Detailed Scope of Work

Evaluation of the long-term bioretention soil infiltration rate related to vegetation, maintenance, soil media and geotechnical site parameters

LOI #13

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1.0 PROJECT PURPOSE

The objectives of this study are to:

- Communicate the long-range bioretention effectiveness to a broad base of NPDES jurisdictions. Information on design, age, vegetation conditions, maintenance practices and geotechnical data can provide baseline information for better understanding of bioretention life spans and considerations for benefit ratio and equivalent area when assessing stormwater impacts to our receiving waters.
- Evaluate a large number of operating systems in order to assess their performance regarding current guidelines, including:
    - Site and facility design information including drainage basin area, impervious acreage, facility design specifics (age, BSM surface area, inlets, underdrains, outlets, ponding depth, assumed design rate);
    - Overall condition including evidence of inlet efficiency, erosion, deposition, clogging, debris accumulation and overflow;
    - Vegetation community data including vegetation composition and structure, stem density of woody plants, and estimating the percent basal cover of herbaceous plants using quadrats;
    - Maintenance practices and frequency through interviews with maintenance personnel or managers;
    - Geotechnical data including media thickness and composition (grain size, organic content); mulch layer presence, extent, and thickness; facility infiltration rate; soil compaction; and subsurface geologic and groundwater conditions using hand-augered boreholes.
- Gather a large dataset on different systems to understand the possible influence of the above factors on performance.
- Provide guidance on the long-term performance, design and construction of bioretention facilities, based on findings of the survey.

Bioretention systems are increasingly being used to manage polluted stormwater runoff in western Washington. However, there are some concerns about their lifespan, particularly due to the possibility of (1) clogging of the systems over time, and (2) soil compaction, both of which can result in an overall reduction in permeability. Slow-draining facilities can also cause problems of stagnant water and aesthetic problems, leading to difficulties in acceptance of bioretention as a drainage or stormwater solution. Previous field assessment of installed facilities (SAM Bioretention Hydrologic Performance [BHP] Studies I and II) demonstrated variability in plant

community (type, density), bioretention media composition, soil compaction, and permeability between facilities. However, these previous assessments generally did not assess the longevity of the hydrologic performance of the sites.

We propose to leverage the BHP Phase I and II outreach, experience and information gained from the site assessment and monitoring efforts to identify older facilities and conduct a streamlined assessment without conducting the intensive wet-season flow monitoring or modeling of the past projects.

Field assessments will be performed on approximately 50 bioretention systems to provide documentation on infiltration and vegetation. Site selection will be focused on older systems. Information on bioretention age, design features, vegetation composition, maintenance practices and geotechnical data can provide baseline information for a broader perspective on bioretention life spans and considerations for benefit ratio and equivalent area when assessing stormwater impacts to our receiving waters. The research can be used to broadly communicate bioretention effectiveness, provide confidence that facilities are long-lived, and adequately sized and provide feedback to Ecology and municipalities for future design and maintenance guidance.

2.0 PROJECT DESCRIPTION/SCOPE OF WORK

2.1 Study design and main project tasks

The project will measure and compare hydrologic performance of constructed bioretention facilities across age classes, basic design types (with and without underdrains), and ratio of impervious area to bioretention area. Using this comparison, and drawing from additional site data such as vegetation density and composition, local surficial geology, infiltration rates, presence of shallow groundwater or hydraulically restrictive layers, actual constructed site conditions, working hypotheses will be proposed for factors leading to the long term performance of older facilities.

There are fundamental reasons for demonstrating the long-term hydrologic performance of bioretention facilities. If the protection of receiving water habitat is based on instream hydrologic goals in a basin utilizing Low Impact Development (LID), the performance of the individual facilities must meet their expected performance to ensure success of the combined hydrologic response of all the facilities.

Overall, accurate hydrologic performance of bioretention facilities must first be met before other related performance goals (protection of downstream receiving waters, pollutant removal) can be fully realized. This research will: provide data to support confidence in long-term performance; provide feedback on Stormwater Management Manual for Western Washington (SWMMWW) bioretention design; correlate the drainage rates to the vegetation type and density in the cell to help steer planting plans to assist in the longevity of the cells; and suggest

maintenance recommendations for jurisdictions to help maintain the hydrologic performance of their facilities.

