

November 29, 2015

Ms. Dana Shuler, P.E.
Weber County Engineering Division
2380 Washington Blvd., Suite 240
Ogden, UT 84401

Subject: Geologic Review
Lot 13, Summit Eden Ridge Nests Subdivision
7914 East Heartwood Drive, Unit 13
Eden, Utah
SA Project No: 15-160

Report: IGES Letter – Response to Additional Review Comments – Geology,
Geotechnical Investigation, The Ridge Nests Development, Powder Mountain
Resort, Weber and Cache Counties, Utah (IGES Project No. 01628-008), dated
November 4, 2015: prepared for Summit, LLC, 3632 North Wolf Creek Drive,
Eden, Utah 84310.

Geologic Submittal Status: INCOMPLETE SUBMITTAL

Dear Ms. Shuler,

At your request, Simon Associates (SA) reviewed the above referenced November 4, 2015, IGES letter. The November 4, 2015, IGES letter was submitted in response to the following SA review letter:

Geologic Review, Lot 13, Summit Eden Ridge Nests Subdivision, 7914 East Heartwood Drive, Unit 13, Eden, Utah (SA Project No: 15-160), dated October 14, 2015: prepared for Dana Shuler, P.E., Weber County Engineering Division, 2380 Washington Blvd., Suite 240, Ogden, UT 84401.

The purpose of SA's review is to evaluate whether or not the IGES documents adequately addresses geologic conditions at the site, consistent with concerns for public health, safety, and welfare; reasonable professional standards-of-care, and; the Weber County Code of Ordinances (Weber County, 2015).

Chronology of Prior Reports and Letters

The chronology of prior SA review and IGES response letters follow:

1. The October 14, 2015, SA letter was submitted in response to the following September 23, 2015, IGES letter:

Response to Review Comments – Geology, Geotechnical Investigation, The Ridge Nests Development, Powder Mountain Resort, Weber and Cache Counties, Utah (IGES Project No. 01628-008), dated September 23, 2015: prepared for Summit, LLC, 3632 North Wolf Creek Drive, Eden, Utah 84310.

2. The September 23, 2015, IGES letter was submitted in response to the following September 7, 2015, SA review letter:

SA Geologic Review Response, Review of Professional Qualifications – Peter Doumit (IGES), Lot 13, Ridge Crest Subdivision, 7914 East Heartwood Drive, Eden, Utah (SA Project No: 15-160), dated September 7, 2015: prepared for Dana Shuler, P.E., Weber County Engineering Division, 2380 Washington Blvd., Suite 240, Ogden, UT 84401.

3. The September 7, 2015, SA letter was submitted in response to professional qualifications for Peter Doumit provided by IGES in a September 3, 2015, email.

4. The September 3, 2015, IGES email was provided in response to the following September 3, 2015, SA review letter:

SA Request for Professional Qualifications (SA Project No: 15-160), dated September 3, 2015: prepared for Dana Shuler, P.E., Weber County Engineering Division, 2380 Washington Blvd., Suite 240, Ogden, UT 84401.

5. The September 3, 2015, SA letter was submitted in response to the following September 1, 2015, IGES letter:

IGES Letter - Response to Review Comments – Geology, Geotechnical Investigation, The Ridge Nests Development, Powder Mountain Resort, Weber

and Cache Counties, Utah (IGES Project No. 01628-008), dated September 1, 2015: prepared for Summit Powder Mountain, 3632 North Wolf Creek Drive Eden, Utah 84310

6. The September 1, 2015, IGES letter was submitted in response to the following August 28, 2015, SA review letter:

SA Geologic Review, Lot 13, Ridge Crest Subdivision, 7914 East Heartwood Drive, Eden, Utah (SA Project No: 15-160), dated August 28, 2015: prepared for Dana Shuler, P.E., Weber County Engineering Division, 2380 Washington Blvd., Suite 240, Ogden, UT 84401.

7. The August 28, 2015, SA letter was submitted in response to the following August 19, 2015, IGES letter:

IGES Letter - Preliminary Response to Geologic Review Comments, The Ridge Nests Development, Powder Mountain Resort, Weber County, Utah (IGES Project No. 01628-005 L11), dated August 19, 2015: prepared for Summit, LLC, 3632 North Wolf Creek Drive, Eden, Utah 84310.

