Whatcom County 2012 Water Quality Report and Priority Areas

Fecal Coliform in Coastal Drainages

Whatcom County Public Works

March 2013

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 90th 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 2012 data and the above described ranking criteria and scores are:

1. CA14c- California Creek (42 points)
2. TribDak3- Dakota Creek (42 points)
3. CCO- Cain Creek (42 points)
4. CA1- California Creek (33 points)
5. TribDak2- Dakota Creek (33 points)
6. TribDak4- Dakota Creek (33 points)
7. K1a- Portage SPD (30 points)
8. CA9- California Creek (27 points)
9. BB8- Birch Bay Coastal (24 points)
10. TribTerBC2- Terrell Creek (22 points)

Based upon this ranking and other considerations, WCPW will initially focus community engagement and landowner assistance programs on water quality improvement projects in Lower Dakota Creek (TribDak2, TribDak3, TribDak4) in 2013. 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. 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 has focused on water quality monitoring, follow up monitoring at sites with elevated bacteria levels, and coordination with County departments and other agencies to identify and address potential bacteria sources.

Whatcom County is enhancing its PIC Program to include an annual review of routine monitoring sites located throughout the county and an active community engagement strategy. Restructuring these components will help 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. A large portion of these sites have been sampled through various programs for six to fourteen years (Douglas 2013). Sample collection is conducted following standard protocols by trained staff, contractors, and volunteers (WCPW 2009). Sample analysis is conducted following standard methods and quality control and assurance measures at DOE-certified laboratories. In July 2012, Nooksack Salmon Enhancement Association (NSEA) took over sample collection and analysis for Terrell Creek sites upstream of Ter3.3. Sample collection for Terrell Creek is conducted in coordination with WCPW and NSEA's data is included in this report. 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.

In past years, results from monthly sampling runs were compared with threshold bacteria levels established in the High Bacteria Response Strategy (WCPW 2008). Follow up actions were determined based upon land use activities, potential pollution sources, and department and agency jurisdictions. In practice, this approach led to resources spread too thinly across the county as staff responded to single incidents of high counts in different watersheds each month.

An alternative and more effective approach has been deployed by Kitsap County that is now held as a model for the Puget Sound region (PSAT 2005, DOH 2012). The enhanced Whatcom County PIC Program builds off several elements of the Kitsap program. 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 will focus 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 84 freshwater stations with at least three years of data, only 16 (less than 20%) 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, the community is now tackling the harder non-point sources in an effort to regain full Approved status for the entire area.

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. In the past three years, the geometric mean of the mainstem site located at Marine Drive (M1) has doubled. While the levels are still meeting water quality standards, this substantial increase creates 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 within an 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 (Mud 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 implement water quality improvement projects.
- Provide water quality data to the public and other interested parties.
- Provide technical and financial assistance to landowners in priority drainages.

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 Cain Creek, Birch Bay watershed	Primary Contact Nooksack, Drayton, and Chuckanut watersheds
• Geometric Mean-14FC/100mL • Estimated 90th Percentile-43 FC/100mL	• Geometric Mean-50FC/100mL • Not more than 10% exceed 100 FC/100mL	• Geometric Mean-100FC/100mL • 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, 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, and State Departments of Agriculture (WSDA) and Ecology 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 2010 through 2012, there were 36 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 32% had a RSD of greater than 20%. These RSDs meet the data quality objectives listed above.

Birch Bay Watershed (WCPW)

From 2010 through 2012, there were 71 sampling events in the Terrell Creek/Birch Bay routine monitoring program conducted by WCPW 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 12% had a RSD of greater than 50% and 42 % had a RSD of greater than 20%. These field duplicates meet the data quality objectives for RSDs greater than 20%, but are slightly greater than the objectives for RSDs greater than 50%. Most duplicates with RSDs greater than 50% had average results below 20FC/100mL. When duplicates with low bacteria levels are separated, the data objectives are met with 7% exceeding a RSD of 50%. These data are accepted as adequate for this water quality review.

Portage Bay Shellfish Protection District (NWIC, WCPW)

From 2010 through 2012, 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 5% had a RSD of greater than 50% and about 28% had a RSD of greater than 20%. These RSDs meet the data quality objectives listed above. For the WCPW samples, approximately 17% had a RSD of greater than 50% and 48% had a RSD of greater than 20%. When duplicates with low bacteria levels are separated, the data objectives are nearly met with 14% exceeding the 50% RSD objective. 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 2010 through 2012, there were 35 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. Thirteen percent of the duplicates had a RSD of greater than 50% and about 45% had a RSD of

greater than 20%. When duplicates with low bacteria levels are separated, the data objectives are met with 2.2% 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 2012 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 2012.

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	14	4 (27%)	5 (36%)	5 (36%)
Dakota Creek	17	3 (18%)	6 (35%)	8 (47%)
Terrell Creek	15	7 (47%)	6 (40%)	2 (13%)
Portage SPD	15	6 (40%)	5(33%)	4 (27%)
Birch Bay Coastal	15	10 (67%)	4 (27%)	1 (7%)
Drayton Coastal	5	2 (40%)	3 (60%)	0 (0%)
Chuckanut Coastal	4	0 (0%)	3 (75%)	1 (25%)
Lummi Island Coastal	2	0 (0%)	1 (50%)	1 (50%)
Cain Creek	2	2 (100%)	0 (0%)	0 (0%)

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 will determine 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 held 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 focus 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 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 in 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 2012 to be included in the 2012 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 90th 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) 90th Percentile:

- Creek meets the appropriate standard for FC 90th percentile during most recent calendar year – 0 points.
- Creek 2012 90th percentile is 1 to 5 times the appropriate standard – 2 points.
- Creek 2012 90th 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 2012 data and the above described ranking criteria and scores are:

1. CA14c- California Creek (42 points)
2. TribDak3- Dakota Creek (42 points)
3. CCO- Cain Creek (42 points)
4. CA1- California Creek (33 points)
5. TribDak2- Dakota Creek (33 points)
6. TribDak4- Dakota Creek (33 points)
7. K1a- Portage SPD (30 points)
8. CA9- California Creek (27 points)
9. BB8- Birch Bay Coastal (24 points)
10. TribTerBC2- Terrell Creek (22 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 to February. 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 2012 geometric mean nearly two times the standard and a dry season three-year geometric mean nearly six times the standard. TribDak3 had a 2012 geometric mean almost three times the standard and dry season three-year geometric mean over five times the standard. At each of these sites, twenty-five to sixty percent of the samples exceeded 200FC/100mL. TribDak4 similarly had a dry season three-year geometric mean over five times the standard.

California Creek

The California Creek watershed is the other of the two major areas discharging to Drayton Harbor. Three of fourteen routine sites monitored in the California Creek watershed ranked in the top ten priority drainages for the PIC Program: CA14c, CA9, and CA1. CA14c 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). CA14c has shown consistently high bacteria levels since 2006 when the creek was first monitored. The 2012 geometric mean was over two times the standard and the dry season three-year geometric mean is over ten times the standard (Appendix A). The 2012 geometric mean for CA9 met standards, however the three-year geometric mean continues to exceed the standard and the dry season three-year geometric mean is over five times the standard. CA1 is a perennial creek in the lower portion of the watershed. The annual geometric mean for CA1 is over two times the standard and the dry season three-year geometric mean is nearly six times the standard. Over fifty percent of the 2012 samples exceeded 200FC/100mL at sites CA14c and CA1.

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 CCO is ranked in the top ten priority drainages for the PIC program. The dry season three-year geometric mean for CCO is over six times the standard and over sixty percent of the 2012 samples exceeded 100FC/100mL (the threshold for this drainage).

Lower Terrell Creek

Terrell Creek is the primary freshwater discharge to Birch Bay. There is currently a closure of shellfish harvesting around the mouth of Terrell Creek due to poor water quality in the creek. One of fourteen Terrell Creek routine sites ranked in the top ten priority drainages for the PIC Program: TribTerBC2. This site is a seasonal creek that discharges into the lower portion of Terrell Creek. TribTerBC2 has a dry season geometric mean that is over twelve times the standard.

