AGEC
Applied GeoTech

PROPOSED SUMMERSET FARMS, PHASE 1

APPROXIMATELY 3750 WEST 2300 SOUTH

TAYLOR, WEBER COUNTY, UTAH

PREPARED FOR:

ED GREEN DEVELOPMENT, INC.
2150 NORTH VALLEY VIEW DRIVE
LAYTON, UTAH 84040

ATTENTION: ED GREEN

PROJECT NO. 1190435 **JUNE 18, 2019**

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EXECUTIVE SUMMARY

1. Approximately 1 to 2 feet of fill (plowed soil) was encountered in the upper portion of the test pits. Natural silty sand was encountered below the fill and extends the full depth investigated in the test pits. Occasional layers of silt and lean clay were encountered below a depth of approximately 8 feet. The sand extends the maximum depth investigated, approximately 12 feet.

2. Water was encountered at depths ranging from approximately 3½ to 5 feet when checked 5 days after excavation.

3. Approximately 1 to 2 feet of fill (plowed soil) was encountered in the upper portion of the test pits. Unsuitable fill, debris, organics and other deleterious material should be removed from below proposed structures, pavements and other settlement-sensitive improvements.

4. The proposed residences may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil. Footings bearing on the undisturbed natural soil may be designed using an allowable net bearing pressure of 1,200 pounds per square foot (psf). Footings bearing on at least 2 feet of properly compacted structural fill extending down to the undisturbed natural soil may be designed using an allowable net bearing pressure of 2,000 psf.

5. The site is located in an area mapped as having a "high" liquefaction potential (Anderson and others, 1994). The soil type most susceptible to liquefaction during a large magnitude earthquake is loose, clean sand below the water level. Sand was encountered below the water level, but test pits are not deep enough and do not provide sufficient information to evaluate liquefaction potential. Liquefaction may be a potential hazard at this site. A site-specific liquefaction study that includes investigation to a greater depth would be needed to evaluate the liquefaction potential at the site. Such a study is beyond the scope of this report.

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

SCOPE

This report presents the results of a geotechnical investigation for the proposed Summerset Farms, Phase 1 subdivision to be located at approximately 3750 West 2300 South in Taylor, Weber County, Utah. The report presents the subsurface conditions encountered, laboratory test results and recommendations for foundation support and pavement. The study was conducted in general accordance with our proposal dated July 27, 2018. The client did not request a site-specific liquefaction analysis for this site.

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 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

The site consists of an undeveloped 3-acre parcel. There are no permanent structures or pavements at the site. At the time of our investigation, the site was being used for agricultural purposes. The south portion of Phase 1 had been recently planted.

The ground surface at the site is relatively flat with a gentle slope down to the northwest. There is approximately 10 feet of elevation difference (southeast to northwest) across the site.

There is a residential subdivision with one and two -story wood-framed structures with partial-depth basements to the north. There are agricultural fields to the east, south and west of the site.

FIELD STUDY

The field study was conducted on June 5, 2019. Three test pits were excavated at the approximate locations indicated on Figure 1 using a client-provided backhoe. 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.

The test pits were backfilled with the excavated material without significant compaction. The backfill in the test pits should be removed and properly compacted where it will support the proposed structures, floor slabs, pavements or other site improvements.

SUBSURFACE CONDITIONS

Approximately 1 to 2 feet of fill (plowed soil) was encountered in the upper portion of the test pits. Natural silty sand was encountered below the fill and extends the full depth investigated in the test pits. Occasional layers of silt and lean clay were encountered below a depth of approximately 8 feet. The sand extends the maximum depth investigated, approximately 12 feet.

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

Fill - The fill consists primarily of plowed soil consisting of silty sand. The fill is slightly moist to moist, mottled and brown to dark brown.

Silty Sand - The sand contains a small to moderate amount of silt and some clayey sand. Occasional layers of silt and lean clay were encountered below a depth of approximately 8 feet. It is loose to medium dense, moist to wet and light to dark brown with some iron oxide staining.

Laboratory tests conducted on samples of the sand indicate that it has natural moisture contents ranging from 20 to 28 percent and natural dry densities ranging from 95 to 106 pcf.

Results of the laboratory tests are summarized on Table I and are included on the logs of exploratory test pits, Figure 2.

