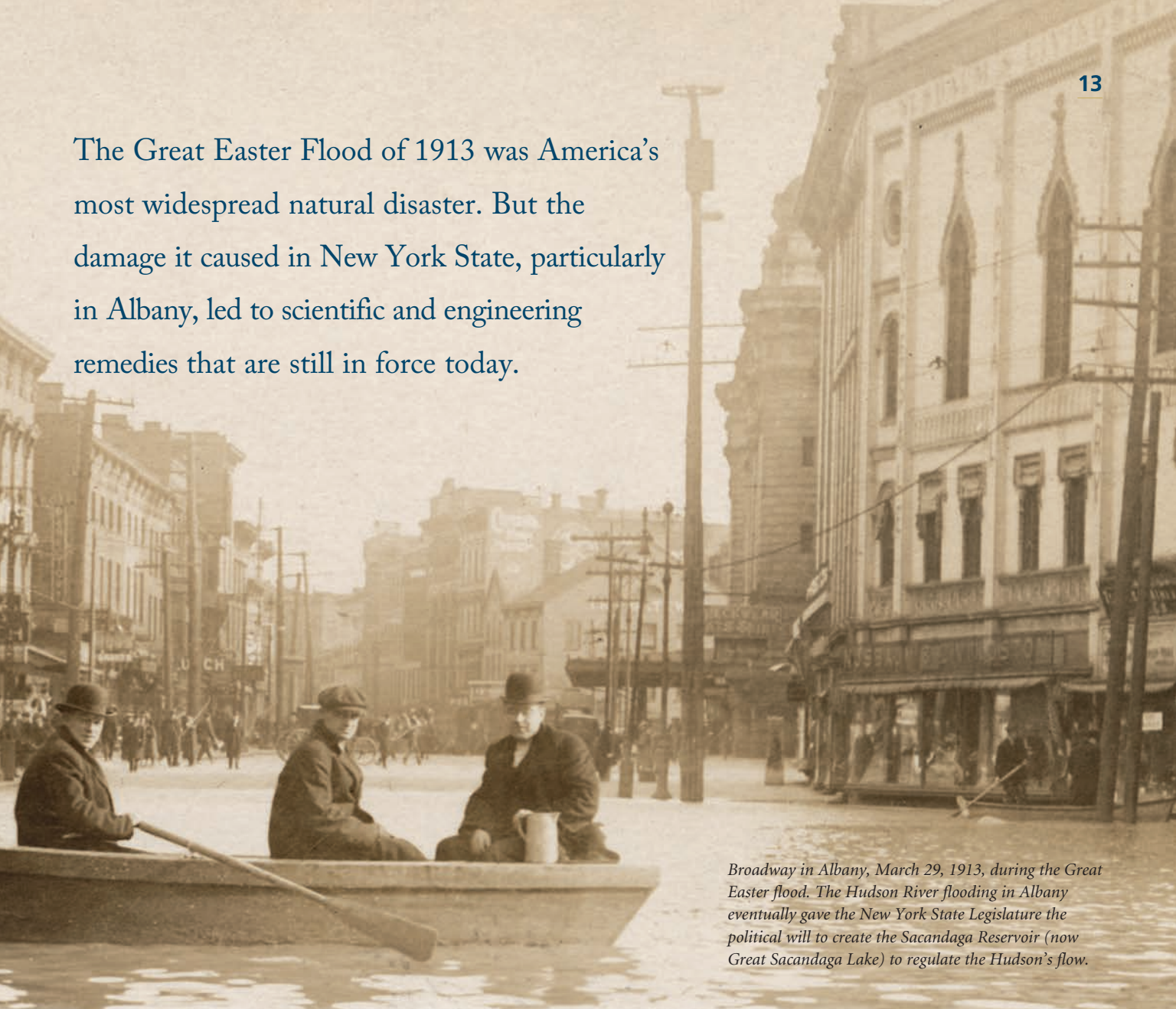
ANGRY

In March of 1913, on Easter weekend and with no warning, disaster struck upstate New York. Wreaking death and destruction, the Hudson River rapidly rose to flood heights that still stand as records in some places. The flooding was part of a mammoth and violent storm system that hit about fifteen states in total and devastated half a dozen Midwestern states, especially Ohio. But the great 1913 flood in New York brought two significant legacies to the state and the nation: the creation of Great Sacandaga Lake (in Fulton, Saratoga, and Hamilton Counties) as part of a statewide system of reservoirs for controlling the flow of the Hudson River; and dramatic proof of the effectiveness of chlorinated

The Great Easter Flood of 1913 was America's most widespread natural disaster. But the damage it caused in New York State, particularly in Albany, led to scientific and engineering remedies that are still in force today.



Broadway in Albany, March 29, 1913, during the Great Easter flood. The Hudson River flooding in Albany eventually gave the New York State Legislature the political will to create the Sacandaga Reservoir (now Great Sacandaga Lake) to regulate the Hudson's flow.

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WATERS

BY TRUDY E. BELL

drinking water to combat typhoid fever and other water-borne diseases.

A One-Two Punch

After an unusually warm and wet winter of soaking rains and almost no snow, the sodden soils across New York could absorb no more water. On Good Friday, March 21, a strong arctic high-pressure system swept from Ontario to the Gulf of Mexico with sustained hurricane-force winds that in Buffalo topped ninety miles an hour. Winds and heavy sleet downed telegraph and telephone poles and wires across the eastern half of the nation. The resulting communications outages prevented the U.S. Weather Bureau from either gathering information or sending warnings

NEW YORK STATE ARCHIVES

Runoff from saturated soil tripled the discharge of both the Hudson and Mohawk Rivers in forty-eight hours, giving them a combined flow equivalent to that of the Niagara River.

Above: *Homes along the Hudson River in Fort Edward, Washington County, in the Adirondacks were partially submerged during the Great Easter 1913 flood.*

about much worse to come.

On Easter Sunday, March 23, torrential rains began to pound. In New York, the Genesee River rose so fast that it surpassed its previous height of 1865 and flooded downtown Rochester up to six feet deep for three days. North of Albany, the equivalent of four to six weeks of normal rainfall fell in five days over the watersheds of the Mohawk and Hudson Rivers. Runoff from saturated soil tripled the discharge of both rivers in forty-eight hours, giving them a combined flow equivalent to that of the Niagara River. Both the Mohawk and the Hudson reached record heights on Friday, March 28. Worse, the crests of the two rivers coincided by the time high water reached the rivers' confluence at Albany and Troy.

The churning rivers tore out bridges, undermined railway embankments, destroyed river walls, and rose well above the lowlands into downtown city streets, flooding streetcar lines, power generating stations, and sewage treatment plants. In Watervliet, the angry waters reached five feet deep in some streets. In Troy, burst gas lines ignited fires that raged through downtown, leaving smoking ruins.

On April 5, a special report in *Dun's Review* estimated that direct damage to the state's business property, and collateral effects from the interruption of transportation and industrial activities, exceeded $1 million (equivalent to about $22 million today), more than half of it suffered by Troy. But the report did not tally losses for many cities, including Binghamton and Rochester, nor did it include losses to agriculture or damage to personal property, even though thousands of homes and farms were flooded. Such uncounted losses ruined many: in 1913—as is still the case today—most homes and businesses did not carry flood insurance, nor was flooding covered by standard policies.

Trying to Control Water

By 1913, both major and minor floods along the lowlands of the Hudson River were common. Moreover, as the Industrial Revolution spread in the late nineteenth and early twentieth centuries, paper mills and manufacturing plants built along the Hudson relied on both water power and hydroelectric power. Not only was flooding a problem, but so was low water during dry summers.

As early as 1867, a series of dams and reservoirs to protect against floods was first proposed to the New York State Legislature—but to no avail. In 1905, the state established a Water Supply Commission to examine regulation of the Hudson's

flow during both floods and droughts to keep hydroelectric turbines turning. In 1907, the commission proposed a system of reservoirs throughout the state for storing water in times of excessive runoff and releasing it as needed to maintain stable river flows. Pulp and paper mills also proposed the building of an enormous water storage reservoir on the Sacandaga River in the Adirondacks, the largest tributary of the Hudson River entering from the west. Yet the monumental scale and cost of engineering such a system were daunting, and the proposals went nowhere.

In 1913, Albany drew its drinking water from two hilltop reservoirs, each of which delivered water through separate pipes and supplied about half of the city. Bleecker Reservoir was fed primarily from Rensselaer Lake in Albany (itself fed by several surface streams), as well as from the Hudson River. The other, Prospect Reservoir, was fed only from the Hudson. Before being pumped uphill to these reservoirs, however, the Hudson's water was first treated by the Albany Pump Station (then called the Quackenbush Pumping Station), located riverside on Quackenbush and Montgomery Streets just off Broadway, which ran parallel to the river downtown. Today the pump station's original buildings survive as a well-known restaurant and brew pub.

Suspended particulates in the cloudy river water were filtered out by the pump station to clarify the water, then the filtered water was chlorinated to disinfect it. Municipal disinfection of water supplies, which added small amounts of hypochlorite of lime (basically powdered bleach) to combat serious waterborne diseases such as typhoid fever, was still controversial in 1913; indeed, the two cities that pioneered chlorination—Jersey City, New Jersey and Chicago, Illinois—had started doing so only five years earlier. Thus Albany was one of the first cities to chlorinate its drinking water.

By 8 a.m. on Thursday, March 27, the Hudson River was rising so fast that workers at the Albany Pump Station barricaded the doors and caulked all cracks with oakum (tarred fiber) to prevent river water from entering and contaminating the filters and chlorination facilities. Despite these precautions, water pressure from the swollen river burst the door of one of the regulator houses at about 4 a.m. on Friday morning, and untreated river water flooded the filters and halted the disinfection operation of the pump station. The Hudson stayed high enough to keep the station's filters submerged for thirty hours—and thus raw river water, including contamination from human waste, was pumped up to Prospect Reservoir.

