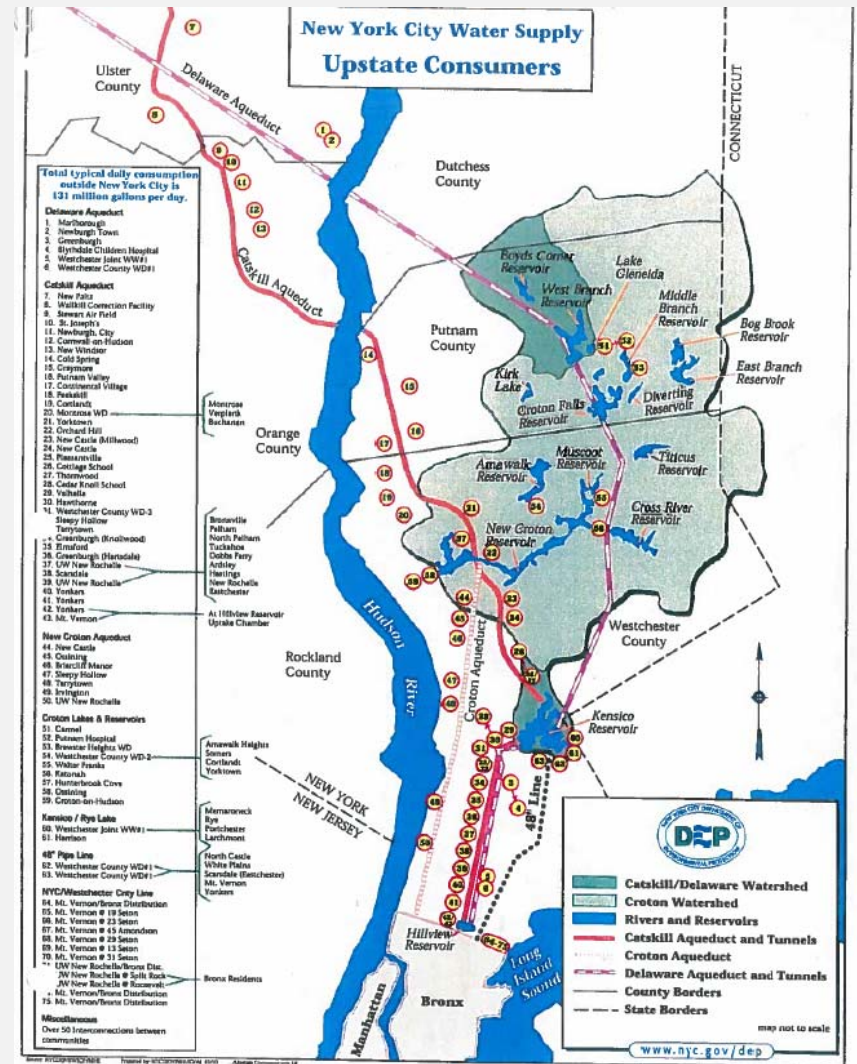
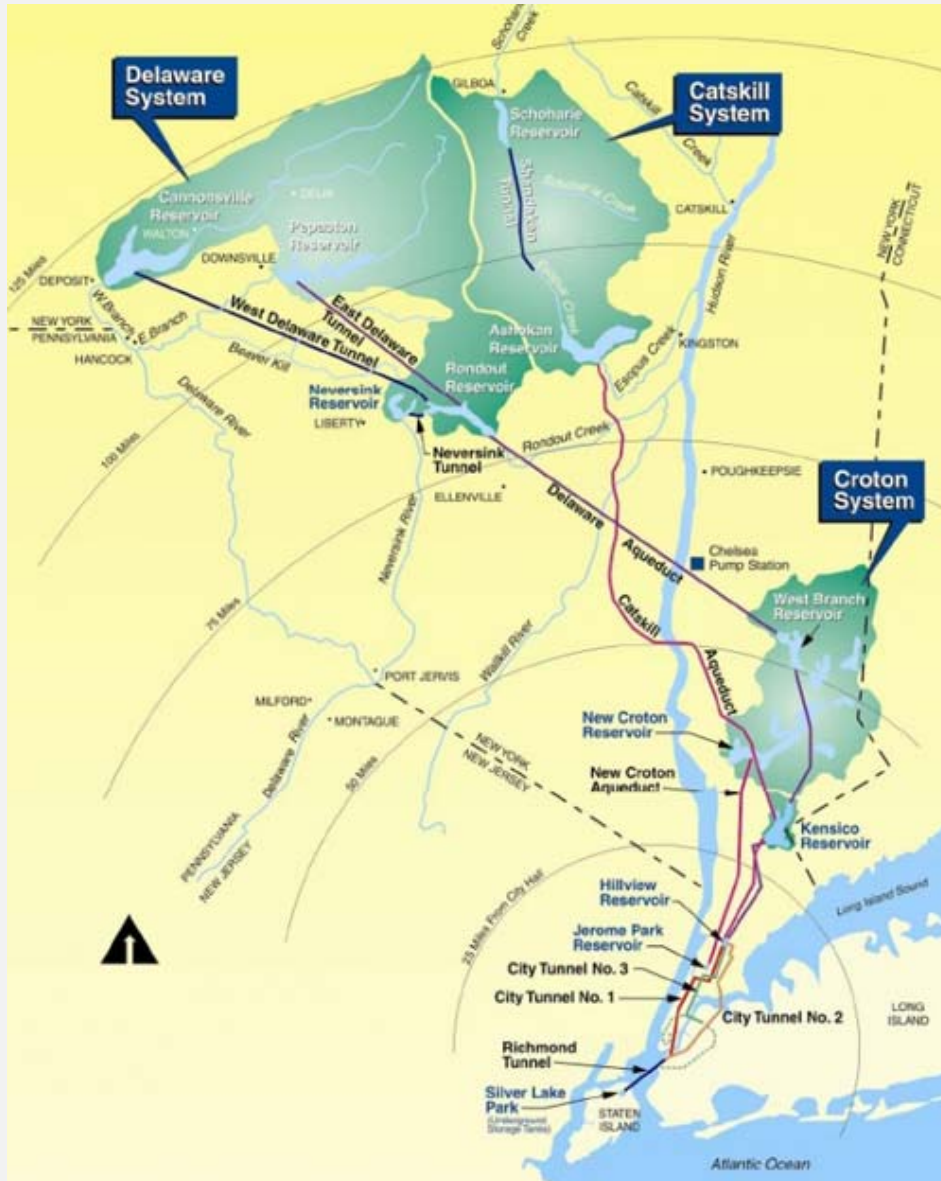


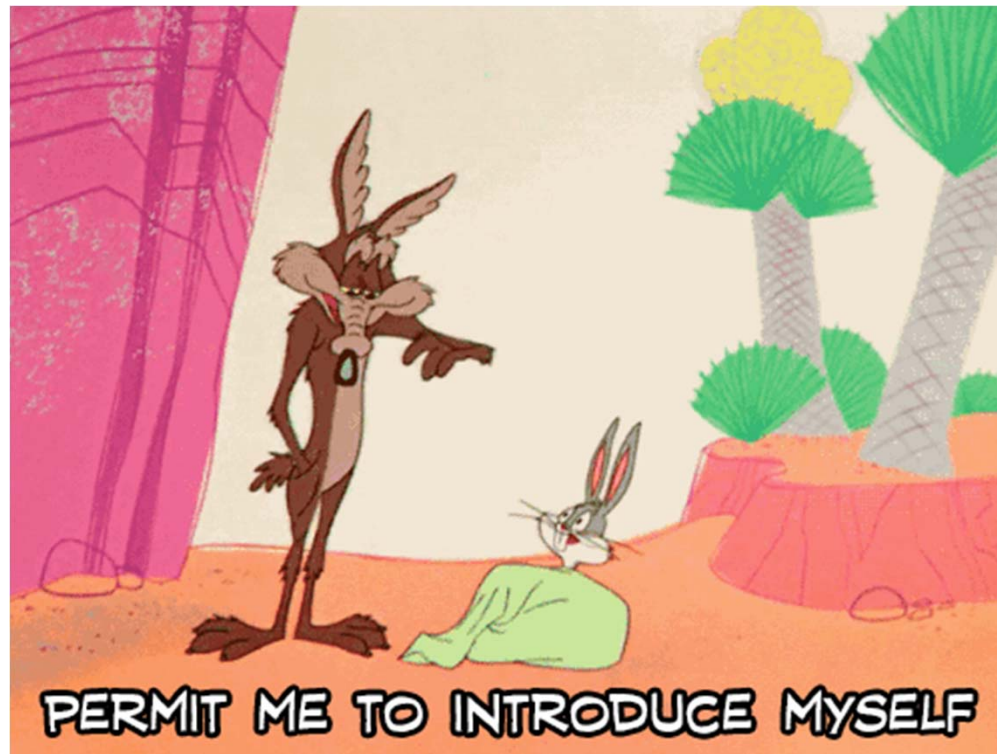


History of New York City Water Supply System

Gravity Works

Paul D. Smith, P.E. – NYCDEP Bureau of Engineering
Design and Construction





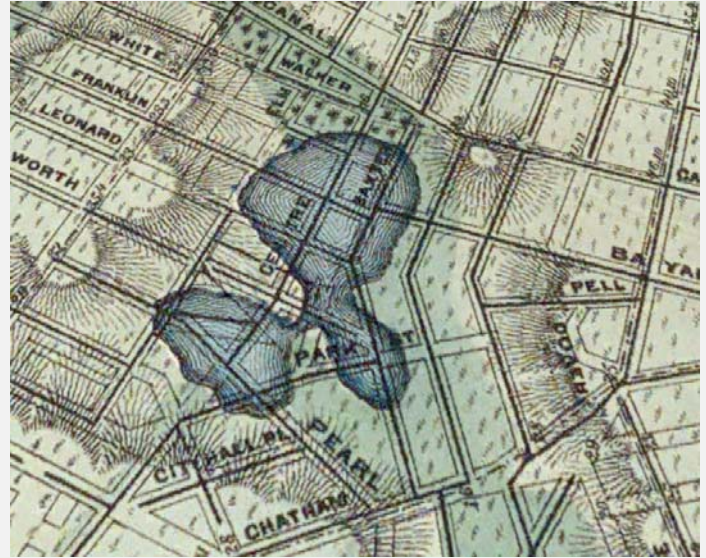


NYC Water Supply History

- 1600-1700's
- 1800's Croton System
- 1900-1920's Catskill System
- 1920's to 1960's Delaware System
- 1980's to Present

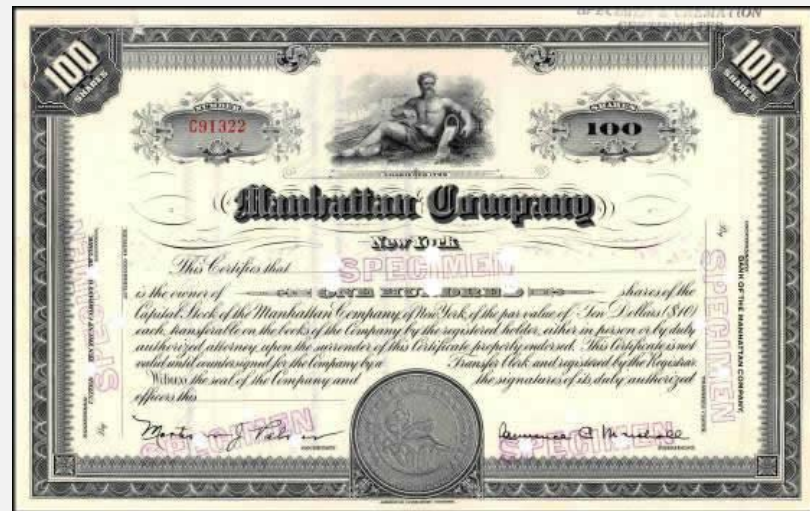
NYC Water Supply History 1600's -1700's

- 1677 – First public well, dug at Bowling Green
- 1776 – (NYC Pop: 22,000) Collect Pond (S of present day China Town)
 - Water pumped through wooden mains from Collect pond, the reservoir and multiple wells



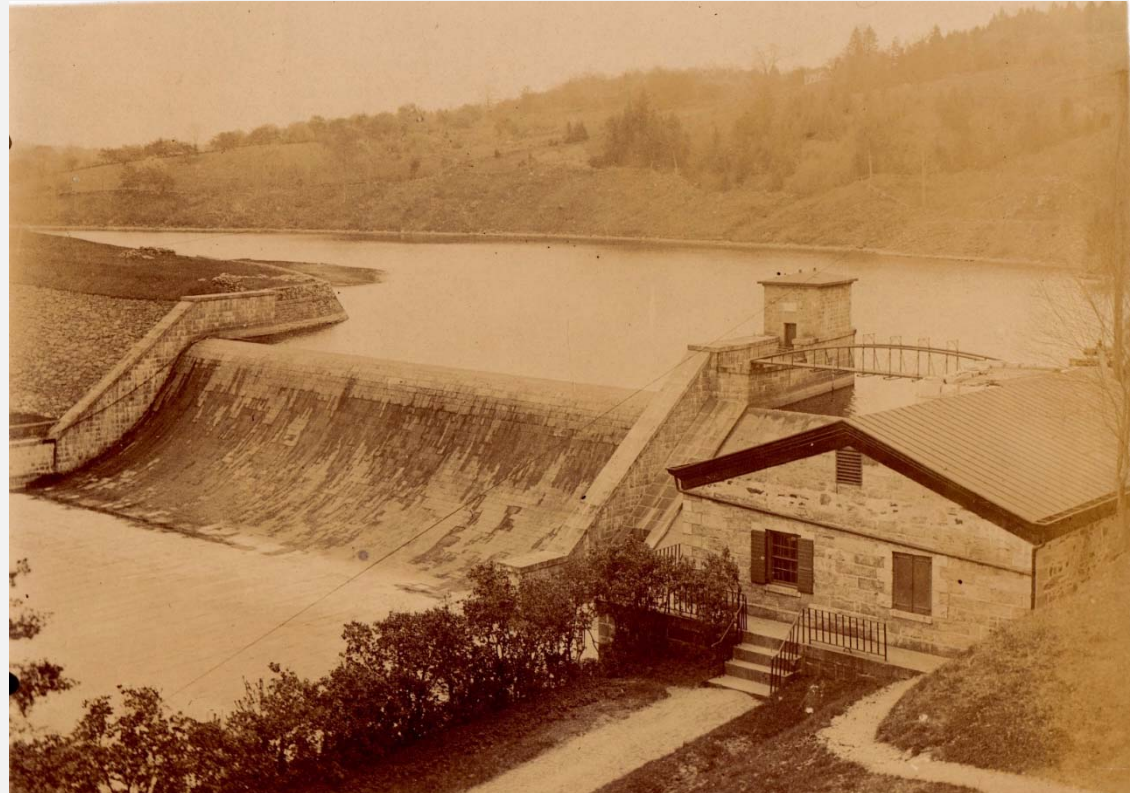
1800's Croton System

- 1800 – Manhattan Company (now Chase Bank) sank a well at Read and Center St, pumped water to Collect Pond
- 1811 – Commissioner's Plan
 - Established Manhattan's grid system
- 1830 – NYC built a tank for fire protection on Broadway and 13th St; water was conveyed through 12" cast iron pipes



Old Croton Dam

- Constructed: 1837-1842
- *Croton River*
- *Construction: Town of Yorktown, Westchester Co*
- Capacity: 600 Million Gallons
- 670 feet long, 57 feet high



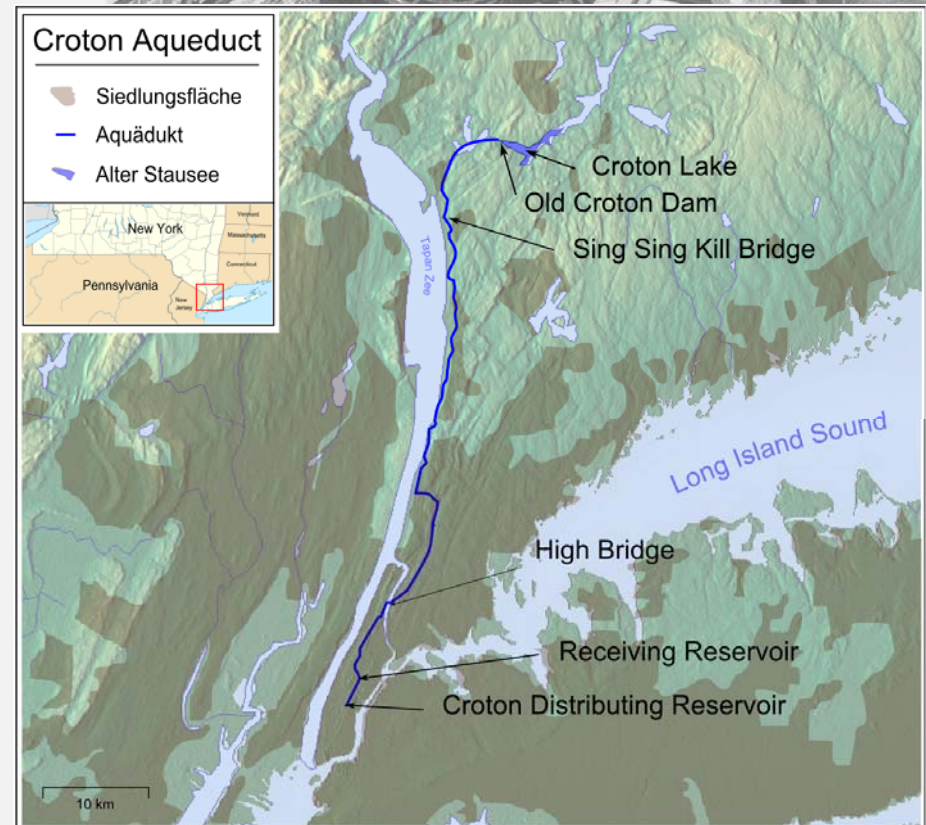
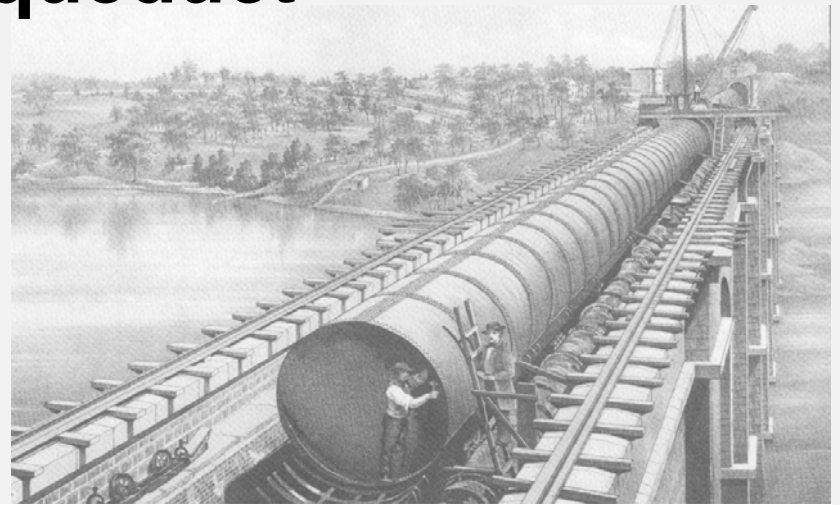
1835 NYC Fire

- Dec 16-Dec 17
- Water taken from rivers froze in pipes of hand-pump carts
- Shipping and merchant area between Wall St and Hanover square
- 700 buildings destroyed
- Fire fighters came from NJ
- Sailors from Brooklyn Navy Yard were finally able to put it under control by blowing up buildings in the fires path with gun powder

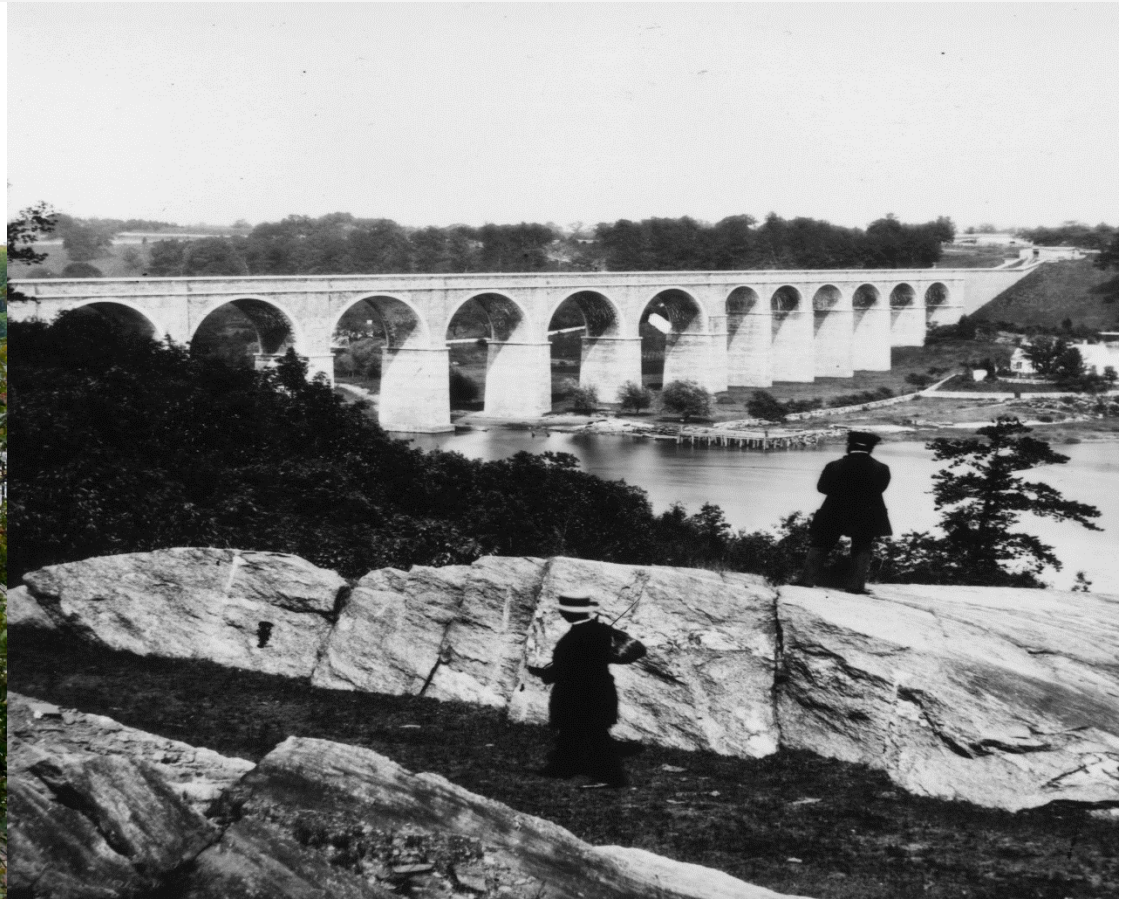


Old Croton Aqueduct

- **Constructed 1837-1842**
- **Capacity 90MGD**
- 40 mi long
- From Old Croton Dam to Central Park then to 42nd St reservoir (discontinued 1925)

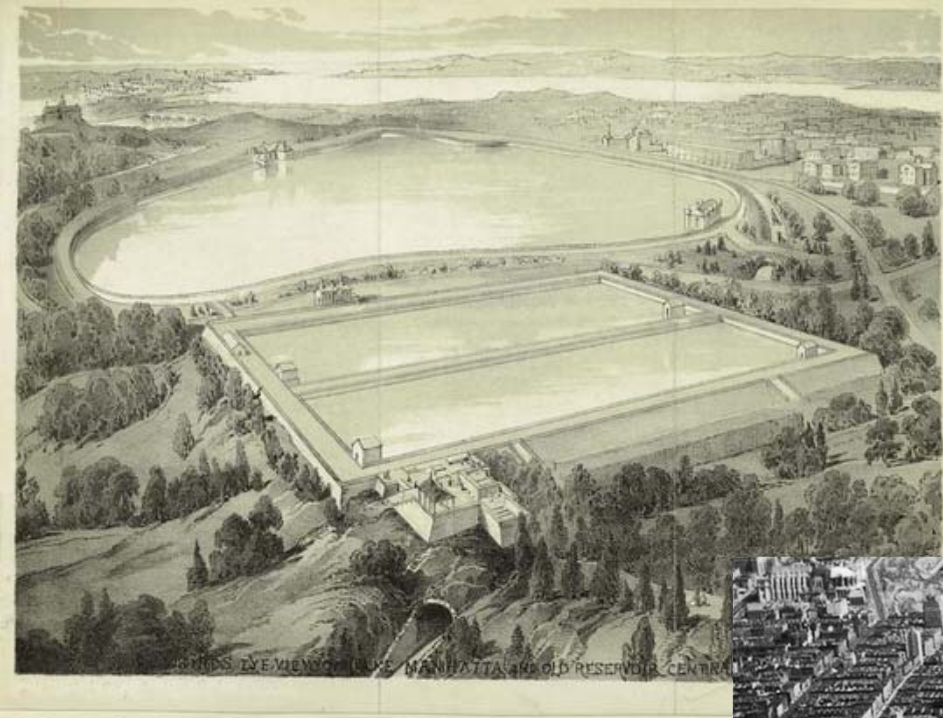


High Bridge



High Bridge has recently opened to the public in the last 2 years.

Lake Manahatta and Yorkville Reservoir (Central Park Reservoir)



- Constructed 1858 -1862
- 1.03B Capacity
- 96 Acres
- Yorkville Reservoir
(now Great Lawn)

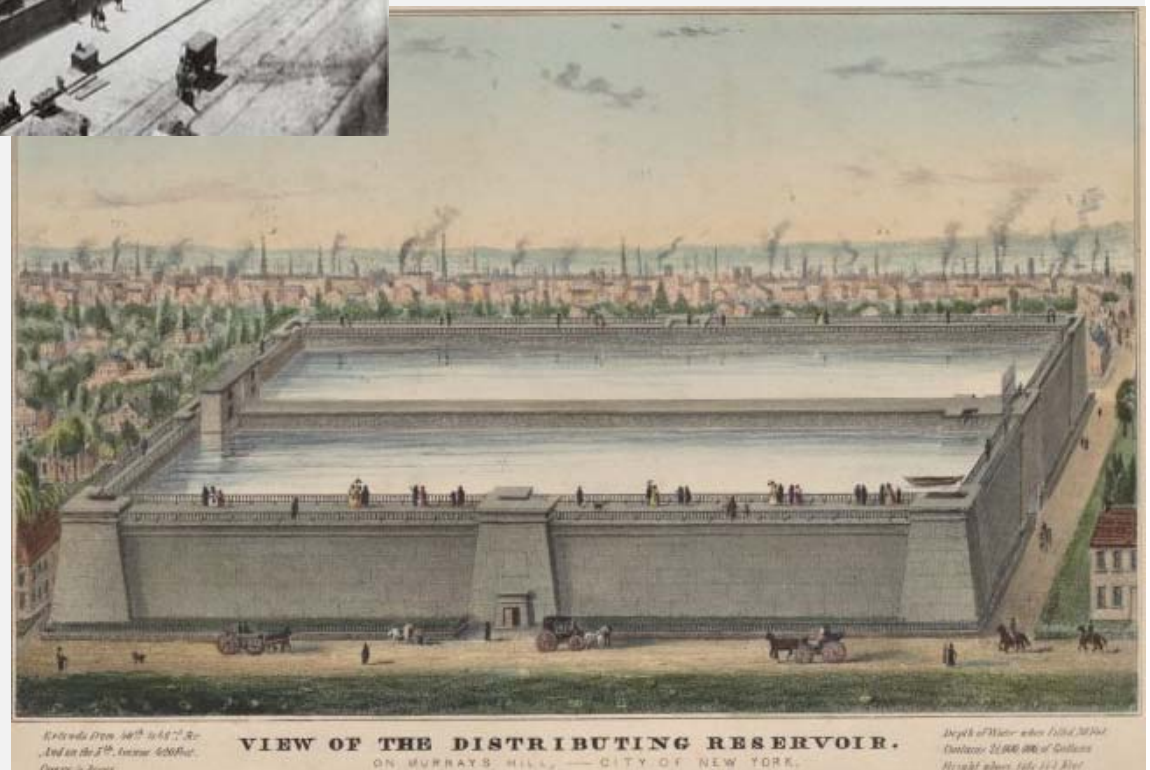


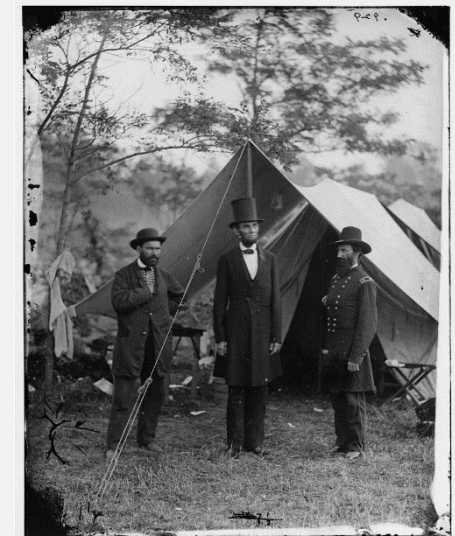
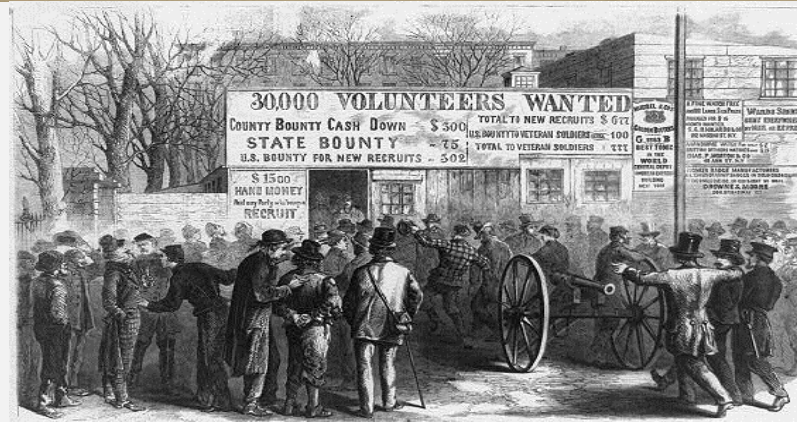
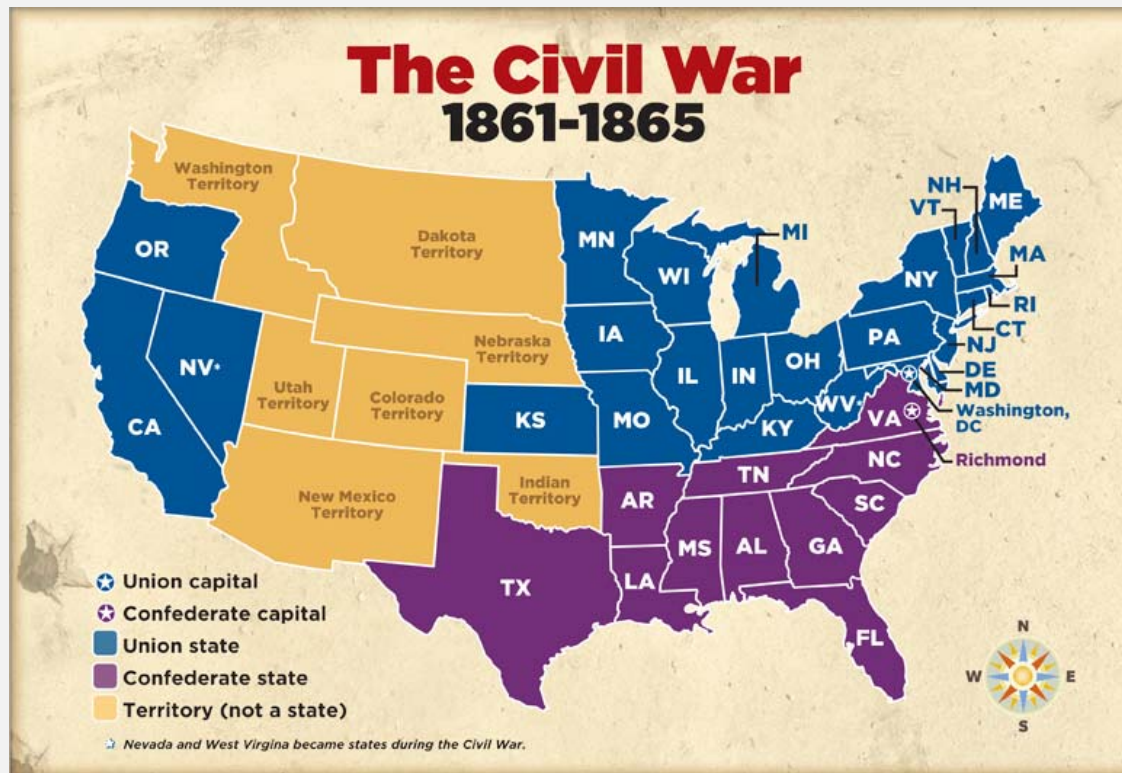
Murray Hill Reservoir (Croton Distributing Reservoir)



- Completed 1842
- 5th Ave and 42nd St. (present site of NY Public Library)
- Capacity 20M Gallons
- 4 Acres
- 50ft High, 25ft Thick walls
- Public access parapets
- Demolished 1890s

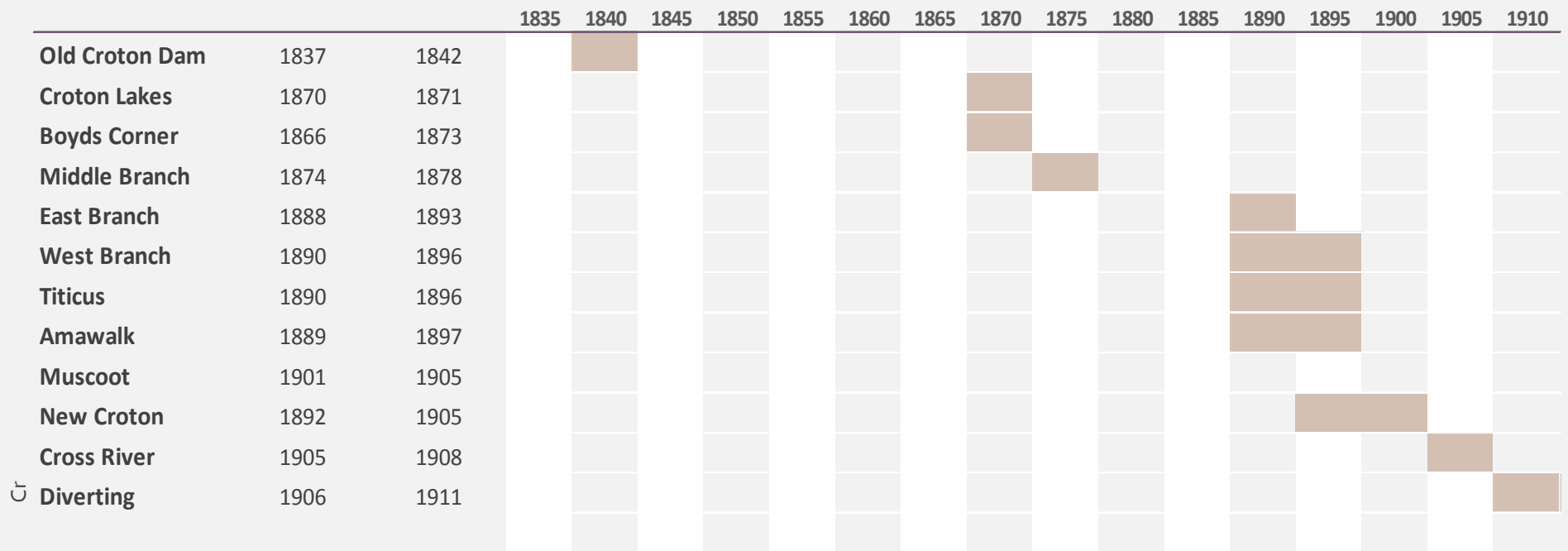
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President Abraham Lincoln
battlefield of Antietam, 1862
The battle of Antietam was the
bloodiest day in American History.

Development of Croton System



Boyd's Corner

- **Constructed 1866-1873**
- Town of Kent. Putman Co
- West Branch of Croton River
- Dam: 670 ft long, 57/78 ft high
- Capacity: 1.7 Billion Gallons
- Size: 300 acres, 5.6 mi shoreline



Middle Branch Dam

- **Constructed 1874 - 1878**
- Town of Southeast Putnam Co
- Middle Branch of Croton River
- Dam:
 - 515 ft long, 94 ft high
- Capacity:
 - 3.0 Billion Gallons
- Size:
 - 404 acres, 6.6 mi shoreline



June 25–26, 1876 Battle of the Little Bighorn



"The Custer Fight" by [Charles Marion Russell](#)



George Armstrong Custer



Frederick Benteen



Marcus Reno



Crazy Horse



Sitting Bull

Location:

Near the Little Bighorn River, Montana

Commanders and leaders

Sitting Bull
Crazy Horse
Chief Gall
Lame White Man
Two Moon

George Armstrong Custer
Marcus Reno
Frederick Benteen
Myles Keogh
James Calhoun

Lakota
Dakota
Northern Cheyene
Arapaho

7th Regiment

Strength

900–2,500

647

Casualties and losses

136 warriors,
6 women
4 children killed
up to 160 wounded

268 killed
49 wounded+6 Died of wounds

East Branch and Bog Brook Reservoirs

- **Constructed 1888 - 1893**
- Placed in service 1891 & 1892
- Town of Southeast Putnam Co
- East Branch of Croton River
- Dams:
 - **Sodom** 500 ft long, 78/98 ft high
 - **Bog Brook Dam 1:**
1340 ft long, 47/60 ft high
 - **Bog Brook Dam 2:**
1956 ft long, 23/35 ft high
- Capacity: 3.9 Billion Gallons
- Size:
 - 521 acres, 11.8 mi shoreline
 - 381 acres, 5.6 mi shoreline
- Connected tunnel 1778 ft

