

City of Longview, Washington Interim Measures for Water Quality Improvement Scope of Work

Objectives

The City of Longview is investigating measures which could be implemented to mitigate on-going taste and odor (T&O) issues associated with the Mint Farm Regional Water Treatment Plant (MFRWTP) water supply. The City has received customer complaints related to sulfurous and chlorinous T&O. The cause of these has been attributed to two mechanisms: 1) loss of oxidizing conditions (and associated sulfate reversion to sulfides) within low flow areas of the distribution system and in home plumbing systems; and 2) naturally-occurring organic nitrogen in the raw water, resulting in the formation of chlorinated compounds with objectionable T&O. The objective of this work is to investigate relatively simple and low-cost treatment measures that could be implemented at the MFRWTP to mitigate these mechanisms and reduce T&O issues. This work includes further evaluation of dissolved oxygen addition to better maintain oxidizing conditions, and evaluation of potential treatment process modifications to remove organic nitrogen. The treatment approaches will be investigated first at the bench-scale to assess feasibility. If the bench-scale tests are promising, subsequent pilot-scale testing will be performed to demonstrate performance.

Scope of Work

Task 1 – Project Management and QA/QC

Objective

Organize and manage the project to fulfill the project objectives described in this Scope of Work.

Activities

- 1) Manage budget, schedule, and activities of project team.
- 2) Implement Confluence QA protocol and provide QC review of all deliverables.
- 3) Prepare monthly progress reports and invoices.

Deliverables

- 1) Monthly progress reports and invoices.

City Responsibilities

- 1) Review invoices and submit payment per agreed-upon terms.

Task 2 – Dissolved Oxygen Addition – Feasibility Evaluation

Objective

Confluence previously evaluated dissolved oxygen (DO) addition during pipe loop testing at the MFRWTP, demonstrating notable improvement in iron and manganese and color levels in the treated

water after stagnation in unlined cast iron pipes. However, the effect of DO on chlorine levels was inconclusive, and sulfide levels were not tested since sulfide is not present in the MFRWTP finished water. Recent water quality evaluations performed at two homes indicated that the low oxidizing potential of the water delivered from the distribution system contributed to the development of sulfide and other objectionable tastes and odors.

The objective of this task is to evaluate the effect of increased DO on water quality within premise plumbing. This additional work within the homes will supplement the work previously conducted using the pipe rigs, and will provide additional information regarding the benefits of DO injection. To do this, commercially-available customer-sized aeration equipment will be obtained and tested under controlled conditions first at the MFRWTP to assess device feasibility to achieve targeted levels of DO addition under potential operating schemes as encountered in a residence. If these tests indicate feasibility, one device will be selected for in-home testing under Task 3.

Activities

Confluence will perform the following activities:

- 1) **Assess Commercially Available In-Line Aeration Systems.** Identify two small-scale commercially available in-line aeration systems for procurement by the City (*e.g.* Aer-Max Closed Tank Aeration System, from Pure Water Products, LLC; and a venturi injector, from Mazzei Injector Company LLC). Modify devices as necessary to plumb into the POE line used for the test pipe rig at the MFRWTP. Determine the extent of DO increase under selected operating conditions and develop process curves. Assess the feasibility of using the modified equipment for in-home tests and present a recommendation to City staff as to whether to proceed with Task 3; and if so, identify which aeration device/equipment to be used for in-home tests.

Deliverables

- 1) Recommendation whether or not to proceed with Task 3. If Task 3 is performed, Task 2 information will be incorporated into the technical memorandum for Task 3. If Task 3 is not performed, Draft and Final Technical Memorandum for Task 2.

City Responsibilities

- 1) Procure in-home aeration system and venturi injector.
- 2) Pay all external laboratory fees.

Task 3 – Dissolved Oxygen Addition – In-Home Evaluation (Contingent)

Note: this task is contingent upon the outcome of and recommendation from Task 2.

Objective

Evaluate the effect of increased DO on water quality within premise plumbing at two selected residences.

Activities

Confluence will perform the following activities:

- 1) **Perform In-Home Pilot Tests.** Prior to installation, collect background water quality samples from the kitchen and bathroom cold water taps, and one sample from the bathroom hot water. Aeration equipment to be installed by a qualified plumber in one home selected by Longview and one home selected by BHWSD. Once installed, review the installation at each location, confirm operations, and perform initial water quality tests. Develop a test plan to include water quality monitoring to be performed by City staff in order to assess effects of DO on water quality. City to operate system and monitor water quality over a one-month duration.
- 2) **Compile/Interpret Data.** Compile data, prepare key tables/graphs, and develop findings.
- 3) **Technical Memorandum.** Summarize key findings in a brief Technical Memorandum. Pull findings into overall Final report.
- 4) **WebEx Meeting.** Discuss findings with City and BHWSD via conference/WebEx call.

Deliverables

- 1) Draft and Final In-Home Pilot Test Plan.
- 2) Draft and Final Technical Memorandum.

City/BHWSD Responsibilities

- 1) Identify location for in-home pilot testing at one home in Longview and one home within the BHWSD service area. Coordinate with plumber(s) and homeowners to install device.
- 2) Conduct water quality monitoring per the test plan. Compile and provide data to Confluence.
- 3) Pay all external laboratory fees.
- 4) Review test plans and Technical Memorandum and provide unified comments.