SUBSURFACE WATER

Slotted PVC pipe was installed in the test pits to facilitate measurement of the subsurface water level at the site. Water was encountered at depths ranging from approximately 3½ to 5 feet when checked 5 days after excavation. Fluctuations in the water level will occur over time. Water levels are expected to be highest in the spring and summer and lowest in the fall and winter. An evaluation of such fluctuations is beyond the scope of this report.

PROPOSED CONSTRUCTION

We understand that Phase 1 of the development is planned to be subdivided into 17 single-family residential building lots. The proposed residences are planned to be two to three-story, wood-framed structures with the potential for basements. We have assumed building loads will consist of wall loads up to 3 kips per lineal foot and column loads up to 50 kips based on typical residential construction in the area.

We understand that roads are planned to be constructed into the proposed development. We anticipate that traffic will consist primarily of relatively light passenger vehicles, occasional light delivery trucks and two garbage trucks per week.

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

RECOMMENDATIONS

Based on the subsurface conditions, our understanding of the proposed construction and our experience in the area, the following recommendations are given:

A. Site Grading

We anticipate that relatively small amounts of grade change (less than 3 feet) will be needed to facilitate construction at the site. Fill placed to raise grade for the project should be placed as soon as possible prior to building construction.

1. Existing Fill

   Approximately 2 feet of fill (plowed soil) was encountered in the upper portion of test pits. The unsuitable fill, debris, organics and other deleterious material should be removed from below proposed structures, pavements and other settlement-sensitive improvements.

2. Pavement Subgrade Preparation

   Subgrade areas should be proof-rolled prior to fill placement to identify soft areas. Soft areas should be removed and replaced with gravel containing less than 15 percent passing the No. 200 sieve. If the subgrade consists of very moist to wet clay or silt, the subgrade should not be proof-rolled

but cut to the undisturbed natural soil below existing fill, topsoil and other deleterious materials and a sufficient thickness of gravel placed to provide construction equipment access.

3. Excavation

Excavation at the site can be accomplished with typical excavation equipment. Consideration should be given to using excavation equipment with a flat cutting edge when excavating for building foundations, to minimize disturbance of the bearing soil.

Excavations that extend to very moist soil near the groundwater level will require the use of excavation equipment supported from outside and above excavations. If excavations extend below the water level, care should be taken to dewater the excavations. The water level should be maintained below the base of the excavation during placement of fill and concrete. Free-draining gravel with less than 5 percent passing the No. 200 sieve should be used for fill or backfill below the original water level. Consideration should be given to using a support fabric above the subgrade prior to placement of free-draining material.

4. Materials

Materials used as fill for the project are anticipated to consist of imported fill and the on-site soil. Recommendations for these materials are shown below.

a. Imported Fill

Listed below are materials recommended for imported structural fill:

Fill Location	Recommendation
Below Foundation	Non-expansive granular soil Passing the No. 200 Sieve <35% Liquid Limit < 30% Maximum size 4 inches
Below Floor Slabs (Upper 4 inches)	Non-e Sand and/or Gravel Passing the No. 200 Sieve <5% Maximum size 2 inches
Below Floor Slabs (Deeper than 4 inches)	Non-expansive granular soil Passing the No. 200 Sieve <50% Liquid Limit < 30% Maximum size 6 inches
Base Course (Pavement Areas)	Utah Department of Transportation Specification

Free-draining gravel with less than 5 percent passing the No. 200 sieve should be used as fill and backfill below the original water level.

b. On-site Soil

The natural soil consists predominantly of sand. Sand meeting the criteria above may be considered for use as fill below structures. Silt and clay are not recommended for use as structural fill below the proposed buildings, but may be considered for use as utility trench backfill or below the pavement section. The on-site soil may also be used in landscape areas.

Prior to using the on-site soil as fill, topsoil, organic material, and other deleterious material should be removed.

Depending on the moisture content of the soil at the time of construction, the soil may require wetting or drying prior to use as fill. Drying of the soil may not be practical during cold or wet times of the year.

5. 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	≥ 90%
Pavement	
Base Course	≥ 95%
Fill placed below Base Course	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 - 90%

The moisture of the fill should be adjusted to within 2 percent of the optimum moisture content to facilitate compaction.

