2018 Community Watershed Monitoring Network Results

presented by Julie Pisani & Lauren Fegan

Introduction

- Julie Pisani, Drinking Water & Watershed Protection Program Coordinator

- Lauren Fegan, Drinking Water & Watershed Protection Special Projects Assistant

REGIONAL DISTRICT OF NANAIMO

DRINKING WATER WATERSHED PROTECTION

Outline of Today's Results Session

- Program Overview
- Trend Analysis 2011-2017
- 2018 Results
- RDN Stewardship Group Support
- 2019 Monitoring Season Update
- Questions?

Thank you to…

Community Stewardship Groups

- Fanny Bay Salmonid Enhancement Society (FBSES)
- Nile Creek Enhancement Society (NCES)
- Qualicum Beach Streamkeepers (QBS)
- Friends of French Creek Conservation Society (FFCCS)
- Mid Vancouver Island Habitat Enhancement Society (MVIHES)
- Lantzville & Nanoose Streamkeepers Society (LNS & NSS)
- Island Waters Fly Fishers (IWFF A & B)
- Walley Creek Streamkeepers (WCS)
- Departure Creek Streamkeepers (DCS)
- Vancouver Island University Research Lab (VIU)
- Nanaimo and Area Land Trust (NALT)
- Gabriola Streamkeepers (GSk)

Other Partners

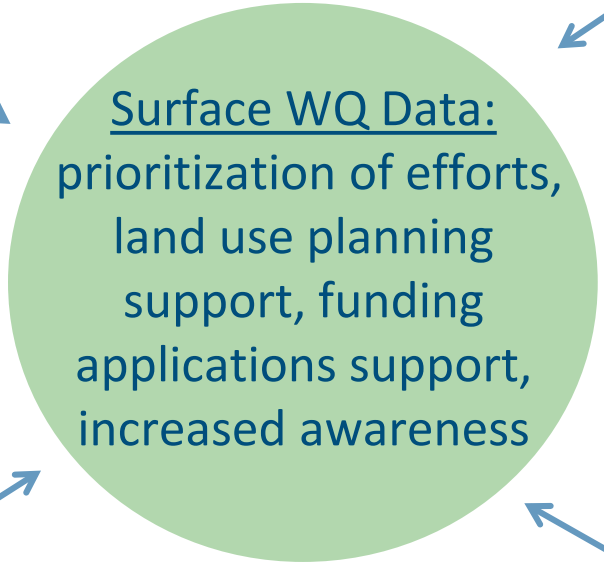
- BC Ministry of Environment and Climate Change Strategy (ENV)
- Island Timberlands LP (IT under Mosaic Forest Management)

DRINKING WATER WATERSHED PROTECTION

Community Watershed Monitoring Network Partners

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

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



Community Stewardship Groups – attend annual training, perform equipment calibrations & sampling, provide local knowledge

Island Timberlands (Mosaic Forest Management): provide safety gear, land access, QA/QC lab analysis sponsorship

Water Quality Monitoring Parameters

Dissolved Oxygen

- supports aquatic life
- lower when flows are lower

Turbidity

- particles in water linked to higher levels of contaminants
- QA/QC lab analysis

Temperature

- affects processes in water and in aquatic life

Specific Conductivity

- ability to conduct electric current
- higher when more dissolved minerals, higher turbidity or less dilution

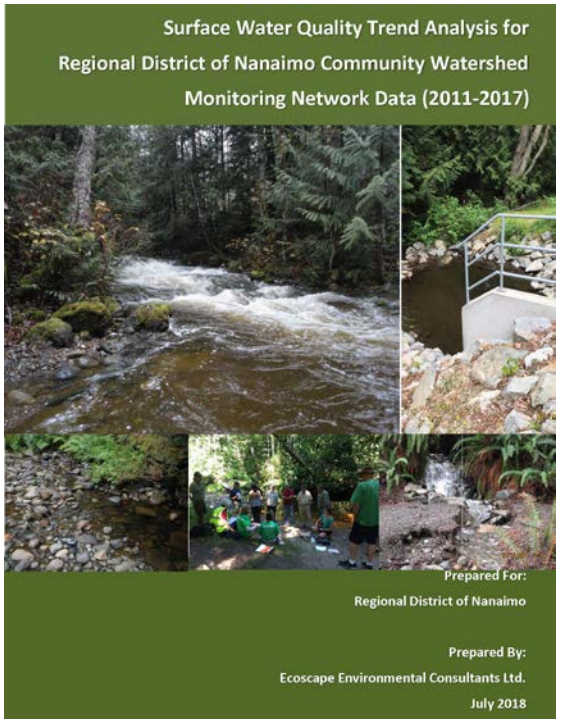
Water Quality Objectives & Guidelines

- **Water Quality Objective**
  - Developed for **specific water bodies** manage for water quality to protect water uses in that watershed
  - i.e. Englishman River Aesthetic Water Temperature Objective ≤15^{o}C
- **Water Quality Guideline**
  - Developed 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
  - i.e. Coho Rearing Water Temperature Guideline ≤17^{o}C

Analyzing Trends

A comprehensive analysis of the 7-year dataset was completed by Ecoscape Environmental Consultants, expert water quality biologists. The analysis considered land use data to investigate influence on water quality trends.

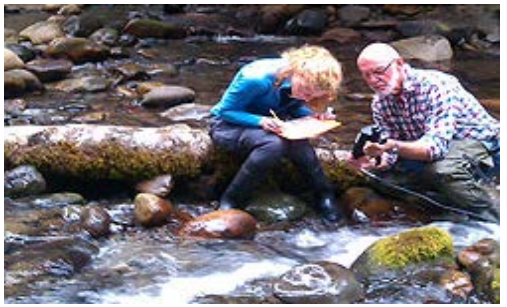
The objective of the analysis was to find meaning in the comprehensive dataset to direct future action; help to target and inform:



7- Year Analysis

Temperature, Dissolved Oxygen, Conductivity, Turbidity Data collected from 2011-2017

- Were there observable **changes** in water quality over time?
- Were there frequent **exceedances** of water quality guidelines or objectives?
- Does **land use and watershed characteristics** have a statistically predictable **effect** on water quality?



Key Findings

Changes over time

Mann- Kendall tests were run on the 34 sites that had at least 6 years of data to analyze for significant trends overtime.

- 27 /34 sites had stable water quality and changes over time were not observed
- 5 sites experienced increases in mean summer and fall turbidity from 2011- 2017
    - Little Qualicum, Beach @ Hemsworth, French @ Grafton, Nanaimo R u/s Haslam, Englishman @ Hwy 19A
- 2 sites experienced changes in conductivity from 2011-2017
    - Beach Creek decreasing trend; Cat Stream increasing trend

Key Findings

Frequent Exceedances of Water Quality Guidelines / Objectives

- 12 sites of concern*
  - 7/12 have high agricultural use within the watershed
  - 2/12 have upstream stormwater outfalls
  - 3/12 not well understood – likely related to annual differences in rainfall and temp.

*Mallett Creek (turbidity); Holden Creek x2 (dissolved oxygen); Haslam Creek (dissolved oxygen); Cat Stream (turb, temp, cond); Walley Creek (DO, turbidity); Shelly Creek (DO, temp, turb); Swane Creek (DO, temp, turb); French Creek (DO, temp, turb); Grandon (DO, temp, turb); Little Qualicum (temp); Annie Creek (DO, temp, turb).

Key Findings

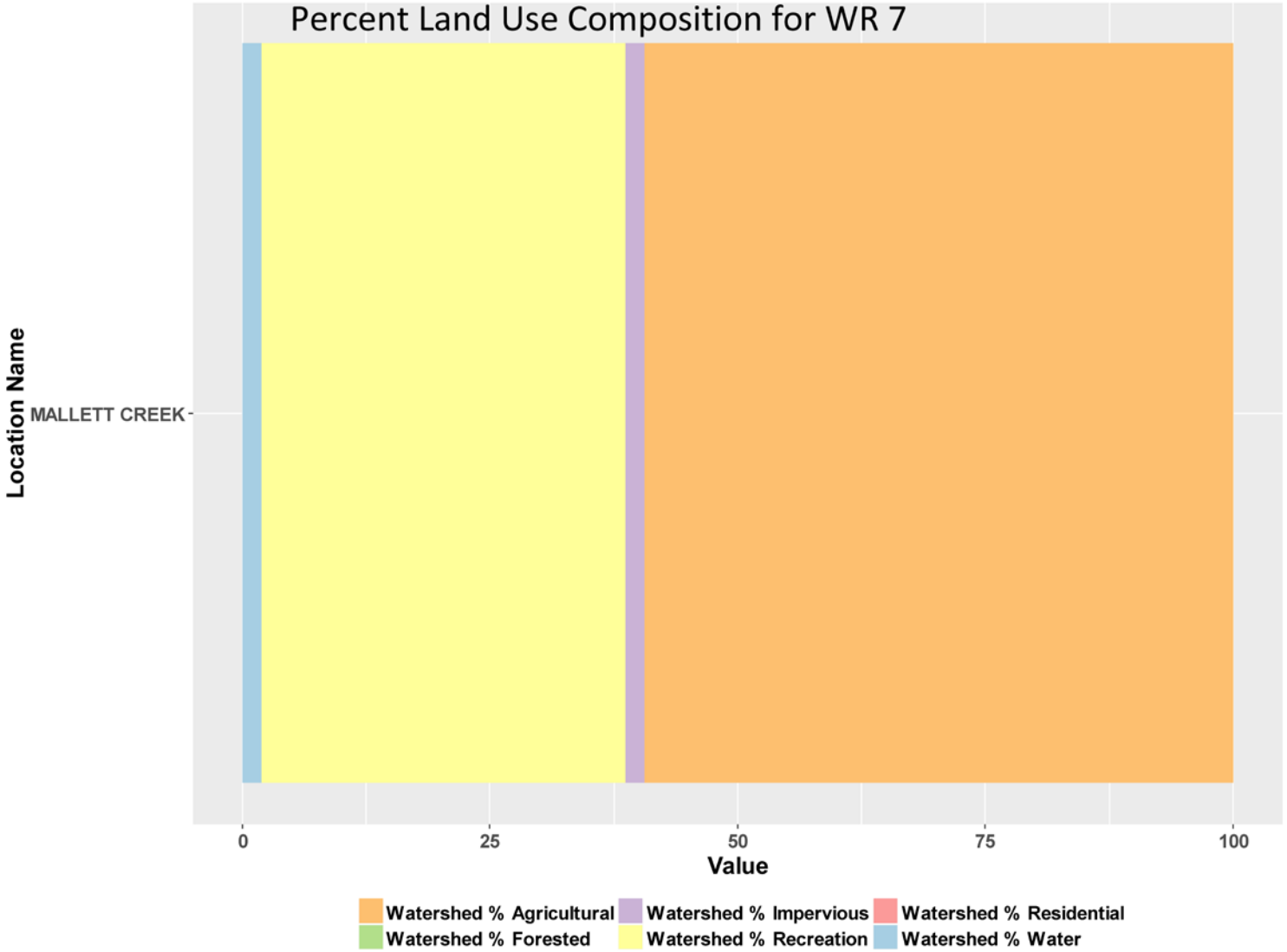
Land Use Modelling – Statistical Predictors of Water Quality

- Watersheds with **<60% forest land use** area associated with changes in turbidity and conductivity
- Watersheds with **>20% agricultural and rural residential land use** associated with higher turbidity and lower dissolved oxygen
- Watersheds with **paved road densities >0.002m/m^2** associated with increases in conductivity and higher water temperatures

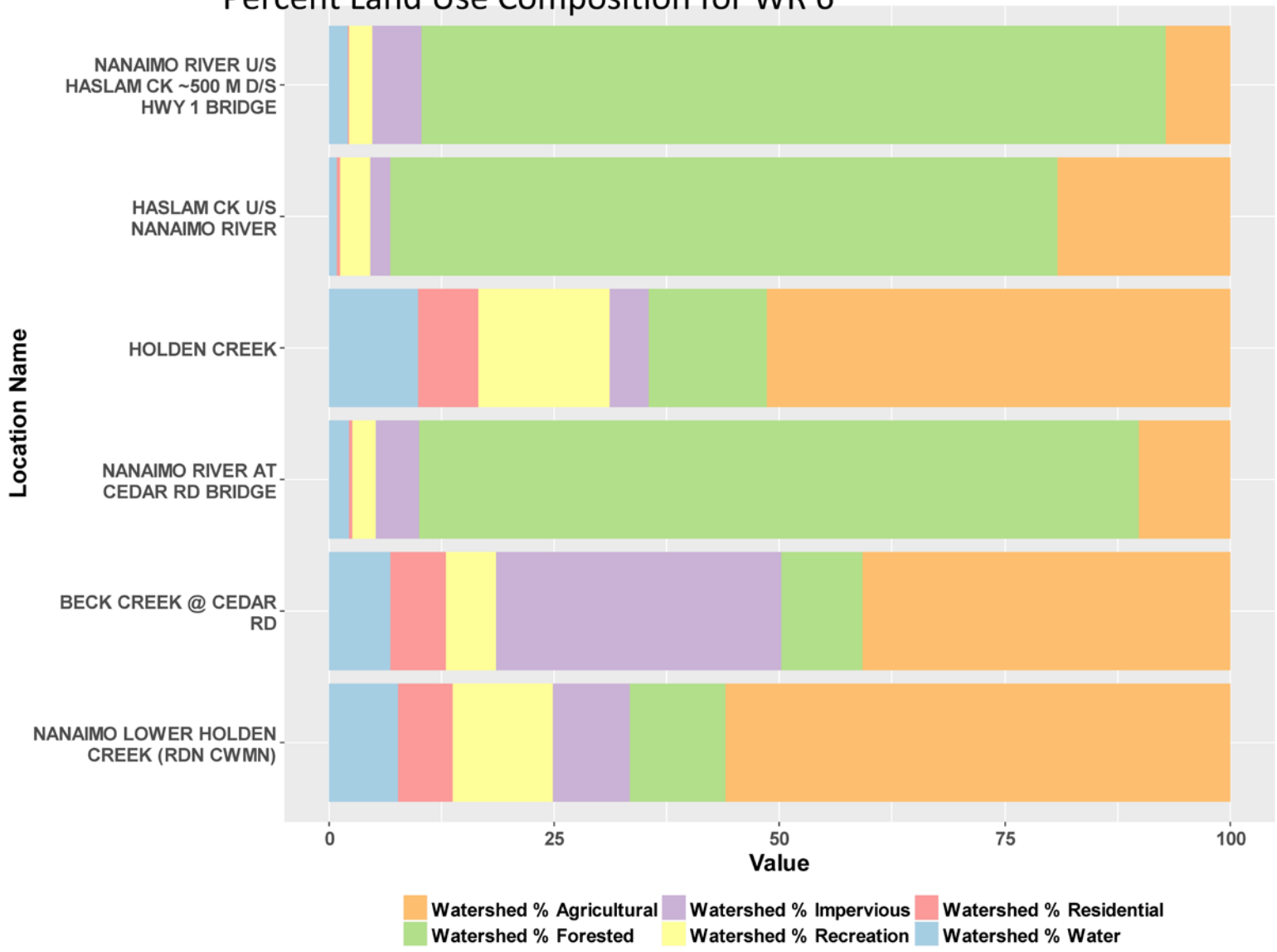
Percent Land Use Composition

- Watershed area upstream of each site
- Land use delineated from GIS maps
- Percentage of six land use categories
- Land Use Statistical Modelling on all sites

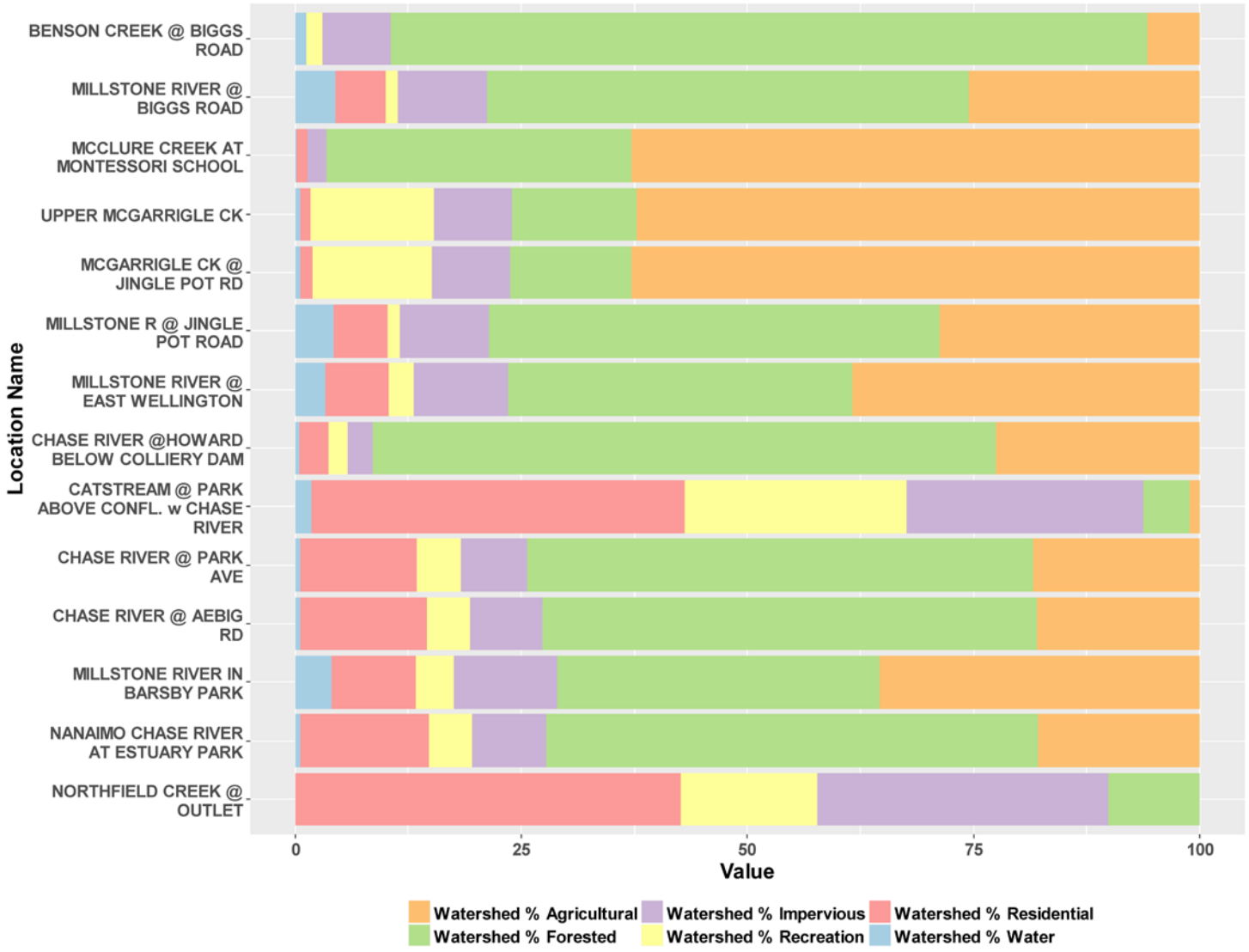
Class	Calculation
Agricultural	Rural Residential + Agriculture
Forested	Forestry + Conservation
Impervious	Commercial + Industrial + Transportation
Recreation	Institutional + Recreation
Residential	Comprehensive + Multi-Family Residential + Single-Family Residential
Water	Water + Wetland


Percent Land Use Composition for WR 7
Location Name
MALLETT CREEK
0
25
50
75
100
Value
Watershed % Agricultural
Watershed % Impervious
Watershed % Residential
Watershed % Forested
Watershed % Recreation
Watershed % Water

