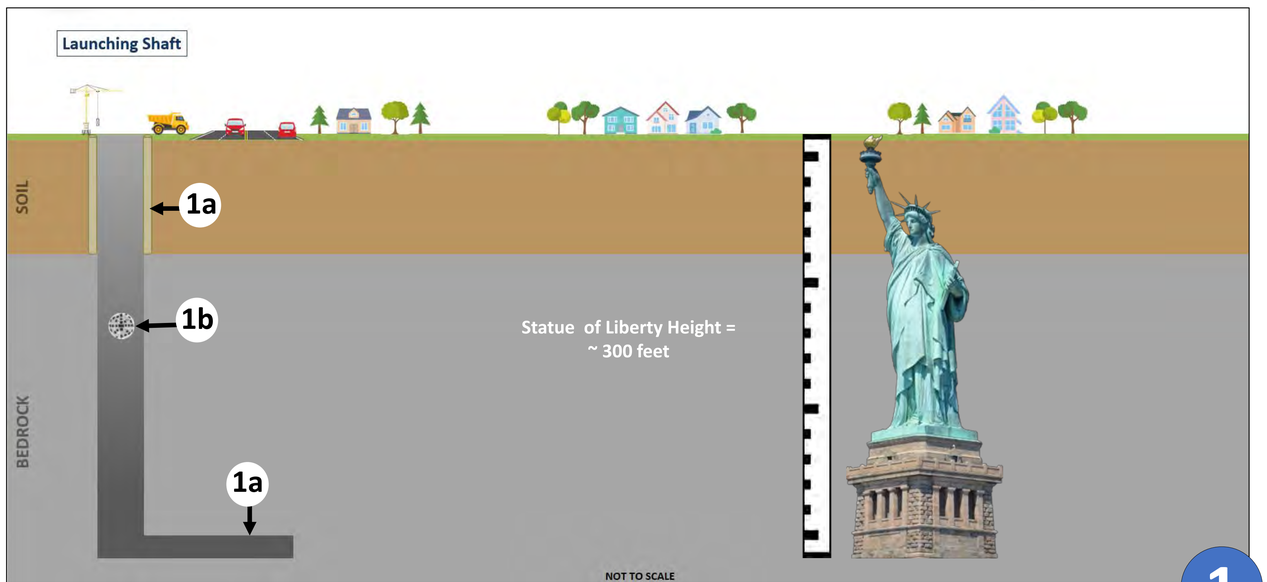
MWRA Metropolitan Water Tunnel Program

Conceptual Tunnel Construction



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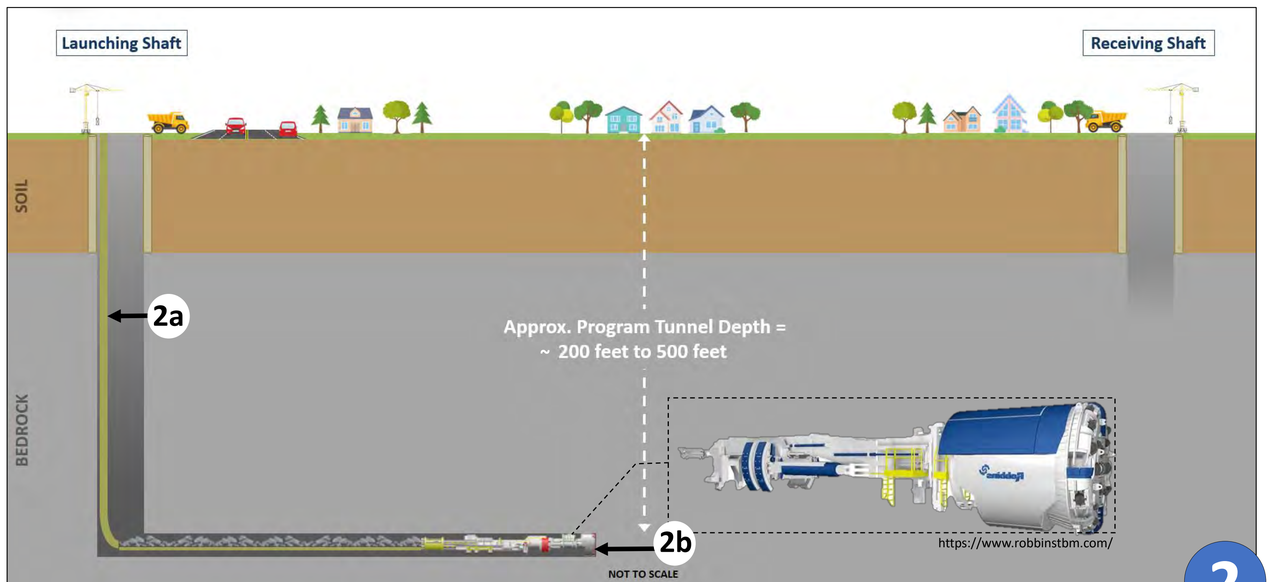

