



March 18, 2019

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Subject: Geologic-hazard Study
The Retreat
Retreat and Elkhorn Drives
Eden, Utah
Project No. 1190213

PURPOSE AND SCOPE OF INVESTIGATION

This letter presents the results of a geologic-hazard study for the proposed development of The Retreat located west of Retreat Drive and north of Elkhorn Drive in Eden, Utah.

This study was conducted to evaluate geologic hazards that may affect the proposed development. The hazards evaluated are surface fault rupture, landslide, tectonic subsidence, rockfall, debris flow and liquefaction. The study included a review of geologic literature, aerial photographs and lidar data, site reconnaissance, and geologic analysis. This report has been prepared to summarize the data obtained during the study and to present our conclusions.

PROPOSED CONSTRUCTION

We understand that townhomes are planned to be constructed on the property. We anticipate the buildings will be of wood-frame construction typical of the area. The buildings are planned to be cut into the hillside with cuts and fills generally less than about 5 feet.

SITE DESCRIPTION

At the time of our site visit, there were no permanent structures or pavement on the site in the area of the proposed development. The site consists of an undeveloped hillside with a slope of approximately 3.7 horizontal to 1 vertical and flatter down to the south and southwest.

Vegetation at the site consists of grass and brush.

There are townhouses south and west of the property and undeveloped land to the north and east. There is a water-storage pond in the distance to the north of the site.

OFFICE METHODS OF INVESTIGATION

Geologic conditions at the site were evaluated by a review of geologic literature, aerial photographs and lidar data. Aerial photographs and lidar data used during the investigation were downloaded from the Utah Geological Survey website. One set of aerials has photograph numbers of ELK-2-169 and 170 and a photograph date of June 25, 1963. The other set has numbers AAJ-2B-46 and 47 with a date of August 10, 1946.

A. Geologic Literature Review

The site is located in Ogden Valley, which is a northwest trending valley within the Wasatch Mountains of north/central Utah. The valley is filled with an accumulation of lacustrine, alluvial and colluvial sediments from deposition during the past 15 million years (Sorensen and Crittenden, 1979). The surface deposits across the site consist of Quaternary-age colluvium and alluvial-fan deposits likely composed of clayey gravel with cobbles and boulders.

Ogden Valley is a down-dropped structure with the Ogden Valley Northeast margin fault along the northeast side of the valley and the Ogden Valley Southwest margin fault and the Ogden Valley North Fork fault along the southwest side of the valley. These faults are oriented in a general northwest/southeast direction with the two western faults estimated to have moved in the last 750,000 years and the east fault having evidence of movement in the last 2.6 million years. The faults are considered normal faults with dip direction down to the northeast on the two west fault systems and down to the southwest for the Ogden Valley Northeast margin fault. The faults are considered relatively old structures and do not represent a significant surface-fault-rupture hazard for development within the Ogden Valley area. Tectonic subsidence associated with fault movement would similarly not be a significant hazard at this site.

The Utah Fault and Fold database shows the Ogden Valley North Fork fault located along the north fork of the Ogden River approximately 1.6 miles to the southwest and the Ogden Valley Northeast margin fault located on the hillside to the northeast, approximately 1 mile from the site. No active faults are mapped through or near the site. The closest active fault to the site based on the Utah Geological Survey database is the Wasatch fault located approximately 6 miles to the west.

The geologic map by Sorensen and Crittenden (1979) shows the site to be underlain by colluvium and slope wash of Holocene age.

Mapping by Coogan and King (2001) and King and others (2014) shows the area underlain by alluvium-fan deposits with landslide deposits to the east.

The Elliott and Harty (2010) landslide map shows the landslide deposits mapped by Coogan and King (2001) and no landslide deposits on the property.

B. Aerial Photograph and Lidar Review

The geologic literature indicates that there are landslide deposits in the area of the site. Review of aerial photographs and lidar data finds no evidence of landslide geomorphology at the site.

Based on the topography of the site and surrounding area, rockfall and debris flow are not potential geologic hazards at the site.

C. Seismicity

The property is located in the Intermountain Seismic Zone, which consists of an area of relatively high historical seismic activity. The most intense seismic ground shaking at the site is expected to originate from the Wasatch fault zone. The Wasatch fault zone is considered capable of producing earthquakes on the order of 7 to 7.5 magnitude and can result in significant seismic ground shaking at the site. The US Geological Survey data indicate that a peak ground acceleration of 0.36g can be expected to have a 2 percent probability of being exceeded in a 50-year time period at this site (IBC, 2015).

D. Liquefaction Potential

Groundwater is expected to be below 50 feet at the site and the natural soil likely consists of clayey gravel with sand based on soil exposed in excavation slopes behind the townhouses to the south. Liquefaction is not considered a hazard at this site.

FIELD METHODS OF INVESTIGATION

A site visit was made on March 15, 2019 by a geologist from AGECE. There is no evidence of geologic hazards that would affect the property, such as rockfall, debris flow, avalanche and landslide.

CONCLUSIONS

Seismic ground shaking is considered the only significant geologic hazard at the site. This hazard will be mitigated through structural design. It is our professional opinion that landslide, debris flow, rockfall, surface fault rupture, tectonic subsidence and liquefaction are not significant hazards at the site.

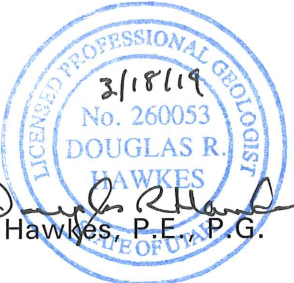
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LIMITATIONS

The analysis and report findings are based on published geologic maps and reports, aerial photographs and lidar data of the site and our interpretation of geologic conditions at the site. Our conclusions are based on currently accepted geologic interpretation of this information.

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.


Douglas R. Hawkes, P.E., P.G.

Reviewed by James E. Nordquist, P.E.

