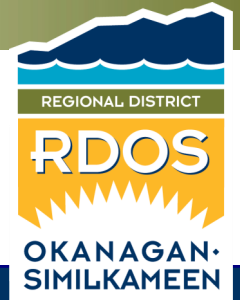


Regional District of Okanagan-Similkameen

Missezula Lake Water System Upgrade

Spring 2024



Keeping the Community Informed

Background

The Regional District of Okanagan-Similkameen (RDOS) owns and operates the Missezula Lake water system. The water system draws water from Missezula Lake and services approximately 190 residential/seasonal lots comprised of approximately 440 residents. A dam, partly owned by the RDOS, is located on Summers Creek at the outlet of Missezula Lake. The B.C. Ministry of Water Land and Natural Resource Stewardship (WLRN) manages lake water levels and balances the needs of lake water users, downstream water uses, and environmental flow needs (EFN).



Due to prolonged dry conditions in the Similkameen Valley during 2021, water levels within Missezula Lake and Summers Creek were lower than normal. The province identified the need to release more water from the lake to meet downstream water user and EFN demands.

The RDOS expressed a concern with the province's release plan as additional releases from the lake could result in water system infrastructure becoming non-functional, resulting in a state of emergency for the community. Understanding the RDOS concern, the former B.C. Ministry of Forests, Lands and Natural Resource Operations (FLNRO) reduced the water releases from the lake to help limit lake draw down. The water conservation strategies implemented by the RDOS and FLNRO in July and August 2021, helped limit further lake draw down and reduced the water supply risk to the Missezula Lake water users.

The RDOS is concerned about the immediate and long-term risk of the Missezula Lake water supply availability to the community related to future drought events. As part of the infrastructure upgrade work for Missezula Lake, the RDOS retained Associated Environmental Consultants Inc. (AE) to complete a review of the current Missezula Lake water management strategy and to provide recommendations for further work required to help ensure the community has a long-term reliable water supply source.

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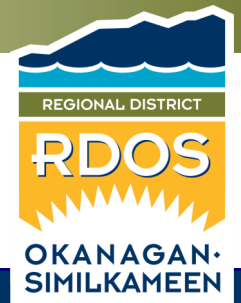
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Regional District of Okanagan-Similkameen

Missezula Lake Water System Upgrade



Keeping the Community Informed

Background

On January 1, 2020, the RDOS assumed ownership and operations of the Missezula Lake Water System. The Improvement District requested help to provide for the financial and operational requirements to maintain the system and meet all regulatory obligations.

Prior to the RDOS assuming ownership, an engineering assessment was done by a third party, TRUE Consulting (TRUE), that identified numerous deficiencies in the system infrastructure, including insufficient water treatment, lack of water storage, and fire protection, and issues with



the distribution system that lacked proper engineering records.

To address these deficiencies and meet the requirements of the Provincial Drinking Water Protection Act (to protect against bacteria, viruses, and Protozoa), major upgrades were proposed. The report indicated the following requirements:

- Installation of a chlorination system, an ultraviolet (UV) disinfection system, and a filtration system to meet turbidity and treatment requirements for a surface water source.

Historically, the Missezula Lake Water System had sporadically issued a boil water notice or water advisory for poor water quality for periods of time from a couple of days, to several months. These poor water quality events typically are caused when the presence of coliform bacteria was detected in the distribution system. The proposed system upgrades would address those issues.

Regional District of Okanagan-Similkameen

Missezula Lake Water System Upgrade



Keeping the Community Informed

The Issue

The proposed treatment is required to meet the provincial 4-3-2-1-0 Drinking Water treatment standards for a surface water source. This standard can be met with a filtration, UV and Chlorine system. The project presented to the community included a treatment system designed and constructed near the existing reservoir and lake intake.

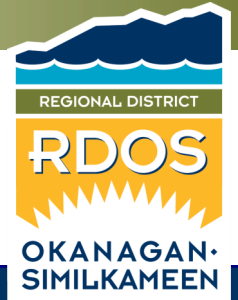
The proposed project was used to apply for senior government grant funding using the cost estimates supplied in the infrastructure review study.

