

RESEARCH/PD ANNUAL REPORT - PROGRESS REPORT

2015 annual report - progress

Nancy Rottle

Effects of Waterfront Stormwater Solution Prototypes on Water Quality Runoff in Penn Cove, Town of Coupeville
R/COCC-4

Submitted On: 05/03/2016 02:51:14 PM

METRICS & MEASURES

| Metric/Measure | Value | Note |
|--|-------|---|
| Acres of coastal habitat | 0 | |
| Fishermen and seafood industry personnel | 0 | |
| Communities - economic and environmental development | 0 | There is potential in future implementation of sustainable development practices as a result of our research on Kitsap County's implementation of innovative stormwater treatment practices. |
| Stakeholders - sustainable approaches | 0 | Project was already in place before SeaGrant funds were released to monitor the effectiveness of the new treatment system. |
| Informal education programs | 0 | |
| Stakeholders who receive information | 1050 | The video that we produced using SeaGrant funds is posted on Vimeo and has received over 1000 viewings. We have given presentations and an on-site tour, and talked with casual visitors who have visited the site. |
| Volunteer hours | 12 | Local neighbors have assisted with sampling equipment calibration and monitoring. |
| P-12 students reached | 0 | Students may have visited the site but haven't yet interacted with SeaGrant funded staff. |
| P-12 educators | 0 | Educators may have visited the site but haven't yet interacted with SeaGrant funded staff. |

REQUESTED INFORMATION

Publications

No **Publications** information reported

Students Supported

Yuan Gao (Continuing Student)
gaoyuan702@gmail.com
University of Washington, Civil and Environmental Engineering

Field of Study: Water Quality
Advisor:

Degree Type: PhD
Degree Year: 2015

Student Project Title:

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Primary data collection and analysis; post-doc

Post-Graduation Plans (employer, grad school, etc.): professional or university

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: continuing

Degree awarded this reporting period?: Yes

Financially supported?: Yes

Narratives

“Effects of Waterfront Stormwater Solutions Prototypes on Water Quality Runoff in Puget Sound near Pomeroy Park, Manchester Beac
Uploaded File: [Rottle_Sea_grant_Interim_Report___Narrative_NR_Changesoff.docx](#)

Partners This Period

Manchester Environmental Laboratories, Washington State Department of Ecology
Types: Government
Scale: STATE
Notes: Water analysis

Kitsap County Public Works
Types: Government
Scale: REGIONAL
Notes: Equipment installation

Kitsap Public Health District
Types: Government
Scale: LOCAL
Notes: Taking grab samples for fecal bacteria and TPH. Also performing analysis for fecal bacteria

CONTECH Engineered Solutions LLC
Types: Industry/Business
Scale: FEDERAL or NATIONAL
Notes: Help with equipment installation and training

STANDARD QUESTIONS

Impacts and Accomplishments

(1)

Type

accomplishment

| | |
|------------------------------|--|
| Title | Washington Sea Grant research tests the effectiveness of biofiltering waterfront stormwater pollution |
| Relevance | Stormwater runoff is the leading source of pollutants entering heavily impacted Puget Sound. Waterfront-sited green stormwater infrastructure (GSI) has been proposed as a relatively inexpensive approach to filtering out toxic and pathogenic pollutants using bioretention. It can also augment park design and waterfront redevelopment. But little monitoring information is available to evaluate GSI effectiveness. |
| Response | Washington Sea Grant-sponsored researchers are assessing waterfront GSI at Manchester Beach, Washington, where bioretention cells filled with Filterra soil media treat stormwater and a spiral raingarden treats lower base flows. The project sampled winter flows into and out of the system; state and county labs analyzed water quality in both. Researchers presented the park design directly to the public and in an online video. |
| Results | Repeated testing found that the GSI system reduced dissolved metals in runoff by varying degrees and achieved dramatic reductions, ranging from 42 to 99 percent, in fecal coliform bacteria. |
| Recap | Washington Sea Grant-supported monitoring showed that waterfront bioretention reduces dissolved metals and fecal coliform bacteria in stormwater runoff. |
| Comments | |
| Primary Focus Area | Resilient Communities and Economies |
| Secondary Focus Areas | |
| Goals | Coastal water resources sustain human and ecosystem health. |
| Partners | CONTECH Engineered Solutions LLC Kitsap County Department of Public Works Kitsap Public Health District Sustainable Path Foundation The Russell Family Foundation Washington State Department of Ecology, Manchester Environmental Laboratories |
| | <p>* Type accomplishment * Title “Effects of Waterfront Stormwater Solutions Prototypes on Water Quality Runoff in Puget Sound near Pomeroy Park, Manchester Beach” (formerly titled “Effects of Waterfront Stormwater Solution Prototypes on Water Quality Runoff in Penn Cove, Town of Coupeville”) * Relevance Stormwater pollution is one of the leading causes of degradation to Puget Sound. Rainwater washes pollutants such as heavy metals, oils, fertilizers, pesticides and other toxins from human</p> |