8. The August 19, 2015, IGES letter was submitted in response to the following August 18, 2015, SA review letter:

SA Geologic Review, Lot 13, Ridge Crest Subdivision, 7914 East Heartwood Drive, Eden, Utah (SA Project No: 15-160), dated August 18, 2015: prepared for Dana Shuler, P.E., Weber County Engineering Division, 2380 Washington Blvd., Suite 240, Ogden, UT 84401.

9. The August 18, 2015, SA letter was submitted in response to the following September 16, 2014, IGES geotechnical engineering report:

Geotechnical Investigation, The Ridge Nests Development, Powder Mountain Resort, Weber and Cache Counties, Utah (IGES Project No. 01628-008), dated September 16, 2014: prepared for Summit, LLC, 3632 North Wolf Creek Drive, Eden, Utah 84310 (i.e., initial IGES report).

SA Comments

On October 16, 2015, Mr. Chuck Payton (IGES) contacted Mr. David Simon (SA) to discuss the October 14, 2015, SA review letter. Mr. Payton's primary concern was whether SA was suggesting a program of subsurface exploration to evaluate the age of surface-fault-rupture along the fault documented at the subject property.

1. Mr. Simon stated that SA was not suggesting a program of subsurface exploration to evaluate the age of surface-fault-rupture along the fault documented at the subject property.
2. Mr. Simon suggested Mr. Payton respond to the following statement on page 6 of the October 14, 2015, SA review letter:

"Additionally, SA recommends Weber County suggest IGES consider the following, long established standard of practice, methods for evaluating the potential for surface-fault-rupture along the documented faults:

- Review of aerial photographs and surface observations to identify any fault-related geomorphic features indicative of past surface faulting at or near the property (e.g., fault scarps, vegetation lineaments, gullies, vegetation/soil contrasts, aligned springs and seeps, sag ponds, aligned or disrupted drainages, faceted spurs, grabens, and/or displaced landforms such as terraces, shorelines, geologic units, etc.).
 - The USGS Quaternary Fault and Fold Database of the United States. (<http://earthquake.usgs.gov/hazards/qfaults>)."
3. Mr. Simon noted that the information in Item 2 above, will be more than sufficient to address surface-fault-rupture at the property and other items regarding faulting documented at the property in the October 14, 2015, SA review letter would no longer be germane.

Based on comments by IGES in the November 4, 2015, IGES document, Mr. Payton, apparently chose an alternate approach to respond to SA comments regarding surface-fault rupture at the property, rather than the suggestions offered by SA. IGES's alternate

approach has given rise to additional questions which are discussed in the SA Recommendations section below.

SA Conclusions

Based substantially in and on reliance of the technical documentation and assurances provided by IGES, including their findings and conclusions, it is SA's opinion that the November 4, 2015, IGES report does not adequately address geologic parameters at the site, consistent with concerns for public health, safety, and welfare, reasonable professional standards-of-care, and the requirements of the Weber County Code of Ordinances (Weber County, 2015).

SA Recommendations

SA recommends Weber County not consider the November 4, 2015, IGES response letter complete from a geologic perspective and recommends Weber County requests IGES adequately address the following items.

1. Item 1 of the October 14, 2015, SA review letter, recommended Weber County request documentation of the bedding, joint, and/or fracture properties, and incorporation of the geologic data in the slope stability analyses.

On page 2 (second paragraph) of the November 4, 2015, IGES response letter, IGES states: "...These lithologies tended to fracture into rectangular blocks with highly variable dimensions, ranging in width and length from between a couple inches to several feet, though larger blocks (with dimensions of several feet *x several feet x several feet*) were most common (Photo 2).¹ (italics added for emphasis).

It appears the preceding sentence from the November 4, 2015, IGES response letter is incomplete. *SA recommends Weber County request IGES clarify the seeming discrepancy.*

2. On page 5 (first bullet) of the November 4, 2015, IGES response letter, IGES provides a definition for inactive fault, referencing Chapter 38-3 of the Weber

¹ SA recommends review of the November 4, 2015, IGES letter where quoted so quotes are placed in proper context.

