SYNTHESIS OF STREET SWEEPING RESEARCH & PRACTICES

GUIDING PROGRAM DEVELOPIMENT & IMPLEMENTATION

LOI# 12
Stormwater Action Monitoring
Round 4 Proposal

May, 31 2023

SAM
Stormwater Action Monitoring

WASHINGTON STORMWATER CENTER

EVERGREEN STORMH2O

Prepared by the Washington Stormwater Center (WSC) – Washington State University (WSU) in partnership with Evergreen StormH2O (see letter of commitment, last page of this document).

WSU is committed to completing the proposed scope of work on budget and on time.

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Washington State University
May 31, 2023

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PROJECT PURPOSE

Requirements to develop and implement a street sweeping program (no later than July 1, 2027) are anticipated in the Operations and Maintenance Section of the Phase I and II 2024-2029 Municipal Stormwater Permits (MS4) Permits. While considerable research has been conducted on street sweeping, there is no Washington MS4 Permit specific synthesis of pollutants and overall street sweeping effectiveness, including emerging issues or where gaps exist, nor is there a document to assist Permittees with developing or expanding a street sweeping program. From discussions with Permittees, we understand that additional guidance would be helpful to support compliance with the new MS4 Permit requirement. **The goal of this project is to develop a guidance manual that will provide Permittees with information and tools that they can use to assist with developing and/or improving their street sweeping program to support meeting their MS4 permit requirements.** This information could also be used to support other clean water initiatives such as the Puget Sound recovery efforts.

Note: Comments provided by the SAM Study Selection Subgroup on our team's letter of interest (LOI) included reviewing and building on previous reports, identifying sources of information, and creating a more detailed guidance manual outline. Those comments were used to shape and focus ~~out~~ our study goal and approach as described in this proposal.

PROJECT DESCRIPTION

Our approach to achieve the project goal begins with building on a literature review and policy discussions initiated by the Street Sweeping Technical Sub-Group to evaluate street sweeping effectiveness. This group included members from Puget Sound Partnership, Seattle Public Utilities, City of Tacoma, Ecology, Washington State Department of Transportation (WSDOT), USGS, GeoSyntec, and WSC. Originally the group focused on reducing toxins in fish. The technical advisory team then recommended expansion to all pollutants affecting receiving waters. This study will refine and expand the existing literature review started by the sub-group to collect and analyze information and data that will be used to address the topics needed to develop the guidance manual content (see the **Table 1** guidance manual conceptual outline) such as those shown below.

- Street sweeping effectiveness studies including the quantity and particle size of solids removed and pollutant characteristics.
- Program management decisions such as understanding differences in street waste characteristics based on roadway/parking lot classifications and average annual daily traffic (AADT).
- Equipment differences (function, cost, efficacy, sharing).
- Methods for determining o~~O~~ptimal sweeping frequency, etc.
- How climate conditions and other site conditions may impact program efficiency.
- How to estimate the amount of waste generated.
- Methods for disposing of waste, including reuse if possible.
- Estimating the number and size of decant facilities needed.

The information needed to develop the manual will start with the literature review and analysis developed by the advisory group (see **Table A1**) which will be expanded as part of the SAM project. In addition, the WSC has collected an extensive library of resources including removal effectiveness based on particle size and pollutant, conceptual models, and program characteristics. The project team will also identify and survey/interview Permittees (voluntarily) in Washington State (Task 2), and elsewhere if appropriate, who have street sweeping programs, to glean information on their programs. This information will be used to help shape the manual content and make the information more usable. The literature review will include identifying other street sweeping manuals or program information both locally and nationally for information useful to include in the manual.

Suggestions from the SAM Study Selection Sub-group on the LOI included reviewing sources such as the Herrera decant study, CASQA, and Tacoma Heat Maps. This project will embark on filling some of the gaps identified in the Herrera study and update the information if appropriate. ~~The~~ CASQA ~~is~~ has a searchable database with links to information on relevant topics which will be used in the literature search to identify appropriate articles for this project. The Tacoma Heat Map is currently in development. This information could be used directly or as an example to assist with developing an effective program. The team will also search for other online tools developed for street sweeping programs that we could use or build upon to develop the guidance manual content.

Communication Plan - The WSC will develop a webpage to host the manual documents. The webpage will be updated during the manual development posting draft chapters for review and comment and final chapters upon completion. The WSC shall check in with permittees' operation staff and the ROAD Map group to determine if updated resources are required near the end of the 2024-2029 permit cycle. If updates are required, WSC staff will pursue funding to implement the identified needs. This may also include addressing research gaps identified during this study (see next paragraph).

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Key Deliverables anticipated from this project include a guidance manual as well as a summary of research gaps and recommendations for future research. **Table 1** provides an overview of the proposed guidance manual contents. The target audience for this document is staff who develop, manage, and/or implement street sweeping programs. The research gap document will summarize the research gaps identified during the literature review and provide recommendations for future research that can be used to assist with identifying future street sweeping research priorities.

The **Technical Advisory Committee** (TAC) will play an integral role in providing input on the study plan and deliverable content. We plan to include a balance of TAC members that are part of the target audience for the guidance manual along with practitioners who have experience in establishing or managing a street sweeping program. The TAC's experience will help the team deliver a manual that is as useful and informative for the target audience.

Table 1. Street Sweeping Guidance Manual Concept Outline
CHAPTER 1. MANUAL INTRODUCTION *Purpose: Describe the manual's intended use and audience, relevant permit requirements, background on why the manual was developed, and an overview of the manual organization and content.*
CHAPTER 2. STREET SWEEPING WATER QUALITY BENEFITS *Purpose: Summarize the impacts that street waste can have on water quality and the benefits street sweeping can provide to reduce those impacts.*
CHAPTER 3. IDENTIFYING HIGH PRIORITY AREAS *Purpose: Provide guidance to assist Permittees in identifying their specific high priority areas for their street sweeping program using information from Chapter 2 and available jurisdictional information.*
CHAPTER 4. ESTABLISHING AND IMPROVING STREET SWEEPING PROGRAMS *Purpose: Introduce street sweeping program elements; guidance for defining program goals, starting new programs, and right sizing street sweeping programs; selecting equipment; and developing/selecting a defendable way to assess and measure program benefits. Guidance for how to establish and organize multi-department collaborations that support street sweeping programs.*
CHAPTER 5. OPTIMIZING STREET SWEEPING PRACTICES *Purpose: Provide guidance for designing sweeping routes, improving efficiency/efficacy of existing programs including instructions for collecting data, and variables that may influence efficiency/efficacy. This chapter will also include guidance for developing performance measures for street sweeping activities.*

Table 1. Street Sweeping Guidance Manual Concept Outline
CHAPTER 6. DOCUMENTING AND TRACKING STREET SWEEPING ACTIVITIES *Purpose: Provide guidance for documenting and tracking sweeping activities to assist Permittees with MS4 Permit compliance and tracking program costs.*
CHAPTER 7. DISPOSING OF STREET SWEEPING WASTE *Purpose: Provide guidance for estimating the quantity of waste generated from street sweeping based on specific jurisdictional conditions (i.e., road-miles, sweeping frequency, land use, traffic volumes, climate, tree-cover, etc.). The guidance will be used to develop a spreadsheet that Permittees can use to input jurisdictional conditions to estimate the amount of waste generated and another that estimates the number and size of decant facilities needed. Considerations will be provided for disposal locations and planning for designing/constructing/operating a decant facility.*
CHAPTER 8. COST CONSIDERATIONS FOR ESTABLISHING AND MAINTAINING PROGRAMS *Purpose: Provide guidance for estimating street sweeping program costs using information collected by the jurisdiction or information collected from literature/surveys (for jurisdictions without data). This will include developing a spreadsheet for conducting a lifecycle cost estimate and projecting costs based on growth. Information about potential funding sources will also be provided.*
CHAPTER 9. OTHER CONSIDERATIONS *Purpose: Discuss topics that do not fit in other chapters, but Permittees may need to know when implementing a street sweeping program (e.g., emerging contaminants, when/why to test waste, etc.)*

SCOPE OF WORK

TASK 1. PROJECT ADMINISTRATION AND MANAGEMENT

This task focuses on providing project administration and management, which is expected to include tracking and reporting project costs; developing, managing, and adjusting the project schedule as needed; preparing quarterly progress reports and invoices; and general project communications and coordination between WSC and the Consultant. As noted in **Table 7** (Preliminary Project Schedule) on Page 10, the expected duration of this proposed project is ~~eighteen~~ twenty-four months from the date funds are available. More details about work anticipated for this task are included in the Project Management Strategy Section of this proposal on Page 10.

Table 2. Task 1 Deliverables and Target Completion Dates

Deliverable	Cost	Target Date
D1.1 1st Quarterly Status Report	$6,852.22	2 weeks after Each quarter ends
D1.2 2nd Quarterly Status Report	$6,852.22	
D1.3 3rd Quarterly Status Report	$6,852.22	
D1.4 4th Quarterly Status Report	$6,852.22	
D1.5 5th Quarterly Status Report	$6,852.22	
D1.6 6th Quarterly Status Report	$6,852.22	
D1.7 7th Quarterly Status Report	$6,852.22	
D1.8 8th Quarterly Status Report	$6,852.22	
D1.~~7~~ 9 Draft Project Fact Sheet with links to relevant manual sections	$2,000.20	End of 6th quarter
D~~1.8~~ 1.10 SWG Presentation	$2,377.00	
Total	**$~~45,490.50~~59,195**	

