



MEMORANDUM

To: Greg Johnson – MCES

From: Uma Vempati, PE
George Sendrey, PE (OH)
Petros Paulos, PE
Justin Macke, PE (IN)
Emily Schabert, EIT
Kimley-Horn and Associates, Inc.

Date: June 29, 2026

Subject: White Bear Lake Study 15: Serve the City of North Oaks with treated drinking water supplied by the City of Shoreview

Executive Summary

This memorandum evaluates the planning-level feasibility of serving the City of North Oaks with treated drinking water supplied through the City of Shoreview's water system. The evaluated concept includes two new Prairie du Chien-Jordan aquifer wells, a new 2 million gallons per day (MGD) water treatment plant (WTP), and conveyance through Shoreview's distribution system to North Oaks.

At a planning level, the concept appears technically feasible. Hydraulic modeling indicates Shoreview's existing distribution system can deliver up to 2 MGD to North Oaks under current maximum day demand conditions without major pipeline improvements or high service pump motor upgrades, provided operational controls are modified. Under Ultimate Development conditions, delivery remains feasible without major pipeline improvements; however, a third high service pump would be required, and Shoreview may need to consider additional pumping capacity as part of future water treatment plant expansion planning.

The proposed infrastructure includes two new 700 gpm wells, two pumphouses, raw water transmission mains, and a new 2 MGD treatment facility. The base treatment scenario assumes iron and manganese removal similar to Shoreview's existing WTP. Because the proposed wells are located near known regional contaminant plumes, additional treatment for 1,4-dioxane and trichloroethylene (TCE) may be required based on groundwater modeling, test well results, and regulatory review. Final well locations should be based on hydrogeologic suitability, water quality, land and easement requirements, stakeholder impacts, and plume impact analysis.

Conceptual site verification indicates that the existing WTP property is likely sufficient to accommodate either the base treatment plant or an expanded plant with advanced contaminant

treatment. Further evaluation will be needed to confirm utility relocations, stormwater management, setback requirements, backup power, construction access, and final site layout.

Planning-level capital costs are estimated at approximately \$16.1 million to \$17.9 million for the base treatment scenario and approximately \$29.5 million to \$31.3 million if advanced treatment for 1,4-dioxane and TCE is required. Annual operation and maintenance costs are estimated at approximately \$573,000 for the base treatment scenario, with additional costs expected if advanced treatment is required. These estimates should be refined as design assumptions, well locations, and treatment requirements are confirmed.

The project's primary benefit is that it would provide North Oaks with a long-term treated drinking water supply while avoiding additional groundwater withdrawals within White Bear Lake's area of influence. The project is not expected to independently raise White Bear Lake water levels; its water-resource benefit is avoiding potential future impacts associated with continued or expanded withdrawals from the White Bear Lake area.

Before advancing beyond planning, project partners should complete test well drilling and water quality sampling, groundwater modeling to evaluate plume migration and well interference risks, coordination with the Minnesota Pollution Control Agency, Minnesota Department of Health, and Minnesota Department of Natural Resources, and preliminary design refinement. These steps are necessary to confirm regulatory feasibility, treatment requirements, final well locations, and overall project cost.

Acronyms

DNR	Department of Natural Resources
EST	Elevated storage tank
GAC	Granular activated carbon
GIS	Geographic information system
LF	Linear feet
MCES	Metropolitan Council Environmental Services
MDH	Minnesota Department of Health
MGD	Million gallons per day
MPCA	Minnesota Pollution Control Agency
MPFA	Minnesota Public Facilities Authority
MRDL	Maximum residual disinfectant level
O&M	Operation and maintenance
PFAS	Per- and polyfluoroalkyl substances
PPL	Project Priority List
RMP	Risk Management Plan
TCAAP	Twin Cities Army Ammunition Plant
TCE	Trichloroethylene
US EPA	United States Environmental Protection Agency
UV	Ultraviolet
UVAOP	Ultraviolet advanced oxidation process
VFD	Variable frequency drive
VOCs	Volatile organic compounds
WTP	Water treatment plant

Purpose and Scope

Purpose of the Study

The Minnesota legislature has provided funding for the Metropolitan Council of Environmental Services (MCES) to work with the 14 communities in the White Bear Lake area to develop a comprehensive plan that ensures sufficient access to drinking water while supporting municipal growth. The plan will identify strategies to maintain the long-term sustainability of both surface water and groundwater resources for future generations.

Study 15 evaluates the feasibility, infrastructure needs, estimated costs, regulatory considerations, and water-resource implications of serving North Oaks through Shoreview's water supply system.

Scope of the Study

- Review Shoreview's existing water distribution system to determine the system's ability to supply treated drinking water to North Oaks
- Model the modifications required to Shoreview's water distribution system to determine:

- The need for upgrading the existing booster pumps located at the Shoreview Water Treatment Plant (WTP), and if yes, how the higher booster station pumping rates would significantly increase downstream water pressures and, if so, identify needed watermain upsizing to maintain, or not significantly increase, pressures
- Whether locating the new (second) WTP and high service booster pumps at one of the proposed well sites closer to the existing elevated storage tank (EST) would more efficiently and cost-effectively deliver treated drinking water to North Oaks without significantly increasing water pressures within Shoreview's distribution system
- Evaluate construction of two new Prairie du Chien-Jordan aquifer wells at potential sites in Shoreview, including:
 - Consultation with MPCA staff on the locations and flow paths of the existing 1,4-dioxane and TCE plumes west of Shoreview to verify the proposed wells would not redirect contaminated groundwater toward existing Shoreview wells
 - Evaluation and cost estimation for the new wells with either a pumphouse and vertical turbine well pump or a submersible well pump with a pitless adaptor unit
 - Sizing and routing raw water transmission mains from each well to a common location and a single transmission main to the second WTP influent and, alternatively, estimate the cost of a second raw water transmission main from the existing 24-inch raw water transmission main if the two new wells cannot supply up to 2 MGD due to aquifer limitations
- Verify site requirements and available space for the proposed second WTP on the open lot south of the existing WTP. Include:
 - A basic process schematic for the proposed wells and water treatment processes and a basic footprint drawing to verify site adequacy
 - Verification of site requirements for locating the second water treatment plant at a proposed well site and include the same schematic and footprint drawing for that option
- Verify with Shoreview's WTP design engineering consultant that the existing onsite emergency generator can run the added electrical loads from the second WTP and possible booster station expansion, in addition to existing peak loads
- Coordinate with the City of North Oaks staff and/or their engineering consultant on a connection point at the North Oaks border to receive treated drinking water from Shoreview
 - Model improvements needed to Shoreview's existing distribution system, if any, to supply up to 2 MGD at the North Oaks border
 - Illustrate proposed watermain improvements on a GIS map and estimate costs, noting that North Oaks is responsible for modeling, improvements, and costs within its city limits, including boosting Shoreview's treated drinking water to future elevated storage tanks, as needed

Work Performed

To achieve the above-mentioned scope of the study, the following tasks were performed:

- Data collection and review
- Hydraulic distribution system modeling and infrastructure evaluation

- Creation of a 2 MGD WTP conceptual model and proposed layouts for site verification
 - Note: Conversations with Shoreview's City Engineer and North Oaks' engineering consultants identified a mutual desire to keep the proposed WTP on the same site as Shoreview's existing WTP; therefore, the alternative scenario of locating the proposed WTP at one of the proposed well sites was not explored further.
- Evaluation of proposed well sites
- Cost estimation
- Review of regulatory considerations and potential funding mechanisms

Data Collection and Review

Table 1 outlines the data that was obtained for use in this study, along with the data sources.

Table 1: Data Sources

Data	Source
City of Shoreview Water Supply Plan	City of Shoreview
Proposed Future Well Locations	
Shoreview WTP Record Drawings	
Shoreview WTP 2017 Construction Costs	
Shoreview Water Distribution System InfoWater Model	City of Shoreview Engineering Consultant
Shoreview and North Oaks Projected Annual Water Demand (2050 and Ultimate Development)	MCES
Superfund Plume Information (TCAAP & MacGillis and Gibbs)	MPCA

Hydraulic Distribution System Modeling

The City of Shoreview provided an InfoWater hydraulic model of their water distribution system that was updated in 2022 by its engineering consultant. The Shoreview Water Distribution System Hydraulic Modeling Tech Memo dated August 22, 2022, summarized the results of a 24-hour simulation of the City's 2022 maximum day water demands to evaluate how the distribution system performs over the course of a typical peak-demand day. It also evaluated the system's ability to provide required fire flows under the same peak-demand conditions. The maximum-day demand scenario represented approximately 5.9 million gallons of water use over a typical peak-demand day, distributed throughout the City's water distribution system based on customer water use patterns. The evaluation found that the system maintained adequate water pressure and fire flow capacity under these peak-demand conditions, with no areas of immediate concern.

The water distribution system model represents Shoreview's existing pipe network with diameters ranging from 4-in. to 30-in. and roughness coefficients ranging from 100 to 140. Two 1.5-million-

gallon ESTs serve the city and float in a 10' range in the existing maximum day demand scenario. A manually controlled butterfly valve located on a 16" watermain near the intersection of Rustic Place and Rice Street N is set to 70% open, which adds head loss and helps the south tank float with the north tank. There are no altitude valves at the ESTs, so the butterfly valve is the only operating valve that functions to control tank levels. The WTP high service pump station has four parallel pumps, and two pumps supply the existing scenario of 5.9 MGD with time settings and pump speed settings ranging from 80% to 94%.

A scenario was created that added North Oaks' ultimate demand to the existing maximum day demand to understand the impact on the distribution system performance. Through conversations with North Oaks and MCES, a constant demand of 1,400 gpm was added at the intersection of Wildflower Way and Hodgson Road as a delivery point for North Oaks, as shown in Appendix A. This constant demand results in a little more than 2 MGD over a day. North Oaks' engineering consultant provided updated maximum day water demand projections of 1.67 MGD for the buildout of the North Oaks service area, so 2 MGD provides a conservative buffer for planning. The time-based pump controls and speeds from the existing maximum day demand scenario could not re-fill the existing ESTs with the added demand, so the existing level-based pump controls were utilized in the model based on the south EST to fill and balance the towers. Two pumps with level-based controls and constant speed of 95% were able to re-fill both ESTs and maintain a 10' range in an extended period simulation. The butterfly valve was closed to divert more flow from the high service pump station toward the north EST and the North Oaks delivery point. Velocities and pressure loss were both in acceptable ranges with these modifications indicating no pipeline projects or additional high service pumping are required to deliver 2 MGD to North Oaks with Shoreview's existing maximum day demands. However, costs are included in Appendix F to account for upgrading the butterfly valve from manual controls to electric and integrating with the existing SCADA system.

The high service pump station's existing motors are 250 horsepower with a 1.0 service factor and utilize variable frequency drives (VFD). VFDs do not have a service factor, but calculations were performed to make sure the pumps with North Oaks still operate under the motors' rated horsepower limitation. The calculated brake horsepower at the low and high flow conditions during the extended period simulation with an assumed pump efficiency of 82% was 211 horsepower at 95% speed, which verifies that the pumps still operate in a realistic range and do not require motor upgrades to supply water to North Oaks.

HSPS Pump Brake Horsepower:

Pump Efficiency = 82%

High Flow = 3,555 gpm

Low Flow = 3,246 gpm

Low Head = 193 ft

High Head = 211 ft

Brake Horsepower = 211 hp

Brake Horsepower = 211 hp

Available fire flow capacity was evaluated for all 1,308 existing fire hydrants under the maximum day demand scenario, including the additional North Oaks demand, with the storage tank at 50%

operating level. One high service pump operating at 95% speed was assumed, and a steady-state hydraulic analysis was performed to determine the available fire flow at each hydrant while maintaining a minimum residual pressure of 20 psi. The analysis did not identify any widespread fire flow deficiencies under the evaluated conditions.

Ultimate demand scenarios were created using MCES' projections of cities' water demand, which projected an ultimate development maximum day demand ranging from 6.8 MGD to 9.2 MGD for Shoreview. The high range projection was utilized for a conservative ultimate system analysis. Shoreview's existing maximum day demands were scaled up by a factor of 1.56 to achieve 9.2 MGD ultimate maximum day demand allocation. This Shoreview buildout scenario was created both with and without the North Oaks demand with similar results and control modifications. North Oaks' ultimate maximum day demand projection is 2 MGD, so the 1,400 gpm constant demand at Wildflower Way and Hodgson Rd remained. This scenario required a third high service pump to be active with level-based controls in order to re-fill the ESTs and maintain a range of 10' in their levels. The butterfly valve stayed closed and the pump speeds remained at 95% for these ultimate scenarios. Three pumps with level-based controls and constant speed of 95% were able to re-fill both ESTs and maintain a 10' range in an extended period simulation. Velocities and pressure loss were both in acceptable ranges with these modifications indicating no pipeline improvements are required to deliver 2 MGD to North Oaks with Shoreview's ultimate maximum day demands. The three-pump configuration meets the 10-States Standard of conveying the maximum day demand of the distribution system with the largest pump out of service, since all four existing pumps have the same capacity. North Oaks and Shoreview may want additional redundancy for their systems, but no costs were included for high service pump improvements as the current pump station capacity is sufficient based on industry standards.

Connection Point between Shoreview and North Oaks

As noted above, the hydraulic model currently supports adding a 2 MGD demand at the corner of Wildflower Way and Hodgson Road. This is part of the existing infrastructure in Shoreview. However, there may be a need to connect a tee and install an additional water main across the street; this is currently being modeled as a 24-in. main, but is subject to change based on North Oaks' system modeling.

Contaminant Plume Consideration

The proposed well locations are near two superfund plumes: the Twin Cities Army Ammunition Plant (TCAAP) plume, which is approximately 1 mile from the closest well, and the MacGillis and Gibbs plume, which is approximately 3 miles away from the closest well.

TCAAP

- The TCAAP plume is located to the west of the proposed well locations. Both shallow and deep groundwater contamination are noted in the Prairie du Chien-Jordan Aquifer. Monitoring currently shows flows to the south and southeast of the TCAAP site.
- Primary contaminants of concern are chlorinated volatile organic compounds (VOCs), and 1,4-dioxane.

- There is an active onsite groundwater pump and treat facility.

