GEOTECHNICAL STUDY
12549 SOUTH 2200 WEST
RIVERTON, UTAH

PREPARED FOR:

HOLMES HOMES
126 WEST SEGO LILY DRIVE, SUITE 250
SANDY, UT

PREPARED BY:

SUMMIT ENGINEERING SERVICES
A DIVISION OF PANGEAN-CMD ASSOCIATES, INC.
3640 SOUTH 500 WEST
SALT LAKE CITY, UTAH 84115

JOB NO. TC-0G2249 **JUNE 2013**

June 10, 2013

Summit Engineering Services
A Division of Pangean-CMD

Mr. Curtis Leavitt
Holmes Homes
126 West Sego Lily Drive, Suite 250
Sandy, Utah

Subject: **Geotechnical Study**
Riverton Subdivision
12549 South 2200 West
Riverton, Utah
SES Project No. TC-0G2249-01

Dear Mr. Leavitt:

Summit Engineering Services (SES), a division of Pangean-CMD Associates, Inc., has completed a geotechnical study for the proposed Riverton Subdivision to be constructed at 12549 South 2200 West, Riverton, Utah. Details of the findings and recommendations, along with the supporting field and laboratory data, are presented in the enclosed report. The study was performed in general accordance with proposal P-G2099 dated May 23, 2013 as authorized by you on May 28, 2013.

Eight test pits terminating at depths of 8 to 15 feet were completed within the anticipated footprint of the proposed subdivision. In general, the subsurface soils encountered consisted of 12 to 16 inches of topsoil, underlain by CLAY to a of depth 2 feet, underlain by SILT to a depth of 11 feet, overlying well graded, sandy GRAVEL (GW) extending to the maximum depths explored. The aforementioned sandy GRAVEL layer was encountered at a depth of 3 feet at Test Pit 5. Groundwater did not develop in any of the test pits.

SES appreciates the opportunity to be of service to you on this project. Please call us if you have any questions or need additional information.

Sincerely,

SUMMIT ENGINEERING SERVICES
A Division of Pangean-CMD Associates, Inc.

REGISTERED PROFESSIONAL ENGINEER
No. 7459308-2202
DAVID A. SCHMIDT
STATE OF UTAH

Curt Stripeika
Project Engineer

David A. Schmidt, P.E.
Vice-President
Utah License Number: 7459308-2022

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1.0 INTRODUCTION

This report presents the results of the geotechnical study conducted at the site of the proposed residential subdivision to be located at 12549 South 2200 West, Riverton, Utah. The purpose of this study was to gather information on site soil/groundwater conditions, so that recommendations for site preparation and grading, pavement design, foundation types and depths, soil bearing capacities, anticipated total and differential settlements, and other construction considerations could be provided based the subsurface conditions encountered. In addition, a percolation test was also performed in the area of the proposed retention basin to determine design infiltration rates.

The study included a site reconnaissance, test pit excavation, soil sample collection, laboratory testing, engineering analysis, client consultation, and preparation of this report.

2.0 PROPOSED CONSTRUCTION

SES understands that the proposed subdivision will consist of conventional single-family homes that will be constructed on 50 lots. The entire site proposed for development is 7.96 acres with 0.22 acres proposed for commercial development. A retention basin is also planned for the property. Finished floor elevations were not available at the time of this report but are likely to be at or near existing site grades. Roads and paved parking are also planned for the development.

3.0 SITE CONDITIONS

The property is 7.96 acres in size and is currently vacant agricultural. The ground surface slopes to the east with an elevation difference of approximately 20 feet.

Surrounding properties are commercial to the south and east and residential to the north and west.

4.0 SUBSURFACE CONDITIONS

Eight test pits terminating at depths of 8 to 15 feet were completed within the anticipated footprint of the proposed subdivision. In general, the subsurface soils encountered consisted of 12 to 16 inches of topsoil, underlain by CLAY to a of depth 2 feet underlain by SILT to a depth of 11 feet, overlying well graded, sandy GRAVEL (GW) extending to the maximum depths explored. It should be noted that the aforementioned sandy GRAVEL was encountered at a depth of 3 feet at Test Pit 5. Groundwater did not develop in any of the test pits.

A detailed description of the subsurface soils encountered within each of the test pits is presented on the Test Hole Logs included in **Appendix A** as **Figures A-3** through **A-10**. **Figure A-11** is the key to symbols and abbreviations used on the Test Pit Logs.