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 2012 geometric mean for BB8 was ten times the standard and the dry season three-year geometric mean was fifty-two times the standard. Eighty-seven percent of the samples collected in 2012 exceeded 100 FC/100mL (the threshold for this drainage). While flows from these drainages are 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 2012 geometric mean for K1a was nearly three times the standard and the dry season three-year geometric mean was nearly four times the standard. Over sixty percent of the samples collected in 2012 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. Thus, with a comprehensive look across the county, the PIC Program will initially focus on Drayton Harbor and Birch Bay sites unless additional resources are identified.

Recommendations

The following are recommendations for 2013 County water quality improvement programs in the priority areas described above.

- Priority Area 1- In 2013, 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. An initial community meeting will be targeted for the second quarter of 2013. WCPW staff will 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 a pink outline.
- 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 outline in Appendix D.
- Priority Area 3- 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. These drainages are depicted in Appendix D with red and orange dots and orange outlines.

- 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. An increase in bacteria levels has been observed in CA1 over the past year. As resources allow, additional monitoring and community outreach will be considered in this drainage. 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 2013 through partnerships with WC Health, PDS, WSDA, and the City of Lynden.

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Appendix A: Water Quality Review by Monitoring Station

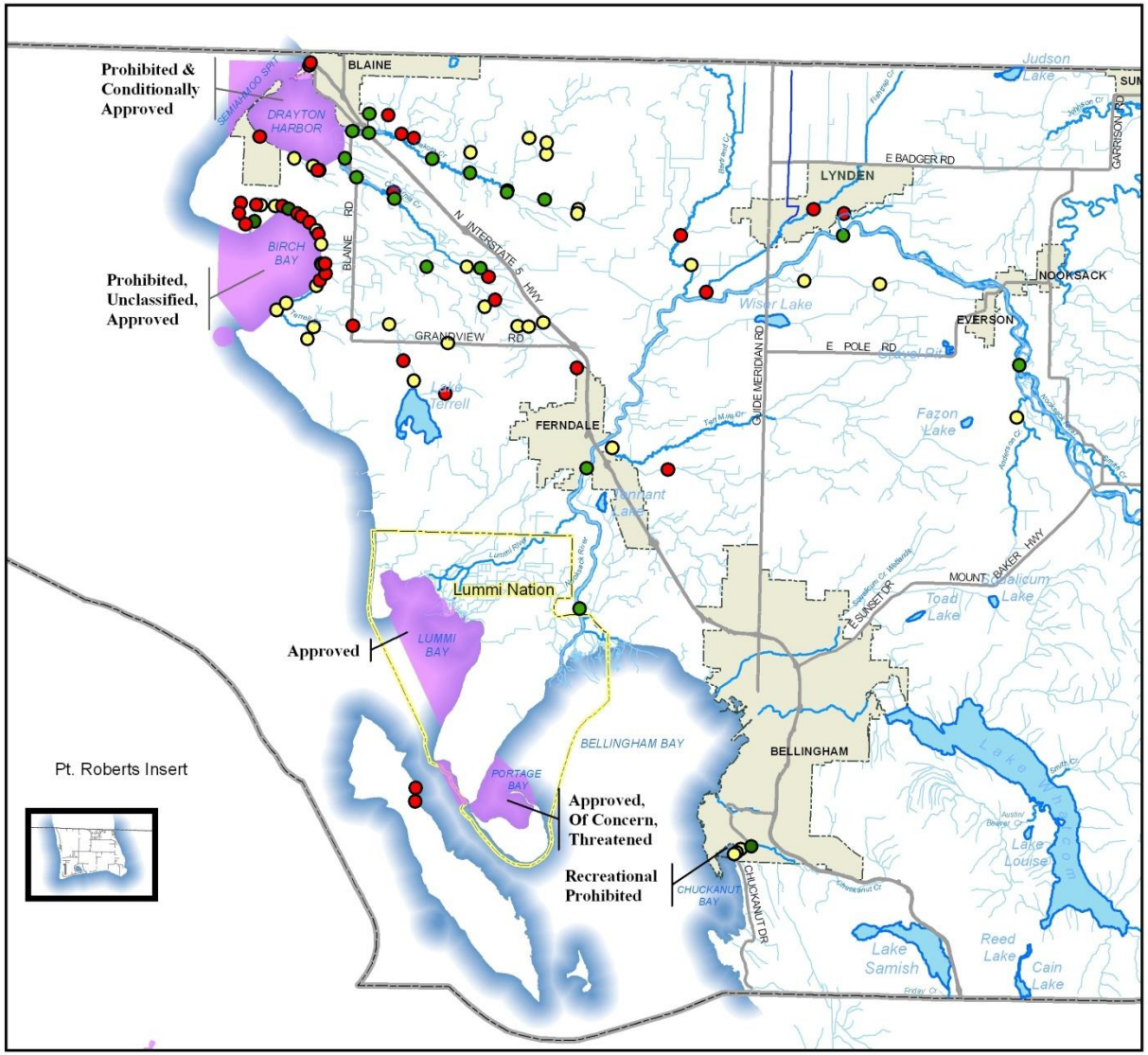
		2012				2010-2012 GMV		
Project Area	Station	#	GMV	%>200*	2012 Meets Stnd?	All	Wet	Dry
