



2011-2012

Skagit Stream Team Annual Water Quality Report



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Sponsored by:
Skagit Conservation District, and
Padilla Bay National Estuarine Research Reserve
in partnership with:
City of Mount Vernon, City of Anacortes, City of Burlington, Skagit County,
and Local Citizens

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City of Anacortes,, and the City of Burlington*

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I. Introduction

This report summarizes the results of the 2011-2012 Skagit Stream Team Program, the fourteenth consecutive year of data collection by volunteers. From October 2011 through August 2012, seventy-five dedicated citizen volunteers monitored the water quality of freshwater streams that drain into Skagit County's Samish Bay, Padilla Bay, and the Skagit River. This past year, sampling continued in: Samish River, Gages Slough, Kulshan Creek, Trumpeter Basin, Fisher Creek and Nookachamps Creek—all in the Skagit River watershed, and Bay View Drainage, No Name Slough and Joe Leary Slough in the Padilla Bay watershed. This year, four new sites were sampled in Clyde Creek—Anacortes. Brickyard Creek sampling was discontinued. In addition to regularly sampled watersheds, the ten members of the Bay View/No Name Storm Team sampled eighteen sites on Bay View Ridge during eleven rain events.

This report is meant to provide valuable background WQ data collected at the highest possible level, but it is NOT intended to provide a legal documentation of water quality violations. All data and methods are available to the public.

Background

The Skagit Stream Team Program was established in 1998 to educate and involve local citizens in the protection and stewardship of local streams. It is sponsored by the Skagit Conservation District (SCD) in partnership with the Padilla Bay National Estuarine Research Reserve (PBNERR), City of Mount Vernon, City of Burlington, City of Sedro-Woolley, and Skagit County. Funding was provided by the Washington State Conservation Commission, the Washington State Department of Ecology's Centennial Clean Water Fund Program, and partnering jurisdictions. Volunteers gave of their own time (unpaid) for the duration of the study.

Skagit Stream Team Objectives

- To inspire community stewardship of water resources by educating local citizens about land use and non-point sources of pollution and involving them in the process of water quality data gathering;
- To develop and implement a routine sampling program that can be used to assess water quality trends, characterize the existing water quality of priority freshwater drainages, and determine how water quality conditions compare to State Standards;
- To document improvements in water quality as a result of the implementation of Best Management Practices on farmlands and the repair and/or replacement of failing septic systems;
- To teach community volunteers the sampling and analytical techniques used by environmental professionals, how to manage the data collected and create a database, and the importance of establishing a long-term water quality monitoring program.

Volunteers measured fecal coliform (FC) bacteria, dissolved oxygen (DO), water temperature, turbidity, and total depth. Some of the questions the study hoped to address were:

- How do water quality conditions compare to State Standards in our priority watersheds?
- Could water quality conditions support aquatic life such as salmon?

II. Methods

Efforts were made to insure high quality data from this volunteer-based study. Quality Assurance/Quality Control (QA/QC) plans and laboratory plans were submitted to and approved by the WA Department of Ecology. These plans have since been updated and revised. Volunteers were given ten hours of training before sampling in the field, and were accompanied by a trainer for their first sampling. All analysis and collection methods are detailed in the QA/QC plan, and are available on request.

The Samish watershed was divided into two upper and two lower teams, and was coached by Jennifer Hinderman, SCD. The Padilla Bay watershed had two teams each on No Name Slough, Joe Leary Slough, and in the village of Bay View, coached by Susan Wood, PBNERR. Nookachamps Creek had two upper and two lower teams coached by Cindy Pierce, SCD. Fisher Creek, Kulshan Creek, and Trumpeter Basin each had two teams coached by Kristi Carpenter, SCD. Gages Slough each had two teams coached by Cindy Pierce. Clyde Creek was monitored by two teams, coached by Susan Wood.

At each site, samples were usually taken twice monthly. Temperature, dissolved oxygen (DO), and salinity (when applicable) were measured on-site with an electronic YSI Data Probe. Field measurements and samples were taken just below the surface, in the deepest part of the stream that could be reached. Depth was measured on staff gages or with a weighted measuring tape. Samples were tested for Fecal coliform either at the Padilla Bay volunteer lab (Padilla, Samish, Nookachamps, Fisher Creek samples), taken to Edge Analytical Laboratory (Gages Slough), taken to the Mount Vernon Wastewater Treatment Plant (Trumpeter Basin, Kulshan Creek) or the Anacortes Waste Water Treatment Plant (Clyde Creek) for analysis. Turbidity samples were either taken back to Padilla Bay's lab to be tested, or measured in the field. Volunteers also recorded water appearance/ color. Quality procedures are outlined in more detail in Appendix C.

Quality control checks by staff were conducted periodically in the lab and in the field to assure that volunteers were using proper and consistent protocols, and to emphasize the importance of quality control measures.

The data was recorded on field sheets (See Appendix D) and transferred to a Microsoft Excel spreadsheet by a volunteer. Padilla Bay staff then went back and verified all the original data with the computer entries, making edits as appropriate. Any anomalies were recorded in the metadata.

In accordance with state standards, average annual FC results were calculated using the geometric mean. “Too Numerous To Count” (TNTC) results were assigned a value of 1600 FC/100 ml. Readings of zero FC were entered as 1 FC/100 ml. Volunteer FC lab tests documented both a high and low reading, from which an average was calculated. Averages were calculated for dissolved oxygen, temperature and turbidity levels.

III. Bay View/No Name Storm Team

Our dedicated Storm Team volunteers completed a second year of rain event fecal coliform monitoring in the Bay View and No Name Slough drainages. Recent and historical data indicate that bacterial contamination is a significant and ongoing problem throughout these two freshwater drainages that flow to Padilla Bay. In addition, marine water sampling at stations located off the Bay View area shoreline (conducted by the State Department of Health), resulted in the decline of a request for commercial shellfish harvesting on Padilla Bay tidelands, and the closure of Bay View State Park for recreational shellfish harvest in 2005. Assessing water quality during high flows is important since storms can flush large volumes of pollutants into streams. Monitoring many sites throughout the drainage during storm events when high fecal coliform numbers are expected will help detect priority areas for clean up as well as provide data that will complement the Stream Team’s regular ambient monitoring program. Special thanks to our Storm Team volunteers for their ongoing commitment – in the worst of weather.

Complete data are found in Appendix B.

IV. Sites

Samish River Watershed

Figure 1. Map of Samish Sites



Table 1. Samish Sampling Locations

US #1	Friday Creek @ Pomona Grange Park	N48°33'55.02 W122°20'49.49
US #2	Swede Creek @ Grip Rd	N48°33'17.75 W122°17'16.23
US #3	Thomas Creek @ F&S Grade Rd	N48°31'42.93 W122°16'44.69
US #4	Willard Creek @ 8274 F & S Grade Rd	N48°31'13.65 W122°15'58.07
LS #1	Hwy 99 Bridge over Samish River	N48°31'32.58 W122°20'24.78
LS #2	Samish River @ Jolly Road	N48°32'25.47 W122°20'36.36
LS #3	Chuckanut Bridge over Samish River	N48°31'0.69 W122°22'43.29
LS #4	Mouth of the Samish River (boat dock)	N48°19'11 W122°19'47

Fisher Creek

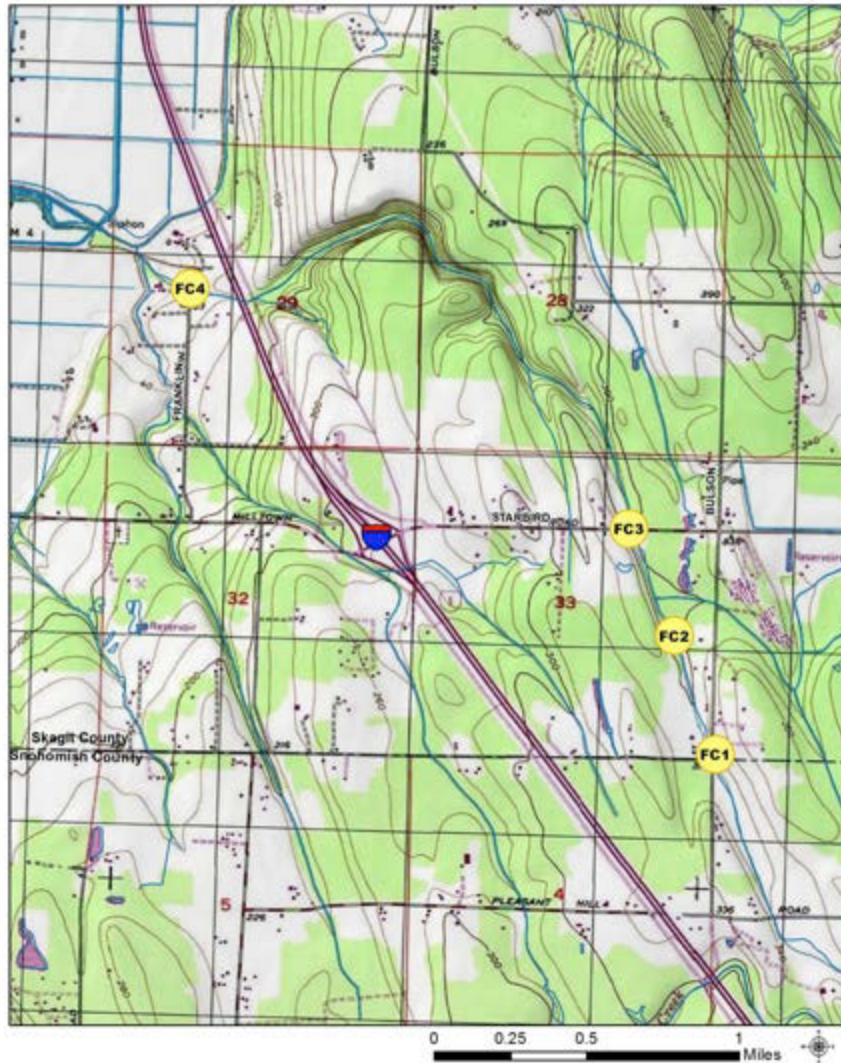


Figure 2. Map of Fisher Creek Sites

Table 2. Fisher Creek Sampling Locations

FC #1	Bulson Road at Skagit/Snohomish County Line	N48°17'53. W122°17'31
FC #2	Private Property Access at 23616 Bulson Road	N48°18'121 W122°17'41
FC #3	Fisher Creek Crossing at Starbird Hill Road	N48°18'30. W122°17'53
FC #4	Fisher Creek at Franklin Road Bridge	N48°19'11 W122°19'47

Nookachamps Creek



Figure 3. Map of Nookachamps Creek Sites

Table 3. Nookachamps Creek Sampling Locations

UN1	Lake McMurray Estates	N48°19'37 W122°13'10
UN2	Big Lake Outflow	N48°23'57 W122°14'24
UN3	Otter Pond Road	N4824'10 W122°13'44
UN4	Knapp Road	N4825'43 W122°15'32
LN1	SR 538 and N Waugh Road	N48°26'10.14 W122°17'29.88
LN2	SR 9 and Babcock	N48°26'45.56 W122°15'8.65
LN3	Swan Road	N48°27'13.79 W122°16'17.84
LN4	Francis Road	N48°28'5.47 W122°17'38.72

No Name Slough



Figure 4. Map of No Name Slough Sites

Table 4. No Name Slough Sampling Locations

NN #1	Marihugh Road Culvert	N48°17'53. W122°17'31
NN #2	Bay View Road Ravine	N48°18'121 W122°17'41
NN #3	Egber's Field Bridge	N48°18'30. W122°17'53
NN #4	Field Culvert, Bay View-Edison Road	N48°19'11 W122°19'47

Bay View Drainage

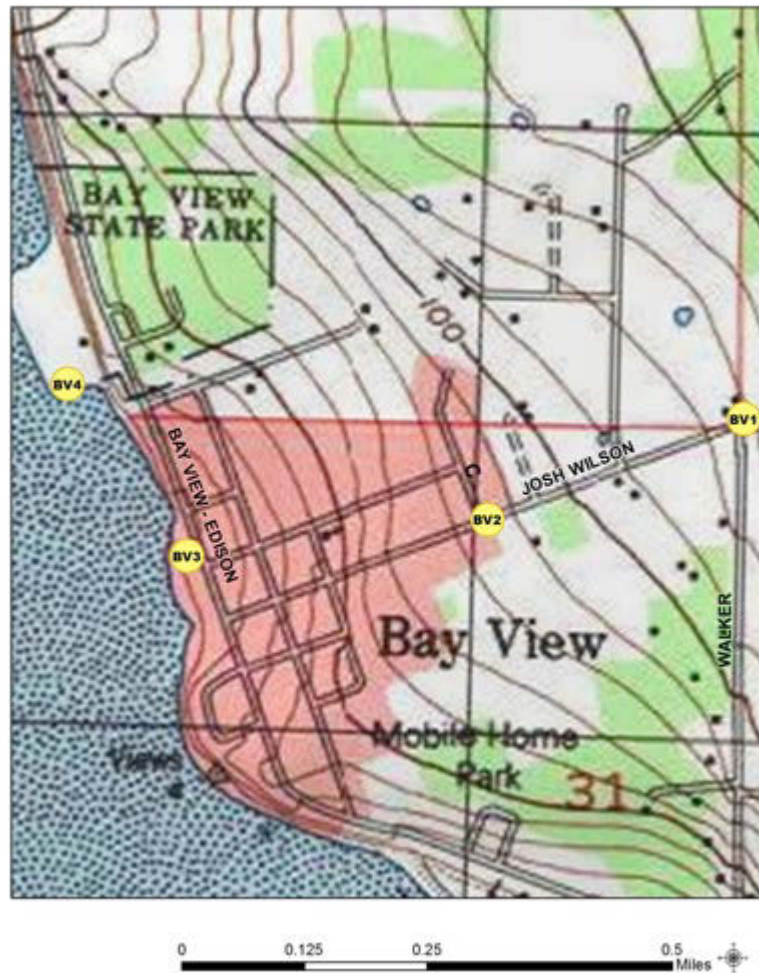


Figure 5. Map of Bay View Sites

Table 5. Bay View Sampling Locations

BV #1	Wilson Road and Walker Road	N48°29'11.94 W122°27'58.92
BV #2	Wilson Road and C Street	N48°29'6.3 W122°28'19.26
BV #3	Culvert at Boat Launch	N48°29'4.02 W122°28'43.2
BV #4	N Beach at Bay View State Park	N48°29'13.02 W122°28'53.04

Joe Leary Slough



Figure 6. Map of Joe Leary Slough Sites

Table 6. Joe Leary Slough Sampling Locations

JL#1	Dahlstedt Road	N48°30'53.35 W122°19'2.46
JL #2	Hwy 99	N48°29'35.37 W122°20'6.61
JL#3	Wilson Rd and Avon-Allen Rd.	N48°29'11.33 W122°22'41.96
JL #4	Tide Gate	N48°31'4.90 W122°28'27.87

Trumpeter Basin

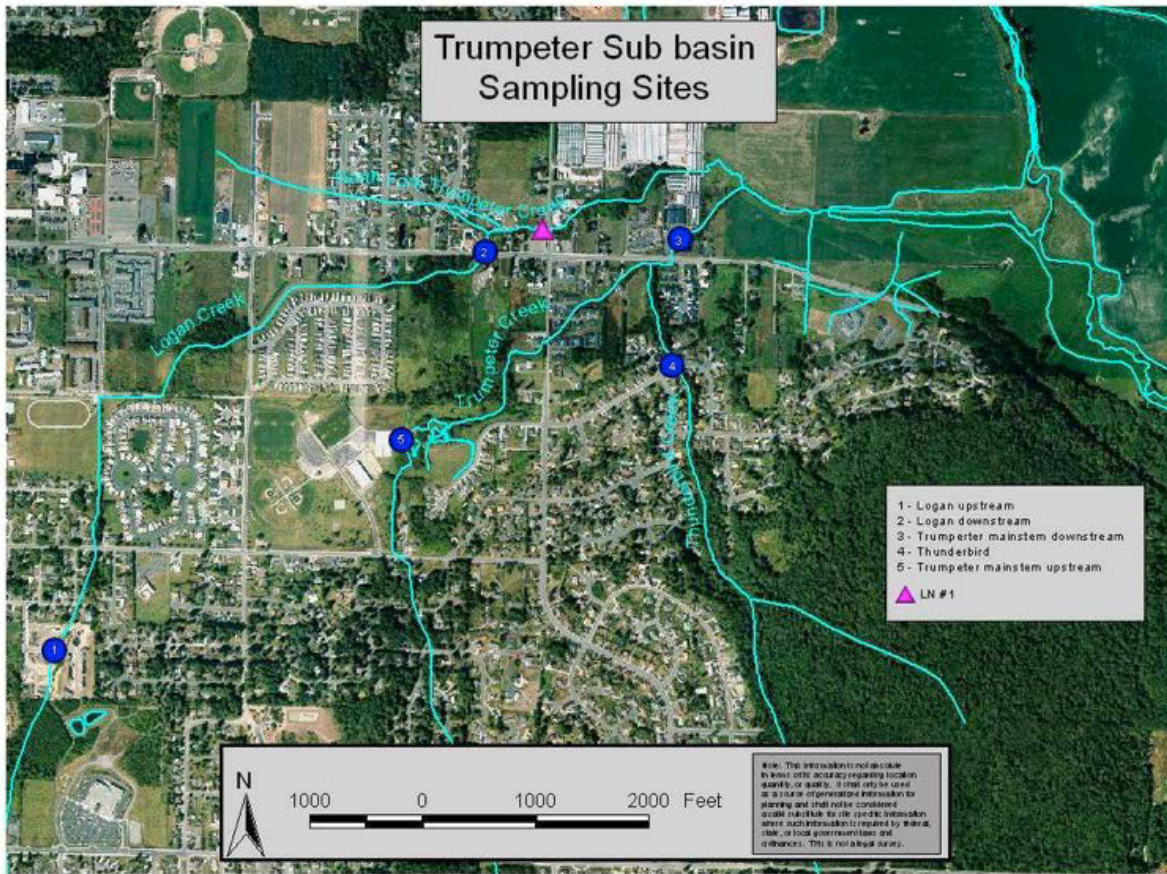


Figure 7. Map of Trumpeter Basin Sites

Table 7. Trumpeter Basin Sampling Locations, Mount Vernon, WA

TC #1	Stonebridge Adult Community, Logan Creek Bridge	N48°25'33 W122°18'32
TC #2	College Way west of Martin /Vaugh Road, Logan Creek	N48°26'09 W122°17'12
TC #3	Summersun Nursery Footbridge, Trumpeter/Thunderbird	N48°26'07 W122°17'17
TC #4	Culvert on Kiowa, Thunderbird	48°25'53 W122°17'12
TC #5	Bakerview Park Footbridge, Trumpeter	N48°25'51 W122°17'48

Kulshan Creek

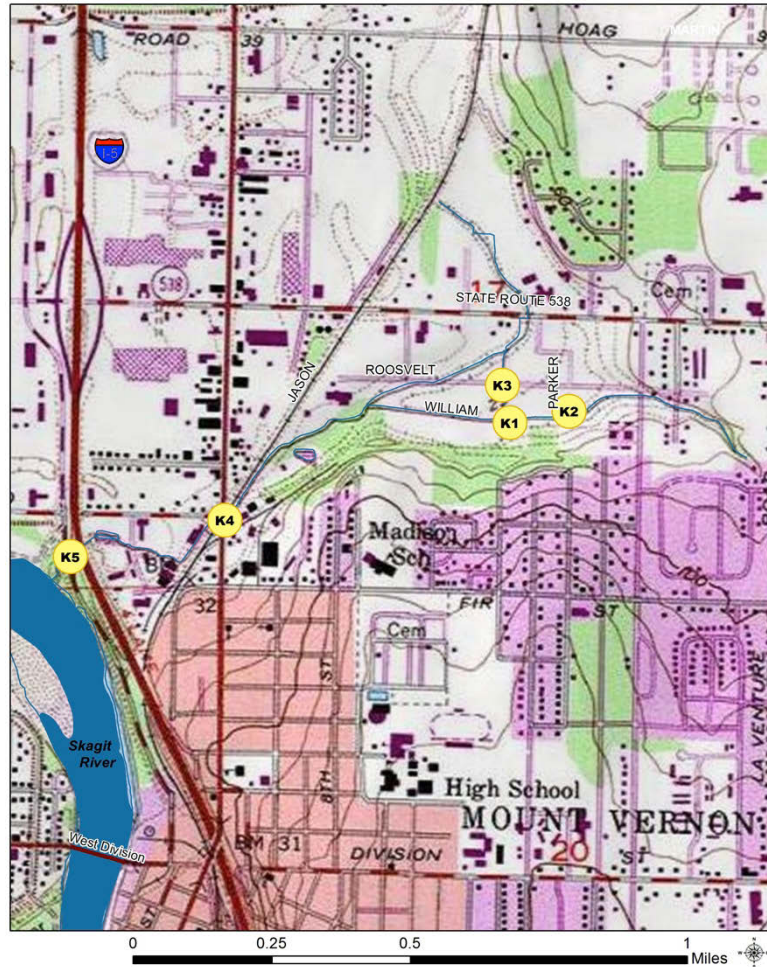


Figure 8. Map of Kulshan Creek Sites

Table 8. Kulshan Creek Sampling Locations, Mount Vernon, WA

KC #1	North end of S 14 th /Kulshan Trail	N48°25'59 W122°19'27
KC #2	Parker Way	N48°25'59 W122°19'17
KC #3	S side Roosevelt/1 blk W of Parker Way	N48°26'11 W122°19'25
KC #4	E of Riverside - N of RR crossing	N48°25'54 W122°20'04
KC #5	Freeway Drive at Lions Park	N48°25'43 W122°20'28

Clyde Creek



Figure 9. Map of Clyde Creek Sites

Table 9. Clyde Creek Sampling Locations, Anacortes, WA

CC #1	Jasper Way	N48° 29'43.4 W122°39'34.3
CC #2	Clyde Way	N48°29'29.3 W122°39'40.9
CC #3	Queen Ann Way	N48°29'21.1 W122°39'48.8
CC #4	Marine Drive	N48°29'10.9 W122°39'54.5

Gages Slough

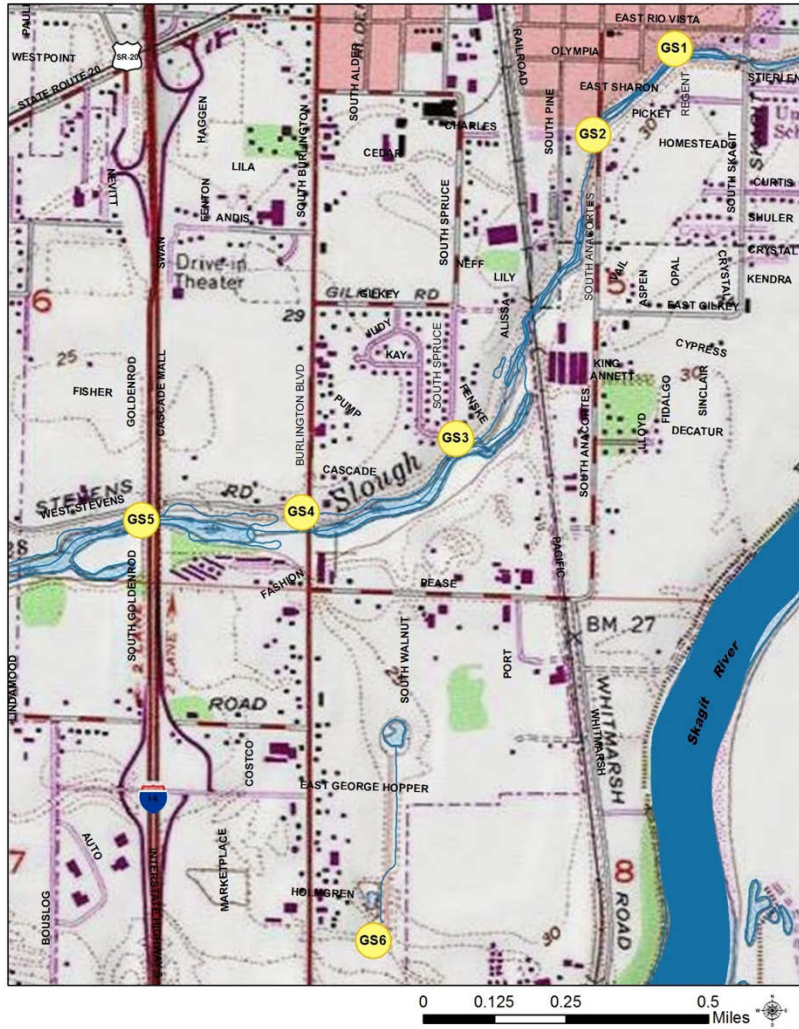


Figure 10. Map of Gages Slough Sites

Table 10. Gages Slough Sampling Locations, Burlington, WA

GS #1	Regent and East Rio Vista Streets	N48°28'16 W122°19'19
GS #2	South Anacortes Street	N48°28'08 W122°19'30
GS #3	South Spruce Street	N48°27'40 W122°19'48
GS #4	Burlington Boulevard	N48°27'33 W122°20'09
GS #5	Goldenrod Road	N48°27'32 W122°20'31
GS #6	Sportsman's Warehouse	N48°26'54 W122°19'58

V. Results

This section presents the data collected in this project and provides a preliminary overview for each parameter followed by details for each watershed and a comparison of annual site averages for the past four sampling seasons. Complete data for all watersheds are provided in Appendix A.

Dissolved Oxygen Standards

Dissolved oxygen (DO) measurements determine how much oxygen is available in the water for fish and other organisms. The state water quality standards for dissolved oxygen are based on aquatic life uses. Streams in this program fall under two categories based on aquatic life use. For the lowland watercourses, Joe Leary Slough, No Name Slough, Bay View, Gages Slough, Brickyard Creek and all Samish sites except Thomas Creek (Upper Samish 3) the minimum standard is 8.0 mg/L for salmon spawning and rearing. For Fisher Creek, Nookachamps Creek, Trumpeter Basin, Kulshan Creek, and Upper Samish Site 3, the standard is 9.5 mg/L required for core summer salmonid habitat. (Higher dissolved oxygen levels are better.)

Annual averages are referenced to the state standard for the purpose of comparison, but this data cannot determine whether the water body meets the standard. The standard is based on the lowest single-day measurement, not on the annual average. It is important to note that most of the teams do not monitor during the warmer summer months when DO would likely drop with warmer air and water temperatures.

Temperature Standards

Temperature is a water quality concern in part because warm water holds less dissolved oxygen than cool water. Many northwest fish species require cool temperatures and high oxygen levels at various stages in their life cycle. Warm water temperatures can cause stress to animals that lowers resistance to disease and infections. Many factors affect water temperature. These include large fluctuations in air temperature, changes in the shape of stream channel and lake margins, reductions in overhanging vegetation, cloudiness, and reductions in water flow.

State standards for temperature are based on the 7-day average of the daily maximum temperatures (7-DADMax). For Fisher Creek, Nookachamps Creek, Trumpeter Basin, Kulshan Creek, and Upper Samish Site 3, that maximum is 16°C. All other sites must be less than 17.5°C to meet standards. (Lower temperatures are better.)

The average temperatures presented below are used for comparison, but this data cannot determine whether the water body meets the standard. Most sites were not monitored during the critical summer warm periods and none were monitored daily in order to obtain a 7-DADMax.

Turbidity Standards

Turbidity data in this report are not referenced to a state standard because that standard is relative to naturally occurring background levels and varies for each stream. For streams with

background levels less than 50 NTU (all of the Stream Team sites), turbidity should not exceed 5 NTU above the background level. Short-term occurrences of high turbidity are not as harmful to aquatic animals as extended periods of moderately elevated turbidity.

Fecal Coliform Standards

To meet state standards, streams must meet two criteria. Part I: The geometric mean of fecal coliform bacteria levels cannot exceed 100 colony-forming units (cfu)/100 ml. A minimum of five samples in the database is needed to calculate the geometric mean. Part II: No more than 10% of the samples can exceed 200 colonies /100 ml.

State regulations for fecal coliform use the geometric mean, which reduces the weight of occasional extreme results or results that don't fall within a reasonable range of the overall sample database This is helpful when analyzing bacteria concentrations, because levels may vary anywhere from 10 to 10,000 fold over a given period.

Upper Samish Results

Figures 11 through 17 below present results from Upper Samish sampling.

For dissolved oxygen, all sites showed improvement from the past 2 years. The Willard Creek site had the lowest levels, with an annual average below the state standard of 8.0 mg/L. Site 3, Thomas Creek is considered core summer salmonid habitat, and should maintain DO levels above 9.5 mg/L. Site 1 was the only site to stay above standard throughout the season. The standard is based on the lowest single day, not annual average.

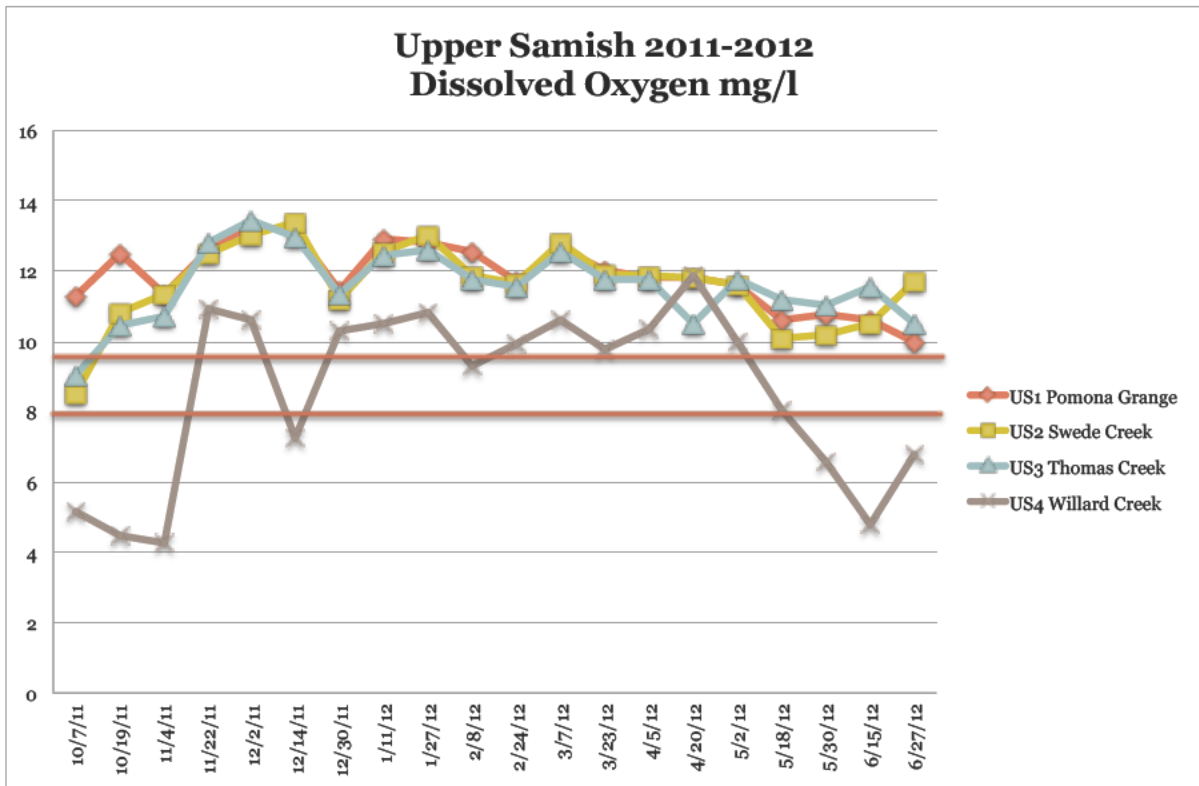


Figure 11. Upper Samish DO: 2011-2012

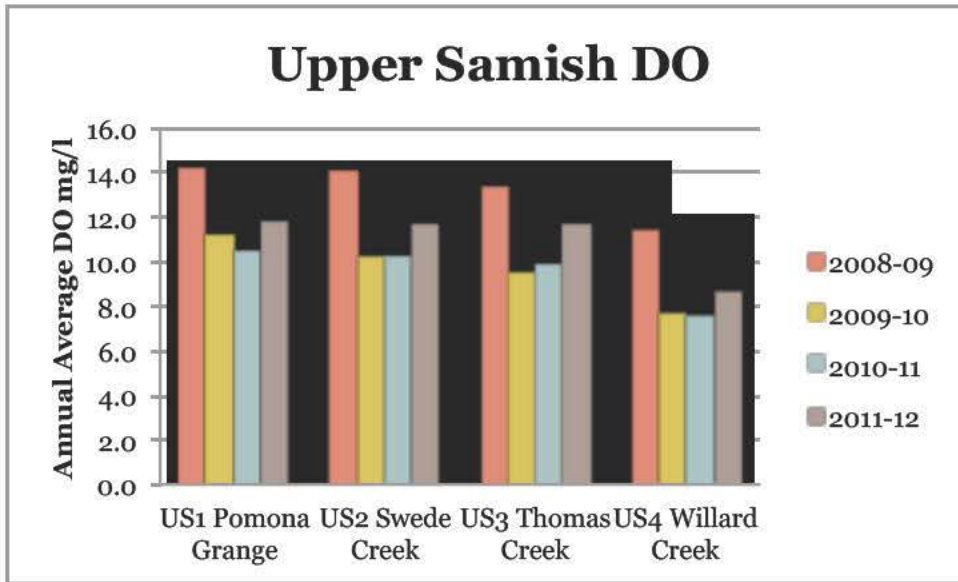


Figure 12. Upper Samish DO: Four year comparison

Though all temperature readings during the sampling season fell within state standard temperatures, sampling stopped before the warm season. Temperatures were similar for all Upper Samish sites. Average annual temperatures were slightly warmer than 2008-09 and slightly cooler than the past 2 years.

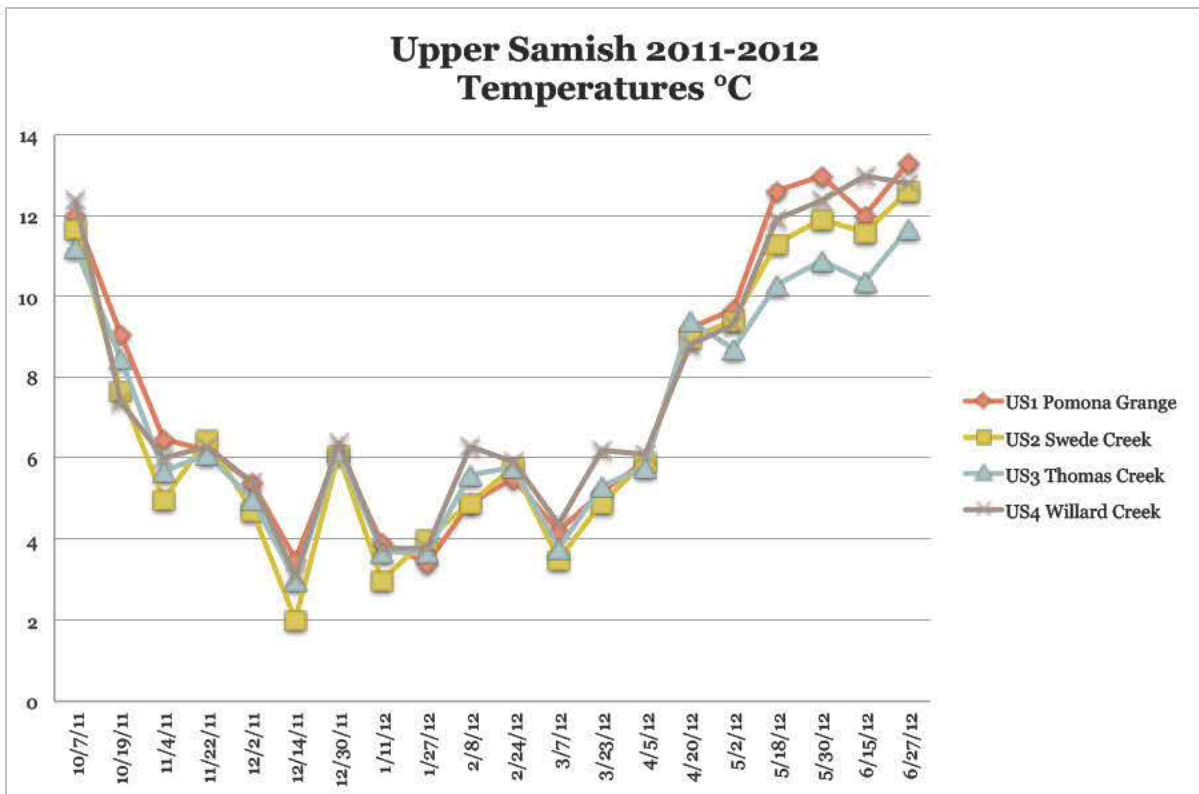


Figure 13. Upper Samish Temperature: 2011-2012

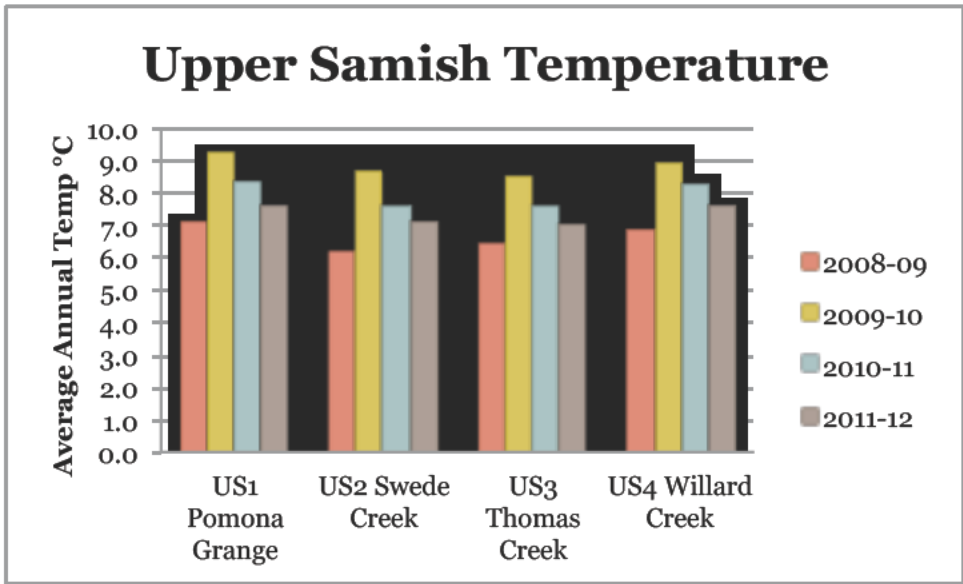


Figure 14. Upper Samish Temperature: Four year comparison

Turbidity improved from past years at sites 1 and 2, but was higher at sites 3 and 4. Willard Creek had unusually high turbidity, with levels above 60 in October and April. (data p. 75.)

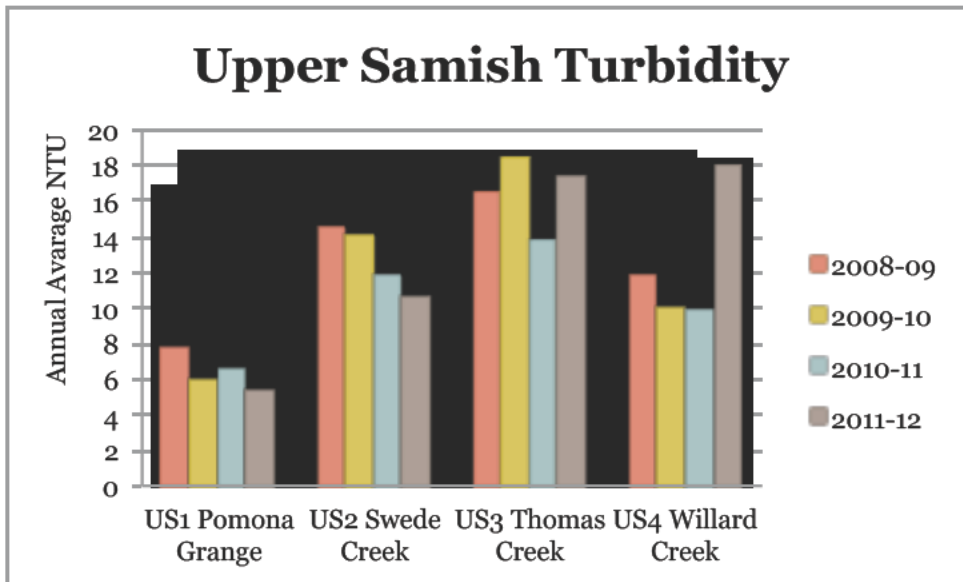


Figure 15. Upper Samish Turbidity: Four year comparison

Upper Samish site 3, Thomas Creek, again had the highest levels of fecal coliform, though it showed improvement over last year. (Figures 16 and 17 below). All sites showed spikes corresponding to rain events. All sites had over 10% of the samples over 200 CFU/100ml.

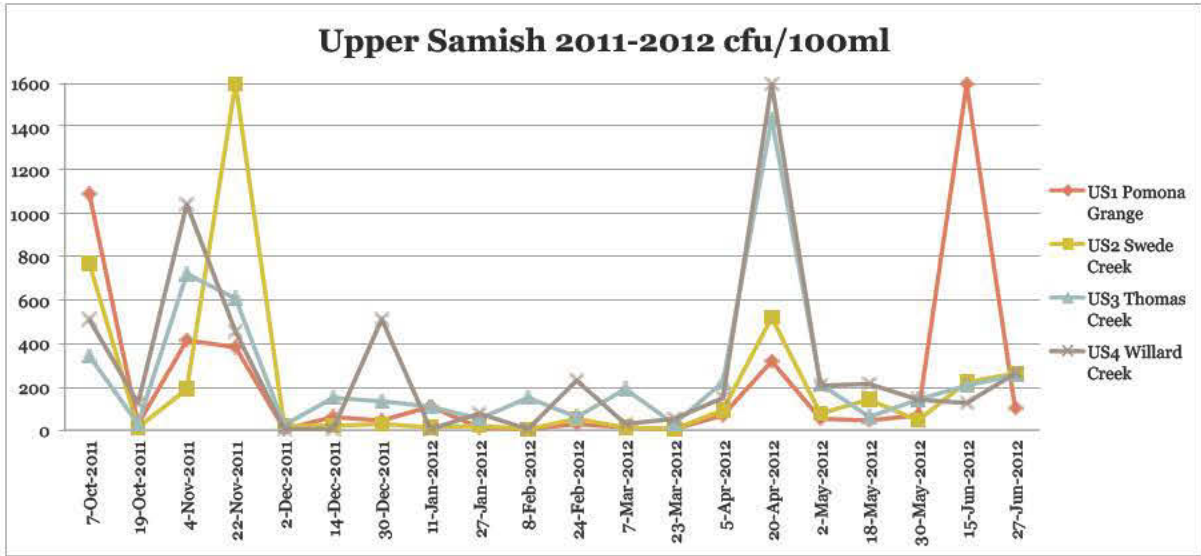


Figure 16. Upper Samish Fecal Coliform: 2011-2012

Average Fecal coliform levels (geometric mean) were higher than last year and lower than 2009-2010. Sites 3 and 4 geometric means were above 100cfu/100ml.

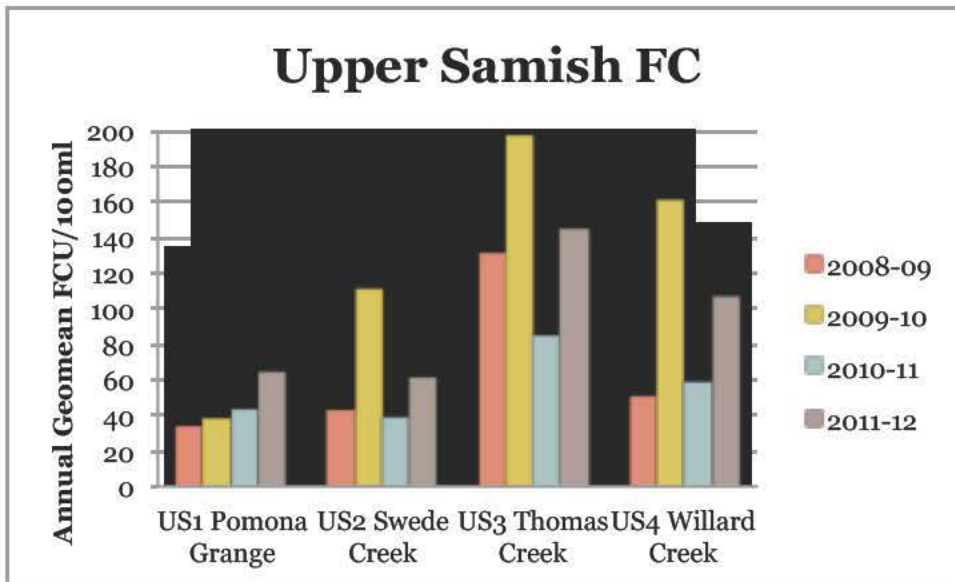


Figure 17. Upper Samish Fecal Coliform: Four year comparison

Lower Samish Results

Figures 18 through 24 below present results from Lower Samish sampling.

Dissolved oxygen levels (Figure 18 below) were usually highest upstream and lowest downstream, as would be expected. They stayed above the standard level of 8mg/l at all sites except site 4. Note a few instances of high DO. Unusually high DO levels (above 15 mg/L) may be caused by daytime plant growth due to excessive nutrient levels. This is often followed by low DO levels at night when plants respire.

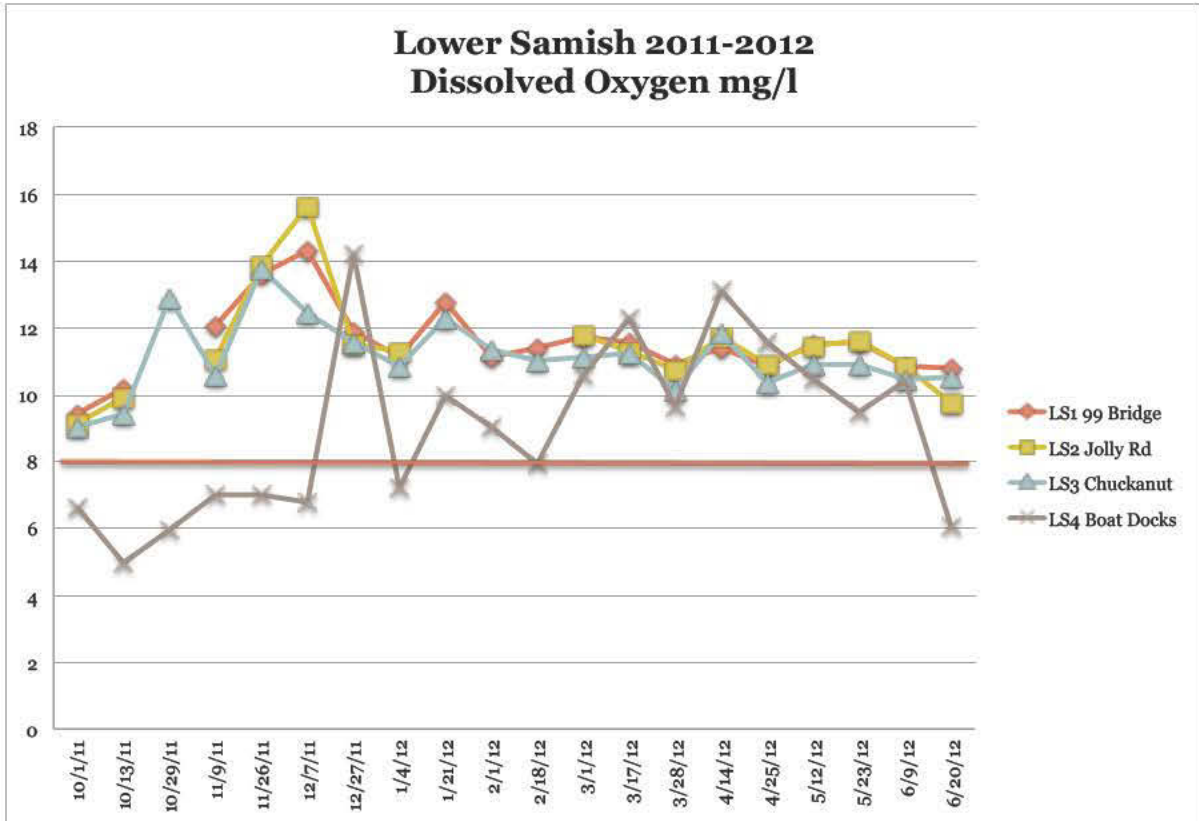


Figure 18. Lower Samish DO: 2011-2012

Compared with last year, dissolved oxygen levels dropped slightly at Site 1, and were slightly higher at sites 2-4. The standard is based on the lowest single day, not on an annual average.

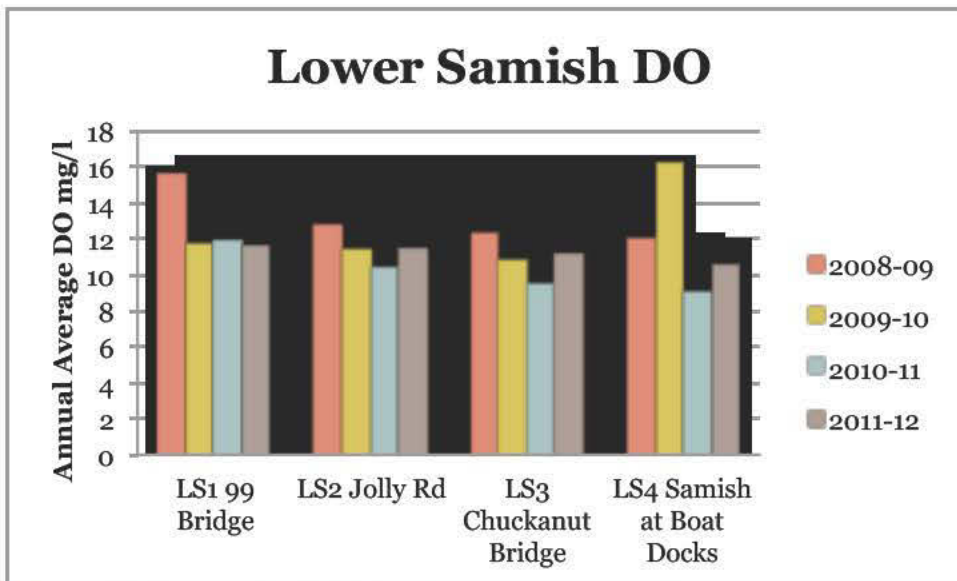


Figure 19. Lower Samish DO: Four year comparison

Though all temperature readings during the sampling season fell within state standard temperatures, sampling stopped before the warm season. Temperatures were similar for all Lower Samish sites, with annual averages varying less than 1°C.

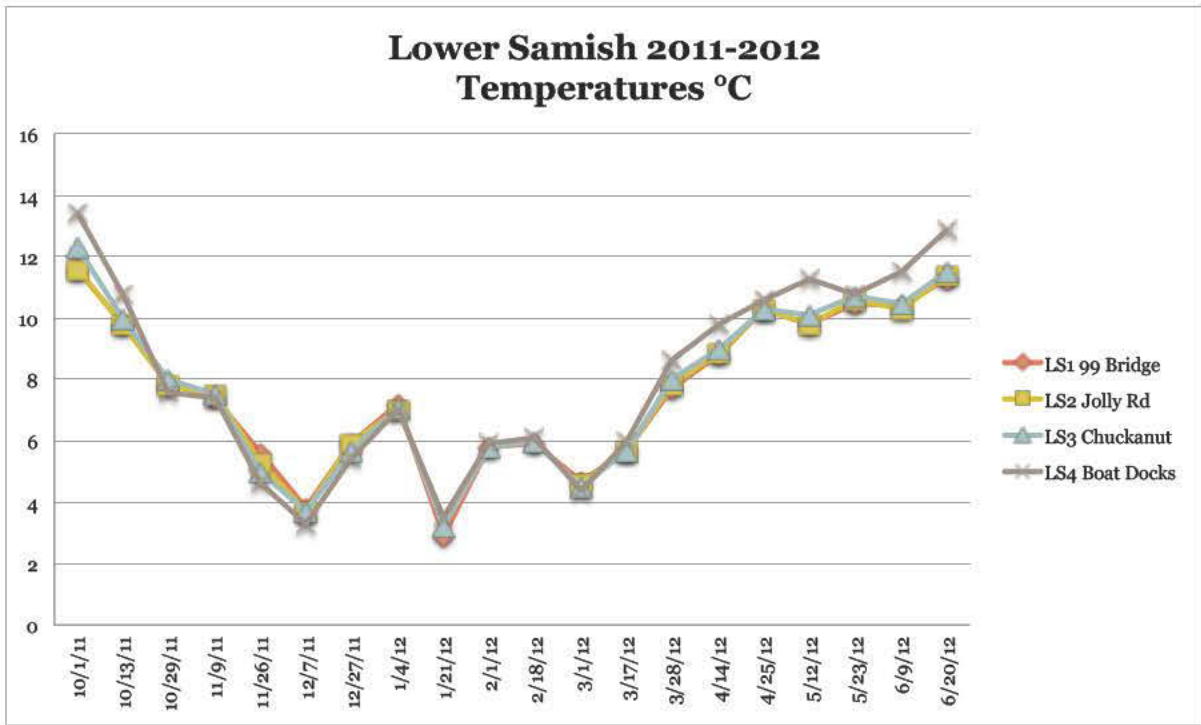


Figure 20. Lower Samish Temperature: 2011-2012

Compared to the previous three years, average annual temperatures were slightly cooler except for LS2, which showed an unusual increase.

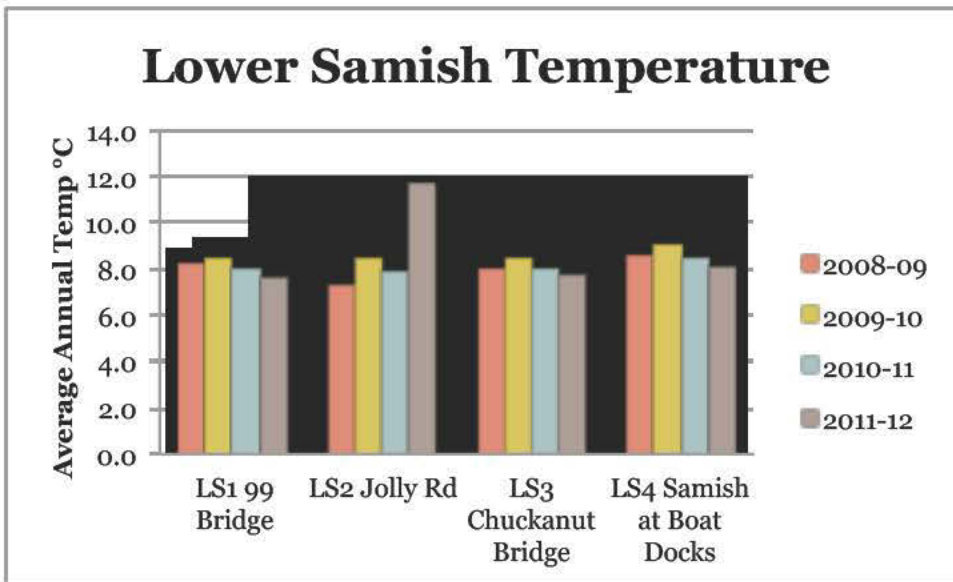


Figure 21. Lower Samish Temperature: Four year comparison

2011-2012 Turbidity levels for Lower Samish sites were lower than the past 3 years, with the single exception of site 3 which was slightly lower in 2009-2010. Variation between sites was similar to patterns in the previous two years, with lowest turbidity at Site 2. The highest levels this year were at Site 3.

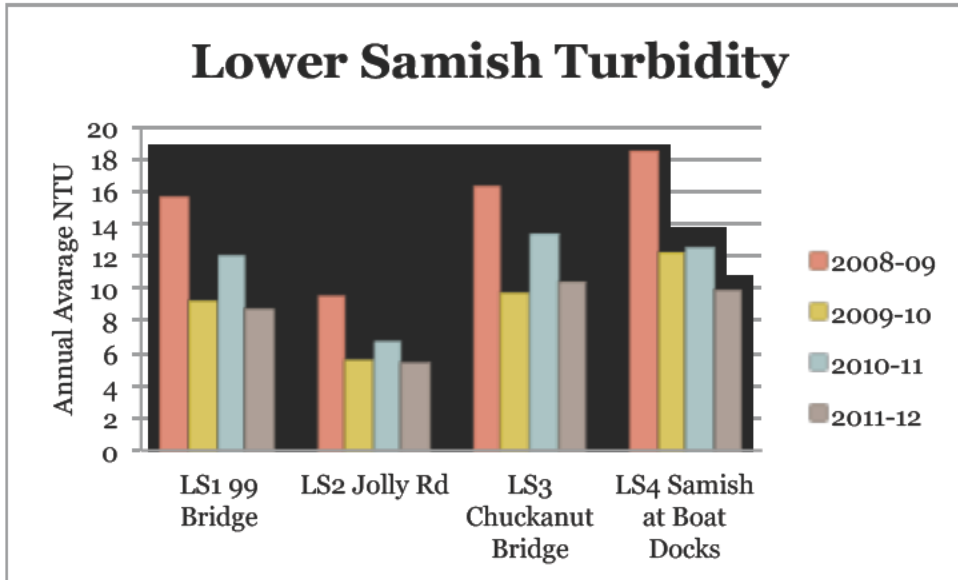


Figure 22. Lower Samish Turbidity: Four year comparison

Fecal Coliform levels for the Lower Samish were generally low with extreme spikes during rain events. Geometric mean averages for all four sites were below 100 cfu/100 ml. None of the sites met Part II of the state standards for fecal coliform. More than 10% of the samples were over 200 cfu/100 ml.

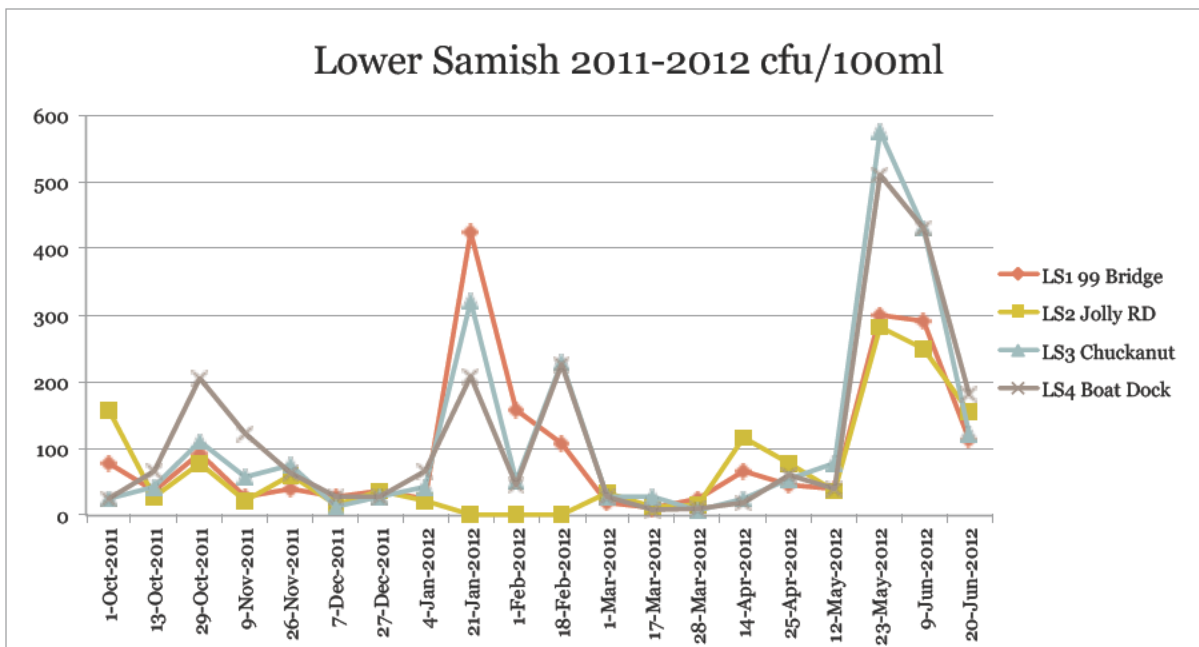


Figure 23. Lower Samish Fecal Coliform: 2011-2012

Lower Samish fecal coliform levels were similar to last year. Geometric means all still meet the state standard. Levels at all four sites were higher than in 2008-2009 and 2009-2010.

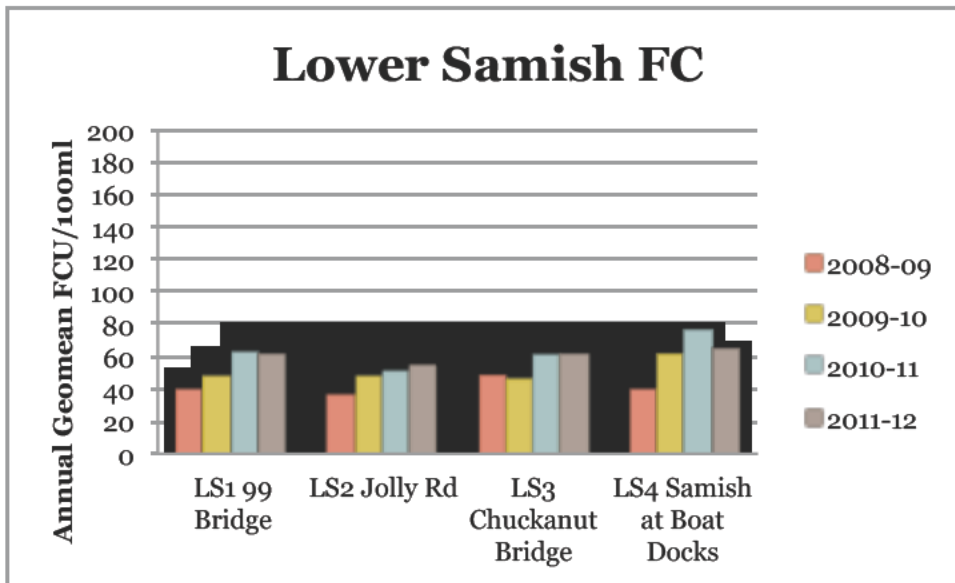


Figure 24. Lower Samish Fecal Coliform: Four year comparison

Fisher Creek Results

Figures 25 through 31 below present results from Fisher Creek sampling.

For dissolved oxygen (Figure 25 below), site 2-4 DO measurements were below the standard of 9.5mg/l during October but increased during the winter. Fall rains were unusually late this year, resulting in lower than normal water flow. There were uncharacteristically low dissolved oxygen levels measured at all sites on January 10. Field notes January 10 mentioned cattle in the stream and a dead fish. Decomposing manure and organic matter can cause low DO levels, but turbidity levels and fecal coliform counts were very low on January 10.

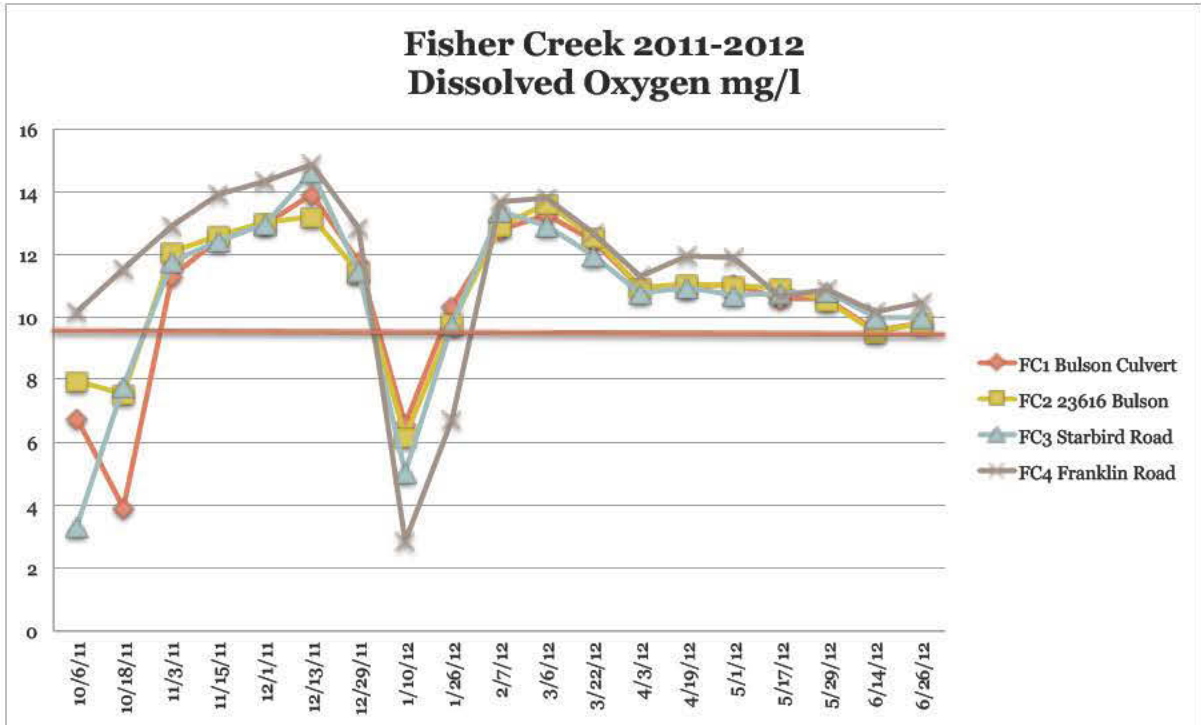


Figure 25. Fisher Creek DO: 2011-2012

Though the annual averages for all sites were above 9.5 mg/l, the standard is based on the lowest single day. All sites had higher DO levels than the past 3 years.

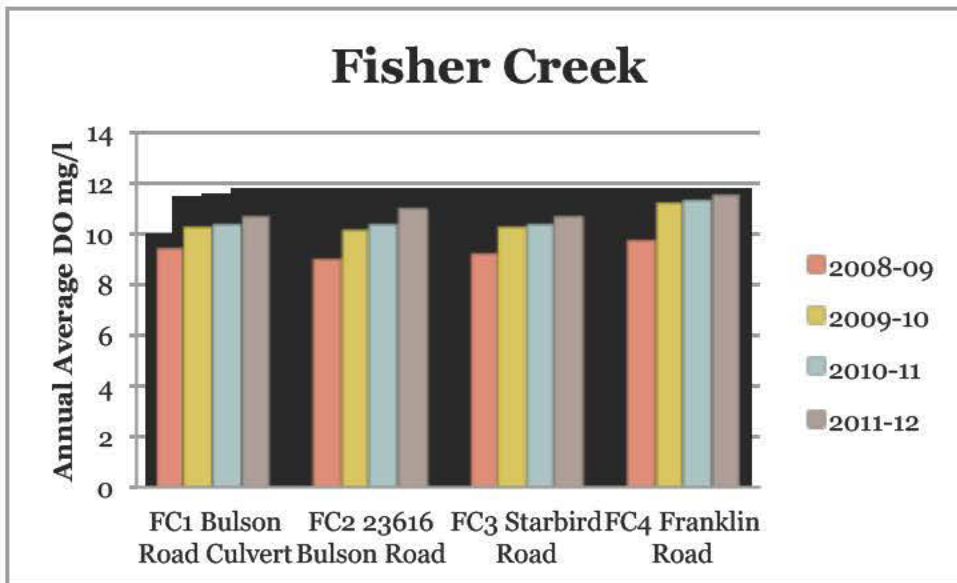


Figure 26. Fisher Creek DO: Four year comparison

Temperatures for Fisher Creek (Figure 27 below) were similar for all sites, dropping in the winter and rising in the spring. Though all temperature readings during the sampling season fell within state standard temperatures, sampling stopped before the warm season.

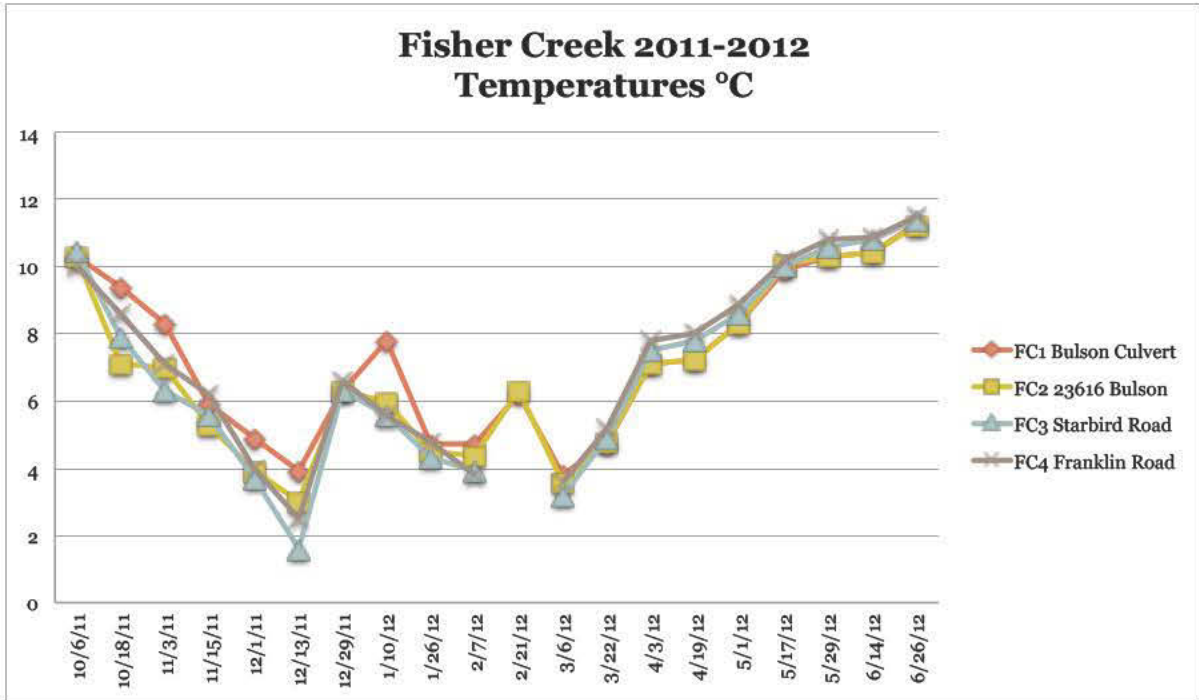


Figure 27. Fisher Creek Temperature: 2011-2012

Compared to the past two years, Fisher Creek temperatures were warmer than 2010-2011 and 2008-2009, but cooler than 2009-2010. There is little variation between sites.

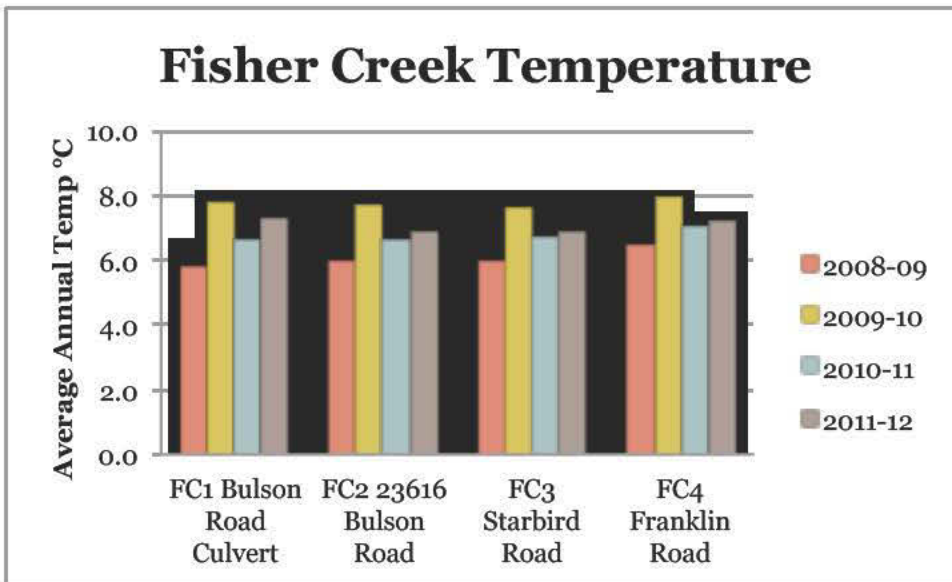


Figure 28. Fisher Creek Temperature: Four year comparison

Turbidity for Fisher Creek (Figure 29 below) was higher than the previous 3 years at all sites. The highest levels were at site 4, Franklin Road.

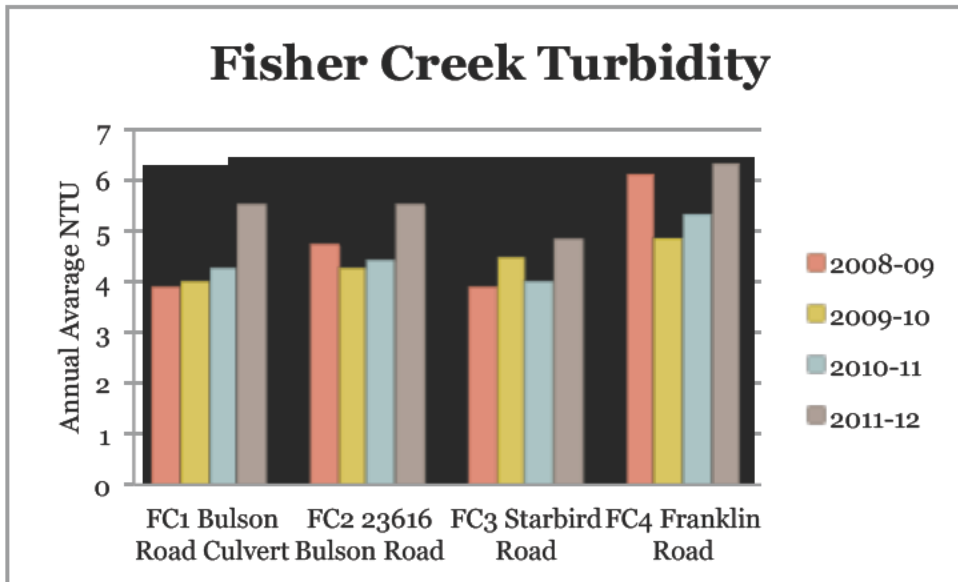


Figure 29. Fisher Creek Turbidity: Four year comparison

Fisher Creek fecal coliform numbers were consistently low during most of the sampling year, with a high spike in mid October and again in May and June.

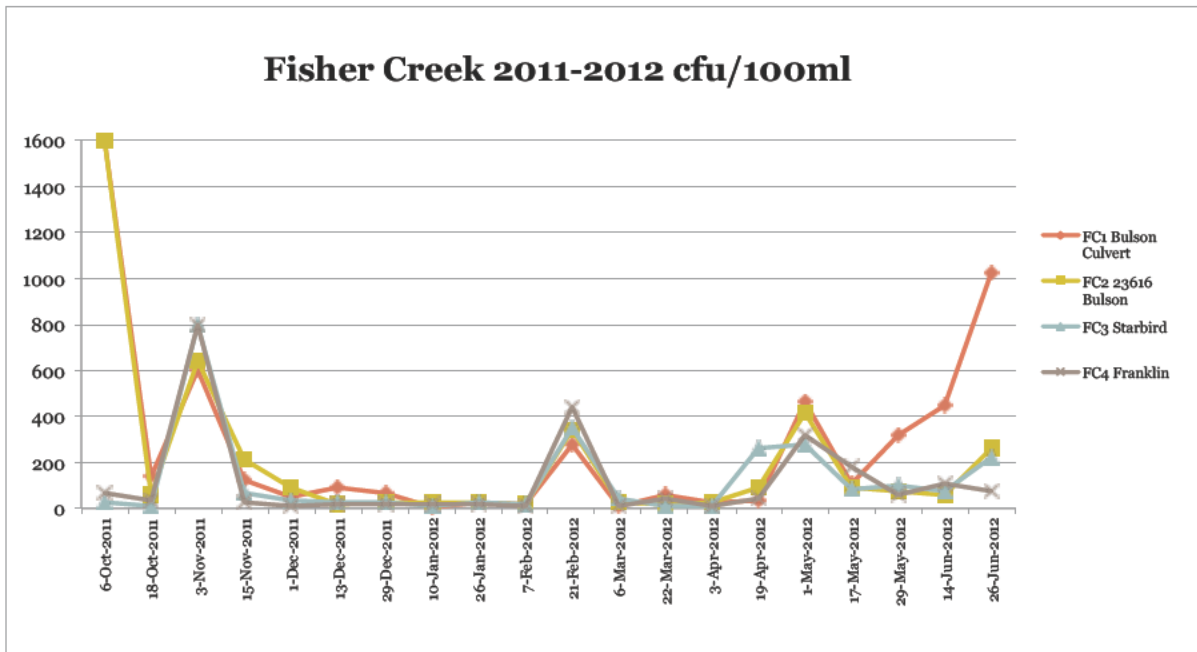


Figure 30. Fisher Creek Fecal Coliform: 2011-2012

Figure 31 below shows geomeans over three years. Site 1 showed a large increase from previous years. Other sites were about the same as last year. Annual geometric means for all four sites were below the first part of the standard (100 cfu/100ml). None of the sites met Part II of the standard with fewer than 10% of the counts above 200 cfu/100ml.

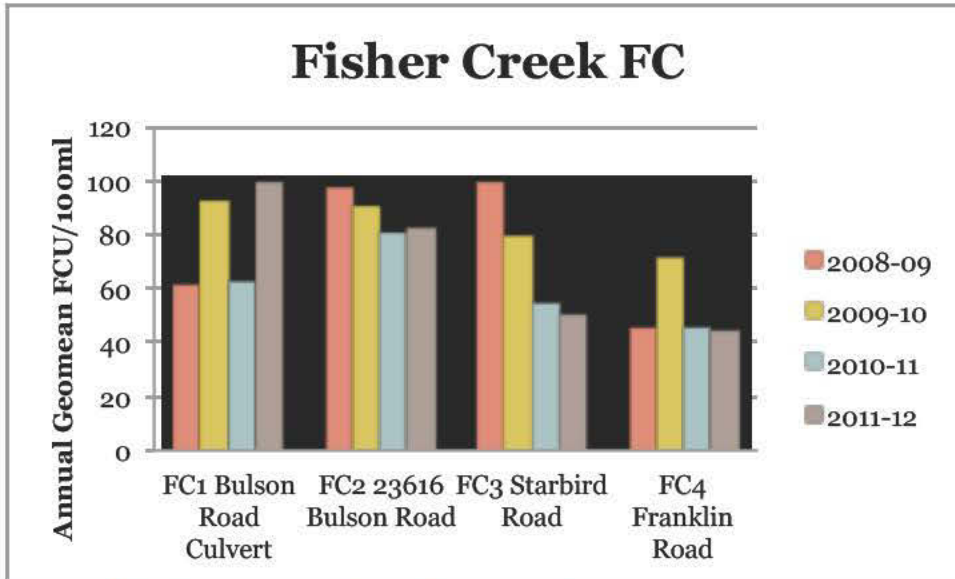


Figure 31. Fisher Creek Fecal Coliform: Three-year comparison

Upper Nookachamps Results

Figures 32 through 38 below present results from Upper Nookachamps Creek sampling.

Site 1, Lake McMurray Estates had the lowest DO levels, with very low levels in September and again in May and June.

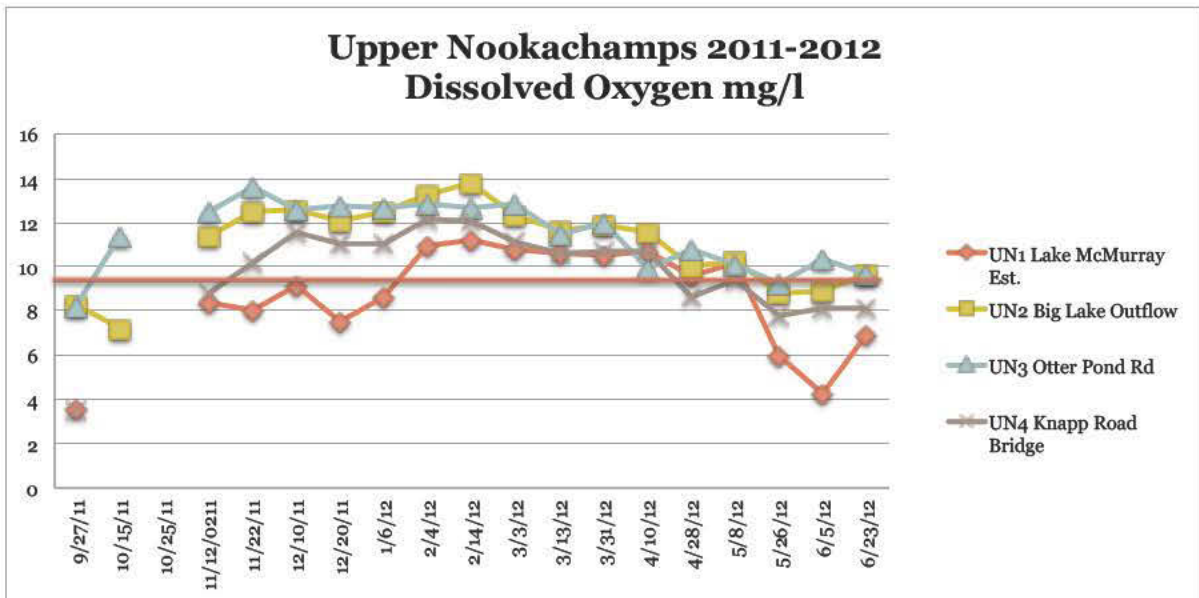


Figure 32. Upper Nookachamps DO: 2011-2012

DO levels were lower at sites 1-3 than last year. Annual averages were lowest for site 1 and highest for site 3. The 9.5mg/l line in Figure 33 is for reference only. State standards are based on the single lowest measurement, not on annual averages. No samples were taken during the warmest season when dissolved oxygen levels would presumably be lowest.

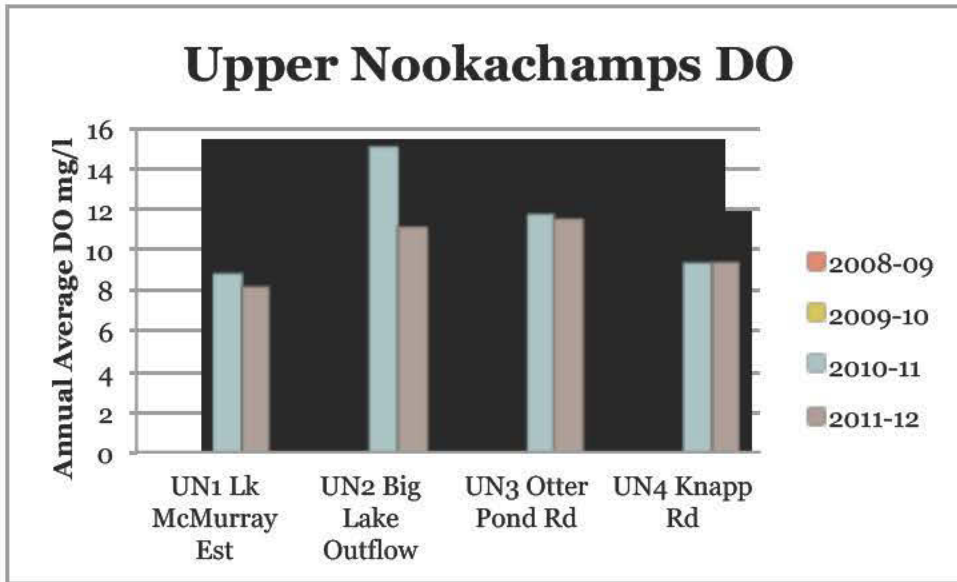


Figure 33. Upper Nookachamps DO: Two year comparison

Temperatures for the Upper Nookachamps sites followed seasonal air temperatures. Trends indicate that temperatures likely rise above the standard of 16°C during July and August.

