FINAL PROJECT REPORT

FOR

Agreement Number WQC-2015-KitPHD-00012

Directed Pollution Identification and Correction Project
For Burley and Lofall Creek Watersheds

Kitsap Public Health District

Total Cost of Project: $422,806.00
Grant or Loan Amount: $317,104.50

Project Start Date: July 1, 2014
End Date: July 1, 2017

John Kiess, R.S.
Environmental Health Director

&/or

Leslie Banigan, R.S.
Project Lead
July 1, 2017

Kitsap Public Health District

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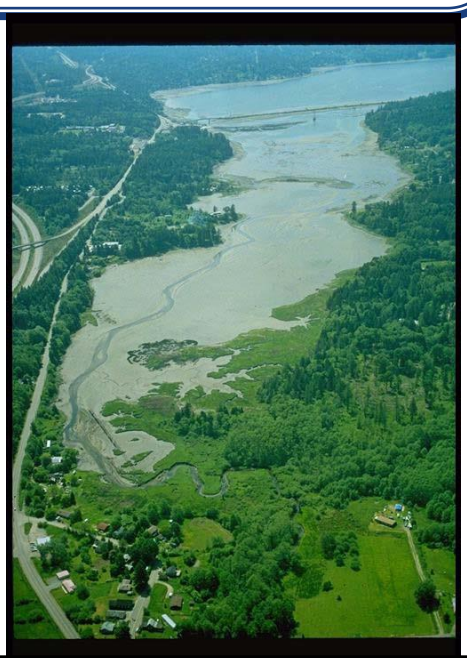
Project Description

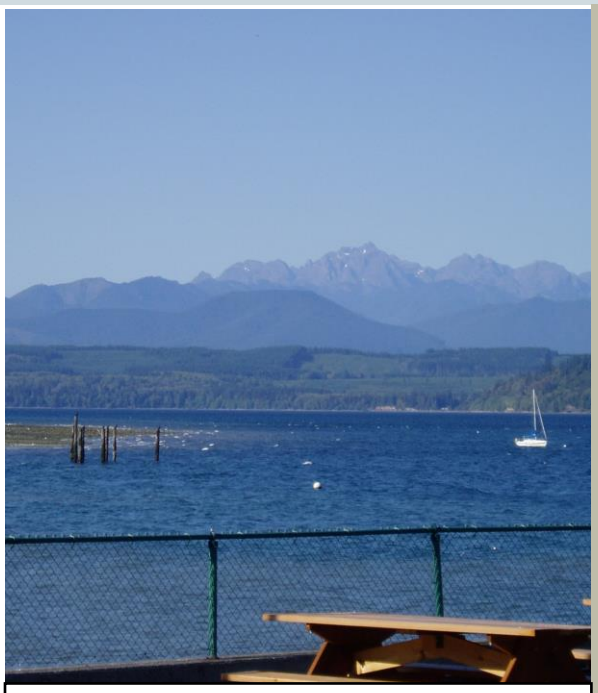
Burley Lagoon is an abundant commercial and recreational shellfish harvest area with extensive oyster, clam and geoduck resources on the Kitsap-Pierce County line. Burley Creek, located at the north end of the lagoon in Kitsap County, is the largest stream in the watershed and has a documented history of water quality problems associated with failing onsite sewage systems (OSS) and inadequate animal waste management. OSS in the area are challenged by poor and shallow soils and high wet season water tables.

Lofall Creek discharges to Hood Canal in North Kitsap. The mouth of the creek is very close to a popular shellfish beach adjacent to Kitsap Memorial Park. Lofall Creek has a persistent fecal pollution problem and is the most polluted stream in Kitsap County.

Kitsap Health developed a directed Pollution Identification and Correction approach to solve fecal pollution in the Burley Lagoon and Lofall Creek watersheds. Work was directed toward areas with fecal pollution and parcels with no permit or maintenance records.



