HOW BANGOR, MAINE WILL EXPAND A 20-YEAR OLD STORAGE FACILITY THREEFOLD ALONG A VIBRANT WATERFRONT

Kate Mignone, AECOM

John Theriault, City of Bangor Engineering Department

Andy Rudzinski, City of Bangor WWTP

Gregory Heath, AECOM

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Agenda

– Background
– Davis Brook Storage Tank (DBST) Design
– Project Schedule
– Conclusions

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Background

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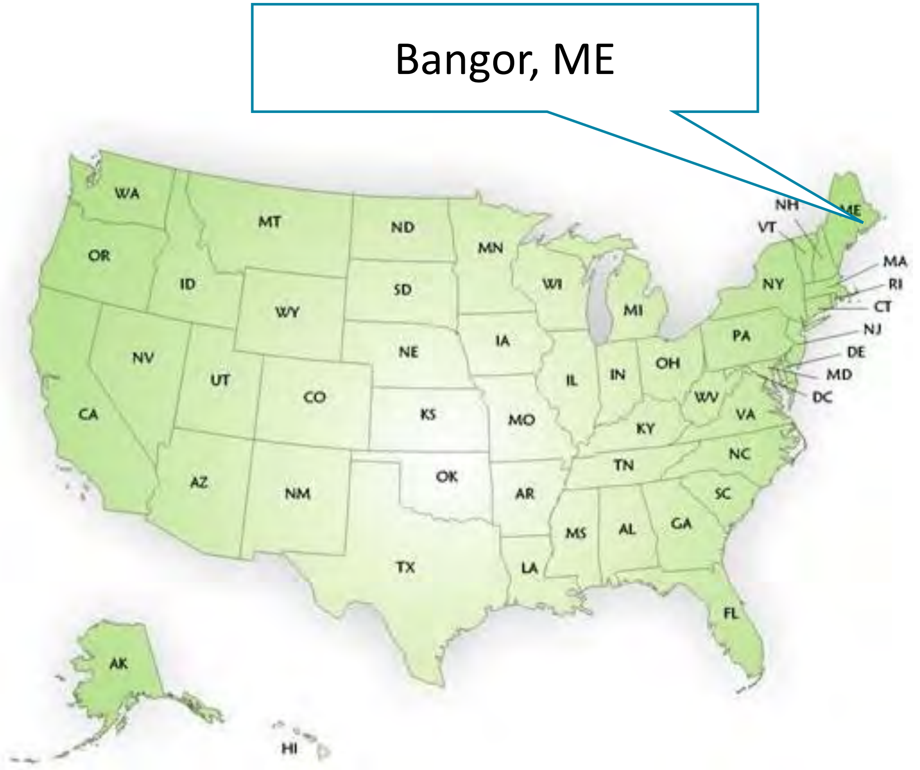
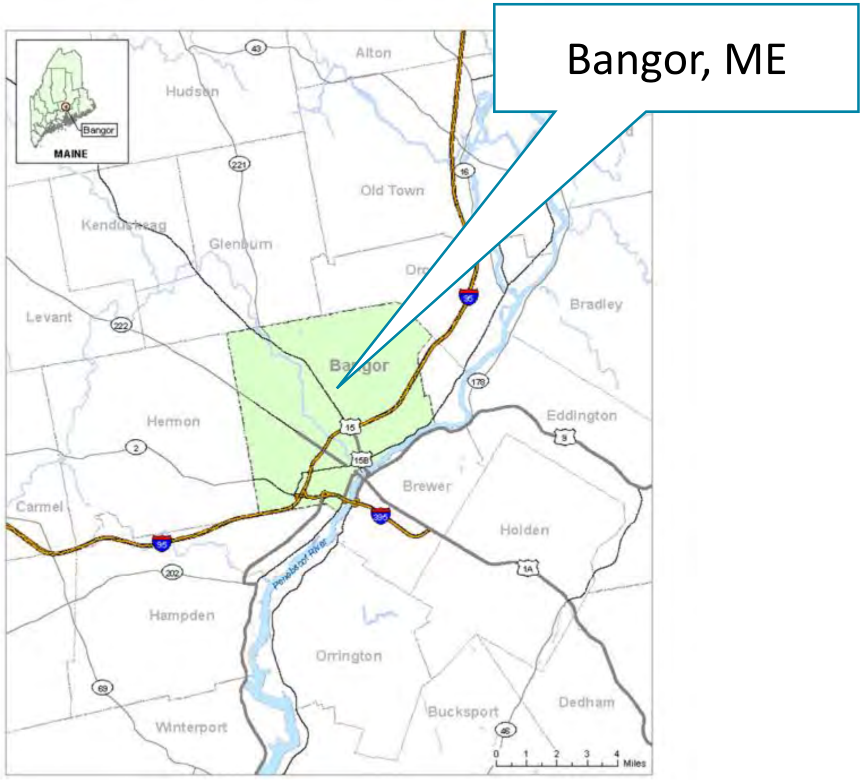
Location Plan





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Community Setting

– Located on Penobscot River at confluence with Kenduskeag River
– Older “Working” City with long history in lumber and trade
– Population:
  - 32,569 (2014)
  - High percentage of low income and elderly

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Wastewater Collection System

– Service Area: 33 Mi^2

– Population Served:

  - 32,500 in Bangor
  - 8,000 in Connected Communities

– 157 Miles of Gravity Sewer

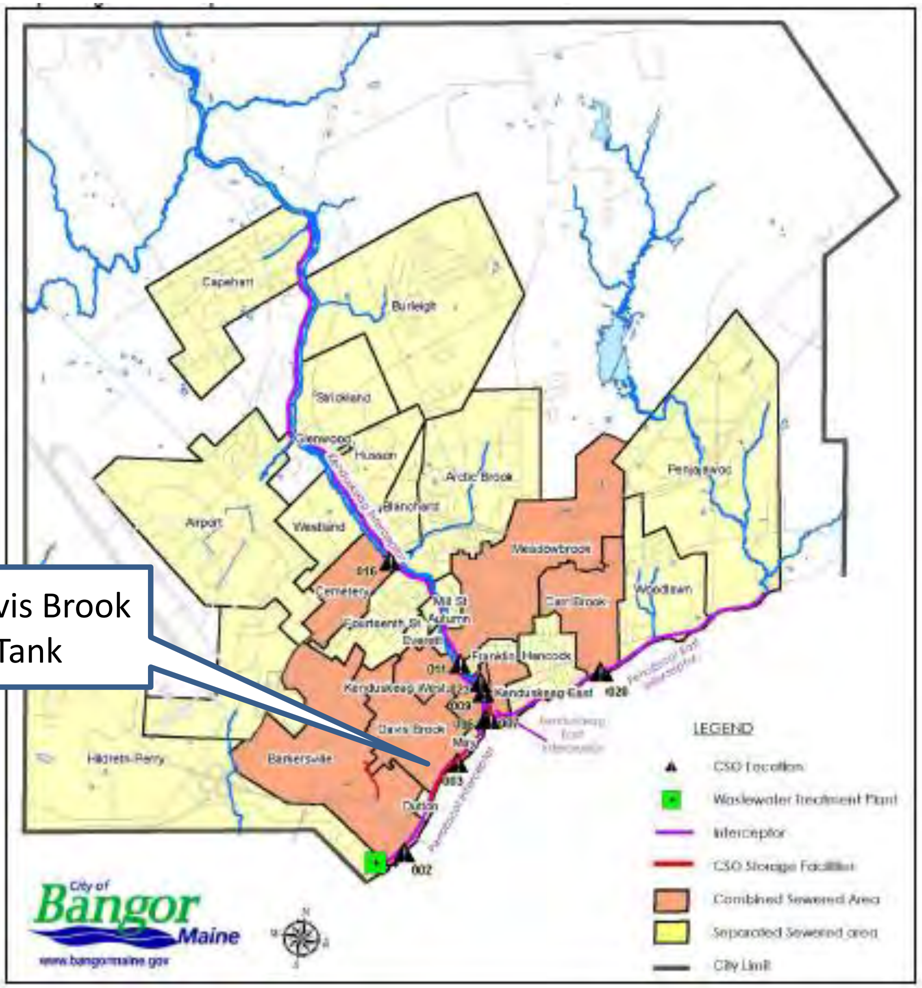
– 9 Miles of Interceptor

– 4,000 Ft. of Force Main

– 5 Pump Stations

– 8 Siphons

– 9 Permitted CSOs



Proposed Davis Brook Storage Tank

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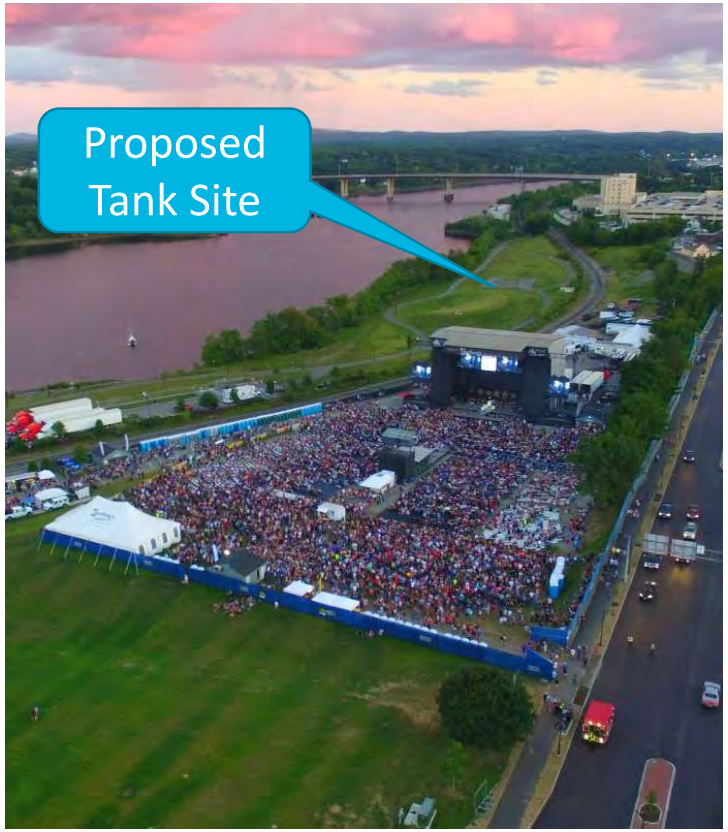
Clean Water Act Compliance Milestones

30-Year History Working With EPA & ME DEP on CWA Compliance

- 1987: CD with ME DEP to begin CSO control
- 1991: CD with EPA for CSO LTCP I
- 1994: EPA accepts LTCP I
- 2009: All LTCP I projects complete
- 2012: DRAFT PHASE 2 LTCP
- 2013: Negotiation begins on new CD
- 2015: New CD finalized
- 2017: FINAL PHASE II LTCP

First LTCP Project - Davis Brook Storage Tank

- Frequency and volume of overflows at the Davis Brook CSO
- Location of the proposed DBST in the vicinity of the Waterfront
- Coordinate the DBST project with other Waterfront development plans
- Opportunity to improve hydraulics at the existing Davis Brook CSO regulator structure



