Building a Better World for All of Us®

TECHNICAL MEMORANDUM

TO: Emily Schon, PE, MCES

FROM: Christopher Larson, PE

DATE: July 11, 2025

RE: Study 6 - Wastewater Reuse for Aquifer Injection or Direct Lake Augmentation
White Bear Lake Area Comprehensive Plan

INTRODUCTION

The White Bear Lake Area is facing complex water supply challenges including groundwater use that impacts the water levels in White Bear Lake. Metropolitan Council Environmental Services (MCES) is moving forward with Comprehensive Planning, in collaboration with the White Bear Lake Area Work Group, to support regional efforts to ensure equitable access to sufficient, safe, and affordable water for communities in the White Bear Lake Area to meet current and future needs while safeguarding the sustainability of surface water and groundwater resources.

Based on 2023 legislation requirements, the White Bear Lake Work Group evaluated several main areas to address:

1) Converting water supplies that are groundwater dependent to total or partial supplies from surface water
2) Reuse water, including water discharged from contaminated wells
3) Projects designed to increase groundwater recharge
4) Other methods for reducing groundwater use

One of the solutions that was prioritized for further investigation by the Work Group includes wastewater reuse for aquifer injection or direct lake augmenation (Item 3). Injecting treated wastewater into the aquifer would augment the aquifer and help maintain water levels in White Bear Lake. Direct lake augmenation would help maintain water levels and some of the augmenation water would end up recharging the aquifer.

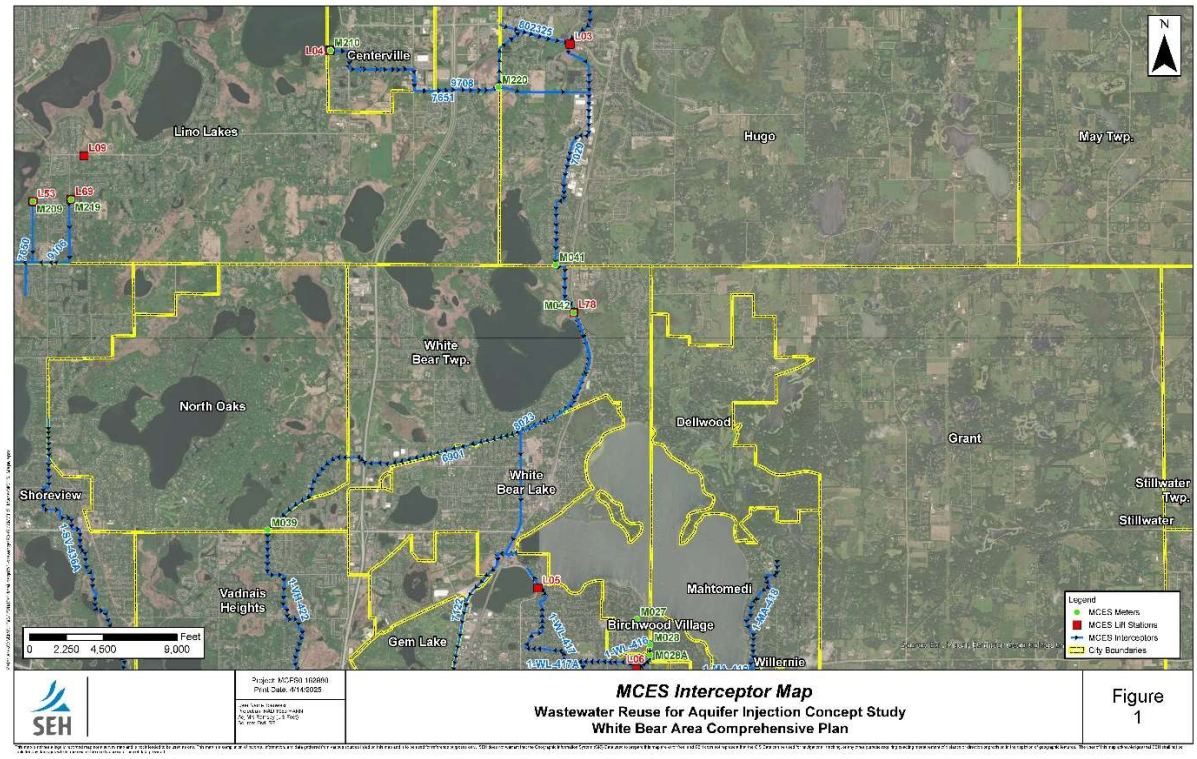
This technical memorandum seeks to provide conceptual treatment requirements and siting of facilities, along with capital cost estimates and anticipated operating cost estimates for wastewater reuse for aquifer injection or direct lake augmentation.

WASTEWATER RESOURCES IN WHITE BEAR LAKE AREA

Injecting reclaimed wastewater into the aquifer or direct lake augmentation of reclaimed wastewater would help sustain White Bear Lake water levels. The potential for aquifer injection or direct lake augmentation to replenish the aquifer or sustain White Bear Lake water levels is proportional to the volume of wastewater available.

As shown on Figure 1, the wastewater from Hugo, Forest Lake, and portions of Centerville and Lino Lakes is conveyed south in MCES interceptor 7029. Lift Station L-78, just south of the Hugo border in White Bear Township, is a relief lift station that can divert flow from Interceptor 6901 to Interceptor 8023

Figure 1


N
Centerville
Lino Lakes
Hugo
May Twp.
White Bear Twp.
North Oaks
Dellwood
Grant
White Bear Lake
Shoreview
Stillwater Twp.
Stillwater
Vadnais Heights
Gem Lake
Mahtomedi
Birchwood Village
Willernie
Legend
MCES Meters
MCES Lift Stations
MCES Interceptors
City Boundaries
Feet
0 2,250 4,500 9,000
MCES Interceptor Map
Wastewater Reuse for Aquifer Injection Concept Study
White Bear Area Comprehensive Plan
Figure 1

to 7122 if needed. The flow at Meter 041 (M041) would be available for potential wastewater reuse. The wastewater flows at M041 are shown in Table 1.

