Applied Geotechnical Engineering Consultants, P.C.

DESERET INDUSTRIES

GEOTECHNICAL INVESTIGATION

PROPOSED RETAIL DEVELOPMENT

3650 WEST 12600 SOUTH

RIVERTON, UTAH

PREPARED FOR:

HIBERNIA PARTNERS
4751 SOUTH ICHABOD STREET
SALT LAKE CITY, UTAH 84117

ATTENTION: ERROL CHILDS

PROJECT NO. 1060615

AUGUST 1, 2006

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

John Whitaker

From: Doug Hawkes <DougH@agecinc.com>
Sent: Thursday, May 12, 2016 11:37 AM
To: John Whitaker
Subject: RE: Riverton d.I.

John,

Craig asked about geotechnical concerns with raising grade 5 to 6 feet at this site in preparation for a DI store. The load from the fill will cause some settlement and should be placed as soon as practical prior to building construction.

There are many areas in the Salt Lake valley where filling a site 5 to 6 feet is a significant concern because the settlement from the fill load is slow to happen in clay since clay does not drain quickly. However, there is a relatively thin layer of clay over gravel at this site. Settlement in gravel is generally rapid and much lower magnitude compared to clay. The clay at this site is described to have sand layers and because the thickness of the clay is not great, settlement should happen fairly quickly and probably as fast as they construct the building and possibly nearly as fast as the fill is placed and compacted. Therefore, I see no significant geotechnical concerns associated with filling this site 5 to 6 feet as long as the fill is properly compacted, meets the material recommendations given in the report and the fill is placed as soon as practical prior to constructing portions of the building that may be sensitive to settlement.

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

600 West Sandy Parkway
Sandy, UT 84070
801-566-6399

www.agecinc.com

A solid understanding from the ground up.

-----Original Message-----
From: John Whitaker [mailto:john@pgaw.net]
Sent: Thursday, May 12, 2016 11:10 AM
To: Doug Hawkes <DougH@agecinc.com>
Subject: Riverton d.I.

Riverton D.I. Site plans

Thank You

John Whitaker
PGA&W Architects
5263 Commerce Drive, Suite 204
Murray, UT. 84107
P.801-266-4669
john@pgaw.net

OK
RC - BKM

EXECUTIVE SUMMARY

1. The subsurface soils encountered at the site consist of approximately 1 to 2 feet of topsoil overlying lean clay. Sand and gravel was encountered below the clay generally at a depth ranging from approximately 4 to 7 feet and generally extends to the maximum depth investigated, approximately 20½ feet. In Boring B-14, the lean clay was approximately 17½ feet thick overlying the gravel. Silty sand and clayey sand were encountered between the lean clay and gravel in Borings B-4 and B-12, respectively.

2. No subsurface water was encountered in the borings to the maximum depth investigated, approximately 20½ feet.

3. 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. Spread footings bearing on the undisturbed natural soil or on compacted structural fill may be designed using an allowable net bearing pressure of 2,500 pounds per square foot.

4. The near surface soil consists of clay that may result in access difficulties for rubber-tired construction equipment when the upper soil is very moist to wet such as during the winter or spring or following periods of precipitation. Care should be taken to not disturb the natural soil to remain in proposed building and pavement areas. Placement of 1 to 2 feet of granular fill may be needed to provide limited support for construction equipment when the upper soil is very moist to wet.

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

TABLE OF CONTENTS

SCOPE

This report presents the results of a geotechnical investigation for the proposed retail development to be located at 3650 West 12600 South in Riverton, 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 May 31, 2006.

Field exploration was conducted to obtain information on the subsurface conditions. Samples obtained during 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

The site consists of an alfalfa field. There were no structures or pavement on the site at the time of our field study. There are irrigation canals along the east and west sides of the site that run north to south.

The site slopes down gently to the east.

Vegetation at the site consists of alfalfa.

The site is bordered to the north by a detention pond beyond which is an undeveloped field. The site is bordered to the east by residential properties with one-story, wood and brick homes with basements. The site is bordered to the south by a four-lane, asphalt-paved road with a median (12600 South). The site is bordered to the west by a roadway which is under construction beyond which is a Lowe's Home Improvement Store which is under construction.

FIELD STUDY

The field study was conducted on June 29 and 30 and July 5, 2006. Nine borings were drilled in the area of the proposed Deseret Industries building and parking area and five borings were drilled in the other areas of proposed retail development. The borings were drilled at the approximate locations indicated on Figure 1. The borings were drilled with 8-inch diameter hollow-stem auger powered by an all-terrain drill rig. The borings were logged and soil samples obtained by an engineer from AGEC. Logs of the subsurface conditions encountered in the borings are graphically shown on Figures 2, 3 and 4.

SUBSURFACE CONDITIONS

The subsurface soils encountered at the site consist of approximately 1 to 2 feet of topsoil overlying lean clay. Sand and gravel was encountered below the clay generally at a depth ranging from approximately 4 to 7 feet and generally extends to the maximum depth investigated, approximately 20½ feet. In Boring B-14, the lean clay was approximately 17½ feet thick overlying the gravel. Silty sand and clayey sand were encountered between the lean clay and gravel in Borings B-4 and B-12, respectively.

A description of the various soils encountered in the borings follows:

Topsoil - The topsoil consists of sandy lean clay that is moist and brown with roots.

Lean Clay - The clay contains a small to moderate amount of sand and occasional silty sand layers. It is medium stiff to very stiff, slightly moist to moist and brown.

Laboratory tests conducted on samples of the clay indicate natural moisture contents range from 10 to 21 percent and natural dry densities range from 84 to 109 pounds per cubic foot (pcf).

An unconfined compressive strength of 3,360 pounds per square foot (psf) was measured for a sample of the clay tested in the laboratory.

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. One of the samples expanded a small amount when wetted under a constant pressure of 1,000 psf. Results of the consolidation tests are presented in Figures 6 and 7.

Sand - The sand contains moderate to large amounts of clay and silt. The sand is loose to medium dense, moist and brown.

