

*Pierce County Public Works & Utilities  
Surface Water Management Division*

**Pierce County Shellfish Project  
G1100202**

**QUALITY ASSURANCE PROJECT PLAN**

*July 2012*

**Funded By:**

**Washington State Department of Ecology,  
Centennial Clean Water Fund, and**



# **Pierce County Shellfish Project QUALITY ASSURANCE PROJECT PLAN**

*July 2012*

**Prepared by:  
Barbara Ann Smolko  
Pierce County Public Works & Utilities,  
Surface Water Management Division**

**For the:  
Key Peninsula-Gig Harbor-Islands Watershed**

**Funded By:  
Washington State Department of Ecology,  
Centennial Clean Water Fund #G1100202**

Approved as to form and content:

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Tammy Riddell, Project Manager, Washington State Department of Ecology      Date

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Barbara Ann Smolko, Project Manager, Pierce County Surface Water Management      Date

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Tom Kantz, Project Lead,      Pierce County Surface Water Management      Date

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## **Distribution List**

This Quality Assurance Project Plan (QAPP), once approved by the Washington State Department of Ecology, will be distributed electronically to the following individuals:

Barbara Ann Smolko, Project Coordinator  
Senior Planner  
Pierce County Surface Water Management  
(253) 798-6156 [bsmolko@co.pierce.wa.us](mailto:bsmolko@co.pierce.wa.us)

Tom Kantz, Project Lead  
Water Quality & Watershed Lead  
Pierce County Surface Water Management  
(253) 798-4625 [tkantz@co.pierce.wa.us](mailto:tkantz@co.pierce.wa.us)

Ray Hanowell, R.S.  
Environmental Health Specialist  
Tacoma-Pierce County Health Department  
(253) 798-2845 [ghanowell@tpchd.org](mailto:ghanowell@tpchd.org)

Windy Kruse  
Water Quality Technician  
Pierce County Surface Water Management  
(253) 798-3092 [wkruse@co.pierce.wa.us](mailto:wkruse@co.pierce.wa.us)

Diane Klavano, Water Quality Technician  
Pierce County Surface Water Management  
(253) 798-6822 [dklavan@co.pierce.wa.us](mailto:dklavan@co.pierce.wa.us)

Berl Eldridge  
Water Quality Technician  
Pierce County Surface Water Management  
(253) 798-2248 [beldrid@co.pierce.wa.us](mailto:beldrid@co.pierce.wa.us)

Leslie Banigan  
Kitsap Public Health District  
Water Quality Program  
345 6<sup>th</sup> Street, Suite 300  
Bremerton, WA 98337-1466  
(360) 337-5627  
[banigl@health.co.kitsap.wa.us](mailto:banigl@health.co.kitsap.wa.us)

Scott Berbells, R.S.  
Public Health Advisor  
Washington State Department of Health  
(360) 236-3324 [scott.berbells@doh.wa.gov](mailto:scott.berbells@doh.wa.gov)

## **PIERCE COUNTY SHELLFISH PROJECT QUALITY ASSURANCE PROJECT PLAN**

This Monitoring and Quality Assurance/Quality Control Plan outlines the data collection and quality assurance (QA) procedures for surface water sample collection, analysis, and reporting for the Pierce County Shellfish Project of Pierce County Public Works & Utilities, Surface Water Management Division (SWM). This plan was prepared in accordance with the Washington State Department of Ecology's *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Ecology 2004). The goals of this document are as follows:

- To ensure that high quality, verifiable data are collected
- To ensure cost-effective use of resources
- To ensure that the data are useable by citizens, organizations, and state and local agencies, including the Washington State Department of Ecology.

Data generated from this project, from the Washington State Department of Health Office of Shellfish Programs (DOH), Tacoma-Pierce County Health Department (TPCHD), and from SWM will be used to identify problem areas for targeted corrective activities to achieve and maintain acceptable water quality in the shellfish watersheds of Pierce County.

This plan addresses the QA needs associated with sampling and data collection activities to be performed by Pierce County, its partners, and its representatives. This plan presents objectives, activities, and specific QA procedures designed to assure that scientifically representative data are obtained throughout the project.

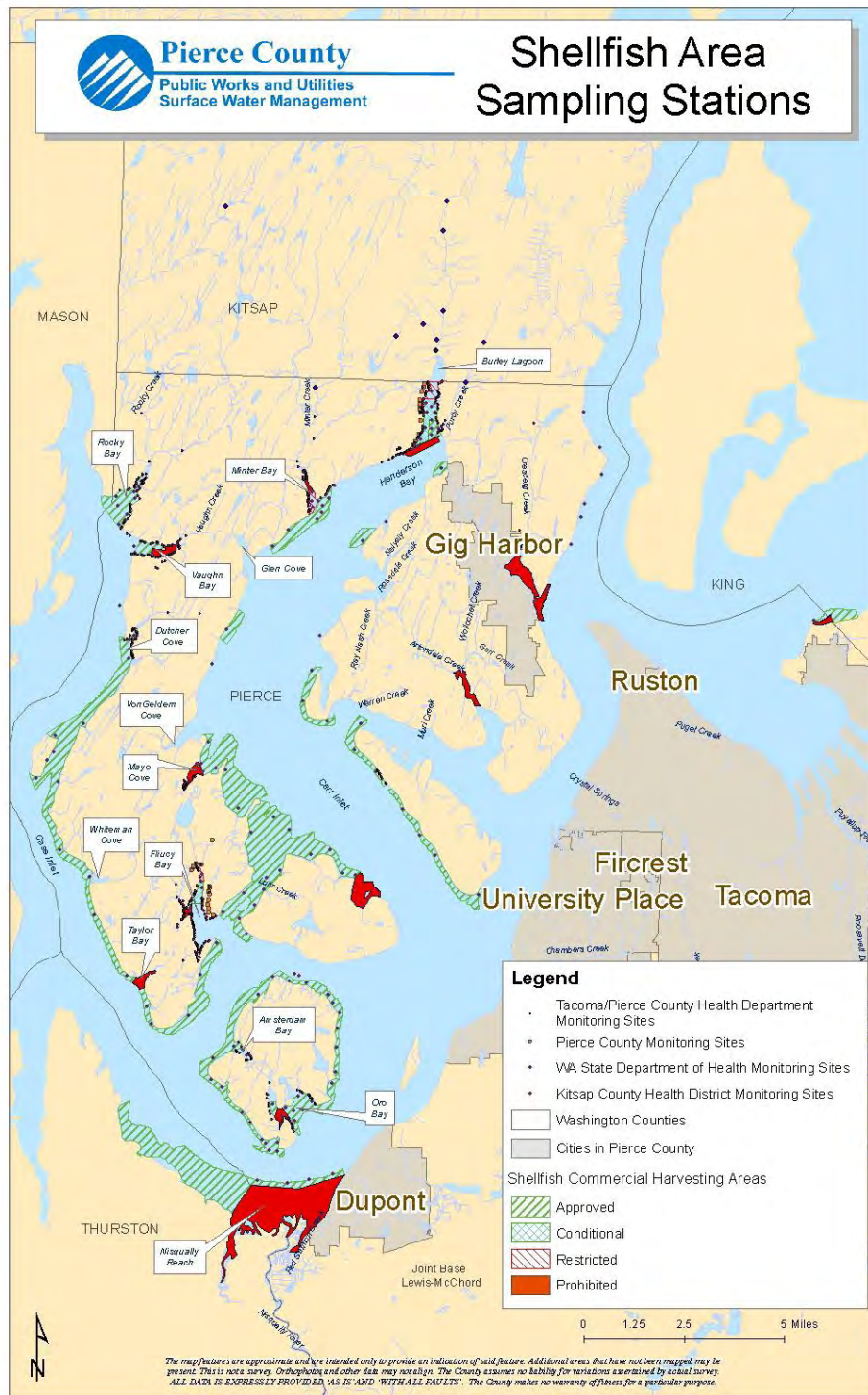
### **1. Background and Problem Statement**

Study Area and Surroundings: The project focuses on the Key Peninsula-Gig Harbor-Islands (KGI) Watershed, which includes approximately 25% of Water Resource Inventory Area (WRIA) 15, the *Kitsap Basin*. The KGI Watershed includes that portion of WRIA 15 that drains to marine waters in Pierce County. The remainder of WRIA 15 takes in the eastern portion of Kitsap County. The project area is shown in Figure 1. The watershed lies primarily within unincorporated Pierce County but does include the City of Gig Harbor and portions of Kitsap County. The watershed is within the usual and accustomed fishing and hunting grounds of the Puyallup, the Nisqually, and the Squaxin Tribes of Indians, so these tribes have treaty rights to shellfish grown in this area even if they are outside of their formal reservation boundaries.

The KGI Watershed covers approximately 158 square miles and is located primarily in the Puget Sound Partnership's South Sound Action Area. The South Sound Action Area includes all surface waters that drain to Puget Sound south of the Tacoma Narrows bridge. The area of the watershed that is east of State Route 16 and drains to Colvos Passage is included in the Partnership's North Central Action area. The Key Peninsula

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is bounded on the west by Case Inlet and on the east by Carr Inlet. The Gig Harbor Peninsula is bounded on the west by Carr Inlet and on the east by Colvos Passage and the Tacoma Narrows. The Islands included in the project area include: Anderson, Cutts, Fox, Herron, Ketron, and Raft Islands.



**Figure 1 - Map of Project Area**

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The area has a mild climate and receives approximately 50 to 55 inches of precipitation each year.

The Washington State Department of Health (DOH) 2009 Shellfish Growing Areas Annual Report identifies thirteen shellfish growing areas, covering over 8,000 acres, in the KGI Watershed. These growing areas include: Anderson Island, Burley Lagoon, Drayton Passage, Fox Island, Henderson Bay, Oro Bay, Penrose Point, Rocky Bay, Vaughn Bay, West Key Peninsula, and Wyckoff Shoal. There are 26 public beaches in the project area. Commercially harvested shellfish from this area include geoduck, manila clams, Pacific oysters, and mussels.