5.0 GEOLOGIC HAZARDS

5.1 Site Geology

The site appears to consist of Pleistocene lake deposits consisting of inter-bedded layers of clay and sand. These lake deposits likely formed in Ancient Lake Bonneville, ancestral to the existing Great Salt Lake.

5.2 Faulting and Seismicity

Review of available literature for relevance to this site indicates that no known active faults traverse the property. The closest known active fault is the Wasatch Fault located approximately 6 miles to the east. The site does not appear to be within a special study area proximal to a specific fault location as defined by Salt Lake County.

According to the 2009 International Building Code (IBC), it appears the site is a seismic site class of "C". This evaluation is not based upon a 100 foot deep boring as required by the IBC but an analysis of the N-values (blow counts) and soil types encountered and with SES's experience with the soil conditions in the area. If needed for design, the building at this site can utilize an assumed critical earthquake of magnitude M=7 and a peak ground acceleration of 0.25.

Spectral Response Accelerations

Period (sec)	Sa (g)	Parameter
0.2	1.317	S_{MS}
1.0	0.685	S_{M1}

Period (sec)	Sa (g)	Parameter
0.2	0.878	S_{DS}
1.0	0.456	S_{D1}

S_{MS} - Maximum considered earthquake, 5 percent damped spectral response acceleration parameter short periods adjusted for site class effects.
S_{M1} - Maximum considered earthquake, 5 percent damped spectral response acceleration parameter a period of one second adjusted for the site class effects.
D_{SD} - The design, 5 percent damped, spectral response acceleration at short periods.
S_{D1} - The design, 5 percent damped, spectral response acceleration a period of one second.

The results are the peak ground acceleration (PGA), the 0.2 second spectral acceleration (SA), and the 1.0 second SA. All acceleration values are presented in percent of the acceleration of gravity. A printed copy of the seismic parameters is included in **Appendix B**.

5.3 Slope Stability

There are no mapped or known landslides in this area. Given the relatively flat grades in this area, landslides and slope instability are not expected to be of concern.

5.4 Liquefaction Potential

The general liquefaction potential classification is rated as "very low" for this area. Due to the low hazard rating a site specific liquefaction analysis is not required and was not performed.

5.5 Non-Engineered Fill

Non-engineered fill was not encountered at the project site.

6.0 SITE PREPARATION AND GRADING

Proper subgrade preparation is critical for satisfactory foundation, concrete flatwork, and pavement performance. Therefore, all topsoil, vegetation, undocumented/non-engineered fill and any other deleterious materials overlying the site should be stripped from building, flatwork, and pavement areas. Stripping should extend at least 5 lateral feet beyond the perimeter of the buildings; 2 lateral feet beyond the perimeter of pavement areas and 1 foot beyond the perimeter of concrete flatwork areas. Following site stripping and any additional over-excavation that may be recommended in this report, the exposed subgrade should be scarified and compacted to a firm non-yielding surface prior to structural fill or sub-base placement. Depending on the time of the year, the subgrade may have to be stabilized prior to structural fill placement. Stabilization of soft soil or areas exhibiting excessive pumping can be achieved by undercutting up to 18 inches of the soft material and replacing it with coarse gravel over a geo-fabric that is approved by the geotechnical engineer.

The earthwork contractor should be advised that failure of excavation slopes, exceeding 4 feet in depth, should be expected. The United States Department of Labor, Occupational Safety and Health Administration (OSHA) guidelines require that all excavations (for example, utility trenches, basement excavations, and/or footing excavations) be constructed in accordance with their applicable guidelines. During the construction of the project, the general contractor should be made aware that he is solely responsible for the designing and constructing of stable

temporary excavations and that he should shore, slope, or bench the sides of the excavations as required to maintain stability. The contractor's competent person, as defined in 29 CFR Part 1926, Subpart P, is required to evaluate the exposed soil in each excavation as part of the contractor's safety procedures.

The soils at this site may destabilize under construction traffic wheel loads during periods of prolonged wet weather. Should this be the case, these areas should be stabilized as recommended above.

