Regional District of Nanaimo Community Watershed Monitoring Network

Nanoose Streamkeepers Three Year Trend Report 2013 - 2015

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Environmental Protection Division
Regional Operations Branch

Acknowledgements

This program would not be possible without the dedication, passion and excellent work of the participating members of the stewardship group: Lantzville Nanoose Streamkeepers.

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Executive Summary

This report presents a summary of trends observed in the first three years (2013, 2014, and 2015) of data collected by the Lantzville-Nanoose Streamkeepers as part of the Regional District of Nanaimo Community Watershed Monitoring Network (CWMN).

This program is a partnership between Ministry of Environment, the Regional District of Nanaimo, Island Timberlands LP and local environmental stewardship groups. The goal of the program in its early stage was to conduct a simple, quick assessment of multiple watersheds to raise watershed health awareness in local communities and obtain a three year dataset for trend analysis. Longer term goals are to use trend data collected in the early stage to determine in which watersheds more detailed monitoring and/or improved watershed management need occur, and to assist in land use planning. In this document, data presented from three different sites in two different watersheds (Craig Creek and Nanoose Creek) were compared to existing BC Water Quality Guidelines (BC MOE, 1997) and/or Englishman River Water Quality Objectives (Barlak *et al.*, 2010), applicable to other watersheds within the same ecoregion.

Based on water quality guidelines and objectives, an exceedance of one of the measured parameters (temperature, dissolved oxygen or turbidity) occurred at each of the three sample locations during at least one of the sample periods. Temperature and dissolved oxygen exceedances were observed in all three sites, which are reflective of general summer conditions for most east coast Vancouver Island streams, particularly in the lower watershed where the streams are wide, slow moving and have little stream cover.

Only the Craig Creek site displayed exceedances in turbidity. As turbidity is associated with higher levels of other contaminants, it is considered the highest priority when determining at which sites more sampling needs to occur. It was recommended that supplementary data be collected on Craig Creek, as resources allow, to determine the cause of the turbidity. A number of additional recommendations were made for future sample years to maintain data quality and use resources most efficiently.

Program Outline

The purpose of this report is to present a summary of trends observed in the first three years of data collected by the Lantzville Nanoose Streamkeepers as part of the Community Watershed Monitoring Network (CWMN) partnership.

The CWMN partnership was initiated in 2011 by the Regional District of Nanaimo (RDN) and the British Columbia (BC) Ministry of Environment (MOE) to collect data across the RDN by community environmental stewardship organizations. The goal of the program in its early stage was to conduct a simple, quick assessment of multiple watersheds to raise watershed health awareness in local communities and obtain a three year dataset for trend analysis. Longer term goals are to use trend data collected in the early stage to determine in which watersheds more detailed monitoring and/or improved watershed management need occur, and to assist in land use planning.

The synergistic partnership between environmental stewardship groups, the MOE, the RDN and Island Timberlands is core to the success of this program. At the beginning of each sampling year the MOE and/or the RDN trained stewardship participants in monitoring protocols.

Five stewardship groups within the RDN started participating in the monitoring program in 2011 (Nile Creek Enhancement Society (NCES), Friends of French Creek Conservation Society (FFCCS), Qualicum Beach Streamkeepers (QBS), Mid Vancouver Island Habitat Enhancement Society (MVIHES), Nanaimo & Area Land Trust (NALT) and Parksville-Qualicum Fish and Game Association (PQFG), with safety gear and land access provided by Island Timberlands LP. The results of those groups' first three years of sampling at a total of 25 different sites in 9 different watersheds were summarized in the RDN CWMN Water Quality Trend Report, 2011 – 2013 (Barlak and Fegan, 2014).

Three additional groups were added to the program in 2012: Island Waters Fly Fishers (IWFF), Departure Creek Streamkeepers (DCSK), and Vancouver Island University (VIU) Fisheries and Aquaculture Department. The City of Nanaimo (CoN) assisted with data collection on Northfield Creek in 2014. The results of sampling between 2012 and 2014 at a total of 19 different sites in 4 different watersheds are summarized in the RDN CWMN Water Quality Trend Report 2012-2014 (Barlak *et al.*, 2015).

The Lantzville-Nanoose Streamkeepers joined the network in 2013, initially monitoring 12 sites between two groups of volunteers under the banner group Lantzville-Nanoose Streamkeepers. However over the three year period from 2013-2015, only three of those sites (Figure 1) were monitored consistently each year. Those three sites are reported on in this document. Since the three sites reported on here are in Nanoose, and none in Lantzville, we will refer to the group as "Nanoose Streamkeepers" here forward. Samples were collected weekly according to BC MOE sampling procedures and quality assurance/quality control standards (BC MOE, 2003) between the dates listed in Table 1 below.

Table 1 – 2013, 2014 and 2015 Community Watershed Monitoring Network weekly sample periods

Year	Summer Low Flow (sampling occurred between)	Fall Rains (sampling occurred between)
2013	August 13 and September 10	October 15 and November 12
2014	August 12 and September 9	October 14 and November 12
2015	August 4 and September 1	October 13 and November 10

Figure 1 - Map of Nanoose Streamkeepers monitoring sites

Data Summary

In this document, data presented were compared to existing BC Water Quality Guidelines (BC MOE, 1997) and/or Englishman River Water Quality Objectives (Barlak *et al*., 2010), applicable to other watersheds within the same ecoregion. Based on these Water Quality Guidelines or Objectives (Table 2), the data were grouped into summer and fall data (Quarter 3 and Quarter 4, respectively, where each quarter included 5 weekly samples in a 30 day period as required to determine if guidelines or objectives are being met per year.)

