Western Technologies Inc.

GEOTECHNICAL EVALUATION REPORT

THE LOFTS AT ROSE CREEK CROSSING
13600 South Hamilton View Road
Riverton, Utah
WT Reference No. 6126JW117

PREPARED FOR:
Rose Creek Crossing LLC
P.O. Box 520
Tooele, Utah 84047

August 5, 2016

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TABLE OF CONTENTS

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1.0 PURPOSE

This report contains the results of our geotechnical evaluation for The Lofts at Rose Creek Crossing project and was performed in general accordance with our contract. The purpose of our services is to provide information and recommendations regarding:

- Subsurface conditions
- Groundwater
- Geology
- Geologic hazards
- Foundation design parameters, including footing types, depths, allowable bearing capacities, and estimated settlements
- Lateral earth pressures
- Seismic considerations
- Slabs-on-grade
- Pavements
- Drainage
- Corrosivity to concrete
- Excavation conditions
- Earthwork, including site preparation, fill placement, and suitability of existing soils for fill materials, and compaction

Results of the field exploration, field tests, and laboratory testing program are presented in the Appendices.

2.0 PROJECT DESCRIPTION

Project information supplied by Mr. Bob Elder on July 1, 2016, indicates that the proposed project will consist of 2 to 3-story townhomes with slab-on-grade and/or basement structures using wood frame construction. The maximum wall and column loads are assumed to be 2 to 3 kips per linear foot and 100 to 150 kips, respectively. We anticipate that the ground floor level will be within three

feet of existing site grade and that no extraordinary slab-on-grade criteria are required. On-site asphalt paved areas for parking and driveways and rigid pavement sections for loading/unloading areas will be constructed. Final site grading plans were not available at the time of this report. Should our assumptions not be correct, we should be notified immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Nine borings were drilled to depths ranging from 20.4 to 21.5 feet below existing grade in the proposed building and parking areas. The borings were at the approximate locations shown on the attached Boring Location Diagram. A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Appendix A, represent our interpretation of the field logs and may include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thicknesses, and the locations where samples were obtained.

The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria.

The boring logs included in this report are indicators of subsurface conditions only at the specific locations and dates noted. Variations from the field conditions represented by the borings may become evident during construction. If variations appear, we should be contacted to re-evaluate our recommendations.

3.2 Laboratory Analyses

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils for preparation of this report. The following tests were performed in general accordance with applicable procedures, and the results are presented in Appendix B.

- Field moisture content
- In-situ soil density
- Consolidation/collapse
- Sieve analysis

- Liquid limit and plasticity index
- Water soluble sulfate content

3.3 Analyses and Report

Analyses were performed and this report was prepared for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

This geotechnical engineering report includes a description of the project, a discussion of the field exploration and laboratory testing programs, a discussion of the subsurface conditions, and design recommendations as required to satisfy the purpose previously described.

4.0 SITE CONDITIONS

4.1 Surface

At the time of exploration, the Site was vacant land. The ground surface was flat and contained a moderate growth of vegetation. Site drainage trended to the northeast as sheet surface flow.

4.2 Subsurface

As presented on the boring logs, surface soils to a depth of seven feet consisted of one to 5.5 feet of fill overlying hard to very stiff clay, very dense silty sandy gravel, hard to very stiff sandy silt overlying hard clay, or hard clay overlying very dense silty sandy gravel. The materials underlying the surface soils and extending to the full depths of exploration consisted of various alternating layers of medium to very dense gravels, very stiff clays, medium to very dense sands, and hard silts.

4.3 Groundwater

Groundwater was not encountered at the time of exploration. These observations represent the groundwater conditions at the time of measurements and may not be indicative of other times. Groundwater levels can be expected to fluctuate with varying seasonal and weather conditions, groundwater withdrawal and recharge, local irrigation practices, and future development.

4.4 Geology and Geologic Hazards

The Site is located in the Jordan Valley on Pleistocene-age lacustrine deposits of the transgressive phase of the Bonneville lake cycle. Soils consist of clay, silt, and minor fine sand and pebble gravel. The nearest mapped fault is approximately six miles to the east (*Surficial Geologic Map of the Salt Lake City Segment and Parts of Adjacent Segments of the Wasatch Fault Zone, Davis, Salt Lake, and Utah Counties, Utah,* U.S. Geological Survey, 1992). Liquefaction potential is shown as "very low" (*Selected Critical Facilities and Geologic Hazards, Salt Lake County, Utah*, Utah Geological Survey, 1994).

5.0 GEOTECHNICAL PROPERTIES & ANALYSIS

5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that native subsoils near shallow foundation level exhibit low to moderate compressibility at existing water contents. Low to moderate additional compression occurs when the water content is increased.

Chemical tests were performed on a representative sample to determine the sulfate exposure for concrete due to sulfates in the on-site soils. The sulfate content test was performed by American West Analytical Laboratories and the results are presented in **Appendix B.**

5.2 Field Tests

Native subsoils near shallow foundation level exhibited moderate to high resistance to penetration using test methods ASTM D1586 and ASTM D3550. This corresponds to a moderate to high bearing capacity for existing soils in their present condition.

The boring logs included in this report are indicators of subsurface conditions only at the

specific locations and dates noted. Variations from the field conditions represented by the borings may become evident during construction. If variations appear, we should be contacted to re-evaluate our recommendations.

