



DEPARTMENT OF
ECOLOGY
State of Washington

AMENDMENT NO. 2

TO

CONTRACT NO. 1500140

BETWEEN THE

STATE OF WASHINGTON DEPARTMENT OF ECOLOGY

AND

THE CITY OF BELLINGHAM

PURPOSE: To amend the Agreement between the state of Washington, Department of Ecology, hereinafter referred to as "ECOLOGY" and THE CITY OF BELLINGHAM, hereinafter referred to as "BELLINGHAM" or "CONTRACTOR".

WHEREAS: This Agreement is undergoing a substantial extension and increase in scope to implement the monitoring on bioretention facilities that was planned under the first set of tasks (1-3).

IT IS MUTUALLY AGREED the agreement is amended as follows:

- 1) The project end date is changed from December 31, 2015 to June 30, 2018.
- 2) Attachment A- Scope of Work is amended to extend tasks 1 and 3, and add tasks 4, 5, and 6. Deletions are indicated by strikethrough (~~strikethrough~~) and additions are underlined (underline).
- 3) The total amount for this contract is increased from \$88,634 to \$467,186.

Attachment A

Bioretention Hydrologic Performance Study Phase I Site Selection Process and QAPP Development and Phase II Monitoring Implementation, Data Analysis and Final Reporting Scope of Work

A. Background

1. Purpose of the Project

This project will provide adaptive management feedback from actual hydrologic performance of bioretention facilities and related site conditions that affect hydrologic performance to the Stormwater Management Manual for Western Washington (SWMMWW) design guidelines and to local jurisdiction design engineers. Regional benefits will come from working with Ecology and local jurisdictions to select and assess multiple sites that represent a wide range in geographic and design conditions. Results of the study will guide improvements to performance of facilities across the Puget Sound.

There are fundamental reasons for assuring the actual hydrologic performance of bioretention facilities. If goals for protection of receiving water habitat are based on instream hydrologic goals in a basin utilizing LID, the performance of the individual facilities needs to meet their expected hydrologic performance to ensure success of the combined hydrologic response of all the facilities at the sub-basin scale. As a practical site space issue, expecting that facilities can be accurately sized will support efficient use of space in site design layout, especially for retrofit opportunities where space may be limited by existing structures.

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 lead to not only feedback on the design process for more dependable overall performance, but will also suggest maintenance recommendations for jurisdictions to help maintain the hydrologic performance of their facilities.

2. Project Objectives

The project objective is to compare actual hydrologic performance of constructed bioretention facilities with the expected modeled performance from the original site engineering design. Modeled results using original design data will be compared with field results based on actual rainfall during the site monitoring. Using this comparison, and drawing from additional site data such as local media composition, surficial geology, infiltration rates, groundwater fluctuation, actual constructed site geometry, and vegetation density and health, working hypotheses will be proposed for factors leading to the hydrologic performance observed. These working hypotheses will be supported by published literature on bioretention hydrologic performance.

The initial project objectives are:

- develop a list of candidate bioretention sites from the Ecology Stormwater Grants Program Database, recommendations of local design firms, and the 16 participating local jurisdiction stormwater programs listed in the original proposal,
- develop a site selection criteria checklist,
- conduct a site checklist review of each of the candidate sites,

- select bioretention facilities to be monitored for flow and other site-specific data in Phase II, the Implementation Phase,
- write a report summarizing the approach and findings of the selection process, and
- write a Quality Assurance Project Plan (QAPP) to guide implementation of the monitoring and assessment to be conducted in Phase II.
- monitor chosen facilities through multiple storms and site conditions
- analyze monitoring data and compare to WWHM2012(or agreed upon newer version) modeling results to evaluate performance expectations, and reach conclusions for bioretention hydrologic designs, construction and maintenance needs
- provide reporting of the study and recommendations from the study for use by NPDES permittees and the Department of Ecology

B. Scope of Work

Task 1 Project Management

(\$9,452, May - ~~October 2015~~ June 30, 2018)

1. Prepare consultant contract scopes and contracting
This task will involve conducting the process to procure and manage consultant services for Phase I. These will include Co-project manager, flow monitoring, modeling, geotechnical, and vegetation assessment team members.
2. Prepare quarterly progress reports
This task will involve completing reporting responsibilities to Ecology.
3. Coordinate communication with Ecology and partner jurisdictions and consultants.
This task is to conduct communications with jurisdictions and consultants related to managing their roles in the project, and communications not otherwise budgeted in other tasks.

