

December 16, 2022

Stephan Higgins
Assistant City Engineer
City of Blaine
10801 Town Square Drive NE
Blaine, MN 55449

Re: Water Treatment Plants 1-3 Upgrade Scope Modification and Amendment Request

Dear Mr. Higgins:

Barr Engineering (Barr) is pleased to present to the City of Blaine (City) a proposal to amend our Water Treatment Plants 1-3 (WTP 1-3) Upgrade project. The purpose of this proposal is to amend the original scope of work for this project since it changed significantly following its inception. The proposal will include a description of tasks undertaken at the direction of the City not included in the original scope and request additional budget to finalize the modified work plan requested by the City.

The original project (scope available upon request) began as planning and design for a general maintenance and aesthetic improvements project (formerly known as the "coat of paint" project) intended to accelerate maintenance and improve the appearance of WTP 1-3. The project began with an inspection and condition assessment of each plant to identify what items needed repair, maintenance, or upgrades, and was then intended to include developing bidding documents for the work to perform those tasks. At the same time, Barr prepared five "mini-feasibility studies" to inform upgrades to the following systems.

- Flow Meters
- Automatic Valves
- Backwash Reclaim
- Chlorine Disinfection
- Dehumidification

These studies were to inform upgrades that might occur as part of the initial project or in subsequent work. Four of the studies were completed and are applicable for future upgrades at WTP 1-3; however, as the Backwash Reclaim study progressed, it became apparent that there are underlying inconsistencies with the filters including: filter vessel size, loading rate, backwash rate, backwash supply, control valve functionality, filter distribution piping, and filter backwash collection piping.

Even without resolving these inconsistencies, the required upgrades to allow backwash reclaim at the plants were going to be significant enough that they would disrupt and/or significantly change the nature of the initial project. As a result, the project shifted to a wholistic review of the plants intended to inform more significant work to improve total plant function. The decision was made to delay the initial projects until a better understanding of why the plants were not performing as designed or as expected was identified.

The recent media change in the filters from Electromedia by Filtronics to pyrolusite resulted in a required increase in backwash flow rates. That in turn has affected many plant systems and operations. As a result, the City requested a scope change before moving into the design of the initial plant improvements project. The recommended scope change is described below.

Modifications to Original Scope of Work

Work tasks were added to the original work scope, in place of the originally intended design work, and have already been performed at the request of the City. The changes in scope occurred when the “mini-feasibility studies” made it clear that the aesthetic upgrades proposed in the original scope would be quickly undone by follow up plant maintenance and repairs required by the challenges with plant operations associated with the filtration units. A description of work scope modifications follows:

- ***Backwash testing and analysis at WTP 1 and 3.*** This task was helped to better understand the potential for backwash reclaim. In executing the original scope, it became apparent that not only would it be difficult to reclaim backwash water due to the volume generated and available backwash tank size, but that other more significant issues exist with the backwash process at all three WTPs. These results were documented in a draft memo to the City on March 9, 2022. The memo noted that insufficient backwash rates currently in use in at WTP 1 and 3 do not provide sufficient backwash performance. The memo also predicted excessive wear on pipes and valves due to excessive velocities and poor backwash distribution across the filters due to high velocity in the underdrain and short-circuiting between backwash supply and backwash collection.
- ***WTP 2 media inspection.*** This work was added to better understand to the reason behind annually acid washing the filter media. The inspection revealed the build-up of mud balls in the WTP 2 filters prior to the City’s periodic filter cleaning. During the inspection on March 14, 2022, it was noted that the mud balls are more prevalent farther from the filter backwash water inlet. Mud ball formation indicates that current backwash operations are insufficient at the far end of the filters and that backwash flow is not distributed evenly across the filter area. Both problems are related to the excessive flow velocities required to fluidize the pyrolusite media that the current piping cannot distribute evenly across the media or without excessive wear to the piping.
- ***Design of backwash rate control for WTP 1.*** Premature wear of a backwash flow control valve occurred because of the high backwash flow rate required by the filter media. As a result, the City requested that Barr review their proposed valve change. This resulted in adding pressure reducing orifice plates in addition to the proposed valve change to allow for better and longer-term flow control. This work was completed in August 2022, and included the following tasks:
 - Determine appropriate layout of a new backwash rate control system.
 - Preparation of a design basis for controlling backwash rate-of-flow with a system of orifice plates and a butterfly valve rather than the previous system using an automatic pressure control valve.
 - Preparation of design drawings for the orifice plates.
 - Recommendations for location of butterfly valve, orifice plates and flow meter.

