

INFRASTRUCTURE COMMITTEE
Tuesday, March 29, 2016 at 5:15 p.m.
City Hall Council Chambers

Agenda

- 1. Review: Long Term Control Plan**
(Materials Attached)



Department of Engineering

John Theriault, PE, PTOE
City Engineer
engineering@bangormaine.gov

To: Infrastructure Committee
From: Engineering Department and Waste Water Treatment Plant
Date: March 24, 2016
Re: Long Term Control Plan Update

The Waste Water Treatment Plant and the Engineering Department have been working with AECOM, the City's Engineering Consultant to develop the 2017 Long Term Control Plan (LTCP) to eliminate and /or reduce the number of Combined Sewer Overflows (CSO's) from the City's sewer collection system. This plan is a requirement of the City's Consent Decree with the USEPA and the Maine Department of Environmental protection. The Plan is intended to be reviewed and updated every five years based on sewer system priorities and the City's financial capability to fund projects. The Plan, for the first 5 years worth of improvement projects, is required to be submitted the USEPA by January 31, 2017.

AECOM provided an update of the LTCP to the City Manager on March 10, 2016. The City Engineer will review the material provided at that meeting with the Infrastructure Committee to make them aware of the coming City requirements to be in compliance with the Consent Decree.



City of Bangor, Maine
2017 Phase 2 Long Term
Control Plan Update

Progress Meeting – March 10, 2016

Contents

- Long-Term Control Plan (LTCP)
- Status of 2017 LTCP
- Regulatory Documents
- Abatement Goals
- CSO Technology Evaluation
- Preliminary Evaluation of Alternatives
- Next Steps in LTCP Development

Long-Term Control Plan or LTCP

- Structured process to eliminate or otherwise bring Combined Sewer Overflows (CSOs) into compliance with State and Federal laws, regulations and guidelines
- Prepared first LTCP in 1993 in response to the 1987 and 1991 Consent Degrees
 - City prepared Final Report on CSO Abatement Program in April 2009
 - EPA informed City that more needed to be done
- 2015 Consent Degree requires:
 - Phase 2 LTCP to be submitted by January 31, 2017
 - Compliance by December 31, 2031
- Submitted Progress Report on the Phase 2 LTCP on September 30, 2012, in response to the May 28, 2010, “308” Letter from EPA

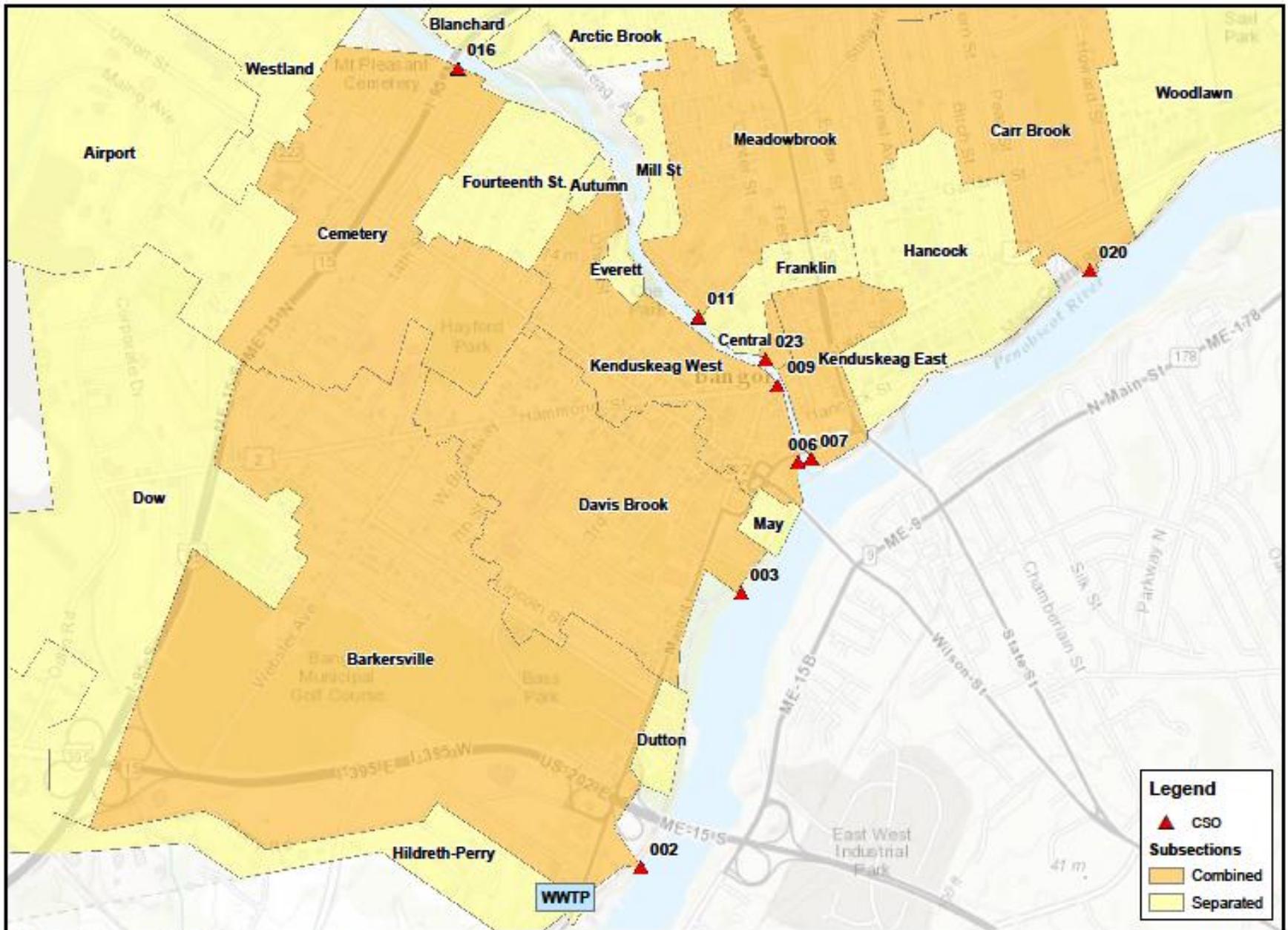
Significant CSO Regulatory Documents

- U.S. Environmental Protection Agency (EPA):
 - Combined Sewer Overflow (CSO) Control Policy, April 1994 (made into an EPA regulation in 2000)
 - CSO Guidance for Financial Capability Assessment and Schedule Development, February 1997
- State of Maine Department of Environmental Protection (DEP):
 - Chapter 570, CSO Abatement, February 2000
 - Program Guidance on Combined Sewer Overflow Facility Plans, September 1994

