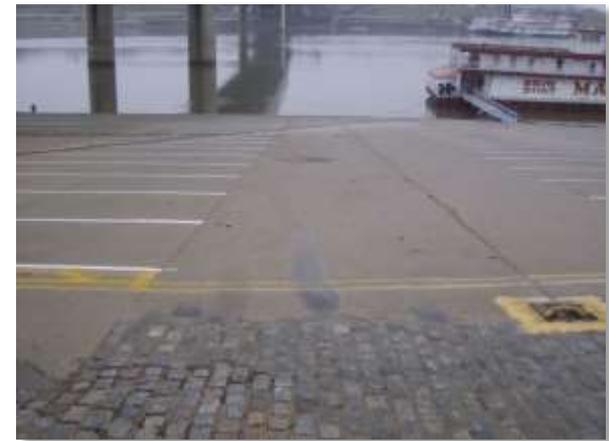


HIGH WATER/DRY WATER PROTECTION: Managing Our Aging CSO Structures



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AGENDA

- Background
- Project Objectives
- Methodology
- Assessments Completed
- Conclusions

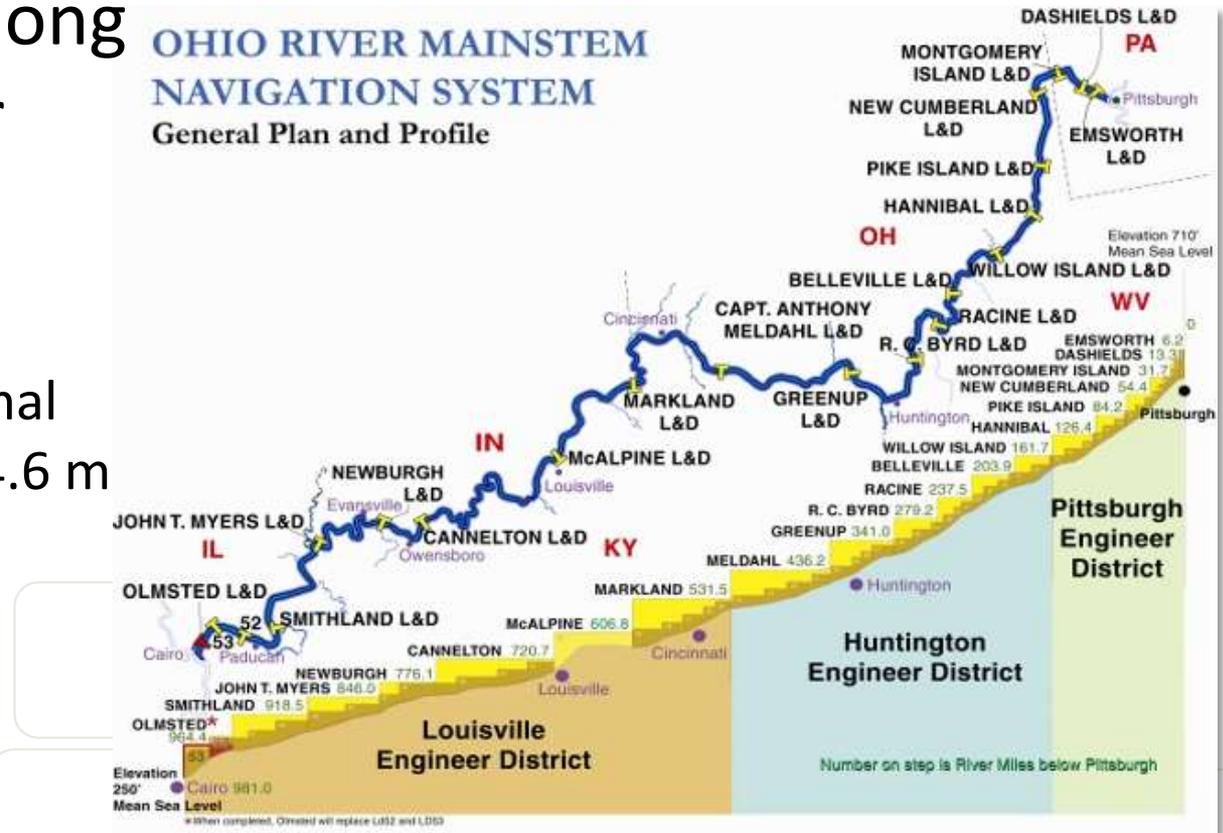


