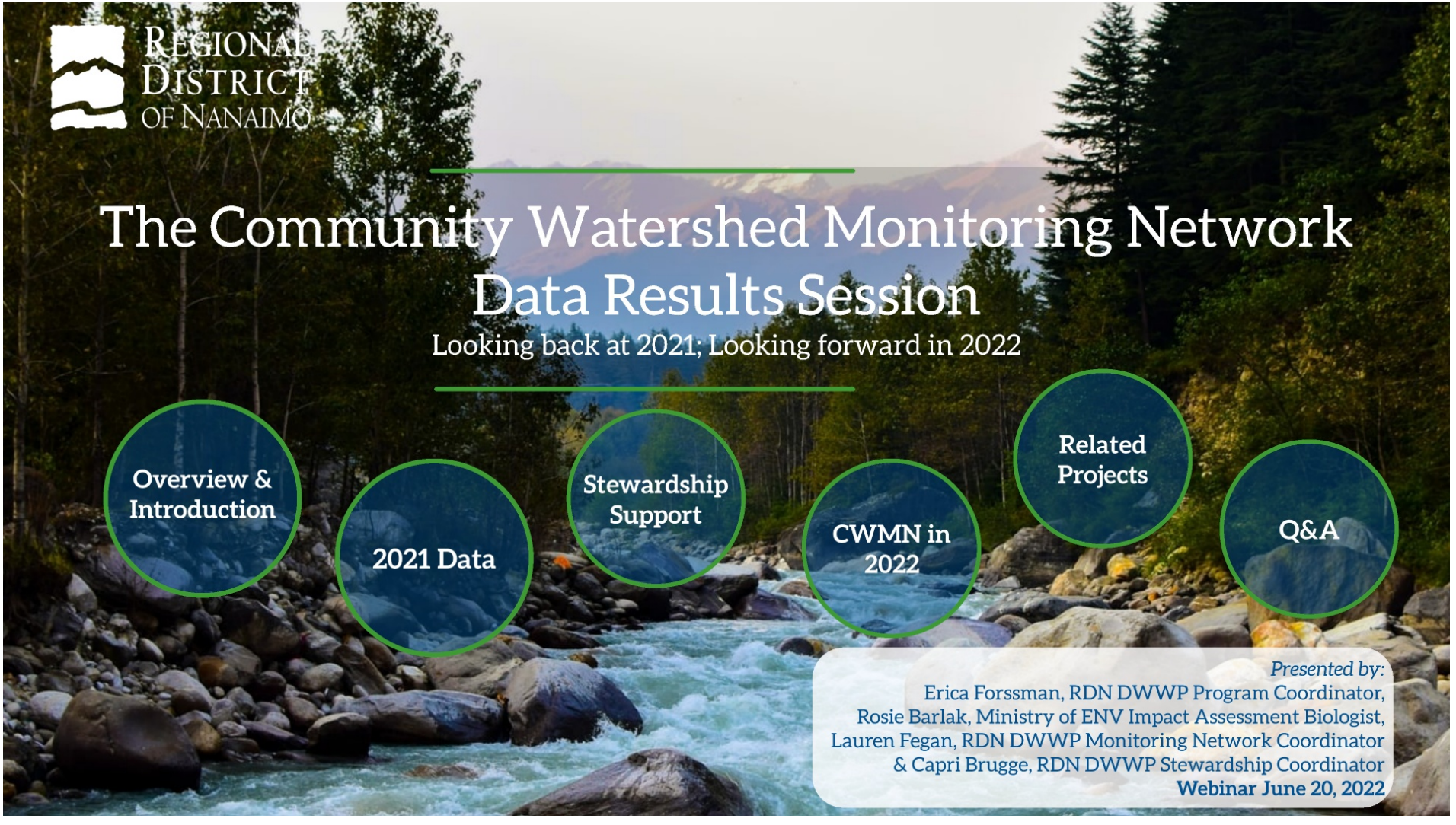

Regional District of Nanaimo
The Community Watershed Monitoring Network
Data Results Session
Looking back at 2021; Looking forward in 2022
Overview & Introduction
2021 Data
Stewardship Support
CWMN in 2022
Related Projects
Q&A
Presented by:
Erica Forssman, RDN DWWP Program Coordinator,
Rosie Barlak, Ministry of ENV Impact Assessment Biologist,
Lauren Fegan, RDN DWWP Monitoring Network Coordinator
& Capri Brugge, RDN DWWP Stewardship Coordinator
Webinar June 20, 2022

First, some context...

why

RDN's DWWP Program

how

CWMN Background

Partnerships

who

Monitoring Sites

Water Quality Parameters

Guidelines & Objectives

what

where

Drinking Water & Watershed Protection Program

- Parcel tax funded regional program established in 2008, implemented in 2009.
- Delivers science, education, and planning initiatives focused on water sustainability in the RDN.
- DWWP Action Plan 2.0 2020 - 2030 and beyond outlines program directives.

Community Watershed Monitoring Network

- Started with shared goal to increase knowledge and understanding of surface water quality in the region.
- Monitoring program began in 2011, designed with provincial protocols and methodologies.
- Partnership between Ministry of Environment & Climate Change Strategy (ENV), RDN DWWP, Streamkeeper volunteers, & private forestry.
- Streams sampled during 2 seasonal periods (summer low flow & fall flush), 5 consecutive weeks each.
- Sites chosen to fill data gaps in provincial monitoring networks, based on local knowledge of Streamkeepers.
- All data entered and stored in publicly accessible, provincially managed database - Environmental Monitoring System (EMS).

Partners

Streamkeepers

Community Stewardship Groups: attend annual training, perform equipment calibrations & all sampling, provide local knowledge.

RDN DWWP: manage equipment, provide technical support & coordination, deliver training, data entry, summarize results.

Surface Water Quality Data: prioritization of efforts, land use planning support, funding applications support, increased awareness.

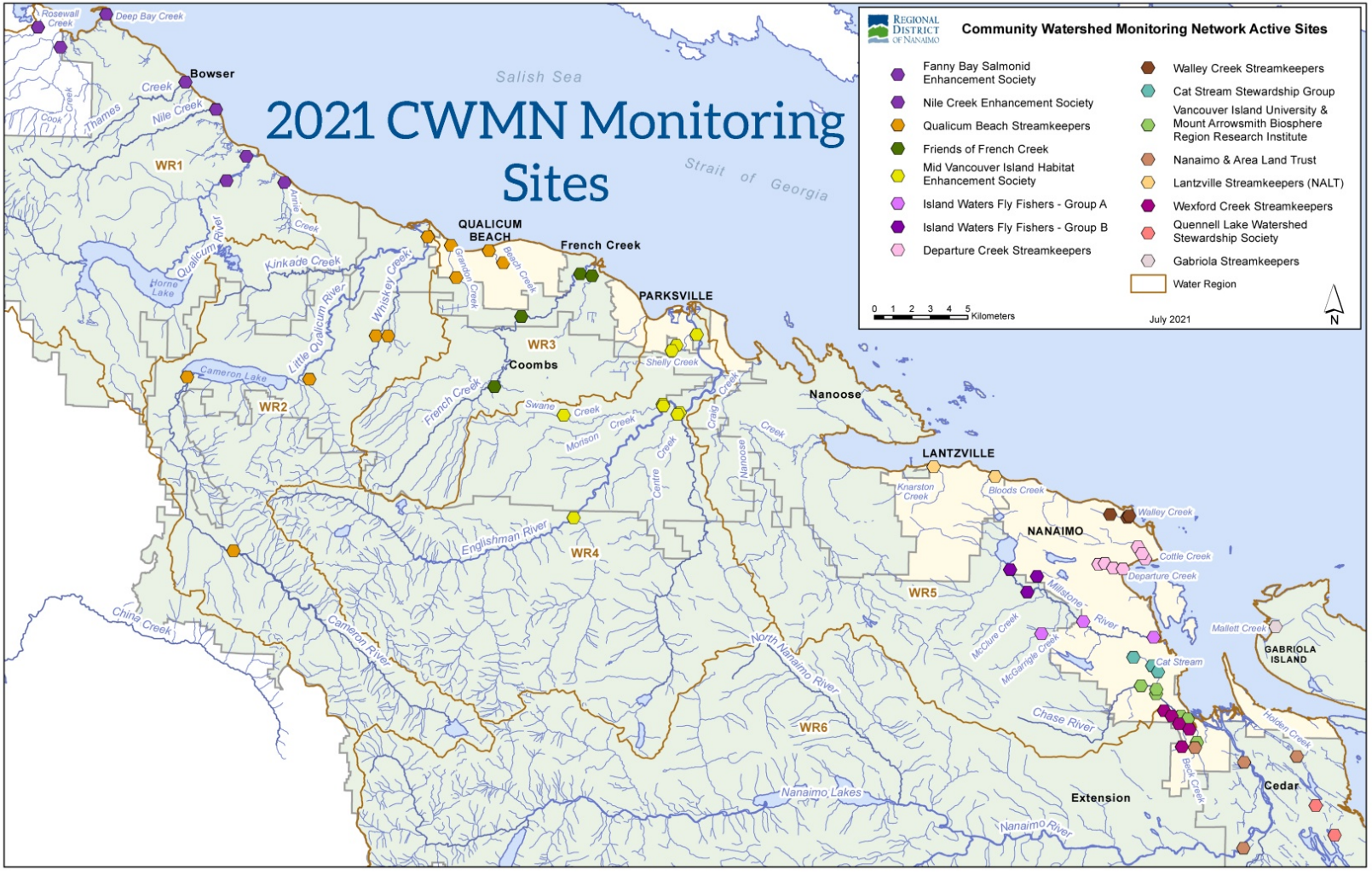
BC ENV: provide technical support, training & sampling protocols, data review, manage database and data portal.

Mosaic Forest Mgmt: provide safety gear, land access to upper watershed sites, sponsor QA/QC lab analysis.

Community Stewardship Groups

- Cat Stream Stewards (CSS)
- Departure Creek Streamkeepers (DCS)
- Fanny Bay Salmonid Enhancement Society (FBSES)
- Friends of French Creek Conservation Society (FFCCS)
- Gabriola Streamkeepers (GSk)
- Island Waters Fly Fishers (IWFF - 2 groups)
- Lantzville Streamkeepers (LS)
- Nanaimo and Area Land Trust (NALT)
- Nile Creek Enhancement Society (NCES)
- Mid Vancouver Island Habitat Enhancement Society (MVIHES)
- Qualicum Beach Streamkeepers (QBS)
- Quennell Lake Watershed Stewardship Society (QLWSS)
- Walley Creek Streamkeepers (WCS)
- Wexford Creek Streamkeepers (WxCS)
- Vancouver Island University & Mount Arrowsmith Biosphere Region Research Institute (VIU & MABRRI)

Thank you!


2021 CWMN Monitoring Sites
Salish Sea
Strait of Georgia
Community Watershed Monitoring Network Active Sites
Regional District of Nanaimo
Fanny Bay Salmonid Enhancement Society
Nile Creek Enhancement Society
Qualicum Beach Streamkeepers
Friends of French Creek
Mid Vancouver Island Habitat Enhancement Society
Island Waters Fly Fishers - Group A
Island Waters Fly Fishers - Group B
Departure Creek Streamkeepers
Walley Creek Streamkeepers
Cat Stream Stewardship Group
Vancouver Island University & Mount Arrowsmith Biosphere Region Research Institute
Nanaimo & Area Land Trust
Lantzville Streamkeepers (NALT)
Wexford Creek Streamkeepers
Quennell Lake Watershed Stewardship Society
Gabriola Streamkeepers
Water Region
0 1 2 3 4 5 Kilometers
July 2021
N
Bowser
QUALICUM BEACH
French Creek
PARKSVILLE
Coombs
Nanoose
LANTZVILLE
NANAIMO
GABRIOLA ISLAND
Cedar
Extension
WR1
WR2
WR3
WR4
WR5
WR6
Deep Bay Creek
Rosewall Creek
Cook Creek
Thames Creek
Nile Creek
Horne Lake
Qualicum River
Little Qualicum River
Kinkade Creek
Whiskey Creek
Brandon Creek
Beach Creek
Cameron Lake
French Creek
Swane Creek
Morison Creek
Centre Creek
Craig Creek
Nanoose Creek
Shelly Creek
Englishman River
China Creek
Cameron River
North Nanaimo River
Nanaimo Lakes
Nanaimo River
Chase River
Knarston Creek
Bloods Creek
Walley Creek
Cottle Creek
Departure Creek
Millstone River
McClure Creek
McGarrigle Creek
Cat Stream
Mallett Creek
Holden Creek
Beck Creek

Water Quality Monitoring Parameters

- Water Temperature
  - Alters physical and chemical properties of water, e.g., DO, CO_2, pH, conductivity, etc.
  - Affects metabolic rates of aquatic organisms.
- Dissolved Oxygen
  - Supports aquatic life.
  - Decreases as temperature increases, also influenced by BOD, water turbulence and amount of flow.
- Specific Conductivity
  - Amount of dissolved minerals, corrected to 25°C.
  - Increases with temperature, turbidity, groundwater, evaporation, saline inputs (e.g., tidal, roads, agri., etc.).
  - Quality assurance-quality control lab analysis.
- Turbidity
  - Suspended particles in water column.
  - Correlated to water temperature.
  - Linked to erosion, contaminants, rainwater, etc.
  - Quality assurance-quality control lab analysis.

Objectives & Guidelines

Water Quality Objective (WQO)

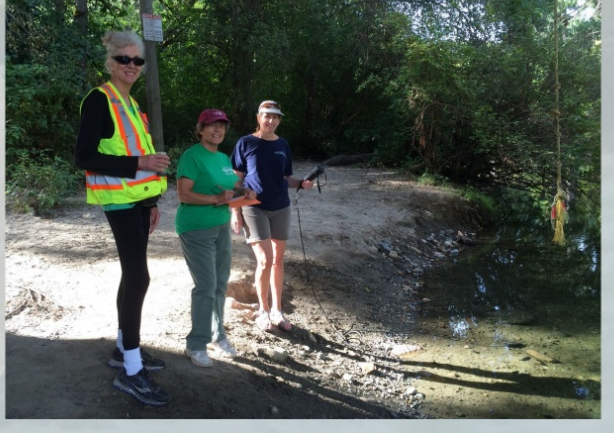
- Developed by the Province for specific water bodies.
- To manage protect specific water uses in that watershed.
- e.g., Englishman River Aesthetic Water Temperature Objective ≤15°C.

Water Quality Guideline (WQG)

- Developed by the Province for B.C.'s aquatic resources and the protection of aquatic life, wildlife, agriculture, drinking water sources, and recreation.
- To assess and manage the health, safety and sustainability of freshwater.
- e.g., Coho Rearing Water Temperature Guideline ≤17°C.