The project and grant application included the following:

- Treatment system with multiple forms of disinfection
- Major upgrades will also include updated electrical, instrumentation, and SCADA components.
 - Given the remote nature of the system and longer response times for operators, an enhanced monitoring and control system is planned.
- Intake upgrades to include pumps in order to provide a constant supply and water pressures for the treatment system
 - At present, the reservoir is supplied through a siphoning action based on the level of the lake.
 - The dependence on the lake level to fill the reservoir has negatively impacted the operations of the Missezula Lake Dam by reducing the amount of water that can be released downstream.
 - If the lake level is dropped to adequately supply the downstream licence holders, the lake level will drop below the intake for the Missezula Lake Water System. To date, the province has been accommodating the water system by operating the dam in an alternative manner to prevent the water system intake from going dry.
 - An intake upgrade is required to ensure the lake level can be maintained for both the safe operation of the water system and a sustainable release from the dam for all downstream agricultural and fisheries needs.

Regional District of Okanagan-Similkameen

Missezula Lake Water System Upgrade



Keeping the Community Informed

Seeking a Solution

The RDOS received a senior government grant to provide a treatment system and intake upgrades for the Missezula Lake Water System. Preliminary designs and analyses have indicated that the cost to install and operate a surface water source treatment plant is beyond the available funding from the grant and the borrowing amount from the community.

As a result, the RDOS and AE have explored other options such as using a ground water source.

The RDOS drilled a test well to find a suitable location in the summer of 2022. Unfortunately, the well cannot be developed as a drinking water well but it can be used as a monitoring well. The decision was made to drill a second well in 2023 which was developed in fall of 2023. The resulting water quality indicated that treatment would be required for the well to be a potable supply for the community. AE was tasked to review the two water source options and provide preliminary treatment designs and cost estimates for each.



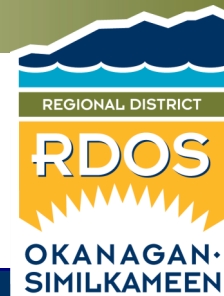
Well No. 2
(fall 2023)

Test Well No. 1
(summer 2022)



Regional District of Okanagan-Similkameen

Missezula Lake Water System Upgrade



Keeping the Community Informed

Options for Consideration

The surface water source and groundwater source each have specific parameters to treat in order to meet regulations. As the table shows below, the groundwater source has issues with iron, manganese, dissolved solids and hardness.

Raw Water Quality

Parameter	Surface Water Samples	Groundwater Samples	GCDWQ Objective
Turbidity	0.61 – 1.07 (Ave 0.84)	0.88 – 1.21 (Ave 1.0)	< 1.0
Hardness (mg/L as CaCO ₃)	133 – 146 (Ave 140)	464 – 583 (Ave 527)	See note
Algae	Present in summer	-	-
Total Iron (mg/L)	< 0.01	0.19 – 0.203 (Ave 0.19)	≤ 0.3
Total Manganese (mg/L)	1. – 0.002 (Ave 0.002)	0.129 – 0.163 (Ave 0.147)	≤ 0.02 (AO) ≤ 0.12 (MAC)
Total Dissolved Solids (TDS; mg/L)	165 – 187 (Ave 176)	708	≤ 500

AO = aesthetic based standard, not health-based

MAC = health-based standard

Note: Not official limit for hardness, though hardness > 500 is considered very hard

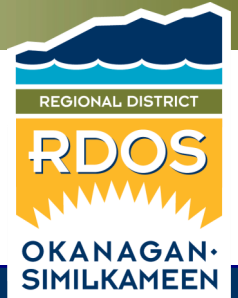
Several options have been identified and preliminary designs have been compiled in order to calculate the costs associated with each option.

The options evaluated include:

- Groundwater: full treatment for manganese, iron and hardness
- Surface water: full treatment with filtration and UV
- Groundwater: partial treatment for manganese and iron only