Table 1
MCES Meter 041 - Monthly Flows (Million Gallons)

	2021	2022	2023	2024	2025
January	74.6	74.2	76.0	82.5	86.5
February	68.9	66.1	72.0	74.7	76.0
March	84.5	79.8	85.8	80.7	88.6
April	84.1	86.4	113.7	91.6	94.3
May	84.7	91.9	90.4	100.3	95.9
June	77.2	79.6	78.7	107.2	99.6
July	74.9	76.5	77.5	91.9	--
August	72.9	76.7	77.4	99.8	--
September	69.4	72.8	74.2	84.4	--
October	71.8	73.7	81.2	82.3	--
November	70.9	72.4	78.0	83.9	--
December	74.4	76.5	83.4	88.3	--
Annual Total:	**908.3**	**926.6**	**988.3**	**1067.6**	**--**

As Table 1 indicates, the average flow at M041 ranged from 2.5 MGD in 2021 to 2.9 MGD in 2024. Based on MCES projections, the 2050 flows at M041 are estimated to be 3.7 MGD and the Ultimate flows at M041 are estimated to be 4.7 MGD.

REGULATORY REQUIREMENTS FOR AQUIFER INJECTION

Several State and Federal agencies could have permitting requirements for aquifer injection. A summary of the potential permitting requirements is included in the following sections.

United States Environmental Protection Agency (USEPA)

USEPA Region 5 considers the aquifer injection process to be a Class V injection well and requires an injection well permit. A Class V injection well permit was issued by USEPA for the aquifer storage and recovery (ASR) well in St. Michael, Minnesota. The ASR process in St. Michael is injecting treated drinking water during periods of low demand and recovers the water during period of high demand.

Minnesota Department of Health (MDH)

Minnesota Rules, Chapter 4725, requires that a well or a boring must not be used for disposal of surface water, groundwater, or any other liquid, gas, or chemical. A variance from MDH for aquifer injection of highly treated reclaimed wastewater would be required. A variance was issued for the ASR well in St. Michael; however, injecting treated wastewater has more risk to the aquifer than injecting treated drinking water.

Minnesota Pollution Control Agency (MPCA)

Aquifer injection of highly treated reclaimed wastewater would require a comprehensive risk-based approach and currently lacks specific MPCA regulations. While non-potable reuse applications have some guidance from the MPCA, a clear regulatory path for aquifer injection of reclaimed wastewater has not yet been established.

Minnesota Department of Natural Resources (DNR)
The Minnesota DNR would likely not have permitting requirements for the aquifer injection process. DNR appropriates water but does not typically regulate water quality. DNR did not have a permitting role in the St. Michael ASR well.

REGULATORY REQUIREMENTS FOR DIRECT LAKE AUGMENTATION

The permits required for direct lake augmentation are not known at this time; however, several agencies could have permit requirements including MPCA (wastewater discharge permit), DNR, and the Army Corp of Engineers.

RAW WASTEWATER QUALITY

MCES does not monitor water quality specifically coming from the WBL area. Therefore, this evaluation assumes standard municipal strength wastewater with the following characteristics:

- Biological Oxygen Demand (BOD): 250 mg/L
- Total Suspended Solids (TSS): 250 mg/L
- Total Phosphorous: 7 mg/L
- Total Nitrogen: 40 mg/L
- Fats, Oil, Grease (FOG): 75 mg/L
- Chlorides: 500 mg/L

Based on experience in the metro area, it is expected that chloride levels in wastewater in the White Bear Lake area will be elevated. The City of Forest Lake utilizes municipal ion exchange treatment for water softening, which discharges salt brine to the wastewater system as part of the regeneration process. In addition, most of the residents of Hugo and Centerville likely soften their water using ion exchange softeners. A chloride concentration of 500 mg/L is approximately the same concentration as the wastewater coming to the MCES Empire Wastewater Resource Recovery Facility (WRRF) which is estimated to have similar water quality.

RECLAIMED WATER USES AND WATER QUALITY REQUIREMENTS

Regulatory Guidance for Wastewater Reuse

Non-potable wastewater reuse in Minnesota is regulated by the MPCA based on type of reuse, with differing treatment requirements[1]:

- *Disinfected tertiary treatment* applies to uses with the highest degree of human contact, such as root crops, residential and public landscape irrigation, toilet flushing, snow making and cooling towers. Total coliform limit is 2.2 MPN (Most Probable Number)/100 ml (milliliters). A turbidity standard of 2 NTU (Nephelometric Turbidity Units) daily average and 10 NTU daily maximum also applies.
- *Disinfected secondary 23* treatment applies to uses with moderate risk of human contact, such as irrigating cemeteries, roadway landscaping, nursery stock and sod farms, pasture for livestock, industrial boiler feed water and similar uses. Total coliform limit is 23 MPN/100 ml.
- *Disinfected secondary 200* treatment applies to uses with little or no potential for human contact, such as spray or sprinkle irrigation of animal feed, fiber, and seed crops, Christmas trees and sod farms. Fecal coliform limit is 200 MPN/100 ml.

[1] *https://www.health.state.mn.us/communities/environment/water/docs/cwf/2018report.pdf*

Although none of the wastewater reuse standards specifically address aquifer injection, it is assumed that the Disinfected Tertiary Treatment standard would be the minimum standard applied to aquifer injection.

Wastewater Reuse for Aquifer Injection - Water Quality Goals
Based on experience with the St. Michael ASR well, it is assumed that the aquifer injection water quality would need to match the water quality of the native groundwater. This would require removing all the chloride and any trace contaminants that are likely present in the wastewater (PFAS, endocrine disruptors, etc.) in addition to nutrients like nitrogen and phosphorus.

Wastewater Reuse for Direct Lake Augmentation - Water Quality Goals
It is assumed that water quality for direct lake augmentation would need to be equal to or better than the water quality in White Bear Lake. This would require removing most of the phosphorus, nitrogen, chloride and any trace contaminants that are likely present in the wastewater (PFAS, endocrine disruptors, etc.).

TREATMENT CAPACITY
For this study, a wastewater reuse facility capable of producing 2 MGD of aquifer injection or direct lake augmentation water will be evaluated. This will result in treating most of the wastewater currently available in the MCES interceptor.

TREATMENT NECESSARY TO MEET WATER QUALITY GOALS
To meet the anticipated regulatory requirements for aquifer injection or lake augmentation, a wastewater treatment plant would need to be constructed followed by reverse osmosis (RO). For this study, the primary wastewater treatment process selected is membrane bioreactors (MBR). The effluent from a membrane bioreactor has very low turbidity and suspended solids making it more suitable for RO.

