



GEOTECHNICAL INVESTIGATION
PROPOSED ALPIZAR MIXED USE BUILDING
4255 SOUTH REDWOOD ROAD
TAYLORSVILLE, UTAH

PREPARED FOR:

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C/O ARCHIPLEX GROUP
255 WEST CROSSROAD SQUARE
SALT LAKE CITY, UTAH 84115

ATTENTION: PRESTON CROXFORD

PROJECT NO. 1240318

AUGUST 26, 2024

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EXECUTIVE SUMMARY

1. Approximately 2 feet of fill was encountered in Boring B-1. Natural silt was encountered below the fill extending to a depth of approximately 4 feet overlying clay extending to a depth of approximately 16 feet overlying sand extending the full depth of the boring, approximately 25½ feet.

Cone penetration test (CPT-1) soundings indicate the subsurface soil consists of clay and silt to a depth of approximately 16½ feet overlying sand with occasional clay and silt layers extending the maximum depth investigated, approximately 50½ feet.

2. Subsurface water was encountered in Boring B-1 at a depth of approximately 8½ feet when checked 2 days after drilling. Fluctuations in the subsurface water level will occur over time. An evaluation of such fluctuations is beyond the scope of this report.
3. A potentially active fault, the West Valley fault, is mapped to the west of the site. The proposed building area is located within an area the Utah Geological Survey recommends having a fault study conducted prior to development. A fault study is beyond the scope of this investigation.
4. A site-specific liquefaction analysis was conducted in conjunction with this study. Based on the subsurface conditions encountered at the site to the depth investigated, the site-specific liquefaction analysis conducted and our understanding of geologic conditions in the area, it is our professional opinion that liquefaction-induced settlement on the order of 1 inch could occur during the design seismic event. The liquefaction hazard can be mitigated using rammed aggregate piers if this amount of liquefaction-induced settlement is considered excessive for the proposed building. It is our professional opinion that lateral spread is not a significant hazard at the project site.
5. The proposed building 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 1,500 pounds per square foot (psf). Footings bearing on at least 2 feet of compacted structural fill extending down to the undisturbed natural soil may be designed for a net allowable bearing pressure of 2,500 psf.
6. The upper soil consists predominantly of silt and clay and will be easily disturbed by construction traffic when the fine-grained soil 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 equipment when the subgrade consists of very moist to wet silt and clay.
7. Geotechnical information related to foundations, subgrade preparation, pavement design and materials is included in the report.

SCOPE

This report presents the results of a geotechnical investigation for the proposed Alpizar mixed-use building to be constructed at 4255 South Redwood Road in Taylorsville, 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 April 25, 2024. The fault study option was not requested by the client.

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

There is asphalt pavement on the northern portion of the site. The pavement is in poor condition. The southern portion of the site is vacant. There are no permanent structures on the site.

The ground surface is relatively flat. The southern portion of the site is covered with weeds. There are trees along the southern property boundary.

There are single-story, slab-on-grade commercial buildings to the north and the northwest. There is asphalt pavement between the buildings and to the west of the site. Residential

development extends to the south. A masonry block wall extends along the eastern property boundary with multifamily development to the east.

FIELD STUDY

Boring B-1 was drilled at the approximate location shown on Figure 1 on August 7, 2024, with direct push. The boring was drilled to observe the subsurface conditions and to obtain soil samples for laboratory testing. The boring was logged and soil samples obtained by a representative of AGECEC. A log of the subsurface conditions encountered in the boring is presented on Figure 2.

A cone penetration test (CPT-1) was conducted on August 7, 2024, at the approximate location shown on Figure 1. The information obtained from the CPT is presented in the appendix.

SUBSURFACE CONDITIONS

Approximately 1½ feet of fill was encountered in Boring B-1. Natural silt was encountered below the fill extending to a depth of approximately 4 feet overlying clay extending to a depth of approximately 16 feet overlying sand extending the full depth of the boring, approximately 25½ feet.