Regional District of Okanagan-Similkameen Missezula Lake Water System Upgrade

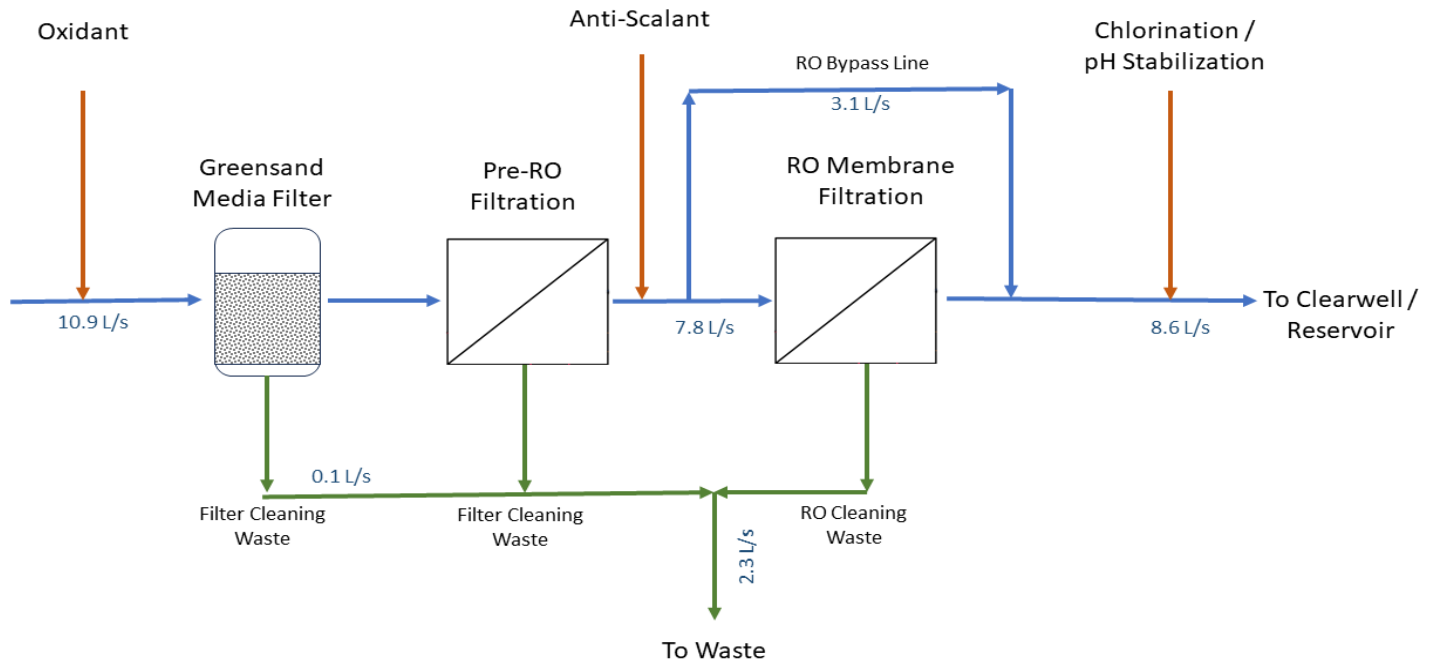


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Solution Options

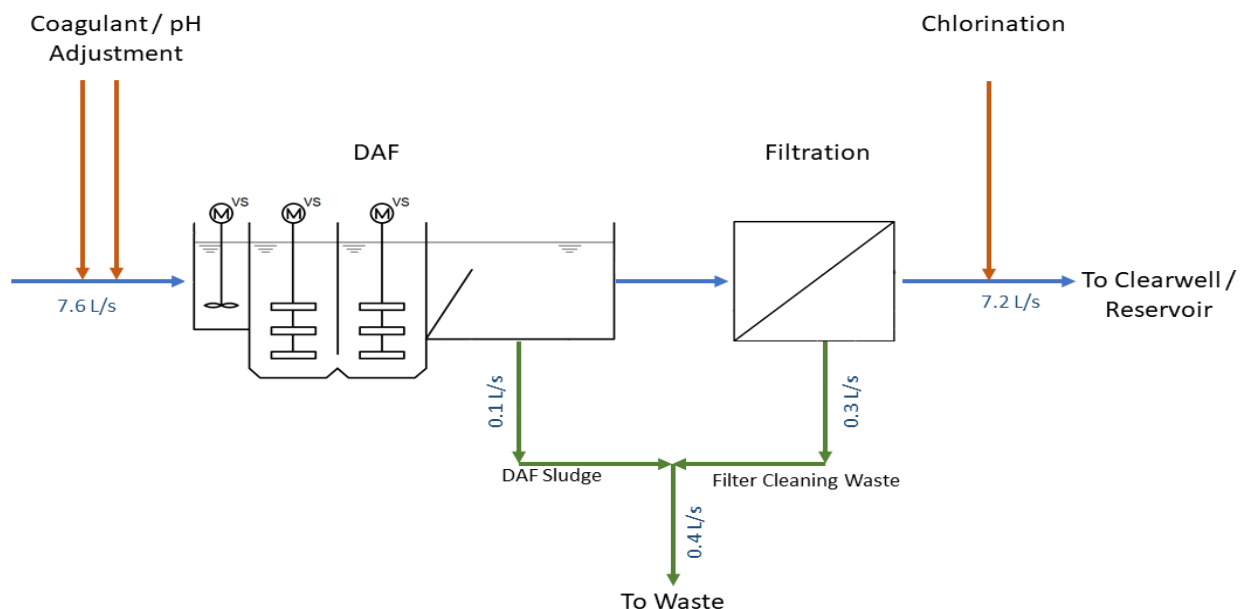
OPTION 1 – GROUNDWATER:

Removes Iron, Manganese, TDS, and Hardness

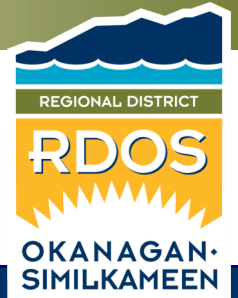


OPTION 2 – SURFACE WATER:

Removes Algae and Microorganisms



Regional District of Okanagan-Similkameen Missezula Lake Water System Upgrade

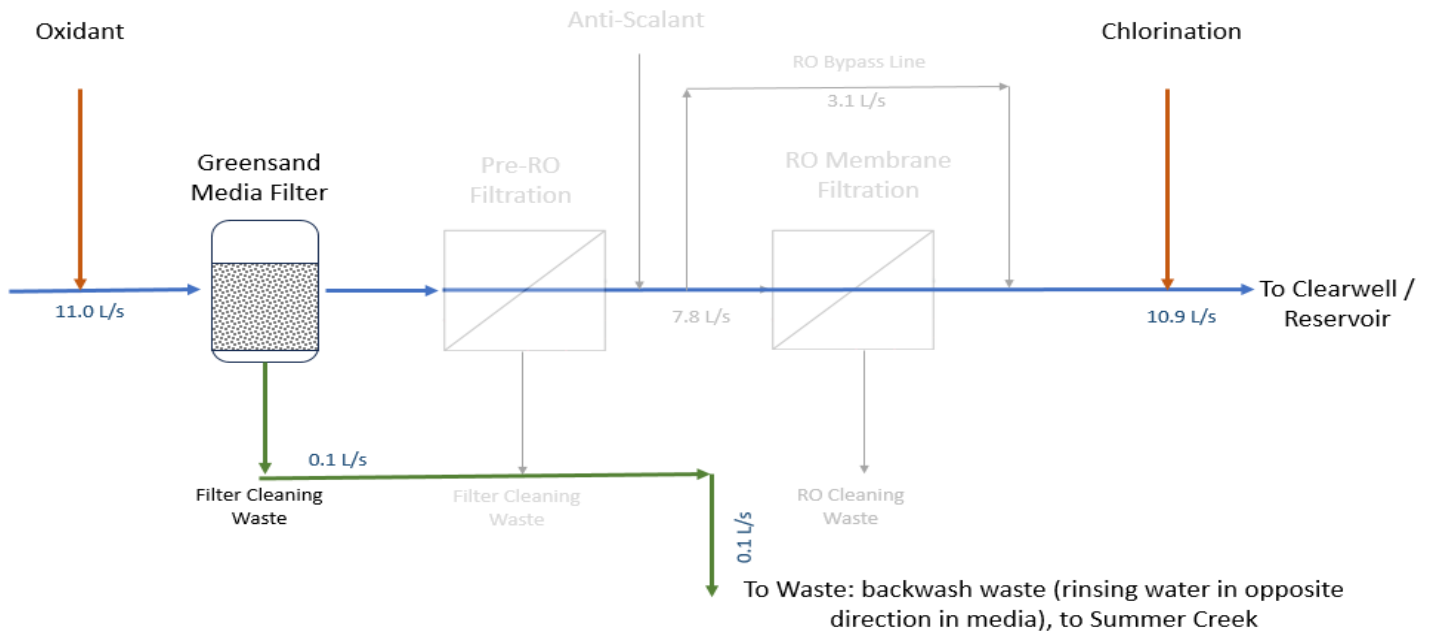


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Solution Options (cont.)