TASK 2. MANUAL PLANNING

The focus of this task is to create ***an actionable plan for developing the Manual*** that defines the entire Manual content, formatting and organization, Manual development schedule, and all sources of information that will be used to develop the Manual content. This will include advancing the conceptual outline shown in **Table 1** to the detailed outline that includes a table of contents, overview of the content plan for each chapter, possible appendices, and identifies the sources of information that will be used to develop the Manual content. During the Task 5 TAC Kick-off meeting, the TAC will be consulted on the action plan content which is expected to include: how success will be measured, the Manual vision and contents, formatting and organization, additional sources (not in **Table A1**) to support manual development, and identifying available data/information (e.g., street sweeping program costs, O&M plans, equipment information; street sweeping and decant studies; templates/forms that could be used as examples, etc.). Permittees will also be identified to interview to develop case studies and/or lessons learned that could be included in the manual. Input on these topics will also be collected through a statewide survey and by attending stormwater workgroup meetings.

The preliminary project schedule will be finalized under this task based on when the project contract is executed which will include the manual development timeline, scheduling TAC meetings, and identifying when TAC engagement will be needed to provide reviews and comment on the project deliverables.

A comprehensive list of sources will be developed during this task that is organized by which specific chapter they will be used to develop and into categories for how they will be used (e.g., case study, lessons learned, examples, templates, etc.). **Table A1** is a list of resources that was developed from sources collected by the Street Sweeping Technical Sub-group which will be expanded as part of this task. The final list will also identify Permittees to contact about interviews.

Table 3. Task 2 Deliverables and Target Completion Dates

Deliverable	Cost	Target Date
D2.1 Develop Statewide Survey & SW Workgroup Meeting Questions	$8,287.37	1st quarter
D2.2 Statewide Survey & SW Workgroup Meetings: Attend Meetings; Analyze & Summarize Results	$15,531.95	
D2.1 Manual Development Schedule & Vision Statement	$5,274.47	1st-2nd quarter
D2.2 Develop Draft Detailed Outline	$9,775.64	
D2.3 Develop Final Detailed Outline	$4,846.55	
D2.4 List of Permittees to interview & Manual Sources	$9,712.90	
Total	**$~~29,609.55~~53,428.88**	

TASK 3. MANUAL DEVELOPMENT

This task will focus on ***implementing the action plan*** completed in **Task 2** to develop the Manual content. This includes hours to review and synthesize sources identified as part of **D2.4** that will be included in the manual. Budget is also included to conduct interviews to develop case studies, lessons learned, or better understand a Permittee's program which will be used to clarify the information presented in the Manual. The project team will develop a draft Manual based on the Task 2 final outline.

During development of the Manual, we will use an elicitation approach through the process, using the perspectives and skills of the TAC, to help inform questions and framing approaches to optimize the usability of the Manual itself. Attention will also focus on the use values of the users, focusing on

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articulated barriers, to ensure the Manual addresses those barriers to the extent possible. Barriers that cannot be addressed in the Manual itself will be referred to programmatic problem solving into the near future (at WSC, with Ecology).

The Manual will be developed in the order in which sections appear in **Table 4** with three chapters being developed simultaneously. It is possible to develop these chapters at the same time because there will be multiple authors who will be working under the direction of the project manager to write the chapters. A draft of each chapter will be developed and submitted to the TAC for a two-week review period. A TAC meeting will be scheduled at the end of the two-week review to discuss the TAC comments. Following the meeting, TAC comments will be incorporated into the draft. Each chapter will also be reviewed by a technical editor to correct grammatical errors and improve the overall clarity of the writing. The final work under this task is compiling the Manual into one document.

During the literature and synthesis, gaps identified will be summarized (**D3.10**) along with recommendations for future research.

Table 4. Task 3 Deliverables and Target Completion Dates

Deliverable	Cost	Target Date
D3.1 Draft Chapter 1, 2, & 3; TAC Comment responses	$36,814.76	2nd quarter
D3.2 Final Chapter 1, 2, & 3	$7,773.13	
D3.3 Draft Chapter 4, 5, & 6; TAC Comment responses	$36,814.76	3rd quarter
D3.4 Final Chapter 4, 5, & 6	$7,773.13	
D3.5 Draft Chapter 7, 8, & 9; TAC Comment responses	$36,814.76	4th quarter
D3.6 Final Chapter 7, 8, & 9	$7,773.13	
D3.7 Draft Complete Manual; TAC Comment responses	$15,873.42	5th quarter
D3.8 Final Published Manual	$12,813.82	
D3.9 Final Manual Posted to WSC website	$262.89	
D3.10 Research Gaps/Research Recommendations	$5,762.87	
Total	**$168,476.68**	

TASK 4. MANUAL TRAINING

This task focuses on developing and implementing an online training program that provides an overview of the Manual content and guidance for how to use the Manual. The training will consist of a standardized curriculum and an online workshop. The workshop will be recorded and posted on the WSC website to provide just-in-time training when Permittees are ready to use the information. The training will be organized by chapter and a recording for each chapter will be developed so Permittees can attend the training on just the chapters they are interested in.

