With participation from: Mid Vancouver Island Habitat Enhancement Society, Qualicum Beach Streamkeepers, Nile Creek Enhancement Society, Friends of French Creek Conservation Society, Nanaimo and Area Land Trust, Departure Creek Streamkeepers, Harbour City River Stewards, Island Waters Fly Fishers, Nanoose – Lantzville Streamkeepers Society and Vancouver Island University

Regional District of Nanaimo
Community Watershed Monitoring Network
2013 Data Summary

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Program Outline

The purpose of this report is to present a summary of data collected as part of the Regional District of Nanaimo (RDN) Community Watershed Monitoring Network partnership. This partnership was initiated in 2011 by the RDN and the British Columbia (BC) Ministry of Environment (MOE) to collect data across the RDN. In its early stages (2011-2013) the program will be used for data gathering with the goals of obtaining enough data to see watershed trends and raise watershed health awareness in local communities. Long term goals are to use multiple years of data to determine in which watersheds more detailed monitoring and/or improved watershed management need occur, and to assist in land use planning.

Partnerships are core to the monitoring program. In 2013 the RDN and MOE organized the program and trained participants in monitoring protocols. Ten stewardship groups within the RDN participated in the monitoring program, with safety gear, land access and funding for Quality Assurance/Quality Control lab analyses provided by Island Timberlands LP. Stewardship groups participating in 2013 were: Nile Creek Enhancement Society (NCES), Friends of French Creek Conservation Society, Qualicum Beach Streamkeepers, Mid Vancouver Island Habitat Enhancement Society, Nanaimo and Area Land Trust, Departure Creek Streamkeepers, Harbour City River Stewards, Island Waters Fly Fishers, Nanoose – Lantzville Streamkeepers Society and Vancouver Island University.

A total of 51 different sites in 17 different watersheds were monitored in 2013, the third year of the program. Samples were collected weekly according to BC MOE sampling procedures (BC MOE, 2003) between August 13 and September 10, 2013 (summer low flow) by all the stewardship groups and between October 15 and November 12, 2013 (fall rains) by all the stewardship groups except NCES which sampled between October 22 and November 19, 2013. Quality assurance/quality control samples were collected by three groups. In this document, data are presented and compared to existing BC Water Quality Guidelines (BC MOE, 1997) and/or Englishman River Water Quality Objectives (Barlak *et al*., 2010) (Table 1), applicable to other watersheds within the same ecoregion. Exceedences and similarity to 2011 and 2012 data (Barlak, 2012 and 2013) are noted. 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. When data collection was missed or a stream had no above ground surface flow the missing data point is represented by a missing bar in the applicable figure in this report.

Table 1 - 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 $\leq 17^{\circ}$C average weekly temperature. Long Term $\leq 15^{\circ}$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.

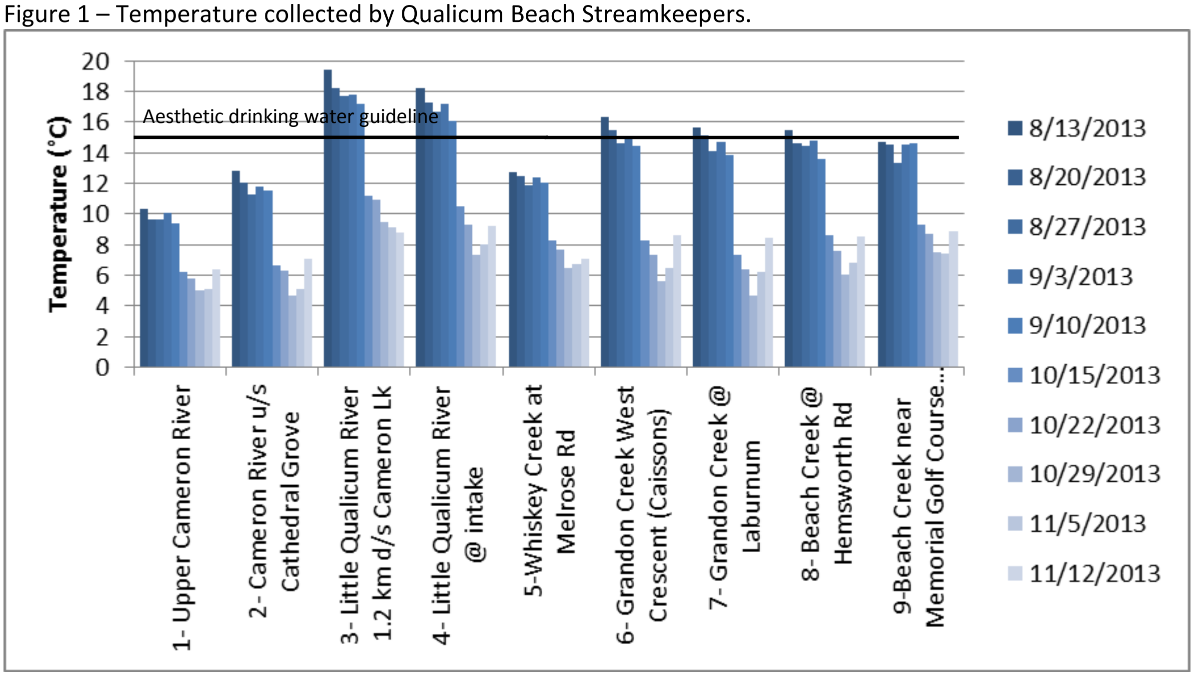
Data Summary

Summer and Fall 2013

Qualicum Beach Streamkeepers

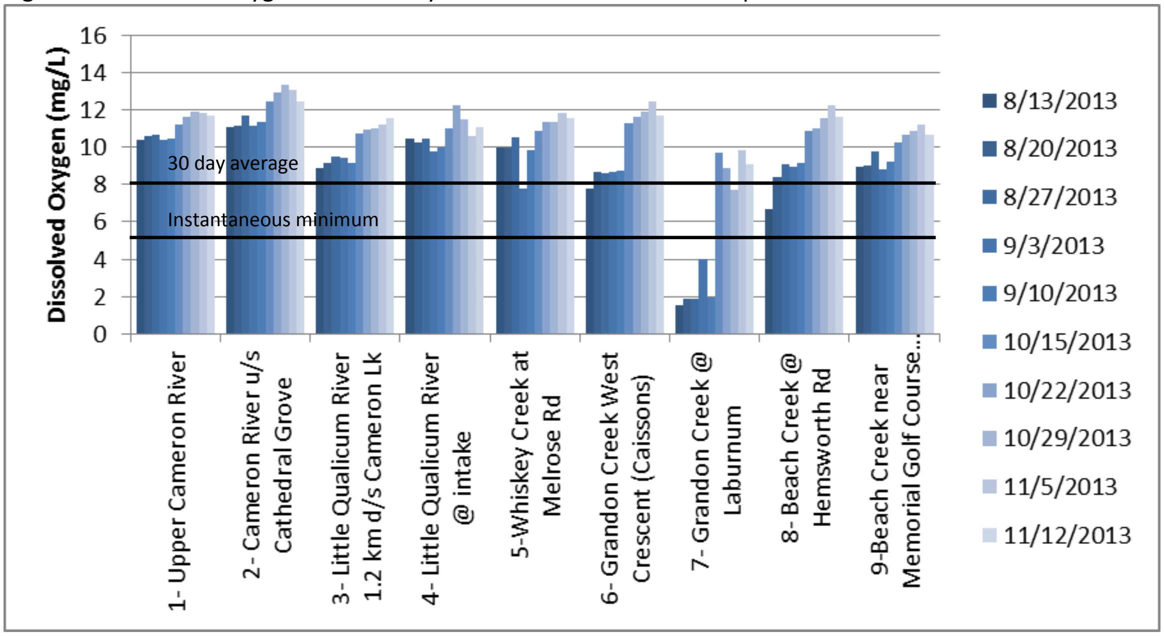
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) in the lower Little Qualicum River throughout the summer sample period (Figure 1). Maximum summer water temperatures at times had potential to exceed the guideline for coho rearing (17°C). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Data were very similar to those collected in 2011 and 2012 as part of this program.

Figure 1 – Temperature collected by Qualicum Beach Streamkeepers.



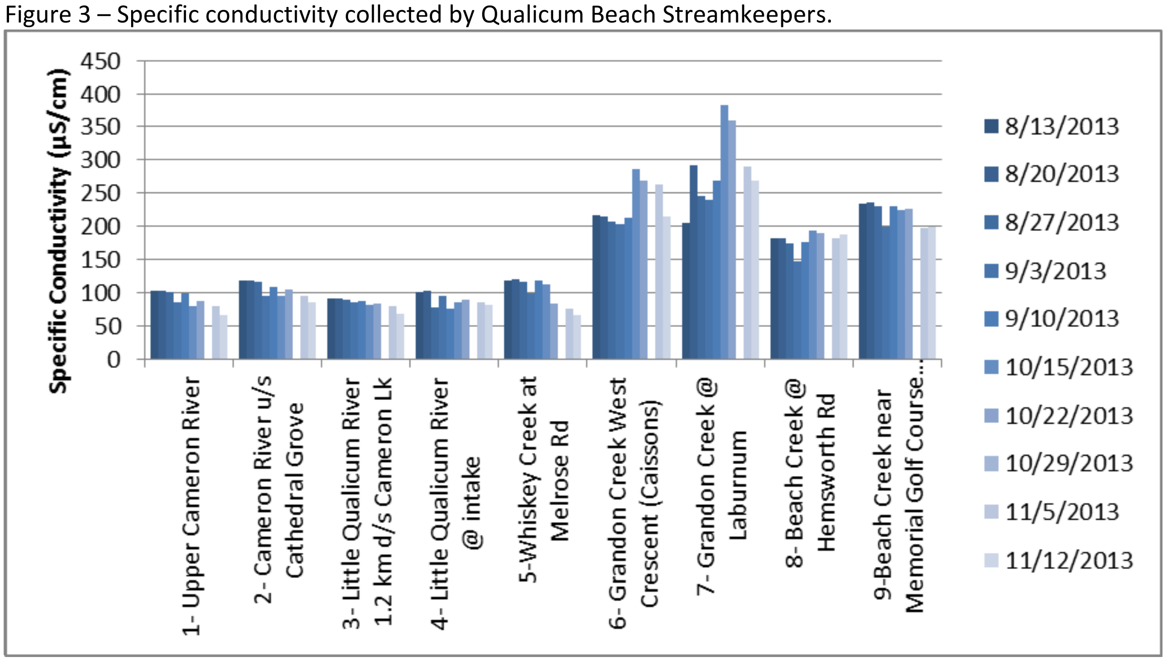
Dissolved oxygen (DO) at Grandon Creek at Laburnum was below the instantaneous minimum aquatic life guideline of 5 mg/L throughout the summer (Figure 2). The summer average (2.25 mg/L, not shown in figure below) of these values for Grandon Creek at Laburnum was below the recommended 30 day average of 8 mg/L. Low DO values may be indicative of very low flow or still water at the Grandon Creek at Laburnum site. Data were very similar to those collected in 2011 and 2012 as part of this program.

Figure 2 – Dissolved oxygen collected by Qualicum Beach Streamkeepers.



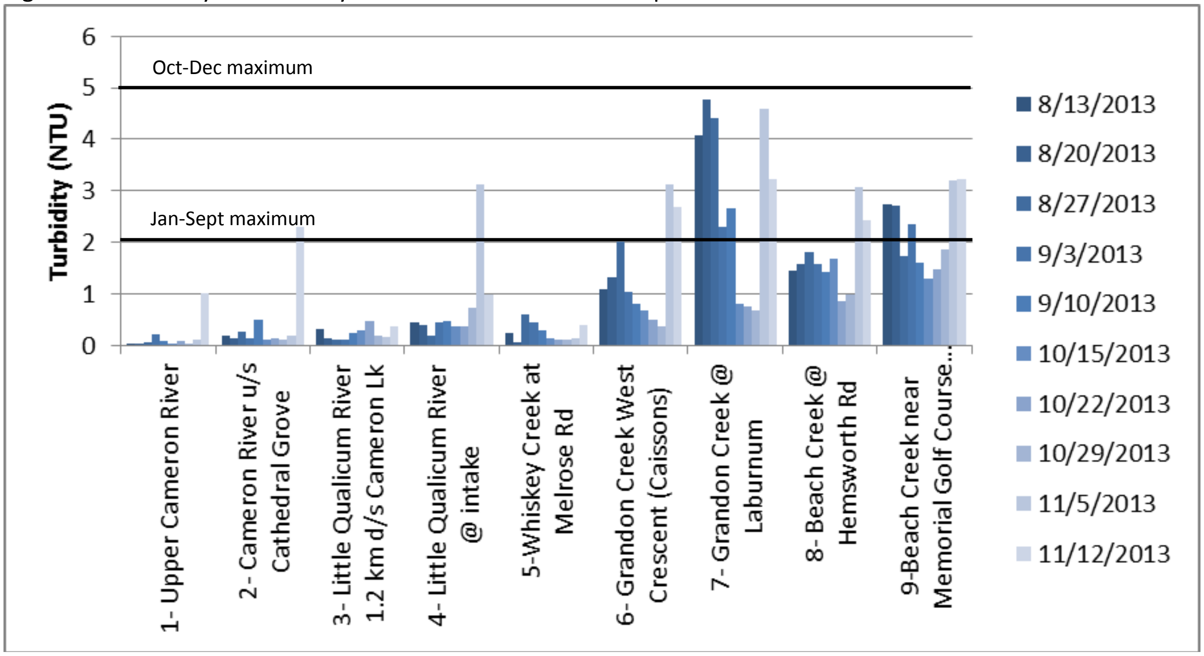
Conductivity was higher than levels typical of coastal streams in both Grandon and Beach Creeks during both sample periods (Figure 3). In Grandon and Beach Creeks increases appear to be associated primarily with increased turbidity in summer and possibly groundwater influences at all times. Summer data were similar to those collected in 2011 and 2012 as part of this program, whereas fall data tended to be lower than 2011 and 2012 data. As higher 2011 values were attributed to calibration error and 2012 values to turbidity events, 2013 data are as expected.

Figure 3 – Specific conductivity collected by Qualicum Beach Streamkeepers.



The January through September summer low flow maximum turbidity objective was at times exceeded in both Grandon and Beach Creeks (Figure 4), similar to that observed in 2011 and 2012. This and the proximity of these creeks to residential development areas suggest increased anthropogenic turbidity inputs to these creeks; further data collection will help determine trends. Increased fall values at all sites were associated with rainfall events and did not exceed October to December turbidity objectives in any samples collected.

Figure 4 – Turbidity collected by Qualicum Beach Streamkeepers.



Nile Creek Enhancement Society

There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at one site in Thames Creek (Figure 5) in the summer. Dissolved oxygen and conductivity values are shown in Figures 6 and 7. Data were similar to those collected in 2011 and 2012 as part of this program.

Figure 5 – Temperature collected by the Nile Creek Enhancement Society.

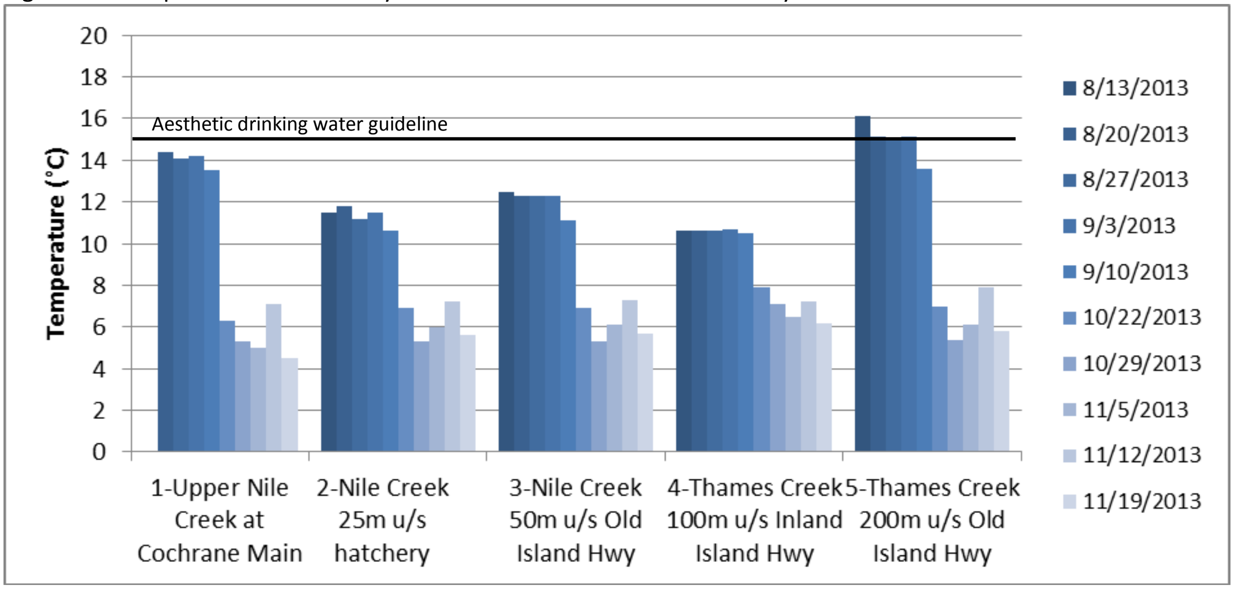


Figure 6 – Dissolved oxygen collected by the Nile Creek Enhancement Society.

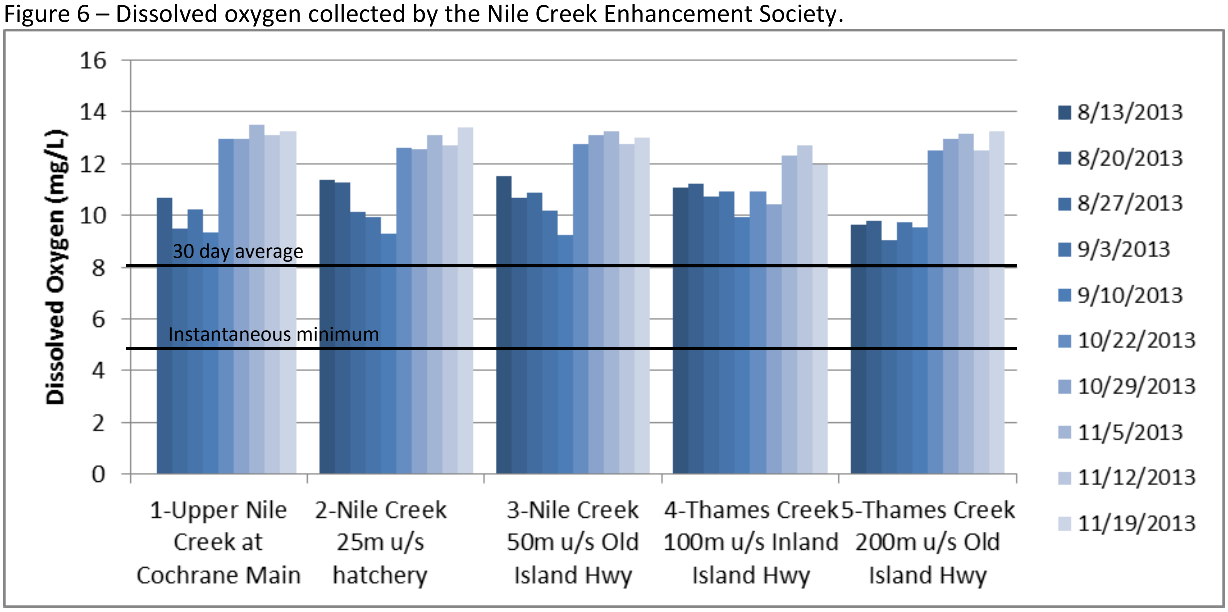
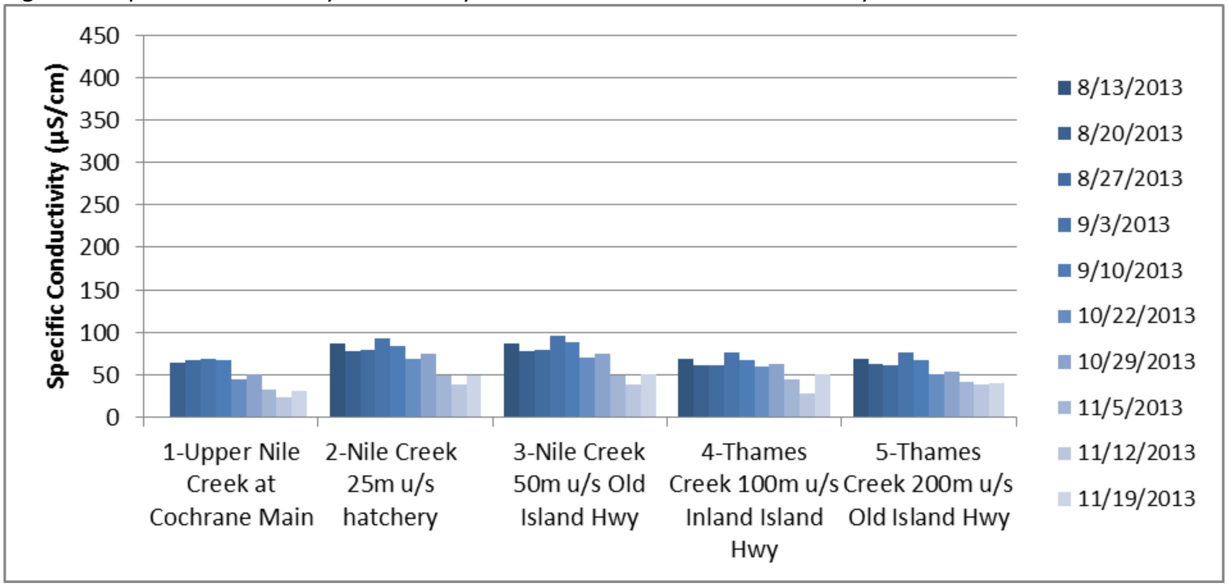
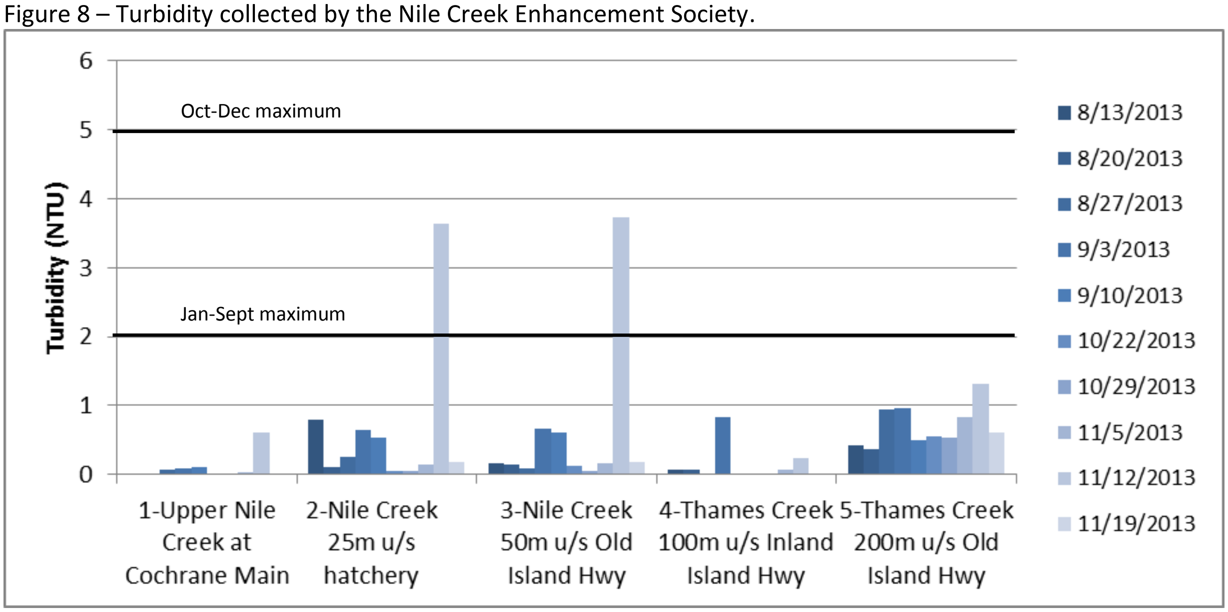


Figure 7 – Specific conductivity collected by the Nile Creek Enhancement Society.



Higher fall turbidity vales (Figure 8) were associated with rainfall events and tended to be highest in the lower watershed sites. Summer turbidity values at Thames Creek 200 m upstream Old Island Highway were slightly higher than those observed in 2011 and 2012; as further data are collected trends may become apparent.

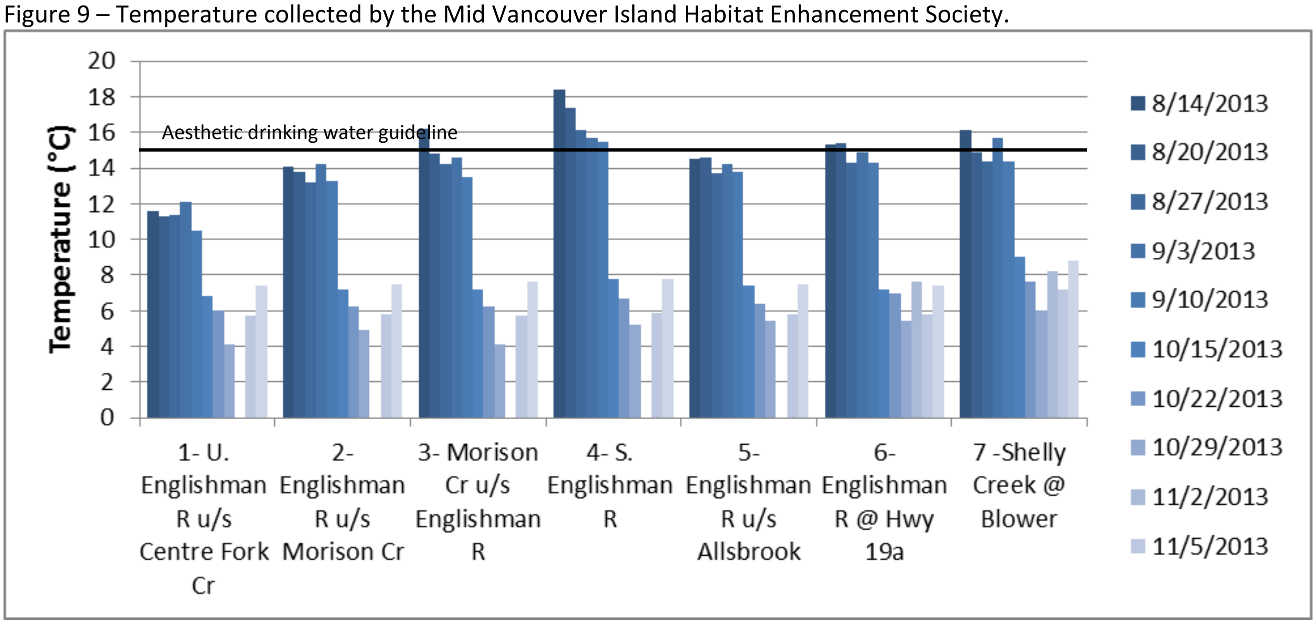
Figure 8 – Turbidity collected by the Nile Creek Enhancement Society.



