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SOUTH JORDAN UTAH

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Requestor's Name: BRIAN ADAMS

Address: [redacted] City: SALT LAKE CITY

State: UT Zip: 84107 Daytime Phone: [redacted] Fax [redacted]

In accordance with the Governmental Records Access Management Act, I am seeking the following record(s) **specifically described as:** A COPY OF THE GEOTECH REPORT FOR the BECKSTEAD LANE SUBDIVISION

which I believe are collected, filed and/or used by the City of South Jordan, 1600 W. Towne Center Drive, South Jordan, Utah 84095 (801) 254-3742.

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B. C. Adams (signature)
Signature

1/8/15
Date

CITY'S RESPONSE TO RECORD REQUEST – FOR OFFICE USE ONLY

_____ APPROVED – Requestor notified on ________________, 20 ___

_____ DENIED – Written denial sent on ________________, 20 ___

_____ Requestor notified that this office does not maintain record; and, if known, was also notified of name and address of agency that does maintain record on ____________, 20 ___

_____ Extension of time for extraordinary circumstances. Required notice sent ________, 20 ___

COPY FEES: $ ________. If waived, approved by: ________________

Signature

Date

AGEC

Applied GeoTech

GEOTECHNICAL INVESTIGATION

BECKSTEAD LANE SUBDIVISION

11010 SOUTH BECKSTEAD LANE

SOUTH JORDAN, UTAH

PREPARED FOR:

CASTLEWOOD DEVELOPMENT
6740 SOUTH 1300 EAST, SUITE 200
SALT LAKE CITY, UTAH 84111

ATTENTION: JARED TURNBOW

PROJECT NO. 1140368 **MAY 30, 2014**

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. Approximately 1 foot and 3 feet of fill was encountered in the upper portion of Test Pits TP-1 and TP-3, respectively. The natural soil encountered below the fill and at the ground surface in the other test pits consists predominantly of lean clay. The clay extends the maximum depth investigated, approximately 16 feet.

2. No subsurface water was encountered in the test pits at the time of excavation to the maximum depth investigated, approximately 16 feet.

3. In our professional opinion, 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. Spread footings bearing on the natural soil may be designed using an allowable net bearing pressure of 2,000 pounds per square foot. Spread footings supported on at least 2 feet of compacted structural fill may be designed using an allowable net bearing pressure of 3,000 pounds per square foot.

4. The upper natural soil consists predominantly of clay. Placement of 1½ to 2 feet of granular fill may be needed to provide equipment access when the upper soil is very moist to wet.

5. 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 Beckstead Lane Subdivision at 11010 South Beckstead Lane (1600 West) in South Jordan, Utah. The report presents the subsurface conditions encountered, laboratory test results and recommendations for foundations. The study was conducted in general accordance with our proposal dated April 30, 2014.

Field exploration was conducted to obtain information on the subsurface conditions and to obtain samples for laboratory testing. Information obtained from the field and laboratory was used to define conditions at the site and to develop recommendations for the proposed foundations and pavements.

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

There is a commercial building in the northwest portion of the site (Parcel A on Figure 1). The building is two-story, slab on grade structure. Asphalt paved parking areas are located along the east, west and south sides of the building. The other areas of the site consist of undeveloped land.

The ground surface at the site is relatively flat with a gentle slope down to the southeast. Vegetation at the site consists of weeds and grass.

The property is bordered on the east and west by Beckstead Lane and Redwood Road, respectively. The site is bordered to the north by 11010 South street. There are several residences and garage structures southwest of the site. Undeveloped land extends southeast of the site.

FIELD STUDY

The field study was conducted on May 22, 2014. Four test pits were excavated at the approximate locations indicated on Figure 1 using a rubber-tired 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 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 buildings, floor slabs, pavement and other settlement sensitive surface improvements.

