COLLEGE OF ENGINEERING

Chemical, Biological, and Environmental Engineering

PEAK Consulting

Preliminary Design of Greensand Filtration System for Removal of Iron, Manganese, and Hydrogen Sulfide

By Phoebe Wu, Emerson Cole, Alexander Dyall, and Kayla Gacosta

Background

The Crestop Well currently produces water with excessive iron, manganese, and hydrogen sulfide, which must be removed by a new treatment plant.

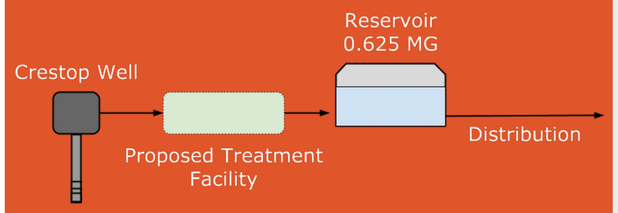

Diagram of current Crestop Well distribution system with the proposed treatment facility.

Objectives

The treatment system meets the following water quality standards while also abiding with local regulations and permits.

• Iron • Manganese • Hydrogen Sulfide	• 0.010 – 0.120 mg/L • 0.046 – 0.060 mg/L • 0.100 – 0.300 mg/L
• pH • Temperature • Alkalinity	• 7.5 – 8.6 • 11.9 – 14.3 °C • 112 – 114 mg/L as $CaCO_3$
• Residual Free Chlorine	• 0.5 – 1.0 mg/L

Methods

- 13 alternatives were reviewed as potential treatment systems
- Top two treatment technologies were evaluated.
- The system's treatment efficiency, cost, longevity, and environmental impact were analyzed.

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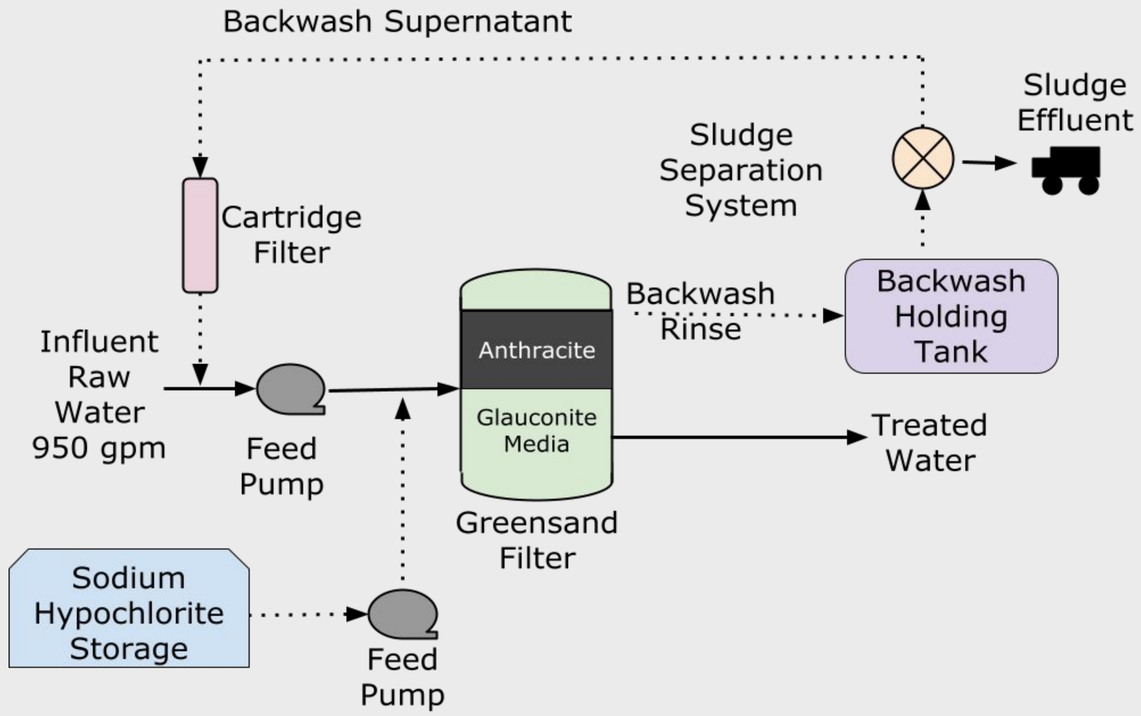

Process flow diagram of proposed Crestop Well treatment system.

Treatment System Results

- Greensand provides high removal rates of iron and manganese.
- Greensand can remove hydrogen sulfide at levels up to 10 ppm and eliminate unpleasant taste and odor from the water.
- Sodium hypochlorite was added to regenerate the greensand and provide disinfection.
- Backwash from the filter is recycled, improving efficiency.

Filter Medium: Greensand

- Greensand is an innovative filter medium consisting of glauconite coated with manganese dioxide (MnO_2).
- Greensand allows efficient oxidation and filtration in one unit.
- The manganese dioxide surface auto-catalyzes the oxidation of manganese, which is otherwise difficult to achieve in solution.
- Greensand can be regenerated using milder oxidants, reducing chemical hazards and cost.

Environmental and Safety Considerations

- Sodium hypochlorite is corrosive, so the system is designed to minimize chemical exposure.
- The plant is designed to minimize waste, producing only 3 kg/day of solids.
- Flow from the well is limited to < 1000 gpm to avoid excessive drawdown in the aquifer.

Future Plans

- Greensand performance varies by manufacturer and water chemistry. Pilot testing must be done to evaluate the actual treatment efficiency and regeneration capacity.
- Construction must be reviewed to ensure compliance with county permits.

Scan the QR Code to Learn More About Greensand!

Acknowledgements

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