associated earth sciences incorporated

August 25, 2020

Stormwater Action Monitoring (SAM)
Washington State Department of Ecology Water Quality Program
300 Desmond Dr. SE
Lacey, Washington 98503

Attention: Keunyea Song, PhD
Brandi Lubliner, PE

Subject: Revised SAM Study: *Evaluation of the Long-Term Bioretention Soil Infiltration Rate Related to Vegetation, Maintenance, Soil media and Geotechnical Site Parameters*
Full Proposal #8 / LOI #13

Associated Earth Sciences, Inc. (AESI) is pleased to present our revised SAM study proposal titled "*Evaluation of the long-term bioretention soil infiltration rate related to vegetation, maintenance, soil media and geotechnical site parameters."* We have incorporated the valuable feedback provided by the proposal review team on the review spreadsheets and also discussed during a follow up meeting with the review team on August 12, 2020.

Our team, comprised of myself as the prime consultant and hydrogeologic/geotech lead; **Bill Taylor**, Principal Investigator; **Doug Beyerlein**, PE, hydrologic lead and **Anne Cline**, vegetation and maintenance lead, have focused our proposal, provided additional information on methods, and streamlined the work to reduce the cost, and included a "per-site" cost for consideration in reducing or expanding the scope of this proposal study.

We look forward to the opportunity to present our study at the upcoming September 16th SAM Study Selection Workshop. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Jennifer H. Saltonstall, L.G., L.Hg.
Principal Geologist/Hydrogeologist

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

Project Team Includes:

Lead:

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Detailed Scope of Work

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

1.0 PROJECT PURPOSE

This study is about bioretention lifespans and the intent is to conduct a point-in-time checkup on up to 50 older (10 years or older) bioretention facilities, and then communicate the long-range bioretention effectiveness to a broad base of NPDES jurisdictions. The results would be based on measuring on how well bioretention continues to perform (especially infiltration rate) and identifying what site characteristics are common for well performing or under-performing systems. It is not a study of hydrologic model parameters, continuous hydrologic performance, or water quality/chemistry.

This study will provide a controlled field study of infiltration rate and related site conditions to evaluate maintenance thresholds (Topic 16) for bioretention facilities and provide key performance information on stormwater control measures (Topic 11).

During the information gathering phase for the intensive bioretention hydrologic performance (BHP) phase I study, we heard anecdotal concerns from jurisdictions and designers about bioretention 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.

There are many facilities that are over 10-years-old and some in excess of 20-years-old. Performance and condition measurements after a decade or more of performance will provide valuable lifespan information. The objectives of this study are to:

- Assess bioretention lifespans and address practical questions about how quickly different sites age through facility infiltration rates, soil composition, vegetation and maintenance practices.
- Conduct a point-in-time checkup on up to 50 older (10 years or older) bioretention facilities. The key field data collected will be:
    - Field infiltration rates using standardized, repeatable procedures;
    - Overall condition including evidence of inlet efficiency, erosion, deposition, clogging, debris accumulation and overflow;
    - Geotechnical data including bioretention media thickness and composition (grain size, organic content); mulch layer presence, extent, and thickness; relative soil compaction; and subsurface geologic and groundwater conditions using hand-augered boreholes.

  - 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; and
  - Site and facility design information including estimated drainage basin area, impervious acreage, facility design specifics (age, BSM surface area, inlets, underdrains, outlets, ponding depth, assumed design rate).
- Communicate the long-range bioretention effectiveness to a broad base of NPDES jurisdictions. Information on infiltration rates, design, age, vegetation conditions, maintenance practices and geotechnical data can provide baseline information for better understanding of bioretention lifespans and considerations for benefit ratio and equivalent area when assessing stormwater impacts to our receiving waters.
- Gather a large dataset on different systems to understand the possible influence of the above factors on performance.
- Bioretention site documentation done in this proposed study can be used as a baseline for a potential follow-up study in another ten years (or so) to see how the sites continue to age over time.
- Provide guidance from an engineering perspective on what lessons we can learn studying these older sites; what are the critical factors to prevent bioretention site performance failure in future designs; and build confidence in the longevity of properly designed/constructed bioretention systems.

Previous field assessment of installed facilities (SAM Bioretention Hydrologic Performance [BHP] Studies I and II) demonstrated variability in infiltration rates, plant community (type, density), bioretention media composition, and soil compaction between facilities. However, these previous assessments generally did not assess the longevity of the hydrologic performance of the sites or how sites change over time.