Mid Vancouver Island Habitat Enhancement Society

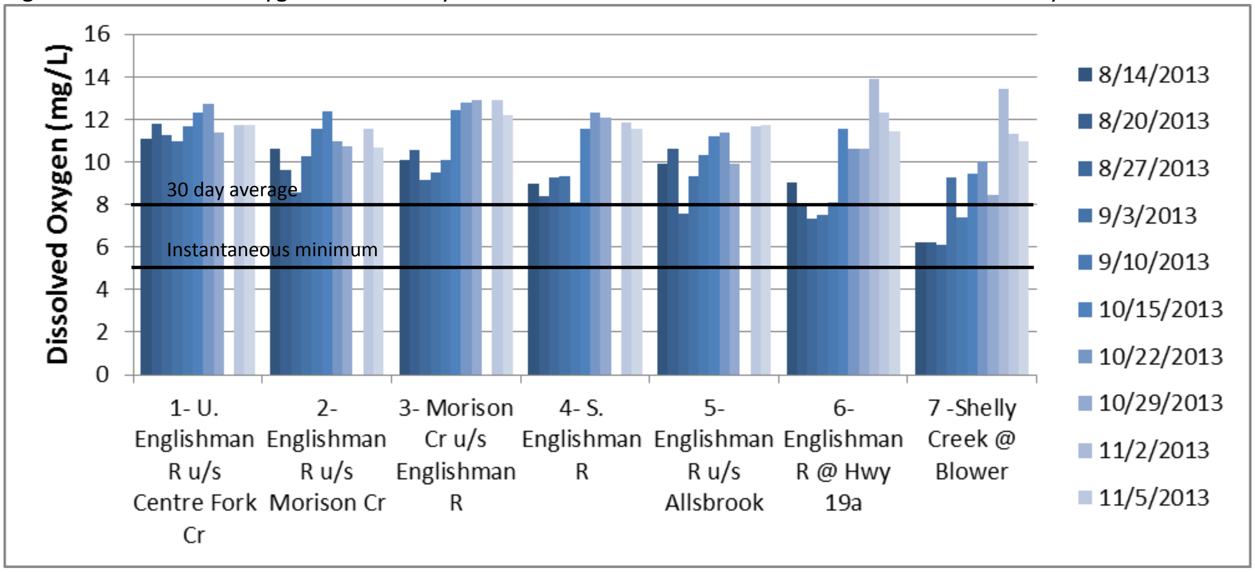
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15^{o}C) in the summer at all sites except the Upper Englishman River (Figure 9). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow. Maximum summer water temperatures had the potential to exceed the guideline for coho (17°C) rearing in the South Englishman River. More data are needed to determine if these observations could be related to the wide and shallow nature of this area of the South Englishman River, low flows, hydrology of the upper watershed (low elevation, inputs from shallow lakes and a wetland) or other factors. As long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Temperature values were slightly higher than those observed in 2011 and 2012.

Figure 9 – Temperature collected by the Mid Vancouver Island Habitat Enhancement Society.



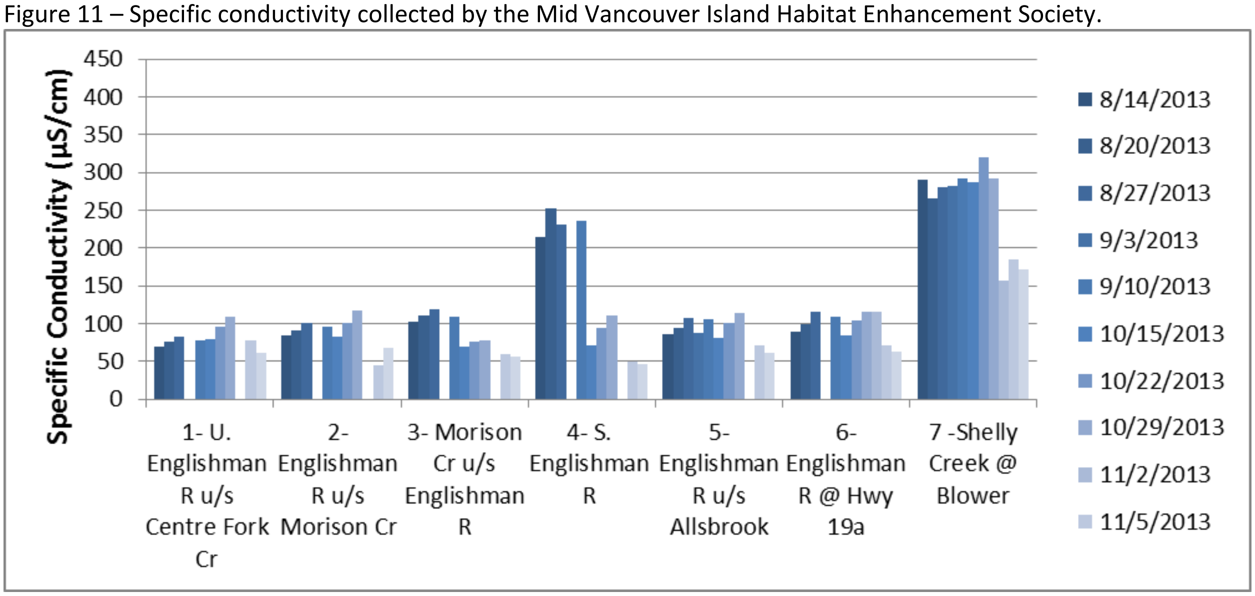
Dissolved oxygen (DO) at the Shelly Creek and Englishman River at Highway 19a sites was below the recommended 30 day average objective of 8 mg/L for the summer low flow period (average of 7.05 mg/L and 7.98 mg/L, respectively, not shown in figure below). Low DO values may be indicative of very low flow in the lower reaches of the Englishman River watershed. At all sample locations, DO levels were above the aquatic life instantaneous minimum of 5 mg/L (Figure 10). Data were similar to those collected in 2011 and 2012 as part of this program.

Figure 10 – Dissolved oxygen collected by the Mid Vancouver Island Habitat Enhancement Society.



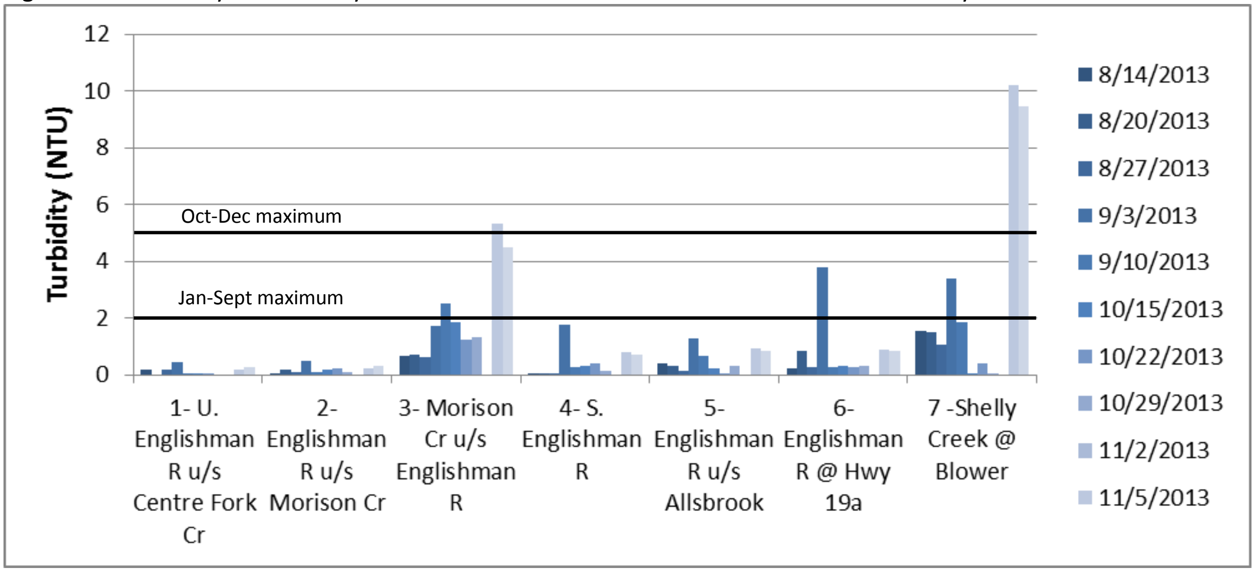
At the South Englishman River site in the summer and Shelly Creek site in the summer and fall, specific conductivity was higher than levels typical of coastal streams (Figure 11). These values were not typically associated with increased turbidity and were most likely influenced by higher groundwater inputs. Further data collection will help determine trends as 2013 data were similar to those observed in 2011 and 2012.

Figure 11 – Specific conductivity collected by the Mid Vancouver Island Habitat Enhancement Society.



Summer turbidity levels were similar to those observed in 2011 and 2012 with the exception of the fourth week of summer sampling which was slightly higher most likely due to a rain event. The January to September 2 NTU maximum was exceeded three times in the summer (Figure 12) most likely due to precipitation events. Increased fall turbidity observations at all sites were associated with rainfall events. Turbidity levels at Morison and Shelly Creeks exceeded the October to December maximum objective on one and two occasions, respectively. Upstream activities are likely influencing these observations. As further data are collected trends may become apparent.

Figure 12 – Turbidity collected by the Mid Vancouver Island Habitat Enhancement Society.

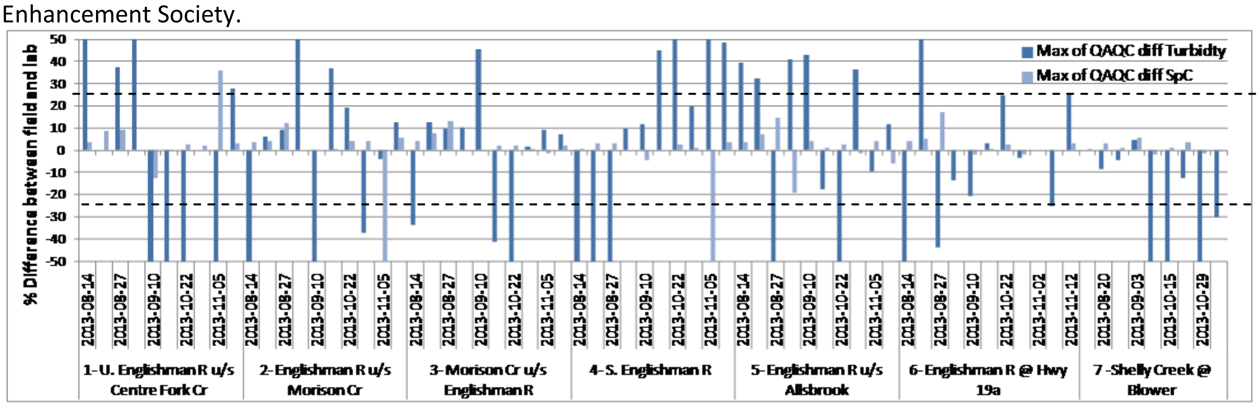


Additional grab sampling (analyzed by a lab) by Mid Vancouver Island Habitat Enhancement Society were available for quality control comparison. Of the 70 turbidity samples taken and compared with meter readings that were higher than the 0.04 NTU accuracy range of the meter, 35 were greater than 25% different than the associated meter reading taken in the field that day, and 16 of these showed a higher lab value than field value (Figure 13). Of these 35 all but six were less than 1 NTU, and all but 16 were less than 0.40 NTU. Therefore, most are not of concern as they would not artificially exceed any objectives or guidelines. One value (10 Sept, 2013 at Shelly Creek at Blower Rd) would have exceeded the 2 NTU objective using the lab value when it did not using the meter value.

Only three of 65 grab samples analyzed in the lab for specific conductivity had readings greater than 25% different than the field readings; these were all taken on the same date.

A higher field than lab value could be due to dust on the vial or in the chamber of the turbidometer; whereas a higher lab than field value may be due to sample technique that may cause sediment disturbance when filling a bottle or more sensitive instruments in the lab. During higher flows and rain events these differences may also be due more variation between readings taken in the same stream.

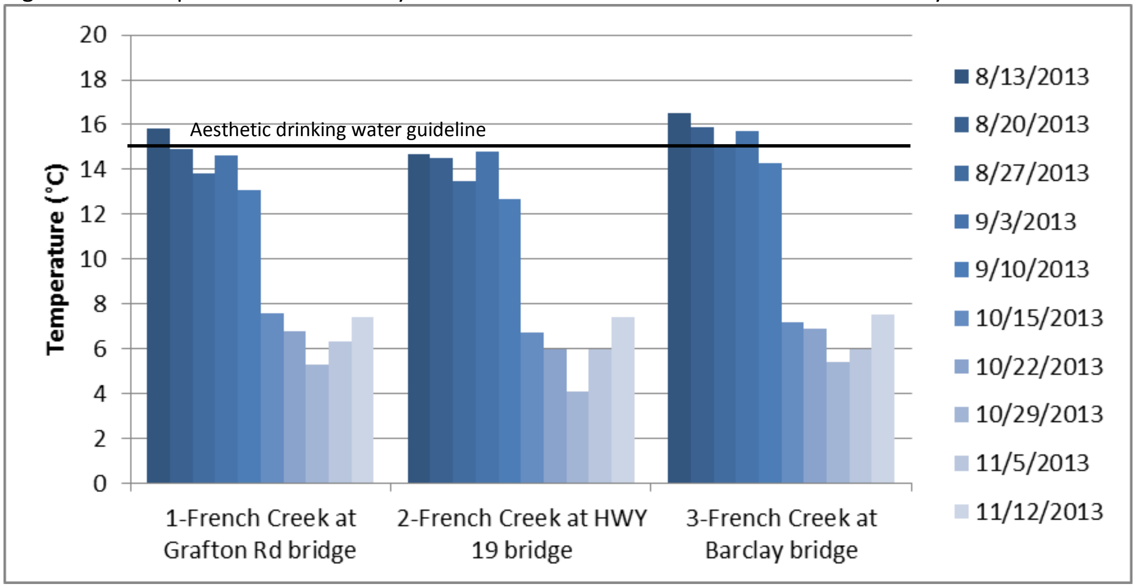
Figure 13 – Percent difference between field and lab samples collected by Mid Vancouver Island Habitat Enhancement Society.



