Appendix C

Hydraulic Model Review
Summary Technical Memoranda

CSO Storage Interceptor Design - 60% Development

Commonwealth Engineers, Inc.

Value Engineering and QA/QC Report Recommendations

January 2014

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TECHNICAL MEMORANDUM

FROM: Brian Desharnais, Ph.D., P.E. – Commonwealth Engineers, Inc.

DATE: **1/15/2014**

SUBJECT: City of Jeffersonville, IN
CSO Interceptor Project – Peer Review / Value Engineering
Review of Hydraulic Model

Purpose

The purpose of this technical memorandum is to summarize the review of the (a) calibrated hydraulic model and (b) design model to verify sizing of facilities associated with the CSO Interceptor Project. The following is a brief summary of Value Engineering (VE) Quality Assurance Quality Control (QA/QC) efforts and questions pertaining to the hydraulic model.

Review of Model Calibration and Assumptions

The calibrated model was reviewed by the Value Engineering (VE) Team in an effort to assess assumptions and calibration. Based on correspondence with Strand Associates and based on the review of the *60% Design Report*, it is the VE Team's understanding that the calibrated / validated model from the Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) was used to size the key hydraulic features of the CSO Interceptor Design. The CSO LTCP model was calibrated using Phase 2 and Phase 3 flow metering data as described in the 2010 LTCP. Based on select calibration and validation figures and calibration scatter diagrams provided by Strand to the VE Team (2/27/09 rainfall event, 4/2/09 rainfall event, 4/5/09 rainfall event, 4/13/09 rainfall event, 5/8/09 rainfall event), the hydraulic model appears to be well calibrated to the Phase 2 and Phase 3 metering data (flow, velocity and level). The CSO LTCP model underwent a thorough review by the United States Environmental Protection Agency (USEPA) and Indiana Department of Environmental Management (IDEM) in 2009. The VE Team agrees that the assumptions and methods documented in the 2010 CSO LTCP that were used to construct and calibrate the CSO LTCP model and alternative model are reasonable.

Model Not Recalibrated using Phase 4 Metering

Prior to design of the storage interceptor, further validation of the hydraulic model was performed using the rainfall events encountered during the Phase 4 metering period conducted between 5/18/09 and 1/31/11. Validation figures were not provided to the VE Team for assessment. The *60% Design Report* states that "total CSO volume discharges were reasonably validated but peak measured flows were higher than model flows. The higher peak measured flows were thought to be the result of the recently implemented catch basin and sewer cleaning programs. The model was not and is not expected to be recalibrated to reflect higher peak flows." Based on working with the XPSWMM model of the selected alternative, it appears that the storage interceptor is sized based on desired CSO containment volume and not peak flow. Therefore, the assumption to not recalibrate the hydraulic model to reflect higher peak flow seems reasonable assuming that there are no interceptors that were sized to handle peak flows and assuming that the Phase 4 metering discharges were validated and documented with the Owner.

VE Team Question: Are there any facilities associated with the 60% design that have been sized based on peak flows that may be detrimentally impacted based on the Design Team's decision to not recalibrate the model?

Design Team Response:

Recently Completed and Anticipated Projects

The hydraulic model was updated to account for several recently completed projects including several sewer separation projects, pump station improvements, and WWTP improvements. Of these improvements, only the sewer separation projects and potentially the stormwater detention basin will affect the flows generated in the runoff layer in XPSWMM.

VE Team Question: How was the model adjusted to account for the sewer separation projects and the stormwater detention basin?

Design Team Response:

Factor of Safety or Contingency

The *60% Design Report* states that a factor of safety was not included in the calibration of the CSO LTCP model and that the effects of recently completed or anticipated projects such as the catch basin and sewer cleaning programs, downspout removal programs, and site specific green infrastructure were not integrated into the model. The VE Team agrees with the Design Team that the hydrologic impacts of these projects are difficult to predict and serve as a nominal factor of safety in the model. In addition, the flow limitation of 35 MGD placed on TSPS serves as an additional factor of safety.

Anticipated 90% Modeling Efforts

The VE Team acknowledges that modeling efforts were completed at 30% design but not at 60% design due to the project being refined. The VE Team agrees with the Design Team that 90% modeling efforts will be needed to confirm the design and the level of control. The proposed 90% modeling efforts in the *60% Design Report* seem reasonable.

Level of Control Discussion

There appears to be an inconsistency with the level of control in various documents. For example, the executive summary in the *60% Design Report* states that the City must reduce combined sewer discharges to a maximum of two (2) to the Ohio River during a statistical year. However, it is the VE Team's understanding that the Consent Decree only allows one (1) permissible overflow in a typical year of rainfall to the Ohio River. In addition, the typical year rainfall was defined as December 2000 through November 2001 in the CSO LTCP, yet this rainfall period does not appear in the global rainfall database in the XPSWMM models. The VE Team has experimented with the model for the 30% Design and has come to the conclusion that the proposed CSO Interceptor (along with the other recent and anticipated projects added to the model) will contain the 6-YR 6-MTH design storm (i.e. CSO 009 is on the verge of activating with this design storm).

VE Team Question: How did the Design Team assess the level of control in the model and how does the 6-YR 6-MTH design storm correlate with the typical year rainfall record?

Design Team Response:

Summary of Reported Model Limitations and Assumptions

The VE Team appreciates the level of detail contained in the *60% Design Report* pertaining to the model limitations and assumptions. The VE Team has no objections to these limitations. As a point of clarification, reference is made to assigned backpressures to CSOs on the Ohio River, though the provided model with the storage interceptor has free outfall designations.

VE Team Question: Please clarify how backpressures were applied at CSO outfalls in the model?

Design Team Response:

General Questions Pertaining to the Design and the Model

VE Team Question: Will the FWCS structures have any deleterious hydraulic capacity impacts on the proposed storage interceptor and if so, will efforts be

made during the 90% design to account for the reduction in cross sectional flow area?

Design Team Response:

VE Team Question: The weir lengths at CSO 009 (i.e. 200 FT) and CSO 011 (i.e. 50 FT) seem very long. Do these values represent anticipated field conditions upon project completion?

Design Team Response:

VE Team Question: As with any in-line storage system, care should be taken to mitigate against basement backups, whereby it is normally desired to have at least 8' of freeboard from the max HGL to the ground surface. Below is a snapshot of the max HGL for the proposed system for the 6-HR 6-YR design storm. Does the model predict that basement backups are a concern in the downstream end of the storage interceptor?

Design Team Response: