

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401



Matthew L. Morgan
State Geologist and Director

October 23, 2023

Madison Harris
Town of Minturn
Planner1@minturn.org

Location:
NW¼ NW½ Section 26
T5S, R81W of the 6th P.M.
39.5938, -106.4304

Subject: **Minturn North Final Plan for Planned Unit Development**
Town of Minturn, Eagle County, CO; CGS Unique No. EA-21-0008

Dear Ms. Harris:

The Colorado Geological Survey has reviewed the revised Minturn North Planned Unit Development (PUD) referral. The applicant proposes a 39-lot residential development on 13.485 acres in Minturn. The site is bordered by Taylor Street on the east, Minturn Road on the west, and Game Creek on the north. With this referral, CGS received a request for review (Email dated October 4, 2023), Final Plat (Slagle Survey Services, August 13, 2023), Cursory Mudflow Evaluation (August 21, 2023), and other documents. CGS previously reviewed the Drainage Report (Wright Water Engineers, Inc. (WWE), December 2022), Geologic Hazard Review (Kumar & Associates, Inc., March 5, 2020), and Soils and Foundation Investigation (CTL Thompson, Inc., August 26, 2020) and we provided comments in our January 29, 2021 and May 16, 2023 letters. No new geological or geotechnical information was provided with the referral documents.

As shown in Figure 1 and as referenced in WWE's drainage study and CTL's and Kumar's reports, an alluvial/debris fan is located at the mouth of Game Creek, which could be a source of debris inundation during a flood event. It should also be noted that existing residential structures are located within/adjacent to the mouth of Game Creek and within the alluvial/debris fan. WWE's cursory mudflow evaluation states, "While the geologic mapping and existing topography indicate that the development site has historically seen active mudflows, there is no evidence of recent mudflow events in the area." However, a detailed mudflow/debris flow analysis for Game Creek was not included in their scope.

As indicated by CTL (page 5) in their report and WWE (page 18) in the drainage report, "Evaluations with regard to mud and debris flows should be completed and evaluated with regard to the proposed development." To the best of our knowledge, this evaluation(s) has not been conducted during our current and previous reviews of this development. Based on the grading plans (sheets C.6 and C.7), a 2.5-foot high deflection berm is planned between Game Creek and Lots 1-5, and a trapezoidal ditch (24 inches deep) is proposed along the east side of the development. However, CGS has yet to receive the mudflow/debris flow analysis for which this deflection berm was designed. Without this analysis, whether the proposed berm will deflect/convey flows (hypercontracted flooding, mudflows, or debris flows) emanating from Game Creek is unknown. WWE states in their cursory review, "This berm will help to reduce the risk of a mudflow from Game Creek impacting the development from the north," but also states, "mudflow events could spill out of Game Creek and impact Taylor Street and the PUD from the west." CGS is

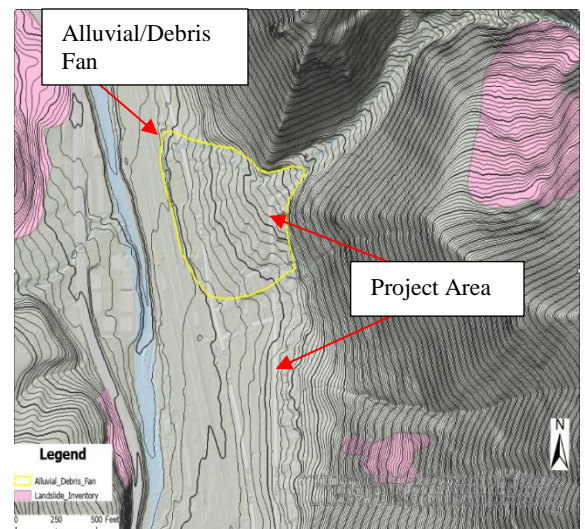


Figure 1: Alluvial/Debris fan and mapped landslides within/adjacent to the project site.

concerned that the risk of debris flows/mudflows has not been assessed and that the berm does not eliminate the mudflow and debris flow hazards on the site and could exacerbate the risk to the existing development.

CGS continues to agree with CTL and WWE and recommends the risk of flood hazards, mudflows, and debris inundation emanating from Game Creek to the alluvial/debris fan is evaluated for both the proposed and existing developments prior to approval. CGS recommends expanding the existing drainage/hydraulic studies or a new study to analyze bulked flow dynamics associated with hyperconcentrated flooding emanating from Game Creek for 10-, 25- and 100-year storm events. In addition, we recommend the following:

- Characterization of the source area and channel areas above the alluvial/debris fan.
- Test pits or trenches to evaluate details on past deposition. Radiocarbon dating of debris flow deposits within the alluvial/debris fan can be used to estimate the age of events and reoccurrence interval.
- A discussion of the anticipated probability of reoccurrence and volume and estimation of flow type, flow depth, deposition area, runout, gradation of debris, flow impact forces, streamflow inundation, and sediment burial depths.

These hazards will increase due to events that reduce hillside vegetation, such as avalanche, disease, wildfire, grading, and other disturbances; debris flow mitigation structures should include an additional factor of safety to account for uncertainty and increased debris volume as a result of wildfires. CGS recommends that the owners seek professional analysis after any wildfire that has impacted the basin and drainage to ensure its design is sufficient for changed conditions or if additional mitigation is necessary. The proposed deflection berm, ditch, or any other mitigation due to the additional analysis will require ongoing inspection and maintenance to maintain effectiveness and must be designed, constructed, and maintained so that hazards to other properties and roads are not exacerbated.

Once the building locations have been identified on the lots and prior to building permit approval, lot-specific geotechnical investigation consisting of drilling, sampling, lab testing, and analysis will be needed to characterize soil and bedrock engineering properties and evaluate the collapse potential of the fan deposits.

Thank you for the opportunity to review and comment on this project. If you have questions or require further review, please call me at 303-384-2632 or email acrandall@mines.edu.

Sincerely,



Amy Crandall, P.E.
Engineering Geologist