Water Treatment Project

Plumas Eureka Community Services District

July 15,2022

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Steps (Arsenic Treatment Pilot Study Guidelines For State Funded Projects 2011)

1. Full definition of the problem and gathering information.
2. Evaluation of the feasibility of consolidation options.
3. Evaluation of source options including development of a new source, source modification or blending.
4. If treatment is the indicated project alternative, evaluation of treatment options (including a pilot study).
5. Preparation of an evaluation report.
6. Making a decision on the treatment to install.

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Additional Steps

7. Identify a site
8. Storage and Transmission system designed
9. Environmental Review Process
10. Financing
11. Complete Design
12. Bid and Construction
13. Opening and Testing
14. Operation

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Full definition of the problem and gathering information

- Stantec PER defined the general needs of the water system and defined the alternatives, concluding that treatment was the only feasible alternative
- Stantect had one pilot test that was not accepted by the state
- Farr West confirmed Stantec's technical conclusions, identified possible locations for the project with a recommendation, and estimated costs of construction.

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Evaluation of the feasibility of consolidation options

- Graeagle Land and Water refused to consolidate with the District's system.

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Evaluation of source options including development of a new source, source modification or blending

- Well Studies conducted from 2009 through 2014 found no suitable alternative sources.
- Blending is being used to meet Title 22 regulations for annual compliance for An. Fe and Mn are out of compliance for both Wells the District has a waiver, but occasionally exceeds the 3XMCL limit for iron at Well 2.
- The Board determined that the current approach is not sustainable

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If treatment is the indicated project alternative, evaluation of treatment options (including a pilot study).

- The Stantect PER and the Farr West Technical memo identified treatment as the recommended, if not only, alternative.
- Pilot studies have been done, but only found challenges to successfully treating the water. A treatment process has not been completely defined.
- To reduce costs of further testing, Farr West developed a design that accommodates pretreatment, coagulation and filtration, adsorbtion, post treatment, blending, and treatment by-pass.
- In considering SRF financing, the SWRCB posed questions about the approach that, to answer, require further pilot testing.

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If treatment is the indicated project alternative, evaluation of treatment options (including a pilot study).

- Stantect had one pilot test that was not accepted by the state
- Farr West conducted one pilot test and one bench test and identified problem with coagulating and filtering of As, Fe and Mn using conventional technology. Possible causes included a high level of soluble (colloidal) iron and phosphates in the water.
- Recent bench by WestTech test found two chemical regimes to coagulate iron and manganese.
- ATEC challenged the assumption that the problems found by Farr West are not an impediment.

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Preparation of an evaluation report
Making a decision on the treatment to install

- The two steps will be completed once the SWRCB is satisfied with the scope and results of future pilot test(s).

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Other Steps

7. Identify a site
8. Storage and Transmission system designed
9. Environmental Review Process
10. Financing
11. Complete Design
12. Bid and Construction
13. Opening and Testing
14. Operation

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Pilot Testing: What do we need to understand

Pretreatment

- Oxidant
- Contact time
- Point of contact
- Coagulant (if needed)
- Polymer (if needed)
- pH adjustment

Treatment

- Filtration Media
- Adsorbtive Media (if needed)
- pH adjustment

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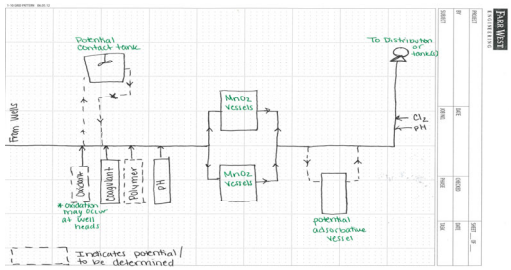
What we need to understand



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Bench Test Results

Two chemical regimens resulted in treated water quality better than the effluent standards.

1. Sodium Hypochlorite Regime
   a. Oxidant: Sodium Hypochlorite
   b. Coagulant: Polyaluminum Chloride
   c. Polymer: Magnafloc LT27

2. Potassium Permanganate Regime
   a. Oxidant: Potassium Permanganate
   b. Coagulant: Aluminum Sulfate
   c. Polymer: Mangafloc LT27

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Bench Test Results

- The well water characteristics significantly changed from the first day of testing (5/3/22) through the rest of the week. Iron and manganese concentrations approximately doubled on 5/4/22, so the water required much higher oxidant doses than found on the first day. This indicates that full-scale operation and dosing will be heavily dependent on the feed characteristics.
- The sample change required additional oxidant dosing and tests than originally anticipated, so it took a longer time than originally expected. Due to the additional oxidant work and the scheduled time on-site, some other parameters and doses were not fully optimized, but they were determined as baselines for effective treatment.

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Proposed Treatment

- An oxidant (NaOCl or $KMnO_4$) is going to be added to the raw water to oxidize iron, manganese, and arsenic so that these constituents can precipitate or turn from a soluble compound to an insoluble compound. Additionally, arsenic has an affinity for precipitated Iron so the more Iron we precipitate the greater the opportunity for Arsenic to bond and be removed. This co-precipitated compound is known as ferric arsenate.
- The coagulant is then added to neutralize the particles, allowing them to "clump" together more effectively – as opposed to repelling if they share a like-charge.
- The benefit of using a Manganese Dioxide (MnO_2) media in your filter vessel is that MnO_2 acts as a catalyst for all Iron, Manganese, and Arsenic which was not oxidized and remains in solution and removes these constituents via an adsorptive process. Note: This adsorptive process is different from the Stage 2 adsorption vessel our original design proposed.

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Proposed Treatment

- Where Phosphates come into play is that a) Phosphates will be oxidized before Iron so if the oxidant is not added at high enough doses, the iron will remain in solution, and b) Phosphates are very similar chemically to Arsenic and will out-compete Arsenic when it comes to co-precipitation with Iron. This phenomena explains the problems with the past pilot studies which saw insufficient iron oxidation and arsenic removal because phosphates were oxidizing, and consuming the oxidant, before Iron, leaving too much Iron in solution; Phosphates were also outcompeting Arsenic to co-precipitate with any Iron which was oxidized; and finally, was also out-competing all other constituents for the catalytic precipitation and ultimate adsorption to the MnO_2 media.
- Ultimately, the bench test gives us strong confidence that all 3 problem constituents (Iron, Manganese, and Arsenic) can be oxidized, giving a strong indication that an oxidation/filtration process will be effective at removing all three constituents

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Actions

- Decide whether or not to continue with the project
- Decide whether to proceed with De Nora Pilot
- If not, how to procure other pilot study from other contractor
- Determine if project management team is acceptable
- Determine if the best approach to procurement of the project and project components
- Complete Design and Bid Docs (if required)
- Complete and submit SRF Application

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