

**PRELIMINARY
SOIL AND FOUNDATION INVESTIGATION**

Kittredge West Commons
University of Colorado
2501 Kittredge Loop Drive
Boulder, Boulder County, Colorado

PREPARED FOR:

University of Colorado at Boulder
3500 Marine Street, Room 122, 451 UCB
Boulder, Colorado 80309

Attention: Ms. Marina Florian

Project 102036

January 19, 2011

TABLE OF CONTENTS

Summary	Page 1
Scope of Study	Page 1
Proposed Construction	Page 2
Field Investigation	Page 2
Laboratory Testing	Page 3
Subsurface Conditions	Page 3
Foundations	Page 4
Floor Slab Construction	Page 6
Earthwork	Page 8
Groundwater	Page 9
Lateral Earth Pressures	Page 10
Design and Construction Details	Page 11
On-Site Pavement	Page 12
Miscellaneous	Page 15
Boring Location Plan	Plate 1
Logs of Exploratory Borings	Plate 2
Legend and Notes	Plate 3
Swell-Consolidation Test Result	Plates 4-8
Summary of Laboratory Test Results	Table 1

SUMMARY

(1) The subsurface conditions at the site are variable. Our borings generally encountered various clay and sand soils, including some existing fills, over generally claystone bedrock. Some of the present groundwater levels are at depths of less than 10 feet.

(2) In our opinion, a straight shaft pier (caissons) foundation will be suitable for the proposed building structure at the site. The piers should be drilled at least 6 feet into the bedrock. Shallow foundations placed below frost depth on at least 2 feet of new fill may be possible below site structures such as retaining walls. The need for some deeper overexcavation below some footings could be required.

(3) Floor slabs may be supported, with some risk of movement, on-grade on at least 4 feet of compacted fill, as discussed. The need for some deeper overexcavation below floor slabs could also be required.

(4) Relatively high perched water tables are known to be present on the site. The proposed construction is feasible but subsurface drainage will be needed.

(5) Pavement recommendations are provided in that section of this report.

(6) A final geotechnical report should be performed prior to new construction at the site. A representative from our firm should observe the construction operations discussed in this report.

SCOPE OF STUDY

This report presents the results of a preliminary soil and foundation investigation at the site of the proposed Kittredge West Commons project to be located at 2501 Kittredge Loop Drive on the University of Colorado campus Boulder, Boulder County, Colorado.

The purpose of this study was to explore the general subsurface conditions, obtain some data of the pertinent engineering characteristics of the underlying strata, determine potential foundation systems, develop preliminary foundation design criteria, attempt to evaluate the risks of slab-on-grade construction, provide preliminary on-site pavement thickness criteria, and address other geotechnical factors in the proposed development.

It should be understood the economic and practical constraints limit our sampling and laboratory testing to only a miniscule fraction of the total mass of soil and bedrock that lies within the zone of influence of the proposed structure. Our analyses, conclusions and recommendations are based upon the assumption that the samples of subsurface strata, which we observed and tested, are representative of the entire soil mass.

PROPOSED CONSTRUCTION

As we understand, the proposed construction is still to be determined. However, it is expected to generally be a 2 to 3 story structure to be constructed after demolition of the existing construction on the site. The structure is not expected to have a below-grade level other than being set into the higher ground on the northern side of the site. Various site development measures (sidewalks, pavements, utilities, landscaping, etc.) will be undertaken around the structure. Existing structures at the site will be demolished.

FIELD INVESTIGATION

Four (4) exploratory test borings were drilled at the site. The boring locations are shown on Plate 1. The borings were drilled with solid-stem, continuous flight augers using a powered drill rig.

At regular intervals the drilling tools were removed from the boreholes and soil samples were obtained with a 2-inch I. D. California Spoon Sampler. The sampler was driven into the various subsoil strata with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler one foot, or a fraction thereof, constitutes the penetration test. This field test is similar to the standard penetration test described by ASTM Method D-1586. Penetration resistance values, when properly evaluated, are an index to the soil strength and density. The depths at which the samples were taken and the penetration resistance

values are shown on the Logs of Exploratory Borings, Plate 2. Legend and Notes for the borings are presented on Plate 3.

LABORATORY TESTING

All samples were carefully inspected and classified in the laboratory by the project engineer. Natural water contents, dry unit weights, Atterburg limits, partial (percents passing the U.S. No. 200 sieve) gradations and a percent water soluble sulfate were obtained from relatively undisturbed drive samples of typical materials encountered (see Table 1).

Swell-consolidation tests were performed on typical specimens of potentially swelling material (see Plates 4 through 8). This is to indicate the behavior of these materials upon loading and wetting. Some of the swell tests were performed on specimens which were allowed to partially air-dry prior to testing.

SUBSURFACE CONDITIONS

The subsurface conditions are variable. Generally, various clay and sand soils overlie generally claystone bedrock. From 2 to 3 feet of existing fill was noted in our borings. Deeper fills are to be expected on the site at least in the area of prior wall backfills.

The various clay and sand soils are medium stiff to very stiff and medium dense to very dense. The clayey soils presently possess very low to low swell potentials which would increase with drying. The sands are non-expansive when not mixed with clay.

The bedrock is initially encountered at depths of 9 to 16 feet. The claystone bedrock is medium hard to very hard. At deeper depths, the claystone is harder and less weathered. The claystone presently possesses moderate swell potentials that

increase with drying. Some lenses of very to extremely hard sandstone are also present.

The higher present groundwater levels in our borings at the site are at depths of less than 10 feet. Even shallower levels, within a gravel layer immediately below the lower level floor of the existing structure, are known to have been present in recent years. It should be noted that the water levels shown on the logs are not stabilized levels after a period of time. True water table levels are higher. It should also be noted that the water table can vary with changes in precipitation, irrigation and land use.

FOUNDATIONS

In our opinion, a straight shaft pier (caissons) foundation or a shallow (footing) foundation will be suitable for the proposed building structure at the site. The straight shaft piers (caissons) should be drilled at least 6 feet into the bedrock strata. The bedrock penetration at each pier should also be at least 2 times the pier diameter. Piers should also have minimum lengths of at least 20 feet.

Based on the supporting capacity of the bedrock materials encountered, it is probable that the piers could be designed for a maximum end bearing pressure of 40,000 psf and an average compressive side shear value of 3,500 psf. Tension side shear of 60 percent of the compressive value would be suitable.

All piers should carry a minimum dead-load of 20,000 psf times the pier end area. If the minimum dead-load can not be met, additional bedrock penetration utilizing the tension side shear should be used along with additional steel reinforcing. A minimum pier diameter of 18 inches should be used. The length to diameter ratio of the piers should not exceed 30. Piers should be spaced at least two diameters, edge-to-edge, apart. If closer piers must be used, design pressures will need to be adjusted. The allowable design pressures would be a linear relationship from 100

percent at two diameters apart down to 75 (end bearing) and 67 percent (side shear) at no diameters apart, that is with edges touching. If two nearby piers are of different diameters, the spacing ratio should be determined based on the smaller diameter of the two.

Pier movements are expected to generally be less than 3/8 inch, depending upon the pier diameter and the hardness of the bedrock at each pier.

Lateral pier design parameters are horizontal modulus of subgrade reaction values of 40 tcf (soil and fill) and 260 tcf (weathered bedrock). The modulus values are based on a pier diameter of 1 foot. Values used should be the proceeding divided by the actual pier diameter in feet. Lateral pier design based on allowable passive equivalent fluid density values of 140 pcf and 500 pcf may be used for any upper soils and all of the bedrock, respectively. Other pier design and 'L Pile' parameters are provided in Table A. In L-Pile, the bedrock category is "very stiff clay."

Table A - Soil Strength Design Parameters

Soil Desc.	Soil Type	Dry Density (lb/in ³)	Average Undrained Shear Strength (lb/in ²)	Average Friction Angle (Deg)	Strain @ 50% Max. Strength	Modulus of Subgrade Reaction (tcf)
Soil	varies	0.062	10.0	22.5	0.015	40
Bedrock	A-7-6	0.065	75.0	0	0.005	260

Piers are recommended for support of building related construction. However, with the assumption of greater risk of movement, features such as site retaining walls that are not directly related to the building, could be supported on shallow footing foundations. Footing foundations would be placed below frost depth, 36 inches, on at least 2 feet of new fill including at the top 1 foot of new granular fill. Potential movements would be on the order of 1-inch maximum settlement and up to 2-1/2

inches of uplift. Some deeper removal and replacement of existing fill and/or particularly clayey or claystone materials could be necessary. The shallow foundations would be designed using a maximum net allowable soil bearing pressure of 1,750 psf.

FLOOR SLAB CONSTRUCTION

Slabs constructed at the site could be subject to some movements due to expansion of any underlying clayey and/or claystone materials. Generally, we would expect slabs constructed per this report to heave no more than approximately 1-1/2 inches. Slabs should be placed on a minimum of 4 feet of new fill. Some deeper removal and replacement of existing fill and/or particularly clayey or claystone materials could be necessary.

Measures, which we recommend to assure a suitable subgrade supporting the slabs and also to help minimize the movement, are as follows:

- 1) Any fill placed immediately beneath, upper 2 feet, the floor slabs should be an imported, non-swelling, granular material that is approved by the geotechnical engineer prior to its placement. All the underslab fill should be compacted to at least 95 percent of the maximum Standard Proctor density (per ASTM D-698) at a moisture content near the optimum.

- 2) Floor slab control joints should be used to reduce damage due to shrinkage cracking. The requirement for slab reinforcement and thickness should be established by the designer based on experience and intended slab use. A polyethylene moisture barrier should be used below the slabs in finished areas with relatively impermeable floor covings. This moisture barrier must be continuous and would be placed shortly before concrete placement. Any moisture/vapor barrier used should be installed per recommendations of ASTM

E-1643. Areas without relatively impermeable floor coverings would not need a moisture barrier.

3) Place a minimum 2 inch "void" above, or preferably below non-bearing partitions in slab-on-grade areas. Doorjambes, drywall, heating and cooling equipment, etc., should be similarly protected. Floor slabs should generally be separated from bearing walls and columns with expansion joints that allow unrestrained vertical movement. However, if significant structural benefits result, slabs could be tied

4) Any exposed clayey or claystone materials should be kept moist during construction by occasional sprinkling.

5) Only very well controlled irrigation should occur for a distance of 6 feet beyond the building limits. Those areas may be covered with decorative gravel or artificial lawn, or preferably pavement. All exterior joints (building-sidewalk, curb pavement, etc.) should be well sealed. Roof downspouts should discharge on splashblocks, downspout extensions, or pavements to beyond the limits of the foundation backfill but not less than 6 feet from the building.

6) All plumbing lines should be tested before operation. Where plumbing lines enter through the floor, a positive bond break should be provided.

7) A modulus of subgrade reaction of 150 pci can be used for slab design.

It should be noted that these floor slab comments and recommendations would also apply to the exterior slabs, particularly at critical areas such as sidewalks near building entrances.

EARTHWORK

We recommend that permanent cut and fill slopes generally be no steeper than 3 (horizontal) to 1 (vertical). Steeper slopes may be suitable but would need to be individually considered. Slopes will need to be protected against erosion. Vegetation, benched timber walls, rock walls, rip-rap, etc. would all be suitable measures.

All elements of existing structures, to be demolished, should be removed to at least 1 foot below new construction levels. It should be noted that previous underground obstructions could be present on the site in "vacant areas." If any existing organic and/or rubble fill is encountered, they must be removed and cannot be reused on-site.

Existing fills on the site could need reworking below new footings, slabs and pavements. Prior fills should be observed for suitability during earthwork operations. Typically it is expected that any existing fill materials will be suitable for reuse as general new fill but not as specific granular fill. However, any organics, trash and any large (greater than 12 inches) rubble should not be reused at all. Rubble larger than 6 inches should not be reused within 3 feet of the surface.

Removal and replacement in order to achieve the required depth of new fill below footings and slabs should be done in any case.

Structural fill should consist of either inherently non-swelling material such as sands or materials which can be placed and maintained in such manner that their swell potential is minimized. The clayey on-site soils are of the later type. Any imported material should be approved prior to its use. Structural granular fill materials for use directly below footings or slabs should have a liquid limit of less than 30, a plasticity index of less than 15, a maximum particle size of 2 inches, and a percent passing the U.S. No. 200 sieve of no more than 30 percent. Importing of

the granular materials should be expected. Claystone should not be reused as structural fill.

Structural fill should be compacted to at least 95 percent of the maximum Standard Proctor density (per ASTM D-698) at a moisture content appropriate for the particular material. We would expect that the on-site clayey soils will require a moisture content on the order of from the 2 percent below to 1 percent above the optimum order to minimize swell potentials. **The specific minimum moisture content of each on-site material encountered will be determined by the geotechnical engineer during construction.** The specific minimum moisture content for each clayey material would be that at which a maximum swell of 1 percent occurred under a 150-psf loading. The swell tests would be run as each proctor test was performed. The necessary moisture content of any imported material would be determined at the time of approval. The moisture content of essentially granular material such as sand would not be critical.

It should be noted that soft, wet subgrades may be exposed in some areas of the site. Stabilizing fills could be needed prior to proceeding with the general fill in those areas.

GROUNDWATER

Very high perched water levels are known to be present on the site. If underground spaces are to be constructed, including those set into the northern higher side of the site, at least a perimeter subsurface drainage system suitably connected to a sump or other acceptable outlet must be provided around (wall drainage board and/or gravel "chimney") and at least 18 inches below the slab level at the perimeter (perforated pipe and gravel). All subsurface drainage pipe at the site should be sloped a minimum of 1 percent. Lateral drains below floor slabs may also be needed.

LATERAL EARTH PRESSURES

Structure Walls: Structure walls which will be comparatively rigid and should, in our opinion, be designed for 'at rest' lateral soil pressures. If general on-site backfill is to be used, the lateral earth pressure design value would 70 pcf. As an alternative, imported granular, non-swelling soil (less than 10 percent passing the U.S. No. 200 sieve) could be used as backfill. The sand and gravel, if that alternative is selected, must be present within an area defined by a line extending upward from the base of the wall at an angle of 30 degrees from the wall. The lateral earth pressure may then be estimated by using an equivalent fluid density of 50 pcf. The upper 1 foot of backfill should be fairly impermeable to prevent surface water from entering the backfill. If significantly upward sloping backfill (steeper than 3 horizontal to 1 vertical) is to be used we should be contacted to provide recommendations.

Temporary Excavation Bracing: No temporary bracing is necessary for excavated areas if a 1.5 (horizontal) to 1 (vertical) slope is maintained. Should bracing be necessary at some critical area or desirable for personnel safety are recommended that an "active" earth pressure of $40 \times Z - 150$ psf be used, where Z=depth of excavation (for example, if a 12 foot excavation is planned, the temporary bracing should be designed for a lateral earth pressure of $40 \times 12 - 150 = 330$ psf per linear foot).

Retaining Walls: The data presented in the section on structure walls is also generally applicable to site retaining walls, and other walls which can move slightly, with the following modifications:

- 1) The active lateral earth pressure may be computed by using an equivalent fluid density of 35 pcf with imported granular backfill or 50 pcf with general on-site backfill.

2) Drainage should be provided to prevent water build-up behind site retaining walls. Generally, weep holes would be a suitable drainage provision.

Resistance: Lateral pressures on walls retaining earth walls may be resisted by an ultimate passive equivalent fluid density of 240 pcf (soil or compacted fill). An ultimate coefficient of friction of 0.4 may also be used in the design.

DESIGN AND CONSTRUCTION DETAILS

1) Piers should be reinforced longitudinally with steel (Grade 60) of at least 0.005 times the pier cross-sectional area to help prevent breakage of the piers due to uplift on their sides by swelling materials. Additional reinforcing may be necessary for other structural reasons. The bedrock penetration portion of the pier holes should be roughened artificially with a side tooth added to the auger after drilling and prior to cleaning in order to assure a good bond between the concrete and the bedrock. The roughening should consist of at least 1 inch by 1-1/2 inch high grooves at a vertical spacing of 18 inches. The upper portion of the piers should be kept relatively smooth to reduce the adhesion between any swelling materials and the piers. Care should be taken to minimize enlargement of the piers at the top.

2) A 4 to 6 inch minimum "air space" should be provided beneath the portions of the grade beams that span between the piers.

3) Temporary casing of the pier holes is often expected. Even with casing, excessive water infiltration from within the bedrock, greater than 4 inches, is possible. If that occurs pumping to remove water or to place concrete below the water would then be required. Concrete should be placed immediately after drilling, cleaning, and observation in order to minimize water infiltration problems. Pier concrete should have a design slump of 5 to 7 inches. The pier-

drilling contractor should be aware of the hardness of the bedrock and plan for suitable equipment in order to achieve bedrock penetration.

4) Backfill around the structure should be moistened and well-compacted (95 percent of Standard Proctor density and potentially higher where overlying slabs or pavements are to be present). A minimum exterior slope, away from the structure, of at least 8 inches in the first 10 feet is recommended. Flatter slopes would be acceptable in hard-surfaced areas such as pavements, sidewalks, etc.

5) We recommend, as a precautionary measure, that Type I/II or equivalent cement be used in all concrete exposed to the earth at the site.

6) Precautions should be taken against drying any exposed clayey soils or claystones during construction or wetting thereafter.