The training curriculum will be developed in three parts. A draft outline will be produced and submitted to the TAC for review. Comments received from the TAC will be incorporated into the draft to produce the final outline. The project team will develop the draft curriculum based on the final curriculum outline. The draft will be submitted to the TAC for a two-week review period. A TAC meeting will be scheduled at the end of the two-week review period to discuss the TAC comments. Following the meeting, TAC comments will be incorporated into the draft to produce the final curriculum. The training workshop will be delivered and recorded using an online platform such as Team or Zoom.

Table 5. Task 4 Deliverables and Target Completion Dates

Deliverable	Cost	Target Date
D4.1 Draft Training Outline	$8,090.49	6th quarter

D4.2 Final Training Outline	$3,358.29	
D4.3 Draft Training Curriculum	$18,061.97	
D4.4 Final Training Curriculum	$5,726.57	
D4.5 Implement & Record Online Training	$7,415.62	
D4.6 Training Posted to WSC Website	$262.89	
Total	**$42,915.83**	

TASK 5. TAC COORDINATION

This task focuses on managing and coordinating with the TAC. The TAC will play an integral role in this project starting with a kick-off meeting where their input will shape the Manual vision to support the development of an informative and useful resource. A total of six online TAC meetings are planned which will focus on finalizing the Manual outline (**Table 1)** and providing feedback throughout the Manual development on project deliverables. Work on this task also includes assembling a TAC of 12 to 15 members consisting of primarily Permittees with one or two Ecology staff members. The goal is to assemble a TAC with members representing all three MS4 Permits who have experience in developing and/or implementing street sweeping programs. Budget has also been included for the project team to prepare for and facilitate meetings with the TAC. Individuals who have agreed to be on the TAC are shown in **Figure 1**.

Table 6. Task 5 Deliverables and Target Completion Dates

Deliverable	Cost	Target Date
D5.1 List of TAC Members	$1,515.77	1st month of project
D5.2 1st TAC Meeting Agenda's & Meeting Notes	$4,621.07	Each quarter
D5.3 2nd TAC Meeting Agenda's & Meeting Notes	$4,621.07	
D5.4 3rd TAC Meeting Agenda's & Meeting Notes	$4,621.07	
D5.5 4th TAC Meeting Agenda's & Meeting Notes	$4,621.07	
D5.6 5th TAC Meeting Agenda's & Meeting Notes	$4,621.07	
D5.7 6th TAC Meeting Agenda's & Meeting Notes	$4,621.07	
D5.8 7th TAC Meeting Agenda's & Meeting Notes	$4,621.07	
D5.9 8th TAC Meeting Agenda's & Meeting Notes	$4,621.07	
Total	**$~~29,242.22~~38,485.54**	

Figure 1. Identified TAC Members

Shelly Basketfield, PE, Seattle Public Utilities Jeremy Graham, Olympia, Don McQuilliams, Bellevue, Jackie Caldwell, Vancouver, Grant Gilmore& Steve Craig, Tumwater, Angela Gallardo, Jim Crawford, Brent Dhoore, King county, Rhea Smith, Ecology Art Jenkins, PE, Ecology ERWO Stormwater Staff, Snohomish County Larry Schaffner, Thurston County

PROJECT TEAM DESCRIPTION

Our team includes staff from Washington Stormwater Center (WSC) and Evergreen StormH2O. The project team combines extensive experience studying stormwater problems and developing solutions that meet regulatory requirements. **Laurie Larson-Pugh** has experience coordinating with Permittees to support their permit compliance, working with multidisciplinary groups, and is active in national stormwater organizations providing her with connections to a wide range of resources that will support the guidance manual development. **Heidi Siegelbaum's** work focuses on policy and program

development. She takes an interdisciplinary approach to problem solving and her perspective from involvement in multiple regional environmental steering committees, technical advisory committees and stormwater advisory groups will support development of guidance manual that considers the bigger picture of receiving water recovery efforts. **Aimee Navickis-Brasch, PhD, PE** has extensive experience in stormwater research, design, planning, and policy development, which she utilizes as an applied researcher to develop solutions that can be applied to meet MS4 Permit requirements.

The WSC, as the designated stormwater center for the State of Washington (RCW.90.48.545), has built an integrated stormwater program over the past 13 years. As a partnership between Washington State University and the University of Washington, the WSC's primary mission is to provide stormwater leadership through research, education, and training. The WSC works with a diverse array of partners from federal agencies to state agencies to local entities.

Faculty at WSC have conducted award-winning research in stormwater runoff toxicology, and effective stormwater treatment practices that are widely published and accessed internationally. In addition, WSC staff work closely with several municipalities and have become the central point for stormwater research, technical and educational information to ensure these stormwater permittees successfully comply with stormwater permits. WSC prides itself in providing information that meets the rigorous academic and peer-review standards of a large-research university.

