

STAFF SUMMARY


TO: Board of Directors
FROM: Frederick A. Laskey, Executive Director
DATE: March 13, 2024
SUBJECT: Metropolitan Water Tunnel Program
Program Look Ahead



COMMITTEE: Water Policy and Oversight

X INFORMATION
 VOTE

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Preparer/Title


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RECOMMENDATION:

For information only. This staff summary provides a summary of ongoing and future activities for the Metropolitan Water Tunnel Program (Tunnel Program).

DISCUSSION:

Program Schedule

The Tunnel Program is a multi-decade effort with planning, permitting, design, and construction each taking significant time to complete. Early Tunnel Program planning began in 2015 with preliminary design and environmental review. Geotechnical investigations began in 2020. Preliminary design is now complete, environmental review is nearing completion, and final design is anticipated to begin in fall 2024. Tunnel system construction is targeted to begin in 2028 and is estimated to be completed with the new tunnel systems in service by 2040.

Completed, Ongoing and Future Contracts

To date, three professional services contracts have been approved by the Board, executed in support of the Tunnel Program and are managed by the Metropolitan Water Tunnel Department. The professional services contracts include the following:

- Program Support Services, which provides general consulting, submittal review, risk management support, constructability reviews, cost estimating/validation, schedule support, staff augmentation, and Expert Review Panel engagement support. This contract was for an initial term of five years for \$10,247,877. The initial term will end in April 2024 and the first of two optional two-year terms at \$7,000,000 was approved by the Board in December 2023;
- Preliminary Design, which consists of early geotechnical investigations, preparation of Environmental Impact Reports and preparation of a Preliminary Design Report, drawings, schedule and cost estimate. This contract was for \$15,692,527 and ended in January 2024;

- Geotechnical Support Services, which focuses on the collection of extensive geotechnical/geological data to support final design, bidding and construction of the Tunnel Program. This contract is for \$12,789,889 and is scheduled to end in January 2026.

One real estate lease was approved by the Board in November 2022 and executed for approximately 19,000 square feet of warehouse/flex space in Needham, Massachusetts for the processing and storage of geotechnical samples (primarily rock core) that are needed for the Tunnel Program. The warehouse/flex space includes offices for Tunnel Program use. More details on the overall Tunnel Real Estate Program are included later in this staff summary.

Additional professional services contracts are planned in support of the Tunnel Program. These include Final Design Engineering Services and Construction Management. The Final Design Engineering Services contract procurement is ongoing with an anticipated recommendation for award at the September 2024 Board meeting. This contract is the subject of a separate staff summary.

The Construction Management (CM) contract(s) procurement is anticipated to begin in 2025. However, provided the overall Tunnel Program schedule is maintained, it is anticipated that one CM contract will be awarded for both tunnel construction packages, similar to the approach used for the MetroWest Water Supply Tunnel (MWWST).

Two tunnel construction contracts are planned; one for the North Tunnel and one for the South Tunnel. Bidding of the South Tunnel construction contract is targeted for 2027 with tunnel construction starting in 2028. Bidding and start of construction of the North Tunnel is targeted for 2028 and 2029 respectively. Tunnel construction, including surface work and commissioning, is estimated to take 8 to 12 years to complete. It is expected that two or three smaller construction contracts will be procured and completed prior to the start of tunnel construction to remove early enabling works from the tunnel contracts' critical paths. These enabling contracts are related to demolition of existing buildings, site reconfiguration to allow continuity of current use, and dewatering drain line work at or near future launching shaft sites.

Project Labor Agreement

MWRA has begun the process of evaluating the use of a Project Labor Agreement for the Tunnel Program and intends to secure counsel to assist in these efforts. Staff will return to the Board for further updates on this item.

Tunnel Department

In 2018, the Authority established the Metropolitan Tunnel Redundancy Department (Tunnel Department) to develop and execute the Tunnel Program and lead its day-to-day management, decision-making and selection of implementation strategies as well as be responsible for the management of all professional services and construction contracts for the Tunnel Program. In addition, the Tunnel Department oversees aspects of the Tunnel Program that MWRA will self-perform (land acquisition, outreach, and stakeholder agreements) and program level controls (schedule, budget, and change management).

The Tunnel Department is leading the Tunnel Program in all respects noted above and is currently focused on executing critical path activities, to control both Tunnel Program schedule and budget,

as discussed below. These include systematic monitoring of budget expenditures and schedule milestones of the various consultants. The Tunnel Department has integrated the MWRA self-performed work into the Tunnel Program schedule and is managing this work to meet schedule milestones. Reorganization of the Tunnel Department to align staffing for the next phase of the Tunnel Program was the subject of a staff summary and presentation at the December 2023 meeting of the Board of Directors.

Critical Path

As the Tunnel Program transitions from preliminary to final design, the focus of the work will shift to completing a detailed final design and permitting for each construction contract, acquiring land, expanding outreach efforts, achieving stakeholder agreements and preparing for tunnel construction. The planned overall schedule for the Tunnel Program is similar to the overall schedule achieved for the MetroWest Water Supply Tunnel (MWWST). This schedule is considered achievable, provided several critical path activities, such as geotechnical investigations, land acquisition, stakeholder agreements, and Tunnel Boring Machine (TBM) power supply are not significantly delayed. Extending the Program schedule beyond that currently planned will add inflationary and other costs to the overall Tunnel Program. Depending on the actual rate of inflation, the number of unawarded contracts, and impact on awarded contracts at the time, a six-month schedule slippage could add between \$15 million to over \$100 million to the total Tunnel Program cost. Accordingly, staff continue to focus on critical path items without sacrificing quality of work, stakeholder engagement, or adding unnecessary costs to the Tunnel Program.

Current critical path activities, including those that will involve Board approvals are as follows:

Geotechnical Investigations: Completion of deep rock test borings throughout the tunnel alignments has been on the critical path for some time. The Geotechnical Support Services contract was implemented to assist in collecting the geotechnical and geological data necessary for design, bidding and construction of the tunnel contracts. Upwards of 100 test borings were planned with over 40 borings drilled to date, however, progress in completing this work has been slower than originally anticipated. The boring locations have proved to be difficult to site, due in part to the dense urban nature of the Tunnel Program area, property access limitations and restrictions, and the complexity of the local geology. In addition, there are resource constraints (locally and nationally) in the industry to execute this work (e.g., skilled drillers, testing labs, geophysical survey firms, experienced field staff, qualified geologists, etc.). A similar size investigation program has not been conducted in the Boston area since the Central Artery/Tunnel, the Boston Harbor Project and MWWST, over 20 years ago. The quality and completeness of this data will serve as a key foundational basis for final designs, future engineers' cost estimates, contractors' bids, and claims mitigation. Therefore, successfully completing this work without affecting the Tunnel Program schedule is a high priority. Staff are leveraging the current Geotechnical Support Services contract to prioritize geotechnical data collection in areas that could have a material impact on the tunnel alignment, construction methods, construction duration, or costs in an effort to mitigate potential schedule impacts.

Land Acquisition: Much of the land on which the Tunnel Program will be constructed is not currently owned by MWRA. Land associated with three launching shaft sites, three receiving shaft sites, one large connection shaft site, and three of the six connection shaft sites will need to be acquired. All three launching shaft sites, one receiving shaft site, and the large connection shaft site are under the care and control of Massachusetts Department of Transportation (MassDOT)

with the right-of-way for the Hultman Aqueduct under the care and control of MWRA. One receiving shaft site and one connection shaft site are owned by the City of Waltham. The third receiving shaft site and one connection shaft site are under the care and control of DCR and will require Article 97 legislation and must meet the obligations of the Public Lands Preservation Act (PLPA), including the identification and dedication of replacement land. One connection shaft site is owned by the Town of Wellesley and may also require Article 97 legislation.

MWRA currently owns the land associated with three connection shaft sites: School Street (Waltham), St. Mary Street Pumping Station (Needham), and Newton Street Pumping Station (Brookline). In July 2021, the Board approved the purchase of a parcel of land on School Street in Waltham for the purposes of constructing a connection shaft for the Tunnel Program. In September 2021, the School Street parcel was purchased for \$1,850,000. The St. Mary Street Pumping Station connection shaft site is located within an existing easement for the Sudbury Aqueduct over which MWRA has care and control. The Newton Street Pumping Station connection shaft site is located within the limits of the existing MWRA station and will require no new land acquisition.

MWRA plans to acquire most new land and shaft sites in fee with the exception of MassDOT-controlled sites which will be acquired by permanent easement. In addition to land currently owned by MWRA, approximately nine acres of land will be permanently acquired for shaft sites, of which approximately 3.8 acres require Article 97 legislation. Temporary easements for approximately 38 acres of construction staging areas will also be needed in addition to the permanent land acquired at various shaft sites.

Easements in roadways or on public land for new water and drain pipelines will be required at eight sites involving approximately 6,000 feet of new pipeline easement. Permanent access easements will be needed at approximately nine sites to allow for long term operations and maintenance of the future valve vaults and top of shaft structures where the planned permanent site limits do not extend to a public way.

Subterranean easements will be required for each property below which the new tunnels will be constructed. The subterranean easements will run the entire length of the new tunnels and dimensionally extend 50 feet wide by 50 feet high centered on the tunnel axis. The subterranean easements will be 200 to 450 feet below ground and will not allow for surface access, and thus will not affect property usage above the tunnel. Subterranean easements that extend below protected and recreational open space will require Article 97 Legislation to acquire, however, since these easements will not affect property usage above, replacement land obligations of the PLPA are not anticipated. The number of subterranean easements to be acquired will depend on the final tunnel alignments; however, it is estimated that approximately 160 subterranean easements will be required for the North Tunnel and approximately 440 subterranean easements for the South Tunnel.

Figure 1 shows shaft site locations with current ownership as well as land (both shaft sites and subterranean easements) that may require Article 97 legislation to acquire.

For shaft sites that will need to be purchased, costs are expected to be based on negotiations and an appraised value consistent with MWRA's Real Property Acquisition Policy. Costs for subterranean easements will also be based on appraised values but because the easements are 200 to 450 feet below ground and do not impact surface use or development, the subterranean easements are typically acquired at nominal cost.

All property acquisitions will be coordinated and in compliance with MWRA's Real Property Acquisition Policy and approval requirements. Of significance, many of the current landowners are state agencies and municipalities, and they too have their own multi-step requirements and approval processes for property dispositions. Recommended property acquisitions will be presented in detail to the Board for authorization.

Applicable acquisitions will need to be completed prior to bidding of each tunnel construction package, preferable by the 90% design stage. The design details necessary to prepare acquisition documents will likely not be finalized until after the 60% design stage. The expected time period between 60% and 90% design is around 12 months, leaving a significant number of acquisitions to be executed in a relatively short amount of time. Therefore, land acquisition will be on the critical path in the future. Staff have already begun coordinating the shaft site acquisitions, pipeline easements, and access easements with landowners in order to mitigate a potential schedule impact.

Community/Stakeholder Agreements: Memoranda of Understanding (MOUs) will need to be executed with each community in which the tunnel alignment crosses. These memoranda typically address a wide range of topics including land acquisition, permitting and local regulations, public safety, public communications, water supply contingency, work hours, hauling hours and routes, traffic management, dust and noise control, blasting and vibration control, connections to community water systems, mitigations, and final site conditions (fencing, lighting, landscaping, etc.). These topics will need to be resolved with each of the seven communities in which the tunnels and shafts will be located. Although discussions with communities have already begun, similar to land acquisition, sufficient design details at 60% design stage are needed to include in the MOUs.

MWRA is coordinating with local fire and emergency management entities from multiple communities to support the Tunnel Program with emergency response to the Tunnel Program sites. As has been done on past MWRA tunnel projects and consistent with industry practice, advance coordination during the design phase is necessary to ensure a proper framework is established for local fire and emergency response during construction. The framework will include local fire and EMS personnel receiving specialized training, procuring necessary equipment and establishing a coordinated response by the various communities. Staff have been working with emergency personnel from the seven communities who have indicated they will have to rely on mutual aid agreements between communities as no one community in the Tunnel Program area is large enough to be the sole emergency responder during construction. Community emergency personnel have indicated that significant advance coordination will be required to obtain the necessary equipment and train sufficient numbers of emergency personnel to ensure that enough properly trained staff can be available to respond to emergencies at multiple active shaft sites, if needed, over the course of construction, without affecting their emergency readiness. Resource commitments by MWRA will be required and included in each community MOU.

All recommended MOUs will be presented to the Board for authorization. Each MOU will need to be executed prior to construction, ideally by the 90% design stage, and will be included in the contract documents for the respective construction bid packages. Thus, MOUs will be on the critical path in the future.

Tunnel Boring Machine Power Supply: High voltage power for the Tunnel Boring Machines (TBM) is not readily available at the three launch sites. It is estimated that approximately 9,000kVA is required at each site. Power supply is often a long lead work activity for tunnel projects. Staff have been working with Eversource since 2021 to develop a plan to have high

voltage power brought to each launch site prior to the start of construction. This work will involve installation of approximately 1.7 miles of new and reused duct bank and cable through Needham for the two South Tunnel launch shaft sites at Highland Avenue in Needham. Approximately 3.2 miles of new duct bank and cable through Waltham, Newton, and Weston will be needed for the North Tunnel launch shaft site at the Tandem Trailer site in Weston. The work, including a power supply assessment and routing study, the design of the new duct banks and construction, would be undertaken by Eversource. It is anticipated that MWRA and Eversource will enter into an agreement, which will address the required schedule and compensation for this work. When the Tunnel Program is complete, the added power supply will remain and provide further resilience to the power grid. The full details of an agreement with Eversource to supply power for the Tunnel Program will be presented to the Board for authorization.

Figure 2 shows a conceptual Tunnel Program Critical Path Schedule with the items noted above.

Challenges and Opportunities

The Tunnel Program is considered a “megaproject” in that it is a large scale, complex project that will take many years to design, permit and build and it involves multiple private and public stakeholders, with a total cost of over one billion dollars. MWRA has a history of successfully completing large complicated projects and understands that with any big endeavor, challenges will arise along with opportunities to address those challenges. A few items that staff have identified as challenges and opportunities are as follows.

Resources: Completion of the Tunnel Program within the currently planned schedule will require the collaboration and coordination of a number of parties including, but not limited to, the MWRA Board of Directors, the MWRA Advisory Board, and multiple MWRA Departments, numerous federal and state agencies, seven host communities, key stakeholders, design and construction consultants, construction contractors and subcontractors, labor groups, and a small army of talented construction workers. It is estimated that during the construction period, approximately 200 people will be directly employed at one time in some form by the Tunnel Program. The specialty nature of this work will require people both locally available but will also draw from national talent. This influx of quality jobs provides an opportunity for MWRA to continue to support certified minority-owned and women-owned businesses.

Given the number of parties involved, with many experiencing resource challenges currently, resource constraints will inevitably occur over the course of the Tunnel Program. Some level of resource constraint is anticipated on any large project but the current labor and economic climate makes the potential occurrence and possible consequence greater. In an effort toward early identification that should allow time to mitigate some of these challenges, staff have developed an initial program schedule, extending into construction and with sufficient granular detail, to identify required sequential activities and overlapping resource needs. For example, community representatives and MWRA staff (Tunnel Department, Law Division and Public Affairs) are involved in both finalizing land acquisitions and executing community agreements, which preferably occur between the completion of 60% and 90% design. Staff have already begun coordinating acquisitions and MOU development in order to mitigate a potential schedule impact; however, it is expected that this resource constraint will require continued monitoring and mitigation.

In addition, tunneling is a highly specialized, national and international market with significant tunnel work ongoing worldwide and closer to home, as well as in the North American pipeline. As a result, this may lead to impacts related to the availability of contractors, labor workforce, and longer lead times for materials and equipment. MWRA cannot control national and international market conditions. However, staff continue to monitor the conditions that influence the tunneling industry for the purposes of identifying potential increases and/or decreases in the cost of commodities and resources to be able to most accurately reflect current climates that may influence Tunnel Program costs.

Geologic Conditions: A tunnel project is unique in that most, if not all, of the project is constructed below ground. The largest costs and often the greatest risks to cost increases, schedule delays, and safety are related to the geologic conditions. Although MWRA has a long history of tunneling in the Boston area, each project is unique due to the geologic conditions in which it is constructed. These conditions are challenging in part due to the wide range of rock types that will be mined (hard granites and volcanic rocks, conglomerates to soft shales; abrasive rocks that can be faulted, fractured, and water bearing). In addition, at least four known fault zones will need to be crossed along the tunnel alignments. Fortunately, many of these rock conditions are relatively well understood and have been successfully mined in past projects. However, the geotechnical investigations conducted to date for the Tunnel Program have identified some previously unknown geologic conditions.

Along the North Tunnel alignment in Waltham, where the Northern Boundary Fault was anticipated but no previous test borings had been drilled to sufficient depth to confirm its presence or geometry, multiple fault zones, deep soil overburden, and some low-quality sedimentary rock have been identified. Although these ground conditions do not impact the overall constructability of a rock tunnel with a modern TBM, areas of poor quality rock can add to construction durations and cost impacts, as mining production can be slower and require more dewatering, stabilization grouting and/or additional ground support. Accordingly, staff are focused on conducting geotechnical explorations at target locations in Waltham to better understand these conditions, where they occur, as well as to look at means to avoid, minimize or mitigate the impact (e.g., shift the alignment between shaft sites to avoid them, shorten tunnel lengths in challenging rock formations to minimize encountering them, and specify stabilization methods rather than allow a contractor to select certain construction methods to mitigate them).

Along portions of the South Tunnel alignment, naturally occurring asbestos has been found within thin veins in some rock types. Naturally occurring asbestos refers to a family of very thin and fibrous minerals that are formed as a result of natural geologic processes and is present in many rock types in over 30 states. However, it is not prevalent in Massachusetts. It is expected that, where present in the Tunnel Program area, only trace levels occur but the exact limits and amount along the South Tunnel alignment are unclear at this time. Naturally occurring asbestos does not dissolve in water or evaporate, and, if left undisturbed, is not a health risk. However, it can become a health risk if it is released from its bound, crystalline form in the rock during construction, potentially becoming airborne and inhaled. The presence of naturally occurring asbestos may require additional engineering controls during tunnel construction (i.e., ventilation, dust control, etc.) as well as added management of excavated rock handling and disposal. Massachusetts has no regulations specific to handling or disposal of rock with naturally occurring asbestos. Staff have been working with MassDEP to develop safe work protocols for the current geotechnical exploration program. In addition, staff are currently focused on conducting explorations at target locations to better understand the limits, occurrences and concentrations of naturally occurring

asbestos in suspect rock types. The presence of naturally occurring asbestos in the rock in which the tunnel will be constructed will not impact the long term safety or performance of the tunnel system.

BUDGET/FISCAL IMPACTS:

The proposed FY25 CIP includes \$2.1 billion for the Tunnel Program. This budget will be refined during final design.

ATTACHMENT:

Figure 1 – Shaft Site Locations, Current Ownership Land Requiring Article 97 Legislation

Figure 2 – Conceptual Tunnel Program Critical Path Schedule



Figure 1 – Shaft Site Locations, Current Ownership, and Land Requiring Article 97 Legislation

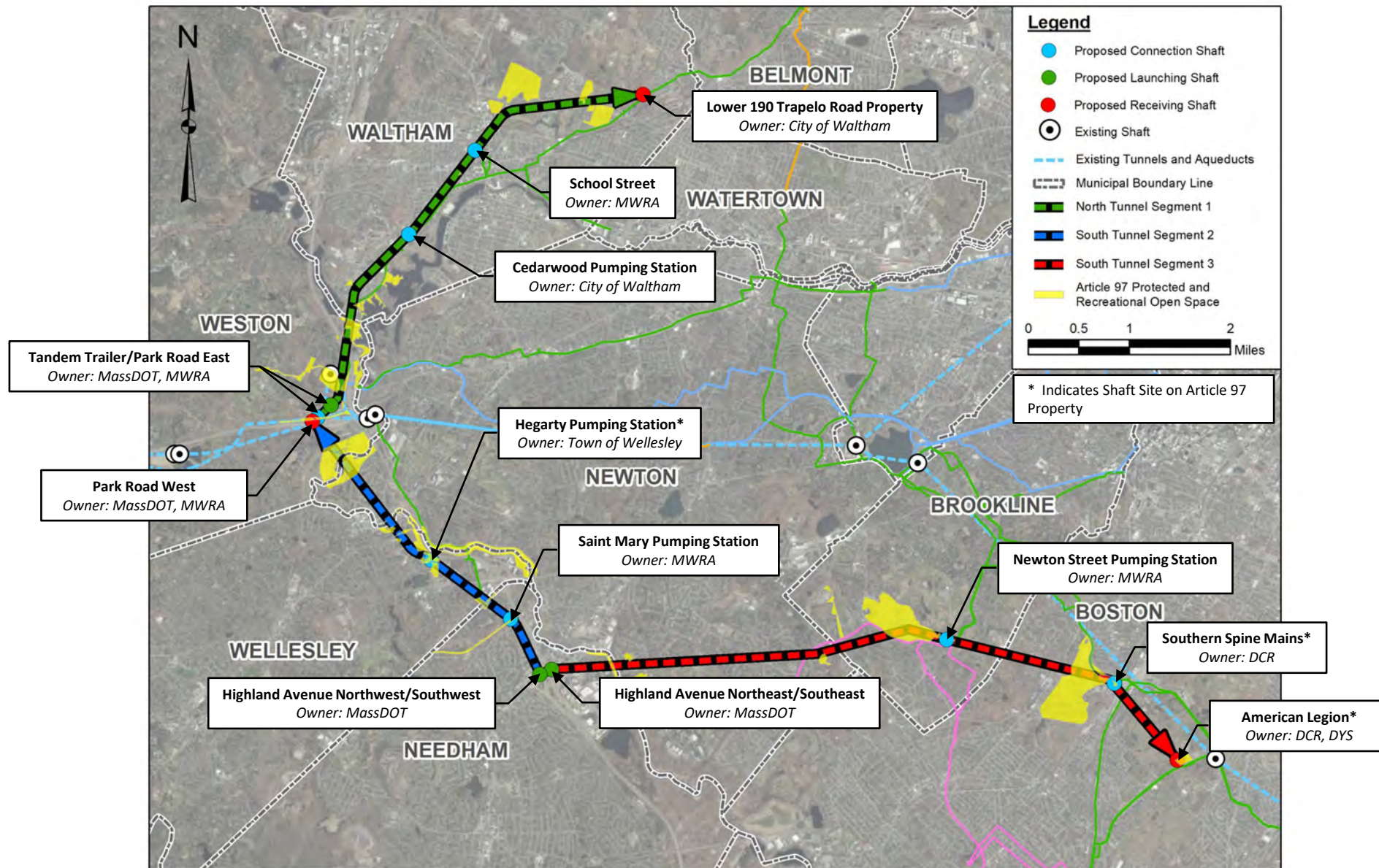
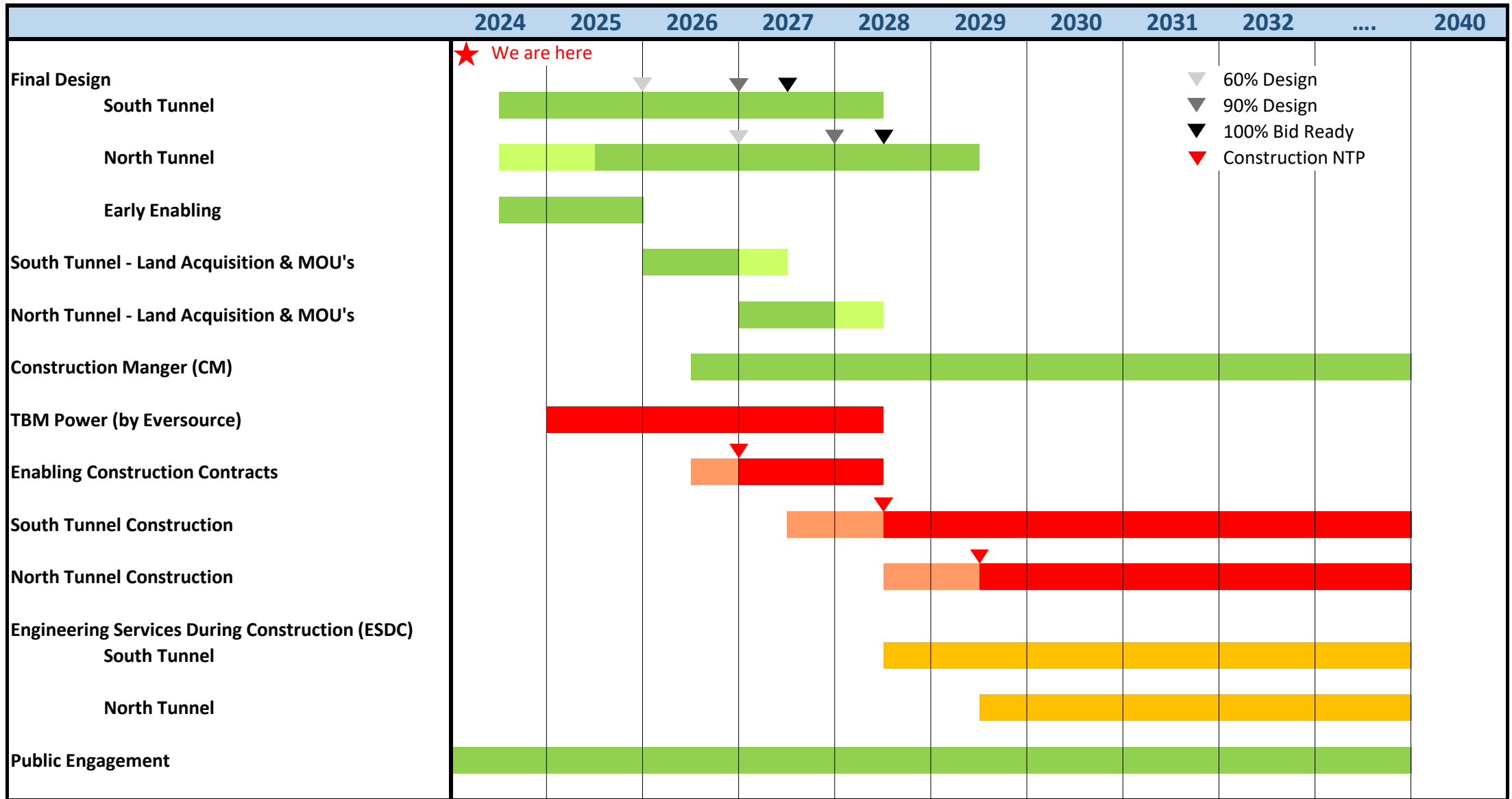