History of Study Area: Since the mid-1980's bacterial contamination has impacted shellfish growing areas in the Key Peninsula-Gig Harbor-Islands (KGI) Watershed. A map of the KGI Watershed is attached as Figure 2. At that time, all (or most) of Vaughn Bay, Minter Bay, and Burley Lagoon were classified by the Washington State Department of Health (DOH) as Restricted. Pierce County responded by working with local residents to create the Burley-Minter Basin Water Quality Plan (1988) that focused on reducing nonpoint sources of bacterial pollution from agricultural activities, failing septic systems, and new construction. Subsequently, Burley Lagoon was upgraded in 1993 to include Approved and Conditional growing areas while maintain a much smaller Restricted area. Problematic bacteria counts in Mayo Cove, on which Penrose Point State Park is located and supports popular recreational harvest areas spurred the Tacoma-Pierce County Health Department to develop the Mayo Cove/Penrose Point Shellfish/Water Quality Plan (1995). A series of downgrades followed: Rocky Bay in 1996 from Approved to Restricted, Burley Lagoon in 1999 from Approved to Conditional, and Filucy Bay from Approved to Conditional in 2002.

The *Pierce County Shellfish Partners* program was created in 2006 after these three growing areas were downgraded and additional downgrades were threatened in Oro Bay and Burley Lagoon. The goal of the program was to coordinate pollution identification and correction efforts for the watershed as a whole and in a proactive manner rather than addressing individual areas as they were threatened with downgrades. The creation of the program was formalized in the Key Peninsula-Islands Basin Plan (a water quality, flood control, and fish habitat plan directing SWM's work in the area) which was adopted by the Pierce County Council in December 2006. Pierce County Surface Water Management (SWM), the Pierce Conservation District (PCD), and TPCHD were the founding members of the Pierce County Shellfish Partners team. This has enabled a continuous, proactive approach to improving and protecting water quality in the shellfish watersheds of Pierce County. Rocky Bay was upgraded in 2006 and in 2008, and 154 acres of Vaughn Bay were reopened after more than 30 years following coordination sampling and action on the part of the Pierce Conservation District, TPCHD, SWM, and the Washington State Department of Ecology.

Contaminants of Concern: Pierce County's project will study the problem of fecal coliform bacteria (FC) pollution in the KGI Watershed.

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Results of Previous Studies: Since the mid-1980's bacterial contamination has impacted shellfish growing areas in the Key Peninsula-Gig Harbor-Islands (KGI) Watershed. Since that time, a considerable amount of monitoring has occurred. Over that time period, we have seen notable improvements in water quality in Vaughn Bay and Rocky Bay. Filucy Bay improved somewhat which allowed DOH to adjust the Conditional use condition from 0.5 inches of rainfall to 0.75. Filucy Bay and Burley Lagoon have maintained a certain equilibrium in that both bays have remained opened but continue to stay on DOH's "Threatened" list. Minter Bay has not improved to a point at which DOH has considered a reclassification. *Table 2- FC Geometric Mean and 90<sup>th</sup> Percentile of Area Streams* summarizes Pierce County's results from local area streams. Some streams, like Rocky and Herron are easily meeting State water quality standards. The most polluted streams are Crescent, Ray Nash, and Whiteman. However, none of these drain to a commercial shellfish growing area. Of the streams draining to shellfish beds Vaughn, Purdy, and Schoolhouse Creek on the Key Peninsula show the highest potential for contributing bacteria to shellfish beds. DOH's marine samples have confirmed that contributing streams are a threat with the highest bacterial levels generally found at the heads of Burley Lagoon, Minter Bay, Filucy Bay, and Vaughn Bay.

These findings influenced our decision to prioritize Minter, Little Minter, and Huge Creeks for targeted sampling on top of our current sampling, because they drain to a "Restricted" shellfish growing area. Minter Bay has potential for reclassification if we are able to successfully identify and correct pollutant sources to those streams. Figure 10 - New Minter Creek Sampling Sites illustrates the locations of those additional sites.

The following is a list of plans that have been prepared in response to water quality concerns in the KGI area, most of which include a description of water quality sampling results.

- Burley-Minter Basin Water Quality Plan (1988), Pierce County: An "Early Action" nonpoint pollution control plan developed by a local stakeholder group which included recommendations for agency actions and regulatory changes.
- Mayo Cove/Penrose Point Shellfish/Water Quality Plan (1995), Tacoma-Pierce County Health Department: Included a significant water quality monitoring element, pollution source identification, and project recommendations for immediate action, locations and frequencies for on-going monitoring, and proposed land-use guidelines for future development in the watershed.
- Rocky Bay Shellfish Protection District (SPD) & Program (1996), Pierce County: Established the Rocky Bay SPD in cooperation with Kitsap County and included a closure response plan addressing stormwater and septic sources.
- Burley Lagoon Shellfish Protection District & Program (1999), Pierce County: Established the Burley Lagoon SPD in cooperation with Kitsap County and included a closure response plan addressing primarily septic and agricultural sources.
- KGI Watershed Action Plan (2000), Pierce County, Kitsap County, and the City of Gig Harbor: A WAC 400-12 plan focused on reducing sources of nonpoint pollution. The plan was developed by a stakeholder group and proposed recommendations for agriculture, boats & marinas, forestry, on-site, stormwater and other sources. Established the KGI Watershed Council.

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- Rocky Bay Subwatershed Plan (2000), Pierce County: A supplement to the KGI Watershed Plan, the Rocky Bay Plan provided specific examples of how recommendations included in the KGI Plan might be implemented in the Rocky Bay drainage.
- Filucy Bay Shellfish Protection District & Program (2002), Pierce County: Established the Filucy Bay SPD and included a closure response plan addressing primarily septic and agricultural sources.

Since the creation of the Rocky Bay SPD, DOH, Tacoma-Pierce County Health Department, Pierce County Surface Water Management, Pierce Conservation District, Kitsap Public Health District, and Kitsap Conservation District have met quarterly to review water quality results and provide updates on their shellfish area activities.

The following is a list of previous studies that included water quality sampling components:

Determan, Timothy A. and James A. Hoyle. 1992. **Penrose Point/Mayo Cove Water Quality Project Report**. Prepared for the U.S. Environmental Protection Agency. Prepared by Tacoma-Pierce County Health Department Environmental Health Division and Washington State Department of Ecology Shorelands and Coastal Zone Management Program. July 1992. Findings: Half of the freshwater sampling stations met the state fecal coliform standard for Class AA waters. Overall, Mayo Cove waters met marine water quality standards. Examined as subareas, the outer cove met the standards consistently, but the inner cove did not. A gradient of decreasing fecal coliform levels from the inner cove to the outer cove was demonstrated.

Determan, Timothy. 1999. **Trends in Fecal Coliform Pollution in Eleven Puget Sound Embayments**. A Report for the Puget Sound Ambient Monitoring Program. Washington State Department of Health. Office of Shellfish Programs. March 25, 1999. Findings: Trends indicated increasing FC levels and the 3 southern-most sites in Burley Lagoon and SWM and TPCHD saw this as evidence of the need to continue to search for pollution sources in nearby uplands.

Dickes, Betsy and Barbara Patterson. 1994. **Water Quality Assessment in the Burley and Minter Creek Watersheds, Kitsap and Pierce Counties, Washington**. Environmental Investigations and Laboratory Services Program, Watershed Assessments Section, Washington State Department of Ecology, Olympia. Publication No. 94-172. October 1994. Findings: Violations of State Water Quality Standards for Class AA waters were found throughout the Burley and Minter watersheds in 1992-94. Elevated concentrations occurred primarily during rain events. Conditions were particularly poor in the lower reaches of Burley and Purdy Creeks and in the upper reaches of Minter Creek.

Washington State Department of Ecology. 1985. **Sources Affecting the Sanitary Conditions of Water and Shellfish in Minter Bay and Burley Lagoon**. WDOE 84-10. September 1985. Findings: Tributary waters adjacent to developed areas in both the Minter and Burley/Purdy watersheds violated State Water Quality Standards for FC.

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Tributary waters near undeveloped areas generally met standards. FC concentrations appeared to increase during summer months.

In addition to these specific projects, the Washington State Department of Health, Kitsap County Health District, Tacoma-Pierce County Health Department, and Pierce County Surface Water Management have collected water quality samples on an ongoing basis. Many of these samples are collected as a regular part of continuing programs and some were made possible through grant funding opportunities. Due to the sheer volume of results, the list of previous results included in this QAPP will be limited to the past five years and are attached as Appendix E.

It should be noted that the sampling program proposed within this QAPP is a continuation of a coordinated sampling effort established in 2008, when Pierce County received Local Stormwater Grant funding from Ecology for work in Burley Lagoon, Rocky Bay, and Filucy Bay. The results of previous sampling efforts by TPCHD and SWM from the sites proposed for additional sampling in this Plan are attached in Appendix E.

The KGI Watershed has a history of water quality issues and hosts a number of pre-existing water quality sampling sites. There are at least 4 agencies collecting samples in the area that include fecal coliform bacteria as a sampling parameter. Figures showing previously existing sampling locations include:

- Figure 3 – DOH Marine Sampling Sites
- Figure 4 – TPCHD Sample Sites - North
- Figure 5 – TPCHD Sample Sites - South
- Figure 6 – Pierce County WQI Sample Sites
- Figure 7 – Pierce County Shellfish Sample Sites
- Figure 8 – Kitsap Public Health Sample Sites
- Figure 9 – TPCHD Swimming Beach Sample Site

Regulatory Criteria or Standards: The “Water Quality Standards for Surface Waters of the State of Washington” are codified in Chapter 173-201A of the Washington Administrative Code. All surface waters in the project area are currently designated in the WAC as Extraordinary Primary Contact Recreational Waters. Freshwater and marine water standards for fecal coliform bacteria are shown in Table 1.

