EARTHTEC ENGINEERING

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

3662 West 2100 South
Salt Lake City, Utah - 84120
Phone (801) 787-9138

1596 W. 2650 S. #108
Ogden, Utah - 84401
Phone (801) 399-9516

August 22, 2017

Lighten Investments
Attention: Mr. Rich Lighten
13563 South Lovers Lane
Riverton, UT 84065

Re: Geotechnical Study Update
Lovers Creek Subdivision
13270 South Lovers Lane
Riverton, Utah
Job No: 179019

Gentlemen:

This letter summarizes our updates to the geotechnical report for Lovers Creek Subdivision located in Riverton, Utah. Our scope of work consisted of a site visit to observing the soil conditions and the preparation of this letter. A geotechnical study[1] for the subdivision was previously prepared by Earthtec Engineering.

Site Visit
At your request, Earthtec Engineering visited the subject site on August 18, 2017 to observe the existing site conditions. We observed that some fill was placed around the construction of the road. The rest of the site appears to be undisturbed and similar to the conditions as observed in the referenced geotechnical report.

Seismic Design
The residential structures should be designed in accordance with the 2015 International Residential Code (IRC). The IRC designates this area as a seismic design class D_2.

The site is located at approximately 40.509 degrees latitude and -111.924 degrees longitude from the approximate center of the site. The IRC site value for this property is 0.945g. The design spectral response acceleration parameters are given below.

Design Acceleration for Short Period

S_S	F_a	Site Value (S_{DS})
		2/3 S_S*F_a
1.417g	1.0	0.945g

S_S = Mapped spectral acceleration for short periods
F_a = Site coefficient from Table 1613.3.3(1)
S_{DS} = $\frac{2}{3}S_{MS}$= $\frac{2}{3}$ ($F_a \cdot S_s$) = 5% damped design spectral response acceleration for short periods

Strip/Spread Footings
Footings founded on native soils may be designed using a maximum allowable bearing capacity

[1] Geotechnical Study, Lovers Creek Subdivision, Approximately 13270 South Lovers Lane, Riverton, Utah, Earthtec Engineering, Job No. 131713, December 4, 2013.

OK
RC - BKM

of 1,500 pounds per square foot. Footings founded on a minimum 24 inches of structural fill may be designed using a maximum allowable bearing capacity of 1,800 pounds per square foot. The values for vertical foundation pressure can be increased by one-third for wind and seismic conditions per Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2015 International Building Code.

Lateral Earth Pressures

Below grade walls act 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 dependent on the rigidity of the structure and its ability to resist rotation. Most retaining walls that can rotate or move slightly will develop an active lateral earth pressure condition. Structures that are not allowed to rotate or move laterally, such as subgrade basement walls, will 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. For static conditions, the resultant forces are applied at about one-third the wall height (measured from bottom of wall). For seismic conditions, the resultant forces are applied at about two-third times the height of the wall both measured from the bottom of the wall. The lateral pressures presented in the table below are based on drained, horizontally placed native soils as backfill material using a 28° friction angle and a dry unit weight of 110 pcf.

Lateral Earth Pressures (Static and Dynamic)

Condition	Case	Lateral Pressure Coefficient	Equivalent Fluid Pressure (pcf)
Active	Static	0.36	40
	Seismic	0.61	67
At-Rest	Static	0.53	58
	Seismic	0.78	86
Passive	Static	2.77	305
	Seismic	3.13	345

*Seismic values combine the static and dynamic values

These pressure values do not include any surcharge, and are based on a relatively level ground surface at the top of the wall and drained conditions behind the wall. It is important that water is not allowed to build up (hydrostatic pressures) behind retaining structures. Retaining walls should incorporate drainage behind the walls as appropriate, and surface water should be directed away from the top and bottom of the walls.

Lateral loads are typically resisted by friction between the underlying soil and footing bottoms. Resistance to sliding may incorporate the friction acting along the base of foundations, which may be computed using a coefficient of friction of soils against concrete of 0.30 for native clay, 0.40 for native sands, and 0.55 for native gravels or structural fill meeting the recommendations presented herein. For allowable stress design, the lateral resistance may be computed using Section 1807 of the 2015 International Building Code and all sections referenced therein. Retaining wall lateral resistance design should further reference Section 1807.2.3 for reference of Safety Factors. Retaining systems are assumed to be founded upon and backfilled with granular structural fill. If backfilling with clay or silt, it is required to contact Earthtec prior to

construction for further review and recommendations. The values for lateral foundation pressure can be increased by one-third for wind and seismic conditions per Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2015 International Building Code.

The pressure and coefficient values presented above are ultimate; therefore, an appropriate factor of safety may need to be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project structural engineer.

Subsurface Drainage

Section R405.1 of the 2015 International Residential Code states, "Drains shall be provided around all concrete and masonry foundations that retain earth and enclose habitable or usable spaces located below grade." Section R310.2.3.2 of the 2015 International Residential Code states, "Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system." An exception is allowed when the foundation is installed on well drained ground consisting of Group 1 soils, which include those defined by the Unified Soil Classification System as GW, GP, SW, SP, GM, and SM. The soils observed in the explorations at the depth of foundation consisted primarily of clay (CL) which is not a Group 1 soil. The recommendations presented below should be followed during design and construction of the foundation drains:

- A perforated 4-inch minimum diameter pipe should be enveloped in at least 12 inches of free-draining gravel and placed adjacent to the perimeter footings. The perforations should be oriented such that they are not located on the bottom side of the pipe, as much as possible. The free-draining gravel should consist of primarily ¾- to 2-inch size gravel having less than 5 percent passing the No. 4 sieve, and should be wrapped with a separation fabric such as Mirafi 140N or equivalent.
- The highest point of the perforated pipe bottom should be equal to the bottom elevation of the footings. The pipe should be uniformly graded to drain to an appropriate outlet (storm drain, land drain, other gravity outlet, etc.) or to one or more sumps where water can be removed by pumping.
- A perforated 4-inch minimum diameter pipe should be installed in all window wells and connected to the foundation drain.
- To facilitate drainage beneath basement floor slabs we recommend that the minimum thickness of free-draining fill beneath the slabs be increased to at least 10 inches (approximately equal to the bottom of footing elevations). A separation fabric such as Mirafi 140N or equivalent should be placed beneath the free-draining gravel. Connections should be made to allow any water beneath the slabs to reach the perimeter foundation drain.
- The drain system should be periodically inspected and clean-outs should be installed for the foundation drain to allow occasional cleaning/purging, as needed. Proper drain operation depends on proper construction and maintenance.

General Conditions

The information presented in this letter applies only to the subject property in the referenced

geotechnical report. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against the basement walls, mass grading of the site, or any other aspect of the house construction. The geotechnical recommendations as presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in the area at this time. No warranty or representation is intended in our proposals, contracts or reports.

Closure

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

Respectfully;
EARTHTEC ENGINEERING

Jeremy A. Balleck, E.I.T.
Staff Engineer

PROFESSIONAL ENGINEER
No. 5567049-2202
TIMOTHY ALLAN MITCHELL
8/22/17
STATE OF UTAH

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

JB/tm