MacGillis and Gibbs

- The MacGillis and Gibbs site is approximately 3 miles away from the proposed well sites and impacts to the Prairie du Chien-Jordan aquifer are not currently being monitored.
- There are currently no indications that the plume is actively moving offsite.
- Primary contaminants of concern are pentachlorophenol (PCP), arsenic, chromium, polyaromatic hydrocarbons (PAHs), their derivatives, and polychlorinated dibenzo-p-dioxins (dioxins).
- There is an active onsite groundwater pump and treat facility.

Because of the potential impacts to the groundwater plumes, the MPCA advises the completion of environmental due diligence to identify how additional groundwater pumping may impact existing flow paths associated with these plumes. Impacts to groundwater plumes caused by the new wells could bear legal responsibilities for the City, as well as impact other existing water supplies.

The MPCA advises entering the Brownfield Redevelopment Program to access technical assistance when evaluating the placement of future wells.

Treatment Facility Conceptual Layout

Shoreview's existing WTP employs a combination of aeration for iron and manganese oxidation, gravity filtration using anthracite and greensand media, and chemical treatment using chlorine gas and hydrofluorosilicic acid (fluoride). Given the proximity of the new wells that will serve North Oaks to the existing wells that serve Shoreview, it is expected that the water chemistry will have similar contaminant concerns. The primary contaminants of concern are iron and manganese, which can be treated using the same treatment process as is currently employed in Shoreview. This existing treatment process is depicted in Figure 1.

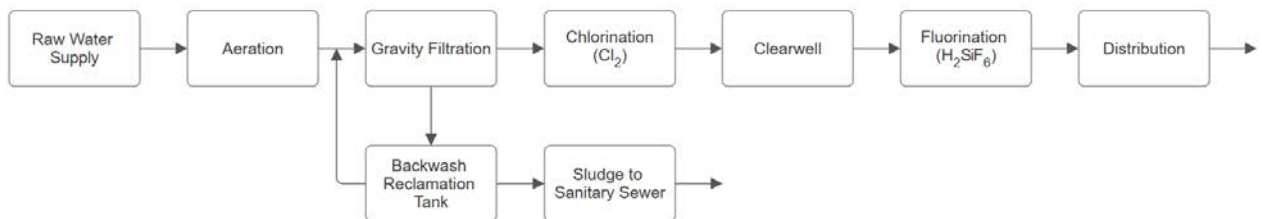


Figure 1: Iron and Manganese Removal Process

The process described above was modeled at the conceptual level to determine appropriate facility sizing. A 2 MGD facility using this process would result in a facility that is approximately 97 ft x 36 ft from exterior length to exterior width. However, groundwater modeling may indicate that the two new wells to be drilled could impact the contaminant plumes of 1,4-dioxane and trichloroethylene (TCE)

from the Twin Cities Army Ammunition Plant (TCAAP) and result in contaminated raw water entering the proposed WTP. If groundwater modeling and water sampling from monitoring wells determine that the construction of the proposed wells could result in contaminated raw water, two potential alternatives must be evaluated: (1) adding the advanced oxidation process and granular activated carbon treatment to the proposed WTP to address potential TCAAP plume, or (2) diverting portions of the flows from the existing well system to the proposed treatment facility. In the first alternative, an additional treatment train must be added to the proposed WTP as shown in Figure 2, employing an advanced oxidation process (ultraviolet light and hydrogen peroxide treatment) and granular activated carbon pressure filters.

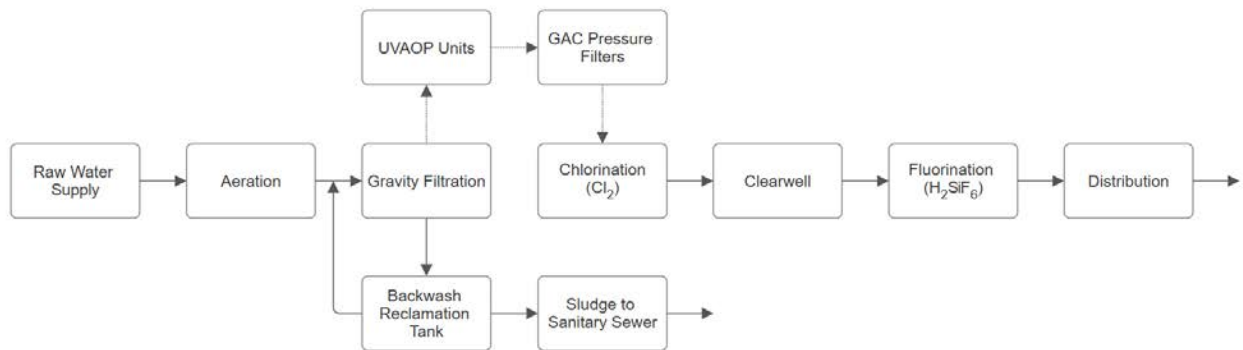


Figure 2: Iron and Manganese Removal Process with Added 1,4-Dioxane and TCE Removal

Preliminary evaluation suggests this may involve three small Ultraviolet Advanced Oxidation Process (UVAOP) units with hydrogen peroxide for the breakdown of 1,4-dioxane at 1,400 gpm, four vertical granular activated carbon (GAC) pressure filters for adsorption of TCE, and excess hydrogen peroxide at 1,400 gpm. Based on an existing treatment facility designed for treating TCAAP contaminated water, the Saint Anthony Water Treatment Plant, the UVAOP system footprint is expected to be approximately 75 ft x 50 ft, and the GAC pressure filter system footprint is expected to be approximately 56 ft x 50 ft. This additional facility can therefore be estimated to occupy approximately 131 ft x 50 ft in total space. The additional contaminant treatment would be located at the same site as the iron and manganese removal facility, immediately south of the existing WTP.

The second alternative mentioned above involves diverting raw water from Shoreview's existing distribution system to the proposed WTP. If this alternative is selected, the existing well system in Shoreview may be used to supply both the existing and proposed WTP by connecting a new 16-in. main at a tee near the existing WTP's raw water supply line to divert raw water to the proposed WTP.

Treatment Facility Site Verification

For planning-level evaluation, the proposed wells were assumed to require iron and manganese treatment comparable to Shoreview's existing wells; at this time, this assumption is based on proximity to Shoreview's existing wells and should be confirmed through test well sampling. Additional

treatment of 1,4-dioxane and TCE may also be required dependent on the location of the two new wells and resultant contaminant plume impacts. Therefore, two scenarios were explored for the layout of the proposed WTP: (1) an aeration and filtration facility for iron and manganese removal only, and (2) an iron and manganese removal facility with additional treatment of 1,4-dioxane and TCE. The facility layouts for these scenarios are described below.

Iron & Manganese Treatment Only

In a scenario in which only iron and manganese need to be removed from the raw water, a 2 MGD facility may be constructed on the site of the existing Shoreview WTP including the following:

- Four 14 ft x 10 ft filter cells, allowing for maintenance of rated flow with the largest filter out of service; filter media is assumed to have a filter loading rate of 3.5 gpm/ft²
- Backwash reclamation tanks and pump system with estimated backwash rate of 2,100 gpm
- Two forced draft aerators – with one being redundant – with baffled aeration troughs
- Chemical testing laboratory
- Chlorine gas feed system
- Chlorine gas storage room and separate future chemical storage room
- Control room, electrical room, and restrooms

The dimensions for this facility layout are approximately 97 ft x 36 ft from exterior to exterior. This was verified by creating a 3-dimensional model of the facility at the conceptual level using Autodesk Revit to confirm that all elements will have sufficient space within this facility footprint. See Appendix B for plan, section, and isometric views of the conceptual 3D model.

This facility may be connected to Shoreview's existing WTP via an enclosed hallway. Whether or not the hallway is included, the proposed WTP will be set back from the existing WTP by a minimum of 20 ft so as not to impact the existing building foundations. In addition to the building itself, the following site developments and parameters will likely be required:

- Southward extension of the existing gravel drive on the west side of the Shoreview facility to accommodate chemical delivery truck access to the proposed WTP chlorine storage room.
- Additional stormwater management/storage will be required due to the increased impervious area anticipated to result from construction of the new WTP. Based on a local rain intensity of 3.4 inches per hour during 100-year storm events, it is estimated that peak flow will increase by 260 gpm of stormwater, requiring additional storage/management during peak stormwater events.
- Per conversations with the City of Shoreview, maintenance of a 40-ft setback from arterials is required in this zone. Therefore, a minimum of 40 ft must be maintained as a buffer between the southern edge of the proposed WTP and the northern boundary of County Highway 96 right-of-way. Though if development proceeds, additional conversations with local zoning regulators will be required.

This scenario uses the following assumptions:

- No additional clearwell storage is necessary because there is sufficient storage between the existing Shoreview clearwell and future water towers in North Oaks.

- Based on discussions with the City of Shoreview personnel, it was determined that the existing WTP capacity of 8 MGD is sufficient to accommodate Shoreview's projected maximum day demand at Ultimate Development, and therefore the existing WTP does not need to be upsized. Therefore, any existing space may be allocated to the proposed WTP and does not need to be retained for future development in Shoreview.
- Construction on the south side of the existing WTP property will require relocation of multiple sanitary sewer lines – including 4-in., 8-in., and 24-in. diameter lines – as well as potential relocation of a 12-in. watermain. Utility relocations will impact both the total cost of the project as well as the construction timeline.
- No treatment of TCAAP plume contaminants is necessary in this scenario.
- The proposed WTP and outbuildings should be co-located on the property of existing WTP; however, if the existing space is insufficient, the future UVAOP and GAC facility may be proposed on the property to the east currently occupied by the Shoreview Ice Arena, per the City of Shoreview. The City of Shoreview would need to purchase the arena from its owner (Ramsey County) and demolish the structure to allow this space to be used, if needed.

Based on the information above, the proposed site is likely sufficient to add the 2 MGD iron and manganese treatment facility. A conceptual site layout and WTP conceptual model based on this information are available in Appendix B.

Iron & Manganese Treatment with TCAAP Plume (1,4-Dioxane and TCE) Treatment

In a scenario in which iron, manganese, 1,4-dioxane, and TCE need to be removed from the raw water, a 2 MGD facility may be constructed on the site of the existing WTP including the following:

- Four 14 ft x 10 ft filter cells, allowing for maintenance of rated flow with the largest filter out of service; filter media is assumed to have a filter loading rate of 3.5 gpm/ft²
- Backwash reclamation tanks and pump system with estimated backwash rate of 2,100 gpm
- Two forced draft aerators – with one being redundant – with baffled aeration troughs
- Three Ultraviolet & Hydrogen Peroxide Advanced Oxidation (UVAOP) units
- Four vertical pressure GAC filters
- Chemical testing laboratory
- Chlorine gas feed system
- Chlorine gas storage room and separate future chemical storage room
- Control room, electrical room, and restrooms
- Additional chemicals, such as citric acid for UV lamp cleaning

The dimensions for the iron and manganese removal portion of the facility would remain the same at 97 ft x 36 ft from exterior to exterior. Based on initial evaluations, the dimensions of the 1,4-dioxane and TCE treatment train are assumed to be 131 ft x 50 ft from exterior to exterior. Therefore, the overall footprint needed for the facility to support both treatment processes is approximately 131 ft x 86 ft. This facility may be connected to the existing WTP via an enclosed hallway. Whether or not the hallway is included, the proposed WTP will be set back from the existing WTP by a minimum of 20 ft so as not to impact the existing building foundations. In addition to the building itself, the following site developments and parameters will likely be required:

- Southward extension of the existing gravel drive on the west side of the existing WTP to accommodate chemical delivery truck access to the proposed WTP chlorine storage room.
- Further evaluation will be required to identify stormwater storage capacity and any potential additional stormwater storage needed based on final layout design.
- Per conversations with the City of Shoreview, maintenance of a 40-ft setback from arterials is required in this zone. Therefore, a minimum of 40 ft must be maintained as a buffer between the southern edge of the proposed WTP and the northern boundary of County Highway 96 right-of-way.

This scenario uses the following assumptions:

- No additional clearwell storage is necessary because there is sufficient storage between the existing WTP clearwell and future water towers in North Oaks.
- The City of Shoreview anticipates the existing WTP capacity of 8 MGD is sufficient to accommodate Shoreview's projected maximum day demand at Ultimate Development, and therefore the existing WTP does not need to be upsized. Therefore, any existing space may be allocated to the proposed WTP and does not need to be retained for future development in Shoreview.
- Construction on the south side of the existing WTP property will require relocation of multiple sanitary sewer lines – including 4-in., 8-in., and 24-in. diameter lines – as well as potential relocation of a 12-in. watermain. Utility relocations will impact both the total cost of the project as well as the construction timeline.
- Any proposed WTP and outbuildings should be co-located on the property of existing WTP; however, if the existing space is insufficient, the future UVAOP and GAC facility may be proposed on the property to the east currently occupied by the Shoreview Ice Arena, per the City of Shoreview.

Based on the information above, the proposed site is likely sufficient to add this 2 MGD iron and manganese treatment facility with treatment of 1,4-dioxane and TCE. A conceptual site layout showing both treatment facilities is presented in Appendix B.

Treatment Facility Backup Generator Upgrades

The existing WTP currently operates with a 1000 KW backup diesel generator, which provides power to both the WTP and the high-service pump station during power outages. The existing WTP commissioning notes indicate that approximately two-thirds of the generator's capacity is utilized, with around 30% dedicated to the treatment facility and managing transient spikes. Given that the proposed WTP will be about one-quarter the size of the current facility, the existing generator may be able to support operations of the proposed WTP while staying below 80% of its rated capacity. However, during peak flow periods requiring additional high-service pump operation, the generator will likely be unable to handle the increased demand. Additionally, if TCE treatment is required and a proposed WTP is designed to accommodate this, the energy needs would exceed the generator's capacity.

It is recommended to plan for an upgrade to the backup generator system to account for potential TCE and 1,4-dioxane treatment operations and additional booster pumping capacity needs. Once specific equipment and treatment requirements are further defined, the generator can be properly sized to meet the anticipated load. A 750 kW backup power generator was assumed and included in the construction cost estimate to account for this possibility in the future.

