Flow Monitoring Pays for Itself Many Times Over

Case Studies Where Pro-Active Flow Monitoring Resulted in Potential for $$ Millions in Savings

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Agenda

1 Role of flow monitoring throughout project life cycle?

2 Case Study 1: City of Akron's Northside Interceptor Tunnel

3 Case Study 2: NEORSD Westerly Storage Tunnel

1 Role of Flow Monitoring throughout the Project Lifecycle

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Flow Monitoring is a vital tool in management, maintenance, and capital improvements of collection systems

Flow Monitoring is often the backbone of a CIP

- Hydraulic models are based on Flow Monitoring
- Hydraulic Models form the basis for most capital improvement plans (LTCPs, I/I, SSO Abatement, etc.)

Yes, it is perceived as unaffordable and is frequently short changed

Flow monitoring data can be a valuable component of nearly every aspect of the project lifecycle

Facilities Planning

Advanced Facility Planning / Detailed Design

Post Construction Monitoring

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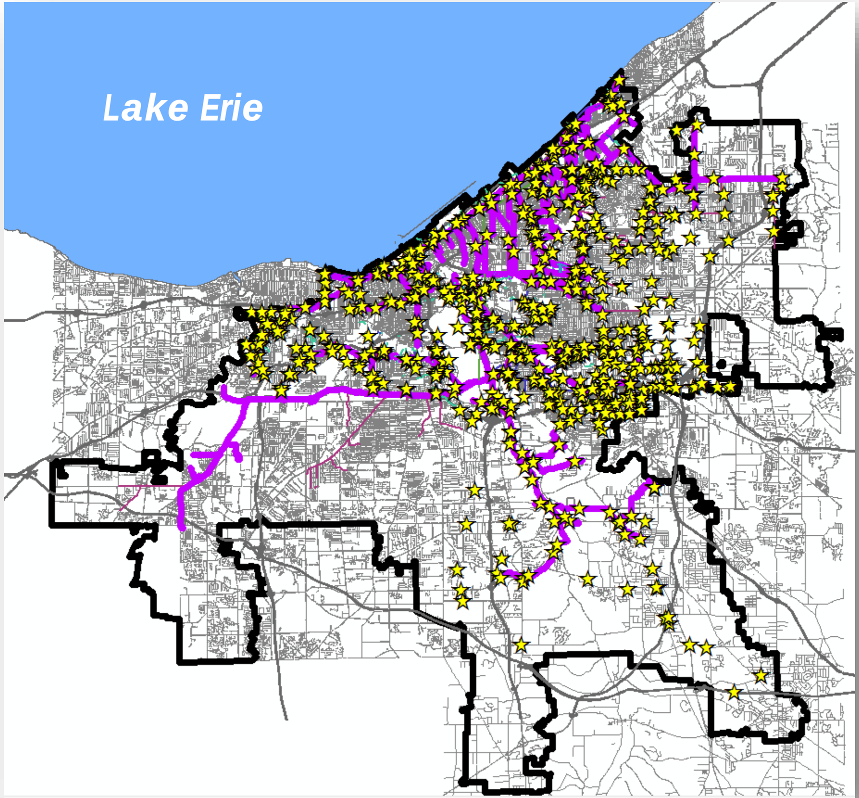
Flow Monitoring in Facilities Planning

Traditional Facilities Planning Flow Monitoring

- Frequently the most expensive monitoring program a utility will undertake
- Widespread coverage, large number of meters
- Often performed 10 – 20 years ago (or more!)
- Sites selected from sewer plans (many studies pre-dated accurate GIS)
- Short duration, often terminated regardless of rainfall or data quality for cost reasons



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Flow Monitoring in Facilities Planning

Traditional Facilities Planning Flow Monitoring

Flow Monitoring Data

Hydraulic Model

Plan (LTCP, Master Plan, Facilities Plan, etc.)

Consent Decree

Design Criteria may specify the **exact size** of a facility that has to be built, a size that came directly from planning level modeling based on a **flow monitoring program**

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Flow Monitoring in Design

Drivers for Design Stage Flow Monitoring

- System Understanding is better
- Significant time may have passed since original planning)
- Improvements in/around project area have occurred since original planning
- Validation of flows at locations of expensive facilities are planned (may not have been metered during original planning)
- Revisions to flow projections can results in significant cost implications (up or down)

The more modeling that is done, underpinned by good flow monitoring, the less conservative the assumptions need to be and the more likely that projected facility sizes (and costs) may come down

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Flow Monitoring in Design Yields Confidence

The more accurate the model, underpinned by good flow monitoring, the less conservative the assumptions need to be and the more likely that projected facility sizes (and costs) may come down.

Reasons for Insufficient Flow Monitoring in Detailed Design

Already Spent Large $$ Monitoring During Planning Stages

- Tendency is to remember the cost more than any limitations that may have existed

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Reasons for Insufficient Flow Monitoring in Detailed Design

Consent Decree Dictates Facility Size

- Any size reductions would require a modification to the Consent Decree
- Integrated Planning/Adaptive Management may provide flexibility
- Over-sized facilities may be leveraged in other ways
  - Additional CSO capture to offset short-comings elsewhere,
  - Optimization of system performance to reduce non-CD mandated capital improvements

Reasons for Insufficient Flow Monitoring in Detailed Design

Requirement for Post-Construction Monitoring

- Flows/Models will have to be updated at that time
  - This is NOT the time to realize your flows are off
  - Potential huge costs for remedial action if performance isn’t being achieved
  - PR issue if facilities are over-sized at rate payers’ expense

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2 Case Study 1: City of Akron's Northside Interceptor Tunnel