CWMN Data

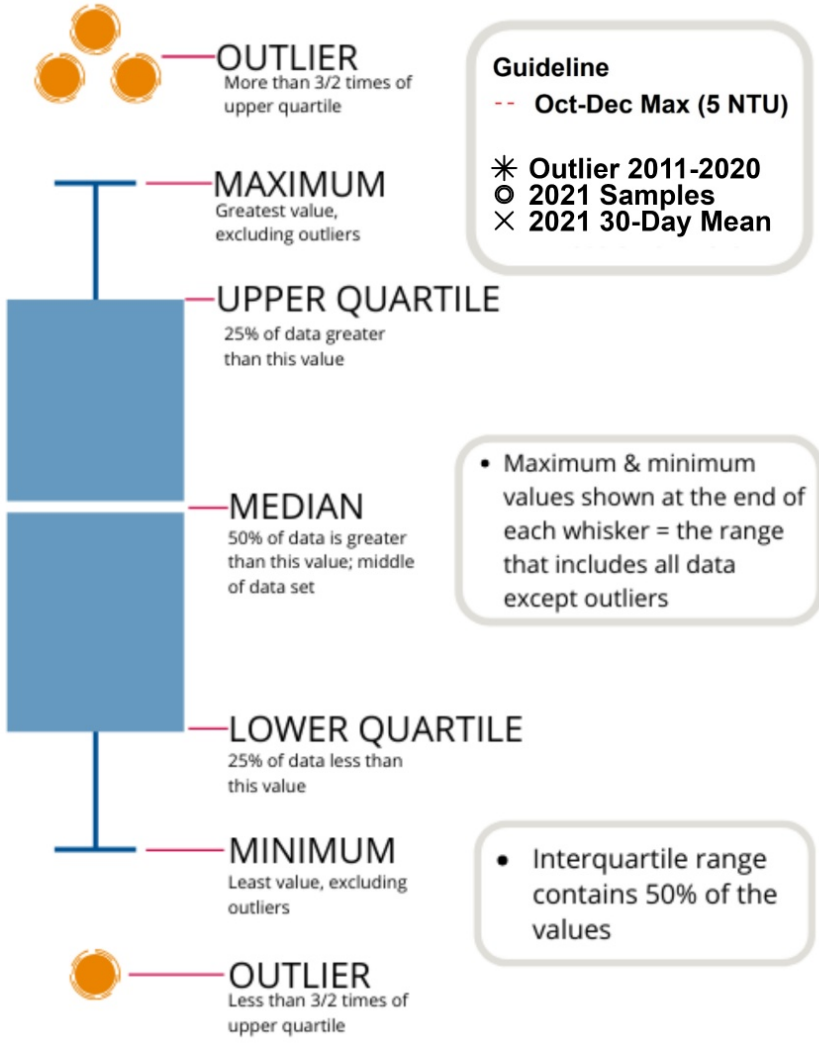
- Sites with data exceeding WQO's & WQG's flagged for further investigation - physical stream assessments, lab analysis, etc.
- Regular reporting of results publicly available: **www.rdn.bc.ca/cwmn**
  - Annual reports/summaries since 2011.
  - Milestone reports:
    - 3 year trend reports (2013, 2014, 2015).
    - 7 year trend report (2018).
    - CWMN trend & data analysis (2021).



2021 CWMN Data

- 70 surface water quality sites sampled on 41 streams in 26 watersheds.
- A new streamkeeper organization, the Cat Stream Stewards, joined the CWMN adding three new sites in Water Regions 5.
- Engaged Ecoscape to update charts and exceedance compilation for 2011-2021 data. Subset of data shown in this presentation; all data will be posted online.
- Nutrient analysis and turbidity QA/QC were completed in 2021.

How to Interpret a Box Plot



Guideline

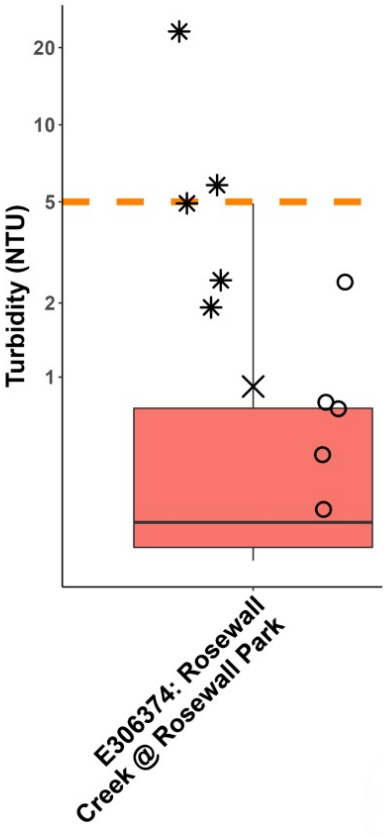
-- **Oct-Dec Max (5 NTU)**

✳ **Outlier 2011-2020**
○ **2021 Samples**
× **2021 30-Day Mean**

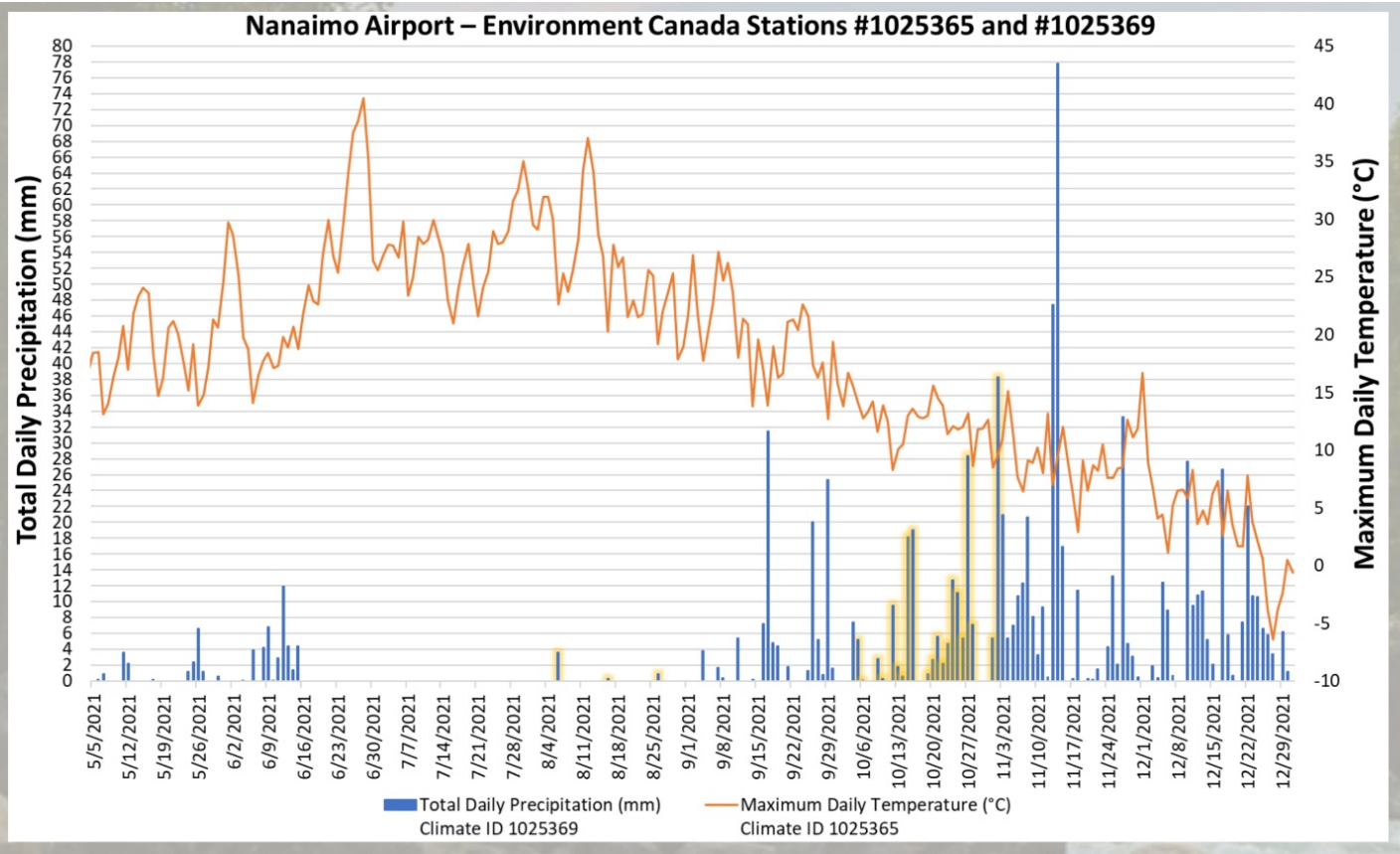
- Maximum & minimum values shown at the end of each whisker = the range that includes all data except outliers

- Interquartile range contains 50% of the values

Example:



SOUTH END



Summer Sample Period Maximum Daily Average:

- 2014 - 24.8°C
- 2015 - 25.2°C
- 2016* - 26.0°C
- 2017 - 26.9°C
- 2018 - 25.8°C
- 2019 - 24.8°C
- 2020 - 24.5°C
- 2021 - 26.0°C

*only 16 dates with temperature data.

Fall Sample Period: Rainfall is Associated with Turbidity Spikes

2021 rainfall:
4.8 mm Summer
(Aug 1 – Aug 31)
189.3 mm Fall
(Oct 1 – Nov 2)

2014 rainfall:
22.6 mm Summer
(Aug 1 – Sept 10)
282.2 mm Fall
(Oct 1 – Nov 12)

2015 rainfall:
22.1 mm Summer
(Aug 1 – Sept 1)
116.7 mm Fall
(Oct 1 – Nov 11)

2016 rainfall:
23.4 mm Summer
(Aug 1 – Aug 31)
379.2 mm Fall
(Oct 1 – Nov 8)

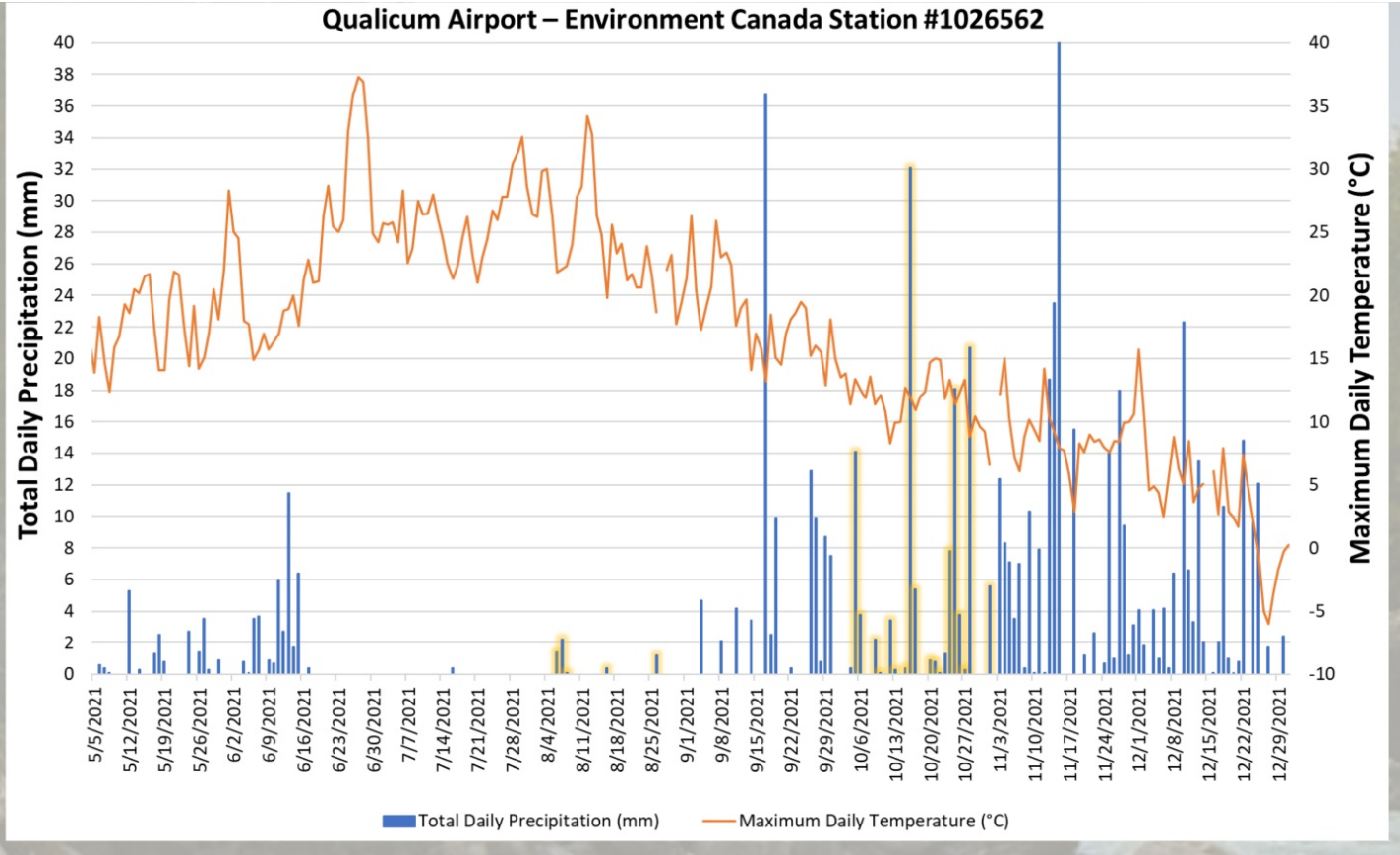
2017 rainfall:
3 mm Summer
(Aug 1 – Aug 31)
336.4 mm Fall
(Oct 1 – Nov 21)

2018 rainfall:
3 mm Summer
(Aug 1 – Aug 31)
109.1 mm Fall
(Oct 1 – Nov 6)

2019 rainfall:
24.6 mm Summer
(Aug 1 – Sept 10)
74.1 mm Fall
(Oct 1 – Nov 5)

2020 rainfall:
43.7 mm Summer
(Aug 1 – Sept 10)
174.9 mm Fall
(Oct 1 – Nov 10)

NORTH END



Summer Sample Period Maximum Daily Average:
2014 - 23.7°C
2015 - 23.0°C
2016 - 24.2°C
2017 - 25.3°C
2018 - 24.7°C
2019 - 23.2°C
2020 - 22.8°C
2021 - 24.2°C

Fall Sample Period: Strongest Turbidity Association to Rainfall within 24 Hours of Sample

2021 rainfall:
5.3 mm Summer
(Aug 1 – Aug 31)
121.6 mm Fall
(Oct 1 – Nov 2)

2014 rainfall:
29.4 mm Summer
(Aug 1 – Sept 10)
187.5 mm Fall
(Oct 1 – Nov 12)

2015 rainfall:
24.0 mm Summer
(Aug 1 – Sept 1)
82.3 mm Fall
(Oct 1 – Nov 11)

2016 rainfall:
15.7 mm Summer
(Aug 1 – Aug 31)
252.2 mm Fall
(Oct 1 – Nov 8)

2017 rainfall:
3.5 mm Summer
(Aug 1 – Aug 31)
257.2 mm Fall
(Oct 1 – Nov 21)

2018 rainfall:
0.8 mm Summer
(Aug 1 – Aug 31)
53 mm Fall
(Oct 1 – Nov 6)

2019 rainfall:
14.3 mm Summer
(Aug 1 – Sept 10)
57.3 mm Fall
(Oct 1 – Nov 5)

2020 rainfall:
37.6 mm Summer
(Aug 1 – Sept 9)
107.9 mm Fall
(Oct 1 – Nov 10)

Water Temperature

- **Englishman River aesthetic drinking water temperature (temp) objective = weekly average ≤15°C.**

- **Aquatic life temp guideline = weekly average ≤17°C for Coho rearing.**

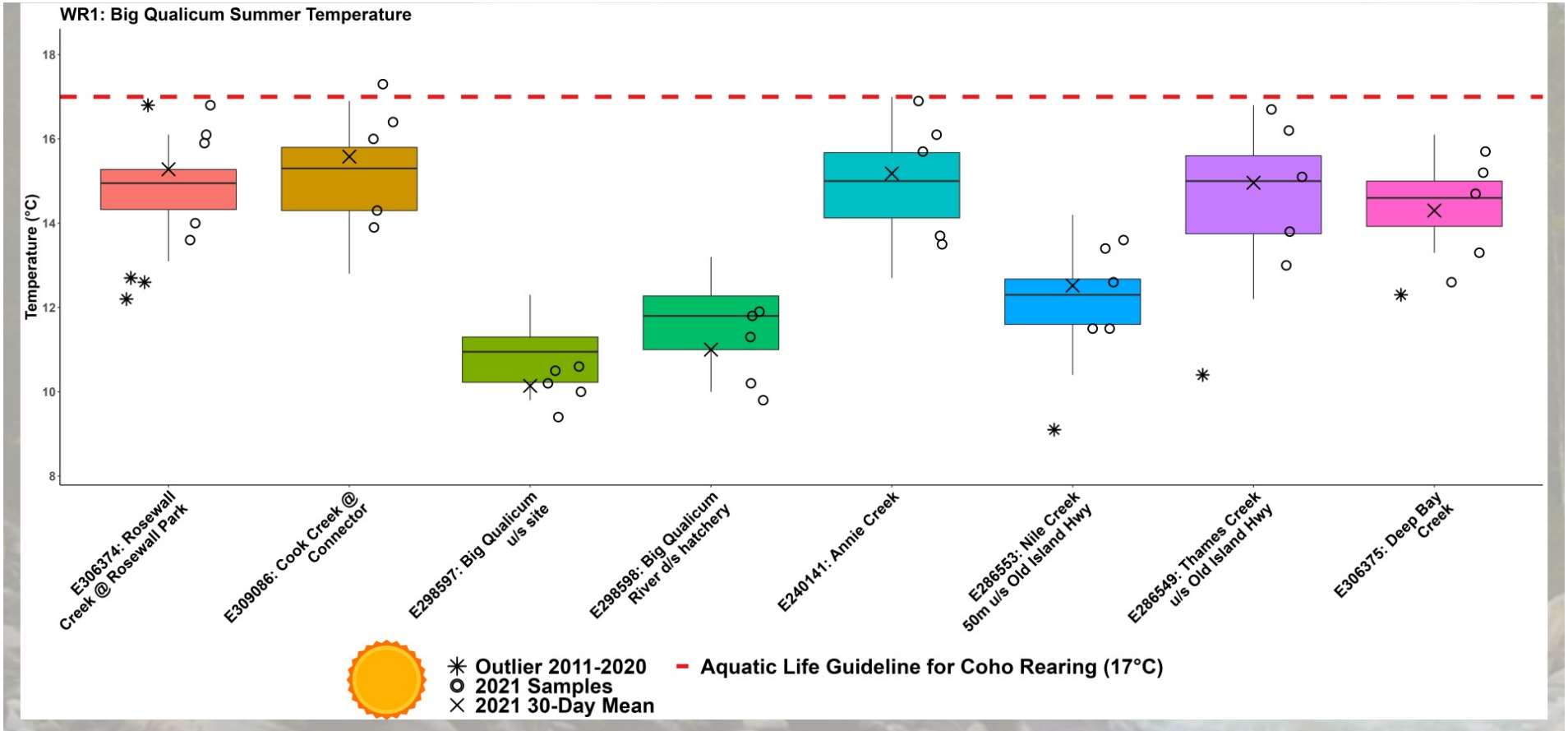
Photo credit: Departure Creek Streamkeepers

- ***Exceedances recorded in summer low-flow period.***

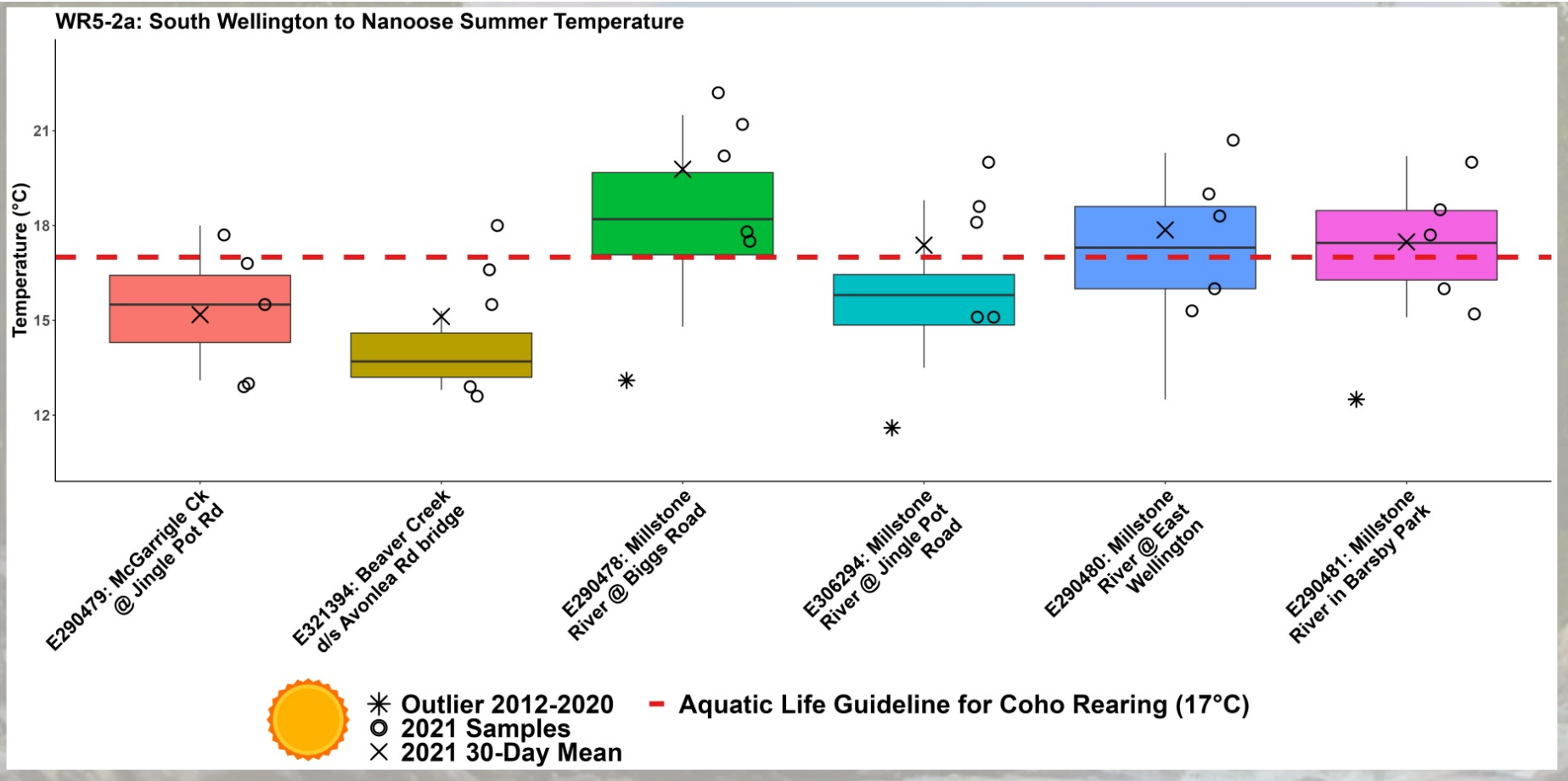
- Affects metabolic rates of aquatic organisms.

- Can alter physical and chemical properties of water (e.g., dissolved oxygen, pH, conductivity).

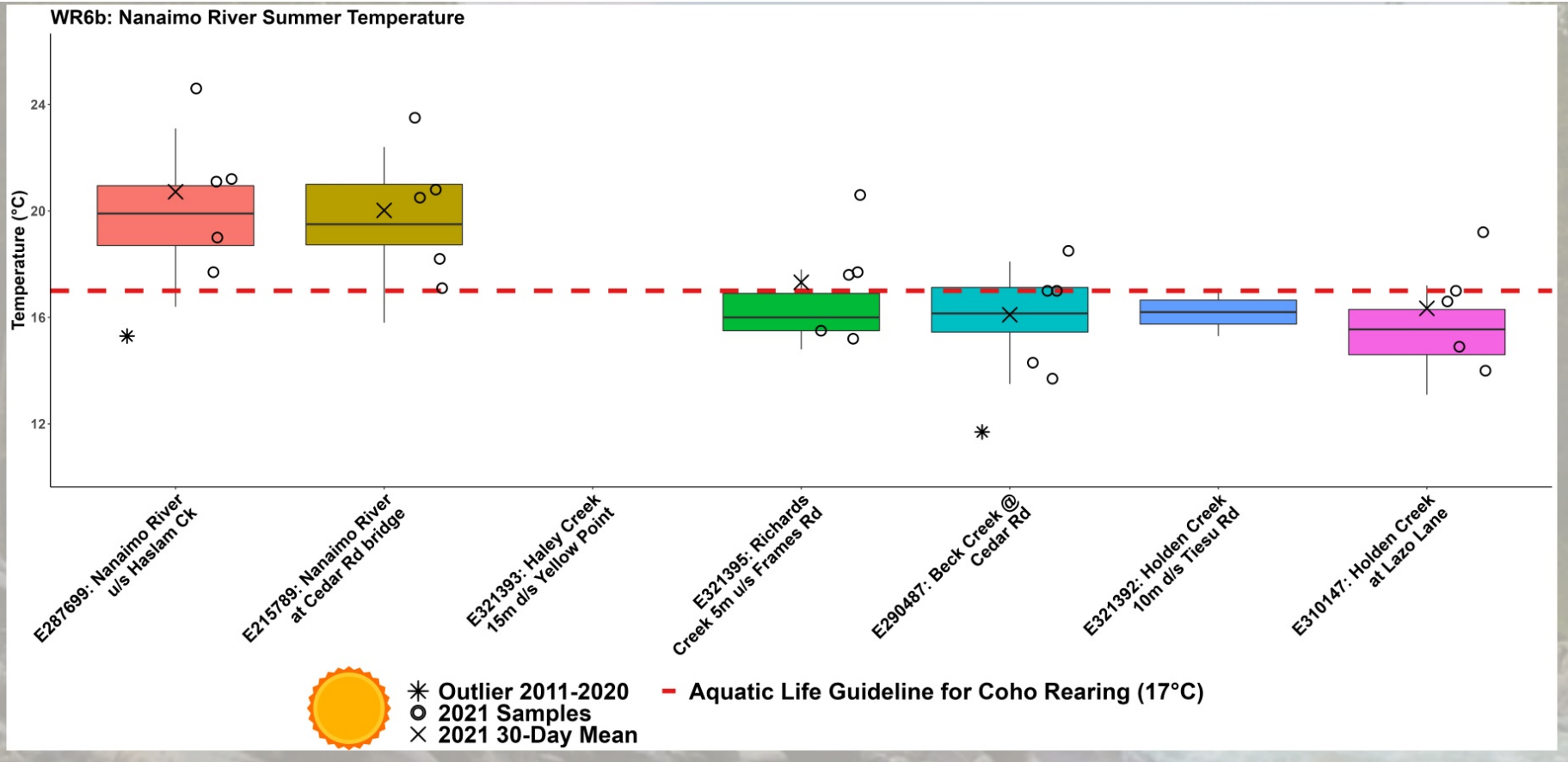
- **Influenced by air temperature, stream exposure (canopy cover, riparian vegetation), hydraulic connectivity (groundwater - surface water interaction), stream flow and physical attributes.**



- *WR1 provides background data.*
- *At all WR1 sites, highest water temperatures recorded during week 1 of sampling; weeks 4 and 5 recorded lower than average water temperatures.*



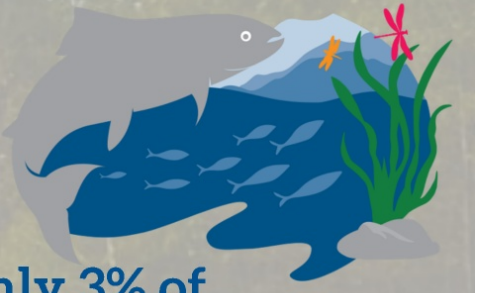
- *Exceedances in water temperature at all but six WR5 sites.*
- *Influencing factors: water source, riparian coverage, and upstream land-uses.*



- *Higher water temperatures and more sites with subsurface flows in 2021.*
- *Riparian, stream width, and flow correlated to results.*

Water Temperature

Exceedances recorded in summer low-flow sample period.



- Aquatic life temp guideline = weekly average ≤17°C.
- Influenced by air temp, upstream inputs, & physical stream characteristics (riparian, stream structure, etc.).
- 46% of summer values ≥17°C occurred on Aug. 3 while only 3% of summer values ≥17°C occurred on Aug. 31.
- Watercourses in **black text** below also had potential to exceed in 2020 as well.

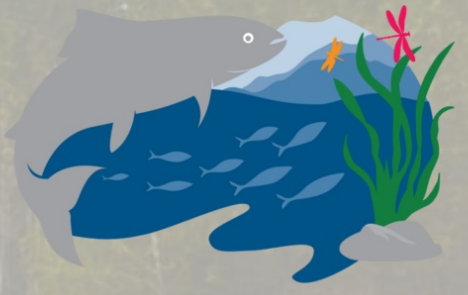
Watercourses with the Potential to Exceed Aquatic Life Temp Guideline

Beck Creek
Beaver Creek
Centre Creek
Cat Stream
Chase River
Cook Creek
Cottle Creek
Englishman River
French Creek
Grandon Creek
Holden Creek
Knarston Creek
Little Qualicum River
McGarrigle Creek
Morrison Creek
Morningstar Creek
Millstone River
Nanaimo River
Richards Creek
Shelly Creek
Swayne Creek
S. Englishman River
Walley Creek

Water Temperature

Exceedances recorded in summer low-flow sample period.