Portage	M5	24	11.6	0.0	Meets Both	14.4	11.9	18.9
Portage	M4	24	13.4	4.2	Meets Both	14.6	13.6	16.2
Portage	M2	24	20.3	0.0	Meets Both	25.2	30.0	19.8
Portage	M1	24	16.0	0.0	Meets Both	24.4	26.0	22.4
Portage	AND	24	75.0	25.0	Exceeds One	93.2	52.1	210.3
Portage	S1	24	87.8	20.8	Exceeds One	128.3	132.7	122.7
Portage	S3	24	44.1	20.8	Exceeds One	97.8	121.6	73.0
Portage	K1	24	116.9	29.2	Exceeds Both	156.9	125.1	215.5
Portage	K1a	24	290.3	62.5	Exceeds Both	308.6	258.5	388.5
Portage	F1	24	111.7	20.8	Exceeds Both	139.0	121.3	165.9
Portage	F4	24	128.0	41.7	Exceeds Both	145.6	106.1	226.7
Portage	B1	24	94.7	29.2	Exceeds One	99.0	78.3	137.4
Portage	B3	12	114.8	25.0	Exceeds Both	103.3	71.9	171.5
Portage	T1	24	49.2	20.8	Exceeds One	61.9	39.2	112.0
Portage	DRC	12	117.7	41.7	Exceeds Both	126.7	98.9	179.2
Terrell	TribFERN1	16	84.0	43.8	Exceeds Both	82.1	52.3	243.0
Terrell	TribFIN1	12	9.3	16.7	Exceeds One	9.0	4.9	47.2
Terrell	Ter8.4	18	23.3	11.1	Exceeds One	22.4	14.0	49.1
Terrell	Ter7.8	18	62.3	27.8	Exceeds Both	51.7	20.0	227.3
Terrell	Ter5.0	19	73.3	36.8	Exceeds Both	52.0	33.1	110.2
Terrell	Ter3.3	17	29.4	11.8	Exceeds One	23.8	20.0	38.7
Terrell	Ter1.9	20	59.4	25.0	Exceeds Both	48.2	33.5	85.7
Terrell	Ter1.6	23	62.2	39.1	Exceeds Both	41.4	31.0	63.8
Terrell	Ter0.7	23	42.2	17.4	Exceeds One	50.9	42.4	67.5
Terrell	Ter0.1*	23	24.3	4.3	Meets Both	26.1	28.4	23.1
Terrell	Ter0.1	23	28.8	8.7	Meets Both	30.6	27.2	36.5
Terrell	TribTerJ1	15	28.4	13.3	Exceeds One	25.8	15.5	144.3
Terrell	TribTerLP1	23	50.0	26.1	Exceeds One	50.6	29.5	115.5
Terrell	TribTerBC1	17	55.4	35.3	Exceeds Both	95.0	80.7	171.1
Terrell	TribTerBC2	17	70.3	23.5	Exceeds Both	92.7	48.7	637.2
BB Coastal	BB3	8	21.5	12.5	Exceeds One	39.3	34.3	41.8
BB Coastal	BB4	10	235.9	80.0	Exceeds Both	125.1	103.0	137.6
BB Coastal	BB5	5	99.7	60.0	Exceeds Both	41.6	27.1	98.4
BB Coastal	BB6	6	124.8	50.0	Exceeds Both	104.6	71.0	514.4
BB Coastal	BB7	7	169.7	57.1	Exceeds Both	127.0	57.9	1146.9
BB Coastal	BB8	8	530.5	87.5	Exceeds Both	728.3	431.1	2602.7

