using a 140-pound hammer falling 30 inches to drive a 2-inch O.D. split barrel sampler for 18 inches. The hammer associated with the drill rig used to drill this site was calibrated on January 16, 2012 and has a rod energy ratio of 79.8 percent.

Ground surface elevation at the test boring location was interpolated as 824.0 feet from the final land space survey prepared by Precision Surveying Services, LLC.

## **III. FINDINGS**

### **A. Visual Observations**

The existing grade within the lease area is relatively flat, gently sloping down to the north. The site is adjacent to the paved asphalt parking lot for the New Life Baptist Church. An existing building is located near the site. At the time of our drilling, no signs of surface water retention were noted across the lease area.

### **B. Subsurface Conditions**

At the surface, the boring encountered 12 inches of gravel. Below the gravel, the boring encountered native soils described as sandy lean clay (CL) to a depth of 3.0 feet below the existing grade. These soils exhibited a corrected standard penetration ( $N_{60}$ ) value of 13 blows per foot (bpf), with a natural moisture content value of 19 percent.

The boring then exhibited cohesive sandy silty clay, silty clay with sand (CL-ML) or sandy silty (ML) soils extending downward to the drilled depth of 40.0 feet. A thin layer of well graded sand with silt (SW-SM) was encountered between 13.5



and 14.0 feet below grade. The CL-ML soils were further classified as glacial till deposits. These soils exhibited  $N_{60}$  values ranging from 21 to 35 bpf, with natural moisture content values ranging from 9 to 19 percent.

Groundwater was encountered during drilling at a depth of 13.0 feet. Upon completion of drilling, the groundwater level was measured at a depth of 37.0 feet below existing grade, after the augers were removed, cave in was recorded at a depth of 12.1 feet below grade.

#### IV. ANALYSIS AND RECOMMENDATIONS

Recommendations provided in the following paragraphs are based upon the assumption that subsurface conditions encountered at the tower and equipment shelter locations are similar to those encountered in the drilled boring. Therefore, subsurface conditions in the areas of the tower and equipment shelter should be observed and approved during construction by the Soils Engineer. In the event that subsurface conditions in these areas differ from those encountered in the boring, modifications should be made to the recommendations stated in this report.

Based upon the preceding considerations, as well as the soil data obtained from the field and laboratory testing, the following recommendations are provided.

##### A. Equipment Shelter

###### 1. Site Preparation

- a. All gravel and any topsoil encountered within the construction limits should be stripped. Topsoil may be stockpiled for landscaping purposes.
- b. Subsequent to topsoil removal and prior to any new fill placement, the exposed surface should be compacted and/or proofrolled until a relatively unyielding surface is achieved. Soft or loose soils, if encountered, should be disked, dried and recompacted, or undercut and replaced with engineered fill, or otherwise as directed by the Soils Engineer.
- c. During earthwork operations, adequate drainage should be provided for the exposed soils. Absorption of heavy rainfall, accumulations of water and heavy construction traffic may result in softening these soils, hence, severely weakening the strength of the subgrade soils.



- d. Fill material required to raise the grade may consist of clay/silt soils, crushed limestone aggregate, or bankrun sand and gravel. It is anticipated that the in-place soils will generally be suitable for reuse as engineered fill. However, these soils may need to be dried prior to reusing as engineered fill. Topsoil and organically contaminated materials are not acceptable for use as fill. All fill materials should be observed and approved by the Soils Engineer.
- e. The engineered fill should be placed in layers not exceeding 8 inches in loose thickness, with each layer compacted to 100 percent of the maximum dry density as determined by ASTM D-698 Standard Method (AASHTO T-99), or otherwise as specified by the Soils Engineer.
- f. Temporary excavations in excess of 4.0 feet in depth, if required, should be sloped or shored according to OSHA requirements.
- g. No groundwater is anticipated during excavation and construction of shallow foundation units.

**2. Foundation Support**

- a. The proposed equipment shelter may be supported onto standard foundation units constructed into native soils.
- b. The foundations may be proportioned using an allowable bearing capacity not exceeding 2.5 Kips per square foot (Ksf). This soil bearing value applies to the total of all design loads and was computed using a factor of safety of 3.0.