6.0 RECOMMENDATIONS

6.1 General

Recommendations contained in this report are based on our understanding of the project criteria described in **Section 2.0**, and the assumption that the soil and subsurface conditions are those disclosed by the borings. Others may change the plans, final elevations, number and type of structures, foundation loads, and floor levels during design or construction. Substantially different subsurface conditions from those described herein may be encountered or become known. Any changes in the project criteria or subsurface conditions shall be brought to our attention in writing.

6.2 Design Considerations

Laboratory test results indicate that the fine-grained soils at shallow foundation level are slightly collapsible. The potential for collapse decreases with depth, so structures with basements are recommended.

Undocumented fill was encountered across the Site. Structures and slabs that are supported by undocumented fill have the potential for settlement. These soils are not suitable for support of the foundations and concrete slabs in their present state and should be over-excavated and reworked as, or replaced with, engineered fill as recommended in the **EARTHWORK** section of this report.

6.3 Foundations

The proposed townhomes with slabs-on-grade and/or basements can be supported by conventional spread and continuous wall footings bearing on native, undisturbed granular soils or engineered fill. The maximum allowable bearing pressure for footings placed upon the native granular soils or engineered fill is 2500 psf.

The maximum allowable bearing capacity applies to dead loads plus design live load conditions. Recommended minimum widths of column and wall footings are 24 inches and 16 inches, respectively. Minimum footing depth below any adjacent soil surface due

to frost is 2.5 feet. Any existing fill encountered on the Site should not be used for support of foundations.

Thickened slab sections can be used to support interior partitions, provided that:

- loads do not exceed 900 plf,
- thickened sections have a minimum width of 12 inches, and
- thickness and reinforcement are consistent with structural requirements.

We anticipate that differential movement of the proposed structures, supported as recommended, should be less than one inch. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

All footings, stem walls, and masonry walls should be reinforced to reduce the potential for distress caused by differential foundation movements. The use of joints at openings or other discontinuities in masonry walls is recommended.

We recommend that the geotechnical engineer or his representative observe the footing excavations before reinforcing steel and concrete are placed. This observation is to assess whether the soils exposed are similar to those anticipated for support of the footings. Any soft, loose or unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials or lean concrete. Soil backfill should be properly compacted.

6.4 Lateral Design Criteria

Lateral loads may be resisted by concrete interface friction and by passive resistance. For shallow foundations bearing on native granular soils or engineered fill at this site, we recommend the following lateral resistance criteria:

- Coefficient of Friction 0.30
- Passive Pressure.....250 psf/ft

The frictional resistance and the passive pressure may be combined without reduction in determining the total lateral resistance.

6.5 Earth Retaining Structures

a. Unrestrained Structures

Earth retaining structures less than eight feet in height, above any free water surface, with level backfill and no surcharge loads may be designed using the equivalent fluid pressure method. Recommended equivalent fluid pressures and coefficients of base friction are:

- Active:
  Undisturbed subsoil .....30 psf/ft
  Compacted imported backfill .....35 psf/ft
  Compacted site soils (non-clay) .....35 psf/ft
  Clay site soils .....not recommended for use

- Passive:
  Shallow wall footings .....250 psf/ft
  Shallow column footings.....375 psf/ft

- Coefficient of base friction..... 0.40*

  * The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

b. Restrained Structures

Where the design includes restrained elements less than eight feet in height, the following equivalent fluid pressures are recommended:

- At-rest:
  Undisturbed subsoil .....45 psf/ft
  Compacted granular backfill .....50 psf/ft

The lateral earth pressures presented herein do not include the lateral pressures arising from the presence of:

- Hydrostatic conditions, submergence or partial submergence
- Sloping backfill, positively or negatively

- Surcharge loading, permanent or temporary
- Seismic or dynamic conditions

We recommend a free-draining soil layer or manufactured geosynthetic material, be constructed adjacent to the back of the wall. A filter may be required between the soil backfill and drainage layer. This drainage zone should help prevent development of hydrostatic pressure on the wall. This vertical drainage zone should be tied into a gravity drainage system at the base of the wall.

It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in layers. Flooding or jetting should not be permitted. Care should be taken not to damage the walls when placing the backfill. Backfills should be observed and tested during placement.

Fill against footings, stem walls, basement walls, and retaining walls should be compacted to densities specified in **EARTHWORK**. Medium to high plasticity clay soils should not be used as backfill against retaining walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Over-compaction may cause excessive lateral earth pressures that could result in wall movements.

6.6 Seismic Considerations

For structural designs based upon the International Building Code 2012/2015, the following criteria will apply:

- The seismic site class for the on-site soils is D.
- S_s, the mapped spectral acceleration for short periods, is 1.248 g.
- S_1, the mapped spectral acceleration for one second periods, is 0.414 g.
- The design spectral response acceleration parameter for short period S_{DS} is 0.833 g.
- The design spectral response acceleration parameter for 1-second period S_{D1} is 0.438 g.
- Maximum considered earthquake spectral response for short period S_{MS} is 1.249 g.
- Maximum considered earthquake spectral response for 1-second period S_{M1} is 0.657 g.

Due to the lack of groundwater and the fine-grained and very dense granular soils at the Site, the potential settlement and lateral spread due to liquefaction is low and not a significant concern.

6.7 Conventional Slab-on-Grade Support

Floor slabs can be supported on properly placed and compacted engineered fill or approved native soils. The slab subgrade should be prepared by the procedures outlined in this report. A minimum 4-inch layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab. The recommended modulus of subgrade reaction (k) is 200 pounds per cubic inch for the native granular soils and engineered fill.