WSU's land grant mission ensures that WSC's primary responsibility is the community and the people of the state of Washington. This mission was recently articulated in the university's strategic plan as:

- Educating all people regardless of means or background;
- Performing scholarly activities that benefit the public and Washington residents; and
- Sharing our expertise and positively impacting people and communities.

WSC's role in this project will be to ensure that the same rigor and peer review standards that we currently use are applied to this project. As an independent entity, we can provide a level of transparency and independence in how the information for this project is analyzed and synthesized. In combination with our sub-consultant, we have the requisite skills and staff to complete this project satisfactorily and inform the State of Washington's future stormwater permits and design manuals. WSC's role will also be to ensure the draft results from the 2-year Street Sweeping Technical Sub-group designed to address water quality issues within Puget Sound recovery, are used responsibly.

Evergreen was established in 2015 as NB Engineering, LLC, and in 2022 we adopted the trade name Evergreen StormH2O. We specialize in municipal stormwater management: research, MS4 Permit compliance support, planning, and design. Our team leads all have working knowledge of stormwater regulatory requirements and frequently work with Ecology and permittees state-wide on all types of stormwater projects including conducting research that is utilized to develop standards, guidance, and templates permittees can use to support and demonstrate compliance with regulatory requirements. This close working relationship and diverse stormwater project experience provides us with a big-picture understanding of stormwater management, allowing our staff to assess how different project solutions can benefit our clients. Our proactive solutions aim to address emerging issues and support the sustainability of our work products long after our work is complete. Our team also incorporates a community-based participatory approach where we work collaboratively with clients, stakeholders, and regulatory agencies, respecting their autonomy and unique insights, to produce project results that inform practical applications.

KEY TEAM MEMBERS

Abbreviated resumes for key team members are included on the following pages along with their

anticipated project roles. The project team is organized with the intent of providing collaboration and support across project team members and tasks to ensure a continuity of the project work.

LAURIE LARSON-PUGH | Project Role: WSU Project Manager and TAC Lead; lead for coordinating with MS4 Phase I & II Permittees and regional coordinator groups to assist with data collection and interviews.

Education: BS in Landscape Architecture, Washington State University

Licenses/Registrations: CESCL Certification

Qualifications: For 12 years, Laurie Larson-Pugh has managed the WSC's (WSC) Permit Assistance Stormwater Program for Municipal, Industrial, and Construction General Permits. Laurie has provided products, tools, and training resources that Permittees can use to support successfully managing stormwater and staying in compliance with their municipal permits. She also co-coordinates five regional stormwater groups, including the Regional Operations and Maintenance Program (ROAD Map) group.

Past Project Performance:

- **SAM funded Source Control Business Inspection Guidance Manual and Training.** This project created a resource for WWA Phase II Permittees to support meeting their permit requirement S5.C.8. Laurie served as the program project manager, organized, and coordinated the TAC, and organized the in-person business source control inspection training sessions.
- **Evaluating Effectiveness of Stormwater E&O: Permittee Guidance for Addressing Challenges through Behavior Change**, *Ecology*. As the TAC lead for this SAM funded study, Laurie assembled TAC members, organized meetings, and facilitated coordination between the TAC and project team.
- **Washington Statewide Municipal Stormwater Conference (MuniCon).** Organization and Implementation of the five MuniCon conferences. Manages the development, execution with the municipal planning team, close-out, budget management and reporting.

HEIDI SIEGELBAUM | Project Role: WSU Project Technical Advisor for Tasks 2, 3, and 4; Lead for bridging previous Street Sweeping Sub-group work and approaches with this SAM Project.

Education: Juris Doctorate, Vermont Law School; B.S. Politics and Psychology, Ithaca College; Certificate in Industrial Ecology, Portland State University

Licenses/Registrations: Previously licensed to practice law in Massachusetts and Federally

Qualifications: Science communicator with 30 years of bridging science and engineering fields with tailored audiences to advance environmental policy, collaboration, and change. Senior Performance Analyst for the Washington State Department of Ecology and currently serving as the WSU lead for the Stormwater Strategic Initiative Lead Team leveraging work on the PSEMP Steering Committee to advance resonant science. Managed Salish Sea Transboundary Indicator Process for 4 years.

Past Project Performance:

- **Puget Sound Partnership's Technical Street Sweeping Group.** Heidi served as the group co-manager which conducted early street sweeping literature searches, best practices in program development and gaps in understanding. She also connects permittee issues with efforts to support BMPs that reduce exposures to aquatic species under the Toxics in Aquatic Life Implementation Strategy.
- **Puget Sound Ecosystem Monitoring Program (PSEMP).** Heidi served on the Steering Committee and Communications Subcommittee providing program, policy, and communications advice on a range of topics. Heidi links Stormwater and Toxics Work Group issues with Spatial Data, Modeling, and other Work Groups to enhance shared, collaborative work and more effective outcomes.
- **Stormwater Strategic Initiative Lead Team.** As the Washington Stormwater Center Representative for this ongoing project, Heidi ensured WSC research and approaches are shared and utilized, Puget Sound

recovery work is linked back to WSC's portfolio, and support policies and research that advance BMPs that protect aquatic resources while supporting Permittee needs.