Well and Pump House Site Verification & Raw Water Transmission

Each of the two new well sites will require a pumphouse. Each pumphouse will contain the well with vertical turbine pump, sample tap, check valve, an electromagnetic flowmeter, butterfly valve, VFD, transformer, heater, and shutoff. The building roof will be constructed with a hatch so that the pump may be lifted out for cleaning, repairs, and/or sealing in accordance with Minnesota Rules Chapter 4725.2175.^[1] The layout of these elements was modeled in 3D using Autodesk Revit to ensure that the proposed footprint will include sufficient space for all elements. See Appendix C for plan, section, and isometric views of the conceptual 3D model. Based on these conceptual layouts, each pump house building will measure approximately 20 ft x 15 ft.

The following four sites were identified as potential locations for the new wells to be drilled (see Appendix D for a map of the locations):

- **Site 1:** 34-acre site located at the northeast corner of the intersection of Tanglewood Drive and Nottingham Place. The westernmost edge of this site is approximately 1.2 miles from the easternmost edge of the TCAAP contaminant plume.
- **Site 2:** 12-acre site located at the northeast corner of the intersection of Lexington Avenue N and Tomlyn Avenue, just north of the Shoreview Village Mall. The westernmost edge of this site is approximately 1 mile from the easternmost edge of the TCAAP contaminant plume.
- **Site 3:** 11-acre site located along the south side of County Highway 96. Bordered to the north by the County Highway 96 right-of-way boundary and extending approximately 280 ft south, bordered to the east by Scandia Shores Retirement Community, and to the west by the intersection of Dale Street N and County Highway 96. The westernmost edge of this site is approximately 2 miles from the easternmost edge of the TCAAP contaminant plume.
- **Site 4:** 3-acre site extending for approximately 0.35 miles along a northeast-southwest diagonal property that crosses Larson Road, Tanglewood Drive, and North Lake Court. The westernmost edge of this site is approximately 1.5 miles from the easternmost edge of the TCAAP contaminant plume.

All four of the proposed sites have sufficient space for a 20 ft x 15 ft pumphouse. However, chosen well sites must also consider technical parameters including those listed in Table 2.

Table 2: Well Site Selection Parameters

Parameter	Evaluation
Hydrogeologic Suitability	To be determined by contractor during test well drilling
Separation from Existing Wells	Generally, service wells should maintain at least 1,500 feet of separation to limit the potential for well interference. Based on current data from MDH's published well index, all four potential sites have sufficient space to maintain adequate separation. However, it should be noted that Sites 1 and 4 border within 600 ft of each other and the final well location should be chosen carefully.
Separation from Contaminant Sources	Per Minnesota Rules Chapter 4725, wells must be located away from various contaminant sources. All four potential well sites provide sufficient space for separation from contaminant sources such as feedlots, hazardous waste disposal areas, and other sources listed in Chapter 4725. ^[3]
Separation from TCAAP Contaminant Plume	All four potential sites are a minimum of one mile from the edge of the TCAAP contaminant plume based on current MPCA models. However, determining if this is sufficiently far away from the plume so as not to impact raw well water quality will be dependent on the outcome of DNR groundwater modeling.
Risk of Drawdown and Well Interference	To be determined by contractor during test well drilling
Raw Water Quality	To be determined by contractor during test well drilling
Site Access and Constructability	There do not appear to be any access limitations to any of the potential sites; however, portions of County Highway 96 may need to be closed during construction regardless of which well sites are selected.
Transmission Main Length and Routing Complexity	Each of the four well sites are located approximately equidistant from the proposed WTP and therefore require a similar total length of raw water transmission main. However, each alternative combination of well sites will require slightly different main sizing and routing, including different numbers of road crossings and traffic control changes during construction. Sites 2 and 3 have the simplest routes, requiring the fewest road crossings, potential road closures, and the shortest raw water transmission main length. See Table 4 for further information on potential transmission main routing.

Land Ownership, Acquisition/Easements, and Stakeholder Impacts	Two of the four sites will require land acquisition or easements from Ramsey County, private industry, or private homeowners. To minimize stakeholder impacts, sites that do not require construction directly next to private homes or businesses should be prioritized. See Table 3 for a summary of current landownership at all four potential well sites.
--	--

Because the selection of well sites is dependent on test well drilling and analysis yet to be completed, analysis of the potential well sites for this report prioritized parameters that could be assessed without those data. These parameters include landownership and stakeholder impacts, raw water transmission main and routing complexity, setback requirements, and separation from existing wells and known contaminant locations.

Regarding ownership, only Sites 2 and 4 contain property that is currently owned by the City of Shoreview and could therefore accommodate the pumphouses without requiring land acquisition costs. An overview of landownership within the four potential well sites is summarized in Table 3.

Table 3: Current Ownership of Proposed Well Sites

Site	Ownership
Site 1	All residential single-family homes, owned by private owners
Site 2	Combination of city-owned property (approx. 4.6 acres), and land owned private organizations including the Lake Martha Association, Midwest Special Services, Inc., and J Merritt Properties, LLC (approx. 7.4 combined acres)
Site 3	Combination of property owned by Ramsey County Parks and Recreation (approx. 1.6 acres) and private organizations including 580 Shoreview, LLC and Harbor Place Associates, Inc (approx. 8.3 combined acres)
Site 4	Primarily owned by Northern States Power Co. (approx. 1.9 acres), with remaining land divided between many private single-family homeowners (0.93 combined acres) and city-owned property (approx. 0.17 acres)

Selecting two well sites for drilling from the group of four potential sites results in six possible alternatives, each with varying transmission line lengths and land easement or acquisition costs. These alternatives are summarized in Table 4, along with each alternative's estimated cost. Maps with proposed transmission main routes are presented in Appendix E. Detailed calculations for new, directionally drilled raw water transmission mains and associated land acquisition and easement costs are presented in Appendix F.

Table 4: Well Site Alternatives

Alternative	Well Site Combination	Estimated Total Transmission Line Length (LF)	Land Easement / Acquisition Involved	Estimated Land Acquisition and Raw Water Transmission Cost
A	Site 1 & Site 2	7200	Yes (Residential)	\$2,000,000
B	Site 1 & Site 3	8500	Yes (Residential; County or Private)	\$2,200,000
C	Site 1 & Site 4	5700	Yes (Residential)	\$1,800,000
D	Site 2 & Site 3	8900	Yes (County or Private)	\$2,200,000
E	Site 2 & Site 4	7400	No	\$1,900,000
F	Site 3 & Site 4	8300	Yes (County or Private)	\$2,200,000

To avoid requiring land and easement acquisition and minimize stakeholder impacts, the City of Shoreview should consider using city property at Sites 2 and 4 for the placement of the two new wells and pumphouses (Alternative E). However, prior to drilling, any potential well site must be tested both for standard water quality and hydraulic measures as well as its potential impact on the TCAAP contaminant plume. If groundwater modeling determines that any specific well location would shift the contaminant plume boundaries and/or draw contaminated raw water, the MDH and the MPCA may determine that the site is ineligible for drilling a new well. If such a site moves forward through the approval process with these agencies, it will require additional treatment as mentioned in the Treatment Facility Site Verification section above.

Cost Estimation

Level 4 cost estimates were created for capital costs and operations and maintenance costs using 2026 dollar values. Level 4 cost estimates can generally be considered accurate within -30 to +50 percent given the preliminary planning stage nature of the study. Details about both cost estimates are provided below.

Capital and Land Acquisition & Easement Costs

As discussed above, there are two primary scenarios on which capital costs may be based: (1) removal of iron and manganese only, or (2) removal of iron and manganese with treatment of 1,4-dioxane and TCE. Both scenarios will require the following capital investments:

- Drilling of two 700 gpm wells
- Construction of two pumphouses to house the new wells
- Raw water transmission mains to transport well water to the proposed WTP
- A new treatment facility capable of treating up to 2 MGD
- SCADA and control modifications and operational adjustments

- Upgrades to Shoreview's high service pump capacity
- Stormwater retention pond and other site improvements

The expected capital cost for these items is approximately \$15,300,000. This includes all items listed above, as well as labor, engineering, construction, legal, and administrative fees and a 20% contingency.

In addition to the items listed above, the second scenario involving the treatment of 1,4-dioxane and TCE will also require an expanded facility with ultraviolet advanced oxidation process (UVAOP) and GAC filtration treatment trains. The capital cost for the expanded facility, including all items from the iron and manganese removal-only scenario, is approximately \$28,700,000. This includes all items listed above, as well as labor, engineering, construction, legal, and administrative fees and a 20% contingency.

In addition to the items listed above, both scenarios will also require investment either in raw water transmission lines to transport water from the proposed wells to the proposed treatment facility, or in a new main to divert raw water from the existing well system. The cost of this line item will vary based on which of the well site alternatives from Table 4 is selected due to differences in land acquisition or easement costs and variance in the total length of transmission main required. If new wells and transmission mains are constructed, the cost for this line item would vary between \$1,800,000 and \$2,200,000 depending on which alternative is chosen. If raw water is diverted directly from the existing well system, the total cost for this item would be approximately \$400,000. A detailed breakdown of cost estimates is available in Appendix F.

Annual Operation and Maintenance Costs

The annual operation and maintenance (O&M) costs associated with the proposed infrastructure includes the following annual costs:

Water Treatment Facility:

- Labor and benefit costs for one operator at 50% time and additional managerial labor
- Utility costs such as electricity, sanitary sewer, HVAC, and internet connection
- Routine maintenance, cleaning, and repairs of process equipment
- Disposal and replacement of spent filter media, including anthracite and Greensand/Oxiplus Media for iron and manganese removal
- Chemical feed, including fluoride and chlorine
- Routine groundskeeping and building maintenance
- Miscellaneous incidental expenses

Wells and Pump Houses:

- Development, disinfection, and testing of each well every three years
- Inspection of motor and pump components every six months
- Monthly water quality testing
- Gate valve replacement every 15 years

- Air release valve rebuild every seven years
- Air release valve replacement every 25 years
- Watermain inspection every 12 years
- Small electrical replacements including lights, fittings, etc. as needed
- Various incidental costs as needed

The estimated annual O&M costs associated with the iron and manganese removal treatment facility are \$309,000. Each pumphouse can expect an annual O&M cost of approximately \$132,000, for a total of \$264,000 per year for both pumphouses. This results in an expected total annual O&M cost of \$573,000 for the system. Additional details regarding the calculation of these costs are available in Appendix F. A summary of probable costs is presented in Table 5.

Table 5: Opinion of Probable Cost Summary

No.	Line Item	Iron and Manganese Removal Only	Iron and Manganese Removal with TCAAP Contaminant Treatment
1	Facility Costs	\$15,300,000	\$28,700,000
2	Connection Point Between Shoreview and North Oaks Distribution Networks	\$400,000	\$400,000
3A	Diversion of Raw Water to Proposed WTP	\$400,000	\$400,000
3B	Raw Water Transmission Costs from Well Sites	\$1,800,000 to \$2,200,000	\$1,800,000 to \$2,200,000
4	Range of Total Estimated Capital Costs	\$16,100,000 to \$17,900,000	\$29,500,000 to \$31,300,000
5	Annual O&M Costs	\$573,000	\$573,000+

From Table 5, the Facility Costs and Connection Point line items (numbers 1 and 2) are required in any scenario, as this is the required infrastructure to treat water in the proposed WTP and deliver the treated water to North Oaks. The cost of the raw water transmission to the proposed WTP will depend on which alternative is chosen as a result of groundwater modeling and water quality testing. If raw water will be diverted from the existing well system, item number 3A: Diversion of Raw Water to Proposed WTP represents the cost of transmission of water to the proposed WTP and should be included in the total capital cost estimate. However, if new wells will be drilled at any of the four proposed well sites, item number 3B: Raw Water Transmission Costs from Well Sites represents the cost of transmission of water to the proposed WTP and should be included in the total capital cost estimate. The low end of the range of total estimated capital costs in line number 4 represents the least expensive combination of alternatives – diverting raw water from the existing well system. The high end of the range represents the more expensive combination of alternatives – using a new well system and selecting the highest-cost well site combination from Table 4.

Regulatory Considerations

Federal Agencies

Because the proposed 2 MGD facility for North Oaks will be co-located on the same site as the existing WTP and connected via an enclosed hallway, it is possible that both treatment facilities will be considered one larger structure for regulatory purposes. This would have impacts primarily on chemical regulations, including the Clean Air Act's Chemical Accident Prevention Provisions. This regulation requires submission of a Risk Management Plan (RMP) for facilities storing 2,500 pounds or more of chlorine gas at any given point.^[2] Shoreview's existing chlorine gas storage has the capacity to hold up to five tons (10,000 pounds) of chlorine gas at a given time. If these facilities are to be considered one building under this regulation, the additional chemical storage required for the proposed WTP would increase the total storage requirement and likely trigger the need for resubmission of the RMP even if proposed WTP chlorine supply is stored in a separate room from existing WTP. Additionally, updates would be required to the facility's Emergency Planning and Community Right-to-Know Act reporting due to the increased chlorine gas storage. While the existing WTP chlorine storage area is large enough to house an adequate supply for both WTPs while maintaining a 30-days' supply on hand, it is recommended that each WTP's chlorine be stored separately. This adds minimal square footage to the overall footprint of the proposed WTP while reducing the need for extended piping of chlorine gas, which increases potential safety risks.

Additionally, the National Primary Drinking Water Regulations require routine water quality testing to be performed to evaluate levels of volatile organic compounds, bacteria, heavy metals and inorganics, chemical disinfectant residuals and byproducts, and more. The proposed plan indicates treatment of water with chlorine gas and fluoride; therefore, the maximum residual level may not exceed 4 mg/L for both chemicals. If there have been plume impacts on this aquifer, the PFAS, TCE, and 1,4-dioxane levels must be tested to ensure the levels remain below 4 parts per trillion, 5 parts per billion, and 1 part per billion*, respectively.

Minnesota State Agencies

To mitigate exposure risk from the TCAAP contaminant plume, the DNR and MDH enforce stringent siting and drilling constraints mandated under the City of Shoreview's Water Appropriations Permit. Physical work may only begin once the MDH receives and approves the notification form with the appropriate fee detailing the owner and property address, a Preliminary Assessment outlining the well location, target aquifer, and estimated withdrawal volumes. Following construction, a formal Well and Boring Record must be submitted to the MDH. This report documents the final well depth, geology, groundwater levels, and pump specifications, and must include certified laboratory test results verifying that the water is safe from bacteria, nitrate, and arsenic. Additionally, MPCA Brownfield

* The United States Environmental Protection Agency does not enforce a national maximum contaminant level for 1,4-dioxane in drinking water. However, the Minnesota Pollution Control Agency and Minnesota Department of Health monitor 1,4-dioxane levels in drinking water and recommend a non-enforceable maximum contaminant level of 1 part per billion.

