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WILDERNESS MOUNTAIN WATER SERVICE COMMISSION
Notice of Meeting on **Monday, February 6, 2023 at 9:30 a.m.**
Goldstream Conference Room, 479 Island Highway, Victoria, BC

For members of the **public who wish to listen to the meeting** via telephone please call **1-833-353-8610** and enter the **Participant Code 1911461 followed by #.** You will not be heard in the meeting room but will be able to listen to the proceedings.

L. Cutler | M. Lechowicz | D. Pepino | A. Wickheim, Electoral Area Director

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AGENDA

1. ELECTION OF CHAIR

Pursuant to Bylaw No. 3511
Election conducted by Senior Manager

2. ELECTION OF VICE CHAIR

Pursuant to Bylaw No. 3511
Election conducted by the Chair

3. APPROVAL OF AGENDA

4. ADOPTION OF MINUTES 3

***Recommendation**: That the minutes of the following meetings be adopted:*

- *November 21, 2022*
- *November 28, 2022*

5. CHAIR'S REMARKS

6. PRESENTATIONS/DELEGATIONS

Delegations will have the option to participate electronically. Please complete the online application for "Addressing the Board" on our website and staff will respond with details.

Alternatively, you may email your comments on an agenda item to the Wilderness Mountain Water Service Commission at iwsadministration@crd.bc.ca.

Requests must be received no later than 4:30 p.m. two calendar days prior to the meeting.

7. SENIOR MANAGER'S REPORT

8. COMMISSION BUSINESS

8.1. Project and Operations Update 9

There is no recommendation. This report is for information only.

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*To ensure quorum, advise **Mikayla Risvold mrisvold@crd.bc.ca** if you cannot attend.*

IWSS-297445977-10025

9. WILDERNESS MOUNTAIN WATER SERVICE COMMISSION MEETING SCHEDULE

Regular meetings of the Wilderness Mountain Water Service Commission shall be held in the Goldstream Conference Room, 479 Island Highway, Victoria, BC on Monday, February 6, Monday, June 12 and a date to be determined in November to approve the Operating and Capital Budget. Meetings will commence at 9:30 am unless otherwise determined.

10. CORRESPONDENCE

10.1. WMWS – Cover Letter Final Report: Associated Engineering Dec. 2022
10.2. Associated Engineering to Island Health Letter: Manganese clarification
10.3. Wilderness Mountain Update to Island Health Letter February 2023

11. NEW BUSINESS

12. ADJOURNMENT

Next Meeting: Monday, June 12, 2023

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MINUTES OF A MEETING OF THE Wilderness Mountain Water Service Commission, held Monday, November 21, 2022 at 9:30 a.m., Goldstream Meeting Room, 479 Island Highway, Victoria, BC

PRESENT: **Commission Members:** L. Cutler (Vice Chair); A. Wickheim (Electoral Area Director); M. Lechowicz

Staff: S. Irg, Senior Manager, Water Infrastructure Operations; C. Moch, Manager, Water Quality Operations; J. Kelly, Manager, Capital Projects; L. Xu, Manager, Finance Services; M. Risvold, Committee and Administrative Clerk (Recorder)

REGRETS: D. Pepino (Chair)

The meeting was called to order at 9:32 AM.

1. APPROVAL OF AGENDA

The agenda was am to move Item 7, Correspondence to immediately follow Item 6.1.

MOVED by M. Lechowicz, **SECONDED** by L. Cutler,
That the agenda be approved as amended.

CARRIED

2. ADOPTION OF MINUTES

MOVED by M. Lechowicz, **SECONDED** by L. Cutler,
That the minutes of the June 28, 2022 meeting be adopted.

CARRIED

3. CHAIR'S REMARKS

The following documents are available upon request:

- Chair's written remarks
- Critiques prepared by the commission

MOVED by M. Lechowicz, **SECONDED** by L. Cutler,

1. That the Wilderness Mountain Water Service Commission directs CRD staff to direct Associated Engineering to formally retract their October 4, 2022 letter to Vancouver Island Health Authority pending further analysis of the CRD monitoring and SCADA data on which it is based;

2. That the two critiques prepared by the commission and presented to Vancouver Island Health Authority on November 17, 2022 be transmitted to Associated Engineering; and

3. That the two critiques be included with the minutes of this meeting as a public record.

CARRIED

4. PRESENTATIONS/DELEGATIONS

There were none.

5. SENIOR MANAGER'S REPORT

S. Irg informed the Commission of expiring member's terms and advised the Electoral Area Director has made a recommendation for members to the board.

6. COMMISSION BUSINESS

6.1. Project and Operations Update

S. Irg presented the project and operations update.

Discussion ensued regarding concerns with manganese and turbidity. The Commission thanked staff for providing data, and expressed concerns that the letter from Associated Engineering to Island Health, dated October 4, 2022, was based on incorrect data and analysis. Staff advised that the water needs additional treatment, and boil water advisory's (BWA's) are taken very seriously. A stable trend is required prior to removing a BWA. Staff advised that SCADA is used for operational surveillance, and there are operators at the treatment plant monitoring the data 24/7. Island Health is unable to make an exemption regarding the filtration exemption request. Staff advised that once the Associated Engineering report is complete, the Commission can recommend to complete further analysis if they would like. Staff will seek advice regarding the motion to have Associated Engineering rescind their letter to Island Health. Staff will confirm the Water License Agency is aware the watershed is bound by a covenant placed by CRD.

Discussion ensued regarding:
- Vulnerability study
- Hot, dry summers
- Risk of algal blooms
- SCADA system
- Utilizing expertise within the commission
- Water License

6.2. Correspondence – WMWSC – June 28 Meeting Follow-up

Staff responded to a question regarding liability insurance advising that they received advice from CRD Manager of Risk, who advised that CRD carries Commercial General Liability Insurance for third party property damage or injury resulting from all CRD assets. Staff noted this is a CRD policy that would not specifically impact Wilderness Mountain if there was a claim within the Wilderness Mountain area.

Staff responded to a question regarding the piped water study, adding the study is complete. Staff advised details of the piped water study will be provided to the Commission in 2023 after it has been provided to the Juan de Fuca Water Service Commission.

6.3. 2023 Operating and Capital Budget

This Item was not considered at the November 21, 2022 meeting. The Commission agreed to defer this item to November 28, 2022.

Staff recommended proceeding with the presentation of the 2023 Operating and Capital budget, as there is a deadline for the Fee and Charges Bylaw. Staff advised amendments can be made to the budget at a later date.

7. CORRESPONDENCE

7.1. WMWSC – June 28 Meeting Follow-up

This item was moved to item 6.2 on the agenda.

8. ADJOURNMENT

MOVED by M. Lechowicz, **SECONDED** by L. Cutler,
That the November 21, 2022 meeting be adjourned at 10:59 AM.

CARRIED

_____
CHAIR

_____
SECRETARY

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MINUTES OF A MEETING OF THE Wilderness Mountain Water Service Commission, held Monday, November 28, 2022 at 9:30 a.m., In the Goldstream Meeting Room, 479 Island Highway, Victoria, BC

PRESENT: **Commission Members:** D. Pepino (Chair); L. Cutler (Vice Chair); A. Wickheim (Electoral Area Director); M. Lechowicz

Staff: I. Jesney, Acting General Manager, Integrated Water Services; S. Irg, Senior Manager, Water Infrastructure Operations; C. Moch, Manager, Water Quality Operations, Environmental Protection; L. Xu, Manager, Finance Services; T. Duthie, Manager, Administrative Services; M. Risvold, Committee and Administrative Clerk (recorder)

The meeting was called to order at 9:30 a.m.

1. APPROVAL OF AGENDA

Item 5.1 Update on Previous Meeting Motions was added to the agenda.

MOVED by M. Lechowicz, **SECONDED** by L. Cutler,
That the agenda be approved as amended.

CARRIED

2. ADOPTION OF MINUTES

The minutes of the November 21, 2022 meeting were unavailable and will be approved at the February 2023 meeting.

3. CHAIR'S REMARKS

The Chair provided the following remarks:
On Thursday Nov 17, a video conference was held between VIHA, CRD and Commission members as it relates to Wilderness Mountain Water Service. The points the commission stressed (as guided by our Commission Handbook) were the facts that the costs borne by the community were escalating rapidly beyond affordable rates, the information communicated by the consultant was flawed and did not recognize the fundamental need for affordable solutions, and that the narrow interpretation of regulation being applied to the issue of turbidity levels was causing undue expense and community concern in the form of multiple boil water advisories.

VIHA's position was that the staff would dictate the Medical decision making, and the staff's decision at that point was that 1 NTU turbidity is a hard upper limit. Small water systems in B.C. were highlighted by the Auditor General in her 2019 report as needing much more attention on the issues of affordability and competence in their operation.

This Commission has worked diligently to supply detailed analysis to the CRD and VIHA in an effort to address those above identified issues in a calm and measured way.

We would like to continue to do that, however, we are looking for some support on the part of both CRD and VIHA to solve this apparent impasse.

4. PRESENTATIONS/DELEGATIONS

There were none.

5. COMMISSION BUSINESS

5.1. Update on Previous Meeting Motions

Staff advised that internal discussion has taken place, and there is currently no further information regarding the request to withdraw the letter from Associated Engineering to Island Health (IH).

5.2. Wilderness Mountain 2023 Operating and Capital Budget

S. Irg presented the 2023 Operating and Capital Budget.

The staff recommendation was discussed. Staff responded to a question regarding property located at the end of Ambiance Way advising the property will likely be auctioned in the future, and the Provincial Government does not participate in taxable folios. Funds from the purchase of the land are often derived from unpaid taxes, and liens cannot be placed on Government owned property.

Discussion ensued regarding:

- Concern with the Alternative Approval Process (AAP)
- Request to withdraw letter from Associated Engineering to IH
- Water quality data
- Lack of additional low-cost options
- Previous report from Stantec in 2011 with additional options provided
- 2018 piped water study

MOVED by M. Lechowicz, **SECONDED** by L. Cutler,
That the Wilderness Mountain Water Service Commission:
Reject the Wilderness Mountain Water Service 2023 Operating and Capital Budget.

CARRIED
Abstained: Wickheim

6. CORRESPONDENCE

There was none.

7. NEW BUSINESS

MOVED by D. Pepino, **SECONDED** by L. Cutler,
That the Wilderness Mountain Water Service Commission:

1. Establish a working group with CRD staff and Commission members reporting directly to the General Manager, Integrated Water Services;
2. That staff allow detail and information access to the working group and charge staff time to discretionary funds; and
3. That the working group provide a report with findings to Island Health by December 21, 2022.

CARRIED
Opposed: Wickheim

Discussion ensued regarding:

- Floating intake
- Improvements to SCADA system
- CRD obligations for health of the community
- Long term liability
- Short term solutions

Staff advised that there are no discretionary funds. Staff time would be charged to the Commission, and Community Works Funds cannot be used for staff time. Staff do not have resources, time or availability to join a working group, and CRD is required to follow IH requirements. Staff recommended hiring a third party if the Commission would like further analysis of the system.

The Commission further discussed the 2023 Operating and Capital Budget.

Staff advised the provisional budget has been reviewed by the Electoral Areas Committee (EAC) and Board. Staff recommended amending the budget and working toward a solution for approving the provisional budget.

Discussion ensued regarding:

- Removing the AAP from the budget
- Removing all capital projects from the budget
- Having a zero percent operational increase for five years
- Having a zero percent tax increase for five years

Staff will ensure IH is aware of the Commission's request to have the letter from Associated Engineering withdrawn.

8. ADJOURNMENT

MOVED by L. Cutler, **SECONDED** by M. Lechowicz,
That the November 28, 2022 meeting be adjourned at 10:29 a.m.

CARRIED

_____
CHAIR

_____
SECRETARY

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REPORT TO WILDERNESS MOUNTAIN WATER SERVICE COMMISSION
MEETING OF MONDAY, FEBRUARY 06, 2023

SUBJECT **Capital Project Status Reports and Operational Updates – February 2023**

ISSUE SUMMARY

To provide the Wilderness Mountain Water Service Commission with capital project status reports and operational updates.

BACKGROUND

The Wilderness Mountain Water System is located near the top of Mount Matheson in East Sooke on Vancouver Island in the Juan de Fuca Electoral Area and provides drinking water to approximately 74 customers. Capital Regional District (CRD) Integrated Water Services is responsible for the overall operation of the water system with day-to-day operation, maintenance, design and construction of water system facilities provided by the CRD Infrastructure Engineering and Operations Divisions. The quality of drinking water provided to customers in the Wilderness Mountain Water System is overseen by the CRD Water Quality Section.

CAPITAL PROJECT UPDATE

There are currently no capital projects.

OPERATIONAL UPDATE

- November 16: Dam inspections and site safety inspections
- December 17: Dam inspections and site safety inspections
- December 20: Snow clearing of access road to the treatment plant
- December 28-30: Dam maintenance

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Shayne Irg, P.Eng., Senior Manager, Water Infrastructure Operations
Concurrence:	Joseph Marr, P.Eng., Acting Senior Manager, Infrastructure Engineering
Concurrence:	Ian Jesney, P.Eng., Acting General Manager, Integrated Water Services

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REPORT TO ELECTORAL AREAS COMMITTEE
MEETING OF WEDNESDAY, JUNE 8, 2022

SUBJECT **Electoral Areas Water Conservation Bylaw No. 1, 2022 (Bylaw No. 4492)**

ISSUE SUMMARY

Approval of a water conservation bylaw for the Electoral Areas.

BACKGROUND

Over the past several years, the need for water conservation measures in the Electoral Areas' local water services has become more critical due to seasonal drought conditions imposing stress on source water supplies. The Capital Regional District (CRD) Electoral Area water services have adhered to voluntary conservation measures since 2016 when staff and the Local Service Area water committees agreed to measures tailored to each individual service. The basis for the voluntary restrictions were the conservation stages set out in Bylaw No. 4099, "Consolidated Capital Regional District Water Conservation Bylaw No. 1, 2016". However, there is a need to formalize these measures and add an enforcement provision in order to improve the effectiveness and adherence to the restrictions across the local services.