SUBSURFACE CONDITIONS

Approximately 1 foot and 3 feet of fill was encountered in the upper portion of Test Pits TP-1 and TP-3, respectively. The natural soil encountered below the fill and at the ground surface in the other test pits consists predominantly of lean clay. The clay extends the maximum depth investigated, approximately 16 feet.

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

> Fill - The fill consists of sandy lean clay and clayey gravel with sand. The fill is slightly moist, dark brown with some roots. The fill in Test Pit TP-3 contains some wood and plastic debris.

Lean Clay - The clay has moderate to high plasticity and is stiff to very stiff, slightly moist to moist and brown to gray.

Laboratory tests conducted on samples of the clay indicate that the natural moisture contents range from 12 to 26 percent and natural dry densities range from 91 to 97 pounds per cubic foot.

Consolidation tests conducted on samples of the clay indicate that the soil will compress a small to moderate amount with the addition of light to moderate loads. Results of the consolidation tests are presented on Figures 4 and 5.

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

SUBSURFACE WATER

No subsurface water was encountered in the test pits at the time of excavation to the maximum depth investigated, approximately 16 feet.

PROPOSED CONSTRUCTION

We understand that the site will be developed for single-family residences. We anticipate that the residences will consist of one to two-story, wood-frame structures with basements.

We have assumed building loads consisting 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 have assumed traffic for the roads consisting of 500 cars and occasional delivery truck per day and one garbage truck 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 our recommendations.

RECOMMENDATIONS

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

A. Site Grading

Site grading plans were not available at the time of our investigation. We anticipate that less than 3 feet of site grading fill may be placed at the site to facilitate construction. Site grading fill should be placed as soon as possible prior to building construction. If greater than 3 feet of site grading fill is placed over relatively large areas of the site, the settlement due to the load of the fill should be monitored to determine when building construction may proceed.

1. <u>Excavation</u>

   We anticipate that excavation can be accomplished with typical excavation equipment. Consideration should be given to using a smooth cutting edge for excavations in the fine grained soil to reduce the potential for disturbance of the soil to remain below the structures.

2. <u>Pavement Subgrade Preparation</u>

   Prior to placing site grading fill or base course, topsoil, organics, unsuitable fill, debris and other deleterious material should be removed.

   The upper approximately 9 inches of subgrade soil in pavement areas should be scarified, the moisture content adjusted to near the optimum moisture content and the soil compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557. Consideration should be given to having the subgrade observed by an engineer from AGEC.

The upper soil at the site consists primarily of clay. Access difficulties may be encountered when the upper fine-grained soil is very moist to wet. Increased difficulties can be expected during the winter or spring months or after periods of rainfall or irrigation. The subgrade should not be scarified under these conditions but the subgrade should be cut down to the natural soil and a sufficient thickness of gravel placed to provide construction equipment access. Generally, 1½ to 2 feet of gravel will provide limited support for moderately loaded rubber-tired construction equipment above very moist to wet fine-grained soils.

3. Materials

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

The on-site soil consists predominantly of clay. The clay is not recommended for use as structural fill but may be used as site grading fill, utility trench and wall backfill if the topsoil, organics, debris, and other deleterious material are removed or it may be used in landscaping areas.

The moisture of the upper soil is generally near or below the optimum moisture content. Moisture conditioning (wetting or drying) will likely be needed to facilitate proper compaction. Drying of the soil may not be practical during cold or wet periods of the year.

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	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 - 90%

Base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557.

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

Fill placed for the project should be frequently tested during construction for compaction. Fill should be placed in thin enough lifts to allow for proper compaction.

5. Drainage

The ground surface surrounding the proposed residences should be sloped away from the residences in all directions. Roof downspouts 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 residences may be supported on spread footings bearing on the natural soil or on structural fill. Structural fill should extend down to the natural soil and should extend out away from the edge of footings a distance at least equal to the depth of fill beneath footings.

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

2. Bearing Pressure

Spread footings bearing on the undisturbed natural soil may be designed using an allowable net bearing pressure of 2,000 psf. Spread footings supported on at least 2 feet of compacted structural fill may be designed using an allowable net bearing pressure of 3,000 psf.