Gravel - The gravel ranges from clayey gravel to poorly-graded gravel and contains moderate to large amounts of sand. The gravel is medium dense to very dense, moist and brown. Laboratory tests conducted on the gravel indicate natural moisture contents range from 4 to 5 percent and the natural dry densities range from 107 to 109 pcf.

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

SUBSURFACE WATER

No subsurface water was encountered in the borings at the time of drilling to the maximum depth investigated, approximately 20½ feet.

PROPOSED CONSTRUCTION

We understand that the proposed construction will consist of commercial buildings with a Deseret Industries building and associated parking located in the northwest portion of the site. The proposed Deseret Industries building will have a footprint of approximately 48,000 square feet. The buildings for the remainder of the development have not been determined. It is assumed that the buildings will consist of one-story, wood or steel-frame buildings with slab-on-grade construction. We have assumed maximum column loads of 100 kips and maximum wall loads of 4 kips per lineal foot for our analysis.

We anticipate that car parking areas and truck access areas will be constructed. We have assumed three traffic conditions for pavement areas as indicated below.

Traffic Condition	Cars	Garbage Trucks	Delivery Trucks	Semis
1	1,000/day	2/week	Occasional	none
2	1,000/day	2/week	5/day	1/day
3	1,000/day	1/day	10/day	5/day

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 subsoil 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 report writing. We have assumed that the site will be raised less than 3 feet above the original grade. The fill should be placed as soon as possible prior to building construction to allow the significant portion of settlement with the underlying soil induced by the load to occur prior to building construction.

1. Subgrade Preparation

Topsoil, organics and other deleterious material should be removed from below proposed building and pavement areas.

The subgrade in proposed pavement areas should be proof-rolled to identify soft areas. Soft areas should be removed and replaced with properly compacted fill consisting predominantly of gravel and having less than 15 percent passing the No. 200 sieve.

The upper soil at the site consists of clay that may be easily disturbed by construction equipment when it is very moist to wet such as in the winter or spring or after periods of precipitation. Care should be taken to avoid disturbance of the natural soil to remain in proposed building and pavement areas. When the upper soil is very moist to wet, it may be necessary to place approximately 1 to 2 feet of granular borrow to provide equipment access and facilitate construction of the pavement.

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 for 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
Foundations	≥ 95%
Concrete Slabs and Pavement	≥ 90%
Retaining Wall Backfill	85% - 90%
Landscaping	≥ 85%

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

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

Fill and pavement materials placed for the project should be frequently tested for compaction.

4. Materials

Material placed as fill to support buildings should be non-expansive granular soil. The upper natural soil consists of clay and is not recommended for use as structural fill below the proposed building but may be considered for use as site grading fill, utility trench backfill or wall backfill outside of the building area if the topsoil, organics and other deleterious materials are removed or it may be used in landscaping areas.

The moisture of the natural soil is generally near or slightly above the optimum moisture content. Use of the on-site soil as fill or backfill will likely require moisture conditioning (wetting or drying) to facilitate compaction. Drying of the soil may not be practical during cold or wet periods of the year.

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

5. Drainage

Roof downspouts and drains should discharge beyond the limits of backfill.

The ground surface surrounding the proposed building should be sloped away from the building in all directions.

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 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.

Topsoil, organics and other deleterious material should be removed from below proposed foundation areas.

2. Bearing Pressures

Spread footings bearing on the undisturbed natural soil may be designed using an allowable net 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 bearing pressure indicated above may be increased by one-half for temporary loading conditions such as for wind and seismic loads.

4. Settlement

Based on the subsoil conditions encountered and the assumed building loads, we estimate that total settlement will be on the order of 1 inch for footings designed as indicated above. We estimate that differential settlement will be on the order of ¾ of an inch.

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 fill or concrete placement.

7. Construction Observation

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

C. Concrete Slab-on-Grade

1. Slab Support

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

3. Vapor Barrier

A vapor barrier should be placed below 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 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 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 assume a horizontal surface adjacent the wall.

Soil Type	Active	At-Rest	Passive
Sand & Gravel	40 pcf	55 pcf	300 pcf
Clay & Silt	50 pcf	60 pcf	250 pcf

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 28 pcf for active and at-rest conditions and decreased by 28 pcf for the passive condition. This assumes a short period spectral response acceleration of 1.19g for a 2 percent probability of exceedance in a 50-year period (IBC, 2003).

4. Safety Factors

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

E. Seismicity, Faulting and Liquefaction

1. Seismicity

Listed below is a summary of the site parameters for the 2003 International Building Code.

a.	Site Class	C
b.	Short Period Spectral Response Acceleration, S_s	1.19g
c.	One Second Period Spectral Response Acceleration, S_1	0.44g

2. Faulting

There are no mapped active faults extending near or through the site. The closest mapped fault considered to be active is the Wasatch Fault located approximately 7½ mile east of the site (Salt Lake County, 1995).

3. Liquefaction

The site is located within an area mapped as having a "very low" potential for liquefaction (Salt Lake County, 1995). Based on our understanding of the geologic conditions in the area, it is our professional opinion that liquefaction is not a hazard at the site.

F. Water Soluble Sulfates

One sample of the natural soil was tested in the laboratory for water soluble sulfate content. Test results indicate that there is less that 0.1 percent water soluble sulfate in the sample tested. Based on the test results and published literature, sulfate resistant cement is snot needed 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.

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 natural soil at the site consists of lean clay. A California Bearing Ratio (CBR) of 3 percent was used for our analysis.

2. Pavement Thickness

   Based on the subsoil conditions, assumed traffic conditions, a design life of 20 years for flexible and 30 years for rigid pavement and methods presented by the Utah Department of Transportation, the following pavement sections are calculated:

	Rigid Pavement	Flexible Pavement		
Traffic Condition*	Portland Cement Concrete, in.	Asphaltic Concrete	Base Course	Granular Borrow
1	—	3"	6"	—
	5"	—	—	—
2	—	3"	10"	—
	—	3"	6"	6"
	5"	—	—	—
3	—	3½"	14"	—
	—	3½"	6"	10"
	6"	—	—	—

*Traffic conditions assumed are described in the Proposed Construction section of the report.