The use of vapor retarders is desirable for any slab-on-grade where the floor will be covered by products using water based adhesives, wood, vinyl backed carpet, impermeable floor coatings (urethane, epoxy, acrylic terrazzo, etc.) or where the floor will be in contact with moisture sensitive equipment or product. The design and installation should be in accordance with the recommendation given in ACI 302.2R-06.

All concrete placement and curing operations should follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (high water-cement ratio) could cause excessive shrinkage, cracking or curling. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture sensitive floor covering.

6.8 Drainage

In areas where sidewalks or paving do not immediately adjoin the structure, protective slopes should be provided with an outfall of about five percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to minimize the possibility of moisture infiltration.

If planters and/or landscaping are adjacent to or near the structures, we recommend the following:

- Grades should slope away from the structures.
- Only shallow rooted landscaping should be used.
- Watering should be kept to a minimum.

According to Table R405.1 of the International Residential Code, the clay soils at the Site are Group II. Therefore, a perimeter drain at the bottom of footing level is required. This drain should consist of a perforated four inch diameter pipe in a clean gravel layer a minimum of 12 inches thick. The gravel layer should be covered with a filter fabric (Mirafi 140 n or equivalent). The pipe should flow by gravity to a sump which extends a minimum of 24 inches below the basement finish floor elevation.

6.9 Corrosivity to Concrete

For determining the exposure categories and classes for concrete in accordance with **Section 1904 Durability Requirements** for concrete of the *2012 International Building Code,* sulfate exposure from the soils at the site classify as "not applicable" (Class S0) according to Table 4.2.1 of ACI 318-11, Building Code Requirements for Structural Concrete.

6.10 Pavements

The on-site fill and clay and silt soils are considered as poor quality materials for support of pavements. The types of traffic anticipated to use the facility include passenger vehicles and small to medium size trucks. On this basis, a daily traffic value of two Equivalent 18-kip Single Axle Load (ESAL) was estimated for passenger car parking and drives. A resilient modulus (M_r) of 4500 pounds per square inch was assigned to the on-site soil. A reliability value of 85 percent was assigned to the facility that corresponds to occasional interruption of traffic for pavement repairs. Based upon these parameters, the resulting pavement sections according to the AASHTO procedure for a 20-year design life are:

Traffic Area	Asphaltic Concrete (inches)	Base Course (inches)
Parking and Driveways	3	8

The "design life" of a pavement is defined as the expected life at the end of which reconstruction of the pavement will need to occur. Normal maintenance, including crack sealing, slurry sealing, and/or chip sealing, should be performed during the life of the pavement.

Bituminous surfacing should be constructed of dense-graded, central plant-mix, asphalt concrete. The asphalt concrete and base course materials should conform to the specification requirements for the city of Riverton or the Utah Department of Transportation.

Due to the high static loads imposed by trucks at loading/unloading areas, we recommend that a rigid pavement section be considered for these locations. A minimum 5-inch thick Portland cement concrete pavement with six inches of base course material is recommended.

Material and compaction requirements should conform to recommendations presented under **Earthwork**. The gradient of paved surfaces should ensure positive drainage. Water should not pond in areas directly adjoining paved sections.

7.0 EARTHWORK

7.1 General

The conclusions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance that occurs after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. It is not reasonable to rely upon our conclusions and recommendations if any future unobserved and untested trenching, earthwork activities or backfilling occurs.

Fills or underground facilities such as septic tanks, cesspools, basements, utilities, and dry wells might be encountered during construction. These features should be demolished in accordance with the recommendations of the geotechnical engineer. Any loose or disturbed soils resulting from demolition should be removed or recompacted as engineered fill and any excavations should be backfilled in accordance with recommendations presented herein.

7.2 Site Clearing

Strip and remove any existing vegetation, organic topsoil, debris, fill material, and any other deleterious materials from the building area. The building area is defined as that area within the building footprint plus five feet beyond the perimeter of the footprint. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

7.3 Excavation

We anticipate that excavations for shallow foundations, basements and utility trenches for the proposed construction can be accomplished with conventional equipment.

7.4 Temporary Excavations and Slopes

Temporary, unsurcharged construction excavations should be sloped or shored. Slopes should not be steeper than 1 to 1 (Horizontal to Vertical) in sands and gravels and 0.5H to 1V in fine-grained soils. Slopes may need to be flattened depending on conditions exposed during construction. If there is not enough space for sloped excavations, shoring should be used. Exposed slopes should be kept moist (not saturated) during construction. Underpinning may be required to protect adjacent structures, if excavations are deeper than existing foundations.

If any excavation, including a utility trench, is extended to a depth of more than 20 feet, it will be necessary to have the side slopes designed by a professional engineer.

As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance back from the crest of the slope at least equal to the slope height. The exposed slope face should be protected against the elements.

We recommend that the contractor retain a geotechnical engineer to observe the soils exposed in all excavations and provide engineering design for the slopes. This will provide an opportunity to classify the soil types encountered, and to modify the excavation slopes as necessary. This also allows the opportunity to analyze the stability of the excavation slopes during construction.

7.5 Foundation Preparation

Footings should bear upon undisturbed, native granular soils or engineered fill. In footing areas, remove the existing fill and a minimum of two feet of native clay soils below the bottom of the footing. Removal should extend a minimum of two feet beyond the footing edges. Replace with engineered fill material. Removal of native soils may be terminated at a shallower depth if native soils are granular as identified by the geotechnical engineer.

7.6 Conventional Interior Slab Preparation

To minimize the potential for slab settlement, all fill material should be removed from interior slab areas. Prior to the placement of fill or aggregate base course, the exposed native soil should be scarified a minimum depth of 8 inches, moisture conditioned, and recompacted as recommended herein.

7.7 Exterior Slab Preparation

The existing fill in exterior slab areas may be left in place, provided the Owner is aware of the potential for settlement in these areas, possibly resulting in increased maintenance costs, if the fill is not entirely removed and replaced.

Exterior slabs should be founded on a minimum of four inches of aggregate base. Scarify, moisten, and recompact subgrade soil for a minimum depth of 10 inches prior to placement of base.

Compacted subgrade soils may heave due to frost, resulting in cracking or vertical offsets. To reduce the potential for damage, we recommend:

- Use of fill with low to negligible frost susceptibility
- Placement of effective control joints on relatively close centers
- Moisture-density control during placement of subgrade fills
- Provision for adequate drainage in areas adjoining the slabs
- Use of designs which allow vertical movement between the exterior slabs and adjoining structural elements

7.8 Pavement Preparation

The existing fill in pavement areas may be left in place, provided the Owner is aware of the potential for settlement in these areas, possibly resulting in increased maintenance costs, if the fill is not entirely removed and replaced.

The subgrade should be scarified, moistened as required, and recompacted for a minimum depth of 10 inches prior to placement of fill and pavement materials.

7.9 Materials

Native granular soils or imported materials may be used as fill material for the following:

- foundation areas
- interior slab areas
- backfill

On-site fine-grained soils should not be used as engineered fill below structures.

Imported soils should conform to the following:

- Gradation (ASTM C136):

	percent finer by weight
6"	100
4"	85-100
¾"	70-100
No. 4 Sieve	50-100
No. 200 Sieve	25 (max)

Frozen soils should not be used as fill or backfill.

The materials used as engineered fill should be reasonably free of rocks or lumps having a particle diameter greater than 6 inches. Acceptance of the quantity of oversize material shall be at the discretion of the geotechnical engineer.

Base course should conform to the APWA standard specification for untreated base, current edition.

7.10 Placement and Compaction

a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended water contents and densities throughout the lift.
b. Uncompacted fill lifts should not exceed 10 inches.
c. No fill should be placed over frozen ground.

d. Materials should be compacted to the following:

Material	Minimum Percent Compaction (ASTM D1557)
• On-site soil, reworked and fill:	
Below footings	95
Below slabs-on-grade	95
• Imported soil:	
Below footings	95
Below slabs-on-grade	95
• Aggregate base	95
• Nonstructural backfill	90

On-site fine-grained soils should be compacted within a water content range of one percent below to three percent above optimum. Imported and on-site granular soils should be compacted within a water content range of two percent below to three percent above optimum.

7.11 Compliance

Recommendations for slabs-on-grade and foundation elements supported on compacted fills or prepared subgrade depend upon compliance with **Earthwork** recommendations. To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer.

8.0 LIMITATIONS

This report has been prepared assuming the project criteria described in **Section 2.0**. If changes in the project criteria occur, or if different subsurface conditions are encountered or become known, the conclusions and recommendations presented herein shall become invalid. In any such event, WT should be contacted in order to assess the effect that such variations may have on our conclusions and recommendations.

The recommendations presented are based entirely upon data derived from a limited number of samples obtained from widely spaced borings. The attached logs are indicators of subsurface

conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between borings, however variations can and often do exist. Whenever any deviation, difference or change is encountered or becomes known, WT should be contacted.

This report is for the exclusive benefit of our client alone. There are no intended third-party beneficiaries of our contract with the client or this report, and nothing contained in the contract or this report shall create any express or implied contractual or any other relationship with, or claim or cause of action for, any third party against WT.

This report is valid for the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall rely on this report without the express written authorization of WT.

9.0 CLOSURE

This report was prepared as an aid to the designers of the proposed project. The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon data obtained at the location of the borings and from laboratory tests. Work on this project was performed in accordance with generally accepted standards and practices utilized by professionals providing similar services in this locality. No other warranty, express or implied, is made.