Fill and pavement materials placed for the project should be frequently tested for compaction. Fill should be placed in thin enough lifts to allow for proper compaction.

6. Drainage

The ground surface surrounding the proposed buildings should be sloped away from the buildings in all directions. Roof down spouts and drains should discharge beyond the limits of backfill.

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

With the proposed construction and the subsurface conditions encountered, the proposed buildings may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil. Structural fill should extend out away from the edge of footings at least a distance equal to the depth of fill beneath the footings.

Topsoil, organics, unsuitable fill, debris and other deleterious materials should be removed from below proposed footing areas.

2. Bearing Pressure

Foundations bearing on the undisturbed natural soil may be designed using an allowable net bearing pressure of 1,200 pounds per square foot (psf). Footings bearing on at least 2 feet of properly compacted structural fill extending down to the undisturbed natural soil may be designed using an allowable net bearing pressure of 2,000 psf.

Footings should have a minimum width of 1½ feet and a minimum depth of embedment of 1 foot.

3. Settlement

We estimate that settlement will be less than ¾ inch for footings designed as indicated above. Differential settlement is estimated to be on the order of ½ of an inch or less.

Disturbance of the soil below foundations can result in greater settlement. Care should be taken to minimize disturbance of the soil to remain below foundations so that settlement can be maintained within tolerable limits.

4. Temporary Loading Conditions

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

5. Frost Depth

Exterior footings and footings beneath unheated areas should be placed at least 30 inches below grade for frost protection.

6. Foundation Base

The base of foundation 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 Slabs on Grade

1. Slab Support

Concrete slabs may be supported on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil.

Topsoil, unsuitable fill, organics, debris and other deleterious materials should be removed from below proposed floor slabs.

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 concrete slabs for ease of construction and to promote even curing of the slab concrete.

D. Lateral Earth Pressures

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on compacted structural fill or the natural soil is controlled by sliding resistance developed between the footing and the structural fill or natural soil. Friction values of 0.4 may be used in design for ultimate lateral resistance for footings bearing on the natural sand.

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

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 30 pcf for the active condition and 15 pcf for the at-rest condition. The equivalent fluid weight should be decreased by 30 pcf for the passive condition. This assumes a horizontal ground acceleration of 0.50g, which

represents a 2 percent probability of exceedance in a 50-year period (IBC, 2018).

4. Safety Factors

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

E. Seismic, Faulting and Liquefaction

1. Seismicity

Listed below is a summary of the site parameters for the International Building Code 2018:

a.	Site Class	D*
b.	Short Period Spectral Response Acceleration, S_S	1.23g
c.	One Second Period Spectral Response Acceleration, S_1	0.41g

* Site Class F may be representative of the soil profile if liquefaction is found to be significant.

2. Faulting

There are no mapped active faults extending near or through the project site. The closest mapped fault, considered to be active, is the Wasatch fault located approximately 6.9 miles northeast of the site (UGS, 2019).

3. Liquefaction

The site is located in an area mapped as having a "high" liquefaction potential (Anderson and others, 1994). The soil type most susceptible to liquefaction during a large magnitude earthquake is loose, clean sand below the water level. Sand was encountered below the water level, but test pits

are not deep enough and do not provide sufficient information to evaluate liquefaction potential. Liquefaction may be a potential hazard at this site. A site-specific liquefaction study that includes investigation to a greater depth would be needed to evaluate the liquefaction potential at the site. Such a study is beyond the scope of this report.

F. Water Soluble Sulfates

One sample of the natural soil was tested in the laboratory for water soluble sulfate content. Results of the test 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. Sulfate resistant cement is not needed for concrete placed on contact with the natural soil. 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 near surface soil consists predominantly of silty sand. A CBR of 5 percent was used in the analysis which assumes a sand subgrade.

2. Pavement Thickness

   Based on the subsoil conditions encountered, assumed traffic conditions presented in the Proposed Construction section of this report, 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

6 inches of high quality base course is calculated. Alternatively, a rigid pavement section consisting of 5 inches of Portland cement concrete may be used.

3. Pavement Materials and Construction

a. Flexible Pavement (Asphaltic Concrete)

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

b. Rigid Pavement (Portland Cement Concrete)

The pavement thickness indicated 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 5,000 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 depth of joints should be approximately one-fourth of the slab thickness.

