Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Notice of Meeting and Meeting Agenda
Regional Water Supply Commission

Wednesday, May 17, 2023 | **11:30 AM** | **6th Floor Boardroom, 625 Fisgard St., Victoria, BC V8W 1R7**

MEMBERS:
G. Baird (Chair); C. Stock (Vice Chair); J. Caradonna; N. Chambers; C. Coleman; Z. de Vries; S. Duncan; C. Graham; S. Gray; C. Green; K. Guiry; S. Hammond; K. Harper; K. Jordison; S. Kim; D. Lajeunesse; T. Morrison; T. Phelps Bondaroff; J. Rogers; M. Wagner; M. Westhaver; A. Wickheim

1. TERRITORIAL ACKNOWLEDGEMENT

2. APPROVAL OF THE AGENDA

3. ADOPTION OF MINUTES

3.1. 23-226 Adoption of April 19, 2023 Minutes

Recommendation: That the minutes of the April 19, 2023 Regional Water Supply Commission meeting be adopted.

Attachments: Draft Minutes of the April 19, 2023 Meeting

4. CHAIR'S REMARKS

5. PRESENTATIONS/DELEGATIONS

Please complete the https://www.crd.bc.ca/about/board-committees/addressing-the-board 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 Regional Water Supply Commission at iwsadministration@crd.bc.ca. Requests must be received no later than 4:30 p.m. two calendar days prior to the meeting.

6. GENERAL MANAGER'S REPORT

7. WATER ADVISORY COMMITTEE UPDATE

7.1. 23-361 Water Advisory Committee Meeting Summary

Recommendation: There is no recommendation. The summary is for information only.

Attachments: Water Advisory Committee Meeting Summary

8. COMMISSION BUSINESS

8.1. 23-345 Bylaw No. 4099 - Water Conservation Amendment: Once-Through Cooling Equipment

Recommendation: The Regional Water Supply Commission recommends to the Capital Regional District Board:
1. That Bylaw No. 4549, "Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 3, 2023", be introduced and read a first, second, and third time; and
2. That Bylaw No. 4549 be adopted.
3. That Bylaw No. 4553 "Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 76, 2023" be introduced and read a first, second, and third time; and
4. That Bylaw No. 4553 be adopted.

(WA)

Attachments: Staff Report: Bylaw No. 4099 - Water Conservation Amendment: OTC Equipme
Appendix A: Bylaw No. 4099 - Consolidated Bylaw 2021
Appendix B: Bylaw No. 4549
Appendix C: Bylaw No. 4553

8.2. 23-353 Greater Victoria Drinking Water Quality - 2022 Annual Report

Recommendation: The Regional Water Supply Commission recommends to the Capital Regional District Board:
That the Greater Victoria Drinking Water Quality 2022 Annual Report be approved. (NWA)

Attachments: Staff Report: Greater Victoria Drinking Water Quality - 2022 Annual Report
Appendix A: Greater Victoria Drinking Water Quality - 2022 Annual Report

8.3. 23-340 Water Quality Summary Report for Greater Victoria Drinking Water System - January to March 2023

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

Attachments: Staff Report: Water Quality Summary Report for GVDWS - January to March 20
Appendix A: Water Quality Summary Report for GVDWS - January to March 20

8.4. 23-354 Proposed Regional Water Supply Service Development Cost Charge Program and Bylaw

Recommendation: That the Regional Water Supply Commission direct Capital Regional District staff to proceed with the next phases of developing and implementing a Development Cost Charge program and bylaw.
(NWA)

Attachments:
- Staff Report: RWS Service DCC Program and Bylaw
- Appendix A: Presentation: Regional Water Supply Commission DCC
- Appendix B: WAC March 28, 2023 Staff Report Including Urban Systems Ltd. P
- Appendix C: WAC Questionnaire Results
- Appendix D: Table of Contents, Development Cost Charge Guide for Elected Of
- Appendix E: Table of Contents, Development Cost Charge Best Practices Guide

8.5. 23-355 Summary of Recommendations from Other Water Commissions

Recommendation: There is no recommendation. The report is for information only.

Attachments: Summary of Recommendations

8.6. 23-356 Water Watch Report

Recommendation: There is no recommendation. The report is for information only.

Attachments: Water Watch Report

9. NOTICE(S) OF MOTION

10. NEW BUSINESS

11. ADJOURNMENT

Votinq Key:
NWA - Non-weighted vote of all Commissioners
NWP - Non-weighted vote of participants (as listed)
WA - Weighted vote of all Commissioners
WP - Weighted vote of participants (as listed)

Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Meeting Minutes

Regional Water Supply Commission

Wednesday, April 19, 2023 **11:30 AM** **6th Floor Boardroom**
625 Fisgard St.
Victoria, BC V8W 1R7

PRESENT:
G. Baird (Chair); C. Stock (Vice Chair) (EP); J. Caradonna; C. Coleman;
Z. de Vries (EP); S. Duncan (EP); C. Graham (EP); S. Gray; C. Green;
K. Guiry; S. Hammond (EP); K. Harper; K. Jordison; S. Kim; T. Morrison (EP);
T. Phelps Bondaroff; J. Rogers; M. Wagner; M. Westhaver; A. Wickheim

STAFF:
T. Robbins, CAO; I. Jesney, Acting General Manager, Integrated Water Services;
A. Constabel, Senior Manager, Watershed Protection; G. Harris, Senior Manager,
Environmental Protection; J. Marr, Acting Senior Manager, Infrastructure Engineering;
S. Irg, Senior Manager, Water Infrastructure Operations; J. van Niekerk, Senior Manager,
Customer & Technical Services; S. Carey, Senior Manager, Legal & Risk Management;
J. Zimmerman, Communications Coordinator, Integrated Water Services;
D. Dionne, Administrative Coordinator; M. Risvold, Committee and Administrative Clerk

REGRETS: N. Chambers; D. Lajeunesse

EP = Electronic Participation

The meeting was called to order at 11:31 am

1. TERRITORIAL ACKNOWLEDGEMENT

The Chair provided a territorial acknowledgement.

2. APPROVAL OF THE AGENDA

MOVED by Commissioner Green and **SECONDED** by Commissioner Coleman,
That the agenda be approved as circulated.
CARRIED

3. ADOPTION OF MINUTES

3.1. Adoption of the February 15, 2023 Minutes

Attachments: Draft Minutes, February 15, 2023

MOVED by Commissioner Phelps Bondaroff and **SECONDED** by Commissioner Westhaver,
That the Minutes of the February 15, 2023 meeting be adopted.
CARRIED

4. CHAIR'S REMARKS

The Chair had no remarks.

5. PRESENTATIONS/DELEGATIONS

There were no presentations or delegations.

6. GENERAL MANAGER'S REPORT

I. Jesney noted the following:
- The Water Advisory Committee had its first meeting and Katie Oppen was elected as Chair
- An agricultural sub-committee was formed by the Water Advisory Committee and has met
- Regional development cost charge program
- Staff applied for a $6 million dollar grant which was successful

7. COMMISSION BUSINESS

7.1. Bylaw No. 4541 Water Supply Local Service Area Establishment Bylaw Amendment

Attachments: Staff Report: Bylaw No. 4541 Amendment

Appendix A: Bylaw No. 4541

Appendix B: Bylaw No. 2537 Unofficial Consolidation (Redlined)

A. Constabel spoke to item 7.1.

Discussion ensued regarding:
-Tree thinning and location
-Possible sale of logs
-Cost recovery
-Capital plan amendment
-Tree branches crossing property lines
-Recycling wood chips
-Treatment of invasive wildlife and species
-Benefits of leaving cut logs on the ground
-Wildfire and other potential risks to the watershed
-Long-term effects of thinning
-Reducing forest fuels
-Drought stress amongst trees

MOVED by Commissioner Harper, **SECONDED** by Commissioner Westhaver,
That the Regional Water Supply Commission recommends to the Capital Regional District Board:

1. That Bylaw No. 4541, "Capital Regional District Water Supply Local Service Area Establishment Bylaw No. 1, 1997, Amendment Bylaw No. 3, 2023", be introduced and read a first, second, and a third time.
2. That Bylaw No. 4541 be referred to the service participants for approval by way of council and electoral area director consent on behalf, and that if successful, Bylaw No. 4541 be referred to the Inspector of Municipalities for approval.

CARRIED

7.2. Potential Impacts of Climate Change on Regional Water Supply Operations

Attachments: Staff Report: Potential Impacts of Climate Change

Appendix A: Current and Potential Climate Change Impacts

A. Constabel spoke to item 7.2.

Discussion ensued regarding:
-Increased pressure for population density on south Vancouver Island
-Concern regarding density projections
-Tree mortality and removal of trees
-Future impact on the water
-Trends that are foreseen
-Water restrictions
-Water conservation bylaw
-Demand management report

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

7.3. Summary of Recommendations from Other Water Commissions

Attachments: Summary Of Recommendations from Other Water Commissions

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

7.4. Water Watch Report

Attachments: Water Watch Report

I. Jesney spoke to item 7.4.

Staff responded to a question regarding snow melting in the watershed.

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

8. NOTICE(S) OF MOTION

There were no notices of motion.

9. NEW BUSINESS

There was no new business.

10. ADJOURNMENT

MOVED by Commissioner Coleman and **SECONDED** by Commissioner Westhaver,
That the meeting be adjourned at 12:40 pm.
CARRIED

_____
CHAIR

_____
SECRETARY

Capital Regional District

HOTSHEET AND ACTION LIST

Water Advisory Committee

Tuesday, March 28, 2023 **12:00 PM** **6th Floor Boardroom**
625 Fisgard Street
Victoria, BC

The following is a quick snapshot of the FINAL Water Advisory Committee decisions made at the meeting. The minutes will represent the official record of the meeting. A name has been identified beside each item for further action and follow-up.

2. ELECTION OF CHAIR

Katie Oppen was elected as Chair by Acclamation.

3. ELECTION OF VICE CHAIR

Jennifer Todd was elected as Vice Chair by Acclamation.

5. ADOPTION OF MINUTES

That the minutes of the September 1, 2022 meeting be adopted.

CARRIED

9. COMMISSION BUSINESS

The following items were received for information:

9.1. Water Advisory Committee Orientation Presentation
9.2. Proposed Regional Water Supply Development Cost Charge Program and Bylaw
9.3. Agricultural Water Rate Review – Progress Update
9.4. Summary of Recommendations from Regional Water Supply Commission
9.5. Water Watch Report

ACTIONS:
Staff to send a meeting follow up email to the Committee:

- Providing links to:
  - Regional Water Supply Commission Budget staff report
  - 2017 Strategic Plan
  - 2022 Master Plan
- Attaching the DCC questionnaire for completion by April 14
- Providing the link to the Agricultural Water Rate questionnaire for completion by April 11

- Initiating the implementation of the Agricultural Water Rate Working Group – and providing some background on how the working groups work

Denise

The Committee requested a different view of the Water Watch reports, that shows year over year and/or month over month – rather than week over week.

Ian

10. WATER ADVISORY COMMITTEE PROPOSED MEETING SCHEDULE

Regular meetings of the Water Advisory Committee shall be held on the fourth Tuesday of the month commencing at 12 pm unless otherwise determined.

- March 28, 2023
- June 27, 2023
- September 26, 2023
- December 12, 2023 Special date (in lieu of December 26)

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EEP 23-24

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, MAY 17, 2023

SUBJECT **Bylaw No. 4099 – Water Conservation Amendment: Once-Through Cooling Equipment**

ISSUE SUMMARY

Staff were directed to investigate options for reinstating a Water Conservation Bylaw ban on once-through cooling equipment (OTC).

BACKGROUND

In 2016, the Capital Regional District (CRD) created Bylaw No. 4099, "Consolidated Capital Regional District Water Conservation Bylaw No. 1, 2016", which included a ban on OTC equipment (Appendix A). OTC service providers and approximately 200 businesses were notified in early 2017 of the upcoming ban.

In late 2017, staff became aware of changes to the BC Building Code (BCBC) and the implementation of the *Building Act* (BC) that had the potential to affect some CRD services. Staff met with representatives from the Ministry of Municipal Affairs and Housing and understood that the Bylaw No. 4099 prohibition against OTC equipment was in conflict with the revised BCBC. In response to these provincial changes, Bylaw No. 4248 amended the existing Water Conservation Bylaw to remove definitions and sections related to OTC.

At the June 16, 2021 Regional Water Supply Commission meeting, staff were directed to investigate options for reinstating the CRD Water Conservation Bylaw's ban on the use of OTC equipment. Following discussions with provincial staff and a CRD internal legal review of options, staff have now developed a regulatory approach that would be effective within the CRD's existing regulatory framework.

Bylaw No. 4549, "Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 3, 2023" (Appendix B), amends the Water Conservation Bylaw by inserting definitions and clauses to regulate the use of water for once-through cooling rather than the previous approach of regulating OTC equipment. The amendment contains a five-year period until enforcement, to allow time to budget and replace equipment, and also allows for emergency use and exceptions as approved by the General Manager.

Bylaw No. 4553, "Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 76, 2023" (Appendix C) amends the CRD's ticketing bylaw to add a new offence of "Use Water for Once-Through Cooling" and corrects item numbering errors introduced by the previous ticketing amendment in 2020.

These amendments will be supported with the current OTC rebate program, as well as engagement activities, such as a follow-up letter and a Frequently Asked Questions brochure to the service providers and businesses that were contacted in 2017, and a new messaging campaign promoting the regulatory change and emphasizing the economic and water conservation benefits of OTC equipment replacement.

ALTERNATIVES

Alternative 1

The Regional Water Supply Commission recommends to the Capital Regional District Board:
1. That Bylaw No. 4549, "Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 3, 2023", be introduced and read a first, second, and third time; and
2. That Bylaw No. 4549 be adopted.
3. That Bylaw No. 4553 "Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 76, 2023" be introduced and read a first, second, and third time; and
4. That Bylaw No. 4553 be adopted.

Alternative 2

That Bylaw No. 4549, "Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 3, 2023" be referred to staff for changes.

SOCIAL IMPLICATIONS

Once-through cooling systems use clean potable water for the purpose of removing heat before discharging the water to sewer. Examples of OTC are refrigeration compressor units for walk-in coolers and freezers, ice machines, server room cooling systems and air conditioners.

A typical OTC unit (1 ton, 12,000 BTU/hour) uses about 1,600,000 litres of water per year per unit. Eliminating or reducing the use of this equipment will have a significant impact on the CRD's efforts to reduce regional water usage.

ECONOMIC IMPLICATIONS

Businesses that have already converted to non-OTC equipment see significant savings on their water bill and a short payback period on their investment. Switching to an air-cooled walk-in cooler unit from a typical OTC unit costs about $5,000-$8,000 and the average payback period is approximately two years. This is a very quick return on investment for equipment that has a positive impact on reducing the region's overall water consumption and, as an additional benefit, utility savings continue throughout the life of the unit.

REGULATORY IMPLICATIONS

Changes in the BCBC meant that local governments have no authority to regulate building standards where they are the subject of the code or any other provincial enactment. As a result, the CRD's previous approach to regulate once-through cooling equipment conflicted with the code.

Shifting the OTC ban to focus on regulating the use of the water instead of the OTC devices is within the CRD's existing powers to regulate the use of the CRD's regional water supply and is consistent with how other water uses are regulated (e.g., lawn watering).

CONCLUSION

The Regional Water Supply Commission directed staff to investigate options for reinstating the CRD Water Conservation Bylaw's ban on the use of one-through cooling (OTC) equipment. This ban was rescinded in 2017 in response to changes to the BC Building Code that affected local government powers.

Following discussions with provincial staff and a CRD internal legal review of options, staff have now developed a regulatory approach that would be effective within the CRD's existing regulatory framework. Shifting the OTC ban to focus on regulating the use of water instead of the OTC equipment is within the CRD's powers and consistent with how other water uses are regulated.

RECOMMENDATION

The Regional Water Supply Commission recommends to the Capital Regional District Board:

1. That Bylaw No. 4549, "Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 3, 2023", be introduced and read a first, second, and third time; and
2. That Bylaw No. 4549 be adopted.
3. That Bylaw No. 4553 "Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 76, 2023" be introduced and read a first, second, and third time; and
4. That Bylaw No. 4553 be adopted.

Submitted by:	Glenn Harris, Ph.D., R.P.Bio., Senior Manager, Environmental Protection
Concurrence:	Larisa Hutcheson, P. Eng., General Manager, Parks & Environmental Services
Concurrence:	Ian Jesney, P. Eng., Acting General Manager, Integrated Water Services
Concurrence:	Kristen Morley, J.D., General Manager, Corporate Services & Corporate Officer
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENTS

Appendix A: Bylaw No. 4099 – "Capital Regional District Water Conservation Bylaw No. 1, 2016", Official Consolidation – April 30, 2021
Appendix B: Bylaw No. 4549 – A Bylaw to Amend Water Conservation Bylaw (Bylaw No. 4099)
Appendix C: Bylaw No. 4553 – A Bylaw to Amend Bylaw No. 1857, CRD Ticket Information Authorization Bylaw, 1990

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BYLAW NO. 4099

CAPITAL REGIONAL DISTRICT WATER CONSERVATION BYLAW NO. 1, 2016

(As amended by Bylaw Nos. 4248 and 4261)

A bylaw to regulate water use

For further details please consult CRD's Environmental Protection Division,
Glenn Harris, Senior Manager, Environmental Protection
Phone: 250-360-3090

For reference to original bylaws and amendments,
please contact the Legislative Services department, Capital Regional District,
625 Fisgard Street, Victoria, B.C., V8W 2S6
Phone: 250-360-3129

CAPITAL REGIONAL DISTRICT

Bylaw No. 4099

****

WATER CONSERVATION BYLAW

****

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

AND WHEREAS under section 335 of the *Local Government Act* a regional government has authority to regulate Water use even though a participating Municipality is responsible for Water distribution within that municipality;

AND WHEREAS the Capital Regional District ("CRD") under the *Capital Region Water Supply and Sooke Hills Protection Act* (the "Act") has established a Water supply local service sourcing drinking water from the Sooke Lake and Goldstream Reservoirs in the following participating municipalities:

The Corporation of the City of Victoria
The Corporation of the District of Oak Bay
The Corporation of the District of Saanich
Corporation of the Township of Esquimalt
District of Central Saanich
Town of Sidney
District of North Saanich
District of Metchosin
City of Colwood
Town of View Royal
City of Langford
District of Sooke
District of Highlands
That portion of the Juan de Fuca Electoral Area as shown in Schedule "B".

AND WHEREAS the CRD supplies bulk Water to the following:

The Corporation of the City of Victoria
The Corporation of the District of Oak Bay
The Corporation of the District of Saanich
Corporation of the Township of Esquimalt
Saanich Peninsula Water Commission
Juan de Fuca Water Distribution Commission

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.

[Bylaw 4261]

"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.

"Commission" means the Regional Water Supply Commission.

"CRD" means the Capital Regional District.

"Even-Numbered Address" see "Odd-Numbered Address"

"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.

"Municipality" means the District of Sooke, District of Metchosin, City of Colwood, Town of View Royal, City of Langford, District of Highlands, that portion of the Juan de Fuca Electoral Area as shown on Schedule "B", the Corporation of the City of Victoria, Corporation of the Township of Esquimalt, The Corporation of the District of Oak Bay, The Corporation of the District of Saanich, District of Central Saanich, District of North Saanich and the Town of Sidney.

"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.

[Bylaw 4261]

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

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

[Bylaw 4261]

"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*.

""Odd-Numbered Address" or "Even-Numbered Address" means the numerical portion of the street address of a property, and in the case of multi-unit commercial or residential complex such as but not limited to a townhouse, condominium or other strata-titled property, means the numerical portion of the street address that is assigned to the entire complex, and not the individual unit number.

"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.

[Bylaw 4261]

"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.

"Regional Water Supply" means the CRD drinking water supply operated and administered by the CRD under the authority referred to in the Recitals to this bylaw.

"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.

[Bylaw 4261]

"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.

[Bylaw 4261]

"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 the Regional Water 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 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 Municipality.

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 Regional Water Supply, the Commission, by resolution, may:

(a) amend the effective period of time for Stage 1, 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.

(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.

[Bylaw 4261]

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) delivery of notices; or

(d) publication in a local newspaper.

[Bylaw 4261]

6. Determining Water Use Restriction Stages

In making a determination under Section 4(2), the Commission 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 and draw down rates;

(4) stream flows and inflows into CRD Reservoirs;

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

(6) Regional Water Supply System performance;

(7) the effects of climate change; and

(8) any other factor the Commission considered to be relevant for making a determination under Section 4(2).

[Bylaw 4261]

7. Water Use Restrictions

(1) The Water Use Restrictions for each Stage are prescribed 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 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 the Municipality, shall use Water or cause Water to be used contrary to the provisions of this bylaw in effect at the time of use.

[Bylaw 4261]

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".

[Bylaw 4261]

9. Schedules

Schedules "A" and "B" of this bylaw form part of and are enforceable in the same manner as the bylaw.

[Bylaw 4261]

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 he or she has 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.

[Bylaw 4261]

11. Repeal

Capital Regional District Water Conservation Bylaw No. 1, 2003 is repealed.

12. Effective Date

This bylaw shall take effect upon the date of its adoption.

13. Bylaw Citation

This Bylaw may be cited as “Capital Regional District Water Conservation Bylaw No. 1, 2016”.

READ A FIRST TIME, this	11th	day of	May,	2016
READ A SECOND TIME, this	11th	day of	May,	2016
READ A THIRD TIME, this	11th	day of	May,	2016
ADOPTED this	11th	day of	May,	2016

[original signed by]
CHAIR

[original signed by]
SECRETARY

SCHEDULE "A"
to Bylaw No. 4099

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, with

(i) an even-numbered address, other than on Wednesday and Saturday between the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.; and

(ii) an odd-numbered address other than on Thursday and Sunday between the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.; and

(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) in the case of Municipalities only, water lawns and Boulevards other than on Mondays and Fridays during the hours of 1:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.;

(ii) in the case of all Public Authorities, water public, institutional or community playing fields 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 any day other than Wednesday; and

(iii) in the case of all Public Authorities, water trees, shrubs, flowers and vegetable gardens other than at the times and in the manner prescribed under Sections 1(1)(b)(i) and (ii) 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), 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.

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, with

(i) an even-numbered address, other than on Saturday between the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.;

(ii) an odd-numbered address, other than on Sunday 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 Regional Water Supply; and

(e) no person shall

(i) water trees, shrubs, flowers and vegetables on any day 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 three days per week unless failure to water will result in a permanent loss of plant material;

(iv) 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 and commercial car washes.

(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) in the case of Municipalities only, water lawns and Boulevards other than on Monday between the hours of 1:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.;

(ii) in the case of all Public Authorities, water public, institutional or community playing fields 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 three days per week if failure to water will result in a permanent loss of plant material;

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

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

(i) fairways more than two days 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) fill with Water or operate 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; and

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

(b) no person or Public Authority shall

(i) water trees, shrubs, flowers and vegetables on any day 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, 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. only 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 3 days a 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

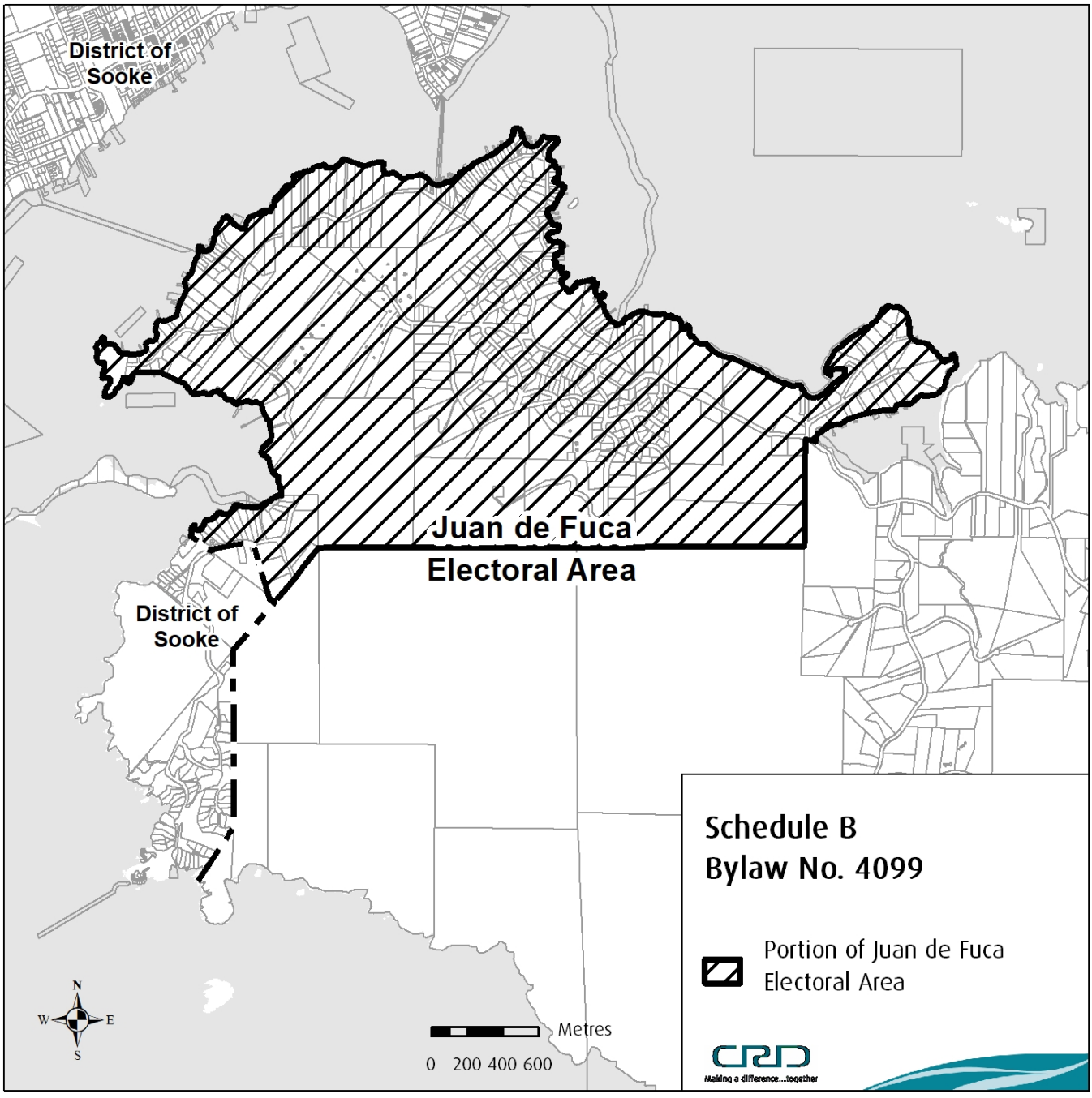
(i) fairways more than one day per week during the hours of 4:00 a.m. to 10:00 a.m. or 7:00 p.m. to 10:00 p.m.;

(ii) trees, shrubs, flowers and vegetables grown on golf courses other than in accordance with Section 3(1)(b)(i), (ii) and (iii) 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 car dealerships and 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.

SCHEDULE "B"
to Bylaw No. 4099



CAPITAL REGIONAL DISTRICT
BYLAW NO. 4549

****

A BYLAW TO AMEND WATER CONSERVATION BYLAW (BYLAW NO. 4099)

****

WHEREAS:

A. Under Bylaw No. 4099, Capital Regional District Water Conservation Bylaw No. 1, 2016, the Regional Board has established a bylaw to regulate water use for a Water supply local service sourcing drinking water from the Sooke Lake and Goldstream Reservoirs;

B. The Regional Board wishes to restrict wasteful use of Water by prohibiting the use of Water in Once-Through Cooling Systems;

C. The Regional Board wishes to amend Bylaw No. 4099;

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

1. Bylaw No. 4099, "Capital Regional District Water Conservation Bylaw No. 1, 2016" is hereby amended as follows:

   (a) by inserting the following definitions, in alphabetical order, under section 1:

   “Emergency Back-up System” means a Once-Through Cooling System that is not normally operated and is only activated either in an emergency situation (including, but not limited to, power outages, severe weather, or natural disasters) or in the event of a sudden failure of an otherwise properly designed, operated and maintained primary cooling system that is not a Once-Through Cooling System;

   “Once-Through Cooling System” means a system or equipment that produces a cooling effect through the transfer of heat to water that is circulated only once through the system, and is then discharged, whether to a sewer, stream, other water body, the ground, or otherwise;

   (b) by inserting the following as section 7(5):

   7(5) Commencing on July 1, 2028, no person shall use Water in a Once-Through Cooling System unless:

   (a) the Once-Through Cooling System is an Emergency Back-up System, or

   (b) the person has obtained written authorization from the General Manager to use Water in the Once-Through Cooling System in accordance with section 7(6).

   (c) by inserting the following as section 7(6):

   7(6) The General Manager may grant a person authorization to use Water in a Once-Through Cooling System if there is no reasonable alternative to using Water in a Once-Through Cooling System.

2. This bylaw may be cited for all purposes as “Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 3, 2023".

READ A FIRST TIME THIS	th	day of	2023
READ A SECOND TIME THIS	th	day of	2023
READ A THIRD TIME THIS	th	day of	2023
ADOPTED THIS	th	day of	2023

CHAIR

CORPORATE OFFICER

APPENDIX C

CAPITAL REGIONAL DISTRICT
BYLAW NO. 4553

****

A BYLAW TO AMEND BYLAW NO. 1857, CAPITAL REGIONAL DISTRICT TICKET INFORMATION AUTHORIZATION BYLAW, 1990

****

WHEREAS the Regional Board amended the Capital Regional District Water Conservation Bylaw No. 1, 2016 by way of Bylaw No. 4549, Amendment Bylaw No. 3, 2023, to prohibit the use of Water in Once-Through Cooling Systems;

AND WHEREAS the Regional Board wishes to correct numbering errors introduced by the adoption of Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 68, 2020;

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

1. Bylaw No. 1857, Capital Regional District Ticket Information Authorization Bylaw, 1990, is amended by replacing the existing Schedule 26 with the Schedule 26 attached to this bylaw.

2. This Bylaw may be cited for all purposes as "Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 76, 2023".

READ A FIRST TIME THIS	DAY OF	2023
READ A SECOND TIME THIS	DAY OF	2023
READ A THIRD TIME THIS	DAY OF	2023
ADOPTED THIS	DAY OF	2023

_____ _____

CHAIR CORPORATE OFFICER

SCHEDULE 26 TO BYLAW NO. 1857

CAPITAL REGIONAL DISTRICT WATER CONSERVATION BYLAW NO. 1, 2016

	WORDS OR EXPRESSIONS DESIGNATING OFFENCE	SECTION	FINE
1.	Hinder/Prevent Inspection	3	$500.00
2.	Wasting water during Stage 1	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.	Water contrary to restriction	7.(4)	$200.00
6.	Use Water for Once-Through Cooling	7.(5)	$400.00
7.	Stage 1 – water lawn contrary to even-numbered address dates/times	Sch. A 1.(1)(a)(i)	$200.00
8.	Stage 1 – water lawn contrary to odd-numbered address dates/times	Sch. A 1.(1)(a)(ii)	$200.00
9.	Stage 1 – water playing field contrary to dates/times	Sch. A 1.(1)(b)(iv)	$100.00
10.	Stage 1 – operate Public Spray Park contrary to restrictions	Sch. A 1.(1)(c)	$100.00
11.	Stage 1 – Public Authority watering contrary to dates/time	Sch. A 1.(2)(b)	$100.00
12.	Stage 1 – watering golf courses contrary to dates/times	Sch. A 1.(2)(c)	$200.00
13.	Stage 2 – water lawn contrary to even-numbered address dates/times	Sch. A 2.(1)(a)(i)	$250.00
14.	Stage 2 – water lawn contrary to odd-numbered address dates/times	Sch. A 2.(1)(a)(ii)	$250.00
15.	Stage 2 – wash sidewalks/driveways/exterior surfaces	Sch. A 2.(1)(b)(i)	$250.00
16.	Stage 2 – use motion-activated sprinkler device	Sch. A 2.(1)(b)(ii)	$250.00

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

Making a difference...together

EEP 23-23

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, MAY 17, 2023

SUBJECT **Greater Victoria Drinking Water Quality – 2022 Annual Report**

ISSUE SUMMARY

To present the Greater Victoria Drinking Water Quality 2022 Annual Report to the Regional Water Supply Commission prior to submission to the provincial regulator.

BACKGROUND

The Capital Regional District (CRD) undertakes a comprehensive water quality monitoring program as part of its multi-barrier approach to provide a safe drinking water supply to the region. The Water Quality Monitoring Program reports water trends on a regular basis to the Regional Water Supply Commission, along with a comprehensive annual report for each calendar year. The Greater Victoria Drinking Water Quality 2022 Annual Report is attached as Appendix A. Water suppliers in BC are responsible for monitoring and providing an annual report to the provincial regulator (i.e., Island Health Authority). To assist in meeting these responsibilities, the CRD has prepared this report, which will be distributed to Island Health and all municipal water purveyors and posted on the CRD website.

ALTERNATIVES

Alternative 1

The Regional Water Supply Commission recommends to the Capital Regional District Board:
That the Greater Victoria Drinking Water Quality 2022 Annual Report be approved.

Alternative 2

That the Regional Water Supply Commission direct staff to provide further information.

IMPLICATIONS

Environmental & Climate Implications

The report indicates that our source water remains in good condition and there is excellent drinking water quality in all system components of the Greater Victoria Drinking Water System. The system is monitored for physical, chemical and biological water quality parameters. All trends are stable and indicate good conditions overall. 2022 saw some unusual weather patterns: spring and early summer were unusually cold and wet, which resulted in higher reservoir levels and cooler water temperatures. In contrast, fall was unusually warm and dry, into December. This, in turn, resulted in lower reservoir levels in the fall and warmer water temperatures. Despite these unseasonal weather conditions, the quality of the raw and treated water remained excellent. This has demonstrated the resilience of a water source that is integrated in a healthy and stable ecosystem, such as the Sooke Lake watershed.

Monitoring results indicate the CRD continues to meet guidelines for maintaining an unfiltered source water supply. Further monitoring within the distribution systems also indicates a good balance between managing bacterial growth and ensuring good water quality with low concentrations of disinfection byproducts.

Financial and Regulatory Implications

The reporting function is included within the overall budget for the Water Quality Monitoring Program. This task ensures there is adequate information to inform and work with Island Health officials, meet provincial regulatory requirements and federal guidelines, and ensure CRD staff have sufficient information to maintain proper oversight of the water supply system.

The CRD continues to provide compliance monitoring of the municipal systems within the region to deliver effective and efficient oversight for both monitoring and reporting of water quality within the overall distribution system. Responsibility for any issues that may arise in the municipal infrastructure remains the responsibility of the municipalities.

Social Implications

The full disclosure of water quality monitoring data maintains public confidence that the CRD is effectively managing the regional drinking water supply. The data and reports are available online through the CRD public website. Staff respond directly to any customer concerns and questions, and work with CRD operational staff, municipal staff, small system operators and Island Health officials to ensure good communication and support for the overall system.

CONCLUSION

The Water Quality Monitoring Program remains an essential component in the delivery of a safe drinking water supply to the region. Monitoring results summarized in the Greater Victoria Drinking Water Quality – 2022 Annual Report indicate good water quality overall, with the low risks associated with the unfiltered source water being well managed by the CRD's multi-barrier approach. Once the report is approved by the Board, it will be submitted to the Island Health Authority, as per the requirement under the BC Drinking Water Protection Act.

RECOMMENDATION

The Regional Water Supply Commission recommends to the Capital Regional District Board:
That the Greater Victoria Drinking Water Quality 2022 Annual Report be approved.

Submitted by:	Glenn Harris, Ph.D., R.P.Bio., Senior Manager, Environmental Protection
Concurrence:	Larisa Hutcheson, P. Eng., General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Greater Victoria Drinking Water Quality – 2022 Annual Report

Making a difference...together

APPENDIX A

Greater Victoria Drinking Water Quality
2022 Annual Report

Parks & Environmental Services Department | Environmental Protection

Prepared By
Water Quality Program
Capital Regional District
479 Island Highway, Victoria, BC, V9B 1H7
T: 250.474.9680 F: 250.474.9691 www.crd.bc.ca

May 2023

Greater Victoria Drinking Water Quality
2022 Annual Report

EXECUTIVE SUMMARY

This report provides the annual overview of the Capital Regional District (CRD) Water Quality Monitoring program and 2022 water quality results within the Greater Victoria Drinking Water System (GVDWS) and its individual system components (see Map 1). The results indicate that Greater Victoria's drinking water continues to be of good quality and is safe to drink.

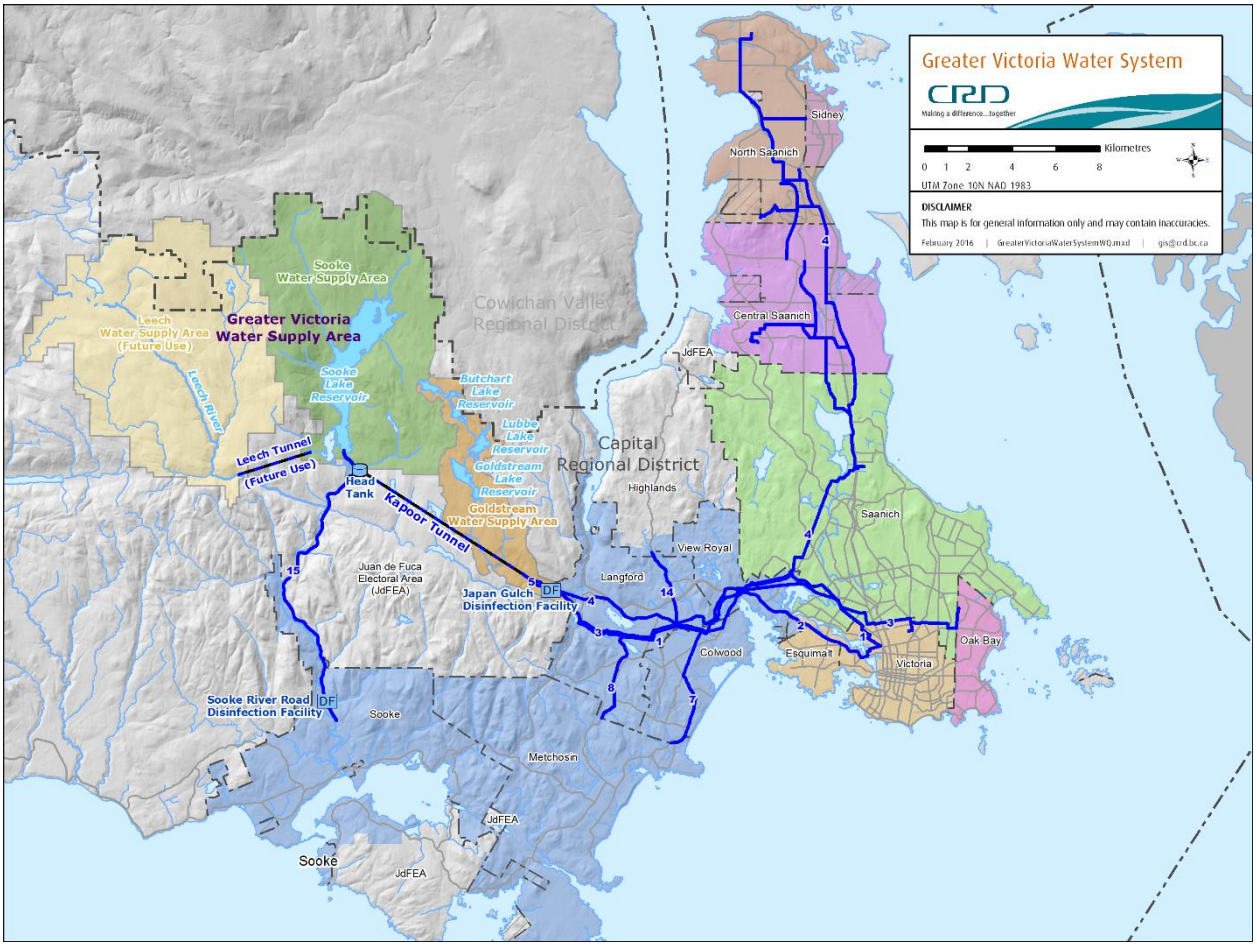
The monitoring program is designed to meet the requirements of the provincial regulatory framework, which is defined by the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation*, and to follow the federal guidelines for drinking water quality.

The approximately 11,000 hectares of the Sooke and Goldstream watersheds comprise the source of our regional drinking water supply area. Water flows from the reservoirs to the Sooke and Goldstream water treatment plants and then through large-diameter transmission mains and a number of storage reservoirs into eight different distribution systems, which in turn deliver the drinking water to the consumers. The monitoring program covers the entire system to anticipate any issues (i.e., source water monitoring), ensure treatment is effective (i.e., monitoring at the treatment facilities), and confirm a safe conveyance of the treated water to customers (i.e., transmission and distribution system monitoring). It also enables CRD staff to address any concerns or questions by the general public. The program adopts a multiple-lines-of-evidence approach (biological, chemical and physical) to ensure all aspects of water quality are considered. The program is comprehensive, collecting approximately 10,000 samples and conducting approximately 75,000 individual analyses annually. The results are discussed with the Island Health Authority, which oversees compliance with drinking water standards, and with CRD operations and municipal staff, who rely on the information to properly operate and maintain the system components.

The source water reservoirs, with established and intact ecosystems, provide raw water of excellent and stable water quality that can be utilized unfiltered for the preparation of potable water. Water quality monitoring in the watersheds serves several purposes: 1) to verify that the CRD continues to comply with the criteria for an unfiltered surface water source; 2) to understand the quality of the water flowing into the reservoirs; 3) to ensure that staff are aware of the presence and absence of water quality-relevant organisms, including specific pathogens in the lakes, prior to any treatment; 4) to confirm that the water quality parameters remain within the effectivity range of the disinfection treatment; and 5) to detect any taste and odour or other aesthetic concerns that could then pass through the system.

This annual water quality report separates the water system components that are the CRD's responsibility from system components that are the responsibility of the municipalities. The CRD provides water quality sampling and testing services for compliance purposes to all municipal water systems. Each water distribution system was assessed for compliance with the regulatory requirements. This annual report contains the compliance summary for the CRD and municipal water distribution systems in the GVDWS.

MAP 1. Greater Victoria Drinking Water System



Greater Victoria Drinking Water Quality
2022 Annual Report

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Greater Victoria Drinking Water Quality
2022 Annual Report

1.0 INTRODUCTION

This report is the annual overview of the results from water quality samples collected in 2022 from the Greater Victoria Drinking Water System (GVDWS) (see Map 1). The report summarizes data from the Capital Regional District (CRD) owned and operated water infrastructure that includes the source reservoirs, the Regional Transmission System and the Juan De Fuca Water Distribution System, as well as data from the municipal distribution systems. Monthly and weekly summary reports on water quality data are posted on the CRD's website at: https://www.crd.bc.ca/about/data/drinking-water-quality-reports.

2.0 WATER SYSTEM DESCRIPTION

In 2022, the GVDWS supplied drinking water to approximately 405,000 people and is the third-largest drinking water system operating in British Columbia. It comprises two separate service areas:

1. The **Goldstream Service Area** that supplies water to approximately 388,200 people in Victoria, Saanich, Oak Bay, Esquimalt, Central Saanich, North Saanich, Sidney, Highlands, Colwood, Langford and Metchosin via the Goldstream Water Treatment Plant.

2. The **Sooke Service Area** that supplies water to approximately 16,800 people in Sooke and East Sooke via the Sooke River Road Water Treatment Plant.

2.1 Source Water Systems

Drinking water for the GVDWS comes from protected watersheds called the Greater Victoria Water Supply Area (see Map 1). This CRD-owned and managed area, which is approximately 20,500 hectares in size, is located about 30 km northwest of Victoria and encompasses about 98% of the Sooke Lake, 98% of the Goldstream Lake and 92% of the Leech River catchment areas. The Goldstream and Sooke watersheds, with 11,000 ha area, comprise the active water supply area, whereas 9,500 ha of the Leech watershed are currently inactive and designated for future water supply.

Goldstream Service Area

The five reservoirs in the supply area have been used as a source of drinking water since the early 1900s. The Sooke Lake Reservoir, the largest of the reservoirs, is the primary water source for this system, supplying typically between 98% and 100% of Greater Victoria's drinking water. In 2022, Sooke Lake Reservoir supplied 100% of the source water. The four reservoirs in the Goldstream system (Butchart, Lubbe, Goldstream and Japan Gulch) are typically off-line and are used only as a backup water supply. Controlled releases from the Goldstream watershed provide water for salmon enhancement in the lower Goldstream River. The Leech River watershed does not yet contribute to the water supply for the GVDWS.

Water at the southern end of Sooke Lake Reservoir enters two of the variable depth gates in the intake tower and is screened through a stainless-steel travelling screen (openings of 0.5 mm). From the intake tower, the water passes through two 1,200 mm-diameter pipelines to the head tank and then through the 8.8 km-long, 2.3 m-diameter Kapoor Tunnel and then into 1,525 mm- and 1,220 mm-diameter pipes connecting the Kapoor Tunnel to the Goldstream Water Treatment Plant, where it is disinfected.

During occasional brief periods of use (typically used only when the Kapoor Tunnel is out of service for inspection by CRD staff), water in the Goldstream Watershed is released from Goldstream Reservoir and flows down the upper reaches of Goldstream River into Japan Gulch Reservoir. Water from Japan Gulch Reservoir enters the Japan Gulch intake tower through a low-level and a high-level intake, passing through a 14-mesh, stainless steel screen and is then carried in a 1,320 mm-diameter pipe into the Goldstream Water Treatment Plant.

Sooke Service Area

Drinking water for the Sooke Service Area is only supplied from Sooke Lake Reservoir but travels a different route. This water is passed through a 14.5 km-long (9 miles), 600 mm-diameter PVC and ductile iron pipe from a point just above the head tank to the Sooke River Road Water Treatment Plant. The Sooke Service Area has no backup water source.

2.2 Water Disinfection

The drinking water of the GVDWS is only treated by a multi-stage disinfection process. Further treatment such as filtration is not required due to compliance with the BC Ministry of Health requirements for a Filtration Exemption (Drinking Water Treatment Objectives for Surface Water Supplies in BC). A Filtration Exemption is also supported by meeting the USEPA requirements under the Surface Water Treatment Rules for unfiltered water systems. The disinfection process in the GVDWS is both simple and effective and uses two water treatment plants to provide disinfected drinking water to the two service areas.

Both water treatment plants utilize the same disinfection concepts and process methods. The Goldstream Water Treatment Plant uses delivered liquid sodium hypochlorite and liquid ammonia for the disinfection process and still has the old chlorine gas injection plant as a backup system. The Sooke River Road Water Treatment Plant generates sodium hypochlorite on site and injects delivered liquid ammonia to achieve the disinfection effect.

At both water treatment plants, the water passes through a three-part disinfection process in sequential order—two primary disinfection steps that provide disinfection of the water entering the system, followed by a secondary disinfection step that provides continuing disinfection throughout the transmission system and the distribution systems:

1. **UV Disinfection**. Ultraviolet (UV) disinfection provides the first step in the primary disinfection process (disinfection of the raw source water entering the plants) and inactivates parasites, such as *Giardia* and *Cryptosporidium* [3-log (99.9%) inactivation], as well as reducing the level of bacteria in the water. Based on the consistently applied high UV dosage at the Goldstream plant (50-90 mJ/cm^2), it can be assumed that it is also effective in inactivating certain viruses (66-99% rotavirus inactivation).

2. **Free Chlorine Disinfection**. Free chlorine disinfection provides the second step in the primary disinfection process, using a free chlorine dosage of approximately 1.5-2.5 mg/L and a minimum of 10-minute (depending upon flow) contact time between the free chlorine and the water. The free chlorine disinfection step inactivates bacteria and provides a 4-log (99.99%) reduction of viruses.

3. **Ammonia Addition**. The secondary disinfection process consists of the addition of ammonia to form chloramines at a point downstream where the water has been in contact with the free chlorine for approximately 10 minutes or more. The ammonia is added at a ratio of approximately one part ammonia to four-five parts chlorine. In the water, these chemicals combine to produce a chloramine residual (measured as total chlorine). Monochloramine is the desired residual product, which typically represents 90% of the total chlorine when leaving the plants. This residual remains in the water and continues to protect the water from bacterial contamination (secondary disinfection), as it travels throughout the pipelines of the distribution system.

In East Sooke, at the Iron Mine Reservoir, the CRD re-chloraminates the water to boost the chlorine residual provided to the extremities of that system. In Metchosin, at Rocky Point Reservoir, the CRD maintains another re-chloramination station, which has not been in service for approximately seven years. It has been deemed unnecessary for maintaining adequate residuals. Currently, there are no provisions to re-chloraminate the water at the far reaches of the distribution system on the Saanich Peninsula; however, emergency re-chlorination stations are provided at Upper Dean Park Reservoir and Deep Cove pump station, supplying Cloake Hill Reservoir. These re-chlorination stations are able to add free chlorine to the system if the total chlorine residuals were to drop to inadequate levels or during water quality emergencies.

2.3 CRD Transmission System

The CRD Transmission System comprises a number of large-diameter transmission mains and several connected supply storage reservoirs. Almost all of the supply storage reservoirs are on the Saanich Peninsula, leaving the Core Area municipalities without any supply storage. Using a series of large-diameter transmission mains, the CRD supplies treated water to its downstream customers. These large-diameter transmission mains are sorted into three sections:

1. Regional Transmission System, that supplies the Westshore and the Core Area municipalities, and up to the Saanich Peninsula boundary;

2. The Saanich Peninsula Trunk Water Distribution System that receives water at two points on the Saanich Peninsula from the Regional Transmission System and supplies it to the three municipalities and other customers on the Saanich Peninsula; and

3. The Sooke Supply Main.

2.3.1 Regional Transmission System

The CRD currently uses seven large-diameter transmission mains to supply drinking water to the municipal distribution systems in the Goldstream Service Area. These transmission mains range in diameter from 1,525 mm (60”) down to 460 mm (18”) and transfer water from the Goldstream Water Treatment Plant to the distribution systems listed in Section 2.4.

- Main #1 is a 1,067 mm-diameter (42”), cement mortar-lined, welded steel pipe that starts at the Humpback pressure regulating valve (PRV) below the Humpback Reservoir Dam and ends at the David Street vault. This transmission main provides water primarily to the City of Victoria, but also services portions of Saanich and the Westshore communities.

- Main #2 is a 780 mm-diameter (31”) steel and ductile iron pipe, which starts at the Colwood overpass and runs primarily through View Royal, Esquimalt and Vic West along the Old Island Highway and Craigflower Road. Main #2 joins Main #1 at the David Street vault after crossing the Bay Street Bridge. This supply main is 7.6 km in length and provides water to View Royal, Victoria and Esquimalt.

- Main #3 is primarily a 990 mm-diameter (39”) steel pipe that supplies water from the Humpback PRV and terminates at the CRD’s Mt. Tolmie Reservoir. There are several sections in this line that include 1,220 mm-diameter (48”) and 810 mm-diameter (32”) pipes. The 810 mm-diameter pipe terminates at the Oak Bay meter vault. This supply main is 21.3 km in length and provides water to the Westshore communities, Saanich, Victoria and Oak Bay.

- Main #4, a high-pressure transmission main, is primarily a 1,220 mm-diameter (48”) welded steel pipe that supplies water from the Goldstream Water Treatment Plant primarily to Saanich and the Saanich Peninsula. There are two small sections of 1,320 mm (52”) and 1,372 mm (54”) reinforced concrete pipe. This transmission main is 26.2 km in length and terminates near the Saanich-Central Saanich boundary, where it transfers water to the 762 mm (30”) trunk main, which extends to McTavish Reservoir. It supplies the municipalities on the Saanich Peninsula and to Bear Hill Reservoir and Hamsterly pump station, near Elk Lake.

- Main #5 is a 1,524 mm-diameter (60”) pipe that connects the Kapoor Tunnel via the Goldstream Water Treatment Plant to the Humpback PRV just below the old Humpback Reservoir dam. It is approximately 1.6 km in length and provides water to mains #1 and #3.

- Main #7 is a 610 mm-diameter (24”) steel pipe that runs from Goldstream and Whitehead Road to Metchosin and Duke Road. It is 4 km in length and provides water to portions of Colwood, Langford and Metchosin.

- Main #8 is a 457 mm-diameter (18”) steel and asbestos cement pipe that runs from Glen Lake School, primarily along Happy Valley Road to Happy Valley and Glenforest. It is 3.6 km in length and provides water to Langford, Colwood and Metchosin.

There are three active inter-connections between the high-pressure Main #4 and the low pressure mains #1 and #3, where water can be transferred from Main #4 to the other two mains via PRV stations. These stations are located at Watkiss Way, Millstream at Atkins, at Goldstream/Veteran's Memorial Parkway, and Burnside at Wilkinson Road. There is also a series of inter-connections between mains #1 and #3, with the major inter-connections being at Price, Station, Tillicum and Dupplin roads.

2.3.2 Saanich Peninsula Trunk Water Distribution System

The Saanich Peninsula Trunk Water Distribution System receives water at two points on the Saanich Peninsula from the Regional Transmission System and supplies it to four customers on the Saanich Peninsula: the municipalities of Central Saanich, North Saanich, Sidney and the Agricultural Research Station. Several First Nations distribution systems are supplied via a short proxy-connection by either the Central Saanich or North Saanich municipality.

The Saanich Peninsula Trunk Water Distribution System is comprised of 46 km of transmission mains, including the 762 mm (30") Bear Hill Main, the 400 mm (16") Martindale Main, the 300 to 400 mm (12"-16") Dean Park Main and the 250-500 mm (10-20") Saanich Peninsula mains.

The McTavish Reservoir is the terminus of the Regional Transmission System and Main #4, a 610 mm-diameter (24") concrete cylinder pipe). The Saanich Peninsula Trunk Water Distribution System begins with pipes from or bypassing McTavish Reservoir, which then continue further along the peninsula. In the vicinity of the airport at Mills Road, the main from McTavish Reservoir reduces from a 500 mm (20") to a 406 mm-diameter (16") asbestos cement pipe that terminates at the Deep Cove pump house. A dedicated 300 mm-diameter (12") ductile iron (DI) supply main from Deep Cove pump station transitions at the end of Hillgrove Road to 250 perm/PVC pipe just before it connects with Cloake Hill Reservoir. A 457 mm-diameter (18") AC pipe along Mills Road connects the trunk main to the northwest end of the Sidney Distribution System.

The CRD also operates five major pumping stations located at Hamsterly, Lowe Road, Dean Park Lower, Dean Park Middle and Deep Cove, along with one minor pumping station located at Dawson Upper Reservoir, that are all considered part of the transmission system.

2.3.3 Sooke Supply Main

The Sooke Drinking Water Service Area is supplied by Main #15, a 600 mm pipe (upper section, PVC; lower high-pressure section, ductile iron) that conveys raw water from Sooke Lake Reservoir to the Sooke River Road Water Treatment Plant. Main #15 feeds directly into the Sooke Distribution System downstream of the water treatment plant.

2.3.4 Supply Storage Reservoirs

A number of supply storage reservoirs are considered part of the transmission system, even though most of them technically operate as a distribution reservoir with all of its typical functions: balancing, fire and emergency storage.

The only CRD-owned and operated transmission system storage reservoir in the Regional Transmission System is:

- Mt. Tolmie Reservoir, a two-cell concrete in-ground reservoir, 27,300 m^3 (6 M gallon), located on Mt. Tolmie, at the terminus of Main #3 near the Oak Bay-Saanich boundary.

Haliburton Reservoir, a one-cell concrete in-ground reservoir, 22,700 m^3 (5M gallon), located off Haliburton Road in Saanich, has been disconnected from the system (off Main #4) and is empty. It is anticipated that this reservoir will not be used for drinking water purposes again.

The CRD-owned and operated transmission system storage reservoirs in the Saanich Peninsula Trunk Water Distribution System are:

- Bear Hill Reservoir, a two-cell concrete above-ground reservoir, 4,546 m^3 (1M gallon), located on Bear Hill in Saanich.

- Cloake Hill Reservoir, a one-cell, 4,546 m^3 (1M gallon) reservoir located on Cloake Hill in North Saanich.

- Dawson Upper Reservoir, a one-cell, 455 m^3 (100,000 gallon) reservoir located off Benvenuto Avenue in Central Saanich.

- Dean Park Lower Reservoir, a two-cell concrete above-ground reservoir, 4,546 m^3 (1M gallon), located beside Dean Park Road in North Saanich.

- Dean Park Middle Reservoir, two cylindrical concrete above-ground tanks, 2,730 m^3 (600,000 gallon), located near the bottom of Dean Park in North Saanich.

- Dean Park Upper Reservoir, a two-cell concrete partly in-ground reservoir, 4,546 m^3 (1M gallon), located near the top end of Dean Park in North Saanich.

- McTavish Reservoir, a two-cell concrete in-ground reservoir, 6,820 m^3 (1.5M gallon), located on the south side of McTavish Road in North Saanich.

2.4 Distribution Systems

The GVDWS contains eight individual distribution systems. Six distribution systems are separately owned and operated by the municipalities of Central Saanich, North Saanich, Oak Bay, Saanich, Sidney and Victoria. Victoria owns and operates the distribution system in Esquimalt. Two distribution systems are owned by the CRD and operated by the CRD Integrated Water Services Department. These latter two systems include the combined distribution system in the Westshore communities of Langford, Colwood, Metchosin, View Royal and a small portion of the Highlands, and a separate system supplying water to Sooke and parts of East Sooke. Each distribution system owner/operator is defined as a water supplier and is responsible for providing safe water to their individual customers and meeting all the requirements under the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation*.

2.4.1 Juan de Fuca Water Distribution System – CRD

In 2022, water was supplied to the Juan de Fuca Water Distribution System primarily from mains #1 and #3. In this report, the Juan de Fuca Water Distribution System does not include Sooke. For Sooke/East Sooke, see section 2.4.2 Sooke/East Sooke Distribution system below. Parts of Langford and View Royal were supplied from Main #4. The development at Bear Mountain in Langford was supplied by Main #4. The Westhills development, serviced by its own privately-operated distribution system, was supplied via mains #1 and #3. In the Juan de Fuca Water Distribution System, water flowed generally in a northerly and southerly direction away from the supply mains. The federal William Head Institution and the Beecher Bay meter vault are located at the southern extremities of this system.

The Juan de Fuca Water Distribution System includes the following distribution reservoirs:

- Bear Mountain Reservoir #1, a two-cell, 1,250 m^3 (275,000 gallon) reservoir located on the lower slopes of the Bear Mountain development in Langford.

- Deer Park Reservoir, a one-cell, 1,657 m^3 (365,000 gallon) reservoir located downstream of Rocky Point Reservoir re-chloramination station near the extremity of the water system off of Deer Park Trail in Metchosin (new in 2022).

- Fulton Reservoir, a two-cell, 4,580 m^3 (1,007,459 gallon) reservoir located at the end of Fulton Road in Colwood.

- Peacock Reservoir, a two-cell, 583.8 m^3 (128,420 gallon) reservoir located north of the Trans-Canada Highway off of Peacock Place in Langford.

- Rocky Point Reservoir, a three-cell, 546 m^3 (120,000 gallon) reservoir located near the end of Rocky Point Road in Metchosin.

- Skirt Mountain Reservoir, a three-cell, 6,525 m^3 (1,435,300 gallon) reservoir located near the top of Skirt Mountain in the Bear Mountain development in Langford.

- Stirrup Place Reservoir, a two-cell, 242 m^3 (53,300 gallon) reservoir located off of Stirrup Place Road in Metchosin.

- Walfred Reservoir, a three-cell, 560 m^3 (123,180 gallon) reservoir located on Triangle Mountain in Colwood.

2.4.2 Sooke/East Sooke Distribution System – CRD

The Sooke/East Sooke Distribution System begins downstream of the Sooke River Road Water Treatment Plant, at the end of Main #15 on Sooke River Road, where the ammonia storage and metering building is located. The primary water supply main to the community follows Sooke River Road downstream and splits at Milne's Landing going east toward Saseenos and west toward the central area of Sooke. Two underwater pipelines across Sooke Basin supply East Sooke. Sunriver Estates came on-line in 2006 and is serviced by a 300 mm (12") pipeline on Phillips Road and the two-cell concrete Sunriver Reservoir. In 2020, the water main along West Coast Road was extended to connect the formerly self-sufficient Kemp Lake Waterworks District to the Sooke/East Sooke Distribution System. At this most western extremity of the Sooke/East Sooke Distribution system, the CRD now supplies bulk water to the Kemp Lake District. The CRD infrastructure ends with a meter station on West Coast Road before a Kemp Lake District-owned and operated pump station supplies their distribution system.

The Sooke/East Sooke Distribution System includes the following distribution reservoirs:

- Coppermine Reservoir, a one-cell concrete partly in-ground reservoir, 455 m^3 (100,000 gallon), located off of Coppermine Road in East Sooke.

- Helgesen Reservoir, a four-cell concrete partly in-ground reservoir, 6,973 m^3 (1,533,850 gallon), located at the west end of Helgesen Road in Sooke.

- Henlyn Reservoir, a one-cell steel tank tower, 224 m^3 (49,270 gallon), located off of Henlyn Drive in Sooke.

- Silver Spray Reservoir, a two-cell cylindrical concrete tank, 841 m^3 (185,000 gallon), located off of Silver Spray Drive in East Sooke.

- Sunriver Reservoir, a two-cell concrete above-ground reservoir, 1,800 m^3 (395,944 gallon) plus a single cell 1,355 m^3 (300,000 gallon) steel tank (new in 2022), located off of Sunriver Way in Sooke.

2.4.3 Central Saanich Distribution System – District of Central Saanich

In 2022, drinking water was supplied to the Central Saanich Distribution System via 10 pressure zones (seven off the Bear Hill main and three off the Martindale Valley main). The Bear Hill main supplied the Tanner Ridge area by direct feed, the central area in one pressure zone through three PRVs, the Saanichton area in two pressure zones through two PRVs, the Brentwood Bay area, and the Tsartlip First Nation through a PRV. Five smaller pressure zones served the rest of Central Saanich. Dawson Upper

Reservoir (CRD-owned and operated) supplied a small area of higher elevation residences in Brentwood Bay. Martindale metering station supplied an agricultural area in the southeast corner of the municipality. The Island View Road area was supplied by the Lochside metering station. The Mount Newton metering station provided water to the northeast corner and to the Tsawout First Nation lands. A municipally-owned pump station on Oldfield Road serviced a small area in the southwest corner.

Bear Hill Reservoir (CRD-owned and operated) has the largest service population in Central Saanich, providing approximately 80% of the Central Saanich's water. It is the primary supply to most of Central Saanich (south of Haldon Road), including Brentwood Bay.

The Central Saanich Distribution System has technically no balancing, fire or emergency storage, but relies on the CRD transmission system infrastructure to provide this. One CRD-owned reservoir (Dawson Upper) in Central Saanich, that is considered part of the transmission system, functions as a distribution reservoir for the Central Saanich Distribution System.

2.4.4 North Saanich Distribution System – District of North Saanich

In 2022, drinking water was supplied to the North Saanich Distribution System from a number of points along the Saanich Peninsula Trunk Water Distribution System. This included Dean Park via the Lowe Road pump station, Dean Park pump stations and Dean Park Reservoirs (all CRD-owned and operated), Deep Cove/Lands End area via connections upstream of the Deep Cove pump station, Cloake Hill Reservoir via Deep Cove pump station (all CRD-owned and operated), and Swartz Bay. In the North Saanich Distribution System, Cloake Hill Reservoir (CRD-owned and operated) was the largest pressure zone. Water flowed generally in an easterly direction through the Dean Park pressure zone, northwest into the Deep Cove/Lands End area and northeast to the Swartz Bay area. Dean Park Upper Reservoir (CRD-owned and operated) supplied a small portion of the Dean Park Estates.

The North Saanich Distribution System has technically no balancing, fire or emergency storage, but relies on CRD transmission system infrastructure to provide this. Several CRD-owned reservoirs in North Saanich, that are considered part of the transmission system, function as distribution reservoirs for the North Saanich Distribution System.

North Saanich provides water to the Greater Victoria Airport Authority via the water main on the south side and the east side of the airport. As water quality in the airport distribution system falls under federal jurisdiction, it was not monitored by the CRD in 2022 and is, therefore, not included in this report.

2.4.5 Oak Bay Distribution System – District of Oak Bay

In 2022, drinking water was supplied to the Oak Bay Distribution System at Lansdowne and Foul Bay roads from Main #3. The water flowed in a west to east direction across Lansdowne with north and south branches. Oak Bay conveys water via a 406 mm main, which crosses Oak Bay diagonally from northwest to southeast. Water was distributed from the north end to the south end via the 406 mm main. Oak Bay has an outer loop flow on Beach Drive to the Victoria boundary. The Oak Bay Distribution System has no balancing, fire or emergency storage and the CRD transmission system infrastructure has limited provisions for this.

Oak Bay used four local pressure zones supplied by booster pumps. Sylvan Lane pump station supplied the Barkley-Sylvan area; Plymouth supplied the north Henderson area; Foul Bay supplied the south Henderson area; and Uplands pump station (seasonal) supplied the Uplands area. There are two inter-connections with the Victoria/Esquimalt Distribution System, which are normally closed, but can be used in emergencies.

2.4.6 Saanich Distribution System – District of Saanich

In 2022, drinking water was supplied to the Saanich Distribution System at a number of points from the CRD's transmission mains. Water was supplied from Main #1 at Dupplin, Wilkinson and Marigold, Holland/Burnside, and Admirals/Burnside; from Main #3 at Douglas, Tillicum, Admirals, Shelbourne, Richmond, Foul Bay, Mt. Tolmie and Maplewood pump house; and from Main #4 at Burnside, Blue Ridge,

Roy Road, Markham, Layritz, Cherry Tree Bend and Sayward. In the Saanich Distribution System, water flowed generally in a northerly direction from mains #1 and #3 and both east and west from Main #4.

There are four major pumping systems in the Saanich Distribution System. Maplewood pumps water north from Main #3, ending in the Gordon Head area. Cherry Tree Bend pumps from Main #4 to Wesley Reservoir and the west central high elevation area. The Mt. Tolmie/Plymouth pump station pumps water from Main #3 and the CRD Mt. Tolmie Reservoir to Saanich's Mt. Tolmie Reservoir and the Gordon Head area via a 610 mm-diameter (24") main.

Water from Sayward supplies the north end of the Saanich Distribution System via Main #4 with a southerly flow through Cordova Bay. Saanich also has a number of other small pressure zones controlled by pump stations.

The Saanich Distribution System includes some storage for balancing, fire and emergency purposes. The following distribution reservoirs are owned and operated by Saanich:

- Hartland Reservoir, a one-cell, 769 m^3 (170,000 gallon) reservoir located on Hartland Road in Saanich. This new one-cell steel tank reservoir was constructed in 2020 to replace the smaller old reservoir.

- Mt. Tolmie Reservoir (Saanich), a one-cell, 4,545 m^3 (1M gallon) reservoir located on the east side of the summit of Mt. Tolmie near Cromwell Reservoir in Saanich.

- Rithet Reservoir, a one-cell, 16,807 m^3 (3.7M gallon) reservoir located at the end of Perez Drive in Broadmead in Saanich.

- Wesley Reservoir, a two-cell, 3,182 m^3 (700,000 gallon) reservoir located at the end of Wesley Road on Haliburton Ridge in Saanich.

2.4.7 Sidney Distribution System – Township of Sidney

In 2022, drinking water was supplied to the northern portion of the Sidney Distribution System from the 457 mm CRD transmission main on Mills Road from upstream of the Deep Cove pump station. The southern portion of the distribution system is supplied from a 300 to 400 mm ductile iron main that is connected to the CRD transmission system and McTavish Reservoir. Within the Sidney Distribution System, water flowed generally from the west via Mills Road and from the south via McTavish Reservoir and met in the middle of the distribution system, with approximately 60% of the water coming from the Mills Road supply.

The Sidney Distribution System has no balancing, fire or emergency storage, but rather relies on the CRD transmission system infrastructure to provide this.

2.4.8 Victoria/Esquimalt Distribution System – City of Victoria/Township of Esquimalt

Note: The City of Victoria also owns and operates the Water Distribution System in the Township of Esquimalt.

In 2022, drinking water was supplied to the Victoria/Esquimalt Distribution System from mains #1 and #2 at David Street/Gorge Street and David Street/Rock Bay Avenue. From these supply points, the system divides into several smaller looped water mains within the distribution system. Water was also supplied to Victoria from Main #3 at Cook Street/Mallek Crescent, Somerset Street/Tolmie Avenue, Douglas Street/Tolmie Avenue and Shelbourne/North Dairy. In general, water flows from a north to south direction.

Water was supplied at multiple locations to Vic West and Esquimalt from Main #2. These locations include Tyee Road/Bay Street, Burleith Crescent/Craigflower Road, Garthland Road/Craigflower Road and Admirals Road/Maple Bank Road.

The Victoria/Esquimalt Distribution System has no balancing, fire or emergency storage and the CRD transmission system infrastructure has limited provisions for this.

3.0 MULTIPLE BARRIER APPROACH TO WATER QUALITY

The CRD and the municipalities that operate their distribution systems use a multiple barrier approach to prevent the drinking water in the GVDWS from becoming contaminated. Multiple barriers can include procedures, operations, processes and physical components. In a drinking water system, any individual contamination barrier used in isolation has an inherent risk of failure and may result in contamination of the drinking water. However, if a number of individual barriers are used together in combination with each other and, especially if they are arranged so that they complement each other, these multiple barriers are a very powerful means of preventing drinking water contamination. All CRD-owned and operated, and most other large drinking water utilities, use the multiple barrier approach to prevent drinking water contamination. The exact types and applications of barriers are unique for each system, to address the system-specific risks.

The following barriers are used in the GVDWS to prevent the drinking water from becoming contaminated:

1. **Good Water System Design**. Good water system design is one of the preeminent barriers to drinking water contamination, as it allows all of the other components within the water system to operate in an optimal fashion and does not contribute to the deterioration of the quality of the drinking water contained within the system. Good water system design includes such aspects as: drinking water treatment plants that are easy to operate; piping appropriately sized to the number of users being supplied; and the use of appropriate pipe materials. All new designs are designed by qualified professionals registered in BC, reviewed and approved by qualified CRD or municipal staff, and approved and permitted by a Public Health Engineer from the Island Health Authority. This acts as a multiple check on good system design.

2. **Source Water Protection**. The CRD uses what is considered the ultimate source water protection: ownership of the catchment (watershed) lands surrounding the source reservoirs. This land area is called the Greater Victoria Drinking Water Supply Area. Within this area, no public access, commercial logging, farming, mining or recreation is permitted, and no use of herbicides, pesticides or fertilizers is allowed. This source water protection barrier eliminates many of the organic and inorganic chemicals that can contaminate the source water and virtually eliminates the potential for human disease agents being present. Very few drinking water utilities in Canada and the United States can claim this type of protection. In addition, the CRD Watershed Protection Division operates a complete and comprehensive watershed management program that provides additional protection to the quality of Greater Victoria's source water.

3. **Water Disinfection**. The GVDWS is an unfiltered drinking water system that continues to meet the provincial, as well as the stringent United States Environmental Protection Agency (USEPA) criteria, to remain an unfiltered surface water supply. The treatment process consists of primary disinfection (ultraviolet light and free chlorine) of the raw source water entering the treatment plant, and secondary disinfection (chloramination) that provides a disinfectant residual throughout the transmission and distribution systems. Although the water treatment barrier used in Greater Victoria is not as rigorous as that provided by most drinking water utilities using a surface water supply, the microbiological quality of the source water is exceptionally good and the chief medical health officer for Island Health has approved this treatment process as providing safe drinking water for the public.

4. **Distribution System Maintenance**. All water suppliers in the GVDWS provide good distribution system maintenance, including activities such as annual water main flushing, hydrant maintenance, valve exercising, leak detection, and reservoir cleaning and disinfection. This barrier helps to promote good water quality within the distribution systems.

5. **Infrastructure Replacement**. The timely replacement of aging water system infrastructure is an important mechanism to prevent the deterioration of water quality in the pipes and provides a continual renewal of the water system. The CRD's water infrastructure replacement program is informed by its asset management system thereby ensuring that critical components are replaced before their end of service life.

6. **Well Trained and Experienced Staff**. All water system operators must receive regular training and be certified to operate water system components. In addition, the laboratory staff cannot analyze drinking water samples in accordance with the *BC Drinking Water Protection Regulation* unless the laboratory has been inspected by representatives of the BC Ministry of Health and issued an operating certificate. CRD and municipal staff meet these requirements.

7. **Cross Connection Control**. Cross connection control provides a barrier to contamination by assisting in the detection of conditions that have the potential to introduce contaminants into the drinking water from another type of system. Therefore, in cooperation with the other water suppliers, in 2005, the CRD implemented a regional Cross Connection Control Program throughout the GVDWS. 2008 saw the implementation of the first CRD Cross Connection Control Bylaw for the GVDWS. This bylaw was reviewed and updated last in 2019 to its current form as CRD Bylaw 4340.

8. **Water Quality Monitoring**. Rigorous water quality monitoring can be considered a barrier not only because it verifies the satisfactory operation of other barriers and detects contaminations quickly, but comprehensive monitoring data may also allow water suppliers to see trends and react proactively, before a contamination occurs. The CRD has designed and executes a comprehensive water quality monitoring program for the GVDWS that collects daily bacteriological samples across the entire region for compliance purpose (on CRD water infrastructure and in the municipal water distribution systems). This CRD monitoring program tests for water quality parameters beyond the legislated requirements to verify good drinking water quality in the GVDWS.

4.0 WATER QUALITY REGULATIONS

The CRD and the municipal water suppliers in the GVDWS must comply with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation*. The regulation stipulates the following water quality and sampling criteria for water supply systems:

- No detectable *Escherichia coli (E.coli)* per 100 mL
- At least 90% of samples have no detectable total coliform bacteria per 100 mL and no sample has more than 10 total coliform bacteria per 100 mL
- 5,000-90,000 population served: one sample per month per 1,000 population served
- >90,000 population served: 90 + 1 samples per month per 10,000 in excess of 90,000 population served

In addition to the aforementioned water quality monitoring criteria by the *Drinking Water Protection Regulation*, as due diligence to ensure public safety and maintain public trust, the CRD Water Quality Monitoring Program also uses the much larger group of water quality parameters listed in the current version of the *Guidelines for Canadian Drinking Water Quality* (the Canadian guidelines) for compliance purposes. These limits are provided in Appendix A, tables 1 to 5, under the column titled 'Canadian Guidelines'. The water quality limits in the Canadian guidelines[1] fall into one of the following five categories:

1. **Maximum Acceptable Concentration**. This is a health-related limit and lists the maximum acceptable concentration (MAC) of a substance that is known or suspected to cause adverse effects on health. Thus, an exceedance of a MAC can be quite serious and requires immediate action by the water supplier.

2. **Aesthetic Objectives**. These limits apply to certain substances or characteristics of drinking water that can affect its acceptance by consumers or interfere with treatment practices for supplying good quality drinking water. These limits are generally not health related, unless the substance is well above the aesthetic objectives (AO).

3. **Parameters without Guidelines**. Some chemical and physical substances have been identified as not requiring a numerical guideline because data currently available indicate that it poses no health risk or aesthetic problem at the levels currently found in drinking water in Canada. These substances are listed as 'No Guideline Required' in Appendix A, tables 1 to 5.

4. **Archived Parameters**. Guidelines are archived for parameters that are no longer found in Canadian drinking water supplies at levels that could pose a risk to human health, including pesticides that are no longer registered for use in Canada, and for mixtures of contaminants that are addressed individually. Some of these parameters are still being included in the current water quality monitoring program because the analytical laboratory includes them in their scans. These parameters are listed as 'Guideline Archived' in Appendix A, tables 1 to 5.

5. **Operational Guidance**. The limit was established based on operational considerations and listed as an operational guidance value. For example, the limit for aluminum is designed to apply only to drinking water treatment plants using aluminum-based coagulants.

It should be noted that not all of the water quality parameters analyzed by the CRD Water Quality Monitoring Program have the Canadian guidelines' limits, since some of these parameters are used for operational purposes. Where the Canadian guidelines are silent for a particular parameter, the limit for that parameter is left blank in Appendix A, Tables 1 to 5.

[1] (see: https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html)

In addition to the Canadian provincial regulations and federal guidelines, on a voluntary basis, the CRD also complies with most of the USEPA rules and regulations. Some of the limits in the USEPA rules are used as the basis for the CRD's water treatment goals.

The GVDWS, as an unfiltered surface water system, must meet the provincial Drinking Water Treatment Objectives for Surface Water Supplies in BC, which includes similar criteria as the conditions for filtration exemption in the Canadian guidelines. In summary, the applicable criteria are:

- 4-log inactivation of viruses (met with chlorination)
- 3-log removal or inactivation of parasites (*Giardia* and *Cryptosporidium*) (met with UV disinfection)
- Two forms of disinfection (UV and chlorination)
- Water entering disinfection facilities has average daily turbidity <1 nephelometric turbidity unit (NTU) and not more than two days/year with an average daily turbidity of >5 NTU
- No *E. coli* or total coliform in treated water
- A watershed control program to minimize fecal, parasite and viral contamination of source water (in place)
- Detectable disinfectant residual in distribution system
- *E. coli* in source water ≤20 CFU/100 mL

5.0 OPERATIONAL CHANGES AND EVENTS – CRD SYSTEMS

5.1 Use of Goldstream Water

In 2022, the Goldstream Supply System was not used at all. A Kapoor Tunnel inspection project, necessitating a switch to the Goldstream Supply System, was scheduled for early December but had to be cancelled due to adverse weather conditions that could have resulted in increased turbidity in the raw water supply. It is anticipated that the Kapoor Tunnel inspection project will be delayed until the fall of 2023 and the Goldstream System will only be used for emergency purposes until then.

5.2 Weather Conditions

Figure 1 shows the Sooke Lake Reservoir water levels in 2022 compared to previous years. As has been typical for most years prior to 2022, the reservoir was already at full capacity at the beginning of January. But it remained 100% full until May 10, which is approximately a month later than in previous years. With unusually wet and cool weather until early July, the reservoir level only receded to 95% capacity at that time, which is approximately 1 m higher than in prior years. With drier and warmer weather after that, the reservoir levels continuously receded throughout the summer and fall and into December. The typical fall rains in October and November did not materialize in 2022 and it was not until the middle of December 2022 when the reservoir recharge began, driven by a mix of rainfall and snowmelt. On December 31, the reservoir was still only at 83% capacity, the fifth lowest year-end level since the dam was raised in 2003.

Both extreme weather events in 2022, first the unusually cold and wet spring and early summer, and then the prolonged drought in the fall did not have any measurable adverse water quality impacts on Sooke Lake Reservoir. The prolonged high water temperatures in the fall caused chlorine residual levels in some areas in the Juan de Fuca Water Distribution system (Rocky Point to Beecher Bay) to drop to very low levels, and CRD operators conducted extra main flushing and investigations.

While heavy snowfall combined with freezing temperatures just before the holiday season at the end of December brought operational challenges through frozen pipes and inaccessibility of facilities, the source water quality in Sooke Lake Reservoir and the treated drinking water quality was not measurably affected by the weather event.

5.3 Chlorine Dosage

In 2022, the CRD Integrated Water Services Department did make some minor adjustments to the chlorine dosage rate at both plants, based on daily or weekly monitoring results. The objective for the chlorine dosage has been to dose sufficiently for adequate primary and secondary disinfection, while minimizing the amount of chemicals added. Critical for proper primary disinfection is achieving the required CT (Concentration x Contact Time), which was consistently achieved in 2022 at both plants. Critical for adequate secondary disinfection is achieving a high ratio of Total Chlorine/Monochloramine. The new hypochlorite plant at the Goldstream Water Treatment Plant consistently achieved ratios of 90%. The Sooke River Road Water Treatment Plant generally achieved ratios of 85-95%.

5.4 CRD Reservoir Maintenance

CRD water system operators have followed the reservoir cleaning schedule developed through the reservoir review project led by the CRD Water Quality Operations Section. This schedule is based on a thorough water quality data review for each CRD-owned and operated transmission or distribution reservoir and is regularly updated based on new data and information. Following this cleaning schedule has resulted in improved water quality conditions and operational efficiencies in a number of reservoirs.

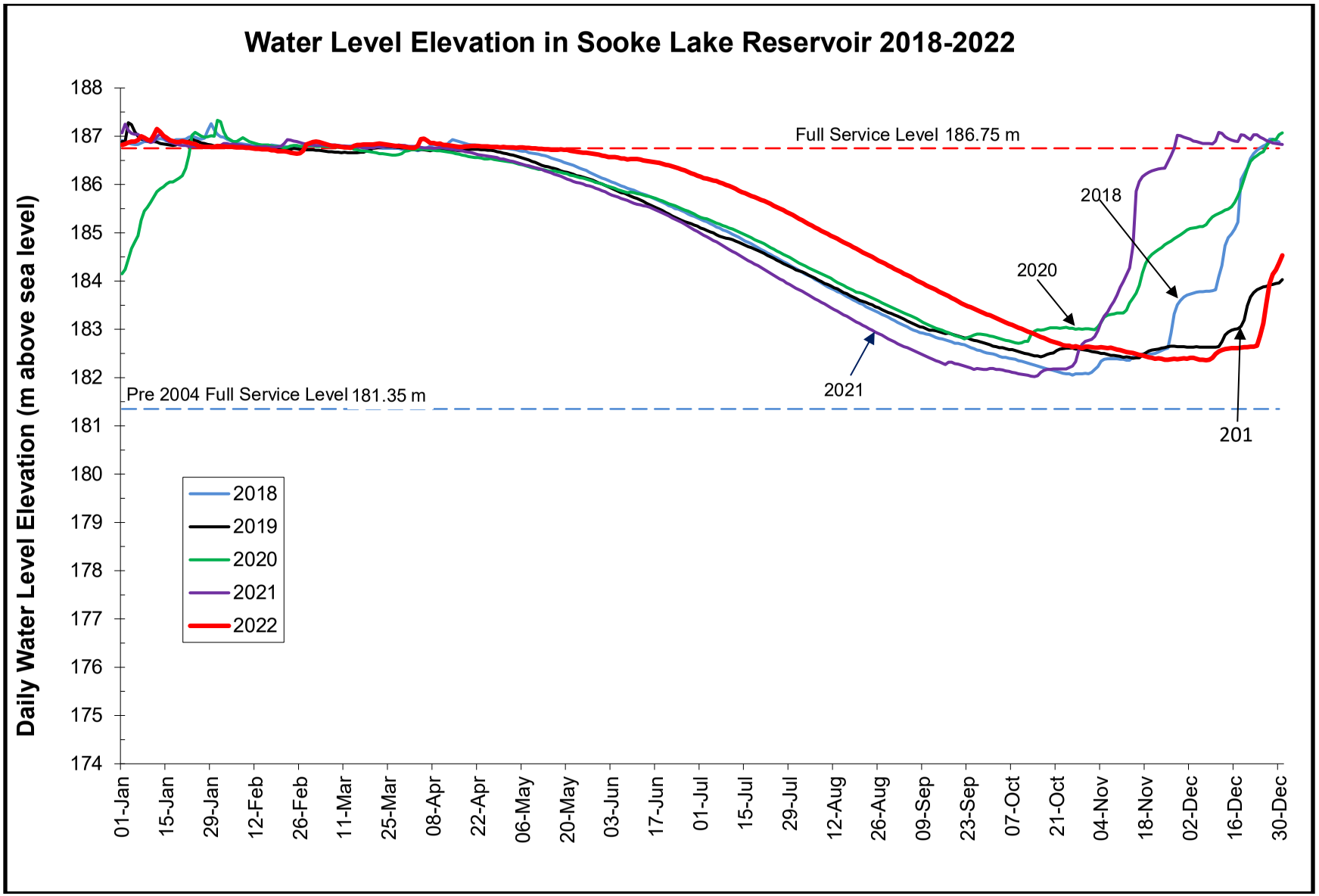

Figure 1 Water Level Elevation in Sooke Lake Reservoir 2018-2022

6.0 WATER QUALITY MONITORING

The Water Quality Program, as delivered by the Water Quality Operations, the Cross Connection Control, and the Laboratory Services sections (all within the CRD Parks & Environmental Services Department), is responsible for the collection, analysis and reporting of water quality information in all CRD-owned and operated portions of the GVDWS from the source reservoirs to the point of delivery (typically the water meter) to each consumer. While the municipal water suppliers are responsible for water quality and any potential corrective measures within their particular distribution system, CRD staff provide water sampling and testing for regulatory compliance monitoring to these municipalities.

The CRD Water Quality Program has dedicated professional staff who are trained to collect water samples from source water and treated water sampling locations across the region, as well as technical staff trained to analyze and interpret water quality data in support of operational decisions. The CRD Water Quality Laboratory is certified for a number of water quality test methods and is staffed with highly-trained laboratory technicians. The CRD Aquatic Ecology Laboratory has professional staff specialized to analyze phyto- and zooplankton in lake water, periphyton communities in lakes and streams, to test for cyanotoxins and understand the source water limnology. The Cross Connection Control Section includes certified plumbing and cross connection control inspectors, as well as staff trained to process data in order to administer the requirements of the BC Building Code and the CRD Cross Connection Bylaw No. 3516.

6.1 CRD Water Quality Monitoring Program

The CRD Water Quality Monitoring Program consists of the following three components that provide direction for the collection and analysis of water quality samples from the water systems:

- **Compliance Monitoring:** The goal of the compliance monitoring is to ensure that water quality from source to consumer meets the relevant drinking water regulations and guidelines. The Island Health Authority, as the provincial regulator, has issued the CRD two operating permits (for CRD water infrastructure in the Goldstream Service Area and in the Sooke Drinking Water Service Area). These operating permits require, in addition to the water quality and sampling criteria, as per the *Drinking Water Protection Regulation*, continuous monitoring of turbidity. The CRD Water Quality Operations Section, therefore, conducts bacteriological monitoring on the raw water entering the treatment plants, treated water after leaving the plants, at the first customer sampling locations, sampling locations on the large transmission mains and sampling locations in the CRD-owned distribution systems, including distribution reservoirs. Bacteriological samples are collected at a frequency that meets the regulatory requirements and provides a consistent and day-to-day system-wide water quality oversight. Continuous turbidity monitoring, as per operating permits, is accomplished by on-line turbidity meters (monitored via Supervisory Control and Data Acquisition) at each water treatment plant (at each plant: two analyzers in line to provide redundancy). Part of the compliance monitoring program are the services provided by the CRD to the municipal water suppliers where CRD staff collect and analyze bacteriological samples from inside the municipal water distribution systems, report monthly results on the CRD website and include the results and findings in this annual report.

  The Island Health Authority has granted the GVDWS an exemption from filtration treatment, the conventional water treatment requirement for surface water source users in BC, based on the evidence of year-round high source water quality. However, it expected that the CRD closely monitors a number of water quality parameters, in addition to the criteria listed in the regulations and in the operating permits. As a result, the CRD has included in its compliance monitoring program a number of water quality parameters that are regularly tested on the raw, as well as on the treated water to verify compliance with the Canadian guidelines and USEPA rules and regulations. Such parameters in the raw water include parasites, organic and inorganic compounds, including metals and various water chemistry and physical parameters. On the treated water, these include disinfection byproducts, metals and water chemistry and physical parameters that are used to verify good drinking water quality.

- **Aquatic Ecology Monitoring:** The goal of the aquatic ecology monitoring is to understand and document the components that affect or may affect the natural cycles of the source streams and reservoirs. The source reservoirs and streams in the Greater Victoria Water Supply Area (see Map 1) are monitored according to the recommendations by the CRD Aquatic Ecology Section, as there are no legislated requirements for either sampling frequency or parameter selection for these water bodies. It is, however, important for the CRD, as the supplier of unfiltered surface water, to have a comprehensive understanding of the natural processes taking place in the source waters and potential implications for the drinking water quality in the GVDWS. Depending on the season, the source lakes and their tributaries are sampled at a frequency ranging from quarterly to weekly for parameters, such as algal species, distribution and concentrations, zooplankton species and concentrations, chlorophyll-a concentrations and nutrient concentrations. Additional samples may be collected based on risk management decisions, for instance, as a response to severe weather conditions or unusual observations.

- **Operational Water Quality Monitoring:** The CRD Water Quality Monitoring Program provides an audit function on all water quality-related aspects of the GVDWS, including performance monitoring of the treatment plants and distribution system. Specific sampling and testing occurs to support operational decisions by the CRD and municipal system operators. Daily field tests of chloramine residual concentrations are conducted to verify the efficiency of the secondary disinfection region-wide. A number of qualitative (e.g., taste and odour) and quantitative tests [e.g., heterotrophic plate count (HPC), turbidity] are regularly performed on samples across the region to verify the need for specific system maintenance. The customer inquiry program is also part of this monitoring program component, as a water quality complaint or observation by the public can give clues to ongoing system issues or identify water quality risks in the system. Water samples are occasionally collected from taps within individual houses or facilities, in response to inquiries from customers about the quality of water being received at their address.

- **Drinking Water Safety Plan:** In 2018, the CRD Water Quality Operations Section developed a Drinking Water Safety Plan, following the principle of a method developed by the Alberta Ministry of Environment for all drinking water systems in Alberta. This plan is a comprehensive water quality risk assessment and registry in the GVDWS. Identified risks have been documented and are being tracked as the CRD Integrated Water Services Department addresses them. At the end of 2022, the Drinking Water Safety Plan included 23 High Risks and 171 Moderate Risks to water quality; 23 and 177 respectively in 2021, for comparison.

6.2 Sampling Plans

The efforts to collect the required number of samples for the CRD Water Quality Monitoring Program are organized in three distinct sampling plans:

1. The **Watershed Sampling Plan** manages the sampling frequency, schedule and parameter list for the source water lakes and tributaries and is based on an up-to-date risk to water quality assessment. Sooke Lake Reservoir is sampled from a boat at three dedicated lake sampling stations from weekly in the summer to bi-weekly in the winter (see Figure 2). Goldstream Reservoir is sampled monthly from a boat at two dedicated lake sampling stations. Tributary creeks to Sooke Lake Reservoir are sampled monthly near their mouths. Significant tributary lakes in the Sooke Lake watershed, as well as Butchart Lake and Japan Gulch Reservoir in the Goldstream System, are sampled quarterly by boat. The Leech watershed is currently sampled monthly in four different locations, following a more comprehensive sampling/testing project in 2019-2020.

2. The **Treatment Plant Sampling Plan** includes the daily samples collected at the Goldstream Water Treatment Plant and the two first customer locations (for mains #4 and #5), the weekly samples collected at the Sooke River Road Water Treatment Plant and the Sooke first customer location. This plan is designed to verify adequate treatment at both treatment plants and to detect unusual water quality conditions, before they spread across the systems.

4. The **Transmission and Distribution System Sampling Plan** is a designed sampling plan that manages sampling at approximately 220 permanent sampling stations across the GVDWS, including all municipal systems. These permanent sampling stations are installed on transmission mains, storage reservoirs, distribution mains, booster pump stations and meter or valve stations. The plan is designed to achieve an evenly distributed two-week rotation for most sampling stations, while providing a representative snapshot of the entire Goldstream Service Area on each business day. The Sooke Drinking Water Service Area is sampled once per week. Samples collected on the daily runs, as part of this plan, are primarily used for compliance monitoring, but also for operational purposes.

   When total coliform-positive bacteriological results are found in a CRD-owned system, CRD sampling staff resample those locations and, depending upon the situation, may direct CRD operators to flush the affected mains and/or drain and clean affected storage reservoirs. When total coliform-positive bacteriological results are found in a municipal system, the CRD sampling staff resample those locations and notify the municipal operators of the results. If a sample tests positive for *E.coli*, the Island Health Authority is notified immediately, and emergency response procedures are followed.

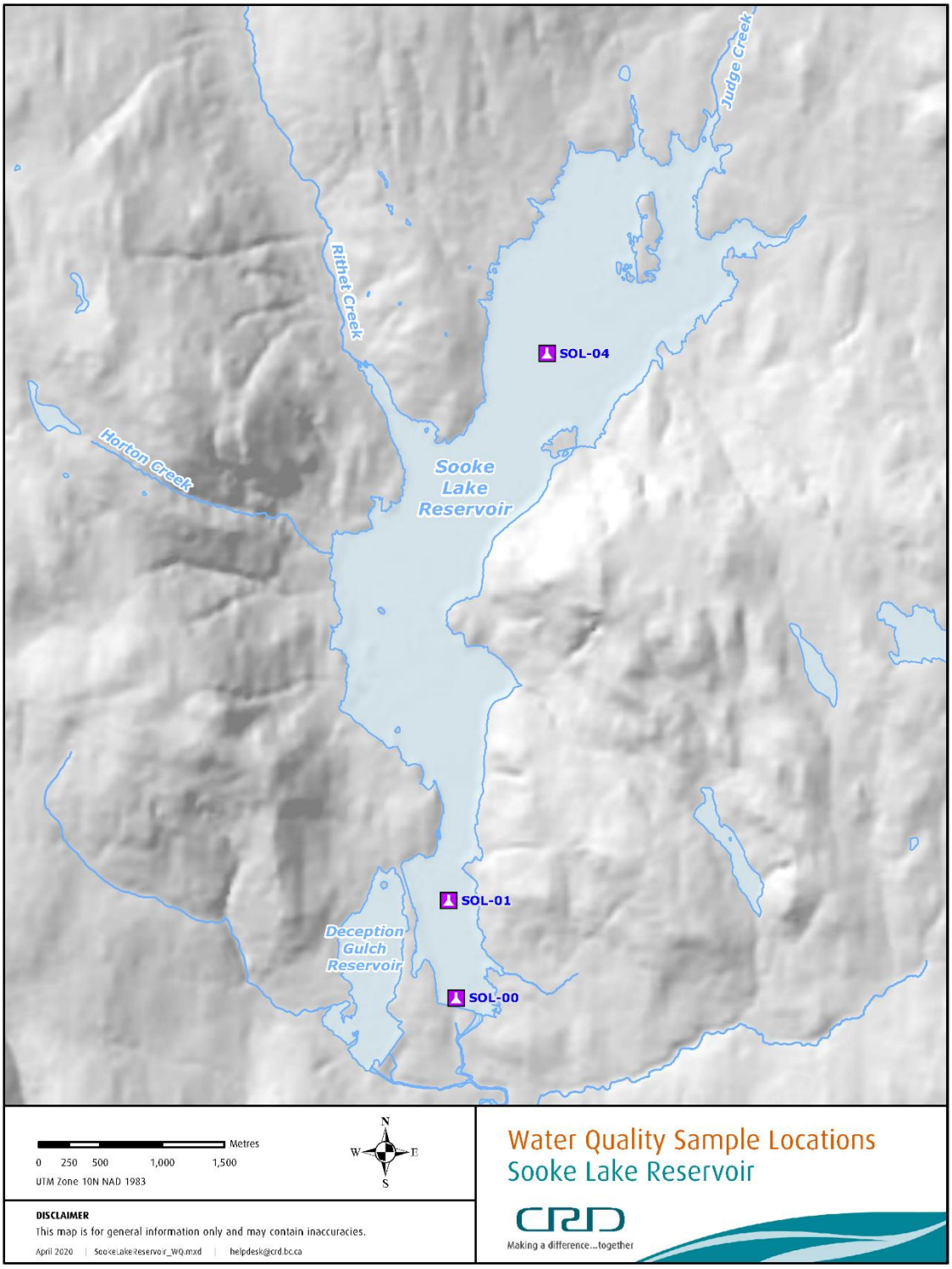

Figure 2 Sooke Lake Reservoir Water Sampling Stations

6.3 Bacteriological Analyses

A description of the bacteriological parameters used in the CRD Water Quality Monitoring Program, and the regulatory limits that were in place in 2022 for those parameters, are outlined below.

Total Coliform Bacteria

Total coliforms. Total coliforms are a group of bacteria found in high numbers in both human and animal intestinal (fecal) wastes and are found in water that has been contaminated with fecal material. Total coliform bacteria are also ubiquitous in the environment (water, soil, vegetation). Thus, in the absence of *E. coli*, the presence of total coliforms may indicate surface water infiltration or the presence of decaying organic matter. The total coliform bacteria group is used as an indicator for treatment adequacy and microbial conditions in drinking water systems because of its superior survival characteristics.

Test Method. In 2022, total coliform bacteria were analyzed at the CRD Water Quality Laboratory using the membrane filtration method and Chromocult Coliform Agar incubated at 36-38ºC for 21-24 hours. Test results were reported as colony-forming units (CFU) per 100 millilitres (mL) of water. Methods employing defined substrate technology rely on the fact that coliforms possess the enzyme β-galactosidase, which cleaves a chromogenic substrate, thus releasing a chromogen (coloured compound) that can be measured. In compliance with regulations, the CRD Water Quality Monitoring Program tests for total coliforms to ensure treatment efficacy and to monitor intrusion of organisms into the system post-treatment.

Regulatory Limits. Based on the requirements in the *Drinking Water Protection Regulation* and the *Guidelines for Canadian Drinking Water Quality*, the maximum acceptable concentration for the GVDWS is summarized as follows:

- *No sample should contain more than 10 total coliform organisms per 100 mL.*
- *No consecutive sample from the same site should show the presence of coliform organisms.*
- *Not more than 10% of the samples based on a minimum of 10 samples should show the presence of coliform organisms.*

Escherichia coli

***Escherichia coli* (*E. coli*)**. *E. coli* is the only member of the total coliform group found exclusively in the feces of human beings and warm-blooded animals. Although most members of this species are considered harmless, some strains of *E. coli* can be pathogenic. The presence of *E. coli* in water indicates recent fecal contamination and the possible presence of intestinal disease-causing bacteria, viruses and protozoa. The absence of *E. coli* in drinking water generally indicates that the water is free of intestinal disease-causing bacteria.

Test Method. In 2022, *E. coli* were analyzed by the CRD Water Quality Laboratory using the membrane filtration method and Chromocult Coliform Agar incubated at 36-38ºC for 21-24 hours. Test results were reported as CFU per 100 mL of water. The *E. coli* test measures bacteria possessing the enzymes β-galactosidase and β-glucuronidase.

Regulatory Limits. In disinfected drinking water, the maximum acceptable concentration of *E. coli* (both federal and provincial limits) is zero *E. coli* per 100 mL.

Heterotrophic Plate Count Bacteria

Heterotrophic Plate Count Bacteria. Heterotrophic plate count bacteria are used to monitor trends in water treatment and distribution systems. Under increasing nutrient conditions and/or a reduction in the concentration of chlorine residual, the heterotrophic bacteria are usually the first group to increase and provide an early warning of the potential growth of coliforms. The CRD Water Quality Monitoring Program uses heterotrophic plate count bacteria to monitor treatment efficacy at the disinfection plants and to track the decline in chlorine residuals in the distribution system and storage reservoirs.

Test Method. In 2022, heterotrophic plate count bacteria were analyzed by the CRD Water Quality Laboratory using membrane filtration onto R2A medium and incubated at 21-28°C for seven days. Heterotrophic bacteria can be measured in several different ways; in this test method, the low incubation temperature and long incubation time improves the recovery of stressed and chlorine-tolerant bacteria. Raw water samples and water leaving the treatment plant were analyzed for heterotrophic bacteria. In addition, treated water samples with low chlorine residual levels (below 0.2 mg/L) were also analyzed using this method.

Regulatory Limits. There is no federal or provincial regulatory limit for heterotrophic bacteria in drinking water. However, the US EPA Surface Water Treatment Rule considers 500 CFU/mL of heterotrophic bacteria as an indicator for a "detectable chlorine residual" when using membrane filtration onto Standard Methods Agar incubated at 35°C for 48 hours. Therefore, in the absence of a Canadian regulatory limit, the CRD Water Quality Monitoring Program uses the US EPA value as a monitoring criterion to trigger site-specific operational measures for assessing and mitigating drinking water quality.

6.4 Certification and Audits

To ensure that analytical testing is carried out to the highest possible standard, the CRD Water Quality Laboratory participates in several types of external quality assurance and quality control (QA/QC) programs, in addition to rigorous internal QA/QC procedures that are included as part of the methodology and are a normal component of good laboratory practice.

6.4.1 Certification

All laboratories analyzing drinking water samples for total coliforms and *E. coli* according to the Drinking Water Protection Act/Regulation are required by the Province of BC to be approved in writing by the Provincial Health Officer. Laboratory approval requires both an approval certificate and a proficiency testing certificate, as noted below:

- **Water Bacteriology Testing Laboratory Approval Certificate**. This certificate is issued by the BC Provincial Health Officer for bacteriological testing of drinking water in the Province of BC. This certificate is renewed every three years via an on-site inspection (audit) of the analytical laboratory.

- **Clinical Microbiology Proficiency Testing Program Certificate of Participation**. This certificate is issued by the Advisory Committee for Water Bacteriology Laboratories, which is operated by the Department of Pathology and Laboratory Medicine at the University of British Columbia. Satisfactory performance is required to maintain laboratory certification. Three rounds of proficiency tests are carried out per year.

6.4.2 Accreditation

In 2017, the CRD Water Quality Laboratory attained accreditation to the global ISO/IEC 17025 standard used by testing and calibration laboratories. The accreditation has management, quality, and technical requirements. Accreditation is maintained by successful reassessment every two years by an accrediting body (Canadian Association for Laboratory Accreditation; CALA) and satisfactory participation in an external proficiency testing program for all methods (two rounds per year). The CRD Water Quality Lab was last assessed in 2021 and the Lab will be reassessed in 2023.

7.0 WATER QUALITY RESULTS

The overview results of the 2022 CRD Water Quality Monitoring Program for the GVDWS are provided below. Water quality data are listed in Appendix A (tables 1, 2 and 3). Note that the median (middle value between the high and low) is used in these tables rather than the average value, as the median eliminates the effect of extreme values (very high or very low) on the average value and provides a more realistic representation of typical conditions.

7.1 Source Water Quality Results

Total Coliform Bacteria (TC). Similar to previous years, the raw (untreated) source water entering both plants exhibited generally very low concentration of total coliform bacteria, with some increased concentrations between July and October when the Sooke Lake south basin was destratified and, therefore, fully mixed with warm water. Compared to previous years, Sooke Lake Reservoir experienced average total coliform concentrations during the summer months with no concentration reaching the Operational Alert Level of 1000 CFU/100mL. No seiche-related total coliform spikes were recorded in 2022. The peak of the summer total coliform concentrations was slightly later than in previous years due to the cooler temperatures at the start of summer and the prolonged heat and drought during the fall season (Figure 3).

With 242 samples analyzed in 2022, the total coliform concentration ranged from 0-260 CFU/100 mL, with a median value of 6 CFU/100 mL (Appendix A, Table 1). The types of total coliforms present were not indicative of any particular type of contamination.

The United States Environmental Protection Agency (USEPA) *Surface Water Treatment Rule* for avoiding filtration has a non-critical total coliform criteria of maximum 100 CFU/100 mL at the 90th percentile of a six-month sample set. The 90 percentile of total coliform concentrations in the raw water between January and June 2022 was 8 CFU/100mL, and between July and December 2022, it was 160 CFU/100 mL. Therefore, the source water was compliant with this non-critical USEPA filtration exemption criteria in the first half of 2022 but not in the second half. This is a typical pattern for Sooke Lake Reservoir and indicates a vulnerability of the water quality with rising temperatures due to climate change.

***E. coli* Bacteria**. During three decades of monitoring bacteria within the GVDWS, it has been found that virtually 100% of the fecal coliform bacteria detected in the source water and the distribution system are *E. coli*. In 2022, as in previous years, the low detection of *E. coli* bacteria indicated that the raw water entering the Goldstream Water Treatment Plant from Sooke Lake Reservoir was good quality source water and complied with the primary criteria in the USEPA *Surface Water Treatment Rule* to remain an unfiltered drinking water supply (Figure 4).

In 2022, about 5.8% of the 241 samples collected from the raw source water contained *E. coli* and those that were positive for *E. coli* had levels well below 20 CFU/100 mL. The concentration ranged from 0-2 CFU/100 mL, with a median value of 0 CFU/100 mL. The low occurrence, as well as the low concentrations of *E.coli* bacteria in Sooke Lake, are in line with long-term historical bacteria concentrations. These results do not indicate a particular source of *E.coli* bacteria, but rather point to low levels of naturally occurring fecal matter in a healthy and unproductive aquatic ecosystem. The few sporadic *E. coli* hits are typically the result of the rainfall and runoff into Sooke Lake, which transported organic matter accumulated in the watershed to the lake. The lack of any extreme rainfall and runoff events during 2022 is likely the reason for even lower *E. coli* occurrences and concentrations (Figure 4). In years with a Kapoor Tunnel Inspection Project, a slight *E. coli* concentration increase in mid-December can be attributed to the supply from the Goldstream System. In 2022, the Goldstream System was not used as a drinking water source.

***Giardia and Cryptosporidium* Parasites**. In 2022, parasite samples were collected eight times per year, as part of the CRD's routine monitoring program. This sampling frequency was set after an evaluation of long-term data showed extremely low detection of these organisms. The eight parasite samples were collected from the raw water sampling location at the Goldstream Water Treatment Plant and shipped for analysis to an external laboratory. It should be noted that the efficiency of the analysis for detecting *Giardia*, and especially *Cryptosporidium*, is quite low (typically in the 15-25% range).

In 2022, no *Giardia* cysts and no *Cryptosporidium* oocysts were detected in all samples on the raw water entering the Goldstream Water Treatment Plant. The 10-year median value for total *Giardia* cyst and total *Cryptosporidium* oocyst concentrations is 0/100L; however, historical data shows that occasionally very low concentrations of parasites can be found in the raw water from Sooke Lake. While these are extremely low values for a surface water supply, the addition of UV disinfection provides assurance that no infective parasites can enter the GVDWS.

The treatment target specified by the Canadian federal and provincial regulations, as well as the USEPA *Surface Water Treatment Rule*, require 3-log (99.9%) parasite inactivation to meet the filtration exemption criteria for surface water systems. Both CRD disinfection facilities provide UV treatment that, in conjunction with the CRD's drinking watershed management concept, is able to meet these targets and, therefore, adequately protects the public from waterborne parasitic illnesses.

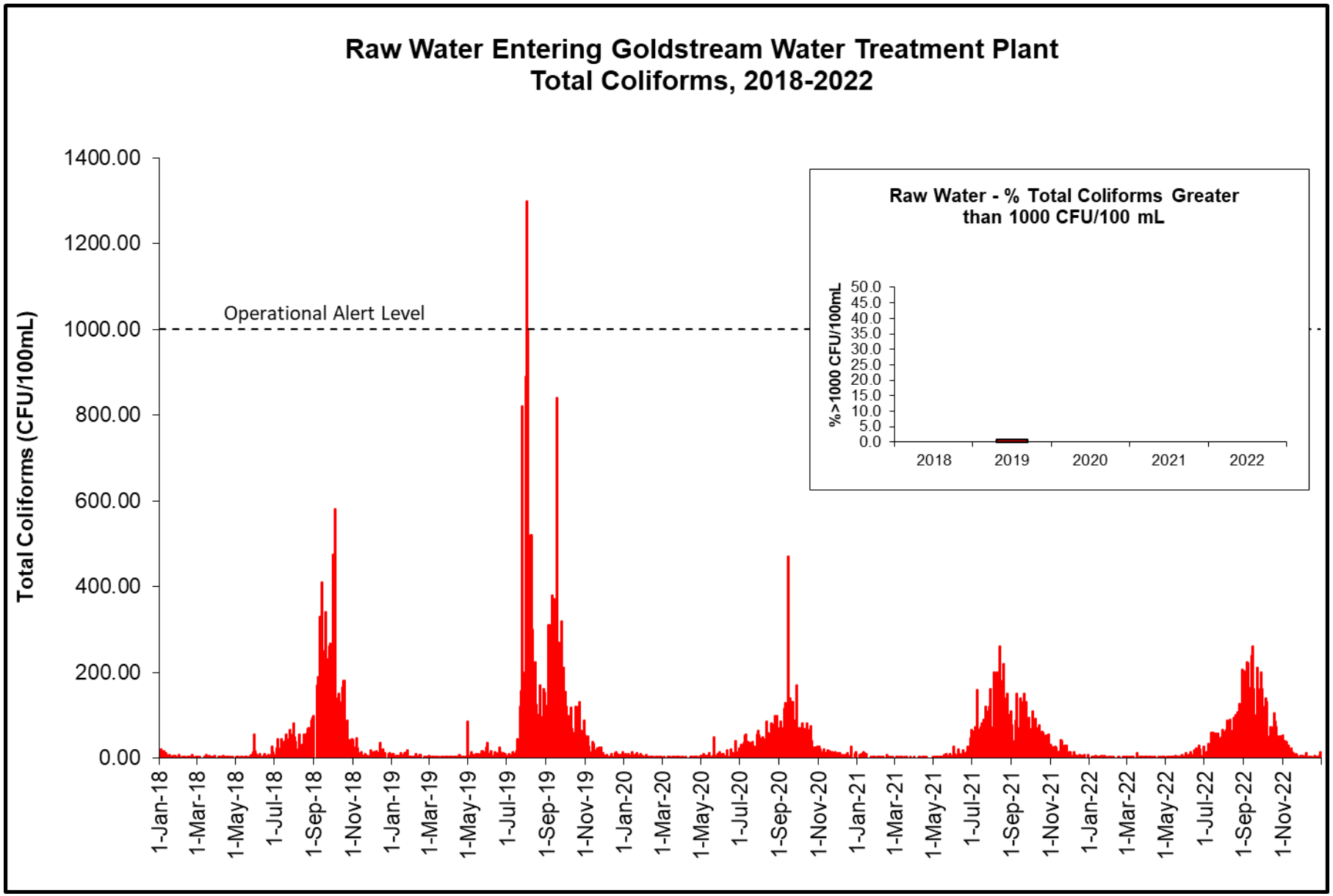

Figure 3 **Raw Water Entering Goldstream Water Treatment Plant Total Coliforms 2018-2022**

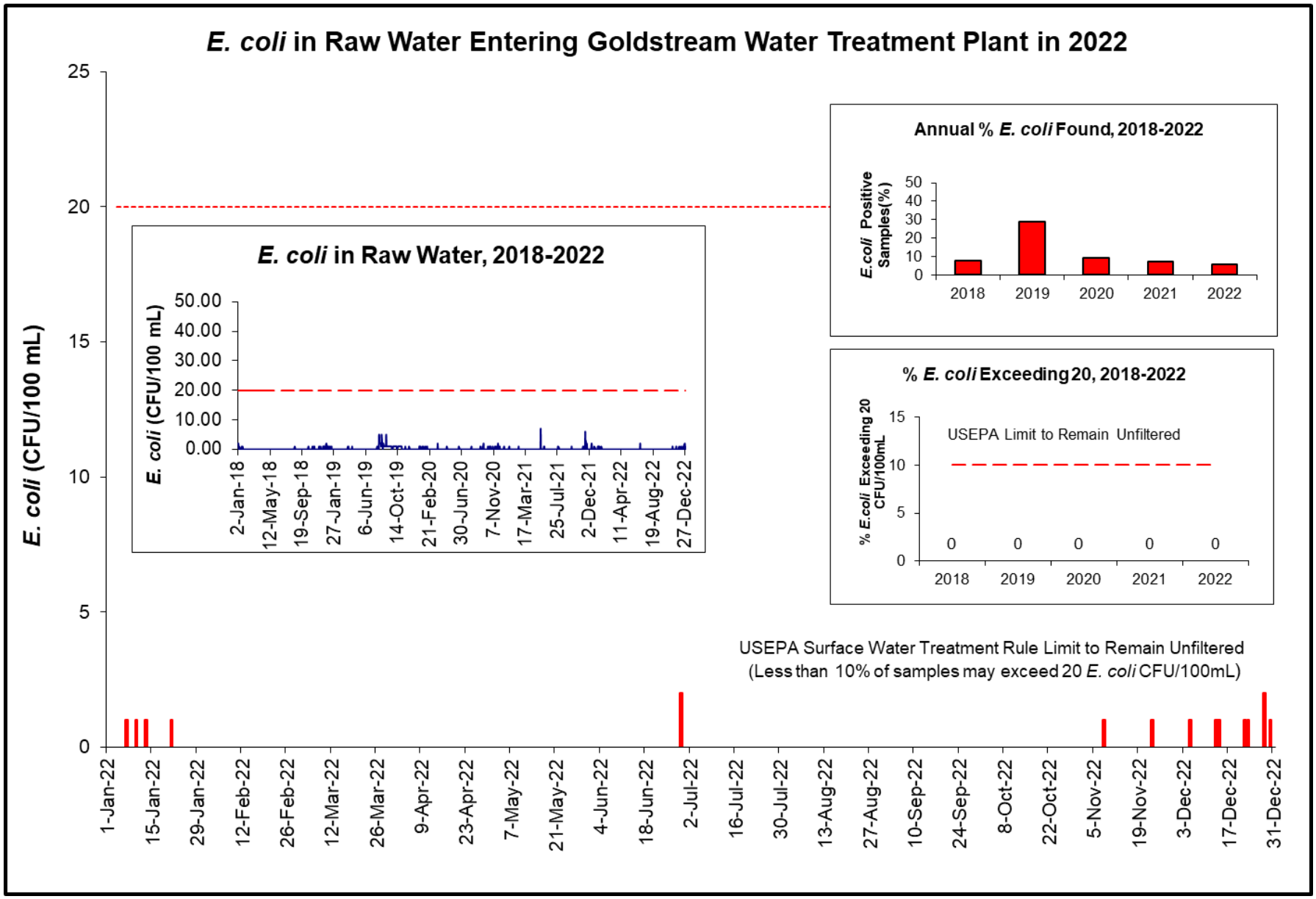

Figure 4 ***E.coli*** **in Raw Water Entering Goldstream Water Treatment Plant in 2022**

Algae – *Sooke Lake Reservoir (SOL).* In 2022, the algal dynamics were generally in line with the long-term trend. During the spring and summer, the algal density was slightly above average, with the typical spring peak occurring slightly earlier (Figure 5, Figure 6, Figure 7). Algae have a remarkable ability to quickly adapt to environmental factors, such as temperature, nutrient availability and light intensity. The Greater Victoria region experienced favourable conditions for the growth of certain algae species in the early spring and summer of 2022, especially with continued nutrient input from rainfall and runoff into early July. However, no actual bloom of a specific algae species occurred in Sooke Lake Reservoir in 2022, which demonstrates the robustness of an intact ecosystem with a balanced and diverse algae population.

There were three distinctive algae activity peaks in 2022 (Figure 5, Figure 6, Figure 7): mid-March: dominant species *Chrysochromulina sp.* (Haptophyta); 3,193 NU/mL, early July: dominant species *Cyanodictyon sp.* (Pico-Cyanoacbacteria); 2,791 NU/mL, and early September: dominant species *cf.Monomastix sp.* (Chlorophyta); 865 NU/mL. None of these events caused any water quality concern but they are indicators of dynamic conditions in the lake. Often peaks of algae concentrations are followed by peaks in certain zooplankton concentrations demonstrating the food web dynamics in the lake.

Throughout the year, abundant populations of small sized flagellates (~ 5 microns, possibly the green flagellates *Pedinomonas* spp.), and single cells of golden algae (~ 6 microns) were recorded. Due to their small size, they only contribute insignificantly to the total algal biomass in the reservoir and for consistency with historical data, they were excluded in the analyses and the presented composition graphs below.

During certain times of the year (typically the warm water months), cyanobacteria can comprise a significant portion of the algae spectrum (Figure 8, Figure 9, Figure 10). While this may seem like a major water quality risk, the risk of potential toxin production comes with blooms of certain cyanobacteria species and not with an overall abundance of a variety of species. For instance, in Sooke Lake Reservoir in 2022, the most abundant cyanobacteria species was a small size picocyanobacteria *Cyanodictyon* spp. (~2 microns), which has been described in previous annual reports. They are common in lacustrine environments and are not known to produce toxins. Other cyanobacteria species recorded in Sooke Lake are potential toxin producers when in bloom conditions, such as *Dolichospermum/Anabaena* spp. or *Pseudanabaena* sp. However, the densities of these species were well below the critical threshold recommended by Health Canada (2017), (i.e., 2000 cells/mL). For example, the maximum count of *Dolichospermum/Anabaena* spp. was 45.5 cells/mL reported on August 15, 2022. Based on those low specific concentrations, the water quality risk from cyanobacteria was low again in 2022.

There were no algae-related water quality concerns in 2022.

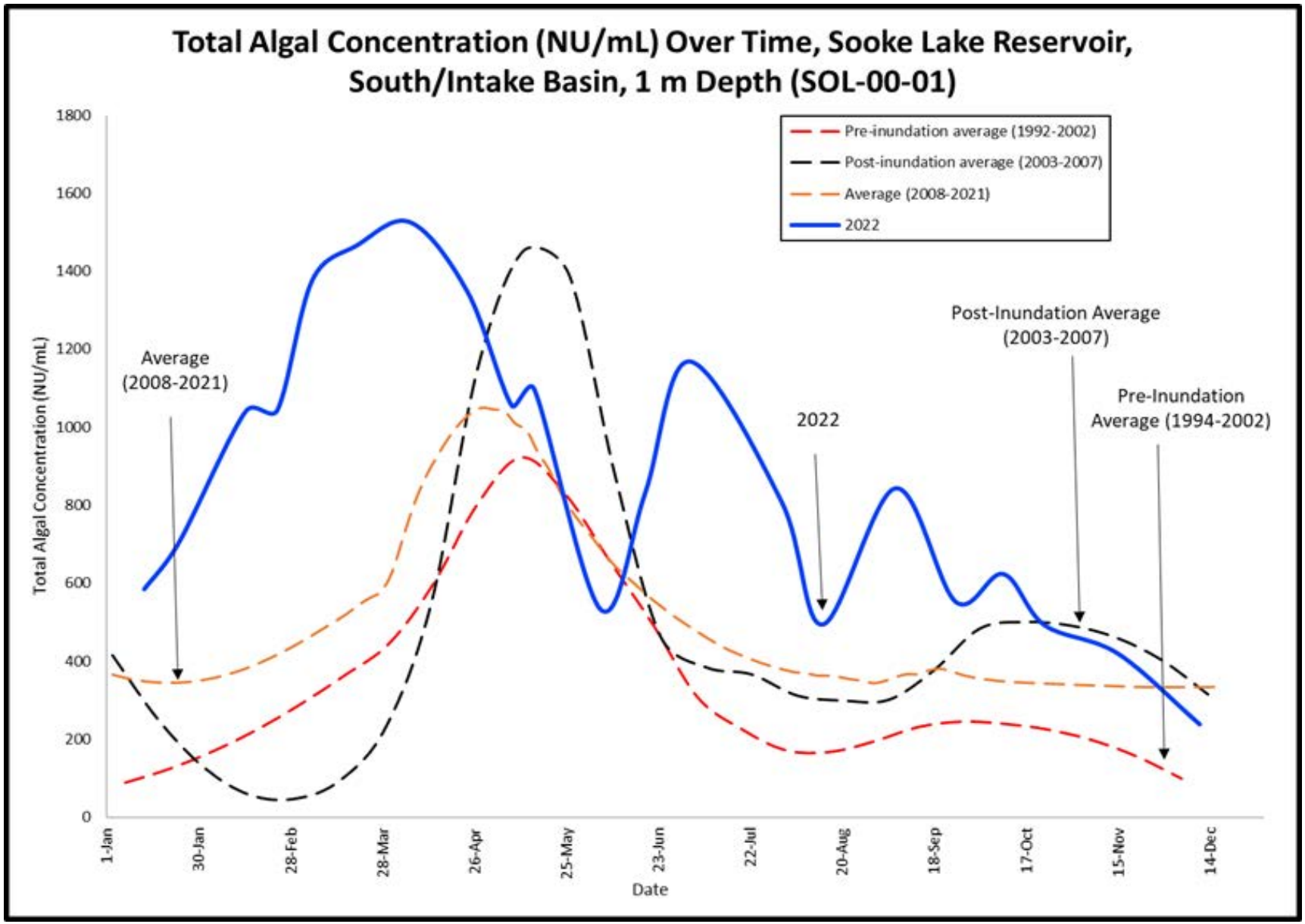

Figure 5 Total Algal Concentration (natural units/mL) Over Time, Sooke Lake Reservoir, South/Intake Basin, 1 m depth (SOL-00-01)

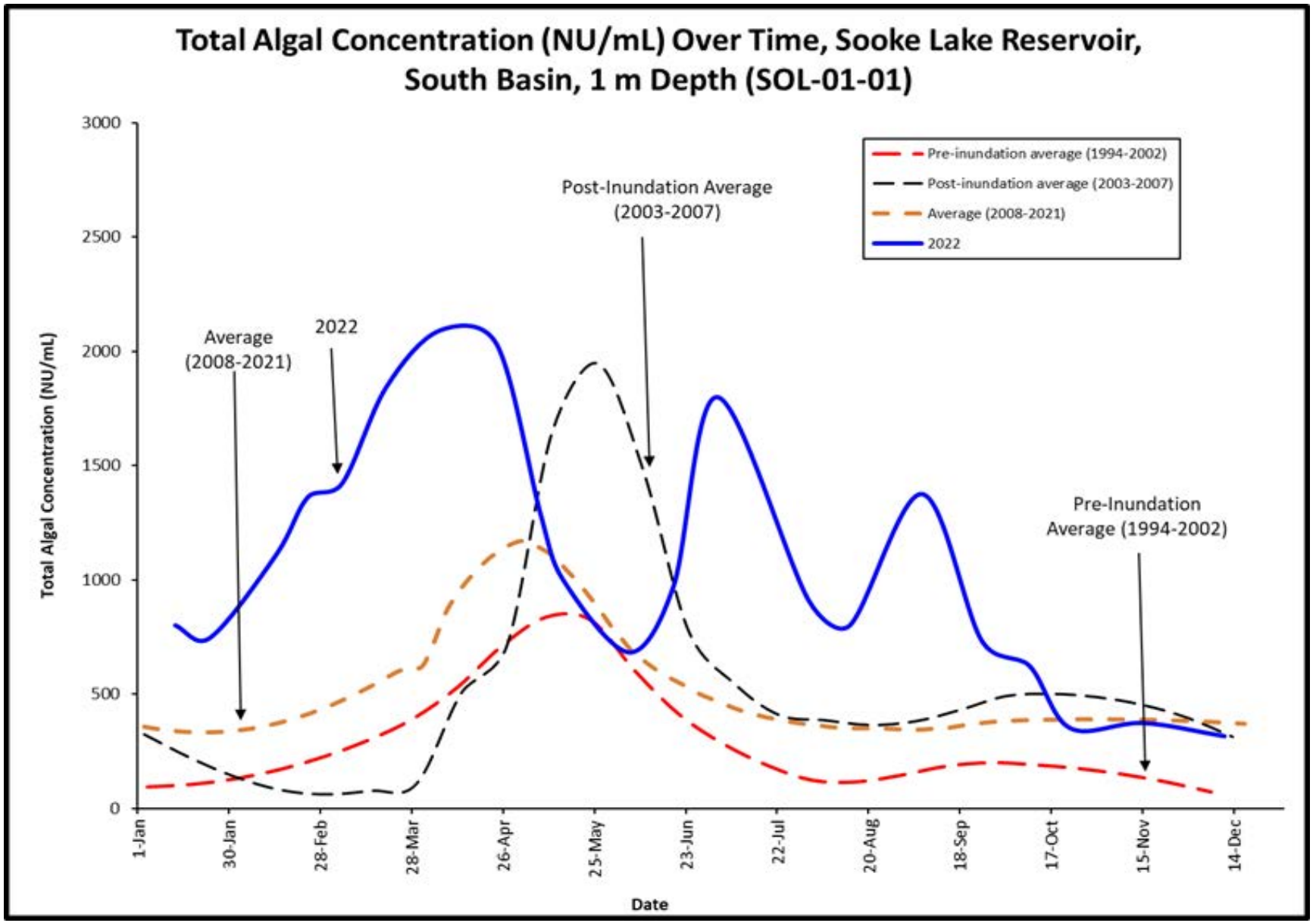

Figure 6 **Total Algal Concentration (natural units/mL) Over Time, Sooke Lake Reservoir, South Basin, 1 m depth (SOL-01-01)**

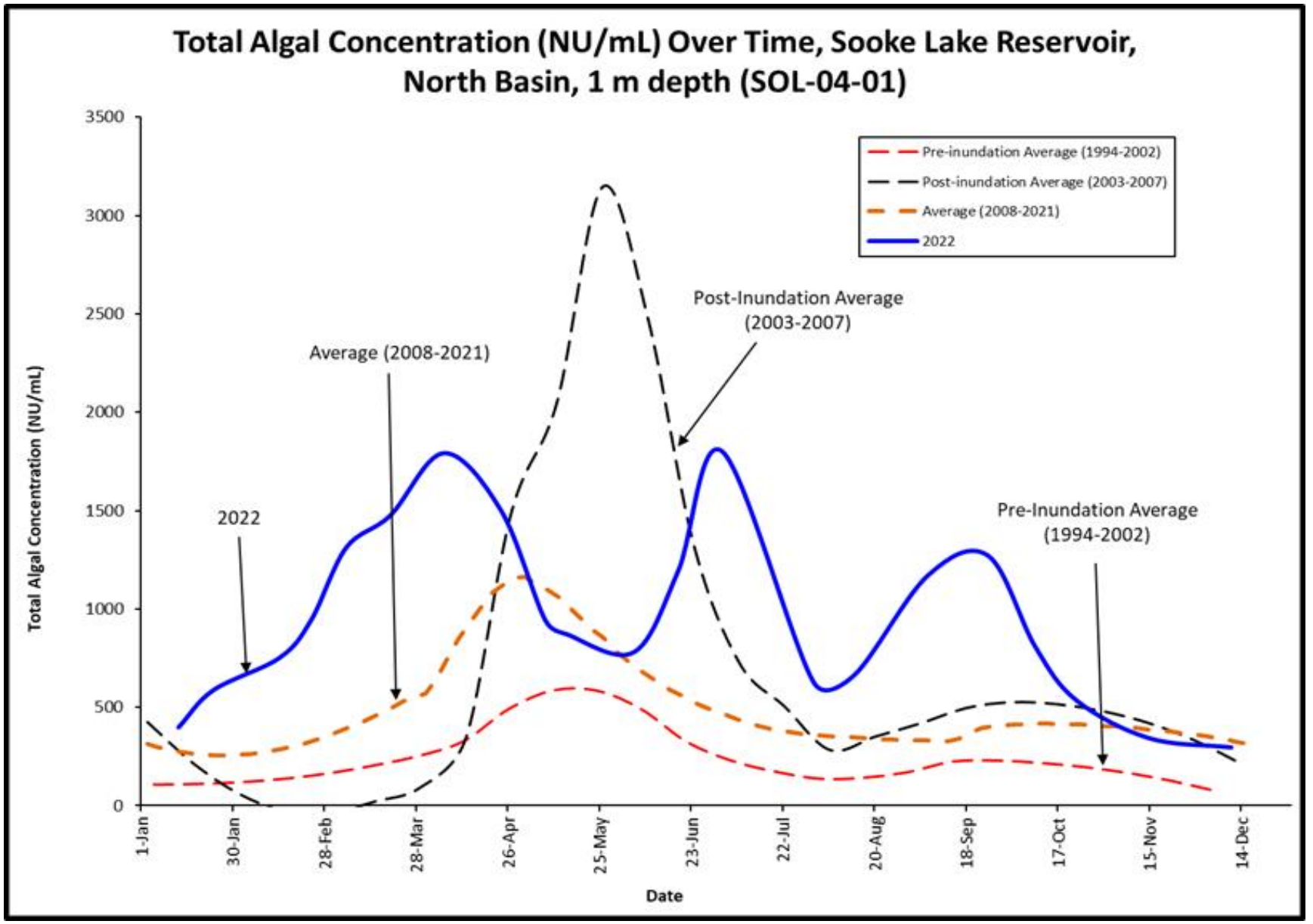

Figure 7 Total Algal Concentration (natural units/mL) Over Time, Sooke Lake Reservoir, North Basin, 1 m depth (SOL-04-01)

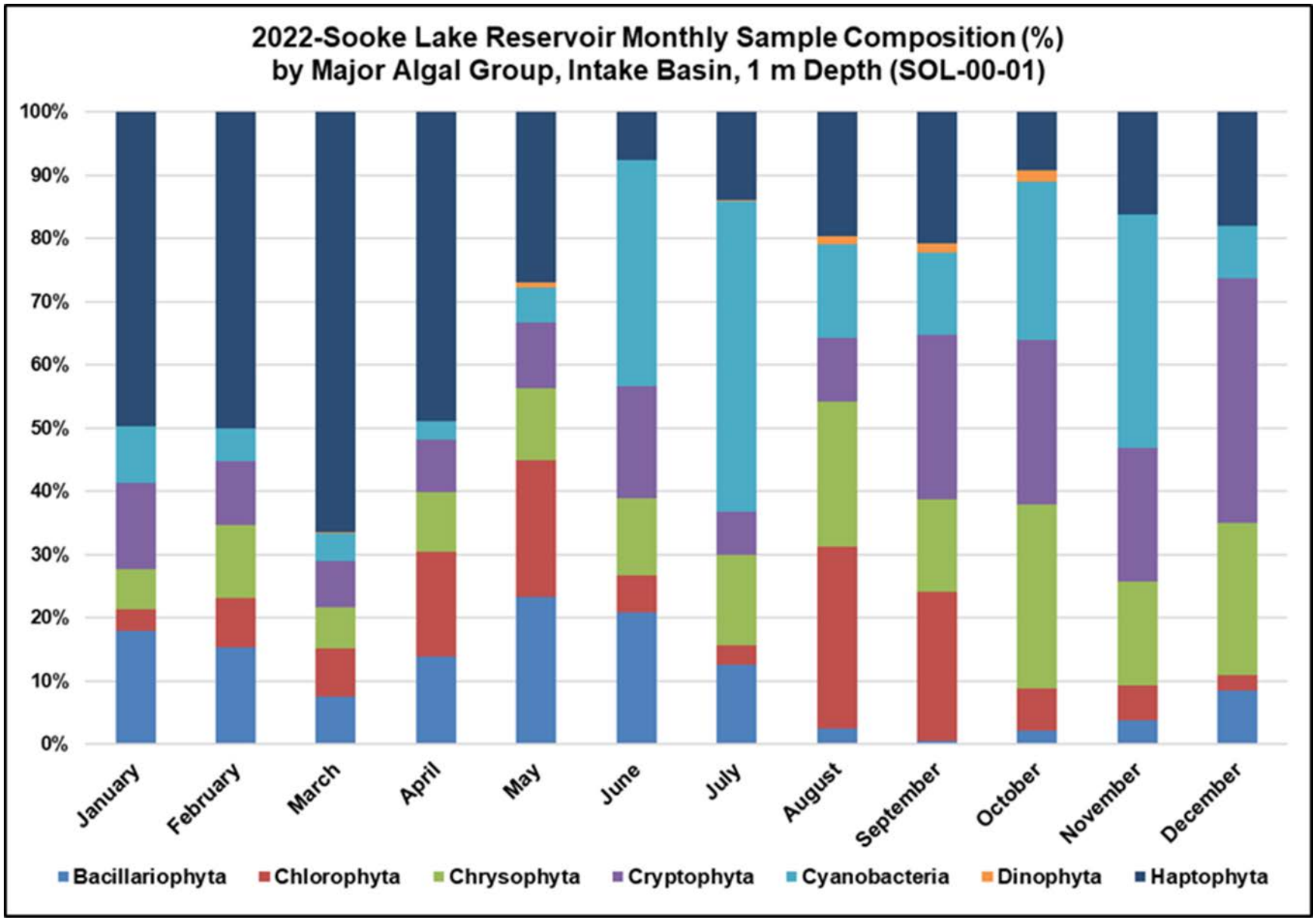

Figure 8 Monthly Abundance Percent of Different Algal Groups, Intake Basin, 1 m depth, SOL-00-01, 2022

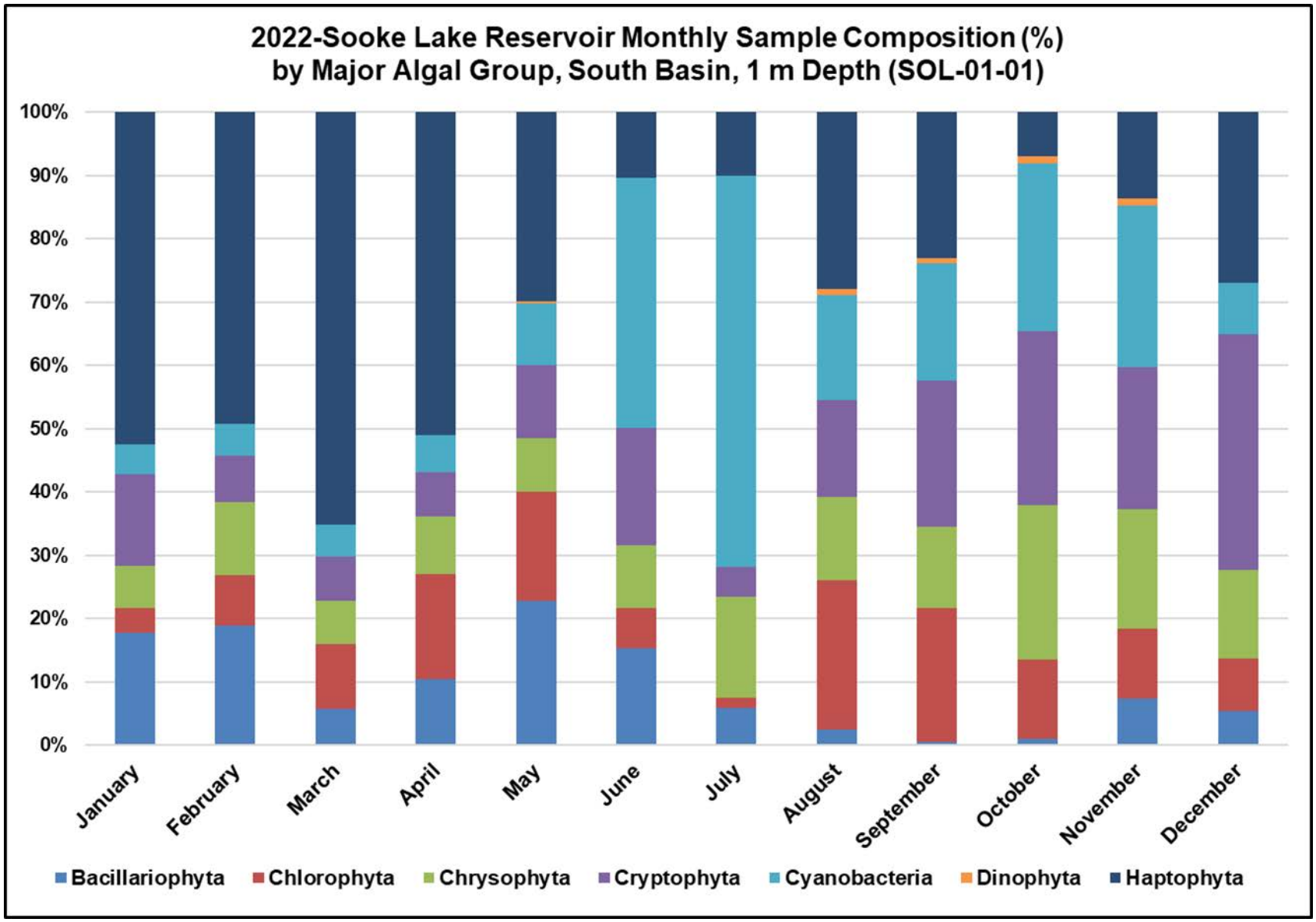

Figure 9 Monthly Abundance Percent of Different Algal Groups, South Basin, 1 m depth, SOL-01-01, 2022

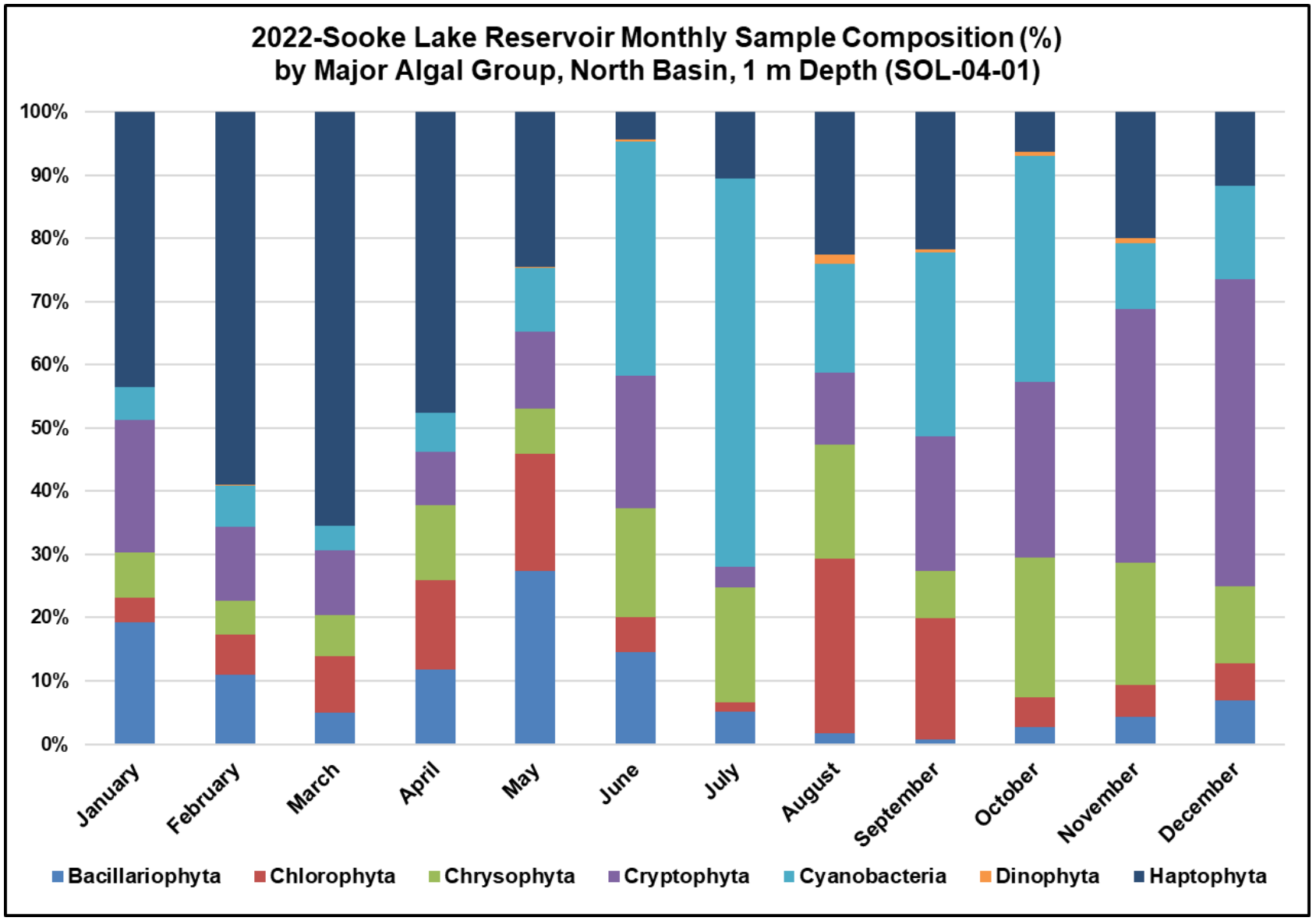

Figure 10 Monthly Abundance Percent of Different Algal Groups, North Basin, 1 m depth, SOL-04-01, 2022

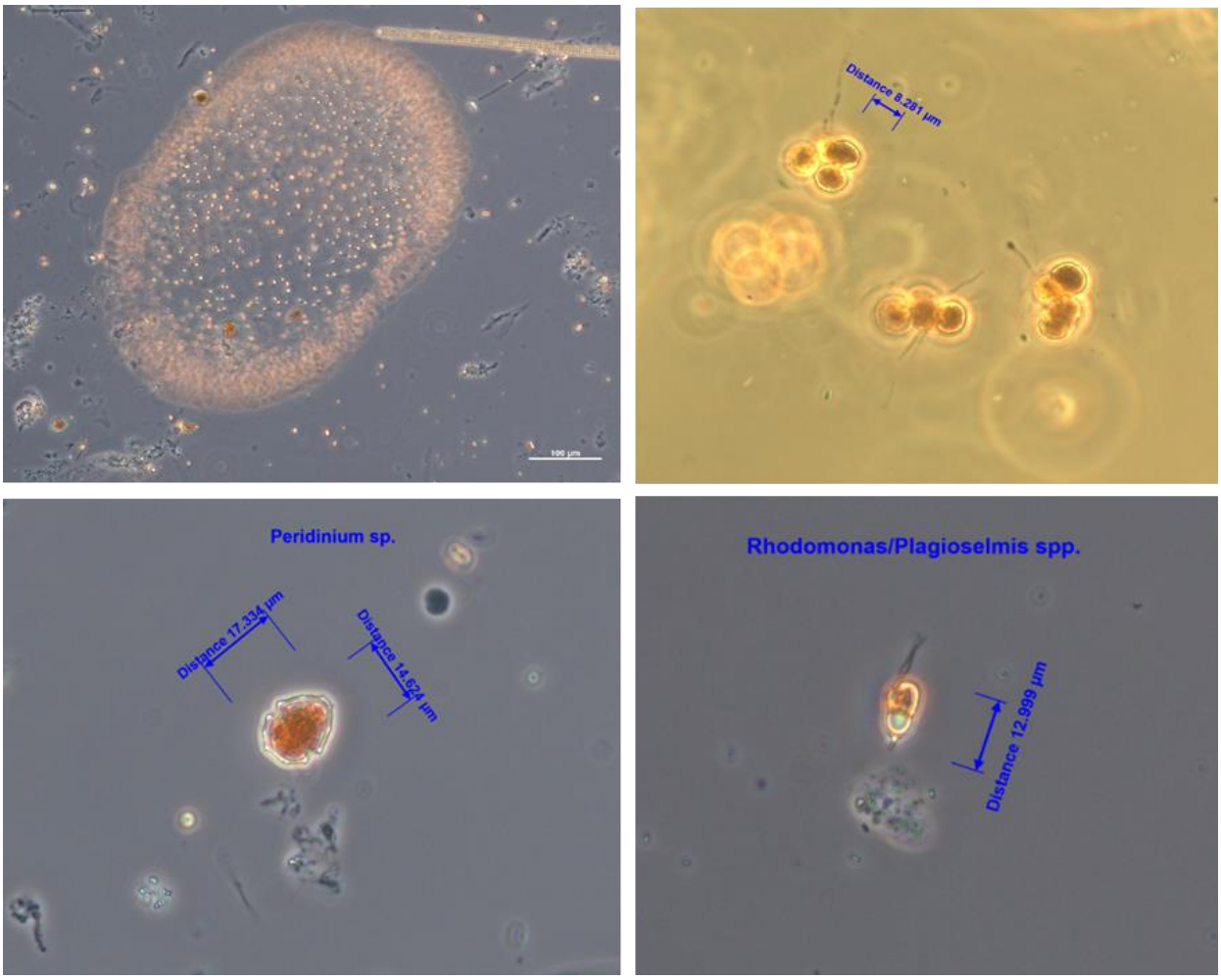

Figure 11 Some algae present in Sooke Lake Reservoir
Golden algae - *Uroglena* sp. (top left), Green algae - *Tetraspora* sp. (top right), Dinophytes - *Peridinium* sp. (bottom left) and Cryptophytes – *Plagioselmis/Rhodomonas* sp. (bottom right).

Zooplankton – *Sooke Lake Reservoir (SOL)*. Zooplankton play an important role as an intermediate trophic stage, ensuring the energy flow from primary producers to higher trophic levels, e.g., macroinvertebrates, fish and other aquatic animals in aquatic ecosystems. Previous studies have shown that fish in Sooke Lake Reservoir predominantly rely on zooplankton for forage. Because of this important biological role, the CRD has included a regular zooplankton analysis to its source water monitoring program. Zooplanktonic species themselves can be herbivores, carnivores or omnivores. Studies have shown that any change of zooplankton species composition or densities or both could influence not only the trophic structure, but also physiochemical parameters in the ecosystems. There are three main zooplankton groups: Protozoa, Rotifera and Crustacea (Copepoda and Cladocera). In the ecosystems, phytoplankton are considered as a main food source for zooplankton and, therefore, phytoplankton dynamics can significantly reflect the changes of zooplankton and *vice versa*. The peak of zooplankton abundance normally occurs after the peak of phytoplankton. In general, zooplankton tend to have higher density during the spring-to-fall period than in winter.

In Sooke Lake Reservoir, zooplankton mainly consist of Rotifera and Copepoda, although Cladocera taxa, such as *Daphnia* spp., can be occasionally recorded. In 2022, these three main zooplankton groups were recorded in Sooke Lake. Rotifera was the most dominant group. Abundances of Rotifera and Copepoda were consistent with the long-term trends. Cladocera zooplankton, on the other hand, was less common and only observed in some discrete samples and was therefore excluded from the analysis.

As rotifers are considered one of the main food sources for copepods, these two groups might show opposite abundance trends. Zooplankton dynamics in Sooke Lake are also regulated by other higher trophic organisms, such as macroinvertebrates and fish.

Zooplankton trends in Sooke Lake Reservoir are typical of ecological succession models. 2022 zooplankton activity was consistent with long-term trends (Figure 12 to 17).

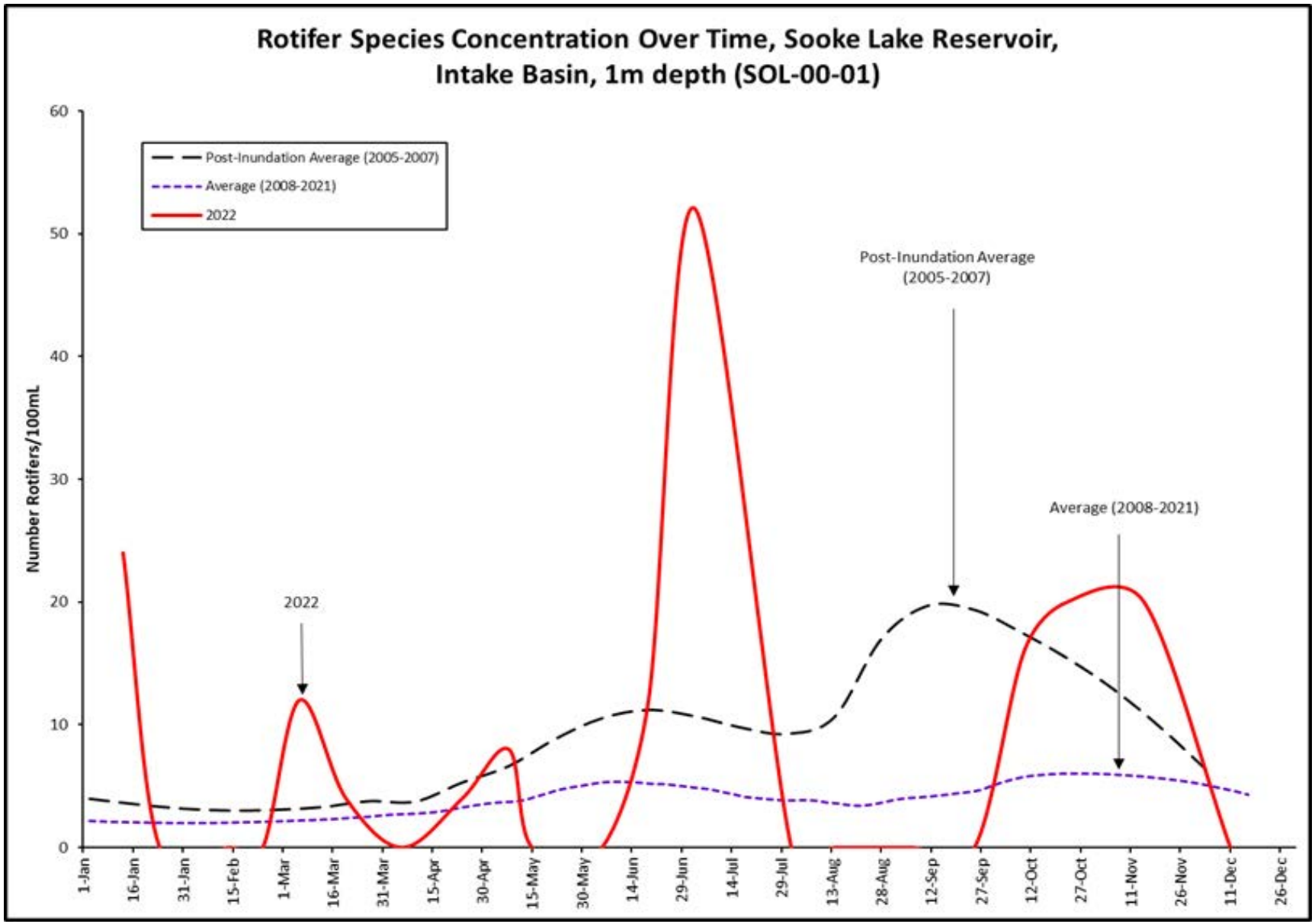

Figure 12 The Total Number of Rotifers Over Time, Sooke Lake Reservoir, Intake Basin, 1 m depth (SOL-00-01)

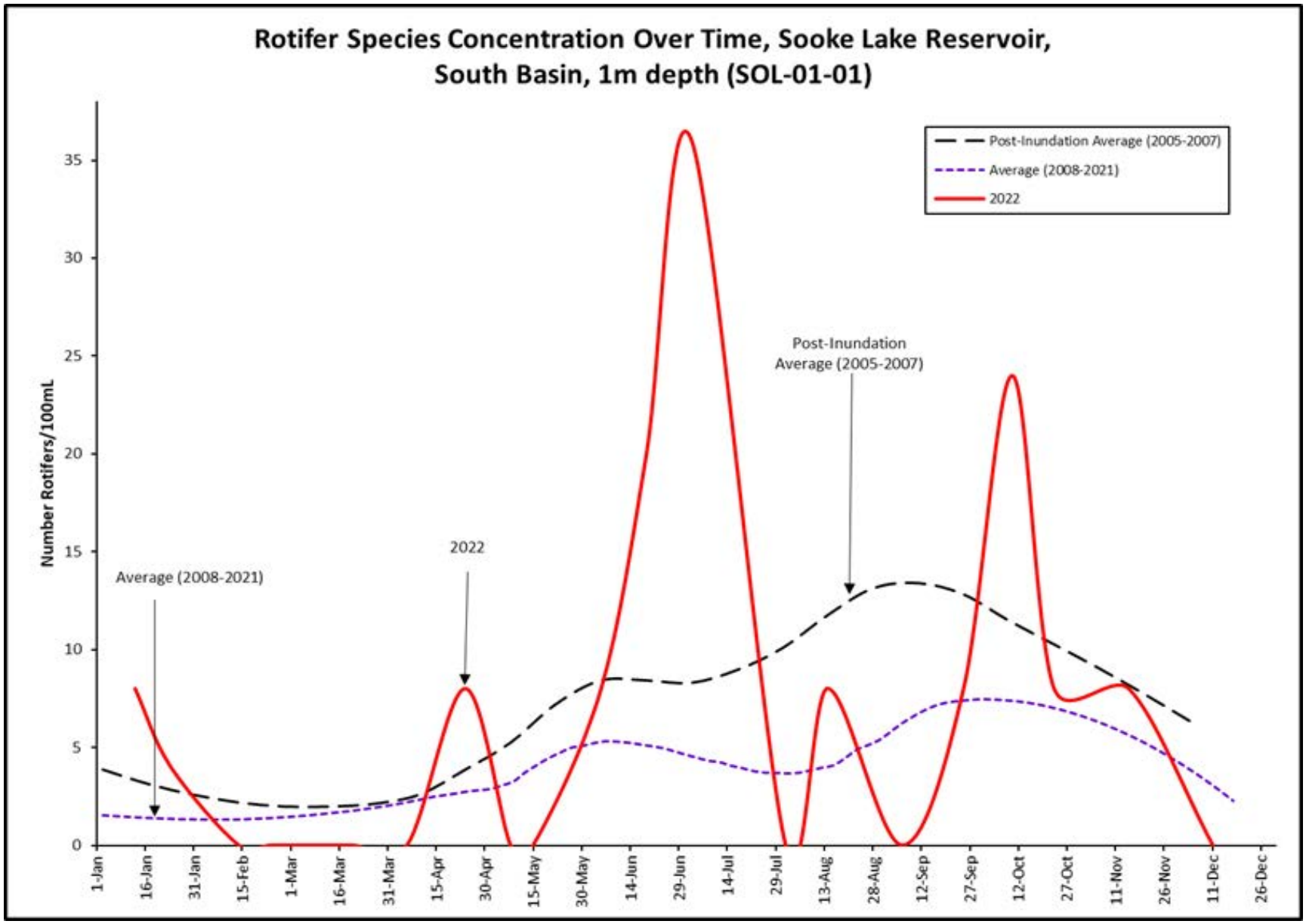

Figure 13 The Total Number of Rotifers Over Time, Sooke Lake Reservoir, South Basin, 1 m depth (SOL-01-01)

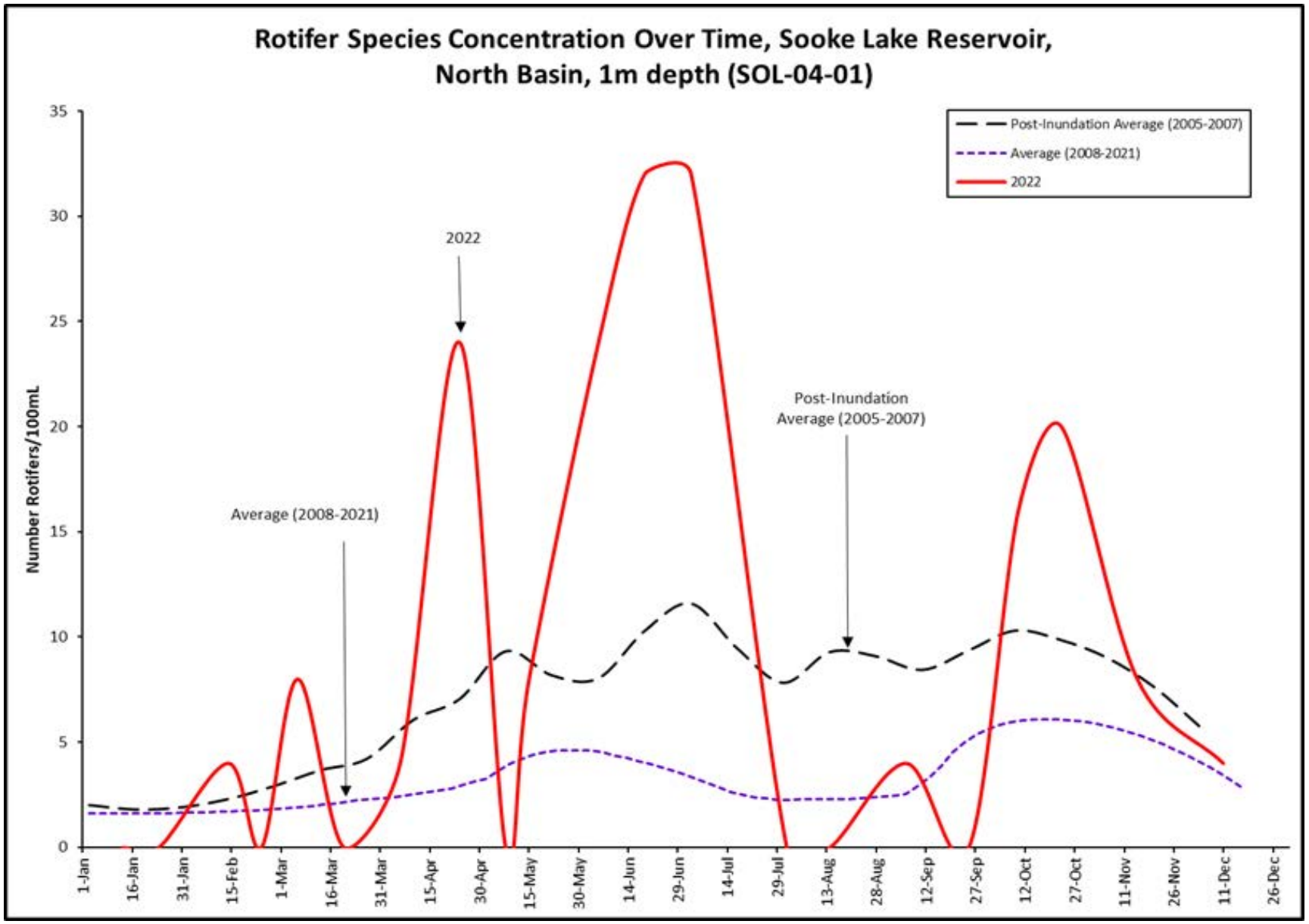

Figure 14 The Total Number of Rotifers Over Time, Sooke Lake Reservoir, North Basin, 1 m depth (SOL-04-01)

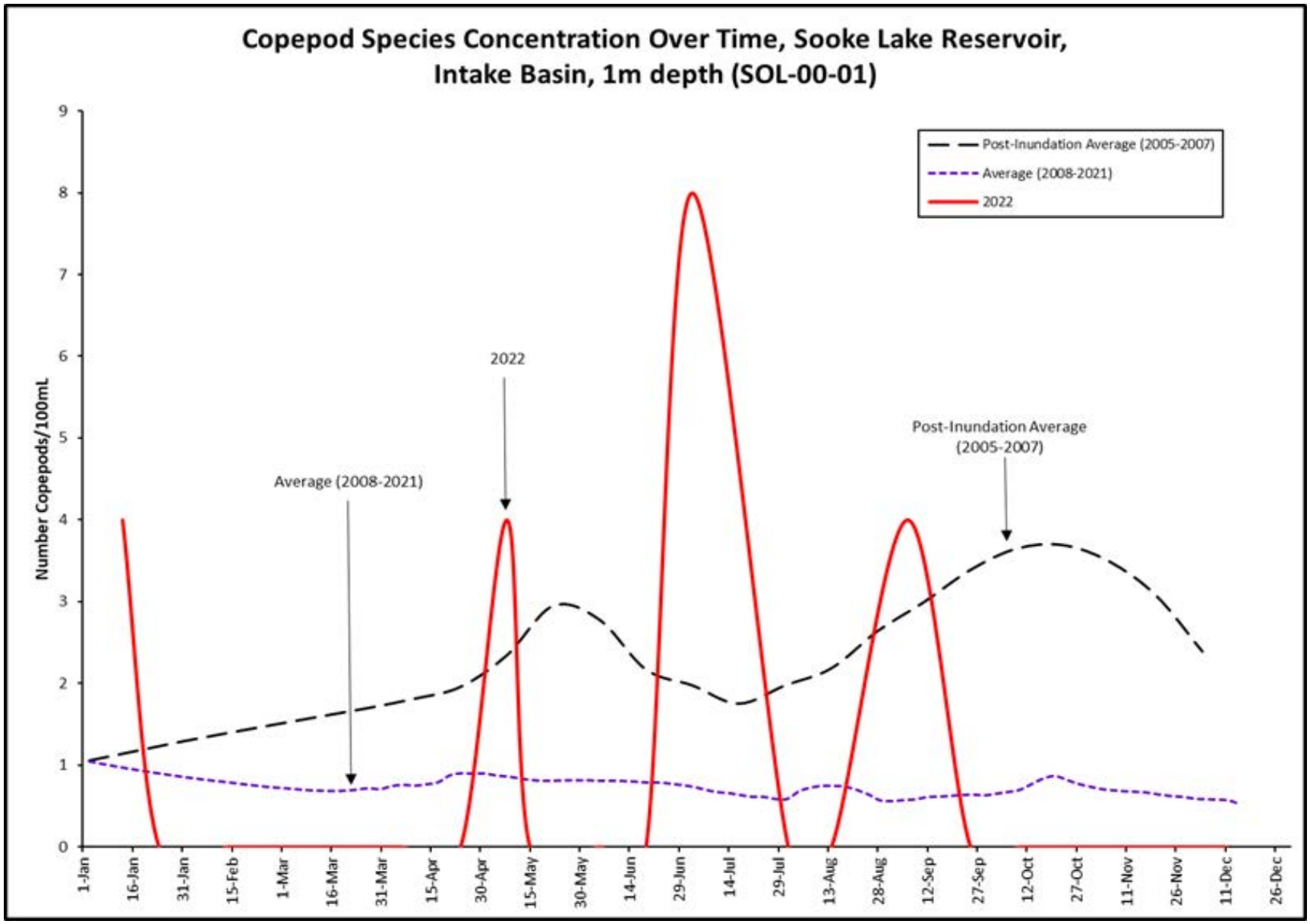

Figure 15 The Total Number of Copepods Over Time, Sooke Lake Reservoir, Intake Basin, 1 m depth (SOL-00-01)

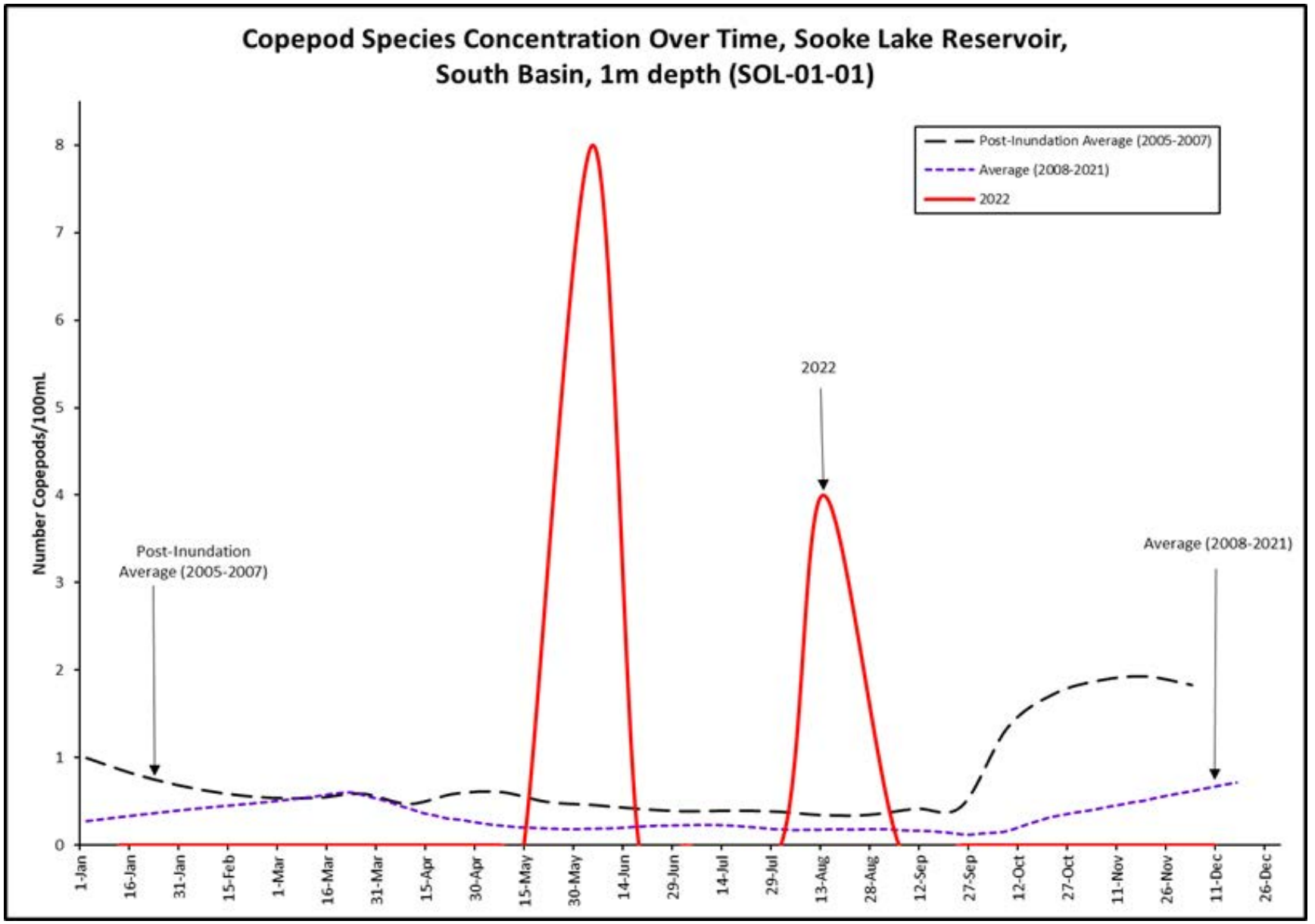

Figure 16 The Total Number of Copepods Over Time, Sooke Lake Reservoir, South Basin, 1 m depth (SOL-01-01)

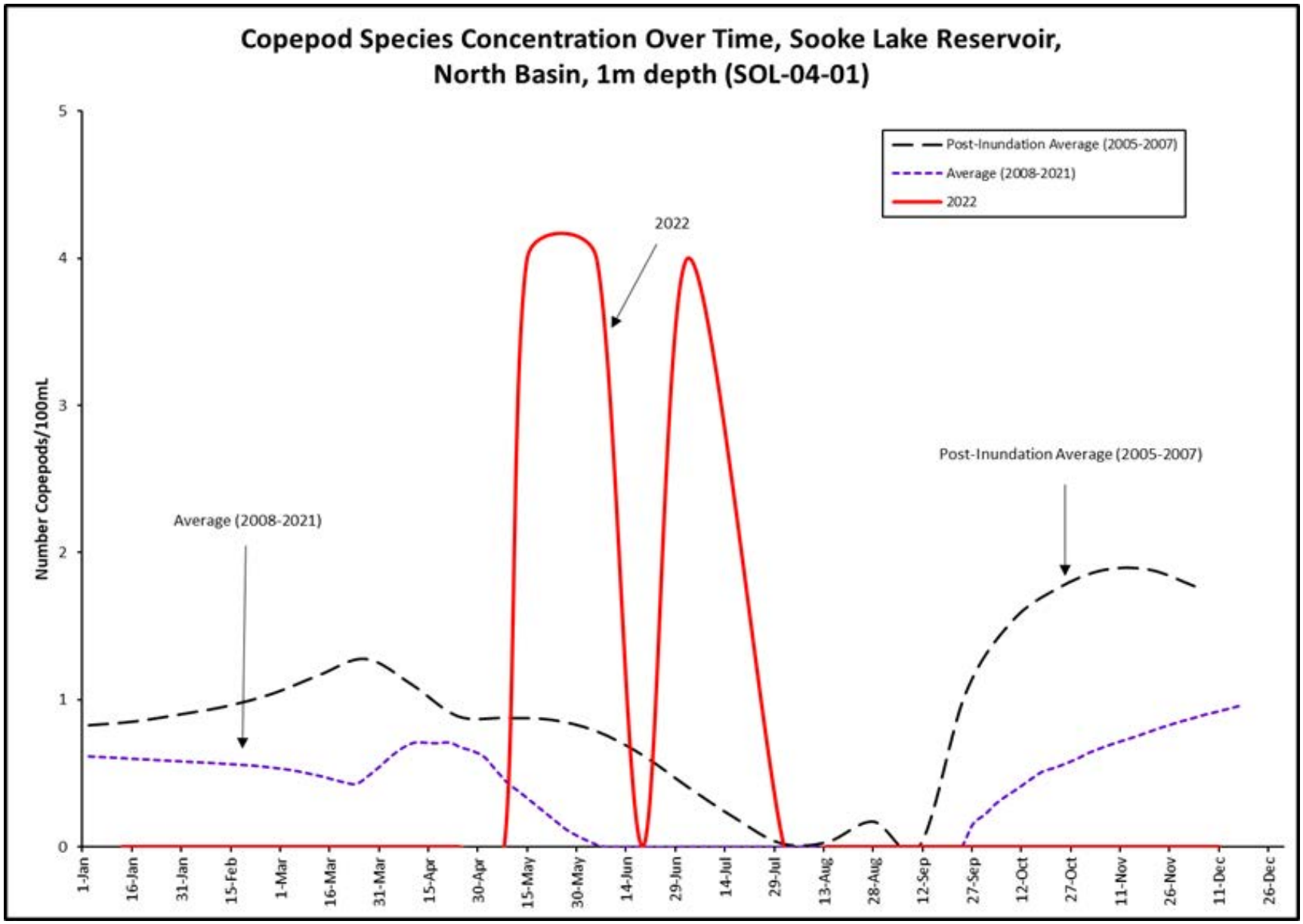

Figure 17 The Total Number of Copepods Over Time, Sooke Lake Reservoir, North Basin, 1 m depth (SOL-04-01)

Stratification: The 2022 thermal stratification pattern in Sooke Lake Reservoir was consistent with historical trends, as stratification occurred during spring, summer and early fall months. This phenomenon happens when the water column is divided in three layers from top to bottom, including: *epilimnion* (atop, warm, circulating and fairly turbulent), *metalimnion* (characterized by a steep thermal gradient or rapid temperature change) and *hypolimnion* (bottom, denser and colder water with little temperature change). The stratification reflects the vertical heat distribution in the water column and, therefore, might have a significant association with the dynamics of plankton communities. In 2022, Sooke Lake started to stratify slightly later due to unseasonal cool spring weather – likely in early May. Due to an unavailability of the temperature profiler before June 2022, the exact timing of the stratification onset could not be determined. The South Basin remained stratified until mid-August when the hypolimnion was depleted due to the continuous deep-water extraction. Compared to 2021, this hypolimnion depletion in the South Basin occurred about three weeks later, which is explained by the cool and wet weather conditions in spring and early summer, and the resulting lower water temperatures and higher reservoir level. The deeper parts of the reservoir destratified naturally, later in the fall – sometime between late November and early December.

Turbidity. The turbidity is continuously measured at both water treatment plants and at the Sooke Lake intake tower, but also sampled and lab tested daily from the Goldstream Water Treatment Plant and weekly at the Sooke River Road Water Treatment Plant. Figure 18 shows that the source water turbidity was well under 1 NTU throughout 2022; however, on two days during the summer season, June 22 and June 29, with peak demand and high flows due to outdoor water demand, sediments in the mains downstream of the Kapoor Tunnel were dislodged and caused short-period turbidity excursions to above 1 NTU (June 22 peak at 3.4 NTU, June 29 peak at 1.15 NTU). The second peak on June 29, 2022 was very short (<2h) and was not captured with grab sampling but analyzed using the recorded data by the online turbidity analyzer. Similar events in the past have usually occurred on Wednesdays or Thursdays from 4 am to approximately 10 am or 11 am during the peak summer demand times, only at the Goldstream and not at the Sooke River Road Water Treatment Plant. Supervisory Control and Data Acquisition monitoring data shows that the average daily turbidity was still well below 1 NTU on both turbidity event days. Also, the UV transmittance, a measure of how much ultraviolet light can pass through the water, was always around 90% during this event and the UV dose at least 60 mJ/cm^2, ensuring effective UV treatment. In prior years, CRD had taken measures to mitigate these turbidity events at the Goldstream Water Treatment Plant (e.g., changed watering restrictions in the region, flushed raw water mains upstream of Goldstream plant in April) and these measures were successful in greatly reducing the number of turbidity exceedances, compared to summers before 2018. The CRD was unable to undertake raw water main flushing in the spring of 2022 which resulted in these two turbidity events. In 2021, with completed water main flushing, there was only one smaller turbidity event in early summer.

Another turbidity excursion occurred on December 20, 2022 at both treatment plants: a power outage at the Head Tank due to adverse weather conditions in the evening of December 19, 2022, and a generator failure led to extremely high flows through Main #10 and #11 between the Intake Tower and the Head Tank. These high flows mobilized pipe sediments in these two mains, which caused a turbidity spike at both plants in the morning of December 20, 2022. At the Goldstream plant, the turbidity rose to 1.1 NTU for about 10 minutes while at the Sooke plant, the turbidity rose to 1.5 NTU for about 50 minutes.

The short duration of these turbidity events, low natural pathogen concentrations in the raw water, the fact that these events were not caused by an actual water contamination, and fully functional treatment processes during these events were the main criteria for assessing these events as very low risks to public health.

Overall, Sooke Lake water was very clear in 2022, and turbidity of the raw water was at no time a factor of concern to the drinking water quality in the GVDWS.

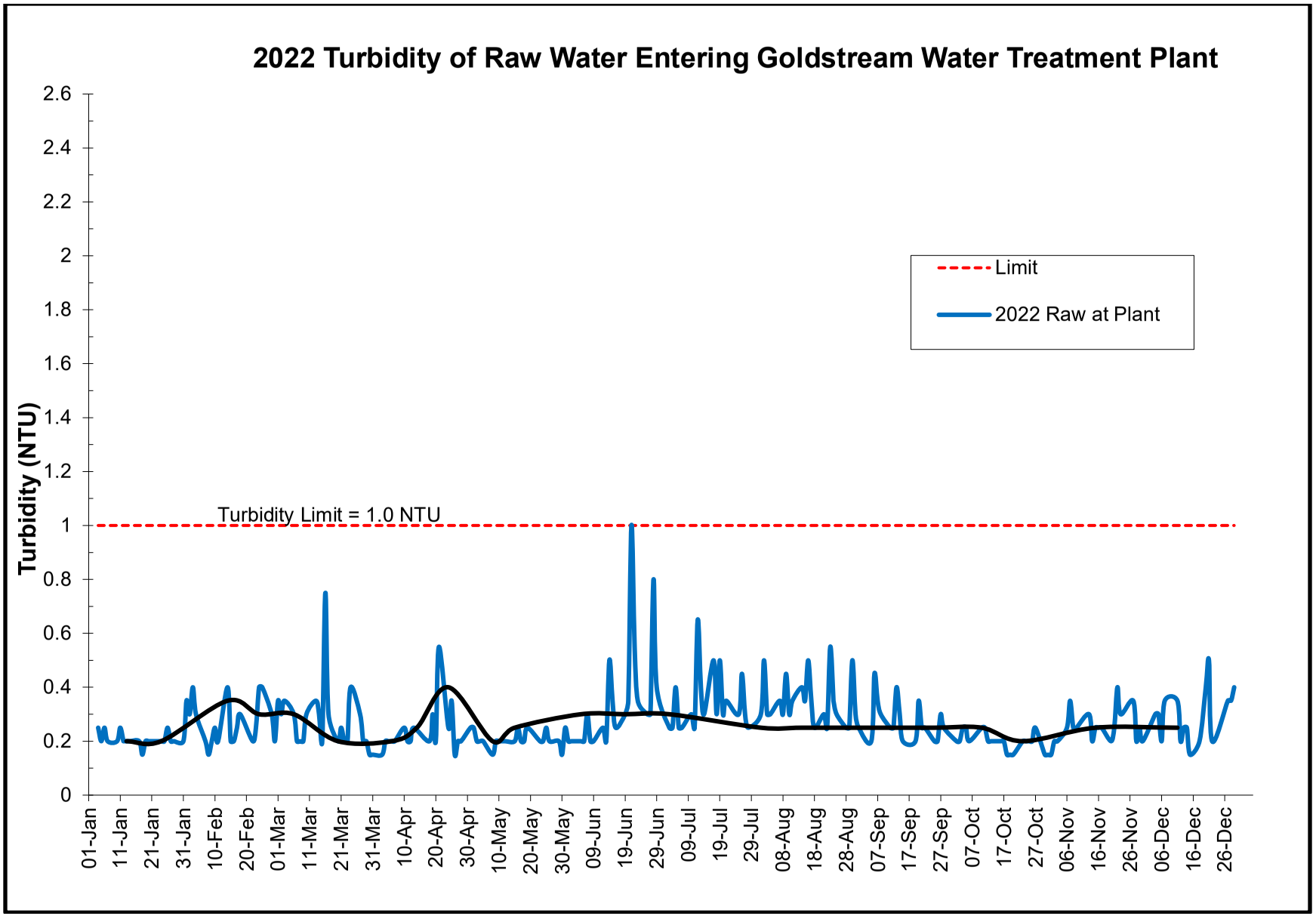

Figure 18 2022 Turbidity of Raw Water Entering Goldstream Water Treatment Plant (from Grab Sampling)

Raw Water Temperature. Cool water is beneficial in a distribution system because it reduces the potential for losses of chlorine residual and regrowth of bacteria. For that reason, the Canadian guidelines suggest a temperature limit of 15°C.

The temperature of the water entering the Goldstream Water Treatment Plant in 2022 was much cooler during the spring and particularly during the summer and only caught up to the long-term average trend line by the middle of September. The following prolonged heat and drought throughout the fall resulted in higher than seasonally normal water temperature during the month of October. In November, with the onset of destratification of the deep Sooke Lake north basin, cooler temperatures from the hypolimnion mixed with surface water and led to a rapid decrease of the water temperatures at the intake in the south basin. After that, the water temperatures remained mostly just below the long-term average trend line (Figure 19). The raw water entering both treatment plants exceeded the 15°C guideline limit between the end of August and end of October. While this is approximately the same duration of exceedance, it is however four-six weeks later in the year than normal. The maximum (weekly average) temperature peak remained below 18°C for the first time in several years, and also slightly below the maximum of the long-term trend.

The usage of the lowest intake gates during the summer led to the depletion of the cool water stored in the hypolimnion water column of the reservoir's south basin. This occurred approximately in mid-August and can be seen as a sharp incline in temperature at that time in Figure 19. The cool water stored in the hypolimnion of the much deeper north basin is currently inaccessible for the CRD with the existing infrastructure.

High raw water temperatures during the summer are not a new problem for the CRD. Before the expansion of the Sooke Lake Reservoir in 2004, the water temperature entering the plant reached 15°C as early as mid-June. Warmer and longer summers, as a result of climate change, will likely exacerbate this problem in the future.

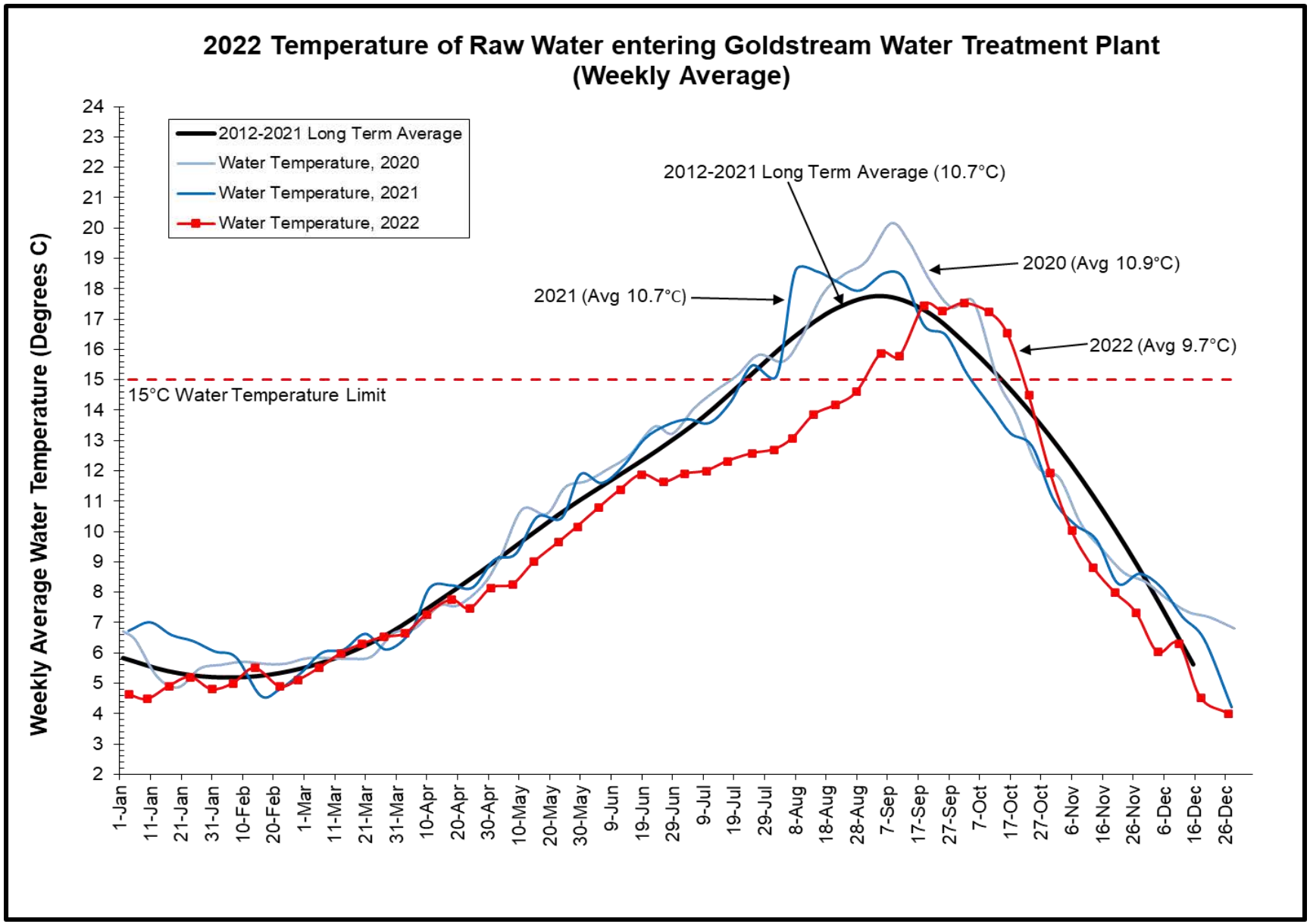

Figure 19 2022 Temperature of Raw Water Entering Goldstream Water Treatment Plant (Weekly Average)

Physical/Chemical Parameters. The raw water entering the Goldstream Water Treatment Plant had the following physical and chemical characteristics:

- Median pH: 7.2
- Median CaCO3 Hardness: 15.90 mg/L
- Median Alkalinity: 14.80 mg/L
- Median Colour: 6.0 TCU
- Median Total Organic Carbon: 1.75 mg/L
- Median Conductivity (25ºC): 41.30 µS/cm

The values of the parameters above are consistent with those of previous years.

Inorganics/Metals. Table 1 in Appendix A lists all the inorganic and metal parameters tested in the source water in 2022. No unusual or concerning levels or trends have been detected.

Organics/Radionuclides. Table 1 in Appendix A lists all the organic radiological parameters tested in the source water in 2022. Most of them were not detected or were in insignificant concentrations. These results confirm the high level of protection from any anthropogenic impacts on the supply watershed.

Nutrients. Figure 20 to 23 show the total nitrogen and the total phosphorus concentrations in both the south and north basins at 1 m depths in Sooke Lake Reservoir. Total phosphorus concentrations at both stations trended near or below the long-term average. In both lake basins, the total phosphorus concentration dropped at times to levels below the detection limit of 1µg/L, which indicates that biological activity in the lake used up all available phosphorus nutrients in the lake. The lack of phosphorus at the end of March and July was a result of increased algal activity prior to these periods. This limited the biological productivity during the summer, which resulted in a favorably lower algal activity. Nitrogen concentrations have been very consistent with the long-term average trend. The majority of this nitrogen was present in the form of organic nitrogen and likely remained available for biological uptake due to the growth limitation dictated by the lack of phosphorus. This confirms previous conclusions that Sooke Lake Reservoir is extremely phosphorus limited.

In general, the nutrient concentrations confirm the ultra-oligotrophic status (extremely unproductive, phosphorus limited) of Sooke Lake Reservoir, which is positive for a drinking water supply source.

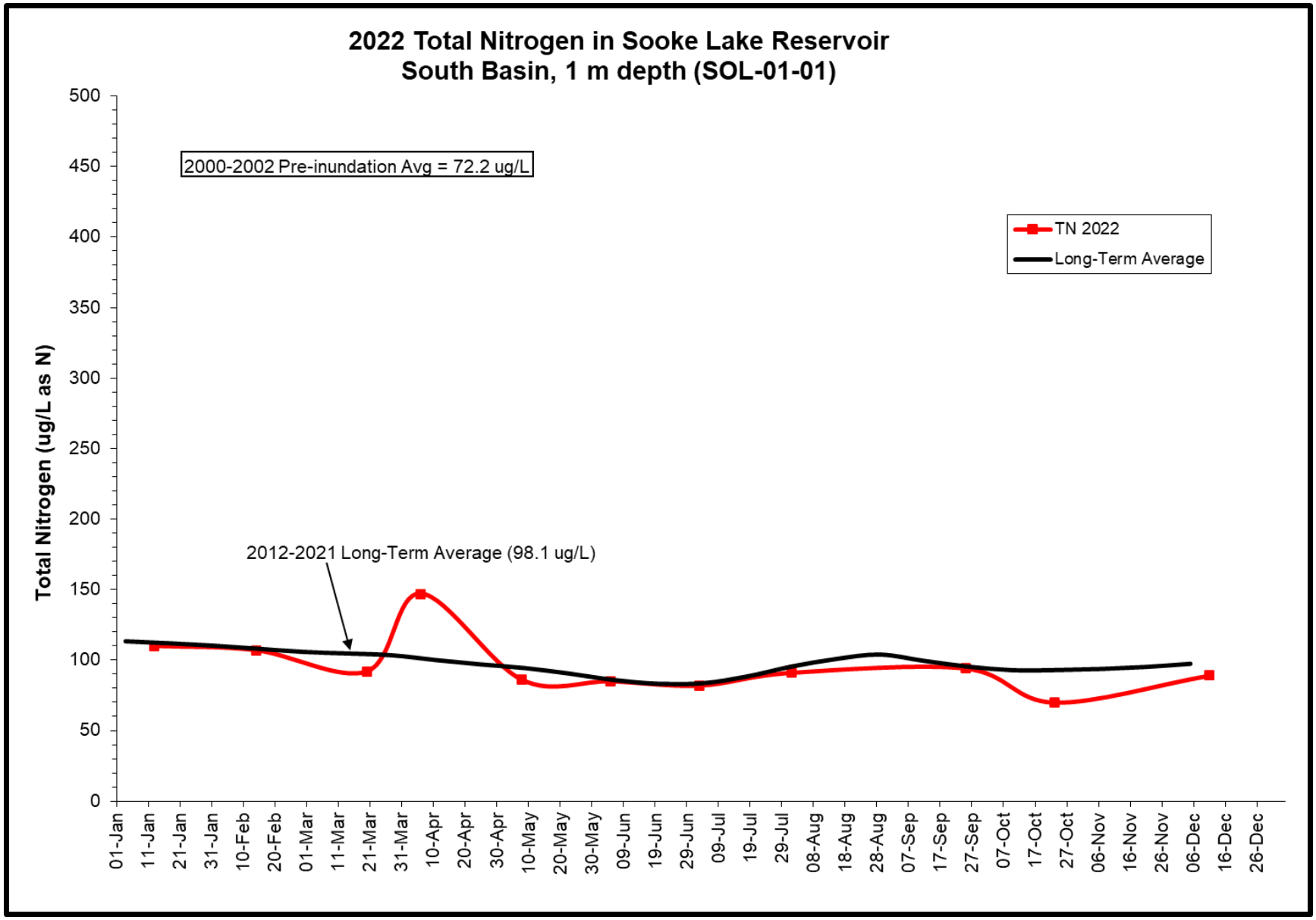

Figure 20 Total Nitrogen in Sooke Lake Reservoir, South Basin, 1 m depth (SOL-01-01)

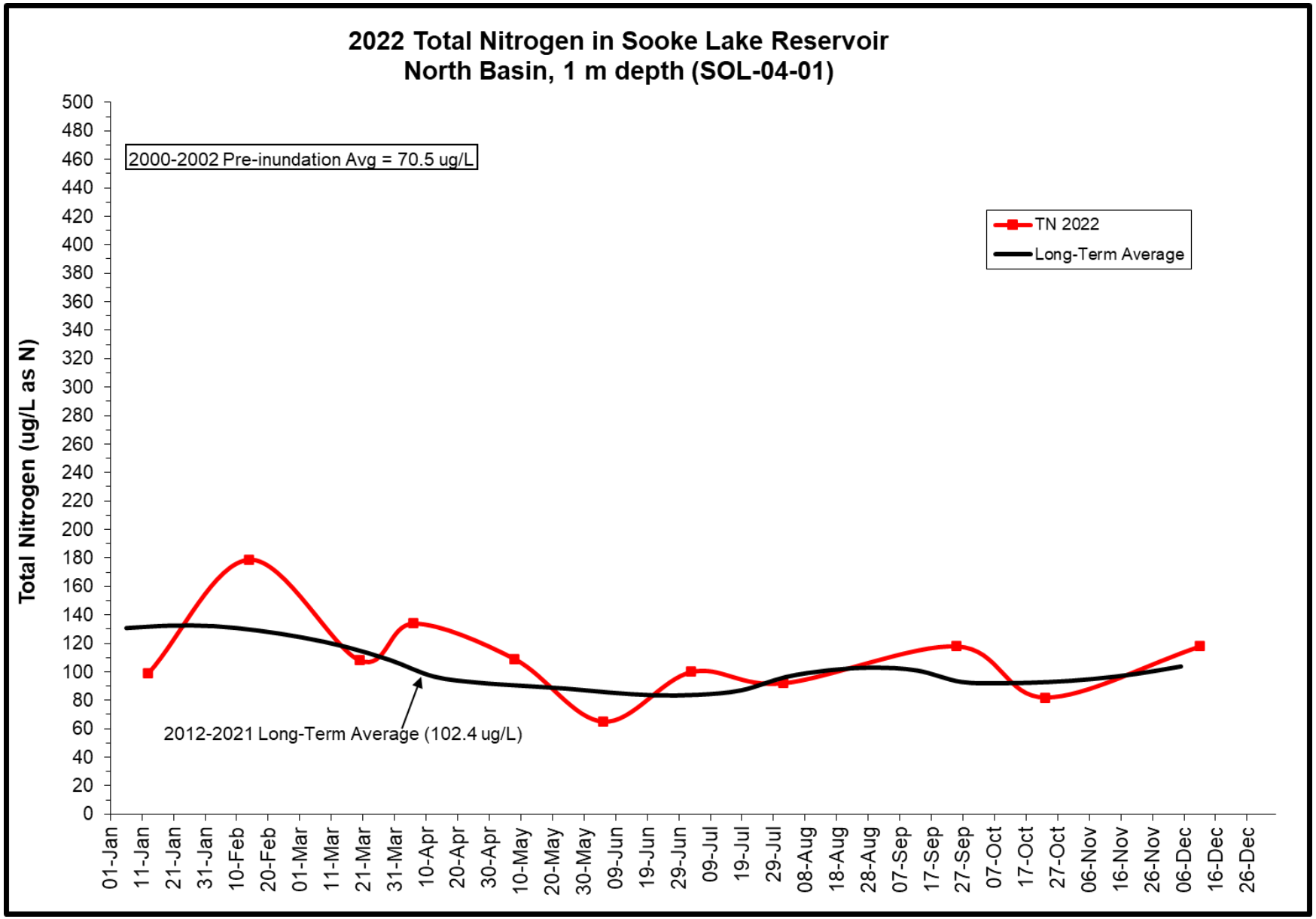

Figure 21 Total Nitrogen in Sooke Lake Reservoir, North Basin, 1 m depth (SOL-04-01)

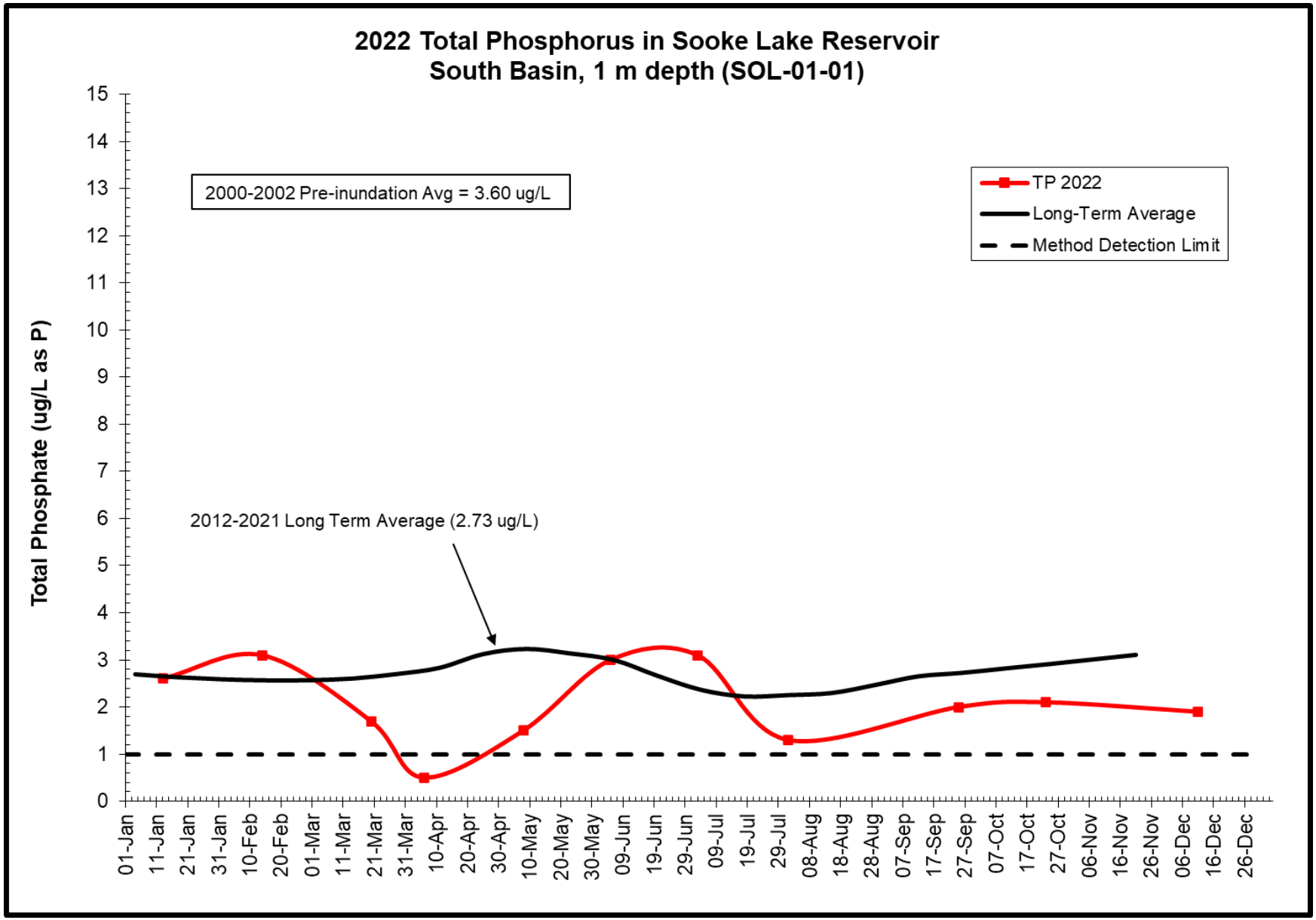

Figure 22 Total Phosphorus in Sooke Lake Reservoir, South Basin, 1 m depth (SOL-01-01)

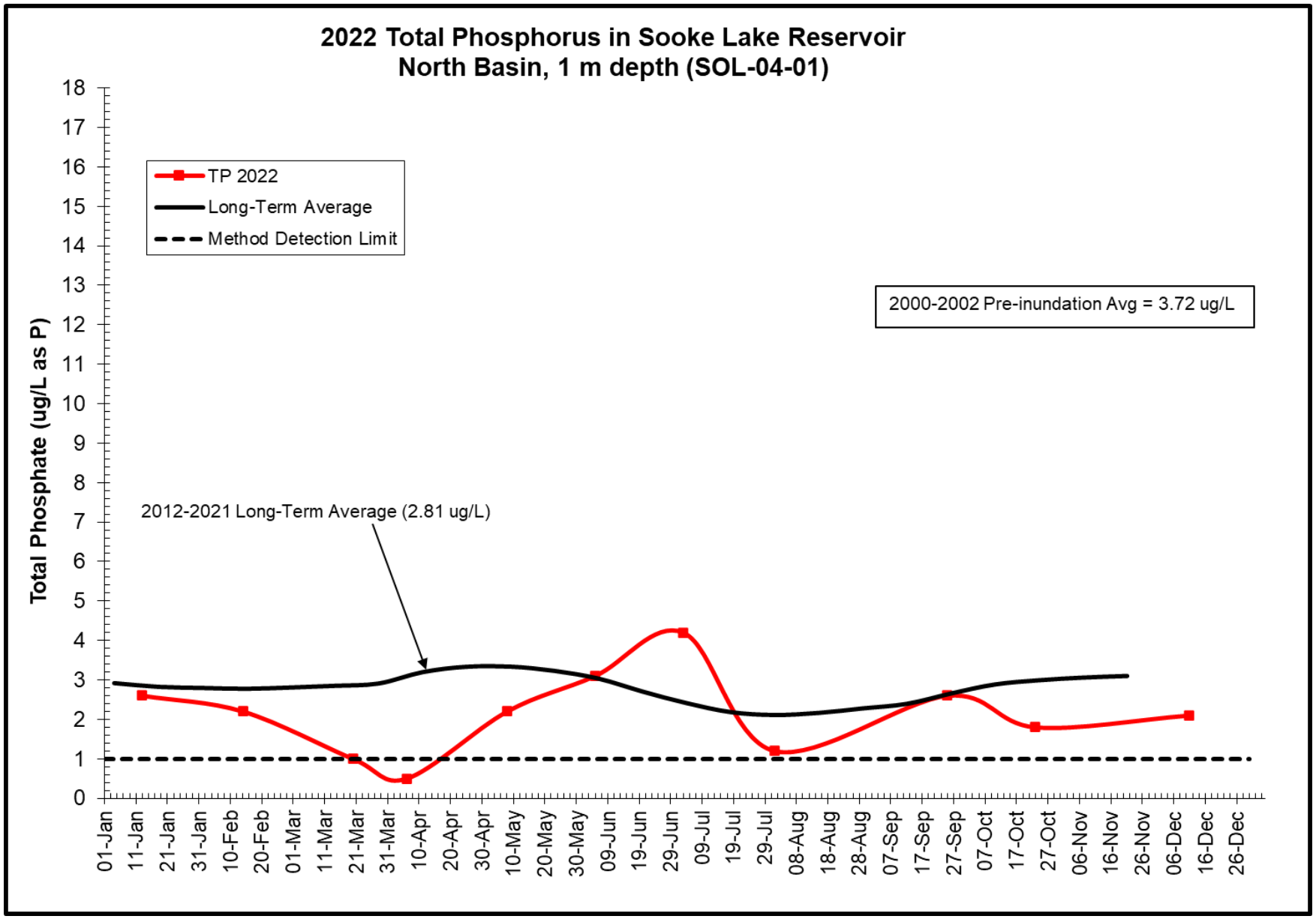

Figure 23 Total Phosphorus in Sooke Lake Reservoir, North Basin, 1 m depth (SOL-04-01)

7.2 Treatment Monitoring Results

The following sections summarize the water quality data collected and analyzed to monitor and verify the effectiveness of the disinfection process at both CRD disinfection facilities in the GVDWS.

7.2.1 Goldstream Water Treatment Plant

Bacteriological Results after UV Treatment. Figure 24 shows the results from 242 samples collected and analyzed just downstream of the UV reactors. The results indicate that the UV treatment is capable of greatly reducing the *E. coli* and total coliform concentrations. On very few occasions, six in all of 2022, and only in very low concentrations, have total coliform bacteria been found downstream of the UV treatment. The UV treatment is followed up by chlorination disinfection, designed to kill viruses and bacteria. These multiple disinfection stages are important components of the multi-barrier concept, which eliminates the reliance on only one module to achieve compliance.

Turbidity. The Goldstream Water Treatment Plant experienced three adverse turbidity events in 2022.

June 22, 2022: First high-demand watering day (Wednesday) of the year. With peak demand and high flows due to outdoor water demand, sediments in Main #4 and #5 between the Kapoor Tunnel and the Goldstream plant were dislodged and caused a short-period turbidity excursion to above 1 NTU (4h exceedance with a peak at 3.4 NTU).

June 29, 2022: Second high-demand watering Wednesday of the year. With peak demand and high flows due to outdoor water demand, sediments in Main #4 and #5 between the Kapoor Tunnel and the Goldstream plant were dislodged and caused a short-period turbidity excursion to above 1 NTU (2h exceedance with a peak at 1.15 NTU).

December 20, 2022: A power outage at the Head Tank due to adverse weather conditions in the evening of December 19, 2022, and a generator failure led to extremely high flows through Main #10 and #11 between the Intake Tower and the Head Tank. These high flows mobilized pipe sediments in these two mains, which caused a turbidity spike at the Goldstream plant in the morning of December 20, 2022. The turbidity at the Goldstream plant rose to 1.1 NTU for about 10 minutes.

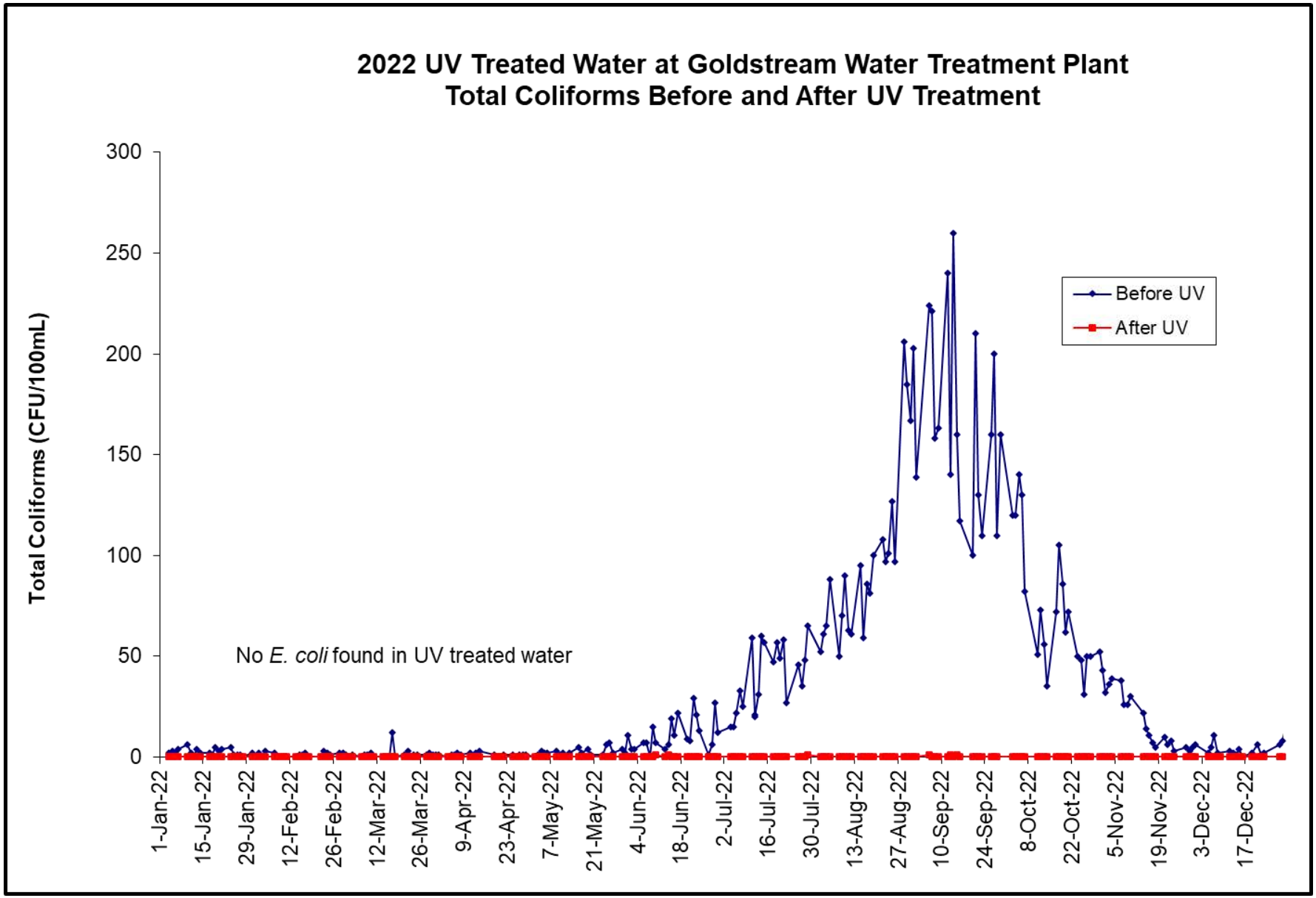

Figure 24 2022 UV Treated Water at Goldstream Water Treatment Plant Total Coliforms Before and After UV Treatment

Treated Water at Both First Customer Sampling Locations. The data collected from the two treated water sampling locations near the first customers below the Goldstream Water Treatment Plant (one at Main #4 and one at Main #5) indicated that the bacteriological quality of the disinfected water was good in all months of 2022 (Figure 25 and Appendix A, Table 2). In total, 240 samples were collected from the Main #4 first customer location and 218 samples from the Main #5 first customer location, for a combined total of 458 samples.

There were only five total coliform-positive samples from both sampling stations throughout the year. Four positive samples registered at the Main #5 first customer sampling station and one at the Main #4 station. All were very low total coliform concentrations. For all five positive results, no subsequent resample was positive for total coliform bacteria.

The few total coliform-positive results remained well under 10% of the monthly totals at both first customer locations. None of the positive results were in exceedance of the 10 CFU/100 mL total coliform limit, as per *Drinking Water Protection Regulation*. The negative resample results ruled out a breach in the system and any real contamination of the treated water. While the regulations require 90% of all monthly samples in the entire system to be free of total coliform bacteria, the CRD monitors the first customer locations based on even more stringent criteria, where water quality is gauged on the bacteriological results of these two first customer locations only.

The total chlorine residual ranged from 1.53-2.23 mg/L (Appendix A, Table 2), with a median value of 1.86 mg/L (Figure 25).

The treated water leaving the Goldstream Water Treatment Plant had the following physical and chemical characteristics:

- Median pH: 7.4
- Median Alkalinity: 16.20 mg/L
- Median Colour: 2.0 TCU
- Median Total Organic Carbon: 1.85 mg/L
- Median Conductivity (25ºC): 50.30 µS/cm
- Median Turbidity: 0.2 NTU

The values of the parameters above are consistent with those of previous years.

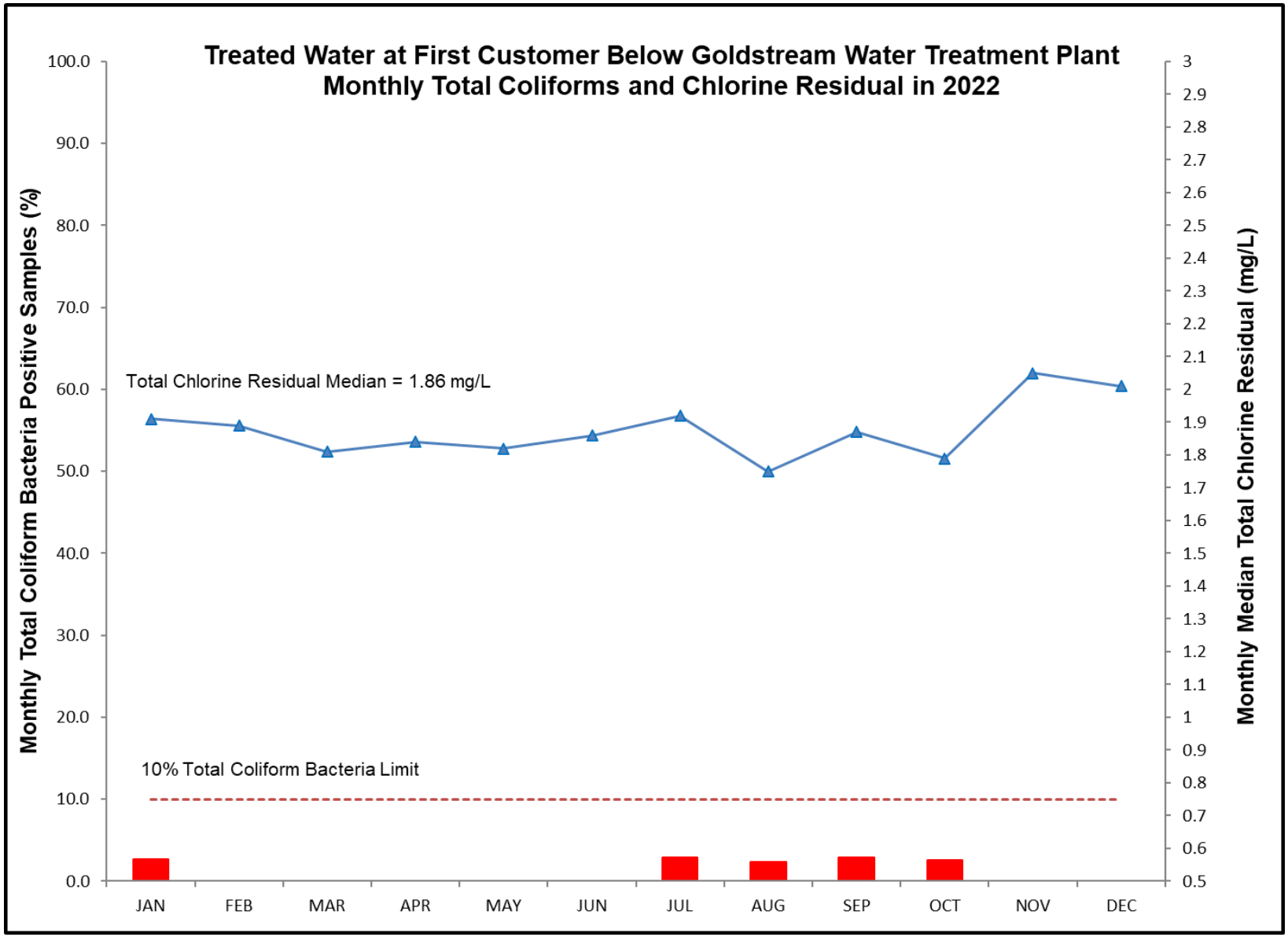

Figure 25 **Treated Water at First Customer Locations below Goldstream Water Treatment Plant; Monthly Total Coliforms and Chlorine Residual in 2022**

7.2.2 Sooke River Road Water Treatment Plant

Bacteriological Results after UV Treatment. Figure 26 shows the results from 37 samples collected and analyzed just downstream of the UV reactors. The results indicate that the UV treatment is capable of greatly reducing the *E. coli* and total coliform concentrations. Only on one occasion, and only in very low concentration, have total coliform bacteria been found downstream of the UV treatment. This is evidence of a very effective UV disinfection stage at this plant. The UV treatment is followed up by chlorination disinfection, designed to kill viruses and bacteria. These multiple disinfection stages are important components of the multi-barrier concept, which eliminates the reliance on only one module to achieve compliance.

Turbidity. The Sooke River Road Water Treatment Plant experienced one adverse turbidity event in 2022.

December 20, 2022: A power outage at the Head Tank due to adverse weather conditions in the evening of December 19, 2022, and a generator failure led to extremely high flows through Main #10 and #11 between the Intake Tower and the Head Tank. These high flows mobilized pipe sediments in these two mains, which caused a turbidity spike at the Sooke plant in the morning of December 20, 2022. The turbidity at the Sooke plant rose to 1.5 NTU for about 50 minutes.

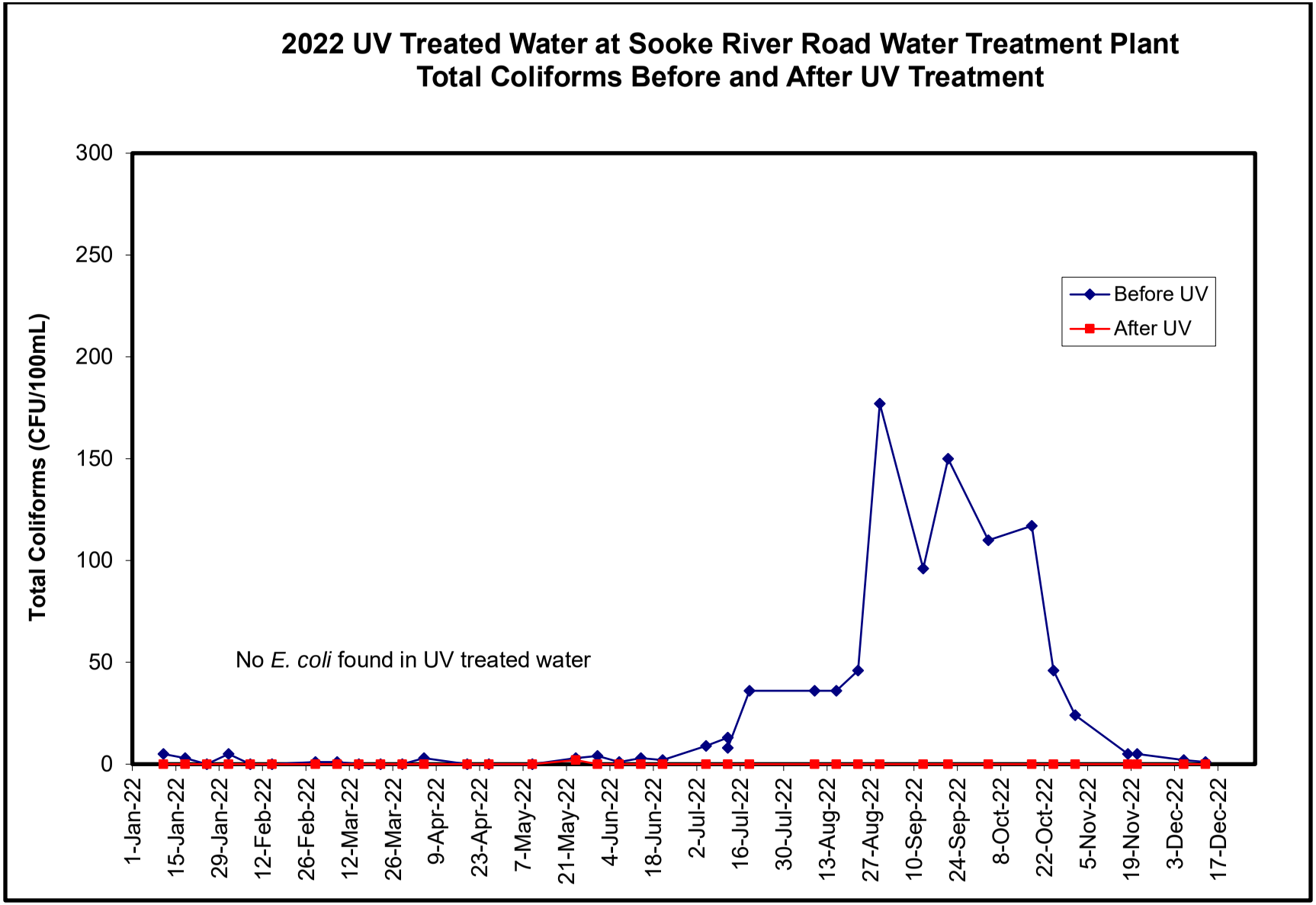

Figure 26 2022 UV Treated Water at Sooke River Road Water Treatment Plant Total Coliforms Before and After UV Treatment

Treated Water at First Customer. The data collected from the treated water sampling location near the first customer below the Sooke River Road Water Treatment Plant indicated that the bacteriological quality of the disinfected water was good in all months of 2022 (Figure 27).

No total coliform bacteria were detected in all 39 samples from this sampling station in 2022.

There were two total coliform-positive samples in 39 samples from this sampling station throughout the year. One positive sample occurred on June 21 and another on August 9. Both were very low total coliform concentrations and no subsequent resample was positive for total coliform bacteria.

Due to the low number of samples per month at this sampling station (four per month), the total coliform-positive results exceeded 10% of the monthly totals at this first customer location. None of the positive results were in exceedance of the 10 CFU/100 mL total coliform limit, as per *Drinking Water Protection Regulation*. The negative resample results ruled out a breach in the system and any real contamination of the treated water. While the regulations require 90% of all monthly samples in the entire system to be free of total coliform bacteria, the CRD monitors the first customer locations based on even more stringent criteria, where water quality is gauged on the bacteriological results of this first customer locations only. While total coliform hits at this sampling station are rare and unusual, they do occur from time to time and are likely a result of sampling error. These rare hits in the context of the aforementioned circumstances do not pose a risk to public health.

The total chlorine residual ranged from 1.28 - 2.38 mg/L with a median value of 2.03 mg/L.

The treated water leaving the Sooke River Road Water Treatment Plant had the following physical and chemical characteristics:

- Median pH: 7.5
- Median Alkalinity: 15.90 mg/L
- Median Colour: 2.0 TCU
- Median Conductivity (25ºC): 52.70 µS/cm
- Median Turbidity: 0.25 NTU

The values of the parameters above are consistent with those of previous years.

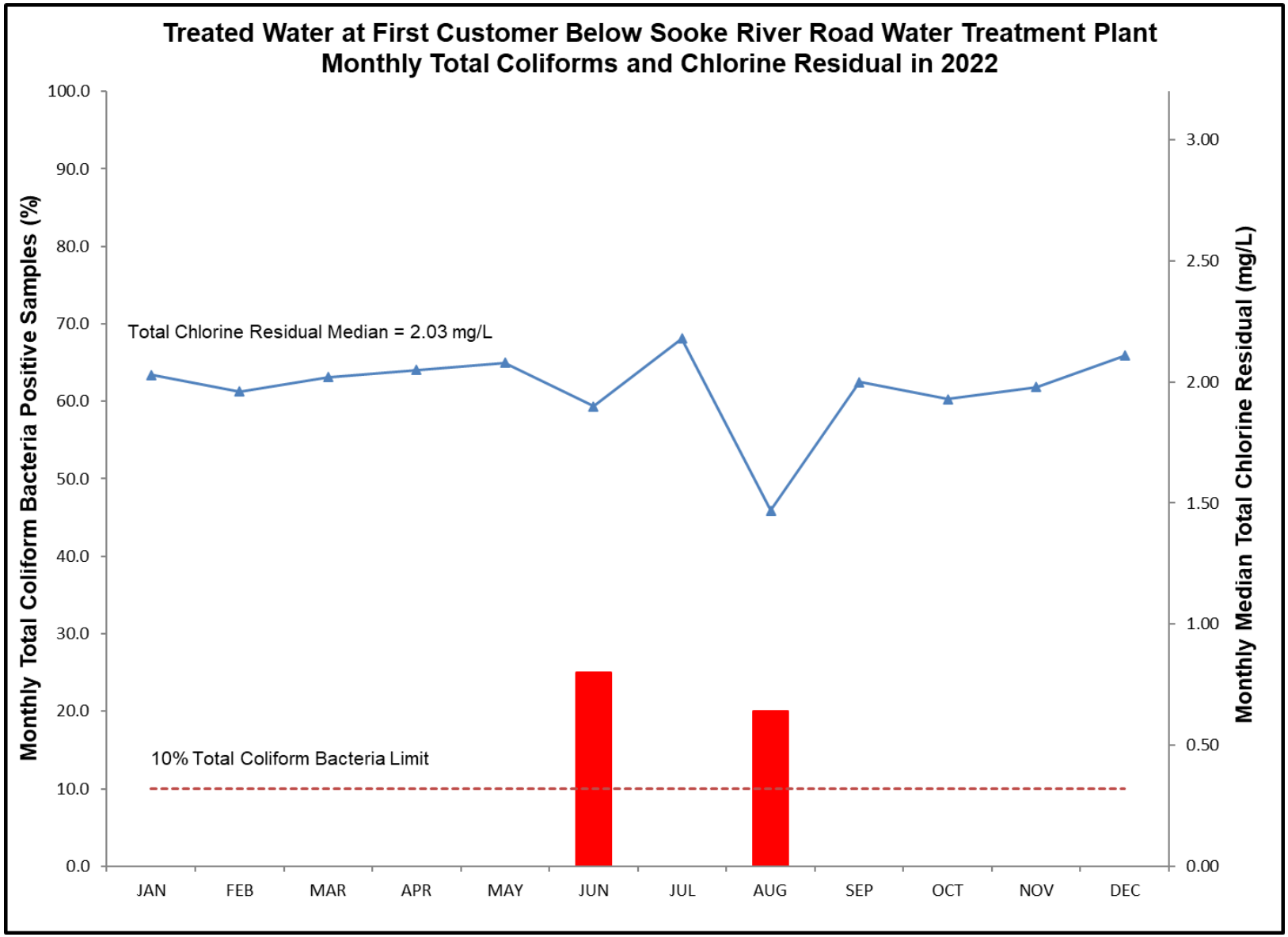

Figure 27 **Treated Water at First Customer below Sooke Rover Road Water Treatment Plant, Monthly Total Coliforms and Chlorine Residual in 2022**

7.3 CRD Transmission System Results

The following sections summarize the water quality data collected and analyzed for monitoring and verifying the safety of the drinking water conveyed through the transmission system before it reaches the municipal distribution systems. Bacteriological results of the samples collected in the transmission system are considered for compliance purposes. There is no applicable requirement for monthly sample numbers for a transmission system. The number of samples collected monthly from the CRD Transmission System infrastructure was based on a water quality risk assessment, and based on professional judgement.

7.3.1 Transmission Mains

The CRD transmission mains were sampled in 19 different sampling locations. The sampling locations for CRD transmission mains also include the Main #4 and Main #5 first customer sampling stations. In 2022, a total of 872 bacteriological and 848 water chemistry samples were collected and analyzed.

Bacteriological Results. Figure 28 and Table 1 show the results from 872 CRD transmission main samples collected and analyzed in 2022. The results (no *E. coli* and few total coliform bacteria detected) indicate that the water delivered through the transmission mains was bacteriologically safe. This system complied with the 10% total coliform-positive limit for all months. One sample each in July and August exceeded the 10 CFU/100 mL total coliform concentration threshold. There were no consecutive positive samples in 2022.

There were no *E coli* or total coliform positive samples in 2022.

Chlorine Residual. Table 1 and Figure 28 demonstrate that the annual median total chlorine concentration in the transmission mains was 1.63 mg/L and, therefore, provides for adequate secondary disinfection within the transmission system and within most areas of the downstream municipal distribution systems. In October, the declining total chlorine levels almost reached the operational minimum target of 1.5 mg/L at the Main #4 and #5 First Customer locations. Hence, the chlorine dosage was increased in November 2022.

Water Temperature. The annual median water temperature in the transmission mains was 9.3°C, with monthly medians ranging between 5.1°C (January) and 17.0°C (September) (Table 1). Based on these results, the water temperatures in the transmission mains were lower than in previous years.

Table 1 2022 Bacteriological Quality of the CRD Transmission Mains

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as	Median ° C
JAN	72	1	1.4	0	0	0	39	0	1.70	5.1
FEB	69	0	0.0	0	0	0	38	0	1.66	5.5
MAR	85	0	0.0	0	0	0	45	0	1.56	6.3
APR	68	0	0.0	0	0	0	38	0	1.62	7.6
MAY	76	0	0.0	0	0	0	43	0	1.56	9.1
JUN	78	0	0.0	0	0	0	47	2	1.65	11.5
JUL	69	3	4.3	0	1	0	36	0	1.61	12.8
AUG	86	3	3.5	0	1	0	44	0	1.58	14.4
SEP	67	1	1.5	0	0	0	35	0	1.57	17.0
OCT	72	1	1.4	0	0	0	41	0	1.56	16.7
NOV	72	1	1.4	0	0	0	39	0	1.77	9.0
DEC	58	0	0.0	0	0	0	35	0	1.77	6.2
Total:	872	10	1.1	0	2	0	480	2	1.63	9.3

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Disinfection Byproducts. The CRD collected six sets of samples for a disinfection byproduct analysis from a transmission main at Mills Road. The annual average total trihalomethane (TTHM) and annual average total haloacetic acid (HAA) concentrations were 17.5 and 17.2 µg/L, respectively, well below the MAC (TTHM = 100 and HAA = 80 µg/L) stipulated in the Canadian guidelines. These annual averages are in-line with the pre-2021 disinfection byproduct concentrations. At the beginning of 2021, the GVDWS was switched to free chlorine for about one month, which resulted in higher disinfection byproduct concentrations (see 2021 Annual Report). While this was a short-term effect and concentrations remained below the health limits, these results have demonstrated the importance of using chloramines for secondary disinfection for the purpose of disinfection byproduct management. This sampling location was also sampled and tested for the disinfection byproduct Nitrosodimethylamine (NDMA), a newly-listed parameter that is classified as "probably carcinogenic" by Health Canada and associated with disinfection using chloramines. The Canadian guidelines MAC for NDMA is 40 ng/L. All NDMA results at this location were below the detection limit of 1.9 ng/L.

This was the only transmission main where disinfection byproduct samples were collected (bi-monthly). The CRD disinfection byproduct monitoring focuses on locations with higher potential for disinfection byproduct formation, such as system extremities with high water age or areas downstream of re-chlorination stations (free chlorine).

Metals. The CRD Water Quality Monitoring Program for the CRD Transmission System included regular metals tests in three strategic locations, where the water transitions from the CRD Transmission System to a downstream distribution system. In particular, the CRD pays attention to metals commonly found in drinking water, such as iron, manganese, copper and lead. All metal results were below the Canadian guideline.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Physical/Chemical Parameters. The drinking water in the regional transmission mains had the following physical and chemical characteristics:

- Median pH: 7.4
- Median CaCO3 Hardness: 16.5 mg/L
- Median Alkalinity: 16.40 mg/L
- Median Colour: 2.00 TCU
- Median Turbidity: 0.25 NTU
- Median Conductivity (25ºC): 50.60 µS/cm

Compliance Status. The transmission mains of the CRD Transmission System were in compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation*, **except** for July and August, with two total coliform-positive results in exceedance of 10 CFU/100 mL. Immediate resamples following these results were negative for total coliform bacteria and did, therefore, confirm the safety of the drinking water.

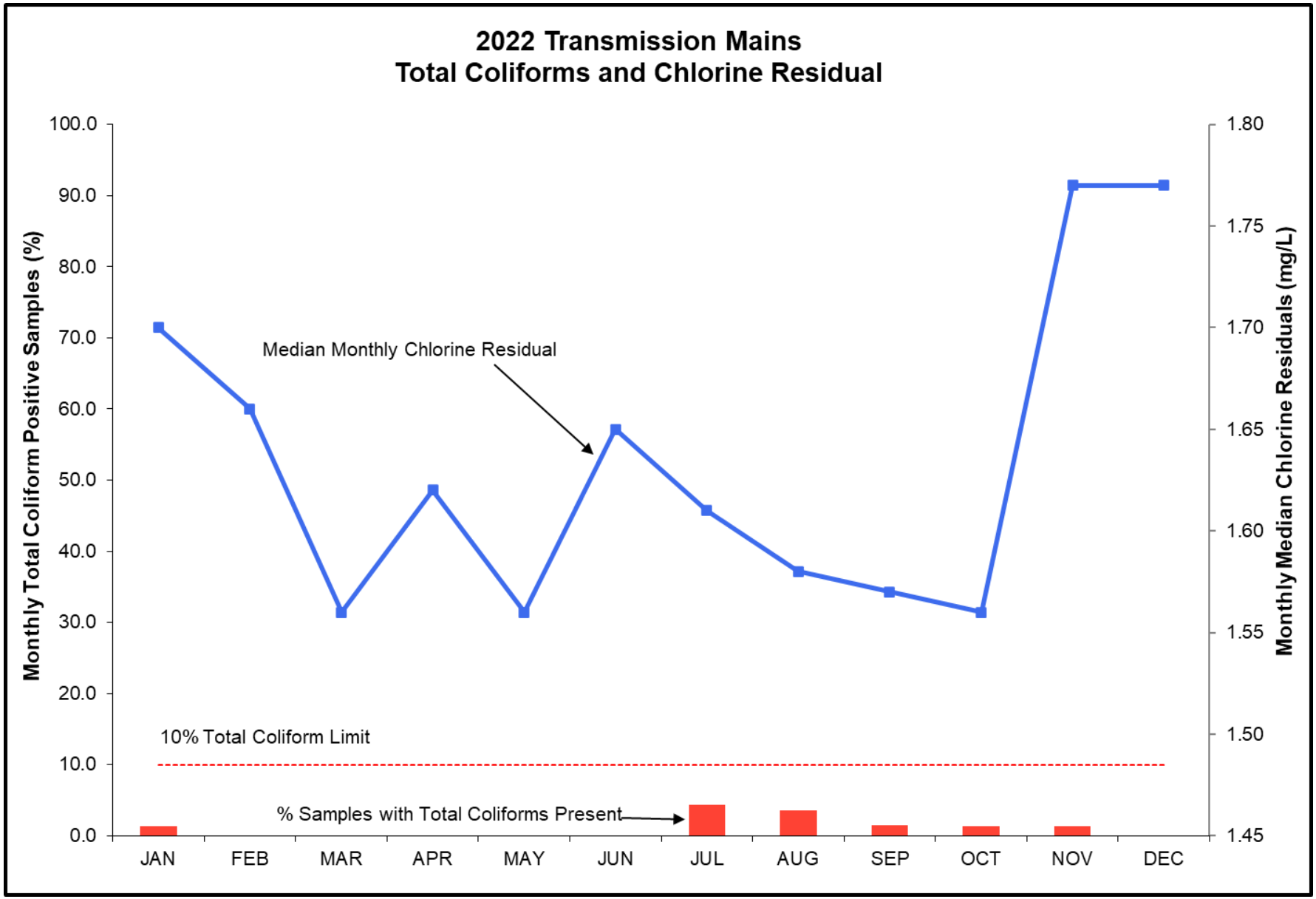

Figure 28 Transmission Mains Total Coliforms and Chlorine Residual in 2022

7.3.2 Supply Storage Reservoirs

The CRD supply storage reservoirs were sampled in seven different sampling locations. In 2022, a total of 166 bacteriological and 79 water chemistry samples were collected and analyzed.

Bacteriological Results. Typically, storage reservoirs are vulnerable to bacteria regrowth and potential contamination, due to the long retention times and generally lower chlorine residual concentrations. Because of the higher risks to water quality in reservoirs compared to pipes, the CRD typically monitors the water quality closely in all of its storage reservoirs and follows a rigorous maintenance schedule at these facilities.

Figure 29 and Table 2 show the 2022 results from the samples on the CRD supply storage reservoirs that are considered part of the CRD Transmission System. There was one total coliform-positive sample in June and two more in July (Table 2). The June total coliform positive sample and one of the July positive samples exceeded the 10 CFU/100 mL total coliform concentration threshold. This system complied with the 10% total coliform-positive limit for all months except for July when 12.5% of all collected bacteriological samples tested positive for total coliforms. All resamples following a total coliform positive hit tested negative for total coliform bacteria. The annual total coliform positive percentage was well below the 10% limit at 1.8% (Table 3).

The number of total coliform positive tests and the number of 10 CFU/100mL exceedances in June and July in the Supply Storage Reservoirs were unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. Such suspicious test results occurred between June and September 2022 randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

There were no *E coli* or total coliform positive samples in 2022.

Table 2 2022 Bacteriological Quality of Storage Reservoirs

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	9	0	0.0	0	0	0	2	0	1.53	6.0
FEB	14	0	0.0	0	0	0	2	0	1.44	6.3
MAR	18	0	0.0	0	0	0	2	0	1.42	6.6
APR	16	0	0.0	0	0	0	1	0	1.39	8.0
MAY	11	0	0.0	0	0	0	2	0	1.30	10.3
JUN	15	1	6.7	0	1	0	2	0	1.44	11.8
JUL	16	2	12.5	0	1	0	2	0	1.42	13.4
AUG	14	0	0.0	0	0	0	2	0	1.29	14.8
SEP	18	0	0.0	0	0	0	2	0	1.35	17.2
OCT	14	0	0.0	0	0	0	1	0	1.33	16.0
NOV	13	0	0.0	0	0	0	2	0	1.58	10.5
DEC	8	0	0.0	0	0	0	1	0	1.49	7.7
Total:	166	3	1.8	0	2	0	21	0	1.42	10.6

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli;* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Chlorine Residual. Table 2 and Figure 29 indicate that the median total chlorine concentration in the storage reservoirs ranged from 1.29-1.58 mg/L, with an annual median total chlorine concentration of 1.42 mg/L. These results demonstrate adequate secondary disinfection within the Supply Storage Reservoirs.

Water Temperature. The annual median water temperature in the storage reservoirs was 10.6°C, with monthly medians ranging between 6.0°C (January) and 17.2°C (September) (Table 2).

Disinfection Byproducts. The CRD collected a total of 36 samples for a disinfection byproduct analysis. The samples were collected at two storage reservoirs in the CRD Transmission System (Cloake Hill and Upper Dean Park reservoirs). Upstream of both locations, the CRD maintains a re-chlorination station that can boost free chlorine concentrations, if the residuals fall below 0.2 mg/L. While this procedure is rarely exercised, any free chlorine concentration can lead to an increase in disinfection byproduct formation. The annual average TTHM and HAA concentrations were 17.2 and 17.3 µg/L at Cloake Hill and 17.7 and 12.7 µg/L at Upper Dean, respectively, well below the MAC (TTHM = 100 and HAA = 80 µg/L) stipulated in the Canadian guidelines. These annual averages are in-line with the pre-2021 disinfection byproduct concentrations. At the beginning of 2021, the GVDWS was switched to free chlorine for about 1 month which resulted in higher disinfection byproduct concentrations (see 2021 Annual Report). While this was a short-term effect and concentrations remained below the health limits, these results have demonstrated the importance of using chloramines for secondary disinfection for the purpose of disinfection byproduct management. In five out of six samples, the NDMA concentrations at both locations were below the detection limit (1.9 ng/L). One sample from Upper Dean Park reservoir recorded a very low NDMA concentration of 2.1 ng/L. All NDMA results were therefore well below the Canadian guideline MAC of 40 ng/L.

Physical/Chemical Parameters. The drinking water in the regional supply storage reservoirs had the following physical and chemical characteristics in 2022:

- Median pH: 7.7
- Median Alkalinity: 16.1 mg/L
- Median Colour: 2.5 TCU
- Median Turbidity: 0.25 NTU
- Median Conductivity (25ºC): 51.40 µS/cm

Metals. No data for 2022.

Nitrification. Nitrification occurs in many chloraminated water systems. It is a complex bacteriological process in which ammonia is oxidized initially to nitrite and then to nitrate and is caused by two groups of bacteria that have low growth rates relative to other bacteria. Water temperature seems to be a critical factor for nitrification in distribution systems, as it has been almost exclusively associated with warm water temperatures. Nitrification is also associated with high water age (reservoirs, dead ends, low-flow pipes) and with sediment biofilms.

Monitoring for nitrifying bacteria directly is inefficient; however, the extent of nitrification in the distribution system can be monitored by measuring chlorine residuals and nitrite (also nitrate, free ammonia). When the chlorine residuals drop (in the absence of any pipe break or plant disinfection failure), accompanied by increases of nitrite, then nitrification is occurring. Since Greater Victoria's source water has no background nitrite, the presence of nitrite in the distribution system is the best indicator of nitrification.

The control of nitrification in a chloraminated distribution system involves limiting the excess free ammonia leaving the disinfection plant, maintaining an adequate chlorine residual throughout the distribution system, minimizing water age in storage facilities and in the low-flow areas of the distribution system, and maintaining annual flushing routines to limit the accumulation of sediment and biofilm in the distribution system piping. CRD Water Quality Operations staff, in conjunction with Integrated Water Services Department Operations and Engineering staff, are undertaking projects to optimize the reservoir and pipe-cleaning schedules to address nitrification and other water quality affecting processes throughout the

distribution systems. The new hypochlorite plant at the Goldstream Water Treatment Plant has improved the chemical dosing system and reduced the potential for free ammonia in the treated water.

Compliance Status. The CRD-owned and operated supply storage reservoirs in the CRD Transmission System were in compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* **except** for June, with one total coliform-positive result in exceedance of 10 CFU/100 mL, and July, with an exceedance of the 10% total coliform-positive limit and one total coliform-positive result in exceedance of 10 CFU/100 mL. In all these cases, immediate resamples confirmed the safety of the drinking water.

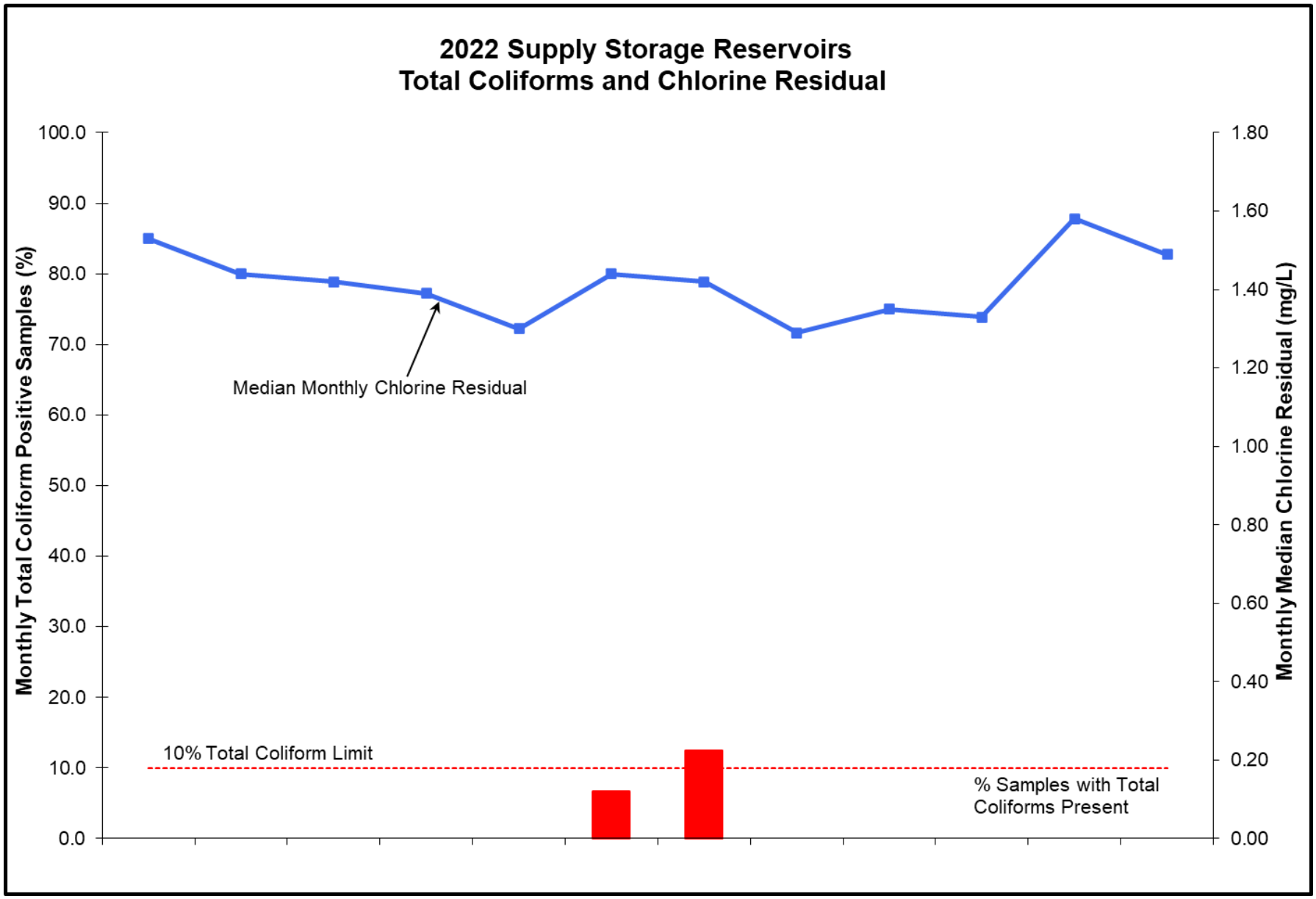

Figure 29 Supply Storage Reservoirs Total Coliforms and Chlorine Residual in 2022

7.4 Distribution System Results

The following sections summarize the water quality monitoring results within the various distribution systems and indicate the compliance status of each system.

7.4.1 Juan de Fuca Water Distribution System – Westshore Municipalities (CRD-owned and operated)

In 2022, 32 distribution system sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the Westshore system.

Sample Collection. In 2022, 903 bacteriological and 248 water chemistry samples were collected from the Juan de Fuca Water Distribution System (Table 3). Based on current population data for the Westshore municipalities, 66 samples are required for bacteria testing each month. Table 3 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. Total coliforms were found in seven samples throughout the year. All resamples, immediately collected after a total coliform positive result, were free of total coliform bacteria. No sample exceeded the 10 CFU/100 mL total coliform concentration threshold. This system complied with the 10% total coliform-positive limit for all months of the year during 2022. The annual total coliform positive percentage was well below the 10% limit at 0.8% (Table 3).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

There were no *E coli*-positive samples in 2022.

Table 3 2022 Bacteriological Quality of the Juan de Fuca Distribution System – Westshore Municipalities (CRD)

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	71	0	0.0	0	0	0	6	0	1.39	5.6
FEB	71	0	0.0	0	0	0	8	0	1.31	6.0
MAR	84	0	0.0	0	0	0	8	0	1.32	7.1
APR	73	0	0.0	0	0	0	7	0	1.34	8.5
MAY	71	0	0.0	0	0	0	8	0	1.23	10.4
JUN	83	0	0.0	0	0	0	9	0	1.30	13.0
JUL	71	3	4.2	0	0	0	8	0	1.09	15.3
AUG	82	0	0.0	0	0	0	8	0	1.03	16.9
SEP	73	2	2.7	0	0	0	7	0	1.06	17.8
OCT	74	2	2.7	0	0	0	7	0	1.07	17.3
NOV	81	0	0.0	0	0	0	6	0	1.04	10.2
DEC	69	0	0.0	0	0	0	4	0	1.38	7.0
Total:	903	7	0.8	0	0	0	86	0	1.24	10.7

Notes:
TC = Total Coliforms, E. coli = Escherichia coli, Cl2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Chlorine Residual. The annual median chlorine residual in the Westshore municipalities of the Juan de Fuca Water Distribution System was 1.24 mg/L (Table 2). The lowest monthly median was in August (1.03 mg/L) and the maximum monthly median was in January (1.39 mg/L) (Figure 30, Table 3).

Water Temperature. The annual median water temperature in the Juan de Fuca Water Distribution System was 10.7ºC, with monthly medians ranging between 5.6°C (January) and 17.8ºC (September) (Table 3).

Disinfection Byproducts. One location in the Juan de Fuca Water Distribution System had 18 samples collected for disinfection byproducts. The annual average TTHM and haloacetic acid (HAA5) concentrations in six samples each were 15.5 µg/L and <5 µg/L, respectively, far below the Canadian guideline MAC (TTHM = 100; HAA5 = 80). In five samples, the NDMA concentrations were below the detection limit of 1.9 ng/L, and in one sample 1.92 ng/L, well below the Canadian guideline MAC of 40 ng/L.

Physical/Chemical Parameters. The drinking water in the Westshore municipalities of the Juan de Fuca Water Distribution System had the following physical and chemical characteristics in 2022:

- Median pH: 7.4
- Median CaCO3 Hardness: 16.5 mg/L
- Median Alkalinity: 16.60 mg/L
- Median Colour: 2.0 TCU
- Median Conductivity (25ºC): 52.50 µS/cm
- Median Turbidity: 0.20 NTU

Metals. One sampling station in this system was sampled for metals bi-monthly. All metals were below the Canadian guideline limits.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems as well as in the vast majority of private plumbing systems is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Westshore municipalities of the Juan de Fuca Water Distribution System were in full compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* in 2022.

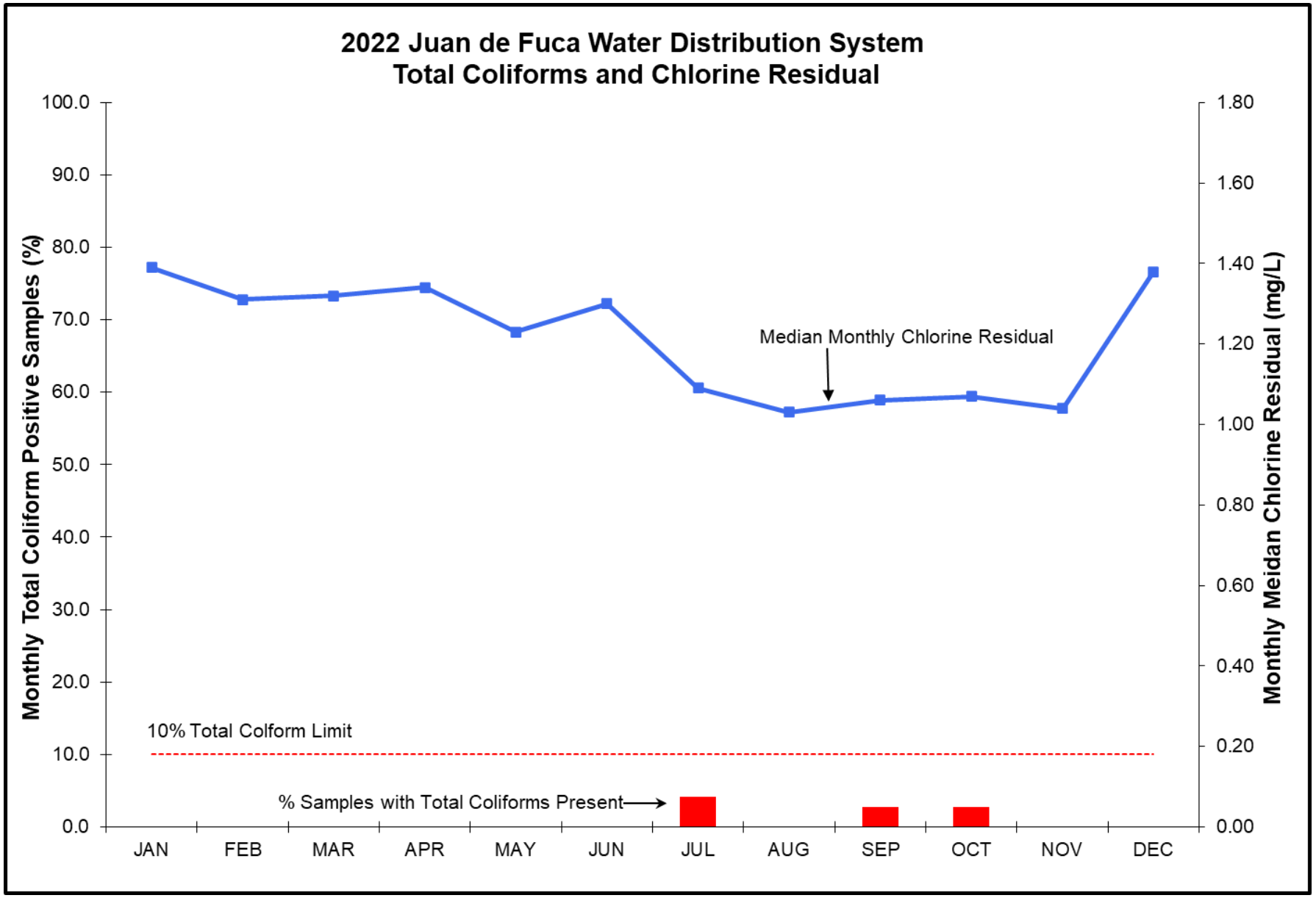

Figure 30 Juan de Fuca – Westshore Distribution System Total Coliforms and Chlorine Residual in 2022

7.4.2 Sooke/East Sooke Distribution System (CRD-Owned and Operated)

In 2022, 20 sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in Sooke/East Sooke system. Half of all Sooke/East Sooke sampling stations were typically sampled once per week for a bi-weekly sampling frequency of all stations.

Sample Collection. In 2022, 384 bacteriological and 206 water chemistry samples were collected from the Sooke/East Sooke Distribution System (Table 4). Based on current population data for the District of Sooke, 13 samples are required for bacteria testing each month. Table 4 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. Total coliforms were found in six samples throughout the year. All resamples, immediately collected after a total coliform positive result, were free of total coliform bacteria. No sample exceeded the 10 CFU/100 mL total coliform concentration threshold. This system complied with the 10% total coliform-positive limit for all months of the year during 2022. The annual total coliform positive percentage was well below the 10% limit at 1.6% (Table 4).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

No *E. coli* bacteria were found in any sample collected in 2022 (Table 4).

Table 4 2022 Bacteriological Quality of the Sooke/East Sooke Distribution System (CRD)

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	30	0	0.0	0	0	0	6	0	1.20	6.0
FEB	29	0	0.0	0	0	0	9	1	1.20	6.5
MAR	48	0	0.0	0	0	0	12	0	1.13	7.3
APR	30	0	0.0	0	0	0	8	0	1.09	8.9
MAY	31	1	3.2	0	0	0	9	0	0.95	11.1
JUN	32	2	6.3	0	0	0	7	0	1.08	13.1
JUL	30	0	0.0	0	0	0	9	0	1.04	15.5
AUG	48	3	6.3	0	0	0	11	0	0.99	17.2
SEP	25	0	0.0	0	0	0	7	0	0.53	17.3
OCT	31	0	0.0	0	0	0	7	1	0.68	15.3
NOV	31	0	0.0	0	0	0	9	0	0.83	9.8
DEC	19	0	0.0	0	0	0	5	0	1.10	7.2
Total:	384	6	1.6	0	0	0	99	2	1.02	10.9

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Chlorine Residual. The annual median chlorine residual in the Sooke/East Sooke Distribution System was 1.02 mg/L (Table 4, Figure 31). The lowest monthly median was in September (0.53 mg/L), and the maximum monthly median was in January/February (1.20 mg/L). The low chlorine residual in early fall is typical for the Sooke/East Sooke System, due to the increased chlorine demand in the warm water season.

Water Temperature. The annual median water temperature in the Sooke/East Sooke Distribution System was 10.9°C, with monthly medians ranging between 6.0ºC (January) and 17.3°C (September) (Table 4).

Disinfection Byproducts. One location in the Sooke distribution system had 18 samples collected for disinfection byproducts. The annual average TTHM and HAA5 concentrations from six samples each were 26.7 and 23.5 µg/L, respectively, far below the Canadian guideline MAC (TTHM = 100; HAA5 = 80). In six samples, the NDMA concentrations were below the detection limit of 1.9 ng/L, well below the Canadian guideline MAC of 40 ng/L.

Physical/Chemical Parameters. The drinking water in the Sooke/East Sooke Distribution System had the following physical and chemical characteristics:

- Median pH: 7.5
- Median CaCO3 Hardness: 16.8 mg/L
- Median Colour: 2.0 TCU
- Median Alkalinity: 16.10 mg/L
- Median Turbidity: 0.20 NTU
- Median Conductivity (25ºC): 53.70 µS/cm

Metals. The CRD Water Quality Monitoring Program for the Sooke/East Sooke system included bi-monthly metal tests in two strategic locations in 2022: first customer sampling station on Sooke River Road, and Whiffen Spit Road. All metallic parameters, including lead, were well below the Canadian guideline limits.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Sooke/East Sooke Distribution System was in full compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* in 2022.

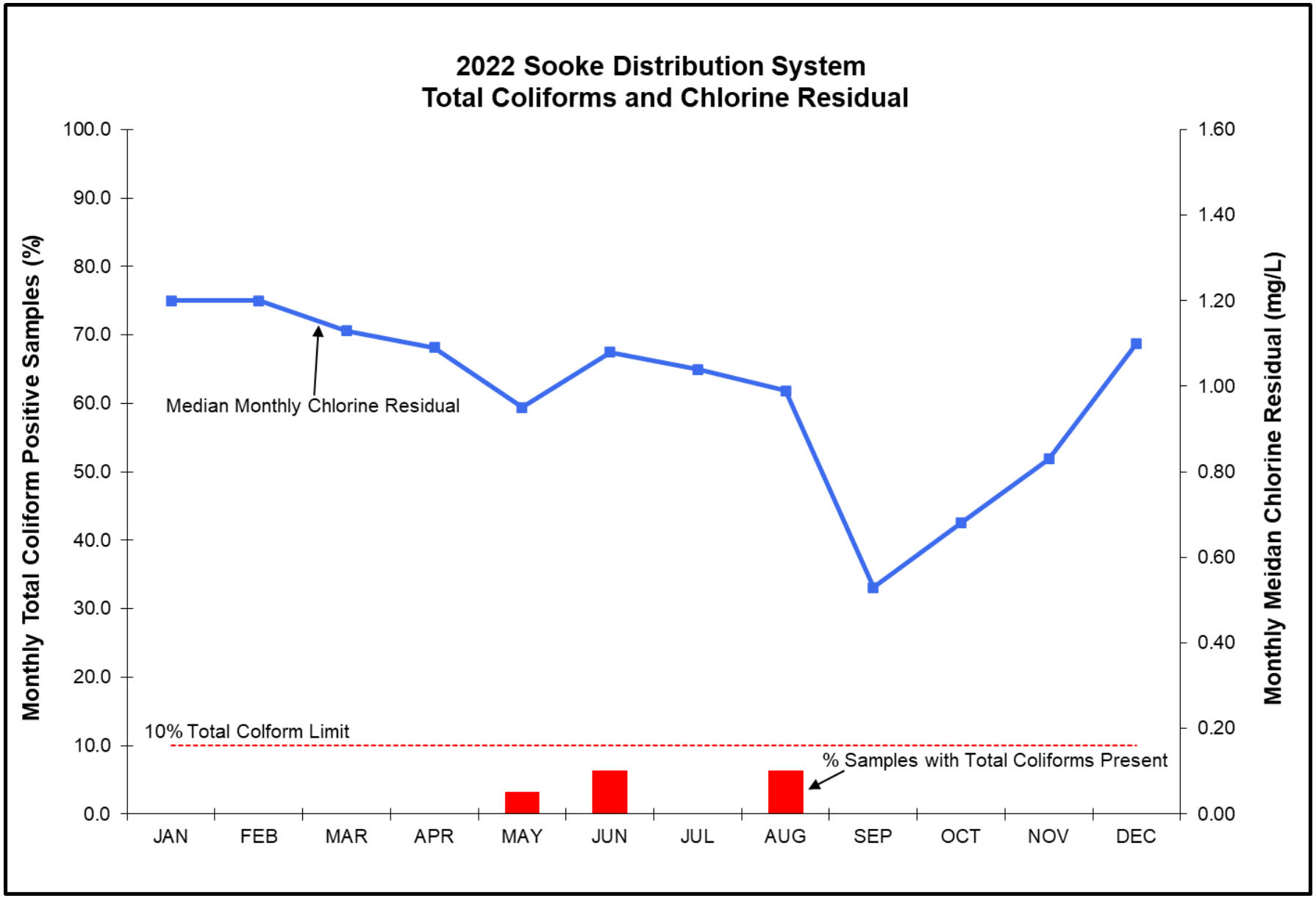

Figure 31 Sooke/East Sooke Distribution System Total Coliforms and Chlorine Residual in 2022

7.4.3 Central Saanich Distribution System – (District of Central Saanich-Owned and Operated)

In 2022, 11 sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the Central Saanich Distribution System. Central Saanich sampling stations are part of the daily distribution sampling runs by CRD staff.

Sample Collection. In 2022, 274 bacteriological and 218 water chemistry samples were collected from the Central Saanich Distribution System (Table 5). Based on current population data for the District of Central Saanich, 17 samples are required for bacteria testing each month. Table 5 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. Total coliforms were found in four samples throughout the year. All resamples, immediately collected after a total coliform positive result, were free of total coliform bacteria. No sample exceeded the 10 CFU/100 mL total coliform concentration threshold. This system complied with the 10% total coliform-positive limit for all months of the year during 2022. The annual total coliform positive percentage was well below the 10% limit at 1.5% (Table 5).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

No *E. coli* bacteria were found in any sample collected in 2022 (Table 5).

Chlorine Residual. The annual median chlorine residual in the Central Saanich Distribution System was 1.46 mg/L (Table 5). The lowest monthly median was in October (1.34 mg/L) and the maximum monthly median was in December (1.62 mg/L) (Figure 32, Table 5).

Water Temperature. The annual median water temperature in the Central Saanich Distribution System was 11.4°C, with monthly medians ranging between 6.5°C (January) and 17.8°C (September) (Table 5).

Table 5 2022 Bacteriological Quality of the Central Saanich Distribution System

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	23	0	0.0	0	0	0	10	0	1.57	6.5
FEB	21	0	0.0	0	0	0	10	0	1.41	7.0
MAR	25	0	0.0	0	0	0	7	0	1.45	7.8
APR	20	0	0.0	0	0	0	9	0	1.45	9.2
MAY	22	0	0.0	0	0	0	11	0	1.42	10.8
JUN	26	1	3.8	0	0	0	12	0	1.47	13.1
JUL	20	0	0.0	0	0	0	10	0	1.41	15.1
AUG	25	0	0.0	0	0	0	10	0	1.42	16.8
SEP	25	2	8.0	0	0	0	9	0	1.45	17.8
OCT	23	0	0.0	0	0	0	10	0	1.34	16.7
NOV	26	1	3.8	0	0	0	10	0	1.53	11.2
DEC	18	0	0.0	0	0	0	7	0	1.62	8.4
Total:	274	4	1.5	0	0	0	115	0	1.46	11.4

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Disinfection Byproducts. No data for 2022.

Physical/Chemical Parameters. The drinking water in the Central Saanich Distribution System had the following physical and chemical characteristics in 2022:

- Median pH: 7.6
- Median Turbidity: 0.25 NTU
- Median Colour: 2.0 TCU
- Median Alkalinity: 16.40 mg/L
- Median Conductivity (25ºC): 51.20 µS/cm

Metals. No data for 2022.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Central Saanich Distribution System was in full compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* in 2022.

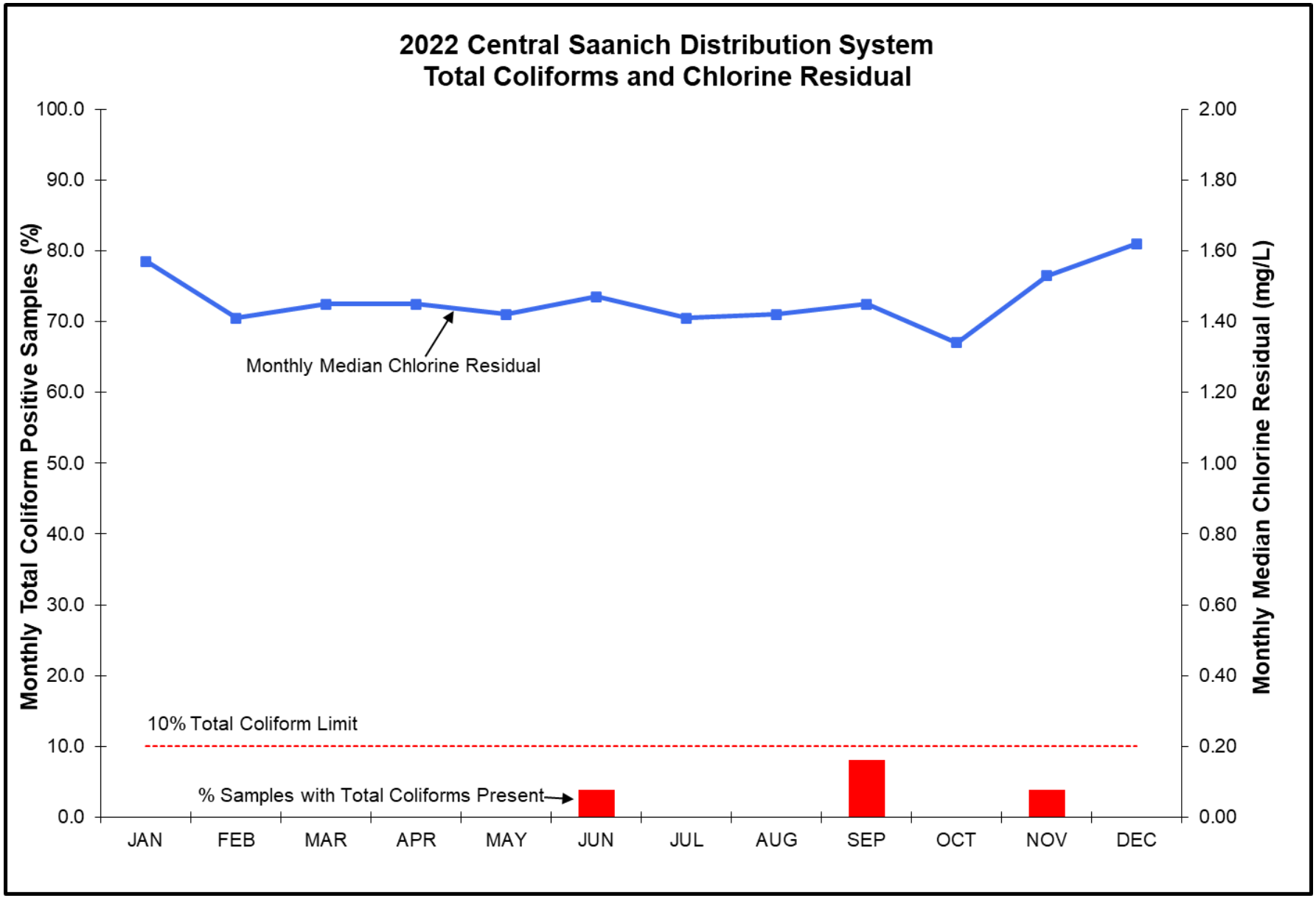

Figure 32 Central Saanich Distribution System Total Coliforms and Chlorine Residual in 2022

7.4.4 North Saanich Distribution System – (District of North Saanich-Owned and Operated)

In 2022, eight sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the North Saanich Distribution System. North Saanich sampling stations are part of the daily distribution sampling runs by CRD staff.

Sample Collection. In 2022, 235 bacteriological and 81 water chemistry samples were collected from the North Saanich Distribution System (Table 6). Based on current population data for the District of North Saanich, 12 samples are required for bacteria testing each month. Table 6 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. There were five total coliform-positive samples in 2022 (Table 6). Two of the three total coliform positive samples in August exceeded the 10 CFU/100 mL total coliform concentration threshold. This system complied with the 10% total coliform-positive limit for all months except for August, when 11.1% of all collected bacteriological samples tested positive for total coliforms. All resamples following a total coliform positive hit tested negative for total coliform bacteria. The annual total coliform positive percentage was well below the 10% limit at 2.1% (Table 6).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

None of the samples contained *E. coli* in 2022 (Table 6).

Table 6 2022 Bacteriological Quality of the North Saanich Distribution System

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	19	0	0.0	0	0	0	1	0	1.19	7.0
FEB	18	0	0.0	0	0	0	2	0	1.10	7.3
MAR	19	0	0.0	0	0	0	2	0	1.16	7.8
APR	18	0	0.0	0	0	0	2	0	1.19	9.2
MAY	18	0	0.0	0	0	0	2	0	1.13	10.7
JUN	22	0	0.0	0	0	0	3	0	1.22	13.4
JUL	18	1	5.6	0	0	0	2	0	1.32	15.4
AUG	27	3	11.1	0	2	0	2	0	1.14	16.7
SEP	20	0	0.0	0	0	0	1	0	1.14	17.5
OCT	19	0	0.0	0	0	0	2	0	1.04	16.6
NOV	21	1	4.8	0	0	0	3	0	1.05	11.5
DEC	16	0	0.0	0	0	0	1	0	1.25	8.5
Total:	235	5	2.1	0	2	0	23	0	1.15	11.4

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Chlorine Residual. The annual median chlorine residual in the North Saanich Distribution System was 1.15 mg/L (Table 6). The lowest monthly median was in October (1.04 mg/L) and the maximum monthly median was in July (1.32 mg/L) (Figure 33, Table 6).

Water Temperature. The annual median water temperature in the North Saanich Distribution System was 11.4°C, with monthly medians ranging between 7.0°C (January) and 17.5°C (September) (Table 6).

Disinfection Byproducts. No data in 2022.

Physical/Chemical Parameters. The drinking water in the North Saanich Distribution System had the following physical and chemical characteristics in 2022:

- Median pH: 7.7
- Median Colour: 2.0 TCU
- Median Turbidity: 0.20 NTU
- Median Alkalinity: 16.40 mg/L
- Median Conductivity (25ºC): 52.00 µS/cm

Metals. No data in 2022.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The North Saanich Distribution System was in compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* **except** for August, with two total coliform-positive results in exceedance of 10 CFU/100 mL, and an exceedance of the 10% total coliform-positive limit. In all these cases, immediate resamples confirmed the safety of the drinking water.

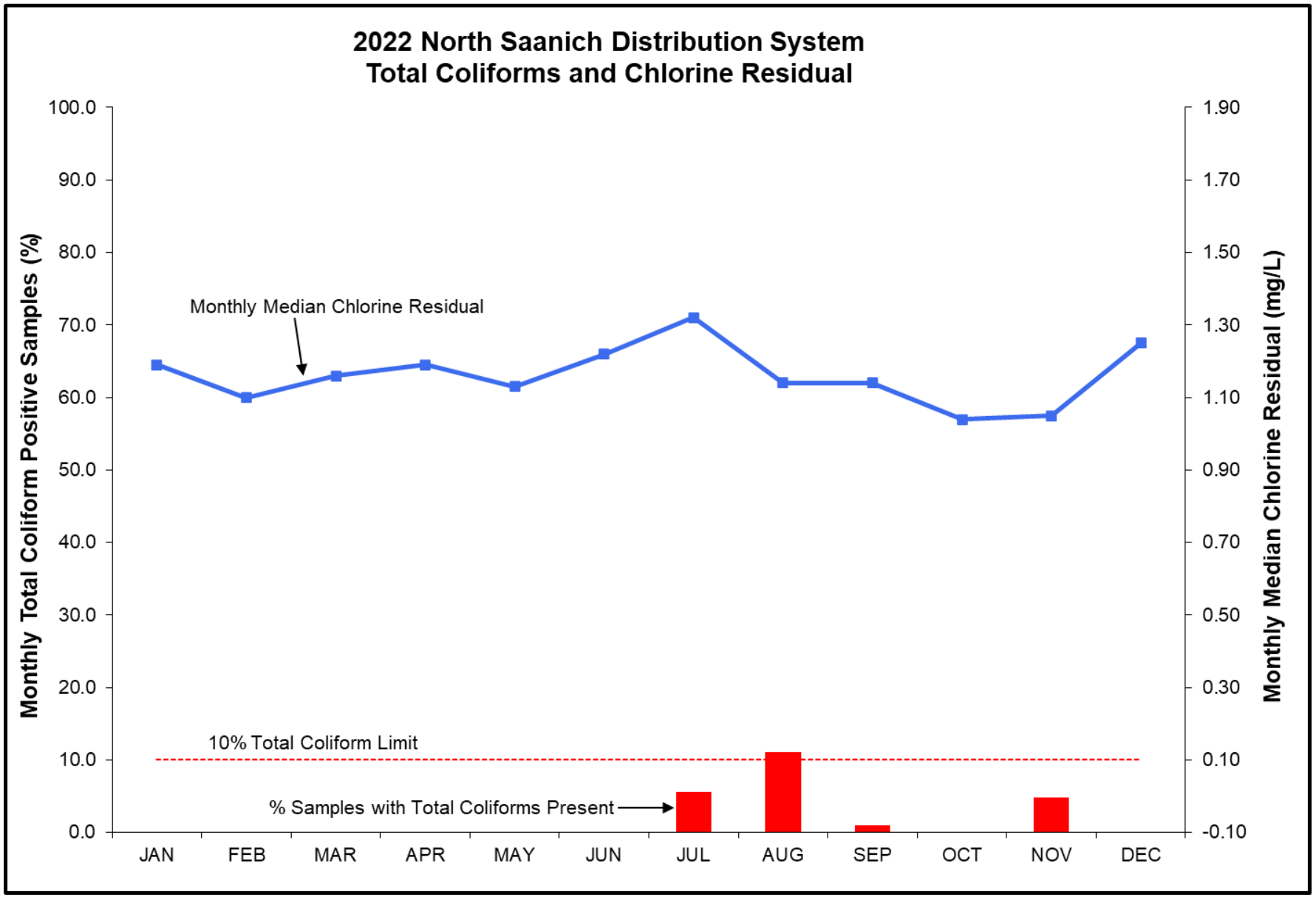

Figure 33 North Saanich Distribution System Total Coliforms and Chlorine Residual in 2022

7.4.5 Oak Bay Distribution System – (District of Oak Bay-Owned and Operated)

In 2022, eight sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the Oak Bay Distribution System. Oak Bay sampling stations are part of the daily distribution sampling runs by CRD staff.

Sample Collection. In 2022, 285 bacteriological and 160 water chemistry samples were collected from the Oak Bay Distribution System (Table 7). Based on current population data for the District of Oak Bay, 19 samples are required for bacteria testing each month. Table 7 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. Five samples throughout the year tested positive for total coliform bacteria. With three total coliform hits and therefore 11.1% of all samples collected in June testing total coliform positive, this system did not comply with the 10% total coliform-positive limit for that month. All resamples following a total coliform positive hit tested negative for total coliform bacteria. No sample exceeded the 10 CFU/100 mL total coliform concentration threshold. The annual total coliform positive percentage was well below the 10% limit at 1.8% (Table 7).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

No *E. coli* bacteria were found in any sample collected in 2022 (Table 7).

Chlorine Residual. The annual median chlorine residual in the Oak Bay Distribution System was 1.46 mg/L (Table 7). The lowest monthly median was in October (1.38 mg/L) and the maximum monthly median was in December (1.61 mg/L) (Figure 34).

Water Temperature. The annual median water temperature in the Oak Bay Distribution System was 11.8°C, with monthly medians ranging between 6.7°C (January) and 18.4°C (September) (Table 7).

Table 7 2022 Bacteriological Quality of the Oak Bay Distribution System

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	23	0	0.0	0	0	0	3	0	1.60	6.7
FEB	21	0	0.0	0	0	0	3	0	1.46	7.3
MAR	25	0	0.0	0	0	0	3	0	1.50	8.1
APR	21	0	0.0	0	0	0	4	1	1.45	10.1
MAY	24	0	0.0	0	0	0	5	0	1.42	11.8
JUN	27	3	11.1	0	0	0	4	0	1.40	14.0
JUL	22	1	4.5	0	0	0	3	0	1.49	15.6
AUG	26	1	3.8	0	0	0	3	0	1.39	17.0
SEP	25	0	0.0	0	0	0	3	0	1.40	18.4
OCT	24	0	0.0	0	0	0	4	0	1.38	17.4
NOV	25	0	0.0	0	0	0	3	0	1.46	10.9
DEC	22	0	0.0	0	0	0	2	0	1.61	8.0
Total:	285	5	1.8	0	0	0	40	1	1.46	11.8

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Disinfection Byproducts. No data for 2022.

Physical/Chemical Parameters. The drinking water in the Oak Bay Distribution System had the following physical and chemical characteristics:

- Median pH: 7.7
- Median Alkalinity: 16.90 mg/L
- Median Turbidity: 0.25 NTU
- Median Conductivity (25ºC): 51.30 µS/cm
- Median Colour: 4.0 TCU

Metals. No data in 2022.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Oak Bay Distribution System was in compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* **except** for June, with an exceedance of the 10% total coliform-positive limit. In all these cases, immediate resamples confirmed the safety of the drinking water.

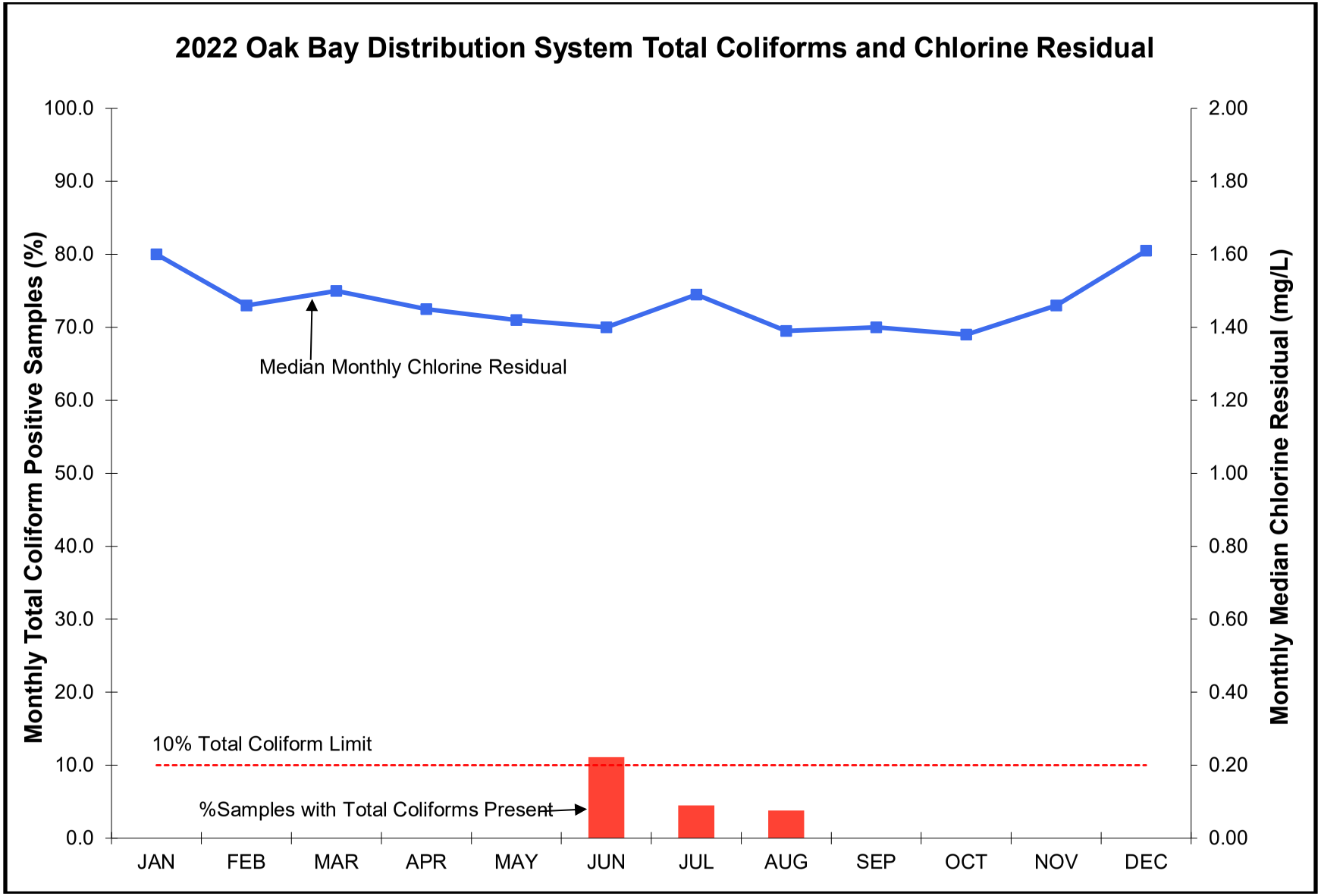

Figure 34 Oak Bay Distribution System Total Coliforms and Chlorine Residual in 2022

7.4.6 Saanich Distribution System – (District of Saanich-Owned and Operated)

In 2022, 64 sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the Saanich Distribution System. Saanich sampling stations were part of the daily distribution sampling runs by CRD staff and a weekly run by Saanich staff.

Sample Collection. In 2022, 1,171 bacteriological and 177 water chemistry samples were collected from the Saanich Distribution System (Table 8). Based on current population data for the District of Saanich, 93 samples are required for bacteria testing each month. Table 8 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. A small number of total coliform-positive results were recorded throughout the year. There were no consecutive positive samples in 2022. One sample in August exceeded the 10 CFU/100 mL total coliform concentration limit. This system complied with the 10% total coliform-positive limit for all months. The annual total coliform positive percentage was well below the 10% limit, at only 0.3% (Table 8).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

No *E. coli* bacteria were found in any sample collected in 2022 (Table 8).

Chlorine Residual. The annual median chlorine residual in the Saanich Distribution System was 1.44 mg/L (Table 8). The lowest monthly median was in October (1.28 mg/L) and the maximum monthly median was in December (1.59 mg/L) (Figure 35).

Water Temperature. The annual median water temperature in the Saanich Distribution System was 11.3°C, with monthly medians ranging between 6.0°C (January) and 18.2°C (September) (Table 8).

Table 8 2022 Bacteriological Quality of the Saanich Distribution System

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	95	0	0.0	0	0	0	3	0	1.58	6.0
FEB	94	0	0.0	0	0	0	5	0	1.50	6.6
MAR	100	0	0.0	0	0	0	5	0	1.42	7.8
APR	96	0	0.0	0	0	0	4	0	1.42	9.4
MAY	96	0	0.0	0	0	0	6	1	1.39	11.0
JUN	101	1	1.0	0	0	0	6	0	1.45	13.2
JUL	98	1	1.0	0	0	0	6	1	1.43	15.0
AUG	99	1	1.0	0	1	0	6	0	1.38	16.6
SEP	99	0	0.0	0	0	0	4	0	1.41	18.2
OCT	96	0	0.0	0	0	0	6	0	1.28	17.0
NOV	101	0	0.0	0	0	0	7	0	1.47	11.5
DEC	96	0	0.0	0	0	0	4	0	1.59	7.6
Total:	1171	3	0.3	0	1	0	62	2	1.44	11.3

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Disinfection Byproducts. No data for 2022.

Physical/Chemical Parameters. The drinking water in the Saanich Distribution System had the following physical and chemical characteristics in 2022:

- Median pH: 7.5
- Median Alkalinity: 16.8 mg/L
- Median Turbidity: 0.25 NTU
- Median Conductivity (25ºC): 52.80 µS/cm
- Median Colour: 2.0 TCU

Metals. No data in 2022.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Saanich Distribution System was in compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* **except** for August, with one total coliform-positive result in exceedance of 10 CFU/100 mL. An immediate resample confirmed the safety of the drinking water.

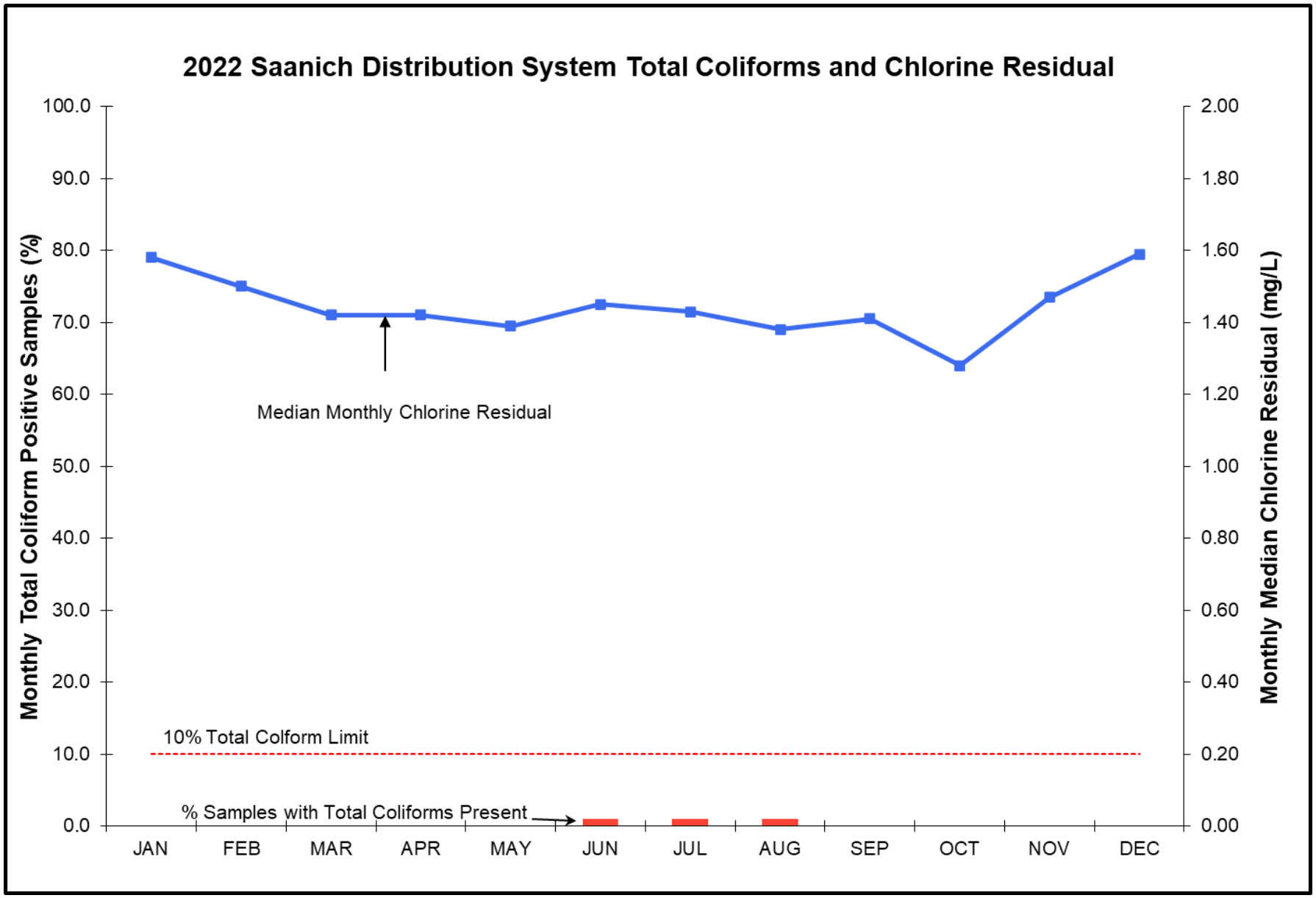

Figure 35 Saanich Distribution System Total Coliforms and Chlorine Residuals in 2022

7.4.7 Sidney Distribution System – (Town of Sidney-Owned and Operated)

In 2022, seven sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the Sidney Distribution System. Sidney sampling stations are part of the daily distribution sampling runs by CRD staff.

Sample Collection. In 2022, 204 bacteriological and 82 water chemistry samples were collected from the Sidney Distribution System (Table 9). Based on current population data for the Town of Sidney, 12 samples are required for bacteria testing each month. Table 9 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. Two samples tested positive for total coliforms in 2022. The resamples were negative, so there were no consecutive positive samples in 2022. No sample exceeded the 10 CFU/100 mL total coliform concentration. This system complied with the 10% total coliform-positive limit for all months. The annual total coliform positive percentage was well below the 10% limit at only 1.0% (Table 9).

No sample tested positive for *E. coli* in 2022 (Table 9).

Chlorine Residual. The annual median chlorine residual in the Sidney Distribution System was 1.38 mg/L (Table 9). The lowest monthly median was in October (1.27 mg/L) and the maximum monthly median was in December (1.58 mg/L) (Figure 36).

Water Temperature. The annual median water temperature in the Sidney Distribution System was 11.4°C, with monthly medians ranging between 7.1°C (January) and 18.2°C (September) (Table 9).

Table 9 2022 Bacteriological Quality of the Sidney Distribution System

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	16	0	0.0	0	0	0	3	0	1.45	7.1
FEB	15	0	0.0	0	0	0	1	0	1.34	7.3
MAR	16	0	0.0	0	0	0	1	0	1.39	8.1
APR	16	0	0.0	0	0	0	2	0	1.40	9.3
MAY	17	0	0.0	0	0	0	2	0	1.33	10.8
JUN	20	0	0.0	0	0	0	2	0	1.39	12.9
JUL	16	0	0.0	0	0	0	2	0	1.40	14.7
AUG	18	0	0.0	0	0	0	3	0	1.28	16.6
SEP	17	0	0.0	0	0	0	2	0	1.39	18.2
OCT	17	0	0.0	0	0	0	1	0	1.27	17.1
NOV	20	1	5.0	0	0	0	2	0	1.46	11.4
DEC	16	1	6.3	0	0	0	1	0	1.58	8.5
Total:	204	2	1.0	0	0	0	22	0	1.38	11.4

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Disinfection Byproducts. No data for 2022.

Physical/Chemical Parameters. The drinking water in the Sidney Distribution System had the following physical and chemical characteristics in 2022:

- Median pH: 7.7
- Median Alkalinity: 16.50 mg/L
- Median Turbidity: 0.20 NTU
- Median Conductivity (25ºC): 51.00 µS/cm
- Median Colour: 2.5 TCU

Metals. No data in 2022.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Sidney Distribution System was in full compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation*.

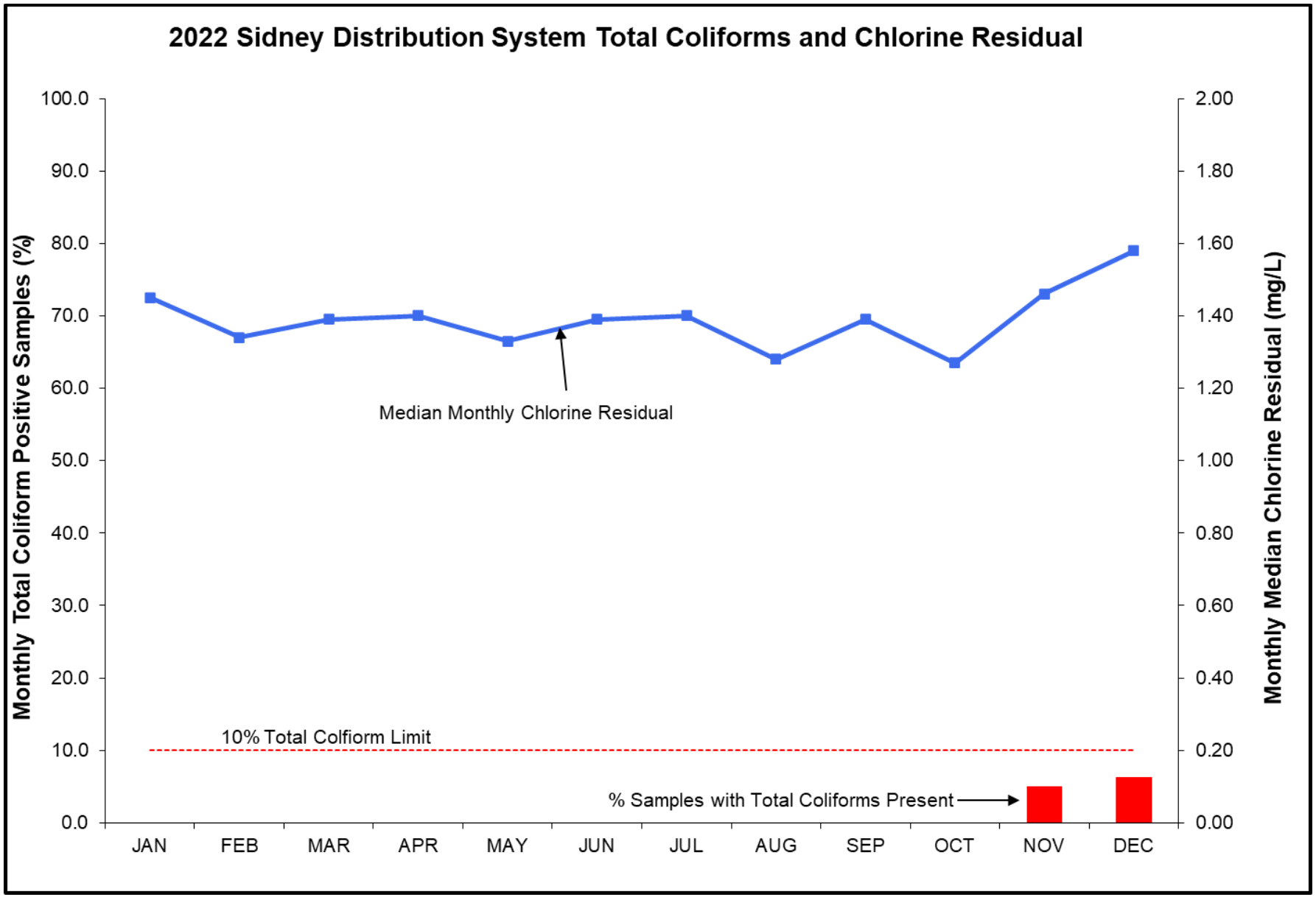

Figure 36 Sidney Distribution System Total Coliforms and Chlorine Residuals in 2022

7.4.8 Victoria/Esquimalt Distribution System – (City of Victoria-Owned and Operated)

In 2022, 16 sampling locations were used by the CRD Water Quality Monitoring Program to monitor the bacteriological quality of the water in the Victoria/Esquimalt Distribution System. Victoria/Esquimalt sampling stations are part of the daily distribution sampling runs by CRD staff.

Sample Collection. In 2022, 1,213 bacteriological and 220 water chemistry samples were collected from the Victoria/Esquimalt Distribution System (Table 10). Based on current population data for Victoria and Esquimalt, 92 samples are required for bacteria testing each month. Table 10 shows the number of monthly samples collected and analyzed for compliance.

Bacteriological Results. Nine total coliform-positive results were recorded throughout the year. All resamples were negative, so there were no consecutive positive samples in 2022. One sample in June and one in August exceeded the 10 CFU/100 mL total coliform concentration limit. This system complied with the 10% total coliform-positive limit for all months. The annual total coliform positive percentage was well below the 10% limit at only 0.7% (Table 10).

The number of total coliform positive tests in the GVDWS between June and September was unusual and subject of a thorough investigation by CRD staff. Sampling and laboratory procedures and equipment were reviewed and investigated for possibly producing false positives. Unfortunately, no conclusive answers were found. These suspicious test results occurred randomly across all parts of the GVDWS, including the separately treated and supplied Sooke/East Sooke Distribution System. This, and the fact that all resamples tested negative, supports the conclusion that no actual drinking water contamination that could have posed a risk to public health occurred.

No *E. coli* was detected in any sample in 2022 (Table 10).

Chlorine Residual. The annual median chlorine residual in the Victoria/Esquimalt Distribution System was 1.43 mg/L (Table 10). The lowest monthly median was in August (1.31 mg/L) and the maximum monthly median was in December (1.62 mg/L) (Figure 37).

Water Temperature. The annual median water temperature in the Victoria/Esquimalt Distribution System was 12.1°C, with monthly medians ranging between 6.4°C (January) and 18.8°C (September) (Table 10).

Table 10 2022 Bacteriological Quality of the Victoria Distribution System

Month	Samples Collected	Total Coliforms (CFU/100mL)				*E.coli* CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC>0	Resamples TC > 0	Samples TC > 10	Samples >0	Samples Collected	Samples >1 NTU	Median mg/L as CL2	Median ° C
JAN	96	0	0.0	0	0	0	8	0	1.61	6.4
FEB	94	0	0.0	0	0	0	8	0	1.49	7.1
MAR	111	0	0.0	0	0	0	7	0	1.43	8.2
APR	95	0	0.0	0	0	0	8	0	1.43	10.0
MAY	96	0	0.0	0	0	0	9	0	1.43	12.2
JUN	110	2	1.8	0	1	0	10	0	1.45	14.5
JUL	98	5	5.1	0	0	0	8	0	1.40	17.0
AUG	111	2	1.8	0	1	0	9	0	1.31	18.3
SEP	106	0	0.0	0	0	0	7	0	1.37	18.8
OCT	95	0	0.0	0	0	0	7	0	1.34	17.2
NOV	107	0	0.0	0	0	0	10	0	1.53	10.9
DEC	94	0	0.0	0	0	0	6	0	1.62	7.5
Total:	1213	9	0.7	0	2	0	97	0	1.43	12.1

Notes:
TC = Total Coliforms, *E. coli* = *Escherichia coli,* Cl_2 = chlorine, NTU = Nephelometric turbidity unit.
> = Greater than, mg/L = milligrams per litre, °C = degrees Celsius

Disinfection Byproducts. No data for 2022.

Physical/Chemical Parameters. The drinking water in the Victoria/Esquimalt Distribution System had the following physical and chemical characteristics in 2022:

- Median pH: 7.5
- Median Alkalinity: 16.60 mg/L
- Median Turbidity: 0.25 NTU
- Median Conductivity (25ºC): 52.00 µS/cm
- Median Colour: 3.0 TCU

The system experienced occasional elevated turbidity in certain dead-end pipe sections, which were addressed with regular or ad hoc flushing at those locations.

Metals. No data in 2022.

The Greater Victoria pH & Corrosion Study completed in 2021 concluded that metal corrosion and lead leaching in the public piping systems, as well as in the vast majority of private plumbing systems, is not an issue in the Greater Victoria Drinking Water System.

Compliance Status. The Victoria/Esquimalt Distribution System was in compliance with the *BC Drinking Water Protection Act* and *Drinking Water Protection Regulation* **except** for June and August, with one total coliform-positive result each in exceedance of 10 CFU/100 mL. Immediate resamples confirmed the safety of the drinking water.

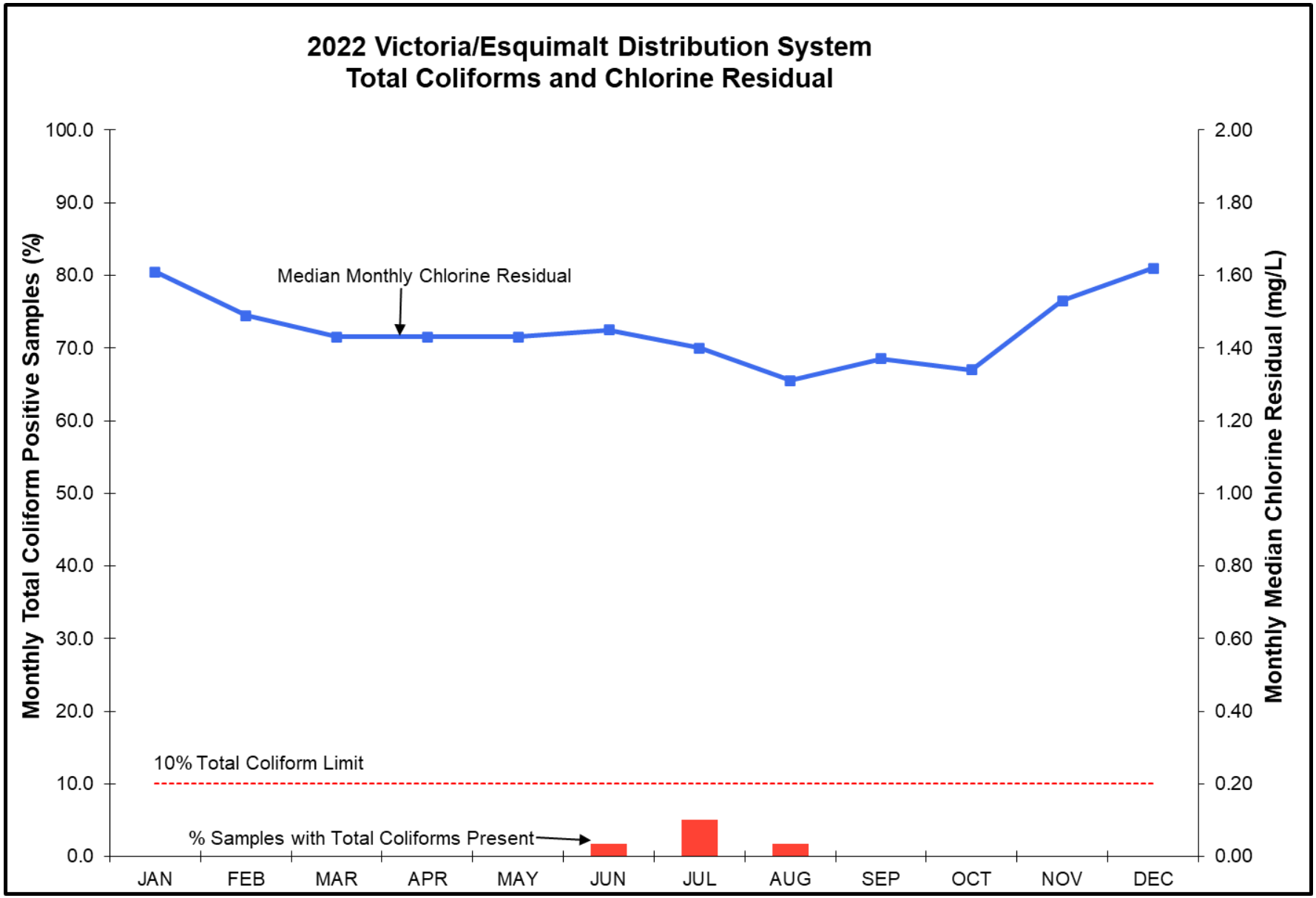

Figure 37 Victoria/Esquimalt Distribution System Total Coliforms and Chlorine Residuals in 2022

7.5 Water Quality Inquiry Program

Records of customer inquiries, including complaints about drinking water quality, have been maintained since 1992. In 2022, there was no single category of water quality inquiry or complaint that stood out among the rest. During periods of water main flushing activities (January-May, September-December) in the distribution systems, complaints or concerns about water discolouration were more prevalent. Throughout the year, a number of inquiries or complaints about chlorine taste and odour were received in 2022, but most of these were of a general nature where people object to the addition of any chemical to the drinking water. A few complaints were related to residue observed in water kettles and fouling of tap filters. Both phenomena are not uncommon in an unfiltered water system.

CRD staff have communicated regularly with Island Health hospital facility management staff to provide useful water quality information to these facilities. No hospital staff complaints or concerns were raised in 2022.

In addition to complaints, CRD staff received a number of queries from people concerned about the general safety of their drinking water. These concerns were addressed individually and, in general, most customers are content to know that CRD staff are actively sampling both the source water and the treated drinking water being delivered to their homes. For those people wanting to know more about the composition of their drinking water, they were either provided with the annual tables or directed to the CRD website. Newly emerging topics in customer inquiries were related to potential contamination of the drinking water with microplastics and forever chemicals (PFAS), both topics that have had a strong presence in the media recently. A few questions to staff were also related to a potential addition of fluoride to the drinking water, with some customers strongly against and some in favour.

7.6 Cross Connection Control Program

This program was created based on an Order by the Chief Medical Health Officer of the Island Health Authority in 2005. Since then, it has become exemplary for an effective and efficient cross connection control program in Canada and it forms an important component of the multi-barrier concept in the Greater Victoria Drinking Water System. Working with Island Health, the 13 municipalities and participating electoral areas, the objective of this program is to identify, eliminate and prevent cross connections within the Greater Victoria Drinking Water System that could lead to drinking water contaminations. The CRD was tasked to take over the responsibility for this program under a newly-created Cross Connection Control Bylaw (enacted in 2006). In 2019, the CRD Cross Connection Control Bylaw 3516 was amended in whole by amendment Bylaw No. 4340. This most recent update brought the technical and administrative requirements in line with new provincial legislation, the *BC Building Act*. The method by which the program meets its objectives is enforcement of the backflow prevention requirements under the BC Building Code and as described by the Canadian Standard Association's CSAB64 series, and through public education. CRD staff work with municipal building officials, industry professionals and business and facility owners to achieve the goals of the Cross Connection Control Program.

In 2022, the Cross Connection Control Program conducted a total of 678 facility audits on high risk (393) and moderate risk (285) facilities. The focus for 2022 was on severe hazard facilities and reaudits of these severe connections with a fresh look at agricultural connections, which CRD staff started late in 2022 and expect to continue into 2023. Another priority in 2022 was checking construction sites for compliance with cross connection control requirements. Staff found a notable improvement in construction site compliance by the end of the year. The compliance rate, measured as facilities with outstanding deficiencies divided by the number of facilities audited, increased from 78% in 2021 to 92% by the end of 2022. This success is attributed to a shift to an outcome-oriented approach, coupled with effective outreach campaigns. The goal for 2023 is to continue with these audits and maintain or further improve current compliance levels.

In total, by the end of 2022, the Cross Connection Control Program had 28,768 cross connection control devices registered in 14,087 facilities, an increase of 1,284 assemblies in 706 new or newly-audited facilities across the region. On all testable devices, a total of 23,318 test reports (11,623 digital, 11,695 paper) were received and recorded by CRD staff in 2022. The compliance rate for getting testable devices tested in

accordance with the bylaw was 70%. Through more public education and a “Get On The Portal” campaign, staff expect to increase these testing numbers.

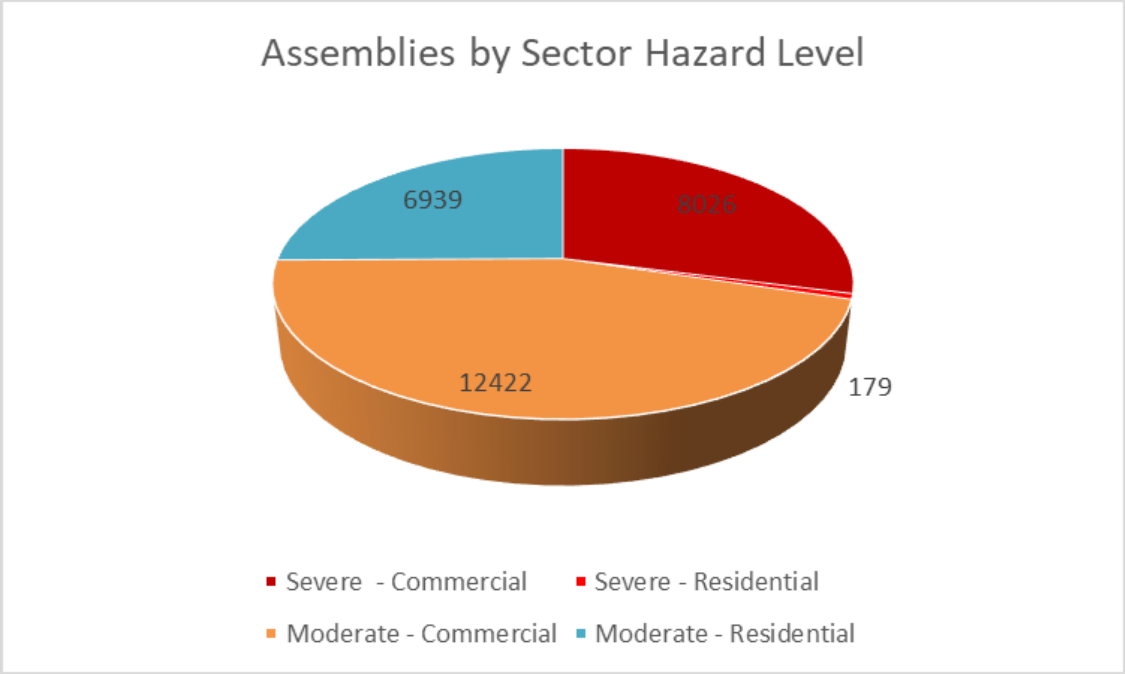

Figure 38 Backflow Devices in Greater Victoria in Different Sectors and Hazard Categories

In 2022, the CRD conducted a study on all bulk water connections to the CRD transmission system to identify potential backflow risks. As per Bylaw No. 4340, all connections to CRD water mains shall be protected against backflow risks. This is consistent with requirements of many other large water suppliers in North America (e.g., Metro Vancouver, Seattle Public Utilities, Massachusetts Water Resource Utility, San Francisco Public Utilities Commission). An inventory of all known connections was created and all connections were ranked according to their risk to water quality in the supply system. Several high-risk connections were identified for upgrades to mitigate the backflow and water quality risk. The final report will be presented in the spring of 2023.

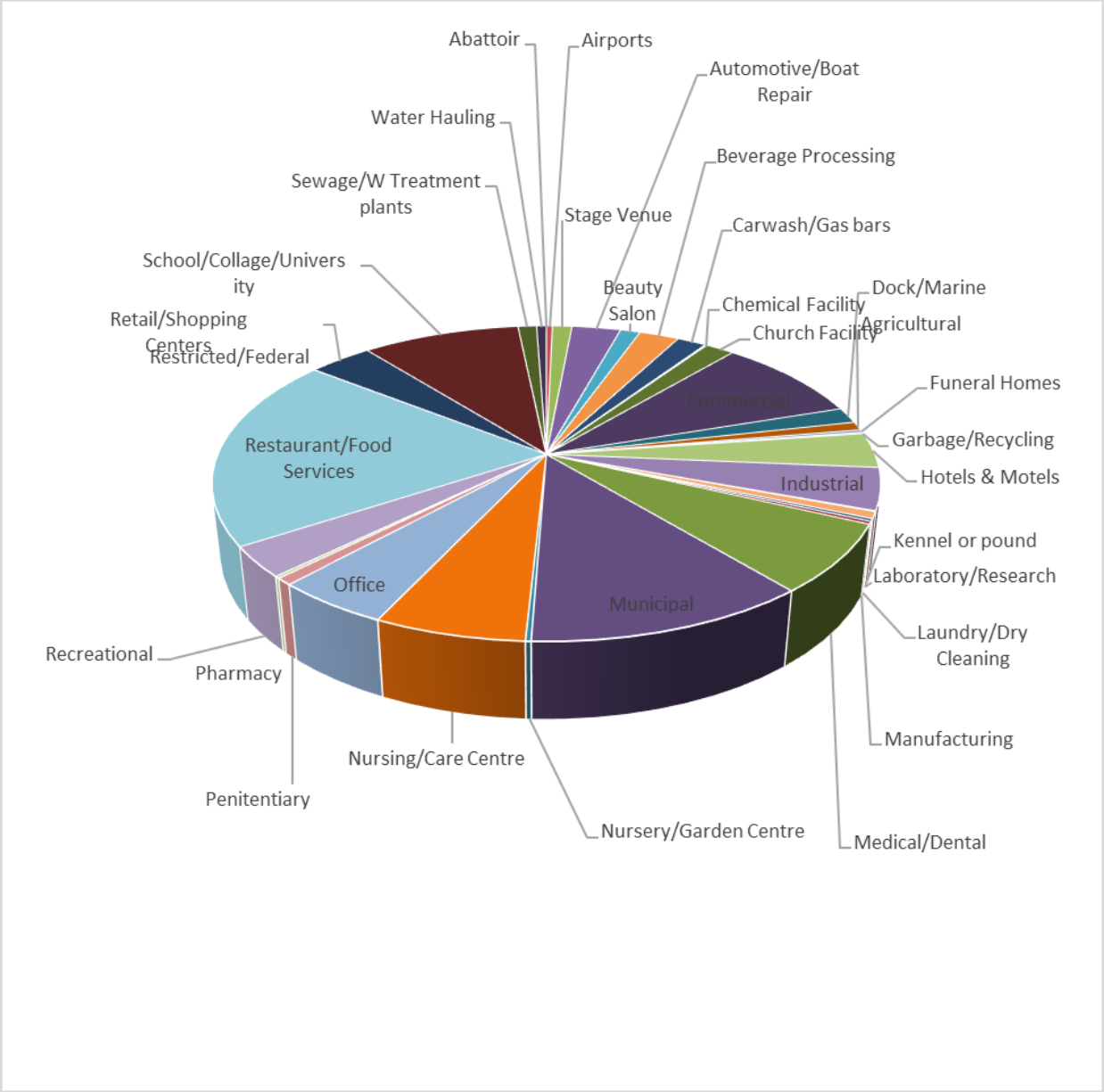

Figure 39 Cross Connection Relevant Facilities Across Greater Victoria

8.0 CONCLUSIONS

1. The water quality data collected in 2022 indicate that the drinking water in Greater Victoria was of good quality and safe to drink. The drinking water temperature exceeded the aesthetic objective of 15°C between the end of August and the end of October. This is the only parameter that system-wide did not meet water quality criteria listed in the G*uidelines for Canadian Drinking Water Quality*.

2. Greater Victoria continues to enjoy a water supply in which *Giardia* and *Cryptosporidium* parasites are well below the levels commonly considered by the health authorities to be responsible for disease outbreaks.

3. The bacteriological quality of the raw source water was excellent in 2022. Total coliform concentrations during the summer months were naturally elevated but very low during the rest of the year. The higher total coliform concentrations during the summer were consistent with concentrations in previous years. This seasonal increase in bacteria load had no impact on the treated water quality. *E. coli* bacterial levels in the raw source water were very low for the entire year.

4. Consumers in the GVDWS received drinking water that had very low disinfection byproducts. Overall levels of trihalomethanes and haloacetic acids remain well below the Canadian guideline limits and the USEPA limits. The newly-monitored disinfection byproduct, Nitrosodimethylamine, was, if detected at all, only in concentrations well below the current MAC in the Canadian guidelines.

5. The algal activity in 2022 was in line with the long-term average trend in Sooke Lake Reservoir. The species that were active, and relatively abundant in 2022, belonged to known and low-risk algal species. Cyanobacteria, with the potential to produce harmful cyanotoxins under bloom conditions, were present, as usual, throughout the year. However, a stable and nutrient-poor ecosystem, such as the Sooke Lake Watershed, does not provide conditions needed for cyanobacteria or other adverse algal blooms with serious implications for the drinking water quality. These natural nutrient-poor conditions limit the biological productivity in Sooke Lake Reservoir, which is very favourable for a drinking water source.

6. The number of water quality inquiries and complaints received by CRD staff in 2022 was lower than in 2021 when the CRD temporarily switched to free chlorine for one month and had several complaints about chlorine taste and odour. In 2022, the number and nature of customer complaints or inquiries were similar to years prior to 2021.

7. The CRD Transmission System, the CRD Supply Storage Reservoirs, North Saanich, Saanich and Victoria/Esquimalt were not in full compliance with the *BC Drinking Water Protection Regulation*, due to samples containing total coliform concentrations higher than the limit of 10 CFU/100 mL. Oak Bay, North Saanich and CRD Supply Storage Reservoirs were also not in full compliance with the *BC Drinking Water Protection Regulation* due to more than 10% of the monthly samples collected being positive for total coliform bacteria. The unusual occurrence of total coliform positive results and concentration exceedances warranted an investigation by staff. While no cause for the random bacteria hits was found, staff also found no evidence of an actual drinking water contamination and it was concluded that no risk to public health existed.

8. The Sidney, Central Saanich, CRD Sooke/East Sooke and CRD Juan de Fuca systems were in full compliance with the *BC Drinking Water Protection Regulation.*

9. All systems did meet the monthly sampling requirements, as per *BC Drinking Water Protection Regulation.*

10. The analytical results in all CRD and municipal water systems show that the drinking water was of good quality and was safe for consumption at all times throughout 2022.

APPENDIX A
TABLE 1. UNTREATED (RAW) WATER QUALITY ENTERING GOLDSTREAM WATER TREATMENT PLANT
(Guideline values provide reference only for untreated water)

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Physical Parameters (ND means less than instrument can detect)										
Alkalinity, Total	mg/L	**14.8**	12	13.6	16.7		15.3	143	8.84-19.1	12/yr
Carbon, Dissolved Organic	mg/L as C	**1.8**	12	1.2	2.3		1.7	116	< 0.5-4	12/yr
Carbon, Total Organic	mg/L as C	**1.8**	12	1.1	2.0	Guideline Archived	1.87	117	0.82-3.9	12/yr
Colour, True	TCU	**6.0**	55	< 2	9.0	≤15 AO	6.3	526	< 2-19	52/yr
Conductivity @ 25 C	uS/cm	**41.3**	54	38.3	45.5		42.3	519	28.2-62.9	52/yr
Hardness as $CaCO_3$	mg/L	**15.9**	7	15.3	17.3	No Guideline Required	17.3	139	6.95-20.9	6/yr
pH	pH units	**7.2**	56	6.5	7.4	7.0 - 10.5 AO	7.29	548	6.45-7.94	52/yr
Tannins and Lignins	mg/L	**< 0.2**	3	< 0.2	0.3	Guideline Archived	< 0.2	21	< 0.1-0.38	2/yr
Total Dissolved Solids	mg/L	**31.0**	12	14.0	58.0	≤500 AO	26.75	112	< 10-48	12/yr
Total Suspended Solids	mg/L	**< 1.3**	12	< 1	3.2		< 1	111	0.1-< 4	12/yr
Total Solids	mg/L	**< 1.3**	12	< 1	3.2		< 1	111	0.1-< 4	12/yr
Turbidity, Grab Samples	NTU	**0.3**	242	0.2	1.0	1.0 MAC	0.3	2432	0.15-3.1	250/yr
Ultraviolet Absorption, 5 cm	Abs.@254 nm	**0.3**	56	0.1	0.3		0.255	499	0.158-88.2	52/yr
Ultraviolet Transmittance	%	**87.7**	56	86.3	91.0		88.8	493	0.203-94.4	52/yr
Water Temp., Grab Samples	degrees C	**8.8**	242	3.7	18.7	≤15 AO	10.3	2489	2.7-21	250/yr
Non-Metallic Inorganic Chemicals **(ND means less than instrument can detect)**										
Bromide	ug/L as Br	**< 0.01**	4	< 0.01	0.011		< 0.7	52	0.011-13	4/yr
Chloride	mg/L as Cl	**2.4**	4	2.1	2.50	≤ 250 AO	2.4	26	< 0.045-4.9	4/yr
Cyanide	mg/L as Cn	**< 0.0005**	4	< 0.0005	0.001	0.2 MAC	< 0.0005	26	< 0.0005-< 0.006	4/yr
Fluoride	mg/L as F	**< 0.05**	4	< 0.05	< 0.05	1.5 MAC	0.022	27	< 0.007-< 0.05	4/yr
Iodide, dissolved	mg/L as I	**< 0.1**	2	< 0.1	< 0.1		< 0.1	10	< 0.1-< 0.1	4/yr
Nitrate, Dissolved	ug/L as N	**< 20**	12	< 20	41.00	10000 MAC	< 20	108	0.3-46.4	12/yr
Nitrite, Dissolved	ug/L as N	**< 5**	12	< 5	< 5	1000 MAC	< 5	107	< 0.3-< 10	12/yr
Nitrate + Nitrite	ug/L as N	**< 20**	12	< 20	41.00		< 20	109	0.3-46.4	12/yr
Nitrogen, Ammonia	ug/L as N	**< 15**	12	< 15	30.00	No Guideline Required	< 15	112	0.079-130	12/yr
Nitrogen, Total Kjeldahl	ug/L as N	**102**	12	65	820.00		101.5	108	52.4-610	12/yr
Nitrogen, Total	ug/L as N	**109.5**	12	83	153.00		112	113	49.4-610	12/yr
Phosphate, Ortho, Dissolved	ug/L as P	**< 1**	12	< 1	1.70		< 3	109	0.05-24.3	12/yr
Phosphorus, Total, Dissolved	ug/L as P	**1.65**	12	< 1	2.00		2.49	112	0.35-31	12/yr
Phosphorus, Total	ug/L as P	**2.4**	12	1	8.00		3.2	113	< 1-< 10	12/yr
Silica	mg/L as SiO_2	**4.8**	11	4.5	4.90		4	101	0.09-5.6	12/yr
Silicon	ug/L as Si	**2130**	7	1790	2350.00		1870	81	681-2520	6/yr

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Sulphate	mg/L as SO_4	**1.4**	12	< 1	< 10	≤ 500 AO	1.5025	112	< 0.5-8.16	12/yr
Sulphide	mg/L as H_2S	**< 0.0018**	13	< 0.0018	< 0.0018	≤ 0.05 AO	< 0.0018	11	< 0.0018-< 0.0019	12/yr
Sulphur	mg/L as S	**< 3**	7	< 3	< 3		< 3	80	< 3-< 3	6/yr
Metallic Inorganic Chemicals (ND means less than instrument can detect)										
Aluminum	ug/L as Al	**17.8**	7	6.7	20.20	2900 MAC / 100 OG	14.3	81	3.9-52.3	6/yr
Antimony	ug/L as Sb	**< 0.5**	7	< 0.5	< 0.5	6 MAC	< 0.5	81	< 0.5-< 5	6/yr
Arsenic	ug/L as As	**< 0.1**	7	< 0.1	< 0.1	10 MAC	< 0.1	81	< 0.1-0.24	6/yr
Barium	ug/L as Ba	**3.5**	7	3.4	3.90	2000 MAC	3.8	81	1.6-5.3	6/yr
Beryllium	ug/L as Be	**< 0.1**	7	< 0.1	< 0.1		< 0.1	81	< 0.1-< 10	6/yr
Bismuth	ug/L as Bi	**< 1**	7	< 1	< 1		< 1	81	< 1-< 10	6/yr
Boron	ug/L as B	**< 50**	7	< 50	< 50	5000 MAC	< 50	81	< 50-< 50	6/yr
Cadmium	ug/L as Cd	**< 0.01**	7	< 0.01	< 0.01	7 MAC	< 0.01	81	< 0.01-0.07	6/yr
Calcium	mg/L as Ca	**4.53**	7	4.37	5.05	No Guideline Required	4.98	81	2.06-6.13	6/yr
Chromium	ug/L as Cr	**< 1**	7	< 1	< 1	50 MAC	< 1	81	< 1-< 1	6/yr
Cobalt	ug/L as Co	**< 0.2**	7	< 0.2	< 0.2		< 0.5	81	< 0.2-< 0.5	6/yr
Copper	ug/L as Cu	**0.97**	7	0.85	1.12	2000 MAC / ≤ 1000 AO	1.35	81	0.33-13.9	6/yr
Iron	ug/L as Fe	**19.3**	7	12.7	37.4	≤ 300 AO	28	81	12-217	6/yr
Lead	ug/L as Pb	**< 0.2**	7	< 0.2	< 0.2	5 MAC	< 0.2	81	< 0.2-0.3	6/yr
Lithium	ug/L as Li	**< 2**	7	< 2	< 2		< 5	62	< 2-10.4	6/yr
Magnesium	mg/L as Mg	**1.11**	7	1.06	1.18	No Guideline Required	1.18	81	0.439-1.42	6/yr
Manganese	ug/L as Mn	**4.3**	7	1.4	6.70	120 MAC / ≤ 20 AO	5.4	81	1.4-81.8	6/yr
Mercury, Total	ug/L as Hg	**< 0.0019**	7	< 0.0019	< 0.0019	1.0 MAC	< 0.01	80	< 0.0019-< 10	6/yr
Molybdenum	ug/L as Mo	**< 1**	7	< 1	< 1		< 1	81	< 1-< 1	6/yr
Nickel	ug/L as Ni	**< 1**	7	< 1	< 1		< 1	81	< 1-2.3	6/yr
Potassium	mg/L as K	**0.128**	7	0.127	0.14		0.136	81	0.081-0.214	6/yr
Selenium	ug/L as Se	**< 0.1**	7	< 0.1	< 0.1	50 MAC	< 0.1	81	< 0.1-< 0.1	6/yr
Silver	ug/L as Ag	**< 0.02**	7	< 0.02	0.07	No Guideline Required	< 0.02	81	< 0.02-0.021	6/yr
Sodium	mg/L as Na	**1.62**	7	1.49	1.86	≤ 200 AO	1.71	81	0.651-2.91	6/yr
Strontium	ug/L as Sr	**13.5**	7	13.2	15.00	7000 MAC	15.3	81	6.3-21.8	6/yr
Thallium	ug/L as Tl	**< 0.01**	7	< 0.01	< 0.01		< 0.05	81	< 0.01-< 0.05	6/yr
Tin	ug/L as Sn	**< 5**	7	< 5	< 5		< 5	81	< 5-< 5	6/yr
Titanium	mg/L as Ti	**< 5**	7	< 5	< 5		< 5	81	< 5-< 5	6/yr
Uranium	ug/L as U	**< 0.1**	7	< 0.1	< 0.1	20 MAC	< 0.1	81	< 0.01-< 0.1	6/yr
Vanadium	ug/L as V	**< 5**	7	< 5	< 5		< 5	81	< 5-< 5	6/yr
Zinc	ug/L as Zn	**< 5**	7	< 5	< 5	≤ 5000 AO	< 5	81	< 5-82.9	6/yr
Zirconium	ug/L as Zr	**< 0.1**	7	< 0.1	< 0.1		< 0.5	81	< 0.0005-< 0.5	6/yr

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Microbial Parameters										
Coliform Bacteria										
Coliforms, Total	Coliforms/100 mL	**6**	242	< 1	260.00		11	2436	0-24200	250/yr
E. coli	*E. coli*/100 mL	**< 1**	241	< 1	2.00		< 1	2439	0-15	250/yr
Heterotrophic / Other Bacteria										
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	**300.0**	246.0	22.0	1200.0		330	2309	< 1-7200	250/yr
Cyanobacterial Toxins										
Anatoxin a	ug/L	Analyzed as required - last analyzed in 2005								Special
Microcystin-LR	ug/L	Analyzed as required - last analyzed in 2011				1.5 MAC (Total Microcystins)				Special
Parasites										
Cryptosporidium, Total oocysts	oocysts/100 L	**ND**	8	ND	ND	Zero detection desirable	0	70	0-< 1	8/yr
Giardia, Total cysts	cysts/100 L	**ND**	8	ND	ND	Zero detection desirable	0	69	0-1.1	8/yr
Radiological Parameters (ND means less than instrument can detect)										
Gross alpha radiation	Bq/L	**<0.02**	2	<0.02	<0.03	0.5 (Screening)	<0.03	17	<0.02-0.06	2/yr
Gross beta radiation	Bq/L	**<0.02**	2	<0.02	0.03	1.0 (Screening)	<0.02	17	<0.02-0.11	2/yr
Iodine-131	Bq/L	**<0.2**	2	<0.2	<0.2	6 Bq/L	<0.2	17	<0.1-<0.5	Special
Cesium-137	Bq/L	**<0.1**	2	<0.1	<0.1	10 Bq/L	<0.2	17	<0.04-<0.2	Special
Organic Parameters (ND means less than instrument can detect)										
Pesticides/Herbicides										
1,4-DDD	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.001	6	< 0.001-< 0.001	2/yr
1,4'-DDE	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.001	6	< 0.001-< 0.001	2/yr
1,4'-DDT	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.001	6	< 0.001-< 0.001	2/yr
2,4,5-T	ug/L	**<0.5**	2	<0.08	<0.5	Guideline Archived	<1.0	20	<0.5-<1.0	2/yr
2,4,5-TP (Silvex)	ug/L	**<0.5**	2	<0.08	<0.5	Guideline Archived	<0.1	20	<0.1-<1.0	2/yr
2,4-D (2,4-Dichlorophenoxyacetic acid)	ug/L	**< 0.05**	2	< 0.05	< 0.05	100 MAC	<0.1	14	<0.1-<1.0	2/yr
2,4-D (BEE)	ug/L	**< 0.5**	2	< 0.5	< 0.5		< 2	27	< 0.5-< 2	2/yr
2,4-DP (Dichlorprop)	ug/L	**<0.05**	2	<0.08	<0.5		<0.5	19	<0.5-<1.0	2/yr
4,4'-DDD	ug/L	**< 0.005**	2	<0.001	<0.005	Guideline Archived	<0.001	16	<0.001-<0.005	2/yr
4,4'-DDE	ug/L	**< 0.005**	2	<0.001	<0.005	Guideline Archived	<0.001	17	<0.001-<0.005	2/yr
4,4'-DDT	ug/L	**< 0.005**	1	< 0.005	< 0.005	Guideline Archived	< 0.001	14	< 0.001-< 0.005	2/yr
Alachlor	ug/L	**Not tested in 2022**				Guideline Archived	< 0.5	6	< 0.5-< 0.5	2/yr
Aldicarb	ug/L	**<0.1**	2	< 0.1	< 5	Guideline Archived	< 0.1	20	< 0.1-< 5	2/yr
Aldrin	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	19	< 0.003-< 0.005	2/yr
Aldrin + Dieldrin	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.003	11	< 0.003-< 0.005	2/yr
Atrazine	ug/L	**< 0.05**	2	< 0.05	< 0.05	5 MAC	< 0.1	20	< 0.1-< 1	2/yr

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Azinphos-methyl	ug/L	**< 0.2**	2	< 0.2	< 0.2	Guideline Archived	< 0.2	17	< 0.001-< 2	2/yr
BHC (alpha)	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	19	< 0.003-< 0.005	2/yr
BHC (beta)	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	19	< 0.003-< 0.005	2/yr
BHC (delta)	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	4	< 0.003-< 0.003	2/yr
Bendiocarb	ug/L	**<0.1**	2	< 0.1	< 2	Guideline Archived	< 0.1	20	< 0.1-< 2	Irregular
Bromacil	ug/L	**< 0.05**	2	< 0.05	< 0.05		< 0.1	16	< 0.1-< 0.1	2/yr
Bromoxynil	ug/L	**< 0.02**	2	< 0.02	< 0.02	5.0 MAC	< 0.1	18	< 0.1-< 0.5	2/yr
Captan	ug/L	**< 0.1**	2	< 0.1	< 0.1		< 0.1	13	< 0.003-< 1	2/yr
Carbaryl	ug/L	**<0.1**	2	< 0.1	< 5	90 MAC	< 0.1	20	< 0.1-< 5	2/yr
Carbofuran	ug/L	**<0.1**	2	< 0.1	< 5	90 MAC	< 0.1	20	< 0.1-< 5	2/yr
Chlordane (alpha)	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.003	16	< 0.003-< 0.005	2/yr
Chlordane (gamma)	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.003	18	< 0.003-< 0.005	2/yr
Chlorpyrifos (Dursban)	ug/L	**< 0.01**	2	< 0.01	< 0.01	90 MAC	< 0.01	20	< 0.0008-< 2	2/yr
Chlorothalonil	ug/L	**< 0.05**	2	< 0.05	< 0.05		< 0.003	14	< 0.003-< 0.003	2/yr
Cyanazine (Bladex)	ug/L	**< 0.05**	2	< 0.05	< 0.05	Guideline Archived	< 0.1	18	< 0.1-< 5	2/yr
Demeton	ug/L	**< 2**	2	< 2	< 2		< 2	9	< 2-< 2	2/yr
Diazinon	ug/L	**< 0.02**	2	< 0.02	< 0.02	20 MAC	< 0.02	21	< 0.002-< 2	2/yr
Dicamba	ug/L	**< 0.005**	2	< 0.005	< 0.005	120 MAC	< 0.006	20	< 0.006-< 1	2/yr
Diclofop-methyl	ug/L	**< 0.05**	2	< 0.05	< 0.05	90 MAC	< 0.05	17	< 0.0007-< 0.9	2/yr
Dichlorvos	ug/L	**< 2**	2	< 2	< 2		< 2	18	< 2-< 2	2/yr
Dieldrin	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.002	19	< 0.002-< 0.005	2/yr
Dimethoate	ug/L	**< 0.05**	2	< 0.05	< 0.05	20 MAC	< 0.05	2	< 0.05-< 0.05	2/yr
Dinoseb (DNBP)	ug/L	**< 0.02**	2	< 0.02	< 0.02	Guideline Archived	< 0.05	4	< 0.05-< 0.05	2/yr
Diquat	ug/L	**< 7**	2	< 7	< 7	70 MAC	< 7	19	< 7-< 350	2/yr
Endosulfan I	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	18	< 0.003-< 0.005	2/yr
Endosulfan II	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	18	< 0.003-< 0.005	2/yr
Endosulfan Sulphate	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	19	< 0.003-< 0.005	2/yr
Endosulfan (Total)	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	17	< 0.003-< 0.005	2/yr
Endrin	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.005	19	< 0.005-< 0.005	2/yr
Endrin Aldehyde	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	20	< 0.003-< 0.005	2/yr
Endrin Ketone	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	19	< 0.003-< 0.005	2/yr
Ethion	ug/L	**< 1**	2	< 1	< 1		< 1	15	< 0.5-< 1	2/yr
Parathion Ethyl	ug/L	**<0.05**	2	<0.05	<2.0		< 2	15	< 1-< 2	2/yr
Fenchlorophos (Ronnel)	ug/L	**< 2**	2	< 2	< 2		< 2	19	< 0.5-< 2	2/yr
Fenthion	ug/L	**< 1**	2	< 1	< 1		< 1	15	< 0.5-< 1	2/yr
Fonofos	ug/L	**< 2**	2	< 2	< 2		< 2	15	< 0.5-< 2	2/yr
Glyphosate	ug/L	**< 10**	2	< 10	< 10	280 MAC	< 10	20	< 10-< 10	2/yr
Heptachlor	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.003	19	< 0.003-< 0.005	2/yr

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Heptachlor Epoxide	ug/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.003	19	< 0.003-< 0.005	2/yr
Imazapyr	ug/L	**< 0.1**	2	< 0.1	< 0.1		< 0.1	13	< 0.1-< 0.1	2/yr
IPBC	ug/L	**< 0.1**	2	< 0.1	< 0.1		< 0.1	13	< 0.1-< 0.1	2/yr
Malathion	ug/L	**< 0.05**	2	< 0.05	< 0.05	190 MAC	< 0.05	21	< 0.002-< 2	2/yr
MCPA	ug/L	**< 0.02**	2	< 0.02	< 0.02	100 MAC	< 0.03	26	< 0.025-< 2	2/yr
MCPP	ug/L	**< 0.08**	2	< 0.08	< 0.08		< 2	18	< 0.5-< 2	2/yr
Methoxychlor	ug/L	**< 0.01**	2	< 0.01	< 0.01	Guideline Archived	< 0.003	18	< 0.003-< 0.01	2/yr
Methyl Parathion	ug/L	**< 2**	2	< 2	< 2	Guideline Archived	< 2	20	< 0.1-< 2	2/yr
Metolachlor	ug/L	**< 0.05**	2	< 0.05	< 0.05	Guideline Archived	< 0.1	20	< 0.1-< 5	2/yr
Metribuzin (Sencor)	ug/L	**< 0.1**	2	< 0.1	< 0.1	80 MAC	< 0.1	18	< 0.0004-< 5	2/yr
Mevinphos	ug/L	**< 2**	2	< 2	< 2		< 2	18	< 0.5-< 5	2/yr
Mirex	mg/L	**< 0.005**	2	< 0.005	< 0.005	Guideline Archived	< 0.0039	19	< 0.003-< 0.005	2/yr
Nitrilotriacetic acid (NTA)	ug/L	**< 0.05**	2	< 0.05	< 0.05	400 MAC	< 0.05	19	< 0.05-0.099	Irregular
Oxychlordane	ug/L	**< 0.005**	2	< 0.005	< 0.005		< 0.003	13	< 0.003-< 0.005	2/yr
Parathion	ug/L	**< 0.05**	2	< 0.05	< 0.05	Guideline Archived	< 0.05	21	< 0.0004-< 2	2/yr
Paraquat (ion)	ug/L	**< 1**	2	< 1	< 1	10 MAC	< 1	19	< 1-< 1	2/yr
Permethrin	ug/L	**Not tested in 2022**					< 0.04	14	< 0.0005-< 3.3	2/yr
Phorate (Thimet)	ug/L	**< 0.05**	2	< 0.05	< 0.05	2 MAC	< 0.05	20	< 0.0003-< 1	2/yr
Phosmet	ug/L	**< 2**	2	< 2	< 2		< 2	19	< 0.5-< 2	2/yr
Picloram	ug/L	**< 0.08**	2	< 0.08	< 0.08	190 MAC	< 0.1	20	< 0.1-< 5	2/yr
Prometryn	ug/L	**< 1**	2	< 1	< 1		< 1	17	< 0.25-< 1	Irregular
Simazine	ug/L	**< 0.05**	2	< 0.05	< 0.05	10 MAC	< 0.1	20	< 0.1-< 2	2/yr
Tebuthiuron	ug/L	**< 0.1**	2	< 0.1	< 0.1		< 0.5	1	< 0.5-< 0.5	2/yr
Temephos	ug/L	**Not tested in 2022**				Guideline Archived	< 10	5	< 10-< 10	2/yr
Terbufos	ug/L	**< 0.05**	2	< 0.05	< 0.05	1 MAC	< 0.05	21	< 0.0002-< 1	2/yr
Toxaphene	ug/L	**< 0.2**	**2**	**< 0.2**	**< 0.2**	Guideline Archived	< 0.2	9	< 0.2-< 0.2	2/yr
Trifluralin	ug/L	**< 0.05**	2	< 0.05	< 0.05	45 MAC	< 0.05	21	< 0.0003-< 5	2/yr
Polycyclic Aromatic Hydrocarbons (PAH's)										
Acenaphthene	ug/L	**0.025**	2	< 0.01	< 0.04	Guideline Archived	< 0.04	21	< 0.01-< 0.2	2/yr
Acenaphthylene	ug/L	**0.025**	2	< 0.01	< 0.04	Guideline Archived	< 0.04	21	< 0.01-< 0.2	2/yr
Anthracene	ug/L	**0.025**	2	< 0.01	< 0.04	Guideline Archived	< 0.01	21	< 0.01-< 0.1	2/yr
Benzo(a)anthracene	ug/L	**0.025**	2	< 0.01	< 0.04	Guideline Archived	< 0.01	21	< 0.01-< 0.1	2/yr
Benzo(a)pyrene	ug/L	**0.0125**	2	< 0.005	< 0.02	0.04 MAC	< 0.005	21	< 0.0009-< 0.05	2/yr
Benzo(b)fluoranthene	ug/L	**Not tested in 2022**				Guideline Archived	< 0.04	16	< 0.01-< 0.2	2/yr
Benzo(g,h,i)perylene	ug/L	**<0.02**	2	< 0.02	< 0.08	Guideline Archived	< 0.04	21	< 0.02-< 0.22	2/yr
Benzo(b&j)fluoranthene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	< 0.01	2	< 0.01-< 0.01	2/yr
Benzo(k)fluoranthene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	< 0.04	21	< 0.01-< 0.2	2/yr
Chrysene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	< 0.02	21	< 0.01-< 0.15	2/yr

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Dibenz(a,h)anthracene	ug/L	**<0.02**	2	<0.02	<0.08	Guideline Archived	<0.02	20	<0.003-<0.25	2/yr
Fluoranthene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	< 0.02	21	< 0.01-< 0.1	2/yr
Fluorene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	< 0.03	21	< 0.01-< 0.15	2/yr
Indeno(1,2,3-c,d)pyrene	ug/L	**<0.02**	2	<0.02	<0.08	Guideline Archived	<0.02	20	<0.02-<0.3	2/yr
Naphthalene	ug/L	**0.01**	2	0.01	< 0.04	Guideline Archived	0.3	20	< 0.01-< 2.5	2/yr
Phenanthrene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	< 0.03	21	< 0.01-< 0.15	2/yr
Pyrene	ug/L	**<0.01**	2	< 0.01	< 0.04	Guideline Archived	0.027	21	< 0.01-< 0.15	2/yr
Volatile Hydrocarbons	ug/L	**< 300**	2	< 300	< 300	Guideline Archived	< 300	26	< 300-< 300	2/yr
Phenols										
2,3,4,5-Tetrachlorophenol	ug/L	**<0.5**	2	<0.5	<1.0		<0.1	12	<0.1-<0.5	2/yr
2,3,4,6-Tetrachlorophenol	ug/L	**<0.5**	2	<0.5	<1.0	100 MAC and ≤ 1.0 AO	<0.1	17	<0.1-<0.5	2/yr
2,3,5,6-Tetrachlorophenol	ug/L	**<0.5**	2	<0.5	<2.0	Guideline Archived	<0.1	12	<0.1-<0.5	2/yr
2,4,6-Trichlorophenol	ug/L	**<0.5**	2	<0.5	<2.0	5.0 MAC and ≤ 2.0 AO	<0.1	21	<0.1-<0.5	2/yr
2,4-Dichlorophenol	ug/L	**<0.5**	2	<0.5	<2.0	90 MAC	<0.1	9	<0.1-<0.5	2/yr
2,4-Dimethylphenol	ug/L	**<2.5**	2	< 2.5	< 10		<0.1	19	<0.5-<2.5	2/yr
2,4-Dinitrophenol	ug/L	**<0.5**	2	<0.5	<2.0		<1.3	19	<1.3-<6.5	2/yr
2-Chlorophenol	ug/L	**<0.5**	2	<0.5	<2.0		< 0.1	21	< 0.1-< 0.5	2/yr
2-Nitrophenol	ug/L	**<2.5**	2	< 2.5	< 10		< 0.5	16	< 0.5-< 2.5	2/yr
4,6-Dinitro-2-Methylphenol	ug/L	**<2.5**	2	< 2.5	< 10		<0.5	20	<0.5-<2.5	2/yr
4-Chloro-3-Methylphenol	ug/L	**<1**	2	< 1	< 4		< 0.2	17	< 0.2-< 1	2/yr
4-Nitrophenol	ug/L	**<2.5**	2	< 2.5	< 10		< 0.5	21	< 0.5-< 2.5	2/yr
Alpha-Terpineol	ug/L	**<5**	2	< 5	< 20		< 1	21	< 1-< 5	2/yr
Pentachlorophenol	ug/L	**<2.5**	2	< 0.5	< 2	60 MAC and ≤ 30 AO	< 0.1	21	< 0.1-< 0.5	2/yr
Phenol	ug/L	**<2.5**	2	< 2.5	< 10		< 0.5	21	0.0022-3	2/yr
Polychlorinated Biphenyls (PCBs)										
PCB-1016	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
PCB-1221	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
PCB-1232	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
PCB-1242	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
PCB-1248	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
PCB-1254	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
PCB-1260	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	18	< 0.00005-< 0.0001	Irregular
PCB-1262	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	9	< 0.00005-< 0.0001	Irregular
PCB-1268	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	9	< 0.00005-< 0.0001	Irregular
Total PCBs	ug/L	**< 0.00005**	2	< 0.00005	< 0.00005	Guideline Archived	< 0.00005	17	< 0.00005-< 0.0001	Irregular
Other Synthetic Chemicals										
1,1,1-Trichloroethane	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	22	<0.5-<0.5	
1,1,1,2-Tetrachloroethane	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	23	<0.5-<0.5	

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
1,1,2,2-Tetrachloroethane	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	21	<0.5-<0.5	
1,1,2-Trichloroethane	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	22	<0.5-<0.5	
1,1-Dichloroethane	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	24	<0.5-<0.5	
1,1-Dichloroethene (1,1-Dichloroethylene)	ug/L	**<0.5**	2	<0.5	<0.5	14 MAC	<0.5	19	<0.5-<0.5	
1,2,3-Trichlorobenzene	ug/L	**<2.0**	2	<2.0	<2.0		<2.0	18	<2.0-<2.0	
1,2,4-Trichlorobenzene	ug/L	**<2.0**	2	<2.0	<2.0		<0.04	24	<0.04-<2.0	
1,2-Dibromoethane	ug/L	**<0.2**	2	<0.2	<0.2		<0.2	18	<0.2-<0.2	
1,2-Dichlorobenzene	ug/L	**<0.5**	2	<0.5	<0.5	200 MAC	<0.5	21	<0.5-<0.5	
1,2-Dichloroethane	ug/L	**<0.5**	2	<0.5	<0.5	5.0 MAC	<0.5	21	<0.5-<0.5	
1,2-Dichloroethene (cis)	ug/L	**<1.0**	2	<1.0	<1.0		<1.0	22	<1.0-<1.0	
1,2-dichloroethene (trans)	ug/L	**<1.0**	2	<1.0	<1.0		<1.0	22	<1.0-<1.0	
1,2-Dichloropropane	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	21	<0.5-<0.5	
1,2-Diphenylhydrazine	ug/L	**<0.05**	2	<0.05	<0.2		<0.01	21	<0.01-<0.05	
1,3-Dichlorobenzene	ug/L	**<0.5**	2	<0.5	<0.5		<0.5	20	<0.5-<0.5	
1,3-Dichloropropene (cis)	ug/L	**<1.0**	2	<1.0	<1.0		<0.5	20	<0.5-<0.5	
1,3-Dichloropropene (trans)	ug/L	**<1.0**	2	<1.0	<1.0		<1.0	23	<1.0-<1.0	
1,4-Dichlorobenzene	ug/L	**<0.5**	2	<0.5	<0.5	5.0 MAC and ≤ 1.0 AO	<0.5	20	<0.5-<0.5	
2,4-Dinitrotoluene	ug/L	**<0.25**	2	<0.05	<1.0		<0.05	20	<0.05-<1.3	
2,6-Dinitrotoluene	ug/L	**<0.25**	2	<0.05	<1.0		<0.05	20	<0.05-<0.25	
2-Chloronaphthalene	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	21	< 0.05-< 0.25	
1-Methylnaphthalene	ug/L	**<0.01**	2	< 0.01	< 0.04		< 0.01	8	< 0.01-< 0.05	
2-Methylnaphthalene	ug/L	**<0.01**	2	< 0.01	0.16		< 0.03	21	< 0.01-< 0.15	
3,3'-Dichlorobenzidene	ug/L	**<0.5**	2	< 0.5	< 2		< 0.1	20	< 0.1-< 0.5	
4-Bromophenyl-phenylether	ug/L	**<0.05**	2	< 0.05	< 0.2		< 0.01	21	< 0.01-< 0.05	
4-Chlorophenyl-phenylether	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	21	< 0.05-< 0.5	
Atrazine	ug/L	**< 0.05**	1	< 0.05	< 0.05	5.0 MAC	< 0.1	20	< 0.1-< 1	
Benzene	ug/L	**< 0.4**	3	< 0.4	< 0.4	5.0 MAC	< 0.4	28	< 0.4-< 0.5	
Benzidine	ug/L	**Not tested in 2022**					< 10	11	< 10-< 50	
Bis(-2-chloroethoxy) methane	ug/L	**<0.25**	2	< 0.25	< 1		< 0.25	1	< 0.25-< 0.25	
Bis(-2-chloroethyl) ether	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	21	< 0.05-< 0.25	
Bis(2-chloroisopropyl) ether	ug/L	**<0.25**	2	< 0.25	< 1		< 0.25	1	< 0.25-< 0.25	
Bis(2-ethylhexyl) phthalate	ug/L	**<5**	2	< 5	< 20		1.1	21	< 1-< 5	
Bromodichloromethane	ug/L	**< 1**	2	< 1	< 1		< 1	21	< 1-< 1	
Bromobenzene	ug/L	**< 2**	2	< 2	< 2		< 2	15	< 2-< 2	
Bromoform	ug/L	**< 1**	2	< 1	< 1		< 1	20	< 1-< 1	
Bromomethane	ug/L	**< 1**	2	< 1	< 1		< 1	21	< 1-< 2.7	
Butylbenzyl phthalate	ug/L	**<2.5**	2	< 2.5	< 10		< 2.5	3	< 2.5-< 2.5	
Carbon Tetrachloride (Tetrabromomethane)	ug/L	**< 0.5**	2	< 0.5	< 0.5	2.0 MAC	< 0.5	21	< 0.5-< 0.5	

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Chloroform	ug/L	**< 1**	2	< 1	< 1		< 1	21	< 1-< 1	
Chloroethane	ug/L	**< 1**	2	< 1	< 1		< 1	21	< 1-< 1	
Chloromethane	ug/L	**< 1**	2	< 1	< 1		< 1	21	< 1-< 1	
Desethyl Atrazine	ug/L	**< 0.1**	1	< 0.1	< 0.1		< 0.1	13	< 0.1-< 0.5	
Dibromochloromethane	ug/L	**< 1**	2	< 1	< 1		< 1	20	< 1-< 1	
Dichlorodifluoromethane	ug/L	**< 2**	2	< 2	< 2		< 2	18	< 2-< 2	
Dichloromethane	ug/L	**< 2**	2	< 2	< 2	50 MAC	< 2	20	< 2-< 2	
Diethyl phthalate	ug/L	**<0.05**	2	< 0.25	< 1		0.0615	20	< 0.05-1	
Dimethyl phthalate	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	20	< 0.05-< 0.25	
Di-n-butyl phthalate	ug/L	**<2.5**	2	< 2.5	< 10		0.93	19	< 0.05-4.9	
Di-n-ocyl phthalate	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	20	< 0.05-< 0.25	
Diuron	ug/L	**< 10**	2	< 10	< 10	150 MAC	< 0.1	16	< 0.1-< 10	
Ethylbenzene	ug/L	**< 0.4**	2	< 0.4	< 0.4	140 MAC and ≤ 1.6 AO	< 0.4	28	< 0.4-< 0.5	
Formaldehyde	ug/L	**< 10**	2	< 10	< 10	No Guideline Required	< 10	19	< 10-< 10	
Hexachlorobenzene	ug/L	**< 0.005**	1	< 0.005	< 0.005		< 0.003	20	< 0.003-< 0.5	
Hexachlorobutadiene	ug/L	**< 0.5**	2	< 0.25	< 1		< 0.25	27	< 0.004-< 0.5	
Hexachlorocyclopentadiene	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	22	< 0.01-< 0.25	
Hexachloroethane	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	22	< 0.003-< 0.25	
Isophorone	ug/L	**<0.5**	2	< 0.25	< 1		< 0.05	21	< 0.05-< 0.25	
Methyltertiarybutylether (MTBE)	ug/L	**< 4**	2	< 4	< 4	15 AO	< 4	34	< 0.5-< 4	
Monochlorobenzene	ug/L	**< 0.5**	2	< 0.5	< 0.5	80 MAC	< 0.5	21	< 0.5-< 0.5	
N-Nitrosodimethylamine (NDMA)		**2.5**	2	< 1	< 4		< 0.2	19	< 0.2-< 1	
Nitrobenzene	ug/L	**<0.25**	2	< 0.25	< 1		< 0.05	21	< 0.05-< 0.25	
N-nitroso-di-n-propylamine	ug/L	**2.5**	2	< 1	< 4		< 0.2	20	< 0.2-< 1	
N-nitrosodiphenylamine	ug/L	**2.5**	2	< 1	< 4		< 1	2	< 1-< 1	
Octachlorostyrene	ug/L	**< 0.005**	1	< 0.005	< 0.005		< 0.003	20	< 0.003-< 0.005	
Styrene	ug/L	**<0.4**	2	<0.4	<0.5		<0.4	32	<0.4-<0.5	
Tetrachloroethene	ug/L	**< 0.5**	2	< 0.5	< 0.5	10 MAC	< 0.5	21	< 0.5-< 0.5	
Toluene	ug/L	**< 0.4**	3	< 0.4	< 0.4	60 MAC and ≤ 24 AO	< 0.4	28	< 0.4-< 0.5	
Triallate	ug/L	**< 0.05**	2	< 0.05	< 0.05	Guideline Archived	< 0.05	20	< 0.0003-< 5	
Trichloroethylene	ug/L	**< 0.5**	2	< 0.5	< 0.5	5.0 MAC	< 0.5	18	< 0.5-< 0.5	
Trichlorofluoromethane	ug/L	**< 4**	2	< 4	< 4		< 4	1	< 4-< 4	
Trichlorotrifluoroethane	ug/L	**< 2**	2	< 2	< 2		<0.5	20	<0.5-<0.5	
Vinyl Chloride (Chloroethene)	ug/L	**<0.5**	2	<0.5	<0.5	2.0 MAC	<0.5	21	<0.5-<0.5	
o-Xylene	ug/L	**< 4**	2	< 4	< 4		< 4	1	< 4-< 4	
m&p-Xylene	ug/L	**< 0.4**	2	< 0.4	< 0.4		< 0.4	27	< 0.4-< 1	
Xylenes (Total)	ug/L	**< 0.4**	2	< 0.4	< 0.4	90 MAC and ≤ 20 AO	< 0.4	27	< 0.4-< 1	

Appendix A, Table 1 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Miscellaneous										
Perfluoropentanoic Acid (PFPeA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorohexanoic Acid (PFHxA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluoroheptanoic Acid (PFHpA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorooctanoic Acid (PFOA)	ng/L	**< 2**	2	< 2	< 2	0.2 MAC	< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorononanoic Acid (PFNA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorododecanoic acid (PFDoA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorodecanoic Acid (PFDA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluoroundecanoic Acid (PFUnA)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perflurotridecanoic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorotetradecnoic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorobutanesulfonic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluoropentanesulfonic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	1	< 0.02-< 0.02	2/yr
Perfluorohexanesulfonic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluoroheptanesulfonic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorooctanesulfonic Acid	ng/L	**< 2**	2	< 2	< 2		< 0.02	1	< 0.02-< 0.02	2/yr
Perfluorononane sulfonic Acid (PFOS)	ng/L	**< 2**	2	< 2	< 2	0.6 MAC	< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorodecanesulfonic Acid (PFDS)	ng/L	**< 2**	2	< 2	< 2		< 0.02	3	< 0.02-< 0.02	2/yr
Perfluorooctane Sulfonamide (PFOSA)	ng/L	**< 4**	2	< 4	< 4		< 0.02	3	< 0.02-< 0.02	2/yr
4:2 Flurotelomer Sulfonic Acid	ng/L	**< 4**	2	< 4	< 4		< 0.02	2	< 0.02-< 0.02	2/yr
6:2 Flurotelomer Sulfonic Acid	ng/L	**< 4**	2	< 4	< 4		< 0.02	1	< 0.02-< 0.02	2/yr
8:2 Flurotelomer Sulfonic Acid	ng/L	**< 4**	2	< 4	< 4		< 0.02	1	< 0.02-< 0.02	2/yr

Notes: mg/L = milligrams per litre; ug/L = micrograms per litre; ND = Not Detected; CFU = Colony Forming Units; NTU = Nephelometric Units; TCU = True Colour Units; AO = Aesthetic Objective; MAC = Max. Acceptable Conc.; Median = middle point of all values

APPENDIX A
TABLE 2. 2022 TREATED WATER QUALITY AFTER GOLDSTREAM WATER TREATMENT PLANT

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Physical Parameters (ND means less than instrument can detect)										
Alkalinity, Total	mg/L	**16.15**	12	14.7	17.7		13.4	109	6.92-18.1	12/yr
Carbon, Dissolved Organic	mg/L	**1.9**	12	1	2.3		1.7	90	< 0.5-370	12/yr
Carbon, Total Organic	mg/L	**1.75**	12	1.4	2.1	Guideline Archived	1.8	90	0.93-4.99	12/yr
Colour, True	TCU	**< 2**	53	< 2	6	≤ 15 AO	3.9	393	< 1.4-10	52/yr
Conductivity @ 25 C	uS/cm	**50.3**	54	45.4	56.8		45.7	390	31.1-98.6	52/yr
Hardness as $CaCO_3$	mg/L	**16.35**	12	15.2	17.7	No Guideline Required	17.3	121	12-22.1	12/yr
Odour	Odour Profile	**1**	233	1	1	Inoffensive	1	1811	1-1	250/yr
pH	pH units	**7.35**	55	6.9	7.84	7.0-10.5 AO	7.05	412	6.54-8.24	52/yr
Taste	Flavour Profile	**1**	229	1	1	Inoffensive	1	1800	1-1	250/yr
Total Dissolved Solids	mg/L	**42**	12	28	54	≤500 AO	27.15	90	< 10-78	12/yr
Total Suspended Solids	mg/L	**< 1**	12	< 1	2.7		< 1	89	0.1-10.9	12/yr
Total Solids	mg/L	**34**	12	20	110		32	86	< 1-< 100	12/yr
Turbidity, Grab Samples	NTU	**0.2**	241	0.15	0.85	1.0 MAC	0.3	1859	0.14-6.3	250/yr
Water Temperature, Grab Samples	degrees C	**8.8**	241	3.7	18.6	≤ 15 AO	10.6	1862	2.5-21.1	250/yr
Non-Metallic Inorganic Chemicals (ND means less than instrument can detect)										
Bromate	mg/L as BrO3	**< 0.0095**	12	< 0.0095	< 0.0095	0.01 MAC	< 0.0095	10	< 0.0095-0.011	
Bromide	ug/L as Br	**< 0.01**	4	< 0.01	0.018		< 10	30	0.018-43	4/yr
Chloride	mg/L as Cl	**3.9**	4	2.4	4.30	≤ 250 AO	4.2	23	< 0.045-5.3	4/yr
Chlorate, dissolved	mg/L as ClO2	**< 0.1**	12	< 0.1	< 0.1	1 MAC	< 0.1	16	< 0.1-< 0.1	4/yr
Chlorite, dissolved	mg/L as ClO3	**<0.1**	9	<0.1	<0.1	1 MAC	< 0.1	10	< 0.1-< 0.1	12/yr
Cyanide	mg/L as Cn	**< 0.0005**	4	< 0.0005	0.00181	0.2 MAC	0.00055	22	< 0.0005-< 0.006	4/yr
Fluoride	mg/L as F	**< 0.05**	4	< 0.05	< 0.05	1.5 MAC	< 0.05	11	< 0.02-< 0.05	4/yr
Nitrate, Dissolved	ug/L as N	**< 20**	12	< 20	29	10000 MAC	< 20	86	< 0.02-47.5	12/yr
Nitrite, Dissolved	ug/L as N	**< 5**	12	< 5	< 5	1000 MAC	< 5	85	< 0.3-5	12/yr
Nitrate + Nitrite	ug/L as N	**< 20**	12	< 20	29		< 20	86	2.9-47.5	12/yr
Nitrogen, Ammonia	ug/L as N	**245**	12	98	340		< 190	90	0.11-760	12/yr
Nitrogen, Total Kjeldahl	ug/L as N	**371**	12	208	449		344	85	74-950	12/yr
Nitrogen, Total	ug/L as N	**371**	12	208	467		343	90	75.6-976	12/yr
Phosphate, Ortho, Dissolved	ug/L as P	**< 1**	12	< 1	2.7		< 5	86	0.1-6.2	12/yr
Phosphorus, Total, Dissolved	ug/L as P	**2.15**	12	1.3	4.2		2.9	90	0.37-< 30	12/yr
Phosphorus, Total	ug/L as P	**2.6**	12	< 1	5.5		2.9	90	< 1-14	12/yr
Silica	mg/L as SiO2	**4.8**	12	4	5.2		4.1	81	2.91-5.2	12/yr
Silicon	ug/L as Si	**2075**	12	1760	2590		1,930.00	91	1400-2740	12/yr
Sulphate	mg/L as SO4	**1.25**	12	< 1	< 10	≤ 500 AO	1.5	88	0.8-5.31	12/yr
Sulphide	mg/L as H2S	**< 0.0018**	12	< 0.0018	< 0.0018	≤ 0.05 AO	< 0.0018	11	< 0.0018-0.027	12/yr
Sulfur	mg/L as S	**< 3**	12	< 3	< 3		< 3	91	< 3-< 3	12/yr

Appendix A, Table 2 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Metallic Inorganic Chemicals (ND means less than instrument can detect)										
Aluminum	ug/L as Al	**13.9**	12	6.3	29.5	2900 MAC / 100 OG	16.4	91	4.5-67.7	12/yr
Antimony	ug/L as Sb	**< 0.5**	12	< 0.5	< 0.5	6 MAC	< 0.5	91	< 0.02-< 0.5	12/yr
Arsenic	ug/L as As	**< 0.1**	12	< 0.1	< 0.1	10 MAC	< 0.1	91	0.04-0.17	12/yr
Barium	ug/L as Ba	**3.65**	12	3.3	4	2000 MAC	3.8	91	3.3-4.8	12/yr
Beryllium	ug/L as Be	**< 0.1**	12	< 0.1	< 0.1		< 0.1	90	< 0.01-< 0.1	12/yr
Bismuth	ug/L as Bi	**< 1**	12	< 1	< 1		< 1	91	< 0.005-< 1	12/yr
Boron	ug/L as B	**< 50**	12	< 50	< 50	5000 MAC	< 50	91	< 10-50	12/yr
Cadmium	ug/L as Cd	**< 0.01**	12	< 0.01	< 0.01	7 MAC	< 0.01	91	< 0.005-< 0.1	12/yr
Calcium	mg/L as Ca	**4.725**	12	4.33	5.06	No Guideline Required	4.95	91	4.18-6.82	12/yr
Chromium	ug/L as Cr	**< 1**	12	< 1	< 1	50 MAC	< 1	91	< 0.1-1.2	12/yr
Cobalt	ug/L as Co	**< 0.2**	12	< 0.2	< 0.2		< 0.2	91	0.023-< 0.5	12/yr
Copper	ug/L as Cu	**1.965**	12	1.24	6.28	2000 MAC / ≤ 1000 AO	13	91	1.03-202	12/yr
Iron	ug/L as Fe	**19.6**	12	11.5	50.4	≤ 300 AO	26	91	12.1-198	12/yr
Lead	ug/L as Pb	**< 0.2**	12	< 0.2	< 0.2	5 MAC	< 0.2	91	0.017-0.92	12/yr
Lithium	ug/L as Li	**< 2**	12	< 2	< 2		< 5	53	< 0.5-13.5	12/yr
Magnesium	mg/L as Mg	**1.105**	12	1.03	1.24	No Guideline Required	1.15	91	0.146-1.41	12/yr
Manganese	ug/L as Mn	**4**	12	1.6	17.6	120 MAC / ≤ 20 AO	4.8	91	1.4-51.1	12/yr
Mercury, Total	ug/L as Hg	**< 0.0019**	12	< 0.0019	< 0.0019	1.0 MAC	0.0023	89	< 0.0019-< 10	12/yr
Molybdenum	Ug/L as Mo	**< 1**	12	< 1	< 1		< 1	91	< 0.05-< 1	12/yr
Nickel	mg/L as Ni	**< 1**	12	< 1	< 1		< 1	91	0.206-1.6	12/yr
Potassium	mg/L as K	**0.127**	12	0.119	0.135		0.135	91	0.111-0.216	12/yr
Selenium	ug/L as Se	**< 0.1**	12	< 0.1	< 0.1	50 MAC	< 0.1	91	< 0.04-< 0.1	12/yr
Silver	ug/L as Ag	**< 0.02**	12	< 0.02	< 0.02	No Guideline Required	< 0.02	91	< 0.005-0.058	12/yr
Sodium	mg/L as Na	**3.195**	12	1.66	3.55	≤ 200 AO	1.7	91	1.39-3.56	12/yr
Strontium	ug/L as Sr	**14.1**	12	13	14.9	7000 MAC	15.4	91	13-19.7	12/yr
Thallium	ug/L as Tl	**< 0.01**	12	< 0.01	< 0.01		< 0.01	91	< 0.002-< 0.05	12/yr
Tin	ug/L as Sn	**< 5**	12	< 5	< 5		< 5	91	< 0.2-< 5	12/yr
Titanium	ug/L as Ti	**< 5**	12	< 5	< 5		< 5	91	< 0.05-< 5	12/yr
Uranium	ug/L as U	**< 0.1**	12	< 0.1	< 0.1	20 MAC	< 0.1	91	0.004-< 0.1	12/yr
Vanadium	ug/L as V	**< 5**	12	< 5	< 5		< 5	91	< 0.2-< 5	12/yr
Zinc	ug/L as Zn	**< 5**	12	< 5	< 5	≤ 5000 AO	< 5	91	0.37-54.1	12/yr
Zirconium	ug/L as Zr	**< 0.1**	12	< 0.1	< 0.1		< 0.1	91	< 0.1-< 0.5	12/yr
Microbial Parameters (ND means less than method or instrument can detect)										
Coliform Bacteria										
Coliforms, Total	CFU/100 mL	**< 1**	241	< 1	6	0 MAC	1874	0-200	ND-85	250/yr
E. coli	CFU/100 mL	**< 1**	241	< 1	< 1	0 MAC	1873	0-< 1	ND	250/yr

Appendix A, Table 2 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Heterotrophic/Other Bacteria										
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	**< 10**	235	< 1	40		< 10	1736	0-770	250/yr
Disinfectants (ND means less than instrument can detect)										
Disinfectants										
Chlorine, Total Residual	mg/L as Cl_2	**1.86**	239	1.53	2.23	No Guideline Required (chloramines)	1.85	678	0.8-2.33	250/yr
Monochloramine	mg/L as Cl_2	**1.72**	239	1.09	2.13	No Guideline Required (chloramines)	1.71	663	0-2.17	250/yr

Notes: mg/L = milligrams per litre; ug/L = micrograms per litre; ND = Not Detected; CFU = Colony Forming Units; NTU = Nephelometric Units; TCU = True Colour Units; AO = Aesthetic Objective; MAC = Max. Acceptable Conc.; Median = middle point of all values

APPENDIX A
TABLE 3. 2022 TREATED WATER QUALITY AFTER SOOKE RIVER ROAD WATER TREATMENT PLANT

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Physical Parameters (ND means less than instrument can detect)										
Alkalinity, Total	mg/L	**15.9**	13	14.8	17.7		16.35	146	7.1-19.4	12/yr
Colour, True	TCU	**< 2**	36	< 2	7.0	≤ 15 AO	3	461	1-11.3	52/yr
Conductivity @ 25 C	uS/cm	**52.7**	36	49.0	61.5		56.7	458	26.4-71.6	52/yr
Hardness as $CaCO_3$	mg/L	**16.25**	8	15.1	16.5	No Guideline Required	16.9	35	15.3-29.3	6/yr
Odour	Flavour Profile	**1.0**	36	1.0	1.0	Inoffensive	1	468	1-1	52/yr
pH	pH units	**7.5**	34	7.0	8.2	7.0-10.5 AO	7.43	459	6.32-8.32	52/yr
Taste	Flavour Profile	**1.0**	34	1.0	1.0	Inoffensive	1	467	1-2	52/yr
Turbidity, Grab Samples	NTU	**0.3**	37	0.2	0.5	1 MAC	0.29	485	0.15-1.3	52/yr
Water Temperature, Grab Samples	degrees C	**9.3**	39	4.7	18.0	≤ 15 AO	11.05	486	4.3-20	52/yr
Microbial Parameters (ND means less than instrument can detect)										
Coliform Bacteria										
Coliform, Total	CFU/100 mL	**< 1**	39	< 1	1	0 MAC	0	487	0-1	52/yr
E. coli	CFU/100 mL	**< 1**	40	< 1	< 1	0 MAC	0	487	0-< 1	52/yr
Heterotrophic Bacteria										
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	**< 10**	35	< 10	30		< 10	438	<10-1230	52/yr
Disinfectants (ND means less than instrument can detect)										
Disinfectants										
Chlorine, Total Residual	mg/L as Cl_2	**2.03**	39	1.28	2.38	No Guideline Required	1.48	490	0.78-4.2	52/yr
Monochloramine	mg/L as Cl_2	**1.79**	37	1.16	2.1	No Guideline Required	1.62	471	0.03-3.1	52/yr
Metallic Inorganic Chemicals (ND means less than instrument can detect)										
Aluminum	ug/L as Al	**13.55**	8	7.4	19.5	2900 MAC / 100 OG	13.9	35	5.3-22.7	6/yr
Antimony	ug/L as Sb	**< 0.5**	8	< 0.5	< 0.5	6 MAC	< 0.5	35	< 0.5-< 0.5	6/yr
Arsenic	ug/L as As	**< 0.1**	8	< 0.1	< 0.1	10 MAC	< 0.1	35	< 0.1-< 0.1	6/yr
Barium	ug/L as Ba	**3.6**	8	3.5	4	2000 MAC	3.7	35	3.3-4.2	6/yr
Beryllium	ug/L as Be	**< 0.1**	8	< 0.1	< 0.1		< 0.1	35	< 0.1-< 0.1	6/yr
Bismuth	ug/L as Bi	**< 1**	8	< 1	< 1		< 1	35	< 1-< 1	6/yr
Boron	ug/L as B	**< 50**	8	< 50	< 50	5000 MAC	< 50	35	< 50-< 50	6/yr
Cadmium	ug/L as Cd	**< 0.01**	8	< 0.01	< 0.01	7 MAC	< 0.01	35	< 0.01-0.015	6/yr
Calcium	mg/L as Ca	**4.68**	8	4.35	4.79	No Guideline Required	4.91	37	4.31-7.67	6/yr
Chromium	ug/L as Cr	**< 1**	8	< 1	< 1	50 MAC	< 1	35	< 1-< 1	6/yr
Cobalt	ug/L as Co	**< 0.2**	8	< 0.2	0.3		< 0.2	35	< 0.2-< 0.5	6/yr
Copper	ug/L as Cu	**37.5**	8	19.2	67.9	2000 MAC / ≤ 1000 AO	28.7	35	10.9-80.4	6/yr

Appendix A, Table 4 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Iron	ug/L as Fe	**19.95**	8	12.2	31.4	≤ 300 AO	24.4	35	12-53	6/yr
Lead	ug/L as Pb	**< 0.2**	8	< 0.2	0.3	5 MAC	0.22	37	< 0.2-0.64	6/yr
Lithium	ug/L as Li	**< 2**	8	< 2	< 2		< 2	17	< 2-< 5	6/yr
Magnesium	mg/L as Mg	**1.105**	8	1.03	1.17	No Guideline Required	1.15	35	1-1.34	6/yr
Manganese	ug/L as Mn	**2.45**	8	1.6	5.9	120 MAC / ≤ 20 AO	3.4	35	1.3-10	6/yr
Mercury, Total	ug/L as Hg	**< 0.0019**	8	< 0.0019	< 0.0019	1.0 MAC	< 0.002	35	< 0.0019-< 0.01	6/yr
Molybdenum	ug/L as Mo	**< 1**	8	< 1	< 1		< 1	35	< 1-< 1	6/yr
Nickel	ug/L as Ni	**< 1**	8	< 1	< 1		< 1	35	< 1-< 1	6/yr
Potassium	mg/L as K	**0.127**	8	0.121	0.143		0.134	35	0.115-0.247	6/yr
Selenium	ug/L as Se	**< 0.1**	8	< 0.1	< 0.1	50 MAC	< 0.1	35	< 0.1-0.1	6/yr
Silver	ug/L as Ag	**ND**	6	ND	0	No Guideline Required	< 0.02	35	< 0.02-< 0.02	6/yr
Sodium	mg/L as Na	**3.53**	8	3.24	4.67	≤ 200 AO	4.41	35	3.44-7.02	6/yr
Strontium	ug/L as Sr	**13.9**	8	13.2	15.2	7000 MAC	14.8	35	13.2-17.1	6/yr
Thallium	ug/L as Tl	**< 0.01**	8	< 0.01	< 0.01		< 0.01	35	< 0.01-< 0.05	6/yr
Tin	ug/L as Sn	**< 5**	8	< 5	< 5		< 5	35	< 5-< 5	6/yr
Titanium	ug/L as Ti	**< 5**	8	< 5	< 5		< 5	35	< 5-< 5	6/yr
Uranium	ug/L as U	**< 0.1**	8	< 0.1	< 0.1	20 MAC	< 0.1	35	< 0.1-< 0.1	6/yr
Vanadium	ug/L as V	**< 5**	8	< 5	< 5		< 5	35	< 5-< 5	6/yr
Zinc	ug/L as Zn	**< 5**	8	< 5	< 5	≤ 5000 AO	< 5	35	< 5-79.4	6/yr
Zirconium	ug/L as Zr	**< 0.1**	8	< 0.1	< 0.1		< 0.1	35	< 0.1-< 0.5	6/yr

Notes: mg/L = milligrams per litre; ug/L = micrograms per litre; ND = Not Detected; CFU = Colony Forming Units; NTU = Nephelometric Units; TCU = True Colour Units; AO = Aesthetic Objective; MAC = Max. Acceptable Conc.; Median = middle point of all values

APPENDIX A
TABLE 4. 2022 TREATED WATER QUALITY TRANSMISSION / DISTRIBUTION SYSTEMS GOLDSTREAM SERVICE AREA

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Metals (ND means less than instrument can detect)										
Mercury, Total	ug/L as Hg	**< 0.0019**	24	< 0.0019	0.00	1 MAC	< 0.002	136	< 0.0019-< 0.01	24/yr
Aluminum	ug/L as Al	**13.6**	24	5	23.20	2900 MAC / 100 OG	14.1	153	6.3-61	24/yr
Antimony	ug/L as Sb	**< 0.5**	24	< 0.5	< 0.5	6 MAC	< 0.5	153	< 0.5-5.59	24/yr
Arsenic	ug/L as As	**< 0.1**	24	< 0.1	0.25	10 MAC	< 0.1	153	< 0.1-1.55	24/yr
Barium	ug/L as Ba	**3.65**	24	2.9	4.20	2000 MAC	3.8	153	2.8-4.7	24/yr
Boron	ug/L as B	**< 50**	24	< 50	< 50	5000 MAC	< 50	153	< 50-50	24/yr
Cadmium	ug/L as B	**< 0.01**	24	< 0.01	< 0.01	7 MAC	< 0.01	153	< 0.01-0.468	24/yr
Chromium	ug/L as Cr	**< 1**	24	< 1	< 1	50 MAC	< 1	153	< 0.1-1.3	24/yr
Copper	mg/L as Cu	**5.815**	24	1.65	34.60	2000 MAC / 1000 AO	24.4	153	0.66-12400	24/yr
Iron	ug/L as Fe	**19.75**	24	11.3	32.60	300 AO	28	153	12.5-359	24/yr
Lead	ug/L as Pb	**< 0.2**	24	< 0.2	0.43	5 MAC	0.265	8	< 0.2-1.93	24/yr
Manganese	ug/L as Mn	**3.3**	24	1.5	6.40	120 MAC / 20 AO	4.1	153	1.4-35.1	24/yr
Selenium	ug/L as Se	**< 0.1**	24	< 0.1	< 0.1	50 MAC	< 0.1	153	< 0.1-< 0.1	24/yr
Strontium	ug/L as Sr	**14.45**	24	13.1	17.60	7000 MAC	15.3	153	11.1-18.8	24/yr
Uranium	ug/L as U	**< 0.1**	24	< 0.1	< 0.1	20 MAC	< 0.1	153	< 0.1-< 0.1	24/yr
Zinc	ug/L as Zn	**< 5**	24	< 5	13.40	≤ 5000 MAC	< 5	153	< 5-1660	24/yr
Sodium	mg/L as Na	**3.22**	24	3.04	3.78	≤ 200 AO	1.725	152	1.46-13	24/yr
Disinfection By-products Parameters (ND means less than method or instrument can detect)										
Nitrosamines										
N-Nitrosodiethylamine	ng/L	< 1.9	23	< 1.9	< 2.2		< 1.9	98	0.000375-3.8	24/yr
N-Nitrosodimethylamine	ng/L	< 1.9	23	< 1.9	3.3	40 MAC	< 1.9	19	< 1.9-4.9	24/yr
N-Nitroso-di-n-butylamine	ng/L	< 1.9	23	< 1.9	< 2.2		< 2	93	< 0.157-42	24/yr
N-nitroso-di-n-propylamine	ng/L	< 1.9	23	< 1.9	< 2.2		< 2	35	< 1.9-< 2.2	24/yr
N-Nitrosoethylmethylamine	ng/L	< 1.9	23	< 1.9	< 2.2		< 2	92	0-< 2.2	24/yr
N-Nitrosomorpholine	ng/L	< 1.9	23	< 1.9	< 2.2		< 2	93	0.00102-4.6	24/yr
N-nitrosopiperidine	ng/L	< 1.9	23	< 1.9	< 2.2		< 2	91	< 0.0357-< 10	24/yr
N-Nitrosopyrrolidine	ng/L	< 1.9	23	< 1.9	< 2.2		< 2	92	< 0.0662-< 8	24/yr
Haloacetic Acids (HAAs)										
Total Haloacetic Acids	ug/L	**16**	24	< 5	20	80 MAC	14	184	4.23-104	24/yr
Monobromoacetic Acid (MBAA)	ug/L	**< 5**	24	< 5	< 5		< 5	185	< 0.2-15.04	24/yr
Dichloroacetic Acid (DCAA)	ug/L	**10**	24	< 5	13		7.05	185	0.58-30	24/yr
Trichloroacetic Acid (TCAA)	ug/L	**5.9**	24	< 5	7.2		6.4	185	1.3-56	24/yr
Bromochloroacetic Acid (BCAA)	ug/L	**< 5**	24	< 5	< 5		< 5	185	0.13-11.63	24/yr

Appendix A, Table 4 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Dibromoacetic Acid (DBAA)	ug/L	**< 5**	24	< 5	< 5		< 5	185	< 0.2-5.6	24/yr
Monochloroacetic Acid (MCAA)	ug/L	**< 5**	24	< 5	< 5		< 5	185	0.2-< 5	24/yr
Trihalomethanes TTHMs)										
Total Trihalomethanes	ug/L	**17**	24	12	23	100 MAC	19	188	3.3-77.9	24/yr
Bromodichloromethane	ug/L	**2**	24	< 1	2.1		2	17	1.2-2.9	24/yr
Bromoform	ug/L	**< 1**	24	< 1	< 1		< 1	188	< 0.1-< 2	24/yr
Chlorodibromomethane	ug/L	**< 1**	24	< 1	< 1		< 1	17	< 1-< 1	24/yr
Chloroform	ug/L	**16**	24	12	21		16	17	9.6-19	24/yr

Notes: mg/L = milligrams per litre; ug/L = micrograms per litre; ND = Not Detected; CFU = Colony Forming Units; NTU = Nephelometric Units; TCU = True Colour Units; AO = Aesthetic Objective; MAC = Max. Acceptable Conc.; Median = middle point of all values

APPENDIX A
TABLE 5. 2022 TREATED WATER QUALITY DISTRIBUTION SYSTEM SOOKE SERVICE AREA

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Metals (ND means less than instrument can detect)										
Mercury, Total	ug/L as Hg	**< 0.0019**	6	< 0.0019	< 0.0019	1 MAC	< 0.002	36	< 0.0019-< 0.05	6/yr
Aluminum	ug/L as Al	**15.3**	6	4.9	22.3	2900 MAC / 100 OG	14	38	7.5-242	6/yr
Antimony	ug/L as Sb	**< 0.5**	6	< 0.5	< 0.5	6 MAC	< 0.5	38	< 0.5-< 0.5	6/yr
Arsenic	ug/L as As	**< 0.1**	6	< 0.1	< 0.1	10 MAC	< 0.1	38	< 0.1-0.24	6/yr
Barium	ug/L as Ba	**3.45**	6	3.2	4.1	2000 MAC	3.7	38	3.2-4.6	6/yr
Boron	ug/L as B	**< 50**	6	< 50	< 50	5000 MAC	< 50	38	< 50-< 50	6/yr
Cadmium	ug/L as B	**< 0.01**	6	< 0.01	< 0.01	7 MAC	< 0.01	38	< 0.01-0.075	6/yr
Chromium	ug/L as Cr	**< 1**	6	< 1	< 1	50 MAC	< 1	38	< 1-< 1	6/yr
Copper	mg/L as Cu	**6.42**	6	4.35	31.7	2000 MAC / 1000 AO	5.40	44	0.85-417	6/yr
Iron	ug/L as Fe	**53.9**	6	39.2	91.5	300 AO	36.30	38	19.5-278	6/yr
Lead	ug/L as Pb	**0.205**	6	< 0.2	0.75	5 MAC	< 0.2	92	< 0.2-22.5	6/yr
Manganese	ug/L as Mn	**2.65**	6	2.1	4.9	120 MAC / 20 AO	2.90	45	< 0.01-1760	6/yr
Selenium	ug/L as Se	**< 0.1**	6	< 0.1	< 0.1	50 MAC	< 0.1	37	< 0.1-< 0.1	6/yr
Strontium	ug/L as Sr	**16.25**	6	15.8	19.2	7000 MAC	18.30	37	16.1-21.5	6/yr
Uranium	ug/L as U	**< 0.1**	6	< 0.1	< 0.1	20 MAC	< 0.1	38	< 0.1-< 0.1	6/yr
Zinc	ug/L as Zn	**< 5**	6	< 5	21.1	≤ 5000 MAC	< 5	38	< 5-660	6/yr
Sodium	mg/L as Na	**3.635**	6	3.36	4.23	≤ 200 AO	4.47	37	3.41-6.08	6/yr
Disinfection By-products Parameters (ND means less than method or instrument can detect)										
Nitrosamines										
N-Nitrosodiethylamine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	27	0.0000625-3.22	6/yr
N-Nitrosodimethylamine	ng/L	**2**	6	< 1.9	4.3	40 MAC	< 2	28	< 1-3.71	6/yr
N-Nitroso-di-n-butylamine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	24	< 0.268-< 3	6/yr
N-nitroso-di-n-propylamine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	9	< 1.9-< 2	6/yr
N-Nitrosoethylmethylamine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	24	< 0.082-< 2.1	6/yr
N-Nitrosomorpholine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	25	< 0.257-< 6.6	6/yr
N-nitrosopiperidine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	24	< 0.0806-< 25.9	6/yr
N-Nitrosopyrrolidine	ng/L	**1.95**	6	< 1.9	< 2.1		< 2	24	< 0.0806-< 141	6/yr
Haloacetic Acids (HAAs)										
Total Haloacetic Acids	ug/L	**22.5**	6	18	29	80 MAC	27	28	16-34	6/yr
Monobromoacetic Acid (MBAA)	ug/L	**< 5**	6	< 5	< 5		< 5	28	< 5-< 5	6/yr
Dichloroacetic Acid (DCAA)	ug/L	**12.5**	6	10	15		13	28	9.3-19	6/yr
Trichloroacetic Acid (TCAA)	ug/L	**10**	6	8	13		13	28	7-18	6/yr
Bromochloroacetic Acid (BCAA)	ug/L	**< 5**	6	< 5	< 5		< 5	28	< 5-< 5	6/yr

Appendix A, Table 5 continued

PARAMETER		2022 ANALYTICAL RESULTS				CANADIAN GUIDELINES	TEN YEAR RESULTS (2012-2021)			Target Sampling Frequency
Parameter Name	Units of Measure	Median Value	Samples Analyzed	Range		≤ = Less than or equal to	10 Year Median	Samples Analyzed	Range	
				Minimum	Maximum				Minimum - Maximum	
Dibromoacetic Acid (DBAA)	ug/L	**< 5**	6	< 5	< 5		< 5	28	< 5-< 5	6/yr
Monochloroacetic Acid (MCAA)	ug/L	**< 5**	6	< 5	< 5		< 5	28	< 5-< 5	6/yr
Trihalomethanes TTHMs)										
Total Trihalomethanes	ug/L	**27**	6	21	30	100 MAC	33	28	25-49	6/yr
Bromodichloromethane	ug/L	**2**	6	< 1	3		3	28	< 1-4.4	6/yr
Bromoform	ug/L	**< 1**	6	< 1	< 1		< 1	28	< 1-< 1	6/yr
Chlorodibromomethane	ug/L	**< 1**	6	< 1	< 1		< 1	28	< 1-< 1	6/yr
Chloroform	ug/L	**25**	6	21	28		30	28	22-45	6/yr

Notes: mg/L = milligrams per litre; ug/L = micrograms per litre; ND = Not Detected; CFU = Colony Forming Units; NTU = Nephelometric Units; TCU = True Colour Units; AO = Aesthetic Objective; MAC = Max. Acceptable Conc.; Median = middle point of all values

Making a difference...together

EEP 23-22

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, MAY 17, 2023

SUBJECT **Water Quality Summary Report for Greater Victoria Drinking Water System – January to March 2023**

ISSUE SUMMARY

Staff provide regular updates on the monitoring results for water quality conditions observed in the Greater Victoria Drinking Water System in between annual reporting to the regulator.

BACKGROUND

The Capital Regional District (CRD) supplies drinking water to the water distribution systems across Greater Victoria via the Regional Water Supply System. As a requirement under the *BC Drinking Water Protection Act*, the CRD monitors and reports on water quality to ensure the region's drinking water supply is safe and potable. The results are presented on a regular basis directly to the Commission and Island Health, and to the general public through the CRD website.