Cone penetration test (CPT-1) soundings indicate the subsurface soil consists of clay and silt to a depth of approximately 16½ feet overlying sand with occasional clay and silt layers extending the maximum depth investigated, approximately 50½ feet.

A description of the soil encountered in the borings follows:

Fill - The fill consists of silt with sand. It is slightly moist, mottled and brown to dark brown.

Lean Clay - The clay contains occasional silt and silty sand layers. It is soft, moist to wet and brown to grayish brown.

Laboratory tests performed on samples of the clay indicate it has natural moisture contents ranging from 20 to 37 percent and natural dry densities ranging from 85 to 87 pounds per cubic foot (pcf).

A consolidation test conducted on a sample of the clay indicates that the clay will compress a small amount with the addition of light to moderate loads. Results of the consolidation test are presented on Figure 3.

Silt - The silt contains small to moderate amounts of sand. The silt is medium stiff, slightly moist to moist and brown with slight iron oxide staining.

Laboratory tests performed on a sample of silt with sand indicate it has a natural moisture content of 13 percent and a natural dry density of 105 pcf. An unconfined compressive strength of 5,095 pounds per square foot (psf) was measured for the sample tested.

Poorly Graded Sand with Silt - The sand contains occasional gravel and some silt layers. It is medium dense, wet and gray.

Laboratory tests performed on a sample of the sand indicate it has a natural moisture content of 16 percent and a natural dry density of 119 pcf. Results of a gradation test conducted on a sample of the sand are presented on Figure 4.

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

SUBSURFACE WATER

Subsurface water was encountered in Boring B-1 at a depth of approximately 8½ feet when checked 2 days after drilling. Fluctuations in the subsurface water level will occur over time. An evaluation of such fluctuations is beyond the scope of this report.

PROPOSED CONSTRUCTION

We anticipate the building will be a two-story structure with a slab-on-grade floor. We have assumed maximum column loads of 100 kips and maximum wall loads of 5 kips per lineal foot.

We anticipate that traffic for paved areas will consist of up to 1000 cars and five delivery trucks per day and three 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

We have assumed that the site grade will not be raised more than 2 feet above the existing grade.

1. Subgrade Preparation

The topsoil, organics, unsuitable fill and other deleterious materials should be removed from below proposed slabs and pavement prior to placement of site grading fill or base course.

The upper natural soil consists predominantly of silt and clay and will be easily disturbed by construction traffic when it has a high moisture content. Placement of 1 to 2 feet of granular fill consisting predominantly of gravel and having less than 15 percent passing the No. 200 sieve will provide limited support for construction traffic when the subgrade consists of very moist to wet silt and clay. Consideration may be given to placing a support fabric between the subgrade and granular fill to facilitate construction.

2. Excavation

Excavation at the site can be accomplished with typical excavation equipment. A flat cutting edge should be used for excavation equipment when excavating foundations to reduce disturbance of the bearing soil.

3. 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 Criteria
Foundations	≥ 95%
Concrete Slabs	≥ 90%
Pavement	
Base Course	≥ 95%
Fill placed below Base Course	≥ 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. Drying of the soil may not be practical during cold or wet periods of the year.

Fill and pavement materials should be frequently tested during construction for compaction.

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 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

b. On-Site Soil

The on-site silt and clay soil are not recommended for use as fill below structures but may be considered for site grading fill below areas of proposed pavement or other site improvements or as utility trench or foundation wall backfill.

Depending on the moisture condition 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. Drainage

The ground surface surrounding the proposed building should be sloped away from the building 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 building 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 the footings at least a distance equal to the depth of fill beneath footings.

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

2. Bearing Pressure

Footings bearing on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil may be designed for a net allowable bearing pressure of 1,500 psf. Footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 2,500 psf.

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

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 on the order of 1 inch and ¾ inch, respectively.

Care will be required not to disturb the natural soil at the base of foundation excavations to maintain settlement within tolerable limits.

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

7. Construction Observation and Testing

A representative of the geotechnical engineer should observe subgrade areas and foundation excavations prior to placement of site grading fill and observe foundation excavations prior to placement of structural fill or concrete.

C. Concrete Slab-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, organics, materials, unsuitable fill and other deleterious materials should be removed from below proposed slab areas.

2. Underslab Sand and/or Gravel

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. Vapor Barrier

A vapor barrier should be placed under the concrete floor if the floor will receive an impermeable floor covering. The barrier will reduce the amount of water vapor passing from below the slab to the floor covering.

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. Friction values of 0.35 and 0.45 may be used in design for ultimate lateral resistance for footings bearing on fine-grained and granular soil, respectively. The passive resistance of the soil adjacent to the footings may be used in design.

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 to 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 44 pcf for the active condition, 29 pcf for the at-rest condition and decreased by 44 pcf for the passive condition. This assumes a peak ground acceleration of 0.73g for a 2 percent probability of exceedance in a 50-year period.

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. Liquefaction, Faulting and Seismicity

1. Liquefaction

The site is located in an area mapped as having a “high” potential for liquefaction (Salt Lake County, 2002). The soil type most susceptible to liquefaction during a large earthquake is loose, clean sand. The liquefaction potential for soil decreases with an increase in fines content and density.

A site-specific liquefaction analysis was conducted in conjunction with this study. Based on the subsurface conditions encountered at the site to the depth investigated, the site-specific liquefaction analysis conducted and our understanding of geologic conditions in the area, it is our professional opinion that liquefaction-induced settlement on the order of 1 inch could occur during the design seismic event. The liquefaction hazard can be mitigated using aggregate piers if this amount of liquefaction-induced settlement is considered excessive for the proposed building. It is our professional opinion that lateral spread is not a significant hazard at the project site.

2. Faulting

A potential active fault, the West Valley fault, is mapped to the west of the site. The proposed building area is located within an area the Utah Geological Survey recommends having a fault study conducted prior to development. A fault study is beyond the scope of this investigation (Utah Geological Survey, 2024).

3. Seismicity

Listed below is a summary of the site parameters that may be used with the 2021 International Building Code:

Description	Value ¹
Site Class	D ²
S _s - MCE _R ground motion (period=0.2s)	1.47g
S ₁ - MCE _R ground motion (period=1.0s)	0.52g
F _a - Site amplification factor at 0.2s	1.2
F _v - Site amplification factor at 1.0s	1.79
PGA - MCE _G peak ground acceleration	0.66g
PGA _M - Site modified peak ground acceleration	0.73g

¹Values obtained from information provided by the Applied Technology Council at <https://hazards.atcouncil.org>.

²This potential for seismically induced ground movement indicates that Site Class F is representative of the site. The parameters given above for Site Class D may be used if the fundamental period of the structure is equal to or less than 0.5 second as per ASCE 7-16 Section 20.3.1 or the liquefaction hazard is mitigated.

F. **Water Soluble Sulfates**

One sample of the natural soil was tested for water soluble sulfate content. Results of the test indicate there is 0.21 percent water soluble sulfate in the sample tested. The laboratory test results and published literature indicate that the natural soil possesses a severe sulfate attack potential on concrete based on a rating of negligible, moderate,

severe and very severe. The concentration of water soluble sulfates present in the soil tested indicates that sulfate resistant (Type V) cement should be used for concrete placed in contact with the natural soil. The concrete should also have maximum water-cementitious materials ratio by weight of 0.45 and a minimum compressive strength of 4,500 pounds per square inch (psi).

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 subgrade material will likely consist of silt and clay. We have assumed a California Bearing Ratio (CBR) value of 3 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 AASHTO, a pavement section consisting of 3 inches of asphaltic concrete overlying 8 inches of base course is calculated. The base course could be reduced to 6 inches if at least 6 inches of granular borrow is provided below the base course. Alternatively, a rigid pavement section consisting of 5 inches of Portland cement concrete may be used.

A pavement section consisting of 6½ inches of Portland cement concrete over 4 inches of base course is recommended for the trash dumpster approach slab.

Approximately 1 to 2 feet of granular borrow may be needed to provide equipment access and facilitate construction of the pavement when the subgrade is very moist to wet.