Communication of the findings will be conducted through presentations to the Stormwater Work Group and County-based presentations for the benefit of both County and City permittee audiences.

It is unclear how many older bioretention facilities (pre-2005) will be discovered, however, discovering the extent of these facilities will be a valuable outcome of this proposal. There were many facilities in the 2005 to 2010 time frame reviewed during BHP Phase I that were not selected. Considerable effort will be brought to identifying appropriate facilities. Sources for site identification will include expanded outreach to NPDES jurisdictions, school districts (early adopters of bioretention), and outreach to the hundreds of engineers trained in the model by Mr. Beyerlein. We fully expect a wide range of candidate facilities from throughout the Puget Sound Basin. We also expect the outreach and communication plan to result in improved participation with smaller jurisdictions, including a proposed six-County tour to present findings to smaller jurisdictions.

Task 1. Project Management

This task includes project management and will be performed by the municipal project manager (Olympia) and subcontractor (Associated Earth Sciences, Inc.). This task includes completing a contract with the subcontractor, subcontract management, quarterly progress reporting, budget management, team meetings, staff management, coordination with the technical advisory committee (TAC), and communications with the Ecology SAM Coordinator. Associated Earth Sciences, Inc. (Jennifer Saltonstall) will conduct project management to support Tasks 2 to 5, including coordinating with subcontractor consultants Clear Creek Solutions (Doug Beyerlein), Raedeke Associates, Inc. (Bill Taylor and Anne Cline) budget management, and deliverable schedule.

Subtasks

1.1 **Prepare consultant contract scopes and contracting.** This task will involve conducting the process to procure and manage consultant services for the project.

1.2 **Prepare quarterly progress reports.** This task will involve completing reporting responsibilities to Ecology.

1.3 **Coordinate communication with Ecology and partner jurisdictions and consultants.** This task is to communicate with jurisdictions and consultants related to administration of the contract.

Deliverable 1.1: Document contracting, coordination with team, and communications via quarterly progress reports by the City of Olympia with consultant support.

Task 2: Study Design Communication, QAPP Update and Site Selection

This task will also include activities related to either designating a Project Liaison or creation of Technical Advisory Committee (TAC), refining the study design details, updates to the QAPP and site selection.

An initial planning meeting with the Ecology SAM Coordinator and the Ecology-designees will cover project design details, including specific study parameters and data collection criteria, roles and responsibilities of team members, and logistics for site assessment. Discussions at the initial planning meeting will determine if a Project Liaison or Technical Advisory Committee is warranted. A follow-up meeting will be held with the Project Liaison or Technical Advisory Committee, Ecology or Ecology-designees, the coordinating municipality and team members to refine study design prior to finalization of the QAPP and site selection. The QAPP will rely on the QAPP developed for the Bioretention Hydrologic Performance (BHP) studies, will be prepared following Ecology guidelines, and will include details of the study design, sampling and analysis methods and quality assurance and quality control procedures. The QAPP will be submitted to Ecology prior to Task 3 Field Site Assessment activities.

A large part of site selection includes using the facilities and site contacts developed as part of the BHP Phase I and II studies and the State water quality stormwater grants. Many facilities previously reviewed were not selected for inclusion in the BHP studies but could more easily qualify for the current study. Site contacts will be reviewed, updated and then we will contact municipal stormwater managers, the Stormwater Center, school facility managers (many schools were early adopters of bioretention) and other consultants for additional candidate sites.

Subtasks

2.1 **Planning meetings and Project Liaison or TAC.** This task include two key meetings, (1) a kick-off meeting with applicable Stormwater Work Group members, Ecology staff and City of Olympia staff to discuss study design details, and designate either a Project Liaison and/or TAC, and (2) a follow-up meeting with either with Project Liaison and/or Technical Advisory Committee.

2.2 **Update Quality Assurance Project Plan (QAPP).** This task includes modifications to the QAPP developed for the BHP studies. The revised QAPP will follow Ecology's *Guidelines and Specifications for Preparing Quality Assurance Project Plans for Environmental Studies*, February 2001 (Ecology Publication No. 01-03-003 and be submitted to the Department of Ecology with time for revision, comment, and approval.