In areas where the subgrade soil consists of very moist to wet clay, granular borrow may be needed to support construction traffic and facilitate pavement construction as discussed in the Subgrade Preparation section of the report.

3. Pavement Material and Construction

a. Flexible Pavement (Asphaltic Concrete)

The pavement materials should meet the material 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 design assumes that a concrete shoulder or curb will be placed at the edge of the pavement and that the pavement will have aggregate interlock joints.

The pavement materials should meet the material specifications for the applicable jurisdiction. The pavement thicknesses indicated above assume 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. The maximum allowable slump will depend on the method of placement, but should not exceed 4 inches.

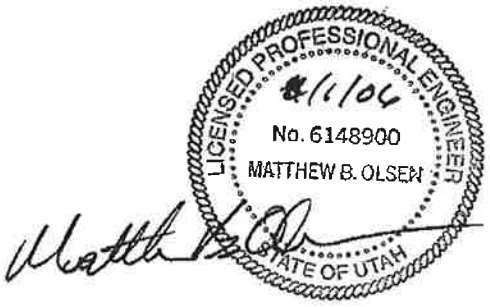
4. Jointing

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 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 borings drilled 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 the recommendations given.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



Matthew B. Olsen, P.E.

Douglas R. Hawkes by dc

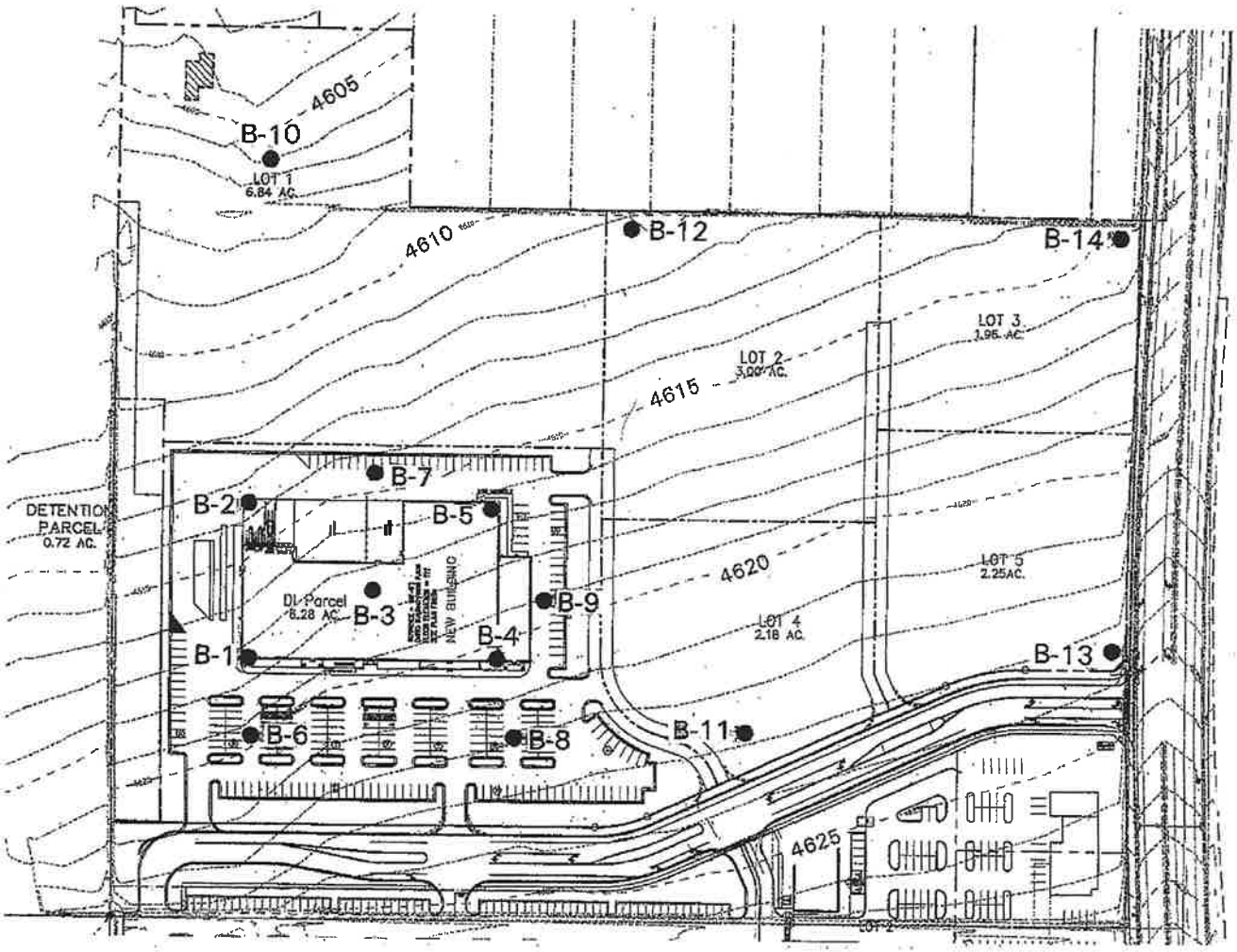
Reviewed by Douglas R. Hawkes, P.E., P.G.

MBO/dc

REFERENCES CITED

International Building Code, 2003; International Code Council, Inc., Falls Church, Virginia.

Salt Lake County, 1995; Surface Rupture and Liquefaction Potential Special Study Areas Map, Salt Lake County, Utah, adopted March 31, 1989, revised March 1995, Salt Lake County Public Works - Planning Division, 2001 South State Street, Salt Lake City, Utah.