Davis Brook Storage Tank Design

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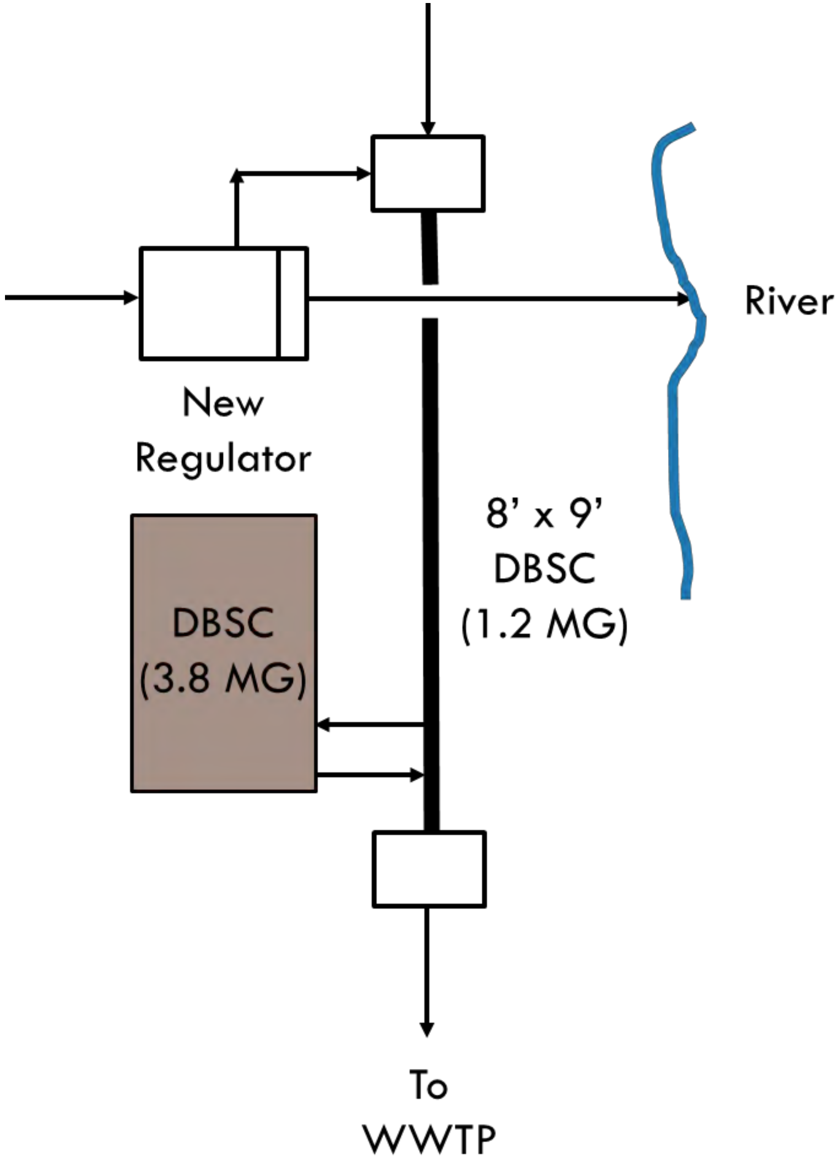
Design Criteria

– O.F. target:	4 per year
– Storage required:	5 MGAL
– Existing conduit:	1.2 MGAL
– Tank storage:	3.8 MGAL
– **TOTAL SYSTEM:**	**5.0 MGAL**



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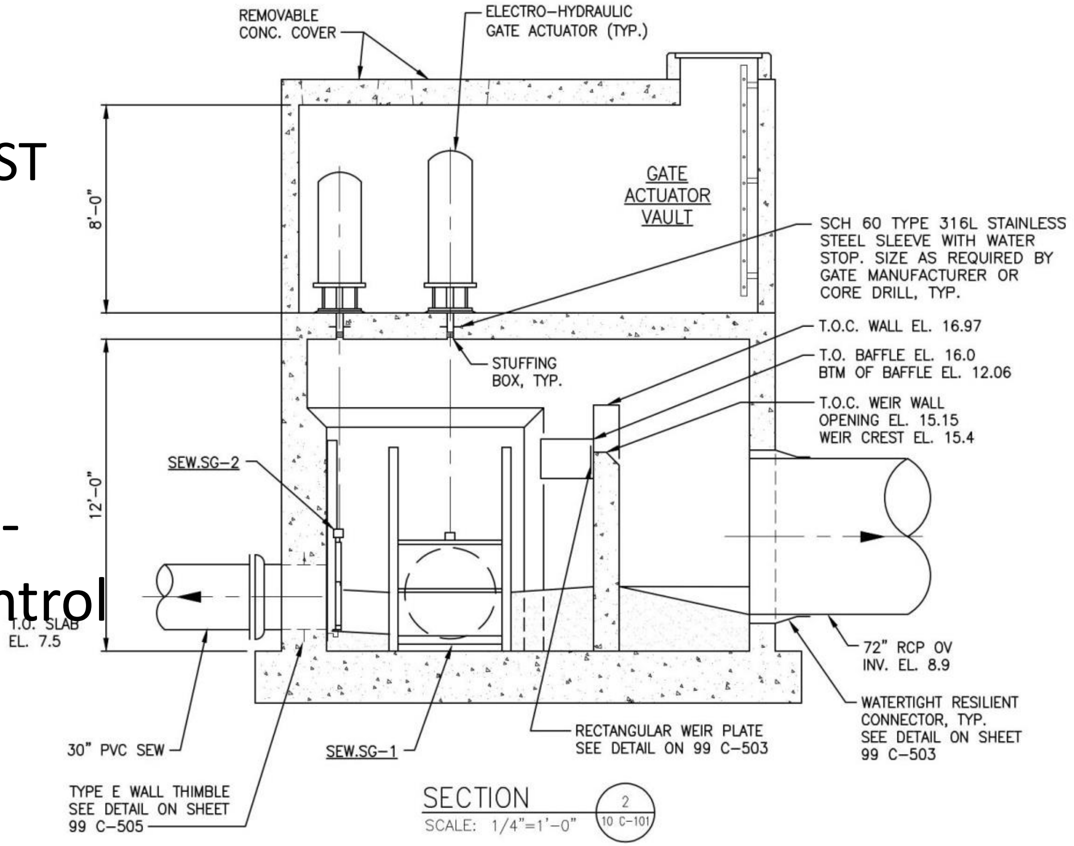
New Regulator Structure

- Under construction
  - Separate contract from DBST
- Increases dry weather connection size
  - 30 / 21 inch to 42 inch
- Provides new hydraulically-actuated gates for flow control