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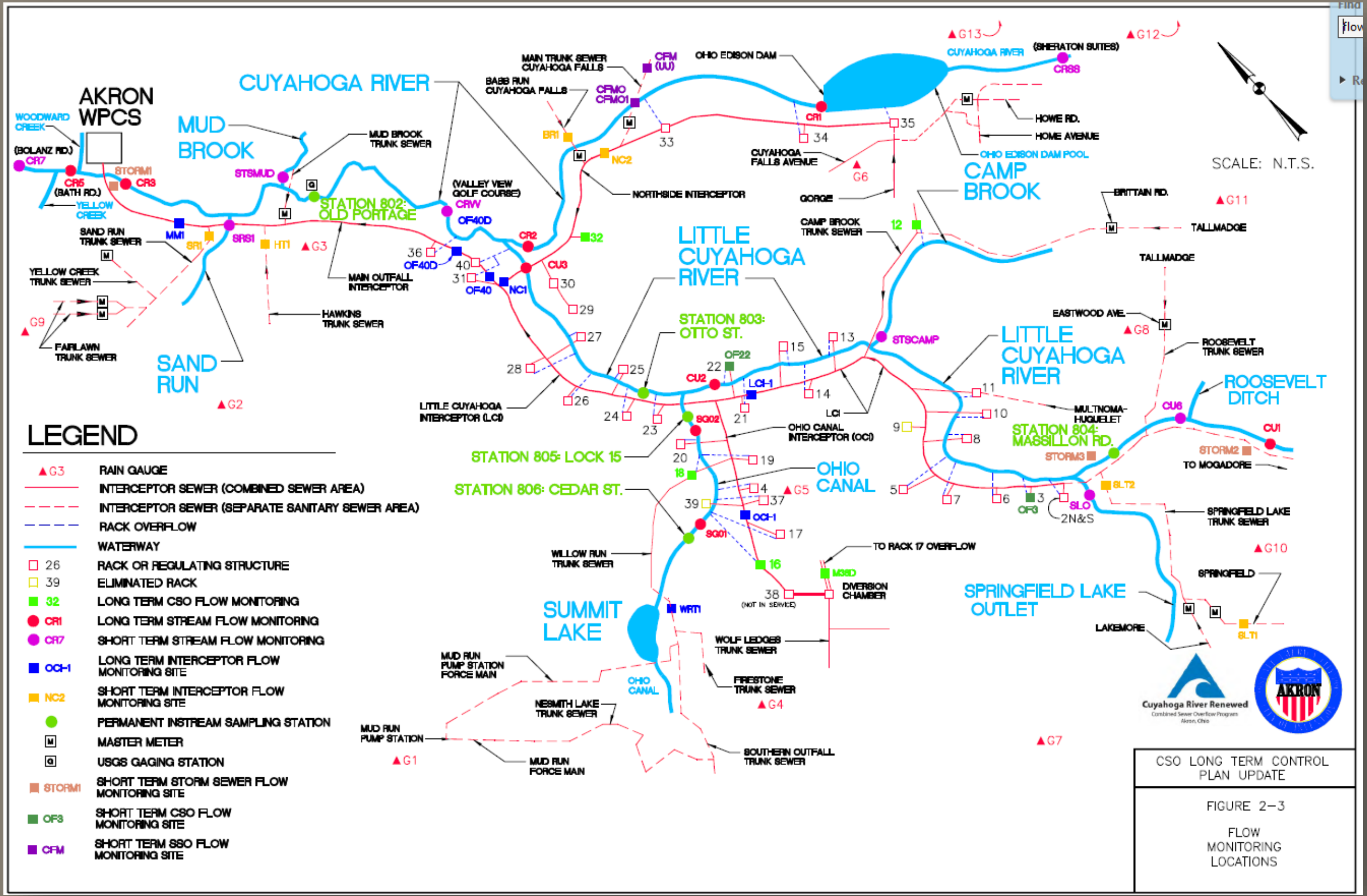
Original Facilities Planning /Monitoring in the late 90's



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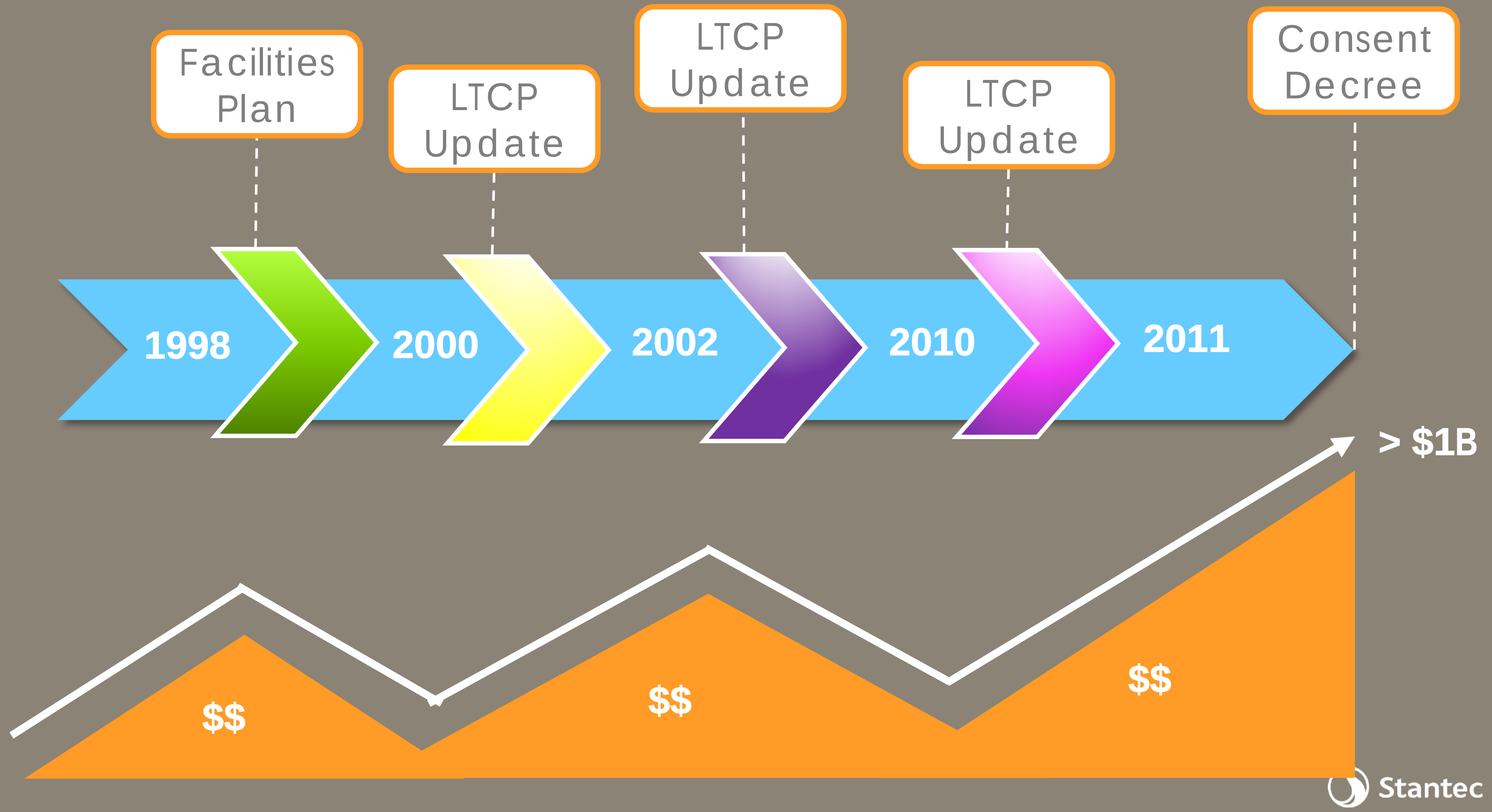

