

**STAFF SUMMARY**




**TO:** Board of Directors  
**FROM:** Frederick A. Laskey, Executive Director  
**DATE:** March 13, 2024  
**SUBJECT:** Metropolitan Water Tunnel Program  
FY25 CIP Updated Program Cost Estimate and Cost Controls

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**COMMITTEE:** Water Policy and Oversight

X  INFORMATION  
  VOTE

Thomas J. Durkin, Director, Finance  
Paul V. Savard, P.E., Director, Design and Construction  
Preparer/Title

  
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**RECOMMENDATION:**

For information only. This staff summary provides an update on the cost estimates for the Metropolitan Water Tunnel Program (Tunnel Program) as reflected in the proposed FY25 Capital Improvement Plan and summarizes cost control measures for the Tunnel Program.

**DISCUSSION:**

The Tunnel Program was originally added to the Capital Improvement Plan (CIP) in 2017 as item “625 Long Term Redundancy” with an estimated program cost of approximately \$1.47 billion (value date of December 2016). This estimate was a planning level estimate and included a 30 percent contingency and a four percent contractor escalation.

Modifications to this original CIP item occurred in FY18 CIP with some sub-phases moved out to other CIP items and annual inflation added to future contracts. The FY18 CIP for 625 Metro Tunnel Redundancy was \$1.36 billion. Between the FY18 and FY24 CIPs, modifications to 625 Metro Tunnel Redundancy have been limited to the addition of annual inflation, award of three professional services contracts, and purchase of one parcel of land. The FY24 CIP was \$1.8 billion. The difference between the FY18 and FY24 CIPs (approximately \$438 million) is due to annual inflation added each year to bring the CIP value consistent with the mid-point of each fiscal year. Base costs to plan, design and construct the Tunnel Program have not been updated since 2016.

**Proposed FY 25 CIP**

With the completion of preliminary design, which included the development of the first bottom-up cost estimate for the Tunnel Program, CIP Project 625 can be updated to accurately reflect the preliminary design documents, likely construction methods, ground conditions as currently understood, planned construction packaging, schedule, and current market conditions (among other factors).

The proposed FY25 CIP for 625 Metro Tunnel Redundancy includes an estimated program cost of approximately \$2.1 billion (value date of December 2024). This estimate includes an increase for annual inflation to unawarded construction contracts (\$130 million) and an increase to the base

construction cost (\$200 million). Design, construction management, land acquisition, legal, and administrative costs were increased for annual inflation only (\$17 million). The proposed FY25 CIP 625 Metro Tunnel Redundancy also includes modifications to several sub-phases to reflect the Tunnel Program contracts as they are currently envisioned to be executed (i.e., two tunnel construction packages) as well as updates to the expenditure forecast to better reflect the projected cash flow. These changes are important, as projected spending for the Tunnel Program will become a large part of near term spending as well as upcoming five-year Cap Periods.

The following table summarizes the CIP for 625 Metro Tunnel Redundancy from FY17 to FY25 (\$ in millions).

	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>FY22</b>	<b>FY23</b>	<b>FY24</b>	<b>FY25</b>
Other Projects	\$191.4	\$4.8 <sup>1</sup>	\$3.5	\$3.5	\$3.5	\$3.5	\$3.5	\$3.5	\$3.5
Design/CM	\$204.5	\$216.8	\$210.4	\$240.3	\$257.5	\$256.4	\$274.5	\$310.4	\$324.8
Construction	\$919.4	\$963.1	\$997.6	\$1,024.5	\$1,046.7	\$1,041.6	\$1,083	\$1,306.7	\$1,636.8 <sup>2</sup>
Adm/Legal/PR	\$153.4	\$160.7	\$163.7	\$140.3	\$140.5	\$140.1	\$135.9	\$157.3	\$159.3
Future Projects	\$5.9	\$12.3	\$12.8	\$13.1	\$14.6	\$14.6	\$15.1	\$17.5	\$18.0
<b>Total FY CIP</b>	<b>\$1,474</b>	<b>\$1,358</b>	<b>\$1,388</b>	<b>\$1,422</b>	<b>\$1,507</b>	<b>\$1,500</b>	<b>\$1,558</b>	<b>\$1,795</b>	<b>\$2,142</b>
Annual Inflation Added <sup>3</sup>	N/A	\$69.6	\$30.2	\$33.8	\$85.2	(\$6.7)	\$57.5	\$237.6	\$147.1
Cumulative Inflation Added Since 2017	N/A	\$69.6	\$99.8	\$133.6	\$218.8	\$212.1	\$269.6	\$507.2	\$654.3