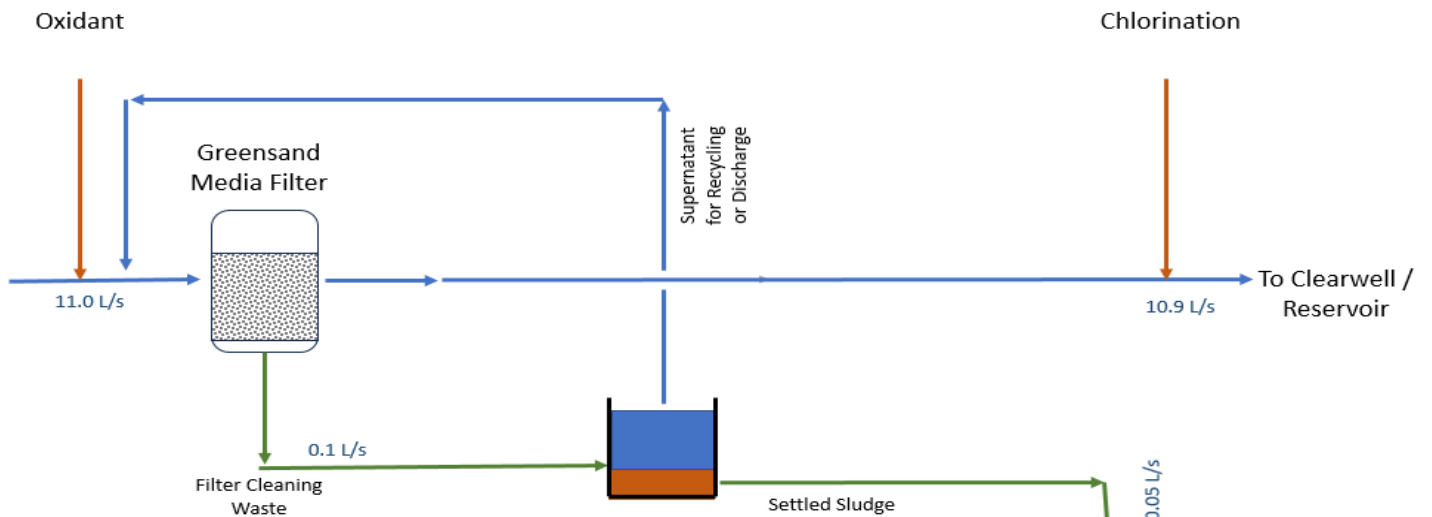
Option 3A – GROUNDWATER:

Removes Iron and Manganese (TDS and hardness not addressed)



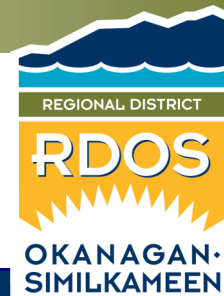
Option 3B – GROUNDWATER:

Removes Iron and Manganese, recycles some of the waste residuals (TDS and hardness not addressed)



Sludge (manganese) gets collected in holding tank and pumped to an offsite location. Approximately half the waste is sent back to treatment plant and half pumped and hauled offsite. 4,000 L/day, 20,000 litre hauling trucks, so every 5 days in busy season. Would still need some dewatering before ready for landfilling, so would go to a wastewater facility.

Regional District of Okanagan-Similkameen Missezula Lake Water System Upgrade



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Costs for Solution Options

Capital Cost Summary

Water Source	Option 1 - Groundwater	Option 2 - Surface Water	Option 3a – GW (hard water)
Design Flowrate	8.6*	7.2 L/s*	11 L/s
Other Notes	Removed Filter & RO redundancy	Removed DAF & Filter redundancy	Includes redundancy Backwash recycle not incl.
WTP Footprint	4 m x 16 m	4 m x 12 m	4 m x 16 m*
Capital Cost (OPC – Class “D”)	\$1.3 m	\$1.3 m	\$0.9 m
30% E&C	\$ 0.4 m	\$0.4 m	\$0.3 m
Total Estimate	\$1.7 m	\$1.7 m	\$1.2 m
Cost per Flow (\$ per L/s)	\$155,000 / L/s	\$224,000 / L/s	\$109,000 / L/s
Source Upgrades	Add a second well (each 5 L/s) \$100,000	Upgrade intake (not calculated)	Add a second well (each 5 L/s) \$100,000
One Hour Storage	36 m ³ ~ \$60,000 - 85,000	31 m ³ ~ \$50,000 - 75,000	Extra storage not required.

