CSO Control Facilities
Phase III Reevaluation
IPF: Alternative Plans & Affordability
4 December 2014
Outline

- Alternative Plans
- Alternative Plan Comparisons
  - CSO volumes / water quality
  - Affordability
- Conclusions
Alternatives Development
- April 10 & May 22, Grey & Green Infrastructure

Alternatives Evaluation
- June 19, Evaluation Criteria
- September 4, Alternatives Analysis Workshop

Plan Definition
- October 23, IPF: Affordability & Alternatives Costs
- December 4, Alternative Plans & Affordability
Alternative Plans
Alternative Plans

• Alternative 1: Baseline CDRA
  – One phase
  – Complete 2025

• Alternative 2: Modified Baseline with Phased Implementation
  – Four phases
  – Complete 2038

• Alternative 3: Modified & Phased Baseline with Extended Schedule & Interim Water Quality Projects
  – Six phases
  – Complete 2047

• Alternative 4: BPWWTF Storage & Treatment (No Tunnel)
  – Different design goal
  – Four phases
  – Complete 2038
Alternative 1: Baseline CDRA
Alternative 1: Baseline CDRA

- Pawtucket Tunnel
- Pawtucket Avenue Interceptor
- High & Cross Streets Interceptor
- Middle Avenue Interceptor
- Sewer Separation
- Bucklin Point WWTF
Alternative 1: Baseline CDRA Timeline

One Phase

- 2019 – 2023: Tunnel; 206 Separation; & Pawtucket Avenue Interceptor
- 2024 – 2025: High & Middle Street Interceptors; 035, 039, 056 Separation

Completion: end of 2025
Cumulative Costs and CSO Volume Reductions

Alternative 1: Baseline CDRA Scenario

- Baseline 3-Month Storm CSO Discharge (MG)
- Baseline Cumulative Cost ($M)
Subsystem Alternatives Analysis
Conclusion
• Baseline components confirmed as preferable
  – Pawtucket Tunnel
  – High Street Interceptor / Middle Street Interceptor
  – 035 Sewer Separation
• Baseline components altered
  – 206 Hybrid Separation ($1.6M savings vs. Sewer Separation)
  – West River Interceptor ($6.3M savings vs. 035-056 Separation)
  – 220 Stub Tunnel (adds $33.5M cost vs. Pawtucket Ave Interceptor)
• New components introduced
  – Green Stormwater Infrastructure
  – Consideration for interim disinfection projects
Alternative 2: Modified Baseline with Phased Implementation
Alternative 2: Modified & Phased Baseline

- Pawtucket Tunnel
- 220 Stub Tunnel or Morley Field Tank
- Sewer Separation
- High & Cross Streets Interceptor
- Middle Street Interceptor
- West River Interceptor
- Bucklin Point WWTF
- Sewer Separation
- Hybrid GSI/Sewer Separation
- GSI in Targeted Areas

Phased Baseline:
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
Alternative 2: Modified & Phased Baseline Timeline

Four Phases – Design & review follows construction of previous phase

• 2015: Concept Review
• 2016: Phase III-A – Pawtucket Tunnel, Drop Shafts & Regulator Modifications; GSI in 212, 213, 214
• 2024: Phase III-B – High & Cross Street Interceptor; Middle Street Interceptor; 206 Hybrid Separation; GSI in 101, 104, 105
• 2029: Phase III-C – 220 Stub Tunnel; GSI in 216, 217
• 2034: Phase III-D – West River Interceptor; 035 Separation; GSI in 201 thru 204

Complete at end of 2038
Alternative 2: Modified & Phased Baseline

Cumulative Costs and CSO Volume Reductions
Real Time Controls
22’ Dia Pawtucket Tunnel
TPI Modifications,
Real Time Controls,
GSI – Combine 217 with 213/214 Drop-shaft
Extend Tunnel
High & Cross Streets Interceptor
Real Time Controls
Interceptor
Improve Siphons,
GSI Middle Street Interceptor

Potential Optimization
Potential System Optimization

- Concepts:
  - GSI reduces grey infrastructure size / cost
  - Increase siphon capacity
  - Eliminate / Alter Middle Street Interceptor
  - Modify Taft-Pleasant Interceptor
  - Combine drop shafts for 217 and 213/214
  - Eliminate sewer separation component of 206
  - Extend tunnel to 103 and eliminate High & Cross Street Interceptor
  - Introduce Real Time Controls (RTC) / “smart system”
  - 23’ diameter tunnel (standard transit tunnel size)
  - 20’ diameter Pawtucket & 220 Stub tunnel (same volume)
  - 220 Tank options

- Potential program cost reduction of $50M to $100
- Require additional investigation for confirmation
- Not included in affordability analysis
• Add 1 to 2 years and cost to Phase III-A
  – Siphon work
  – Taft-Pleasant work
  – Real time controls
  – Longer tunnel, 23-foot diameter, 5 drop shafts (combines 213/14 with 217, adds 103)
  – Or 20-foot diameter main & stub tunnels, 6 drop shafts (includes 220)
• Eliminate Phases III-B and/or III-C
  – Delete High & Cross St Interceptor, Middle St Interceptor, 206 separation
  – Combine stub tunnel into main tunnel contract
  – Cost savings
  – Schedule shortening
• Overall completion: 2031 - 2035
Alternative 3: Modified & Phased Baseline with Extended Schedule & Interim Water Quality Projects
Alternative 3: Modified, Extended & Augmented Baseline Timeline

Six Phases – Design & review follows construction of previous phase

- 2015: Concept Review
- 2016: Phase III-A – 218-BPWWTF Wet Weather Interceptor; 206 Hybrid Separation; GSI in 212, 213, 214
- 2020: Phase III-B – 220 Screening & Disinfection; GSI in 101, 104, 105, 216, 217, 201 thru 204 (Note: this phase could be extended)
- 2025: Phase III-C – Pawtucket Tunnel, Drop Shafts & Regulator Modifications; GSI in 215 (218-BPWWTF off-line)
- 2033: Phase III-D – High & Cross Street Interceptor; Middle Street Interceptor; GSI in 205
- 2034: Phase III-E – West River Interceptor; 035 Separation; GSI in 205
- 2038: Phase III-F – 220 Stub Tunnel; GSI in 205 (220 Disinfection off-line)

Complete at end of 2047
Cumulative Costs and CSO Volume Reductions

Alternative 3: Modified, Augmented & Extended Baseline

- Alt 3 Extended with Interim 3-Month Storm Total Treated CSO Discharge (MG)
- Alt 3 Extended with Interim 3-Month Untreated Discharge (MG)
- Alternative 3 Cumulative Cost ($M)
Alternative 4:
BPWWTF Storage & Treatment
(No Tunnel)
Four Phases – Design & review follows construction of previous phase

• 2015: Concept Review
• 2016: Phase III-A – 218 Interceptor, 14MG BP tank, 21MG BP disinfection; GSI in 212, 213, 214
• 2024: Phase III-B – 220 2.7 MG NSS tank; 218 to 205 Interceptor; GSI in 101, 104, 105
• 2029: Phase III-C – High & Cross Street Interceptor; Middle Street Interceptor; GSI in 216, 217
• 2034: Phase III-D – West River Interceptor; 035 Separation; GSI in 201 thru 204

Complete at end of 2038
Cumulative Costs and CSO Volume Reductions

Alternative 4: BPWWTF Storage & Treatment (No Tunnel)
BPWWTF Storage & Treatment (No Tunnel) Optimization

- Requires additional investigations
- Refinement of interceptor & tank design
- Pumping assumptions
- Additional modeling & cost estimation
Alternative Plan Comparisons
CSO Volumes
Alternative Plan Comparison

Discharge Volume Comparison

- Alt 1 Baseline CDRA 3-Month Storm CSO Discharge (MG)
- Alt 2 Modified & Phased Alpha 3-Month Storm CSO Discharge (MG)
- Alt 3 Extended with Interim 3-Month Untreated Discharge (MG)
- Alt 3 Extended with Interim 3-Month Storm Total Treated CSO Discharge (MG)
- Alt 4 No Tunnel 3-Month Untreated Discharge (MG)
- Alt 4 No Tunnel 3-Month Storm Total Treated CSO Discharge (MG)
Narragansett Bay Water Quality

Conimicut Point Concentrations for 3-mo Design Storm

- Phase II
- Phase III
- 14 FC/100mL geomean limit
- 49 FC/100mL upper 10% limit

• Draft results subject to change
Conimicut Point Concentrations for 3-mo Design Storm

- Phase II
- Phase III
- Pawtucket Tunnel Only
- 14 FC/100mL geomean limit
- 49 FC/100mL upper 10% limit

Draft results subject to change
Narragansett Bay Water Quality

Conimicut Point Concentrations for 3-mo Design Storm

- Phase II
- Phase III
- Pawtucket Tunnel Only
- Alternative 4
- 14 FC/100mL geomean limit
- 49 FC/100mL upper 10% limit

Draft results subject to change
Costs & Rates
Financing Assumptions

• Previous presentation – “SRF 20 / Rev 20”
  – Annual availability of $25M from RICWFA SRF for 20 years at 2.5%
  – Remainder from revenue bond for 20 years at 5%

• New Alternative – “SRF 20 / Rev 30”
  – Annual availability of $25M from RICWFA SRF for 20 years at 2.5%
  – Remainder from revenue bond for 30 years at 5%
  – “Wrap” debt (interest only for first 10 years)

• New Alternative – “SRF 30 / Rev 30”
  – Annual availability of $25M from RICWFA SRF for 30 years at 3.3%
  – Remainder from revenue bond for 30 years at 5%
  – “Wrap” debt (interest only for first 10 years)
Alternative 2: Modified & Phased Baseline Rate Impacts for Different Financing

Projected Average Bills

- Existing S20/R20
- SRF 20 / Rev 30
- SRF 30 / Rev 30

Years: 2015 to 2038

Costs: $400 to $800
Rate Increases

Projected Rate Increases

- Alt 1
- Alt 2
- Alt 3
- Alt 4

Year: 2015, 2016, 2017, 2018, 2019, 2020...

Percentage: 0.0%, 2.0%, 4.0%, 6.0%, 8.0%, 10.0%, 12.0%, 14.0%
Affordability vs. 2% MHI – NBC Service Area, NBC Costs

Projected Affordability

- Alt 1
- Alt 2
- Alt 3
- Alt 4
Affordability Pre-Phase III

2015

Households > 2% of MHI:
- Entire NBC Service Area = 45,318
- City of Providence = 21,905
- City of Pawtucket = 8,027
- City of Central Fall = 2,924
Households > 2% of MHI:
Entire NBC Service Area = 64,046
City of Providence = 29,067
City of Pawtucket = 12,894
City of Central Fall = 3,723

Unaffordable for 56% of households
Unaffordable for 44% of households
Unaffordable for 47% of households
Affordability Alternative 2 – Modified & Phased Baseline

2031

Households > 2% of MHI:
Entire NBC Service Area = 58,938
City of Providence = 27,198
City of Pawtucket = 11,057
City of Central Fall = 3,569
## Alternative 2 Affordability – 2% MHI

<table>
<thead>
<tr>
<th>Location</th>
<th>2015</th>
<th>2023</th>
<th>2031</th>
<th>2038</th>
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<tbody>
<tr>
<td>Service Area</td>
<td>29%</td>
<td>36%</td>
<td>38%</td>
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<tr>
<td>Providence</td>
<td>36%</td>
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<td>Central Falls</td>
<td>44%</td>
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<tr>
<td>Pawtucket</td>
<td>28%</td>
<td>38%</td>
<td>38%</td>
<td>38%</td>
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</tbody>
</table>
Affordability Alternative 3 – Modified, Augmented & Extended Baseline

2031

Households > 2% of MHI:
Entire NBC Service Area = 55,693
City of Providence = 25,545
City of Pawtucket = 10,979
City of Central Fall = 3,352
## Alternative 3 Affordability – 2% MHI

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2023</th>
<th>2031</th>
<th>2038</th>
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<tr>
<td>Service Area</td>
<td>29%</td>
<td>30%</td>
<td>35%</td>
<td>32%</td>
<td>31%</td>
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<tr>
<td>Providence</td>
<td>36%</td>
<td>36%</td>
<td>41%</td>
<td>39%</td>
<td>37%</td>
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<tr>
<td>Central Falls</td>
<td>44%</td>
<td>44%</td>
<td><strong>51%</strong></td>
<td>46%</td>
<td>44%</td>
</tr>
<tr>
<td>Pawtucket</td>
<td>28%</td>
<td>32%</td>
<td>38%</td>
<td>32%</td>
<td>32%</td>
</tr>
</tbody>
</table>
Affordability Alternative 4 – No Tunnel

Households > 2% of MHI:
- Entire NBC Service Area = 49,924
- City of Providence = 23,746
- City of Pawtucket = 9,346
- City of Central Fall = 2,924
## Alternative 4 Affordability – 2% MHI

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<thead>
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<th>2015</th>
<th>2023</th>
<th>2031</th>
<th>2038</th>
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<td>Service Area</td>
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<tr>
<td>Providence</td>
<td>36%</td>
<td>36%</td>
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<tr>
<td>Central Falls</td>
<td>44%</td>
<td>44%</td>
<td>44%</td>
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<td>Pawtucket</td>
<td>28%</td>
<td>32%</td>
<td>32%</td>
<td>29%</td>
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</tbody>
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Affordability vs. 2% MHI
– City of Providence, NBC Costs

Projected Affordability - NBC Costs Only

- Alt 1
- Alt 2
- Alt 3
- Alt 4
Affordability vs. 2% MHI
– City of Providence, NBC Costs + Collection System CIP

Projected Affordability - NBC + Providence Costs

Alt 1
Alt 2
Alt 3
Alt 4
Conclusions
## Alternative Plan Evaluation

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<tr>
<th></th>
<th>1 – Baseline CDRA</th>
<th>2 – Modified &amp; Phased</th>
<th>3 – Extended &amp; Augmented</th>
<th>4 – No Tunnel</th>
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<tbody>
<tr>
<td><strong>Total Cost</strong></td>
<td>$750M</td>
<td>$710M to $810M</td>
<td>$825M to $925M</td>
<td>$450M</td>
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<td><strong>2025 Rates</strong></td>
<td>$812</td>
<td>$670</td>
<td>$534</td>
<td>$544</td>
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<td><strong>2035 Rates</strong></td>
<td>$812</td>
<td>$769</td>
<td>$719</td>
<td>$627</td>
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<tr>
<td><strong>2047 Rates</strong></td>
<td>$812</td>
<td>$769</td>
<td>$776</td>
<td>$627</td>
</tr>
<tr>
<td><strong>2025 Volume Captured</strong></td>
<td>100%</td>
<td>72%</td>
<td>32%</td>
<td>23%</td>
</tr>
<tr>
<td><strong>2035 Volume Captured</strong></td>
<td>100%</td>
<td>97%</td>
<td>82%</td>
<td>32% (70%)</td>
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<tr>
<td><strong>Compliance</strong></td>
<td>2025</td>
<td>2038</td>
<td>2047</td>
<td>N/A</td>
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## Alternatives Compared to Baseline CDRA

<table>
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<tr>
<th></th>
<th>2 – Modified &amp; Phased</th>
<th>3 – Extended &amp; Augmented</th>
<th>4 – No Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Cost</strong></td>
<td>5% less to 8% more</td>
<td>10% to 23% more</td>
<td>40% less</td>
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<tr>
<td><strong>2025 Rates</strong></td>
<td>17% lower</td>
<td>34% lower</td>
<td>33% lower</td>
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<tr>
<td><strong>2035 Rates</strong></td>
<td>5% lower</td>
<td>11% lower</td>
<td>23% lower</td>
</tr>
<tr>
<td><strong>2047 Rates</strong></td>
<td>5% lower</td>
<td>4% lower</td>
<td>23% lower</td>
</tr>
<tr>
<td><strong>2025 Volume Captured</strong></td>
<td>28% less</td>
<td>68% less</td>
<td>77% less</td>
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<tr>
<td><strong>2035 Volume Captured</strong></td>
<td>3% less</td>
<td>18% less</td>
<td>68% less</td>
</tr>
<tr>
<td><strong>Compliance</strong></td>
<td>13 years longer</td>
<td>22 years longer</td>
<td>N/A</td>
</tr>
</tbody>
</table>
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IPF: Alternative Scenarios & Affordability
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