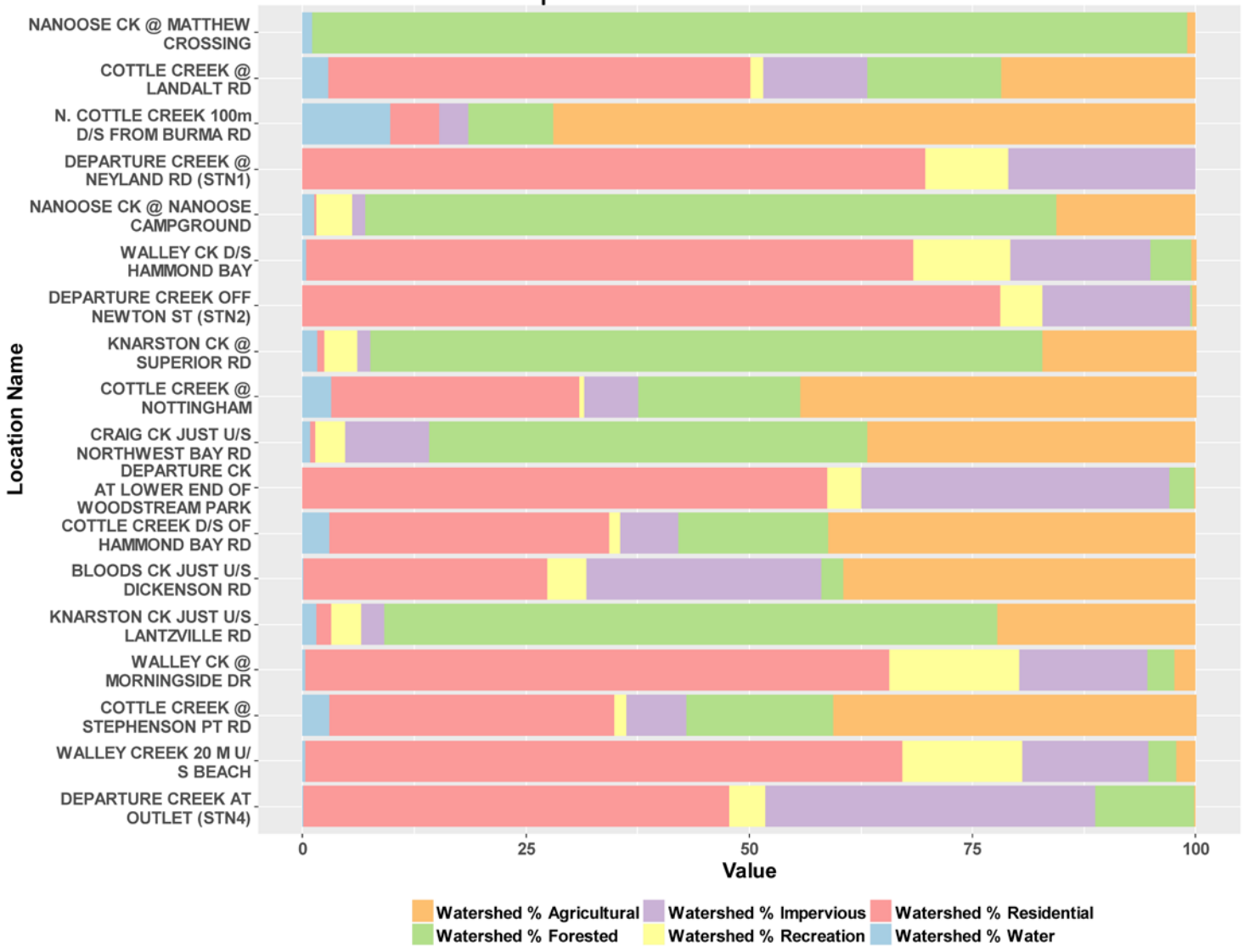
Percent Land Use Composition for WR 6



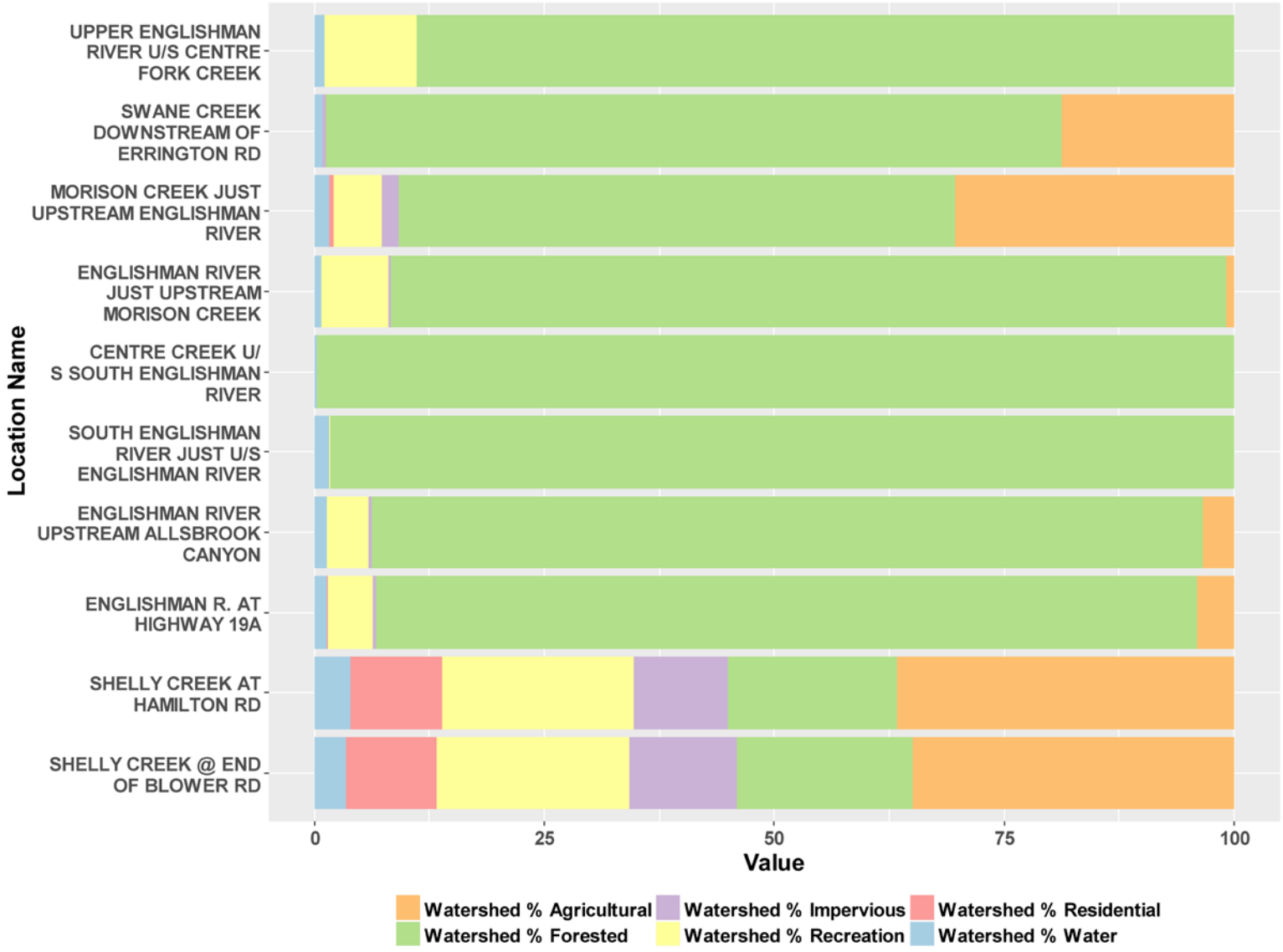
Percent Land Use Composition for WR 5-2

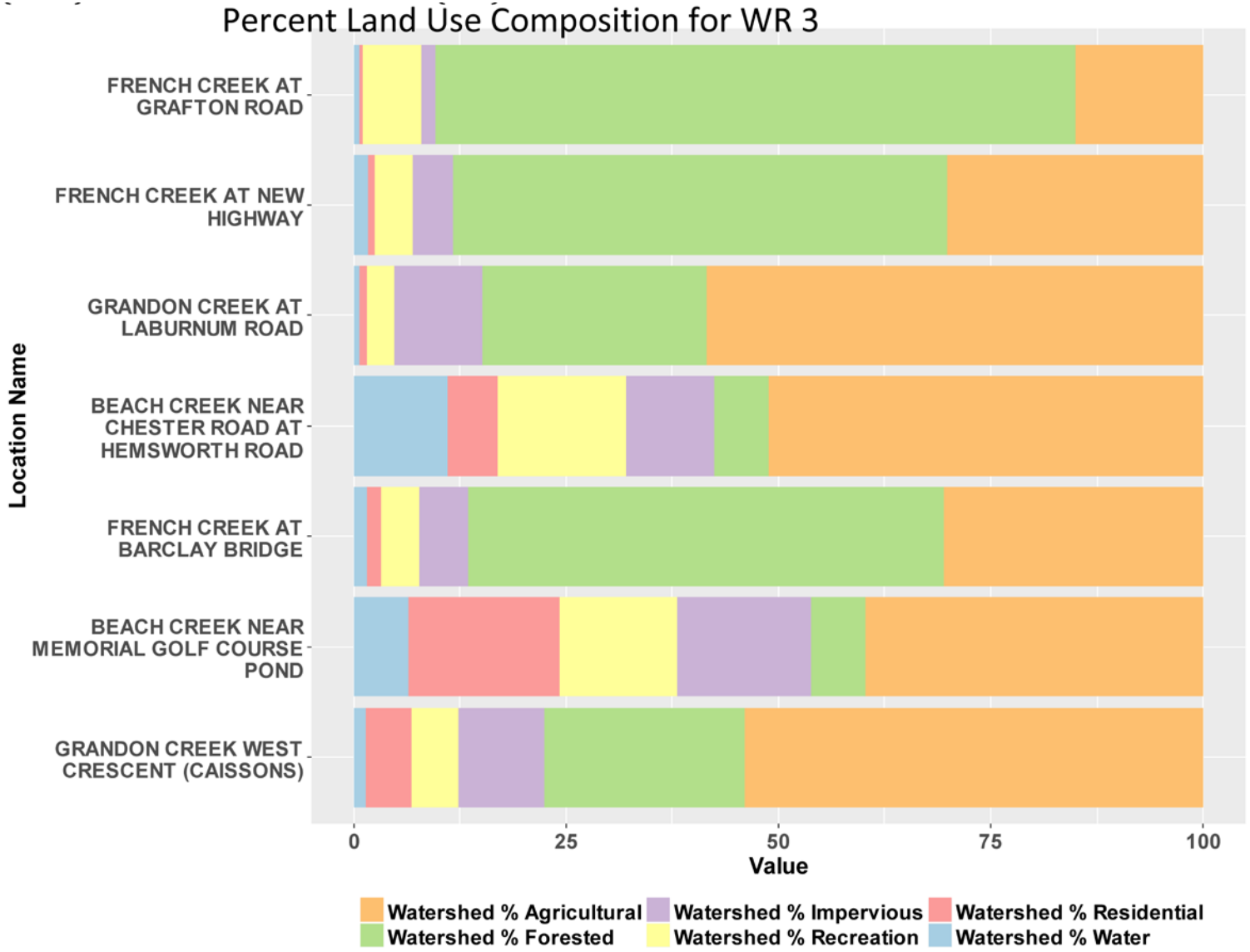


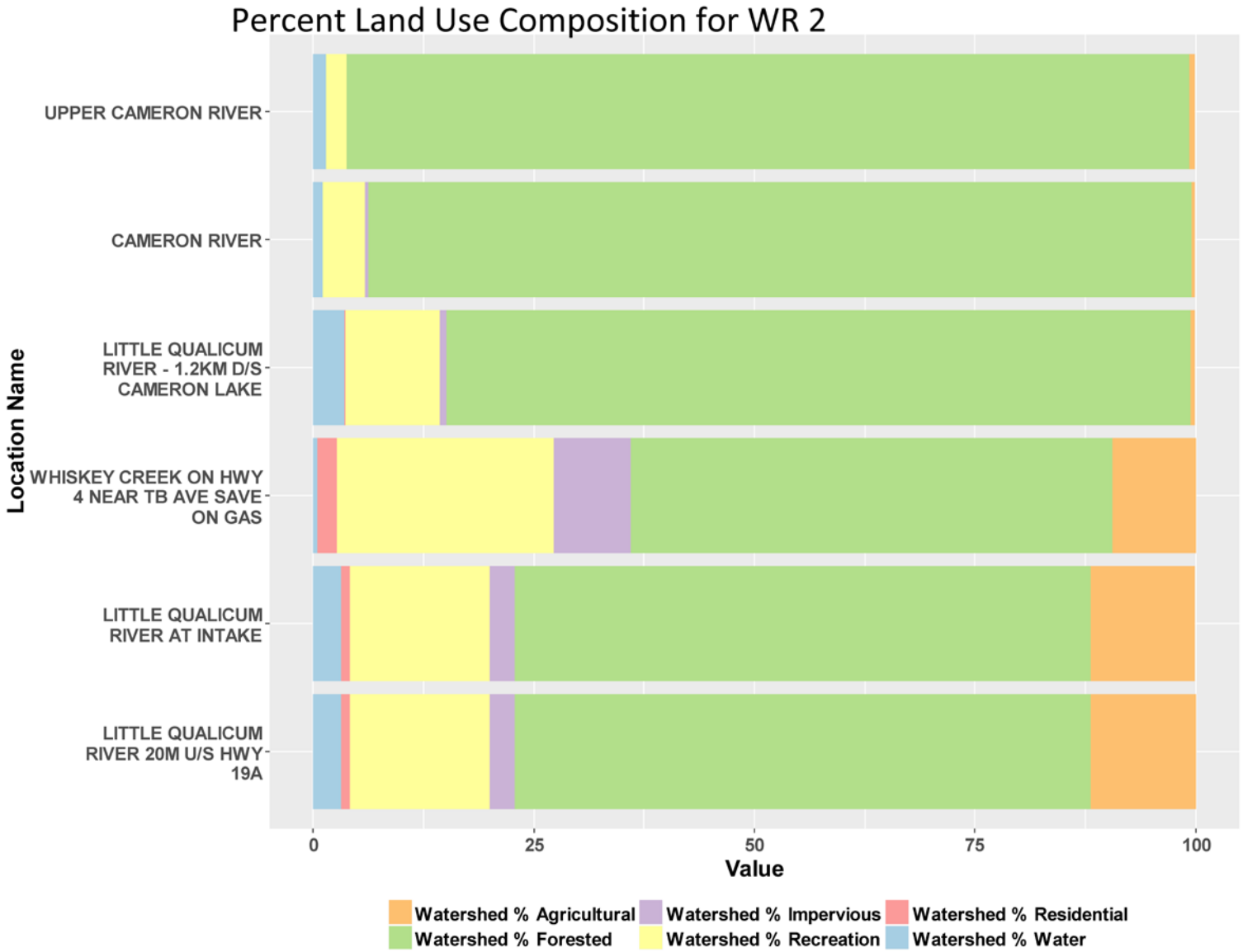
Percent Land Use Composition for WR 5-1



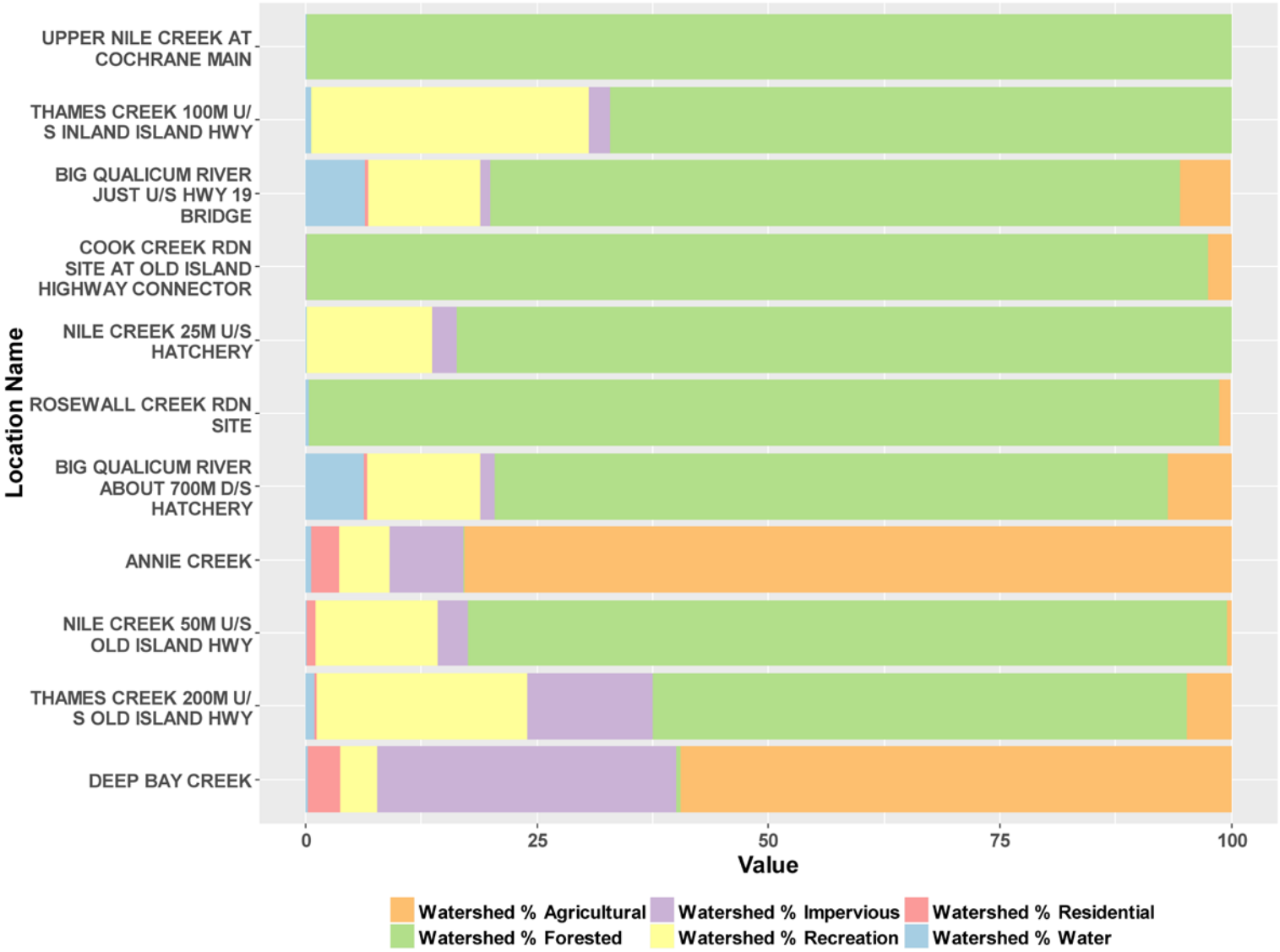
Percent Land Use Composition for WR 4

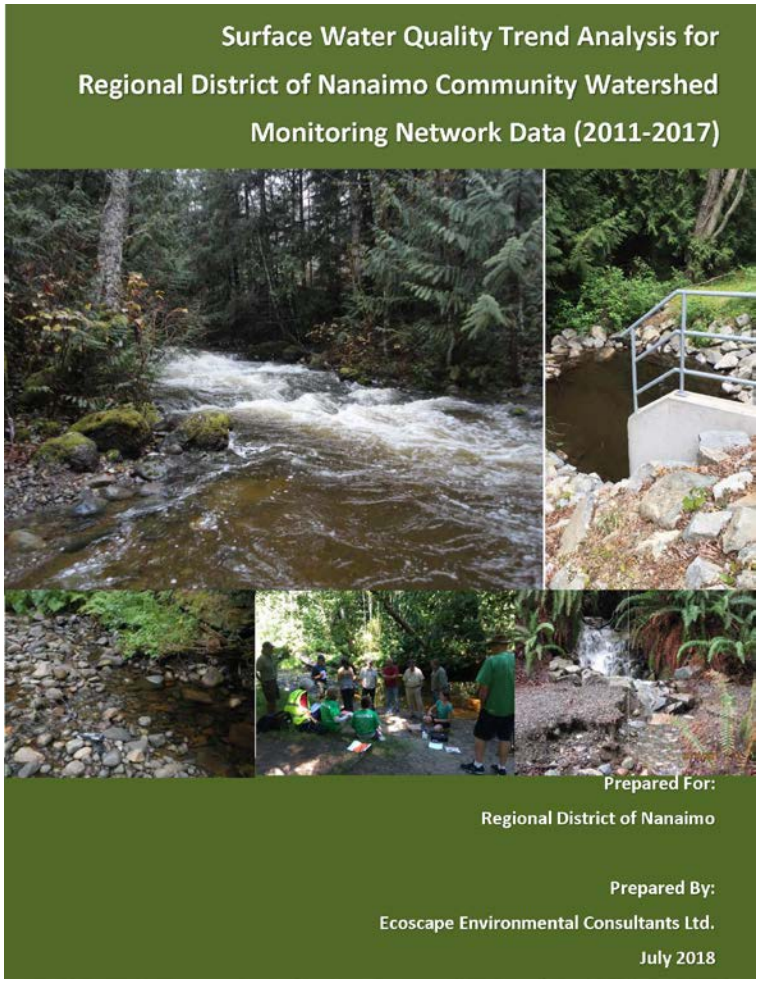



Percent Land Use Composition for WR 3
FRENCH CREEK AT GRAFTON ROAD
FRENCH CREEK AT NEW HIGHWAY
GRANDON CREEK AT LABURNUM ROAD
BEACH CREEK NEAR CHESTER ROAD AT HEMSWORTH ROAD
FRENCH CREEK AT BARCLAY BRIDGE
BEACH CREEK NEAR MEMORIAL GOLF COURSE POND
GRANDON CREEK WEST CRESCENT (CAISSONS)
Location Name
0
25
50
75
100
Value
Watershed % Agricultural
Watershed % Impervious
Watershed % Residential
Watershed % Forested
Watershed % Recreation
Watershed % Water


Percent Land Use Composition for WR 2
Location Name
UPPER CAMERON RIVER
CAMERON RIVER
LITTLE QUALICUM RIVER - 1.2KM D/S CAMERON LAKE
WHISKEY CREEK ON HWY 4 NEAR TB AVE SAVE ON GAS
LITTLE QUALICUM RIVER AT INTAKE
LITTLE QUALICUM RIVER 20M U/S HWY 19A
0
25
50
75
100
Value
Watershed % Agricultural
Watershed % Impervious
Watershed % Residential
Watershed % Forested
Watershed % Recreation
Watershed % Water

Percent Land Use Composition for WR 1





Report received by the RDN Board for information Dec. 2018.

Presentations given to councils on results of interest to their municipality between Jan – March 2019.

Report available online at at *rdn.bc.ca/dwwpreports*

In 2018….

- All sites maintained
- QA/QC lab analysis completed, 10% of sites:
  - Grandon @ Laburnum
  - Beach @ Memorial Golf Course
  - French @ new hwy
  - French @ Barclay
  - Millstone @ Biggs
  - Millstone @ Jingle Pot
- VIU Coastal Hydrology & Climate Change Research Lab joined the network
- New and returning volunteers

2018 Sample Period (Tuesdays):

Summer Low Flow Aug 7 – Sept 4*

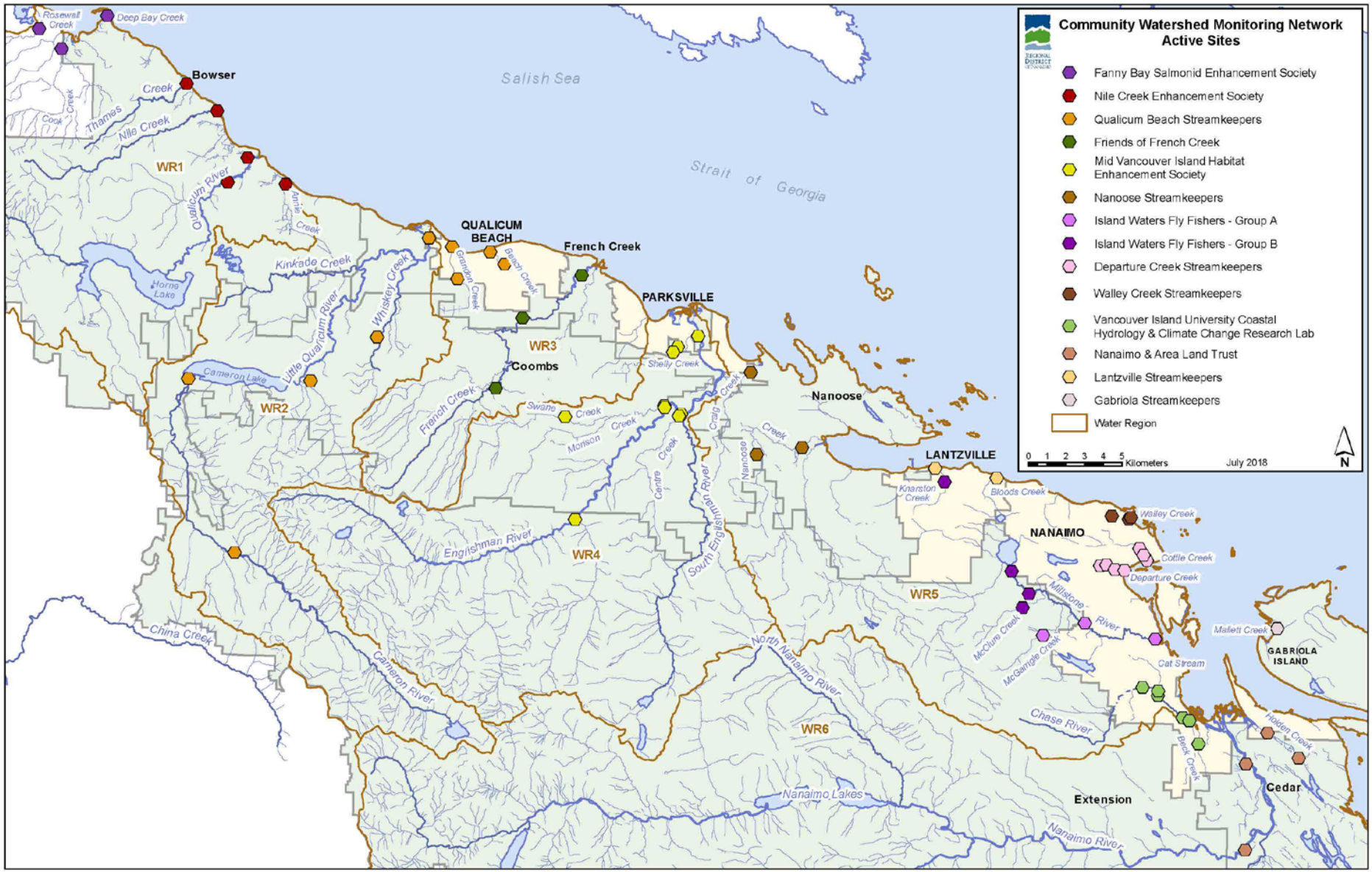
Fall Flush Oct 2 – Nov 6**

**Additional sampling depending on the site Sept 11 & 18*

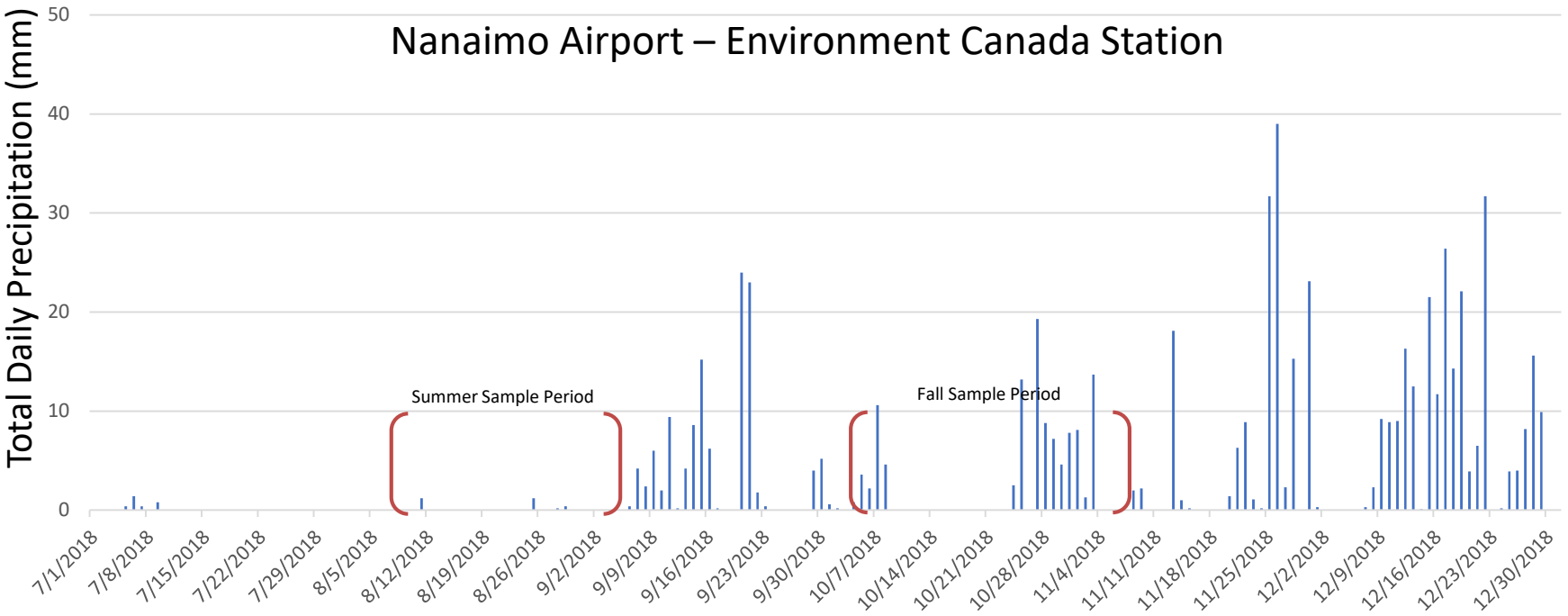
***Some groups started Oct 2, some started Oct 9*

Positives

- Excellent cooperation between all partners
  - Sharing equipment
  - Fire hazard road closures
- Stream stewardship & growing awareness in community
  - Restoration projects
  - Physical stream assessments
- Great coverage!
  - 62 sites; 36 streams; 25 watersheds


Community Watershed Monitoring Network
Active Sites
Fanny Bay Salmonid Enhancement Society
Nile Creek Enhancement Society
Qualicum Beach Streamkeepers
Friends of French Creek
Mid Vancouver Island Habitat Enhancement Society
Nanoose Streamkeepers
Island Waters Fly Fishers - Group A
Island Waters Fly Fishers - Group B
Departure Creek Streamkeepers
Walley Creek Streamkeepers
Vancouver Island University Coastal Hydrology & Climate Change Research Lab
Nanaimo & Area Land Trust
Lantzville Streamkeepers
Gabriola Streamkeepers
Water Region
0 1 2 3 4 5 Kilometers
July 2018
N
Salish Sea
Strait of Georgia
Bowser
QUALICUM BEACH
French Creek
PARKSVILLE
Coombs
Nanoose
LANTZVILLE
NANAIMO
GABRIOLA ISLAND
Cedar
Extension
WR1
WR2
WR3
WR4
WR5
WR6
Rosewall Creek
Deep Bay Creek
Cook Creek
Thames Creek
Nile Creek
Qualicum River
Horne Lake
Annie Creek
Kinkade Creek
Whiskey Creek
Little Qualicum River
Cameron Lake
Grandon Creek
Beach Creek
French Creek
Shelly Creek
Craig Creek
Swane Creek
Morrison Creek
Centre Creek
South Englishman River
Englishman River
Nanoose Creek
Knarston Creek
Bloods Creek
Walley Creek
Cottle Creek
Departure Creek
Millstone River
McClure Creek
McGarrigle Creek
Cat Stream
Mallett Creek
Holden Creek
Beck Creek
Chase River
North Nanaimo River
Nanaimo Lakes
Nanaimo River
China Creek
Cameron River

Precipitation Data - South



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

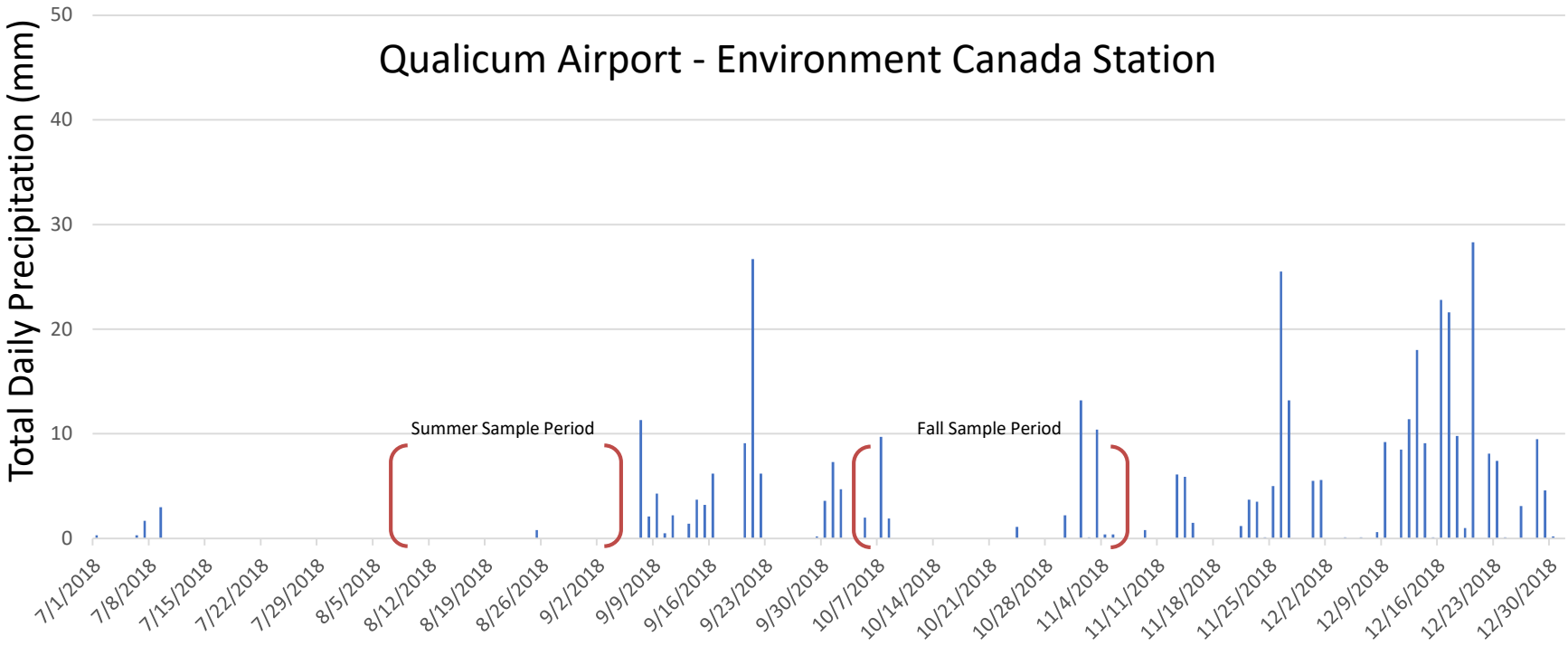
2015 rainfall:
22.1 mm Summer
(Aug 1 – Sept 1)
116.7 mm Fall
(Oct 1 – Nov 11)

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)

Precipitation Data - North



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

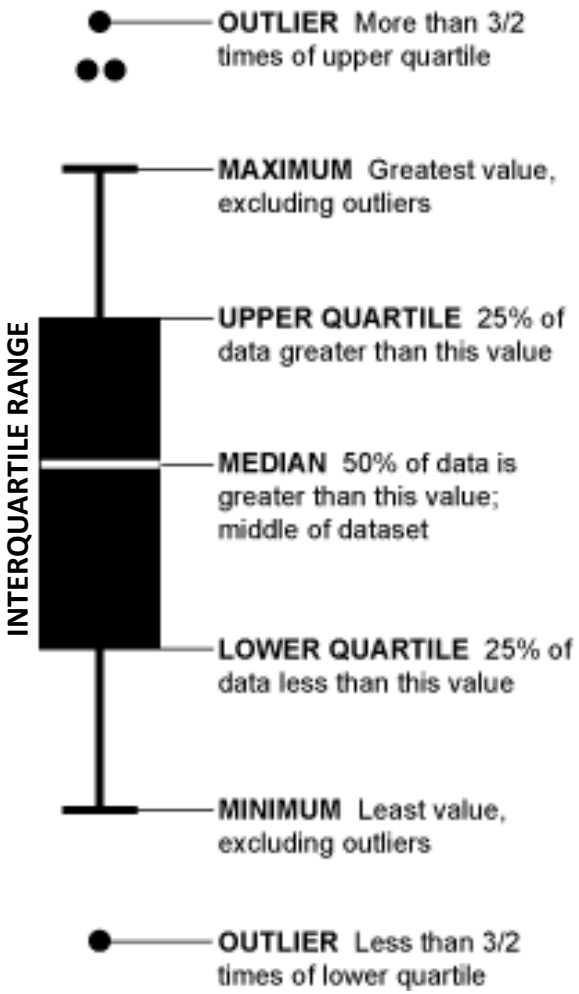
2015 rainfall:
24.0 mm Summer
(Aug 1 – Sept 1)
82.3 mm Fall
(Oct 1 – Nov 11)

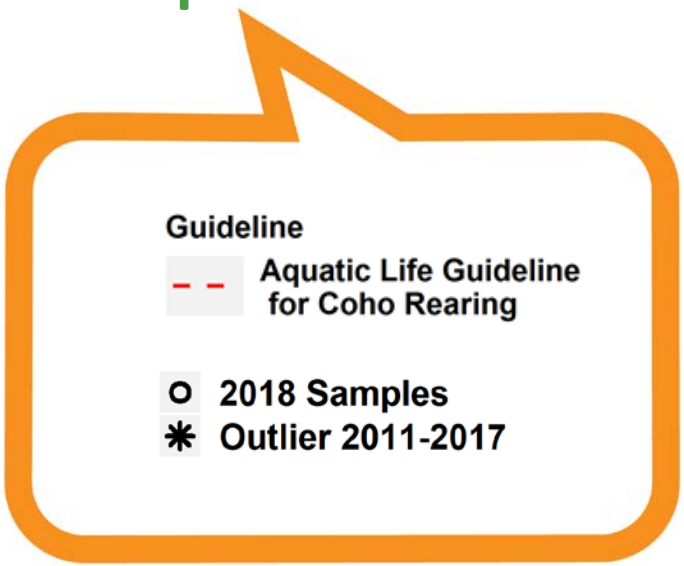
2016 rainfall:
15.7 mm Summer
(Aug 1 – Aug 31)
252.2 mm Fall
(Oct 1 – Nov 8)

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)

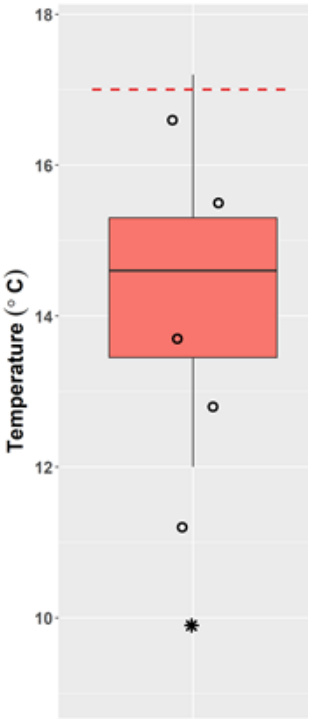
How to Interpret a Box Plot





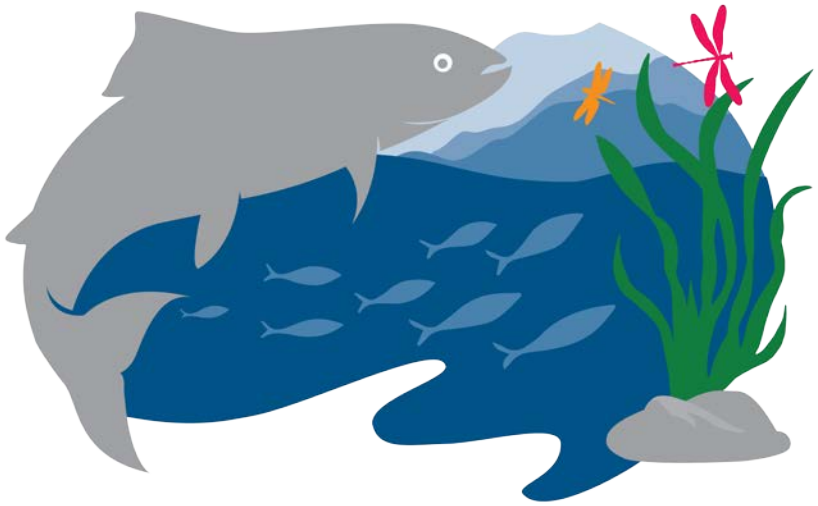
- Interquartile range contains 50% of the values
- Maximum & minimum values shown at the end of each whisker = the range that includes all data except outliers

Example:



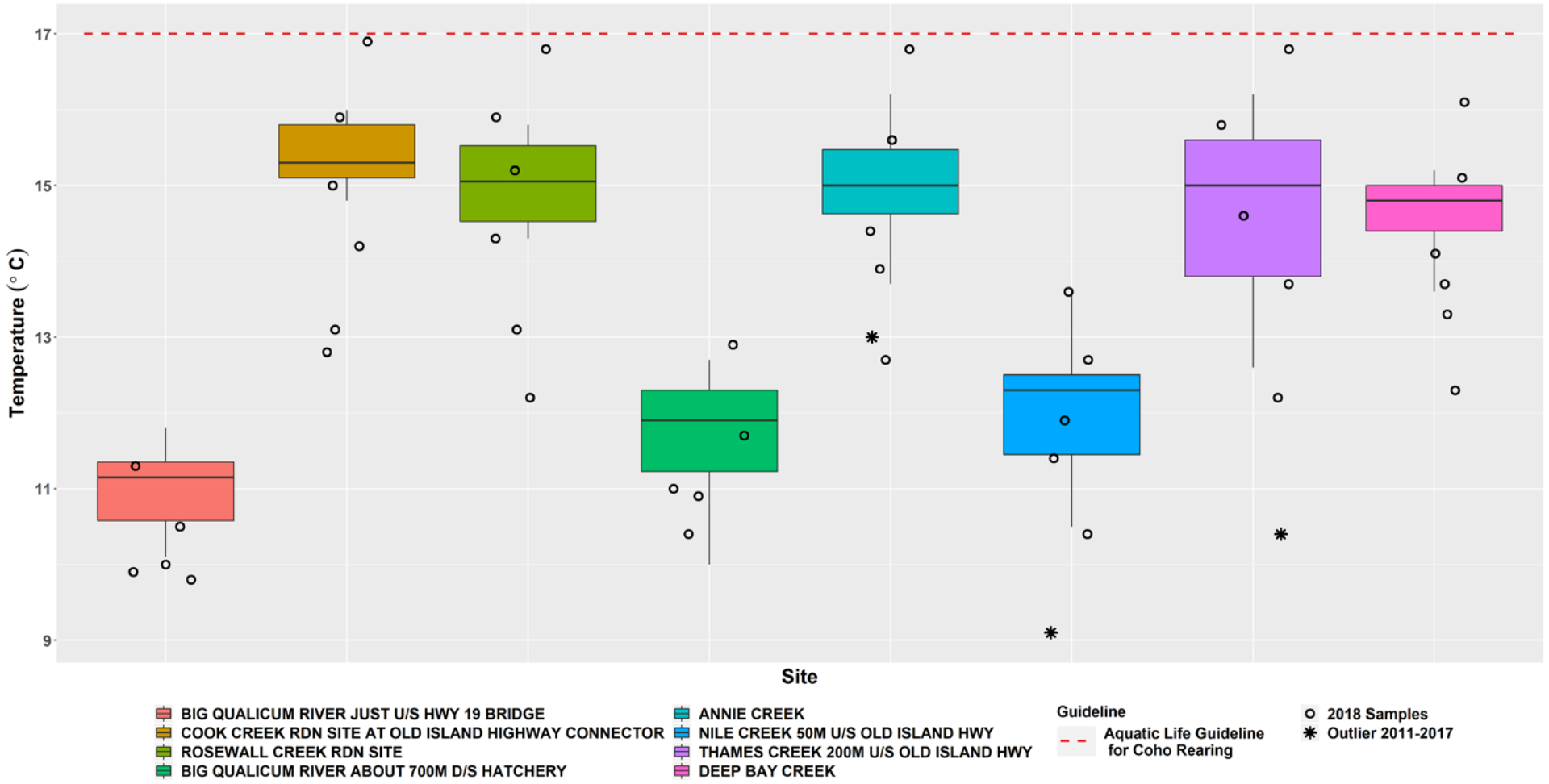
Water Temperature

- **Englishman River aesthetic drinking water objective (weekly average ≤15°C)**
- **Aquatic life guideline for Coho rearing (weekly average ≤17°C)**