		2012				2010-2012 GMV		
Project Area	Station	#	GMV	%>200*	2012 Meets Stnd?	All	Wet	Dry
BB Coastal	BB11	8	138.7	50.0	Exceeds Both	120.1	71.9	609.0
BB Coastal	BB12	6	27.6	16.7	Exceeds One	8.7	9.5	2.0
BB Coastal	BB15	8	6.3	0.0	Meets Both	9.1	7.5	20.1
BB Coastal	BB16	8	279.4	87.5	Exceeds Both	140.4	161.5	84.9
BB Coastal	BB18	8	62.3	37.5	Exceeds Both	57.4	38.2	360.8
BB Coastal	BB19	8	47.6	25.0	Exceeds One	16.1	11.7	99.1
BB Coastal	BB20	8	47.7	37.5	Exceeds One	44.1	38.5	72.4
BB Coastal	BB21	8	723.3	87.5	Exceeds Both	328.0	224.8	3168.2
BB Coastal	BB22	8	37.2	12.5	Exceeds Both	64.1	46.1	149.9
California	Cal 0.1	11	31.6	0.0	Meets Both	39.7	44.0	33.8
California	Cal 0.8	11	54.0	0.0	Meets Both	58.1	52.6	67.0
California	Cal 1.9	11	48.6	9.1	Meets Both	51.8	37.4	86.4
California	Cal 5.0	11	91.2	27.3	Exceeds One	68.5	42.3	146.1
California	Cal 6.2	11	116.3	36.4	Exceeds Both	83.0	51.4	180.1
California	Cal 7.5	11	106.2	9.1	Exceeds One	81.3	53.4	175.4
California	CA1	11	244.8	54.5	Exceeds Both	187.6	89.9	596.5
California	CA3	3	23.5	0.0	Meets Both	15.1	11.6	82.9
California	CA6	11	47.1	0.0	Meets Both	34.2	21.1	70.8
California	CA8	8	29.4	12.5	Exceeds One	47.6	22.7	209.4
California	CA9	8	88.5	12.5	Exceeds One	185.1	116.6	554.4
California	CA14c	8	233.5	50.0	Exceeds Both	373.7	276.3	1023.3
California	CA15	9	50.5	33.3	Exceeds One	43.3	23.5	119.7
California	CA16	11	141.2	36.4	Exceeds Both	123.6	58.8	410.7
Dakota	Dak 0.1	11	39.1	0.0	Meets Both	37.8	39.0	36.0
Dakota	Dak 0.6	10	45.2	0.0	Meets Both	50.7	45.3	58.8
Dakota	Dak 3.1	10	44.1	0.0	Meets Both	49.5	37.7	73.2
Dakota	Dak 6.8	11	58.6	0.0	Meets Both	51.8	43.1	68.1
Dakota	NFDak0.1	11	72.0	9.1	Meets Both	71.9	60.6	93.0
Dakota	SFDak0.2	11	36.8	0.0	Meets Both	43.2	31.1	70.7
Dakota	NFDak2.5	11	109.3	18.2	Exceeds One	123.1	73.6	266.4
Dakota	TribDak1	8	59.7	0.0	Meets Both	80.6	76.8	92.3
Dakota	TribDak2	11	187.6	36.4	Exceeds Both	257.5	153.0	562.2
Dakota	TribDak3	10	287.9	60.0	Exceeds Both	357.8	270.3	534.1
Dakota	TribDak4	11	149.2	27.3	Exceeds Both	212.3	114.5	536.5
Dakota	TribDak5	11	56.3	27.3	Exceeds One	51.7	28.5	126.2
Dakota	TribDakN1	8	44.1	12.5	Exceeds One	56.7	54.4	63.2
Dakota	TribDakN2	11	63.5	27.3	Exceeds One	77.3	38.6	218.5
Dakota	TribDakS1	11	62.4	9.1	Meets Both	58.4	43.6	90.6
Dakota	TribDakS2	11	96.9	36.4	Exceeds One	78.5	39.5	219.8

