# Whatcom County 2013 Water Quality Report and Priority Areas

**Fecal Coliform in Coastal Drainages**

Whatcom County Public Works

June 2014

## Executive Summary

Whatcom County Public Works (WCPW) uses water quality monitoring, priority area ranking, pollution source identification, community education, technical and financial assistance programs, and regulatory enforcement to protect public health and prevent pollution of surface waters.

This annual report summarizes Whatcom County's bacterial water quality concerns, outlines the routine monitoring program, characterizes the current status of water quality at each monitoring station based upon the last three years of data, prioritizes areas for water quality improvement projects, and describes the areas where Whatcom County will be focusing efforts in the next year.

WCPW coordinates regular monitoring of fecal coliform levels at a fixed-network of approximately 90 sites in county watersheds that discharge to marine waters. All samples are analyzed at Department of Ecology certified laboratories using standard methods for fecal coliform analysis. Quality control steps are used to measure variability due to sampling methods and conditions. Sampling events are pre-scheduled, typically at least a month in advance, and provide data from a broad spectrum of environmental conditions throughout the year.

The status of each drainage area was evaluated based upon the most current water quality data available. The criteria and associated scores are described below for the five categories analyzed: annual geometric mean, annual 90$^{th}$ percentile, three year geometric mean, three year geometric mean for the dry season, and three year geometric mean for the wet season. Additionally, each site was scored for current status of the shellfish growing area to which the waterbody discharges. Higher points indicate higher levels of bacterial impairment. The top ten ranked drainages based upon 2013 data and the above described ranking criteria and scores are:

1. CCO- Cain Creek (54 points)
2. CA1- California Creek (45 points)
3. TribDak3- Dakota Creek (42 points)
4. CC- Cain Creek (42 points)
5. TribDak2- Dakota Creek (39 points)
6. TribDak4- Dakota Creek ( 39 points)
7. CA14- California Creek (36 points)
8. CA16- California Creek (33 points)
9. CA9- California Creek (30 points)
10. K1a- Portage SPD (30 points)

Based upon this ranking and other considerations, WCPW will initially focus community engagement and landowner assistance programs on water quality improvement projects in the Lower Dakota Creek (TribDak2, TribDak3, TribDak4), Loomis Trail (CA1) and Brown Malloy (CA14) drainages in 2014. WCPW will also continue work with the Birch Bay Watershed and Aquatic Resources Management District (BBWARM) and the Marine Resources Committee (MRC) to address issues in the Cottonwood Drainage (BB8) in 2013. WCPW will continue partnering with the Whatcom Clean Water Program in the Portage Bay Shellfish Protection District. As resources allow, partnerships are formed, or water quality improves, additional focus areas will be addressed.

## Introduction

Purpose

Whatcom County Public Works' (WCPW) Pollution Identification and Correction (PIC) Program includes water quality monitoring, follow up monitoring at sites with elevated bacteria levels, community outreach, and coordination with County departments and other agencies to identify and address potential bacteria sources.

Whatcom County's PIC Program includes an annual review of routine monitoring sites located throughout the county. This annual review helps characterize the current status of watershed health and associated public health threats, focus limited county resources on the areas that will most benefit from water quality improvement efforts, and engage landowners in community solutions.

Currently, Whatcom County Public Works (WCPW) monitors fecal coliform and other water quality parameters at approximately 90 stations on at least a monthly basis. Sample collection is conducted following standard protocols by trained staff, contractors, project partners, and volunteers (WCPW 2008, WCPW 2013). Sample analysis is conducted following standard methods and quality control and assurance measures at DOE-certified laboratories. Data from the routine monitoring program assist the County Health Department, County Planning and Development Services (PDS), and other agencies to identify sources of bacterial pollution.

The Whatcom County PIC Program builds off several elements of the Kitsap County PIC program (BKCHD, KCHD 2011). These are routine monitoring, annual review and ranking of drainages, and initial voluntary interactions with landowners to identify pollution sources and provide tools to help improve management practices that may be impacting water quality. The annual review and ranking of drainages focuses pollution prevention efforts in areas that have most consistently shown high bacteria counts.

This annual report summarizes Whatcom County's bacterial water quality areas of concern, outlines the routine monitoring program, characterizes the current status of water quality at each monitoring station, prioritizes areas for water quality improvement projects, and describes the areas where Whatcom County will be focusing efforts in the next year.

Fecal Coliform in Whatcom County Waters

Water Resource Inventory Area (WRIA) 1 is located in the northwest corner of Washington State and encompasses over 60 percent of Whatcom County which is the most populated portion (Blake and Peterson 2005). WRIA 1 also includes small portions of Skagit County and British Columbia. Since 1998 a variety of water resource management stakeholders, local and state agencies, and tribal governments have worked together under the Watershed Management Act to characterize issues related to water quantity, water quality, fish habitat, and instream flows as well as to identify potential management solutions. The characterization completed in 2005 found fecal coliform to be the predominant water quality issue in Whatcom County based upon 303(d) listings. Of the 274 individual 303(d) listings for WRIA 1 in 1998, 82 were for fecal coliform, while the next most frequent, dissolved oxygen, had 48 listings. In 2008, there were 253 individual Category 5 303(d) listings for water in WRIA 1. Sixty-six of these Category 5 listings were for fecal coliform and listings for dissolved oxygen increased to 106.

Continuation of this widespread problem of elevated fecal coliform in Whatcom County waters is illustrated by the WCPW routine monitoring program data, recurring shellfish harvest closures, and recent public health advisories. Of the 87 freshwater stations with at least three years of data, only 18 (21%) meet water quality standards for fecal coliform (Appendix A). Elevated bacteria levels in marine waters have led to the establishment of three shellfish protection districts in Whatcom County: Drayton Harbor, established in 1995, Portage Bay, established in 1998, and Birch Bay, established in 2009.

Drayton Harbor historically supported non-tribal commercial, tribal commercial, ceremonial, and subsistence harvests, and recreational shellfish harvesting. The harbor has been at the top of the Washington State Department of Health (DOH) Fecal Pollution Index (FPI) list for over 10 years. Although water quality improvements led to upgrades in portions of the harbor to Conditional Approval in 2004 and 2010, there is a seasonal closure between November and February and a large portion of the harbor remains prohibited. The community is now tackling the harder non-point sources in an effort to regain Approved status throughout the year and the entire harbor.

Portage Bay supports commercial, ceremonial, and subsistence shellfish harvest for members of the Lummi Nation. Portions of the Portage Bay shellfish growing area were re-opened in 2003 and the remaining closed areas were reopened in 2006; however, starting in 2004 fecal coliform levels in the mainstem of the Nooksack River began increasing again. Between 2009 and 2012, the fecal coliform geometric mean at the mainstem site located at Marine Drive (M1) more than doubled. While the levels are still meeting water quality standards, this substantial increase created concern for the potential impact on the shellfish growing area status. Due to elevated bacteria levels, 5 of 12 marine monitoring stations in Portage Bay were described as threatened and 2 of 12 were described as sites of concern in DOH's 2012 Annual Growing Area Review.

Birch Bay is a large draw for recreational shellfish harvesters, including both locals and tourists. Birch Bay State Park has consistently been one of the top recreational shellfish areas of the state. The shellfish growing area around the mouth of Terrell Creek was downgraded to Prohibited in 2008 due to elevated levels of fecal coliform bacteria in the creek. Current fecal coliform levels in Terrell Creek are not as high as have been historically documented; however, several tributaries and the majority of coastal drainages discharging to the bay exceed both parts of the water quality standard for fecal coliform.

Northern Chuckanut Bay has been closed for recreational shellfish harvest since 1994 due to elevated bacteria levels and on-site sewage system (OSS) findings. Beginning in 2011, Wildcat Cove in Larrabee State Park was posted with a swimming advisory due to elevated bacteria levels. These advisories and closures are included in the *Whatcom County Fecal Coliform Levels and Shellfish Growing Area Status* map (Appendix B).

<u>Sources of Fecal Coliform Water Pollution</u>

The primary cause of pollution in Whatcom County's creeks and marine waters is nonpoint source pollution. Nonpoint source pollution is the term used to describe pollutants that come from many smaller sources, rather than a few large sources. This accumulation of pollutants often results from common activities in both urban and rural areas.

Although there are many types of water pollutants, Whatcom County focuses on fecal coliform bacteria as the primary indicator of surface water quality. Fecal coliform bacteria are found in the feces of human and warm-blooded animals. While most fecal coliform strains do not cause human illness, detection in a creek or bay do indicate that human and/or animal wastes and the associated harmful pathogens are present. Examples of pathogen-related illnesses are giardia, salmonella, viral gastroenteritis, hepatitis, and cholera. People are exposed to these pathogens through direct water contact, such as swimming, wading, or eating shellfish from waters with high bacteria levels.