1. FY18 Other Projects item reflects ~\$186M in costs moved out of 625 Metro Tunnel Redundancy and into other CIP items.
2. FY25 construction item includes \$200M cost increase and \$130M in annual inflation over FY24.
3. Annual Inflation is included in the Total FY CIP amount for each FY.

The increase in construction cost reflects the first change to the Tunnel Program’s base construction cost estimate since FY17. The FY25 proposed construction cost is based on two detailed cost estimates: one prepared by the Preliminary Design Engineer; and a second independent cost estimate prepared by the Program Support Services consultant. Both estimates were detailed “bottom-up” cost estimates developed in early 2023 (January 2023 value date) reflecting current market conditions and the recently completed preliminary design. Each involved detailed cost and schedule analysis, at an in-depth level, that consider quantity take-offs for materials, labor and equipment for anticipated construction means and methods, anticipated construction sequencing, and construction contract packaging (among other factors). A 25 percent design contingency is recommended, and included in the construction estimate, to reflect the current level of design definition. The 25 percent design contingency is consistent with the standard contingency factor for preliminary design provided in MWRA’s Guidelines for Life Cycle Cost Estimating.

The increase in base construction cost is primarily attributable to a few factors as further detailed below.

- There are Program configuration differences between the FY17 conceptual design and the FY24 preliminary design.
  - Three additional intermediate shafts were added to provide improved redundancy to the Cedarwood Pumping Station in Waltham, Hegarty Pumping Station in Wellesley, and the St. Mary Street Pumping Station in Needham

- Two new launch shafts at Highland Avenue in Needham were added to facilitate construction of the 10 mile long South Tunnel
- One large connection shaft was added at the Park Road East site in Weston which allows for a connection to the Hultman Aqueduct as the Tandem Trailer shaft site, which is of sufficient size for a launching shaft site, does not allow for a direct connection to the Hultman Aqueduct on that site
- An additional one mile of tunnel was added to connect to the additional shafts and to reduce risk of constructing along better defined boundary faults and geologic conditions
- There were adjustments to tunnel mining production rates (slower) due to better understanding of geologic conditions.
- The preliminary design cost estimates reflect a volatility in the market that was not present during 2017. The current-day quotes and pricing for material, equipment and labor received from vendors and specialty contractors reflect a particularly volatile market with global influence on commodities including steel, cement and fuel costs. While difficult to quantify, such volatility likely contributed to the increase in base construction cost estimates. This volatility will be monitored as design advances and cost estimates are updated.

Although the 2017 planning level cost estimate included a 30 percent contingency in accordance with the MWRA's Guidelines for Life Cycle Cost Estimating, which was intended to account for advancement of the design (number of connections, shaft site availability, ground conditions, etc.), this contingency was not sufficient to accommodate compounding of the influences described above plus recent market volatility.

While the 2023 construction cost estimates reflect the factors discussed above, the cost estimates do not consider factors that cannot be accurately forecasted such as market conditions more severe or unpredictable than recent experience, new or changes to regulations, and stakeholder mitigations that could have a material influence on construction methods or schedule.

The cost estimates do not include MWRA's allocation for construction contingency (7% for non-tunnel projects and 15% for tunnel projects) which is included in the FY CIP, but outside item 625 Metro Tunnel Redundancy. This construction contingency is intended to cover potential change orders.