Figure 2 - Conceptual Tunnel Program Critical Path Schedule





Presentation to

MWRA Board of Directors

Metropolitan Water Tunnel Program Tunnel Program Look Ahead

March 13, 2024



Tunnel Program Contracts

| Awarded Contracts | Value | Duration | Dates |
|--|--|-----------------------------|-----------------------------|
| Program Support Services | \$10,247,877 | 5 years + 2 year extension | April 2019 – April 2026 |
| Preliminary Design (complete) | \$15,692,527 | 3.5 years | July 2020 – January 2024 |
| Geotechnical Support Services | \$12,789,889 | 3 years | January 2023 – January 2026 |
| Rock Core Storage Facility | \$6,950,000 (base annual rent) + taxes and operating costs | 10 years w/ option to renew | April 2023 – April 2033 |
| Future Contracts | Proposed FY25 CIP (actuals TBD) | Estimated Duration | Approximate Dates |
| Possible 2 nd PSS Extension | \$7.5M | One 2 year extension | 2026 – 2028 |
| Final Design Engineering Services | \$77.8M | 5 years | NTP late 2024 |
| Engineering Services During Construction (Amendment) | \$40M | ~10 years | ~2028 – project completion |
| Construction Manager | \$159.3M | ~12 years | NTP in 2026 |
| Early Enabling Construction Contracts | \$10.6M | ~1.5 years | 2026 – 2028 |
| Two Tunnel Construction Contracts | \$1,626.2M | ~6 to 8 years | Btwn 2028 – 2040 |



Critical Path Tasks

- Geotechnical Investigations
- Land Acquisitions
- Community/Stakeholder Agreements (MOU's)
- TBM Power Supply



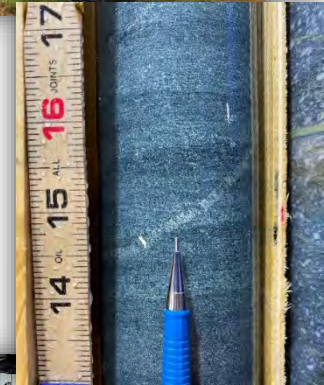
- Tunnel Construction



Geotechnical Explorations

Understanding geologic conditions are essential to a successful rock tunnel:

- More than ½ the Tunnel Program cost is associated with making a hole through the ground
- Crossing at least 4 major fault zones
- No previous deep borings along portions of both tunnel alignments
- TBM's will be built for the specific ground conditions
- Takes ~8 weeks to fully drill & test a deep rock boring
- Test boring locations will be increasingly difficult to access as design progresses
- Currently ~40% complete with planned deep test boring program
- Have encountered a few unexpected conditions:
 - Poor quality rock with thick overburden through portions of Waltham / North Tunnel
 - Small amount of naturally occurring asbestos has been found in 3 rock formations along South Tunnel
- Core Storage Facility in Needham allows for accelerated processing of data