The key potential sources of bacteria that have been identified in Whatcom County coastal drainages are (1) **animal waste** from agricultural operations, domestic pets, waterfowl, and urban wildlife, and (2) **human sewage** from failing on-site sewage systems (OSS), leaking sewers, or cross-connections.

## Water Quality Program

Water Quality Monitoring

WCPW conducts routine water quality monitoring to guide water quality improvement projects and meet the following goal and objectives.

*Goal:* Reduced fecal coliform levels at priority drainages to meet applicable water quality standards and support human health, recreational uses, animal health, and shellfish harvest.

*Objectives:*

- Assess surface water quality status and trends through long-term monitoring.
- Compare results against applicable standards.
- Prioritize hot spots for water quality improvement projects (both within the county and within a creek).
- Identify public health concerns.
- Identify potential sources of bacteria and guide implementation of water quality improvement projects.
- Provide water quality data to the public and other interested parties.

Washington State Water Quality Standards

Table 1 lists water quality standards for fecal coliform bacteria at marine and freshwater sites in Whatcom County coastal drainages. The Lummi Nation has similar water quality standards for the Lummi Indian Reservation but these waters are monitored by the Lummi Natural Resources Department. The water quality standards that govern Whatcom County are established and regulated by the Washington State Department of Ecology and approved by the U.S. Environmental Protection Agency. They are described more fully in Chapter 173-201A of the Washington Administrative Code (WAC).

**Table 1.** Department of Ecology Water Quality Standards for coastal drainages.

| **Marine Water Standards** | **Freshwater Standards** | **Freshwater Standards** |
|---|---|---|
| All Areas | Extraordinary Primary Contact<br>Cain Creek, Birch Bay watershed | Primary Contact<br>Nooksack, Drayton, and Chuckanut watersheds |
| • Geometric Mean-14FC/100mL<br>• Estimated 90$^{th}$ Percentile-43 FC/100mL | • Geometric Mean-50FC/100mL<br>• Not more than 10% exceed 100 FC/100mL | • Geometric Mean-100FC/100mL<br>• Not more than 10% exceed 200 FC/100mL |

Routine Monitoring

WCPW coordinates regular monitoring of fecal coliform levels at a fixed-network of approximately 90 sites in county watersheds that discharge to marine waters. Water samples are collected by WCPW staff, Northwest Indian College (NWIC) staff, Washington Conservation Corps (WCC) crew members, Nooksack Salmon Enhancement Association (NSEA) staff, and trained Marine Resources Committee (MRC) volunteers. Field teams are trained in sampling, storage, and lab delivery protocols. All samples are analyzed at Department of Ecology-certified laboratories using standard methods for fecal coliform analysis. Quality control steps are used to measure variability due to sampling methods and conditions. Results are compared against data quality objectives to measure precision of results. Sampling events are pre-scheduled, typically at least a month in advance, and provide data from a broad spectrum of environmental conditions throughout the year. During some seasons, samples are unable to be collected due to no flow, tidal, or other environmental conditions. Water quality data are used to prioritize drainages for pollution identification and control projects and to characterize general patterns in declining and improving water quality. The WCPW staff coordinates with County Health, PDS, Whatcom Conservation District (WCD), and State Departments of Agriculture (WSDA) and Ecology (DOE) to respond to drainages where elevated bacteria levels are consistently observed.

Data Quality Objectives

The various fecal coliform monitoring programs coordinated by Whatcom County include collection of field duplicates for 10% of the samples. For example, eight samples would require one field duplicate and fourteen samples would require two field duplicates. Field duplicates are collected immediately after the original sample in the same location. Precision of the field duplicates is evaluated in terms of relative standard deviation (RSD). The data quality objectives are 1) not more than 50% of duplicates have a RSD of greater than 20% and, 2) not more than 10% of duplicates have an RSD of greater than 50%. Field duplicates with low bacteria levels (below 20FC/100mL) often show the higher variability and are analyzed separately from other duplicates for calculation of the RSD (Mathieu 2006). As summarized below, fecal coliform data collected over the last three years were compared to the data quality objectives for Drayton Harbor, Birch Bay, Portage Bay, and Coastal Drainage routine monitoring programs.

*Drayton Harbor Watershed (WCPW)*

From 2011 through 2013, there were 34 sampling events in the Drayton Harbor routine monitoring program conducted by WCPW staff. Field duplicates were collected for 10% of the samples. Approximately 5% had a RSD of greater than 50% and about 23% had a RSD of greater than 20%. These RSDs meet the data quality objectives listed above.

*Birch Bay Watershed (WCPW, NSEA)*

From 2011 through 2013, there were 71 sampling events in the Terrell Creek/Birch Bay routine monitoring program conducted by WCPW and NSEA staff. In July 2012, NSEA began collecting the Terrell Creek samples upstream of Ter3.3 in coordination with WCPW. Field duplicates were collected for 10% of the samples. Approximately 9% had a RSD of greater than 50% and 44 % had a RSD of greater than 20%. These RSDs meet the data quality objectives listed above.

*Portage Bay Shellfish Protection District (NWIC, WCPW)*

From 2011 through 2013, there were 34 sampling events in the Portage Bay Shellfish Protection District routine monitoring program conducted by NWIC staff. In 2012, WCPW began conducting a second sampling run each month resulting in 12 additional sampling runs. Field duplicates were collected for 10% of the NWIC and WCPW samples. For the NWIC samples, about 15% had a RSD of greater than 50% and about 44% had a RSD of greater than 20%. These field duplicates meet the data quality objectives for the number of RSDs that exceed 20%, but exceeds the objectives for the number of RSDs that exceed 50%. Similarly, review of the WCPW samples show approximately 17% had a RSD of greater than 50% and 57% had a RSD of greater than 20%, exceeding both data objectives. When WCPW duplicates with low bacteria levels are separated, one data objective is met with 49% of RSDs exceeding 20%. The second data objective is nearly met with 12% of RSDs exceeding 50%. These data have been combined for analysis in this report and are accepted as adequate for this water quality review.

*Coastal Drainages (WCC, MRC volunteers)*

From 2011 through 2013, there were 30 sampling events in the Coastal Drainage routine monitoring program conducted by the WCC crew, WCPW staff, and trained MRC volunteers. Field duplicates were collected for 10% of the samples. Twelve percent of the duplicates had a RSD of greater than 50% and about 34% had a RSD of greater than 20%. When duplicates with low bacteria levels are separated, the data objectives are met with 2.3% exceeding the 50% RSD objective. Overall, the coastal drainage RSDs are accepted as adequate for this water quality review.

Water Quality Status in Whatcom County Creeks and Rivers

The following table summarizes how 2013 fecal coliform results at each routine monitoring site compare to the state water quality standards. The total number of sites and the number of sites failing the standard, partially meeting the standard, and meeting the standard are summarized for each watershed. More specific details for each monitoring site are provided in Appendix A.

**Table 2.** Summary of monitoring sites within each watershed in comparison to fecal coliform standards in 2013.

| Watershed | Number of Sites | Number of Sites Exceeding Both Parts of Standards[a] | Number of Sites Exceeding One Part of Standard[b] | Number of Sites Meeting Both Parts of Standards[c] |
|---|---|---|---|---|
| California Creek | 13 | 8 (62%) | 4 (31%) | 1 (8%) |
| Dakota Creek | 17 | 7 (41%) | 4 (24%) | 6 (35%) |
| Terrell Creek | 14 | 5 (36%) | 7 (50%) | 2 (14%) |
| Portage SPD | 15 | 10 (67%) | 1 (1%) | 4 (27%) |
| Birch Bay Coastal | 15 | 7 (47%) | 4 (27%) | 4 (27%) |
| Drayton Coastal | 5 | 0 (0%) | 5 (100%) | 0 (0%) |
| Chuckanut Coastal | 4 | 0 (0%) | 4 (100%) | 0 (0%) |
| Lummi Island Coastal | 2 | 0 (0%) | 1 (50%) | 1 (50%) |
| Cain Creek | 2 | 2 (100%) | 0 (0%) | 0 (0%) |
| **Totals** | **87** | **39 (45%)** | **30 (34%)** | **18 (21%)** |

a- Indicates frequent elevated fecal coliform levels.
b- Indicates occasional elevated fecal coliform levels (or spikes).
c- Indicates consistently lower fecal coliform levels.

Water Pollution Clean Up Programs

Through the enhanced PIC program, Whatcom County watersheds discharging to marine waters are ranked and drainage-specific water quality improvement strategies are developed and implemented through community outreach and engagement for the highest priority areas. Each year staff determines the extent of priority areas that can be targeted based upon staff and other resource availability. Whatcom County, in partnership with the Whatcom Conservation District, will work with landowners to identify and implement community solutions to elevated fecal coliform bacteria levels. Through community engagement, technical assistance, and incentive programs a community sense of ownership and stewardship will be developed for neighborhood creeks. A regulatory backstop will be utilized as a final tool when elevated fecal coliform levels remain in an area and where landowners have selected not to participate in the voluntary program and there are egregious or repeated violations of regulations.

The drainage-specific community outreach strategies build off successful outreach components in programs implemented in Kitsap County and Whatcom County's Tenmile Watershed. The drainage-specific strategies at a minimum include a series of three neighborhood meetings, a landowner survey, and educational materials. Neighborhood meetings are targeted at an initial stage, mid-stage, and a final stage of each local effort. The landowner survey is modeled after the Tenmile Watershed Restoration Project and focuses on characteristics of the property, activities the landowner would be willing to do to improve water quality, attitudes toward watershed and water quality issues, decision-making factors, and ways to learn about land and water management activities. Educational materials include options for controlling bacteria from diverse sources found in the rural landscape such as OSS, farm animals, pets, and urban wildlife. The form of appropriate educational materials is determined in part by results of the meetings and landowner survey for each specific drainage.

Once high ranking drainages are identified through routine monitoring, bracketed monitoring is needed to help track down hot spots in the drainage and identify stretches of the creek to be targeted for outreach, technical assistance, and financial assistance programs. If landowners choose to participate in the monitoring program, it helps raise awareness of water quality problems and develop ownership in identifying solutions. Developing a framework for improving water quality is most effective when hot spots or areas of consistently high bacteria levels can be identified within the neighborhood creek. Microbial source tracking may be used to assist landowners in developing a greater understanding of the bacteria sources within their neighborhood creek and

where to focus best management practices. The use of this technique will be limited to areas where very specific questions about bacteria sources have been identified.

When landowners are asked to change their practices to improve water quality, it is important to make these changes as easy as possible to implement. Two key resources that assist landowners to implement new management practices and repairs to OSS are technical and financial assistance. Agricultural Best Management Practices (BMP) technical assistance is provided by the Whatcom Conservation District. A financial cost-share program for agricultural BMPs is under development. County Health has partnered with the Industrial Credit Union to provide low-interest loans for landowners replacing or making repairs to their OSS.

## Ranking Purpose, Criteria, and Methods

Through this program, watersheds in Whatcom County that discharge to marine waters have been ranked by order of priority for Whatcom County water quality improvement programs. Drainage-specific water quality improvement strategies are developed and implemented for the highest priority drainages first.

The following ranking methods are an adaptation of the ranking methods used for the Kitsap County PIC Program (KCHD 2011). They consider water quality status (short and moderate-term) and potential public health threats. The application of the ranking methods to the routine monitoring stations identifies priority areas for water quality improvement projects. Some routine monitoring sites did not have three years of data as of December 2013 and thus were not included in the 2013 ranking process.

The water quality status category evaluated waterbodies based upon the most current water quality data available. Water quality data were evaluated for the most recent calendar year and the previous three years (Appendix A). The data objective was a minimum of monthly sampling; however, some sites were not able to be sampled every month due to no or low flow conditions. Data for each site were compared to applicable standards for that waterbody.

The criteria and associated scores are described below for the five categories analyzed: annual geometric mean, annual 90$^{th}$ percentile, three year geometric mean, three year geometric mean for the dry season, and three year geometric mean for the wet season. Additionally, each site was scored for current status of the shellfish growing area to which the waterbody discharges. For each monitoring site, points were assigned for each of these five categories and the sum of the five scores was multiplied by the shellfish growing area score. The scores for each monitoring site are included in Appendix C.

Scoring Formula:

Total Water Quality Score = (12month GM score + 12month %score + 3year GM score + 3yeardry GMscore + 3yearwet GMscore)* shellfish growing area score

Twelve Month (2012) Geometric Mean:

- Creek meets the appropriate standard for FC geometric mean during most recent calendar year – 0 points.
- Creek 2012 geometric mean is 1 to 5 times the appropriate standard – 2 points.
- Creek 2012 geometric mean is over 5 times the appropriate standard – 4 points.

Twelve Month (2012) 90$^{th}$ Percentile:

- Creek meets the appropriate standard for FC 90$^{th}$ percentile during most recent calendar year – 0 points.
- Creek 2012 90$^{th}$ percentile is 1 to 5 times the appropriate standard – 2 points.
- Creek 2012 90$^{th}$ percentile is over 5 times the appropriate standard – 4 points.

Three Year Geometric Mean:

- Creek FC three-year geometric mean meets the appropriate standard– 0 points.
- Creek FC three-year geometric mean is 1 to 2 times the appropriate standard – 1 point.
- Creek FC three-year geometric mean is 2 to 5 times the appropriate standard – 2 points.
- Creek FC three-year geometric mean is 5 to 10 times the appropriate standard – 4 points.
- Creek FC three-year geometric mean is greater than 10 times the appropriate standard – 6 points.

Three Year Geometric Mean for Dry Season:

- Creek FC three-year geometric mean for the dry season (May-September) meets the appropriate standard– 0 points.
- Creek FC three-year geometric mean for the dry season (May-September) is 1 to 2 times the appropriate standard – 1 point.
- Creek FC three-year geometric mean for the dry season (May-September) is 2 to 5 times the appropriate standard – 2 points.
- Creek FC three-year geometric mean for the dry season (May-September) is 5 to 10 times the appropriate standard – 4 points.
- Creek FC three-year geometric mean for the dry season (May-September) is greater than 10 times the appropriate standard – 6 points.

Three Year Geometric Mean for Wet Season:

- Creek FC three-year geometric mean for the wet season (October- April) meets the appropriate standard– 0 points.
- Creek FC three-year geometric mean for the wet season (October- April) is 1 to 2 times the appropriate standard – 1 point.
- Creek FC three-year geometric mean for the wet season (October- April) is 2 to 5 times the appropriate standard – 2 points.
- Creek FC three-year geometric mean for the wet season (October- April) is 5 to 10 times the appropriate standard – 4 points.
- Creek FC three-year geometric mean for the wet season (October- April) is greater than 10 times the appropriate standard – 6 points.

Shellfish Growing Area Score:

- Recreational, tribal, and commercial shellfish growing area with no advisory or closure – 1 point.
- Closed recreational shellfish growing area. – 2 points.
- Threatened tribal or commercial shellfish growing area – 2.5 points.
- Closed or conditionally approved tribal or commercial shellfish growing area – 3 points.

## Ranking Results

The water quality scores were calculated for all monitoring stations that had three years of data (Appendix C). Higher points indicate higher levels of bacterial impairment. Appendix D provides a map illustrating levels of priority for all routine monitoring sites. The top ten ranked drainages for Whatcom County water quality improvement projects based upon 2013 data and the above described ranking criteria and scores are:

1. CCO- Cain Creek (54 points)
2. CA1- California Creek (45 points)
3. TribDak3- Dakota Creek (42 points)
4. CC- Cain Creek (42 points)
5. TribDak2- Dakota Creek (39 points)
6. TribDak4- Dakota Creek ( 39 points)
7. CA14- California Creek (36 points)
8. CA16- California Creek (33 points)
9. CA9- California Creek (30 points)
10. K1a- Portage SPD (30 points)

## Discussion

Dakota Creek

The Dakota Creek watershed is one of the two major areas discharging to Drayton Harbor. Drayton Harbor currently has a seasonal closure to shellfish harvesting from November through January. Three of seventeen routine sites monitored in the Dakota Creek watershed ranked in the top ten priority drainages for the PIC Program. TribDak2, TribDak3, and TribDak4 are all located in the lower portion of the Dakota Creek watershed and are perennial creeks. TribDak2 had a 2013 geometric mean two times the standard and a dry season three-year geometric mean over six times the standard. TribDak3 had a 2013geometric mean over four times the standard and dry season three-year geometric mean over five times the standard. TribDak4 had a 2013geometric mean over four times the standard and dry season three-year geometric mean over seven times the standard. At each of these sites, over fifty percent of the samples exceeded 200FC/100mL.

California Creek

The California Creek watershed is the other of the two major areas discharging to Drayton Harbor. Four of thirteen routine sites monitored in the California Creek watershed ranked in the top ten priority drainages for the PIC Program: CA1, CA14, CA16, and CA9. CA1 is a small perennial creek in the lower portion of the watershed. The 2013 geometric mean for CA1 was over three times the standard and the dry season three-year geometric mean is over eleven times the standard. CA16 is a small perennial creek in the upper portion of the watershed. The 2013 geometric mean for CA16 was nearly two times the standard and the dry season three-year geometric mean is over five times the standard. CA14 and CA9 are seasonal creeks located in the upper portion of the watershed above Cal 6.5. This area was identified as being in most need of fecal coliform reductions through the *Draft Drayton Harbor Watershed Fecal Coliform Total Maximum Daily Load: Water Quality Improvement Report* (Hood and Mathieu 2010). CA14 has shown consistently high bacteria levels since 2006 when the creek was first monitored. The 2013 geometric mean was over three times the standard and the dry season three-year geometric mean is over four times the standard (Appendix A). The 2013 geometric mean for CA9 was over two times the standard and the dry season three-year geometric mean is over five times the standard. Over fifty percent of the 2013 samples exceeded 200FC/100mL at each of these sites.