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New Regulator Structure

– Unsheeted excavation due to rock, other potential obstructions to sheet piles

– Construction suspended during summer concert season

  • To be completed winter 2020

Site Access

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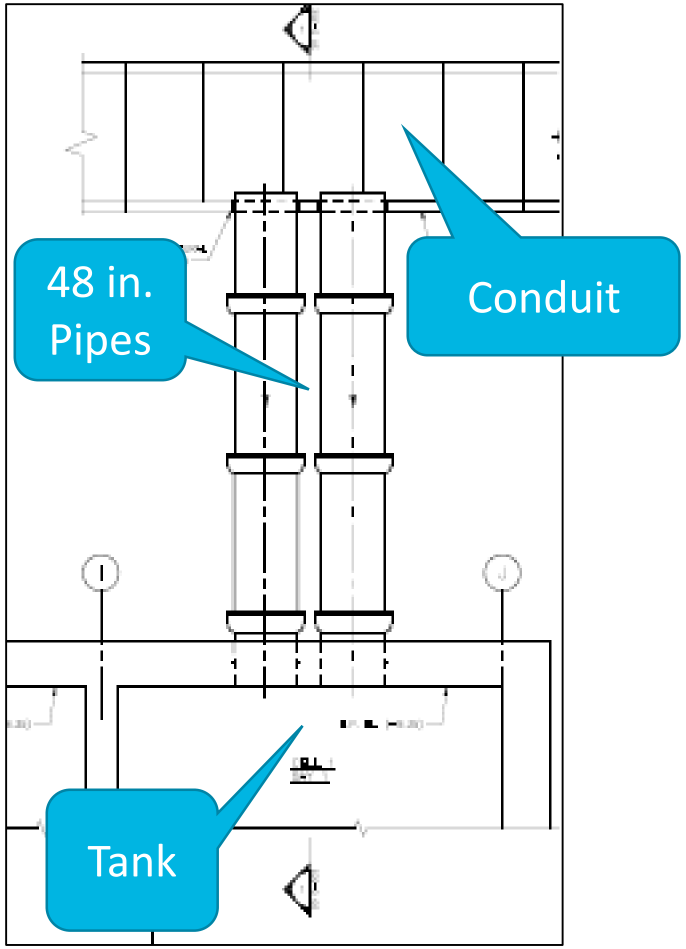
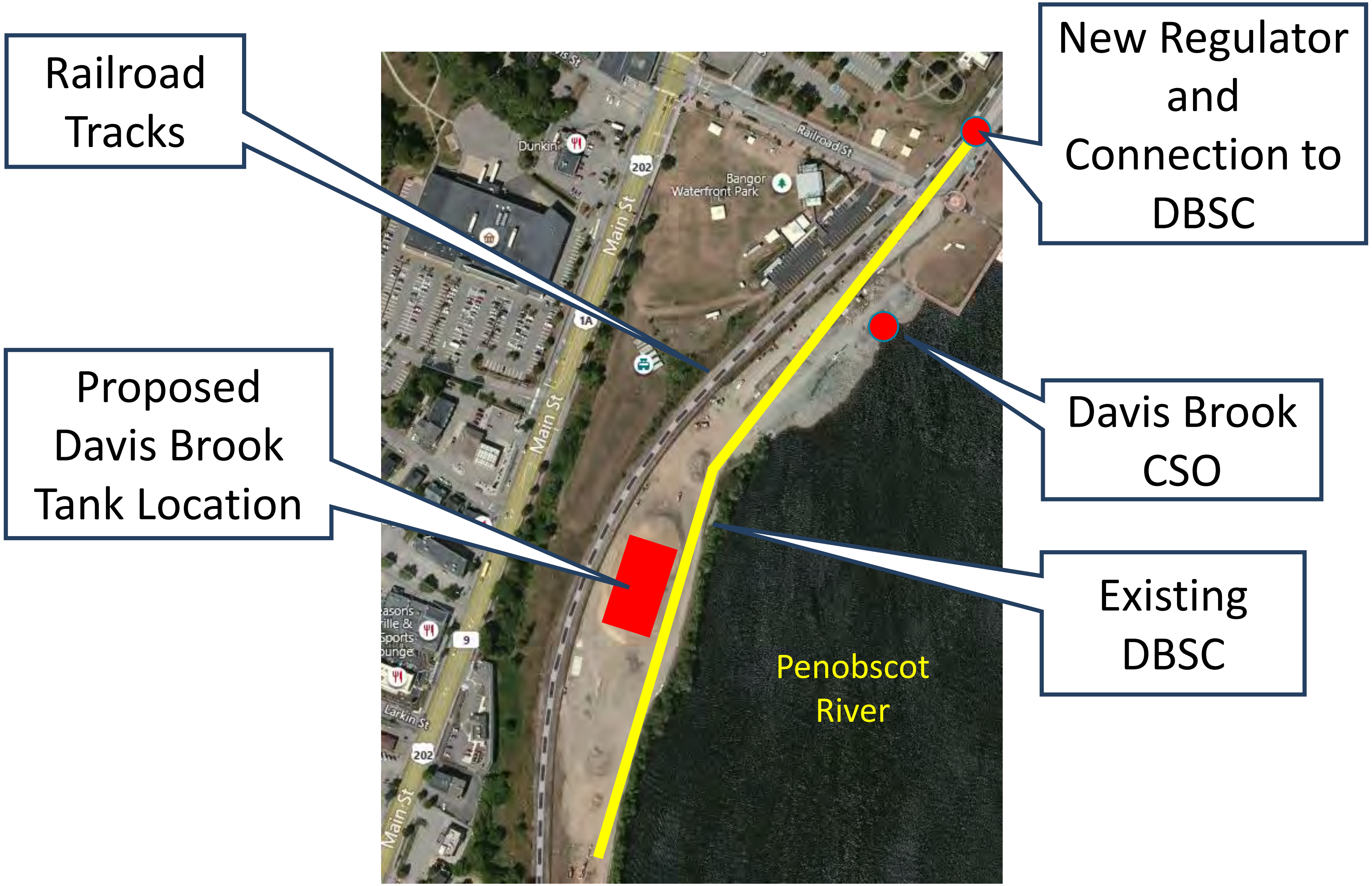
Connection Between Conduit and Tank