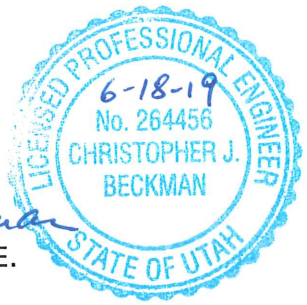
H. Preconstruction Meeting

A preconstruction meeting should be held with representatives of the owner, project architect, geotechnical engineer, general contractor, earthwork contractor and other members of the design team to review construction plans, specifications, methods and schedule.

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 the site plan, the data obtained from laboratory testing and our experience in the area. Variations in the subsurface conditions may not become evident until additional exploration or excavation is conducted. If the proposed construction, 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.



Christopher J. Beckman, P.E.

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

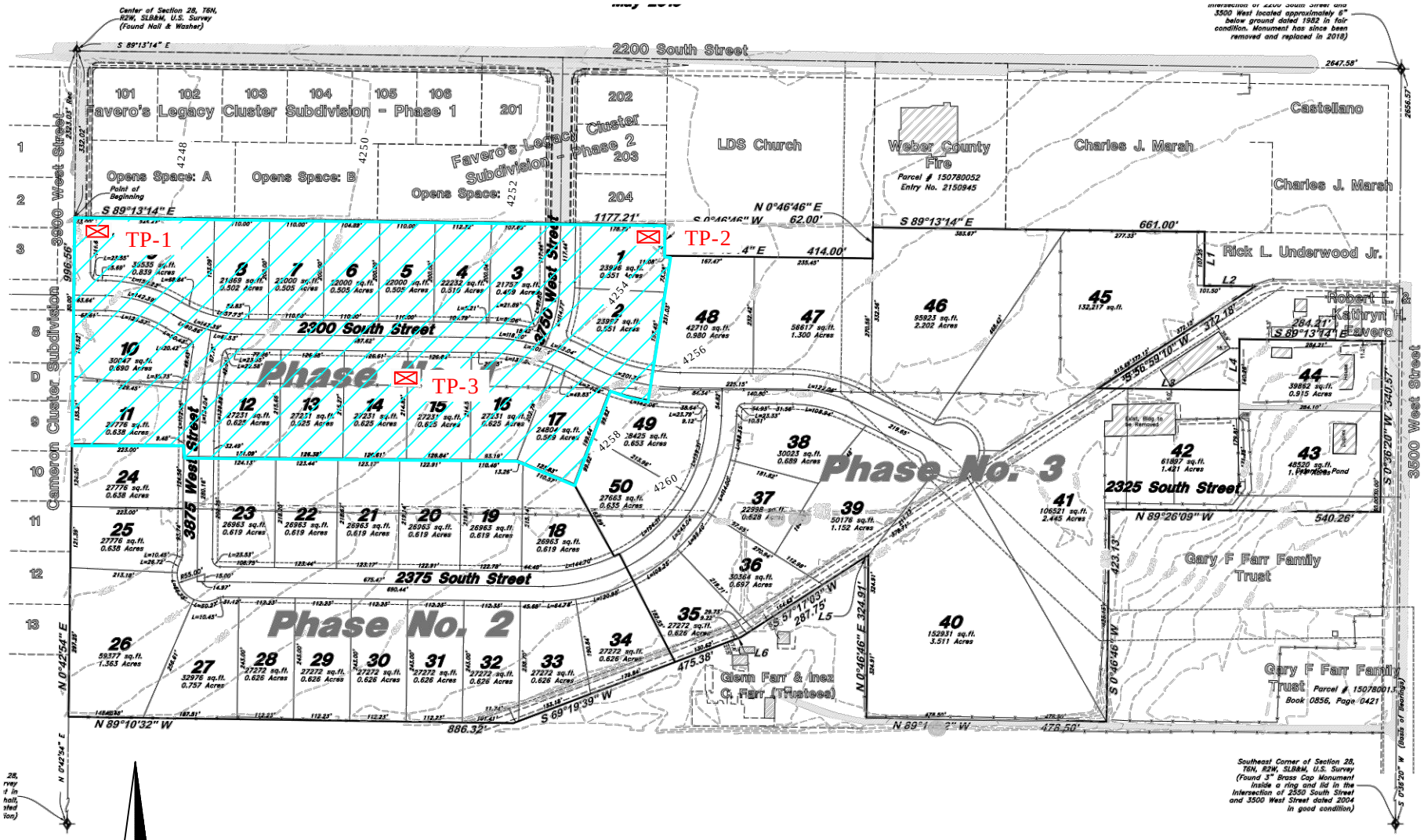
CJB/rs

REFERENCES

Anderson, L., Bay, J., Keaton, J.R., 1987; "Liquefaction Potential map for Weber County, Utah", Utah Geological Survey Contract Report 14-08-0001-22015.

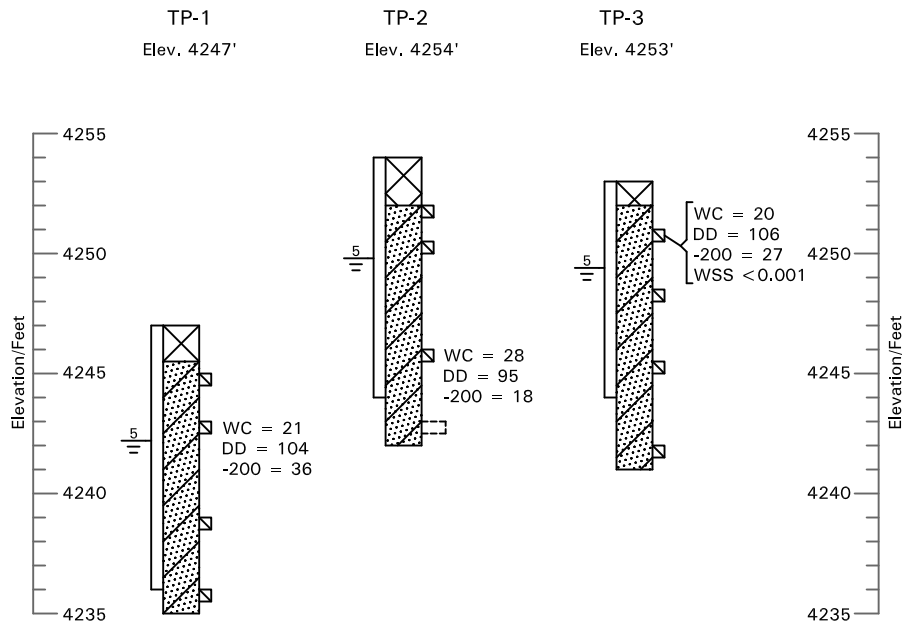
International Building Code, 2018; International Code Council, Inc., Falls Church, Virginia.

Utah Geological Survey, 2019; Utah Quaternary Fault and Fold Database, http://geology.utah.gov/resources/data-databases/qfaults/ Accessed June 6, 2019



SUMMERSET FARMS, PHASE 1
2300 SOUTH 3750 WEST
TAYLOR, WEBER COUNTY, UTAH

1190435	AGEC	Test Pit Locations	Figure 1



Approximate Vertical Scale 1" = 8'

LEGEND:

Fill; plowed soil, silty sand, slightly moist to moist, dark brown, some roots and organics.

Silty Sand (SM); small to moderate amounts of silt, occasional layers of silt and clay below approximately 8 feet, loose to medium dense, moist to wet, light to dark brown, some iron oxide staining.

Indicates relatively undisturbed hand drive sample taken.

Indicates disturbed sample taken.

5 Indicates the depth to free water and the number of days after excavation the measurement was taken.

NOTES :

1. The test pits were excavated on June 5, 2019 with a rubber-tired backhoe.
2. The locations of the test pits were measured by pacing from features shown on the site plan provided.
3. The elevations of the 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 materials shown on the test pit logs represent the approximate boundaries between materials and the transitions may be gradual.
6. The water level readings shown on the logs were made at the time and under the consitions indicated. Fluctuations in the water level will occur with time.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   -200 = Percent Passing the No. 200 Sieve;
   WSS = Water Soluble Sulfates (%).

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER: 1190435

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	4	21	104			36					Silty Sand (SM)
TP-2	8	28	95			18					Silty Sand (SM)
TP-3	2	20	106			27				<0.001	Silty Sand (SM)