Looking south at Burley Lagoon https://fortress.wa.gov/ecy/coastalatlas/tools/ShorePhotosCompare.aspx?photo=PIE0380&vintage=1990



Looking southwest at Hood Canal from the Lofall dock

Project Accomplishments

Developed the directed PIC approach, prioritizing parcels for survey based on: within 200 feet of impaired stream segment, without records or maintenance, with concern conditions, or built pre-1990, Parcel surveys included: water quality overview, OSS records and materials, field inspection, and identifying conditions that can cause premature failure. Completed 278 parcel surveys and reviewed 46 Property Conveyance Inspections. Identified and corrected 53 sewage sources. Updated the farm inventory with Kitsap Conservation District (KCD) and investigated 16 high priority farms. No animal waste violations were identified. Two animal waste complaint referrals to KCD resulted in the implementation of multiple best management practices under separate funding.

Partnered with Public Works, WSU-Extension, and KCD to conduct two Septic Sense workshops in Burley and one in Lofall. KCD conducted a mud management workshop in Burley. Developed multi-agency drainage workshop development team. Utilized social marketing to conduct wildlife audience research in Lofall.

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Water Quality Improvements

Kitsap's ambient fresh water monitoring fecal coliform data shows fecal coliform water quality improvement in Burley watershed (Burley Creek, Bear Creek, Purdy Creek, and Minter Creek) and Lofall Creek between this project's inception in July 2014 during water year 2014 and water year 2016. We anticipate continued improvements from this project's identification and correction of 53 sewage sources.

BURLEY & LOFALL WATERSHED ANNUAL WATER QUALITY fecal coliform geomeans					
	Burley Creek	**Bear Creek**	**Purdy Creek**	**Minter Creek**	**Lofall Creek**
Pre-project	128	148	32	62	636
Post-project	82	81	21	29	235
% reduction	35.9%	45.3%	35.5%	53.2%	63.0%

The Next Step for Continued Success

Kitsap Health has moved to a watershed lead approach for conducting pollution identification and correction. Watershed leads are responsible for investigating, identifying, and correcting fecal pollution sources in confirmed shoreline hotspots and fresh waters listed by Washington State Department of Ecology as impaired. The goal is to remove fresh waters from the impaired water list through documented corrections and post-corrective sampling.

The Burley watershed lead will continue to survey and investigate priority parcels in the "directed" PIC approach. The Hood Canal watershed lead will continue "directed" PIC work and will utilize the results of the wildlife audience research to develop and implement educational outreach based on social marketing principles.

The Kitsap County multi-agency drainage partners will conduct a four-hour Drainage Sense Pro workshop in December of 2017. A two-hour residential Drainage Sense workshop will follow in late February or March 2018.

Lessons Learned

This grant helped us pilot the "directed" PIC approach, focusing work on parcels within 200 feet of impaired stream segments, without OSS records or maintenance, with concern conditions, or built pre-1990.

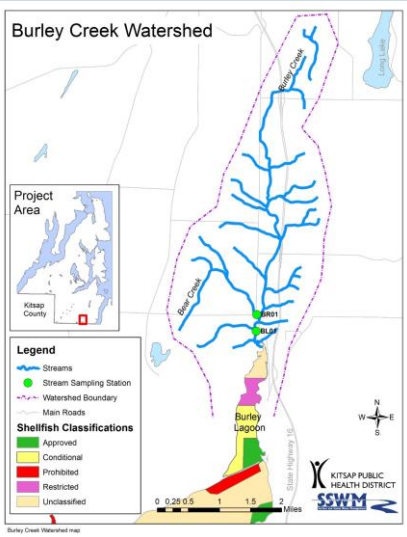
We were able to achieve significant cost savings by partnering with our network of organizations on related projects under separate funding.