– Twin 48-inch ductile iron pipes
– Sized to meet 4 overflows per year level of control
– Installed into replacement section of conduit
  • Replacement section includes improved access to conduit
– Included two joints in each pipe to account for potential differential settlement



Siting Considerations



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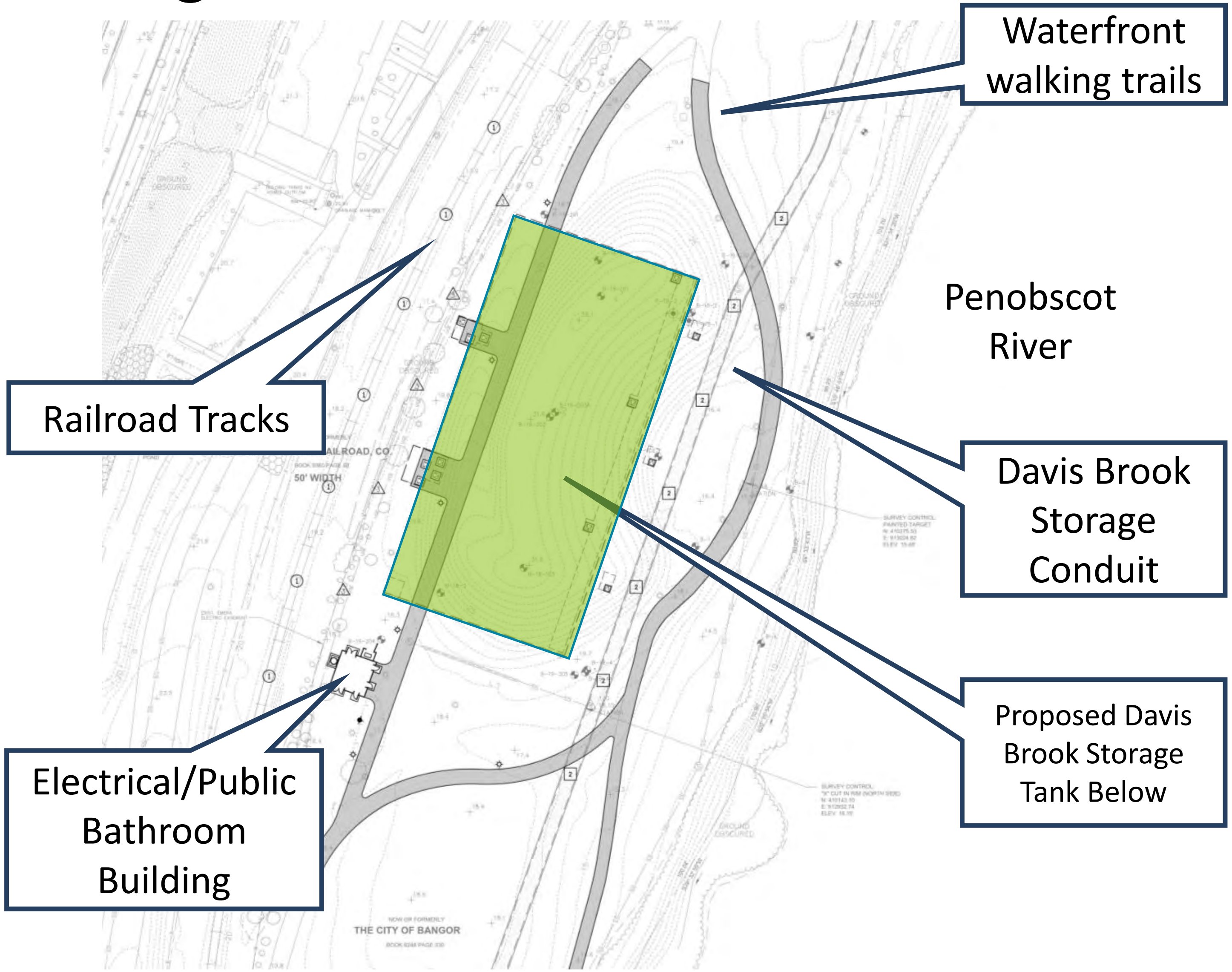

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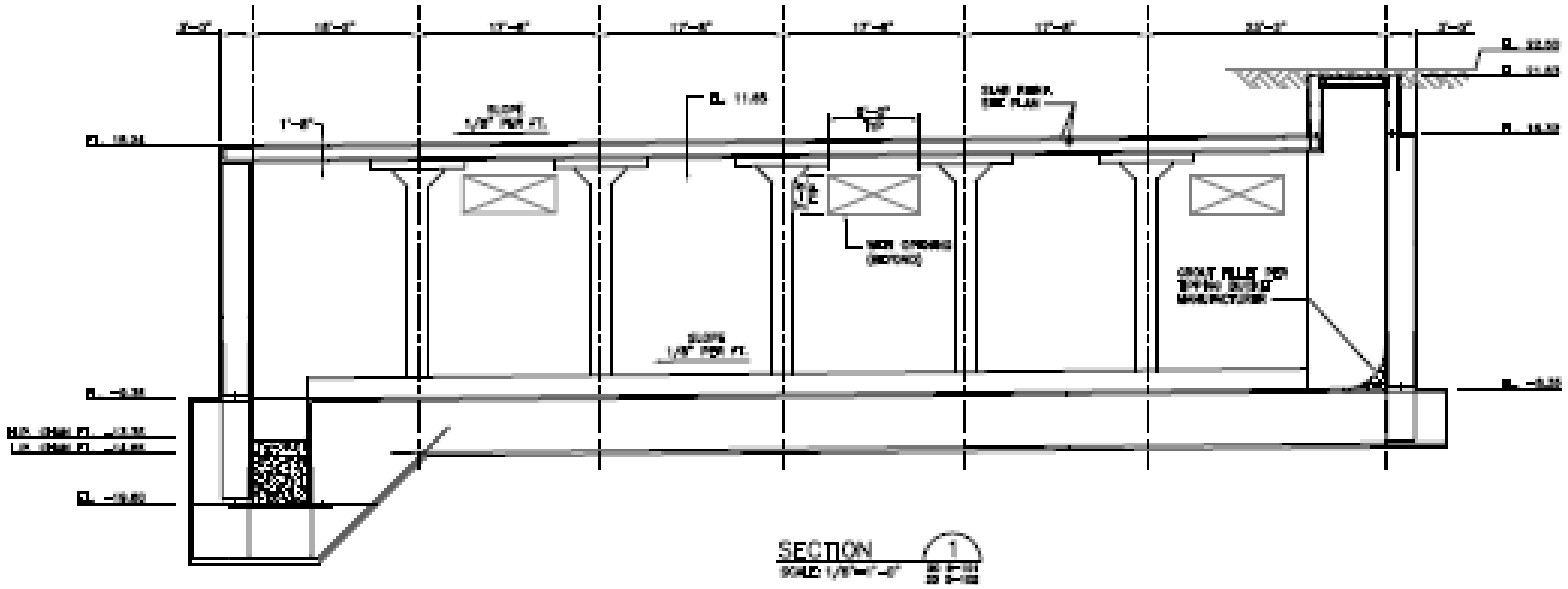
Tank Geometry and Key Features

- Length: 116 ft.
- Width: 242 ft.
- Side water depth: 20.5 ft.
- Freeboard: 3.1 ft.
- Longitudinal slope: 1%
- Gutter cross slope: 2%



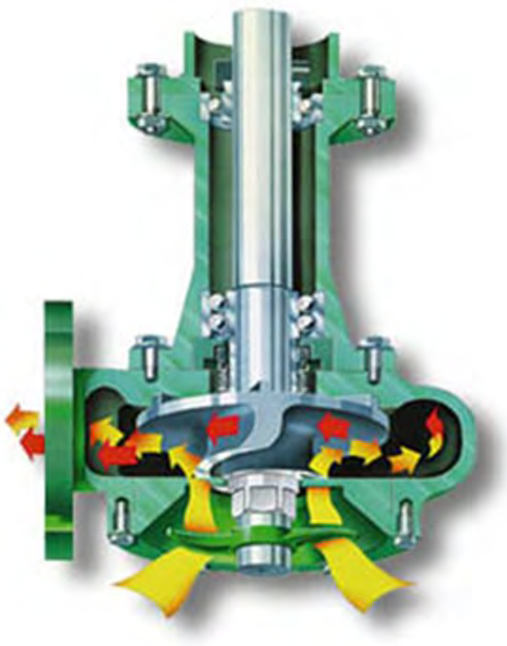
Tank Dewatering

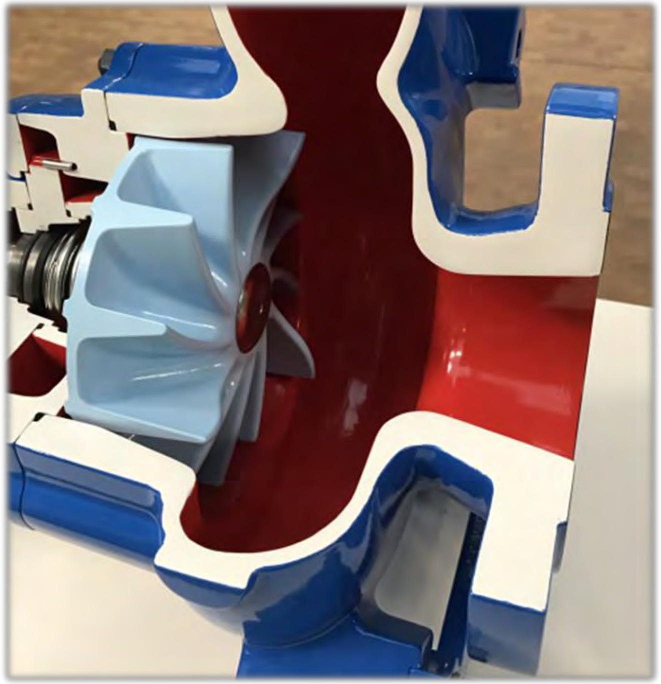
<u>Pump Types Evaluated</u>

– Recessed impeller

– Screw centrifugal

– Chopper





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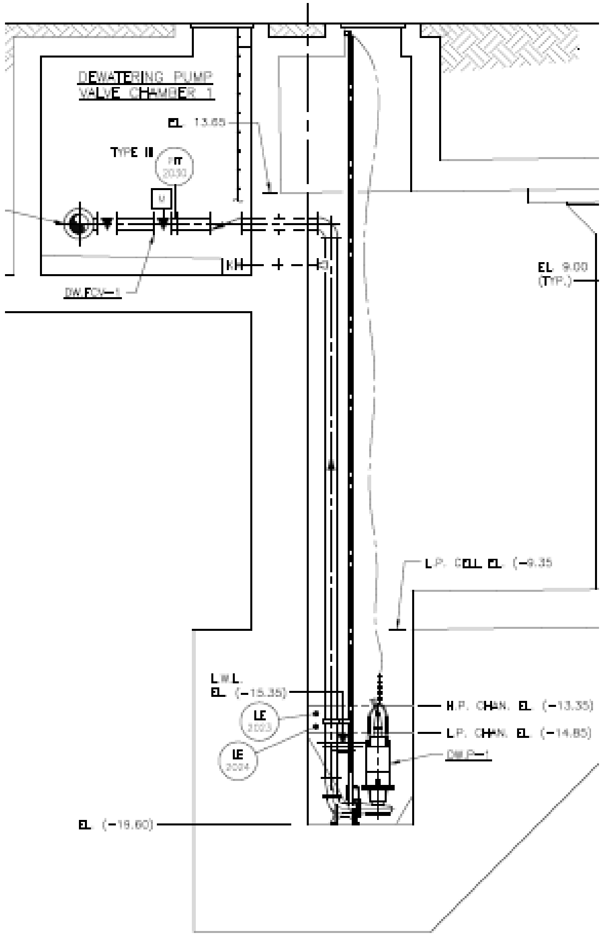
Dewatering Pump Design

- Rail-mounted submersible chopper pumps
- Three installed pumps (one per cell) plus shelf spare
- Part of automated post-event clean-up sequence
- Sized to:
  - Operate over full range of water levels in tank
  - Dewater full tank in 24 hours



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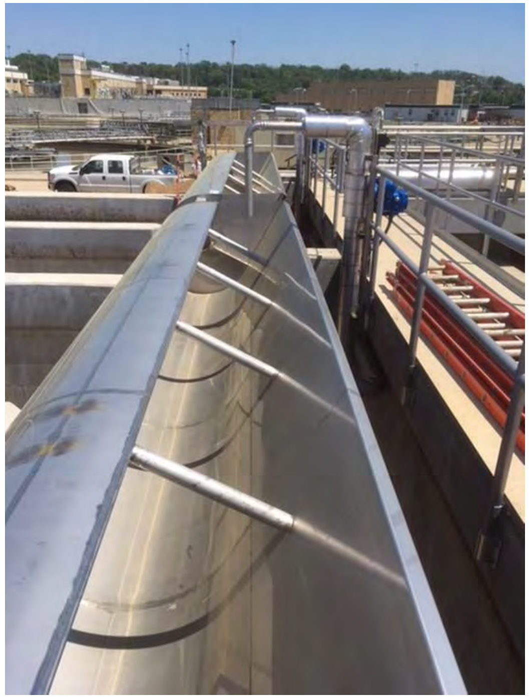
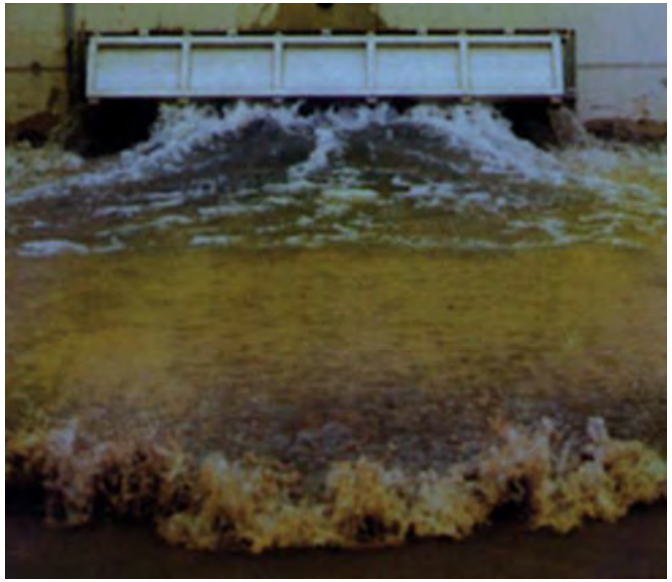
Post-Event Cleaning

<u>Options Considered</u>

– Tipping buckets

– Flushing gates





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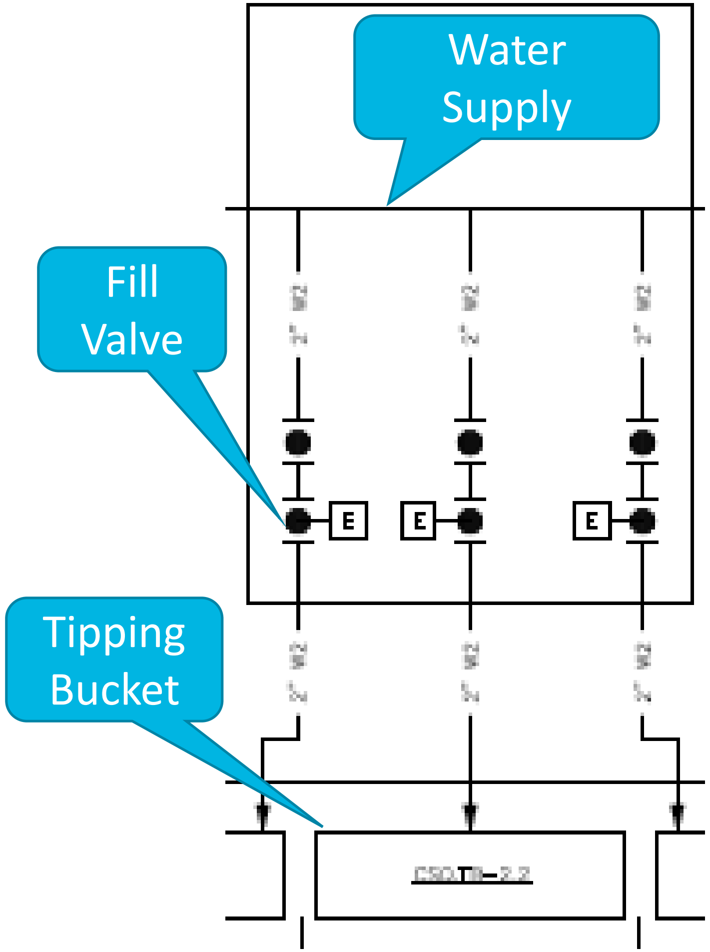
Tipping Bucket Design

- Three tipping buckets per cell
- Part of automated post-event clean-up sequence :
  - Dewatering pumps empty each cell containing storm flow
  - Tipping buckets sequentially fill and tip
  - Dewatering pumps empty gutter and sump after each bucket tips



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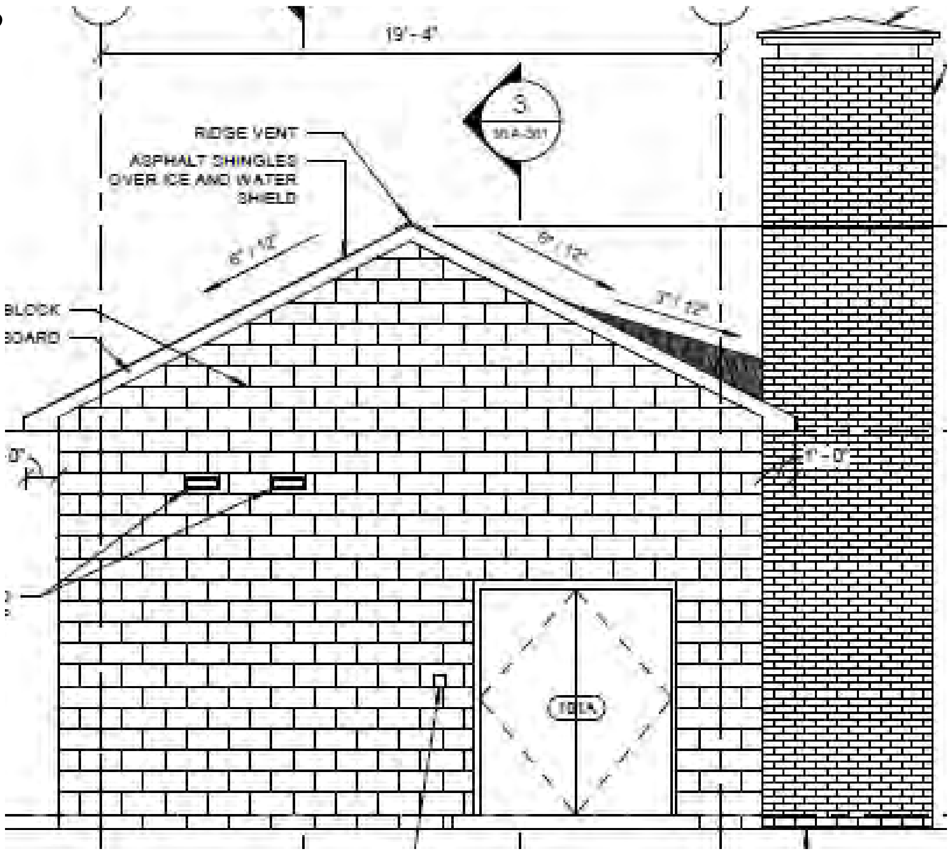
Tank Vent

- Capable of exhausting air during tank filling
  - Sized based on peak flow into tank
  - Styled to resemble chimney
- Admits air into tank when emptying
- May add odor control in future if warranted



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Other Design Challenges

- Presence of competent rock
- Alternatives to counteract buoyancy
- Contaminated soil
- Facility start-up and acceptance testing

SAMPLE INFORMATION

Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data / PID Readings
1D		0-2	24/16	WOH-9-14-13	PID=0.5 ppm
2D		2-4	24/20	17-18-13-11	PID=0.4 ppm
3D		4-6	24/10	7-6-6-8	PID=0.3 ppm
4D		6-8	24/12	7-7-5-5	PID=0.2 ppm
5D		8-10	24/10	3-7-5-10	PID=0.3 ppm
6D		10-12	24/8	11-9-8-15	PID=0.3 ppm
7D		12-14	24/6	12-9-10-10	PID=0.3 ppm
8D		14-16	24/12	7-4-2-1	PID=0.3 ppm
9D		16-18	24/12	2-15-16-15	PID=0.3 ppm
10D		21-23	24/4	18-12-10-8	
11D		24.5-26.5	24/6	10-7-2-20	PID=0.3 ppm
12D		30-31.1	13/6	9-31-50/1"	PID=0.2 ppm w =10.5 %

Depth (ft)	Sample Description & Classification
0.5	Loose, brown Sandy SILT (Fill)
	Medium dense, brown Silty SAND, trace gravel, black ash, and red brick (Fill)
4.0	Medium dense, brown Silty SAND, trace gravel and black ash (Fill)
10.0	Medium dense, brown Silty SAND and GRAVEL, trace black ash (Fill)
14.0	Loose, brown Silty SAND, trace gravel (Fill)
16.5	Medium dense, brown Silty SAND and GRAVEL (Fill)
18.5	Medium dense, GRAVEL, trace sand and silt (Fill)
24.0	Medium dense to loose, brown Sandy SILT and GRAVEL with, trace wood (Fill)
27.0	Dense, brown Silty GRAVEL and SAND (Glacial Till)
31.2	Probable BEDROCK

Roller Cone Refusal at 37.0 feet

Existing Site

Future Tank Site - Amphitheater Mound to be Removed

Walking Trail – Continues on Both Sides of Future Tank Site

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Future Site

Tank Site - Amphitheater Mound Removed

Electrical Building with Public Restrooms

Project Schedule and Conclusions

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Project Schedule

2019		2020				2021				2022			
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

- Complete DBST Design / Advertise for Bids
- Begin DBST Construction
- Complete CSO Regulator Construction

- Complete DBSC Construction

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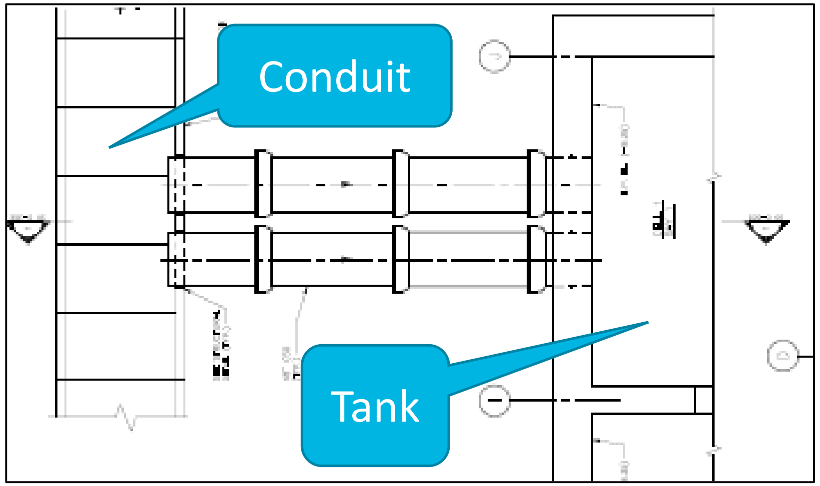
Conclusions and Take-Aways

- Importance of designing CSO facilities for future expansion
- Innovative approach for expanding CSO storage with integrated storage solution
- Collaboration within City to meet needs of CSO control and future waterfront expansion



Questions

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