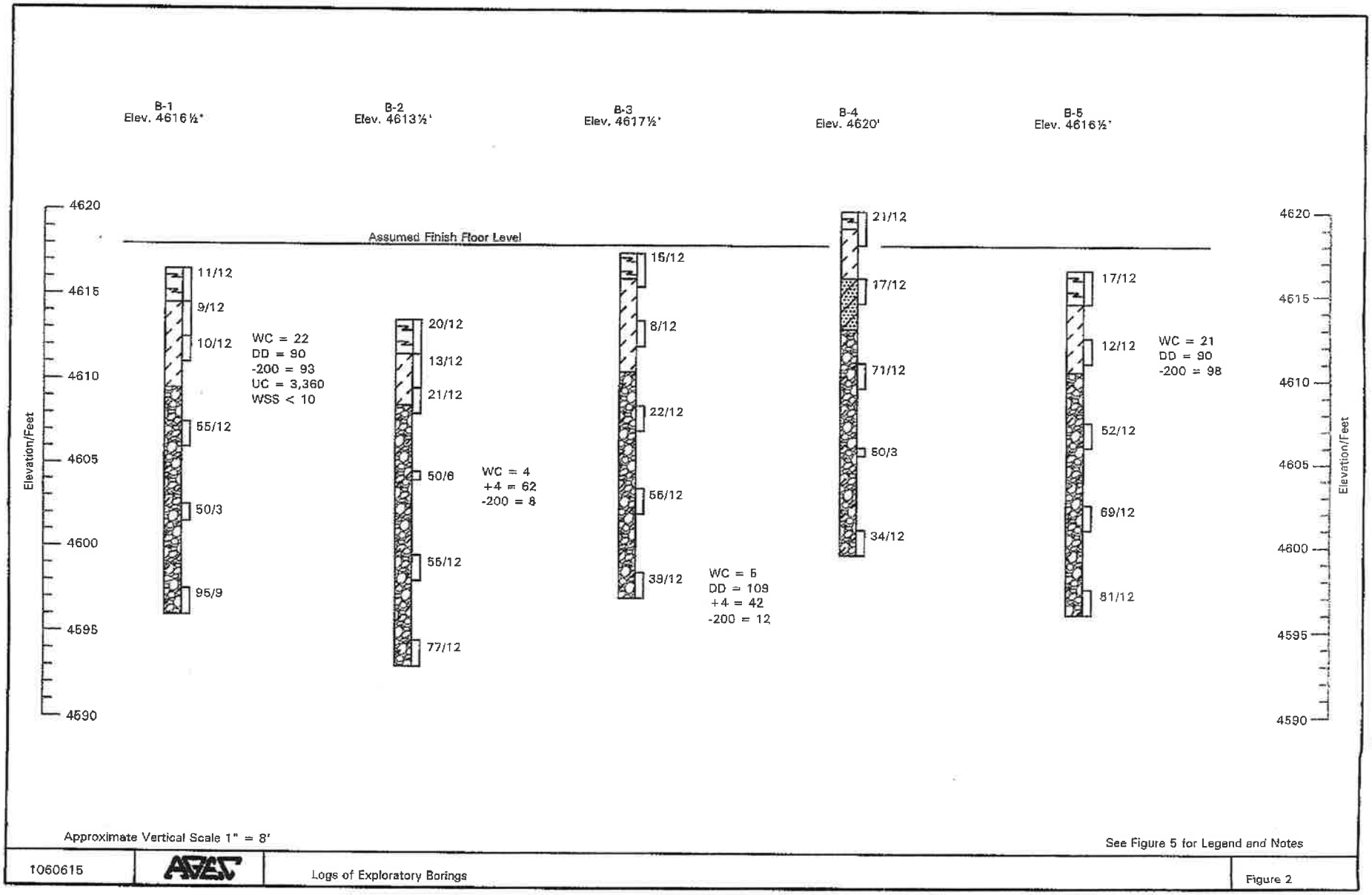
N

0 200 400 feet

Approximate Scale

PROPOSED RETAIL DEVELOPMENT
3650 WEST 12600 SOUTH
RIVERTON, UTAH

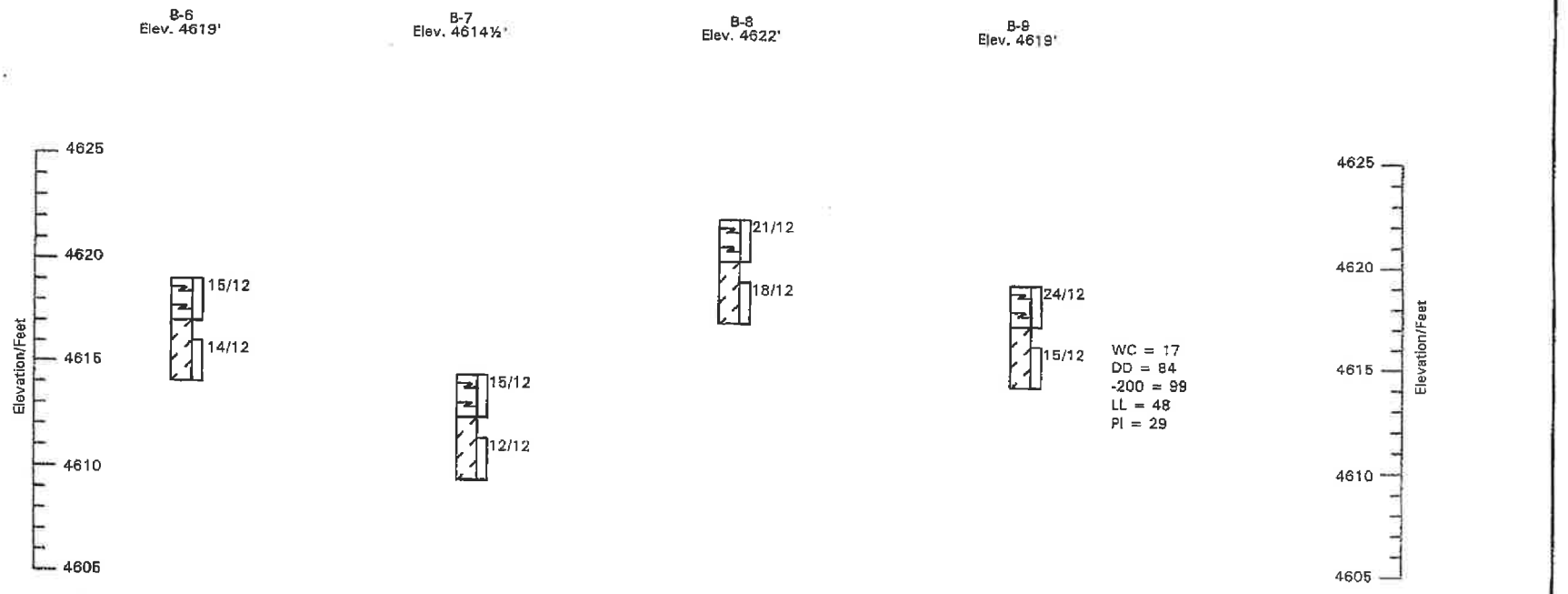
1060615	AGEC	Locations of Exporatory Borings	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 5 for Legend and Notes