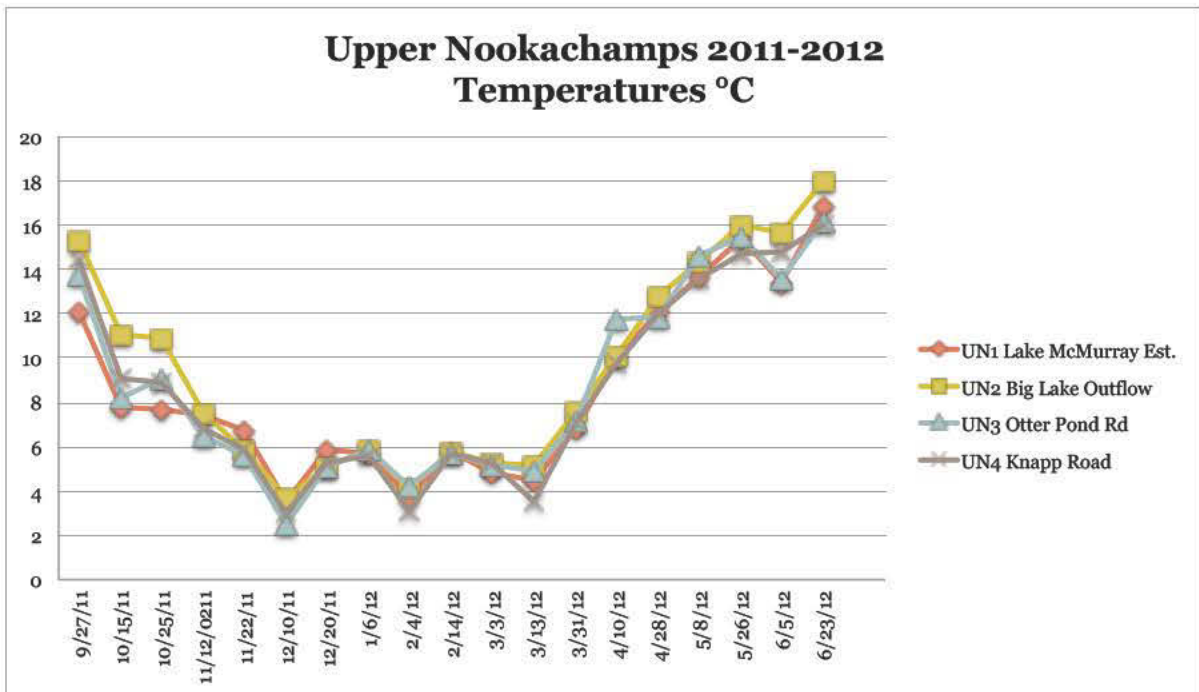


Figure 34. Upper Nookachamps Temperature: 2011-2012

Average temperatures for Upper Nookachamps sites were higher in 2011-12 than the previous year. State standards are not based on average annual temperature.

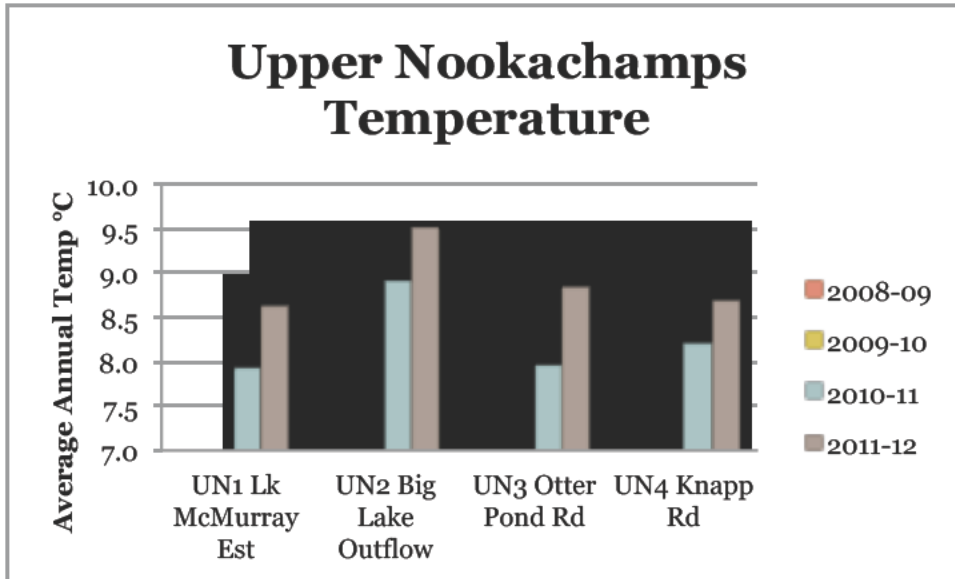


Figure 35. Upper Nookachamps Temperature: Two year comparison

As in the previous year, turbidity was lowest upstream and highest downstream, with Site 4 average nearly twice as high as Site 1.

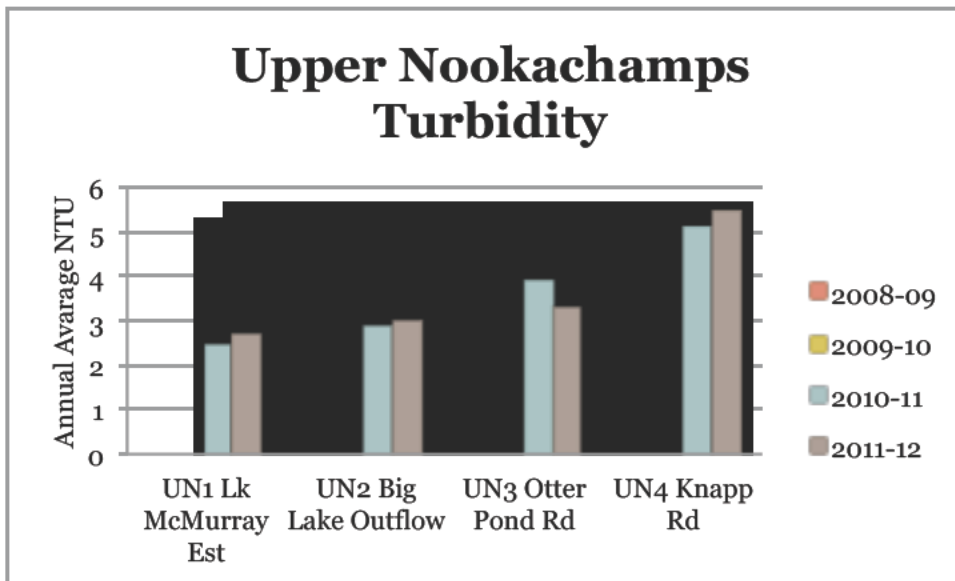


Figure 36. Upper Nookachamps Turbidity: Two year comparison

Fecal coliform levels (Figure 37 below) at Site 4, Knapp Road, were frequently above the state standard of 100 cfu/100ml.

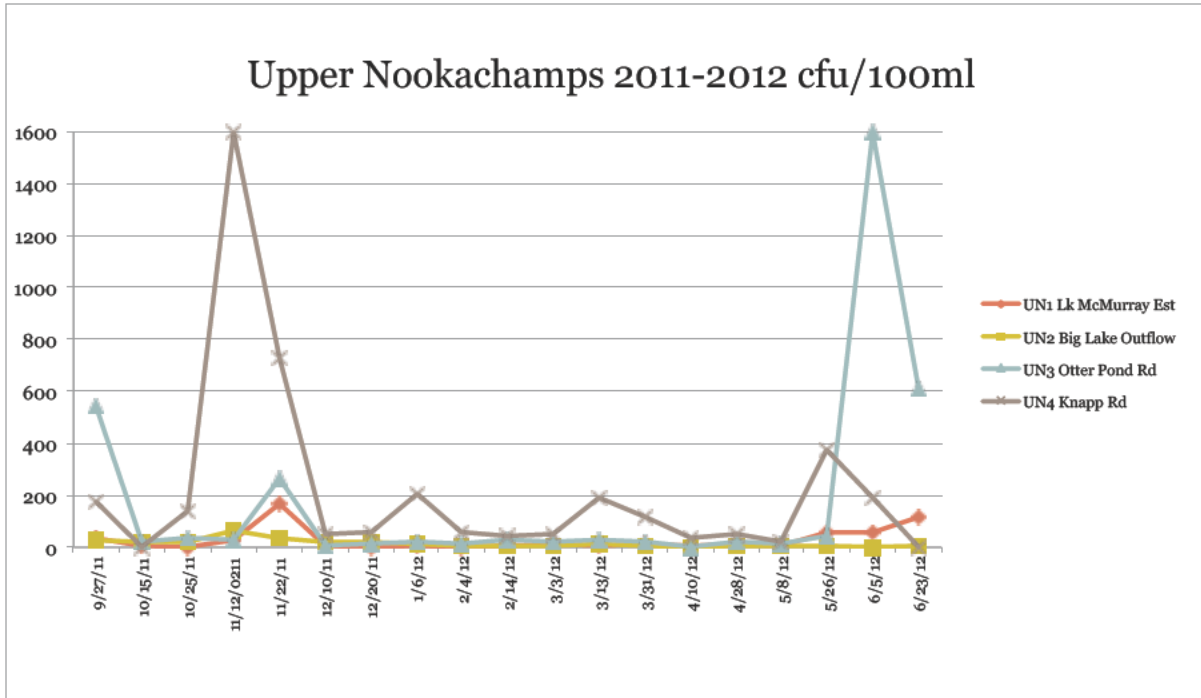


Figure 37. Upper Nookachamps Fecal Coliform: 2011-2012

Annual geometric means for fecal coliform were below the first part of the standard (100 cfu/100ml) for sites 1-3. Site 4 was slightly higher than the standard. Sites 1 and 2 also met the standard of <10% of samples below 200 cfu/100ml.

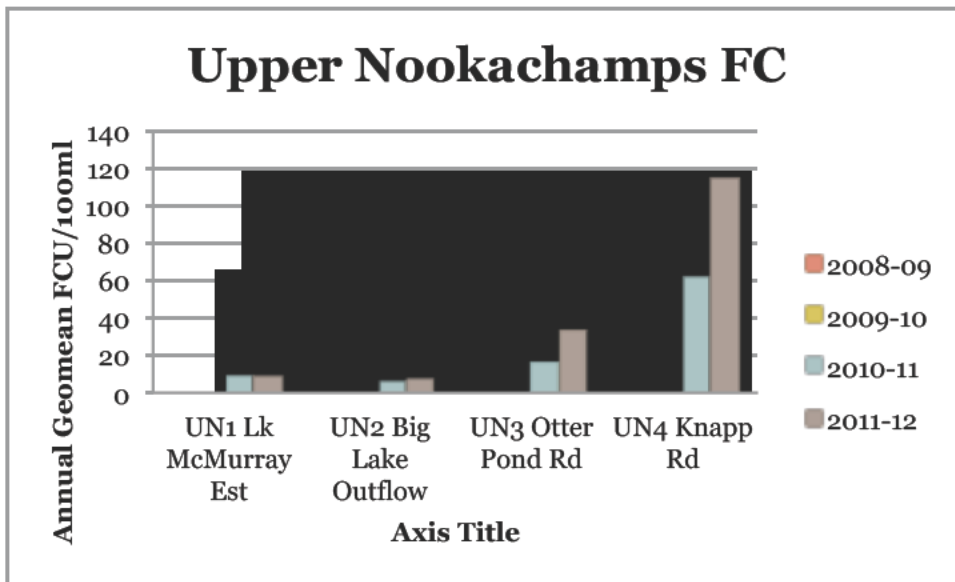


Figure 38. Upper Nookachamps Fecal Coliform: Two year comparison

Lower Nookachamps Results

Figures 39 through 45 below present results from Lower Nookachamps Creek sampling. This is the third year of sampling on the Lower Nookachamps.

All Lower Nookachamps sites had similar dissolved oxygen levels, usually between 10 and 14 mg/l, but below the state standard at some point during the year.

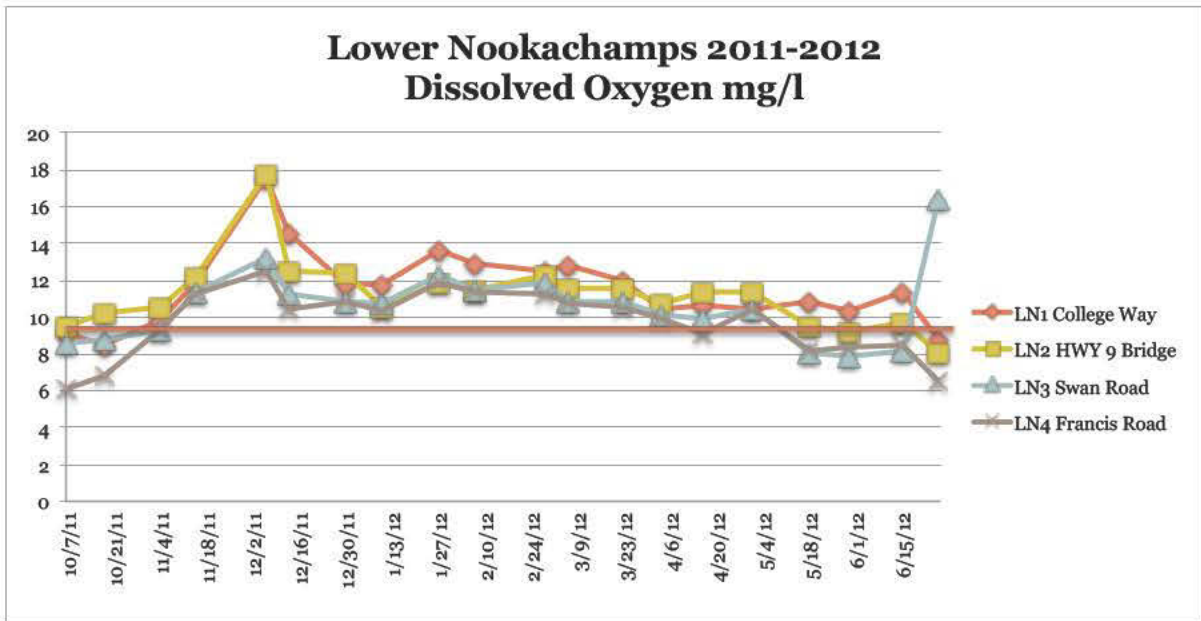


Figure 39. Lower Nookachamps DO: 2011-2012

Dissolved oxygen levels were similar to the past two years for Sites 1-3, and significantly lower for Site 4. Averages are shown below for comparing sites and years. Standards are not based on the annual average, but on single lowest measurement.

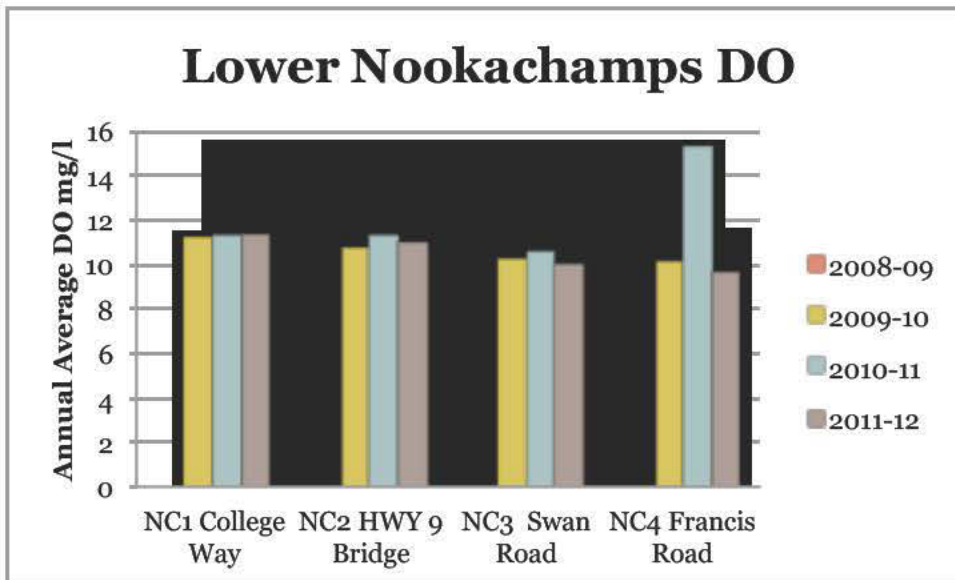


Figure 40. Lower Nookachamps DO: Three year comparison

Temperatures for all samples at all sites were below the state standard of 16°C. No samples were taken during the summer when temperatures may have risen above the state standard.

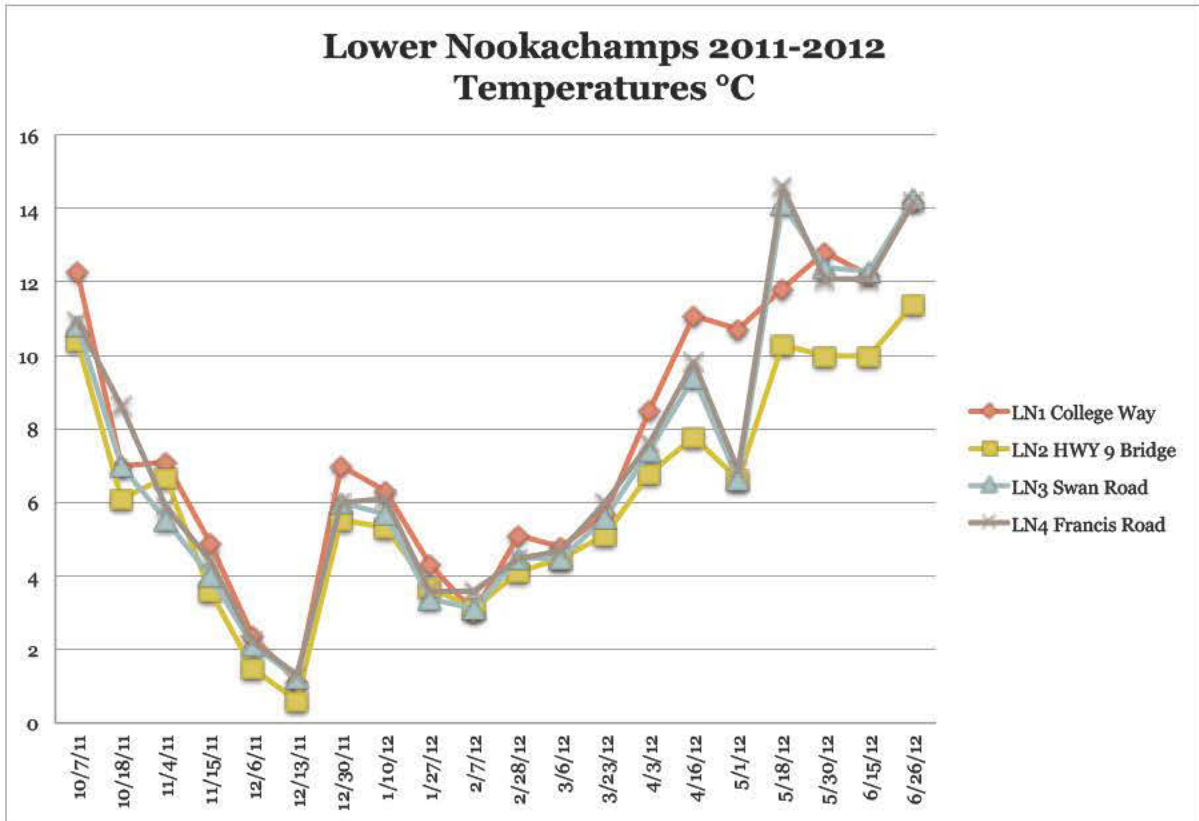


Figure 41. Lower Nookachamps Temperature: 2011-2012

Annual average temperatures for Lower Nookachamps were similar to last year. State standards are not based on the annual average

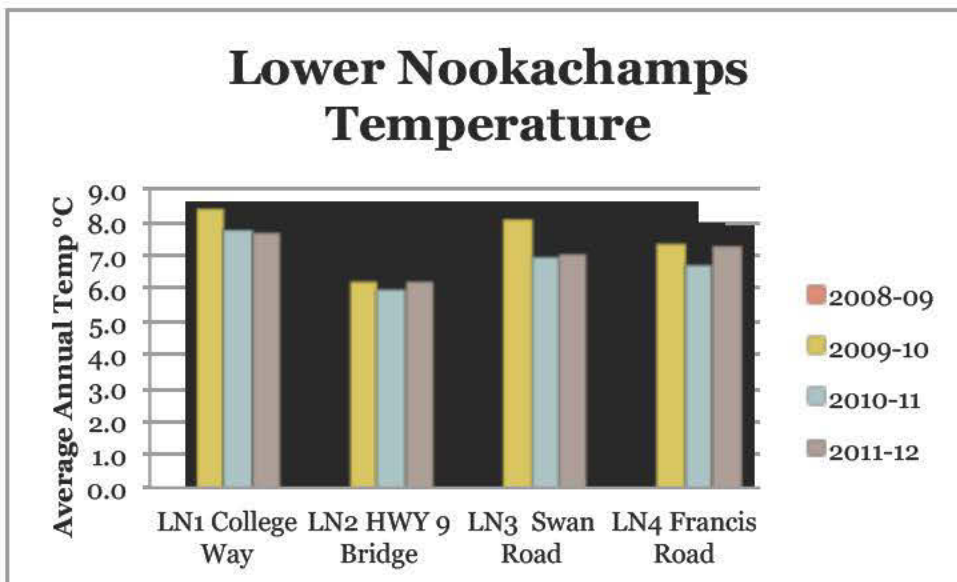


Figure 42. Lower Nookachamps Temperature: Three year comparison

Turbidity levels in 2011-2012 were the lowest in three years for all sites.

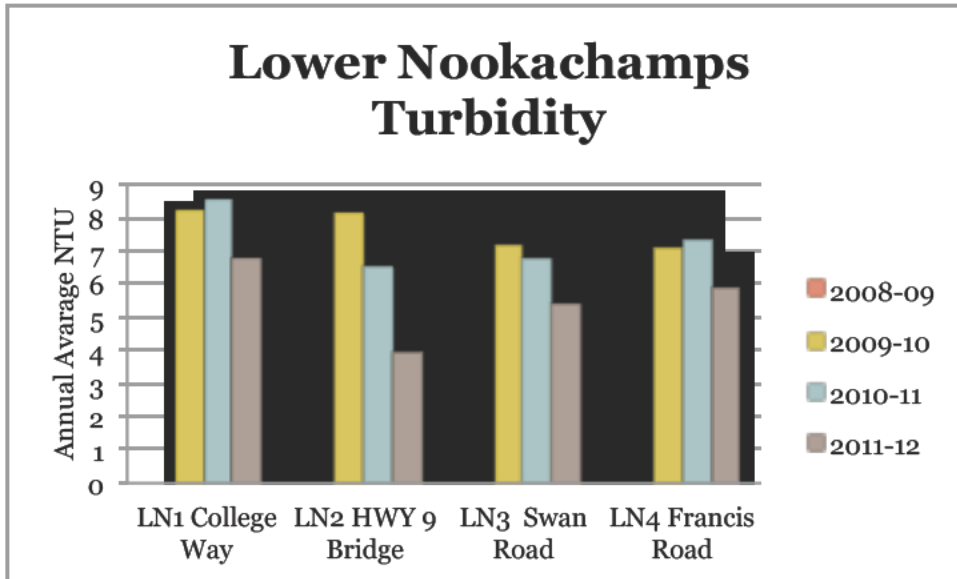


Figure 43. Lower Nookachamps Turbidity: Three year comparison

Fecal coliform levels were highly variable and the highest at Site 1, College Way. Site 1 did not meet the first part of the standard (100 cfu/100ml). Sites 1 and 3 did not meet the <10% over 200 cfu/100ml standard. Sites 2 and 4 met both requirements.

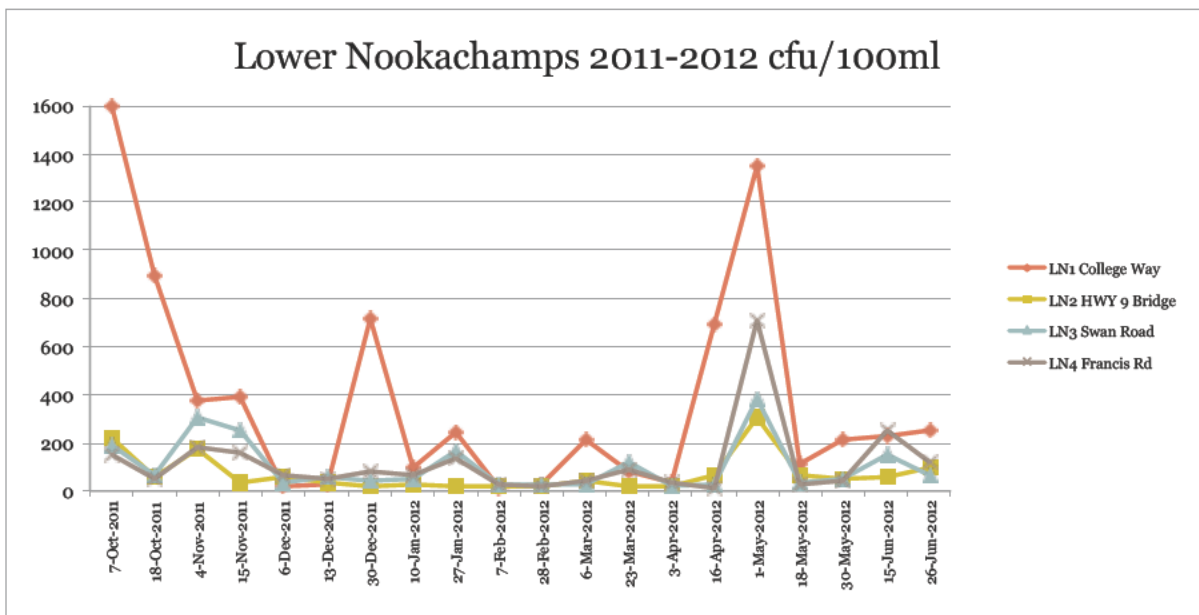


Figure 44. Lower Nookachamps Fecal Coliform: 2011-2012

Site 1 continues to have very high levels of fecal coliform bacteria, though levels were lower this year than in the past two years. Sites 2-4 were similar to the past two years.

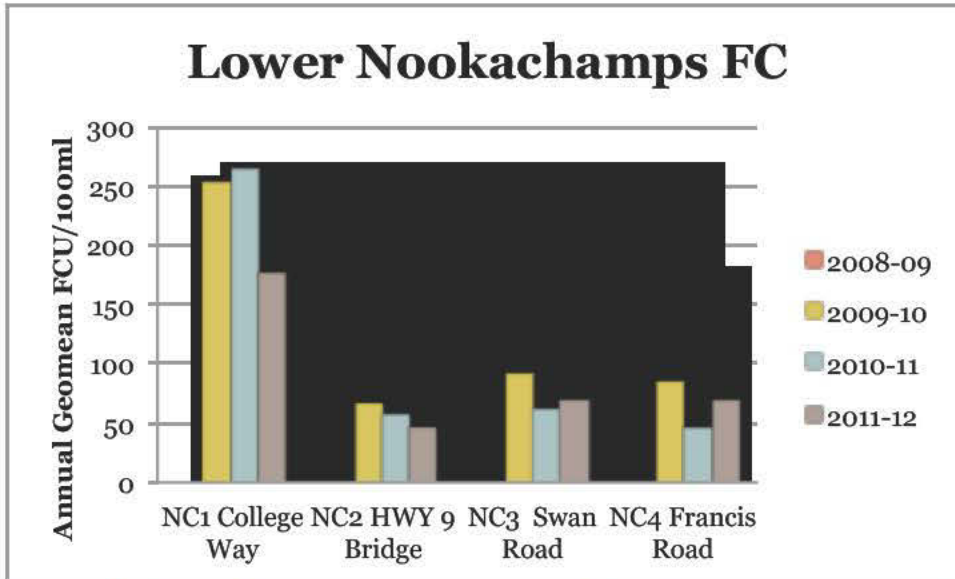


Figure 45. Lower Nookachamps Fecal Coliform: Three year comparison

No Name Slough Results

Figures 46 through 52 below present results from No Name Slough sampling.

Dissolved oxygen levels fell below the state standard of 8mg/l for sites 1, 3 and 4 at some point during the sampling season. Site 4 consistently had the lowest DO. Site 2 was always above the standard.

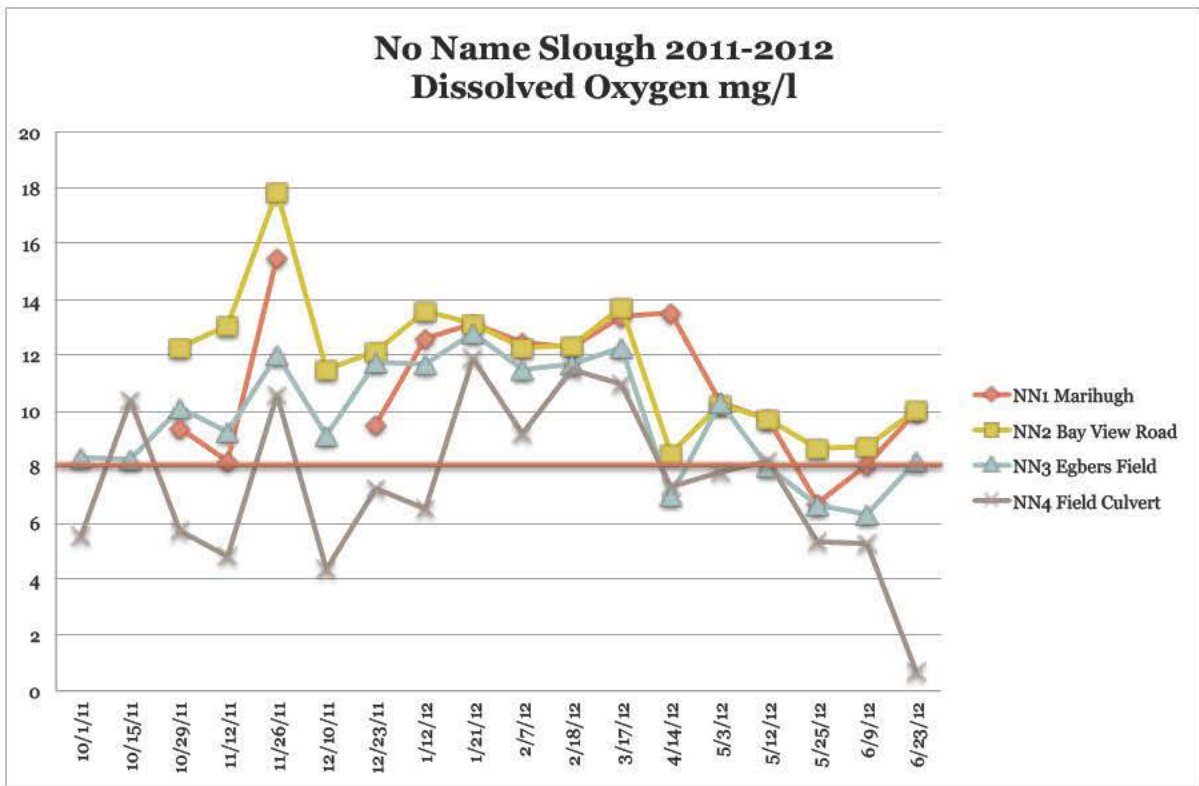


Figure 46. No Name Slough DO: 2011-2012

Compared with the past 3 years, average dissolved oxygen levels were about the same for all sites, with slight improvement at site 2. State standards are not based on the annual average.

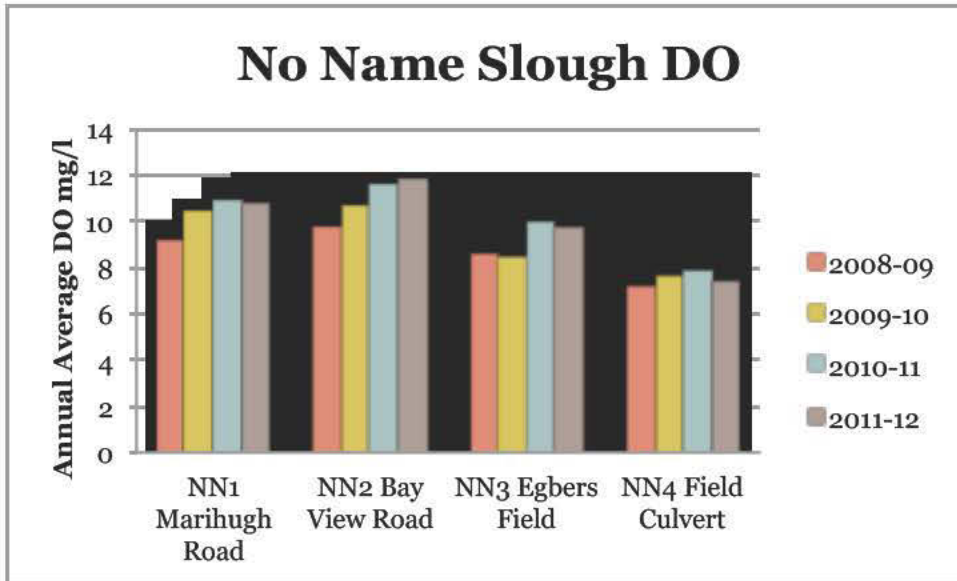


Figure 47. No Name Slough DO: Four year comparison

Temperatures for all No Name samples at Sites 1-3 were below the optimum level of 17.5°C. Site 4 was above this temperature in June 2012. No samples were taken during the warmest summer season when temperatures may have been above the state standard.

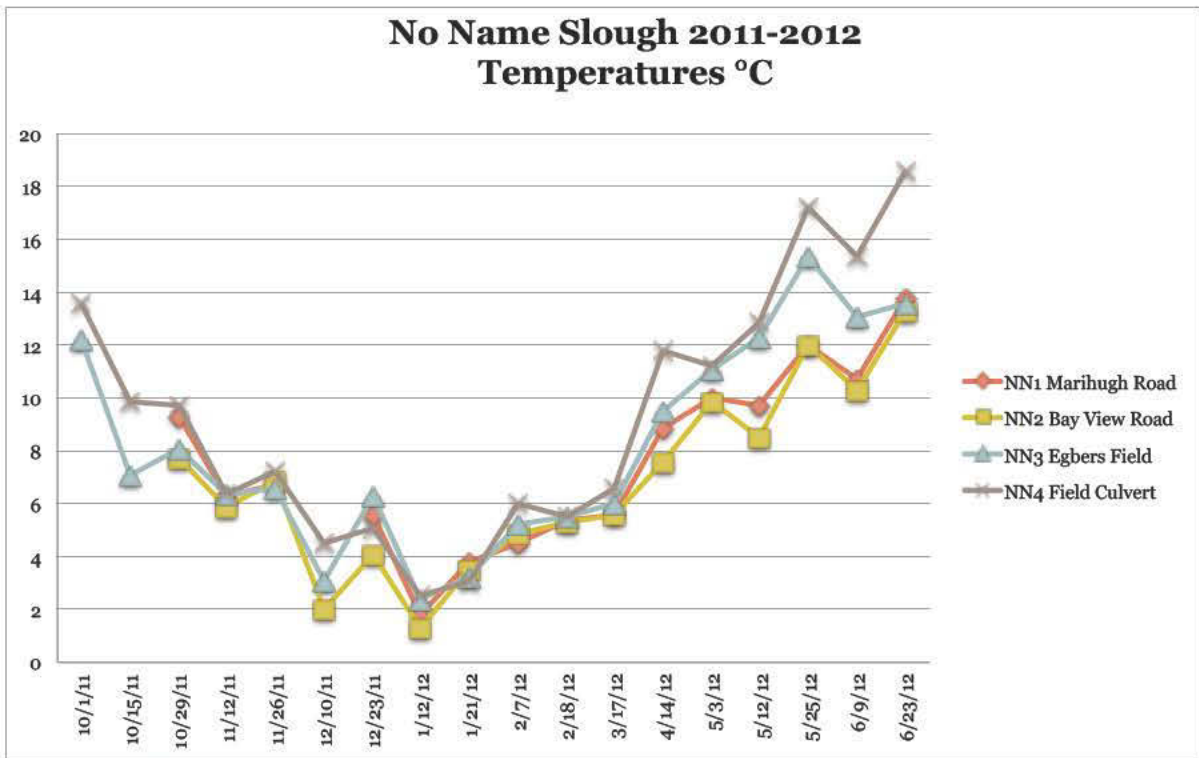


Figure 48. No Name Slough Temperature: 2011-2012

Average annual temperatures were similar to the past, with temperatures increasing downstream. State standards are not based on the annual average.

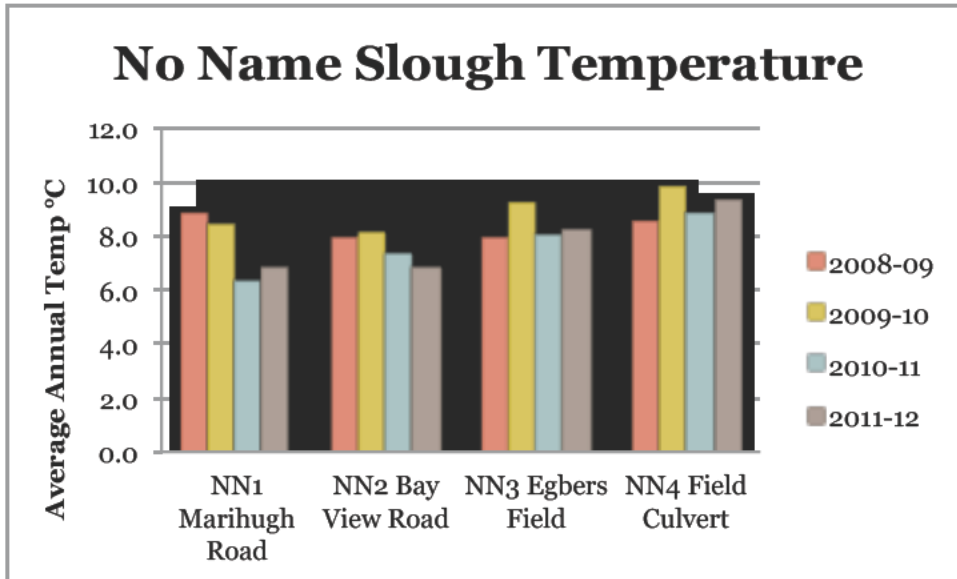


Figure 49. No Name Slough Temperature: Four year comparison

Turbidity in No Name was the lowest in four years for all sites, with increasing turbidity from top to bottom of the watershed.

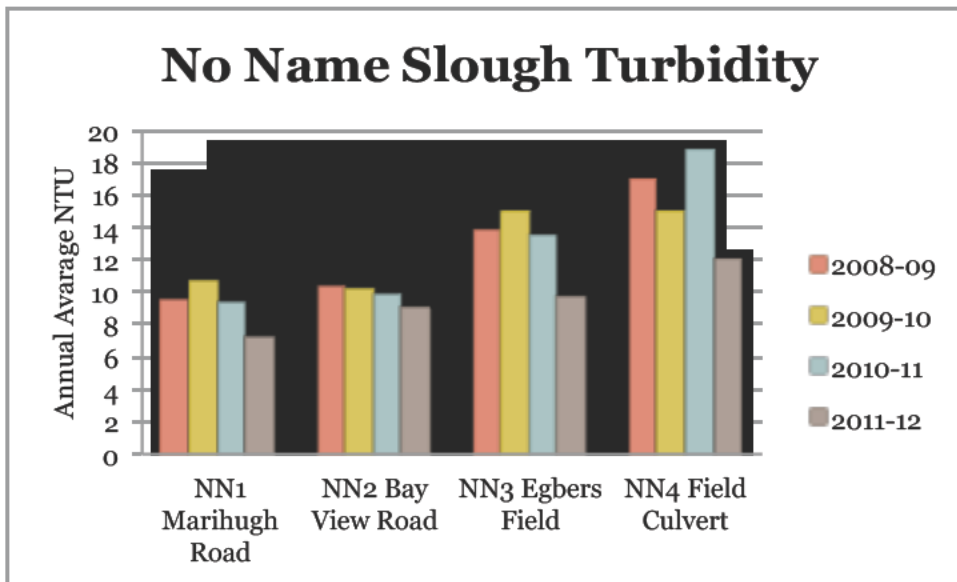


Figure 50. No Name Slough Turbidity: Four year comparison

All No Name sites had variable and often high fecal coliform levels throughout the season. None of the sites met the <10% over 200 CFU/100ml standard.