**Table 1**  
**Washington State Surface Water Quality Standards**  
**(Chapter 173-201A-030 WAC)**

<b>Parameter</b>	<b>Freshwater - Extraordinary Primary Contact</b>	<b>Marine - Extraordinary Aquatic Primary Contact</b>
<b>Fecal Coliform bacteria (FC)</b>	<p><b>Part 1:</b> ≤ 50 FC/100ml (geometric mean)</p> <p><b>Part 2:</b> Not more than 10% of all samples obtained for calculating a geometric mean &gt;100 FC/100 ml</p>	<p><b>Part 1:</b> ≤ 14 FC/100ml (geometric mean)</p> <p><b>Part 2:</b> Not more than 10% of all samples obtained for calculating a geometric mean &gt;43 FC/100 ml</p>

The Washington Department of Health (DOH) has established standards for the quality of marine waters in shellfish harvesting areas that are designed to protect public health. The standards are based on guidelines developed by the National Shellfish Sanitation Program. To determine the compliance of a shellfish harvesting area with standards a minimum of 30 water samples must be taken and analyzed for fecal coliform content. Two statistics, a geometric mean and a 90<sup>th</sup> percentile value, are calculated from the 30 analytical results. The concentration of fecal coliform bacteria in marine waters over shellfish harvesting areas must not exceed a geometric mean of 14 organisms per 100 milliliters or a 90<sup>th</sup> percentile value of 43 organisms per 100 milliliters. This means that, according to DOH, no more than 10% of the samples can exceed the 90<sup>th</sup> percentile value. The standards are the same for commercial and recreational shellfish harvesting.

To put the shellfish data in perspective, Table 2 – FC Geometric Mean and 90<sup>th</sup> Percentile of Area Streams, provides the geometric mean from streams sampled by SWM between March 2006 and February 2012.

**Table 2- FC Geometric Mean and 90<sup>th</sup> Percentile of Area Streams**

<b>Stream</b>	<b>GeoMean</b>	<b>90<sup>th</sup> Percentile</b>	<b>Stream</b>	<b>GeoMean</b>	<b>90<sup>th</sup> Percentile</b>
Artondale	38.79	185	Herron	6.71	68
McCormick	28.96	210	Dutcher	23.6	175.4
Crescent	183.81	830	Vaughn	43.21	256
Ray Nash	166.73	865	Rocky	9.96	62.75
Nelyaly	76.69	255.5	Minter	17.36	100.5
Rosedale	50.21	231.2	Little Minter	17.92	106.5
Goodnough	49.62	508.5	Purdy	43.29	281
Schoolhouse AI	33.03	134.4	Schoolhouse KP	36.65	386
Whiteman	194.98	1398.4	Mark Dickson	83.32	362.5

Logistical Problems: Logistical problems with sampling in the KGI Watershed can include the need for private property owner permission to access some sampling

locations, the overall size and travel time needed to traverse the sample area, coordinating the joint agency sampling, and difficulty reaching some outfall sites during low tide due to mucky conditions. Under good driving conditions, the travel time between the most outlying sampling sites and the laboratory facilities should be an hour or less so we do not foresee the distance of the sample collection sites from the laboratory as being a significant limiting factor. However, sites located on Anderson Island may be impacted by the travel time associated with ferry travel and will need to be factored into sample collection scheduling. Also, the sample delivery route goes through an urban area with traffic issues that are not always predictable. Finally, collection of bacterial samples will be limited to Monday through Thursday since Friday and weekend collected samples have substantially higher processing costs.

## **2. Project Description**

### Project Goals:

- Net increase in the number of acres of shellfish growing area with upgraded growing classifications.
- Restore and protect beneficial uses in the Key Peninsula-Gig Harbor-Islands Watershed.
- Restore and protect 303(d) listed water bodies.
- Prevent degradation of healthy waters.

### Project Objectives:

- Upgrade 50 acres or more in Minter and Henderson Bays from Restricted to Conditional status by 2016.
- Reduce FC contamination from freshwater discharges to the marine waters and shorelines of the KGI Watershed. The major tributaries include the following creeks: Rocky, Burley, Minter, Huge, Crescent, Purdy, Schoolhouse (KP), Schoolhouse (AI), Vaughn, Dutcher, and McCormick.
- Investigate at least 50 onsite sewage systems (OSS) targeted for survey in the project area. Prevent premature OSS failures by providing education to homeowners about system operation and maintenance.
- Locate failing OSS or other FC sources associated with FC “hot spots” identified during the marine shoreline surveys of the KGI Watershed.
- Repair failing OSS in accordance with Tacoma-Pierce County Board of Health Resolution 2010-4222 “Environmental Health Code, Chapter Two, On-Site Sewage”, February 3, 2010.
- Work with the Kitsap and Pierce Conservation Districts to update and prioritize agricultural inventories for properties in the project area.
- Investigate high-priority agricultural sites.
- Kitsap and Pierce Conservation Districts work with agricultural property owners in the watershed to install best management practices that protect and/or restore water quality.
- Correct livestock manure management problems by encouraging voluntary cooperation with the Conservation Districts. If this is unsuccessful, correction will be achieved through enforcement of the Kitsap and Pierce County Board of Health “Solid Waste Regulations.”

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- Distribute pet waste education materials.
- Implement marina pump-out outreach and incentive program.
- Work with Pierce Conservation District to provide workshops for realtors that address topics such as low impact development, natural landscaping, and designing rain gardens, that are beneficial for water quality.
- Increase awareness of the actions that individuals can take to improve water quality, through public meetings, press releases, and displays in the project area.

Information Needed and Sources: Fecal coliform bacteria levels in freshwater need to be identified and measured. Revisit on-site sewage systems that were identified as questionable but having “No Apparent Problems” in the 2008/2009 survey. Inventory potential agricultural source sites and prioritize for action.

Target Population: Freshwater streams, drainages, and stormwater outfalls within the KGI Watershed. Property owners with septic systems in water quality impaired areas and with poor animal keeping practices.

Study Boundaries: The geographical boundary for the project will be the Key Peninsula-Gig Harbor-Islands Watershed excluding those portions in Kitsap County – See **Figure 1- Map of the Project Area** in attachments.

Tasks Required:

The following tasks will be implemented to meet the goals and objectives for this project. The tasks will be completed in accordance with the grant agreement between Ecology and Pierce County (G1100202) and according to the project timeline and milestones found in Table 3.

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**Table 3: Pierce County Shellfish Program Timelines and Milestones**

Project Tasks	2011				2012				2013			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Quarterly Reports	R	R	R	R	R	R	R	R	R	R	R	
Final Report												R
Quarterly Team Meetings	M	M	M	M	M	M	M	M	M	M	M	M
QAPP – develop and submit to Ecology					X							
QAPP – Ecology review & approval					X	X						
Set up output & outcome tracking						X						
Track outputs & outcomes						X	X	X	X	X	X	C
Collect and track water sampling data						X	X	X	X	X	X	C
Soil sampling	D	D	D	D	D	D	D	D	D	D		
Pollution source identification sampling						W	W	W	W	W	W	W
Follow-up sampling						W	W	W	W	W	W	W
Develop water quality plans with BMPs					X	X	C					

M = Staff meeting

P = Public meeting or workshop

R = Report

W = Water quality sampling

D = Soil sampling

C = Task completed

**Task 1 - Project Administration/Management**

Staff from Pierce County will administer the project. Responsibilities will include, but not be limited to: maintenance of project records; submittal of payment vouchers, fiscal forms, and progress reports; compliance with applicable procurement, contracting, and interlocal agreement requirements; application for, receipt of, and compliance with all required permits, licenses, easements, or property rights necessary for the project; and submittal of required performance items.

**Task 2 - On-site Sewage System Pollution ID, Correction and Education**

Staff will prepare and submit a Quality Assurance Project Plan (QAPP) to Ecology for approval prior to starting the environmental monitoring activities. Staff will collect water quality samples for fecal coliform bacteria from streams and low tide channels that drain into priority shellfish harvesting areas. Also, staff will investigate suspect properties and provide technical assistance to property owners that need to resolve failing systems and offer generalized educational information to the public about proper septic system care and maintenance. An additional 10 water samples will be collected for fecal coliform and/or E. coli enumeration above and beyond SWM and TPCHD's existing ambient monitoring program data collection for a 24-month period of approximately 50 samples.

**Task 3 – Agricultural Pollution Identification, Correction and Education**

Staff will complete a GIS farm inventory of the focus area using Arc Map / ArcGIS 9, version 9.3.1. The inventory will map farm locations, and prioritize farms based on their risk to local water quality. Farms will be added to the inventory using one of two methods; a) using a GPS unit to document an individual location then importing that location or ArcView or b) using 2008 orthophotos and GIS parcel data of the area then field verifying the actual agricultural activity. The location of the farm with respect to area streams, shoreline, and drainages, as well as the animal densities and existing farm management practices will be used in the prioritization process.

Staff will contact landowners with information about BMPs and farm planning assistance and will offer to perform soil samples and site specific recommendations for participating land owners. Soil samples will include information on the level of nutrients, such as nitrogen, phosphorous, and potassium in their soils and will be collected by Conservation District staff and processed by A&L Laboratories. These results are provided as an educational tool for property owners to assist in designing and selecting appropriate BMPs. Small farm workshops will be offered as another means to distribute this information. Staff will offer best management practices (BMP) implementation assistance to property owners with preference given to high priority farms. Based on our characterization of agricultural activities within the area, the BMPs that are most likely to be proposed for cost share will include: exclusion fencing to establish 35' vegetated buffers from surface water, manure storage structures with reapplication or removal schedules, off stream feeding or watering areas and heavy use area protection. Finally, staff will investigate high priority farms and pursue compliance with water quality regulations. Water quality results collected under Task 2 will be utilized to direct and prioritize actions under Task 3, but Task 3 does not include any specific or separate fecal coliform bacteria water quality sampling.

**Task 4 – Boater Education**

Staff will coordinate a clean boating educational event at the Longbranch Marina on Filucy Bay. This event will include staffing a booth and providing water quality information, information on oil/fuel-absorbent materials to boat owners, materials about using pump-out services and their benefits, arrange for a portable pump-out vessel to provide additional education and pump-out services for vessels moored within the bay and document the amount of septage confirmed to have been collected and disposed of properly rather than released to Puget Sound.

Also, staff will develop and implement a clean boating educational program targeting anglers including on-water education, with a focus on encouraging the proper handling of human and solid waste.

Staff will inventory and prioritize derelict and illegally moored vessels in high priority shellfish areas. This will provide the baseline information needed to remove or resolve problem vessels that will occur outside of this project.

**Task 5 – Natural Yard Care Education Program and Technical Assistance**

Staff will conduct three Natural Yard Care workshops targeting area residents, garden centers, garden clubs, and landscape professionals. The workshops will cover topics including: shoreline planting and maintenance, natural lawn care, integrated pest management, basic soils, composting, and garden design using native plants.

Staff will work with home and garden retailers and nurseries on the Key Peninsula to promote natural yard care products and native plants. This will include distributing copies of the Natural Yard Care Buyer's Guide and brochures that have already been developed to garden supply retailers.

**Task 6 – Shoreline Education**

Staff will provide an interpretive program on the marine environment to be held at beach locations throughout Gig Harbor and the Key Peninsula. Information will be shared with beach visitors about local flora and fauna and how they are impacted by human behavior and pollution. The program will be publicized to local residents.

Staff will offer 50 classroom workshops investigating environmental topics relevant to the understanding and promotion of stewardship of the local ecosystem. Topics to be addressed will include understanding watershed systems, estuaries, water quality impacts on fish and other aquatic life, and behaviors that contribute to water quality decline. These classroom workshops will be offered at all elementary schools in the Peninsula School District. The Peninsula School District boundaries are contained entirely within the KGI Watershed.

Staff will hold three shoreline and critical areas workshops for local landowners and realtors. Workshops will address geologic processes, habitat, water quality, and development regulations

Staff will develop an interactive, portable display to increase awareness of marine and estuarine underwater habitat and how they are impacted by stormwater and nonpoint sources of pollution.

Staff will utilize a pollutant source-specific fair booth display and offer incentives to enhance local residents' awareness of septic systems, boating, livestock, and pet waste impacts on water quality.

**Task 7 – Stream Team Monitoring Training**

Staff will provide training to area residents on volunteer stream monitoring. Methods will be consistent with current Pierce Stream Team procedures and protocols. Staff will also provide training to KGI watershed residents on volunteer beach monitoring. Beach monitoring training will be consistent with the Beach Watchers format administered by Washington State University Cooperative Extension. Training will include core curriculum, beach naturalist training, and native plant/shoreline stewardship advisor training.

**Task 8 – Project Assessment**

Staff will develop and mail pre- and post-project surveys to a representative sample of Burley Lagoon and Vaughn Bay drainage area residents. The surveys will be designed to assess residents understanding and concerns about septic systems, natural yard care, and other water quality related topics.

Practical Constraints: The ability to collect and accurately analyze data as part of this project may be hindered by: tidal fluctuations, lack of permission to access private property, low instream flows, muddy estuarine conditions and heavy vegetation that make access hazardous, sediment re-suspension in samples, and the fact that fecal coliform bacteria levels do not precisely correlate to human health risk.

Systematic Planning Process Used: Pollution identification and correction efforts will be based on the following previously adopted/implemented plans, contracts, and programs:

- Pierce County's Key Peninsula-Islands Basin Plan, 2006
- Tacoma-Pierce County Health Department Operation and Maintenance Program
- Washington State Department of Health. *Onsite Sewage System Management Plan Guidance for the Twelve Puget Sound Counties*. Marine Recovery Areas Guidance. June 2006.
- Kitsap County's 2011 Priority Area Work List Fecal Pollution Identification and Correction. October 2011
- Tacoma-Pierce County Health Department, *EPA grant to develop a Pollution Identification and Correction Program through the Washington State Department of Health*, 2012
- Pierce County's Water Quality Index program

The programs mentioned above are listed in the references section with links to websites with further information.

Quarterly team meetings will be held and will include: SWM, TPCHD, Kitsap County Health District, Washington State Department of Health, Kitsap Conservation District, Pierce Conservation District, Citizens for a Healthy Bay, Harbor WildWatch, and WSU/Kitsap Beach Watchers. These meetings will be used to coordinate monitoring activities and decisions regarding where to target technical assistance, education, and enforcement efforts.

### **3. Organization and Schedule**

Project Team: The following individuals were essential to this plan's development, and key to its implementation:

Project Manager: The Project Manager is responsible for ensuring that all aspects of the grant agreement are carried out.

Barbara Ann Smolko, Senior Planner  
Pierce County Public Works & Utilities  
Surface Water Management Division  
2702 South 42<sup>nd</sup> St, Ste. 201  
Tacoma, WA 98409-7322  
(253) 798-6156 FAX (253) 798-7709

Lead Field Staff: The Lead Field Staff is responsible for supervising all monitoring requirements included in the grant agreement.

Tom Kantz, Interim Water Quality Lead  
Pierce County Surface Water Management  
(253) 798-4625 [tkantz@co.pierce.wa.us](mailto:tkantz@co.pierce.wa.us)

Field Staff: Field staff are responsible for conducting sanitary surveys and/or monitoring in the project area.

Diane Klavano  
Water Quality Technician  
Pierce County Surface Water Management  
(253) 798-6822 [dklavan@co.pierce.wa.us](mailto:dklavan@co.pierce.wa.us)

Berl Eldridge  
Water Quality Technician  
Pierce County Surface Water Management  
(253) 798-2248 [beldrid@co.pierce.wa.us](mailto:beldrid@co.pierce.wa.us)

Ray Hanowell, R.S.  
Environmental Health Specialist  
Tacoma-Pierce County Health Department  
3629 South D Street, Tacoma, WA 98418-6813  
(253) 798-2845 [ghanowell@tpchd.org](mailto:ghanowell@tpchd.org)

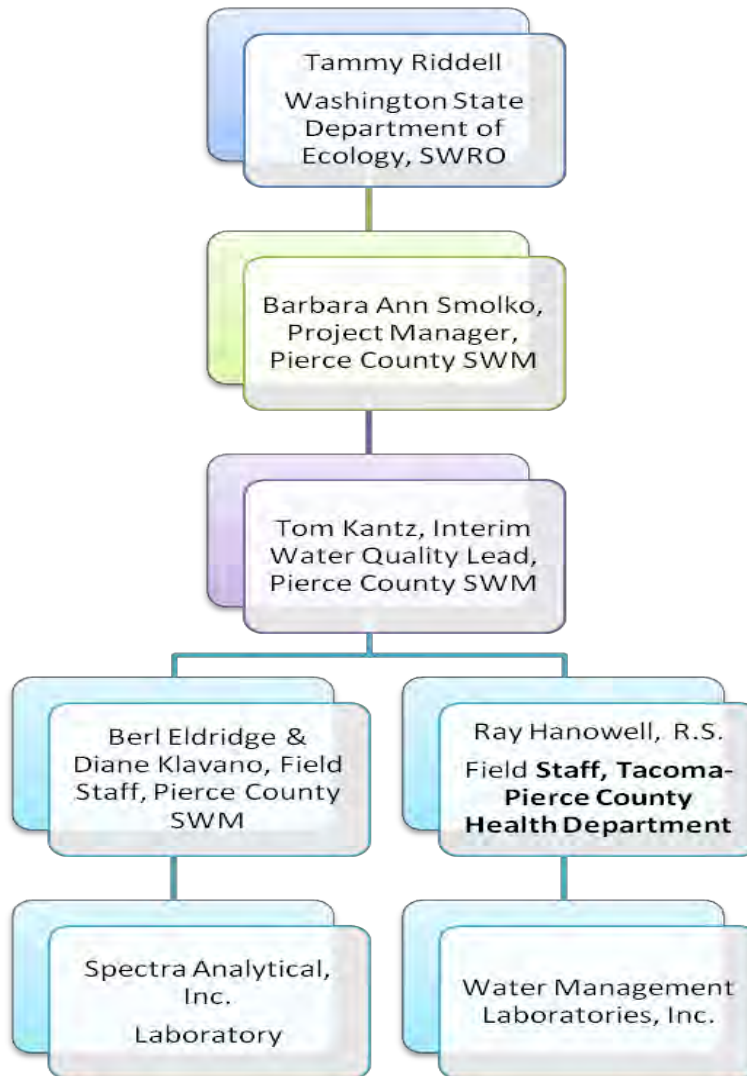
Laboratories: Laboratories are responsible for processing samples in using methodologies consistent with the quality compliance and assurance protocols that gained them accreditation by Ecology.

Water Management Laboratories, Inc.  
1515 80th St E Tacoma WA 98404- 3315  
(253) 531-3121

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Spectra Analytical, Inc.  
2221 Ross Way Tacoma WA 98421  
(253) 272-4850

Organization Chart:



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Project Schedule:

**Table 4- Project Schedule**

<b>Activity</b>	<b>Dates</b>
Reconnaissance visits	Completed by March 31, 2012
Field activities	Ongoing
Delivery of samples to the laboratory	Ongoing
Laboratory results management & data verification	Completed with Final Report, November 2013
Data entry to the EIM database	November 2013
Progress, draft, and final reports, as needed	Quarterly Reports and Draft Final due November 2013
Disposal of samples	Upon completion of processing

Limitations On Schedule: Schedule is limited by the November 30, 2013 end date for project completion. Since DOH classifications are based on 30 monthly samples, pollution correction efforts resulting from this project may not affect shellfish growing area classification changes until after the project is complete.

Project Budget and Funding: Funding for this project is provided through a grant from the Washington State Department of Ecology's Centennial Clean Water Fund (grant # G1100202), and the Pierce County SWM Program (Table 5).