Program Services have requirements that address the redevelopment of contaminated sites by providing legal liability assurances for developers in accordance with MN Statutes Chapter 115B.

Local Considerations

Coordination with Shoreview and North Oaks city officials and Ramsey County Public Works will be necessary for final approvals on construction activities, including zoning, setback requirements, easements, permitting, and potential road closures or traffic control changes during construction. Additionally, coordination with local watershed districts may be required to confirm final stormwater storage requirements.

Findings and Implications

The infrastructure improvements investigated in this study are not explicitly water conservation methods. Rather, drilling wells in Shoreview to supply water to North Oaks allows for the City of North Oaks to develop – which will likely lead to increased water consumption overall, up to the Ultimate Development level of consumption – while avoiding further reduction of the water levels in White Bear Lake by moving North Oaks' water source outside the White Bear Lake groundwater area of influence. This is both an effective way for North Oaks to develop while ensuring that North Oaks will have sustainable access to safe drinking water by moving off an at-risk water supply. However, this infrastructure is not expected to independently increase the water levels in White Bear Lake. Determinations on whether this method will maintain the water level in White Bear Lake are subject to modeling by DNR.

While these infrastructure improvements are likely to allow North Oaks to develop while avoiding further reduction in White Bear Lake water levels, there are challenges to consider as well:

- The construction of a water treatment facility requires significantly more technical design expertise than water conservation methods proposed in other studies
- Compared to other studies, major capital construction is significantly more expensive and the timeline for implementation will be on the order of multiple years, not months to years
- Careful monitoring of contaminant plumes will be required to ensure that well activity does not shift the boundaries of the contaminant plumes to impact existing wells
- Requires significant investment of time and resources without increasing the level of White Bear Lake, while other studies may increase the water level at lower cost

Despite presenting financial and technical challenges to address, this study presents an effective method of providing sustainable water supply to the City of North Oaks. However, it is not guaranteed to have an impact on the water levels in White Bear Lake; rather, these infrastructure investments would avoid potential future negative impacts to White Bear Lake's water levels.

Risks and Data Needs

- Because new wells have not yet been drilled for North Oaks, it is not possible to guarantee what the raw water quality will be, and therefore what exact treatment processes will be required. The type of treatment that will be necessary has considerable impact on the total cost and footprint of the proposed WTP. Therefore, further analysis of raw water quality will be necessary before more precise designs and cost estimates may be produced.
- Further analysis of the well location, existing contaminant plumes and well design is required. The MPCA and MDH will require environmental due diligence to be completed by the well owner to assess any potential impacts on existing contaminant plumes in the area. The MPCA recommends enrolling in the Brownfield Redevelopment Program to access technical assistance and liability assurance if/when work is being completed at or near existing contaminant plumes, because disturbance and impacts to the plume can cause the well owner to be legally associated with the release in accordance with MN Statutes 115B.

Conclusion

This study indicates that supplying North Oaks through new wells in Shoreview, treatment at a new 2 MGD facility co-located with Shoreview's existing WTP, and delivery through Shoreview's distribution system is technically feasible at a planning level. Hydraulic modeling indicates that Shoreview can deliver up to 2 MGD to North Oaks without major pipeline improvements. While present analysis of ultimate demand conditions show that the existing high service pumps are sufficient to handle the proposed flow, the City may desire additional high service pumps in the future for redundancy.

The proposed treatment facility site appears sufficient for either iron and manganese removal only or expanded treatment for 1,4-dioxane and TCE, pending confirmation of raw water quality and contaminant plume impacts. This approach would provide North Oaks with a long-term drinking water supply while avoiding additional withdrawals from White Bear Lake's groundwater area of influence; however, it is not expected to independently raise lake levels. Before advancing design, project partners should confirm well locations, water quality, treatment requirements, and regulatory approvals.

Appendices

Appendix A: Existing Shoreview Distribution Network

Appendix B: Treatment Facility Conceptual Site Layouts

Appendix C: Pumphouse Layout

Appendix D: Map of Potential Well Sites

Appendix E: Proposed Raw Water Transmission Lines by Alternative

Appendix F: Opinion of Probable Construction Cost

References

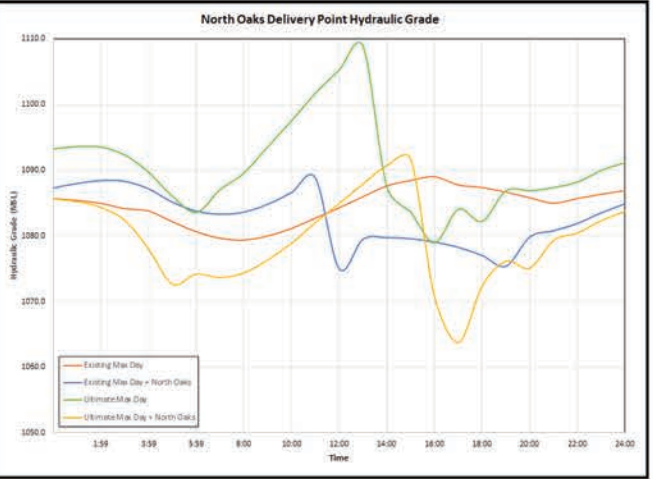
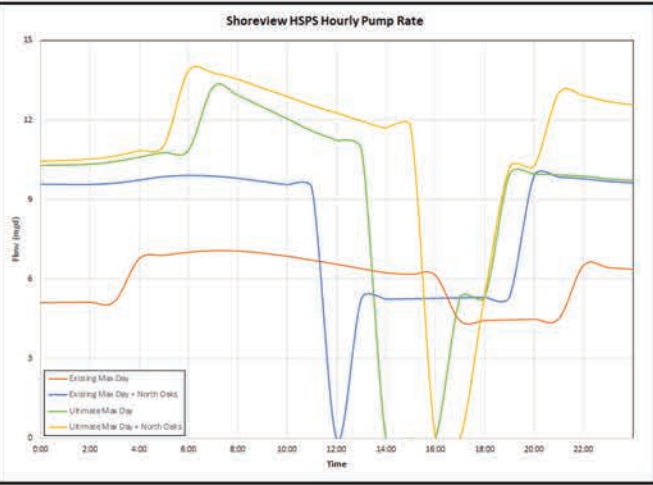
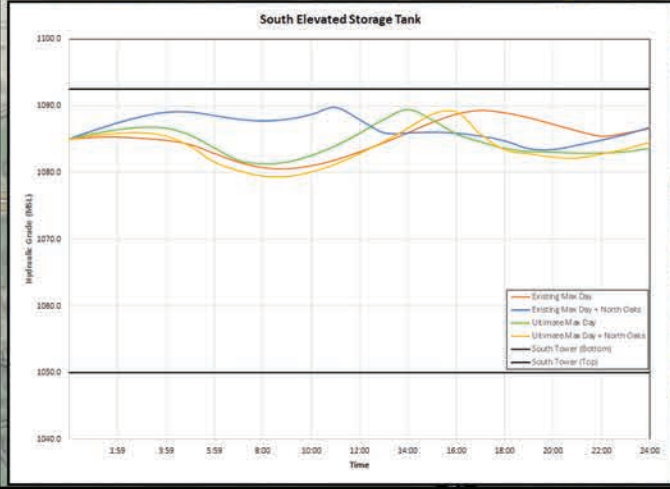
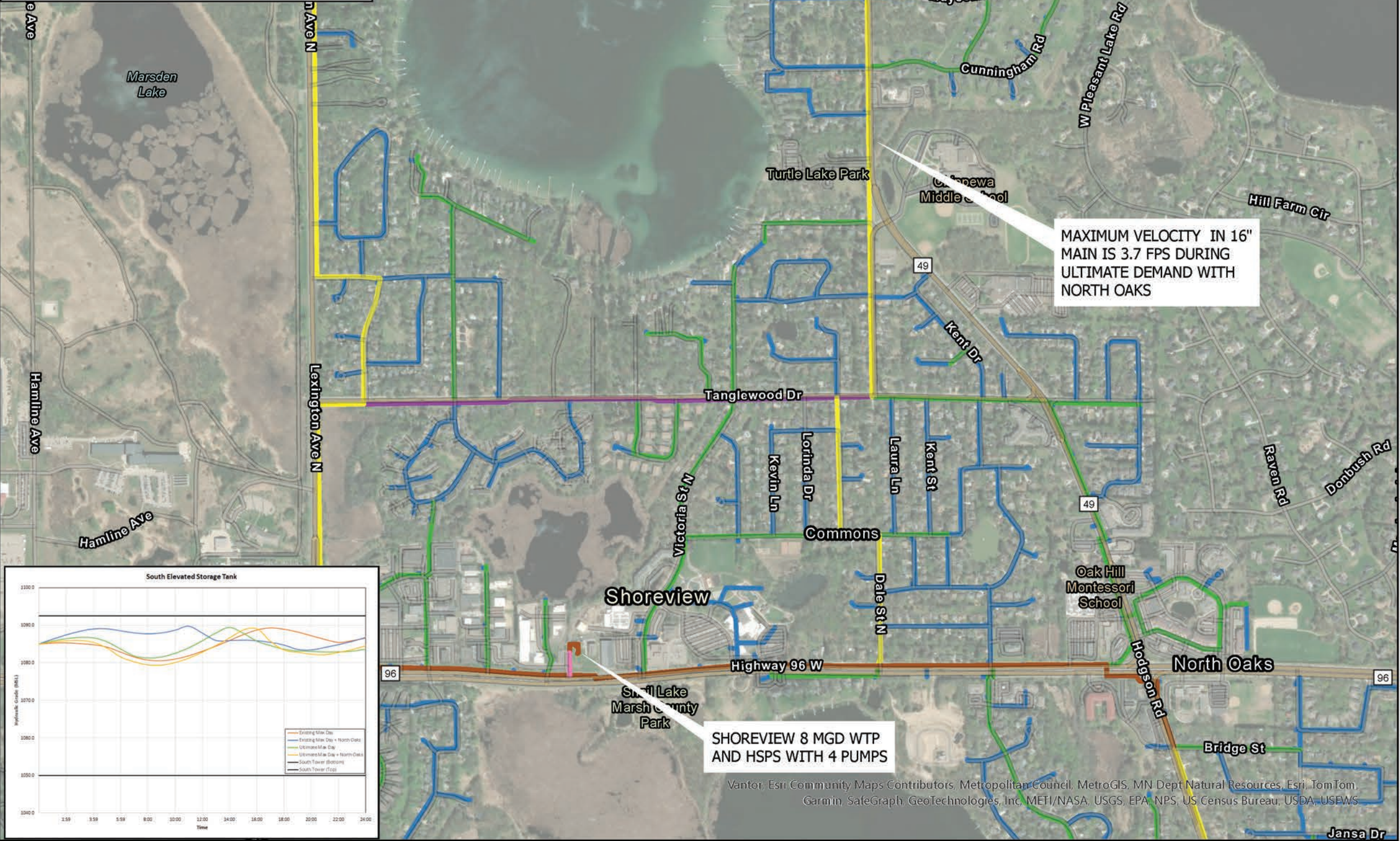
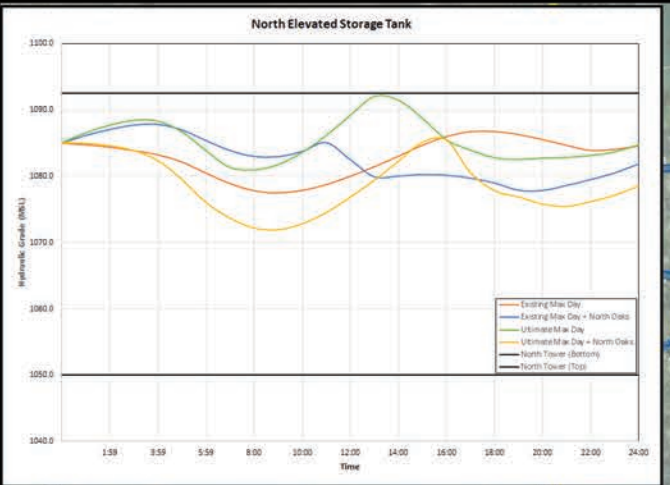
1. Minnesota Administrative Rules Chapter 4725.2175 LOCATION OF WELL OR BORING WITHIN BUILDING. Published online September 2, 2008. Accessed June 25, 2026. <https://www.revisor.mn.gov/rules/4725.2175/>
2. United States Code of Federal Regulations, 40 C.F.R. pt. 68. Published 1994. Accessed June 22, 2026. <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-68>
3. Minnesota Department of Health, *Isolation Distances from a Water-Supply Well*. Published online October 1, 2019. Accessed June 25, 2026. <https://www.health.state.mn.us/communities/environment/water/docs/wells/construction/isolate.pdf>
4. City of Shoreview, Shoreview Water Distribution System Hydraulic Model Update Technical Memorandum, AE2S, August 22, 2022