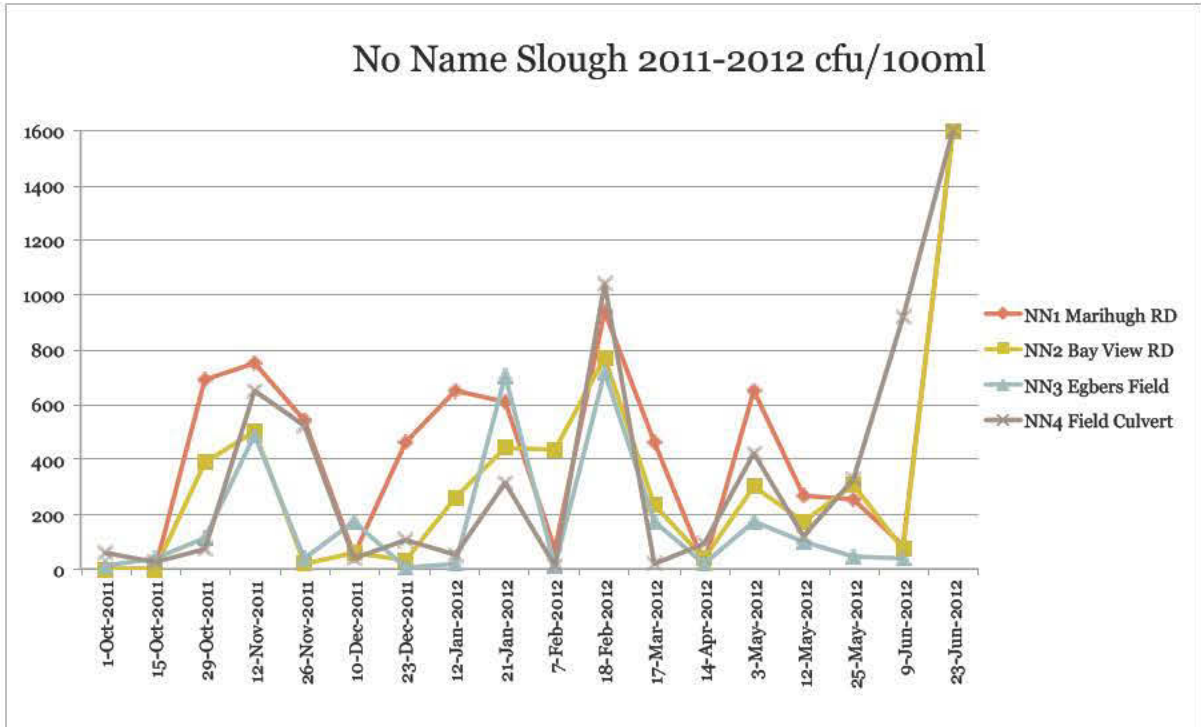


Figure 51. No Name Slough Fecal Coliform: 2011-2012

Like last year, only Site 3, Egbers Field met the first part of the standard (100 cfu/100ml). Site 3 continued to improve from past years while Site 1 showed a very high increase.

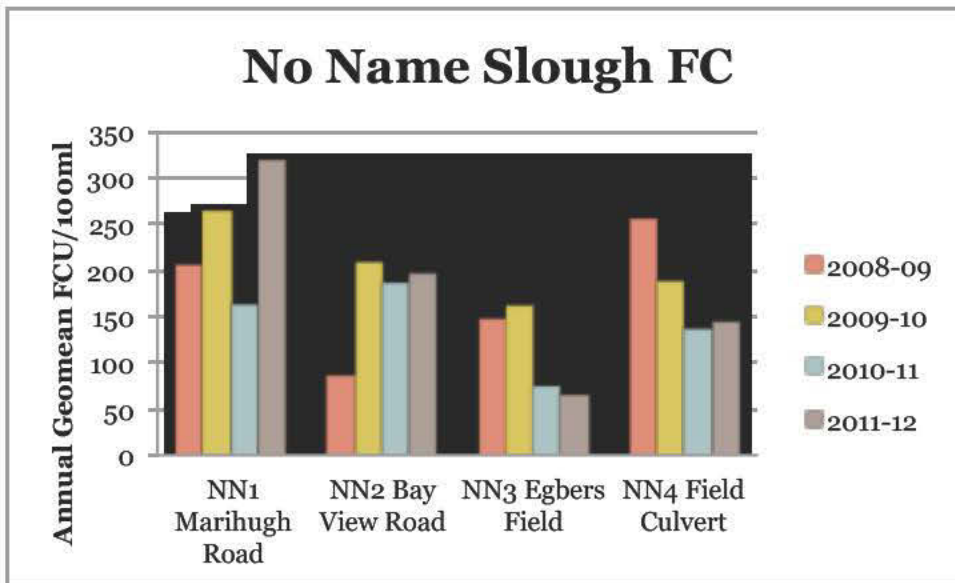


Figure 52. No Name Slough Fecal Coliform: Four year comparison

Bay View Drainage Results

Figures 53 through 59 below present results from Bay View Drainage sampling.

All sites in Bay View had similar dissolved oxygen results during the 2010-2011 season.

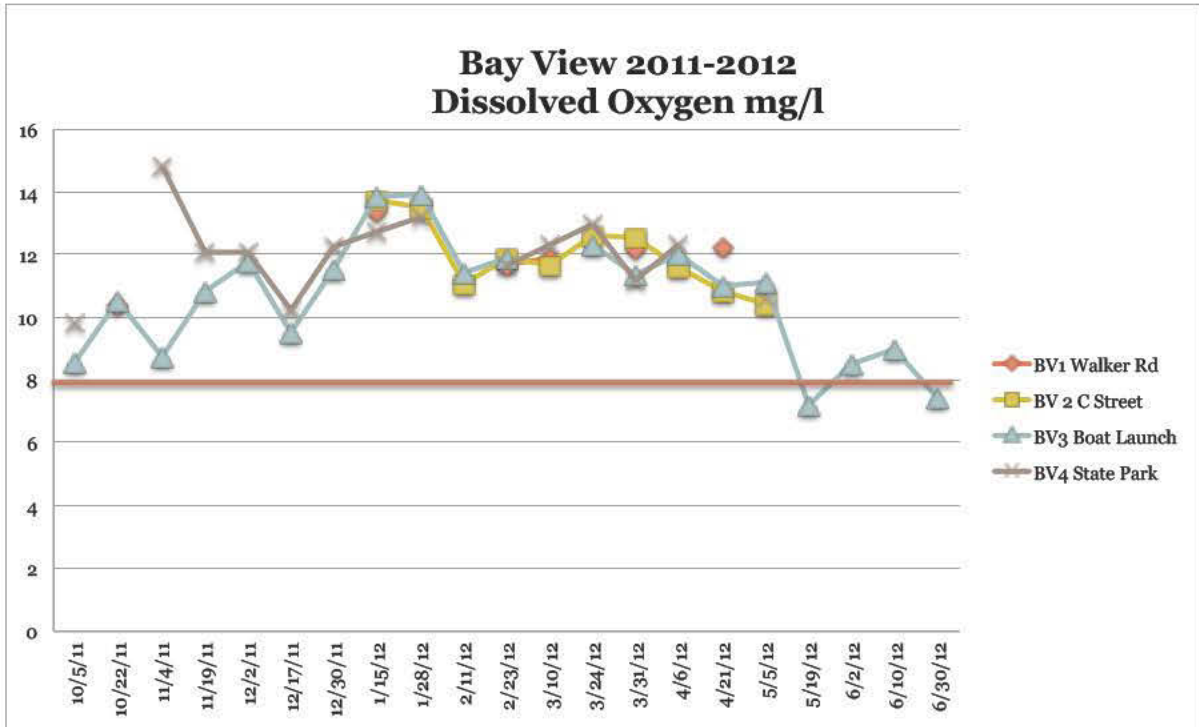


Figure 53. Bay View Drainage: 2011-2012

Site 3 showed higher dissolved oxygen levels than past years. Dissolved oxygen levels at other sites were very similar to those from the previous two years. State standards are not based on the annual average.

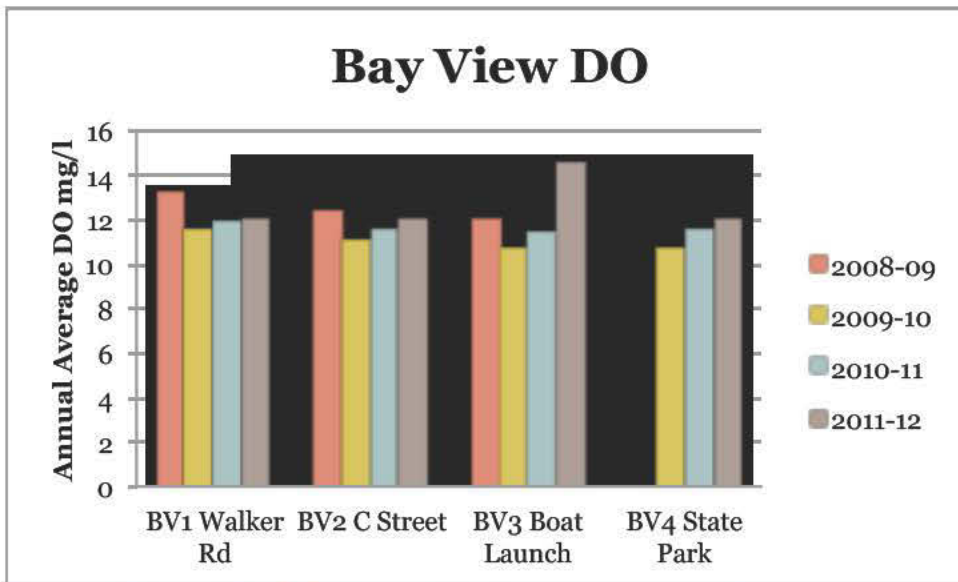


Figure 54. Bay View Drainage DO: Four year comparison

Temperatures for all samples at all sites were below the optimum level of 17.5°C. No samples were taken during the warmest summer season when temperatures may have risen above the state standard.

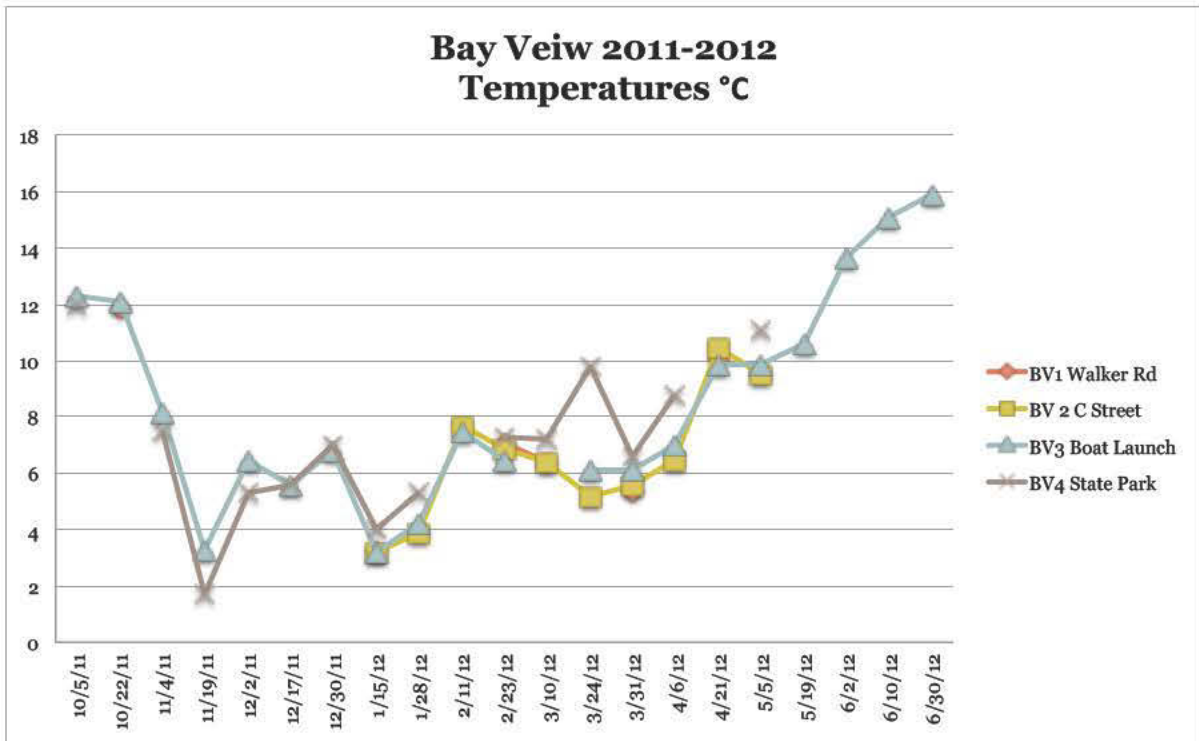


Figure 55. Bay View Drainage Temperature: 2011-2012

Compared to the previous three years, average annual temperatures were slightly cooler for sites 2 and 4.

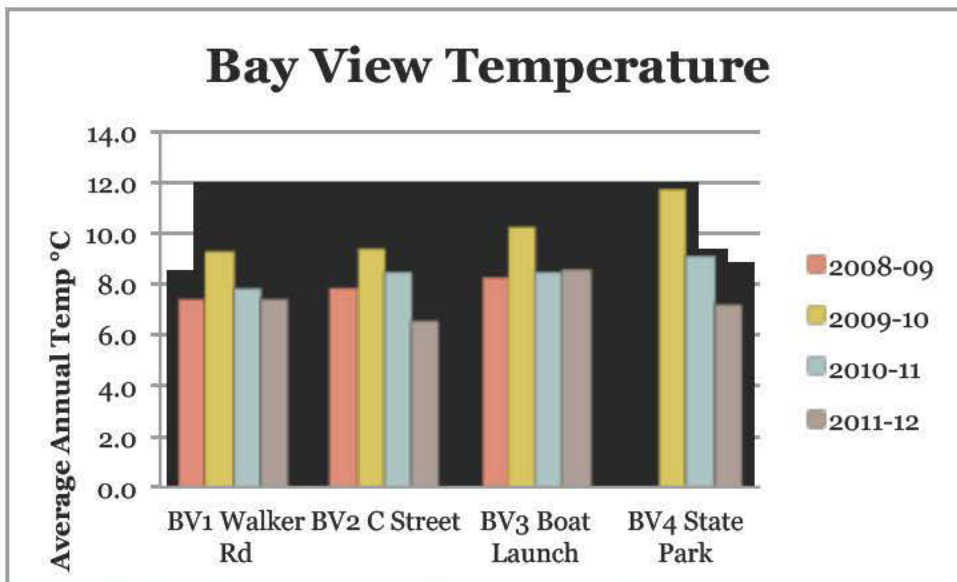


Figure 56. Bay View Drainage Temperature: Four year comparison

As in the past, the highest turbidity levels were at the salt water site at Bay View State Park.

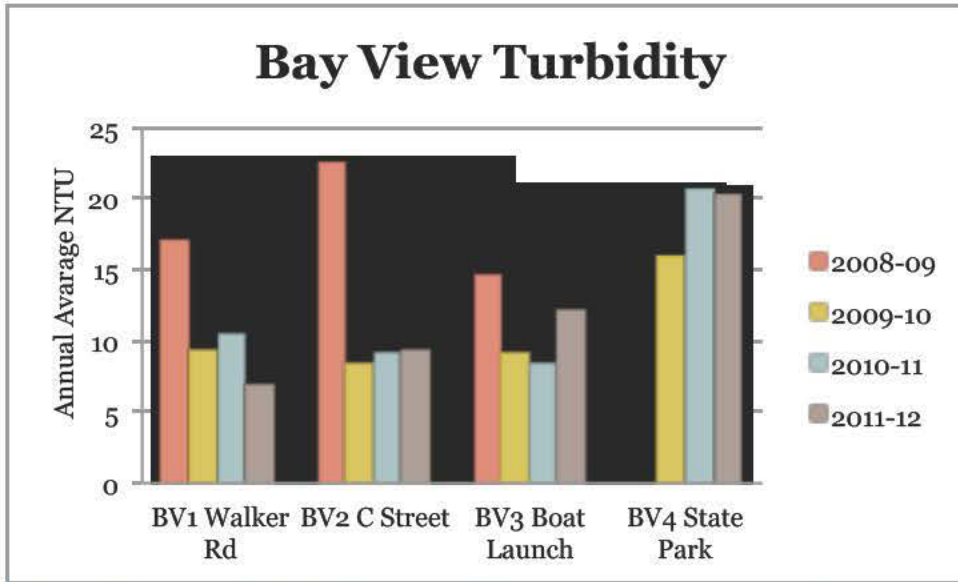


Figure 57. Bay View Drainage Turbidity: Four year comparison

Fecal coliform numbers were relatively low for much of the season, with a large spike March 31. Site 3 showed the most frequent jumps in numbers. None of the sites met Part II of the state standard of <10% above 200cfu/100ml.

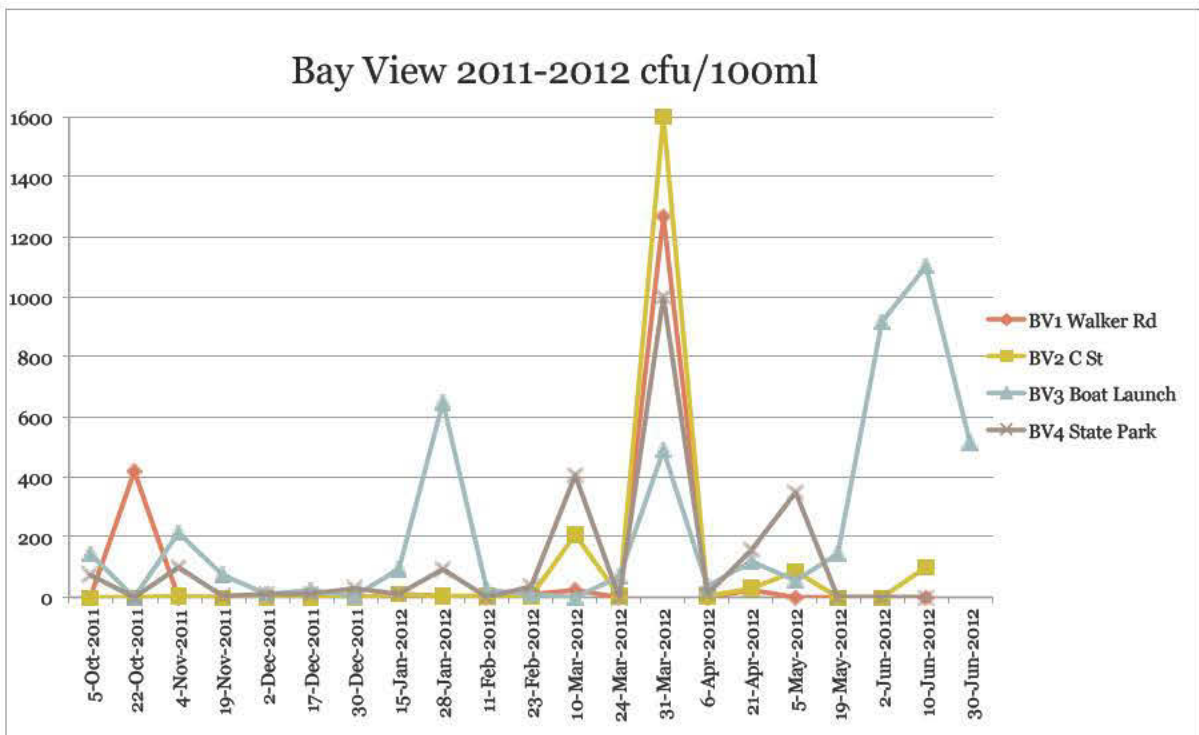


Figure 58. Bay View Drainage Fecal Coliform: 2011-2012

Annual geometric means for Bay View fecal coliform were higher than last year, though all sites met Part I of the state standard.

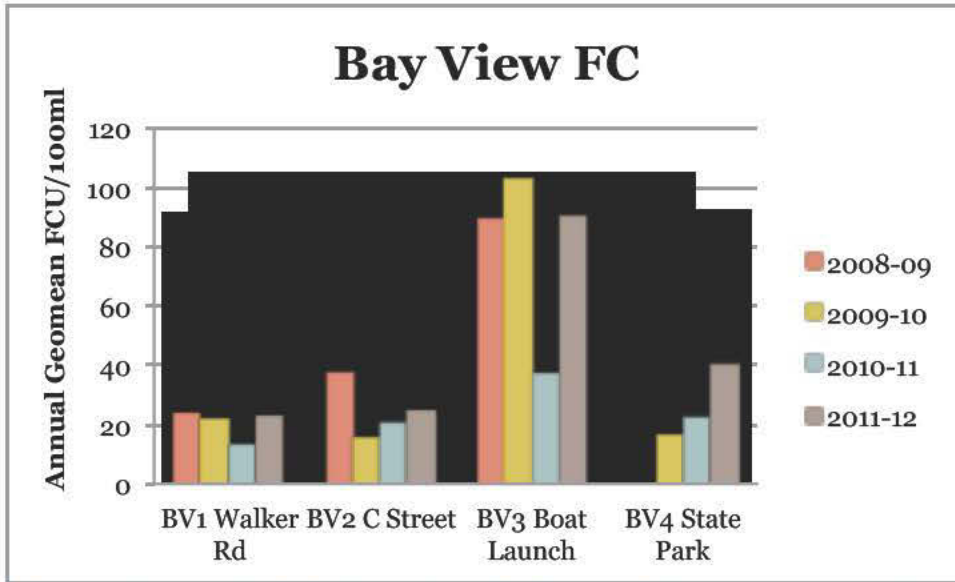


Figure 59. Bay View Drainage Fecal Coliform: Four year comparison

Joe Leary Slough Results

Figures 60 through 66 below present results from Joe Leary Slough sampling.

Dissolved oxygen levels were consistently below standards for all sites, even during the cold winter months. These levels are the lowest of any watershed in the program.

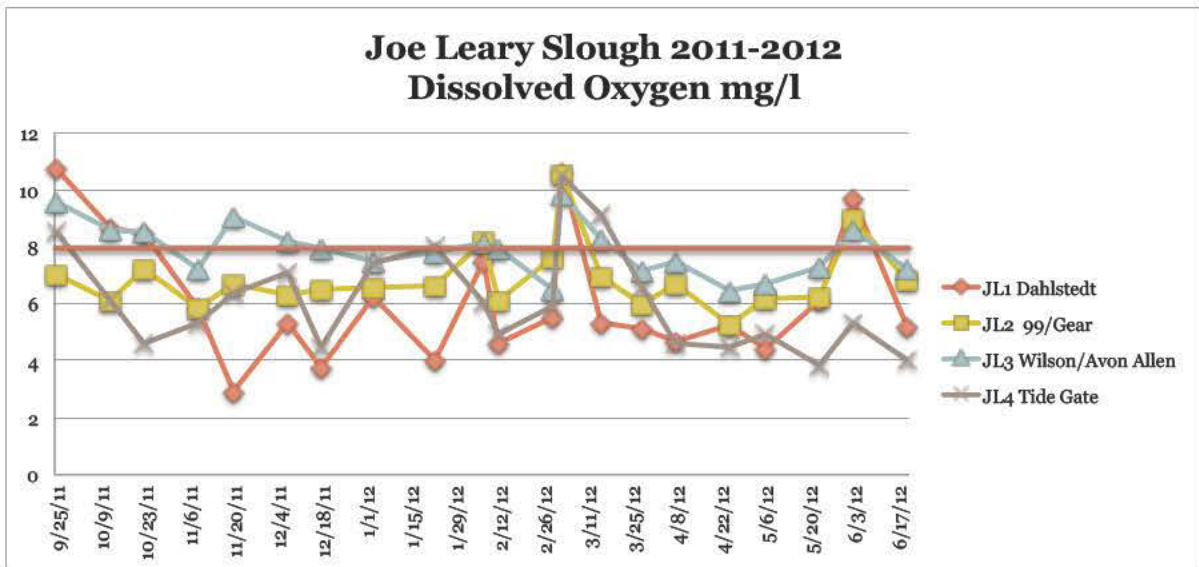


Figure 60. Joe Leary Slough DO: 2011-2012

Dissolved oxygen levels were similar to past years: very low, with averages below the state standard of 8mg/l.

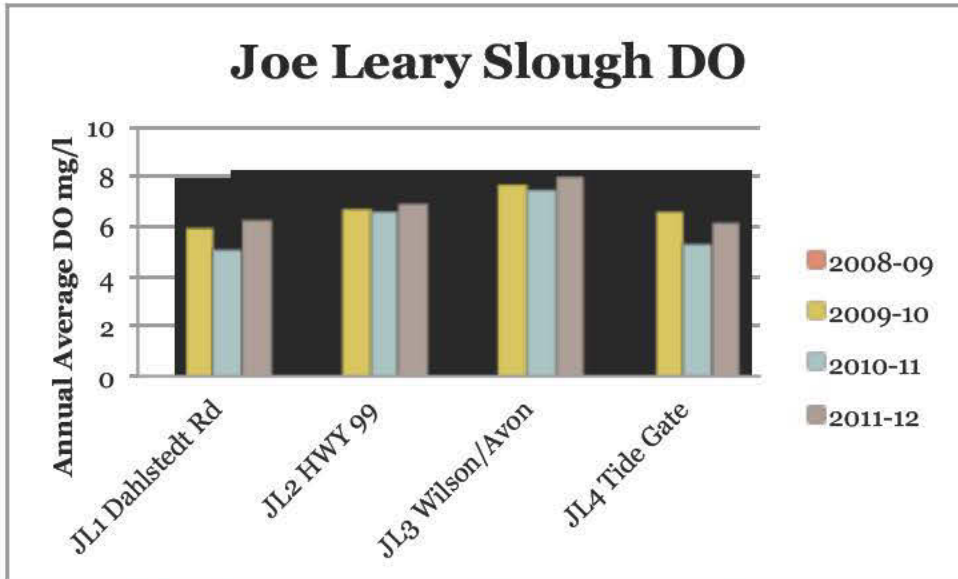


Figure 61. Joe Leary Slough DO: Three year comparison

Temperatures for Site 3 were above the optimum level of 17.5°C on two occasions. All other samples were consistently below 17.5 °C. No samples were taken during the warmest summer season when temperatures may have risen above the standard.

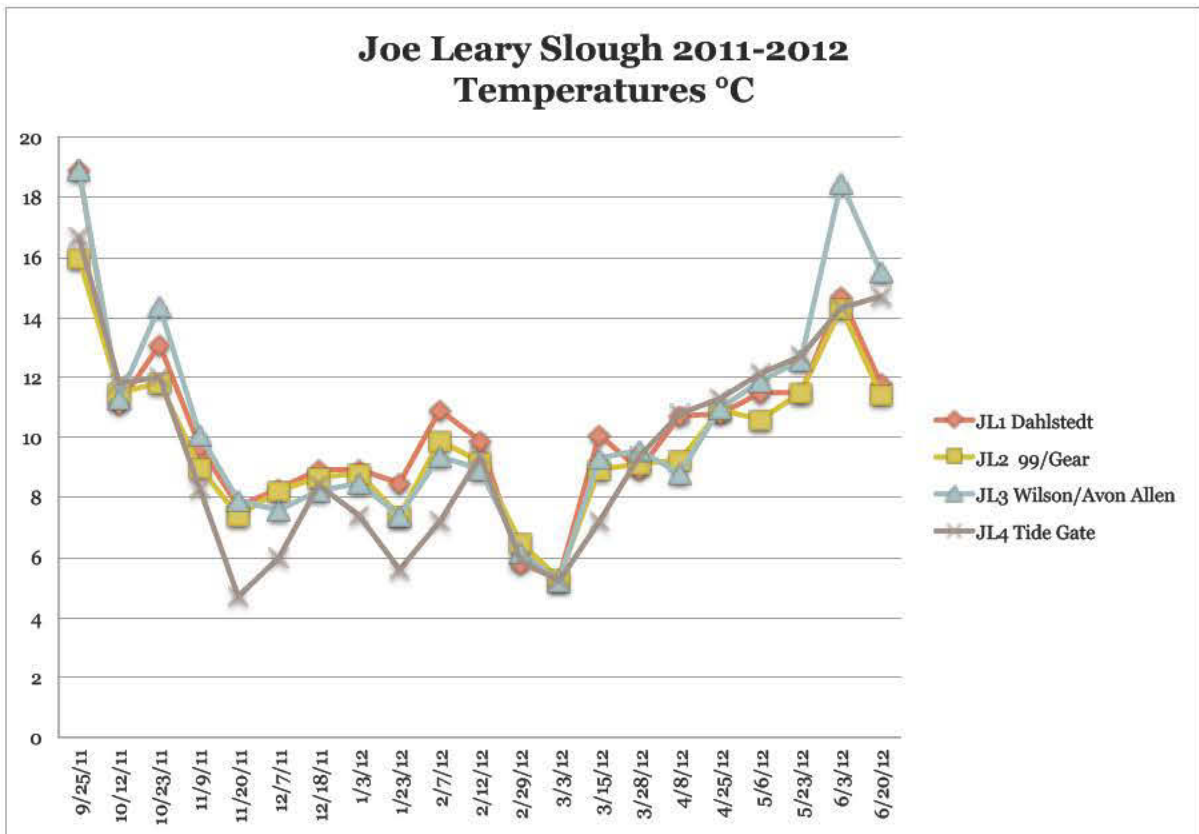


Figure 62. Joe Leary Slough Temperature: 2011-2012

Compared to past years, average annual temperatures were cooler for Sites 1-3 and slightly warmer for Site 4. Standards are not based on average temperature.

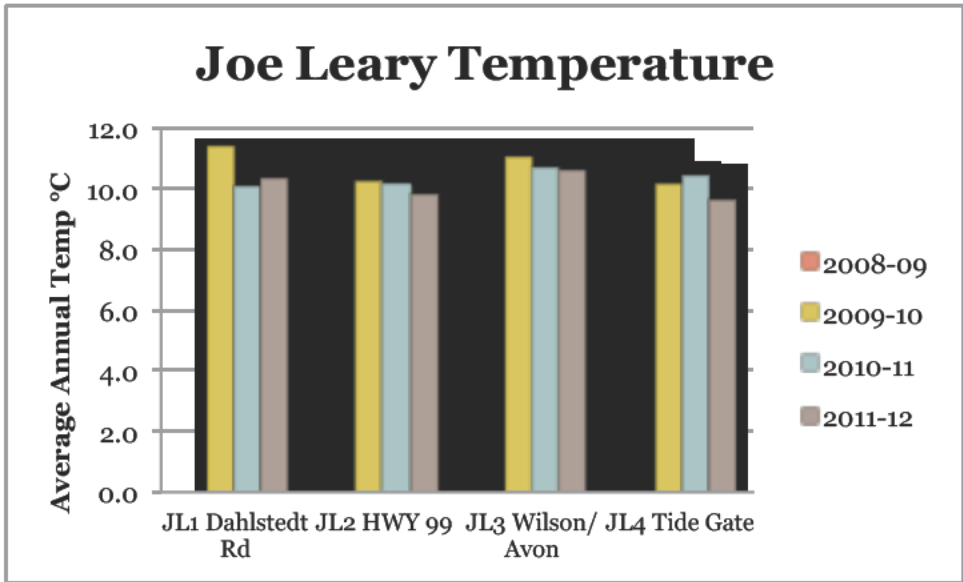


Figure 63. Joe Leary Slough Temperature: Three year comparison

Turbidity in Joe Leary Slough was higher at site 3 compared to other sites and past years. Levels were lower for sites 1, 2, and 4.

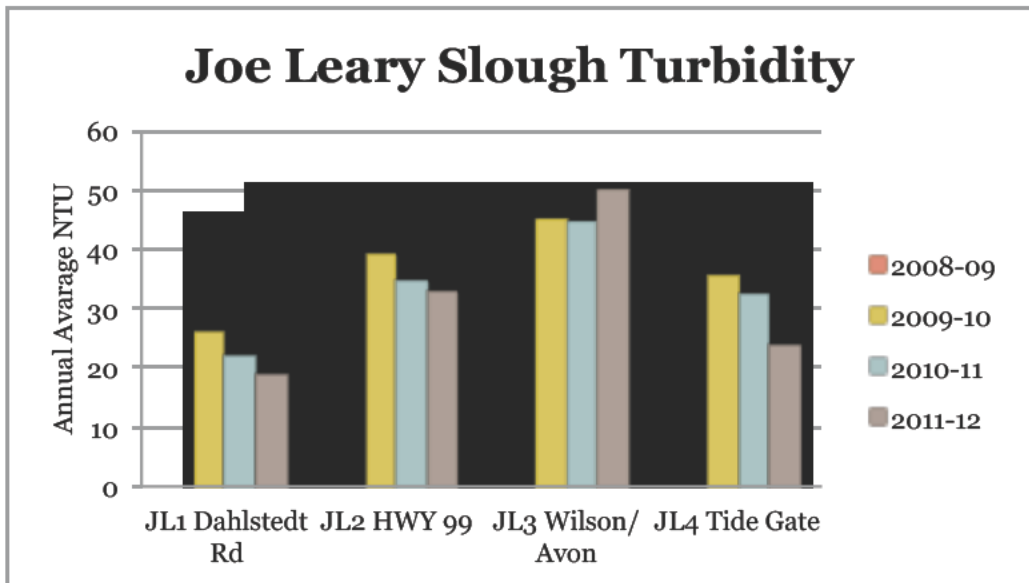


Figure 64. Joe Leary Slough Turbidity: Three year comparison

Site 3 was the only site to meet Part II of the state standard, with only 1 out of 21 samples higher than 200cfu/100ml.

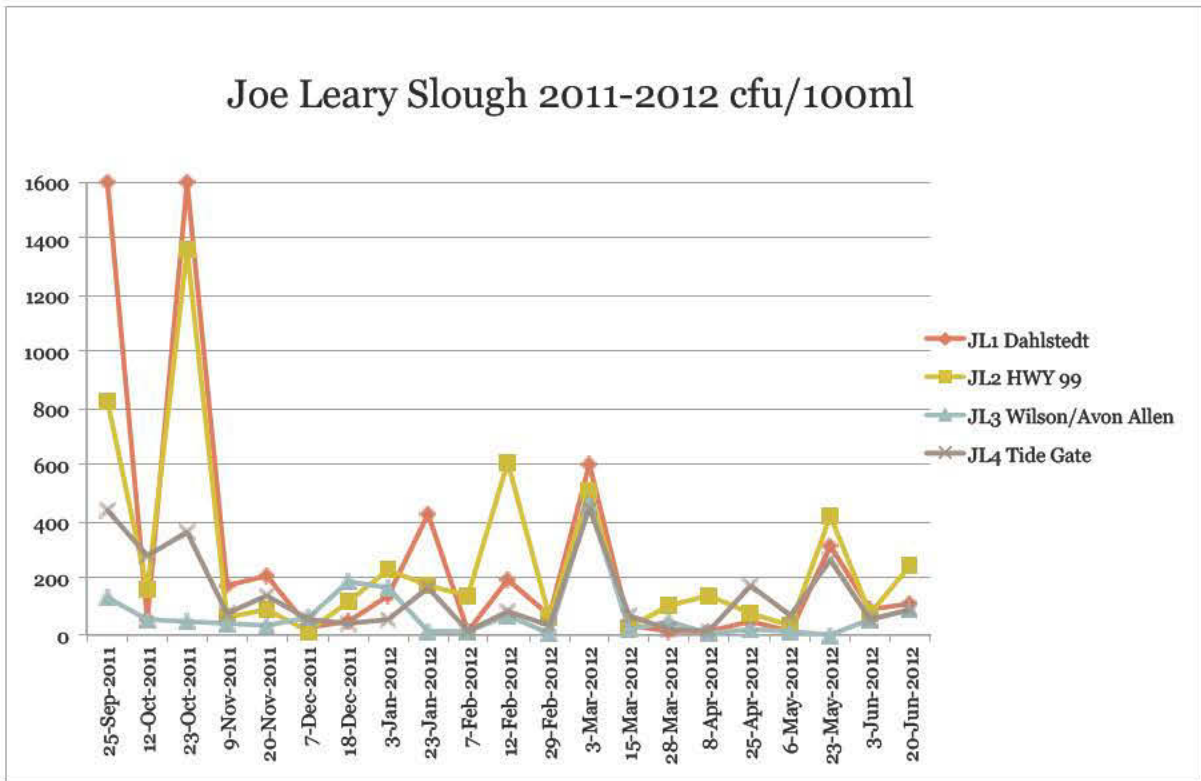


Figure 65. Joe Leary Slough Fecal Coliform: 2011-2012

Sites 1, 3, and 4 met Part I of the standard of geometric mean <100 cfu100ml. Site 3 met both requirements.

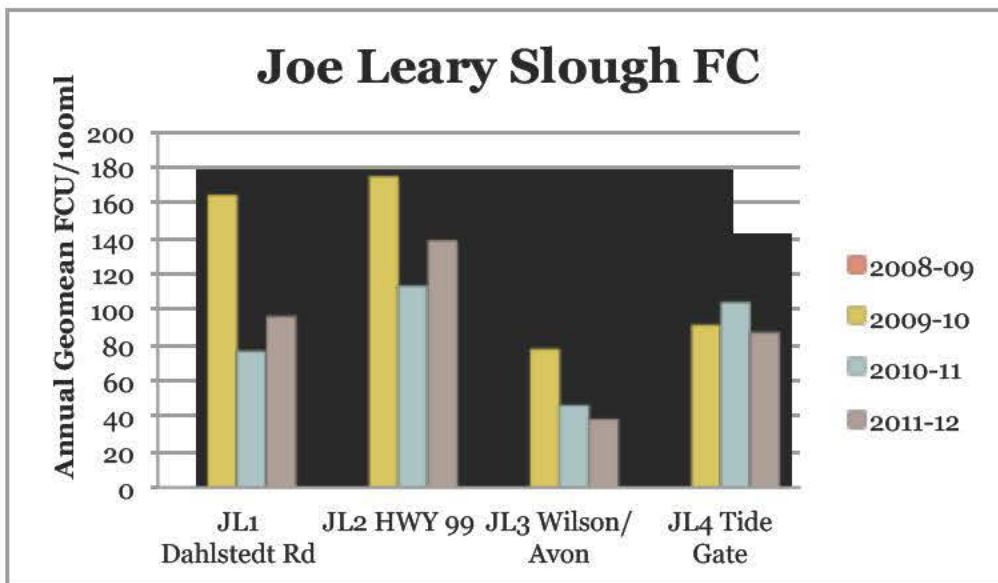


Figure 66. Joe Leary Slough Fecal Coliform: Three year comparison

Trumpeter Basin Results

Figures 67 through 73 below present results from Trumpeter Basin sampling.

Dissolved oxygen levels dropped below the standard of 9.5mg/l at all sites in early fall when water levels were low.

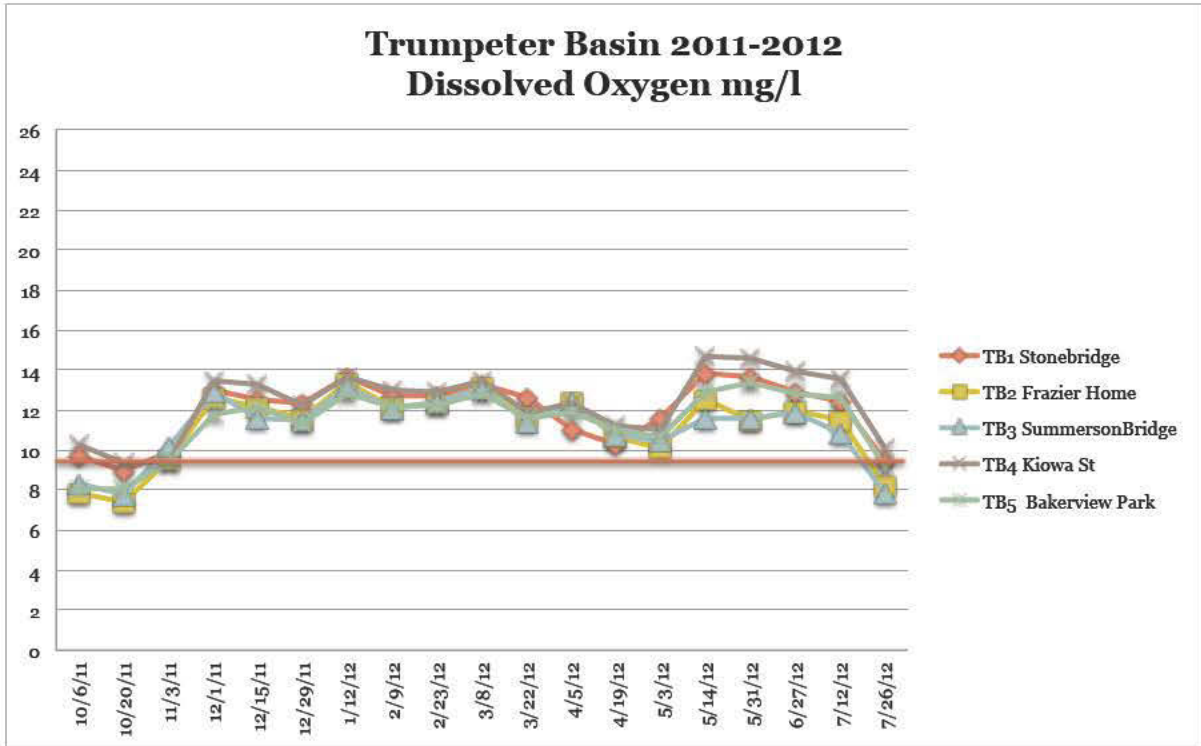


Figure 67. Trumpeter Basin DO: 2011-2012

Average annual dissolved oxygen levels were higher for all sites compared to past years. State standards are not based on annual averages.

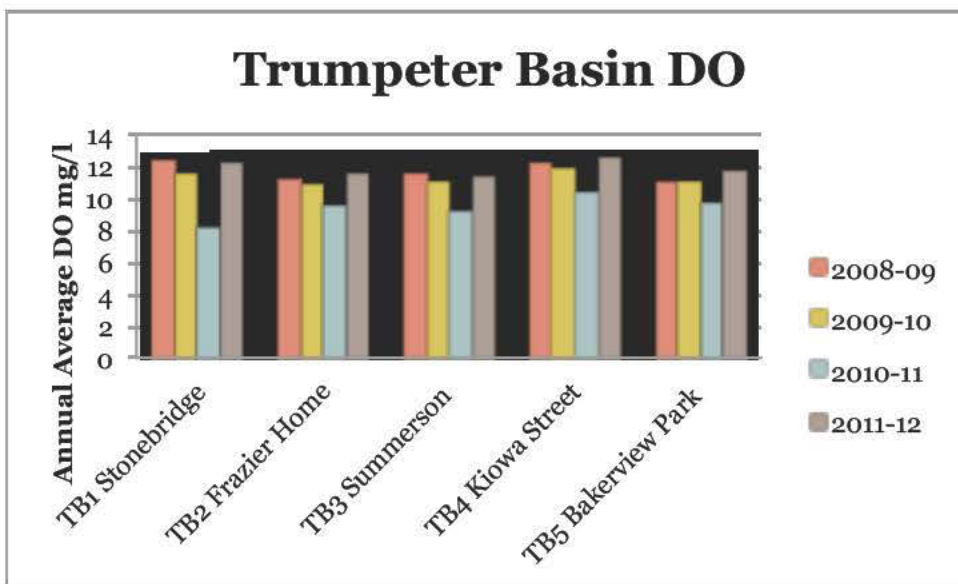


Figure 68. Trumpeter Basin DO: Four year comparison

Temperatures for site 2 was higher than 16°C on July 26. No samples were taken during August when temperatures at all sites may have risen above the state standard.

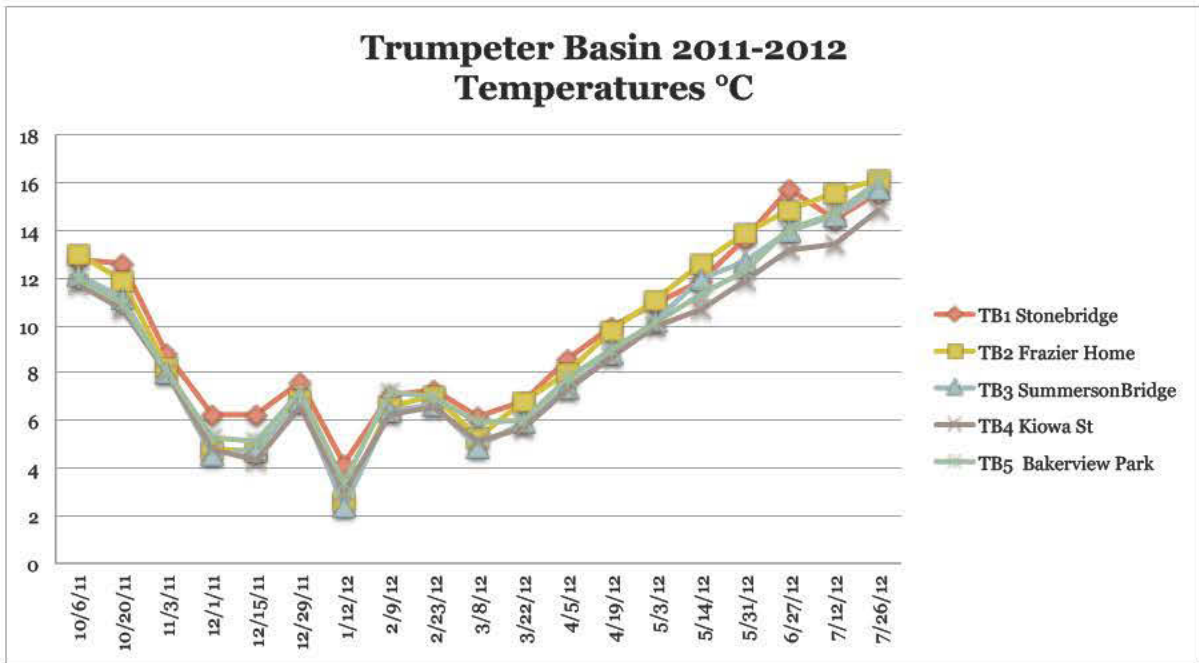


Figure 69. Trumpeter Basin Temperature: 2011-2012

Trumpeter Basin average annual temperatures in 2011-2012 were similar to past years. State standards are not based on the annual averages.

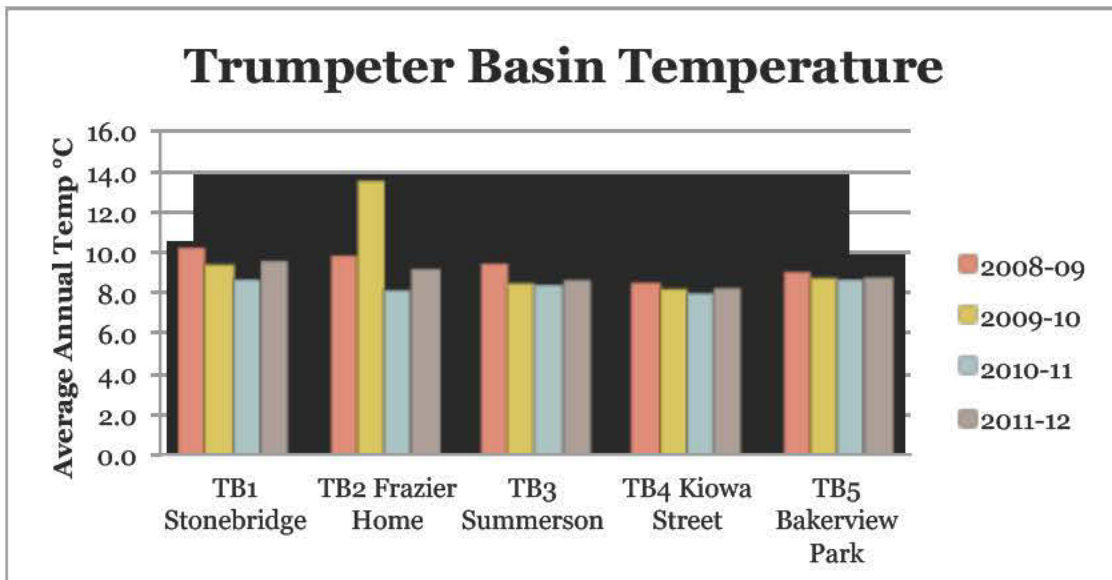


Figure 70. Trumpeter Basin Temperature: Four year comparison

Turbidity levels in Trumpeter Basin were lower than last year at all sites, with the lowest average at site 4.

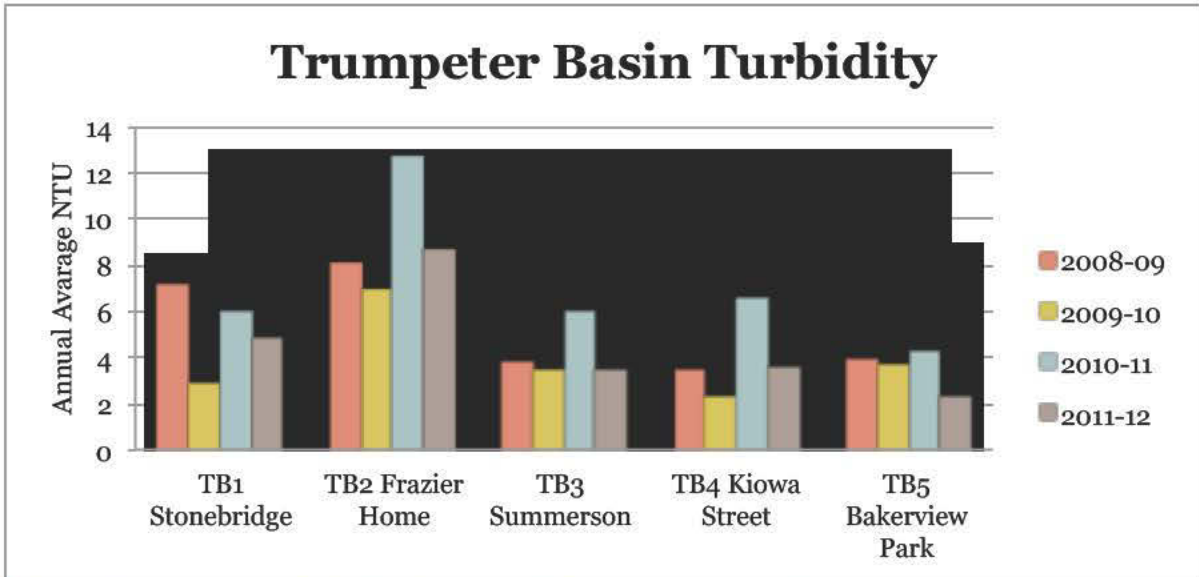


Figure 71. Trumpeter Basin Turbidity: Four year comparison

Sites 1-3 had extremely high spikes of fecal coliform during the sampling season. Site 2 had the most frequent spikes in numbers, with 7 out of 17 higher than 200 CFU/100ml. None of the sites passed the standard of <10% of counts under 200 CFU/100ml.

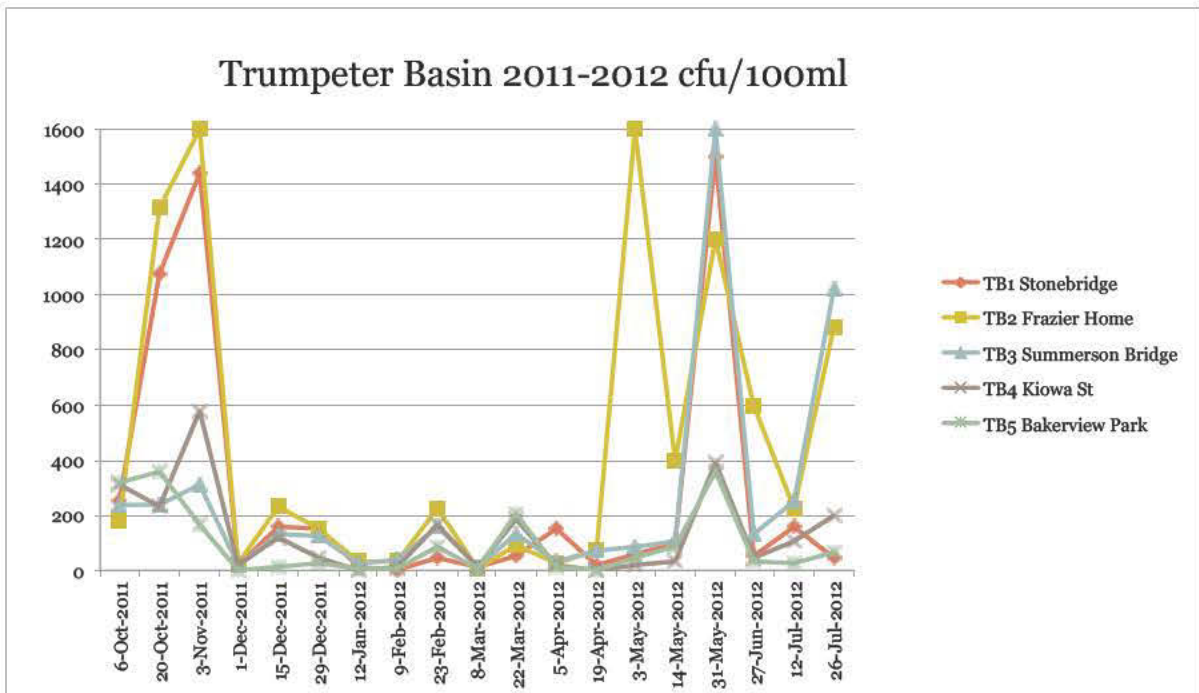


Figure 72. Trumpeter Basin Fecal Coliform: 2011-2012

Site 2 had much higher fecal coliform levels than the previous three years. Site 5 has shown a consistent improvement each year. Sites 1, 4, and 5 met Part I of the state standard: geomean of 100cfu/100ml.

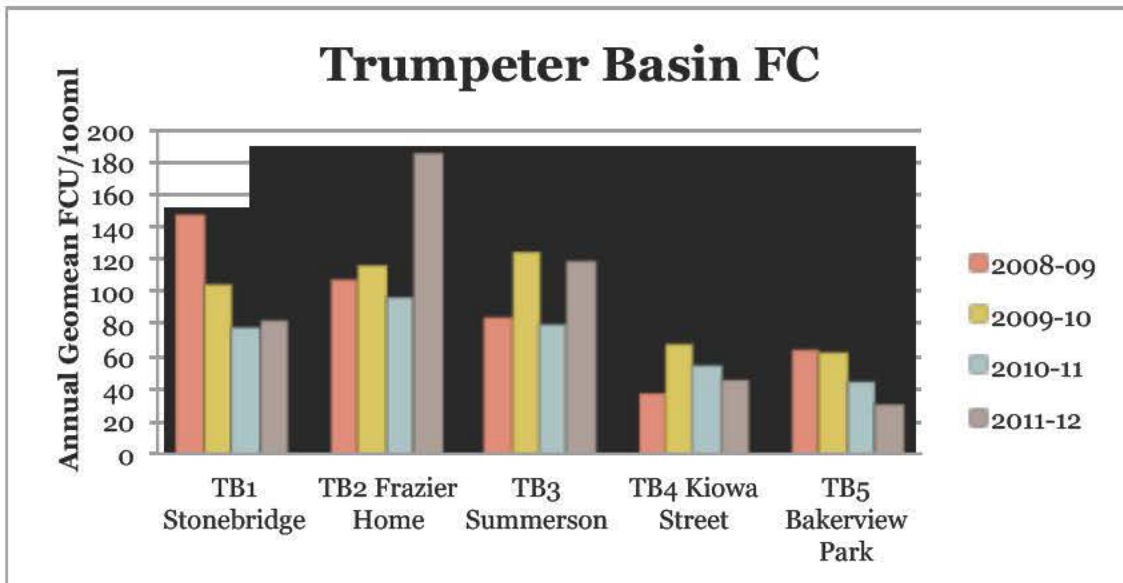


Figure 73. Trumpeter Basin Fecal Coliform: Four year comparison

Kulshan Creek Results

Figures 74 through 80 below present results from Kulshan Creek sampling.

Dissolved oxygen in all Kulshan Creek sites went below the state standard of 9.5mg/l during this sampling season. Site 3 was rarely above the standard.

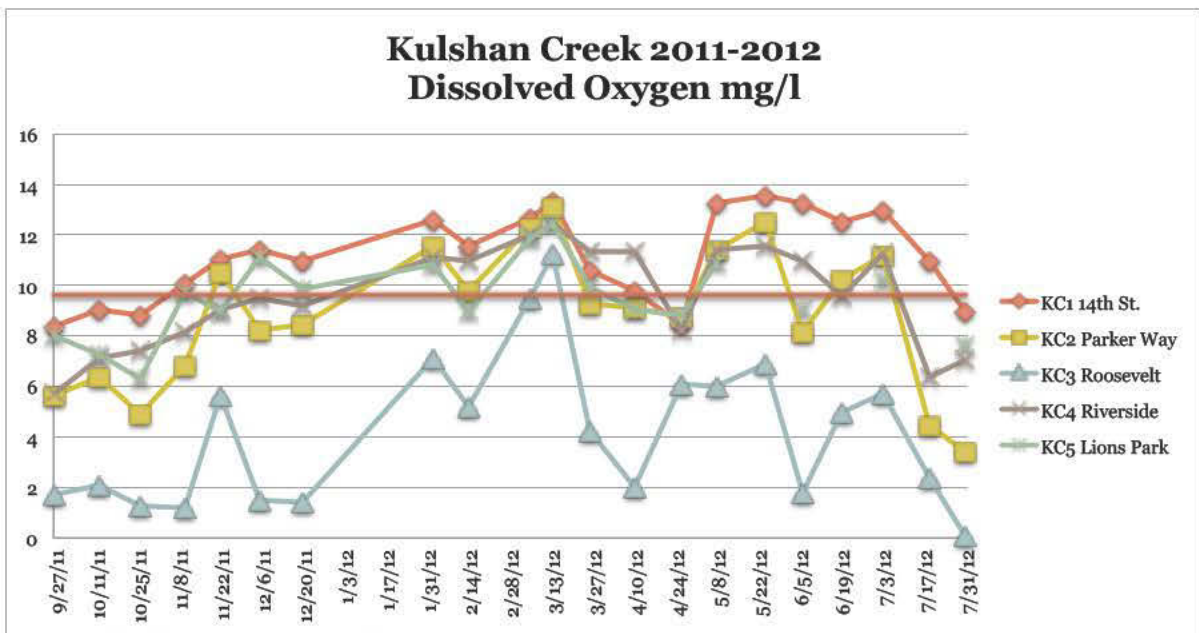


Figure 74. Kulshan Creek DO: 2011-2012

Dissolved oxygen levels for sites 1-3 improved over all previous years. The average DO at site 4 went down. Standards are not based on annual average measurements.

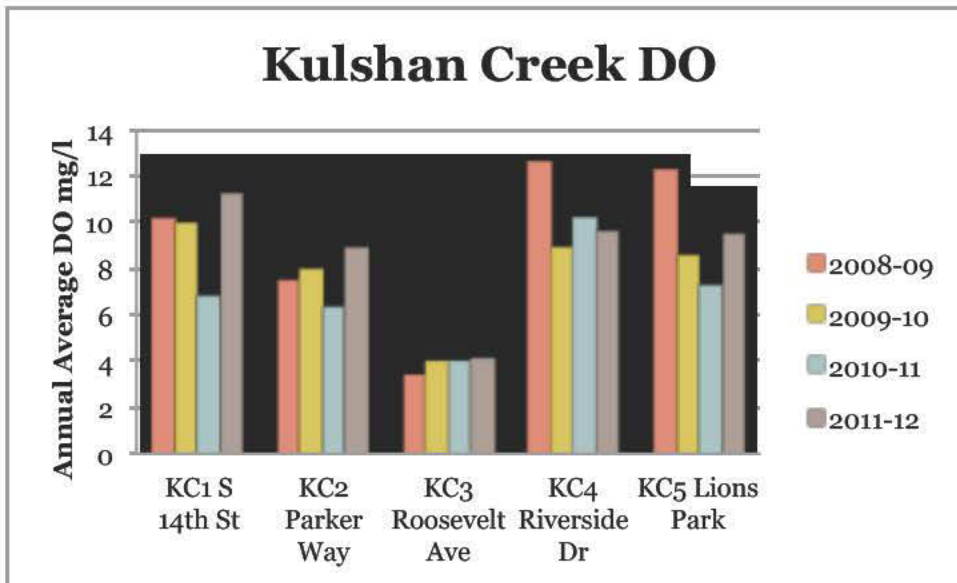


Figure 75. Kulshan Creek DO: Four year comparison

Sites 1 and 5 remained cooler than the maximum standard of 16° throughout the sampling season. Sites 2-4 were all above the standard in July.

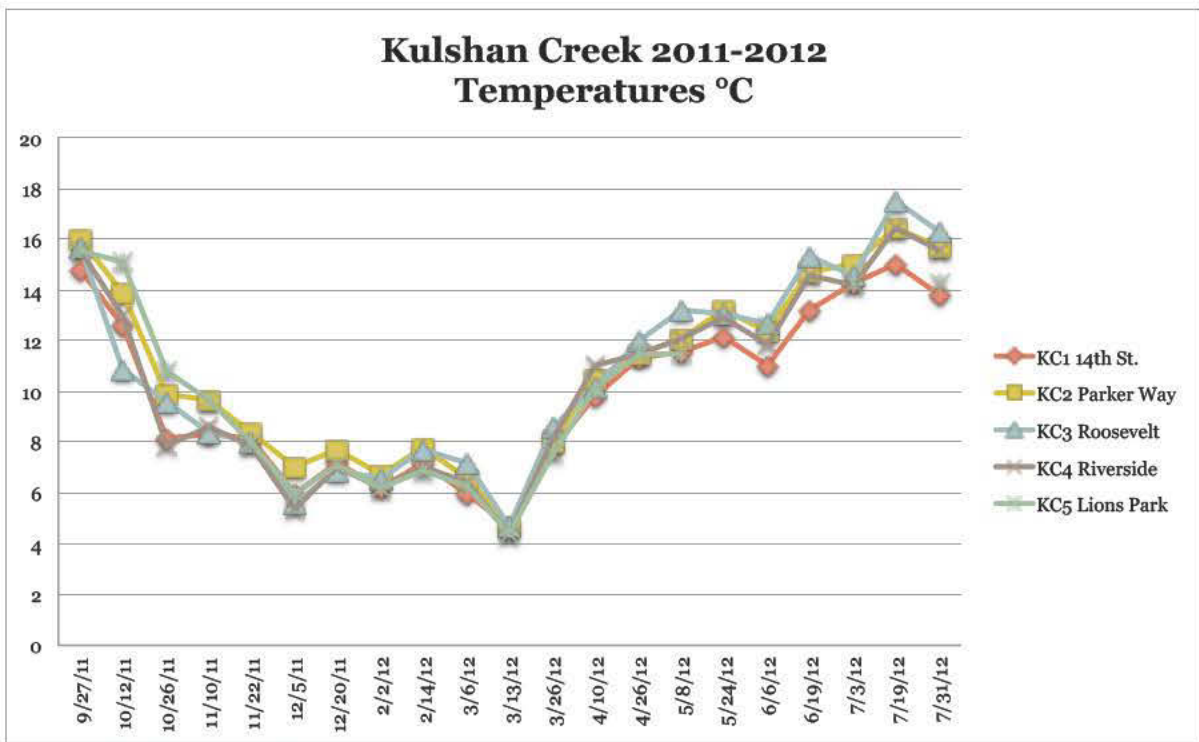


Figure 76. Kulshan Creek Temperature: 2011-2012

Kulshan Creek had consistent average temperatures among sites and among years: all around 10°C.

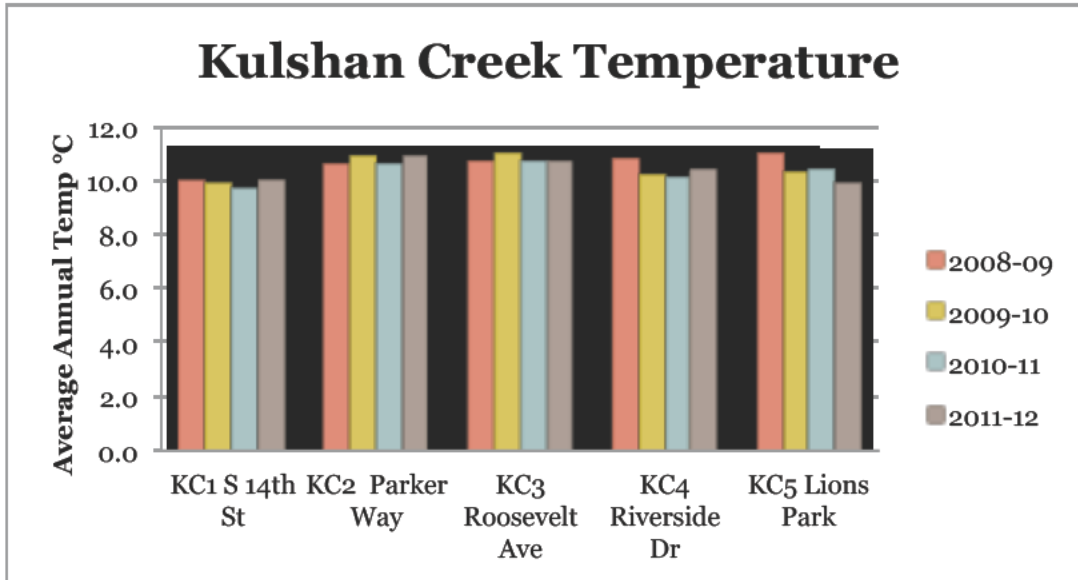


Figure 77. Kulshan Creek Temperature: Four year comparison

Turbidity in Kulshan Creek at all sites was lower than 2010-2011 and higher than 2009-2010. Site 3 continued to have the highest turbidity of the five sites.

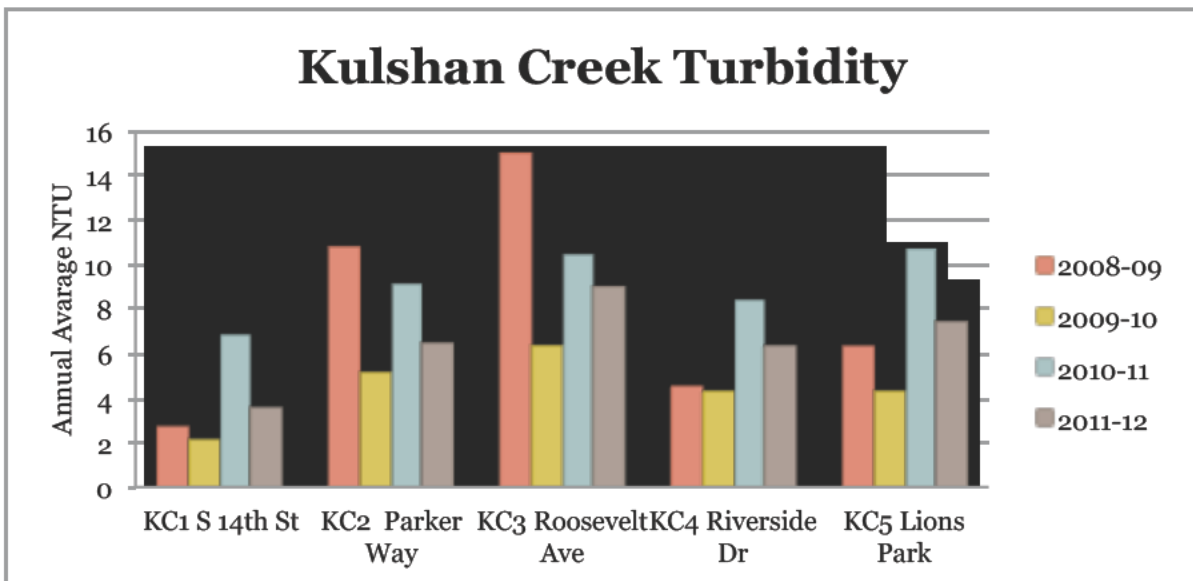


Figure 78. Kulshan Creek Turbidity: Four year comparison

Fecal coliform counts in Kulshan Creek were highly variable throughout the year. All sites had over 10% of the samples over 200 CFU/100ml. Site 1 had over 50% of the counts above 200 CFU/100ml.

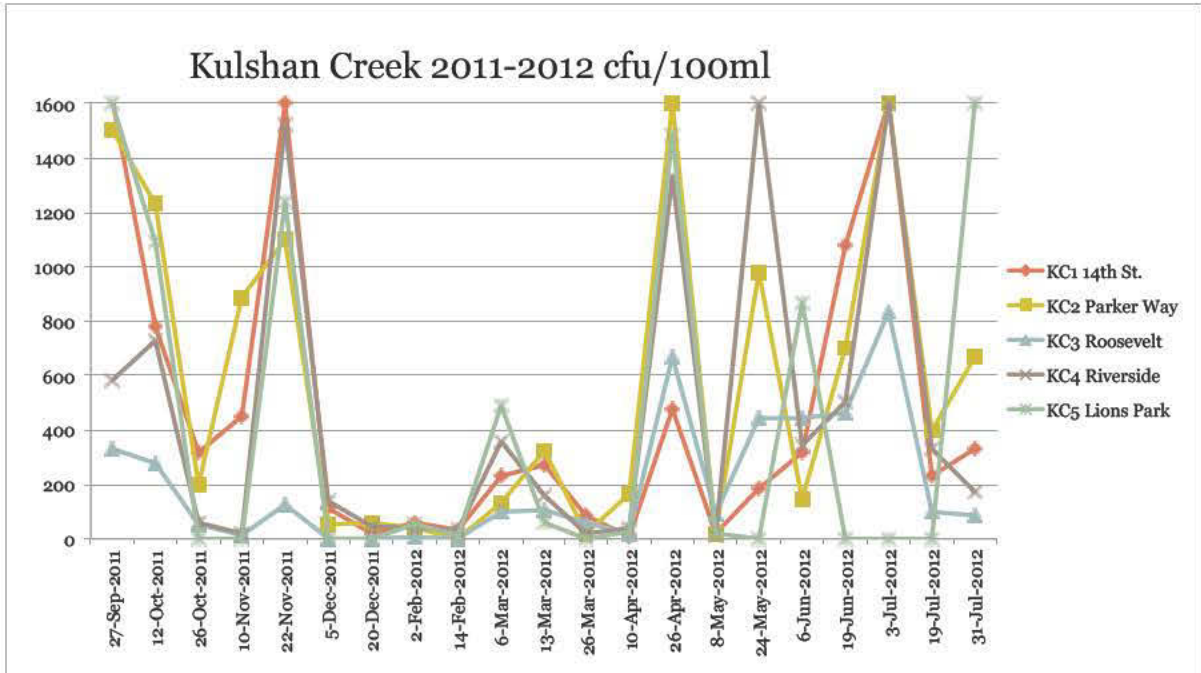


Figure 79. Kulshan Creek Fecal Coliform: 2011-2012

Sites 2 and 4 had the highest average fecal coliform levels in four years. As in all past years, sites 1, 2, and 4 had annual geometric means over the standard of 100 CFU/100ml.

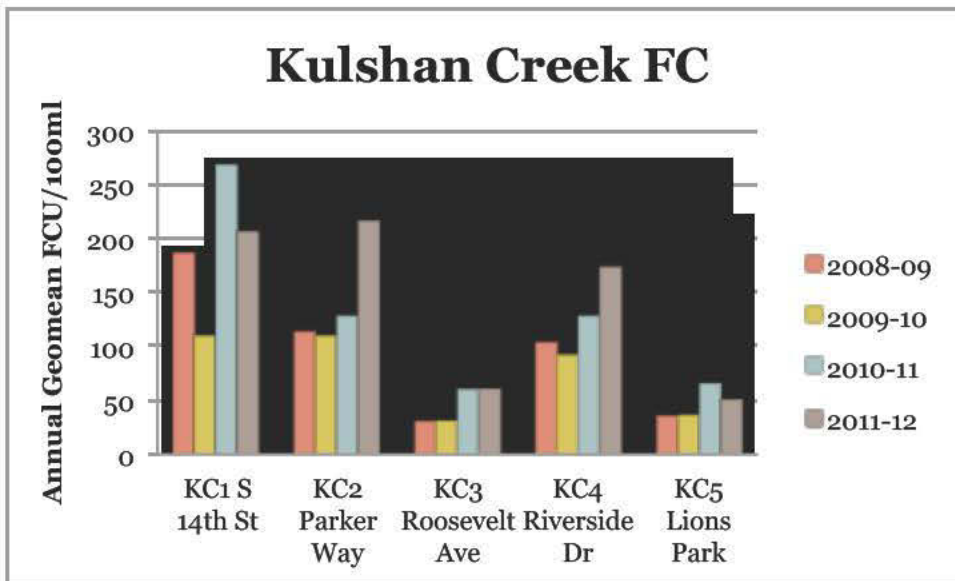


Figure 80. Kulshan Creek Fecal Coliform: Four year comparison

Clyde Creek Results

Figures 81 through 87 below present results from Clyde Creek sampling. Because this was the first year for sampling in Clyde Creek, there are no comparisons from past years.

Dissolved oxygen for Site 2 dropped below the standard in May. Other sites were above the standard throughout the sampling season.

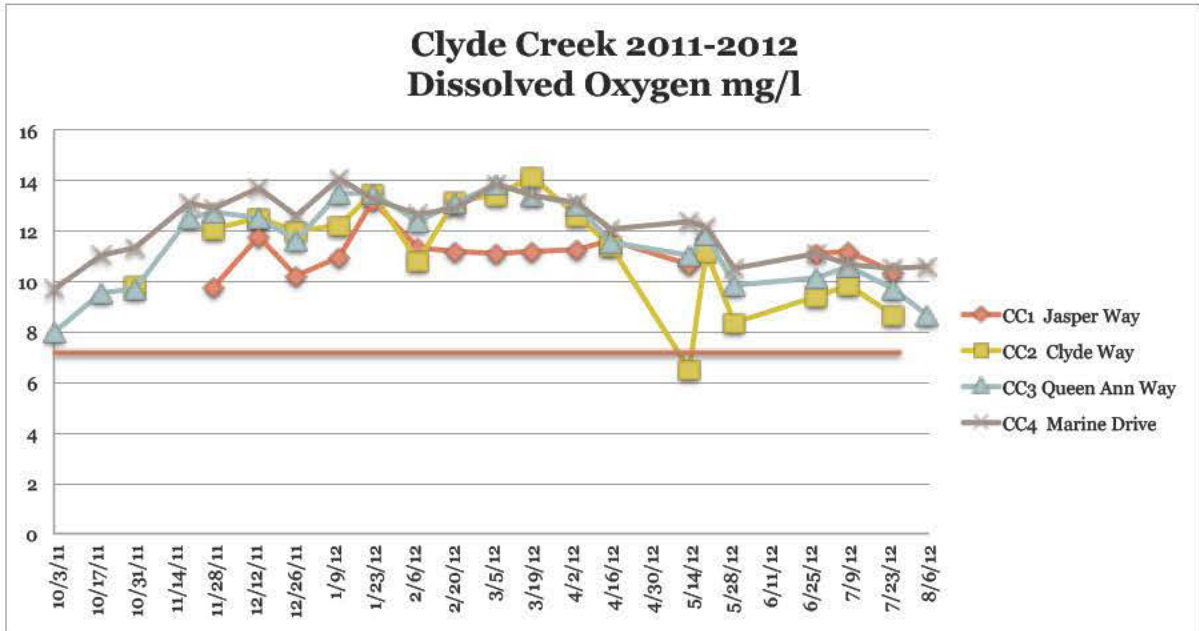


Figure 81. Clyde Creek DO: 2011-2012

Average dissolved oxygen levels increased slightly from top to bottom of the watershed. All were above 8mg/l. State standards for DO are not based on the annual average.

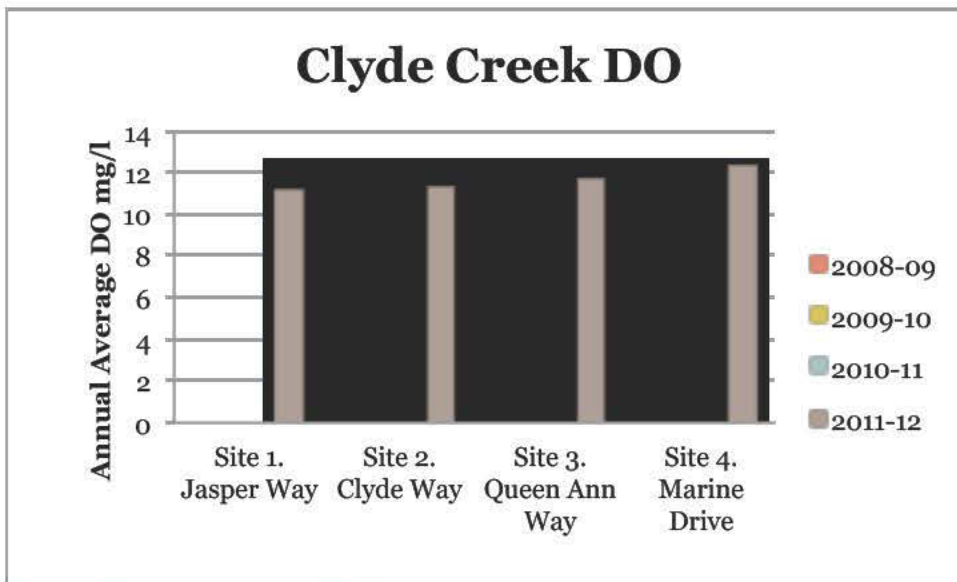


Figure 82. Clyde Creek DO: Annual average

Temperatures for all Clyde Creek samples were below the maximum level of 17.5°C.

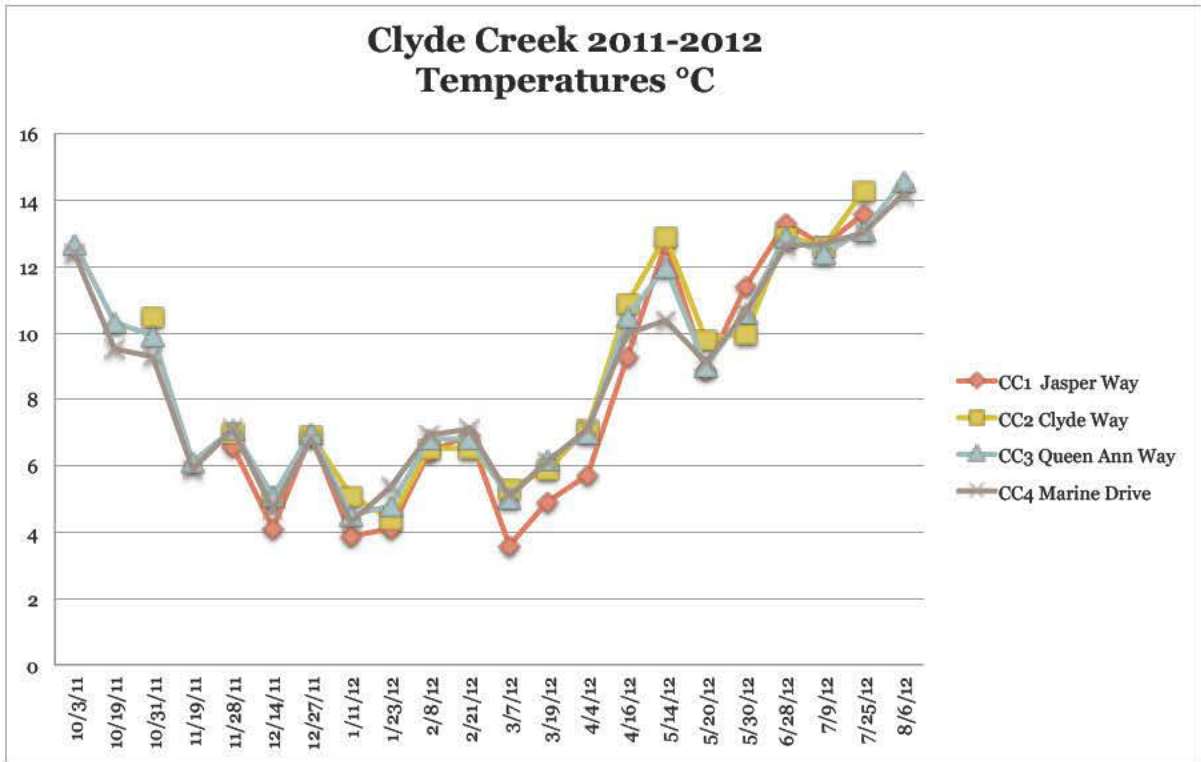


Figure 83. Clyde Creek Temperature: 2011-2012

Average annual temperatures at all sites were much cooler than the standard of 16°C. State standards are not based on the annual averages.

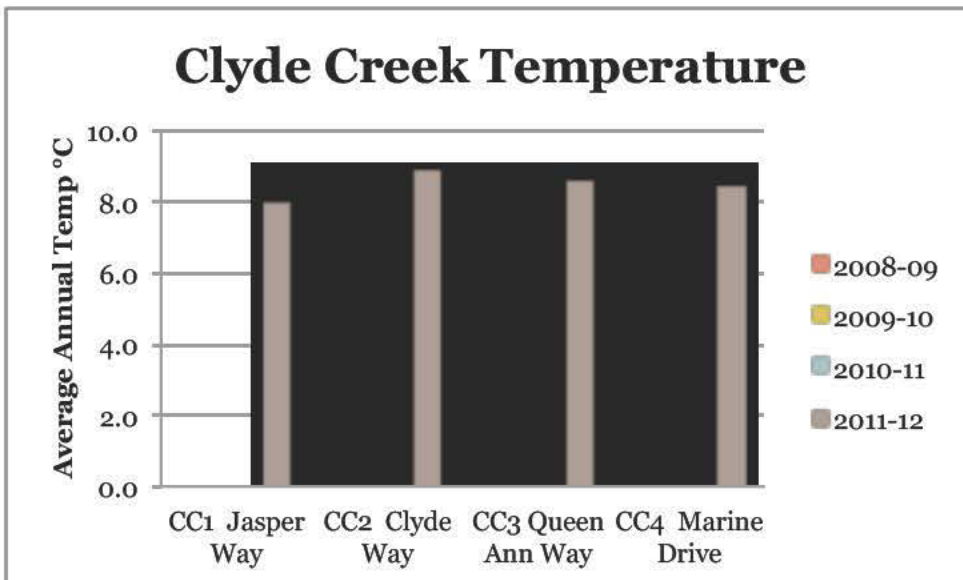


Figure 84. Clyde Creek Temperature: Annual average

Turbidity was highest at site 1 and lowest at site 3 for Clyde Creek.