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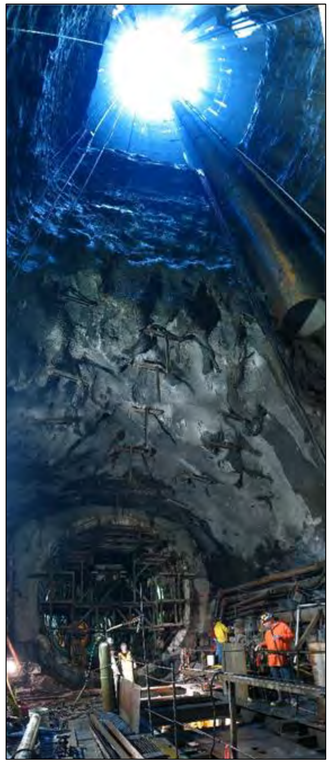
Launching Shaft Construction



1a. The launching shaft and starter tunnel will be constructed by drill and blast methods to provide access and a workspace for tunnel construction, roughly 200 to 500 feet below ground.
The launching shaft is where excavated rock is removed and workers, materials and equipment access the tunnel.

1b. The Tunnel Boring Machine (TBM) is lowered in pieces to the bottom of the launching shaft. Crews assemble the TBM underground, preparing it for mining.

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Tunnel Excavation

2a. The TBM requires significant electrical power to operate. Cables from the surface supply energy to drive the cutting head, conveyor systems, and support machinery underground. Ventilation ducts and fans are installed to provide clean air to the workers deep underground.

2b. As the TBM advances steadily through the bedrock, excavated rock is transported back to the launching shaft for removal. TBM operations are continuous, 24-hours a day, 7-days a week. The TBM will mine a maximum distance of ~6.8 miles from a launching shaft to a receiving shaft.

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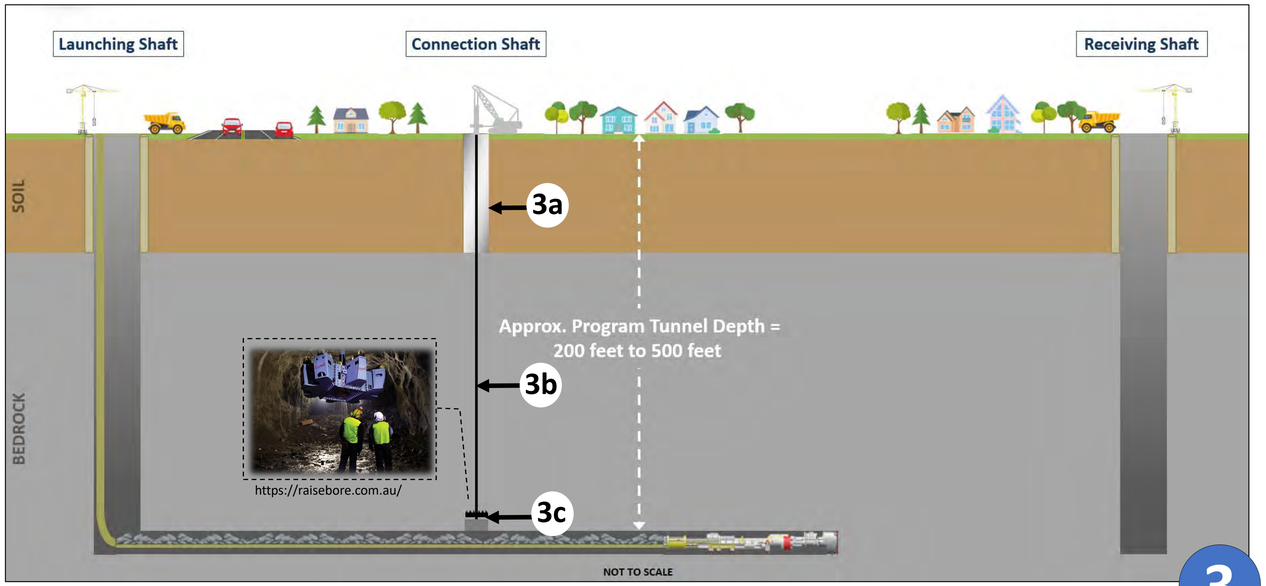
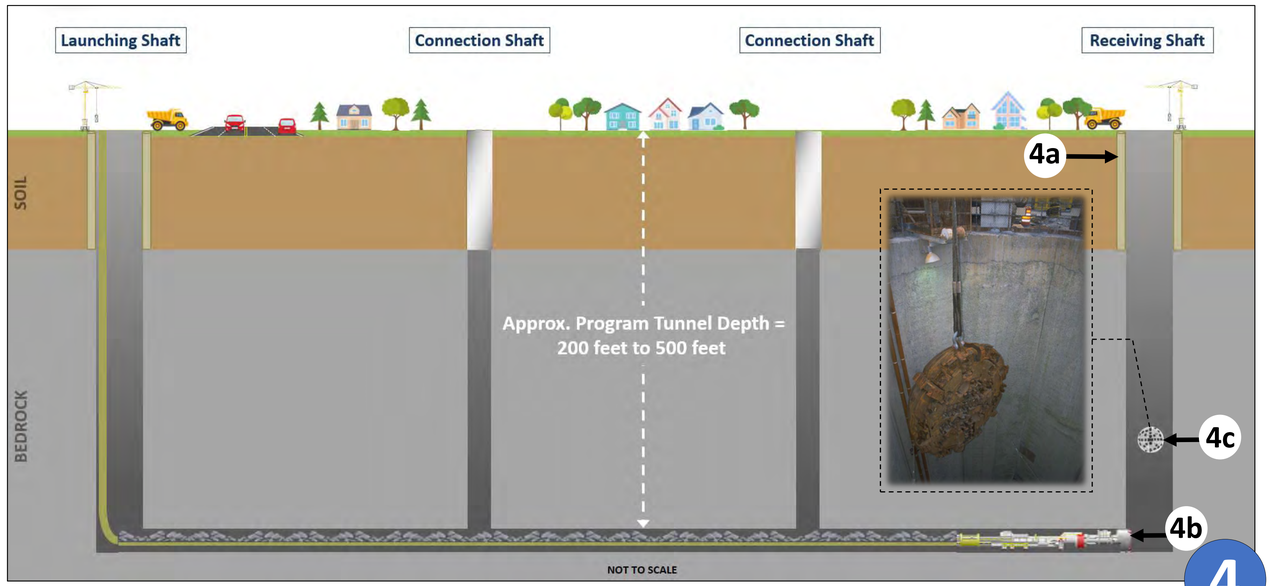