PI Draft

activities into the Sound without treatment, and thus poses hazardous effects on aquatic life. Stormwater outfalls may be the final opportunity to improve the quality of stormwater before it enters Puget Sound or other regional water bodies. * Response Monitoring of the Waterfront Stormwater Solution (WSS) Prototype implemented by Kitsap County assesses the effectiveness of an innovative waterfront-located stormwater park in reducing the harmful effects of stormwater pollution. The park Prototype will assist coastal communities in finding ways to capture the combined infrastructural and recreational benefits of green stormwater solutions. * Results The significant improvement of water quality after the treatment by the WSS Prototype is indicated in initial water parameters from laboratory analysis. Public education is being fulfilled by the project's ongoing outreach program. The project's academic and public partnerships will be valuable in communicating the significance of and solutions for healthy coastal ecosystems to the public. With proven efficacy, use of the sustainable WSS prototype can be expanded for wider application in coastal areas. * Recap The Waterfront Stormwater Solution (WSS) Prototype Monitoring project assesses the effectiveness of waterfront-located green stormwater infrastructure in reducing the harmful effects of human activities, assists coastal communities to address local and regional planning decisions regarding green stormwater solutions, and may provide conclusive data that will expand the applicability of the innovative WSS solution to other waterfront sites. Comments Primary Focus Area Healthy Coastal Ecosystems Secondary Focus Areas Resilient Communities and Economies Goals Coastal communities and economies are vibrant and resilient.,Coastal communities engage in comprehensive planning and sustainable development.,Coastal water resources sustain human and ecosystem health.,The public is ocean literate.,The future workforce is skilled in disciplines critical to coastal and ocean economies and ecosystem health. Partners

Tools, Technologies, Information Services / Sea Grant Products

(1)

| | |
|--------------------------------------|---|
| Description | Time-lapse video of construction of stormwater treatment park in Kitsap County, WA. |
| Developed (in the reporting period)? | Yes |
| Used (in the reporting period)? | Yes |
| Used for EBM? | No |
| ELWD product? | Yes |

| | |
|--------------------------------------|---|
| Number of managers | 0 |
| Description/Names of managers | |

Economic Impacts

No **Economic Impacts** information reported

Community Hazard Resilience

No **Community Hazard Resilience** information reported

Meetings, Workshops, Presentations

(1)

| | |
|----------------------------|---|
| Type of Event | Public or professional presentation |
| Description | Delivered presentation to Sustainable Path Foundation. Gave Sustainable Path Board Members a site tour. |
| Event Date | 12-03-2015 |
| Number of Attendees | 42 |

Leveraged Funds

(1)

| | |
|-------------------|---|
| Purpose | Effects of Waterfront Stormwater Solutions Prototypes on Water Quality Runoff in Puget Sound near Pomeroy Park, Manchester Beach - design and construction of stormwater park, and assistance with monitoring equipment set-up. |
| Source | Kitsap County |
| Amount | 1500000 |
| Start Date | 01-01-2014 |
| End Date | 04-01-2016 |

Interim SeaGrant Narrative Report for

“Effects of Waterfront Stormwater Solutions Prototypes on Water Quality Runoff in Puget Sound near Pomeroy Park, Manchester Beach”

(formerly titled “Effects of Waterfront Stormwater Solution Prototypes on Water Quality Runoff in Penn Cove, Town of Coupeville”)

Objective and Activities

The project’s objective is to assess the effectiveness of waterfront-located green stormwater infrastructure (GSI), or Low Impact Development (LID,) in reducing the harmful effects of human activities, including contamination such as heavy metals, nutrients, petroleum hydrocarbons, and coliform. During the reporting period, from June 2015 to April 2016, progress has been made towards meeting the project objectives, and in fact ahead of the schedule. An array of tasks have been efficiently fulfilled, described as below:

May 2015-June 2015: staff hiring accomplished

June, 2015-September, 2015: Finished quality assurance project plan (QAPP) writing and distributed it to partners (i.e., Kitsap County Public Works, Kitsap Public Health District) for synchronizing the objectivity, schedule and expectation of the project

June, 2015-October, 2015: Site evaluation: determining the locations for equipment installation, pre-and-post treatment. Equipment selection, and lab selection for water analysis. Development of video from Kitsap County time-lapse photography.

October, 2015-November 2015: Equipment installation. Calibration and staff training for equipment and sampling software (partnering with CONTECH Engineered Solutions LLC). Presentation to Sustainable Path conference.

December 2015- April 2016: 9 out of 12 (the total number of events expected to capture in the whole project period) storm events have been captured, and water quality parameters have been analyzed by Manchester Environmental Laboratories (Washington State Department of Ecology) and Kitsap County Public Works. Presentation to Sustainable Path Board Members.

