Shellfish Restoration & Protection Project: Kitsap Public Health District

EPA Grant #POJ09501-2

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KITSAP PUBLIC HEALTH DISTRICT

Clean Water Kitsap
Partners in Stormwater Solutions

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EXECUTIVE SUMMARY

In 2010 Kitsap Public Health District received a grant from the US Environmental Protection Agency to conduct the Shellfish Restoration and Protection Project. Clean Water Kitsap[1] provided matching funds for this grant. The purpose for the project was to restore and protect shellfish growing areas throughout Kitsap County by conducting a comprehensive shoreline survey. It was also to demonstrate our proven, on-the-ground approach, to investigate and correct sources of fecal pollution. The goals for this project were to:

- Achieve an increase in harvestable shellfish growing areas
- Obtain sustainable funding to establish a routine shoreline monitoring program
- Achieve measureable improvements in water quality in at least 50% of targeted fresh and marine waters
- Increase education and awareness of water quality and shellfish protection
- Achieve sustained participation in a local community shellfish farm

Kitsap Public Health successfully completed the project by meeting the goals and objectives set forth in the grant contract and work plan. Shoreline surveys were conducted in all project areas and expanded on Bainbridge Island to include more shoreline areas on the Island than initially proposed (Figure 1.)

An increase in harvestable shellfish growing areas was achieved. This occurred in Fragaria, Prospect Point, and Wilson creek drainages along Colvos Passage (located in southeastern Kitsap County) with an upgrade of 30.1 acres. There was also a small upgrade of 1.2 acres in the Holly area on Hood Canal. The Washington State Department of Health (DOH) is in the process of conducting monitoring in the currently prohibited area of Miller Bay, in response to a shellfish harvest application that was received during this project. This could result in an upgrade of 270 acres. Kitsap Public Health's shoreline survey information and the results from this project will be used by DOH to support this upgrade.

As a result of the successful completion of this project, Kitsap Public Health received sustainable funding from Clean Water Kitsap to establish an ongoing shoreline monitoring program. All classified shoreline growing areas in Kitsap County will be surveyed on a 4 year rotational basis, thereby enabling Kitsap Public Health to proactively address fecal water pollution sources on a more targeted and frequent basis. This shoreline monitoring program

[1] Stormwater management fees from unincorporated Kitsap County fund a unique multiagency program managed by Kitsap County Public Works and programs implemented by Public Works Stormwater Division, Kitsap Public Health District, Kitsap Conservation District and Washington State University Extension Kitsap.

will be conducted in accordance with the shoreline monitoring plan approved by the Washington State Department of Ecology. (KPHD Shoreline Monitoring Plan 2013).

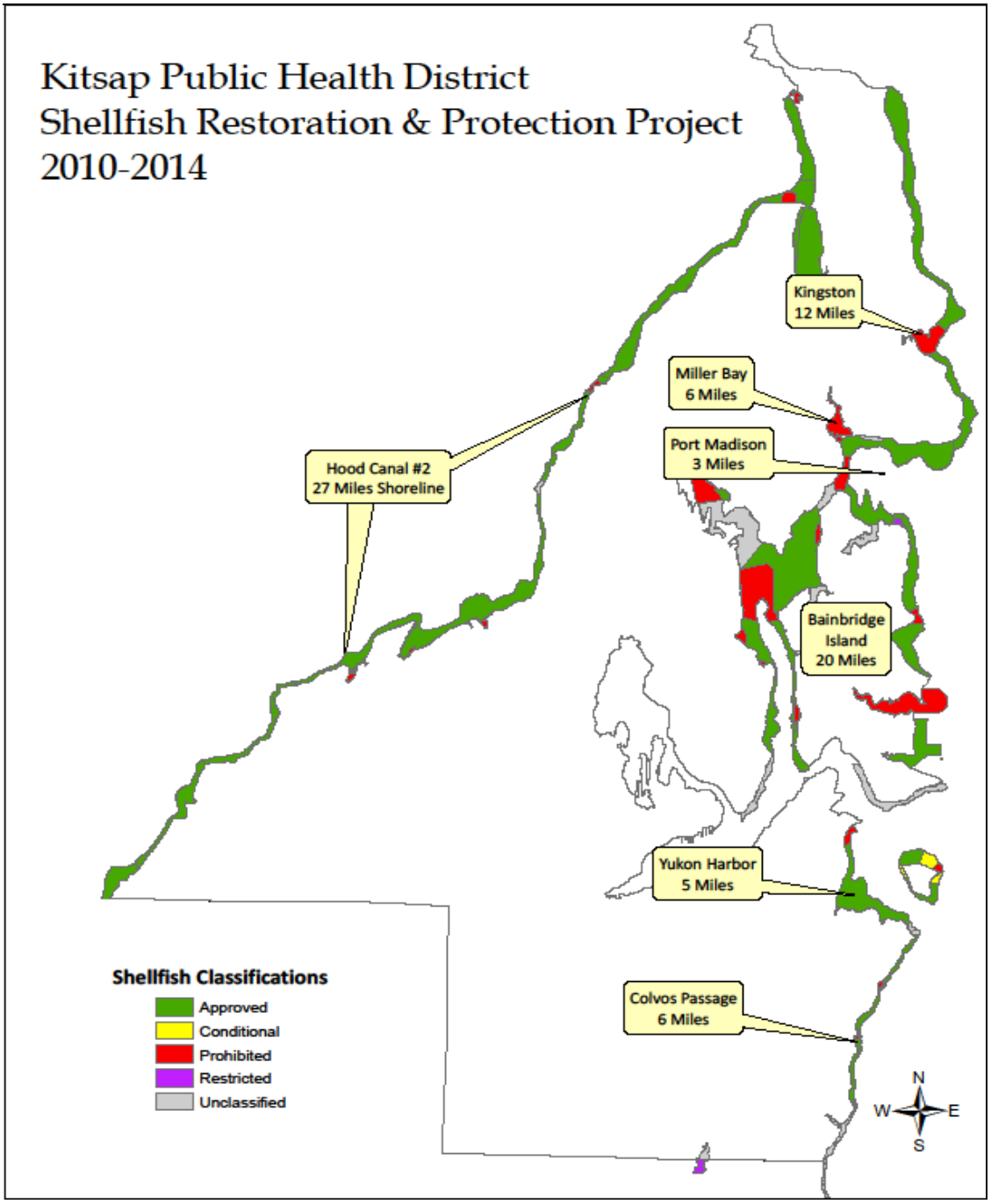
This ongoing shoreline monitoring program will also enhance coordination with the DOH. Kitsap Public Health will continue to notify DOH of potential fecal pollution sources to marine waters and subsequent identification and correction of these sources. We will also continue to provide additional information to DOH to assist with the agency's shellfish growing area reports.

Kitsap Public Health completed 558 property inspections during this project (which exceeded our target of 115 inspections). There were 126 shoreline hot spots identified and investigated, with 56 onsite septic system failures identified. These septic system failures have either been corrected or are in the process of being corrected.

Kitsap Public Health has been conducting pollution identification and correction (PIC) projects since 1996. On average there has been an onsite septic system failure rate of 7% (found during property inspections, public complaints and shoreline investigations). Since this project focused on tracking sources from shoreline "hot spots" the onsite septic system failure rate was higher at 10%. This demonstrated the effectiveness of using a more targeted approach.

We also worked with the Puget Sound Restoration Fund (PSRF) to provide education and outreach related to increasing participation in the Port Madison Community Shellfish Farm. PSRF exceeded their goal for participation in the farm from 13 families in 2010 to 59 families in 2013. Educational materials and information was provided throughout the community raising the level of awareness regarding the importance of water quality and shellfish protection.

Figure 1. Project areas



SUMMARY OF OUTPUTS

The following tasks were accomplished during the Shellfish Restoration and Protection Project. They are presented according to the objectives described in both the grant agreement and work plan and in response to the format requested by EPA.

TASK ACCOMPLISHMENTS

Objective #1 : *To implement a targeted program to clean up "Prohibited" and "Closed" shellfish growing areas, and protect "Approved" growing areas with a routine shoreline monitoring program that locates FC "hot spots" and tracks the source(s).*

Kitsap Public Health met this objective by completing the following tasks:

Shoreline monitoring surveys were performed according to an Approved Quality Assurance Project Plan. Water pollution source identification and correction was completed according to our approved Pollution Identification and Correction Protocol Manual.

Shoreline monitoring was completed in the "Approved" and "Prohibited" shellfish growing areas listed in the grant application and shown in Table 1. Shoreline miles on Bainbridge Island were expanded compared to the original estimates to ensure all Approved shoreline growing areas were assessed. Source identification on Bainbridge Island was also expanded to include follow up work in Agate Pass and Crystal Springs, with approval from our grant officer. Table 1 presents a summary of the areas included in the shoreline monitoring surveys completed during this project.

Property information was gathered using GIS and Kitsap Public Health records to conduct source investigations and complete targeted property inspections in areas impacting shellfish growing areas.

There were **126** confirmed "hot spots" identified during the project, and all have been investigated. **109** hot spot investigations have been concluded. All sampling data collected during four shoreline surveys were submitted to EPA's STORET system. These data were also entered into the PIC water quality database and used for tracking and reporting purposes.

When hot spot sources were identified and corrected, such as failing onsite septic systems, faulty stormwater systems, or changes in behavior regarding removal of pet waste, or when wildlife was determined to be the source the hot spot investigation was concluded. Some hot spots related to failing septic systems will be concluded when the new systems are installed. All identified failing septic systems were placed under enforcement during this project. Table 2 presents a summary of these hot spots.