NORTH

NOT TO SCALE

Geotechnical
Environmental
Inspections
Materials

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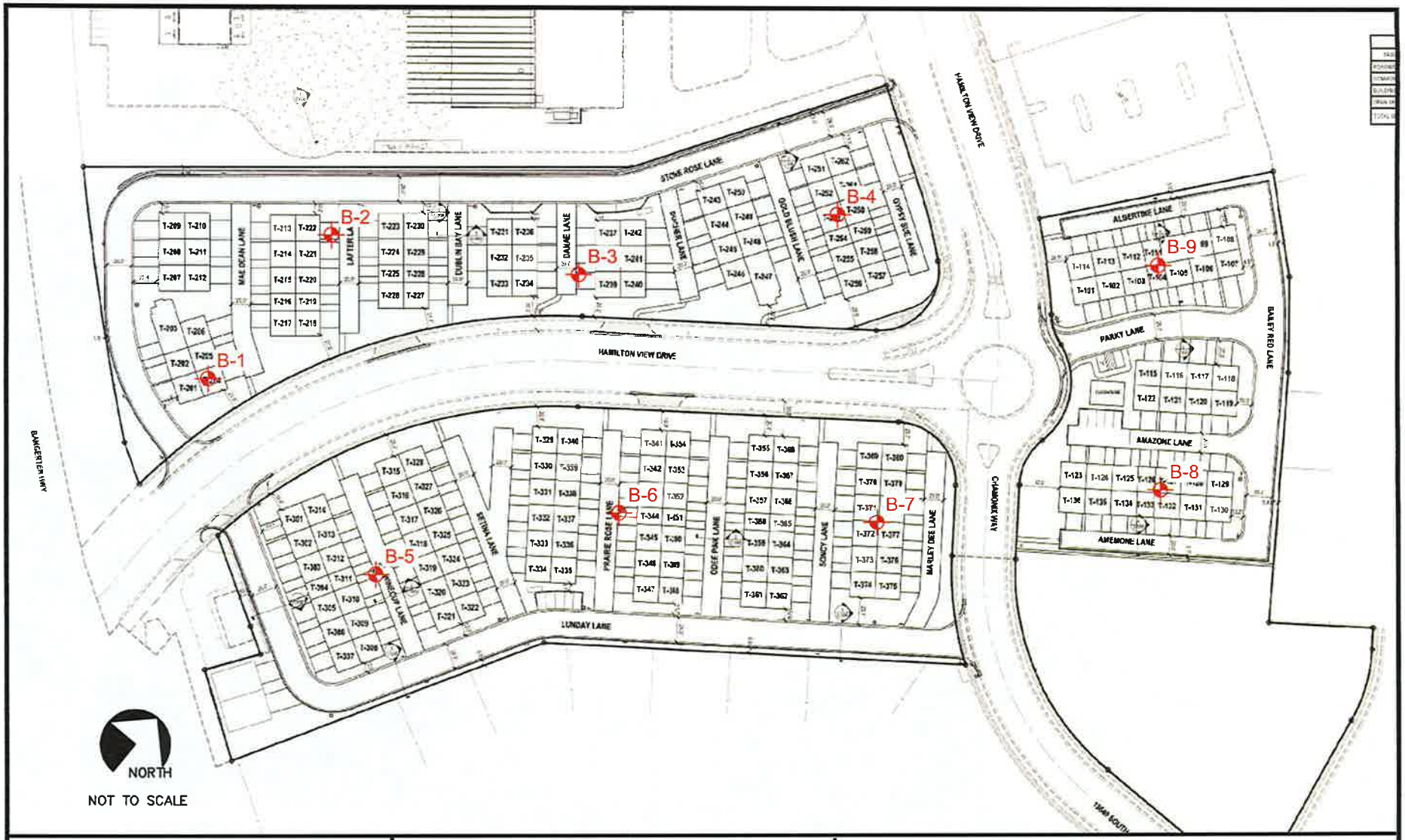
Since 1955

PLATE 1. SITE VICINITY MAP
The Lofts at Rose Creek Crossing
13600 South Hamilton View Road
Riverton, Utah

WT Job No. 6126JW117



LEGEND

Approximate Boring Location

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PLATE 2. BORING LOCATION DIAGRAM
The Lofts at Rose Creek Crossing
13600 South Hamilton View Road
Riverton, Utah

WT Job No. 6126JW117

APPENDIX A

Allowable Soil Bearing Capacity	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
Backfill	A specified material placed and compacted in a confined area.
Base Course	A layer of specified aggregate material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson/Drilled Shaft	A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson).
Concrete Slabs-On-Grade	A concrete surface layer cast directly upon base course, subbase or subgrade.
Crushed Rock Base Course	A base course composed of crushed rock of a specified gradation.
Differential Settlement	Unequal settlement between or within foundation elements of a structure.
Engineered Fill	Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.
Existing Fill	Materials deposited through the action of man prior to exploration of the site.
Existing Grade	The ground surface at the time of field exploration.
Expansive Potential	The potential of a soil to expand (increase in volume) due to absorption of moisture.
Fill	Materials deposited by the actions of man.
Finished Grade	The final grade created as a part of the project.
Gravel Base Course	A base course composed of naturally occurring gravel with a specified gradation.
Heave	Upward movement.
Native Grade	The naturally occurring ground surface.
Native Soil	Naturally occurring on-site soil.
Rock	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
Sand and Gravel Base Course	A base course of sand and gravel of a specified gradation.
Sand Base Course	A base course composed primarily of sand of a specified gradation.
Scarify	To mechanically loosen soil or break down existing soil structure.
Settlement	Downward movement.
Soil	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
Strip	To remove from present location.
Subbase	A layer of specified material placed to form a layer between the subgrade and base course.
Subbase Grade	Top of subbase.
Subgrade	Prepared native soil surface.

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COARSE-GRAINED SOILS

LESS THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVEL OR WELL-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE
GP	POORLY-GRADED GRAVEL OR POORLY-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	
GM	SILTY GRAVEL OR SILTY GRAVEL WITH SAND, MORE THAN 12% FINES	
GC	CLAYEY GRAVEL OR CLAYEY GRAVEL WITH SAND, MORE THAN 12% FINES	
SW	WELL-GRADED SAND OR WELL-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE
SP	POORLY-GRADED SAND OR POORLY-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	
SM	SILTY SAND OR SILTY SAND WITH GRAVEL, MORE THAN 12% FINES	
SC	CLAYEY SAND OR CLAYEY SAND WITH GRAVEL, MORE THAN 12% FINES	

NOTE: Coarse-grained soils receive dual symbols if they contain 5% to 12% fines (e.g., SW-SM, GP-GC).