County Natural Hazards Overlay Districts. Chapter 38-3 of the Weber County Natural Hazards Overlay Districts is obsolete (see Weber County, 2015). SA is unaware of the Weber County Code of Ordinances providing a definition for "inactive fault." *SA recommends Weber County request IGES provide definitions from current references.*

3. On page 5 of the October 14, 2015, SA review letter, SA stated:

"However, regardless of the definitions, SA considers several of the factors not to be applicable in regards to timing of surface-fault-rupture, for instance: ... 'The fault extends up to, but not through, the overlying soil profile.' Without the age of the overlying soil profile, the statement is unsubstantiated."

On page 5 (second paragraph) of the November 4, 2015, IGES letter, IGES responded:

"Though the age of the soil profile overlying the faults is unknown, the presence of undisturbed soil provides a lower limit for most recent displacement along the fault traces. Soil formation can take hundreds to thousands of years to develop. Taking the conservative estimate of 100 years per inch of topsoil development (NRCS)², and the fact that 3.5 feet of soil were encountered in TP-1, provides a lower limit of at least 3,600 years since last displacement along the faults."

The USDA National Resource Conservation Service (NRCS) referenced in the November 4, 2015, IGES letter states the following in regards to soil formation:

"One of the first processes to occur during soil formation is the movement of organic matter into the surface of a soil giving it a characteristic dark color. An often asked question is, "How long does it take to form an inch of topsoil?" This question has many different answers but most soil scientists agree that it takes at least 100 years and it varies depending on climate, vegetation, and other factors."

² http://www.nrcs.usda.gov/wps/portal/nrcs/detail/wa/soils/?cid=nrcs144p2_036333

"In a wet, hot climate soil horizons will form fairly quickly compared to those in cold, dry environments. Therefore, soils in cold, dry climates develop rather slowly in comparison. It is not just the amount of time that determines the degree of soil development but also the parent material, climate, vegetation, and intensity of soil-forming factors during that time that ultimately determine soil development."

Consistent with long-established, geologic standards-of-practice (Birkeland, 1999; McCalpin, 2009), when using pedogenic development (i.e., "soil genesis") to estimate fault activity, it is appropriate to document soil-stratigraphic development by providing at least one, representative, standard soil-profile (at times supplemented by radiocarbon ages for the pedogenic horizons) (i.e., Birkeland, 1999).

Should IGES decide to pursue pedogenic development as an "individual piece of evidence that collectively indicates fault activity," SA recommends Weber County request IGES:

- a. *Provide at least one, representative, standard soil-profile measurement and description, including the location of the profile on the site-specific geologic map.*
- b. *Provide the climatic, vegetation, and other factors unique, to the subject site, supporting the applicability of the NRCS generality that it takes at least 100 years to form an inch of topsoil (which can vary depending on climate, vegetation, and other factors).*
- c. *Clarify how the 3.5 feet of soil documented by IGES in TP-1 translates to 3,600 years.*
- d. *Clarify how a lower limit of 3,600 years for the soil profile precludes Holocene displacement.*

4. On page 6 (first paragraph), of the October 14, 2015, SA review letter, SA states:

"Additionally, SA recommends Weber County suggest IGES consider the following, long established standard of practice, methods for evaluating the potential for surface-fault-rupture along the documented faults... Review of aerial photographs and surface observations to identify any fault-related geomorphic features indicative of past surface faulting at or near the property (e.g., fault scarps, vegetation lineaments, gullies, vegetation/soil contrasts, aligned springs and seeps, sag ponds, aligned or disrupted drainages, faceted spurs, grabens, and/or displaced landforms such as terraces, shorelines, geologic units, etc.)."

On page 6, fourth paragraph, of the November 4, 2015, IGES letter, IGES responded:

"IGES is unaware of any paleoseismic studies that pertain to similar geologic conditions as found in this investigation, but rather the conclusion of fault inactivity is by way of taking all of the geologic data collectively through the application of the geological principles of cross-cutting relationships and uniformitarianism."

