AGEC
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GEOTECHNICAL INVESTIGATION

PROPOSED SUMMIT AT SKI LAKE
PHASES 12 AND 13

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. 1130917 **NOVEMBER 13, 2013**

600 West Sandy Parkway • Sandy, Utah 84070 • (801) 566-6399 • FAX (801) 566-6493

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EXECUTIVE SUMMARY

1. The subsurface materials encountered at the site consist of approximately 1 foot of topsoil overlying clay. Silty sand was encountered in TP-1 at a depth of approximately 3 feet and extends to sandstone bedrock at a depth of approximately 8 feet. The clay in Test Pit TP-2 is silty and extends to a depth of approximately 5 feet. Sandstone bedrock was encountered below the clay and is underlain by claystone bedrock at a depth of approximately 10 feet. The clay in Test Pit TP-3 extends to a depth of approximately 3 feet. Sandstone bedrock was encountered below the clay and is underlain by claystone bedrock at a depth of approximately 5 feet. The clay in Test Pit TP-4 is silty below a depth of approximately 3 feet and is underlain by sandstone bedrock at a depth of approximately 6½ feet. Claystone bedrock was found below the sandstone bedrock at a depth of approximately 9 feet.

   Practical excavation equipment refusal was encountered in the bedrock at depths of approximately 11, 13, 10 and 9½ feet in Test Pits TP-1 through TP-4, respectively.

2. No subsurface water was encountered in the test pits at the time of our field study. We anticipate that some perched water conditions may develop during the wet times of the year or in the spring when the snow melts.

3. The higher plastic clay and claystone bedrock are moisture-sensitive (expansive). Additional subsurface investigation should be considered to better define the depth and extent of expansive clay and claystone bedrock at the site. The expansive soil and bedrock in their present condition are not suitable for support of conventional spread footing foundations. It appears that claystone bedrock underlies most of Phase 12 and a deep foundation system will be needed for houses in this area. There may not be claystone bedrock in the Phase 13 area at a depth where it would be a concern but additional study is recommended to determine subsurface conditions in this area. Houses to be constructed in the area of expansive clay or claystone bedrock 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 or bedrock remains below the floor with adequate gaps provided below structural floors to accommodate soil or bedrock expansion. Alternatively, where practical, the expansive soil and bedrock can be removed from below the proposed buildings and a conventional spread footing foundation system may be used.

   Lot specific geotechnical studies are recommended to determine the recommended foundation type for each house at the site.

Executive Summary (continued)

4. 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 sandstone bedrock 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.

5. 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.

6. 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.

7. 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 Summit at Ski Lake Subdivision Phases 12 and 13 located at Via Cortina 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 proposal dated October 11, 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, the site consisted of undeveloped hillside. A portion of the proposed roadway had been cleared of vegetation. Silt fences had been installed at the site. There are some grade stakes and lot corner stakes in portions of the site.

The ground surface generally slopes down toward the north but the grade slopes down to the east on the east side of the property and down to the west on the west side of the property. The general topography of the site is presented on Figure 1.

Vegetation at the site consists of grass and brush with some trees, primarily in the east half of Phase 13 and the eastern portion of Phase 12.

There is undeveloped land to the south, east and west of the site and several houses to the north of the site.

FIELD STUDY

The field study was conducted on October 28, 2013. Four test pits were excavated at the approximate locations indicated on Figure 1 using a tracked excavator. Tree cover and weather did not allow for excavation of two test pits planned in the central and western portions of Phase 13. The test pits were logged and soil and bedrock samples were obtained by a representative 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 subsurface materials encountered at the site consist of approximately 1 foot of topsoil overlying clay. Silty sand was encountered in TP-1 at a depth of approximately 3 feet and extends to sandstone bedrock at a depth of approximately 8 feet. The clay in Test Pit TP-2 is silty and extends to a depth of approximately 5 feet. Sandstone bedrock was encountered below the clay and is underlain by claystone bedrock at a depth of approximately 10 feet. The clay in Test Pit TP-3 extends to a depth of approximately 3 feet. Sandstone bedrock was encountered below the clay and is underlain by claystone bedrock at a depth of approximately 5 feet. The clay in Test Pit TP-4 is silty below a depth of approximately 3 feet and is underlain by sandstone bedrock at a depth of approximately 6½ feet. Claystone bedrock was found below the sandstone bedrock at a depth of approximately 9 feet.