Table 1. Shoreline survey segments completed 2012-2014

Growing Area	Growing area designation	Description	Approximate Mileage	Dates completed
Bainbridge Island (Port Madison, Port Blakely)	Approved	All Bainbridge shoreline excluding Pt. Monroe, Eagle Harbor & Rich Passage. Segments along Agate Pass and Crystal Springs were added in 2013	22	2012-2014
Blake Island	Approved/Prohibited	Perimeter of island	3	2012 summer only
Colvos Passage	Prohibited	Wilson Creek	0.6	2011-2012
Colvos Passage	Prohibited	Fragaria	1.0	2011-2012
Colvos Passage	Prohibited	Prospect Point	1.0	2011-2012
Colvos Passage	Approved	From Kitsap county line to Manchester	7	2011-2012
Hood Canal 2,4 & 5	Approved (including prohibited areas at Seabeck marina, Big Beef creek, Ioka and Bangor)	Kitsap/Mason County line north to and including Bangor submarine base	27	2012-2013
Kingston	Approved	Marina north to Point No Point and marina south to Pt Jefferson	14	2012-2013
Miller Bay	Prohibited	Entire bay	6	2011-2012
Port Madison	Approved	Kitsap County (Indianola & Suquamish)	3	2011-2013
Yukon Harbor	Approved	Entire harbor	5	2012-2013

Table 2. Shoreline "hot spots"[2]

Growing area	Hot spots identified and investigated	Hot spot investigations concluded	Results/comments of hot spot investigations
Bainbridge Island (entire shoreline (excluded segments; Eagle Harbor, Pt Monroe and Rich Passage)	49	42	**21** OSS failures (corrected or under enforcement for correction) **4** sites were in Pt White area of Rich Passage;(most properties on sewer) **17** no human sources found, sources likely due to wildlife (and/or in a few cases flows stopped). **7** sites were lower priority and not investigated.
Colvos Passage	16	15	**8** OSS failures (all corrected) **2** sources due to wildlife **5** investigated and found that flows either stopped, or subsequent resampling was low **1** OSS is suspect and under investigation
Hood Canal 2, 4 & 5	20	20	**8** OSS failures (corrected or under enforcement) **1** storm water system replaced **1** source due to wildlife feeding, when the practice stopped follow up samples were below threshold **10** investigated no human sources found (5 of these all included dye tracing with negative results)
Kingston	4	4	**3** OSS failures (all corrected) **1** was due to wildlife
Miller Bay	6	5	**2** OSS failures (both corrected) **1** source found to be directly due to pet waste, owners started to dispose of pet waste correctly, follow up water samples were below bacteria threshold. **1** site stopped flowing & **1** property was vacated **1** property is still under investigation
Port Madison; Indianola Suquamish	7	6	All hot spots were investigated, no human sources found and/or flows stopped. 1 site remains under investigation pending dye trace results.
Yukon Harbor	24	17	**11** OSS failures (all corrected) **3** sources were attributed to wildlife **3** properties were vacated **7** unresolved; will be re-surveyed in 2015 as part of shoreline monitoring program
Total	**126**	**109**	

[2] When Geometric mean of three water samples > 160 E.coli/100 ml the sample is classified as a "hot spot"

There were four shoreline surveys conducted during this project. Two of these were conducted during wet- weather months (between October-April), and two were completed in dry- weather months (May-Sept) in each of the shoreline sections shown in Table 1. All shoreline monitoring was completed during the timeline identified in the work plan, e.g. 2010-2014.

There were 558 property inspections completed for the project. The tasks associated with objective #1 included the compilation of property information utilizing GIS and Kitsap Public Health records to assess onsite septic systems. Property inspections also included a review of land practices specific to the site, e.g. management of livestock waste, pet waste, stormwater drainage patterns, and inspection of onsite sewage systems.

Table 3 presents findings from these property inspections. The total number of completed inspections by area, along with associated onsite septic system ratings are shown in the table.

Of 558 properties inspected, 361 OSS were functioning to design standards and received a rating of No Apparent Problem. 141 OSS were rated as either Suspect, Concern or No Records. 56 systems were found failing (~10% failure rate). Of all failing systems, 91% (51), have either been repaired or are in the process of being repaired.

The failure rates of onsite septic systems were higher in more developed residential areas, e.g. Bainbridge Island (20%) compared to the Hood Canal area which is more rural (8%). An exception was noted along the Kingston shoreline which is more rural than Bainbridge Island and similar to Hood Canal. Along the Kingston shoreline, five onsite septic system failures were found to be associated with shoreline hot spots. The failure rate here was higher than normal at 41%, however this may be due to the fact that only twelve properties were inspected. In other shoreline areas, there were more hot spots found and more properties inspected. Many of the systems found to be failing were 25-year or older systems.

