

E SE Section 32 and S SW Section 33, T12S, R65W, 6th P.M.
NW NW Section 4 and NE NE Section 5, T13S, R65W, 6th P.M.
38.958, -104.6822

Colorado Geological Survey review of Sterling Ranch Filing No. 2 (Phase 1) Final Plat SF2015 Resubmittal 2 (Amy Crandall, acrandall@mines.edu):

The available referral documents include a revised Soil, Geology, and Geologic Hazard Study, Copper Chase and Sterling Ranch Filing No. 2 (Entech Engineering, Job No. 191088, Revised March 18, 2021), a set of Grading & Erosion Control Plans (JR Engineering, April 15, 2021), a set of six Sterling Ranch Filing No. 2 Final Plat sheets (JR Engineering, May 24, 2021), and other documents.

As noted in our 3/10/2021 review, two of Entech's borings, TB-3 and TB-4, are located within the area of the 49 currently proposed residential lots. Groundwater was observed in TB-3 at three feet below the ground surface, and in TB-4 at two feet below the ground surface at the time of drilling, at the surface in both borings a few weeks later, and in TB-3 at three feet below the ground surface in February 2020. No water level observation was made in boring TB-4 in February 2020.

In response to CGS's 3/10/2021 review comments (italicized below), Entech has revised their Soil, Geology, and Geologic Hazard Study. We offer the following comments and recommendations:

1. Entech's water level data do not support their characterization of the site's shallow groundwater condition as "seasonal." Entech's Figure 7, plat note 26 on sheet 2, and sheet 7 of the plat should be corrected to identify the entire Sterling Ranch Filing No. 2 (Phase 1) site as a shallow groundwater area.

- The "seasonal" designation was removed in Entech's Figure 7 and their revised report. However, we recommend the entire Sterling Ranch Filing No. 2 (Phase 1) site is designated as a shallow groundwater area and updated on the final plat (note 26). Sheet 7 was not included in the updated final plat drawings (May 24, 2021).

2. Plat note 26 states, "In areas of high groundwater, all foundations shall incorporate an underground drainage system." Individual foundation perimeter drains are needed around any below-grade (basement) space determined to be feasible, and may discharge to an underdrain system, if constructed, but are intended to handle small amounts of intermittent, perched water and may NOT be used as sole mitigation of a persistent shallow groundwater condition such as exists on this site.

- Plat note 26 was revised to remove "In areas of high groundwater, all foundations...." and now states, "No basements are permitted in Sterling Ranch Filing No. 2 unless during the building permit process the more detailed lot-specific geology and soils studies determine that a basement is feasible." As noted on page 11 of Entech's revised report, "Where shallow groundwater is encountered, underslab drains or interceptor drains may be necessary." Also, "The suitability of the site for below-grade areas should be evaluated after additional investigation following site grading and storm sewer construction." In our experience, underdrain designs and the feasibility of basement levels should not be case by case, (i.e. not determined during lot-specific geology and soil studies) as the individual underdrains are typically tied to the storm sewer system or underdrain system that gravity discharges to a daylight outfall. **CGS recommends that underdrain systems and the feasibility of basements are determined and designed early in the design stage and noted on the plans.**

3. Based on Entech's water level observations, it is not clear that an underdrain system and interceptor drains will be effective at lowering water levels sufficiently to allow full-depth basement construction. CGS recommends that the County require the applicant's qualified consultant to verify that proposed mitigation will result in a separation distance of at least three feet between shallowest anticipated water levels and lowermost basement floor elevations, and that this

separation distance can be maintained year-round, based on project grading, interceptor drain and underdrain plans, and proposed basement floor elevations.

- **CGS continues to recommend the County require the applicant's qualified consultant to verify that the proposed mitigation will result in a separation distance of at least three feet between the shallowest anticipated groundwater levels and lowermost floor elevations and maintained year-round.** A groundwater monitoring/observation program is typically employed. This program should be conducted early in the design stage to determine if basements are feasible and/or if an underdrain system and interceptor drains could be employed for this site.

4. No drawings were included with the current referral documents showing an underdrain system. An underdrain system should be allowed ONLY if it can gravity discharge to a daylight outfall, or is connected to an existing underdrain system that gravity discharges to a daylight outfall.

- No drawings were included with the revised and current referral documents showing an underdrain system.

5. It remains unclear, based on the Grading & Erosion Control Plan (sheet 2, JR Engineering, 2/1/2021) that "much of the area is to be filled" (Entech, page 11). CGS recommends that the county require a cut and fill plan. It appears there will be up to 5 feet of fill in some areas, with similar cuts in other areas (e.g. Lots 9 and 10) but the grading plan is very difficult to interpret, and it appears that contour intervals may be inconsistent (2 feet for existing grades and 1 foot for proposed grades).

- A cut and fill plan (figure 4A) was included in the revised Entech report. As noted on page 11 of Entech's report, "high areas in the extreme northern and western portions are to be cut 1 to 4 feet, and low areas are to be filled. Fill depths up to 7 feet are proposed in the areas where shallow groundwater was encountered. Most of the proposed fill depths range from 2 to 4 feet." The proposed grading may not be sufficient to result in a separation distance of at least three feet between the shallowest anticipated water levels and lowermost basement floor elevations in some areas.

In summary, CGS recommends:

- Note 26 on the Final Plat is updated to include the entire Sterling Ranch Filing No. 2 (Phase 1) site as a shallow groundwater area.
- Underdrain systems and the feasibility of basements are determined and designed early in the design stage and noted on the plans.
- The County require the applicant's qualified consultant to verify that the proposed mitigation will result in a separation distance of at least three feet between the shallowest anticipated groundwater levels and lowermost floor elevations and maintained year-round.
- Entech's recommendations are incorporated in the project planning and design.