RO is a water purification process that uses a semi-permeable membrane to separate water molecules from other substances, including salts and other contaminants. Under high pressure, water is forced through the membrane, leaving behind the contaminants. This process results in purified water (permeate) that is collected for use, while the rejected contaminants are flushed away as a concentrate. Reverse osmosis is widely used for desalination and the production of high-purity water for various applications.

The treatment process for this study is as follows:

1. **Wastewater Pretreatment:** This includes screening to remove large debris, grit removal to separate heavy, inorganic solids, and grease/oil removal.

2. **Activated Sludge:** The activated sludge process is a biological treatment method where oxygen or air is introduced into a mixture of sewage and activated sludge, which is a collection of beneficial bacteria and protozoa. This process breaks down organic pollutants and nutrients in the wastewater, resulting in the formation of a sludge that can be separated and treated.

3. **MBR/Sludge Thickening**: The MBR process uses low pressure, submerged, hollow-fiber membranes to filter the water. In this process the sludge is also thickened and sent to a sludge load out tank. It is assumed that the sludge would be hauled to the MCES Metro Facility for processing and incineration.

4. **RO**: The last step in the process is RO which is a water purification process that uses a semi-permeable membrane to separate water molecules from other substances. Because RO

treatment produces pure water, the water needs to be re-mineralized to avoid having adverse reactions when injected into the aquifer or discharged into White Bear Lake.

Approximately 20% of the water in the RO process is reject water that contains concentrated salts and contaminants. To be able to produce 2 MGD of water from the RO process, approximately 2.5 MGD of water from the wastewater treatment process is needed. It is assumed that the RO reject water can be put back into the MCES sewer.

5. **Injection Wells (Aquifer Injection):** Two aquifer injection wells would be provided to inject approximately 1 MGD of water into each well. The injection wells would be very similar to a typical submersible municipal well without the submersible pump. A pitless adaptor and an injection pipe would be located in the well casing. The water would be injected into the Prairie du Chien-Jordan sandstone aquifer.

6. **Augmentation Outfall (Lake Augmentation):** An outfall pipe would be provided to discharge 2 MGD of reuse water directly into White Bear Lake. It is assumed that the augmentation pipe would be kept on the lakebed using concrete armor mat. Diffusers in the outfall pipe would be used to reduce injection velocity.

An aquifer injection and lake augmentation treatment schematic is included as Figure 2. The only difference between the two processes is whether the water is discharged into aquifer injection wells or into White Bear Lake. The treatment process is assumed to be the same. Approximate building and tank sizes are included.

REUSE FACILTY LOCATION

The wastewater reuse facilities for this study would require a minimum of 10 acres of land. It is assumed that private property would need to be purchased. To avoid showing a wastewater reuse facility on someone's private property, a general area for the facility was identified on Figure 3. The location of aquifer injection wells is also shown on Figure 3. The location of the lake augmentation outfall is shown on Figure 4.

STORAGE

The aquifer injection/lake augmentation reuse treatment process, pumping, and conveyance will require water storage at several stages in the process including raw wastewater equalization, ground storage for detention, RO reject water equalization, and wastewater sludge storage.

Raw Water Equalization

To provide equalization ahead of treatment for consistent feed rates, it is assumed that equalization storage will be provided after the diversion structure ahead of the treatment facility. For the 2 MGD reuse facility, 0.5 MG of raw water equalization is provided.

Ground Storage/Detention

After treatment, 2 MG of ground storage is provided to allow for water samples to be analyzed to ensure that the treatment process is working and that the water injected into the aquifer or discharged into White Bear Lake meets the water quality requirements. Baffles are included in the tank to provide plug flow and reduce mixing. The detention time provided by the tank is approximately one day.

Figure 2 – Aquifer Injection/Lake Augmentation Schematic

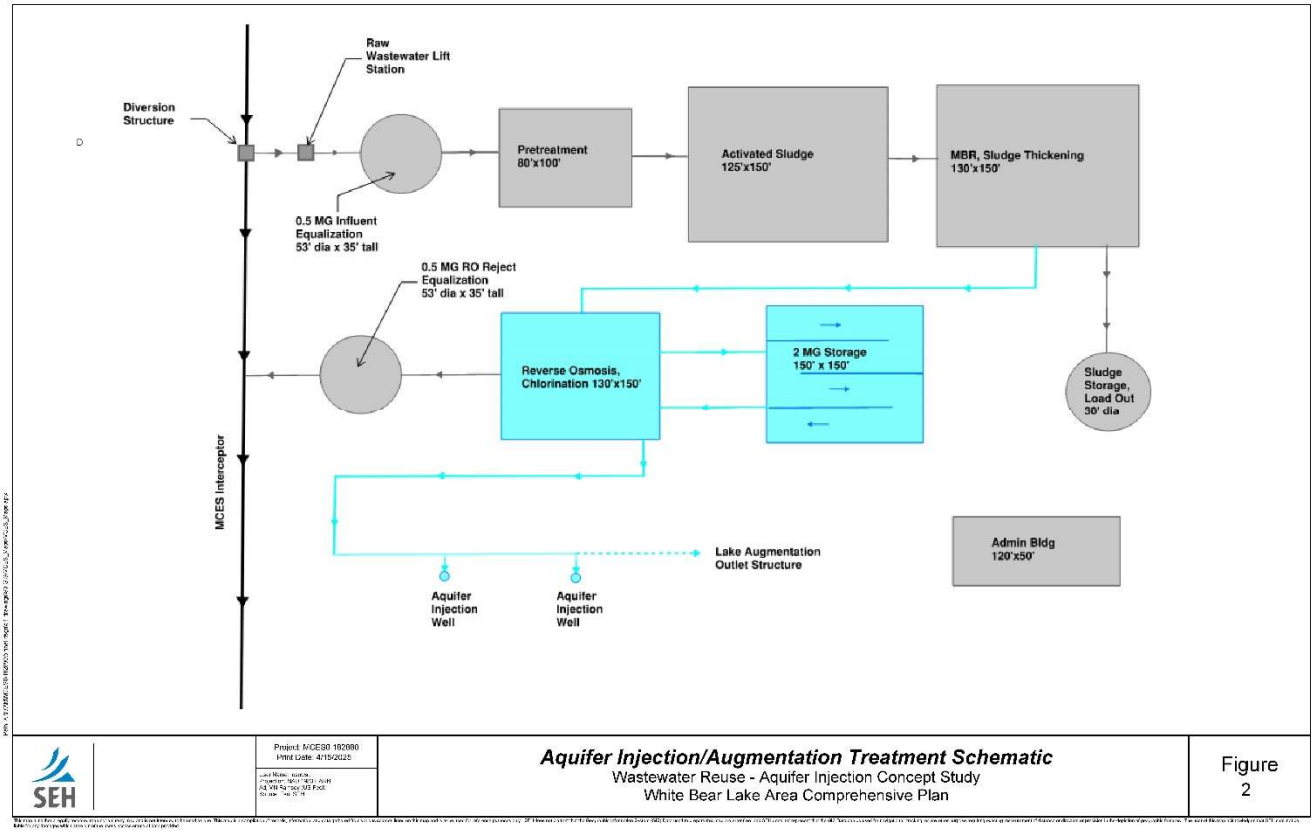


Figure 3

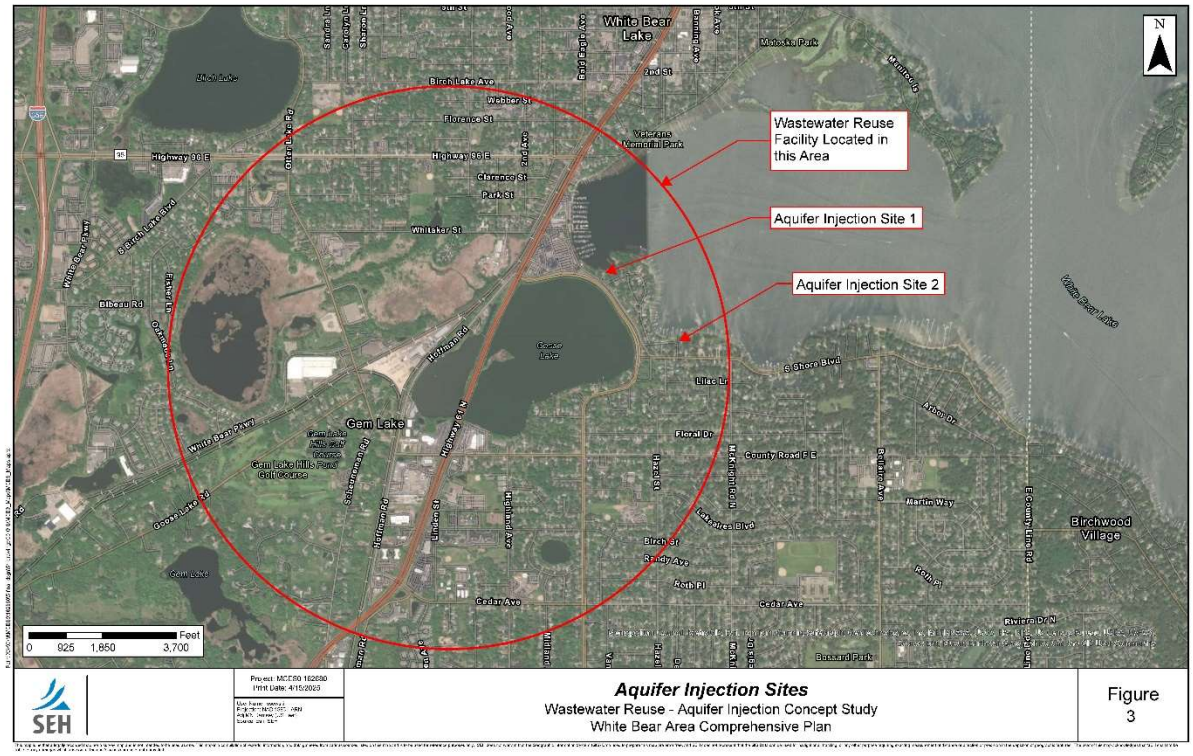
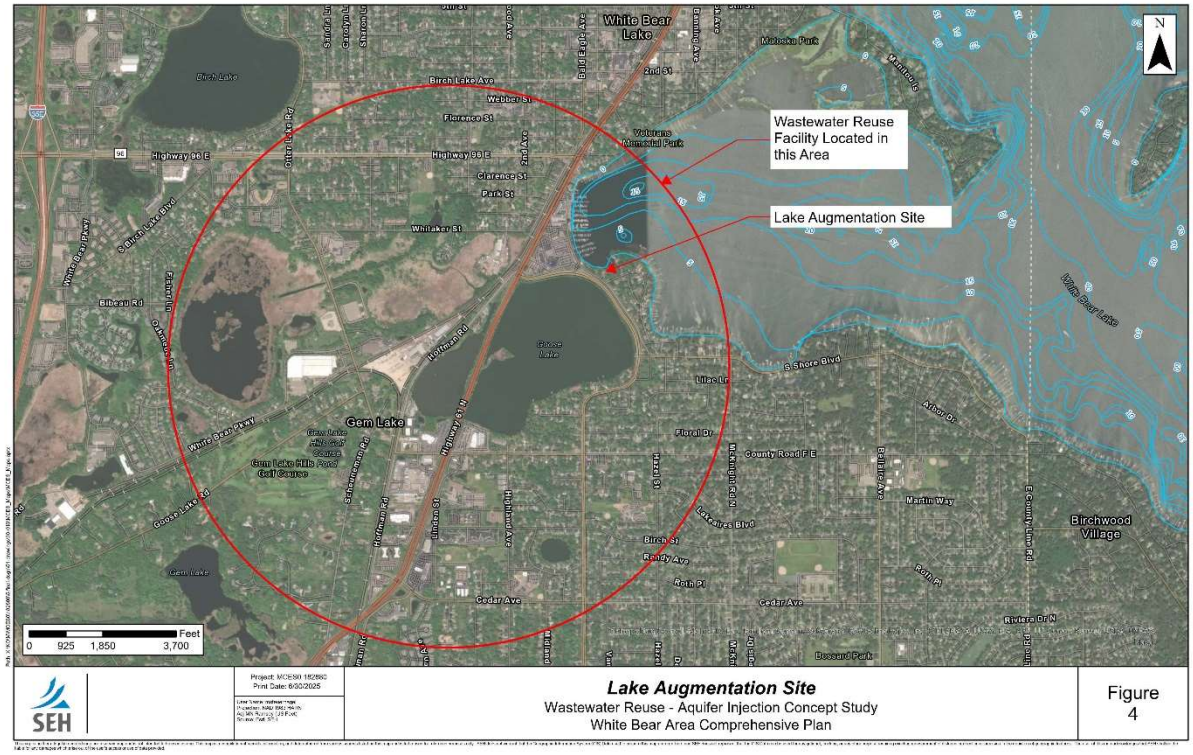

