PROJECT MEMORANDUM

TERRY RANCH GROUNDWATER TREATMENT PEER REVIEW

Date: February 15, 2021
Project No.: 12186A00

City of Greeley

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Subject:	Treatment Concept Design Technical Memorandum – Peer Review Findings

Background

Carollo Engineers (Carollo) performed a technical peer review of engineering documents prepared by Brown and Caldwell (B&C) for the conceptual design of the Terry Ranch Groundwater treatment system for the City of Greeley (City). This project memorandum is a summary of the recommendations and key findings identified during Carollo's review of the Treatment Concept Design (TCD) Technical Memorandum.

Project Recommendations

Based on the review of the material provided, the treatment of the Terry Ranch groundwater, as described in the B&C documents, is a viable approach as a potable water supply for the City of Greeley.

Carollo recommends additional pilot testing be conducted to further optimize or improve the efficiency of the proposed treatment approach as well as to understand the long-term operational considerations associated with this process.

Carollo also recommends conducting a comprehensive corrosion control study and disinfection byproduct formation study to evaluate the blending of the treated Terry Ranch groundwater supply with the current surface water supplies from Bellvue and Boyd Lake water treatment plants.

Treatment Process Considerations

Ion Exchange

The ion exchange (IX) vessels will operate in an up-flow, sub-fluidized configuration. Biofouling within the vessels should be carefully considered due to the upstream aeration process and high bed volumes. Water Remediation Technologies (WRT) has been part of the TCD and pilot study with B&C. WRT has suggested peracetic acid (PAA) could be used to control potential biological growth/fouling in the vessels. This should be a component of the additional pilot testing.

Equalization Tank

Based on previous project experience, Carollo has observed that radium may accumulate on the sand, which could lead to elevated radium concentrations in the equalization tank (and also in pipeline from wells to the treatment plant). Consider the potential for disposal of the sand as radioactive waste.

System Capacity and Phasing

The project phasing was not defined in the TCD; however, B&C has clarified that initial project elements will consist of drilling wells and installing the pipeline between Terry Ranch and the City's distribution system. Treatment is not expected to be constructed until 2030 or later.

Alternatives Treatment

Packed tower aeration was considered in Table 10 of the TCD as an alternative to aerating the equalization tank; however, it was not selected. This approach would require much less air (approximately 10 times less horsepower) than the diffused bubble system and would have the additional benefit of stripping out free carbon dioxide, which could further improve corrosion characteristics of the finished water. Consider building the packed tower aeration on top of the equalization tank. There is also a question about raw water supply to industrial customers, which was shown prior to radon removal.

An alternative consideration for implementing reverse osmosis (RO) would be to treat the well water with RO and then treat the brine through the same IX resin. The treated brine (downstream of IX) could be re-introduced into the finished water since radionuclides will be removed and other water quality parameters would likely not be a concern.

Supplemental Evaluations

Carollo has identified future studies to be conducted in order to evaluate treatment considerations. These items include:

1. Additional pilot testing (approximately 6 to 12 months) will provide additional water quality and treatability data to better characterize potential variability in groundwater quality, treatment efficacy, and considerations for long term treatment and maintenance (e.g., fouling).
2. Distribution system analyses based on more extensive water quality data as well as additional corrosion control testing (pipe loop or coupon testing) and disinfection byproduct formation testing. A full corrosion control study has not been conducted but should be conducted in conjunction with the long-term pilot system operation, as it will be required by the Colorado Department of Public Health and Environment (CDPHE).