In the event that soils at the proposed footing bearing level exhibit soft conditions, the soft soils should be removed from below the footings and lean concrete placed up to the proposed footing bearing level.

- c. The bottom of the foundations should be constructed at a minimum depth of 3 feet below the lowest adjacent exterior grade, or in accordance with the local building code, whichever is deeper, to offset the effects of frost penetration.
- d. Settlement of footings supported as recommended may vary somewhat across the site due to variations in soil composition, void ratio, depth to groundwater, and loading. It is estimated however, that total and differential settlements will be within tolerable limits.



**B. Tower**

The proposed tower may be constructed onto a drilled pier foundation system constructed into the underlying strong native soils. Foundation support recommendations are provided in the following paragraphs.

1. The drilled pier may be proportioned using an allowable end bearing capacity not exceeding those tabulated below. Recommended allowable bearing capacity values were computed based on a factor of safety of 3.0

Depth (feet)	Allowable Bearing Capacity (Ksf)
Below 10.0	4.0
Below 28.0	6.0

2. Groundwater should be expected during excavations and construction of the drilled pier. The groundwater concentration could be heavy at this site. Concrete placement below the groundwater level will require tremie methods.
3. The pier should be cased to prevent soil cave-in, minimize water seepage into the hole and to protect the Soils Engineer\Inspector during cleaning and observation. OSHA and ADSC safety regulations should be followed during cleaning and observation.
4. The drilled pier may be designed using the soil parameters tabulated below. The downward and uplift values were computed using a factor of safety of 2.0.

Parameters	Depth (feet)		
	0.0 - 3.0	3.0 - 15.0	Below 15.0
Downward Friction, psf	0	800	1000
Uplift Friction, psf	0	525	700
Cohesion, psf	0	250	250
Total Unit Weight, pcf	120	125	130
Angle of Internal Friction, Degrees	20	25	30
At Rest Pressure Coefficient, Ko	0.66	0.58	0.50
Active Pressure Coefficient, Ka	0.49	0.41	0.33
Passive Pressure Coefficient, Kp	0.00	2.46	3.00
Undrained Shear Strength, psf	0.00	3000	3875



## V. CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can be modified, if required.

## VI. TESTING AND OBSERVATION

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

## VII. CLOSING

This report has been prepared for the exclusive use of New Par dba Verizon Wireless for use only on this project. Our services have been performed in accordance with generally accepted Geotechnical Engineering principles and practices. No warranty is either expressed or implied.

This report addresses only the geotechnical aspects of this project and does not include any environmental issues.



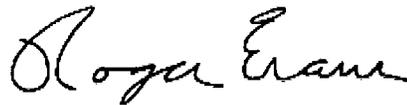
Specific design and construction recommendations have been provided in this report.  
Therefore, the report should be used in its entirety.

Respectfully Submitted,

**CTLENGINEERING, INC.**



Nikki Zvonek, P.E.  
Staff Engineer



Roger Evans, P.E.  
Project Engineer



**APPENDIX A  
TEST BORING RECORD**



## SOIL DESCRIPTION

Descriptors for soil consistency used in this report are based upon the Standard Penetration Test (SPT), ASTM D 1587, with the penetration (N) values corrected to  $N_{60}$ , based upon the efficiency of the SPT Hammer used for the soil sampling.

Descriptors for both non-cohesive and cohesive soils are presented below, with the corresponding range of corrected penetration values.

<u>NON-COHESIVE SOIL DESCRIPTION</u>	<u>CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)</u>
Very Loose.....	0 – 4
Loose.....	5 – 10
Medium Dense.....	11- 30
Dense.....	31 – 50
Very Dense.....	Over 50

<u>COHESIVE SOIL DESCRIPTION</u>	<u>CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)</u>
Very Soft.....	0 – 1
Soft.....	2 – 4
Medium Stiff.....	5 – 8
Stiff.....	9 – 15
Very Stiff.....	16 – 30
Hard.....	Over 30

Moisture term descriptors for both non-cohesive and cohesive soils are presented below.