Six comparisons were examined: maximum and average temperature, minimum and average dissolved oxygen, maximum specific conductivity and maximum turbidity. Exceedances in the 2013, 2014 and 2015 data (Barlak, 2013; Barlak and Fegan, 2014) are noted and priority areas are indicated. When any turbidity samples were less than 0 NTU, or not a true reading, calibration corrections were applied to all samples measured with the same instrument on that day and the corrected values presented here.

Table 2 - BC Water Quality Guidelines and/or Englishman River Water Quality Objectives.

Parameter	Guideline or Objective Value	Importance
Turbidity (Englishman River Water Quality Objective)	October to December: 5 NTU maximum January to September: 2 NTU maximum	Measures clarity or cloudiness of water. High values are associated with higher levels of other contaminants (e.g. bacteria).
Temperature (Englishman River Water Quality Objective)	Short Term, at any location in the river ≤ 17°C average weekly temperature. Long Term ≤ 15°C average weekly temperature. *Weekly averages could not be calculated with available data.	If too warm not aesthetically pleasing to drink and can affect health and survival of aquatic organisms.
Dissolved Oxygen (BC Water Quality Guideline for aquatic life)	30 day average 8 mg/L Instantaneous minimum 5 mg/L	If too low affects the health and survival of aquatic organisms.
Conductivity (no guideline)	No guidelines exist; coastal streams generally less than 80 µS/cm but can be more if significant ground water influences.	The more dissolved ions in water, the greater the electrical conductivity. Dilution decreases conductivity but groundwater influences or sediment introduced in water can increase it.

Precipitation data from the Fairwinds Golf Course rain gauge was reviewed for the sample periods in 2013, 2014, and 2015 (Figures 2-4). These data were selected over the Nanaimo Airport or Qualicum Airport, due to the closer proximity of Fairwinds Golf Course to the water quality monitoring sites in Nanoose. The Nanoose peninsula is known to have a particular microclimate that often experiences different local weather than Nanaimo or Qualicum. The review of the rainfall data helped determine if climate could have been an influencing factor on the measured parameters and to ensure that the fall flush was captured.

