

## 100<sup>th</sup> Anniversary of Water from the Catskills

**T**his week marks 100 years since the first drop of drinking water from the Catskills reached consumers in New York City. The arrival of water from the mountains on December 27, 1915, was humbly marked in an annual report the following year, which noted that city engineers began to draw 7 million gallons a day from the new system to serve portions of the Bronx. To reflect its importance, the date was later carved on a granite slab inside a decorative portico at the western end of Kensico Dam.

For New York City, the importance of water from the Catskills—now and then—cannot be overstated. By 1900, New York City was home to 3.4 million people and growing at a rate of 115,000 new residents each year. Textile, manufacturing, and shipping industries were booming. As water demand also increased, businessmen and politicians of the day realized that the Old Croton System was nearing

its full capacity. They feared “water famine” could stunt the city’s growth.

To answer that dilemma, city leaders pursued construction of a massive new water system that would convey clean, abundant water from the Catskills to the newly consolidated five boroughs of New York. As its original dams, reservoirs, and aqueducts were constructed from 1907-1915, the ambitious water system was hailed as one of the greatest infrastructure projects in human history. Engineers compared their water project to the great works of Rome, Egypt, and Babylon—and they promised that New York’s water system would “pale into insignificance” similar works of those great empires.

“It is, as a matter of fact, the greatest engineering work having to do with a water supply in the history of the world,” said Charles Strauss, president of the Board of Water Supply, as he presided over the completion of the last of its tunnels



in 1914. “There has never been anything like it either in ancient or modern history.”

The system included four reservoirs—Ashokan, Kensico, Hillview, and Silver Lake—along with the Catskill Aqueduct and City Tunnel No. 1, which comprised more than 127 miles of conduit. The dams, aqueducts and chambers that created those facilities cost a total of \$177 million by the time they were finished in 1915.

### Laws and Exploration

In the 1890s, the Manufacturer’s Association of Brooklyn was among the first politically influential groups that urged city leaders to search for new sources of water. From 1897-1903, the city commissioned at least three reports that examined potential new sources of water. Engineers looked at sources on Long Island, in Orange and Rockland counties, in the Berkshire Mountains of Massachusetts, and as far north as Lake George in the Adirondacks.

The city initially wanted to move north of the Croton System into Dutchess County to avoid building an aqueduct that crossed the Hudson River—an engineering feat that seemed daunting if not impossible at the time. But the city was blocked from Dutchess County when the owner of a dry goods business in Beacon teamed with other powerful

politicians to pass a 1904 law in Albany that prohibited New York City from developing water resources in the county.

New York City ultimately focused on the Catskills. Water from the mountains was ideal. It was cool, clear, odorless and tasteless, and soft. It was also abundant. The high peaks of the Catskills practically guaranteed a reserve of water from snow each winter, and their proximity to the coast meant the region would also catch rain from storms that swung up the Atlantic.

**“New York City’s Catskill Mountain water supply system is the greatest of waterworks, modern or ancient, and ranks among the most notable enterprises ever carried out by any city, state or nation”**

— New York City Board of Water Supply Report (1917)

Still, legal hurdles needed to be cleared. In 1904, New York City championed a change to the state constitution that separated water debt from general municipal debt. The bill was key to financing the future water system.

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## Spotlight on Safety

Let’s take a moment to reflect on some important Environmental, Health and Safety (EHS) accomplishments that happened within DEP during 2015:

- Continued to focus on a programmatic or systems related evaluation during EHS assessments and worked collaboratively with bureaus to develop the best fit corrective actions.
- Through formal feedback from bureaus and a third party audit, OEHS improved the efficiency and quality of the EHS assessment process.
- Formed a new unit of professionals capable of carrying out both EHS and workplace violence (WPV) investigations. This unit

will enhance DEP’s ability to handle reviews and investigations, while also maintaining a proactive approach to reducing and managing EHS and WPV risks.

- Distributed the “Maintaining a Safe and Respectful Workplace” and “Respect” print campaigns.

More work lies ahead. In 2016, OEHS will lead the implementation of a web-based EHS audit and incident information management system that will be supported by new DEP policies for reporting, investigating and auditing. The system will aim to proactively identify risk factors that are critical to reducing costly impacts to employee health and infrastructure.

At DEP, everyone is responsible for safety. If you or anyone on your team is concerned about your working conditions, it’s okay to ask your supervisor or your bureau’s EHS liaison how they can help. If you’ve still got questions, you can call the EHS Employee Concerns Hotline. It’s DEP’s responsibility to acknowledge and fix unsafe situations, procedures, and practices. With your help, we’ll not only get the job done, we’ll make it safer for ourselves, our coworkers, our families, and our city. CALL (800) 897-9677 OR SEND A MESSAGE THROUGH [PIPELINE](#). HELP IS ON THE WAY.

And in 1905—after four years of trying unsuccessfully—New York City secured passage of the Water Supply Act in Albany. The act created the Board of Water Supply and allowed New York City to use the powers of eminent domain to obtain land for the construction of upstate reservoirs and tunnels. Coincidentally, the law also set forth many of the programs DEP is familiar with today. It required the city to allow fishing from the shore and approved boats at all its reservoirs. In counties that hosted New York City’s water infrastructure, the law gave all communities the legal right to tap into the city’s water system and purchase water for their citizens.

**“It is one of the greatest feats in history. The names of Waldo Smith, and the men who achieved it will live in history forever”**

— NYC Mayor William J. Gaynor, January 31, 1912

The 1905 law also created progressive labor standards for those building the water system, including one of the first formalized 8-hour work days in America. That provision came seven years before Teddy Roosevelt pitched an 8-hour work day as part of his 1912 presidential campaign, 11 years before Con-

gress passed a bill restricting railroad workers to 8 hours of labor each day, and 32 years before the Fair Labor Standards Act that included an 8-hour work day for nearly all Americans.

**Getting to work**

On June 20, 1907, New York City Mayor George B. McClellan plunged a spade into the sod at Peekskill to mark the start of construction on the Catskill Aqueduct, billed by journalists as “the great water tube.”

Thousands of laborers would live in camps along the 92-mile route from Ashokan Reservoir to the Bronx while they built segments of the aqueduct. The camps were similar to small hamlets. They included doctors and nurses, schools, post offices, bakeries, savings banks, well laid-out streets, YMCA clubs, and English lessons for those who were not proficient. Electric lights were strung up in some camps. Food and “ample supplies of wholesome water” were provided. In 1908, the Police Bureau was founded to patrol the camps and the communities that surrounded them.

Work on the aqueduct and all the reservoirs happened without a single labor strike.

Some of the most talked-about work occurred on the banks of the Hudson River, where engineers and laborers approached the intimidating task of

building a tunnel 1,114 feet below the riverbed. The Hudson River Siphon—which stretches between two mountains known as Storm King and Breakneck Ridge—remains the deepest part of the city’s water supply. Its construction was such a captivating feat of modern engineering that it inspired stories and poetry published in some of the most popular magazines of the day.

One such poem in the Saturday Evening Post spoke to the difficulty and thrill of the work. It began:

*Up at the Storm King Canyon they're working us day and night;*

*We've got our standard to hold to, we've got the elements to fight;*

*We live in boots and a slicker, we sleep when we get the time,*

*And our faces and hands are plastered with the stickiest hard-rock grime;*

*We're too dog-tired for drinking, to sleepy to couch a card:*

*Our talk is all of the siphon—of rock that is soft or hard.*

*The wise guys laughed at the project; they said it would “never do!”—*

*But up at the Storm King Canyon we're putting the siphon through!*

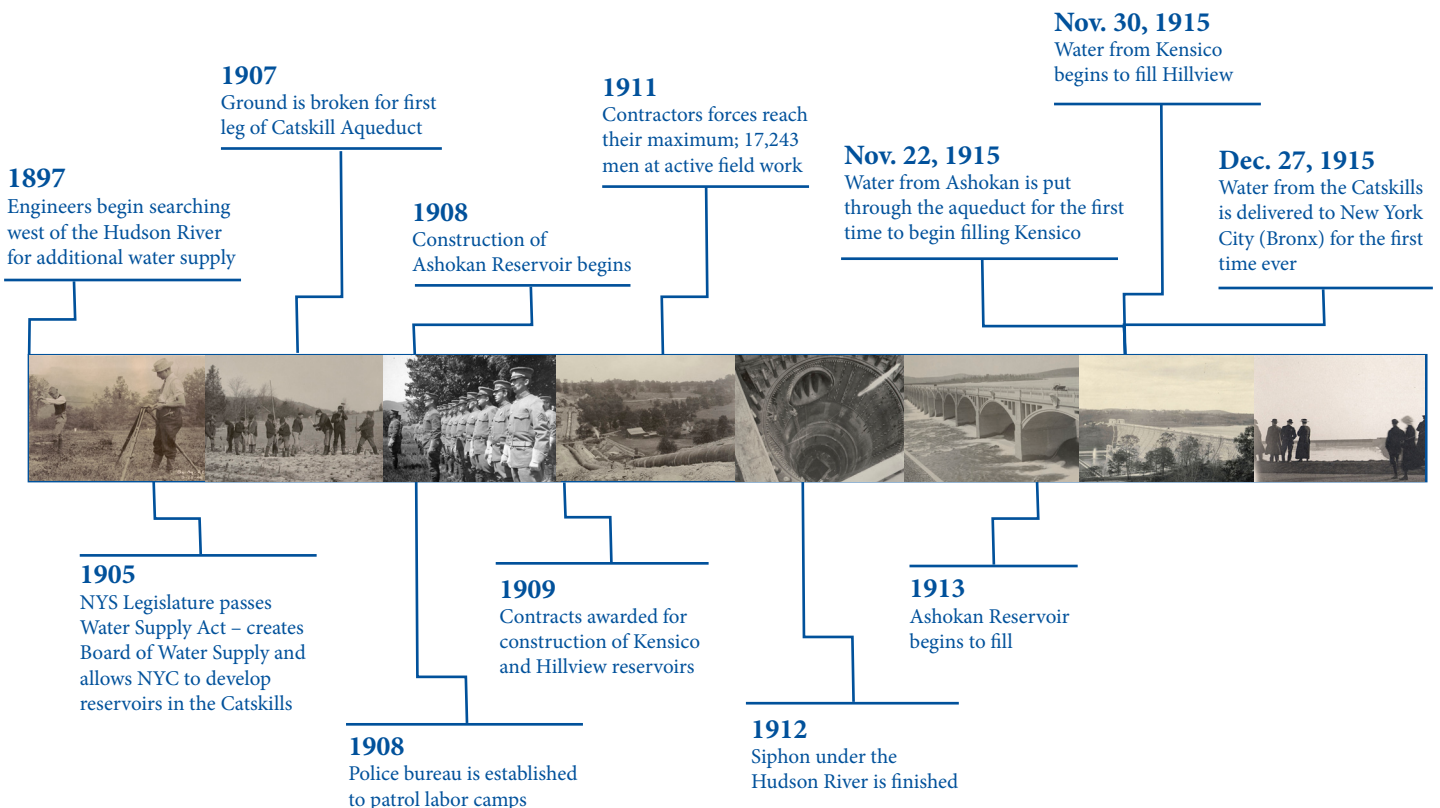
The aqueduct would carry more than 600 million gallons of fresh water from Ashokan Reservoir once it was finished, billed as a quantity greater than any water conduit in history.

Laborers were constructing four reservoirs, along with their dams, chambers and other facilities, at the same time. Ashokan Reservoir captured the public’s attention with its size alone. It would store 128 billion gallons of water—a quantity that engineers promised would end New York City’s fear of water famine forever. (That fear came back by the late 1920s after water from the Catskills allowed the city’s population to double.) The water held in Ashokan Reservoir was enough to submerge Manhattan to a depth of 30 feet, and it was more than double the storage of all the Croton reservoirs combined.

The Kensico Reservoir in Westchester County was initially constructed with maintenance in mind. Its storage would allow the 75 miles of aqueduct between it and Ashokan Reservoir to be shut down periodically for inspection, cleaning, or repair. Kensico became best known for its 310-foot-tall dam. The beautiful structure included crudely-carved friezes and a decorative parapet. All the stone for the dam was obtained from a nearby quarry. The quarry’s location, on the back side of a hill about a mile away, was carefully chosen so that the “scar in the landscape” wouldn’t be seen from any nearby highways.

Ashokan and Kensico also became known for their grand aerator systems. Equipped with 1,600

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nozzles each, the aerators at both locations shot water dozens of feet into the air. Aside from their visual appeal, the aerators served a practical purpose—they added oxygen to the water and removed odors and tastes caused by organic matter.

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— Charles Strauss, President of the Board of Water Supply, January 13, 1914, at the completion of City Tunnel No. 1

Two other reservoirs were built as part of the new system. Hillview Reservoir was built atop a knoll in Yonkers. As a balancing reservoir, it served as the start of City Tunnel No. 1 and reacted to fluctuations in water demand from the city. Silver Lake Reservoir on Staten Island provided fresh water to residents there. Ashokan water filled Silver Lake Reservoir through another one of the system’s engineering marvels, the Narrows Siphon, a 10,620-foot-long iron pipe. The siphon solved one of the new water system’s biggest quandaries—conveying water across the entry to

New York Harbor, one of the busiest ports in the world.

The 18-mile-long City Tunnel No. 1 was the longest pressure tunnel in the world when it was finished in 1914 to deliver drinking water to the network of water mains in the city. Two of its 25 shafts were deeper than the city’s tallest building at the time. (That was the Woolworth Building, scraping the sky at 792 feet.) A total of 34 miles of steel and cast-iron pipes brought Catskills water to Brooklyn, Queens and Staten Island.

In the Catskills and Hudson Valley, much of this work came at the sacrifice of local residents whose homes were purchased, whose communities were submerged, and whose farms were moved out of the valleys. For the construction of Ashokan Reservoir alone, seven villages were submerged, 32 cemeteries were removed, 2,800 bodies were interred, and 11 miles of railroad were relocated. The Board of Water Supply created a Bureau of Claims to hear cases of local residents who suffered damages as a result of the water supply construction. Many of the first claims pertained to farming. In 1907, the New York Times attended one of the first claim hearings, at which farmers decried the loss of crops, rabbits and woodcock that were driven from the land, and more. One farmer was awarded \$150 by the city controller after his cow ingested a stick of dynamite near Ashokan Reservoir and died, apparently of poisoning.

## By the Numbers

<b>\$177 million</b>	Cost to construct the Catskills System, which included Ashokan, Kensico, Hillview and Silver Lake Reservoirs, along with the Catskill Aqueduct and City Tunnel No. 1.
<b>17,243</b>	the maximum number of workers building the system at the peak of work
<b>92 miles</b>	length of the Catskill Aqueduct from Ashokan Reservoir to the Bronx
<b>3,000 miles</b>	total linear length of surveys performed to guide the construction
<b>45 miles</b>	combined length of all exploratory borings performed to support the work
<b>3 million</b>	evergreen trees planted around Ashokan and Kensico reservoirs to prevent erosion and support water quality
<b>6.7 million</b>	barrels of cement used to construct the tunnels, dams and other infrastructure
<b>32,000 tons</b>	weight of steel used during construction of the Catskill System
<b>3 million pounds</b>	total amount of brass and bronze used to construct the system

## Looking ahead

By the time fresh water from the Catskills began flowing into the city in 1915—and long before it reached all five boroughs in 1917—Board of Water Supply engineers were already thinking ahead. Development of the Schoharie Reservoir had begun to ensure adequate flow into Ashokan. During construction of the Catskill Aqueduct, New York City also set aside 315 acres near Kensico Reservoir in case a filtration plant was necessary one day. The Catskill-Delaware Ultraviolet Light Disinfection Facility was built on that property, and a portion of the land is still available for filtration in the future, if necessary.

In 1917, Board of Water Supply engineers warned that such a filtration plan would “necessarily be very much larger than any which has yet been built.” That remains true.

The designers and builders of the system also left behind carefully drawn

plans, newsletters, guides for proper maintenance, and other documents that are still referenced on a regular basis by today’s DEP employees.

Predictions on the future and tidbits of advice can also be found in many of these documents. As New York City planned a three-day celebration in 1917 to mark the arrival of Catskills water to all its five boroughs, some of the engineers wrote a report that included a section labeled “THE FUTURE.”

“Conservation of the supplies through metering and other means for reducing waste and extravagant use may postpone the date when the City must once more undertake the extension of its water system,” it said. “It is important that vigilance should be exercised to maintain the quality of all the present supplies by protecting them from pollution and treating them by approved modern methods, and that the structures should be kept constantly in good repair.”

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