2.3 **Develop site selection criteria checklist.** This task will be to create a site selection criteria checklist in coordination with Ecology staff, consultants, and participating jurisdiction partners. The checklist will be a modification of the BHP checklists.

2.4 **Communicate selection criteria to partners; receive and organize candidate sites; visit sites.** This task will involve communicating with the individual partners submitting candidate sites; collecting and evaluating background engineering and construction data;

visiting candidate sites to conduct the on-site selection checklist, scoring the complete list of candidate sites and making selections of sites to be monitored. Nominal goals are to identify up to 100 candidate sites and select up to 50 sites for site assessment.

2.5 Summary technical memo. Write technical memo on the site selection process and results including sections on: site selection criteria, candidate sites, site visit checklist results, scoring results, and proposed list of sites to be assessed.

Deliverable 2.1: Summary of study kick-off meeting and follow-up meeting with Project Liaison and/or Technical Advisory Committee. Deliverable will include summary meeting notes.

Deliverable 2.2: Draft QAPP for all sites addressing site assessment/monitoring methods and analysis delivered to Ecology.

Deliverable 2.3: Respond to Ecology's and other technical reviewers' comments and finalize QAPP. Final QAPP to be delivered to Ecology.

Deliverable 2.4: Site selection criteria checklist submitted to Ecology.

Deliverable 2.5: Technical memorandum on the site selection process, summary of results of site evaluation and list of final sites submitted to Ecology.

Task 3: Field Assessment, Data Collection and Analysis

Based upon the QAPP, site assessment shall be conducted to provide the information necessary to meet the goals of this study. This includes but is not limited to:

- Site and facility design information include drainage basin size, impervious acreage, facility design specifics (age, planned BSM surface area, inlets, underdrains, outlets, ponding depth, assumed design infiltration rate for BSM and subsurface geologic unit, if applicable);
- Vegetation data including vegetation composition and structure, stem density of woody plants, and estimating the percent basal cover of herbaceous plants using quadrats;
- Maintenance practices and frequency from interviews with maintenance personnel or managers;
- Overall facility condition including inlet efficiency and blockage; sidewall and base erosion type or patterns; sediment, organic matter, or trash deposition/coverage; clogging or debris accumulation; and ponding or overflow indicators;
- Geotechnical data including media composition (grain size, organic content) and thickness; presence, extent, and thickness of mulch layer; facility infiltration testing; soil compaction; and subsurface geologic and groundwater conditions using hand-augered boreholes.

Deliverable 3.1: Review and memo report on hydrologic design review with summary tables of facility design parameters.

Deliverable 3.2: Field data collection and memo report on facility conditions and geotechnical investigations with individual reports for each facility.

Deliverable 3.3: Field data collection and summary memo report on vegetative composition of older cells and a correlation between the vegetation composition and drainage rates of older cells. Maintenance activities for the cells will also be summarized and analyzed to investigate if more frequent maintenance is associated with compacted bioretention soil.

Task 4: Summary Analysis and Report

This task consists of maintaining, managing, and utilizing data collected from the study to provide relevant information on the long-term hydrologic function of bioretention facilities. The final report will describe the study design, methods, and findings of the study. Analysis and discussion of the individual facilities will compare the performance of facilities in relation to measured variables. The information should be used to inform and support conclusions for the design and long-term hydrologic performance of bioretention facilities on a wide scale for Western Washington. A draft report will be reviewed by City of Olympia and a final draft will be reviewed by Ecology. The final report will be submitted for approval by Ecology.

Deliverable 4.1: Meeting with Stormwater Work Group members, Ecology staff and City of Olympia staff to discuss results of site assessment, adequacy of data set and next steps for analysis.

Deliverable 4.2: Electronic Draft Final Report for review and comments by City of Olympia, Ecology, and Stormwater Work Group.

Deliverable 4.3: Meeting with Stormwater Work Group members, Ecology staff and City of Olympia staff to discuss Draft Report and provide feedback prior to final reporting.

Deliverable 4.4: Three printed copies of Final Report, one electronic version of Final Report plus all data files, reports and miscellaneous data relevant to the project.

Task 5: Distribution of Findings

Communication of the findings will be conducted through a presentation to the Stormwater Work Group, preparation of a 2-page summary of the project finings for web publication and six County-based presentations for the benefit of both County and City permittee audiences.