Table 3. OSS Ratings for Completed Property Inspections

Growing area	Total Inspections	# of Failures	OSS failure rate	Suspect	No Apparent Problems	Concern	No Records	Denied Access
Colvos Passage:								
Fragaria	25	1		1	20	1	3	0
Prospect Pt	20	2		0	17	0	1	0
Wilson Creek	5	1		0	4	0	0	0
Shoreline	27	4		0	13	5	5	0
Area subtotal	77	8	10%					
Yukon Harbor	91	11	12%	11	45	2	22	5
Miller Bay Shoreline	47	2	2%	3	31	1	10	2
Miller Bay Estates (upland)	70	0		0	67	1	2	3
Port Madison; Grover's Creek	61	1	1.5%	2	41	6	11	3
Bainbridge Island (excluding; Eagle Harbor, Pt Munroe and Rich Passage)	107	21	20%	3	61	6	16	1
Hood Canal 2,4 & 5	93	8	9%	5	56	7	17	0
Kingston	12	5	36%	0	6	1	0	1
Grand Totals	**558**	**56**	**10%**	**25**	**361**	**29**	**87**	**15**

The following definitions for onsite septic system ratings include:

SUSPECT. When one or more of the following conditions apply: drain field is saturated; water sample results from bulkhead drains, curtain drains or other pipes or seeps at or above 500 FC/100 ml or 406 EC/100 ml and a positive non-visual dye test confirmed by Ozark underground laboratories; water sample results are less than 500 FC/100 ml or 406 EC/ml and positive visual dye test. A follow up wet season dye trace will be conducted and a suspect letter will be mailed to the owner.

CONCERN. This includes; system with no records and drainfield less than 50 ft. from surface waters or wells, improper use of designated reserve area, vehicular traffic and/or pavement on OSS components, roof drains or other drainage impacting OSS, unpermitted expansion or modification that affects OSS, unpermitted work conducted on the OSS, excavation or excess fill within OSS area, or a cut, down slope of the OSS that has potential to impact performance. In cases where there are unpermitted alterations, expansions, repairs etc., PIC staff consult with the Program Manager regarding enforcement options.

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Kitsap Public Health's Trend monitoring program includes regularly scheduled monitoring of freshwater streams and marine waters. The annual water quality report presents short and long term trends, including issuing public health advisories. This report is most commonly made available via the website with hard copies provided to stakeholders and the public upon request.

According to the 2013-2014 water quality report there were water quality improvements realized in several streams located in the various project areas. Five of 16 (31%) of monitored streams showed statistically significant improvements in water quality, with the remaining 69% showing stationary trends. There were no streams with worsening trends.

In marine waters there were three of eleven stations (27%) that showed improvements in water quality trends.

Colvos Passage/Yukon Harbor showed three of five monitored streams with improving water quality trends these included; Wilson, Salmonberry, and Olalla. Two of ten marine stations sampled showed significantly improving trends with others remaining stationary.

In Miller Bay, two of four freshwater streams sampled, Cowling and Indianola, showed improving water quality trends with Grover's and Kitsap creeks remaining stationary. There is one marine station monitored in Miller Bay which showed an improving water quality trend.

In the Hood Canal area of the project (Holly north to the Bangor submarine base) all seven freshwater streams showed stationary water quality trends. These included Big Anderson, Big Beef, Boyce, Little Anderson, Big Anderson, Seabeck and Stavis. Marine water quality analyses

were performed by DOH and provided to Kitsap Public Health for our report. Their data showed that all marine stations located in the project area, with the exception of Little Anderson Creek, had stationary water quality trends.

Objective # 2: *To improve coordination with DOH regarding response to potential fecal pollution sources affecting shellfish growing areas and investigate sources identified in the DOH annual sanitary survey of shellfish growing areas.*

Information is provided regarding shoreline hot spots reported to DOH in the "Commercial Shellfish Growing Area- Kitsap DOH Impact List" in Table 4. DOH updated this list in November 2014 on the status of sites. Notifications were made to DOH when drainages with elevated fecal bacteria counts were directly impacting approved shellfish growing areas and pollution sources were confirmed. Temporary closures were issued by DOH. The PIC program staff notified property owners in the affected areas. Following source corrections and sampling, DOH was notified and the temporary closures were removed and the area re-opened.

Coordination efforts between Kitsap county and municipalities regarding storm water systems were conducted throughout the project.

Data was shared with stakeholders, including DOH, EPA, Ecology and the public. A mid project summary report was posted to the KPHD website as called for in the work plan.

Table 4. Commercial Shellfish Growing Area - Kitsap Impact List- WSDOH Update 11-19-14

Growing Area	Address / Tax Account	Description	Corrective Actions	Status
Colvos Passage		Prospect Point	Shoreline survey conducted, 2 failures repaired	**CLOSURE REMOVED** **12.2 acres upgraded**
Colvos Passage		Fragaria		**CLOSURE REMOVED** **17.9 acres upgraded**
Colvos Passage		Cove Lane		Under Investigation
Dyes Inlet	7474 Chico Way &7534 Chico Way	Failing OSS	7474 corrected, 7534 transferred to OSS Repair on 1 /21/14	Request removal of closure, both properties now connected to public sewer. **CLOSURE REMOVED**
Hood Canal 1	Mouth of Kinman	Contaminated stream		1/21/14. Email Ann Harvey with last three water years of data. Repair completed at 28502 State Highway 3, Poulsbo. Request removal of closure. **CLOSURE REMOVED**
Hood Canal 1	Mouth of Lofall	Contaminated stream		Under Investigation
Hood Canal 1	Mouth of Vinland	Contaminated stream		Under Investigation
Kingston	Site 1	Contaminated drainage		Request removal of closure zone. All samples collected since 7/16/2008 have ranged from <1 - 170 (EC & FC). Also, all inputs to wetland have been sampled, sample results range from <1 - 18 EC. 2/25/14. . DOH REQUESTING ADDITIONAL DATA: 4-6 SAMPLES TAKEN WITHIN A ONE YEAR PERIOD.
Kingston	Site 32	Contaminated drainage		6/2/2014 Submitted email to Amy Jorgenson at DOH requesting removal of closure zone. DOH REQUESTING ADDITIONAL DATA: 4-6 SAMPLES TAKEN WITHIN A ONE YEAR PERIOD.
Kingston	Site 52	Contaminated drainage		6/2/2014 Submitted email to Amy Jorgenson at DOH requesting removal of closure zone.

				DOH REQUESTING ADDITIONAL DATA: 4-6 SAMPLES TAKEN WITHIN A ONE YEAR PERIOD.
Port Madison	Tax ID# 112502-4-207-2003 Parcel# 1292416	Failing OSS is discharging sewage to beach	Repaired 8/19/14 (11488 Logg Rd. NE, Bainbridge)	Request removal of closure, new system installed and permitted as of 8/19/2014 **CLOSURE TO BE REMOVED**
Port Orchard Passage	Tax ID #1642545 47.61171/122.59603	Failing OSS	Vacant – house burned down (5408 Illahee Rd NE)	Request removal of closure - new system installed and permitted as of 8/18/2014 **CLOSURE TO BE REMOVED**
Port Orchard Passage	GPS:47.64734,-122.61166	Contaminated Drainage **UP03**/DOH 051	9295 Illahee Rd	Under Investigation
Port Orchard Passage	GPS:47.63837,-122.60134	Contaminated Drainage **UP23**/DOH 345	8022 Illahee Rd	Under Investigation
Port Orchard Passage	GPS:47.63798,-122.59952	Contaminated Drainage **UP24**/DOH 344	8002 Illahee Rd	Under Investigation
Port Orchard Passage	14737 Sandy Hook	Contaminated Drainage		Request removal of closure. Five samples collected between 11/8 and 11/20/13 for E.coli (Collilert) analysis. Geometric mean was 71.86 EC/100 ml. DOH REQUESTING ADDITIONAL DATA: 4-6 SAMPLES TAKEN WITHIN A ONE YEAR PERIOD.
Lemolo Cove	16905 Lemolo Shore Drive	Failing OSS		Request removal of closure. This house has been connected to public sewer as of 10/8/2014. **CLOSURE TO BE REMOVED**
Bainbridge Island	Tax ID# 17250230272009	Failing OSS	9649 Olympus Beach Road	Case in litigation, Owner in process of hiring designer
Bainbridge Island	9240 Ferncliff	Failing OSS	Phased Repair and remediation	Repair pending

Objective # 3: *To connect residents with healthy shellfish growing areas through the establishment of a Port Madison Community Shellfish Farm.*

The tasks to meet this objective included collaborating with the Puget Sound Restoration Fund (PSRF) to launch and expand the Port Madison Community Shellfish farm. From September 2010 through May 2013 the Puget Sound Restoration Fund completed numerous activities. A summary of these follow:

- Established a "community support aquaculture (CSA) program" as part of the Port Madison Community Shellfish Farm. Membership increased over the course of the project from 13 families in 2010 to 59 in 2013.
- Involved 232 volunteers in the farm who contributed 660.5 hours during the grant period. Activities included seeding, processing and harvesting oysters, see Figure 2.
- Hosted PSRF's annual seed sale for local shellfish gardeners in 2011, 2012 and 2013.
- Designed and distributed 590 handouts to Port Madison watershed residents about the farm, highlighting watershed information and providing incentives for clean water actions.
- Distributed free oysters to 5 homeowners who had their septic systems inspected and/or pumped.
- Distributed dog bones with pet waste bags and "scoop the poop" information at several locations on Bainbridge Island.
- Staffed several local events to provide information about the community shellfish farm and importance of water quality, such as the Town & Country Earth Day Festival (in 2012 and 2013) that included a shellfish identification game, dog bones, poop scoop bags and a watershed model.
- Educated Planning Commission about the benefits of shellfish and shellfish gardening in terms of providing both natural filtration and homeowner incentives.