Cain Creek

Cain Creek (CC) and the Cain Creek Stormwater Outfall (CCO) are two drainages within the City of Blaine that discharge to Semiahmoo Bay, just northeast of the mouth of Drayton Harbor. Both of these sites are exceeding both parts of the water quality standard and are ranked in the top ten priority drainages for the PIC program. The 2013 geometric mean for both of these sites is over eight times the standard and all 2013 samples exceeded 100FC/100mL (the threshold for this drainage).

Birch Bay Coastal Drainage

There are several smaller coastal drainages that discharge directly to Birch Bay and exceed water quality standards. BB8 is a seasonal creek where the highest bacteria levels at routine monitoring sites have been observed. In fact, in 2011 one sample had a result of 110,000FC/100mL. The 2013 geometric mean for BB8 had dropped significantly in comparison to other years, however remains over three times the standard. The dry season three-year geometric mean was thirty-six times the standard. Thirty-three percent of the samples collected in 2013 exceeded 100 FC/100mL (the threshold for this drainage). While flows from this drainage is far smaller than those seen at Terrell Creek, the bacteria levels can represent significant public health concerns.

Portage Bay Shellfish Protection District (SPD)

One of fifteen routine sites in the Portage Bay Shellfish Protection District ranked in the top ten priority areas for the PIC Program. K1a is a small creek that discharges into Kamm directly upstream of the bridge at Hampton Road. The 2013 and three-year geometric means for K1a were both over three times the standard. Over seventy percent of the samples collected in 2013 exceeded 200FC/100mL.

While fecal coliform levels have been seen increasing at several sites in the Portage Bay SPD over the past few years, the current status of the shellfish harvesting area and geometric means are not at the same levels seen in the Drayton Harbor and Birch Bay watersheds. Additionally, the Whatcom Clean Water Program (WCWP) and the Department of Ecology inspectors are focusing their efforts in the Portage Bay SPD. Thus, with a comprehensive look across the county, the Whatcom County PIC Program will initially focus on Drayton Harbor and Birch Bay sites unless additional resources are identified.

## Recommendations

The following are recommendations for 2014 County water quality improvement programs in the priority areas described above.

- Priority Area 1- In 2014, develop and implement a water quality improvement strategy for the three tributaries in the lower portion of Dakota Creek (TribDak2, TribDak3, and TribDak4). These drainages are adjacent to each other, all rank in the top ten, are perennial creeks, and have a similar rural character. Initial work to characterize the watershed, establish additional monitoring sites, and develop outreach materials was completed in 2012 and 2013. An initial community meeting was held in early summer 2013, however few community members attended. A landowner survey was sent to approximately 270 landowners in this drainage in fall 2013 to help identify community values and concerns with their creeks as well as the best mechanisms to communicate. WCPW staff will continue work with the Drayton Harbor Shellfish Protection District Advisory Committee to develop and refine a community engagement strategy and outreach materials. These drainages are depicted in Appendix D with red dots and pink shading.
- Priority Area 2- Continue enhanced water quality monitoring and landowner communication in Brown-Malloy drainage (CA14c). This is a seasonal creek and is generally dry for 3-4 months of the year. While this area should remain a priority, a greater priority should be placed on high ranking perennial creeks. This drainage is in the upper portion of the California Creek watershed and is depicted with a red dot and pink shading in Appendix D.
- Priority Area 3- An increase in bacteria levels has been observed in CA1 over the past year. WCPW and the Nooksack Tribe Natural Resources Department partnered to collect additional water quality samples in this drainage during the wet season (Drayton Harbor seasonal closure period) and identified areas with elevated bacteria within the drainage. As resources allow, additional monitoring and community outreach will be pursued in this drainage. This drainage is in the lower portion of the California Creek watershed and is depicted with a red dot and pink shading in Appendix D.
- Priority Area 4- Continue work with Birch Bay Watershed and Aquatic Resources Management District (BBWARM) to identify sources of bacterial pollution in residential drainages in the priority Birch Bay coastal drainage (BB8). As resources allow, this work may be expanded to the priority drainage in lower Terrell Creek (TribTerBC2). WCPW will work with BBWARM and the MRC to develop and distribute community education materials for residential sources of bacteria (e.g. OSS, urban wildlife, and pets). While these sites are not the highest ranking of the top ten, the

established partnerships provide additional resources and efficient mechanisms for sharing information with the community.

- Other Areas-The CCO drainage is within the City of Blaine. Additional water quality monitoring has been conducted in the Cain Creek drainage in the last three years through partnered efforts between the City, Nooksack Tribe, and Puget Sound Restoration Fund (PSRF). The City of Blaine is seeking grant funds to continue some of this work. Additional work in this drainage could be pursued through partnerships as resources allow. Initial work to characterize potential sources of bacteria in the K1a drainage began in 2012. This is a small drainage and this work should be continued in 2014 through partnerships with WC Health, PDS, WSDA, and the City of Lynden.

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# Appendix A: Water Quality Review by Monitoring Station