**Table 5 - Project Budget**

<b>Pierce County Shellfish Program</b>		
<b>TASKS/OBJECTS</b>	<b>TOTAL PROJECT COST</b>	<b>TOTAL ELIGIBLE COST (TEC)</b>
1 - Project Administration/Management	\$41,000	\$41,000
2 - On-site System Pollution ID & Correction	\$89,333	\$89,333
3 - Agricultural Pollution ID & Correction	\$41,000	\$41,000
4 - Boater Education	\$40,000	\$40,000
5 - Natural Yard Care Education	\$12,000	\$12,000
6 - Shoreline Education	\$61,000	\$61,000
7 - Monitor Training	\$45,000	\$45,000
8 - Project Assessment	\$4,000	\$4,000

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<b>Total</b>	\$333,000	\$333,000
The DEPARTMENT's Fiscal Office will track to the Total Eligible Cost.		
<b>MATCHING REQUIREMENTS</b>		
DEPARTMENT Share: 75% of Total Eligible Costs (50 % for some BMPs)		\$250,000
RECIPIENT Share: 25% of TEC		\$83,333

#### 4. Quality Objectives

Decision Quality Objectives: *This project is intended to provide data on fecal coliform bacteria pollutant concentrations at a broad spectrum of typical freshwater sites receiving stormwater runoff, such as creeks, ditches, culverts, pipes, and ponds. In many cases the data will serve as an indication of water quality for sites for which there has been no prior water quality sampling. Because this is a general information study rather than one for determinations of compliance or allocation of wastewater loads, decision quality objects governing whether data are useable will be based on the goal of providing general information and preliminary evaluation. However, in each case, the data will be assessed for appropriateness for comparing to state water quality standards. In general, the reporting limits for the parameter results should allow for such comparisons, since analytical procedures for quantifying low level concentrations will be used.*

Measurement Quality Objectives:

**Precision:** Precision is defined as the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions, calculated as either the range or as the standard deviation. It may also be expressed as a percentage of the mean of the measurements, such as relative range or relative standard deviation (coefficient of variation).

Precision for samples collected during this project will be determined by the following:

- Collection and analysis of field duplicates (not splits) for fecal coliform will be conducted for a minimum of 10% of the samples collected for each monitoring day or event. When possible, duplicates will be collected from sites with expected higher densities of fecal coliform in order to determine variability of bacterial density.
- Calculation of the percent relative standard deviations (%RSD) of the pooled log transformed fecal coliform results will be made. Results pooled by magnitude will be evaluated allowing the higher percentage %RSDs of low values to be taken into account. If %RSDs do not meet the quality objectives, staff will assess as to whether there are any problems

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with the laboratory methodology which may warrant corrective actions. If lab procedures are not the issue, field staff will collect more duplicates randomly and re-calculate the %RSD.

- Maintain documentation of ongoing field equipment maintenance and operation.

The total precision for field duplicate measurements should not exceed 10% RSD for results at or above 10 times the reporting limit of 1 cfu per 100mg/L (cfu = colony forming units). Precision up to 50% of the RSD for any lower field replicate results, and for the E. coli duplicates, is acceptable. At levels close to the method detection limit %RSDs greater than 50% are to be expected and are acceptable. Duplicate samples that are “non-detects” shall not be used to measure precision. Also, investigative monitoring (ie. parcel specific) does not require replicates.

**Bias:** Bias is considered the consistent deviation of measured values from the true value, caused by systematic errors in a procedure. Bias within the project will be reduced to the extent practicable by the following:

- Strict adherence to the sampling procedures of the project work plan.
- Complete data collection and organization.
- Regular maintenance of field equipment.
- Periodic reviews and evaluations of field sampling procedures.
- Analyzing data in an appropriate manner based upon essential considerations, such as temporal variations.

Targets Developed:

**Comparability:** Precision, comparability, and reproducibility of station locations are achieved through Global Positioning System (GPS) mapping of the stream stations, and the identification and documentation of major landmarks and road crossings.

We expect to have very good comparability between the freshwater MF method datasets whether they are collected by TPCD or SWM. Samples processed using the MPN method will play an indicator role. While we do not expect MPN and MF method samples to be fully comparable, a previous study indicated that the two techniques provided results 87.1 percent in agreement. Results obtained by the MF and MPN methods from waters having large coliform counts are expected to have a greater percentage agreement than results obtained from waters having a low coliform count. (Presnell, Arcisz, & Kelly, 1954)

**Representativeness:** Representativeness of the analytical data is described as an adequate number of samples and monitoring events to determine water quality. In this situation, sampling needs to be representative of “wet” and “dry” seasons and will be planned and scheduled accordingly. Representativeness will be primarily achieved through the following:

- Strict adherence to the specific procedures of the work plan including the selection of correct sample locations and methods.
- Thorough documentation of applicable environmental factors (e.g., weather and tidal conditions, observable changes, etc.).

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- Entering all applicable environmental information into the water quality database and Excel spreadsheet for use in reporting data collected during the project.
- Limit sample sites to fresh water sites.

**Completeness:** Quality control checks will be conducted after each dataset is entered into the Excel spreadsheet and again after the results will be entered into the Access database. These data are evaluated for completeness and correctness. For example, data are verified to ensure replicates have been entered correctly, the correct value is attributed to the correct constituent, and the sample collection time matches the sampling identification name. The level of detail for performing data review and verification is relatively simple since only a few parameters are being analyzed or measured: fecal coliform, on occasion E. coli, temperature, pH, conductivity, and flow.

Completeness of valid data will be confirmed when 90% of the samples fall within two times the standard deviation of the data set. This may only occur for samples collected at trend monitoring sites. For this project, completeness is determined by the ability to use the collected data for flow and fecal coliform bacterial pollution identification and quantification purposes.

## **5. Sampling Process Design**

### Study Design:

**Sampling Location and Frequency:** Sampling locations are listed in Appendix D. They may also be found in the following Figures:

- Figure 1 – Map of Project Area
- Figure 4 – TPCHD Sample Sites – North
- Figure 5 – TPCHD Sample Sites – South
- Figure 6 – Pierce County WQI Sample Sites
- Figure 7 – Pierce County Shellfish Sample Sites
- Figure 10 – New Minter Creek Sampling Sites

Sampling locations were selected to optimize comparability to historical data by selecting locations that have been successfully used in the past. New sampling locations (see Figure 10) were selected based on access and the likelihood of the data from the site allowing us to better characterize the sources and locations of potential pollutants.

Locations will be sampled three times during each “wet” season (October 1-April 30) and once during each “dry” season (May 1-September 30) that occurs during the course of this project. We expect to sample during two dry seasons, one complete wet season, and one partial wet season over the course of the project.

**Parameters to be Determined:** The following parameters will form the basis for the study design.

***Fecal Coliform Bacteria (FC)***

Both laboratories will use Standard Methods as described in Methodologies for Analytical Procedures Following USEPA Approved Methods (APHA et al, 1992, USEPA 1983,1984). Each will use the membrane filter (MF) method to analyze for fecal coliform (Method 9222D) for the following reasons:

- Increases capacity of laboratories to analyze fecal bacteria samples.
- Gives a more accurate count of fecal colonies in freshwater than MPN method.
- Costs less per sample.
- It is more environmentally friendly, producing less laboratory waste.

The method detection limits for SM 9222D (MF method) will vary depending on the volume of sample filtered. In most cases, the minimum detection limit is reported as 1 cfu/100ml. This works fine for source identification and correction work since our action level is >200 cfu/100ml for TPCHD and >500 cfu/100ml. for SWM. If a sample exceeds the action level, the sampling agency will respond with pollutant source investigation and follow up sampling. Follow up sampling will occur within one week of receiving notice of an action level sample. If follow up sampling continues to indicate the presence of a chronic pollutant, additional sampling may be performed to isolate potential sources along with a windshield survey of land uses in the source area. If the follow up sampling and field survey indicate that the potential source is human in nature, TPCHD will investigate and pursue compliance. If the potential source is non-human, SWM Illicit Discharge Detection and Elimination (IDDE) staff will investigate and pursue compliance.

In the event that a water quality sample is determined to contain too much sediment to accurately process using the MF method, the laboratories will contact either SWM or TPCHD depending upon which agency's staff provided the sample and use the multiple-tube fermentation technique, also called the Most Probable Number (MPN) method (Procedure 9221-E - APHA, et. al, 1998) of fecal coliform analysis for surface water samples. For methods 9221C or 9221E(MPN) the limit of detection is <2 cfu per 100mls. Samples are generally reported out to >16,000 cfu/100ml. This method of fecal coliform analysis uses dilutions of the water sample to obtain statistically valid MPN estimates of fecal coliform densities, through gas production in the incubated samples. FC concentrations in stormwater are typically ten-fold higher than streams and surface flows. Therefore, stormwater storm event samples will be analyzed at a 1:10 dilution. Excess turbidity in samples taken from the study area are most likely to occur in samples collected during storm events or low flow events.

**Field Measurements:** Field measurements will be collected using the following instruments: Marsh-McBirney, Inc. Flo-Mate Model 2000 Portable Flowmeter, Swiffer 2100 Current Velocity Meter, YSI Multimeter 600R, Oakton meter, and/or PCTestr35. Field notes will include which method was used for flow data collection and (if used) which instrument.

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Reporting limits for field measured parameters using the previously listed instruments at upland and evaluation sites are as follows:

Flow: Range: -0.1 to +25 feet per second.

Resolution: to hundredths of a foot.

Accuracy: To within  $\pm 2\%$ . However, based upon past field checks at USGS gauging stations, the error range will more likely be plus or minus 10%.

Water Temperature: Range: 0 to 50 degrees C.

Resolution: 0.1 degrees C.,

Accuracy:  $\pm 0.5$  degrees C.

pH: Range: 0.0 to 14.0,

Resolution: 0.1,

Accuracy:  $\pm 0.1$

Conductivity: Range: 0 to 1999  $\mu\text{S}$ ,

Resolution: 1  $\mu\text{S}$ ,

Accuracy:  $\pm 1\%$  full scale

If velocities are outside of accurate instrument data collection range, the bucket flow or visual estimation methods may be used. If so, field notes will state which method was used, justification for the chosen method, and a description of the measurement and/or estimation process.

Assumptions Underlying Design:

1. During investigative sampling, fecal coliform bacteria will be the only obligatory parameter.
2. Fecal bacteria counts can be used to indicate potential pollutant sources.
3. Flow measures are necessary to gage loading.
4. Flow, temperature, pH, and conductivity measures can be used to inform decisions about potential pollutant sources.

