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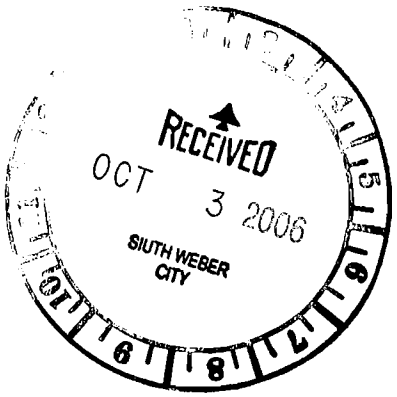

GEOTECHNICAL STUDY
S&S ESTATES, APPROXIMATELY APPROX. 1750 EAST 7600 SOUTH SOUTH WEBER, UTAH

Prepared By:

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Y² JOB NUMBER: 06G-146

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September 12, 2006

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed subdivision to be located at approximately 1750 East 7600 South in South Weber, Utah. The general location of the site, with respect to existing roadways, is shown on Figure No. 1, *Vicinity Map*, at the end of this report.

This investigation was done to assist in evaluating the subsurface conditions and engineering characteristics of the foundation soils and in developing our opinions and recommendations concerning appropriate foundation types, floor slabs, and pavements. This report presents the results of our geotechnical investigation including field exploration, laboratory testing, engineering analysis, and our opinions and recommendations. Data from the study is summarized on Figures 3 thru 6 and in the Laboratory Results.

2.0 PROPOSED CONSTRUCTION

We understand that the proposed development will consist of approximately 5 acre residential subdivision. We anticipate that the buildings will be one to two story structures either slab on grade or with basements. We estimate that the maximum loads for the proposed structures will not exceed 4 kips per linear foot for bearing walls, 30 kips for columns, and 150 to 200 pounds per square foot for floor slabs. If structural loads are significantly greater than those discussed herein or if the project is substantially different than described above, our office should be notified so that we may review our recommendations, and if necessary, make modifications.

In addition to the structures described above it is anticipated that utilities will be constructed to service the buildings, that exterior concrete flatwork will be placed in the form of curb and gutter, and sidewalks, and that an asphalt concrete paved access way will be constructed.

3.0 CONCLUSIONS

The following is a brief summary of our findings and conclusions:

1. The subject site is suitable for the proposed construction provided the recommendations presented in this report are followed.

2. Based upon the 4 test pits excavated for this investigation, this site is covered with 24 to 30 inches of silty sand with topsoil and cobbles. The native soils below the topsoil generally consisted of supported medium dense gravels and cobbles. The matrix materials around the cobbles consisted of poorly graded gravel (GP), poorly graded gravel with silt and sand (GP-GM), well graded gravel with sand (GW), silty sand with gravel (SM), silty gravel with sand (GM), and well graded gravels with silts and sands (GW-GM) which extended which extended to the maximum depth investigated (10 ft).

3. Conventional strip and spread footings are recommended for supporting the proposed structures. Footings should be founded either on the undisturbed native soils, or on properly placed and compacted structural fill extending to the undisturbed native soils. Footings may be designed using a maximum bearing capacity of 2,000 psf. More detailed information pertaining to the construction of foundations is provided in Section 10.0, Foundations of this report.

4. Residential pavements should consist of 3 inches of asphalt and 6 inches of untreated aggregate base placed on the native subgrade. Additional pavement recommendations are stated in Section 14.0 of this report.

5. This investigation was performed with test pits. Section 10.0 of this report provides specific requirements for placement of structures near test pit locations.

4.0 SITE CONDITIONS

The site is an irregarly shaped parcel of land located at approximately 1750 East 7600 South in South Weber, Utah. The site is undeveloped and vegetated with grasses, trees, weeds and bushes. The site sloped downward to the south at 2 to 3 percent. The site is bound to the south by single family residential developments and to the east. The site is bound to the north and west by undeveloped farm fields. Irrigation and gas lines were found on site.