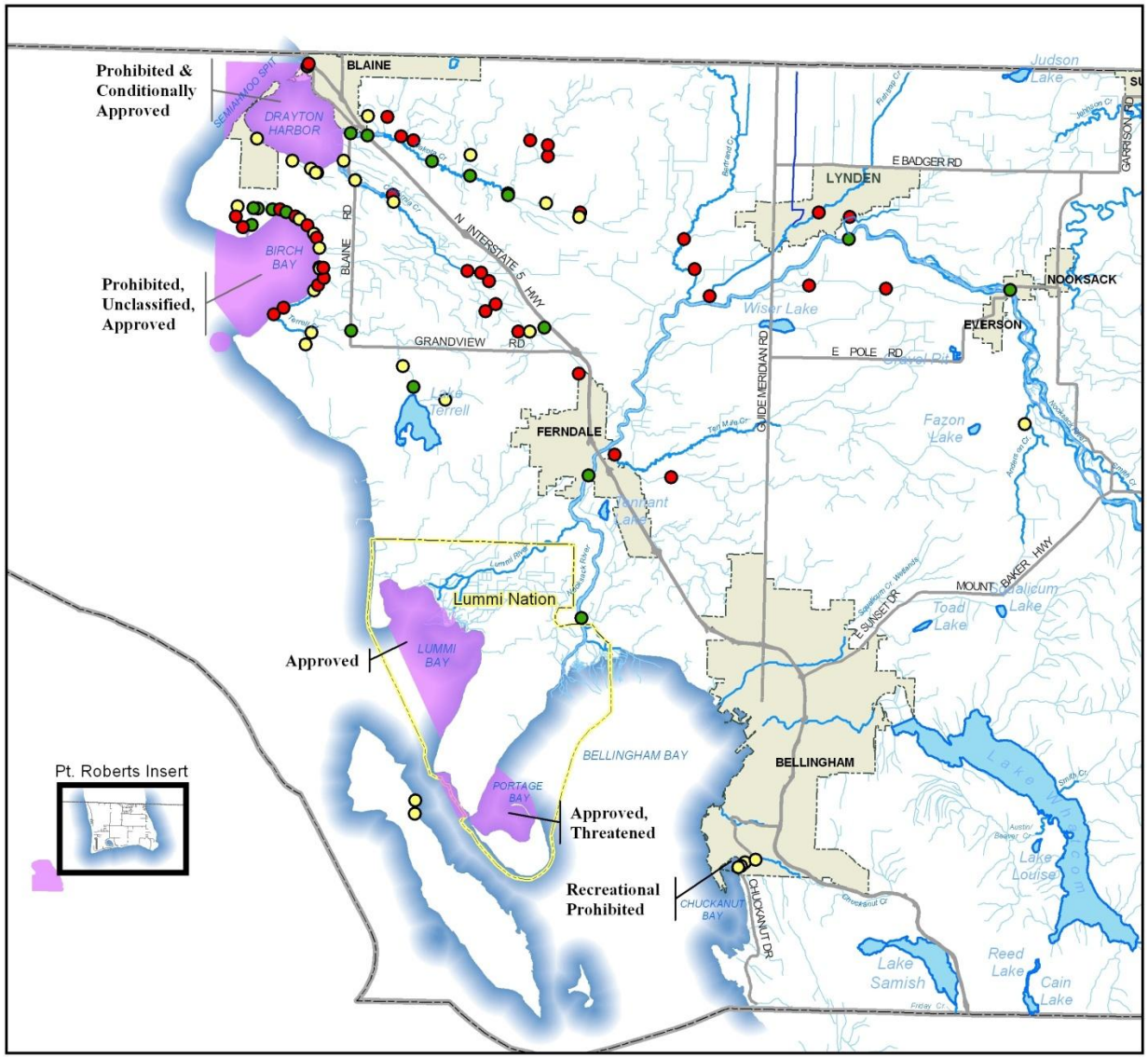
| | | 2013 | | | | 2011-2013 GMV | | |
|---|---|---|---|---|---|---|---|---|
| Project Area | Station | # | GMV | %>200* | 2013 Meets Stnd? | All | Wet | Dry |
| BB Coastal | BB4 | 6 | 92.5 | 33.3 | Exceeds Both | 147.5 | 114.2 | 333.5 |
| BB Coastal | BB6 | 6 | 113.4 | 33.3 | Exceeds Both | 116.5 | 91.3 | 224.7 |
| BB Coastal | BB8 | 6 | 175.6 | 33.3 | Exceeds Both | 509.0 | 389.6 | 1827.4 |
| BB Coastal | BB11 | 5 | 62.7 | 40.0 | Exceeds Both | 127.3 | 79.5 | 884.3 |
| BB Coastal | BB16 | 5 | 109.1 | 60.0 | Exceeds Both | 159.4 | 161.7 | 110.4 |
| BB Coastal | BB21 | 4 | 129.7 | 50.0 | Exceeds Both | 388.2 | 255.1 | 3168.2 |
| BB Coastal | BB22 | 6 | 29.9 | 16.7 | Exceeds Both | 48.2 | 35.6 | 110.3 |
| BB Coastal | BB3 | 7 | 21.4 | 14.3 | Exceeds One | 26.5 | 20.2 | 34.2 |
| BB Coastal | BB5 | 6 | 31.4 | 50.0 | Exceeds One | 41.3 | 38.8 | 64.7 |
| BB Coastal | BB7 | 5 | 39.3 | 20.0 | Exceeds One | 102.6 | 43.3 | 1146.9 |
| BB Coastal | BB20 | 5 | 34.7 | 20.0 | Exceeds One | 36.6 | 35.6 | 46.3 |
| BB Coastal | BB12 | 4 | 4.8 | 0.0 | Meets Both | 9.1 | 10.1 | 2.0 |
| BB Coastal | BB15 | 5 | 3.4 | 0.0 | Meets Both | 5.4 | 4.6 | 14.1 |
| BB Coastal | BB18 | 4 | 3.3 | 0.0 | Meets Both | 37.2 | 25.5 | 246.1 |
| BB Coastal | BB19 | 4 | 9.7 | 0.0 | Meets Both | 20.6 | 15.0 | 99.1 |
| California | Cal 5.0 | 11 | 127.1 | 27.3 | Exceeds Both | 76.5 | 51.4 | 150.0 |
| California | Cal 6.2 | 11 | 112.3 | 36.4 | Exceeds Both | 81.0 | 51.8 | 176.6 |
| California | CA1 | 11 | 349.5 | 63.6 | Exceeds Both | 269.1 | 115.8 | 1121.4 |
| California | CA6 | 11 | 151.2 | 27.3 | Exceeds Both | 49.6 | 36.8 | 82.5 |
| California | CA8 | 11 | 123.5 | 45.5 | Exceeds Both | 65.2 | 37.5 | 208.0 |
| California | CA9 | 10 | 251.0 | 50.0 | Exceeds Both | 166.9 | 100.8 | 588.2 |
| California | CA14c | 8 | 376.2 | 62.5 | Exceeds Both | 292.6 | 243.9 | 479.9 |
| California | CA16 | 11 | 199.4 | 63.6 | Exceeds Both | 135.2 | 65.0 | 518.3 |
| California | Cal 0.1 | 11 | 38.7 | 18.2 | Exceeds One | 37.6 | 42.9 | 30.1 |
| California | Cal 0.8 | 11 | 48.5 | 18.2 | Exceeds One | 51.8 | 51.4 | 52.5 |
| California | Cal 1.9 | 11 | 84.8 | 27.3 | Exceeds One | 55.3 | 41.5 | 89.5 |
| California | Cal 7.5 | 9 | 92.2 | 22.2 | Exceeds One | 75.5 | 55.2 | 162.9 |
| California | CA15 | 11 | 35.8 | 0.0 | Meets Both | 36.5 | 19.1 | 113.0 |
| Coastal | CB1 | 6 | 9.8 | 33.3 | Exceeds One | 13.9 | 3.5 | 221.7 |
| Coastal | CB2 | 7 | 23.7 | 14.3 | Exceeds One | 23.5 | 10.5 | 78.9 |
| Coastal | CB3 | 7 | 39.6 | 14.3 | Exceeds One | 35.0 | 14.8 | 127.4 |
| Coastal | CB4 | 7 | 26.7 | 14.3 | Exceeds One | 35.7 | 15.4 | 95.2 |
| Coastal | DH14 | 6 | 30.9 | 50.0 | Exceeds One | 22.2 | 12.9 | 102.3 |
| Coastal | DH2 | 7 | 48.2 | 28.6 | Exceeds One | 14.5 | 5.4 | 74.9 |
| Coastal | DH3 | 7 | 24.8 | 14.3 | Exceeds One | 54.1 | 29.6 | 180.7 |
| Coastal | DH4 | 5 | 14.0 | 20.0 | Exceeds One | 8.8 | 5.1 | 40.0 |

| | | 2013 | | | | 2011-2013 GMV | | |
|---|---|---|---|---|---|---|---|---|
| Project Area | Station | # | GMV | %>200* | 2013 Meets Stnd? | All | Wet | Dry |
| Coastal | DH5 | 7 | 33.7 | 42.9 | Exceeds One | 52.1 | 21.4 | 214.6 |
| Coastal | LI1 | 3 | 70.0 | 33.3 | Exceeds One | 67.4 | 41.2 | 567.1 |
| Coastal | LI4 | 3 | 56.7 | 0.0 | Meets Both | 90.7 | 127.2 | 69.7 |
| Dakota | NFDak2.5 | 11 | 165.2 | 27.3 | Exceeds Both | 107.0 | 85.4 | 156.8 |
| Dakota | TribDak2 | 11 | 204.1 | 54.5 | Exceeds Both | 232.8 | 123.6 | 680.2 |
| Dakota | TribDak3 | 11 | 434.1 | 72.7 | Exceeds Both | 399.7 | 323.4 | 562.9 |
| Dakota | TribDak4 | 11 | 423.8 | 63.6 | Exceeds Both | 266.7 | 147.5 | 727.0 |
| Dakota | TribDakN1 | 8 | 118.1 | 37.5 | Exceeds Both | 59.0 | 54.5 | 75.9 |
| Dakota | TribDakN2 | 11 | 251.0 | 63.6 | Exceeds Both | 102.8 | 55.4 | 293.0 |
| Dakota | TribDakS2 | 11 | 115.9 | 36.4 | Exceeds Both | 89.7 | 49.5 | 245.4 |
| Dakota | TribDak1 | 8 | 88.2 | 25.0 | Exceeds One | 72.4 | 71.6 | 75.0 |
| Dakota | TribDak5 | 11 | 74.5 | 18.2 | Exceeds One | 55.6 | 36.1 | 115.5 |
| Dakota | TribDakS1 | 11 | 54.2 | 27.3 | Exceeds One | 54.4 | 43.7 | 78.7 |
| Dakota | SFDak2.2 | 11 | 72.0 | 18.2 | Exceeds One | 64.4 | 47.2 | 109.2 |
| Dakota | Dak 0.1 | 11 | 48.8 | 9.1 | Meets Both | 38.8 | 39.0 | 38.5 |
| Dakota | Dak 0.6 | 11 | 48.3 | 9.1 | Meets Both | 49.1 | 48.2 | 50.7 |
| Dakota | Dak 3.1 | 11 | 57.7 | 9.1 | Meets Both | 47.9 | 36.0 | 76.0 |
| Dakota | Dak 6.8 | 11 | 53.4 | 0.0 | Meets Both | 48.1 | 41.9 | 60.6 |
| Dakota | NFDak0.1 | 11 | 81.5 | 9.1 | Meets Both | 66.0 | 58.6 | 80.8 |
| Dakota | SFDak0.2 | 11 | 50.4 | 9.1 | Meets Both | 37.5 | 27.0 | 65.5 |
| Drayton | CC | 11 | 542.5 | 100 | Exceeds Both | 202.8 | 103.5 | 164.4 |
| Drayton | CCO | 12 | 403.9 | 100 | Exceeds Both | 255.8 | 179.6 | 391.7 |
| Portage | S1 | 23 | 160.3 | 34.8 | Exceeds Both | 137.0 | 121.7 | 160.2 |
| Portage | S3 | 24 | 142.8 | 41.7 | Exceeds Both | 101.2 | 103.4 | 98.2 |
| Portage | K1 | 22 | 166.6 | 40.9 | Exceeds Both | 155.7 | 121.7 | 222.4 |
| Portage | K1a | 23 | 328.5 | 73.9 | Exceeds Both | 317.5 | 295.5 | 349.0 |
| Portage | F1 | 23 | 175.1 | 54.2 | Exceeds Both | 157.5 | 143.7 | 178.3 |
| Portage | F4 | 22 | 180.0 | 40.9 | Exceeds Both | 156.7 | 109.4 | 271.0 |
| Portage | B1 | 24 | 156.0 | 25.0 | Exceeds Both | 123.7 | 94.9 | 179.3 |
| Portage | B3 | 13 | 141.1 | 30.8 | Exceeds Both | 114.6 | 82.3 | 186.2 |
| Portage | T1 | 23 | 103.9 | 26.1 | Exceeds Both | 74.1 | 40.7 | 163.6 |
| Portage | DRC | 12 | 172.9 | 41.7 | Exceeds Both | 151.8 | 114.5 | 225.3 |
| Portage | AND | 24 | 99.5 | 29.2 | Exceeds One | 90.6 | 48.8 | 228.0 |
| Portage | M5 | 12 | 18.4 | 0.0 | Meets Both | 17.8 | 13.3 | 26.8 |
| Portage | M4 | 24 | 18.3 | 0.0 | Meets Both | 17.8 | 14.8 | 23.2 |
| Portage | M2 | 24 | 33.4 | 4.2 | Meets Both | 29.9 | 29.5 | 30.5 |
| Portage | M1 | 24 | 35.9 | 4.2 | Meets Both | 28.1 | 26.6 | 30.2 |
| Terrell | Ter1.9 | 24 | 65.1 | 29.2 | Exceeds Both | 54.5 | 33.1 | 116.3 |
| Terrell | Ter1.6 | 23 | 63.7 | 34.8 | Exceeds Both | 54.3 | 34.8 | 102.1 |

| | | 2013 | | | | 2011-2013 GMV | | |
|---|---|---|---|---|---|---|---|---|
| Project Area | Station | # | GMV | %>200* | 2013 Meets Stnd? | All | Wet | Dry |
| Terrell | TribTerLP1 | 21 | 63.9 | 42.9 | Exceeds Both | 60.1 | 28.2 | 166.5 |
| Terrell | TribTerBC1 | 12 | 67.2 | 16.7 | Exceeds Both | 86.0 | 68.1 | 219.9 |
| Terrell | TribTerBC2 | 16 | 62.9 | 43.8 | Exceeds Both | 60.1 | 28.2 | 166.5 |
| Terrell | TribFERN1 | 15 | 47.1 | 26.7 | Exceeds One | 77.6 | 46.1 | 425.3 |
| Terrell | Ter7.8 | 18 | 43.6 | 16.7 | Exceeds One | 56.5 | 26.0 | 247.9 |
| Terrell | Ter3.3 | 18 | 42.2 | 27.8 | Exceeds One | 30.9 | 22.2 | 74.4 |
| Terrell | Ter0.7 | 24 | 45.3 | 16.7 | Exceeds One | 56.8 | 47.7 | 73.1 |
| Terrell | Ter0.1* | 24 | 35.6 | 25.0 | Exceeds One | 29.9 | 31.5 | 27.7 |
| Terrell | Ter0.1 | 24 | 46.7 | 20.8 | Exceeds One | 38.4 | 31.2 | 52.0 |
| Terrell | TribTerJ1 | 14 | 38.7 | 21.4 | Exceeds One | 34.0 | 17.2 | 155.9 |
| Terrell | Ter8.4 | 15 | 14.3 | 0.0 | Meets Both | 21.3 | 15.0 | 42.2 |
| Terrell | Ter5.0 | 16 | 33.3 | 6.3 | Meets Both | 48.9 | 32.5 | 103.9 |

* Greater than 100FC/100mL in Birch Bay and Terrell Creek.

# Appendix B: Whatcom County 2013 Fecal Coliform Levels and Shellfish Growing Area Status Map




This map illustrates water quality status for sites sampled through the County's routine monitoring program. Red dots indicate fecal coliform results exceed both parts of the water quality standard, yellow dots indicate results exceed one part of the standard, and green dots indicate results meet both parts of the water quality standard. Areas highlighted in purple are shellfish growing areas monitored by the Washington State Department of Health.

# Appendix C: Water Quality Scores by Station

| Stream | Station | 12 Month GM | 12 Month % > 200 | 3 Year GM | 3 Year Wet Season GM | 3 Year Dry Season GM | Shellfish Area Multiplier* | Total Score** | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Drayton | CCO | 4 | 4 | 4 | 2 | 4 | 3 | 54 | City of Blaine DOE Grant |
| California | CA1 | 2 | 4 | 2 | 1 | 6 | 3 | 45 | Perennial, Supplemental monitoring by NIT |
| Dakota | TribDak3 | 2 | 4 | 2 | 2 | 4 | 3 | 42 | 2013 WC Focus Area, Perennial |
| Drayton | CC | 4 | 4 | 2 | 2 | 2 | 3 | 42 | City of Blaine DOE Grant |
| Dakota | TribDak2 | 2 | 4 | 2 | 1 | 4 | 3 | 39 | 2013 WC Focus Area, Perennial |
| Dakota | TribDak4 | 2 | 4 | 2 | 1 | 4 | 3 | 39 | 2013 WC Focus Area, Perennial |
| California | CA14c | 2 | 4 | 2 | 2 | 2 | 3 | 36 | Seasonal, Supplemental monitoring by NIT |
| California | CA16 | 2 | 4 | 1 | 0 | 4 | 3 | 33 | Perennial |
| California | CA9 | 2 | 2 | 1 | 1 | 4 | 3 | 30 | Seasonal |
| Portage | K1a | 2 | 4 | 2 | 2 | 2 | 2.5 | 30 | Health follow up OSS, within DOE 2014 focus area |
| Dakota | TribDakN2 | 2 | 4 | 1 | 0 | 2 | 3 | 27 | |
| Portage | F1 | 2 | 4 | 1 | 1 | 1 | 2.5 | 23 | |
| BB Coastal | BB21 | 4 | 4 | 4 | 4 | 6 | 1 | 22 | |
| BB Coastal | BB8 | 2 | 2 | 6 | 4 | 6 | 1 | 20 | 2013 WC Focus Area, Partnership with BBWARM and MRC, Seasonal |
| Portage | DRC | 2 | 2 | 1 | 1 | 2 | 2.5 | 20 | |
| Portage | F4 | 2 | 2 | 1 | 1 | 2 | 2.5 | 20 | |
| Portage | K1 | 2 | 2 | 1 | 1 | 2 | 2.5 | 20 | DOE 2014 Focus Area |
| California | CA8 | 2 | 2 | 0 | 0 | 2 | 3 | 18 | |
| Dakota | NFDak2.5 | 2 | 2 | 1 | 0 | 1 | 3 | 18 | |
| Dakota | TribDakS2 | 2 | 2 | 0 | 0 | 2 | 3 | 18 | |
| Portage | S1 | 2 | 2 | 1 | 1 | 1 | 2.5 | 18 | |
| Terrell | TribTerBC1 | 2 | 2 | 1 | 1 | 2 | 2 | 16 | |
| Terrell | TribTerLP1 | 2 | 2 | 1 | 1 | 2 | 2 | 16 | |
| California | Cal 5.0 | 2 | 2 | 0 | 0 | 1 | 3 | 15 | |
| California | Cal 6.2 | 2 | 2 | 0 | 0 | 1 | 3 | 15 | |