Structural fill required to bring the site to grade should be placed in 8-inch maximum loose lifts, at the moisture content optimum for compaction (generally two to three percentages points above, or below, the optimum moisture content), and compacted to at least 95 percent modified Proctor (ASTM D1557) maximum dry density. The native soils do not appear to be suitable for re-use as structural fill because of the large amounts of fines. All imported fill should be approved by the geotechnical engineer prior to its delivery to the site. In general, imported fill should consist of sands and gravels containing 10 to 40 percent fines (material passing the No. 200 sieve, based on the minus ¾-inch fraction), and should have a maximum particle size of 1.5 inches. The plasticity index of the fines should not exceed 15.

All site grading and fill operations should be observed by a representative of the geotechnical engineer to determine the adequacy of site preparation, the suitability of fill materials, and compliance with compaction requirements. Further, the site should be inspected immediately after the completion of site stripping to possibly identify prior fill areas or unexpected soil conditions that may underlie the site.

7.0 FOUNDATION RECOMMENDATIONS

Spread footings placed on the native soils or structural fill should provide adequate support for the proposed buildings. The following design and construction details should be observed:

1. Footings supported on native soils or structural fill should be designed for a maximum soil pressure of 1,500 psf. This may be increased by one-third for short-term transient wind and seismic loads. Under this pressure, the total footing settlement is expected to be about 1 inch. The differential settlement between adjacent footings or for a 25-foot span of continuous wall footing is not expected to exceed about 50 to 75% of the estimated total settlement. As noted previously, dewatering of the site will most likely be required to complete the foundation construction.
2. Continuous (wall) and individual (column) footings should be at least 16 and 24 inches wide, respectively, and should be placed a minimum of 30 inches below the lowest adjacent final grade.
3. All exterior footings should be placed below frost depth (expected to be about 30 inches in this area).

4. Continuous foundation walls should be adequately reinforced both top and bottom. As a guide, it is recommended that an amount of steel equivalent to that required for a simply supported span of 20 feet be utilized.
5. Structural fill where required should extend horizontally beyond footing peripheral boundaries for a distance equal to one-half of the fill depth.

8.0 FLOOR SLABS

Six inches of free-draining gravel should be placed directly underneath the slabs to distribute floor loads and break the rise of capillary water. The slabs should be provided with frequent joints to minimize damage due to shrinkage cracking, and they should be adequately reinforced for the loads to be imposed on the space. The slabs should be separated from all bearing walls and partitions with a slip joint. Exterior concrete flat work is recommended to be supported on a minimum of 12 inches of structural fill.

9.0 BELOW GRADE WALLS

It is recommended that the following equivalent fluid pressures and a triangular shaped pressure distribution be used for the design of any below grade walls resisting lateral loads:

Wall Type	Ult. Equiv. Active Fluid Pressure/Seismic (pound per cubic foot-pcf)	Ult. Equiv. Passive Fluid Pressure (pcf)
Pit or basement floors, restrained at top	60/85*	300
Retaining, free to rotate at top	35/60*	300

*Seismic assumed to act 0.6H above base of wall where H = wall height.

For seismic considerations, the combined static (P_A) and dynamic lateral forces (P_E) are combined such that $P_{AE} = P_A + P_E = \frac{1}{2}(\gamma)H^2K_{ao} + 3/8(\gamma)\,H^2K_h$ where:
γ = Wall backfill moist/total unit weight ~ 120 pcf for this project
H = Wall height
K_{ao} = Active (unrestrained) or at rest (restrained) earth pressure coefficient. For this project assume the active earth pressure coefficient ~ 0.3 and the at rest earth pressure coefficient ~ 0.5.
K_h = Horizontal ground acceleration in g's (0.25g to 0.3g has been used in the Salt Lake City area for many years for an assumed critical earthquake with a magnitude of 7.0). The horizontal ground acceleration can also be specifically derived for the site from the Peak Ground Acceleration (PGA) determined for the Maximum Considered Earthquake (MCE). Local practice is to consider K_h = PGA/2.

P_A, as is standard practice for equivalent fluid pressures, acts 1/3H up from the base of the wall; P_E is assumed to act at 0.6H up from the base of the wall. The factor of safety for the combined effect of static and seismic loading is recommended to be in the range of 1.1 to 1.2.

As an alternate method, lateral resistance can be calculated based on sliding resistance. For this case, a friction factor of 0.35 for concrete against soil may be used for design. If passive pressures and friction are used in combination, we further recommend using a reduced co-efficient of base friction equal to 0.25. The above equivalent fluid pressure recommendations assume a level surface grade and a drained condition adjacent to the wall. EFP recommendations for sloping backfill conditions can be provided upon request.