DRH/rs

Enclosures

REFERENCES

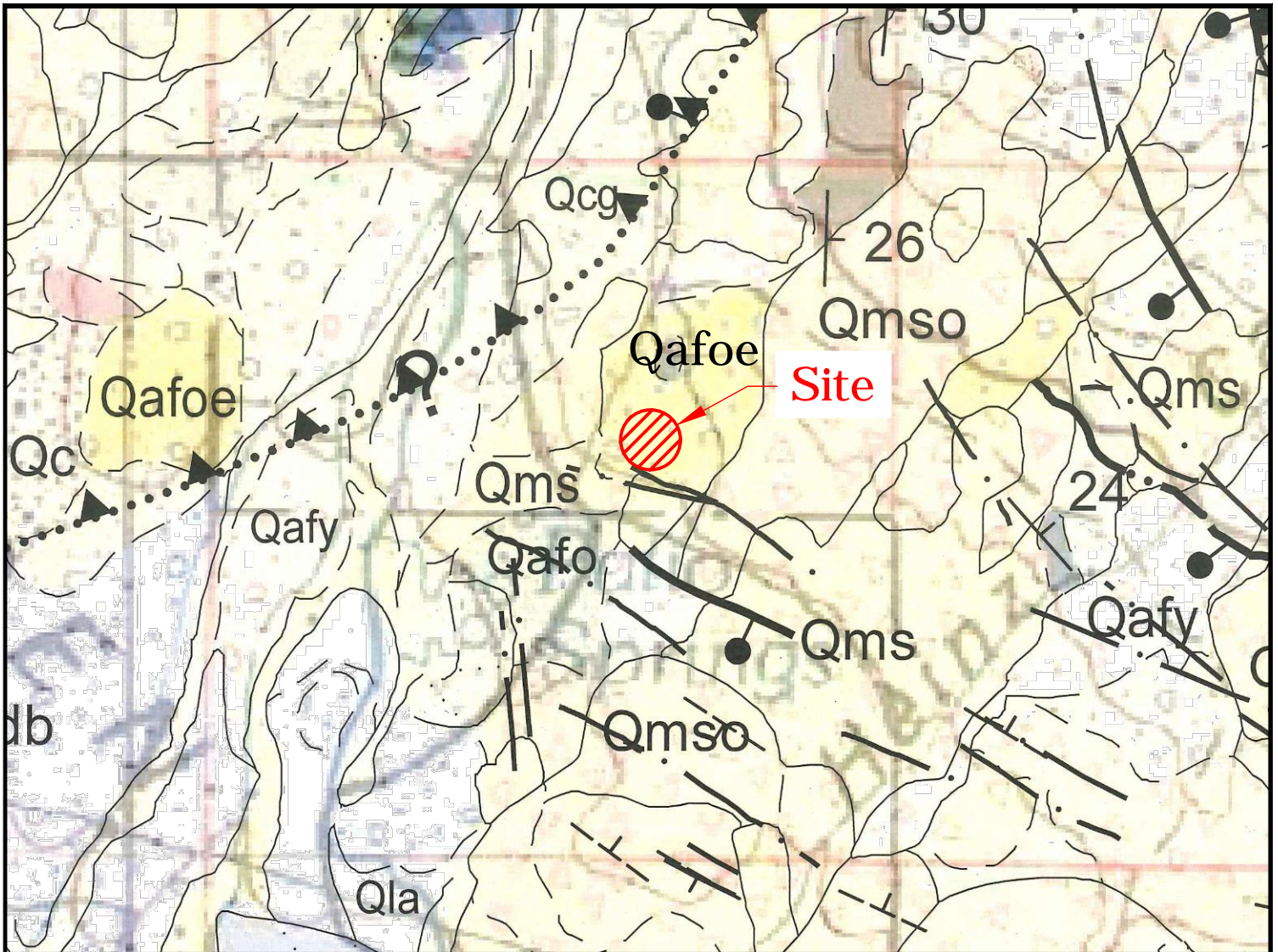
Coogan, J.C. and King, J.K., 2000; Progress report geologic map of the Ogden 30' X 60' quadrangle, Utah and Wyoming, Utah Geological Survey Open-file Map 380.

Elliott, A.H. and Harty, K.M., 2010; Landslide maps of Utah, Ogden 30' X 60' quadrangle, Utah Geological Survey Map 246DM, Plate 6.

King, J.K., McDonald, G.N. and Coogan, J.C., 2014; Progress report geologic map of the Huntsville quadrangle, Weber and Cache Counties, Utah, Utah Geological Survey map in progress.

Sorensen, M.L. and Crittenden, M.D., Jr., 1979; Geologic map of the Huntsville quadrangle, Weber and Cache Counties, Utah, US Geological Survey Map GQ-1503.

Utah fault and fold database accessed on March 14, 2019 at geology.utah.gov/resources/data-databases/qfaults/.



from Coogen and King (2000)

EXPLANATION OF SYMBOLS AND GEOLOGIC UNITS IN AREA OF PROPOSED DEVELOPMENT

- Qafoe - Older eroded alluvial-fan deposits (middle and lower Pleistocene).
- Qafo - Older alluvial-fan deposits (mostly upper Pleistocene).
- Qms - Landslide deposits (Holocene to middle Pleistocene).
- Qmso - Landslide deposits (middle Pleistocene).
- Qcg - Gravelly colluvial deposits (Holocene and Pleistocene).

— — — Geologic contact between units.

—●— Normal fault, bar and ball on down thrown side, dashed where approximate, dotted where concealed.

.....▲..... Concealed thrust fault.

— Lineation.



0 2000 4000 feet
Approximate Scale

THE RETREAT
RETREAT AND ELKHORN DRIVES
EDEN, UTAH



THE RETREAT
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AGEC

Site Plan

Figure 2