AGEC
Applied GeoTech

GEOTECHNICAL INVESTIGATION

PROPOSED CHALETS AT SKI LAKE SUBDIVISION
PHASES 7 AND 8

HUMMINGBIRD POINT AND HAWKS LANE

WEBER COUNTY, UTAH

PREPARED FOR:

VALLEY INVESTMENTS, LLC
C/O GREAT BASIN ENGINEERING, INC.
PO BOX 150048
OGDEN, UT 84415

ATTENTION: MARK BABBITT

PROJECT NO. 1120924

JULY 23, 2013

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EXECUTIVE SUMMARY

1. The soil at the site consists of 4 to 8 inches of topsoil overlying clay, except gravel was encountered below the topsoil in Test Pit TP-2 and extended the full depth of the test pit. The clay extends the full depth of Test Pit TP-5. Gravel was encountered below the clay at depths of approximately 3½, 3, 2 and 8 feet in Test Pits TP-1, TP-3, TP-4 and TP-6, respectively. Sand was encountered below the gravel in Test Pits TP-1 and TP-4 at depths of approximately 7 and 6 feet, respectively and extends the full depth of Test Pit TP-1 and to a depth of approximately 10½ feet in Test Pit TP-4. Clay was encountered below the sand in Test Pit TP-4 and below the gravel in Test Pit TP-6. Bedrock was encountered below a depth of approximately 7 feet in Test Pit TP-3.

2. No water was encountered in the test pits. It appears that seepage may occur at Test Pit TP-4 during wet or snow melt times of the year.

3. The upper clay in Test Pit TP-4 and the clay in Test Pits TP-5 and TP-6 is moisture-sensitive (expansive). Additional subsurface investigation should be considered to better define the depth and extent of expansive clay at the site. The expansive soil in its present condition is not suitable for support of conventional spread footing foundations. Houses to be constructed in the area of expansive clay should be supported on deep foundations extending below the expansive soil or to a depth of at least 15 feet below the lowest floor level. Structural floors should be used where expansive soil remains below the floor with adequate gaps provided below structural floors to accommodate soil expansion. Alternatively, where practical, the expansive soil can be removed from below the proposed buildings and a conventional spread footing foundation system may be used.

   An alternative that includes the risk of approximately ¾ inch of differential movement would be to remove at least 5 feet of the expansive soil from below slab areas and at least 4 feet from below foundation areas. Foundations should be provided with at least 1,000 pounds per square foot dead load with this option. The removed soil should be replaced with low-permeable, nonexpansive structural fill.

4. The houses outside of expansive soil areas may be supported on spread footings bearing on the undisturbed, non-expansive natural soil, bedrock or on compacted structural fill extending down to the non-expansive natural soil or bedrock. Footings may be designed for a net allowable bearing pressure of 1,500 pounds per square foot (psf). Footings bearing on at least 2 feet of compacted structural fill, at least 2 feet of natural gravel or on the bedrock may be designed for a net allowable bearing pressure of 3,500 psf.

Executive Summary (continued)

5. Slope stability is a common problem in this area. Grading plans for individual lots should be reviewed by a geotechnical engineer and cuts and fills should be minimized. Permanent, unretained cut and fill slopes up to 15 feet in height may be constructed at 4 horizontal to 1 vertical or flatter. There are some areas of siltstone bedrock and possibly areas of gravel where steeper slopes could be considered. Steeper and/or higher slopes should be evaluated for stability on an individual basis. This assumes there is no water seepage encountered in the slopes. Steeper slopes will generally require retainage. Flatter slopes and/or drains will be required where seepage is encountered. Slopes should be protected from erosion by revegetation or other methods.

6. Perched water is expected to develop in the wet time of the year. Houses with basements should be provided with subsurface drains designed to intercept potential perched water.

7. The upper soil in many parts of the site consists of clay, which will be easily disturbed by construction traffic when it is very moist to wet, such as in the winter and spring or at times of prolonged rainfall. Placement of 1 to 2 feet of gravel will provide limited support for construction traffic when the soil consists of very moist to wet clay.

8. Geotechnical information related to foundations, subgrade preparation, materials and pavement is included in the report.

SCOPE

This report presents the results of a geotechnical investigation for the proposed Phases 7 and 8 of the Chalets at Ski Lake subdivision located at Hummingbird Point and Hawks Lane in Weber County, Utah. The report presents the subsurface conditions encountered, laboratory test results and recommendations for foundations and pavement. The study was conducted in general accordance with our proposals dated June 28, 2013.

Field exploration was conducted to obtain information on the subsurface conditions. Samples obtained from the field investigation were tested in the laboratory to determine physical and engineering characteristics of the on-site soil. Information obtained from the field and laboratory was used to define conditions at the site for our engineering analysis and to develop recommendations for the proposed foundations and pavement.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

SITE CONDITIONS

At the time of our field investigation, most of the property consisted of undeveloped fields and hillside. There is a drainage that extends through Lot 72 and along the west and south sides of the property.

The ground surface in the south and west sides of the property slopes gently to moderately down to the east. There is a knoll in the central portion of the property with gentle slopes down to the northeast, east and southeast. The general topography of the site is presented on Figure 1.

Vegetation through most of the area proposed for development consists predominantly of grass with some areas of trees and brush, particularly at the west and along the drainage.

The property is bordered on the northwest, west and south by undeveloped land. The first phases of the subdivision are to the northeast where there are some residential houses. A portion of the east edge of the property is bordered by Old Snow Basin Road, a two-lane asphalt paved road in good condition.

FIELD STUDY

The field study was conducted on July 9, 2013. Six test pits were excavated at the approximate locations indicated on Figure 1. The test pits were logged and soil samples obtained by an engineer from AGEC. Logs of the subsurface conditions encountered in the test pits are graphically shown on Figure 2 with legend and notes on Figure 3.

The test pits were backfilled without significant compaction. The backfill in the test pits should be properly compacted where it will support proposed buildings, slabs and pavement.

SUBSURFACE CONDITIONS

The soil at the site consists of 4 to 8 inches of topsoil overlying clay, except gravel was encountered below the topsoil in Test Pit TP-2 and extended the full depth of the test pit. The clay extends the full depth of Test Pit TP-5. Gravel was encountered below the clay at depths of approximately 3½, 3, 2 and 8 feet in Test Pits TP-1, TP-3, TP-4 and TP-6, respectively. Sand was encountered below the gravel in Test Pits TP-1 and TP-4 at depths of approximately 7 and 6 feet, respectively and extends the full depth of Test Pit TP-1 and to a depth of approximately 10½ feet in Test Pit TP-4. Clay was encountered below the sand in Test Pit TP-4 and below the gravel in Test Pit TP-6. Bedrock was encountered below a depth of approximately 7 feet in Test Pit TP-3.

A description of the various soils and bedrock encountered in the test pits follows:

Topsoil - The topsoil consists of sandy lean clay to clayey sand. The topsoil is slightly moist to moist, dark brown and contains roots and organics.

Sandy Lean Clay - The clay contains some gravel and some sand and gravel layers. The clay is stiff to very stiff, slightly moist to very moist and brown to dark brown.

Laboratory tests performed on a sample of the clay indicate that it has a natural moisture content of 30 percent, a liquid limit of 39 and plasticity index of 18.

Fat Clay - The fat clay contains sand and gravel. It is stiff to hard, slightly moist to moist and brown to dark brown to olive brown.

Laboratory tests performed on samples of the clay indicate that it has natural moisture contents ranging from 24 to 27 percent and natural dry densities ranging from 86 to 112 pcf, a liquid limit of 60 and a plasticity index of 43. Results of a direct shear test performed on a sample of the clay are presented on Figure 5.

Results of a consolidation test performed on an air-dried sample of the fat clay indicate that the clay is moisture-sensitive and expands when wetted. Results of the consolidation test are presented on Figure 4.

Clayey Sand - The sand is medium dense, moist and brown.

Laboratory tests performed on a sample of the sand indicate that it has a natural moisture content of 18 percent, a liquid limit of 33 and plasticity index of 18.

Poorly-graded Sand with Silt - The sand contains some gravel. It is medium dense, very moist and brown.

Laboratory tests performed on a sample of the sand indicate that it has a natural moisture content of 14 percent.

Clayey Gravel with Sand - The gravel contains cobbles. It is medium dense, moist and brown.

Siltstone Bedrock - The siltstone bedrock is hard, slightly, moist and grayish brown.

A summary of the laboratory test results is presented on Table I and included on the logs of the test pits.

SUBSURFACE WATER

No subsurface water was encountered in the test pits to the depths investigated. It appears that seepage may occur at Test Pit TP-4 during wet or snow melt times of the year. We anticipate that perched water conditions will develop during the wet time of the year and during snow melt time.

PROPOSED CONSTRUCTION

We understand that the property is planned to be subdivided for residential construction. We anticipate that buildings will be one to two-story, wood-frame structures with a potential for basements. We have assumed maximum column loads of 30 kips and maximum wall loads of 2½ kips per lineal foot.

Roads are planned to extend through the proposed development. We have assumed traffic consisting predominantly of car and pickup traffic with occasional light delivery trucks.

If the proposed construction, building loads or traffic is significantly different from what is described above, we should be notified so that we can reevaluate the recommendations given.

RECOMMENDATIONS

Based on the subsurface conditions encountered, laboratory test results, and the proposed construction, the following recommendations are given:

A. Site Grading

1. Cut and Fill Slopes

Slope stability is a common problem in this area. Grading plans for individual lots should be reviewed by a geotechnical engineer and cuts and fills should be minimized. Permanent, unretained cut and fill slopes up to 15 feet in height may be constructed at 4 horizontal to 1 vertical or flatter. There are some areas of siltstone bedrock and possibly areas of gravel where steeper slopes could be considered. Steeper and/or higher slopes should be evaluated for stability on an individual basis. This assumes there is no water seepage encountered in the slopes. Steeper slopes will generally require retainage. Flatter slopes and/or drains will be required where seepage is encountered. Slopes should be protected from erosion by revegetation or other methods.

The fill should be placed in relatively horizontal lifts with lift thicknesses thin enough to allow for proper compaction. The fill should be keyed into slopes steeper than 5 horizontal to 1 vertical with a key for every approximately 2 feet of vertical rise.

2. Subgrade Preparation

Prior to placing grading fill or base course, existing fill, organics, topsoil, debris and other deleterious material should be removed. The subgrade in proposed road areas should be proof-rolled to identify soft areas. Soft areas should be removed and replaced with gravel containing less than 15 percent passing the No. 200 sieve.

When the subgrade consists of very moist to wet clay, the subgrade should not be proof-rolled, but cut to undisturbed natural soil below the topsoil and a sufficient thickness of gravel placed to facilitate construction. Typically, 1 to 2 feet of gravel will provide limited support for moderately sized rubber-tired construction equipment. Consideration may be given to placing a support fabric between the gravel and natural soil.

3. Excavation

Excavation for much of the site can be accomplished using typical excavation equipment. However, heavy-duty excavation equipment will likely be needed where bedrock is encountered. Increased excavation equipment difficulties can be expected for confined excavations such as for utilities where bedrock is encountered. Some light blasting, jackhammering or other rock excavating methods may be needed in bedrock.

4. Compaction

Compaction of materials placed at the site should equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D-1557.

Fill To Support	Compaction
Foundations	≥ 95%
Concrete Slabs and Pavement	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 - 90%

To facilitate the compaction process, fill should be compacted at a moisture content within 2 percent of the optimum moisture content.

Base course for roads should be compacted to at least 95 percent of the maximum dry density determined by ASTM D1557.

Fill should be frequently tested for compaction.

5. <u>Materials</u>

Materials placed as fill to support foundations should be non-expansive granular soil. The natural sand and gravel and the siltstone bedrock that can be broken down to a suitable size to allow for proper compaction, exclusive of organics, debris, oversized particles and other deleterious materials, are suitable for use as structural fill. The clay and bedrock containing significant clay content are not suitable for use as structural fill. The sand, gravel, clay and bedrock containing significant clay content may be considered for use as site grading fill, utility trench backfill and retaining wall backfill if the organics, topsoil and other deleterious materials are removed from the material. The high plastic clay and possible bedrock containing significant clay content may be moisture sensitive. This material would not be suitable for use as fill below buildings, pavement and slabs nor would it be suitable as backfill for retaining walls.

Listed below are materials recommended for imported structural fill.

Fill to Support	Recommendations
Footings	Non-expansive granular soil Passing No. 200 Sieve < 35% Liquid Limit < 30% Maximum size 4 inches
Floor Slab (Upper 4 inches)	Sand and/or Gravel Passing No. 200 Sieve < 5% Maximum size 2 inches
Slab Support	Non-expansive granular soil Passing No. 200 Sieve < 50% Liquid Limit < 30% Maximum size 6 inches

Low permeable, granular soil is defined as material with between 30 and 50 percent passing the No. 200 sieve and a liquid limit less than 30 percent. Maximum particle size for the low permeable fill should be 4 inches.

6. Drainage

The ground surface surrounding the proposed residences should be sloped away from the buildings in all directions with at least ½ foot of drop for the first 10 feet out from the building. Roof downspouts and drains should discharge beyond the limits of backfill. Perimeter drains are recommended for floors extending below grade and are discussed later in the report. The upper 2 feet of wall backfill should consist of low permeable soil compacted to at least 90 percent of the the maximum dry density as determined by ASTM D-1557.

The collection and diversion of drainage away from the pavement surface is important to the satisfactory performance of the pavement section. Proper drainage should be provided.

B. Foundations

1. Bearing Material

The upper clay in Test Pit TP-4 and the clay in Test Pits TP-5 and TP-6 is moisture-sensitive (expansive). Additional subsurface investigation should be considered to better define the depth and extent of expansive clay at the site. The expansive soil in its present condition is not suitable for support of conventional spread footing foundations. Houses to be constructed in the area of expansive clay should be supported on deep foundations extending below the expansive soil or to a depth of at least 15 feet below the lowest floor level. Where a deep foundation system is selected, additional recommendations can be provided based on the location of the house and final grade changes. Structural floors should be used where expansive soil remains below the floor with adequate gaps provided below structural floors to accommodate soil expansion. Alternatively, where practical, the expansive soil can be removed from below the proposed buildings and a conventional spread footing foundation system may be used.

An alternative which includes the risk of approximately ¾ inch of differential movement would be to remove at least 5 feet of the expansive soil from below slab areas and at least 4 feet from below foundation areas. Foundations should be provided with at least 1,000 pounds per square foot dead load with this option. The removed soil should be replaced with low-permeable, nonexpansive structural fill.

Care should be given to not allow soil in building excavations to dry significantly in areas of expansive soil.

Existing fill, topsoil, organics, debris and other deleterious materials should be removed from below proposed building areas.

2. Bearing Pressures

The houses outside of expansive soil areas may be supported on spread footings bearing on the undisturbed, non-expansive natural soil or on compacted structural fill extending down to the non-expansive natural soil. Footings may be designed for a net allowable bearing pressure of 1,500 pounds per square foot. Footings bearing on at least 2 feet of compacted structural fill, at least 2 feet of natural, undisturbed gravel or on the bedrock may be designed for a net allowable bearing pressure of 3,500 pounds per square foot. Footings should have a width of at least 1½ feet and a depth of embedment of at least 10 inches.

3. Temporary Loading Conditions

The allowable bearing pressure may be increased by one-half for temporary loading conditions such as wind or seismic loads.

4. Settlement

Based on the subsurface conditions encountered and the assumed building loads, we estimate that total and differential settlement will be less than 1 and ¾ inch, respectively. This assumes that footings are not supported above expansive clay or bedrock.

5. Frost Depth

Exterior footings and footings beneath unheated areas should be placed at least 36 inches below grade for frost protection.

6. Foundation Base

The base of footing excavations should be cleared of loose or deleterious material prior to structural fill or concrete placement.

7. Construction Observation

A representative of the geotechnical engineer should observe footing excavations prior to structural fill or concrete placement.

C. Concrete Slab-on-Grade

1. Slab Support

Concrete slabs may be supported on the undisturbed natural non-moisture sensitive soil or on compacted structural fill extending down to the non-moisture sensitive soil. Potentially moisture-sensitive soil should, ideally, be removed from below floor slabs or the floors structurally supported and an adequate void provided between the structural floor and moisture-sensitive soil.

Consideration could be given to leaving a portion of the expansive soil below floor slabs. With this option, at least 4 feet of low permeable fill should be provided below the slab and since there is a potential of up to approximately 1 inch of slab heave with this option, a gap of at least 1 inch should be provided below walls which extend over slabs and the slab should be free-floating.

Existing fill, topsoil, organics, debris and other deleterious materials should be removed from below proposed slab areas.

2. Underslab Sand and/or Gravel

A 4-inch layer of free-draining sand and/or gravel (less than 5 percent passing the No. 200 sieve) should be placed below the floor slab to promote even curing of the concrete.

3. Slab Joints

In areas of potential expansive soil (see Figure 1), a positive joint should be provided between the bearing walls and the floor slabs to allow unrestrained vertical movement.

D. Lateral Earth Pressures

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on the natural soil or on compacted structural fill is controlled by sliding resistance between the footing and the foundation soils. A friction value of 0.3 may be used in design for ultimate lateral resistance.

2. Subgrade Walls and Retaining Structures

The following equivalent fluid weights are given for design of subgrade walls and retaining structures. The active condition is where the wall moves away from the soil. The passive condition is where the wall moves into the soil and the at-rest condition is where the wall does not move. The values listed below assume a horizontal surface adjacent the top and bottom of the wall.

Soil Type	Active	At-Rest	Passive
Clay & Silt	50 pcf	65 pcf	250 pcf
Sand & Gravel	40 pcf	55 pcf	300 pcf

High plastic clay is not recommended for fill below foundations and behind retaining walls.

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 24 pcf for active and 9 pcf for at-rest conditions and decreased by 24 pcf for the passive condition. This assumes a peak ground acceleration of 0.33g for a 2 percent probability of exceedance in a 50-year period (IBC 2012).

4. Safety Factors

The values recommended above assume mobilization of the soil to achieve soil strength. Conventional safety factors used for structural analysis for such items as overturning and sliding resistance should be used in design.

E. Subsurface Drains

Perched water conditions may develop during the wet time of the year or during snow melt times. Subsurface drains should be installed around the perimeter of the houses where floor levels extend below grade. The subsurface drains should consist of the following:

a. The underdrain system should consist of a perforated pipe installed in a gravel filled trench around the perimeter of the subgrade floor portion of the building. The gravel should extend up foundation walls high enough to intercept potential subsurface water. A geosynthetic drain board may be considered as an alternative to the gravel that extends up the foundation wall.

b. The flow line of the pipe should be placed at least 18 inches below the finished floor level and should slope to a sump or outlet where water can be removed by pumping or by gravity flow.

c. If placing the gravel and drain pipe requires excavation below the bearing level of the footing, the excavation for the drain pipe and gravel should have a slope no steeper than 1 horizontal to 1 vertical so as not to disturb the soil below the footing.

d. A filter fabric should be placed between the natural soil and the drain gravel. This will help reduce the potential for fine-grained material filling in the void spaces of the gravel.

e. The subgrade floor slab should have at least 6 inches of free-draining gravel placed below it and the underslab gravel should connect to the perimeter drain.

f. Consideration should be given to installing cleanouts to allow access into the perimeter drain should cleaning of the pipe be required in the future.

F. Seismicity, Faulting and Liquefaction

1. Seismicity

Listed below is a summary of the site parameters for the 2012 International Building Code.

a.	Site Class	D*
b.	Short Period Spectral Response Acceleration, S_S	0.85g
c.	One Second Period Spectral Response Acceleration, S_1	0.29g

*Site Class C may be used in areas of bedrock.

2. Faulting

There are no mapped active faults extending through the site. The closest mapped active fault to the site is the Wasatch Fault located approximately 6½ miles to the west (Black and Others, 2003).

3. Liquefaction

Based on the subsurface conditions encountered at the site and our understanding of the geology of the area, liquefaction is not a hazard at the site.

G. Water Soluble Sulfates

One sample of the natural soil was tested in the laboratory for water soluble sulfate content. Test results indicate there is less than 0.1 percent water soluble sulfate in the sample tested. Based on the results of the test and published literature, the natural soil possesses negligible sulfate attack potential on concrete. No special cement type is required for concrete placed in contact with the natural soil. Other conditions may dictate the type of cement to be used in concrete for the project.

H. Pavement

Based on the subsoil conditions encountered, laboratory test results and the assumed traffic as indicated in the Proposed Construction section of the report, the following pavement support recommendations are given:

1. Subgrade Support

   The upper soils at the site range from clay to gravel. We have assumed a California Bearing Ratio (CBR) value of 2½ percent which assumes a clay subgrade.

2. Pavement Thickness

   Based on the subsoil conditions encountered, assumed traffic, a design life of 20 years for flexible pavement and 30 years for rigid pavement and methods presented by the Utah Department of Transportation, a flexible pavement section consisting of 3 inches of asphaltic concrete overlying 9 inches of base course is calculated. Alternatively, a rigid pavement section consisting of 5 inches of Portland cement concrete may be used.

   The base course thickness could be reduced to 6 inches in areas where the subgrade consists of at least 6 inches of gravel and in areas where no significant truck traffic is expected such as for cul-de-sacs.

3. Pavement Materials and Construction

a. Flexible Pavement (Asphaltic Concrete)

The pavement materials should meet the specifications for the applicable jurisdiction. Other materials may be considered for use in the pavement section. The use of other materials may result in the need for different pavement material thicknesses.

b. Rigid Pavement (Portland Cement Concrete)

The rigid pavement thickness assumes that the pavement will have aggregate interlock joints and that a concrete shoulder or curb will be provided.

The pavement materials should meet the specifications for the applicable jurisdiction. The pavement thickness indicated above assumes that the concrete will have a 28-day compressive strength of 4,000 pounds per square inch. Concrete should be air entrained with approximately 6 percent air. Maximum allowable slump will depend on the method of placement but should not exceed 4 inches.

4. Jointing

Joints for concrete pavement should be laid out in a square or rectangular pattern. Joint spacings should not exceed 30 times the thickness of the slab. The joint spacings indicated should accommodate the contraction of the concrete and under these conditions steel reinforcing will not be required. The joints should be approximately one-fourth of the slab thickness.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the test pits excavated at the approximate locations indicated on Figure 1 and the data obtained from laboratory testing. Variations in the subsurface conditions may not become evident until additional exploration or excavation is conducted. If the subsurface conditions or groundwater level is found to be significantly different from what is described above, we should be notified to reevaluate our recommendations.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, P.C.

LICENSED PROFESSIONAL ENGINEER
7/31/13
No. 260053
DOUGLAS R. HAWKES
STATE OF UTAH

Douglas R. Hawkes, P.E., P.G.

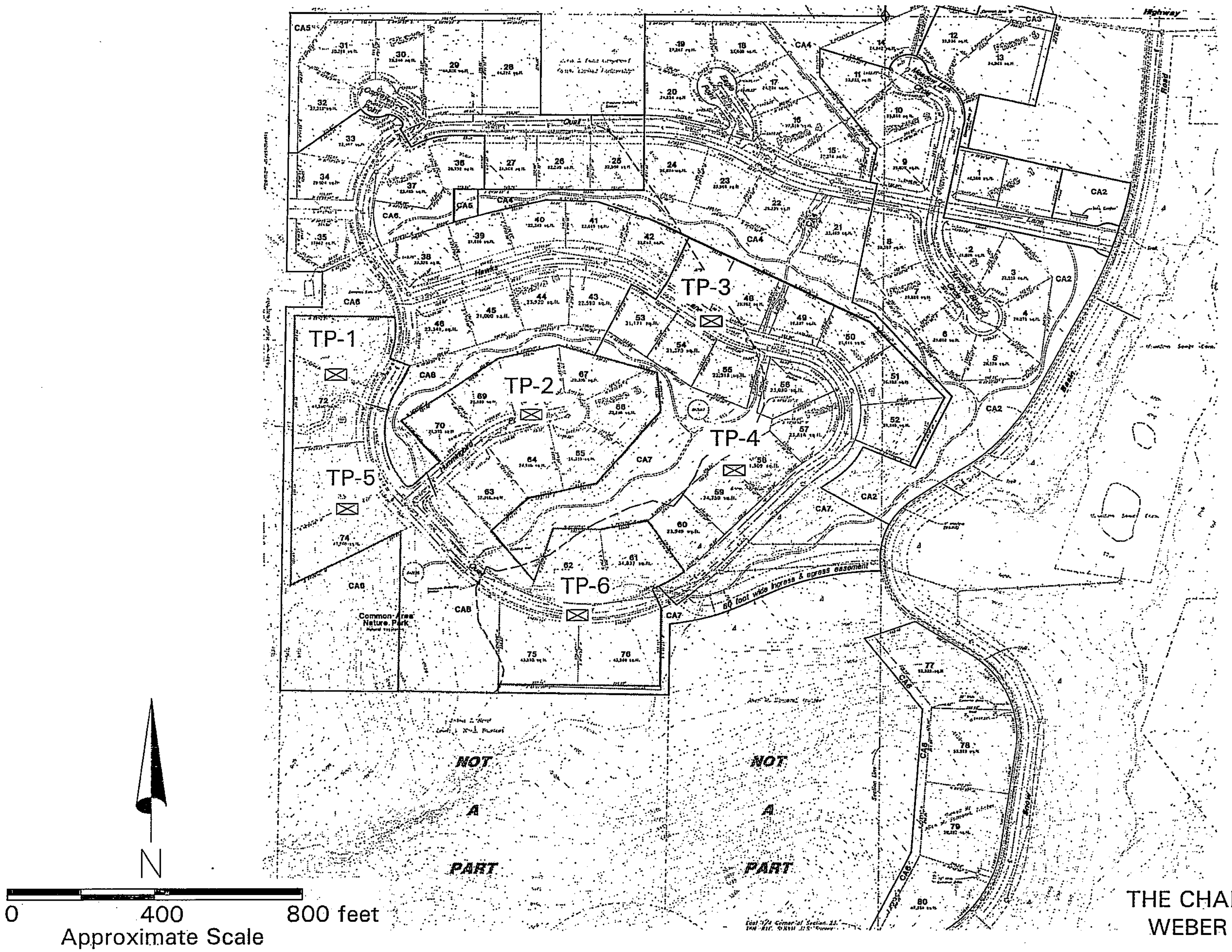
Reviewed by Scott D. Anderson, P.E.

DRH/dc

REFERENCES CITED

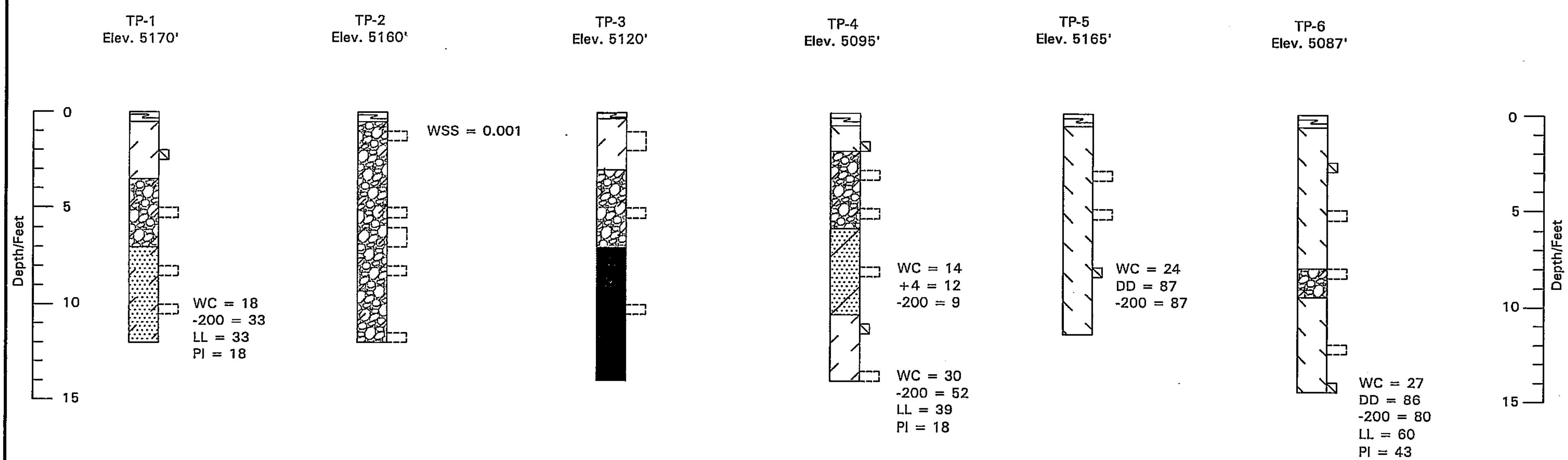
Black, B.D., Hecker, S., Hylland, M.D., Christenson, G.E., and McDonald, G.N., 2003; Quaternary fault and fold database and map of Utah; Utah Geological Survey Map 193DM.

