

# Stormwater BMPs Maintenance Conditions Evaluation

Proposal for SAM Effectiveness Study, 2020

**City of Bellevue and  
Aspect Consulting**

May 15, 2020



## Project Purpose and Objective

This purpose of this project is to evaluate the maintenance thresholds, or conditions, for selected stormwater best management practices (BMPs) in the 2019 Stormwater Management Manual for Western Washington (SWMMWW). The selected stormwater BMPs are those noted in the RFP Priority Topics related to Operations and Maintenance (O&M), specifically ponds, vaults, tanks, and trenches. The maintenance conditions of interest are those in Volume V of the SWMMWW on “Runoff Treatment, Flow Control, and LID BMP Library”. Appendix V-A: BMP Maintenance Tables (the Tables) of Volume V is comprised of several tables by BMP general category with descriptions of “*conditions when maintenance is needed.*” The emphasis of the Tables is on identifying conditions that require maintenance, and municipal stormwater permittees of the National Pollutant Discharge Elimination System (NPDES) have the leeway to prioritize BMP maintenance activities and are not required to complete all maintenance needs identified for all BMPs.

While the Tables provide helpful guidance for maintenance of a broad range of runoff treatment and flow control BMPs, some of the maintenance conditions are questionable (based on permittee experience) and would benefit from a review. The primary goal of this project is to address Priority Topic 7<sup>1</sup> from the SAM Priority Topic List, specifically to evaluate the “*water quality benefits of the maintenance thresholds that are required in the SWMMWW for vaults, ponds, and trenches.*” We also add “tanks” to this list since they are commonly used BMPs and their maintenance conditions are grouped with vaults in the BMP Maintenance Tables. The secondary

goal of the project is to evaluate what data are available to support addressing Priority Topics 13 or 16<sup>2</sup> to quantify habitat and other benefits, including reduced maintenance provided by mature vegetation in stormwater ponds. As a widely used traditional BMP, more information about vegetation maintenance in ponds that relates to habitat and water quality is needed to support decisions to replace or retrofit these facilities (Priority Topic 7.2)

From the experience of Bellevue Utilities and other jurisdictions, some of the maintenance conditions for the range of ponds, trenches, vaults, and tanks in the Tables could be refined to better inform inspection and maintenance practices of the BMPs while preserving water quality benefits and potentially lowering maintenance costs for permittees. For some BMPs, the review will dig into quantitative data and identify more accurate maintenance conditions that can save permittees time and cost while not degrading water quality.

An example of this project’s scope for evaluating maintenance conditions is for Debris and Sediment in the storage areas of closed detention systems (tanks/vaults) from Table V-A:3. The condition for maintenance per the Table is when sediment depth exceeds 10 percent of the diameter of the storage area in more than half of the tank/vault or when any point depth exceeds 15 percent. The sediment depth that triggers maintenance (10 percent) is provided as a likely conservative value that could apply to all types and sizes of closed tanks/vaults. A range of accumulation would be more helpful for permittees, particularly as guidance to municipal stormwater inspectors, which would account for the type and size of the tank/vault; frequency of input; and typical distribution of settled sediment

<sup>1</sup> Priority Topic 7. What is known about the water quality benefits of the maintenance thresholds that are required in the SWMMWW for vaults, ponds, and trenches?

7.1. Can we more cost-effectively clean vaults, ponds, infiltration trenches, and catch basins?

7.2. When is it more effective to replace/retrofit versus provide significant maintenance to a facility?

<sup>2</sup> Priority Topic 13. Quantify the habitat and other benefits and reduced O&M provided by mature vegetation in stormwater ponds. Are we still getting the pollutant removal? What are the tradeoffs?

Priority Topic 16. Informed by a white paper, do a controlled field study to evaluate maintenance thresholds required in the SWMMWW

in the structure. For a large tank that slowly accumulates sediment, perhaps a greater sediment accumulation is acceptable, which would then reduce potential maintenance frequency and cost if water quality from the tank discharge is not worsened.

For other BMPs, the review will be of the maintenance condition description to recommend better language based on permittee experience using the BMPs considering habitat or water quality benefits as applicable. An example is Tree Growth and Hazard Trees maintenance conditions for detention ponds. The general maintenance conditions noted in the Tables include when dead, diseased, or dying trees are identified. However, dead trees support habitat for numerous animals, which may be a desired outcome of the pond depending its type, purpose, and setting. In this instance, the maintenance condition language could be updated to account for a range of pond and vegetation conditions to allow for permittees to consider site-specific habitat goals, if any.