5.0 FIELD INVESTIGATION

The field investigation consisted of excavating 4 test pits to depth of 10 feet below current site grades approximate locations shown on Figure 2, at the end of this report. The soils encountered at the site were continuously logged by a qualified member of our geotechnical staff. Due to the granular nature of the subsurface soils only disturbed samples were obtained and returned to our laboratory for testing.

6.0 LABORATORY TESTING

The samples obtained during the field investigation were sealed and returned to our laboratory where samples were selected for laboratory testing. Laboratory tests included natural moisture determinations and grain size distribution analyses. The results of these tests are shown at the end of this report.

Samples will be retained in our laboratory for 30 days following the date of this report at which time they will be disposed of unless a written request for additional holding time is received prior to the disposal date.

7.0 SUBSURFACE CONDITIONS

Based upon the 4 test pits excavated for this investigation, this site is covered with 24 to 30 inches of silty sand with topsoil and cobbles. The native soils below the topsoil generally consisted of supported medium dense gravels and cobbles. The matrix materials around the cobbles consisted of poorly graded gravel (GP), poorly graded gravel with silt and sand (GP-GM), well graded gravel with sand (GW), silty sand with gravel (SM), silty gravel with sand (GM), and well graded gravels with silts and sands (GW-GM) which extended which extended to the maximum depth investigated (10 ft).

Graphical representations of the soil conditions encountered are shown on the Test Pit Logs, Figures 3 thru 6. The stratification lines shown on the logs represent the approximate boundaries between soil units; the actual transition may be gradual.

8.0 SITE GRADING

8.1 General Site Grading

Prior to construction unsuitable soils and vegetation should be removed from below areas which will ultimately support structural loads. This includes areas below foundations, floor slabs, exterior concrete flatwork, and asphaltic concrete paved roads. Unsuitable soils consist of topsoil, organic soils, undocumented fill, soft, loose or disturbed native soils, and any other deleterious materials. Topsoil was encountered to a maximum depth of 30 inches at the test pit locations. The topsoil and any other unsuitable soils should be completely removed.

8.2 Excavations

Due to the nature of the soils at this site, we recommend that temporary construction slopes for excavations into the native soils or structural fill, less than five feet in depth, not be made steeper than 0.5:1.0 (horizontal:vertical). Excavations deeper than 5 feet should be sloped at 1:0:1.0 or be shored prior to anyone entering the excavation. If unstable conditions or groundwater seepage are encountered, flatter slopes or shoring and bracing may be required. All excavations should meet applicable OSHA[1] Health and Safety Standards for type C soils.

8.3 Structural Fill

If fill is needed, all fill placed below the buildings, pavements, and concrete flatwork should be compacted structural fill. All other fills should be considered as backfill. Structural fill should consist of the native sand and gravel soils with material larger than 3 inches removed or imported structural material. Imported structural fill material should consist of well-graded sandy gravels to

[1] Occupational Safety and Health Administration

silty sand with a maximum particle size of 3 inches and 5 to 20 percent fines (materials passing the No. 200 sieve). The liquid limit of the fines should not exceed 35 and the plasticity index should be below 15. Clean gravel ranging from pea gravel to 3 inches with less than 5 percent fines and sand combined may also be used as structural fill. All fill soils should be free from topsoils, highly organic material, frozen soil, and other deleterious materials.

8.4 Backfill

The native soils may be used as backfill in utility trenches and against outside foundation walls. Backfill, not under structural elements, should be placed in lift heights suitable to the compaction equipment used and compacted to at least 90 percent of the maximum dry density (ASTM D-1557).

