

December 8, 2021

Mr. Joe DeLuca
Crabtree Group, Inc.
325 D Street
Salida, CO 81201

Subject: Response to Geotechnical Review
Gunnison Rising Subdivision
Gunnison, Colorado
Project No. 21.6055

Dear Mr. DeLuca:

Huddleston-Berry Engineering & Testing, LLC (HBET) conducted a review of Cesare, Inc.'s report, "Geotechnical Study, Gunnison Rising Subdivision Phase I, Gunnison, Colorado", dated October 21, 2020. HBET provided its review comments in a letter dated November 22, 2021. This letter provides Cesare's responses to HBET's comments.

(1) HBET comment

1. *Section 10. Groundwater, Page 5* – This section of the report includes information regarding groundwater conditions observed in standpipe piezometers installed in several of the borings. In general, the piezometer data shows shallow groundwater during the irrigation season and deeper groundwater during the non-irrigation season. However, it is unclear in the report whether or not the site was actively being flood irrigated during the monitoring period. In addition, it is unclear when the Cemetery ditch was emptied.

If the site was actively irrigated during the monitoring period, it is likely that groundwater levels could drop significantly over time. However, since it is unclear when the Cemetery ditch was emptied, it is not possible to determine from the data whether or not the Cemetery ditch is leaking – which could adversely impact the site over time.

(1) Cesare's response

The site was actively being flood irrigated at the time of Cesare's study in July 2020 and ceased in August 2020, as stated in section **3. SITE CONDITIONS**. Borings B-1 to B-8 were completed in July 2020. Borings B-8 to B-15 were completed in September 2020 after flood irrigation ceased (see Section **7.1 EXPLORATORY BORINGS**).

(2) HBET comment

2. **Section 13.1 Spread Footings, Page 7** – This section of the report includes bearing capacity values for shallow foundation design. However, the report does not discuss whether or not structural fill should be used below foundations. In addition, the allowable bearing capacity values provided in the report are significantly higher than what HBET would recommend in areas where collapsible soils may be present.

On Page 1 of the report, Cesare recommends site-specific geotechnical studies for structures north of East College Avenue. However, based upon the limited foundation recommendations in the report, HBET recommends that site-specific geotechnical reports be completed for each structure in the subdivision.

(2) Cesare's response

The first paragraph in Section **13.1 SPREAD FOOTINGS**, Cesare states that "*Spread footings can be used on the clayey sands if the collapse potential is reduced to provide a risk of movement of less than 1 inch.*" This condition must be met to be able to use spread footing foundations. Less than 1 inch is a low risk of collapse and the bearing capacity of 2,500 psf should be appropriate for the soil remediation. Cesare's report is a subdivision-level report and the actual means of remediation and allowable bearing capacities should be determined based on site-specific studies. Cesare agrees that site specific geotechnical studies should be performed.

(3) HBET comment

3. **Section 21.1 Design Criteria, Page 14** – This section of the report includes pavement design criteria used by Cesare in developing the pavement section recommendations included in Section 21.3. In general, most of the criteria in Table 21.1 are consistent with the Standard of Practice for pavement design in Colorado. However, the 18 kip ESAL values included in the table are less than HBET would typically use for a subdivision of this size.

In general, for local, residential streets with truck traffic limited to school busses, trash trucks, and moving trucks, HBET typically uses an ESAL value of 80,000 to 100,000. For small local collector streets with more truck traffic, HBET typically uses an ESAL value of 200,000 to 300,000.

The Guideline for the *Design and Use of Asphalt Pavements for Colorado Roadways* by the Colorado Asphalt Pavement Association recommends even higher ESAL values. For residential streets, they recommend ESAL values of between 300,000 and 500,000. For minor collector streets, they recommend ESAL values of between 500,000 and 1,000,000.

HBET is not stating that Cesare's design ESAL values are absolutely inappropriate; we are simply stating that the values are lower than expected for this size of development.

(3) Cesare's response

Delivery trucks, garage trucks, school buses, and delivery trucks is the most significant loading to a

pavement system. Passenger vehicles are typically ignored in ESAL calculations as the load from one school bus is equivalent to about 13,000 passenger vehicles and one trash truck is equivalent to 17,500 passenger vehicles.

The ESAL values stated by HBET are typical values for larger cities and not applicable for rural communities. The ESAL estimates for Local and Collector roadways are shown in Table 1.

TABLE 1. ESAL Calculations

Roadway Type	Vehicle Type	Load factor (relative to 18-k axle load)	Quantity	ESAL per year
Collector	School bus	2.578	360 ⁽¹⁾	928
	Garbage truck	1.693	104 ⁽²⁾	176
	Delivery truck	0.617	730 ⁽³⁾	450
Total: 1,554				
Local	School bus	2.578	0 ⁽⁴⁾	0
	Garbage truck	1.693	104 ⁽²⁾	176
	Delivery truck	0.617	730 ⁽³⁾	450
Total: 626				

(1) 180 school days/year, 2 trips/day

(2) 2 per week

(3) 2 per day

(4) Assumes school buses use collector streets

Cesare's report indicates the design period is 20 years. The 20 year ESAL for Collector roadways are 31,080 (20 x 1,554). ESAL during construction is typically assumed to be 80, per residence. Each Collector roadway will typically service about 250 residences for a total construction ESAL of 20,000 resulting in a total ESAL over 20 years of 51,080. Cesare used 150,000 in its design, nearly three times the calculated ESAL. The 20 year ESAL for a Local roadway is 12,520 (20 x 626). Each Local roadway will typically service about 16 residences per block for a total construction ESAL of 1,280, resulting in a total ESAL over 20 years of 13,800. Cesare used 60,000 in its design, over four times the calculated ESAL.

Please contact Cesare with any questions or comments regarding this information.

Sincerely,
CESARE, INC.



Darin R. Duran, P.E.
Principal, Manager - Salida and Crested Butte

DRD/ksm