O&M Considerations

Water Source	Groundwater	Surface Water	Option 3- Groundwater Reduced Treatment
<u>O&M</u> Considerations			
Labour	- Visit 1-2 times/week - Prefiltration maintenance	Visit 1-2 times/week	Visit 1-2 times/week
Power Consumption	- Lights and heating - Process chemical pumps - Filter backwash pumps - Membrane permeate pumps - Membrane hydraulic cleaning pumps - Membrane chemical circulation pumps - Membrane chemical cleaning dosing pumps	- Lights and heating - Process chemical pumps - DAF mixers - DAF sludge skimmer - DAF compressor - DAF recycle pump - DAF sludge pump - Filter backwash pumps	- Lights and heating - Process chemical pumps - Filter backwash pumps - Waste recycle pumps
Chemicals	- Sodium hypochlorite - Anti-scalant - Membrane cleans (chlorine) - Membrane cleans (acid) - Chlorine waste neutralizer - Acid waste neutralizer	- Sodium hypochlorite - Soda ash - Polymer - Chlorine waste neutralizer	Sodium hypochlorite

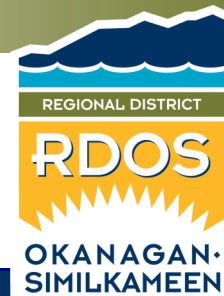
* QUANTIFYING CHEMICAL AND ENERGY COSTS WILL DEPEND ON WHAT IS SET AS THE “AVERAGE” FLOW

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Missezula Lake Water System Upgrade



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Waste from Treatment Processes

Waste Considerations

Description	Option 1 – Groundwater	Option 2 – Surface Water	Option 3- Groundwater Reduced Treatment
Waste Generated	- Greensand media backwash waste - RO hydraulic cleaning waste - RO chemical cleaning waste (neutralized) - Spent cartridge filters	- DAF sludge - Filter backwash waste	Greensand media backwash waste
Direct Release to Environment?	- High volumes of liquid waste - Spent cartridges taken to landfill	Waste contains aluminum	Likely can safely discharge to environment
Additional Considerations	-	-	Backwash recycle option creates smaller volume of waste, but should be sent to a WWTP

The RDOS and AE have prepared the various options for consideration and feedback from the community is being sought on the preferred method to proceed with.

The RDOS is also looking at potential locations for a second groundwater well if the project proceeds with the groundwater options. A second well is necessary to meet demands for the water system. The RDOS would like to ask the community whether any resident is aware of a good location for a second well. If so, please contact the Electoral Area “H” Director or the Senior Manager of Utilities listed below.

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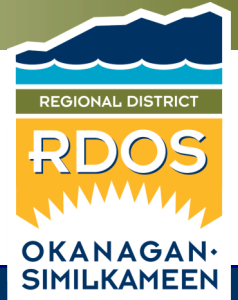
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Missezula Lake Water System Upgrade



Keeping the Community Informed

Water Source Multi-Criteria Evaluation of Importance Weighting

In order to select a suitable water treatment option for the community, a multi-criteria evaluation has been compiled.

Criterion Description	Importance Weighting
Capital Investment Cost	%
Ongoing Operating, Maintenance and Energy Costs	%
Amount of Space Required for Water Source, Treatment Plant and Storage	%
Water Quality Comparable to Existing	%
Sustainability and Protection of Water Source	%
Confidence in Water Quantity	%
Confidence in Water Quality	%
Waste Stream (Environmental) Management	%

100%

Community Involvement

It is important for the community to consider the above criteria in order to better qualify the options, and select a suitable direction. The table shown above shall be used to review the criteria and apply weighting to each of the categories. The total percentage must add up to 100.

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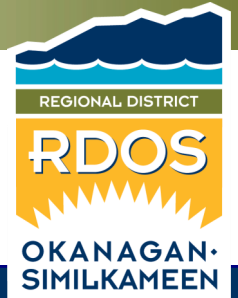
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Missezula Lake Water System Upgrade



Keeping the Community Informed

Elements to consider

- Max day demand vs max capacity of surface water or groundwater
 - Surface water limited by licenses
 - Groundwater limited by capacity of wells (predicted to be 5 L/s each)

Option 3 specific elements to consider

- Acceptance of hard water
 - Softeners or sink Reverse Osmosis (RO) units can be used within the home if desired
- IHA acceptance of not treating total dissolved solids and hardness
- Waste management
 - Sludge disposal location to be determined
 - Likely at a wastewater treatment plant
 - Discharge to creek for some waste may be possible based on parameters removed from the water



Next Steps

In June of 2024, the RDOS must determine which is the most suitable water source and treatment for Missezula Lake Water System and move the design work forward for the upgrades. Activities to determine the best option will include:

- Discussion with community
- Liaise with regulatory agencies
- Prepare Conceptual Design Report
- Community Open House on predesign of selected source and treatment option
- Proceed with detailed design and construction of the treatment system.

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