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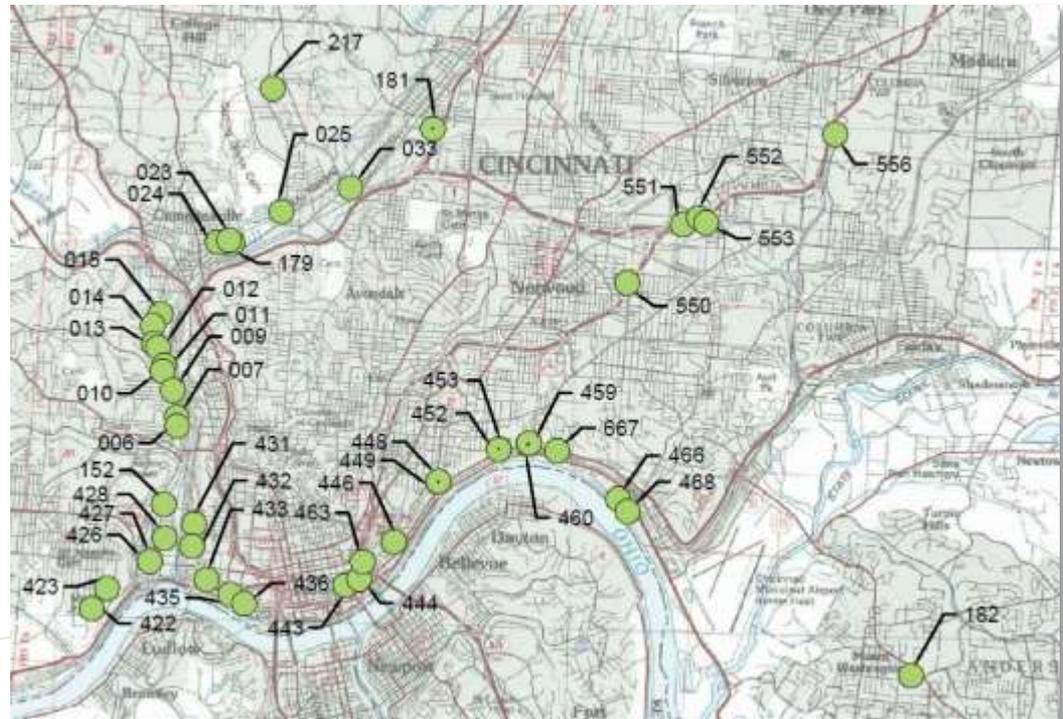
BACKGROUND

- Cincinnati's combined sewer overflow (CSO) system was installed in the 1950's and 1960's
- Lock system along the Ohio River completed in 1963
 - Raised the normal pool elevation 4.6 m (15ft)



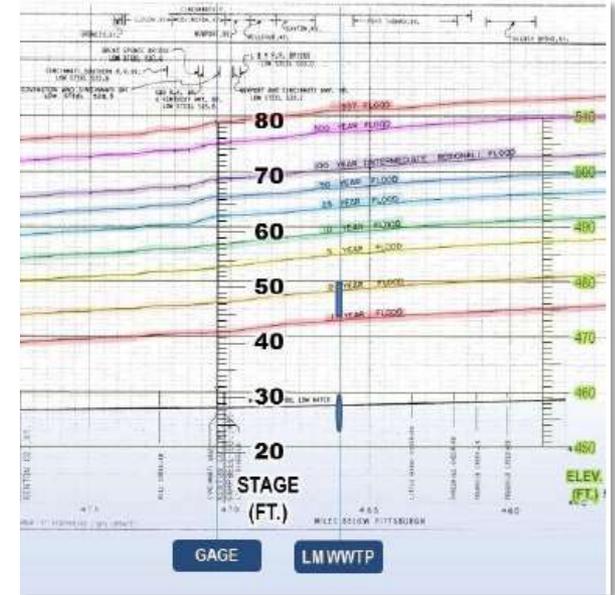
PROJECT OBJECTIVES

- Study 46 selected CSOs and create Capital Improvement Plan that prioritizes projects for:
 1. High Water/Dry Weather Protection
 2. Regulator Replacement
 3. Site Access Improvements



METHODOLOGY

- Collect data and review existing conditions at CSOs
 - Record drawings
 - Previous study reports
 - GIS data
 - River elevations
 - Site inspections and confined space entry



SITE VISIT ASSESSMENTS

- **CSO Structure Assessment**
 - Condition of cover/rim fit, walls, trough, etc.
- **Pipe Condition Assessment**
 - Material, deposition, cracking, etc.
- **Regulator Assessment**
 - Condition of all regulator components
- **High Water Protection Assessment**
 - Condition of all components, proper seating, etc.
- **Safety Assessment**
 - Any hazards or potential hazards located around the site



CSO STRUCTURE ASSESSMENT

- Assessed condition of:
 - Cover/Rim Fit
 - Frame-to-Corbel Seal
 - Frame Condition
 - Corbel Condition
 - Wall Condition
 - Bench Condition
 - Trough Condition



Condition	Quantity	% of Total
Good	39	87
Fair	3	6
Poor	3	6



PIPE CONDITION ASSESSMENT



Results of Pipe Condition Assessment

Condition	Quantity	% of Total
Good	232	88
Fair	23	9
Poor	8	3

Pipe Condition and Ratings

Description	Condition Rating
Good	Good
Aggregate Visible/Projecting	Fair
Circular Cracking	Fair
Deterioration	Fair
Infiltration	Fair
Joint Separation/Offset	Fair
Longitudinal Cracking	Fair
Brick Cracked, Leaking, or Missing	Poor
Broken	Poor
Collapsed	Poor



REGULATOR ASSESSMENT

- Assessed condition of:
 - Bolts
 - Chains
 - Float
 - Support Structure
 - Pulley
 - Regulator Gate

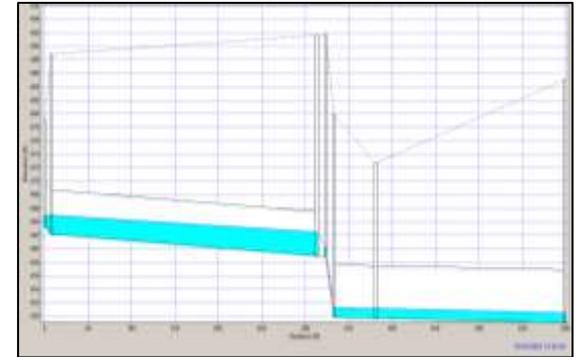


Condition	Quantity	% of Total
Good	3	6
Fair	34	74
Poor	9	20

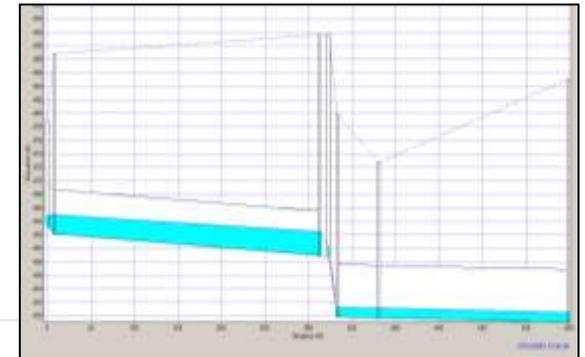


REGULATOR REMOVAL OR REPLACEMENT

- Functionality of regulators was not checked for safety reasons
- From site visits:
 - 8 CSOs previously had regulators removed
 - 2 CSOs had regulator gates tied open
- Modified SWMM model to remove regulator and determine impact on system
 - 1 regulator required replacement
 - 4 regulators that can potentially be removed after additional analysis
 - 12 regulators can be removed without replacement