Preliminary Results:

The results for water quality are summarized in Table 1 and Table 2, for composite samples and grab samples for fecal coliform, respectively. The results are updated as of March 2016, as part of the results are still under processing by the time of this report. Stormwater samples have been collected by the methodology described in the QAPP and “methodology” part in this report. The stormwater treatment system consists of a series of level bioretention cells filled with Filterra soil media, which form the edges of a small public park, and a spiral rain garden with three bioretention cells filled with standard bioretention soils. These facilities are shown in Figure 1. The Filterra cells treat stormwater flows smaller than the 6-month storm (WA State Water Quality standard), whereas the bioretention cells treat the lower base flows. The sampling locations are at the inlet and outlets of the waterfront stormwater park. The outlets consist of two outlets from the Filterra bioretention cells (labeled as “Filterra E” and “Filterra W”) and one from the spiral rain garden bioretention cells.

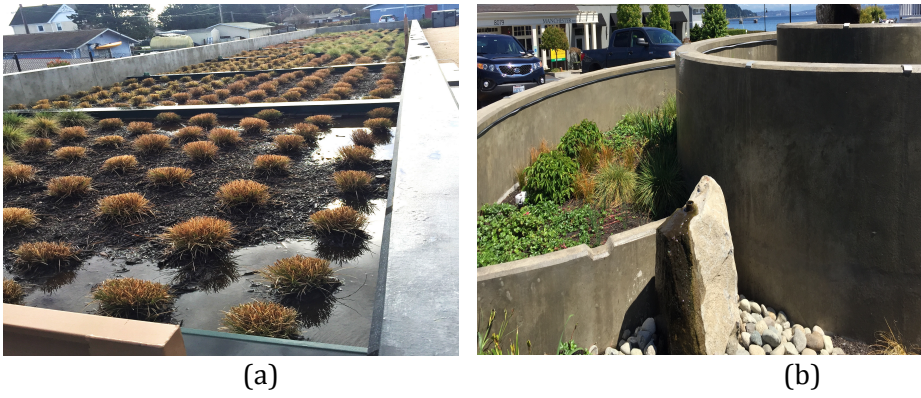


Figure 1 Filterra bioretention cells (a); and spiral rain garden (b)

Table 1. Manchester Stormwater Park Monitoring Data - Ranges

| Variable | Mass Reduction (%) | |
|-------------------------------------|--------------------|---------|
| | Minimum | Maximum |
| Volume | 7.94% | 43.73% |
| TSS | 90.47% | 98.89% |
| NH ₃ -N | 20.30% | 63.22% |
| NO ₃ +NO ₂ -N | -65.16% | 57.06% |
| TN | -37.43% | 62.10% |
| PO ₄ -P | -431.98% | 90.91% |
| TP | -32.52% | 84.71% |
| TOT _{Cu} | 15.94% | 85.73% |
| Dis _{Cu} | 1.34% | 61.93% |
| TOT _{Pb} | 75.40% | 97.97% |
| Dis _{Pb} | 37.11% | 79.42% |
| TOT _{Zn} | 79.24% | 97.65% |
| Dis _{Zn} | 37.11% | 94.78% |

Table 2. Manchester Stormwater Park Monitoring Data – Fecal Coliform (No./100 mL)

| Date | Inflow | Rain Garden | Filtterra E | Filtterra W | System Outflow |
|----------|--------|-------------|-------------|-------------|----------------|
| 12/17/15 | 290 | 50 | 70 | 150 | |
| 1/15/16 | 10 | 5 | 5 | 5 | |
| 1/21/16 | >2000 | | | | 1630 |
| 1/26/16 | 70 | 30 | 40 | 30 | |
| 1/28/16 | 35 | 0.5 | 4 | 8 | |
| 2/11/16 | 1040 | 90 | 5 | 5 | |
| 2/19/16 | 540 | 30 | 260 | 170 | |
| 3/1/16 | 340 | 30 | 60 | 20 | |

From Table 1, it can be seen that the system does reduce flow volume, presumably by evapotranspiration. The volume reductions have declined in recent storms, probably because of persistent saturation due to frequent precipitation. Mass loadings of particulate pollutants have been consistently high, as can be seen particularly with TSS and Total Pb. Dissolved metal mass reductions are more variable but always positive. Nutrient reductions are very variable possibly due to the leaching of nitrogen and phosphorus of the relatively fresh composite, although presumably in the end of the monitoring year there will be overall positive nutrient mass loading reductions when the system matures. For fecal coliforms (FC) in Table 2, there is a great reduction of FC in both rain garden and Filtterra bioretention systems. The reduction varies from 42% to over 99%, for effective reduction of bacteria.