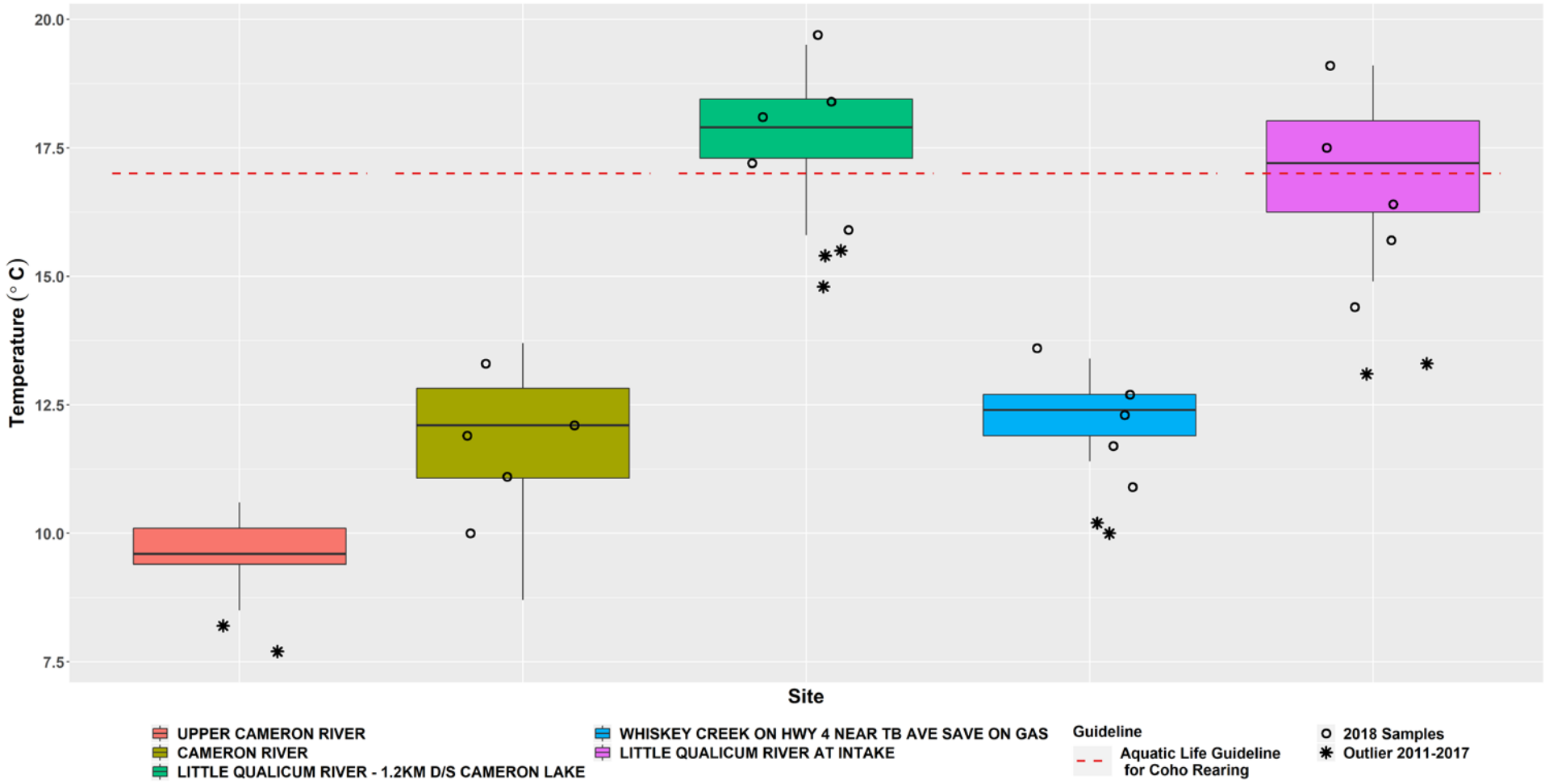
- Affects metabolic rates of aquatic organisms
- Can alter physical and chemical properties of water

Water Region 1 – Summer Temperature



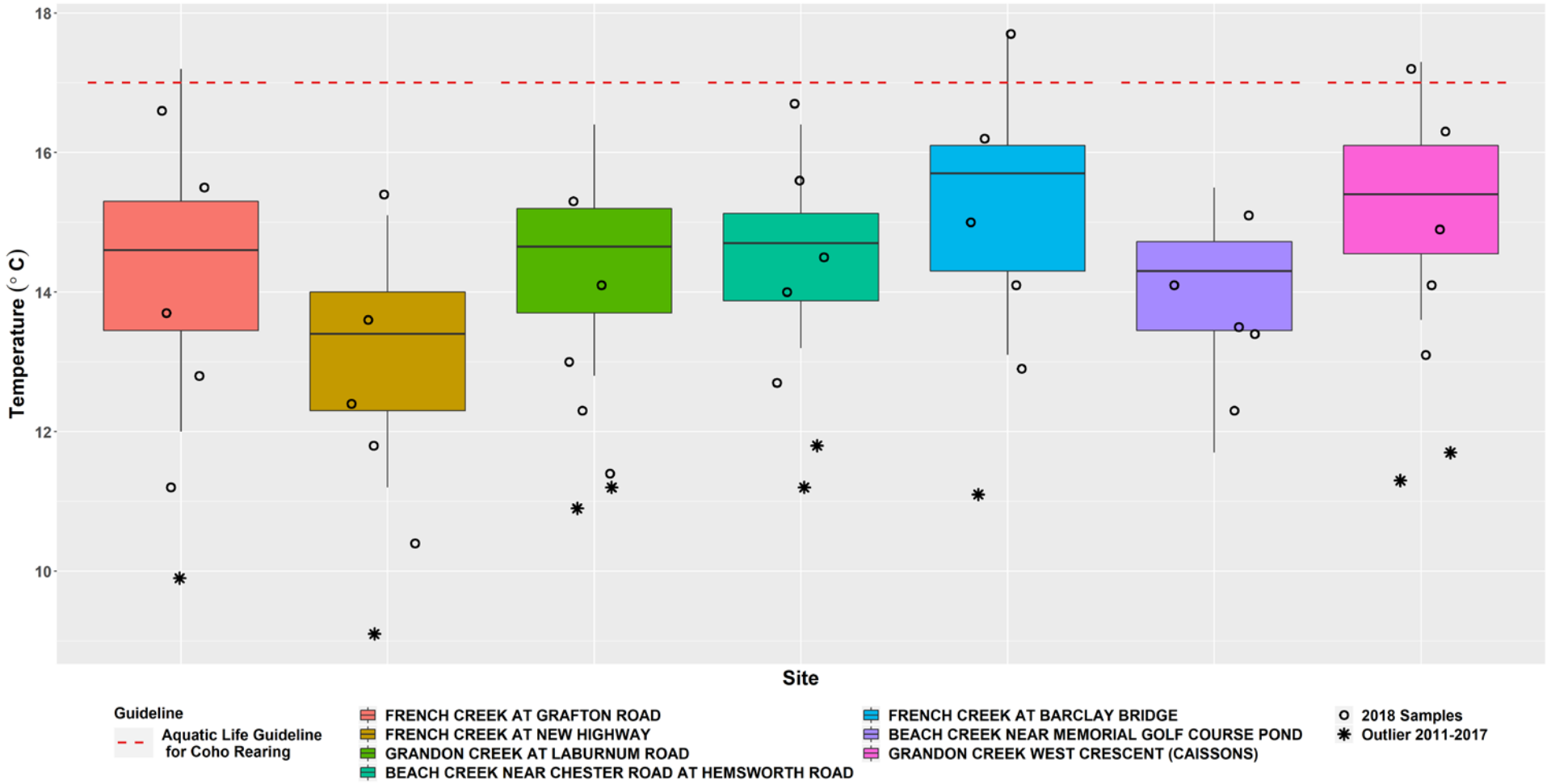
Aug 7th had values close to guideline: 16.9 °C at Cook Creek & 16.8 °C at Rosewall, Annie & Thames Creeks

Water Region 2 – Summer Temperature



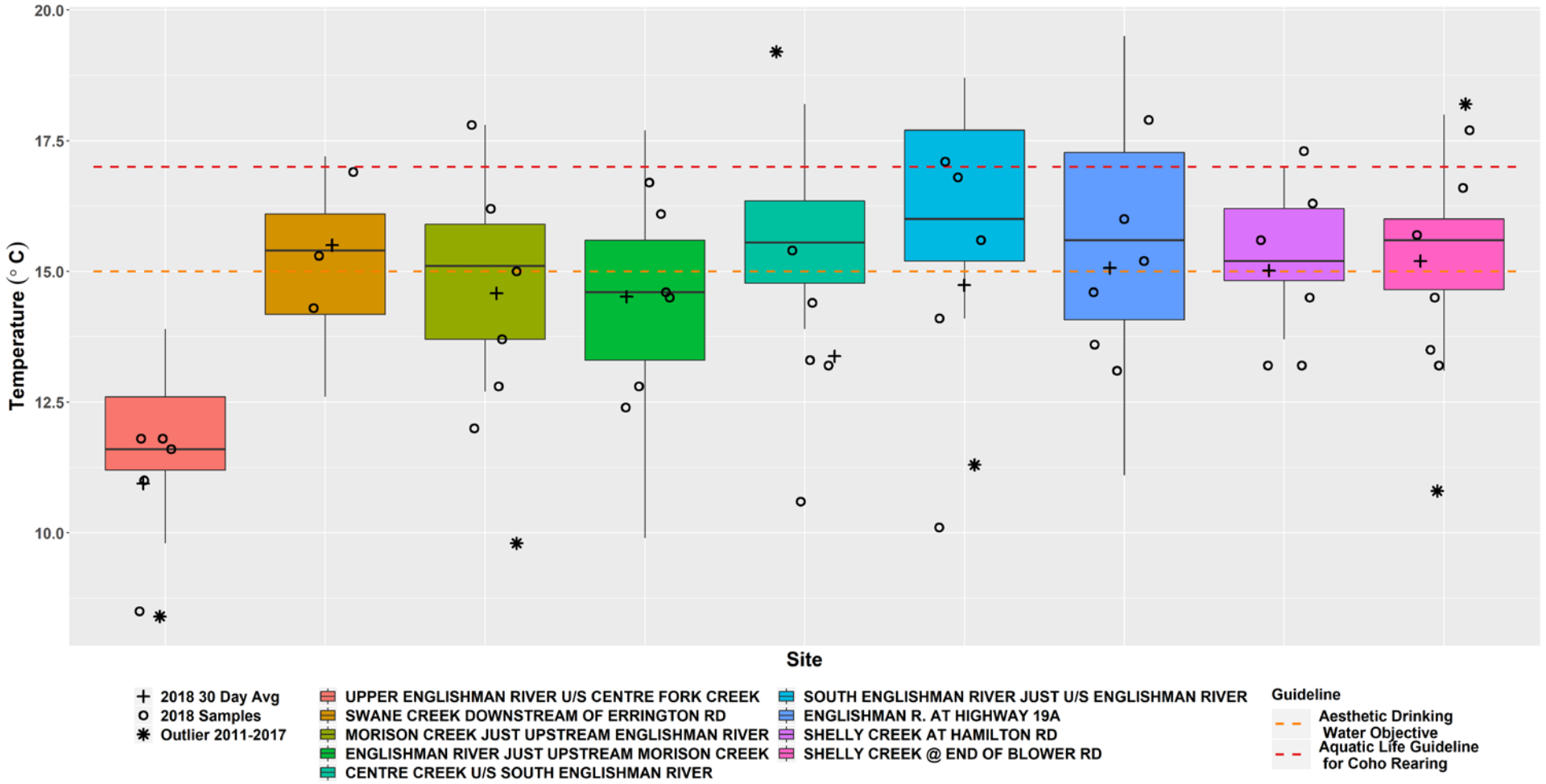
Both Little Qualicum River sites had temperature exceedances on multiple dates, a contributing factor could be the warm surface discharges from Cameron Lake

Water Region 3 – Summer Temperature



Aug 7th exceedances at French Creek (Barclay) & Grandon Ck (West Cres)

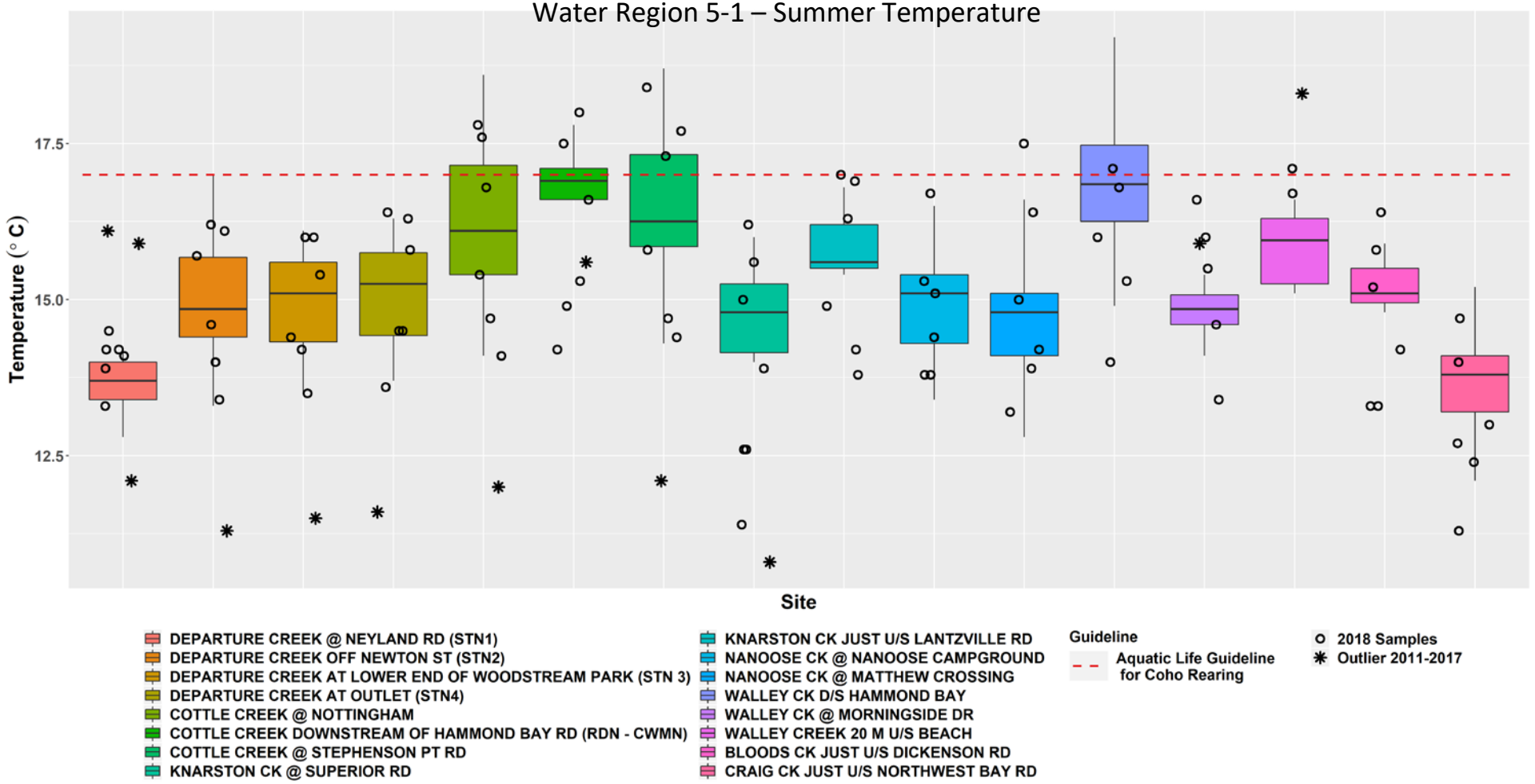
Water Region 4 – Summer Temperature



Aug 7th exceedances at Englishman River (19A), Morison Creek & both Shelly Creek sites

Aug 21st exceedance at South Englishman River

Water Region 5-1 – Summer Temperature

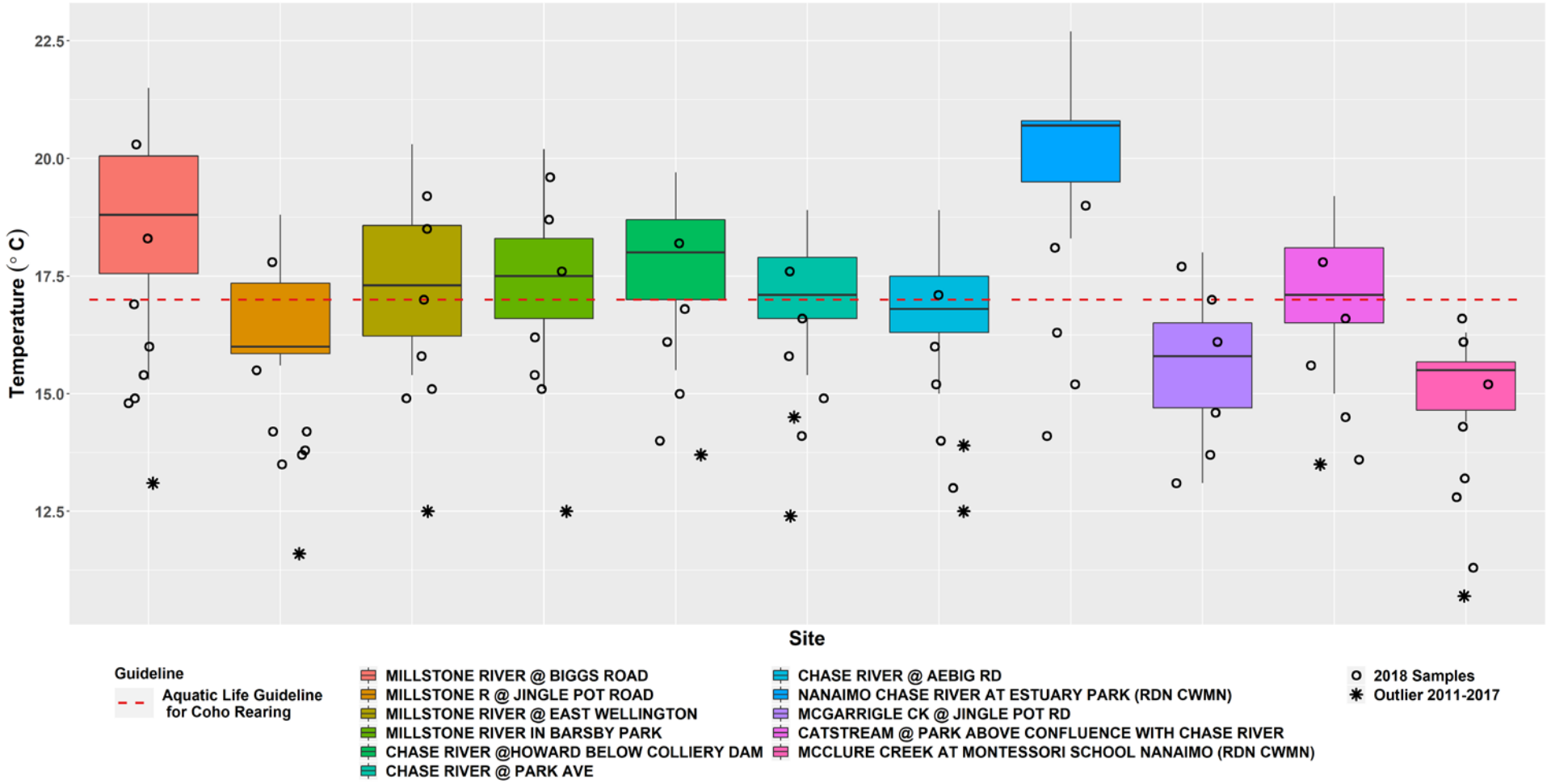


Aug 7th exceedances at Knarston (Lantzville), Nanoose (Matthew X) & Walley (Hammond & u/s beach) Creeks

Exceedances Aug 7th & 14th at Cottle (Nottingham & Hammond)

Aug 7th, 14th & 21st exceedances at Cottle (Stephenson)

Water Region 5-2 – Summer Temperature

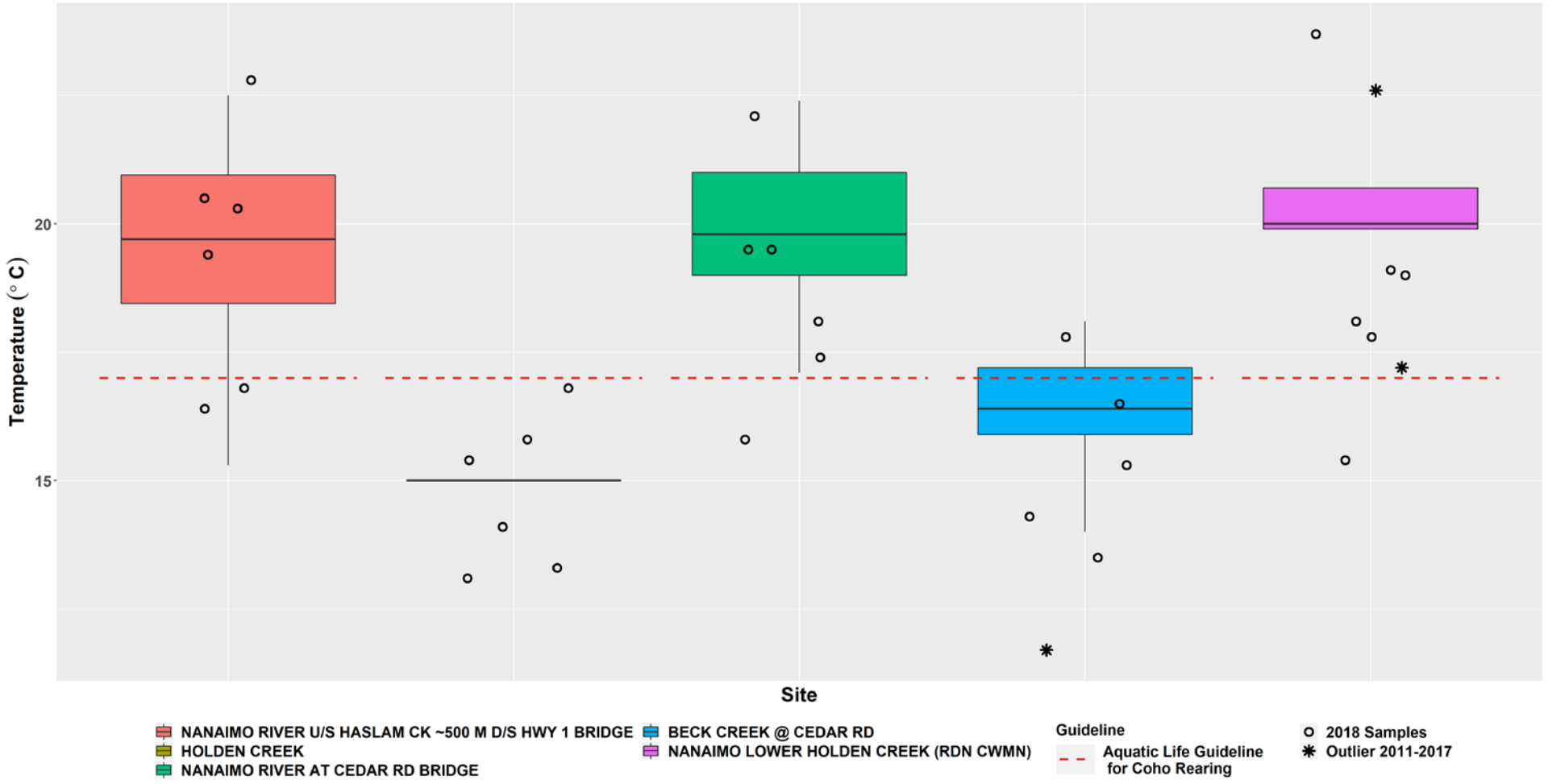


Aug 7th exceedances at Chase River (all sites), Cat Stream, Millstone (all sites) & McGarrigle

Exceedances Aug 14th at McGarrigle, Millstone (Jingle Pot) & Chase River (Estuary)

Exceedances Aug 14th & 21st Millstone River (East Wellington & Barsby Park)

Water Region 6 – Summer Temperature

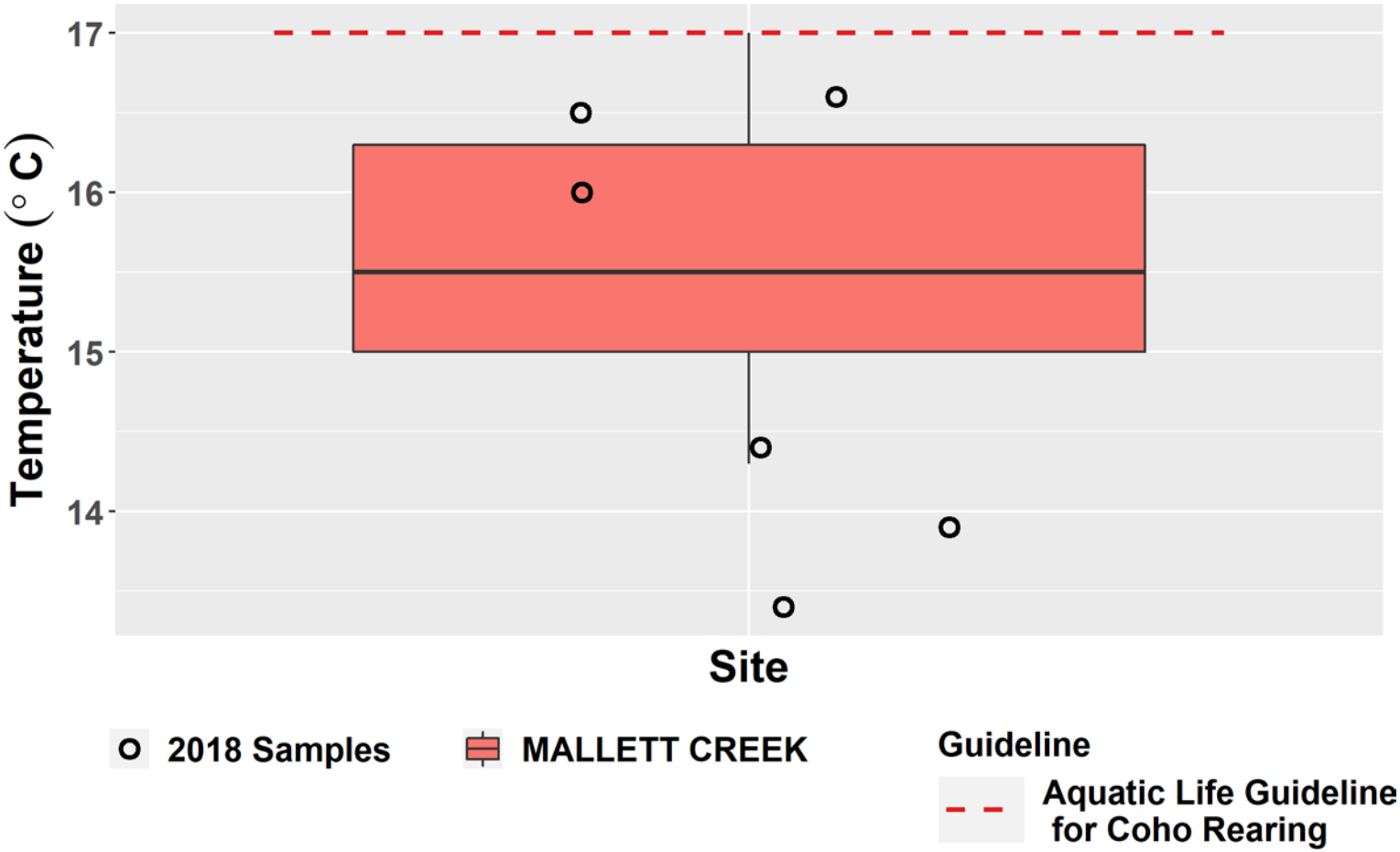


Aug 7th exceedances at Beck Creek

Exceedance for 4 consecutive weeks (Aug 7th – Aug 28th) at Nanaimo River (u/s Haslam)

Exceedance for all 5 summer sample dates at Nanaimo River (Cedar Rd) & Lower Holden Creek

Water Region 7 – Summer Temperature

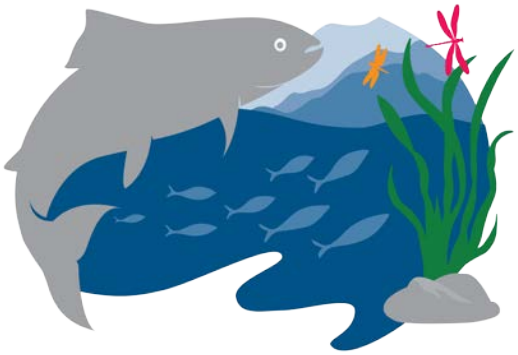


Summer temperatures average 15.5 °C

Temperature

Aquatic life guideline for Coho rearing (mean weekly maximum temperatures ≤17°C) potential to exceed at:		
Little Qualicum River	Shelly Creek	McGarrigle Creek
French Creek Barclay	Nanoose Matthew X	Chase River
Grandon Creek W Cr	Knarston u/s Lantz	Cat Stream
Englishman River 19A	Walley HBRd, Beach	Nanaimo River
Morison Creek	Cottle Creek	Beck Creek
S. Englishman River	Millstone River	Lower Holden Creek

- Typical of shallow wide portions and areas with minimal canopy cover.
- Okay if juvenile fish have lower temperature refuges



Sample Year	# Summer Samples	# Summer ≥17°C	% Summer ≥17°C
2014	250	73	29.2%
2015	225	51	22.7%
2016	274	58	21.2%
2017	282	80	28.4%
2018	299*	56	18.7%

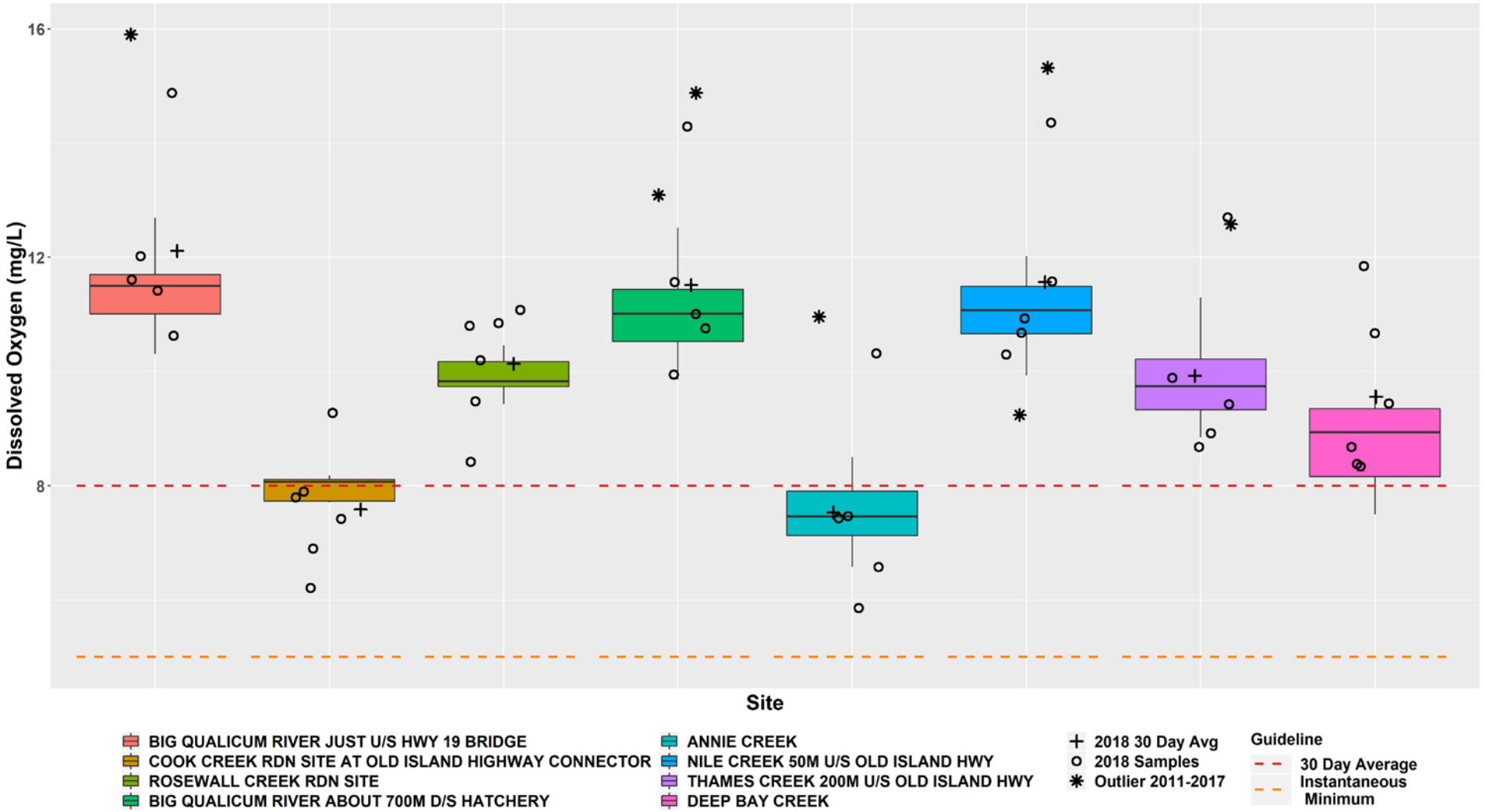
**Includes samples taken Aug 7, 2018 through to and including Sept 4, 2018.*