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. <u>Settlement</u>

We estimate that total and differential settlement will be less than 1 inch for footings bearing on the natural soil or on compacted structural fill.

5. <u>Frost Depth</u>

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

6. <u>Foundation Base</u>

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

7. <u>Construction Observation</u>

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

C. Concrete Slab-on-Grade

1. <u>Slab Support</u>

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

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

2. <u>Underslab Sand and/or Gravel</u>

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

D. Lateral Earth Pressure

1. Lateral Resistance for Footings

Lateral resistance for 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 0.35 may be used in design for ultimate lateral resistance.

2. Subgrade Walls and Retaining Structures

The following equivalent fluid weights are given for the 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 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 34 pcf for the active condition and 19 pcf for the at-rest condition. The equivalent fluid weight should be decreased by 34 pcf for the passive condition. This assumes a horizontal ground acceleration of 0.54g which represents 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 the soil strength under active and passive conditions. Conventional safety factors used for structural analysis for such items as overturning and sliding resistance should be used in design.

E. Subsurface Drains

Although no subsurface water was encountered in test pits excavated for the project to the depth investigated, the International Residential Code indicates that structures with subgrade floors in areas of clay soil be protected with a subsurface perimeter drain.

F. Seismicity, Faulting and Liquefaction

1. Seismicity

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

a.	Site Class	D
b.	Short Period Spectral Response Acceleration, S_S	1.29g
c.	One Second Period Spectral Response Acceleration, S_1	0.43g

2. Faulting

There are no active faults mapped as extending through the area of the proposed development. The nearest mapped active fault is the Wasatch fault located approximately 5.8 miles southeast of the site (Salt Lake County, 2002).

3. Liquefaction

The site is located in an area mapped by Salt Lake County (2002) as having a "very low" liquefaction potential. The soil most susceptible to liquefaction is loose clean sand. The liquefaction potential for soil tends to decrease with an increase with an increase in fines content and density. Clay and soil above the free water level are not susceptible to liquefaction.

Based on the subsurface conditions encountered to the depth investigated and our understanding of geologic conditions in the area, it is our professional opinion that liquefaction is not a hazard for the site.

G. 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 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 subsurface conditions encountered, laboratory test results and the assumed traffic, the following pavement support recommendations are given:

1. Subgrade Support

   The near surface soil consists primarily of lean clay. A California Bearing Ratio (CBR) value of 3 percent was used in the analysis which assumes a clay subgrade.

2. Pavement Thickness

   Based on the subsoil conditions encountered at the site, assumed traffic as described in the Proposed Construction section of the 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. 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 given above 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 depth of 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
6-2-14
No. 264456
CHRISTOPHER J. BECKMAN
STATE OF UTAH

Christopher J. Beckman, P.E.