8.5 Fill Placement and Compaction

The thickness of each lift should be appropriate for the compaction equipment that is used. We recommend a maximum lift thickness of 6 inches for hand operated equipment, 8 inches for most "trench compactors", and 12 inches for larger rollers, unless it can be demonstrated by in-place density tests that the required compaction can be obtained throughout a thicker lift. The full thickness of each lift of structural fill placed should be compacted to at least the percentages of the maximum dry density, shown in Table 1 below, as determined by ASTM D-1557:

TABLE 1: STRUCTURAL FILL COMPACTION

Structural fill	Percent of Maximum Dry Density
Below foundations, flatwork, and pavements:	95%
For fills thicker than 6 feet:	98%
In landscape areas not supporting structural loads:	90%

Generally, placing and compacting fill at a moisture content within 2% of the optimum moisture content, as determined by ASTM D-1557, will facilitate compaction. The further the moisture

content is from the optimum, the more difficult it will generally be to achieve the required compaction.

We recommend that fill be tested frequently during placement. Early testing is recommended to demonstrate that placement and compaction methods are achieving the required compaction for the entire depth of fill. It is the contractor's responsibility to ensure that fill materials and compaction efforts are consistent so that tested areas are representative of the entire fill.

Clean gravel fill used as structural fill may be placed in loose lifts up to 2 feet thick. The gravel will need to be compacted with at least 4 passes of a heavy vibratory plate or slow moving vibratory smooth drum compactor. Typically, the gravel will settle 1 to 3 inches when properly compacted, depending on the size and shape of the gravel. Gravel compaction should be verified by either an engineer from Y^2 Geotechnical or a materials testing technician trained in proper gravel placement techniques.

9.0 SEISMIC CONSIDERATIONS

9.1 Faulting

Based on published data, no active faults are known to traverse the site and no faulting was indicated during our field investigation. The nearest known active fault is the Wasatch Fault located about 1.5 mile east of the property[2].

9.2 Seismic Design Criteria

The residential structures should be designed in accordance with IRC building code. Based on section R301.2.2 of the IRC this site is classified as a Seismic Design Category D_2.

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[2] Utah Geologic Survey, Selected Critical Facilities and Geologic Hazards, Davis County, Utah

9.3 Liquefaction

Liquefaction is a phenomenon where soils lose their intergranular strength due to an increase of pore pressures during a dynamic event such as an earthquake. The potential for liquefaction is based on several factors, including 1) the grain size distribution of the soil, 2) the plasticity of the fine fraction of the soil (material passing the No. 200 sieve), 3) relative density of the soil, 4) earthquake strength (magnitude) and duration, and 5) overburden pressures. In addition, the soils must be near saturation for liquefaction to occur. According to the Davis County liquefaction map, this site is in an area classified as having low potential for liquefaction[2].

10.0 FOUNDATIONS

10.1 Footing Design

The native soils at this site are capable of supporting the proposed structures if the recommendations presented in this report are followed. The recommendations presented below should be utilized during design and construction of this project:

1. Spread footings founded on undisturbed native soils should be designed for a maximum allowable soil bearing capacity of 2,000 psf. A one-third increase is allowed for short term transient loads such as wind and seismic events. Footings should be uniformly loaded.

2. Continuous and spot footings should have minimum widths of 18 and 36 inches, respectively.

3. Exterior footings should be placed below frost depth which is determined by local building codes. Generally 30 inches is adequate in this area. Interior footings, not subject to frost, should extend at least 18 inches below the lowest adjacent final grade.

4. Foundation walls on continuous footings should be well reinforced both top and bottom. We suggest a minimum amount of steel equivalent to that required for a simply supported span of 12 feet.

5. This investigation was preformed with test pits. If a structure is constructed over an uncompacted test pits significant amounts of differential settlement may occur. Test pits typically disturb an area 15 feet long and 5 feet wide extending to the depths

indicated in the logs. If a structure is to be placed within 25 feet of a test pit location, Y^2 Geotechnical should be contacted to verify the structure is not placed over an uncompacted test pit. If a test pit is encountered within the building pad, the disturbed test pit soils should be completely removed and properly placed and compacted structural fill should be used to return the test pit location to design grade. Approximate test pit locations are shown on Figure 2, with approximate Pocket GPS coordinates listed on Figure 3, at the end of this report.