Practical excavation equipment refusal was encountered in the bedrock at depths of approximately 11, 13, 10 and 9½ feet in Test Pits TP-1 through TP-4, respectively.

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

Topsoil - The topsoil consists of lean clay. It is slightly moist, dark brown and contains roots and organics.

Lean Clay - The clay contains some fat clay layers. It is stiff to very stiff, slightly moist to moist and brown to dark brown with occasional roots.

Laboratory tests performed on a sample of the clay indicate that it has a natural moisture content of 12 percent and a natural dry density of 105 pounds per cubic foot (pcf). Results of a consolidation test indicate that it will compress a small to moderate amount with the addition of light to moderate loads. The sample of clay tested was found to be sensitive to changes in moisture content (expansive). The sample of clay was measured to swell 1.9 percent under a pressure of 1,000 psf when wetted. Results of the consolidation test are presented on Figure 4.

Silty Clay - The clay contains some sand layers. It is stiff to very stiff, slightly moist to moist and brown.

Laboratory tests performed on samples of the silty clay indicate that it has a natural moisture content of 9 percent.

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

Sandstone Bedrock - The bedrock is hard, slightly moist and brown.

Laboratory tests performed on a sample of the sandstone bedrock indicate that it has a natural moisture content of 9 percent.

Claystone Bedrock - The claystone bedrock contains some siltstone layers. It is hard, slightly moist and brown.

Laboratory tests performed on a sample of the claystone bedrock indicate that it has a natural moisture content of 25 percent.

Results of the laboratory tests are summarized on Table I and are included on the logs of the test pits.

SUBSURFACE WATER

No subsurface water was encountered in the test pits at the time of excavation. We anticipate that perched water conditions will develop during the wet time of the year and as snow melts during the spring and early summer.

PROPOSED CONSTRUCTION

We understand that the property is planned to be subdivided for residential construction. We anticipate that buildings will be one to three-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 ten delivery and two garbage trucks per week.

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 sandstone bedrock 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, unsuitable 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 or bedrock 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. Materials

Materials placed as fill to support foundations should be non-expansive granular soil. The natural sand and sandstone 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, clay and bedrock 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

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 higher plastic clay and claystone bedrock are moisture-sensitive (expansive). Additional subsurface investigation should be considered to better define the depth and extent of expansive clay and claystone bedrock at the site. The expansive soil and bedrock in their present condition are not suitable for support of conventional spread footing foundations. It appears that claystone bedrock underlies most of Phase 12 and a deep foundation system will be needed for houses in this area. There may not be claystone bedrock in the Phase 13 area at a depth where it would be a concern but additional study is recommended to determine subsurface conditions in this area. Houses to be constructed in the area of expansive clay or claystone bedrock 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 or bedrock remain below the floor with adequate gaps provided below structural floors to accommodate soil or bedrock expansion. Alternatively, where practical, the expansive soil and bedrock can be removed from below the proposed buildings and a conventional spread footing foundation system may be used.

Lot specific geotechnical studies are recommended to determine the recommended foundation type for each house at the site.

2. Bearing Pressures

The allowable bearing pressure will depend on the results of the site specific studies and can be provided once those studies are completed.

3. Frost Depth

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

C. Lateral Earth Pressures

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on the natural soil, bedrock or on compacted structural fill is controlled by sliding resistance between the footing and the foundation soils or bedrock. A friction value of 0.35 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

- 24 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 0.32g 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.

D. Subsurface Drains

Perched water conditions may develop during the wet time of the year or as snow melts during the spring and early summer. 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.

E. 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	0.83g
c.	One Second Period Spectral Response Acceleration, S_1	0.28g

* *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 7.3 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.

F. Water Soluble Sulfates

Previous testing in the area indicates the soil and bedrock in the area possess negligible sulfate attack potential on concrete. No special cement type is required for concrete placed in contact with the natural soil or bedrock. Other conditions may dictate the type of cement to be used in concrete for the project.

G. 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 generally consists of clay. 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, INC.