Wastewater Reuse Facility Located in this Area
Aquifer Injection Site 1
Aquifer Injection Site 2
White Bear Lake
Gem Lake
Birchwood Village
Highway 96 E
Birch Lake Ave
Webber St
Florance St
Clarence St
Park St
Whitaker St
Bilbeau Rd
Highland Rd
S Shore Blvd
Lake Ln
Fierrel Dr
County Road F E
Martin Way
Birch St
Cedar Ave
Bellaire Ave
Highway 61 N
White Bear Pkwy
Gem Lake Hills Park/ Golf Course
Veterans Memorial Park
Matoska Park
Bossard Park
Riviera Dr N
N
0 925 1,850 3,700 Feet
SEH
Aquifer Injection Sites
Wastewater Reuse - Aquifer Injection Concept Study
White Bear Area Comprehensive Plan
Figure 3

Figure 4


Wastewater Reuse Facility Located in this Area
Lake Augmentation Site
White Bear Lake
Gem Lake
Birchwood Village
Highway 96 E
Bellaire Beach
Boatworks Commons
Bossard Park
Feet
0 925 1,850 3,700
SEH
Lake Augmentation Site
Wastewater Reuse - Aquifer Injection Concept Study
White Bear Area Comprehensive Plan
Figure 4

RO Reject Water Equalization

In addition to raw water equalization and finished water storage, waste holding tanks will likely be required due to the high volume and high concentration of chlorides in the RO reject stream. The RO reject stream will contain chloride and other constituent concentrations approximately 4 times that of the raw wastewater. To ensure that RO reject water can be metered back into the MCES interceptor at a constant rate, a 0.5 MG equalization tank is shown.

DIVERSION, PUMPING AND CONVEYANCE

In addition to treatment and storage, the aquifer injection/augmentation wastewater reuse facility will require additional infrastructure. This includes a diversion structure, low lift pumping, and aquifer injection/augmentation watermain. The diversion structure and low lift pumping will be sized to meet the treatment capacity.

ALTERNATIVE DEVELOPMENT – AQUIFER INJECTION

The wastewater reuse for aquifer injection project components are summarized as follows:

- Effluent Diversion Structure
- Low Lift Pumping
- 0.5 MG Raw Wastewater Equalization
- 2.5 MGD Wastewater Reuse Treatment
    - Pretreatment
    - Activated Sludge
    - MBR/Sludge Thickening
    - RO Feed Pumps
    - 2 MG RO Membranes
    - Chemical Feed Systems
    - Sludge Holding Tank
- 2 MG Ground Storage/Detention
- 0.5 MG RO Reject Water Equalization
- Administration Building
- 5,400 feet of Aquifer Injection Watermain
- 2 Aquifer Injection Wells

ALTERNATIVE DEVELOPMENT – LAKE AUGMENTATION

The wastewater reuse for lake augmentation project components are summarized as follows:

- Effluent Diversion Structure
- Low Lift Pumping
- 0.5 MG Raw Wastewater Equalization
- 2.5 MGD Wastewater Reuse Treatment
    - Pretreatment
    - Activated Sludge
    - MBR/Sludge Thickening
    - RO Feed Pumps
    - 2 MG RO Membranes
    - Chemical Feed Systems
    - Sludge Holding Tank
- 2 MG Ground Storage/Detention
- 0.5 MG RO Reject Water Equalization

- Administration Building
- 2,800 feet of Reuse Watermain
- Augmentation Outfall

CONCEPT LEVEL CAPITAL COST OPINIONS

Concept level opinions of probable cost (OPCs) were developed for the aquifer injection and lake augmentation wastewater reuse concepts. The OPCs were developed using cost from vendors, previous treatment plant projects, or indexed from previous reuse studies. Due to the concept level nature of the OPCs, a 40% contingency is being applied.

The OPCs presented assume the storage tanks on the reuse treatment sites are above-grade prestressed concrete tanks. Prestressed concrete tanks were assumed because they are cost effective; however, buried cast-in-place concrete tanks could also be used.

Table 2
Concept Level OPC
2 MGD Aquifer Injection

Component	Unit	Est. Quantity	Unit Price	Cost
Effluent Diversion	LS	1	$910,000	$910,000
0.5 MG Equalization Tank	LS	1	$2,500,000	$2,500,000
2.5 MGD Wastewater Treatment Plant[1]	LS	1	$75,000,000	$75,000,000
2 MGD RO Reuse Treatment Plant	LS	1	$18,000,000	$18,000,000
2 MG Storage	LS	1	$5,000,000	$5,000,000
0.5 MG Reject Water Equalization	LS	1	$2,500,000	$2,500,000
12” Aquifer Injection Watermain	LF	5,400	$500	$2,700,000
Injection Wells	EA	2	$1,000,000	$2,000,000
			Subtotal	**$108,600,000**
			40% Contingency	$43,400,000
			Construction Subtotal:	**$152,000,000**
			Easement and Land Acquisition	$2,000,000
			Pilot Testing	$3,000,000
			15% Engineering	$22,800,000
			15% Construction Administration	$22,800,000
			Total:	**$202,600,000**

Note: 1. WWTP construction cost based on previous projects in Minnesota on a per MGD basis, and prorated to 2025 using ENR Index.

Table 3 Concept Level OPC 2 MGD Lake Augmentation				
Component	**Unit**	**Est. Quantity**	**Unit Price**	**Cost**
Effluent Diversion	LS	1	$910,000	$910,000
0.5 MG Equalization Tank	LS	1	$2,500,000	$2,500,000
2.5 MGD Wastewater Treatment Plant[1]	LS	1	$75,000,000	$75,000,000
2 MGD RO Reuse Treatment Plant	LS	1	$18,000,000	$18,000,000
2 MG Storage	LS	1	$5,000,000	$5,000,000
0.5 MG Reject Water Equalization	LS	1	$2,500,000	$2,500,000
12" Aquifer Injection Watermain	LF	2,800	$500	$1,400,000
Augmentation Outfall[2]	LS	1	$4,100,000	$4,100,000
			Subtotal	**$109,400,000**
			40% Contingency	$43,800,000
			Construction Subtotal:	**$153,200,000**
			Easement and Land Acquisition	$2,000,000
			15% Engineering	$23,000,000
			15% Construction Administration	$23,000,000
			Total:	**$201,200,000**

Note: 1. WWTP construction cost based on previous projects in Minnesota on a per MGD basis, and prorated to 2025 using ENR Index.
2. Augmentation Outfall cost was taken from the 2017 SEH White Bear Lake Augmentation Design Building Proposal. The ENR Index was used to develop 2025 costs.