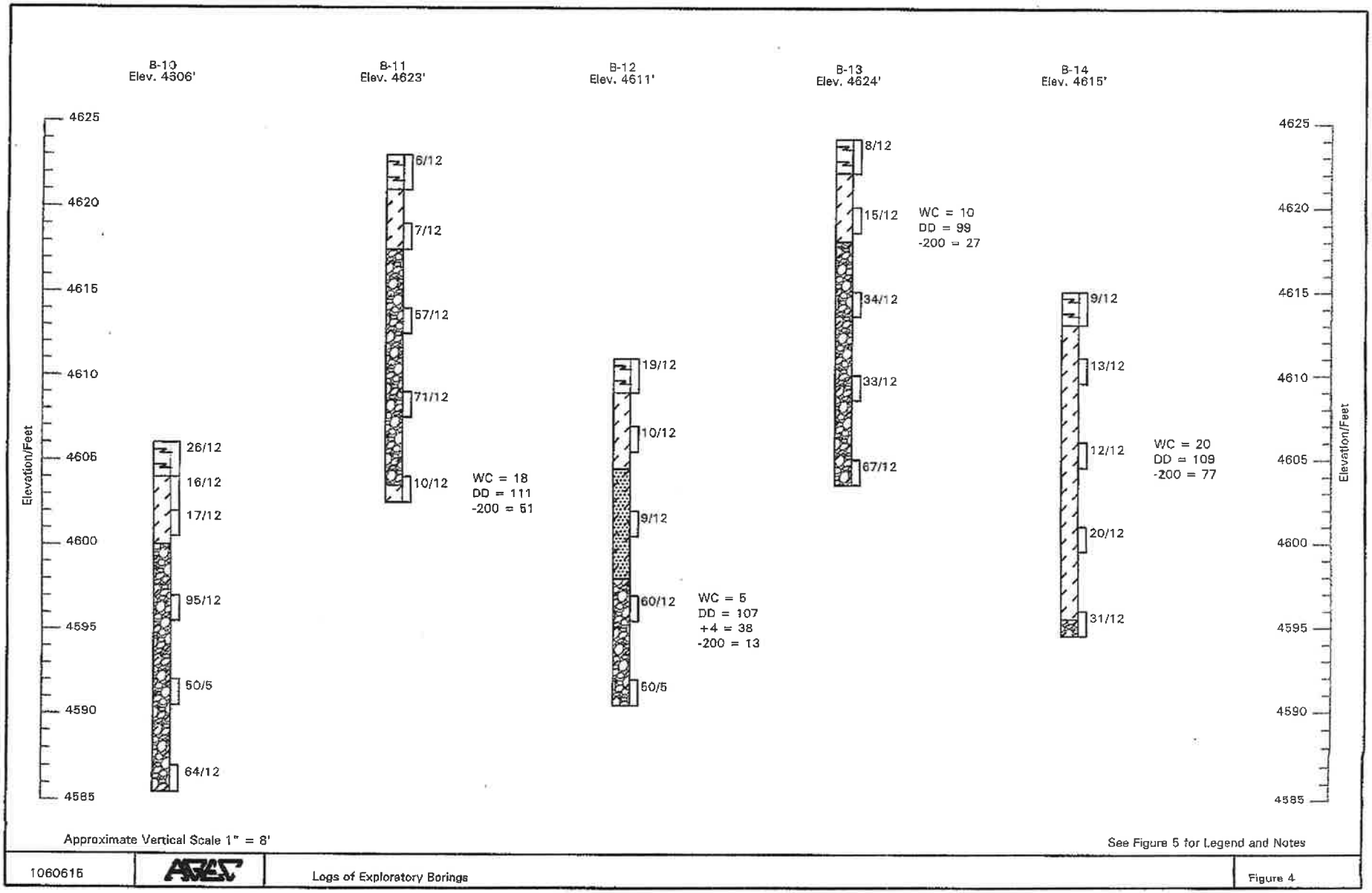
1060615	ASEC	Logs of Exploratory Borings	Figure 2



Approximate Vertical Scale 1" = 8'

See Figure 5 for Legend and Notes

1060615	AGES	Logs of Exploratory Borings	Figure 3



1060615 | ASES | Logs of Exploratory Borings | Figure 4

LEGEND:

Topsoil; sandy lean clay, moist, brown with roots.

Lean Clay (CL); with small to moderate amounts of sand, occasional silty sand layers, medium to very stiff, slightly moist to moist, brown.

Clayey Sand (SC); loose, moist, brown.

Silty Sand (SM); medium dense, moist, brown.