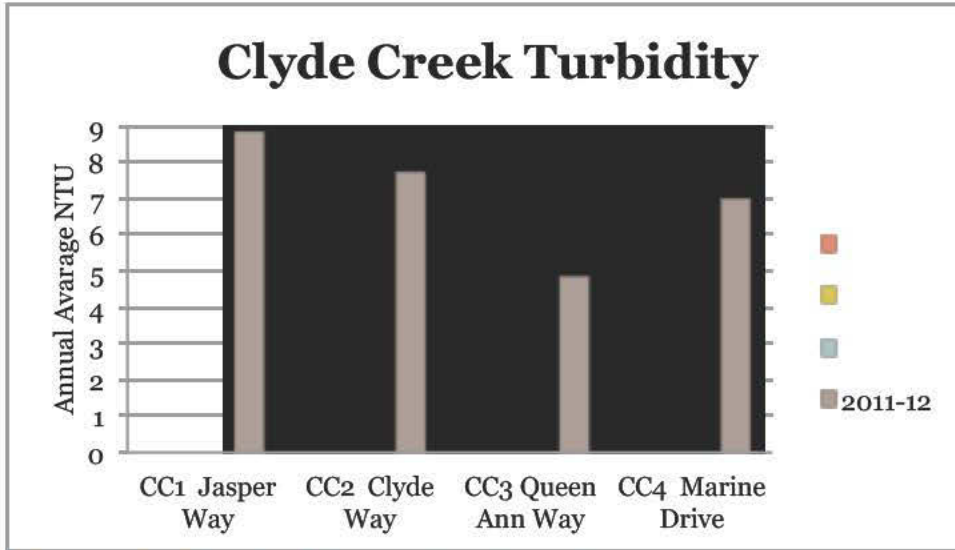


Figure 85. Clyde Creek Turbidity: Annual average

Fecal coliform in Clyde was variable, with high numbers at some point for each site. Sites 1, 3, and 4 met Part II of the standard, with fewer than 10% of the counts higher than 200 cfu/100ml.

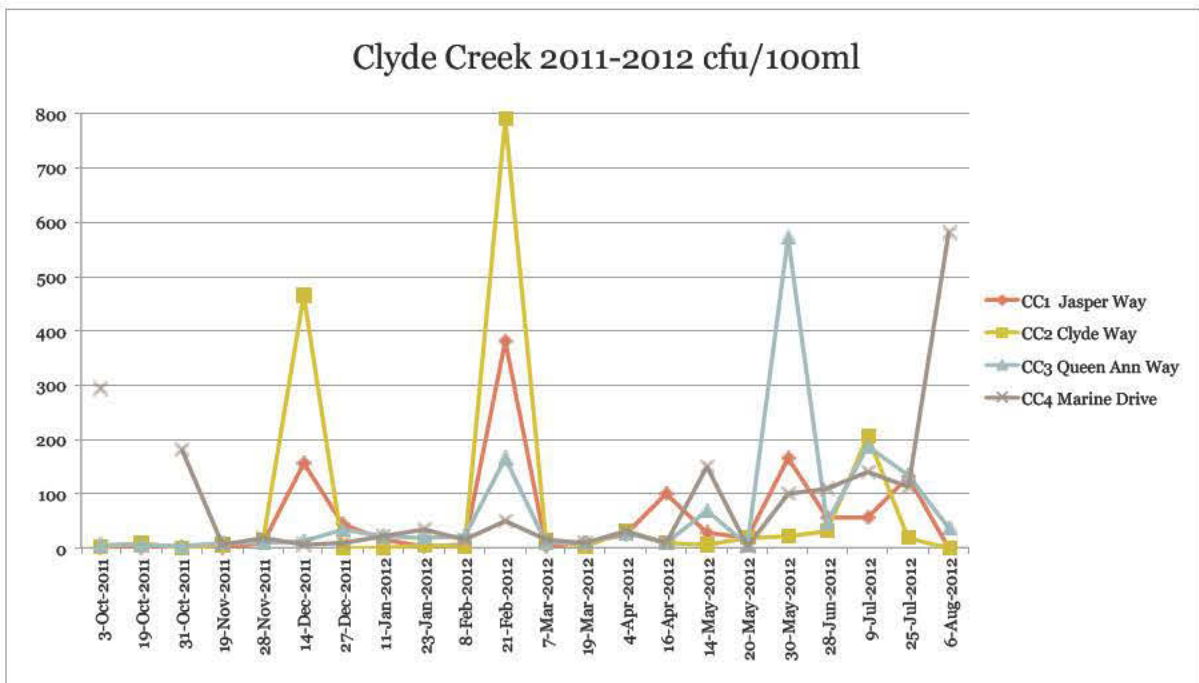


Figure 86. Clyde Creek Fecal Coliform: 2011-2012

Geometric means (Figure 87) for all Clyde Creek sites were lower than the 100 cfu/100ml standard.

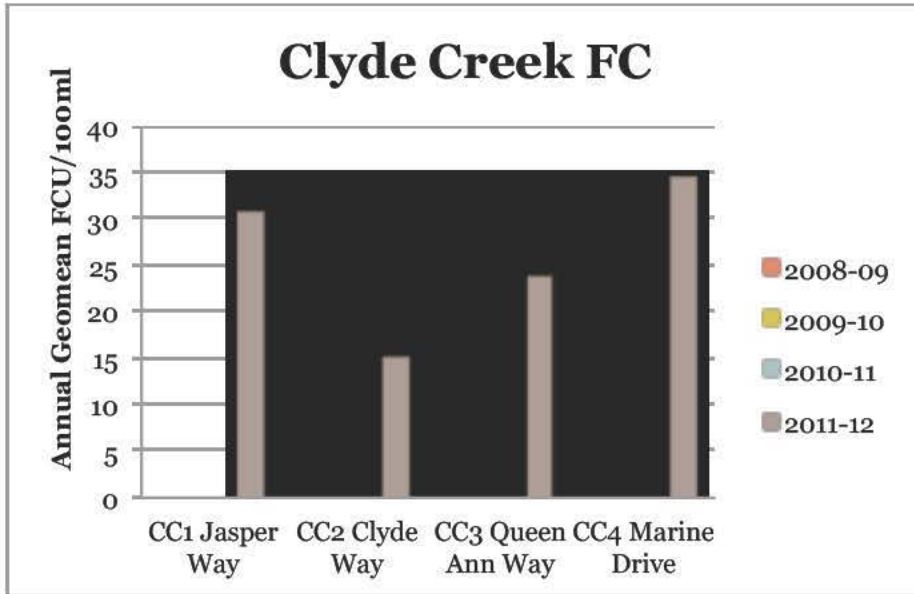


Figure 87. Clyde Creek Fecal Coliform: 2011-2012

Gages Slough Results

Figures 88 through 94 below present results from Gages Slough sampling.

Dissolved oxygen at all Gages Slough sites was below the standard in the fall and spring. Water levels are very low and slow-moving in the summer and early fall, which may cause the very low dissolved oxygen levels.

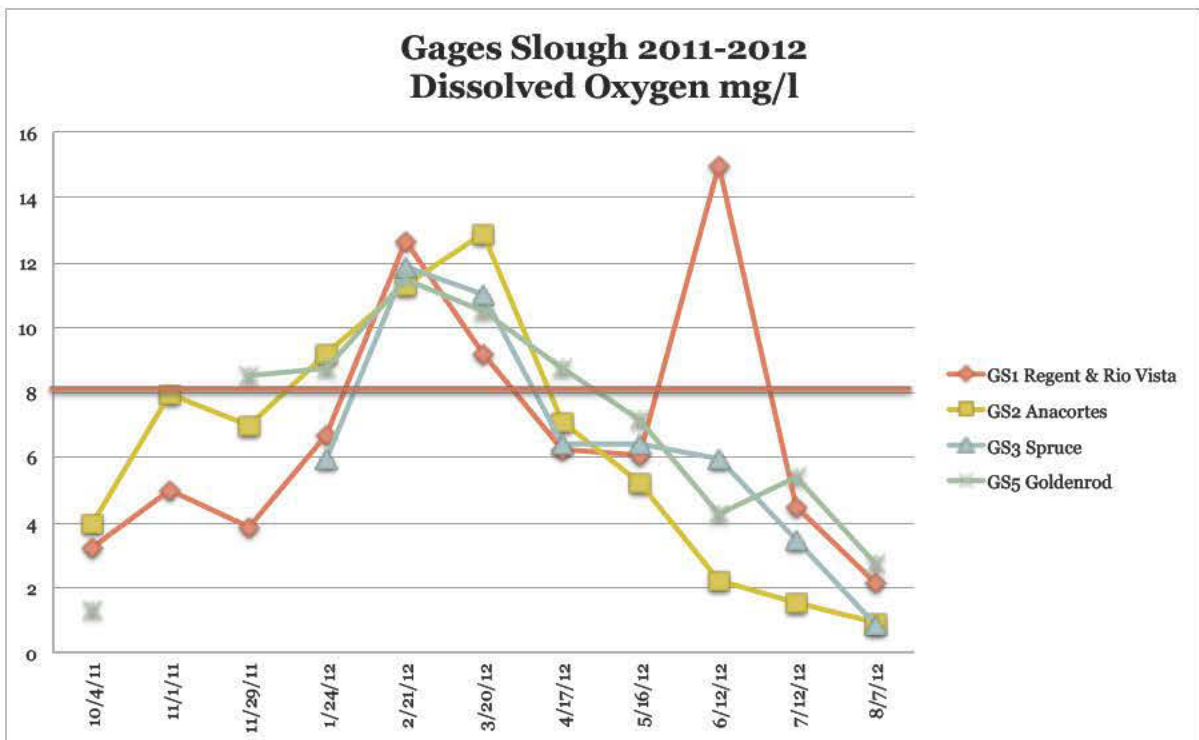


Figure 88. Gages Slough DO: 2011-2012

Average dissolved oxygen levels were lower in 2011-2012 than last year. Sites 4 and 6 are no longer being sampled. State standards are not based on annual averages.

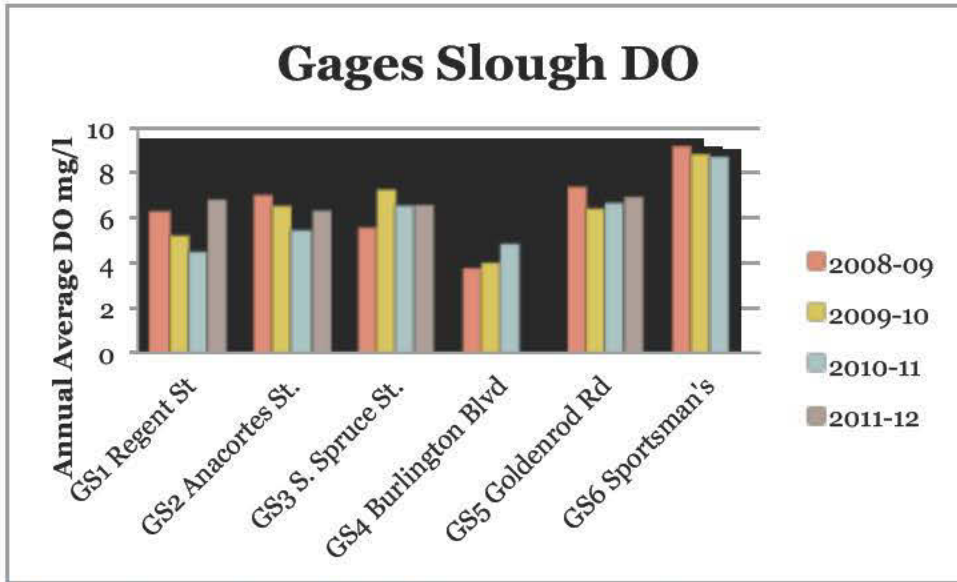


Figure 89. Gages Slough DO: Four year comparison

Gages Slough Sites 2 and 3 were warmer than 17.5°C once during the season. Other sites remained below the standard.

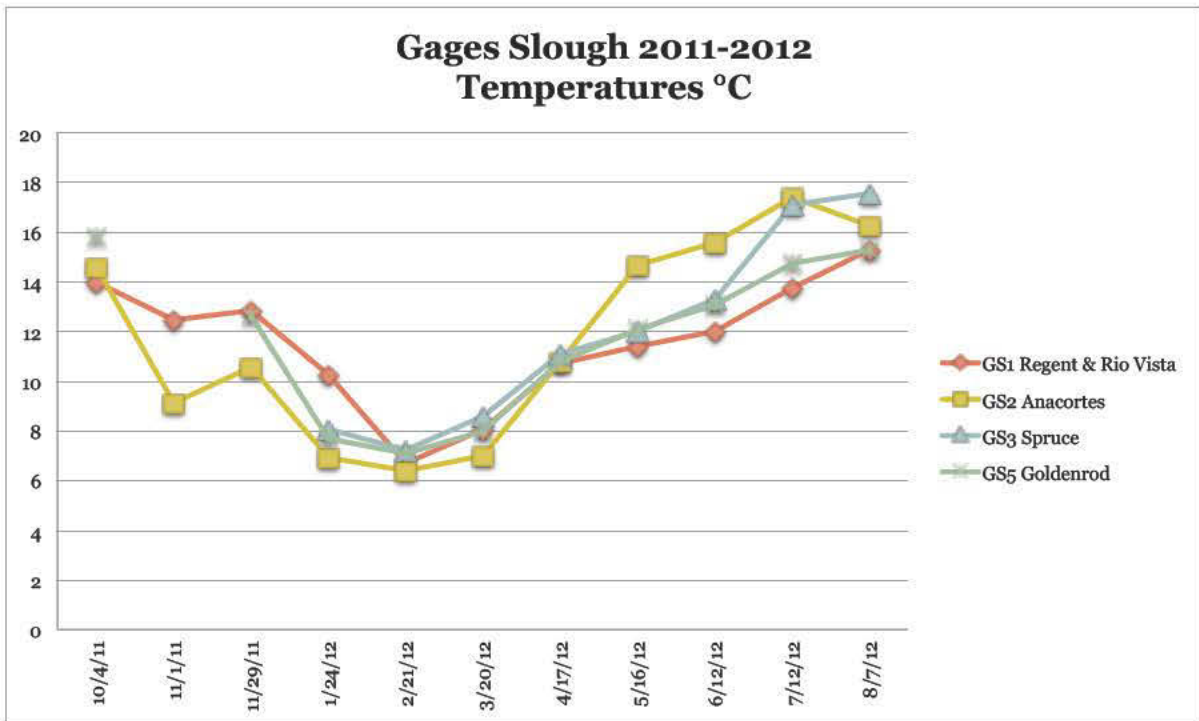


Figure 90. Gages Slough Temperature: 2011-2012

Averages temperatures in Gages Slough were much the same as past years, with little difference among sites. The state standard is not based on average temperature.

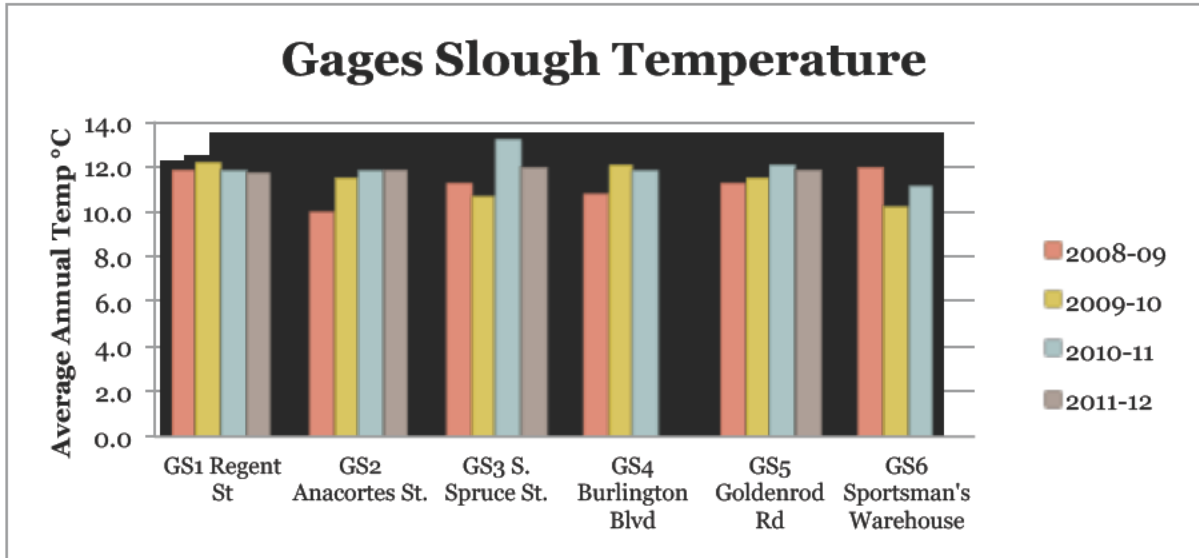


Figure 91. Gages Slough Temperature: Four year comparison

Turbidity levels in Gages Slough were much higher at site 2 in 2011-2012. Other sites were similar or lower than previous years.

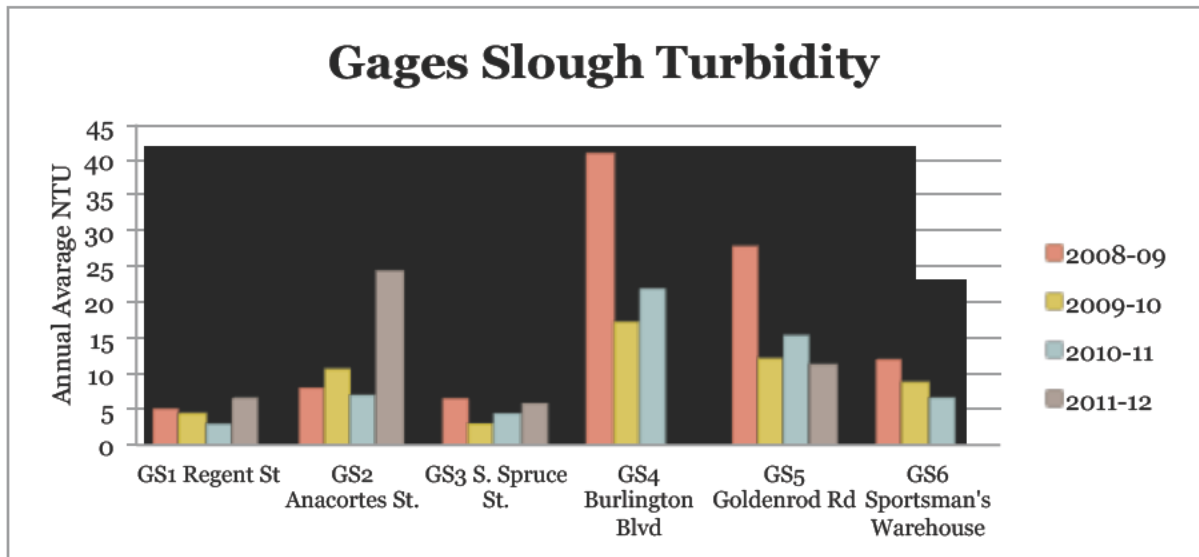


Figure 92. Gages Slough Turbidity: Four year comparison

Fecal coliform numbers (Figure 93 below) were sometimes very high for sites 1-3. Sites 2 and 4 met Part II of the state standard with fewer than 10% of the samples <200cfu/100 ml.

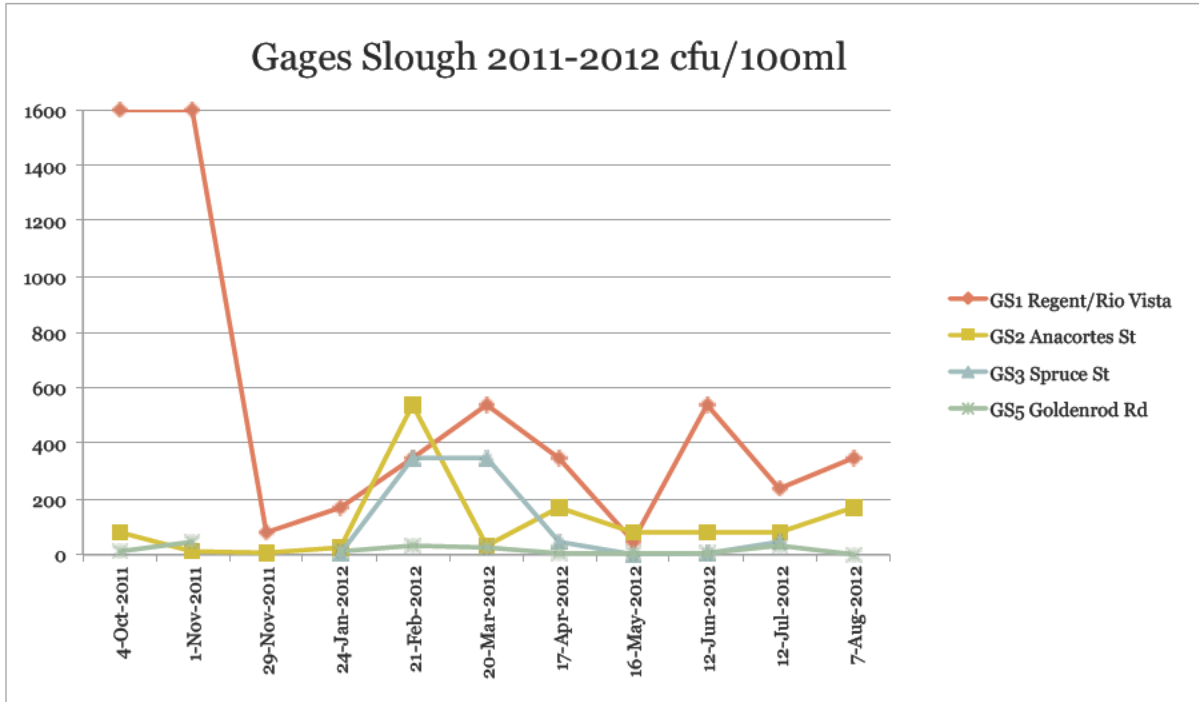


Figure 93. Gages Slough Fecal Coliform: 2011-2012

Compared to last year, Gages Slough had lower fecal coliform levels. Site 1 is still many times higher than other sites, and is the second highest site of all 50 Stream Team sites. Sites 2-4 met Part I of the standard with annual geomean less than 100cfu/ 100ml.

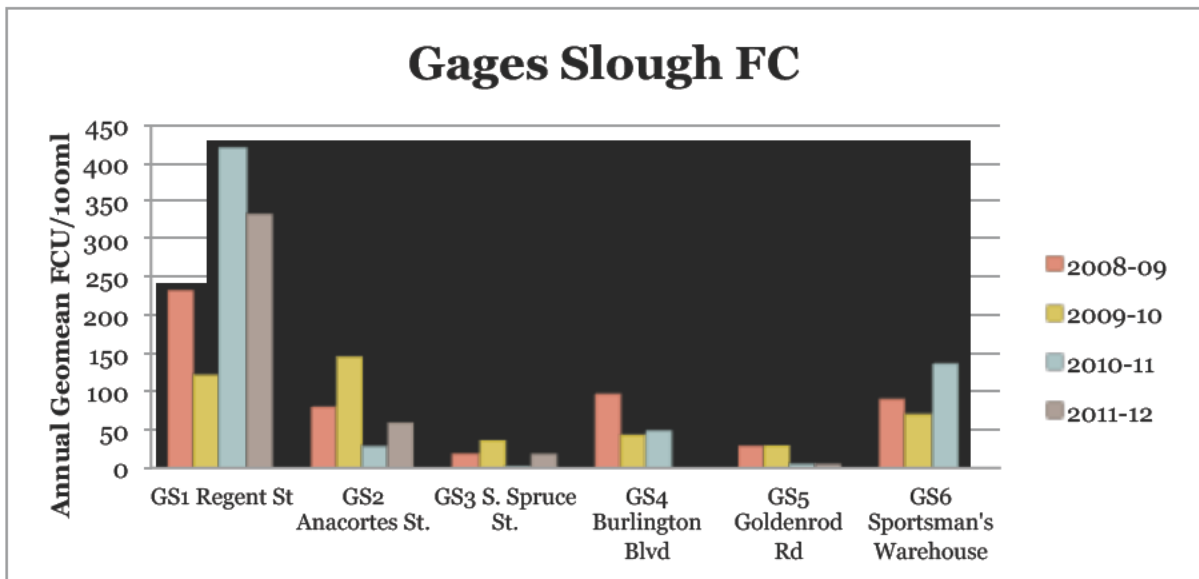


Figure 94. Gages Slough Fecal Coliform: Four year comparison

Storm Team Results

Bay View/No Name Storm Team volunteers sampled 19 sites on Bay View Ridge draining to Padilla Bay. Three sites from 2010-2011 were eliminated, and three new sites were added. Volunteers sampled during 11 rain events.

As seen in Figure 95 below, all Bay View sites experienced high numbers of fecal coliform bacteria during rain events, often higher than the upper test limit of 1600 CFU/100ml. Even sites with the lowest counts were sometimes many times the first part of the standard (100 cfu/100ml). BV2, the ditch just south of Bay View State Park has lowest levels overall.

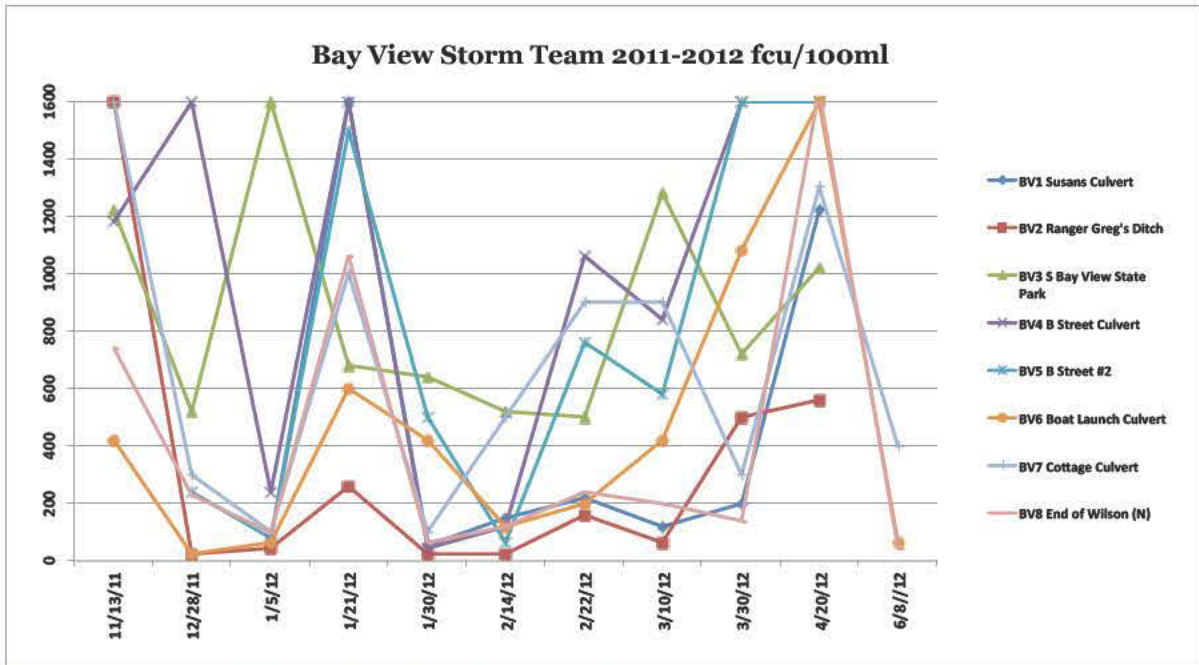


Figure 95. Storm Team: Bay View Fecal Coliform

Figures 96 and 97 below present fecal coliform results for No Name Creek and No Name Slough sites during rain events. All sites had very high counts during most of the sampling events. NN10, NN14, and NN18 had the lowest counts.

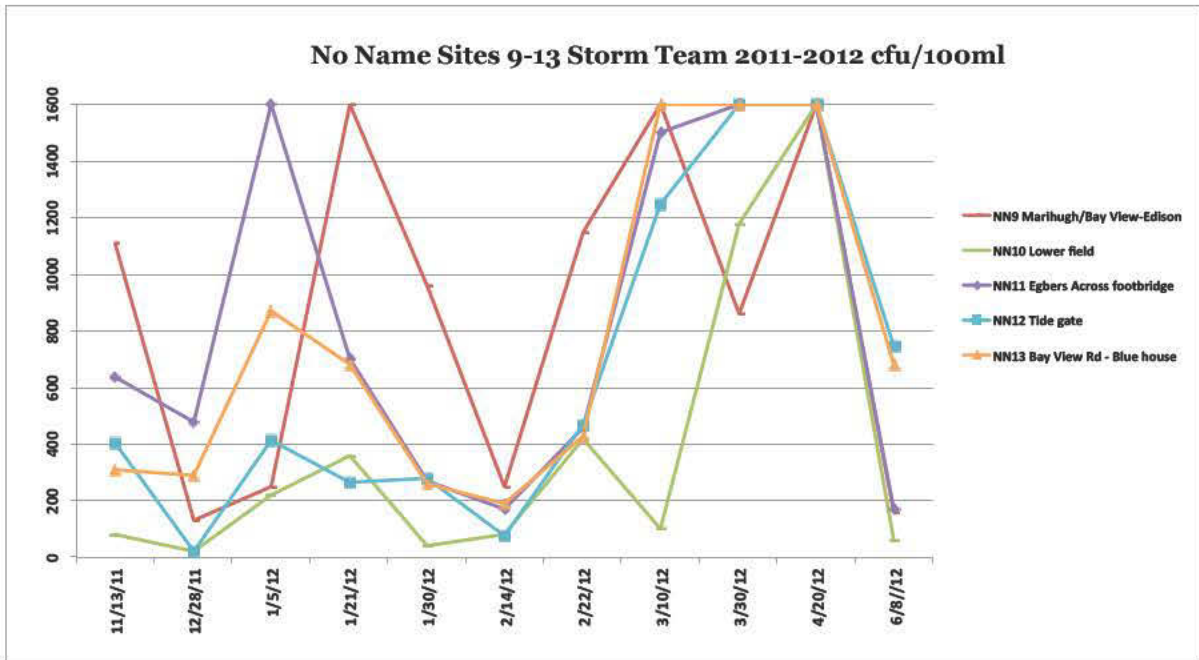


Figure 96. Storm Team: No Name Sites 8-13 Fecal Coliform

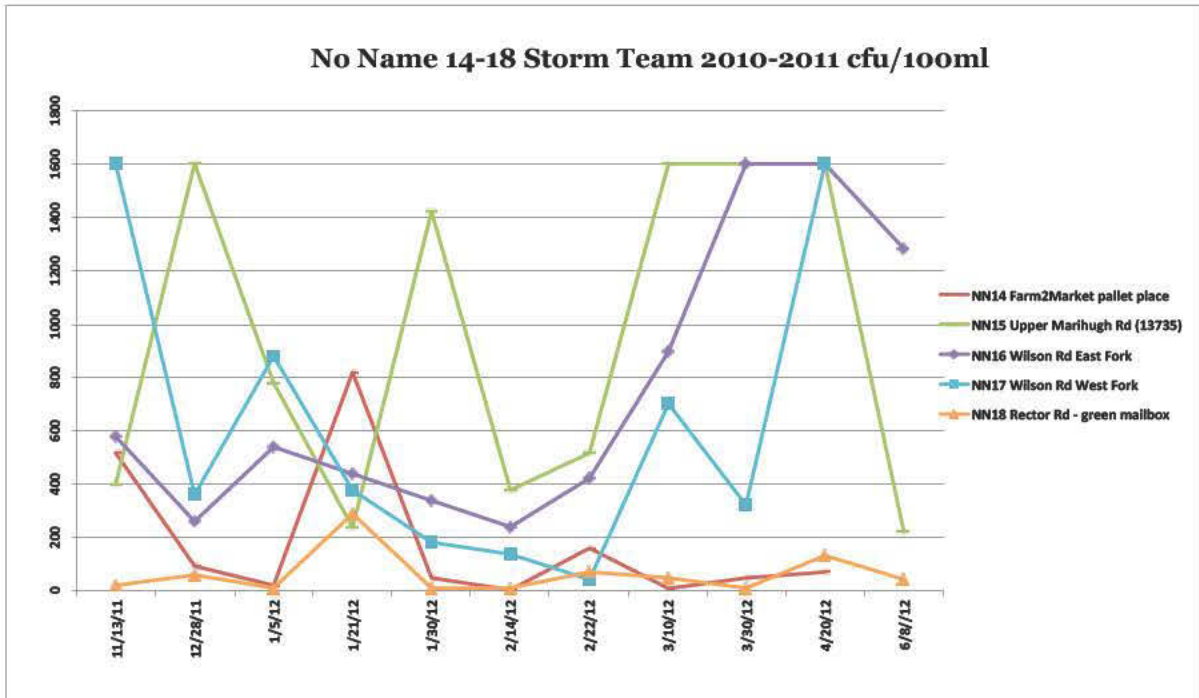


Figure 97. Storm Team: No Name Sites 14-18 Fecal Coliform

The geometric mean for each Storm Team site is presented in Figure 98 below. Some sites are not labeled by number because site IDs changed from 2010-2011. NN14, Farm2Market Pallet Place and NN19, Rector-Green Mailbox met the first part of the standard (100 cfu/100ml). Though all other sites exceed the first part of the standard (100 cfu/100ml), it is important to note that this does not represent the overall annual average for the sites. This

study only presents the very highest levels of fecal coliform during periods of high runoff. It should not be compared to regularly scheduled Stream Team measurements taken during all seasons and levels of runoff.

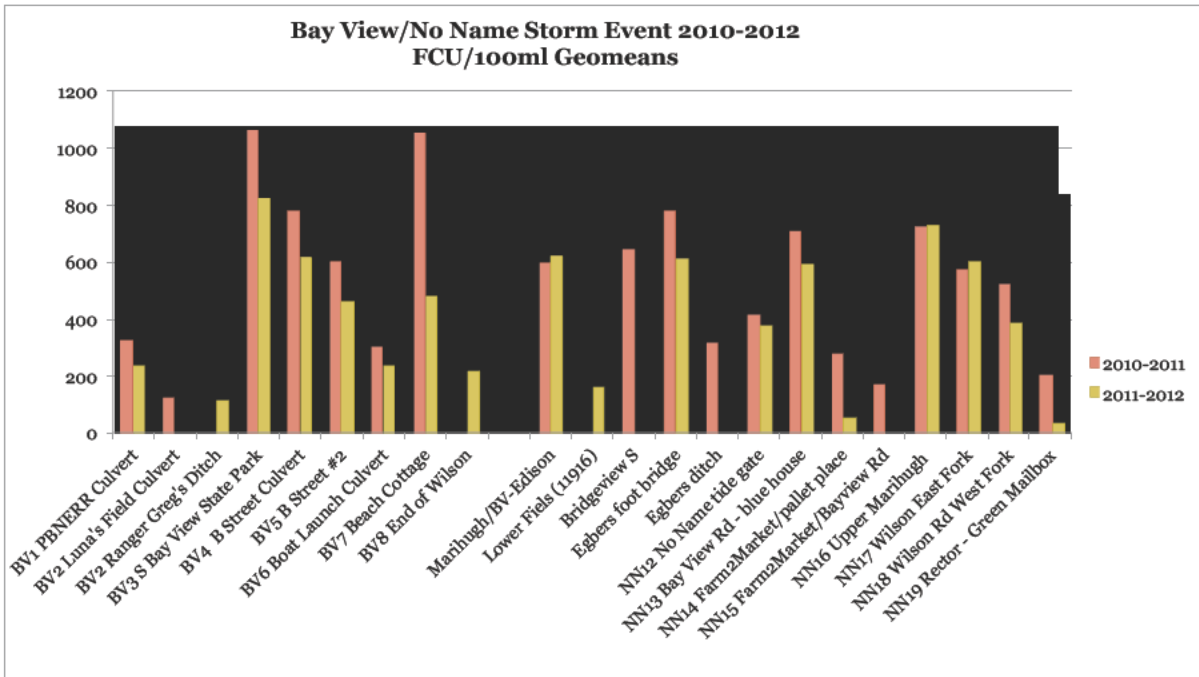


Figure 98. Storm Team: All Sites, Fecal Coliform Geometric Means

One site, BV7 showed marked improvement from 2010-2011—decreasing by more than 50%. Though nearly all sites had lower levels of fecal coliform than the previous year, 2011-2012 numbers are still unacceptably high. It is clear that high levels of fecal coliform are entering Padilla Bay from both No Name Slough and from ditches and culverts draining the town of Bay View. These data should prove useful to regulators with WA Department of Ecology and Skagit County as they begin to address this problem.

I. Summary

Figures 99-102 below show annual averages for all parameters at each site. While it is interesting to compare watersheds, it is important to note that each water body has unique characteristics that naturally influence water quality. Variation is normal, and what might be considered “healthy” for water backed up behind a tide gate might not be healthy for a small wooded stream in the Upper Nookachamps.

For dissolved oxygen, a number of sites in Figure 99 have annual averages below 8mg/l. Considering regulations do not allow even one occurrence of levels below the standard, it is clear that these sites are in need of attention.

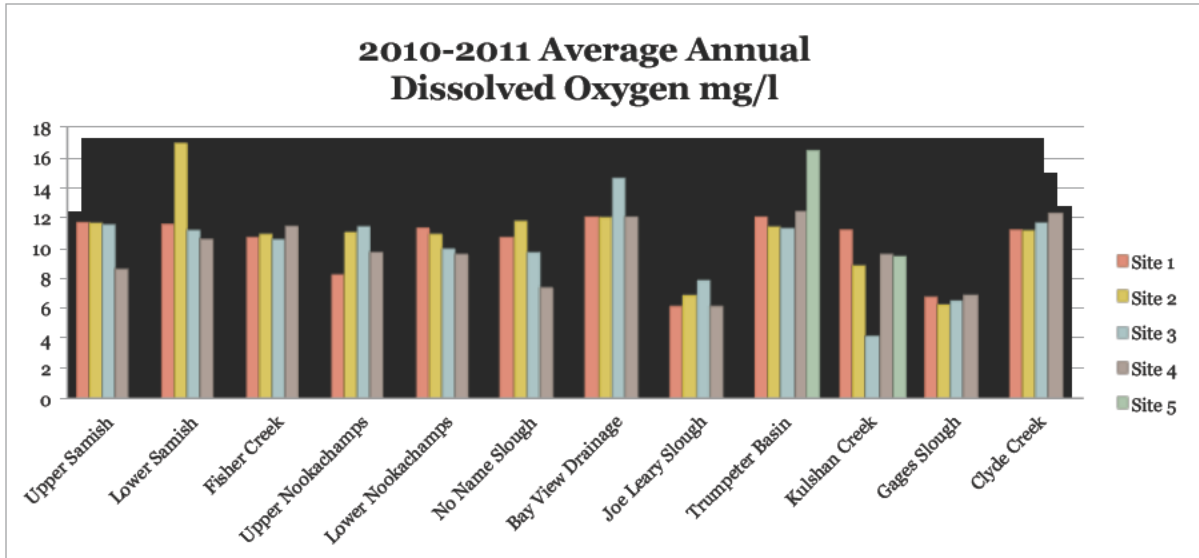


Figure 99. Annual Average Dissolved Oxygen: All sites

In Figure 100, measurements in many watersheds show increasing temperatures at sites farther downstream. Slow moving, urban streams like Gages Slough have higher temperatures than rural, shaded streams like the Nookachamps or Fisher Creek. Gages Slough, Joe Leary Slough, and Kulshan Creek stand out with the warmest water in the Stream Team study area.

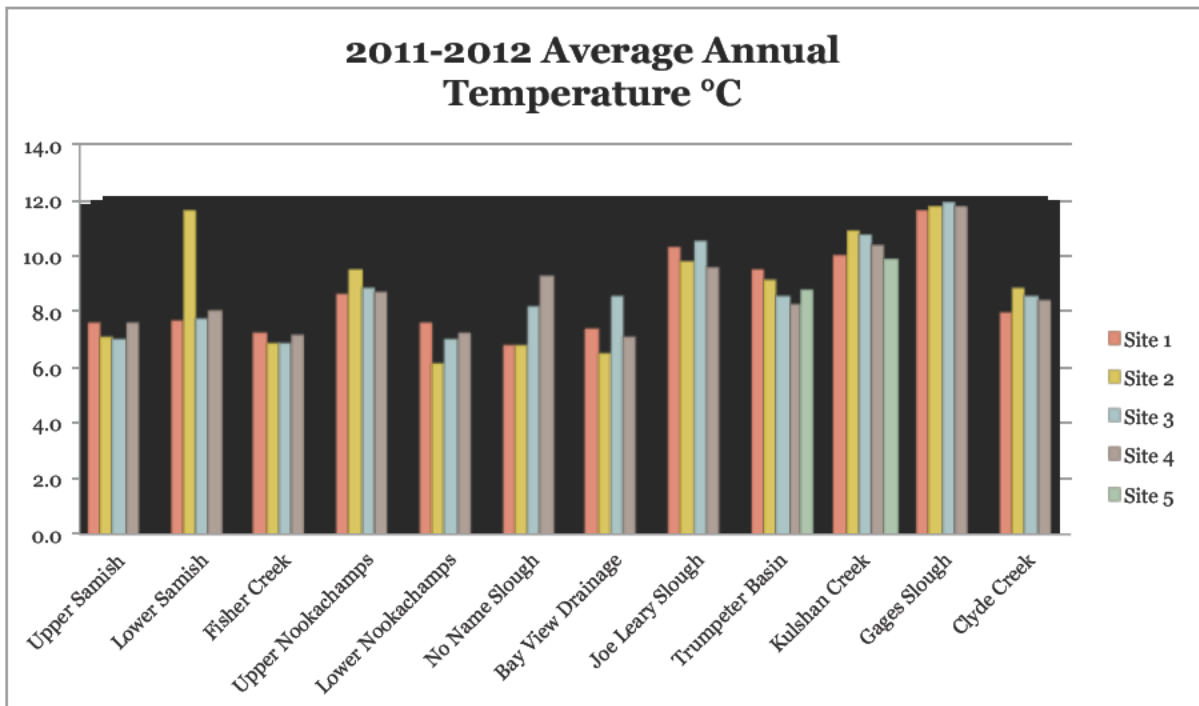


Figure 100. Annual Average Temperature: All sites

While turbidity may be the parameter with the greatest naturally occurring variation, Joe Leary Slough sites 2 and 3 stand out. Along much of its course, it drains cultivated cropland and is periodically dredged to improve drainage.