Deliverable 5.1: Presentation to the Stormwater Work Group.

Deliverable 5.2: Two-page summary of the project results/findings following the SAM Fact Sheet template.

Deliverable 5.3: Conduct a six-County “road show” presenting results for Counties and City permittees. Venues could include local NPDES coordinator meetings, Phase I or Phase II permittee meetings, the APWA Stormwater Committee meetings, or other stormwater-related gatherings.

2.2 Communication plan

See Task 4, Deliverable 4.3, for an interim findings presentation to the SWG before the final report is completed.

See Task 5, Deliverable 5.2, for production of a two-page summary of the project results/findings and Task 5, Deliverable 5.3, discussing presentation of findings to the larger community.

3.0 PROJECT TEAM DESCRIPTION

See Task 2, Subtask 2.1, for discussion of Project Liaison or Technical Advisory Committee.

Project Team Includes:

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Municipal Partner: Eric Christensen, City of Olympia, Water Resources Director – Public Works
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4.0 PROJECT MANAGEMENT STRATEGY

See Task 1 for discussion of project management.

5.0 PROJECT BUDGET AND SCHEDULE

Project budget and schedule is currently in progress. We have provided a time frame based on our experience conducting similar assessments and surveys.

5.1 Project duration and requirements

Task 2 and Task 3 will require the largest amount of time to complete. The Task 2 schedule is driven in part by Ecology and review staff availability. We have provided a Task 2 duration of three months to allow sample time for communicating with the individual partners submitting candidate sites to gather the background information. The Task 3 schedule is based on selection of 50 bioretention cells. The site assessment time will include one full field day per site, and the schedule is based on an average two to three sites per week to allow for weather or other complications.

Approximate Schedule for Tasks

Item	Task Description	Time Frame
Task 1	Project management	Throughout
Task 2	Study Design Communication, QAPP and Site Selection	3 months
Task 3	Field Assessment, Data Collection and Analysis	7 months
Task 4	Summary Analysis, Draft and Final Report	2 months
Task 5	Distribution of Findings	3 months

5.2 Key project deliverables and cost

Key project deliverables are summarized from Task 1 to Task 5, with the deliverable lead. The designated “Lead Team Member” indicates point-of-contact and member responsible for the deliverable. However, all team members will participate in project meetings, site selection, QAPP and summary report. Total project costs are $PLACEHOLDER. Detailed breakout of cost including hourly labor costs, travel, field supplies, water for testing or hydrant meter rental, and geotechnical testing will be included as a future attachment.

Summary of Task Deliverables, Team Lead(s), and Cost

Item	Deliverable Description	Lead Team Member(s)*	Cost
1.1	Quarterly progress reports documenting contract, coordination with team, and communications	Eric Christensen, Jennifer Saltonstall	
2.1	Summary meeting notes for Kick-off Meeting and Follow up meeting with Project Liaison and/or TAC	Jennifer Saltonstall	
2.2	Draft QAPP	Jennifer Saltonstall Bill Taylor	
2.3	Comment Response and Final QAPP		
2.4	Site Selection Checklist		
2.5	Site Selection Technical Memorandum		
3.1	Hydrologic Design Review Technical Memorandum	Doug Beyerlein	
3.2	Geotechnical Assessment and Facility Condition Technical Memorandum	Jennifer Saltonstall	
3.3	Vegetation Assessment and Maintenance Survey Summary Technical Memorandum	Anne Cline Bill Taylor	
4.1	Summary meeting notes for an initial meeting with Ecology, SWG to discuss results, adequacy, and analysis.	Jennifer Saltonstall	
4.2	Electronic Draft Report	Jennifer Saltonstall Bill Taylor	
4.3	Summary meeting notes for discussion of draft report prior to final report.	Jennifer Saltonstall	
4.4	Final report	Jennifer Saltonstall Bill Taylor	
5.1	Stormwater Work Group Presentation	Full team	
5.2	SAM Fact Sheet summary	Jennifer Saltonstall Bill Taylor	
5.3	Six presentations throughout Puget Sound	Jennifer Saltonstall Bill Taylor	
		Total Project Cost	
		10% Contingency	
		Total Project Cost with Contingency	