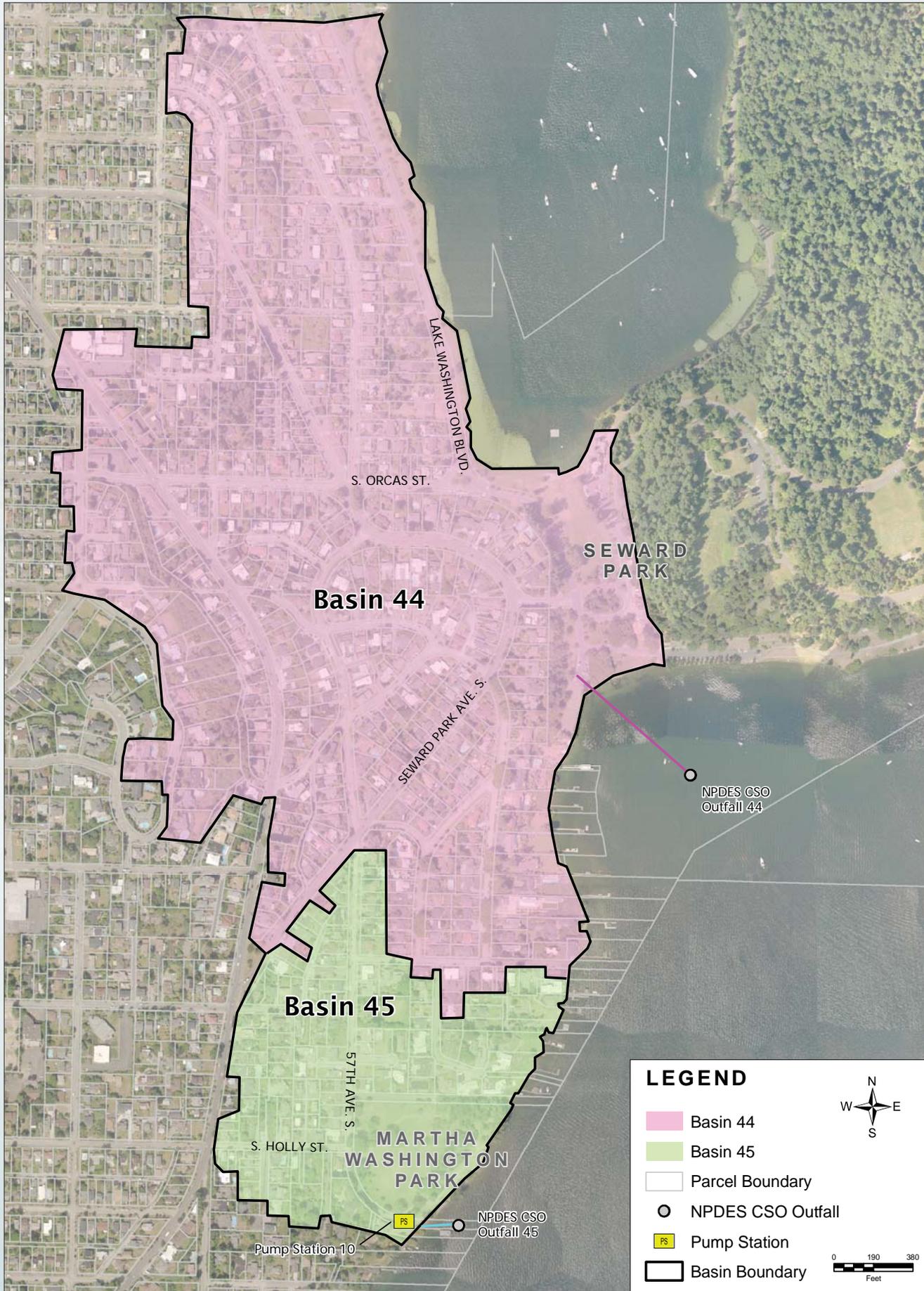


North Henderson (Basins 44 & 45)



The North Henderson CSO Reduction Project will reduce the amount of sewage and stormwater that overflows into Lake Washington

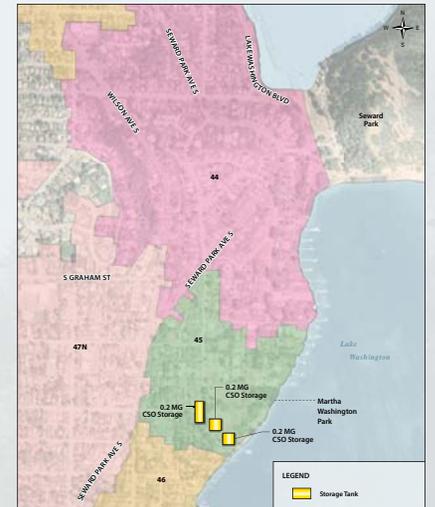
Summary of North Henderson Alternatives



Distributed Storage ➔ Cost Range \$ \$35-75 Million

These alternatives would construct two underground storage tanks to hold approximately 2.4 million gallons (Basin 44) and 200,000 gallons (Basin 45)

- Requires one location in both Basin 44 and Basin 45
- Location could be under park, under street, or under private property