WHITE BEAR LAKE STUDY 15

APPENDIX A.2
SHOREVIEW WATER
DISTRIBUTION NETWORK AND
NORTH OAKS DELIVERY POINT

LEGEND

DIAMETER	
4	14
6	16
8	24
12	30



SHOREVIEW 8 MGD WTP
AND HSPS WITH 4 PUMPS

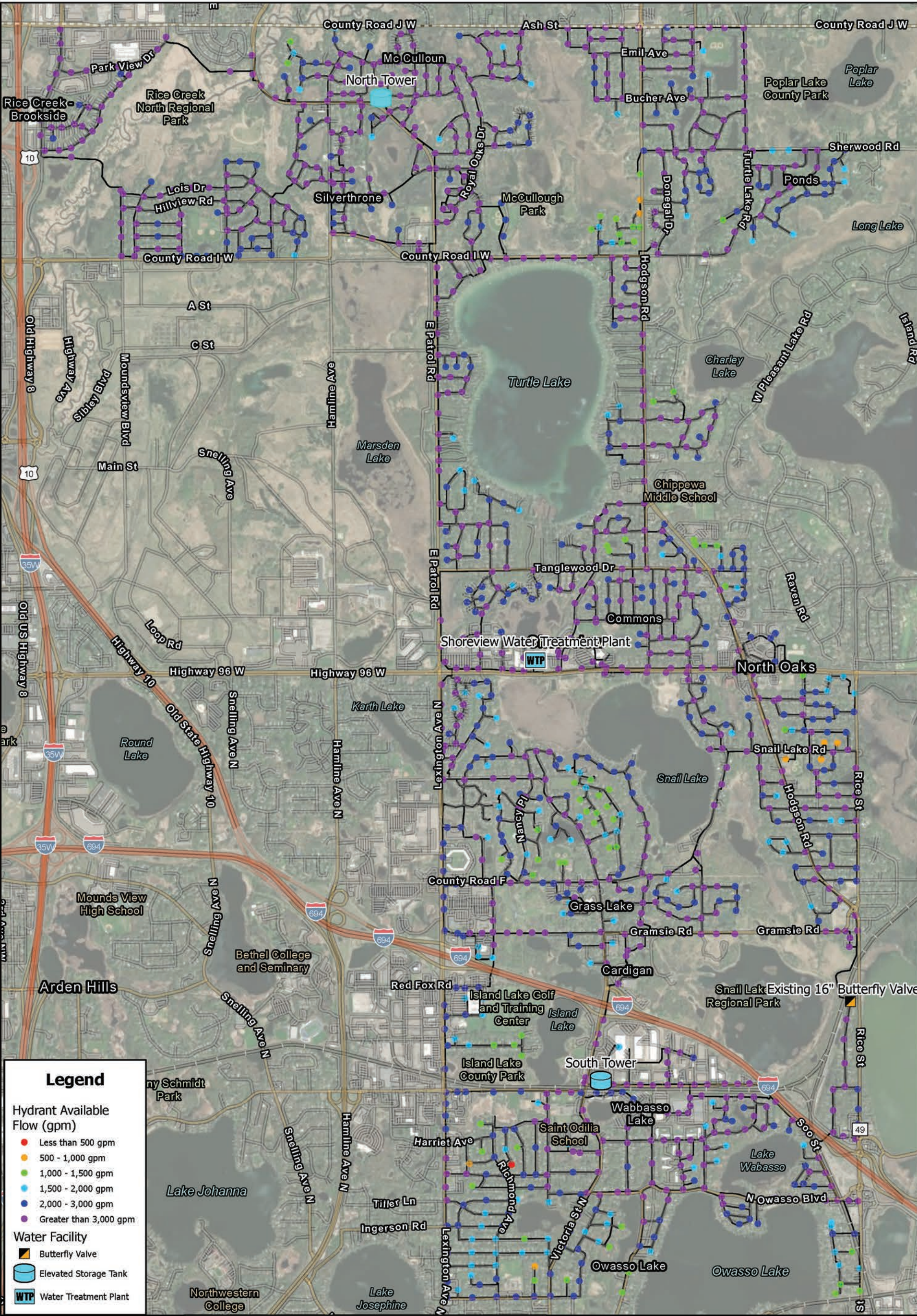
NORTH OAKS 1,400 GPM
DELIVERY POINT ALONG
16" MAIN

MAXIMUM VELOCITY IN 16"
MAIN IS 3.7 FPS DURING
ULTIMATE DEMAND WITH
NORTH OAKS

N

1,000

Feet



PREPARED BY:

Kimley»Horn

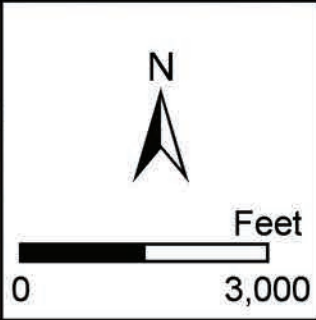
FOR: METROPOLITAN COUNCIL

APPENDIX A.3: SHOREVIEW ULTIMATE CONDITIONS AVAILABLE FIRE FLOW

WHITE BEAR LAKE STUDY 15
HENNEPIN, STATE

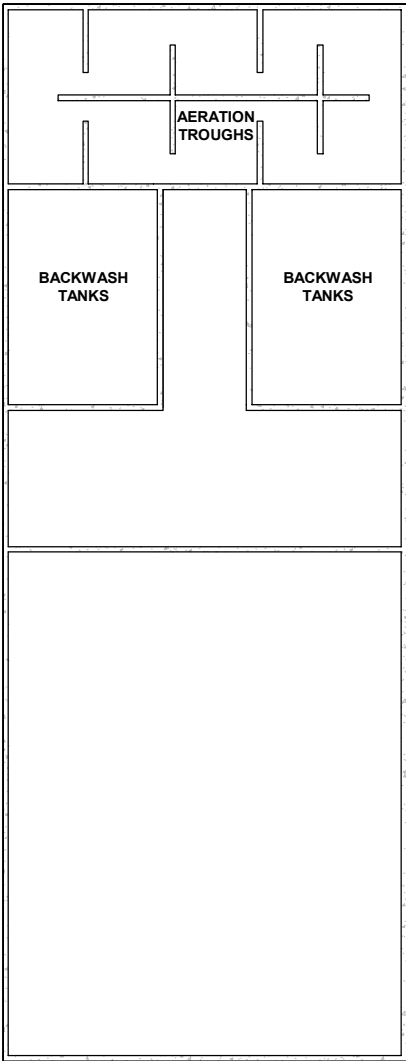
Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community, University of Minnesota, Metropolitan Council, MetroGIS, MN Dept Natural Resources, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS, Esri, CGIAR, USGS, Metropolitan Council, MetroGIS, MN Dept

Coordinate System: NAD 1983 HARN Adj MN Ramsey Feet

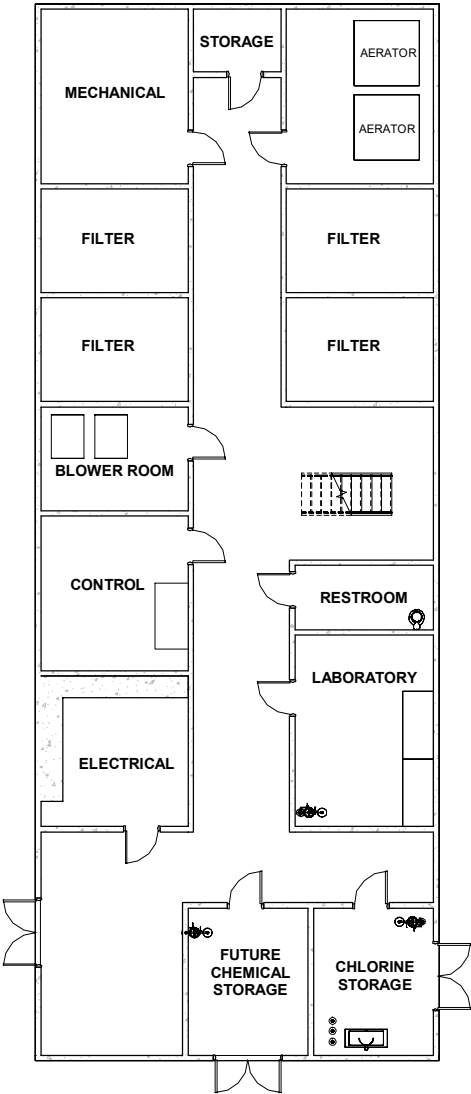




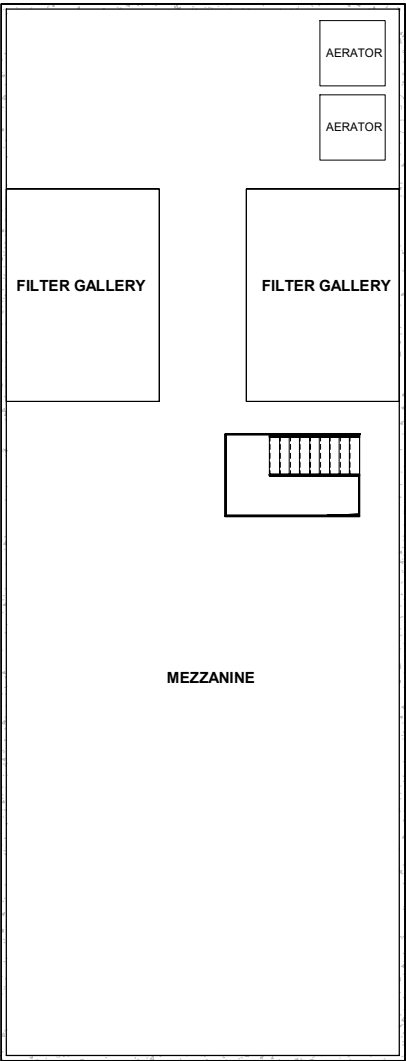
Appendix B.2: Iron and Manganese Treatment Facility Layout



1 Lower Level
1/8" = 1'-0"



2 Main Level
1/8" = 1'-0"



3 Upper Level
1/8" = 1'-0"

NOT FOR CONSTRUCTION

CONCEPTUAL FE AND MN TREATMENT FACILITY LAYOUT	WHITE BEAR LAKE STUDY 15 PREPARED FOR METROPOLITAN COUNCIL ENVIRONMENTAL SERVICES	KHA PROJECT ### DATE JULY 2026 SCALE AS SHOWN -- DRAWN BY: --	LICENSED PROFESSIONAL: FOR NAME -- MN LICENSE NUMBER 00000 DATE: xx/xx/xx	Kimley»Horn © 2024 KIMLEY-HORN AND ASSOCIATES, INC. 767 N. ELSTB STREET #100, ST. PAUL, MN 55114 PHONE: 651-645-4187 WWW.KIMLEY-HORN.COM REGISTRY NO. 35105	No.	Revisions	By	Date

