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July 5, 2022

Mr. John Cattles, Assistant County Manager for Operations and Sustainability
Gunnison County
200 E. Virginia Avenue
Gunnison, Colorado 81230

Subject: Whetstone Development – Town of Crested Butte Preliminary Utility Connection Capacity Assessment

Dear Mr. Cattles:

Gunnison County (County) is pursuing an affordable housing development located approximately 2 miles outside of the Town of Crested Butte's (Town) water and wastewater service area. The Whetstone Development (Development) will be a high density, multi-family development near the intersection of Brush Creek Road and Highway 135 requiring water and sewer service. This letter documents the available projections of population, wastewater flow and load, and water demand, and provides a preliminary assessment of the available capacity of the Town's water and wastewater utilities to serve the Development. A conceptual evaluation of the distribution and collection system infrastructure alignments to connect to the Town's system is also included. This assessment is preliminary in nature and therefore, the necessary next steps to confirm and better understand the implications of these connections are summarized in the final section of this letter.

Town Service Area Population Projections

As part of the Town's Wastewater Treatment Plant (WWTP) Improvements Project, population projections were developed for the current service area through 2040. To complete these projections, the Town provided information regarding development of all available, empty lots within this planning horizon. It is therefore possible that the current projections may represent the existing service area build out condition. However, this assessment could be low since it did not account for redevelopment of existing properties that would increase population density. In addition to the residential population for the service area, the projections included seasonal occupancy assumptions to account for the variability associated with tourism. The rated capacity of the WWTP (i.e., the Colorado Department of Public Health and Environment [CDPHE] permitted hydraulic and organic loading) is based on the average daily maximum month flow (ADMMF) and average daily maximum month loading (ADMML) conditions; therefore, only the maximum month population scenario was projected.

Additional details pertaining to these projections are available in *Project Memorandum (PM) 1 – Preliminary Design Conditions* (Carollo, December 2021), which can be provided to Gunnison County by the Town upon request.

These projections result in a total service area population of 4,905 (full-time residential population of 2,008; second home population of 782; and a short-term rental and hotel population of 2,115) in 2040 during the maximum month population scenario (which historically occurs in July). Population projections through 2040 are shown in Figure 1.

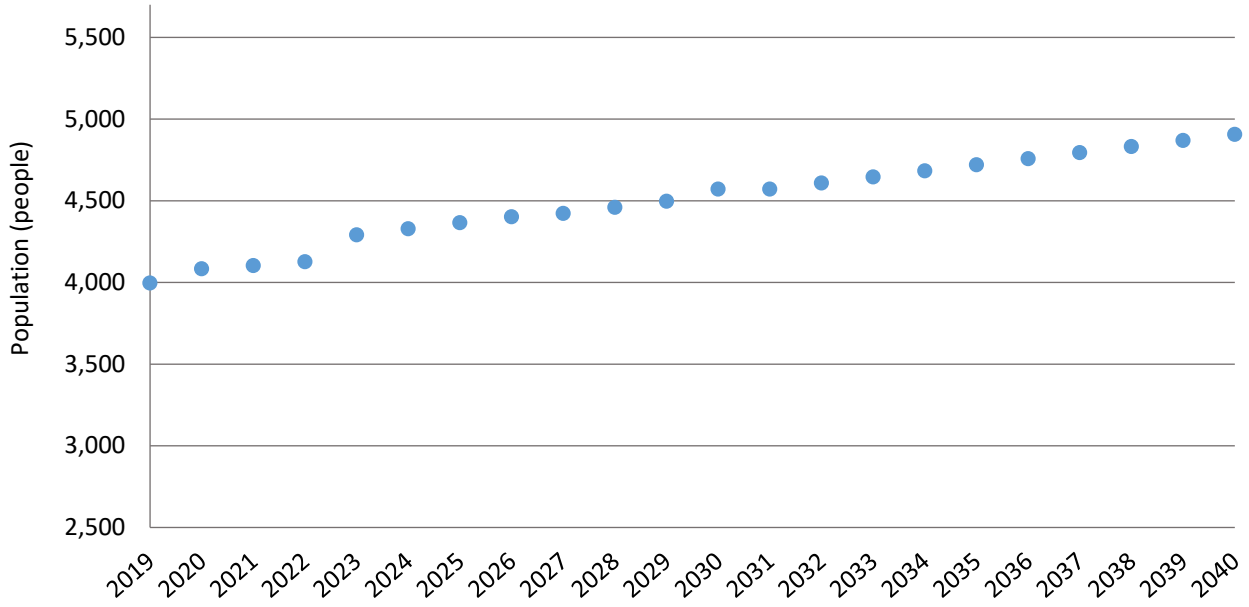


Figure 1 Maximum Month Occupancy Scenario Projected Service Area Population

As part of the 2018 Water Treatment Plant (WTP) Improvements Project, population and demand projections from a previous water supply study conducted by Wright Water Engineers in 2015 were used as future water demand in the Town's service area. Upon comparing the projections associated with the peak day water demand scenario (typically occurring in July) to the updated projections for the WWTP, the population projections from the WTP project were found to be lower than those developed for the WWTP Project. Projections for the WWTP Project are used for both facilities, providing a consistent basis of planning and reflecting the more recent and significant efforts to project population in the WWTP project.

Wastewater Projections and Available Treatment Capacity

The Town's 2019 population scenario was coupled with historical influent wastewater flow and organic loading (5-day biological oxygen demand [BOD_5]) to the WWTP to develop per capita flow and loading parameters. Based on that analysis, the unit ADMMF and ADMML values for the Town's service area are 150 gallons per capita per day (gpcd) and 0.23 pounds per day BOD_5 (ppd BOD_5) per capita, respectively. Per capita flow values were applied to projected populations to develop the influent projections for the existing service area Gunnison County provided flow and loading assumptions for the proposed Development of 75,000 gallons per day (gpd) and 281 ppd BOD_5 (March 10, 2022).

The Town experiences a significant increase in flow (0.3 to 0.5 million gallons per day [mgd]) to the WWTP due to existing residential groundwater sump pumps within the service area that discharge into the collection system. These additional flows were documented and attributed to groundwater sump pumps as part of the 2020 Inflow and Infiltration Study conducted by JVA Engineers (JVA). The Town is in the process of developing a sump pump disconnection program (Disconnection Program) which will greatly reduce the influent flows to the WWTP during wet weather years. Figure 2 shows the projected flows through 2040 for the existing service area and the addition of the Development flows, including the groundwater sump pump contribution. Without implementation of the Disconnection Program, the projected ADMMF for the existing service area in 2040 is 0.74 mgd. Including the Development, the 2040 ADMMF projection is 0.81 mgd.

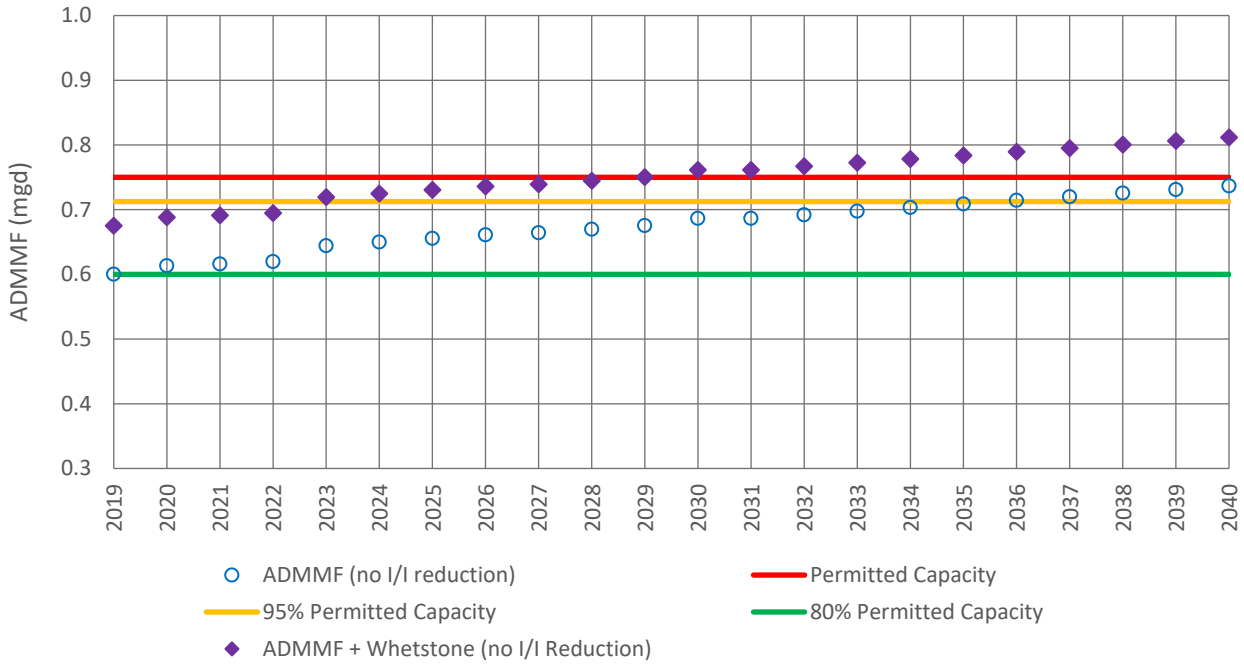


Figure 2 Projected WWTP Influent Flow without Disconnection Program Reduction through 2040

Figure 3 shows the shows the projected WWTP influent flows through 2040 for the service area with and without the addition of the Development flows, assuming successful implementation of the Disconnection Program. With the successful implementation of the Disconnection Program, the projected ADMMF for the existing service area in 2040 is 0.44 mgd. With the Development flows included, the 2040 projected flow increases to 0.51 mgd.

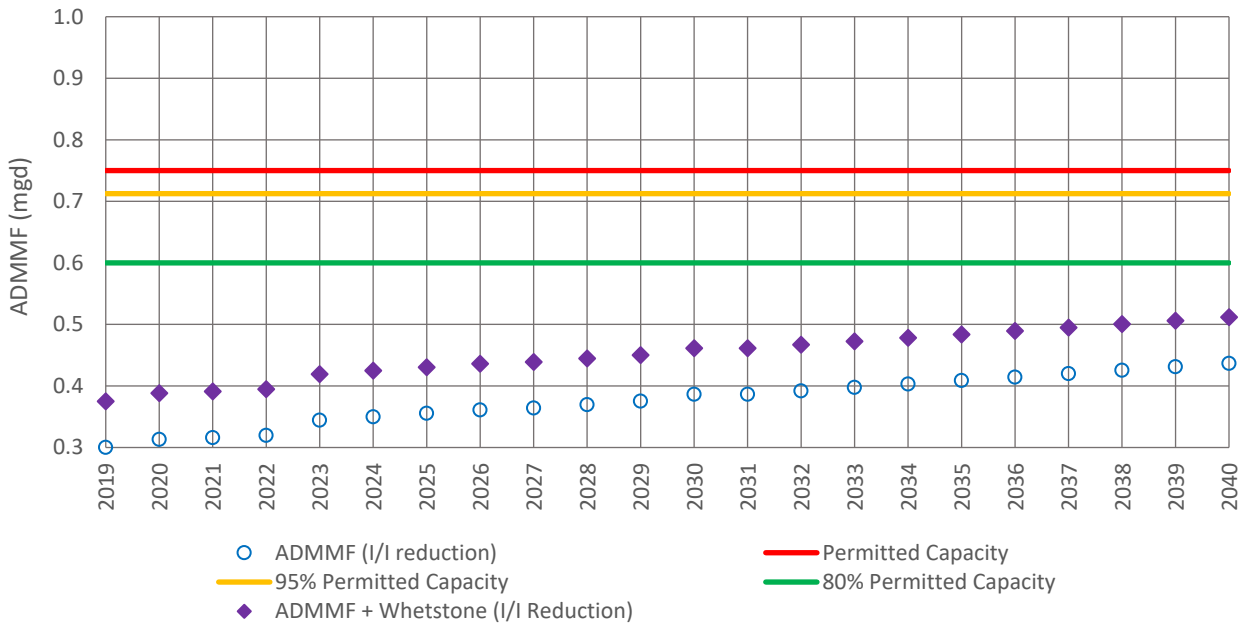


Figure 3 Projected WWTP Influent Flow with Disconnection Program through 2040

The projected ADMML in 2040 for BOD_5 conditions were developed for BOD_5 and are shown in Figure 4. The projected ADMMF for the existing service area in 2040 is 1,139 ppd BOD_5. Including the additional organic load from the Development, the 2040 ADMML projection increases to 1,420 ppd.

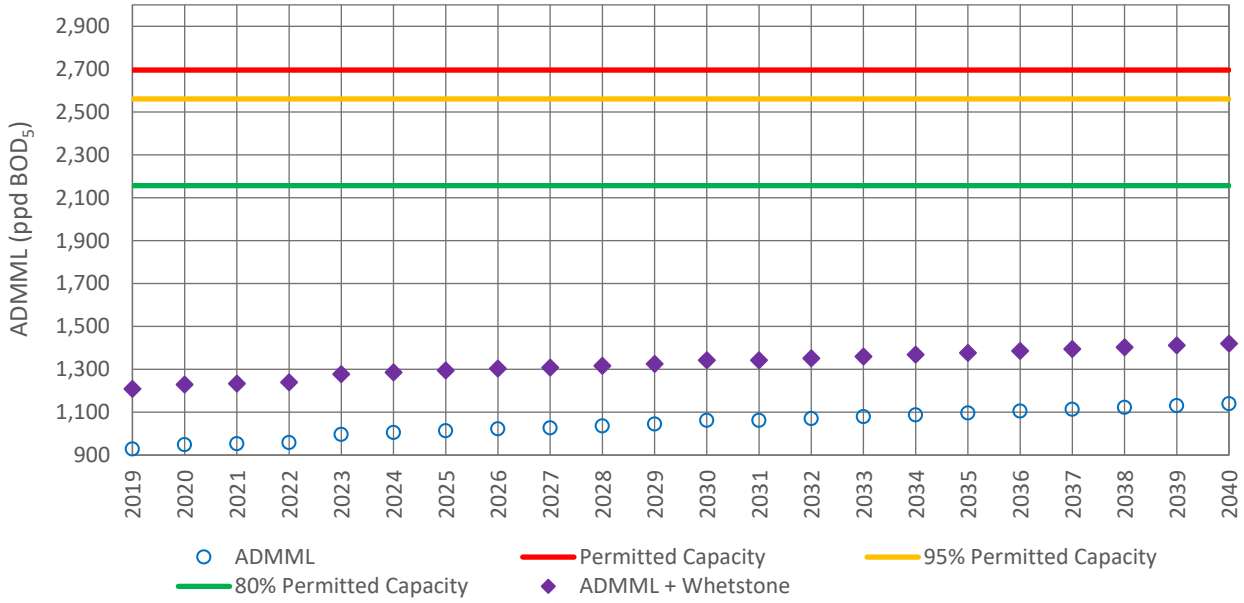


Figure 4 Projected WWTP Influent Load through 2040

Three types of wastewater treatment capacity were conceptually considered as part of this assessment: permitted capacity, treatment capacity to meet future regulatory limits, and solid handling capacity. These findings are summarized in the subsections below.

Permitted Capacity

Per CDPHE regulations, domestic wastewater treatment works are required to 1) initiate engineering and financial planning for expansion whenever the ADMMF reaches 80 percent of design capacity, and 2) commence construction of such expansion whenever ADMMF reaches 95 percent of the design capacity. Note that without the Disconnection Program and excluding the Development flow contribution, the WWTP is already at 80 percent of its hydraulic capacity and is expected to reach 95 percent of permitted capacity by 2035 and 100 percent of permitted capacity by 2040. When adding the total flows from the ultimate buildout capacity of the Development, during a wet weather year, the WWTP could exceed the permitted hydraulic capacity as early as 2029 and reach the 95 percent permitted capacity (requiring construction for expansion) as early as 2023. Essentially, without the Disconnection Program and by adding in projected flow from the Development, the Town would need to initiate an immediate hydraulic expansion of the WWTP to reduce the risk of a permit violation and capacity exceedance.

Assuming successful implementation of the Disconnection Program, the WWTP will not reach 80 percent, 95 percent, or 100 percent of its permitted capacity until sometime after 2040, even considering the additional flow from the Development, as shown in Figure 3. The Town is working to achieve a reduction in inflow and infiltration (contributed by the sump pumps) to below the CDPHE threshold of 120 gpcd. For the purposes of this analysis, we have assumed that a successful reduction of sump pump contribution accounts for a minimum of 0.3 mgd influent flow to the WWTP during wet weather years. The successful implementation of this program is essential for the Town to accommodate any additional flow contributions to avoid triggering a significant WWTP expansion project. To provide reliable Disconnection Program implementation and monitoring, one additional full-time employee is anticipated be necessary to administer the program.

If the Disconnection Program does not reduce the influent flow to the WWTP during wet weather years by a minimum of 0.3 mgd during the average day maximum month condition, a WWTP expansion to accommodate the additional hydraulic capacity would be required. One possibility to accommodate the additional flow would be the design and construction of an equalization basin. This alternative and other options should be evaluated further during a preliminary design or planning phase to determine the best expansion strategy for the Town's facility.

The WWTP has ample organic loading capacity available, and the added organic loading from the Development Program is not expected to trigger WWTP expansion prior to 2040 due to the organic permit limitations as shown in Figure 4.

Treatment Capacity

The capacity of the existing WWTP to meet future discharge permit limits was not thoroughly assessed in the WWTP Improvements Project. A preliminary desktop assessment was completed as part of *PM 2 – Secondary Treatment Capacity Review and Future Nutrient Removal Recommendation* (Carollo, December 2021);

however, Carollo recommended a dynamic process modeling effort to fully understand the existing WWTP's ability to meet future nutrient discharge limits, considering the highly variable seasonal fluctuations experienced at the WWTP. This effort is outside the scope of this preliminary analysis but would be prudent prior to formalizing a service agreement. Such an analysis would better characterize the long-term treatment implications associated with the additional hydraulic, organic, and nutrient loading associated with the Development. It is anticipated that this evaluation will be completed by the applicant during the Development review process.

Solids Processing Capacity

The Town produces waste activated sludge (WAS) in the WWTP aeration basins and receives WAS from Mount Crested Butte Water and Sanitation District (MCBWSD). WAS from both facilities is stored, thickened, dewatered, and composted on-site. Both the Town and MCBWSD WWTPs currently have available capacity relative to their permitted organic loading capacity. Using population projections from each community, the projected WAS flow and load to the Town's solids processing facility (through the 2040 planning horizon) and the permitted capacity were evaluated as part of the WWTP Improvements Project. The addition of the projected 281 ppd BOD_5 from the Development would impact the solids process but would not exceed the solids processing capabilities included in the improvements that are scheduled to be installed in 2023.

The additional organic loading from the Development will increase the solids processing operational requirements more quickly than otherwise anticipated. While the current project at the WWTP will increase its solids processing capacity, there is no increase in compost capacity planned as part of this project. Increasing the solids loading at the WWTP will lead to additional solids disposal at landfill sites due to the compost capacity limitations, therefore increasing the Town's annual operation and maintenance (O&M) costs. At a minimum, one additional full time WWTP operations staff member may be required to support more frequent solids processing operation. Detailed analysis of these ongoing operational costs are recommended as a next step to understanding the implications of connecting the Development.

Water Demand Projections and Available Treatment Capacity

The existing WTP was expanded in 2018 to increase the facility's firm treatment capacity (i.e., capacity with the largest treatment unit out of service) to 1.25 mgd (868 gallons per minute [gpm]), which provided redundancy and reliability of the WTP. This project expanded the overall treatment capacity at the facility to 1.67 mgd (1,200 gpm). From the *WTP Improvements Project Needs Assessment* (JVA, May 2018), the service area peak day summer water demand in 2018 was 0.96 mgd to serve a total population of 2,912, which equates to 330 gpcd. The 2018 per capita peak day water use value was applied to the revised population projections developed for the WWTP Improvements Project in 2021 to revise the Town's peak day summer water demand projections through 2040. The peak day per capita demand conditions assumption of 330 gpcd should be verified as part of a future assessment to confirm this value is appropriate. During the 2018 assessment, the water demand evaluation included potable water used for irrigation of the Town's park properties. The use of potable water for this application has been transitioned to non-potable/irrigation water; therefore, the per capita demand during the peak day scenario has likely decreased.

The Development will not use potable water for irrigation and preliminary average hourly and peak hourly water use values were provided to complete this assessment. Per email correspondence with JVA on February 18, 2022, the Development's average hourly water demand is 50 gpm and its peak hourly water demand is 300 gpm. For the peak day condition, it was assumed that the average hourly rate is used for 17 hours of a 24-hour period, the peak hourly rate was used for 2 hours of a 24-hour period, and there is minimal to no water use during the remaining 5 hours to calculate a peak day demand of 87,000 gpd.

Figure 5 presents the projected peak day summer water demand with and without the Development based on the population projections presented in the previous section through 2040. An evaluation of the Town's peak day water production data since 2018 was not conducted as part of this preliminary assessment.

Figure 5 demonstrates that without the additional Development demand, the existing WTP has already exceeded its firm capacity as of 2019 (this value has not been verified with water production or water use records) and will increase steadily to a peak day demand of 1.62 mgd in 2040 without the Development. Operating the WTP beyond its firm capacity presents risks with respect to the Town's ability to reliably meet the community's full water needs, unless treated water storage in the distribution can buffer peak day demands against lower WTP production rates.

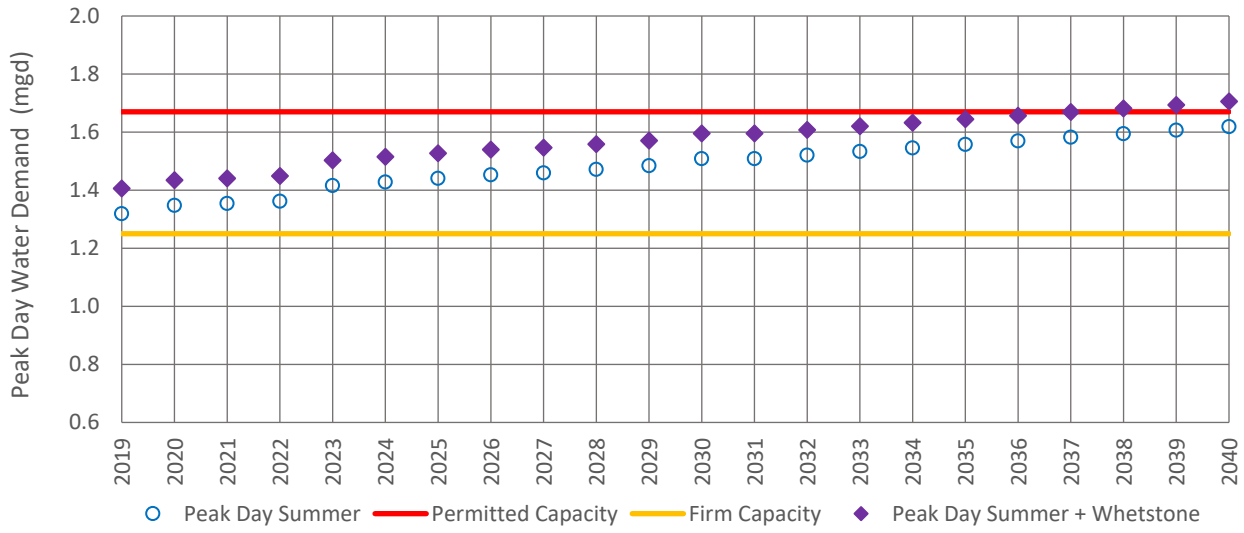


Figure 5 Projected Peak Day Potable Water Demand through 2040

With the inclusion of the Development demands, the WTP capacity could be exceeded during the peak day condition by 2036. A WTP expansion project to accommodate the additional demand may or may not be necessary to accommodate this scenario. An assessment of finished water storage volumes, treatment capacity, and fire flow capabilities within the Town service area is recommended to more thoroughly assess strategies to serve the Development while minimizing risk to the existing service area. Additionally, the Town could consider implementation of a robust water conservation program, which could decrease the peak day demand conditions within the existing service area. Similar to the Disconnection Program, this would require additional staff support for program administration.

Distribution and Collection System Capacity and Connections

Utility Corridor

Two utility corridor routing options have been identified for connecting the Development to the Town's collection and distribution systems, as shown in Figure 6. There are several unknowns associated with each option, which would further inform the selection of a preferred approach. To minimize depth of bury for the collection system and reduce risks associated with elevation challenges and gravity flow infrastructure, a lift station at the Development property is assumed coupled with a pressurized force main to the Town's collection system connection point. A drawback to this strategy is the ability to connect future developments adjacent to the force main to this infrastructure. However, connection of additional developments in the future may not be feasible due to the potential treatment limitations at the WWTP and WTP. If the treatment capacity issues are addressed, one alternative could be to maintain the system as a force main for a portion of the corridor and then transition to gravity flow to accommodate future connections. Details on whether the collection system infrastructure along the utility corridor would be designed and constructed as a force main for the entire length or if this strategy is necessary based on existing elevation and required bury depth information, should be further developed during a more detailed subsequent evaluation.

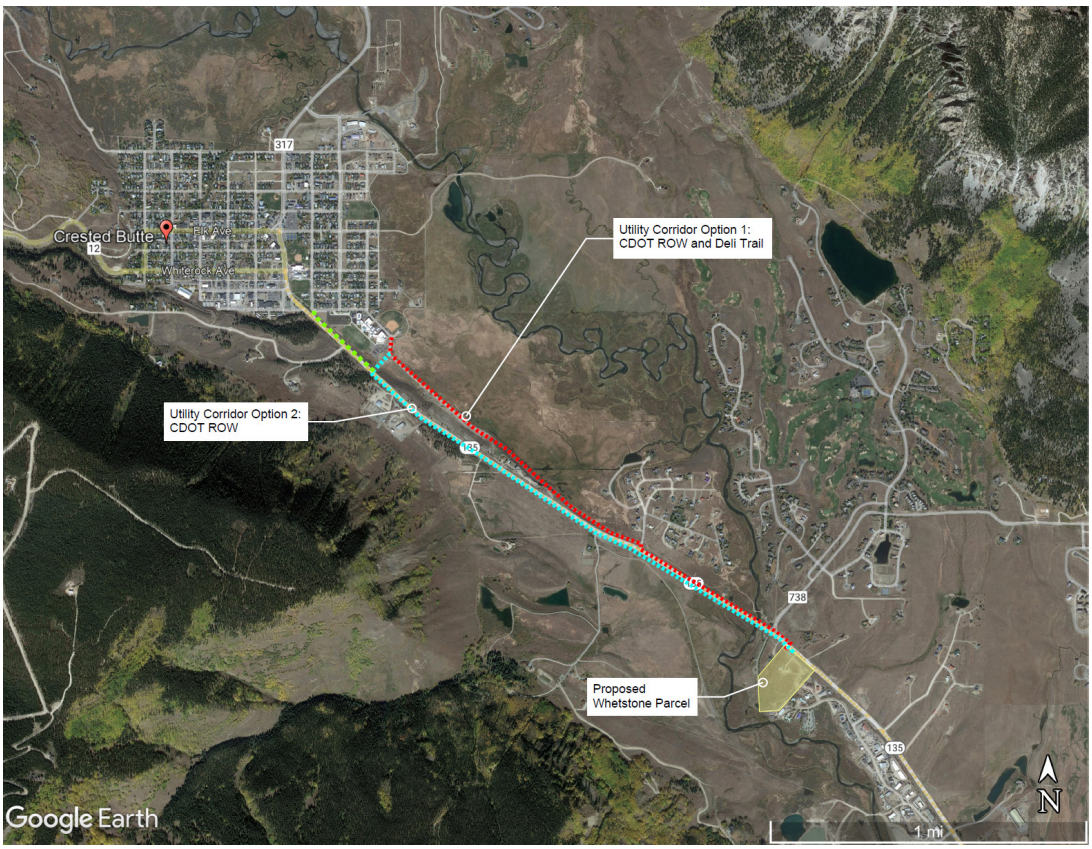


Figure 6 Utility Corridor Options

Trenchless construction could be considered for either corridor option if the subsurface conditions are suitable and utility conflicts are minimal. These field evaluations are typically conducted during preliminary design development.

Advantages and disadvantages for each option are summarized in Table 1.