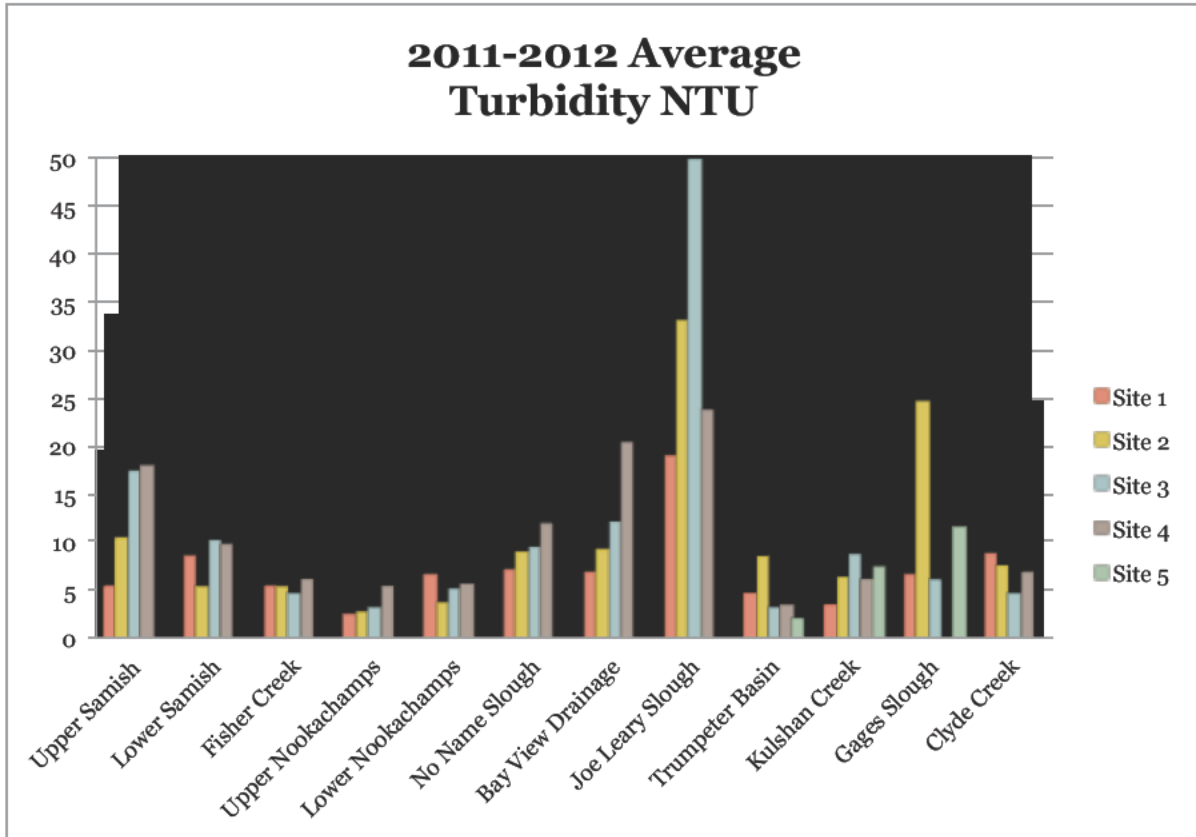


Figure 101. Annual Average Turbidity: All sites

Fecal coliform shown in Figure 102 below is the parameter of greatest interest to regulators, health officials, and shellfish growers and harvesters. Sites in Upper Samish, Upper and Lower Nookachamps, No Name Slough, Joe Leary Slough, Trumpeter Basin, Kulshan Creek, and Gages Slough did not meet the first part of the standard (100 cfu/100ml) for fecal coliform. And as discussed earlier, many sites whose annual averages sit comfortably below the 100 cfu/100ml line below did not meet the second requirement that no more than 10% of the counts can be higher than 200 cfu/100ml. The following sites met both parts of the state standard: Upper Nookachamps sites 1 and 2, Lower Nookachamps sites 2 and 4, Joe Leary Slough site 3, Clyde Creek sites 1, 3 and 4, Gages Slough sites 2 and 4. That represents 10 sites out of the 50 stream team sites.

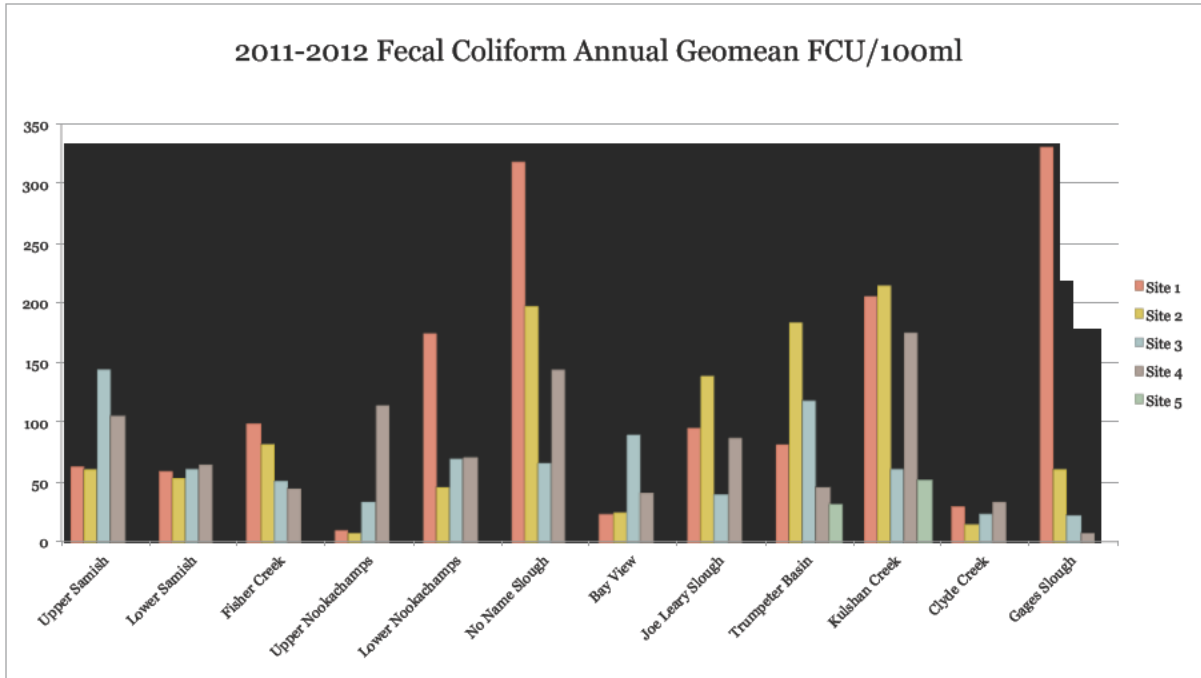


Figure 102. Fecal Coliform Annual Geomean: All sites

VI Conclusion

The 2011-2012 Stream Team volunteers built upon the success of previous years, and provided a fourteenth year of WQ data for Skagit County's priority watersheds. This year saw the addition of Clyde Creek in Anacortes, and continuation of fearless Storm Team sampling of Bay View and No Name drainages during heavy rain events.

Over 70 adult volunteers were exposed to a firsthand view of the impact that non-point source pollution has on local water quality. Along the way they experienced sampling techniques used by environmental professionals, learned the importance of establishing a long-term, routine sampling program, and enriched their own lives through volunteering.

Thanks to over 1000 volunteer hours, this program has provided valuable data to citizens and agencies, assessing current conditions so water quality improvements can be made, and documented in the future. This is key data for the long-term protection of our water resources. We hope that our data is useful in identifying trends, improvements, and problem areas for the attention of the appropriate agencies.

Appendix A - Data

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
NO NAME SLOUGH						
NN1 Marihugh Road	Average/Geomean	6.81	7.31	89.60	10.7	318
no data	10/1/11	-	-	-	-	-
no data	10/15/11	-	-	-	-	-
-	10/29/11	9.30	5.75	88.10	9.36	690
-	11/12/11	6.30	8.30	66.50	8.18	750
-	11/26/11	6.70	4.60	125.30	15.50	540
-	12/10/11	-	5.90	-	-	55
-	12/23/11	5.60	6.83	76.30	9.53	460
-	1/12/12	1.80	6.39	90.50	12.60	650
-	1/21/12	3.80	20.70	100.10	13.14	610
-	2/7/12	4.50	6.02	96.60	12.50	75
-	2/18/12	5.40	11.20	98.00	12.26	940
-	3/17/12	5.60	8.90	106.50	13.40	465
-	4/14/12	8.90	8.80	116.30	13.51	20
-	5/3/12	10.00	9.75	90.60	10.31	650
-	5/12/12	9.70	4.30	86.00	9.72	270
-	5/25/12	12.00	3.37	60.70	6.70	255
-	6/9/12	10.70	5.35	72.60	8.10	85
-	6/23/12	13.80	14.30	94.20	10.01	1600
NN2 Bay View Road	Average/Geomean	6.80	9.08	95.54	11.74	197
no data	10/1/11	-	-	-	-	-
no data	10/15/11	-	-	-	-	-
-	10/29/11	7.70	10.83	102.50	12.30	390
-	11/12/11	5.90	9.40	103.80	13.06	505
-	11/26/11	6.90	4.30	150.50	17.83	20
-	12/10/11	2.00	9.60	83.40	11.50	60
-	12/23/2011	4.10	3.00	93.20	12.17	30
-	1/12/12	1.30	8.57	97.40	13.60	260
-	1/21/10	3.50	24.00	99.00	13.14	445
-	2/7/12	4.90	7.10	95.60	12.27	435
-	2/18/12	5.30	12.70	97.40	12.32	770
-	3/17/12	5.60	9.00	108.90	13.69	235
-	4/14/12	7.60	7.10	70.50	8.49	40
-	5/3/12	9.90	10.80	90.60	10.23	300
-	5/12/12	8.50	5.40	83.30	9.73	175
-	5/25/12	12.00	4.35	78.50	8.70	310
-	6/9/12	10.30	3.59	76.80	8.75	75
-	6/23/12	13.30	15.60	97.20	10.05	1600
NN3 Egbers Field	Average/Geomean	8.17	9.70	81.33	9.74	66
-	10/1/11	12.20	9.39	78.20	8.33	12
-	10/15/11	7.10	6.30	70.10	8.30	41
-	10/29/11	8.10	3.40	86.00	10.09	113
-	11/12/11	6.40	9.50	74.50	9.28	489
-	11/26/11	6.60	7.50	98.10	11.99	36

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
NN3 Egbers Field	12/10/11	3.10	5.90	64.30	9.11	176
-	12/23/11	6.30	3.51	90.40	11.74	5
-	1/12/12	2.40	9.22	85.70	11.70	20
-	1/21/12	3.20	29.70	95.70	12.82	703
-	2/7/12	5.20	10.59	90.80	11.51	12
-	2/18/12	5.50	17.10	93.00	11.70	721
-	3/17/12	6.00	11.90	100.00	12.30	176
-	4/14/12	9.50	10.00	60.80	6.95	21
-	5/3/12	11.10	13.10	94.30	10.30	170
-	5/12/12	12.30	5.80	74.90	7.99	97
-	5/25/12	15.40	3.51	65.50	6.62	44
-	6/9/12	13.10	2.53	60.40	6.29	36
-	6/23/12	13.60	15.60	81.30	8.24	-
NN4 Field Culvert	Average/Geomean	8.81	18.85	66.88	7.40	144
-	10/1/11	13.60	6.57	63.40	5.53	58
-	10/15/11	9.90	10.80	99.10	10.38	23
-	10/29/11	9.70	3.72	60.40	5.73	70
-	11/12/11	6.40	12.70	64.20	4.77	650
-	11/26/11	7.20	9.80	92.50	10.59	520
-	12/10/11	4.50	19.70	34.90	4.35	35
-	12/23/11	5.10	15.35	60.30	7.25	105
-	1/12/12	2.50	15.70	40.40	6.50	53
-	1/21/12	3.10	22.60	88.50	11.87	315
-	2/7/12	6.00	14.00	76.30	9.21	10
-	2/18/12	5.50	18.00	89.00	11.50	1043
-	3/17/12	6.60	8.70	86.90	10.96	15
-	4/14/12	11.80	10.00	68.40	7.30	95
-	5/3/12	11.20	15.55	71.60	7.83	421
-	5/12/12	12.90	6.00	78.10	8.22	120
-	5/25/12	17.20	5.10	56.40	5.32	325
-	6/9/12	15.40	6.05	54.50	5.23	918
-	6/23/12	18.60	17.50	18.90	0.64	1600
Average - all sites		7.77	9.55	83.34	9.90	181
UPPER SAMISH						
US1 Pomona	Average/Geomean	7.59	5.44	98.86	11.87	64
Grange	10/7/11	12.00	3.40	94.50	11.28	1093
-	10/19/11	9.10	1.30	108.80	12.51	28
-	11/4/11	6.50	6.70	93.50	11.35	415
-	11/22/11	6.20	15.30	101.30	12.60	382
-	12/2/11	5.40	3.60	105.00	13.26	4
-	12/14/11	3.50	3.10	98.20	13.15	65
-	12/30/11	6.20	6.32	92.10	11.44	42
-	1/11/12	3.90	3.32	98.40	12.93	109
-	1/27/12	3.40	5.00	96.60	12.80	13

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)	
US1 Pomona Grange	2/8/12	4.90	3.80	97.80	12.54	7	
	2/24/12	5.50	8.80	92.20	11.70	27	
	-	3/7/12	4.20	4.56	97.10	12.64	11
	-	3/23/12	5.20	4.20	95.00	12.03	9
	-	4/5/12	5.90	10.03	94.90	11.81	69
	-	4/20/12	9.20	12.10	102.90	11.80	321
	-	5/2/12	9.70	4.61	110.20	11.63	56
	-	5/18/12	12.60	2.65	100.10	10.62	45
	-	5/30/12	13.00	3.88	100.70	10.78	67
	-	6/15/12	12.00	2.52	100.21	10.63	1600
-	6/27/12	13.30	3.60	97.70	9.97	105	
US2 Swede Creek	Average/Geomean	7.08	10.61	94.39	11.62	62	
	-	10/7/11	11.70	5.90	78.20	8.52	769
	-	10/19/11	7.70	3.20	90.30	10.80	11
	-	11/4/11	5.00	11.30	89.20	11.37	193
	-	11/22/11	6.50	12.30	105.00	12.50	1600
	-	12/2/11	4.70	9.90	101.50	13.04	22
	-	12/14/11	2.00	9.60	97.00	13.38	23
	-	12/30/11	6.10	19.50	90.20	11.19	29
	-	1/11/12	3.00	7.72	93.00	12.53	13
	-	1/27/12	4.00	13.80	96.00	13.00	23
	-	2/8/12	4.90	10.30	92.00	11.88	9
	-	2/24/12	5.80	14.30	93.30	11.66	50
	-	3/7/12	3.50	7.78	96.40	12.81	12
	-	3/23/12	4.90	7.50	93.20	11.90	6
	-	4/5/12	5.90	16.13	94.40	11.89	91
	-	4/20/12	9.00	26.80	101.80	11.82	516
	-	5/2/12	9.40	12.79	101.70	11.60	78
	-	5/18/12	11.30	5.42	91.80	10.06	145
	-	5/30/12	11.90	6.12	94.30	10.19	46
	-	6/15/12	11.60	5.10	95.50	10.49	222
-	6/27/12	12.60	6.70	92.90	11.71	259	
US3 Thomas Creek	Average/Geomean	7.04	17.43	95.19	11.59	144	
	-	10/7/11	11.20	6.70	83.50	9.05	345
	-	10/19/11	8.50	2.30	89.50	10.47	27
	-	11/4/11	5.70	23.30	84.50	10.70	720
	-	11/22/11	6.10	56.00	103.00	12.80	610
	-	12/2/11	5.00	15.30	105.20	13.42	24
	-	12/14/11	3.00	8.50	96.40	12.99	147
	-	12/30/11	6.20	29.20	91.90	11.35	135
	-	1/11/12	3.70	16.09	94.00	12.42	108
	-	1/27/12	3.70	13.50	94.90	12.62	52
	-	2/8/12	5.60	19.70	94.00	11.76	147
	-	2/24/12	5.80	18.10	92.40	11.58	65
	-	3/7/12	3.80	12.44	95.40	12.56	189
	-	3/23/12	5.30	13.20	92.80	11.74	26
	-	4/5/12	5.80	36.50	93.80	11.75	225

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
US3 Thomas Creek	4/20/12	9.40	26.00	91.80	10.52	1433
-	5/2/12	8.70	19.84	100.90	11.78	211
-	5/18/12	10.30	6.95	100.70	11.20	58
-	5/30/12	10.90	7.57	99.60	11.01	141
-	6/15/12	10.40	5.30	103.10	11.54	210
-	6/27/12	11.70	12.10	96.30	10.53	255
US4 Willard Creek	Average/Geomean	7.59	17.94	70.96	8.61	106
-	10/7/11	12.40	38.50	49.80	5.18	515
-	10/19/11	7.40	62.30	36.00	4.50	127
-	11/4/11	6.00	15.40	33.10	4.25	1045
-	11/22/11	6.30	15.60	89.00	10.90	459
-	12/2/11	5.40	5.90	83.50	10.60	5
-	12/14/11	3.10	5.80	56.60	7.26	5
-	12/30/11	6.40	20.90	83.30	10.29	509
-	1/11/12	3.80	8.79	80.20	10.50	6
-	1/27/12	3.80	6.90	83.20	10.82	78
-	2/8/12	6.30	16.70	75.40	9.30	7
-	2/24/12	5.90	10.70	79.00	9.94	231
-	3/7/12	4.40	12.00	81.30	10.60	31
-	3/23/12	6.20	4.60	78.90	9.76	51
-	4/5/0212	6.10	19.00	83.30	10.37	149
-	4/20/12	8.80	68.60	101.90	11.87	1600
-	5/2/12	9.30	9.43	86.70	9.96	208
-	5/18/12	11.90	6.60	74.20	8.02	217
-	5/30/12	12.40	12.46	61.71	6.57	139
-	6/15/12	13.00	6.20	44.00	4.77	124
-	6/27/12	12.80	12.40	58.00	6.80	259
Average - all sites		7.32	12.85	89.85	10.92	94
LOWER SAMISH						
LS1 99 Bridge	Average/Geomean	7.65	8.66	102.18	11.54	60
-	10/1/11	11.60	2.04	86.00	9.44	79
-	10/13/11	9.80	2.80	95.40	10.19	36
-	10/29/11	7.90	3.14	-	-	93
-	11/9/11	7.40	4.40	100.60	12.07	27
-	11/26/11	5.60	6.17	105.00	13.61	39
-	12/7/11	3.80	3.80	109.40	14.30	29
-	12/27/11	5.90	6.68	96.70	11.89	38
-	1/4/12	7.20	7.60	91.70	11.15	26
-	1/21/12	2.90	50.50	93.20	12.80	424
-	2/1/12	5.80	20.50	94.00	11.14	159
-	2/18/12	5.90	10.27	91.60	11.40	109
-	3/1/12	4.70	9.10	91.10	11.71	19
-	3/17/12	5.70	6.30	92.70	11.58	12
-	3/28/12	7.70	6.80	91.50	10.92	25
-	4/14/12	8.80	3.56	103.40	11.40	67
-	4/25/12	10.30	6.50	96.50	10.87	46

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)		
LS1 99 Bridge	5/12/12	9.80	3.82	100.40	11.51	40		
	-	5/23/12	10.50	10.60	104.10	11.59	299	
	-	6/9/12	10.40	3.80	97.60	10.85	291	
	-	6/20/12	11.30	4.90	98.80	10.78	113	
LS2 Jolly Rd	Average/Geomean	7.65	8.66	102.18	11.54	54		
	-	10/1/11	11.60	2.24	84.20	9.14	157	
	-	10/13/11	9.80	2.10	87.80	9.93	47	
	-	10/29/11	7.80	3.84	-	-	79	
	-	11/9/11	7.50	3.20	92.80	11.10	21	
	-	11/26/11	5.30	8.21	118.30	13.88	61	
	-	12/7/11	3.70	3.80	128.50	15.64	15	
	-	12/27/11	5.90	5.67	92.40	11.54	37	
	-	1/4/12	7.00	8.10	92.90	11.29	24	
	no data	1/21/12	-	-	-	-	-	
	no data	2/1/12	-	-	-	-	-	
	no data	2/18/12	-	-	-	-	-	
	-	3/1/12	4.60	9.20	91.10	11.79	35	
	-	3/17/12	5.70	6.10	91.00	11.31	14	
	-	3/28/12	7.80	6.50	90.00	10.72	15	
	-	4/14/12	8.90	3.69	99.40	11.71	117	
	-	4/25/12	10.30	6.90	97.40	10.93	77	
	-	5/12/12	9.80	3.77	101.20	11.45	38	
	-	5/23/12	10.60	9.50	104.50	11.63	283	
	-	6/9/12	10.30	5.10	96.40	10.85	249	
	-	6/20/12	11.40	5.30	97.70	10.72	156	
	LS3 Chuckanut Bridge	Average/Geomean	7.73	10.37	93.98	11.14	60	
		-	10/1/11	12.30	4.36	84.60	9.04	26
		-	10/13/11	10.00	3.20	83.60	9.43	44
		-	10/29/11	8.00	3.56	110.40	12.91	111
		-	11/9/11	7.50	4.20	88.00	10.60	58
		-	11/26/11	5.00	9.81	127.80	13.76	75
-		12/7/11	3.70	5.70	98.40	12.44	12	
-		12/27/11	5.70	6.71	90.50	11.59	29	
-		1/4/12	7.10	9.90	90.10	10.88	42	
-		1/21/12	3.20	35.80	90.50	12.31	321	
-		2/1/12	5.80	20.10	91.00	11.34	52	
-		2/18/12	6.00	19.12	89.10	11.02	230	
-		3/1/12	4.50	18.20	86.20	11.14	27	
-		3/17/12	5.70	7.50	89.00	11.25	27	
-		3/28/12	8.00	6.00	85.60	10.12	6	
-		4/14/12	9.00	4.62	98.60	11.82	25	
-		4/25/12	10.30	12.10	92.50	10.35	54	
-		5/12/12	10.10	4.57	95.00	10.91	78	
-		5/23/12	10.70	13.20	98.30	10.93	577	
-		6/9/12	10.50	8.30	94.10	10.48	431	
-	6/20/12	11.50	-	96.20	10.53	122		

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
LS4 Samish at Boat	Average/Geomean	8.05	9.84	90.16	10.57	64
Docks	10/1/11	13.40	3.31	63.20	5.72	25
-	10/13/11	10.80	6.00	73.20	7.64	66
-	10/29/11	7.60	4.31	94.20	10.01	207
-	11/9/11	7.40	7.20	84.90	10.13	122
-	11/26/11	4.60	13.23	117.90	13.87	64
-	12/7/11	3.30	3.90	97.00	13.04	28
-	12/27/11	5.40	10.63	91.20	11.45	29
-	1/4/12	7.00	9.80	90.20	10.99	65
-	1/21/12	3.50	12.50	88.50	11.73	208
-	2/1/12	5.90	12.70	89.40	11.16	46
-	2/18/12	6.10	32.30	87.80	11.00	225
-	3/1/12	4.40	21.10	85.20	11.06	29
-	3/17/12	6.00	6.80	86.90	10.85	9
-	3/28/12	8.60	5.10	86.50	10.06	11
-	4/14/12	9.80	4.08	93.70	10.46	18
-	4/25/12	10.60	10.50	92.40	10.40	60
-	5/12/12	11.30	3.45	97.80	10.37	40
-	5/23/12	10.80	16.40	94.00	10.41	511
-	6/9/12	11.50	7.00	92.00	10.90	432
-	6/20/12	12.90	6.40	97.20	10.22	181
Average - all sites		7.89	8.59	97.62	11.18	60
GAGES SLOUGH						
GS1 Regent St. & E. Rio Vista St.	Average/Geomean	11.61	6.76	53.35	6.79	330
-	10/4/11	14.00	4.40	33.30	3.24	1600
-	11/1/11	12.50	2.86	47.90	5.01	1600
-	11/29/11	12.90	4.21	36.50	3.84	79
-	1/24/12	10.30	2.10	59.80	6.71	170
-	2/21/12	6.70	23.50	103.70	12.64	350
-	3/20/12	8.10	17.90	78.60	9.20	540
-	4/17/12	10.70	1.72	57.50	6.27	350
-	5/16/12	11.40	6.85	56.20	6.06	49
-	6/12/12	12.00	3.97	46.30	15.00	540
-	7/12/12	13.80	5.00	44.40	4.51	240
-	8/7/12	15.30	1.81	22.60	2.16	350
GS2 Anacortes St.	Average/Geomean	11.76	24.58	58.26	6.30	61
-	10/4/11	14.60	5.58	40.10	3.99	79
-	11/1/11	9.10	76.20	69.10	7.96	11
-	11/29/11	10.6	33.3	63.2	7.01	7
-	1/24/12	6.90	93.10	76.50	9.20	27
-	2/21/12	6.40	20.80	89.20	11.28	540
-	3/20/12	7.00	3.43	106.20	12.87	33
-	4/17/12	10.80	3.07	64.20	7.10	170
-	5/16/12	14.70	5.95	52.00	5.23	79
-	6/12/12	15.60	6.56	21.90	2.21	79

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
GS2 Anacortes St.	7/12/12	17.40	17.90	44.80	1.53	79
	8/7/12	16.30	4.54	13.70	0.93	170
GS3 S. Spruce St.	Average/Geomean	13.14	4.66	60.20	6.56	22
-	10/4/11	-	-	-	-	-
-	11/1/11	-	-	-	-	-
-	11/29/11	-	-	-	-	-
-	1/24/12	-	8.10	2.86	50.70	5
-	2/21/12	1.50	7.20	12.70	99.70	350
-	3/20/12	1.00	8.60	3.21	95.70	350
-	4/17/12	0.90	11.10	3.18	58.80	49
-	5/16/12	0.90	12.00	6.66	59.50	1
-	6/12/12	0.90	13.30	1.85	55.70	2
-	7/12/12	1.20	17.10	8.66	31.60	49
-	8/7/12	-	17.60	10.66	10.80	-
GS5 Goldenrod Rd	Average/Geomean	11.73	11.55	61.76	6.89	8
-	10/4/11	15.80	11.80	11.20	1.32	9
-	11/1/11	-	-	-	-	49
-	11/29/11	12.6	9.84	80.4	8.54	-
-	1/24/12	7.70	5.51	66.20	8.72	13
-	2/21/12	7.10	27.30	94.30	11.47	33
-	3/20/12	8.00	20.50	88.10	10.52	23
-	4/17/12	10.80	6.84	78.50	8.77	2
-	5/16/12	12.10	1.39	71.30	7.13	2
-	6/12/12	13.10	6.97	42.80	4.24	2
-	7/12/12	14.80	4.90	45.30	5.41	30
-	8/7/12	15.30	20.40	39.50	2.75	1
Average - all sites		11.74	12.28	57.80	11.74	105

BAYVIEW

BV1 Walker Rd	Average/Geomean	7.37	6.97	99.25	11.99	23
no data	10/5/11	-	-	-	-	-
-	10/22/11	11.90	8.20	95.10	10.45	420
no data	11/4/11	-	-	-	-	-
no data	11/19/11	-	-	-	-	-
no data	12/2/11	-	-	-	-	-
-	12/17/11	-	-	-	-	-
no data	12/30/11	-	-	-	-	-
-	1/15/12	3.30	5.30	100.30	13.40	12
-	1/28/12	-	3.00	-	-	3
no data	2/11/12	-	-	-	-	-
-	2/23/12	7.10	4.50	96.50	11.70	10
-	3/10/12	6.40	6.28	96.80	11.90	21
-	3/24/12	-	2.10	-	-	1
-	3/31/12	5.40	21.60	97.10	12.22	1265
no data	4/6/12	-	-	-	-	-
-	4/21/12	10.10	4.80	109.70	12.25	22

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
BV1 Walker Rd	5/5/12	-	-	-	-	-
no data	5/19/12	-	-	-	-	-
no data	6/2/12	-	-	-	-	-
no data	6/10/12	-	-	-	-	-
no data	6/30/12	-	-	-	-	-
BV2 C Street	Average/Geomean	6.54	9.39	97.42	12.00	26
no data	10/5/11	-	-	-	-	-
no data	10/22/11	-	-	-	-	-
-	11/4/11	-	3.40	-	-	7
no data	11/19/11	-	-	-	-	-
no data	12/2/11	-	-	-	-	-
no data	12/17/11	-	-	-	-	-
-	12/30/11	-	-	-	-	-
-	1/15/12	3.20	10.80	101.90	13.73	12
-	1/28/12	3.90	9.30	103.30	13.50	7
-	2/11/12	7.7	9.7	93.7	11.1	6
-	2/23/12	6.90	9.30	98.10	11.91	7
-	3/10/12	6.40	12.12	95.80	11.70	207
-	3/24/12	5.20	4.10	99.50	12.64	6
-	3/31/12	5.60	24.00	99.30	12.54	1925
-	4/6/12	6.50	4.92	94.50	11.59	6
-	4/21/12	10.50	6.90	97.10	10.83	28
-	5/5/12	9.50	6.00	91.00	10.44	88
no data	5/19/12	-	-	-	-	-
no data	6/2/12	-	-	-	-	-
-	6/10/12	-	12.1	-	-	100
no data	6/30/12	-	-	-	-	-
BV3 Boat Launch	Average/Geomean	8.53	12.23	90.71	14.56	90
-	10/5/11	12.30	2.80	80.00	8.56	143
-	10/22/11	12.10	64.20	98.60	10.52	-
-	11/4/11	8.20	4.00	92.70	87.30	213
-	11/19/11	3.30	19.50	82.60	10.81	73
-	12/2/11	6.50	4.00	96.50	11.81	8
-	12/17/11	5.60	9.70	76.50	9.54	24
-	12/30/11	6.80	6.80	93.90	11.53	3
-	1/15/12	3.20	14.80	104.40	13.85	91
-	1/28/12	4.20	20.20	106.90	13.91	650
-	2/11/12	7.50	9.60	95.30	11.42	21
-	2/23/12	6.50	10.30	96.80	11.88	14
no data	3/10/12	-	-	-	-	-
-	3/24/12	6.10	4.00	92.60	12.31	68
-	3/31/12	6.10	29.30	92.20	11.40	491
-	4/6/12	7.00	6.03	98.60	12.04	37
-	4/21/12	9.90	10.60	97.60	11.02	120
-	5/5/12	9.90	6.30	98.80	11.14	56
-	5/19/12	10.60	4.20	64.90	7.21	146
-	6/2/12	13.70	7.40	80.50	8.52	914
-	6/10/12	15.1	7.5	89.4	9.01	1103
-	6/30/12	15.9	3.45	75.3	7.44	518

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
BV4 Bay View State	Average/Geomean	7.09	20.30	92.22	12.02	41
Park	10/5/11	12.00	2.00	90.50	9.80	75
no data	10/22/11	-	-	-	-	-
-	11/4/11	7.50	1.20	24.30	14.80	103
-	11/19/11	1.70	2.40	94.70	12.10	6
-	12/2/11	5.30	61.60	95.60	12.07	9
-	12/17/11	5.60	4.60	81.30	10.22	12
-	12/30/11	7.00	14.43	101.20	12.24	33
-	1/15/12	4.00	2.70	96.90	12.73	9
-	1/28/12	5.30	4.00	104.60	13.22	97
no data	2/11/12	-	-	-	-	-
-	2/23/12	7.30	58.10	96.70	11.69	37
-	3/10/12	7.20	10.68	98.50	12.30	410
-	3/24/12	9.80	5.50	115.10	12.99	1
-	3/31/12	6.60	22.70	91.40	11.20	1000
-	4/6/12	8.80	1.54	106.30	12.30	13
-	4/21/12	-	67.00	-	-	160
-	5/5/12	11.10	46.00	94.00	10.60	347
no data	5/19/12	-	-	-	-	-
no data	6/2/12	-	-	-	-	-
no data	6/10/12	-	-	-	-	-
no data	6/30/12	-	-	-	-	-
Average - all sites		7.38	12.22	94.90	12.64	45

FISHER CREEK

FC1 Bulson Road	Average/Geomean	7.27	5.52	87.67	10.64	99
Culvert	10/6/11	10.30	2.70	60.30	6.79	1600
-	10/18/11	9.40	6.30	37.50	3.90	140
-	11/3/11	8.30	12.80	96.90	11.32	598
-	11/15/11	5.90	4.25	99.40	12.51	128
-	12/1/11	4.90	1.60	99.60	12.97	53
-	12/13/11	3.90	12.86	102.00	13.95	90
-	12/29/11	6.30	9.30	95.70	11.78	68
-	1/10/12	7.80	6.85	57.70	6.62	5
-	1/26/12	4.70	4.30	79.70	10.33	25
-	2/7/12	4.70	4.60	100.40	12.82	15
-	2/21/12	6.20	13.60	-	-	277
-	3/6/12	3.80	4.70	101.00	13.25	10
-	3/22/12	4.70	2.10	97.30	12.42	55
-	4/3/12	7.10	3.00	89.80	10.95	23
-	4/19/12	7.20	2.00	91.00	10.97	33
-	5/1/12	8.30	4.80	93.90	11.08	465
-	5/17/12	9.90	0.98	93.70	10.58	105
-	5/29/12	10.30	2.60	95.50	10.58	315
-	6/14/12	10.40	2.75	85.50	9.55	450
-	6/26/12	11.30	8.40	88.80	9.80	1028

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)	
FC2 23616 Bulson Road	Average/Geomean	6.86	5.50	88.81	10.88	82	
	10/6/11	10.30	7.67	71.20	7.99	1600	
	-	10/18/11	7.10	8.70	62.70	7.53	60
	-	11/3/11	7.00	14.30	100.10	12.09	645
	-	11/15/11	5.30	3.25	100.30	12.64	215
	-	12/1/11	3.90	5.60	99.50	13.01	95
	-	12/13/11	3.00	11.15	97.60	13.20	20
	-	12/29/11	6.30	2.40	92.40	11.43	30
	-	1/10/12	6.00	4.10	48.10	6.18	25
	-	1/26/12	4.50	7.10	75.90	9.79	30
	-	2/7/12	4.40	4.20	96.60	12.94	20
	-	2/21/12	6.30	14.10	-	-	345
	-	3/6/12	3.60	5.20	103.50	13.64	25
	-	3/22/12	4.80	2.40	97.10	12.53	15
	-	4/3/12	7.10	2.60	93.10	10.95	30
	-	4/19/12	7.20	2.20	91.10	11.05	95
	-	5/1/12	8.30	5.20	93.70	11.02	415
	-	5/17/12	10.10	0.95	96.80	10.97	95
	-	5/29/12	10.30	2.55	93.60	10.51	75
	-	6/14/12	10.40	2.34	85.10	9.51	60
-	6/26/12	11.20	4.00	89.00	9.81	260	
FC3 Starbird Road	Average/Geomean	6.87	4.82	86.23	10.61	51	
	-	10/6/11	10.50	2.10	30.50	3.33	25
	-	10/18/11	7.90	8.20	68.00	7.78	9
	-	11/3/11	6.30	9.80	95.20	11.80	796
	-	11/15/11	5.60	3.45	99.10	12.42	66
	-	12/1/11	3.70	3.80	98.70	12.99	34
	-	12/13/11	1.60	7.45	103.90	14.67	23
	-	12/29/11	6.30	3.20	92.80	11.49	23
	-	1/10/12	5.60	3.30	39.70	5.06	9
	-	1/26/12	4.30	5.20	74.60	9.73	23
	-	2/7/12	3.90	4.10	97.70	13.40	20
	-	2/21/12	-	11.40	-	-	354
	-	3/6/12	3.20	4.20	96.30	12.93	44
	-	3/22/12	4.90	3.40	93.60	11.96	12
	-	4/3/12	7.50	2.40	89.40	10.77	9
	-	4/19/12	7.80	2.80	92.20	10.94	262
	-	5/1/12	8.60	5.30	92.20	10.70	277
	-	5/17/12	10.00	1.57	95.90	10.78	81
	-	5/29/12	10.60	2.60	97.30	10.81	100
	-	6/14/12	10.80	8.70	89.80	9.97	72
-	6/26/12	11.40	3.50	91.40	9.98	222	

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
FC4 Franklin Road	Average/Geomean	7.16	6.30	94.48	11.46	45
-	10/6/11	10.00	1.27	90.00	10.16	70
-	10/18/11	8.60	3.20	99.80	11.56	32
-	11/3/11	7.10	9.00	107.20	12.94	793
-	11/15/11	6.20	2.75	111.00	13.90	27
-	12/1/11	4.00	1.80	108.4	14.32	13
-	12/13/11	2.50	6.62	108.30	14.89	15
-	12/29/11	6.60	2.70	104.60	12.84	19
-	1/10/12	5.60	3.90	22.90	2.85	18
-	1/26/12	4.80	3.70	52.40	6.71	21
-	2/7/12	3.80	3.60	106.20	13.71	8
-	2/21/12	-	54.40	-	-	438
-	3/6/12	3.60	4.70	104.20	13.82	14
-	3/22/12	5.20	3.50	99.70	12.70	45
-	4/3/12	7.80	2.60	95.30	11.29	7
-	4/19/12	8.00	2.30	101.10	11.97	46
-	5/1/12	8.90	8.00	102.80	11.91	317
-	5/17/12	10.20	1.33	94.30	10.64	179
-	5/29/12	10.80	2.40	98.20	10.90	56
-	6/14/12	10.90	4.04	92.50	10.16	104
-	6/26/12	11.50	4.10	96.20	10.50	74
Average - all sites		7.04	5.54	89.30	10.90	69
TRUMPETER BASIN						
TB1 Stonebridge Adult Community	Average/Geomean	9.52	4.79	105.54	12.07	82
-	10/6/11	12.80	0.00	91.00	9.75	250
-	10/20/11	12.61	4.60	84.50	8.94	1073
-	11/3/11	8.80	11.70	87.00	9.94	1440
-	12/1/11	6.30	2.59	106.90	13.01	20
-	12/15/11	6.30	3.10	101.00	12.53	160
-	12/29/11	7.60	5.01	104.30	12.37	153
-	1/12/12	4.20	1.55	104.60	13.68	13
-	2/9/12	7.10	0.82	105.40	12.76	3
-	2/23/12	7.30	14.20	106.00	12.76	47
-	3/8/12	6.20	3.61	107.70	13.31	12
-	3/22/12	6.80	5.29	100.50	12.60	53
-	4/5/12	8.60	5.31	93.80	10.99	153
-	4/19/12	10.00	1.70	92.10	10.27	20
-	5/3/12	10.90	8.19	105.60	11.60	60
-	5/14/12	11.90	0.21	125.80	13.80	100
-	5/31/12	13.70	18.20	130.90	13.61	1500
-	6/27/12	15.80	0.13	127.70	12.93	52
-	7/12/12	14.50	0.00	124.90	12.42	160
-	7/26/12	15.60	0.00	95.40	9.46	47
TB2 Frazier Home on College Way	Average/Geomean	9.11	8.62	97.83	11.36	184
-	10/6/11	13.00	3.10	74.00	7.80	180
-	10/20/11	11.90	11.90	68.90	7.41	1313

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)	
TB2 Frazier Home on College Way	11/3/11	8.30	13.00	81.50	9.52	1600	
	12/1/11	4.80	7.00	97.20	12.63	27	
	-	12/15/11	4.70	16.70	95.00	12.19	230
	-	12/29/11	6.90	11.50	96.00	11.57	153
	-	1/12/12	2.60	3.60	98.90	13.39	33
	-	2/9/12	6.60	5.58	99.50	12.20	30
	-	2/23/12	7.10	17.80	101.10	12.30	227
	-	3/8/12	5.30	7.36	103.60	13.17	8
	-	3/22/12	6.80	9.02	94.70	11.70	93
	-	4/5/12	8.00	11.50	104.00	12.42	26
	-	4/19/12	9.80	5.97	91.00	10.62	73
	-	5/3/12	11.10	14.70	92.00	10.10	1600
	-	5/14/12	12.60	8.24	117.30	12.54	400
	-	5/31/12	13.90	6.38	111.40	11.50	1200
	-	6/27/12	14.90	1.85	118.70	11.95	600
	-	7/12/12	15.60	0.00	116.20	11.54	227
	-	7/26/12	16.20	0.84	83.50	8.24	880
	TB3 Summerson Nursery Bridge	Average/Geomean	8.53	3.44	96.56	11.33	118
10/6/11		12.10	0.00	76.60	8.35	240	
-		10/20/11	11.20	1.17	70.90	7.79	240
-		11/3/11	8.00	4.17	86.20	10.20	310
-		12/1/11	4.60	0.88	102.40	12.93	20
-		12/15/11	4.80	2.57	89.30	11.56	133
-		12/29/11	6.80	1.72	93.80	11.46	127
-		1/12/12	2.40	0.75	95.90	13.15	27
-		2/9/12	6.40	0.71	97.40	12.04	43
-		2/23/12	6.70	22.50	102.50	12.40	160
-		3/8/12	4.90	4.44	102.10	13.06	14
-		3/22/12	5.90	2.60	92.80	11.44	133
-		4/5/12	7.40	2.63	100.80	12.40	33
-		4/19/12	8.80	0.48	93.20	10.76	73
-		5/3/12	10.20	13.60	93.20	10.48	87
-		5/14/12	11.99	0.00	108.00	11.63	105
-		5/31/12	12.70	3.65	108.70	11.58	1600
-		6/27/12	14.00	0.00	115.20	11.90	130
-		7/12/12	14.60	0.00	109.00	10.89	253
-	7/26/12	15.80	0.00	79.60	7.84	1020	
TB4 Kiowa Street	Average/Geomean	8.22	3.61	105.88	12.45	46	
	-	10/6/11	11.70	0.70	94.80	10.30	310
	-	10/20/11	10.70	3.36	84.10	9.34	233
	-	11/3/11	8.00	0.77	79.50	9.44	580
	-	12/1/11	4.80	13.90	104.00	13.45	20
	-	12/15/11	4.30	5.80	101.80	13.26	120
	-	12/29/11	6.60	13.60	99.60	12.22	47
	-	1/12/12	3.00	21.00	101.50	13.63	1
	-	2/9/12	6.30	13.10	105.90	12.98	10
	-	2/23/12	6.60	3.85	104.80	12.86	167
-	3/8/12	5.10	6.04	104.90	13.43	10	