The Electoral Areas Water Conservation Bylaw applies to all of the CRD's electoral area water services, including:

Salt Spring Island Electoral Area:

- Beddis Water System (Bylaw No. 3188)
- Cedar Lane Water System (Bylaw No. 3424)
- Cedars of Tuam Water System (Bylaw No. 3021)
- Fulford Water System (Bylaw No. 3202)
- Highland/Fernwood Water System (Bylaw No. 3753)

Southern Gulf Islands Electoral Area:

- Lyall Harbour/Boot Cove Water System (Bylaw No. 2920)
- Magic Lakes Water System (Bylaw No. 1874)
- Skana Water System (Bylaw No. 3089)
- Sticks Allison Water System (Bylaw No. 2556)
- Surfside Parks Water System (Bylaw No. 3087)

Juan de Fuca Electoral Area:

- Port Renfrew Water System (Bylaw No. 1747)
- Wilderness Mountain Water System (Bylaw No. 3503)

ALTERNATIVES

Alternative 1

The Electoral Areas Committee recommends to the Capital Regional District Board:

1. That Bylaw No. 4492, "Capital Regional District Electoral Areas Water Conservation Bylaw No. 1, 2022", be introduced and read a first, second, and third time; and
2. That Bylaw No. 4492 be adopted.
3. That Bylaw No. 4499, "Capital Regional District Ticket Information Authorization Bylaw, 1990, Amendment Bylaw No. 74, 2022", be introduced and read a first, second and third time; and,
4. That Bylaw No. 4499 be adopted.

Alternative 2

That CRD Bylaws No. 4492 and 4499 be referred back to staff for additional information.

IMPLICATIONS

Service Delivery Implications
Similar to the Regional Water Conservation Bylaw, adherence to water conservation measures are best managed through education and proactive communications to increase the chances of voluntary behavioral change. These means have proven effective for a number of years in reducing water demand in the systems in which they are requested. However, the addition of a bylaw will provide formalization and standardization of language as well as provide a venue for enforcement in the event it is required.

Bylaw No. 4492 only applies to the regulation of water use provided under each CRD local service. It does not apply to private wells or water systems provided by other public authorities.

Financial Implications

The costs of promoting and enforcing Bylaw No. 4992 would be borne by the specific service in which the action is taken as an operational expenditure. However, the Electoral Areas will benefit from the Regional approach to education and promotion thereby reducing the costs to more localized education and enforcement as required.

Environmental & Climate Implications
The Electoral Areas Water Conservation Bylaw aligns with the regional water conservation bylaw and is consistent with CRD's strategic goals to provide adequate and long term supply of drinking water to the customers in which each system serves. It forms part of the planning and preparation for future water supply needs to meet demand and consider the impacts of climate change, population growth and per-capita demand trends. It is the foundation of a strategy to reduce per capita water use in order to defer the need for additional water supply and treatment capacity in the supply system, until necessary to support population growth.

CONCLUSION

Bylaw No. 4492, "Capital Regional District Electoral Areas Water Conservation Bylaw No. 1, 2022", is recommended to formalize language and measures already requested voluntarily of the customers of the CRD's water systems in the Electoral Areas. It will allow for standardized water conservation stages, the adherence to which would be primarily through education and proactive communications measures. However, the bylaw also includes a provision for enforcement in the event that is required to drive behavior.

RECOMMENDATION

The Electoral Areas Committee recommends to the Capital Regional District Board:

1. That Bylaw No. 4492, "Capital Regional District Electoral Areas Water Conservation Bylaw No. 1, 2022", be introduced and read a first, second, and third time; and
2. That Bylaw No. 4492 be adopted.
3. That Bylaw No. 4499, "Capital Regional District Ticket Information Authorization Bylaw, 1990, Amendment Bylaw No. 74, 2022", be introduced and read a first, second and third time; and,
4. That Bylaw No. 4499 be adopted.

Submitted by:	Matt McCrank, MSc, P.Eng., Senior Manager, Wastewater Infrastructure Operations
Concurrence:	Ted Robbins, B.Sc., C.Tech., General Manager, Integrated Water Services
Concurrence:	Kristen Morley, J.D., General Manager, Corporate Services & Corporate Officer
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

ATTACHMENTS

Appendix A: Bylaw No. 4492, "Electoral Areas Water Conservation Bylaw No. 1, 2022"
Appendix B: Bylaw No. 4499, "Capital Regional District Ticket Information Authorization Bylaw, 1990, Amendment Bylaw No. 74, 2022"

APPENDIX A

CAPITAL REGIONAL DISTRICT
Bylaw No. 4492

****

ELECTORAL AREAS WATER CONSERVATION BYLAW

****

WHEREAS under Section 335 of the *Local Government Act*, a regional district may regulate in relation to a service;

AND WHEREAS the Capital Regional District ("CRD") has established or continued Water Supply local services providing drinking water in the Southern Gulf Islands, Salt Spring Island, and Juan de Fuca Electoral Areas;

AND WHEREAS the CRD desires to enact regulations to protect local Water System supplies to mitigate the risk of low water storage levels within these Water Systems;

AND WHEREAS this bylaw does not apply to water not provided under a Water System operated by the CRD on behalf of service participants, such as water from private water systems, irrigation wells, or water provided by other public authorities;

NOW, THEREFORE, the Board of the Capital Regional District in open meeting assembled enacts as follows:

1. Definitions

In this bylaw, the following terms, whether capitalized or not, have the following meanings:

"Automatic shut-off nozzle" means a nozzle, attached to a water hose, that shuts off the supply of water automatically unless the application of hand pressure allows the supply of water.

"Board" means the Board of the Capital Regional District.

"Boat" means a vessel propelled on water by an engine, oars or sails.

"Boulevard" means that portion of any highway other than the paved, improved or main travelled roadway, driveway or sidewalk and includes any landscaped median.

"Bylaw Enforcement Officer" means a person appointed or contracted by the Board or the Council of a Municipality to enforce this bylaw.

"CRD" means the Capital Regional District.

"Excess Water Use" means to apply or use more Water than is required to provide a service, produce a product or complete a task, and without limitation includes the application of Water to a hardscape, such as a sidewalk, driveway or parking lot, or to exterior windows or exterior building surfaces, through a hose or power-washer to the point that Water runs-off or spreads to surrounding areas.

"Exempted Person" means an Owner or Occupier of property identified in Schedule "A" as exempt or excused from one or more of the regulations under this bylaw.

"Farm" refers to a parcel of land classified as farmland for assessment and taxation purposes.

"Fill" means to completely fill or partially fill with Water an empty or substantially empty hot tub, swimming pool, fountain, wading pool, or similar structure, but for certainty does not include topping up with or adding Water in the normal course of operation, where the hot tub, swimming pool, fountain, wading pool, or similar structure is filled with Water and is in operation at the time Water Use Restrictions come into effect.

"General Manager" means the General Manager of the Capital Regional District Integrated Water Services Department.

"Irrigation System" means an irrigation system that consists of controllers, wiring, and accessories such as climate and soil sensors, piping, and emission devices such as sprinklers, rotors or micro-irrigation components that artificially supplies water to a landscaped area, lawn or garden.

"Lawn" or "Turf" means a cultivated area that surrounds or is adjacent to an institutional, commercial or residential building, and that is covered by grass, turf or other plants used as ground cover, such as but not limited to clover, and that is used for decorative, ornamental or recreational purposes.

"Micro-irrigation or Drip-irrigation System" means a system using irrigation components which consume less than 20 gallons per hour and operate at less than 25 Pounds per square inch to deliver Water to the root zone of the plant material being irrigated, and includes spray emitter systems (Micro-Sprays), point source emitters and linear tape systems as defined in the BC Trickle Irrigation Manual prepared and published by the Irrigation Industry Association of British Columbia (1999), but does not include weeper hoses or soaker hoses.

"Motion-Activated Sprinkler Device" means a water sprinkling device that automatically operates through detection of motion or similar event and is used to deter wildlife and other animals.

"New Lawn" or "New Turf" means a lawn that is newly established either by seeding or the laying of new sod or turf on a property.

"Newspaper" has the same meaning as in the *Community Charter.*

"Notice" means a Notice given under Section 5 of this bylaw.

"Nursery" means a commercial business in which flowers, plants, trees or shrubs are grown or displayed for sale.

"Occupier" has the same meaning as in the *Community Charter*.

"Once-Through Cooling" means to use Water to provide a cooling effect through the transfer of heat to Water that circulates only once through equipment, and is then discharged,

whether to a sewer, stream, other water body, to the ground, or otherwise.

"Over-Water" means to apply Water in a manner that saturates the lawn, Boulevard or landscaped area being watered to the point of saturation and results in Water spreading or running-off to other areas including, but not limited to, municipal storm drains.

"Owner" has the same meaning as in the *Community Charter*.

"Public Authority" has the same meaning as in the *Community Charter*.

"Public, Institutional or Community Playing Field" means grass, sod or turf covered grounds that are owned, maintained or operated by a public authority, or by a private institution such as a private school, and are designed to be played upon, or that are used for sporting or other community events and activities, but for certainty does not include a lawn or turf on private residential property.

"Public Spray Park" means a facility that is open to the public and that that is equipped with water sprays, water jets, sprinklers and similar devices that spray water for recreation and enjoyment of the users.

"Residential Property" means a property which is used primarily for the purpose of residence by persons on a permanent, temporary or seasonal basis.

"Soaker Hose" or "Weeper Hose" means a garden hose or a pipe with small holes that allow water to seep into the ground, to the roots of plants, discharging water through the entire length of its porous surface.

"Sprinkler" means an Irrigation System, a sprinkler system, or a hose connected, water emitting device such as sprinklers, rotors, or sprayer components, that artificially supply water to a landscaped area, lawn or garden, but excludes a Micro-irrigation or Drip-irrigation System.

"Stage" refers to the Stages 1, 2 and 3 of Water Use Restrictions prescribed in Schedule "A" of this bylaw.

"Surface Coating" means one or more coatings such as paint, preservative, or stucco applied to exterior building surfaces.

"Tree Farm" means a commercial operation or business such as a tree plantation, tree nursery, or Christmas tree farm that grows trees for sale, and includes a privately owned forest that is managed for timber production.

"Turf Farm" means a commercial operation or business that grows and sells sod or turf.

"Vehicle" means a device in, on or by which a person or thing is or may be transported or drawn on a highway or other roadway.

"Water", when used as a noun, means drinking water supplied by the CRD from a Water System Supply directly or indirectly to an Owner or Occupier, and when used as a verb means the act of using or applying such Water.

"Water System" or "Water Systems" means the following local services, individually or collectively as applicable, as set out in the below table:

Water System Name	**Establishing Bylaw**
Beddis Water System	Bylaw No. 3188, "Beddis Water Service Establishment Bylaw No. 1, 2004"
Cedar Lane Water System	Bylaw No. 3424, "Cedar Lane Water Service Establishment Bylaw No. 1, 2007"
Cedars of Tuam Water System	Bylaw No. 3021, "Salt Spring Island Cedars of Tuam Water System Service Establishment Bylaw No. 1, 2002"
Fulford Water System	Bylaw No. 3202, "Fulford Water Service Establishment Bylaw No. 1, 2004"
Highland/Fernwood Water System	Bylaw No. 3753, "Highland and Fernwood Water Service Establishment Bylaw No. 1, 2010"
Lyall Harbour/Boot Cove Water System	Bylaw No. 2920, "Lyall Harbour/Boot Cove Water Service Establishment Bylaw No. 1, 2001"
Magic Lake Estates Water System	Bylaw No. 1874, "Outer Gulf Islands Magic Lake Estates Water System Local Service Establishment Bylaw, 1990"
Skana Water System	Bylaw No. 3089, "Skana Water Service Establishment Bylaw No. 1, 2003"
Sticks Allison Water System	Bylaw No. 2556, "Sticks Allison Water Local Service Establishment Bylaw No. 1, 1997"
Surfside Park Water System	Bylaw No. 3087, "Surfside Park Estates Water Service Establishment Bylaw No. 1, 2003"
Port Renfrew Water System	Bylaw No. 1747, "Port Renfrew Water Supply Local Service Establishment Bylaw No. 1, 1989"
Wilderness Mountain Water System	Bylaw No. 3503, "Wilderness Mountain Water Service Establishment Bylaw No. 1, 2008"

"Water System Area" means the area serviced by a Water System, as may be amended by the CRD from time to time.

"Water System Supply" means the CRD drinking water supplies for the Water Systems operated and administered by the CRD under the authority referred to in the Recitals to this bylaw.

"Water Use Restrictions" means the restrictions prescribed in Schedule "A" of this bylaw.

"Wading Pool" means a shallow, artificial pool 600 mm or less in depth, of portable or permanent construction for children to play or wade in.

2. Application

The restrictions and regulations in this bylaw are applicable in each Water System's service area.

3. Inspection

A Bylaw Enforcement Officer has the authority to enter at all reasonable times on any property which is subject to this bylaw to ascertain whether the requirements of this bylaw are being met or the regulations in this bylaw are being observed.

4. Water Use Restriction Stages

(1) The Stage 1 Water Use Restrictions prescribed in Schedule "A" are in effect each year from May 1 to September 30 inclusive, except as provided under subsection (2).

(2) When necessary for the conservation of Water or the preservation of the Water Supply the General Manager may:

(a) amend the effective period of time for Stage 1 for any or all Water Systems, or

(b) terminate or bring into effect a Stage more restrictive than Stage 1 at any time of the year for any period of time for any or all Water Systems.

(3) The Stage determined under subsection (2) and the Water Use Restrictions prescribed under Schedule "A" for that Stage take effect 48 hours after the Notice for that Stage under section 5(1) and remain in effect until that Stage is terminated.

(4) A Stage will remain in effect until it is terminated under this bylaw, or until the commencement of another Stage.

5. Notice

The General Manager must make a public announcement of the activation or termination of any water use restriction stage, other than the automatic activation and termination of the Stage 1 water use restriction on May 1 and September 30 of each calendar year, and may do so by one or more of the following means:

(a) radio or television broadcast;

(b) posting on the CRD website and social media;

(c) posting or delivery of notices; or

(d) publication in a local newspaper.

6. Determining Water Use Restriction Stages

In making a determination under Section 4(2), the General Manager may consider the following factors:

(1) time of year and typical seasonal water demand trends;

(2) precipitation and temperature conditions and forecasts;

(3) current and forecasted storage levels and storage volumes of CRD Reservoirs or Water Systems and draw down rates;

(4) stream flows and inflows into CRD Reservoirs and Water Systems;

(5) water usage, recent consumption and trends, and customer compliance with restrictions on Water use under this bylaw;

(6) Water System performance;

(7) the effects of climate change; and

(8) any other factor the General Manager considers to be relevant for making a determination under Section 4(2).

7. Water Use Restrictions

(1) The Water Use Restrictions for each Stage are prescribed for each Water System in Schedule "A" to this bylaw and must be followed during the period that the applicable Stage is in effect under this bylaw.

(2) For greater clarity, when a Stage is in effect under this bylaw, no person shall perform any of the outdoor watering activities described in Schedule "A" to this bylaw except at the days and times, and in the manner permitted, during that Stage as set out in Schedule "A".

(3) No person shall waste Water by using more Water from a Water System than is required to provide a service, produce a product or complete a task, including but not limited to:

(a) allowing a tap or hose to run Water unnecessarily,

(b) the Over-Watering of plants or lawns,

(c) power-washing, using water from a hose, or otherwise applying or using Water in a manner that constitutes Excess Water Use, or

(d) using a Motion-Activated Sprinkler Device or Sprinkler in such a manner that water spray patterns are not confined to the property on which the device is located, and are allowed to spray onto adjoining public or private property.

(4) No person, being an Owner or Occupier of property in a Water System Area, shall use Water or cause Water from a Water System to be used contrary to the provisions of this bylaw in effect at the time of use.

8. Exemptions to Water Use Restrictions

(1) Nurseries, Farms, Turf Farms and Tree Farms are exempted from all Stage restrictions.

(2) Exempted Persons are exempted from Section 7 to the extent permitted by Schedule "A".

9. Schedules

(1) Schedule "A" of this bylaw forms part of and is enforceable in the same manner as the bylaw.

10. Offences and Penalties

(1) A person who contravenes this bylaw commits an offence and is liable to a fine not less than $100 and not exceeding $10,000.

(2) Where an offence is committed or continues for more than one day, a person shall be

deemed to have committed separate offences for each day on or during which an offence occurs or continues, and separate fines, each not less than $100 and not exceeding $10,000, may be imposed for each day on or during which an offence occurs or continues.

(3) Nothing in this bylaw shall limit the District from pursuing any other remedy that would otherwise be available to the District at law.

(4) A Bylaw Enforcement Officer may, if they have reason to believe an offence has been committed against this bylaw, complete and leave with the alleged offender, or at the address of the alleged offender with someone who appears to be 16 years of age or older, a ticket information pursuant to Bylaw No. 1857, "Capital Regional District Ticket Information Authorization Bylaw, 1990", as may be amended or repealed and replaced from time to time, indicating a penalty equal to the amount stipulated for such an offence.

11. Bylaw Citation

This Bylaw may be cited as "Capital Regional District Electoral Areas Water Conservation Bylaw No. 1, 2022".

READ A FIRST TIME THIS	th	day of	2022
READ A SECOND TIME THIS	th	day of	2022
READ A THIRD TIME THIS	th	day of	2022
ADOPTED THIS	th	day of	2022

CHAIR

CORPORATE OFFICER

SCHEDULE "A"
to Bylaw No. 4492

OUTDOOR WATER USE RESTRICTION STAGES

APPLICATION
This schedule does not apply to Nurseries, Farms, Turf Farms and Tree Farms.

1. STAGE 1 Water Restrictions

(1) During Stage 1,

(a) no person shall, by any method, water a lawn growing on a property, including but not limited to a property that is used for residential, commercial, or institutional purposes, on more than one day per week between the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.

(b) no person shall

(i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler other than during the prescribed hours for Stage 1 lawn watering or on any day at any time if watering is done other than by hand-held container, hand held hose equipped with an automatic shut-off nozzle, or by Micro-irrigation or Drip-irrigation systems;

(ii) water newly planted trees, shrubs, flowers and vegetables by any method referred to in Section 1(1)(b)(i) of this Schedule other than during installation and the following 24 hours;

(iii) outside the prescribed Stage 1 lawn Watering hours, water new sod or newly seeded lawns, other than on new sod installation and during the first 21 days after installation, or for newly seeded lawns, water until growth is established or for 49 days after installation, whichever is less;

(iv) water public, institutional or community playing fields other than between the hours of 1:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m. on any day, unless failure to water will result in a permanent loss of plant material;

(v) wash a Vehicle with Water other than by using a hand held container or a hand held hose equipped with an automatic shut-off nozzle or at car dealerships or commercial car washes; and

(vi) use Water to wash sidewalks, driveways, parking lots, exterior windows or exterior building surfaces, by means of other than a power washer or hand-held hose equipped with a shut-off valve or in a manner that results in Excess Water Use.

(c) a person must not allow a Public Spray Park

(i) to emit Water continuously;

(ii) to be operated other than by either:

1) a motion sensor timer, or

2) manually by the user provided the device that is activated manually by the user is equipped with a timer or automatic shut-off that prevents continuous emission of Water.

(2) As exceptions to the Stage 1 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, and whose property is not equipped with an automatic in-ground Irrigation System, with the written approval of the General Manager given under this bylaw, shall not water their lawn or turf on more than two days of the week for a maximum of 9 hours per day;

(b) no Public Authority shall:

(i) water public, institutional or community playing fields, lawns and Boulevards other than during the hours of 1:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m. on more than one day per week; and

(ii) water trees, shrubs, flowers and vegetable gardens other than at the times and in the manner prescribed under Section 1(1)(b)(i) of this Schedule.

(c) owners or operators of golf courses shall not water

(i) fairways on any day, other than during the Stage 1 lawn prescribed times;

(ii) trees, shrubs, flowers and vegetables grown on golf courses other than in accordance with Section 1(1)(b)(i), of this Schedule; and

(iii) golf greens and tees on any day unless failure to water will result in permanent loss of plant material.

2. STAGE 2 Water Restrictions

(1) During Stage 2,

(a) no person shall, by any method, water a lawn growing on a property including but not limited to property that is used for residential, commercial or institutional purposes, on more than one day per two-week period between the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.

(b) no person shall

(i) use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, except as necessary for applying surface coating, preparing a surface prior to paving or repointing bricks, or if required by law to comply with health or safety regulations;

(ii) utilize a Motion-Activated Sprinkler Device to deter animals or wildlife;

(iii) water a lawn on property used as a cemetery;

(c) a person must not allow a Public Spray Park

(i) to emit Water continuously;

(ii) to be operated other than by either:

1) a motion sensor timer, or

2) manually by the user provided the device activated manually by the user is equipped with a timer or automatic shut off that prevents continuous emission of Water;

(d) a person must not

(i) fill an ornamental fountain with Water, or

(ii) operate an ornamental fountain that uses Water, other than an ornamental fountain that re-circulates continuously and is not replenished or re-Filled with Water from the a Water System Supply; and

(e) no person shall

(i) water trees, shrubs, flowers and vegetables on more than one day per week with a Sprinkler other than during the prescribed morning hours (4:00 a.m. to 10:00 a.m.) for Stage 2 lawn watering or on any day at any time if watering is done other than by hand-held container, hand-held hose equipped with an automatic shut-off nozzle, or by Micro-irrigation or Drip-irrigation system;

(ii) water newly planted trees, shrubs, flowers and vegetables during installation and for the following 24 hours other than by any method referred to in Section 2(1)(e)(i) of this Schedule;

(iii) water public, institutional or community playing fields other than between the hours of 1:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m., on more than one day per week unless failure to water will result in a permanent loss of plant material;

(iv) wash a Vehicle or Boat with Water other than commercial car washes using less than 57 litres of Water per Vehicle wash or using 50% recirculated Water as long as the total amount of Water, excluding recirculated Water, does not exceed 57 litres per Vehicle wash; or

(v) leave water service turned on, at the residential point of connection to the residence, home, or dwelling, when property is uninhabited for more than 30 consecutive days.

(2) As exceptions to Stage 2 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, and whose property is not equipped with an automatic in-ground Irrigation System, with the written approval of the General Manager given under this bylaw, shall not water their lawn or turf on more than one day per week for a maximum of 9 hours per day;

(b) no Public Authority shall:

(i) water public, institutional or community playing fields, lawns and Boulevards other than during the hours of 1:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m., on no more than one day per week if failure to water will result in a permanent loss of plant material;

(ii) water trees, shrubs, flowers and vegetable gardens other than at the times and in the manner prescribed under Section 2(1)(e)(i), and (ii) of this Schedule;

(c) owners or operators of golf courses shall not water

(i) fairways more than one day per week during prescribed lawn watering times;

(ii) trees, shrubs, flowers and vegetables grown on golf courses other than in accordance with Section 2(1)(e)(i) and (ii) of this Schedule; and

(iii) golf greens and tees on any day unless failure to water so will result in permanent loss of plant material.

3. STAGE 3 Water Restrictions

(1) During Stage 3,

(a) no person shall

(i) water a lawn, turf or Boulevard;

(ii) fill a wading pool, swimming pool, hot tub or garden pond;

(iii) operate a Public Spray Park;

(iv) operate or fill an ornamental fountain with Water;

(v) wash a Vehicle or a Boat with Water;

(vi) use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, except as necessary for applying a surface coating, preparing a surface prior to paving or repointing bricks, or if required by law to comply with health or safety regulations;

(vii) utilize a Motion-Activated Sprinkler Device to deter animals or wildlife; or

(viii) leave water service turned on when property is uninhabited for more than 30 consecutive days.

(b) no person or Public Authority shall

(i) water trees, shrubs, flowers and vegetables on any day, except where watering only one day per week between the hours of 4:00 a.m. to 10:00 a.m. and when watering is done by hand-held container, a hand held hose equipped with an automatic shut-off nozzle, or by Micro-irrigation or Drip-irrigation systems;

(ii) water newly planted trees, shrubs, flowers and vegetables other than between the

hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m. if watering is done by hand-held container or a hand held hose equipped with an automatic shut-off nozzle, during installation and during the following 24 hours after installation is completed;

(iii) water public, institutional or community playing fields other than between the hours of 4:00 a.m. to 10:00 a.m., on no more than one day per week, if failure to water will result in a permanent loss of plant material.

(2) As exceptions to the Stage 3 restrictions,

(a) owners or operators of golf courses shall not water

(i) fairways more than one day per week during the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.;

(ii) trees, shrubs, flowers and vegetables grown on golf courses other than in accordance with Section 3(1)(b)(i) and (ii) of this Schedule; and

(iii) golf greens and tees on any day unless failure to water will result in permanent loss of plant material;

(b) Vehicles and Boats must not be washed with Water other than at commercial car washes using less than 57 litres of Water per Vehicle wash or using 50% recirculated Water as long as the total amount of Water, excluding recirculated Water, does not exceed 57 litres per Vehicle wash.

APPENDIX B

CAPITAL REGIONAL DISTRICT
BYLAW NO. 4499

****

A BYLAW TO AMEND BYLAW NO. 1857, CAPITAL REGIONAL DISTRICT TICKET INFORMATION AUTHORIZATION BYLAW, 1990 TO INSERT ELECTORAL AREA WATER CONSERVATION TICKET AMOUNTS

****

WHEREAS:

A. Under Bylaw No. 1857, "Capital Regional District Ticket Information Authorization Bylaw, 1990", the Regional Board established a municipal ticket information scheme for various regional district services;

B. Bylaw No. 4434 reserved Item 19 in Schedule 1, as well as Schedule 20, for future use; and

C. The Board wishes to amend Bylaw No. 1857 to insert a ticketing provision for Bylaw No. 4492, "Capital Regional District Electoral Area Water Conservation Bylaw No. 1, 2022";

NOW THEREFORE, the Capital Regional District Board in open meeting assembled hereby enacts as follows:

1. Bylaw No. 1857, "Capital Regional District Ticket Information Authorization Bylaw, 1990" is hereby amended as follows:

   (a) Schedule 1, Item 19 is amended as follows:

DESIGNATED BYLAW		DESIGNATED BYLAW ENFORCEMENT OFFICER
"19.	Capital Regional District Electoral Area Water Conservation Bylaw No. 1, 2022	Bylaw Enforcement Officer Police Officer Peace Officer"

   (b) Schedule 20 is replaced with Appendix 1 to this Bylaw.

2. This bylaw may be cited for all purposes as "Capital Regional District Ticket Information Authorization Bylaw, 1990, Amendment Bylaw No. 74, 2022".

READ A FIRST TIME THIS th day of 2022

READ A SECOND TIME THIS th day of 2022

READ A THIRD TIME THIS th day of 2022

ADOPTED THIS th day of 2022

CHAIR

CORPORATE OFFICER

APPENDIX 1 TO BYLAW NO. 4499

SCHEDULE 20 TO BYLAW NO. 1857

CAPITAL REGIONAL DISTRICT ELECTORAL AREAS WATER CONSERVATION BYLAW NO. 1, 2022

	WORDS OR EXPRESSIONS DESIGNATING OFFENCE	**SECTION**	**FINE**
1.	Hinder/Prevent Inspection	3	$500.00
2.	Wasting water	7.(3)	$200.00
3.	Wasting water during Stage 2	7.(3)	$300.00
4.	Wasting water during Stage 3	7.(3)	$400.00
5.	Use water contrary to bylaw	7.(4)	$200.00
6.	Stage 1 – water lawn contrary to days/times	Sch. A 1.(1)(a)	$200.00
7.	Stage 1 – water contrary to restrictions	Sch. A 1.(1)(b)	$100.00
8.	Stage 1 – operate Public Spray Park contrary to restrictions	Sch. A 1.(1)(c)	$100.00
9.	Stage 1 – Public Authority watering contrary to days/time	Sch. A 1.(2)(b)	$100.00
10.	Stage 1 – watering golf courses contrary to restrictions	Sch. A 1.(2)(c)	$200.00
11.	Stage 2 – water lawn contrary to days/times	Sch. A 2.(1)(a)	$250.00
12.	Stage 2 – wash sidewalks, driveways, parking lots, or exterior surfaces	Sch. A 2.(1)(b)(i)	$250.00
13.	Stage 2 – use motion-activated sprinkler device	Sch. A 2.(1)(b)(ii)	$250.00
14.	Stage 2 – water cemetery lawn	Sch. A 2.(1)(b)(iii)	$250.00
15.	Stage 2 - operate Public Spray Park contrary to restrictions	Sch. A 2.(1)(c)	$250.00
16.	Stage 2 – fill ornamental fountain	Sch. A 2.(1)(d)(i)	$250.00

17.	Stage 2 – operate ornamental fountain	Sch. A 2.(1)(d)(ii)	$250.00
18.	Stage 2 - water contrary to restrictions	Sch. A 2.(1)(e)	$250.00
19.	Stage 2 – Public Authority watering contrary to days/times	Sch. A 2.(2)(b)	$200.00
20.	Stage 2 – watering golf courses contrary to restrictions	Sch. A 2.(2)(c)	$250.00
21.	Stage 3 – water lawn, turf or boulevard	Sch. A 3.(1)(a)(i)	$400.00
22.	Stage 3 – fill pool, hot tub or garden pond	Sch. A 3.(1)(a)(ii)	$400.00
23.	Stage 3 – operate a Public Spray Park	Sch. A 3.(1)(a)(iii)	$400.00
24.	Stage 3 – operate or fill ornamental fountain	Sch. A 3.(1)(a)(iv)	$400.00
25.	Stage 3 – wash vehicle or boat with Water	Sch. A 3.(1)(a)(v)	$400.00
26.	Stage 3 – wash sidewalks, driveways, parking lots or exterior surfaces	Sch. A 3.(1)(a)(vi)	$400.00
27.	Stage 3 – use motion-activated sprinkler device	Sch. A 3.(1)(a)(vii)	$400.00
28.	Stage 3 – leave water service turned on	Sch. A 3.(1)(a)(viii)	$400.00
29.	Stage 3 –water contrary to restrictions	Sch. A 3.(1)(b)	$400.00
30.	Stage 3 – watering golf courses contrary to days/times	Sch. A 3.(2)(a)	$400.00
31.	Stage 3 – washing vehicle or boat contrary to restrictions	Sch. A 3.(2)(b)	$400.00

Associated Engineering | 75 YEARS

REPORT

Capital Regional District

Wilderness Mountain Water Services Commission Treatment Concept Updates

DECEMBER 2022

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

The Wilderness Mountain Water Services Commission (WMWSC) is located on Mount Matheson and services 74 active connections, drawing water from the Wilfred Reservoir. The WMWSC was a private water utility from 1983 to 2008 when the Capital Regional District (CRD) took over the management of daily operations. Currently, the source water is treated with a series of cartridge filters, ultraviolet (UV) light treatment, and chloramination in the existing water treatment system, along with two existing reservoir tanks that are in place for the distribution of the treated water.