LICENSED PROFESSIONAL ENGINEER
11/13/13
No. 280053
DOUGLAS R. HAWKES
STATE OF UTAH

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

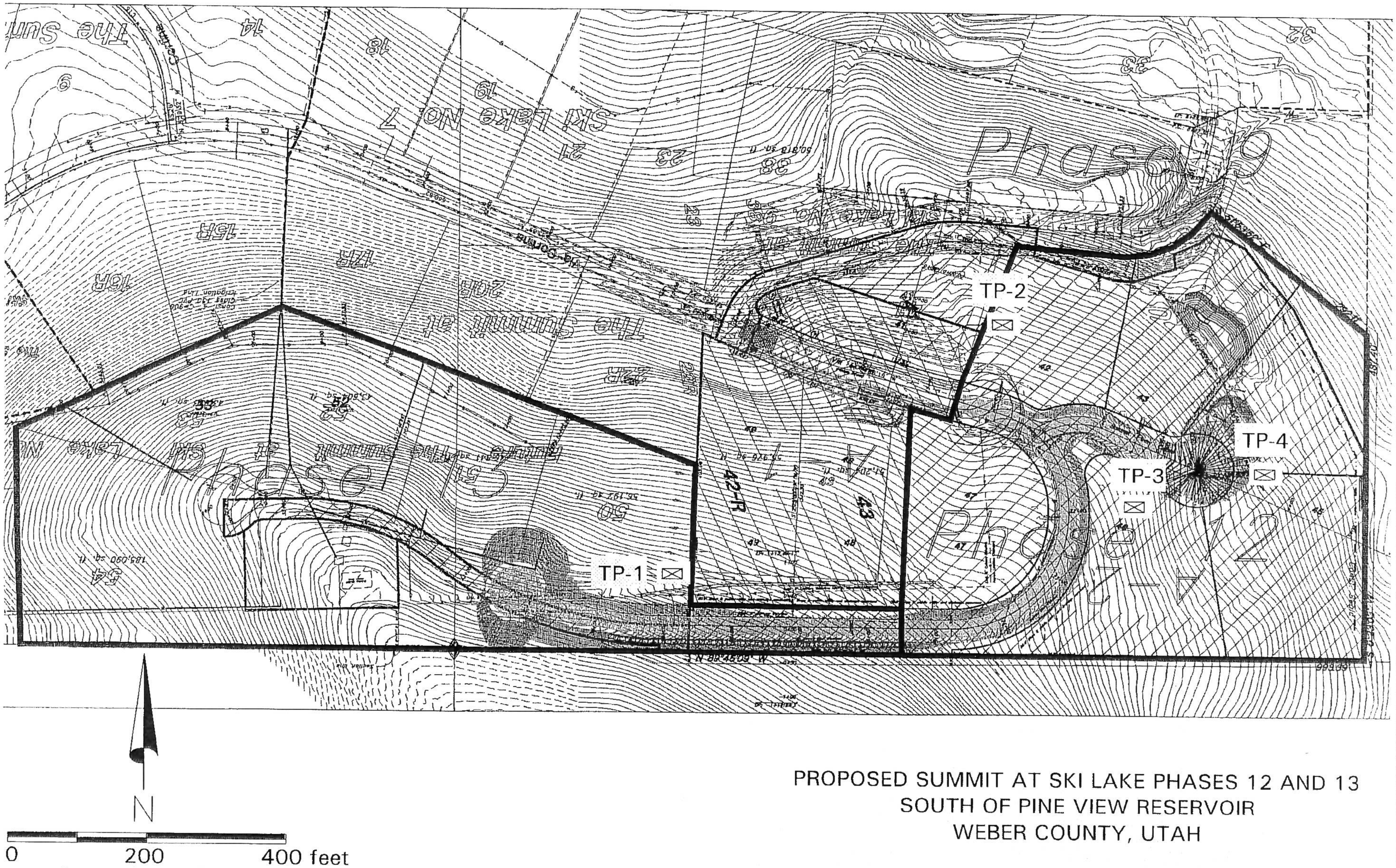
Reviewed by Scott D. Anderson, P.E.