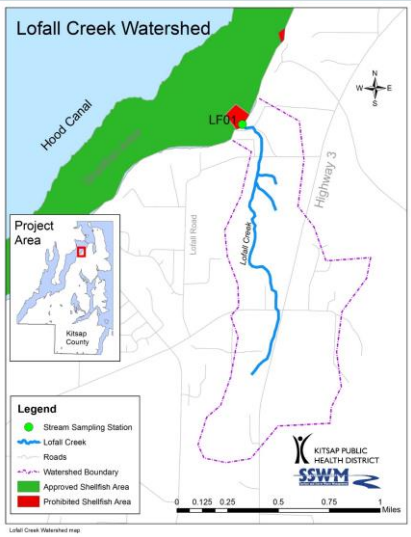
We found that the directed PIC approach is a very efficient method of conducting water quality improvement work. This pilot approach has been adopted for Kitsap Health's local pollution control plans.

Recipient Contact Information

Kitsap Public Health District
345 6th Street, Suite 300
Bremerton, WA 98337
(360) 728-2235

Leslie Banigan, Project Lead
(360) 728-2243
Leslie.banigan@kitsappublichealth.org





OVERVIEW DESCRIPTION OF PROJECT

Burley Lagoon is an abundant commercial and recreational shellfish harvest area with extensive oyster, clam and geoduck resources on the Kitsap-Pierce County line. Burley Creek, located at the north end of the lagoon in Kitsap County, is the largest stream in the watershed and has a documented history of water quality problems associated with failing onsite sewage systems (OSS) and inadequate animal waste management. OSS in the area are challenged by poor and shallow soils and high wet season water table.

Lofall Creek discharges to Hood Canal in north Kitsap. The mouth of the creek is very close to a popular shellfish beach adjacent to Kitsap Memorial Park. Lofall Creek has a persistent fecal pollution problem and is the most polluted stream in Kitsap County.

This project was designed to reduce fecal coliform (FC) bacteria and associated pathogens and pollutants in Burley and Lofall area surface water and shellfish beds. Improvements were achieved through an innovative combination of water quality monitoring, directing surveys toward parcels with OSS concerns, conducting public education and outreach, and utilizing social marketing principles to improve PIC project effectiveness.

Kitsap Health developed the directed Pollution Identification and Correction approach to more efficiently solve fecal pollution in the Burley Lagoon and Lofall Creek watersheds. Work was directed toward stream segments with fecal pollution problems and to priority parcels: within 200 feet of surface waters, no OSS permit or maintenance records, built before 1990, and OSS with un-corrected deficiencies or other conditions of concern.

The project involved a multi-pronged approach including: project reporting, public education and outreach, pollution identification and correction, and investigative monitoring.

The comprehensive public education and outreach components of this project included multiple public workshops: Septic Sense workshops in Burley and Lofall; Drainage Sense workshops; and a Kitsap Conservation District mud management workshop. The project included developing and providing social marketing-based education and outreach for high priority farms.

Project pollution identification and correction components included: compile list of priority parcels for “directed” PIC surveys, conduct 300 parcel surveys, and correct 25 OSS failures; and identify and correct agricultural waste contamination of surface waters.

Water quality monitoring components of the project included: develop and submit Quality Assurance Project Plan; collect investigative samples to bracket potential fecal sources; and discuss monitoring methods, results, and evaluation in final report.

OUTCOMES

Project Reporting

Kitsap Health prepared and entered monthly project progress reports into the EAGL database. This final project report, including the two-page executive summary, will be completed and submitted to our grant officer by the July 1, 2017 deadline.

Public Education and Outreach

Septic Sense Workshops

Kitsap Health worked with Clean Water Kitsap partners Kitsap Public Works, Washington State University Extension – Kitsap, and Kitsap Conservation District to conduct three Septic Sense workshops for this project, one more than was committed. Burley Septic Sense workshops were conducted October 14, 2014 (19 attendees) and October 27, 2015 (65 attendees) in Port Orchard. A Lofall Septic Sense workshop was conducted on October 6, 2015 at Olympic College in Poulsbo (46 attendees).

Drainage Workshops

The drainage workshops are a great example of using grant funding to develop a multi-agency pilot project that will be implemented by local stormwater utility funding.

The project funded the development of a drainage workshop team based on the Septic Sense partners and adding Kitsap County Department of Community Development. The team had six meetings (6/2/15, 11/30/15, 9/1/16, 1/4/17, 2/14/17, and 6/14/17).

The drainage workshops have been delayed to optimize workshop elements and outcomes:

- The workshops incorporate Kitsap County's new site plan and stormwater regulations that were adopted December 2016
- The drainage team chose to utilize the proven successful approach to rain garden training developed by our Washington State University Extension-Kitsap partners. This entails training contractors first and providing a list of trained contractors for participants in subsequent residential workshops.
- Contractors are more likely to attend a workshop in the slower winter season.
- Contractor trainings require more lead time to get approval for continuing education credits and to advertise and attract registrations.

The drainage workshop team developed the project components, partner responsibilities, and workshop outlines, and is working to develop the Drainage Sense Pro presentations. We plan to incorporate electronic

audience polling equipment to pilot tailoring workshop presentations based on audience composition and needs.

Kitsap County's stormwater utility incorporated the drainage workshops into the Clean Water Kitsap 2017 and 2018 scope of work and is funding the drainage workshop team partners to continue the development and implementation of a four-hour pilot "Drainage Sense Pro" workshop for contractors on December 7 or 8, 2017 in Bremerton. A two-hour "Drainage Sense" residential workshop is planned for late February or March 2018 and a full day "Drainage Sense Pro" workshop will take place in late 2018. Kitsap Health will continue to coordinate the workshops.

Mud Management Workshop

Kitsap Conservation District (KCD) covered mud management and other farm water quality BMPs during their June 2015 farm tour at Possum Run Farm in the Burley watershed. They created and distributed a BMP packet for participants including a farm map with BMP locations and descriptions. All of the 21 participants received follow-up contacts.

Kitsap Health and other shellfish partners participated in Puget Sounds Like Fun Day at Key Peninsula Civic Center on March 14, 2015. Kitsap Health provided a water quality display booth with family activities (waste relay and clean beach game). The event was sponsored by Citizens for a Healthy Bay and had 172 attendees despite windy and rainy weather. Surprisingly, both health agencies (Kitsap Health and Tacoma-Pierce Health) sang water quality songs.

Social Marketing

Kitsap Health partnered with a Puget Sound Partnership grant funded, collaborative social marketing outreach project conducted by Washington Conservation Commission (WCC) and Washington State University Extension between April 2014 and June 2015. We were able to collaborate with their social marketing project, attending their meetings to advocate for, develop and conduct a livestock audience research and social marketing outreach project in Burley Lagoon to meet both of our objectives. They selected the watersheds of Burley Lagoon, Rocky Bay, Vaughn Bay, and Hood Canal shellfish growing area #6 to conduct audience research and develop and conduct outreach projects.

Audience Research

The project was informed by audience research conducted during the planning phase. We attended the audience research planning meetings to advocate for collecting information in the Burley Lagoon watershed and to add livestock owner audience research.

The audience research indicated that landowners wanted visits from trusted sources like WSU Extension and conservation districts and they were strongly motivated by their concern for water quality. They were also concerned about regulatory consequences and potential costs of implementation. Coupons or rebates for

septic inspection and pumping were the most popular incentive. The main reason for not wanting a Clean Water Advisor site visit was cost and liability for making repairs or improvements. Some people would not agree to a site visit because they are confident they do not contribute to pollution yet they were out of compliance on septic inspection and pet waste. There was low awareness and believability around the issue of pet waste.

Four of the eleven marine property owners who participated in audience research were located in Burley Lagoon. One of these was not compliant with dog waste recommendations. Seven of the eleven upland audience research property owners were located in Burley. Six of the seven were not compliant: (four OSS, two pet waste). Nine of the twelve livestock property owners who participated were located in Burley Lagoon. Eight of the nine were not compliant with the water quality recommendations; six-pet waste, four-OSS, four-livestock wastes, two-compost, and one-fence).

Clean Water Advisor site visits and follow-up interviews

We partnered in the BMP selection and site visit planning process. Water quality advisor site visits were offered to increase knowledge about the four focus BMPs selected: inspecting OSS every three years and repair when needed: pick-up, bag and dispose of dog waste; collect, contain and cover livestock waste; and install vegetation to absorb and filter water.

Sixty-two Clean Water Advisor site visits were conducted, twelve in the Burley Lagoon watershed. Participants were provided free, confidential, site-specific recommendations. They were educated about how the focus BMPs would benefit environmental and human health and the connection between BMPs and improved water quality and wildlife habitat. They were shown how vegetative buffers can be used to absorb and filter water and provided financial incentives and resources for implementing BMPs.

Fifty percent of the ten participating livestock owners never collect, contain, and cover their livestock waste and 20% do it daily. During site visits, livestock owners indicated multiple management techniques for their property. A landowner might collect, contain, and cover manure from one species daily, but not from another species. Three of the ten livestock owners allow livestock access to vegetative buffers for grazing and water access.

A post site visit phone interview indicated that all eight of the livestock owners participating would likely collect, contain, and cover livestock waste in the future.

Some lessons learned from the Clean Water Advisor site visits and follow-up interviews:

- Door knocking yielded the most site visits
- 97% of landowners needed to be contacted at least three times to schedule a site visit
- Most landowners would recommend a site visit to others

- Site visits conducted in pairs were more successful due to the range of expertise
- There was a general lack of knowledge about the difference between pumping and inspection
- Native plants were the most requested incentive (50 of 62 site visits)
- On 25% of the landowners who did not participate in site visits indicated that they have their septic system professionally inspected every 1-3 years.
- All of the livestock owner respondents were interested in additional assistance from their local conservation district
- Follow-up interviews of three livestock owners indicated that they have started using BMPs to collect, contain, and cover their manure. One landowner mentioned that they had planned to do it before, but after the site visit they were "more likely to keep putting the cover over the manure pile". Another landowner rents their property for a livestock facility and provided the lessee with manure management education and insists they use the correct practices.
- Cost is the primary constraint for not implementing the focus BMPs

Partner agencies received a GIS map layer with the project's specific geographic information to allow the conservation districts to continue making contact with landowners.

Non-participant survey

The project included an education an educational survey mailing to non-participants and produced a 5% return rate. Landowners indicated that the main reasons they did not participate in a site visit was because they were not aware of the opportunity (30%) and because they currently manage their property with no problems (31%). Only three livestock owners responded to the mail survey and one of them reported that they collect, contain, and cover their livestock waste, but they do so rarely.

Lofall audience research

Kitsap Health conducted 15 social marketing based audience research interviews in the Lofall watershed to inform a wildlife education project. Kitsap Health has conducted extensive PIC work in Lofall since 2004. The audience research will be used to craft a follow-up local correction project.

Interview participants have lived in the area an average of 16.8 years (range=2-40 years). One-third noticed changes in wildlife activity in their neighborhood: more bunnies, possums, rodents and squirrels (+19); and less raccoons (-3). Nearly half have experienced wildlife damage: 3 unknown, 2 bear, 2 raccoon, one deer, and one chipmunk. More than 25% have family or pets that have been injured by wildlife. Two cats were injured, one cat is missing, and a neighbor was chased by raccoons.

Nearly half have experienced wildlife activity around their garbage. Three specified raccoons, squirrel (1), mice (1), crow (1), and bear (1). Forty percent compost (4 veggies, 5 yard waste) and one person had to quit because of raccoons. Sixty percent of the compost containers are accessible to wildlife and forty percent have seen evidence of wildlife in their compost. Only one person has experienced wildlife activity (possum) around their barbeque.

Twenty percent of the participants feed pets or livestock outdoors and twenty-seven percent feed wildlife (including birds) outdoors. Only one of these leaves the food out overnight. Forty percent of the participants were aware of neighborhood behavior or conditions that encourage wildlife: 3 birdfeeders, 2 neighbors used to feed raccoons, 1 heard an older neighbor feeds raccoons.

We asked a series of questions about motivators and barriers to changing behavior that provides food or shelter to wildlife. The answers will inform the development and implementation of a Lofall education and outreach project through Kitsap Health's local pollution control plan for Hood Canal.

Farm Education and Outreach

Kitsap Health investigated 16 high priority farms by bracket sampling three times during wet weather and found no water quality violations. We provided site-specific education and outreach for ten high priority farms, eight of which were downgraded to medium priority after the parcel survey. Two high priority farms came from public complaints and were referred to Kitsap Conservation District for waste management planning and implementation under separate funding. One farm installed multiple BMPs: roof runoff structure, heavy use area protection, fencing, waste storage facility and cover. The other farm installed a waste storage facility and will be implementing farm plan BMPs.

KCD conducted Clean Water Advisor site visits at three Burley farms and provided a BMP farm tour for 21 farm owners.

Pollution Identification and Correction

Parcel Surveys

The directed PIC approach prioritizes parcels for survey based on: stream segment impaired by fecal pollution, parcel within 200 feet of surface water, no sewage permit records, no maintenance within 5 years, built pre-1990, or other concerns. Kitsap Health's GIS coordinator completed a GIS map that showed priority parcels in December 2015. He built a query that exported watershed parcel lists with "directed" criteria and exported lists that were made available to the watershed leads in March 2017. This pilot "directed" PIC process has been adopted for Kitsap Health local pollution control projects. During the course of this project, a streamlined process of parcel identification was developed and implemented.

Parcel surveys included a water quality overview, providing OSS records and materials, conducting a field inspection, and identifying conditions that can cause premature failure. We distributed plastic physical drain cleaners to remind people not use drain cleaning chemicals that harm OSS.

During this project, we completed 278 parcel surveys and reviewed 46 Property Conveyance Inspections. We identified and corrected 53 sewage sources (16%): seven new alternative OSS; 19 new gravity OSS; 16 minor repairs; one Terralift; four remediations; three RV discharges disconnected; and three approved repair plans (new alternative OSS) are awaiting optimal installation conditions. Three parcels were rated suspect, 53 had conditions of concern, 139 had no apparent problems, and 30 had no records. Suspect, concern, no records, denied access, and non-participating parcels were investigated with three rounds of bracket sampling during the dry weather season and the wet weather season.

Over the course of this project, Kitsap Health built upon the directed PIC approach and assigned watershed leads responsible for conducting PIC work in fresh waters listed as impaired by Washington State Department of Ecology. The goal is to provide fecal source identification and correction and post corrective monitoring to support a request to remove the fresh water segment from the impaired fresh water list. Local pollution control activities include: reviewing ambient water quality monitoring data, identifying impaired fresh waters, investigating fecal pollution hotspots, and identifying and correcting fecal pollution sources.

Agricultural Waste

Kitsap Conservation District and Kitsap Health conducted a joint farm inventory and ranking update in the Burley, Minter, Purdy, and Rocky Creek watershed on March 14 and May 8, 2015 and identified 325 farms, 16 of which were ranked high priority.

During this project, we identified two potential agricultural waste violations and referred to KCD. Follow-up for the Minter farm is underway under Clean Water Kitsap and for the Burley farm under the Burley Lagoon local pollution control plan.

Monitoring

Quality Assurance Project Plan

On 1/5/15, we received permission to begin work on the QAPP before final contract approval. We submitted the draft on 2/11/15, re-sent the draft 3/19/15 and the QAPP was approved 4/24/15.

EIM Data Submittal

Kitsap Health ambient trend monitoring data was utilized to target PIC work, and to show post corrective water quality improvements. Kitsap submits trend monitoring data to EIM annually.

Investigative Sampling

Kitsap Health conducted investigative bracket sampling for the following:

- 16 high farms identified by updated KCD farm inventory and found no water quality violations.
- 11 follow-up site visits to confirm vacancy
- 30 parcel investigations during wet weather
- 60 survey follow-up bracket samples

Burley Lagoon Water Quality Team

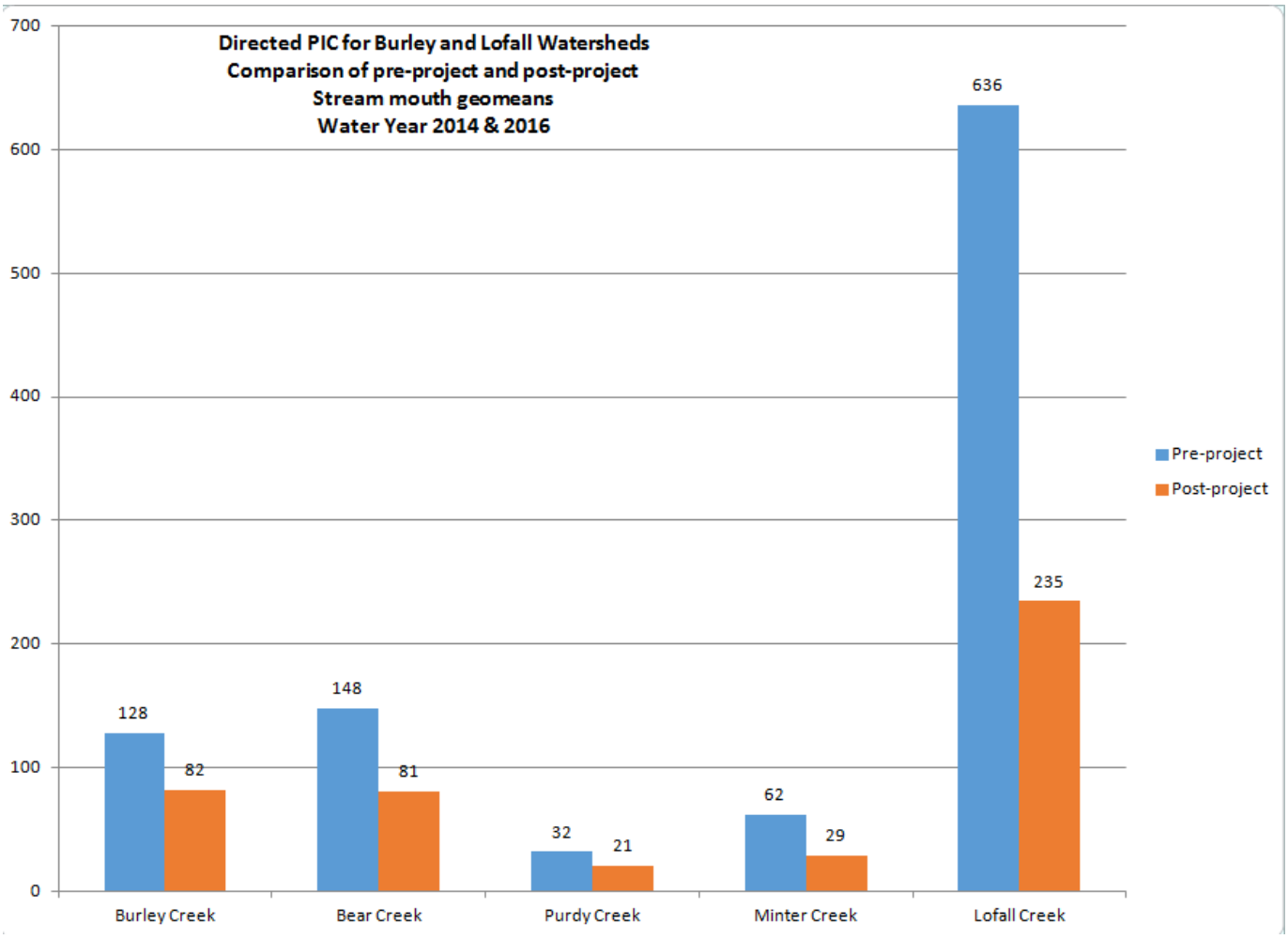
Washington State Department of Health, Kitsap County, and Pierce County have been meeting since late 1998 to coordinate water quality efforts to protecting water quality, public health, and commercial shellfish harvesting in Burley Lagoon. Pierce County coordinated the quarterly meetings, agendas, and minutes until Kitsap County took over in Fall 2015. Six team meetings were conducted and minutes distributed during this project. The team has begun updating the Burley Lagoon closure response plan.