### **Future Cost Updates**

Updated construction cost estimates will be performed throughout final design. Cost estimates will be updated at the 60%, 90%, and 100% design stage for each construction package. These future cost estimates will also be bottom-up estimates, with increased level of detail, and will account for design advancement, additional understanding of geologic conditions, refined material quantities, updated construction means and methods, risk allocation, some stakeholder mitigations, annual inflation, and market conditions. Future cost estimates will include a design contingency that is reduced in consideration of the stage of design advancement. The next

bottom-up cost estimate will be available at the completion of 60% design for the first tunnel construction package, which is projected to be approximately 18 months after the final design notice to proceed. This cost estimate will be reflected in the subsequent CIP update.

## **Cost Controls**

Staff are implementing a number of cost control measures, including managing to a Program schedule to reduce the influence of inflation on the Program and robust project controls processes to manage expenditures. Monthly monitoring of the Program schedule and detailed dashboards to monitor consultant costs are two key project control measures that help Staff manage to the budgets established in the CIP.

Cost control measures are being incorporated in the design of the Program as well. Measures to reduce risks and increase efficiency in construction are considered throughout the design development. As part of the design development, staff are implementing a risk management process to identify and mitigate risk, qualitatively and quantitatively. As a result, staff and Program consultants are actively incorporating mitigations into the design of the Program. These include:

- Suitably locating and sizing launching shaft sites that reduce impacts on the environment and third parties, which could result in costly mitigation, such as locating them adjacent to highways for ease of material/equipment transport and near water bodies for simplified groundwater treatment and discharge;
- Shifting tunnel alignments to reduce risk presented by key geologic features, such as the Northern Border Fault;
- Developing a contract packaging approach that reduces construction contract interface risks, and controlling contract sizes to ensure a maximum number of qualified bidders;
- Planning for early enabling works packages in order to prepare shaft sites for the tunnel contractors and reduce the risk of delaying the start of tunnel construction;
- Selecting consultants with sufficient expertise and resources to complete quality work on time and maintain schedule; and
- Implementing construction contract practices that will promote good competition by qualified bidders and reduce the amount of contingency included in the bids. These practices include risk allocation tools such as Geotechnical Baseline Reports, commodity escalation clauses (per Massachusetts Law), and potentially prequalifying tunnel contractors.

## **Program Financial Considerations**

The estimated cost of the Tunnel Program has evolved as information and time have progressed. During the early presentations to the Board, the Advisory Board, and stakeholder groups, staff used an estimate of \$1.341 billion, representing the average of two possible alternatives: Alternative 2A - two tunnels, one to the north and one to the south, totaling 14 miles with an

estimated cost of \$1.183 billion; and Alternative 3D – also, two tunnels, though further north to Shaft 9A in Malden and south to Shaft 7C, totaling 18.2 miles with an estimated cost of \$1.499 billion (value date of October 2015).

The Tunnel Program was first included as Project 625 Metro Tunnel Redundancy in the Proposed FY17 CIP. Project 625 as proposed was revised from earlier alternatives to include additional sub-phase work on the WASMs, the Wachusett Aqueduct Pumping Station and other improvements. In the FY17 CIP, Project 625 included an estimated project cost of \$1.429 billion plus \$41 million related to inflation. For the FY18 CIP, the additional sub-phases were moved from Project 625 to a different project, reducing the cost to \$1.259 billion plus \$99 million for inflation. Annually, the Project cost estimate is revised to reflect updated amounts due to contract awards, design progress, revised estimates and inflation.

Staff continue to assume the Tunnel Program will be financed with long-term tax exempt bonds and funding from the Massachusetts Clean Water Trust<sup>1</sup> through State Revolving Funds. The debt service for these bonds is modeled based on the current CIP estimated cost, conservative estimated interest rates and a thirty-year level amortization. The water utility assessment projections included with the Proposed FY25 Current Expense Budget (CEB) include this additional debt service.