If retaining walls are planed as part of the development, the backfill within four lateral feet of the back of the wall should consist of free-draining sand/gravel (less than 5% clay/silt fines) or an appropriate manufactured drainage product. Open-graded aggregates should be avoided unless enveloped in an SES approved geotextile filter fabric. Beyond 4 feet/drainage product, wall backfill can consist of any available soil material free of organics, large rocks or other deleterious materials or as required by the drainage product manufacturer/supplier. The top 2 feet of wall backfill should consist of an impervious clay cap (the on-site native lean clay is anticipated to be suitable). Wall backfill should be compacted to at least 88 percent but not more than 92 percent of modified Proctor maximum dry density. Relatively light manually propelled compactors should be used within 5 feet of walls. Compactors used beyond 5 feet should be limited in weight to 3,000 lbs. A gravel drain behind retaining walls is also recommended. Drain details will be provided once wall location and heights are known.

10.0 SURFACE DRAINAGE

Adequate surface drainage must be maintained during the course of construction and after construction has been completed. Backfill against the exterior face of footings and foundation walls should be moistened and compacted to at least 85 percent of the maximum dry density as determined by the ASTM D 1557-78 method. The ground surface surrounding the exterior of the building should be sloped to drain away from the buildings in all directions. SES recommends a minimum slope of 6 inches in the first 10 feet. Roof downspouts should discharge into splash blocks extended beyond the limits of all backfill. All sprinkler heads should be aimed away and kept at least 4 feet from the foundation walls.

11.0 PERCOLATION TESTS

A percolation test was performed in the area of the proposed retention basin. The test was performed at an approximate depth of 4 feet. Results of the percolation tests were 27 min/in. However, SES recommends a design value of 35 min/in to compensate for potential silt buildup in the retention basin. The retention basin should be periodically maintained so debris and silt buildup does not occur.

12.0 PAVEMENT DESIGN

Preparation of the pavement subgrade is critical to construction of a satisfactory flexible (asphalt and aggregate base course section) pavement. All topsoil, fill, soft or loose soils encountered in the upper 2 feet of subgrade in car traffic areas (actual depth of removal dependent on depth of fill but not to exceed 2 feet) should be removed and replaced with non-frost susceptible structural fill, defined as a material with a maximum of 8% by weight passing the No. 200 sieve and a maximum nominal rock size of 1.5 inches.

After stripping and/or excavating to the proposed subgrade level has been completed, the construction area should then be proof-rolled with a moderately heavy pneumatic-tired vehicle (for example, loaded dump truck or earth mover). Soils which are observed to rut or deflect excessively under the moving load, or are otherwise judged to be unsuitable, should be undercut and replaced with properly compacted fill. All proof-rolling operations should be observed by a representative of the geotechnical engineer.

For stable pavement area subgrades prepared as recommended and light traffic volumes, it is recommended that a pavement section consisting of 3 inches of bituminous concrete surface course and 6 inches of aggregate base course over a minimum of 12 inches of non-frost susceptible structural sub-base (as previously defined) for car and light truck traffic/parking areas. The bituminous concrete should be compacted to a minimum of 95 percent Marshall density; the base course should be compacted to 95 percent modified Proctor density. Field density testing should be conducted to confirm that the specified relative compaction is achieved. Subgrades below the sub-base are recommended to be graded to drain any surface water collected in the sub-base away from the pavement area.

It is recommended that all materials comprising the pavement section be in accordance with the appropriate sections of the current edition of ***State of Utah Standard Specification for Road and Bridge Construction.***

For rigid pavement area subgrades prepared as recommended and light traffic volumes, a pavement section consisting of 5 inches of Portland Cement Concrete (PCC) and 6 inches of aggregate base course for passenger vehicle drives/parking areas is recommended. Concrete pavements and slabs should be constructed according to the guidelines of the Portland Cement Association. A modulus of subgrade reaction equal to 200 pounds per cubic inch can be used to design a rigid pavement section for this project.

Paved areas should be graded to shed surface water well away from the perimeter of the paved areas. In addition, paved areas should be inspected frequently, particularly in the fall, and cracks sealed as soon as possible.