Dissolved Oxygen

- **30 day average LESS THAN 8 mg/L**
- **Instantaneous minimur LESS THAN 5 mg/L**

- Solubility of Oxygen ↓ as temperature ↑
- Additional factors affecting DO: photosynthesis, water turbulence and oxygen demand
- Most pristine coastal streams would average >8 mg/L

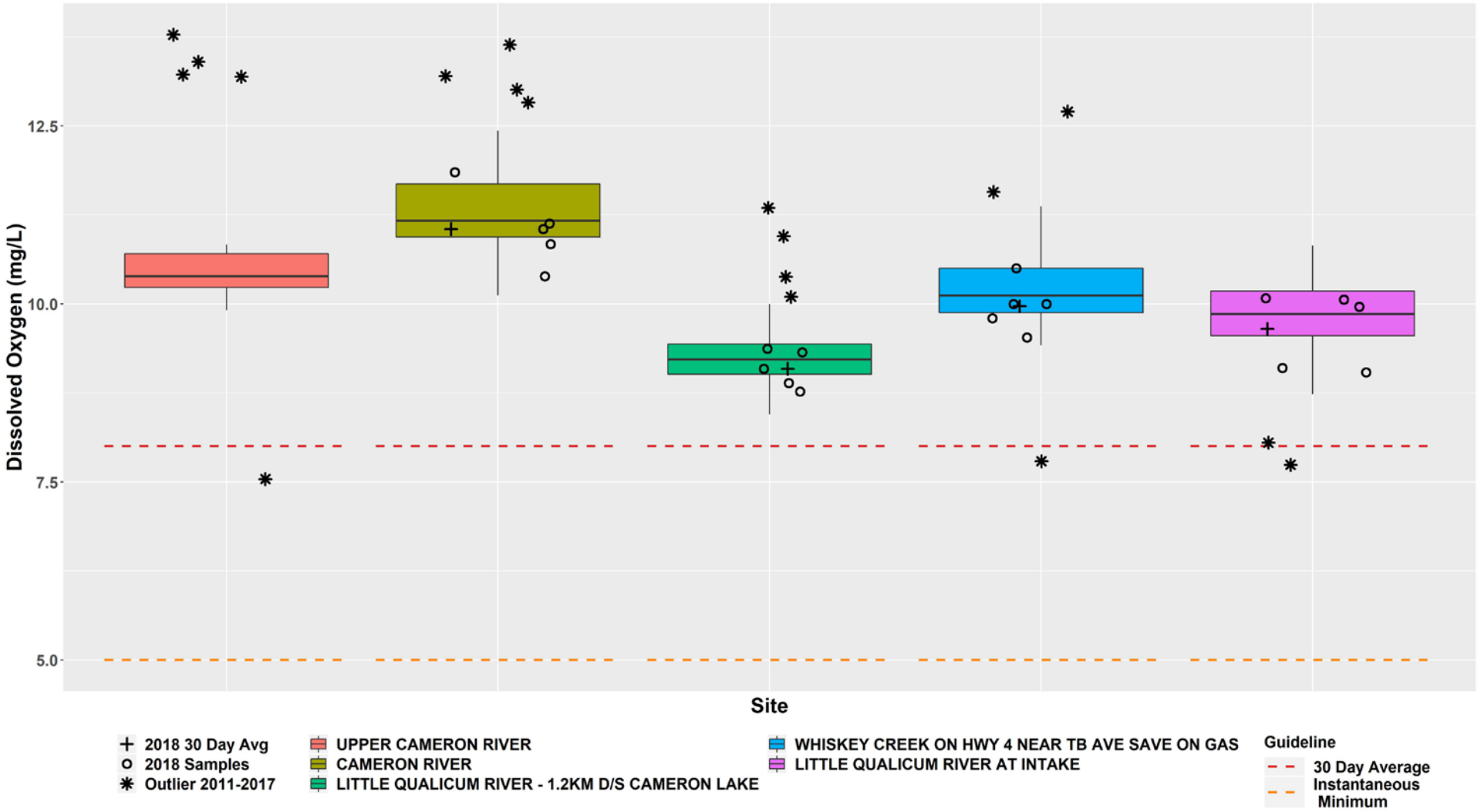
Water Region 1 – Summer Dissolved Oxygen



Annie (7.53 mg/L) & Cook (7.58 mg/L) Creeks both were below the 30-day average threshold

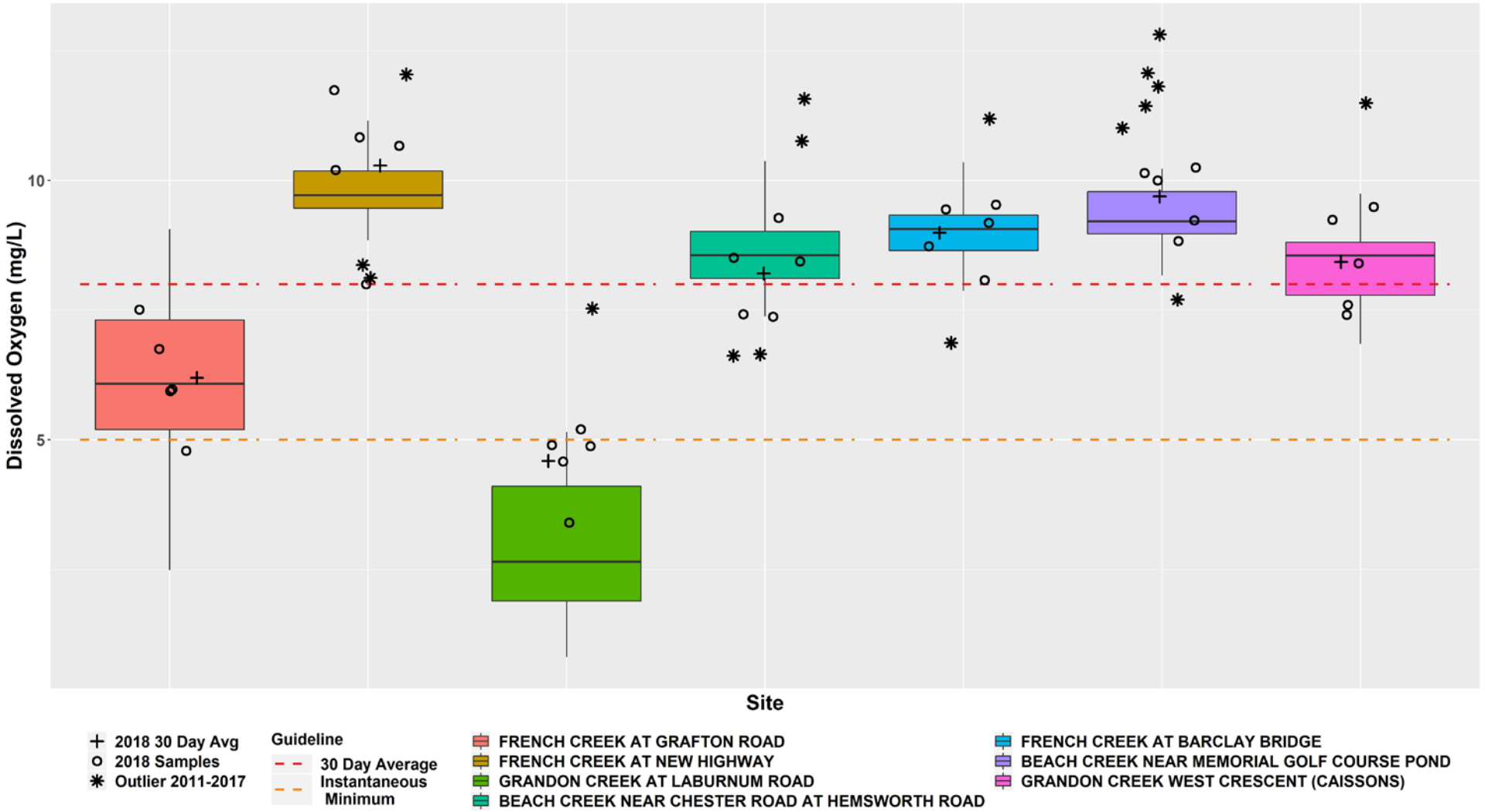
Lowest DO levels experienced Aug 7th at both sites

Water Region 2 – Summary Dissolved Oxygen



No exceedances in 2018

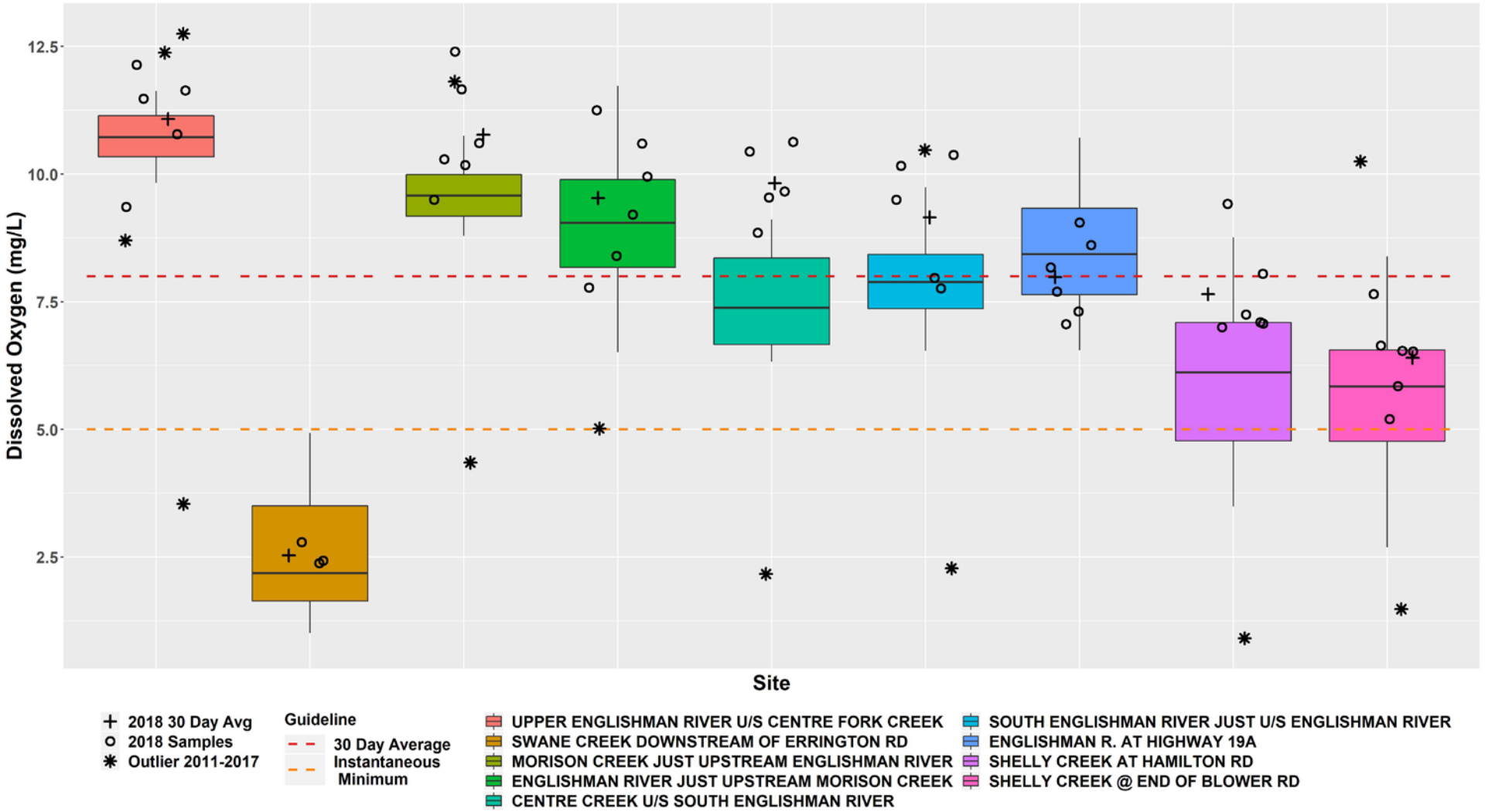
Water Region 3 – Summer Dissolved Oxygen



DO below 30-day average: Grandon Ck (Laburnum, 4.59 mg/L) & French Ck (Grafton, 6.19 mg/L)

Lowest DO levels experienced Aug 7th at Grandon (Laburnum) & Aug 13th at French (Grafton)

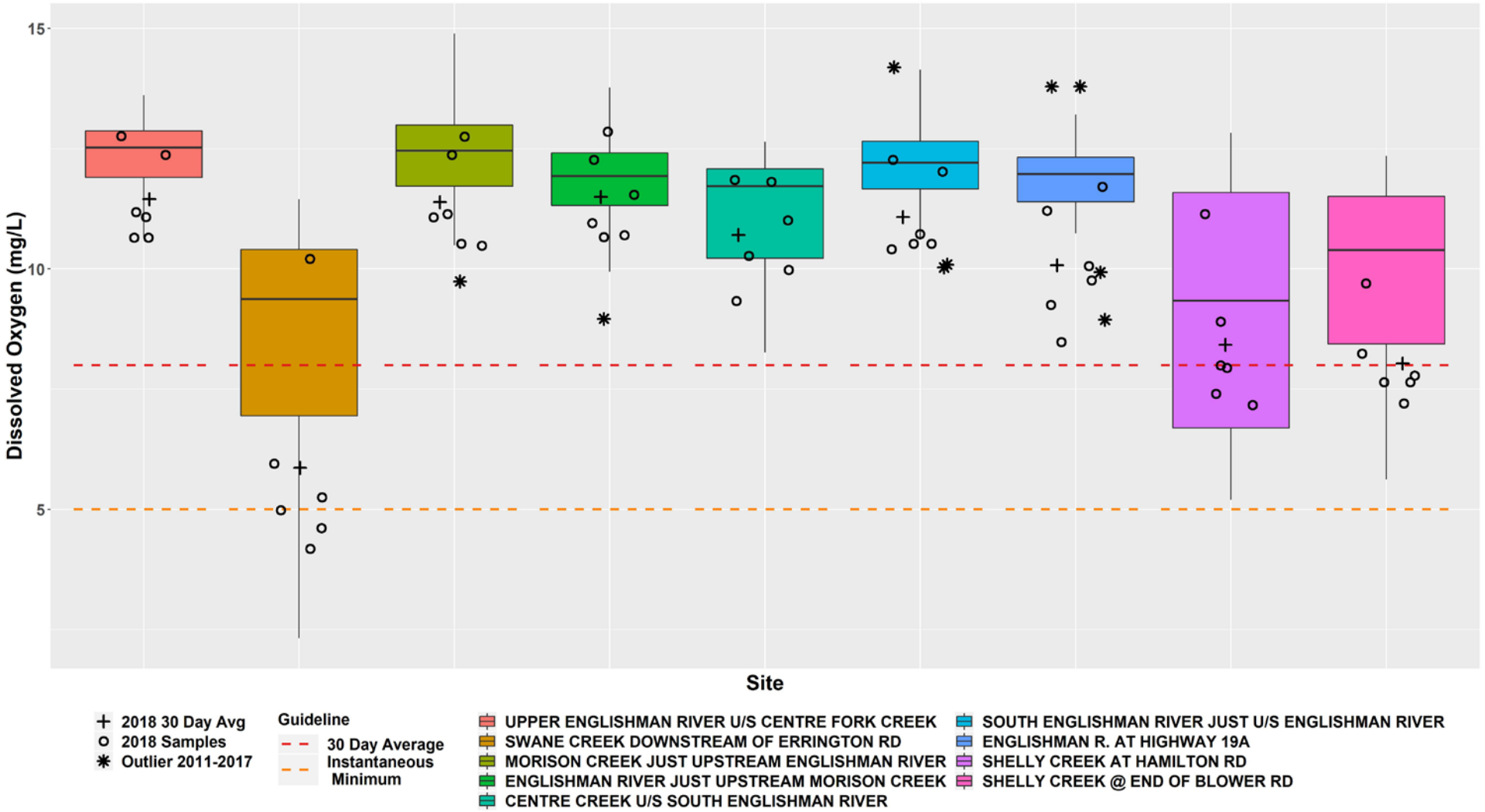
Water Region 4 – Summer Dissolved Oxygen



Below 30-day average at Swane* (2.53 mg/L), Englishman (19A, 7.98 mg/L) & Shelly (Blower, 6.4 mg/L & Hamilton, 7.65 mg/L)

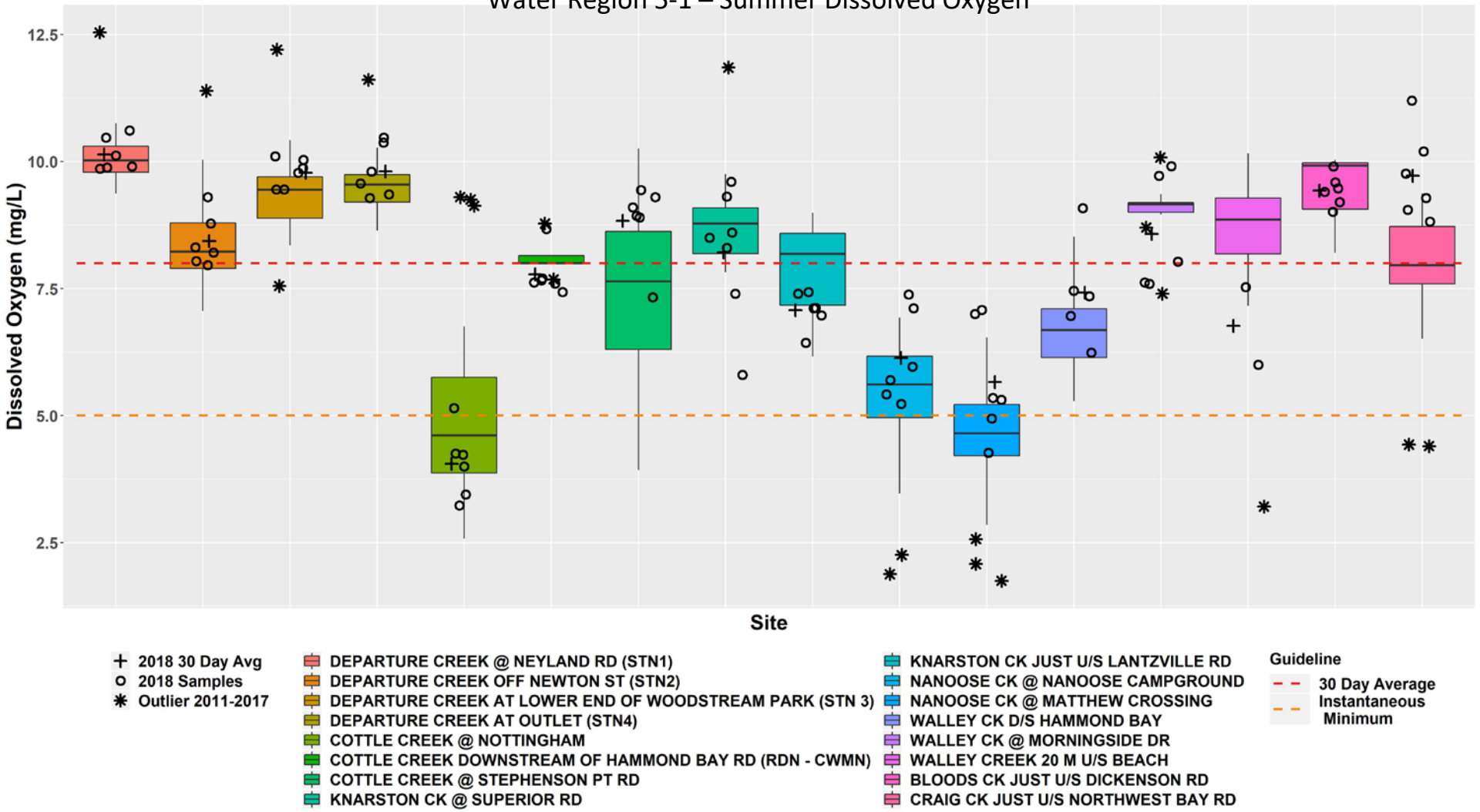
**Swane Creek – went subsurface after Aug 21st*

Water Region 4 – Fall Dissolved Oxygen



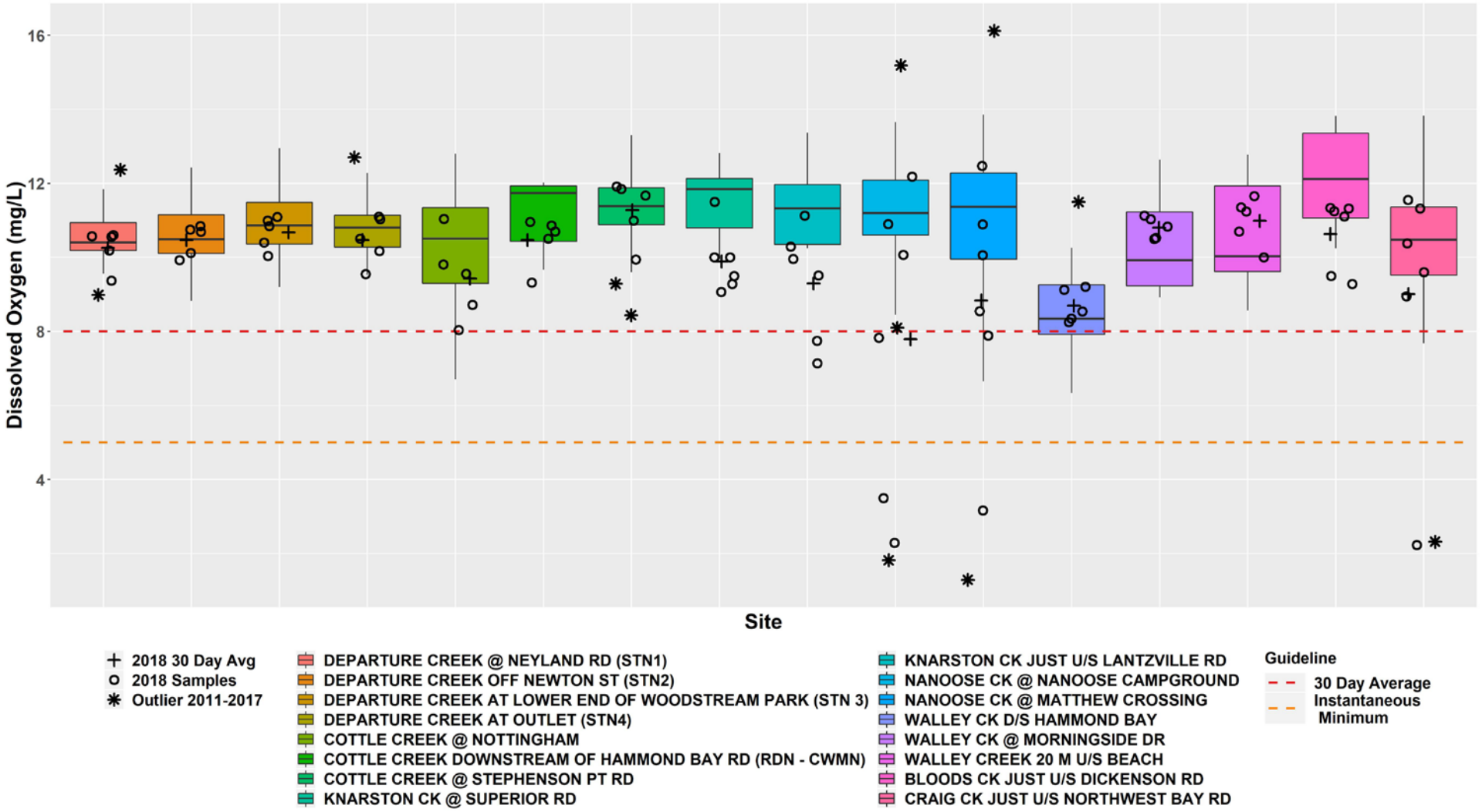
Fall DO below 30-day average at Swane Creek (5.86 mg/L)

Water Region 5-1 – Summer Dissolved Oxygen



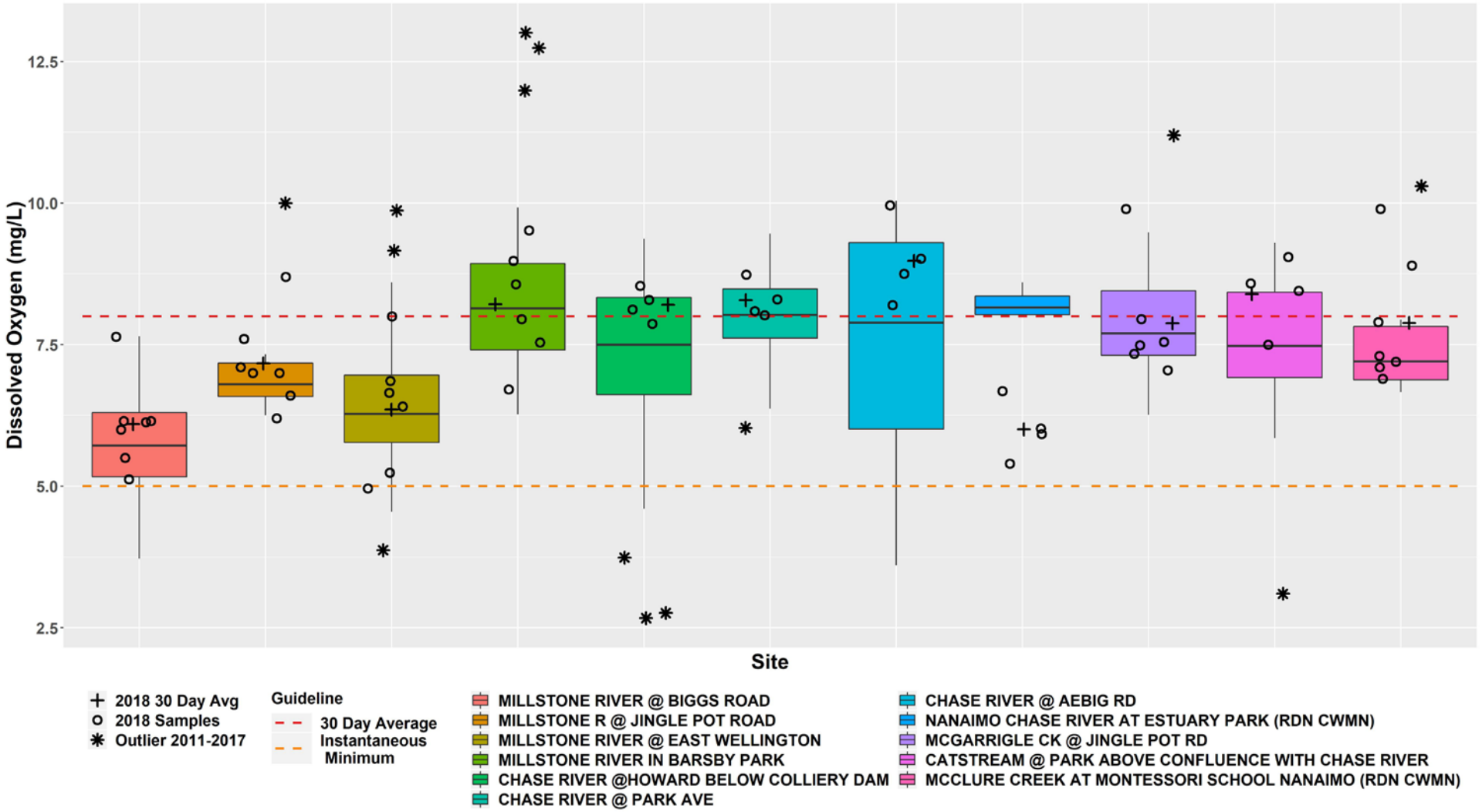
Below 30 day-average: Cottle (Nottingham, 4.05 mg/L & Hammond 7.78 mg/L), Knarston (Lantzville, 7.08 mg/L), Nanoose (Campground, 6.13 mg/L & Matthew, 5.66 mg/L) & Walley (Hammond, 7.42 mg/L & u/s beach, 6.77 mg/L)

Water Region 5-1 – Fall Dissolved Oxygen



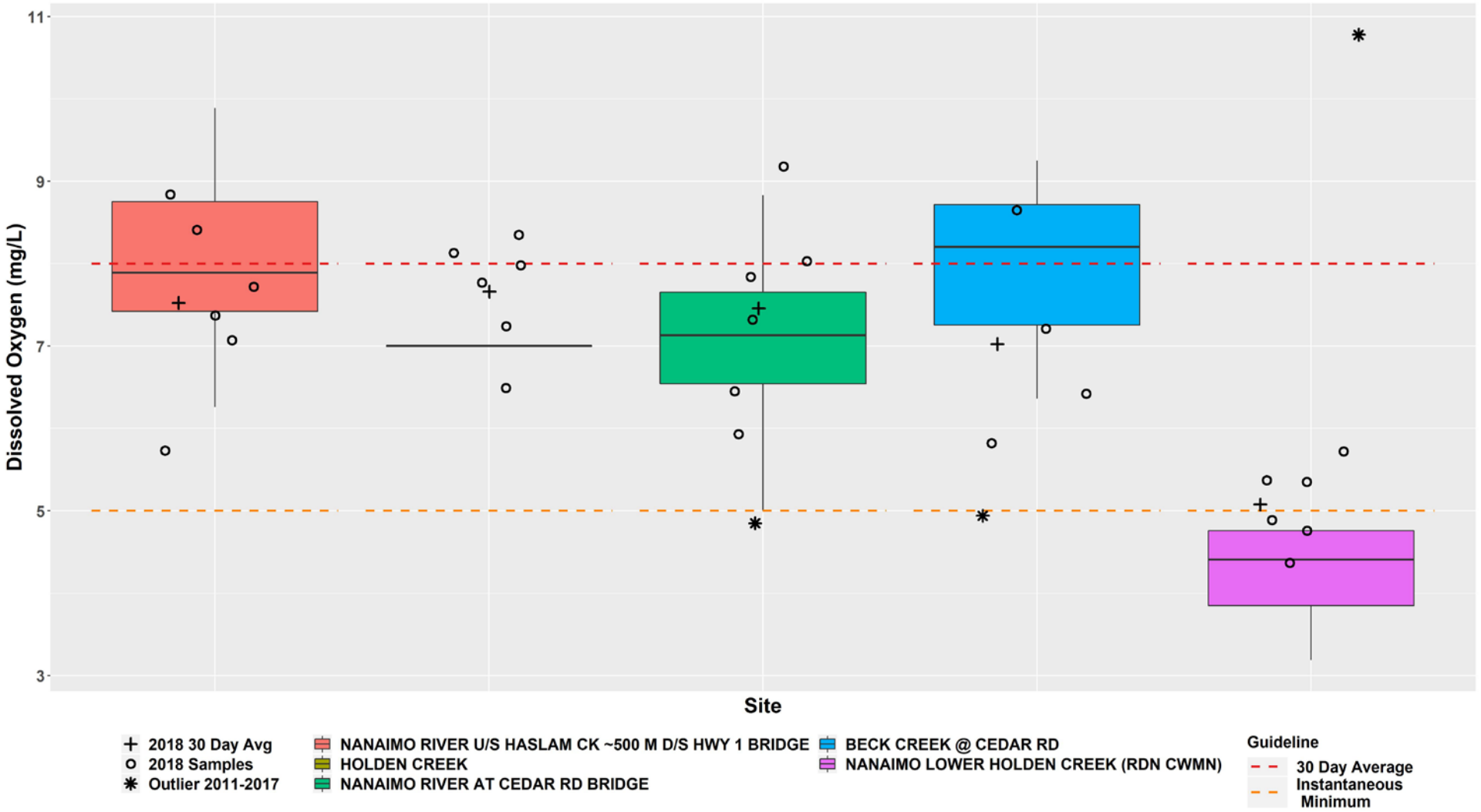
Fall DO below 30 day-average at Nanoose Creek (Campground, 7.8 mg/L)

Water Region 5-2 – Summer Dissolved Oxygen



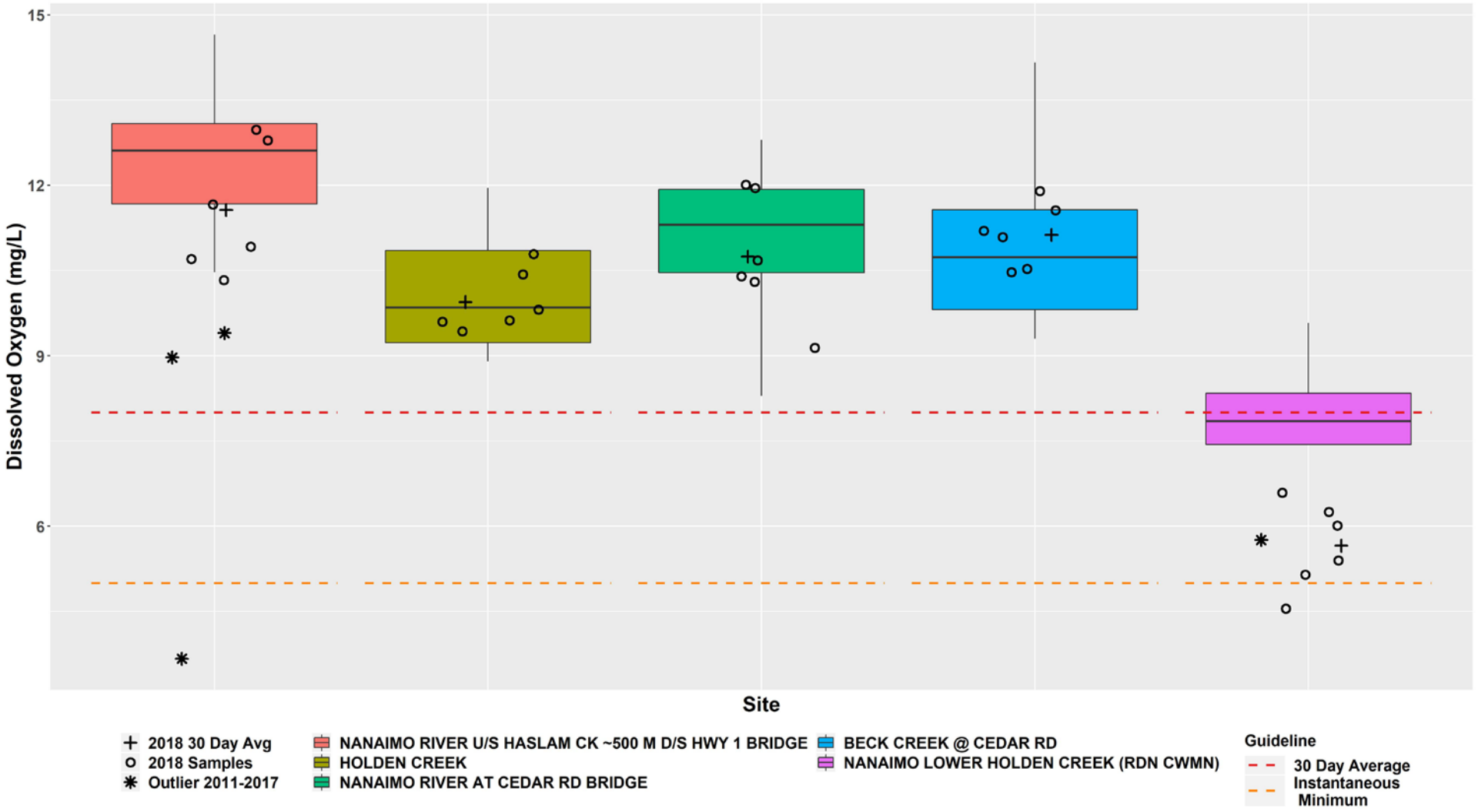
Below 30-day average: Chase (Estuary, 6 mg/L), Millstone (Biggs, 6.1 mg/L; Jingle Pot, 7.17 mg/L & East Well, 6.35 mg/L), McClure (7.89 mg/L) & McGarrigle (7.88 mg/L)

Water Region 6 – Summer Dissolved Oxygen



Below 30-day average at all sites in Water Region 6: Lower Holden (5.08 mg/L), Nanaimo (u/s Haslam, 7.52 mg/L & Cedar Rd, 7.46 mg/L), Beck (7.03 mg/L) & Holden (7.66 mg/L)

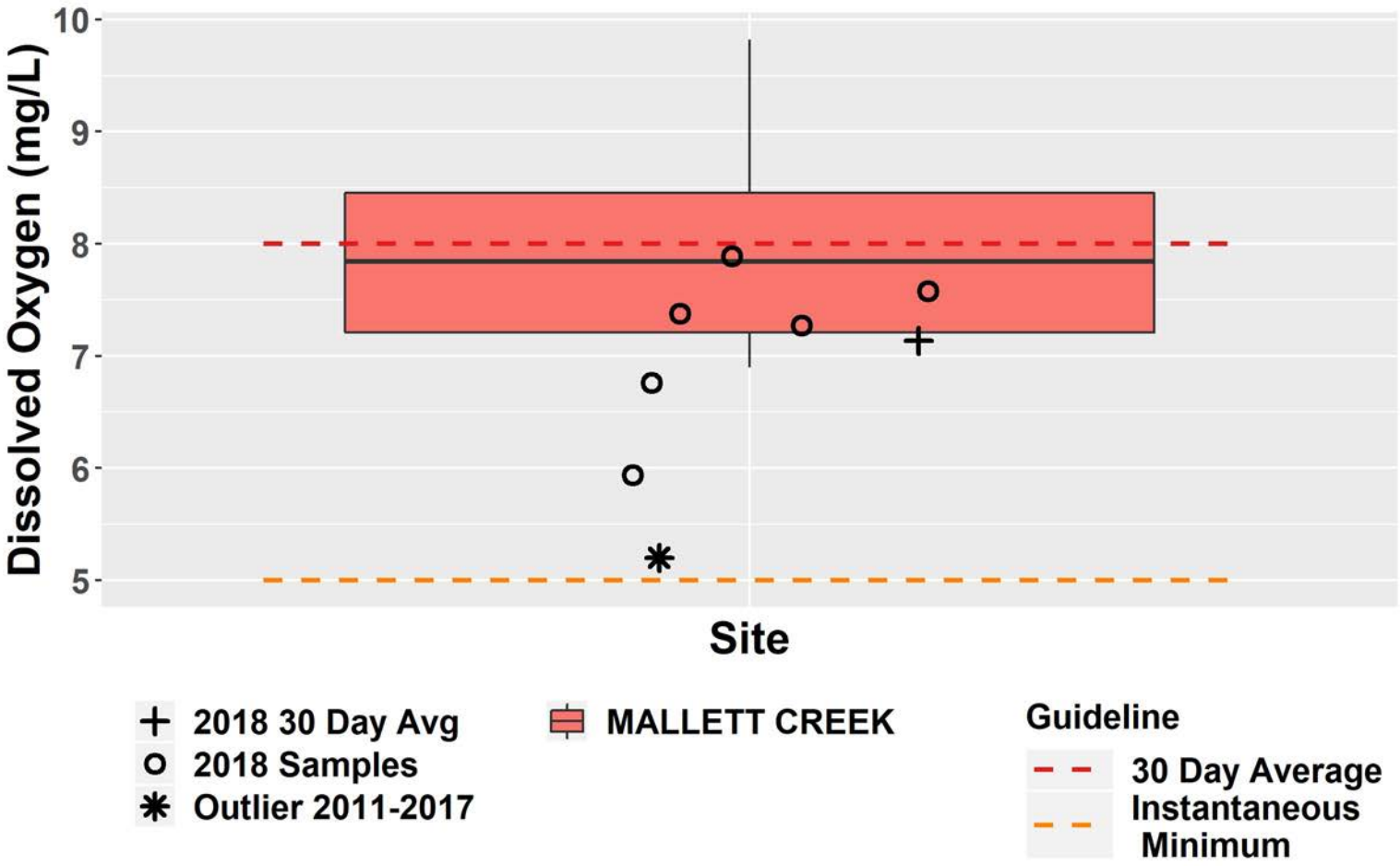
Water Region 6 – Fall Dissolved Oxygen



Below fall DO 30-day average at Lower Holden Creek (5.66 mg/L)

Lower Holden ditched u/s of site and could contribute to lower DO levels

Water Region 7 – Summer Dissolved Oxygen



Below 30-day average Mallett Creek (7.14 mg/L)

Dissolved Oxygen (DO)

Below instantaneous min. guideline (5 mg/L) at:	
Grandon Ck (Laburnum)	Craig Ck (u/s NWB)
French Ck (Grafton)	Nanoose Ck (both sites)
Swane Ck (Errington)	Lower Holden Ck
Cottle Ck (Nottingham)	Millstone (E Well)

- Occurred consistently at very low flow sites
- In 2018 all sites with values <5 mg/L also were below the 30-day average threshold (8 mg/L)

- Both summer & fall 2018 sample periods had values <5 mg/L minimum in Swane, Craig, Nanoose (both sites) and Lower Holden Creeks

Dissolved Oxygen (DO)

- Sites in **blue** had levels below both DO guidelines
- Both summer & fall 2018 sample periods had 30-day averages <8 mg/L minimum in Swane, Nanoose (Campground) and Lower Holden Creeks
- In 2018 one site went subsurface:
  - Swane Creek downstream Errington Road between Aug 14th & Aug 28th

Below 30 day average (8 mg/L) at:	
Annie Creek	Beck Ck
Cook Creek	McGarrigle Creek
Swane Creek**	Englishman (19A)
McClure Creek	Chase (Estuary)
French Creek (Grafton)	
Knarston u/s Lantzville Rd	
Nanoose Creek (both sites)	
Shelly Creek (both sites)	
Cottle Ck (Nottingham & Hammond)	
Millstone (Biggs, E Well, Jingle Pot)	
Walley Creek (Hammond & Beach)*	
Lower Holden Creek	
Holden Creek	
Nanaimo River (both sites)	
Mallett Creek	

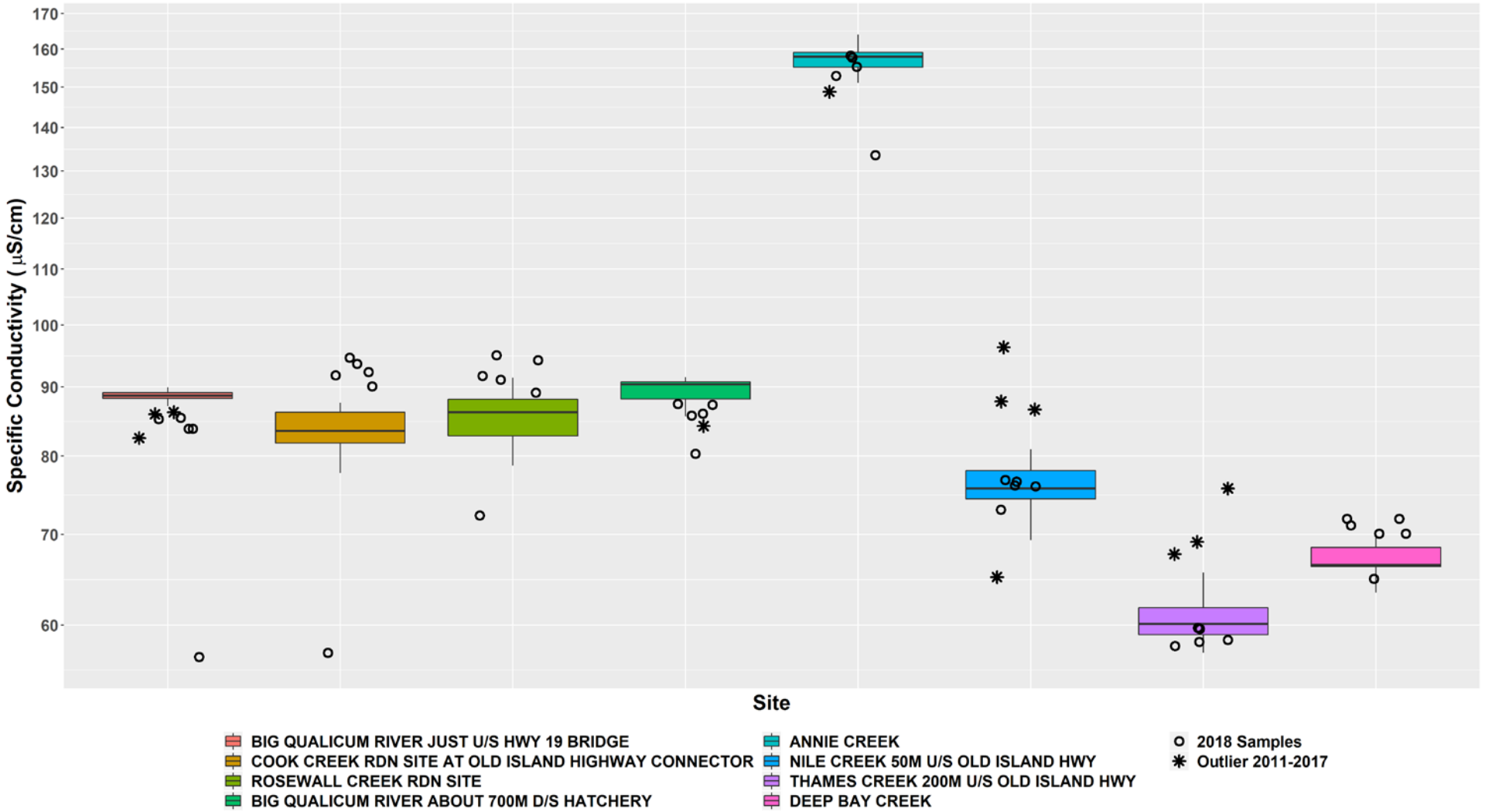
*4 in 30 rather than 5 in 30 **3 in 30

Specific Conductivity

- **Most pristine coastal streams measure <80 uS/cm**
- **No provincial guideline for this parameter**

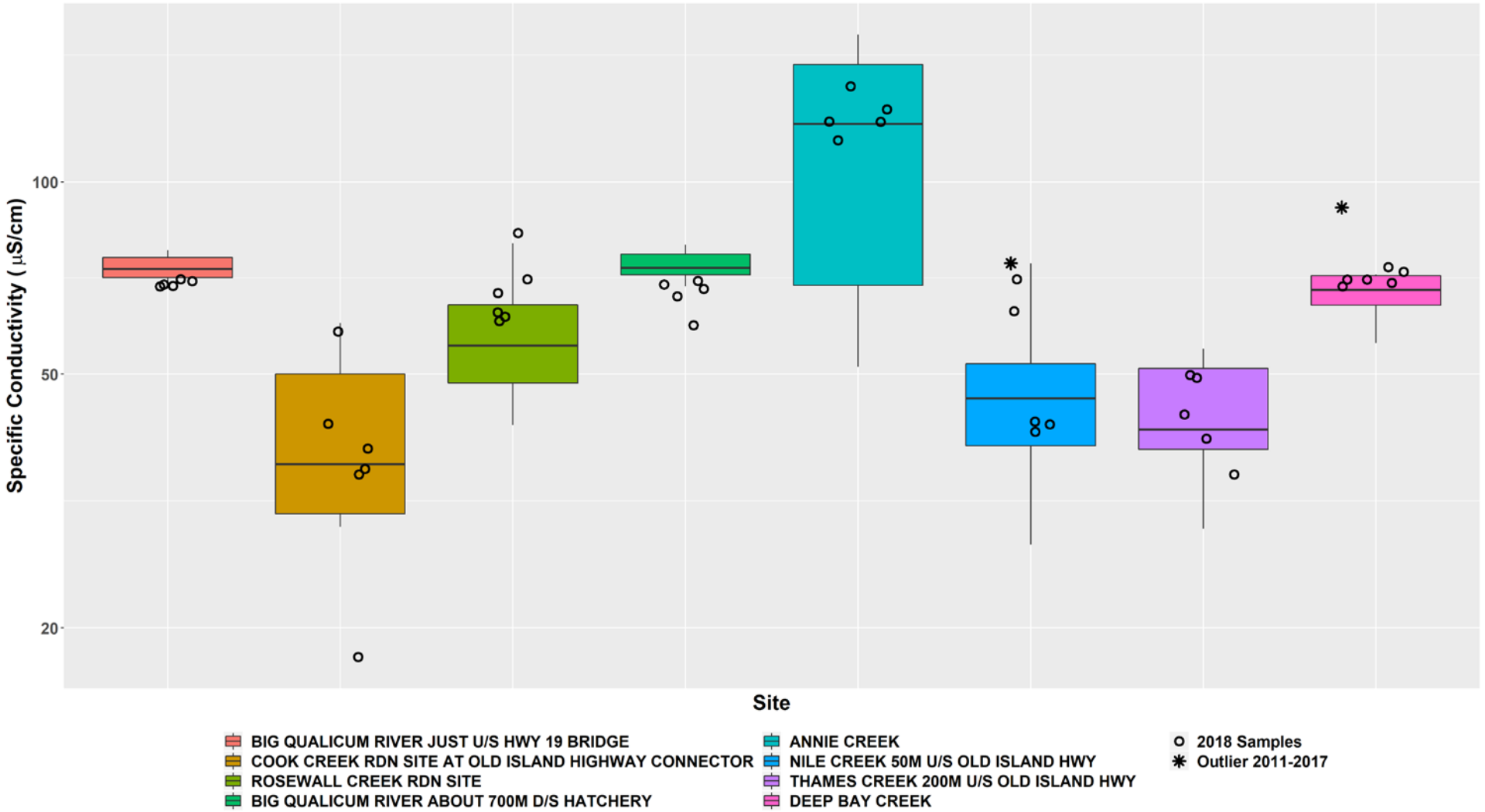
- Measure of concentration, charge and mobility of dissolved ions in water
  - Usually ↑ as water temperature ↑
- Specific conductance measures conductivity corrected to 25°C

Water Region 1 – Summer Specific Conductivity



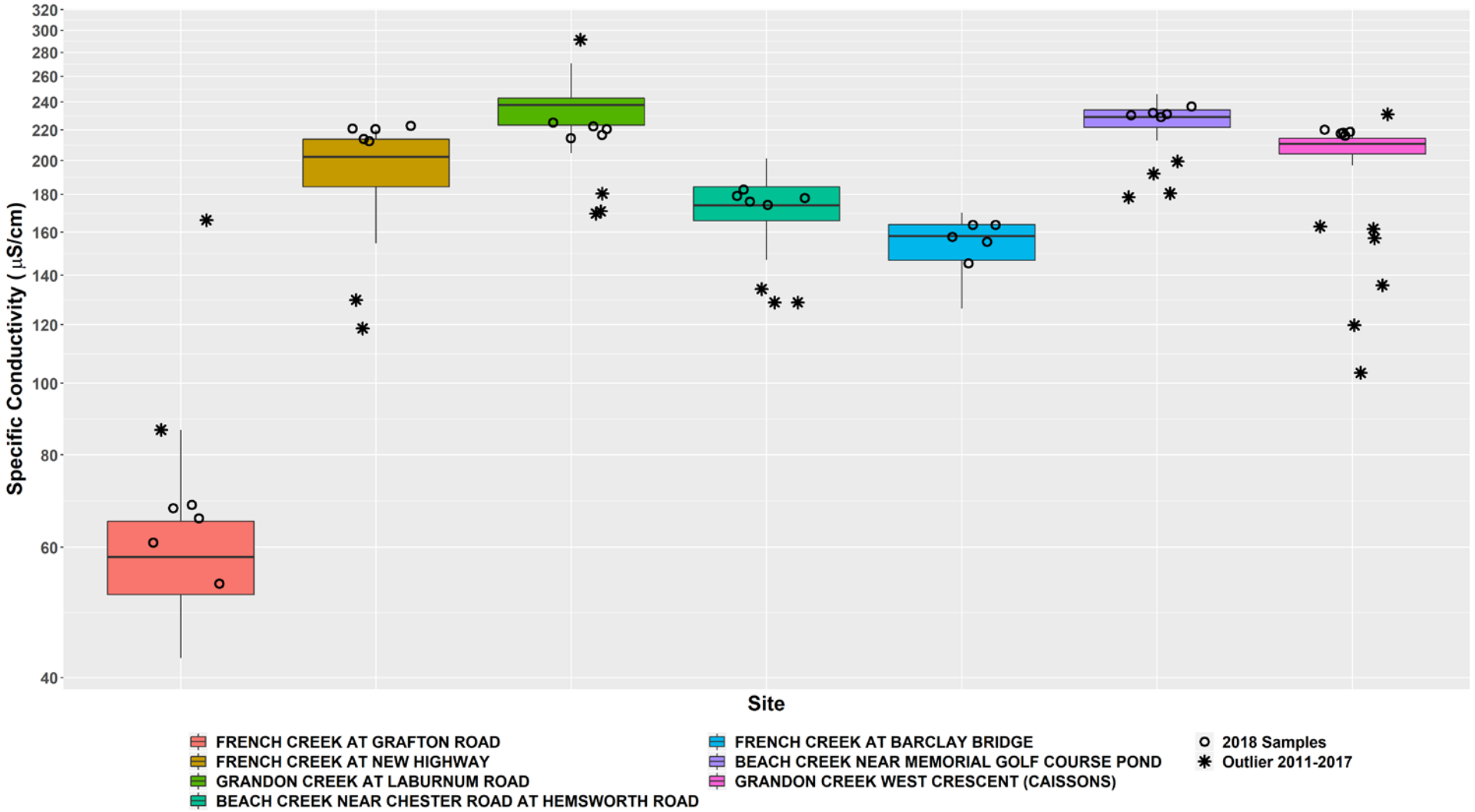
Annie Creek 2011-2017 averages: fall >100 µS/cm & summer >150 µS/cm → values suggest groundwater influence

Water Region 1 – Fall Specific Conductivity



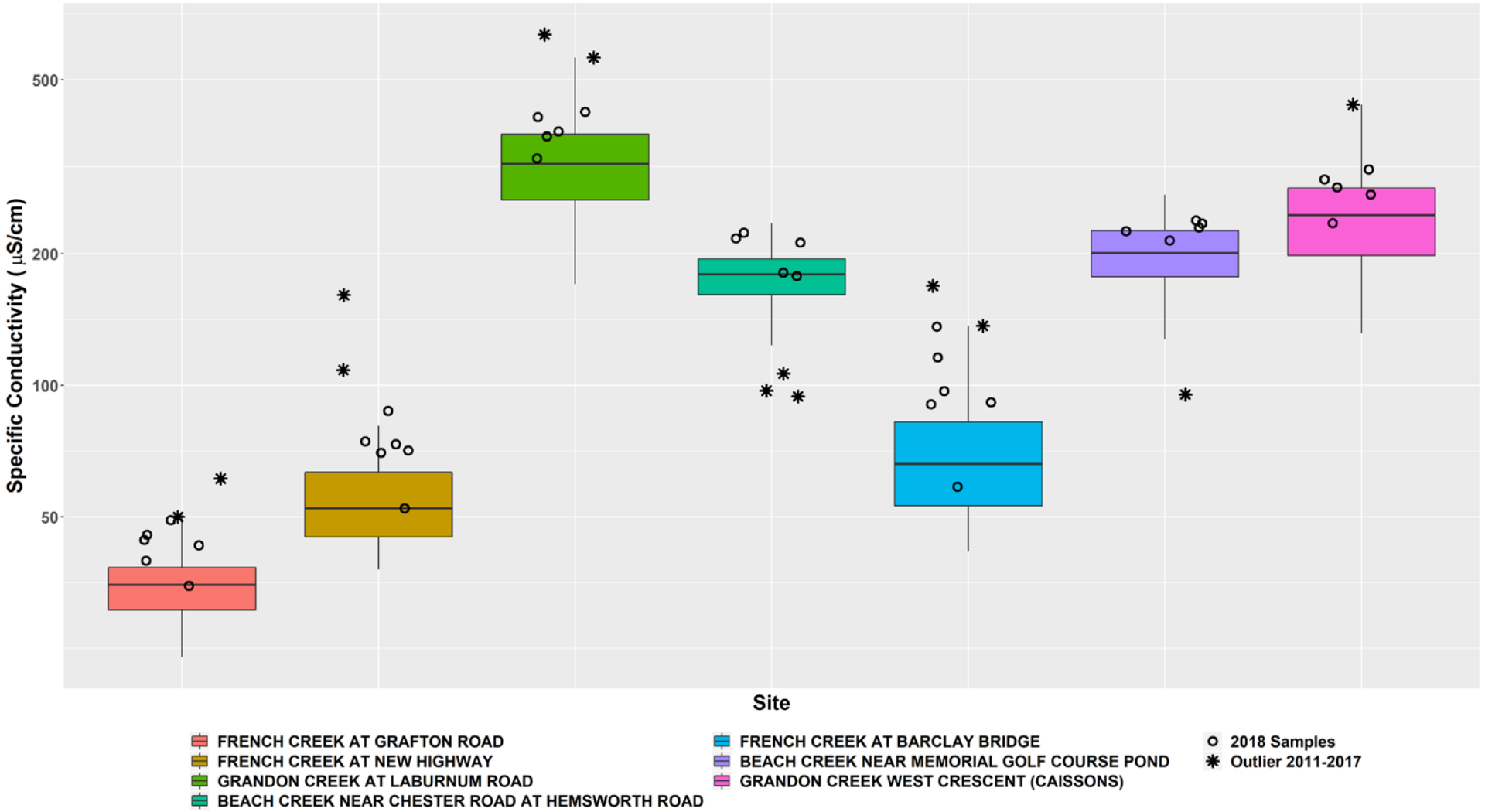
Annie Creek 2011-2017 averages: fall >100 µS/cm & summer >150 µS/cm → values suggest groundwater influence

Water Region 3 – Summer Specific Conductivity

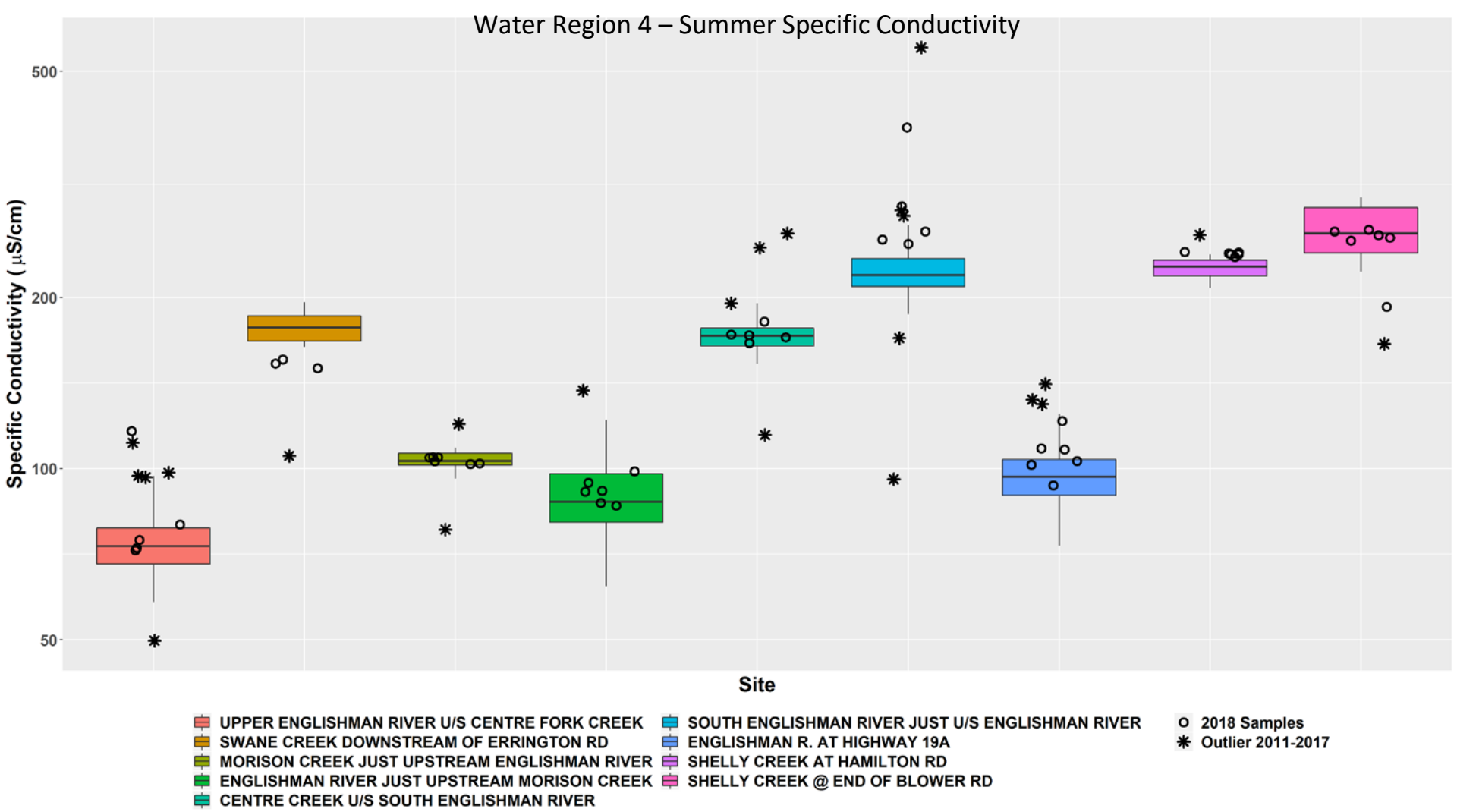


All sites except French Ck @ Grafton: average 2011-2017 summer conductivities >160 µS/cm → values suggest groundwater influence or salinized inflow from adjacent lands

Water Region 3 – Fall Specific Conductivity



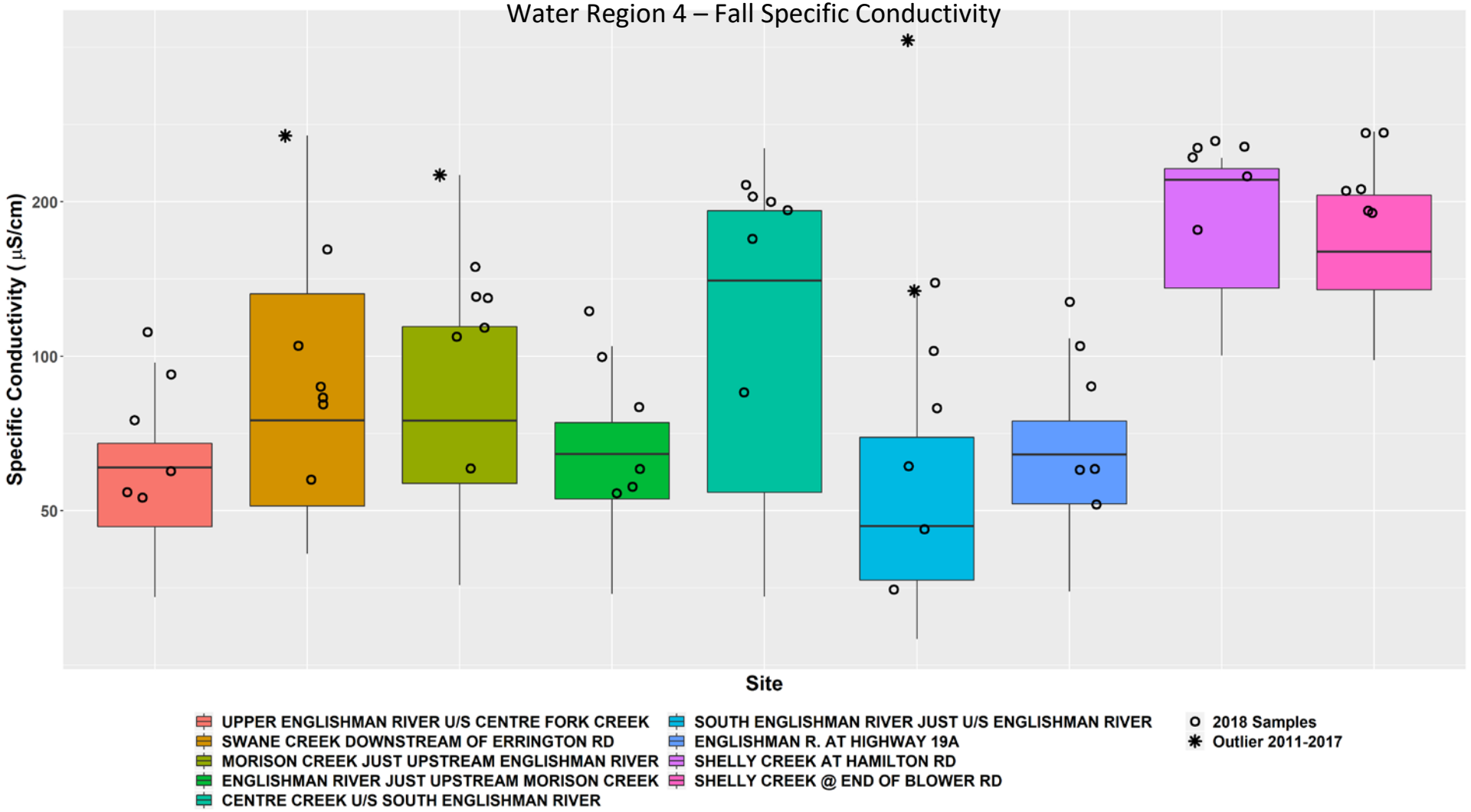
Decrease in fall conductivity suggests dilution of groundwater influence in lower French Creek sites (new hwy & Barclay bridge)



Centre & Shelly Ck sites 2011-2017 average: summer >200 µS/cm; fall >150 µS/cm → values suggest groundwater influence

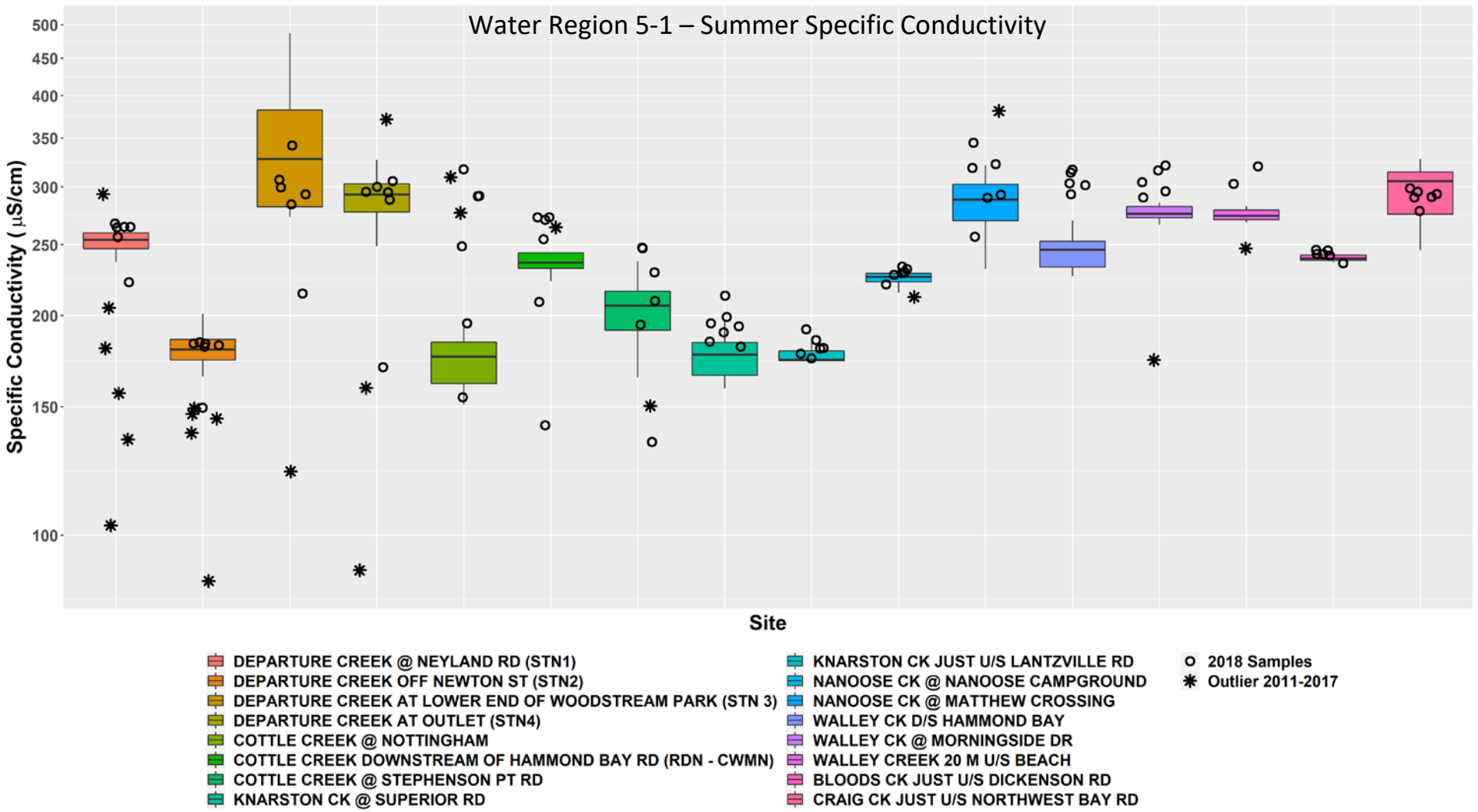
Upper Englishman generally <70 µS/cm → less groundwater influence

Water Region 4 – Fall Specific Conductivity



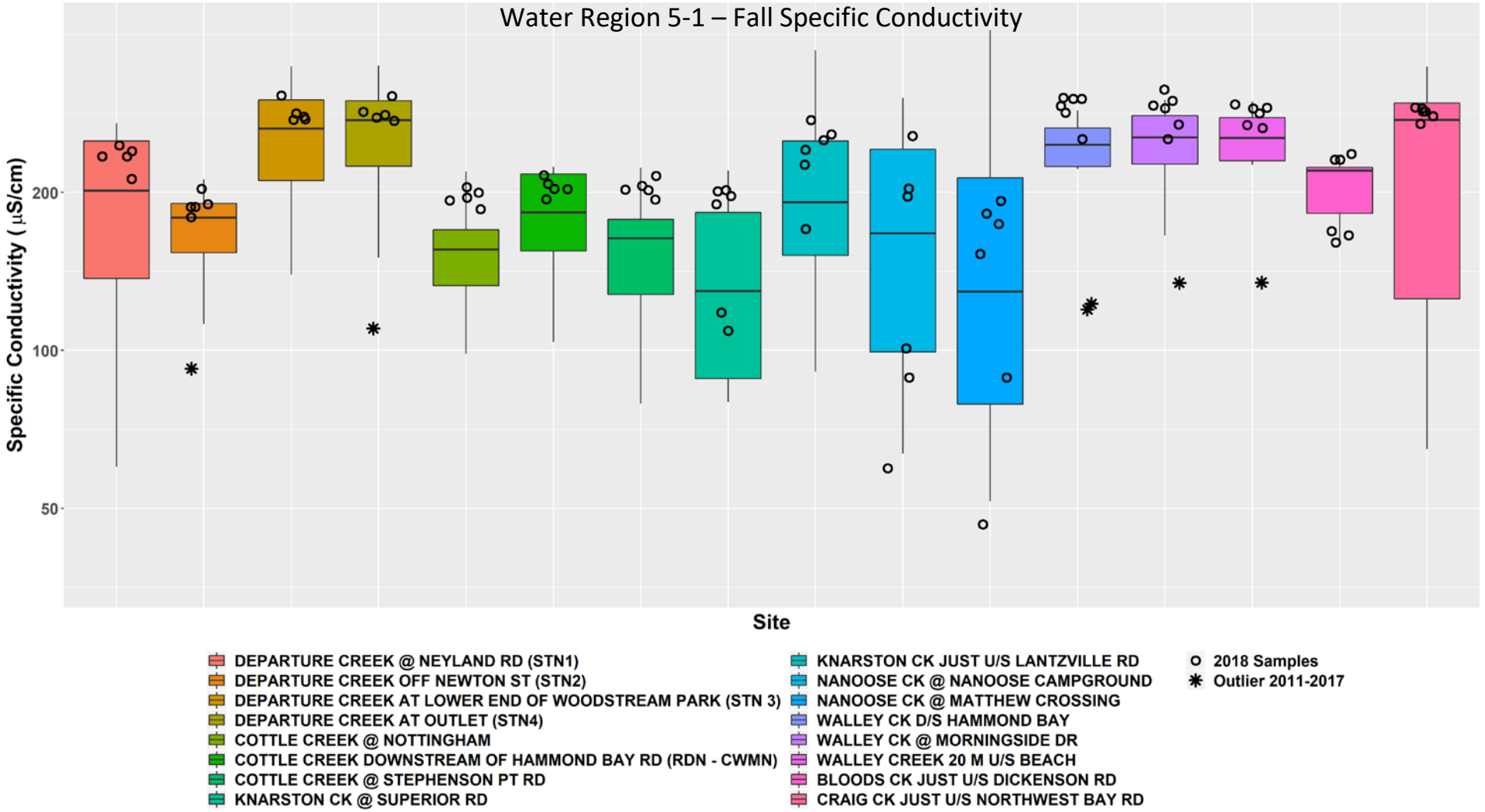
Centre & Shelly Ck sites 2011-2017 average: summer >200 µS/cm; fall >150 µS/cm → values suggest groundwater influence

Upper Englishman generally <70 µS/cm → less groundwater influence



Conductivity levels in Nanoose, Departure, Cottle & Walley Cks indicate significant groundwater component

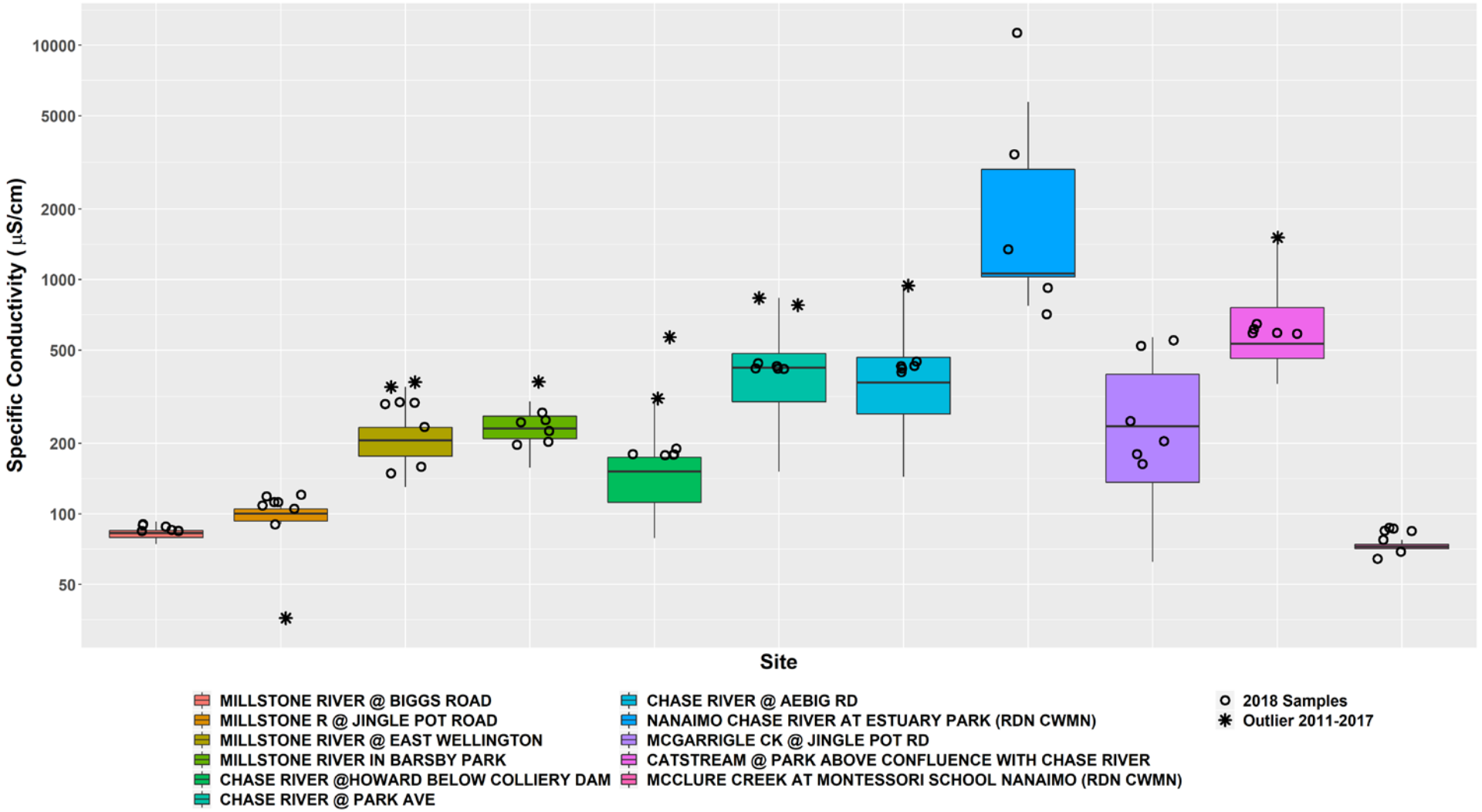
All of these except Nanoose could also be associated with stormwater influences



Conductivity levels in Nanoose, Departure, Cottle & Walley Cks indicate significant groundwater component

All of these except Nanoose could also be associated with stormwater influences

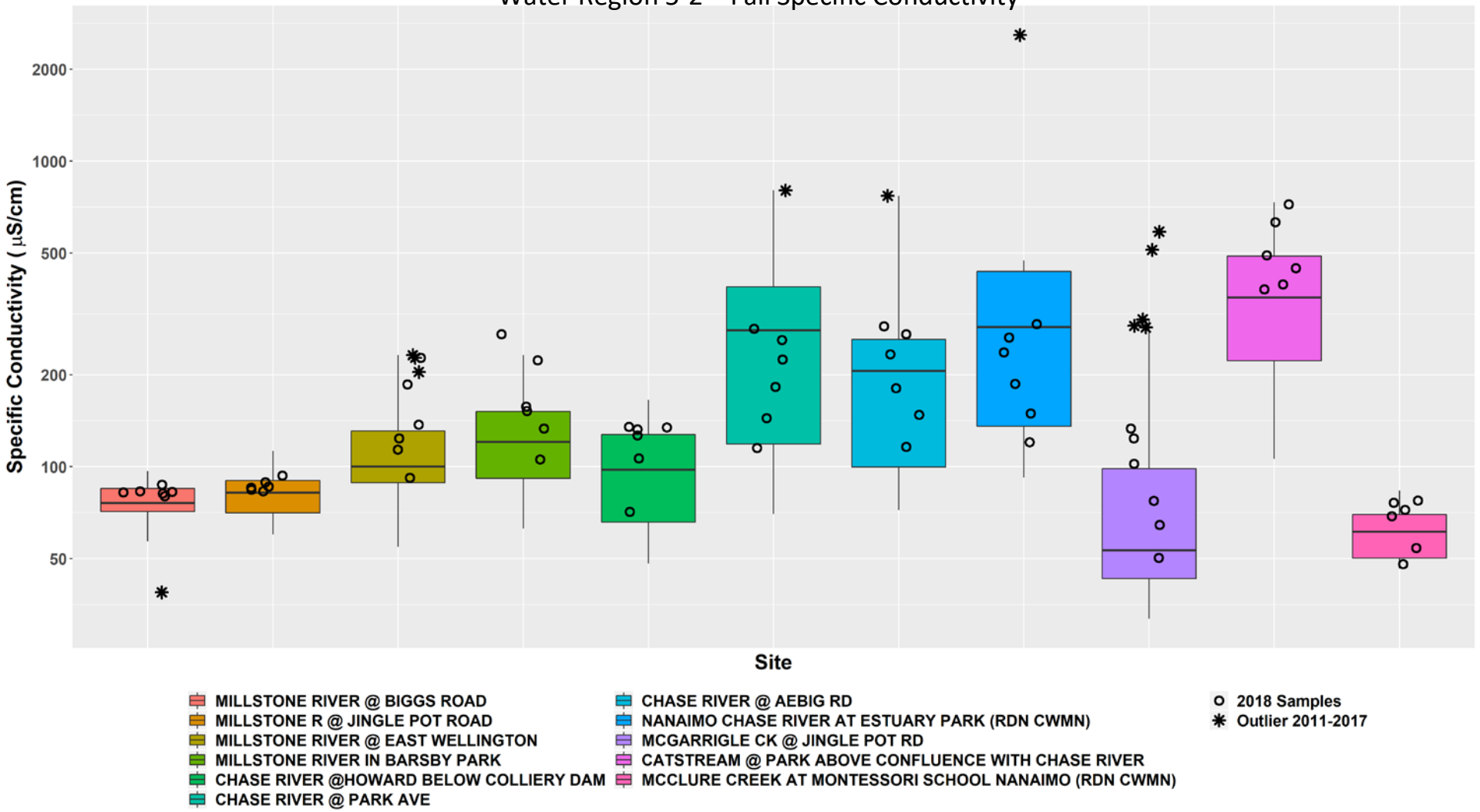
Water Region 5-2 – Summer Specific Conductivity



Conductivity levels >1000 µS/cm suggest saline influence (tidal)

Higher conductivity values in developed areas could also be associated to anthropogenic influences (road run-off)

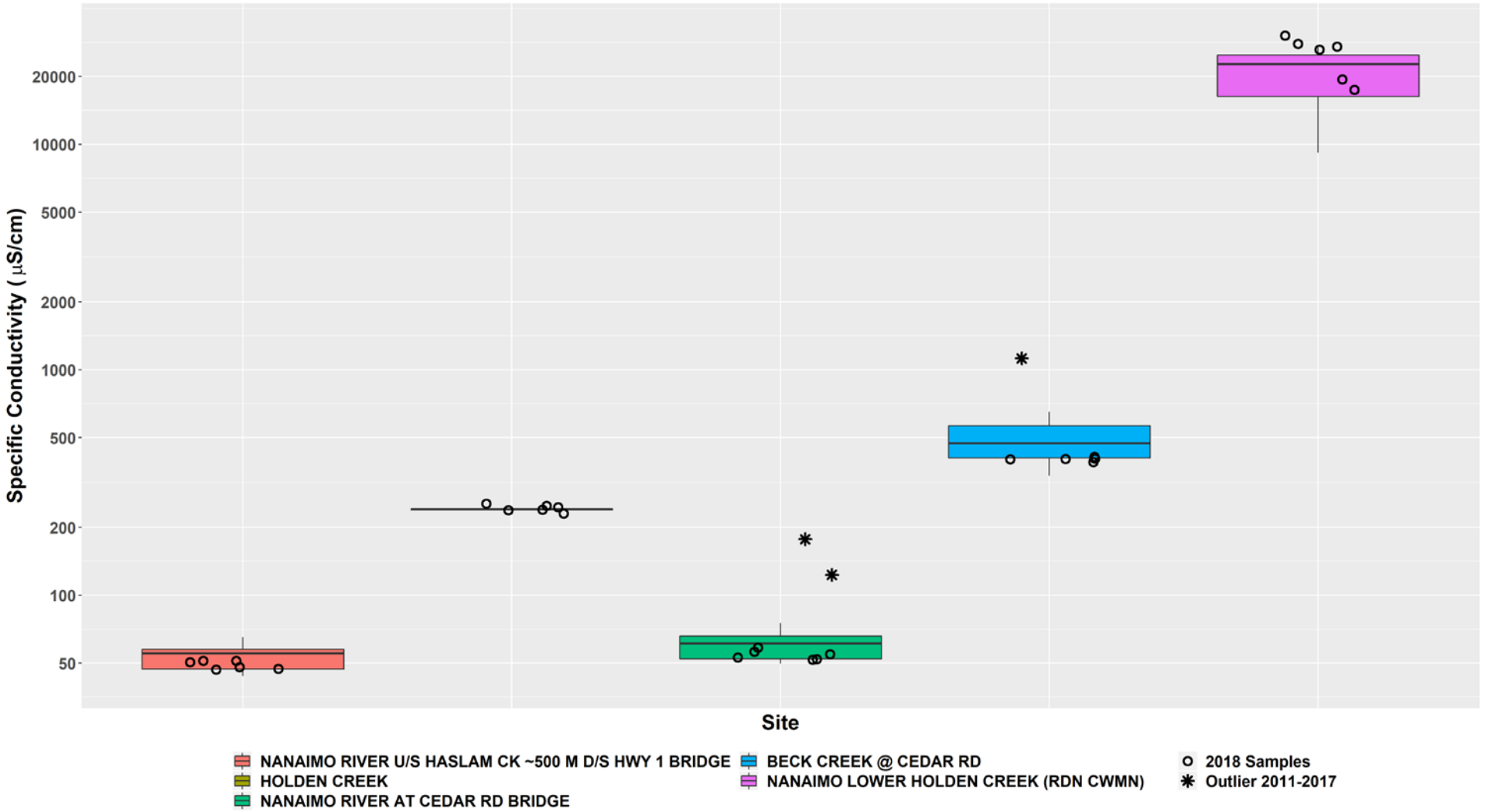
Water Region 5-2 – Fall Specific Conductivity



Conductivity levels in >1000 µS/cm suggest saline influence (tidal)

Higher conductivity values in developed areas could also be associated to anthropogenic influences (road run-off)

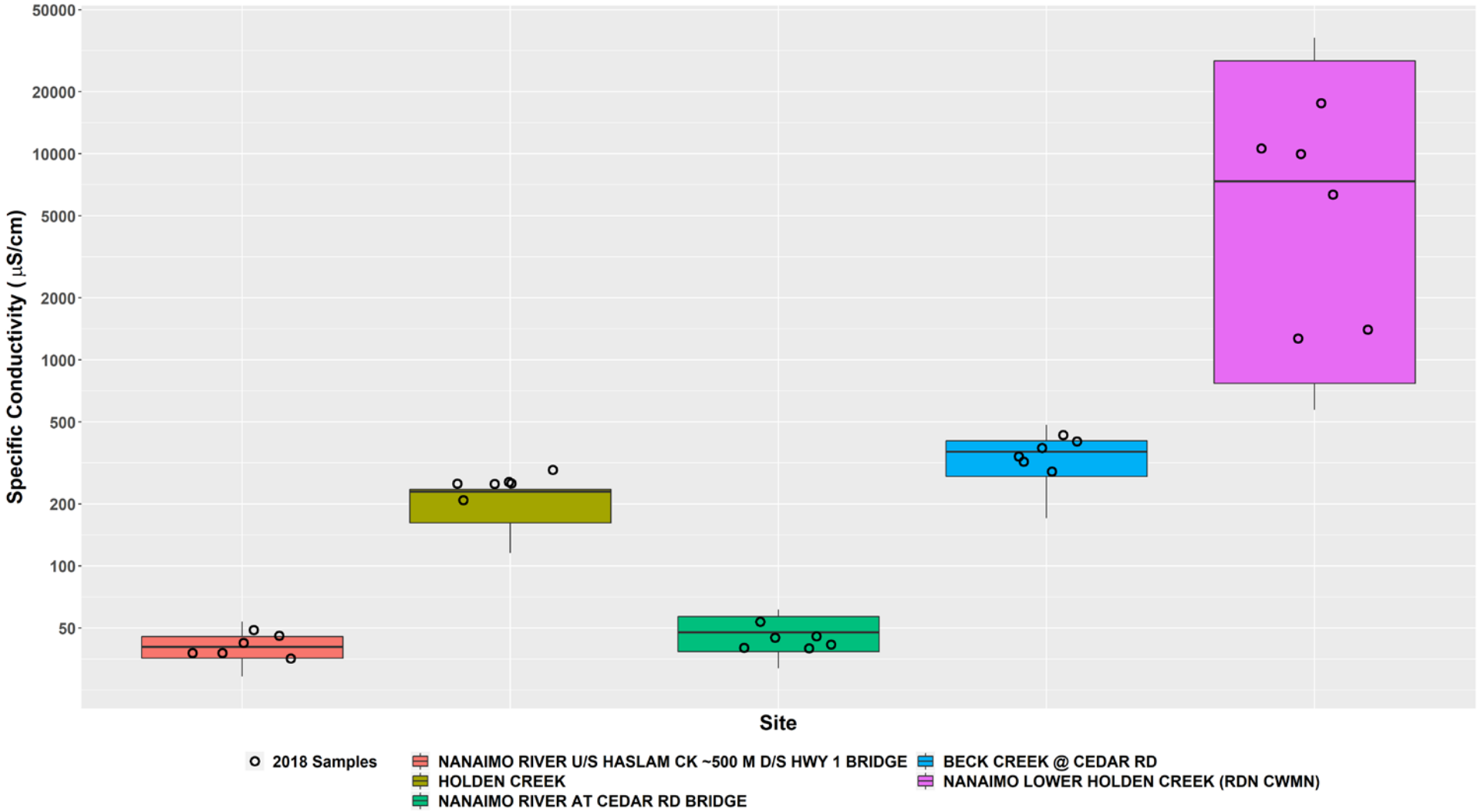
Water Region 6 – Summer Specific Conductivity



Lower Holden Ck conductivity averages 20,000 µS/cm suggesting saline influence (tidal)

Beck Ck 2011-2017 averages 500 µS/cm, potentially from historic coal mining in the area

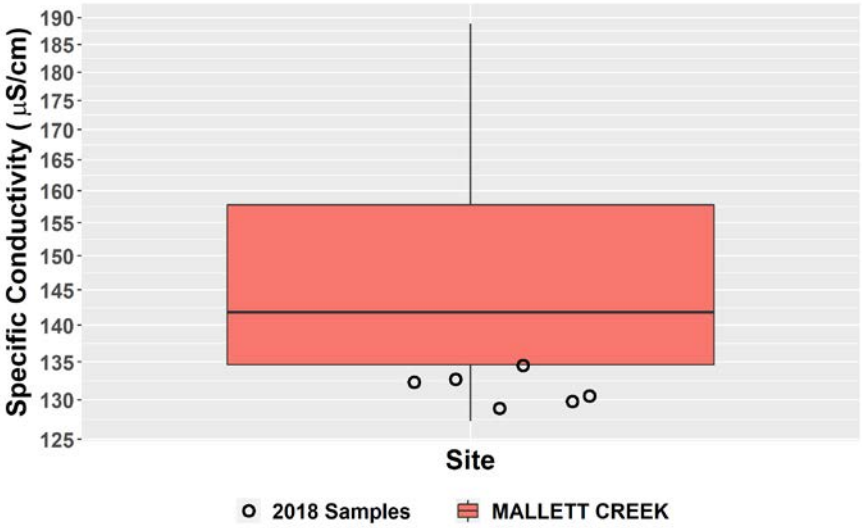
Water Region 6 – Fall Specific Conductivity



Lower Holden Ck conductivity averages 20,000 µS/cm suggesting saline influence (tidal)

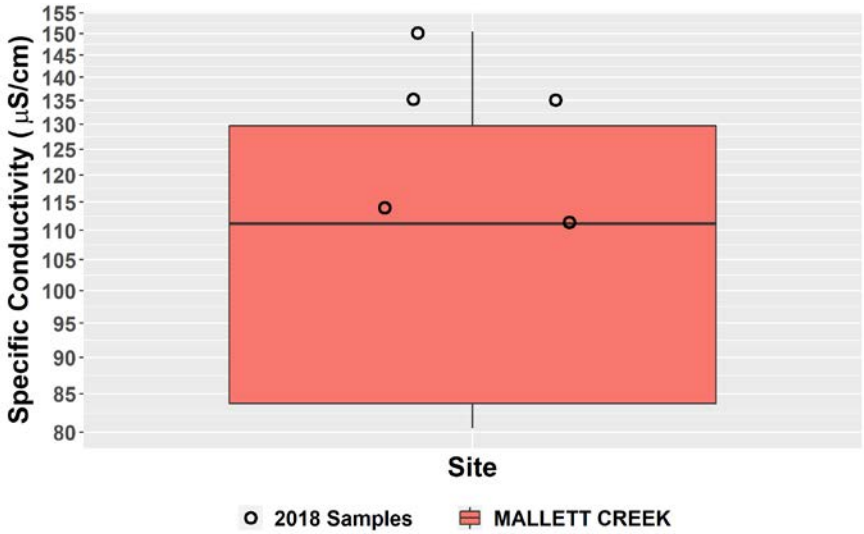
Beck Ck 2011-2017 averages 500 µS/cm, potentially from historic coal mining in the area

Water Region 7 – Summer Specific Conductivity



Mallett Creek conductivity 2011-2017 averaged summer 142 µS/cm; fall 110 µS/cm, suggesting groundwater influence

Water Region 7 – Fall Specific Conductivity



Specific Conductivity

Possible groundwater influence:			
South Englishman	Annie Creek	Nanoose Creek	Walley Creek
French Creek	Cottle Creek	Mallet Creek	Shelley Creek
Swane Creek	Centre Creek	Craig Creek	Departure Creek

Possible human contaminant influence:			
Millstone River	McGarrigle Creek	Chase River	Beach Creek
Cat Stream	Beck Creek	Holden Creek	Grandon Creek

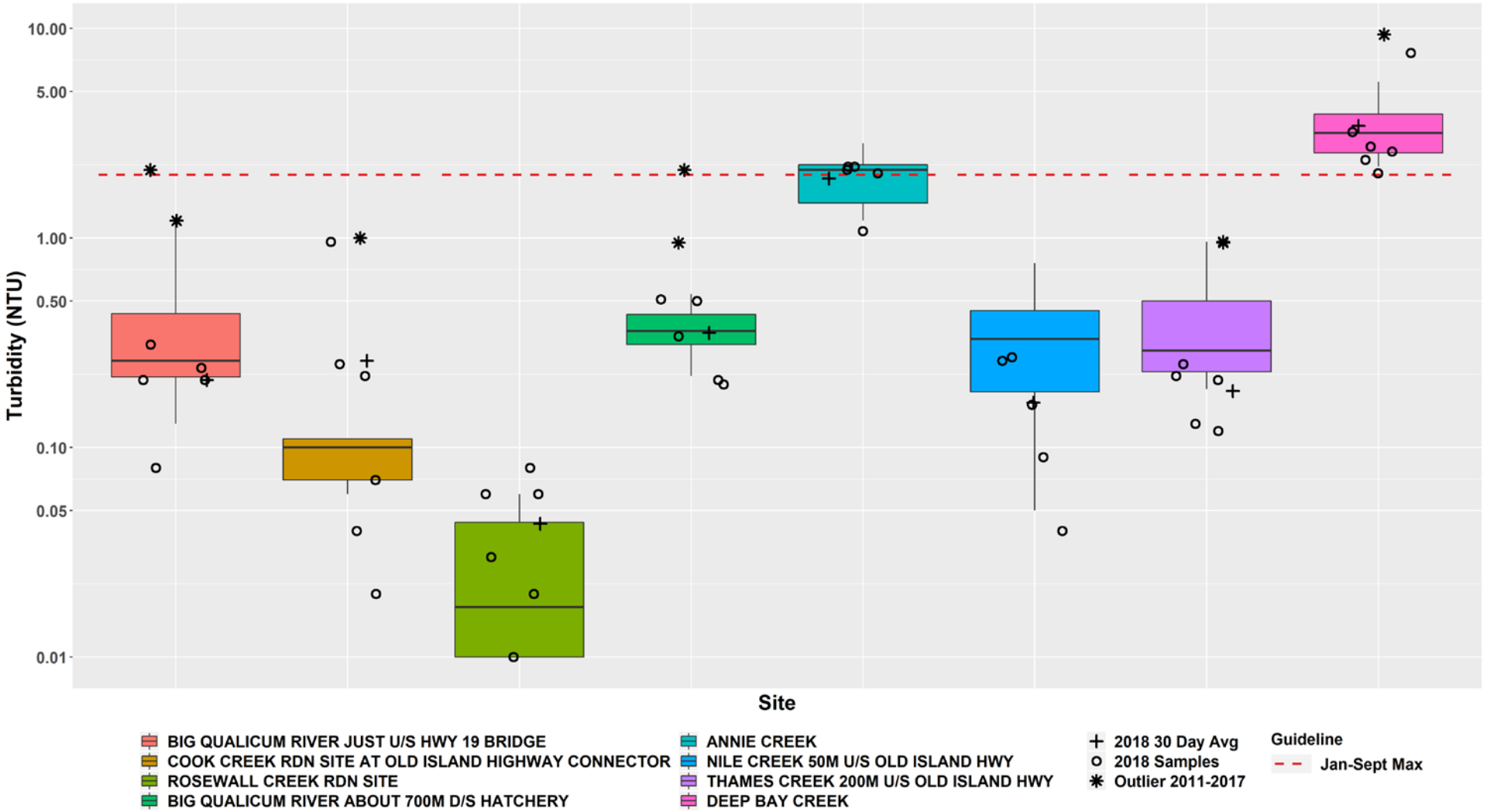
- Turbidity increases in the fall are often due to rain events, observations listed above are mostly attributed to summer season values
- Most east coast Vancouver Island streams have both groundwater and human influences

Turbidity

- **January to September (summer period) maximum: 2 NTU**
- **October to December (winter period) maximum: 5 NTU**