AIMEE NAVICKIS-BRASCH, PhD, PE | Project Role: Evergreen StormH2O Project Manager (PM) and Tasks 2-4 Lead; provide consultant team technical support and guidance manual supporting author.

Education: PhD, Civil Engineering, University of Idaho; MS, Civil Engineering, Washington State University; BS, Mechanical Engineering, Gonzaga University

Licenses/Registrations: Civil Engineer, WA #45258; Gonzaga University Adjunct Civil Engineering Professor

Qualifications: Aimee has over 29 years of water resources and environmental engineering experience with specialized expertise in stormwater management research, planning, design, MS4 Permit compliance support, and technical training. She has a comprehensive understanding of both regional and national stormwater regulations and practices and was the lead/supporting author for several stormwater design/guidance manuals. Aimee has also designed, conducted, and directed stormwater effectiveness studies for Structural, Operational, and Educational BMPs to support Permittees in meeting requirements for MS4 Permit S8. Monitoring and Assessment. She understands how research informs policy and has successfully used research results to justify stormwater policy changes.

PAST PROJECT PERFORMANCE:

- **Street Sweeping vs. Catch Basin Cleaning Effectiveness Study**, *City of Ellensburg*. As the PM/PI, Aimee led the development of the Ecology-approved QAPP, and technical evaluation report (TER) including recommendations for catch basin inspection/cleaning frequency based on street sweeping frequency.
- **Stormwater Structural Controls (SSC) Project Science Review & Synthesis Project**, *City of Tacoma*. As the PM, Aimee led a team of stormwater specialists and a TAC, to develop a white paper that was used to inform policy discussions for SSC requirements in the MS4 Permit 2024-2029 reissuance.
- **Effect of Particle Size Distribution (PSD) on Stormwater BMP Effectiveness**, *DNR & Ecology*. As the PM for this SAM funded study, Aimee led a literature search/synthesis, data analysis, and whitepaper development that provides Permittees guidance with selecting BMPs based on what is known about PSD, recommendations for PSD measurement methods, and a summary of research gaps.

FRANCESCA WHITE, PE | Project Role: Evergreen StormH2O Deputy Project Manager and lead author.

Education: MS & BS, Civil Engineering, Water Resources Focus, University of Washington

Licenses/Registrations: Civil Engineer, WA #54969; Low Impact Development Certification

Qualifications: Francesca has 11 years of experience in water resources, specializing in MS4 Permit compliance, planning, and design. She regularly supports Permittees to meet their MS4 Permit requirements including developing Source Control programs, O&M Plans, Stormwater Management Action Planning (SMAP), ordinance updates, selecting asset management programs for municipalities, and mock audits. She also has experience conducting and synthesizing literature searches as well as working collaboratively with TACs to develop guidance manuals, report templates, and training material.

Past Project Performance:

- **Stormwater Management Guidance Manual: Strategies for Privately Owned BMPs,** *Yakima County*. As the lead author, Francesca wrote the manual, conducted literature searches, interviewed Permittees, and developed training materials. The manual provides Phase II Permittees guidance to develop/improve their inspection, maintenance, and enforcement program, customized to their jurisdiction's goals.
- **Evaluating Effectiveness of Stormwater E&O: Permittee Guidance for Addressing Challenges through Behavior Change**, *WSU & Ecology*. As the deputy PM and supporting author for this SAM funded project, Francesca assisted with developing a report template and evaluation guidance manual including

conducting interviews/surveys with Stormwater E&O Leads and Ecology to develop the documents vision; and a literature review of best practices for evaluating/reporting on behavior change campaigns.
- **Comprehensive Stormwater Plan & Rate Study**, *City of Moses Lake*. As the deputy PM and compliance lead, Francesca led the development of an O&M Plan including multiple Facility SWPPPs and conducted a mock audit to evaluate the City's compliance with their MS4 Permit and the UIC Rule.

TAYLOR HOFFMAN-BALLARD, PE | Project Role: Evergreen StormH2O guidance manual supporting author and support conducting literature reviews; lead for developing Task 3 research gaps/recommendations document as well as decant sizing and lifecycle cost estimate tools.

Education: BS, Bioproducts & Biosystems Engineering, University of Minnesota, Twin Cities

Licenses/Registrations: Civil Engineer, WA #57629; Stormwater Practices Inspection & Maintenance Certification; Gonzaga University Adjunct Civil Engineering Professor

Qualifications: Taylor has 9 years of experience, specializing in applied stormwater research, MS4 Permit compliance, and planning. Taylor's research projects have included structural, operational, and educational BMPs including conducting detailed literature searches; developing QAPPs, surveys, and interview questions; analysis of quantitative and qualitative data sets; and synthesis of study results in the form of technical reports and fact sheets. Taylor regularly coordinates with maintenance staff on projects to ensure the BMP selection and lifecycle are incorporated into project planning.