With Regulator



Without Regulator

HIGH WATER PROTECTION ASSESSMENT

- Documented which CSOs have high water protection and its effectiveness

High Water Protection?	
Yes	21
No	25



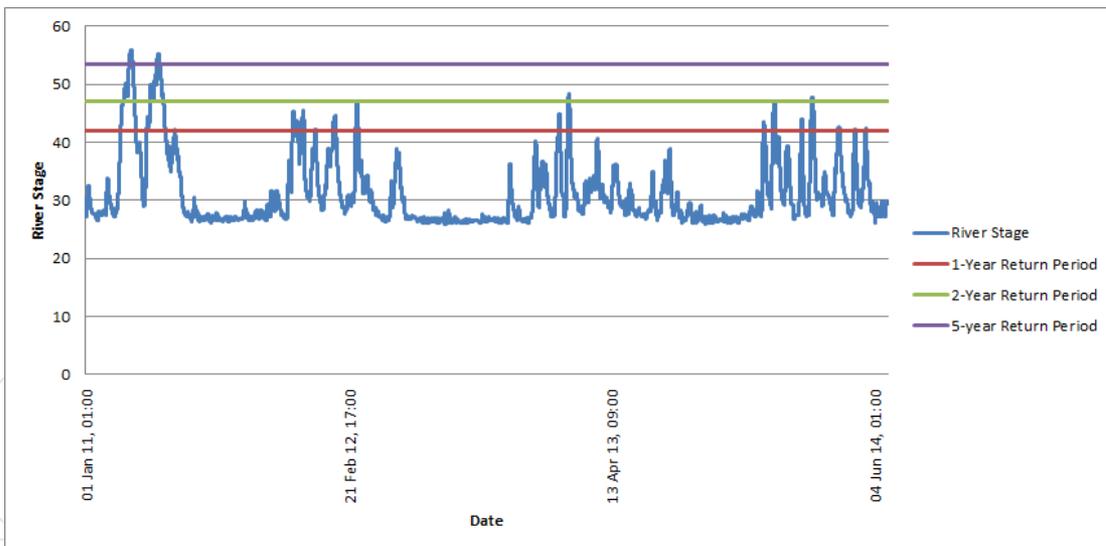
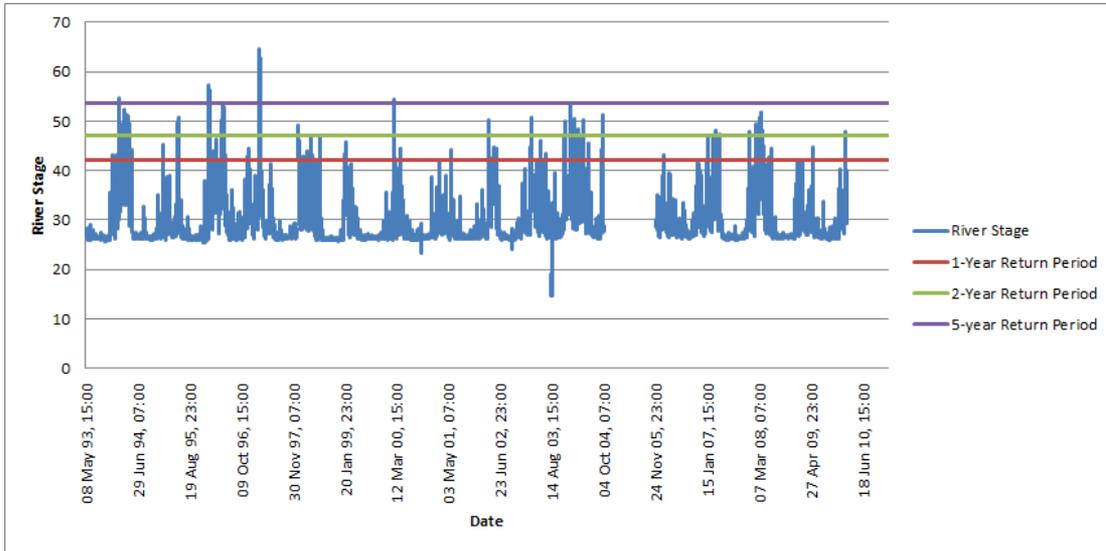
RIVER INFLOW

- Compared diversion dam elevation to river elevation during various return period floods
- 12 CSOs experience inflow from 10-year or less return period flood
- River inflow increases treatment volumes and costs at MSDGC wastewater treatment plants

Flood Return Period	Number of CSOs with River Inflow	Range of Inflow Rates, m ³ /s (cfs)
1-year	2	6.0-7.6 (212-268)
2-year	2	0.3-2.6 (10-91)
5-year	6	0.1-8.0 (3-281)
10-year	2	2.7-8.0 (97-281)



RIVER INFLOW



Ohio River Elevation Historical Data

5-year return period flood exceeded 6 times from May 1993 through June 2014

HIGH WATER PROTECTION

- Two strategies evaluated
 - Raise diversion dam
 - Install high water protection technology
- Evaluation of strategies
 - Raise diversion dam
 - Only feasible in one location, other locations required dam to be raised a minimum of 0.9 m (3 ft) which would impact the hydraulics of the system
 - Install high water protection technology
 - Used at remaining locations where raising the diversion dam was not feasible

HIGH WATER PROTECTION

- Three high water technologies evaluated
 - TF-1 Check Valve, Tideflex® Technologies
 - CheckMate® Check Valve, Tideflex® Technologies
 - Flexible Flap Valve, Rodney Hunt-Fontaine



<http://www.tideflex.com/tf/index.php/products-systems/tideflex-check-valves>

TF-1 Check Valve



<http://www.tideflex.com/tf/index.php/products-systems/tideflex-check-valves>

CheckMate® Check Valve



http://www.rodneyhunt.com/index.php?eID=tx_nawsecured&u=0&file=fileadmin/Productmanagement/File/RHF-Flap-Gates-0414lo.pdf&t=1426280498&hash=bdc66824a500a119f78d64aca75a974ec2f30b12

Flexible Flap Valve



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HIGH WATER PROTECTION

- Outfalls for CSOs either submerged in river or in headwall not owned by utility
 - Required inline high water protection or installation in a confined space chamber
 - TF-1 Check Valve not used because of size requirements for confined space chamber
 - CheckMate® installed inline for small diameter pipes
 - Flexible Flap Valve installed in confined space chamber for larger pipes



SAFETY ASSESSMENT

- CSO sites were reviewed for potential safety hazards such as:
 - Steep slopes
 - Protruding metal or objects
 - Location of chambers in streets



CAPITAL IMPROVEMENT PLAN

- Priority
 - Inflow during 10-year return period flood and less
 - Regulator replacement
 - Site Access Improvements
- Projects
 - 8 high priority for high water protection (4 CSOs share 2 common outfalls)
 - 2 medium-high priority for one regulator replacement and one potential regulator replacement
 - 19 medium priority for regulator removal
 - 5 low priority for site access improvements
 - 8 CSOs have no recommended projects
 - 2 CSOs have already have projects underway



CONCLUSIONS

- Identified:
 - CSOs requiring high water protection
 - Regulators that can be removed and regulators that must be replaced
 - Potential site access hazards
- Site inspections provided Collections staff detailed information regarding potential issues in the collections system

ACKNOWLEDGEMENTS

- RJN Group, Inc.
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