The water system has had several Boil Water Advisories, including in 2016, 2018, 2021 and 2022. In a letter dated July 19, 2017 Island Health (IH) stated that the WMWSC would no longer have a filtration deferral, and that the WMWSC water system was not in compliance with the Ministry of Health (MOH) "Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia" (SWTO).

As indicated in WSP's "Water Vulnerability Study on the Wilderness Mountain Water System" (2020), the Wilfred Reservoir is prone to events of elevated turbidity that last between 8 to 13 hours, and the water contains manganese levels that exceed the current aesthetic objective (AO) of the Guidelines for Canadian Drinking Water Quality (GCDWQ). Significant algae blooms have also been observed in the raw water reservoir, and raw water organics have been measured to be between 2 and 9 mg/L as Total Organic Carbon. The organics and algae have contributed to rapid plugging of the cartridge filters, such that the filters reportedly require daily or near-daily replacing. Since 2011 several studies have been conducted to find cost-effective, easy-to-operate options for water system upgrades that would provide the WMWSC with treated water that meets current BC standards for drinking water.

As part of these efforts Colquitz Engineering proposed in their 2018 report to upgrade treatment with dissolved air flotation (DAF) as the key new feature. Based on an assumed treatment capacity of 3.5 L/s (300 m^3/day) Colquitz provided an opinion of probable costs equaling $4,230,000 of capital costs and $160,000 of annual operating and maintenance costs.

On August 11th, 2021; the CRD submitted a letter to Island Health that indicated that the WMWSC had rejected the proposal for an upgraded treatment system due to the potential financial burden it would impose on the WMWSC community. The letter stated that a Source Water Vulnerability Study had been conducted, and based on the study WMWSC proposed to instead complete a source water protection plan and explore an alternate treatment configuration consisting of roughing filters, cartridge filtration, UV disinfection, chlorination and chloramination.

1.2 Study Objectives

Associated was retained to complete the following tasks:

- Review historical water quality for the WMWSC, identify where treatment or water quality does not meet current BC drinking water standards, and request confirmation from IH on the water quality and water treatment requirements for the existing system.
- Provide an updated opinion of probable costs, in 2022 dollars, of Colquitz's proposed water treatment upgrades, that is, a DAF treatment system that would meet current BC drinking water standards.
- Provide an opinion of probable costs for the treatment system proposed in CRD's August 11, 2021 letter.
- Provide recommendations for assessing the viability of changing the existing raw water intake to a floating intake, and an opinion of probable costs for executing the change.

2 EXISTING SYSTEM OVERVIEW

Raw water is pumped through an intake located to the east of the Wilfred Reservoir to a pumphouse and treatment building. Following filtration and UV treatment, the process water is sent to a chloramination building before the treated water is sent to the distribution system.

The current system has an approximate capacity of 3.0 L/s and consists of pre-treatment using 50-micron and 20-micron cartridge filters in series, followed by two parallel trains of 25-micron and 5-micron cartridge filters. Following the filtration units, the water undergoes UV treatment through three parallel Trojan PRO MAX-30 UV reactors rated at 40 mJ/cm^2.

The treated water then goes through a disinfection building where ammonia, then chlorine are added to provide a chloramine residual for secondary disinfection. Water is then conveyed to the distribution system and to two storage tanks with a combined capacity of 250 m^3. See **Figure 2-1** for a Map of the Wilderness Mountain Water Service Area

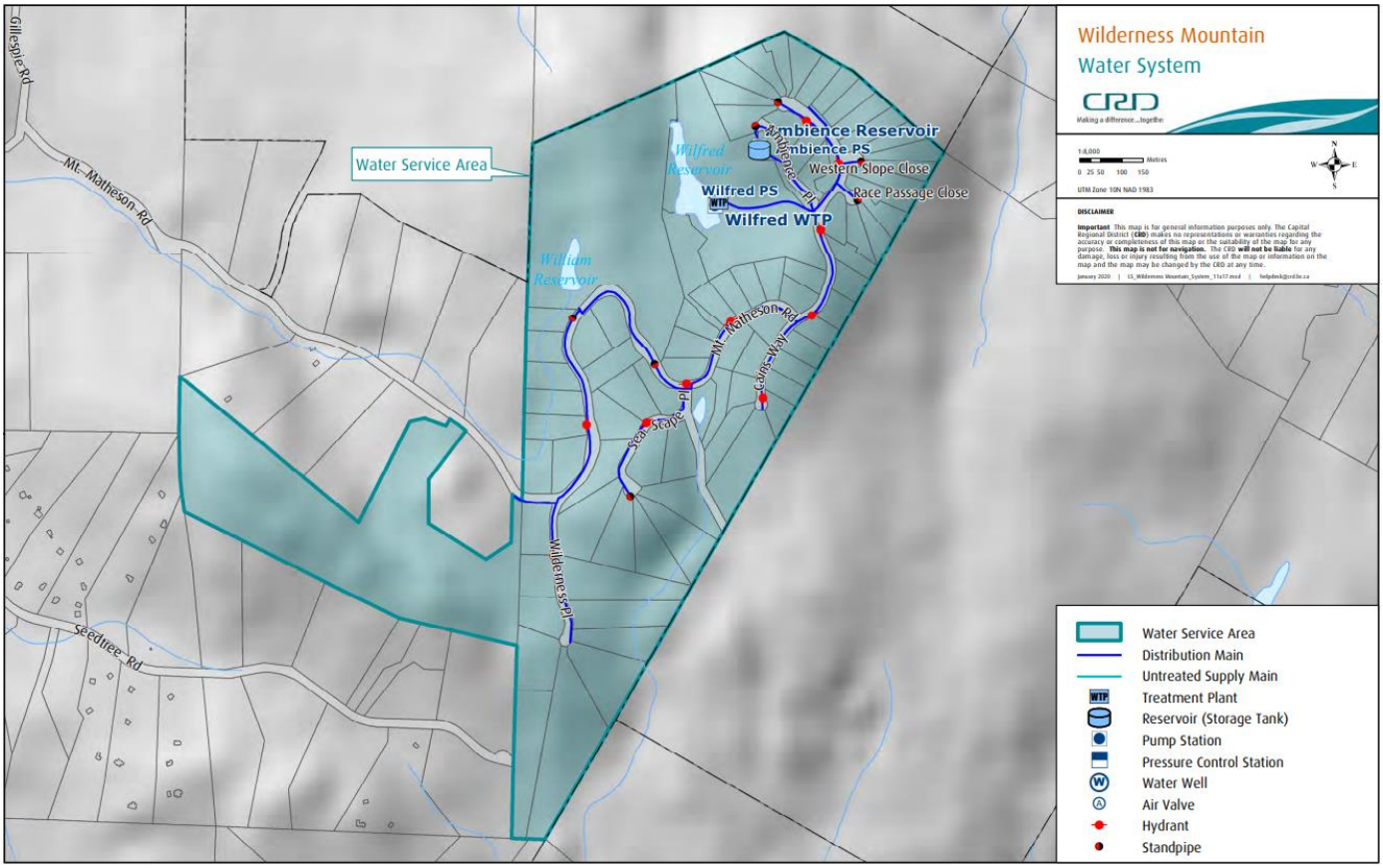

Figure 2-1: Map of the Wilderness Mountain Service Area

Source: CRD, 2022. Wilderness Mountain Water Service Area Boundary Map

3 WATER DEMAND AND QUALITY SUMMARY

3.1 Water Demand

Figure 3-1 shows the annual measured water demand for WMWSC from 2015 to 2021. The demand in 2021 was 19% higher than in 2020 and 29% higher than the five-year average.

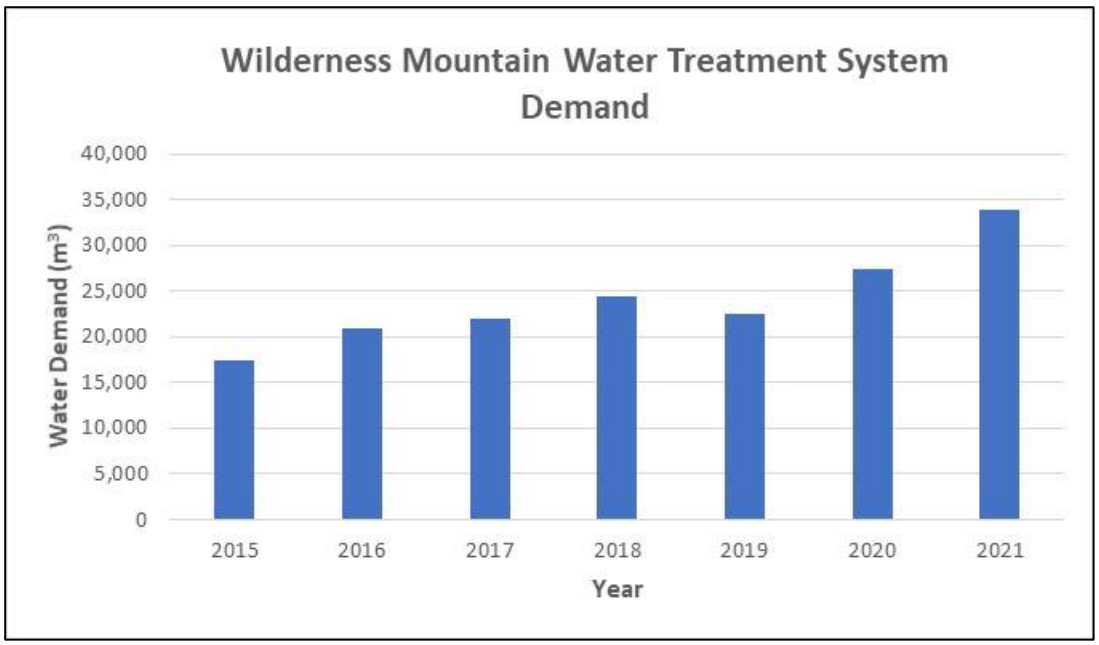

Figure 3-1: Measured Annual Water Demand for WMWSC from 2015-2021

Source: CRD, 2021. Wilderness Mountain Water System 2021 Annual Report

Based on the annual water demand in 2021, it is estimated that the average daily demand (ADD) for the year was approximately 93 m^3/day (1.1 L/s). The 2020 Water Vulnerability Study on the Wilderness Mountain Water System prepared by WSP recommended that WTP upgrades be sized to 1.7 L/s ADD and 4.1 L/s maximum daily demand (MDD) design flows.

3.2 Treatment Objectives – Chemical and Physical Parameters

Raw and treated water quality samples taken between January 2017 and May 2022 were compiled and presented in **Table 3-1**.

At the time of this report, the WMWSC remains on a boil water advisory (BWA). The advisory was posted on July 20, 2022 on the CRD website and was last updated on August 29th. The advisory is in effect until flushing and water samples indicate the water quality no longer poses a risk to public health. CRD's 2021 Wilderness Mountain Water System Annual Report indicated that the WMWSC was on a BWA for 224 days in 2021 due to elevated turbidity in the treated water. High algal activity and limitations of the filtration system in place to remove small algae species were identified as additional factors leading to the BWA.

Table 3-1: Water Quality Summary
December 12, 2022
Data obtained between January 2017 and May 2022

Parameter	Unit	Sample Count	Min	Max	Median	Average	Range	Drinking Water Quality Objective
E. Coli, Raw Water	CFU/100 mL	111	< 1	40	2	4	< 1 - 40	-
E. Coli, Treated Water	CFU/100 mL	486	< 1	< 1	< 1	< 1	< 1	< 1
Turbidity, Raw Water	NTU	114	0.5	2.2	1.1	1.2	0.5-2.2	-
Turbidity, Treated Water	NTU	381	0.2	5.8	0.7	0.8	0.2-5.8	≤ 1.0
Total Organic Carbon, Raw Water	mg/L	28	1.9	9.0	3.9	4.2	1.9 - 9.0	-
Total Organic Carbon, Treated Water	mg/L	9	2.5	8.7	3.7	4.2	2.5 - 8.7	-
Total Iron, Raw Water	mg/L	19	0.11	0.64	0.15	0.2	0.11 - 0.64	-
Total Iron, Treated Water	mg/L	12	0.05	0.90	0.11	0.2	0.05 - 0.90	≤ 0.3
Manganese, Raw Water	mg/L	19	0.024	0.137	0.048	0.058	0.024 - 0.137	-
Manganese, Treated Water	mg/L	12	0.012	0.364	0.023	0.067	0.012 - 0.364	≤ 0.02
True Colour, Raw Water	TCU	29	7	26	14	15	26-Jul	-
True Colour, Treated Water	TCU	26	5	19	11	12	5 -19	≤ 15
Alkalinity	mg/L as CaCO3	20	7	20	11.0	11.0	7 - 20	-
Ammonia	mg/L N	10	0.015	0.063	0.018	0.0	0.015 - 0.063	-
Arsenic	mg/L	31	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	≤ 0.010
Aluminum	mg/L	31	0.005	0.082	0.033	0	0.005 - 0.082	2.9
pH	pH units	92	6.1	9.1	7.00	7.1	6.1-9.1	7.0 - 10.5
Nitrate	mg/L as N	9	< 0.020	0.028	0.021	0	< 0.020 - 0.028	≤ 10
Total Suspended Solids	mg/L	5	1.2	7.2	2	2.8	1.2-7.2	-
UV Transmittance	UV % Transmittance (lab)	50	72	82.1	76.8	76.8	72-82.1	-
Total Algal Concentration	NU/mL	35	659	9538	4073	3762	659-9538	-
Chlorophyll-a	µg/L	48	0.3	10.4	2.8	3.4	0.3 - 10.4	-
Cyanobacteria	No. filaments	19	1	68	2	11	1-68	-
Total THMs	ug/L	20	1	6	2	2	1-6	≤ 0.100
Total HAAs	ug/L	22	< 5	22	11	10	< 5 - 22	≤ 0.080
HPC Bacteria	CFU/1 mL	38	10	17,000	4000	5109	10-17,000	-

Iron and Manganese: Elevated iron and manganese concentrations were observed throughout the entire year, regularly exceeding their respective AOs. Samples from November 19, 2021, taken after a storm event, measured manganese exceeding its health-based maximum acceptable concentration (MAC) of 0.120 mg/L. At levels exceeding the AO (0.3 mg/L) iron can cause a reddish discolouration of the water, staining laundry and plumbing fixtures, as well as produce undesirable tastes and promote the growth of micro-organisms. Aesthetically manganese can cause a dark discolouration of the water (AO 0.02 mg/L), as well as taste and odour issues, while at levels exceeding the MAC manganese is linked to negative neurological effects in children.

True Colour: True colour exceeded the drinking water AO (15 TCU) in 16 of the 55 collected samples. The AO was established by Health Canada based on true colour levels that are observable to the eye, as well as in consideration of the potential for undesirable substances to complex with or adsorb to organic colouring agents.

Turbidity: Raw water turbidity averaged 1.2 NTU and exceeded 1.0 NTU in 75 of 114 collected samples. Treated water turbidity averaged 0.8 NTU and exceeded 1.0 NTU in 77 of 381 collected samples. According to WSP's 2020 report, turbidity as measured by a turbidimeter downstream of the cartridge filters ranged from 0.05 to 5.01 NTU, with sudden turbidity spikes or events as summarized in **Table 3-2**.

Table 3-2
Raw Water Turbidity Events (2016-2020)

Year	No. of Turbidity Events	Average Duration (hrs)	Average Turbidity (NTU)
2016	138	13.0	1.5
2017	55	10.1	1.9
2018	32	7.7	1.6
2019	29	9.7	1.6
2020	26	12.9	1.5

Source: WSP, 2020. Report 1 – Treatment Assessment & Recommendation.

The GCDWQ provides turbidity guidelines for treated water that are dependent on the type of filtration used during treatment, though a guideline for cartridge filtration is not provided. The MOH "Guidelines for Pathogen Log Reduction Credit Assignment" states the following effluent turbidity criteria for cartridge filters:

- Less than 0.3 NTU in at least 95% of the measurements per month;
- For each filter, the maximum level of filter effluent turbidity is less than or equal to 1.0 NTU.

The GCDWQ also recommends turbidity in water entering the distribution system to be 1.0 NTU or less to ensure effective disinfection and good operation of the distribution system.

Disinfection By-products: The grab sample data showed very low levels of trihalomethanes (THM) and haloacetic acids (HAA) forming in the WMWSC distribution system when ammonia was added upstream of sodium hypochlorite, that is, when water is chloraminated without any significant interaction with free chlorine. In comparison WSP's 2020 report documented a period where the ammonia system was offline and a free chlorine residual was present in the distribution system. During that period without ammonia THM and HAA levels in the distribution system increased

significantly to as high as 0.160 mg/L (MAC 0.100 mg/L) and 0.220 mg/L (MAC 0.080 mg/L), respectively, as shown in **Table 3-3**.

Table 3-3
Disinfection By-product Concentrations at Ambience P1 Cell 1-North and P1 Cell 2 – South)

Parameter	No. Samples	Range (mg/L)	Median Value (mg/L)
Total THMs	31	0.001 – 0.160	0.004
Total HAAs	4	0.005 – 0.22	0.016

Source: 2020. WSP. Report 1 – Treatment Assessment & Recommendation.

Algae: The source water experiences a wide range of algal bloom concentrations throughout any given year. The CRD has stated that the algal blooms have historically caused the cartridge filters to plug quickly, requiring frequent replacement of the cartridges, and in some instances the algal blooms have led to taste and odour issues in the treated water.

pH: The GCDWQ operational guidelines for pH was revised by Health Canada in 2015 to a range of 7.0 to 10.5 in finished drinking water. A low pH can indicate an aggressive water matrix, leading to corrosion and leaching of minerals from distribution pipe materials and plumbing fixtures. According to the pH data collected, the pH of WMWSC drinking water is below the operational guideline range in 42 of 92 collected samples.

HPC Bacteria: A drinking water standard for HPC bacteria is not provided in the GCDWQ. However, HPC is regularly used to monitor for bacteriological stability in distribution systems. Specifically, a sharp increase in HPC counts generally suggests a decline in water quality, and potentially the introduction of undertreated water into the system.

All of the recorded HPC samples were collected from the same location in the distribution system, and indicate that HPC bacteria levels can vary by several orders of magnitude throughout a given year. At this time it cannot be determined whether these large variations are due to inadequate treatment or other factors in the distribution system. Further sampling of HPC counts is recommended after the WMWSC treatment system is upgraded to see if significant variations in HPC counts in the distribution system persist.

Summary: In summary, the historic data indicates that water that has been supplied to the WMWSC does not meet current BC drinking water standards for the following physical and chemical parameters:

- Iron
- Manganese
- Turbidity
- True Colour
- pH
- THM and HAA (if free chlorine is used for disinfection)

3.3 Treatment Objectives - Microbiological

The BC Drinking Water Protection act assigns the drinking water officer the authority and discretion to prescribe treatment, monitoring and reporting requirements for a water system on a case-by-case basis. The Drinking Water Officers Guide further directs the drinking water officers to follow the federal (Health Canada) standards of the

GCDWQ and the provincial (MOH) guidelines such as the SWTO. Both the GCDWQ and the SWTO refer to the "4-3-2-1-0" for surface water treatment, summarized as follows:

- 4-log (99.99%) reduction or inactivation in viruses.
- 3-log (99.9%) reduction or inactivation in protozoa.
- Dual treatment (2 treatment processes) for the removal of microorganisms. Typically in the form of filtration and disinfection.
- 1 NTU turbidity or less.
- No detectable E.Coli, fecal and total coliforms downstream of treatment.

Furthermore, the Drinking Water Protection Regulation states that all drinking water from a surface water supply must be disinfected.

The SWTO includes a criteria where, if met, the water source may be a viable candidate for Filtration Exemption. However, per our letter dated October 4, 2022 (**Appendix A**), in our opinion the existing WMWSC system does not meet the criteria for Filtration Exemption, and treatment in the form of filtration and disinfection is recommended to meet the drinking treatment objectives for microbiological parameters. Island Health's response, dated November 7, 2022, is included in Appendix A.

3.4 Summary

Based on the water quality data reviewed, it is recommended that treatment for the WMWSC drinking water system includes the following components:

- Filtration and disinfection to achieve 4-log reduction of viruses and 3-log removal of *Cryptosporidium* and *Giardia*.
- Treatment for the removal of iron and manganese.
- Treatment for the removal of true colour.
- Chemical addition for pH adjustment and stabilization
- Treatment for organics removal or use of a disinfection system that minimizes the formation of THM and HAA.

4 FLOATING INTAKE CONSIDERATIONS

The current intake is located at a depth of approximately 3 m below the water surface, adjacent to the bank on the east side of the Wilfred Reservoir. Its current location may make the intake prone to introducing silt, particulates, and algae to the system. During a conversation with the WMWSC Commission members and the CRD, a request to Associated was made to consider the impacts of implementing a floating intake to determine whether relocating the intake would lead to improved water quality, reducing the number of parameters that would require treatment to meet current drinking water standards.

4.1 Bathymetric Survey of the Wilfred Reservoir

For the purpose of selecting the optimal location for the proposed water intake, it is recommended that a bathymetric survey be used to determine preferred locations to potentially place a floating intake. A bathymetric survey was previously conducted in 1999, but it could not be confirmed whether the 1999 profiles accurately represent current conditions in the reservoir. Conservatively the costs to conduct an updated survey are included in the WMWSC-proposed Water Treatment System Costs (**Appendix D**).

4.2 Sampling

Following the results of the bathymetric survey, two potential locations for the floating intake would be identified. A water quality sampling program would be the next recommended step, monitoring water from three locations for the duration of the study:

- Current water intake location as the baseline sampling location and used for comparison
- First potential location for proposed water intake
- Second potential location for proposed water intake

The proposed water quality study would occur over a minimum period of one year, to capture seasonal changes to water quality, with possible additional sampling required following significant rainfall events. Laboratory data obtained over the sampling period would be reviewed to compare water quality at the three sampling locations, leading to an assessment of the most beneficial location for the proposed water intake, if applicable, as well as the potential impacts that the revised intake would have on the water quality parameters requiring treatment to meet drinking water standards.

Typical water source monitoring programs of this nature consist of two qualified staff collecting samples at various depths using a 2.2 L horizontal Beta Water Sampler. These devices descend parallel to the bottom and are able to be opened at the desired depth to collect representative samples. Equipment blanks are run in the field prior to use to ensure that there is no cross-contamination and that the device is working properly.

Sampling locations are recorded using GPS coordinates to ensure that future samples are relevant and able to be compared throughout the monitoring program. Additionally, a marker buoy could be set in place at each sampling location for future reference. Samples are sent to a private laboratory for analysis, while field parameters such as turbidity, oxidation-reduction potential, conductivity, dissolved oxygen, pH, and temperature are also documented.

4.3 Floating Intake Design

For an intake located away from the reservoir shoreline and at a shallow depth below the water surface, a floating intake could be a viable system if the water body does not experience extreme waves or severe storm events that could impact the structural integrity of the intake. Typical floating intakes consist of a pump, floats, an intake screen, anchors, and restraints. Flexible piping such as HDPE is typically used to connect the floating intake to rigid piping onshore.

The most-cost effective version of a floating intake suitable for WMWSC's size has the raw water pump located on land, however, due to the difference in elevation between where the potential new intake may be and the water treatment system, as well as possible fluctuating water levels; it is possible that a pump on land will not be able to provide enough suction to draw water from the intake, or will experience priming issues that lead to cavitation damage along the intake line and pump. Therefore, the opinion of probable costs presented below are based on a conceptual design that uses a submersible pump, connected to the floating structure and submerged in the reservoir for pumping water out of Wilfred Reservoir.

4.4 Opinion of Probable Costs

The opinion of probable costs for a floating intake is detailed in **Appendix D** and summarized in **Table 4-1**. Costs are presented as a Class D estimate as a preliminary estimate to approximate magnitude of cost of the proposed project, accurate to ± 50%.

Table 4-1
Floating Intake Opinion of Probable Costs

Task	Cost
Site Study	
Bathymetric Survey	$7,000
Water Quality Monitoring Program	$58,000
Floating Intake Study Subtotal	$65,000
Design and Construction	
Design and Construction	$170,000
Administration and Contingency	$143,000
Design and Construction Subtotal	$313,000
Total Costs	**$378,000**

5 PROBABLE COSTS – OPTION 1 - DAF

5.1 Conceptual Design Overview

This design concept involves the following steps:

- Chemical conditioning of microorganisms, organics, algae and colour; iron and manganese oxidation; and pH adjustment.
- DAF clarification for the removal of chemically precipitated and light particulates (organic and inorganic).
- Media filtration, involving catalytic material (GreensandPlus or equivalent) and anthracite to remove iron and manganese, and for microorganism filtration credits.
- Chlorination with a contact tank for virus inactivation and secondary disinfection (providing a disinfection residual throughout the distribution system) .

Chemical dosing using a alkaline substance like soda ash, as well as a coagulant such as polyaluminum chloride (PACL), would be dosed at the head of the plant and rapidly mixed. Particulates would then be given time aggregate and form removable floc.

The DAF treatment system consists of air injection manifolds responsible for introducing microbubbles dissolved in water through saturators that allow flocculated particles and suspended solids to float to the water surface for removal by the mechanical scrapers included in each DAF unit.

It has been assumed that integrated filters consisting of a multi-media of Greensand Plus and anthracite could successfully be used to remove manganese and iron and particulates in the same filter, reducing the footprint of the treatment system without the need for additional filters downstream of the DAF units.

Chlorine in the form of sodium hypochlorite would also be dosed in the water, either upstream or downstream of the filters. Water leaving the filters would then bass through a 40,000 L tank to ensure the minimum amount of chlorine contact time has been achieved to ensure at least 4-log inactivation of viruses.

It is assumed that the ammonia system would be abandoned, as the organic precursors for disinfection by-products would be substantially removed by the DAF system, allowing free chlorine contact without high levels of THM and HAA forming. However, if a chloramine residual is preferred over a free chlorine residual, this can be accommodated by keeping the existing ammonia system but moving the point of ammonia dosing downstream of the chlorine contact tank.

5.2 Residual Management

Based on 2% solids generated from plant operations, it is estimated that approximately 500 litres of DAF sludge would be generated per day. Similarly, it is expected that approximately 10,790 litres of backwash would be generated per backwash cycle. Based on the operation conditions, it is expected that the system will likely go through a backwash cycle once every two (2) days.

With the current design, both DAF sludge and backwash water are directed to the waste collection tank. Options to reduce the amount of waste requiring disposal offsite include the following:

- Send filter-to-waste water back to the head of the plant.

- Send backwash to a settling tank. After several hours of holding time, pump the supernatant to the head of the plant and pump the settled sludge to the sludge holding tank to be disposed offsite.

For the purposes of developing a conservative budgetary estimate of the treatment upgrades, it is assumed that DAF system would include a recycling system that sends filter-to-waste water and backwash wastewater decant to the head of the plant.

5.3 Confirmation Testing of DAF System

The characteristics of every body of water is unique, and in turn a water body's response to treatment is similarly unique. The performance of the treatment system cannot be reliably guaranteed without some level of simulated treated of the water body, in the form of bench-scale "fingerprinting" testing and/or reduced-scale pilot testing. These simulations are used to identify effective chemical types and doses, and effective operating setpoints, as well as the discover unexpected treatment responses. For these reasons, it would be desired that a simulation of the combined DAF and GreenSandPlus treatment systems be conducted.

It may not be economically feasible for small water treatment systems to conduct pilot testing. In that case conducting DAF and iron/manganese sorption by Greensand media simulations at bench-scale only may be an acceptable alternative, though it would necessitate a more conservative design than if pilot test data was available. For budgetary purposes, however, the opinion of probable costs prepared for this option assume that the DAF and multi-media filter will be tested at pilot scale.

5.4 Opinion on Probable Costs

The design assumptions for the implementation of the DAF system are as follows:

- Include 275 m of 100 mm diameter raw water main connecting the intake to the DAF system, as per the assumptions used in the Colquitz 2018 report.
- Design flows of 1.7 L/s (ADD) and 4.1 L/s (MDD).
- N+1 redundancy to maintain one operational and one standby units throughout the treatment system.
- Inclusion of chemical systems such as soda ash, coagulant and oxidant consisting of chemical tanks with containment, and duty/standby chemical pumps mounted on a chemical skid.
- System is to be delivered in a prefabricated enclosure.
- DAF system includes 6,500 L sludge holding tanks, 13,000 L backwash waste tank with decant and pump recycling system, and 11,000 backwash supply tank with backwash pumps.
- Additional waste storage tanks may be installed outside of the fabricated enclosure, however, these have not been priced in the provided estimate.
- Cost estimate includes the decommissioning of the cartridge filters, UV units, and ammonia injection system in the existing WTP.
- Existing chlorination system kept to maintain free chlorine residual at desired concentration.
- Chlorine contact tank consists of a 40,000 L tank with no baffles.
- Annual (O&M) labour, materials and power costs are based on CRD's 2022-2026 operating budgets for the Beddis Water System (a 3.8 L/s DAF system operated by the CRD) and the 2022-2026 operating budgets for Fulford (1 4.5 L/s DAF system operated by the CRD).
- O&M costs also include the replacement of the following equipment:

  - Chemical metering pumps replaced every 10 years
  - Backwash, recycling pumps and compressors replaced every 15 years
  - Filter media replaced every 15 years
- Lifecycle costs based on 25 years of operation, accounting for 4% interest rates and an 18% approximate cumulative inflation change since 2018.

The updated Class "D" opinion of probable costs for the DAF treatment option are summarized in **Table 5-1**. Refer to Appendix B for a breakdown of the DAF Treatment System Opinion of Probable Costs and the 25-year Lifecycle Costs Calculation, respectively.

Table 5-1
Opinion of Probable Costs – Option 1

Capital Cost	**$5,270,000**
Annual Cost	$168,000 /year
25-Year Lifecycle Cost	$8,080,000

6 PROBABLE COSTS – OPTION 2 – ROUGHING FILTER

This option follows the design proposed in CRD's August 11, 2021 letter, consisting of the following treatment steps:

- Chemical addition.
- Roughing filter.
- Cartridge filters in series sized 5-micron and recommended to be installed prior to the originally proposed 0.35-micron filters.
- UV disinfection at doses that achieve 4-log virus inactivation.
- Chlorination and ammonia addition for chloramination.

6.1 Conceptual Design Overview

6.1.1 Roughing Filters

Roughing filters are multi-media filters that enable tapered removal of particulates from coarse to fine within a single vessel. Progressively decreasing filter media size allows for the removal of suspended solids while reducing clogging and maximizing the removal efficiency at each of the filtration stages. The supplier contacted proposed a 3-unit roughing filter to accommodate the flows even when one filtration unit is offline for cleaning.

It is intended that the roughing filters will reduce organic concentrations, and remove algae, iron and manganese from the incoming water and protect the treatment processes downstream. Chemical conditioning upstream of the roughing will be required to achieve these objectives, and at this stage, it is assumed that a combination of a coagulant, an oxidant, and soda ash will be sufficient. Validation of this assumption is key to the viability of this treatment option, as discussed further in **Section 6.3**.

6.1.2 Cartridge Filters

The system would be comprised of two (2) 5-micron and two (2) 0.35-micron filters with their corresponding filter housings. The size of these filters were set to match the upstream requirements as mandated by the UV reactor manufacturer. The cartridge filters, like the rest of the system, are designed based on n+1 redundancy, allowing one component of each treatment stage to be operational if another one is to undergo repairs or maintenance. The purpose of the filters is to further remove suspended solids and microorganisms, protecting the UV reactors downstream and improving the ability of the reactors to disinfect the water.

6.1.3 Ultraviolet Treatment

Two (2) TrojanUV SwiftSC D12 units provides broad-spectrum protection against a wide range of pathogens, including viruses and protozoa. The Units are sized to provide a dose of 186 mJ/cm^2 to achieve at least 4-log inactivation of viruses.

The reactors are validated to UVT value of 77% and up. However, historical data shows that raw water from Wilfred Reservoir can have UVT values as low as 72%. For this system to meet its regulatory requirements for disinfection, the roughing filters and cartridge filters will need to be able to remove organic matter enough that a minimum UVT of 77% can be guaranteed before reaching the UV reactors. For this exercise, it is assumed that this objective can be achieved.

6.1.4 Chlorination

As per the design as outlined in CRD's August 2021 letter, a chlorination step has been included to provide 4-log reduction of viruses. If the UV system performs as intended, chlorination for primary disinfection may be redundant and could be removed, though chlorination or chloramination for secondary disinfection would still be required. It is assumed that the existing chlorination system would kept in the new WTP arrangement.

To calculate contact time, it is assumed that a free chlorine residual of 0.5 mg/L will be maintained leaving the WTP. The minimum contact time to achieve at least 4-log virus inactivation (minimum water temperature 5 °C, pH between 6 and 9) would therefore be in the order of 16 minutes. It is assumed that 40,000 L of storage, with no baffles, would be installed to ensure that at least 16 minutes of chlorine contact time is achieved before water reaches the nearest consumer.

6.2 Residual Management

The roughing filters require regular air scouring and backwash to remove particulate that accumulates on the media and in the filtration units over time. Each roughing filter unit requires a 40 L/min backwash flow for approximately 25 minutes including rinse time. Typically, the frequency of the backwash depends on the volume of solids to be removed over time, however, this cycle often only occurs once a day. Based on this information, it is expected that a three-unit roughing filter system would generate approximately 2860 L of waste daily. A combination of settling and recirculation of the supernatant could be used to reduce the amount of waste produced by this process, however, a packaged recycling system could not be sourced as part of this report. For the purposes of budgetary estimates, it is assumed that all roughing filter waste will be pumped out of a holding tank and disposed of offsite.

It is anticipated that cartridge filters in this system will plug regularly, requiring regular changeouts of the cartridges in the filter housings. Waste cartridge filters are to be disposed of at a landfill.

6.3 Confirmation Testing of Treatment Processes

The feasibility and satisfactory performance of this treatment system would largely depend on the effective removal of iron, manganese, organics, and algae by the roughing and cartridge filters, and the conditioning chemicals dosed upstream. Case studies that reported successful application of roughing and cartridge filters to remove the aforementioned list of parameters from drinking were not readily available to review. It is therefore difficult to predict the effectiveness of roughing and cartridge filtration for Wilfred Reservoir water.

It is strongly recommended that pilot testing be done to verify the performance of these two treatment technologies to remove iron, manganese, organics and algae. The costs developed for this option include piloting of roughing and cartridge filtration prior to full-scale installation.

6.4 Opinion on Probable Costs

The design assumptions for the implementation of the roughing filter water treatment system are as follows:

- Include 275 m of 100 mm diameter raw water main connecting the intake to the roughing filter system, consistent with the assumption used in the Colquitz 2018 report.
- Design flows of 1.7 L/s (ADD) and 4.1 L/s (MDD).
- N+1 redundancy to maintain one operational and one standby units throughout the treatment system.

- Inclusion of chemical systems such as soda ash, oxidant and coagulant consisting of chemical tanks with containment, and duty/standby chemical pumps mounted on a chemical skid.
- The roughing filter is to be delivered in a prefabricated enclosure.
- New cartridge filters installed in roughly same location as existing cartridge filters in the existing WTP.
- New UV system installed at roughly same location as existing UV system in the WTP.
- Existing chlorination system kept to maintain free chlorine residual at desired concentration.
- Decommission the cartridge filters, UV units, and ammonia injection system in the existing WTP.
- Chlorine contact tank consists of a 40,000 L tank with no baffles.
- Annual costs are based on the following assumptions:
  - The frequency of replacing the cartridge filters will be reduced from daily replacements to replacement every second day.
  - Operators will pump out and dispose of waste from the holding tank on a weekly basis.
  - Operator hourly rate of $85/hr
  - Average power costs are $0.14 / kWh
  - Average chemical doses as follows:
    - Coagulant: 15 mg/L of PACl
    - pH adjustment: 30 mg/L of soda ash
    - disinfection: 1.0 mg/L sodium hypochlorite
  - An average of 12 UV lamps replaced annually
  - General mechanical cost allowance of 0.5% of the upgrade's mechanical capital cost
  - General electrical parts allowance of 0.5% of the upgrade's electrical capital cost
- O&M costs also include the replacement of the following equipment:
  - Chemical metering pumps replaced every 10 years
  - Backwash and air scour compressors replaced every 15 years
  - UV ballasts replaced every 5 years
  - UV quartz sleeves replaced every 10 years
- Lifecycle costs based on 25 years of operation, accounting for 4% interest rates and an 18% approximate cumulative inflation change since 2018.

The Class "D" opinion of probable costs for the roughing and cartridge filtration treatment option are summarized in **Table 6-1**. Refer to **Appendix C** for the Roughing Filter Treatment System Opinion of Probable Costs and the 25-year Lifecycle Costs Calculation, respectively.

Table 6-1
Opinion of Probable Costs – Option 2

Capital Cost		$1,920,000
Annual Cost		$390,000 /year
25-Year Lifecycle Cost		$8,350,000

7 SUMMARY

7.1 Treatment Objectives

To meet current BC drinking water standards, we recommend that treatment for the WMWSC include the following:

- Filtration and disinfection to achieve 4-log reduction of viruses and 3-log removal of *Cryptosporidium* and *Giardia*.
- Treatment for the removal of iron and manganese.
- Treatment for the removal of true colour.
- Chemical addition for pH adjustment and stabilization
- Treatment for organics removal or use of a disinfection system that minimizes the formation of THM and HAA.

7.2 Floating Intake

At this time it is unknown whether relocating the raw water intake will impact the quality of raw water pumped into the WMWSC and in turn change the recommended treatment objectives.

If the WMWSC and the CRD intend to replace the existing intake with a floating intake, we recommend that a bathymetric survey be conducted to short-list potential locations for the intake, and that a monitoring program be implemented to characterize the raw water pumped from this new location and update the recommended treatment objectives. A Class "D" Opinion of Probable Costs for the study and construction of a floating intake was calculated as $378,000 (including $65,000 for Intake Site Study and $313,000 for Design & Construction of new intake).

7.3 Treatment Upgrades

An updated Opinion of Probable Costs was developed for an upgrade to the WMWSC treatment system, as initially proposed by Colquitz Engineering, involving DAF and media filtration. Similarly, an Opinion of Probable Costs was developed for an alternative treatment option that involves roughing filtration, cartridge filtration, UV disinfection and chlorination. Costs for these two options are summarized below.

Description	Option 1 – DAF	Option 2 – Roughing & Cartridge Filters
Capital Cost	$5,270,000	$1,920,000
Annual Cost	$168,000 /year	$390,300 /year
25-Year Lifecycle Cost	$8,080,000	$8,350,000

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CERTIFICATION PAGE

This report presents our findings regarding the Wilderness Mountain Water Concept which includes considerations for the procurement and installation of a DAF treatment system and the system presented by the Wilderness Mountain Commission. The report represents a screening level assessment of concepts advanced in previous work (by others) to help ascertain the potential cost impacts of those concepts, the technical requirements in relation to regulatory standards, and to identify additional information needs before proceeding with project implementation.

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Engineering (B.C.) Ltd.
Engineers & Geoscientists BC Permit Number 1000163

Prepared by:

2022-12-15

Keith Kohut, M.A.Sc., P.Eng.
Process Engineer

CR/KK/fd

APPENDIX A - ASSOCIATED'S DRINKING WATER SUPPLY SOURCE REQUIREMENTS OPINION LETTER

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October 4, 2022
File: 2021-2386

Morgan Martin, P.Eng.
Public Health Engineer
Island Health
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Port Alberni, BC
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Re: WILDERNESS MOUNTAIN WATER SERVICES COMMISSION
DRINKING WATER TREATMET OBJECTIVES

Dear Ms. Martin:

At the CRD's request, Associated Engineering (B.C.) Ltd. (AE) is issuing this letter to document their opinion of the treatment requirements for Wilderness Mountain Water Services Commission (WMWSC) drinking water supply source. We request that Island Health comment on whether they agree or disagree with this assessment based on the information provided.

1 BACKGROUND

1.1 EXISTING INFRASTRUCTURE

Our understanding of the WMWSC water system is as follows:

- The current system can pump water into the distribution system at a maximum daily demand of 3.0 L/s.
- Water is pulled from the Wilfred Reservoir, which acts as a lake for the community.
- Water is pumped to the water treatment plant (WTP), to undergo the following treatment:
  - Pre-screening through four stages of cartridge filters: 50 micron, 20 micron, 25 micron, and 5 micron.
  - UV disinfection (three Trojan PRO MAX-30 reactors, each sized for 40 mJ/cm^2 at 1.85 l/s)
  - Ammonia addition, followed by sodium hypochlorite addition to create a chloramine residual.
- Water leaves the WTP and enters the distribution system, as well as connecting to the treated water reservoir. Water can travel directly from the WTP to the distribution system for consumption, and takes approximately 25 minutes from the WTP to reach the first consumer.
- When the source water intake and WTP are not pumping, treated water gravity flows from the reservoir to the distribution system.

1.2 REVIEWED DATA

The review is based on water quality data provided by the CRD, representing grab samples from the raw water and from the distribution system between January 2017 and May 2022. This data set was also compared to the data analysis presented in a 2020 assessment of the Wilfred Reservoir, titled "Report 1 – Treatment Assessment & Recommendation" (WSP).

1.3 REGULATORY REQUIREMENTS

The BC Drinking Water Protection Act assigns the drinking water officer the authority and discretion to prescribe treatment, monitoring and reporting requirements for a water system on a case-by-case basis. The Drinking Water Officers Guide further directs the drinking water officers to follow the federal (Health Canada) standards of the Guidelines for Canadian Drinking Water Quality (GCDWQ), as well as provincial (Ministry of Health) guidelines such as the "Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia".

The WMWSC water source and water quality was compared to these federal and provincial standards to identify treatment requirements.

2 TREATMENT REQUIREMENTS: PHYSICAL/CHEMICAL PARAMETERS

A summary of the physical and chemical water quality data is provided in Table 2-1 and was compared to the drinking water standards listed in GCDWQ. Based on the data that was submitted, the following parameters do not fully meet current Canadian drinking water standards.

Iron: The GCDWQ provides a non-health based Aesthetic Objective (AO) for total iron of 0.3 mg/L. At elevated concentrations iron can cause a reddish discolouration of the water, staining laundry and plumbing fixtures, as well as produce undesirable tastes and promote the growth of micro-organisms. While measured iron concentrations were typically below the AO (based on average and median concentrations), iron concentrations exceeded the AO in seven of 31 collected samples.

Manganese: The GCDWQ lists a non-health based AO for manganese of 0.020 mg/L and a health-based Maximum Acceptable Concentration (MAC) of 0.120 mg/L. Based on the median and average concentrations, manganese concentrations in the WMWSC's source water regularly exceeded the AO. Raw water manganese concentrations also exceeded the MAC in three of the 31 collected samples.