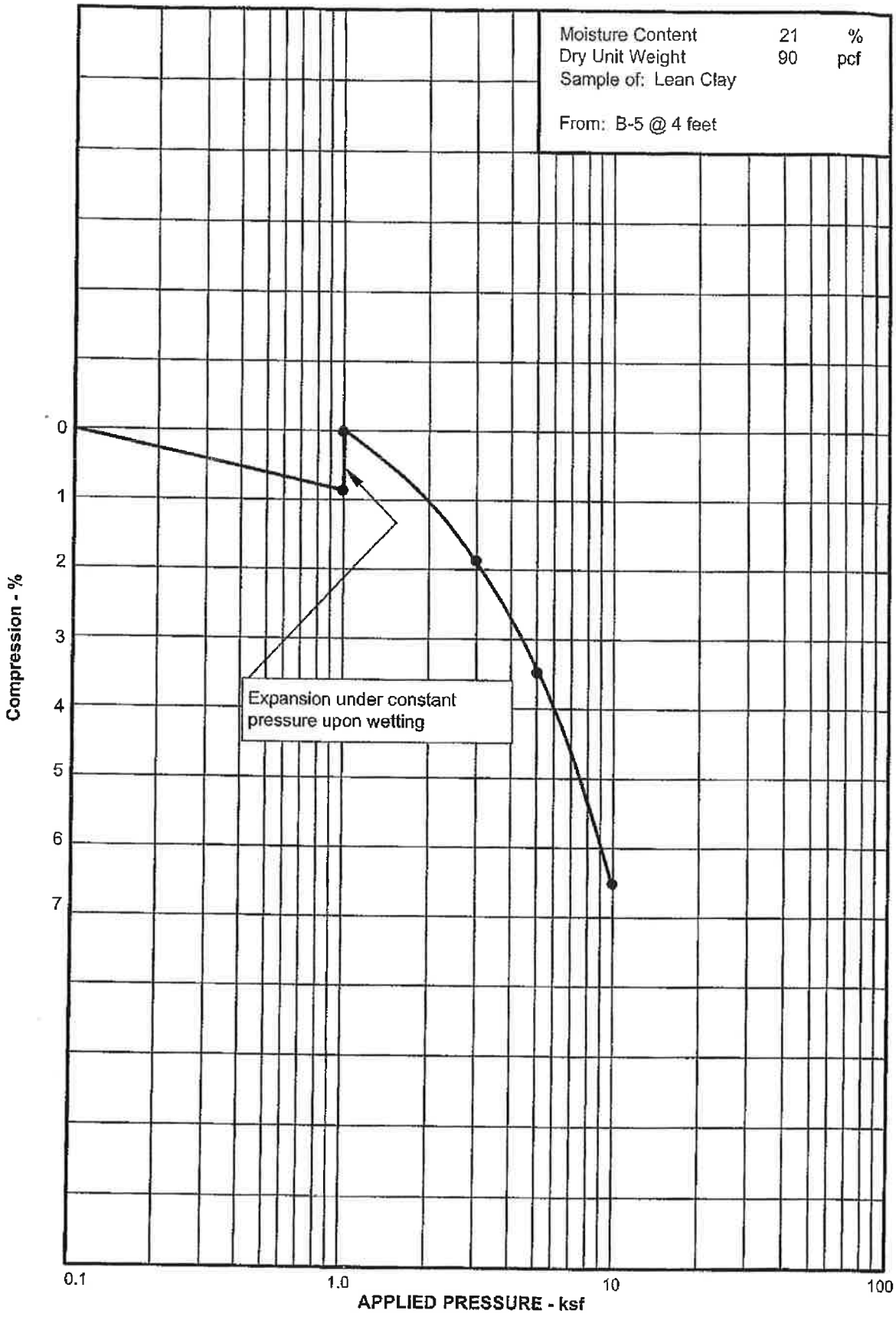
Poorly Graded Gravel with Clay and Sand (GP-GC); dense to very dense, moist, brown.

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.

NOTES:

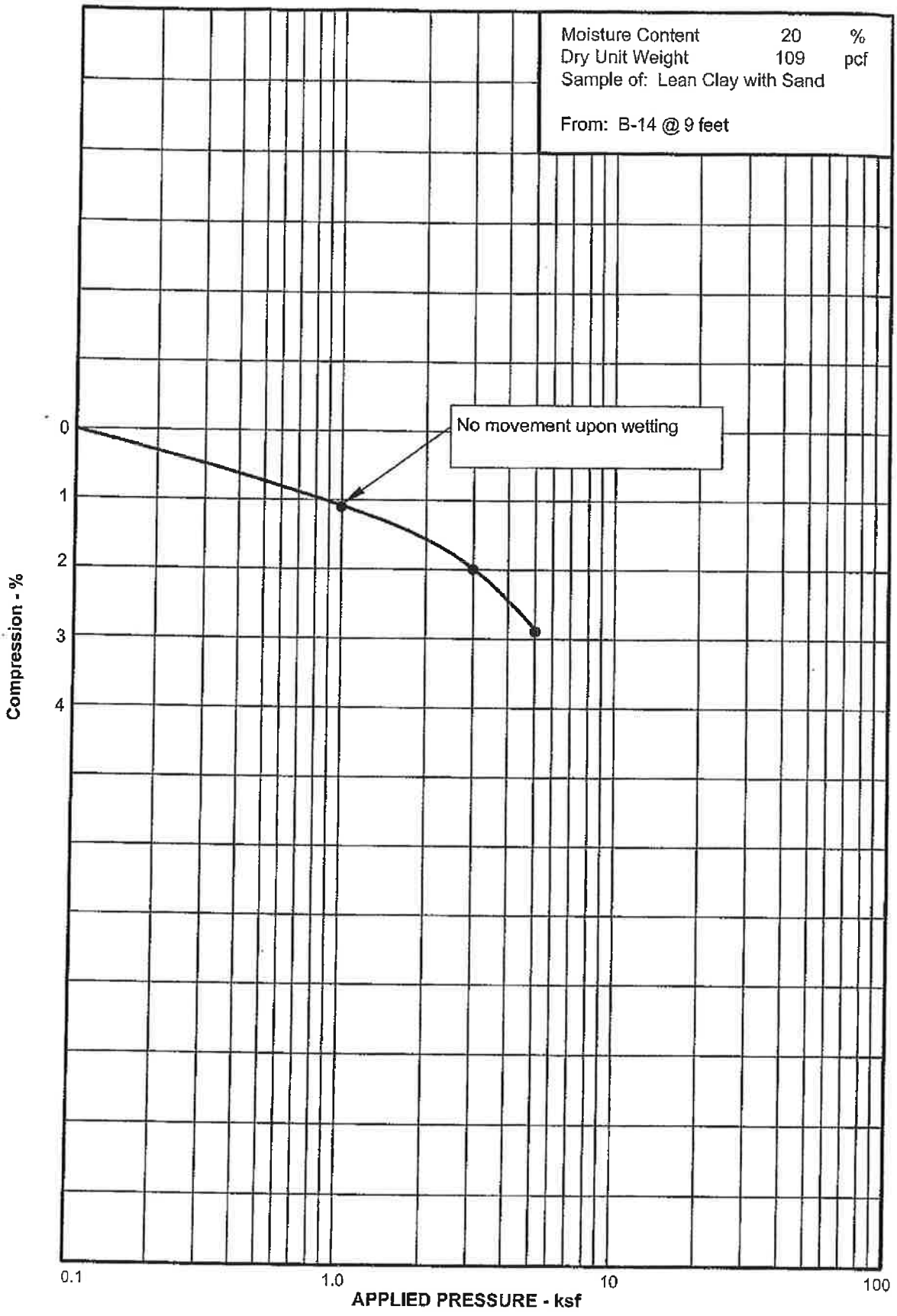
1. Borings were drilled on June 29 and 30 and July 5, 2006 with 8-inch diameter hollowstem auger.
2. Locations of borings were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of borings were determined by interpolating between contours shown on Figure 1.
4. The boring 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 boring logs represent the approximate boundaries between material types and the transitions may be gradual.
6. No free water was encountered in the borings at the time of drilling.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   +4 = Percent Retained on No. 4 Sieve;
   -200 = Percent Passing No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%);
   UC = Unconfined Compressive Strength (psf);
   WSS = Water Soluble Sulfates (ppm).