Friends of French Creek Conservation Society

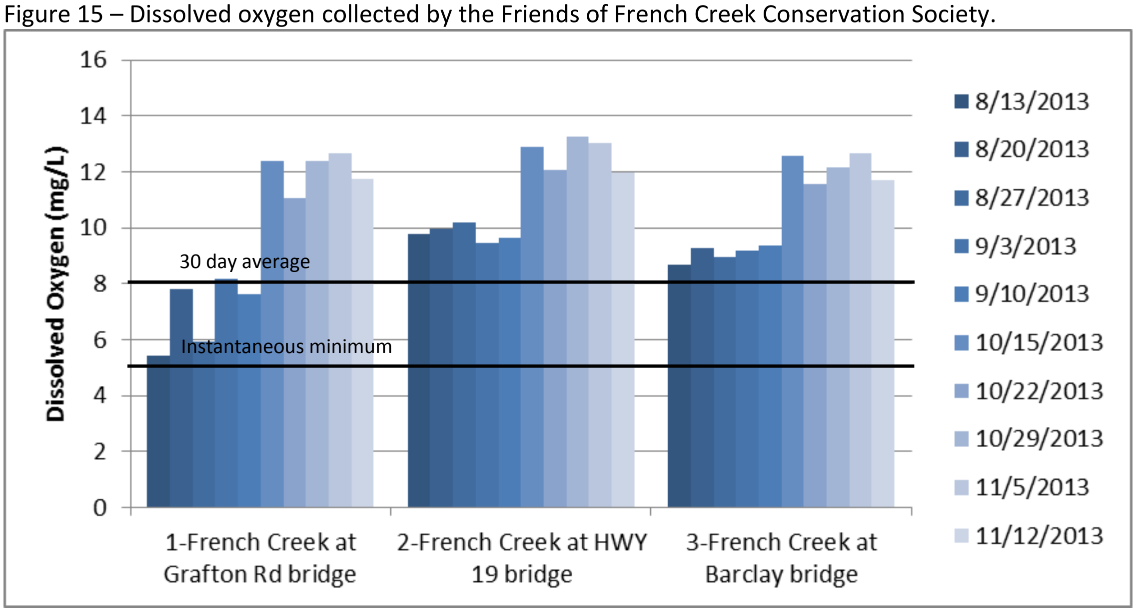
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at all three sites (Figure 14). Values were similar to those observed in 2011 and 2012.

Figure 14 – Temperature collected by the Friends of French Creek Conservation Society.



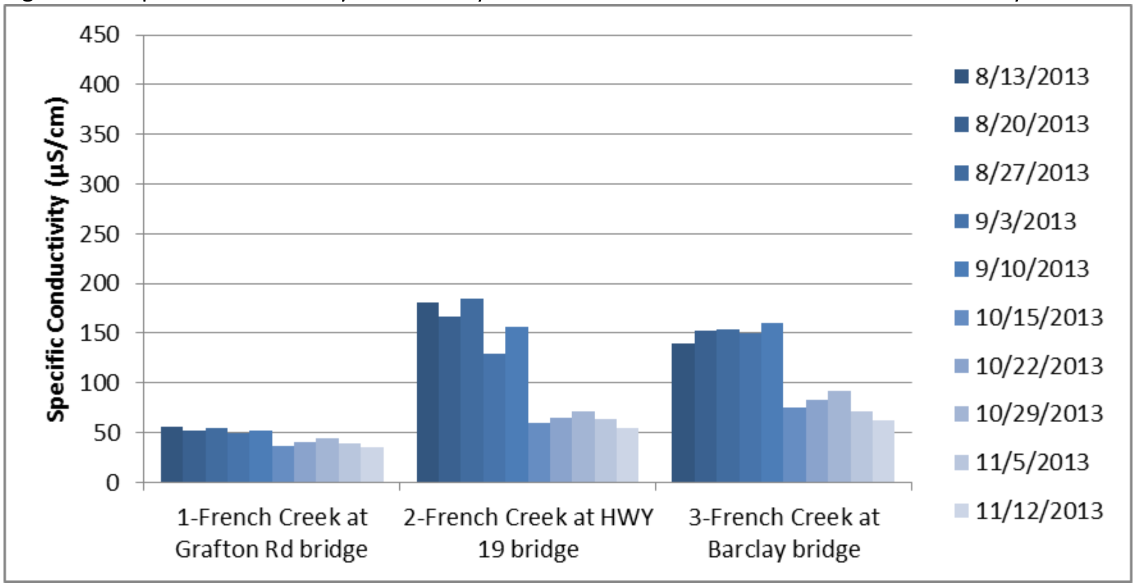
Dissolved oxygen (DO) at the Grafton Road site was below the recommended 30 day average (average of 7.01 mg/L not shown; Figure 15). Low DO values were associated with very low flow or still water at this site. Values were similar to those observed in 2011 and 2012.

Figure 15 – Dissolved oxygen collected by the Friends of French Creek Conservation Society.



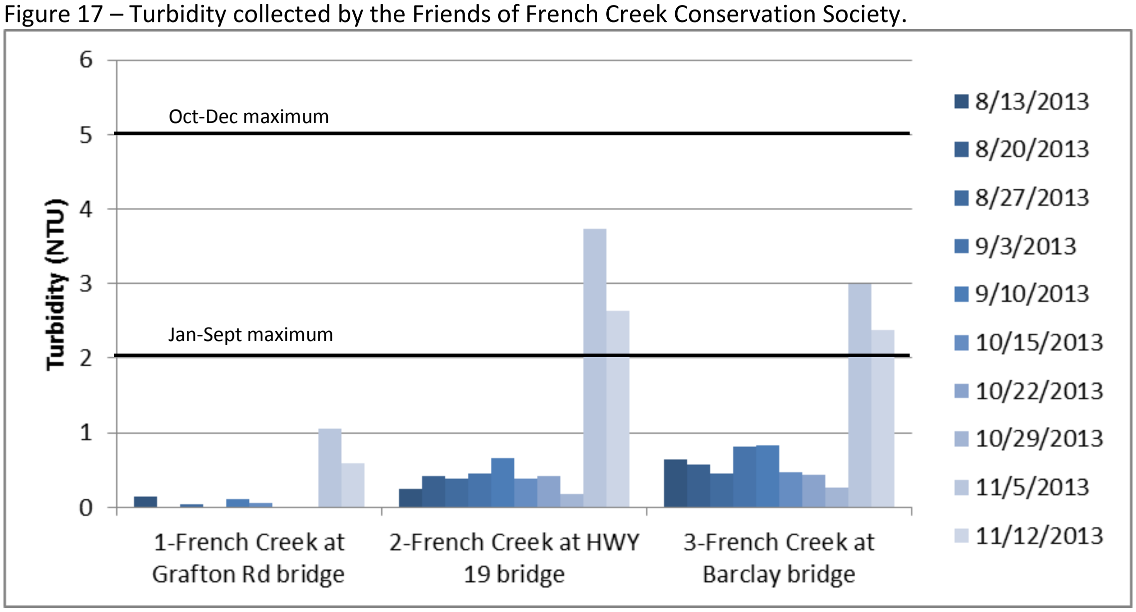
At the Highway 19 and Barclay Bridge sites, conductivity was higher than levels typical of coastal streams in the summer (Figure 16). The higher values at both of these sites may have been influenced by higher groundwater inputs. Values were similar to those observed in 2011 and 2012.

Figure 16 – Specific conductivity collected by the Friends of French Creek Conservation Society.



Summer turbidity levels were well below the January to September maximum turbidity level of 2 NTU and were similar to data collected in 2011 and 2012 (Figure 17). Higher fall values at all three sites were associated with rainfall events.

Figure 17 – Turbidity collected by the Friends of French Creek Conservation Society.

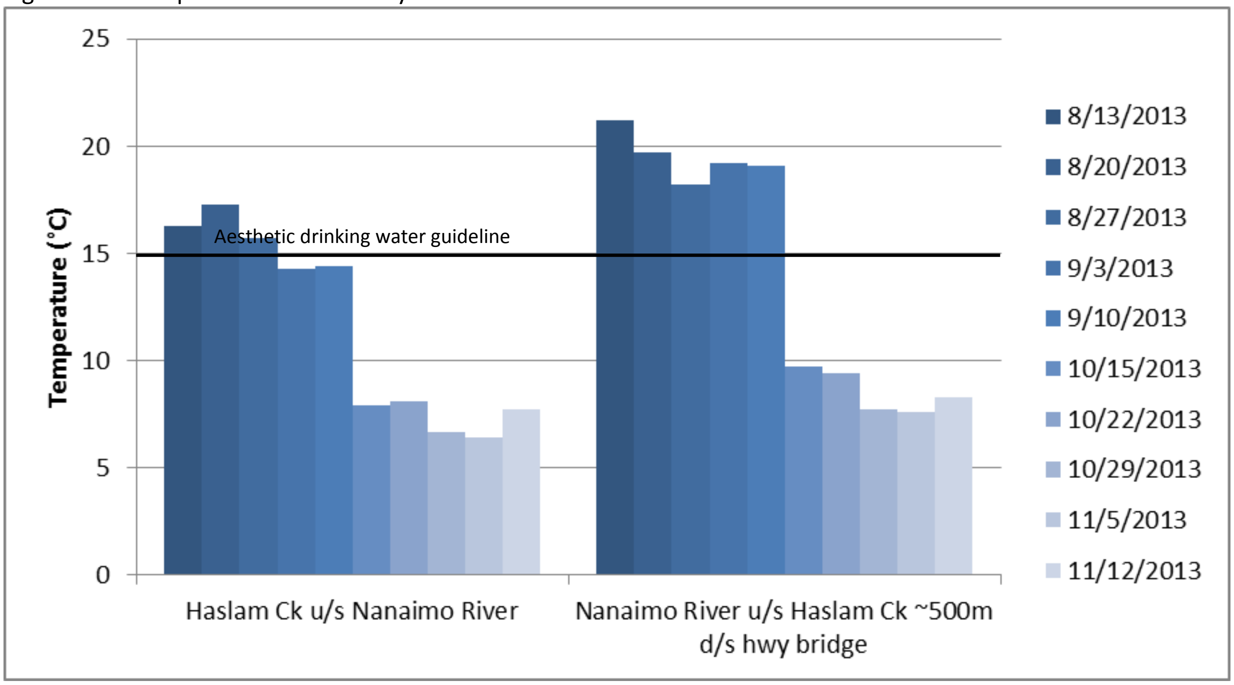


Duplicate turbidity readings for quality assurance purposes were taken at the French Creek sites, re-zeroing the meter before each new reading. Six of the 30 duplicate samples taken had duplicate readings that were both within the accuracy of the meter (i.e. higher than 0.04 NTU) and more than 25% different from the first readings. In addition, two more readings were taken at each site, not zeroing the meter after each reading. On eight occasions out of 30 triplicate readings, one of the duplicate and/or triplicate readings was greater than 25% different from the first reading. None of these values were of concern as they were on the low range of the meter (i.e. less than 1 NTU) and most were less than 0.40 NTU, thus none would have the potential to artificially show a turbidity objective exceedence.

Nanaimo and Area Land Trust (NALT)

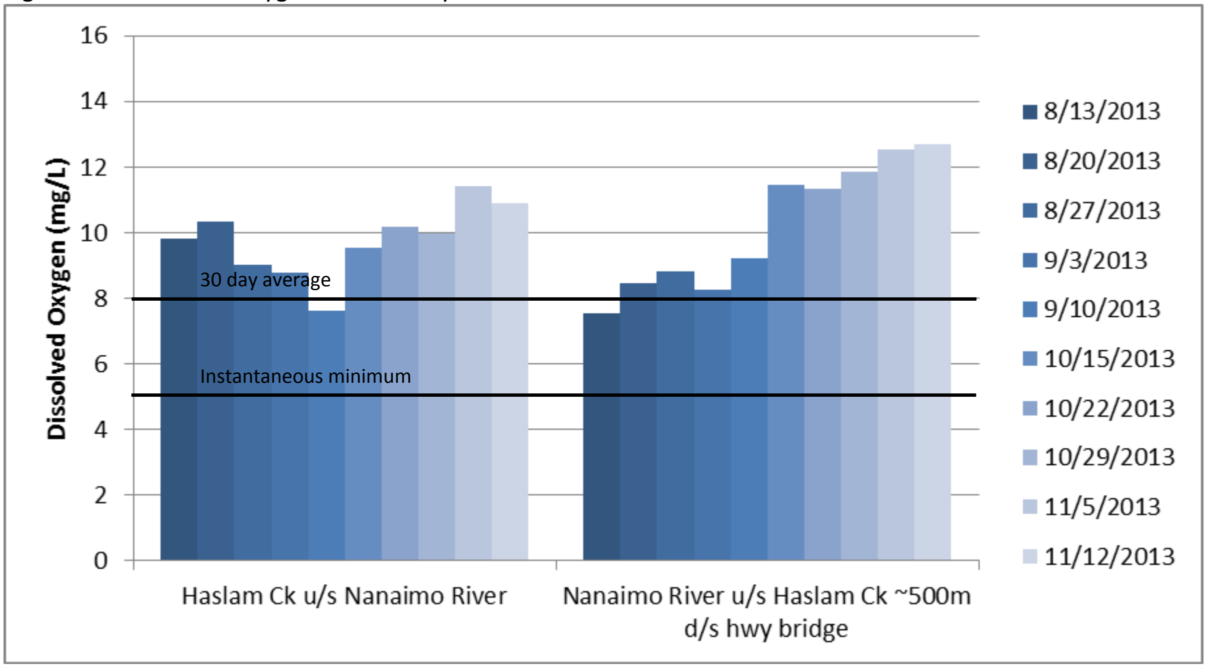
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15ºC) in Haslam Creek and throughout the summer sample period in the Nanaimo River upstream Haslam Creek (Figure 18). Summer temperatures exceeded the guideline for coho rearing (17°C) once at the Haslam Creek site and throughout all five weeks of summer sampling at the Nanaimo River site. This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Data were similar to 2012.

Figure 18 – Temperature collected by the Nanaimo and Area Land Trust.



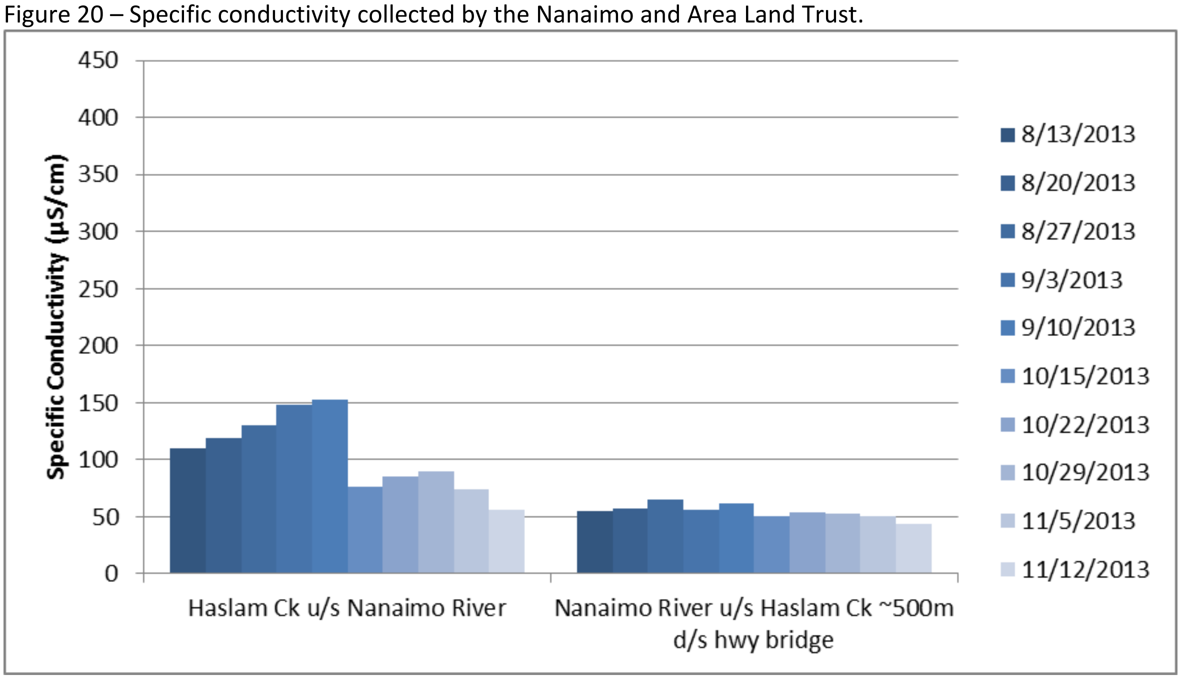
Dissolved oxygen values are shown in Figure 19 and data were similar to that gathered in 2012.

