

PROBLEM STATEMENT

Lakedale Utility District requires year round drinking water from the Crestop Well. The water must be treated for iron, manganese, and hydrogen sulfide.

Contaminant	Influent (mg/L)	Effluent Goal (mg/L)
Iron	0.01-0.12	<0.15
Manganese	0.046-0.060	<0.03
Hydrogen Sulfide	0.01-0.03	Below Detection



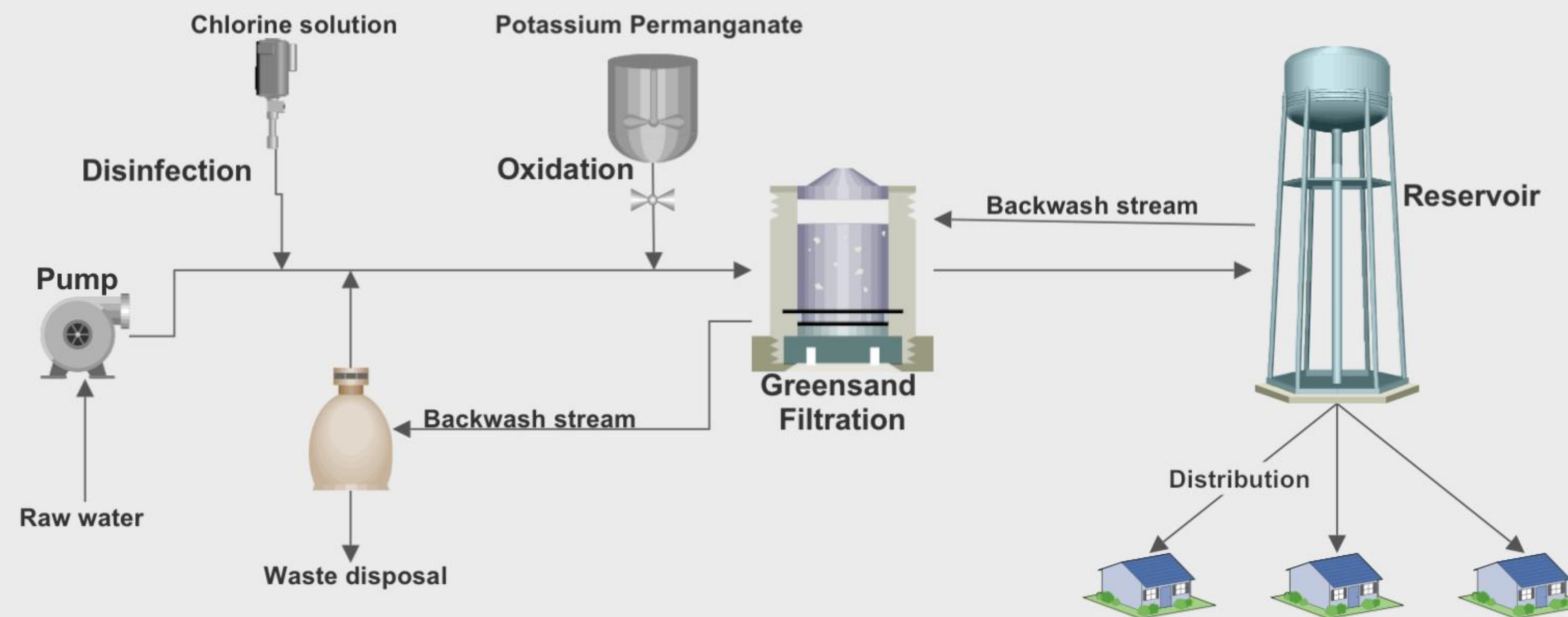
PURPOSE FOR PROJECT

- Hydrogen sulfide at low enough concentrations that health concerns are not an issue, but has offensive odor
- Manganese causes discoloration, and can cause neurological problems in children
- Iron can stain appliances and is harmful to humans at high doses
- Low cost is high priority
- Impervious surfaces must be less than 2000 ft² to avoid stormwater permitting