International Building Code, 2012; International Code Council, Inc., Falls Church, Virginia.



THE CHALETS AT SKI LAKE
WEBER COUNTY, UTAH

1120924	AGEC Applied GeoTech	Locations of Test Pits	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 3 for Legend and Notes

1120924	AGEC Applied GeoTech	Logs of Test Pits	Figure 2

LEGEND:

- Topsoil; sandy lean clay to clayey sand, slightly moist to moist, dark brown, roots, organics.
- Sandy Lean Clay (CL); some gravel, some sand and gravel layers, stiff to very stiff, slightly moist to very moist, dark brown to brown.
- Fat Clay (CH); some sand and gravel, stiff to hard, slightly moist to moist, brown to dark brown to olive brown.
- Clayey Sand (SC); medium dense, moist, brown.
- Poorly-graded Sand with Silt (SP-SM); some gravel, medium dense, very moist, brown.
- Clayey Gravel with Sand (GC); occasional cobbles, medium dense, moist, brown.
- Siltstone bedrock, hard, slightly moist, grayish brown.
- Indicates relatively undisturbed hand drive sample taken.
- Indicates disturbed sample taken.

NOTES:

1. Test pits were excavated on July 9, 2013 with a rubber-tired backhoe.
2. Locations of test pits were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of test pits were determined by interpolating between contours shown on the site plan provided.
4. The test pit locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between the materials shown on the test pit logs represent the approximate boundaries between material types and the transitions may be gradual.
6. No free water was encountered in the test pits at the time of excavation.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   +4 = Percent Retained on the No. 4 Sieve;
   -200 = Percent Passing No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%);
   WSS = Water Soluble Sulfates (%).

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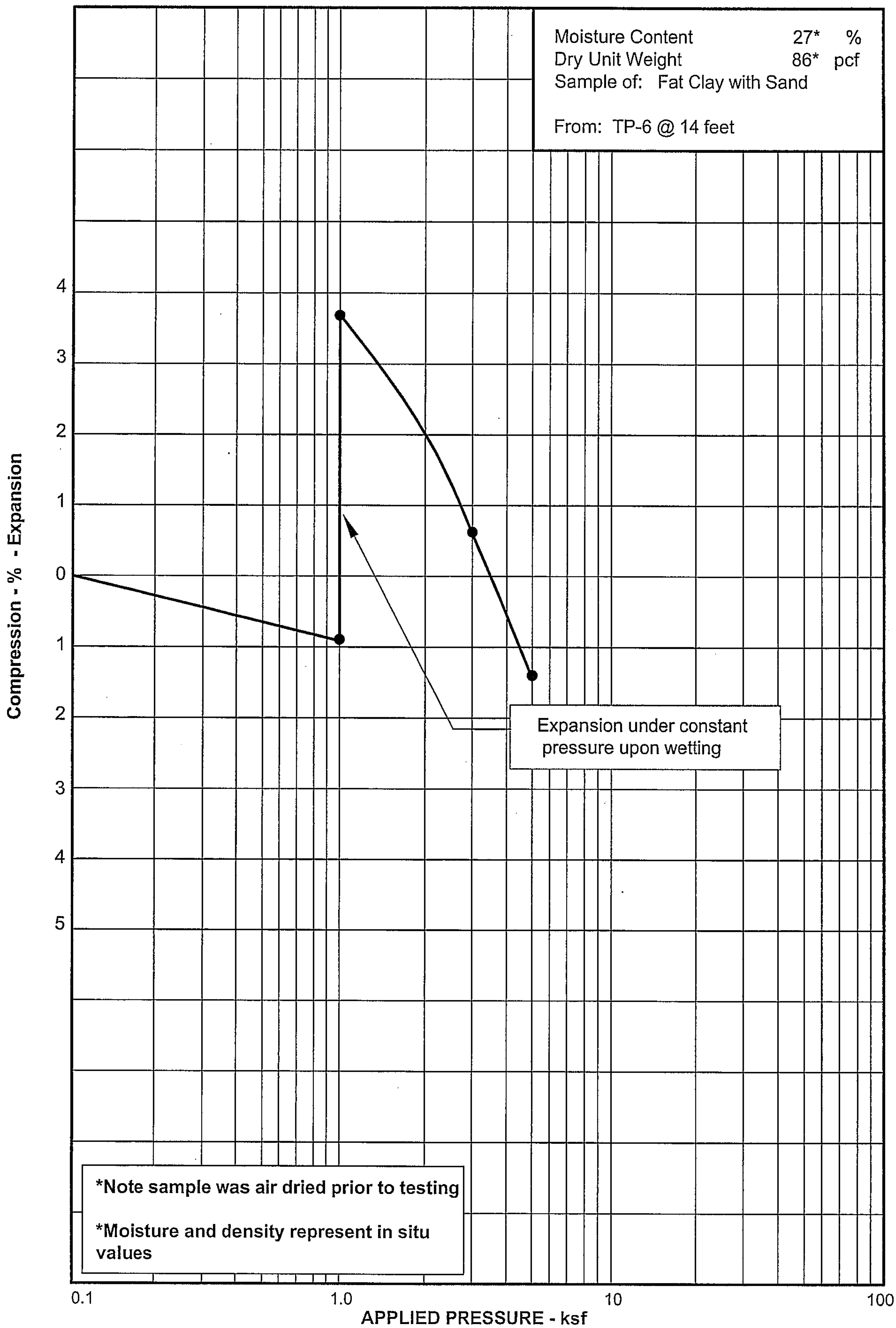