DRH/rs

REFERENCES

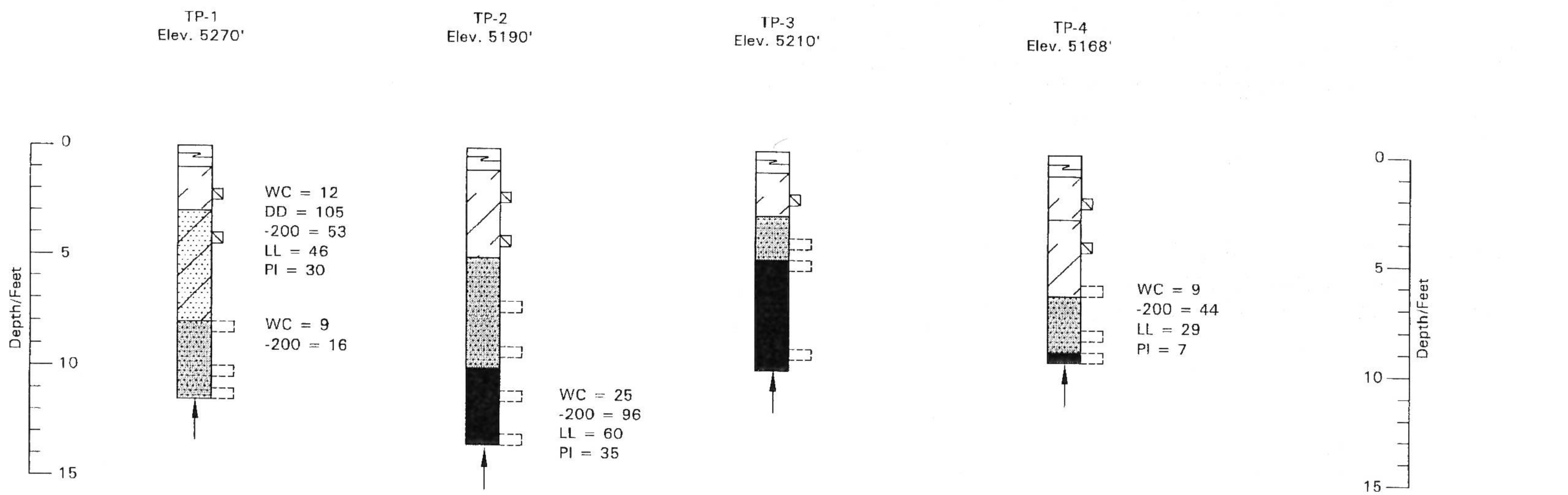
Black, B.D., Hecker, S., Hylland, M.D., Christenson, G.E., and McDonald, G.N., 2003; Quaternary fault and fold database and map of Utah; Utah Geological Survey Map 193DM.

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



PROPOSED SUMMIT AT SKI LAKE PHASES 12 AND 13
SOUTH OF PINE VIEW RESERVOIR
WEBER COUNTY, UTAH

1130917	AGEC Applied GeoTech	Locations of Test Pits	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 3 for Legend and Notes

