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, October 6, 2021) and Response to Colorado Geological Survey Comments (Geoquest, LLC, stamped September 24, 2021).

Geoquest has responded to our comments and recommendations from our September 10, 2021 comments (in italic). Our responses are indicated below.

1. *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.*

   The maximum slope angles are noted on the updated site plan.

2. *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.*

   In Geoquest's June 21, 2021 report, the upper level stability (Stage – analysis: 1-1) yielded a factor of safety of 1.13. Geoquest states in their response letter, "The native downslope stability has a factor of safety of 1.13 which matches the preconstruction stability downslope of the proposed structure." However, I cannot seem to find an "initial downslope stability" analysis and am unsure how Geoquest concluded, "The proposed construction has no impact on the native slope stability past the area of disturbance."

   I agree with Geoquest that a licensed Colorado Professional Engineer should design the upper wall stability (and lower wall stability) and achieve a factor of safety greater than 1.5.

3. *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.*

   Geoquest states on page 1 of their response report, "We disagree that this additional testing (shear strength testing) is necessary. This would require a Direct Shear or Tri-Axial test on an undisturbed soil sample. This is beyond the standards of practice for residential construction."

   Gequest's statement that "This is beyond the standards of practice for residential construction" is not accurate. The project site is mapped as containing "potentially unstable slopes" with slopes greater than 30 percent. An analysis with site-specific laboratory testing is crucial to the long-term stability of the slopes. We understand that Geoquest does not have the ability to perform these tests. As the on-site materials are granite/decomposed granite, **the values provided by Geoquest in their slope stability analysis for the on-site materials appear reasonable**. However, in the future, at other sites with variable soil/rock consistencies, we recommend that shear strength values be measured from site-specific samples and lab testing as these values are prone to vary, potentially impacting the calculated factor of safety.

4. *No seismic factors were included in the analysis, even though the site is within 0.5 miles of the Ute Pass Fault zone.*

   Geoquest states on page 2, "The slope stability has also been updated with seismic analysis" and "Seismic effects have been applied to "Stage of Construction 7"." The input values are not noted in the printout of the analysis, therefore, CGS cannot confirm these results.

5. *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.*

   The revised site plan includes a note regarding the recommendation for retaining wall design.

6. *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.*

   Drainage patterns and erosion control protection are noted on the site plan.

7. *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.*

   The revised site plan includes a note (Note 2) regarding this recommendation.

In addition, the geologic hazard note on the site plan indicates "potentially seasonal shallow groundwater, loose soils, and erosion". Based on Geoquest's geohazard report, potentially unstable slopes should also be included.

Submitted 10/21/2021 by Amy Crandall, Engineering Geologist, Colorado Geological Survey (303-384-2632 or acrandall@mines.edu)