CONCEPT LEVEL OPERATION AND MAINTENANCE COSTS

In addition to capital costs, the reuse treatment facilities for aquifer injection or lake augmentation would also incur annual O&M costs including labor, membrane replacement, chemicals, electricity, natural gas, and equipment repair. The concept level O&M costs are presented in Table 3. The O&M costs assume that the reuse facility is operated the whole year.

Table 3 Concept Level Operation and Maintenance Costs 2 MGD Aquifer Injection	
Item	**Annual Cost**
Labor (3 FTE)	$450,000
Membrane Replacement (5 yr for RO and 7 yr for MF)	$125,000
Chemicals	$150,000
Electricity	$225,000
Natural Gas	$100,000
Equipment Repair	$200,000
Lab Testing	$200,000
Total Annual O&M:	**$1,450,000**

Note: 1. Labor, chemicals, electricity, natural gas, and equipment repair is primarily based on budget from the Detroit Lakes WWTP for 2025 with additional costs added for RO. Detroit Lakes operates a 2 MGD MBR WWTP.

CAPITAL COST OFFSET
Constructing a wastewater reuse facility in the White Bear Lake area would add treatment capacity to the MCES Metropolitan service area. It would also reduce flow in downstream sewer interceptors. This has the potential to offset or reduce the cost of future MCES projects.

The MCES Metropolitan Water Resource Recovery Facility (Metro Facility) currently treats wastewater for the White Bear Lake area and upstream communities in addition to a large portion of the Twin Cities metropolitan area. The Metro Facility currently treats an average of 172 MGD and has a capacity of 251 MGD. The 2050 flow to the Metro Facility is estimated to be 189 MGD in the Metropolitan Council 2050 Water Policy Plan. There is no indication that capacity expansion will be needed at the Metro Facility in the 2050 planning period.

It is not currently known if there will be a need to expand sewer interceptor capacity in the White Bear Lake area. A sewer model is currently being developed to evaluate the interceptors from Forest Lake to the Metro Facility.

Based on the information currently available, it is not clear that adding a wastewater reuse treatment facility in the White Bear Lake area would offset future treatment or conveyance costs without additional analysis.

EFFECTS OF AQUIFER INJECTION OR AUGMENTATION ON WHITE BEAR LAKE WATER LEVELS
The Minnesota DNR modeled the levels of White Bear Lake under the aquifer injection scenarios. Both 1 MGD and 2 MGD aquifer injection scenarios were modeled. The result of the lake level modeling are included on a slide in Attachment A. In general, when 2 MGD of treated wastewater is injected into the aquifer at locations adjacent to White Bear Lake, the predicted water level is approximately one foot higher than what was observed.

The effect of adding 2 MGD of augmentation water directly to White Bear Lake would result in higher water levels than aquifer injection because the water is being added directly to the lake. However, it is estimated that it could take up to 4.0 MGD of augmentation during the open water periods (DNR modeling) to maintain White Bear Lake's water levels at the protective elevation of 922.0. While augmenting White Bear Lake by 2 MGD would help maintain water level elevations, it may not be sufficient to maintain the protective elevation without other measures.

EFFECTS ON AQUIFER SUSTAINABILITY
Aquifer injection of treated reuse water would increase the water in the aquifer by the amount injected; therefore, having a positive impact on the sustainability of the aquifer. This would directly offset up to 2 MGD of aquifer withdrawals.

Lake augmentation would have an indirect positive impact on the sustainability of the aquifer because White Bear Lake is hydraulically connected to the Prairie du Chien-Jordan aquifer.

EFFECTS ON DRINKING WATER QUALITY
Neither aquifer injection nor lake augmentation would change existing drinking water quality with adequate treatment of the wastewater or surface water.

EFFECTS ON DRINKING WATER RESILIENCY
Neither aquifer injection nor lake augmentation add resiliency to the drinking water supplies of the White Bear Lake area.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this concept study, the following conclusions can be made regarding wastewater reuse for aquifer injection or augmentation in the White Bear Lake area:

1. Wastewater reuse for aquifer injection or augmentation requires a treatment process that has very high capital and O&M costs.
2. Modeling showed that aquifer injection would have a modest beneficial effect on White Bear Lake Water levels. This should be compared to the beneficial effect of other alternatives.
3. Lake augmentation with 2 MGD of reuse water would result in higher water levels than aquifer injection because the water is being added directly to the lake. However, it is estimated that it could take up to 4 MGD of augmentation during open water periods (DNR modeling) to maintain White Bear Lake's water levels at the protective elevation of 922.0.
4. Aquifer injection would require overcoming regulatory challenges including an injection well permit from the EPA, an MPCA permit, and an MDH well code variance.

The following recommendations are offered:

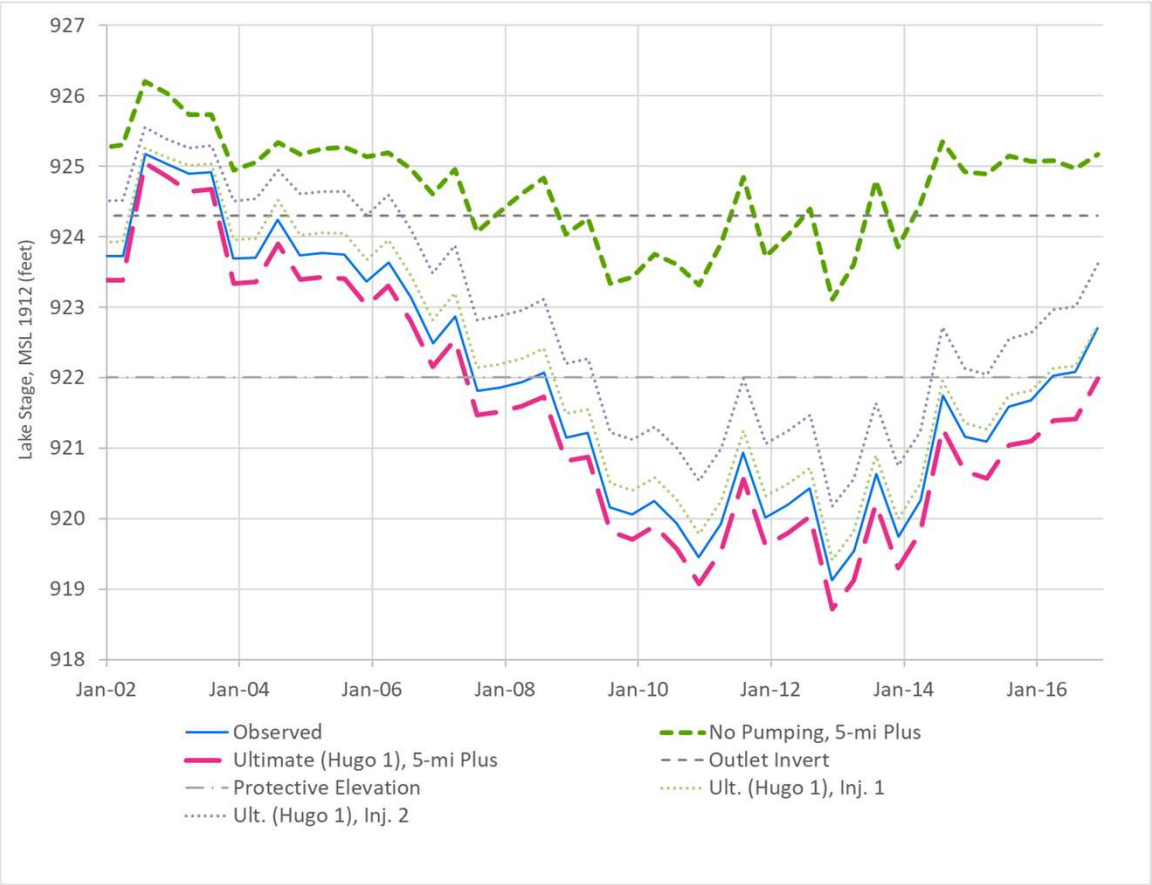
1. The White Bear Lake Work Group should continue to explore other more cost-effective options to ensure equitable access to sufficient, safe, and affordable water for communities in the White Bear Lake Area to meet current and future needs while safeguarding the sustainability of surface water and groundwater resources.
2. Wastewater samples should be collected from the interceptors in the White Bear Lake area and analyzed for general water quality parameters and likely contaminants.

Attachment A – White Bear Lake Aquifer Injection Model Results
Attachment B – Concept Level Cost Opinions

Attachment A

White Bear Lake Aquifer Injection Modeling Results

Injection of Treated Wastewater



- Ultimate (Hugo 1)
- Injection well(s) adjacent to WBL, 1 mgd or 2 mgd

Attachment B

Concept Level Cost Opinions

Project Name:	**MCES Water Reuse Evaluation**
SEH Project No:	**MCES 182880**
Date:	**July 1, 2025**
Estimator:	**SEH**
Description:	**Concept Level OPC - 2 MGD RO WTP**

DIVISION 1 - GENERAL REQUIREMENTS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
CONTRACTOR MOBILIZATION, OVERHEAD, PROFIT (15%)	LUMP SUM	1	$ 2,314,180.00	$ 2,314,180.00
SUBTOTAL DIVISION 0 AND 01				*$ 2,314,180.00*
DIVISION 2 - EXISTING CONDITIONS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
CLEARING AND GRUBBING	LUMP SUM	1	$ 60,000.00	$ 60,000.00
SUBTOTAL DIVISION 2				*$ 60,000.00*
DIVISION 3 - CONCRETE	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
CAST IN PLACE CONCRETE	CY	490	$ 1,700.00	$ 833,000.00
SUBTOTAL DIVISION 3				*$ 833,000.00*
DIVISION 4 - MASONRY	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
PRECAST STRUCTURAL CONCRETE	LUMP SUM	1	$ 1,300,000.00	$ 1,300,000.00
MASONRY	LUMP SUM	1	$ 126,000.00	$ 126,000.00
SUBTOTAL DIVISION 4				*$ 126,000.00*
DIVISION 5 - METALS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
METAL FABRICATIONS	LUMP SUM	1	$ 250,000.00	$ 250,000.00
SUBTOTAL DIVISION 5				*$ 250,000.00*
DIVISION 7 - THERMAL & MOISTURE PROTECTION	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
THERMAL & MOISTURE PROTECTION (ROOFING, ETC.)	LUMP SUM	1	$ 610,000.00	$ 610,000.00
SUBTOTAL DIVISION 7				*$ 610,000.00*
DIVISION 8 - OPENINGS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
DOORS AND WINDOWS	LUMP SUM	1	$ 175,000.00	$ 175,000.00
SUBTOTAL DIVISION 8				*$ 175,000.00*
DIVISION 9 - FINISHES	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
EQUIPMENT/PROCESS PIPING PAINTING	LUMP SUM	1	$ 240,000.00	$ 240,000.00
SUBTOTAL DIVISION 9				*$ 240,000.00*
DIVISION 10 - SPECIALTIES	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
SPECIALTIES	LUMP SUM	1	$ 20,000.00	$ 20,000.00
SUBTOTAL DIVISON 10				*$ 20,000.00*
DIVISION 12 - FURNISHINGS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
LAB CASEWORK	LUMP SUM	1	$ 53,856.00	$ 53,856.00
SUBTOTAL DIVISION 12				*$ 53,856.00*
DIVISION 21 - FIRE SUPPRESSION	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
FIRE PROTECTION SYSTEM	LUMP SUM	1	$ 76,000.00	$ 76,000.00
SUBTOTAL DIVISION 21				*$ 76,000.00*
DIVISION 22 - PLUMBING	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
PLUMBING	LUMP SUM	1	$ 450,000.00	$ 450,000.00
SUBTOTAL DIVISION 22				*$ 450,000.00*
DIVISION 22 - HVAC	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
HVAC	LUMP SUM	1	$ 450,000.00	$ 450,000.00
SUBTOTAL DIVISION 23				*$ 450,000.00*
DIVISION 26 - ELECTRICAL	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
ELECTRICAL	LUMP SUM	1	$ 3,100,000.00	$ 3,100,000.00
SUBTOTAL DIVISION 26				*$ 3,100,000.00*
DIVISION 31 - EARTHWORK	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
EARTHWORK	LUMP SUM	1	$ 720,000.00	$ 720,000.00
SUBTOTAL DIVISION 31				*$ 720,000.00*
DIVISION 32 - EXTERIOR IMPROVEMENTS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
EXTERIOR IMPROVEMENTS (PAVEMENT, FENCING, LANDSCAPING, ETC)	LUMP SUM	1	$ 280,000.00	$ 280,000.00
SUBTOTAL DIVISION 32				*$ 280,000.00*
DIVISION 33 - UTILITIES	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
UTILITIES		1	$ 620,000.00	$ 620,000.00
SUBTOTAL DIVISION 33				*$ 620,000.00*
DIVISION 40 - PROCESS INTERCONNECTIONS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
PROCESS PIPING AND VALVES	LUMP SUM	1	$ 1,900,000.00	$ 1,875,000.00
SUBTOTAL DIVISION 40				*$ 1,875,000.00*