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 continuous flow monitoring or modeling of the past projects.

2.0 PROJECT DESCRIPTION/SCOPE OF WORK

2.1 Study design and main project tasks

The project will measure field infiltration rate 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, 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 expectations 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 for monitoring due to dispersed inflow or other features which would impede monitoring. Because inflow/overflow monitoring will not be included as part of this study, those facilities may be suitable for inclusion in this study. 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 efforts 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. Bioretention performance is a function of many variables. Fundamental criteria affecting performance include the infiltration capacity of the imported bioretention soil media and any underdrain components, the infiltration capacity of the native

subgrade sediments, and the effects of shallow ground water inflow or mounding. Criteria that may affect bioretention longevity include vegetation composition and structure, maintenance practices, design features, and surrounding site use. Data collection will include but is not limited to:

- **Site and facility design information**. Review sites to identify fatal flaws in bioretention design/construction that prevent individual sites from performing as expected. Data reviewed will 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). The design will be compared with 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.
- **Vegetation data information.** Vegetation composition and structure, stem density of woody plants, and estimating the percent basal cover of herbaceous plants using quadrats. Plants will not be identified to the genus and species within the cell but the overall plant palette will be noted within the cell and if the plants appear to be installed or volunteered from the surrounding landscape. Also, we will try to generalize the overall wetland indicator status of the plants present in the cell The vegetation data will be analyzed with the infiltration rates to find if there is a correlation between vegetation type and the infiltration within the cells.
- **Maintenance Information.** Interviews will be conducted with maintenance personnel or managers on frequency and type of maintenance conducted and if the vegetation within the cell is maintained or the cell is only maintained for proper functioning, such as trash removal. Also we will note if the cell is irrigated. The type and frequency of maintenance will be correlated to the infiltration rates of the cells.
- **Shallow subgrade soil and groundwater information.** Representative samples of the bioretention soil media, underdrain aggregate (if applicable) and native subgrade sediments would be collected, classified in the field, and retained for additional testing as needed. A hand boring will be performed in the facility bottom and advanced to a depth of 8 to 10 feet or refusal. A detailed record of the observed subsurface soil, geology and ground water conditions will be made. The sediments will be described by visual and textural examination using the soil classification in general accordance with ASTM D2488, Standard Recommended Practice for Description of Soils. Hydrogeologic analysis and geologic unit assignment will be conducted to estimated infiltration capacity of the native subgrade sediments.
- **Field infiltration rates.** Large-scale in-situ infiltration measurements using either a controlled flood test or the Pilot Infiltration Test (PIT) is the preferred method for estimating the measured (initial) saturated hydraulic conductivity (K_{sat}) of the soil profile beneath the bioretention facilities. The PIT is not a standard test but rather a practical field procedure recommended by Ecology. Temporary staff gauges will be installed to measure ponding depth. A controlled flood test will be performed in the footprint of each bioretention facility

with a 5-hour pre-soak and 1-hour constant head test per the guidelines for a Large-Scale Test as described by Ecology. If available source water flow is not sufficient to fully pond across the facility, the soaking time will be increased by 1-hour and the wetted area will be regularly measured throughout the testing period to identify when the pool stabilizes. Following the constant head portion of testing, the water will be shut off and falling head data will be collected.

- **Temporary wellpoints to monitor groundwater.** Shallow ground water conditions are an important site variable. Temporary well points will be installed to measure the subsurface water during infiltration testing. The well points will be equipped with dataloggers and then used to obtain information on response to infiltration testing. This data would be compared to staff gauge water level data within the facility.
- **Conduct geotechnical laboratory testing on bioretention and native subgrade soils.** The bioretention media and native subgrade sediments will be further classified using geotechnical laboratory testing procedures. The bioretention media will be tested for organic matter content using the Loss on Ignition test method (ASTM D2974) to estimate the percent organic matter, and the burned material will then be sieved using the Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis (ASTM D6913). The native subgrade sediments will be sieved in accordance with ASTM D6913 test procedures. Hydrometer analyses will only be conducted if the native material is composed of greater than 15 percent (by weight) silt/clay. Each site will have 3 sets of lab testing completed.

Deliverable 3.1: Hydrologic review and summarize hydrologic/engineering facility design parameters in a memo report. Identify the critical factors that prevent bioretention site performance failure in future designs.

Deliverable 3.2: Geotechnical and hydrogeologic field data collection and memo report on facility conditions with individual reports for each facility.

Deliverable 3.3: Vegetation and maintenance 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 findings for web publication and six 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 six virtual presentations 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:

Lead:

Name(s): Jennifer H. Saltonstall, L.Hg.
Organization(s): Associated Earth Sciences, Inc.
Phone(s): 425-827-7701
Email(s): jsaltonstall@aesgeo.com

Team Members:

Name(s): Bill Taylor and Anne Cline
Organization(s): Raedeke Associates, Inc.
Phone(s): 206-525-8122
Email(s): btaylor@raedeke.com; acline@raedeke.com;

Name(s): Doug Beyerlein, P.E.
Organization(s): Clear Creek Solutions
Phone(s): 425-225-5997
Email(s): beyerlein@clearcreeksolutions.com

Municipal Partner: Eric Christensen, City of Olympia, Water Resources Director – Public Works
Phone: 360-570-3741
Email: echriste@ci.olympia.wa.us

4.0 PROJECT MANAGEMENT STRATEGY

See Task 1 for discussion of project management.

5.0 PROJECT BUDGET AND SCHEDULE

We have provided a time frame and budget 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

Total project costs for selecting and conducting field assessments of 50 bioretention sites are $614,159. We have also broken out a per-site field assessment cost as suggested by the review committee for narrowing or expanding the scope of data collection. Key project deliverables are summarized in the following table for Task 1 to Task 5, with the deliverable lead identified. 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. Detailed breakout of cost including hourly labor costs and other direct costs (travel, field supplies, water for testing or hydrant meter rental, and geotechnical laboratory testing) are included in the detailed budget attachment.

Summary Costs, Table of Task Deliverables and Team Lead(s)

Task and Key Deliverable Description		Lead Team Member(s)	50 Sites Cost
Task 1 Project Management			**$22,380**
1.1	*Prepare consultant scope and contract*	*Eric Christensen, Jennifer Saltonstall*	
1.2	*Quarterly progress reports*		
1.3	*Coordinate communication w/ Ecology, partner jurisdictions and consultants*		
Task 2 Study Design, QAPP Update and Selection			**$58,180**
2.1	*Summary meeting notes for Kick-off Meeting and Follow up meeting with Project Liaison and/or TAC*	*Bill Taylor*	*9,614*
2.2	*Draft QAPP*		*2,908*
2.3	*Comment Response and Final QAPP*		*921*
2.4	*Communication, Site Selection and Checklist*		*39,789*
2.5	*Site Selection Technical Memorandum*		*4,948*
Task 3 Field Assessment, Data Collection and Analysis			**$457,829**
3.1	*Hydrologic Design Review Technical Memorandum*	*Doug Beyerlein*	*24,820*
3.2	*Geotechnical Assessment and Facility Condition Technical Memorandum*	*Jennifer Saltonstall*	*301,894*
3.3	*Vegetation Assessment and Maintenance Survey Summary Technical Memorandum*	*Anne Cline*	*131,115*
Task 4 Summary Analysis and Report			**$43,922**
4.1	*SWG/Ecology meeting, summary notes to discuss initial results, adequacy, and analysis*	*Bill Taylor*	*4,408*
4.2	*Electronic Draft Report*		*28,250*
4.3	*Meeting and summary meeting notes for discussion of draft report prior to final report*		*8,564*
4.4	*Final report*		*2,700*
Task 5 Distribution of Findings			**$13,869**
5.1	*Stormwater Work Group Presentation*	*Full team*	*9,400*
5.2	*SAM Fact Sheet summary*	*Bill Taylor*	*656*
5.3	*Six virtual presentations*	*Full Team*	*3,813*
Summary of Cost			
	Total Project Cost – Labor and ODC		596,180
	3% Contingency		17,979
	Total Project Cost with 3% Contingency		**$614,159**
	Task 3 Per site cost – $7,602 labor + $1,554 ODC		**$9,157**

ODC = Other direct costs, which include mileage, cost of water supply for infiltration testing, geotechnical laboratory testing (sieves and organic matter content) and field supplies including temporary well point, staff gauge, mounting hardware, flow metering and datalogger equipment.

					Principal		Hydrologic Design		Hydro/Geotechnical Assessment					Plant Community and Maintenance					
Long-Term Bioretention Study (LOI #13)		Olympia			Investigator		Clear Creek Soln		Associated Earth Sciences, Inc.					Raedeke Associates					
	Detailed scope of work and budget	PM	Finan.	Mngt	Lead		Consultant		Principal	Sr. Staff/	Staff	WP		Senior	Lead	Field II	Field I		Labor
					$164		$200		$205	$110	$95	$60		$222	$164	$116	$103		Subtotal
Task 1	Project Management																		
1.1	Prepare consultant scope and contract								*8*										
1.2	Prepare quarerly progress reports (15 months, 5 reports)								*50*			*4*							
1.3	Coordinate communication w/ Ecology and partner jurisdictions and consultants								*50*										
	Task 1 subtotal												$22,380						$22,380
Task 2	Study Design, QAPP Update and Site Selection																		
2.1	Planning meetings and Project Liaison or TAC, Summary Meeting Notes				*18*		*8*		*18*			*1*			*8*				
2.2	Update Quality Assurance Project Plan (QAPP)				*8*		*0*		*4*			*2*			*4*				
2.3	Develop site selection criteria checklist				*4*		*0*		*1*			*1*							
2.4	Site selection communication; doc organization; visit sites				*155*		*2*		*20*	*80*		*2*			*2*				
2.5	Site selection summary TM				*15*		*2*		*8*			*2*			*2*				
	Task 2 subtotal					$32,800		$2,400					$19,735					$2,624	$57,559
Task 3	Field Assessment, Data Collection and Analysis																		
3.1	Hydrologic review and memo report						*120*		*4*										
3.2	Geotech assessment and memo report								*105*	*1175*	*800*	*10*							
	-site/regional soil/geo review, data sheet creation								10	50	0	0							
	-hydrant meter/water supply requests - 50 sites								10	50	0	0							
	-access/locate site visit, pick up hydrants/water supply parts								10	0	200	0							
	-50-sites: infiltration test, geotech augers, wellpoints								25	400	600	0							
	-laboratory testing: grain size and organic matter testing									25									
	-Data analysis/report: test data, lab data reduction, compilation								50	400									
	-Site maps (3 per site) - USGS topo, aerial subbasin, facility aerial/sketch									200									
	-Compile facility testing data, summary memo, composite tables									50		10							
3.3	Vegetation assessment and maintenance survey memo report								*4*					*20*	*300*	*500*	*150*		
	-Field													0	200	300	150		
	-Report								2					20	100	200	0		
	Task 3 subtotal					$0		$24,000					$229,015					$127,090	$380,105
Task 4	Summary Analysis and Report																		
4.1	SWG/TAC meeting and prep, Summary meeting notes				*8*		*4*		*8*						*4*				
4.2	Analysis and Draft report				*104*		*10*		*18*	*24*		*4*			*16*				
	-Format collected performance data for site comparison/ SWG meeting				8		6		6	24					6				
	-compare geotech data, veg data, maintenance data, design data				24				6						6				
	-Identify result differences				16														
	-Produce summary comparisons				16														
	-draft report				40		4		6			4			4				
4.3	Summary meeting notes, discuss draft, inc SWG/Ecology edits to draft report				*24*		*8*		*12*			*4*			*2*				
4.4	Final Report				*10*				*4*			*4*							
	Task 4 subtotal					$23,944		$4,400					$11,970					$3,608	$43,922
Task 5	Distribution of Findings																		
5.1	Prepare and Present Findings to the SWG				*24*		*6*		*16*						*6*				
5.2	Two-page summary for SAM Fact Sheet				*4*														
5.3	Virtual presentations - coordinate with 6 organizations				*12*				*9*										
	Task 5 subtotal					$6,560		$1,200					$5,125					$984	$13,869
	Total Hours				386		160		339	1279	800	34		20	344	500	150		
	total hours * rate					$63,304		$32,000					$288,225					$134,306	$517,835
	Total Labor	$517,835			*Task 3 Per site cost - labor*		*$7,602*												
	Total ODC's	$78,345			*Task 3 Per site cost - ODC*		*$1,554*												
	Grand Total	$596,180			*Task 3 Per site cost - total*		*$9,157*												