Table 1 Utility Corridor Alternatives Advantage/Disadvantage Summary

	Advantages	Disadvantages
Option 1: CDOT ROW and Deli Trail	• No impact to Highway (Hwy.) 135 traffic during construction along the trail. • Easier connection to future development on the north side of Hwy. 135. • Lower likelihood of utility conflicts.	• Would likely require removal and replacement of entire trail during construction. • Unknown right-of-way (ROW) or easement requirements along trail. Long-term maintenance easement would be required. • More challenging to repair infrastructure in the event of future maintenance issues (particularly during winter months). • Two roadway crossings. • Required CDOT coordination for installation along Hwy. 135 ROW.
Option 2: CDOT ROW	• Access to pipe in the event of an emergency may be easier than Option 1. • Subsurface conditions along CDOT ROW may be more predictable than along trail.	• Impacts to Hwy. 135 traffic and required intermittent lane shutdowns during construction. • Additional utility conflicts within the ROW are likely. • Three roadway crossings. • Required CDOT coordination for installation along ROW. • More difficult connection to future developments on the north side of Hwy. 135 in the future.

Notes:
CDOT Colorado Department of Transportation

Collection System Connection Alternatives

The Town provided three alternative connection locations within the service area for the wastewater from the Development. These are shown in Figure 7 and a summary of each alternative is provided in Table 2. Each of the three connection locations would convey flow to the 8th Avenue collection system main. All pipelines are indicated as 8-inch diameter, excluding the 8th Avenue collection system main which is 12-inch diameter.

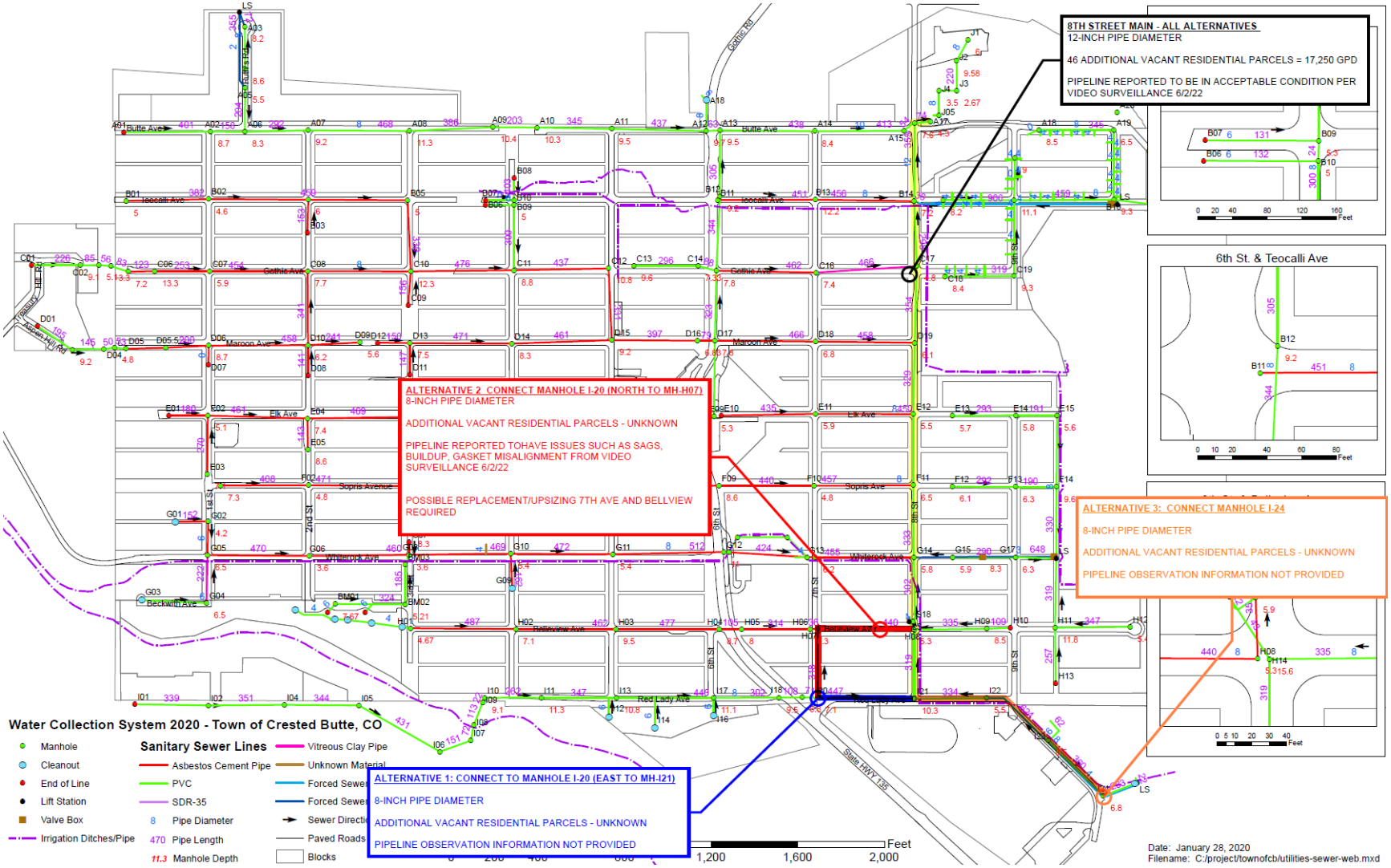


Figure 7 Collection System Connection Alternatives

Table 2 Collection System Connection Alternatives

Alternative	Utility Corridor	Pipe	Connection Manhole	Future Service Area Connections	Future Service Area Flow (gpd)
Alternative 1	Option 1	8-inch PVC	I-20 East to MH I-21	Unknown	Unknown
Alternative 2	Option 2	8-inch PVC	I-20 North to MH H-07	Unknown	Unknown
Alternative 3	Option 1	8-inch PVC	I-24	Unknown	Unknown
8th Avenue Main (downstream of all alternatives)	Either	12-inch PVC		46	17,250 gpd

Notes:
PVC polyvinyl chloride

To fully understand the capacity of the collection system infrastructure, invert elevations of each manhole are required to calculate the available hydraulic capacity in a pipeline segment (between two manholes). The Town does not have existing record drawings for these portions of the collection system to evaluate the inverts and available existing capacity. As part of a future assessment, a field survey of the manhole inverts along each alternative is necessary to fully understand any existing the capacity limitations associated with including the additional Development flows. Hydraulic modeling of the proposed connection system pipelines is recommended to confirm capacity and contributions from the existing service area.