13.0 UNDERGROUND UTILITIES

All trench backfill should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density except in non-critical areas. Critical areas are defined as areas that are structurally loaded.

14.0 LIMITATIONS

The analysis and recommendations submitted in this study are based upon the data obtained from eight test pits drilled at the locations shown on **Figure A-2** and the structure details provided to us. This study does not reflect any variations that may occur away from the test pits. The nature and extent of such variations may not become evident until the course of construction and are sometimes sufficient to necessitate changes in the designs. Thus, it is important that SES observe subsurface materials exposed in the project excavations to take advantage of all opportunities to recognize differing conditions that could affect the performance of the proposed construction.

This study has been prepared in order to assist the engineer/contractor in the design of this project. In the event that any changes are planned in the design, location, or elevation of the proposed construction as outlined in this study, the conclusions and recommendations contained in this study shall not be considered valid unless the changes are reviewed and conclusions of this study modified or approved in writing by SES.

The study should be available to prospective contractors for information on technical data only as interpreted from the test pits and not as a warranty of subsurface conditions.

APPENDIX A

Field Exploration, Vicinity Map, Site Plans, and Logs of Test Pits

FIELD EXPLORATION

The field exploration consisted of the drilling, logging, and sampling of eight, 8-foot to 15-foot deep test pits as shown on Figure A-2. Samples were taken at selected intervals, sealed, and returned to the laboratory for classification and testing. A continuous log of the subsurface conditions as encountered in the test pits was kept during drilling. Mr. Curt Stripeika of SES supervised the excavating and sampling operations. The test pits were excavated by Skyline Contractors of Salt Lake City, Utah.

LEGEND

— — — — PROPERTY LINE

MAP SOURCE: AERIAL IMAGE

N

0 300 600

APPROX. SCALE FEET

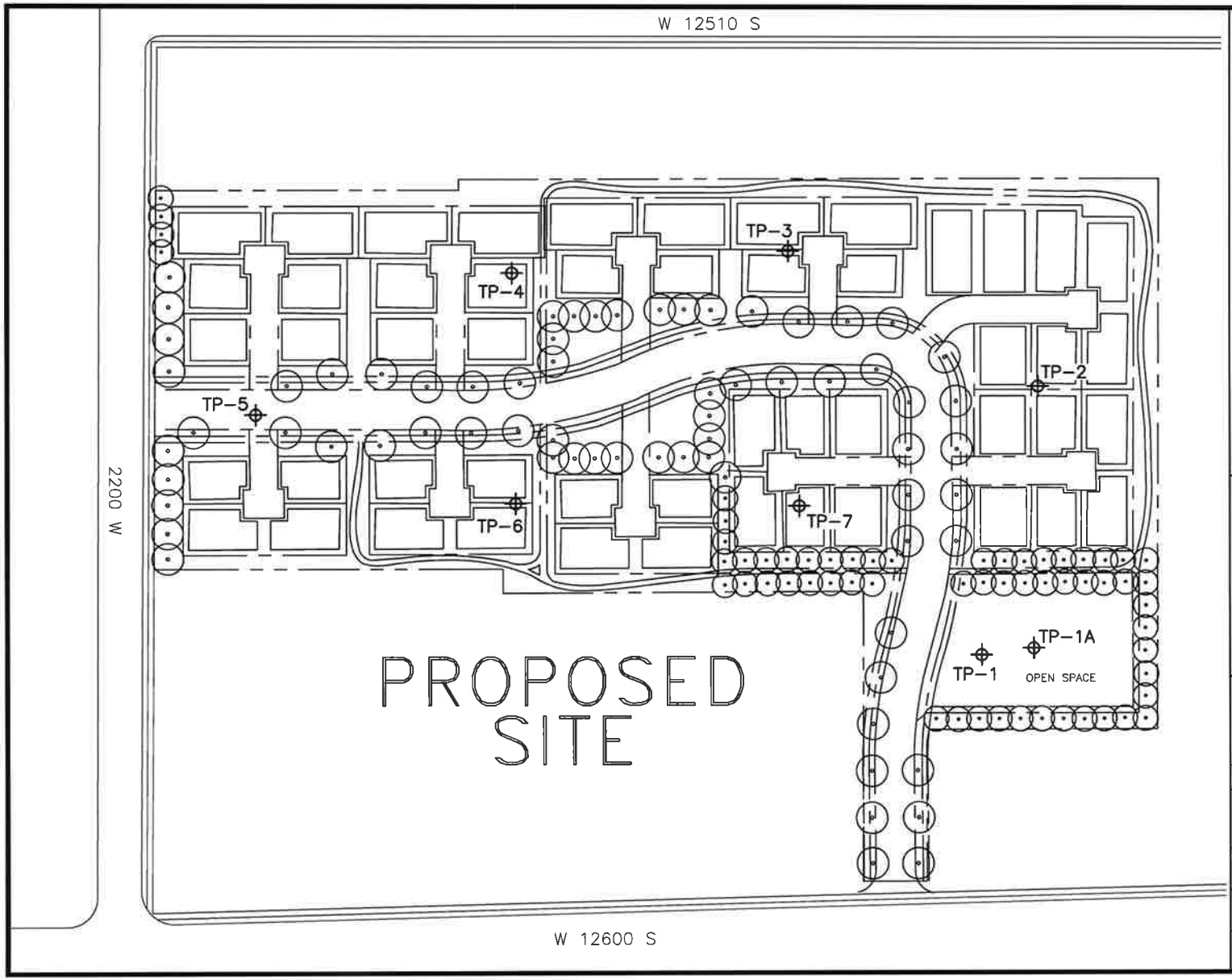
SES
Summit Engineering Services
A Division of Pangean-CMG

