

Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Company
Subject: Item 5C - Review Budget and Timeline for XP-SWMM Phase II Project and Determine Next Steps
BCWMC April 16, 2015 Meeting Agenda
Date: April 6, 2015
Project: 23/27-0051 2015

5C Review Budget and Timeline for XP-SWMM Phase II Project and Determine Next Steps

At their March 5, 2015 meeting, the Technical Advisory Committee (TAC) recommended that the Commission 1) begin the XP-SWMM Phase 2 project in 2015, using Flood Control Project Long Term Maintenance Funds; 2) seek additional funding for the project from other sources; and 3) complete the project in as short a time as possible (within two years being preferred). At their March 19, 2015 meeting, the Commission considered the TAC's recommendations and directed Commission staff to develop a project scope and timeline for the project to start this year, along with information regarding advantages and disadvantages.

This memo summarizes the status of the current (Phase 1) model, the recommended revisions to the model (Phase 2), and the estimated costs and funding options for the Phase 2 project, assuming the project starts in 2015 and is completed in 2016.

1. Summary of the 2012 XP-SWMM Modeling Effort (Phase 1)

In 2012, Phase 1 of the XP-SWMM modeling was completed and included updates to watershed divides based on recent digital topographic data, modifications to hydrologic inputs (because of the changes in watershed divides and available methodology), and enhancement of detail along the creeks by using updated channel geometry and current bridge and culvert geometry.

During the Phase 1 effort, the scope did not include subdividing watersheds or incorporating additional municipal storm sewers or watershed storage upstream of the Bassett Creek system.

Limitations of the Current (Phase 1) Model

Although the 2012 XP-SWMM model was developed and calibrated to several precipitation events to ensure predicted results are consistent with actual monitored conditions, the calibration was limited by

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the simplifications in the upper watershed of the XP-SWMM model (large watershed sizes and limited storage upstream of the creek). Because of this, the calibration required unrealistic changes to a model parameter to achieve accurate calibration. This is not good practice, since the model no longer represents "real world" conditions and such a "forcing" usually indicates something is not accounted for in the model, which can lead to unrealistic results for some parameters (such as water surface elevations). In the case of the Phase 1 model, the "roughness numbers," which help control how fast water moves along the creek, needed to be unrealistically high (two to three times the published values) to calibrate the model. This suggests that there are other reasons flows in the watershed are slowed down, such as detention in stormwater ponds and wetlands in the upper watershed that are currently not included in the model.

Uses of the Current Model (Phase 1)

The 2012 XP-SWMM model can be used to compare relative changes in flow rate (i.e. – existing vs. proposed conditions runoff rates), or relative changes in water surface elevations (i.e. – existing vs. proposed conditions maximum water surface elevations in the creeks or storage areas). At this time, caution must be used when using the absolute model results (water surface elevations and flow rates) because of the calibration concerns. The updated model inputs, such as channel geometry and current bridge and culvert geometry, can be used by the cities to assist in their modeling efforts.

In the downstream portions of the model, the results are significantly impacted by and reflect the cumulative impacts of the lack of upstream storage in the model. However, in the upstream reaches of the watershed, portions of the model may be useful for evaluating projects, depending on location.

2. Proposed Revisions to the XP-SWMM Model (Phase 2)

Proper calibration of the XP-SWMM model using acceptable parameters will require enhancing the current XP-SWMM model by further subdividing the watershed divides, incorporating upstream storage in ponds and wetlands, and including the associated storm sewer data. The recommended Phase 2 of the XP-SWMM modeling includes:

- subdividing the 55 watersheds (from the original HEC-1 model) into approximately 850 watersheds (consistent with the watersheds in the BCWMC P8 water quality model),
- incorporating additional municipal storm sewer systems between upstream modeled ponds,
- integrating detailed storage in modeled ponds upstream of the creek system,
- incorporating Atlas 14 precipitation depths and the MN MSE3 storm distribution (replacement of "Type 2" storm distribution; developed by the Natural Resource Conservation Service (NRCS) and approved in early 2015)
- incorporating updated USDA soils data

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- ensuring vertical datums are consistent throughout model (see below)
- monitoring flows and using the flow data (or already-collected flow data) to aid in calibration of the model (see below)

By incorporating these changes, we expect the modeled runoff rates to the creek system to more realistically represent actual conditions, resulting in an acceptable calibration.

Additionally, in using the current model, we have identified that select portions of the current model are not in the same vertical datum as the rest of the model (e.g. DeCola Ponds area, Sweeney Lake area, and Wirth Lake area). The majority of the current model was developed in NAVD88; however, portions of the larger model (which were developed as separate efforts and provided to the BCWMC for use in the Phase 1 model development) are in NGVD29. The difference between these vertical datums is 0.18 feet and will require adjustments in the pipe inverts, overflows, and storage curves to maintain consistency.

Phase 2 would also include additional flow monitoring and calibration at select locations in the watershed. For several years, the Three Rivers Park District has collected flow monitoring data at two locations along Plymouth Creek for the City of Plymouth; this data will be used for calibration, assuming the city is willing to share the data. A flow monitoring station on the North Branch of Bassett Creek is also proposed to improve model calibration. During the calibration process, the WOMP station flow data and the Wisconsin Avenue control structure flow data will be used, along with any data logger water surface elevations at Medicine Lake (if available).

Uses of the Updated Model (Phase 2)

With the changes summarized above, the Phase 2 XP-SWMM model could be used to determine (and compare) absolute water surface elevations and flow rates. The revised model results could be beneficial to the BCWMC and member cities for revising the BCWMC's jurisdictional flood elevations and the results could also be submitted to FEMA for possible use in future Hennepin County flood insurance rate maps. The model could also be useful to the member cities to assess flood elevations at other ponds or wetlands throughout the watershed. By refining and recalibrating the XP-SWMM model, the Commission will be more able to share the model with other units of government for use on public projects (e.g. Blue Line LRT). The updated model can also be used by the Commission and/or the member cities to evaluate the impacts of proposed projects on flood levels.

3. Cost Estimate and Funding Options for Phase 2 Modeling

The Phase 2 modeling effort could be completed as one project, or in stages based on need and available budget, with each stage focusing on specific areas of the watershed. As presented below, the following table shows the estimated year, budget, and approximate schedule for the Phase 2 modeling to be completed in stages, moving from upstream to downstream in the watershed.

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Table 1 Phase 2 XP-SWMM Modeling Schedule and Budget

Year	Study Area	Budget¹	Approximate Time to Complete
2015 (through January 31, 2016)	Detailed Modeling, Plymouth Creek Watershed	\$54,000	Six Months
	Flow Monitoring, Plymouth Creek	\$0	Completed ²
	Detailed Modeling, Medicine Lake Direct Watershed	\$40,000	Four Months
	Three Months Flow Monitoring, North Branch Bassett Creek	\$9,000 ³	Three Months
2015 Total		\$103,000	
2016 (through January 31, 2017)	Detailed Modeling, North Branch Bassett Creek	\$39,000	Four Months
	Detailed Modeling, Bassett Creek Main Stem – Medicine Lake to Confluence with North Branch	\$54,000	Five Months
	Detailed Modeling, Bassett Creek Main Stem – Downstream of the Confluence with North Branch (including Sweeney Branch)	\$49,000	Four Months
	Final Modeling Methodology Report	\$16,000	Three Months
2016 Total		\$158,000	
Phase 2 – Total		\$261,000	

¹Budget is based on 2015 dollars

²Utilize historic flow data along Plymouth Creek from Three Rivers Park District, collected for City of Plymouth

³Flow monitoring estimated cost currently assumes Barr to perform monitoring in 2015. Costs may be less if completed by Three Rivers Park District; however, based on discussions with Three Rivers Park District staff, they are unsure if they would be able to add an additional monitoring station to the 2015 stormwater monitoring program. They could include the proposed station on the North Branch in their 2016 monitoring program.

Funding Options

2015 = \$103,000. Options include:

1. Use Flood Control Project Long-term Maintenance Funds. Fund balance would drop from \$580,000 to \$477,000
2. If the administration fund balance is sufficient, the Commission could fund (or partially fund) 2015 costs using the fund balance.
3. Use remaining Surveys and Studies budget; upon completion of the revised Requirements document, the remaining budget may be up to \$10,000.

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2016 = \$158,000. Options include:

1. Include in administration fund for 2016 (i.e., fund via assessments to cities)
2. Use Flood Control Project Long-term Maintenance Funds. Fund balance would drop from \$580,000 to \$422,000; or from \$477,000 to \$319,000 (if these funds are used to fund the entire project).
3. If the administration fund balance is sufficient, the Commission could fund (or partially fund) 2016 costs using the fund balance.
4. Add this year of the project to the Plan as a CIP project and request Hennepin County tax levy to pay for this part of the project.