AGEC

Applied Geotechnical Engineering Consultants, P.C.

GEOTECHNICAL INVESTIGATION

THE VILLAGE AT RIVER WALK DEVELOPMENT

APPROXIMATELY 700 WEST 10200 SOUTH

SOUTH JORDAN, UTAH

PREPARED FOR:

ARBOR COMMERCIAL/RESIDENTIAL
45 WEST 10000 SOUTH, SUITE 301
SANDY, UTAH 84070

ATTENTION: MIKE MADDOX

PROJECT NO. 1040659

AUGUST 24, 2004

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

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. Up to approximately 2 feet of topsoil was encountered at the site. Lean clay was encountered below the topsoil in all areas investigated, except Test Pit TP-4. The clay extends to a depth of up to approximately 10 feet below the ground surface. Sand and gravel was encountered below the topsoil in Test Pit TP-4 and below the clay and extends the maximum depth investigated, approximately 59 feet.

   A moderate to large amount of organic material was encountered in the clay in Test Pit TP-2.

2. Subsurface water was encountered in the test pits and borings at depths ranging from approximately 4 to 7½ feet below the existing ground surface when checked up to 11 days after the excavation/drilling.

3. The proposed residences may be supported on spread footings bearing on compacted structural fill extending down to the undisturbed natural soil or on the undisturbed natural sand and gravel. Topsoil and soil with significant organics should be removed from below proposed footings. Footings bearing on at least 2 feet of compacted structural fill extending down to the undisturbed natural soil or on at least 2 feet of the undisturbed natural sand and gravel may be designed using an allowable net bearing pressure of 2,500 pounds per square foot. Foundation recommendations are presented in the report.

4. Lean clay with moderate to large amounts of organic material was encountered in Test Pit TP-2. Soil with significant organics may exist in other areas of the site and possibly along the Jordan River. Topsoil, soil with significant organics and other deleterious materials should be removed from below proposed building areas. A geotechnical engineer should observe foundation excavations prior to placement of structural fill or concrete. Additional study may be considered to better define the extent of organic soils.

5. The upper natural soil encountered at the site consists primarily of clay with a relatively high moisture content and subsurface water is relatively shallow. The clay and shallow subsurface water level may result in construction access difficulties for rubber-tired construction equipment when the upper soil is very moist to wet such as during the winter or spring or periods of precipitation. Care will be required to minimize disturbance of the natural soil during construction. Placement of granular fill will generally improve site conditions for construction and will likely be needed in areas where the subgrade soil consists of very moist to wet clay and silt.

Executive Summary Continued

6. If the lowest floor level of a proposed structure extends below grade, the subgrade floor portion of the proposed structure should be protected with a perimeter drain system. Recommendations related to subsurface drains are presented within the report.

7. A site specific liquefaction analysis was conducted in conjunction with our previous investigation at the site. Based on the subsurface encountered to the depth investigated, our understanding of geologic conditions in the area and our engineering analysis, it is our professional opinion that the site has a "very low" potential for liquefaction and liquefaction is not considered a hazard for the project. Additional information related to liquefaction potential at the site is presented within the report.

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

SCOPE

This report presents the results of a geotechnical investigation for The Village at River Walk development to be located at approximately 700 West 10200 South in South Jordan, 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 July 15, 2004.

AGEC previously conducted a preliminary geotechnical investigation for the site for Bowen, Collins and Associates and presented our findings and recommendations in a report dated November 19, 2003 under AGEC Project No. 1030854.

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 augmented with our experience in the area and information presented in the above-referenced geotechnical report and 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 undeveloped pasture lands and wetland areas. There are no permanent structures or pavement on the site. There is an underground sewer line which extends in an east/west direction through the central portion of the site. Another underground sewer line extends in a north/south direction along the east site boundary.

There are several unlined irrigation ditches which extend in an east/west direction through the central portion of the site. Generally, the northeast portion of the site consists of marshy, wetland areas.

The site is relatively flat with a gentle slope down to the east. There is approximately 5 feet of elevation difference across the site. Vegetation at the site consists of short grasses and occasional weeds. Occasional Russian Olive trees extend along the southeast portion of the site. Dense, Russian Olive trees and Tamarisk extend along the northeast corner portion of the site.

The Jordan River Parkway corridor extends along the east side of the site. The parkway corridor consists of an unpaved horse and animal trail, an asphalt paved pedestrian path and the Jordan River. Mulligans Golf Course and Driving Range extend along the south side of the site. The area consists primarily of grass covered landscaped areas. Undeveloped land, similar to the site, extends north of the site. There is a slope which extends along the west side of the site. The slope slopes moderately down to the east.

FIELD STUDY

Four borings were drilled for our previous investigation at the site and were drilled on November 3, 4, and 5, 2003. The borings were drilled with 8-inch diameter hollow-stem auger powered by an truck-mounted drill rig. Test Pits TP-1 through TP-6 were excavated on July 29, 2004 with a rubber-tired backhoe.

The borings and test pits were logged and soil samples obtained by representatives from AGEC. Logs of the subsurface conditions encountered in the borings and test pits are presented on Figures 2 and 3, respectively, with legend and notes on Figure 4.

The test pits were backfilled without significant compaction. The backfill in the test pits should be properly compacted where it will support proposed buildings, floor slabs or pavement.

SUBSURFACE CONDITIONS

Up to approximately 2 feet of topsoil was encountered at the site. Lean clay was encountered below the topsoil in all areas investigated, except Test Pit TP-4. The clay extends to a depth of up to approximately 10 feet below the existing ground surface. Sand and gravel was encountered below the topsoil in Test Pit TP-4 and below the clay and extends the maximum depth investigated, approximately 59 feet.

A moderate to large amount of organic material was encountered in the clay in Test Pit TP-2.

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

> Topsoil - The topsoil consists of lean clay with small amounts of sand. It is moist to very moist, dark brown and contains roots and organics.
>
> Lean Clay - The clay contains small amounts of sand. It is soft to very stiff, moist to wet and light gray to dark brownish gray. Lean clay with moderate to large amounts of organic material was encountered in Test Pit TP-2.

Laboratory tests conducted on samples of the clay indicate that it has natural moisture contents ranging from 31 to 177 percent and natural dry densities ranging from 33 to 85 pounds per cubic foot (pcf).

Unconfined compressive strengths of 590, 845 and 965 pounds per square foot (psf) were measured for samples of the clay tested in the laboratory.

Results of consolidation tests conducted on samples of the clay indicate that it will compress a moderate to large amount with the addition of light to moderate loads. Results of the consolidation test are presented on Figures 5 and 6.

<u>Silt</u> - The silt contains small to moderate amounts of sand and occasional clay layers. It is dense, wet and brown in color.

<u>Sand and Gravel</u> - The well and poorly graded sand and gravel contains small to moderate amounts of silt. It is dense to very dense, wet and gray to brown.

Laboratory tests conducted on samples of the sand and gravel indicate that it has natural moisture contents ranging from 8 to 24 percent and natural dry densities ranging from 103 to 131 pcf.

Results of gradation tests conducted on samples of the sand and gravel are presented on Figures 7 and 10.

Results of laboratory tests are summarized on Table I and are included on the logs of the exploratory borings and test pits, Figures 2 and 3.

SUBSURFACE WATER

Subsurface water was encountered in the test pits and borings at depths ranging from approximately 4 to 7½ feet below the ground surface when measured 4 days after excavation and up to 11 days after drilling.

Slotted PVC pipe was installed in the test pits and borings to facilitate future measurement of the subsurface water level. Water levels will fluctuate with time. The evaluation of water level fluctuations is beyond the scope of this report. Generally, the water level is expected to be highest in the spring and summer and lowest in the fall and winter months.

PROPOSED CONSTRUCTION

We understand that the site consists of approximately 32 acres and is planned to be subdivided into 89 residential building lots. We anticipate that residences will be one to three-story, wood-frame structures with the possibility of basements. We have assumed building loads consisting of wall loads of less than 3 kips per lineal foot and column loads of up to 20 kips based on typical residential construction in the area.

Paved roads are planned to extend through the proposed development. We have assumed traffic consisting primarily of relatively light passenger vehicles, two delivery trucks per day and two garbage trucks and 5 buses per week.

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

RECOMMENDATIONS

Based on the subsurface conditions encountered, laboratory test results, the proposed construction and our experience in the area, the following conclusions and recommendations are given:

A. Site Grading

Final site grading plans were not available at the time of our investigation. We anticipate that up to approximately 3 feet of cut and fill may be needed to facilitate development at the site. Fill placed over relatively large areas should be placed as soon as possible prior to building construction.

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

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

The upper natural soil consists primarily of clay. The soil has a moderate to high moisture content and there is a relatively shallow depth to ground water at the site. Construction access difficulties can be expected during times when the upper natural soil is very moist to wet such as in the winter or spring or after periods of prolonged rainfall or when excavations extend down near the very moist to wet soil. Care should be taken not to disturb the natural soil to remain in the proposed pavement areas.

Placement of granular fill consisting predominantly of gravel with less than 15 percent passing the No. 200 sieve and possibly lowering the water level in areas of shallow ground water will generally improve site access. Approximately 1 ½ to 2 ½ feet of granular fill will likely be required to support moderately loaded rubber-tired construction equipment above the very moist to wet clay at the site.

2. Excavation

We anticipate that excavation at the site can be accomplished with typical excavation equipment. Consideration should be given to using excavating equipment with a smooth cutting edge when excavating for building foundations to minimize the disturbance of the natural soil.

Low ground pressure construction equipment may be required when excavations extend down near the subsurface water level or the excavation equipment will need to be supported from above the excavation.

Excavations which extend below the original free-water level should be dewatered during excavation and fill and concrete placement. Fill placed below the original water level should consist of free draining gravel with less than 5 percent passing the No. 200 sieve.

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 Flatwork and Pavement	≥ 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.

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

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

4. Materials

Materials placed as fill to support foundations should be non-expansive granular soil. The upper natural soil consists predominantly of clay and is not suitable for use as fill below buildings, but may be considered for use in pavement areas or as utility trench backfill if the topsoil, organics, debris and other deleterious materials are removed or they may be used in landscaping areas.

The natural sand and gravel are suitable for use as structural fill, site grading fill in pavement areas or as utility trench backfill if the topsoil, organics, debris and other deleterious materials are removed or they may be used in landscaping areas.

Free-draining granular fill with less than 5 percent passing the No. 200 sieve should be used as fill below the subsurface water level.

The natural soil will likely require moisture conditioning (wetting or drying) prior to use as fill. Drying of the soil may not be practical during the cold or wet times 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. <u>Drainage</u>

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

The collection and diversion of drainage away from the pavement surface is important to the satisfactory performance of the pavement section. Proper drainage should be provided.

B. Foundations

1. <u>Bearing Material</u>

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

The topsoil, organic material, unsuitable fill, debris and other deleterious material should be removed from below proposed foundation areas.

2. Bearing Pressure

Spread footings bearing on at least 2 feet of compacted structural fill or on at least 2 feet of undisturbed natural sand and gravel may be designed using an allowable net bearing pressure of 2,500 psf.

Footings should have a minimum width of 18 inches and a minimum depth of embedment of 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. Settlement

Based on the subsoil conditions encountered and the assumed building loads, we estimate that total and differential settlement will be on the order of 1 inch.

Disturbance of the soil below foundations can result in greater settlement. 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. <u>Foundation Base</u>

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

Excavations which extend below the water level should be dewatered before and during fill and concrete placement as discussed in the excavation section of the report.

7. <u>Construction Observation</u>

A representative of the geotechnical engineer should observe footing excavations prior to structural fill or concrete placement. This is particularly important due to potentially high organic content in the soil.

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.

The topsoil, organic material, unsuitable fill, debris and other deleterious material should be removed from below proposed concrete 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 the concrete slab for ease of construction and to promote even curing of the slab concrete.

D. **Lateral Earth Pressures**

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on 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 below assume a horizontal surface adjacent the top and bottom of the wall.

Soil Type	Active	At-Rest	Passive
Clay & Silt	50 pcf	65 pcf	250 pcf
Sand & Gravel	40 pcf	55 pcf	300 pcf

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 30 pcf for active and at-rest conditions and decreased by 30 pcf for the passive condition. This assumes a mapped short period spectral response acceleration of 1.30g which represents a 2 percent probability of exceedance in a 50 year period (IBC, 2003).

4. Safety Factors

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

E. **Subsurface Drains**

If the lowest floor level of a structure extends below existing grade, the subgrade floor portion of the proposed structure should be protected with a perimeter drain system. The perimeter drain system should consist of at least the following items:

1. The underdrain system should consist of a perforated pipe installed in a gravel filled trench around the perimeter of the subgrade floor portion of the building.

2. The flow line of the pipe should be placed at least 18 inches below the finished floor level and should slope to a sump or outlet where water can be removed by pumping or by gravity flow.

3. If placing the gravel and drain pipe requires excavation below the bearing level of the footing, the excavation for the drain pipe and gravel should have a slope no steeper than 1:1 (horizontal to vertical) so as not to disturb the soil below the footing.

4. A filter fabric should be placed between the natural soil and the drain gravel. This will help reduce the potential for fine grain material filling in the void spaces of the gravel.

5. The subgrade floor slab should have at least 6 inches of free draining gravel placed below it and the underslab gravel should connect to the perimeter drain.

6. Consideration should be given to installing cleanouts to allow access into the perimeter drain should cleaning of the pipes be required in the future.

F. Seismicity, Faulting and Liquefaction

1. Seismicity

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

a.	Site Class	D
b.	Short Period Spectral Response Acceleration, S_S	1.30g
c.	One Second Period Spectral Response Acceleration, S_1	0.532g

2. Faulting

There are no mapped active faults extending through the property. The closest mapped fault, which is considered active, is the Wasatch Fault located approximately 4½ miles southeast of the site (Salt Lake County, 1995).

3. Liquefaction

The Salt Lake County Liquefaction Hazard Map (Salt Lake County, 1995) indicates that the site is located in an area mapped as having a "high" liquefaction potential. The "high" designation represents a greater than 50 percent probability that the soil may be subjected to seismic ground shaking sufficient to result in liquefaction in a 100 year time period.

Research indicates that the soil type most susceptible to liquefaction during a large magnitude earthquake is loose, clean sand. In order for liquefaction to occur, the soil must be saturated. The liquefaction potential for soil tends to decrease with an increase in fines content and density.

A site specific liquefaction analysis was conducted in conjunction with our previous investigation at the site. The clay and soil above the free water level are not susceptible to liquefaction. The sand and gravel encountered below the free-water level are relatively dense. Based on the subsurface conditions encountered to the depth investigated, our understanding of geologic conditions in the area and our engineering analysis, it is our professional opinion that the site has a "very low" potential for liquefaction and liquefaction is not considered a hazard for the project. Results of the site specific liquefaction analysis are presented in the Appendix.

G. Water Soluble Sulfates

Two samples of the natural soil were tested in the laboratory for water soluble sulfate content. Results of the tests indicate there is less than 0.1 percent water soluble sulfate in the samples tested. Based on the results of the tests and published literature, the natural soil possesses negligible sulfate attack potential on concrete. The concentration of water soluble sulfates present in the soil at the site indicates that sulfate resistant cement is not needed for concrete 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 subsoil conditions encountered, laboratory test results and the assumed traffic as indicated in the Proposed Construction section of the report, the following pavement support recommendations are given.

1. Subgrade Support

   The near surface soil encountered at the site consists primarily of lean clay. A CBR value of 2½ percent was used in the analysis which assumes a lean clay subgrade.

2. Pavement Thickness

   Based on the subsoil conditions, 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 8 inches of base course is calculated. Alternatively, a rigid pavement section consisting of 5 inches of Portland cement concrete may be used.

   Granular fill will likely be needed to facilitate construction of the pavement due to the shallow ground water and very moist to wet clay subgrade as discussed in the Subgrade Preparation section of the report. The base course thickness could be reduced to 6 inches in areas where at least 6 inches of granular borrow is provided below the base course. The base course thickness may also be reduced to 6 inches for pavement areas which will receive no significant truck traffic.

3. Pavement Materials and Construction

a. Flexible Pavement (Asphaltic Concrete)

The pavement materials should meet the Utah Department of Transportation specifications for gradation and quality. 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 pavement thickness assumes that the pavement will have aggregate interlock joints and that a concrete shoulder or curb will be provided.

Pavement materials should meet the Utah Department of Transportation Specifications. 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 and borings drilled at the approximate locations indicated on the site plan, the data obtained from laboratory testing and our experience in the area. Variations in the subsurface conditions may not become evident until additional excavation or exploration 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, P.C.

LICENSED PROFESSIONAL ENGINEER 8/24/04 No. 264456 CHRISTOPHER J. BECKMAN STATE OF UTAH

Christopher J. Beckman, P.E.

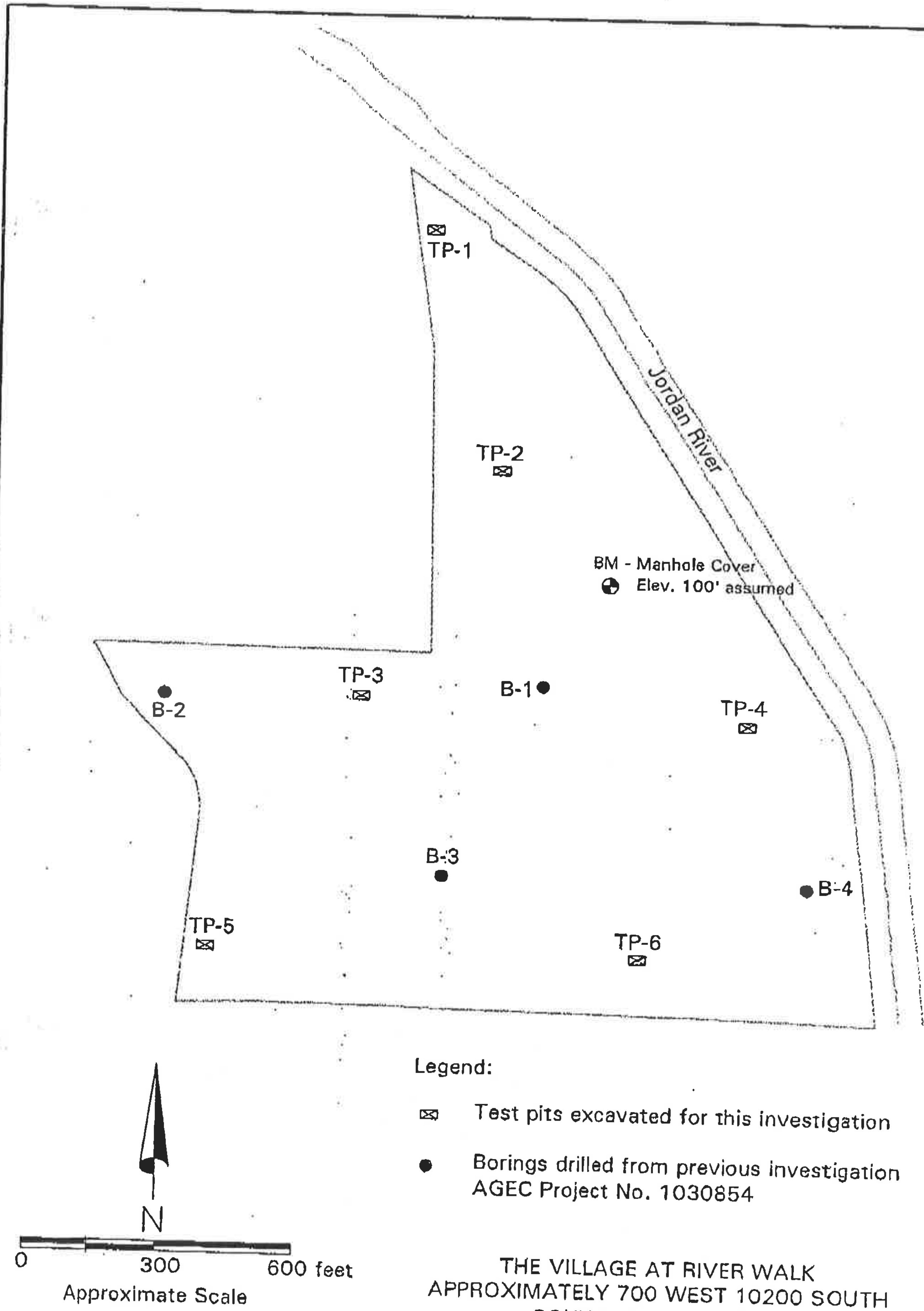
Reviewed by Jay R. McQuivey, P.E.

CJB/sc

REFERENCES

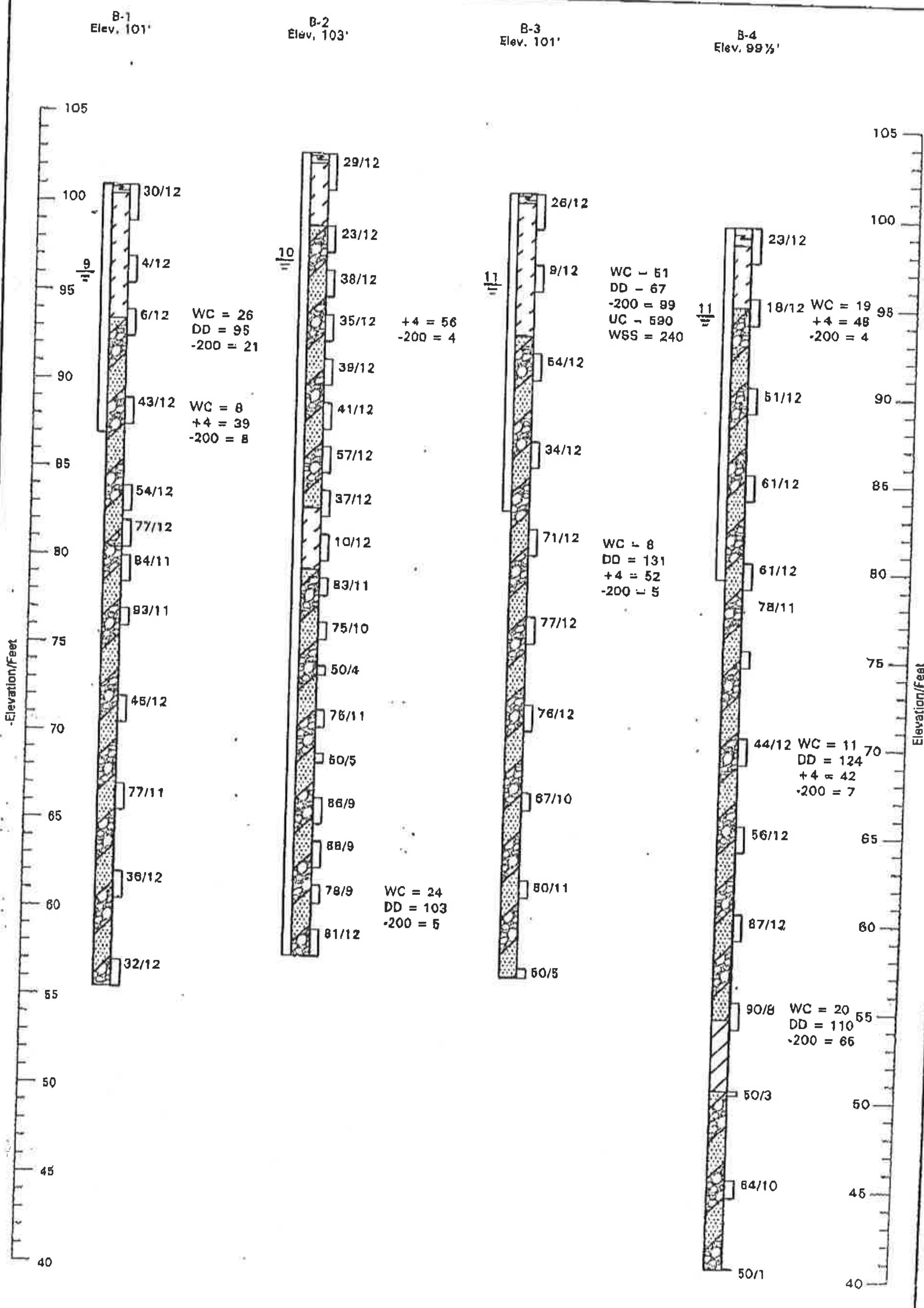
International Building Code, 2003; International Code Council, Inc. Falls Church, Virginia.

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.



THE VILLAGE AT RIVER WALK
APPROXIMATELY 700 WEST 10200 SOUTH
SOUTH JORDAN, UTAH

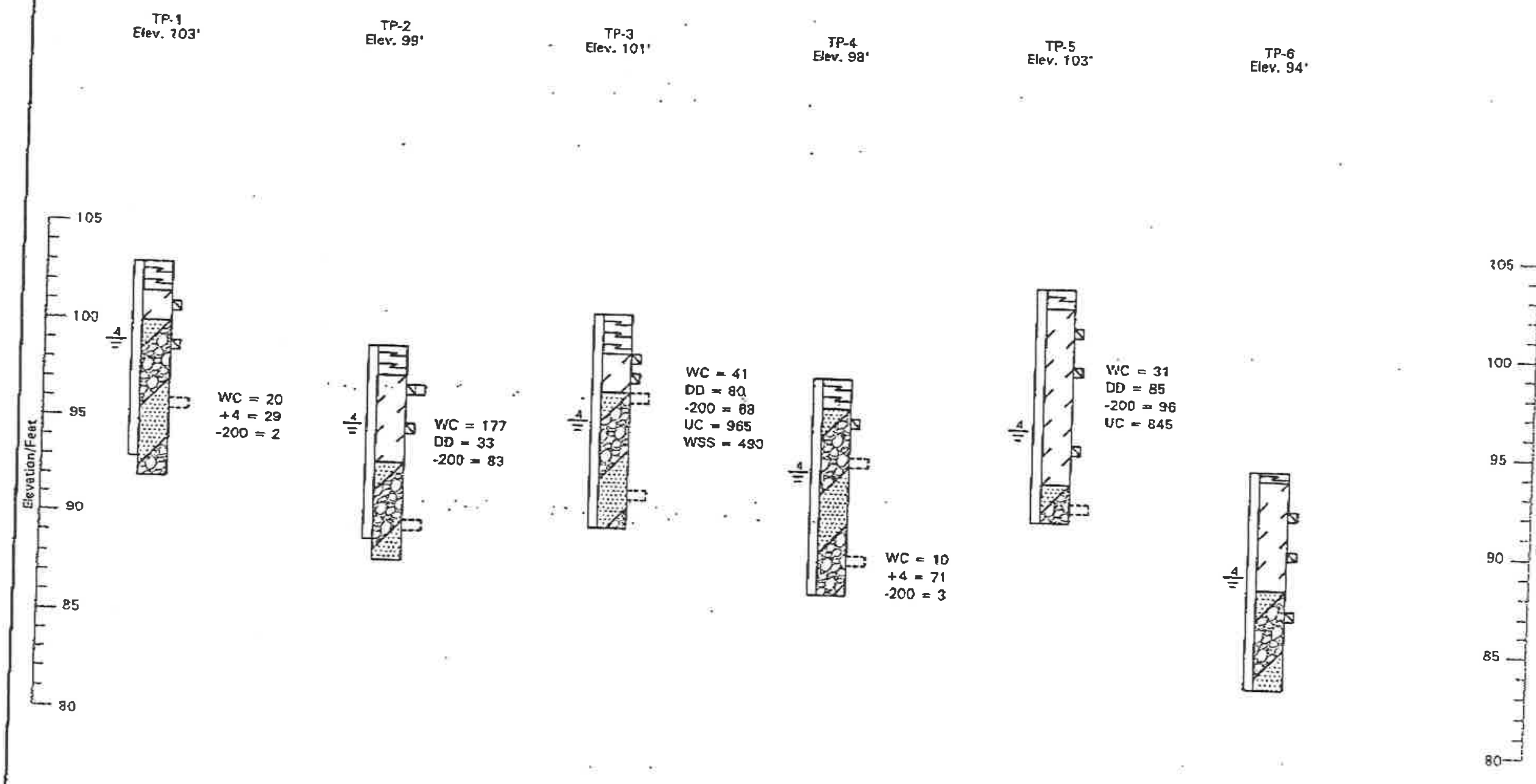
1040659	AGEC	Locations of Exploratory Test Pits and Borings	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 4 for Legend and Notes

1040659	AGEC	Logs of Exploratory Borings	Figure 2



Approximate Vertical Scale 1" = 8'

1040659	AGEC	Logs of Test Pits	See Figure 4 for Legend and Notes	Figure 3

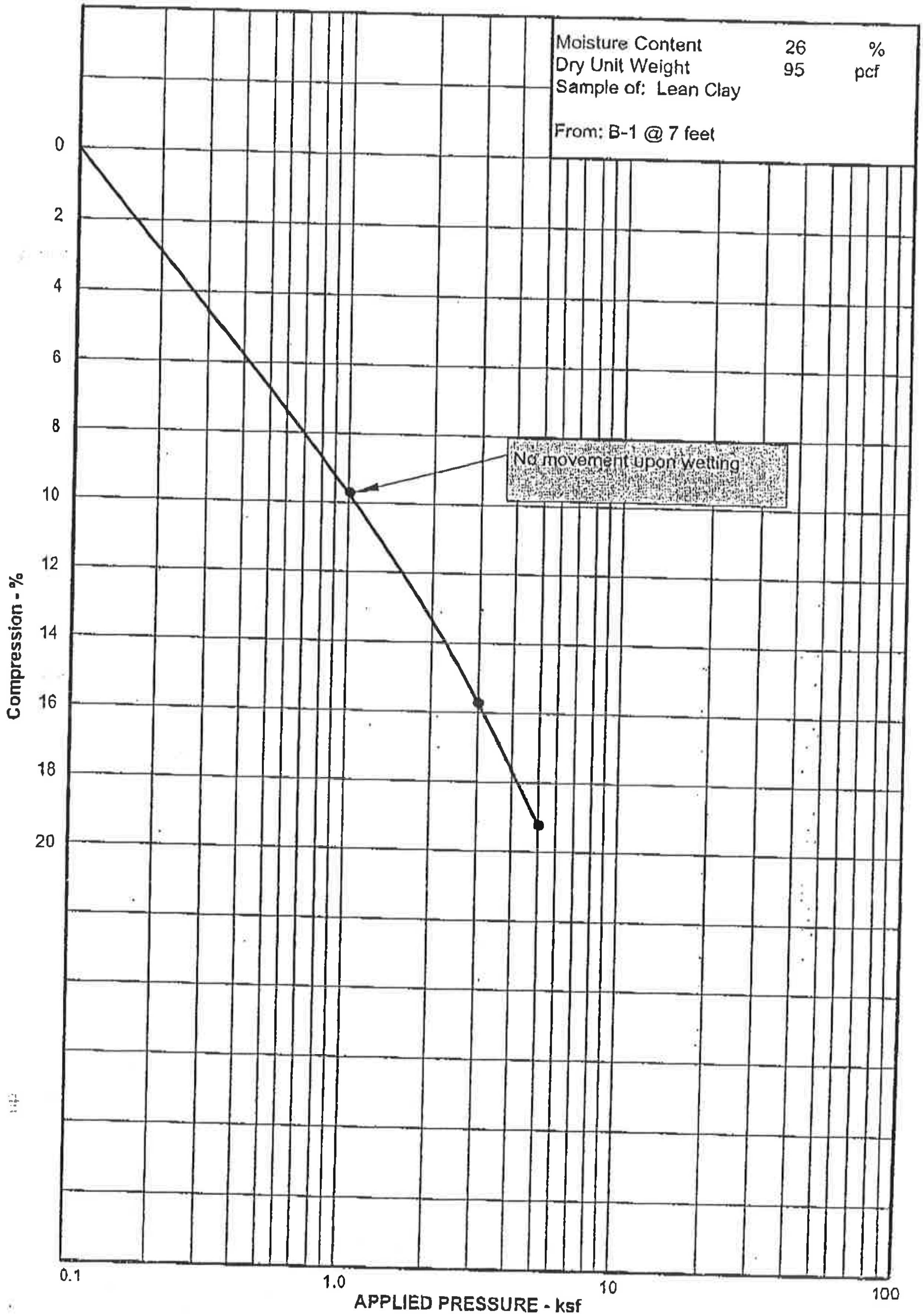
LEGEND:

- Topsoil; lean clay, small amounts of sand, moist to very moist, dark brown, roots and organics.
- Lean Clay (CL); small amounts of sand, soft to very stiff, moist to wet, light gray to dark brownish gray. Moderate to large amounts of organic material was encountered in the clay in Test Pit TP-2.
- Silt (ML); small to moderate amounts of sand, occasional clay layers, dense, wet, brown.
- Well and Poorly Graded Sand and Gravel (SP/GP); small to moderate amounts of silt, dense to very dense, wet, gray to brown.
- 10/12 California Drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.
- Indicates relatively undisturbed hand drive sample taken.
- Indicates relatively undisturbed block sample taken.
- Indicates disturbed sample taken.
- Indicates slotted 1½ inch PVC pipe installed in the test pit or boring to the depth shown.
- 11 Indicates the depth to free water and the number of days after excavation/drilling the measurement was taken.

NOTES:

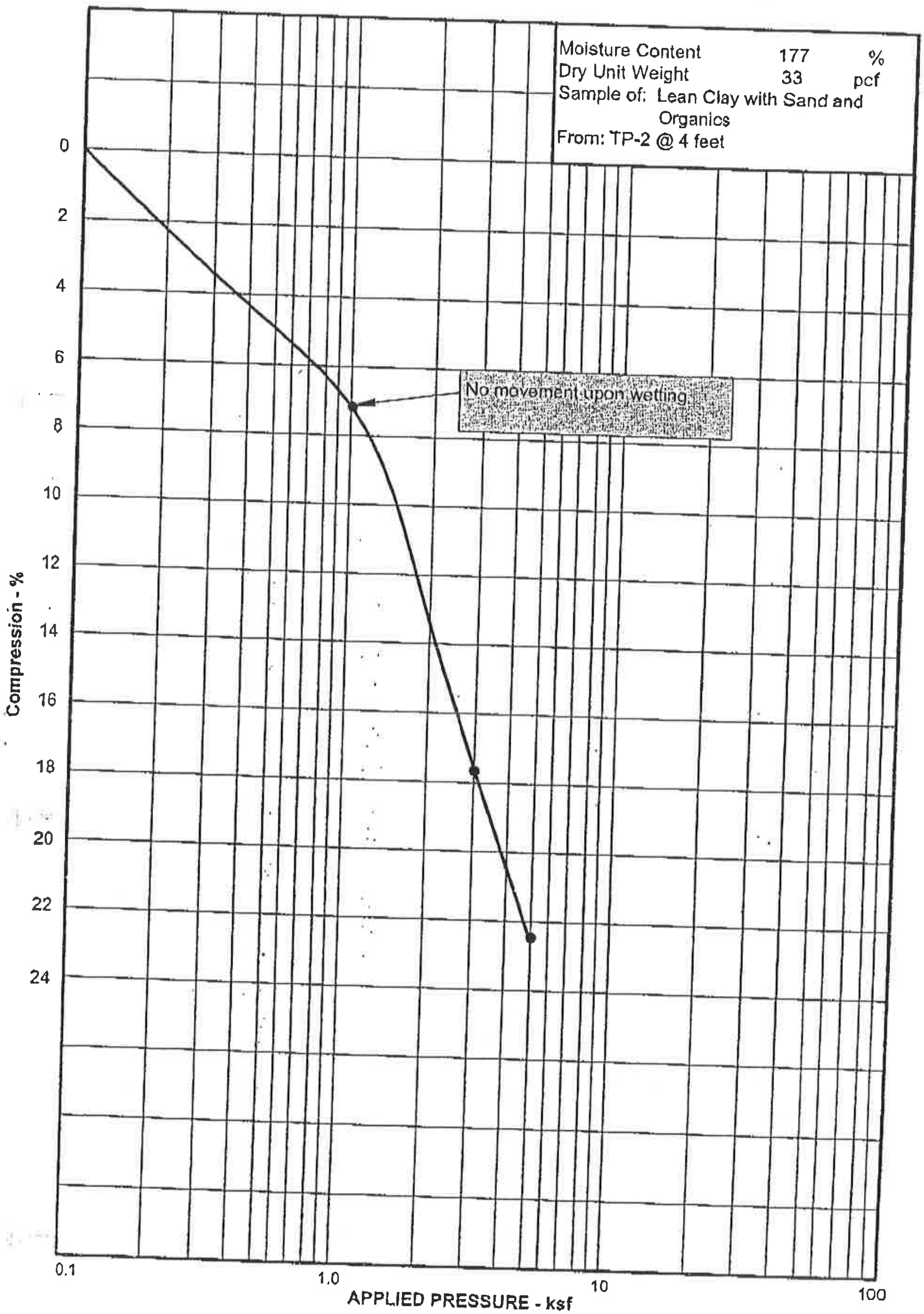
1. Test pits were excavated on July 29, 2004 with a rubber-tired backhoe. Borings were drilled on November 3, 4 and 5, 2003 with 8-inch diameter hollowstem auger provided by a truck mounted drill rig.
2. Locations of test pits and borings were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of test pits and borings were measured with an automatic level and refer to the bench mark shown on Figure 1.
4. The test pit and 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 test pit and boring logs represent the approximate boundaries between material types and the transitions may be gradual.
6. Water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water level may occur with time.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   +4 = Percent Retained on No. 4 Sieve;
   -200 = Percent Passing No. 200 Sieve;
   UC = Unconfined Compressive Strength (psf);
   WSS = Water Soluble Sulfates (ppm).

Applied Geotechnical Engineering Consultants, Inc.



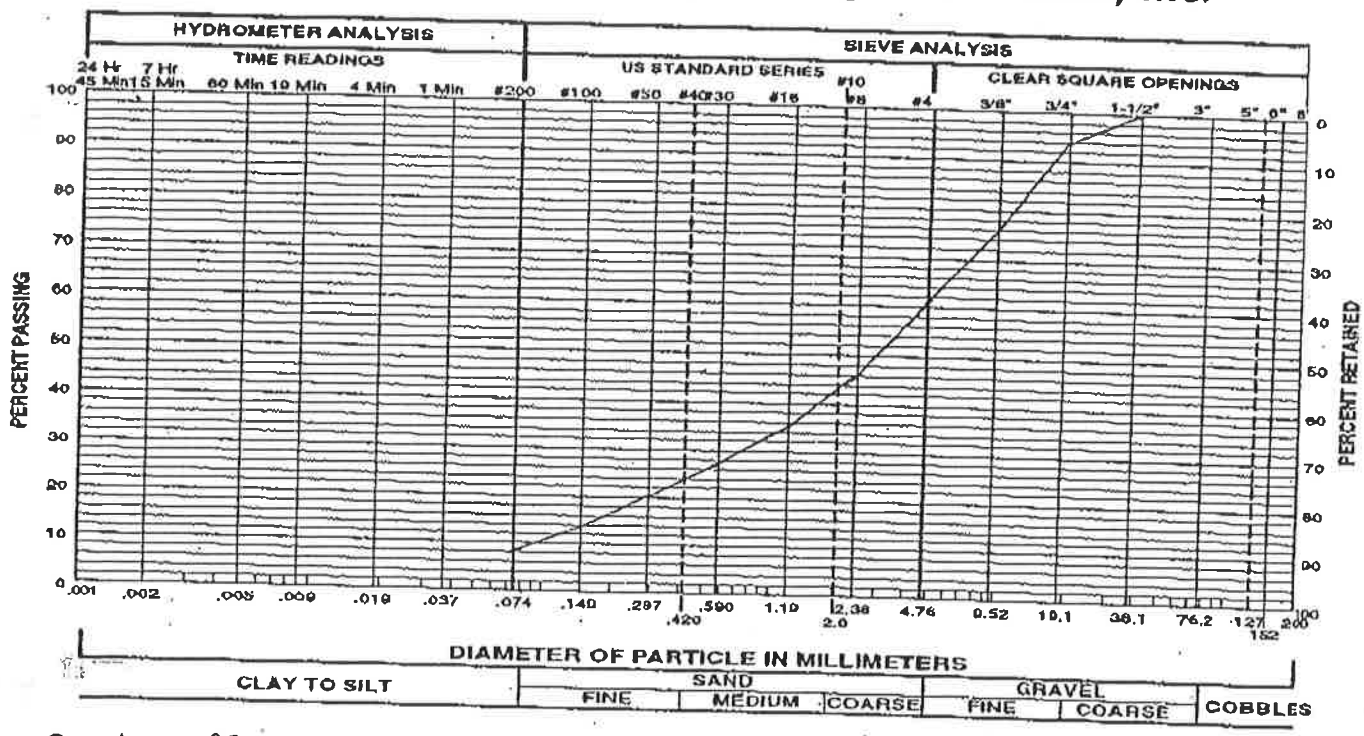
Project No. 1040659 CONSOLIDATION TEST RESULTS Figure 5

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1040659 CONSOLIDATION TEST RESULTS Figure 6

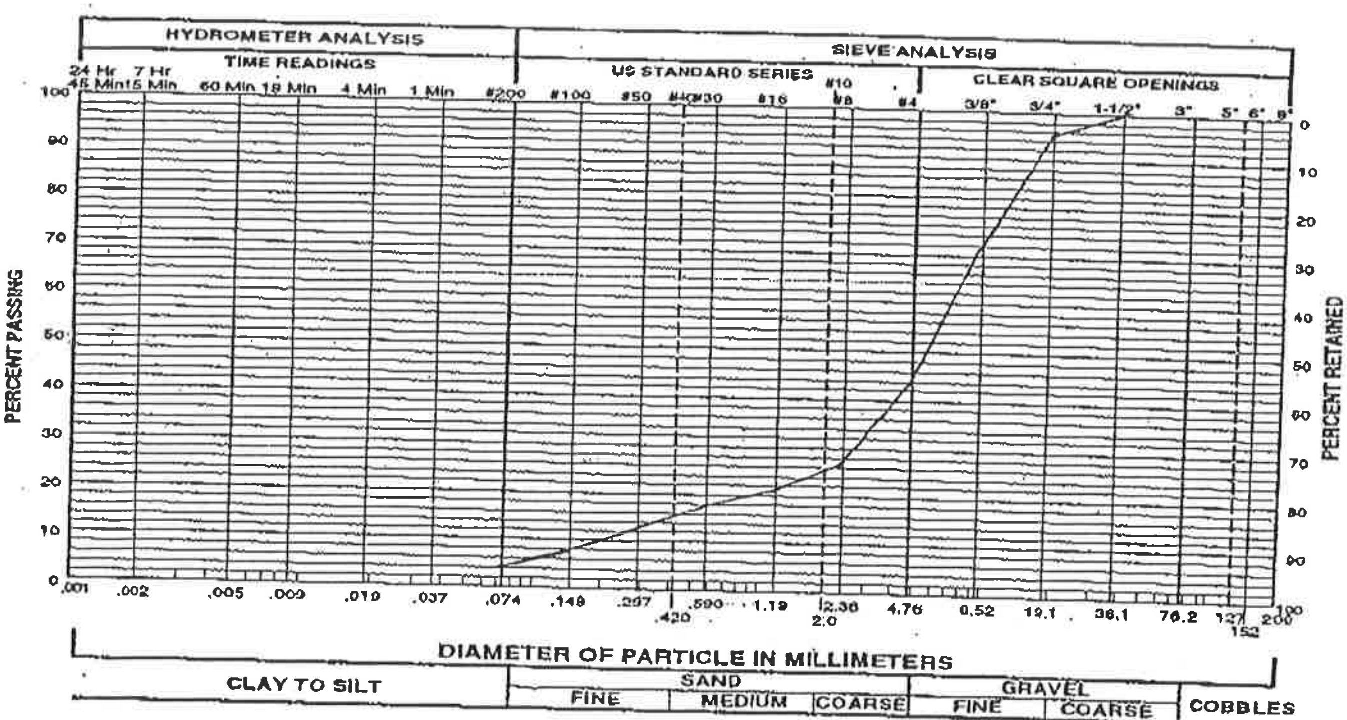
Applied Geotechnical Engineering Consultants, Inc.



Gravel 39 % Sand 53 % Silt and Clay 8 %

Liquid Limit - % Plasticity Index - %

Sample of Well Graded Sand with Silt and Gravel From B-1 @ 11 feet



Gravel 56 % Sand 40 % Silt and Clay 4 %

Liquid Limit - % Plasticity Index - %

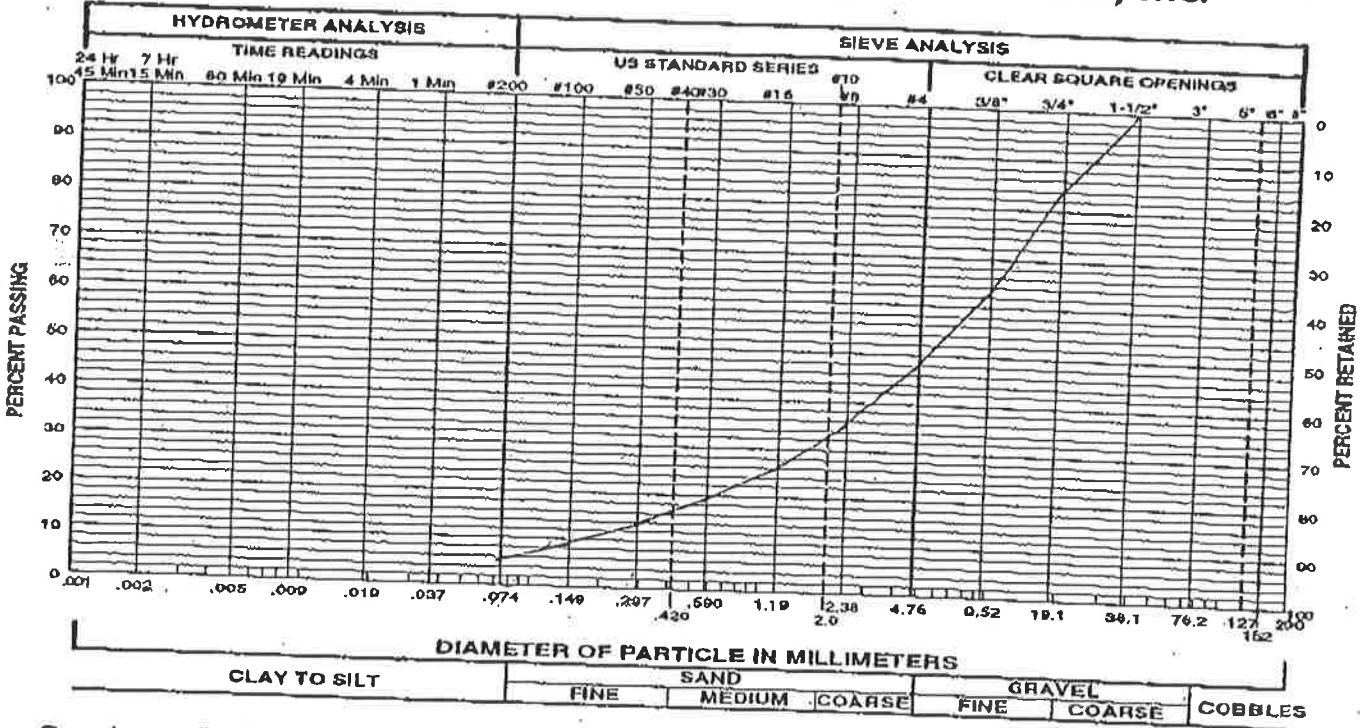
Sample of Poorly Graded Gravel with Sand From B-2 @ 9 feet

Project No. 1040659

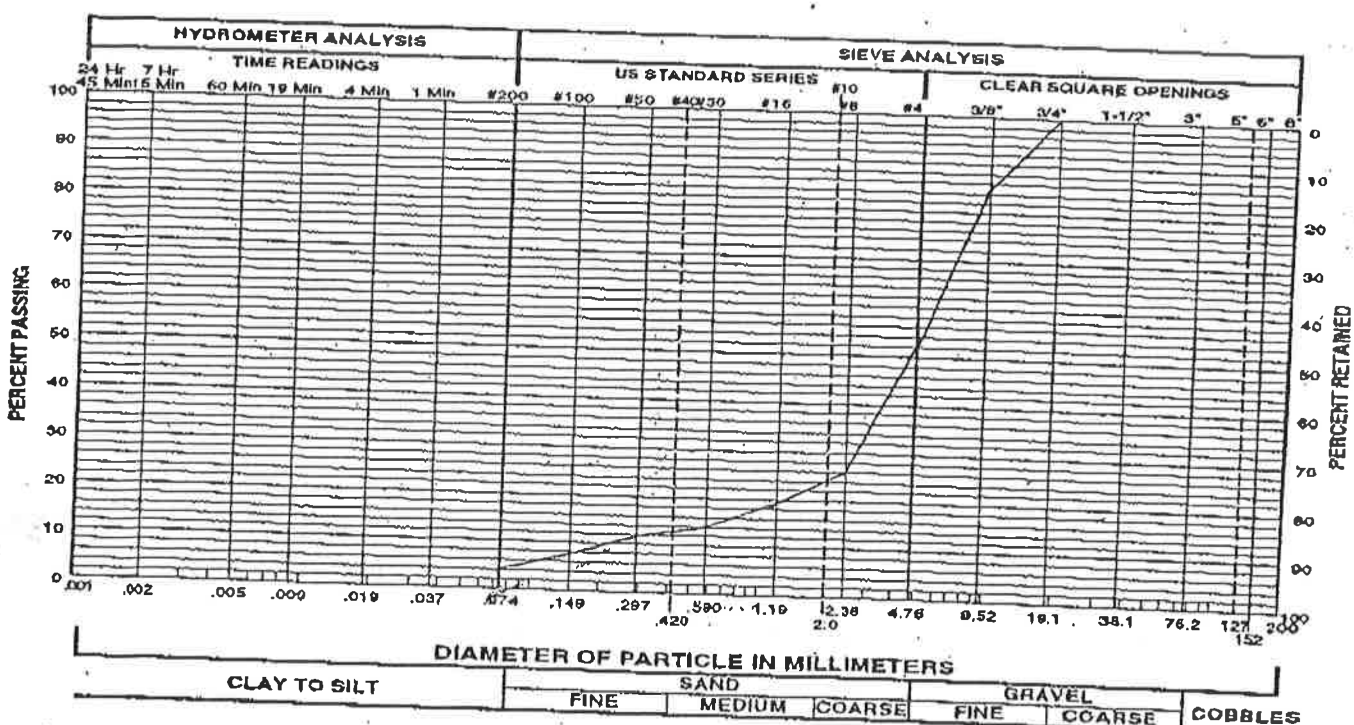
GRADATION TEST RESULTS

Figure 7

Applied Geotechnical Engineering Consultants, Inc.



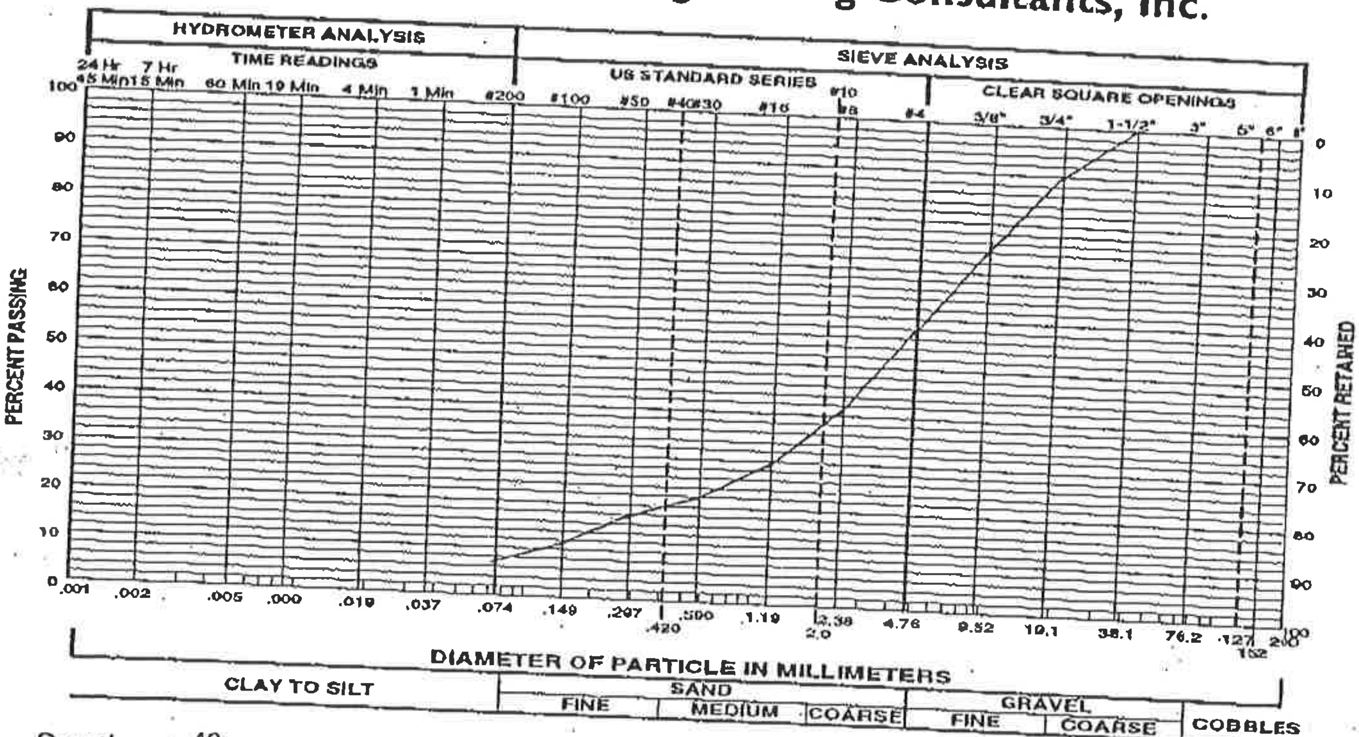
Gravel 52 % Sand 43 % Silt and Clay 5 %
Liquid Limit - % Plasticity Index - %
Sample of Well Graded Gravel with Sand From B-3 @ 19 feet



Gravel 48 % Sand 48 % Silt and Clay 4 %
Liquid Limit - % Plasticity Index - %
Sample of Poorly Graded Gravel with Sand From B-4 @ 4 feet

Project No. 1040659 **GRADATION TEST RESULTS** Figure 8

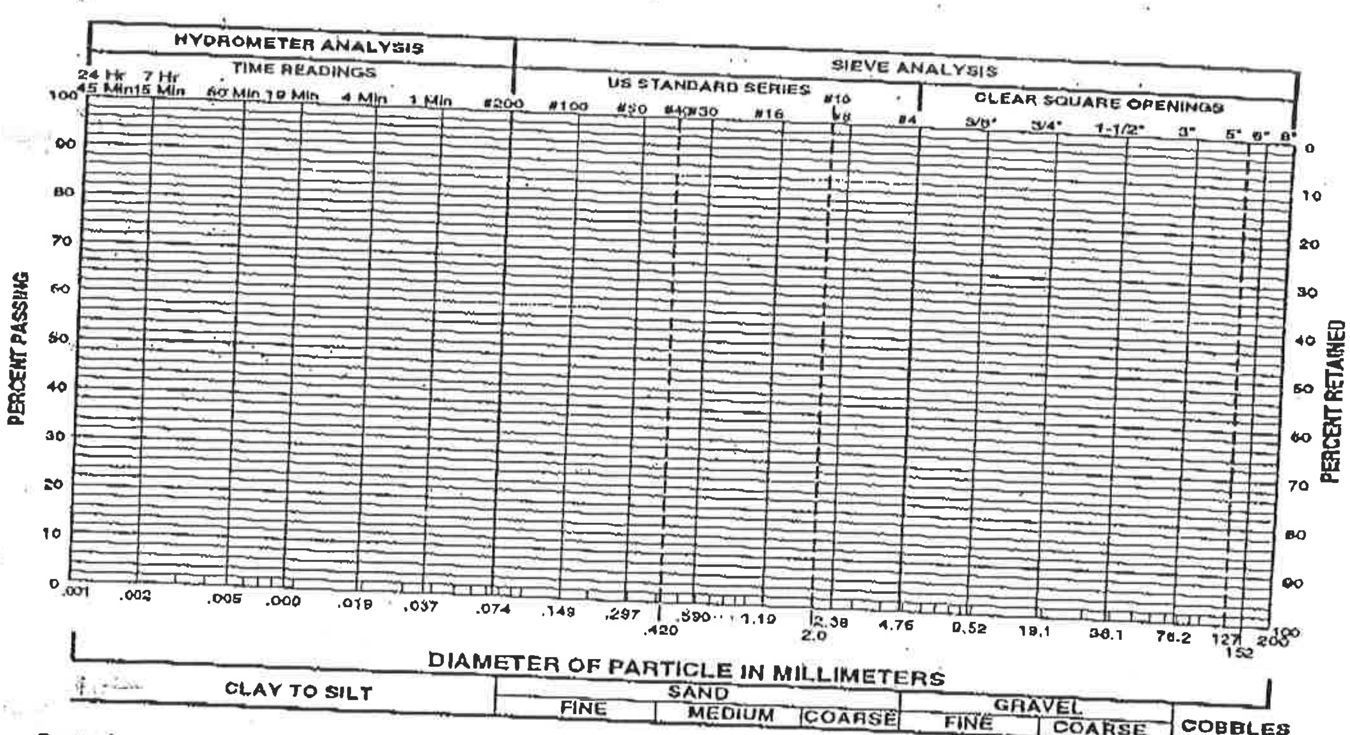
Applied Geotechnical Engineering Consultants, Inc.