<u>NON-COHESIVE SOIL DESCRIPTION</u>	<u>MOISTURE TERMS</u>	<u>COHESIVE SOIL DESCRIPTION</u>
Powdery.....	Dry.....	Powdery
Some Moisture.....	Damp.....	Below Plastic Limit
Damp to the Touch.....	Moist.....	Above Plastic, Below Liquid Limit
Free Water.....	Wet.....	Above Liquid Limit



# TEST BORING RECORD

**CLIENT** : New Par dba Verizon Wireless  
**PROJECT** : McCutcheon CLMB-247  
**LOCATION** : Franklin Co., Ohio  
**PROJECT NO.** : 13050218COL

**BORING NO.:** **B-1**  
**SHEET** 1 OF 2  
**DATE STARTED** : 01-09-14  
**DATE COMPLETED** : 01-09-14

<b>BORING ELEVATION</b> : 824.0 Feet <b>STATION</b> : <b>OFFSET</b> : <b>DEPTH</b> : 40.0 Feet <b>BORING METHOD:</b> HSA	<b>RIG TYPE</b> : CME 75 <b>CASING DIA.</b> : 2.25" <b>CORE SIZE</b> : <b>HAMMER</b> : Auto <b>ENERGY RATIO</b> : 79.8	<b>DRILLER</b> : Wrights <b>TEMPERATURE</b> : <b>WEATHER</b> : Cold
--	--	---

**GROUNDWATER:** ▼ Encountered at 13.0'    ∇ At completion 37.0'    ☒ Caved in at 12.1'

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	N <sub>60</sub>	RECOVERY (%)	MOISTURE CONTENT	TOTAL UNIT WEIGHT pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS			
											LL	PL	PI	
823.0		Gravel (12")	1.0											
821.0		Stiff, Brown <b>SANDY LEAN CLAY (CL-)</b> , with Organcis, Moist	3.0	SS-1	2 4 6	13	83	19		6.0*				
	5			SS-2	7 8 9	23	67	16		4.0*				
		Very Stiff, Brown to Gray <b>SANDY SILTY CLAY (CL-ML)</b> , Damp (TILL)		SS-3	6 8 9	23	94	11		6.0*				
	10			SS-4	5 8 12	27	89	9		7.0*				
810.5		Medium Dense, Gray <b>WELL GRADED SAND with SILT (SW-SM)</b> , Wet	13.5	SS-5A	4									
810.0			14.0	SS-5B	7 9	21	78	12 12		3.0*				
	15													
		Very Stiff to Hard, Gray <b>SILTY CLAY with SAND (CL-ML)</b> , Damp (TILL)		SS-6A	6					8.0*				
				SS-6B	10 15	33	89	12 13		5.0*				
804.5		Hard, Gray <b>SANDY SILT (ML)</b> , Damp to Moist	19.5											
	20													

*Continued on next page*

TEST BORING/PIT RECORD 13050218COL.GPJ CTL CORPORATE.GDT 1/17/14

2860 Fisher Road Columbus, Ohio 43204 Telephone: 614-276-8123 Fax: 614-276-6377 Email: <a href="mailto:ctl@ctleng.com">ctl@ctleng.com</a>	<b>BORING METHOD</b>	<b>SAMPLING METHOD</b>	<b>ABBREVIATIONS</b>
	HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling HA - Hand Auger	SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample	* - Hand Penetrometer LL - Liquid Limit PL - Plastic Limit PI - Plasticity Index SPT - Standard Penetration Test N <sub>60</sub> - Standard Penetration Normalized to 60% Drill Rod ER