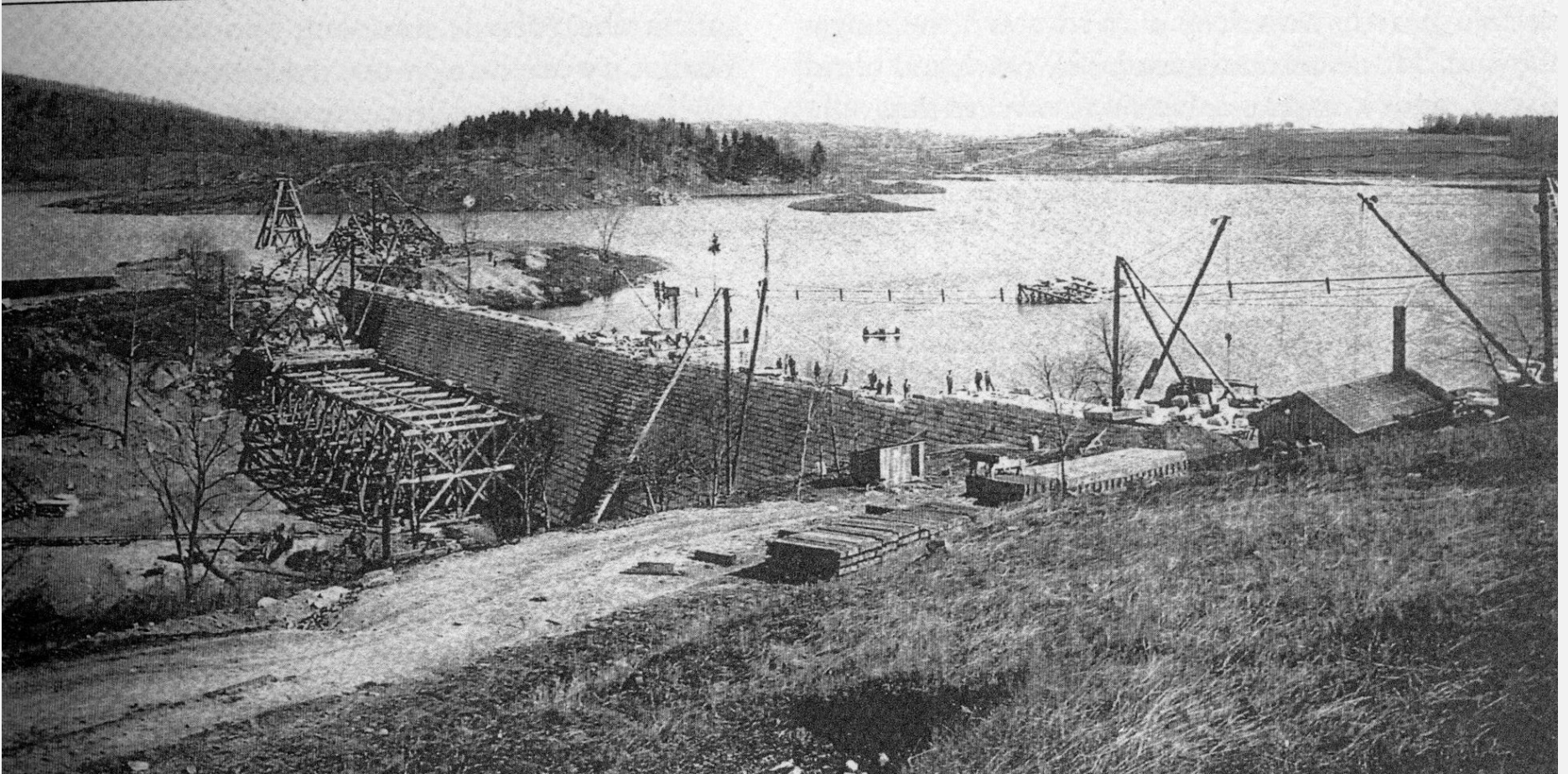


Sodom Dam



Bog Brook

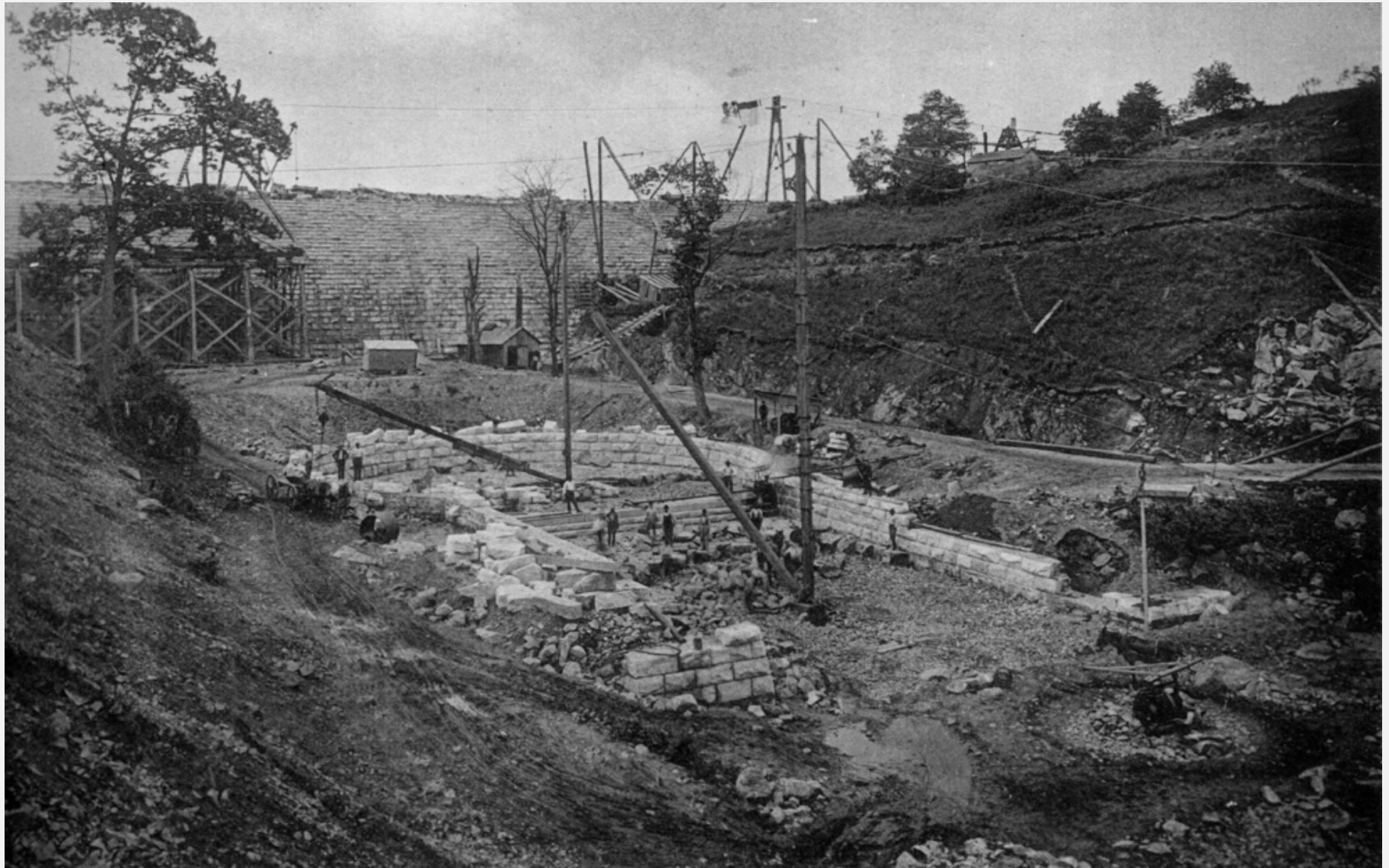
East Branch Reservoir



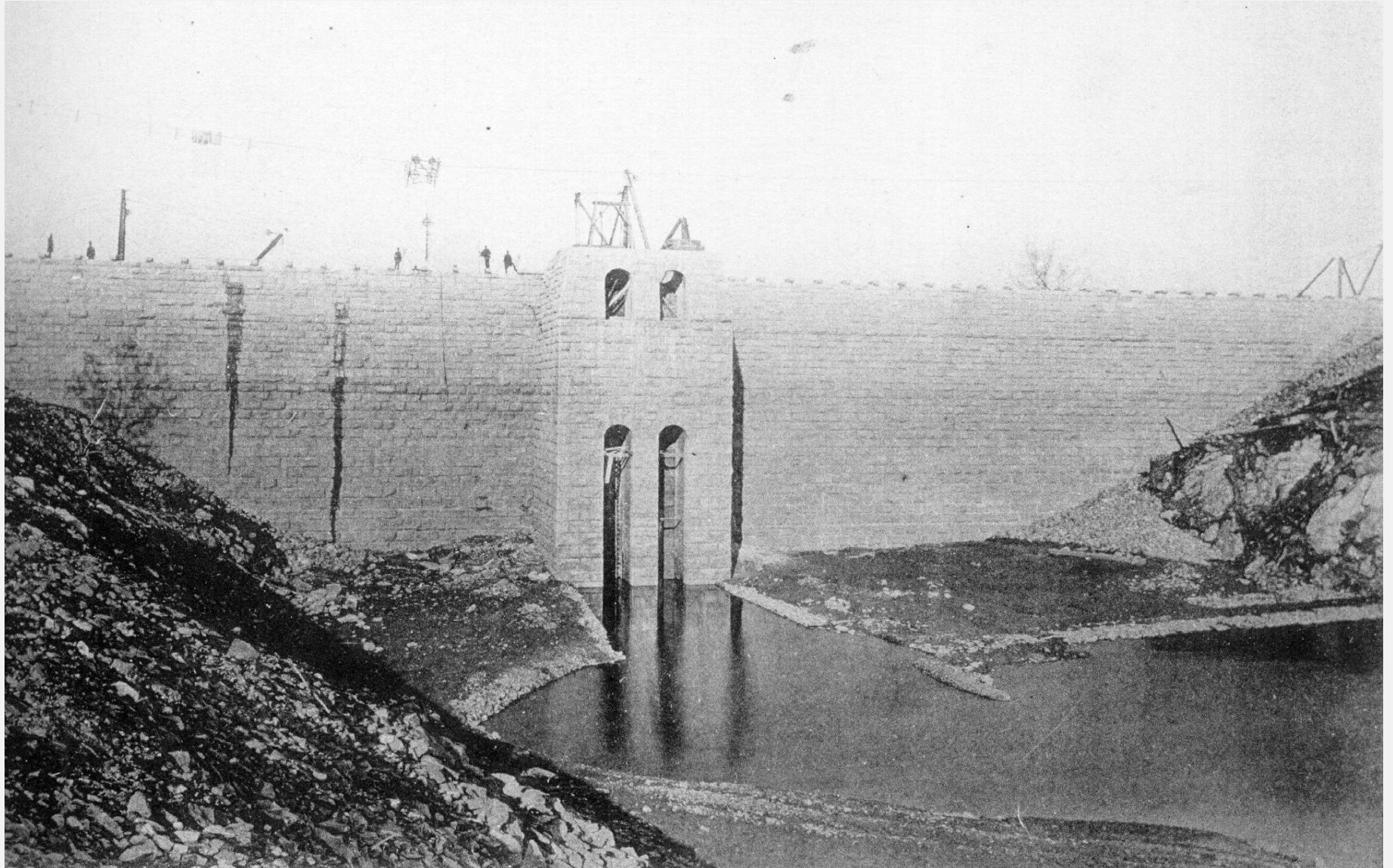
East Branch



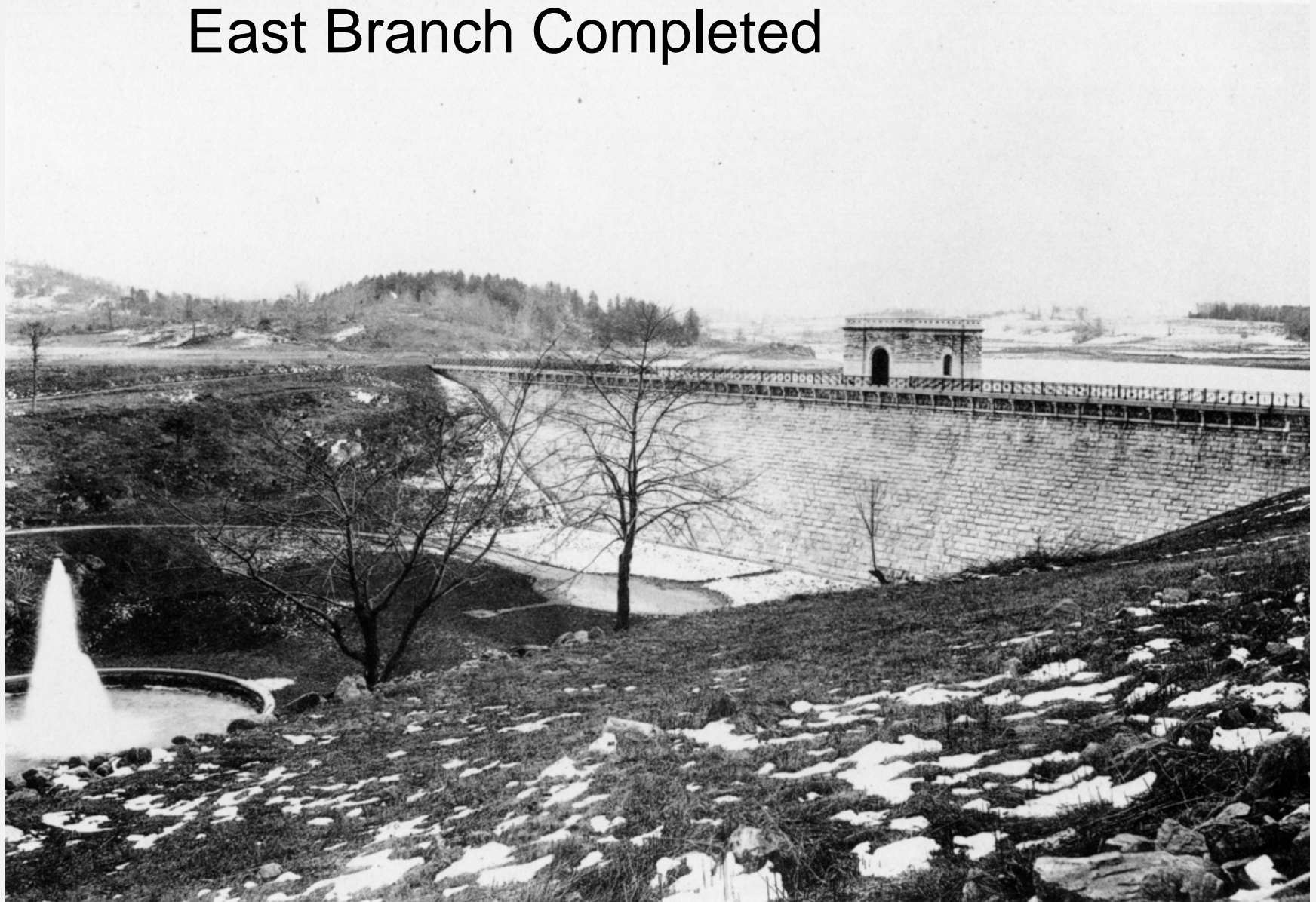
East Branch



East Branch



East Branch Completed



Bog Brook Tunnel Portal



Amawalk Reservoir

- **Constructed 1889 - 1897**
- Town of Somers, Westchester Co
- Muscoot River
- Dam:
 - 1280 ft long, 82 ft high
- Capacity:
 - 6.7 Billion Gallons
- Size:
 - 600 acres,
 - 6.0 mi shoreline

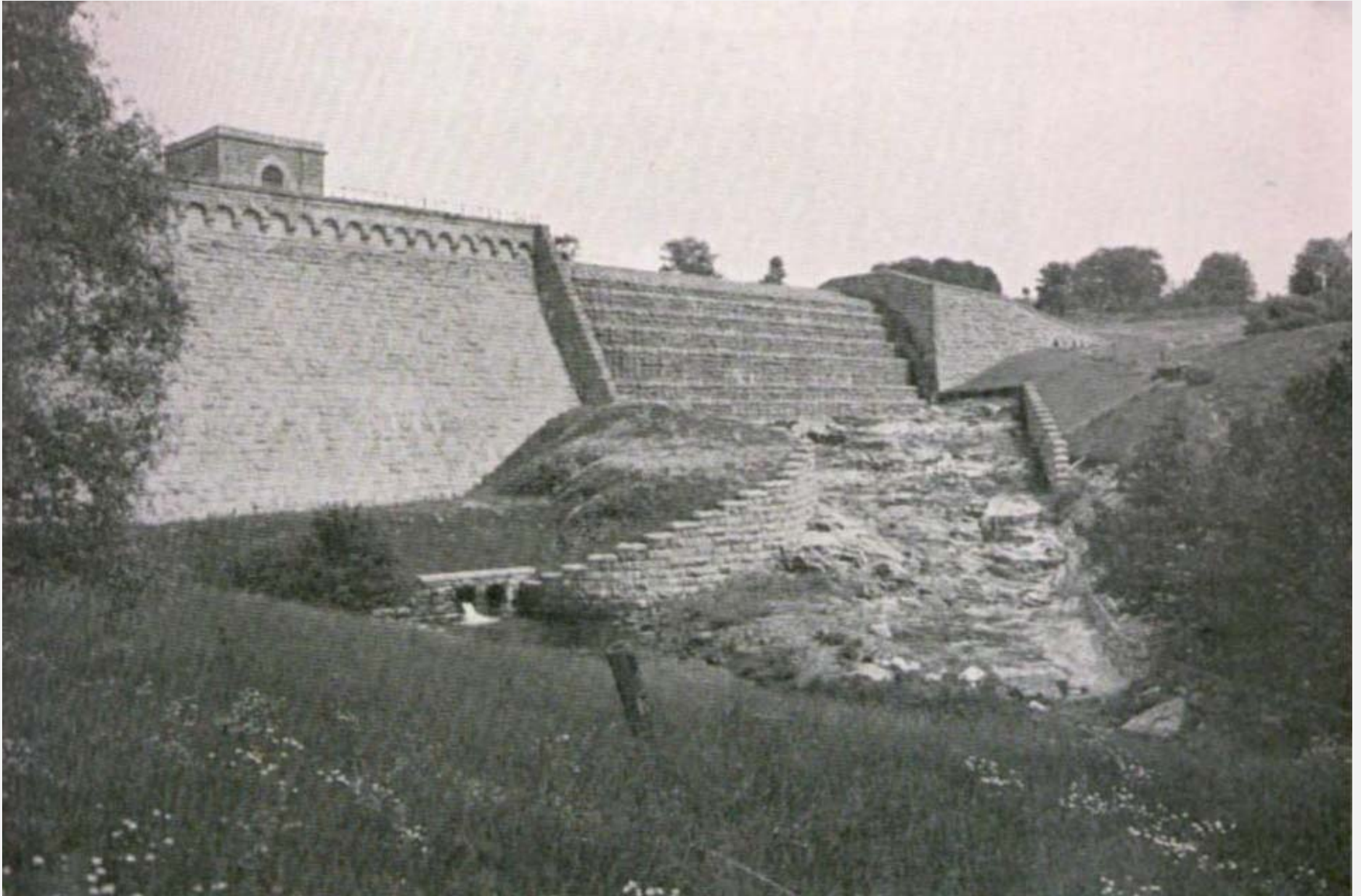


Titicus

- **Constructed 1890 - 1896**
- Placed in service 1893
- Town of Bedford, Westchester Co
- Titicus River
- Dam:
 - 1519 ft long, 109/135 ft high
- Capacity:
 - 7.2 Billion Gallons
- Size:
 - 682 acres, 8.6 mi shoreline
- Communities Flooded:
 - North Salem



Titicus



1890 Wounded Knee Massacre



In 1990, both houses of Congress passed a resolution formally expressing "deep regret" for the massacre.

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Date	29 December 1890
Target	Miniconjou Lakota Hunkpapa Lakota
Where	Near Wounded Knee Creek on the Pine Ridge Reservation, South Dakota

7th Cavalry

438 troopers
22 artillery men
with 4 Hotchkiss Mtn guns
30 Oglala Scouts

Deaths:

7th Cavalry:
25 Killed

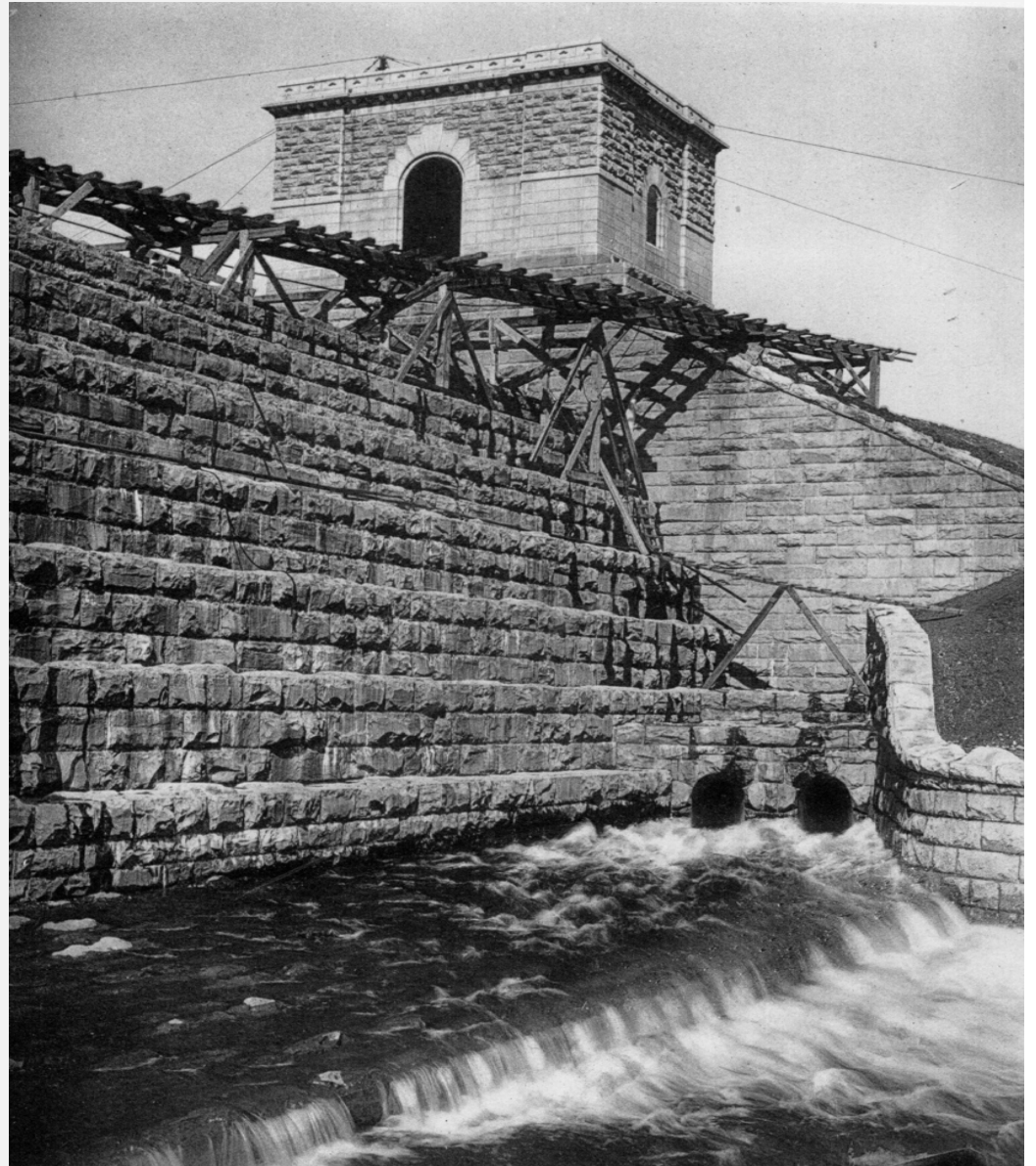
Lakota:
150-300 killed
• 84 men
• 44 women
• 18 children

Non-fatal injuries
39 wounded
(6 later died)