Appendix B.2: Iron and Manganese Treatment Facility Layout



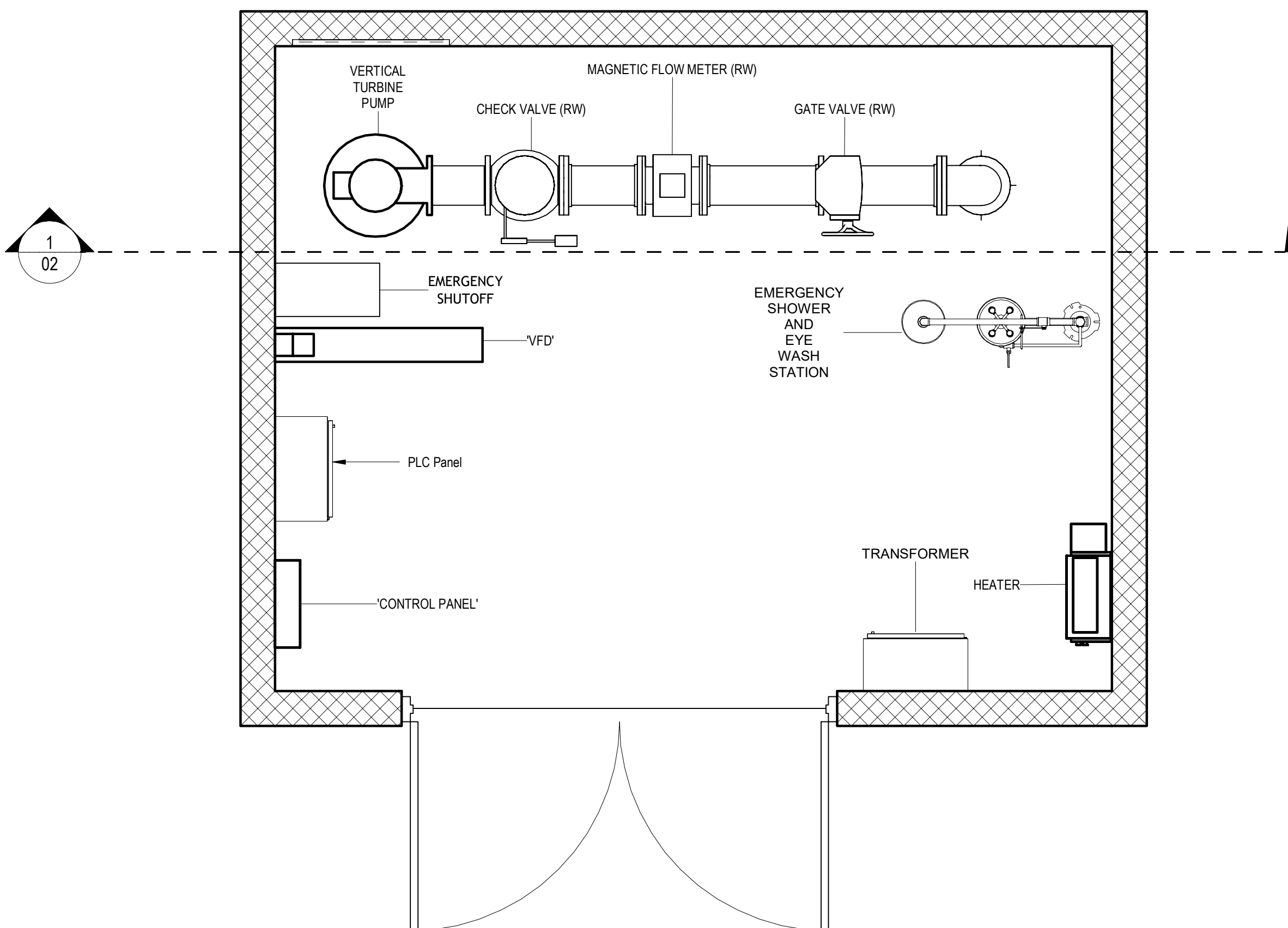
1 PROPOSED WTP ISOMETRIC

0 2 4 6
0 1/4" = 1'-0" 2

NOT FOR CONSTRUCTION

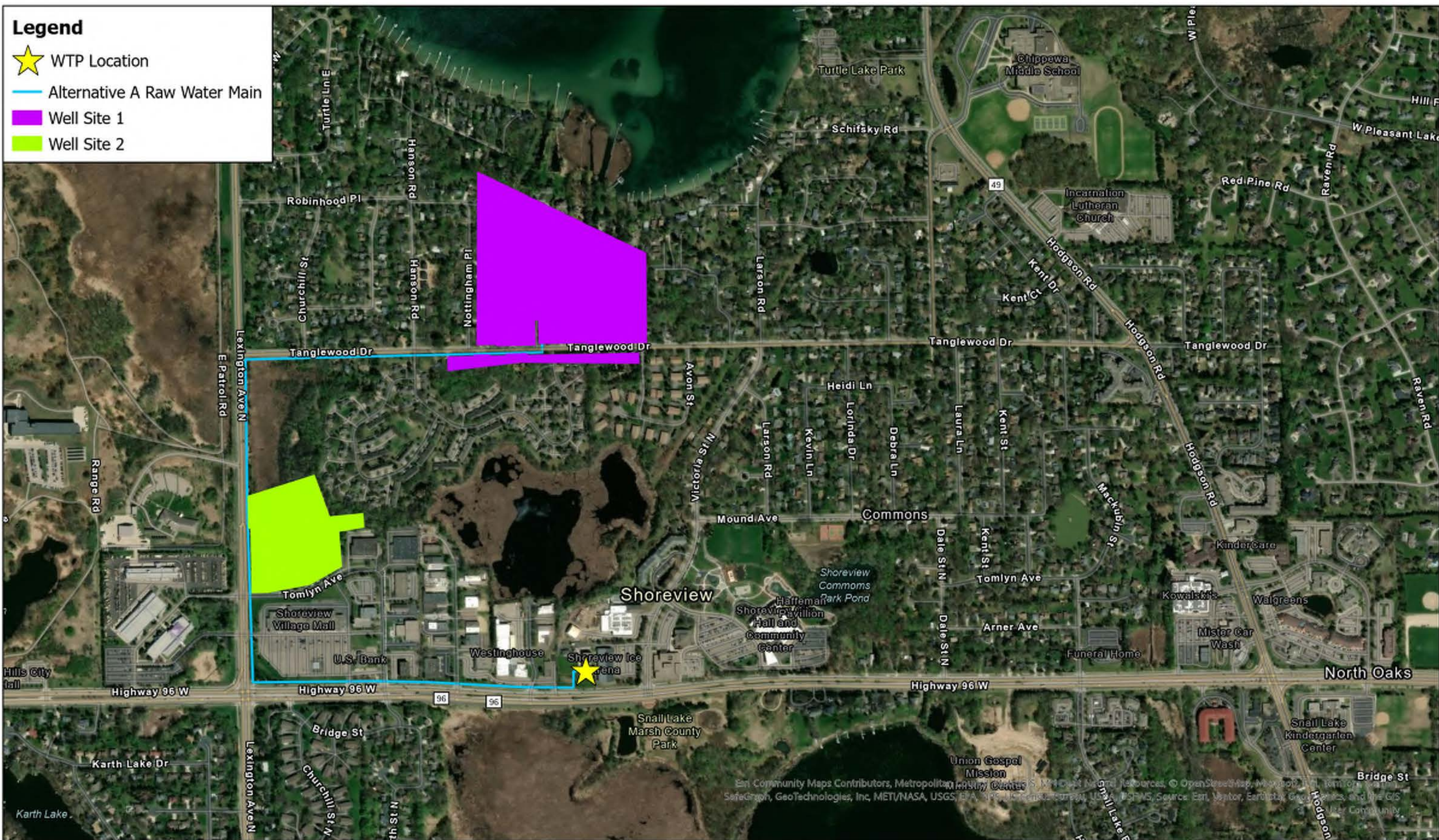
KHA PROJECT #####		DATE JULY 2026		SCALE AS SHOWN --		DRAWN BY: --		DATE: xx/xx/xx		LICENSED PROFESSIONAL: EOR NAME MN LICENSE NUMBER 00000 DATE: xx/xx/xx		Kimley»Horn © 2024 KIMLEY-HORN AND ASSOCIATES, INC. 707 N EUSTIS STREET #100, ST. PAUL, MN 55114 PHONE: 651-645-4197 WWW.KIMLEY-HORN.COM REGISTRY NO. 35106		Revisions		By		Date	
WHITE BEAR LAKE STUDY 15 PREPARED FOR METROPOLITAN COUNCIL ENVIRONMENTAL SERVICES																			
CONCEPTUAL FE AND MN TREATMENT FACILITY LAYOUT																			
SHEET NUMBER 02																			