- Influenced by air temp, upstream inputs, & physical stream attributes.



- Air temp and rainfall vary year to year.

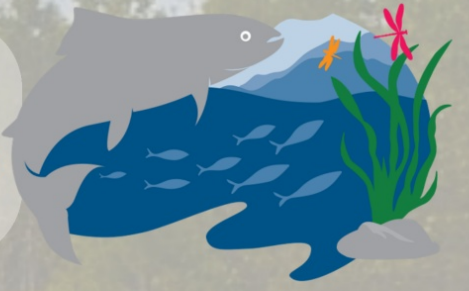
% Summer Values ≥17°C per Year Compared to Summer Air Temp & Precipitation Averages

Year	% ≥17°	Avg °	Total precip.
2014	29.2%	24.3°	26.0 mm
2015	22.7%	24.1°	23.1 mm
2016	21.2%	25.1°	19.6 mm
2017	28.4%	26.1°	3.3 mm
2018	18.7%	25.3°	1.5 mm
2019	15.9%	24.0°	19.3 mm
2020	15.5%	23.7°	40.7 mm
2021	24.4%	25.1°	5.1 mm

- During 2021 sampling, weather was cooler during weeks 4 & 5 of sampling, resulting in fewer potential exceedances despite lack of rainfall.

Temperature WQG

- *Natural to have variation across / within a watercourse.*
- *Deep pools, groundwater inflow, etc. create cool refuges from temp exceedances for juvenile salmon, supporting survival.*



Generally:

- *Urbanized streams tend to have higher temp averages.*
- *Exceedances of temp WQG more common in lower reaches (i.e., wide and shallow, more developed, accumulation of inputs).*

Understanding temp exceedances:

- *Mapping features to locate water bodies u/s, riparian vegetation, salmon refuges, etc.*
- *Desktop studies & physical stream assessments.*

Addressing temp exceedances:

- *Riparian enhancement & restoration.*
- *Groundwater conservation programs & actions.*
- *Offsetting climate change impacts.*

Dissolved Oxygen

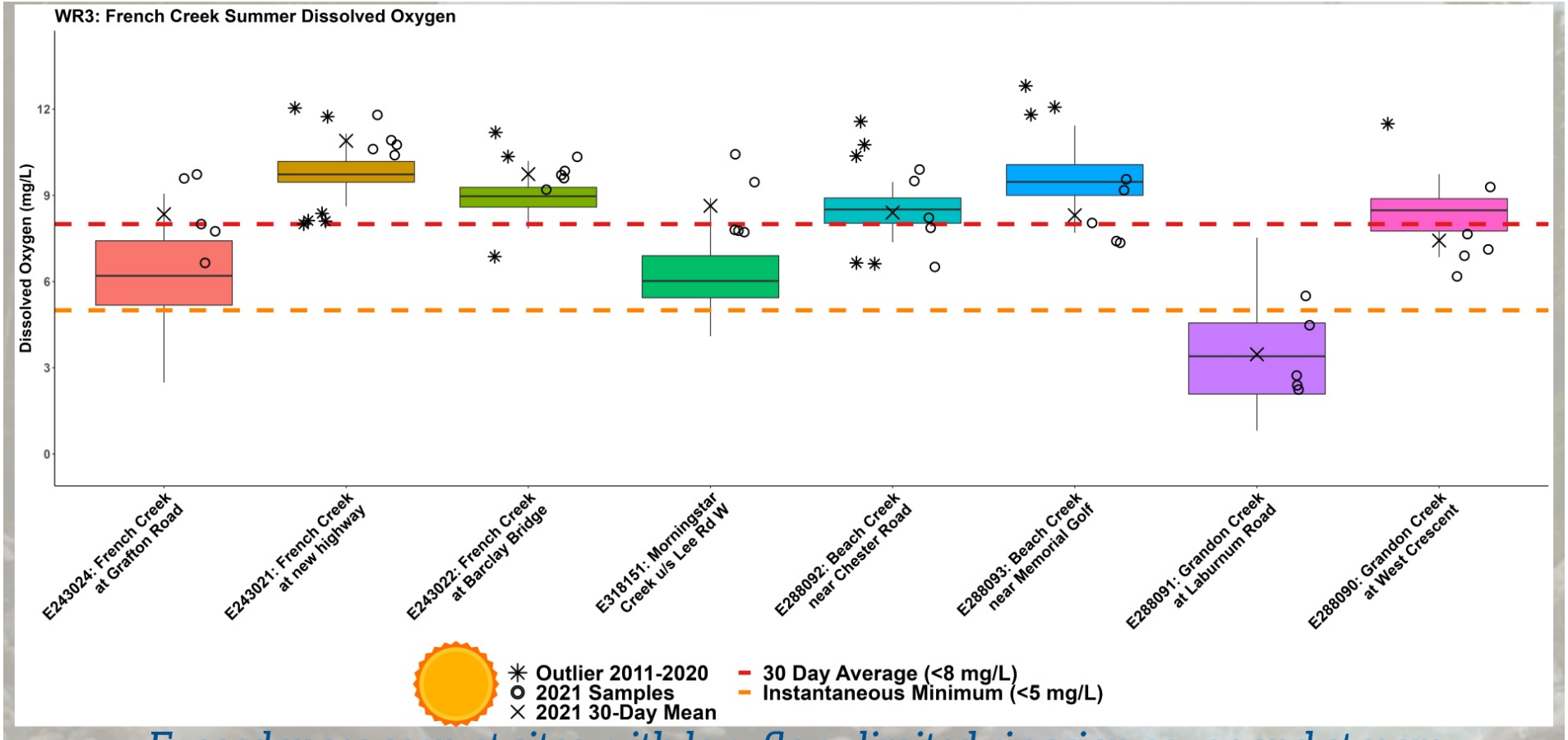
Exceedances most often recorded in summer low-flow sample period.

Can see occasional exceedances in fall sample period at sites with very low flow.

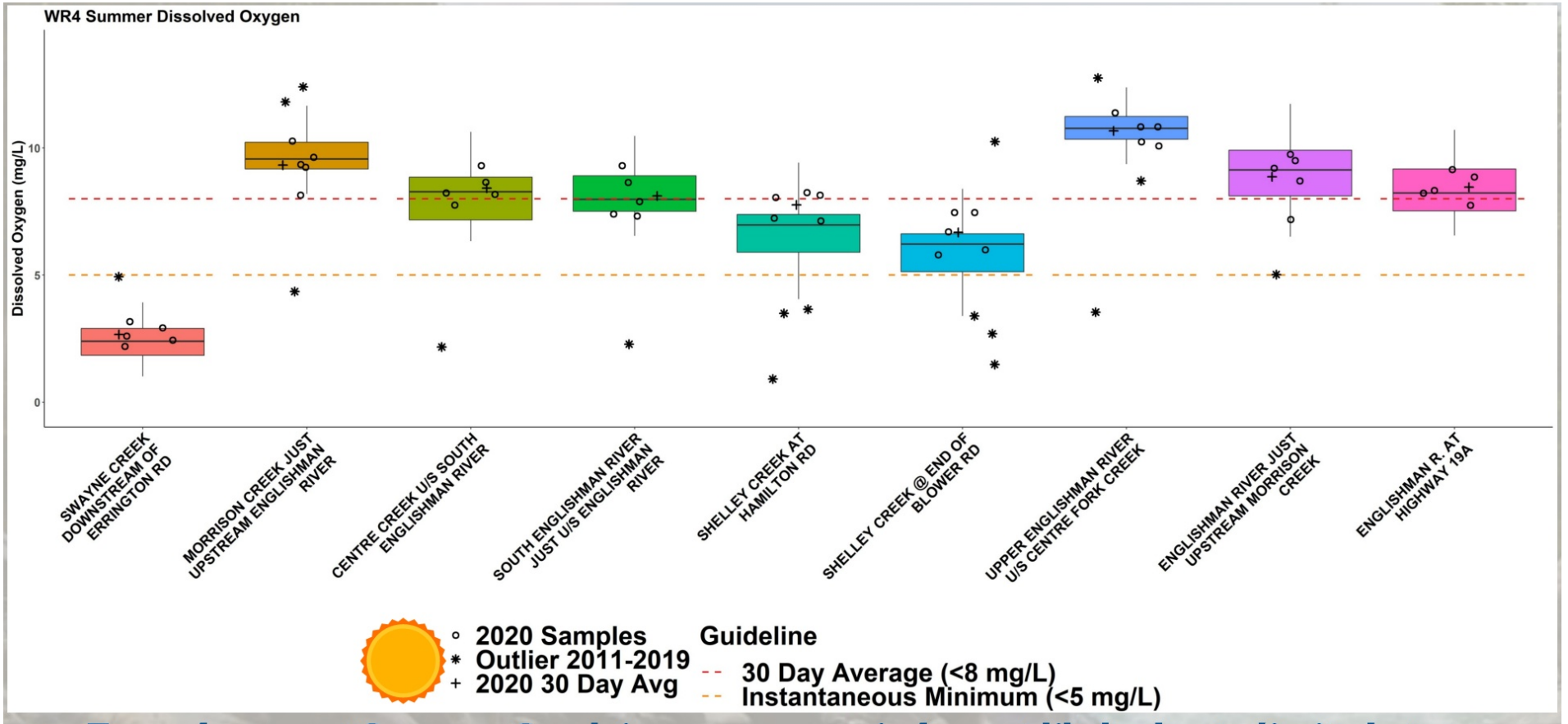
Dissolved Oxygen (DO) Aquatic Life WQG's:

- **5-in-30 day average should be at or above 8 mg/L.**
- **All readings should be above 5 mg/L (instantaneous minimum).**

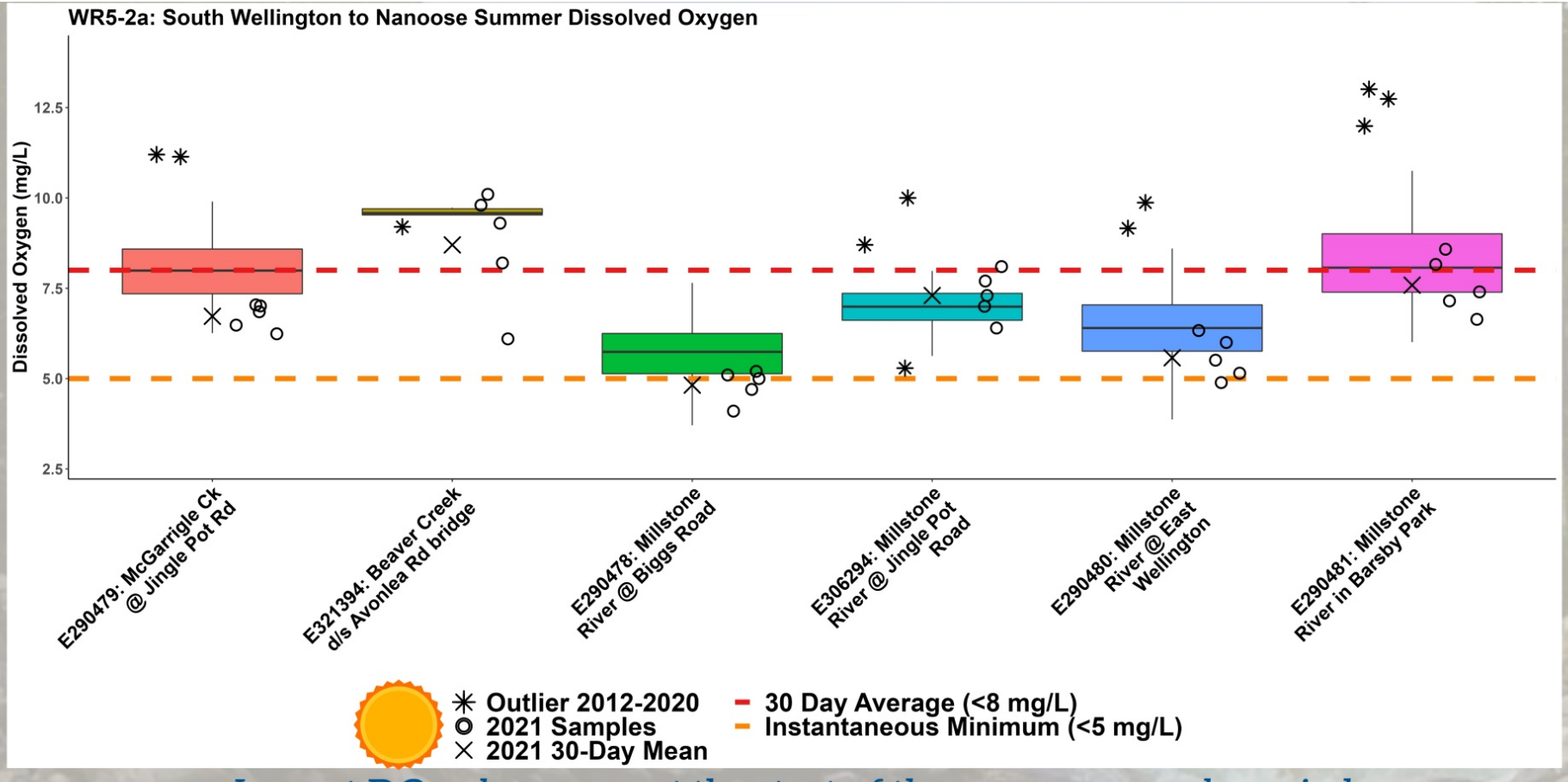
- Supports aquatic life.
- Most pristine coastal streams average >8 mg/L.
- **Influenced by water temp** (O_2 solubility decreases as temp increases); **photosynthesis** (O_2 produced); **BOD** (O_2 consumed); **water turbulence** (increases O_2 absorption); **and amount of flow** (related to temp & turbulence).



- *Exceedances seen at sites with low flow, limited riparian cover and stream structure, and upstream agricultural / high-nutrient land use.*
- *Occurred on dates with greater air temperatures (Aug. 3 and 10).*



- *Exceedances at Swayne Creek in summer period, most likely due to limited stream structure and low flows.*
- *Both Shelly Creek sites continuing to slightly improve - result of restoration efforts.*



- *Lowest DO values were at the start of the summer sample period.*
- *Second year of data for Beaver Creek, outflow of Divers Lake and tributary to Millstone.*
- *All WR5-2a sites except Beaver Creek (avg 8.7 mg/L) were below 30-day avg (8 mg/L).*

Dissolved Oxygen

Sites with Values Below the DO Instantaneous Minimum Guideline (5 mg/L):

Sites in **black** below had values <5mg/L in 2020.

Cottle Creek at Nottingham
Grandon at Laburnum
Mallett Creek
Millstone at Biggs
Millstone at E. Wellington
Richards Creek
Swayne at Errington
Walley u/s Beach

DO Aquatic Life Guidelines:

- 5-in-30 day avg ≤8 mg/L.
- Instantaneous min ≤5 mg/L.