Figure 2. Port Madison Community Shellfish Farm activities

Objective #4: *To ensure correction of failing onsite sewage systems by providing financial assistance to qualified Kitsap County residents through the Shorebank Septic Loan Program.*

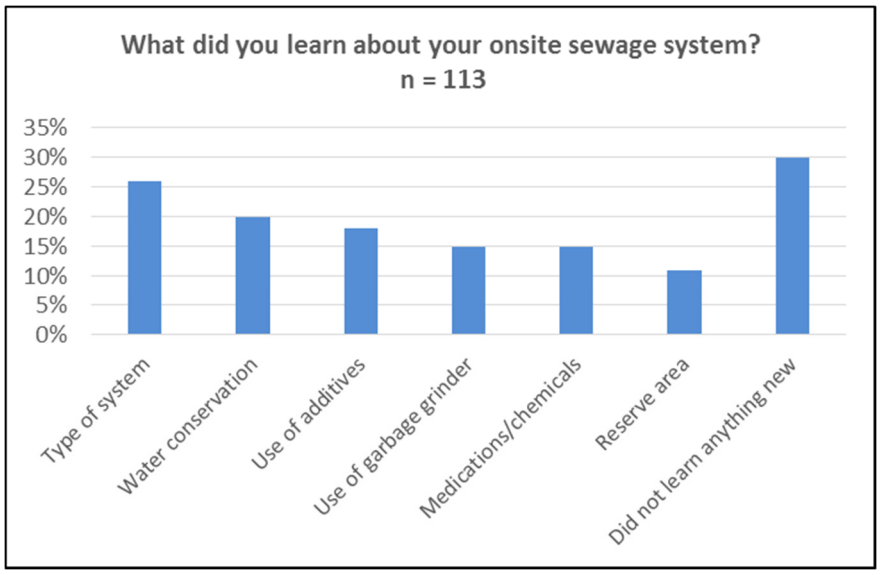
The septic loan program provides resources to residents throughout Kitsap County as well as around Puget Sound. When this project began the program was called the Shorebank Septic Loan Program. In 2011 the program's name was changed to CRAFT3.

This objective and its associated tasks were not completed because residents with failing onsite septic systems chose not to utilize the CRAFT3 septic loan program. The contract with CRAFT3 for this project was cancelled and the funds transferred (via contract amendment) to Objective 1 (Task 1 in the contract). The funding was utilized to conduct investigations of hot spots, identify sources and implement actions to correct these sources.

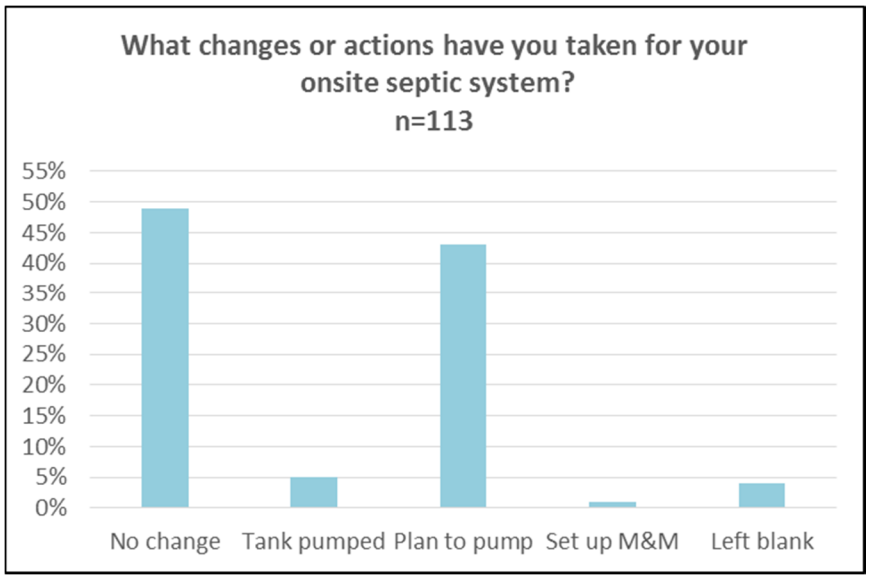
Objective #5: *To provide education to residents regarding sustainable land use practices for the protection of water quality that impact shellfish growing areas.*

There were 558 property inspections completed during the project. PIC staff distributed Fact Sheets, Homeowner's Septic System manuals, pet waste management information and other related brochures. PIC staff also provided residents with their specific onsite septic system records (e.g. sewage permits, as-built drawings etc.). These records are used as a training and outreach tool to assist residents in understanding their type of system, verify its location and help them recognize signs of septic system problems.