6. Footing excavations should be observed by the geotechnical engineer prior to placement of structural fill and construction of footings to evaluate whether suitable bearing soils have been exposed and verify that excavation bottoms are free of loose or disturbed soils.

10.2 Estimated Settlement

If footings are designed and constructed in accordance with the recommendations presented above, the risk of total settlement exceeding 1 inch and differential settlement exceeding 0.5 inch for a 25-foot span will be low. Additional settlement should be expected during a strong seismic event.

11.0 LATERAL EARTH PRESSURES

Resistance to lateral loads (including those due to wind or seismic loads) on foundations may be achieved by frictional resistance between the foundations and underlying soils, and by passive earth pressures of backfill soils placed against the sides of foundations. Retaining walls and below grade walls acting as soil retaining structures and should be designed to resist pressures induced by the backfill soils.

The lateral pressures imposed on a retaining structure are dependant on the rigidity of the structure and its ability to resist rotation. Retaining walls which are free to rotate at least 0.2 percent of the wall height, develop an active lateral soil pressure condition. Structures that are not allowed to rotate or move laterally, develop an at-rest lateral earth pressure condition. Lateral pressures applied to structures may be computed by multiplying the vertical depth of backfill material by the appropriate equivalent fluid density. Any surcharge loads in excess of the soil weight applied to the backfill

should be multiplied by the appropriate lateral pressure coefficient and added to the soil pressure. The lateral pressures presented in Table 2, *Lateral Earth Pressures* below, are based on drained, horizontally placed soils as backfill material. For computing lateral forces we recommend the following equivalent fluid densities:

TABLE 2: LATERAL EARTH PRESSURES

Condition	Static Lateral Pressure Coefficient	Static Equivalent Fluid Pressure (pcf)
Active	0.31	38.4
At-Rest	0.47	58.8
Passive	3.25	406.8

The friction acting along the base of foundations may be computed by using a coefficient of friction of 0.55 for contact with the native sand and gravel soils. These values may be increased by one-third for transient wind and seismic loads.

The values presented above are based on drained conditions and are ultimate, therefore, an appropriate factor of safety (minimum of 2.0) should be applied to these values for design purposes.

12.0 FLOOR SLABS

The native soils below floor slabs should be proof rolled and a minimum 4 inch thick layer of free-draining gravel or imported structural fill should be placed immediately below the floor slab to help distribute floor loads, break the rise of capillary water, and aid in the concrete curing process. For slab design, we recommend a modulus of subgrade reaction of 250 psi/in be used. To help control normal shrinkage and stress cracking, the floor slabs should have adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints and frequent crack control joints.

Special precautions should be taken during placement and curing of concrete slabs and flatwork. Excessive slump (high water-cement ratios) of the concrete and/or improper finishing and curing procedures used during hot or cold weather conditions may lead to excessive shrinkage, cracking, spalling, or curling of slabs. We recommend all concrete placement and curing operations be performed in accordance with American Concrete Institute (ACI) codes and columns.

13.0 SURFACE DRAINAGE

Wetting of the foundation soils may cause some degree of volume change within the soil and should be prevented both during and after construction. We recommend that the following precautions be taken at this site:

1. The ground surface should be graded to drain away from the structures in all directions. We recommend a minimum fall of 6 inches in the first 10 feet.

2. Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits.

3. Sprinkler heads, should be aimed away and kept at least 12 inches from foundation walls.

4. Provide adequate compaction of foundation backfill i.e. a minimum of 90% of ASTM D-1557. Water consolidation methods should not be used.

5. Other precautions which may become evident during design and construction should be taken.

14.0 PAVEMENT SECTION DESIGN

We understand that a flexible pavement is desired for roadways within this development. Unless a more stringent local code is required, we recommend new pavement sections consist of 3 inches of asphaltic concrete over 6 inches of untreated aggregate road base. The pavement design recommendations were developed using visual and laboratory classification of the on-site soils, an assumed California Bearing Ratio (CBR) of 20 for the supporting native soils, assumed traffic for the residential roadways of 1,000 vehicles per day with 1 percent being heavier vehicles such as

delivery trucks (35,000 equivalent 18-kip loading), the site grading recommendations presented in this report, and the following assumptions:

1. The subgrade is proof rolled to a firm non-yielding condition and soft areas are removed and replaced with structural fill.

