EP-21-0051_3 Waterbury PUD Preliminary Plan

SW ¼ SW ¼ Section 28, T12S, R64W, 6th P.M.
38.9718, -104.5693

Colorado Geological Survey has reviewed the Waterbury PUD preliminary plan resubmittal. The applicant proposes 198 single-family residential homes on approximately 62 acres located southeast of Highway 24 and Stapleton Road in Falcon. The available referral documents include a Letter of Intent (William Guman & Associates, Ltd. (Guman), March 10, 2022), Grading and Erosion Control plans (Terra Nova Engineering, Inc., March 3, 2022), PUD Development Plan and Preliminary Plan (Guman, January 27, 2022), Soil, Geology, and Geologic Hazard Addendum and Report (Entech Engineering, Inc., February 2, 2022 and October 18, 2021), and Master Development Drainage Plan (Terra Nova Engineering, Inc., March 2022).

We previously reviewed this site and provided comments on May 24, 2021 and November 10, 2021. CGS appreciates the responses to our comments regarding building setbacks, and we have noted that setbacks for floodplains, wetlands, and unstable slopes are shown on the preliminary plan. Other comments have not been addressed and remain valid. Specifically,

Shallow groundwater and basement feasibility. Entech observed groundwater in all the borings drilled over the entire development at depths near the surface to 12 feet. Entech states on page 15, "*It is anticipated the majority of the areas where shallow groundwater exists on the site will be mitigated with the proposed grading*." However, this mitigation strategy alone may not be effective in ensuring groundwater levels are at least three feet from the lowermost floor levels. According to sheet 6 of the grading and erosion control plans (that includes cut/fill lines), minimal fill is anticipated in shallow groundwater areas (e.g., TB310 and TB6), and areas of cut are noted.

Per El Paso's Engineering Criteria Manual (Appendix C, Section D.6), the seasonal variations and recommendations concerning groundwater level fluctuation should be discussed in the Geologic Hazards Report. Monitoring/observations of groundwater fluctuations have not been conducted, and Entech's drilling program and subsequent groundwater measurements were last obtained in 2012.

Mitigation for shallow groundwater often becomes guesswork due to the inexact method of determining its impact on inhabitable below-grade areas (basements and crawlspaces). Groundwater measurements in test borings are limited to the time of year measured (a snapshot) and are inherently inaccurate in predicting depth to groundwater during the engineering life of a structure/development. The extent of the yearly variation in depth to groundwater must be known to determine basement feasibility.

As noted in the PUD, "*The following lots may have shallow groundwater conditions: 12, 13, 32-35, 43-49, 75, 88-90, 93-95, 107-112, and 115-118, per the Soil, Geology and Geologic Hazard Addendum prepared by Entech Engineering, dated February 2, 2022. The developer is required to disclose this information to potential lot purchasers. Prior to construction these lots shall be further tested to determine the extent of the geohazard conditions, and the constraints that shall be required in construction (no basements, engineered foundation drainage systems, and any other special mitigation as determined by the engineer)*." **CGS recommends that mitigation measures for groundwater conditions be determined during the preliminary plan/PUD, not prior to construction**. **CGS recommends the county require groundwater monitoring/observation to verify that proposed floor levels are at least three feet above maximum anticipated groundwater levels and**

maintained year-round. This monitoring/observation program should be conducted immediately and/or before the installation of public infrastructure **to determine if basements are feasible, to design detention ponds, and understand the effect groundwater will have on public infrastructure**. This monitoring should include observations through fall, winter, and spring to be effective. It is outside the scope of CGS's review to determine whether the 3-ft minimum separation distance exists. If site grades cannot be raised to maintain the minimum separation distance and an area groundwater collection system (underdrain) is determined to be unworkable (or gravity discharge to a daylight outfall is not possible), **then full-depth basements should not be allowed, and a statement indicating "No Basements" be shown on the preliminary plan**.

Entech states on page 16, "*Subsurface drains may be necessary in some areas to prevent the intrusion of water below grade*," and "*Dewatering systems may be necessary in some areas where seepage and perched water occurs*." CGS agrees with Entech on page 11, "*In areas where high subsurface moisture conditions are anticipated periodically, a subsurface perimeter drain will be necessary to help prevent the intrusion of water into areas located below grade*." Individual foundation perimeter drains are needed around any below-grade (basement) space, **if determined to be feasible**, and may discharge to a positive outfall or connection to an underdrain system if constructed. Individual foundation perimeter drains are intended to handle small amounts of intermittent water and **should not be used to mitigate a persistent shallow groundwater condition**.

Note 28 of the Grading, Erosion, and Sediment Control should include Entech's February 2, 2022 addendum and October 18, 2021 report, or the most recent revisions.

Submitted 4/7/2022 by Amy Crandall, Engineering Geologist, Colorado Geological Survey