FINE-GRAINED SOILS

MORE THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	SILT, SILT WITH SAND OR GRAVEL, SANDY SILT, OR GRAVELLY SILT	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50
CL	LEAN CLAY OF LOW TO MEDIUM PLASTICITY, SANDY CLAY, OR GRAVELLY CLAY	
OL	ORGANIC SILT OR ORGANIC CLAY OF LOW TO MEDIUM PLASTICITY	
MH	ELASTIC SILT, SANDY ELASTIC SILT, OR GRAVELLY ELASTIC SILT	SILTS AND CLAYS LIQUID LIMIT MORE THAN 50
CH	FAT CLAY OF HIGH PLASTICITY, SANDY FAT CLAY, OR GRAVELLY FAT CLAY	
OH	ORGANIC SILT OR ORGANIC CLAY OF HIGH PLASTICITY	
PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

NOTE: Fine-grained soils may receive dual classification based upon plasticity characteristics (e.g. CL-ML).

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	Above 12 in.
COBBLES	3 in. – 12 in.
GRAVEL	No. 4 – 3 in.
Coarse	¾ in. – 3 in.
Fine	No. 4 – ¾ in.
SAND	No. 200 – No. 4
Coarse	No. 10 – No. 4
Medium	No. 40 – No. 10
Fine	No. 200 – No. 40
Fines (Silt or Clay)	Below No. 200

NOTE: Only sizes smaller than three inches are used to classify soils

CONSISTENCY

CLAYS & SILTS	BLOWS PER FOOT
VERY SOFT	0 – 2
SOFT	3 – 4
FIRM	5 – 8
STIFF	9 – 15
VERY STIFF	16 – 30
HARD	OVER 30

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS PER FOOT
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

NOTE: Number of blows using 140-pound hammer falling 30 inches to drive a 2-inch-OD (1⅜-inch ID) split-barrel sampler (ASTM D1586).

PLASTICITY OF FINE GRAINED SOILS

PLASTICITY INDEX	TERM
0	NON-PLASTIC
1 – 7	LOW
8 – 20	MEDIUM
Over 20	HIGH

DEFINITION OF WATER CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED

©81 WTI 090414

The number shown in **"BORING NO."** refers to the approximate location of the same number indicated on the "Boring Location Diagram" as positioned in the field by pacing or measurement from property lines and/or existing features, or through the use of Global Positioning System (GPS) devices. The accuracy of GPS devices is somewhat variable.

"DRILLING TYPE" refers to the exploratory equipment used in the boring wherein **HSA = hollow stem auger**, and the dimension presented is the outside diameter of the HSA used.

"N" in "BLOW COUNTS" refers to a 2-inch outside diameter split-barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows, or "blow count", of the hammer is recorded for each of three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the Standard Penetration Test (SPT) "**N**"-Value. Refusal to penetration is considered more than 50 blows per 6 inches. (Ref. ASTM D1586).

"R" in "BLOW COUNTS" refers to a 3-inch outside diameter ring-lined split barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 12 inches is achieved or until refusal. The number of blows required to advance the sampler 12 inches is defined as the "**R**" blow count. The "**R**" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows per foot. (Ref. ASTM D3550).

"CS" in "BLOWS/FT." refers to a 2½-in. outside diameter California style split-barrel sampler, lined with brass sleeves, driven into the ground with a 140-pound hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows of the hammer is recorded for each of the three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the "CS" blow count. The "CS" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D 3550)

"SAMPLE TYPE" refers to the form of sample recovery, in which **N** = Split-barrel sample, **R** = Ring-lined sample, **"CS"** = California style split-barrel sample, **G** = Grab sample, **B** = Bucket sample, **C** = Core sample (ex. diamond bit rock coring).

"DRY DENSITY (LBS/CU FT)" refers to the laboratory-determined dry density in pounds per cubic foot. The symbol **"NR"** indicates that no sample was recovered.

"WATER (MOISTURE) CONTENT" (% of Dry Wt.) refers to the laboratory-determined water content in percent using the standard test method ASTM D2216.

"USCS" refers to the "Unified Soil Classification System" Group Symbol for the soil type as defined by ASTM D2487 and D2488. The soils were classified visually in the field, and where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil or rock types based upon visual field classification at the boring location. The transition between materials is approximate and may be more or less gradual than indicated.

©81WTI 091614

DATE DRILLED: 7-19-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-1

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
		CS		31		ML		SANDY SILT; light brown, organics, very stiff, slightly damp
		N		81	5	GM		SILTY, SANDY GRAVEL; gray-brown, very dense, slightly damp
		N		90				
		N		50-5"	10			
						SM		SILTY, GRAVELLY SAND; gray-brown, very dense, slightly damp
		N		50-5"	15			
		N		50-5"	20			
								BORING TERMINATED AT 20.92 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
The Quality People
Since 1955

PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-4

BORING LOG

DATE DRILLED: 7-19-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-2

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
		N		78		GM		SILTY, SANDY GRAVEL; gray-brown, very dense, slightly damp
3.9		N		50-5"	5			
						CL		CLAY; some sand, brown, iron oxide stains, stiff, damp
43.4	68	N		12				
		CS		14	10			... gray-brown
						SC		CLAYEY SAND; brown, medium dense, damp
		CS		50	15			
						GM		SILTY, SANDY GRAVEL; brown, very dense, slightly damp
		CS		50-5"	20			
								BORING TERMINATED AT 20.42 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-5