Facilities Plan
LTCP Update
LTCP Update
LTCP Update
Consent Decree
1998
2000
2002
2010
2011
> $1B
$$
$$
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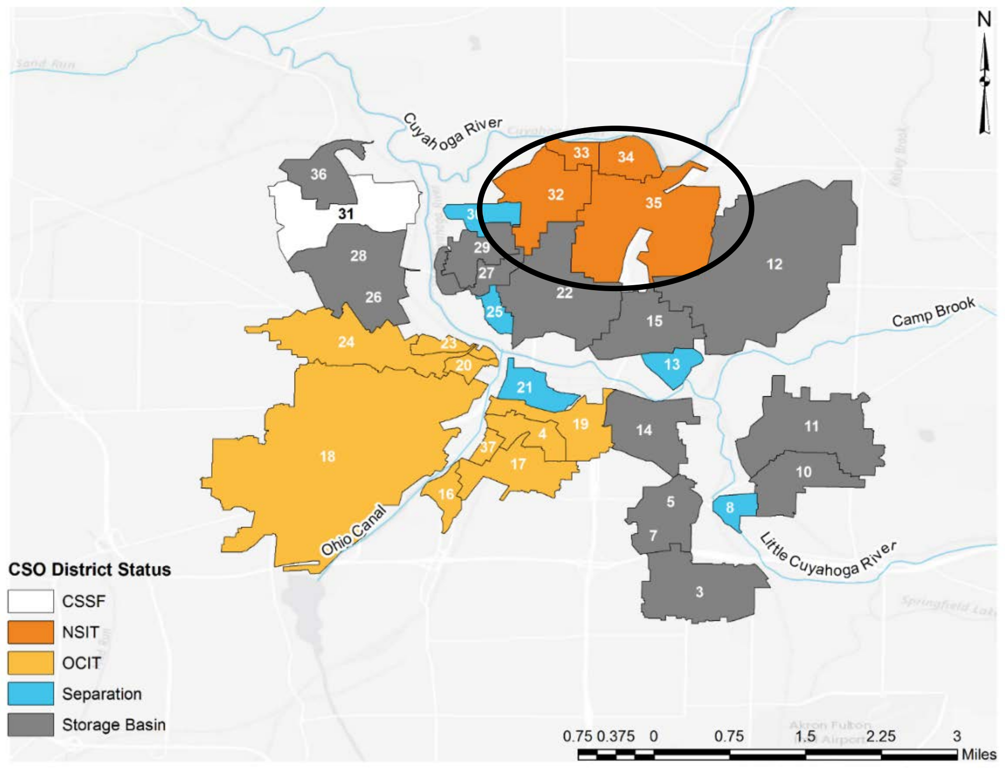
City undertook an Integrated Planning effort to optimize improvements to lower costs

- Model Enhancements required additional Flow Monitoring Data
  - 3 rounds of monitoring = 83 temp meter +12 permanent
  - Previously un-metered separate sanitary areas
  - Data loggers added to 13 master meters



1998 Long Term Control Plan included an 8-ft diameter, 2.5 MG NSI Tunnel

Consent Decree requires 23-MG NSIT (different control level, function)

