

As requested by the county (email, September 13, 2023), the Colorado Geological Survey (CGS) has reviewed the submittal (File Number SKP233, located in the vicinity of 38.7612, -104.6179). Documents relevant to our review include an Application (March 23, 2023), a Letter of Intent (Matrix Engineering, September 6, 2023), a Sketch Plan Amendment (Matrix Engineering, Project No. 21.1129.017, September 6, 2023), and a Soils and Geology Study (RMG, Job No. 187746, August 5, 2022). CGS reviewed the Rolling Hills Ranch Sketch Plan (of which Bull Hill and Rolling Meadows are a part) on November 29, 2005. The applicant requests a Sketch Plan Major Amendment to permit 5,440 units on 1,136.9 acres.

RMG has listed expansive soils and bedrock, compressible soils, potentially shallow groundwater, faults/seismicity, floodplain/floodways, and radon as constraints to development due to the site geology. Other geologic conditions that must be addressed during the preliminary plan phase include shallow bedrock, erosion, the potentially unstable slopes adjacent to the drainage, and the extent of fluctuations in shallow groundwater elevations. We recommend that the geotechnical engineer verify the soil and bedrock assumptions of the Civil Engineer for the flooding and scour erosion mitigation expected from this feature.

The project is in a geologic setting and location known for shallow fluctuating groundwater. The provided Test boring data is for single days in February and March. Two borings are reported with groundwater at depths of 17 and 14 feet. No groundwater elevations are provided. The borings were apparently not left open to measure groundwater later but appear to have been backfilled immediately after drilling. The recorded lack of groundwater is insufficient for evaluating impacts from shallow groundwater at this location and in this geologic setting. Just as the natural drainage within the site will vary in flow rates annually and over differing years, shallow groundwater conditions are expected to fluctuate with differing precipitation events and seasons. February and March are known to be times of lower groundwater than later spring or summer months.

During preliminary plan phases, the potential for shallow groundwater will require further evaluation as site-specific data on the extent of fluctuations in groundwater elevations still need to be collected. Impacts on shallow groundwater from the prominent hydrologic feature that crosses the site will need to be addressed. Investigations for natural fluctuations in shallow groundwater should include monitoring programs that can be used during preliminary and final plans using site-specific groundwater elevation data. This should be combined with the evaluation of publicly available yearly precipitation data for this region. Results from monitoring programs can demonstrate annual fluctuations in shallow groundwater, and these can be evaluated with variations over decades of precipitation events for assessing expected variations in groundwater elevations.

CGS does not object to conditional approval of the sketch plan provided that during preliminary planning

- The soils and geology report is expanded to include all the constraints to development identified at this location. This site was previously investigated in a soil, geology, and geologic hazard by Entech Engineering (July 29, 2005). This previous investigation should be documented and provided as part of the review of this location.

- Shallow groundwater is investigated using site-specific monitoring for seasonal variations. Recording groundwater elevations should be done as part of this monitoring, thus ensuring the data is helpful for site grading and evaluation of any plans for below-grade or basement construction.
 - Investigation of shallow groundwater conditions cannot be left to site-specific investigations due to seasonal and yearly variations of this geologic constraint that are not typically evaluated during a single drilling event. Furthermore, it is generally too late to plan an underdrain for a subdivision that may be needed during site-specific investigations.
- Yearly precipitation data is evaluated in conjunction with the monitoring program to evaluate expected variation in groundwater elevations further.

We understand that shallow foundations are planned. A note should be placed on the preliminary plans that no inhabitable below-grade or basement areas will be allowed unless shallow groundwater conditions have been addressed with a monitoring program through all four seasons combined with a discussion of regional precipitation trends that can periodically increase the fluctuations expected in groundwater elevations. This evaluation can determine if underdrain systems will be needed and if they can be placed during the planned over-excavation for swelling and compressible soils and bedrock.

Matrix Design Group states that the commitment letter from the Water Service provider has been deferred to future submittals. The availability of groundwater for huge developments such as this can be problematic and is becoming more so due to drought and dwindling water resources. CGS recommends that the basis of assumptions of available groundwater for this project be provided to the county for review before approval of final plans.

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