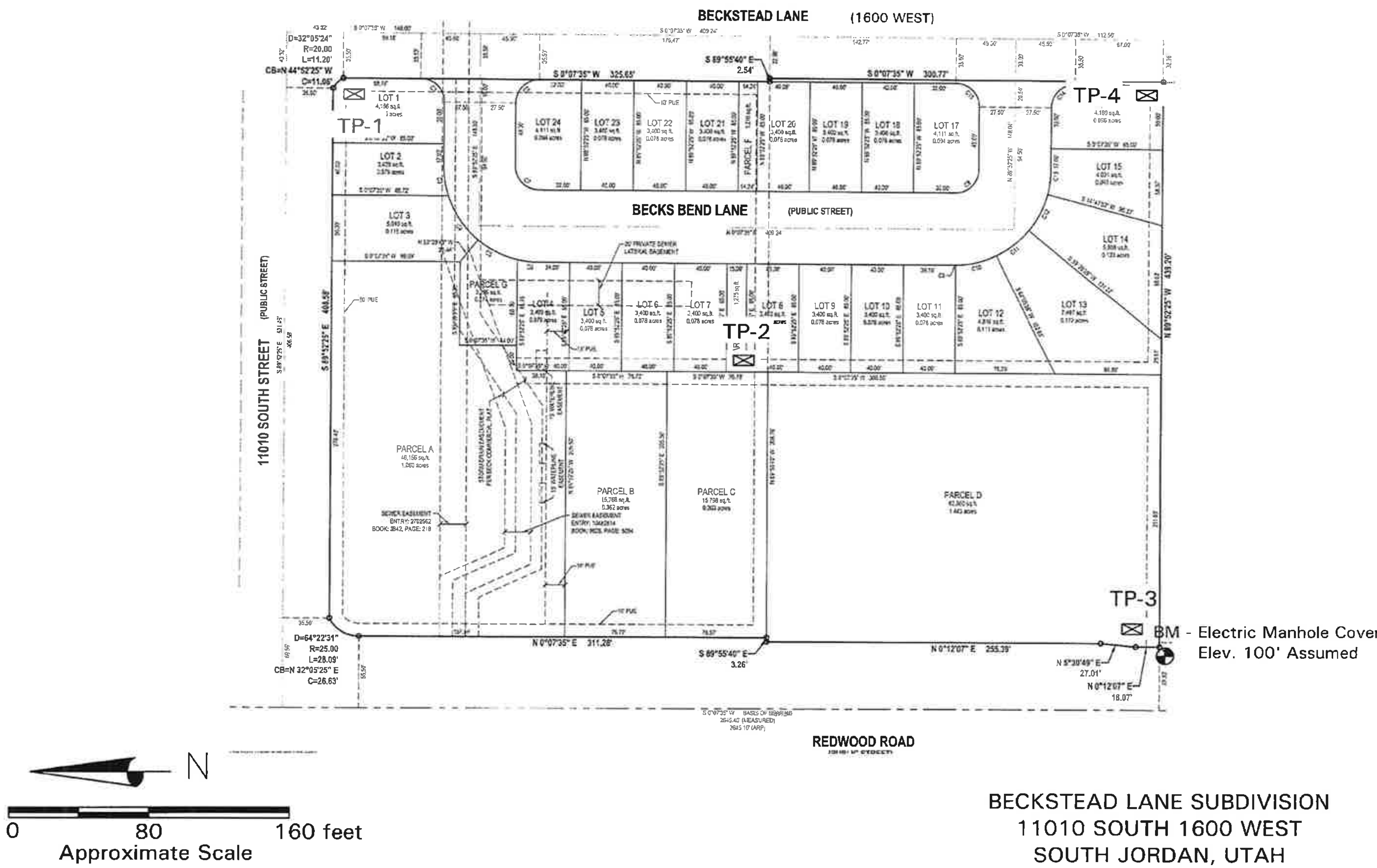
Reviewed by Douglas R. Hawkes, P.E., P.G.