Applied Geotechnical Engineering Consultants, Inc.



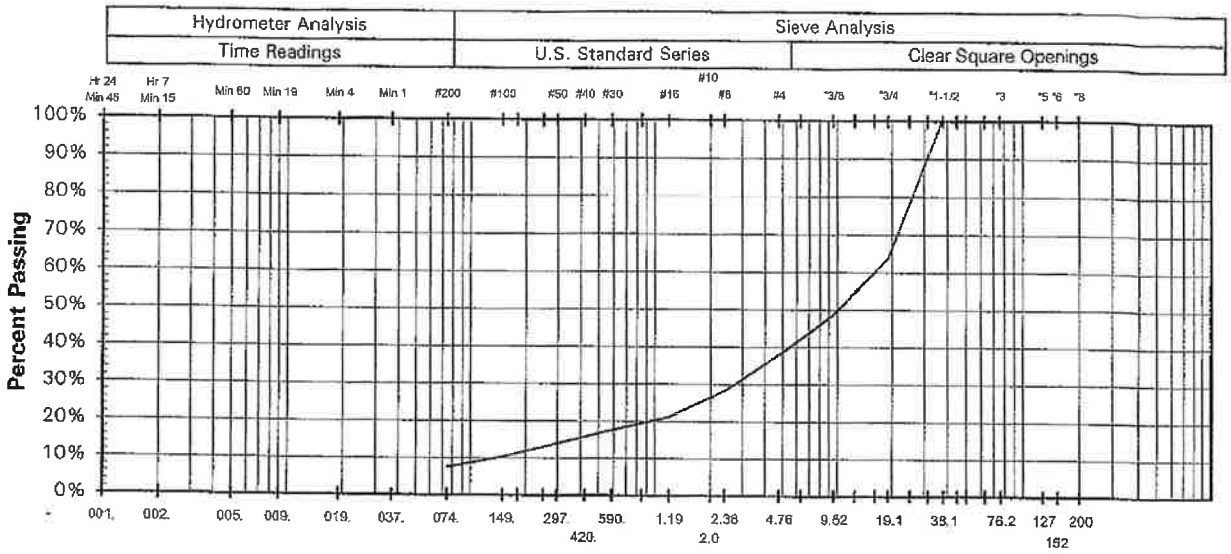
Project No. 1060615 **CONSOLIDATION TEST RESULTS** Figure 6

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1060615 **CONSOLIDATION TEST RESULTS** Figure 7

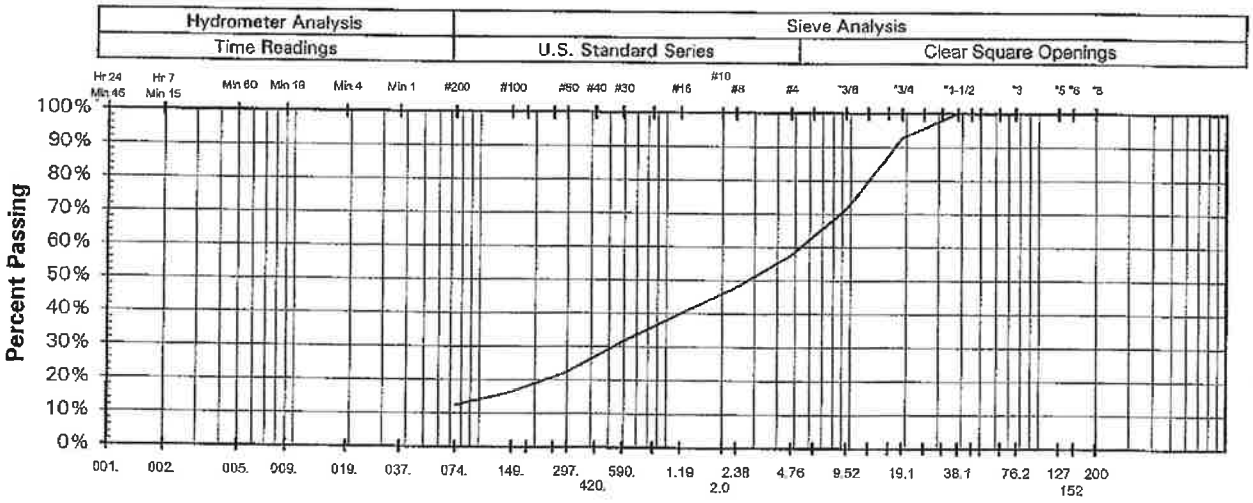
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, P.C.



