



# Delaware Aqueduct Bypass Tunnel

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Commissioner

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## **WATER SUPPLY**

- Deliver 1.1 billion gallons of water to 9.6 million New Yorkers every day and maintain 7,000 miles of water mains
- Protect our 2,000 square mile watershed, including 19 reservoirs and three controlled lakes



## **WASTEWATER TREATMENT**

- Treat 1.3 billion gallons of wastewater each day
- Operate and maintain 14 plants, 96 pumping stations, and 7,500 miles of sewers



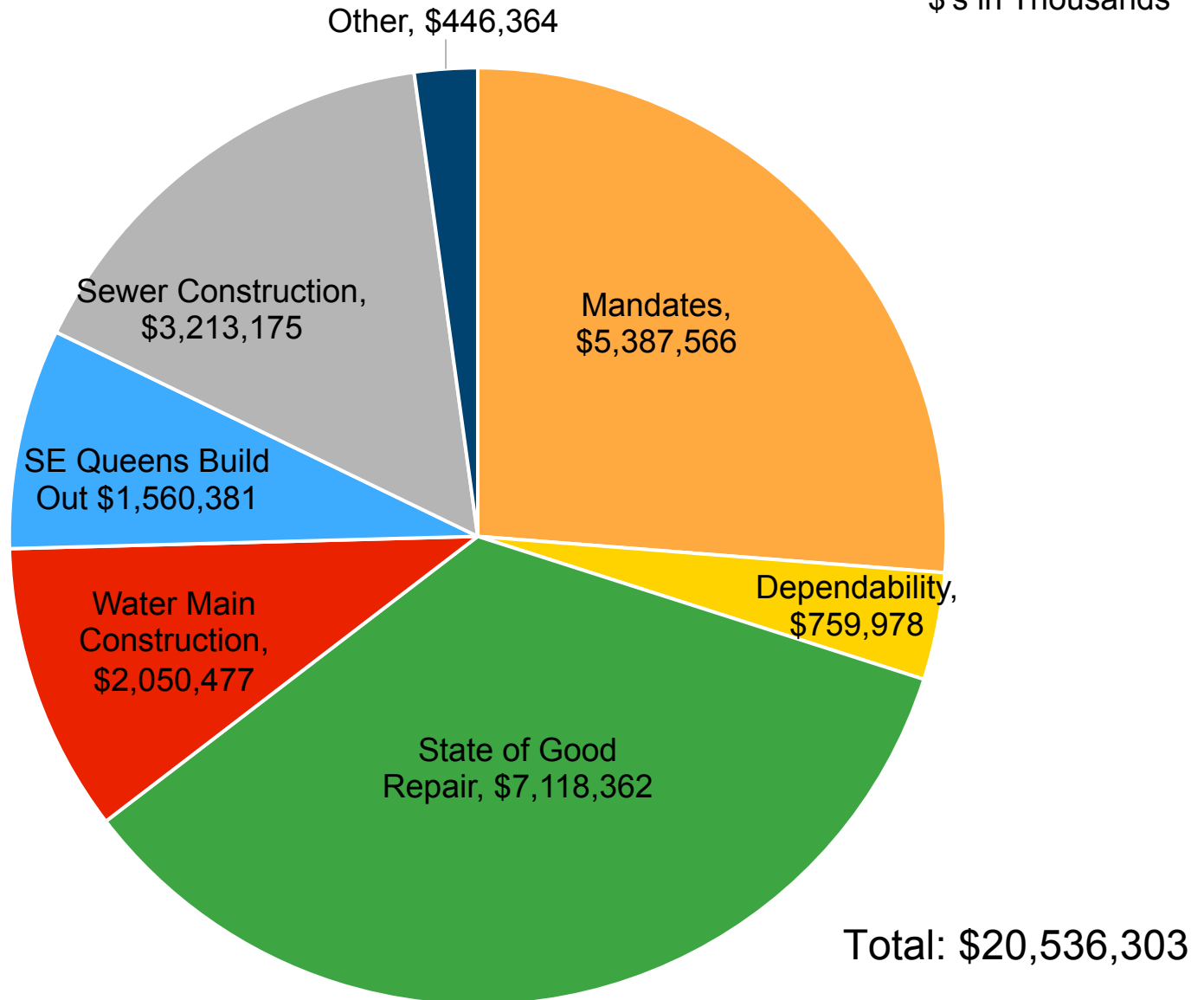
## **AIR, NOISE, AND HAZARDOUS WASTE**

- Update and enforce the Air Code to reduce local emissions, and regulate hazardous waste and noise pollution



# 10 Year Capital Plan: FY20-29

\$'s in Thousands



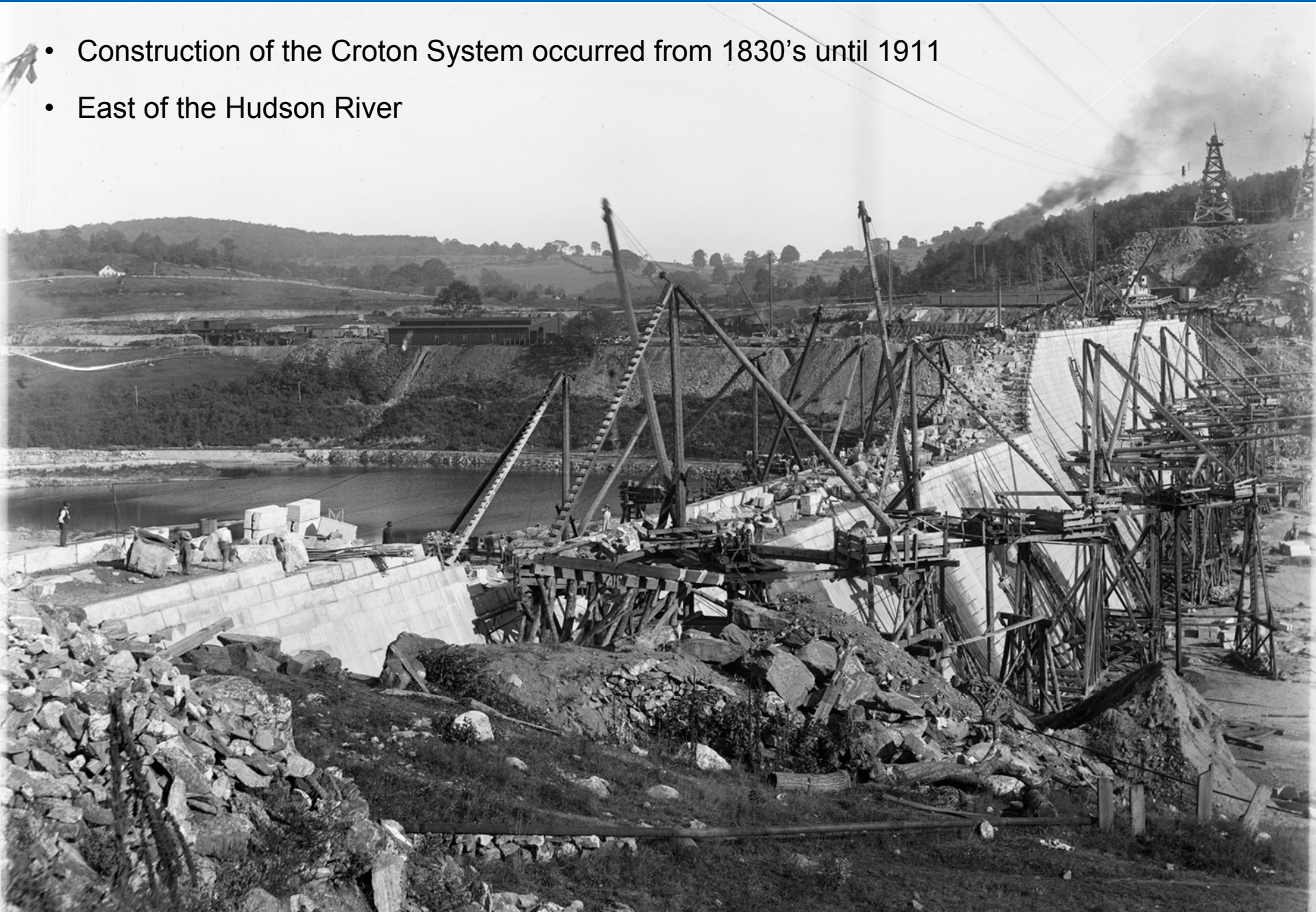
# Repair of the Delaware Aqueduct



- Primarily surface water
- Watershed covers parts of 8 upstate counties in NY plus a small portion of CT
- Nation's largest municipal water supply – 90% unfiltered
- Conveyed by gravity alone

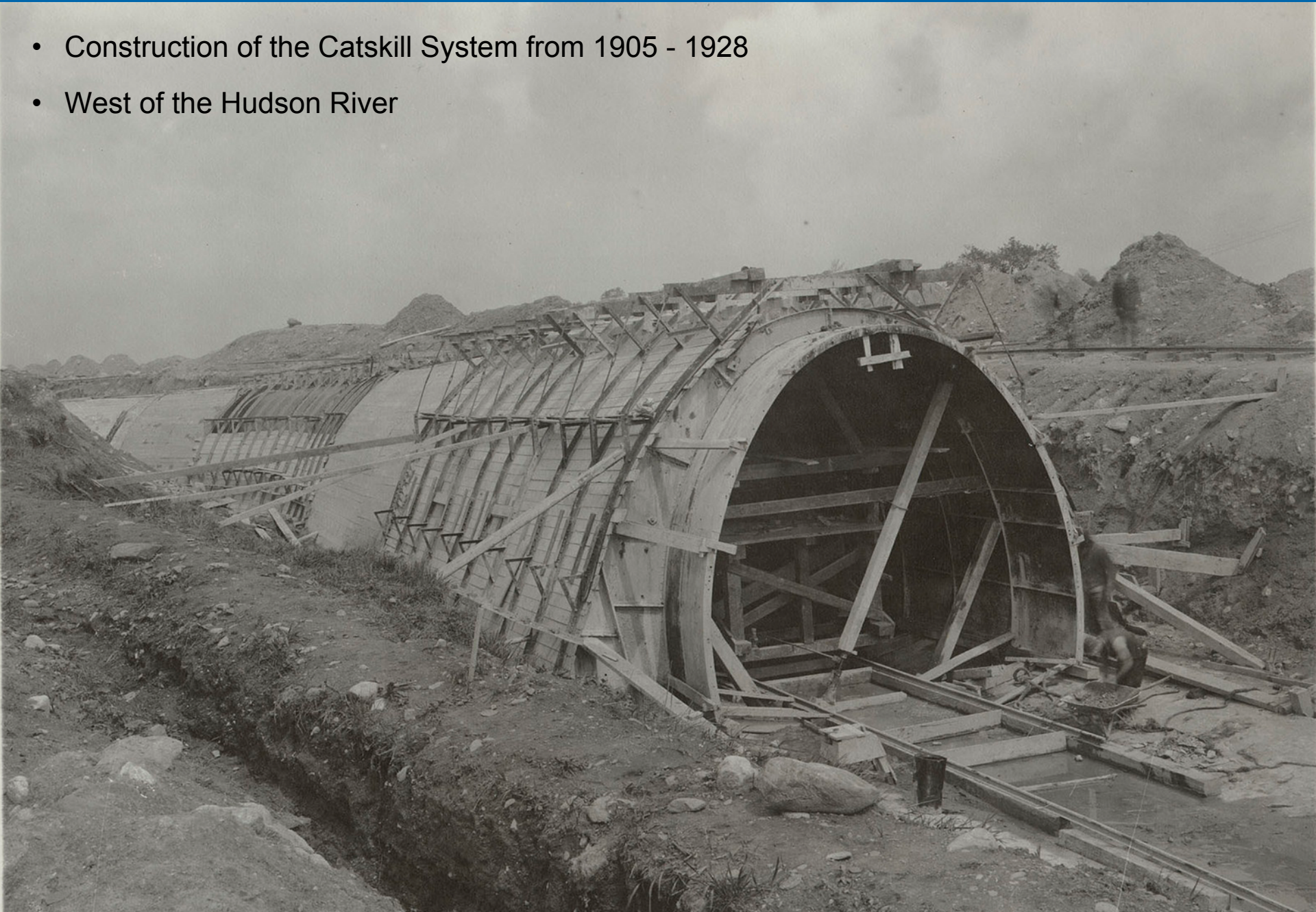


- Construction of the Croton System occurred from 1830's until 1911
- East of the Hudson River





- Construction of the Catskill System from 1905 - 1928
- West of the Hudson River







- Leak discovered in 1990 by utility worker at power plant along Hudson River
- Total leakage rate estimated at approx. 20 MGD on typical day
- Leakage located in Wawarsing and Newburgh
- Approx. 95 percent is leaking from the Newburgh section
- Difficult conditions encountered during construction including faulted limestone
- Steel lining installed through these sections to provide support for the tunnel





# Out of the Limestone

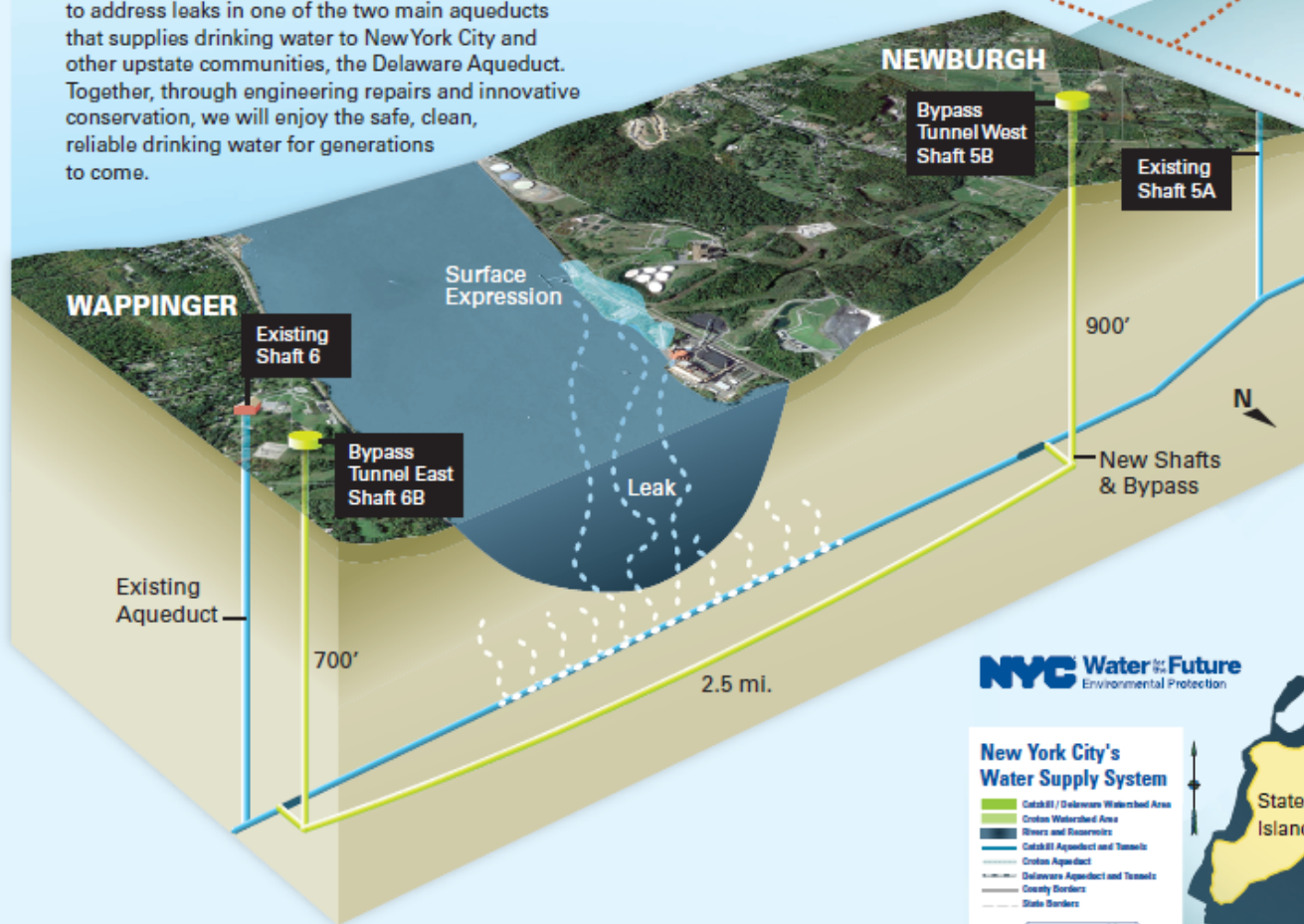
- Three geologic formations make up the valley that the tunnel bore through
  - Normanskill Shale
  - Wappinger Group limestone
  - Mt. Merino Shale



# Delaware Aqueduct Bypass Tunnel

## DELAWARE Aqueduct Bypass

The Water for the Future program has been initiated to address leaks in one of the two main aqueducts that supplies drinking water to New York City and other upstate communities, the Delaware Aqueduct. Together, through engineering repairs and innovative conservation, we will enjoy the safe, clean, reliable drinking water for generations to come.





# Preparations

- Install new pumps inside a shaft at the lowest point of the Delaware Aqueduct for dewatering the existing tunnel before it is connected to the new bypass tunnel.
- Launch a public outreach campaign, with local communities, extensive EIS process including dozens of permits, and acquire properties to build the bypass tunnel
- Excavation of two vertical shafts in Newburgh and Wappinger to gain access to the subsurface.
- The Newburgh site required a significant amount of earthwork, site blasting, and a water treatment system that would treat and dispose of construction related water to the Hudson River



Workers completed a 40 ft. high, 40 ft. wide and 600 ft. long underground chamber at the bottom of the Newburgh shaft to serve as a staging area for the Tunnel Boring Machine (TBM) and the spot from which excavated rock could be brought to the surface by a large hoisting system





# “Nora” Tunnel Boring Machine

- Named after Nora Stanton Blatch Deforest Barney, first female civil engineer in the US
- TBM built to withstand 20 bar of pressure (~300 psi) – the most of any TBM ever manufactured.
- The cutter head is 21.5 feet in diameter, 42.6 feet long, and along with its trailing gear support system, weighs 2.2 million pounds
- Cost \$30M





- Tunneling moved at a pace of approximately 50 feet per day at full production
- Crews worked 24 hours, 5 days per week
- Total length of bypass tunnel is 2.5 miles





# “Breakthrough” in August 2019

Good surveying: Within inches of target!



# Installation of Steel Interliner Sections

- 9,200 linear feet
- 230, 40-foot sections
- 16 feet in diameter
- Each 40-foot section weighs 80,000 pounds
- The new liners are built in full pieces and welded at each joint so they are water tight
- Steel liners are grouted up against the precast segments to hold them in place prior to final concrete lining
- Using concrete pumps, a 1-ft thick final concrete liner is poured around the segments





# Steel liners queued in Newburgh





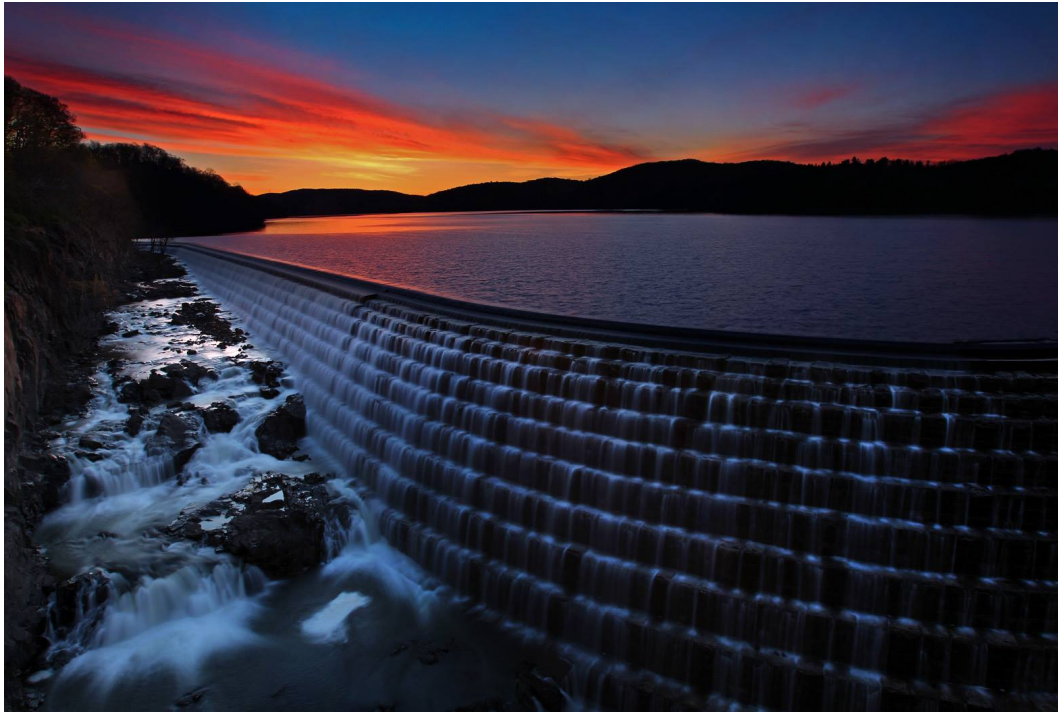
# Interliners lowered into Shaft 5B



- Last interliner installed in May 2020
- 1-ft thick concrete finished liner now being installed

The biggest challenge for this repair project: **Where would NYC get its water during the shutdown of the Delaware Aqueduct?**

- Catskill Aqueduct Rehabilitation – 40 MGD
- Cross River and Croton Falls pumping stations – 240 MGD
- Restart of the Croton System – 290 MGD



New Croton  
Dam Spillway

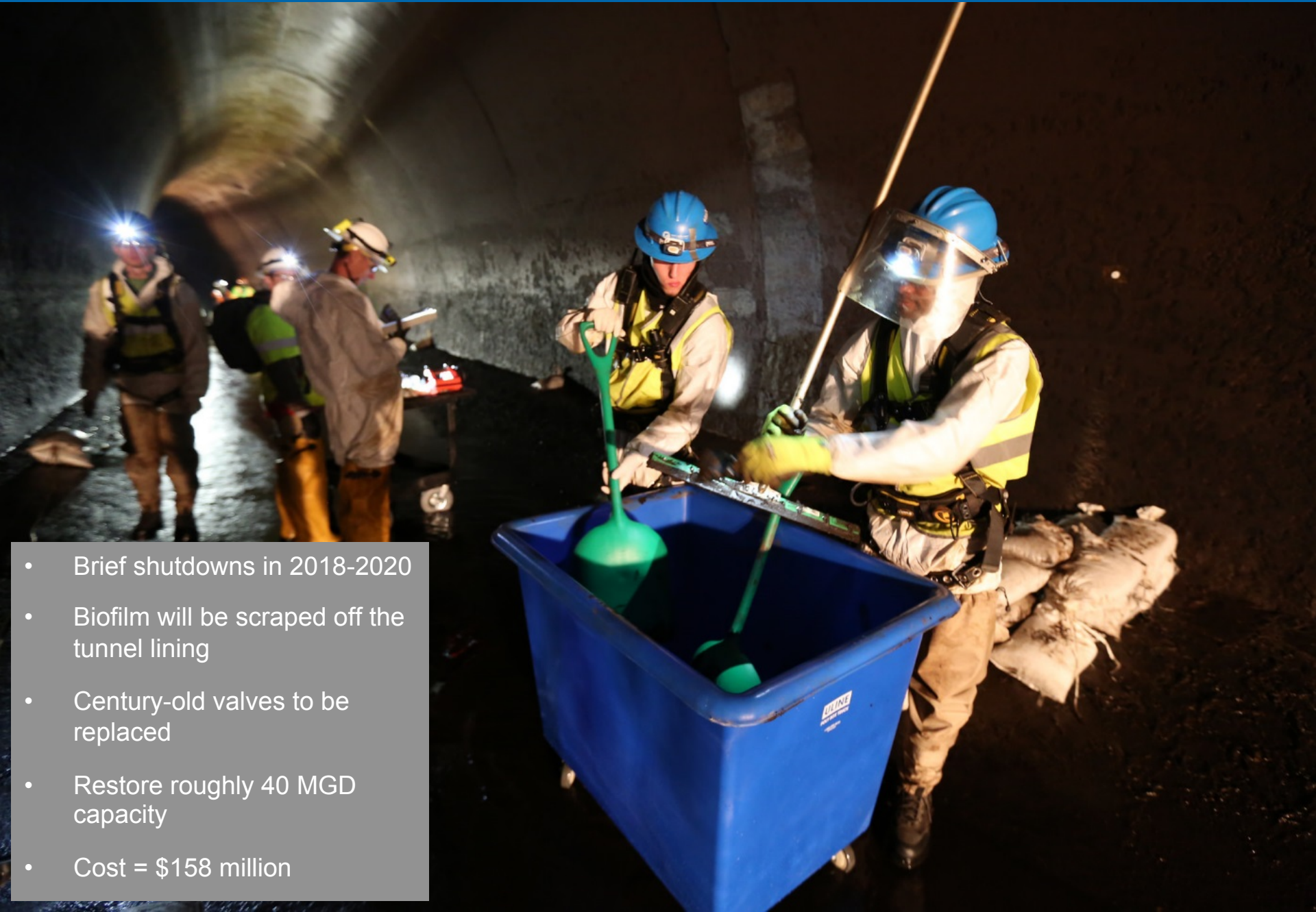


# Catskill Aqueduct Repair and Rehabilitation

- Upper Catskill Aqueduct extends approximately 74 miles from Ashokan to Kensico Reservoir
- Historical capacity = 660 MGD
- Capacity has been reduced by biofilm; now approx. 590 MGD
- Biofilm consists of a filamentous bacteria attached to naturally occurring iron and manganese
- Creates friction in the aqueduct that slows down the flow of water
- Removing the biofilm will increase the speed of the water and the Catskill Aqueduct's daily capacity
- Cleaning began in 2019, expected to be completed prior to shutdown of RWBT



# Catskill Aqueduct Repair and Rehabilitation



- Brief shutdowns in 2018-2020
- Biofilm will be scraped off the tunnel lining
- Century-old valves to be replaced
- Restore roughly 40 MGD capacity
- Cost = \$158 million



- 2018 – 2019 repairs completed:
  - Engineer-of-record inspection
  - Grouting completed at four known leak locations
  - Manhole / boat hole improvements
  - Biofilm removal pilot
- 2019-2020 repairs to include:
  - Biofilm removal - 32.5 miles removed so far
  - Leak and structural repairs – 2.5 miles of cracks grouted so far
  - Blow-off valve replacements





# Shaft 4 Interconnection Facility





# Croton Filtration Plant