The Town reported that there are 46 vacant residential lots along the 8th Avenue collection system main. Based on the residential population assumptions, this equates to a total future flow increase in the 8th Avenue main of 17,250 gpd (375 gpd/house, assuming 2.5 people per house and 150 gpcd). These additional flows need to be included in the future capacity assessment once the field survey information for the manhole inverts is available.

The Town reviewed inspection videos of the proposed alternative alignments and noted that the 7th Avenue and Bellview Avenue collection mains showed pipe sags, gasket displacement, and build-up which may require replacement and/or repair if Alternative 2 is selected. Based on this information, if Alternatives 1 and 3 are confirmed to have suitable capacity to accommodate the future flows and inspection videos indicate minimal existing replacement and/or repair concerns, these alternatives could be prioritized for evaluation. If both alternatives have adequate capacity, the preferred utility corridor solution will drive the selection of the connection alternative.

Distribution System Connection Alternatives

The Town provided three alternative connection locations to the distribution system as shown in Figure 8.

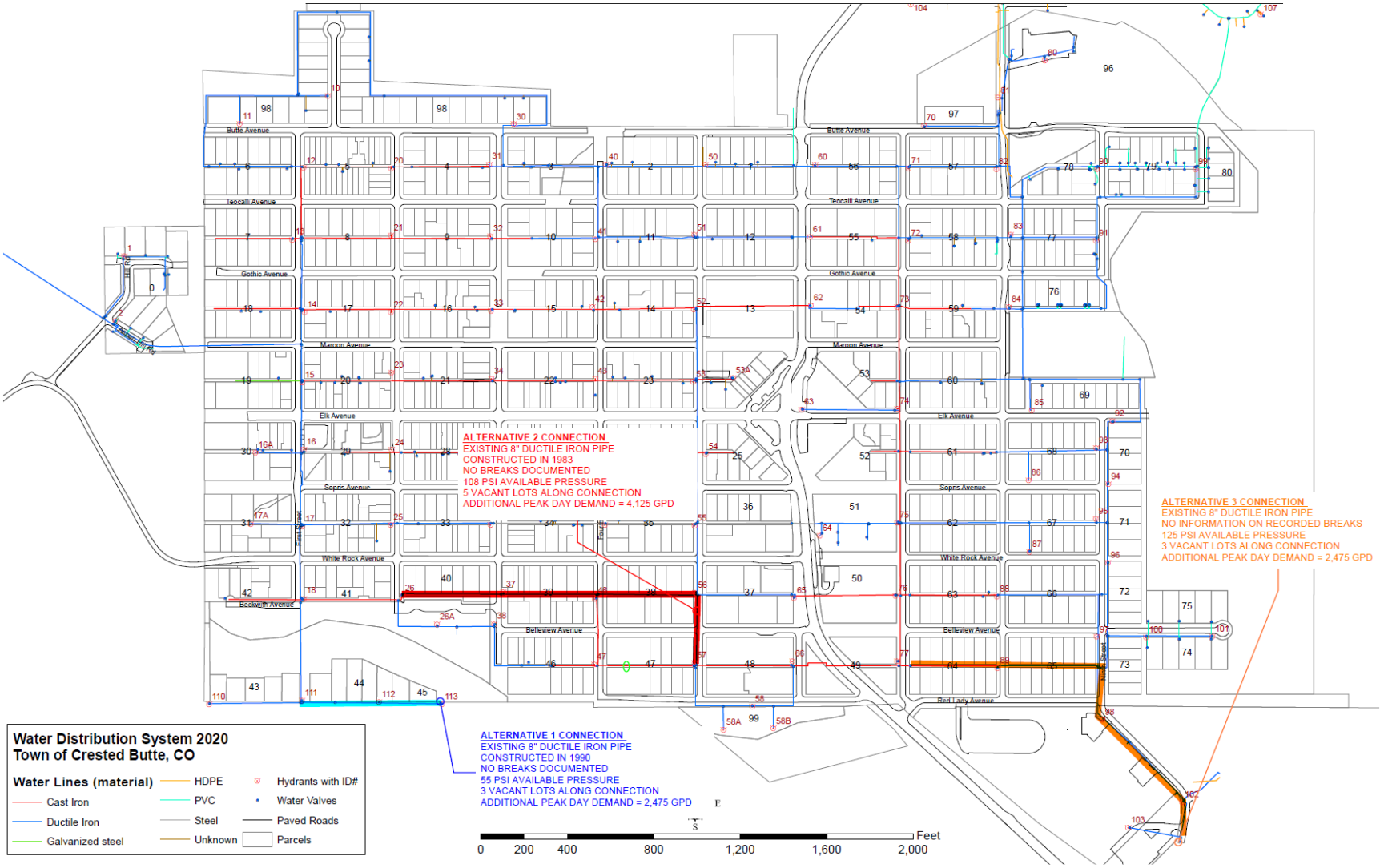


Figure 8 Water Distribution System Connection Alternatives

A summary of the alternatives is provided in the Table 3.