In addition, while the Tables include guidance for maintenance conditions of infiltration-based BMPs, trenches as a specific infiltration BMP are not mentioned in the Tables. The BMP sheet for infiltration trenches in Volume 5 of

the SWMMWW has only a brief description of maintenance criteria without any quantitative guidance. As a group of BMPs, more maintenance information is needed for trenches, which can include infiltration trenches, infiltration basins, some types of swales, and other linear engineered features designed primarily for capturing, detaining, treating, and/or infiltrating runoff.

**Measurable outcomes from this project will include the following.**

- *Inform municipal stormwater permittees in western Washington about maintenance schedules and practices to understand and improve water quality and habitat benefits from BMPs and reduce maintenance costs.*
- *Improve permittees' and Ecology's knowledge of the maintenance needs and water quality performance for a range of stormwater ponds, vaults, tanks, and trenches in use based on published international and local data.*
- *Ecology can use the information from the white paper (discussed further in the Study Design section), and potentially a follow-up field study, to consider updates to the BMP Maintenance Tables in the SWMMWW.*

## Project Description and Scope

### **Study Design**

The design of this project is to review the maintenance conditions guidance in the SWMMWW for a selection of stormwater BMPs that include ponds, vaults, tanks, and trenches. We propose to do this by a focused study that will include surveying municipal stormwater operations and maintenance (O&M) practices in western Washington; identifying and reviewing available published data of the selected BMPs related to inspection and maintenance and water quality; interviewing Ecology staff who are familiar with the BMP Maintenance Tables and the background of its guidance; conducting a pilot-scale analysis of a BMP O&M data from a small number of western Washington permittees;

and writing a white paper on the findings with recommendations for potential follow-up effectiveness studies, such as controlled field study to fill gaps in BMP maintenance conditions information.

### **Tasks**

#### **1. Technical Advisory Committee (TAC) and Project Administration**

As the first task of the project, a TAC will be formed to go over the project goals, tasks, and schedule. Some TAC members have already been identified as noted below who have expressed interest in this study (including the cities of Kirkland, Sammamish, and Newcastle) and other TAC members will be identified as part of this task.

Additional TAC members will be sought to represent O&M programs of Phase I and Phase II permittees and Ecology engineers and permit writers with knowledge of the SWMMWW BMP Maintenance Tables.

Five TAC meetings are planned that will include reviewing project deliverables and discussing technical approaches and information that will inform the project products.

Project administration is also part of this task and will include quarterly invoices and project status reports, general communications, and contract administration. Invoicing will follow Ecology's invoice requirements, and status reports will indicate project progress and status of deliverables.

Deliverables:

- *TAC meeting agendas and minutes*
- *Regular invoices and status reports*

## 2. Survey permittees on BMP maintenance

A survey will be prepared to get information about O&M programs from municipal stormwater permittees in western Washington. Questions will focus on inspection and maintenance practices, records, costs, retrofit versus replace decisions, BMP settings and usage, and associated data related to water quality and habitat, if available. Results from the survey will be summarized in a technical memo and used to inform subsequent tasks.

Deliverables:

- *Draft survey*
- *Technical memorandum summarizing survey results*

## 3. Research published BMP data

In addition to the information obtained from permittees in the survey about their BMP maintenance practices, data from published sources will also be searched and analyzed to provide a broader basis for the evaluation. Online databases to be searched include the International Stormwater BMP Databases (Water Research Foundation), the National Pollutant Removal Performance Database (Center for Watershed

Protection, CWP), the National Stormwater Quality Database (University of Alabama and CWP), and the Recommended Operation and Maintenance Activity and Cost Reporting Parameters for Stormwater BMPs (ASCE Environmental and Water Resources Institute).

Data on ponds, vaults, tanks, and trenches will be sought and analyzed to inform a range of BMP maintenance conditions and associated water quality. A preliminary review of the published sources noted above indicates that they include data for the types of BMPs being evaluated here and could support an analysis of BMP maintenance activities and water quality treatment performance. The findings from the analysis of published data sources will be used to complement the data analysis of permittee O&M data described below in Task 5.

Deliverables:

- *Draft and final technical memorandum summarizing published data analysis*

## 4. Interview Ecology staff

To compliment the survey of how BMPs are used and maintained by permittees, Ecology engineers and permit writers will be interviewed to understand the background and basis for the maintenance conditions in the BMP Maintenance Tables. Up to four Ecology staff will be identified and interviewed with the assistance of the TAC and SAM program staff. Interview questions will be developed with the TAC to better understand how certain maintenance conditions were identified, what publications or references were used, and what BMPs could use more input for maintenance conditions needs.

Deliverables:

- *Interview questions*
- *Draft and final technical memo summarizing interview responses*

## 5. Pilot data analysis of permittee O&M data

A pilot-scale effort will be done to review and analyze municipal procedures and O&M data of BMP inspection and maintenance. The pilot data analysis will be based on available data from a few

permittees on the TAC who agree to a data request, which will be asked about in the survey in Task 2. The goal of the pilot data analysis is to complement the BMP data obtained from published sources in Task 3 with local data to represent western Washington. The pilot data analysis has three specific objectives:

1. *Identify what BMP inspection and maintenance data are present among jurisdictions relevant to the types of BMPs being investigated (ponds, vaults, tanks, trenches)*
2. *Identify what associated data may be available from permittees related to BMP geographic settings, engineering design, water quality benefits, and habitat conditions*
3. *Compare maintenance condition data to guidance in the BMP Maintenance Tables for the types of BMPs being evaluated*

Results from the pilot data analysis are expected to include inspection and maintenance activities and frequencies, data on maintenance-triggering conditions, and geospatial data, such as basin size and gradient and impervious drainage area. The findings from the pilot data analysis of permittee data will be designed to complement the analysis of published data sources described above in Task 3.

Deliverables:

- *Data request from selected jurisdictions*
- *Draft and final technical memorandum summarizing analysis of permittee data*

## 6. Develop White Paper

The outcomes of the project will be provided in a white paper that will be prepared at the end of the project. The white paper will summarize and synthesize the findings from the individual task deliverables with recommendations of potential updates for Ecology to consider for the BMP Maintenance Tables. The white paper will provide a summary of key information from the Ecology staff interviews about the basis for some

maintenance conditions in the Tables, and it will summarize key findings from the permittee survey about western Washington municipal O&M programs and practices. The review of BMP treatment and maintenance data from published sources will be synthesized with the pilot data analysis of permittee BMP inspection and maintenance data. In addition, the white paper will provide conclusions about BMP inspection frequencies and maintenance conditions to help permittees make informed choices when prioritizing O&M activities. The white paper will also include recommendations based on the study findings that may include a potential follow-up controlled field study of selected BMPs to fill gaps in the SWMMWW BMP Maintenance Tables.

Deliverables:

- *Draft and final white paper summarizing outcomes of entire project*

## 7. Communication Plan

The communication plan for this project includes timely sharing of milestones and deliverables with Ecology and municipal stormwater permittees. An approximate project schedule is included in this proposal and will be updated and refined based on feedback during the proposal review and voting process. Communication of the project results will include presentations and a fact sheet as well as the project deliverables posted to the SAM project webpage.

Deliverables:

- *Project schedule*
- *Presentation to the Stormwater Work Group*
- *Two-page fact sheet using the SAM fact sheet template*
- *Presentation at an NPDES coordinators' forum, APWA Stormwater Managers Committee, or other regional group to be determined*

### Data Request

A data request will be made for the pilot data analysis described in Task 5 to evaluate permittee stormwater O&M data as it relates to the BMPs of interest (ponds, vaults/tanks, and trenches). **The data will be requested from up to three western Washington jurisdictions who volunteer in the survey of Task 2.** The data request will likely include maintenance records, structure type and size, land use, land cover, maintenance costs, retrofit costs, and property ownership, among

other data. In addition, data will be requested, if available, of water quality or habitat associated with the BMPs for which O&M data are provided.

The exact format and full list of data types requested will be developed as part of Task 5. The data request will be based on information from the survey indicating what data are available from the TAC jurisdictions who volunteer to provide data. The data request will also consider what data would complement the review and analysis of the published data sources in Task 3.

### Deliverables

Deliverables for the project are noted above in the description of each task. The table below provides a summary of deliverables by task.