1130917	AGEC Applied GeoTech	Logs of Test Pits	Figure 2

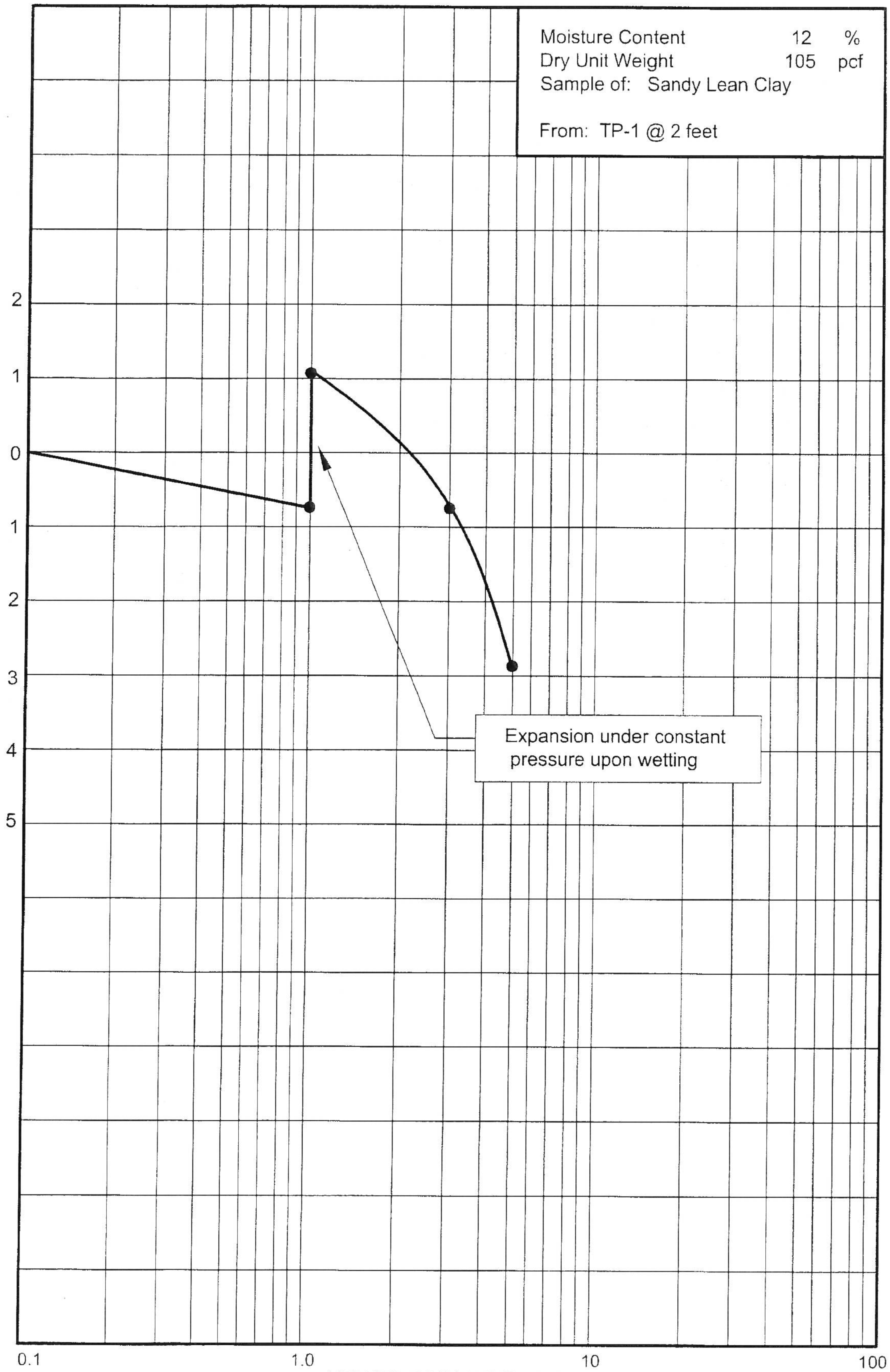
LEGEND:

	Topsoil; lean clay, slightly moist, dark brown, roots, organics.
	Lean Clay (CL); some fat clay layers, stiff to very stiff, slightly moist to moist, brown to dark brown, occasional roots.
	Silty Clay (CL/ML); some sand layers, stiff to very stiff, slightly moist to moist, brown.
	Silty Sand (SM); medium dense, moist, brown.
	Sandstone Bedrock; hard, slightly moist, brown.
	Claystone Bedrock; some siltstone layers, hard, slightly moist, brown.
	Indicates relatively undisturbed hand drive sample taken.
	Indicates disturbed sample taken.
	Indicates practical excavation refusal.

NOTES:

1. Test pits were excavated on October 28, 2013 with a tracked excavator.
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);
   -200 = Percent Passing No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%).

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1130917

CONSOLIDATION TEST RESULTS

Figure 4

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1130917

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	2	12	105			53	46	30			Sandy Lean Clay
	8	9				16					Sandstone Bedrock
TP-2	11	25				96	60	35			Claystone Bedrock
TP-4	6	9				44	29	7			Silty Clayey Sand

AGEC
Applied GeoTech

November 21, 2013

Valley Investments, LLC
c/o Great Basin Engineering, Inc.
PO Box 150048
Ogden, UT 84415

Attention: Mark Babbitt
EMAIL: markb@greatbasinengineering.com

Subject: Waterline Thrust Blocks
Proposed Summit at Ski Lake Subdivision, Phases 12 and 13
Weber County, Utah
Project No. 1130917

Gentlemen:

Applied Geotechnical Engineering Consultants, Inc. was requested to provide an allowable bearing capacity for thrust blocks to be constructed along waterlines at the proposed Summit at Ski Lake subdivision, Phases 12 and 13 in Weber County, Utah.

