

Technical Memo

SUBJECT: Water Filtration Plant Master Plan – Additional Cost Evaluation and Executive Summary

DATE: October 3, 2022

PROJECT NO.: 200104

In November 2020, Fishbeck completed a Water System Master Plan for the City of Mount Clemens (City) Water Filtration Plant (WFP), in which a variety of long-term treatment alternatives were developed and evaluated. In January 2022, the scope of the Master Plan was modified to evaluate connecting the City to the Great Lakes Water Authority (GLWA) system. The draft GLWA Connection Evaluation report was issued in May 2022. Then, in July 2022, Fishbeck issued a memo updating the construction cost estimates for the proposed treatment alternatives from the original 2020 Master Plan to capture escalation to 2022 costs.

In August 2022, the City retained Fishbeck to evaluate the probable project cost of constructing a new 8-million-gallon-per-day (mgd) conventional WFP, and to complete a 20-year present worth analysis to compare this alternative to the alternatives identified by the City for further consideration from the 2020 Master Plan and the 2022 GLWA Connection Evaluation.

Future water demand projections were developed as part of the Master Plan based on historical water use data dating back to 2010. The demand projections are presented in Table 1. The analysis presented in this memo is based on the 2020 average day demand of 2.14 mgd. The sizing for the alternatives was based on the projected maximum day demand of 4.90 mgd.

Table 1 – Water Demand Projections

Year	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Peak Hour Demand (mgd)
2020	2.14	4.66	6.99
2025	2.17	4.72	7.08
2040	2.25	4.90	7.35

Estimated Project Costs

2020 Master Plan Alternatives

Four alternatives were evaluated as part of the 2020 Master Plan. The alternatives and the updated estimated project cost of each are listed in Table 2.

Table 2 – 2020 Master Plan Alternative Cost Estimates

Alternative	Alternative Description	Estimated Project Cost*
1	Existing WFP Rehabilitation	N/A**
2	Filter Expansion using 1959 Conventional Filters	\$40,400,000
3	New Membrane Treatment Plant	\$46,120,000
4	New Conventional Filtration Plant	\$50,610,000

* Costs updated from original report

** No cost estimate made for this option as rehabilitation of existing WFP was not considered to be feasible

Alternative 4 of the 2020 Master Plan report was identified by the City for further consideration. This alternative would involve construction of a new 10 mgd conventional dual media WFP. New construction elements would include a low-service pump station, in-line mechanical rapid mixers, four-stage horizontal flocculation, high-rate sedimentation with sludge collection, ozone contact tanks, dual media gravity filters with air scour, ground storage tanks, and a high-service pump station. New chemical storage and feed facilities would be constructed for alum, chlorine, and phosphate, while the existing liquid oxygen tank could be reused. The new plant would include space for electrical and mechanical rooms and would be approximately 23,000 square feet.

The existing Lake Pump Station, Equalization Tank, and Sludge Drying Beds would be refurbished and their current functionality maintained. The Lake Pump Station would receive architectural, mechanical, and electrical upgrades. The Equalization Tank would receive structural repairs to address cracking and spalling of the concrete and process upgrades to address issues with the pumps and valves. The project would also include demolition of the existing WFP following startup of the new plant.

2022 GLWA Connection Evaluation

Four alternatives were evaluated as part of the 2022 GLWA Connection Evaluation. The alternatives and the updated estimated project cost of each are listed in Table 3. The costs in Table 3 were updated from the originally presented cost to represent July 2022 costs and to include costs for distribution system modifications required to incorporate the connection to GLWA and demolition of the existing treatment plant intakes, which were not included in the original cost.

Table 3 – 2022 GLWA Connection Evaluation Alternative Cost Estimates

Alternative	Alternative Description	Estimated Project Cost*
S-1	Utilize existing 1 MG storage tank	\$7,620,000
S-2A	Construct new 2 MG storage tank on existing 1 MG site; take existing 1 MG storage tank out of service	\$12,704,000
S-2B	Construct new 1 MG storage tank at Shadyside Park (with associated water main); keep existing 1 MG storage tank in service	\$13,556,000
S-3	Construct new 2 MG storage tank at Shadyside Park (with associated water main); keep existing 1 MG storage tank in service	\$16,928,000

* Costs updated from original report

It was assumed water would be supplied to the City by two 16-inch supply meters near Reimold Street to provide redundancy. To establish rates, the estimated distances and elevations of the connections to the City with respect to the centroid of the five GLWA treatment plants were used. GLWA typically uses a 60% fixed fee and 40% commodity charge rate structure.

The City currently supplies customers in portions of Harrison Township whose service lines are connected to the 20-inch and 24-inch water mains that run parallel from the existing WFP to the City proper along Crocker Boulevard. If the GLWA connection alternative is constructed, it would be possible to abandon the 24-inch water main from Reimold Street to the existing WFP. There are a small number of customers whose water services are tapped into this 24-inch main. Those services would need to be tapped into the 20-inch main on the north side of Crocker Boulevard. Therefore, a cost of \$150,000 has been added to the cost estimate to abandon the 24-inch main at Reimold Street and replace the water services.

Water age may become an issue in the 20-inch main that feeds customers on the north side of Crocker Boulevard. Frequent flushing will help to mitigate this issue in the short-term until a smaller main can be constructed. Approximately 5,020 feet of 12-inch water main could be installed to reduce water age issues and provide fire flow capacity to the area. A preliminary cost estimate of \$1,757,000 has been added to the GLWA connection alternatives for this additional water main.

Additionally, the GLWA connection alternatives would require demolition of the existing intake crib and abandonment of the 30-inch intake and 24-inch intake lines for the WFP. Currently, the 30-inch intake line runs approximately one mile from the shore at the WFP out into Lake St. Clair. The portion of the existing intake crib above the lake bottom would be removed by a marine contractor. Flowable fill would then be used to seal the 30-inch intake line, subject to the approval of the U.S. Army Corp of Engineers. Preliminary cost estimates for this demolition are estimated at \$150,000 and are included as a part of the updated estimated project costs. If the project were to move forward, the viability of this alternative should be evaluated in greater detail as part of the preliminary design effort to verify assumptions made as part of this evaluation.

Alternative S-3 of the GLWA Connection Evaluation report was selected by the City for further consideration. This alternative would continue the use of the existing 1 MG elevated storage tank and construct a new 2 MG elevated storage tank, booster pump station, meter pits for the GLWA billing meters, and associated water main improvements. This alternative would allow the City to effectively shave peak hour demands, making the City a “maximum day” GLWA customer, which reduces the rate charged by GLWA. The estimated 2022 GLWA annual wholesale rate for Alternative S-3 is \$1,868,000, based on the demand projections from the 2020 Master Plan. The rate model information was provided by GLWA in April 2022 during development of the GLWA Connection Evaluation report.

Cost Comparison Including 8 mgd Conventional WFP Alternative

A cost estimate was developed for an 8 mgd conventional dual media WFP for comparison purposes with the other alternatives being considered by the City.

An 8 mgd WFP would operate on the same processes and require construction of the same elements as the 10 mgd alternative. Cost savings would be seen in the price of equipment, such as the process piping and valves, flocculation/sedimentation basins, and the gravity filters, which would be downsized in the 8 mgd plant compared to the 10 mgd plant. Savings would also be realized by moderately decreasing the size of the WFP building. The size and configuration of the administration, laboratory, and support spaces would generally remain the same between the two alternatives. A key operational difference between the two plant sizes is that the 10 mgd alternative is sized to meet maximum demand over the course of a 12-hour shift, whereas the 8 mgd alternative would likely require closer to a 16-hour operational period, thus increasing labor costs for periods where longer shifts are necessitated by seasonal high demands.

The 8 mgd treatment alternative includes similar costs for upgrading the existing Lake Pump Station, Equalization Tank, and Sludge Drying Beds and constructing two ground storage tanks as assumed for the 10 mgd alternative. The cost for the 8 mgd treatment alternative is included in Table 4 along with the costs for the other alternatives under consideration.

Table 4 – Alternative Total Project Capital Cost Summary

8 mgd Conventional Dual Media WFP	10 mgd Conventional Dual Media WFP	GLWA Connection
\$44,810,000	\$50,610,000	\$16,928,000

Present Worth Analysis

A present worth analysis for the three alternatives under consideration was completed as part of this evaluation. Present worth is the sum which, if invested now at a given interest or discount rate, would provide the funds required to pay all present and future costs for the respective alternative. The alternative with the lowest present worth represents the most economical solution based on the costs factored in. Sunk costs are not included in the analysis. Sunk costs are any investments or financial commitments made before or during the project planning.

The present worth analysis for all alternatives was performed at a discount rate of 2.5% over 20 years, which is based on the federally posted rate from March 2022.

The operation and maintenance (O&M) costs for the 10 mgd and 8 mgd treatment alternatives were estimated based on cost data from similarly sized plants as well as the City’s existing O&M budget. These costs include estimates for electricity and chemical usage, labor, and miscellaneous expenses such as permitting, training, etc. The O&M costs for the GLWA alternative include the estimated electrical costs and other maintenance costs of running the booster pump station. The replacement costs and salvage value estimates are based on the costs and typical useful lives of the equipment in the respective facilities. The City received an estimated appraisal of \$2,000,000 for the value of the land the existing WFP occupies following demolition; this is accounted for in the GLWA connection alternative.

Table 5 summarizes the components used in the 20-year present worth calculation, where the 20-year present worth is equal to the sum of the construction, replacement, O&M, and GLWA rate costs less the salvage value and value of the sale of the WFP land.

Table 5 – 20-Year Present Worth Analysis

Present Worth	8 mgd Conventional Dual Media WFP	10 mgd Conventional Dual Media WFP	GLWA Connection
Capital Costs	\$44,810,000	\$50,610,000	\$16,928,000
Sale of WFP Land	-	-	(\$2,000,000)
Replacement Costs	\$1,380,000	\$1,607,000	\$250,000
Annual O&M Costs	\$900,000	\$825,000	\$100,000
Annual GLWA Rate Cost	-	-	\$1,868,000
Salvage Value	(\$14,697,000)	(\$16,495,000)	(\$9,934,000)
20-Year Present Worth	\$45,523,000	\$48,583,000	\$35,923,000

The 20-year present worth of the GLWA connection option is the lowest of the three alternatives, primarily due to the significant savings in capital/construction costs. The 8 mgd conventional WFP has the lower cost of the two WFP replacement alternatives. The lower construction cost estimates account for this difference.