- *Five of 70 sites sampled had subsurface flows during summer sample period.*
- *In 2021, there were 18 instances of values below 5 mg/L in the summer while there were no instances in the fall sample period.*

Dissolved Oxygen

Sites with Values Below the 8 mg/L 30-day Average:

Beck Creek
Cat Stream d/s Wakesiah
Cottle at Nottingham
Cottle at Stephenson Pt
Grandon at W. Crescent
Grandon at Laburnum
Holden Ck d/s Tiesu
Knarston Creek u/s Lantzville Rd
Mallett Creek
McGarrigle Creek
Millstone at Biggs
Millstone at E. Wellington
Millstone in Barsby Park
Millstone at Jingle Pot
Richards Creek
Swayne Creek
Walley d/s McGuffie
Walley u/s Beach

- All sites with readings below 5 mg/L were also below the 30-day average. These are in **black text** above.

Five sites were subsurface during summer sampling:

- Sites that were also subsurface in 2020: Haley Creek (Quennell Lake outflow), Holden Creek d/s Tiesu Rd.
- First time since sampling started sites subsurface: Wexford d/s Douglas, Wexford d/s Tenth, and Wexford u/s Seniors complex.

Dissolved Oxygen

- **Influenced by water temp** (O_2 solubility decreases as temp increases), **photosynthesis** (O_2 produced), **BOD** (O_2 consumed), **water turbulence** (increases O_2 absorption), and **amount of flow** (related to temp & turbulence).

Generally:

- *Occurred consistently at very low flow and low gradient sites.*
- *Increased nutrient inputs often lead to low DO.*
- *Riparian coverage (water temp) also a factor.*

Understanding DO exceedances:

- *Physical stream assessments - stream structure, riparian cover, etc.*
- *Flow & nutrient monitoring.*

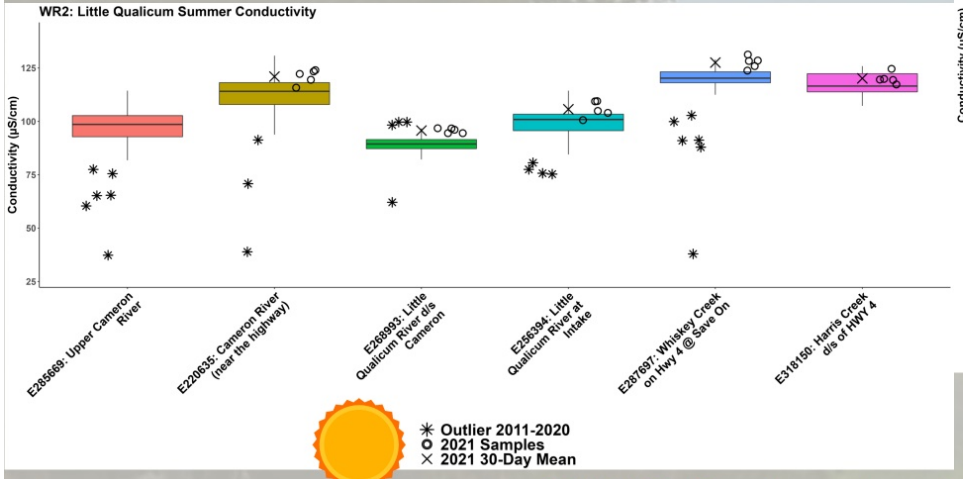
Addressing DO exceedances:

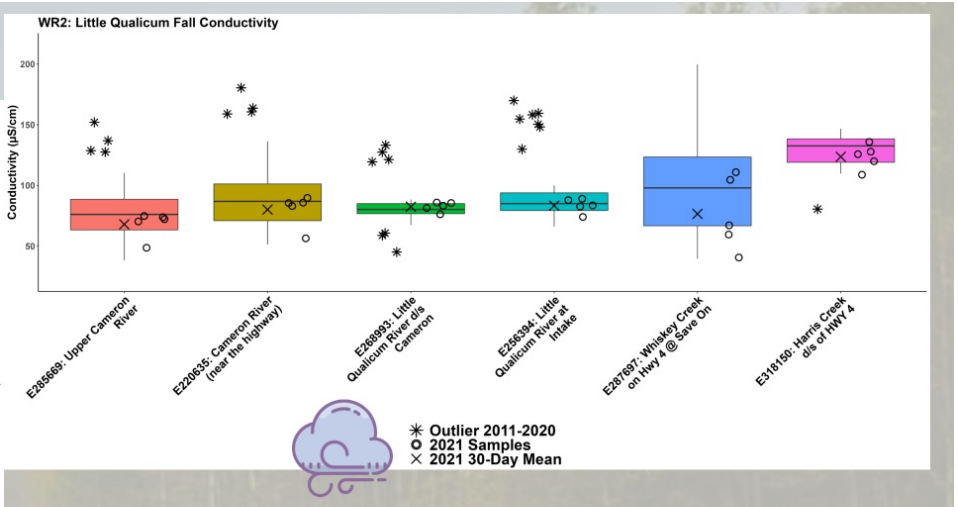
- *Improve temp (restoration & conservation).*
- *Increase stream complexity & structure (i.e., LWD).*
- *Minimize nutrient inputs through outreach & education.*

Specific Conductivity

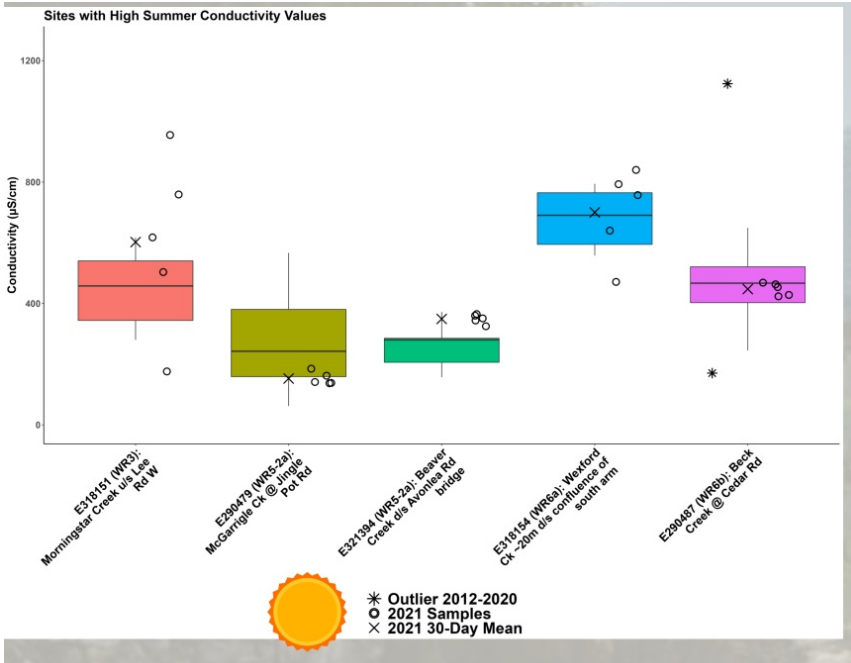
- **Most pristine coastal streams measure <80 uS/cm** *(may be higher if large groundwater influence).*
- **No provincial guideline for this parameter.**

- Measures the concentration, charge, and mobility of dissolved ions in water.
- Specific conductance (SpC) measures conductivity corrected to 25°C, standardizing readings.
- Influenced by water temperature, turbidity, groundwater, evaporation, pollution, and other saline inputs (i.e., sea water, road & agricultural run-off, etc.).
- Adds context when increases/decreases correlate to other parameters measured.



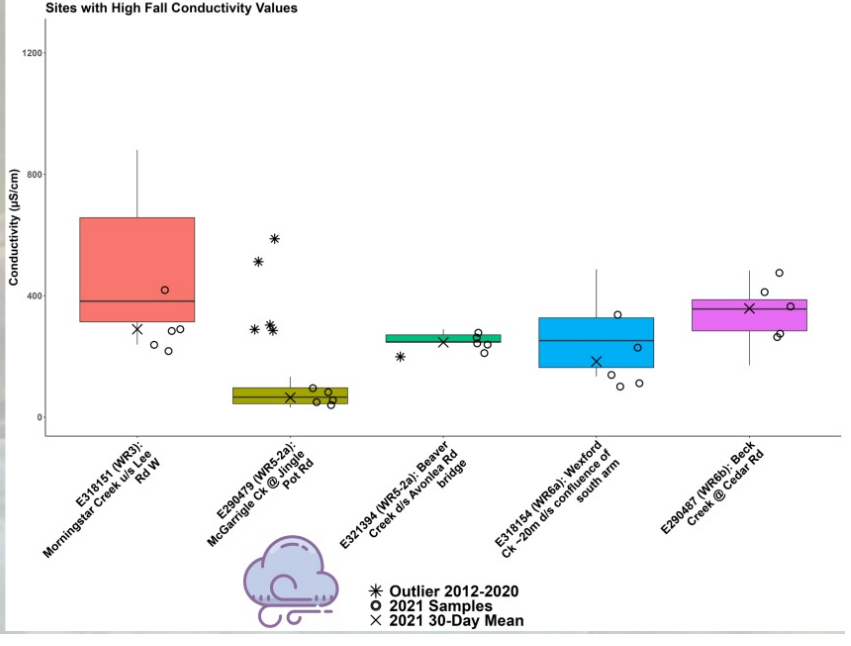


- *WR 2 displays typical seasonal changes.*
- *Summer values elevated in Cameron River - most likely due to groundwater influence.*
- *Little Qualicum d/s Cameron Lake similar values across seasons - primarily surface water influence at this site.*
- *Whiskey Ck in summer is high and fall is more variable - most likely due to road run-off.*
- *Results from other parameters on these dates support suppositions.*



These site readings could indicate naturally higher SpC or be associated with current or legacy anthropogenic influences.

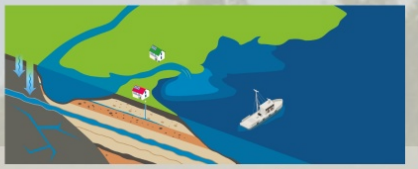
- *Morningstar has groundwater inputs and is d/s agricultural properties & a golf course.*



- *Beaver Creek and Wexford Creek sites have a multitude of human influences.*

- *Beck is downstream agriculture & highways, and has a coal mining history. More investigation is being completed at this site.*

Specific Conductivity (SpC)



SpC Readings ≥130µS/cm:

- 384 instances over Summer & Fall.
- **Occurred at 53 different sites.**
- 55% in Summer & 45% in Fall.
- **Watercourses in black below had sites with readings ≥130µS/cm on all 10 sample dates.**

Watercourses with Readings ≥130µS/cm:

- Annie
- Beach
- Beaver*
- Beck
- Bloods
- Cat*
- Centre
- Chase
- Cook
- Cottle*
- Departure
- French
- Grandon*
- Haley
- Harris
- Holden
- Knarston
- Mallett
- McGarrigle
- Millstone
- Morningstar
- Nanaimo
- Richards*
- Shelly
- S. Englishman
- Swayne
- Walley*
- Wexford
- Whiskey

*Values seen at all sites sampled on watercourse.

- Some watercourses may have naturally higher SpC levels.
- **Increases may correspond with increases in:**
  - water temperature,
  - turbidity,
  - groundwater,
  - evaporation,
  - pollution, and
  - saline inputs (i.e., sea water, road & agricultural run-off).

Most East coast Vancouver Isl. streams have both groundwater and human influences that impact conductivity.

Specific Conductivity (SpC)

Generally:

- *Summer Specific Conductivity values have less variability than fall values.*

- *Fall values have a larger range, usually from additional influences associated with rainfall - i.e. more turbidity from erosion and/or stormwater inputs.*

- **Adds context to other parameters when interpreting data.**

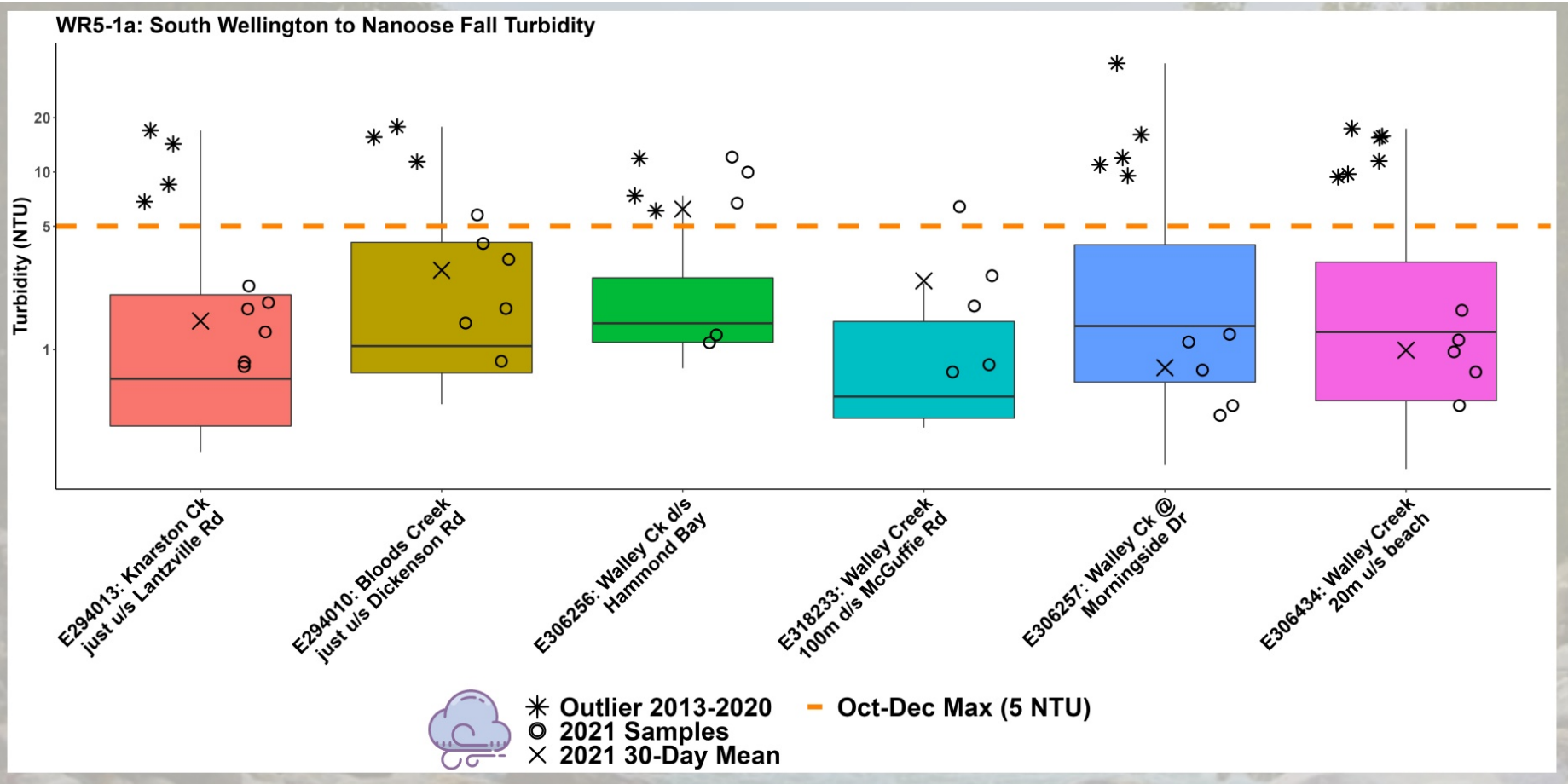
- *i.e., SpC levels >80µS/cm may indicate more groundwater contribution to flow (good) or increased turbidity or anthropogenic inputs entering stream (not good).*