- The amount of suspended solids in water
- ↑ turbidity can ↑ water temperature as suspended particles will absorb sun more efficiently than clear water
- Varies in pristine streams, generally <2 NTU

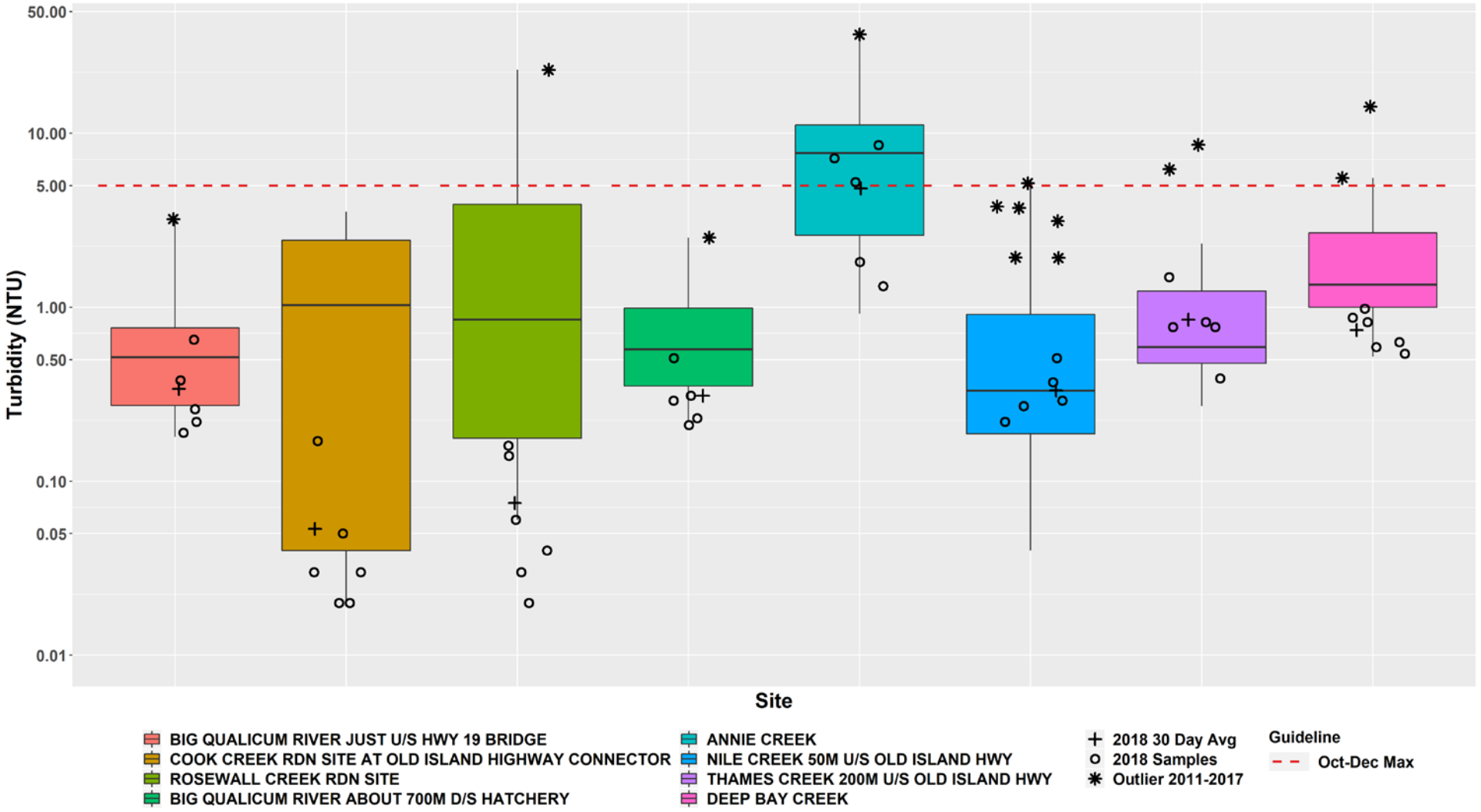
Water Region 1 – Summer Turbidity



Exceedances at Annie Ck on 4 sample days

Deep Bay exceedances all summer sample dates

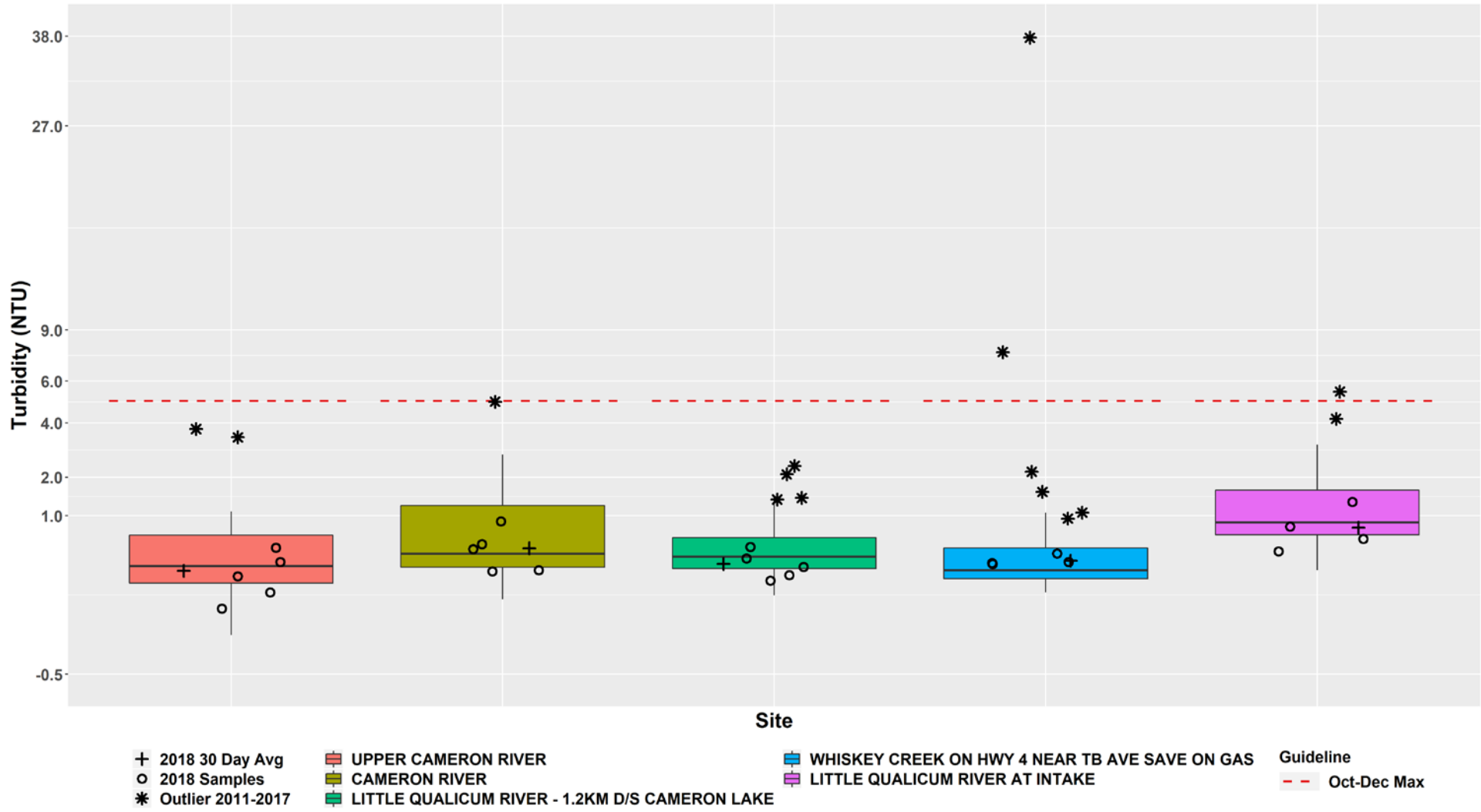
Water Region 1 – Fall Turbidity



Exceedances at Annie Ck on 3 sample days: Oct 9th, Oct 30th & Nov 6th

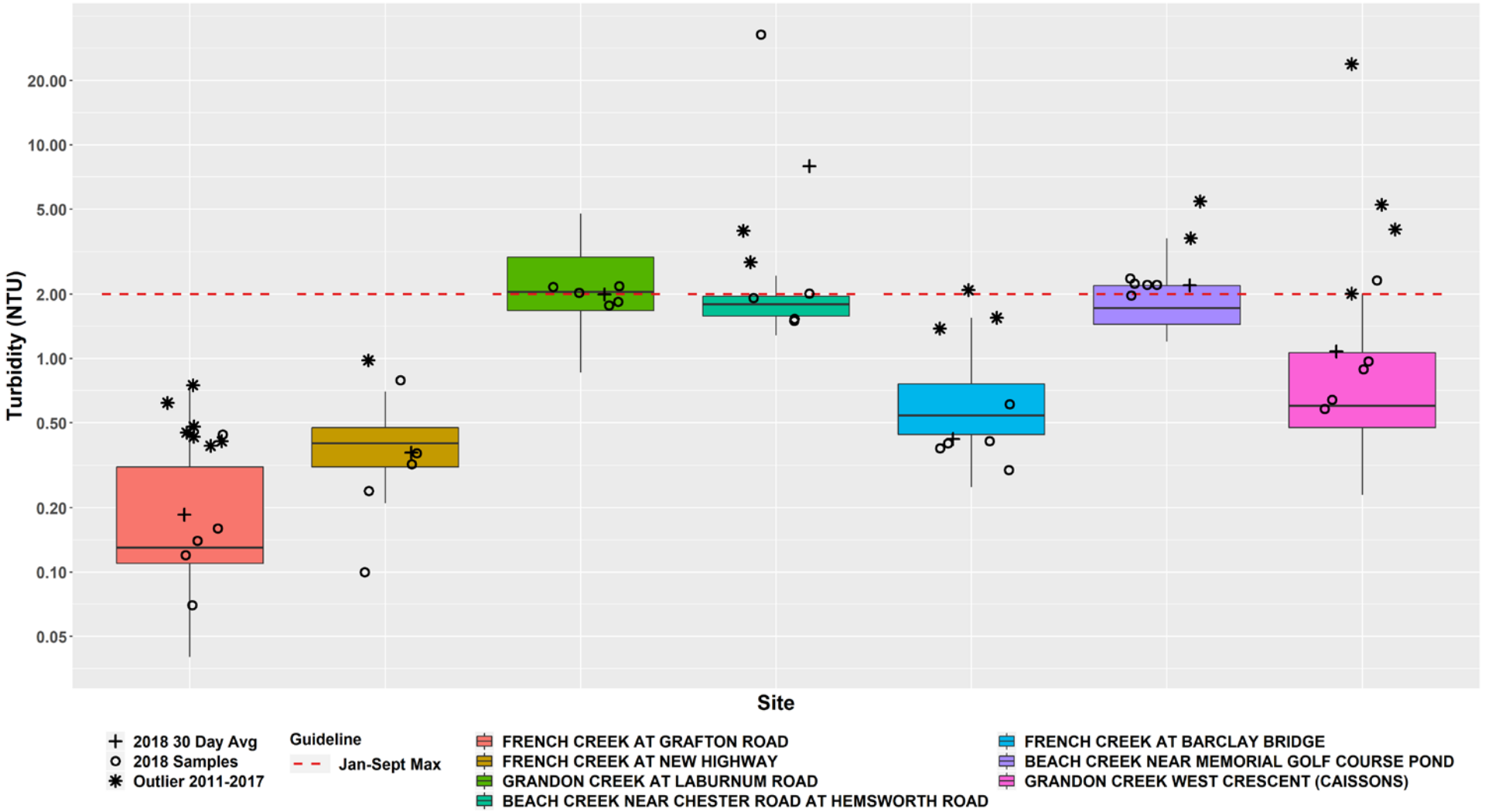
Known bank stability concerns; >20% agriculture upstream of site

Water Region 2 – Fall Turbidity



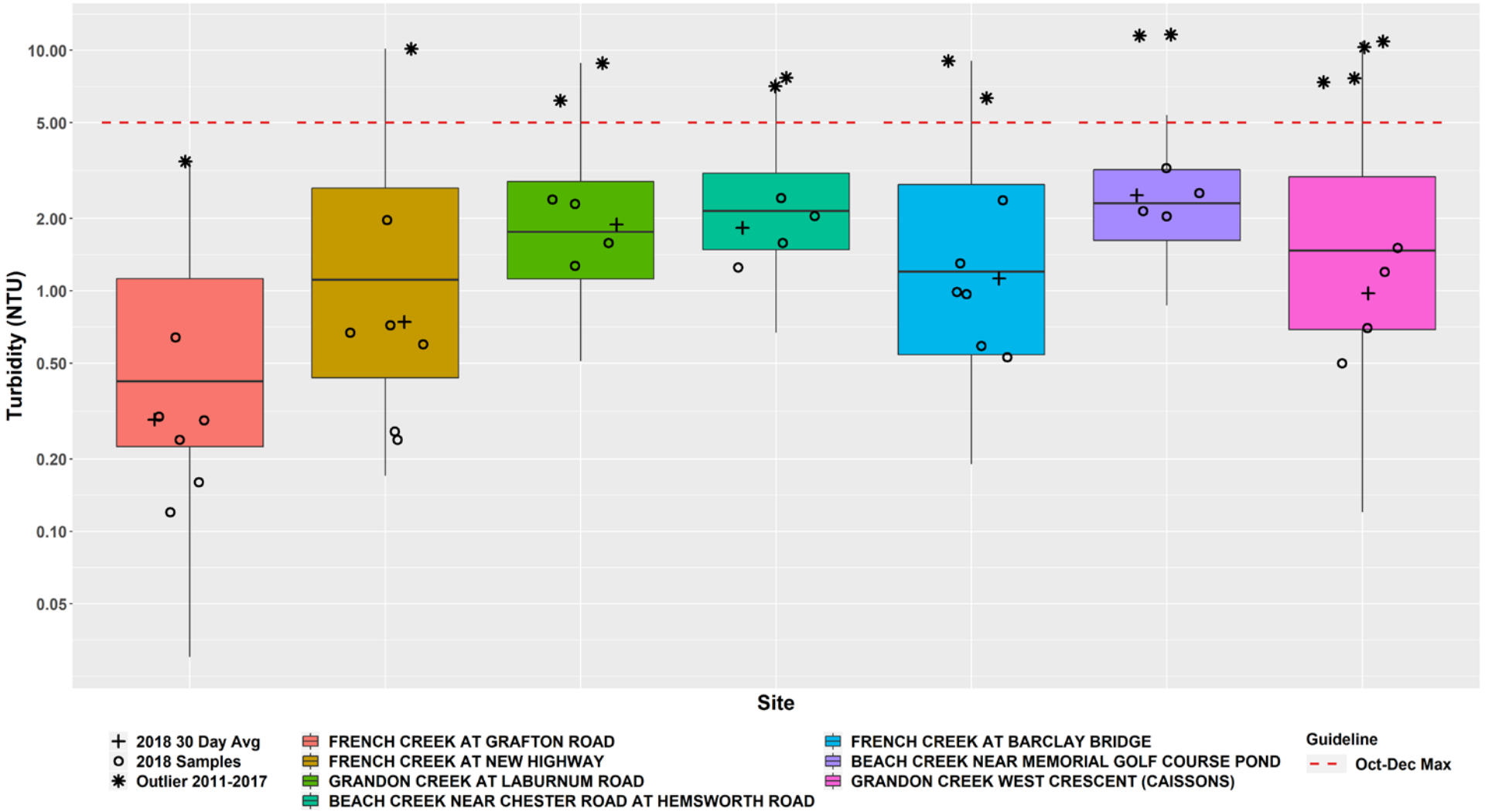
Summer sites no turbidity exceedances; fall occasional turbidity exceedances at lower Cameron River site, Whiskey Creek and Little Qualicum River at intake

Water Region 3 – Summer Turbidity



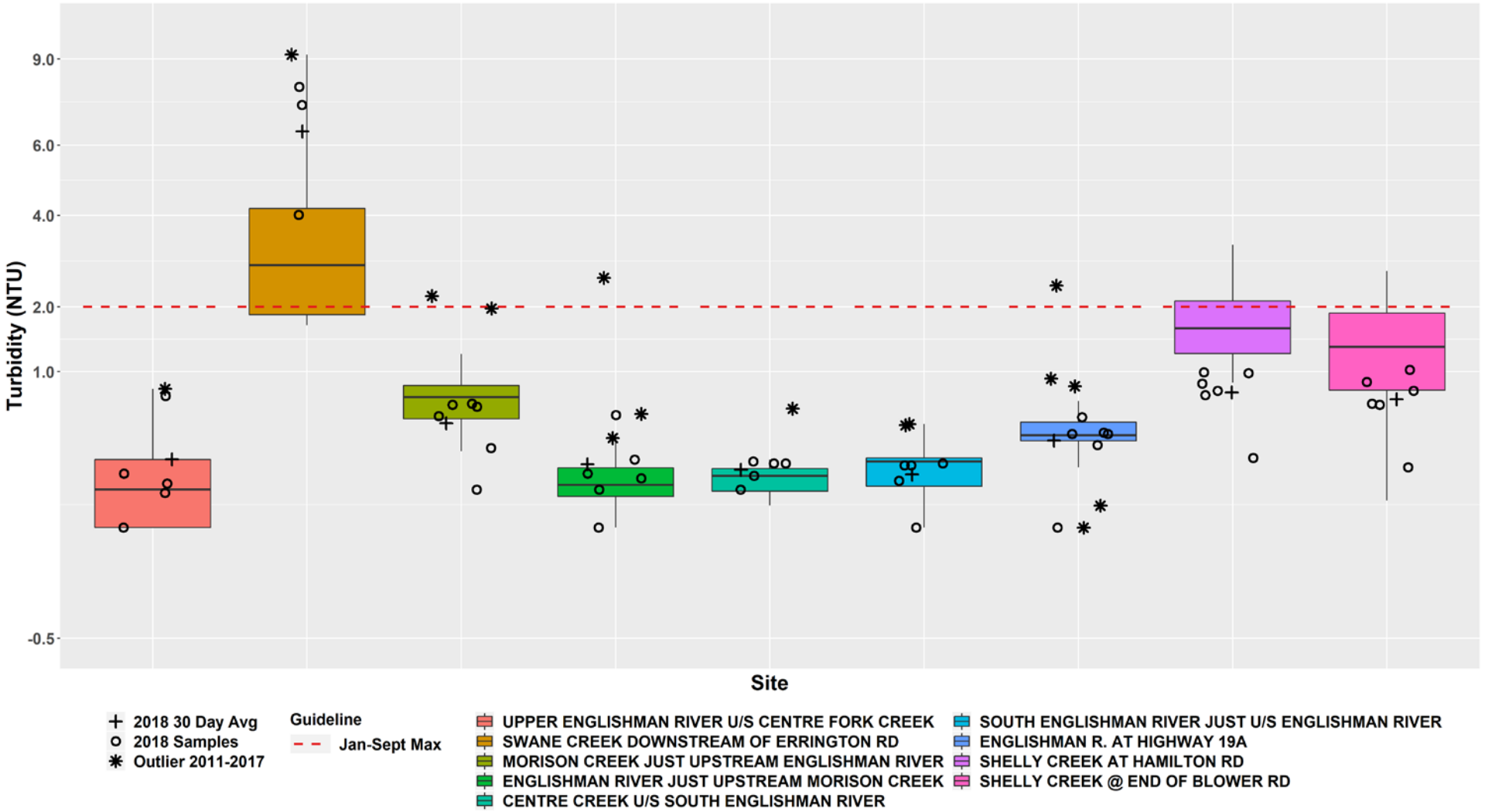
Occasional summer turbidity exceedances at sites in the lower reaches of Water Region 3

Water Region 3 – Fall Turbidity



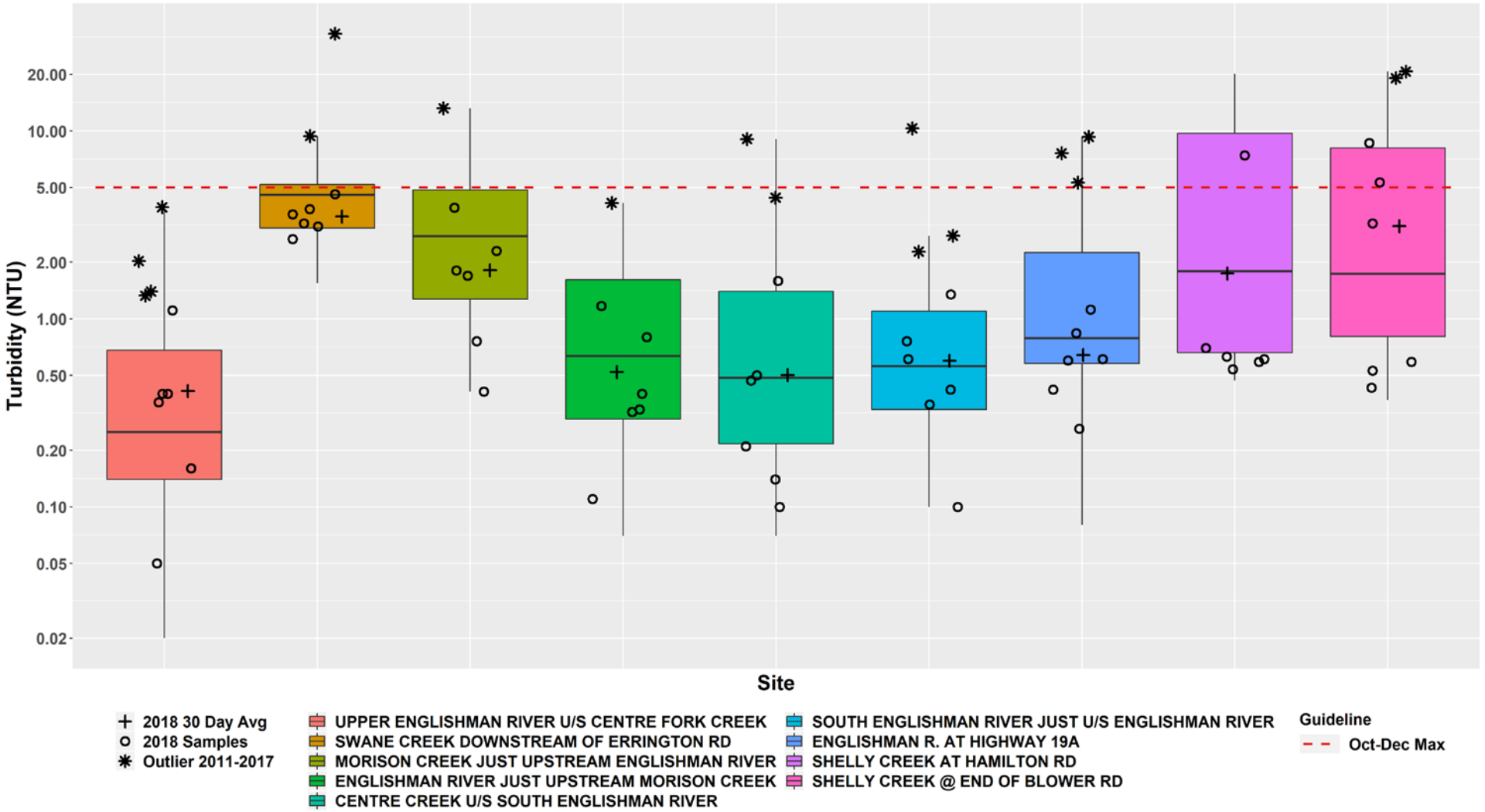
No exceedances in 2018

Water Region 4 – Summer Turbidity



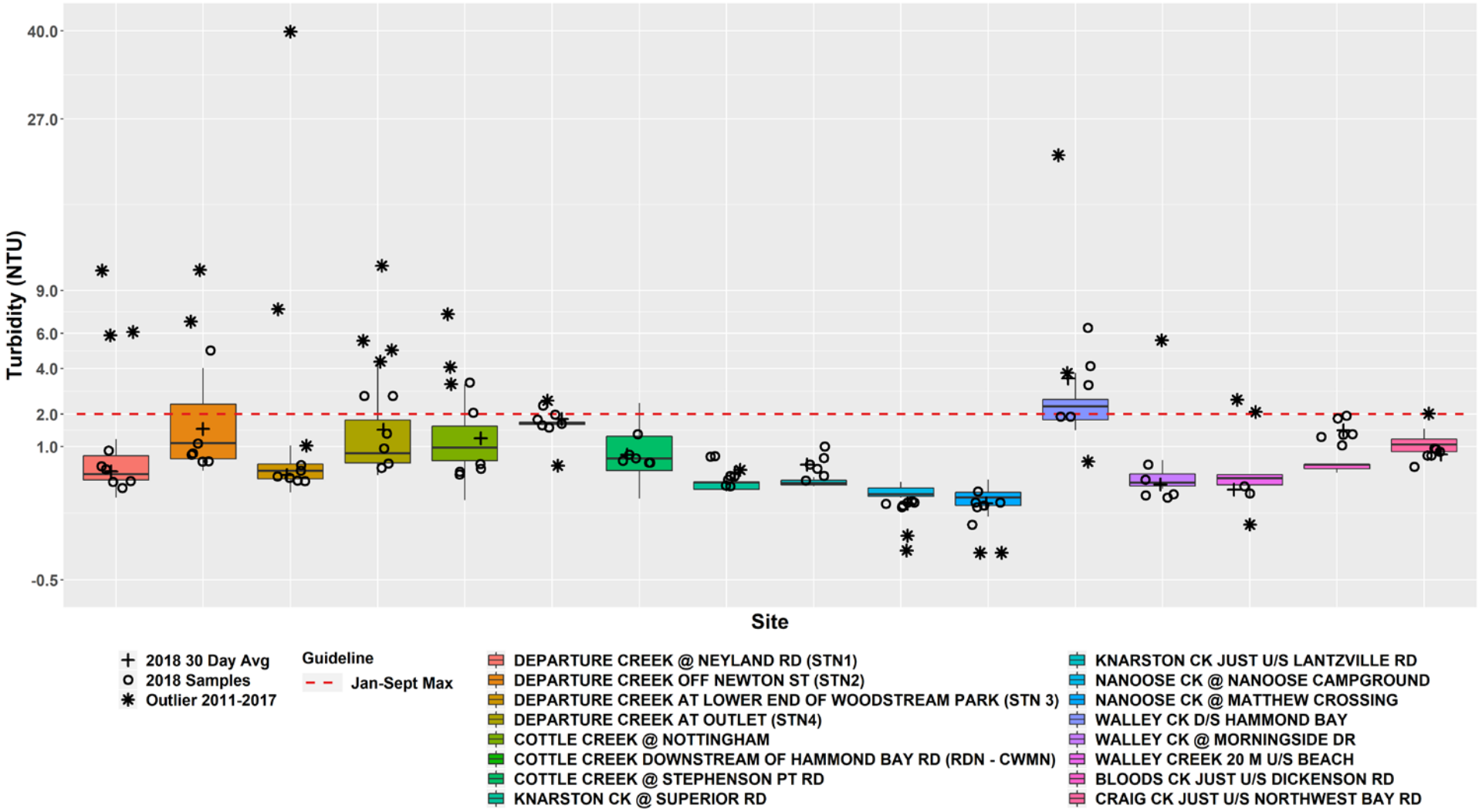
Turbidity exceedances at Swane and Shelly Creek sites; same sites with DO & temperature exceedances

Water Region 4 – Fall Turbidity



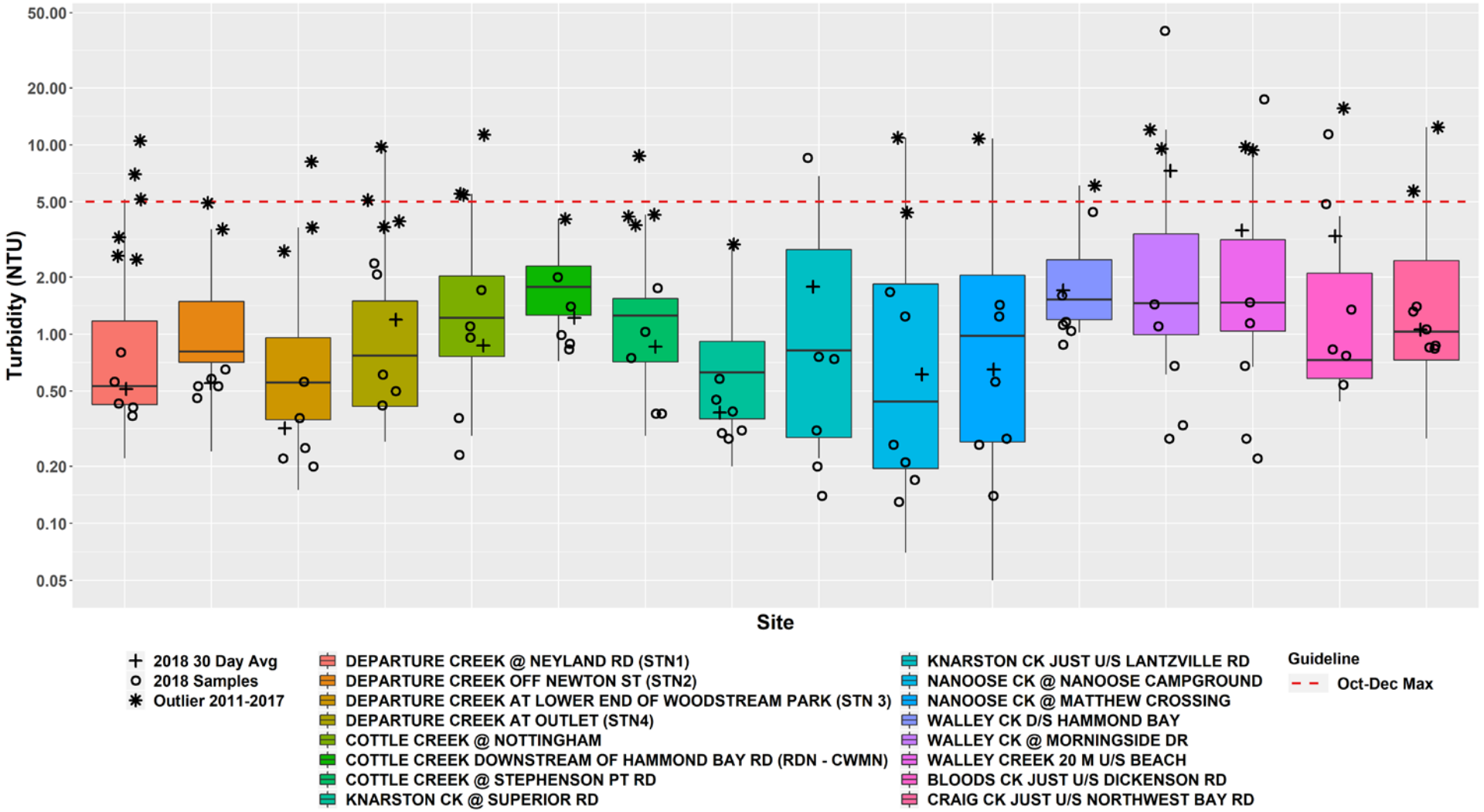
2018 fall turbidity exceedances at both Shelly Creek sites

Water Region 5-1 – Summer Turbidity



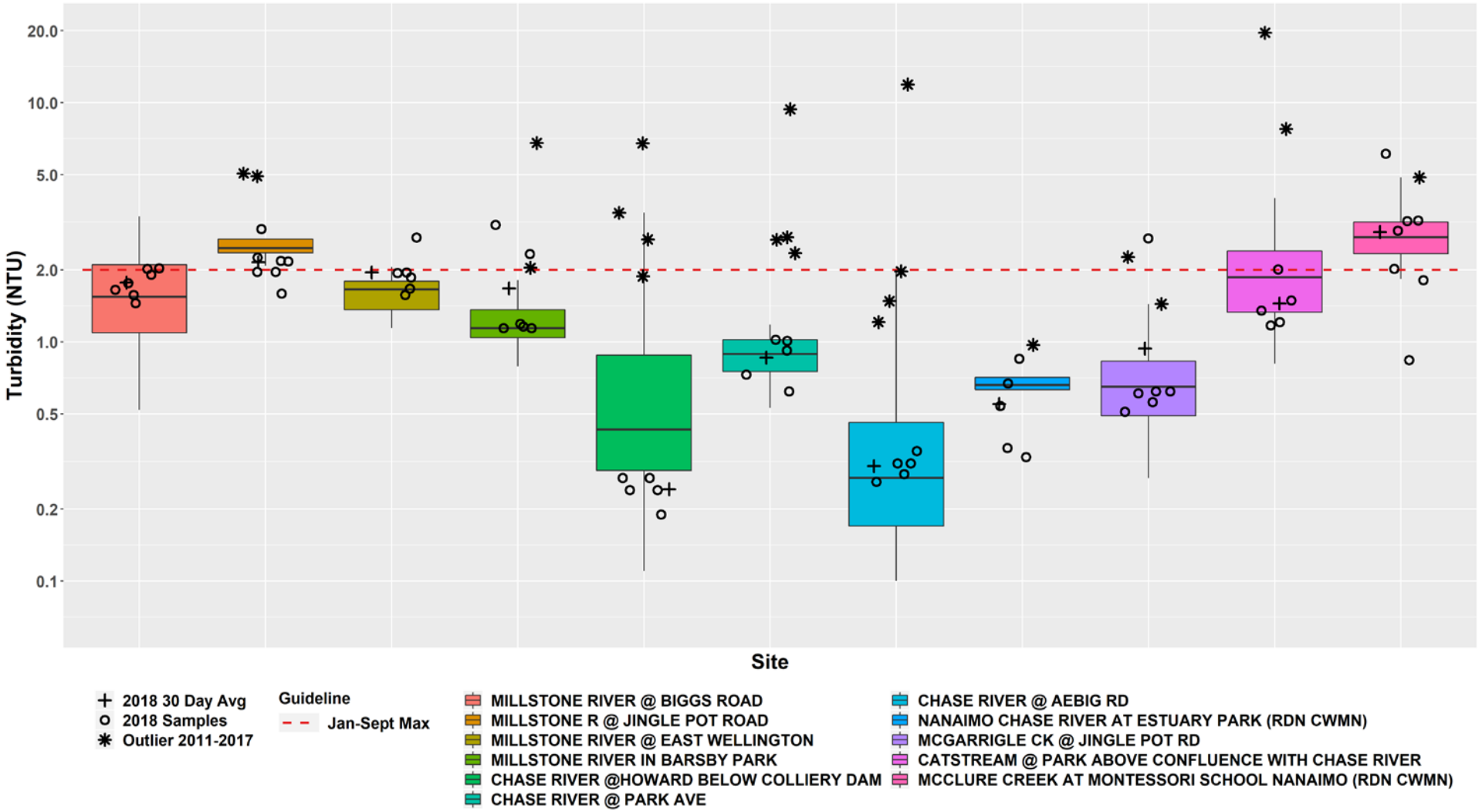
Summer turbidity exceedances at Walley Ck (d/s Hammond Bay), Departure Ck (Stn 2 & 4), Cottle Ck (d/s Hammond Bay & Nottingham)

Water Region 5-1 – Fall Turbidity



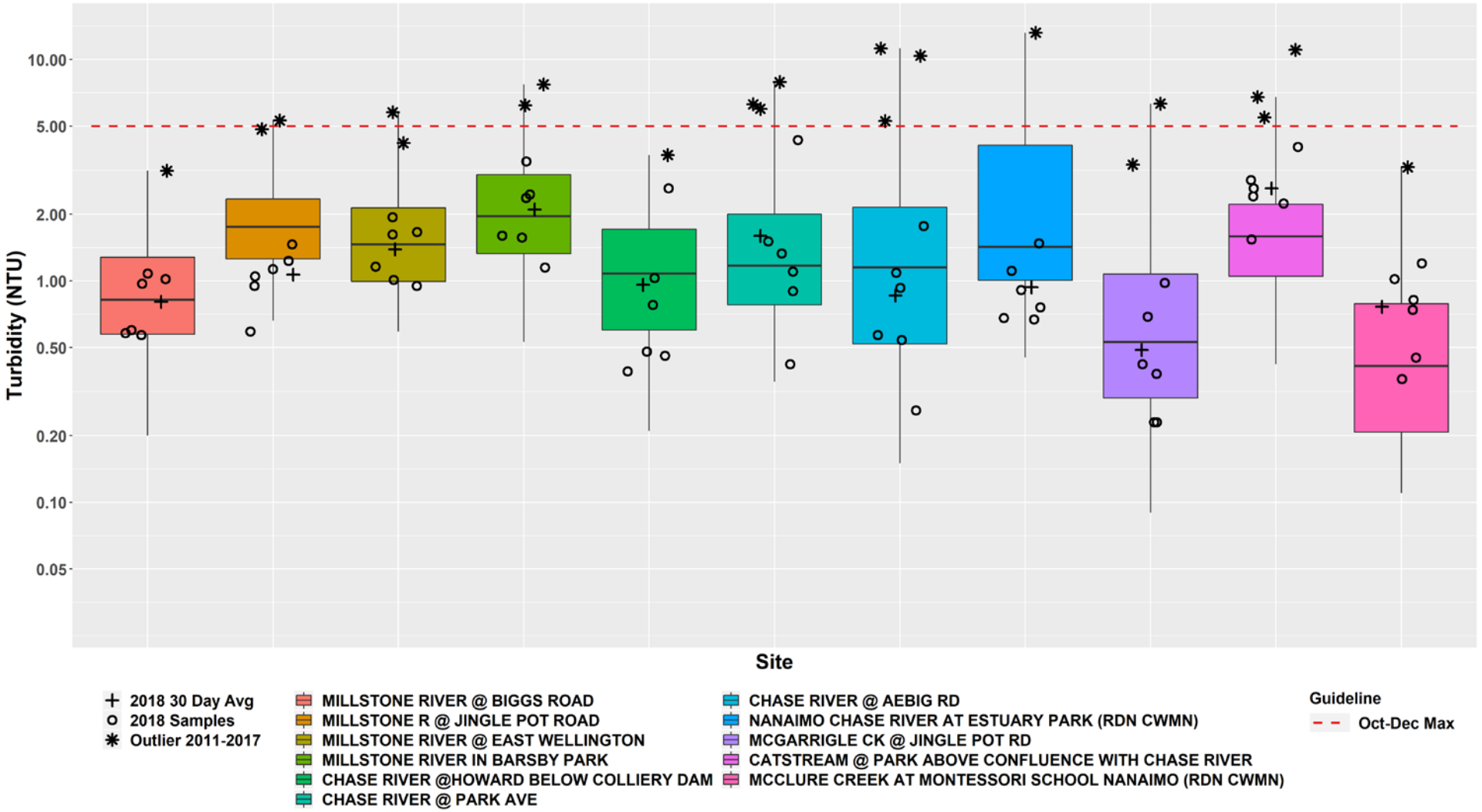
One fall turbidity exceedance at each of the following: Oct 1st at Walley Ck (Morningside Dr & u/s beach); Oct 29th at Bloods Ck (u/s Dickenson) & Knarston Ck (u/s Lantzville)

Water Region 5-2 – Summer Turbidity



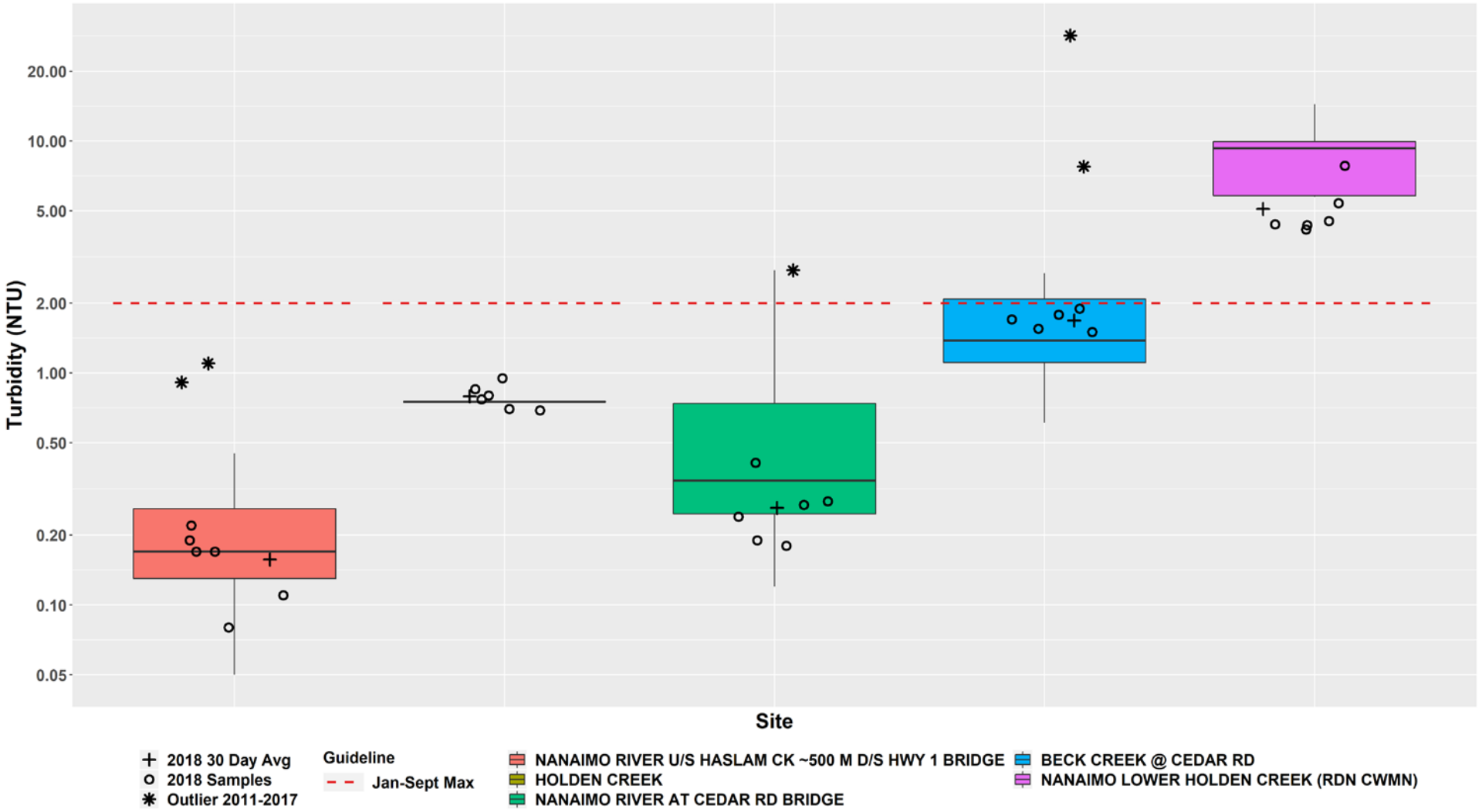
Summer turbidity exceedances at Millstone River (all 4 sites), McClure Ck (all 5 sample dates), McGarrigle (Jingle Pot Rd), Cat Stream (u/s Chase)

Water Region 5-2 – Fall Turbidity



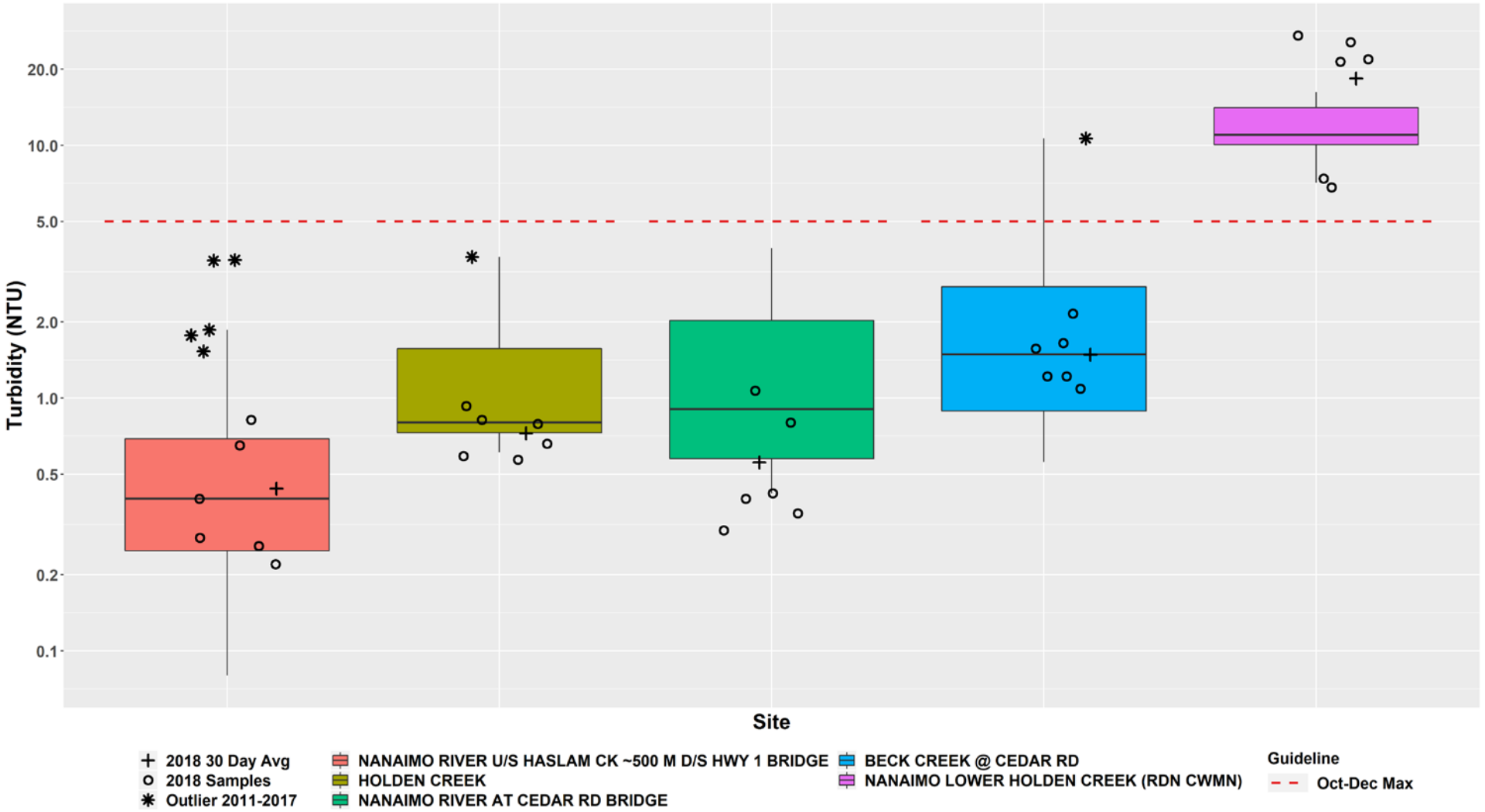
No fall turbidity exceedances in 2018

Water Region 6 – Summer Turbidity



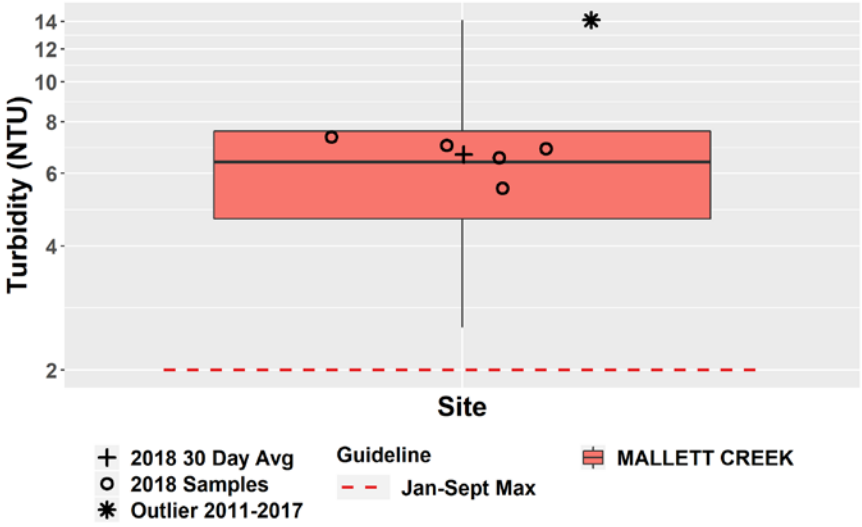
Lower Holden Creek turbidity exceedances most likely from tidal influence

Water Region 6 – Fall Turbidity



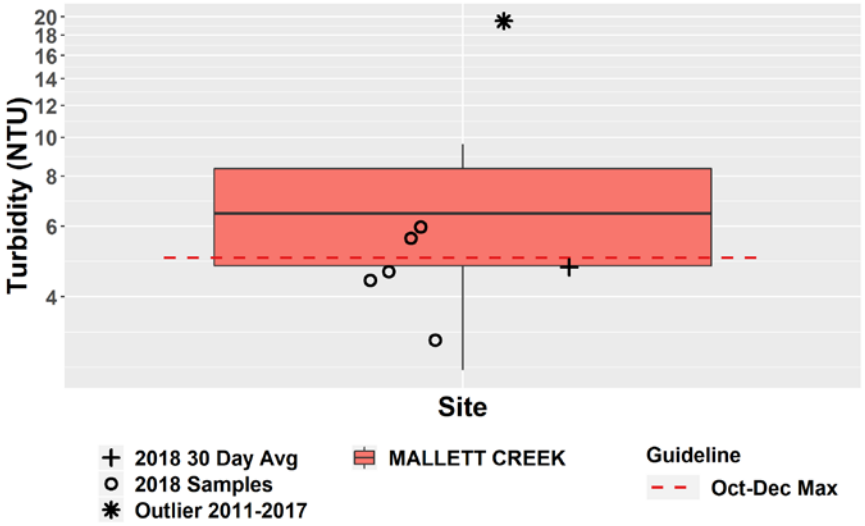
Lower Holden Creek turbidity exceedances most likely from tidal influence

Water Region 7 – Summer Turbidity



Mallett Creek turbidity averaged summer 6.62 NTU; fall exceeded guideline Oct 9th & 30th, suggesting impaired watershed functions

Water Region 7 – Fall Turbidity



Summer Turbidity

# Exce.	Jan-Sept (summer) guideline 2 NTU exceeded at:			
6	Deep Bay Creek		Lower Holden Creek	
5	McClure Creek		Mallett Creek	
4	Beach (Memorial)	Annie Creek	Millstone (Jingle)	
3	Grandon (Laburnum)	Swane Creek	Walley (Hammond)	
2	Beach (Hemsworth)	Departure (Outlet)	Cottle (Nottingham)	
	Millstone (Biggs)		Millstone (Barsby)	
1	McGarrigle (Jingle)	Cat Stream	Grandon (W Cres)	Millstone (E Well)
	Departure (Newton)		Cottle (Hammond)	

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

Fall Turbidity

# Exce.	Oct-Dec (fall) guideline 5 NTU exceeded at:		
6	**Lower Holden Creek**		
3	**Annie Creek**		
2	**Shelly (Blower Rd)**	**Mallett Creek**	
1	**Knarston (Lantzville)**	**Walley (Morningside)**	
	Shelly (Hamilton)	**Walley (u/s beach)**	**Bloods (Dickinson)**

- In 2017, 53 of the 63 fall exceedances were experienced after heavy rain events
- In 2018, there were only 18 fall turbidity exceedances → did not capture fall flush across all sites?

2018 Data Summary

Two or more exceedances at one site

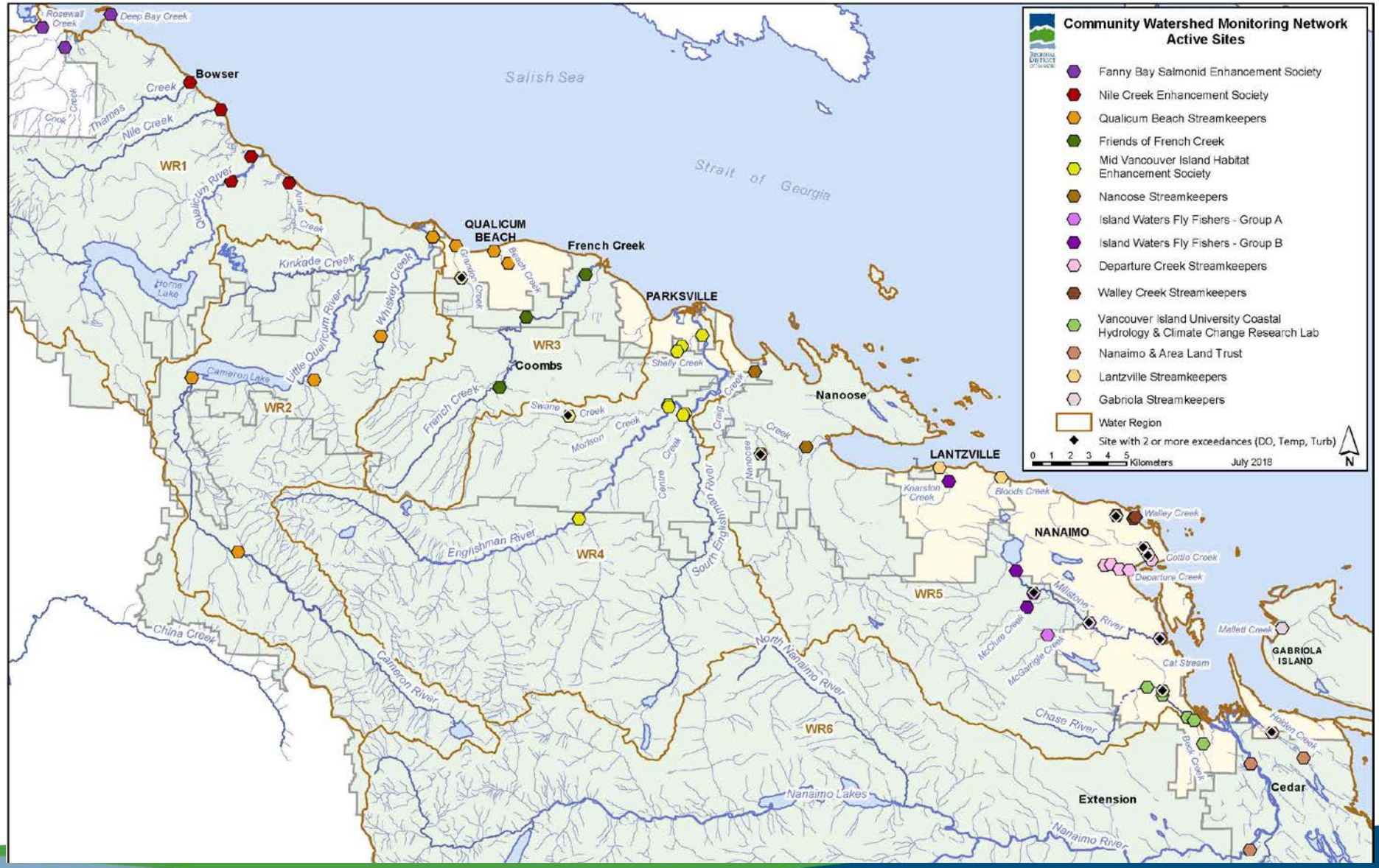
(based on: temperature, dissolved oxygen and turbidity)

Group	Watershed	Sample Location	EMS	Exceedences	Dates
VIU	Chase River	Cat Stream (Park Ave)	E290486	Temp & Turb	Aug 7, 28
DCS	Cottle Creek	Cottle Ck (Nottingham)	E290473	DO & Temp DO, Temp, Turb	Aug 7 Aug 14
DCS	Cottle Creek	Cottle Ck (Hammond)	E309186	Temp & Turb	Aug 7
QBS	Grandon Creek	Grandon (Laburnum)	E288091	DO & Turb	Aug 7, 21
IWFF	Millstone River	Millstone R (E Well)	E290480	DO, Temp, Turb	Aug 7
IWFF	Millstone River	Millstone R (Barsby)	E290481	Temp & Turb	Aug 7
IWFF	Millstone River	Millstone R (Jingle Pot)	E306294	Temp & Turb	Aug 7
NSS	Nanoose Creek	Nanoose (Matthew X)	E294020	DO & Temp	Aug 7
NALT	Holden Creek	Lower Holden Creek	E309281	DO, Temp, Turb Temp & Turb DO & Turb	Aug 7, 14 Aug 21, 28, Sept 4 Sept 11, Oct 16
MVIHES	Englishman R	Swane Ck (Errington)	E308186	DO & Turb	Aug 7, 14, 21
WCS	Walley Creek	Walley Ck (Hammond)	E306256	Temp & Turb	Aug 7

2018 Data Summary

Two or more exceedances at one site

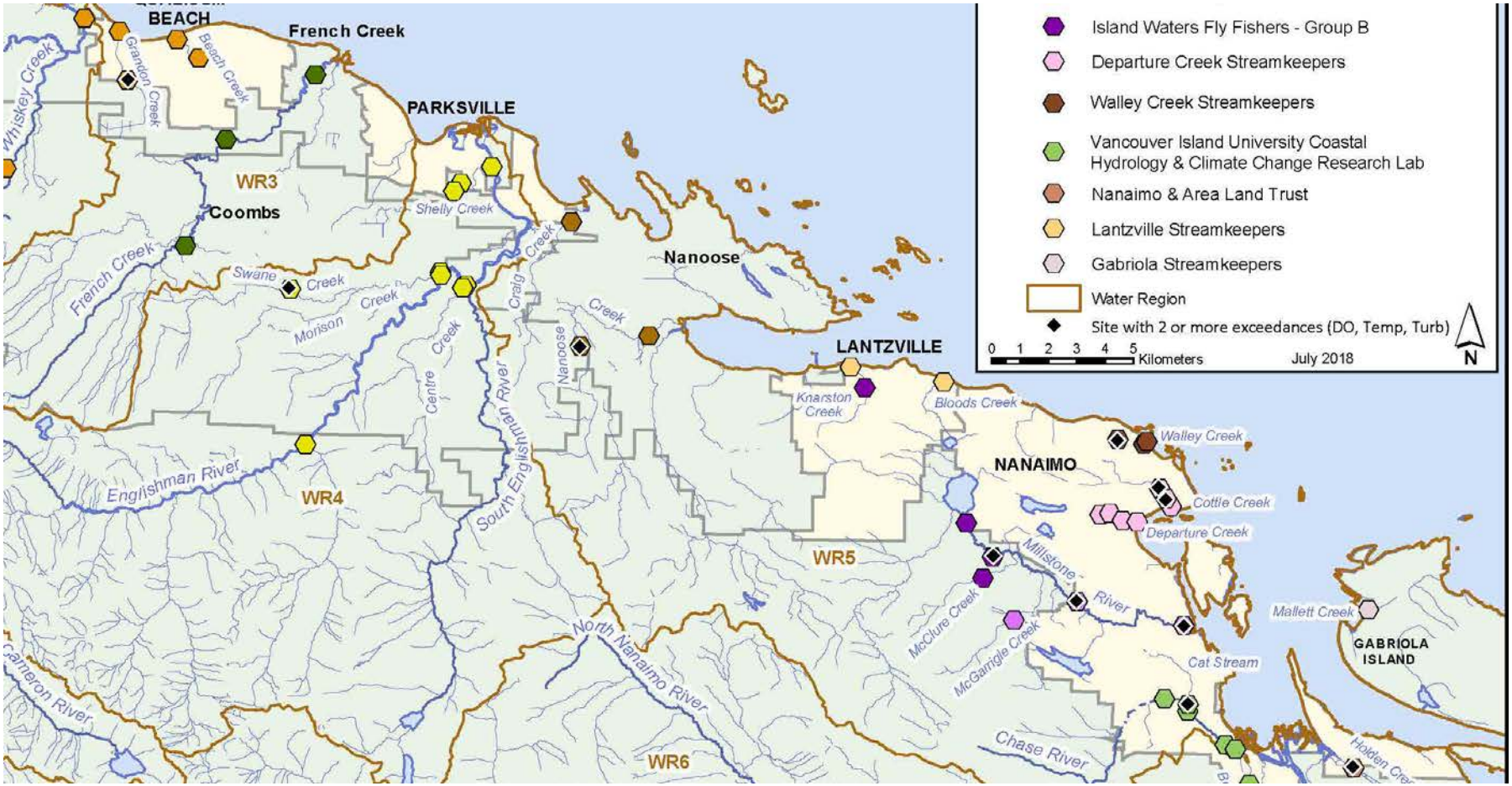
(based on: temperature, dissolved oxygen and turbidity)



2018 Data Summary

Two or more exceedances at one site

(based on: temperature, dissolved oxygen and turbidity)



- 11 / 62 sites had exceedances at one or more parameter on a given sample date
- All these were in summer, except on Oct 16 at Lower Holden Creek (DO & Turb)

Related initiatives

Stewardship Seed Funding

DWWP program offers seed funding for stewardship / restoration projects ($1000- $3000 available per project; limited funds available)

Stream Restoration Tool Lending Library

- DWWP program has a tool kit to help with your streamside projects!
- Borrow it to help with your planting, invasive plant removal, etc.

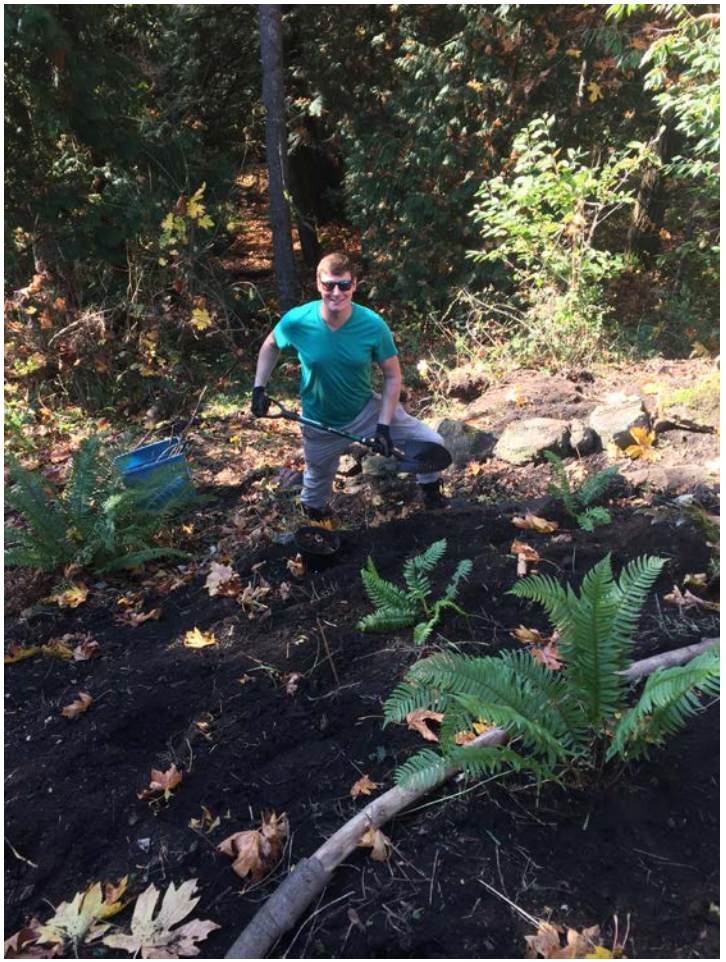
Photo courtesy of IWFF – Millstone R

Apply now for 2019 projects!

Application form available at www.rdn.bc.ca/cwmn

2018 Related initiatives

Example: Chase River Riparian Restoration



Photos courtesy of NALT & Alder Environmental

2018 Related initiatives

Example: Deep Bay Creek Invasive Plant Removal

Before

After

Photos courtesy of FBSES

Related initiatives

Riparian Restorations

- Deep Bay Creek, Shelly Creek, Knarston Creek, Millstone River, McClure Creek, Walley Creek, Grandon Creek, and many more
- Helps to restore natural watershed function

Photo courtesy of IWFF – Millstone Restoration

Stream Assessments

- Using the Provincial "Urban Salmon Habitat Program" (USHP) methodology
- Documents physical characteristics that may be influencing DO, Temperature and Turbidity

Photo courtesy of MVIHES – Morison Ck USHP

In 2019…

- Currently, all sites maintained
- QA/QC lab analysis completed (10% of sites)
- Additional Lab Analysis:
  - Total Phosphorous (May – Sept)
  - Chloride (Summer Sample Period)
  - Biological Monitoring (Sept 15 – Oct 15)
- New and returning volunteers…

2019 Sample Period (Tuesdays):

Summer Low Flow Aug 6 – Sept 3

Fall Flush Oct 8 – Nov 5*

**Tentative dates as fall sampling is weather dependent, may start 1 – 3 weeks before or after dates listed*

See handout for important dates

2019 Training Session

Tuesday, July 23rd:

- **9:30am - 12:00pm at French Creek** (Hatchery/Community Park at 815 Miller Road)
- **1:30pm - 4:00pm at Millstone River** (Bowen Park at the lower picnic shelter off of Wall Street)

One last thing…

We will send this link to all the volunteers and hope you circulate it in your networks so we can get lots of response and input!

Thank you!!