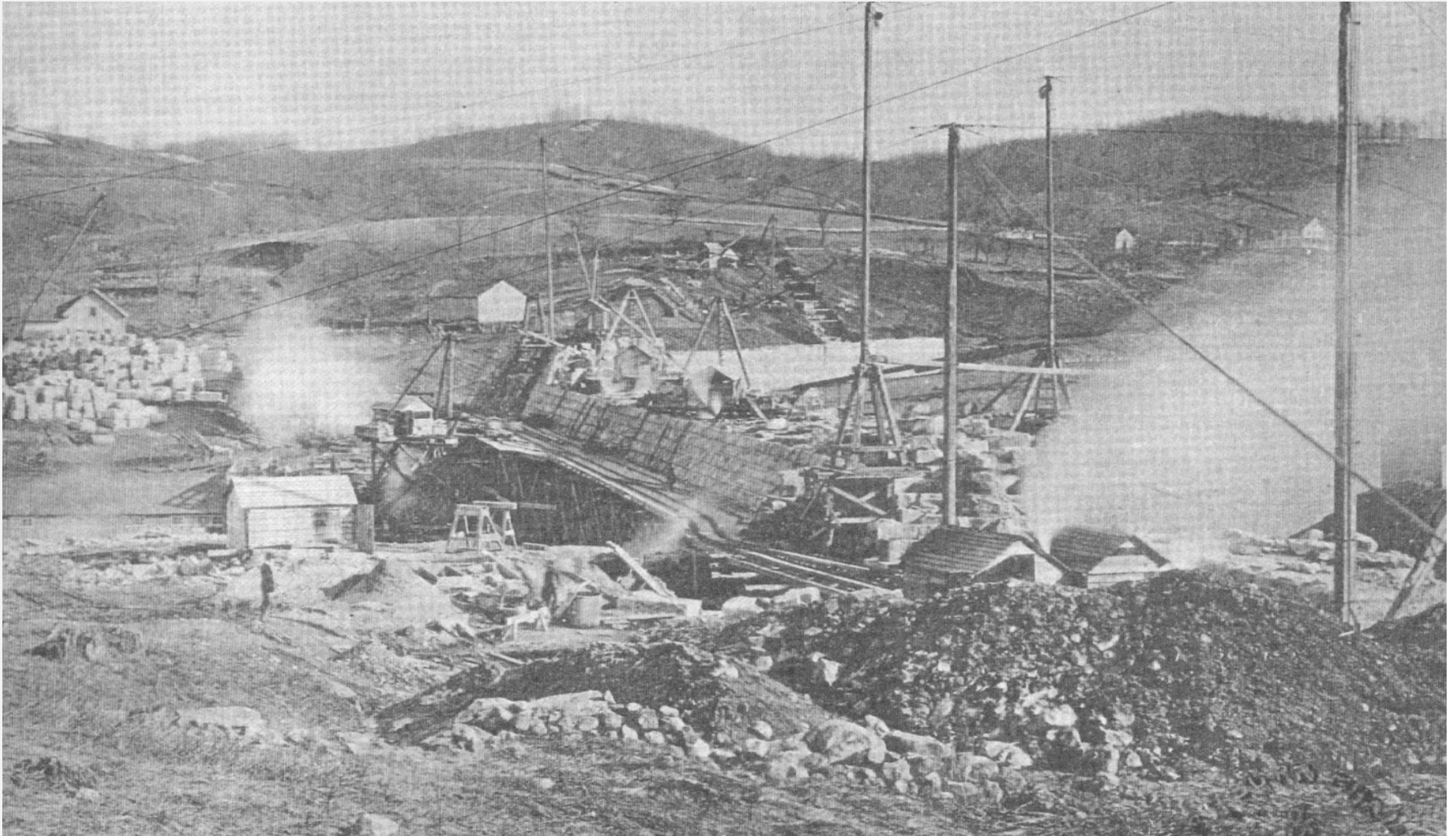
51 wounded
(7 later died)

West Branch – 1895

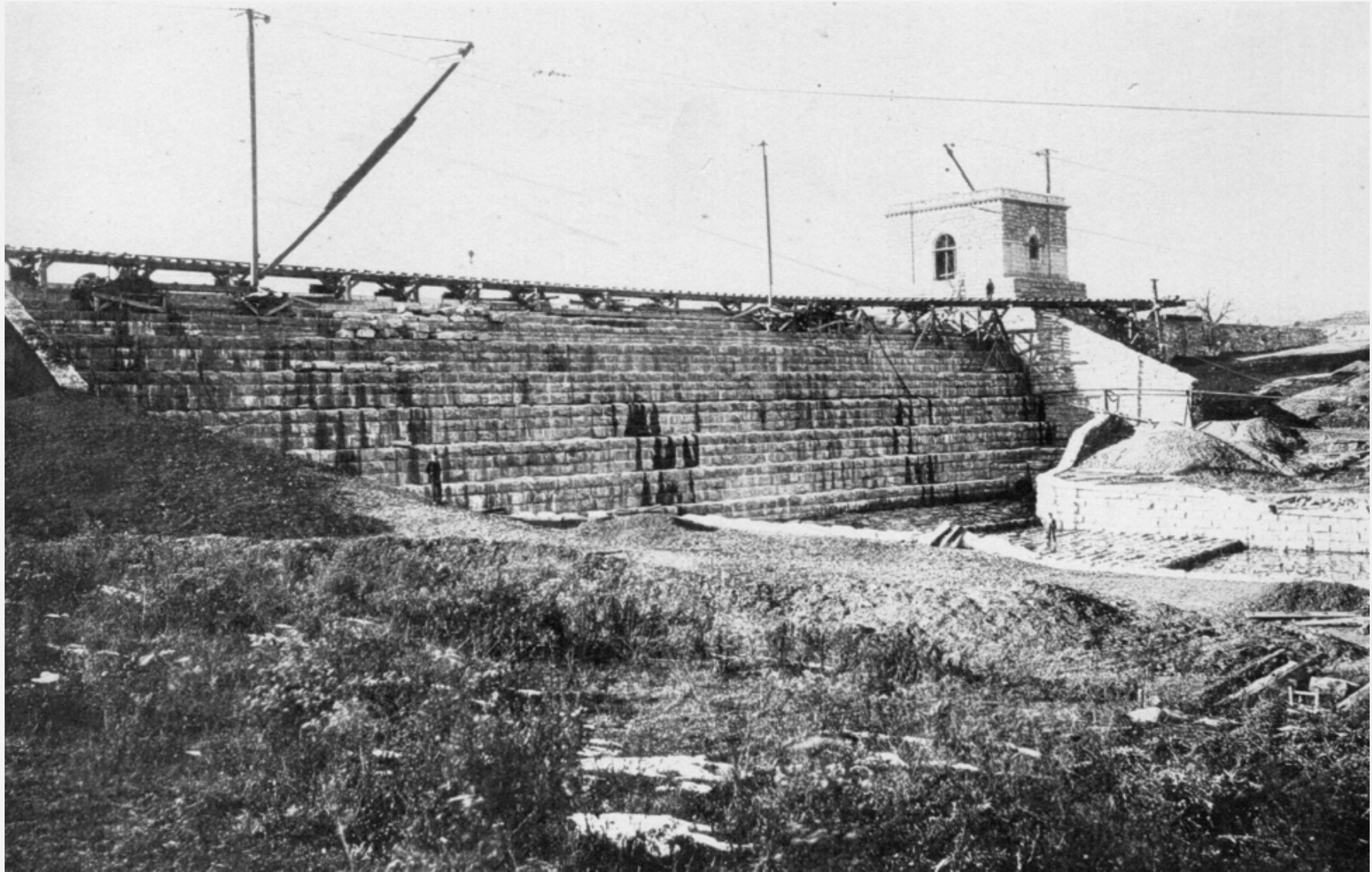
- **Constructed 1890 - 1896**
- Placed in service 1895
- Town of Kent & Carmel, Putnam Co
- West Branch of Croton River
- Carmel Dam:
 - 1800 ft long, 62/86 ft high
- Auxiliary Dam:
 - 720 ft long, 45 ft high
- Capacity:
 - 8.0 Billion Gallons
- Size:
 - 1.5 sq mi, 8.6 mi shoreline
- Presently a major reservoir for Delaware System



West Branch – Early 1890s



West Branch



New Croton Reservoir

- Constructed: **1892-1905**
- Construction: Town of Cortland, Yorktown, New Castle, Bedford, Somers, Westchester Co
- Cornell Dam: 2168 ft long, 174/297 ft high
- Capacity:
 - **19.0 Billion Gallons**
- Size: 19 mi long
 - 1962 acres, 38 mi shoreline
- Communities Flooded :
 - Katonah
 - Golden's Bridge
 - Purdy's Station
 - Croton Falls
- Residents displaced: 2000





Old and “New” Croton Lake Gate House



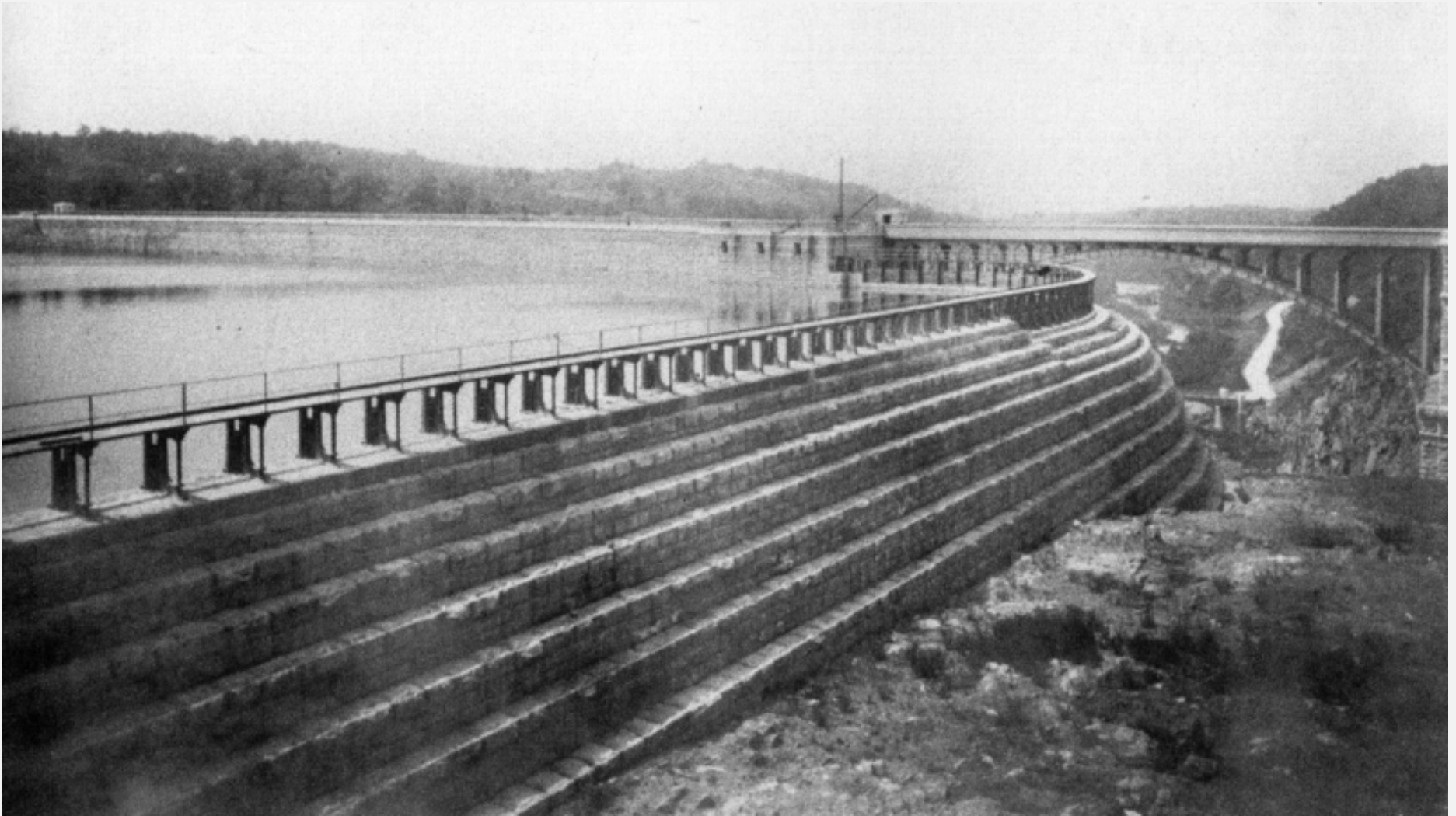
Old and “New” & New Croton Lake Gate House



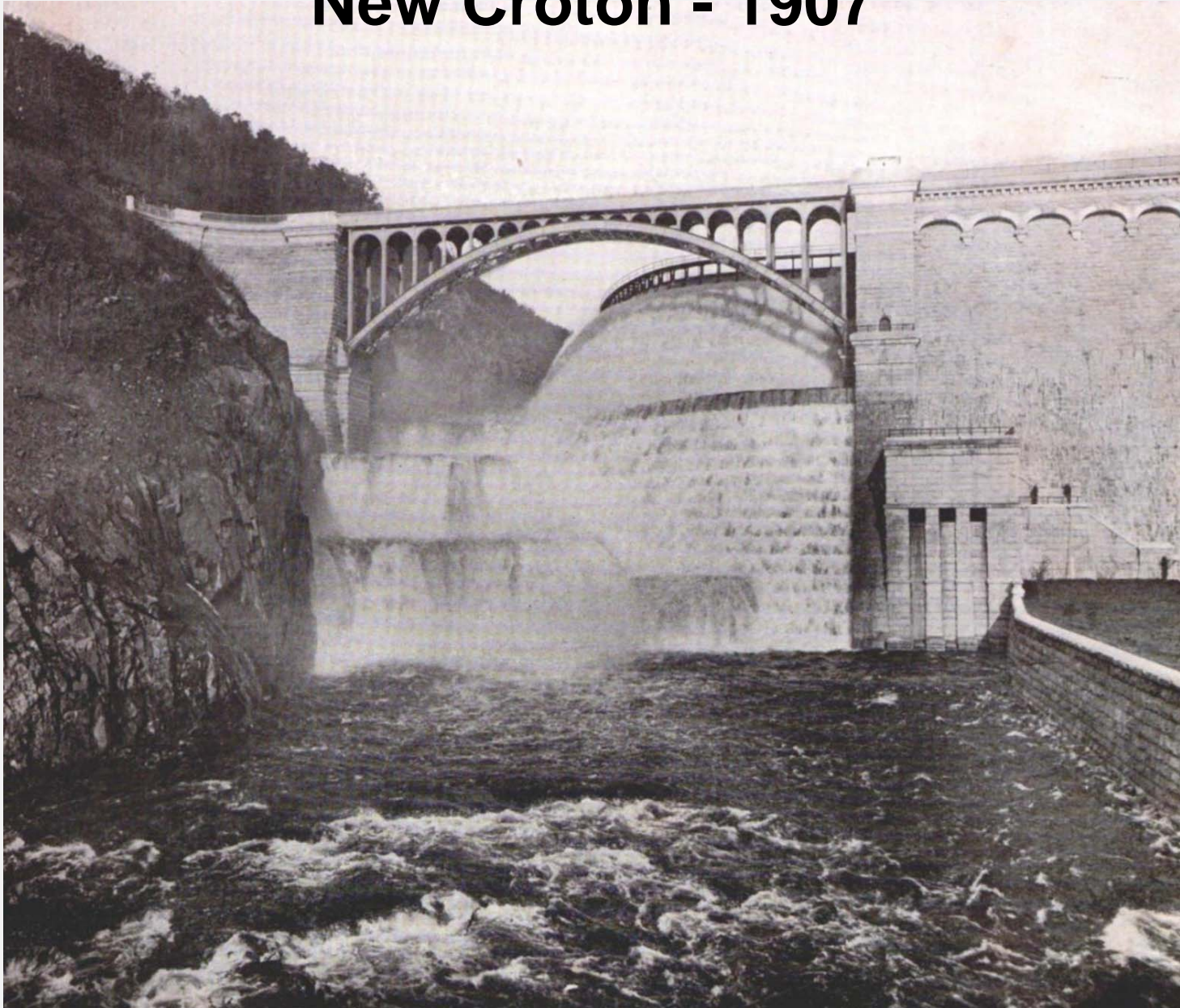
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New Croton - 1907



New Croton - 1907



New Croton – 1970's

- 1970's Original historic bridge replaced with steel arch in (during budget crisis)
- 1990's DEP initiated project to “repair” failing arch
- 2006 “repair” project cancelled
 - replaced with structure to original historic architecture

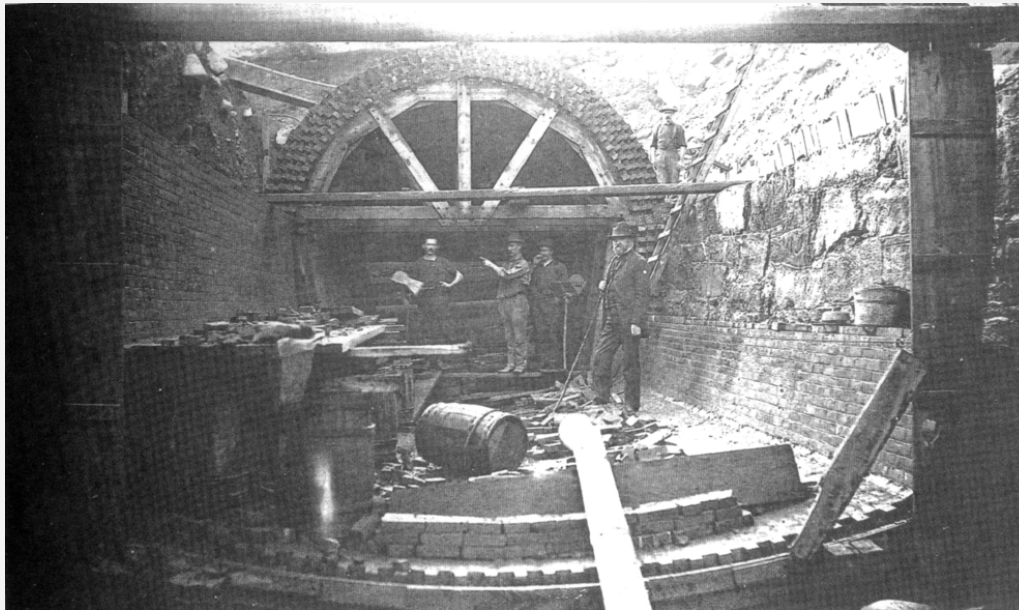


New Croton 2006



New Croton Aqueduct

- Constructed 1885-1893
 - 33 Miles
 - 24 mi brick lined rock tunnel
 - 9 miles masonry
- New Croton Reservoir to Jerome Park Reservoir to Manhattan
- Passes 300 ft below Harlem River
- Cost \$19.6M; 92 lives

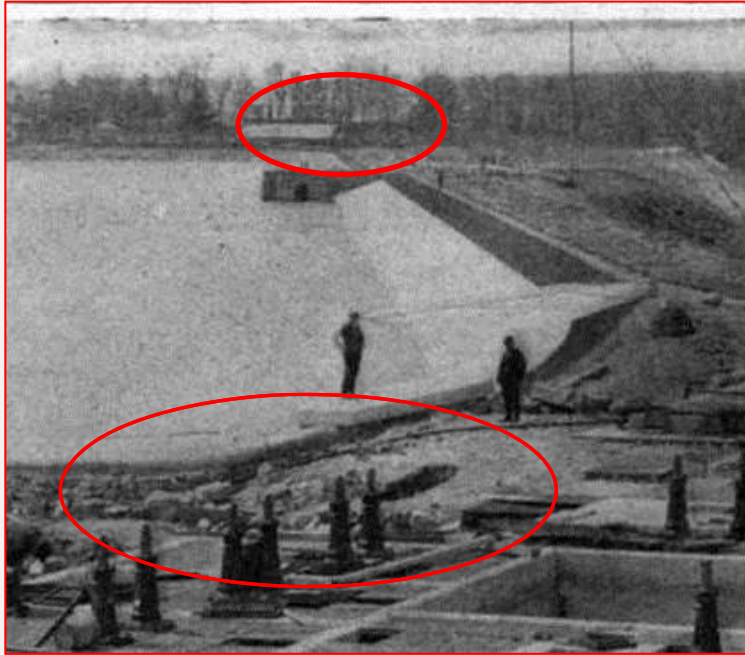


Jerome Park Reservoir Overview

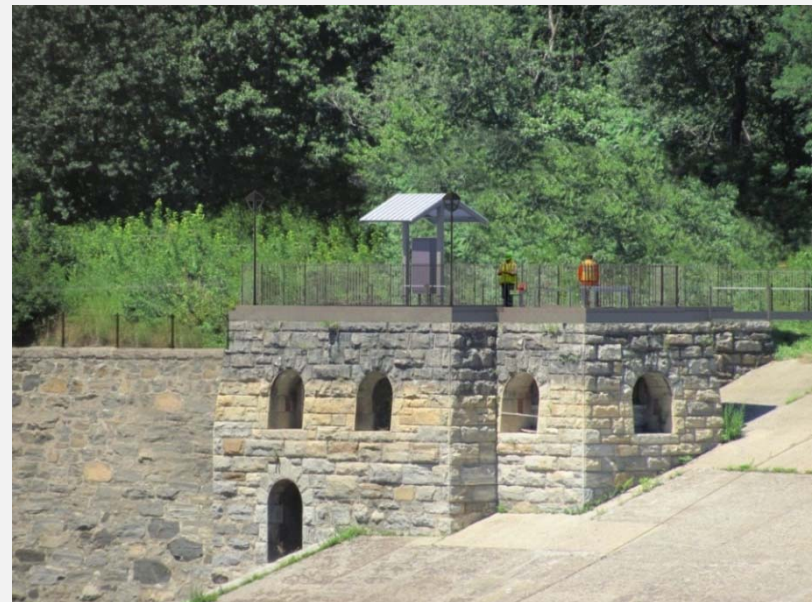
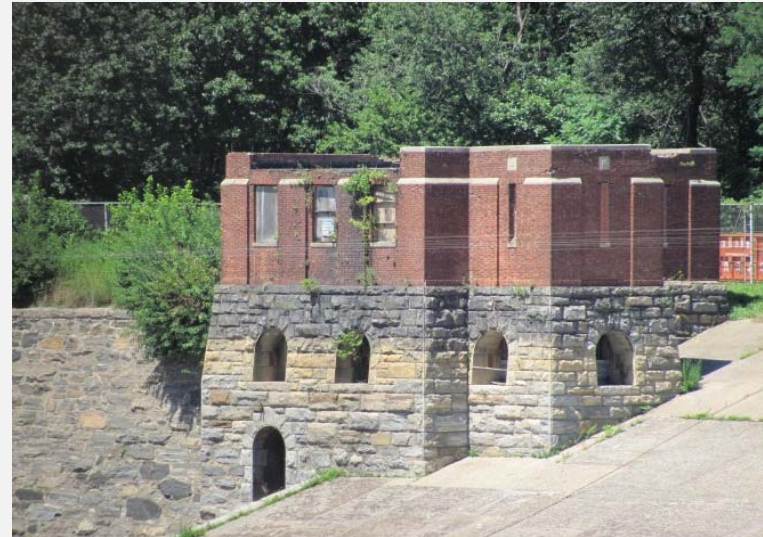
- Constructed in 1889 - 1906
- Named for Jerome Park Racetrack
- Original site planned for future sand filtration



Gatehouse No. 2

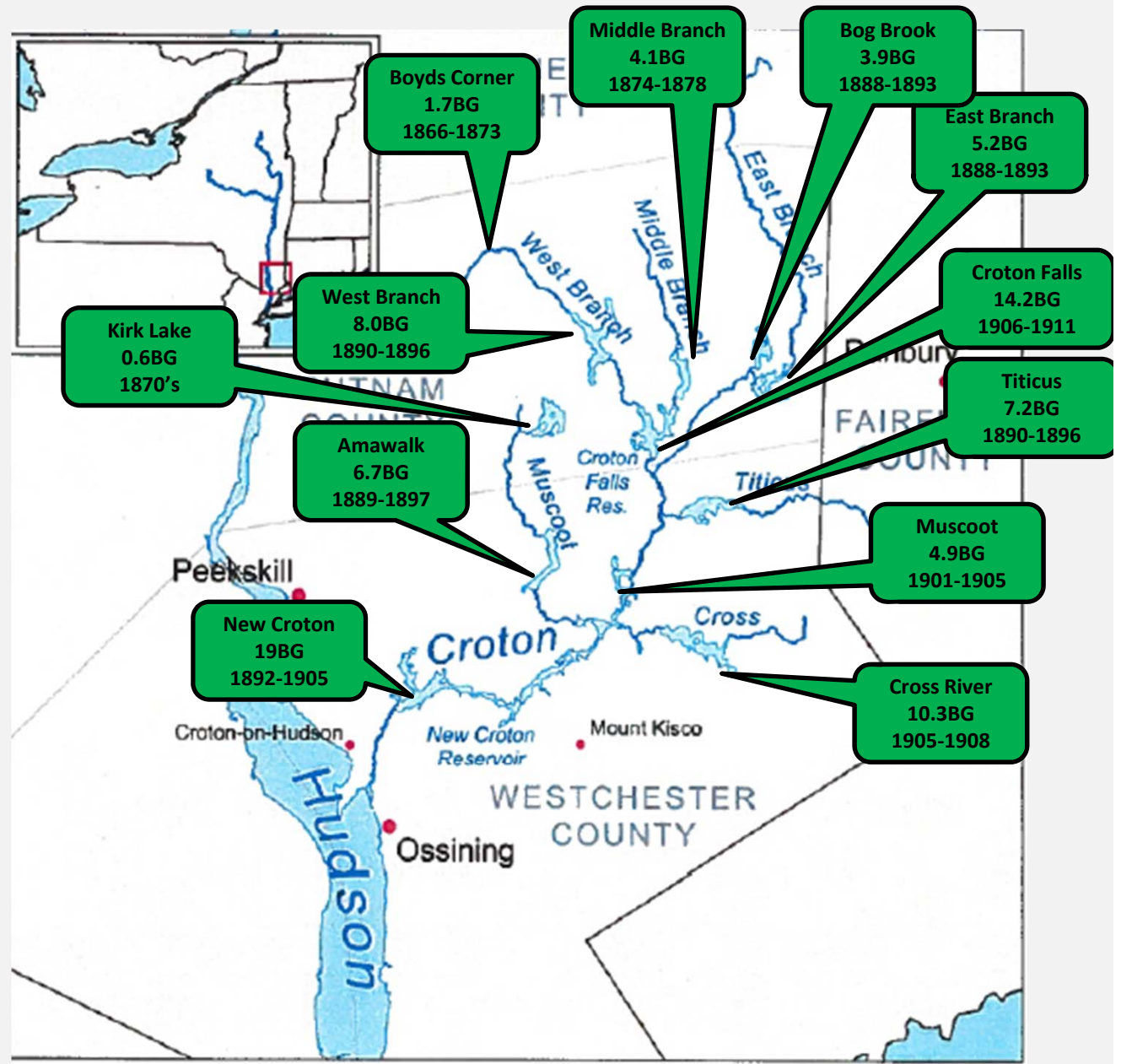


- Original Chambers did not include building (valves exposed)
- Superstructure constructed later
- 2000's- decommissioned and returned to original



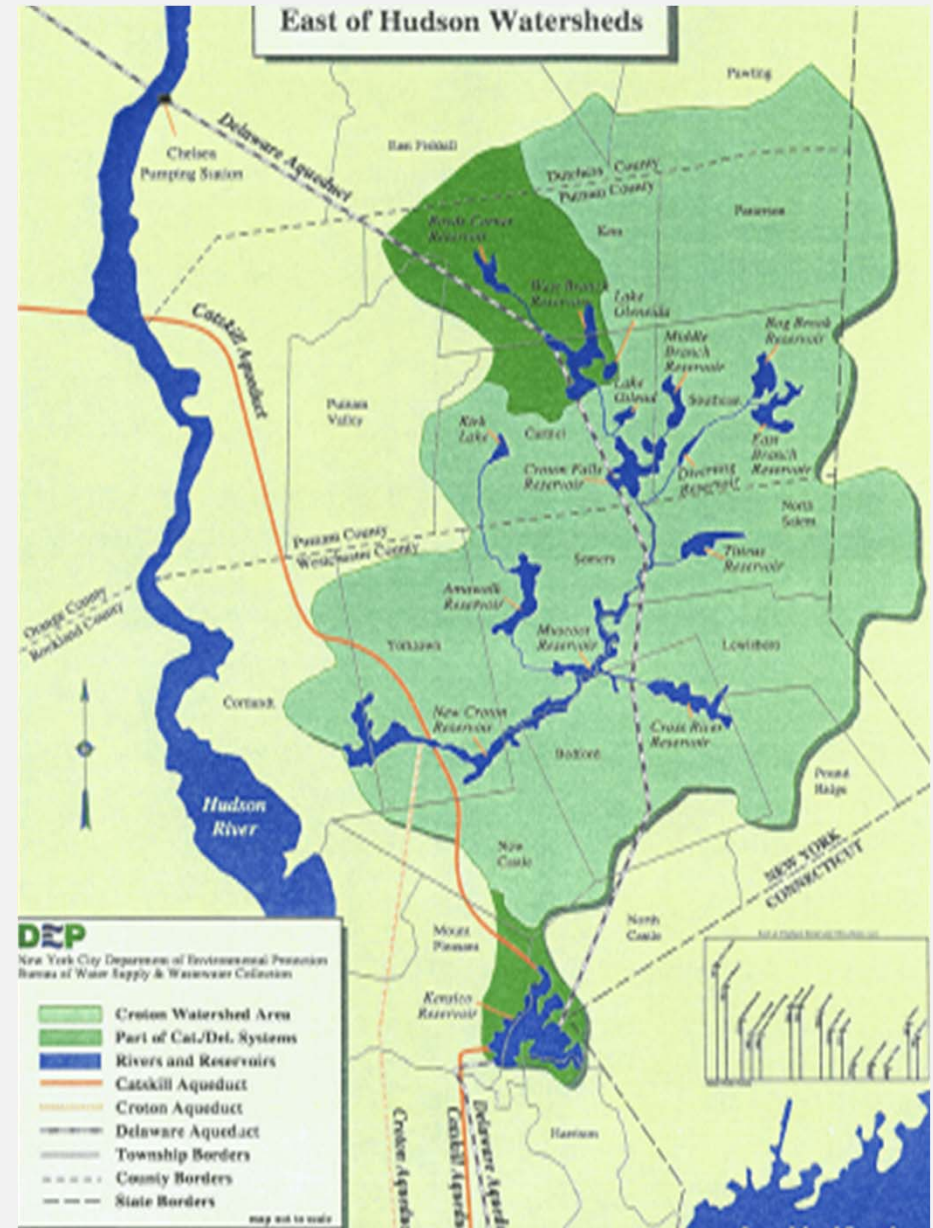
Croton Reservoirs

- Croton System utilizes system of rivers to convey water to New Croton Dam then NCA to Jerome Park Reservoir, NYC



Croton System Summary

- Constructed: 1837 - 1911
- 12 Reservoirs, 3 controlled lakes
- 375 sq mi watershed
- Croton Capacity:
 - 87.8 Billion Gallons
 - **Up to 290 MGD**
- Yield: **240 MGD**
 - **(214 MGD w/o West Branch)**



1980's – Present Upgrades Croton System

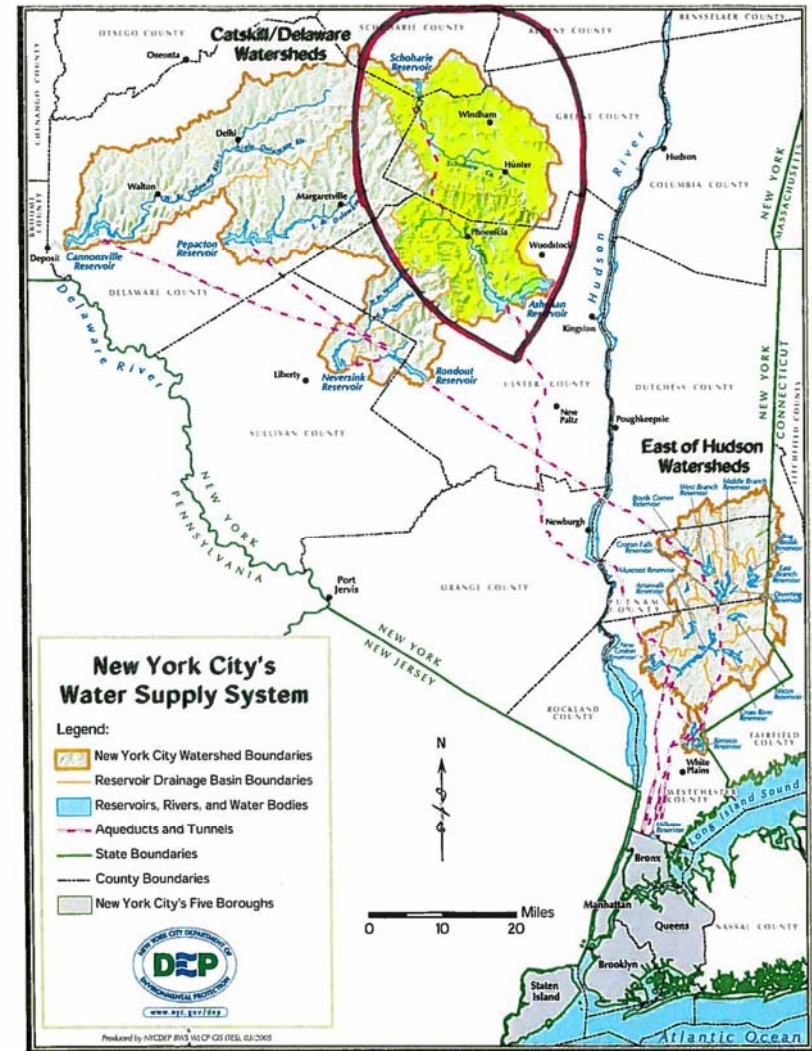
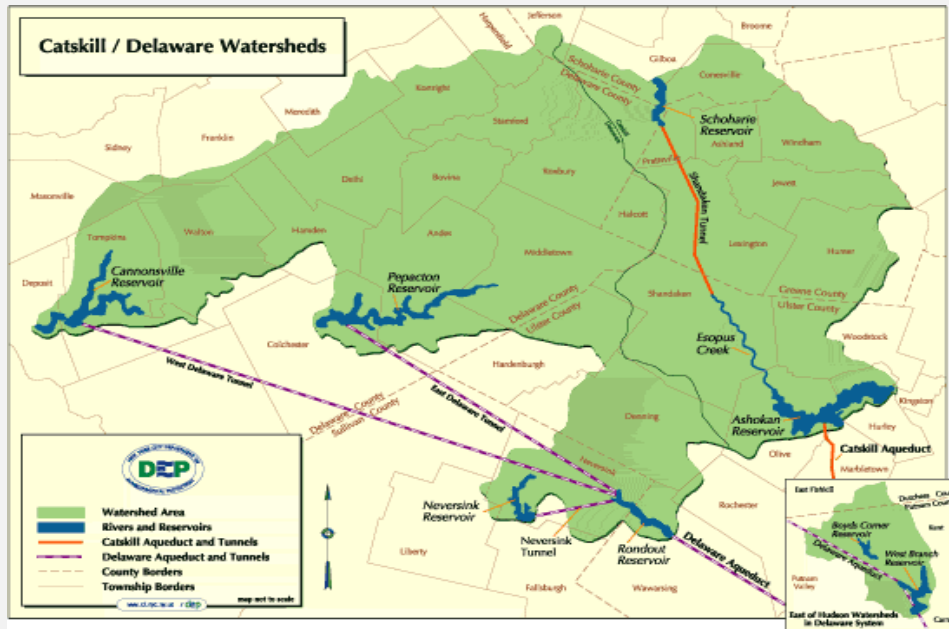
- Replacement of 100+yr old valves and gates
- Minor repairs to chambers
- New Bridges: Cross River, Kensico
- Stability Improvements
 - Major Dam changes at Boyds
 - Anchoring: Croton Falls, Titicus, Sodom
 - Repair spillway: West Branch
 - Fuse plugs: Titicus, Sodom, Bog, Middle Branch
 - New spillways: Boyds, Croton Falls
 - New spillways to meet ½ to full PMF
 - Croton Falls Dam
- Zebra mussel control



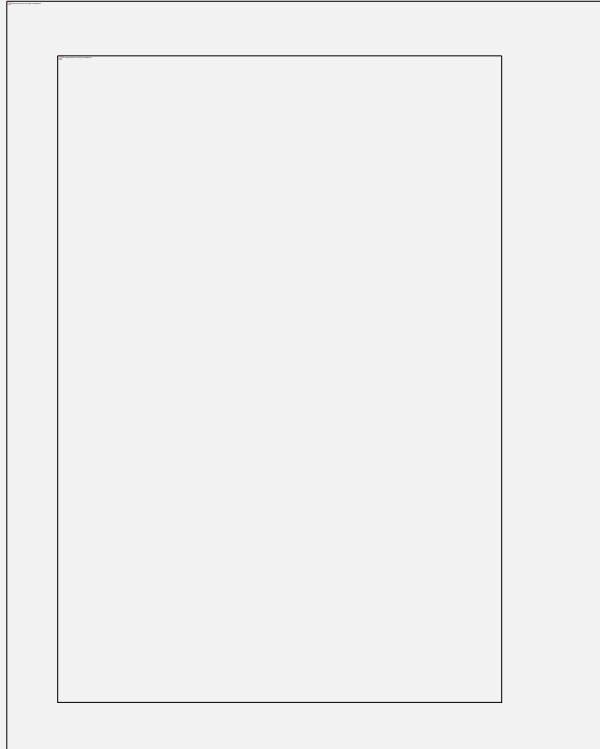


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The Catskill System Constructed 1907-1927



1900- 1920's Catskill System



J. Waldo Smith, Chief Engineer

- 1905 Board of Water Supply created by State Legislature
 - Decided to develop Catskills
 - Appointed J. Waldo Smith as Chief Engineer
- 1906 First Contract
- **1914 - 1918 World War 1**
- 1915
 - Ashokan Reservoir Completed
 - Catskill Aqueduct Completed
 - Kensico Reservoir Completed
 - Water delivered to NYC
- 1928 Gilboa and Shandaken Tunnel completed

Ashokan 1907-1915

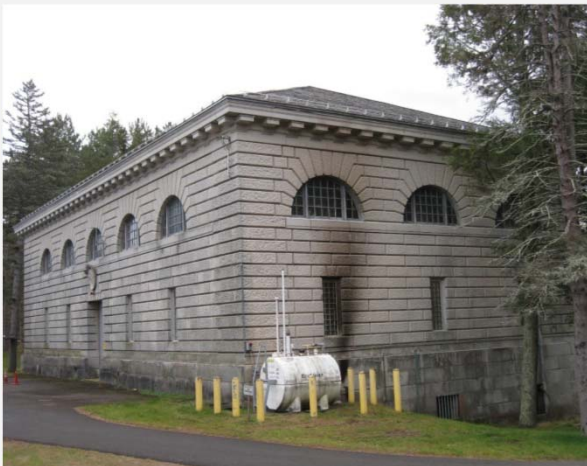
- **Constructed: 1907 - 1915**
 - Towns of Olive, Marbletown, Hurley Ulster Co
 - Esopus Creek
- Olive Bridge Dam: 4650 ft long, 210/252 ft high
- **Capacity: 123 Billion Gallons**
 - 256 sq mi Watershed
- Size: 12.8 sq mi, 12 mi long, 40 mi shoreline, max depth 190 ft
- Communities Flooded:
 - Shokan, Broadhead Bridge, Browns Station, Olive Bridge, West Hurley, Glenford, Olive, Ashton
- Residents displaced: 2000



Ashokan Reservoir



Lower gate chamber



Screen Chamber



Upper gate chambers

Ashokan Dams & Dikes - Perspective

- Croton System: ~15,575ft
 - 15 Structures
- Ashokan length Total: ~29,000ft (5.49mi)
 - 13 Structures

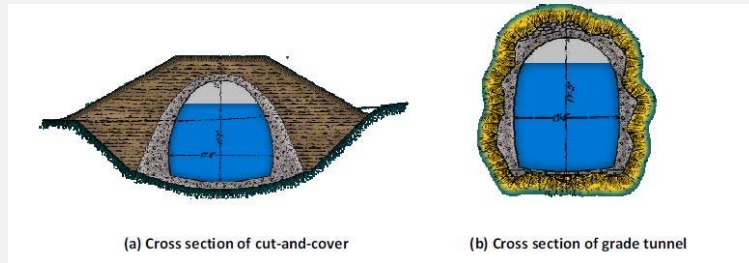


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~WTC to 82nd Street

Catskill Aqueduct



- Flows by gravity from Ashokan to Kensico Reservoir and to Hillview Reservoir
- Future sand filtration planned at Eastview
- 92 mi long
 - 55 mi - cut and cover 17 ft diam
 - 14 mi of grade tunnel through hills
 - 17 mi pressure tunnel at valleys and rivers 300-700 below ground
 - 5 mi steel siphon encase in concrete where poor rock
- 1000 ft below ground by Hudson River



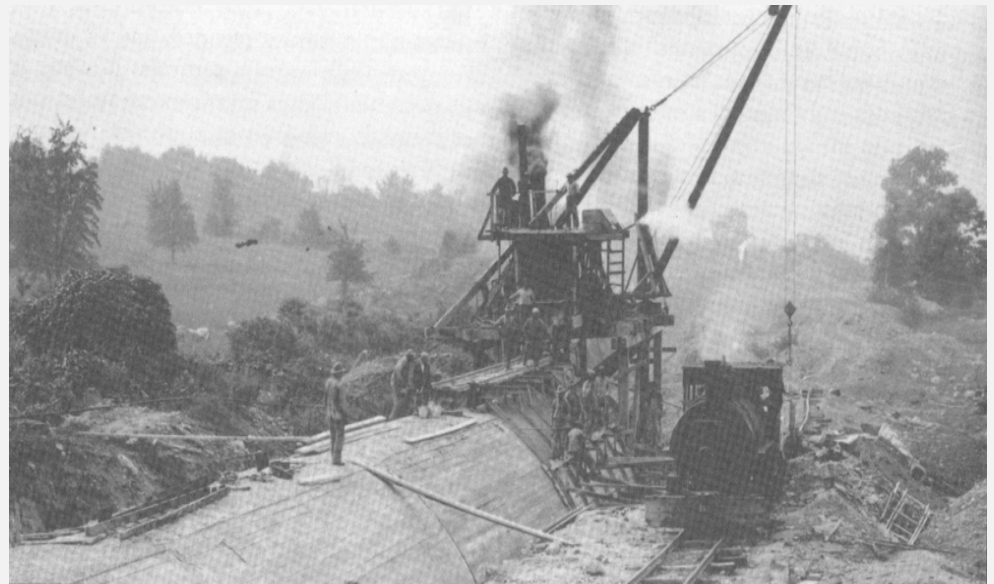
Catskill Aqueduct



Typical Cut and Cover Section



Hudson River Drainage Chamber



Catskill Aqueduct at Peekskill

Catskill Aqueduct Shafts



Croton Lake Downtake



Hudson River Drainage Chamber



Catskill Influent Chamber



Upper Effluent Chamber

Kensico Reservoir

- **Constructed: 1911 start removal of old dam/1913 – 1915 new dam**
- Town of Mt. Pleasant, North Castle, Harrison
- **Kensico Dam: 3300 ft long, 168/307 ft high (size of pyramids)**
- Capacity: **30 Billion Gallons**
- Storage/ Balancing Reservoir
- Size: 3.5 sq mi, 4.0 mi long, 35 mi shoreline, max depth 155 ft
- Communities Flooded:
 - Kensico
 - Armonk
 - Part of Valhalla

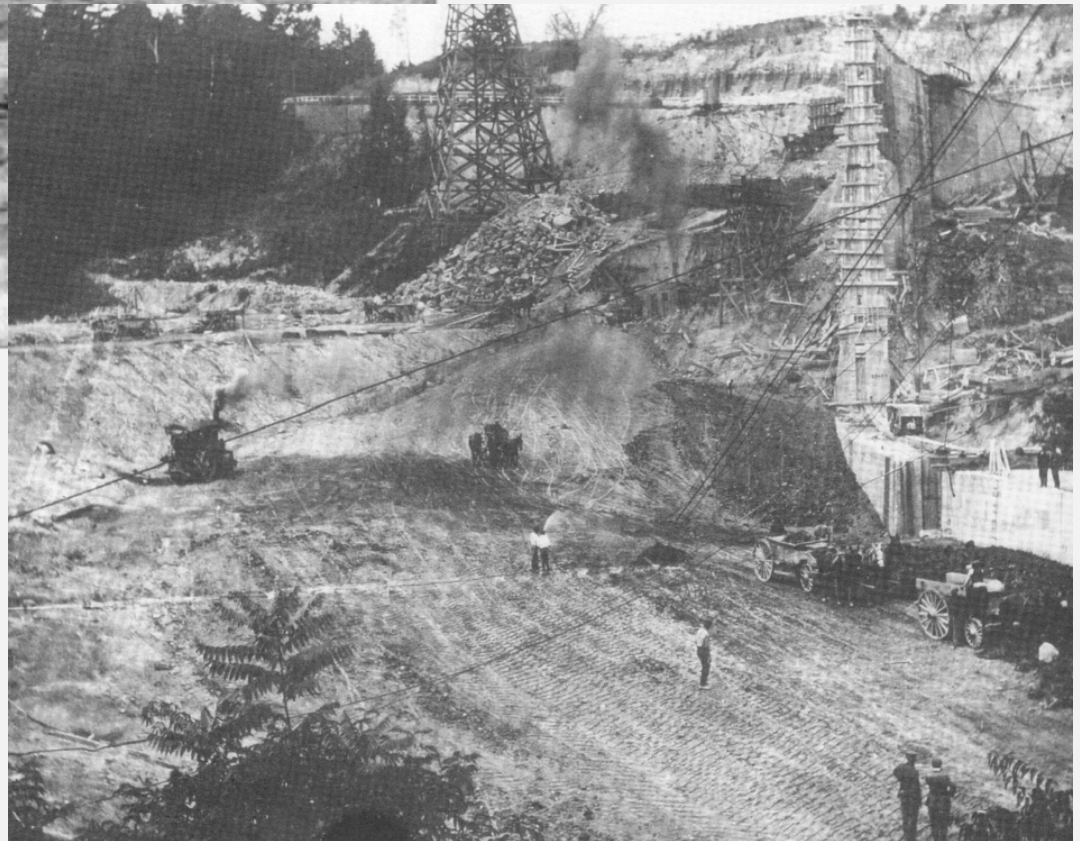


Hillview Reservoir 1909-1915

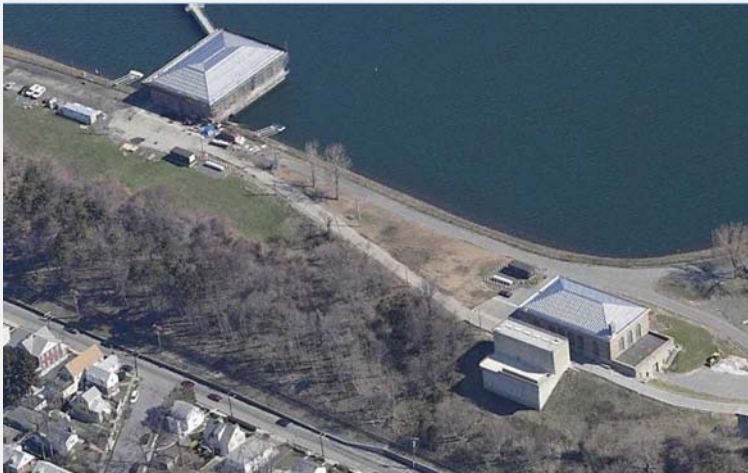


- Constructed: 1909 - 1915
- City of Yonkers
- Dug from a hilltop
- Capacity: 929 Million Gallons
- Storage/ Balancing Reservoir
- Size: 90 acres, max depth 36 ft
- Balances hourly flow for NYC
- Receives Flow from Catskill and Delaware Aqueducts from Kensico Reservoir
- Feeds City Tunnels 1,2,3

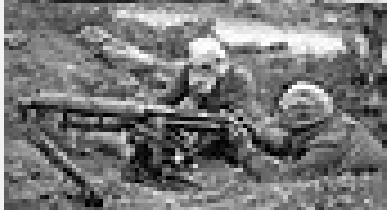
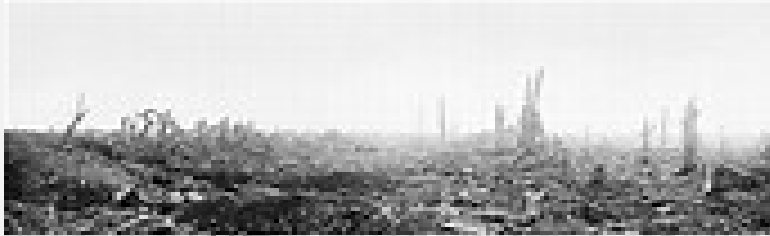
Hillview



Hillview Reservoir Today



World War I - July 1914 to Nov 1918



Commanders and leaders

Allied leaders

[Georges Clemenceau](#)
[Raymond Poincaré](#)
[H. H. Asquith](#)
[David Lloyd George](#)
[Vittorio Orlando](#)
[Victor Emmanuel III](#)
[Woodrow Wilson](#)
[Yoshihito](#)
[Nicholas II](#)
[Peter I](#)
[Ferdinand I](#)

Central Powers leaders

[Wilhelm II](#)
[Franz Joseph I](#)
[Karl I](#)
[Mehmed V](#)
[Ferdinand I](#)

Military dead: 5,525,000
Military wounded: 12,831,500
Military missing: 4,121,000

Total:
 22,477,500 KIA, WIA or MIA

Military dead: 4,386,000
Military wounded: 8,388,000
Military missing: 3,629,000

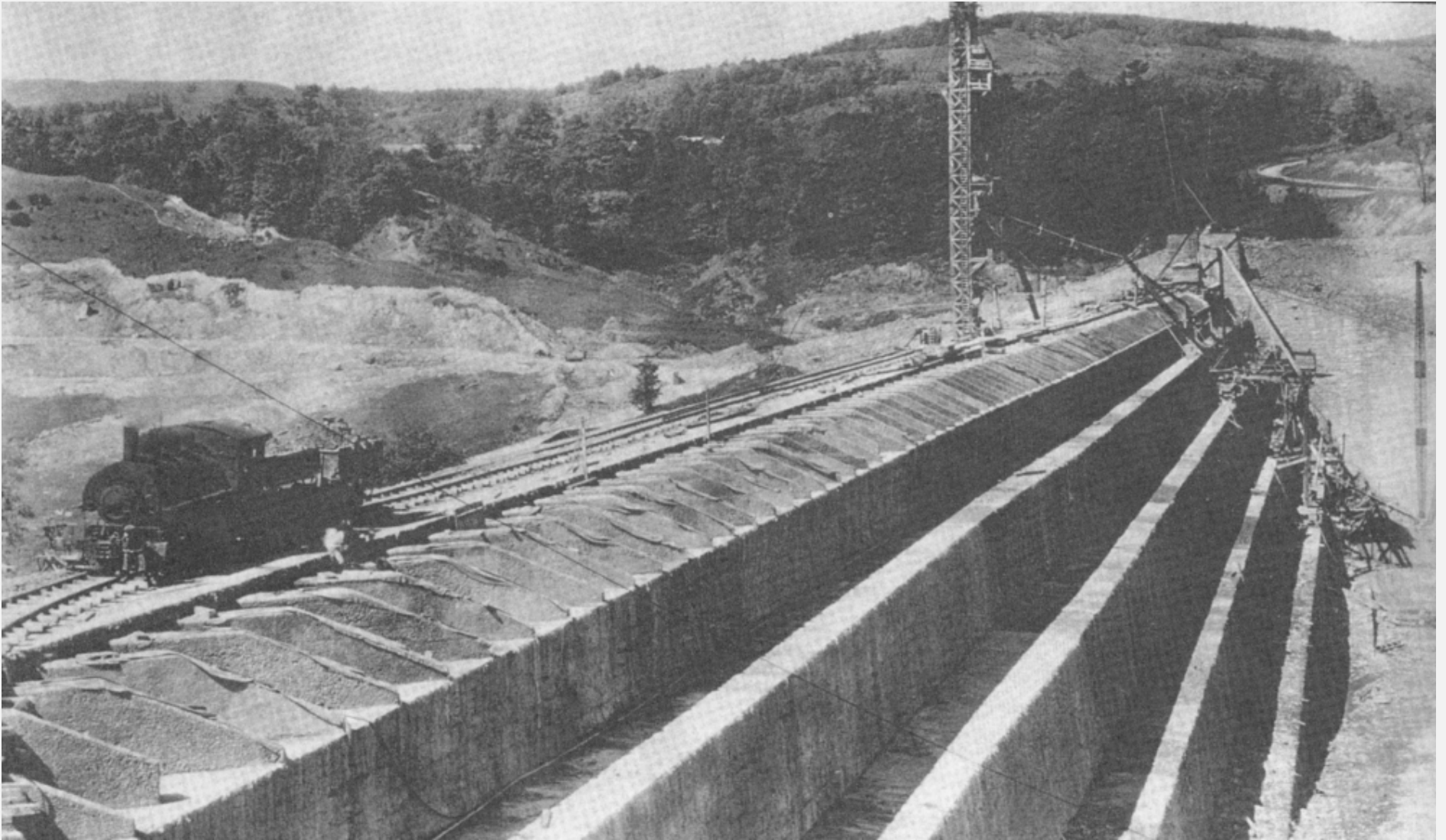
Total:
 16,403,000 KIA, WIA or MIA

Schoharie Reservoir - 1919

- **Constructed: 1919 - 1927**
- Towns of Gilboa, Roxbury and Prattsville
Schoharie, Delaware and Greene Cos
- Gilboa Dam: 2000 ft long, 182 ft high
- **Capacity: 17.6 Billion Gallons**
- Size:
1.8 sq mi, 5.8 mi long, 16.5 mi shoreline, max depth 150 ft
- Feeds Esopus Creek via the Shandaken Tunnel (18 mi)
- Communities Flooded:
Gilboa
- Residents displaced: 350



Gilboa Dam



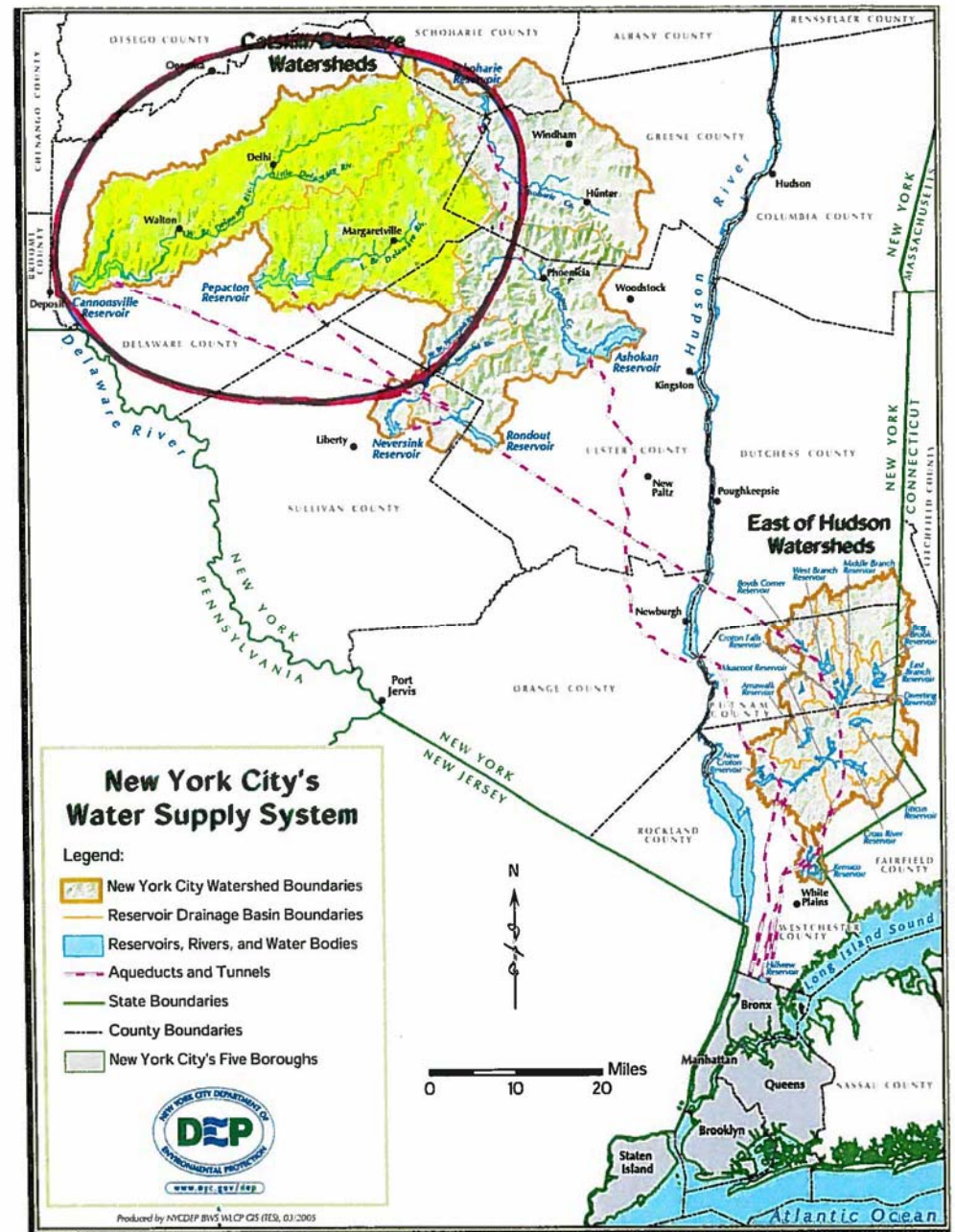
Gilboa Dam



Gilboa Dam - 2016



Delaware Watershed



1920's- 1960's Delaware System

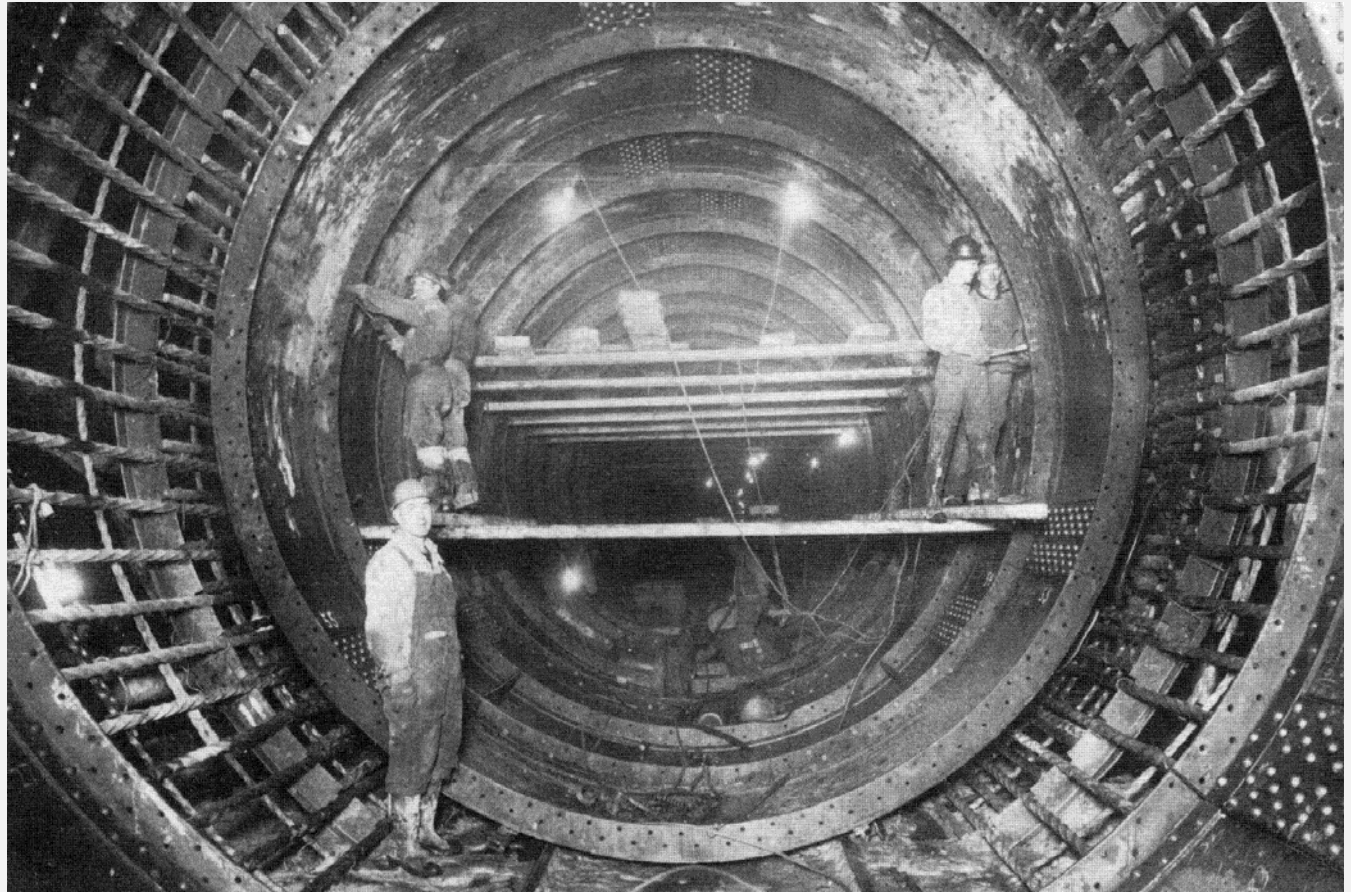
- 1920s Waldo Smith warned water consumption threatening Catskill supply
- 1923 NYS legislature passes act to work with representatives from NJ, PA and Fed
- 1928 Plan for Delaware and Rondout Reservoir approved by Board of Estimate
- *1929 Stock Market Crash*

Delaware System

- 1931 NJ sues NYC
- **1931 Supreme Court denied NJ suit** Justice Oliver Wendel Holmes, *"A river is more than an amenity...."* authorizes diverting **440 MGD** required NYC to release sufficient water to maintain flow targets in the Delaware at Port Jervis and Trenton
 - Construct Port Jervis Wastewater Treatment Plant
- *1935-1945 World War 2*
- 1937 -1964 Construction
- **1954 Supreme Court amends the 1931 decision**
 - allows diversion of **800MGD** on condition that min flow in Montague NJ is 1750cfs
 - Chief Hydraulic Engineer of USGS designated as Delaware River Master

Delaware Aqueduct

- Completed 1940s
- 85-miles long
- Longest continuous tunnel in the world, and
- Depths ranging from 300 to 2400 feet
- Intersects at Eastview for future sand filtration



Rondout Reservoir - Merriman Dam

- **Construction:**
 - 1937 - 1943
 - 1946 - 1954
- Rondout Creek
- Towns of Wawarsing, Neversink
- Ulster & Sullivan Counties
- Merriman Dam:
 - 2400 ft long, 195 ft high
- **Capacity:**
 - **49.6 Billion Gallons**
- **Size:**
 - 7.5 mi long, 19.4 mi shoreline
 - Max depth 175 ft
- **Communities Flooded:**
 - Eureka
 - Montela
 - Lackawack
- Residents displaced: 1200



East Delaware Outlet Chamber
- Power Plant



West Delaware Outlet Chamber – Power Plant



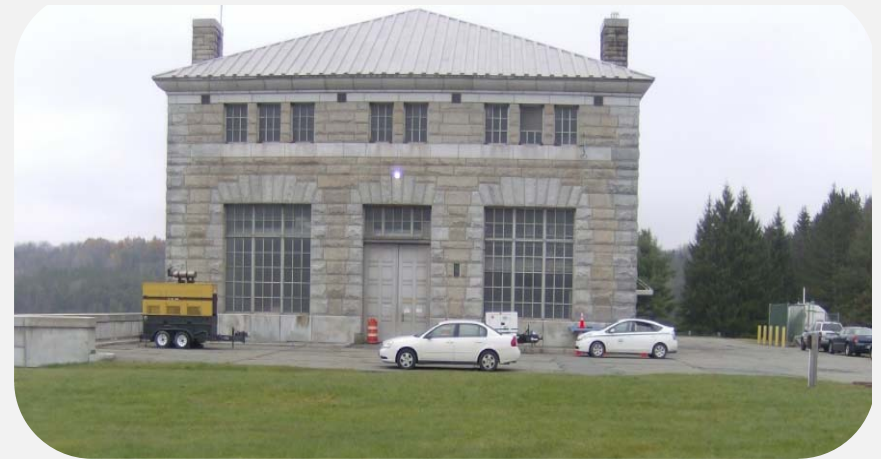
Neversink Intake Chamber – Power Plant



Rondout Effluent Chamber

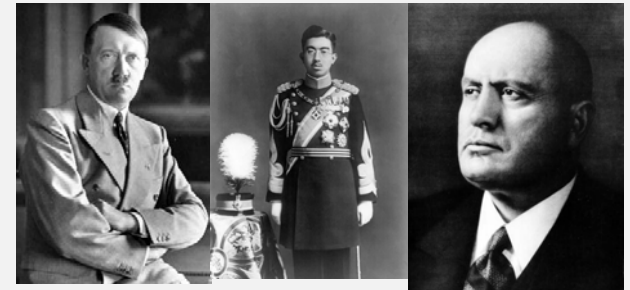
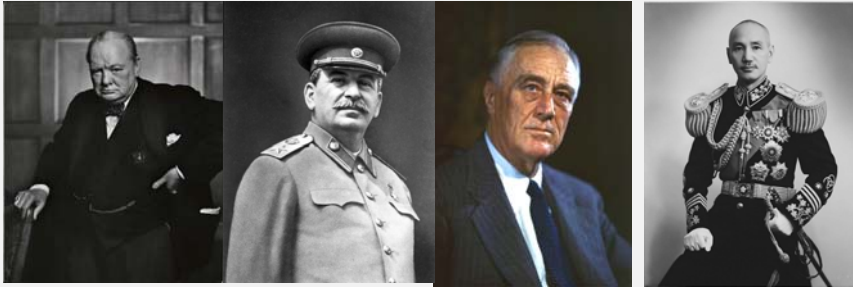
Neversink Reservoir

- **Construction:**
 - 1941 - 1943
 - 1946 - 1953
- Neversink River
- Towns of Neversink
- Sullivan County
- Neversink Dam:
 - 2820 ft long, 195 ft high
- **Capacity:**
 - **34.9 Billion Gallons**
- Size:
 - 5 mi long, 17 mi shoreline
 - Max depth 175 ft
- Communities Flooded:
 - Neversink
 - Parts of Bittersweet & Aden
- Residents displaced: 342



Neversink Intake Chamber

World War II 1939-1945



Commanders and leaders

Main Allied leaders

Joseph Stalin
Franklin D. Roosevelt
Winston Churchill
Chiang Kai-shek

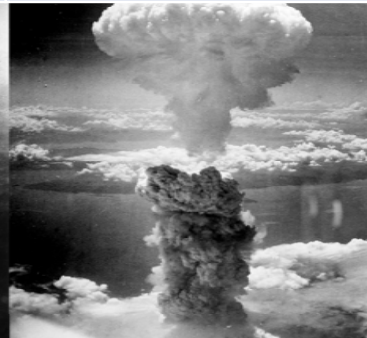
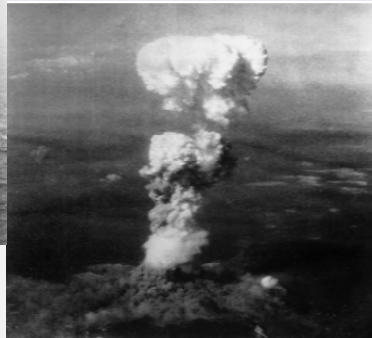
Main Axis leaders

Adolf Hitler
Hirohito
Benito Mussolini

Casualties and losses

Military dead: 16,000,000 +
Civilian dead: 45,000,000+
Total dead: 61,000,000+

Military dead: 8,000,000+
Civilian dead: 4,000,000+
Total dead: 12,000,000 +



Pepactan Reservoir

- **Constructed: 1947 - 1954**
- East Branch of Delaware River
- Towns of Colchester, Andes, Middletown
- Delaware County
- Downsview Dam:
2450 ft long, 204 ft high
- **Capacity:**
140.2 Billion Gallons
- Size:
 - 18.5 mi long, 51mi shoreline
 - Max depth 180 ft
- Communities Flooded:
 - Arena
 - Pepacton
 - Shavertown
 - Union Grove
- Residents displaced: 974



East Delaware Intake Chamber

Cannonsville Reservoir

- **Constructed: 1955 - 1967**
- West Branch of Delaware River
- Towns of Deposit & Tompkins
- Delaware County
- Stilesville Dam:
 - 2800 ft long, 174 ft high
- **Capacity:**
 - **95.7 Billion Gallons**
- Size:
 - 16 mi long, 51.3 mi shoreline
 - Max depth 140 ft
- Communities Flooded:
 - Beerston
 - Cannonsville
 - Granton
 - Rock Rift
 - Rock Royal
- Residents displaced: 941



West Delaware Intake Chamber

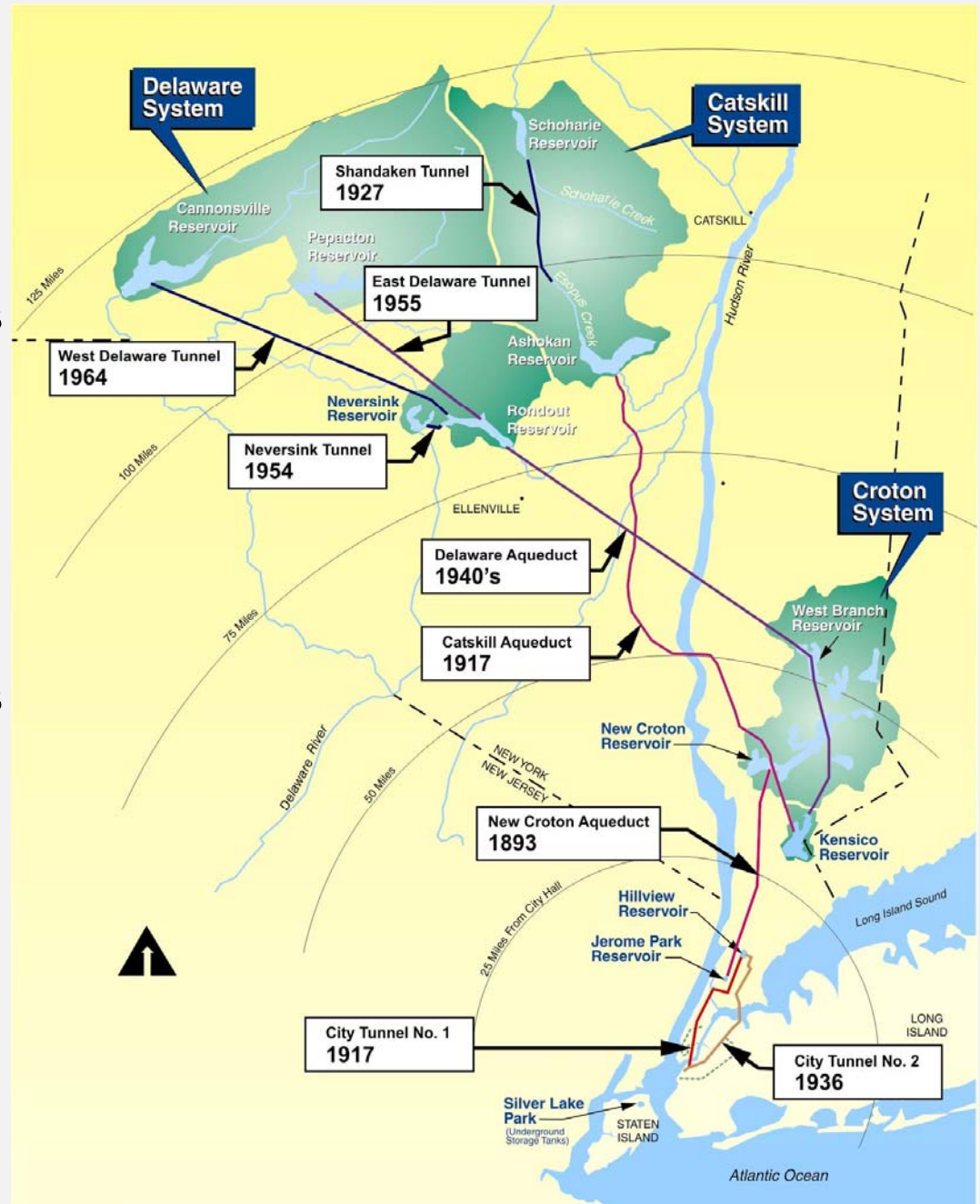
Catskill and Delaware

Catskill System

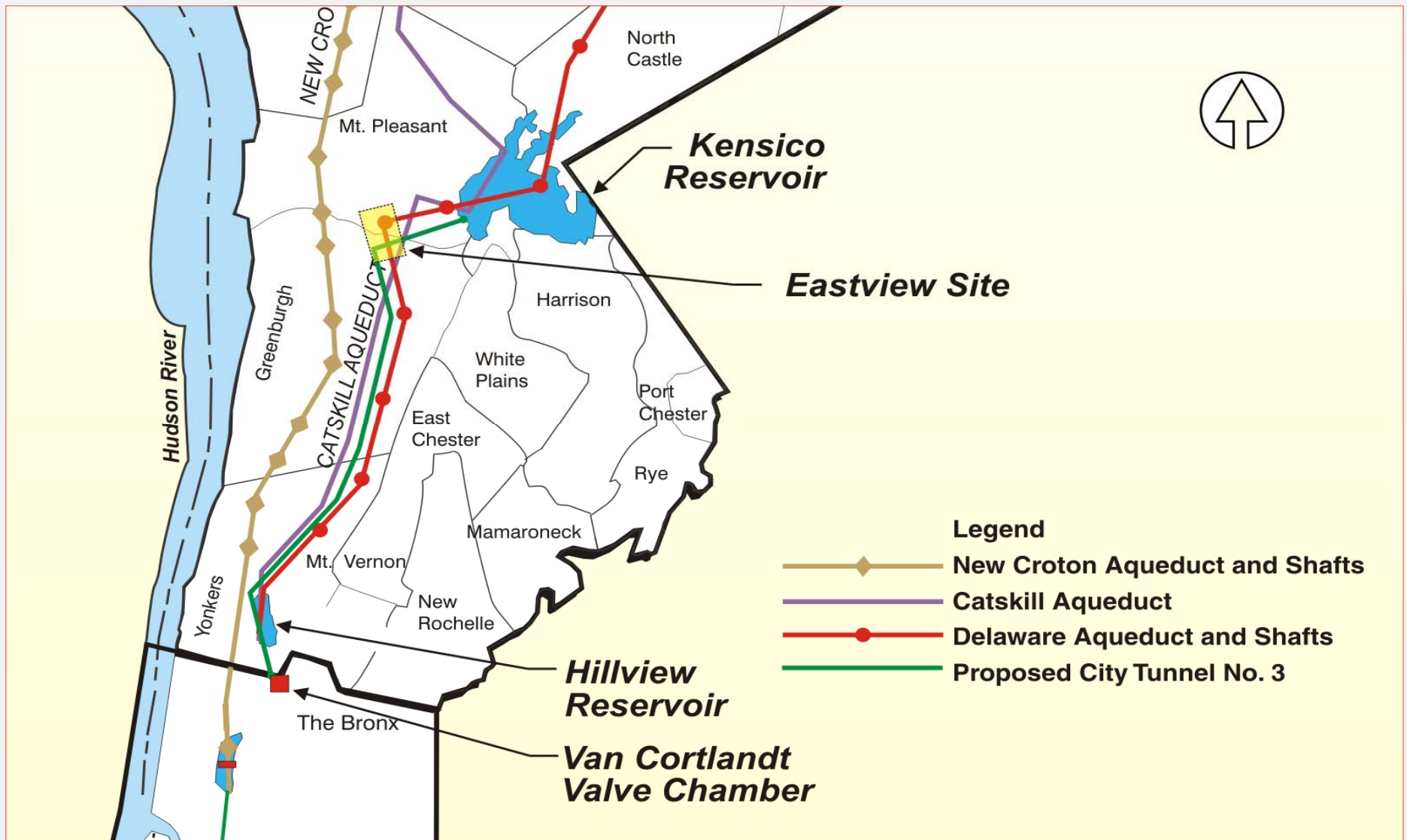
- Built in 1920's
- Two reservoirs
- Stores 140 Billion gallons
- Gravity

Delaware System

- Built in 1940's
- Four Reservoirs
- Stores 320 Billion gallons
- Gravity



Water Supply Kensico to Hillview





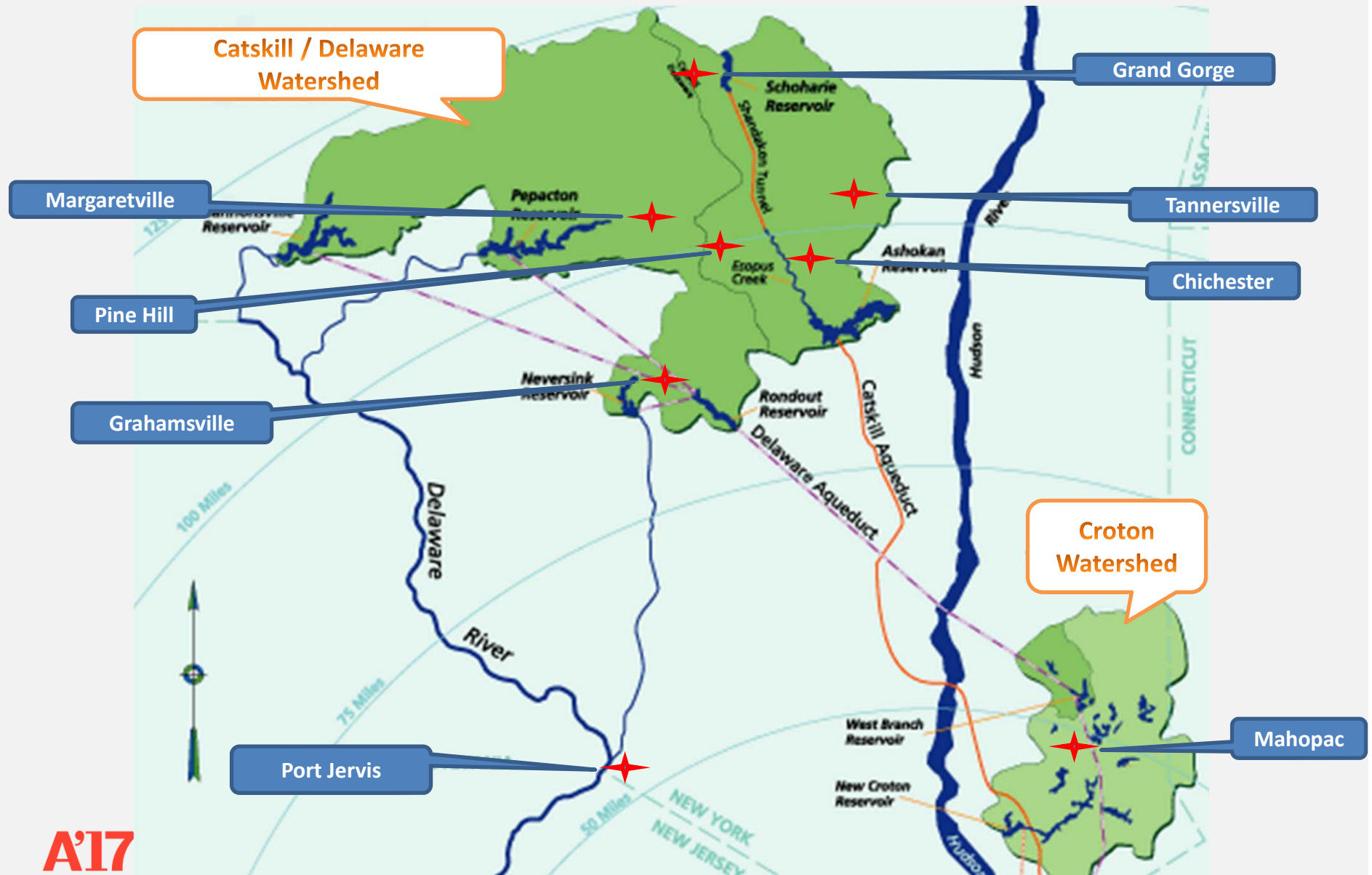
A'17 AIA Conference on Architecture 2017
April 27-29, Orlando

1990's to Present

Quality over Quantity

- Croton Water Treatment Plant
- FAD for Catskill and Delaware Systems
- Wastewater Treatment Plants
- CAT-DEL UV
- Water demand reduction
- Repairs of 100 year old tunnels and aqueducts
 - City Tunnel 3
 - Rondout West Branch Tunnel
 - Catskill Pressurization – Kensico Eastview Connection 2
 - Cat South
- Cat-Del Filtration

Wastewater Treatment Plants



Upgrade of STP's

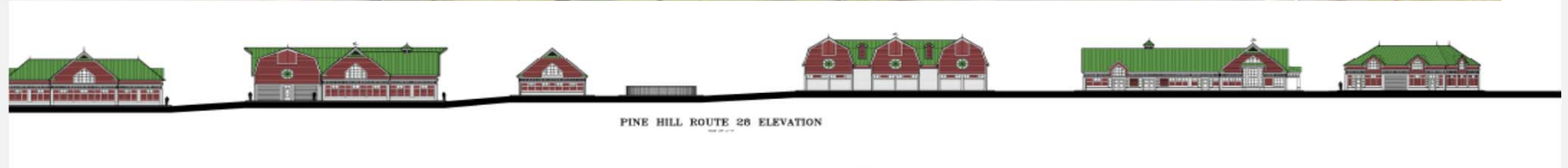


Grand Gorge
WWTF



Tannersville WWTF

Pine Hill WWTF



- Grand Gorge and Tannersville plants, were designed as square, precast concrete buildings that employed a historical neo- classical style typical of waterworks facilities in the region.
- The Pine Hill community objected to this “monolithic windowless tomb-like structure”. Located on the main corridor route to tourist-attracting ski resort areas, they wanted the facility to present a picture of regional spirit and style.