2. Grading fills below the pavements and granular borrow meet imported structural fill material and placement requirements as defined in Sections 8.3 and 8.5 of this report, respectively.

3. Asphaltic concrete and aggregate base meet UDOT specification requirements.

4. Aggregate base is compacted to at least 95 percent of maximum dry density (ASTM D-1557).

5. Asphaltic concrete is compacted to at least 95 percent of the laboratory Marshal mix design density (ASTM D-1559).

6. Pavement design life of 20 years.

15.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project only. Test pits were widely spaced and may not be indicative of subsurface conditions between the test pits or outside the study area and thus have limited value in depicting subsurface conditions for contractor bidding. If it is necessary to define subsurface conditions in sufficient detail to allow accurate bidding we recommend an additional study be conducted which is designed for that purpose.

A copy of this report should be provided to all builders prior to construction to insure that the builder is aware of the geotechnical recommendation for this development.

Variations from the conditions portrayed in the test pits often occur which are sometimes sufficient to require modifications in the design. If during construction, conditions are found to be different than those presented in this report, please advise us so that the appropriate modifications can be

made. An experienced geotechnical engineer or technician should observe fill placement and conduct testing as required to confirm the use of proper structural fill materials and placement procedures.

The geotechnical investigation as presented in this report was conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in the area. This report is valid only for the location and project described in the report. No other warranty or representation, either expressed or implied, is intended in our proposals, contracts or reports.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
Y² GEOTECHNICAL, P.C.
Not official unless stamped and dated

David K. Esser, P.E
Project Engineer

Reviewed by,

R. Jay. Yahne, P.E.
Principal Geotechnical Engineer

4 copies sent

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NORTH

Figure 1: VICINITY MAP

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S&S Estates
South Weber, Davis County, Utah

Y² Job No. 06G-146

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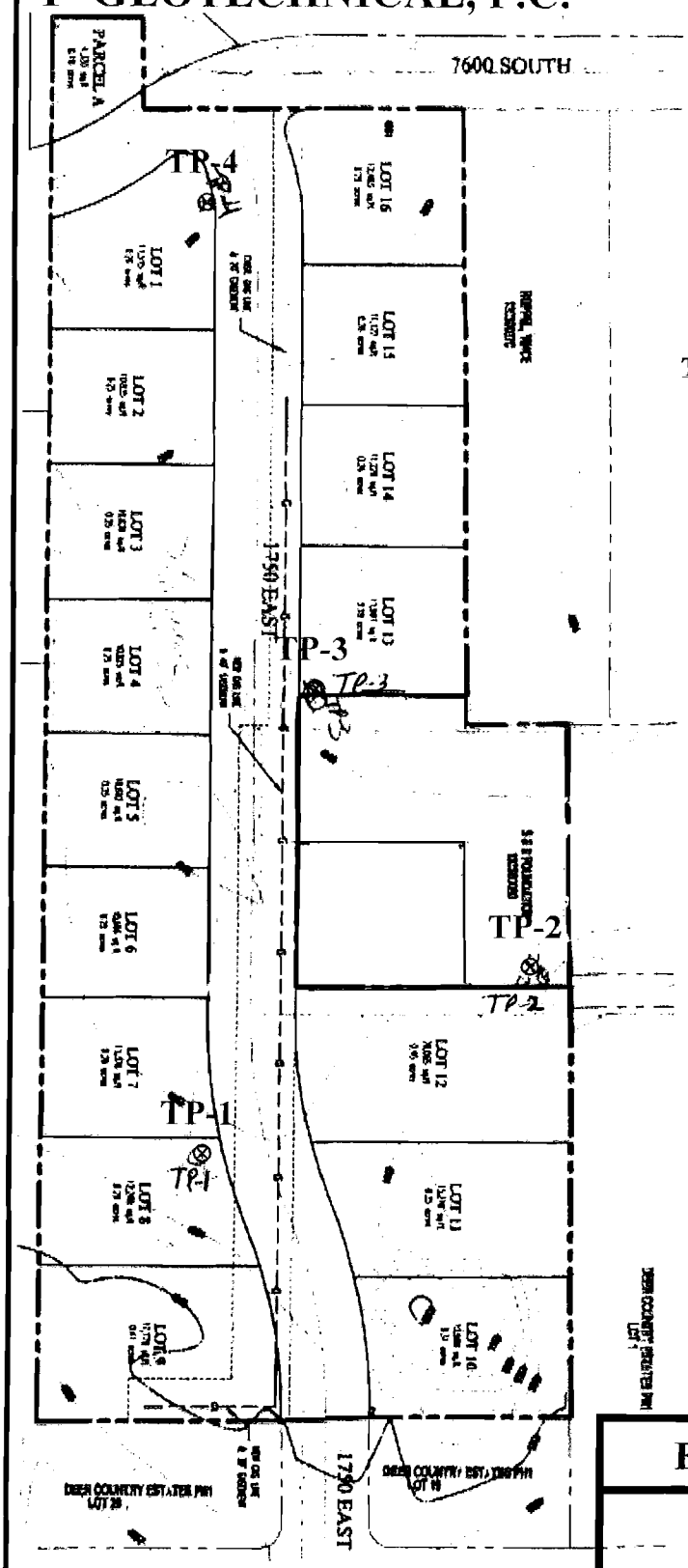

