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STAFF SUMMARY

TO: Board of Directors
FROM: Frederick A. Laskey, Executive Director
DATE: February 15, 2017
SUBJECT: Redundancy for the Metropolitan Tunnel System

COMMITTEE: Water Policy & Oversight

___ INFORMATION
_X_ VOTE

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Preparer/Title

Michael J. Hornbrook
Chief Operating Officer

The following provides a summary of recent efforts towards advancing a program to provide redundancy for the Metropolitan Tunnel System (the City Tunnel, City Tunnel Extension, and the Dorchester Tunnels) for future maintenance and rehabilitation, and requests approval of the project to allow staff to proceed with preliminary design, geotechnical investigations and Massachusetts Environmental Policy Act (MEPA) review of the project.

RECOMMENDATION:

To approve staff's preferred alternative of construction of northern and southern deep rock tunnels from the Hultman Aqueduct and MetroWest Water Supply Tunnel to the Weston Aqueduct Supply Main (WASM) 3 and to the Southern Spine water mains for the purpose of providing redundancy for the Metropolitan Tunnel System (City Tunnel, City Tunnel Extension and Dorchester Tunnel) and to direct staff to proceed with preliminary design, geotechnical investigations and Massachusetts Environmental Policy Act (MEPA) review of the project.

DISCUSSION:

At the October 6, 2016 Special Meeting of the Board of Directors on Redundancy for the Metropolitan Tunnel System, staff provided a briefing to the Board of Directors on the status of the existing MWRA water transmission system and the lack of redundancy for the City Tunnel (1950), City Tunnel Extension (1963), and the Dorchester Tunnel (1976) with an accompanying binder of supporting materials. A summary of the briefing and staff recommendations follows:

- While the tunnels and shafts require little or no maintenance and represent a low risk of failure, staff have determined that the cast iron and steel pipe and valves at the tops of the shafts are in poor condition and in need of rehabilitation and maintenance. Failure at the tops of shafts in the existing system could result in wide-spread outages of water service impacting 60% of the service area which would require activation of emergency back-up

sources of supply, water-use restrictions, pressure swings, and a boil order. The economic impact to the metropolitan region was determined through Federal Emergency Management Agency (FEMA) methodology to be on the order of $300 million per day.

- After discussion of staff efforts to develop and analyze many alternative approaches over several years, staff presented on the advantages and disadvantages of long distance large diameter surface pipelines through dense urban areas and pump station alternatives versus deep rock tunnel alternatives. Staff concluded that:

  - Large diameter long distance surface pipeline options present significant community disruption and have serious implementation challenges;

  - There are operational reliability problems associated with use of Chestnut Hill Emergency Pump Station and other possible pump station options;

  - Tunnel alternatives would allow planned maintenance of the existing tunnel system infrastructure

  - Tunnel alternatives allow emergency response at normal levels of service; and

  - Tunnel alternatives are constructible with reduced impacts to communities.

- Staff presented financial considerations of advancing a capital program to address metropolitan tunnel redundancy with the goal of: preserving sustainable and predictable rates at the water utility level; ensuring adequate capital is available when necessary; and minimizing the cost of borrowing.

- Staff outlined plans for interim improvements to reduce the risk of failure and improve system operating conditions in the event that an emergency occurs. The preferred long-term alternative consists of two deep rock tunnels beginning in the vicinity of the MassPike/Route 128 interchange (see Attachment 1). The Northern Tunnel would be approximately 4.5 miles in length and would connect to the mid-point of MWRA's WASM 3 pipeline. The Southern Tunnel would be approximately 9.5 miles in length and would connect to the southern surface mains at Shaft 7C of the Dorchester Tunnel.

At the conclusion of the Special Meeting, staff were directed to brief member communities and state and local officials on the Metropolitan Tunnel Redundancy initiative in order to build consensus and support for staff's preferred project approach.

On December 8, 2016, staff took part in a Long-Term Water Redundancy Forum hosted by the MWRA Advisory Board at Boston College. MWRA staff presented the history of the MWRA waterworks system, the need for Metropolitan Tunnel redundancy and the challenges, both implementation and financial, of building redundancy. The Honorable Jeanette A. McCarthy, Mayor of Waltham provided the perspective of local communities on the potential for impacts and disruption. The meeting was well attended; with 130 people present. Tours of the nearby Shaft 7, Shaft 7B, and Chestnut Hill Emergency Pump Station facilities were given following the

presentations and the question and answer period.

On January 19, 2017, the MWRA Advisory Board met and voted to support moving forward with a deep-rock, two-tunnel project versus surface piping alternatives. They voted also to recommend: a Program Management Division Approach, similar to the model used for the Boston Harbor Project; concurrent construction of both tunnels, rather than a phased approach; and use of revenue from non-typical or one time water users (e.g. drought connections) for the program.

The Utilities Contractors' Association of New England (UCANE), an organization comprised of contractors who perform underground utility construction projects wrote in opposition of the tunnel option. MWRA staff met with UCANE on February 1, 2017 at the Board's direction to provide information and context on the MWRA program and satisfied the concerns of the organization. UCANE's main concern was that the tunnel program would not divert MWRA funds and staffing resources away from other MWRA necessary pipeline replacement or rehabilitation projects. Staff informed UCANE that would not be the case.

Staff now request approval from the Board of Directors for the preferred alternative which would include construction of a northern and a southern deep-rock tunnel, as presented to the Board of Directors on October 6, 2016 and as recently endorsed by the MWRA Advisory Board. Staff are now evaluating project staffing and alternative organizational structures to oversee planning, design and construction phases of the project and will make a recommendation to the Board in future meetings.

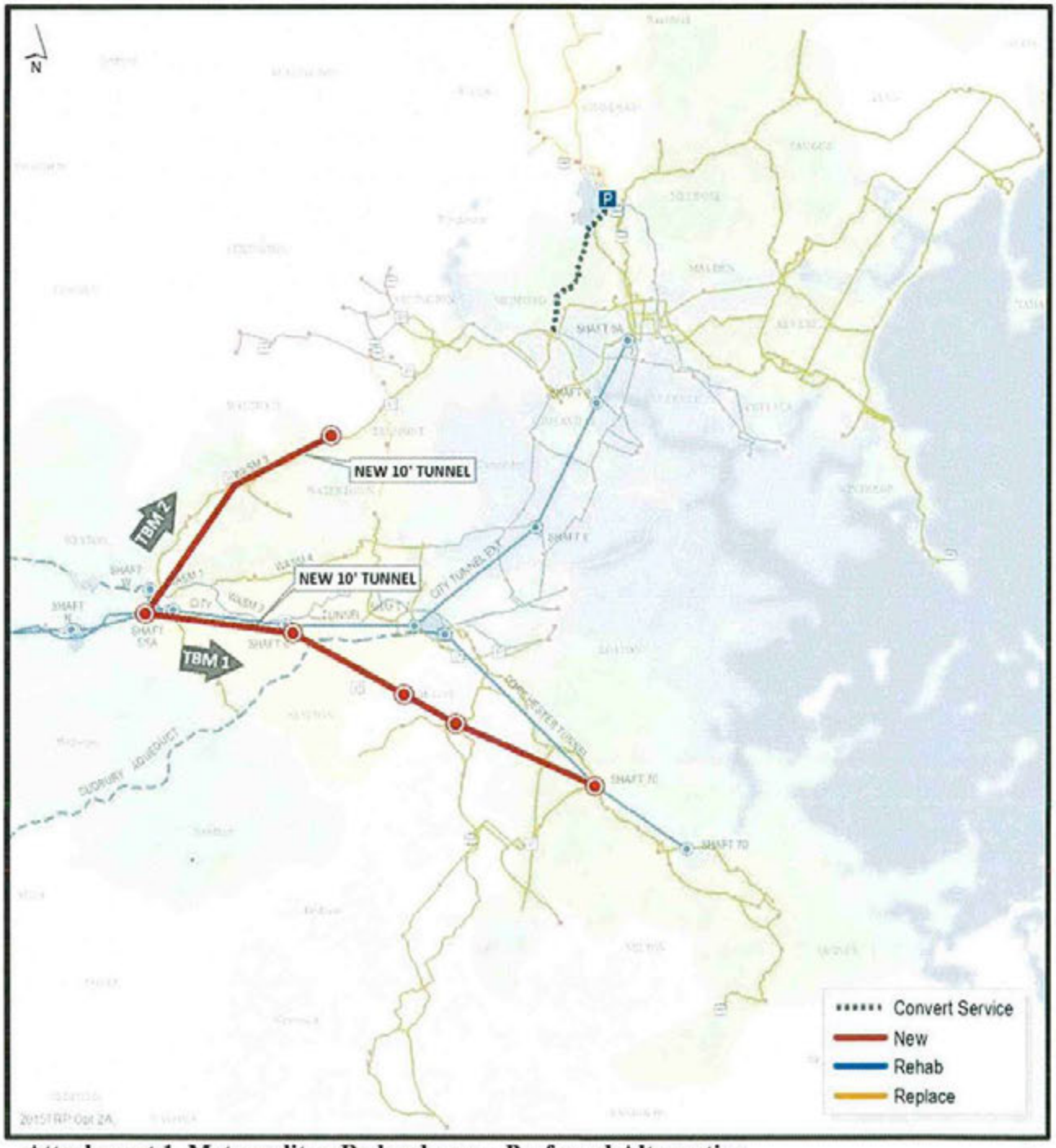
The next step will be development of a scope of services and procurement of a consultant(s) to provide preliminary design, geotechnical investigations, and Massachusetts Environmental Policy Act (MEPA) environmental review for the project. These services would be undertaken over the next couple of years and will provide opportunities for staff briefings and direction from the Board before proceeding with final design of the project.

BUDGET/FISCAL IMPACT:

Budget for the Metropolitan Tunnel redundancy plan in the amount of $1.4 billion has been included in the Draft FY18 CIP as a placeholder.

ATTACHMENT:

Metropolitan Redundancy - Preferred Alternative

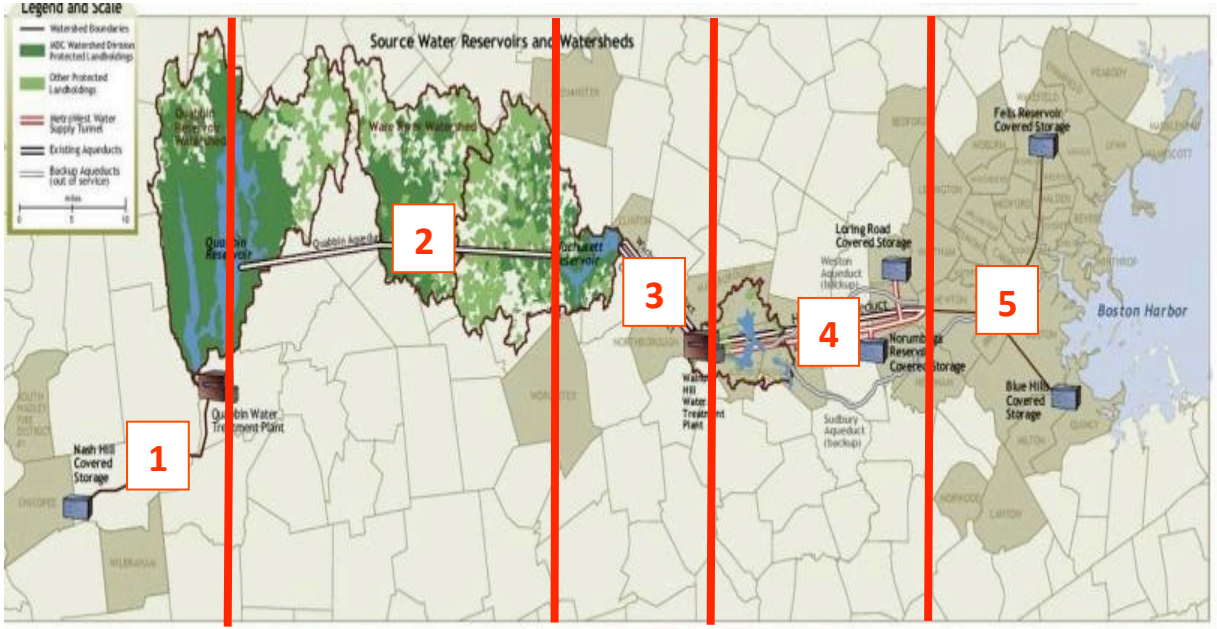


Attachment 1. Metropolitan Redundancy – Preferred Alternative

Metropolitan Tunnel Redundancy

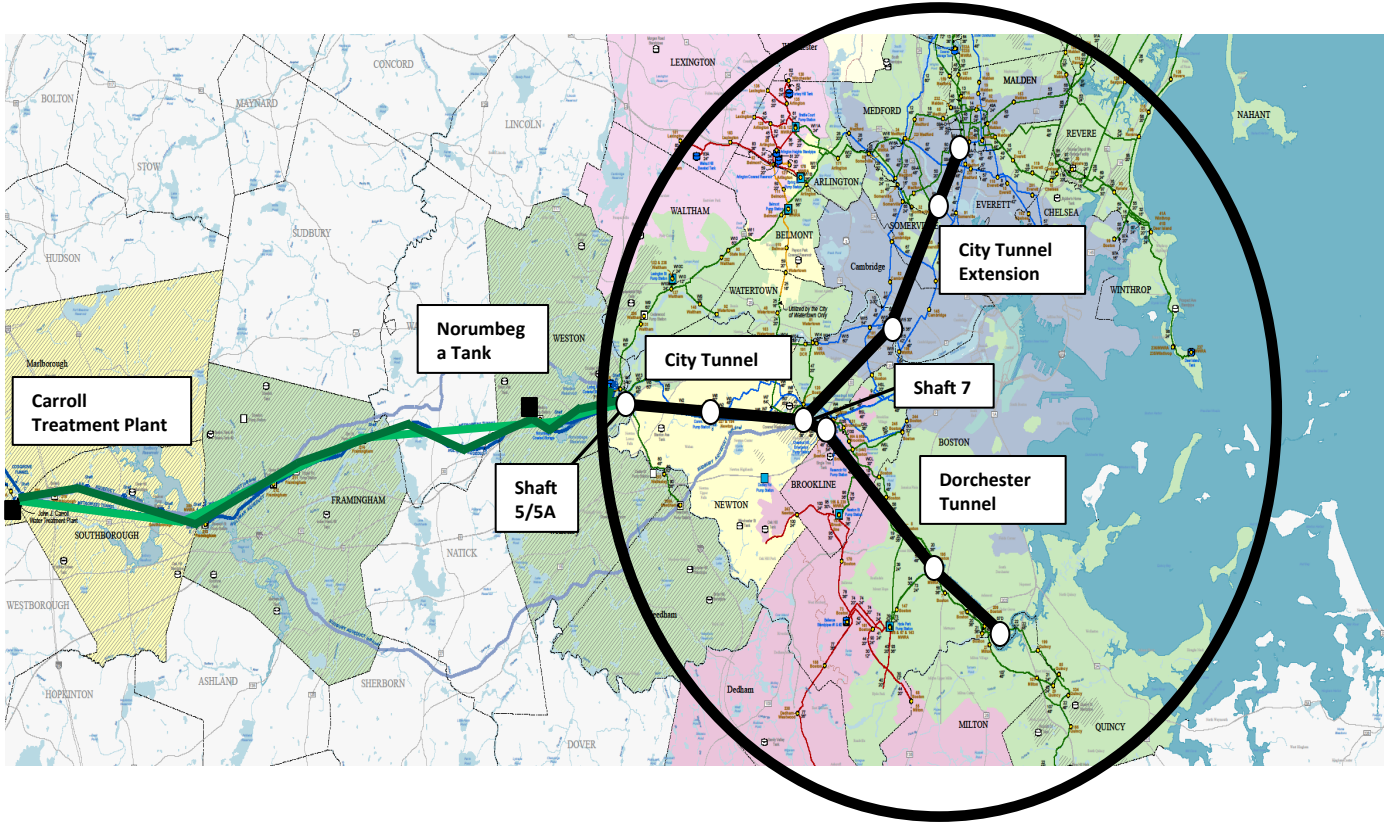
February 15, 2017

MWRA Water Transmission System



1. Chicopee Valley Aqueduct — 2007 Improvements
2. Quabbin Aqueduct — Inspection planned
3. Cosgrove Tunnel / Wachusett Aqueduct — Project underway
4. MetroWest Tunnel / Hultman Aqueduct — 2003/2013 Improvements
5. Metropolitan Tunnels — Significant Needs

Metropolitan Tunnel System



Condition of Metropolitan Tunnel System

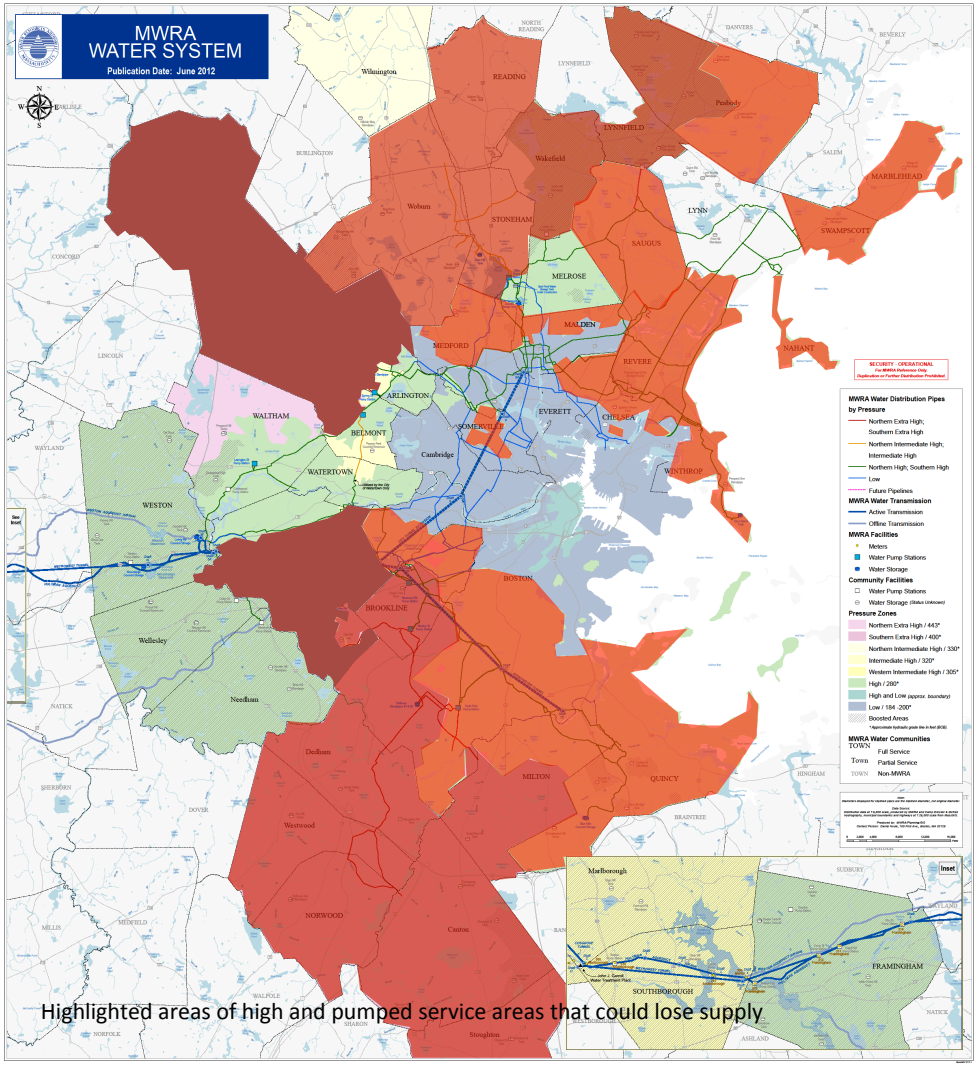
- Tunnel system:
  - Concrete-lined deep rock tunnels
  - Steel and concrete vertical shafts
  - Surface pipe, valves and appurtenances

- Little maintenance required for tunnels and shafts. **Little risk of failure**

- **Pipe, valves and appurtenances need maintenance, replacement, rehabilitation**

Wide-Spread Impact

- Sudden shut down of Metropolitan Tunnel system
- Loss of supply to high service areas
- Pumped Service Areas lose supply as tanks empty
- Whole system would be on boil order

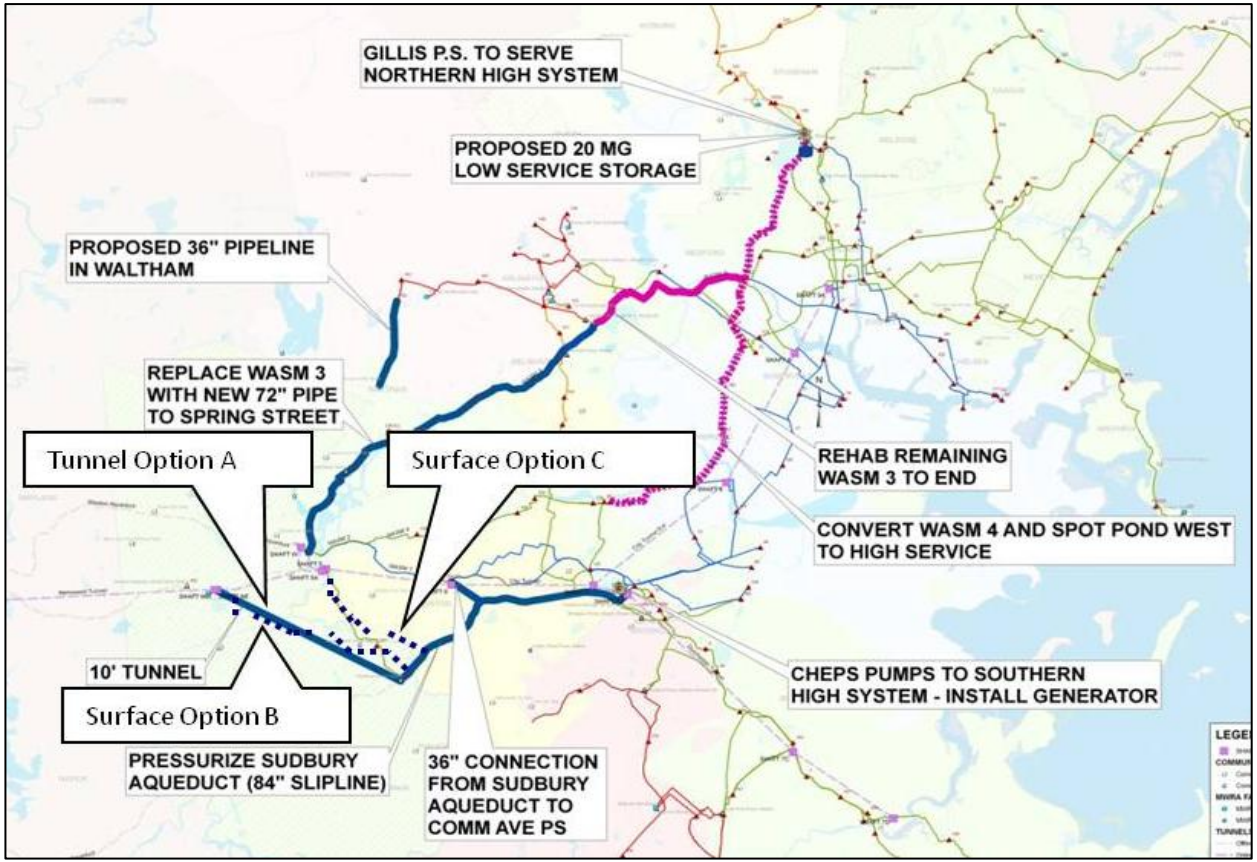


Highlighted areas of high and pumped service areas that could lose supply

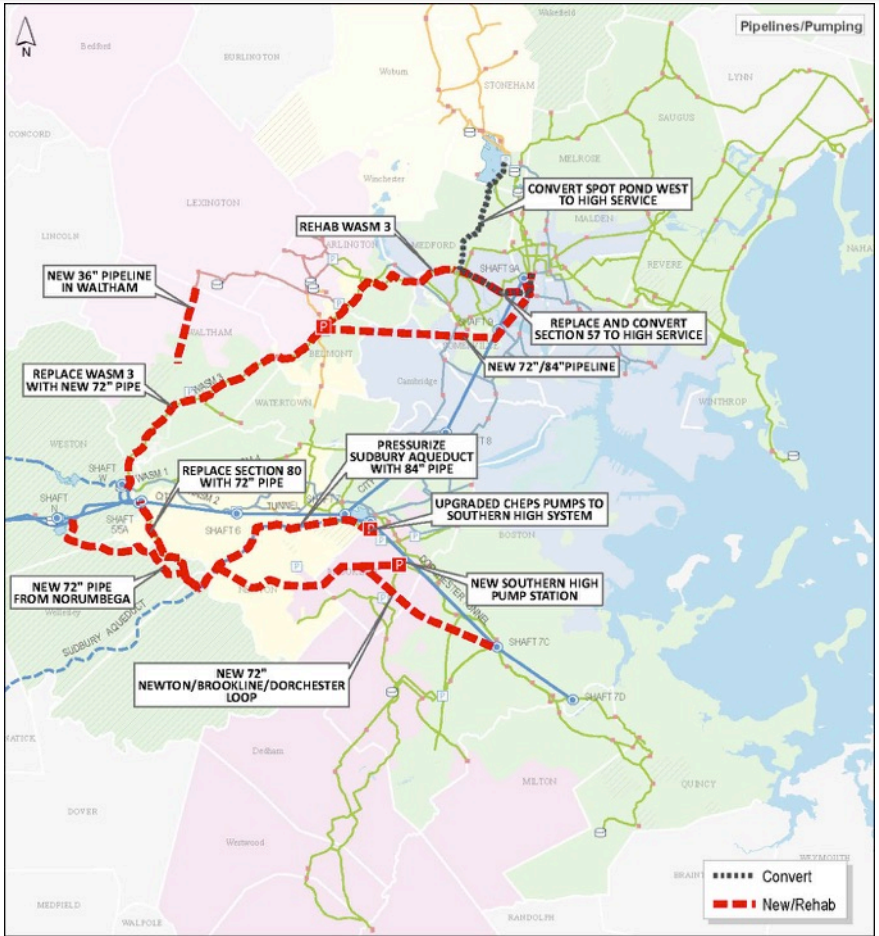
Tunnel System Shut Down – Back-Up Supply

- Partially supplied communities use alternate supplies
- Water use restrictions
- Northern Communities served by pumping from Open Spot Pond Reservoir (High Chlorine Dose and Boil Order)
- Southern Communities served by Open Chestnut Hill Reservoir and Sudbury Aqueduct (High Chlorine Dose and Boil Order)
- Pressure swings, main breaks possible in southern communities
- Regional economic impacts ~ $300 million per day

Next Phase of System Improvements - 2011 Plan



14 Surface and Pump Station Alternatives
$531 - $1,102 million



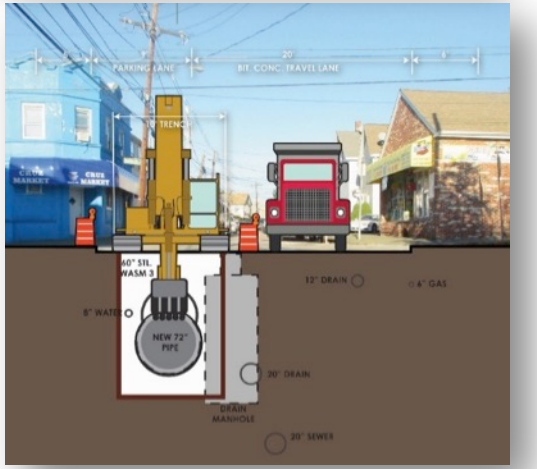
Pump Stations In Lieu of Building Pipeline Capacity

Concerns with using pumps instead of increasing capacity:

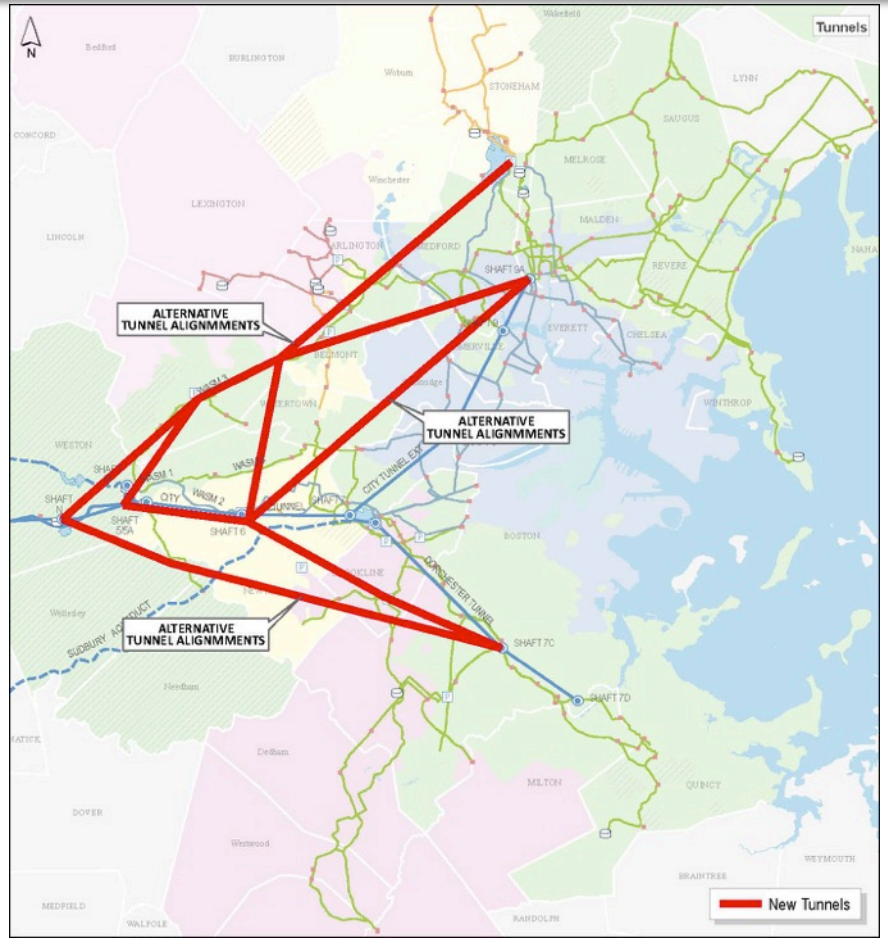
- Too high or too low pressure; inadequate service to some customers and risk of pipeline breaks in community and MWRA systems;
- Pressure surges in MWRA and local community systems on sudden starts/stops;
- Use only in emergency situations; readiness concerns.

Impacts of Large Diameter Surface Pipeline Projects

- Traffic
  - Street Closures and Detours
  - Congested City Streets/Gridlock
- Business Disruption
  - Access Disruption
  - Loss of Business
- Permitting & Approval
  - Multiple Environmental and Agency Permits
  - Street Opening Approvals
- Community Disruption
  - Noise
  - Dust
  - Utility Relocation
  - Long Period of Impacts Over Large Areas

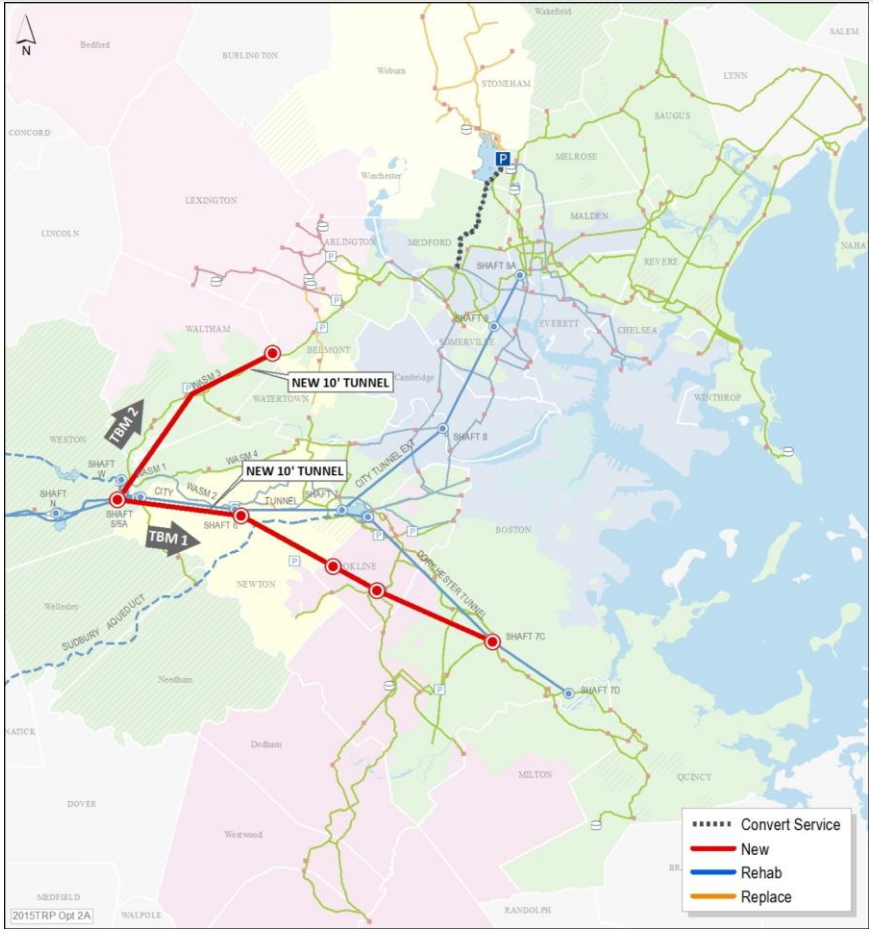


Tunnel Alternatives : $1,188 - $2,326 million

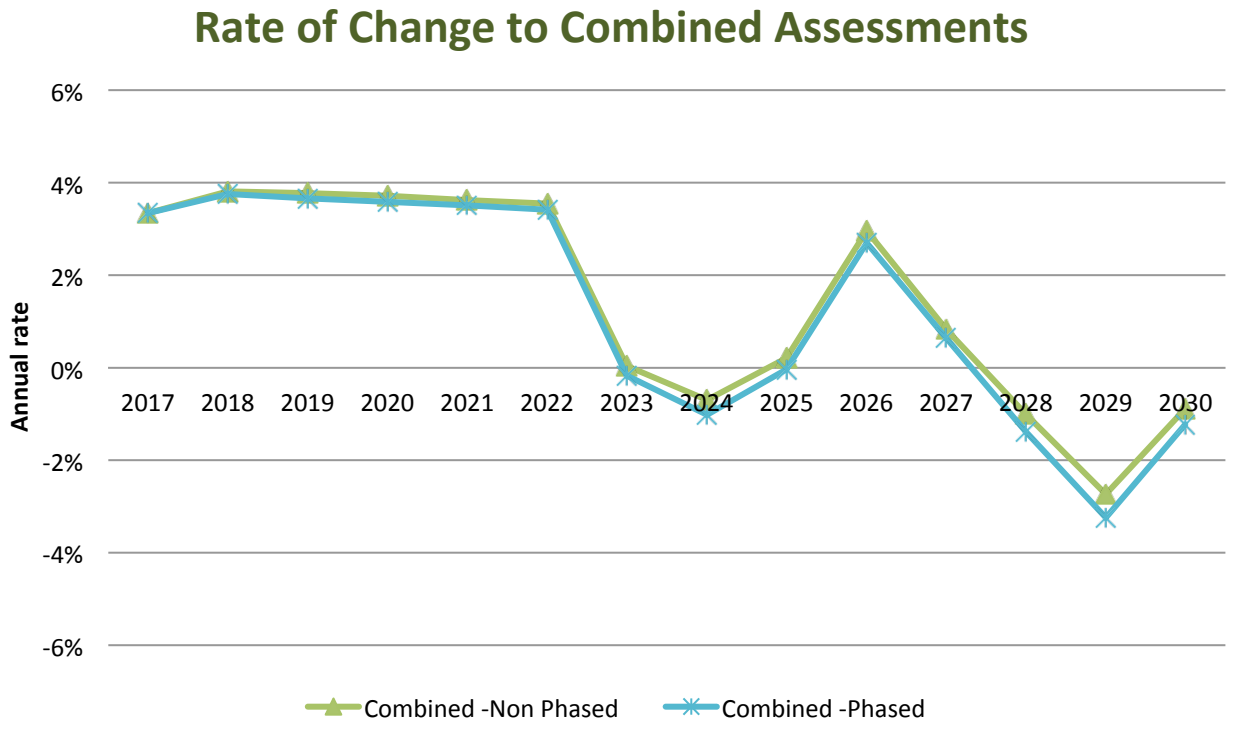


Preferred Alternative for Long-Term Redundancy

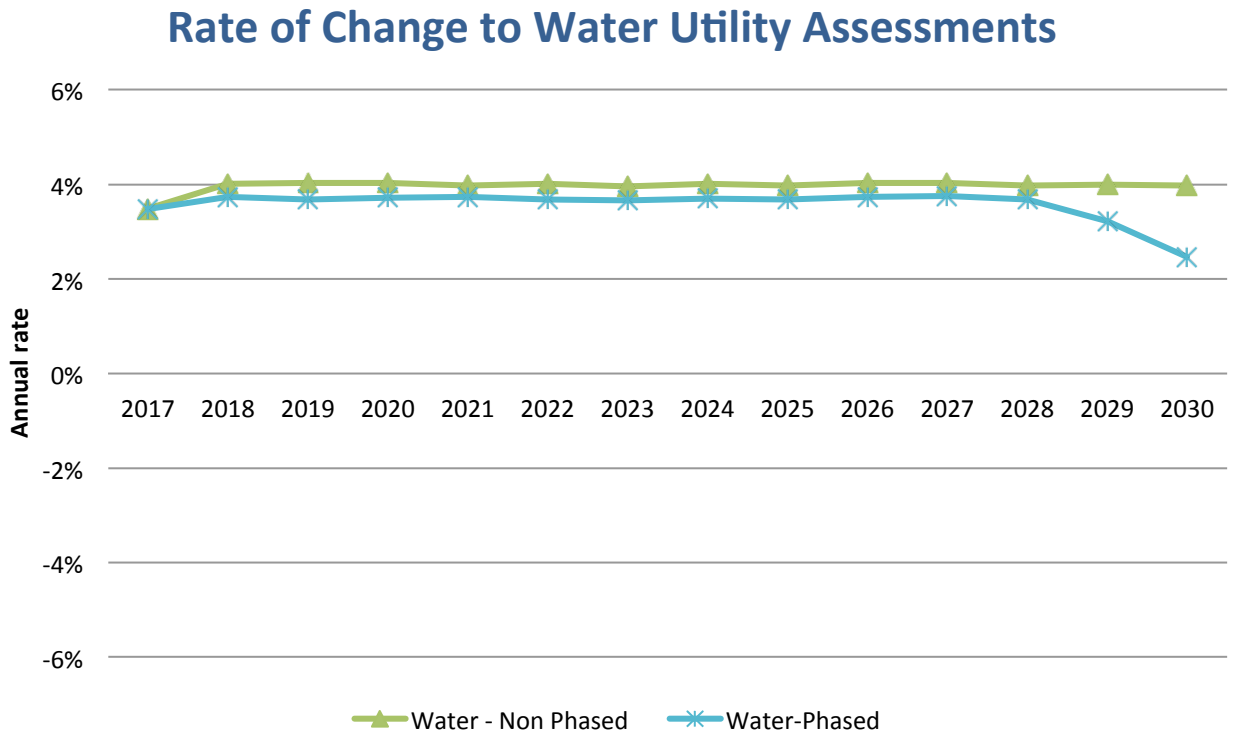
- Midpoint of Construction Cost: $1.470 billion
- Time to Complete: ~17
- Tunnels begin in the Mass Pike/ Route 128 vicinity
- Northern Tunnel - 4.5 miles, ends in Waltham/Belmont area
- Southern Tunnel - 9.5 miles, ends in Mattapan



Combined Rate Projections



Water Utility Rate Projections



Summary

- Redundancy for Metropolitan Tunnel system is necessary for maintenance and emergency response
- Extensive alternatives were identified and evaluated
- Long distance large diameter pipeline alternatives present significant implementation challenges
- Tunnel alternatives meet service objectives and goals
  - Allows planned maintenance of 60+ year old infrastructure that are beyond their useful life
  - Allows emergency response at normal level of service
  - Constructible