



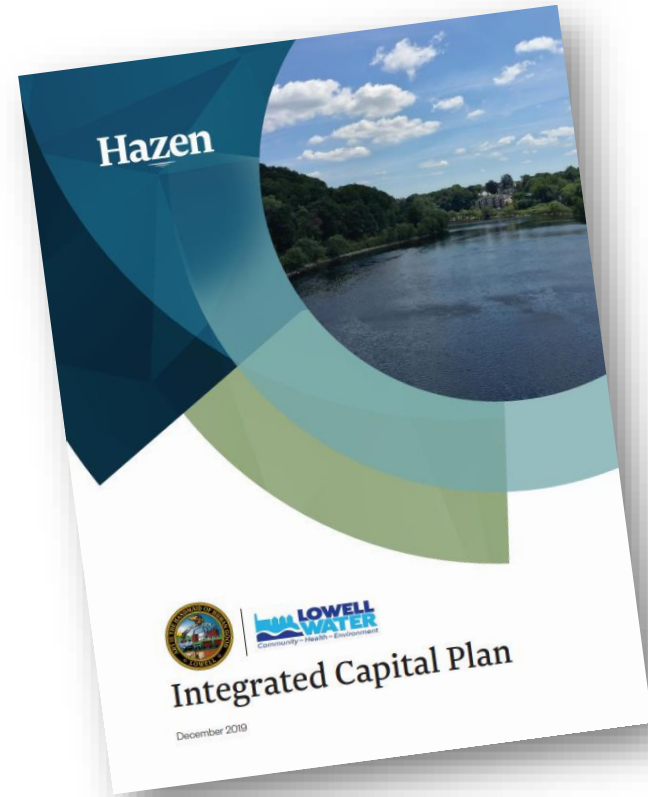
Lowell's Integrated Capital Plan



September 29, 2021

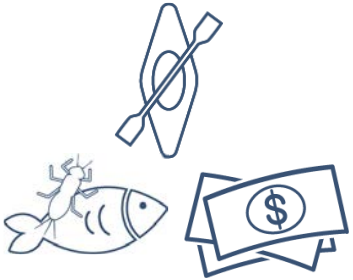
Overview

- What is Integrated Planning?
- About the City of Lowell
- Integrated Plan Framework
- CSO Control Plan
- Affordability
- Implementation Schedule
- Conclusion



Integrated Planning (IP) Background & Process

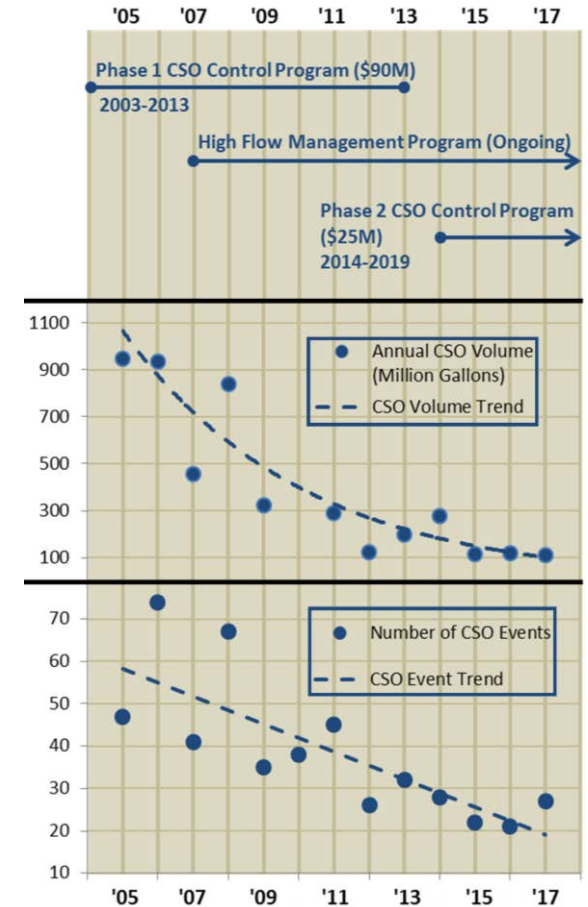
- An LTCP that also considers other water needs, such as drinking water
- Process allows ranking of CSO, wastewater, and drinking water projects according to the same criteria
- Criteria are used measure benefits of ALL projects (CSO, O&M, MS4, etc.)
- Determine which criteria are most important to Lowell (weighting w/ pairwise voting)
- Score projects and determine affordability to set schedule for implementation
- **Consider all water needs**



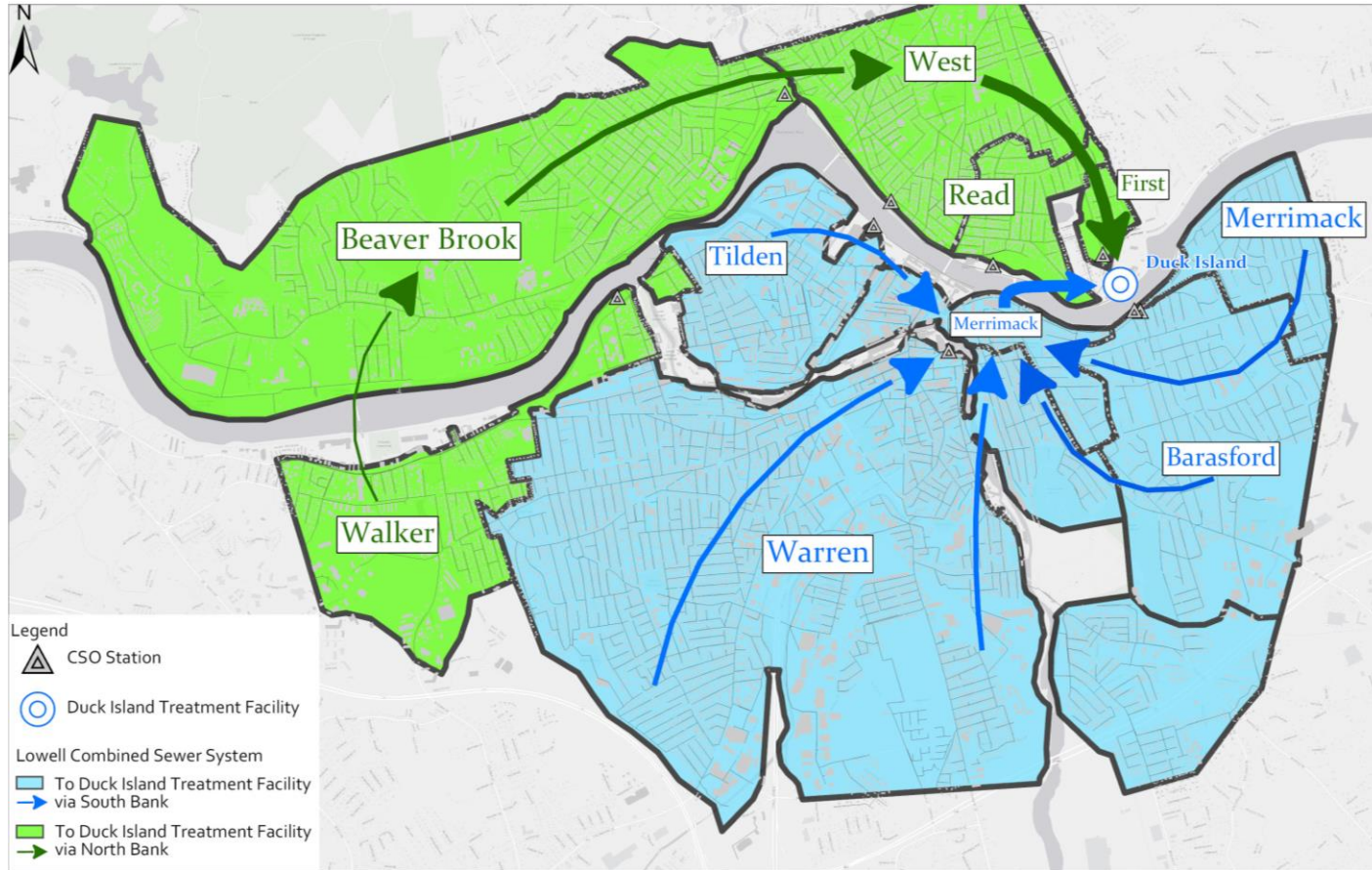
Develop Criteria → Weight Criteria (pairwise voting) → Score Projects → Affordability and Implementation Schedule