Figure 19 – Dissolved oxygen collected by the Nanaimo and Area Land Trust.



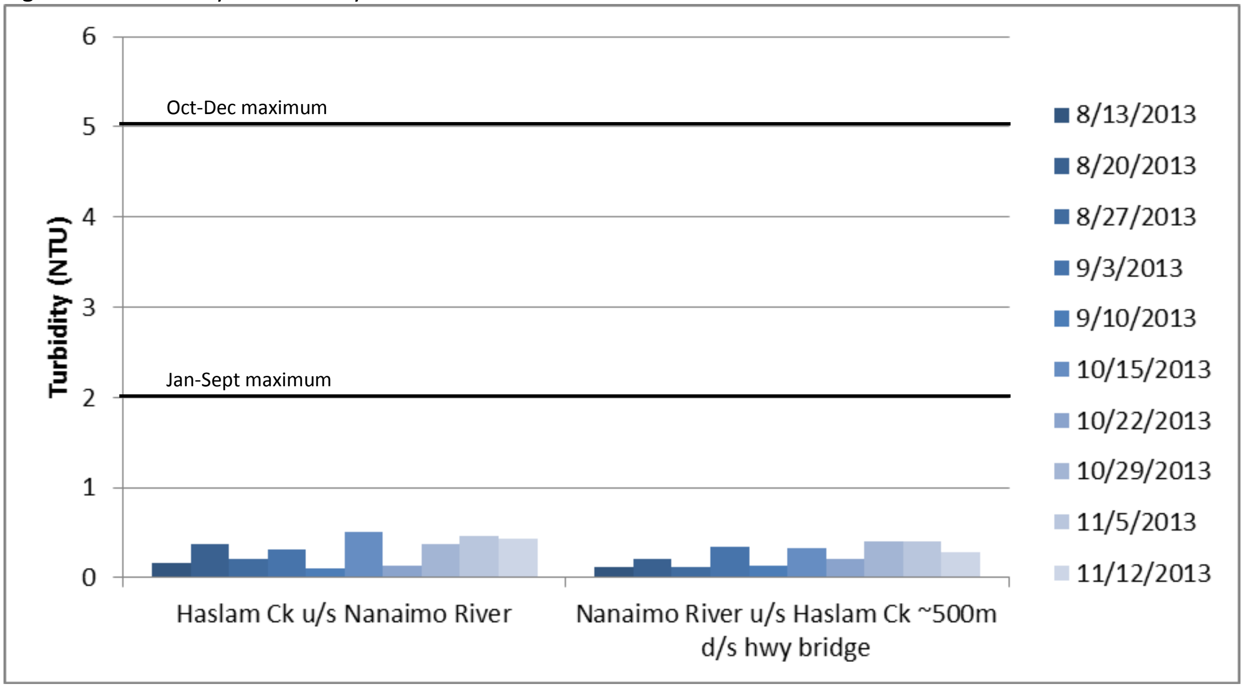
Slightly higher summer specific conductivity values at the Haslam Creek (Figure 20) site may indicate some groundwater influence. 2013 data were similar to that of 2012.

Figure 20 – Specific conductivity collected by the Nanaimo and Area Land Trust.



Slight increases in turbidity were associated with rainfall events and no turbidity objectives were exceeded at either site (Figure 21).

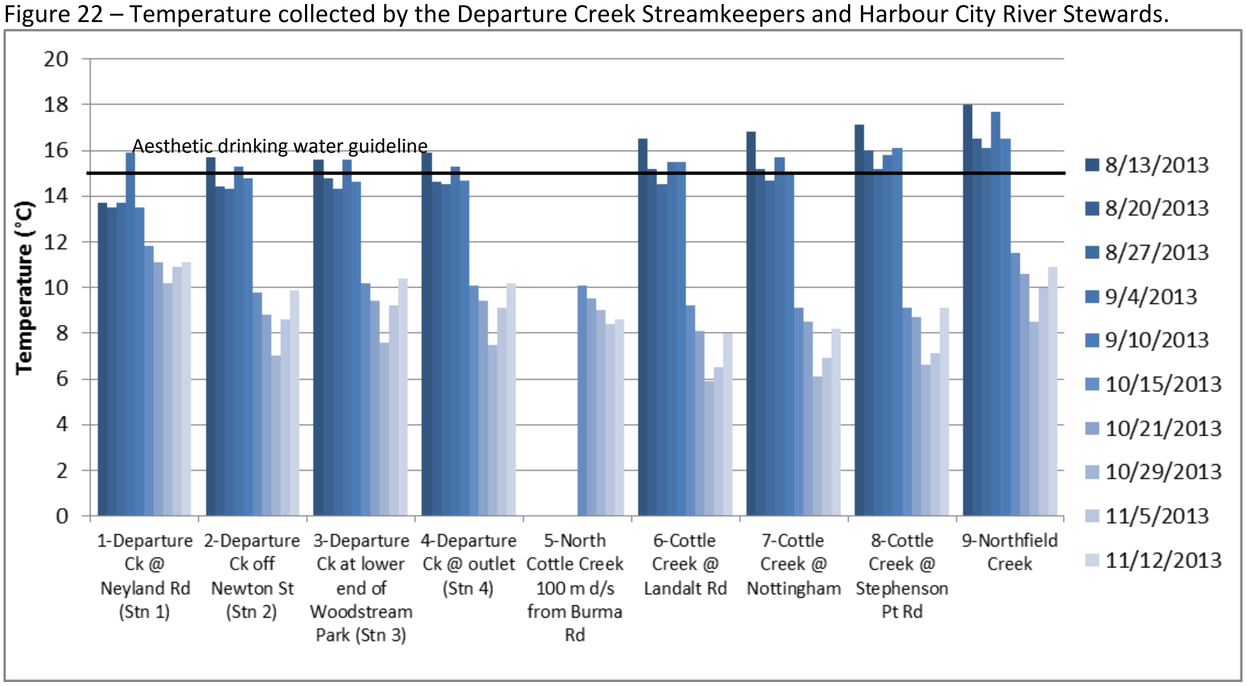
Figure 21 – Turbidity collected by the Nanaimo and Area Land Trust.



Departure Creek Streamkeepers and Harbour City River Stewards (in affiliation with NALT)

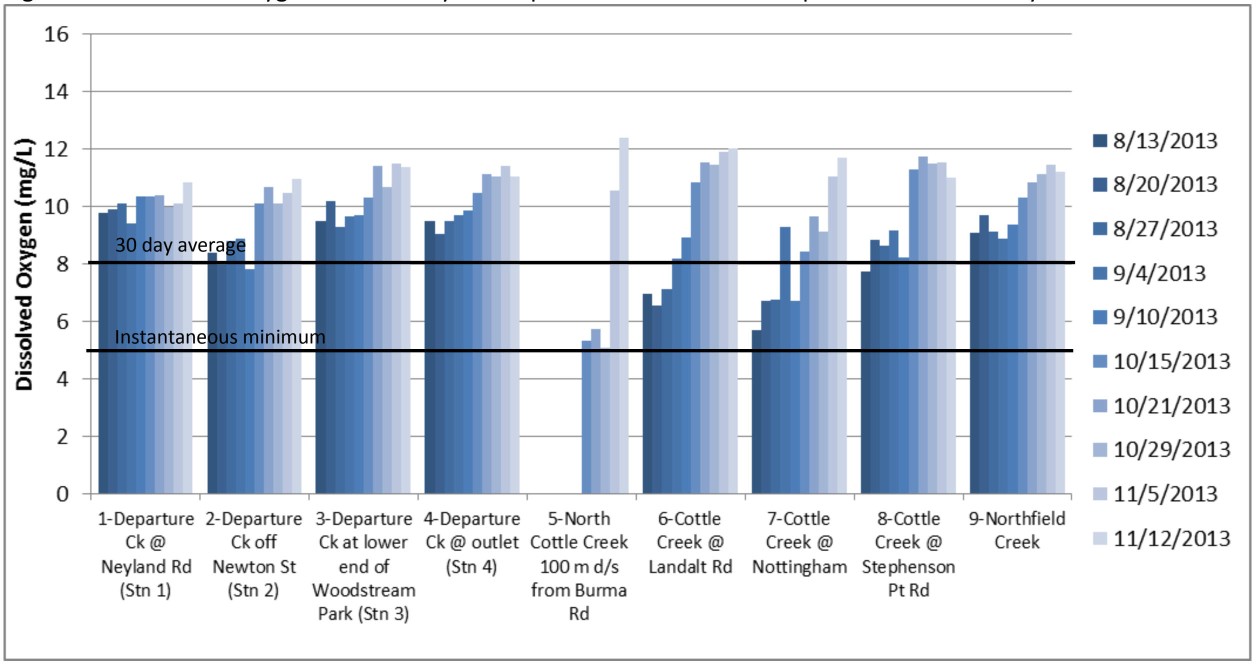
There was potential for summer exceedences of the aesthetic drinking water temperature guideline (weekly average 15ºC) occasionally in all sites (Figure 22) and potential for summer exceedence of the guideline for coho rearing (17°C) in the lower portions of Cottle and Northfield Creeks. Though fisheries information (Habitat Wizard, 2012) indicates only that cutthroat trout are present in Cottle Creek, not coho, cutthroat trout have the same maximum guideline for rearing. High summer temperatures are typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Data were similar to those collected in 2012 as part of this program.

Figure 22 – Temperature collected by the Departure Creek Streamkeepers and Harbour City River Stewards.



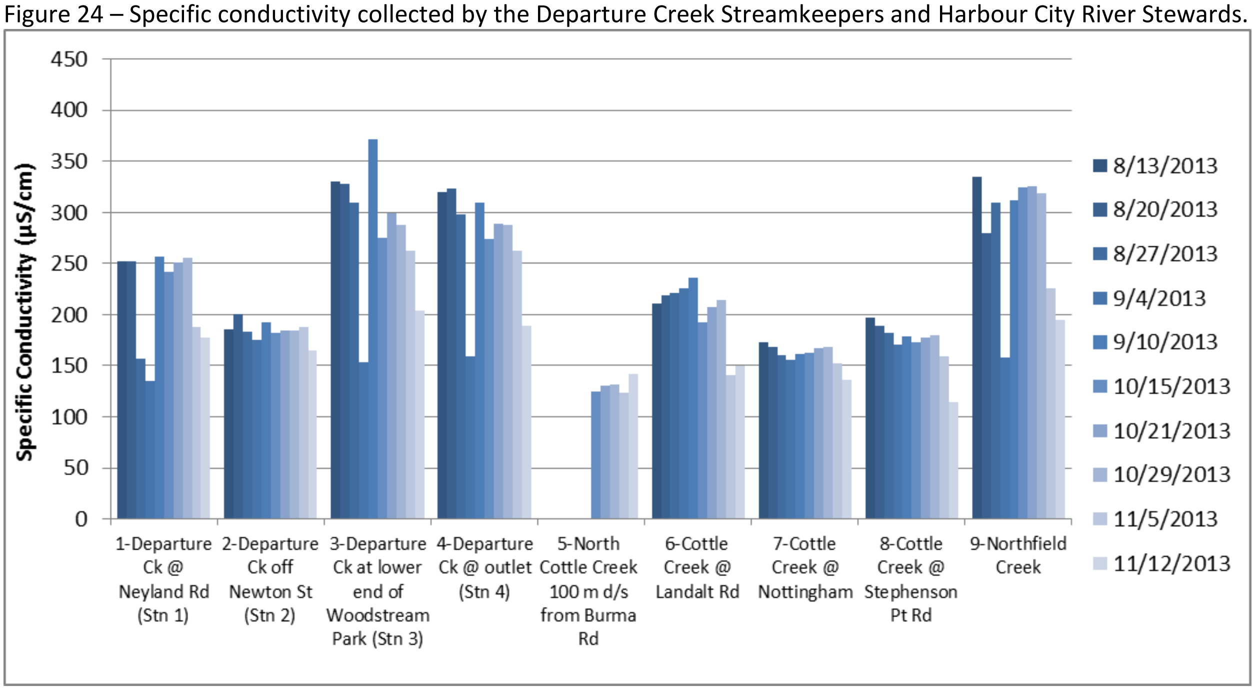
Dissolved oxygen (DO) at the Cottle Creek at Landalt and the Cottle Creek at Nottingham site were below the recommended 30 day average (average of 7.56 mg/L and 7.04 mg/L, respectively, not shown in figure below) for the summer sampling period (Figure 23). In the fall sample period, DO at the North Cottle Creek was below the recommended 30 day average (average of 7.82 mg/L not shown). Low DO values were associated with very low flow or still water all three of these sites. Values were similar to that collected in 2012.

Figure 23 – Dissolved oxygen collected by the Departure Creek Streamkeepers and Harbour City River Stewards.