As Tunnel Program spending increases with the commencement of construction, MWRA will likely utilize short-term borrowings for the construction in progress. Staff will structure the long-term borrowing to permanently finance the Tunnel Program around existing water debt service. The utilization of short-term borrowings for construction in progress and structured long-term debt will help mitigate the impact on the Water Utility's assessments. Each fiscal year as the CEB recommendation is developed, staff iteratively monitor the necessary revenue from community assessments. All additions, deletions and revisions to the CEB are evaluated for the impacts to the rate of increase to the assessments. The Proposed FY25 CEB resulted in a 3.9% increase to the Water Utility assessment and the model projected a 3.9% increase for Fiscal Years 2025-2029. This proposed increase, and the projected increases, includes the impact of the modeled debt service associated with the Tunnel Program included in the Proposed FY25 CIP.

#### **BUDGET/FISCAL IMPACTS:**

The proposed FY25 CIP includes \$2.1 billion for the Metropolitan Water Tunnel Program. This budget will be refined during and at the completion of Final Design.

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<sup>1</sup> The Trust provides low-interest loans and grants to water utilities through the Massachusetts State Revolving Funds to assist in financing water infrastructure projects.



*Presentation to*

## **MWRA Board of Directors**

### *Metropolitan Water Tunnel Program FY25 CIP Updated Program Cost Estimate and Cost Controls*

March 13, 2024



# Tunnel Program CIP History (625 Metro Tunnel Redundancy)

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Annual Adjustment (Including Annual Inflation) <sup>3</sup>	N/A	\$69.6	\$30.2	\$33.8	\$85.2	(\$6.7)	\$57.5	\$237.6	\$347.1

1. FY18 Other Projects item reflects ~\$186M in costs moved out of 625 Metro Tunnel Redundancy and into other CIP items.
2. FY25 construction item includes \$200M cost increase and \$130M in annual inflation over FY24.
3. Annual Adjustment includes annual inflation and other revisions to reflect contract status. FY25 Annual Adjustment includes \$200M construction cost increase. Amounts are included in the Total FY CIP amount for each FY.



# Preliminary Design Construction Cost Estimates & Proposed FY25 CIP

- Based on 30% design / EIR configuration, anticipated construction methods, currently understood ground conditions, contract packaging/sequence/schedule & current market conditions
- Two bottom-up construction cost estimates (Jan 2023 value date)
- Include 25% design contingency, 4% contractor escalation
- First construction cost estimate since 2016
- As compared to FY24 CIP:
  - Added \$200M to tunnel construction plus annual inflation (\$130M)
  - No changes to Design/CM or Admin/Legal/PR beyond annual inflation (\$17M)
- Construction contingency (15% tunnel/7% non tunnel) is included in the CIP separately





## Future Cost Updates

- Updated cost estimates will be done at all design milestones for each construction package during Final Design:
  - 60%, 90%, 100%, Bid
  - 2 tunnel construction packages
  - 2 or 3 early enabling construction packages
- Design contingency will decrease as design stage increases
- Future cost updates will be incorporated into CIPs regularly



# Key Cost Controls Principles

## Implemented:

- Maintained schedule through preliminary design & environmental reviews
- Maintained focus on key Program goals, modified where long-term value is provided or schedule/risk is reduced
- Strategically located shafts, selected segment lengths & contract packaging

## Ongoing & Future:

- Maintain schedule
- Select FDE and CM that are appropriately skilled, organized & resourced
- Identify/avoid/minimize/mitigate geo-hazards
- Avoid costly mitigations
- Execute early enabling construction works
- Promoting good competition
- Balance risks



# Tunnel Program Financial Considerations

- Finance with long-term tax exempt bonds & Mass Clean Water Trust (SRF)
- Debt service is modeled on current CIP\$, conservative interest rates, for 30 yrs
- Water Utility assessment in proposed FY25 CEB includes this debt
- Proposed FY25 CEB includes 3.9% increase to the Water Utility assessment
- Short-term borrowing for construction spending
- Structured long-term debt

} Mitigates impact on Water Utility assessment