		2012				2010-2012 GMV		
Project Area	Station	#	GMV	%>200*	2012 Meets Stnd?	All	Wet	Dry
Dakota	SFDak2.2	11	95.5	27.3	Exceeds One	68.6	41.1	147.9
Coastal	CB1	9	20.9	11.1	Exceeds One	14.9	5.3	132.9
Coastal	CB2	11	27.8	9.1	Meets Both	25.4	13.8	63.5
Coastal	CB3	11	37.1	18.2	Exceeds One	34.8	18.1	92.5
Coastal	CB4	9	67.8	22.2	Exceeds One	39.9	24.2	73.0
Coastal	DH14	7	24.4	14.3	Exceeds One	16.5	13.4	54.6
Coastal	DH2	8	10.5	12.5	Exceeds One	8.4	4.9	27.0
Coastal	DH3	8	127.2	50.0	Exceeds Both	37.6	27.1	109.3
Coastal	DH4	8	6.3	12.5	Exceeds One	6.0	4.3	15.1
Coastal	DH5	9	164.1	22.2	Exceeds Both	56.0	41.4	102.3
Coastal	LI4	9	142.4	33.3	Exceeds Both	84.5	98.5	63.3
Coastal	LI1	8	106.5	37.5	Exceeds Both	71.9	41.5	374.4
Cain	CC	11	89.7	45.5	Exceeds Both	87.9	85.7	91.7
Cain	CCO	11	138.4	63.6	Exceeds Both	219.1	170.1	320.5