DIVISION 41 - MATERIALS PROCESSING & HANDLING EQUIPMENT	UNIT	EST. QUANTITY	UNIT PRICE	AMOUNT
BRIDGE CRANE	UNIT	1	$ 150,000.00	$ 150,000.00
SUBTOTAL DIVISION 41				*$ 150,000.00*
DIVISION 43 - PROCESS GAS & LIQUID HANDLING, PURIFICATION & STORAGE EQUIPMENT	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
HIGH SERVICE PUMPS	UNIT	3	$ 200,000.00	$ 600,000.00
SUBTOTAL DIVISION 43				*$ 600,000.00*
DIVISION 44 - POLLUTION & CONTROL EQUIPMENT	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
REVERSE OSMOSIS SYSTEM SKID - 500 GPM	EACH	4	$ 950,000.00	$ 3,800,000.00
MEMBRANE EQUIPMENT INSTALLATION	LUMP SUM	1	$ 570,000.00	$ 570,000.00
RO FEED PUMPS	EACH	3	$ 65,000.00	$ 195,000.00
CHEMICAL FEED SYSTEM - RO ANTISCALANT	LUMP SUM	1	$ 75,000.00	$ 75,000.00
CHEMICAL FEED SYSTEM - RO DECHLORINATION	LUMP SUM	1	$ 75,000.00	$ 75,000.00
DISINFECTION - SODIUM HYPOCHLORITE FEED SYSTEM	LUMP SUM	1	$ 100,000.00	$ 100,000.00
SODIUM HYPOCHLORITE STORAGE TANKS - FRP	LUMP SUM	1	$ 150,000.00	$ 150,000.00
SUBTOTAL DIVISION 44				*$ 4,965,000.00*
SUB TOTAL				**$ 17,970,000.00**

Project Name:	**MCES Water Reuse Evaluation**
SEH Project No:	**MCES 182880**
Date:	**July 1, 2025**
Estimator:	**SEH**
Description:	**0.5 MG PRESTRESSED TANK**

DIVISION 1 - GENERAL REQUIREMENTS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
CONTRACTOR MOBILIZATION, OVERHEAD, PROFIT (15%)	LUMP SUM	1	$ 325,500.00	$ 325,500.00
SUBTOTAL DIVISION 0 AND 01				*$ 325,500.00*
DIVISION 3 - CONCRETE	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
0.5 MG Prestressed Concrete Tank	LUMP SUM	1	$1,500,000	$1,500,000
SUBTOTAL DIVISION 3				*$1,500,000*
DIVISION 8 - OPENINGS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
HATCHES	EA	2	$ 5,000.00	$10,000
SUBTOTAL DIVISION 8				*$ 10,000.00*
DIVISION 26 - ELECTRICAL	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
LEVEL SENSORS	EA	1	$ 20,000.00	$ 20,000.00
SUBTOTAL DIVISION 26				*$ 20,000.00*
DIVISION 31 - EARTHWORK	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
EXCAVATION AND GRADING	LUMP SUM	1	$ 290,000.00	$ 290,000.00
SUBTOTAL DIVISION 31				*$ 290,000.00*
DIVISION 33 - UTILITIES	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
SITE PIPING	LUMP SUM	1	$ 250,000.00	$ 250,000.00
SUBTOTAL DIVISION 33				*$ 250,000.00*
DIVISION 40 - PROCESS INTERCONNECTIONS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
PROCESS PIPING	LUMP SUM	1	$ 100,000.00	$ 100,000.00
SUBTOTAL DIVISION 40				*$ 100,000.00*
SUB TOTAL				**$ 2,495,500.00**

Project Name:	**MCES Water Reuse Evaluation**
SEH Project No:	**MCES 182880**
Date:	**July 1, 2025**
Estimator:	**SEH**
Description:	**2.0 MG PRESTRESSED TANK**

DIVISION 1 - GENERAL REQUIREMENTS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
CONTRACTOR MOBILIZATION, OVERHEAD, PROFIT (15%)	LUMP SUM	1	$ 649,500.00	$ 649,500.00
SUBTOTAL DIVISION 0 AND 01				*$ 649,500.00*
DIVISION 3 - CONCRETE	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
2.0 MG Prestressed Concrete Tank	LUMP SUM	1	$3,000,000	$3,250,000
SUBTOTAL DIVISION 3				*$3,250,000*
DIVISION 8 - OPENINGS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
HATCHES	EA	2	$ 5,000.00	$10,000
SUBTOTAL DIVISION 8				*$ 10,000.00*
DIVISION 26 - ELECTRICAL	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
WASTE DISCHARGE CONTROL	EA	1	$ 50,000.00	$ 50,000.00
LEVEL SENSORS	EA	1	$ 20,000.00	$ 20,000.00
SUBTOTAL DIVISION 26				*$ 70,000.00*
DIVISION 31 - EARTHWORK	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
EXCAVATION AND GRADING	LUMP SUM	1	$ 450,000.00	$ 450,000.00
SUBTOTAL DIVISION 31				*$ 450,000.00*
DIVISION 33 - UTILITIES	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
SITE PIPING	LUMP SUM	1	$ 300,000.00	$ 300,000.00
SUBTOTAL DIVISION 33				*$ 300,000.00*
DIVISION 40 - PROCESS INTERCONNECTIONS	**UNIT**	**EST. QUANTITY**	**UNIT PRICE**	**AMOUNT**
PROCESS PIPING	LUMP SUM	1	$ 250,000.00	$ 250,000.00
SUBTOTAL DIVISION 40				*$ 250,000.00*
SUB TOTAL				**$ 4,979,500.00**