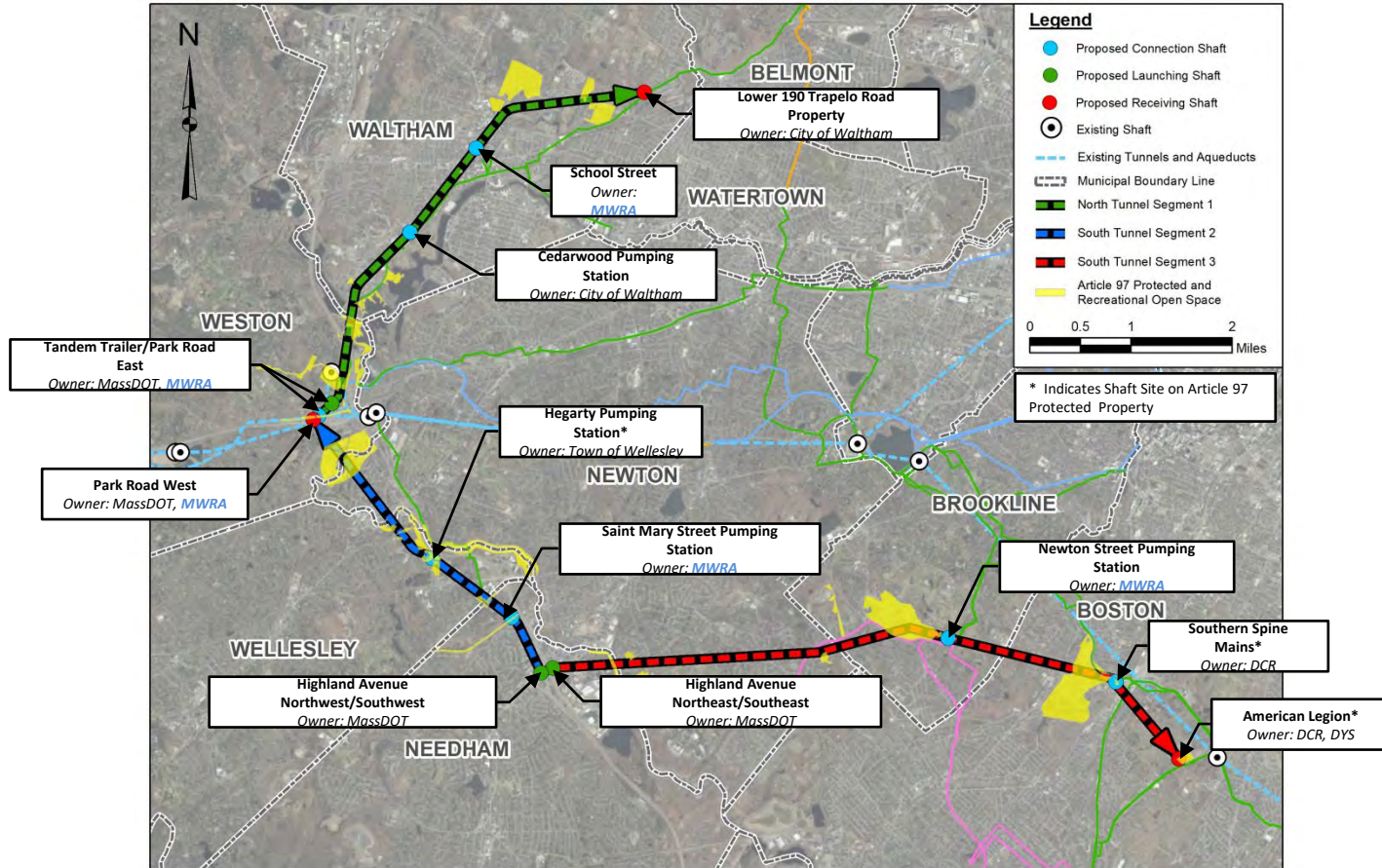


Land Acquisitions

- 13 shaft sites -
 - Larger temporary staging area and smaller permanent facility footprint
 - MWRA owns 3 shaft sites & has partial control of 2 shaft sites already
- Pipeline easements - ~6,000 ft
- Permanent surface access easements - ~9 sites
- Subterranean easements - ~600 individual properties
- ~3.8 acres of land for permanent facilities will require Article 97 legislation
- Land purchases/easements will be based on appraised value and negotiations
- Own in fee (most sites) or permanent easement (MassDOT)
- Land acquisitions will require Board approval



Land Acquisitions & Article 97 Properties

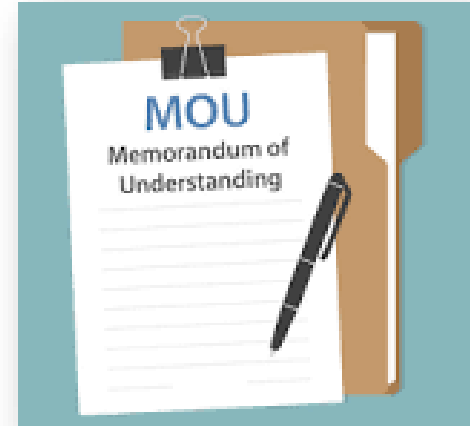




Community/Stakeholder Agreements (MOU's)

Topics may include:

- Land acquisitions
 - Permitting and local regulations
 - Public safety and emergency response
 - Water supply contingency
 - Work hours, hauling hours and routes, traffic management
 - Dust and noise control, blasting and vibration control
 - Connections to community water systems
 - Mitigations and final site conditions (fencing, lighting, landscaping, etc.)
-
- Expect to execute MOU's with 7 communities (Waltham, Weston, Wellesley, Needham, Newton, Brookline & Boston)
 - Expect to have agreements/MOU's (or similar) with DCR, MassDOT, and DYS related to land acquisitions
 - All MOU's will be presented to the Board for approval





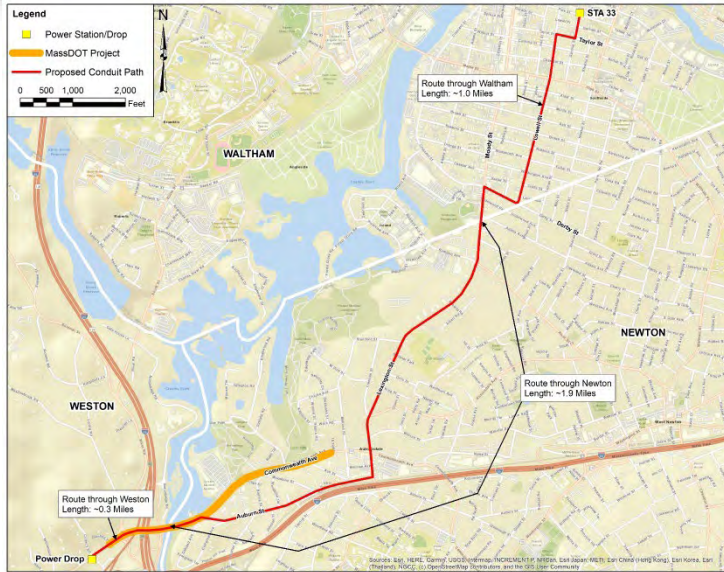
Emergency Response

- Shafts in six (6) communities, tunnel alignment beneath seven (7) communities
- Advance coordination to ensure coordinated emergency response during construction
- Staff have had three (3) meetings with community Emergency Responders:
 - Uniqueness of the underground construction environment and its hazards
 - Anticipated role and responsibilities of the MWRA tunnel contractors and community Emergency Responders
 - Tunnel Contractors to provide all OSHA required tunnel rescue resources (2 teams)
 - Community Emergency Responders assume incident command on the surface and, if needed, support underground for extrication and medical care
 - Training and equipment needed by the community Emergency Responders throughout tunnel construction
- Emergency response coordination needs to be tailored to the supporting communities' capabilities and size
- MWRA resources will be needed to ready the community Emergency Responders
- MOU's between MWRA and each community will include emergency response support





TBM Power Supply



190/195 – Tandem Trailer Launching Shaft Site:

- ~3.2 miles of new duct bank & cable
- Coordinating with ongoing MassDOT project along Route 30
- Through Waltham, Newton & Weston