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

Appendix B: Whatcom County 2012 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
California	CA14c	2	2	2	2	6	3	42	Seasonal
Dakota	TribDak3	2	4	2	2	4	3	42	2013 WC Focus Area, Perennial
Cain	CCO	2	4	2	2	4	3	42	
California	CA1	2	4	1	0	4	3	33	Perennial
Dakota	TribDak2	2	2	2	1	4	3	33	2013 WC Focus Area, Perennial
Dakota	TribDak4	2	2	2	1	4	3	33	2013 WC Focus Area, Perennial
Portage	K1a	2	4	2	2	2	2.5	30	WC Health follow up on OSS
California	CA9	0	2	2	1	4	3	27	Seasonal
BB Coastal	BB8	4	4	6	4	6	1	24	2013 WC Focus Area, Seasonal
Terrell	TribTerBC2	2	2	1	0	6	2	22	
California	CA16	2	2	1	0	2	3	21	Perennial
Dakota	NFDak2.5	2	2	1	0	2	3	21	
Cain	CC	2	2	1	1	1	3	21	
BB Coastal	BB21	4	4	4	2	6	1	20	
Portage	K1	2	2	1	1	2	2.5	20	
Portage	F4	2	2	1	1	2	2.5	20	
Portage	F1	2	2	1	1	1	2.5	17.5	
Terrell	TribFERN1	2	2	1	1	2	2	16	
Terrell	TribTerBC1	2	2	1	1	2	2	16	
Portage	B3	2	2	1	0	1	2.5	15	2013 DOE focus area
Portage	DRC	2	2	1	0	1	2.5	15	
BB Coastal	BB7	2	4	2	1	6	1	15	
California	Cal 6.2	2	2	0	0	1	3	15	
Coastal	DH3	2	2	0	0	1	3	15	
Coastal	DH5	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
Terrell	Ter7.8	2	2	1	0	2	2	14	
Terrell	Ter5.0	2	2	1	0	2	2	14	
BB Coastal	BB6	2	2	2	1	6	1	13	
BB Coastal	BB11	2	2	2	1	6	1	13	
BB Coastal	BB16	4	4	2	2	1	1	13	
Portage	S1	0	2	1	1	1	2.5	12.5	
BB Coastal	BB4	2	4	2	2	2	1	12	
California	CA8	0	2	0	0	2	3	12	
Dakota	TribDakN2	0	2	0	0	2	3	12	
Dakota	TribDakS2	0	2	0	0	2	3	12	
Portage	AND	0	2	0	0	2	2.5	10	
Terrell	Ter1.9	2	2	0	0	1	2	10	
Terrell	Ter1.6	2	2	0	0	1	2	10	
Terrell	TribTerLP1	0	2	1	0	2	2	10	
BB Coastal	BB18	2	2	1	0	4	1	9	
California	Cal 5.0	0	2	0	0	1	3	9	
California	Cal 7.5	2	0	0	0	1	3	9	
California	CA15	0	2	0	0	1	3	9	
Dakota	TribDak5	0	2	0	0	1	3	9	
Dakota	SFDak2.2	0	2	0	0	1	3	9	
Terrell	Ter0.7	0	2	1	0	1	2	8	
Terrell	TribTerJ1	0	2	0	0	2	2	8	
Portage	S3	0	2	0	1	0	2.5	7.5	
Portage	B1	0	2	0	0	1	2.5	7.5	2013 DOE focus area
Portage	T1	0	2	0	0	1	2.5	7.5	
BB Coastal	BB5	2	4	0	0	1	1	7	
Dakota	TribDakN1	0	2	0	0	0	3	6	