Relation to Objectives and Site Characteristics:

1. Freshwater/trend samples will be used to prioritize areas of interest and further investigation. Trend samples will be collected on a regular schedule at predetermined sites throughout the study period as opposed to samples that will be collected opportunistically to identify potential pollution sources.
2. Investigative samples will be taken in close proximity to suspected sources.
3. Sampling will be used to characterize specific effluent sources, first by monitoring fecal coliform bacteria levels and then through dye testing.

Characteristics of Existing Data: For some portions of the study area, the amount of data available is extremely robust. In other areas, data is more limited. However, in all areas, the existing fecal coliform bacteria data seems to be fickle and difficult to characterize. There does not appear to be any reliable and consistent predictors of either low or high bacteria results. Exceedances can be dramatic in one sample and not present at all in another taken under seemingly identical conditions.

Pre-existing data may be compared to data collected as part of this project. Acceptance criteria for use of that pre-existing data will include:

- Location – samples were taken from sites within the project area
- Parameter – Data must be for fecal coliform bacteria collected using the same collection and processing methodologies and standards as those defined in this QAPP.

## **6. Sampling Procedures**

Procedures that will be used by both TPCHD and SWM are included in this section. A greater level of detail on SWM's existing sample collection (and non-bacterial parameter collection methods) and follow up procedures and policies may be found in Appendix A - Pierce County Public Works and Utilities Department, Surface Water Management Division, Water Quality and Watersheds Section Policy for Water Quality Index Monitoring and in Appendix B - Public Works and Utilities, Surface Water Management Division, Water Quality IDDE Response Policy. In addition, TPCHD developed a QAPP for EPA in 2010 and that document is attached in Appendix C.

### Field Measurement and Sampling SOPs:

The goal of the sampling is to collect representative samples, which includes avoiding contamination or sample site disruption. For sampling open surface water streams, sampling personnel will walk to a sample site wearing proper gear, including gloves and hip waders. If working within the right-of-way of a road, workers must wear an approved reflective vest or coat. Prior to entering the stream, the sampler determines if entry is deemed safe, enters just downstream of the sample site, wading in a manner to avoid disturbing the sediment and causing water turbidity. The multimeter sensor should be placed in the moving water. Samples should be collected from the deepest, swiftest moving portion of the stream in a safe and practical manner. The sampler faces upstream and collects samples upstream of his/her body. The sampler removes the cap from the sample bottle, tips the sample container downward vertically and plunges the container so that the mouth is approximately 5 inches below the surface, or in the middle of the water column. In the same motion, the sample container is turned upward so it begins filling with water. The container must remain below the surface until it is full. Field equipment will be calibrated in the field in accordance with the manufacturer's recommendations and recorded on the field record sheet.

One replicate sample per seven samples taken will be collected or at least one replicate per sampling event if less than seven samples collected.

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The following parameters will be measured in the field:

**Table 6 – Field Collected Parameters**

		SWM	TPCHD
Flow	Method	For instream sampling where the conditions allow, flows may be measured using a Flo-Mate 2000 Portable Flowmeter. For smaller discharges and end of pipe flow measures that cannot be accurately measured using the Swoffer flows will be estimated or measured by field staff who will use a bucket and stop watch.	For the instream sampling where conditions allow, flows will be measured using a Swoffer 2100 Current Velocity Meter. For smaller discharges and end of pipe flow measures that cannot be accurately measured using the Swoffer flows will be estimated or measured by field staff who will use a bucket and stop watch.
	Range	0.1 to 25 feet per second	0.1 to 25 feet per second
	Resolution	Hundredths of a foot	Hundredths of a foot
	Accuracy	Possibly to within 1%. However, based upon past field checks at USGS gauging stations, the error range will likely be plus or minus 10%.	Possibly to within 1%. However, based upon past field checks at USGS gauging stations, the error range will likely be plus or minus 10%.
Water temperature	Method	YSI Multimeter 600R	
	Range	0 to 50 degrees C°	0 to 50 degrees C°
	Resolution	0.1 degrees C°	0.1 degrees C°
	Accuracy	+/-0.5 degrees C°	+/-0.5 degrees C°
pH	Method	YSI Multimeter 600R	
	Range	0.0 to 14.0	0.0 to 14.0
	Resolution	0.1	0.1
	Accuracy	+/-0.1	+/-0.1
Conductivity	Method	YSI Multimeter 600R	
	Range	0 to 1999 microsiemens	0 to 1999 microsiemens
	Resolution	1 us	1 us
	Accuracy	+/- 1%	+/- 1%

**Measurement and Sample Collection:** During the site specific investigation, samples may be collected from any flowing discharge points, including: streams, stormwater outfalls, yard drains, bulkhead drains, other pipes, ditches, and seeps. Composite samples may be collected if there are multiple small discharges that appear to enter or leave from one parcel, one source, and/or are close together.

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Water samples for fecal coliform analysis will be collected in sterile 100 or 250 ml plastic bottles. Each bottle will be clearly labeled with the location name and/or identification number, collection time, and date.

A Flo-Mate 2000 or Swiffer 2100 flow meter will be used to measure stream flows. Discharge flows for stormwater outfalls, yard drains, bulkhead drains, other pipes, ditches, and seeps may be measured with a stopwatch and bucket or visually estimated or using a velocity meter. Information regarding the discharge will be recorded in water resistant field notebooks and will include location, drainage, outfall description (if a new site), inspector name(s), water temperature, pH and conductivity (if measured), discharge flow, whether or not the discharge flow was estimated or measured, and weather conditions. Bucket measures will be taken by using a 5 gallon bucket and using a stopwatch to measure how long it takes for the discharge to fill the bucket to capacity. Discharge flows will be reported in gallons per minute.

Water temperature, conductivity and pH will be measured with an Oakton meter, PCTestr 35, or YSI Multimeter 600R. Notes will also be made to record any unusual color and odors, warm temperatures, unusual vegetative growth, laundry lint, food waste, other characteristics that can indicate an intermittent sewage or laundry source, animal waste or tracks near the sampling location, or if the sample contained sediment.

Any sampling conducted during sanitary surveys or source investigation work will follow the same process as described previously for investigative sampling. These samples will be collected on an as-needed basis and won't follow a set schedule.

The freshwater/upland sampling will be conducted on a regular basis, with samples being collected on the same day DOH staff collect marine water samples. The upland samples will be collected using the same process as the shoreline evaluation sampling except that a Flo-Mate 2000 or Swiffer 2100 flow meter will be used to measure stream flows.

Containers, Preservation, Holding Times: Sample containers are pre-cleaned and sterilized by the manufacturer or by the laboratory. To ensure that the sample does not leak in transit, the containers have a watertight screw cap. Sample containers must be tested for sterility, auto fluorescence and measurement per sample to ensure accuracy of sampling and reporting.

Following collection of samples in the field, the samples will be kept in a cooler with cold packs and/or ice sufficient to maintain the sample(s) at less than 6°C and delivered directly to the lab. Generally, field staff will call the lab either the day before or at the start of the sampling day to let the lab know how many samples were collected and what analyses will be needed. This allows the lab to begin preparing the correct media for sample analysis. Sample analysis will begin no later than 24 hours after sample collection and in most cases will begin within six hours of sample collection.

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Equipment Decontamination: Staff will collect empty sample bottles from the laboratory prior to sampling. The sample bottles are sterilized by the laboratory and have a use expiration date.

Sample ID: Water samples for fecal coliform analysis will be collected in sterile 100 or 250 ml plastic bottles. Each bottle will be clearly labeled with the location name and/or identification number, collection time, and date.

Pierce County SWM sites were originally numbered in sample order. For example, FC1 means "Filucy Bay, sample site 1". However, SWM recently created a new database and each site was re-numbered to fit the database sample ID specifications. The old number is referenced in the name of the site but the new Sample ID system simply uses the prefix SF (to indicate Shellfish) and sequential numbering. New sites are given the next available number.

Chain-of-Custody: A Chain of Custody form will be completed by field staff for each sampling event. Included on the form is the identification name or number for each sample, the number of samples, the type of samples, the time and date, sampling staff, the requested analytical method(s), contact information, billing information, and any comments pertinent to the samples. The form is signed and dated, and the time noted, by a field staff person and also by laboratory staff. The laboratory staff person who signs the form first examines each sample to ensure that the chain of custody form correctly captures the necessary information for each sample. A copy of the form is provided to the field staff person who in turn brings it back to the office and gives it to the project lead. A copy of the chain of custody form for each lab is included in Appendix F.

Field Log Requirements: Information regarding the discharge will be recorded in water resistant field notebooks and will include location, drainage, outfall description (if a new site), inspector name(s), water temperature, pH and conductivity (if measured), discharge flow, whether or not the discharge flow was estimated or measured, calibration measurements, and weather conditions. Water temperature, conductivity and pH will be measured with a Oakton meter, PCTestr 35 or YSI Multimeter 600R. Discharge flow may be measured with a stopwatch and bucket or visually estimated. Notes will also be made to record any unusual odors, warm temperatures, unusual vegetative growth, laundry lint, food waste, other characteristics that can indicate an intermittent sewage or laundry source, animal waste or tracks near the sampling location, unusual color, or if the sample contained some sediment. An example of a field record sheet may be found in Appendix G.

Stormwater:

Contaminated stormwater is another potential source of FC contamination in the KGI Watershed. In this project, stormwater impact monitoring will be used as an additional tool to identify specific sources of bacterial pollution. Stormwater outfalls will be sampled for FC during rain events (0.25 inch of rain or more within a 24 hour period preceded by a 24 hour dry period). Outfalls will be selected based on level of flow and likelihood of identifying potential pollutant sources. Land uses or features that may be targeted for outfall sampling will include small lot agriculture, large lot residential, small lot residential, neighborhood scale commercial, and road runoff.

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Samples will be collected during a minimum of five such events during the study period. A rain gage will be used to verify that a qualifying storm event has occurred. SWM operates a rain gage at the Purdy Road Shop which is approximately 1 mile east of Burley Lagoon and data collected at this site will be used for this project.