Task 4 – Organic Nitrogen Removal: Bench-Scale Testing

Objective

Evaluate effectiveness of the following treatment alternatives for removing organic nitrogen (ON) and reducing the formation of intermediate chloramine species in the MFRWTP water:

- Hydrogen peroxide addition
- Coagulant addition

For each strategy, initial bench-scale testing will be performed on raw water as a proof-of-concept and for screening purposes. If bench test data indicate meaningful improvement, pilot-scale tests that mimic the MFRWTP filtration process will be planned and conducted (under Task 5) to develop conceptual design and operating criteria to serve as the basis for equipment sizing and cost estimates.

Activities

Confluence will perform the following activities:

- 1) **Develop Testing Plans.** Determine experimental matrices, test conditions, select chemicals, and coordinate with commercial laboratory.
 - a) Coagulation test to include 2 different polymer chemicals. For each chemical, a range of doses and contact times will be explored, with performance compared to a no-dose control.
 - b) Hydrogen peroxide test to include a range of doses, 2 different pre-oxidation contact times, and hypochlorite doses, with performance compared to a no-dose control.
- 2) **Mobilize Equipment.** Set up bench-scale testing and analytical equipment at the MFRWTP.
- 3) **Conduct Testing.** Bench-scale tests for each strategy will be conducted over multiple days in a single trip, in order to reduce travel and mobilization costs. Test to be conducted on one well water (likely PW-4 since it appears to have the highest level of ON). Tests to include time-series analysis of filtered water chlorine decay (CDD) trends. Preliminary testing may be required to assess alternate analytical methods for ON.
- 4) **Compile/Interpret Data.** Compile data, prepare key tables/graphs, and develop findings.
- 5) **Technical Memorandum.** Summarize key findings in a brief Technical Memorandum. Pull findings into Final report.
- 6) **WebEx Meeting.** Discuss findings with City via conference/WebEx call.

Deliverables

- 1) Draft and Final Test Plan for bench-scale testing.
- 2) Draft and Final Technical Memorandum. To include recommendation on appropriateness of pilot-scale testing for each technology, i.e., whether to proceed with Task 5.

City Responsibilities

- 1) Provide representative raw well waters to accommodate tests. This may require operation of a specific well (likely PW-4).
- 2) Provide the jar-testing assembly for use in bench-scale testing.
- 3) Pay all external laboratory fees.
- 4) Review test plans and Technical Memorandum and provide unified comments.
- 5) Participate in conference call/WebEx meeting.

Task 5 – Organic Nitrogen Removal: Pilot-Scale Testing (Contingent)

Note: this task is contingent upon the outcome of and recommendation from Task 4.

Objective

Conduct pilot-scale testing of hydrogen peroxide and/or coagulant addition to confirm treatment performance for ON removal and develop conceptual design and operating criteria to serve as the basis for cost estimates

Activities

Confluence will perform the following activities:

- 1) **Develop Pilot Testing Plans.** Testing plans will include one or both treatment strategies (as determined in Task 4) and the most-promising combination of chemical, dose, and contact time for each (per results of Task 4).
- 2) **Mobilize Pilot Equipment.** Set up pilot and analytical equipment at the MFRWTP, regenerate/acclimate filter media (system to be monitored by City staff during acclimation period). Pilot equipment will include the Confluence-owned granular media filter skid. Hydrogen peroxide and/or coagulant and hypochlorite addition will occur upstream of the pilot filters, with provisions for mixing and contact time.
- 3) **Conduct Pilot-Scale Testing.** Pilot-scale tests for each strategy will be conducted over multiple days in as few trips as possible to reduce travel costs. Test to be conducted on the same well used in bench-testing at the maximum filter loading rate anticipated within a 7-year time horizon. For each test, two identical filter columns to be run in parallel – one with coagulant/hydrogen peroxide and one control – for direct comparison. Tests will be run starting with a clean bed and will proceed for as long as necessary to determine performance, up to a maximum total pilot-scale testing duration of 6-days. The pilot column will utilize the same media configuration and specifications as used in the full-scale vessels, to the extent feasible.
- 4) **Compile/Interpret Data.** Interpret field and laboratory data and develop findings. Data evaluation will focus on treatment performance (including iron/manganese removal, organic nitrogen removal, DO residual, chlorine dose and CDD characteristics). Samples may also be sent to Seattle Public Utilities for taste and odor profile analysis, depending on panel availability.
- 5) **Technical Memorandum.** Summarize key findings, graphs, and tables in a brief Technical Memorandum. Summarize recommended design and operating criteria to support a cost estimate (to be completed by others) and a recommended ON removal approach for full-scale implementation. Add findings to overall project Final Report.
- 6) **WebEx Meeting.** Discuss findings with City via conference/WebEx call.

Note: This scope does not include preparation of a DOH Project Report, which may be required by DOH if one of the treatment measures were to be implemented at the full-scale. If an approach proves successful and if desired by the City, Confluence will contact DOH to determine the requirements for such a report and then prepare a separate scope/fee for Project Report preparation.

Deliverables

- 1) Draft and Final Test Plan for pilot testing.
- 2) Draft and Final Technical Memorandum describing results and key findings of pilot-scale testing.

City Responsibilities

- 1) Provide secure location for pilot-scale testing.
- 2) Provide representative raw well water to accommodate tests.
- 3) Monitor pilot system and chemical feed during the filter media regeneration/acclimation phase, which is anticipated to last up to 5 days.
- 4) Pay all external laboratory fees.



- 5) Review test plans and Technical Memorandum and provide unified comments.
- 6) Participate in conference call/WebEx meeting.