Turbidity

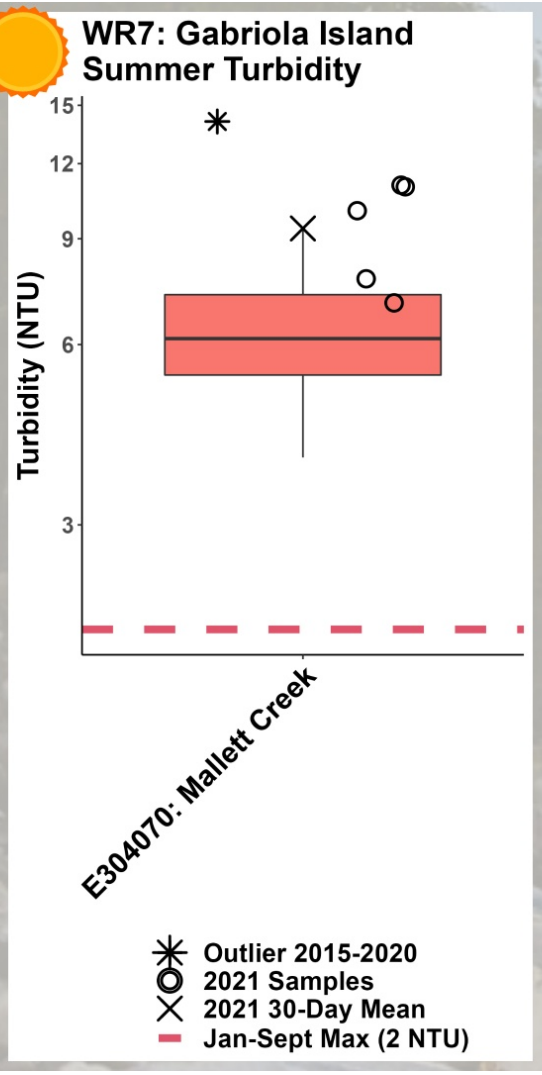
Turbidity (Turb) Aquatic Life Guidelines:

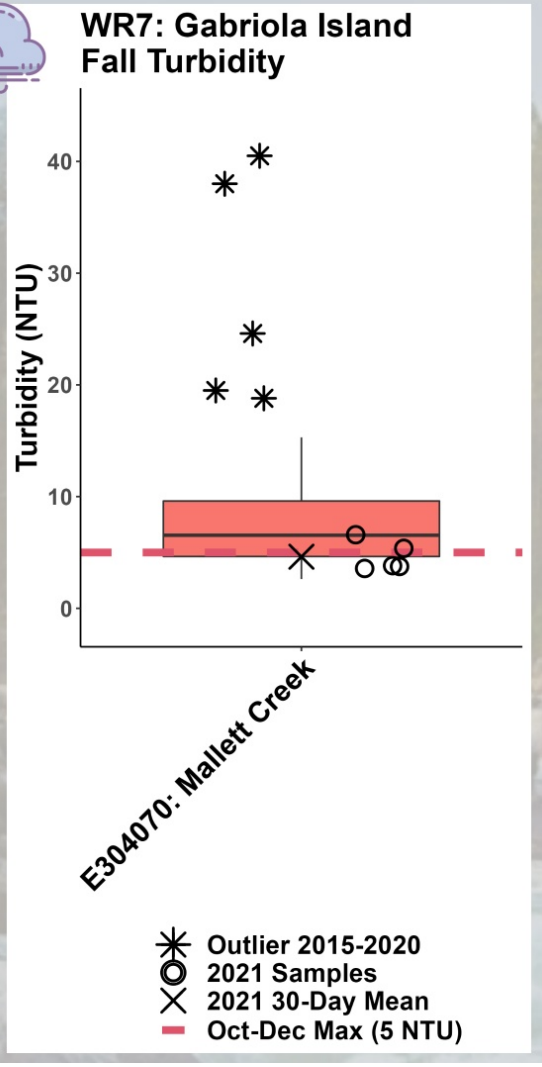
- **January to September (summer period) maximum 2 NTU.**
- **October to December (fall period) maximum 5 NTU.**

- A measure of water clarity via light reflected by suspended particles.
- **Increased turbidity can increase water temperature as suspended particles will absorb heat more efficiently.**
- Values vary in pristine streams generally <2 NTU.
- **Influenced by inputs from erosion, contaminants, rainwater, etc. Algal growth in summer months may increase turbidity readings.**



- *In WR5-1a, all fall exceedances correlate with rainfall events.*





- *Summer exceedances higher than in previous years - potentially due to upstream changes in watercourse and land-use?*
- *Mallett Creek generally has low flow and a high percent of fine sediment during the summer sample period.*
- *Fall turbidity lower than in previous years - potentially due to heavy flows washing fine sediment downstream.*

Summer Turbidity

- *Some high values are explained by field observations or weather on a given day.*
- *Urban streams much more difficult to interpret due to various anthropogenic influences.*

Sites with summer turb values ≥2 NTU

Once at:
- Joseph's Creek
- Knarston Creek
- Millstone at Barsby
- Millstone at Jingle Pot
- Nanaimo River at Cedar Rd

Twice at:
- Annie Creek
- Beck at Cedar Rd
- Swayne Creek

Three times at:
- Cat Stream at Albion
- Millstone at E. Wellington
- Walley d/s McGuffie

Four times at:
- Deep Bay Creek
- Grandon at Laburnum
- Harris Creek
- Richards Creek

Five times at:
- Beach Creek at Golf Course
- Cat Stream d/s Wakesiah
- Cottle Creek d/s Hammond Bay
- Mallett Creek
- Walley Creek d/s Hammond Bay

- *61 summer turb exceedances.*
- *Rainfall negligible throughout summer sample period <0.4 mm within 48 hours of sampling.*
- *Recorded values most likely due to anthropogenic influences or algal growth.*

Fall Turbidity

- *In 2017, 53 of the 63 fall exceedances were experienced after heavy rain events (84%).*
- *In 2018, 18 fall turb exceedances - fall flush was not captured at all sites.*
- *In 2019, 17 of 18 fall exceedances coincide with rain (94%).*
- *In 2020, 84 of 91 fall exceedances occurred on days with rainfall (92%).*
- *In 2021, 26 of 34 fall exceedances occurred on days with rainfall (76%).*

Sites with fall turb values ≥5 NTU

One exceedance:

- Beach Creek at golf course
- Bloods Creek
- Cameron River
- Englishman River at Hwy 19
- Englishman u/s Morison
- French at New Hwy
- Grandon at W. Crescent
- Millstone at Barsby
- Morison Creek
- S. Englishman River
- Wexford d/s Douglas
- Wexford d/s Tenth
- Walley d/s McGuffie

Two exceedances:

- Harris Creek
- Mallett Creek
- Swayne Creek

Three exceedances:

- Annie Creek (2)
- Morningstar Creek (2)
- Shelly Creek at Blower (2)
- Shelly Creek at Hamilton (2)
- Walley Creek d/s Hammond Bay

(#) exceedances that did NOT coincide with a rain event. All occurred on Oct. 19 and Nov. 2.

Turbidity

Addressing summer turb:

- To decrease algal growth, limit nutrients entering the watercourse & promote cooler temp with shading riparian vegetation.

- Community awareness of stream and streambank protection when recreating in summer months.

Potential causes of turb:

- Summer algal growth.
- Stream bank erosion.
- Storm drain inputs.
- Other anthropogenic influences.

Taking action:

- Streamside outreach & education - how to protect the watercourse in your backyard.
- Physical stream assessments to determine best locations for restoration & stabilization projects.
- Implementation of green infrastructure.

Addressing fall turb:

- Riparian restoration & streambank stabilization to prevent erosion.

- Rainwater management to slow & infiltration before inputs enter streams.

Overall

Data:

- The data collected through the CWMN is a cornerstone to the RDN's DWWP program.
- Serves as a baseline and record of regional water quality.
- Has and continues to support and feed into dozens of projects and studies that help to better understand issues in our region and advocate for protection of our watersheds.

Streamkeepers:

- Volunteers from dozens of organizations have dedicated their valuable time gathering baseline data.
- Know their streams and advocate diligently to protect them.
- Complete citizen science to a high standard so data collected can be confidently used.
- Keep the CWMN going, a program modeled in other communities.

Photo courtesy of Island Waters Fly Fishers

Additional Lab Analysis in 2021

1. CWMN Quality Assurance Quality Control.

2. Nutrient Sampling in partnership with Ministry of Environment and Climate Change Strategy (ENV).

Quality Assurance Quality Control

Replicate Quality Assurance Quality Control (QA/QC) sampling was completed to validate field readings.

- *QA/QC samples are taken before CWMN field samples and shipped to the lab for analysis.*
- *Sponsored by Mosaic Forest Management.*
- *Best practice to complete QA/QC at 10% of the sites.*
- *In 2021, nine out of 70 sites had QA/QC samples for both turbidity and conductivity.*
  - *Turbidity samples to validate LaMotte meter readings.*
  - *Conductivity samples to validate YSI ProQuatro meter readings.*

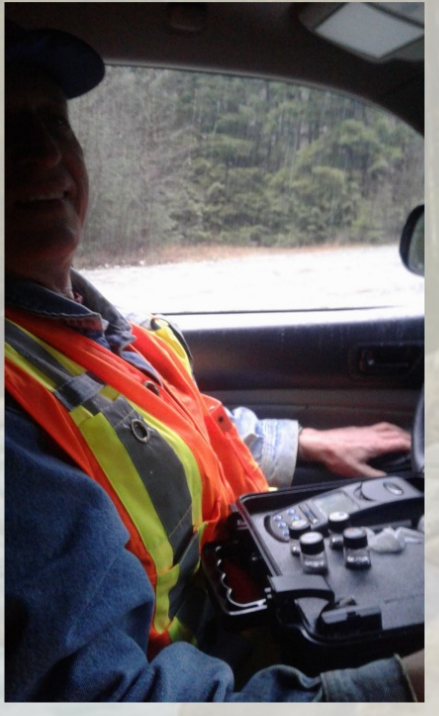
QA/QC

RESULTS:

- 88% of turbidity samples met QA/QC thresholds.
- 96% of SpC samples met QA/QC requirements.
- CWMN sampling protocols & methodologies validated.
- **Volunteer participation in annual training sessions maintain high standard of data collection! Thank you!**

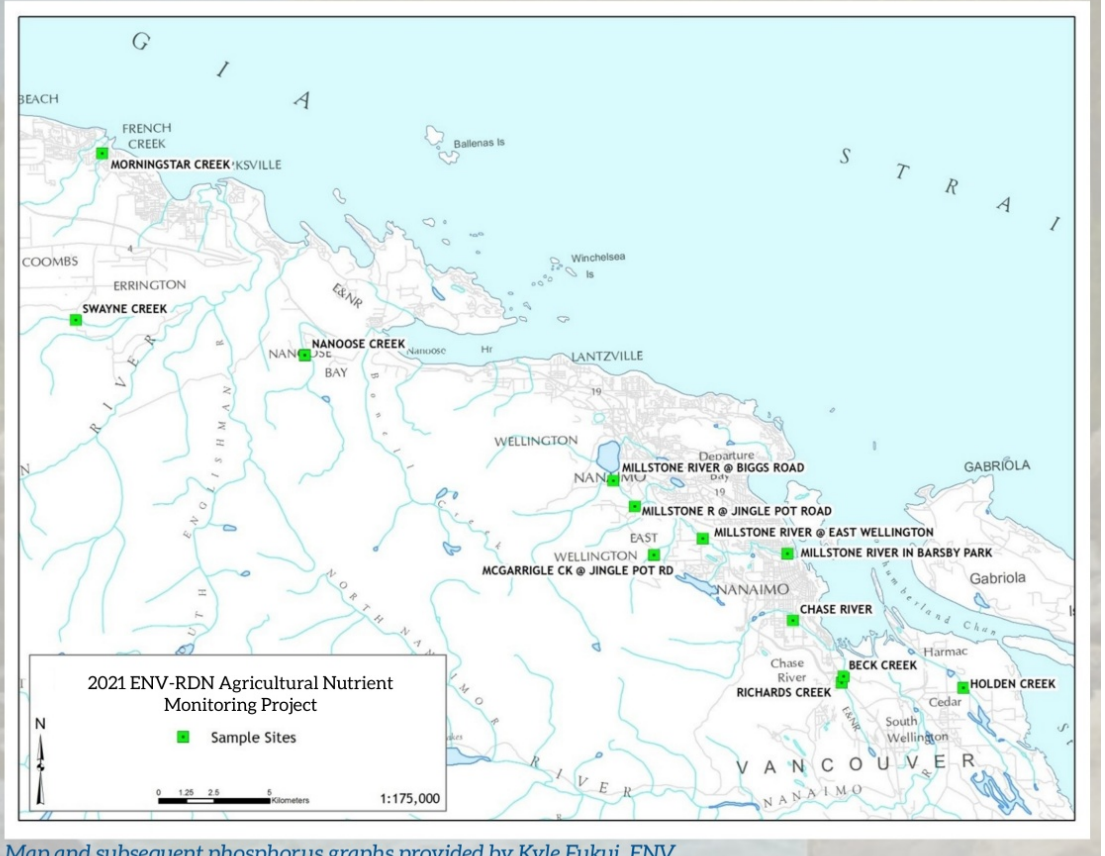
LESSONS:

- Equipment calibrated and in good working order.
- Sample bottle in water column (does not touch stream bed).
- Raining? Complete turbidity analysis under cover.
- Record any potential water quality impacts in field notes.