Deliverable 1.1: Document contracting, grant reporting, and communications via quarterly progress report.

Task 2 Prepare Site Selection Criteria and Conduct Selection Process

(\$65,276, May - October 2015)

1. Develop site selection criteria checklist
This task will be to create the site selection criteria checklist in coordination with the Ecology staff, consultants, and participating jurisdiction partners (see Appendix 1).

Deliverable 2.1: Site selection criteria checklist submitted to Ecology. Target date: May 31, 2015 (\$7,906).

2. Communicate selection criteria to partners; receive and organize candidate sites; visit sites.
This task will involve communicating with the individual partners submitting candidate sites; collect and evaluate 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 20 candidate sites and select up to ten sites to be monitored.

Deliverable 2.2: Summary of results of site evaluation and list of final sites submitted to Ecology. Target date: August 31, 2015 (\$51,386.16).

3. Write report on the site selection process and results including sections on: site selection criteria, candidate sites, site visit checklist results, scoring results, modeling results (if performed) and proposed list of sites to be monitored.

Deliverable 2.3: Report on the site selection process submitted to Ecology. Target date: September 15, 2015 (\$5,984.08).

Task 3 Write Quality Assurance Project Plan (QAPP) and Scope for Phase II, Monitoring Implementation and Analysis

(\$12,506, May -- ~~October 2015~~ February 2016)

1. Write common QAPP for all sites and overall project analysis

A single QAPP following Ecology guidelines will be prepared to address the overall QAQC process of site installation and monitoring, and the bioretention modeling and performance analysis process. Quality assurance steps will be identified for each activity.

Deliverable 3.1: Draft QAPP for all sites addressing monitoring methods and analysis delivered to Ecology. Target date: September 30, 2015 (\$11,225.40).

2. Respond to Ecology's and other technical reviewers' comments and finalize QAPP and Phase II scope.

Deliverable 3.2: Final QAPP and detailed phase II scope of work delivered to Ecology. Target date: ~~October 2015~~ February 2016 (\$1,250.60).

Task 4, Monitoring Implementation

(\$333,952, January 1, 2016 - May 31, 2018)

1. Based upon the QAPP, select and procure monitoring equipment capable of meeting the requirements of this study. Utilize existing equipment where possible if it meets the study requirements and objectives. Any new equipment purchased will become the property of the City of Bellingham upon completion of the study. It shall be understood that the City of Bellingham shall make this equipment available to the Department of Ecology or other NPDES permittees whenever possible for use on other RSMP projects. The City of Bellingham shall be responsible for normal maintenance of this equipment for its use by the City of Bellingham. Use by others shall include their provision of normal maintenance and necessary expendable items. Neither the Department of Ecology nor the City of Bellingham shall be responsible for replacement of said equipment if it is lost, destroyed or unrepairable.

Deliverable 4.1: Proposed Equipment list and approximate cost. Target Date: January 2016

Deliverable 4.2: Proposed purchase plan meeting State open bidding and procurement processes where applicable. Target Date: January 2016

Deliverable 4.3: Documentation of bidding process showing the bid selection and reasoning for any deviation from use of the lowest responsible bidder. Target Date: February 2016

Deliverable 4.4: Invoice and receipt of procured equipment. Target Date: March 2016

2. Based upon the QAPP, testing of the sites shall be conducted to provide the information necessary to meet the goals of this study. This includes but is not limited to:
 - a) Geotechnical/soils design and current conditions
 - b) Review of facility hydrologic design and current conditions
 - c) Analysis of vegetation design and current condition

Deliverable 4.5: Memo report on geotechnical review with attached individual facility site testing reports. Target Date: September 2016