3

Connection Shaft Construction



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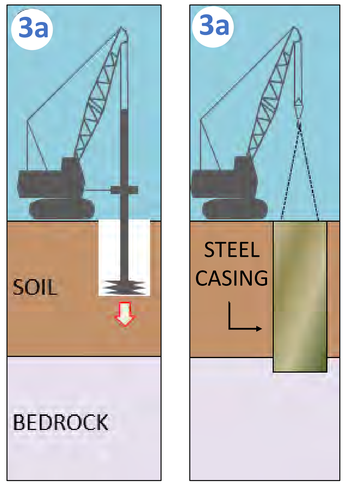
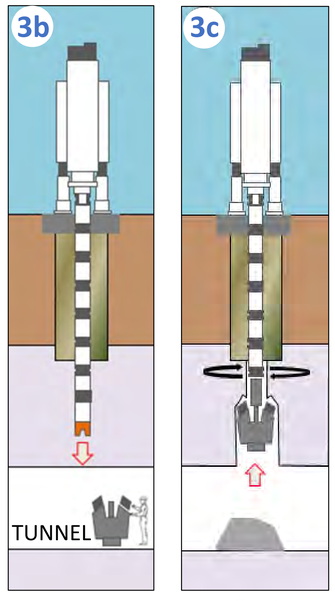
Receiving Shaft Construction

3a. Most connection shafts will be constructed via a raised bore. Auger drilling is done through the soil layer along with installation of steel casing to stabilize the shaft walls.



3b. A small-diameter pilot hole is then drilled through the bedrock to the top of the tunnel.

3c. From inside the tunnel, a large reamer head is attached to the drill unit and pulled upward, enlarging the drill hole to the desired shaft diameter. The rock cuttings drop to the tunnel below and are transported to the launching shaft for removal.



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4a. The receiving shaft is constructed after the TBM is launched.

4b. The TBM keeps tunneling until it reaches the receiving shaft where it “breaks through” the receiving shaft wall.

4c. The TBM is disassembled at the bottom of the receiving shaft and removed.