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)
TB4 Kiowa Street	3/22/12	5.70	4.24	95.70	11.86	186
-	4/5/12	7.30	7.90	102.50	12.30	20
-	4/19/12	8.70	1.60	97.20	11.19	1
-	5/3/12	10.00	3.80	97.90	11.04	20
-	5/14/12	10.70	3.10	132.60	14.73	32
-	5/31/12	11.90	3.00	135.30	14.57	390
-	6/27/12	13.20	10.00	133.10	13.92	49
-	7/12/12	13.40	-	130.60	13.59	107
-	7/26/12	14.90	0.75	99.70	10.12	200
TB5 Bakerview Park Footbridge	Average/Geomean	8.74	2.32	99.54	11.55	31
-	10/6/11	12.00	0.00	80.00	8.07	320
-	10/20/11	10.90	2.51	73.10	8.08	360
-	11/3/11	8.10	3.90	79.10	9.44	167
-	12/1/11	5.30	0.00	93.40	11.80	1
-	12/15/11	5.10	-	95.80	12.11	13
-	12/29/11	7.20	1.72	93.30	11.33	27
-	1/12/12	3.40	0.00	96.20	12.85	7
-	2/9/12	7.20	0.16	99.90	12.13	7
-	2/23/12	7.00	5.39	100.30	12.24	87
-	3/8/12	5.90	0.98	103.00	12.84	4
-	3/22/12	6.00	3.05	94.40	11.59	206
-	4/5/12	7.80	2.89	100.40	11.85	13
-	4/19/12	9.00	0.85	95.80	11.07	1
-	5/3/12	10.10	6.52	94.60	10.68	46
-	5/14/12	11.30	1.83	122.30	12.95	84
-	5/31/12	12.30	7.48	125.60	13.41	360
-	6/27/12	14.10	0.07	124.10	12.80	36
-	7/12/12	14.70	2.04	120.50	12.59	27
-	7/26/12	16.10	1.67	93.40	9.20	67
-	Average - all sites	8.82	4.56	101.07	11.75	92

CLYDE CREEK

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)
CC1 Jasper Way	Average/Geomean	7.94	8.81	93.74	11.17	31
no data	10/3/11	-	-	-	-	-
no data	10/19/11	-	-	-	-	-
no data	10/31/11	-	-	-	-	-
no data	11/19/11	-	-	-	-	-
-	11/28/11	6.60	9.82	76.30	9.76	8
-	12/14/11	4.10	2.99	90.50	11.75	156
-	12/27/11	6.90	2.80	86.20	10.23	45
-	1/11/12	3.90	-	83.90	10.98	16
-	1/23/12	4.10	11.00	88.50	13.20	3
-	2/8/12	6.40	4.67	98.80	11.32	7
-	2/21/12	6.90	30.90	103.10	11.22	380
-	3/7/12	3.60	11.30	84.10	11.15	3
-	3/19/12	4.90	13.80	91.10	11.16	10
-	4/4/12	5.70	26.50	88.70	11.23	25
-	4/16/12	9.30	14.00	104.20	11.60	100
-	5/14/12	12.70	0.09	102.30	10.69	28

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)
CC1 Jasper Way	5/20/12	8.90	3.48	97.90	11.70	18
-	5/30/12	11.40	2.43	-	-	167
-	6/28/12	13.30	2.84	105.70	11.10	56
-	7/9/12	12.60	2.68	100.30	11.17	55
-	7/25/12	13.60	1.69	98.20	10.38	130
-	8/6/12	-	-	-	-	-
CC2 Clyde Way	Average/Geomean	8.54	7.74	95.06	11.22	15
-	10/3/11	-	5.74	-	-	2
no data	10/19/11	-	-	-	-	9
-	10/31/11	10.50	4.10	86.90	9.87	1
-	11/19/11	-	10.52	-	-	5
-	11/28/11	7.00	2.68	107.40	12.10	17
-	12/14/11	5.10	20.50	97.80	12.56	465
-	12/27/11	6.90	5.29	97.10	12.01	-
-	1/11/12	5.10	-	94.70	12.22	-
-	1/23/12	4.40	6.26	103.80	13.50	7
-	2/8/12	6.50	6.36	89.30	10.84	4
-	2/21/12	6.50	42.10	107.00	13.20	790
-	3/7/12	5.30	2.77	105.80	13.45	17
-	3/19/12	5.90	7.33	106.90	14.15	2
-	4/4/12	7.10	12.50	114.90	12.61	30
-	4/16/12	10.90	6.83	103.90	11.39	8
-	5/14/12	12.90	0.44	63.50	6.50	5
-	5/20/12	9.80	1.64	98.60	11.17	18
-	5/30/12	10.00	4.17	78.90	8.38	22
-	6/28/12	12.90	2.66	88.70	9.43	30
-	7/9/12	12.60	3.26	81.50	9.87	205
-	7/25/12	14.30	1.85	84.30	8.70	19
no data	8/6/12	-	-	-	-	-
CC3 Queen Ann Way	Average/Geomean	8.56	4.87	98.18	11.63	24
-	10/3/11	12.70	1.89	74.70	8.00	7
-	10/19/11	10.30	-	85.60	9.55	7
-	10/31/11	9.90	2.78	89.20	9.73	4
-	11/19/11	6.10	1.76	100.70	12.50	8
-	11/28/11	7.10	1.77	99.50	12.78	9
-	12/14/11	5.10	1.11	98.30	12.55	14
-	12/27/11	7.00	1.44	97.70	11.67	33
-	1/11/12	4.50	-	104.50	13.51	21
-	1/23/12	4.80	4.08	102.10	13.50	19
-	2/8/12	6.80	3.57	101.30	12.36	21
-	2/21/12	6.80	39.80	105.60	13.10	165
-	3/7/12	5.00	2.87	108.40	13.84	10
-	3/19/12	6.20	4.68	104.70	13.41	10
-	4/4/12	7.00	9.80	107.10	13.04	28
-	5/14/12	12.00	0.05	103.70	11.03	68
-	5/20/12	9.00	1.35	102.80	11.88	5
-	5/30/12	10.60	2.09	89.10	9.86	570
-	6/28/12	12.90	4.08	96.20	10.15	46
-	7/9/12	12.40	3.73	95.70	10.61	188

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)
CC3 Queen Ann Way	7/25/12	13.10	0.97	92.60	9.67	135
	8/6/12	14.60	0.85	91.40	8.68	38
CC4 Marine Drive	Average/Geomean	8.39	6.95	104.39	12.25	34
-	10/3/11	12.40	4.79	91.30	9.71	293
-	10/19/11	9.50	-	96.30	11.02	-
-	10/31/11	9.30	2.25	98.90	11.37	180
-	11/19/11	5.90	2.09	105.30	13.10	5
-	11/28/11	7.10	1.57	109.20	12.90	20
-	12/14/11	4.70	1.61	106.40	13.75	5
-	12/27/11	6.80	2.86	102.50	12.62	10
-	1/11/12	4.30	-	108.40	14.06	21
-	1/23/12	5.40	6.09	107.40	13.30	33
-	2/8/12	6.90	5.33	103.70	12.65	16
-	2/21/12	7.10	57.10	105.60	12.90	50
-	3/7/12	5.10	2.49	108.50	13.87	17
-	3/19/12	6.10	4.76	108.70	13.44	8
-	4/4/12	7.10	14.80	108.60	13.11	30
-	4/16/12	10.00	7.17	107.60	12.11	10
-	5/14/12	10.40	0.21	111.70	12.36	150
-	5/20/12	9.10	2.36	105.40	12.16	2
-	5/30/12	10.60	4.07	99.80	10.54	100
-	6/28/12	12.60	4.75	104.40	11.09	110
-	7/9/12	12.70	5.50	101.50	10.65	140
-	7/25/12	13.00	2.30	100.90	10.50	112
-	8/6/12	14.20	0.58	101.60	10.60	580
-	Average - all sites	8.36	7.09	97.84	11.57	26

KULSHAN CREEK

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)
KC1 S. 14th St.	Average/Geomean	9.97	3.61	98.37	11.17	206
-	9/27/11	14.80	3.70	82.50	8.36	1600
-	10/12/11	12.60	1.00	85.10	9.06	780
-	10/26/11	8.20	0.00	74.50	8.82	320
-	11/10/11	8.30	0.00	85.90	10.07	447
-	11/22/11	8.20	10.07	93.50	11.08	1600
-	12/5/11	6.00	0.00	91.00	11.40	113
-	12/20/11	7.20	0.00	90.80	11.00	20
-	2/2/12	6.20	0.95	100.50	12.60	60
-	2/14/12	7.20	1.15	95.50	11.55	33
-	3/6/12	6.00	6.18	100.80	12.72	230
-	3/13/12	4.70	10.84	103.30	13.37	270
-	3/26/12	7.80	0.00	89.20	10.58	87
-	4/10/12	9.80	4.06	86.40	9.79	7
-	4/26/12	11.30	10.92	76.50	8.43	473
-	5/8/12	11.60	0.98	123.00	13.31	20
-	5/24/12	12.20	3.51	126.30	13.59	187
-	6/6/12	11.00	1.40	120.30	13.29	320
-	6/19/12	13.20	1.76	118.87	12.55	1080
-	7/3/12	14.30	13.30	126.40	12.98	1600
-	7/19/12	15.00	2.13	109.40	10.99	230
-	7/31/12	13.80	3.95	86.00	8.98	333

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)	
KC2 Parker Way	Average/Geomean	10.86	6.50	78.82	8.87	215	
	-	9/27/11	16.00	7.40	57.10	5.68	1500
	-	10/12/11	13.90	3.60	60.30	6.36	1233
	-	10/26/11	9.90	0.10	43.60	4.90	200
	-	11/10/11	9.70	0.57	59.90	6.80	887
	-	11/22/11	8.40	11.30	84.90	10.50	1100
	-	12/5/11	7.00	1.87	66.50	8.27	53
	-	12/20/11	7.70	1.49	70.80	8.46	60
	-	2/2/12	6.70	4.49	94.20	11.55	40
	-	2/14/12	7.80	6.29	81.80	9.78	1
	-	3/6/12	6.60	10.83	100.00	12.30	133
	-	3/13/12	4.70	17.60	102.10	13.11	327
	-	3/26/12	8.00	2.40	77.00	9.27	20
	-	4/10/12	10.50	17.70	81.40	9.13	166
	-	4/26/12	11.50	16.20	80.50	8.75	1600
	-	5/8/12	12.10	3.09	106.60	11.43	20
	-	5/24/12	13.20	5.54	121.10	12.50	980
	-	6/6/12	12.40	1.69	76.30	8.16	147
	-	6/19/12	14.70	1.62	101.20	10.27	700
	-	7/3/12	15.00	19.20	110.60	11.20	1600
-	7/19/12	16.50	1.42	44.70	4.44	400	
-	7/31/12	15.70	2.04	34.70	3.42	667	
KC3 Roosevelt Ave	Average/Geomean	10.70	8.95	37.14	4.20	62	
	-	9/27/11	15.70	1.30	16.90	1.70	330
	-	10/12/11	10.90	4.80	21.00	2.06	280
	-	10/26/11	9.60	2.44	11.20	1.28	53
	-	11/10/11	8.40	1.17	10.90	1.22	13
	-	11/22/11	8.00	32.20	47.80	5.65	127
	-	12/5/11	5.60	5.32	11.40	1.47	1
	-	12/20/11	6.90	2.93	11.60	1.40	1
	-	2/2/12	6.60	6.17	58.40	7.16	9
	-	2/14/12	7.70	6.37	44.20	5.24	1
	-	3/6/12	7.20	5.99	79.10	9.53	100
	-	3/13/12	4.70	19.20	87.80	11.28	107
	-	3/26/12	8.60	5.37	33.50	4.27	60
	-	4/10/12	10.20	9.22	17.80	2.03	20
	-	4/26/12	12.00	15.40	56.60	6.07	667
	-	5/8/12	13.20	5.32	57.30	6.01	93
	-	5/24/12	13.10	5.27	63.80	6.88	440
	-	6/6/12	12.70	7.66	17.20	1.81	440
	-	6/19/12	15.30	4.13	48.40	4.95	460
	-	7/3/12	14.60	9.34	55.70	5.72	833
-	7/19/12	17.50	13.90	27.60	2.42	100	
-	7/31/12	16.30	24.50	1.70	0.10	87	
KC4 Riverside Drive	Average/Geomean	10.38	6.34	85.33	9.61	174	
	-	9/27/11	15.60	3.30	56.60	5.70	580
	-	10/12/11	13.00	8.30	67.60	7.13	727
	-	10/26/11	7.90	0.21	62.40	7.41	60

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC (CFU/100ml)	
KC4 Riverside Drive	11/10/11	8.60	0.98	69.00	8.13	20	
	11/22/11	7.90	19.20	76.50	9.05	1520	
	-	12/5/11	5.40	3.14	74.70	9.47	140
	-	12/20/11	7.00	1.13	75.50	9.19	47
	-	2/2/12	6.20	4.24	90.40	11.14	37
	-	2/14/12	7.00	4.54	90.40	10.95	30
	-	3/6/12	6.40	14.80	97.10	12.00	360
	-	3/13/12	4.40	19.60	96.10	12.46	160
	-	3/26/12	8.20	2.27	96.80	11.33	20
	-	4/10/12	11.00	3.20	102.80	11.37	40
	-	4/26/12	11.50	11.20	75.90	8.23	1333
	-	5/8/12	12.10	1.50	105.80	11.40	13
	-	5/24/12	12.90	6.89	110.80	11.60	1600
	-	6/6/12	11.90	2.09	101.70	10.98	347
	-	6/19/12	14.60	2.28	97.60	9.56	500
	-	7/3/12	14.20	16.20	110.30	11.30	1600
	-	7/19/12	16.50	1.84	63.20	6.36	330
	-	7/31/12	15.60	6.13	70.80	7.07	173
	Site 5. Lions Park	Average/Geomean	9.89	7.38	83.28	9.50	51
	-	9/27/11	15.60	7.00	79.10	8.05	1600
-	10/12/11	15.10	2.00	69.20	7.25	1093	
-	10/26/11	10.80	3.78	57.00	6.29	1	
-	11/10/11	9.70	1.44	86.60	9.74	2	
-	11/22/11	8.00	20.80	76.20	8.97	1240	
-	12/5/11	6.00	4.21	89.60	11.15	1	
-	12/20/11	7.10	1.39	80.30	9.85	1	
-	2/2/12	6.20	4.51	85.60	10.81	51	
-	2/14/12	6.90	4.84	81.90	8.95	13	
-	3/6/12	6.30	14.60	97.10	11.88	487	
-	3/13/12	4.40	17.30	95.80	12.44	60	
-	3/26/12	7.60	2.61	83.20	9.93	1	
-	4/10/12	10.10	3.48	80.50	9.07	27	
-	4/26/12	11.50	13.70	76.10	8.85	1480	
-	5/8/12	11.50	3.31	99.10	10.88	20	
no data	5/24/12	-	-	-	-	-	
-	6/6/12	12.60	4.07	86.90	9.07	870	
no data	6/19/12	-	-	-	-	-	
-	7/3/12	14.30	17.20	100.20	10.22	-	
no data	7/19/12	-	-	-	-	-	
-	7/31/12	14.30	6.53	74.70	7.63	1600	
Average - all sites		10.26	8.72	74.92	5.97	141	
Joe Leary Slough							
JL1 Dahlstedt Road	Average/Geomean	10.33	18.89	55.42	6.20	96	
-	9/25/11	18.90	46.20	116.00	10.75	1600	
-	10/12/11	11.10	34.60	79.00	8.67	57	
-	10/23/11	13.10	45.10	80.80	8.46	1600	

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
JL1 Dahlstedt Road	11/9/11	9.70	25.10	52.20	5.85	173
-	11/20/11	7.70	12.60	24.70	2.93	212
-	12/7/11	8.30	9.30	46.80	5.30	25
-	12/18/11	8.90	11.60	32.40	3.74	47
-	1/3/12	8.90	13.20	42.30	6.27	135
-	1/23/12	8.50	14.50	34.10	3.99	427
-	2/7/12	10.90	16.75	65.30	7.50	14
-	2/12/12	9.90	9.20	40.90	4.62	195
-	2/29/12	5.80	14.30	43.60	5.50	66
-	3/3/12	5.30	8.70	82.80	10.66	605
-	3/15/12	10.10	25.50	46.70	5.31	34
-	3/28/12	8.90	17.20	45.50	5.14	13
-	4/8/12	10.70	-	42.50	4.70	13
-	4/25/12	10.80	9.00	46.80	5.26	46
-	5/6/12	11.50	9.30	40.40	4.39	14
-	5/23/12	11.50	12.40	56.80	6.14	314
-	6/3/12	14.70	26.30	95.60	9.69	87
-	6/20/12	11.80	16.90	48.60	5.23	108
JL2 HWY 99/Gear Rd	Average/Geomean	9.79	33.00	61.99	6.89	138
-	9/25/11	16.00	59.10	71.30	7.03	828
-	10/12/11	11.50	53.60	57.50	6.10	159
-	10/23/11	11.80	32.40	66.70	7.25	1363
-	11/9/11	9.00	16.50	48.20	5.83	63
-	11/20/11	7.40	19.50	56.30	6.71	89
-	12/7/11	8.20	30.10	93.10	6.32	12
-	12/18/11	8.70	40.50	56.10	6.49	117
-	1/3/12	8.80	35.50	57.30	6.60	227
-	1/23/12	7.40	28.90	55.60	6.65	173
-	2/7/12	9.90	46.50	75.00	8.19	138
-	2/12/12	9.20	28.10	54.70	6.10	606
-	2/29/12	6.50	30.10	45.60	7.60	61
-	3/3/12	5.30	10.80	82.90	10.56	510
-	3/15/12	8.90	38.50	60.00	7.00	24
-	3/28/12	9.10	37.20	50.60	6.00	103
-	4/8/12	9.23	-	58.60	6.70	139
-	4/25/12	10.90	21.20	47.90	5.24	76
-	5/6/12	10.60	23.80	55.50	6.16	32
-	5/23/12	11.50	34.40	57.40	6.25	418
-	6/3/12	14.30	40.70	88.20	9.00	74
-	6/20/12	11.40	32.60	63.20	6.83	245
JL3 Wilson/Avon	Average/Geomean	10.53	49.76	68.33	7.91	39
Allen	9/25/11	18.90	60.10	99.30	9.56	129
-	10/12/11	11.30	66.30	79.00	8.60	58
-	10/23/11	14.40	71.50	83.50	8.56	48
-	11/9/11	10.10	35.10	61.60	7.24	43
-	11/20/11	7.90	34.20	74.70	9.05	31
-	12/7/11	7.60	53.20	66.70	8.20	64
-	12/18/11	8.20	91.50	20.10	7.96	189

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
JL3 Wilson/Avon	1/3/12	8.50	71.20	64.90	7.50	167
Allen	1/23/12	7.40	65.30	65.40	7.85	12
-	2/7/12	9.40	65.10	71.10	8.15	11
-	2/12/12	8.90	41.60	67.90	7.98	65
-	2/29/12	6.20	28.90	51.40	6.50	6
-	3/3/12	5.20	14.40	77.50	9.85	465
-	3/15/12	9.30	35.70	72.20	8.25	18
-	3/28/12	9.60	34.20	63.40	7.16	49
-	4/8/12	8.80	-	64.40	7.50	4
-	4/25/12	11.00	22.20	57.90	6.47	22
-	5/6/12	11.90	31.50	62.20	6.68	10
-	5/23/12	12.60	66.50	68.90	7.28	-
-	6/3/12	18.50	65.80	91.70	8.60	54
-	6/20/12	15.50	40.90	71.20	7.20	91
JL4 Tide Gate	Average/Geomean	9.58	23.83	53.31	6.11	87
-	9/25/11	16.70	15.10	88.30	8.56	438
-	10/12/11	11.80	15.20	57.10	6.12	282
-	10/23/11	12.00	19.20	43.20	4.58	363
-	11/9/11	8.30	18.60	45.80	5.33	76
-	11/20/11	4.70	17.90	51.10	6.40	140
-	12/7/11	6.00	20.30	58.20	7.10	53
-	12/18/11	8.40	26.60	38.10	4.49	38
-	1/3/12	7.40	26.10	62.50	7.46	53
-	1/23/12	5.60	27.60	63.90	8.01	166
-	2/7/12	7.20	33.20	51.00	6.05	15
-	2/12/12	9.40	25.40	43.40	4.93	80
-	2/29/12	5.90	32.20	47.40	5.90	34
-	3/3/12	5.20	17.60	79.30	10.49	445
-	3/15/12	7.20	26.70	75.30	9.10	69
-	3/28/12	9.40	23.20	55.80	6.58	21
-	4/8/12	10.80	-	41.80	4.62	14
-	4/25/12	11.30	21.50	41.10	4.48	171
-	5/6/12	12.10	30.50	46.30	4.96	71
-	5/23/12	12.70	25.00	36.50	3.84	267
-	6/3/12	14.30	33.80	52.40	5.36	57
-	6/20/12	14.70	20.90	41.00	4.02	88
Average - all sites		10.06	31.37	59.76	6.78	90
Lower Nookachamps						
LN1 College Way	Average/Geomean	7.62	6.76	97.07	11.57	175
-	10/7/11	12.30	15.10	84.70	9.06	1600
-	10/18/11	7.00	3.70	72.10	8.50	890
-	11/4/11	7.10	5.20	80.80	9.82	375
-	11/15/11	4.90	4.60	93.10	11.90	390
-	12/6/11	2.40	4.33	-	-	20
-	12/13/11	1.10	3.30	101.00	14.50	30

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
LN1 College Way	12/30/11	7.00	26.40	95.70	11.72	715
-	1/10/12	6.30	5.70	94.10	11.80	95
-	1/27/12	4.30	7.60	102.10	13.61	245
-	2/7/12	3.00	3.90	95.80	12.91	15
-	2/28/12	5.10	6.80	97.90	12.48	30
-	3/6/12	4.80	8.20	101.30	12.80	215
-	3/23/12	5.70	5.90	97.20	11.94	80
-	4/3/12	8.50	5.10	94.50	10.38	35
-	4/16/12	11.10	8.00	98.70	10.68	695
-	5/1/12	10.70	11.90	95.60	10.47	900
-	5/18/12	11.80	2.24	104.50	10.89	110
-	5/30/12	12.80	2.10	98.70	10.28	215
-	6/15/12	12.20	2.30	106.80	11.34	225
-	6/26/12	14.20	2.80	86.80	8.78	250
LN2 HWY 9 Bridge	Average/Geomean	6.16	3.94	89.13	11.21	47
-	10/7/11	10.40	0.90	85.40	9.53	224
-	10/18/11	6.10	2.60	82.40	10.22	55
-	11/4/11	6.70	3.60	82.00	10.52	174
-	11/15/11	3.60	2.00	92.20	12.17	36
-	12/6/11	1.50	4.05	-	-	56
-	12/13/11	0.60	2.80	78.30	12.50	32
-	12/30/11	5.50	11.90	99.20	12.38	20
-	1/10/12	5.30	3.70	83.00	10.48	26
-	1/27/12	3.70	4.20	91.10	11.92	21
-	2/7/12	3.10	2.40	85.00	11.44	20
-	2/28/12	4.10	5.90	91.10	12.30	18
-	3/6/12	4.50	4.90	91.00	11.57	43
-	3/23/12	5.10	2.90	91.90	11.58	20
-	4/3/12	6.80	3.70	89.40	10.71	16
-	4/16/12	7.80	2.50	96.70	11.33	69
-	5/1/12	6.60	11.10	95.00	11.39	308
-	5/18/12	10.30	2.21	85.40	9.48	64
-	5/30/12	10.00	2.30	82.70	9.18	49
-	6/15/12	10.00	2.80	86.10	9.70	56
-	6/26/12	11.40	2.30	74.70	8.03	95
LN3 Swan Road	Average/Geomean	7.00	5.35	83.37	10.62	69
-	10/7/11	10.80	9.10	77.20	8.60	188
-	10/18/11	7.00	9.50	72.70	8.74	63
-	11/4/11	5.50	5.50	73.70	9.33	309
-	11/15/11	4.00	2.70	86.70	11.40	253
-	12/6/11	2.10	7.43	-	-	31
-	12/13/11	1.20	4.40	80.20	11.30	58
-	12/30/11	6.00	10.20	86.90	10.81	44
-	1/10/12	5.70	3.80	86.00	10.78	54
-	1/27/12	3.40	5.30	90.20	12.30	164
-	2/7/12	3.10	3.50	85.00	11.43	28
-	2/28/12	4.50	7.80	93.00	11.92	24
-	3/6/12	4.50	5.20	84.70	10.80	29

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
LN3 Swan Road	3/23/12	5.60	4.30	87.60	10.79	123
-	4/3/12	7.40	4.40	85.40	10.07	22
-	4/16/12	9.40	3.20	88.60	9.94	26
-	5/1/12	6.60	10.90	87.20	10.46	385
-	5/18/12	14.10	2.62	80.20	8.09	38
-	5/30/12	12.40	1.80	74.70	7.87	51
-	6/15/12	12.30	3.00	77.60	8.14	148
-	6/26/12	14.30	2.30	64.80	6.45	68
LN4 Francis Road	Average/Geomean	7.26	5.90	81.81	9.73	71
-	10/7/11	10.90	6.80	55.00	6.06	150
-	10/18/11	8.60	9.70	58.50	6.86	47
-	11/4/11	5.90	6.80	74.40	9.26	183
-	11/15/11	4.40	3.20	86.90	11.30	161
-	12/6/11	2.20	6.40	-	-	62
-	12/13/11	1.30	5.60	77.50	10.40	50
-	12/30/11	6.00	13.90	86.90	10.85	84
-	1/10/12	6.10	4.40	83.30	10.32	64
-	1/27/12	3.60	5.30	90.40	11.90	138
-	2/7/12	3.60	3.70	85.40	11.33	27
-	2/28/12	4.50	8.60	87.20	11.30	19
-	3/6/12	4.70	5.90	84.50	10.70	43
-	3/23/12	6.00	4.20	86.50	10.55	91
-	4/3/12	7.60	4.40	84.30	9.92	36
-	4/16/12	9.80	3.30	82.00	9.14	12
-	5/1/12	6.90	15.40	86.90	10.46	710
-	5/18/12	14.60	2.36	81.70	8.19	26
-	5/30/12	12.10	2.50	79.60	8.40	44
-	6/15/12	12.10	2.90	79.70	8.52	252
-	6/26/12	14.20	2.70	65.40	6.54	118
Average - all sites		7.01	5.49	87.84	10.78	90
Upper Nookachamps						
UN1 Lake McMurray Est.	Average/Geomean	8.63	2.73	67.22	8.23	10
-	9/27/11	12.10	2.70	33.60	3.55	35
-	10/15/11	7.80	11.30	-	-	6
-	10/25/11	7.70	7.50	-	-	1
-	11/12/2011	7.40	2.90	63.20	8.41	26
-	11/22/11	6.70	1.89	80.00	8.00	166
-	12/10/11	3.50	3.50	78.60	9.16	6
-	12/20/11	5.90	1.60	60.80	7.52	1
-	1/6/12	5.70	2.20	69.50	8.67	6
-	2/4/12	3.70	1.33	83.70	10.97	1
-	2/14/12	5.80	1.50	90.40	11.25	5
-	3/3/12	4.80	2.18	8.50	10.81	12
-	3/13/12	4.50	2.45	83.00	10.64	8
-	3/31/12	6.80	2.89	87.90	10.52	15
-	4/10/12	10.00	1.20	96.60	10.68	6
-	4/28/12	12.10	2.20	91.10	9.60	11

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
UN1 Lake McMurray Est.	5/8/12	13.70	0.90	99.60	10.19	3
	5/26/12	15.40	0.94	60.40	5.94	57
	- 6/5/12	13.40	1.78	41.60	4.26	56
	- 6/23/12	16.90	1.00	72.80	6.94	113
UN2 Big Lake Outflow	Average/Geomean	9.49	2.99	95.33	11.04	8
	9/27/11	15.30	6.10	82.30	8.26	26
	- 10/15/11	11.10	2.70	65.80	7.22	21
	- 10/25/11	10.90	2.90	-	-	18
	- 11/12/0211	7.50	3.50	91.00	11.40	65
	- 11/22/11	5.87	2.95	103.00	12.48	35
	- 12/10/11	3.70	4.10	86.30	12.55	19
	- 12/20/11	5.10	3.10	95.00	12.11	17
	- 1/6/12	5.90	5.30	100.50	12.51	10
	- 2/4/12	4.10	2.66	101.40	13.26	7
	- 2/14/12	5.80	2.60	110.00	13.80	6
	- 3/3/12	5.30	6.49	97.90	12.35	3
	- 3/13/12	5.20	4.03	92.80	11.60	14
	- 3/31/12	7.60	2.86	101.50	11.94	3
	- 4/10/12	10.10	1.60	104.20	11.55	1
	- 4/28/12	12.80	1.26	96.70	10.03	8
	- 5/8/12	14.40	0.80	101.80	10.25	3
	- 5/26/12	16.00	0.79	90.60	8.79	7
	- 6/5/12	15.70	1.42	91.10	8.91	1
	- 6/23/12	18.00	1.60	104.00	9.65	4
	UN3 Otter Pond Road	Average/Geomean	8.82	3.31	99.54	11.43
9/27/11		13.80	6.90	98.60	8.25	541
- 10/15/11		8.20	1.10	96.60	11.40	18
- 10/25/11		9.10	2.20	-	-	33
- 11/12/0211		6.50	2.80	98.00	12.50	27
- 11/22/11		5.60	7.07	111.20	13.60	263
- 12/10/11		2.50	2.70	-	12.60	7
- 12/20/11		5.10	2.10	100.20	12.78	11
- 1/6/12		5.90	3.90	101.40	12.70	17
- 2/4/12		4.20	1.88	98.70	12.87	12
- 2/14/12		5.70	2.10	100.20	12.66	30
- 3/3/12		5.20	3.51	100.50	12.81	17
- 3/13/12		4.90	9.77	95.00	11.50	28
- 3/31/12		7.20	2.64	100.80	11.97	20
- 4/10/12		11.80	0.80	93.70	9.95	1
- 4/28/12		11.90	2.56	100.60	10.76	22
- 5/8/12		14.60	2.20	100.60	10.08	12
- 5/26/12		15.50	1.57	94.00	9.23	45
- 6/5/12		13.60	3.50	101.60	10.32	1600
- 6/23/12		16.20	3.50	100.40	9.68	609
UN4 Knapp Road		Average/Geomean	8.67	5.49	83.04	9.75
	- 9/27/11	14.50	5.90	36.30	3.52	177
	- 10/15/11	9.10	12.80	-	-	-

Site	Date	Water Temp(°C)	Turbidity (NTU)	D.O. (% sat.)	D.O. (mg/l)	FC High-Low average (CFU/100ml)
UN4 Knapp Road	10/25/11	8.90	4.70	-	-	138
-	11/12/0211	6.80	6.20	70.80	8.82	1600
-	11/22/11	5.90	16.78	89.10	10.17	730
-	12/10/11	3.00	4.20	80.60	11.59	50
-	12/20/11	5.30	3.10	87.10	11.01	59
-	1/6/12	5.60	5.70	87.60	11.00	205
-	2/4/12	3.10	2.82	90.50	12.18	59
-	2/14/12	5.70	4.20	96.40	12.07	42
-	3/3/12	5.30	6.51	88.40	11.13	46
-	3/13/12	3.50	6.53	81.50	10.60	193
-	3/31/12	7.10	4.22	90.10	10.71	120
-	4/10/12	9.80	3.30	95.80	10.72	33
-	4/28/12	12.00	2.25	81.60	8.63	51
-	5/8/12	13.60	1.50	92.10	9.45	19
-	5/26/12	14.70	2.18	78.30	7.79	374
-	6/5/12	14.80	3.30	81.90	8.15	186
-	6/23/12	16.00	8.20	83.50	8.13	
Average - all sites		8.90	3.63	85.31	8.01	42

Appendix B – Storm Team Data

Site ID	11/13/11	12/28/11	1/5/12	1/21/12	1/30/12	2/14/12	2/22/12	3/10/12	3/30/12	4/20/12	6/8/12
BV1			80	1600	50	150	220	120	200	1220	
BV2	1600	20	40	260	20	20	160	60	500	560	
BV3	1220	520	2180	680	640	520	500	1280	720	1020	
BV4	1180	1600	240	1600	40	120	1060	840	1600	1600	
BV5		240	80	1500	500	60	760	580	1600	1600	
BV6	420	20	60	600	420	120	200	420	1080	1600	60
BV7	1600	300	100	1000	100	500	900	900	300	1300	400
BV8	740	230	100	1060	60	120	240	200	140	1640	40
NN9	1110	130	250	1600	960	250	1150	1600	860	1600	160
NN10	80	20	220	360	40	80	420	100	1180	1600	60
NN11	640	480	1600	700	270	170	460	1500	1600	1600	170
NN12	405	20	415	265	280	75	470	1250	1600	1600	745
NN13	310	290	870	680	260	190	430	1600	1600	1600	680
NN14	520	90	20	820	50	0	160	10	50	70	
NN15	400	1600	780	240	1420	380	520	1600	1600	1600	220
NN16	580	260	540	440	340	240	420	900	1600	1600	1280
NN17	1600	360	880	380	180	140	40	700	320	1600	
NN18	20	60	10	290	10	10	70	50	10	130	40

Site ID	Bay View Site Names	Site ID	No name Slough Sites
BV1	Padilla Bay Culvert	NN9	Marihugh/Bay View-Edison
BV2	Ranger Greg's Ditch	NN10	Lower field (11916)
BV3	S Bay View State Park	NN11	Egbers Across footbridge
BV4	B Street Culvert	NN12	No Name tide gate
BV5	B Street #2	NN13	Bay View Rd - Blue house
BV6	Boat Launch Culvert	NN14	Farm2Market pallet place
BV7	Beach Cottage	NN15	Upper Marihugh Rd (13735)
BV8	End of Wilson (N)	NN16	Wilson Rd East Fork
		NN17	Wilson Rd West Fork
		NN18	Rector Rd - green mailbox

Appendix C. Quality Objectives

parameter	method	precision (Rel. Std. Dev.)	accuracy	detection level
Dissolved Oxygen (DO)	YSI 55 Probe	Unavailable	± 0.3 mg/l	0-20 mg/l
Total depth	Fixed/hand-held Tape	± 20%	± 0.05 meters	0 - 1 cm
Turbidity	Turbidimeter	Unavailable	0.01 NTU	0-19.9 NTU 0-199.9 NTU
Temperature	YSI 55 Probe	Unavailable	0.2° C	°-5 to 45° C

parameter	method	test equipment	filter type	incubation
Fecal coliform bacteria	Membrane Filtration	Millipore sterifil aseptic system	47 mm membrane filter .45 um pore space	Millipore single chamber incubator Temp. range 30°c (±0.5) 44.5°c (±0.2)

Standard Operating Procedures (SOP's)

1. Dissolved Oxygen (DO)- Samples will be taken with a bottle placed in an extension pole and dipped using the Standard Methods. DO will be measured using a YSI 55 probe. Results will be recorded as DO mg/l.

DO testing procedure (YSI 55 Probe):

- i. Turn probe on and calibrate immediately when picking up equipment. Make sure sponge inside the calibration chamber is wet with distilled water.
- ii. Place probe in water below the surface of water and move probe back and forth until the reading stabilizes. Record the result in mg/l. Leave probe on for the rest of the sampling.

2. Temperature will be measured with a YSI probe and recorded in °C.

3. Total depth is measured using depth gauges installed at some sites.

4. Water clarity will be determined by placing a sample into a turbidimeter (EPA approved VWR 66120-200)

- i. Warm-up Turbidimeter 30 minutes and calibrates w/ 0 NTU polymer standard using the "zero-adjustment".
- ii. Thoroughly shake the water sample in a clean sampling jar.
- iii. Pour sample into unscratched, clean, and Kim-wiped vial. Mix again
- iv. Place in turbidimeter w/ index line facing directly out to the front.
- v. Read and record the steady reading after the highest readings settle.

vi. If reading is greater than 200 NTU, dilute the sample by 50%. (x 2).

variable	sampling equipment	sample container	sample preservation	maximum holding time
fecal coliform	Pole w/glass bottle	glass bottle pre-sterilized	ice chest with ice pack	1 hr
<u>d. oxygen</u>	YSI probe	instream	none	immediately
total depth	Installed depth gauge	instream	none	immediately
temperature	YSI probe	instream	none	immediately
	thermometer	instream	none	immediately
turbidity	turbidimeter	glass bottle, wide-mouth	ice chest	2 hrs

Equipment calibration and maintenance

1. Millipore Sterifil Filtration System maintenance

Maintenance: Immediately after use disassemble the apparatus and clean the components to ensure optimum performance.

- i. Remove the cover from the funnel. Carefully remove the O-ring using forceps. Remove the support screen from the base by pushing a short blunt rod through the base outlet.
- ii. Clean all components with a sponge, hot water, and non-alkaline, non-abrasive cleanser (anti-bacterial soap). Remove stubborn residues on the insides of the holder, cover port, and flask side arms using a plastic bristle brush and pipe cleaner dipped in cleanser (do not use any steel wool or abrasive materials that can harm the components).
- iii. Rinse the components with lab water and sterilize.

2. Sample Containers and Equipment maintenance

Maintenance: Empty bottles and place in Liquinox and warm water. Wash with a bottlebrush. Double rinse with tap water and final rinse with distilled water. Autoclave all fecal coliform sample bottles and graduated cylinders.

3. Millipore Portable Single Chamber Incubator maintenance

Maintenance: Clean the exterior case and interior chamber with a damp cloth and warm water (anti-bacterial soap). Give final spray with rubbing alcohol.

4. VWR Turbidimeter

Calibration: Insert 0 NTU polymer standard with the range control set at "20". Set the "Zero Control" to 0. Set the coarse so that the meter reads as close to zero as possible. Calibrate turbidimeter annually.

5. YSI Meters (DO, Temp)

Calibration: Press and release UP ARROW and DOWN ARROW keys at the same time. Enter "0" for altitude and salinity, and ENTER afterwards. Instrument is calibrated.

Maintenance: Turn YSI 55 off and rinse probe with distilled water after each use. Replace membrane filters and Kim-wipe moisturizers monthly. Replace batteries as needed.

Appendix D. Sample Data Sheet

Date: _____

**Lower Samish Watershed
Skagit Stream Team
Water Quality Monitoring**

Field Work By _____

Lab Work By: _____

Dupe Site _____
FC Results _____

Site LS1. Old Hwy. 99 Samish Bridge Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other _____ Field: Biological/Unusual Observations: _____	Time of Sample	Total Depth ft	Water Temp C	Turbidity _____ NTU's Fecal Coliform _____ FC = _____ FC mL 100 mL Fecal Coliform _____ FC = _____ FC mL 100 mL
	D.O. saturation %	D.O. mg/L		
	Lab metadata			

Site LS2. Samish River @ Jolly Road Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other _____ Field: Biological/Unusual Observations: _____	Time of Sample	Total Depth ft	Water Temp C	Turbidity _____ NTU's Fecal Coliform _____ FC = _____ FC mL 100 mL Fecal Coliform _____ FC = _____ FC mL 100 mL
	D.O. saturation %	D.O. mg/L		
	Lab metadata			

Site LS3. Samish River @ Chuckanut Drive Bridge Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other _____ Field: Biological/Unusual Observations: _____	Time of Sample	Total Depth ft	Water Temp C	Turbidity _____ NTU's Fecal Coliform _____ FC = _____ FC mL 100 mL Fecal Coliform _____ FC = _____ FC mL 100 mL
	D.O. saturation %	D.O. mg/L		
	Lab metadata			

Site LS4. Samish River @ Mouth (Boat Dock) Water Appearance <input type="checkbox"/> Scum/Film <input type="checkbox"/> Foam <input type="checkbox"/> Muddy Brown <input type="checkbox"/> Milky <input type="checkbox"/> Clear <input type="checkbox"/> Oily Sheen <input type="checkbox"/> Frozen <input type="checkbox"/> Other _____ Field: Biological/Unusual Observations: _____	Time of Sample	Total Depth ft	Water Temp C	Turbidity _____ NTU's Fecal Coliform _____ FC = _____ FC mL 100 mL Fecal Coliform _____ FC = _____ FC mL 100 mL
	D.O. saturation %	D.O. mg/L		
	Lab metadata			

Additional notes or observations:

