

EP-21-0083 Crystal Park Site S-178R (Miller Residence)

NW¼ SW¼ NE¼ Section 17, T14S, R67W, 6th Meridian

38.8349, -104.9137

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The applicant proposes a single-family residence at 5050 Neeber Valley Road in the Crystal Park development. With this resubmittal, we received the Site Plan (LGA Studios, August 5, 2021) and Geologic Hazards Report (Geoquest, LLC, stamped July 7, 2021).

The Geoquest geologic hazard report addresses the geologic hazards associated with the site. Geoquest references a geologic hazard study (RMG Engineers, Job No. 181816, dated March 17, 2021), however, this report was not provided for CGS's review.

Geoquest has responded to our comments and recommendations from our May 6, 2021 comments (in italic), which are provided below.

1. *A qualified geotechnical professional should determine maximum allowable, unretained temporary, and permanent cut/fill heights and slope angles.*
 - As noted on page 2 of Geoquest's geologic hazard report, "we recommend slopes not exceed 2:1 (horizontal:vertical). Slopes steeper than this are subject to localized slope failure." However, it appears that these slopes are exceeded in the slope stability analysis with local slope failures shown. Recommended slope angles should be noted in the site plan.
2. *All planned cuts exceeding four feet in height should be evaluated for slope stability using proposed slope geometry and considering all foundation and proposed cuts that will affect the slope.*
 - Geoquest's analysis yielded a Factor of Safety (FOS) less than industry standards for the existing slope, maximum construction slope, upper wall stability, and downslope stability. The calculated FOS meets industry standards of 1.5 for the lower wall stability and final construction – global slope stability. It is unclear whether Geoquest's analysis uses measured soil strength values from direct shear testing or if the strength values were obtained from assumed values. The Geoquest subsurface investigations are shallow (15 feet), and bedrock was only encountered in one of the test holes (Soils Report, Geoquest, LLC, stamped December 28, 2017). No seismic factors were included in the analysis, even though the site is within 0.5 miles of the Ute Pass Fault zone. Also, there is little text describing the methods, reasoning, and result of the analysis.

We recommend:

- **Shear strength values should be measured from site-specific samples and lab testing;**
 - **Text is provided that explains the slope stability analysis results presented; and,**
 - **Seismic factors are included in the analysis, if not already.**
3. *Driveway retaining walls, building foundations, and upslope walls that will function as retaining walls must be designed by a qualified geotechnical or civil engineer and must include adequate behind-wall drainage.*
 - As recommended by Geoquest, "Retaining walls should be designed by a qualified geotechnical engineer." Also, "The retaining wall designer should check for local and global slope stability." The recommendations we provided above for the slope stability analysis should also be applied to the retaining wall design.

4. *The structure should be designed with as much rigidity as possible due to the potential of downslope creep.*
 - CGS agrees with Geoquest on page 2 “Foundation walls should be designed for an increased lateral earth pressure for the potential of increased pressure caused by creep.” Also, we agree with their recommendation, “the foundation design engineer account for the increased pressure with an increase in reinforcing steel and/or increased buttress walls.” Geoquest’s recommendations should be strictly adhered to.
5. *Drainage should be designed to prevent any flows from Crystal Park Road from being directed at the lot, and drainage from the proposed lot from being directed further downslope to the location of existing structures.*
 - Geoquest states, “The property is protected from flows off Crystal Park Road due to the way the road is graded. And flows off the property will not directly impact any downslope properties.” CGS recommends that the project civil engineer design a drainage system that protects the subject property and properties further downslope from the flow of surface-generated water.
6. *The existing vegetative cover should be left intact to the extent possible, and every effort should be made to restore native vegetation within disturbed areas as quickly as possible. Irrigation beyond the bare minimum required to reestablish native vegetation should not be permitted.*
 - CGS agrees with Geoquest, “Disturbed soils should be revegetated and protected with erosion control blankets until the seed takes hold.” CGS recommends that erosion control measures are shown in the plans. Site grading should direct water away from the structure.

Geotechnical Considerations. CGS agrees with Geoquest on page 4 of their soils report, “*Perimeter drains are required around all walls of the habitable or usable area portion of the structure that are below finished grade including all common wall(s) adjacent to the basement*” and “*an Open Hole Observation must be performed on each individual structure prior to placement of concrete, and preferably prior to the placement of forms in the excavated area.*” Block slope failures in the bedrock can occur along concealed fractures and weathered zones anywhere beneath the planned building site. **CGS recommends Geoquest or another qualified geotechnical engineer carefully inspect the foundation excavation for evidence of fractures, discontinuities, and weathered zones during the open hole observations.** Should observed conditions indicate differences from those assumed in the foundation design, the structural engineer should re-evaluate the design.

In summary, we recommend:

1. **Proposed slope angles should be included in the site plan.**
2. **The provided slope stability analysis include:**
 - **Shear strength values measured from site-specific samples and lab testing;**
 - **Text that explains the slope stability analysis results presented; and,**
 - **Seismic factors.**
3. **Retaining walls should be designed by a qualified geotechnical engineer and include both global and local slope stability analysis.**
4. **The project civil engineer design a drainage system that protects the subject property and properties further downslope from the flow of surface-generated water.**
5. **Erosion control protection is included in the site plan.**
6. **Foundation excavations are inspected for evidence of fractures, discontinuities, and weathered zones during the open hole observations.**

Submitted 9/10/2021 by Amy Crandall, Engineering Geologist, Colorado Geological Survey (303-384-2632 or acrandall@mines.edu)