SWM will also review/investigate dry weather screening data being collected by TPCHD, and by SWM as part of their Illicit Discharge Detection and Elimination (IDDE) program. This will occur under the auspices of Pierce County's Outfall Reconnaissance Inventory (ORI), which is SWM's dry weather outfall screening procedure. During the ORI, which is expected to occur during the summer of 2012, SWM will monitor flowing outfalls for flow, pH, temperature, and ammonia. Odor, color, turbidity, and floatables will be included among the physical indicators that will be documented.

Following the initial visual inspection and qualitative assessment, additional chemical indicators may be collected, including: pH, chlorine, specific conductivity, ammonia, surfactants, fecal coliform bacteria, fluoride, copper, fluorescence, phenols, potassium, detergents, dissolved oxygen, hardness, and iron. However, these parameters are not included in this QAPP because they are not necessary to meet the goals of the project. If SWM or TPCHD choose to collect these parameters, it will be to inform other program needs. Ecology is not expected to reimburse costs associated with these analyses or assure the quality of the sampling results for these parameters.

**Dye Testing:** In the event that TPCHD identifies a potential failing septic system, they will use the items and methods described in *Table 7 Dye Testing Equipment and Procedures* to perform dye testing procedures. Staff will place charcoal samplers in down gradient locations that are most likely to collect surface runoff from the potentially failing site. Staff may introduce dye by flushing it down toilets, through greywater discharges such as sinks, showers, or washing machines, or by adding it directly to an upland pipe with an unknown discharge point.

**Table 7 – Dye Testing Equipment and Procedures**

<b>Field Supplies/ Equipment</b>	<b>Description</b>	<b>Supplier/Vendor</b>	<b>Comments</b>
Dye tracers	Ready for use individual liquid dye mixtures in 170 ml bottles. Dye tracers used include Fluorescein, Rhodamine, and Eosine.  Used to dye test onsite sewage systems, and other outfalls to track sources of fecal pollution.	Ozark Underground Laboratories, Protem Missouri.	Bottles are stored in a designated cabinet separate from other dye test supplies to prevent contamination.
Charcoal samplers	Used during dye tests to “catch” dye. The charcoal used for the samplers are packets of fiberglass screening partially filled with approximately 4.25 grams of activated coconut charcoal.	Charcoal purchased from VWR Scientific, mesh screen purchased from local hardware store.	
Plastic bags	Used for storage of individual control and dye samplers retrieved from site, prior to shipment to the laboratory for analysis.	Purchased from local stores.	

#### Post-Project Monitoring

TPCHD and SWM will conduct post-project monitoring of identified FC sources following correction, where possible, as necessary to determine if the corrections are effectively reducing FC loading, and as resources allow. Where possible, water quality data is compared before and after correction, to determine if BMP installation projects have been successful. This element will be challenging, due to the length of time some corrections may take. Also, the project timeline will only include one winter season in the data collection. Both SWM and TPCHD perform trend monitoring at a minimum of 12 locations with the project area. This monitoring will continue after formal project completion and may be used to estimate project effectiveness beyond the project period.

#### **7. Measurement Methods**

The water samples will be analyzed for fecal coliform, and in some cases, E. coli enumeration by the contract laboratories. The samples will be run for fecal coliform enumeration using the membrane filter method (MF), SM 9222D. However, if the water

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quality sample contains high levels of sediment, the lab will use the multiple tube method (MPN) SM 9221 C or E since high sediment levels can foul the membrane filters. If it is suspected that the bacteria may not be from the intestinal tracts of warm blooded mammals, as may be the case in areas with large, highly visible shorebird populations, the laboratory may also run the samples for E. coli enumeration using EPA 1103.1 (which is the same method as SM 9213D). The laboratory generally will run multiple dilutions, given that there is such a wide range in fecal coliform counts in surface waters. Details of these procedures may be found in Table 8 “Analyte and Method Detection Limits”. Samples will be collected using 250ml plastic autoclaved bottles and maintained at <6°C.

**Table 8  
Analyte and Method Detection Limits**

<b>Analyte</b>	<b>Sample Matrix</b>	<b>Detection Limits</b>	<b>Range of Sample Values</b>	<b>Estimated Number of samples</b>	<b>Schedule of Delivery of Processed Lab Results</b>	<b>Analytical Method</b>
Fecal Coliform Bacteria (FC)	Freshwater	<1 cfu/100 ml	<1 to ≥1600 (without dilution)	50	3 to 7 days after collection	Membrane filter (MF) method (SM 9222D) or APHA
Fecal Coliform Bacteria (FC)	Freshwater	<2 cfu/100 ml	<2 to ≥16,000	10	3 to 7 days after collection	Procedure 9221-E, MPN Fecal Coliform Direct Test (A-1 Medium)
E. Coli Bacteria (EC)	Freshwater	<1 cfu/100 ml	<1 to ≥16,000	10	3 to 7 days after collection	Membrane filter (MF) method only (SM9213D)

Sample analysis will begin no later than 24 hours after sample collection and in most cases will begin within six hours of sample collection. Sample results are typically returned within 3 days but may take up to a week.

**Sample Preparation Method:** Sample containers are pre-cleaned and sterilized by the manufacturer or by the laboratory. To ensure that the sample does not leak in transit, the containers have a watertight screw cap. Sample containers must be tested for sterility, auto fluorescence and measurement per sample to ensure accuracy of sampling and reporting.

Following collection of samples in the field, the samples will be kept in a cooler with cold packs and/or ice sufficient to maintain the sample(s) at less than 10°C and delivered directly to the lab. Generally, field staff will call the lab either at the start of the sampling day or immediately upon completion of sample collection to let the lab know how many samples were collected and what analyses are needed. This allows the

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lab to begin preparing the correct media for sample analysis. Sample analysis will begin no later than 24 hours after sample collection and in most cases will begin within six hours of sample collection.

Field Procedures: Stream samples will be collected using the following techniques: the collection point is approached from a downstream direction with care being taken not to disturb the bottom sediments; samples will be collected while facing upstream (against the flow) at approximately 15 to 30 cm below the water surface, or at half the depth of the water column (when the depth of the stream is less than twelve inches). To address the fact that bacteria may be concentrated in the surface micro layer, sample bottles will be filled using the “U” scoop motion. This motion ensures that the sample will not be biased with micro layer bacteria.

All meters used in the field will be calibrated on the day of use. They will be calibrated once before field measures are taken and again at the end of the day after field measurements have been completed using manufacturer recommended procedures.

Lab Accredited for Method: TPCHD and SWM both contract with laboratories accredited by Ecology:

**TPCHD:** Water Management Laboratories, Inc., 1515 80th St E Tacoma WA 98404-3315 (253) 531-3121

**SWM:** Spectra Analytical, Inc. 2221 Ross Way Tacoma WA 98421 (253) 272-4850

## **8. Quality Control**

The sampling and analytical quality control checks will utilize the following procedures:

Field Staff Practices:

Field staff follow established SOPs for calibration using manufacturers specifications. Data and time of calibrations are recorded on a field sheet. All instream measurements are collected by field staff using established SOPs for sample collection. Date, time, site location, and measurements are recorded on a field sheet by field staff.

Standard Laboratory Practices:

**Receipt of sample:** Sample(s) must arrive at the laboratory within the Standard Method allocated holding time, which for fecal coliform and E. coli is 24 hours. Laboratory staff will note the condition of the sample and check that the chain of custody form information is identical to the information on the labels on the bottles. If everything is in order, the chain of custody form is signed, a copy given to the field staff, and the samples are entered into the laboratory system. If there are any aberrations the sample will be denied and corrective action will be taken in the form of requesting to correct the paperwork.

**Laboratory Storage of Samples Prior to Analysis:** Sample testing will be initiated as soon as possible. Once samples are logged in, they will be hand carried to the laboratory for analysis. Sample analysis will always begin the same day the sample is collected, within 24 hours of receiving the sample.

**Requirements for media, water and reagents:** Reagent water is laboratory ultra deionized water and is monitored as required by EPA. In addition to the suitability tests, the laboratory analyzes the water for heavy metals. The conductivity, total residual chlorine and sterility through heterotrophic plate count must be monitored monthly. Commercially packaged media must be dated at receipt, the lot number recorded and the expiration date noted. Laboratory prepared media is dated upon initially being opened. Sterility, pH, and inhibition tests must be run per lot number and recorded in the media and QC logbooks.

**Process Quality Control:** All aspects of the laboratory analytical process are monitored by a scheduled system of quality control checks. Glassware, material, and equipment used for analysis all have a specific level of quality to be met and monitored.

Corrective Action:

Results from samples that were collected or processed using methods not believed to be consistent with those described or referenced in this QAPP will be thrown out. TPCHD or SWM may also require additional staff training if appropriate.

## **9. Data Management Procedures**

Proper data management is essential for the successful completion of this project and for all water quality assessment activities. This project will include the collection of data and/or information by activity as detailed in Table 9 “Data Management by Activity”.

**Table 9 - Data Management by Activity**

Activity	Type of Data or Information	Method of data collection/storage
Source Investigation	Water sampling results for fecal coliform and/or E. coli, temperature, pH, conductivity, and flow	Field book, paper files, Excel spreadsheet, Access database, GIS layer
Upland Sampling (done in conjunction with DOH's marine water sampling)	Water sampling results for fecal coliform, temperature, pH, conductivity, and flow	Field book, paper files, Excel spreadsheet, Access database, GIS layer
Sanitary Surveys	Sanitary Survey form	Paper files, Envision database
Stormwater (WQI)	Water sampling results for fecal coliform, temperature, pH, conductivity, and flow	Field book, paper files, Excel spreadsheet, Access database, GIS layer
Outfall Reconnaissance Inventory (ORI)	Water sampling results for fecal coliform, temperature, pH, conductivity, and flow	Field book, paper files, Excel spreadsheet, Access database, GIS layer

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All data collected through the project will be stored in paper files at SWM and electronically, in an Excel spreadsheet, and in the Surface Water Quality Access database.

The temperature, pH, conductivity, and flow measurement results are initially entered into the field book. The field books, when not in use or when full, are kept at TPCHD and SWM depending upon whose staff collected the sample. TPCHD will share copies of project relevant field notes with SWM and these copies will be included with SWM's paper project files. These results for the Shoreline Evaluations and Upland sampling will first be reviewed by the Project Lead and then entered into the Surface Water Quality Access database and [/or](#) Pierce County's NPDES file.