Project No. 1120924 **CONSOLIDATION TEST RESULTS** **Figure 4**

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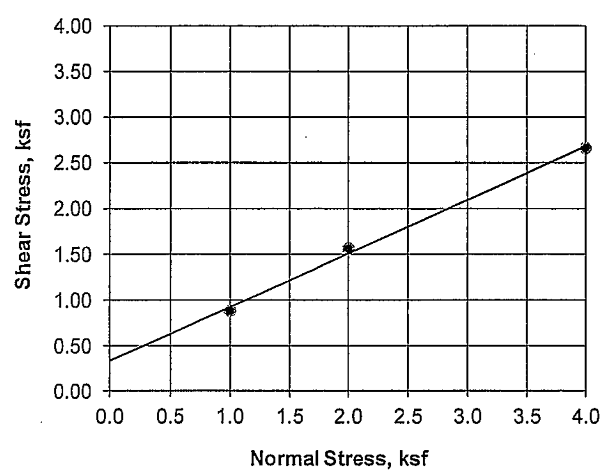
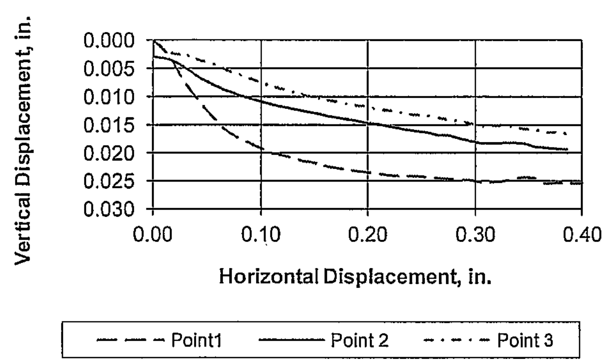


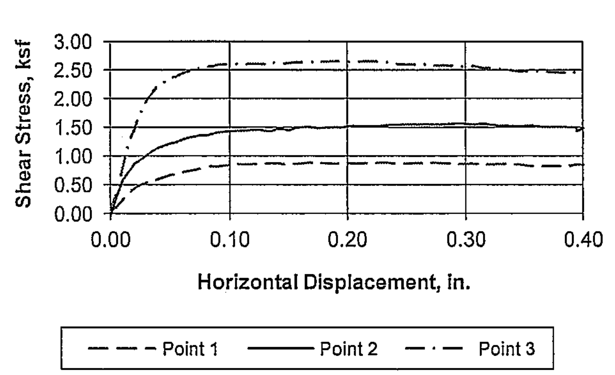
c = 340 psf ϕ = 30 °
Strength Parameters were determined from linear regression of the PEAK shear stress values

Project and Sample Information	
Project Number	1120924
Project Name	Chalet
Sample Identification	TP-5 @ 8'
Sample Description	Fat Clay



Test No. (Symbol)	1 (▲)	2 (■)	3 (●)
Test Type	Consolidated Drained Wetted		
Sample Type	Undisturbed		
Length, in.	0.98	0.98	0.98
Diameter, in.	1.93	1.93	1.93
Dry Density, pcf	77.6	90.5	93.7
Moisture Content, %	23.9	23.9	23.9
Consol. Load, ksf	1.0	2.0	4.0
Normal Load, ksf	1.0	2.0	4.0
Shear Stress, ksf	0.88	1.56	2.66
Rate of Strain	.005 in/min		

Each sample point was wetted when not loaded and allowed to soak for two days.
After the two days, the normal load was applied and the sample point was allowed to consolidate.
After consolidation, each sample point was sheared.



Average Sample Properties	
Dry Density, pcf	87
Moisture Content, %	24
Liquid Limit, %	-
Plasticity Index, %	-
Percent Gravel	-
Percent Sand	-
Percent passing No. 200 Sieve	87

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TABLE I
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1120924

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	WATER SOLUBLE SULFATE (%)	SAMPLE CLASSIFICATION
TEST PIT	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
TP-1	10	18				33	33	18			Clayey Sand (SC)
TP-2	0									0.001	Clayey Gravel with Sand (GC)
TP-4	8	14		12	79	9					Poorly Graded Sand with Silt (SP-SM)
	13½	30				52	39	18			Sandy Lean Clay (CL)
TP-5	8	24	87			87					Fat Clay (CH)
TP-6	14	27	86			80	60	43			Fat Clay with Sand (CH)