Past Project Performance:

- **Street Sweeping vs. Catch Basin Cleaning Effectiveness Study**, *City of Ellensburg*. As the study lead, Taylor assisted with developing an Ecology-approved QAPP and the TER which included data collection and analysis as well as literature review and synthesis.
- **Stormwater Treatment of Tire Contaminants,** *Osborn Consulting & Ecology***.** As the BMP research lead, Taylor developed/applied a qualitative evaluation criteria to over 150 BMPs to assess their potential for reducing 6PPD/6PPDq toxicity. Taylor's work included an extensive literature search, coordinating with subconsultants and a policy advisory group to develop the criteria and assist with writing the final report.
- **BMP Inspection & Maintenance Responsibilities: Privately Owned Facilities Effectiveness Study,** *Yakima County.* As the Deputy PM and Study Lead, Taylor assisted with developing the Ecology approved QAPP, TER, and survey/interview questions; collected responses from Pacific Northwest Permittees, analyzed data, and conducted a literatures search. Study findings were used to justify the development of a guidance manual for privately owned BMPs.

PROJECT MANAGEMENT STRATEGY/PROJECT BUDGET AND SCHEDULE

Laurie Larson-Pugh will serve as the primary point of contact and Project Manager including preparing and submitting deliverables, developing status reports, and budget documents. She will lead monthly project check-in meetings via webinar with the project team. The project will begin with an initial two-hour kick-off workshop (TAC Meeting #1) with WSC and Consultant Key Staff to:

- Refine the guidance manual vision and outline.
- Finalize the manual development schedule including TAC review periods.
- Identify sources to include in the project literature search including staff to interview.
- Define communication protocols and process for reviewing deliverables.

The team will utilize proven internal controls to ensure a streamlined delivery of on-budget and on-schedule tasks throughout the duration of this project. Laurie/WSU will use its accounting software to keep track of staff expenses and sub-contractor billing and tracking sheet to manage deliverable timelines. WSU has many years of experience successfully working with large, data-related projects. In addition, the team will utilize standardized templates and tools for collecting and managing data to

ensure consistency across all team members. We will develop a project folder on a secure shared WSU site that provides our team, Ecology, and the TAC access to the collected information and project deliverables. We will use a comment/response table that outlines a consistent format for comments and tracking responses.

Our proposed project schedule and budget, broken down by Task, are shown in **Table 7** and **Table 8**, respectively. Costs for each deliverable can be found within the Scope of Work section on Pages 3-6.

Table 7. Preliminary Project Schedule

Tasks	Q1-24			Q2-24			Q3-24			Q4-24			Q5-25			Q6-25			Q7-25			Q8-25		
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1. Project Management																								
2. Manual Planning																								
3. Manual Development																								
4. Training																								
5. TAC Coordination																								

~~Tasks~~	~~Q1-2024~~			~~Q2-2024~~			~~Q3-2024~~			~~Q4-2024~~			~~Q5-2025~~			~~Q6-2025~~		
	~~J~~	~~F~~	~~M~~	~~A~~	~~M~~	~~J~~	~~J~~	~~A~~	~~S~~	~~O~~	~~N~~	~~D~~	~~J~~	~~F~~	~~M~~	~~A~~	~~M~~	~~J~~
1. ~~Project Management~~																		
2. ~~Manual Planning~~																		
3. ~~Manual Development~~																		
4. ~~Training~~																		
5. ~~TAC Coordination~~																		

Table 8. Project Fees

Tasks	WSU Costs[a,b]	Evergreen Costs	Total Cost
1. Project Management and Administration	$~~8,065.20~~10,486.93	~~$48,708.00~~$37,425.30	~~$59,194.93~~$45,490.50
2. Manual Planning	~~$4,994.85~~$6,572.18	~~$46,856.70~~$24,614.70	~~$53,428.88~~$29,609.55
3. Manual Development	$9,069.~~60~~59	$159,407.08	$168,476.6~~78~~
4. Manual Training	$2,497.43	$40,418.40	$42,915.83
5. TAC Coordination	$~~3,680.42~~4,731.97	~~$33,753.57~~$25,561.80	~~$38,485.54~~$29,242.22
Total	**$~~28,307.50~~33,358.10**	**~~$329,143.75~~$287,427.28**	**~~$362,501.85~~$315,734.78**

a. WSU is including in this proposal, the following information on other resources available which are in support of similar research/activities undertaken by the Principal Investigator (PI). These resources are listed to identify other support for this research/activity and are not included as a commitment of cost-share by WSU.

b. No fees were included for Laurie Larson-Pugh's time to serve as the TAC lead and coordinator because this work aligns with her current position responsibilities and funding to provide permit assistance.