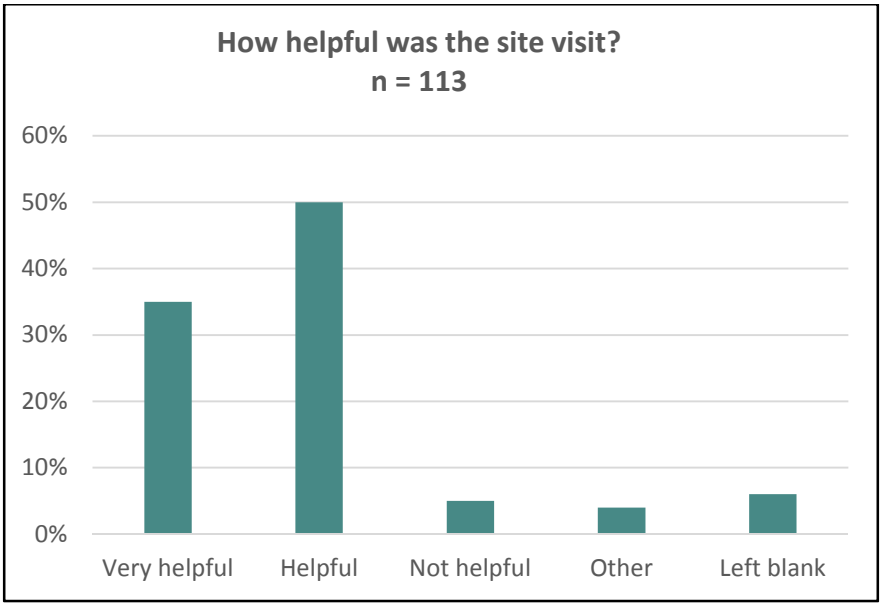
Following most property inspections, a mail-in postcard survey was sent to residents. Properties found to have failing septic systems or other potential water pollution sources did not receive a mail-in survey. There were 255 postcards mailed and 113 completed surveys received for a response rate of 45%. The following charts show the results from each question in the survey. 70% of respondents indicated that they learned something about their septic system as a result of the visit while approximately 30% stated they did not learn anything new. For septic system owners approximately 45% indicated they would have their tanks pumped within 3-5 years. 85% of respondents found the site visits to be either very helpful or helpful.



KCD = Kitsap Conservation District



M & M = OSS monitoring and maintenance contract



In addition to the responses above, there were 42 written comments included in the surveys.

A summary of these written comments are shown below.

Appreciation	Specific information/aspect of visit	Other comments
14 written comments included statements of "Thank You" to naming specific staff and commenting positively on their knowledge and expertise.	24 written comments that included statements regarding either information or aspect of the visit, e.g "shellfish restoration, information", "saving the Hood Canal" "how to handle pet waste" "the drawing of the septic drain field" etc.	4 written comments that included: "been on septic for 40 yrs. self-educated" " did not receive septic records" "not helpful" "records were for neighbors system not mine"

There were four onsite septic system workshops held at the beginning of the project per the contract agreement. The workshops were used to also launch the project and inform residents about the goals and objectives, as well as provide them with information about septic systems. Workshops were held at the north, central and southern parts of the County due to the wide area covered for this project to encourage participation.

Numerous presentations were made during the project to a variety of stakeholders. In 2011 a presentation about the project was made to the US Inspector General of EPA. This presentation also included information about Kitsap's PIC program.

Presentations were also made to the Kitsap Board of Health, the City Council of Bainbridge Island, and a local community group, the Friends of Miller Bay. During the Fall 2014 a presentation was made at a DOH sponsored PIC workshop. This workshop provided us with an opportunity to share the results of this project with our peers from other Puget Sound counties and

REFLECTIONS ON PROJECT

Kitsap Public Health District demonstrated the ability to successfully complete shoreline surveys of over 90 miles during this project. This was repeated four times, twice during wet weather months and twice during dry weather months. As a result we were able to obtain sustainable funding from Clean Water Kitsap to support an ongoing shoreline monitoring program. This funding was approved at the end of 2013, with the Shoreline Monitoring program initiated in 2014. The goal for the shoreline monitoring program is to cover all classified shellfish growing areas in unincorporated Kitsap on a four year rotational basis. This will enable us to proactively work to identify and correct sources of fecal water pollution impacting public health and the environment.

Another success of this project was the upgrade of shellfish growing areas. This project resulted in the upgrade of 30.1 acres in Colvos Passage, (12.2 acres Prospect Point and 17.9 acres at Fragaria).

There were many lessons learned during the project. One of these regarded the septic loan program. We discovered that it was not utilized to the level we had anticipated. The contract with the septic loan program was cancelled and the funds transferred to the task for conducting pollution source identification and correction. This transfer enabled us to conduct more field work which was necessary since we did not anticipate finding the large number of hot spots.

Additionally we learned that there were few shoreline properties with livestock and none of them were causing identifiable pollution problems. Consequently, the contract with the Kitsap Conversation District for BMPs was not needed. The contract was cancelled and the funds transferred to conducting PIC activities.

The property inspection follow-up mail-in survey response rate was 45%. The responses were helpful in providing us with an understanding about what residents learned during the site visit and what changes they might make as a result of the visit. The surveys were anonymous so in retrospect it would have been helpful to have had contact information to follow up with those residents indicating they would make changes to their behavior like having their septic tanks pumped. Future projects that include mail in surveys will be re-designed to include this element so we can follow up on changes in behaviors and/or actions.

Another lesson learned regarded the outcome of shellfish growing area upgrades. The logic model (shown in Table 5), shows our anticipated outcome to “upgrade 50% of the 9 miles of Prohibited areas to Approved.” In hindsight this outcome should have been stated in terms of acres rather than miles since acreage is the unit used by the Washington State Department of Health. Additionally the timeframe for shellfish growing areas upgrades is dictated by DOH’s process which can take more than 2 years following their receipt of a commercial harvest request. Therefore our outcome was overly ambitious for the timeframe of this project.

For example, DOH received a harvest request for Miller Bay in 2012, however the collection of marine samples will not be completed by the conclusion of this grant in December 2014. The information from our Miller Bay shoreline survey, including results from property inspections, will be provided to DOH to assist them with their assessment for the upgrade. DOH has informed us that 270 acres in Miller Bay may be upgraded when they complete their assessment.

Kitsap Public Health's shoreline monitoring program will not include the City of Bainbridge Island since Clean Water Kitsap stormwater management fees only apply to areas located in unincorporated Kitsap County. Bainbridge Island has its own water quality program which does not include shoreline surveys. Our recommendation, as a result of the findings from this project, is for the City of Bainbridge Island to fund a shoreline monitoring program. If needed Kitsap Public Health could provide assistance in coordinating pollution identification and correction activities.

Kitsap Public Health's PIC program was able to secure sustainable funding from Clean Water Kitsap to establish an ongoing shoreline monitoring program. This will enable us to proactively address fecal water pollution sources potentially impacting classified shellfish growing areas on a more frequent basis. This will also enhance coordination with DOH by notifying them of problem areas, source identification and corrections. Additionally our shoreline monitoring plan document is available to other jurisdictions in Puget Sound.

Table 5. Kitsap Public Health Shellfish Restoration & Protection LOGIC MODEL

Activities	Outputs	Outcomes	*PROJECT ACCOMPLISHMENTS*
Implement a routine shoreline monitoring program to assess the impact of development and land use that affect Approved shellfish growing areas. Coordinate response to potential fecal pollution sources affecting shellfish growing areas with the WA State Department of Health. Implement targeted shoreline monitoring and stream monitoring program in priority areas that affect Prohibited and/or closed shellfish growing areas. Investigate potential fecal pollution sources. Implement corrective actions. Provide financial resources to residents through the Shorebank Septic Loan for the repair of OSS. Provide education to residents regarding sustainable land use practices for the protection of water quality, and sustainability of shellfish growing areas.	Shoreline survey report including monitoring data, identification and correction of FC sources. Written report of water quality trend and impact sampling analysis before and after the project. Property survey report describing land use practices OSS ratings, number of repaired and/or replaced systems. Repair 100% of identified failing OSS. Report of agricultural properties that implemented best management practices. Complete a survey following door to door property visits to measure the impact of education and behavior change regarding land use and protection of water quality. Achieve a response rate of 45%. Establishment of community shellfish farm.	1. Water quality improvements that result in an increase in harvestable shellfish growing areas. Upgrade 50% of the 9 miles of Prohibited areas to Approved. 2. Establishment of routine shoreline monitoring program to ensure protection of 100% of Approved growing areas (60 miles). 3. Measurable improvements in water quality in at least 50% of targeted fresh and marine waters included in this project. 4. Ensure adequacy or improvements in sustainable land use practices to protect surface water from fecal pollution sources for 80% of the properties visited during the project. 5. Ensure adequacy or improvement of best management practices for livestock waste for 80% of the agricultural properties visited during the project. 6. A 30% increase in education and awareness of shellfish growing areas and water quality. 7. Sustained participation in local community shellfish farm.	1. 30.1 acres upgraded along Colvos Passage (12.2 acres Prospect Point and 17.9 acres Fragaria) 2. Sustainable funding received for establishment of routine shoreline monitoring program (SMP). SMP initiated in 2014 (to include 90 miles). 3. Water quality improvements in 58% of targeted fresh and marine waters in the project. (31% improvement in streams, 27% improvement in marine waters). 4. Improvements in land use practices e.g. failing onsite septic systems were made. 55 failing systems identified, 100% have either been repaired or are in the process of being repaired. 5. Not applicable. See discussion in “Reflections on Project” section. 6. To measure education and awareness a follow up PIC inspection survey was mailed to residents. 45% response rate received. 7. Community shellfish farm was increased from approximately 13 families to 59 families, and sustained.