Figure 2 - Rainfall data from Fairwinds rain gauge 2013

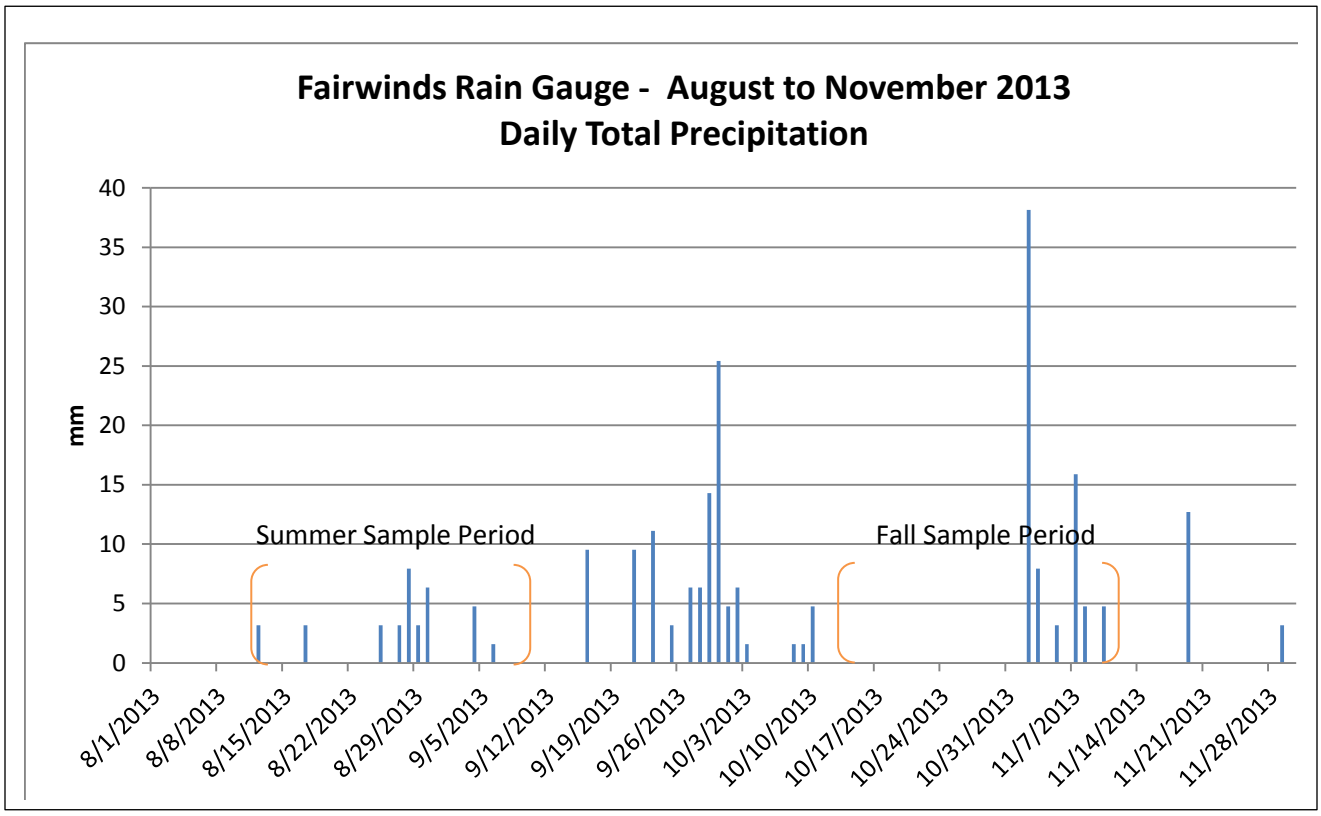


Figure 3 - Rainfall data from Fairwinds rain gauge 2014

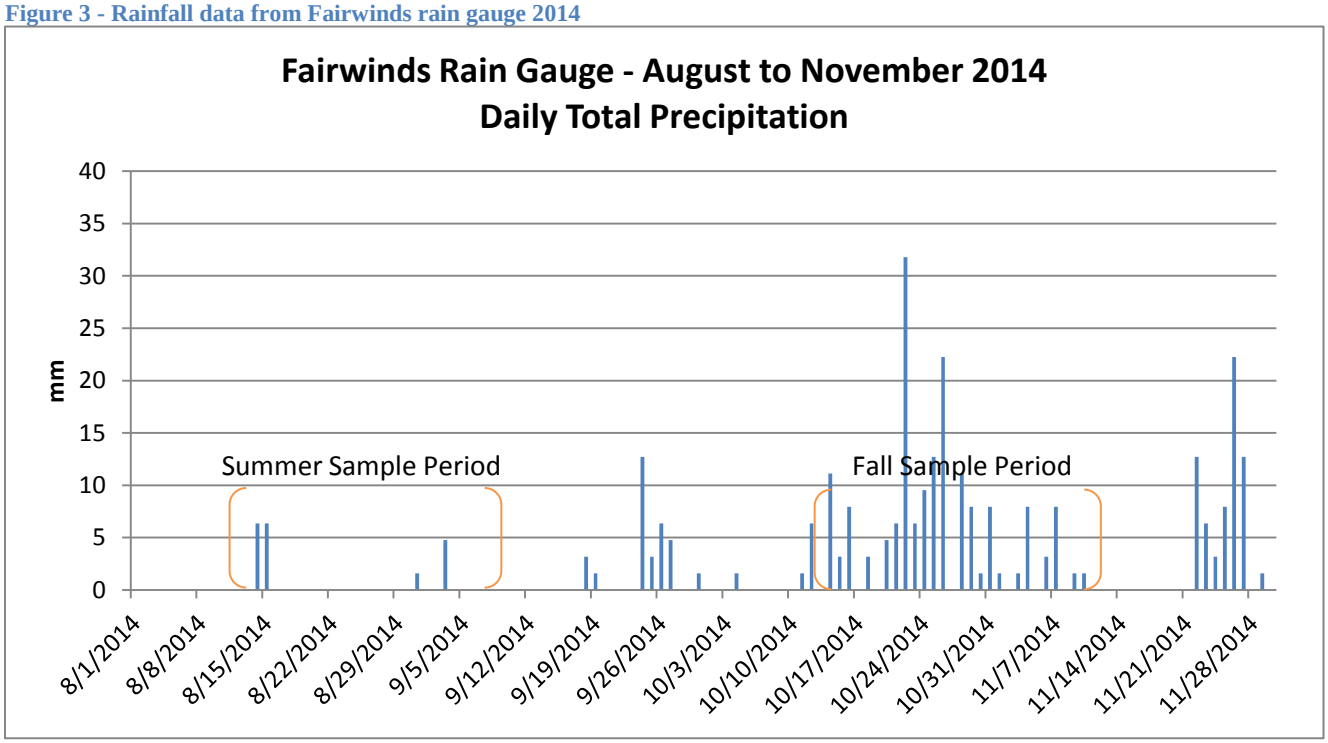
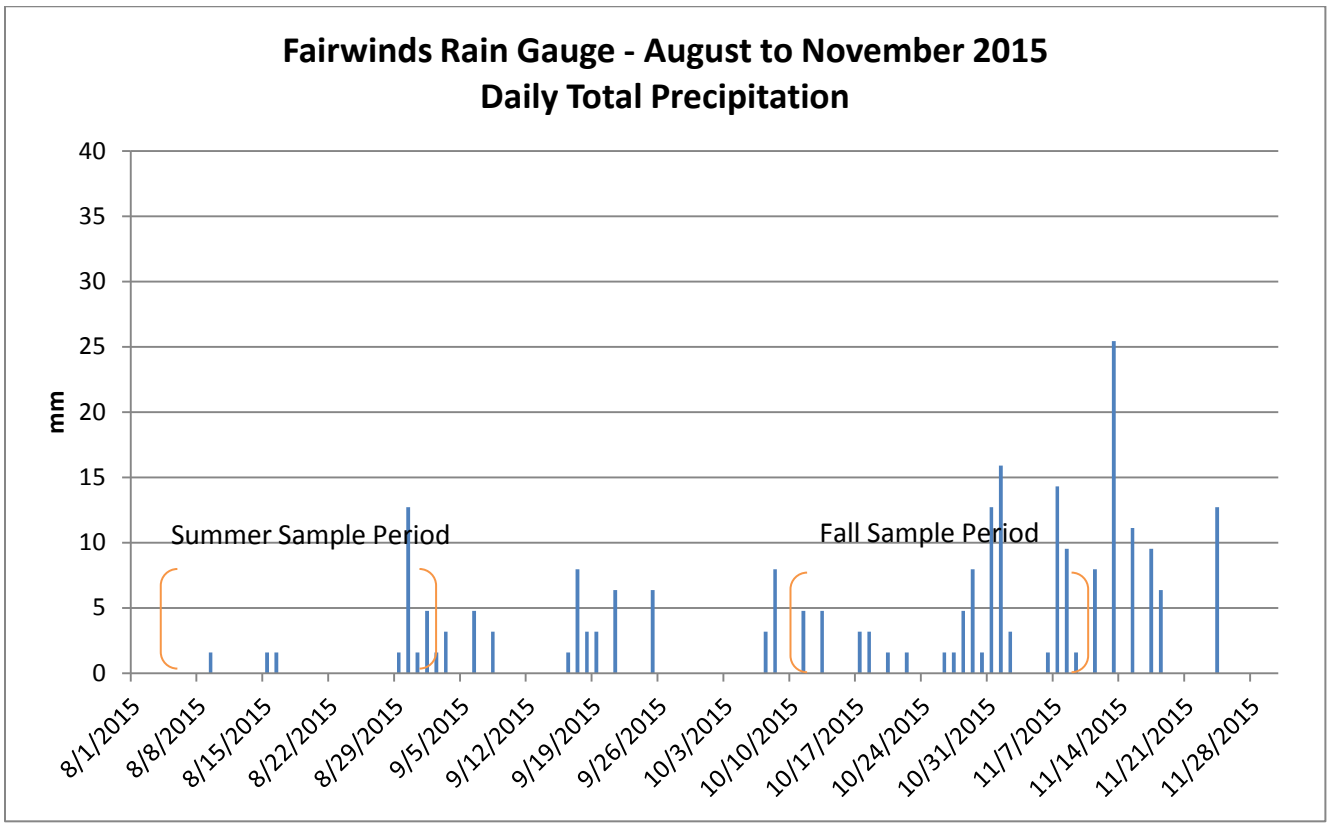


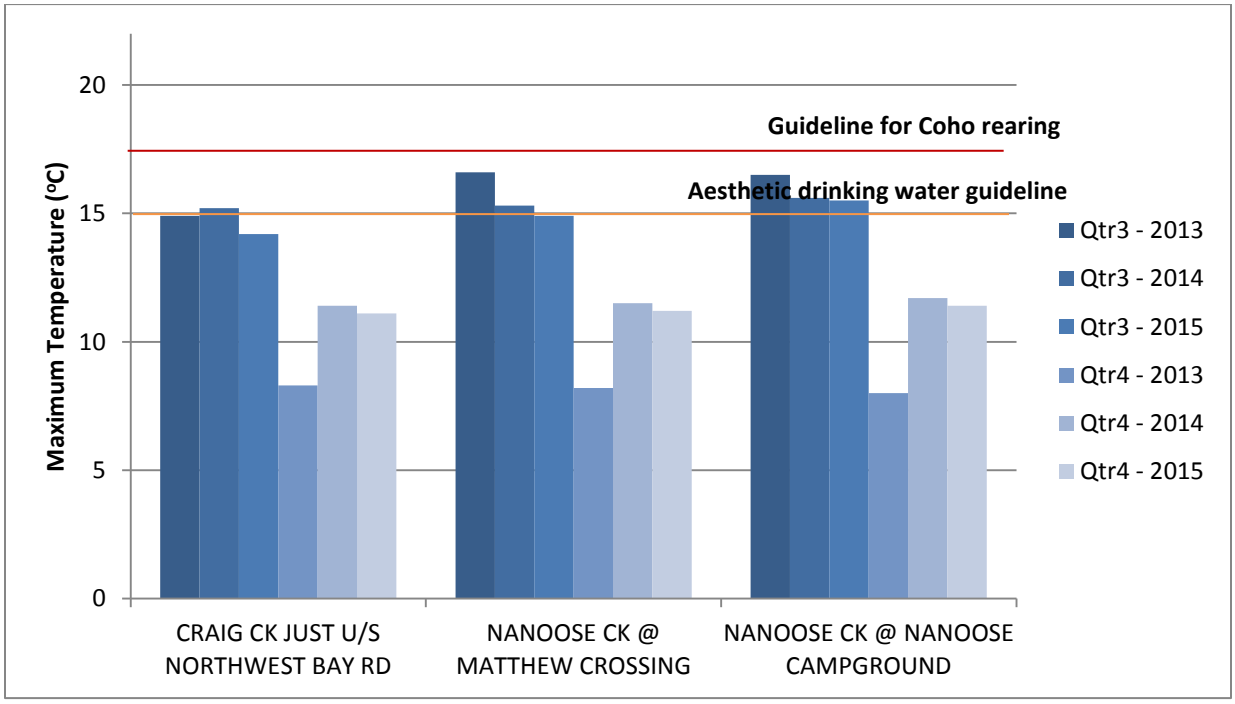
Figure 4 - Rainfall data from Fairwinds rain gauge 2015



In each of the monitoring years reviewed in this report, the fall flush was captured to some degree. In 2013 and 2015, the first moderate rainfall occurred during the summer sample period. The amount of rain that fell in the summer of 2014 was less than in 2013 or 2015. In 2014, fall storms brought a relatively large amount of rain over a short period of time.

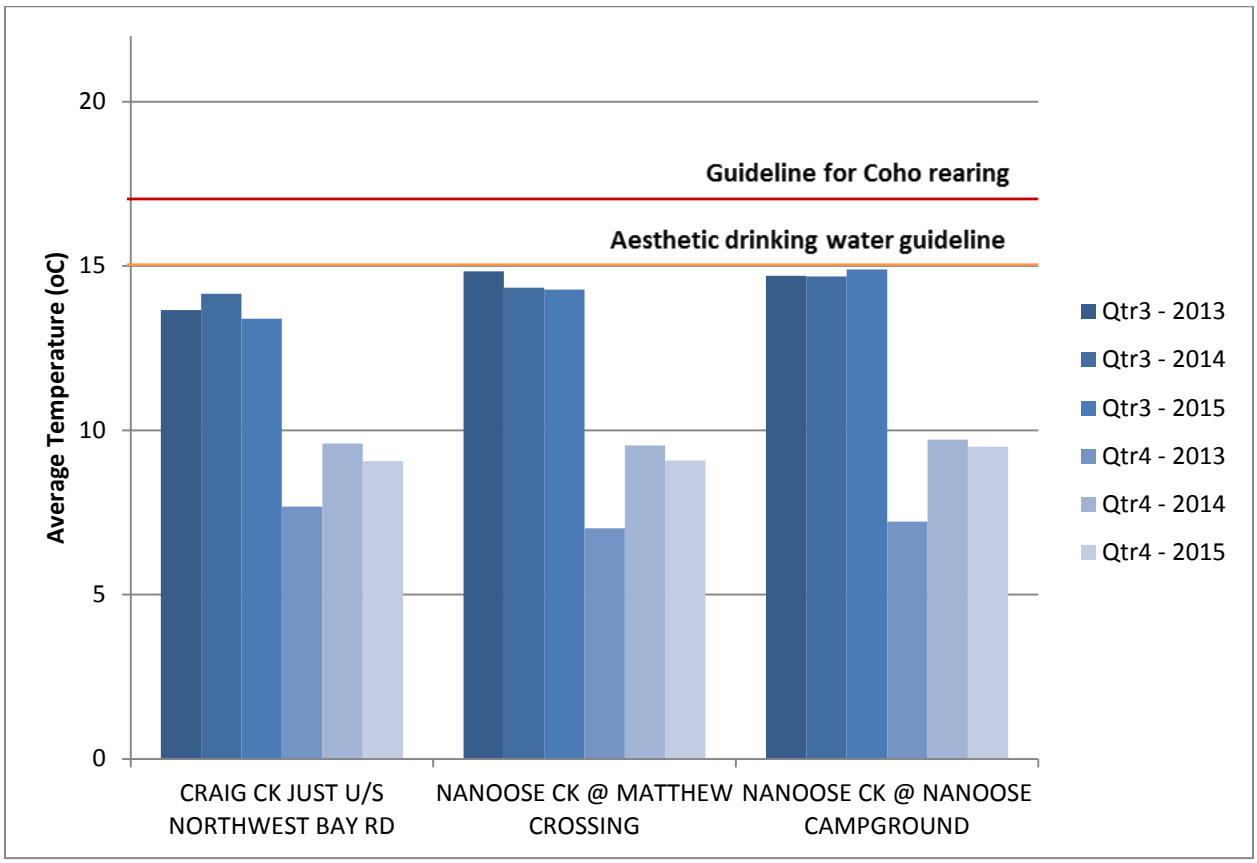
The maximum temperature had the potential for exceedances of the aesthetic drinking water guideline (weekly average ≤15°C) each of the three years during the summer period at the two Nanoose Creek sites (Figure 5). On Craig Creek the maximum temperature only had the potential to exceed the aesthetic drinking water guideline in the summer of 2014. The drinking water temperature guideline is used, as there a few domestic use water licences on the creeks reported on here, though it is not known if the licences are actively used for drinking water. None of the sites displayed the potential to exceed the Coho rearing guideline (weekly average ≤17°C).