Deliverable 4.6: Memo report on hydrologic design review with individual reports for each facility. Target Date: September 2016

Deliverable: 4.7: Memo report on vegetative investigations with individual reports for each facility. Target Date: September 2016

3. Equipment shall be installed in conformance with the QAPP to provide monitoring at a minimum of 10 bio-retention stormwater facilities. The time frame for monitoring may extend over two winters to collect an adequate range of storm event conditions. Monitoring of facility performance during a minimum of 10 storm events shall include:
 - a) Rainfall, continuous
 - b) Temperature, continuous
 - c) Evapotranspiration factors, calculated
 - d) Groundwater elevation, observation
 - e) Water input to the facility, continuous
 - f) Water output from the facility, observation or continuous

Addition to Deliverable 1.1: A monitoring section of the quarterly reports (Deliverable 1.1) will be included once monitoring begins to summarize the status of flow, rainfall, and soil monitoring. Information provided will include the number of monitoring events and sites, relevant issues with monitoring, reasons why events were missed, and electronic spreadsheet of raw data files.

Target Date: Quarterly 2016-2018

Task 5, Data Analysis
(\$36,000, January 1, 2016 - June 15, 2018)

1. This task consists of maintaining, managing and utilizing data from the study to provide relevant information on the hydrologic function of bioretention facilities. Analysis of the individual facilities should be used to inform and support conclusions for the design, use and hydrologic performance of bioretention facilities on a wide scale for Western Washington.

Deliverable 5.1: Meeting with Stormwater Work Group members, Ecology staff and City of Bellingham staff to discuss results of monitoring, adequacy of data set and next steps for analysis. Target Date: November 2016 or as determined by Ecology

Deliverable 5.2: Provide technical memo summarizing the development of models for each bioretention based on as-built construction, confirmed drainage area, and site field conditions

(depth of soil mix, groundwater, native soil infiltration, etc). The memo will also propose analysis framework and endpoints. Target Date: August 2016 or as determined by Ecology

Deliverable 5.3 As-built WWHM 2012 (or agreed upon newer version) model of each bioretention facility in the study. Target Date: October 2016

Deliverable 5.4: Technical memo summarizing interim study findings and conclusions for review and comments prior to creation of final report. This should include:

- Issues with existing designs or construction practices
- Issues with site conditions or maintenance of facilities
- Recommendations for bioretention designs and design methodologies
- Recommendations for revised construction practices
Development of an anticipated hydrologic performance matrix based on multiple variables of design, soils, vegetation, etc. Target Date: April 2018

Deliverable 5.5: Meeting with Stormwater Work Group members, Ecology staff and City of Bellingham staff to discuss Technical Memo and provide feedback prior to final reporting.

Target Date: April 2018 or as determined by Ecology

Task 6, Final Report and Findings Communication
(\$10,000, January 1, 2017 - June 30, 2018)

1. This task is the provision of a final report that provides information on the totality of this project. Due to the uncertainty around the number of months needed for monitoring to capture a wide range of storm events, the target dates for the final report and communications are estimates, but all monitoring will be completed by the spring of 2018. The final report will at a minimum contain the following:

- Design Study Goals
- Selections Process
- A synopsis of the QAPP along with information on any necessary deviations from the proposed plan
- Study results from the monitoring with explanation of any uncharacteristic or any unexpected results.
- Site information for each of the facilities with location and photo. The information should include at a minimum: design performance versus actual performance, deviations between design and construction that led to the differential,
- Final recommendations from the technical memo and meetings in Task 5.

Deliverable 6.1: Electronic Draft Final Report for review and comments by Ecology, City of Bellingham and SWG. Target Date: January 2018

Deliverable 6.2: Presentation to the SWG. Target Date: January 2018

Deliverable 6.3: Three printed copies of Final Report, one electronic version of Final Report plus all data files, reports and miscellaneous data relevant to the project. Target Date: June 2018

Deliverable 6.4: Communication flyer and fact sheet for RSMP communications and website. Target Date: June 2018

Total project costs = ~~\$88,634~~ \$467,186.00