CJB/rs

REFERENCES

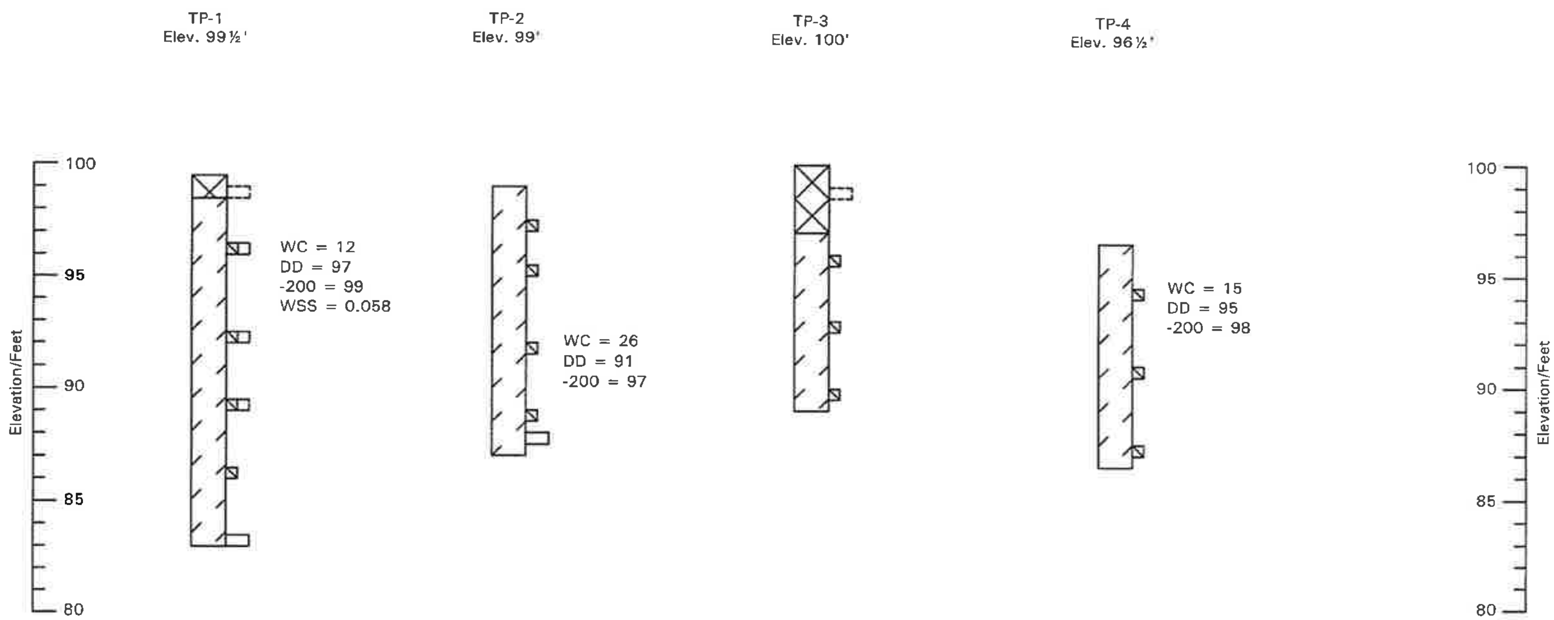
International Building Code, 2012; International Code Council, Inc., Falls Church, Virginia.

Salt Lake County, 2002; Surface Rupture and Liquefaction Potential Special Study Areas Map, Salt Lake County, Utah, adopted March 31, 1989, updated March 2002, Salt Lake County Public Works - Planning Division, 2001 South State Street, Salt Lake City, Utah.



BECKSTEAD LANE SUBDIVISION
11010 SOUTH 1600 WEST
SOUTH JORDAN, UTAH

1140368	AGEC	Locations of Test Pits	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 3 for Legend and Notes

1140368	AGEC	Logs of Test Pits	Figure 2

LEGEND:

Fill; sandy lean clay to clayey gravel with sand, slightly moist, dark brown, roots, wood and plastic debris in Test Pit TP-3.

Lean Clay (CL); moderate to high plasticity, stiff to very stiff, slightly moist to moist, brown to gray.

Indicates relatively undisturbed hand drive sample taken.

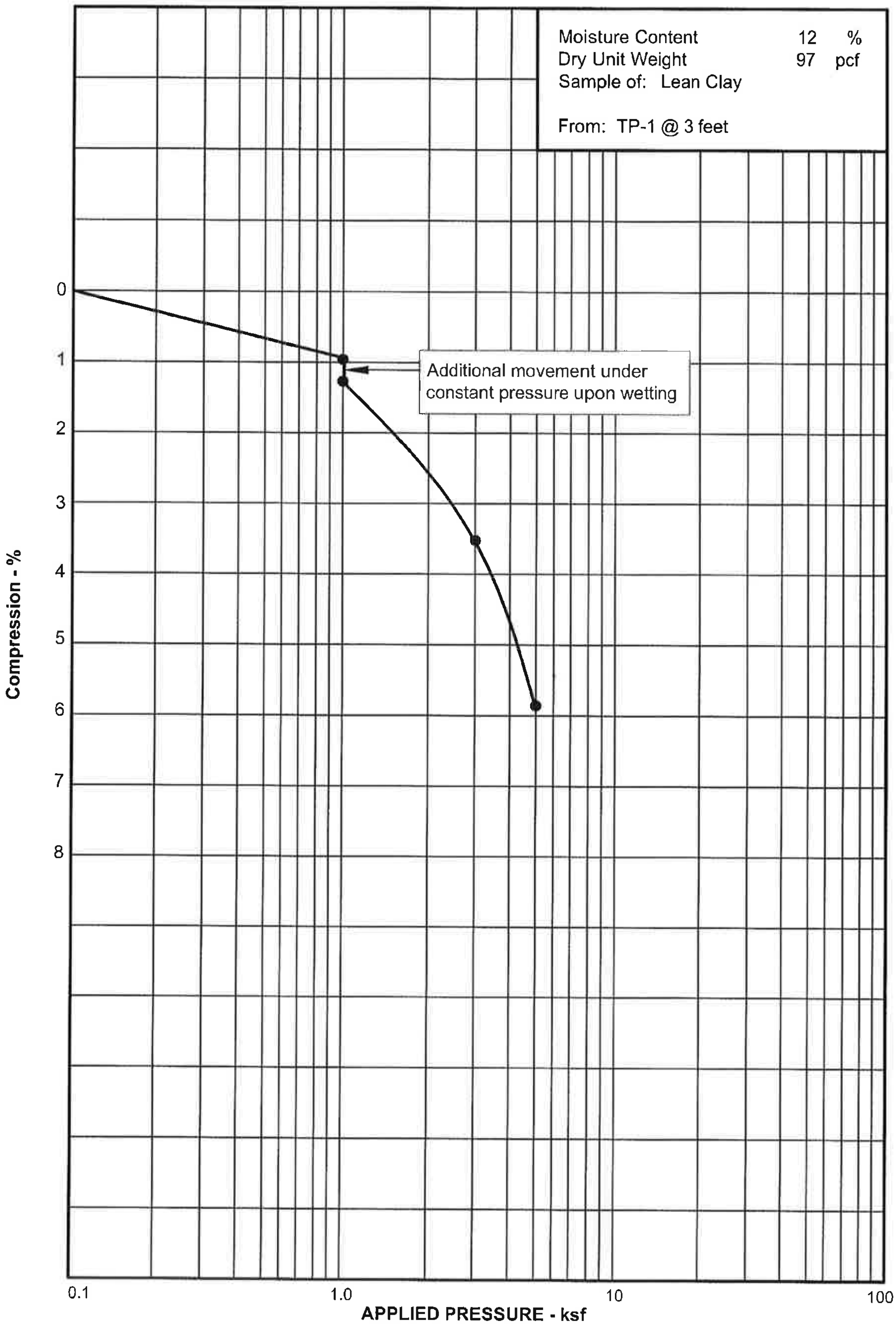
Indicates disturbed sample taken.

Indicates relatively undisturbed block sample taken.

NOTES:

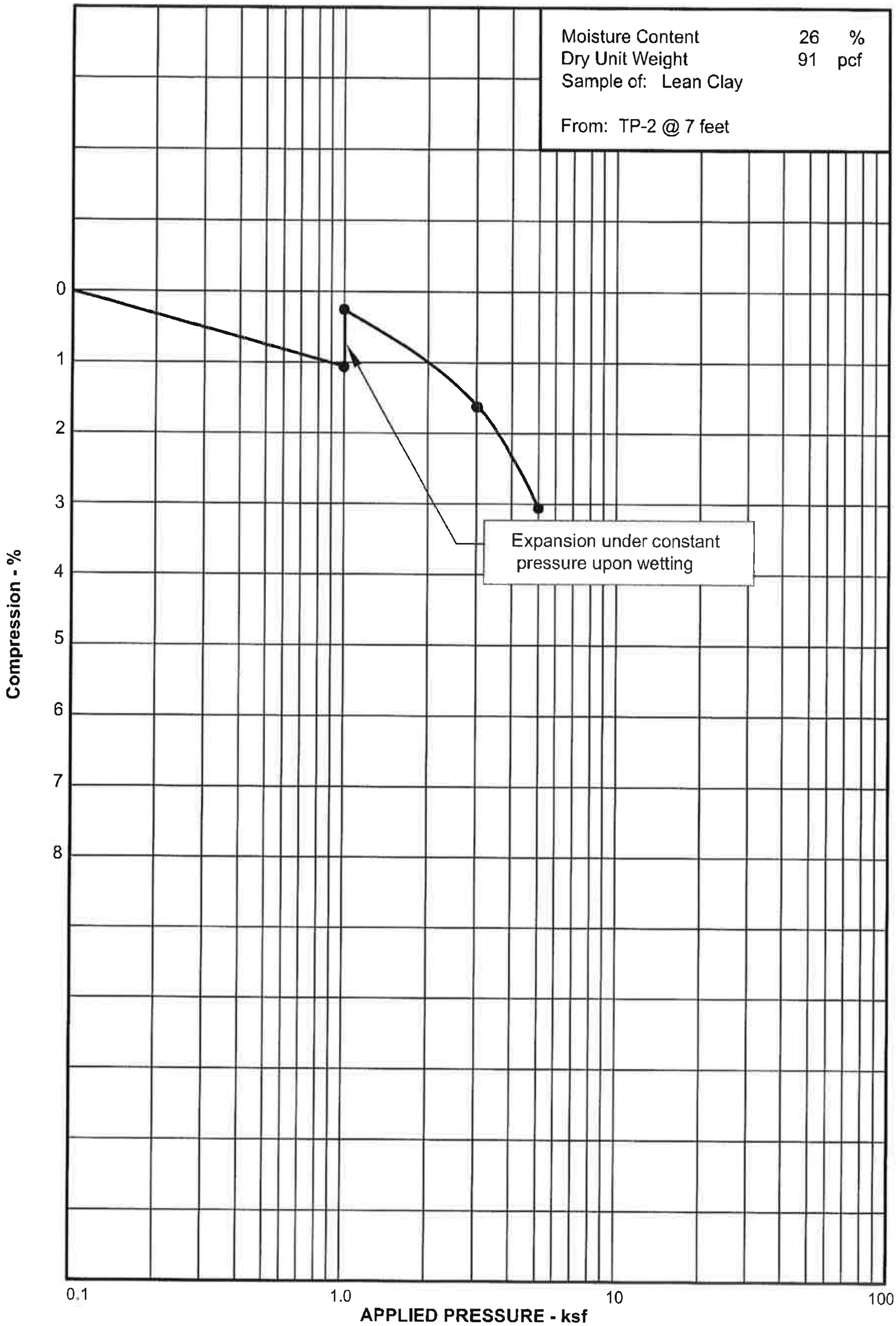
1. Test pits were excavated on May 22, 2014 with a rubber-tired backhoe.
2. Locations of test pits were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of test pits were measured by hand level and refer to the benchmark shown on Figure 1.
4. The test pit 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;
   WSS = Water Soluble Sulfates (%).

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1140368 **CONSOLIDATION TEST RESULTS** **Figure 4**

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1140368 **CONSOLIDATION TEST RESULTS** **Figure 5**

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1140368

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	3	12	97			99				0.058	Lean Clay (CL)
TP-2	7	26	91			97					Lean Clay (CL)
TP-4	2	15	95			98					Lean Clay (CL)