Tunnel Storage ➔ Cost Range \$ \$45-96 Million

This alternative would store 2.6 million gallons in a tunnel underneath private property between Seward Park and Martha Washington Park

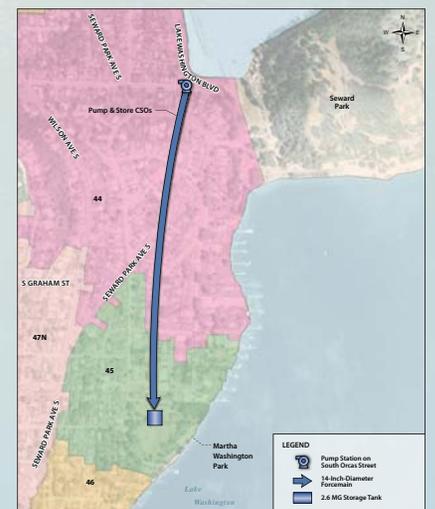
- Inherent risks associated with tunneling technologies



Conveyance and Storage ➔ Cost Range \$ \$43-93 Million

This alternative would send flows through a pipeline from Basin 44 to Basin 45 and store them in a 2.6 million gallon underground tank near Martha Washington Park

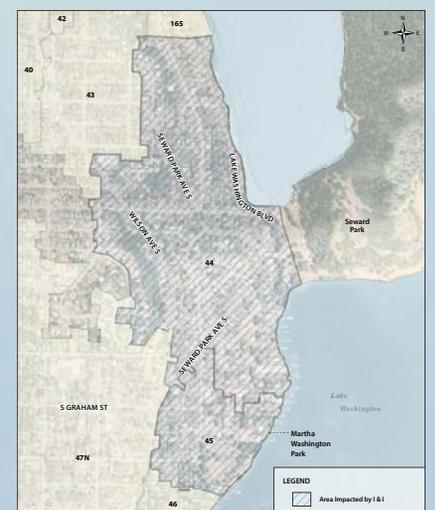
- Construction at a pump station and storage tank site is spread out over a wide area, so impacts to neighborhoods, businesses, and local streets could be extensive



Complete Separation ➔ Cost Range \$ \$55-117 Million

Prevents stormwater runoff from private property from entering the combined sewer system

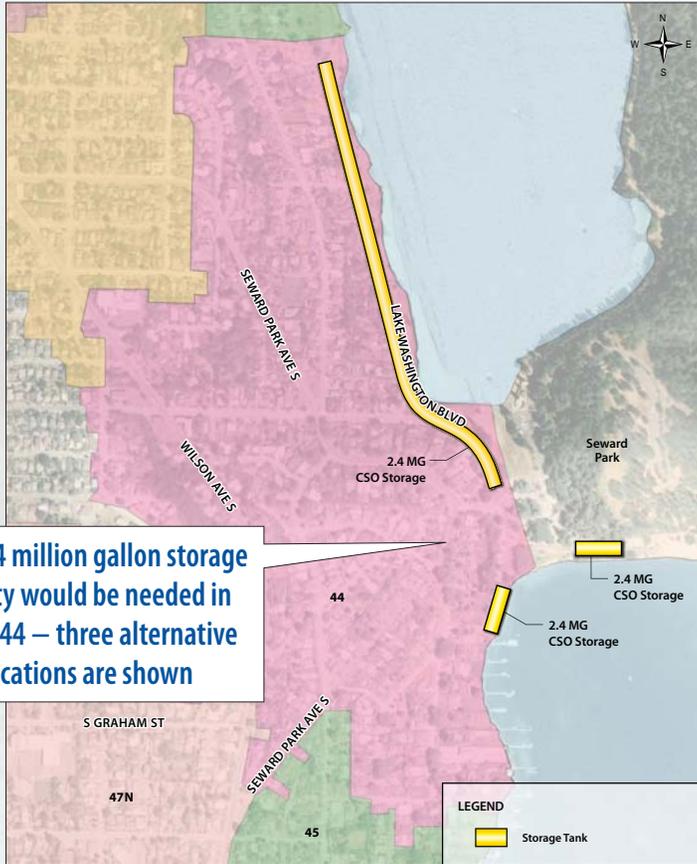
- Requires private property owners to disconnect roof and foundation drains and install rain gardens and cisterns, as well as repair side sewers and sewer mains to prevent infiltration of stormwater



Basin 44 Distributed Storage



What Might it Look Like in Henderson Basin 44?

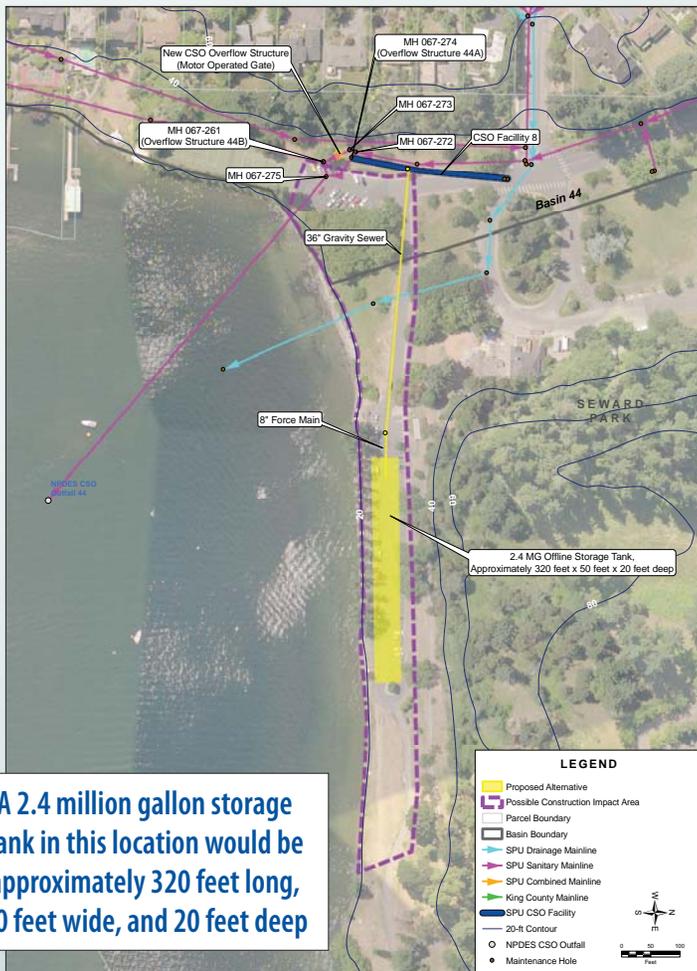


One 2.4 million gallon storage facility would be needed in Basin 44 – three alternative locations are shown

A 2.4 million gallon storage pipeline under Lake Washington Boulevard would require a 12-foot-diameter pipeline approximately 3,000 feet long

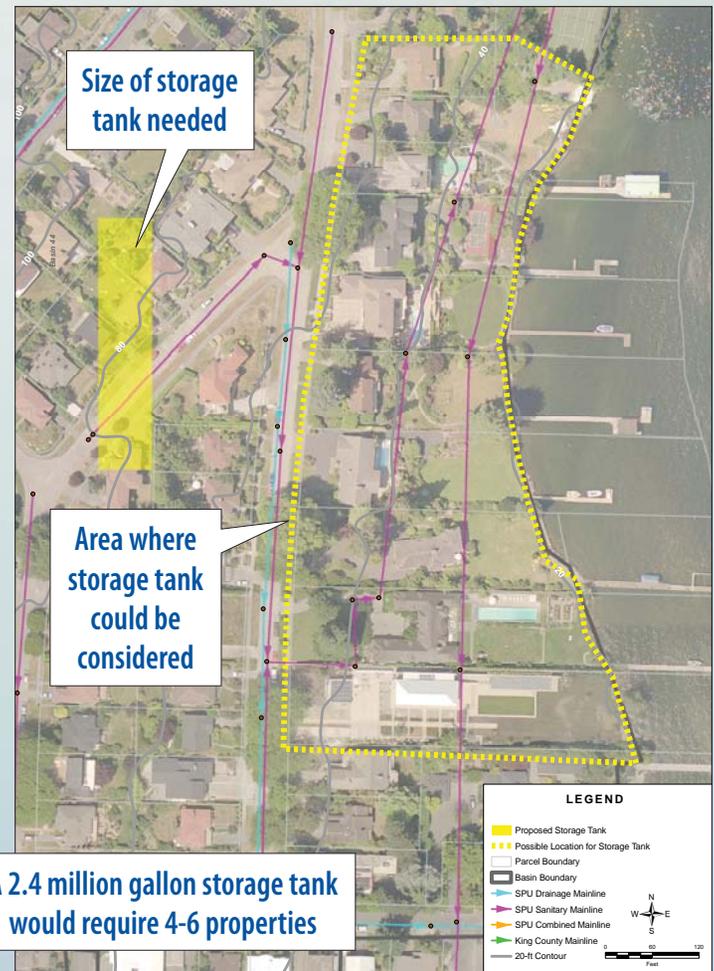


Example of storage under Lake Washington Boulevard



A 2.4 million gallon storage tank in this location would be approximately 320 feet long, 50 feet wide, and 20 feet deep