| Stream | Station | 12 Month GM | 12 Month % > 200 | 3 Year GM | 3 Year Wet Season GM | 3 Year Dry Season GM | Shellfish Area Multiplier* | Total Score** | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Portage | B1 | 2 | 2 | 1 | 0 | 1 | 2.5 | 15 | 2013 DOE focus area |
| Portage | B3 | 2 | 2 | 1 | 0 | 1 | 2.5 | 15 | 2013 DOE focus area |
| Portage | S3 | 2 | 2 | 1 | 1 | 0 | 2.5 | 15 | |
| Terrell | Ter1.9 | 2 | 2 | 0 | 1 | 2 | 2 | 14 | |
| Terrell | TribFERN1 | 0 | 2 | 1 | 0 | 4 | 2 | 14 | |
| Terrell | TribTerBC2 | 2 | 2 | 1 | 0 | 2 | 2 | 14 | |
| BB Coastal | BB11 | 2 | 2 | 2 | 1 | 6 | 1 | 13 | |
| Portage | T1 | 2 | 2 | 0 | 0 | 1 | 2.5 | 13 | |
| BB Coastal | BB16 | 2 | 4 | 2 | 2 | 2 | 1 | 12 | |
| BB Coastal | BB4 | 2 | 2 | 2 | 2 | 4 | 1 | 12 | |
| California | CA6 | 2 | 2 | 0 | 0 | 0 | 3 | 12 | |
| Coastal | DH5 | 0 | 2 | 0 | 0 | 2 | 3 | 12 | |
| Dakota | TribDakN1 | 2 | 2 | 0 | 0 | 0 | 3 | 12 | |
| Terrell | Ter1.6 | 2 | 2 | 1 | 0 | 1 | 2 | 12 | |
| BB Coastal | BB6 | 2 | 2 | 2 | 1 | 4 | 1 | 11 | |
| BB Coastal | BB7 | 0 | 2 | 2 | 0 | 6 | 1 | 10 | |
| Portage | AND | 0 | 2 | 0 | 0 | 2 | 2.5 | 10 | |
| Terrell | Ter7.8 | 0 | 2 | 1 | 0 | 2 | 2 | 10 | |
| California | CA15 | 0 | 2 | 0 | 0 | 1 | 3 | 9 | |
| California | Cal 7.5 | 0 | 2 | 0 | 0 | 1 | 3 | 9 | |
| Coastal | DH14 | 0 | 2 | 0 | 0 | 1 | 3 | 9 | |
| Coastal | DH3 | 0 | 2 | 0 | 0 | 1 | 3 | 9 | |
| Dakota | SFDak2.2 | 0 | 2 | 0 | 0 | 1 | 3 | 9 | |
| Dakota | TribDak5 | 0 | 2 | 0 | 0 | 1 | 3 | 9 | |
| Coastal | CB1 | 0 | 2 | 0 | 0 | 2 | 2 | 8 | |
| Terrell | Ter0.7 | 0 | 2 | 1 | 0 | 1 | 2 | 8 | |
| Terrell | TribTerJ1 | 0 | 2 | 0 | 0 | 2 | 2 | 8 | |

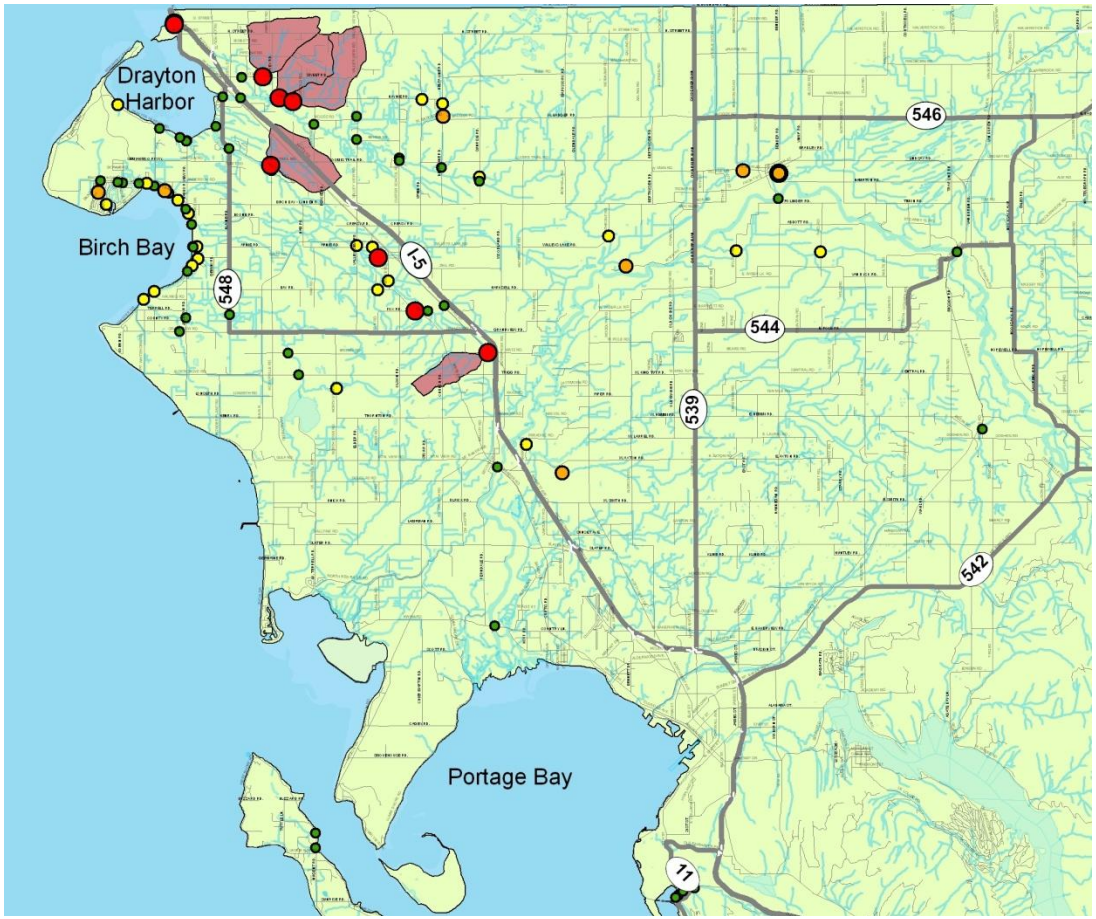
| Stream | Station | 12 Month GM | 12 Month % > 200 | 3 Year GM | 3 Year Wet Season GM | 3 Year Dry Season GM | Shellfish Area Multiplier* | Total Score** | Comments |
|---|---|---|---|---|---|---|---|---|---|
| California | Cal 0.1 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| California | Cal 0.8 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| California | Cal 1.9 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| Coastal | CB3 | 0 | 2 | 0 | 0 | 1 | 2 | 6 | |
| Coastal | DH2 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| Coastal | DH4 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| Dakota | TribDak1 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| Dakota | TribDakS1 | 0 | 2 | 0 | 0 | 0 | 3 | 6 | |
| Terrell | Ter3.3 | 0 | 2 | 0 | 0 | 1 | 2 | 6 | |
| BB Coastal | BB22 | 0 | 2 | 1 | 0 | 2 | 1 | 5 | |
| BB Coastal | BB5 | 0 | 4 | 0 | 0 | 1 | 1 | 5 | |
| BB Coastal | BB18 | 0 | 0 | 0 | 0 | 4 | 1 | 4 | |
| BB Coastal | BB3 | 0 | 2 | 0 | 0 | 0 | 2 | 4 | |
| Coastal | CB2 | 0 | 2 | 0 | 0 | 0 | 2 | 4 | |
| Coastal | CB4 | 0 | 2 | 0 | 0 | 0 | 2 | 4 | |
| Coastal | LI1 | 0 | 0 | 0 | 0 | 4 | 1 | 4 | |
| Terrell | Ter0.1 | 0 | 2 | 0 | 0 | 0 | 2 | 4 | |
| Terrell | Ter0.1* | 0 | 2 | 0 | 0 | 0 | 2 | 4 | |
| Terrell | Ter5.0 | 0 | 0 | 0 | 0 | 2 | 2 | 4 | |
| Coastal | LI4 | 0 | 2 | 0 | 1 | 0 | 1 | 3 | |
| BB Coastal | BB20 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | |
| BB Coastal | BB19 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | |
| BB Coastal | BB12 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| BB Coastal | BB15 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| Dakota | Dak 0.1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | |
| Dakota | Dak 0.6 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | |
| Dakota | Dak 3.1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | |

| Stream | Station | 12 Month GM | 12 Month % > 200 | 3 Year GM | 3 Year Wet Season GM | 3 Year Dry Season GM | Shellfish Area Multiplier* | Total Score** | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Dakota | Dak 6.8 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | |
| Dakota | NFDak0.1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | |
| Dakota | SFDak0.2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | |
| Portage | M1 | 0 | 0 | 0 | 0 | 0 | 2.5 | 0 | |
| Portage | M2 | 0 | 0 | 0 | 0 | 0 | 2.5 | 0 | |
| Portage | M4 | 0 | 0 | 0 | 0 | 0 | 2.5 | 0 | |
| Portage | M5 | 0 | 0 | 0 | 0 | 0 | 2.5 | 0 | |
| Terrell | Ter8.4 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | |

*Shellfish growing area score = 1 for open area, 2 for closed recreational area, 2.5 for threatened tribal/commercial area, 3 for closed or CA tribal/commercial area

** Total Score= (12GM score + 12%score + 3yr GM score + 3yrdry GMscore + 3yrwet GMscore)* shellfish growing area score

# Appendix D: 2012 Ranked Drainages Based Upon Water Quality Scores




This map illustrates ranked drainages for the Whatcom County Pollution Identification and Control (PIC) Program for 2014. The water quality scores are reflective of calculations included in Appendices A and C. Red dots indicate highest priority drainages (water quality score ≥ 30), orange dot indicate moderate priority drainages (water quality score 20-29), yellow dot indicates low priority (water quality score 11-19), and green dot indicates lowest priority (water quality score 0-10). Drainages shaded in pink are priority areas 1, 2, and 3 as described under the recommendation section.