These are in addition to 2015 Consent Decree and pending renewed MPDES Permit

CSO Abatement Progress

- Constructed three CSO storage facilities (3.8 million gallons capacity):
 - Davis Brook
 - Kenduskeag East
 - Barkersville
- Increased capacity of key system components:
 - Kenduskeag Pump Station (KSP)
 - Wastewater Treatment Plant (WWTP)
- Performed sewer rehabilitation/separation projects and modified key hydraulic controls
- Meet or exceeded the 80% volumetric control LTCP target at a cost in excess of \$70M (2015 dollars)



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AECOM

2017 LTCP Status

- LTCP model updates include:
 - GIS/mapping
 - Rainfall and flow metering
 - Hydrologic/hydraulic model update
- Data compiled on the physical system:
 - WWTP
 - Interceptors and pump stations
 - CSO regulator structures
 - CSO storage facilities
 - Wet weather/high flow operations
- Initiated preliminary, conceptual-level evaluation of additional CSO abatement (i.e., storage) facilities

2017 LTCP Status – Mathematical Modeling

- CSO planning requires understanding of the hydrologic and hydraulic characteristics of the wastewater collection and treatment system
- The EPA Stormwater Management Model (SWMM) was used for this purpose as part of the 1993 LTCP
 - Updated over the years and last used by CH2M for the 2012 Phase 2 LTCP Progress Report
 - City provided the CH2 model (2013 version) as a starting point for the 2017 LTCP
- AECOM updating and modifying the SWMM model to reflect recent improvements made to the system and the latest rainfall and CSO, pump station and WWTP flow data

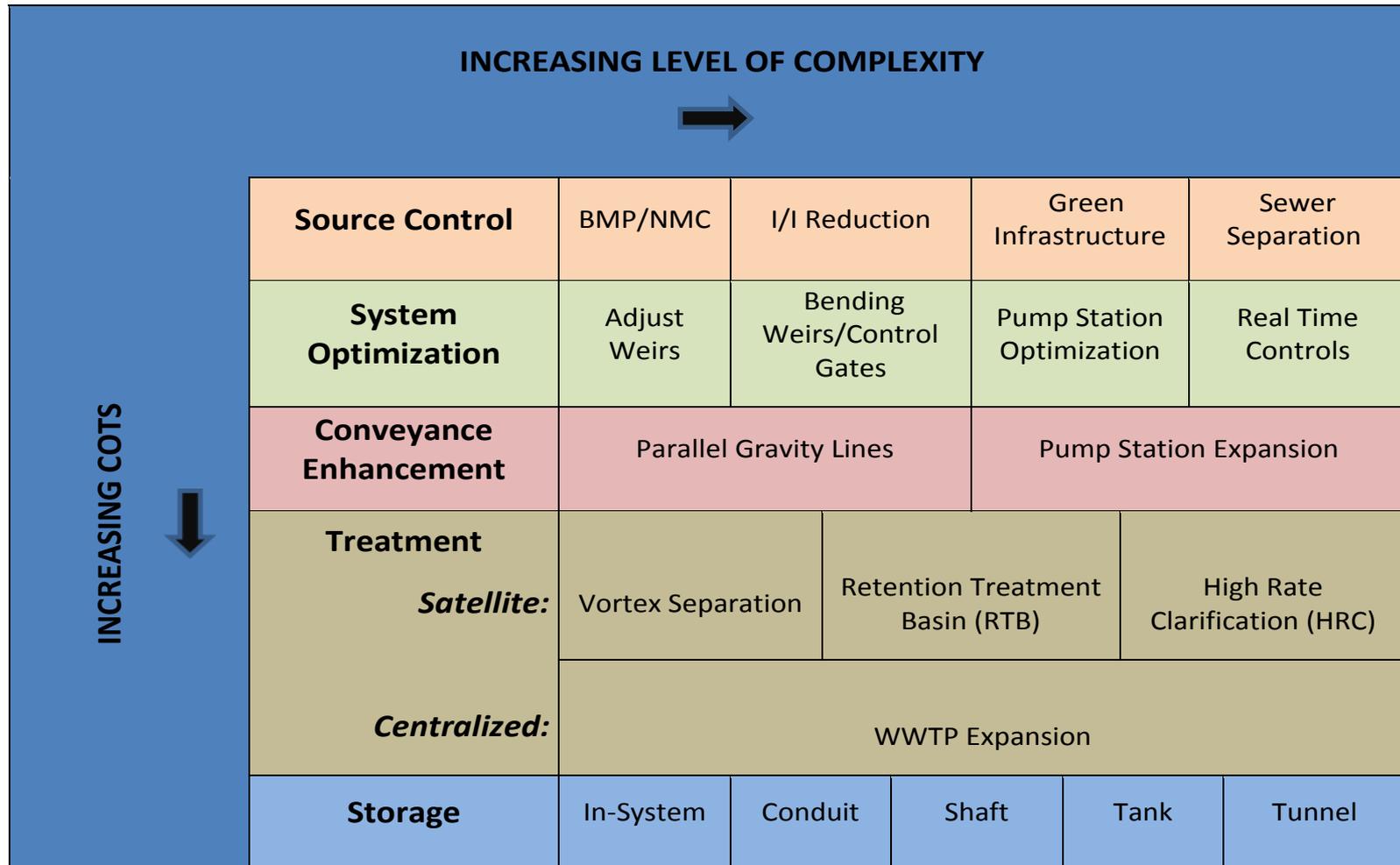
Target Abatement Goals/Level of Control

- 1993 LTCP targeted 80% CSO volumetric reduction
- This was met or possibly exceeded (SWMM versions)
- 2017 Phase 2 LTCP will evaluate alternatives based on:
 - Range of CSO activations per typical year (8, 4, 2, 1 and 0)
 - Associated average annual overflow volume
- Will look for the “knee-of-the-curve”, the cost-effective level of control
- Financial Capability Analysis (FCA) will be a major consideration in City’s ability to meet the 2031 Consent Decree deadline

CSO Technology Evaluation Process

- Begin with low cost, source control measures
 - Best Management Practices/Nine Minimum Controls
- Work up to more complex, more costly measures
- Combinations of controls/technologies also considered
- Recommended CSO controls must be:
 - Rugged
 - Easy to maintain
 - Compatible with existing facilities
 - Ability to phase
- A technology plus a specific site (and level of control) becomes an alternative

Toolbox of Technologies



Preliminary Evaluation of Alternatives

- Until the SWMM is revised, initial evaluations built off the 2012 Phase 2 LTCP Progress Report
- Presently using 2012 CH2M cost projections adjusted using ENR
 - Therefore estimates should not be used for budgeting or released to the public.
 - AECOM will develop bottoms-up cost estimates as part of the 2017 Phase 2 LTCP
- For comparison purposes, this preliminary evaluation focusing on storage, both conduits and tanks
- Looking at individual and combinations of CSO outfalls
 - Combined facilities will require new conveyance, including pumping

Preliminary Evaluation of Alternatives (cont.)

- Targeting the four largest CSOs that represent greater than 95% of the total system annual discharge volume:
 - Barkersville (002)
 - Davis Brook (003)
 - Kenduskeag West (006)
 - Kenduskeag East (007)
- According to the 2012 Progress Report, controlling these outfalls to 4 activations/year, plus Central (023), will also control:
 - Hammond (009)
 - Meadowbrook (011)
 - Cemetery (016)
 - Carr Brook (020)
- Needs to be confirmed with the revised SWMM

Updated Baseline Conditions

- Using updated baseline and projected CSO volumes from partially-revised SWMM
- Existing storage capacities:
 - Barkersville (002) 1.4 MG
 - Davis Brook (003) 1.2 MG
 - Kenduskeag East (007) 1.2 MG
 - Total 3.8 MG
- Modeled peak capacities (per previous LTCP and MPDES Permit):
 - WWTP 43 mgd*
 - KPS 28 mgd

* Theoretical capacity; requires WWTP improvements to reliably accommodate this flowrate.

Updated Baseline Conditions - Systemwide CSO Volume

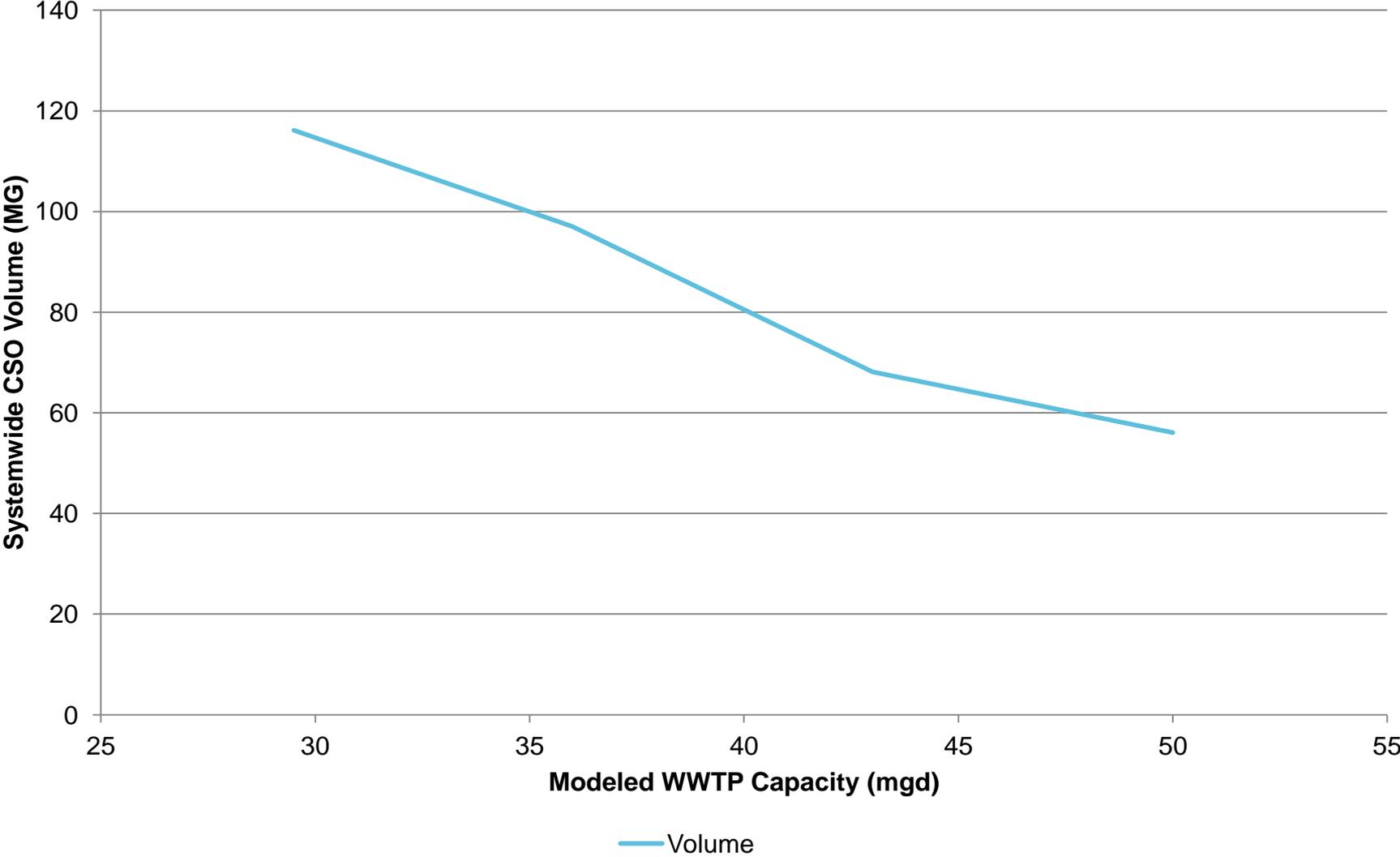
Model	Modeled WWTP Capacity (mgd)	Systemwide CSO Volume (MG)	Percent Control (1993 Baseline)
2012 CH2M*	29.5	154.3	75.7%
2013 CH2M	29.5	116.2	81.7%
2013 CH2M	36.0	97.0	84.7%
2013 CH2M**	43.0	68.1	89.3%***

** Used in the 2012 Phase 2 LTCP Progress Report

** Includes some AECOM adjustments; major model revisions underway to improve accuracy.

*** Used for the preliminary evaluations contained herein.

WWTP Capacity Model Runs



Preliminary Analysis of Additional Required Storage for the Four Largest CSOs – Updated from 2012 TM

Outfall	Existing Storage Capacity (MG)	8 per Year (MG)	4 per Year (MG)	2 per Year (MG)	1 per Year (MG)	0 per Year (MG)
BV/002	1.4	0.07	0.83	1.36	2.95	3.08
DB/003	1.2	0.51	1.42	2.08	2.61	3.02
KW/006	--	1.80	2.61	4.30	3.36	11.14
KE/007	<u>1.2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1.89</u>
Total	3.8	2.38	4.86	7.74	10.92	19.13

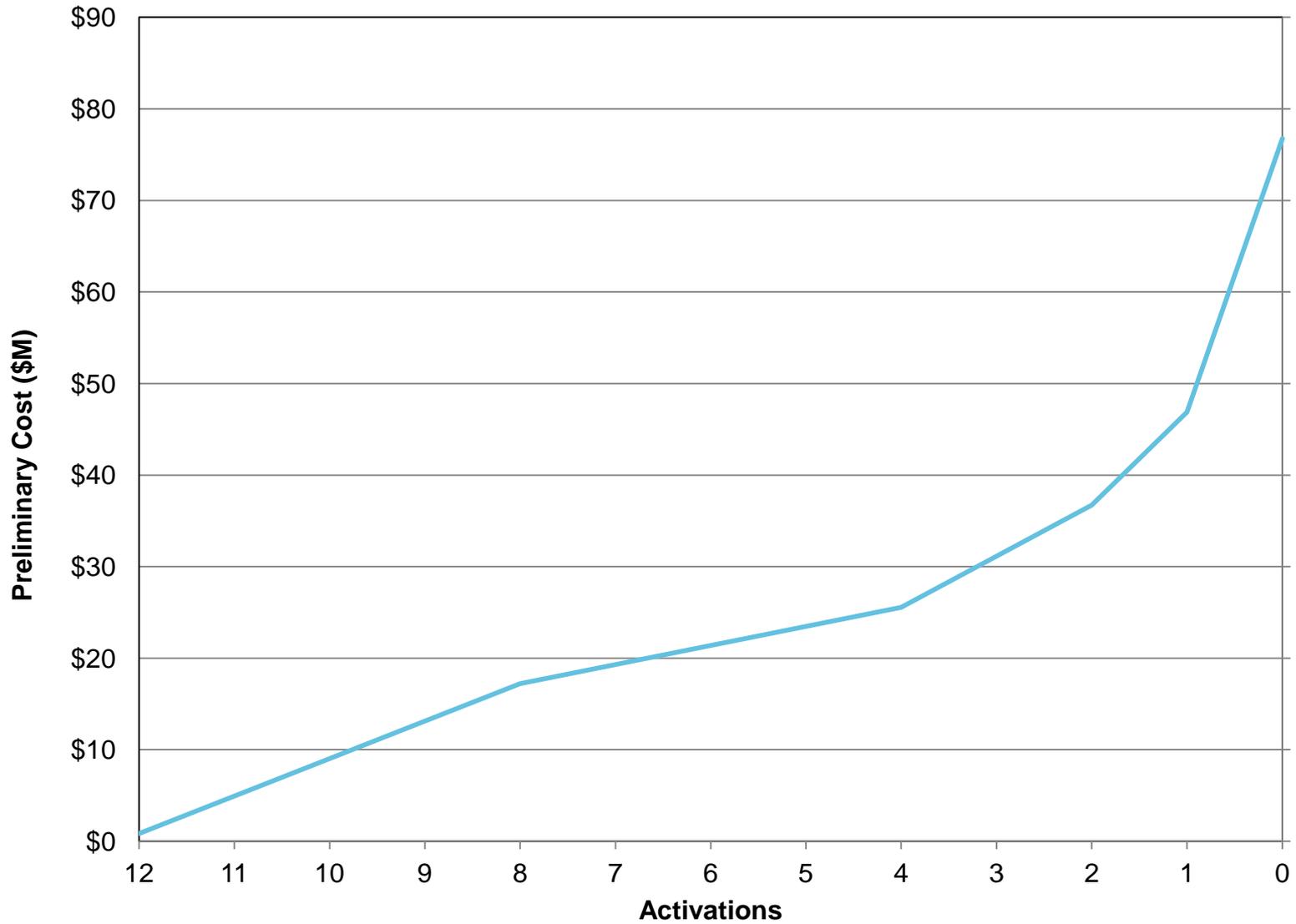
Preliminary Cost Analysis for Additional Required CSO Storage for the Four Largest CSOs – Updated from 2012 TM

Outfall	8 per Year (\$M)	4 per Year (\$M)	2 per Year (\$M)	1 per Year (\$M)	0 per Year (\$M)
BV/002	\$1.95	\$6.59	\$8.44	\$13.52	\$13.89
DB/003	\$5.57	\$8.44	\$10.58	\$12.16	\$13.42
KW/006	\$9.69	\$12.29	\$17.68	\$21.20	\$39.24
KE/007	=	=	=	=	<u>\$10.20</u>
Total	\$17.21	\$27.32	\$36.70	\$46.88	\$76.75

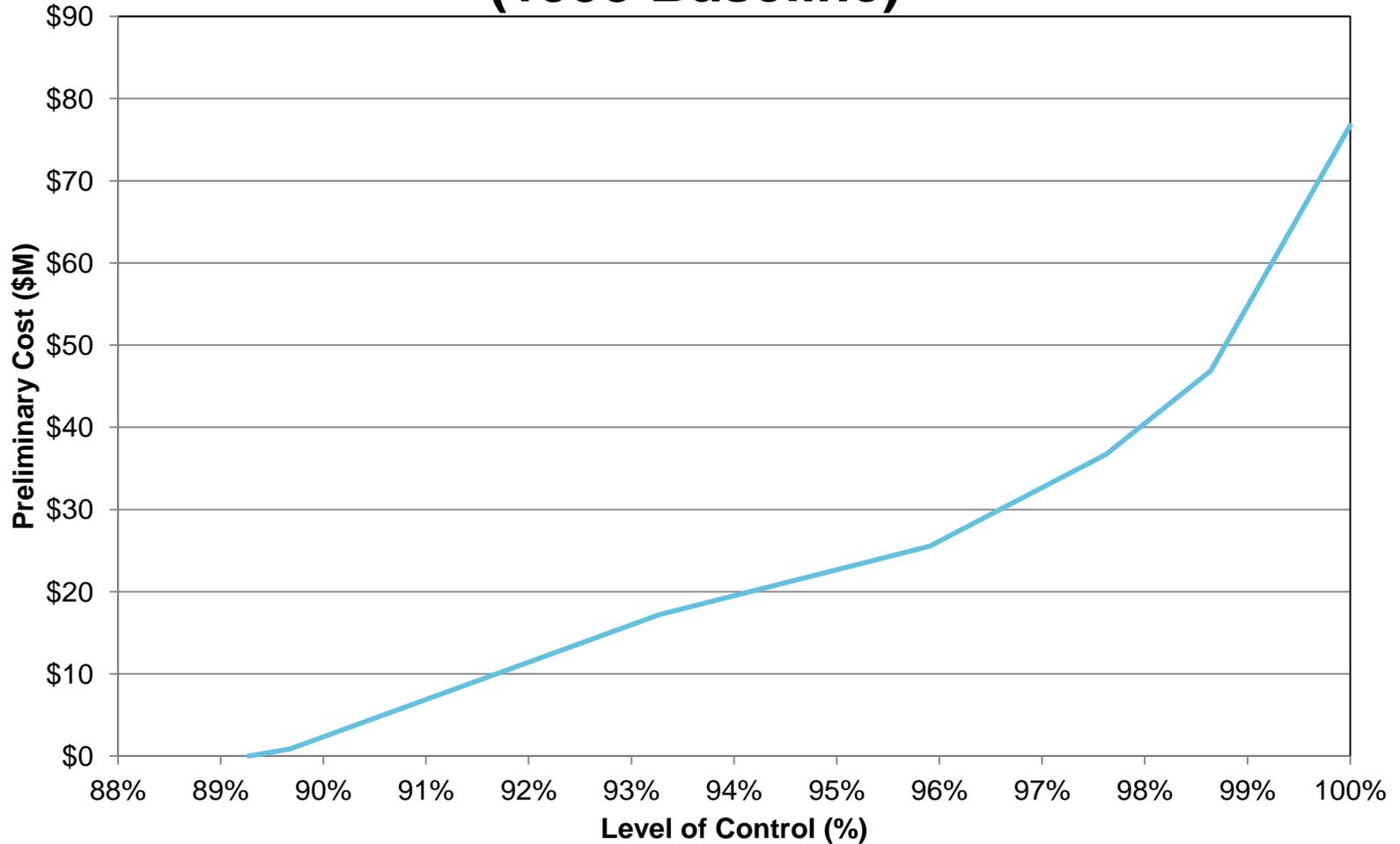
Notes:

1. Costs based on values CH2M presented to City in 2012 (updated based on ENR).
2. Costs should not be used for budgeting or released to public.
3. Costs will be refined by AECOM for the 2017 LTCP.

Preliminary Storage Costs vs. Activations



Preliminary Storage Cost vs. Level of Control (1993 Baseline)



— Level of Control from 1993 Baseline (635 MG)

Preliminary Findings - Snapshot of Abatement Evaluations to Date

- Appears to be a knee-of-the-curve:
 - 4 CSO activations/year
 - 96% volumetric control using the 1993 Baseline
 - Conceptual-level cost estimate for storage (only) is around \$25M-\$30M
 - This estimate will be refined as the 2017 LTCP is advanced
- Not included herein:
 - WWTP CSO Bypass improvements (to safely attain 43 mgd)
 - Ongoing/planned projects
 - Abatement of other smaller CSOs (I/I, sewer separation, GI, etc.)
 - Other CD obligations (field investigations for SSES and updating reports)
- Total obligation could range between \$50M to \$60M

Next Steps in 2017 Phase 2 LTCP Development

- Continue to update SWMM
 - Incorporate new flow metering data
 - Improve calibration and projections
 - Support alternatives evaluations
- Refine the evaluation of alternatives
 - Prepare bottom-up cost estimates as abatement alternatives become more defined
 - Incorporate SSES findings
 - Establish knee-of-the-curve level of control
- Refine the Financial Capability Analysis

Refine the Financial Capability Analysis – *This is Key*

- Submitted draft FCA to EPA in spring of 2015
 - Received numerous comments throughout the CD negotiations
 - Participated in many discussions with EPA
- City and EPA agreed to finalize FCA concurrently with the completion of the 2017 Phase II LTCP*
 - Take into account all wastewater/stormwater obligations
 - Review/incorporate projects in the Bangor CIP
 - Incorporate updated Asset Management results, when available
 - Develop an affordable phasing plan
- Bottom-line: need to assess reasonableness of CD 2031 deadline

***Completion of the FCA will need to be a separate Purchase Order running parallel to the development of the LTCP cost estimates.**

Benchmarking CSO Abatement Costs

Metric	Augusta ¹	Bangor ²	Portland ³
2010 Population	19,136	33,039	66,194
Baseline CSO Discharge Volume (MGY)	58	635	720
Target LTCP Control Level (Initial)	1/year	80%	88%
Current Level of Control (%)	88%	85%	58%
Projected Level of Control at Completion of Current Program	92	96	87
Expenditure to Date (\$M in 2015 Dollars)	43	73	126
Projected Expenditure at Completion of Current Program (\$M in 2015 Dollars)	55	128	311
Percent Expended (%)	77	57	40
Projected Unit Cost of Control (\$/Gal)	1.03	0.21	0.50
Projected Per Capita Cost of Control (\$/person)	2,874	3,874	4,698

¹ Adapted from 2015 LTCP Update.

² *Italicized* figures subject to revision per 2017 Phase 2 LTCP.

³ Adapted from 2013 LTCP Update.

Questions/Discussion

SWMM: Update Status

- Flow Metering

- Phases I & II: Completed, but need to resolve a few meter issues
- Phase III: Ongoing, partial data available?
- The model recalibration tasks have been on hold until current flow metering program data are available

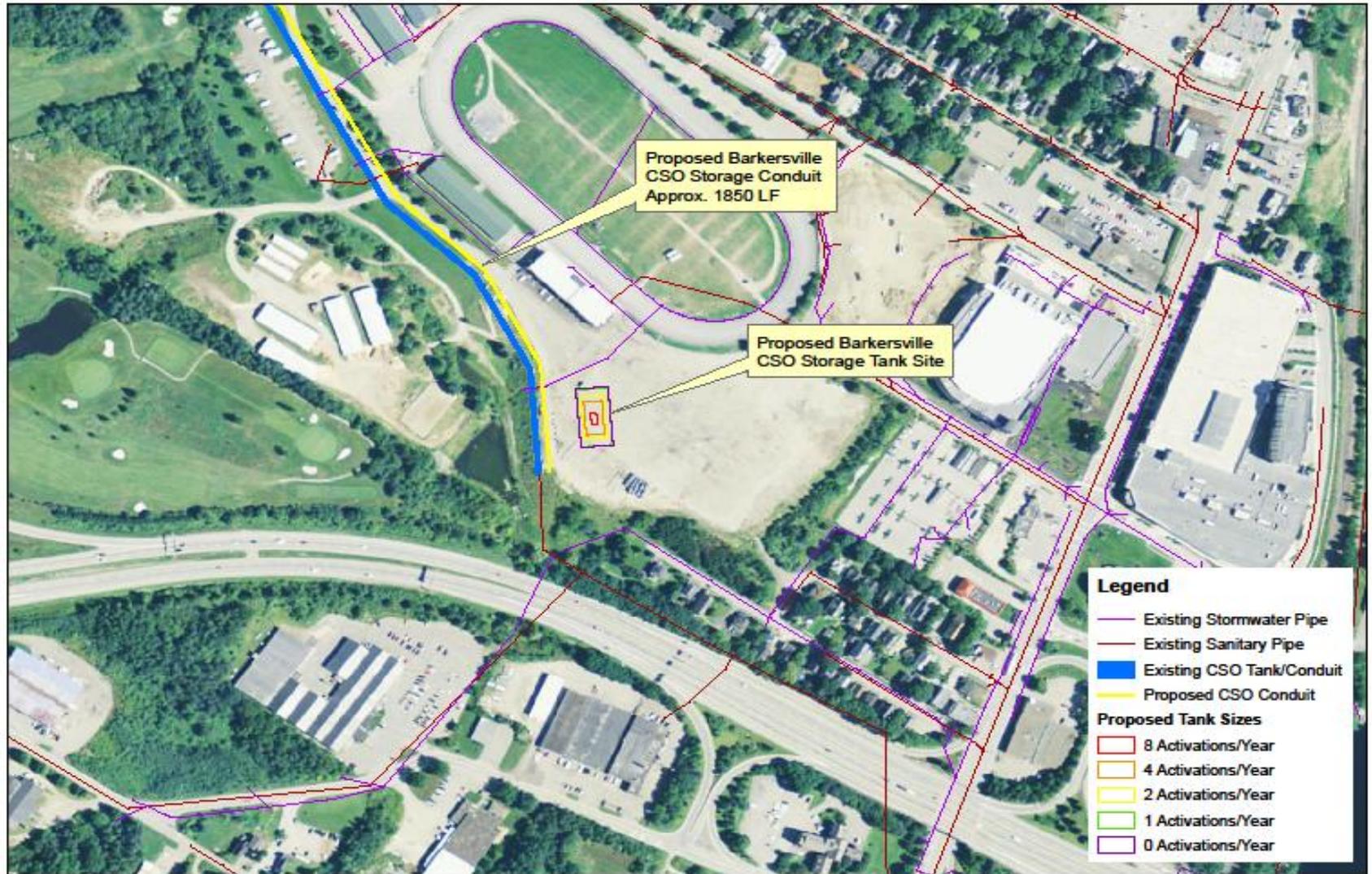
- Model Update

- Model network has been extended further upstream, where appropriate (i.e., larger diameter pipes)
- Incorporate collection system updates since 2012
 - Updated weir elevations
 - Recent construction projects
- Understand system's manual operations during wet weather events

SWMM: Update Status (cont.)

- Preliminary CSO Alternatives Evaluation
 - Using the 2013 CH2M model (“out of the box”)
 - Adjusted WWTP capacity from 29.5 mgd to 43 mgd

Barkersville – CSO 002



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Davis Brook – CSO 003



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Kenduskeag East and West – CSOs 006 and 007



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French/Exchange Street

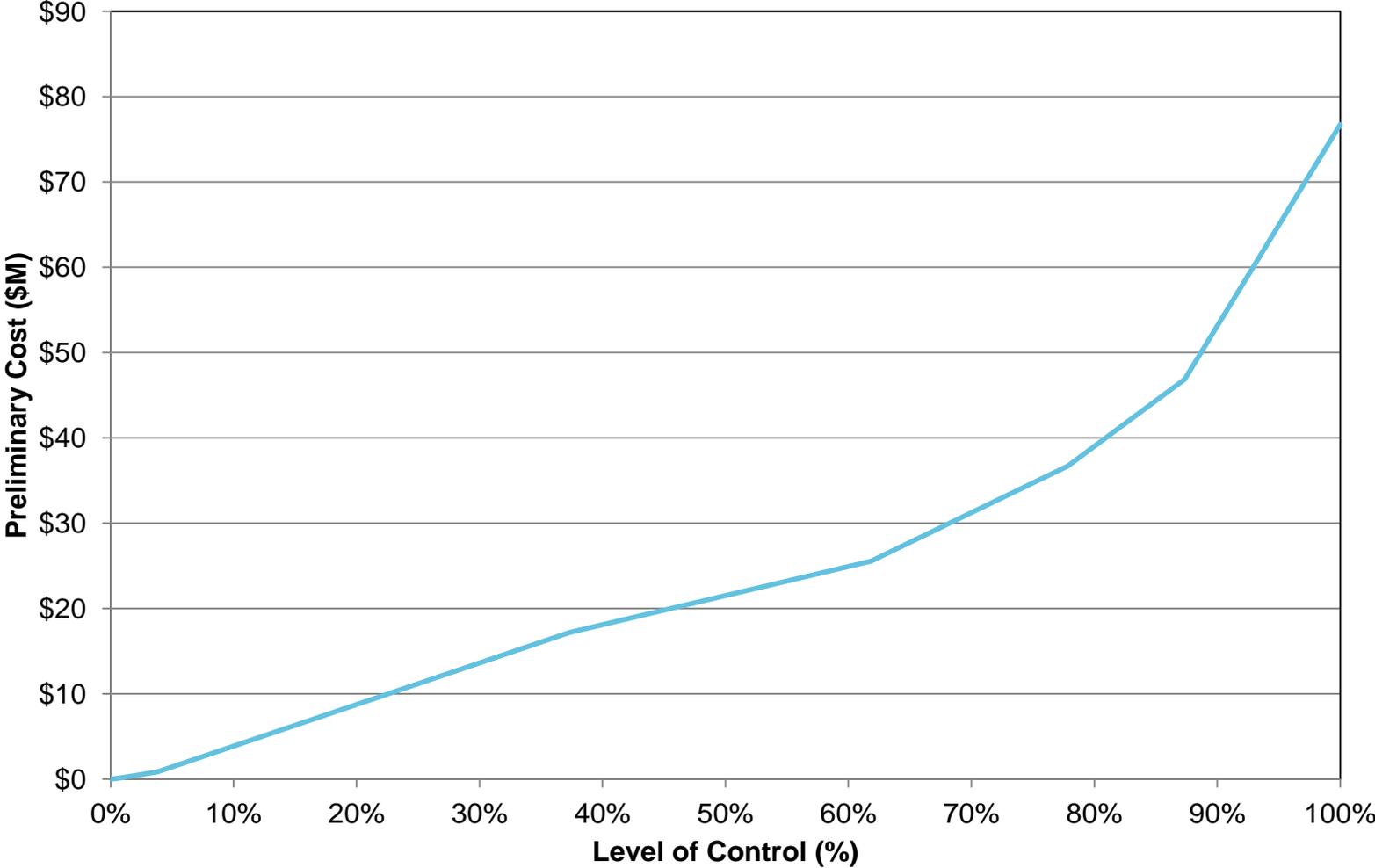
- Reviewed CCTV provided by City on French/Exchange/State Street area
- Per City areas of focus:
 - French Street from Somerset to State
 - State Street from French to Exchange
 - Park Street from the new manhole behind City Hall to State/Exchange intersection, and
 - Exchange Street from State Street all the way down to Washington Street.
- CCTV covers portions of focus area



French/Exchange Street

- Due to potential LTCP projects, not focusing on sewer separation in this area
- Recommend completing CCTV during high groundwater:
 - French Street from Somerset to State
 - State Street from French to Exchange
 - Exchange Street portions have been CCTV'd between State Street to Washington Street.
- Review CCTV to recommend rehab/pipe replacement based on City's needs, Water District work, and LTCP
 - Replace Park Street sewer

Cost vs. Level of Control (LTCP Baseline)



— Level of Control from LTCP Baseline (68.1 MG)

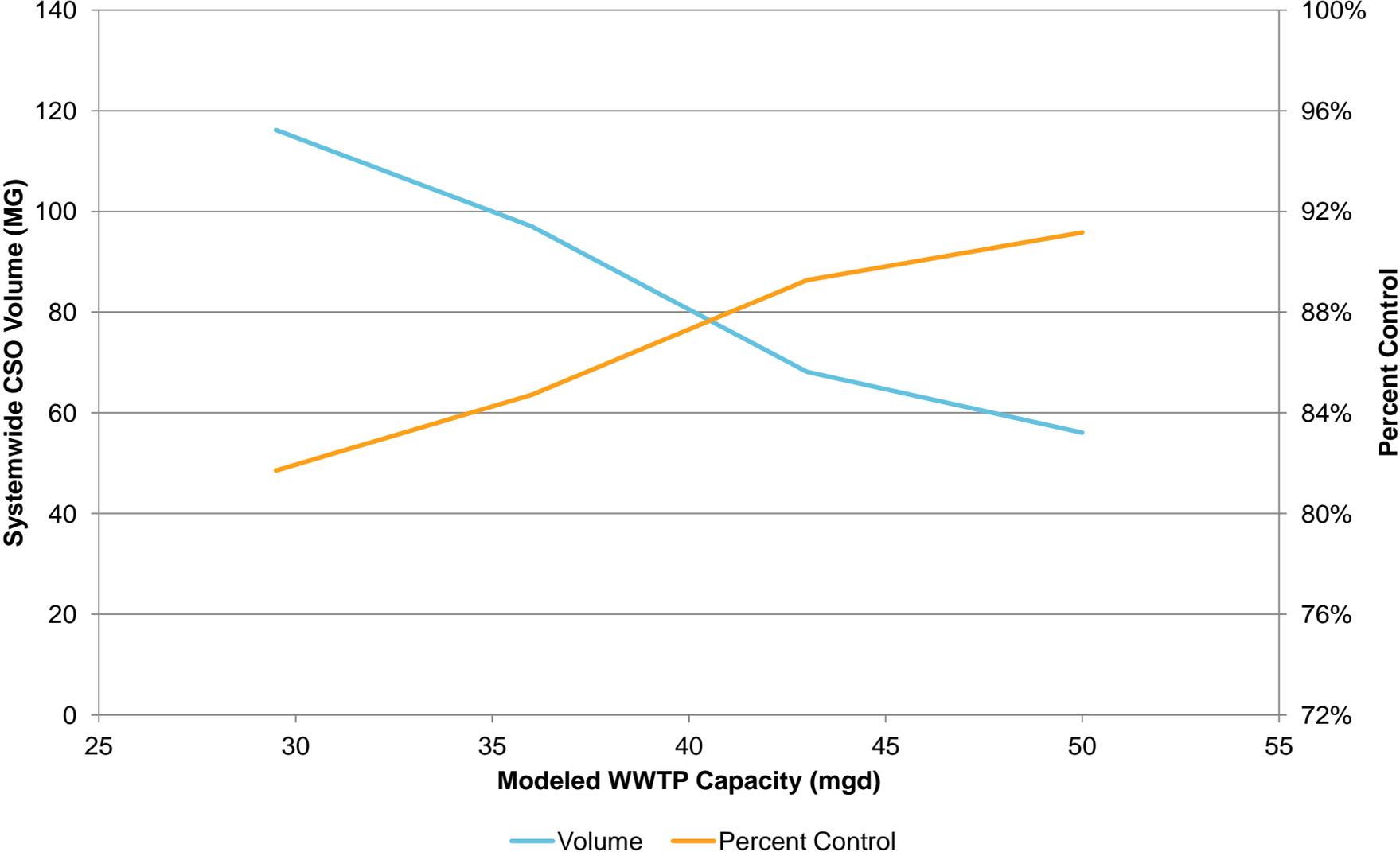
Alternate Storage Configuration – Combining Davis Brook (003) and Kenduskeag West (006)