All public drinking water systems in BC must comply with the *BC Drinking Water Protection Act* and the *BC Drinking Water Protection Regulation*. In addition, the CRD relies upon water quality parameters in the Guidelines for Canadian Drinking Water Quality and guidelines developed by the US Environmental Protection Agency to inform the CRD's water quality monitoring program. The CRD provides compliance monitoring and reporting of the municipal systems, in addition to our regional commitments, to deliver effective and efficient oversight of water quality within the overall water system. Any issues that may arise remain the responsibility of the municipalities.

Water quality monitoring is one of the cornerstones of the multi-barrier approach to providing safe potable drinking water to the region's residents. The monitoring program ensures proper integration of an understanding of source waters, treatment process, distribution infrastructure operations and maintenance, and the delivery of water to customers. The program also ensures that potential risks or concerns are effectively managed to ensure a safe drinking water supply. The system is monitored for physical, chemical and biological water quality parameters. Monitoring results indicate that the CRD continues to meet guidelines for maintaining an unfiltered source water supply. Data from within the distribution systems also indicate a good balance between managing bacterial growth and ensuring good water quality with low concentrations of disinfection byproducts. Metal concentrations, including lead, are very low within the distribution systems, and physiochemical parameters indicate a low metal corrosion potential of the drinking water.

The full disclosure of water quality monitoring data maintains public confidence in the CRD managing the regional drinking water supply effectively. The data and reports are available online through the CRD public website. Staff respond to direct customer concerns and questions, and work with CRD operational staff, municipal staff, small system operators and Island Health officials to ensure good communication and support for the overall system.

Appendix A summarizes the monitoring results for raw water in Sooke Lake Reservoir, the treated water at the two water treatment plants, and for the treated water in various parts of the supply and distribution systems for the winter period from January to March 2023.

CONCLUSION

The water quality monitoring program remains an essential component in the delivery of a safe and abundant drinking water supply to the region. Monitoring results for winter 2023 indicate good water quality overall, and all critical parameters indicate stable general conditions.

RECOMMENDATION

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

Submitted by:	Glenn Harris, Ph.D., R.P.Bio., Senior Manager, Environmental Protection
Concurrence:	Larisa Hutcheson, P.Eng., General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B.Sc., C.Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Water Quality Summary Report for the Greater Victoria Drinking Water System – January to March 2023 (May 2023)

WATER QUALITY SUMMARY REPORT
FOR THE GREATER VICTORIA DRINKING WATER SYSTEM
JANUARY TO MARCH 2023

May 2023

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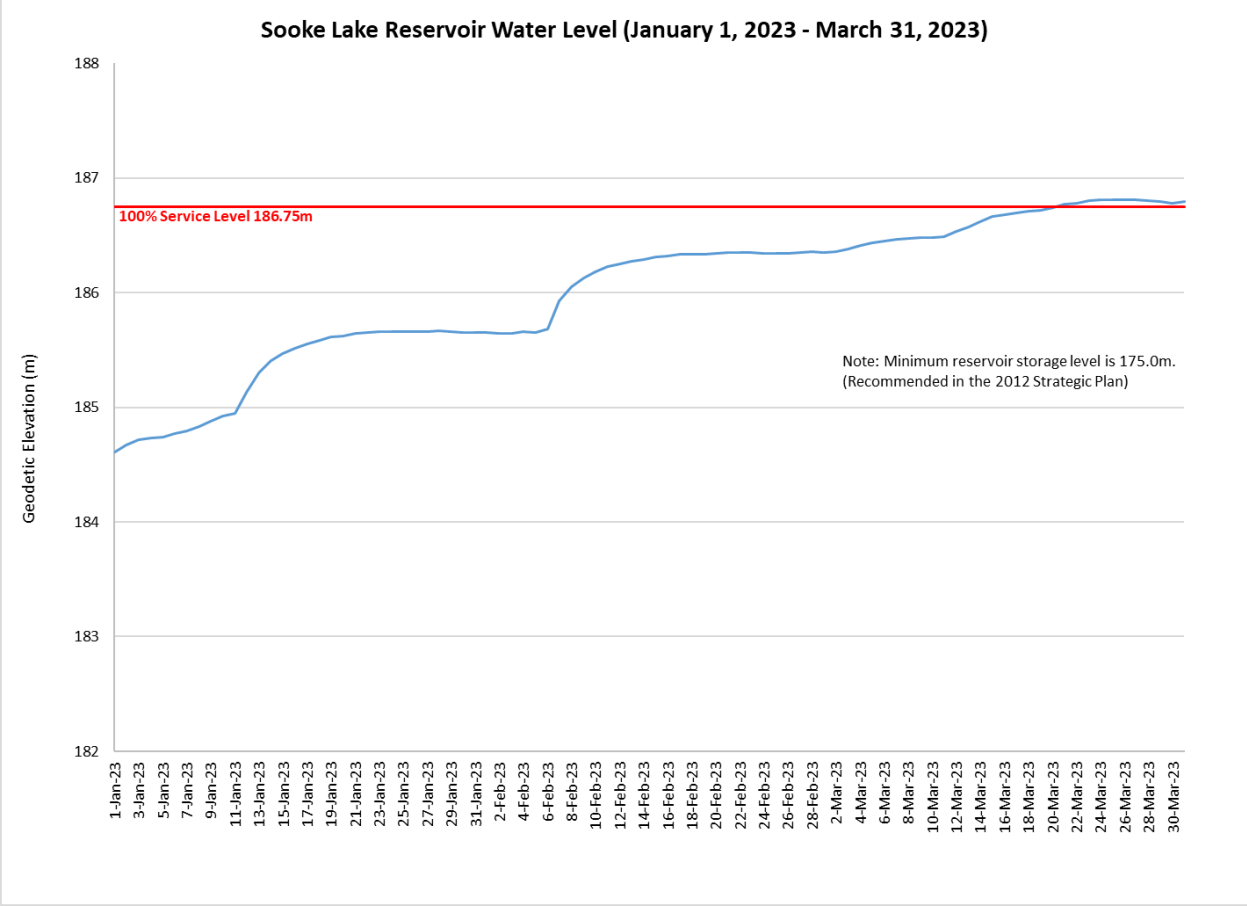
1. SOURCE WATER – SOOKE LAKE RESERVOIR

(a) Physical Parameters

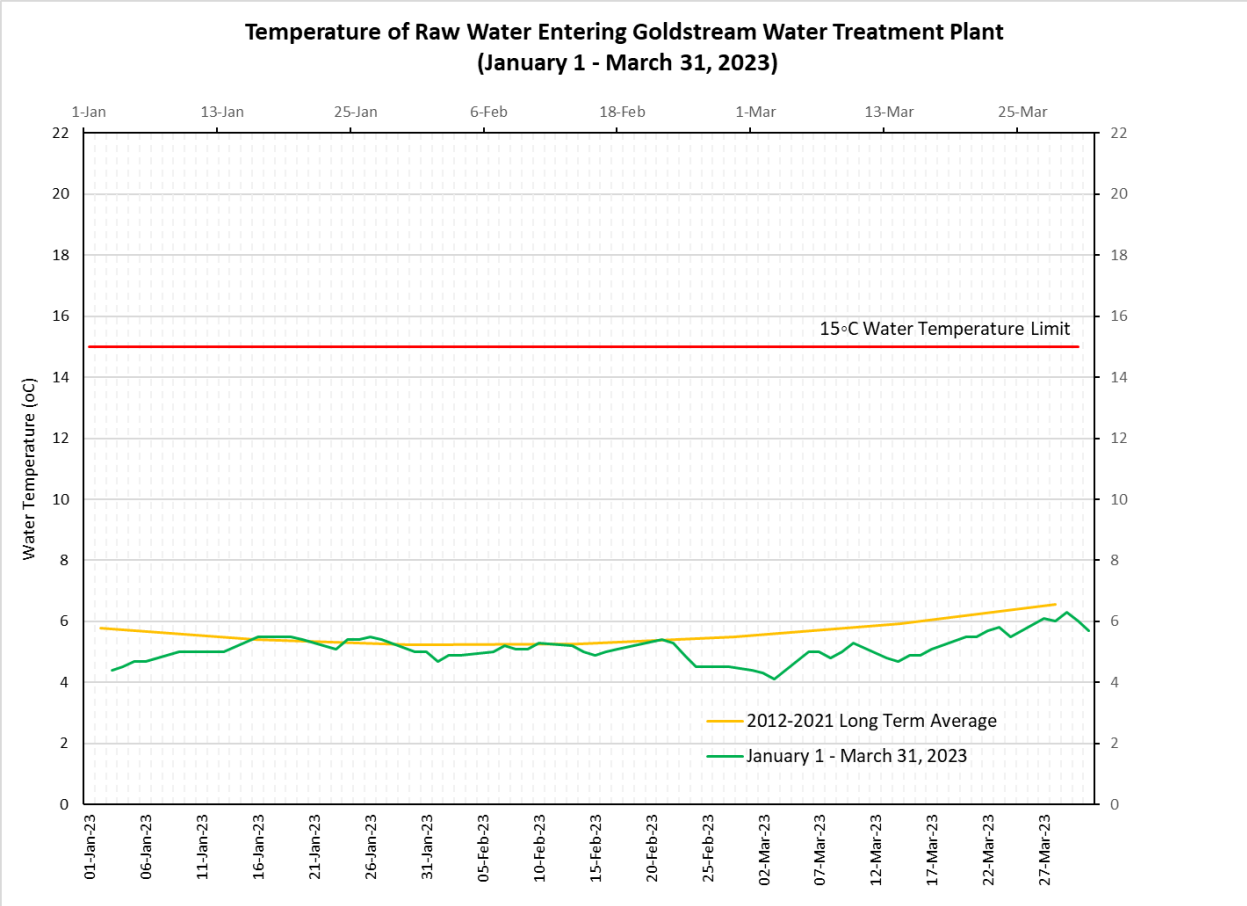
Water Levels. After the Sooke Lake Reservoir did not fill by year's end for the first time in several years, it finally reached full service level on March 21, 2023, and remained at 100% full capacity until the end of the reporting period (see Figure 1).

Figure 1



Water Temperature. The raw water temperature measured at the Goldstream Water Treatment Plant tracked near or slightly below the long-term average trend from January to March (see Figure 2).

Figure 2



Turbidity. Turbidity in the lake near the intake tower remained well below the 1.0 Nephelometric Turbidity Unit (NTU) limit and very consistent for the entire reporting period (Table 1). Frequent rainfall and runoff events during this period had no measurable impact on the raw water turbidity. This demonstrates the robustness of the Sooke Lake Reservoir in terms of turbidity impacts. The low turbidity of the raw water allows the ultraviolet disinfection stage to remain effective at inactivating bacteria and parasites.

Table 1

Sooke Reservoir, South Basin (1m) - SOL-00-01					
	Samples Collected	**Unit of Measure**	**Minimum**	**Maximum**	**Mean**
Turbidity	5	NTU	0.25	0.30	0.26

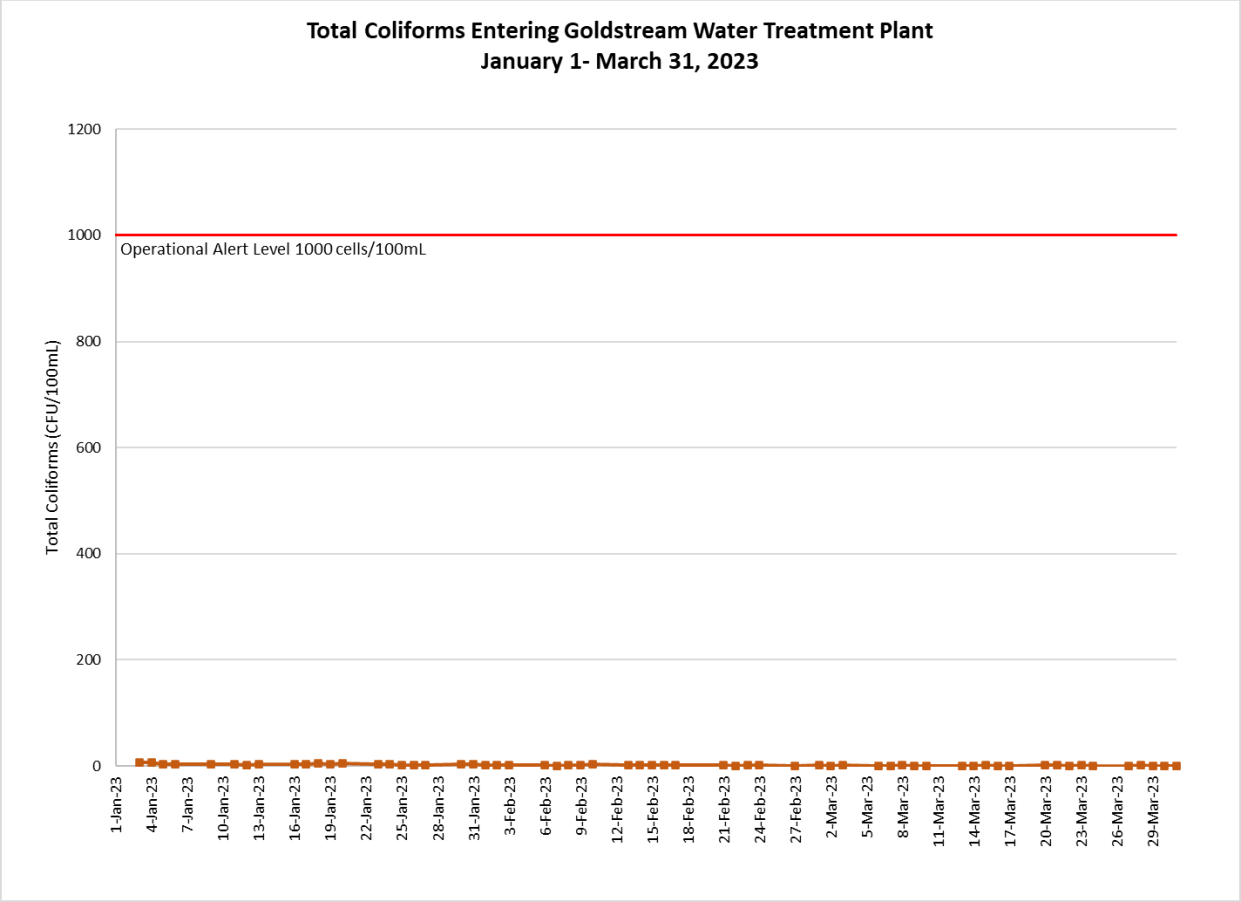
Water Transparency. The transparency of the lake water measured with the Secci Disc in the lake was high (between 7 and 10 m) and consistent with the long-term average. Fluctuating algal abundance throughout the reporting period accounted for periods with slightly lower transparency but with no measurable impact on the treatability of the water.

Dissolved Oxygen. As typical, especially during the cold season, Sooke Lake Reservoir remained well oxygenated from surface to bottom. In all three sampling stations, the dissolved oxygen concentration was from surface to bottom between 10.25 and 10.38 mg/L, the water therefore fully saturated. This state prevents internal nutrient loading or metal releases in anoxic zones, and is another indicator of the oligotrophic status of Sooke Lake.

(b) Bacteria

Total Coliform Bacteria and E. coli. The total coliform concentrations in the raw source water entering the Goldstream Water Treatment Plant were extremely low throughout the reporting period (Figure 3). This is a typical and natural pattern directly related to decreased bioactivity during the cold water period. The United States Environmental Protection Agency (USEPA) Surface Water Treatment Rule for avoiding filtration has a non-critical total coliform criterion of maximum 100 CFU/100 mL at the 90 percentile of a six-month sample set. The 90 percentile of total coliform concentrations in the raw water between October 2022 and March 2023 was 64 CFU/100 mL and was, therefore, in compliance with this non-critical USEPA filtration exemption criterion.

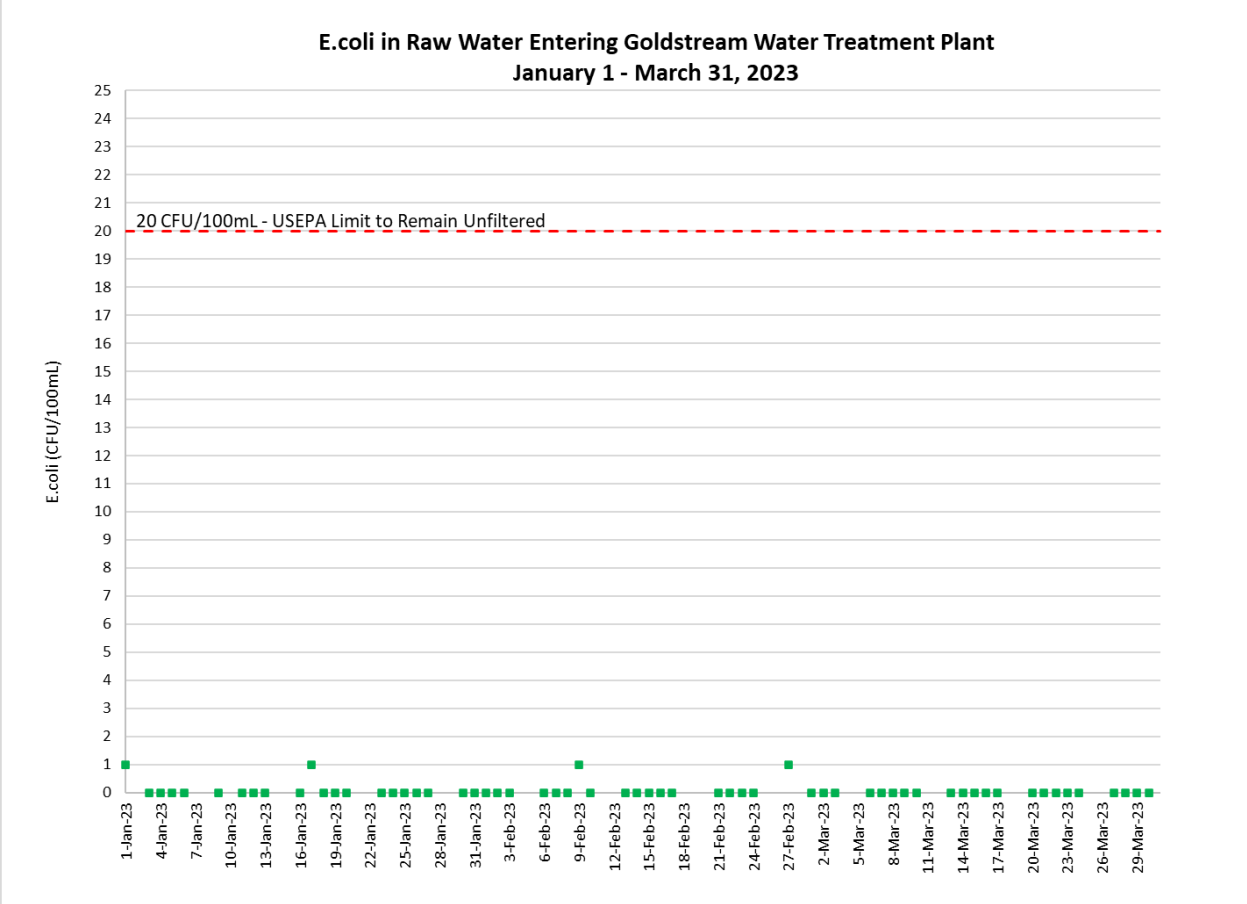
Figure 3



E. coli concentrations during the reporting period were mostly non-detected or extremely low and, therefore, consistently well under the limit for meeting the critical USEPA filtration exemption criteria for surface water used for drinking water supply (Figure 4). Meeting this criterion means

compliance with the USEPA Surface Water Treatment Rule for avoiding filtration. The *E. coli* concentrations were also well below the benchmark used in the *2020 BC Source Drinking Water Quality Guidelines* (90 percentile E. coli ≤10 CFU/100 mL). These results are typical for Sooke Lake Reservoir during the winter season.

Figure 4



(c) Nutrients

In general, the nutrient concentrations during the reporting period confirmed the ultra-oligotrophic status of Sooke Lake Reservoir, which is indicative of very low productivity in an upland lake with a virtually undisturbed catchment. This lake status is demonstrated by very low overall nutrient concentrations with a high nitrogen/phosphorus ratio and dissolved organic nitrogen being the dominant constituent of the total nitrogen. These conditions allow only limited biological activity in the lake, thus ensuring a good quality source for unfiltered drinking water. The lack of substantial rainfall in the fall of 2022 delayed the typical peak nutrient input until the beginning of 2023 when snowmelt and runoff finally recharged tributaries and Sooke Lake itself. These first high stream flows after the dry season brought higher nutrient loads to the lake which was registered as slightly higher phosphorus concentrations than typically recorded in January and February. Throughout the winter, rain-induced runoff events are usually responsible for further pulses of nutrient input and temporary upticks of nutrient concentrations in the lake. These naturally-added nutrients are then quickly consumed by aquatic organisms. This natural cycle is an indication of a healthy and functioning food chain in the lake's ecosystem (Tables 2 and 3).

Table 2

Sooke Reservoir, South Basin (1m) - SOL-00-01					
	Samples Collected	Unit of Measure	Minimum	Maximum	Mean
Total Nitrogen	2	ug/L	92	95	93.5
Total Phosphorus	2	ug/L	1.90	2.70	2.30

Table 3

Sooke Reservoir, North Basin (1m) - SOL-04-01					
	Samples Collected	Unit of Measure	Minimum	Maximum	Mean
Total Nitrogen	2	ug/L	88	91	89.5
Total Phosphorus	2	ug/L	2.00	4.00	3

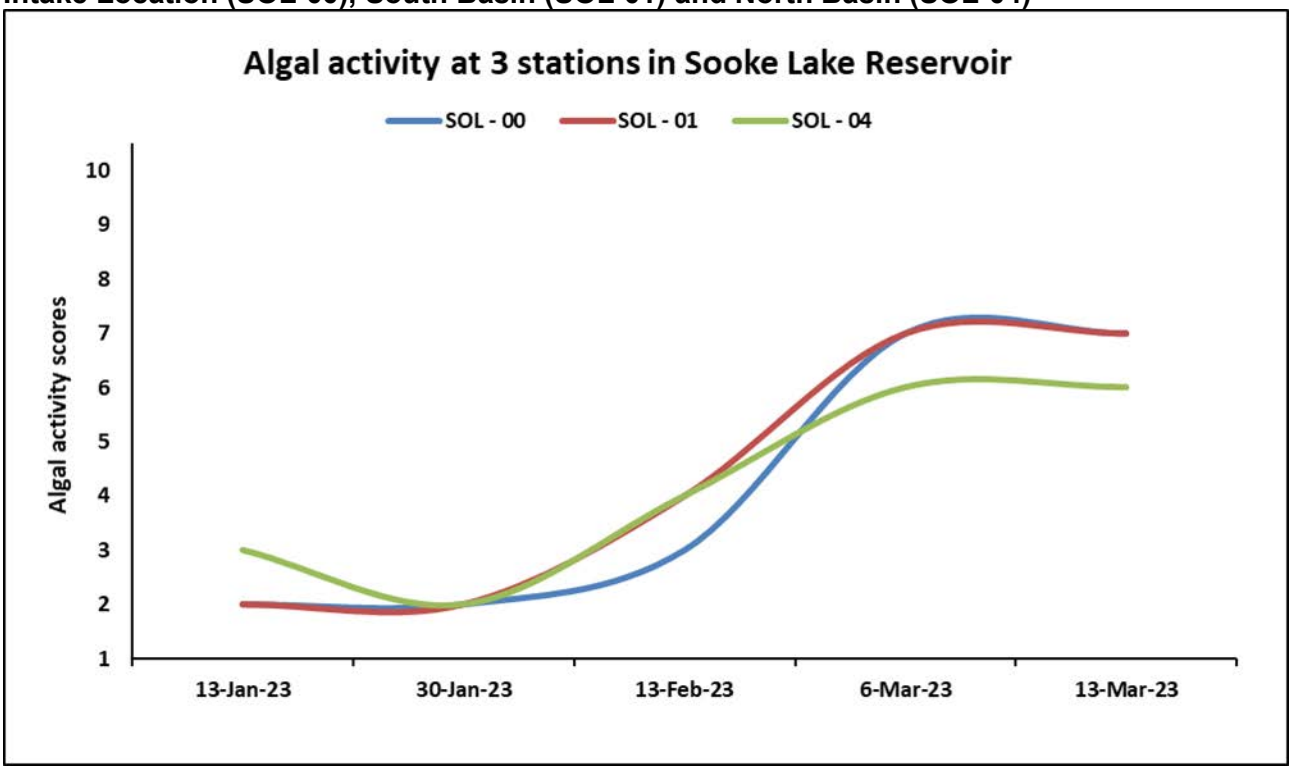
(d) Protozoan Parasites

In three test sets during this reporting period on the raw water entering the Goldstream Water Treatment Plant, no *Cryptosporidium* oocysts and no *Giardia* cysts were found.

(e) Algae

To provide a general picture of the algae activity in Sooke Lake Reservoir, an algal activity index (AA Index) was applied, ranging from 1 to 10, which are assessed via towed samples collected biweekly at three stations. The year began with a very low AA Index due to the delayed nutrient input during the dry fall and winter in late 2022 (Figure 5). The index then inclined at the end of February and early March as temperatures rose, sunlight increased and nutrients were available from higher stream flows and lake level. By mid-March, the AA index stabilized at a moderate level. The dominant and subdominant taxa were colonial algae *Asterionella formosa* and *Dinobryon bavaricum*, respectively. They are common in Sooke Lake, especially during the colder periods, and can cause taste and odour and/or filter clogging issues when in bloom. While dominant throughout most of the reporting period, these algae species never reached the bloom stage. Therefore, the algae-related water quality risk remained low and no adverse water quality effect was recorded.

Figure 5: Algal Activity Index (AA Index) from January-March 2023, Sooke Lake Reservoir, Intake Location (SOL-00), South Basin (SOL-01) and North Basin (SOL-04)



2. WATER TREATMENT PLANTS

(a) Goldstream Water Treatment Plant

Turbidity. The raw water entering the Goldstream Water Treatment Plant was consistently well below 1 NTU during the reporting period (Table 4).

Table 4

Goldstream Water Treatment Plant Turbidity - Raw Water	
Samples Collected	61
Minimum	0.15 NTU
Maximum	0.35 NTU
Mean	0.21 NTU

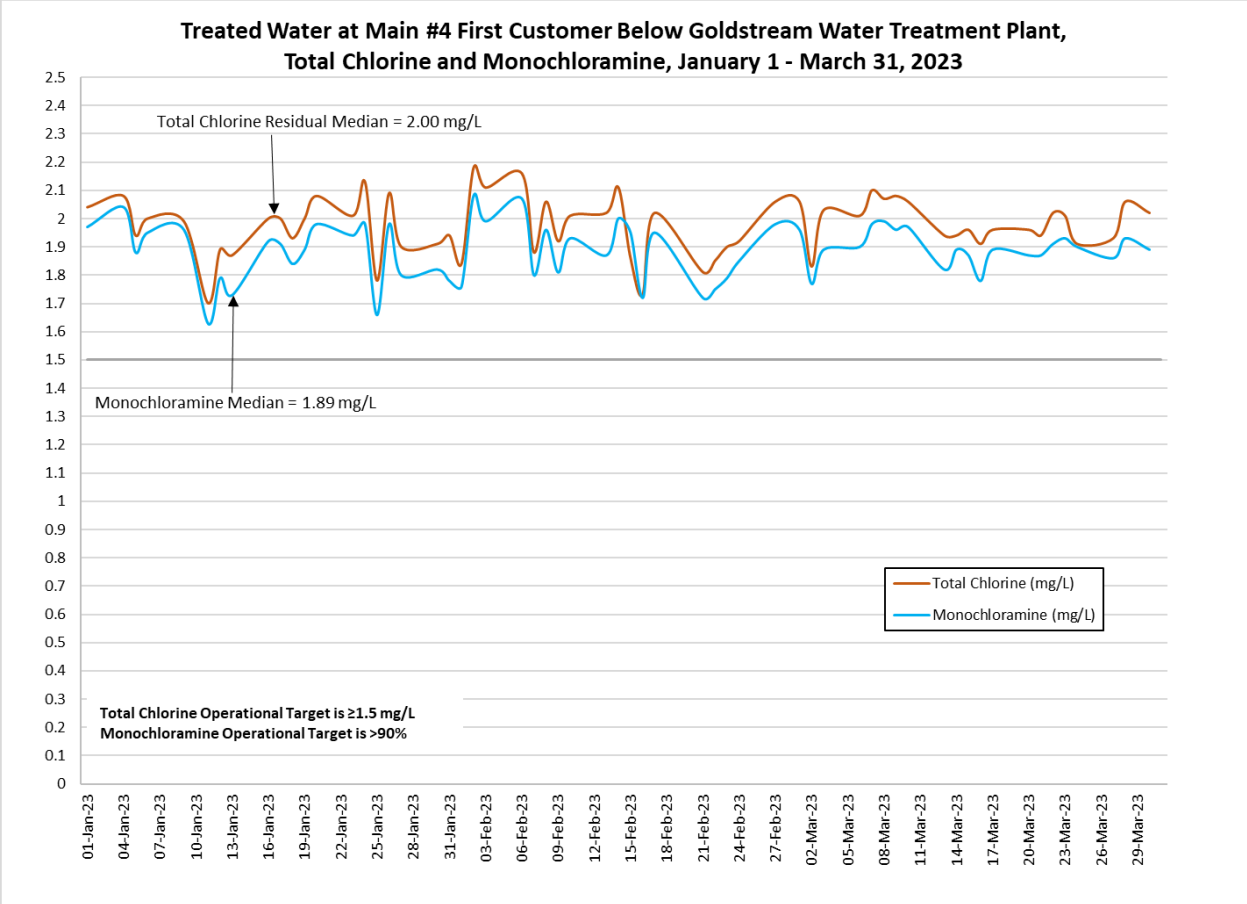
Main #4 First Customer Sampling Station Total Coliform Bacteria and E.coli
The Main #4 First Customer Sampling Station immediately downstream of the Goldstream Water Treatment Plant is sampled daily to monitor the efficacy of the disinfection treatment process. No total coliform or *E. coli* bacteria were found in any sample collected from this site.

Main #5 First Customer Sampling Station Total Coliform Bacteria and E.coli
The Main #5 First Customer Sampling Station immediately downstream of the Goldstream Water Treatment Plant is also sampled daily to monitor the efficacy of the disinfection treatment process. No total coliform or *E. coli* bacteria were found in any sample collected from this site.

These results demonstrate the efficacy of the disinfection process at the Goldstream Water Treatment Plant.

Secondary Disinfection. Figure 7 shows the total chlorine and monochloramine concentrations at the Main #4 First Customer Sampling Station. The target concentration of 1.5 mg/L for total chlorine was consistently achieved. The target ratio of 90% monochloramine was also consistently adequate and effective secondary disinfection was provided across the entire system throughout the reporting period.

Figure 7



(b) Sooke River Road Water Treatment Plant

Turbidity. The raw water entering the Sooke River Road Water Treatment Plant was consistently well under 1 NTU (Table 5).

Table 5

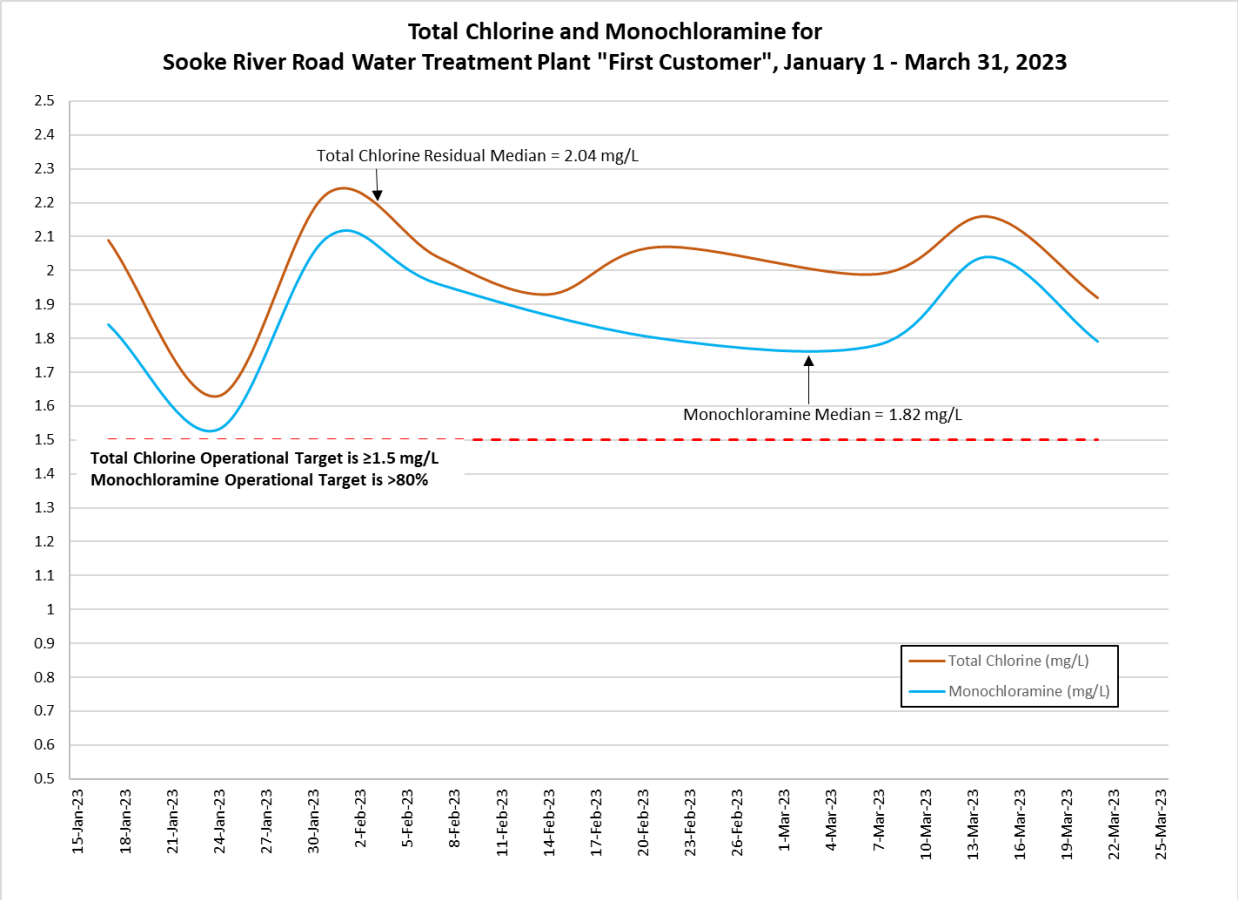
Sooke River Road Water Treatment Plant Turbidity - Raw Water	
Samples Collected	10
Minimum	0.15 NTU
Maximum	0.35 NTU
Mean	0.22 NTU

Sooke First Customer Sampling Station Total Coliform Bacteria and E.coli
The Sooke First Customer Sampling Station immediately downstream of the Sooke Water Treatment Plant is sampled weekly to monitor the efficacy of the disinfection treatment process. No total coliform or *E. coli* bacteria were found in any sample collected from this site.

These results demonstrate the efficacy of the disinfection process at the Sooke Water Treatment Plant.

Secondary Disinfection. Figure 8 shows the total chlorine and monochloramine concentrations at the Sooke First Customer Sampling Station. The target concentration of 1.5 mg/L for total chlorine was consistently achieved during the reporting period. The chloramine concentrations were strong and sufficient throughout. The monochloramine/total chlorine ratio was also fairly consistent and suitable for achieving a stable drinking water chemistry. The slightly lower target ratio of 80% monochloramine for this facility was achieved throughout the entire reporting period, which is an improvement over previous years. The residual concentrations were adequate to provide effective secondary disinfection across this much smaller distribution system.

Figure 8



3. DISTRIBUTION SYSTEMS

(a) Goldstream Service Area

Table 6

Goldstream Water Treatment Plant Service Area										
Month/Year	Samples Collected	Total Coliforms (CFU/mL)				E.coli (CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC > 0	Resamples TC > 0	Samples TC > 10	Samples > 0	Samples Collected	Adverse > 1 NTU	Median mg/L as CL2	Median °C
Jan-23	364	2	0.5	0	0	0	34	1	1.64	7.1
Feb-23	370	0	0.0	0	0	0	38	3	1.63	7.0
Mar-23	373	0	0.0	0	0	0	36	2	1.65	7.2
Total:	1107	2	0.2	0	0	0	108	6	1.64	7.1

Total Coliform Bacteria and E.coli. Only two out of 1,107 distribution system samples tested positive for total coliform bacteria. Both positive samples were from January, one in Victoria and one in Central Saanich. Both samples had a very low total coliform concentration of 1 CFU/100mL and the resamples were negative in both cases. No *E.coli* bacteria were found (Table 6).

Turbidity. Six of the 108 turbidity samples registered higher than 1 NTU (Table 6). One sample location in Langford was responsible for three of these exceedances (up to 4.2 NTU), which were attributed to ongoing construction and construction related hydrant use in this area. The other exceedances were spread over Greater Victoria and probably a result of municipal water main flushing. Overall, these results are an indication of good drinking water quality.

Total Chlorine Residual. A median total chlorine residual concentration of 1.64 mg/L across the system indicates an effective secondary disinfection protecting the potability of the treated drinking water as it flows throughout the system (Table 6).

Water Temperature. The temperature of the drinking water in the system during this reporting period was consistently below the aesthetic objective in the *Canadian Drinking Water Quality Guidelines*.

Water Chemistry. The average pH of the drinking water in the Goldstream Service Area was 7.9 during the reporting period. The pH ranged from 7.3 to 8.6, which is typical when operating the hypochlorite chlorination equipment. The average alkalinity was 16.3 mg/L. Both pH and alkalinity have increased since the commissioning of the hypochlorite chlorination equipment in 2021.

Disinfection Byproducts. The three typically monitored disinfection byproducts in a drinking water system have all been well below the Health Canada established health limits in the Goldstream Service Area (Table 7).

Table 7

Disinfection Byproducts - Goldstream WTP Service Area						
Parameter	**Samples Collected**	**Unit of Measure**	**Minimum**	**Maximum**	**Mean**	**MAC (Maximum Acceptable Concentration)**
Haloacetic Acids (HAAs)	7	ug/L	<5	20.0	12.1	80
Trihalomethanes (THMs)	7	ug/L	13.0	19.0	16.1	100
NDMA	7	ng/L	<1.9	3.6	2.4	40

Metals. A comprehensive metals analysis was conducted every second month at four different locations in the Goldstream Service Area: (1) where treated water enters the Victoria/Esquimalt System, (2) the Oak Bay System, (3) one in Langford and (4) one in North Saanich. Out of the 32 tested metals, five are monitored particularly closely: iron, manganese, lead, aluminium and copper. All metal concentrations were below the respective Health Canada maximum acceptable concentration or the aesthetic objective (Table 8).

Table 8

Metals - Goldstream WTP Service Area								
Parameter	**Samples Collected**	**Unit of Measure**	**Minimum**	**Maximum**	**Mean**	**AO (Aestetic Objective)**	**OG (Operational Guideline)**	**MAC (Maximum Acceptable Concentration)**
Aluminum	8	ug/L	11.5	14.2	12.8		100	2900
Copper	8	ug/L	1.9	15.7	6.6	1000		2000
Iron	8	ug/L	13.0	20.9	16.7	300		
Lead	8	ug/L	<0.2	0.22	0.20			5
Manganese	8	ug/L	1.8	3.2	2.4	20		120

(b) Sooke Service Area

Table 9

Sooke River Road Water Treatment Plant Service Area										
Month/Year	Samples Collected	Total Coliforms (CFU/mL)				E.coli (CFU/100mL)	Turbidity		Chlorine Residual	Water Temp.
		Samples TC > 0	Percent TC > 0	Resamples TC > 0	Samples TC > 10	Samples > 0	Samples Collected	Adverse > 1 NTU	Median mg/L as CL2	Median °C
Jan-23	36	0	0.0	0	0	0	8	0	1.28	7.1
Feb-23	33	0	0.0	0	0	0	7	0	1.17	6.9
Mar-23	40	0	0.0	0	0	0	9	0	1.11	6.8
Total:	109	0	0.0	0	0	0	24	0	1.17	7.0

Total Coliform Bacteria and E.coli. In all of the 109 bacteriological samples during the reporting period, no sample tested positive for total coliform bacteria and no sample contained *E.coli* bacteria (Table 9).

Turbidity. Out of the 24 turbidity samples, none registered above 1 NTU (Table 8). This is an indication of good drinking water quality.

Total Chlorine Residual. A median total chlorine residual concentration of 1.17 mg/L across the system indicates an effective secondary disinfection protecting the potability of the treated drinking water as it flows throughout the system (Table 9).

Water Temperature. The temperature of the drinking water in the system during this reporting period was consistently below the aesthetic objective in the *Canadian Drinking Water Quality Guidelines*.

Water Chemistry. The average pH of the drinking water in the Sooke Service Area was 7.7 during the reporting period. The pH ranged from 7.4 to 8.1 and is typically very stable and consistent across this system. The average alkalinity was 15.9 mg/L.

Disinfection Byproducts. The three typically monitored disinfection byproducts in a drinking water system have all been well below the Health Canada established health limits in the Sooke Service Area (Table 10).

Table 10

Disinfection Byproducts - Sooke River Road WTP Service Area						
Parameter	Samples Collected	Unit of Measure	Minimum	Maximum	Mean	MAC (Maximum Acceptable Concentration)
Haloacetic Acids (HAAs)	2	ug/L	22.0	23.0	22.5	80
Trihalomethanes (THMs)	2	ug/L	22.0	28.0	25.0	100
NDMA	2	ng/L	<1.9	2.4	2.2	40

Metals. A comprehensive metals analysis was conducted every second month in one location in the Sooke Service Area – at the end of the distribution system near Whiffen Spit. Out of the 32 tested metals, five are monitored particularly closely: iron, manganese, lead, aluminium and

copper. All metal concentrations were well below the respective Health Canada maximum acceptable concentration or the aesthetic objective (Table 11).

Table 11

Metals - Sooke River Road WTP Service Area								
Parameter	**Samples Collected**	**Unit of Measure**	**Minimum**	**Maximum**	**Mean**	**AO (Aestetic Objective)**	**OG (Operational Guideline)**	**MAC (Maximum Acceptable Concentration)**
Aluminum	2	ug/L	10.9	11.6	11.3		100	2900
Copper	2	ug/L	6.2	10.6	8.4	1000		2000
Iron	2	ug/L	73.0	89.8	81.4	300		
Lead	2	ug/L	0.40	0.68	0.54			5
Manganese	2	ug/L	2.0	2.7	2.4	20		120

CONCLUSION

The multi-barrier approach applied to the Greater Victoria Drinking Water System ensures the excellent drinking water quality achieved during the reporting period. During this winter reporting period (January-March 2023), all parameters from source water to treated water indicate stable conditions and good water quality. All trends are generally in line with historic data and confirm the adequacy of existing water treatment and performance of all major infrastructure components. There have been no water quality affecting events or emergencies during this reporting period.

Making a difference...together

RWSC 23-05

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, MAY 17, 2023

SUBJECT **Proposed Regional Water Supply Service Development Cost Charge Program and Bylaw**

ISSUE SUMMARY

To provide the Regional Water Supply Commission (Commission) with an update on the progress of the proposed Development Cost Charge (DCC) program and bylaw and to seek direction regarding the implementation of the proposed DCC program and bylaw.

BACKGROUND

The Regional Water Supply (RWS) 2017 Strategic Plan included a commitment to "Explore Regional Water Development Cost Charges to fund future growth-related supply system infrastructure improvements" and further, the recently approved Capital Regional District 2023-2026 Corporate Plan included an initiative to "Implement a development cost charge program for the Regional Water Service", Goal 2a-7 to meet the community need for high quality, safe drinking water.

The RWS service does not have an existing DCC program or bylaw, although a bylaw was considered in the mid-1990's but was ultimately not adopted. As a result of not having a DCC, implications attributed to growth, such as increased sizing of water system assets, are paid by the current RWS service customers. DCC bylaws exist for three existing Capital Regional District (CRD) utility services; Juan de Fuca Water Distribution Service (Bylaw 2758), Saanich Peninsula Water and the Saanich Peninsula Wastewater Services (combined Bylaw No. 3208).

The 2020 RWS Capital Plan included an item to design a Regional Water DCC Program (Item #20-08) and a consultant, Urban Systems Ltd. (USL), was hired to study the issue in a phased approach. In general, the project is progressing through three phases: Phase 1 – Conceptualization, Phase 2 – Refinement and Consultation and Phase 3 – Implementation.

DCC's are used to fund capital costs related to "growth" and are regulated in accordance with the *Local Government Act* (LGA) of BC, *Division 19 – Development Costs Recovery*. The LGA defines the eligibility, application, process, and so on and the Province of BC has issued guidance documents; *Guide for Elected Officials* and *Best Practices Guid*e (~2005) (Appendices D and E). The conceptualization of a DCC program and bylaw generally followed a seven-step process (refer to the *Guide for Elected Officials*):

1. Project Future Growth
2. Identify Required Works
3. Estimate Infrastructure Costs
4. Allocate Costs to Growth/Existing Users
5. Assign Costs to Land Use Types
6. Convert Costs into DCC Rates
7. Apply Assist Factor

USL has undergone the seven-step process and in doing so, has projected growth data, and identified required works from the RWS Capital Plan and the RWS 2022 Master Plan. Further, they have estimated the growth component and applied a municipal assist factor (MAF) to determine conceptual DCC rates for various types of land use, i.e., residential (low, medium and high density), institutional, commercial and industrial. The results of the initial phase including the draft DCC rates are shown in the table below.

Development Category	Collection Unit	Proposed Rate (1% MAF)
Low Density Residential (single family)	per Lot	$9,045
Medium Density Multi Family (duplex, townhouse, etc.)	per Unit	$7,914
High Density Multi-Family (apartments)	per Unit	$5,088
Commercial	per GFA in m^2	$33.92
Industrial	per GFA in m^2	$16.96
Institutional	per GFA in m^2	$73.49

***GFA = Ground Floor Area*

Upon completion of Phase 1, USL will deliver the following:

1. Regional Water Supply (RWS) DCC Policy Memorandum
2. Covering Memorandum (work-in-progress)
3. Regional Water Supply Development Cost Charge Draft Background Report (work-in-progress – to include draft DCC bylaw)

The Water Advisory Committee (WAC) received a staff report at its March 28, 2023 meeting at which time USL presented their results (Appendix B). WAC members were asked to complete an anonymous questionnaire and the results were generally in favour of a DCC program and bylaw and to move forward with implementation (See Appendix C for summary of results).

Phase 2 would generally consist of further program refinement, consultation and finalization of the draft background report and bylaw prior to bylaw adoption by the CRD Board and the Inspector of Municipalities.

The proposed Phase 2 - Refinement and Consultation tasks consist of:

- Meet with staff from member municipalities to confirm growth estimates and update the draft DCC program to reflect any discrepancies.
- Meet with elected officials from member municipalities to inform of the pending program.
- Meet with development community stakeholders to inform and receive feedback.
- Host public open houses to inform and receive feedback.
- Summarize consultation efforts for the Provincial submission.
- Update elected officials from member municipalities of results of the consultation process and any changes to the program.
- Provide the Commission with updates throughout Phase 2, in particular with regards to the impacts of varying MAF's on water rates.
- Obtain input on MAF's prior to seeking Commission approval to move the DCC Bylaw forward to the CRD Board.
- Recommend three readings of the DCC Bylaw to the CRD Board.
- Finalize the draft background report.
- Submit a comprehensive package to the BC Inspector of Municipalities for DCC bylaw approval.

- Provide support workshops to staff of member municipalities not currently collecting DCC's.
- Recommend fourth reading (adoption) of the DCC Bylaw to the CRD Board.

Phase 3, Implementation, would be related to pre- and post-bylaw adoption and include assisting member municipalities with the implementation and ongoing effort to collect and remit DCC's to the CRD. Some municipalities already collect DCC's and others do not, and therefore would need assistance to prepare.

It is proposed to continue to engage USL staff for the remaining phases and to fund the effort from potential DCC eligible capital projects from the approved Capital Plan at an estimated value of $250,000 including CRD staff effort. The third phase is proposed to be included in the 2024 Capital Plan with the intent of implementing the program and bylaw adoption in 2024.

ALTERNATIVES

Alternative 1
That the Regional Water Supply Commission direct Capital Regional District staff to proceed with the next phases of developing and implementing a Development Cost Charge program and bylaw.

Alternative 2
That the report be referred back to staff for further information.

IMPLICATIONS

Regulatory and Policy
The implementation of the proposed RWS DCC program and bylaw aligns with the CRD 2023-2026 Corporate Plan, and the RWS 2017 Strategic Plan. Without a DCC bylaw and related revenue due to growth, the existing users of the service are burdened with the cost of growth such as system component upsizing and increased capacity of water works. A policy decision regarding who is to pay for growth is required and additional details such as confirming a MAF will need to be addressed by the Commission in the future.

Financial
Without a DCC program and bylaw, the existing users of the service will continue to be burdened with the cost due to growth and as growth occurs, remaining system capacity will be depleted. Many pending capital expenditures have been identified in the Capital Plan and the 2022 Master Plan for which there is a growth component. The questionnaire responses from WAC generally indicate that development should be contributing to the costs related to growth. In return, both the existing users and development will benefit from the sustainable water service for drinking water, industry, agriculture, and municipal fire protection. Additionally, it is proposed to seek grant funding opportunities where applicable.

Social
The cost of housing has increased significantly over time, including social housing, and a proposed DCC would be another financial burden to the cost of real estate. Consideration could be given to a separate bylaw to implement DCC waivers and reductions for classes of development such as affordable rental housing, not-for profit rental housing, etc. Should a waiver and reductions bylaw be imposed, the RWS service would be responsible to make up any foregone DCC revenue from alternate revenue sources (non-DCC sources).

Intergovernmental
The administration, collection, and remittance of DCC's requires involvement by both the CRD and the member municipalities and the roles and responsibilities can vary. It is recognized that a new DCC bylaw would be an increase in administrative effort for municipalities and some municipalities do not have existing DCC programs to build upon. The CRD would work with each member municipality to ensure they are resourced and prepared to administer the DCC program and bylaw.

CONCLUSION

The Regional Water Supply 2017 Strategic Plan included a commitment to "Explore Regional Water Development Cost Charges (DCC) to fund future growth-related supply system infrastructure improvements" for which funding for a study had been approved in the 2020 Capital Plan. The Capital Regional District 2023-2026 Corporate Plan included an initiative to "Implement a development cost charge program for the Regional Water Service" to meet the goal of high quality, safe drinking water. The RWS 2022 Master Plan has identified many water system capital improvements.

Urban Systems Ltd. are nearing completion of Phase 1 and the results of which have been summarized for the Commission and were previously presented to the Water Advisory Committee (WAC). WAC provided its initial feedback, the results of which were generally in favour of implementing a DCC program and bylaw.

Capital Regional District staff and the consultant are prepared to proceed with the next phases of the DCC program and bylaw implementation and will keep the Commission informed of the progress and involved in the decision making of the next phases.

RECOMMENDATION

That the Regional Water Supply Commission direct Capital Regional District staff to proceed with the next phases of developing and implementing a Development Cost Charge program and bylaw.

Submitted by:	Joseph Marr, P.Eng., Acting Senior Manager, Infrastructure Engineering
Concurrence:	Ian Jesney, P. Eng., Acting General Manager, Integrated Water Services
Concurrence:	Kristen Morley, J.D., General Manager, Corporate Services & Corporate Officer
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT(S)

Appendix A: Regional Water Supply Commission DCC Presentation
Appendix B: WAC March 28, 2023 Staff Report Including Urban Systems Ltd. Presentation
Appendix C: WAC Questionnaire Results
Appendix D: Table of Contents, Development Cost Charge Guide for Elected Officials
https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/local-governments/finance/dcc_elected_officials_guide_2005.pdf
Appendix E: Table of Contents, Development Cost Charge Best Practices Guide, Ministry of Community Services
https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/local-governments/finance/dcc_best_practice_guide_2005.pdf

APPENDIX A

Proposed Regional Water Service DCC Program & Bylaw

Regional Water Supply Commission

May 17, 2023

APPENDIX A

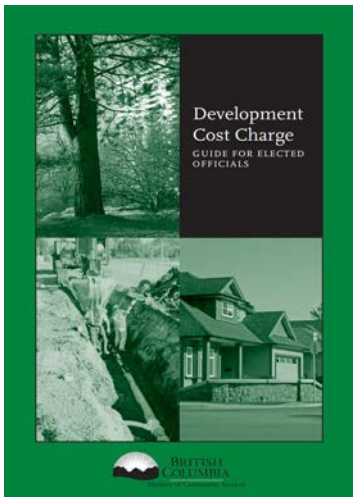
Agenda

- DCC's Overview
- Background
- Progress to Date (Phase 1 – Conceptualization)
- DCC Program Components
- Draft DCC Rates
- WAC Feedback
- Proposed Phase 2 – Refinement and Consultation
- Proposed Phase 3 – Implementation

DCC's Overview

APPENDIX A

- Development Cost Charges (DCC's) are fees collected to finance capital costs related to growth
- DCC's are regulated in accordance with the Local Government Act (LGA) of BC
  - DCC Guide for Elected Officials
  - DCC Best Practices Guide



Who pays?

- Applicants for subdivision approval to create single family development sites, or,
- Applicants for building permits to construct multi-family, commercial, industrial, and institutional development

Background

APPENDIX A

- Currently no RWS DCC bylaw
- CRD 2023-2026 Corporate Plan:

> **2a-7** Implement a development cost charge program for the Regional Water Service

- RWS 2017 Strategic Plan:

> • Explore Regional Water Development Cost Charges to fund future growth related supply system infrastructure improvements.

- Urban Systems Ltd. hired in 2020 to "explore" a RWS DCC Program (Phase 1)
- RWS 2022 Master Plan
  - ~$2B in capital expenditures partially driven by growth

Phase 1 Conceptualization

Progress to Date

1. Project Future Growth
2. Identify Required Works
3. Estimate Infrastructure Costs
4. Allocate Costs to Growth/Existing Users
5. Assign Costs to Land Use Types
6. Convert Costs into DCC Rates
7. Apply Municipal Assist Factor

DCC Program Components

APPENDIX A

- Extent of DCC Application (regional vs area-specific)
  - Regional program for the regional service
- DCC Time Horizon
  - 30-year horizon to align with RWS 2022 Master Plan
- Land Use Categories
  - Consistent with other CRD DCC Programs
- Municipal Assist Factor (MAF)
  - Can vary from 1% to 99%
  - Assist amount is funded through other revenues (not DCC's)
  - RWS DCC currently assumes a rate of 1% to align with other CRD DCC Programs

DCC Program Components

- Reductions/Waivers
  - Have not been considered to date
  - Would be initiated by a separate bylaw to allow waivers and/or reductions for:
    - Not-for-profit rental housing, including supportive living housing;
    - For-profit affordable rental housing;
    - Small lot subdivisions designed for low GHG emissions; and,
    - Development designed to result in low environmental impact.
  - Any waiver/reduction policy does not affect the DCC rates
    - CRD would be required to fund any funding shortfalls caused by waivers and/or reductions

Draft DCC Rates

APPENDIX A

Development Category	Collection Unit	RWS (Proposed) 1% MAF	JDF WDS*	Saanich Peninsula Water**	Saanich Peninsula Wastewater**
Low Density Residential (single family)	per Lot	$9,045	$2,922	$0	$1,790
Medium Density Multi Family (duplex, townhouse, etc.)	per Unit	$7,914	$2,557	$0	$ 1,413
High Density Multi-Family (apartments)	per Unit	$5,088	$1,644	$0	$933
Commercial	per GFA in m^2	$33.92	$10.74	$0	$4.00
Industrial	per GFA in m^2	$16.96	$5.82	$0	$3.89
Institutional	per GFA in m^2	$73.49	$23.74	$0	$5.30

* DCC Bylaw update is underway

** Last reviewed in 2018, next review 2023

APPENDIX A

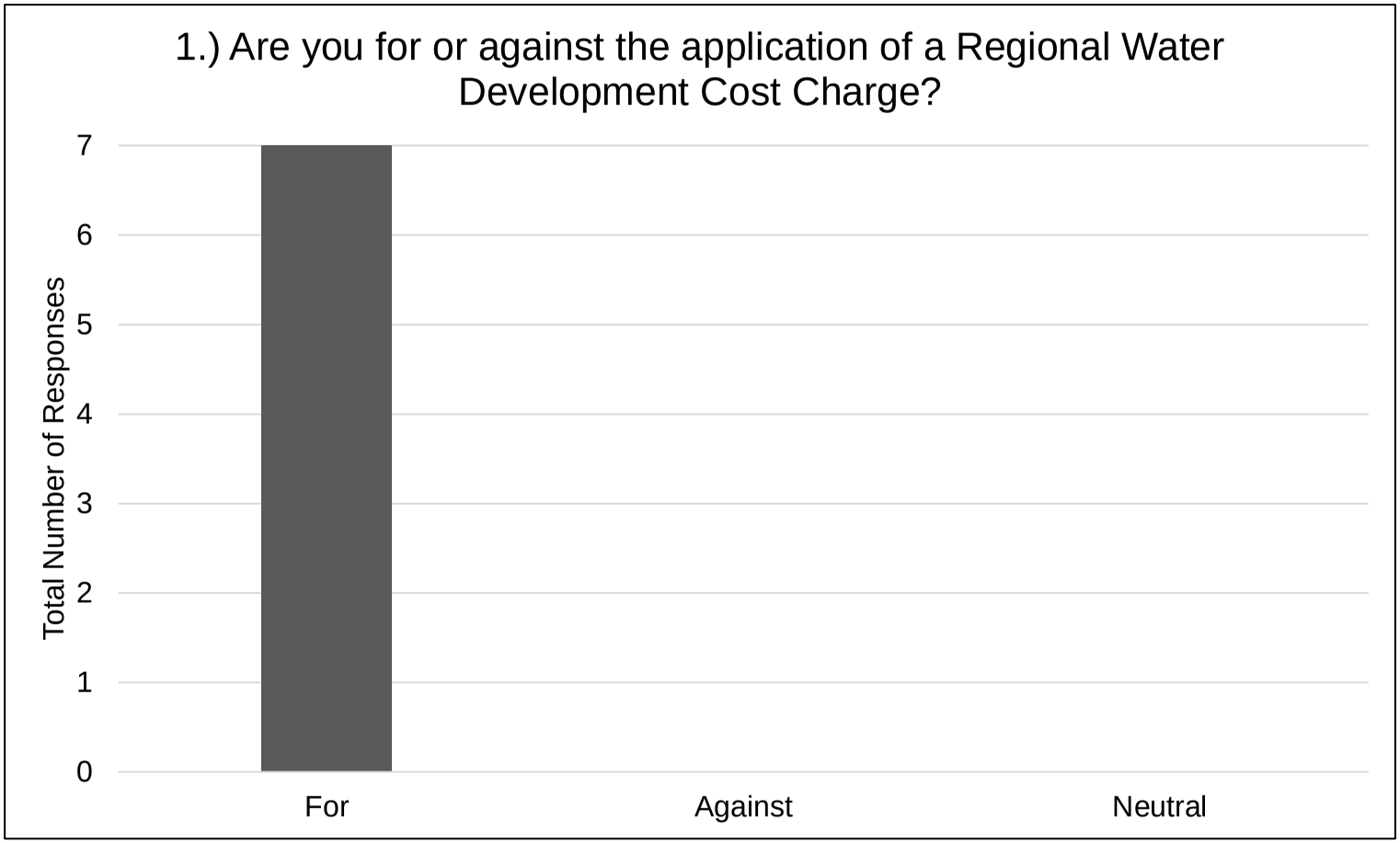
Draft DCC Rates – Varying MAF

Development Category	Collection Unit	RWS DCC (Proposed) 1% MAF	RWS DCC (5% MAF Option)	RWS DCC (15% MAF Option)	RWS DCC (30% MAF Option)	RWS DCC (50% MAF Option)
Low Density Residential (single family)	per Lot	$9,045	$8,679	$7,765	$6,395	$4,568
Medium Density Multi Family (duplex, townhouse, etc.)	per Unit	$7,914	$7,594	$6,795	$5,595	$3,997
High Density Multi-Family (apartments)	per Unit	$5,088	$4,882	$4,368	$3,597	$2,569
Commercial	per GFA in m^2	$33.92	$32.55	$29.12	$23.98	$17.13
Industrial	per GFA in m^2	$16.96	$16.27	$14.56	$11.99	$8.56
Institutional	per GFA in m^2	$73.49	$70.51	$63.09	$51.96	$37.11

WAC Feedback

APPENDIX A

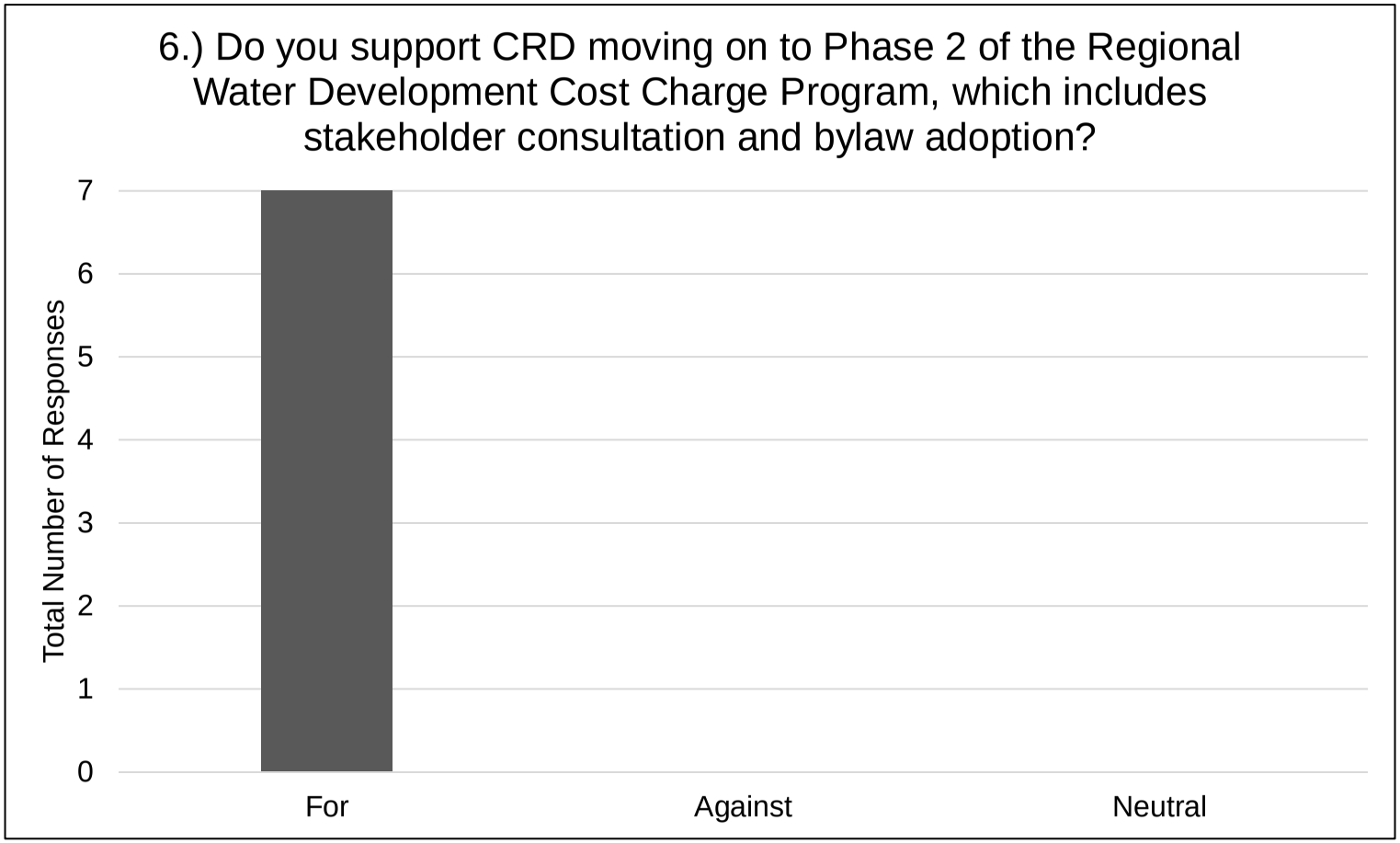
Refer to Appendix C for Full Results



WAC Feedback

APPENDIX A

Refer to Appendix C for Full Results



Phase 2 Refinement and Consultation

If pursued, Phase 2 tasks would generally consist of:

- Meet with member municipalities to confirm growth estimates and revise the draft DCC program as required;
- Meet with elected officials from member municipalities;
- Meet with the development community stakeholders and the public;
- Keep the RWSC informed at key milestones and involved in decision making prior to moving the DCC Bylaw forward;
- Recommend three readings of the DCC Bylaw to the CRD Board;
- Submit a comprehensive package to the BC Inspector of Municipalities for DCC bylaw approval; and,
- Recommend fourth reading and adoption of the DCC Bylaw to the CRD Board.

Phase 3 Implementation

- To be accounted for in 2024 Capital Plan
- Review the system(s) in place for member municipalities to administer, collect, and remit DCC fees from the CRD's existing and proposed regional DCC programs
  - Ensure fees are being collected as intended
- Assist municipalities to implement regional DCC's
  - Some municipalities do not collect DCC's and will require support

Questions?

Making a difference...together

WAC 23-01

REPORT TO WATER ADVISORY COMMITTEE
MEETING OF TUESDAY, MARCH 28, 2023

SUBJECT **Proposed Regional Water Supply Service Development Cost Charge Program and Bylaw**

ISSUE SUMMARY

To provide an update to the Water Advisory Committee (WAC) on the proposed Development Cost Charge (DCC) Program progress and to seek advice from WAC to inform and advise the Regional Water Supply Commission.

BACKGROUND

The Regional Water Supply 2017 Strategic Plan included a Commitment to "Explore Regional Water Development Cost Charges to fund future growth-related supply system infrastructure improvements". The Regional Water Supply service does not have a DCC bylaw, although a bylaw was considered in the mid-1990's but ultimately it was not adopted. DCC bylaws exist for three existing Capital Regional District (CRD) utilities; Juan de Fuca Water Distribution Service (Bylaw 2758), Saanich Peninsula Water and the Saanich Peninsula Wastewater Services (combined Bylaw No. 3208).

The 2020 Regional Water Service Capital Plan included an item to design a Regional Water DCC Program (20-08) and a consultant, Urban Systems Ltd. (USL), was hired to study the issue in a phased approach. In general, the project is being completed in two phases:

Phase 1 – Conduct the background assessment
Phase 2 – Undergo a political process for bylaw adoption (includes stakeholder engagement, etc.)

DCC's are used to finance capital costs related to "growth" and are regulated in accordance with the Local Government Act (LGA) of BC, *Division 19 – Development Costs Recovery*, defines the eligibility, application, process, and so on. The Province of BC has issued guidance documents; *Guide for Elected Officials* and *Best Practices Guide* (~2005) (Appendices A and B).

The design of DCC's (Phase 1) generally follows a seven-step process:

1. Project Future Growth
2. Identify Required Works
3. Estimate Infrastructure Costs
4. Allocate Costs to Growth/Existing Users
5. Assign Costs to Land Use Types
6. Convert Costs into DCC Rates
7. Apply Assist Factor

USL, has undergone the seven-step process and in doing so, has projected growth data, identified required works from the capital plan and the 2022 Master Plan. Further, they have estimated the growth component and applied an assist factor to determine conceptual DCC's for various types of land use (i.e. residential, institutional, commercial and industrial). The results are shown in Appendix C – Regional Water Service DCC Program – Proposed Rates. Staff from USL will

present on this topic at this meeting (Appendix D) to supplement this staff report. Upon completing Phase 1 of this assignment, USL will deliver:

1. Regional Water Supply (RWS) DCC Policy Memorandum
2. Covering Memorandum (work-in-progress)
3. Regional Water Supply Development Cost Charge Background Report (work-in-progress – to include draft DCC bylaw)

IMPLICATIONS

Implications of imposing DCC's have been identified and considered by USL including implications related to First Nations, the Regional Growth Strategy, social, financial, alignment with strategic and master plans, and administration, all of which will be outlined in the noted reports.

CONCLUSION

The *Regional Water Supply 2017 Strategic Plan* included a commitment to "Explore Regional Water Development Cost Charges (DCC) to fund future growth-related supply system infrastructure improvements". Urban Systems Ltd. conducted a study and presented their findings to date. It is proposed to engage the Water Advisory Committee to review the issue and to provide comments to the Regional Water Supply Commission for its consideration. Should the Regional Water Supply Commission pursue a DCC program and bylaw, then Phase 2 would be considered for stakeholder consultation and bylaw adoption. Phase 2 would also include further DCC program maturation, submission to the BC Inspector of Municipalities and ultimately, DCC Bylaw adoption and implementation.

RECOMMENDATION

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

Submitted by:	Patrick Stephens, EIT, Project Engineer, Water Supply Engineering and Planning
Submitted by:	Scott Mason, B.Sc., P.Eng., Manager, Water Supply Engineering and Planning
Concurrence:	Joseph Marr, P.Eng., Acting Senior Manager, Infrastructure Engineering
Cconcurrence:	Ian Jesney, P. Eng., Acting General Manager, Integrated Water Services

ATTACHMENT(S)

Appendix A: Table of Contents, Development Cost Charge Guide for Elected Officials
https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/local-governments/finance/dcc_elected_officials_guide_2005.pdf

Appendix B: Table of Contents, Development Cost Charge Best Practices Guide, Ministry of Community Services
https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/local-governments/finance/dcc_best_practice_guide_2005.pdf

Appendix C: Regional Water Supply Development Cost Charge Program – Proposed

Appendix D: Urban Systems Ltd. Presentation

Appendix E: Feedback Questions

APPENDIX B

Capital Regional District

Regional Water Supply - Development Cost Charge (DCC) Program

DCC Report – Regional Water Supply Commission Presentation

March 28th , 2023

URBAN SYSTEMS

Agenda

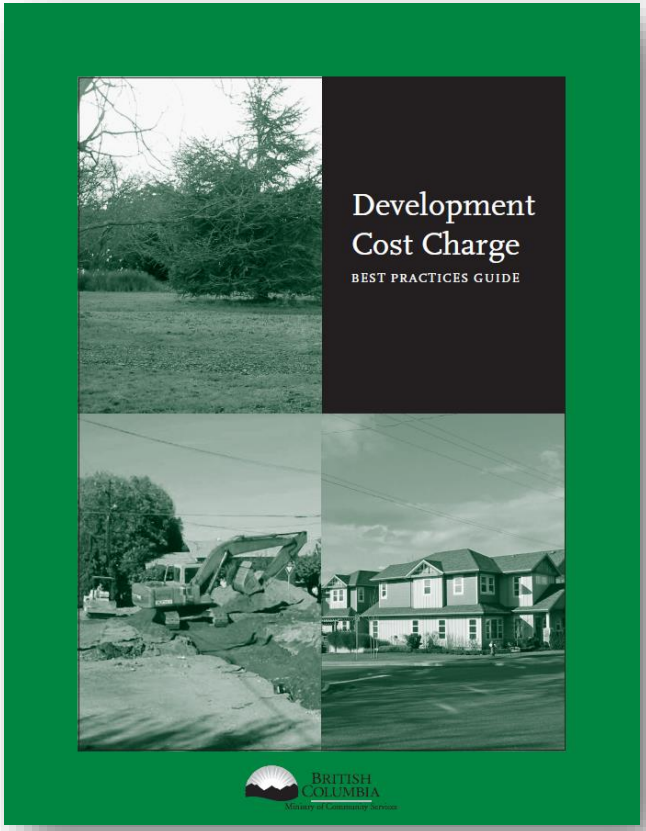
- What are DCC's, what do they pay for, and who pays them?
- Review current DCCs and Regional Water Supply
- Key policy considerations used to develop the proposed RWS DCC Program
- How do we calculate DCCs
  - Growth Estimates
  - Benefit allocation
  - Recoverable costs
  - Assist Factor
- Proposed RWS DCC Program and Rates
- Next Steps

OVERVIEW OF DCCs

What are DCCs?

- Fees to help communities recover the costs of “off-site” infrastructure needed for growth (i.e. capacity)

- Regulated by the province
  - Section 14, Division 19 of the Local Government Act
  - Provincial DCC Best Practices Guide
  - Ministerial approval
- Based on “benefiter pay” principle
- Transparent and equitable



CRD

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Philosophy of DCCs

1. Foster fairness (e.g. growth pays for growth)
2. Ensure consistency
3. Minimize financial risk to the CRD
4. Ensure certainty for the development community (e.g. clear policy framework)
5. Promote transparency
6. Ensure timely processing of development applications

Who pays DCCs?

- Applicants for **subdivision approval** to create single family development sites

- Applicants for **building permits** to construct multi-family, commercial, industrial, and institutional development

CRD

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APPENDIX B

Current DCCs Rates in the CRD

Development Category	Collection Unit	JDF WDS*	Saanich Peninsula Water**	Saanich Peninsula Wastewater**
Low Density Residential (single family)	per Lot	$2,922	$0	$1,790
Low Density Residential (small lot single family)	per Lot	$2,922	$0	$1,429
Medium Density Multi Family (duplex, townhouse, etc.)	per Unit	$2,557	$0	$ 1,413
High Density Multi-Family (apartments)	per Unit	$1,644	$0	$933
Commercial	per GFA in m^2	$10.74	$0	$4.00
Industrial	per GFA in m^2	$5.82	$0	$3.89
Institutional	per GFA in m^2	$23.74	$0	$5.30

* DCC Bylaw update is underway

** Last reviewed in 2018, next review 2023

CRD

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RWS DCC REVIEW
KEY POLICY CONSIDERATIONS & APPROACHES

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Extent of DCC application

- The proposed RWS DCC is based on a region-wide application for the following reasons:
  - Aligns with best practice and other CRD DCC Bylaws
  - Appropriate for the regional nature of water supply service and aligns with the inclusion of large capital projects that will benefit the entire system (e.g., WTP)
  - This approach also facilitates bylaw simplicity and accuracy, reduced administrative effort, cash flow and funding flexibility

Proposed DCC Program Time Horizon

- Options considered either a 20-year time horizon to align with other DCC programs or a 30-year time horizon to align with the RWS 2022 Master Plan and the regional growth projections

- The RWS DCC reflects a 30-year revolving DCC timeframe to align with the infrastructure planning timeframe

- This approach maintains the relationship between anticipated growth and infrastructure needed to service growth

RWS DCC PROGRAM DEVELOPMENT

Work to Date - DCC Program Development

APPENDIX B

(1) Growth Projections and Timeline

Determining project timing and priorities over the 30-year time horizon (2023 – 2053) based on where growth is occurring.

(2) DCC Program Development and Project List

Determining DCC projects based on where new development is occurring over the next 30 years (i.e. where new services will be required), Transportation and Mobility Strategy, 5-year Capital Plan and staff inputs.

(3) Project Benefit Allocations

Determining the relative benefit of each project to the existing community, and new development and the proportion of capital costs attributable to new vs. existing development.

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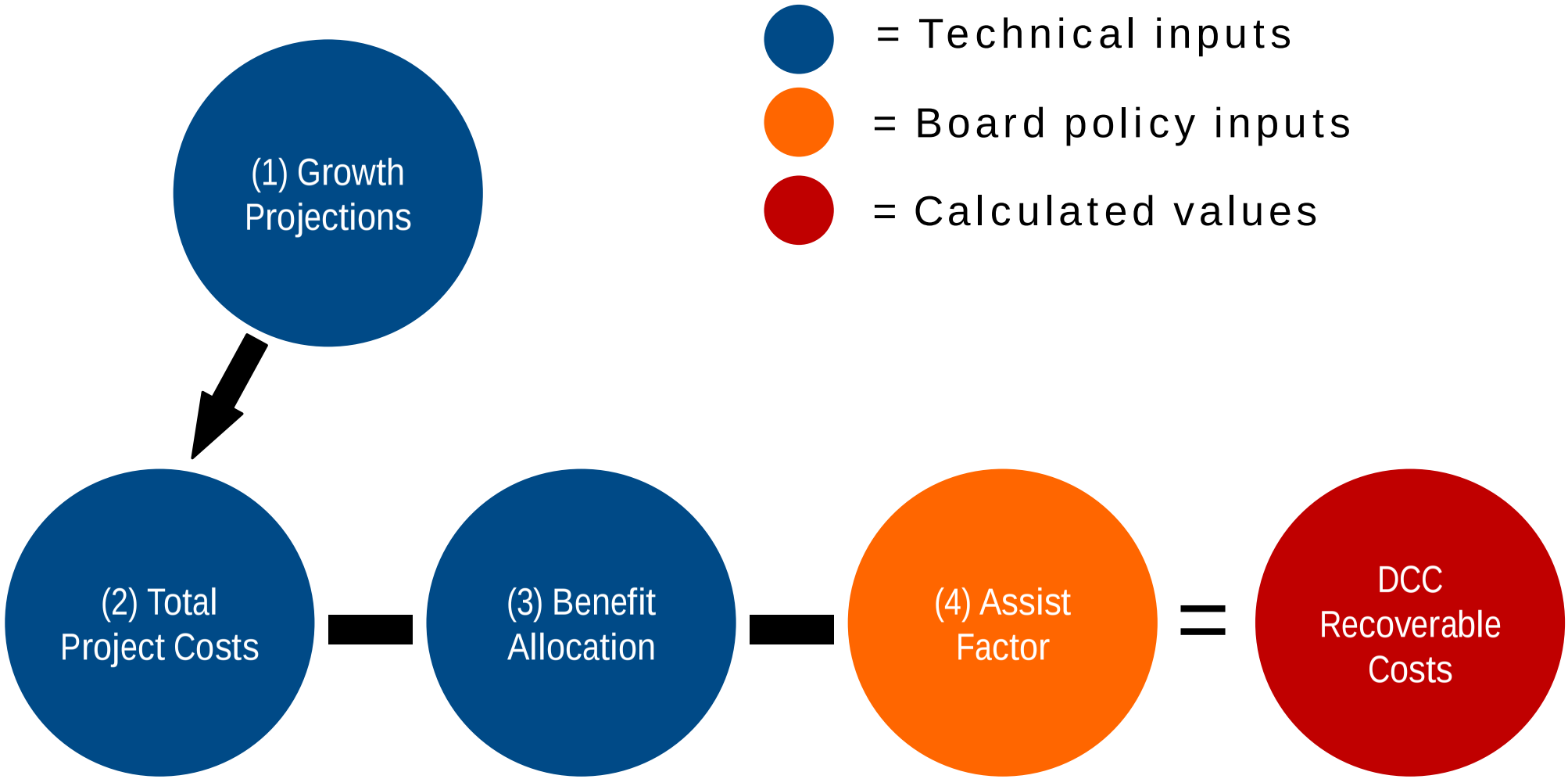
DCC Recoverable Costs (i.e., Net DCCs)



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Growth Estimates Approach

- Growth estimates are calculated for 30-year DCC time horizon

- Growth estimates were developed through a comprehensive growth model, which uses current CRD population growth data in the RGS, and land use information from each local government.

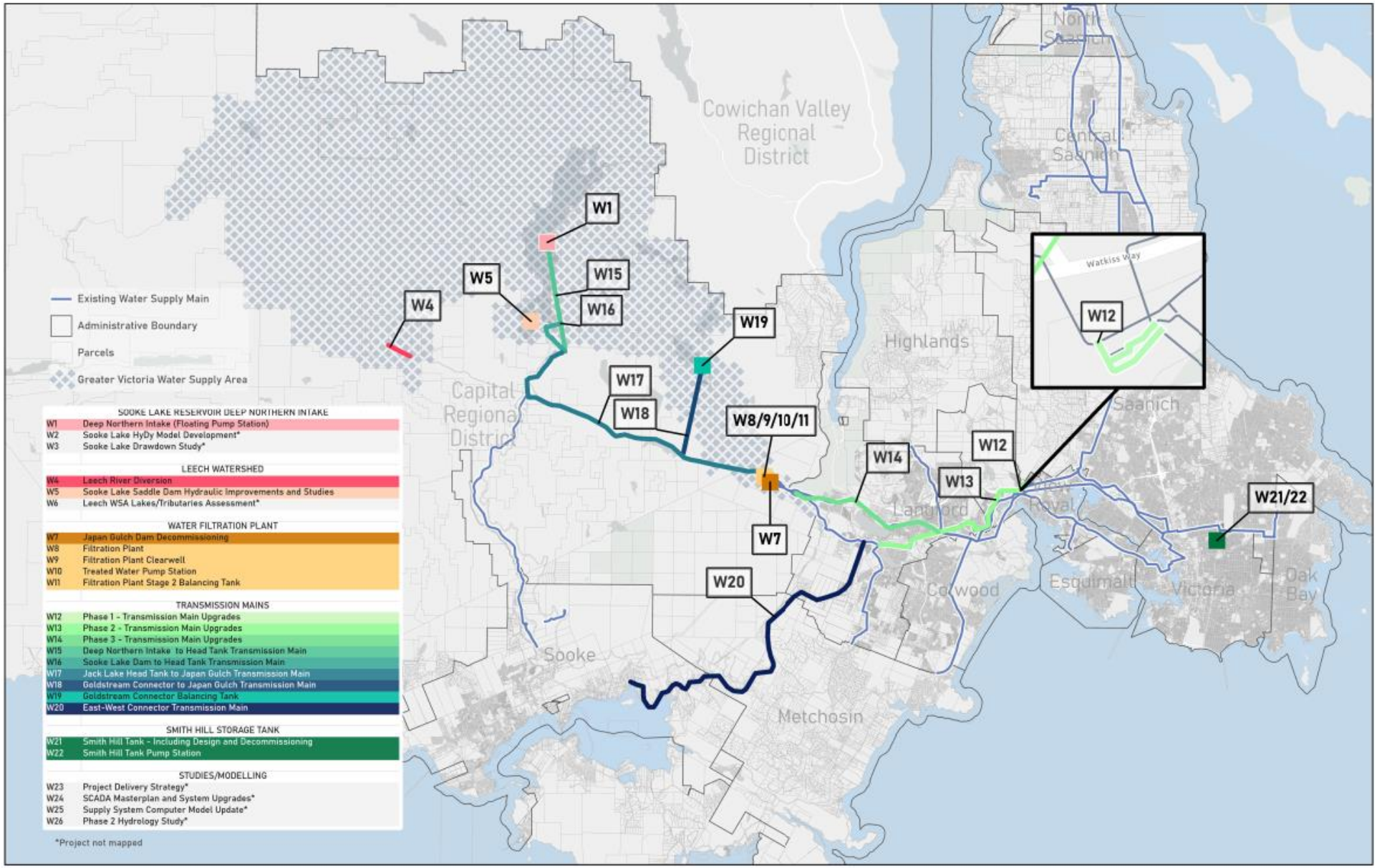
DCC Project List Approach

- DCC projects within the 30-year timeframe were identified from available infrastructure / capital plans and staff input, including:
  - Regional Water Supply 2022 Master Plan
  - CRD RWS Capital Plan

- Eligible DCC projects were prioritized based on their benefit to future growth and their likelihood of being constructed within the 30-year DCC time horizon

- This approach also aligns with the region-wide DCC application as discussed earlier

RWS DCC Program – Mapping



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RWS DCC Program – Projects & Costs – 30 years

Project	Cost Estimate	DCC Benefit Factor	Benefit to New Development	Assist Factor (1%)	DCC Recoverable	CRD Costs (1)
Sooke Lake Reservoir Deep Northern Intake	$74.7M	35%	$26.2M	$0.3M	**$25.9M**	**$48.8M**
Leech Watershed	$28.5M	100%	$28.5M	$0.3M	**$28.2M**	**$0.3M**
Water Filtration Plant	$819.1M	35%	$286.7M	$2.9M	**$283.8M**	**$535.3M**
Transmission Mains	$487.0M	100%/ 35%	$236.1M	$2.4M	**$233.7M**	**$253.2M**
Smith Hill Storage Tank	$31.3M	50%	$15.6M	$0.1M	**$15.5M**	**$15.8M**
Studies/Modelling	$3.8M	100%	$3.8M	$0.04M	**$3.8M**	**$0.04M**
TOTAL	**$1,444.3M**	**35-100%**	**$596.9M**	**$6.0M**	$590.9M	$853.5M

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Benefit Allocation Approach

Each project in the RWS program has been assigned a benefit allocation based on how it will benefit growth versus the existing population as follows:

- 100% benefits for projects required only to increase capacity due to growth or to service growth (technical)
- 50% benefits for projects expected to benefit both new and existing development equally (rule of thumb)
- 35% benefits for projects that benefit new based on % of new population to total (technical)

DCC Assist Factor

- Legislation requires that local governments must "assist" development for DCCs
- The Board has complete discretion – can vary from 1% (least assistance) to 99% (most assistance)
- Most communities have an Assist Factor between 1% and 10%
- Assist amount is funded from other CRD revenues (i.e. not DCCs)
- Proposed RWS DCC Rates assume the minimum 1% Assist Factor

RWS DCC DRAFT RATES

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Proposed RWS DCC Program – Rates

Development Category	Collection Unit	RWS (Proposed) 1% MAF	JDF WDS*	Saanich Peninsula Water**	Saanich Peninsula Wastewater**
Low Density Residential (single family)	per Lot	$9,045	$2,922	$0	$1,790
Medium Density Multi Family (duplex, townhouse, etc.)	per Unit	$7,914	$2,557	$0	$ 1,413
High Density Multi-Family (apartments)	per Unit	$5,088	$1,644	$0	$933
Commercial	per GFA in m^2	$33.92	$10.74	$0	$4.00
Industrial	per GFA in m^2	$16.96	$5.82	$0	$3.89
Institutional	per GFA in m^2	$73.49	$23.74	$0	$5.30

* DCC Bylaw update is underway
** Last reviewed in 2018, next review 2023

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Proposed RWS DCC Program – Rate Options

APPENDIX B

Development Category	Collection Unit	RWS DCC (Proposed) 1% MAF	RWS DCC (5% MAF Option)	RWS DCC (15% MAF Option)	RWS DCC (30% MAF Option)	RWS DCC (50% MAF Option)
Low Density Residential (single family)	per Lot	$9,045	$8,679	$7,765	$6,395	$4,568
Medium Density Multi Family (duplex, townhouse, etc.)	per Unit	$7,914	$7,594	$6,795	$5,595	$3,997
High Density Multi-Family (apartments)	per Unit	$5,088	$4,882	$4,368	$3,597	$2,569
Commercial	per GFA in m^2	$33.92	$32.55	$29.12	$23.98	$17.13
Industrial	per GFA in m^2	$16.96	$16.27	$14.56	$11.99	$8.56
Institutional	per GFA in m^2	$73.49	$70.51	$63.09	$51.96	$37.11

* DCC Bylaw update is underway
** Last reviewed in 2018, next review 2023

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POTENTIAL NEXT STEPS

Stakeholder Consultation and Bylaw Adoption

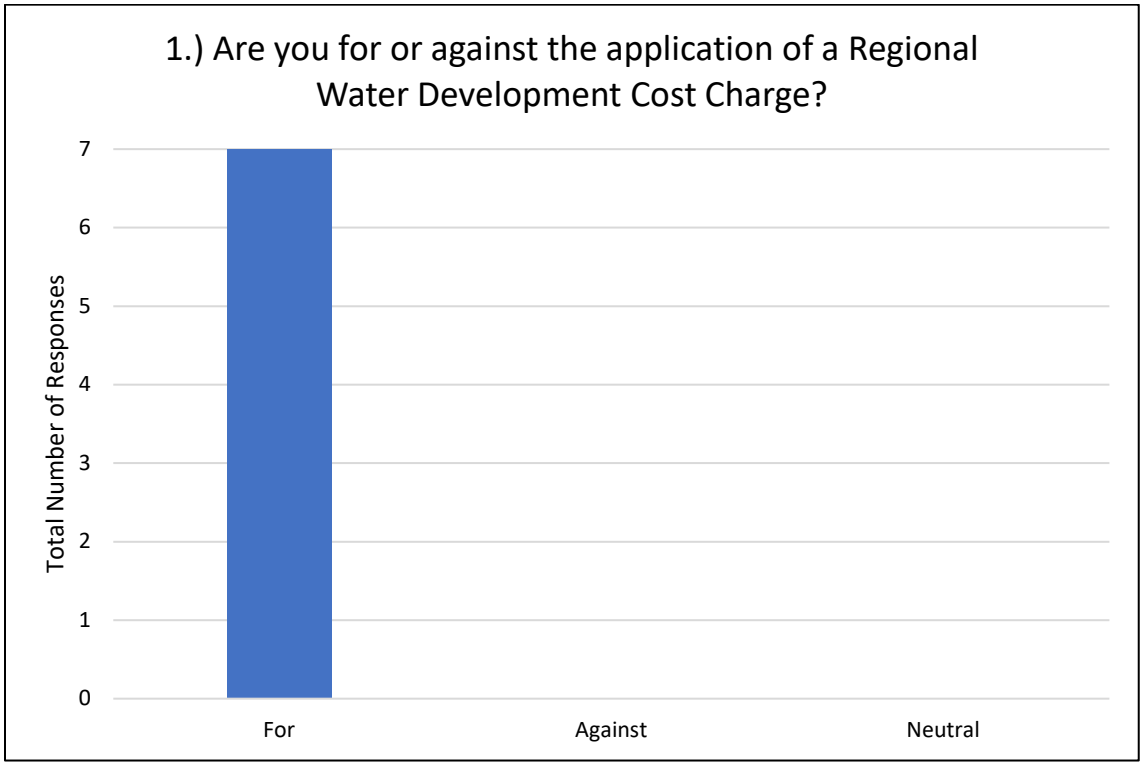
APPENDIX B

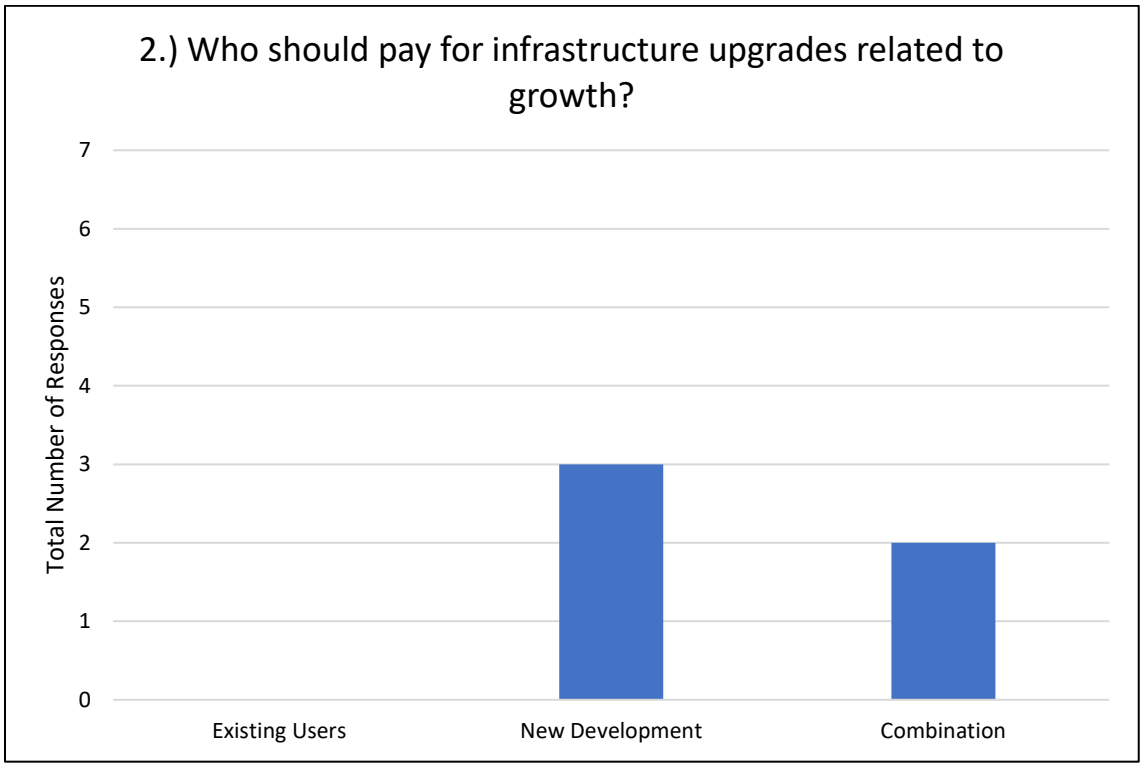
- The Best Practices Guide recommends consulting with key stakeholders as part of a new DCC bylaw or DCC bylaw update

- If the CRD decides to proceed with Phase 2 of the DCC project the following consultation could be undertaken:
  - Meet with Elected Officials in member municipalities to communicate the proposed DCC program and the CRD's intent to implement the RWS DCC Bylaw
  - Consultation with CRD Board, Regional Water Supply Commission and staff
  - Facilitate open houses for the public and/or meetings with the development community in member municipalities to provide notification and seek feedback on proposed DCC rates
  - Use the CRD's website to provide information and updates for the general public as the project progresses.

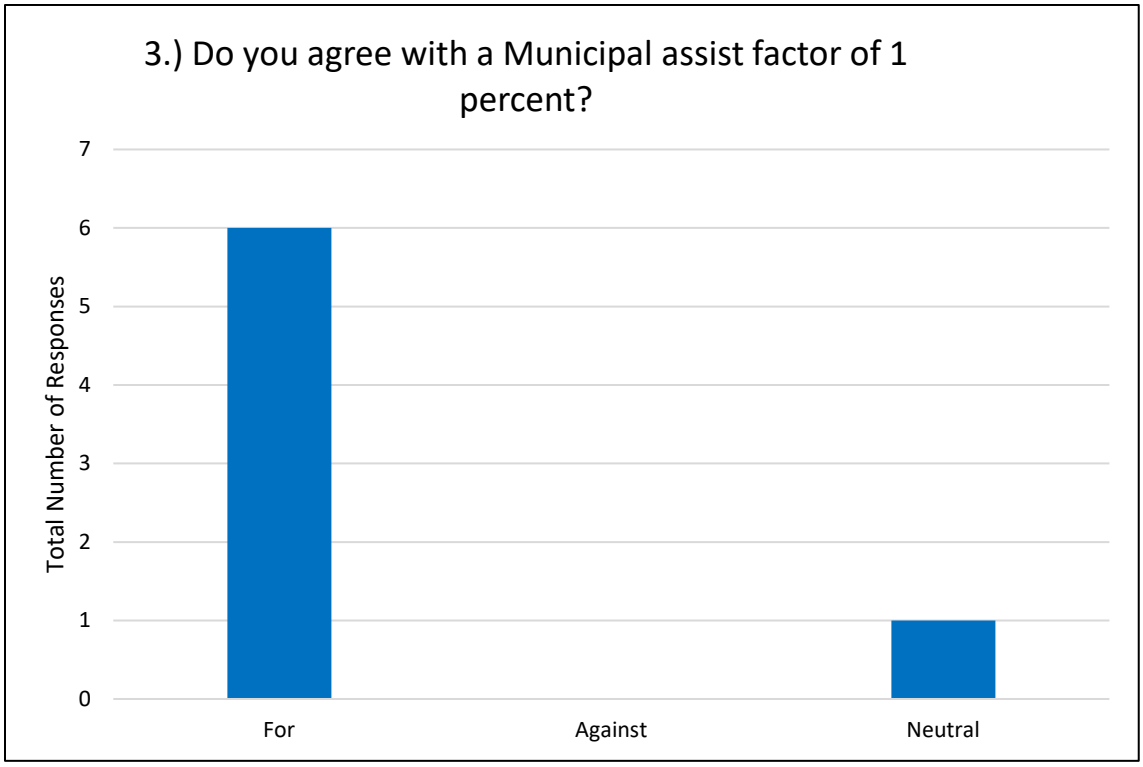

QUESTIONS?

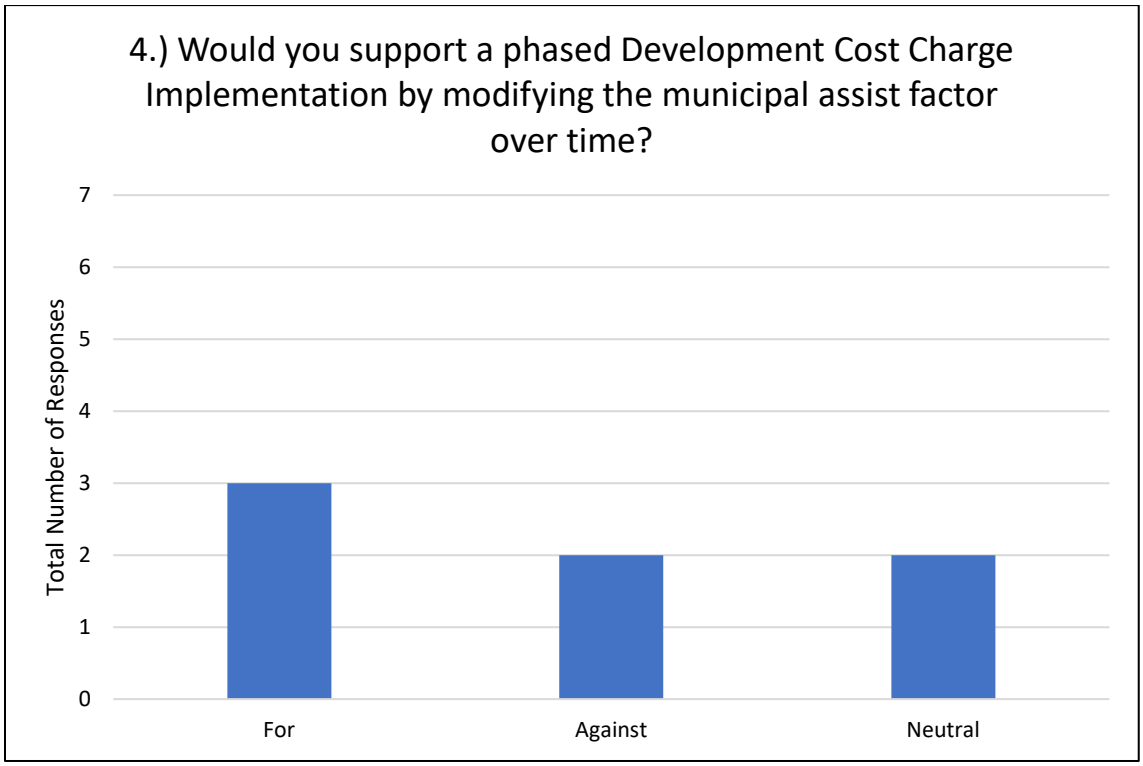
Results of Water Advisory Committee Questionnaire

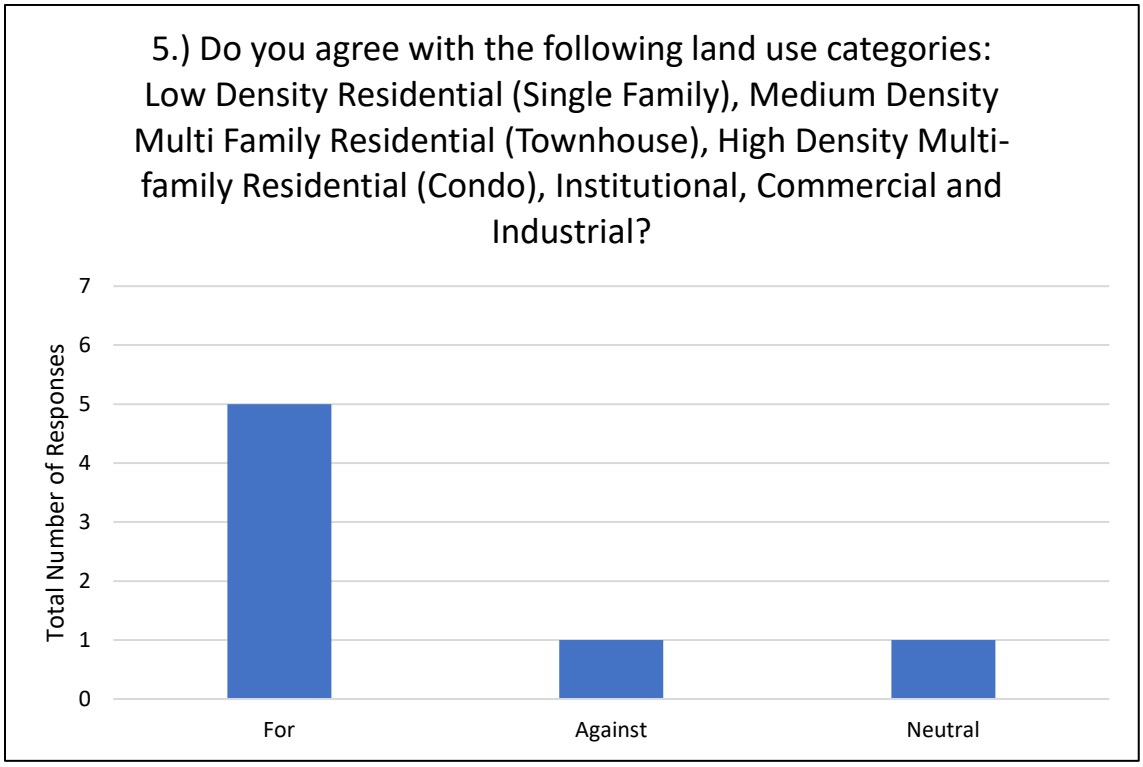


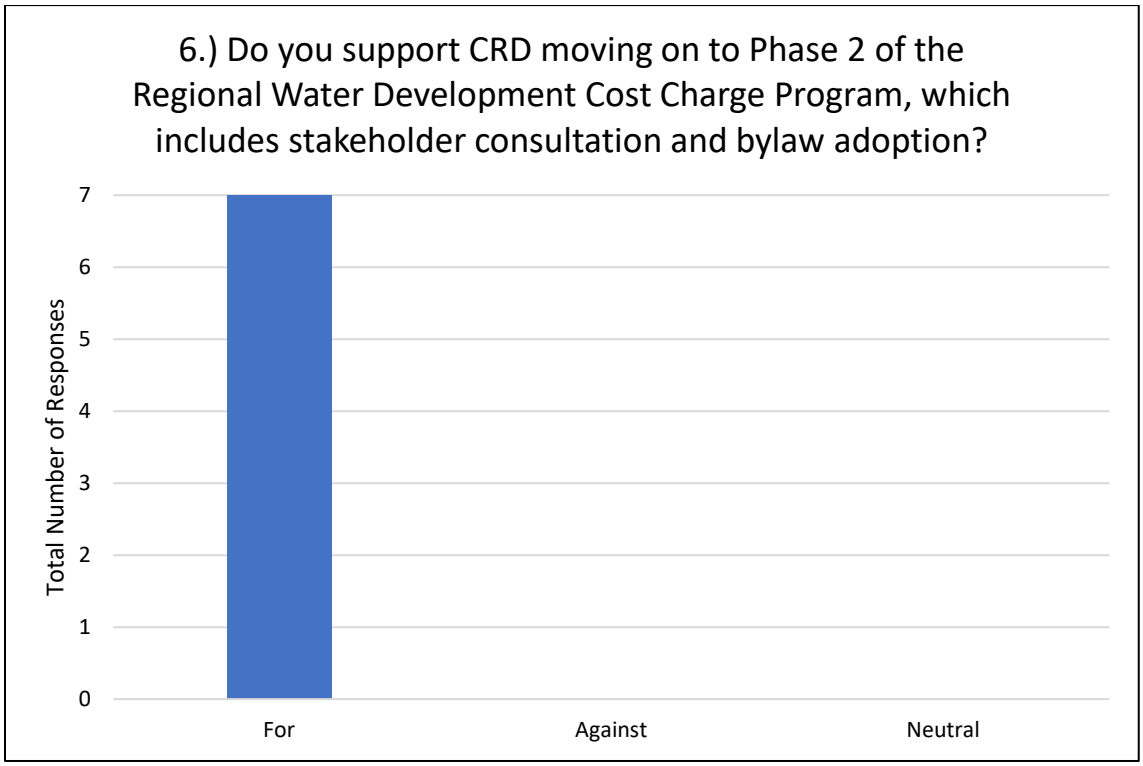


Note: Two respondents did not answer Question #2


3.) Do you agree with a Municipal assist factor of 1 percent?
Total Number of Responses
7
6
5
4
3
2
1
0
For
Against
Neutral


4.) Would you support a phased Development Cost Charge Implementation by modifying the municipal assist factor over time?
Total Number of Responses
7
6
5
4
3
2
1
0
For
Against
Neutral


5.) Do you agree with the following land use categories: Low Density Residential (Single Family), Medium Density Multi Family Residential (Townhouse), High Density Multi-family Residential (Condo), Institutional, Commercial and Industrial?
Total Number of Responses
0
1
2
3
4
5
6
7
For
Against
Neutral


6.) Do you support CRD moving on to Phase 2 of the Regional Water Development Cost Charge Program, which includes stakeholder consultation and bylaw adoption?
Total Number of Responses
0
1
2
3
4
5
6
7
For
Against
Neutral

7.) Do you have any other comments you would like to pass onto the Regional Water Supply Commission?

1)
I am in favour of maximizing cost charges to developers without gouging them. From the presentation given to the Water Advisory Committee, CRD plans to follow established and accepted guidelines for DCCs, supporting their appropriateness for CRD.

A brief comment about the written introduction to the DCC presentation, stating: "It is widely accepted that growth, when facilitated by good planning, benefits communities and their economies."

This is an absurd statement (tell it to any community, small or large, where the residents are happy with the balance between public services and the ability to move around freely) that falls under the category "proof by assertion". CRD does not need to justify future growth with foolish statements. Growth will happen, period. CRD is doing a very good job in preparing!

2)

Does the higher rate for institutional projects capture mainly projects funded by the taxpayers of BC? If so does it make sense to saddle these projects with a much higher rate than other classifications as this could affect the overall budget for example a hospital and result in budget problems that could adversely affect the quality of care provided by the hospital? Same argument for schools and other institutional projects!!

3)

For the medium or high density residential categories in Question 5, if the developer wanted to offer a defined percentage of the units as low income housing, in perpetuity, or the developer is a non-profit or a housing cooperative, and that could be guaranteed (e.g. with restrictive covenant on title, or whatever the appropriate legal means would be), I would be in favour of the CRD further subsidizing the DCC costs based on that defined percentage of units.

4)

Institutional is built with tax dollars already so having such a high rate seems to be adding another huge burden on the taxpayer who is already suffering.

5) N/A

6) N/A

7) N/A

APPENDIX D

Development Cost Charge

GUIDE FOR ELECTED OFFICIALS

BRITISH COLUMBIA
Ministry of Community Services

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Introduction

It is widely accepted that growth, when facilitated by good planning, benefits communities and their economies. Local governments have come to recognize, however, that the accommodation of growth is not a cost-free exercise. Growth creates demands for the construction of new infrastructure, and the expansion of existing local services. The cost of meeting these demands is often substantial and, at times, beyond the ability of local governments to fund using existing financial resources.

The development industry understands that growth creates new demand for local government infrastructure and services. The industry also understands that local governments are not able to directly absorb all growth-related service costs, and that growth itself should assist in funding service needs. A range of development finance tools has been created to enable local governments to collect from development a portion of growth-related expenditures. Development cost charges (DCCs) represent one such tool.

The *DCC Guide for Elected Officials* is designed to increase understanding about DCCs among local government leaders. The *Guide* uses a "question & answer" format, which addresses important questions on DCCs and their use. The questions are grouped under the following headings:

- DCCs Defined;
- Establishing DCCs;
- When to Use DCCs;
- DCCs in the Broader Context;
- DCCs and Development; and,
- DCCs across British Columbia.

APPENDIX D

The *Guide* deals with the basics, or fundamentals, of DCCs.

For a more detailed review and information about the technical aspects of DCCs, please refer to the *Development Cost Charge Best Practices Guide*, a Ministry of Community Services publication available electronically through the search function of the British Columbia Government website at www.gov.bc.ca

Development Cost Charge

BEST PRACTICES GUIDE

BRITISH COLUMBIA
Ministry of Community Services

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Capital Regional District

HOTSHEET AND ACTION LIST

Juan de Fuca Water Distribution Commission

Tuesday, May 2, 2023 **12 PM** **Goldstream Meeting Room**
479 Island Highway
Victoria, BC

The following is a quick snapshot of the FINAL Juan de Fuca Water Distribution Commission decisions made at the meeting. The minutes will represent the official record of the meeting. A name has been identified beside each item for further action and follow-up.

3. ADOPTION OF MINUTES

That the minutes of the March 7, 2023 meeting be adopted.

CARRIED

7. COMMISSION BUSINESS

The Following Items Were Received for Information

7.1 Small Diameter Pipe Replacement Program Update
7.2 Summary of Recommendations from Other Water Commissions
7.3 Water Watch Report

CARRIED

CAPITAL REGIONAL DISTRICT - INTEGRATED WATER SERVICES

Water Watch

Issued May 08, 2023

Water Supply System Summary:

1. Useable Volume in Storage:

Reservoir	May 31 5 Year Ave		May 31/22		May 7/23		% Existing Full Storage
	ML	MIG	ML	MIG	ML	MIG	
Sooke	88,173	19,398	91,646	20,162	92,530	20,357	99.8%
Goldstream	7,736	1,702	9,825	2,162	9,905	2,179	99.9%
Total	95,908	21,100	101,471	22,324	102,435	22,536	99.8%

2. Average Daily Demand:

For the month of May	130.8 MLD	28.77 MIGD
For week ending May 07, 2023	130.8 MLD	28.78 MIGD
Max. day May 2023, to date:	145.9 MLD	32.10 MIGD

3. Average 5 Year Daily Demand for May

Average (2018 - 2022)	147.9 MLD [1]	32.54 MIGD [2]

[1]MLD = Million Litres Per Day [2]MIGD = Million Imperial Gallons Per Day

4. Rainfall May:

Average (1914 - 2022):	47.4 mm
Actual Rainfall to Date	18.1 mm (38% of monthly average)

5. Rainfall: Sep 1- May 7

Average (1914 - 2022):	1,516.8 mm
2022/2023	1,007.7 mm (66% of average)

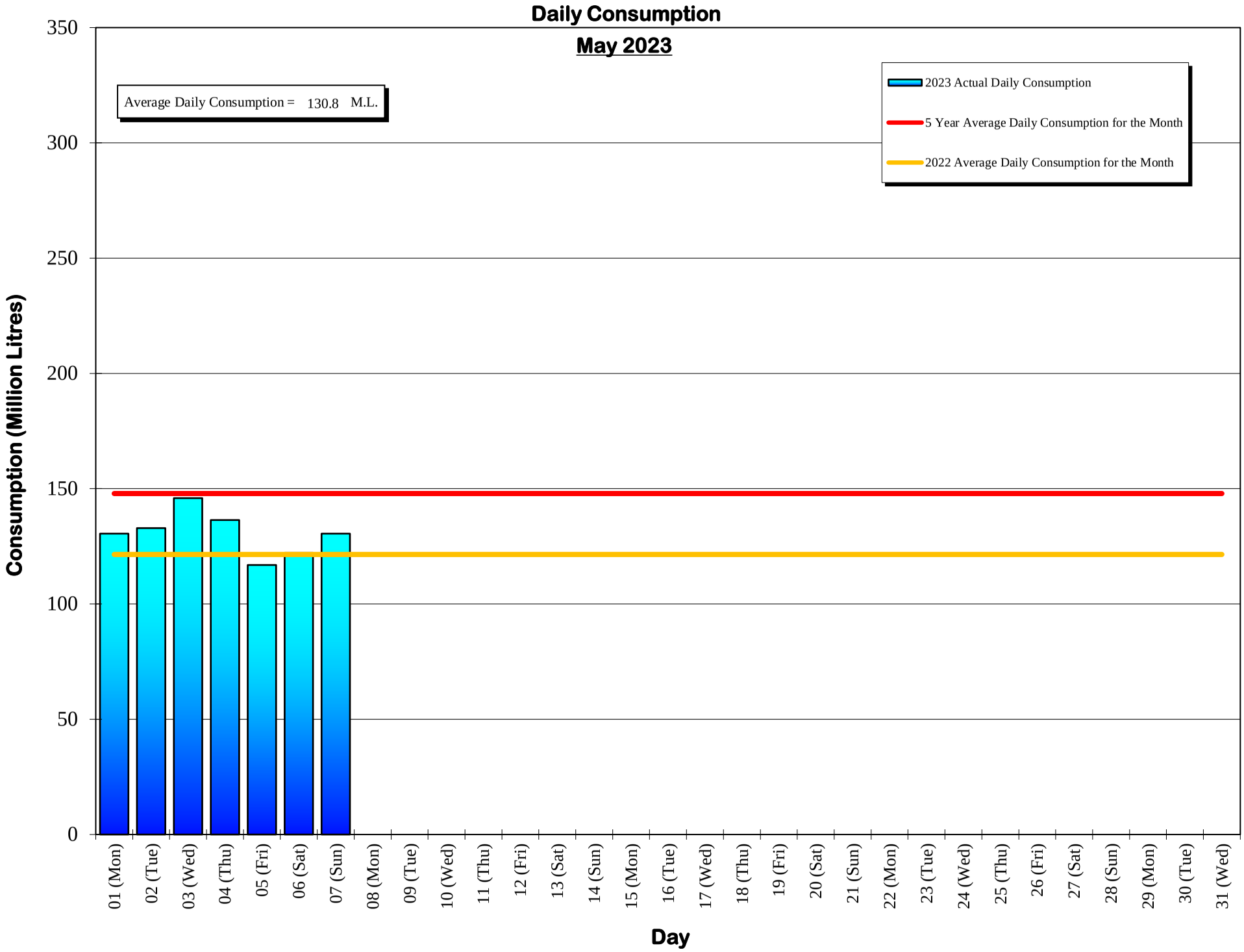
6. Water Conservation Action Required:

CRD's Stage 1 Water Conservation Bylaw is now in effect through September 30, 2023
Visit our website at www.crd.bc.ca/water for scheduling information.

If you require further information, please contact:

Ian Jesney, P. Eng.
Acting General Manager, CRD - Integrated Water Services
or
Glenn Harris, Ph D., RPBio
Senior Manager - Environmental Protection

Capital Regional District Integrated Water Services
479 Island Highway
Victoria, BC V9B 1H7
(250) 474-9600



J:\WATERENG\HYDROLGY\AMRIT\MONTHEND.23\H2o watch 2023Cons. Chart

Daily Consumptions: - May 2023

Date	Total Consumption (ML) [1.]		(MIG) [2.]	Air Temperature @ Japan Gulch High (°C)	Low (°C)	Weather Conditions	Precipitation @ Sooke Res.: 12:00am to 12:00am Rainfall (mm)	Snowfall [3.] (mm)	Total Precip.
01 (Mon)	130.5		28.7	17	7	Cloudy / P. Sunny	0.0	0.0	0.0
02 (Tue)	132.9		29.2	24	8	Sunny	0.0	0.0	0.0
03 (Wed)	145.9	<=Max	32.1	23	11	Sunny / P. Cloudy	0.0	0.0	0.0
04 (Thu)	136.4		30.0	21	11	Sunny / P. Cloudy / Showers	0.2	0.0	0.2
05 (Fri)	116.9	<=Min	25.7	12	8	Cloudy / P. Sunny / Showers	14.4	0.0	14.4
06 (Sat)	122.2		26.9	17	8	Cloudy / P. Sunny / Showers	0.2	0.0	0.2
07 (Sun)	130.5		28.7	17	8	Cloudy / P. Sunny / Showers	3.3	0.0	3.3
08 (Mon)									
09 (Tue)									
10 (Wed)									
11 (Thu)									
12 (Fri)									
13 (Sat)									
14 (Sun)									
15 (Mon)									
16 (Tue)									
17 (Wed)									
18 (Thu)									
19 (Fri)									
20 (Sat)									
21 (Sun)									
22 (Mon)									
23 (Tue)									
24 (Wed)									
25 (Thu)									
26 (Fri)									
27 (Sat)									
28 (Sun)									
29 (Mon)									
30 (Tue)									
31 (Wed)									
TOTAL	915.3 ML		201.37 MIG				18.1	0	18.1
MAX	145.9		32.10	24	11		14.4	0	14.4
AVG	**130.8**		28.77	18.7	8.7		2.6	0	2.6
MIN	116.9		25.72	12	7		0.0	0	0.0

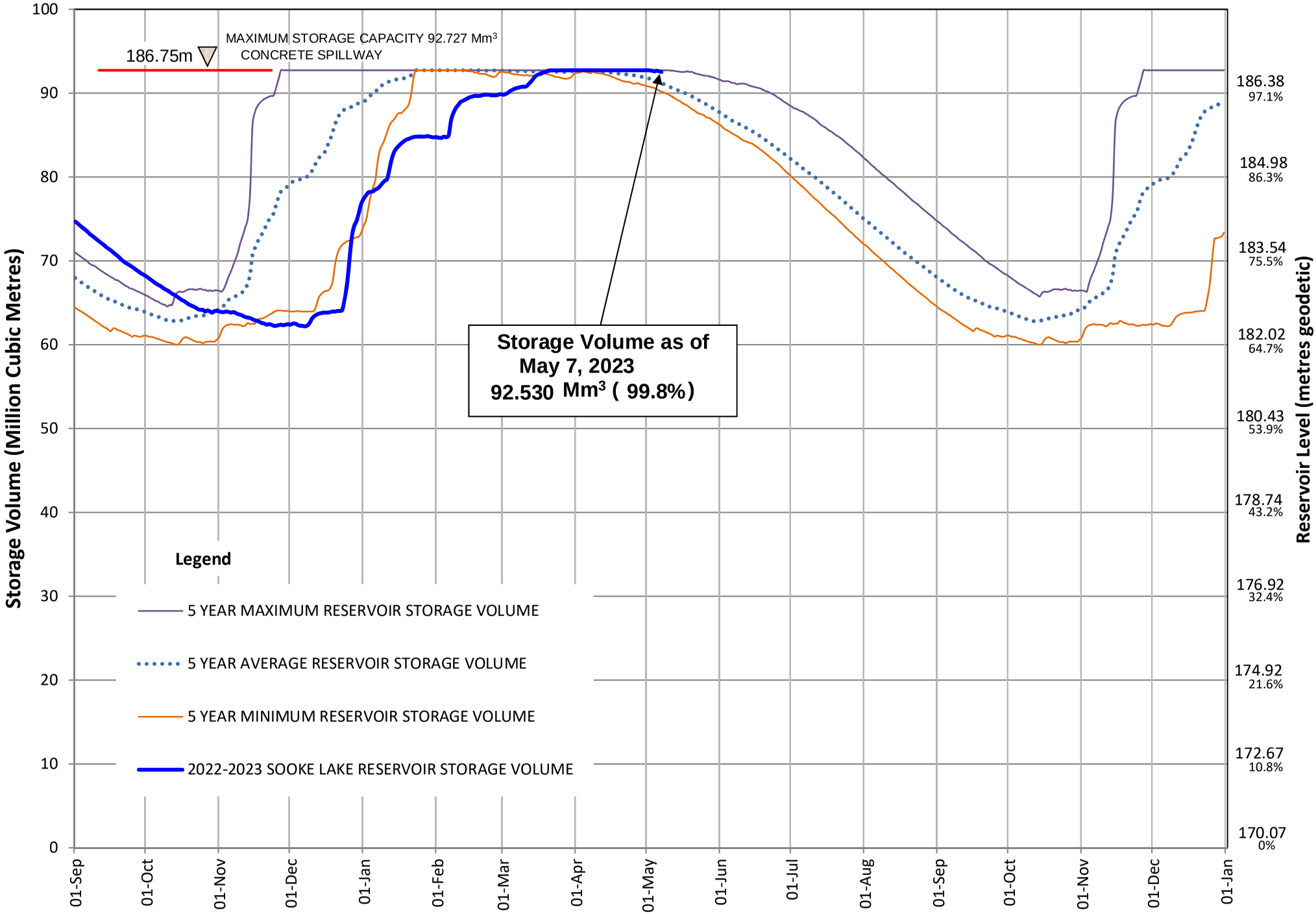
1. ML = Million Litres 2. MIG = Million Imperial Gallons 3. 10% of snow depth applied to rainfall figures for snow to water equivalent.

Average Rainfall for May (1914-2022)	47.4 mm
Actual Rainfall: May	18.1 mm
% of Average	38%
Average Rainfall (1914-2022): Sept 01 - May 07	1,516.8 mm
Actual Rainfall (2022/23): Sept 01 - May 07	1,007.7 mm
% of Average	66%

Number days with precip. 0.2 or more
4

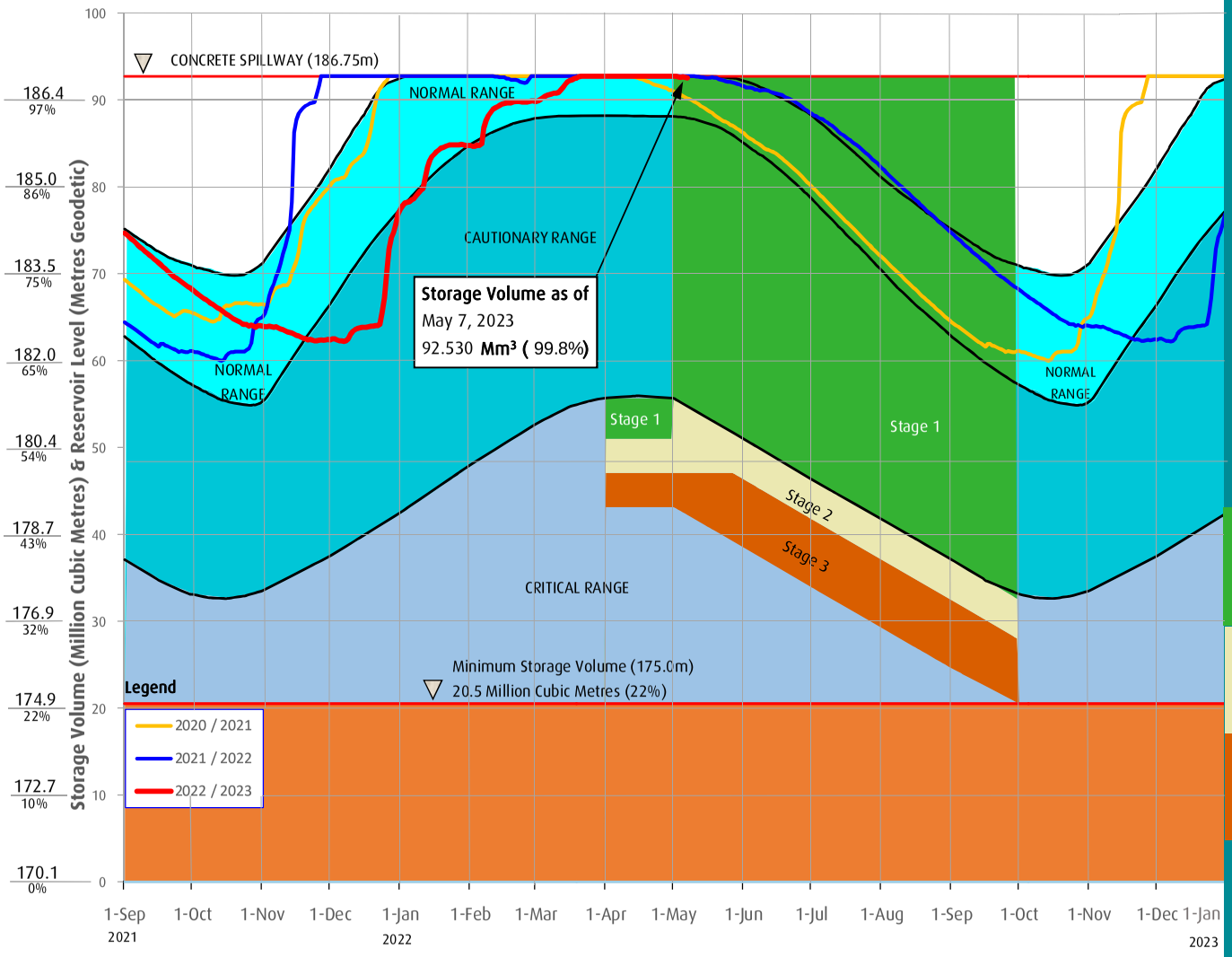
Water spilled at Sooke Reservoir to date (since Sept. 1) = 0.99 Billion Imperial Gallons
= 4.50 Billion Litres

SOOKE LAKE RESERVOIR STORAGE SUMMARY
2022 / 2023



Sooke Lake Reservoir Storage Level

Water Supply Management Plan



FAQs

How are water restriction stages determined?

Several factors are considered when determining water use restriction stages, including,

1. Time of year and typical seasonal water demand trends;
2. Precipitation and temperature conditions and forecasts;
3. Storage levels and storage volumes of water reservoirs (Sooke Lake Reservoir and the Goldstream Reservoirs) and draw down rates;
4. Stream flows and inflows into Sooke Lake Reservoir;
5. Water usage, recent consumption and trends; and customer compliance with restriction;
6. Water supply system performance.

The Regional Water Supply Commission will consider the above factors in making a determination to implement stage 2 or 3 restrictions, under the Water Conservation Bylaw.

At any time of the year and regardless of the water use restriction storage, customers are encouraged to limit discretionary water use in order to maximize the amount of water in the Regional Water Supply System Reservoirs available for nondiscretionary potable water use.

Stage 1 is normally initiated every year from May 1 to September 30 to manage outdoor use during the summer months. During this time, lawn watering is permitted twice a week at different times for even and odd numbered addresses.

Stage 2 Is initiated when it is determined that there is an acute water supply shortage. During this time, lawn water is permitted once a week at different times for even and odd numbered addresses.

Stage 3 Is initiated when it is determined that there is a severe water supply shortage. During this time, lawn watering is not permitted. Other outdoor water use activities are restricted as well.

For more information, visit www.crd.bc.ca/drinkingwater

CRD

Making a difference...together

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Useable Reservoir Volumes in Storage for May 07, 2023