7) Care should be taken in excavating for any footing foundations so as to avoid disturbing the subsoils. Any soils disturbed during footing excavation or preparation should be removed or recompacted prior to placing concrete.

8) Footing foundation walls should be well reinforced, both top and bottom and particularly around openings. This is to give them sufficient strength to resist slight differential movements that may occur in the bearing strata below foundation levels.

ON-SITE PAVEMENT

The on-site pavement subgrade materials at the site are expected to generally consist of various clay soils. These variable materials generally classify as A-7-6 in the AASHTO System. Group indexes of the more clayey soils are typically greater than 30. A Hveem "R" value on the order of 5 would be expected. Modulus of

subgrade reaction values would typically be on the order of 75 to 125 pci. These are relatively poor pavement subgrade soils.

Based on the laboratory test results, the anticipated traffic, and our experience in the area, the following minimum on-site preliminary pavement sections are probable:

- 1) AUTO AND/OR LIGHT TRUCK PARKING AND LIGHT TRAFFIC AREAS (Standard Duty):
 - A) 5 inches full-depth asphalt; OR
 - B) 3 inches of asphalt and
6 inches of aggregate base course; OR
 - C) 5 inches of concrete

- 2) HEAVY TRAFFIC DRIVES AND LOADING/UNLOADING AREAS (Heavy Duty):
 - A) 8 inches full-depth asphalt; OR
 - B) 5 inches of asphalt and
9 inches of aggregate base course; OR
 - C) 6-1/2 inches of concrete

We highly recommend that the concrete pavement be used for loading areas, and areas where truck-turning movements are concentrated. This includes trash dumpster areas where the slab should be below the trash bin and the truck's position while loading.

Prior to placement of the pavement sections, the entire areas should be stripped of all organic matter and debris. The exposed surface should then be proof rolled with a heavy pneumatic-tired vehicle. Any soils, which are noted to be pumping or deforming excessively under the moving wheel loads, should be removed and

replaced with a properly compacted and approved material. It is recommended that a representative of our office observe this operation.

It should be understood that attempting to place and compact any asphalt pavement on a soft and deflecting subgrade generally results in unsatisfactory density of the base course and asphalt and/or formation of cracks in the asphalt. Either of these occurrences can severely weaken the pavement section.

All fill placed in pavement areas should be compacted to at least 95 percent of the maximum Standard Proctor density (per ASTM D-698) at from 2 percent below to 2 percent above the optimum moisture content. The subgrade should be adequately moist at the time of actual paving. In cut areas, the upper one-foot of subgrade material should also be compacted to those criteria.

The aggregate base course should meet Colorado Department of Transportation (CDOT) specifications. The use of Class 6 (3/4-inch) aggregate is suggested. The base course should be compacted to at least 95 percent of the maximum Modified Proctor density (per ASTM D-1557).

The asphalt (hot plant mix) should meet CDOT specifications. We suggest a specific job mix formula meeting grading S (3/4-inch) be used. Concrete used for pavements should also meet CDOT specifications. We suggest the use of Class P concrete.

The pavements are generally not designed to carry repeated heavy construction traffic. Therefore, construction operations subsequent to paving must be planned so that the traffic will avoid paved areas.

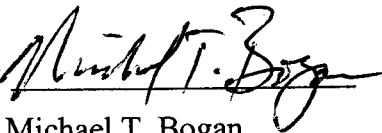
MISCELLANEOUS

In any subsurface investigation it is necessary to assume that foundation conditions do not change greatly from those indicated by our exploratory borings. However, our experience has shown that anomalies do sometimes become apparent during construction. For this reason, we recommend that a representative of our firm who is familiar with the subsurface conditions observe the construction operations discussed in this report. Also, a final geotechnical investigation, with additional borings, should be performed prior to new construction.

Respectfully submitted,

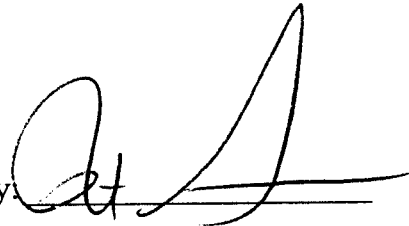
CTC-Geotek, Inc.

By:



Michael T. Bogan
Sr. Geotechnical Consultant

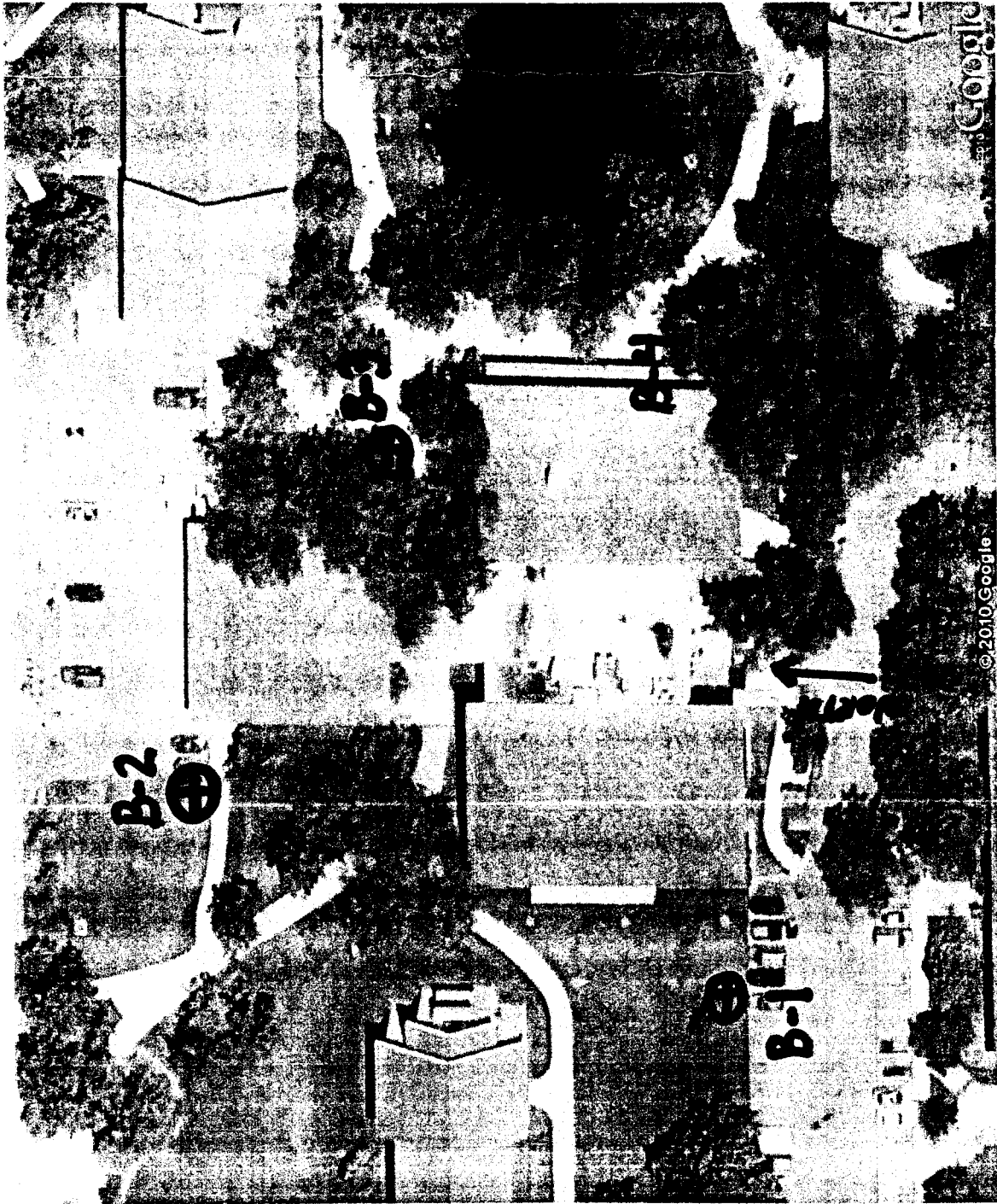
Reviewed by:



Robert Scavuzzo, P E.
Senior Engineer/President

MTB:RS

5 copies sent



BORING LOCATION PLAN

CTC-GEOTEK
ENGINEERING TESTING INSPECTION

Kittredge West Commons
2501 Kittredge Loop Drive
Boulder, Boulder County, Colorado

