Supplemental CSO Team

Meeting No. 7

Long-Term Control Plan Permit Compliance

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

April 11, 2019 – 10:00 am

Peterstown Community Center

408 Palmer Street, Elizabeth, NJ 07202

Meeting no. 7 agenda

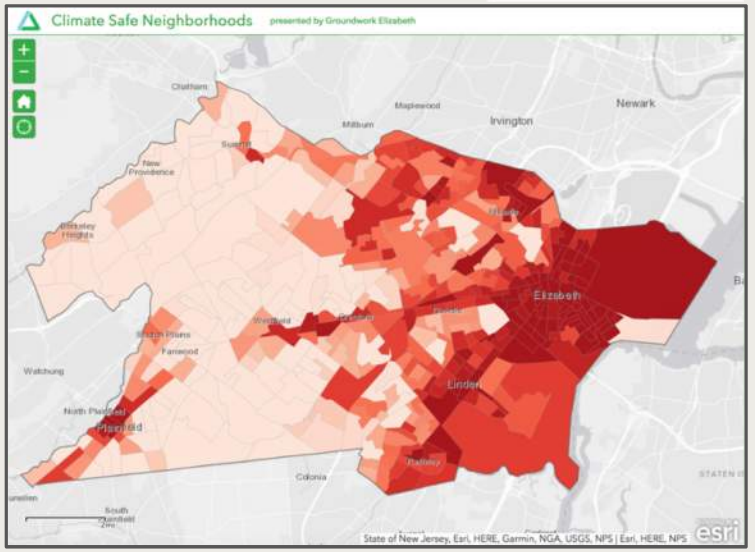
- Prior meeting recap
- Public participation process update
- Long term control plan submission and NJDEP review status
- Background and existing conditions refresher
- Development and evaluation of alternatives
  - Increased conveyance to treatment
  - Sewer separation
  - Increased sewer system storage
  - Green infrastructure
  - Expanded treatment at the JMEUC wastewater treatment facility
  - Infiltration reduction
- Next meeting lookahead

Meeting no. 6 refresher

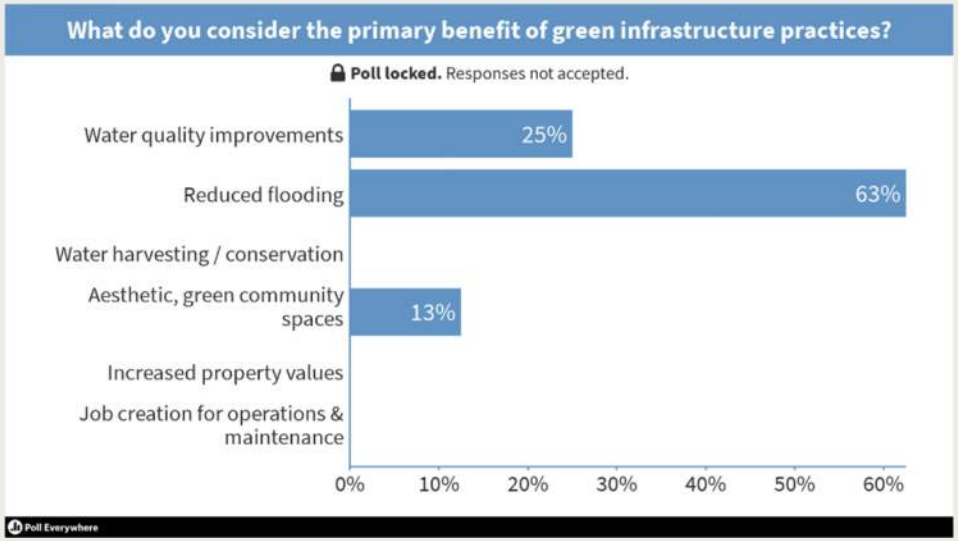
Material covered in prior meeting (1/30/2019):

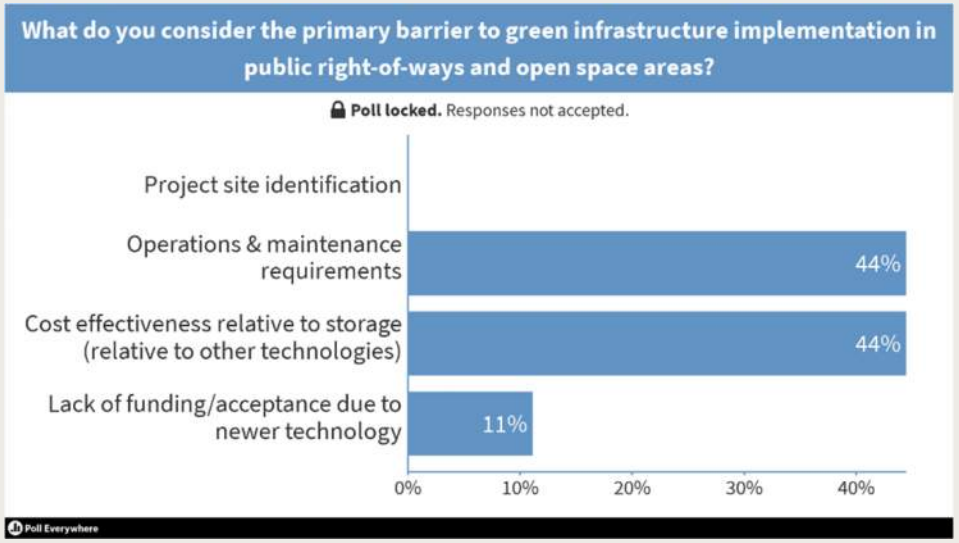
- Interactive surveys
- Groundwork Elizabeth – Climate Safe Neighborhoods presentation
- NJDEP review of LTCP submittals
- Pathogen water quality model baseline estimates
- Alternatives analysis
  - Maximizing wet weather treatment at the JMEUC WWTF
  - Siting Alternatives Analysis
  - Green Infrastructure Analysis

GROUNDWORK Elizabeth



Results of member surveys





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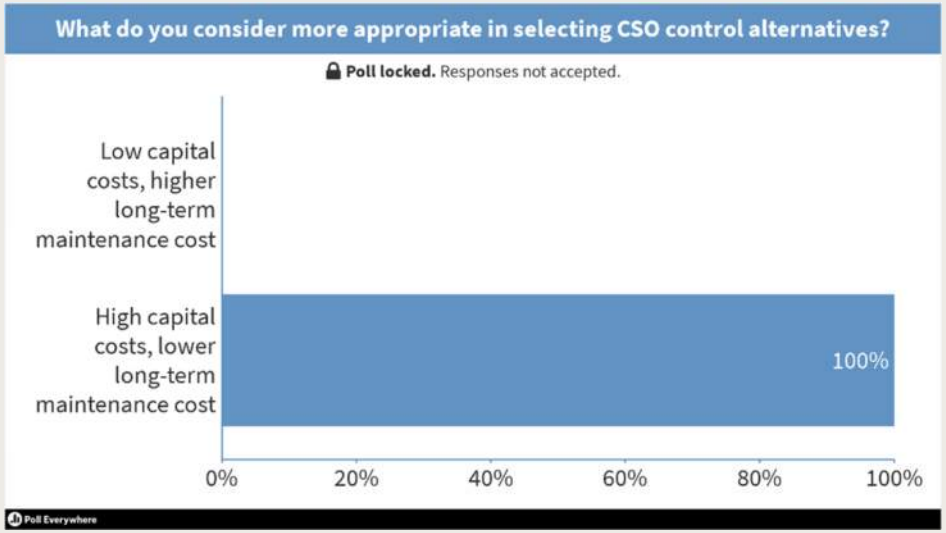

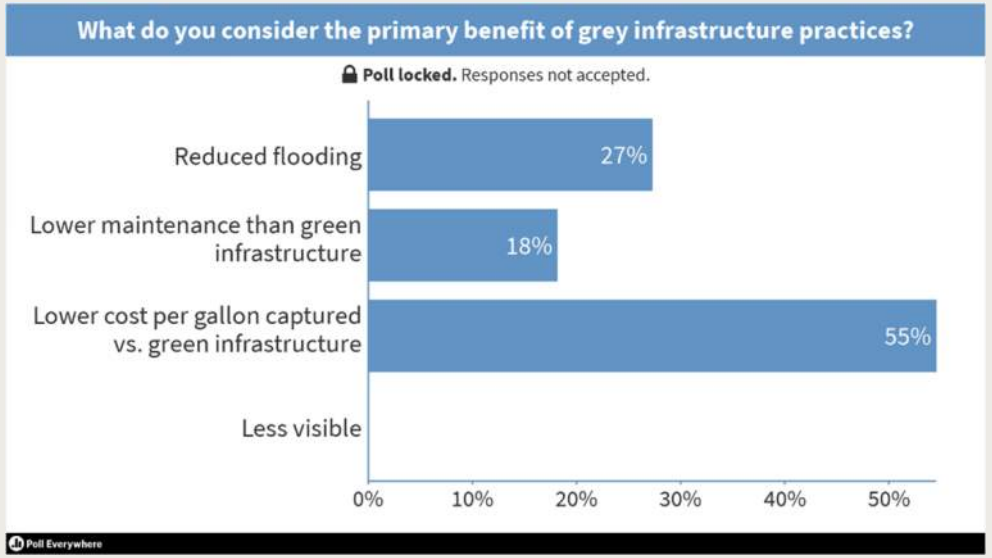

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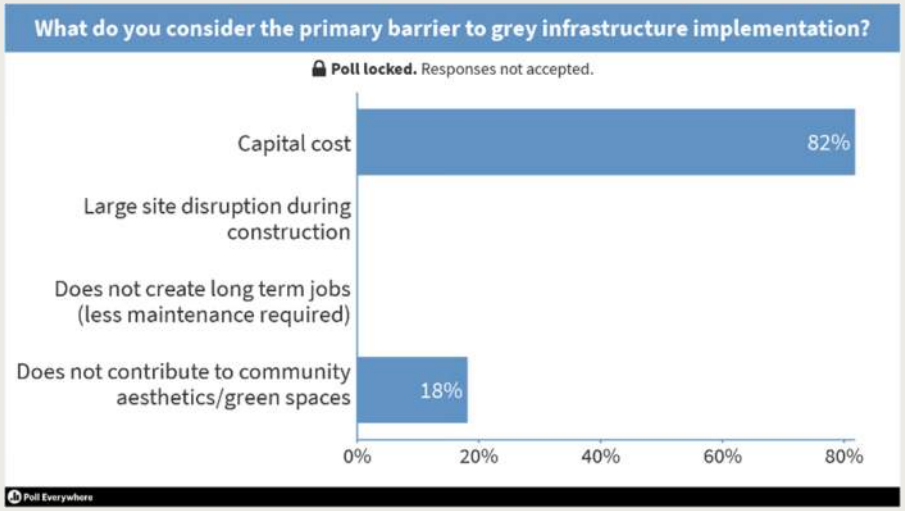
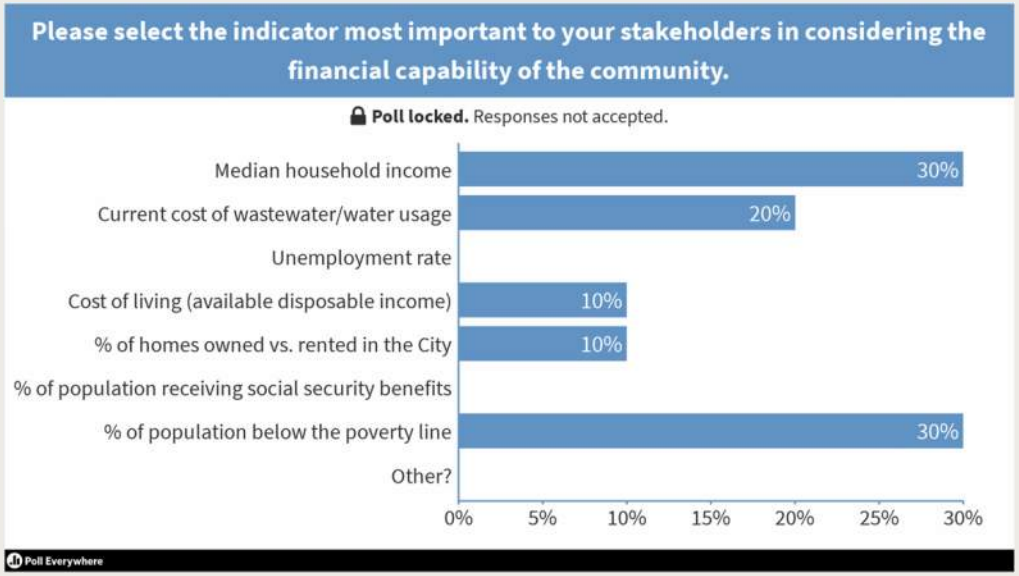