REV. NO.:	DRAWING DATE:	ACAD FILE:
	6-7-13	TC-0G2249-ASIT

SITE VICINITY MAP

CLIENT:	PM:
RIVERTON SUBDIVISION-HOLMES HOMES	JN
LOCATION: 12549 SOUTH 2200 WEST RIVERTON, UTAH	PE/PG:

DESIGNED:	DETAILED:	PROJECT NO.:	FIGURE:
CS	EL	TC-0G2249-01	1



LEGEND

TEST HOLE LOCATION

PROPERTY LINE

PROPOSED SITE LAYOUT

MAP SOURCE: AERIAL IMAGE

N

0 150 300

APPROX. SCALE FEET

SES Summit Engineering Services A Division of Pangaea-CMD

REV. NO.:	DRAWING DATE:	ACAD FILE:
	6-7-13	TC-0G2249-ASIT

LOCATION OF TEST PITS

CLIENT:	PM:
RIVERTON SUBDIVISION-HOLMES HOMES	JN
LOCATION: 12549 SOUTH 2200 WEST RIVERTON, UTAH	PE/PG:

DESIGNED:	DETAILED:	PROJECT NO.:	FIGURE:
CS	EL	TC-0G2249-01	2

Summit Engineering Services
A Division of Pangean-CMD
Associates, Inc.
3640 South 500 West
Salt Lake City, Utah 84115

LOG OF TEST PIT TP-1

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

Drilling Method : Not applicable
Total Depth : 8 feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: Not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1	CL		CLAY (CL), silty, stiff to hard, dry, brown					1
2								2
3	ML		SILT (ML), some clay, medium dense, dry to moist, tan			100	grab	3
4								4
5								5
6								6
7								7
8								8

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 8 feet bgs.

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3640 South 500 West
Salt Lake City, Utah 84115

LOG OF TEST PIT TP-2

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

Drilling Method : Not applicable
Total Depth : 15feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1								1
2	CL		CLAY (CL), silty, stiff to hard, dry, brown					2
3						100	grab	3
4			SILT (ML), some clay, medium dense, dry to moist, tan					4
5								5
6								6
7	ML							7
8								8
9								9
10								10
11			GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					11
12								12
13	GW							13
14								14
15								15

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 15 feet bgs.

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Salt Lake City, Utah 84115

LOG OF TEST PIT TP-3

Drilling Method : Not applicable
Total Depth : 12 feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1								1
2	CL		CLAY (CL), silty, stiff to hard, dry, brown					2
3								3
4			SILT (ML), some clay, medium dense, dry to moist, tan			100	grab	4
5								5
6								6
7	ML							7
8								8
9								9
10								10
11	GW		GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					11
12								12

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 12 feet bgs.