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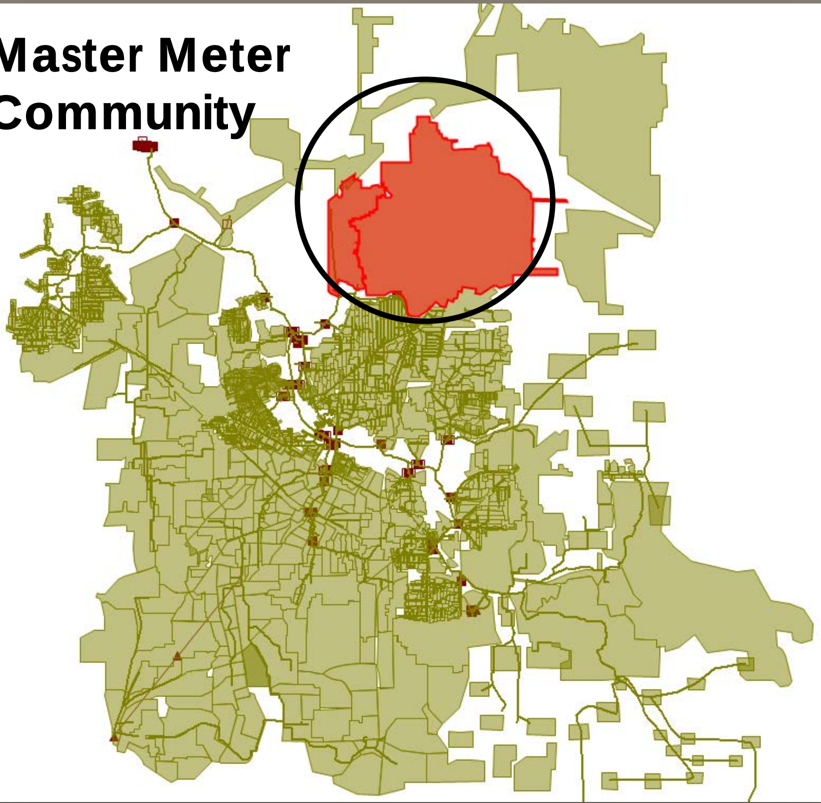
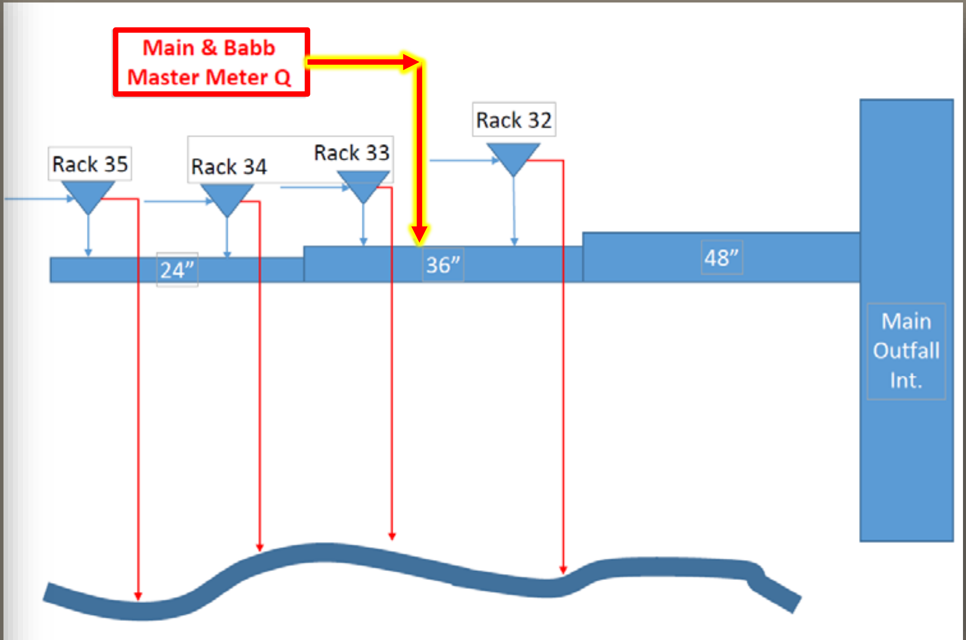
Master Meter Community





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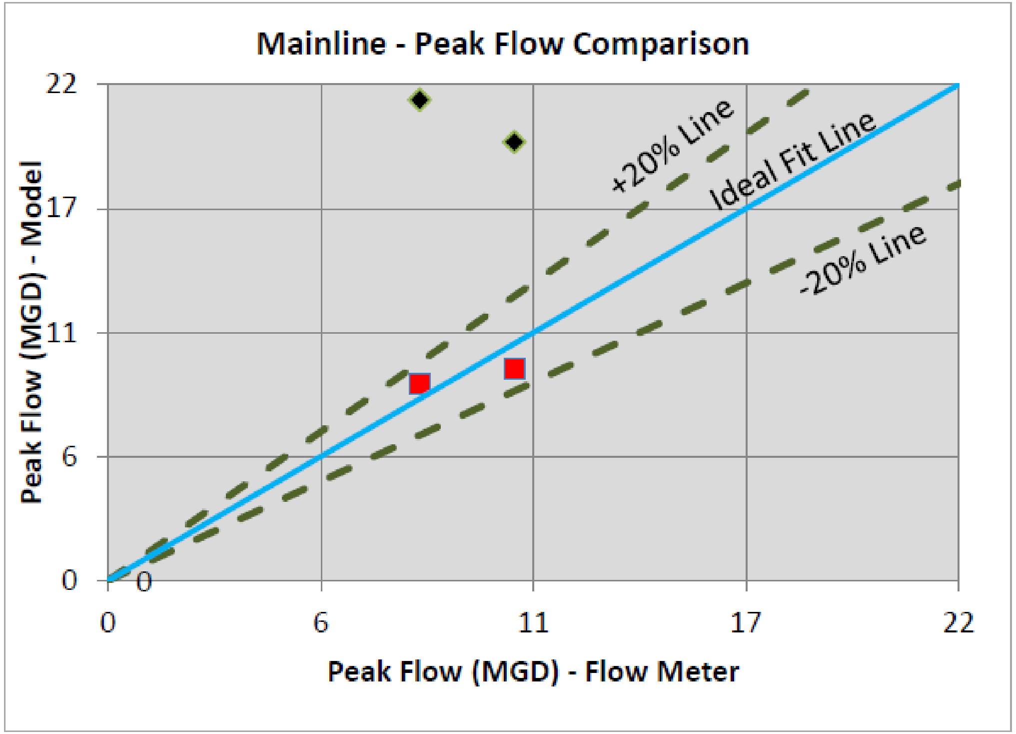
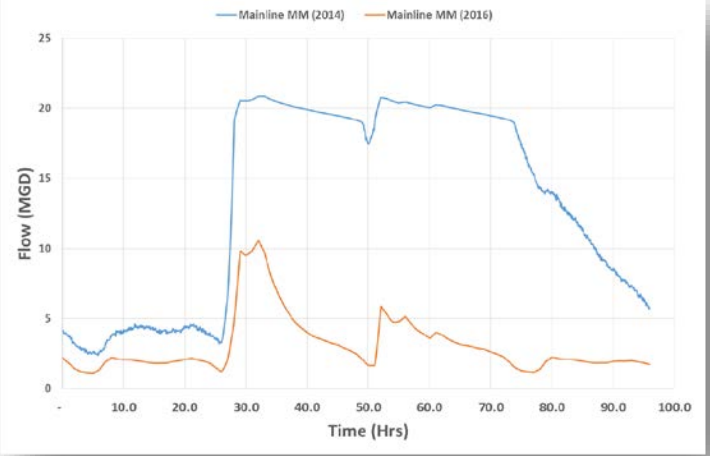
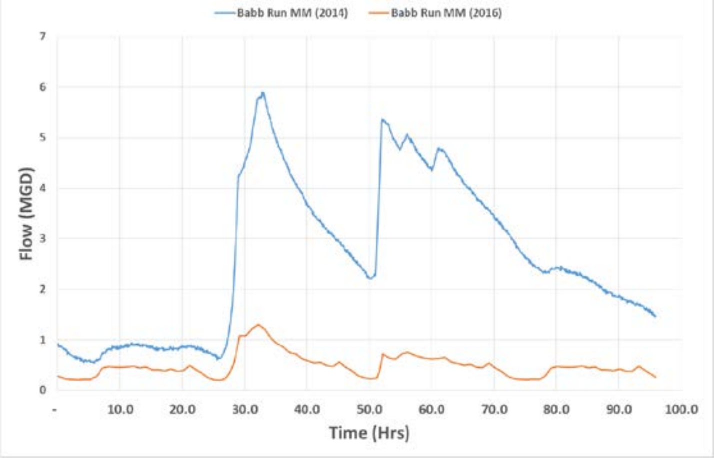
Data loggers were installed on master meters to enable recording of peaks, not just daily totals



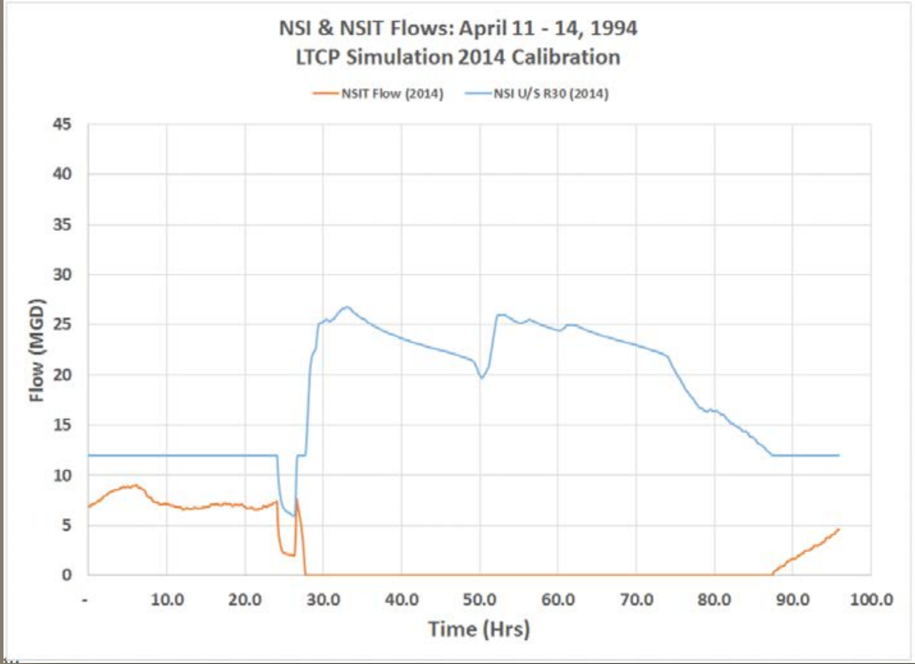
Model was recalibrated to data from new logger



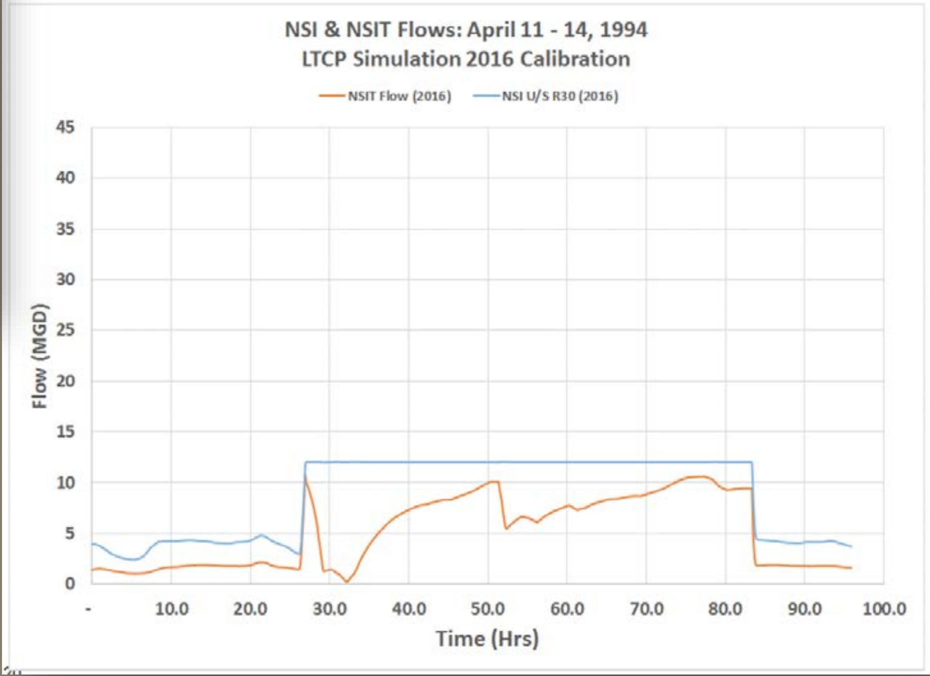
Main Street Master Meter Area Flows



Babb Master Meter Area Flows



Model Predicted Tunnel Storage Requirements ~ 1/3 of Original LTCP



3 Case Study 2: NEORSD Westerly Storage Tunnel

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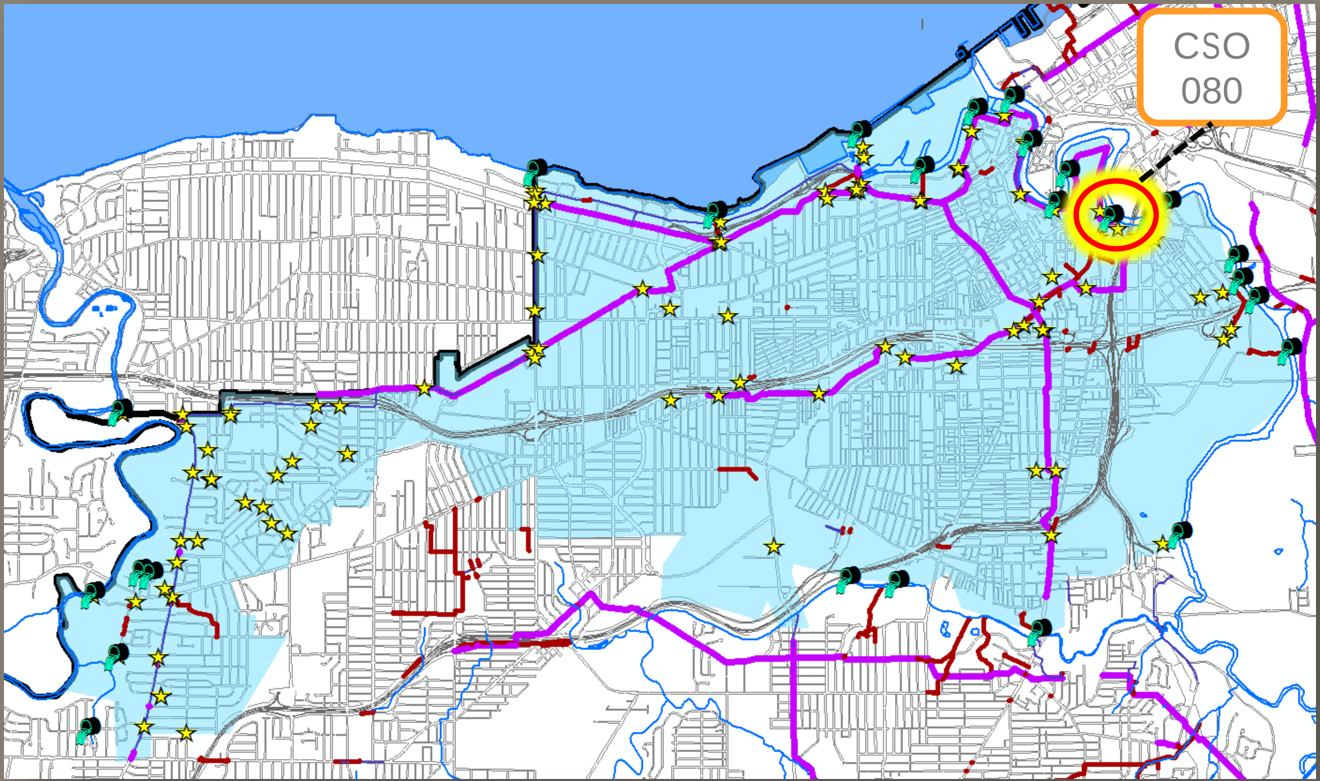
Westerly CSO Phase II Facilities Plan done in 1999



- Sewer inspections
- Over 100 flow monitors
- Modeling
- Recommended LTCP included 21 MG Westerly Storage Tunnel

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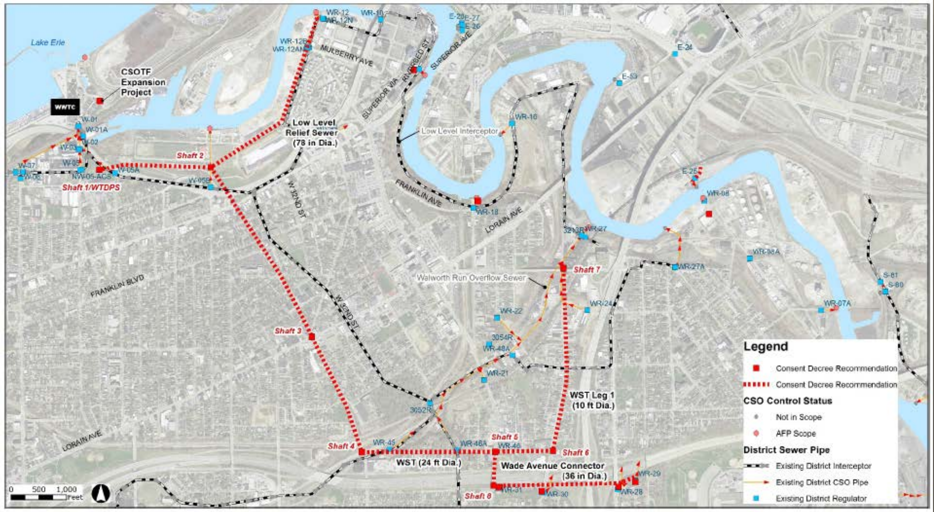
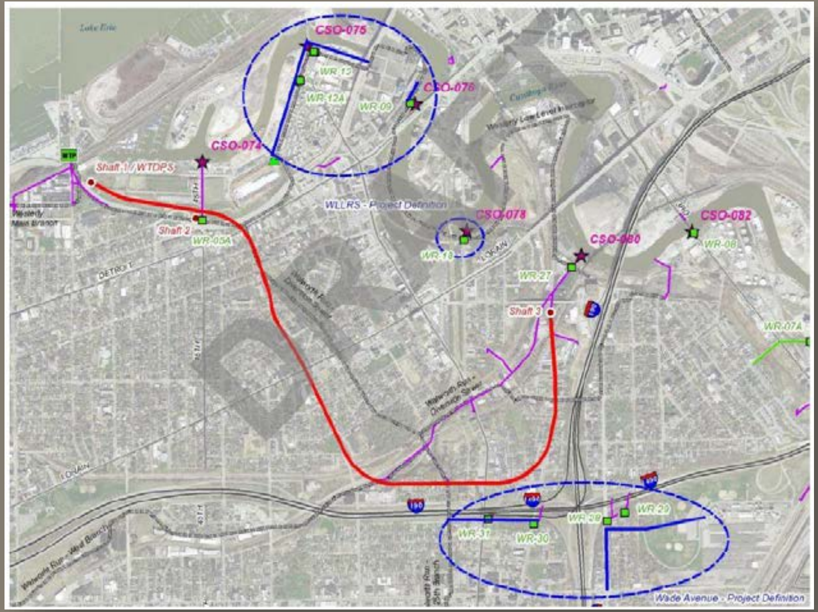
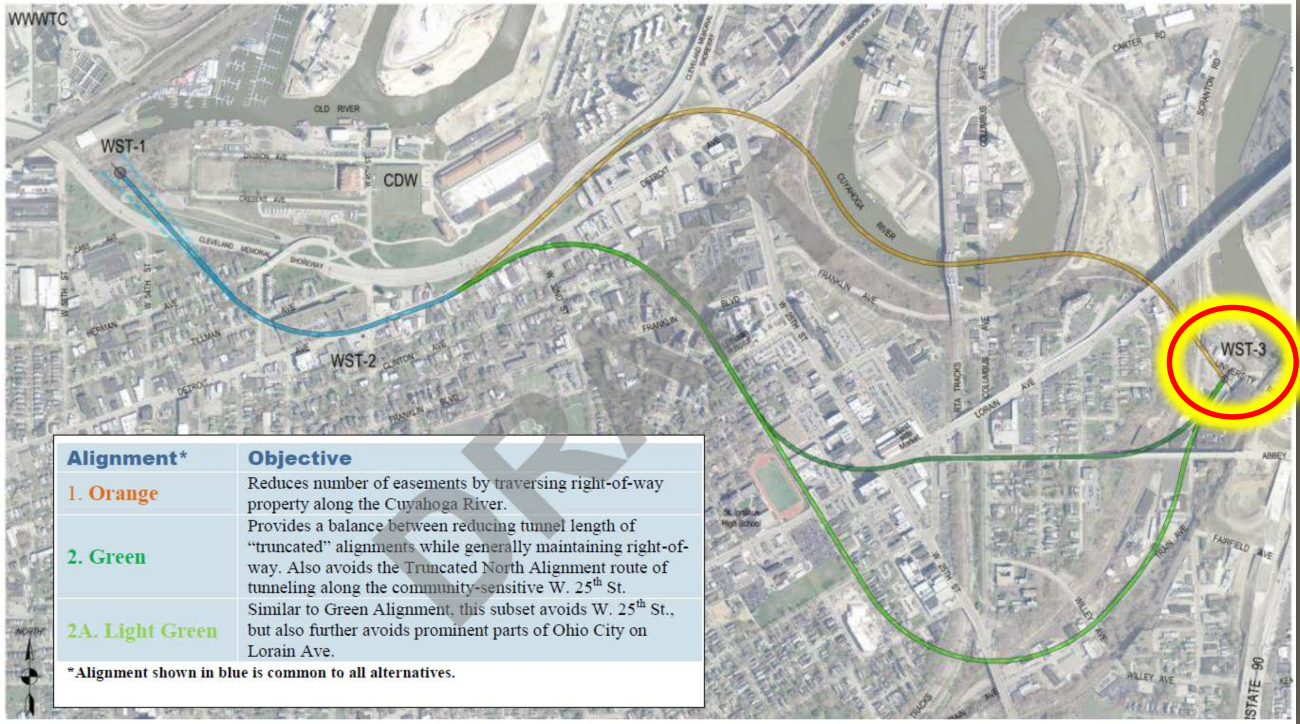
2011 Consent Decree increased CSO 080 Control Level from 4 to 2 CSOs/yr (WST from 21 MG to 36 MG)



2013 – 2015 Advanced Facilities Planning Optimized Plan, eliminated/modified components



Initial Design efforts were focused on alignments and diameters while flow meters were installed to verify design flows



Alignment*	Objective
1. Orange	Reduces number of easements by traversing right-of-way property along the Cuyahoga River.
2. Green	Provides a balance between reducing tunnel length of "truncated" alignments while generally maintaining right-of-way. Also avoids the Truncated North Alignment route of tunneling along the community-sensitive W. 25th St.
2A. Light Green	Similar to Green Alignment, this subset avoids W. 25th St., but also further avoids prominent parts of Ohio City on Lorain Ave.

*Alignment shown in blue is common to all alternatives.

AFP Design Flows at WST-3:

- 5-yr, 6-hr: 1300 MGD
- Largest TY Storm: 619 MGD
- 3rd Largest TY storm: ~ 34 MG stored in tunnel

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Model comparisons to Walworth Run flow monitor from Original Facilities Planning revealed volumes ranging form -50% to +198%

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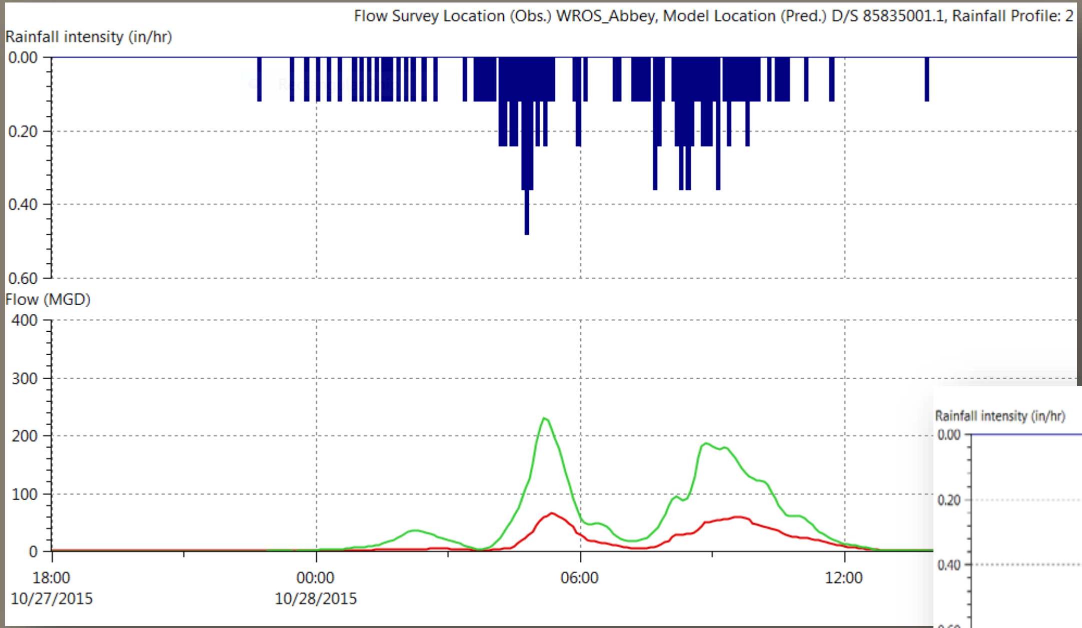
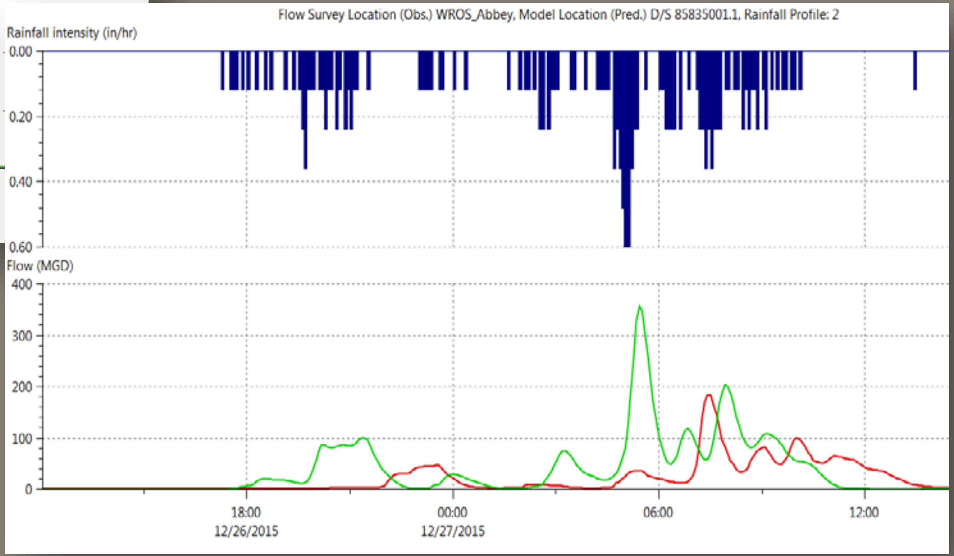
Image via Jim Dubelko, "Where in the World is Walworth Run?," Cleveland Historical, accessed June 12, 2017, https://clevelandhistorical.org/items/show/659.

Initial review of meter data showed lower flows than model was predicting





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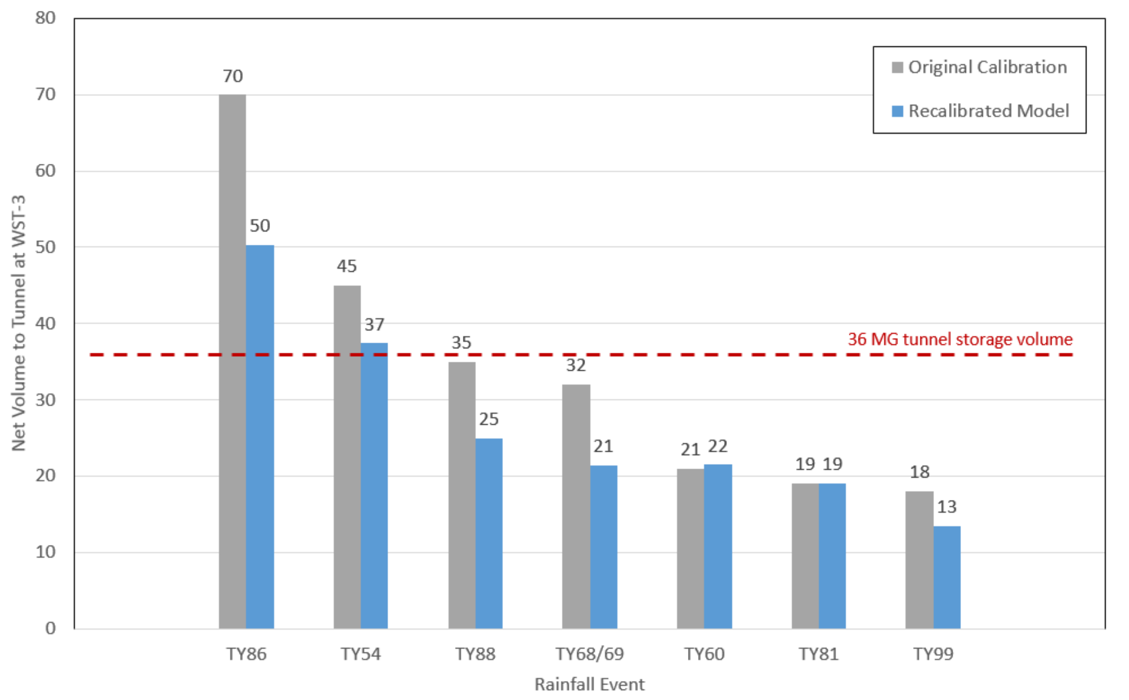
Recalibration had significant impact



Remaining overflow volumes relative to Consent Decree :

- 72 MG of CSO proposed in 2010 per original calibration
- 15 MG CSO predicted per recalibrated model

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Potential Implications of Design Flow Reductions

- Modeled volumes drive tunnel storage volume - dictated by CD, cannot reduce without CD modification
- Modeled Peaks drive shaft/baffle sizing, diversion structure sizing, surge mitigation
- Capture of additional CSO volume beyond CD requirements may offset other capital needs

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Questions?