Figure 5 - Maximum temperature collected by Nanoose Streamkeepers



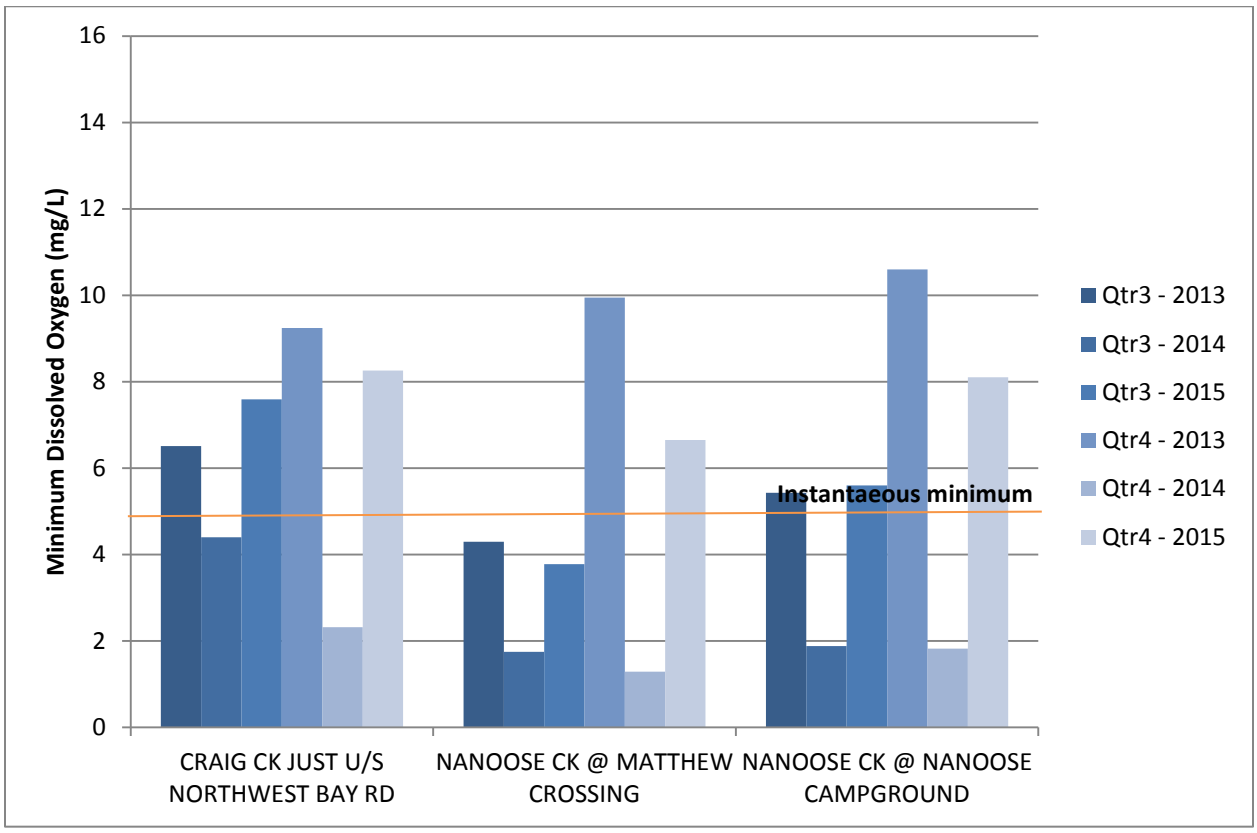
The average temperature approached but did not quite reach the potential to exceed 15°C (aesthetic drinking water temperature guideline) for any of the weekly averages in 2013-2015 at the sites on Nanoose Creek and Craig Creek (Figure 6). This may be indicative of sufficient vegetative canopy cover to shade the creek and keep temperatures from rising too high, or it may suggest groundwater influence to the summer creek flow keeping water temperatures cooler.

Figure 6 - Average temperature collected by Nanoose Streamkeepers



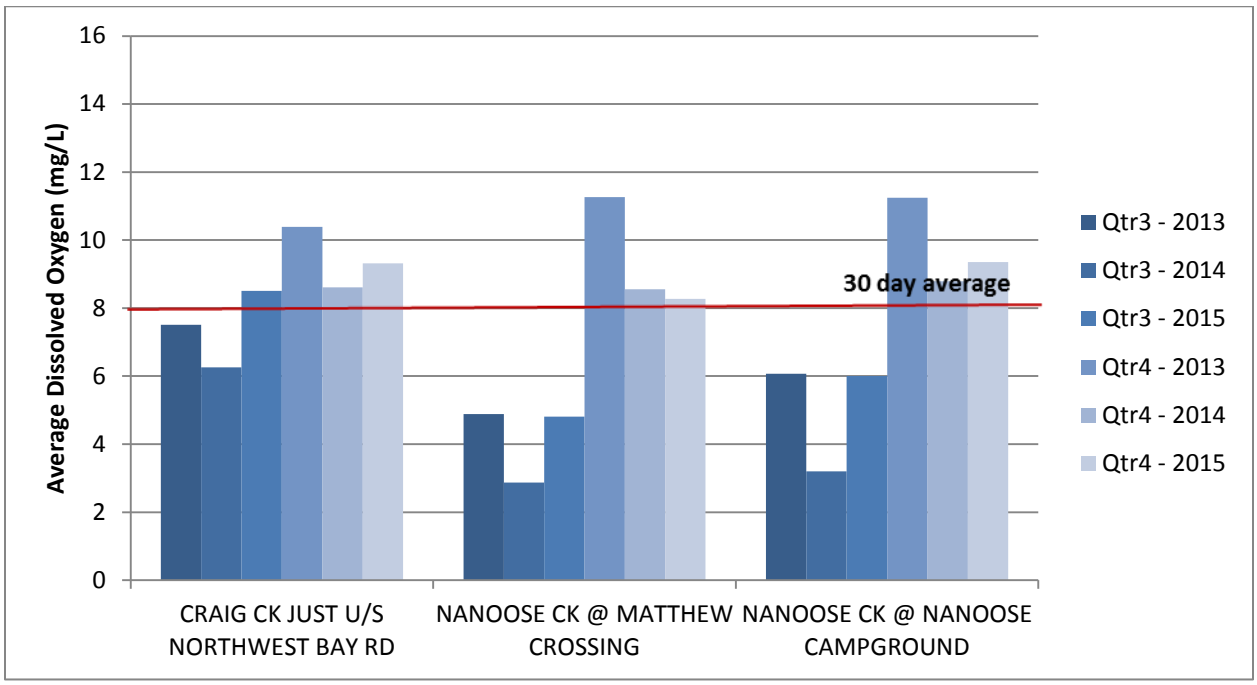
The minimum dissolved oxygen (DO) was below the instantaneous minimum aquatic life guideline of 5 mg/L in all of the summer sample periods at the Nanoose Creek at Matthew Crossing site, and in the 2014 summer sample period at Nanoose Creek at the campground and at the Craig Creek site (Figure 7). In the fall sample period in 2014 only, minimum DO also dropped below the instantaneous minimum guideline for all three sites.

Figure 7 - Minimum dissolved oxygen collected by Nanoose Streamkeepers



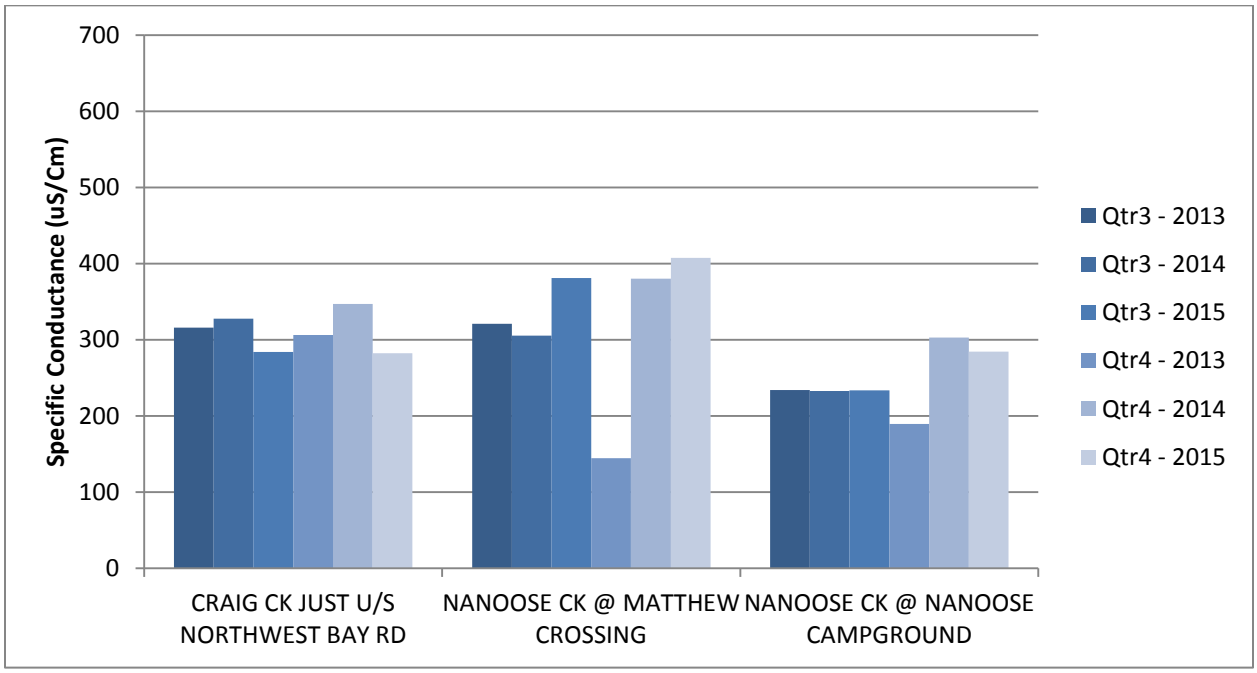
The average DO was below the 30 day average guideline of 8 mg/L in all three years during the summer period, at all three sites, except for Craig Creek in 2015 (Figure 8). Low average and minimum DO values may be indicative of very low flow.