Public Participation Process Update

Public outreach and education

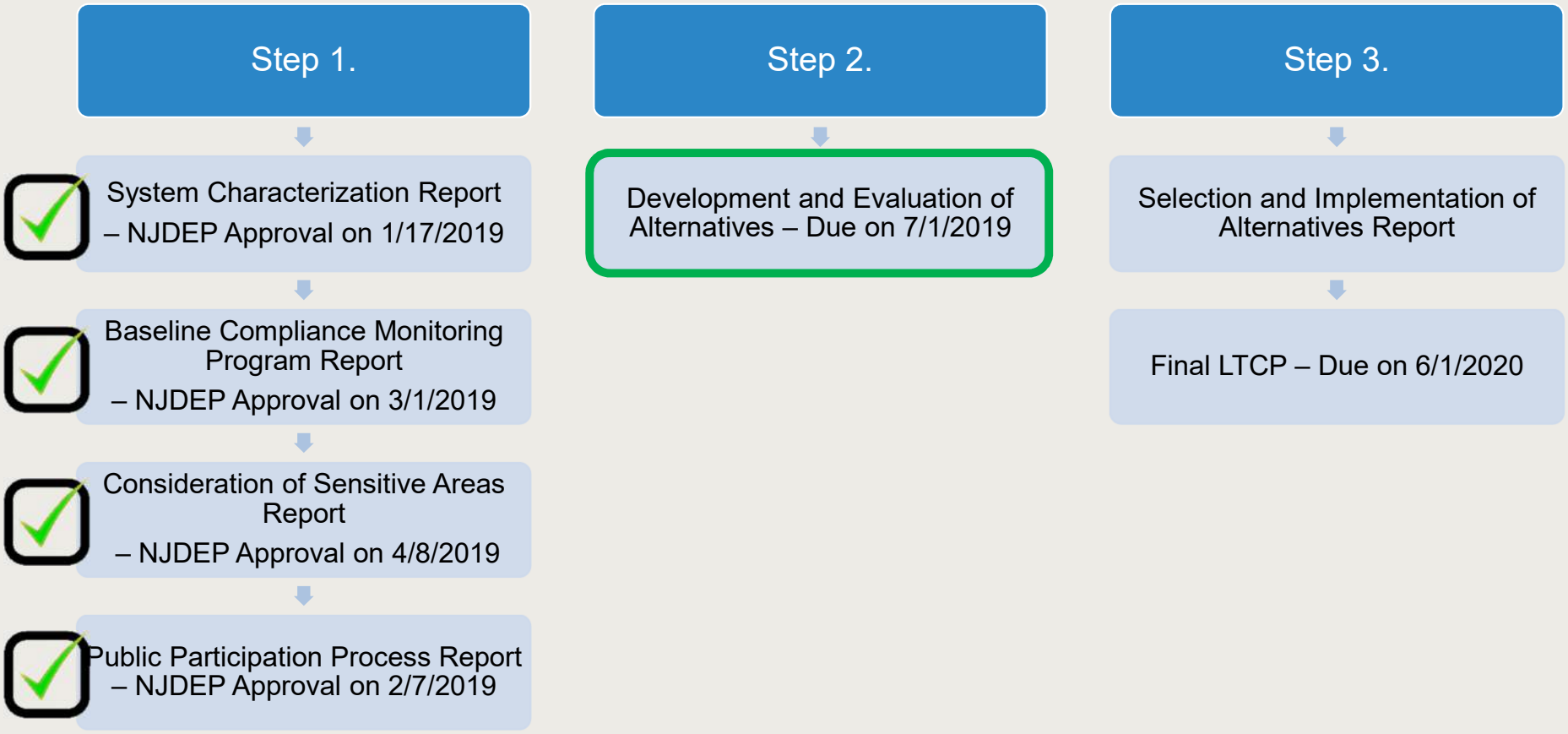
Recent Events

- March 6 - NJDEP Public Participation Workshop
  - Organized by NJDEP to gather Supplemental Team members and CSO Permittees from across the State.
  - Conducted here at Peterstown Community Center!
  - Discussed methods of identifying and effectively engaging with stakeholders
- City of Elizabeth Tree Planting Initiative
  - 15,000 copies of mailer sent in final week of March
  - Spread the word!
- Drone footage of Trumbull Street construction
  - Can be used for future public awareness videos

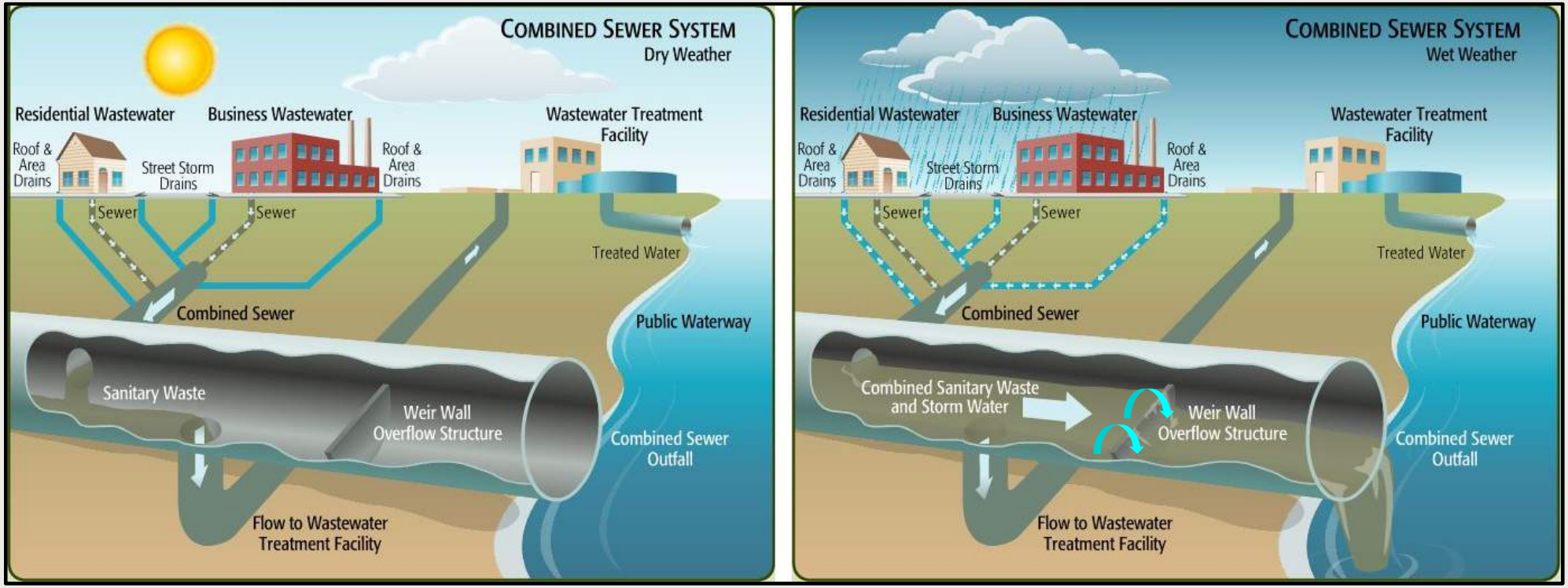
Upcoming Events

- May 3 – Future City Environmental Day school presentations
- June – Union County BioBlitz
- Others?

Long term control plan submission and NJDEP review status



Background and existing conditions refresher



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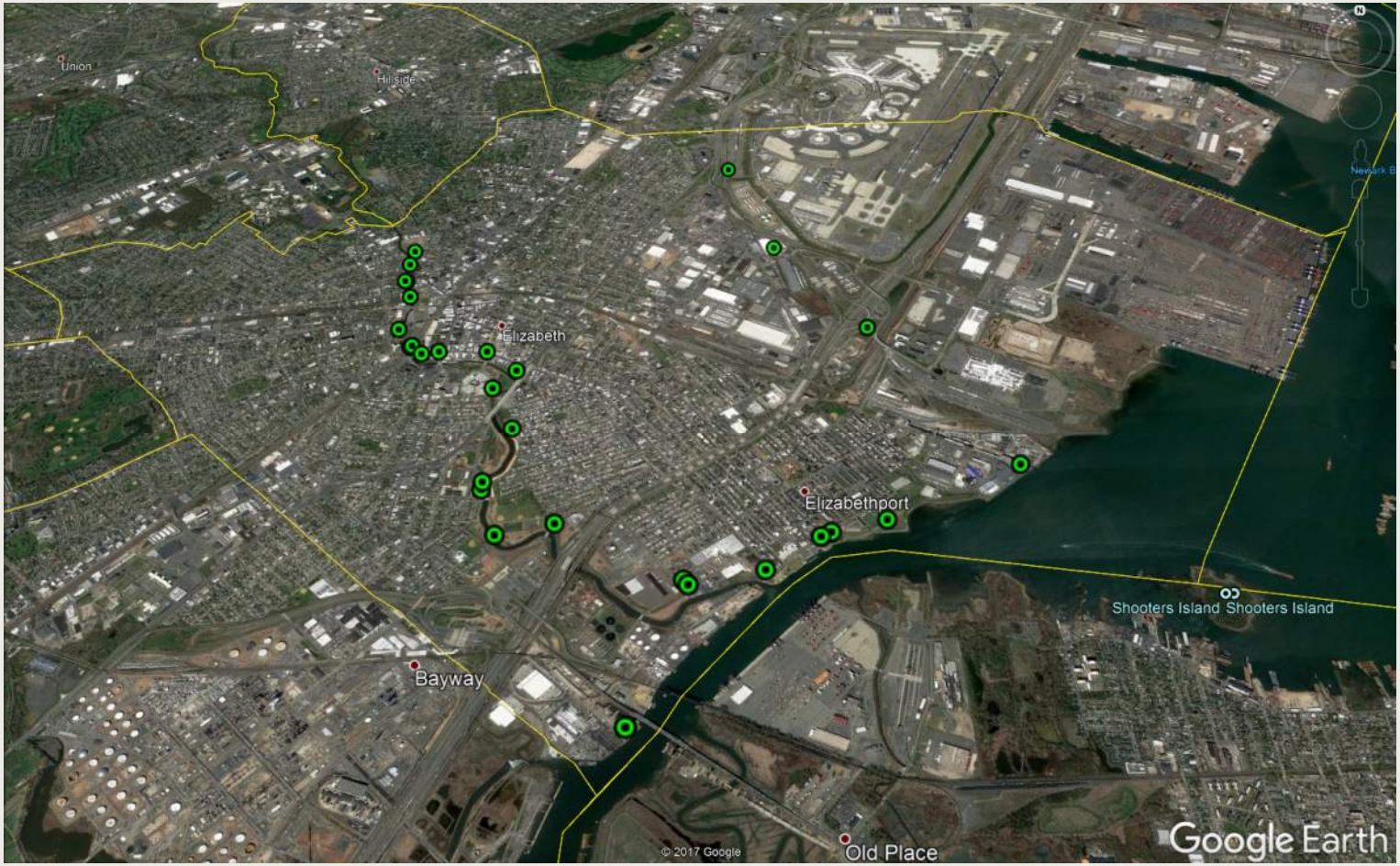
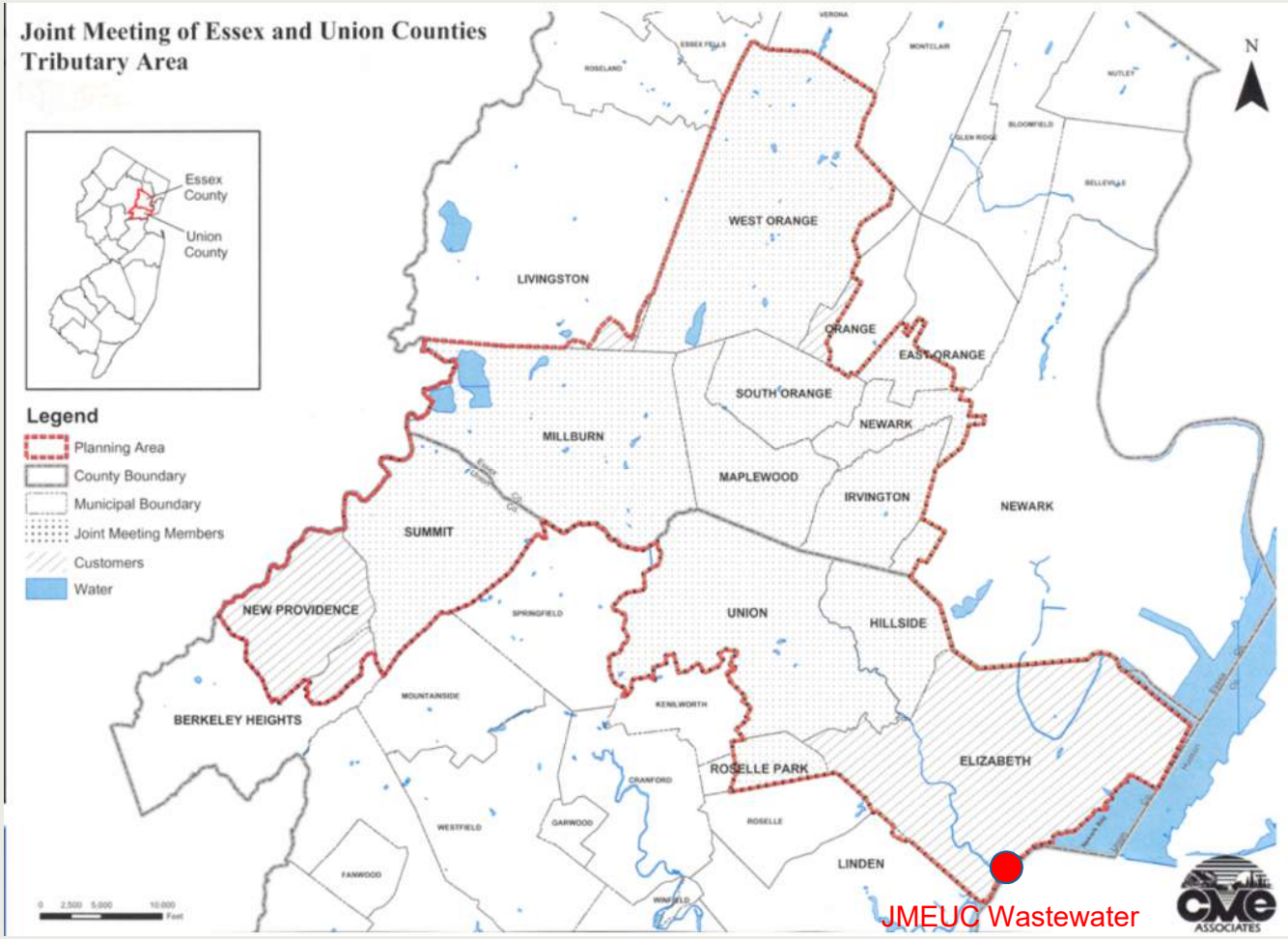


Combined Sewer System

- 29 outfalls
- 36 sub-basin; 3,500 acres
- 38 regulators and diversion chambers
- 166 miles of combined sewers, with 6,400 manholes & 3,300 inlets
- Complex network of interconnections
- 14.7 Mgal/day average flow, Trenton Ave PS
- Roselle Park storm sewer connection

JMEUC Tributary Area

- 11 member communities, 4 customer communities
- Total Service Area = 60 square miles
- Gravity sewers ranging from 10-inches in diameter to the twin 67 x 68-inch rectangular sewers at WWTP
- WWTP capacity:
  - Design flow = 85 mgd
  - Maximum capacity varies with tidal conditions: up to 225 mgd



System Characterization - Typical Year Highlights

73

Rain events

48.4”

Total rainfall

026

Most Active Outfall (at John Street)

3,490

Acres of combined sewered area.

1,065

Million gallons of total CSO volume

56

Total overflow events

Largest overflow volume = 176 million gallons

- At 041 (Morris Ave)

Peak discharge rate = 190 million gallons/day

- At 003 (Westfield & Magie)

Control Objectives

What are the regulatory requirements?

Presumption Approach (performance based)

- No more than 4 to 6 overflows per year
- No less than 85% capture of annual overflow volume

Demonstration Approach (water quality based)

- Control level that will not prevent the attainment of water quality in the future

Receiving waters and water quality standards

- Elizabeth River – Fresh Water FW2 and Saline Estuary SE3
- Newark Bay, Arthur Kill, Peripheral Ditch and Great Ditch – Saline Estuary SE3

Class	Bacterial Standards	Monthly Mean	Single Sample Max	Designated Uses
SE3	Fecal	1500	NA	Secondary Contact
FW2	E-coli	126	235	Primary Contact Public Water Supply

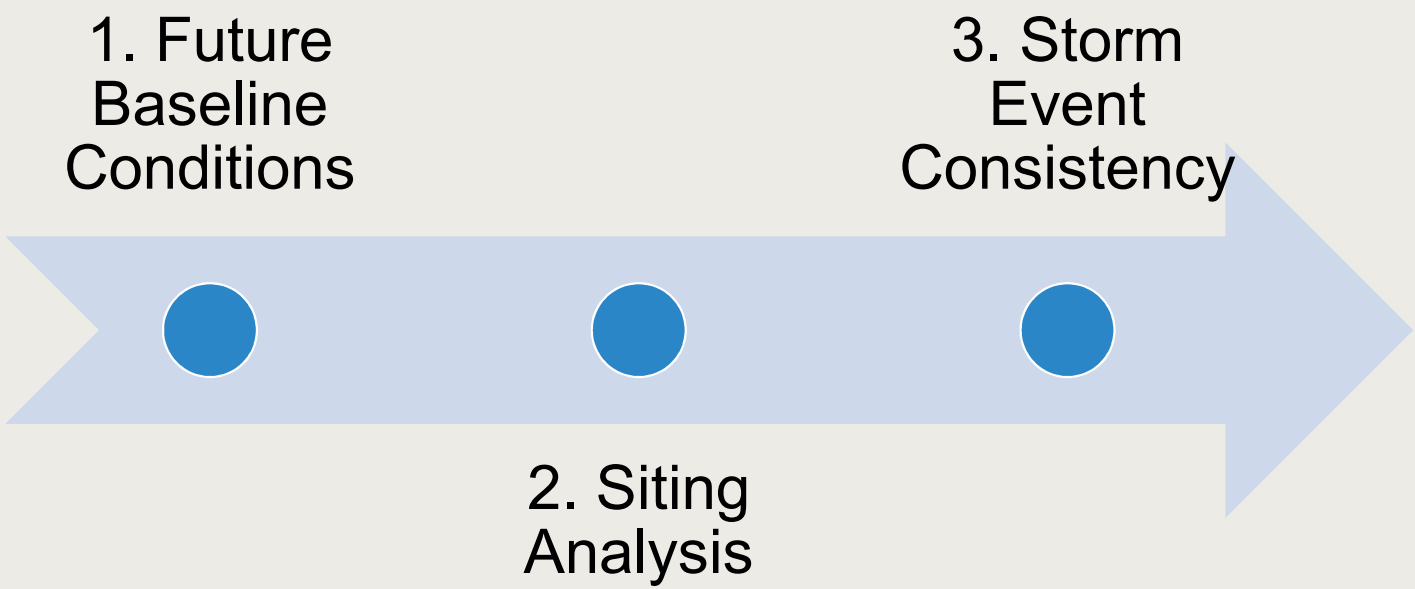
Alternatives Evaluation

Main CSO Control Strategies Evaluated – Part IV G 4 e

1. Increased conveyance to treatment
2. Sewer separation
3. Increased Sewer System Storage
4. Treatment of CSO discharges
5. Green infrastructure
6. Treatment plant expansion
7. Inflow / infiltration reduction
8. CSO operating protocol at treatment plant

Alternatives Evaluation

Preliminary Steps



Future Baseline Conditions

Anticipated 30-Year Project Duration – 2050 Future Baseline

Population Growth – City of Elizabeth

- North Jersey Transportation Planning Authority 2045 ->2050 population=165,000
- New Jersey Department of Labor ->2050 Population 155,000
- US Census extrapolation -> 2050 Population 144,000

Non-Residential Flow Projection (Commercial, Industrial etc.)

- Not significant in combined areas

Current Construction and Planned Capital Projects

- Trumbull Street Stormwater Control Project
- South Street Flood Control Project
- Atlantic Street Stormwater Control Project
- Lincoln Avenue Storm Drainage Improvements Project

Siting Analysis

Identify potential open or under-utilized sites for CSO control facilities

Preliminary assessment

- Reviewed area surrounding each outfall and regulator
- Identified multiple potential sites for each basin
- Generous consideration of possible locations with large paved areas
  - Objective of minimizing need to acquire real estate with existing building and structures

86 initial sites identified

- Reviewed by City for suitability

Favorable	Unfavorable
Open paved or grass areas, vacant land	Buildings / Structures
Industrial, Commercial, Open Space	Green Acres, Residential, Transportation Corridors
Publicly owned	Privately owned
Small elevation change to outfall or regulator	Large elevation change to outfall or regulator
Close to outfall or regulator	Far from outfall and regulator
No soil or groundwater contamination	Known contaminated site or brownfield site

Siting Analysis

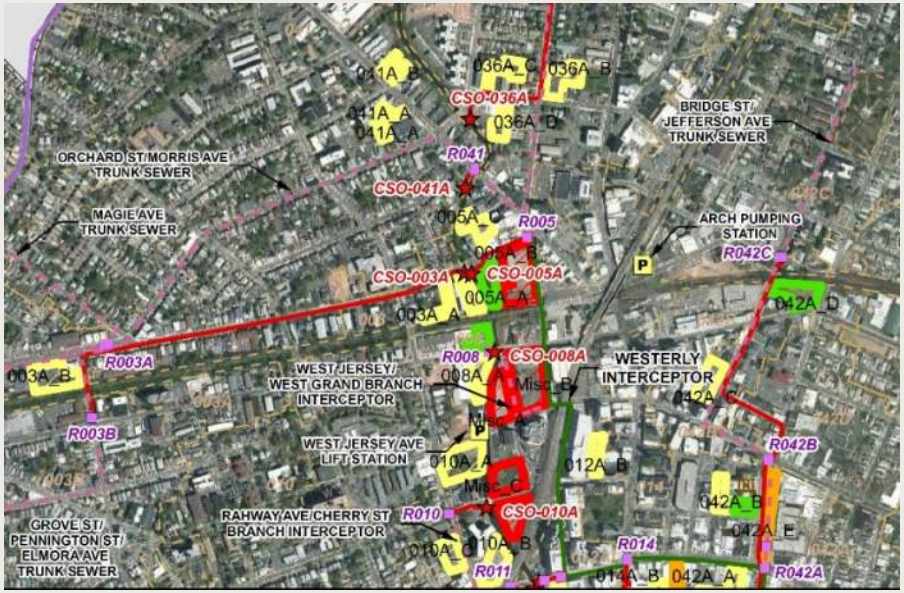
Identify potential open or under-utilized sites for CSO control facilities

City review of potential sites identified several restrictions due to:

- Existing use and ownership
- Easement requirements
- Redevelopment plans and recent construction
- Potential business and community disruptions
- Open space / Green Acres

Most sites rated poor and very poor as suitable locations

Very limited amount of open and under-utilized space; significant land acquisition will likely be required



Storm Event Consistency

System-wide evaluation for control levels

Establish consistent list of storms

- Across outfalls
- Across control methodology

Impacts conveyance, storage, and treatment unit sizes

- Time of maximum discharge rate and overflow volume varies by outfall

Grouping of outfalls by water body to be investigated further

Top 2004 Storm Events by System-wide Volume			
1 thru 4	**5 thru 8**	**9 thru 12**	**13 thru 20**
7/18/2004	5/12/2004	2/6/2004	4/26/2004
9/8/2004	6/25/2004	4/12/2004	5/10/2004
9/18/2004	7/12/2004	7/23/2004	7/5/2004
9/28/2004	11/28/2004	7/27/2004	8/14/2004
			8/21/2004
			11/4/2004
			11/12/2004
			12/1/2004

Increased Conveyance to Treatment

Increased Wet Weather Flow from Existing Facilities

Trenton Avenue Pump Station

Existing System Components

(2) 60” incoming sewers (i.e., Easterly and Westerly Interceptors), with influent flow control gates

(2) mechanical bar screens

(5) extended vertical shaft dry pit centrifugal pumps, original pump casings from late 1950s

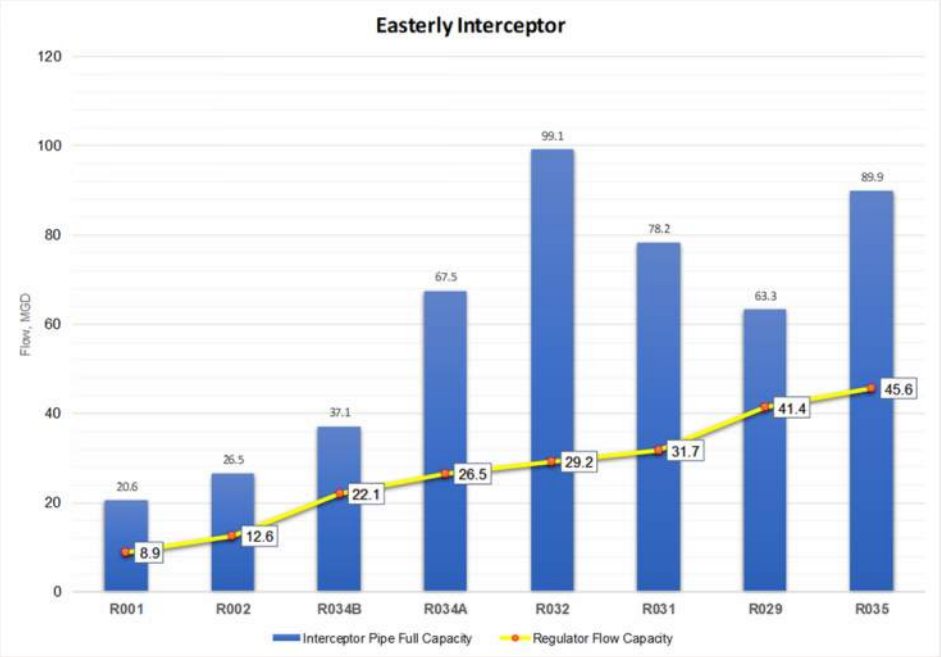
(1) 48” force main, approximately 930 LF

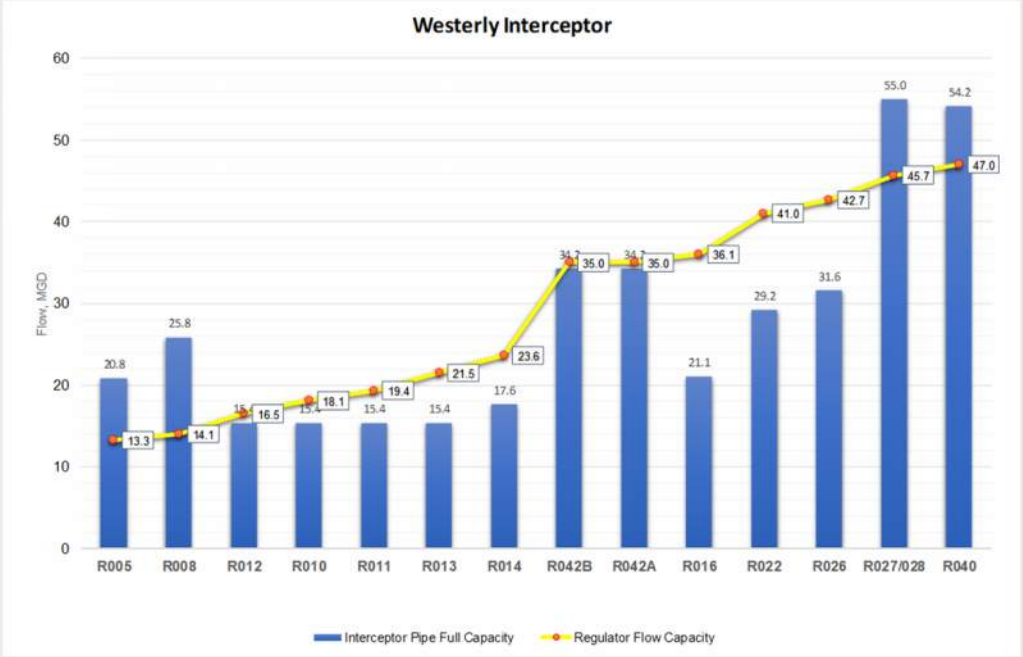
Estimated Maximum Pumping Capacity of 55 mgd

Estimated Force Main Capacity of ~ 65 mgd

Increased Conveyance to Treatment

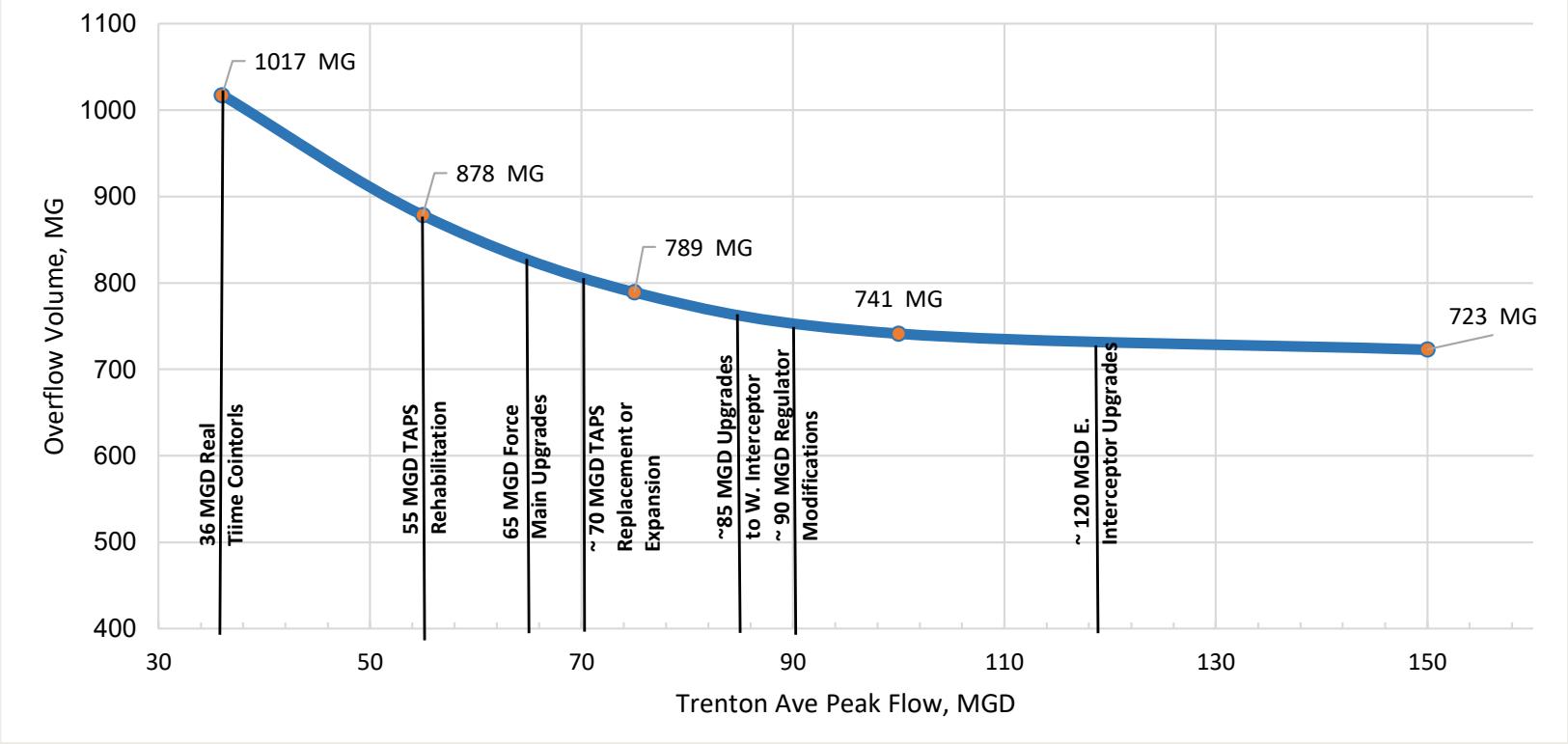
Existing Regulator and Interceptor Capacities





Increased Conveyance to Treatment

Pump Station Flows, System Modifications, and Est. Overflow Reductions



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Sewer Separation

Full Separation: Sanitary in one sewer, Stormwater in another

Install new sanitary sewer ⟶ Existing combined sewer becomes a storm sewer

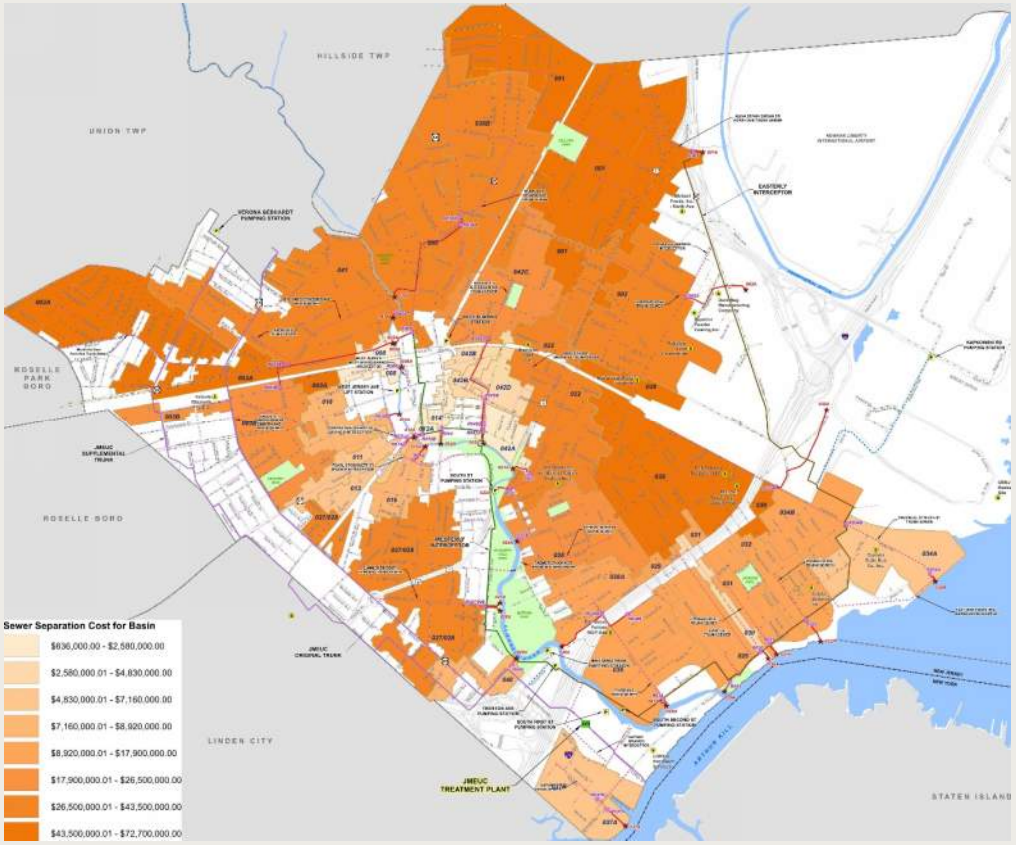
- Work remains in public right-of-way, no new land required
- Opportunity for system renewal, reconstruction
- Highly disruptive
  - Over 100 miles of new sewers required
  - Need to redirect every service connection on each street
  - Over 30 year planning period, about 110 acres, 3.5 miles or 50 blocks need to be addressed each year
- Stormwater contributes to pollution of the receiving waters and will eventually need to be treated or controlled

Sewer Separation

Construction Cost Estimate

- Cost estimated for each basin based on basin area (acres), average daily flow (gallons per day), feet of sewers
- Total cost for all basins ~ $660 million
- Corresponds to about $0.62 per gallon of overflow eliminated per year
- Costs vary by basin

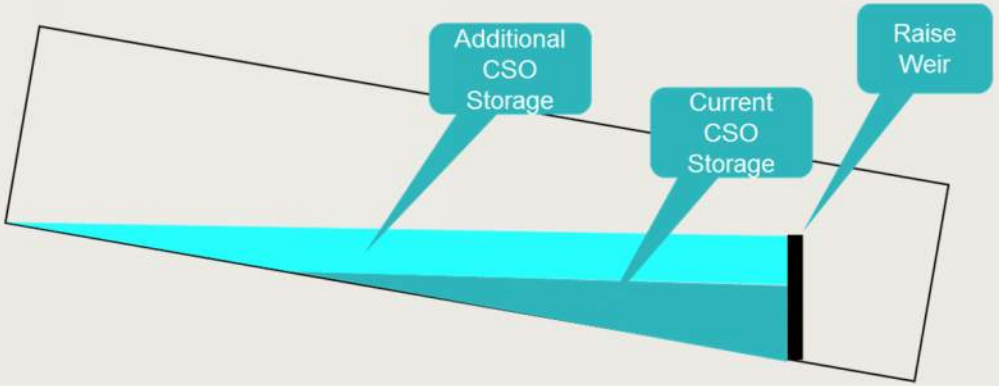
Upper range	Lower range
Basin 001: $72.7 million	Basin 042A: $0.64 million
Basin 039: $57.8 million	Basin 012: $0.89 million
Basin 003A: $57.3 million	Basin 014: $1.61 million



Increased Sewer System Storage

In-line Storage

- Uses available volume in existing sewer or new larger sewers in the same location
- Effectiveness driven by pipe size and slope
- Findings:
  - Larger trunk sewers reach full pipe condition during 2004 model run
  - Minimal additional storage volume is available
  - No reduction in number of overflows per year predicted
  - Very high cost per gallon stored

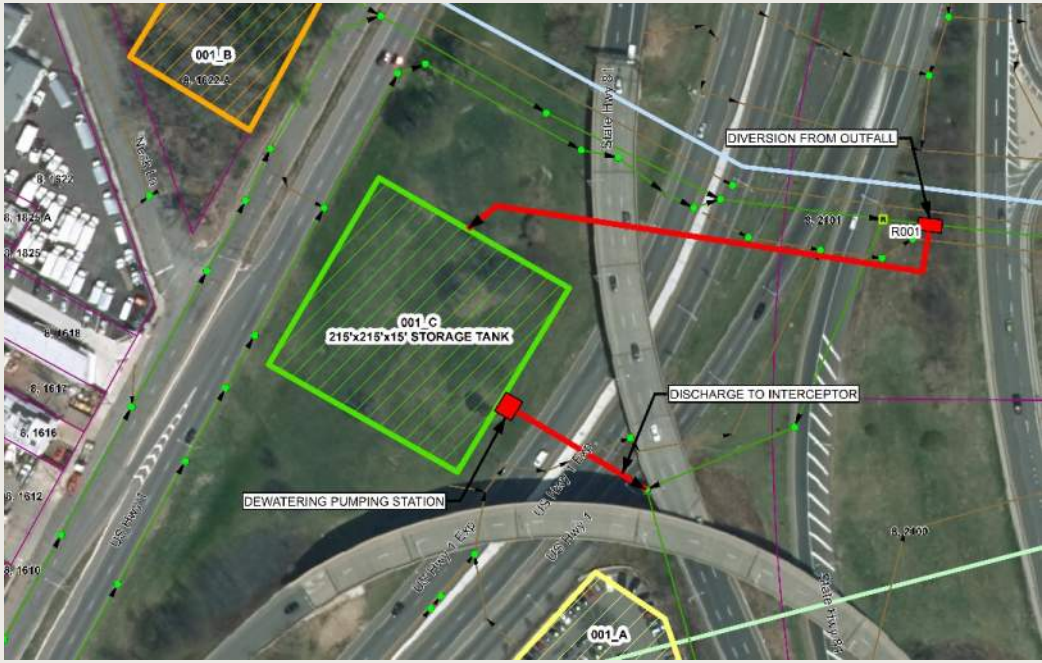


Storage Tanks

Tanks Located at Individual Outfalls

- Redirect outfall to off-line underground storage tank
- Flow stored up to tank volume
- Flow in excess of tank capacity discharged as overflow
- Select tank volume for targeted level of control
- Tank dewatered to interceptor
- Additional interceptor capacity and TAPS pumping may also be required.

Example: CSO-001 Tank Siting



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Storage Tanks

Sizing and Construction Cost Estimates

- Estimated for each basin for:
  - Control levels: 0, 4, 8, 12, and 20 overflows per year
  - System-wide storm event ranking
  - 15’ deep tanks, with factors for dewatering pumps, screens, and connecting pipes
- Total Construction Cost – All Basins

Control Level Overflows per year	0	4	8	12	20
Storage Volume Required (Mgal)	145.0	62.4	46.9	37.7	20.4
Construction Cost ($ million)	$738.0	$374.0	$297.0	$253.0	$159.0
Overflow Volume Captured (Mgal)	1065	950	867	790	576
Cost per Gallon Captured ($/gal)	$0.69	$0.39	$0.34	$0.32	$0.28

Storage Tank Siting Review

Example 1: CSO-001

Area available:

- 1.1 acres near Newark Airport between Spring Street and U.S. Highway 1
- 550 feet west of Outfall 001A

Ownership:

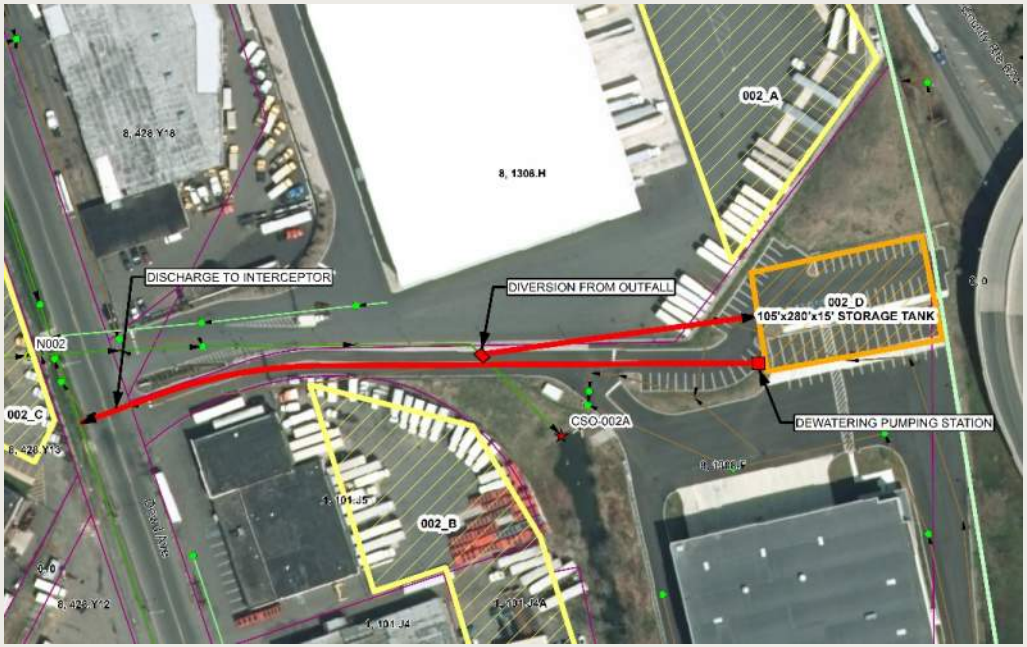
- NJDOT

Site considerations:

- Diversion and return pipes must cross several major highways (outfall on other side of US 1-9 and Route 81)
- NJDOT approvals and easement grants required
- Potential traffic disruption for site access during construction and for tank maintenance

Storage Tank Siting Review

Example: CSO-002



Area available:

- 0.67 acres in parking area of warehouse distribution center
- Adjacent to Outfall 002A
- Possible use of triangular grass area

Ownership:

- Private

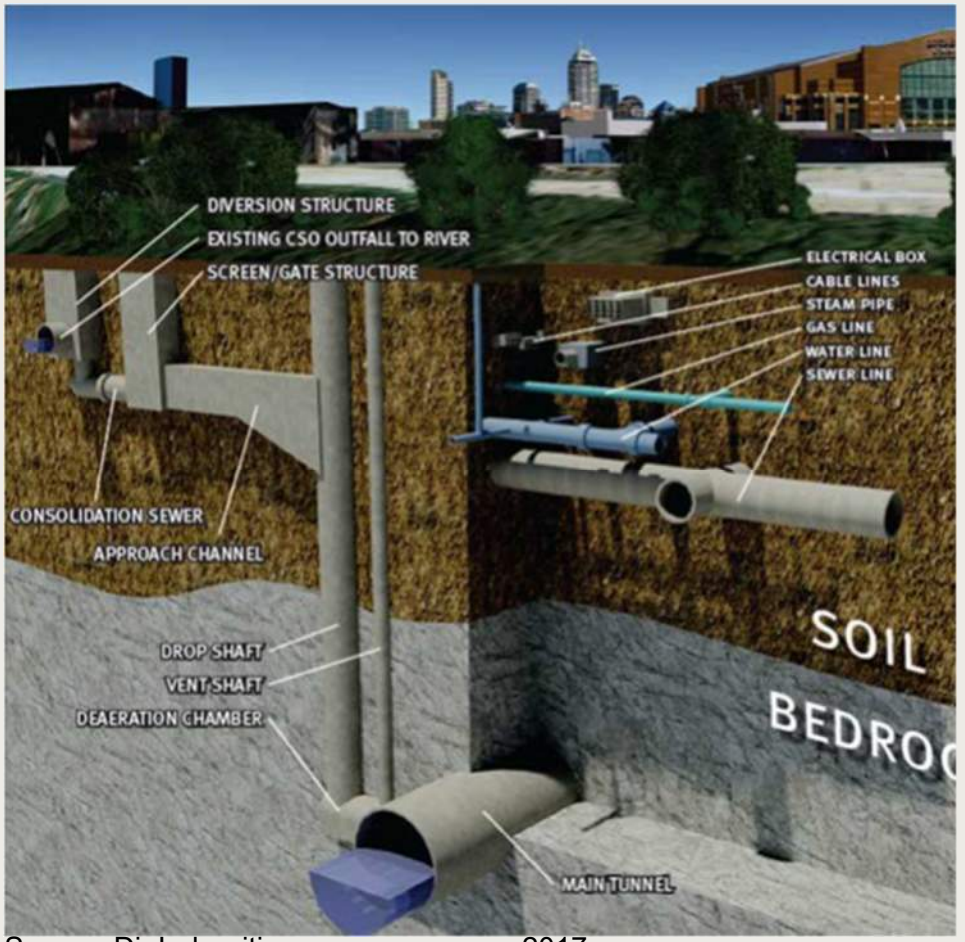
Site considerations:

- Potential interferences with existing infrastructure
- Disruption to business operations during construction and with final arrangement
- Loss of parking spaces.
- Easement requirements for site access and permanent facilities

Deep Tunnel Storage

General System Components

- Diversion structure / regulator
- Consolidation conduits
- Coarse screening
- Drop shafts
  - Approach channel
  - Inlet chamber
  - Vertical shaft
  - De-aeration chamber
  - Air vent shafts, recirculation, and odor control
- Main tunnel
- Dewatering pump station
- Overflow relief points



Source: DigIndy, citizens energy group, 2017

Deep Tunnel Storage

East Tunnel

Primary / south section

- Storage for 8 CSO basins
- South First Street and First Street
- 4 drop shafts, including launch & receiving
- Length: ~9,200 linear feet
- Diameter by control level

	Control Level (overflows/yr)				
	0	4	8	12	20
Vol, Mgal	30.5	13.6	10.5	7.7	4.4
Dia, ft	**24**	**16**	**14**	**12**	**10**

Deep Tunnel Storage

East Tunnel

Northern extension to Basins 001 & 002

- Adds 11,100 feet (120% increase)
- 2 more sites for drop shafts needed
- Excessive additional costs for remote outfall locations
- Tunnel extension – Not recommended

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Deep Tunnel Storage

West Tunnel

Extends north, generally along river

- Storage for 17 CSO basins
- 4 additional drop shafts
- Large consolidation conduits
- Multiple river crossings
- Length: ~10,600 linear feet
- Diameter by control level

	Control Level (overflows/yr)				
	0	4	8	12	20
Vol, Mgal	89.6	38.1	29.1	23.7	12.6
Dia, ft	**38**	**25**	**22**	**20**	**15**

Deep Tunnel Storage

Combined East and West Tunnels

Statistics for both sections

- Length: ~19,800 linear feet
- Diameter by control level

	Control Level (overflows/yr)				
	0	4	8	12	20
Vol, Mgal	120	51.7	39.6	31.4	17
Dia, ft	**32**	**21**	**19**	**16**	**12**

Deep Tunnel Storage

Shaft Siting Considerations

Tunneling operations

1. 2. 3. 4. 5. 6. 7. 8.

Deep Tunnel Storage

Shaft Siting Considerations

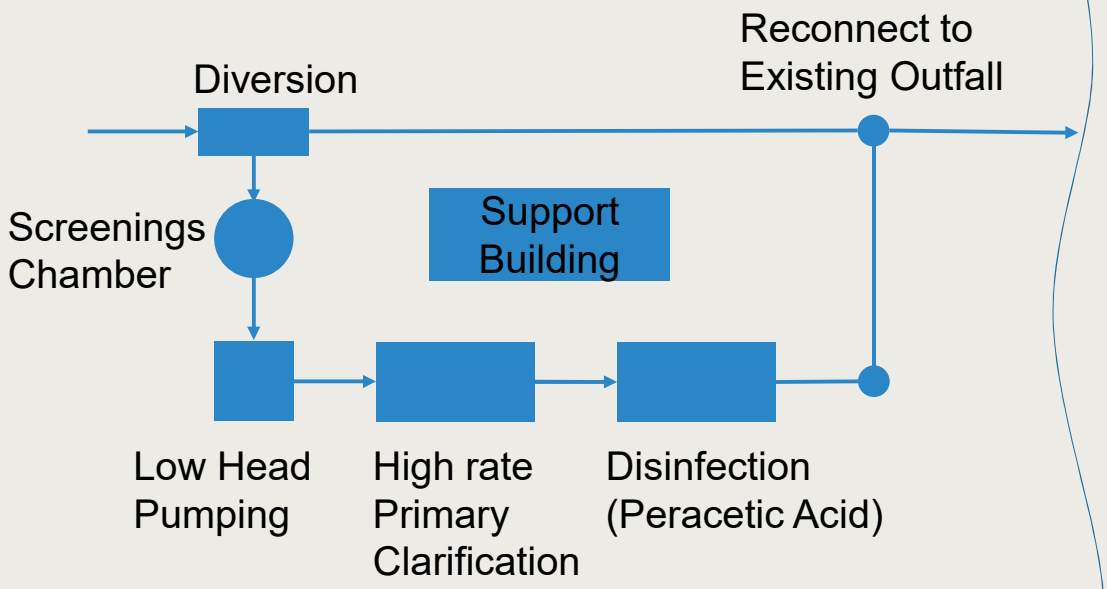
Drop shaft construction

1. 2. 3. 4. 5. 6. 7. 8.

Treatment of CSO Discharges

Primary Clarification and Disinfection

- Permit requirements for CSO discharge minimum treatment
  - Solids and floatables disposal
  - Primary clarification
  - Disinfection of effluent
- Considers disinfection with peracetic acid at 6 min contact time
- Pilot Testing Required



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Treatment of CSO Discharges

Peracetic Acid (PAA)

Acetic Acid and Hydrogen Peroxide solution

- Common Elements
  - 275 gallon totes or 55 gallon drums
  - Feed pumps
  - Mixers / diffusers
  - Instrumentation (flow, TSS)
  - Sampling equipment
  - Pressure relief
  - Heat monitoring

Treatment of CSO Discharges

Preliminary Sizing Calculations

Input requirements

- Peak flow rates
- Operating times
- Treatment volumes

Example: CSO-001
Peak Flow = 75.1 MGD

Item	Footprint (sf)
Screening	120
Pump Station	2,500
Primary Clarification (Actiflo)	5,000
Disinfection Chamber	10,000
Support Building	1,600

Rough Construction Cost = $38 million

Green Infrastructure

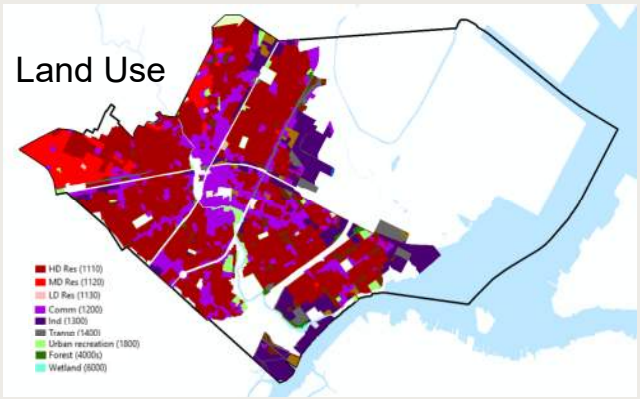
Background

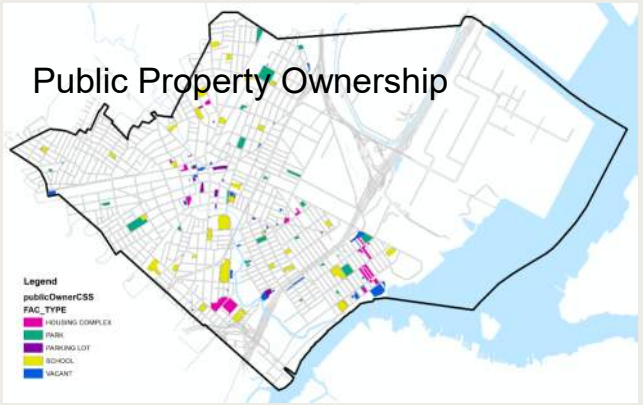
Green infrastructure (GI) = practices which reduce stormwater volume or flow rate by allowing the stormwater to infiltrate, be stored, or be treated by vegetation or soils

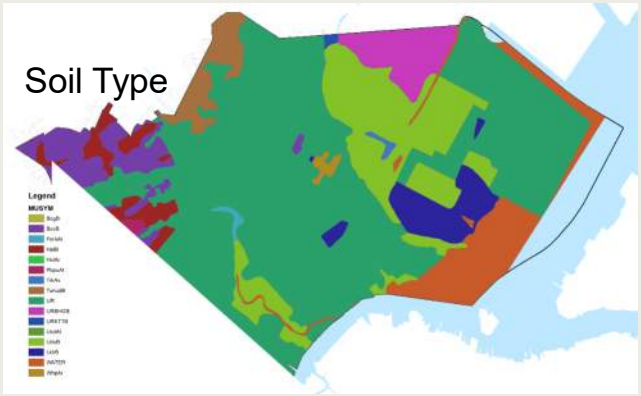
1. Estimate upper bound on impervious acres that could be feasibly managed by GI practices
2. Review GI practices for practical application citywide
3. Estimate potential number and size of units
4. Input GI areas into hydraulic model for performance simulation

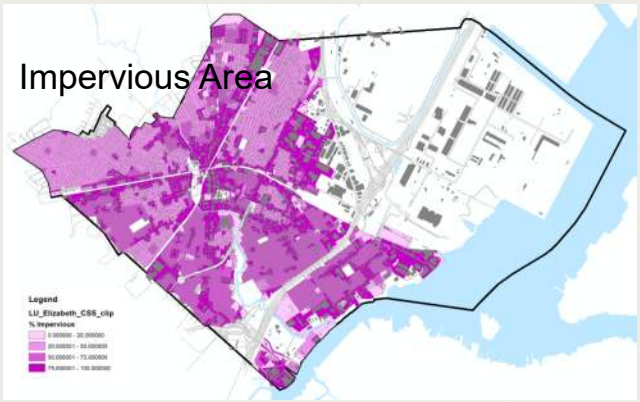
Green Infrastructure

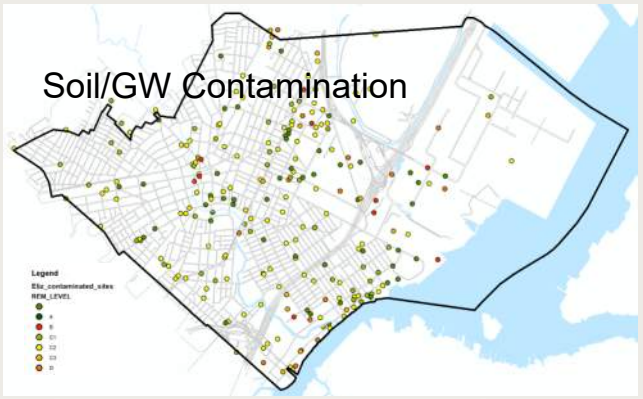
GIS Mapping Analysis











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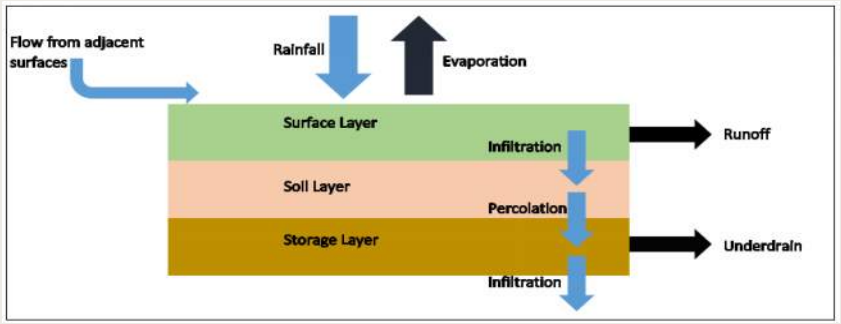
Green Infrastructure

Model Implementation

Representative Bioswale

- 3’ W x 20’ Long
- 18” Soil Depth
- 3.5’ Storage layer (Crushed Stone)
- Loading Ratio of 15:1
- Treated Impervious Area 900sf
- Mimic NJ SW BMP Manual

Source: InfoWorksICM Manual



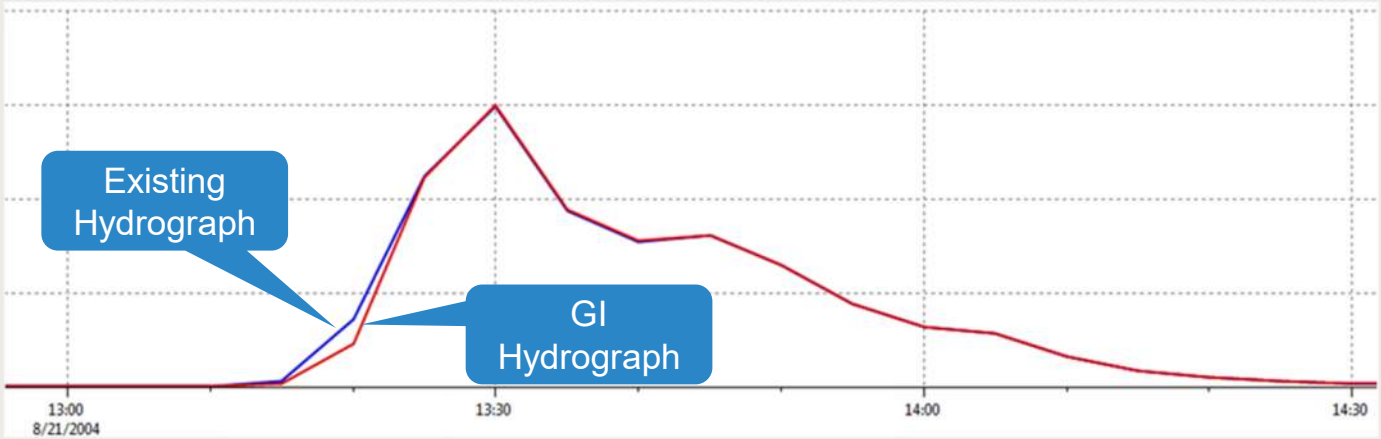
Results: Maximum of 2.6% of City impervious area can practically be directed to GI

- Will manage runoff from 2.9 million SF of impervious area
- 3,150 bioswales across Elizabeth
- Requires 18 additional staff for O&M (1 hr/month per bioswale, EPA)

Green Infrastructure

Model Impact

- Minimal Impact on Peak Flow
- Minimal Impact on Volume



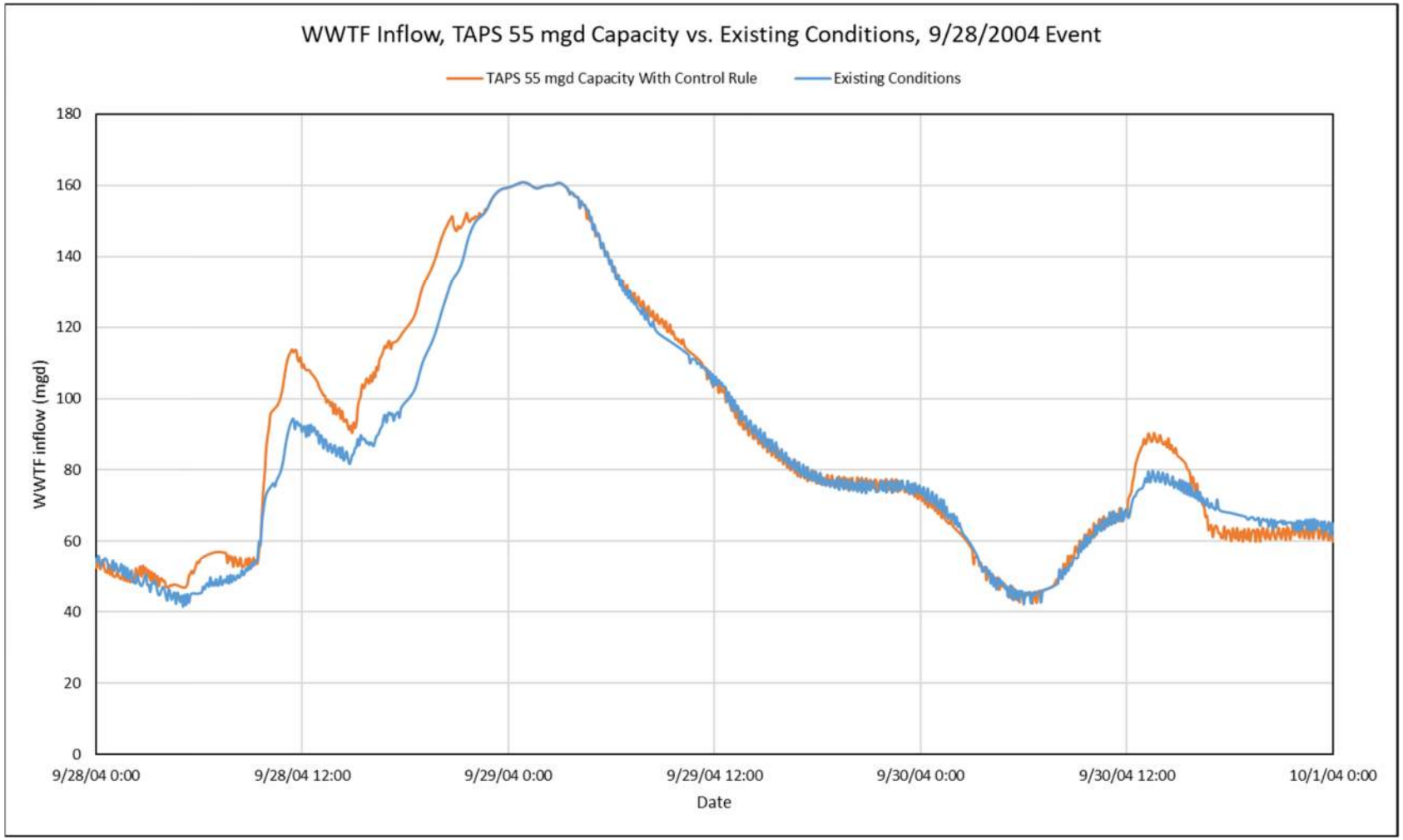
JMEUC Alternatives Evaluations

- Evaluation of expanded treatment of combined sewer flow from Elizabeth at the JMEUC Wastewater Treatment Facility (WWTF)

- Evaluation of costs and benefits of I/I reduction

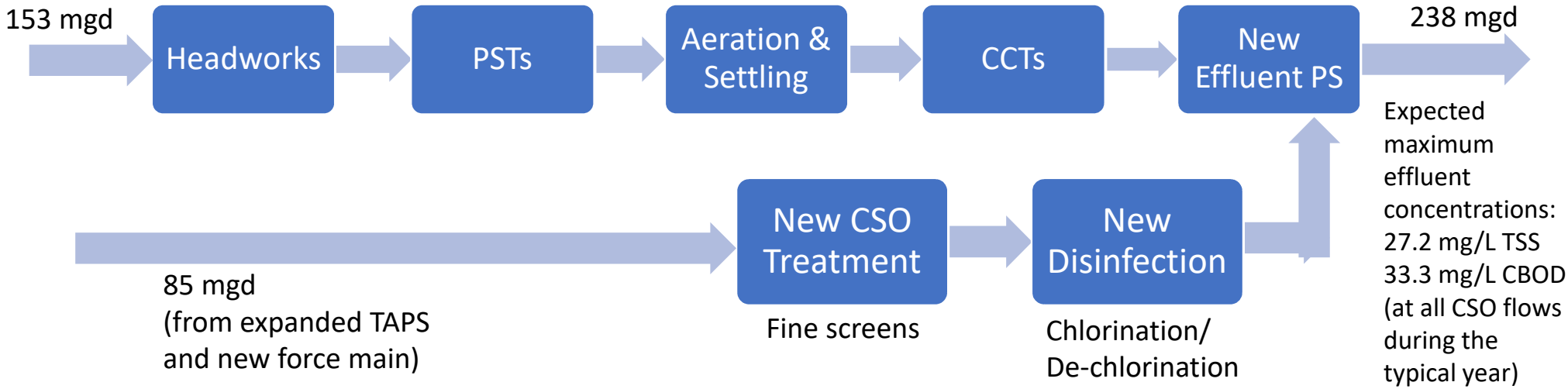
WWTF Expansion Objectives

- Core objective: Increase the capture and treatment of combined sewer flow during wet weather from the City of Elizabeth
- Interim plan to increase peak flow from TAPS to 55 mgd
- Long-term plan to increase peak flow from TAPS to 140 mgd
- Key elements of long-term plan:
  - Disinfection improvements required to accept additional CSO flows
  - Solids removal required for additional CSO flows prior to disinfection
  - Blending of treated CSO flows with normal wet weather plant effluent


WWTF Inflow, TAPS 55 mgd Capacity vs. Existing Conditions, 9/28/2004 Event
TAPS 55 mgd Capacity With Control Rule
Existing Conditions
WWTF inflow (mgd)
180
160
140
120
100
80
60
40
20
0
9/28/04 0:00
9/28/04 12:00
9/29/04 0:00
9/29/04 12:00
9/30/04 0:00
9/30/04 12:00
10/1/04 0:00
Date

Treatment of CSO Flows at JMEUC WWTP

- 153 mgd through existing facility (capacity ≥ 180 mgd)
- 85 mgd through new CSO treatment and new disinfection



Three treatment strategies evaluated:
A: All additional flow to a new treatment train **[SELECTED]**
B: Minimize capacity of new treatment train (maximize use of existing capacity)
C: Maximize use of secondary capacity (minimize additional pumping)

CSO Treatment Options

Treatment Option	Benefits	Limitations	TSS Removal, %	CBOD Removal, %
Mechanical Bar Screens	Small footprint (approx. 8 ft x 11 ft)	Need container to hold screenings and odor control	5	0
Fine Screens	Small footprint (approx. 20 ft x 5 ft)	Need regulators (weirs)	10	0
Vortex/Swirl Units	Easy to operate, TSS removal	Larger footprint (approx. 42 ft x 51 ft), Need ancillary tank to hold screenings (and odor control)	35	15
Ballasted Flocculation	Good TSS and BOD removal	Larger footprint than others (approx. 78 ft x 64 ft), Need ancillary tank, Start-up time	80	50

- Options Eliminated:
  - Band and belt screens: low Technical Guidance Manual matrix rating; primarily due to complexity and land required
  - Drum screens: low Technical Guidance Manual matrix rating; primarily due to complexity and land required
  - Modified vortex: higher level treatment not required for this system
  - Polishing (“Fuzzy”) filter: higher level treatment not required for this system

Disinfection Options

- Chlorination
- Peracetic Acid
- Ultraviolet (UV) Disinfection

- Since the JMEUC WWTF already has a chlorination facility on site, CDM Smith recommends using **chlorination (and dechlorination)** as the disinfection technology for the proposed CSO flows.
- New chlorine contact tank with de-chlorination required

Conclusions and Next Steps – WWTF expansion

- Initial planning-level cost for additional CSO treatment (fine screens) is $14M (capital cost) and $450K annual operating cost
- Potential additional costs for TAPS expansion and new force main costs not yet included
- Evaluate WWTF expansion vs. other controls:
  - Compare these costs/benefits with those of other CSO control alternatives and select CSO controls based on all relevant decision criteria
  - I/I reduction evaluated as a means to reduce plant improvement costs

I/I Reduction Evaluation Approach - Overview

- Establish the maximum attainable I/I reduction for each sewershed
- Estimate potential I/I reduction costs for each sewershed
- Rank sewersheds by potential I/I volume removed per rehab $
- Develop cost effectiveness curve as plot of ranked sewershed removal vs. cost
- Evaluate potential benefits of I/I reduction
- Compare I/I costs and benefits

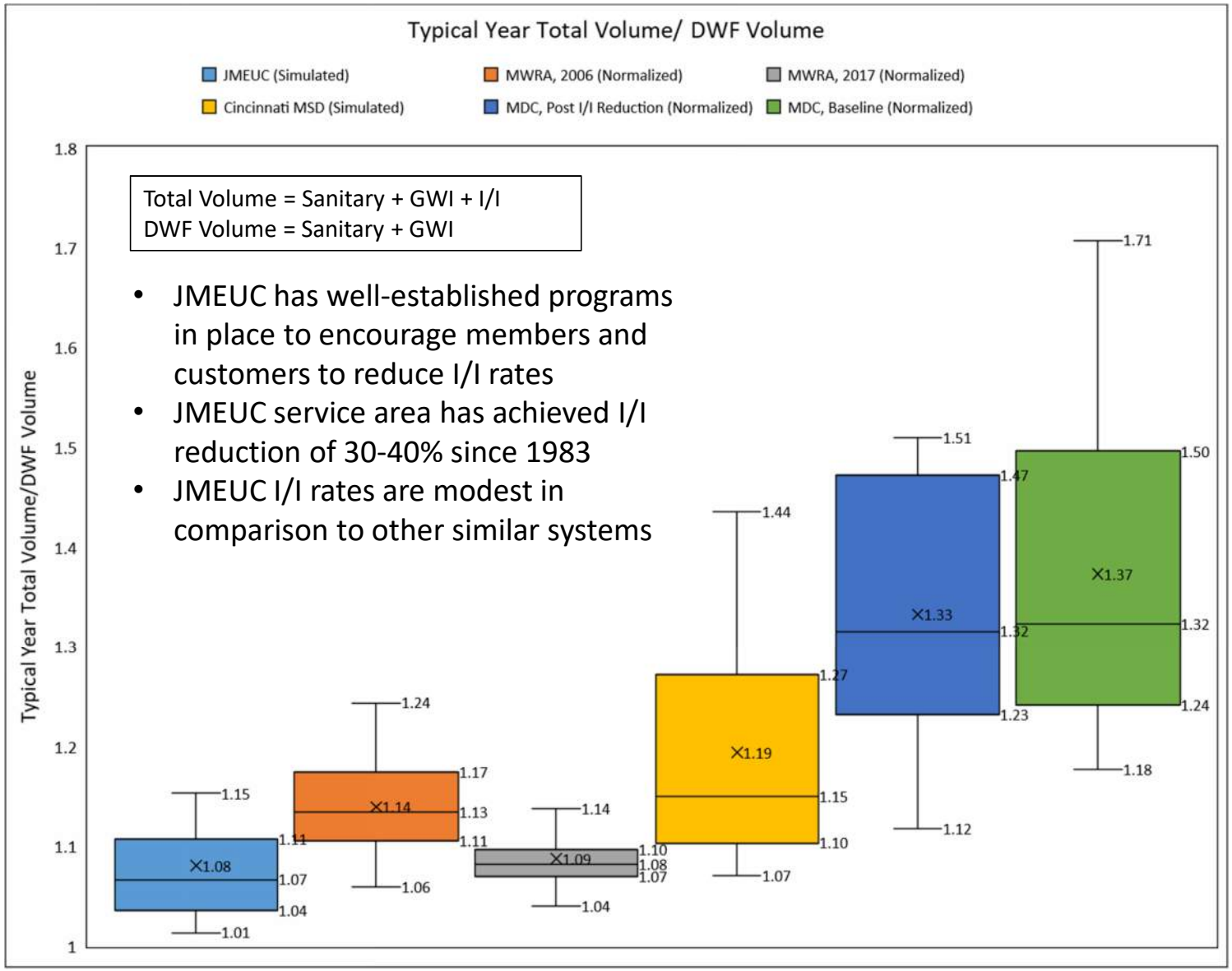
Sanitary Sewer System Components & Infiltration/Inflow Sources

Foundation drains (Inflow/Infiltration)

← Downspout (Inflow)

Inflow Sources:
- Downspouts
- Sump pumps
- Foundation drains
- Storm sewers
- Manhole covers

Infiltration Sources:
- Deteriorated pipes
  - cracks
  - erosion
  - roots
- Leaky joints
- Poor manhole connections


Typical Year Total Volume/ DWF Volume
JMEUC (Simulated)
MWRA, 2006 (Normalized)
MWRA, 2017 (Normalized)
Cincinnati MSD (Simulated)
MDC, Post I/I Reduction (Normalized)
MDC, Baseline (Normalized)
Typical Year Total Volume/DWF Volume
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
Total Volume = Sanitary + GWI + I/I
DWF Volume = Sanitary + GWI
• JMEUC has well-established programs in place to encourage members and customers to reduce I/I rates
• JMEUC service area has achieved I/I reduction of 30-40% since 1983
• JMEUC I/I rates are modest in comparison to other similar systems
1.15
1.11
1.07
1.04
1.01
X1.08
1.24
1.17
1.13
1.11
1.06
X1.14
1.14
1.10
1.08
1.07
1.04
X1.09
1.44
1.27
1.15
1.10
1.07
X1.19
1.51
1.47
1.32
1.23
1.12
X1.33
1.71
1.50
1.32
1.24
1.18
X1.37

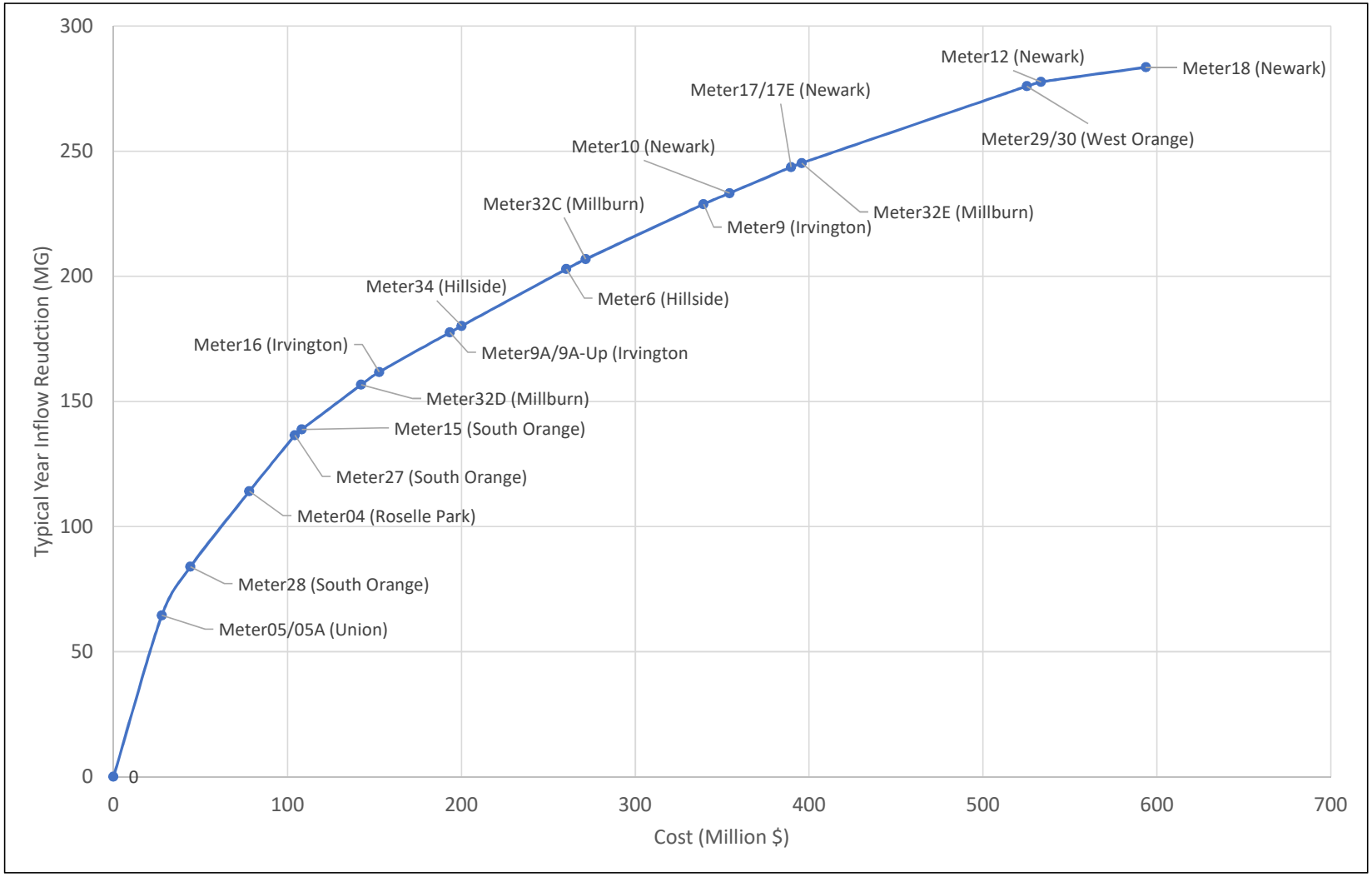
Potential I/I Reduction Targets by Sewershed

	Sewershed	Municipality	Estimated Typical Year Inflow (MG)	Estimated Attainable Inflow Reduction During Typical Year (MG; **50% maximum**)	Incremental Inflow Reduction Target (%)
No I/I reduction achieved to date	Meter16	Irvington	10.15	5.08	50.00%
	Meter04	Roselle Park	60.30	30.15	50.00%
	Meter27	South Orange	44.83	22.41	50.00%
	Meter9	Irvington	43.98	21.99	50.00%
	Meter10	Newark	8.79	4.39	50.00%
	Meter17/17E	Newark	20.89	10.44	50.00%
	Meter12	Newark	3.43	1.72	50.00%
	Meter06	Hillside	45.43	22.72	50.00%
	Meter34	Hillside	5.19	2.60	50.00%
	Meter32D	Millburn	35.73	17.86	50.00%
Partial I/I reduction achieved to date	Meter18	Newark	12.73	5.89	46.30%
	Meter29/30	West Orange	69.06	30.69	44.44%
	Meter28	South Orange	57.43	19.44	33.85%
	Meter15	South Orange	6.84	2.32	33.85%
	Meter32C	Millburn	14.99	3.93	26.25%
	Meter32E	Millburn	6.12	1.61	26.25%
	Meter9A/9A-Up	Irvington	62.77	15.85	25.25%
	Meter05/05A	Union	524.91	64.46	12.28%
Full I/I reduction achieved to date	Meter13	East Orange	12.86	0.00	0.00%
	Meter22	Maplewood	12.01	0.00	0.00%
	Meter21	Maplewood	18.32	0.00	0.00%
	Meter26/31	Maplewood	18.93	0.00	0.00%
	Meter14	East Orange	6.48	0.00	0.00%
	Meter25	Maplewood	8.02	0.00	0.00%
	Meter24	Summit	107.24	0.00	0.00%

I/I Reduction – Ranked List of Sewersheds with Feasible Reduction Opportunities

Subcatchment	Municipality	% Reduction in R values for modeling	% of subcatchment to undergo comprehensive I/I reduction to achieve calculated % Reduction in Inflow	Estimated Dwelling Count	Pipe Length (mi)	Estimated Dwellings with laterals in need of lining	Estimated Cost of CIPP Lining Laterals ($)	Estimated pipe length in need of CIPP lining (ft)	Estimated Cost of CIPP Lining Main Lines ($)	Total Estimated Rehabilitation Cost ($)	Estimated Existing Inflow During Typical Year (MG)	Estimated Attainable Inflow Reduction During Typical Year (MG)	Estimated gallons of I/I removed per $ spent
Meter05/05A	Union	12.28%	14.00%	25,109	122.05	3,515	24,605,217	90,213	$3,157,443	$27,762,660	524.906	64.459	2.322
Meter28	South Orange	33.85%	51.17%	3,940	24.95	2,016	14,113,118	67,422	$2,359,775	$16,472,893	57.428	19.439	1.180
Meter04	Roselle Park	50.00%	100.00%	4,752	3.45	4,752	33,264,000	18,237	$638,295	$33,902,295	60.300	30.150	0.889
Meter27	South Orange	50.00%	100.00%	3,400	12.85	3,400	23,798,412	67,823	$2,373,805	$26,172,217	44.827	22.413	0.856
Meter15	South Orange	33.85%	51.17%	972	4.41	498	3,482,531	11,912	$416,910	$3,899,441	6.841	2.316	0.594
Meter32D	Millburn	50.00%	100.00%	3,966	34.95	3,966	27,762,427	184,553	$6,459,355	$34,221,782	35.725	17.863	0.522
Meter16	Irvington	50.00%	100.00%	1,398	2.98	1,398	9,788,630	15,722	$550,270	$10,338,900	10.153	5.077	0.491
Meter9A/9A-Up	Irvington	25.25%	33.78%	16,459	28.44	5,560	38,918,335	50,728	$1,775,469	$40,693,804	62.772	15.850	0.389
Meter34	Hillside	50.00%	100.00%	865	3.69	865	6,055,070	19,475	$681,625	$6,736,695	5.192	2.596	0.385
Meter06	Hillside	50.00%	100.00%	7,700	34.41	7,700	53,899,930	181,685	$6,358,975	$60,258,905	45.432	22.716	0.377
Meter32C	Millburn	26.25%	35.59%	3,755	25.72	1,336	9,355,270	48,340	$1,691,895	$11,047,165	14.989	3.935	0.356
Meter9	Irvington	50.00%	100.00%	9,039	24.74	9,039	63,269,685	130,642	$4,572,470	$67,842,155	43.983	21.992	0.324
Meter10	Newark	50.00%	100.00%	1,991	5.20	1,991	13,934,851	27,454	$960,890	$14,895,741	8.785	4.393	0.295
Meter17/17E	Newark	50.00%	100.00%	4,706	13.45	4,706	32,943,284	71,028	$2,485,980	$35,429,264	20.886	10.443	0.295
Meter32E	Millburn	26.25%	35.59%	2,114	12.49	752	5,267,341	23,464	$821,244	$6,088,585	6.118	1.606	0.264
Meter29/30	West Orange	44.44%	79.99%	20,179	111.53	16,140	112,982,061	471,021	$16,485,728	$129,467,789	69.056	30.689	0.237
Meter12	Newark	50.00%	100.00%	1,104	2.40	1,104	7,731,462	12,652	$442,820	$8,174,282	3.431	1.715	0.210
Meter18	Newark	46.30%	86.22%	9,626	14.12	8,299	58,094,346	64,258	$2,249,025	$60,343,371	12.725	5.892	0.098
Total				121,075	481.83	77,038	$539,265,968	1,556,628	$54,481,973	$593,747,942			

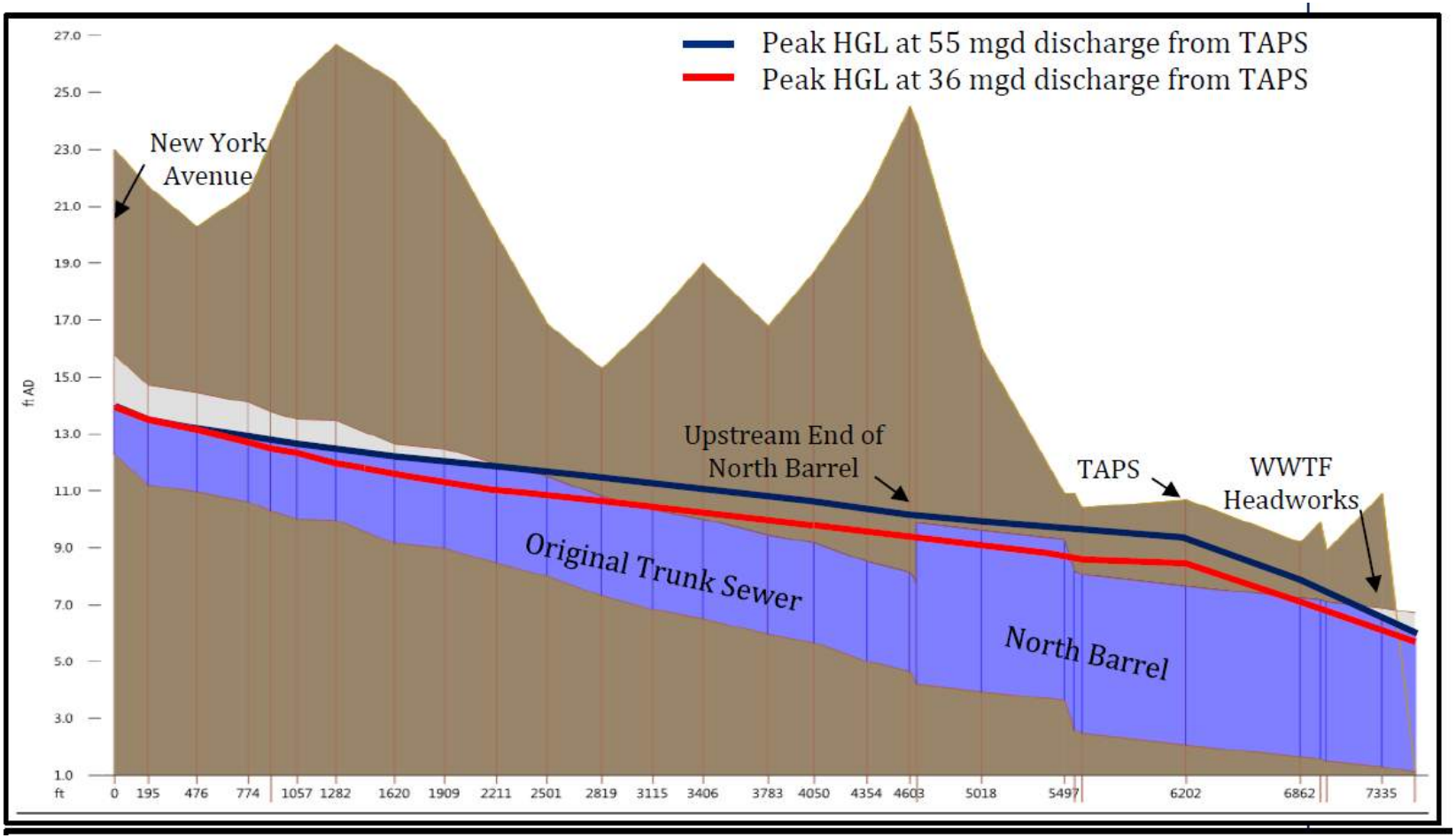
Cost-Effectiveness of I/I Reduction

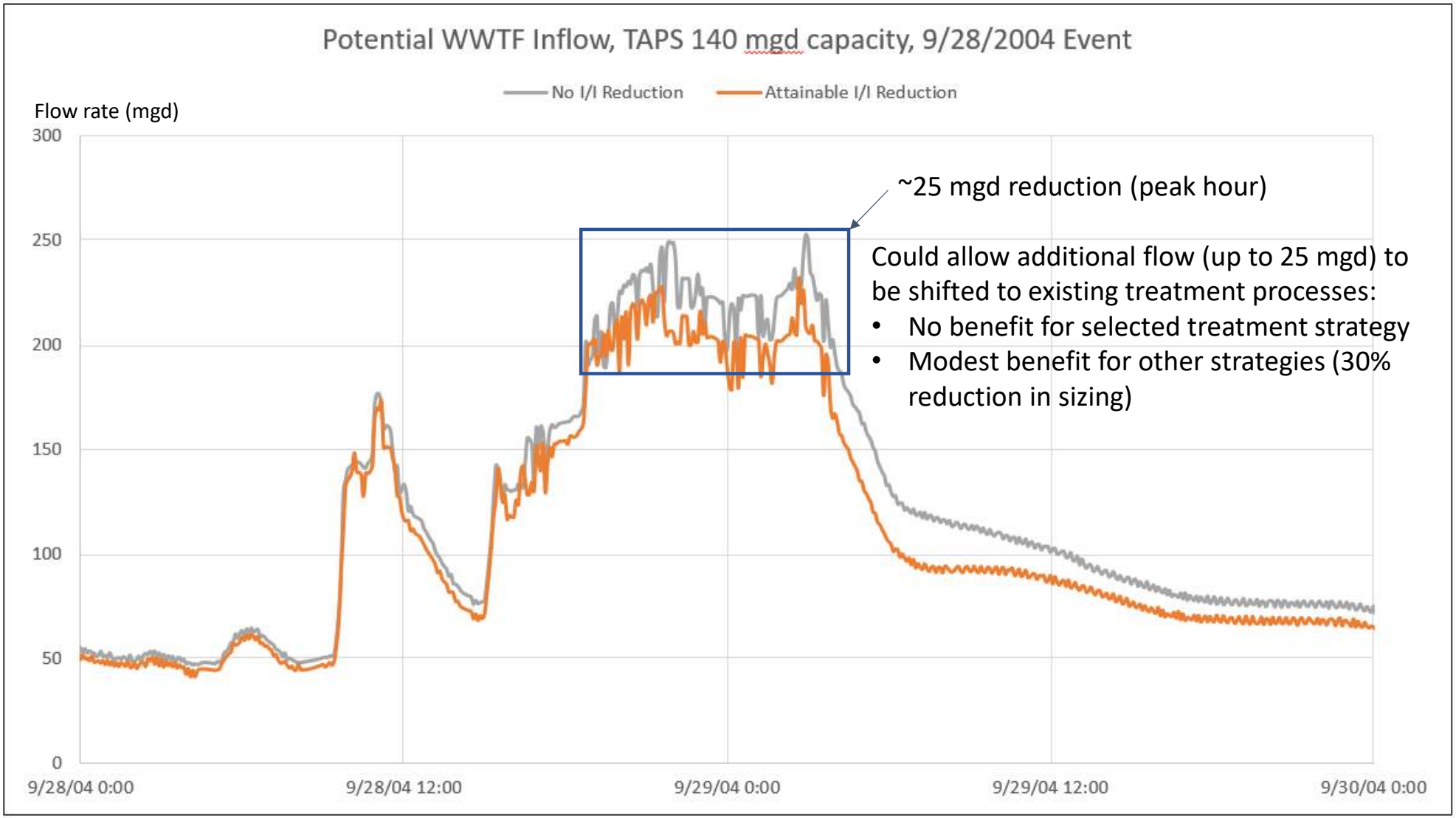


I/I Reduction Benefits – Key Factors

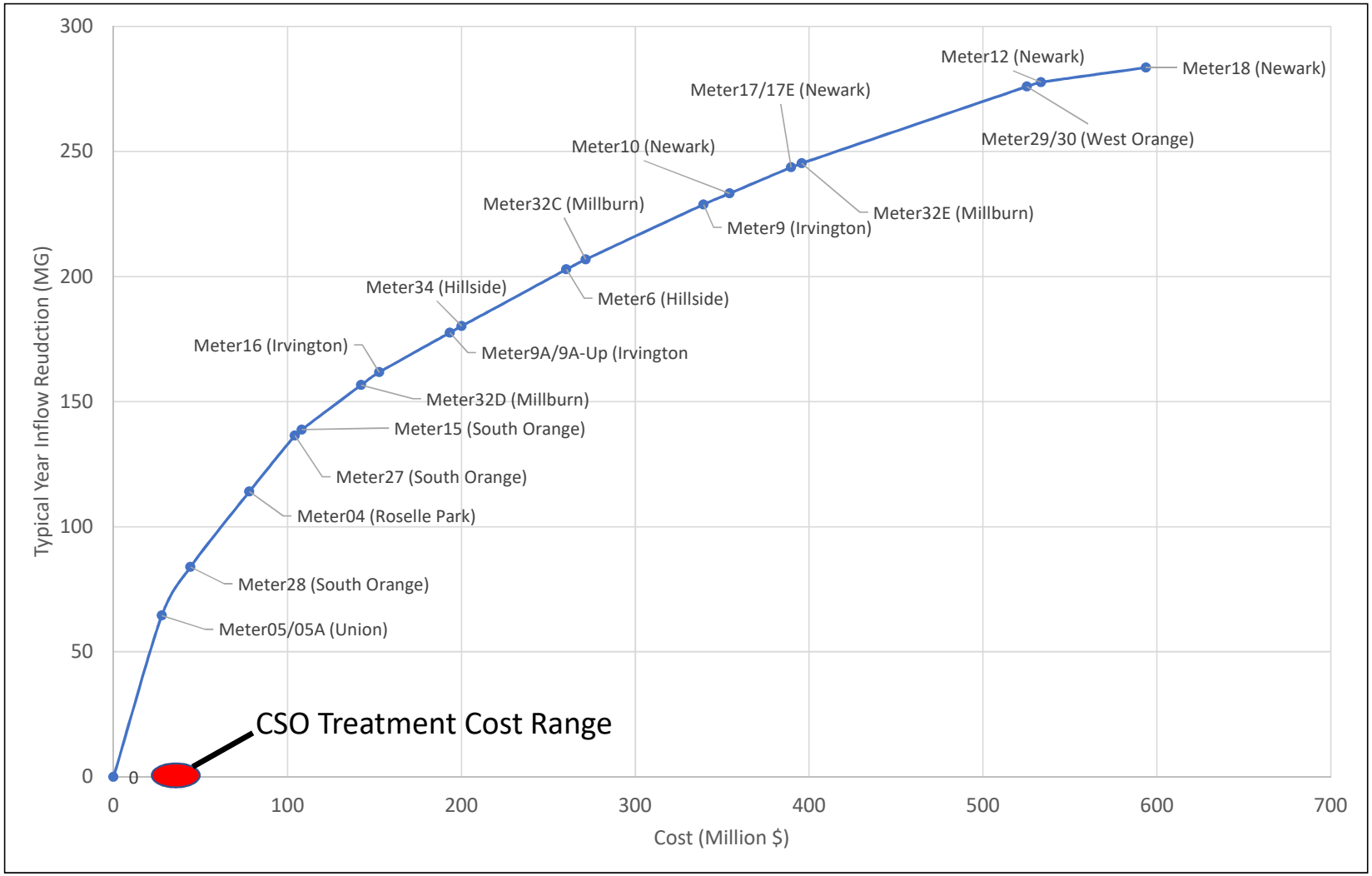
- System Characterization Report demonstrated that all wet weather flow in the typical year from member & customer communities (including TAPS at 55 mgd) can be delivered by JMEUC trunk sewers to the WWTF and fully treated
- Additional combined sewer flow at 140 mgd from Elizabeth/TAPS would require additional conveyance and treatment:
  - 55 mgd thru existing TAPS and JMEUC trunk sewers
  - 85 mgd thru expanded TAPS and new force main requires new CSO treatment train to provide the equivalent of primary treatment
  - **Only I/I reduction benefit for CSO LTCP** is reduction in capacity of the new CSO treatment train (for Options B & C) by 25 mgd (~30%)

I/I does not limit current or future capture of CSO flow




Potential WWTF Inflow, TAPS 140 mgd capacity, 9/28/2004 Event
No I/I Reduction
Attainable I/I Reduction
Flow rate (mgd)
300
250
200
150
100
50
0
9/28/04 0:00
9/28/04 12:00
9/29/04 0:00
9/29/04 12:00
9/30/04 0:00
~25 mgd reduction (peak hour)
Could allow additional flow (up to 25 mgd) to be shifted to existing treatment processes:
• No benefit for selected treatment strategy
• Modest benefit for other strategies (30% reduction in sizing)

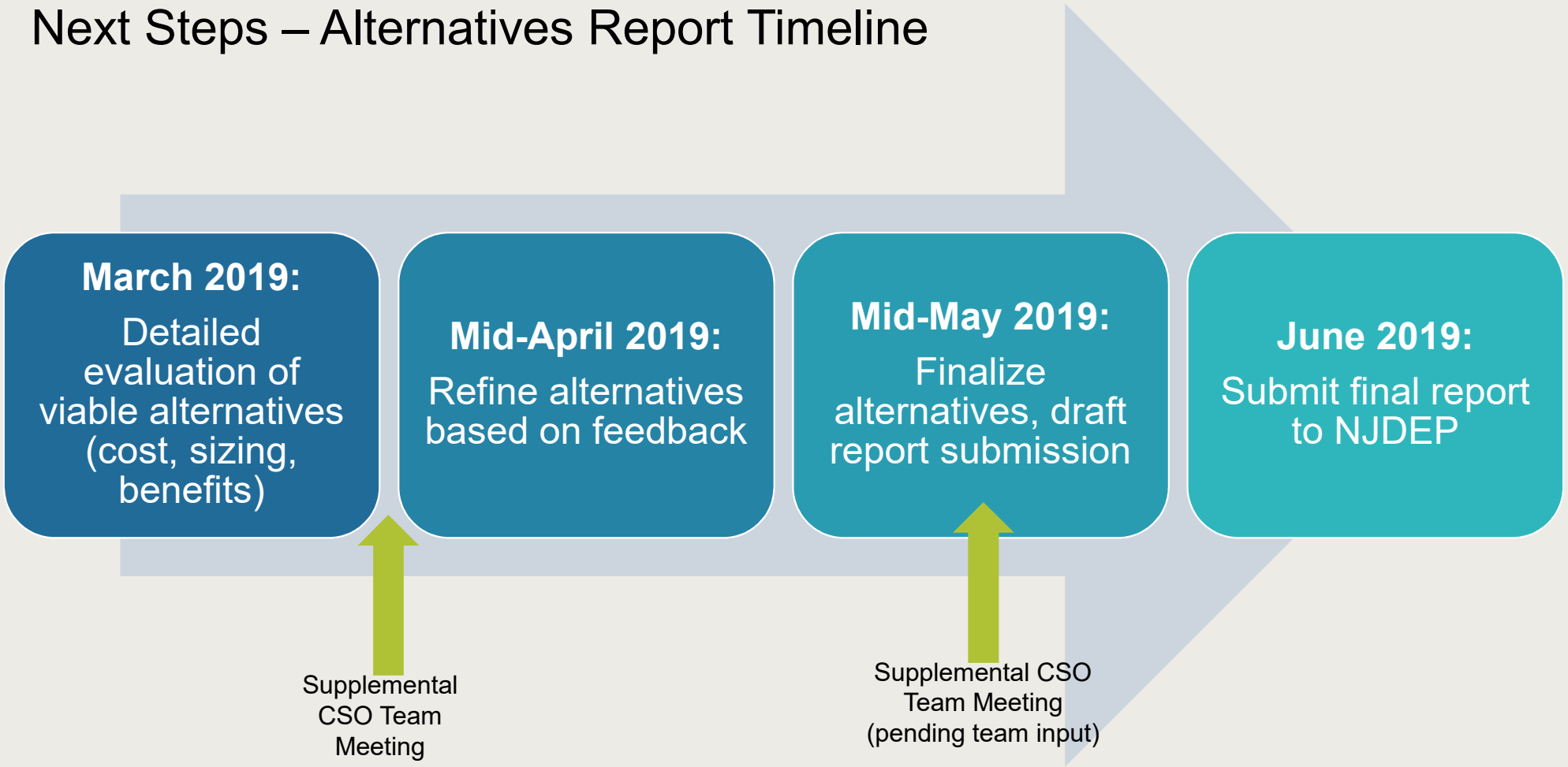
CSO Treatment Cost vs I/I Reduction Cost



Conclusions – I/I Reduction

- I/I reduction costs much higher than CSO treatment train costs:
  - ~$600M in I/I rehab costs ➡ ~$6M in CSO treatment cost savings
- Reducing I/I rates to reduce required CSO treatment train capacity is not cost-effective
- JMEUC will continue to encourage I/I reduction in the sanitary sewer service areas but I/I reduction will not be included as an element of the CSO LTCP

Next Steps – Alternatives Report Timeline



Next meeting lookahead

Next Supplemental CSO Team meeting

June 2019

Timing of meeting – weekday, weeknight, weekend?

Focusing on Development and Evaluation of Alternatives report

- Sizing and costing of viable alternatives
- Modeling for CSO performance
- Draft report sections

Questions?

Thank you

City of Elizabeth and
Joint Meeting of Essex & Union Counties (JMEUC)

Supplemental CSO Team

Meeting No. 7
Long-Term Control Plan Permit Compliance