BORING LOG

DATE DRILLED: 7-19-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-3

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
18.7	91	CS		53		CL		CLAY; some sand, light brown, hard, dry
		N		50-5"	5	GM		SILTY, SANDY GRAVEL; gray, very dense, slightly damp
		N		14		CL		CLAY; some sand, brown, iron oxide stains, stiff, damp
15.6	88	CS		26	10			... grayish-brown, very stiff
						GP-GM		SANDY GRAVEL; with silt, gray, very dense, slightly damp
5.6		N		50-5"	15			
						CL		SANDY CLAY; some gravel, brown, iron oxide stains, dense, damp
20.2		N		39	20			
								BORING TERMINATED AT 21.5 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

BORING LOG

PLATE
A-6

DATE DRILLED: 7-19-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-4

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
		CS		31		ML		SANDY SILT; light brown, very stiff, slightly damp
21.5	91	CS		54	5	CL		CLAY; with sand, gray-brown, hard, slightly damp
		N		19		SM		SILTY, GRAVELLY SAND; light brown, medium dense, slightly damp
		CS		42	10	SC		CLAYEY SAND; some gravel, brown, medium dense, slightly damp
		N		50-5"	15	SM		SILTY, GRAVELLY SAND; light brown-gray, very dense, slightly damp
								... brown
		N		50-5"	20			BORING TERMINATED AT 20.42 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-7

BORING LOG

DATE DRILLED: 7-19-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-5

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
12.2		CS		66		CL		CLAY; with sand, trace gravel, light brown, organics, hard, dry
		CS		39	5			... gray-brown, very stiff
		N		53		GM		SILTY, SANDY GRAVEL; gray-brown, very dense, slightly damp
		N		50-5"	10			... gray
						CL		CLAY; some sand, brown, very stiff, damp
9.8	74	CS		33	15			
						GM		SILTY, SANDY GRAVEL; gray, very dense, slightly damp
		N		50-5"	20			
								BORING TERMINATED AT 20.42 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-8

BORING LOG

DATE DRILLED: 7-20-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-6

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
					0			FILL; gravelly, sandy clay, light brown, dry
						CL		CLAY; with sand and gravel, brown, hard, slightly damp
		N		61				
					5			... very stiff
		CS		27				
18.8		CS		76		ML		SILT; some sand, gray-brown, calcareous, hard, slightly damp
		CS		50-5"	10	SM		SILTY, GRAVELLY SAND; light brown, very dense, slightly damp
								... damp
		N		80	15			
								... slightly damp
		N		50-5"	20			
								BORING TERMINATED AT 20.92 FEET

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-9

BORING LOG

DATE DRILLED: 7-20-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-7

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
						ML		GRAVELLY, SANDY SILT; brown, organics, hard, dry
		CS		89				
		CS		58	5	CL		CLAY; trace sand, light brown, hard, slightly damp
24.2	78	CS		34				... greenish-gray, calcareous, very stiff, damp
16.3		CS		72-11"	10	GM		SILTY GRAVEL; with sand, greenish-gray, calcareous, dense, damp
						SM		SILTY, GRAVELLY SAND; brown, very dense, slightly damp
10.6		N		60	15			
						GP-GM		SANDY GRAVEL, with silt, brown, very dense, slightly damp
5.2		N		50-5"	20			
								BORING TERMINATED AT 20.92 FEET

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-10

BORING LOG

DATE DRILLED: 7-20-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-8

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
14.3	88	CS		65				FILL; gravelly, sandy clay, light brown, dry
		N		52	5	CL		CLAY; with sand and gravel, light brown, hard, slightly damp
		N		35				
		CS		50-5"	10			
						SM		SILTY, GRAVELLY SAND; gray-brown, iron oxide stains, very dense, slightly damp
		CS		74-9"	15			
		N		50-5"	20			
								BORING TERMINATED AT 20.92 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-11

BORING LOG

DATE DRILLED: 7-20-16
LOCATION: See Location Diagram
ELEVATION: Not Determined

BORING NO. B-9

EQUIPMENT TYPE: Mobile B80
DRILLING TYPE: 7" H.S.A
FIELD ENGINEER: M. Schedel

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
								FILL; gravelly, sandy clay, light brown, dry
		CS		50-5"		CL		CLAY; with sand and gravel, light brown, hard, dry
		N		49	5			... brown
		CS		37				... very stiff, slightly damp
		CS		30	10	SM		SILTY, GRAVELLY SAND; brown, medium dense, slightly damp
		N		65	15			... very dense
		N		20	20	CL		CLAY; with sand and gravel, light brown, very stiff, damp
								BORING TERMINATED AT 21.5 FEET

N- STANDARD SAMPLER
R- RING SAMPLER
CS- CALIFORNIA STYLE SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
The Quality People
Since 1955

PROJECT: **THE LOFTS AT ROSE CREEK CROSSING**
LOCATION: **RIVERTON, UTAH**
PROJECT NO.: **6126JW117**

PLATE
A-12

BORING LOG

APPENDIX B

Boring No.	Sample Depth (ft)	USCS Class.	Initial Dry Density (pcf)	Initial Water Content (%)	Percent Passing		Atterberg Limits		Collapse/Compression Properties			Remarks
					#4	#200	LL	PI	Surcharge (ksf)	Total Compression (%)		
										In-Situ	After Saturation	
B-2	5	GM	--	3.9	56	13	--	NP				
B-2	10	CL	68.2	43.4	100	88	42	19	1.6	-3.54	-4.51	1, 4
B-3	2.5	CL	91.3	18.7	100	94	26	9	1.6	-1.83	-4.87	1, 4
B-3	10	CL	87.9	15.6	100	94	29	9	0.4	-0.56		
									0.8	-1.10		
									1.7	-1.74	-3.01	1, 4
									3.4		-4.32	
									6.7		-6.76	
									13.4		-9.15	
									6.7		-8.90	
									3.4		-8.54	
B-3	15	GP-GM	--	5.6	41	9	--	NP				
B-3	20	CL	--	20.2	86	54	26	9				
B-4	5	CL	90.7	21.5	100	84	48	26	1.68	-0.97	-2.38	1, 4
B-5	2.5	CL	--	12.2	95	79	35	17				
B-5	15	CL	74.4	9.8	100	85	34	14	1.7	-3.49	-5.83	1, 4
B-6	7.5	ML	--	18.8	100	92	47	19				
B-7	7.5	CL	77.5	24.2	100	98	46	25	1.7	-1.99	-3.08	1, 4
B-7	10	GM	--	16.3	73	45	41	14				
B-7	15	SM	--	10.6	70	28	--	NP				
B-7	20	GP-GM	--	5.2	48	10	--	NP				
B-8	2.5	CL	88.2	14.3	85	63	30	13				

NOTES: Initial Dry Density and initial Water Content are in-situ values unless otherwise noted.
NP = Non-plastic

REMARKS – Collapse / Compression

1. Submerged to approximate saturation.
2. Sample disturbance observed.
3. Slight rebound after saturation.
4. Additional compression after saturation.

INORGANIC ANALYTICAL REPORT

Client: Western Technologies, Inc. **Contact:** Kim Riding
Project: The Lofts at Rose Creek Crossing / 6146PO517
Lab Sample ID: 1607374-001
Client Sample ID: 6126JW117 B-1 @ 2.5-4'
Collection Date: 7/19/2016
Received Date: 7/22/2016 1646h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Sulfate	mg/kg-dry		7/26/2016 800h	SM4500-SO4-E	114	**632**	&

& - Analysis is performed on a 1:1 DI water extract for soils.

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

All analyses applicable to the CWA, SDWA, and RCRA are performed in accordance to NELAC protocols. Pertinent sampling information is located on the attached COC. Confidential Business Information: This report is provided for the exclusive use of the addressee. Privileges of subsequent use of the name of this company or any member of its staff, or reproduction of this report in connection with the advertisement, promotion or sale of any product or process, or in connection with the re-publication of this report for any purpose other than for the addressee will be granted only on contact. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science.

INORGANIC ANALYTICAL REPORT

Client: Western Technologies, Inc. **Contact:** Kim Riding
Project: The Lofts at Rose Creek Crossing / 6146PO517
Lab Sample ID: 1607374-002
Client Sample ID: 6126JW117 B-8 @ 5-6.5'
Collection Date: 7/20/2016
Received Date: 7/22/2016 1646h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Sulfate	mg/kg-dry		7/26/2016 800h	SM4500-SO4-E	58.2	**140**	&

& - Analysis is performed on a 1:1 DI water extract for soils.

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

All analyses applicable to the CWA, SDWA, and RCRA are performed in accordance to NELAC protocols. Pertinent sampling information is located on the attached COC. Confidential Business Information: This report is provided for the exclusive use of the addressee. Privileges of sub-sequent use of the name of this company or any member of its staff, or reproduction of this report in connection with the advertisement, promotion or sale of any product or process, or in connection with the re-publication of this report for any purpose other than for the addressee will be granted only on contact. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science.

USGS Design Maps Summary Report

User–Specified Input

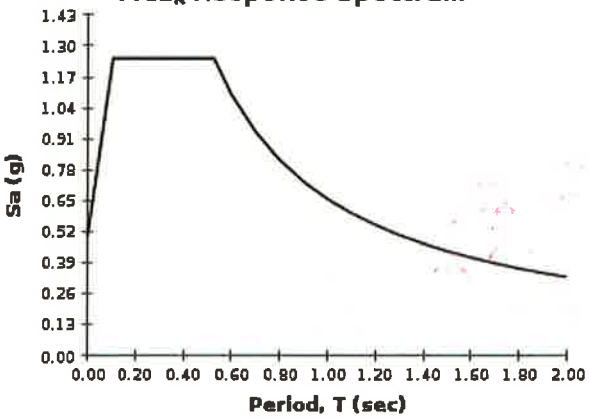
Report Title	The Lofts at Rose Creek Crossing Thu August 4, 2016 21:14:51 UTC
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	40.50419°N, 111.97513°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS–Provided Output

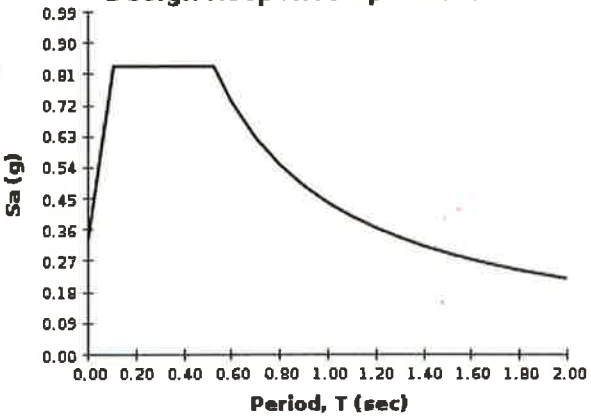
S_S =	1.248 g	S_{MS} =	1.249 g	S_{DS} =	0.833 g
S_1 =	0.414 g	S_{M1} =	0.657 g	S_{D1} =	0.438 g

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.

MCE_R Response Spectrum



Design Response Spectrum



Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.