Gravel 42 % Sand 51 % Silt and Clay 7 %

Liquid Limit - % Plasticity Index - %

Sample of Well Graded Sand with Silt and Gravel From B-4 @ 29 feet



Gravel ______ % Sand ______ % Silt and Clay ______ %

Liquid Limit ______ % Plasticity Index ______ %

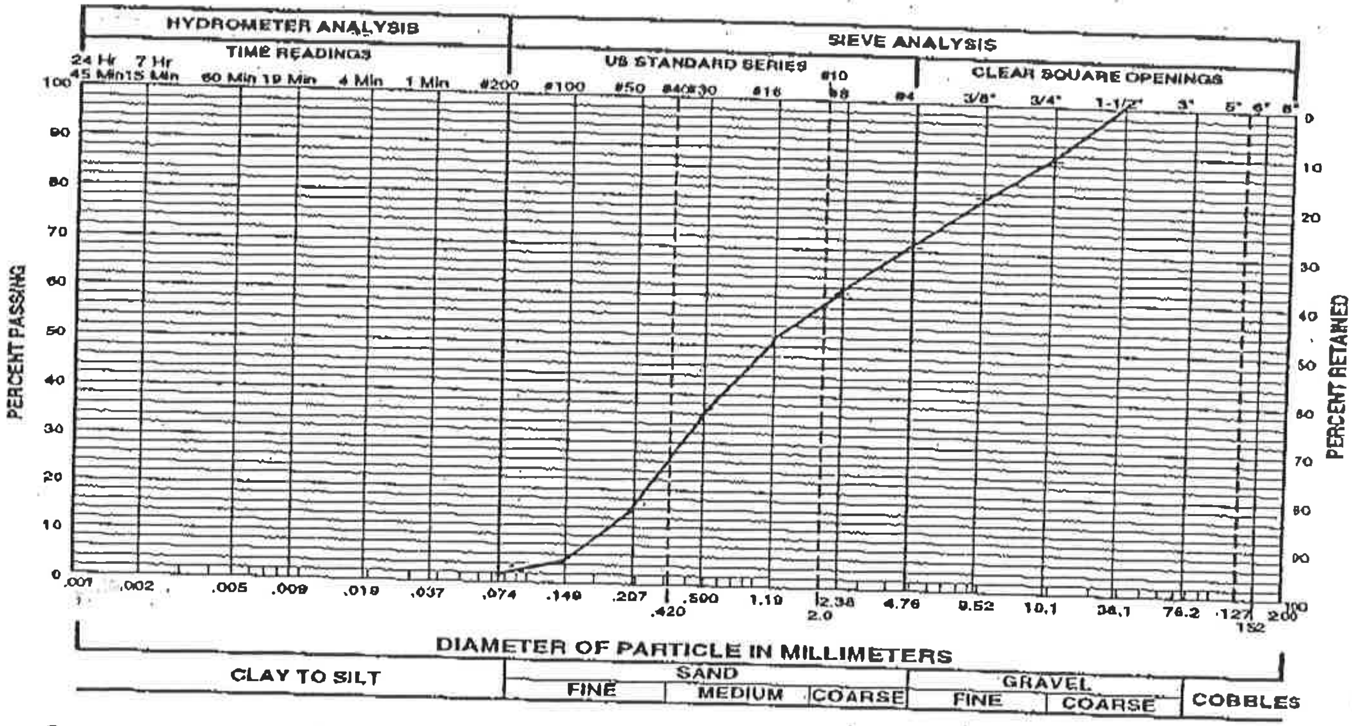
Sample of ______ From ______

Project No. 1040659

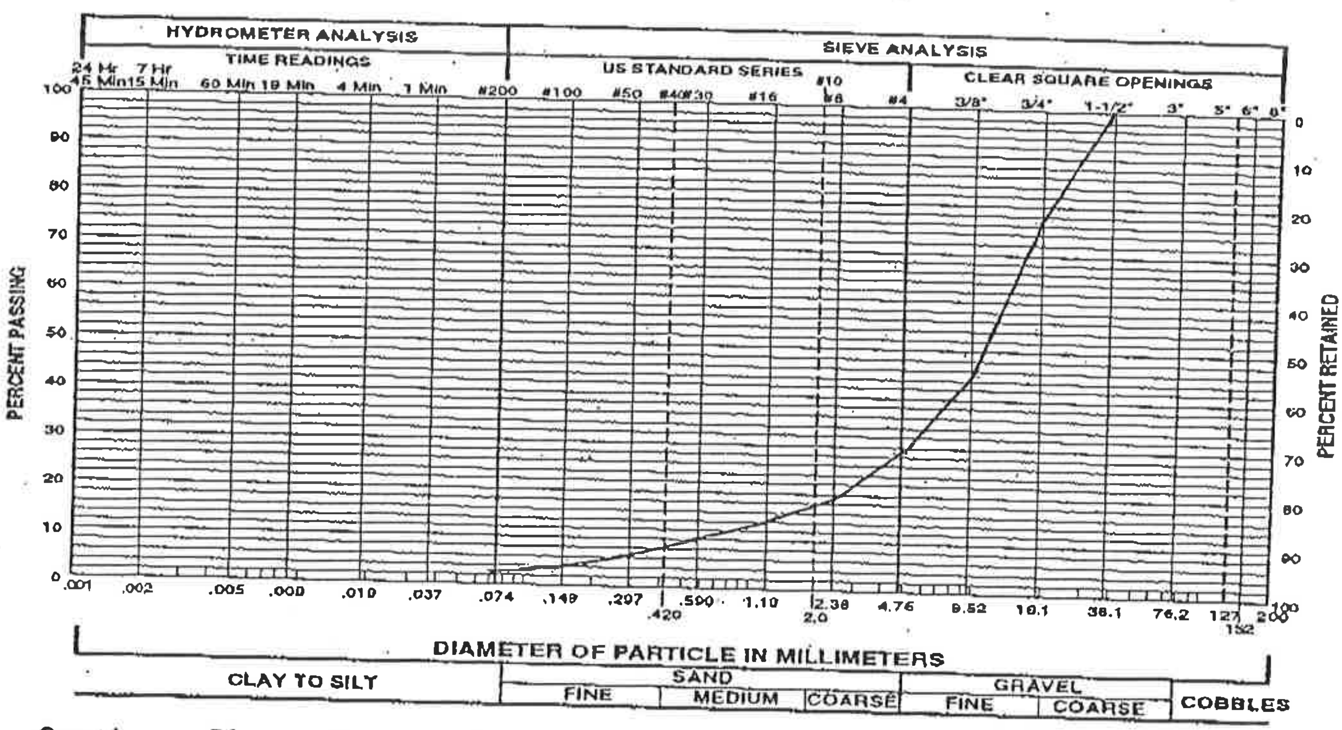
GRADATION TEST RESULTS

Figure 9

Applied Geotechnical Engineering Consultants, P.C.



Gravel 29 % Sand 69 % Silt and Clay 2 %
Liquid Limit - % Plasticity Index - %
Sample of Poorly-graded Sand with Gravel From TP-1 @ 7 feet



Gravel 71 % Sand 26 % Silt and Clay 3 %
Liquid Limit - % Plasticity Index - %
Sample of Poorly-graded Gravel with Sand From TP-4 @ 9 feet

Project No. 1040659 **GRADATION TEST RESULTS** Figure 10

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, P.C.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 104065

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	7	26	95			21					Lean Clay/Silty Sand
	12	8		39	53	8					Well Graded Sand with Silt and Gravel
B-2	9			56	40	4					Poorly Graded Gravel with Sand
	41½	24	103			5					Poorly Graded Sand
B-3	4	51	67	99					590	240	Lean Clay
	19	8	131	52	43	5					Well Graded Gravel with Sand
B-4	4	19		48	48	4					Poorly Graded Gravel with Sand
	29	11	124	42	51	7					Well Graded Sand with Silt and Gravel
	44	20	110			65					Sandy Silt

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, P.C.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 104065

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	WATER SOLUBLE SULFATE (ppm)	SAMPLE CLASSIFICATION
TEST PIT	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
TP-1	7	20		29	69	2					Poorly-graded Sand with Gravel
TP-2	4	177	33			83					Lean Clay with Sand and Organics
TP-3	3	41	80			68			965	490	Sandy Lean Clay
TP-4	9	10		71	26	3					Poorly-graded Gravel with Sand
TP-5	4	31	85			96			845		Lean Clay

LIQUEFACTION POTENTIAL AND LIQUEFACTION INDUCED SETTLEMENT

Project No.: 1040659
Project Name: VILLAGE AT RIVER WALK
Date: 19-Aug-04
Time: 3:28 PM
Site PGA for 10% in 50 yrs: 0.246 g
Site PGA for 2% in 50 yrs: g

Earthquake Magnitude: 7.2
Magitude Scaling Factor: 1.11
Hammer Energy Ratio: 1
Soil Total Unit Wt, pcf: 120
Hole Diameter, in: 3.75 95.25 1

Salt Lake Liq. Hazard Rating	
Liq. Potential	PGA
Very Low	>0.33g
Low	0.23g-0.33g
Moderate	0.13g-0.23g
High	<0.13g

Liquefaction potential based on Youd, T. L. and I. M. Idriss, 1997; Proceedings of the NCEER workshop on liquefaction resistance of soils, Technical Report NCEER-97-0022

Liquefaction induced settlement based on Tokimatsu, A. M. and H. B. Seed, 1987; Evaluation of settlements in sands due to earthquake shaking, Journal of Geotechnical Engineering, Vol. 113, No. 8, pp. 861-878

									LIQUEFACTION POTENTIAL														LIQUEFACTION INDUCED SETTLEMENT					
									Corrections to SPT																			
Boring	Sample Depth, ft	N	Sample Type, 1=Cal 2=SPT	% Fines	Soil Type	Water Depth, ft	Total Stress, tsf	Effective Stress, tsf	Over-burden Press., C_N	Energy Ratio, C_E	Bore Dia., C_B	Rod Length, C_R	Sample Type, C_S	Total SPT Corr.	$(N_1)_{60}$	$(N_1)_{60CS}$	$CRR_{7.5}$	CRR_M	r_d	Acc. To Cause Liq., a_L	Salt Lake Liq. Potential	$(N_1)_{60CS}$	10% In 50 Yr CSR	Layer Thick., ft	Vol. Strain, %	Sett., in	Cum. Sett., in
B-2	1	29	1	90	cl	6	0.060	0.060	2.00	1	1	0.75	0.82	1.23	35.7	47.8	0.457	0.507	1.00	0.781	Very Low	47.8	0.160			0.00	0.00
	5	23	1	5	sp/gp	6	0.300	0.300	1.83	1	1	0.75	0.82	1.12	25.8	25.8	0.297	0.329	0.99	0.512	Very Low	25.8	0.158			0.00	0.00
	7.5	38	1	5	sp/gp	6	0.450	0.403	1.57	1	1	0.75	0.82	0.97	36.8	36.8	0.457	0.507	0.98	0.710	Very Low	36.8	0.176			0.00	0.00
	10	35	1	4	sp/gp	6	0.600	0.475	1.45	1	1	0.75	0.82	0.89	31.2	31.2	0.457	0.507	0.98	0.631	Very Low	31.2	0.198			0.00	0.00
	12.5	39	1	5	sp/gp	6	0.750	0.547	1.35	1	1	0.77	0.82	0.85	33.3	33.3	0.457	0.507	0.97	0.585	Very Low	33.3	0.213			0.00	0.00
	15	41	1	5	sp/gp	6	0.900	0.619	1.27	1	1	0.82	0.82	0.86	35.1	35.1	0.457	0.507	0.97	0.554	Very Low	35.1	0.225			0.00	0.00
	17.5	57	1	5	sp/gp	6	1.050	0.691	1.20	1	1	0.86	0.82	0.85	48.4	48.4	0.457	0.507	0.96	0.533	Very Low	48.4	0.234			0.00	0.00
	20	37	1	5	sp/gp	6	1.200	0.763	1.14	1	1	0.89	0.82	0.83	30.8	30.8	0.457	0.507	0.96	0.519	Very Low	30.8	0.241			0.00	0.00
	22.5	10	1	90	cl	6	1.350	0.835	1.09	1	1	0.91	0.82	0.82	8.2	14.8	0.160	0.178	0.95	0.178	Moderate	14.8	0.246	CLAY		0.00	0.00
	25	83	1	5	sp/gp	6	1.500	0.907	1.05	1	1	0.94	0.82	0.81	67.0	67.0	0.457	0.507	0.94	0.501	Very Low	67.0	0.249			0.00	0.00
	27.5	75	1	5	sp/gp	6	1.650	0.979	1.01	1	1	0.95	0.82	0.79	59.1	59.1	0.457	0.507	0.93	0.497	Very Low	59.1	0.251			0.00	0.00
	30	50	1	5	sp/gp	6	1.800	1.051	0.98	1	1	0.95	0.82	0.76	38.2	38.2	0.457	0.507	0.92	0.495	Very Low	38.2	0.252			0.00	0.00
	32.5	75	1	5	sp/gp	6	1.950	1.123	0.94	1	1	0.96	0.82	0.74	55.6	55.6	0.457	0.507	0.91	0.495	Very Low	55.6	0.252			0.00	0.00
	35	50	1	5	sp/gp	6	2.100	1.195	0.91	1	1	0.96	0.82	0.72	36.0	36.0	0.457	0.507	0.89	0.499	Very Low	36.0	0.250			0.00	0.00
	37.5	86	1	5	sp/gp	6	2.250	1.267	0.89	1	1	0.96	0.82	0.70	60.4	60.4	0.457	0.507	0.87	0.504	Very Low	60.4	0.248			0.00	0.00
	40	88	1	5	sp/gp	6	2.400	1.339	0.86	1	1	0.97	0.82	0.69	60.3	60.3	0.457	0.507	0.85	0.512	Very Low	60.3	0.244			0.00	0.00
	42.5	78	1	5	sp/gp	6	2.550	1.411	0.84	1	1	0.97	0.82	0.67	52.3	52.3	0.457	0.507	0.83	0.521	Very Low	52.3	0.239			0.00	0.00
	45	81	1	5	sp/gp	6	2.700	1.483	0.82	1	1	0.97	0.82	0.66	53.1	53.1	0.457	0.507	0.80	0.533	Very Low	53.1	0.234			0.00	0.00