Table 3 Distribution System Connection Alternatives

Alternative	Utility Corridor	Existing Pipe	Pressure at Connection	Future Service Area Connections	Future Peak Service Area Flow (gpd)(1)
Alternative 1	Option 1	8-inch DIP	55 psi	3	2,475
Alternative 2	Option 2	8-inch DIP	108 psi	5	4,125
Alternative 3	Option 1	8-inch DIP	125 psi	3	2,475

Notes:
(1) Future peak day demand for the additional existing service area contributions to the distribution system main were calculated using residential lot assumptions since commercial and/or industrial use per lot has not been developed. This assumption should be confirmed during future design efforts.
DIP ductile iron pipe
psi pounds per square inch

Based on the information provided, Alternatives 2 and 3 provide the most suitable solutions for connecting to a future 8-inch water main to serve the Development due to the available pressure and flow at those locations. Alternative 1 does have one distinct advantage in that it ties in with the 1st Street distribution main, which is more central to the distribution system. However, the easement/ROW for the Journey's End property would need to be used for construction and maintenance. This property is located within Gunnison County, so additional information would be required to understand the easement/ROW limitations for this location. Additionally, at the Development property an onsite booster pump and chlorination system may be required to meet the minimum pressures and chlorine residual for daily use and to meet property fire flow requirements.

Based on the preliminary information provided, Alternative 3 is slightly more favorable since it has a higher available pressure and fewer future connections. However, depending on which utility corridor is selected, either Alternative 2 or 3 could be viable.

Fire Flow

The Town does not have an existing, calibrated distribution system hydraulic model. Therefore, it is not feasible to assess the impacts of the proposed Development connection on meeting fire flows in the existing service area. The Development fire flow requirements may need to be met through dedicated fire pumps and onsite storage for fire suppression, as it may not be feasible to supply the anticipated 2,000 gpm fire flow demand for 2 hours from the Town's distribution system. It would be prudent to develop a distribution system hydraulic model during subsequent phases of this investigation to better understand the available fire flow for the existing service area and the impact from the proposed connection.

Next Steps and Considerations

Based on this conceptual assessment, additional recommendations for a subsequent phase of the capacity assessment have been developed to confirm the viability and further detail the impacts of connecting the Development to the Town's water and wastewater systems. The recommendations include additional

assessments to understand the impacts of connecting the proposed system, responsibility for operation and maintenance of system components, capital costs associated with the proposed connections and possible facility expansion or storage needs, and long-term operations and maintenance costs (e.g., additional staff requirements to support the near-term additional demands on the existing system, power and chemical costs, etc.). These recommendations are summarized in Table 4.

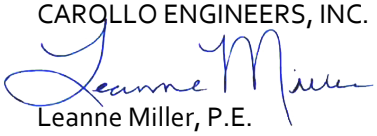
Table 4 Summary of Recommendations and Next Steps for Detailed Capacity Assessment

Category	Recommendation
General Considerations	• Define legal ownership and operation and maintenance responsibilities associated with the force main, distribution system pipeline, property chlorination system, etc. • For all alternatives and utility corridors, assess easement and ROW requirements, assess ongoing maintenance easement access capabilities. • Evaluate onsite reuse options for the Whetstone property to understand if wastewater flows and water demands can be further reduced from the proposed site. A wastewater thermal energy recovery system could also be evaluated for the proposed development. Carollo is currently working on this strategy with the City of Boulder for new multifamily developments to help the existing wastewater treatment facility meet its anticipated effluent discharge temperature limits. This strategy would need to be evaluated to consider minimum winter temperatures and how removing heat from the wastewater at the property site could impact process operations at the WWTP.
Wastewater Treatment	• The successful implementation of the sump pump Disconnection Program is critical for avoiding or deferring/reducing WWTP expansion needs. It is likely that additional staff resources would be required for the Town to implement a successful program. • If the sump pump disconnection program does not reduce influent flows to the WWTP, a WWTP expansion project to accommodate the future hydraulic capacity would be required. • Conduct dynamic biological process modeling for the WWTP to fully understand the existing facility's ability to achieve future nutrient discharge limits, considering the seasonal fluctuations experienced in the WWTP's influent and process performance. • Increasing the solids at the facility will lead to additional solids disposal at landfill sites, therefore will increase the Town's O&M costs. An additional WWTP operations staff member would also likely be needed to support more frequent solids processing operations. Detailed analysis of these costs should be conducted to characterize the implications of this connection.

Category	Recommendation
Water Treatment	• Verify the peak day per capita demand condition assumption of 330 gpcd from the 2018 WTP Project considering the reduction in park irrigation which has now transitioned to non-potable water. • Assess finished water storage volumes, treatment capacity, and fire flow capabilities within the Town service area to more thoroughly assess strategies to serve the Development while minimizing risk to the existing service area. • Evaluate a water conservation program for the Town to understand if a successful water conservation program could reduce peak water demands within the service area. An additional staff member would likely be required for the Town to administer the program.
Collection System	• Field investigations to confirm collection system manhole invert elevations to understand capacity of the existing collection system pipeline alternatives. • Hydraulic modeling of the proposed connection system pipelines is recommended to confirm capacity and contributions from the existing service area. • Include future vacant lot flows contributing to the collection main as part of the capacity assessment.
Distribution System	• Confirm distribution system pipeline diameter size. • Assess requirements for development property booster pump, fire flow, and chlorination system. • Develop a distribution system hydraulic model to better understand the available fire flow for the existing service area and the impact from the proposed connection.
Utility Corridor	• Assess easement and ROW implications for each alternative. • Model collection and distribution system pipelines along corridor to understand bury depth, complexity, accessibility, and costs. • Conduct geotechnical investigations to understand if trenchless construction is suitable for either option. • Develop understanding of whether the collection system infrastructure along the utility corridor needs to be a force main for the entire length or if this can transition to a gravity sewer main.

We appreciate the opportunity to support this evaluation. If you have any questions, please reach out to me directly via email (lmiller@carollo.com) or mobile (720) 878-8465.

Sincerely,
CAROLLO ENGINEERS, INC.



Leanne Miller, P.E.
Senior Engineer / Associate

cc: Shea Earley, Town of Crested Butte,
Public Works Director