DRAWN BY: mtb
CHECKED BY:
DATE: 1-18-11

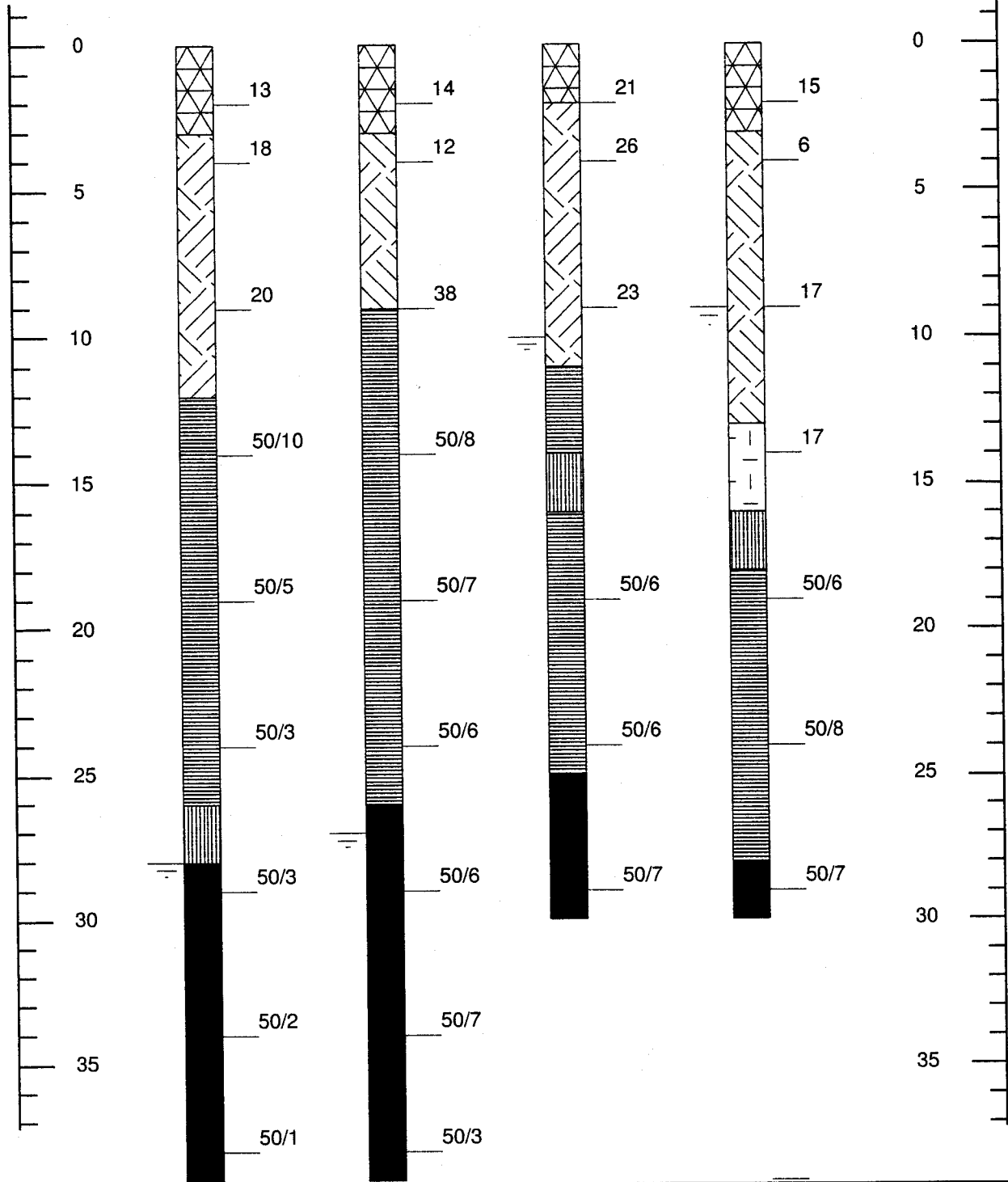
SCALE: N/A
JOB NO. 102036 PLATE 1

B-1

B-2

B-3

B-4



LOGS OF EXPLORATORY BORINGS

CTC-GEOTEK
ENGINEERING TESTING INSPECTION

Kittredge West Commons
2501 Kittredge Loop Drive
Boulder, Boulder County, Colorado

DRAWN BY: mtb

CHECKED BY:

DATE: 1-18-11

SCALE: Vertical 1" = 5'

JOB NO. 102036

PLATE 2



Fill - generally various clay, silt and sand mixtures, medium moist to moist, moderately compact, gravelly



Clay, silt and sand mixtures, medium stiff to stiff, moist to very moist, brown



Sand and clay, silty, medium dense, very moist to wet



Claystone bedrock, weathered, med. hard to very hard, med. moist to moist, brown to gray



Sandstone bedrock, very hard to extremely hard, moist



Claystone bedrock (shale), silty, very hard, medium moist, gray



Water levels noted at the time of drilling (True perched water table generally higher).

NOTES: (1) Borings drilled on December 30, 2010 and January 3, 2011 with solid-stem, power augers.

(2) 13 indicates that 13 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches. 50/10 indicates 50 blows for 10 inches.

(3) Stratification lines are approximate and transitions may be gradual.

(4) The logs only show conditions at the times and locations indicated.

LEGEND AND NOTES

CTC-GEOTEK
ENGINEERING TESTING INSPECTION

Kittredge West Commons
2501 Kittredge Loop Drive
Boulder, Boulder County, Colorado

DRAWN BY: mtb

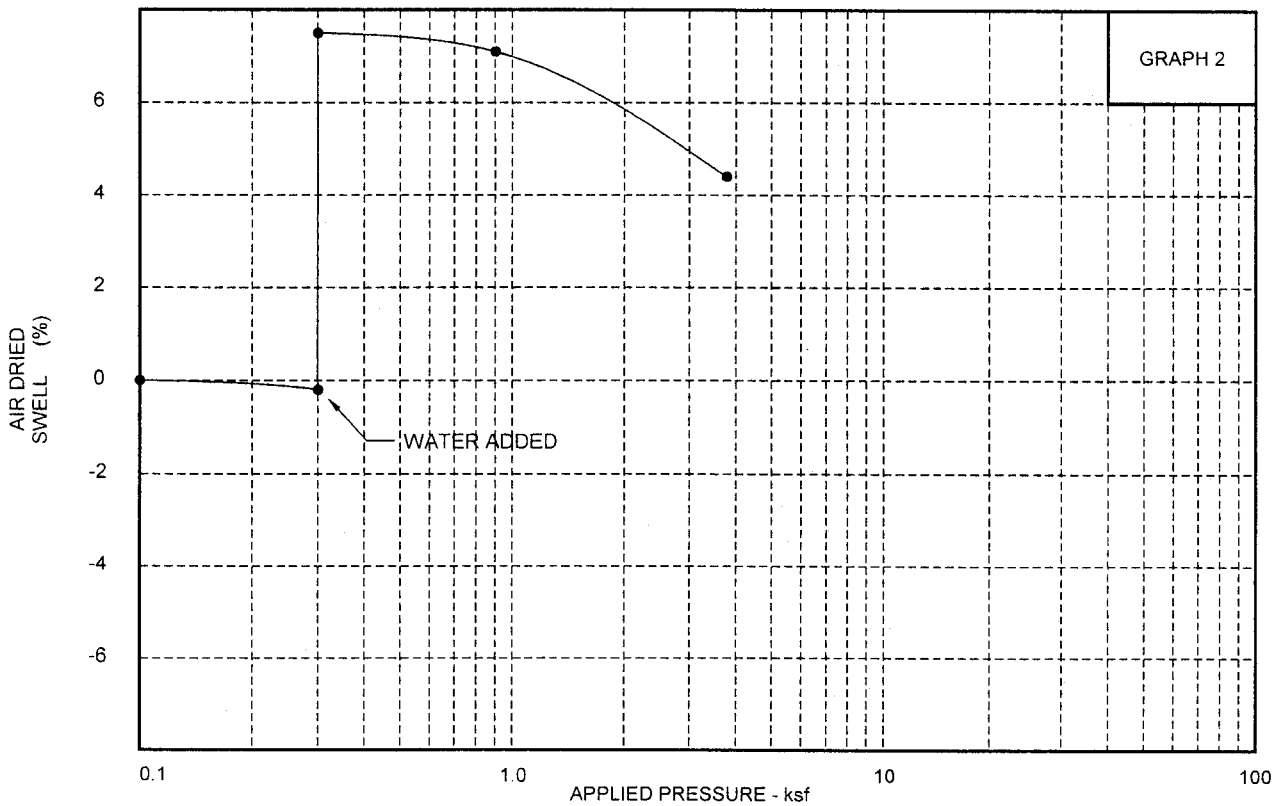
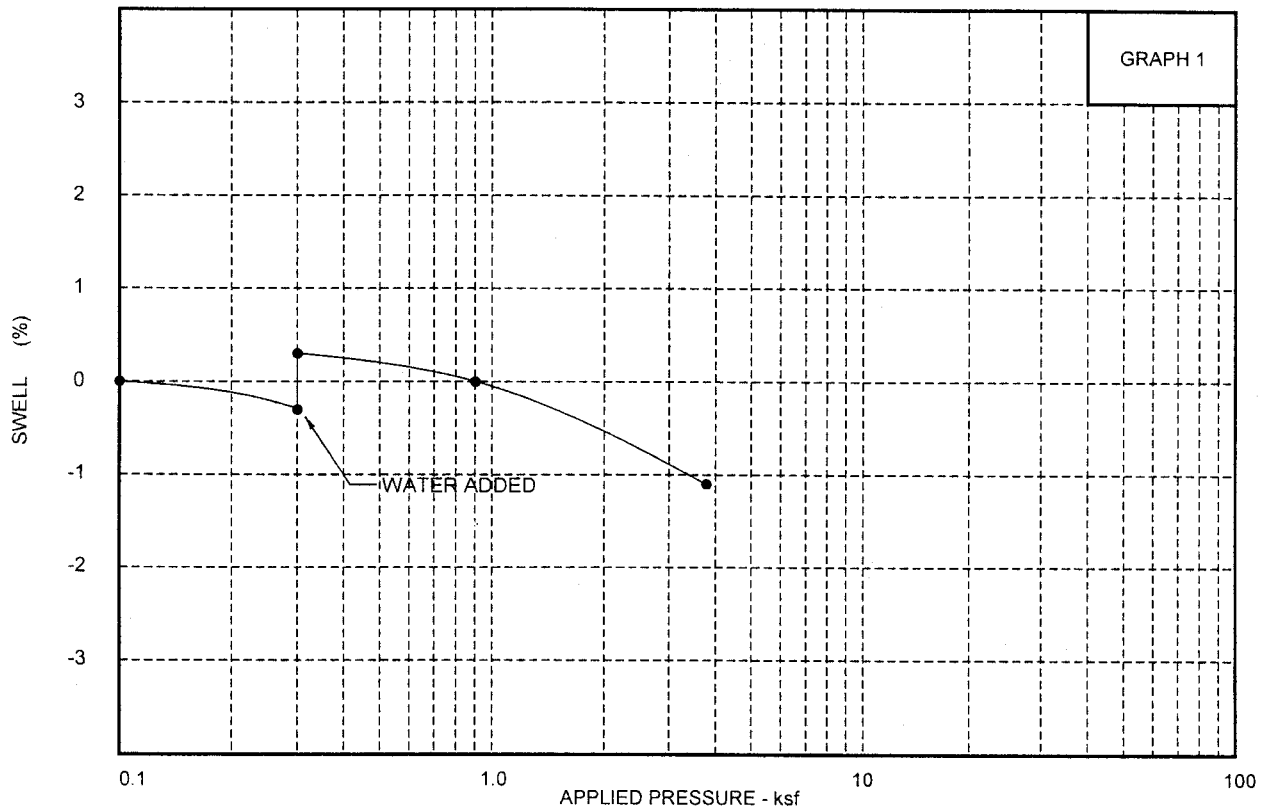
CHECKED BY:

DATE: 1-18-11

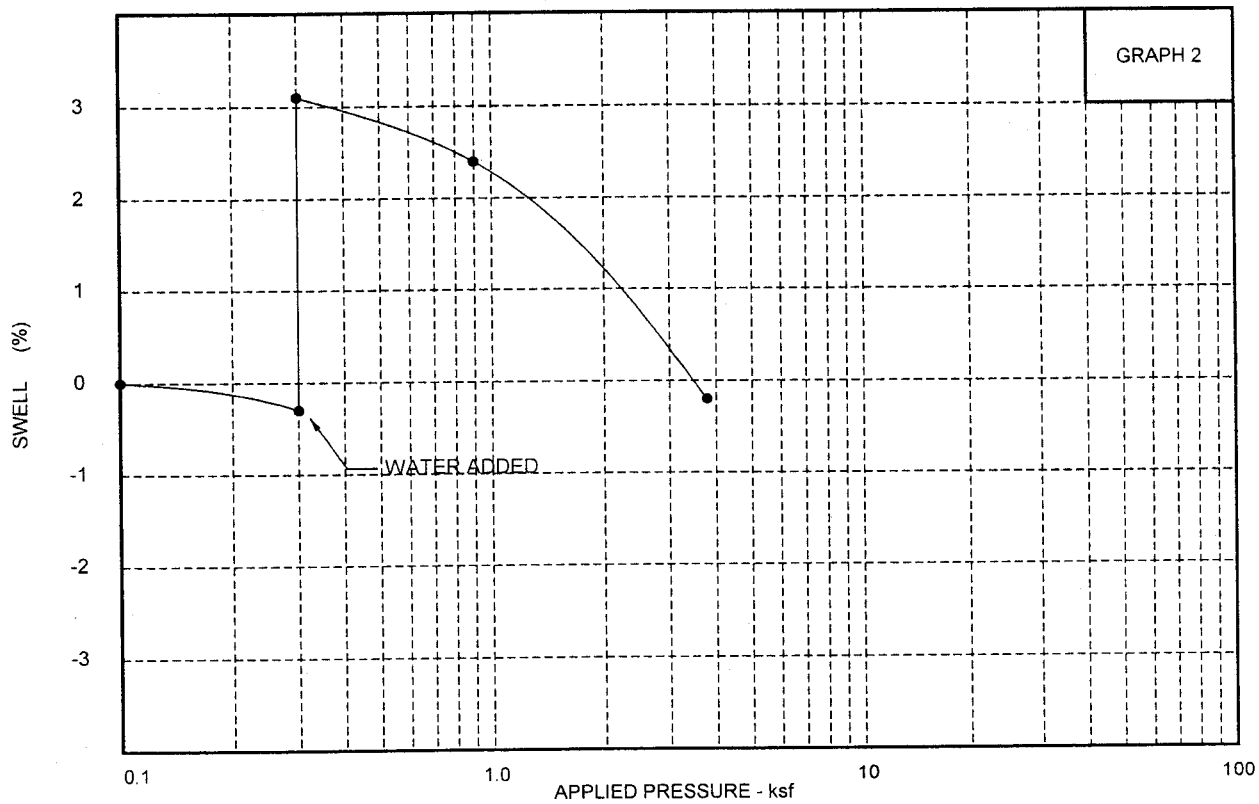
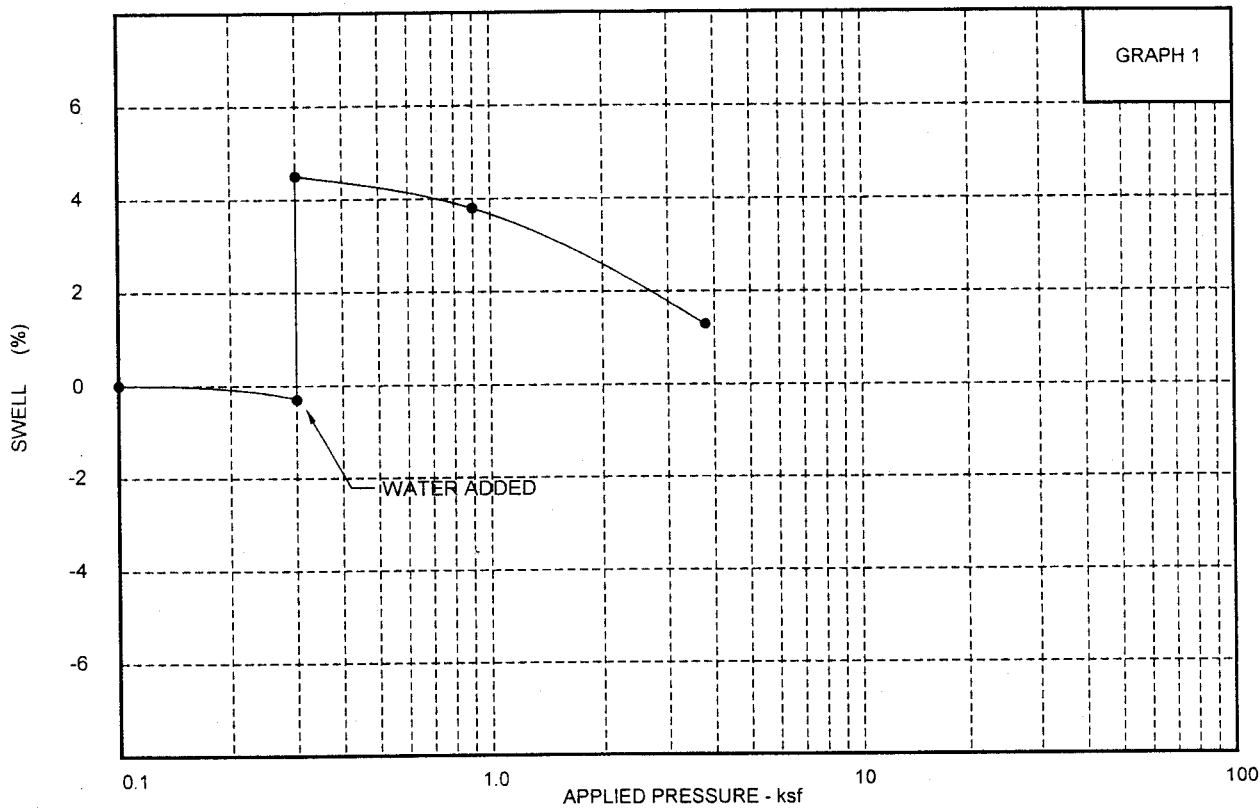
SCALE: N/A

JOB NO. 102036

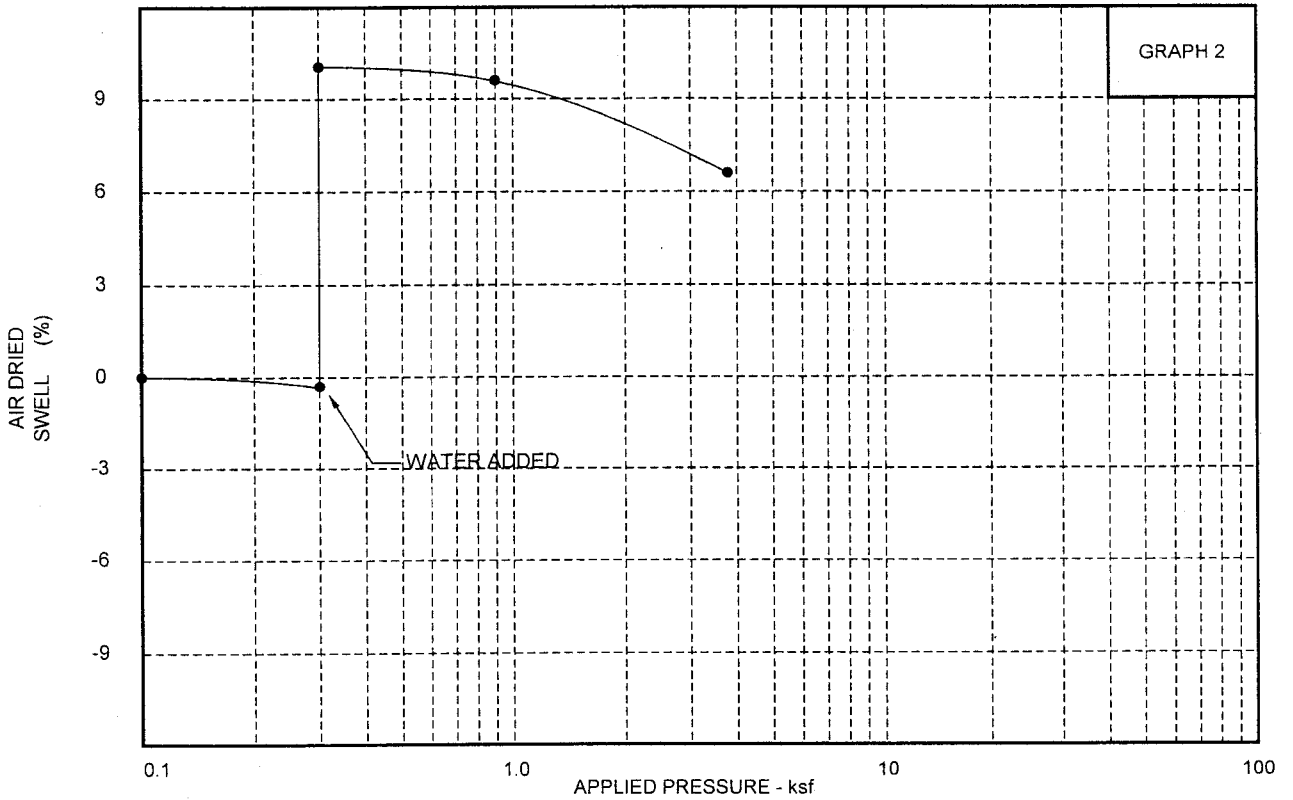
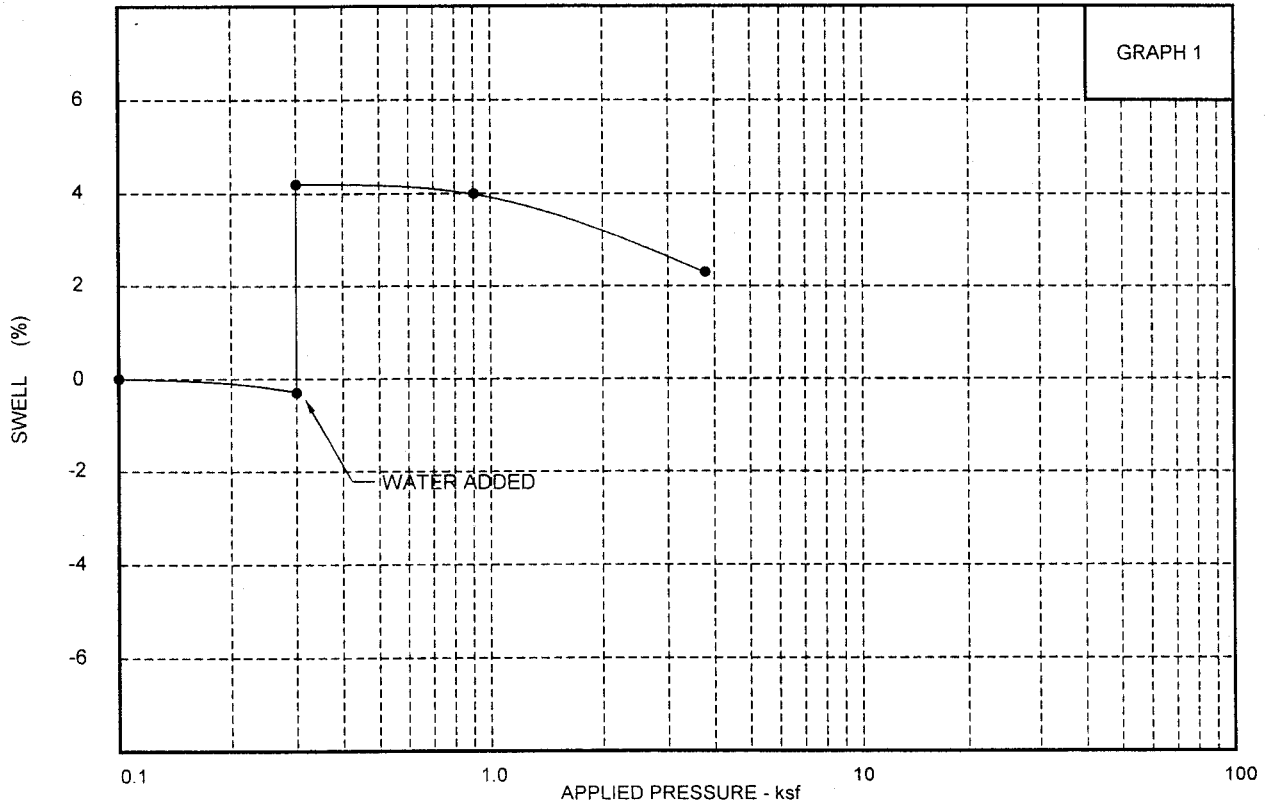
PLATE 3



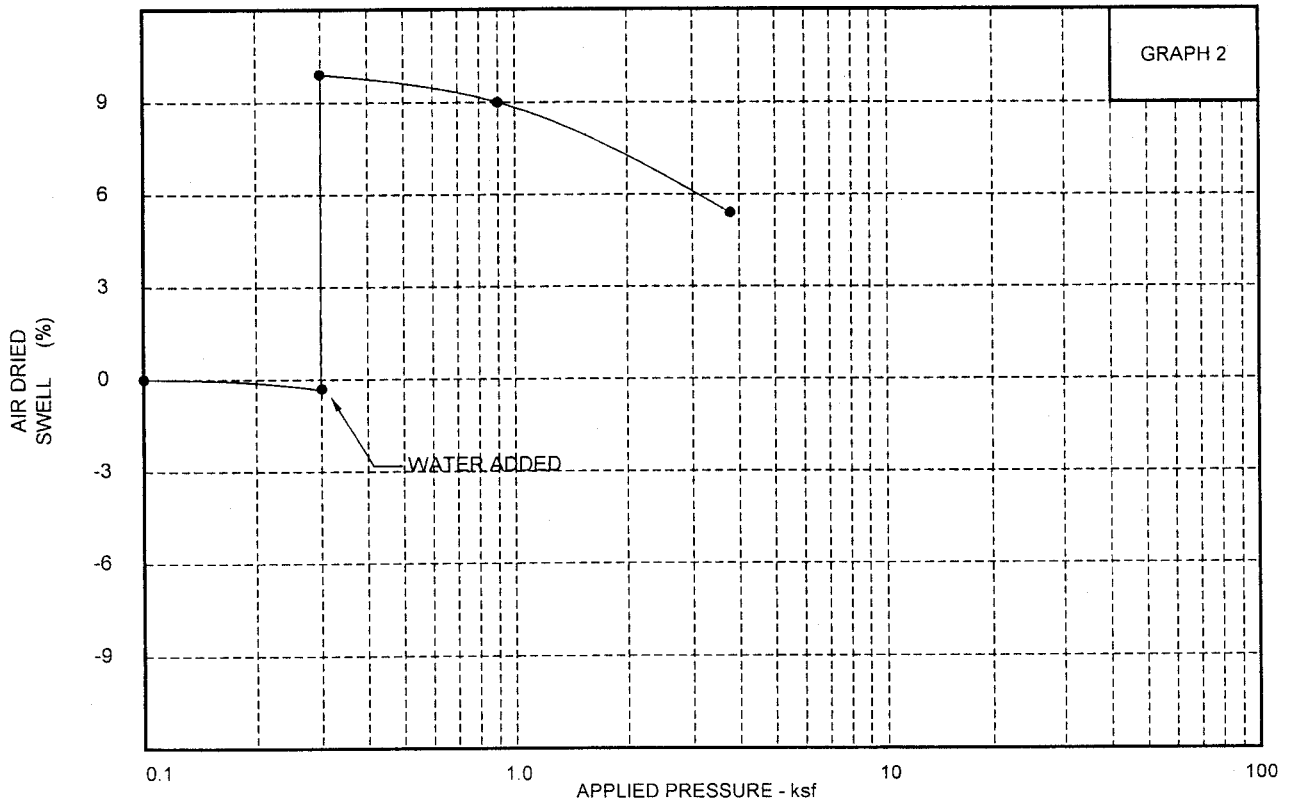
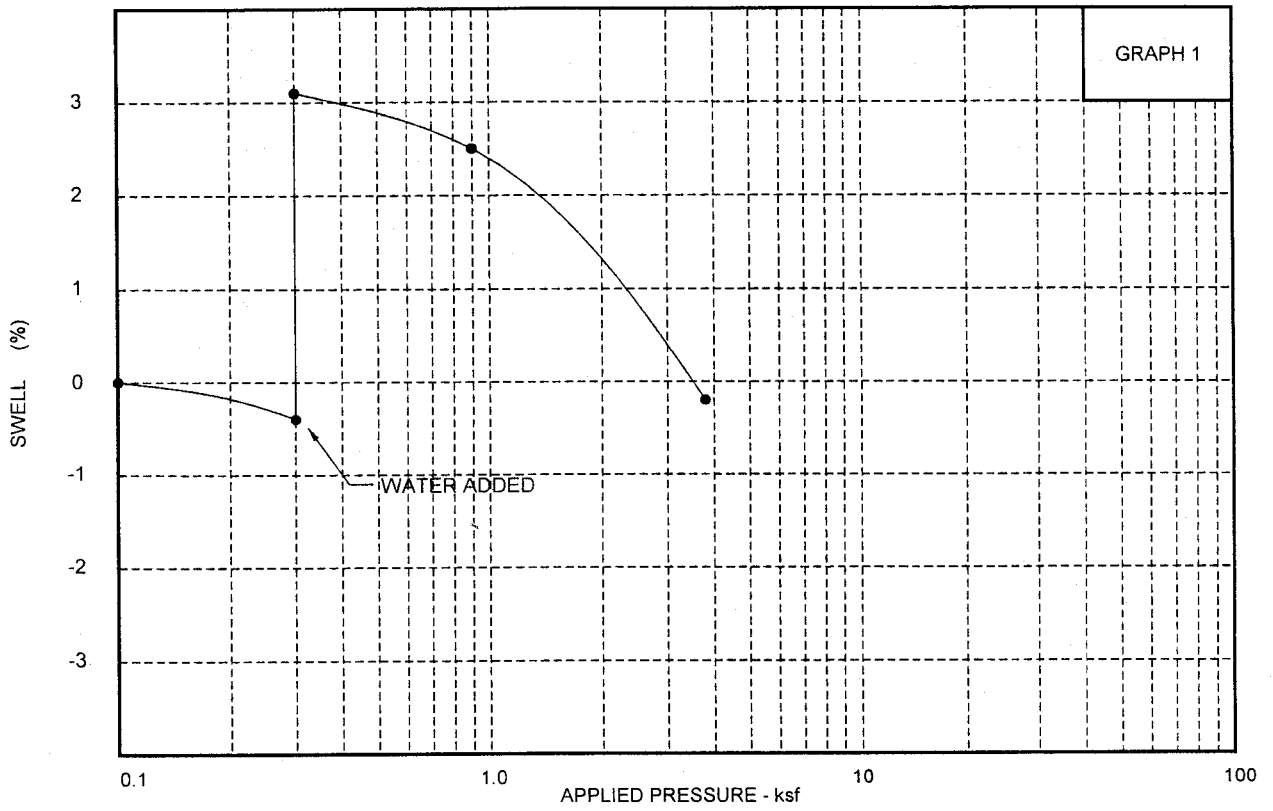
GRAPH NO.	BORING NO.	SAMPLE NO.	DEPTH IN FEET	DRY DENSITY (PCF)	MOISTURE (%)	SOIL DESCRIPTION	GTC-GEOTEK	
1	B1		4	114.1	17.9	Sand, and silty clay, trace gravel	SWELL - CONSOLIDATION TEST	
2	B1		4	114.1	12.5	Sand, and silty clay, trace gravel	DRAWN BY: JLW	JOB NO.: 102036
							DATE: 1-11-2011	PLATE: 4