ENV-RDN Nutrient Sampling

- *Nutrient Sampling completed at sites recommended in 2018 and 2021 Ecoscape **CWMN Trend Reports** (rdn.bc.ca/cwmn).*
- *Goal: to discern if analytes considered a **proxy for agriculture run-off** are impacting water quality.*
- *Parameters analyzed: **T-Phosphorus**, Nitrate (free w/Nitrate: nitrate/nitrite, T-organic, T-kjedal nitrogen), Turbidity, T-Metals, and E. coli.*
- *Completed at **12 CWMN sites** in WR3, WR4, WR5, and WR6.*
- *Data analyzed by ENV to determine potential impacts associated with agricultural activity and rainwater runoff. Report will be released and shared with CWMN network later this year.*



Map and subsequent phosphorus graphs provided by Kyle Fukui, ENV

Total Phosphorus

Why T-Phosphorus?

- Vancouver Island (VI) streams are phosphorus limited.
- Levels slightly higher than background can have exponential adverse effects (i.e., excessive algal growth).
- Potential sources: agriculture, failing septic fields, effluent, residential land practices.

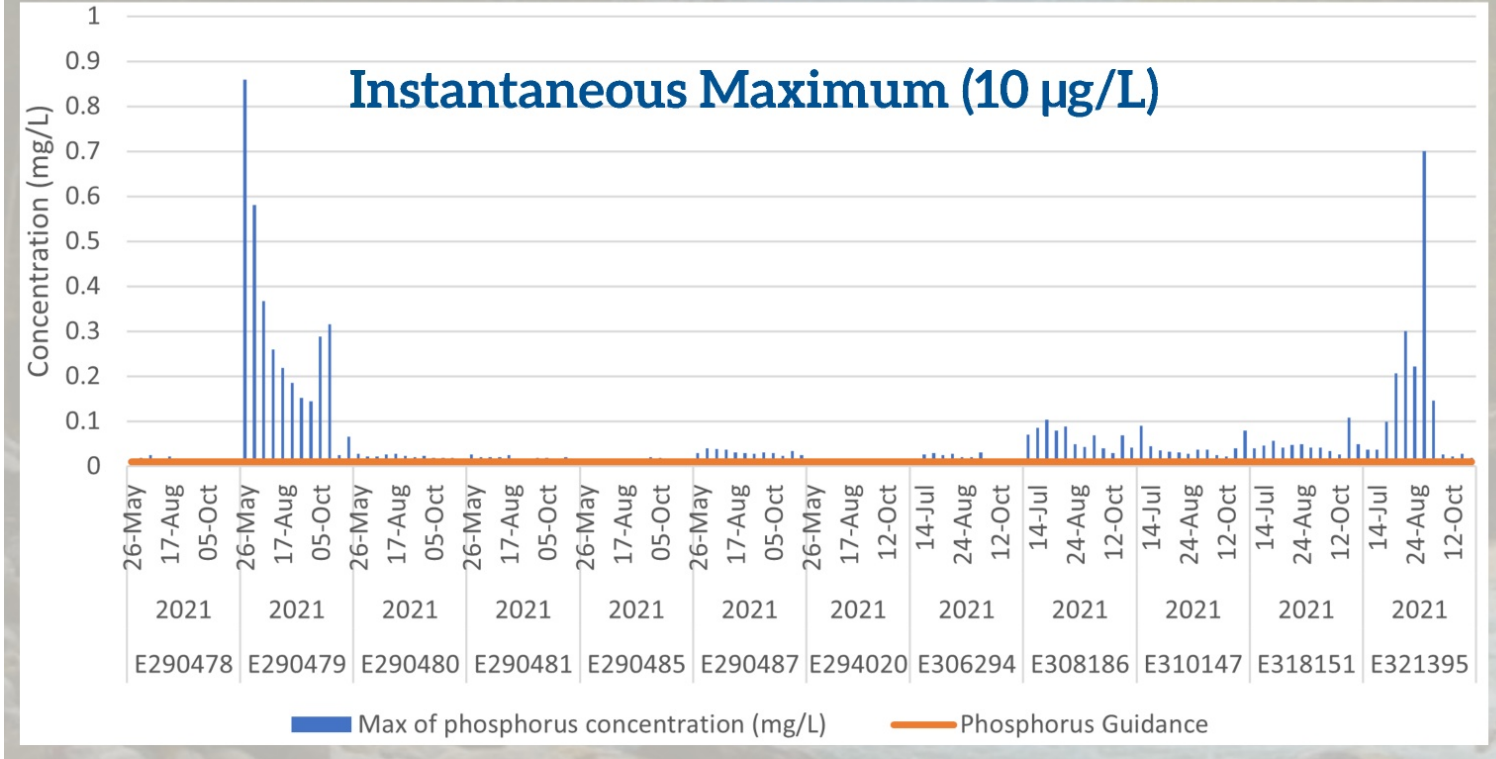
2014 ENV Guiding Document:

- To proactively manage Vancouver Island nutrients in fresh water systems, the following has been recommended:
  - Instantaneous maximum of 10 µg/L (0.01 mg/L)
  - 5-month average maximum of 5 µg/L (0.005 mg/L)

Sampling frequency:

- Monthly for five consecutive months (May-Sept, growing season & lowest flows).
- Both 5-in-30 CWMN sample periods (lowest flows & fall flush).

T-Phosphorus Results



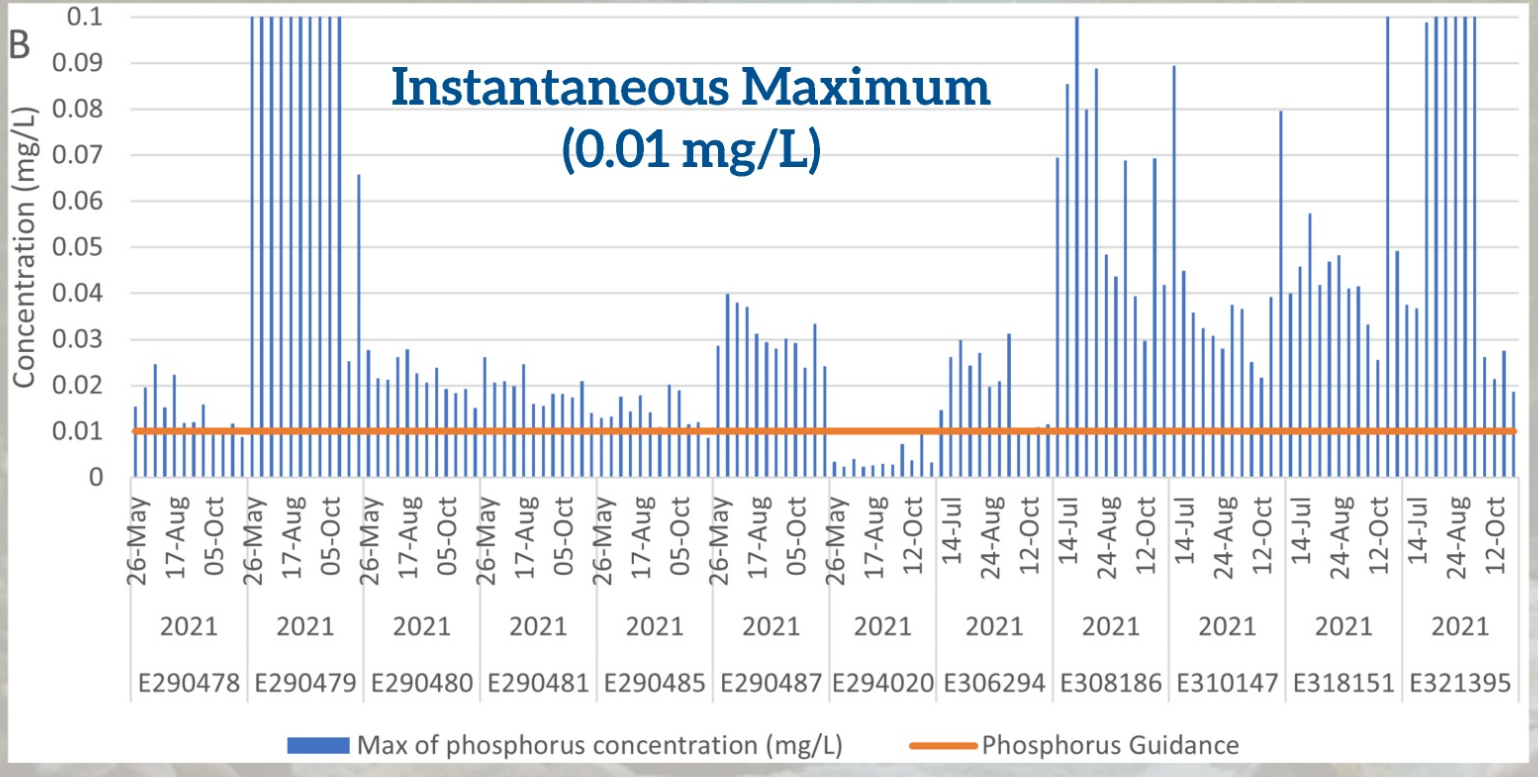
Two sites consistently had readings way above instantaneous maximum guidance values:

1. McGarrigle Creek (E290479), and

2. Richards Creek (E321395).

CWMN sites from left to right: Millstone at Biggs (E290478), **McGarrigle Creek (E290479)**, Millstone at E. Wellington (E290480), Millstone Barsby Park (E290481), Chase River at Park (E290485), Beck Creek (E290487), Nanoose Creek at Matthew (E294020), Millstone at Jingle Pot (E306294), Swayne Creek (E308186), Holden Creek at Lazo (E310147), Morningstar Creek (E318151), and **Richards Creek (E321395)**.

T-Phosphorus Results

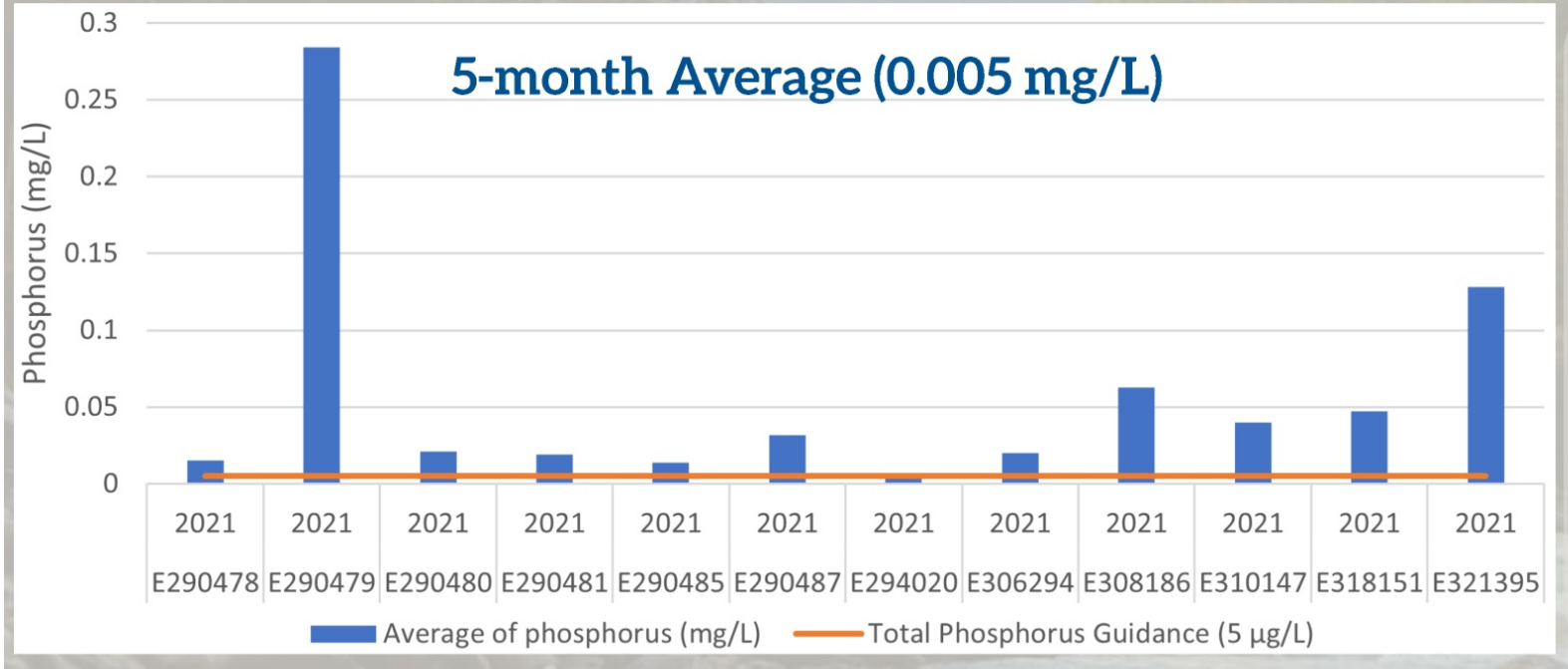


All sites sampled had readings above recommended instantaneous maximum except for the reference site Nanoose at Matthew Crossing (E294020).

Swayne Creek (E308186) values were much lower than in 2019!

CWMN sites from left to right: Millstone at Biggs (E290478), McGarrigle Creek (E290479), Millstone at E. Wellington (E290480), Millstone Barsby Park (E290481), Chase River at Park (E290485), Beck Creek (E290487), **Nanoose Creek at Matthew (E294020)**, Millstone at Jingle Pot (E306294), Swayne Creek (E308186), Holden Creek at Lazo (E310147), Morningstar Creek (E318151), and Richards Creek (E321395).

T-Phosphorus Results



All sites had readings above recommended 5-month average except Nanoose Creek (E294020) reference site.

Both McGarrigle Creek (E290479) & Richards Creek (E321395) had much higher phosphorus averages compared to other sites sampled.

CWMN sites from left to right: Millstone at Biggs (E290478), McGarrigle Creek (E290479), Millstone at E. Wellington (E290480), Millstone Barsby Park (E290481), Chase River at Park (E290485), Beck Creek (E290487), **Nanoose Creek at Matthew (E294020)**, Millstone at Jingle Pot (E306294), Swayne Creek (E308186), Holden Creek at Lazo (E310147), Morningstar Creek (E318151), and Richards Creek (E321395).

Nutrient Study Analysis

Total Phosphorus levels:

- Two sites consistently had readings above both instantaneous maximum and 5-month average guidance values:
    1. McGarrigle Creek (E290479), upstream land uses being investigated by provincial enforcement and regulators who implement the AEM Code of Practice.
    2. Richards Creek (E321395), concentrations increased over summer due to lack of flow (isolated pool).

Overall, ENV nutrient analysis indicates:

- Nanoose Creek, Swayne Creek, Beck Creek, and upper Millstone River had nutrients and metals levels within the ranges of acceptable levels = generally better water quality.
- Morningstar Creek, McGarrigle Creek, Chase River, Richards Creek, Holden Creek, and lower Millstone River had nutrients and/or metals levels in exceedance of acceptable levels = generally poorer water quality.

Land-uses upstream:

- The following have the potential to negatively impact water quality: agricultural activity, land-based aquaculture, septic systems, residential yards and gardens, and impervious surfaces in urban areas where there is likely greater rainwater runoff.