Thrust block resistance may be calculated using the passive earth pressure condition with an equivalent fluid weight of 350 and 1,250 pounds per cubic foot for soil and competent bedrock, respectively. This assumes a ratio of horizontal displacement to height of thrust block of 0.01. A lower equivalent fluid weight should be used if less displacement is needed. An ultimate bearing pressure of 1,400 and 5,000 pounds per square foot for soil and bedrock, respectively may be used in design where the top of the thrust block extends at least 3 feet below final grade and the bottom of the thrust block extends at least 5 feet below final grade. These are ultimate values and an appropriate safety factor should be applied.

Thrust blocks should bear on the undisturbed natural soil or bedrock or on compacted granular fill that extends down to the undisturbed natural soil or bedrock. A coefficient of friction of 0.35 for clay and claystone bedrock and 0.45 for sand and sandstone bedrock or granular fill may be used between the concrete and the soil.

If you have questions or if we can be of further service, please call.

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

LICENSED PROFESSIONAL ENGINEER
11/21/13
No. 260053
DOUGLAS R. HAWKES
STATE OF UTAH

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

Reviewed by JRM, P.E.
DRH/rs
~~Enclosure~~

AGEC
Applied GeoTech

October 2, 2012

Great Basin Engineering
PO Box 150048
Ogden, UT 84415

Attention: Mark Babbitt
EMAIL: markb@gbenorth.com

Subject: Road Base Submittal
The Summit at Ski Lake No. 9
6800 East 1200 South
Huntsville, Utah
Project No. 1120742

Gentlemen:

Applied Geotechnical Engineering Consultants, Inc. was requested to review the gradation results for a sample of 1-inch minus recycled concrete base tested by Intermountain Testing Services. The remarks on the test indicate that the material is nonplastic. The gradation results meet the 2007 APWA recommendation for 1-inch base course and is suitable for use as base course for the project.

We previously reviewed a pit gradation for the 1-inch minus recycled base course and submitted our conclusions and recommendations in a letter dated September 18, 2012 under Project No. 1120742. As stated in the referenced letter, use of this base course could reduce the granular fill section needed below the asphaltic concrete surfacing by 2 inches.

If you have questions or if we can be of further service, please call.

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

LICENSED PROFESSIONAL ENGINEER
10/2/12
No. 260053
DOUGLAS R. HAWKES
STATE OF UTAH

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

Reviewed by JRM, P.E.
DRH/dc

AGEC

Applied GeoTech

September 18, 2012

Great Basin Engineering
PO Box 150048
Ogden, UT 84415

Attention: Mark Babbitt
EMAIL: markb@gbenorth.com

Subject: Road Base
The Summit at Ski Lake No. 9
6800 East 1200 South
Huntsville, Utah
Project No. 1120742

Gentlemen:

Applied Geotechnical Engineering Consultants, Inc. was requested to provide our professional opinion concerning the use of road base in place of 4-inch minus subbase material for a road section.

Road base that meets the American Public Works Association (APWA) specifications provides good load carrying capacity, drainage and stability for a road section. This material typically consists of angular particles that are well-graded and will generally have a California Bearing Ratio (CBR) of 50 or greater. Granular borrow or 4-inch minus subbase material is typically a lower quality material with less stringent gradation criteria, rounded to subrounded particles and generally providing a CBR on the order of 20. Thus, its load carrying capacity would be less than that for road base.

The greater CBR for the road base, compared to the 4 inch minus subbase material means that the road base will provide greater load carrying capacity. Road base used in place of 4-inch minus subbase would allow for the combined road base and subbase material thickness to be reduced by 2 inches for the same support capacity.

The gradation results for the base course to be used for The Summit at Ski Lake No. 9 project indicates that this material will meet the APWA gradation specifications. No information is provided on the test sheet concerning the plasticity index of the material, the amount of fracture faces of the aggregate or CBR.

It is our professional opinion that the road base could be used in place of 4-inch subbase material which would provide greater support capacity for the pavement section. Providing a road base thickness that is 2 inches less than the combined road base and 4-inch minus subbase section would provide a similar support capacity to that of the road base and 4-inch minus subbase combined section.

If you have questions or if we can be of further service, please call.

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

LICENSED PROFESSIONAL ENGINEER
9/18/12
No. 260053
DOUGLAS R.
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STATE OF UTAH

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

Reviewed by JRM, P.E.
DRH/dc