- Increase KPS by 16 mgd
 - Largest pump that can fit into the empty slot (4th pump)
 - Dedicated CSO FM discharge into enlarged Davis Brook facility
 - Would reduce the size of the required Kenduskeag West facility
- Preliminary projected reductions in volume and activations are less than expected
 - Performance implications beyond these two CSO outfalls
 - Need to resolve systemwide hydraulic intricacies with revised SWMM
- Once SWMM is recalibrated
 - Will further explore this concept
 - Also explore a new CSO PS (> 16 mgd) to capture and convey higher percentages of Kenduskeag West flows

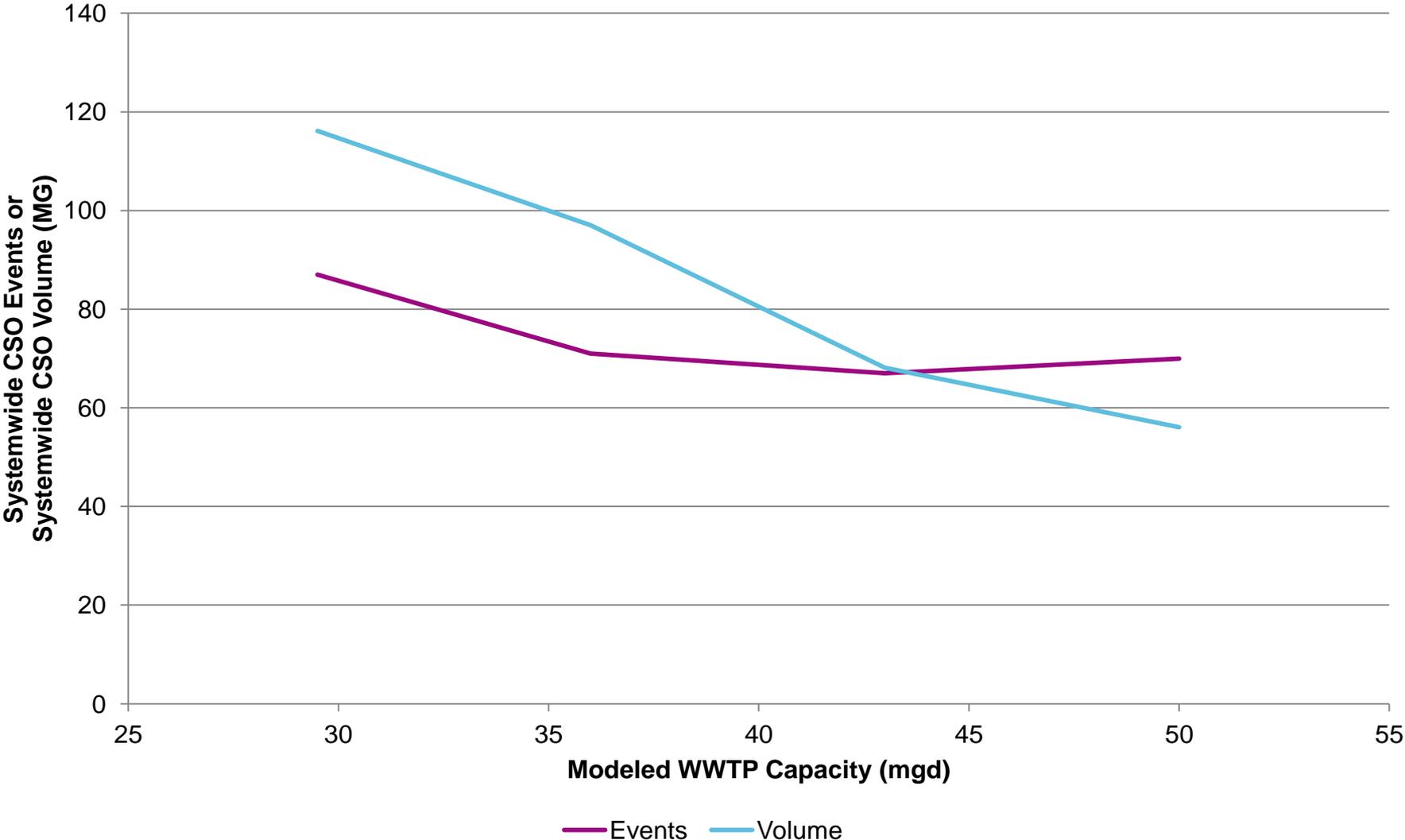
Next Steps in 2017 Phase 2 LTCP Development (cont.)

- Post-construction compliance monitoring (PCM)
- Public outreach
- Consideration of real time controls (RTC)
- Status meeting(s) with EPA
- Draft LTCP later this year

WWTP Capacity Model Runs



WWTP Capacity Model Runs



Updated Baseline Conditions - Activations

CSO Location	2012 CH2M 29.5 mgd	2013 CH2M 29.5 mgd	2013 CH2M 36.0 mgd	2013 CH2M 43.0 mgd
Barkersville (002)	23	26	17	11
Davis Brook (003)	37	30	23	23
Kenduskeag West (006)	17	14	14	15
Kenduskeag East (007)	4	1	1	2
Hammond St. (009)	1	0	0	0
Meadowbrook (011)	35	12	12	12
Cemetery (016)	0	0	0	0
Carr Brook (020)	7	2	2	2
Central St. (023)	<u>11</u>	<u>2</u>	<u>2</u>	<u>2</u>
TOTAL	135	87	71	67