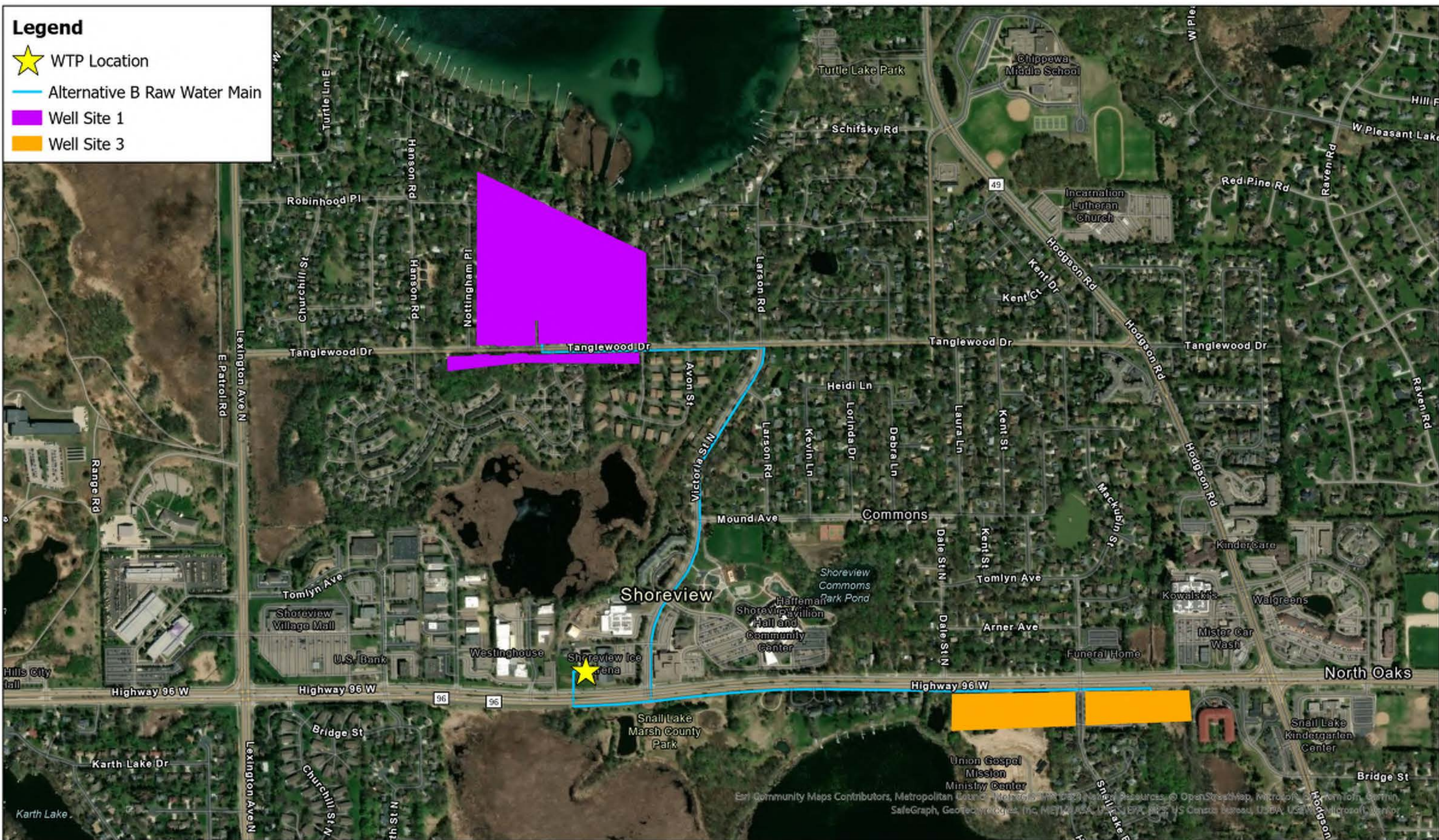
NOT FOR CONSTRUCTION

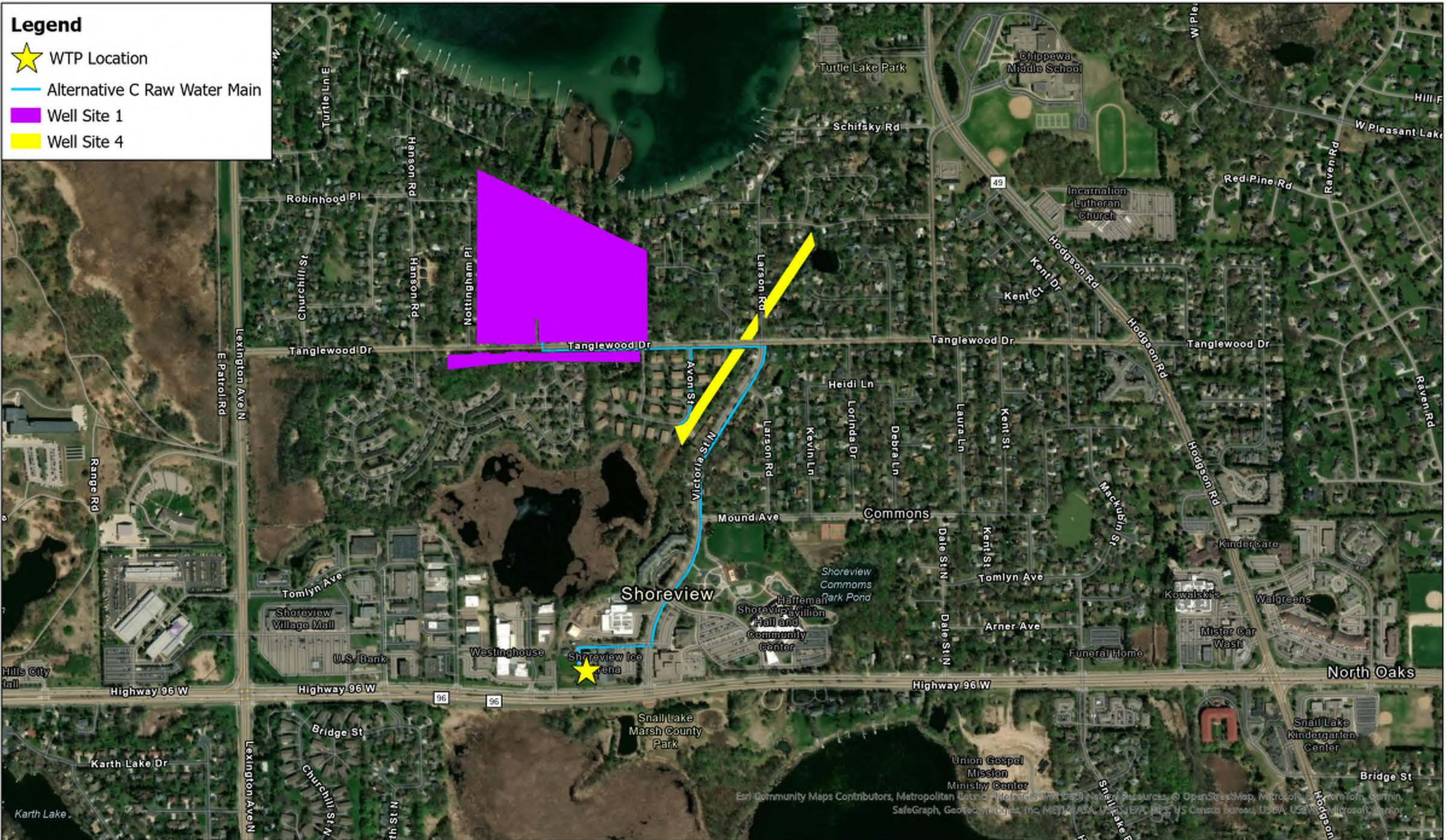


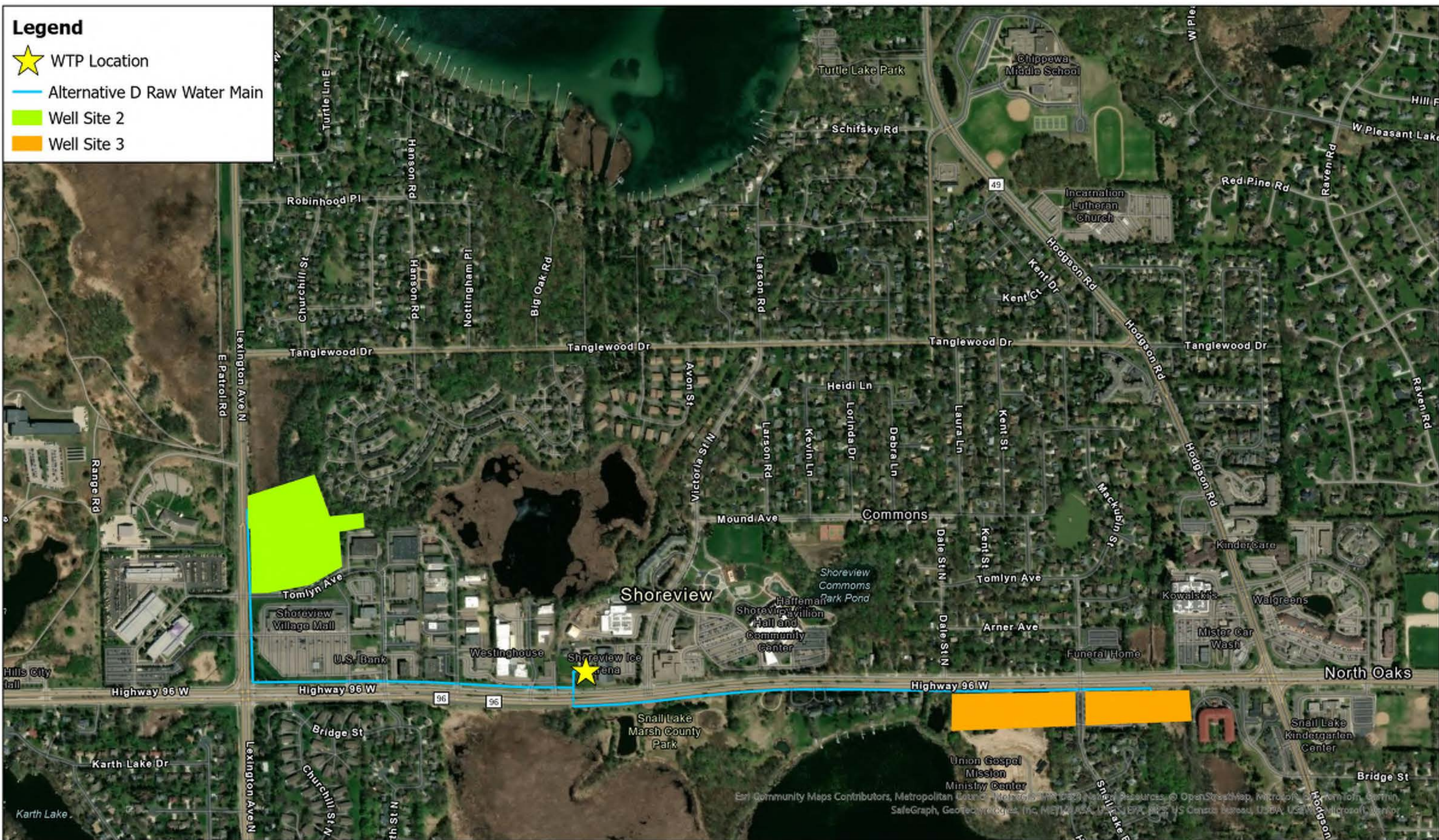
SHEET NUMBER
02

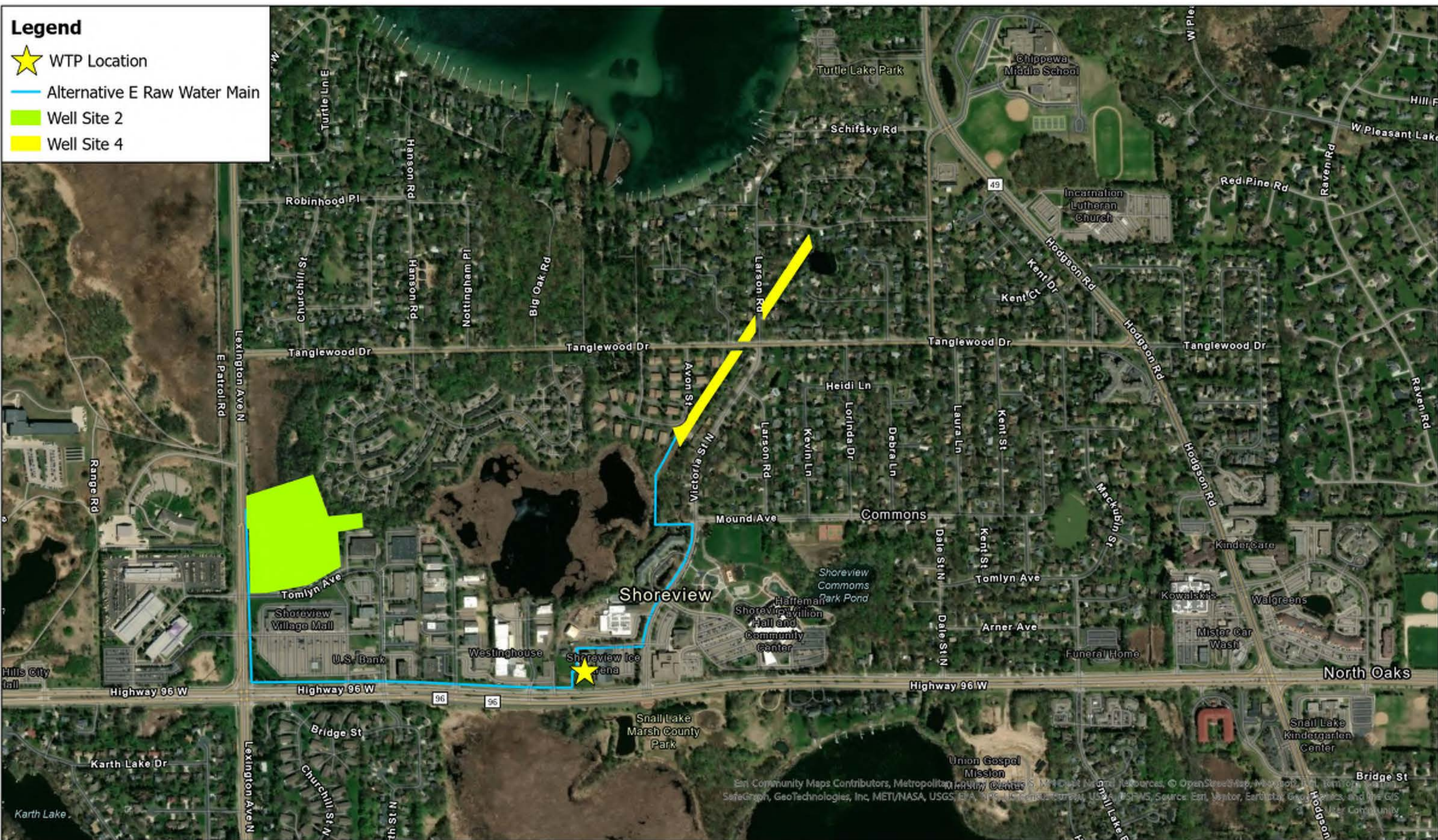












Appendix F.1: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/6/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Connection between Shoreview Distribution Network and North Oaks	Sheet:	1 of 1
--------	--	--------	--------

Item	Quantity	Unit	Cost	Total
1 Mobilization (10%)	1	LS	\$ 110,710.00	\$ 20,135.00
2 General Requirements (15%)	1	LS	\$ 166,065.00	\$ 30,202.50
Distribution Network				
3 Utilities Location (Pot Holing)	50	EA	\$ 1,000.00	\$ 50,000.00
4 24 inch HDPE DR-11 Waterline - Open Cut	250	LF	\$ 375.00	\$ 93,750.00
5 24 inch HDPE DR-11 TEE	1	EA	\$ 1,500.00	\$ 1,500.00
6 Hydrants	1	EA	\$ 11,100.00	\$ 11,100.00
7 Gate Valve and Box (every 1000 ft)	1	EA	\$ 15,000.00	\$ 15,000.00
8 Gate Valve Installation	1	EA	\$ 5,000.00	\$ 5,000.00
9 Air Release Valve (1 every 1500 LF including Vault)	1	EA	\$ 5,000.00	\$ 5,000.00
10 48" standard Manhole for Air Release	1	EA	\$ 5,000.00	\$ 5,000.00
11 Manhole Installation	1	EA	\$ 15,000.00	\$ 15,000.00
Subtotal:				\$ 251,688
Eng./Admin./Legal 20%				\$ 50,338
Conting. (% , +/-) 20%				\$ 60,405
Total				\$ 400,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.2: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Distribution Network Upgrades	Sheet:	1 of 1
--------	-------------------------------	--------	--------

Item	Quantity	Unit	Cost	Total
1 Mobilization (10%)	1	LS	\$ 110,710.00	\$ 39,340.00
2 General Requirements (15%)	1	LS	\$ 166,065.00	\$ 59,010.00
Distribution Network				
3 Easements	1	LS	\$ 10,000.00	\$ 10,000.00
4 Utilities Location (Pot Holing)	50	EA	\$ 1,000.00	\$ 50,000.00
5 16 inch HDPE DR-11 Open	500	LF	\$ 400.00	\$ 200,000.00
6 Hydrants	4	EA	\$ 11,100.00	\$ 44,400.00
7 Gate Valve and Box (every 1000 ft)	2	EA	\$ 6,000.00	\$ 12,000.00
8 Gate Valve Installation	2	EA	\$ 5,000.00	\$ 10,000.00
9 Air Release Valve (1 every 1500 LF including Vault)	1	EA	\$ 5,000.00	\$ 5,000.00
10 16" Electric Actuator Valve and Integration	1	LS	\$ 42,000.00	\$ 42,000.00
11 48" standard Manhole for Air Release	1	EA	\$ 5,000.00	\$ 5,000.00
12 Manhole Installation	1	EA	\$ 15,000.00	\$ 15,000.00
Subtotal:				\$ 491,750
Eng./Admin./Legal 20%				\$ 98,350
Conting. (% , +/-) 20%				\$ 118,020
Total				\$ 800,000

Assumptions: The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.3: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/6/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Pump House Construction Costs	Sheet:	1 of 1
--------	-------------------------------	--------	--------

Item	Quantity	Unit	Cost	Total
1 Mobilization (10%)	1	LS	\$ 374,228	\$ 374,228
2 General Requirements (15%)	1	LS	\$ 561,342	\$ 561,342
Pump House				
3 Geotech (8 Borings)	1	LS	\$ 10,000	\$ 10,000
4 Vertical Turbine Pump	1	EA	\$ 72,000	\$ 72,000
5 8 inch DIP Elbow	1	EA	\$ 600	\$ 600
6 8 inch DIP Check Valve	1	EA	\$ 4,500	\$ 4,500
7 8 inch DIP Service Saddle	1	EA	\$ 300	\$ 300
8 Flow Meter	1	EA	\$ 10,000	\$ 10,000
9 Structure (20' x 15')	1	LS	\$ 210,000	\$ 210,000
10 Utilities and Miscellaneous Site Improvements	1	LS	\$ 50,000	\$ 50,000
11 Bituminous Driveway (16' Wide)	120	LF	\$ 150	\$ 18,000
12 Hydrants	1	EA	\$ 11,100	\$ 11,100
13 Gate Valve	2	EA	\$ 4,000	\$ 8,000
14 Gate Valve and Box	1	EA	\$ 5,000	\$ 5,000
15 Gate Valve Installation	1	EA	\$ 5,000	\$ 5,000
16 Fencing	400	LF	\$ 70	\$ 28,000
Plumbing				
17 Water Fixture	1	EA	\$ 10,000	\$ 10,000
Electrical				
18 Main Breaker Panel	1	EA	\$ 6,000	\$ 6,000
19 Safety Shutoff (Pump)	1	EA	\$ 2,700	\$ 2,700
20 120V Breaker Panel	1	EA	\$ 2,100	\$ 2,100
21 Ceiling Mounted Electrical Heater	1	EA	\$ 2,000	\$ 2,000
22 Transformer	1	EA	\$ 10,000	\$ 10,000
23 Lighting and Receptacles	1	LS	\$ 10,000	\$ 10,000
24 Conduit and Wiring Costs	1	EA	\$ 5,500	\$ 5,500
25 HMI	1	EA	\$ 2,000	\$ 2,000
26 SCADA and PLC Panel Board	1	EA	\$ 25,000	\$ 25,000
27 VFD	1	EA	\$ 13,000	\$ 13,000
28 Electrical Installation Costs	1	EA	\$ 39,150	\$ 39,150
Well Construction Costs				
27 400 Foot Well - 12 inch Diameter Well with Test Pumping (340 Ft Steel Casing), 60' open hole	1	LS	\$ 400,000	\$ 400,000
Subtotal:				\$ 959,950
Eng./Admin./Legal			20%	\$ 191,990
Conting. (% +/-)			20%	\$ 230,388
Total				\$ 1,400,000

Assumptions: The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.4: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Proposed Treatment Facility (Fe/Mn)	Sheet:	1 of 1
--------	-------------------------------------	--------	--------

Item	Quantity	Unit	Cost	Total
1 Mobilization (10%)	1	LS	\$ 646,400	\$ 646,400
2 General Requirements (15%)	1	LS	\$ 969,600	\$ 969,600
Treatment Facility (Fe/Mn)				
3 Geotech	1	LS	\$ 55,000	\$ 55,000
4 Concrete and Reinforcement	1	LS	\$ 1,100,000	\$ 1,100,000
5 Masonry	1	LS	\$ 350,000	\$ 350,000
6 Wood and Plastics	1	LS	\$ 285,000	\$ 285,000
7 Thermal and Moisture Protection	1	LS	\$ 250,000	\$ 250,000
8 Doors and Windows	1	LS	\$ 140,000	\$ 140,000
9 Finishes	1	LS	\$ 210,000	\$ 210,000
10 Specialties (Signage, bathrooms, Accessories, Fire Extinguishers)	1	LS	\$ 25,000	\$ 25,000
11 Plumbing and HVAC	1	LS	\$ 305,000	\$ 305,000
12 Electrical	1	LS	\$ 877,000	\$ 877,000
13 750 kW Backup Generator	1	EA	\$ 350,000	\$ 350,000
14 Earthwork	1	LS	\$ 265,000	\$ 265,000
15 Exterior Site Improvements	1	LS	\$ 167,000	\$ 167,000
16 Utilities (Including Utility Relocations)	1	LS	\$ 350,000	\$ 350,000
17 Process Integration	1	LS	\$ 690,000	\$ 690,000
18 Materials Handling Equipment	1	LS	\$ 40,000	\$ 40,000
19 Process Equipment	1	LS	\$ 600,000	\$ 600,000
20 Initial Anthracite and Greensand Media Filter Charge	1	LS	\$ 195,000	\$ 195,000
21 Stormwater Retention Pond	1	LS	\$ 10,000	\$ 10,000
22 Misc. Charges	1	LS	\$ 200,000	\$ 200,000
Subtotal:				\$ 8,080,000
Eng./Admin./Legal			20%	\$ 1,616,000
Conting. (% +/-)			20%	\$ 1,939,200
Total				\$ 11,700,000

Appendix F.5: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Supplemental Treatment Facility	Sheet:	1 of 1
---------------	--	---------------	---------------

	Item	Quantity	Unit	Cost	Total
1	Mobilization (10%)	1	LS	\$ 744,220	\$ 744,220
2	General Requirements (15%)	1	LS	\$ 1,116,330	\$ 1,116,330
	Building Costs				
3	Building Structures and HVAC	1	LS	\$ 767,200	\$ 767,200
4	Site Work	1	LS	\$ 183,000	\$ 183,000
5	Geotech	1	LS	\$ 55,000	\$ 55,000
6	Electrical	1	LS	\$ 463,000	\$ 463,000
7	Permitting and Piloting	1	LS	\$ 194,000	\$ 194,000
8	Misc. Allowance	1	LS	\$ 379,000	\$ 379,000
	Granular Activated Carbon (GAC) Treatment for TCE				
9	Pressure Filters	1	LS	\$ 1,000,000	\$ 1,000,000
10	Concrete Backwash Basins	1	LS	\$ 53,000	\$ 53,000
11	Concrete Residuals Holding Basins	1	LS	\$ 77,000	\$ 77,000
12	Piping	1	LS	\$ 45,000	\$ 45,000
13	Valves	1	LS	\$ 72,000	\$ 72,000
14	Pumps	1	LS	\$ 53,000	\$ 53,000
15	Instrumentation	1	LS	\$ 74,000	\$ 74,000
16	System Controls	1	LS	\$ 51,000	\$ 51,000
17	Initial GAC Charge	1	LS	\$ 129,000	\$ 129,000
	Ultraviolet Advanced Oxidation Process (UV AOP) Treatment for 1,4-Dioxane				
18	UV AOP Reactors	1	LS	\$ 3,592,000	\$ 3,592,000
19	Hydrogen Peroxide Storage	1	LS	\$ 7,000	\$ 7,000
20	Piping	1	LS	\$ 45,000	\$ 45,000
21	Valves	1	LS	\$ 80,000	\$ 80,000
22	Pumps	1	LS	\$ 3,000	\$ 3,000
23	Instrumentation	1	LS	\$ 69,000	\$ 69,000
24	System Controls	1	LS	\$ 51,000	\$ 51,000
Subtotal:					\$ 9,302,750
Eng./Admin./Legal				20%	\$ 1,860,550
Conting. (%,+/-)				20%	\$ 2,232,660
Total					\$ 13,400,000

Assumptions: The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Appendix F.6: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/6/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Site A +B Distribution Costs	Sheet:	1 of 1
---------------	-------------------------------------	---------------	---------------

	Item	Quantity	Unit	Cost		Total
1	Mobilization (10%)	1	LS	\$	111,456	\$ 111,456
2	General Requirements (15%)	1	LS	\$	167,183	\$ 167,183
	Distribution Network					
3	Land Acquisition and Easements (130% property Value of 50' by 100' lot)	1	LS	\$	50,000	\$ 50,000
4	Utilities Location (Pot Holing)	50	EA	\$	1,000	\$ 50,000
5	8 inch HDPE DR-11 Waterline - Directional Drilled	3,500	LF	\$	100	\$ 350,000
6	12 inch HDPE DR-11 Waterline - Directional Drilled	3,700	LF	\$	125	\$ 462,500
7	Hydrants inc. gate valves	4	EA	\$	11,100	\$ 44,400
8	Gate Valve and Box (every 1000 ft)	7	EA	\$	5,850	\$ 42,120
9	Gate Valve Installation	7	EA	\$	3,500	\$ 25,200
10	Air Release Valve (1 every 1500 LF)	5	EA	\$	4,000	\$ 19,200
11	48" standard Manhole for Air Release	5	EA	\$	9,000	\$ 43,200
12	Manhole Installation	5	EA	\$	3,500	\$ 16,800
13	Restoration	1,392	SY	\$	8	\$ 11,136
				Subtotal		\$ 1,393,195
				Eng./Admin./Legal 20%		\$ 278,639
				Conting. (%,+/-) 20%		\$ 278,639
				Total		\$ 2,000,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.7: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/6/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Alternative B: Site 1 & 3 Distribution Costs	Sheet:	1 of 1
---------------	---	---------------	---------------

	Item	Quantity	Unit	Cost		Total
1	Mobilization (10%)	1	LS	\$	123,268	\$ 123,268
2	General Requirements (15%)	1	LS	\$	184,901	\$ 184,901
	Distribution Network					
3	Land Acquisition and Easements (130% property Value of 50' by 100' lot)	1	LS	\$	80,000	\$ 80,000
4	Utilities Location (Pot Holing)	50	EA	\$	1,000	\$ 50,000
5	8 inch HDPE DR-11 Waterline - Directional Drilled	7,600	LF	\$	100	\$ 760,000
6	12 inch HDPE DR-11 Waterline - Directional Drilled	900	LF	\$	125	\$ 112,500
7	Hydrants inc. gate valves	4	EA	\$	11,100	\$ 44,400
8	Gate Valve and Box (every 1000 ft)	9	EA	\$	5,850	\$ 49,725
9	Gate Valve Installation	9	EA	\$	3,500	\$ 29,750
10	Air Release Valve (1 every 1500 LF)	6	EA	\$	4,000	\$ 22,667
11	48" standard Manhole for Air Release	6	EA	\$	9,000	\$ 51,000
12	Manhole Installation	6	EA	\$	3,500	\$ 19,833
13	Restoration	1,600	SY	\$	8	\$ 12,800
				Subtotal		\$ 1,540,844
				Eng./Admin./Legal 20%		\$ 308,169
				Conting. (%,+/-) 20%		\$ 308,169
				Total		\$ 2,200,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.8: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Alternative C: Site 1 & 4 Distribution Costs	Sheet:	1 of 1
---------------	---	---------------	---------------

	Item	Quantity	Unit	Cost		Total
1	Mobilization (10%)	1	LS	\$	98,711	\$ 98,711
2	General Requirements (15%)	1	LS	\$	148,067	\$ 148,067
	Distribution Network					
3	Land Acquisition and Easements (130% property Value of 50' by 100' lot)	1	LS	\$	100,000	\$ 100,000
4	Utilities Location (Pot Holing)	50	EA	\$	1,000	\$ 50,000
5	8 inch HDPE DR-11 Waterline - Directional Drilled	1,800	LF	\$	100	\$ 180,000
6	12 inch HDPE DR-11 Waterline - Directional Drilled	3,900	LF	\$	125	\$ 487,500
7	Hydrants inc. gate valves	4	EA	\$	11,100	\$ 44,400
8	Gate Valve and Box (every 1000 ft)	6	EA	\$	5,850	\$ 33,345
9	Gate Valve Installation	6	EA	\$	3,500	\$ 19,950
10	Air Release Valve (1 every 1500 LF)	4	EA	\$	4,000	\$ 15,200
11	48" standard Manhole for Air Release	4	EA	\$	9,000	\$ 34,200
12	Manhole Installation	4	EA	\$	3,500	\$ 13,300
13	Restoration	1,152	SY	\$	8	\$ 9,216
				Subtotal		\$ 1,233,889
				Eng./Admin./Legal 20%		\$ 246,778
				Conting. (%,+/-) 20%		\$ 246,778
				Total		\$ 1,800,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.9: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Alternative D: Site 2 & 3 Distribution Costs	Sheet:	1 of 1
---------------	---	---------------	---------------

	Item	Quantity	Unit	Cost		Total
1	Mobilization (10%)	1	LS	\$	121,383	\$ 121,383
2	General Requirements (15%)	1	LS	\$	182,074	\$ 182,074
	Distribution Network					
3	Land Acquisition and Easements (130% property Value of 50' by 100' lot)	1	LS	\$	30,000	\$ 30,000
4	Utilities Location (Pot Holing)	50	EA	\$	1,000	\$ 50,000
5	8 inch HDPE DR-11 Waterline - Directional Drilled	8,700	LF	\$	100	\$ 870,000
6	12 inch HDPE DR-11 Waterline - Directional Drilled	200	LF	\$	125	\$ 25,000
7	Hydrants inc. gate valves	4	EA	\$	11,100	\$ 44,400
8	Gate Valve and Box (every 1000 ft)	9	EA	\$	5,850	\$ 52,065
9	Gate Valve Installation	9	EA	\$	3,500	\$ 31,150
10	Air Release Valve (1 every 1500 LF)	6	EA	\$	4,000	\$ 23,733
11	48" standard Manhole for Air Release	6	EA	\$	9,000	\$ 53,400
12	Manhole Installation	6	EA	\$	3,500	\$ 20,767
13	Restoration	1,664	SY	\$	8	\$ 13,312
				Subtotal		\$ 1,517,284
				Eng./Admin./Legal 20%		\$ 303,457
				Conting. (%,+/-) 20%		\$ 303,457
				Total		\$ 2,200,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.10: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Alternative E: Site 2 & 4 Distribution Costs	Sheet:	1 of 1
---------------	---	---------------	---------------

	Item	Quantity	Unit	Cost		Total
1	Mobilization (10%)	1	LS	\$	104,938	\$ 104,938
2	General Requirements (15%)	1	LS	\$	157,407	\$ 157,407
	Distribution Network					
3	Land Acquisition and Easements (130% property Value of 50' by 100' lot)	1	LS	\$	43,000	\$ 43,000
4	Utilities Location (Pot Holing)	50	EA	\$	1,000	\$ 50,000
5	8 inch HDPE DR-11 Waterline - Directional Drilled	7,000	LF	\$	100	\$ 700,000
6	12 inch HDPE DR-11 Waterline - Directional Drilled	400	LF	\$	125	\$ 50,000
7	Hydrants inc. gate valves	4	EA	\$	11,100	\$ 44,400
8	Gate Valve and Box (every 1000 ft)	7	EA	\$	5,850	\$ 43,290
9	Gate Valve Installation	7	EA	\$	3,500	\$ 25,900
10	Air Release Valve (1 every 1500 LF)	5	EA	\$	4,000	\$ 19,733
11	48" standard Manhole for Air Release	5	EA	\$	9,000	\$ 44,400
12	Manhole Installation	5	EA	\$	3,500	\$ 17,267
13	Restoration	1,424	SY	\$	8	\$ 11,392
				Subtotal		\$ 1,311,728
				Eng./Admin./Legal 20%		\$ 262,346
				Conting. (%,+/-) 20%		\$ 262,346
				Total		\$ 1,900,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.11: Opinion of Probable Construction Cost

Kimley-Horn & Associates, Inc.

Client:	MCES	Date:	7/7/2026
Project:	White Bear Lake Area Comprehensive Plan Study 15	Prepared By:	PSP
		Checked By:	GS

Title:	Alternative F: Site 3 & 4 Distribution Costs	Sheet:	1 of 1
---------------	---	---------------	---------------

	Item	Quantity	Unit	Cost		Total
1	Mobilization (10%)	1	LS	\$	120,135	\$ 120,135
2	General Requirements (15%)	1	LS	\$	180,202	\$ 180,202
	Distribution Network					
3	Land Acquisition and Easements (130% property Value of 50' by 100' lot)	1	LS	\$	73,000	\$ 73,000
4	Utilities Location (Pot Holing)	50	EA	\$	1,000	\$ 50,000
5	8 inch HDPE DR-11 Waterline - Directional Drilled	7,400	LF	\$	100	\$ 740,000
6	12 inch HDPE DR-11 Waterline - Directional Drilled	900	LF	\$	125	\$ 112,500
7	Hydrants inc. gate valves	4	EA	\$	11,100	\$ 44,400
8	Gate Valve and Box (every 1000 ft)	8	EA	\$	5,850	\$ 48,555
9	Gate Valve Installation	8	EA	\$	3,500	\$ 29,050
10	Air Release Valve (1 every 1500 LF)	6	EA	\$	4,000	\$ 22,133
11	48" standard Manhole for Air Release	6	EA	\$	9,000	\$ 49,800
12	Manhole Installation	6	EA	\$	3,500	\$ 19,367
13	Restoration	1,568	SY	\$	8	\$ 12,544
				Subtotal		\$ 1,501,686
				Eng./Admin./Legal 20%		\$ 300,337
				Conting. (%,+/-) 20%		\$ 300,337
				Total		\$ 2,200,000

Assumptions:

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

The cost estimates do not include treatment system construction or operations costs.

Appendix F.12: Opinion of Probable O&M Cost

Well and Raw Watermain Operations and Maintenance Costs

Asset	Task	Current Costs	Units	Quantity	Life Expectancy (years)	O&M		Present Worth
						Frequency Units	Frequency of application	
Well Management	Development, Disinfection, Disposal and Testing	\$ 60,000	Per	2	3 years	Years	3	\$ 4,971,235
	Inspection	\$ 10,000	Per	2	1	Twice Annually	1	\$ 2,323,615
	Annual Testing	\$ 10,000	Per	2	1	monthly	1	\$ 2,323,615
Hydrant	Kits	\$ 100	Per	4	50	Years	25	\$ 2,591
	Replace	\$ 10,000	Per	4	50	Years	50	\$ 175,356
Watermain	Inspection	\$ 3	Per LF	10000	50	foot	12	\$ 314,673
Gate Valve	Replace PRV	\$ 4,000	Per	12	15	Years	15	\$ 461,422
Air Release Valve	Rebuild Air Release Valve	\$ 5,000	Per	2	50	Years	7	\$ 174,215
	Replace Air Release Valve	\$ 15,000	Per	2	50	Years	25	\$ 194,331
								Present Worth \$ 11,000,000
								Contingency (20%) \$ 2,200,000
								Annualized O&M for 50 Years \$ 264,000

Notes:

This O&M Cost Opinion does not include any additional equipment needed to complete tasks

This O&M Cost Opinion does not account for operational and labor costs associated with the proposed treatment facility

The Net Present Value for the Operation and Maintenance cost was calculated utilizing 50 years as a basis and a 3% interest rate.

The O&M Costs Opinion do not include costs associated with the proposed treatment system.

Appendix F.13: Opinion of Probable O&M Cost

Treatment Facility Operations and Maintenance Costs

Asset	Current Costs	Units	Quatity	O&M		Price
				Frequency Units	Frequency of application	
Operator	\$ 70,000	Annual	0.5	Years	1	\$ 35,000
Hydrofluorosilicic Acid 23%	\$ 0.75	Per pound	300	Monthly	12	\$ 22,518
Chlorine Gas	\$ 1	Per pound	1000	Monthly	12	\$ 13,200
Oxiplus*	\$ 71	Per Bag	1680	Years	1	\$ 118,440
Anthracite*	\$ 18	Per pound	560	Years	1	\$ 10,209
Electricity	\$ 8,000	Annual	1	Years	1	\$ 8,000
Wastewater Disposal	\$ 10,000	Annual	1	Years	1	\$ 10,000
Building maintenance and HVAC	\$ 20,000	Annual	1	Years	1	\$ 20,000
Miscellaneous Expenses	\$ 20,000	Annual	1	Years	1	\$ 20,000
Subtotal						\$ 257,367
Contigency (20%)						\$ 51,500
Annual O&M						\$ 308,900

Notes:

This O&M Cost Opinion does not include any additional equipment needed to complete tasks

**Media is estimated on quantity needed to refill vessels and may be less frequent*