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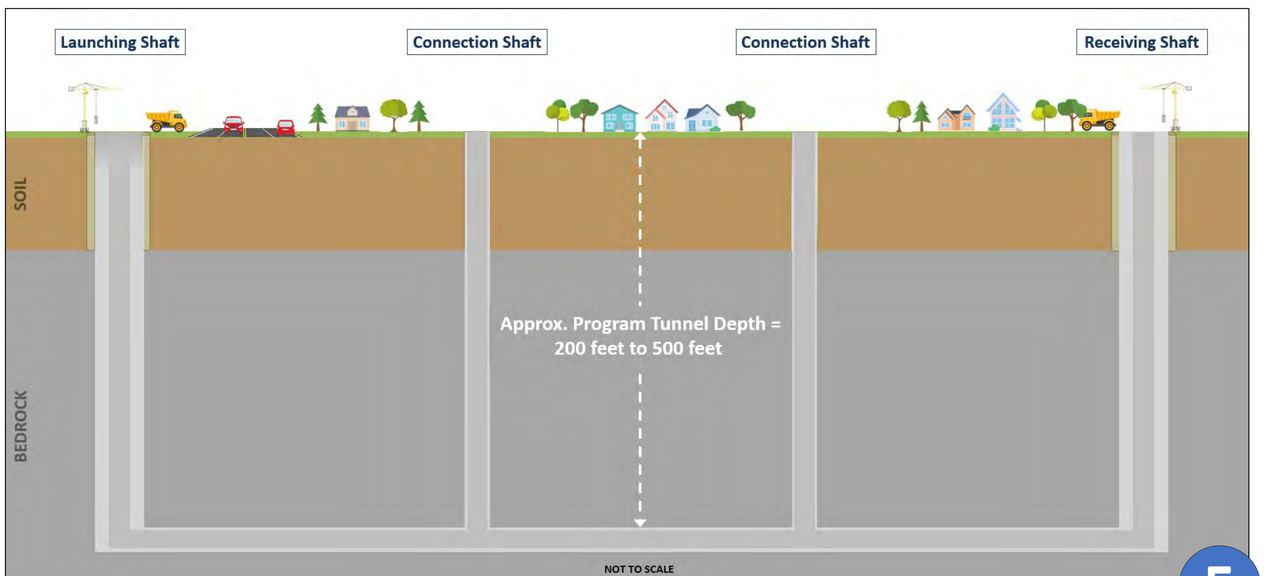

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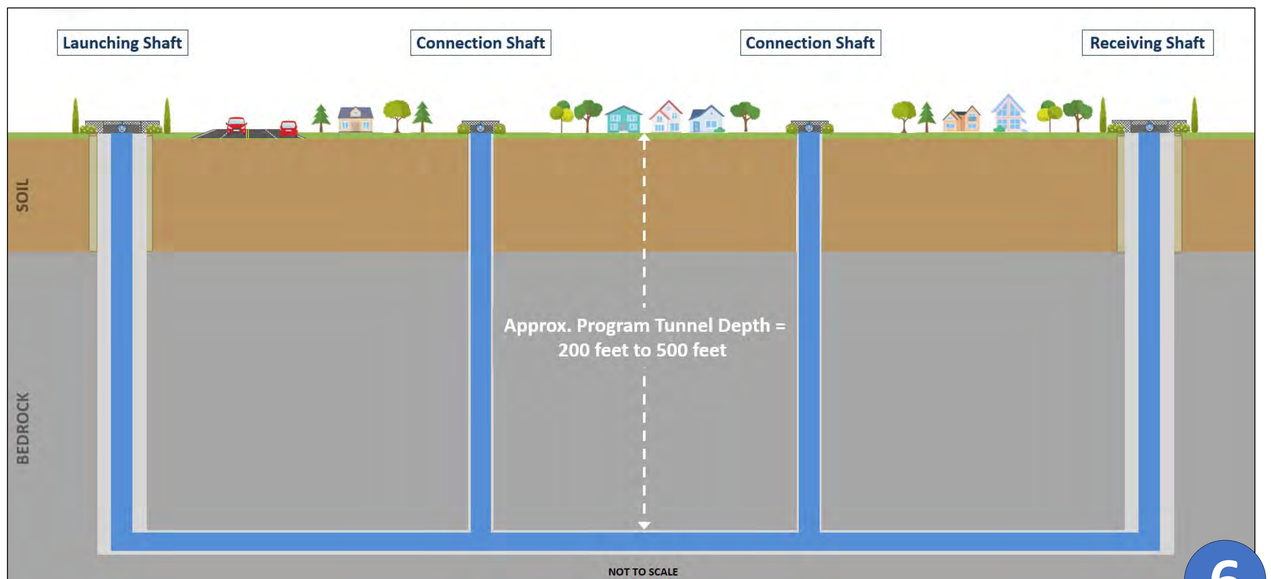

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Tunnel Lining

5. Once excavation is complete, the tunnel and shafts will be lined with a combination of cast-in-place concrete and steel.

Form for Concrete Lining

Final Lining

Reinforcement

Steel Liner

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Surface Connections, Disinfection & Flushing

6. Subsurface valve vaults and pipelines are constructed to complete the connections from the top of shafts to existing water systems.
The tunnel and shafts undergo a disinfection process. Chlorination methods are used to eliminate bacteria and contaminants, ensuring the new system meets water quality standards.

Once testing confirms the system is clean, the tunnel is filled with water and fully integrated into the MWRA Water System.