TASK	DELIVERABLE
1. TAC and project administration	<ul style="list-style-type: none"> <li>TAC meeting agendas and minutes</li> <li>Quarterly invoices and status reports</li> </ul>
2. Survey western Washington municipal stormwater permittees on BMP maintenance	<ul style="list-style-type: none"> <li>Draft survey</li> <li>Technical memo of survey results</li> </ul>
3. Research published BMP data	<ul style="list-style-type: none"> <li>Draft technical memo of analysis of published BMP O&amp;M data</li> <li>Final technical memo of analysis of published BMP O&amp;M data</li> </ul>
4. Interview Ecology staff	<ul style="list-style-type: none"> <li>Interview questions for Ecology staff</li> <li>Draft technical memo of Ecology staff interview results</li> <li>Final technical memo of Ecology staff interview results</li> </ul>
5. Pilot data analysis of permittee O&M data	<ul style="list-style-type: none"> <li>Data request of selected TAC jurisdictions</li> <li>Draft technical memo of pilot data analysis</li> <li>Final technical memo of pilot data analysis</li> </ul>
6. Develop White Paper	<ul style="list-style-type: none"> <li>Draft white paper of all projects findings and recommendations</li> <li>Final white paper of all projects findings and recommendations</li> </ul>
7. Communication Plan	<ul style="list-style-type: none"> <li>Project schedule</li> <li>Presentation to Stormwater Work Group</li> <li>Two-page fact sheet</li> <li>Presentation to regional stormwater group</li> </ul>

## Project Team Description

### Lead Agency

#### Lead Entity: Don McQuilliams

Operations Manager  
Bellevue Utilities  
425.452.7865  
DMcQuilliams@bellevuewa.gov

Bellevue Utilities will be the project sponsor and lead entity, and Don McQuilliams, Operations Manager, will lead the project for Bellevue. Don will coordinate with participating agencies as well as Aspect Consulting to provide overall oversight of the project. Don has 12 years of experience in Stormwater Management and has acted as the Storm & Surface Water Operations and Maintenance Superintendent and Water Quality Supervisor during his time with Bellevue Utilities. Don is a member of the Stormwater Workgroup as well as the Co-chair for the Effectiveness Subcommittee.

### Participating Agencies

Several participating agencies have been identified so far, including the cities of Kirkland, Sammamish and Newcastle, all of which have agreed to have representatives on the TAC as noted on the following page.

### Project Partner

#### Project partner: James Packman

Senior Hydrologist  
Aspect Consulting  
206-780-7723  
jpackman@aspectconsulting.com

As the project partner to Bellevue Utilities, Aspect Consulting's role on the project will be managing, coordinating, and implementing all of the technical aspects of the work. As the consultant project manager, James Packman will lead the development of survey questions, queries and analysis of the published data sources, interview questions and the interviews, pilot-analysis of permittee O&M data, and the preparation of all project deliverables. James will work with the City to establish the TAC and coordinate its activities and input throughout

the project. For administering the project, James will utilize Aspect's project controls and invoicing capabilities to prepare quarterly status reports and provide the materials in the necessary format. Please see the attached letter of commitment from Aspect.

James Packman, Senior Hydrologist with Aspect Consulting, has 22 years of experience in the ecology, engineering, and management of terrestrial surface waters and sediment. James' areas of expertise include: water quality monitoring of a wide range of surface waters and conveyance systems; permit support for NPDES municipal stormwater programs with an emphasis on O&M, Illicit Discharge Detection and Elimination (IDDE), and Source Control programs; assessing pollution source control activities and BMPs in port, municipal, commercial, construction, and industrial settings; monitoring surface water quality, sediment, and stormwater BMP treatment effectiveness; organizing, reviewing, and analyzing data, including statistical data analysis; and writing reports and giving presentations. James has led and participated in several stormwater research and effectiveness projects for Ecology, which have included convening and leading technical advisory committees for guidance and feedback on project deliverables. Projects have included:

#### Relevant current and past projects:

- Ecology, Structural Stormwater Controls Evaluation, May 2020-present
- Port of Bellingham, Municipal Stormwater Operation and Maintenance Plan Update, 2019-present
- City of Burien, Standard Operating Procedures for Stormwater, Streets, and Parks Operations and Maintenance, 2017-2018
- White paper: Synthesis of Stormwater Management Effectiveness Literature, Association of Washington Cities, 2013

## Technical Advisory Committee

<b>Don McQuilliams</b> , City of Bellevue	<b>Audrey Starsy</b> , City of Newcastle
<b>James Packman</b> , Aspect Consulting	<b>TBD</b> , Phase I permittee
<b>Rachel Konrady</b> , City of Kirkland	<b>TBD Ecology engineer</b> , Dept of Ecology
<b>Lisa Werre</b> , City of Sammamish	<b>TBD Ecology permit writer</b> , Dept of Ecology

## Project Management Strategy

The City of Bellevue will manage the overall project as the lead agency. The City’s tasks will include project setup and management, conducting regular working meetings for the project team, tracking work flow and budget expenditures, and providing biannual invoices and reports to Ecology according to contract agreement. The City will review project deliverables and coordinate with Ecology for deliverable review. In addition, the City’s tasks will include helping organize the TAC, including identifying TAC members and organizing and facilitating TAC meetings.

