Report of Geotechnical Subsurface Exploration
Proposed High Knob Tower
Wise County, Virginia

October 25, 2010

Prepared For:

Thompson & Litton, Inc.
PO Box 1307
Wise, Virginia 24293

COMMONWEALTH OF VIRGINIA
ERIC C. HESS
No.040226
10-25-2010
PROFESSIONAL ENGINEER

Prepared By:

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October 25, 2010

Mr. Dick Houchins, AIA
Thompson & Litton, Inc.
P. O. Box 1307
Wise, Virginia 24293

RE: GEOTECHNICAL SUBSURFACE EXPLORATION
PROPOSED OBSERVATION TOWER
HIGH KNOB
WISE COUNTY, VIRGINIA
LEC FILE NO.: 2010-036

Dear Mr. Houchins:

As per the authorization of LEC Proposal No. 2010-09, we have performed a geotechnical subsurface exploration for the above referenced project. Please find enclosed one (1) copy of the Geotechnical Exploration Report. In an effort to conserve resources we have sent one (1) hard copy and one (1) pdf digital version of the report; extra hard copies may be sent upon request. The report presents our conclusions and recommendations based on the findings of the subsurface exploration.

We sincerely appreciate the opportunity to provide our services on this project. If you have any questions or we can be of further assistance to you, please feel free to contact us via telephone at (276) 964-6047 or email at eric@lighthouseengineeringconsultants.com.

Sincerely,
Lighthouse Engineering Consultants, LLC

Eric C. Hess

Eric C. Hess, PE
President

ECH/mah

Enclosure

Contents

EXECUTIVE SUMMARY

The site of the proposed High Knob Observation Tower is located at the highest point of Stone Mountain in Wise County, Virginia. The site is located on a section of property that is primarily grassed. The area surrounding the site is wooded. The project site is shown on the *Site Location Plan* included with this report.

The exploration was performed using a track-mounted drilling rig. The test boring locations encountered approximately 6 inches of topsoil and root matter across the site. Beneath the topsoil, residual soil was encountered to depths varying from 6½ feet to 8½ feet below the ground surface. The residual soils typically consisted of yellow and tan clayey sand or silty sand with broken rock fragments. The residual soil existed in a medium dense to dense or very dense condition. The moisture content of the residual soil typically ranged from moist to dry. The residual materials typically increased in density with depth.

It is our understanding that the proposed tower will consist of a combination masonry, concrete and steel structure with a total height of approximately 25 feet. The structure is planned for support on shallow concrete foundations.

Based on the results of the subsurface exploration, the proposed tower could be supported using shallow concrete foundations. The foundations should bear on the residual soil or the very soft, very weathered bedrock materials. A design bearing capacity of 3000 psf may be used for the foundation design. The geotechnical engineer or a qualified soil technician under the direction of a geotechnical engineer should observe the foundation excavation at the time of construction. Dynamic Cone Penetration (DCP) testing should be performed in the foundation excavations to ensure that the materials encountered are sufficient to provide the recommended design bearing capacity.

SCOPE OF SERVICES

Site Reconnaissance: The site reconnaissance consisted of walking over the subject site. The site was observed for topographic features, drainage patterns, ground surface cover, exposed rock and signs of ground instability.

Information Review: A review of published USGS topographic mapping of the Norton, Virginia quadrangle was performed. A review of published geologic mapping of the Norton, Virginia quadrangle was also conducted to determine the underlying bedrock conditions.

Soil Test Borings: The test borings were located in the field with the assistance of a survey drawing provided by Eric W. Price, PLS, PE Survey Manager of Thompson & Litton, Inc. The borings were located using scaled distances from existing structures. Measuring tapes were used to locate and mark the boring locations. The approximate soil test boring locations are shown on the *Boring Location Plan* included with this report.

Four (4) test boring locations were placed on the proposed site. The test borings were drilled using a track-mounted drilling rig. Standard Penetration testing was performed concurrent with the test boring. The Standard Penetration test is a field test used to evaluate the consistency of the soils encountered.

Split spoon samples of the soils encountered were collected and transported to the laboratory for visual observation. Rock Coring was not performed. A description of the soils encountered is included in the attached *Test Boring Records*.