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Table A1. Project Resources Identified

Authors	Title	Source Type
City of Redmond, City of Seattle, King County, Kitsap County, U.S. EPA, U.S. Geological Survey, Ecology, and Herrera Environmental Consulting	Redmond Paired Watershed Study – Status Update	Fact Sheet
City of Redmond, King County, Herrera Environmental Consultants	Redmond Paired Watershed Study - Interim Findings	Fact Sheet
	WAC 173-350-320 Piles used for storage or treatment	WAC
Selbig, W.R., Bannerman, R.T.	Evaluation of Street Sweeping as a Stormwater-Quality-Management Tool in Three Residential Basins in Madison, Wisconsin	Report
Scott Brown, Rick Susfalk, Domi Fellers, Brian Fitzgerald	Effectiveness of Street Sweeping in Incline Village, NV	Report
City of Seattle, Seattle Public Utilities	Street Sweeping Water Quality Effectiveness Study	Report
Christian Nilson, Geosyntec Consultants	Street Sweeping	Powerpoint Presentation
Anchor QEA, LLC, AMEC Earth and Environmental, Inc.	Effectiveness of Basin-Wide Stormwater Best Management Practices - Thea Foss Drainage Basin City of Tacoma	Report
Lee F Hixon, and Randel L Dymond	State of the Practice: Assessing Water Quality Benefits from Street Sweeping	Journal Article
An Liu, Yukun Ma, Janaka M.A. Gunawardena, Prasanna Egodawatta, Godwin A. Ayoko	Heavy metals transport pathways: The importance of atmospheric pollution contributing to stormwater pollution	Journal Article
Shelly Basketfield	PSP Discussion – Effectiveness of Street Sweeping	Powerpoint Presentation
Steven J Calvillo, E. Spencer Williams, Bryan W. Brooks.	Street Dust: Implications for Stormwater and Air Quality, and Environmental Management Through Street Sweeping	Report
Lee F Hixon, and Randel L Dymond	Characterization of Street Sweeping Material for Addressing TMDL Waste Load Allocations	Report
Sebastian Donner, Bill Frost, Norm Goulet, Marty	Recommendations of the Expert Panel to Define Removal	Report

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Authors	Title	Source Type
Hurd, Neely Law, Thomas Maguire, Bill Selbig, Justin Shafer, Steve Stewart and Jenny Tribo	Rates for Street and Storm Drain Cleaning Practices	
City of Ellensburg	Street Sweeping vs Catch Basin Cleaning Effectiveness Study TER	TER
City of Tacoma	Thea Foss & Wheeler-Osgood Waterways Source Control & Water Year 2014 Stormwater Monitoring Report	Report
Olivia Wright, Bob Bernhard, Timothy Clark, King County Water and Land Resources Division	Water Quality Assessment and Monitoring Study: Estimated Present Day Contaminant Loadings to Duwamish Estuary/Elliott Bay and Lake Union/Ship Canal	Study Report
	Puget Sound Stormwater Pollutant Reduction Tool - Bioretention	Excel Tool
	Puget Sound Stormwater Pollutant Reduction Tool - Sand Filter	Excel Tool
Michelle Marysfield, Karthik Narayanasway, David Jackson	Determining the State of the Practice in Data Collection and Performance Measurement of Stormwater BMP	Report
Ecology	Solid waste permit application	
Brian Morgenroth	N/A	Email
Minnesota Stormwater Manual	Recommended street sweeping practices for water quality purposes	Manual Section

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Letter of Commitment

EVERGREEN STORMH2O
PO BOX 18912
SPOKANE, WA 99228
(509)995-0557

To: Dan Nordquist, Associate VP of Research
Washington State University
From: Aimee S. Navickis-Brasch, PhD, PE
NB Engineering, LLC
DBA Evergreen StormH2O
Date: May 31, 2023

Subject: Letter of Commitment Regarding Stormwater Action Monitoring (SAM) Synthesis of Street Sweeping Research & Practices: Guiding Program Development & Implementation Project

Dear Dr. Nordquist,

Evergreen StormH2O is committed to supporting the Washington Stormwater Center (WSC) to deliver the above noted project. We understand and are committed to meeting the project schedule and budget as described in the Request for Qualifications and in our team's proposal.

Evergreen StormH2O's role includes the following:

- Provide project management for the Evergreen StormH2O consultant team.
- Task 2 Lead for developing guidance manual action plan.
- Task 3 Lead for implementing action plan and developing manual content including conducting literature search, surveys, and interviews.
- Task 4 Lead for developing and implementing training on the manual content.
- Task 5 support WSC in coordinating with the TAC

We look forward to supporting this important project.

Sincerely,

Aimee S. Navickis-Brasch

Aimee S. Navickis-Brasch, PhD, PE
President & Principal Engineer
NB Engineering, LLC
DBA Evergreen StormH2O