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 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 thicknesses indicated above assume 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 joints should be approximately one-fourth of the slab's thickness.

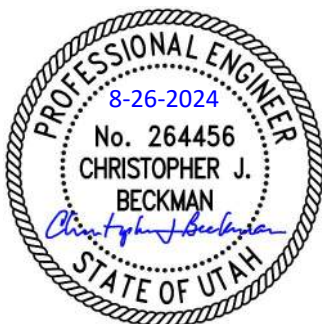
H. Preconstruction Meeting

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 boring drilled and CPT conducted 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.



Christopher J. Beckman, P.E.

A handwritten signature in blue ink that reads "Douglas R. Hawkes".

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

CJB/rs

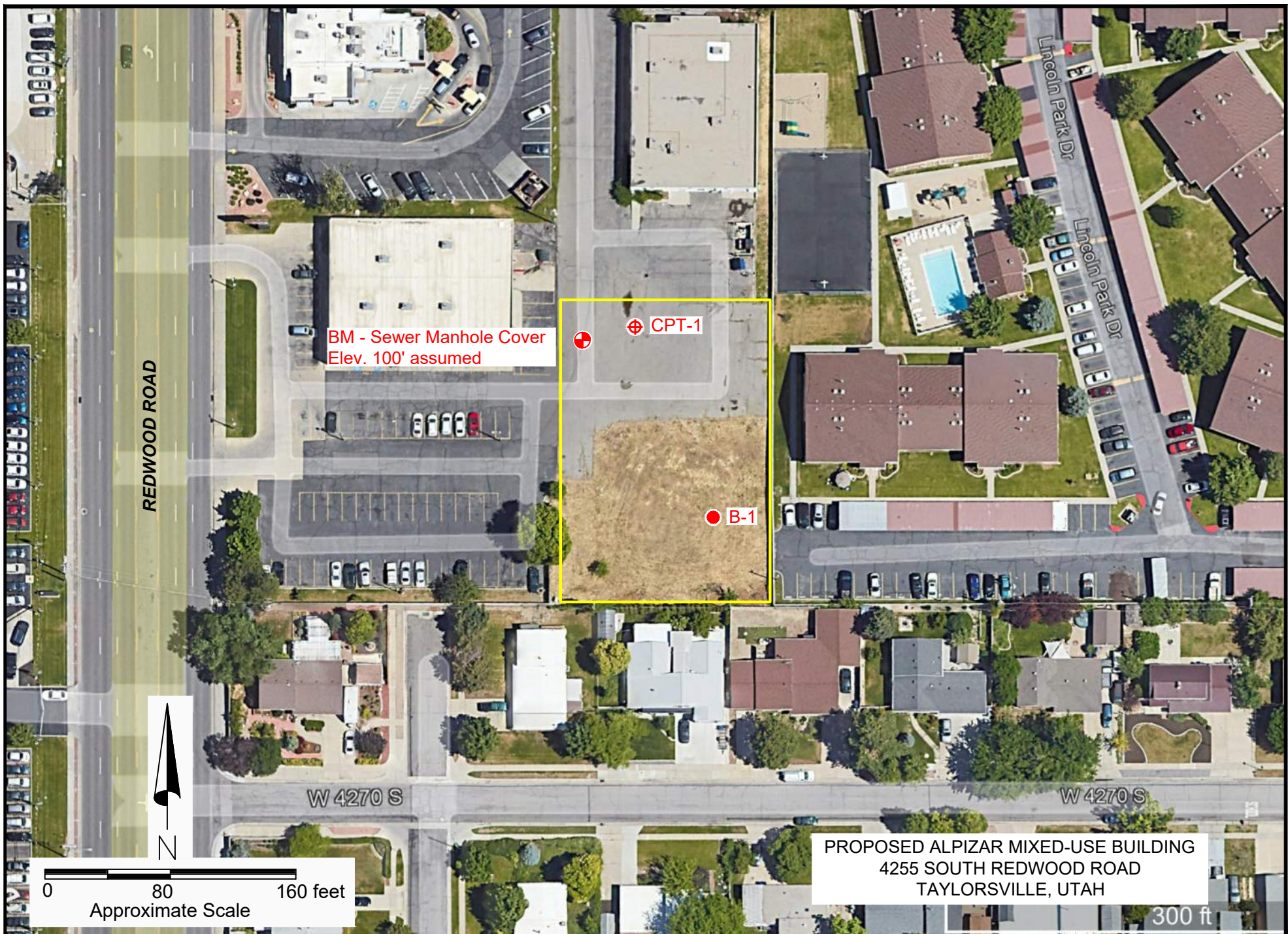
REFERENCES

American Society of Civil Engineers (ASCE), 2017 "Minimum design loads and associated criteria for buildings and other structures, provisions" ASCE / SEI 7-16, American Society of Civil Engineers, Reston, Virginia.

International Code Council, 2020; 2021 International Building Code, 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.

Utah Geological Survey, 2024; Utah Geological Hazard Portal accessed April 25, 2024, at <https://geology.utah.gov/apps/hazards/>.

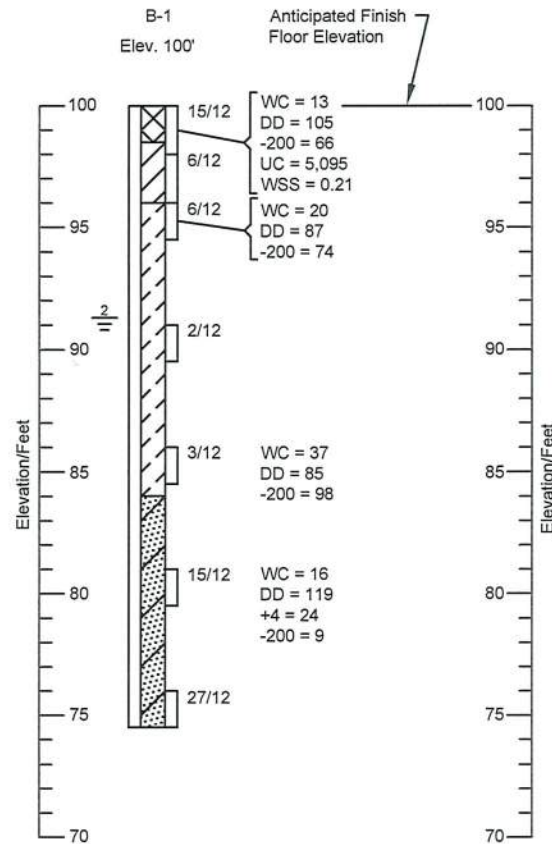


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Exploratory Boring and CPT Locations

Figure 1



LEGEND:



Fill; silt and sand, slightly moist, mottled, brown to dark brown.



Lean Clay (CL); occasional silt and silty sand layers, soft, moist to wet, brown to grayish brown.



Silt (ML); small to moderate amounts of sand, medium stiff, slightly moist to moist, brown, slight iron oxide staining.



Poorly Graded Sand with Silt (SP-SM); some gravel, some silt layers, medium dense, wet, gray.



10/12 California Drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound automatic hammer falling 30 inches were required to drive the sampler 12 inches.



Indicates slotted 1 1/2 inch PVC pipe installed in the boring to the depth shown.



2/12 Indicates the depth to free water and the number of days after drilling the measurement was taken.

NOTES:

- The boring was drilled on August 7, 2024 with direct push.
- The location of the boring was measured approximately by pacing from features shown on Figure 1.
- The elevation of the boring was measured by automatic level and refers to the benchmark shown on Figure 1.
- The boring location and elevation should be considered accurate only to the degree implied by the method used.
- The lines between materials shown on the boring log represent the approximate boundaries between material types and the transitions may be gradual.
- The water level reading shown on the log was made at the time and under the conditions indicated. Fluctuations in the water level will occur with time.
- WC = Water Content (%);
DD = Dry Density (pcf);
+4 = Percent Retained on the No. 4 Sieve;
-200 = Percent Passing the No. 200 Sieve;
UC = Unconfined Compressive Strength (psf);
WSS = Water Soluble Sulfates (%).

Approximate Vertical Scale 1" = 8'

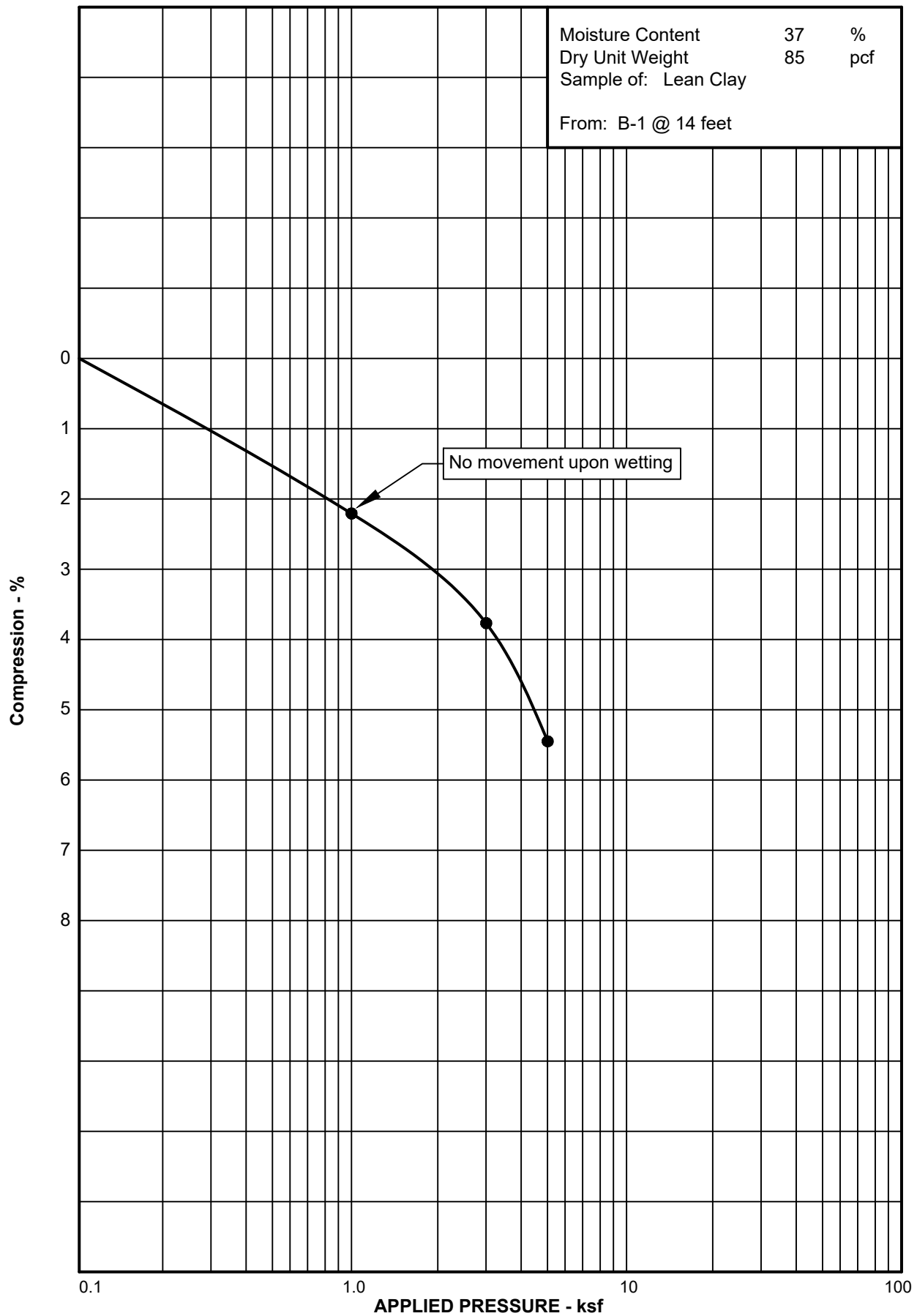
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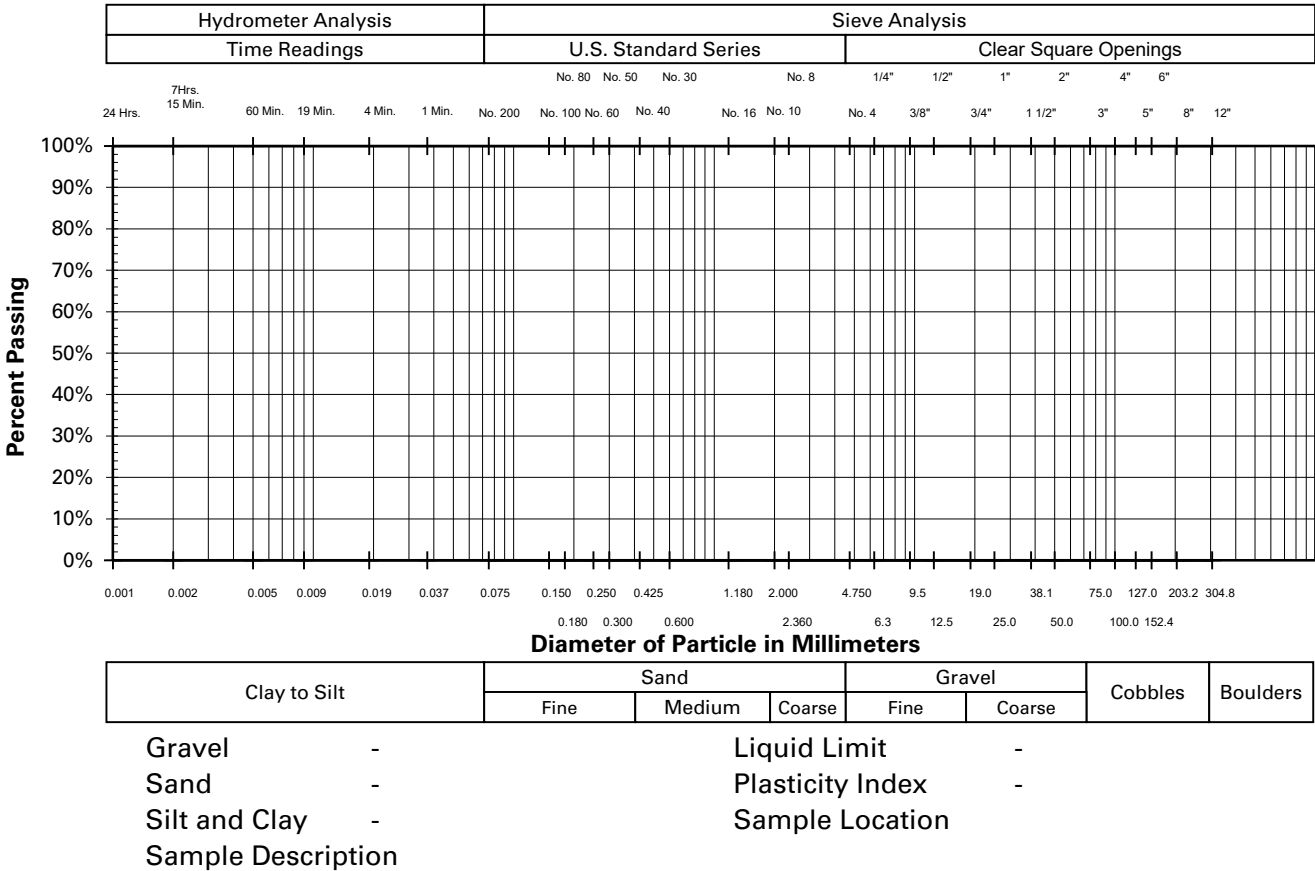
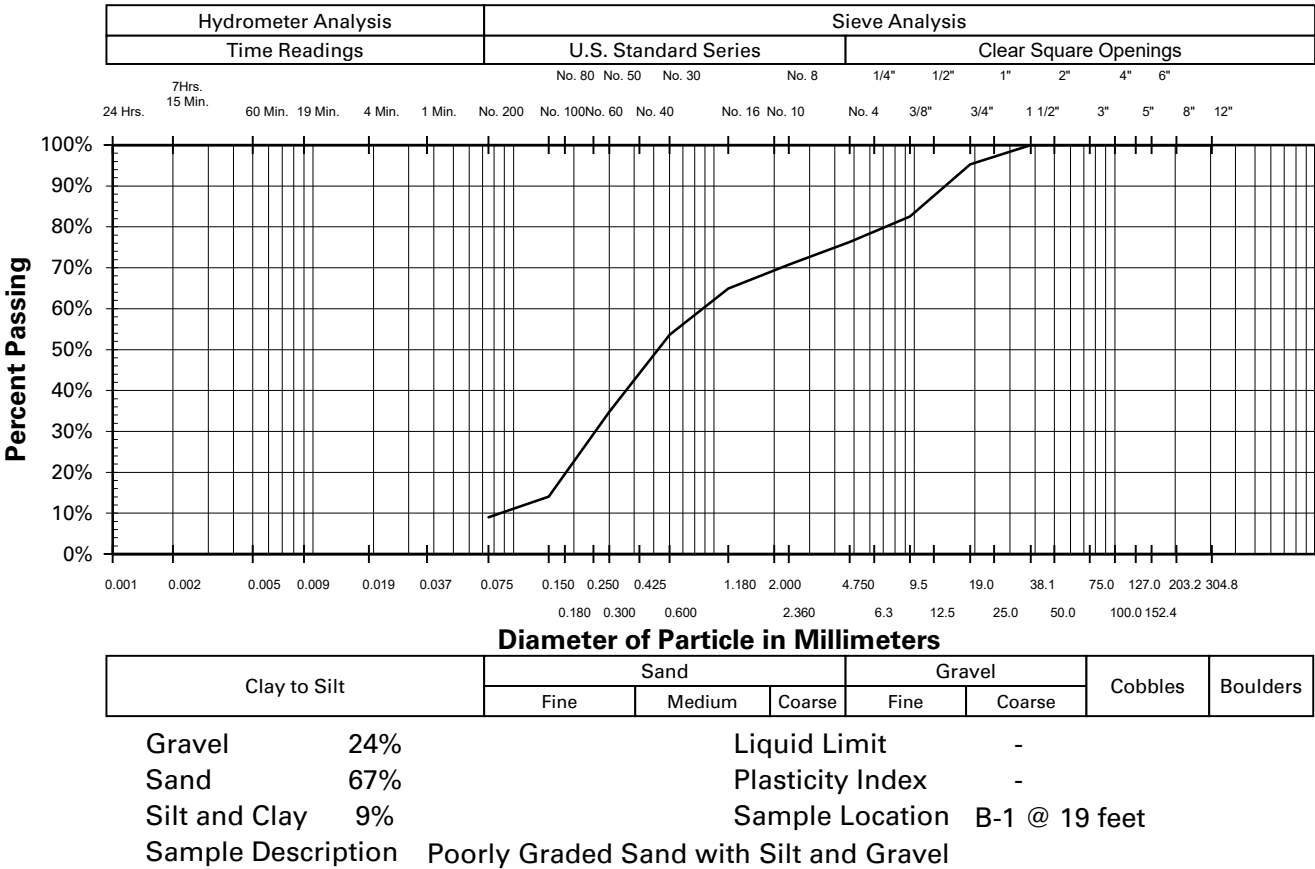
Exploratory Boring Log, Legend and Notes

Figure 2

Applied Geotechnical Engineering Consultants, Inc.



APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER: 1240318

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APPENDIX

CONE PENETRATION TEST RESULTS

Project: 1240318

Location: Taylorsville Mixed Use