Laboratory Testing: The split spoon samples were transported to the laboratory for visual observation. Due to the shallow rock encountered at the site, laboratory testing was not performed. The split spoon samples were predominantly broken and very weathered rock materials rather than soil.

Engineering Analyses: Engineering analysis of the data obtained during the subsurface evaluation was performed in order to provide recommendations for foundation construction. The analyses performed considered such items as seismic design, soil bearing capacity and settlement potential.

PROJECT DESCRIPTION

The proposed High Knob Observation Tower structure will consist of a combination of construction materials including masonry, concrete, and steel. The structure will be supported using shallow concrete foundations. The planned observation tower will have a height of approximately 15 feet at the observation deck and a height of 25 feet at the top of the tower.

Associated walking trails, a sundial, and a small pedestrian bridge connected to the observation tower will also be constructed as part of the project. Up to approximately 12 feet of fill placement will be required to reach the planned finished grade elevations.

SITE DESCRIPTION

Location: The proposed High Knob Observation Tower site is located in a grassed area along the top of Stone Mountain in Wise County, Virginia. The surrounding area is primarily wooded. The project site is shown on the *Site Location Plan* included with this report.

Usage: The site is currently a grassed area where a previous observation tower was located. It is our understanding that the previous tower was destroyed via fire and therefore, a new observation tower is being constructed to replace the previous observation tower.

Ground Cover: The ground surface is currently covered with grass growth. The surrounding area is primarily wooded.

SUBSURFACE DESCRIPTION

Four (4) test boring locations were placed on the site using a track-mounted drilling rig. Standard Penetration testing was performed concurrent with the drilling operations. The Standard Penetration test is a field test that evaluates the consistency of the soils encountered. Split spoon samples of the soils encountered were obtained and transported to the laboratory for visual observation. Based on observation of the soil samples obtained, a description of the soils encountered is included in the attached *Test Boring Records.*

The test borings were located in the field with the assistance of a survey drawing obtained from Thompson & Litton, Inc. The approximate test boring locations are shown on the *Boring Location Plan* included with this report.

Surface Materials: All of the test boring locations encountered topsoil and root matter at the ground surface. The surface materials existed with a thickness of approximately 4 to 6 inches at the test boring locations. The surface materials will vary in thickness between test locations.

Residual Soil: Residual soil was encountered beneath the topsoil materials. Residual soil is soil that has been derived from the weathering of the underlying bedrock material. The residual soil consisted of yellow and tan clayey sand and silty sand soils with broken rock fragments. The residual soils existed in a generally medium dense to dense or very dense condition with a moist to dry water content. The residual soil was encountered to depths of approximately 6½ to 8½ feet below the existing ground surface.

Bedrock/Groundwater: Auger refusal was encountered on the underlying bedrock materials at depths varying from 6½ feet to 8½ feet below the existing ground surface. The bedrock consists of very weathered sandstone. Excavations of deeper than 3 feet should anticipate chipping or blasting for removal of bedrock. Groundwater was not encountered at the test boring locations at the time of drilling.

AREA GEOLOGY/TOPOGRAPHY

A review was performed of published topographic mapping and published geologic mapping of the site vicinity.

Geology: The *Geology of the Norton Quadrangle, Virginia* was obtained from the Virginia DMME, Division of Mineral Resources (DMR). The geologic mapping was published in 1986. The subject site is located in the Valley and Ridge physiographic province of Virginia.

This area has been highly folded and faulted due to past tectonic activity. Review of the mapping indicates that the site is underlain by the Bluestone Formation. This formation is described as clay shale and sandstone bedrock with some interbeds of siltstone and slightly calcareous shale. The formation generally strikes in a northeast to southwest direction with a dip angle of approximately 4 to 8 degrees in the southeast direction.

Topography: The topographic mapping of the Norton, Virginia quadrangle was obtained from the U.S. Geologic Survey (USGS). The topographic mapping was performed in 1957 and photo-revised in 1991. The mapping was performed using 20 feet contour intervals. The topographic mapping indicates that the site exists along the top of the mountain feature known as Stone Mountain. The mapping does not indicate the presence of unstable soils or rock in the site vicinity.

Observation of the site during the site reconnaissance indicated no signs of ground instability on the subject tower site location.

LABORATORY TESTING

Due to the shallow rock encountered at the site, laboratory testing was not performed. Visual observation of the split spoon samples was performed to provide the written descriptions shown on the *Test Boring Records*. The split spoon samples consisted predominantly of broken and very weathered rock materials rather than soil suitable for testing.

RECOMMENDATIONS

Based on the results of the geotechnical subsurface exploration and our review of the information provided, we provide the following recommendations for final design and construction of the proposed High Knob Observation Tower structure.

Site Preparation

The planned structures and fill areas plus an additional five (5) feet beyond the perimeter should be stripped of all vegetation, topsoil, organics, building debris, frozen or soft, wet soils, and all other deleterious materials.

Once clearing and grubbing has been performed, the planned structure and fill areas should be proofrolled using a loaded tandem axle dump truck driving in a criss-cross pattern. Proofrolling should be performed using a minimum load of 15 tons. Proofroll testing should be performed under the observation of a geotechnical engineer. Soft, or unsuitable, areas of soil should undercut and stabilized at the direction of the engineer.

Soil Fill Placement

All soil fill materials should consist of soil free of organics, particles of greater than 4 inches in diameter, frozen soil, and any other deleterious materials. The soil fill should have a Plasticity Index (PI) value of not more than 25 with a Standard Proctor Maximum Dry Density value of not less than 90 pcf.

Fill soil should be placed in loose, horizontal lifts of not more than 8 inches. The compacted thickness of each lift should be approximately 6 inches. Compaction should be performed using a vibratory compactor (sheepsfoot or smoothdrum) appropriate for the material type. The sheepsfoot compactor is appropriate for use with fine-grained soils such as shaley clays, clays and silts. The smoothdrum is appropriate for use with coarse-grained soils such as sands and gravels.

The fill soil should be aerated to within - 2% to + 2% of its optimum moisture content as determined by the Standard Proctor Density Test (ASTM D-698). Compaction of all fill soil supporting structures, sidewalks, and trail areas plus 5 feet beyond the perimeter should be performed until at least 98% of the Standard Proctor (ASTM D-698) maximum dry density value is achieved.

Density testing should be performed concurrent with the soil fill placement to ensure that the proper density is achieved. The recommended minimum rate of testing is 1 test per 2500 square feet or less of fill area for each soil fill lift. Density testing should be performed by a qualified soil technician under the direction of the project geotechnical engineer.

Site Drainage

Surface water drainage should be controlled during construction and once the site is completed to prevent ponding of water in the tower area. If necessary, pumps, ditches or other grading methods should be used to prevent the surface water from ponding on the site.

Seismic Considerations

The International Building Code (IBC) Seismic Design Procedure considers the average material properties of the soil and rock within the upper 100 feet of the ground surface. Based on our review of the IBC Seismic Design Procedures, the results of the subsurface exploration and the proposed method of site preparation, it is our opinion that the structure should be designed using a Site Class B designation.

Excavated Slopes

Temporary construction excavations should be sloped or shored in accordance with local, state and federal regulations including OSHA (29 CFR Part 1926) excavation and trench safety. For the purposes of excavated slopes and trenches, all soil on the site should be classified as Class C material.

Based on review of the conceptual site grading plan, excavated slopes will not be required. However, should the project require excavated slopes, all excavated slopes should be constructed with a geometry of no steeper than 2H:1V for slope heights of less than 10 feet. For slope heights of greater than 10 feet, the project geotechnical engineer should evaluate each slope on a case-by-case basis.

For slopes that will require regular mowing and maintenance, we recommend a geometry of no steeper than 3H:1V.

Fill Embankments

Fill slopes are anticipated for this project. All fill slopes should have a geometry of no steeper than 2H:1V. For slopes that will be permanently maintained by mowing, the slope geometery should not be any steeper than 3H:1V.

Benching should be performed for all fill soil placed on a sloping surface. The existing ground should be notched or benched prior to fill placement to properly tie the new fill into the existing ground.

Foundations

For support of the proposed tower structure, we recommend the use of shallow foundations bearing on the underlying residual soil/rock materials. We recommend that an allowable bearing capacity of 3,000 psf should be used for the foundation design. The foundations should be designed with sufficient size, mass and strength to resist the overturning moment forces of the planned tower structure. Continuous foundations should have a minimum plan width of 2 feet. Pier foundations should have minimum plan dimensions of 3 feet by 3 feet. In addition, vertical building expansion joints should also be used for masonry structures. Building expansion joints should be spaced at not more than 25 feet on center.

Exterior foundations should bear a minimum of 30 inches below the planned finish grade elevation to prevent frost and moisture related movements of the foundations. Foundation excavations of more than 3 feet below the existing ground surface should anticipate encountering soft bedrock materials. These materials may require light chipping or ripping to remove the bedrock. The bedrock will likely increase in strength and become less weathered with depth below the ground surface.

Foundation excavations should be observed by a geotechnical engineer or a qualified soils technician working under the direction of a geotechnical engineer to ensure that the soils encountered are consistent with the design bearing capacity assigned based upon the results of this subsurface exploration. Dynamic Cone Penetration (DCP) testing should be performed within the foundation excavations to determine the actual bearing capacity of the soils encountered in the foundation excavations. If unsuitable soils are encountered, the soils shall be undercut at the direction of the geotechnical engineer.

Settlement

On the prepared site, the anticipated amount of total foundation consolidation settlement is approximately ½ inch. The expected amount of differential settlement is estimated to be approximately ¼ inch.

Below Grade/Retaining Walls

We recommend that constrained retaining wall and below grade building/structure walls be designed based on "at rest" conditions (no movement of the wall is allowed). We recommend that freestanding retaining walls be designed for active conditions (the tops of the walls are able to rotate and develop the shear strength of the soil).

An allowable soil bearing capacity of 3000 psf should be used for the wall foundation design. A friction factor of 0.35 should be used for a soil to concrete interface.

The following values may be used for design. Equivalent fluid pressure values are based on a compacted unit weight of 100 pcf for ASTM C-33, Size No. 57, crushed, graded, limestone gravel and a compacted unit weight of 115 pcf for compacted off site soils.

TABLE I – Lateral Earth Pressures

	No. 57 Stone		Compacted Off Site Soil	
Lateral Earth Pressure Coefficient	**Coefficient Values**	**Equivalent Fluid Pressure (pcf)**	**Coefficient Values**	**Equivalent Fluid Pressure (pcf)**
K_o	0.43	45	0.66	76
K_a	0.27	28	0.49	56
K_p	3.69	369	2.04	235

The above values are based on level, drained backfill conditions. If the backfill is not drained (positive drainage is not provided) then hydrostatic pressures should be used. At least one foot of No. 57 gravel should be placed behind below grade walls with soil backfill to maintain drained conditions.

ASTM C-33 size No. 57 stone used as backfill material behind below grade and retaining walls should be 1 foot wide at the base of the wall/structure and extend 1 foot horizontally for each foot of wall height. The stone fill should be placed up to the level of two feet below finished subgrade elevation. The top two feet of material should consist of silty clay soil. The ground surface should be sloped to provide positive surface drainage away from the building area.

The No. 57 stone should be compacted to a minimum of 90% relative density. Backfill lift thickness should be limited to a maximum of 12 inches loose. All fill should be placed and compacted in horizontal lifts. In-place density testing should be performed concurrent with placement of all fill.

Off site soil fill placed as backfill to below grade walls should be compacted to a minimum of 98% of its maximum dry density as determined by the Standard Proctor test, ASTM D 698. Backfill lift thickness should be limited to a maximum of 6 inches loose. Un-weathered shale or high plasticity (i.e. plasticity index greater than 25%) silt or clay soils should not be used as a backfill material for the below grade and retaining walls.