SA recommends Weber County request IGES:

- a. Clarify the relevance of the preceding response by IGES regarding SA's suggestion that IGES review of aerial photographs and surface observations to identify fault-related geomorphic features is indicative of past surface faulting at or near the property.*
 - b. Provide a summary with site specific examples of IGES' "...application of the geological principles of cross-cutting relationships and uniformitarianism."*
5. In regards to SA's recommendation that Weber County suggest IGES review aerial photographs to identify fault-related geomorphic features indicative of past surface faulting at or near the property, the November 4, 2015, IGES letter stated (page 6):

"Regarding the additional recommendations from SA, IGES reviewed aerial photographs, conducting surface observations, and reviewing the USGS Quaternary Fault and Fold Database of the United States prior to the submittal of the September 23, 2015 letter; regrettably, this information was not incorporated into our response. Prior to undertaking the fieldwork for this investigation, IGES reviewed the Western GeoLogic report for the area (Western GeoLogic, 2012), in which aerial photographs were analyzed and no faults were identified. Additionally, the USGS Quaternary Fault and Fold Database of the United States was reviewed, with the closest fault to the area of investigation being approximately 2.5 miles to the southwest. IGES also analyzed current and historic Google Earth imagery for the area, and did not identify any surficial features relating to faulting in the area. Finally, surface observations were made during the field investigation, and no surficial expression of the faults were found except in the road cut north of the planned development."

SA recommends Weber County request IGES:

- a. Clarify if IGES actually reviewed aerial photographs or is deferring to Western GeoLogic (2012) report.*
- b. Provide the source, date, flightline number, and scale of the stereoscopic aerial photographs reviewed, if any.*
- c. Provide site specific data to support "...no surficial expression of the faults were found except in the road cut north of the planned development."*

Closure

Comments and recommendations in this review are based on data presented in the referenced Consultant's report. SA accordingly provides no warranty that the data in the Consultant's report or any other referenced reports are correct or accurate. SA has not performed an independent site evaluation. Comments and recommendations presented herein are provided to aid Weber County in reducing risks from geologic hazards and to protect public health, safety, and welfare. There is no other warranty, either express or implied.

Geologic Review
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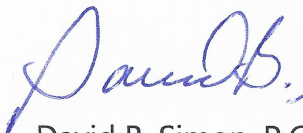
All services performed by SA for this review were provided for the exclusive use and benefit of Weber County; no other person or entity may or is entitled to use or rely upon any of the information or reports generated by SA as a result of this review.

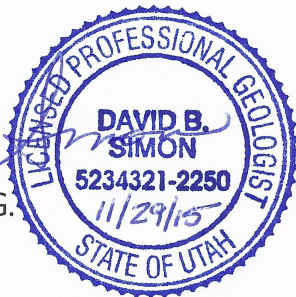
This is the sixth review letter written for the project. In order to expedite, and hopefully finalize, the review process and to clarify remaining issues, SA recommends Weber County consider a project meeting with the Applicant and Consultant to discuss the remaining geologic issues prior to IGES submitting a response.

In the meantime, should you have any questions, please feel free to contact the undersigned. The opportunity to be of service to Weber County is appreciated.

Very truly yours,

SA


David B. Simon, P.G.
Principal Geologist



DBS/AOT
Dist.: 1/addressee

References Cited

Birkeland, P.W., 1999, *Soils and Geomorphology*, Third Edition, Oxford University Press, New York, N.Y., 430 p.

McCalpin, J.P., editor, 2009, *Paleoseismology (second edition)—International Geophysics Series Vol. 95*: Burlington, Mass., Academic Press (Elsevier), variously paginated.

Weber County, 2015, *Weber County, Utah, Code of Ordinances, Supplement 4 Update 1*, Online content updated on September 23, 2015, Code Of Ordinances, Weber County, Utah: Codified through Ordinance No. 2015-16, adopted September 8, 2015 (Supp. No. 4, Update 1).
https://www.municode.com/library/ut/weber_county/codes/code_of_ordinances?nodeId=14935

Western Geologic, 2012, *Report: Geologic Hazards Reconnaissance, Proposed Area 1 Mixed-Use Development, Powder Mountain Resort, Weber County, Utah*, dated August 28, 2012.