Nutrient Study Findings

Conclusion:

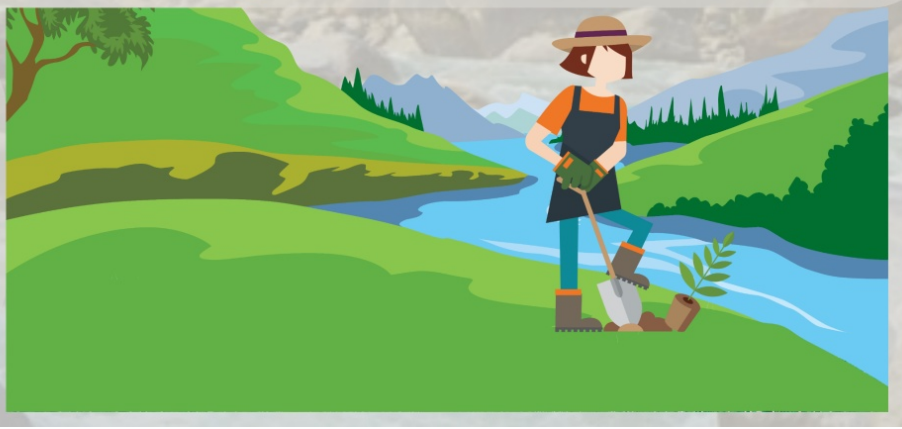
- Monitoring results confirm suspected nutrient inputs from local land uses.
- Support the need for reduction of nutrient inputs into watercourses.
- Data collected will act as baseline data during implementation of the 2018 Agricultural Environmental Management Code of Practice (AEM Code), a 10-year process.
- As AEM Code implementation continues and is enforced, water quality in the study area should improve.

Recommendations:

- Future nutrient monitoring should also include dissolved metals.
- Increase outreach and education on nutrient impacts from rainwater runoff.
- Need for targeted communications on nutrient management to agricultural/rural residential landowners.
- At McGarrigle Creek, future monitoring to confirm land uses in compliance.

Community Action:

- Riparian restoration - removal of invasive species, native plantings.
- Education & outreach - fertilizer use, septic field maintenance, stream-side landowners.
- Nutrient management - best practices for industry/agriculture areas.



Additional Lab Analysis in 2022

1. QA/QC:
   - For turbidity and conductivity will be completed at 10% of the sites.

2. Analysis of additional parameters:
   - Paused in 2022.
   - Focus on outreach, education, stewardship support, and related projects.

Stewardship Support

With **multiple years of data** we can **identify sites** that have consistent water quality concerns, and **support community actions** to address those concerns.

This includes **prioritizing sites for restoration and enhancement works** undertaken by stewards, and **providing funding partnerships and tools** for these efforts.

Supporting additional monitoring to help direct restoration efforts, i.e., physical stream assessments using Urban Salmon Habitat Program methodology.

Stewardship Seed Funding

- **RDN's DWWP program supports efforts of stewardship groups to take community-level action to monitor, restore and enhance local waterways.**
- Funding priority: non-profit organizations that have previously partnered with the DWWP program.
- Eligible projects can apply for up to $5000 per project.
- Since 2016, 23 projects have been supported across the region.
- This year, funding has been allocated to support 4 projects across the region.

Photo credit: David Cotton (QBSS 2020)

To Apply For Funding:

rdn.bc.ca/stewardship-seed-funding

Tool Lending Library

- **DWWP program has a tool kit to help with your streamside projects!**
- Borrow items for your restoration and enhancement projects.
- Dibbler, loppers, shears, rakes, trowels, shovels (tree and spade), extractigator jr., hose, etc.
- **Is there a tool or equipment you would like to see in the library? Send requests & ideas to waterstewardship@rdn.bc.ca**


Photo credits: NALT & Alder Environmental.

To Borrow Equipment:

rdn.bc.ca/tool-lending-library

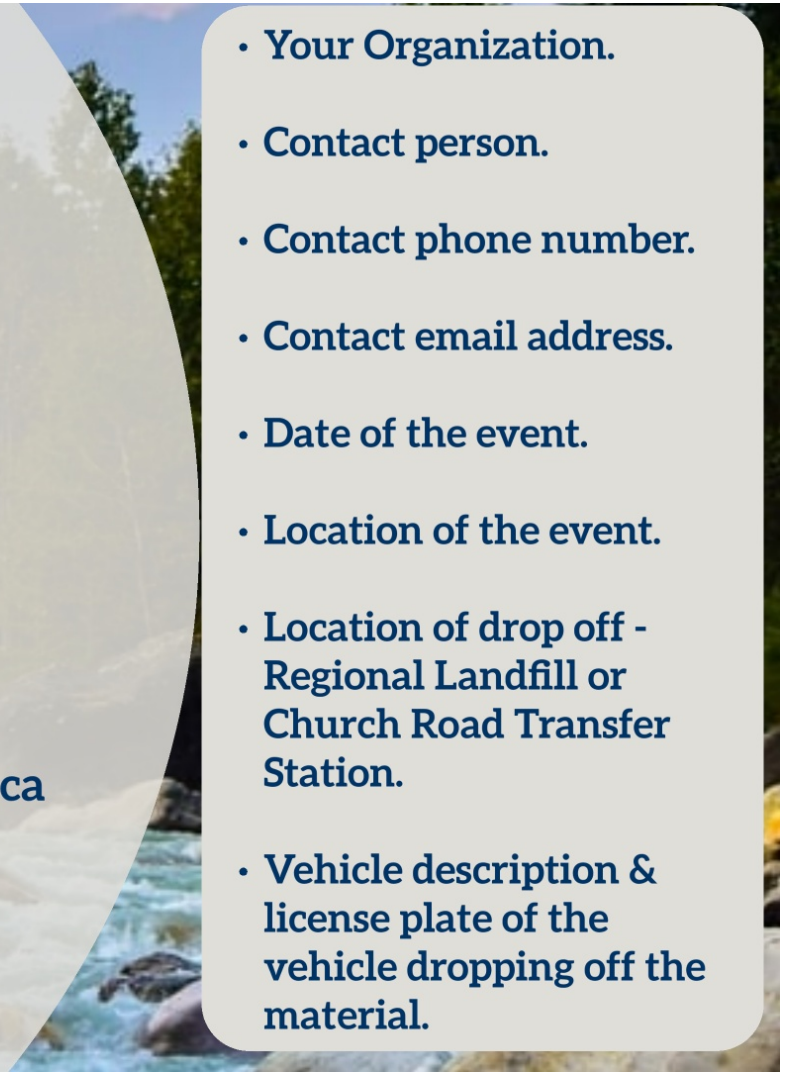
Waiving Tipping Fees

- **The RDN wants to support your community clean up by providing free disposal at the Regional Landfill or Church Road Transfer Station.**

- To have your tipping fees waived - apply to the RDN **at least five business days before** your community clean up.

- **Phone: 250-390-6560 or Email: zerowaste@rdn.bc.ca**

More Info. at:
rdn.bc.ca/community-clean-up



- **Your Organization.**
- **Contact person.**
- **Contact phone number.**
- **Contact email address.**
- **Date of the event.**
- **Location of the event.**
- **Location of drop off - Regional Landfill or Church Road Transfer Station.**
- **Vehicle description & license plate of the vehicle dropping off the material.**

New! DWWP Monitoring & Stewardship GetInvolved Page

Private online open-environment platform for CWMN members and other partner stewardship groups to:

- stay connected with DWWP initiatives,
- highlight their group and the work that they are doing,
- share project updates and ideas,
- recruit volunteers from other groups,
- find resources and information to support,
- and more!

Members will need an account to access and participate - contact **waterstewardship@rdn.bc.ca** to sign-up!

Register and add a comment, story, idea, or pin on the map by **August 5th** to be entered in a draw for a prize!

www.getinvolved.rdn.ca/dwwp-monitoring-and-stewardship-network

CWMN Monitoring

- Annual Training Session
- New Equipment
- 2023 & Beyond

Annual Training

July Training

- Dates being scheduled for July 21 - 27 via Doodle poll.
- **Mandatory for participants completing 2022 sampling & using CWMN equipment.**

Group Sessions

- Maximum of 16 participants & 2 RDN staff.
- **Outdoor, stream-side locations: Nile Creek, French Creek, & Millstone River.**
- All equipment sanitized.

Focused

- Mandatory viewing of background content & sign-off before in-person training.
- **In-person training session will focus on:**
  1) Equipment Calibration
  2) Sampling Procedure

CWMN Sampling - New Equipment

RATIONAL:

- LaMotte 2020we meters first purchased in 2011.
- Repairs on meters older than 2014 no longer supported.

EQUIPMENT SELECTED:

- Hach 2100Q Portable Turbidimeter
- Will be introduced in 2022

LaMotte 2020we meter (left); Hach 2100Q (right)

CWMN Findings

- *Land use is highly correlated to water quality.*
- *Outreach and education makes a difference - e.g., voluntary compliance.*
- *Stewardship and enhancement done right works!*
- *Partnerships and collaboration are key in protecting watersheds.*
- *Streamkeepers are the boots on the ground that maintain and improve our watersheds!*

Watershed Context

- *CWMN chemical analysis highlights sites and creeks that need more investigation, continued stewardship, and enhancement.*
- *Additional avenues of monitoring and stewardship can gather more baseline data and tell more of a streams story.*
- *Avenues include biological monitoring, physical stream assessments, sampling for additional chemical parameters, and hydrometric stations (continuous monitoring).*

Looking to 2023 & Beyond

Water Chemistry
- CWMN (5-in-30's DO, SpC, Temp, Turb)
- additional lab analysis (nutrient, P-T, E. coli, Cl, metals, etc.)
- Agriculture land use monitoring

Reporting
- trend analysis and professional recommendations based on collected data to inform future activities, policy advocacy, and additional stewardship activities (nodes)

Physical
- USHP (physical stream surveys)
- Riaprian Spatial Analysis (regional riparian cover/deficit)
- Geomorphology Studies (channel stability)

Restoration/Stewardship
- riparian planting
- stream structure enhancement
- targeted outreach/education
- stormwater management
- best management practices

Monitoring Water Bodies
- Lake monitoring (BCLSS)
- Wetland monitoring (MABRRI)

Hydrometric
- staff/level gauges
- rain gauges
- manual discharge measurements (i.e., flow tracker)
- continuous flow stations (i.e., province, BCCF, trained streamkeepers)

Biological
- CABIN via parternships (i.e., ENV-RDN, DFO-ENV-RDN, streamkeepers)
- Streamkeeper smolt traps/counts
- BioBlitz

Recommendations and prioritization for future avenues of monitoring and stewardship.

Related Projects

- Data collected through the CWMN has inspired others to collect data, continues to feed into other projects and programs, and supports better decision making within our region.
- Related projects to highlight in 2022:
  - ENV Stewardship Framework
  - RDN Riparian Spatial Analysis
  - Regional Strategy for Rainwater Management

BC ENV Stewardship Framework

- Lead by Monitoring, Assessment and Stewardship Team, Environmental Protection Division (EPD), BC ENV.
- Stewards want to collect data, but provincial manuals aimed at technical experts - errors or omissions in procedures.
- Needs/gaps analysis in 2020 as part of Collaborative Water Monitoring and Reporting Initiative identified the need for provincial toolbox.
- Creation of Water Quality Stewardship Toolbox provides the resources for those that want to collect data to provincial standards and promotes standardized methodologies across BC.

Water Quality Stewardship Toolbox

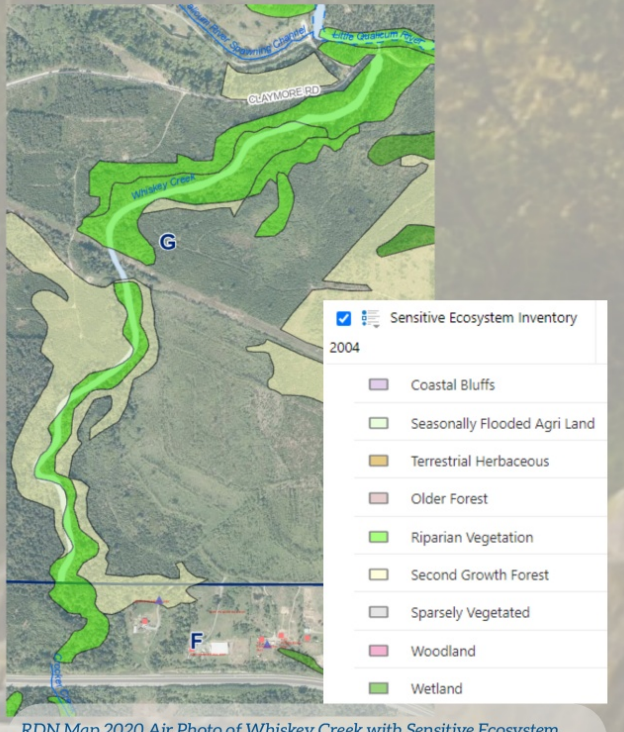
- Toolbox will:
  - clearly outline field procedures,
  - help groups plan monitoring programs and report out on data collected,
  - allow groups to complete self-assessments and self-audits,
  - provide contact forms to track help requests,
  - facilitate collaboration with other monitoring teams (e.g., BC Lake Stewardship Society).

- Website with tools and support documents will be live later this year! Feedback is welcome!

- Notification will be sent out through partner monitoring networks (e.g., CWMN) when toolbox is available.

Riparian Spatial Analysis

- Riparian Spatial Analysis is a desktop compilation of watershed characteristics (canopy cover, soil type, species characterization, etc.) and environmental layers (water quality monitoring locations and results, previous restoration sites, etc.) with a prioritization analysis for restoration or enhancement.
- Main deliverable will be an interactive public mapping tool that will support and inform decision makers, practitioners, and community members in restoration and enhancement efforts.
- Analysis completed by McTavish Resource & Management Consultants Ltd.
- Mapping tool will be presented to streamkeepers July 8, 2022.



RDN Map 2020 Air Photo of Whiskey Creek with Sensitive Ecosystem Inventory Layer

Regional Strategy for Rainwater Management

Key Elements:

Foundation Setting Studies & Assessments
Watershed studies, monitoring, regional climate change assessment, funding options assessment

Development of Performance Targets
Release rate, retention volume, recharge volume, water quality

Implementation tools
Design standards and specifications, guidance documents / manuals, policies, bylaws, DPAs, strategic planning tools.


REGIONAL DISTRICT OF NANAIMO
THANK YOU FOR YOUR PARTICIPATION!
Question & Answer Period
1. Type your question in the meeting chat box, or
2. Hit the 'raise hand' icon and we will call on you & turn your microphone on so you may ask a question verbally.
Erica Forssman (RDN) eforssman@rdn.bc.ca
Rosie Barlak (ENV) Rosie.Barlak@gov.bc.ca
Lauren Fegan (RDN) lfegan@rdn.bc.ca
Capri Brugge (RDN) cbrugge@rdn.bc.ca