Turbidity: The GCDWQ provides turbidity guidelines for treated water that are dependent on the type of filtration used during treatment. The GCDWQ also recommends turbidity in water entering the distribution system to be 1.0 NTU or less to ensure effective disinfection and good operation of the

Table 2-1: Water Quality Summary
October 3, 2022
Data obtained between January 2017 and May 2022

Parameter	Unit	Sample Count	Min	Max	Median	Average	Range
E. Coli, Raw Water	CFU/100 mL	111	< 1	40	2	4	< 1 - 40
E. Coli, Treated Water	CFU/100 mL	486	< 1	< 1	< 1	< 1	< 1
Turbidity, Raw Water	NTU	114	0.5	2.2	1.1	1.2	0.5-2.2
Turbidity, Treated Water	NTU	381	0.2	5.8	0.7	0.8	0.2-5.8
Total Organic Carbon, Raw Water	mg/L	28	1.9	9.0	3.9	4.2	1.9 - 9.0
Total Organic Carbon, Treated Water	mg/L	9	2.5	8.7	3.7	4.2	2.5 - 8.7
Total Iron, Raw Water	mg/L	19	0.11	0.64	0.15	0.2	0.11 - 0.64
Total Iron, Treated Water	mg/L	12	0.05	0.90	0.11	0.2	0.05 - 0.90
Manganese, Raw Water	mg/L	19	0.024	0.137	0.048	0.058	0.024 - 0.137
Manganese, Treated Water	mg/L	12	0.012	0.364	0.023	0.067	0.012 - 0.364
True Colour, Raw Water	TCU	29	7	26	14	15	26-Jul
True Colour, Treated Water	TCU	26	5	19	11	12	5 -19
Alkalinity	mg/L as CaCO3	20	7	20	11.0	11.0	7 - 20
Ammonia	mg/L N	10	0.015	0.063	0.018	0.0	0.015 - 0.063
Arsenic	mg/L	31	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aluminum	mg/L	31	0.005	0.082	0.033	0	0.005 - 0.082
pH	pH units	92	6.1	9.1	7.00	7.1	6.1-9.1
Nitrate	mg/L as N	9	< 20	28	21	20	< 20 - 28
Total Suspended Solids	mg/L	5	1.2	7.2	2	2.8	1.2-7.2
UV Transmittance	UV % Transmittance (lab)	50	72	82.1	76.8	76.8	72-82.1
Total Algal Concentration	NU/mL	35	659	9538	4073	3762	659-9538
Chlorophyll-a	µg/L	48	0.3	10.4	2.8	3.4	0.3 - 10.4
Cyanobacteria	No. filaments	19	1	68	2	11	1-68
Total THMs	ug/L	20	1	6	2	2	1-6
Total HAAs	ug/L	22	< 5	22	11	10	< 5 - 22
HPC Bacteria	CFU/1 mL	38	10	17,000	4000	5109	10-17,000

distribution system. Turbidity exceeded 1 NTU in 75 of 114 raw water samples and in 77 of 381 treated water samples. Turbidity is further discussed in the section on microorganisms.

True Colour: The GCDWQ lists a true colour AO of 15 TCU. The AO was established based on true colour levels that are observable to the eye, as well as in consideration of the potential for undesirable substances to complex with or adsorb to organic colouring agents. The average and median values for true colour in the sample data set indicates that true colour is typically just below the AO, but exceeded the AO in 16 of the 55 collected samples.

Disinfection By-products: The grab sample data showed very low levels of trihalomethanes (THM) and haloaectic acids (HAAs) forming in the WMWSC distribution system when ammonia is added upstream of sodium hypochlorite, that is, when the water is chloraminated without any significant interaction with free chlorine. In comparison, the 2020 "Report 1 – Treatment Assessment & Recommendation" documented a period where the ammonia system was offline and the free chlorine residual was present in the distribution system. During that period without ammonia THM and HAA levels in the distribution system increased significantly to as high as 0.160 mg/L (MAC 0.100 mg/L) and 0.220 mg/L, (MAC 0.080 mg/L), respectively, as shown in Table 2-2.

Table 2-2
Disinfection By-product Concentrations at Ambience P1 Cell1-North and P1 Cell 2 – South)

Parameter	No. Samples	Range (mg/L)	Median Value (mg/L)
Total THMs	31	0.001 – 0.160	0.004
Total HAAs	4	0.005 – 0.22	0.016

Source: 2020. WSP. Report 1 – Treatment Assessment & Recommendation.

If chlorination using free chlorine is contemplated in any water system upgrades, it is recommended that treatment also include steps to remove THM and HAA precursors in the form of reducing organic material concentrations.

Algae: The source water experiences a wide range of algal bloom concentrations throughout any given year. The CRD has stated that the algal blooms have historically caused the cartridge filters to clog quickly, requiring frequent replacement of the cartridges to keep the system running, and in some instances the algal blooms have led to taste and odour issues in the treated water.

In terms of algae-related parameters from a quantitative perspective, Health Canada has developed a MAC for microcystins at 0.0015 mg/L for drinking water systems. Sampling has been done from the WMWSC water source for algae-related measurements such as total algal concentrations, chlorophyll-a concentrations, and cyanobacteria filaments per sample, but not for microcystins. A comparison of

algae characteristics to drinking water quality standards therefore could not be made. Based on the information presented it is recommended that treatment to remove algal blooms from incoming water be incorporated to protect the rest of the treatment system.

pH: The GCDWQ operational guideline for pH was revised by Health Canada in 2015 to a range of 7.0 to 10.5 in finished drinking water. A low pH can indicate an aggressive water matrix, leading to corrosion and leaching of minerals from distribution pipe materials and plumbing fixtures. According to the pH data collected, the pH of WMWSC drinking water is below the operational guideline range for roughly half (42 of 92 samples) of all measurements.

HPC Bacteria: A drinking water standard for HPC bacteria is not provided in the GCDWQ. However, HPC is regularly used to monitor for bacteriological stability in distribution systems. Specifically, a sharp increase in HPC counts generally suggests a decline in water quality, and potentially the introduction of undertreated water into the system.

All of the recorded HPC samples were collected from the same location in the distribution system, and indicate that HPC bacteria levels can vary by several orders of magnitude throughout a given year. At this time it cannot be determined whether these large variations are due to inadequate treatment or other factors in the distribution system. Further sampling of HPC counts is recommended after the WMWSC treatment system is upgraded to see if significant variations in HPC counts in the distribution system persist.

Summary

Based on the data reviewed the following physical/chemical water quality parameters do not meet the GCDWQ standards for potable water, and treatment to address the following parameters is recommended:

- Iron
- Manganese
- Turbidity
- True Colour
- pH
- THM and HAA (if free chlorine is used as part of the upgraded treatment proceses)

Control of algal blooms is also recommended to reduce filtration operation and maintenance costs.

3 TREATMENT REQUIREMENTS: MICROBIOLOGICAL CONSIDERATIONS

3.1 TREATMENT STANDARDS

As a surface water system, the WMWSC water system is subject to the requirements of the provincial "Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia". These provincial standards include the following treatment requirements for surface water systems:

- 4-log reduction or inactivation of viruses
- 3-log reduction or inaction of *Giardia lamblia* and *Cryptosporidium parvum*.
- Two treatment processes for surface water
- Less than or equal to one NTU of turbidity
- No detectable *Escherichia coli*, fecal coliforms and total coliforms

Virus Inactivation: It is our understanding that the existing UV system is sized for the inactivation of *Cryptosporidium* and *Giardia*, and does not provide sufficient dose to achieve any substantial level of virus inactivation.

The existing system also employs chloramines as part of treatment. For chloramines to destroy viruses, the disinfectant requires a minimum contact time with the water before the first consumer in the order of several hours. In its current configuration, virus inactivation is not being achieved. This criteria is not being met.

Cryptosporidium and *Giardia:* Provided that the existing UV system was designed for a minimum UVT of 72%, the WTP will be able to adequately inactivate *Cryptosporidium* and *Giardia* up to 1.85 L/s per one reactor running, up to a maximum of 5.55 L/s when all thre reactors are running. If flow through the WTP is kept within the maximum treatable flow rates of the UV reactors, this criteria is being met.

Two Treatment Processes: Per these provincial standards and the GCDWQ, the two treatment processes are, by default, filtration plus one form of disinfection. The existing cartridge filters do not provide any form of pathogen removal and are not considered suitable filtration for this requirement. The existing WTP contains two forms of disinfection, albeit the chloramination step is not providing adequate inactivation of viruses. The requirement for two treatment processes is not being met.

Turbidity: Turbidity regularly exceeds 1 NTU. This criteria is not being met.

E.Coli, Total Coliforms: WMWSC's data set includes 470 *E.coli* samples have been collected from the distribution system, all of which indicated less than 1 count/100 mL of *E.coli.* The data set also contained 75 samples from the distribution system where only presence or absence of total coliforms

was measured. One sample was recorded as "presence detected". However, in general, it appears that this criteria is being met.

Summary: The existing system's compliance with treatment requirements for microorganisms were summarized in Table 3-1:

Table 3-1
Treatment Requirements for Microorganisms

4-log reduction or inactivation of viruses	No
3-log reduction or inaction of *Giardia lamblia* and *Cryptosporidium parvum*.	Yes if flow through WTP stays within treatable flowrates of UV
Two treatment processes for surface water	No
Less than or equal to one NTU of turbidity	No
No detectable *Escherichia coli*, fecal coliforms and total coliforms	Yes

3.2 FILTRATION EXEMPTION CONSIDERATIONS

The provincial standards state that two forms of disinfection may be considered as an alternative to filtration plus disinfection if certain criteria, that is, the Filtration Exemption criteria, are met. The provincial criteria for Filtration Exemption are as follows:

1. Overall inactivation is met using a minimum of two disinfections, providing 4-log reduction of virus and 3-log reduction of *Cryptosporidium* and *Giardia*.
2. The number of *E.coli* in raw water does not exceed 20/100 mL (If *E.coli* data is not available, less than 100/100 mL) in at least 90% of the weekly samples from the previous six months. In the treated water should could contain no detectable levels of *E.coli* per 100 mL, no total coliform in at least 90% of the samples, and no sample containing more than 10 total coliform bacteria per 100 ml.
3. Average daily turbidity levels measured at equal intervals, at least every four hours, immediately before the disinfectant are less than or equal to 1 NTU, but do not exceed 5 NTU for more than two days in a 12-month period.
4. A watershed control program is maintained that minimizes the potential for fecal contamination in the source water.

Criterion 1 – Two Disinfectants: The existing WMWSC water treatment plant (WTP) is equipped with a chloramination system and a UV system. It is our understanding that the UV system is sized to provide 3-log inactivation of *Cryptosporidium* and *Giardia*. There is insufficient chloramine contact time to achieve at least 4-log reduction of viruses prior to the water reaching the first consumer. If

modifications to the system's chloramination process are made to provide a significant amount of free chlorine contact time prior to ammonia addition, the WMWSC should be able to meet this criterion.

Criteria 2 – E.coli and Total Coliforms: Table 3-2 summarizes the raw water E.coli and total coliforms data provided for the WMWSC.

Table 3-2
Microorganisms Raw Water Data

Parameter	*E. Coli*	Total Coliforms
No. Raw Water Samples	111	108
No. > 20/100 mL	2 (2%)	-
No. > 100/100 mL	-	54 (50%)

Total coliform counts regularly exceed the Filtration Exemption criterion, but are typically not considered when sufficient *E.coli* data is available. *E.coli* concentrations in the raw water do not exceed 20/100 mL in at least 90% of samples. Assuming that treatment would maintain E.coli and total coliforms to non-detectable levels post-treatment, the available data suggests the WMWSC could meet this criterion.

Criteria 3 – Turbidity: Table 3-3 summarizes the turbidity data as collected from manual grab samples. The frequency of these samples is roughly 1-2 samples per month, and do not meet the minimum required frequency of once every four hours, but is roughly indicative of source water quality.

Table 3-3
Raw Water Turbidity (Grab Sample Data)

No. Turbidity Samples	No. Samples > 1 NTU	No. Samples > 5 NTU
114	75 (66%)	0 (0%)

The data set indicates that the source water quality regularly exceeds 1 NTU and does not meet the turbidity criterion for Filtration Exemption.

Turbidity data analysis was also conducted by WSP in their 2020 water vulnerability study, believed to be from the turbiditmeter located inside the WTP, downstream of the cartridge filters and upstream of the UV reacotrs. The turbidimeter data showed turbidity levels in the filtered water ranging from 0.05 – 5.01 NTU, and turbidity events (that is, spikes in measured turbidity levels) as summarized in Table 3-4.

Table 3-4
Raw Water Turbidity Events (2016-2020)

Year	No. of Turbidity Events	Average Duration (hrs)	Average Turbidity (NTU)
2016	138	13.0	1.5
2017	55	10.1	1.9
2018	32	7.7	1.6
2019	29	9.7	1.6
2020	26	12.9	1.5

Source: WSP, 2020. Report 1 – Treatment Assessment & Recommendation.

While the WSP data represents turbidity of the filtered water as opposed to unfiltered raw water, WSP's analysis is consistent with AE's in that the WMWSC source water does not satisfy the turbidity criterion for Filtration Exemption.

Criterion 4 – Watershed Control Program: A source water vulnerability assessment was conducted for WMWSC (WSP, 2020), that included the following recommendations:

1. Upgrade Intake by relocating further from shore.
2. Ongoing monitoring including sampling at various depths and multiple locations, for a better understanding of water quality throughout the raw water reservoir.
3. Dredge or install syphon drain system at bottom of the raw water reservoir.
4. Implement ongoing ground monitoring and sediment control around the lake shore for step slope assessment mapping and erosion control.
5. Standardize regular inspections and preventative maintenance of the existing water system infrastructure.
6. Implement vegetation management around the raw water reservoir to minimize organic transport from near-shore vegetation and reduce risks of lake-shore erosion.
7. Locate all septic disposal for properties partially within the 30-meter setback area of the raw water source.

If these recommended measures are implemented the WMWSC could meet this criterion for Filtration Exemption. If these measures are implemented it is recommended that further sampling take place to determine if these measures have improved water quality.

Summary
Based on the reviewed data, criteria 1, 3 and 4 of the Filtration Exemption are currently not being met. Furthermore the turbidity data indicates that the WMWSC source water quality does not satisfy the turbidity criteria and therefore is likely not a suitable candidate for Filtration Exemption. Recommended treatment to address microbiological parameters is filtration plus disinfection.

4 RECOMMENDATIONS

Based on the water quality data reviewed in this document, we recommend that treatment for the WMWSC drinking water system include the following components:

- Filtration and disinfection to achieve 4-log reduction of viruses and 3-log removal of *Cryptosporidium* and *Giardia*.
- Treatment for the removal of iron and manganese.
- Treatment for the removal of true colour.
- Chemical addition for pH adjustment and stabilization.
- Treatment for organics removal, or modifications to the disinfection system that minimize the potential of THM and HAA formation.

Please let us know if you disagree with this assessment. If you have any questions or wish to discuss, please let me know.

Yours truly,

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
K. D. KOHUT
33868
2022-10-04

Keith Kohut, M.A.Sc. P.Eng.
Process Engineer

KK/fd

c.c. Rory Beise – Island Health
c.c. Shayne Irg – Capital Regional District

Keith Kohut

From: Beise, Rory <Rory.Beise@islandhealth.ca>
Sent: November 7, 2022 2:07 PM
To: Keith Kohut; Martin, Morgan
Cc: Shayne Irg; Jonathan Musser
Subject: RE: Wilderness Mountain Water Services Commission - Confirmation of treatment objectives

Keith and CRD,

Thank you for providing the WMWS report regarding the current system and treatment objectives.

This office agrees that the current treatment system is not meeting the Ministry of Health's Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies and the summary and recommendations in the AE October 4, 2022 Report (File No.: 2021-2386) regarding needed upgrades for the current source water (Wilfred Reservoir).

Island Health would look forward to a proposed treatment system through application of a construction permit through our Public Health Engineer (PHE), meeting these objectives, for continued and future use of this source (Wilfred Reservoir) or an alternate source, that meets the provincial treatment objectives, with a proposed timeframe including dates of completion to update the water system operating permit conditions.

Thank you and we look forward to discussing options in the near future with the CRD and possibly yourselves.

Rory Beise and Morgan Martin (PHE)

From: Keith Kohut <kohutk@ae.ca>
Sent: Tuesday, October 04, 2022 2:38 PM
To: Martin, Morgan <Morgan.Martin@islandhealth.ca>
Cc: Beise, Rory <Rory.Beise@islandhealth.ca>; Shayne Irg <sirg@crd.bc.ca>; Jonathan Musser <musserj@ae.ca>
Subject: Wilderness Mountain Water Services Commission - Confirmation of treatment objectives

Hello Morgan,

My name is Keith Kohut, I am from Associated Engineering, and we have been working with the WMWSC and the Capital Regional District to plan out upgrades for their existing water system to make it compliant with current drinking water standards in BC. Historically there has been some confusion on what the treatment objectives should be for the WMWSC system, so I wanted to help push the work forward by clearly defining the system's water quality and treatment requirements.

Please find attached a summary of the historical water quality data, an overview of the existing infrastructure, and based on this information my opinion on the treatment objectives for the WMWSC. It would be very helpful if Island Health could let us know whether you agree or disagree with our understanding of the treatment objectives.

If you have any questions or wish to discuss please let me know. Thank you,

Keith Kohut, M.A.Sc., P.Eng.
Associated Engineering Ltd

Associated Engineering | 75 YEARS

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Vancouver, BC V5M 4T5 Canada
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December 15, 2022
File: 2021-2386

Morgan Martin, P.Eng.
Public Health Engineer
Island Health
4201 6th Avenue
Port Alberni, BC V9Y 4N1

Re: WILDERNESS MOUNTAIN WATER SERVICES COMMISSION
DRINKING WATER TREATMENT OBJECTIVES - UPDATE

Dear Morgan:

Thank you for your response dated November 7, 2022. Since issuing our letter dated October 4, 2022, enclosed for convenience, it has come to our attention that we misstated a detail about the manganese concentrations in the Wilderness Mountain Water Services Commission (WMWSC) water system, originally as follows:

> "***Manganese***: *The GCDWQ lists a non-health based AO for manganese of 0.020 mg/L and a health-based Maximum Acceptable Concentration (MAC) of 0.120 mg/L. Based on the median and average concentrations, manganese concentrations in the WMWSC's source water regularly exceeded the AO. Raw water manganese concentrations also exceeded the MAC in three of the 31 collected samples.*"

As a correction, the final sentence should be revised as follows:

> "*Manganese concentrations exceeded the MAC in one of the 19 raw water collected samples and in two of the 12 treated water collected samples.*"

This correction does not alter our overall assessment and recommendations for the WMWSC drinking water system, but we wanted to make sure that this clarification was communicated.

If you have any questions please let me know.

Yours truly,

Keith Kohut, M.A.Sc., P.Eng.
Process Engineer

KK/fd

cc: Rory Beise – Island Health
Shayne Irg – Capital Regional District

APPENDIX B – DAF WATER TREATMENT COSTS

Appendix B-1- Opinion of Probable Cost (Class D) for Dissolved Air Flotation System
26-Oct-22
2021-2386

Item	Description	Unit	Quantity		Rate		Total Cost ($)
1	General						
1.1	Bonding and Insurance	Lump Sum	1		2.0%	$	59,289.20
1.2	Mobilization and Demobilization	Lump Sum	1		4.0%	$	118,578.40
1.3	Layout and Survey Control	Lump Sum	1	$	8,000	$	8,000
1.4	Landscaping/Arborist Services	Lump Sum	1	$	2,000	$	2,000
	Subtotal for Task					$	187,868
2	Raw Water Supply Main						
2.1	100 mm PVC watermain	m	275	$	1,200	$	353,100
2.2	Trench Rock (2/3 of excavation)	m3	120	$	400	$	51,360
	Subtotal for Task					$	404,460
3	Water Treatment Plant		1				
3.1	DAF Treatment Plant (4.1 L/s)	Lump Sum	1	$	2,375,000	$	2,375,000
3.2	Mech/Elect/Civil materials & installation	Lump Sum	1	$	35,000	$	35,000
3.3	Chlorine Contact Tank	Lump Sum	1	$	55,000	$	55,000
3.4	Piloting Option (1 month)	Lump Sum	1	$	95,000	$	95,000
	Subtotal for Task		1			$	2,560,000
4	Removals					$	-
4.1	Remove existing treatment works	Lump Sum	1	$	40,000	$	40,000
	Subtotal for Task					$	40,000
	Tasks Subtotal					$	3,192,328
	CRD Administration and Operations	10%				$	319,233
	Engineering	15%				$	478,849
	Contingency	40%				$	1,276,931
	Subtotal					$	5,267,341
	Total Amount Rounded (exc. GST)					$	5,270,000

Appendix B-2- DAF Water Treatment System 25-year Lifecycle Costs Calculation
26-Oct-22
2021-2386

Discount Rate 4.0%

Dissolved Air Flotation (DAF)		
Capital Cost	$	5,270,000
Annual Operation Expenses	$	168,000
Replacement Costs		
Chemical pumps	$6,000 ea	
Backwash, recycle pumps and compressors	$40,000 LS	
Catalytic media	$10,000 LS	
25-Year Lifecycle Costs	$	8,078,000

APPENDIX C – ROUGHING AND CARTRIDGE FILTER WATER TREATMENT COSTS

Appendix C-1- Opinion of Probable Cost (Class D) for WMWSCC-Proposed Water Treatment System
26-Oct-22
2021-2386

Item	Description	Unit	Quantity		Rate		Total Cost ($)
1	General						
1.1	Bonding and Insurance	Lump Sum	1		2.0%	$	18,899
1.2	Mobilization and Demobilization	Lump Sum	1		4.0%	$	37,797
1.3	Layout and Survey Control	Lump Sum	1	$	8,000	$	8,000
1.4	Landscaping/Arborist Services	Lump Sum	1	$	2,000	$	2,000
	Subtotal for Task					$	66,696
2	Raw Water Supply Main						
2.1	100 mm PVC Pipe Water Main	m	275	$	1,200	$	353,100
2.2	Trench Rock (2/3 of excavation)	m3	120	$	400	$	51,360
	Subtotal for Task					$	404,460
3	Treatment System and Piloting						
3.1	Roughing Filters	Lump Sum	1	$	124,688	$	124,688
3.2	Hurricane 5-micron Filters (HC/90-5)	ea	2	$	263	$	525
3.3	Hurricane 0.35-micron filters (HC/90-0.35)	ea	2	$	323	$	646
3.4	Harmsco WB 90SC-2 filter housings	ea	4	$	2,416	$	9,666
3.5	UV Reactors	Lump Sum	1	$	239,945	$	239,945
3.6	Mech/Elect/Civil materials & installation	Lump Sum	1	$	80,000	$	80,000
3.7	Waste Holding Tank	Lump Sum	1	$	30,000	$	30,000
3.8	Chlorine Contact Tank	Lump Sum	1	$	55,000	$	55,000
3.9	Piloting Option (1 month)	Lump Sum	1	$	90,000	$	90,000
	Subtotal for Task					$	630,470
4	Removals						
4.1	Equipment Removal	Lump Sum	1	$	60,000	$	60,000
	Subtotal for Task					$	60,000
	Tasks Subtotal					$	1,161,626
	CRD Administration and Operations	10%				$	116,163
`	Engineering	15%				$	174,244
	Contingency	40%				$	464,650
	Subtotal					$	1,916,683
	Total Amount Rounded (exc. GST)					$	1,920,000

Appendix C-2- Roughing and Cartridge Filtration Water Treatment System 25-year Lifecycle Costs Calculation
26-Oct-22
2021-2386

Discount Rate 4.0%

Roughing and Cartridge Filters		
Capital Cost	$	1,920,000
Annual Operating Costs		
Labour	$	164,100
Chemicals	$	3,000
Power	$	1,600
Cartridge Replacement	$	213,700
UV lamp replacement	$	5,500
Misc. Mechanical	$	2,200
Misc. Electrical	$	200
Subtotal	$	390,300
Replacement Costs		
Chemical pumps	$6,000 ea	
Backwash pumps and compressors	$30,000 LS	
UV ballasts	$1500 ea	
UV sleeves	$400 ea	
25-Year Lifecycle Costs	$	8,351,000

APPENDIX D – FLOATING INTAKE COSTS

Appendix D- Opinion of Probable Cost (Class D) for Floating Intake
26-Oct-22
2021-2386

1	Lake Survey and Sampling						
1.1	Bathymetric Survey	Lump Sum	1	$	7,000.00	$	7,000
1.2	Laboratory Costs (approximate)*	Unit	6	$	749.00	$	4,500
1.3	Accomodation	Lump Sum	1	$	2,160.00	$	2,200
1.4	Disbursements	Lump Sum	1	$	3,000.00	$	3,000
1.5	Labour	Hours	108	$	123.00	$	13,300
1.6	Sampling	Hours	120	$	123.00	$	14,800
1.6	Planning & Reporting	Lump Sum	1	$	20,000.00	$	20,000
	Subtotal for Task					$	64,700
2	Floating Intake						
2.1	Well Pumps	Unit	2	$	8,560.00	$	18,300
2.2	Dock and Walkway	Square Meter	32	$	1,144.90	$	36,600
2.3	Electrical Kiosk and Controls	Lump Sum	1	$	64,200.00	$	64,200
2.4	Piping	Metre	60	$	11.68	$	700
2.5	Planning & Reporting	Lump Sum	1	$	45,000.00	$	45,000
2.6	Labour	Lump Sum	1		$5,350.00	$	5,400
	Subtotal for Task					$	170,200
	Tasks Subtotal					$	234,900
	CRD Administration and Operations	10%				$	23,500
`	Engineering & Construction Admin	15%				$	25,500
	Contingency	40%				$	94,000
	Subtotal					$	377,900
	Total Amount Rounded (exc. GST)					$	380,000

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December 15, 2022
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If you have any questions please let me know.

Yours truly,

Keith Kohut, M.A.Sc., P.Eng.
Process Engineer

KK/fd

cc: Rory Beise – Island Health
Shayne Irg – Capital Regional District

Making a difference...together

Integrated Water Services
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February 1, 2023

File: 5240-20
Wilderness Mountain – Water

Rory Beise
Land Use/Drinking Water Consultant
Island Health, Gateway Village Health Unit
Suite 201 – 771 Vernon Avenue
Victoria, BC V8X 5A7

Dear Mr. Beise,

RE: WILDERNESS MOUNTAIN WATER SYSTEM (CAPITAL REGIONAL DISTRICT), 706 CAINS WAY, SOOKE, BC

This letter is to provide your office with an update regarding the Wilderness Mountain Water System (WMWS). Unfortunately, the Capital Regional District (CRD) has been unable to meet the timelines proposed in our January 20, 2022 letter to achieve the Drinking Water Treatment Objectives (microbiological) for Surface Water Supplies in British Columbia (SWTO).

Following is an update to the schedule proposed in our January 20, 2022 letter:

1) Source Water Vulnerability Study to determine the vulnerability of the source water and its viability as an ongoing water source. **(Complete October 30, 2020)**
2) Examine options to provide conventional filtration on the existing treatment plant and water source to meet Island Health objectives if the existing water source is viable long term. **(Complete October 30, 2020)**
3) Source Water Protection Plan to select and develop the most appropriate management measures and address permitting considerations associated with the reservoir management. **(Complete April 19, 2022)**
4) Explore and implement alternative less costly treatment plant improvements as requested by the WMWS Commission Members.
    - Conceptual design to determine if less costly treatment plant options are feasible to update the treatment process to meet the SWTO. **(Complete December 15, 2022)**
    - Attached for your records is a copy of the Conceptual Design Report completed by Associated Engineering. The lowest cost option to meet the SWTO is approximately $1.92 million initial capital investment not including annual operating costs.

- The WMWS Commission directed staff to remove capital projects related to this report from the five year capital plan (2023-2027) at its annual budget meeting in November 2022. As a result, the referendum to borrow funds for detailed design and construction were removed from the capital plan.

5) Water Supply from the Juan de Fuca Water Distribution System.

   - The preceding option is considered a short-term solution as a water supply connection from the Juan de Fuca Water Distribution System is technically feasible in future years.

   - Through funding provided by the Juan de Fuca Electoral Area Director, the CRD retained a consultant to complete a study of potential development options in the area that would require piped water and could help affordability in bringing the greatest benefit to area residents, including the WMWS community. Attached for your records is a copy of the study completed by McElhanney Engineering. The study reviewed connections from Sooke and East Sooke, and is separate from a previous study that reviewed a connection over Mt. Matheson that would solely feed WMWS. The study concluded that expansion is administratively feasible but would require significant and costly infrastructure. The cost to connect WMWS is undetermined at this time as it would be based on the timing and approval of future adjoining development. Typically, expansion of any future water system is dependent on proposed development.

While the CRD understands that the filtration exemption has been removed for the Wilderness Mountain Water System, please confirm that this is the case.

Should you wish to further discuss the CRD's current operating permit, if you have any questions or require additional information, please contact me at ijesney@crd.bc.ca or 250.360.3061.

Yours truly,

Ian M. Jesney

Ian Jesney, P.Eng.,
Acting General Manager
Integrated Water Services

Attachments: 2

cc: Mike Benusic, Medical Health Officer

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