The fecal coliform results and E. coli results are first faxed or e-mailed by the laboratories to the Project Lead and are considered initial results. The Project Lead keeps these faxes and/or e-mails, along with the chain of custody copy that was provided by lab staff to field staff when the samples were delivered to the lab. The Project Lead then receives in the mail a paper copy of the final results from the lab along with all QC results associated with the data. The Project Lead compares the initial results to the final results, the chain of custody sheet that is attached with the final results to the copy originally provided, and reviews the final results to the attached chain of custody. Only after this review are the results entered into Pierce County's SWMWare database. The paper copy of the results will be stored in a file cabinet that resides with the Water Quality Section of the Surface Water Management division of Pierce County Public Works and Utilities Department.

Data will be reviewed prior to entry into an electronic format to ensure that all required data fields have been included, parameters monitored are characteristic of expected results, and laboratory analytical results are characteristic of expected results. When project staff determines the dataset is incomplete or includes uncharacteristic results, the Project Lead or Project Manager will be consulted for a decision regarding the validity of the data. Data may only be excluded with the approval of the Project Lead or Project Manager.

Once it is determined that the data are acceptable, staff perform data entry. All data input will have a 100% review after input is complete to assure no transcription errors have occurred. The Excel spreadsheets and SWMWare database are backed-up on a daily basis to minimize the risk of data loss caused by electrical or computer malfunctions.

Computerized information systems are maintained by SWM's Information Technology Program and technical assistance is also provided by key individuals in SWM.

Pre-existing data may be compared to data collected as part of this project. Acceptance criteria for use of that pre-existing data will include:

- Location – samples were taken from sites within the project area
- Parameter – Data must be for fecal coliform bacteria collected using the same collection and processing methodologies and standards as those defined in this QAPP.

EIM Data Upload Procedures: EIM data upload procedures will include two primary phases. First, SWM staff will be identified and trained in EIM upload procedures and initial data points (approximately 1,000) will be entered into the system in July and August of 2012. As additional data points are added and additional data collected, SWM will update the database with all project related updates completed by November 2013.

## **10. Audits and Reports**

It will be the responsibility of the Project Lead, together with the Project Manager, to regularly assess that objectives and tasks of the project are being implemented according to this QAPP and grant agreement (G1100202). In addition to the Project Lead, there are four field staff who are responsible for sample collection and performing field measurements. There are additional project staff but these individuals will not be involved in the sampling tasks of the project.

Project staff will meet on a quarterly basis to ensure project activities are being conducted according to the QAPP timeline. These meetings will afford an opportunity to identify potential problems and allow for corrective actions, particularly at the first quarterly meeting after the QAPP is approved by Ecology.

The Project Lead will prepare and submit quarterly performance reports to Ecology. The performance reports will include brief information on each of the following areas: a comparison of actual accomplishments to the output/outcomes established in the assistance agreement work plan for the period; the reasons for slippages if established outputs/outcomes were not met; and, additional pertinent information including, when appropriate, analysis and information of cost overruns or high unit costs.

The Project Lead will meet with the Project Manager monthly to review billing information for the project to ensure that time and activity is commensurate with the budget targets.

Number, Frequency, Type, and Schedule of Audits: An audit of the technical systems will occur in the third quarter of 2012 as the first round of samples is collected and processed for this project. The audit will include the Project Manager, the Project Lead, and representatives from TPCHD. The audit will include: a review of consistency with this QAPP and comparability of results. Additional audits of technical systems may be scheduled if there appears to be problematic and/or inconsistent practices and/or results.

Responsible Personnel: Barbara Ann Smolko, the project manager, will be responsible for compiling all audits and reports.

Frequency of Distribution of Reports: Reports will be distributed quarterly, coincidental with the quarterly progress reports required by Ecology for the Centennial Clean Water Fund grant program, starting with the report due on July 15, 2012. Also, a Final Report,

including all project related sampling results and analyses, will be distributed to Ecology in December 2013.

Responsibility for Reports: The Final Report will be peer reviewed by water quality monitoring and laboratory staff associated with SWM and TPCHD. Finally, Ecology staff familiar with water quality QA/QC procedures are expected to review the Final Report.

## **11. Data Verification**

The Project Lead will assess and report on the fecal coliform counts and, if collected, E. coli counts following the completion of corrective actions taken in the project area. This will be done to demonstrate measureable improvements in water quality. Marine water bacteria results collected by the Washington State Department of Health will also be reviewed and provided if these results indicate a change in water quality following the completion of corrective source control actions.

The Project Lead will submit the final performance report to Ecology within 30 calendar days following the end of the project period (11/30/2013). The final performance report will contain the same information as the periodic reports but will cover the entire project period. The report will include:

- A summary of shoreline evaluation sample results, sanitary survey sample/source control sample results, upland sampling results, and septic effluent sampling results;
- Results from the sanitary surveys, including the number of sites surveyed, a summary of the findings, and follow up survey results;
- Number of failing septic systems identified and corrected;
- Number of septic repair low interest loans and/or grants processed to assist with the repair and/or replacement of the failing septic systems; and,
- Number of animal waste problems noted and the number of problems corrected.

Verification and Validation Methods: Data verification involves examining all data for errors or omissions. Quality control checks will be conducted after each data set is entered into the Excel spreadsheet and again after the results will be entered into the Access database. These data are evaluated for completeness and correctness. For example, data are verified to ensure replicates have been entered correctly, the correct value is attributed to the correct constituent, and the sample collection time matches the sampling identification name. The level of detail for performing data review and verification is relatively simple since only a few parameters are being analyzed or measured: fecal coliform, on occasion E. coli, temperature, pH, conductivity, flow, and, for the nutrient sampling, ammonia, nitrate, Kjeldahl nitrogen, and total phosphorus.

Data validation does not differ from verification for the project due to the low level of complexity of data being generated. Data are collected as described in the Data Generation and Acquisition section.

## **12. Data Quality Assessment**

The goals of this project are to restore and protect water quality of both fresh and marine water in the shellfish watersheds of Pierce County by identifying and correcting sources of fecal pollution.

Data collected from shoreline evaluations, sanitary survey sampling/source identification sampling, and upstream sampling will be analyzed for fecal coliform and, in some situations, E. coli. Field measurements will be made for temperature, pH, conductivity, and flow. These data will be reviewed, verified and reconciled to meet the goals of the project.

Water quality data are reviewed according to procedures stated in the previous Data Management section. Field measurements are reviewed by field staff and then again by the Project Lead when the results are entered into the Access database.

The laboratory faxes or e-mails the initial fecal coliform and/or E. coli results to the Project Lead and then mails a paper copy of the final results with the chain of custody form attached. The Project Lead reviews the final results to the faxed results and compares the chain of custody form attached with the final results to the chain of custody copy that was provided by laboratory staff to the field staff at the time the samples were delivered to the laboratory. The results are only entered into the Excel spreadsheet and Access database after the data review process.

Reconciliation with User Requirements: The data collected for the project will be descriptive in nature and does not include a statistically based design. The data will be presented in tables and charts, and will show the changes in water quality with the project area for the duration of the project.

Data Analysis and Presentation Methods: The fecal coliform data will be analyzed to determine geometric mean values for each location and arithmetic means will be determined for the field parameters. Three to five sets of samples will be used to calculate the geometric mean. These data will be compared with Department of Health shellfish growing standards for fecal coliform bacteria and with the Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC. The assessment data will be compared, using the before and after (correction to failing OSS, etc.) geometric mean values, to assess the relative water quality benefit of the correction.

The data will be organized into a summary table then made available to the public when the Final Report is published and posted on-line. Additionally, the information may be included in Pierce County's Water Quality Index Report which is published annually and significant information may be

Treatment of Non-Detects: Non-detects will need to occur in 3-5 samples before this treatment will be implemented. A standard value of 4 cfu/100ml will be assigned to all samples that result in fewer than 10 cfu/100ml. These results will not affect action levels but will affect the geometric mean calculations.

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Sampling Design Evaluation: The effectiveness of prevention activities will be evaluated primarily by surveying property owners receiving outreach through surveys or workshops. We will assess homeowner knowledge, beliefs, and behaviors concerning household actions using a survey tool very similar to one used previously by TPCHD as part of a Puget Sound Partnership EcoNet education and outreach grant in 2010.

Process for Determining Whether Project Objectives Have Been Met: This will occur during a final project team review prior to drafting the Final Report that will be submitted to Ecology.

Documentation of Assessment: Documentation will be completed by the Project Manager in the Final Report which will be submitted to Ecology at project completion.

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## **APPENDICES**

- A. PIERCE COUNTY PUBLIC WORKS AND UTILITIES DEPARTMENT, SURFACE WATER MANAGEMENT DIVISION, WATER QUALITY AND WATERSHEDS SECTION, POLICY FOR WATER QUALITY INDEX MONITORING
- B. PUBLIC WORKS AND UTILITIES, SURFACE WATER MANAGEMENT DIVISION, WATER QUALITY INDEX RESPONSE POLICY
- C. TPCHD SHELLFISH QAPP FOR EPA, 2010
- D. SAMPLE SITES
- E. RESULTS FROM PREVIOUS SAMPLING EFFORTS
- F. CHAIN OF CUSTODY FORMS
- G. FIELD DATA SHEET

## **FIGURES**

- 1. MAP OF PROJECT AREAS (Imbedded in Document)
- 2. KGI WATERSHED BOUNDARY
- 3. DOH MARINE SAMPLE SITES
- 4. TPCHD SAMPLE SITES - NORTH
- 5. TPCHD SAMPLE SITES - SOUTH
- 6. PIERCE COUNTY WQI SAMPLE SITES
- 7. PIERCE COUNTY SHELLFISH SAMPLE SITES
- 8. KITSAP COUNTY SAMPLE SITES
- 9. TPCHD SWIMMING BEACH SITES
- 10. NEW MINTER CREEK SAMPLING SITES