NORTH

Test Pit ID	Northing	Easting
TP-1	41.12646°	-111.93430°
TP-2	41.12693°	-111.93426°
TP-3	41.12750°	-111.93405°
TP-4	41.12854°	-111.93437°

Figure 2: TEST PIT LOCATIONS

GEOTECHNICAL STUDY
S&S Estates
South Weber, Davis County, Utah

Y² Job No. 06G- 146

Project No. 06g-146	LOG OF TEST PIT NO. TP-1	Figure 3

PROJECT	S&S Estates	CLIENT	Sam Stanger
LOCATION	1750 East 7600 South South Weber, Utah	Surface Elev.:	

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Moisture Content, %	Liquid Limit, %	Plasticity Index, %	Gravel, %	Sand, %	Fines, %
0			24" Topsoil with silty sand and cobbles - loose, dry, light brown.						
2			Well Graded Gravel with Sand (GW) - clast supported, medium dense, dry, light brown.						
4									
6									
8									
10				1.5	NP	NP	71.0	27.6	0.9
			End of hole at 10 feet.						

Grab Sample

LOG OF BOREHOLE/TEST PIT 06G-1 S&S ESTATES GINT.GPJ Y2 GEOTECH.GDT 9/13/06

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WATER LEVELS	STARTED	9/8/06	FINISHED	9/8/06
none	EXCAVATION CO.	Owner	EQUIP.	Backhoe
	EXCAVATION TYPE	Backhoe		
	LOGGED BY	Josh White		

Project No. 06g-146	LOG OF TEST PIT NO. TP-2	Figure 4

PROJECT	CLIENT
S&S Estates	Sam Stanger
LOCATION: 1750 East 7600 South, South Weber, Utah	Surface Elev.:

Grab Sample

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Moisture Content, %	Liquid Limit, %	Plasticity Index, %	Gravel, %	Sand, %	Fines, %
0			30" Topsoil with silty sands - medium dense, dry, dark brown.						
3			Silty Gravels with Sand (GM) - matrix supported, medium dense, dry, light brown.						
4				2.0	NP	NP	37.3	47.5	14.7
10			End of hole at 10 feet.						

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WATER LEVELS					
none	STARTED	9/8/06	FINISHED	9/8/06
	EXCAVATION CO.	Owner	EQUIP.	Backhoe
	EXCAVATION TYPE	Backhoe		
	LOGGED BY	Josh White		

LOG OF BOREHOLE/TEST PIT 06G-1 S&S ESTATES GINT.GPJ Y2 GEOTECH.GDT 9/13/06

Project No. 06g-146	LOG OF TEST PIT NO. TP-3	Figure 5

PROJECT	CLIENT
S&S Estates	Sam Stanger
LOCATION: 1750 East 7600 South, South Weber, Utah	Surface Elev.:

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Moisture Content, %	Liquid Limit, %	Plasticity Index, %	Gravel, %	Sand, %	Fines, %
0			30" Topsoil with silty sands and organics - loose, dry, dark brown.						
3		Grab	Poorly Graded Gravel with Sand (GP) - clast, supported, loose, moist, brown.	3.8	NP	NP	61.1	34.7	4.0
10			End of hole at 10 feet.						

LOG OF BOREHOLE/TEST PIT 06G-1 S&S ESTATES GINT.GPJ Y2 GEOTECH.GDT 9/13/06

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WATER LEVELS	STARTED 9/8/06	FINISHED 9/8/06
none	EXCAVATION CO. Owner	EQUIP. Backhoe
	EXCAVATION TYPE Backhoe	
	LOGGED BY Josh White	

Project No. 06g-146	**LOG OF TEST PIT NO. TP-4**	Figure 6

PROJECT	CLIENT
S&S Estates	**Sam Stanger**
LOCATION **1750 East 7600 South South Weber, Utah**	Surface Elev.:

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Moisture Content, %	Liquid Limit, %	Plasticity Index, %	Gravel, %	Sand, %	Fines. %
1			30" Topsoil with sity sands and gravels with organics - loose, dry, dark brown.						
2									
3			Poorly Graded Gravel with Sand (GP) - clast supported, loose, moist, brown.						
4									
5									
6				1.5	NP	NP	57.5	40.8	1.4
7									
8									
9									
10			End of hole at 10 feet.						
11									
12									
13									
14									

Grab Sample

LOG OF BOREHOLE/TEST PIT 06G-1 S&S ESTATES GINT.GPJ Y2 GEOTECH.GDT 9/13/06

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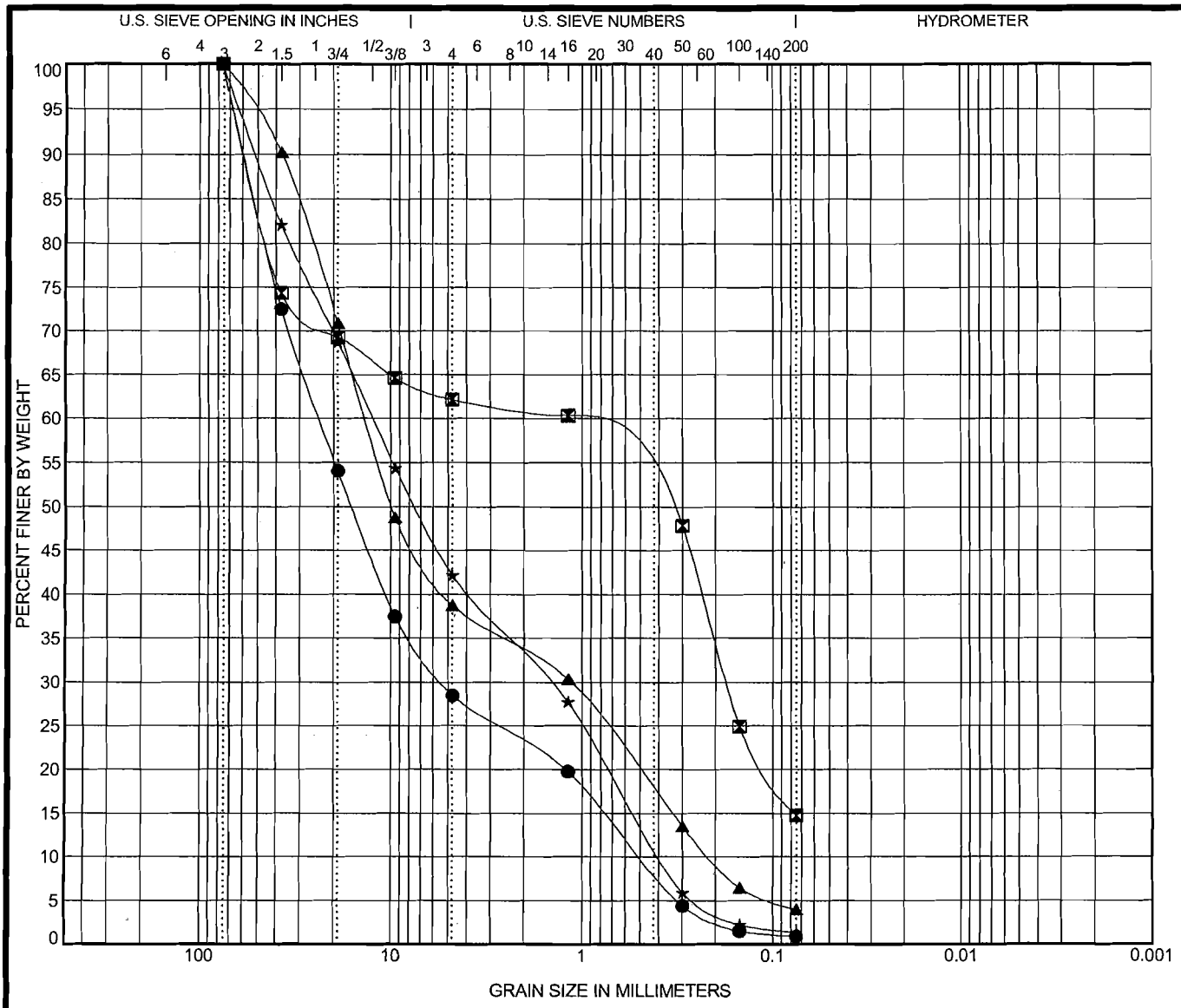
WATER LEVELS	STARTED 9/8/06	FINISHED 9/8/06
none	EXCAVATION CO. Owner	EQUIP. Backhoe
	EXCAVATION TYPE Backhoe	
	LOGGED BY Josh White	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TP-1	9.5	WELL-GRADED GRAVEL with SAND(GW)	NP	NP	NP	2.4	47.9
⊠	TP-2	4.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
▲	TP-3	2.5	POORLY GRADED GRAVEL with SAND(GP)	NP	NP	NP	0.5	63.5
★	TP-4	6.0	POORLY GRADED GRAVEL with SAND(GP)	NP	NP	NP	0.4	32.1

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-1	9.5	76	23.64	5.33	0.49	71.0	27.6	0.9	
⊠	TP-2	4.0	76	1.13	0.17		37.4	47.4	14.7	
▲	TP-3	2.5	76	13.5	1.14	0.21	61.1	34.8	4.0	
★	TP-4	6.0	76	12.43	1.46	0.39	57.5	40.8	1.4	

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GRAIN SIZE DISTRIBUTION

Project: S&S Estates
Location: 1750 East 7600 South South Weber, Utah
Number: 06g-146

US GRAIN SIZE 06G-1 S&S ESTATES GINT.GPJ Y2 GEOTECH.GDT 9/13/06

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
TP-1	9.5	NP	NP	NP	76	1	GW	1.5			
TP-2	4.0	NP	NP	NP	76	15	SM	2.0			
TP-3	2.5	NP	NP	NP	76	4	GP	3.8			
TP-4	6.0	NP	NP	NP	76	1	GP	1.5			

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Summary of Laboratory Results

Project: S&S Estates

Location: 1750 East 7600 South South Weber, Utah

Number: 06g-146