Aspect will implement the technical elements of the project and will manage the consultant project management. Aspect uses the Deltek Ajera CRM project management and accounting system to track budgets in real time, forecast deliverable schedules and burn rate, resource loading, and

generate custom invoicing. This program gives Aspect project managers the ability to check multiple budget metrics with little effort. They are able to detect budget or schedule deviations early and can implement corrections to keep our projects on schedule and within budget.

As a team, Bellevue Utilities and Aspect Consulting have worked together on many projects from stormwater to geotechnical engineering. Because of this familiarity and history and due to both parties’ experience with grant-funded projects and IAA contracts with Ecology, Bellevue and Aspect will be able to work together efficiently to implement the project.

Please see the attached letter of commitment to the project from Aspect Consulting.



## Project Budget and Schedule

An approximate project budget is provided in the table below based on the project description in this proposal. Per RFP requirements, the budget is summarized by deliverable. The scope or work and budget will be refined during the scoping of the project based on feedback on the proposal.

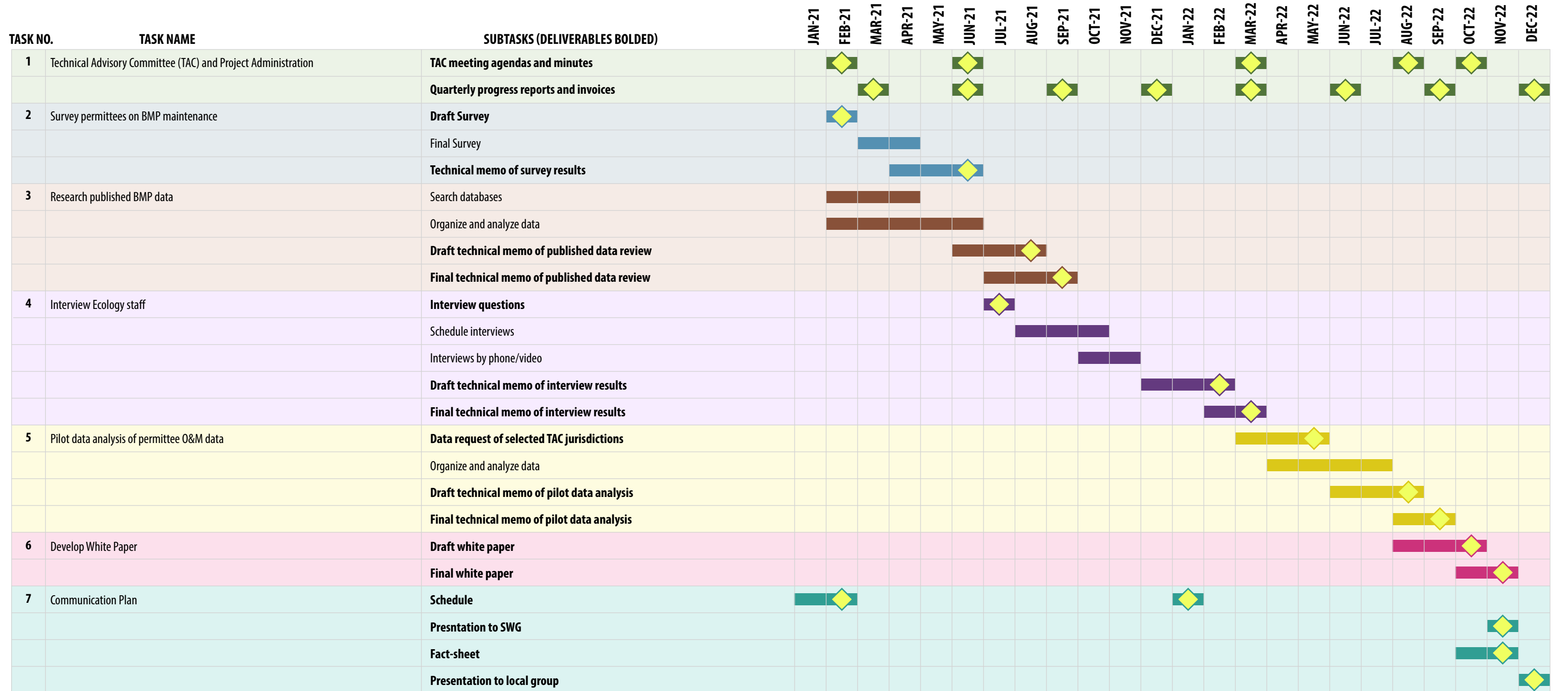
A schedule is attached that shows the overall two-year timeline of the project and the expected timeframes for each task. Dates in the schedule were selected to include consideration of holiday periods, permittee annual reporting, and permit deadlines. The schedule assumes contracting completed and project work starting by January 1, 2021. There are no permit deadlines driving this project, and the project schedule could be adjusted for a later starting date.