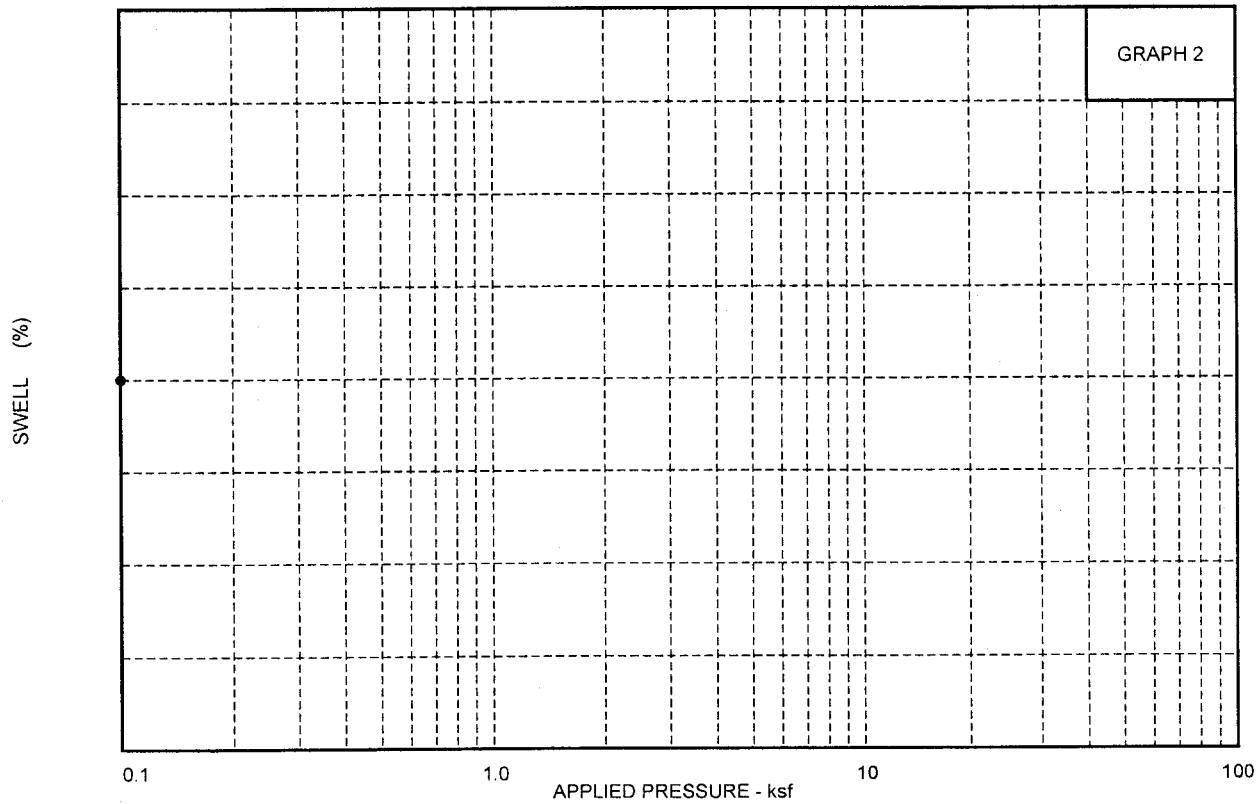
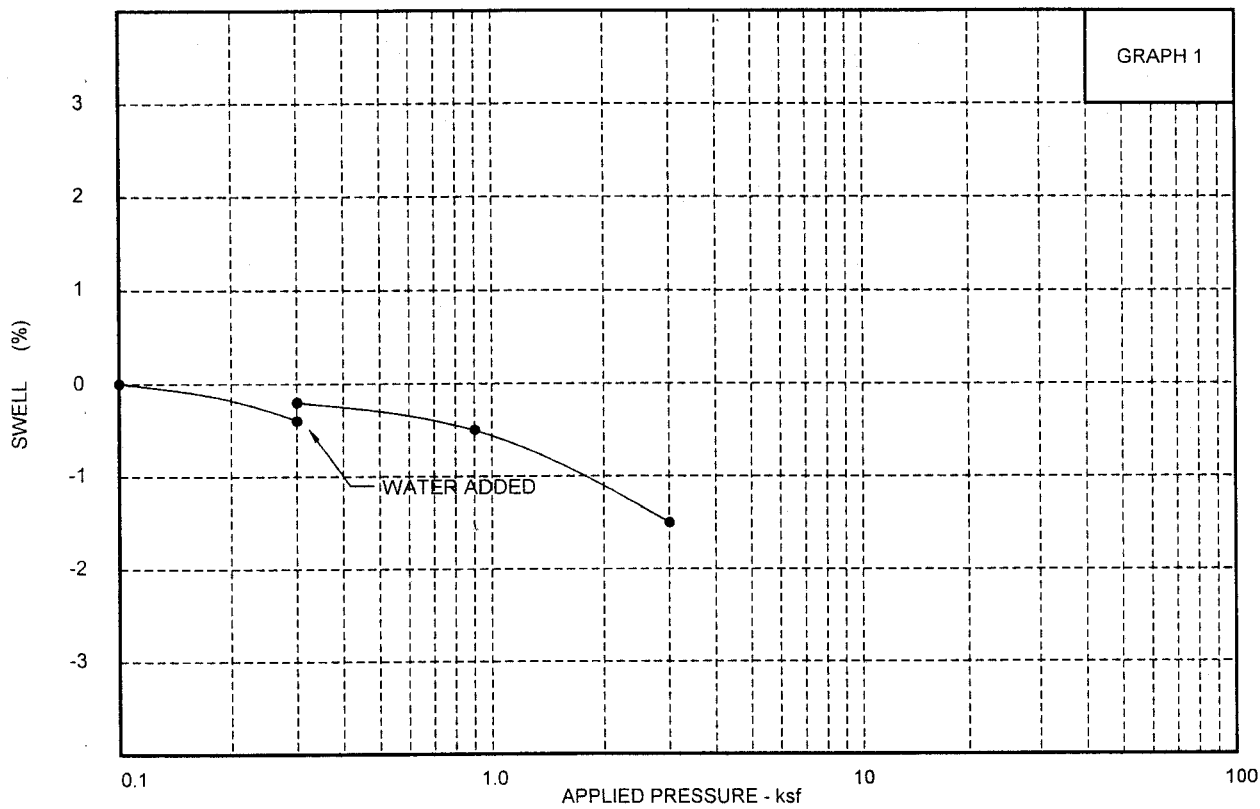
GRAPH NO.	BORING NO.	SAMPLE NO.	DEPTH IN FEET	DRY DENSITY (PCF)	MOISTURE (%)	SOIL DESCRIPTION	GTC-GEOTEK	
1	B1		14	111.8	18.9	Claystone	SWELL - CONSOLIDATION TEST	
2	B2		14	113.9	15.2	Claystone	DRAWN BY: JLW	JOB NO.: 102036
							DATE: 1-11-2011	PLATE: 5



GRAPH NO.	BORING NO.	SAMPLE NO.	DEPTH IN FEET	DRY DENSITY (PCF)	MOISTURE (%)	SOIL DESCRIPTION	CTC-GEOTEK	
1	B3		2	120.1	12.9	Silty Clay, and sand	SWELL - CONSOLIDATION TEST	
2	B3		2	120.1	8.8	Silty Clay, and sand	DRAWN BY: JLW	JOB NO.: 102036
							DATE: 1-11-2011	PLATE: 6



GRAPH NO.	BORING NO.	SAMPLE NO.	DEPTH IN FEET	DRY DENSITY (PCF)	MOISTURE (%)	SOIL DESCRIPTION	CTC-GEOTEK	
1	B3		19	117.2	15.2	Claystone	SWELL - CONSOLIDATION TEST	
2	B3		19	117.2	10.2	Claystone	DRAWN BY: JLW	JOB NO.: 102036
							DATE: 1-11-2011	PLATE: 7



GRAPH NO.	BORING NO.	SAMPLE NO.	DEPTH IN FEET	DRY DENSITY (PCF)	MOISTURE (%)	SOIL DESCRIPTION	CTC-GEOTEK	
1	B4		2	117.1	16.0	Sand, and silty clay, trace gravel	SWELL - CONSOLIDATION TEST	
2							DRAWN BY: JLW	JOB NO.: 102036
						DATE: 1-11-2011	PLATE: 8	

SUMMARY OF LABORATORY TEST RESULTS

Project No. 102036

BORING NO.	SAMPLE NO.	DEPTH IN FEET	SAMPLE TYPE (NOTE 1)	DRY DENSITY (PCF)	MOISTURE (%)	ATTERBERG LIMITS			% FINES	WATER SOLUBLE SULFATES (%)	SHEAR STRENGTH (PSF) (NOTE 2)	ADDITIONAL TEST RESULTS ATTACHED (NOTE 3)	SOIL DESCRIPTION
						LL	PI	PL					
B1		4	CA	114.1	17.9							SW / AD	Sand, and silty clay, trace gravel
B1		14	CA	111.8	18.9							SW	Claystone
B2		4	CA	89.0	33.2	77	58	19	89.3				Clay, little silt A-7-6(56) CH
B2		9	CA	118.9	16.0	47	31	16	97.2				Claystone A-7-6(32) CL
B2		14	CA	113.9	15.2							SW	Claystone
B3		2	CA	120.1	12.9							SW / AD	Silty Clay, and sand
B3		4	CA	110.8	13.3					.054			Silty Clay, and sand
B3		9	CA	108.1	19.6	55	40	15	76.7				Clay, some sand, trace gravel A-7-6(30) CH

NOTE 1 - SAMPLE TYPE

- AD - Air Dried
- AS - Auger Sample
- BS - Bag Sample
- CA - California Sample
- HD - Hand Drive
- RM - Remolded Sample
- ST - Shelby Tube Sample

NOTE 2 - SHEAR STRENGTH TESTS

- C₁ - Unconfined Compression
- C₂ - Miniature Vane Shear
- C₃ - Pocket Penetrometer
- C₄ - Pocket Vane

NOTE 3 - ADDITIONAL TEST RESULTS ATTACHED

- CT - Consolidation Test
- GA - Gradation Analysis
- PT - Proctor
- RV - R-Value
- SW - Swell-Consolidation Test
- TT - Triaxial Test

SUMMARY OF LABORATORY TEST RESULTS

Project No. 102036

BORING NO.	SAMPLE NO.	DEPTH IN FEET	SAMPLE TYPE (NOTE 1)	DRY DENSITY (PCF)	MOISTURE (%)	ATTERBERG LIMITS			% FINES	WATER SOLUBLE SULFATES (%)	SHEAR STRENGTH (PSF) (NOTE 2)	ADDITIONAL TEST RESULTS ATTACHED (NOTE 3)	SOIL DESCRIPTION
						LL	PI	PL					
B3		19	CA	117.2	15.2							SW / AD	Claystone
B4		2	CA	117.1	16.0							SW	Sand, and silty clay, trace gravel

NOTE 1 - SAMPLE TYPE

- AD - Air Dried
- AS - Auger Sample
- BS - Bag Sample
- CA - California Sample
- HD - Hand Drive
- RM - Remolded Sample
- ST - Shelby Tube Sample

NOTE 2 - SHEAR STRENGTH TESTS

- C₁ - Unconfined Compression
- C₂ - Miniature Vane Shear
- C₃ - Pocket Penetrometer
- C₄ - Pocket Vane

NOTE 3 - ADDITIONAL TEST RESULTS ATTACHED

- CT - Consolidation Test
- GA - Gradation Analysis
- PT - Proctor
- RV - R-Value
- SW - Swell-Consolidation Test
- TT - Triaxial Test