Pine Hill Architectural Elements

- Pine Hill was re-designed:
 - “Village” setting of eight Victorian-style buildings
 - Façades: ornamental precast concrete to replicate Victorian wood ornamentation.
 - Roofs: standing seam metal roofs protected with an extended-life, deep green polyvinyl fluoride-based paint.
 - Windows: high-performance, clear insulating glass.
 - Walls: super-insulated for maximum energy efficiency

Croton WTP @ Mosholu Site Preconstruction View 2004

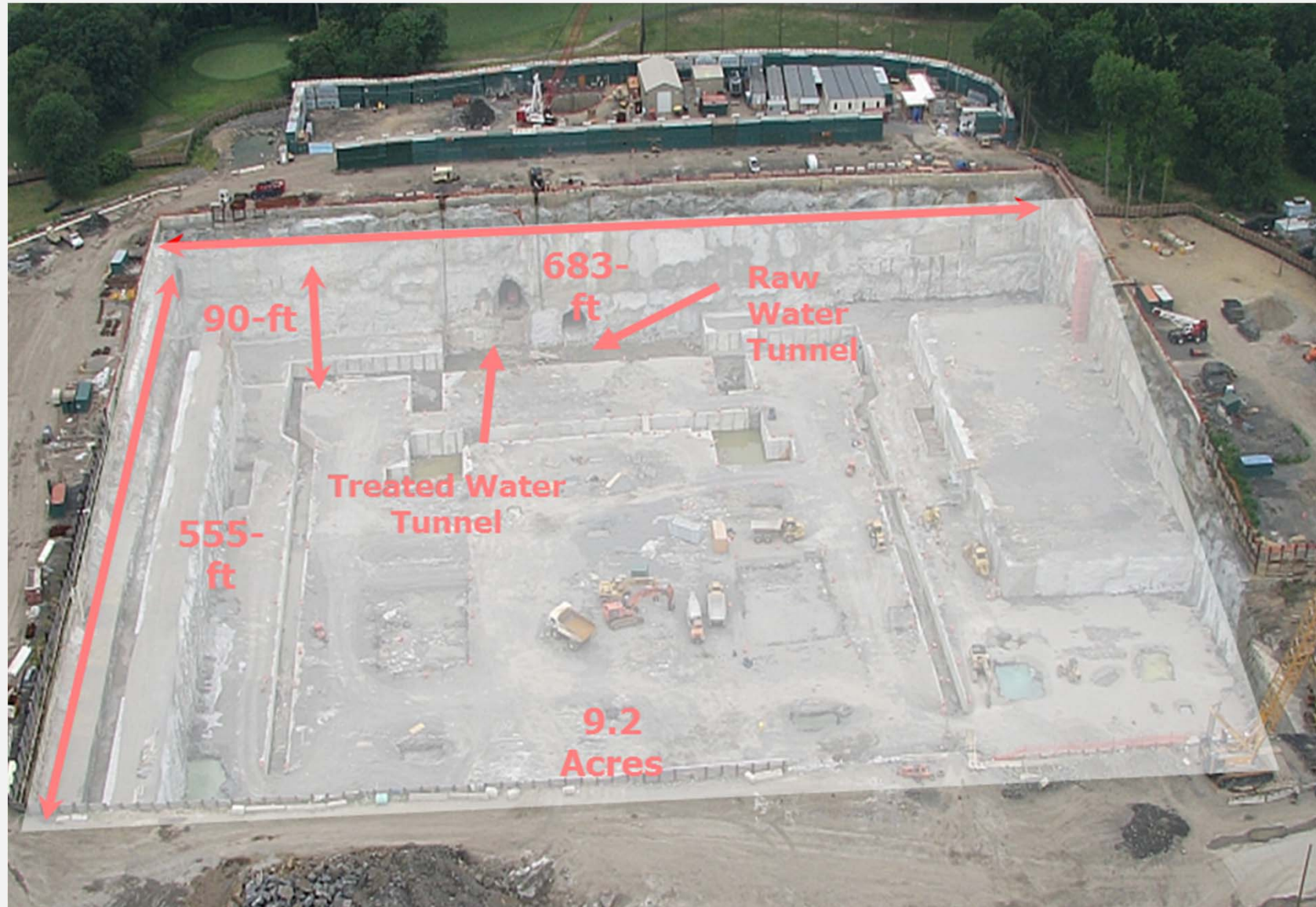




Croton WTP @ Mosholu Site Model View



Croton Water Treatment Plant July 2007



Croton Water Treatment Plant - November 2010



Croton Water Treatment Plant - September 2011



Croton Water Treatment Plant - June 2014



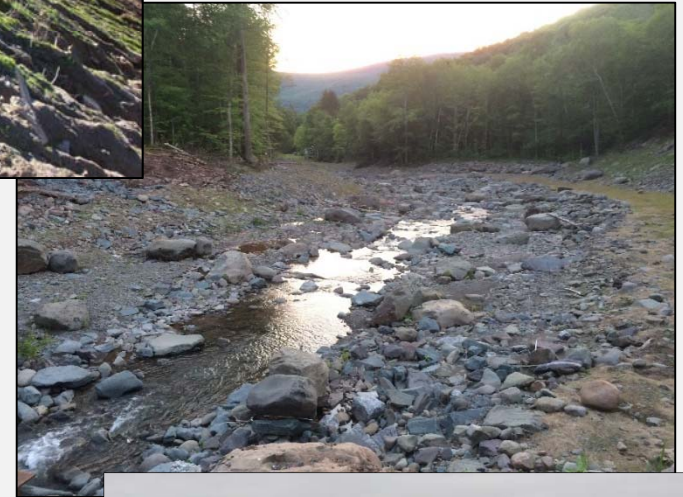
Croton Water Treatment Plant - May 2015



Filtration Avoidance Determination - USEPA

- New watershed regulations were promulgated on May 1, 1997 (since revised and updated)
- Three primary components:
 - **Watershed rules & regulations**
 - **Land acquisition program**
 - **Voluntary partnership programs**
- Economic incentives for watershed stakeholders
- Assessed and refined every five years
- Basis for continued Filtration Avoidance Determinations

Filtration Avoidance Determination

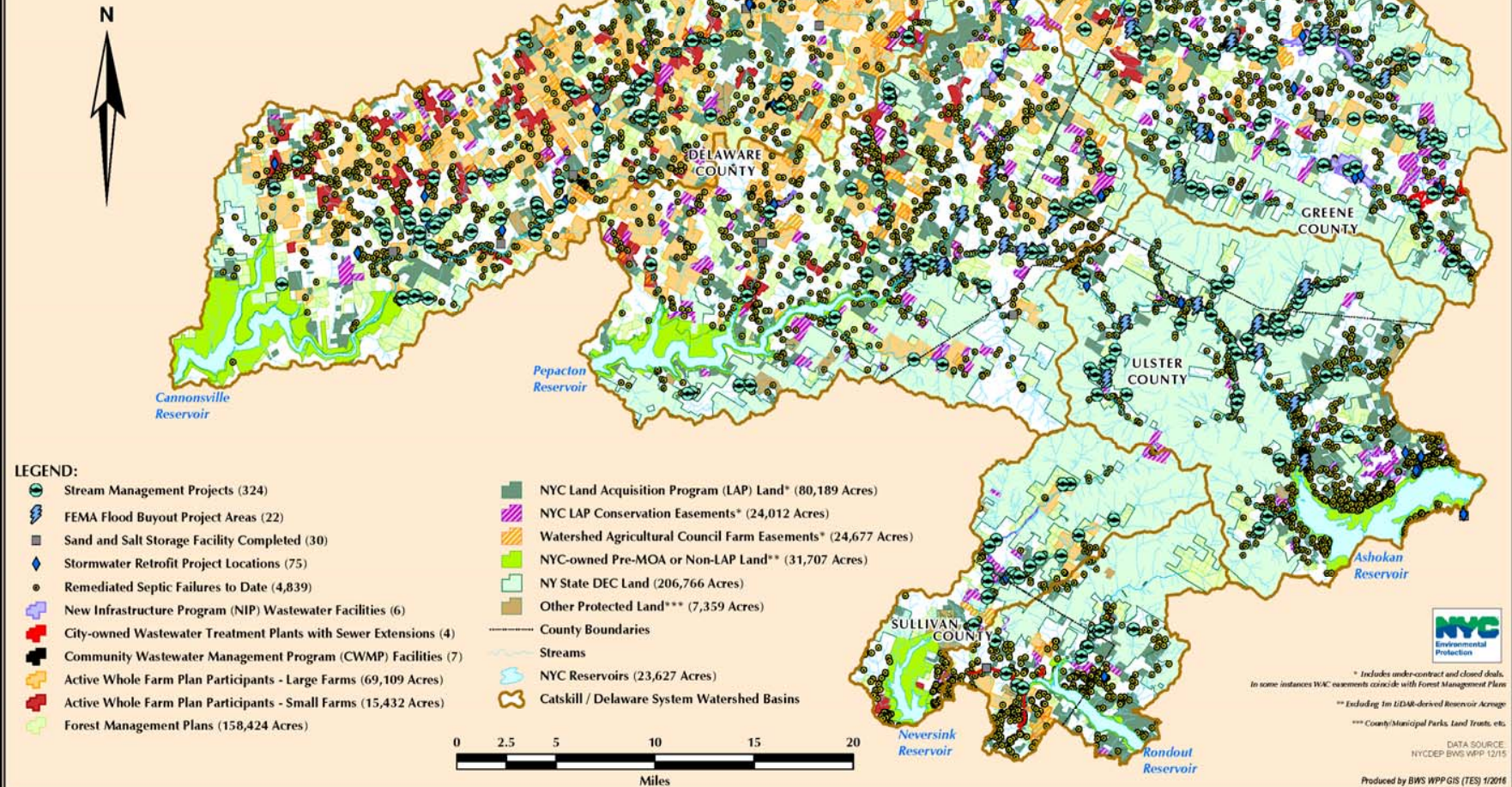


- Agriculture & Forestry
- Stream Management
- Land Acquisition
- Land Management & Recreation
- Education & Outreach
- Stormwater Management
- Wastewater Infrastructure



New York City West-of-Hudson Watershed Protection & Partnership Programs

As of December 2015



FAD Water Treatment

- **1989 -Surface Water Treatment Rule (SWTR) promulgated**
 - Filter or meet requirements specified in SWTR
 - 2-log *Giardia*, *Cryptosporidium* inactivation



Giardia cyst



Cryptosporidium
oocyst

Cat-Del Ultraviolet Disinfection Facility



Eastview Site with Filter Plant



	Approximate Footprint/Area
Mount Pleasant	83 acres
Greenburgh	66 acres

A'17

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Croton Falls Dam – 1950s



Original Croton Falls PS Concept



Shaft 10



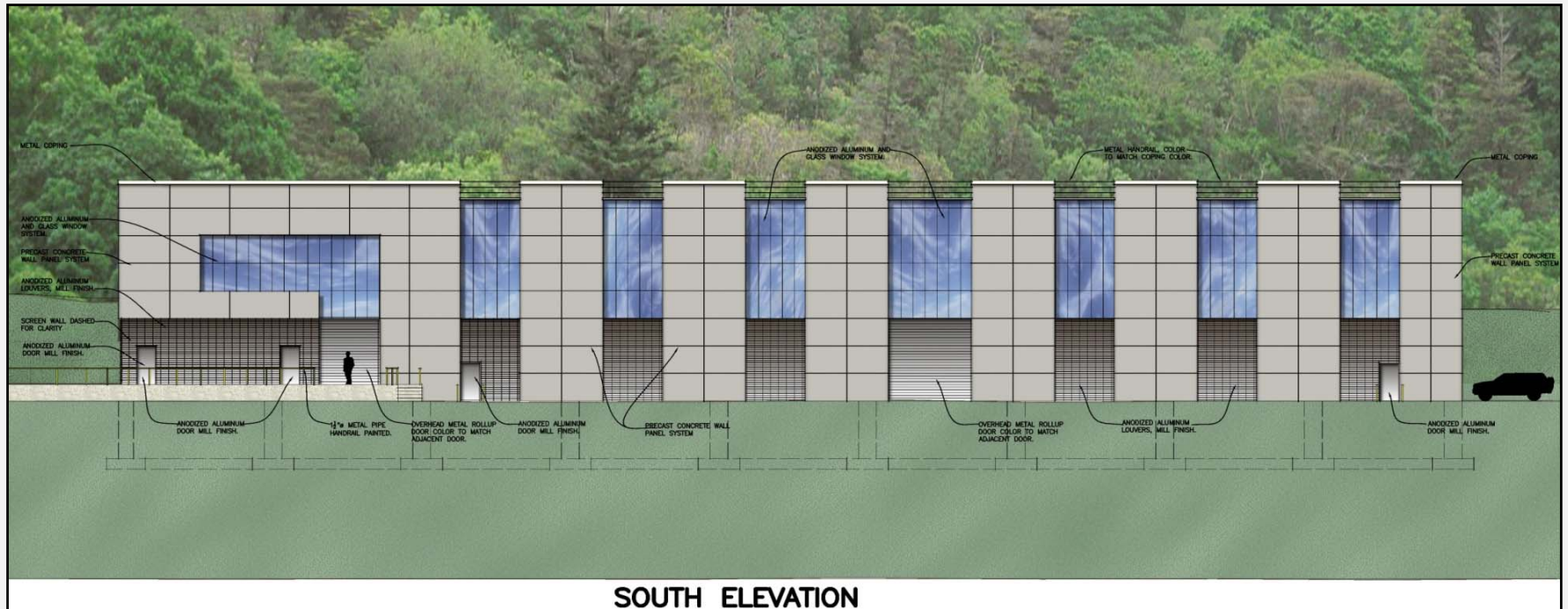
Shaft 13

Nearby Delaware Shafts



Original Concept was rejected

Croton Falls Pump Station South Elevation



- 13,560 SF, 45 ft Tall
- Anodized aluminum Doors, windows and louvers
- Below grade pump room to help reduce the visual size as well as passive insulation



Croton Falls Pump Station Site Considerations

Site Selection:

- Above the 100 year flood zone.
- 100' away from any body of water.

Protect and Restore Habitat

- Native species around site.

Storm Water Design:

- Reduce impervious cover
- Vegetative swales and pervious pavement
- Onsite filtration
- New wetlands



Croton Falls Pump Station - Sustainability

Heat Island Effect:

- Roof: standing seam metal roof
- min Solar Reflectance Index (SRI) of 78 to reduce the buildings heat gain.

Light Pollution Reduction:

- Exterior lighting - no direct uplight
- Rain screen provides sun shade and clerestory windows
 - minimize heat gain
 - minimize light pollution from interior sources.

Optimize Energy Performance

- First floor: below grade adds insulation
- Insulated precast concrete panels
- Terracotta rain screen - sun screens and to minimize light pollution
- High efficiency glazing and horizontal solar shades to lower energy consumption of the HVAC system.
- Temperature to be 55 deg min (unmanned facility)
- Large clerestory windows, with high efficiency glazing

Materials and Resources Recycled Content:

- Aluminum roofing made from 90% recycled material
- Structural steel contains 25% recycled content.
- Precast concrete walls contain fly ash, slag cement, and silica fume.

City Tunnels

1917 City Tunnel 1

1936 City Tunnel 2

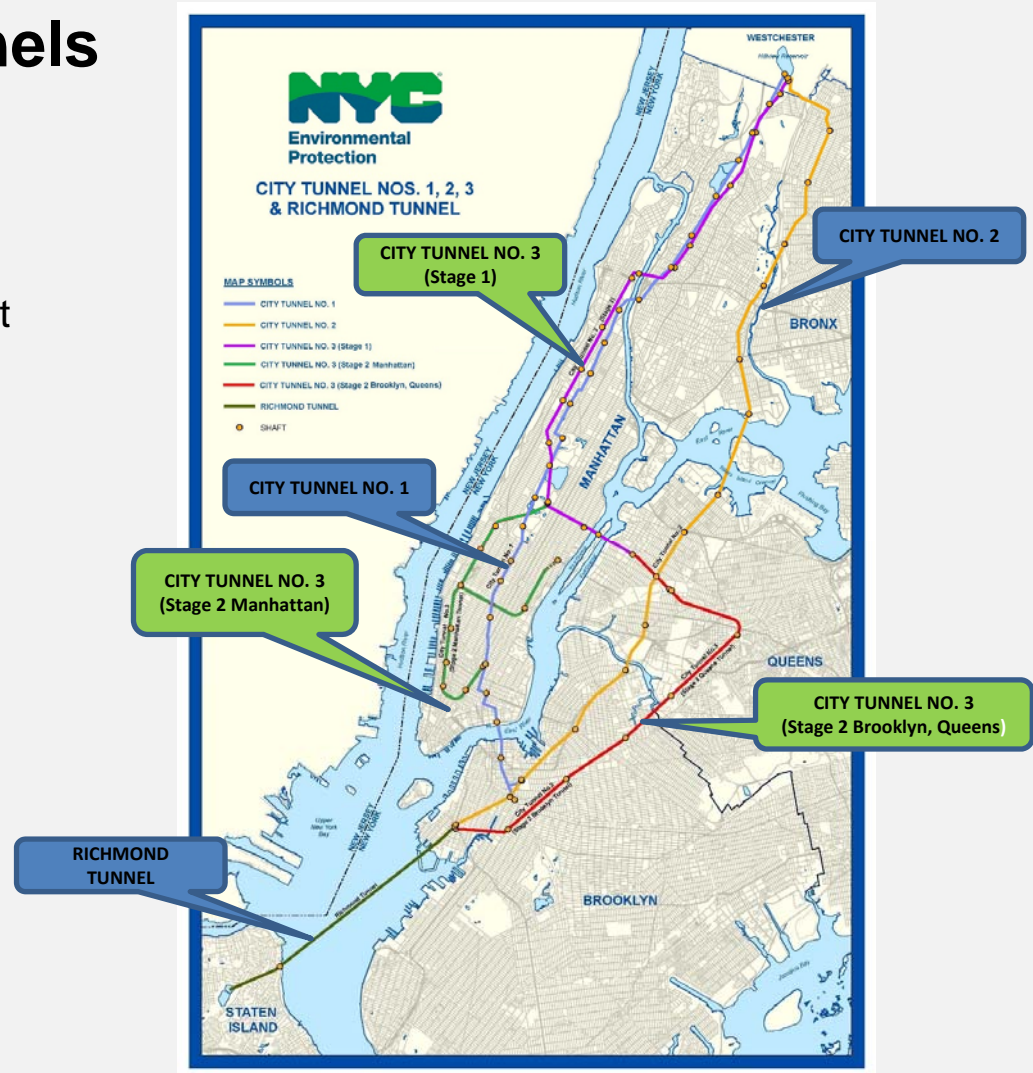
City Tunnel 3

Stage 1: Hillview to Roosevelt Island

Stage 2: Lower Manhattan

Stage 3: Kensico to Hillview

Stage 4: Hillview to Queens



City Tunnel 3

Stage 1: Construction:1970 -1993

- 1998 In service
- 13 mi drill and blast

Stage 2 – Manhattan

- In service 2013
- Redundancy for C.T. #1
- 8.5 mi TBM (10 ft diameter)

Stage 2 – Queens/Brooklyn

- Redundancy for C.T. #1 in Brooklyn
Redundancy for C.T. #2 in Queens,
Brooklyn, and Staten Island
- 10.5 mi (15 – 20 ft. diameter)

Stage 3: Kensico to Hillview

Stage 4: Hillview to Queens

Hybrid TBM (EPB)

Similar TBM Designs:

- City Tunnel 3~ 20ft OD
- RWBT Bypass Tunnel 21 ft OD
- Kensico Eastview Connection Tunnel ~30 ft OD



Tunneling - Fire in the hole



Questions?



Why Public Service?

- Ability to make a difference
- Ability to take charge / make decisions early in career
- Time
 - For raising family
 - For vacations

Question 1

What is the role of architects in your utility infrastructure systems?

(Multiple choice, with more than one answer allowed)

- a. NA – not included
- b. Potable water plants
- c. Wastewater plants
- d. Pumping Stations
- d. Reservoirs
- e. Tunnels and aqueducts

Question 2

To what extent does the presence of design in legacy infrastructure influence your current infrastructure?

(Multiple choice, only one answer allowed)

- a. NA – no legacy infrastructure with aesthetic value
- b. Design vocabulary of legacy infrastructure is used as standards for contemporary projects
- c. Contemporary projects expected to have aesthetic value but not expected to follow earlier design vocabularies
- d. No expectation of aesthetic value for contemporary projects

Question 3

Which aspects of infrastructure system design do you think architects can influence?

(Multiple choice, with more than one answer allowed)

- a. Aesthetics
- b. Environmental practices in building / construction, e.g., sustainable design and materials
- c. Habitat / land use, e.g., wildlife conservation or corridors, community amenities)
- d. Mitigation, e.g., noise, view corridors
- e. Cost
- f. Construction methods
- g. Public perception
- h. Individual reliance on infrastructure systems

Question 4

DISCUSSION

Looking ahead, how can architects shape the presence and role of infrastructure in society and daily lives?