### Budget

Deliverable Number	Deliverable	Aspect		City of Bellevue	Total Cost
		Labor	ODCs*	Labor and Indirect Costs	
1a	TAC meeting agenda and minutes	\$ 7,685	\$ 313	\$ 769	\$ 8,767
1b	Quarterly status reports	\$ 13,394			\$ 13,394
2a	Draft survey	\$ 7,414		\$ 741	\$ 8,155
2b	Technical memorandum of survey results	\$ 5,863		\$ 586	\$ 6,449
3a	Draft technical memo of published BMP data	\$ 32,935			\$ 32,935
3b	Final technical memo of published BMP data	\$ 6,728		\$ 673	\$ 7,401
4a	Ecology staff interview questions	\$ 4,503			\$ 4,503
4b	Draft report of Ecology staff interviews	\$ 13,497	\$ 188		\$ 13,685
4c	Final report of Ecology staff interviews	\$ 4,222		\$ 422	\$ 4,644
5a	Data request memo to 3 TAC permittees	\$ 5,806		\$ 581	\$ 6,386
5b	Draft technical memo of pilot data analysis	\$ 27,518			\$ 27,518
5c	Final tech memo of pilot data analysis	\$ 7,910		\$ 791	\$ 8,701
6a	Draft white paper	\$ 18,762			\$ 18,762
6b	Final white paper	\$ 10,452		\$ 1,045	\$ 11,497
7a	Project schedule	\$ 2,391			\$ 2,391
7b	Presentation to Stormwater Work Group	\$ 5,122	\$ 63	\$ 512	\$ 5,697
7c	2-page fact sheet	\$ 2,826		\$ 283	\$ 3,109
7d	Presentation to other group	\$ 2,534	\$ 63	\$ 253	\$ 2,851
	<b>Total</b>	<b>\$ 179,562</b>	<b>\$ 627</b>	<b>\$ 6,656</b>	<b>\$ 186,844</b>

\* ODCs: other direct costs, includes mileage for meeting attendance

# SCHEDULE



◆ Completion dates of **deliverables**

**Letter of Commitment and Support**



Don McQuilliams  
City of Bellevue  
Operations Manager – Regulatory Compliance & Surface Water  
Utilities Department  
450 110<sup>th</sup> Ave NE  
Bellevue, WA 98004

May 15, 2020

Dear Mr. McQuilliams,

I am writing to express Aspect Consulting's support for our proposal with the City of Bellevue for a Stormwater Action Monitoring effectiveness study.

This valuable study will review and evaluate the maintenance thresholds of several important stormwater BMPs for runoff treatment and flow control—specifically vaults, tanks, ponds, and trenches. This project will directly benefit municipal stormwater permittees by improving and updating the guidance from Ecology on the conditions that trigger maintenance on some BMPs. Improving and updating the Ecology guidance will give permittees a clearer understanding of maintenance frequency and potentially reduce maintenance costs for key BMPs in the study.

Aspect is a leading stormwater consultant in the Pacific Northwest and we are proud to be developing this project with the City of Bellevue and want to express our commitment to implementing this project with you should the proposal be accepted. James Packman is a great choice for developing and managing the technical components of the project as he has highly relevant experience supporting municipal stormwater permittees, especially for operations and maintenance requirements of BMPs.

We are excited to be part of this work and look forward to implementing the project with you.

Sincerely,

A handwritten signature in black ink, appearing to read "Owen Reese".

**Owen Reese, P.E.**  
Sr. Associate Water Resources Engineer