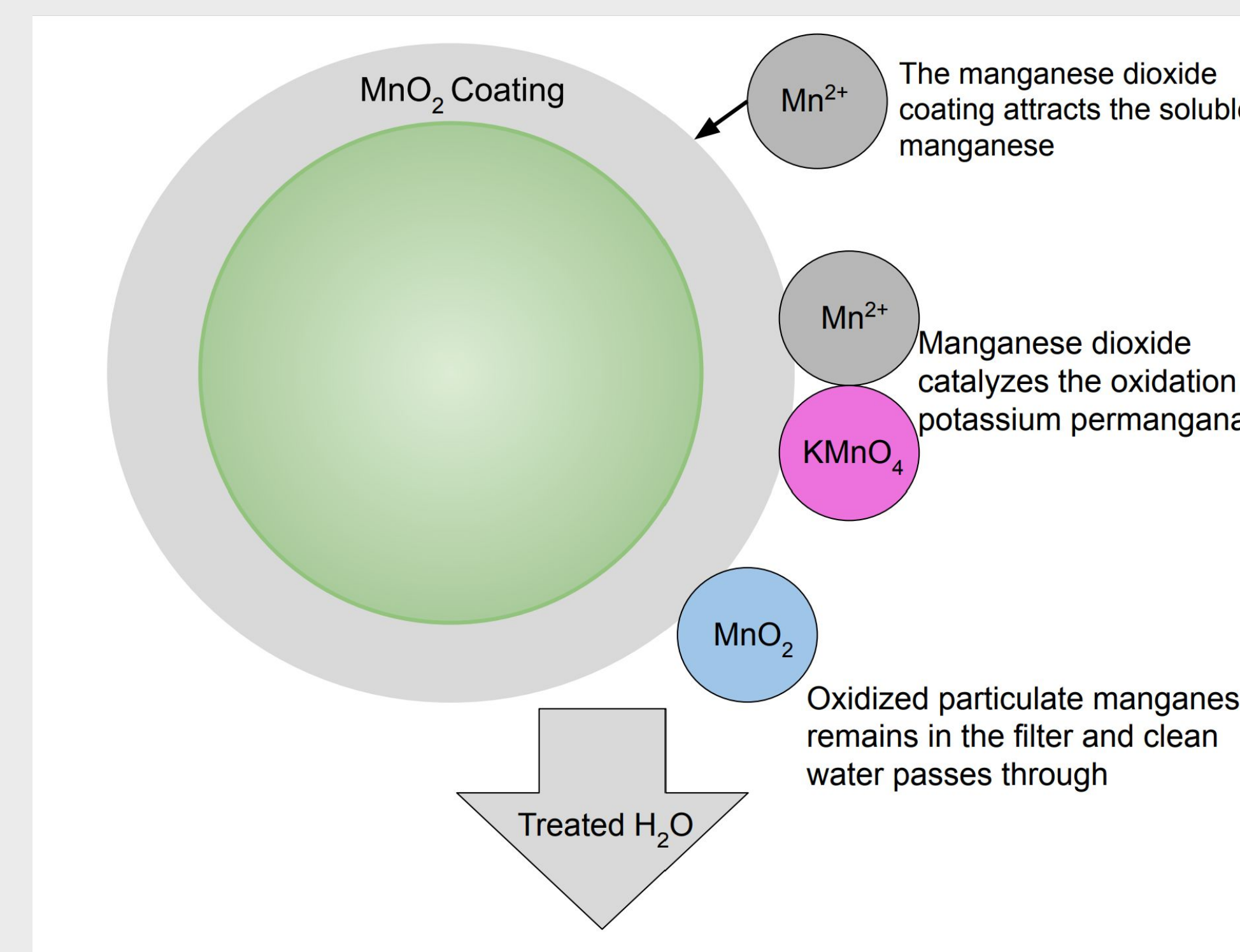
Greensand Filtration Treatment

Using Potassium Permanganate and Greensand to Treat Iron, Manganese, and Hydrogen Sulfide



Potassium Permanganate Oxidation

An oxidant is required to turn iron, manganese, and hydrogen sulfide into particles which can be filtered out. Potassium permanganate was selected for this system because it is a strong oxidant that reacts quickly without altering the pH or temperature. It is also relatively cost effective and can be stored for an extended period of time.



Greensand Filtration

Greensand filtration media is coated with manganese dioxide that attracts the manganese present in the source water and acts as a catalyst for the oxidation process. This innovative process rapidly oxidizes manganese into particulate matter once adsorbed to the media surface. Oxidized contaminants are filtered out and clean water passes through the media. Unlike other filtration methods, coagulation and flocculation are not required, minimizing the treatment process footprint.

DESIGN PROCESS

A literature review was conducted to obtain treatment options. Around 15 treatment alternatives were compared using a decision matrix evaluating each option's ability to meet design criteria. Membrane filtration following chlorine oxidation was the second viable option, but was ruled out after a class 5 cost analysis.



SUMMARY

- The engineered greensand system will treat Crestop Well water to the high quality community standards
- Greensand is a cost and size effective method of treating all three contaminants of concern
- This design was based on established engineering principles and proven performance data
- Chlorine will be dosed to provide a residual in the distribution system
- Design flow rate of 1000 gpm exceeds the community need of 900 gpm

NEXT STEPS

- Pilot Testing
- Sustainability Analysis
- Detailed Cost Analysis
- Detailed Layout Design
- Material Balances

ACKNOWLEDGMENTS

We would like to thank Dr. Mark Carlson and Gregg Thompson for guidance during the design process.