Figure 8 - Average dissolved oxygen collected by Nanoose Streamkeepers



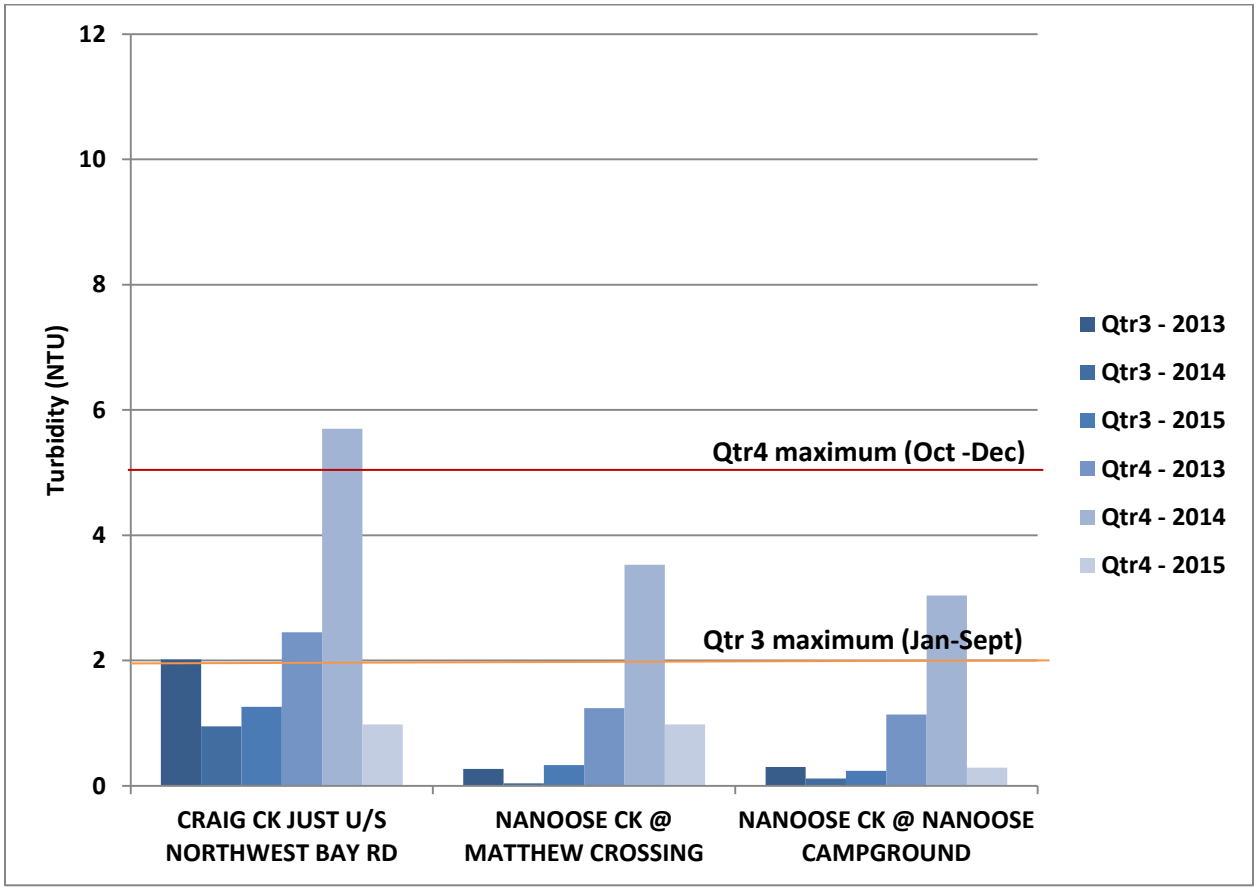
The maximum specific conductance was higher than levels typical of coastal streams in Craig Creek and the two Nanoose Creek sites during all sample periods (Figure 9). This may be indicative of groundwater influences in these systems.

Figure 9 - Specific conductance collected by Nanoose Streamkeepers



The January through September low flow maximum turbidity objective of 2 NTU was exceeded in just one sample year at one sample site: Craig Creek in 2013 (Figure 10). The October through December maximum turbidity objective was also exceeded on Craig Creek in the fall sample period of 2014. No other sites had exceedances of turbidity objectives for their sample periods.

Figure 10 - Turbidity collected by Nanoose Streamkeepers



Recommendations

A summary of the findings of the trend analysis from the 2013-2015 data collected by Nanoose Streamkeepers can be seen in Table 3. Exceedances in temperature, turbidity, and dissolved oxygen are considered below. Specific conductivity is not included in Table 3 as there are no guidelines or objectives set for this water quality parameter.

Table 3 – Summary of Nanoose Streamkeepers three year trend analysis 2013-2015

Watershed	Sample Location	Parameter	Guideline	Exceeded Periods
Craig Creek	just upstream of Northwest Bay Rd.	Temperature	weekly avg. ≤15°C	Summer 2014
		Dissolved Oxygen	Inst. Minimum 5mg/L	Summer 2014, Fall 2014
		Dissolved Oxygen	30 day avg. 8mg/L	Summer 2014
		Turbidity	>2 NTU Jan-Sept	Summer 2013
		Turbidity	> 5 NTU Oct-Dec	Fall 2014
Nanoose Creek	at Matthew Rd. Crossing	Temperature	weekly avg. ≤15°C	Summer 2013, 2014
		Dissolved Oxygen	Inst. Minimum 5mg/L	Summer 2013-2015; Fall 2014
		Dissolved Oxygen	30 day avg. 8mg/L	Summer 2013-2015
	at Nanoose Campground	Temperature (max)	weekly avg. ≤15°C	Summer 2013-2015
		Dissolved Oxygen	Inst. Minimum 5mg/L	Summer 2014; Summer 2015
		Dissolved Oxygen	30 day avg. 8mg/L	Summer 2013-2015

Based on water quality guidelines and objectives, exceedances of one of the measured parameters occurred at each of the sample locations during at least one of the sample periods. The most frequent occurrences of exceedances were:

- Dissolved oxygen at Nanoose Creek at Matthew Rd. Crossing
- Temperature & Dissolved Oxygen at Nanoose Creek at Nanoose Campground
- Dissolved Oxygen & Turbidity at Craig Creek

Temperature exceedances are reflective of general summer conditions for most east coast Vancouver Island streams, particularly in the lower watershed where the streams are wide, slow moving and have little stream cover. Data collected to date as part of this program supports this statement. Assessing upstream and site specific stream cover at these sites should be completed to assist in prioritizing more temperature monitoring. Similarly, low dissolved oxygen levels in smaller streams are indicative of slow moving water. Many streams on the east coast of Vancouver Island go subsurface during the summer. It would be useful to collect flow data on Nanoose Creek in particular, to help understand the context for low DO.

As turbidity is associated with higher levels of other contaminants, it is considered the highest priority when determining which sites require more sampling (i.e. lab analysis for additional parameters). It is recommended that additional sites be added upstream of the high turbidity site (Craig Creek) to determine potential turbidity sources.