# Appendix E: Routine Sampling Stations in Whatcom County

| Watershed | Project Site ID | Site Location |
|---|---|---|
| Terrell | Ter 0.1 | Mouth of Terrell Creek |
| Terrell | Ter 0.1* | Mouth of Terrell Creek, upstream of confluence with Leisure Park |
| Terrell | TribTer LP1 | Leisure Park Tributary, East of Birch Bay Drive |
| Terrell | TribTer BC2 | Birch Creek @Leeside |
| Terrell | TribTer BC1 | Birch Creek @Morrison/Wooldridge |
| Terrell | Ter 0.7 | Lower Terrell Creek @ Jackson Road |
| Terrell | Ter 1.6 | Terrell Creek @Birch Bay State Park Bridge |
| Terrell | Ter 1.9 | Terrell Creek @ Helwig Bridge (State Park) |
| Terrell | Trib Ter J1 | Culvert@Grandview, West of Jackson |
| Terrell | Ter 3.3 | Terrell Creek @ Jackson Road, North of Grandview |
| Terrell | Ter 5.0 | Terrell Creek @ Blaine Road |
| Terrell | Ter 7.8 | Terrell Creek @Brown Road |
| Terrell | Ter 8.4 | Terrell Creek @Aldergrove Road |
| Terrell | Trib FERN1 | North Star Road, South of Aldergrove |
| California | Cal 0.1 (C1) | Mouth of California Creek at Drayton Harbor Road Bridge |
| California | Cal 0.8 (C2) | California Creek at Blaine Road Bridge |
| California | Cal 1.9 | California Creek at Kickerville Bridge |
| California | CA1 (TribCal-2) | Downstream side of cross-culvert at Kickerville, west of Cal Creek |
| California | Cal 5.0 (C3) | California Creek at Valley View, downstream bridge |
| California | CA6 | Upstream side of cross culvert at Arnie Road, west of Bruce |
| California | CA16 (TribCal-5) | Main Street Custer at dead end |
| California | Cal 6.2 | California Creek at Bruce Road |
| California | CA8 (TribCal-4) | Upstream side of cross culvert at Bay Road, west of Bruce Road |
| California | CA9 | Upstream side of cross culvert at Fox and Vista |
| California | Cal 7.5 | California Creek at Fox Road, east of Vista |
| California | CA15 | Upstream side of cross culvert at Portal, south of Farris |
| California | CA14c | Cross culvert at Brown Road, west of railroad |
| Dakota | Dak 0.1 (D1) | Dakota Creek at Blaine Road Bridge |
| Dakota | TribDak1 | Downstream end of cross culvert at Sweet Road, east of Odell |
| Dakota | TribDak2 | Upstream of cross culvert at Sweet Road, west of Harvey |
| Dakota | TribDak4 | Upstream of cross culvert at Hoier Road, east of Harvey |
| Dakota | TribDak3 | Downstream end of cross culvert at Rogers Road, south of Hoier |
| Dakota | Dak3.1 (DG) | Dakota Creek at Giles Road |
| Dakota | TribDak5 | Bridge at Valley View, south of McGee |
| Dakota | Dak6.8 (D2) | Dakota Creek at Valley View and Behme Roads |
| Dakota | NFDak0.1 (D3) | NF Dakota at Custer School Road (upstream of bridge) |
| Dakota | SFDak0.2 (D4) | SF Dakota at Custer School Road (downstream of bridge) |
| Dakota | TribDakN1 | Downstream end of cross culvert at Haynie Road, east of Stein |
| Dakota | NFDak2.5 | NF Dakota Creek at Delta Line Road, south of Haynie |
| Dakota | TribDakN2 | Upstream side of cross culvert at Delta Line, north of Badger |
| Dakota | TribDakS1 | Downstream of 2$^{nd}$ culvert @ Delta Line, south of Loomis Trail |
| Dakota | SFDak2.2 | Upstream side of bridge for SF Dakota at Sunrise Road |
| Dakota | TribDakS2 | Downstream side of bridge at Sunrise Road, north of SF Dakota |
| Chuckanut | CB1 | Small Woodstock Farm creek at culvert below dam structure |
| Chuckanut | CB2 | Chuckanut Creek at Arroyo Park- near stream gage station |
| Chuckanut | CB3 | Chuckanut Creek 18$^{th}$ Street Alley Bridge |
| Chuckanut | CB4 | Mouth of Chuckanut Creek @ end of the footpath from Woodstock |

| Watershed | Project Site ID | Site Location |
|---|---|---|
| Birch Bay | BB3 | Birch Bay Golf Club, 7900 BB. Dr. |
| Birch Bay | BB4 | 8036 BB Dr., Mariners Cove 24" concrete pipe on shoreline |
| Birch Bay | BB5 | 24"concrete pipe on shoreline across BB Dr. from Century Realty |
| Birch Bay | BB6 | Outfall across from old Thai Steakhouse. Concrete culvert. |
| Birch Bay | BB7 | 8178 BB Dr. & Beach Way |
| Birch Bay | BB8 | Shoreline outfall @ 8208 Birch Bay Dr. (Cedar) |
| Birch Bay | BB11 | Deer Trail, Birch Point Rd., 1/2 submerged, 12" metal pipe. |
| Birch Bay | BB12 | 5216 Birch Point Rd. & Shintaffer, shoreline pipe. |
| Birch Bay | BB15 | BB Village, structure draining "Big Lake" detention pond to marina |
| Birch Bay | BB16 | BB Village, Beaver Pond inlet structure to marina @ Comox&Chehalis |
| Birch Bay | BB18 | BB Village, ditch just east of 5550 Salish Road on north side of road |
| Birch Bay | BB19 | BB Village, ditch running perpendicular to Salish @ Cowichan |
| Birch Bay | BB20 | BB Village, inlet to Roger's Slough, located near "old" BB Village gate |
| Birch Bay | BB21 | BB Village, Northeast corner of Skeena Way and Quinault Rd. |
| Birch Bay | BB22 | Culvert under Birch Point Rd. into BB Village (speed limit sign) |
| Drayton | DH2 | Outfall at shoreline at junction of Harborview & Drayton Harbor Rds |
| Drayton | DH3 | 24" cement pipe 10 m west of DH2 outfall |
| Drayton | DH4 | 24" cement pipe 20 m west of DH3 near 4985 DH Rd. |
| Drayton | DH5 | Harbor Hillside Phase 1, 8" PVC pipe via public trail below bioswale |
| Drayton | DH14 | 1565 DH Rd., ditch @ property corner between driveway and DH Rd. |
| Lummi Island | LI1 | Unnamed seasonal creek north of ferry landing |
| Lummi Island | LI4 | Unnamed seasonal creek south of ferry landing |
| Nooksack | M5 | Mainstem Nooksack River at Everson @ E.Pole Rd |
| Nooksack | M4 | Mainstem Nooksack River at Lynden @ Hannegan Rd |
| Nooksack | M2 | Mainstem Nooksack River at Ferndale @ Axton Rd |
| Nooksack | M1 | Mainstem Nooksack River at Marietta @ Marine Dr |
| Nooksack | DRC | Deer Creek @ Judy Lane |
| Nooksack | AND | Anderson Creek @ Roberts |
| Nooksack | S1 | Scott @ Blysma Rd |
| Nooksack | S3 | Scott @ Thiel Rd |
| Nooksack | K1 | Kamm @ Hampton Rd |
| Nooksack | K1a | Side tributary to Kamm upstream of bridge at Hampton Road |
| Nooksack | B1 | Bertrand Creek @ Rathbone Rd |
| Nooksack | B3 | Bertrand Creek @ Lynden-Birch Bay Rd |
| Nooksack | T1 | Tenmile Creek @ Barrett Rd |
| Nooksack | F1 | Fishtrap Creek @ River Rd |
| Nooksack | F4 | Fishtrap Creek @ E. Main (7th) |
| Cain | CC | Mouth of Cain Creek |
| Cain | CCO | Cain Creek Outfall at Mouth |

(Data collected by WCPW, NWIC, NSEA, MRC volunteers, and WCC crew in 2011-2013)