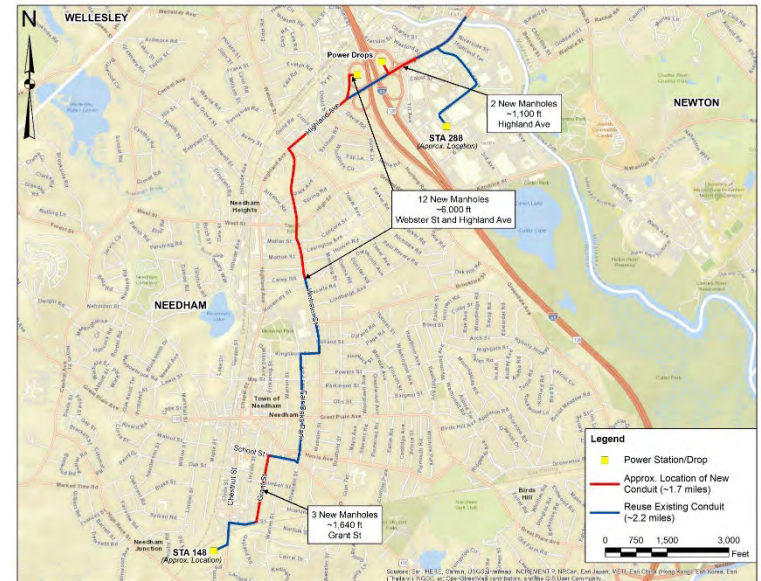
Eversource will design and install all new duct bank & cable

MWRA and Eversource will enter into an agreement addressing completion schedule and compensation, subject to Board approval

Power supply will remain and provide added resilience to the power grid

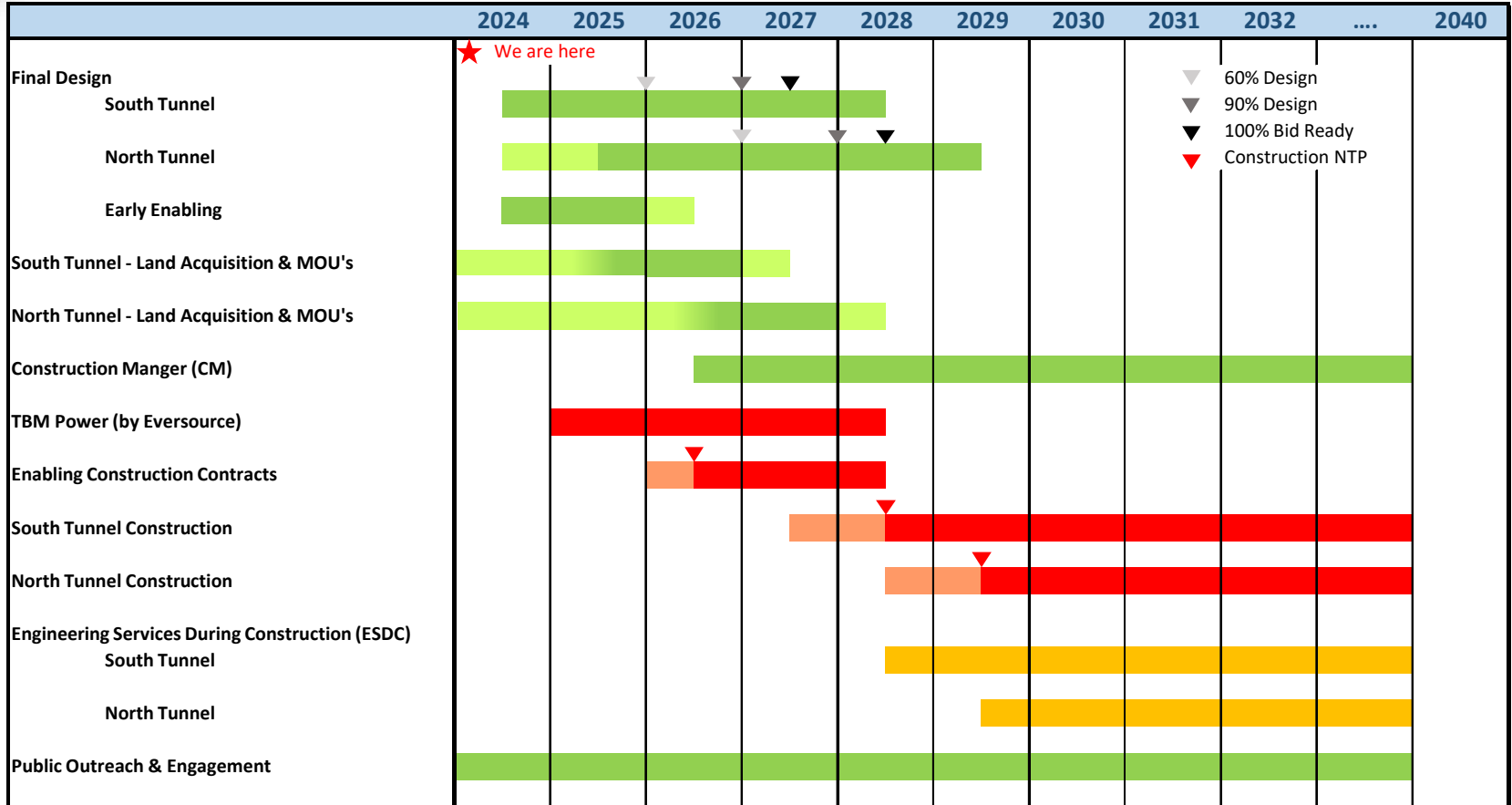
Highland Ave Launching Shaft Sites:

- ~1.7 miles of new duct bank & cable
- ~2.2 miles of reused duct bank & cable
- All within Needham





Tunnel Program - Critical Path Schedule





Tunnel System – Construction Schedule Look Ahead