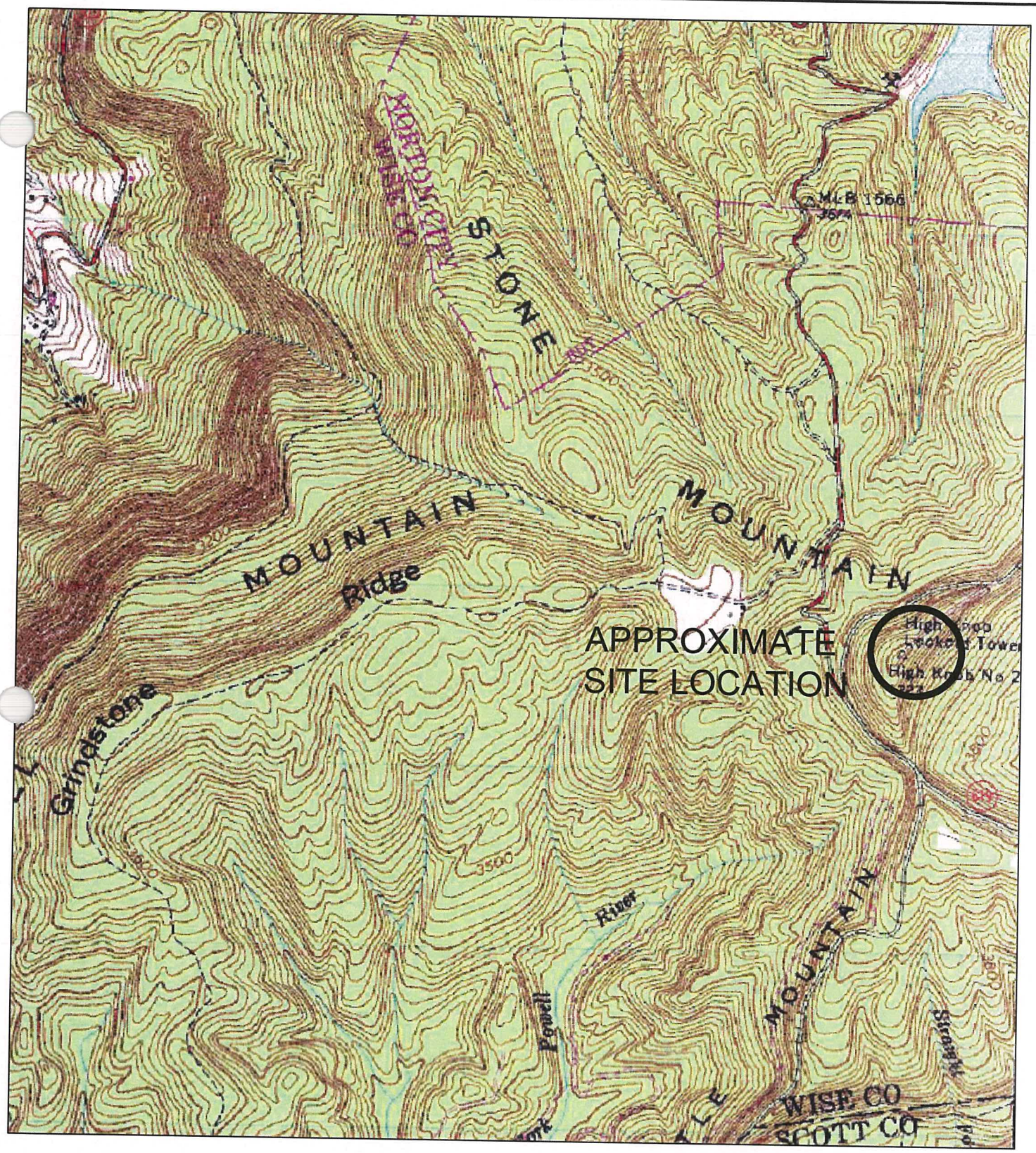
For the design of segmental block retaining walls, we recommend the use of select stone backfill materials with a unit weight of 100 pcf and an internal friction angle of 45 degrees. If the use of an offsite soil is desired, we recommend soil-specific testing to determine the strength parameters of the materials to be utilized during the wall construction. However, the offsite soils should not have an internal friction angle of less than 25 degrees or a wet unit weight of less than 110 pcf.

REPORT LIMITATIONS

This report has been prepared for exclusive use of Thompson & Littion, Inc., to design and construct the proposed High Knob Observation Tower in Wise County, Virginia. This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made. Lighthouse Engineering Consultants, LLC, is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analysis without our express written authorization.

The analyses and professional opinions submitted herein are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of subsurface variations between the test boring locations will not become evident until construction. We strongly recommend that the services of a licensed geotechnical engineer, such as Lighthouse Engineering Consultants, LLC, be obtained for the construction phase of the project to provide engineering evaluation and testing services.

Appendix A
Site Location Plan



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SITE LOCATION PLAN
PROPOSED OBSERVATION TOWER
HIGH KNOB - WISE COUNTY, VIRGINIA

FOR: THOMPSON & LITTON, INC.

DRAWN BY:	NOTES: ADAPTED FROM PUBLISHED USGS MAPPING
ECH	LOCATIONS ARE APPROXIMATE

SCALE: NONE	DATE: 10-25-2010	DWG #: 2010-036A

Appendix B
Boring Logs
&
Boring Location Plan

B-1

High Knob Tower	High Knob		Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric. C. Hess	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil					
	Residual, Medium dense, Moist, Yellow and Tan, Silty sand with broken rock fragments				40	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 4"	
	Auger refusal @ 7.0' No groundwater encountered at time of drilling	10 15 20 25 30 35				

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B-2

High Knob Tower		High Knob	Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric C. Hess, PE	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil					
	Residual, Dense to Very Dense, Moist to Dry, Yellow and Tan, Silty sand with broken rock fragments				50 = 5"	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 3"	
	Auger refusal @ 7.5'				50 = 3"	
	No groundwater encountered at time of drilling	10				
		15				
		20				
		25				
		30				
		35				

B-3

High Knob Tower	High Knob		Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric C. Hess, PE	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil Residual, Very Dense, Dry, Yellow and Tan, Clayey sand with broken rock fragments				50 = 6"	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 5"	
	Auger refusal @ 6.5' No groundwater encountered at time of drilling	10 15 20 25 30 35				

B-4

High Knob Tower		High Knob	Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric C. Hess, PE	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil Residual, Dense, Moist, Yellow and Tan, Silty sand with broken rock fragments				60	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 4"	
					50 = 4"	
	Auger refusal @ 8.5' No groundwater encountered at time of drilling	10				
		15				
		20				
		25				
		30				
		35				