About the City of Lowell & Background

- ~30 miles north of Boston
- 110k population
- Old Mill Town – “Cradle of the American Industrial Revolution”
- Stagnant or declining incomes since 2009
- Competing financial priorities
- Aging infrastructure
- Phase 1 & 2 CSO Control programs
- 2017 – Administrative Order



Lowell's Sewer Interceptor System



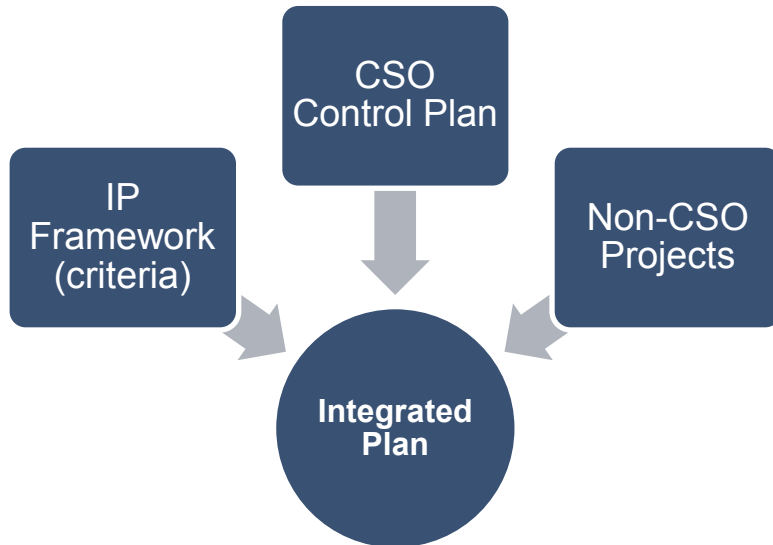
Annual Average Overflow Volume (Model Predictions)

CSO Station	Volume (MG)	Frequency
West Street	121.8	34
Merrimack	115.2	21
Warren	48.8	20
Tilden	22.0	18
Read Street	8.1	17
Walker	7.0	8
Beaver Brook	5.7	5
Barasford Avenue	3.1	6
First Street	0.0	0
Total Volume (MG)	331.7	

CSO stations in Lowell are subjected to “cumulative” flow from upstream sewersheds

Lowell's IP Framework

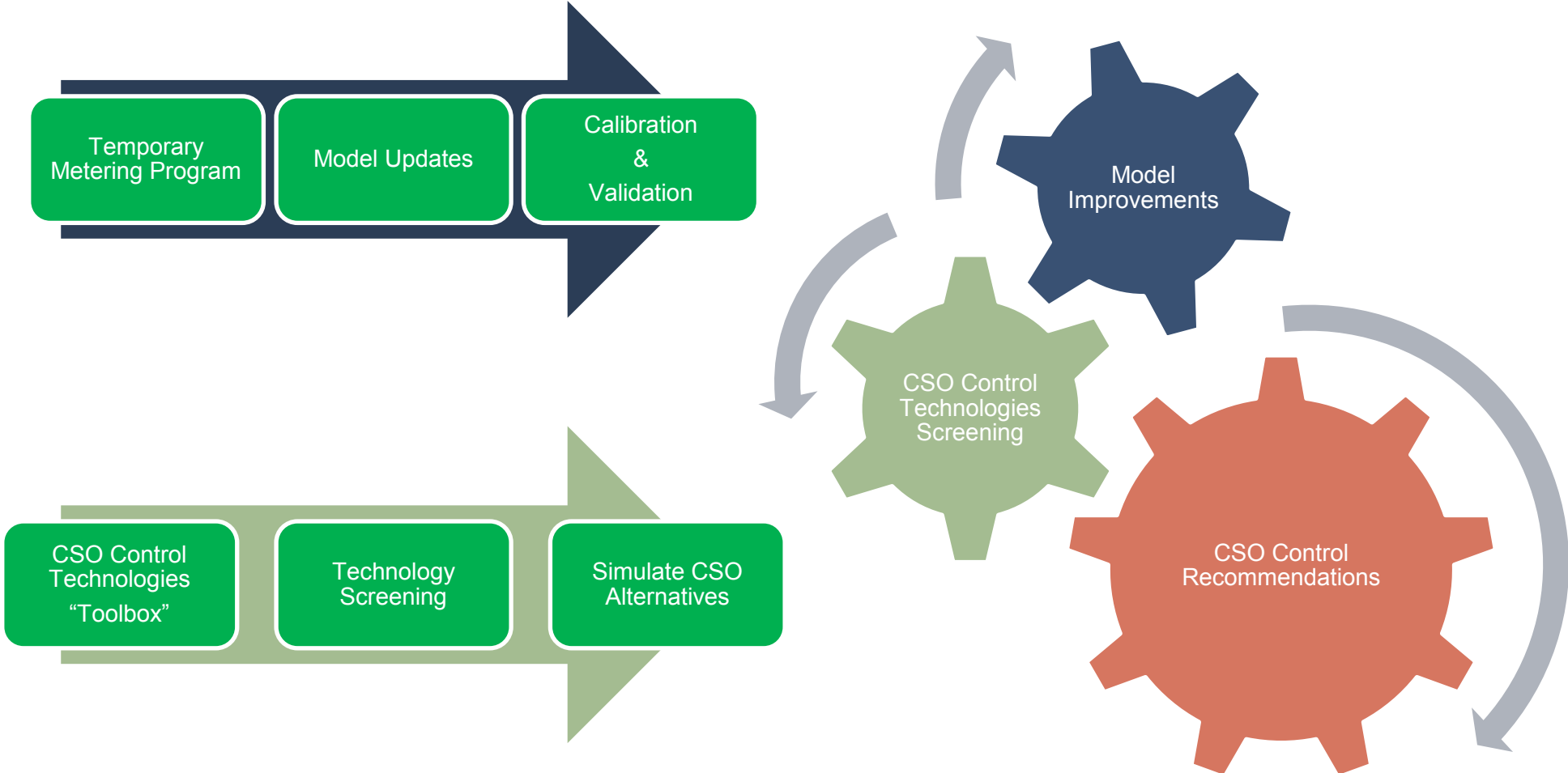
- Environmental and community benefits considered
- Criteria chosen specifically for Lowell
- Criteria weighted (prioritized) by City staff
- **Flexibility**



Lowell's IP Criteria

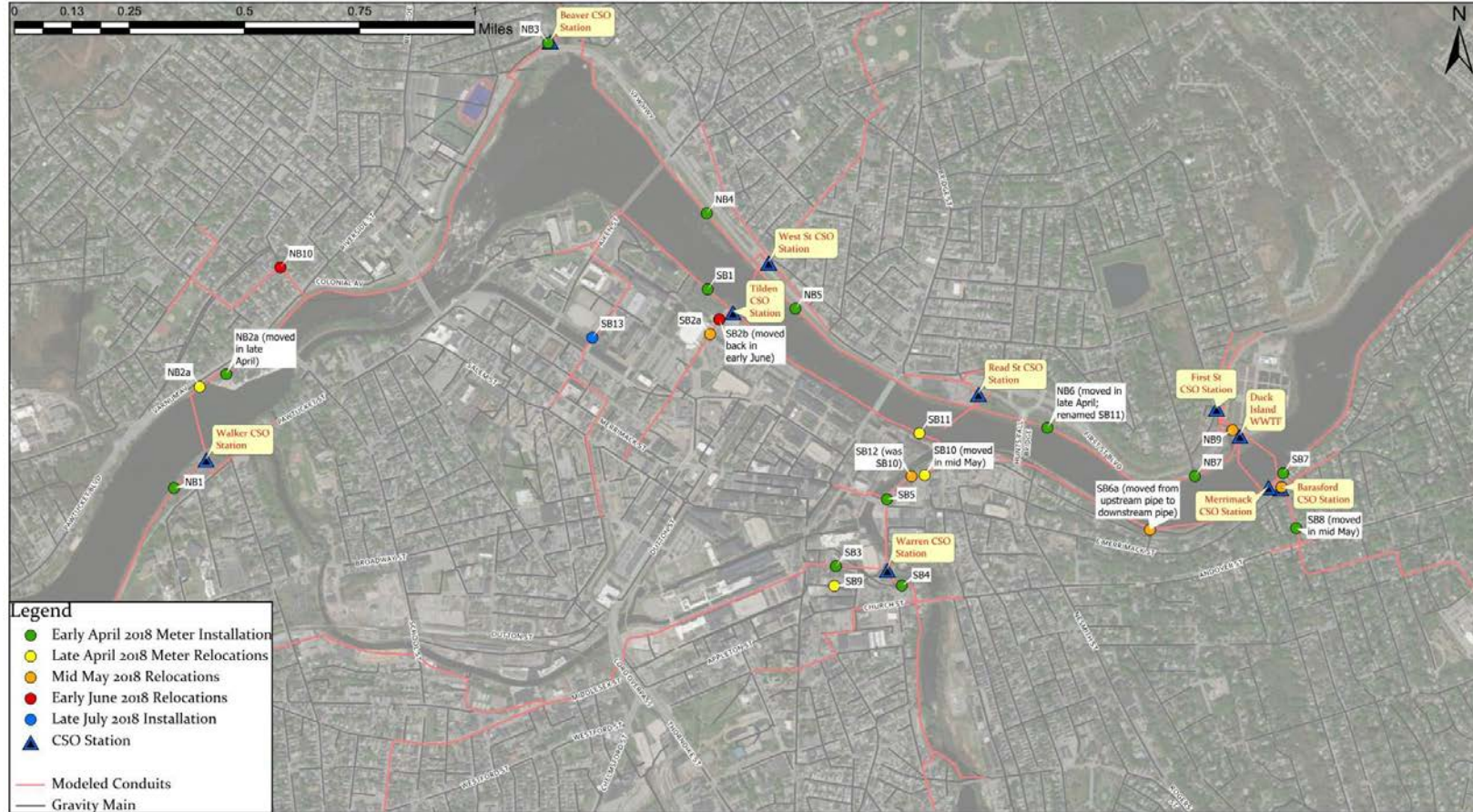
Criterion	Weight
Public Health	20.43%
System/Equipment Reliability	18.39%
Human Life/Safety	15.06%
Property Protection	8.04%
Funding/Financial Advantages	6.78%
Aquatic Life	6.20%
Economic Development	6.02%
Drinking Water Supply	5.50%
Ratepayer Satisfaction	5.14%
Municipal Liability	4.40%
Recreational Use	4.04%

CSO Control Alternatives Analysis

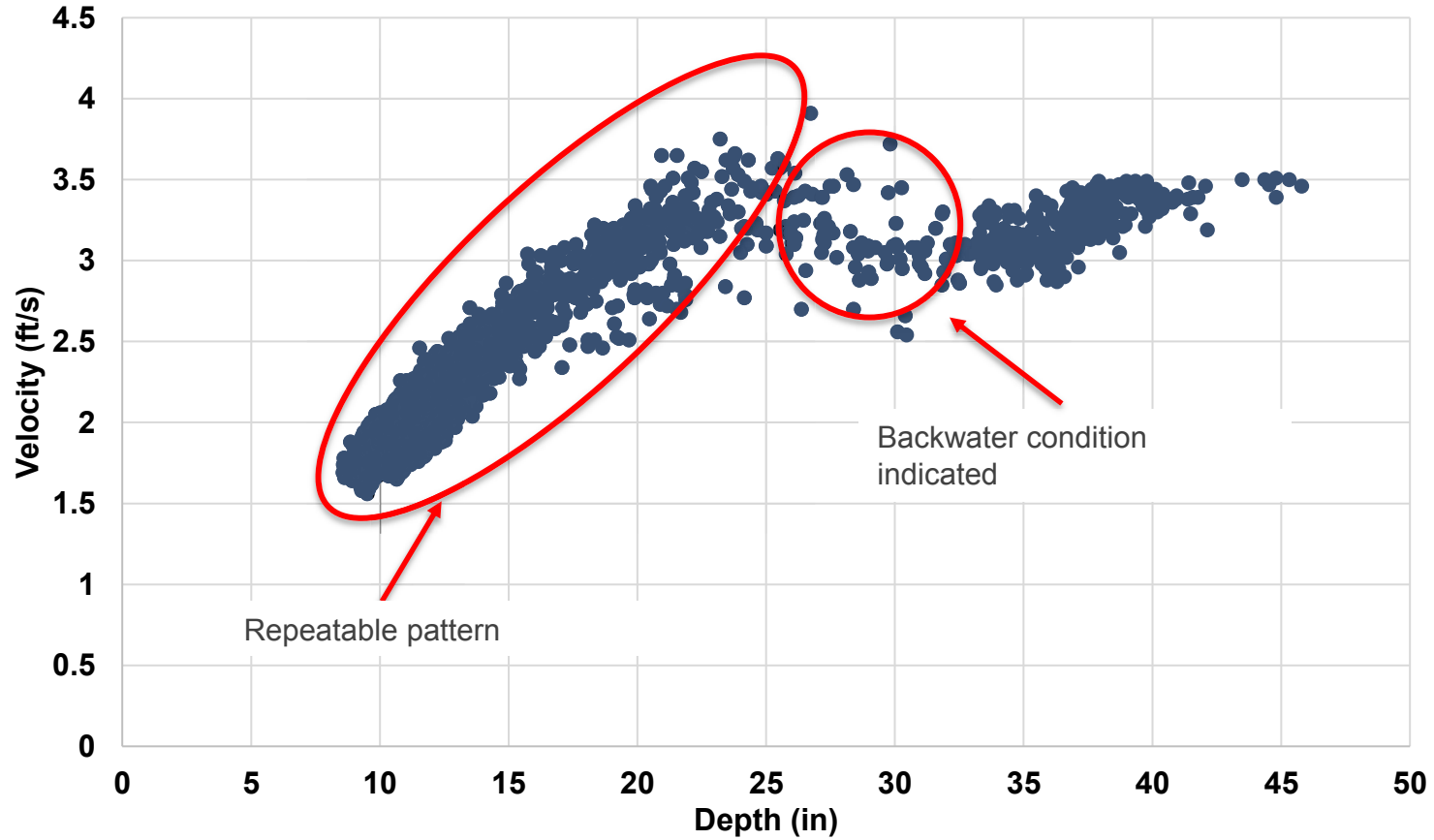


Flow and Rainfall Monitoring Program

- 4-month duration
- 24 individual meter installations
- Collaborative program
- Varied wet weather events captured
- Support model calibration
- Increase system understanding

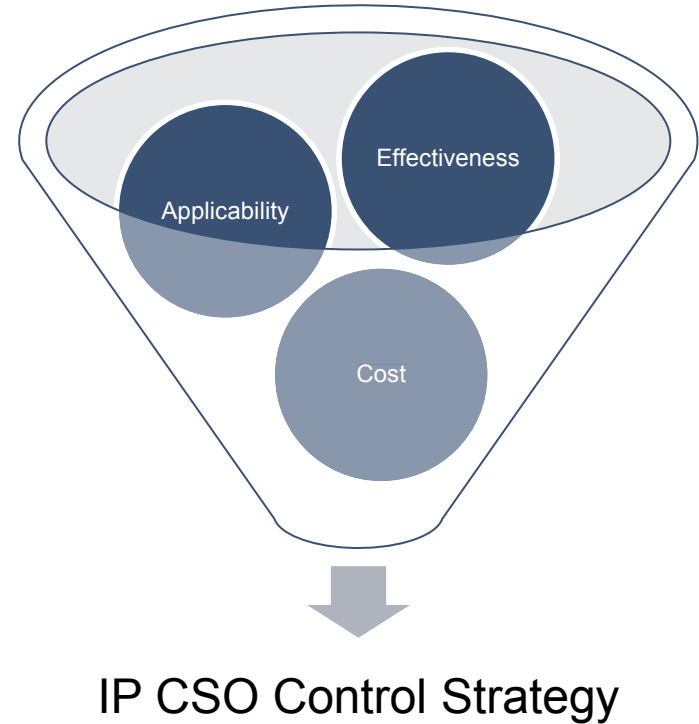


Meter SB11 Example



CSO Control – Alternatives Analysis

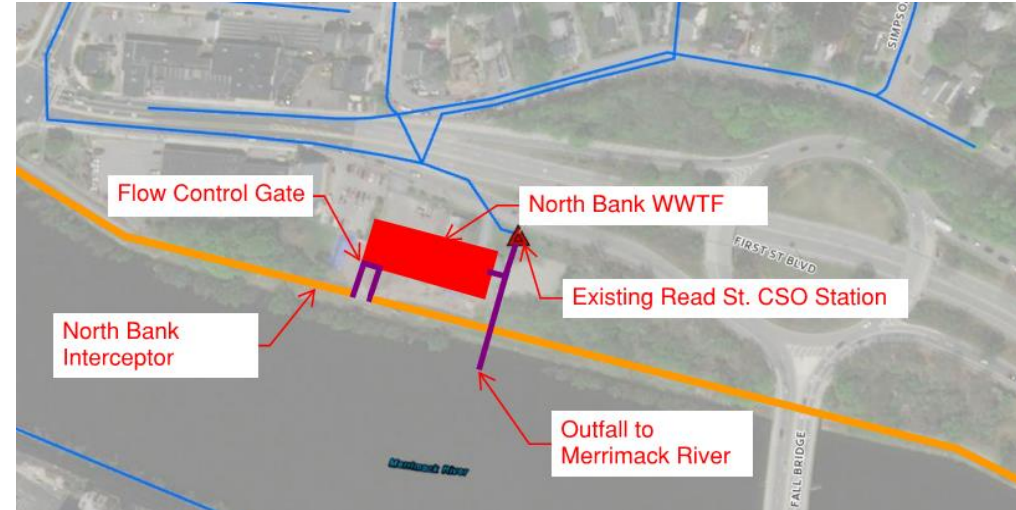
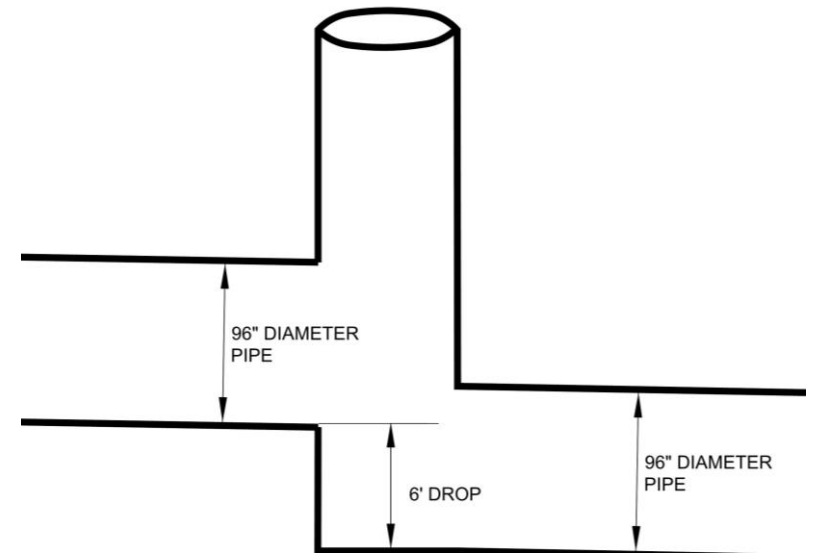
1. Determine Typical Year Rainfall
2. Screen and Analyze CSO Control Alternatives
 - *Quantity source controls (Green Infrastructure)*
 - *Quality sources controls (BMPs)*
 - *Collection System Control*
 - *Storage Facilities*
 - *Treatment Technologies*
3. Cost Estimating
4. Knee-of-the-Curve (KOC) – Maximize Value



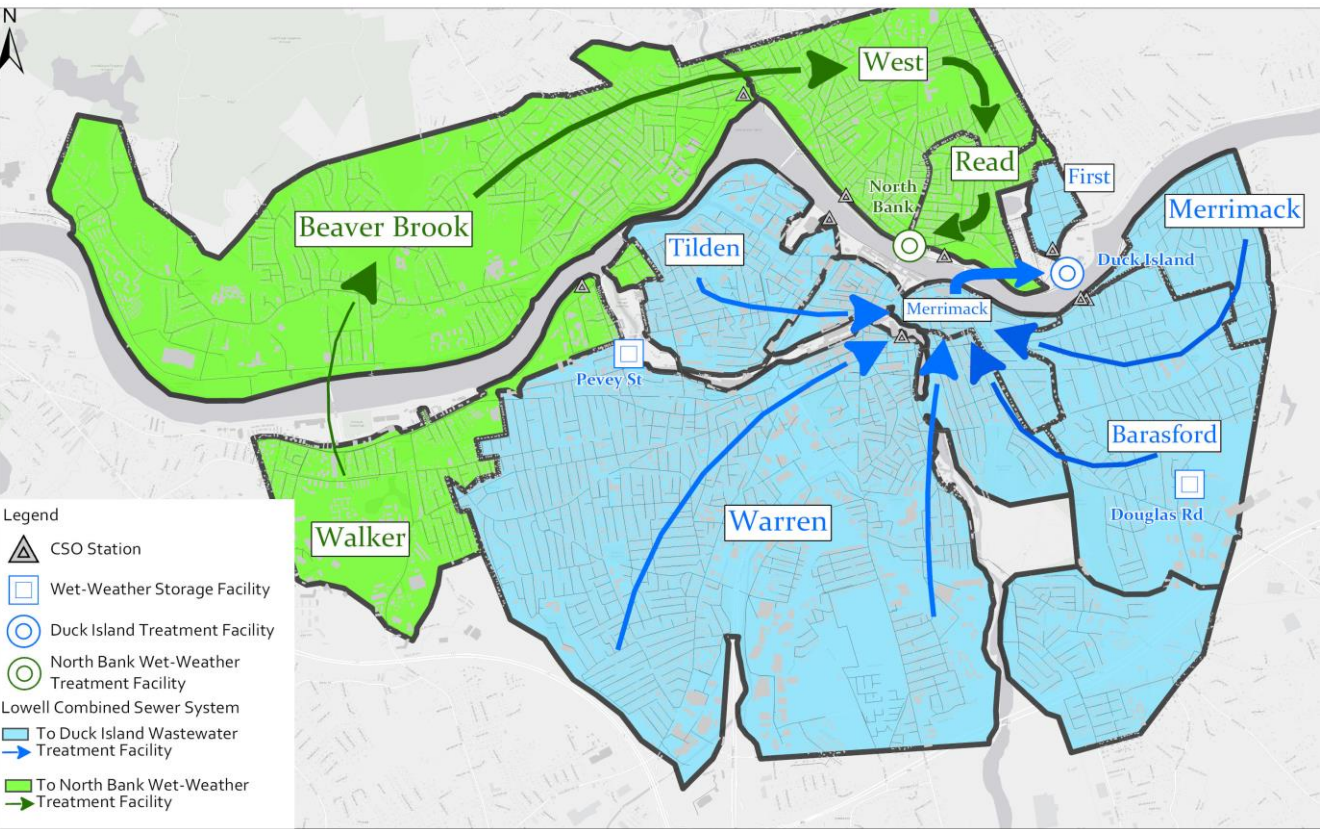
System Wide CSO Control Opportunity

North Bank Screening and Disinfection Facility

- Opportunity afforded by unique system feature
- Utilize flow control gate
- Excess flow screened, enters tank
- Overflows are screened and disinfected
- Remaining volume is returned to interceptor post-event
- **Gravity only operation – no pumping**



North Bank Screening and Disinfection Facility



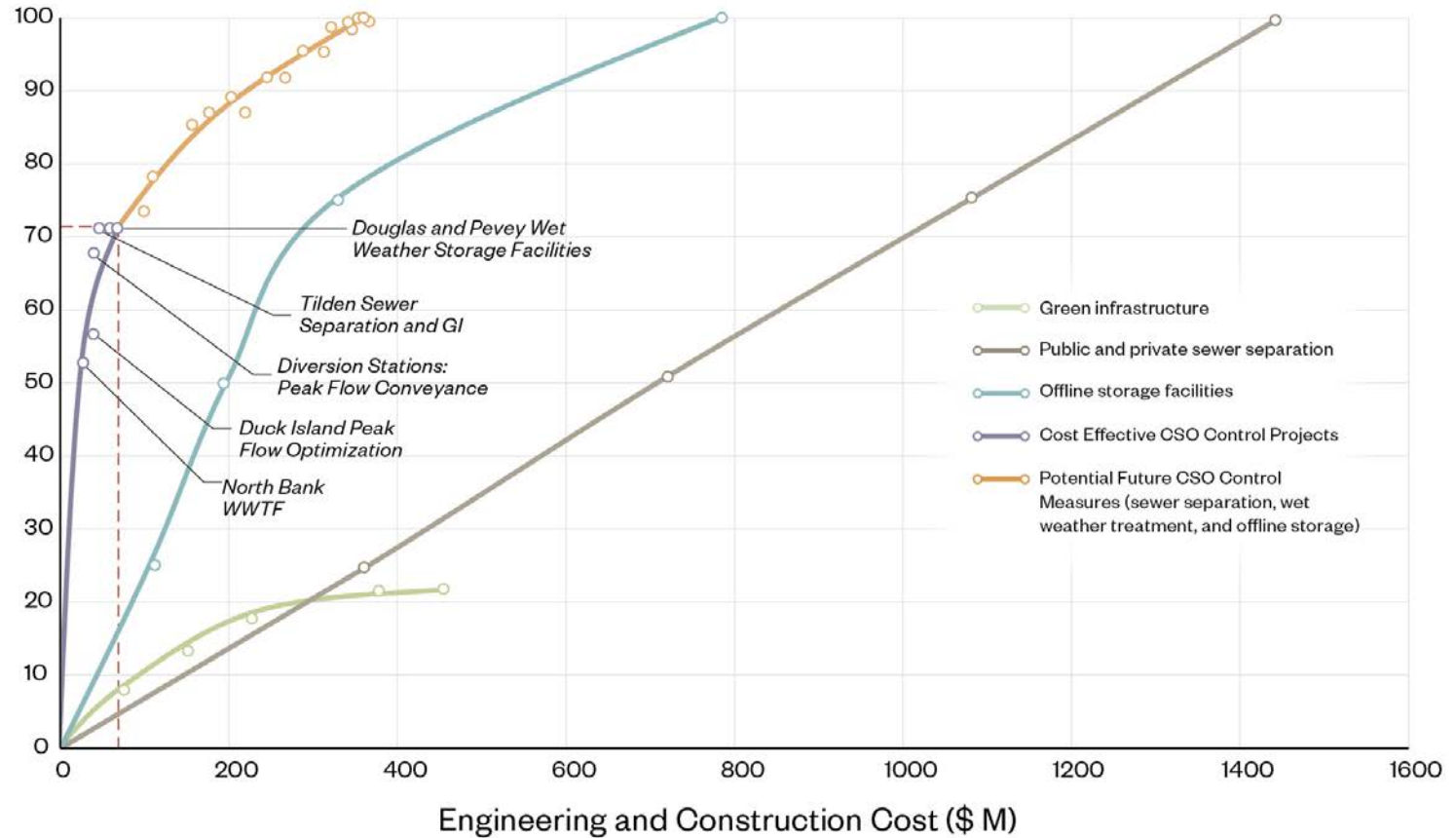
	Existing Conditions	North Bank WWTF
CSO Station	Volume (MG)	Volume (MG)
West Street	121.8	13.9
Merrimack	115.2	58.0
Warren	48.8	49.3
Tilden	22.0	22.6
Read Street	8.1	0.0
Walker	7.0	6.7
Beaver Brook	5.7	2.9
Barasford Avenue	3.1	3.1
First Street	0.0	0.0
CSO Total Volume (MG)	331.7	156.6

- **53% reduction in systemwide CSO volume**
- Significant reduction in frequency of systemwide CSO events
- Benefits are magnified when paired with other CSO control technologies
- Readily implementable system wide CSO control strategy – benefits fully realized immediately

KOC Analysis

- Compare CSO control strategies in terms of cost effectiveness
- Identify point of diminishing returns
- **Maximize value of CSO control program**

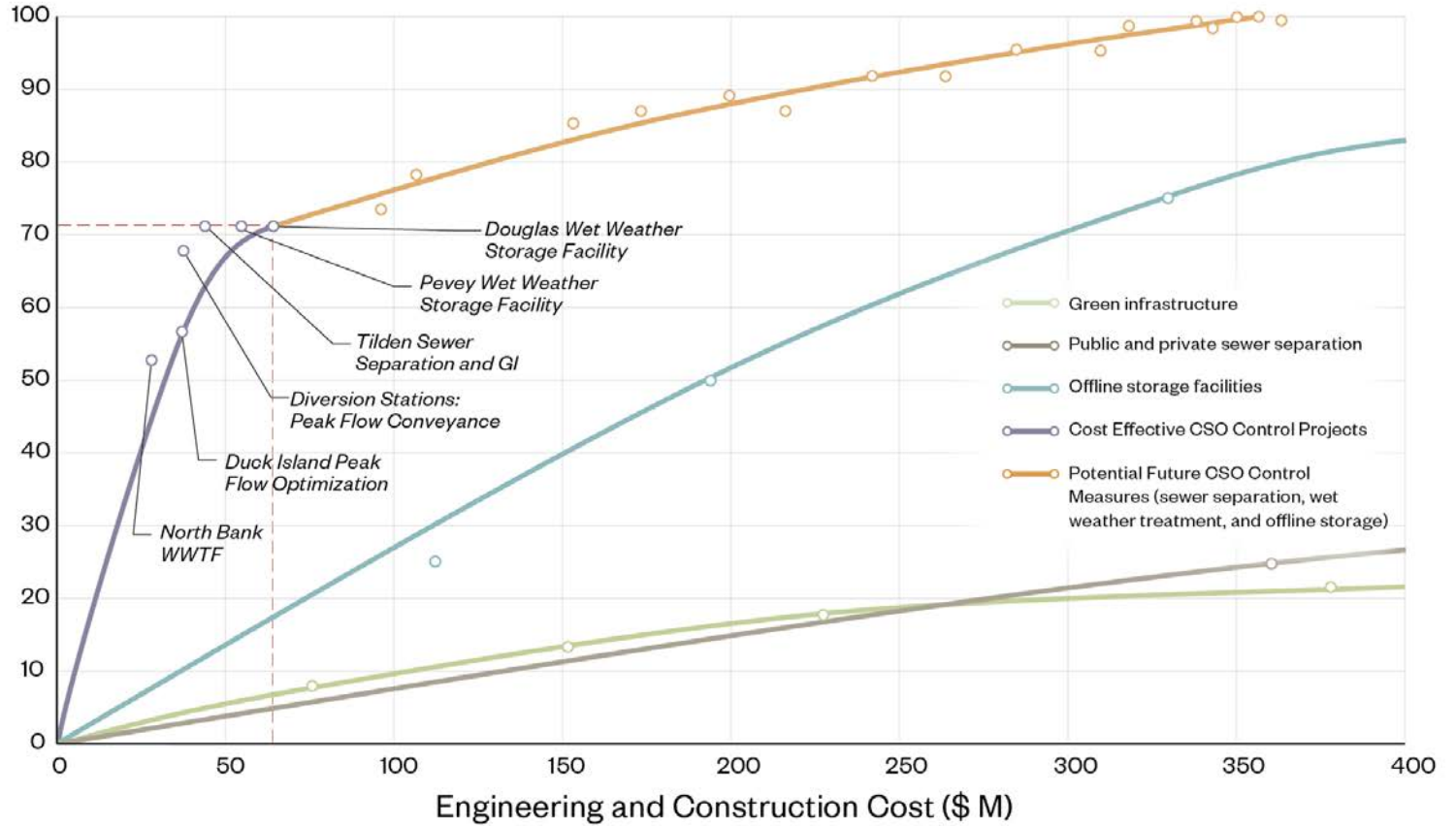
Reduction of Typical Year Predicted Systemwide CSO Volume (%)



KOC Analysis

- Stop at “knee” of the curve
- Identify possible future projects – show analyses to achieve 100% typical year control

Reduction of Typical Year Predicted Systemwide CSO Volume (%)



Lowell's Phase 3 CSO Control Plan

- Typical year CSO volume reduced by >70%
- Includes screening and disinfection facility, green infrastructure, sewer separation, system optimization, and storage
- **Achieves presumptive CWA compliance**
- Post construction monitoring to inform effectiveness

CSO Station	Existing Conditions		CSO Control Plan	
	AAOV (MG)	Frequency	AAOV (MG)	Frequency
West	121.8	34	15.8	12
Merrimack	115.2	21	45.7	8
Warren	48.8	20	11.9	5
Tilden	22.0	18	10.2	9
Read	8.1	17	0.0	0
Walker	7.0	8	7.1	8
Beaver Brook	5.7	5	1.8	2
Barasford	3.1	6	3.1	3
First	0.0	0	0.0	0
Total CSO Volume	331.7	N/A	95.6	N/A

Percent Capture: 83.7%

Percent Capture: 94.8%

Raw Score x Weight = Weighted Score

IP Project Scoring

- A raw score is assigned for each project criterion
- The raw score can be a 0 (no benefit), 1 (medium benefit), or 2 (most benefit)
- Used to score and rank ALL IP projects and programs

Project	Criterion	Raw Score	Weight	Weighted Score
Sewer Separation	Health and Safety	1	20.43%	0.204
	O&M Burden	2	18.39%	0.368
	Service Life/Consequence of Failure	0	15.06%	0.000
	Political/Public Implications	2	8.04%	0.161
	Alternative Funding Source	2	6.78%	0.136
	Aquatic Life & Recreational Use	1	6.20%	0.062
	Sewage Overflow/Basement Backup	1	6.02%	0.060
	I/I Reduction	1	5.50%	0.055
	Ratepayer Satisfaction	2	5.14%	0.103
	Municipal Liability	2	4.40%	0.088
	Recreational Use	2	4.04%	0.081
			Total Weighted Score:	1.317
Wet Weather Treatment	Health and Safety	2	20.43%	0.4086
	O&M Burden	2	18.39%	0.3678
	Service Life/Consequence of Failure	1	15.06%	0.1506
	Political/Public Implications	2	8.04%	0.1608
	Alternative Funding Source	2	6.78%	0.1356
	Aquatic Life & Recreational Use	2	6.20%	0.124
	Sewage Overflow/Basement Backup	2	6.02%	0.1204
	I/I Reduction	0	5.50%	0
	Ratepayer Satisfaction	2	5.14%	0.1028
	Municipal Liability	1	4.40%	0.044
	Recreational Use	1	4.04%	0.0404
			Total Weighted Score:	1.655

Financial Capability Analysis

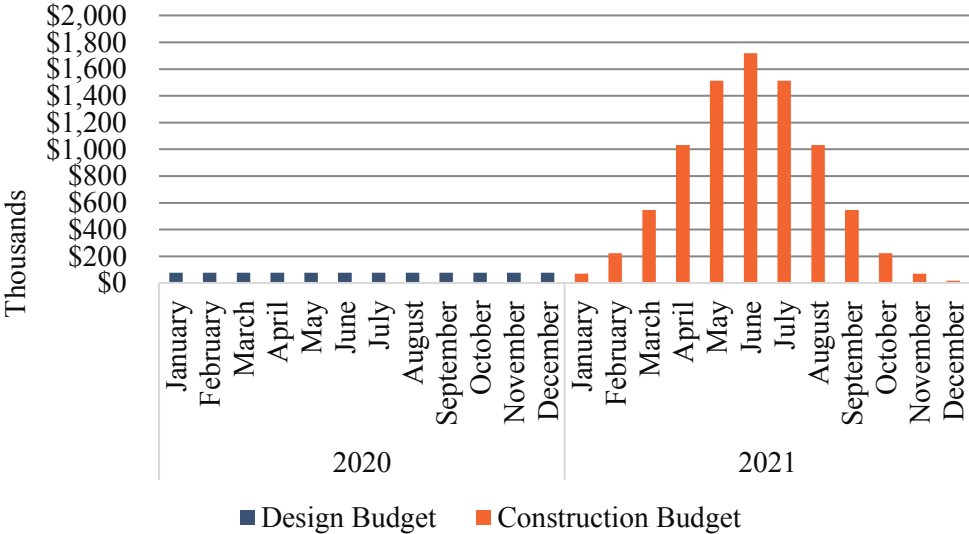
- Updated guidance issued by EPA since 2019
- Determine impact of IP on rate payers
- Consider City’s financial indicators
- Adjust for Cost of Living
- For Lowell, only wastewater costs included

Income Levels	RI
Lowest Quintile	7.9
Second Quintile (Upper Limit)	3.5
Second Quintile (Mean)	5.0
MHI	2.5

Permittee Financial Capability Indicators Average Score	Residential Indicator (Cost Per Household as a Percentage of MHI)		
	Low (Below 1%)	Mid-Range (Between 1 and 2%)	High (Above 2.0%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

Rate Modeling and Project Scheduling

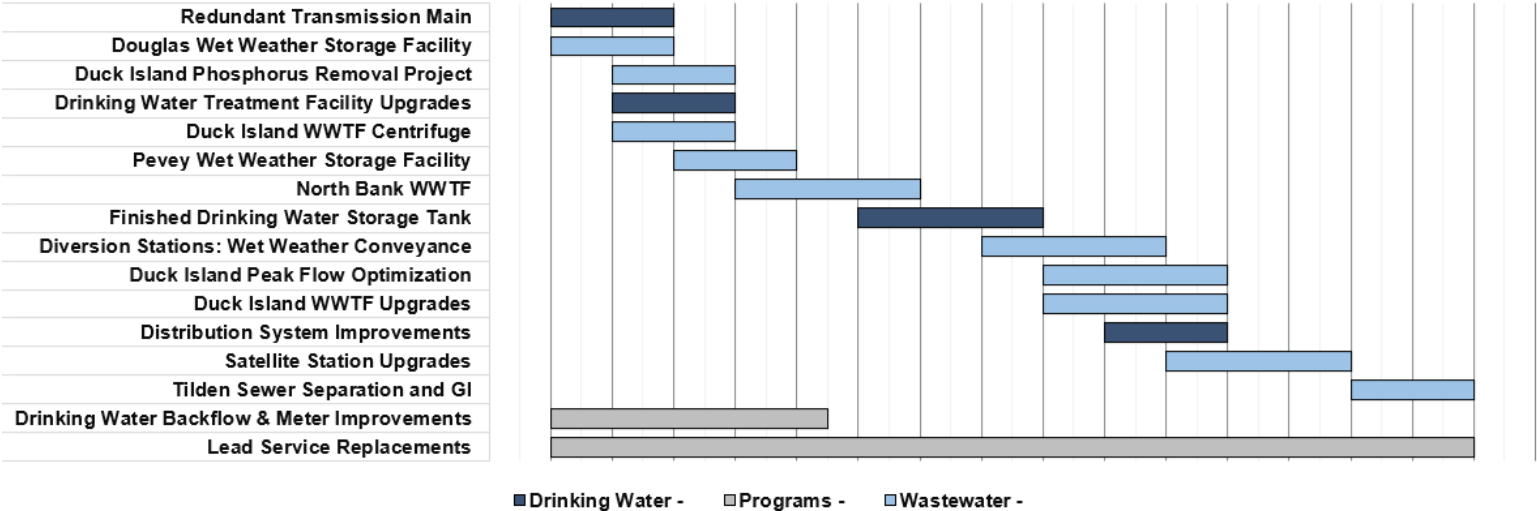
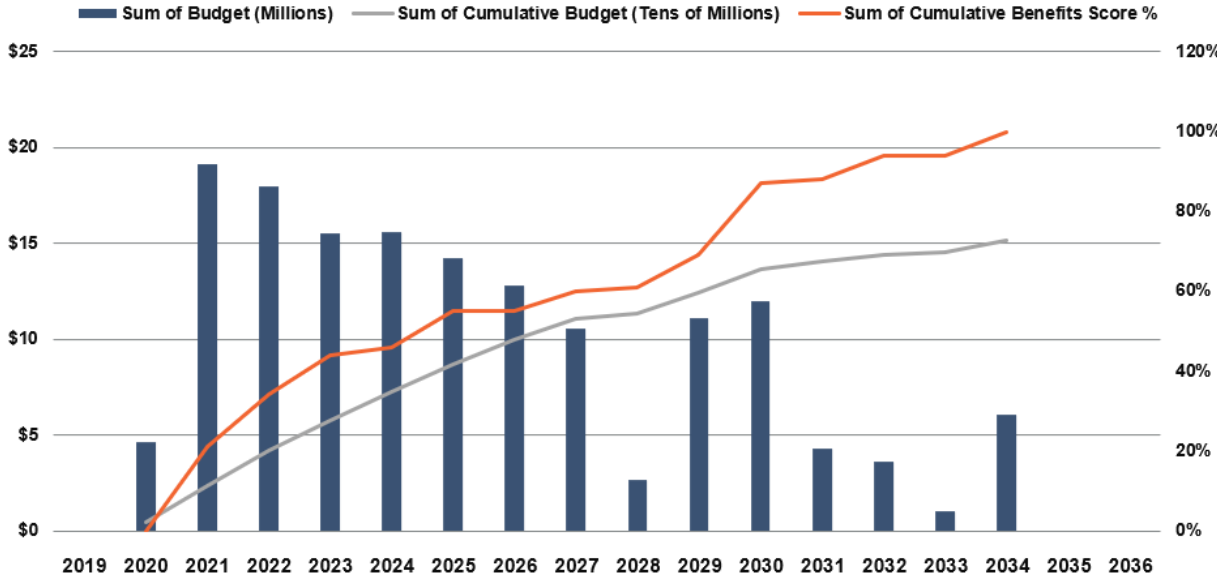
- Distribute costs of the IP over the duration of the plan
- Forecast sewer rates needed to pay for debt service
- Estimate monthly sewer bills
- Only wastewater costs included in analysis
- Increase duration to increase affordability



Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
MHI	1.3%	1.4%	1.5%	1.7%	1.8%	1.9%	1.9%	1.9%	1.9%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
40th Percentile	1.8%	1.9%	2.1%	2.3%	2.4%	2.6%	2.6%	2.6%	2.7%	2.7%	2.8%	2.7%	2.7%	2.8%	2.7%	2.7%
20th Percentile	4.1%	4.4%	4.8%	5.3%	5.6%	5.9%	6.0%	6.0%	6.0%	6.1%	6.3%	6.3%	6.2%	6.3%	6.3%	6.2%

Schedule for Implementation

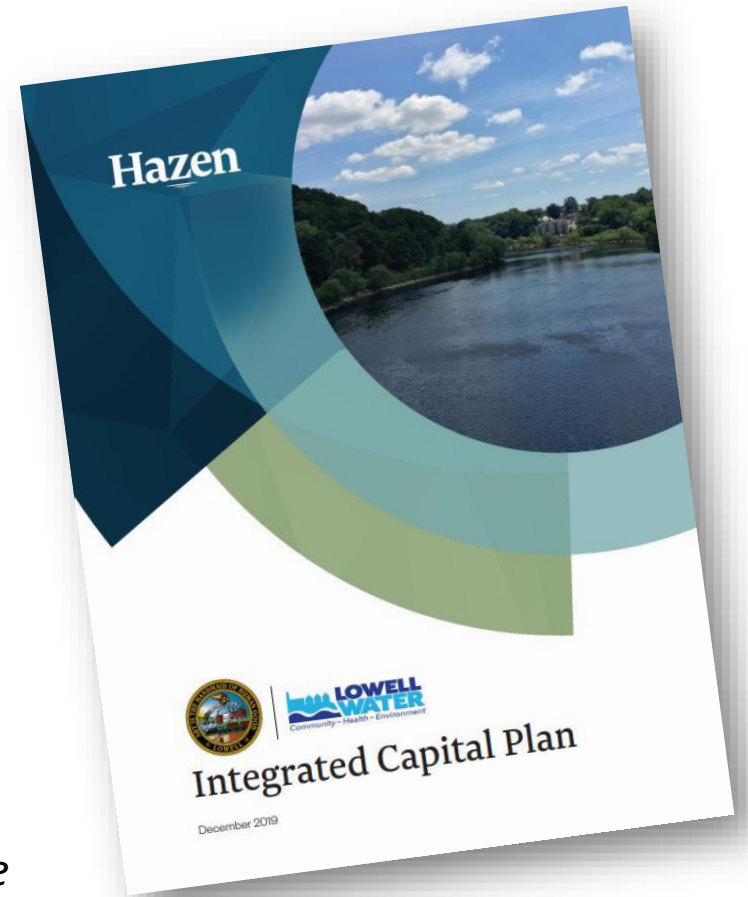
- Maximize benefits early
- Prioritize highly ranked projects
- Achieve regulatory requirements
- Use interactive dashboard to evaluate schedule changes



IP Report & Adaptive Management

- Executive Summary
- Integrated Plan Purpose
- Existing Infrastructure & Regulatory Status
- CSO Control Alternatives Analysis
- KOC Analysis and CSO Control Plan
- Project Scheduling & Optimization
- Financial Analysis
- Proposed Integrated Plan
- **Stakeholder Involvement**
- **Adaptive Management**

Adaptive management framework will allow Lowell to adjust the IP to unforeseen circumstances or to unexpected project benefits



Conclusions and Next Steps

- Integrated Planning part of the CWA
- Utilize up-to-date guidance for affordability analyses
- Identify reasonable “stopping point” to evaluate project benefits
- Balance other community needs with CSO control
- Build consensus and stakeholder support
- Collaboration critical

The EPA and MassDEP have provided comments on Lowell’s IP – negotiation and acceptance are pending

Acknowledgments

City of Lowell

- **Mark Young – Executive Director, Lowell Water**
- **Mike Stuer – Engineering Manager, Lowell Water**
- **Evan Walsh – Engineering Supervisor, Lowell Water**
- **Aaron Fox – Operations Manager, Lowell Water**
- **Conor Baldwin – Chief Financial Officer, City of Lowell**

Questions?

- *Ben Agrawal, PE – bagrawal@hazenandsawyer.com*
- *Chuck Wilson, PE – cwilson@hazenandsawyer.com*