# TEST BORING RECORD

CLIENT : New Par dba Verizon Wireless  
 PROJECT : McCutcheon CLMB-247

BORING NO.: **B-1**  
 SHEET 2 OF 2

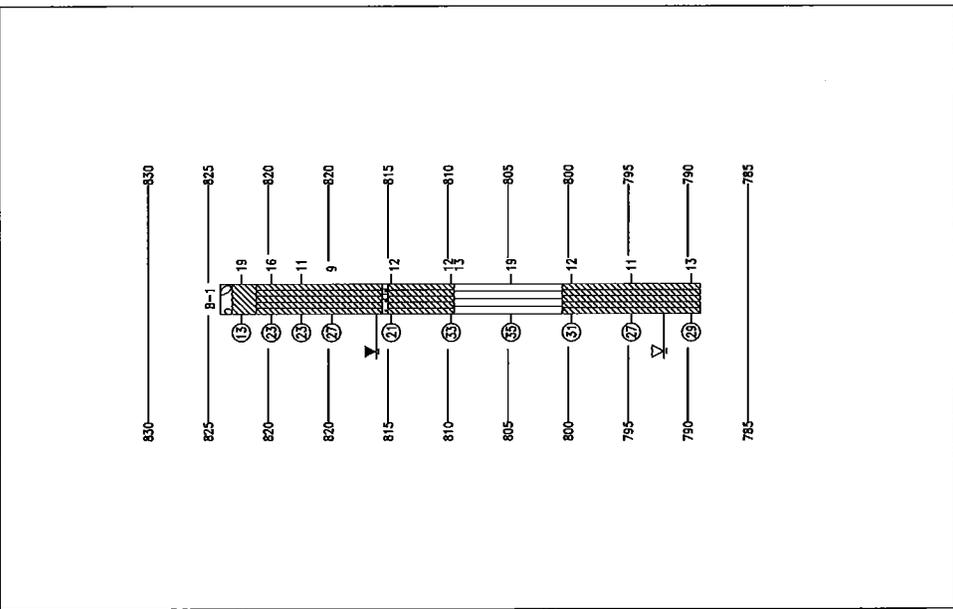
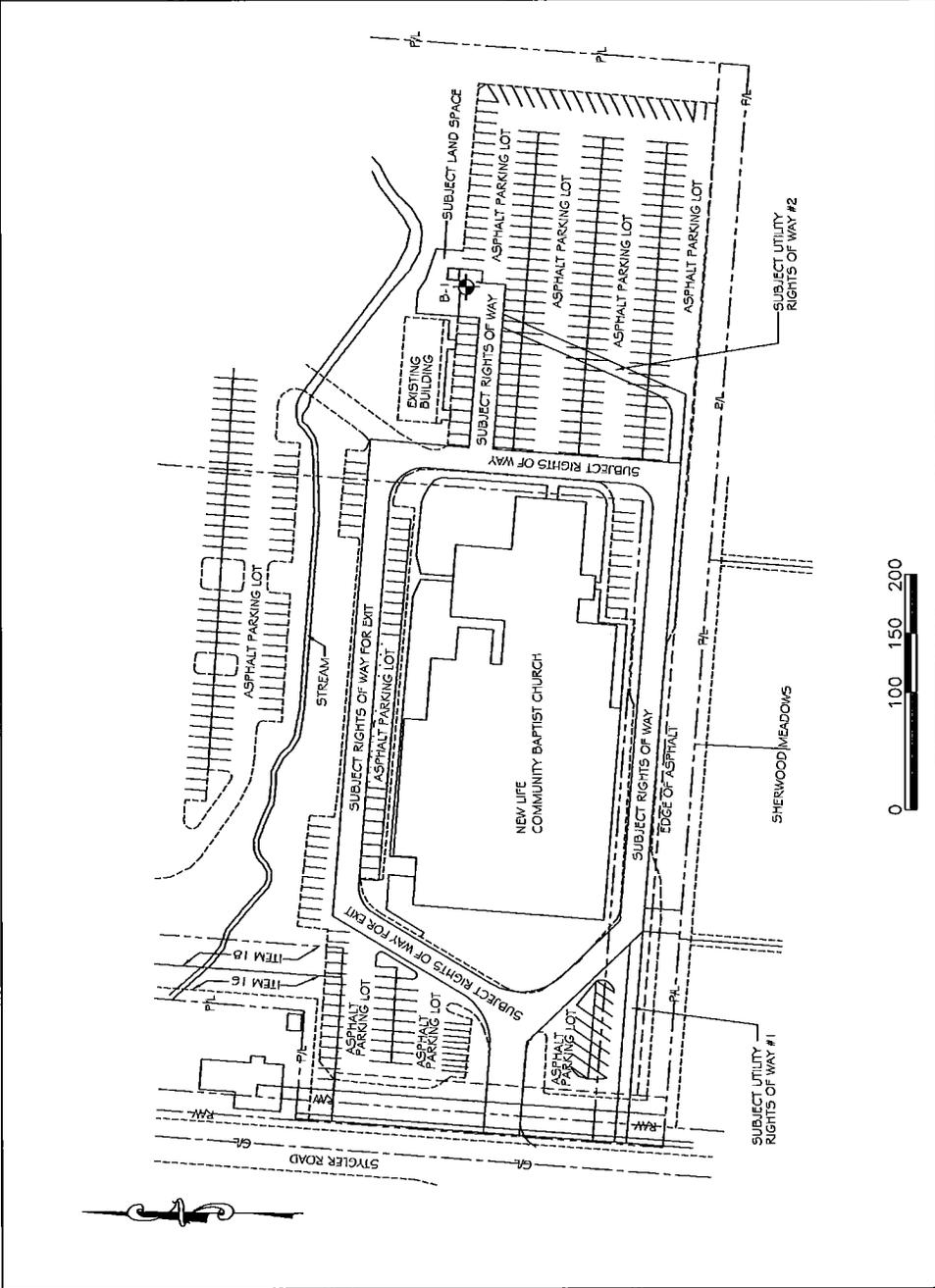
STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	N60	RECOVERY (%)	MOISTURE CONTENT	TOTAL UNIT WEIGHT pcf	UNCONF. COMP., ksf	ATTERBERG LIMITS		
											LL	PL	PI
795.5	25	Hard, Gray <b>SANDY SILT (ML)</b> , Damp to Moist	28.5	SS-7	8 13 13	35	100	19		5.0*			
	30			SS-8	5 11 12	31	100	12		4.0*			
	35			SS-9	6 8 12	27	100	11		9.0*			
784.0	40	Hard to Very Stiff, Gray <b>SILTY CLAY with SAND (CL-ML)</b> , Damp ( <b>TILL</b> )	40.0	SS-10	7 10 12	29	89	13		4.0*			
	45	<b>BOTTOM OF BORING</b>											