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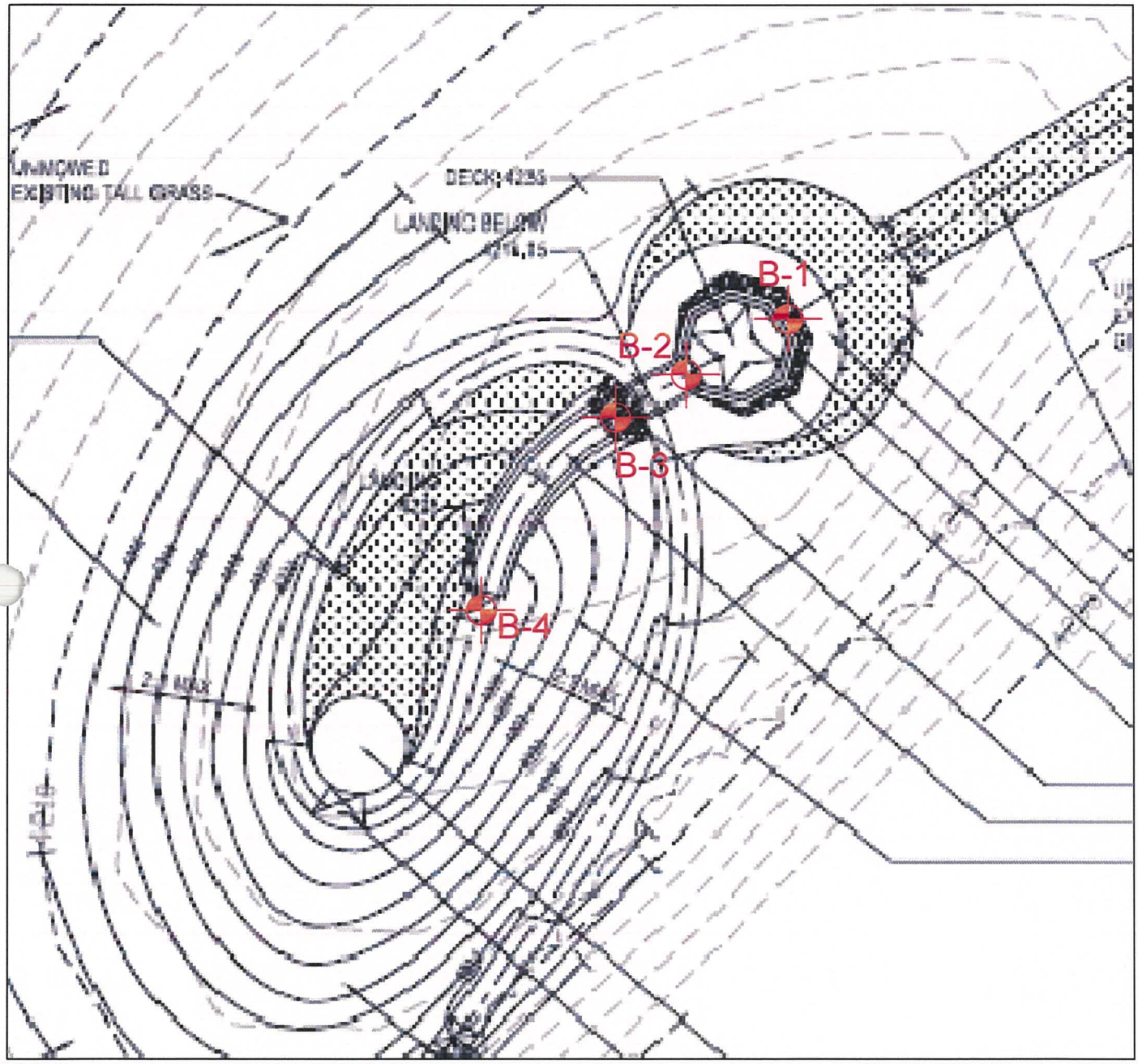

B-1 BORING NUMBER AND LOCATION

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BORING LOCATION PLAN
PROPOSED OBSERVATION TOWER
HIGH KNOB - WISE COUNTY, VIRGINIA

FOR: THOMPSON & LITTON, INC.

DRAWN BY:	NOTES: ADAPTED FROM FIELD MEASUREMENTS
ECH	LOCATIONS ARE APPROXIMATE

SCALE:	DATE:	DWG #:
NONE	10-25-2010	2010-036B

Appendix C
General Notes

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 in and larger
Cobbles:	3 in to 8 in
Gravel:	coarse – ¾ to 3 in
	fine – No. 4 (4.76 mm) to ¾ in
Sand:	coarse – No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium – No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine – No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (Non-plastic)
Clay:	No. 200 (0.074 mm) and smaller (Plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance Correlated to Unconfined Compressive Strength, tsf
PID:	Results ov vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benezene standard. Results expressed in HNU-units (BDL=Below Detection Limits)
N:	Penetration Resistance per 6 inch interval, or fraction thereof, for a standard 2 inch O.D. (1 3/8 inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N values where plus sign is shown.
Nc:	Penetration Resistance per 1 ¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.
Nr:	Penetration Resistance per 6 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube – 3" O.D. (except where noted)
CS:	3" O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	*BLOWS PER FOOT (N)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*
Very Soft	0-2	0-0.25
Soft	3-4	0.25-0.50
Medium Stiff	5-8	0.50-1.00
Stiff	9-15	1.00-2.00
Very Stiff	16-30	2.00-4.00
Hard	31+	4.00+

DEGREE OF PLASTICITY	*PI*
None to Slight	0-4
Slight	5-10
Medium	11-30
High to Very High	31+

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	*BLOWS PER FOOT (N)*
Very Loose	0-4
Loose	5-10
Firm	11-30
Dense	31-50
Very Dense	51+

DEGREE OF EXPANSIVE POTENTIAL	*PI*
Low	0-15
Medium	15-25
High	25+