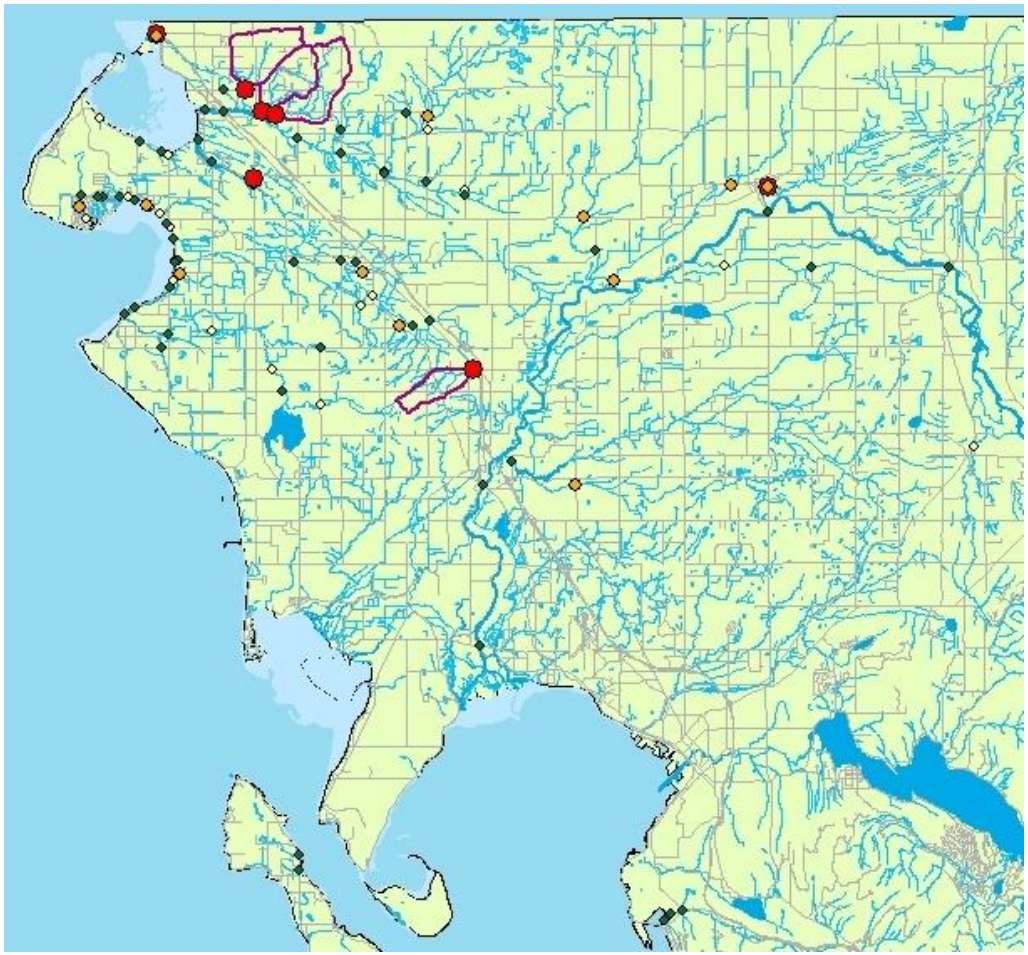
Stream	Station	12 Month GM	12 Month % > 200	3 Year GM	3 Year Wet Season GM	3 Year Dry Season GM	Shellfish Area Multiplier*	Total Score**	Comments
Coastal	CB1	0	2	0	0	1	2	6	
Coastal	DH14	0	2	0	0	0	3	6	
Coastal	DH2	0	2	0	0	0	3	6	
Coastal	DH4	0	2	0	0	0	3	6	
Coastal	LI1	2	2	0	0	2	1	6	
BB Coastal	BB22	0	2	1	0	2	1	5	
BB Coastal	BB3	0	2	0	0	0	2	4	
Coastal	CB3	0	2	0	0	0	2	4	
Coastal	CB4	0	2	0	0	0	2	4	
Coastal	LI4	2	2	0	0	0	1	4	
Terrell	TribFIN1	0	2	0	0	0	2	4	
Terrell	Ter8.4	0	2	0	0	0	2	4	
Terrell	Ter3.3	0	2	0	0	0	2	4	
BB Coastal	BB19	0	2	0	0	1	1	3	
BB Coastal	BB20	0	2	0	0	1	1	3	
BB Coastal	BB12	0	2	0	0	0	1	2	
Portage	M5	0	0	0	0	0	2.5	0	
Portage	M4	0	0	0	0	0	2.5	0	
Portage	M2	0	0	0	0	0	2.5	0	
Portage	M1	0	0	0	0	0	2.5	0	
BB Coastal	BB15	0	0	0	0	0	1	0	
California	Cal 0.1	0	0	0	0	0	3	0	
California	Cal 0.8	0	0	0	0	0	3	0	
California	Cal 1.9	0	0	0	0	0	3	0	
California	CA3	0	0	0	0	0	3	0	
California	CA6	0	0	0	0	0	3	0	
Dakota	Dak 0.1	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 0.6	0	0	0	0	0	3	0	
Dakota	Dak 3.1	0	0	0	0	0	3	0	
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	
Dakota	TribDak1	0	0	0	0	0	3	0	
Dakota	TribDakS1	0	0	0	0	0	3	0	
Coastal	CB2	0	0	0	0	0	2	0	
Terrell	Ter0.1*	0	0	0	0	0	2	0	
Terrell	Ter0.1	0	0	0	0	0	2	0	

*Shellfish growing area score = 1 for open area, 2 for threatened tribal or commercial/closed recreational area, 3 closed or CA 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 2013. 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 outlined in purple are priority areas 1 and 2 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
Terrell	Trib FIN1	Grandview Road, East of North Star, small culvert discharges to pool
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	CA3 (TribCal-3)	Downstream side of cross culvert at Arnie, east of Ham
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 2nd 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

Watershed	Project Site ID	Site Location
Chuckanut	CB3	Chuckanut Creek 18th Street Alley Bridge
Chuckanut	CB4	Mouth of Chuckanut Creek @ end of the footpath from Woodstock
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 2010-2012)