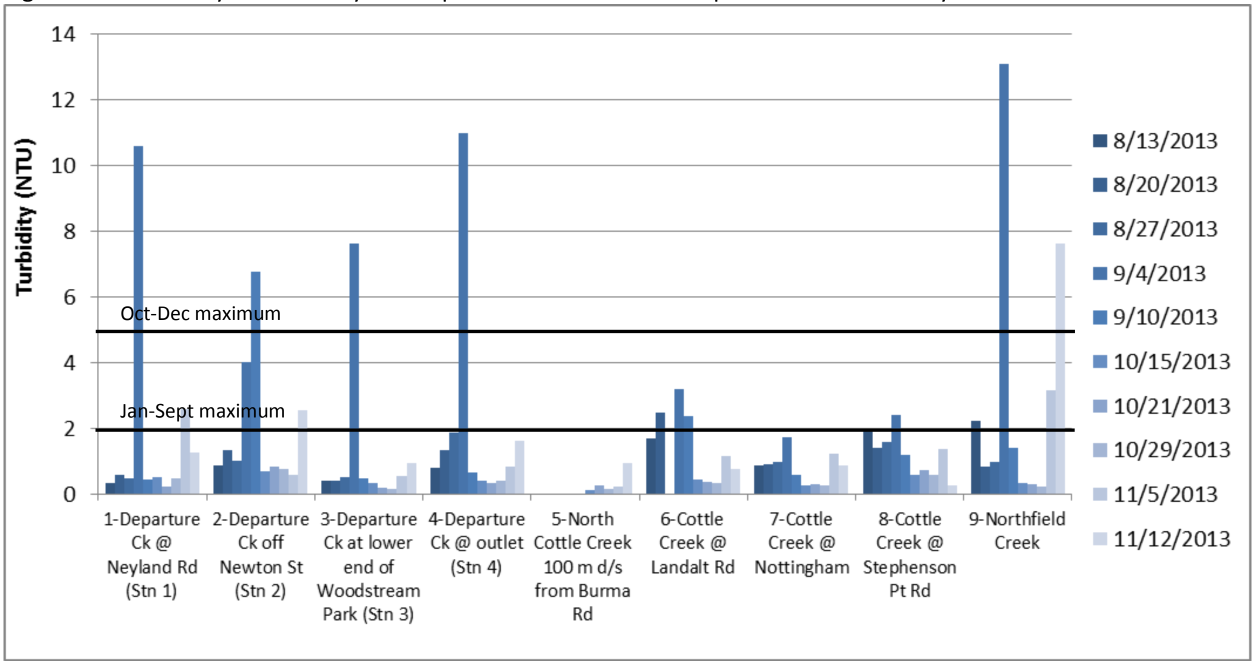
Specific conductivity was higher than levels typical of coastal streams in the summer at all sites (Figure 24). These values appear to be associated with increased turbidity (Figure 25) in Cottle Creek, while in Departure and Northfield Creeks higher conductivity may indicate some groundwater influence in combination with turbidity influences. Further data collection will help determine trends as values collected were similar to that of 2012.

Figure 24 – Specific conductivity collected by the Departure Creek Streamkeepers and Harbour City River Stewards.



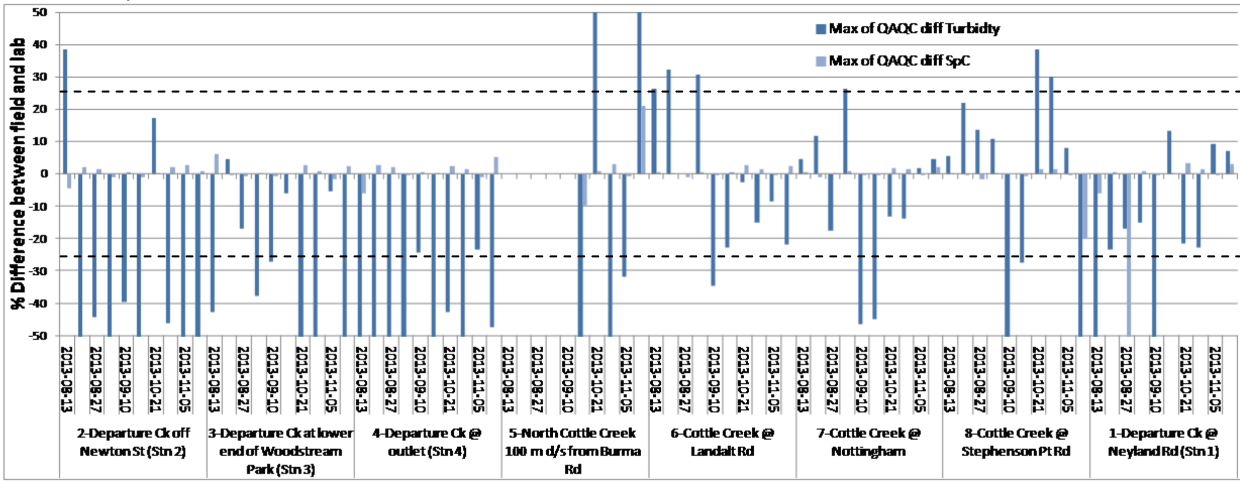
Summer turbidity events were in exceedence of turbidity objectives in all Departure Creek sites, as well as in Cottle Creek at Landalt, Cottle Creek at Stephenson and Northfield Creek (Figure 25). Fall turbidity events were in exceedence of turbidity objectives in Northfield Creek on one sample date. All exceedences relate to rainfall events and are potentially due to anthropogenic influences; further data collection will help determine trends.

Figure 25 – Turbidity collected by the Departure Creek Streamkeepers and Harbour City River Stewards.



At eight of the sampling sites (Departure Creek at Neyland, Newton, Woodstream and outlet; and, Cottle Creek at Burma, Landalt, Nottingham and Stephenson) grab samples were taken for lab analysis as part of quality assurance/quality control procedures (Figure 26). Forty one of the 75 turbidity samples analyzed were greater than 25% different than the associated meter reading taken in the field that day, and 32 of these results showed a higher lab value than field value. All but 16 of these 41 samples were below 1 NTU. Using the lab value in place of the field value, three sites would have shown more objective exceedences (Departure Creek at Newton (20 Aug, 5 Nov and 12 Nov, 2013), Departure Creek at outlet (13 Aug, 20 Aug and 27 Aug, 2013) and Cottle Creek at Stephenson (10 Sept, 2013)). Only one fall sample of the 75 grab samples had specific conductivity readings greater than a 25% difference than the field readings, this one fall sample was higher than the field reading. The samples with greater than 25% difference may be due to sample technique where filling a large bottle had the potential to disturb bottom sediment and result in a higher reading. This is likely the case at most of these sites, as the streams have little flow and filling bottles can be challenging. Also, more sensitive instruments in the lab than the field may influence differences observed. During higher flows and rain events these differences may also be due to more variation between readings taken in the same stream.

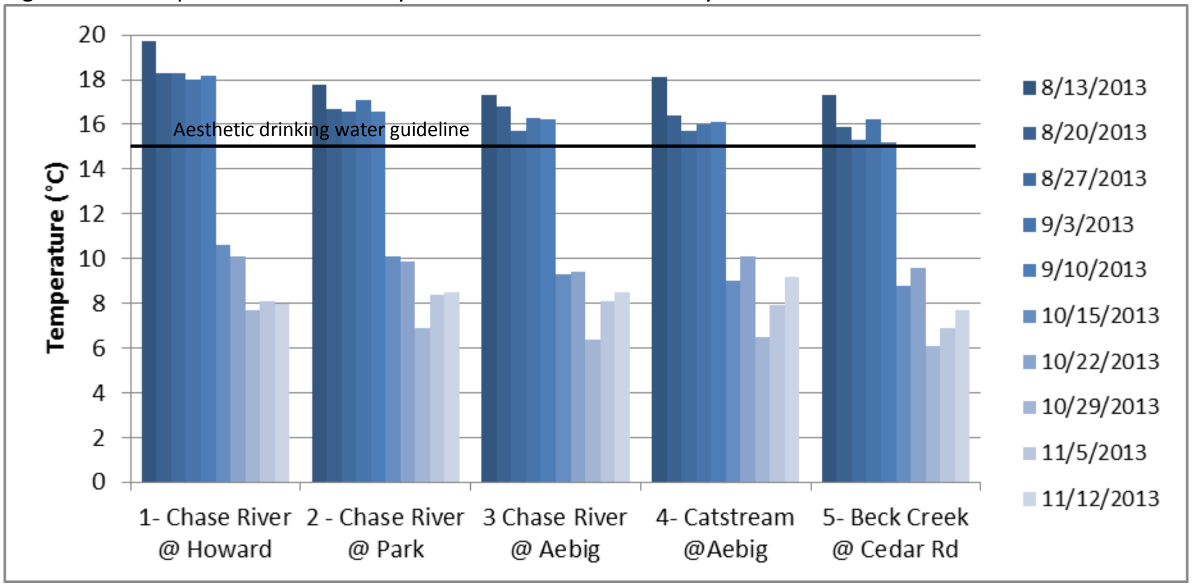
Figure 26 – Percent difference between field and lab samples collected by the Departure Creek Streamkeepers and Harbour City River Stewards.



Vancouver Island University

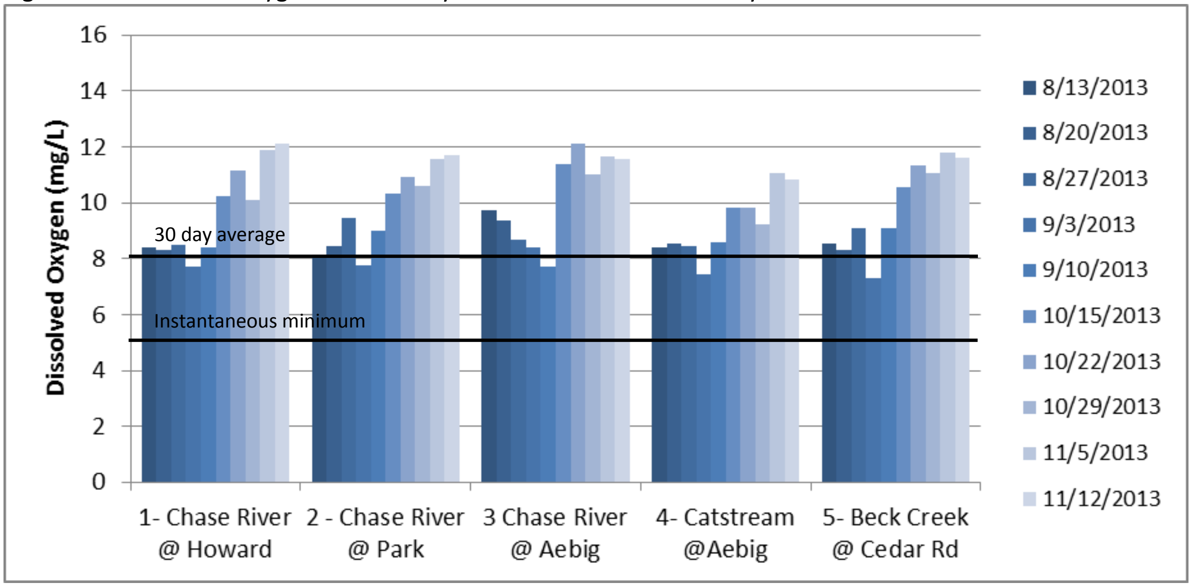
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at all sites and the guideline for coho rearing (17°C) at nearly all sites in the summer (Figure 27). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Values collected were similar to 2012.

Figure 27 – Temperature collected by Vancouver Island University.



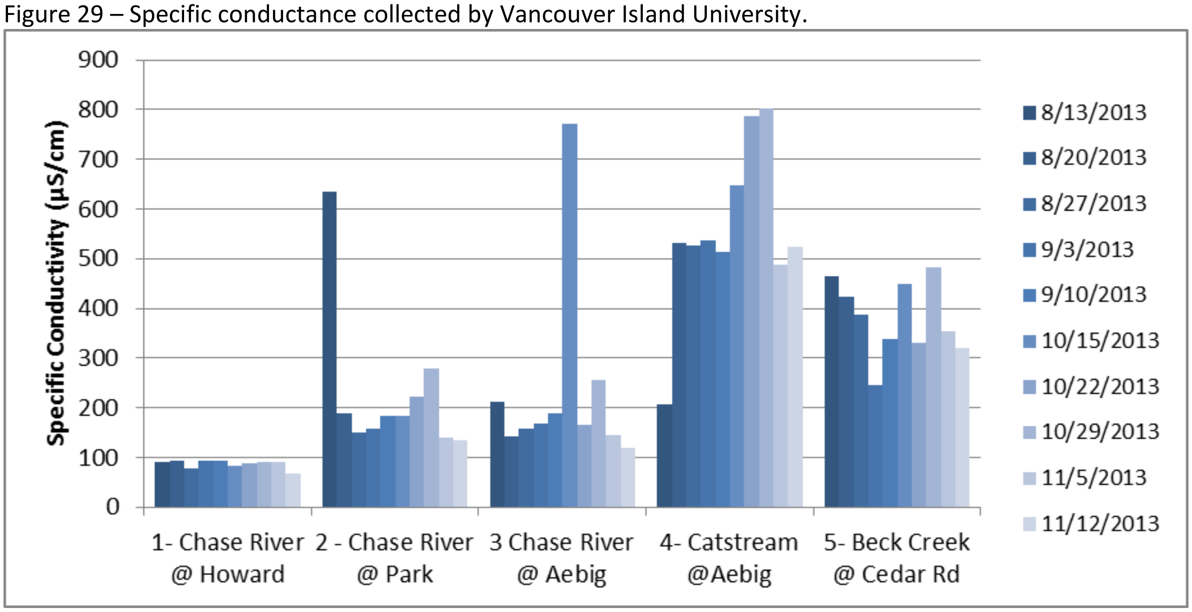
Dissolved oxygen (DO) levels were just above the 30 day average objective of 8 mg/L (Figure 28). Low DO values were associated with very low flow or still water at these sites in the summer. DO values were similar to those collected in 2012.

Figure 28 – Dissolved oxygen collected by Vancouver Island University.



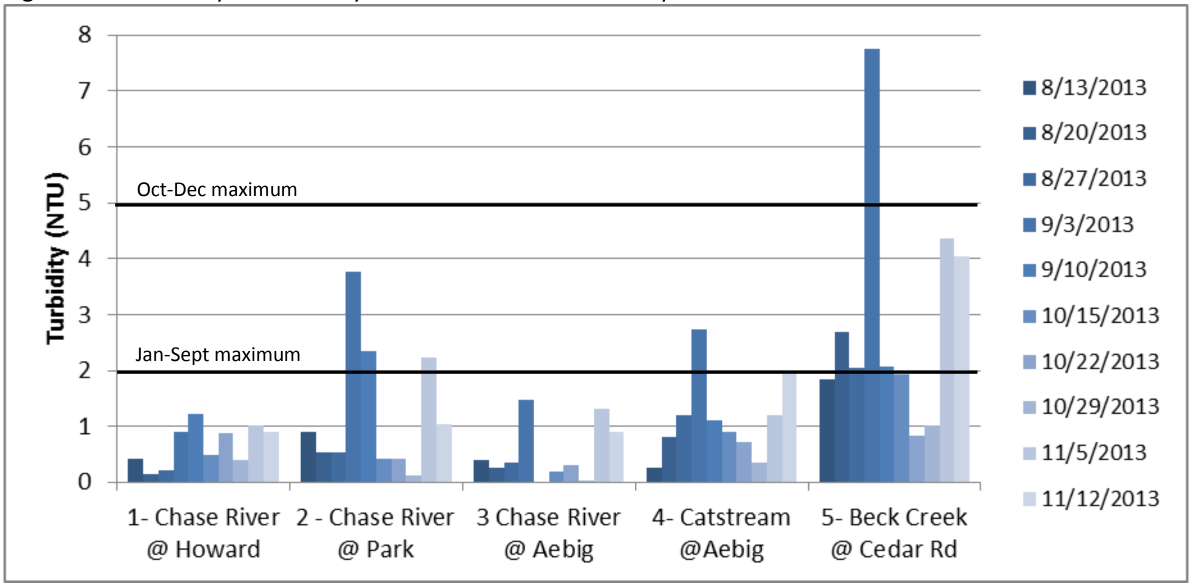
Specific conductivity was higher than levels typical of coastal streams in the summer at all sites except Chase River at Howard (Figure 29). These values may be associated with increased turbidity (Figure 30) but may also indicate some groundwater influence. Further data collection will help determine trends.

Figure 29 – Specific conductance collected by Vancouver Island University.



Summer turbidity events were in exceedence of turbidity objectives in Chase River at Park, Cat Stream and Beck Creek (Figure 30), and relate to rainfall events. Field notes indicated potential turbidity meter issues on September 10, 2013 which may have affected turbidity readings. Fall turbidity events were associated with rainfall events. Further data collection will help determine trends.

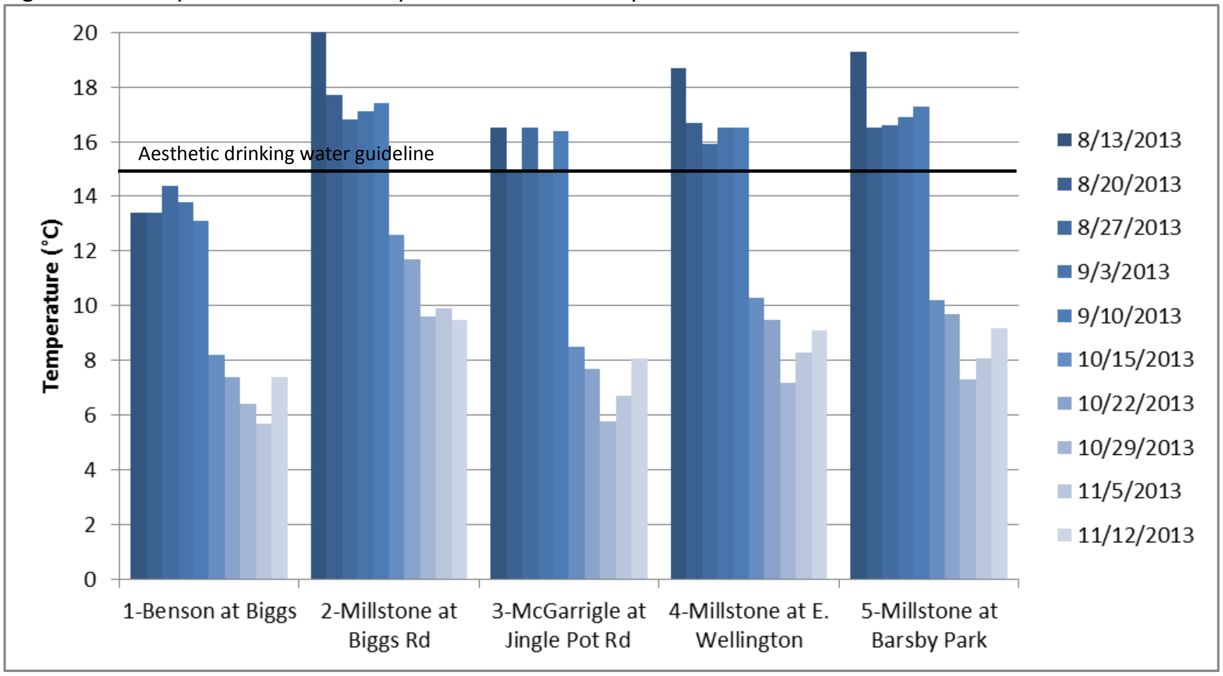
Figure 30 – Turbidity collected by Vancouver Island University.



Island Waters Fly Fishers

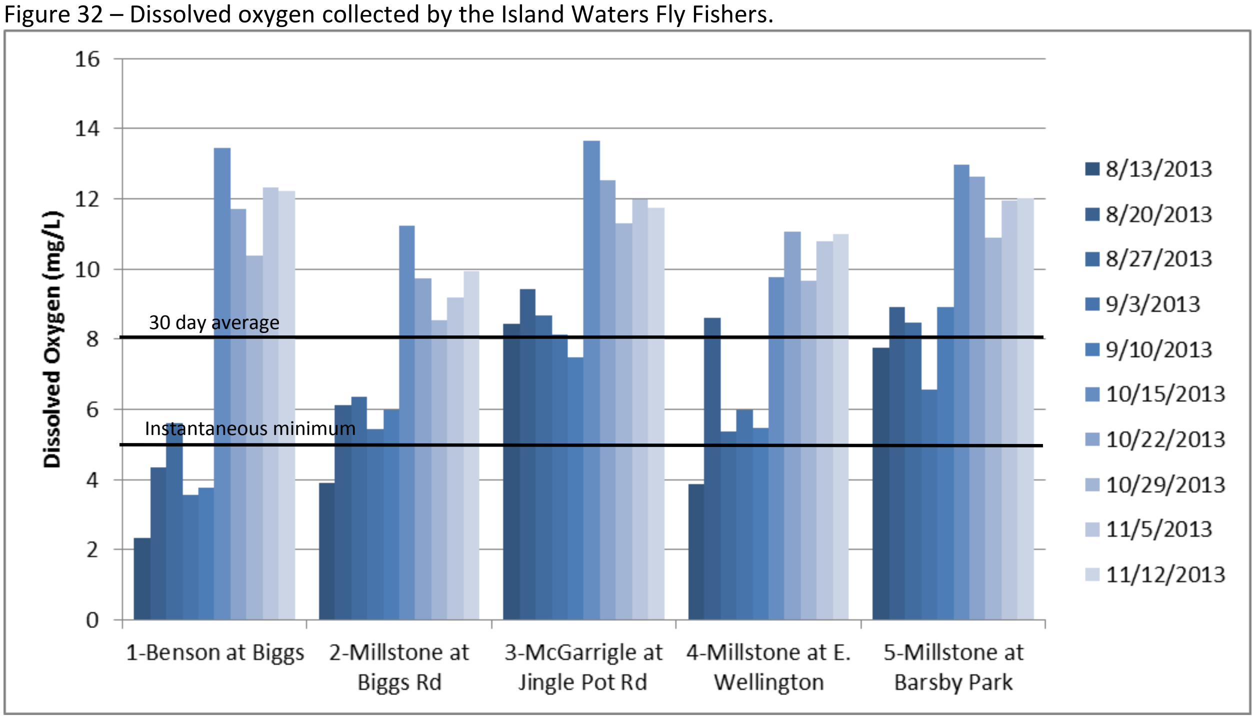
There was potential for summer exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at all sites and the guideline for coho rearing (17°C) at nearly all sites (Figure 31). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Temperature data is similar to that collected in 2012.

Figure 31 – Temperature collected by the Island Waters Fly Fishers.



Summer dissolved oxygen (DO) was below the recommended 30 day average (Figure 32) of 8 mg/L at the Benson Creek (average of 3.92 mg/L not shown in figure below), Millstone at Biggs (average of 5.56 mg/L not shown) and Millstone at East Wellington (average of 5.86 mg/L not shown) sites. The Benson Creek site had several summer observations below the instantaneous minimum DO objective (5 mg/L). Low DO values were associated with very low flow or still water at these sites in the summer.

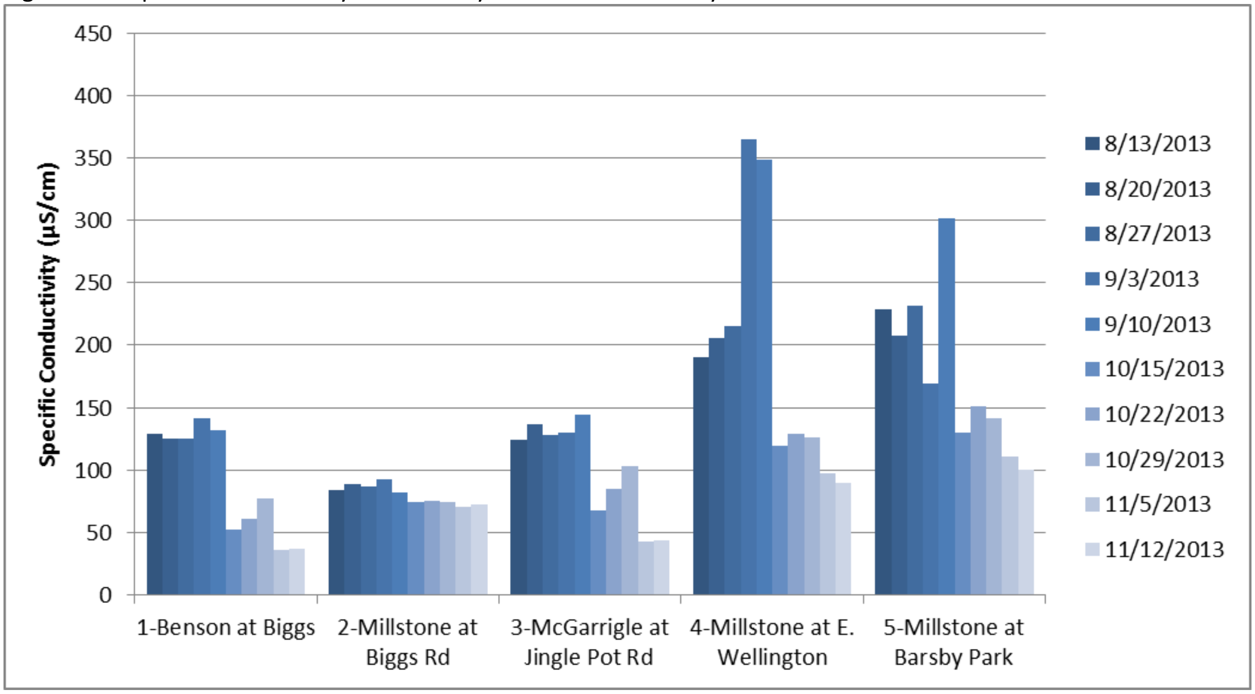
Figure 32 – Dissolved oxygen collected by the Island Waters Fly Fishers.



Specific conductivity was higher than levels typical of coastal streams in the summer at the Benson Creek, McGarrigle at Jingle Pot, Millstone at East Wellington and Millstone at Barsby sites (Figure 33). These values appear to be associated with increased turbidity for all but the Benson and McGarrigle at

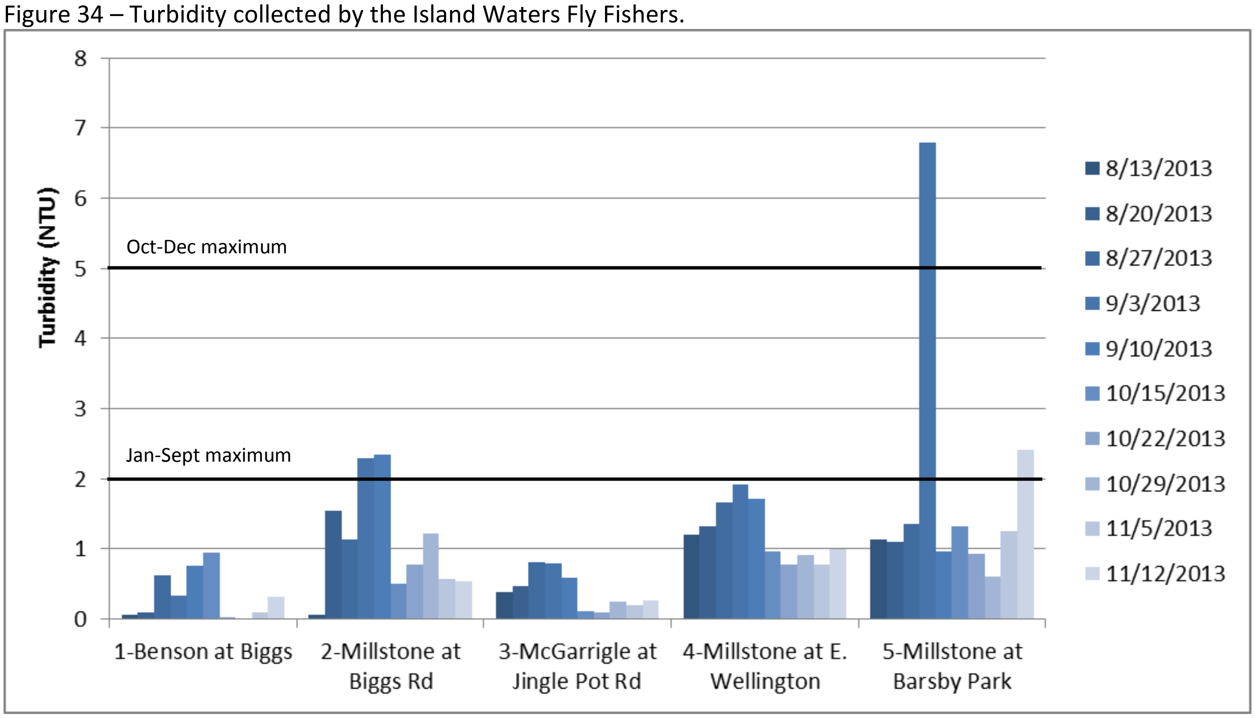
Jingle Pot sites (Figure 34) but may also indicate some groundwater influence. Further data collection will help determine trends.

Figure 33 – Specific conductivity collected by the Island Waters Fly Fishers.



The January to September turbidity maximum objective of 2 NTU was exceeded at the Millstone at Biggs and Millstone at Barsby sites (Figure 34). These exceedences and other high turbidity values observed may indicate athropogenic turbidity influences but may have been exaggerated by rainfall events. Fall turbidity events were associated with rainfall events. Further data collection will help determine trends.

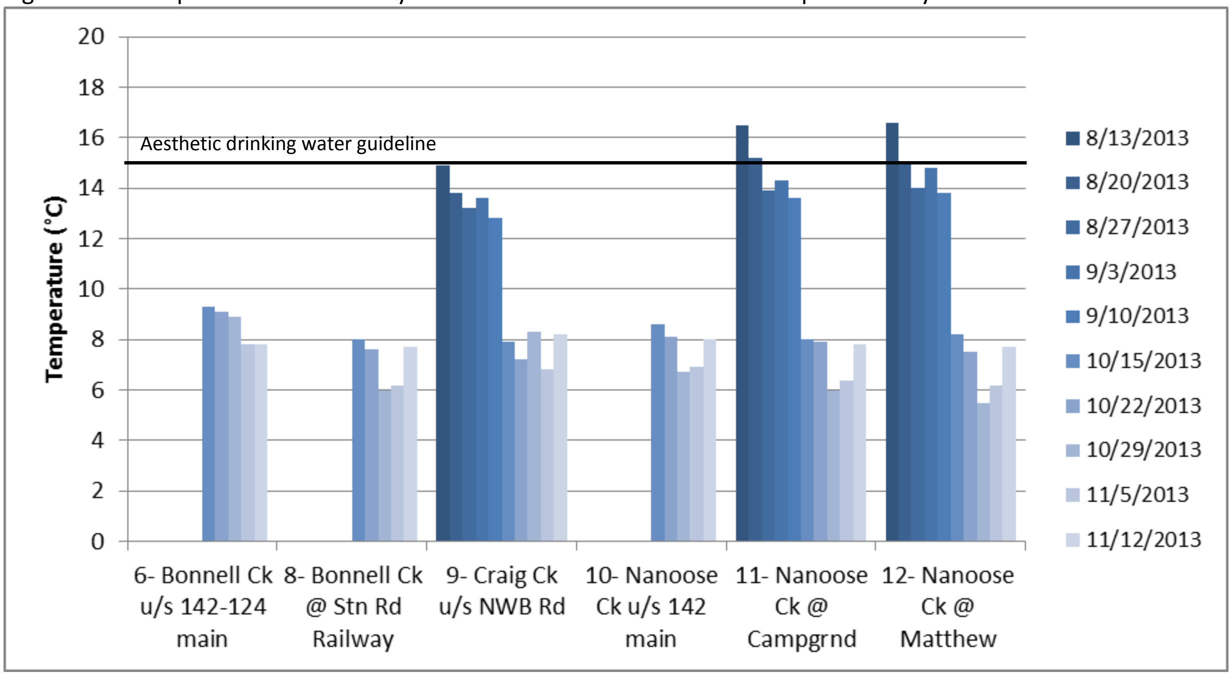
Figure 34 – Turbidity collected by the Island Waters Fly Fishers.



Nanoose – Lantzville Streamkeepers Society

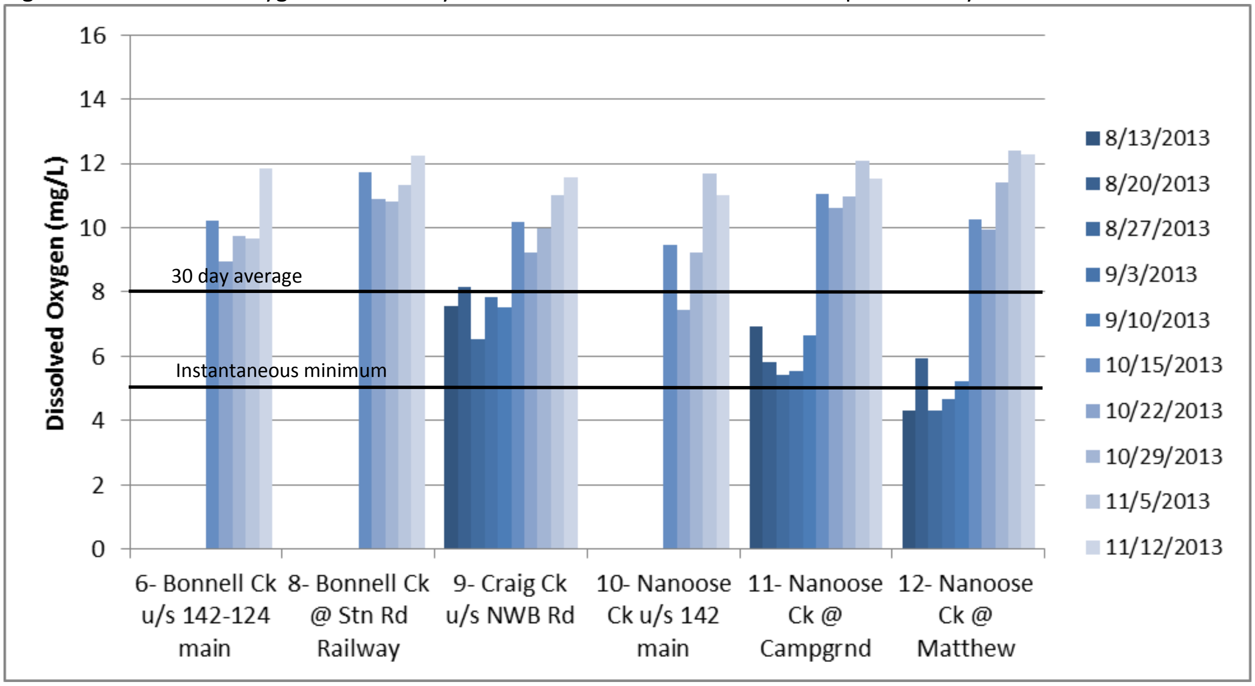
There was potential for summer exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at all three sites that had above surface flow in the summer (Figure 35). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures.

Figure 35 – Temperature collected by the Nanoose – Lantzville Streamkeepers Society.



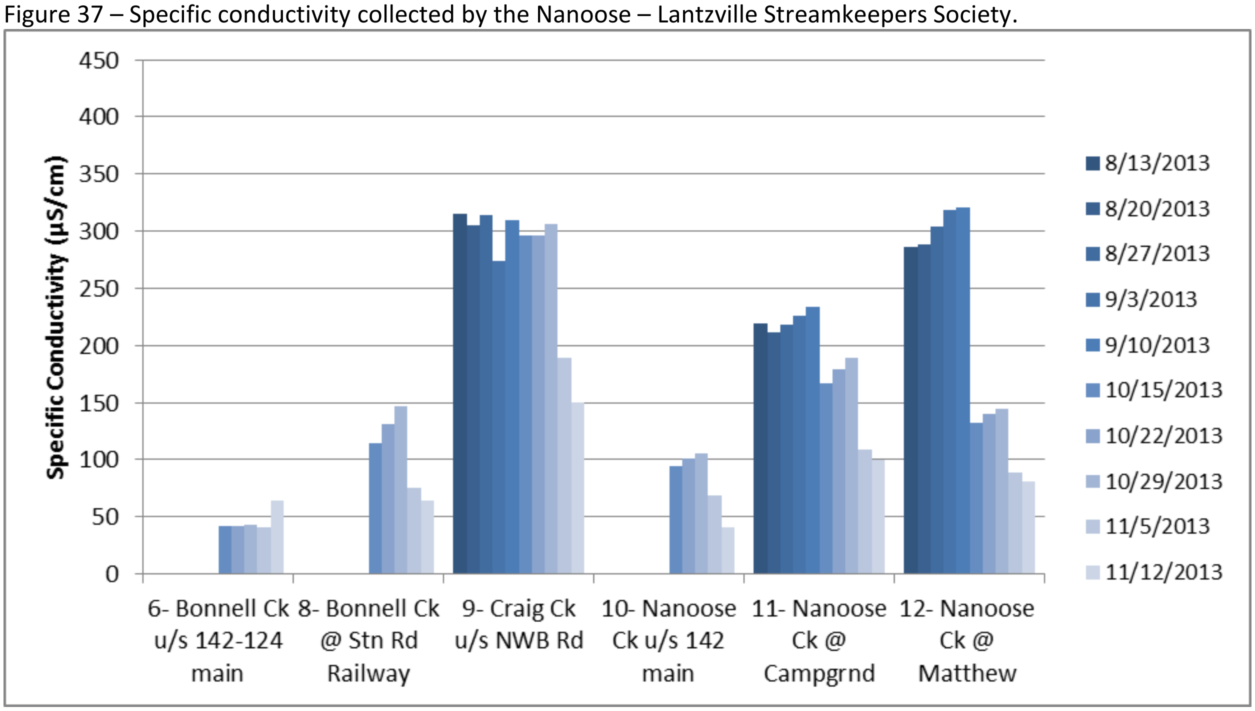
Dissolved oxygen (DO) in the summer was below the recommended 30 day average of 8 mg/L (Figure 36) at the Craig Creek (average of 7.51 mg/L, not shown in figure below), Nanoose Creek at Campground (average of 6.07 mg/L not shown) and Nanoose Creek at Matthew (average of 4.89 mg/L not shown) sites. The Nanoose Creek at Matthew site had several summer observations below the instantaneous minimum DO objective of 5 mg/L. Low DO values were associated with very low flow or still water at these sites in the summer.

Figure 36 – Dissolved oxygen collected by the Nanoose – Lantzville Streamkeepers Society.



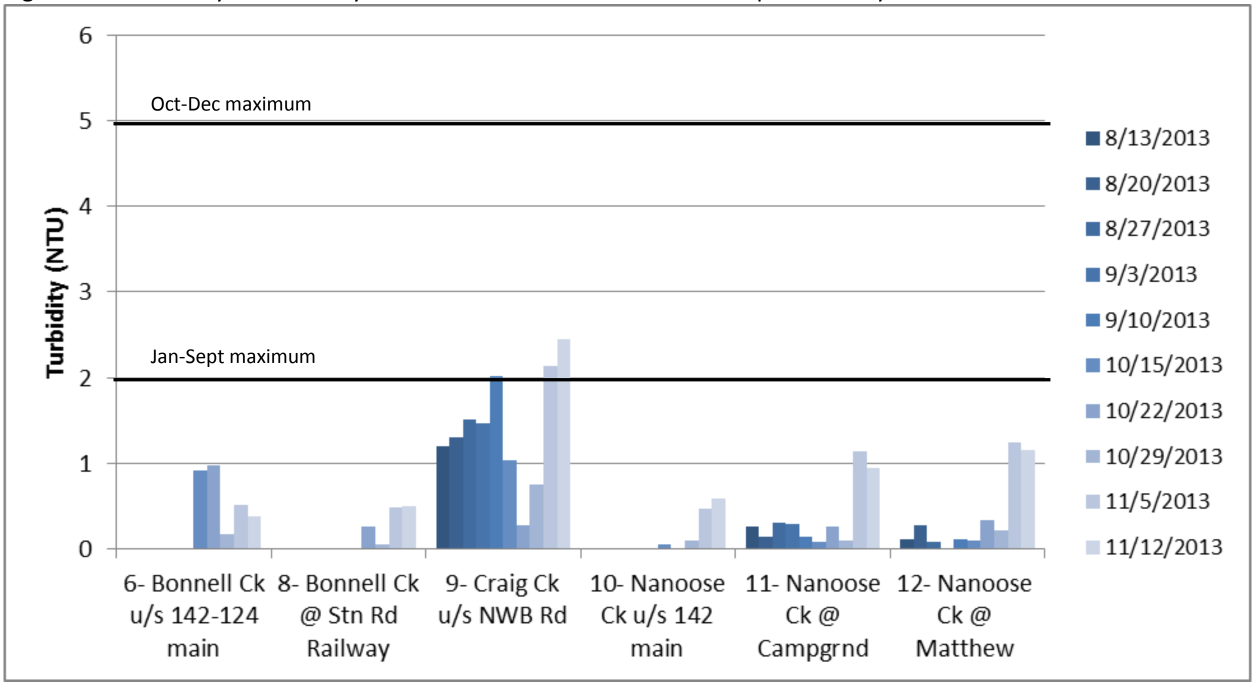
The specific conductance was higher than levels typical of coastal streams in the summer and fall at the Craig Creek, Nanoose Creek at Campground and Nanoose Creek at Matthew sites (Figure 37). Specific conductivity was also occasionally higher than typical levels in coastal streams in the fall at the Bonnell Creek at Station site. These values for the Craig Creek site may be associated with increased turbidity (Figure 38) but higher values at other sites may indicate some groundwater influence. Further data collection will help determine trends.

Figure 37 – Specific conductivity collected by the Nanoose – Lantzville Streamkeepers Society.



The January to September turbidity maximum of 2 NTU was exceeded at the Craig Creek site (Figure 38). This exceedence may indicate athropogenic turbidity influences. Fall turbidity events were associated with rainfall events. Further data collection will help determine trends.

Figure 38 – Turbidity collected by the Nanoose – Lantzville Streamkeepers Society.



Recommendations

The following recommendations are made for future monitoring years:

- Sampling should continue at all sites.
- Re-training of calibration and sampling procedures should occur at least once each year of the program.
- The importance of getting five samples in 30 days for comparison to objectives should be emphasized.
- Quality control samples (e.g. duplicates sent for lab analysis and duplicate meter readings) should occur in 10% of the sample sites.
- Techniques for collecting quality control samples should be reviewed. Streams with higher flows or smaller bottles to fill the larger quality control sample bottles should be used to ensure that sediment is not disturbed from the river bottom when this sampling is conducted.

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