Example of storage in Seward Park



Size of storage tank needed

Area where storage tank could be considered

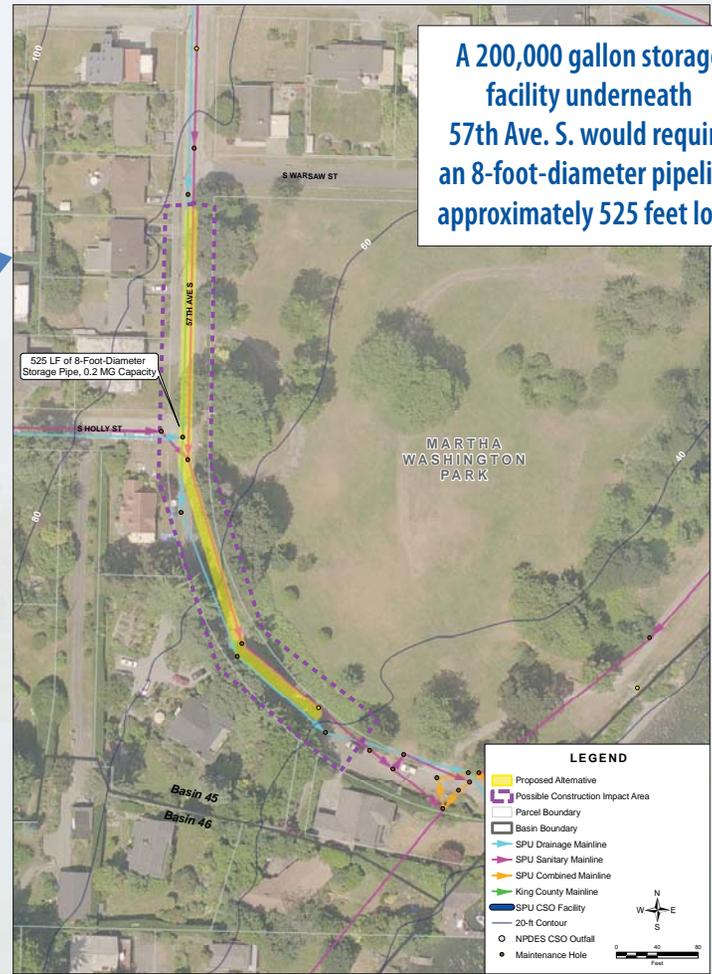
A 2.4 million gallon storage tank would require 4-6 properties

Example of storage under private property

Basin 45 Distributed Storage



What Might it Look Like in Henderson Basin 45?

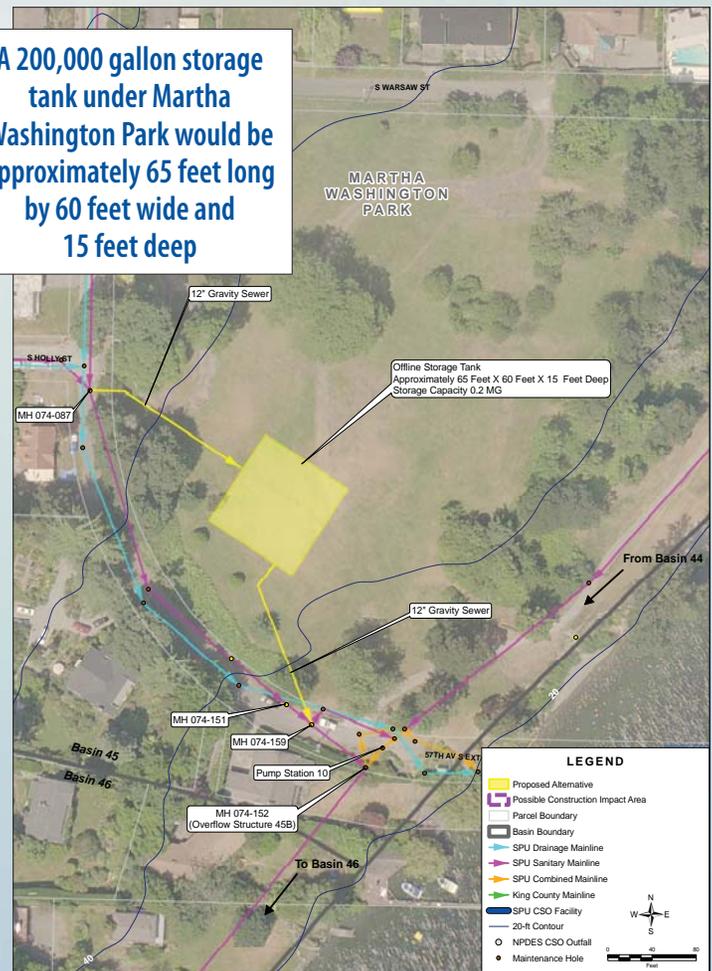


Example of Right of Way Storage



A 200,000 gallon storage tank under private property would require 1-2 properties and a new pump station

Example of storage under private property



Example of storage tank in Martha Washington Park

During Construction...

Tank construction would last 1-2 years



Tank Construction (Oakwood RTB) Detroit, MI



Excavation and shoring



Tank Construction (Oakwood RTB) Detroit, MI

After Construction...

Once construction is complete, most of the facility will be underground – some above ground features are required for maintenance access



Surface features of a below-ground pump station
(53rd Ave. Pump Station) Seattle, WA



Surface features of a below-ground reservoir
(Cal Anderson Park, Capital Hill) Seattle, WA



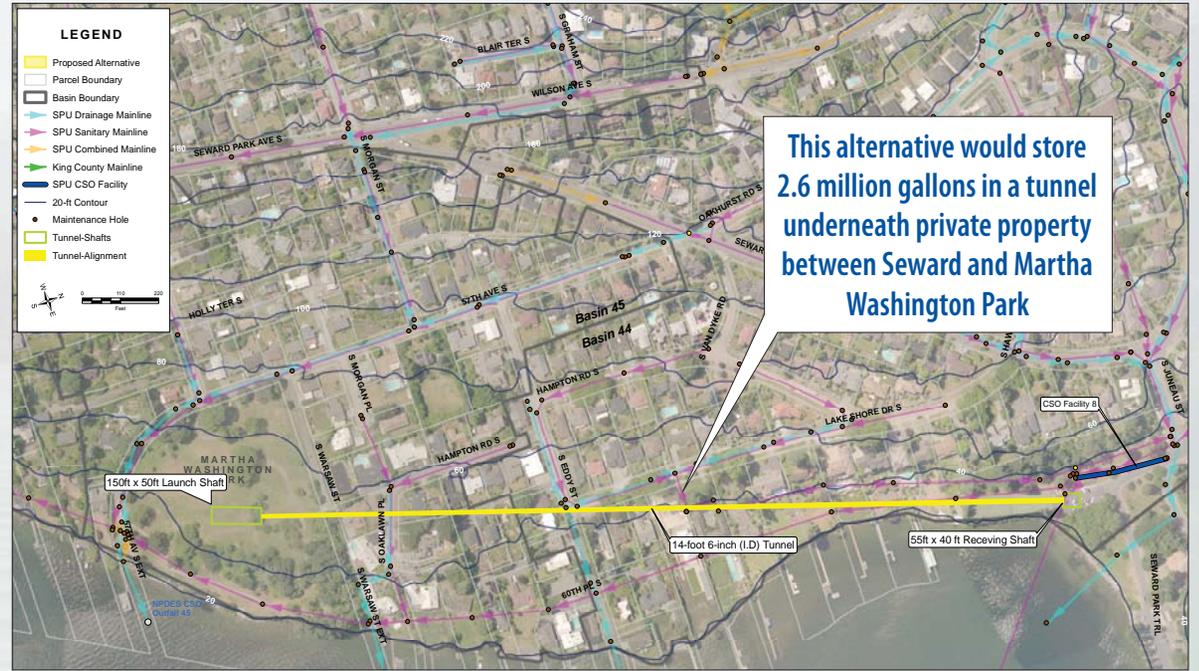
Surface features of a below-ground storage tank
(North Creek Storage Facility) Bothell, WA

An underground storage facility in Seward Park could be located underneath an existing parking lot next to the shoreline, and include shoreline restoration

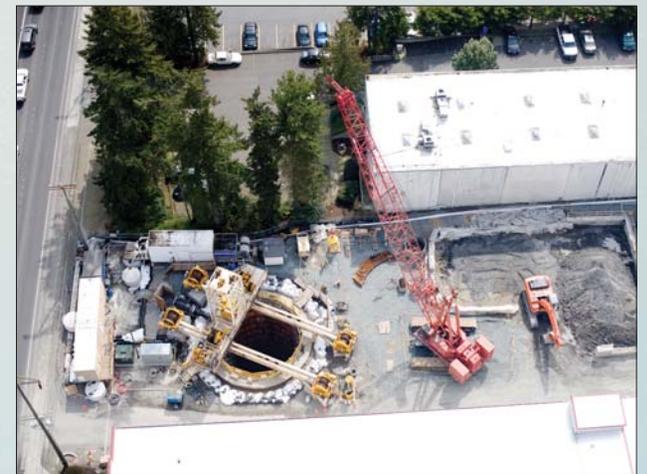


Examples of shoreline restoration projects

What Might it Look Like in North Henderson?



How Would it be Constructed?



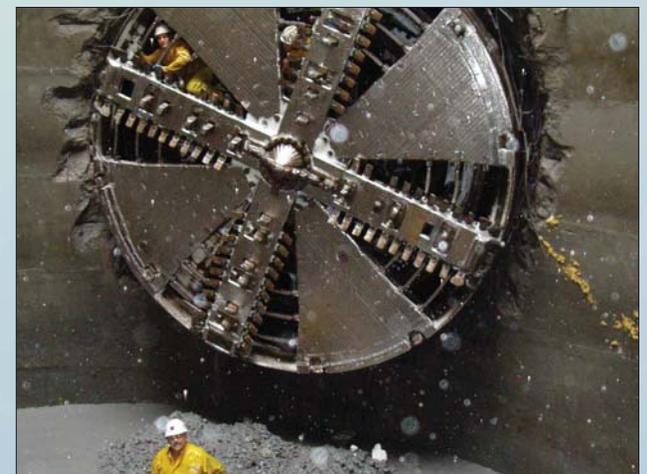
The tunnel would require a construction footprint similar to a large storage tank in order to provide access for the tunnel-boring machine. The entry portal would be approx. 150 feet by 50 feet – the exit portal would be approx. 55 feet by 40 feet



The tunnel would be approximately 2,400 feet long and 14 feet in diameter; a pump station and odor control facilities would also be needed

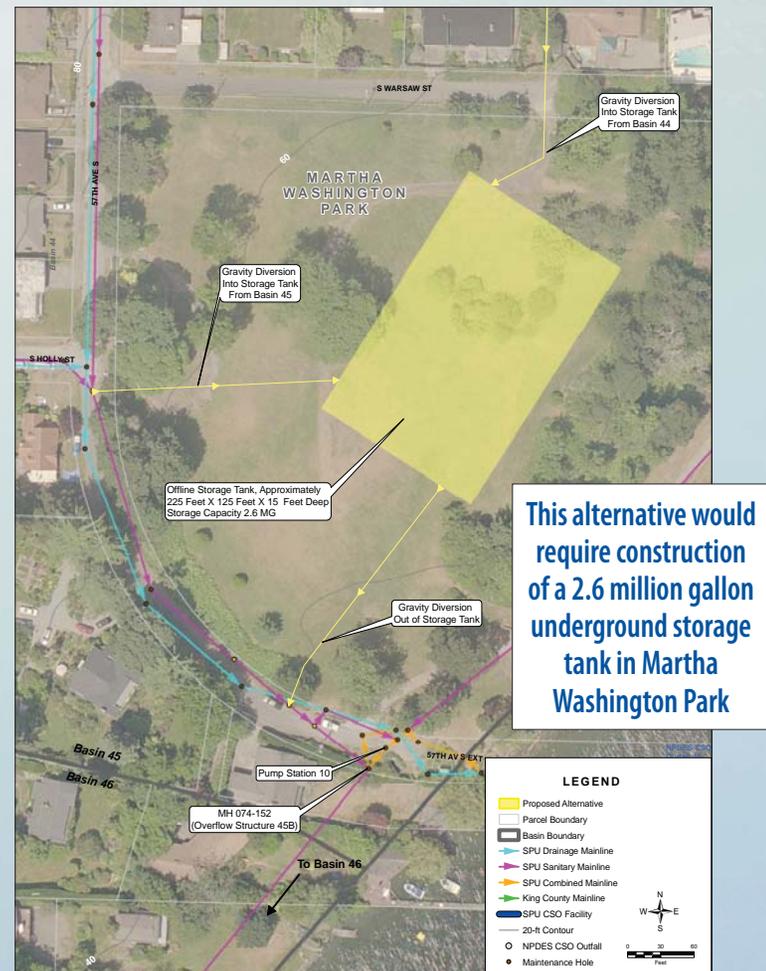
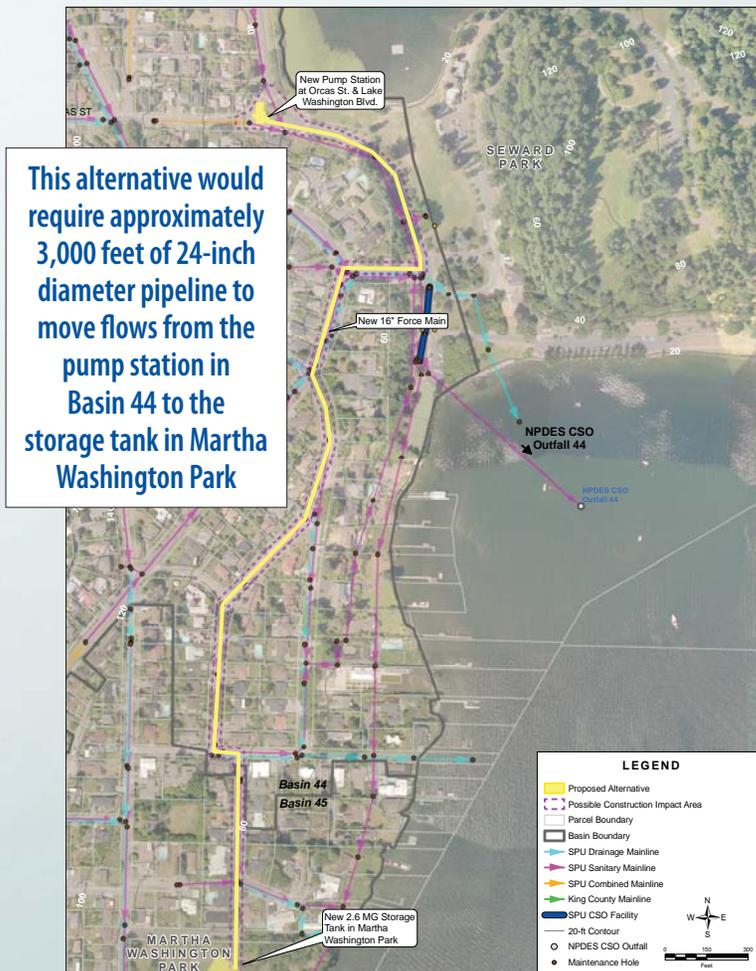
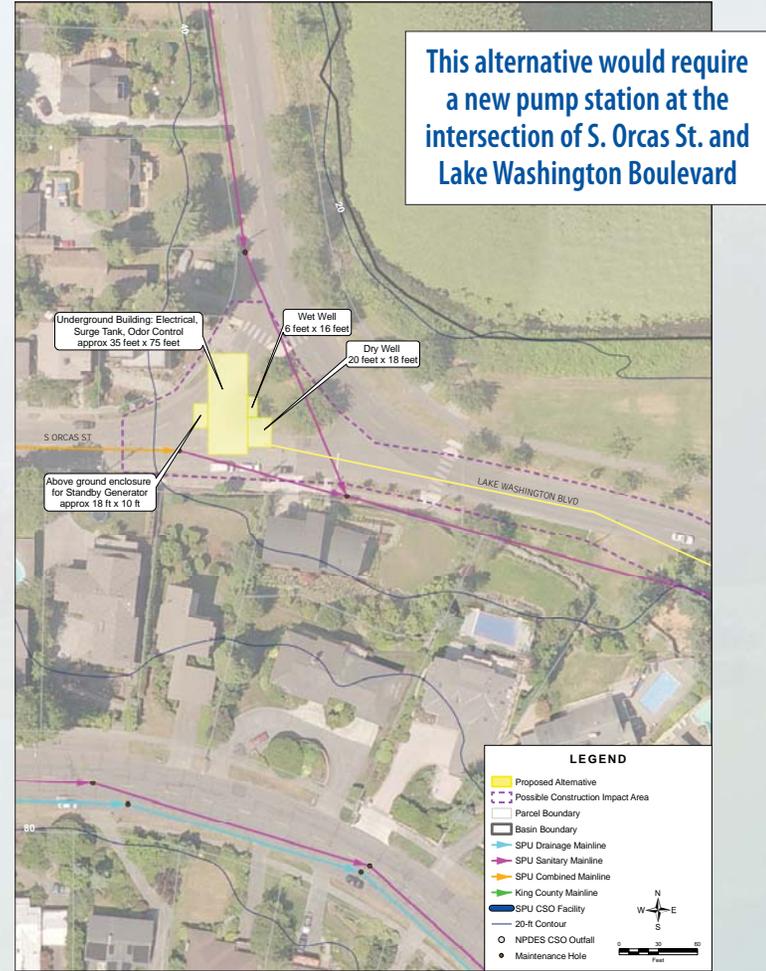
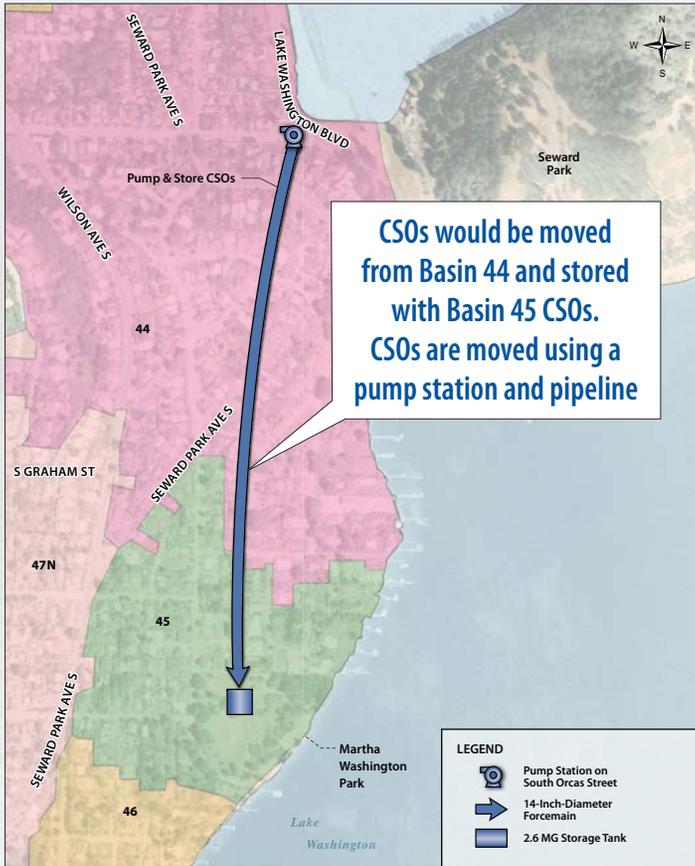


The entrance to the tunnel requires a larger footprint so that the soil and rock excavated from the tunnel can be removed behind the tunnel-boring machine



Easements would be required under 15-20 private properties to allow for tunnel construction

What Might it Look Like in North Henderson?



What Might it Look Like in North Henderson?

To send flows from Basin 44 to Basin 45, a new pump station and pipeline would need to be constructed;
Once the flows are moved from Basin 44, a storage facility must be built to store the volume in Basin 45

During Construction...



Example of pipeline construction



Example of pump station construction



Example of storage tank construction

After Construction...

Once the storage tank is completed, vents, air intakes, and access hatches will be visible on the surface



Example of pipe access



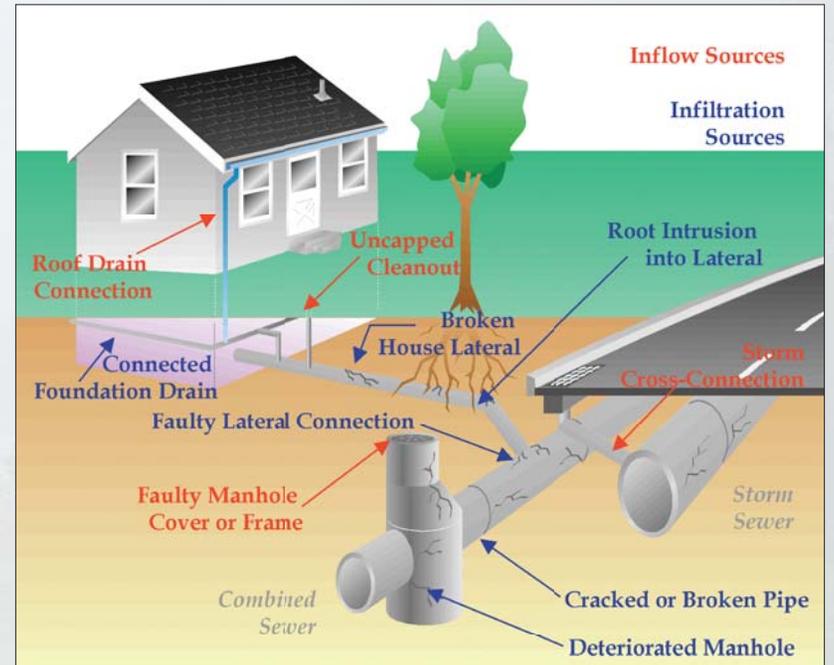
Example of storage access



Example of storage access

Where Does the Rain Get In?

- Inflow is stormwater that enters the combined sewer system from sources such as roof drains, catch basins, and driveway drains
- Infiltration is groundwater that enters the combined sewer system through cracks and openings in the sewers or foundation drains
- Inflow and Infiltration (I & I) Reduction requires disconnecting inflow sources on public and private property, and repairing or replacing broken side sewers and sewer mains
- More than 75 percent of I & I comes from private property

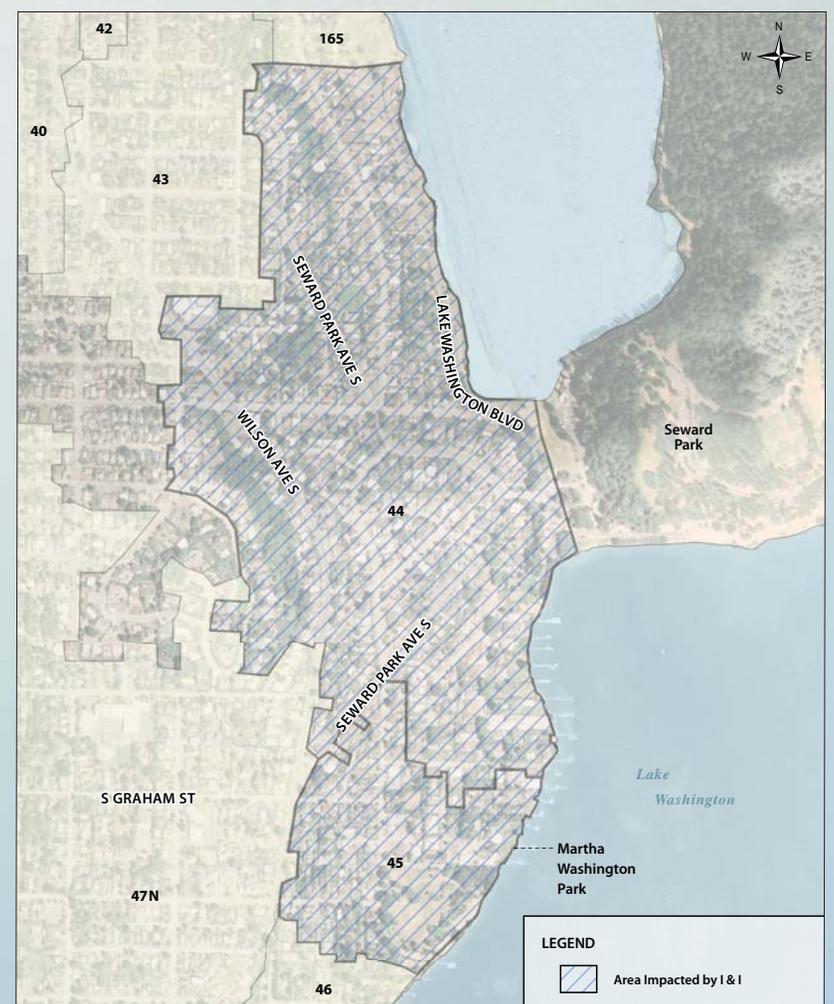


What is Complete Separation?

- Removal of all sources of I & I

How Would it be Constructed?

- Roof and foundation drains would need to be disconnected from existing side sewers and new separated stormwater pipelines would need to be installed from private properties to the storm main
- The existing side sewers serving each property would need to be repaired or replaced
- Every street would require sewer rehabilitation, and the City would also need to extend stormwater mains on streets where there currently are none
- This alternative involves significant repaving of all streets in the neighborhoods
- Full participation from all property owners is required to reduce volumes to the regulatory standard
 - There are 491 homes in Basin 44
 - There are 117 homes in Basin 45



Complete Separation

How Would Complete Separation Work in North Henderson?

Replacing Side Sewers



Legend

- Rain Cisterns
- New Stormwater Lateral
- Pipe Burst Side Sewers and Mains
- Rain Garden
- Pavement Replacement Area

Green Stormwater Infrastructure and Stormwater Treatment for Code Compliance



Replacing Sewer Mains



Actions on Private Property

Repair side sewers



Install a rain garden, where feasible

Install a cistern, where feasible



Almost all homes would require new pipelines to collect runoff and channel it to the stormwater pipeline in the street, as well as a cistern and/or rain garden for stormwater treatment, where feasible

Stormwater treatment vaults needed at each intersection



Disconnect roof and foundation drains from sewer