- **Preliminary review of weather conditions and water use over the past 2 years.** This work was completed in preparation for a meeting with staff to discuss overall WTP capacity and appropriate design bases for each WTP. The analysis was presented at the staff meeting on September 26, 2022. This was needed to inform final completion of the wholistic review of the plants.
- **All Projects Schedule and Budget Update.** Because upcoming work includes numerous projects that rely upon the completion of current projects associated with the City's water system, Barr prepared an all-projects schedule and budgetary estimate to inform planning of the work.

The described changes brought project costs to a point that exceeded the originally approved budget.

Amendment Request – Complete Wholistic Review

A draft version of the wholistic review memo was delivered earlier this year. To finalize recommendations in that memorandum, Barr needed to know the City's tolerance for consuming treated but unfiltered water during peak use times. This information was provided as a result of the fourth sub-bullet in section above. Using that information, the work below is proposed to complete the wholistic review of WTP 1-3:

- **Finalize project recommendations:** Using input provided by the City related to tolerance for unfiltered water, Barr will recommend and describe four projects to improve the appearance and operations of WTP 1-3. These are generally described as follows:
 - *Aesthetic upgrades to WTP 2 (2023 design and construction)*
 - *WTP 1 pilot testing (2023)*
 - *WTP1 & 3 filter upgrades informed by WTP 1 pilot testing (2023 design 2024 construction, assumes new filters are not required)*
 - *WTP 2 filter upgrades informed by WTP 1 pilot testing (2024 design, 2025 construction, assumes new filters are not required)*
- **Stranded asset planning:** The filter functionality improvements to WTP 1-3 operations will likely result in lower plant filtration capacities. The wells currently supplying the plants will be able to pump more water than can be treated (filtered) following the filter upgrades, resulting in stranded assets. Barr will prepare a plan on how the City can utilize these assets and gain the full benefit of their existing infrastructure. This will include a brief discussion on blending sequestered (non-filtered) water with filtered water as part of each plant upgrade identified above, and then provide an initial look at how additional filters could be added to each plant in the future to filter all well water pumped to each plant.

Schedule

The proposed project schedule is shown below.

phase/task	duration	est. completion date
Modifications to Original Scope of Work		Completed
Complete Wholistic Review		
<ul style="list-style-type: none"> Finalize project recommendations 	4 weeks	February 3, 2023
<ul style="list-style-type: none"> Stranded asset planning 	6 weeks	February 17, 2023

Barr is proposing to complete the Wholistic Review in approximately six weeks. Barr will prepare a final draft of the memo and review with the City staff and implement the final comments.

Budget

We request modification of the currently approved project budget to incorporate the work amendments described above.

Task	Estimated Budget
Task 1 – Original Scope Amendments	\$28,223
Task 2 – Work to Complete	\$21,000
Total	\$49,223

If you have any questions regarding the additional scope items, please do not hesitate to call me for further clarification. If the terms of this proposal are acceptable, please sign the document in the appropriate places located below and return a copy to us for our records. The work is performed according to the terms of our master services agreement. Thank you for your continued work with Barr.

Sincerely,



Brian K. LeMon
 Vice President, Sr. Civil Engineer

Accepted this ___ day of _____, 2023

CITY OF BLAINE

By _____

Its _____