Diameter of Particle in Millimeters

Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

Gravel	62%	Liquid Limit	
Sand	30%	Plasticity Index	
Silt and Clay	8%	Sample Location	B-2 @ 9 feet
Sample Description	Poorly Graded Gravel with Clay and Sand (GP-GC)		



Diameter of Particle in Millimeters

Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

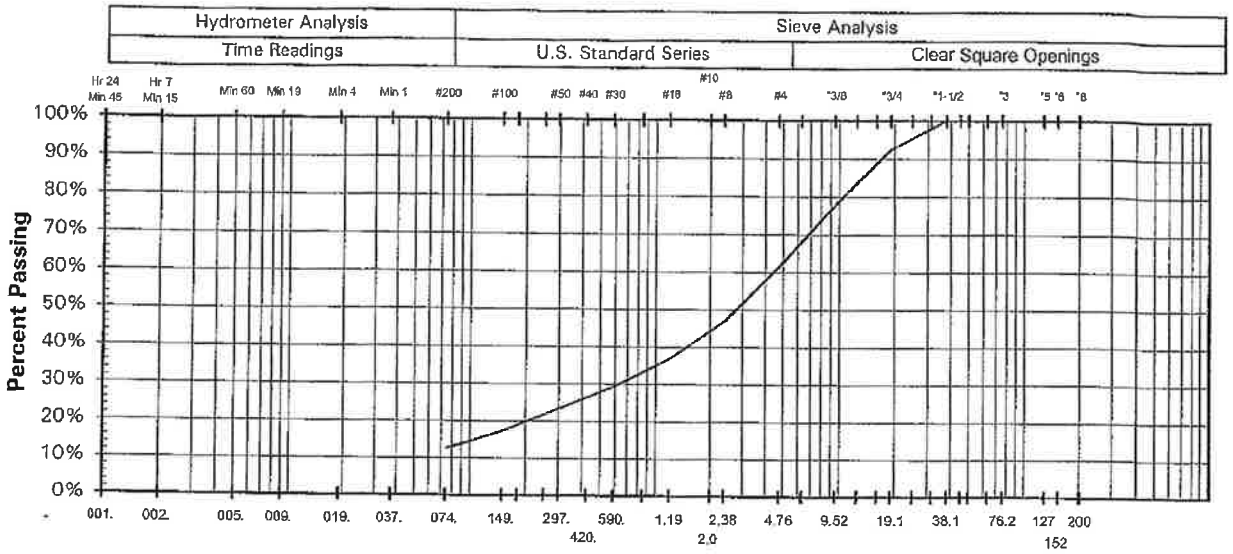
Gravel	42%	Liquid Limit	-
Sand	46%	Plasticity Index	-
Silt and Clay	12%	Sample Location	B-3 @ 19 feet
Sample Description	Poorly Graded Sand with Clay and Gravel (SP-SC)		

Project No. 1060615

GRADATION TEST RESULTS

Figure 8

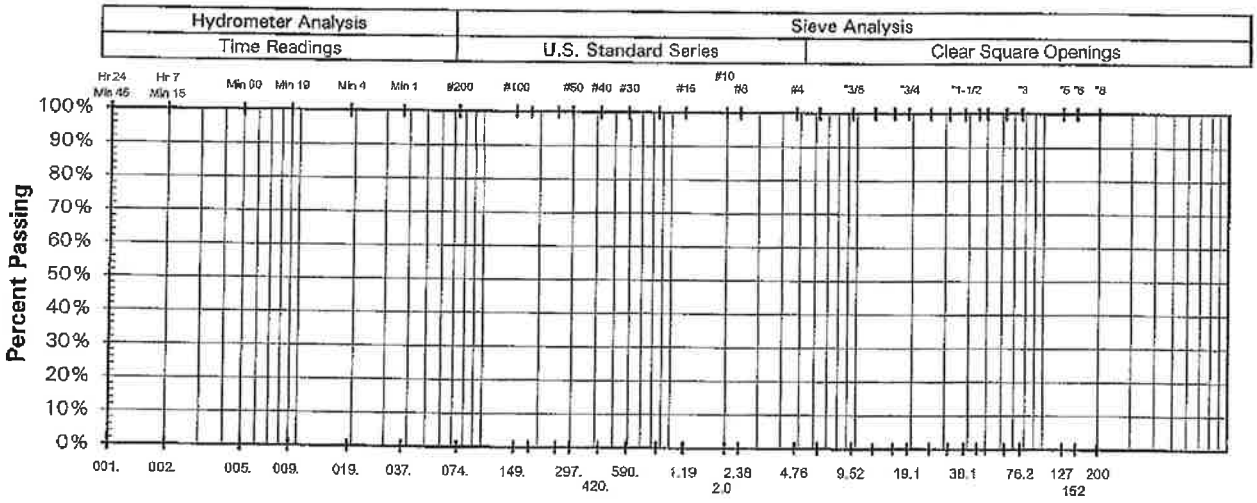
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, P.C.



Diameter of Particle in Millimeters

Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

Gravel	38%	Liquid Limit	
Sand	49%	Plasticity Index	
Silt and Clay	13%	Sample Location	B-12 @ 14 feet
Sample Description	Clayey Sand with Gravel (SC)		



Diameter of Particle in Millimeters

Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

Gravel		Liquid Limit	
Sand		Plasticity Index	
Silt and Clay		Sample Location	
Sample Description			

Project No. 1060615

GRADATION TEST RESULTS

Figure 9

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1060615

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	WATER SOLUBLE SULFATE (ppm)	SAMPLE CLASSIFICATION
BORING	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
B-1	4	22	90			93			3,360	<10	Lean Clay (CL)
B-2	9	4		62	30	8					Poorly-graded Gravel w/Clay & Sand (GP-GC)
B-3	19	5	109	42	46	12					Poorly-graded Sand w/Clay & Gravel (SP-SC)
B-5	4	21	90			98					Lean Clay (CL)
B-9	3	17	84			99	48	29			Lean Clay (CL)
B-11	19	18	111			51					Sandy Lean Clay (CL)
B-12	14	5	107	38	49	13					Clayey Sand w/Gravel (SC)
B-13	4	10	99			27					Silty Sand (SM)
B-14	9	20	109			77					Lean Clay w/Sand (CL)