WATER QUALITY BENEFITS

Kitsap's ambient fresh water monitoring fecal coliform data shows fecal coliform water quality improvements in Burley watershed (Burley Creek, Bear Creek, Purdy Creek, and Minter Creek) and Lofall Creek between pre-project water year 2014 and water year 2016. We anticipate continued improvements from this project's identification and correction of 53 sewage sources.

Directed PIC for Burley and Lofall Watersheds
Comparison of pre-project (WY2014) and post-project (WY2016)
Stream mouth geomeans

	Burley Creek	Bear Creek	Purdy Creek	Minter Creek	Lofall Creek
Pre-project	128	148	32	62	636
Post-project	82	81	21	29	235
reduction	35.55%	45.63%	35.49%	52.64%	62.89%



EVALUATION

This project achieved the goal of reducing FC bacteria and associated pathogens and pollutants in surface water and shellfish beds as shown by dramatic improvements in fecal coliform water quality over the three year project.

- The directed PIC approach proved to be a very efficient way of finding and correcting fecal pollution sources, resulting in significant cost savings. Kitsap Health has incorporated the directed PIC model into Kitsap Health PIC watershed lead local correction projects.

- Kitsap Health and KCD's ongoing efforts in the Burley Lagoon watershed over the past two decades have resulted in a substantial reduction in the number of high priority farms. Only two high priority farms were identified during this project. Both worked with KCD under separate funding to install BMPs. KCD's 2009 Burley farm inventory listed 31 high priority farms, their 2011 inventory showed 40, the 2015 inventory listed 16 high priority farms, and two remain.

- Kitsap Health was able to save $35,000 by working with a Washington State University Extension (WSU) and the Washington Conservation Commission social marketing grant to develop and implement the pilot social marketing for Burley Lagoon livestock owners. We worked with experienced northwest social marketing leaders to conduct audience research and develop the project. KCD and WSU implemented the Burley livestock education and outreach project under separate funding.

- Kitsap Health saved $6,650 on drainage workshop development by partnering with agency partners funded by Clean Water Kitsap. The agency partners developed drainage workshops along the lines of the successful Septic Sense workshops and WSU's successful Rain Garden trainings. The drainage workshops were incorporated into Clean Water Kitsap's 2017 and 2018 Scope of Work. A Drainage Sense Pro contractor workshop will be conducted in December 2017, a residential Drainage Sense workshop in spring 2018, and a full-day Drainage Sense Pro workshop in 2018.

- Additional project savings of $69,450 include:

    - WSU and KCD were funded through Clean Water Kitsap for the Septic Sense workshops (saved $2,250)

    - KCD was funded through a Pierce County Shellfish Partners grant to conduct the mud management workshop (saved $1,000) and farm site visits (saved $6,500)

    - OSS GIS mapping was conducted by Kitsap Health's GIS expert (saved $6,300)

    - Kitsap Health investigated 16 farms instead of the 40 estimated (saved $10,000)

    - Kitsap Health decided not to purchase the two I-Pads budgeted (saved $1,600)

    - Kitsap Health conducted emerging contaminant sampling under separate funding (saved $41,800)

FOLLOW-UP

Directed PIC work will be conducted in impaired water bodies throughout Kitsap County as part of the watershed lead local correction project funded by Centennial Clean Water Fund program funding and matched by Clean Water Kitsap funding.

REFERENCES

Washington Conservation Commission, Focused Watershed Outreach and Shore Stewards Joint Final Report, 6/30/2015