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A Division of Pangean-CMD
Associates, Inc.
3640 South 500 West
Salt Lake City, Utah 84115

LOG OF TEST PIT TP-4

Drilling Method : Not applicable
Total Depth : 12 feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1								1
2	CL		CLAY (CL), silty, stiff to hard, dry, brown					2
3								3
4			SILT (ML), some clay, medium dense, dry to moist, tan			100	grab	4
5								5
6								6
7	ML							7
8								8
9								9
10								10
11	GW		GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					11
12								12

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 12 feet bgs.

Summit Engineering Services
A Division of Pangean-CMD
Associates, Inc.
3640 South 500 West
Salt Lake City, Utah 84115

LOG OF TEST PIT TP-5

Drilling Method : Not applicable
Total Depth : 15feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1	CL		CLAY (CL), silty, stiff to hard, dry, brown					1
2	ML		SILT (ML), some clay, medium dense, dry to moist, tan					2
3						100	grab	3
4	GW		GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					4
5						100	grab	5
6								6
7								7
8								8
9								9
10								10
11								11
12								12
13								13
14								14
15								15

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 15 feet bgs.

Summit Engineering Services
A Division of Pangean-CMD
Associates, Inc.
3640 South 500 West
Salt Lake City, Utah 84115

LOG OF TEST PIT TP-6

Drilling Method : Not applicable
Total Depth : 12 feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
2	CL		CLAY (CL), silty, stiff to hard, dry, brown					2
3	ML		SILT (ML), some clay, medium dense, dry to moist, tan					3
11	GW		GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					11
12								12

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 12 feet bgs.

Summit Engineering Services
A Division of Pangean-CMD
Associates, Inc.
3640 South 500 West
Salt Lake City, Utah 84115

LOG OF TEST PIT TP-7

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

Drilling Method : Not applicable
Total Depth : 12 feet
Hole Diameter : 6 ft by 2 ft
Sampling Method : 2.5 to 5 foot intervals
Initial Depth to water: Not encountered
Static Depth to Water: not measured

Location : 12549 South 2200 West Riverton, UT
Date Started : 5/31/13
Date Completed : 6/1/13
Excavation Co. : Skyline
Rig Type : Backhoe
Operator : Skyline
Logged By : Curt Stripeika

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1								1
2	CL		CLAY (CL), silty, stiff to hard, dry, brown					2
3			SILT (ML), some clay, medium dense, dry to moist, tan					3
4								4
5								5
6								6
7	ML							7
8								8
9								9
10								10
11	GW		GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					11
12								12

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 12 feet bgs.

Summit Engineering Services
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Salt Lake City, Utah 84115

LOG OF TEST PIT TP-8

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G22249-01

Drilling Method	: Not applicable
Total Depth	: 12 feet
Hole Diameter	: 6 ft by 2 ft
Sampling Method	: 2.5 to 5 foot intervals
Initial Depth to water:	Not encountered
Static Depth to Water:	not measured

Location	: 12549 South 2200 West Riverton, UT
Date Started	: 5/31/13
Date Completed	: 6/1/13
Excavation Co.	: Skyline
Rig Type	: Backhoe
Operator	: Skyline
Logged By	: Curt Stripeika

DEPTH (feet)	USCS	GRAPHIC	DESCRIPTION	Blow Count	Sample ID/ Test Results	Measured Recovery (%)	Collection Method	DEPTH (feet)
0	CL		Topsoil: Clay, silty, organics, dry					0
1								1
2	CL		CLAY (CL), silty, stiff to hard, dry, brown					2
3								3
4			SILT (ML), some clay, medium dense, dry to moist, tan					4
5								5
6								6
7	ML							7
8								8
9								9
10								10
11	GW		GRAVEL (GW) sandy, with occasional cobbles, medium dense, slightly moist, tan					11
12								12

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was not encountered below site grades.

Boring terminated at 12 feet bgs.

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Associates, Inc.
3640 South 500 West
Salt Lake City, Utah 84115

KEY TO TEST HOLE/TEST PIT

Site: Riverton Parcel
12549 South 2200 West, Riverton, Ut

Project # TC-0G2249-01

Lithology Graphics	Lithology Descriptions
PT	PT - Peat
AS	AS - Asphalt
FL	FL - Fill
GP	GP - Poorly Graded Gravel
GW	GW - Well Graded Gravel
GM	GM - Silty Gravel
GC	GC - Clayey Gravel
SW	SW - Well Graded Sand
SP	SP - Poorly Graded Sand
SM	SM - Silty Sand
SC	SC - Clayey Sand
ML	ML - Silt
CL	CL - Clay
OL	OL - Organic Silt
MH	MH - Plastic Silt
CH	CH - Plastic Clay
OH	OH - Organic Clay
LS	LS - Limestone
SH	SH - Shale
TS	TS - Topsoil
SC/CL	SC/CL - Clayey Sand/Clay
SM/GM	SM/GM - Sand/Gravel Mix
SP/GP	SP/GP - Sand/Gravel Mix
CL/ML	CL/ML - Clay/Silt Mix
ML/CL	ML/CL - Silt/Clay Mix