TEST BORING/PIT RECORD 13050218COL.GPJ CTL CORPORATE.GDT 1/17/14

 <p>2860 Fisher Road                  Columbus, Ohio 43204                  Telephone: 614-276-8123                  Fax: 614-276-6377                  Email: <a href="mailto:ctl@ctleng.com">ctl@ctleng.com</a></p>	<b>BORING METHOD</b>	<b>SAMPLING METHOD</b>	<b>ABBREVIATIONS</b>
	HSA - Hollow Stem Auger SFA - Solid Flight Auger RC - Rock Coring MD - Mud Drilling WD - Wash Drilling HA - Hand Auger	SS - Split Spoon Sample ST - Shelby Tube Sample CR - Rock Core Sample BS - Bag Sample	* - Hand Penetrometer LL - Liquid Limit PL - Plastic Limit PI - Plasticity Index SPT - Standard Penetration Test N60 - Standard Penetration Normalized to 60% Drill Rod ER

**APPENDIX B**  
**BORING LOCATION PLAN/SOIL PROFILE SHEET**





**GTL ENGINEERING INC.**  
CONSULTING ENGINEERS  
TESTING + INSPECTION  
LABORATORY SERVICES

**ENGINEERING**

DATE: 01-16-14  
SCALE: AS SHOWN  
DRAWN BY: C.L.  
REVIEWED BY: NZ  
PAGE: 1 OF 1  
PROJECT NO.: 13050218COL

**PLAN / SOIL PROFILE**

**LEGEND**

	CL-SP SANDSTONE		SH-SM		GC-GM		GP		TOPSOIL
	SH-SH		SP-SM		SP		GW-GM		GW-GC
	CL-ML		SC-SM		SC		GW-GM		GW-GC
	CH		SP-SM		SP		GW-GM		GW-GC
	MH		SC-SM		SC		GW-GM		GW-GC
	OH		SP-SM		SP		GW-GM		GW-GC
	FT		ML		SC		GW-GM		GW-GC

GROUND WATER DURING DRILLING: W

GROUND WATER AT COMPLETION OF DRILLING: W

GROUND WATER AT 72 HOURS AFTER COMPLETION: W

MOISTURE CONTENT IN PERCENT (%): W

STANDARD PENETRATION NORMALIZED TO 60% DRILL ROD: W

0 100 150 200

**NOTE**

B-1 APPROXIMATE BORING LOCATION

GROUND SURFACE ELEVATION AT THE TEST BORING LOCATION WAS INTERPOLATED AS 824.0 FEET FROM THE LAND SPACE SURVEY PREPARED BY PRECISION SURVEYING SERVICES, LLC.