CONSISTENCY (CLAY)

	SHEAR STRENGTH (PSF)	BLOWS /FOOT
VERY SOFT	<250	<2
SOFT	250 - 500	2 - 4
MED. STIFF	500 - 1000	4 - 8
STIFF	1000 - 2000	9 - 15
VERY STIFF	2000 - 4000	16 - 30
HARD	>4000	>30

RELATIVE DENSITY (SAND & SILT)

	BLOWS/FOOT
VERY LOOSE	<4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	>50

ABBREVIATIONS

LL	-LIQUID LIMIT (%)
PI	-PLASTIC INDEX (%)
W	-MOISTURE CONTENT (%)
DD	-DRY DENSITY (PCF)
NP	-NONPLASTIC
-200	-PERCENT PASSING NO. 200 SIEVE
phi	-ANGLE OF INTERNAL FRICTION
C	-COHESION (PSF)
p	-HAND PENETROMETER (TSF)

Notes:
1. The soils have been classified in accordance with the Unified Soil Classification System.
2. Groundwater was encountered at 3.3 feet below site grades.

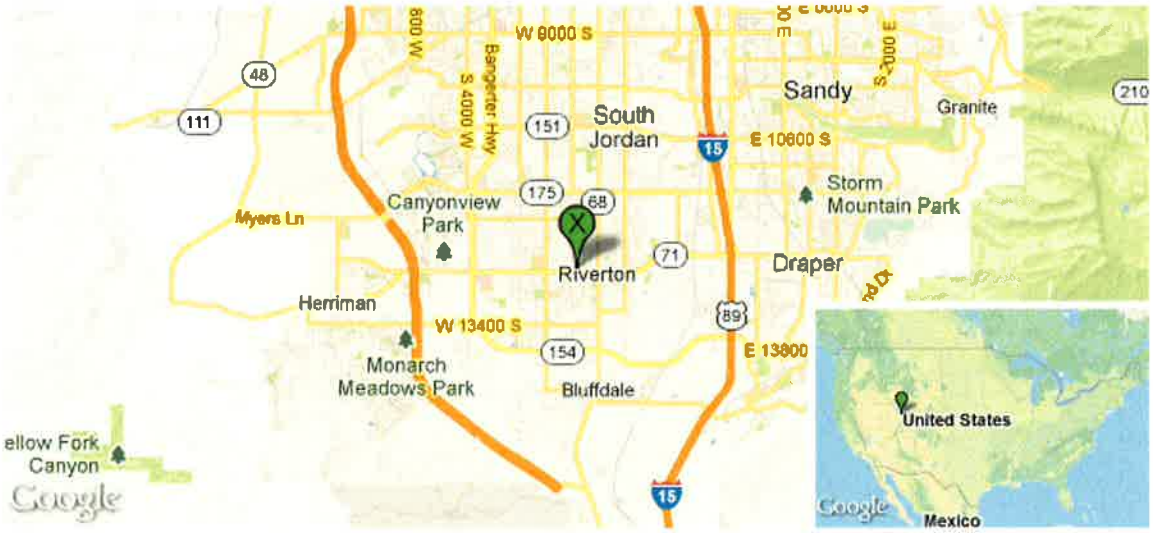
APPENDIX B

Seismic Parameters

USGS Design Maps Summary Report

User-Specified Input

Report Title	Holmes Homes Wed June 5, 2013 01:25:53 UTC
Building Code Reference Document	2012 International Building Code (which makes use of 2008 USGS hazard data)
Site Coordinates	40.52359°N, 111.94679°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III



USGS-Provided Output

S_S =	1.317 g	S_{MS} =	1.317 g	S_{DS} =	0.878 g
S_1 =	0.438 g	S_{M1} =	0.685 g	S_{D1} =	0.456 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.