Knowing that rural areas upriver still relied on outhouses rather than indoor toilets, and that flooding and runoff would have swept human waste into the Hudson, Albany Commissioner of Public Works Wallace Greenalch immediately notified all newspapers to warn Albany citizens to boil their water for at least fifteen minutes before drinking it. Pump station engineers flushed all the water mains by opening the hydrants, and within twenty-four hours they had set up a temporary chlorination plant.

RENSSELAER COUNTY HISTORICAL SOCIETY, TROY, NEW YORK

RENSSELAER COUNTY HISTORICAL SOCIETY, TROY, NEW YORK

Top: *A fire in Troy. One of the ironies—and tragedies—of the Great Easter 1913 flood was fire from broken gas mains. Troy suffered more damage from fire than from water; raging floodwaters prevented firefighters from putting out the flames.*

Bottom: *Foot of Broadway, Troy. Both the Mohawk and Hudson Rivers reached record heights on Friday, March 28; worse, the crests of the two rivers coincided by the time high water reached Albany and Troy. The water was so forceful that it ripped buildings from their foundations.*

Saving Albany's Water

However, despite these quick actions, when the State Department of Health sampled water in the two reservoirs they found organisms from raw sewage contaminating

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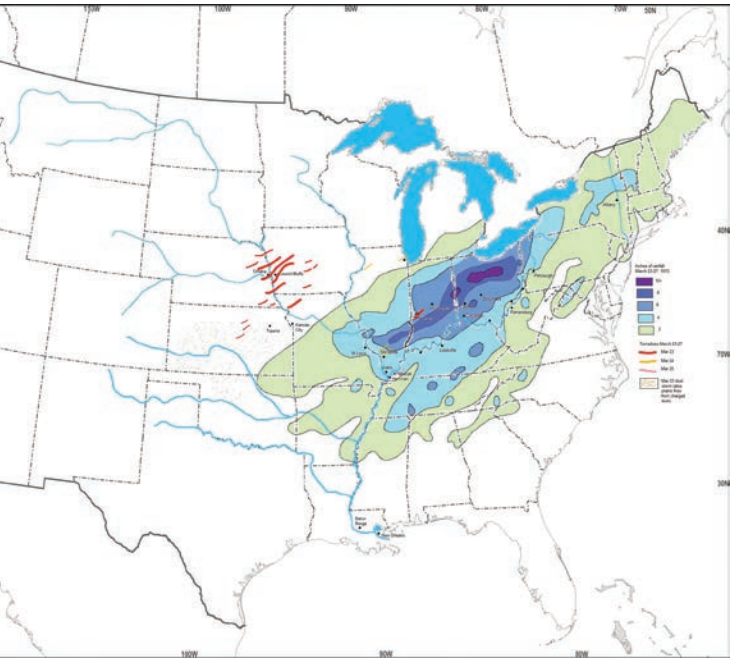

TRUDY E. BELL

Top: *The 1913 flood in Albany submerged the Quackenbush Pumping Station water purification plant, located riverside just off Broadway.*

Bottom: *The Easter 1913 flood across New York State was part of the most geographically widespread natural disaster the United States has ever suffered. The storm system loosed tornadoes and floods that killed more than 1,000 people and devastated parts of fifteen states.*

Prospect Reservoir. But the gate valve shutting off the reservoir from the water distribution system was stuck open. So engineers decided on a desperate measure: they would try to sterilize the entire outdoor reservoir. On April 3, they loaded a small boat with bags of hypochlorite of lime, rowed out into the center of the reservoir, punched holes in the bags, and shook them vigorously as they rowed around the reservoir, releasing the bleach powder into the water. The sterilization treatment was repeated two days later, on April 5.

In 1913, major epidemics of typhoid fever, a wasting disease with a fatality rate of about 10%, were still common, accounting for nearly 10,000 deaths annually nationwide. In those pre-antibiotic days, Walter Reed and his co-workers had demonstrated that infection was linked to unsanitary conditions, including drinking water contaminated by untreated human sewage. Before the flood, Albany was essentially free from typhoid fever, but beginning on April 16 for about a week, at least 180 documented cases of typhoid broke out in the city, mostly in the parts of the city supplied by Prospect Reservoir and its contaminated Hudson River water. The lag from March 28 to April 16 corresponded to the incubation period common for typhoid. However, two to three weeks after Prospect Reservoir had been disinfected by the powdered bleach, the incidence of new typhoid cases suddenly dropped. Meanwhile, areas of the city supplied by Bleecker Reservoir were less affected.

The typhoid outbreak "constitutes one of the most interesting and striking examples of an explosive epidemic due to a sudden… infection of a water supply," wrote Theodore Horton, chief engineer of Albany's State Department of Health, in the weekly newspaper *Engineering News*. Horton illustrated this with a graph that plotted the rise and fall of the Hudson River, the times of the infection of the water supply, the sterilization of Prospect Reservoir, and the corresponding rapid rise and fall of the number of typhoid cases several weeks later. Horton's graph was widely reprinted in national engineering journals, medical and public health journals,

and reference textbooks to demonstrate the effectiveness of chlorinating drinking water to prevent typhoid.

Disaster Spurs Political Will

In November 1913, less than eight months after the Easter flood, the state legislature passed the Burd Amendment to the New York State Constitution, which allowed up to 3% of state forest preserve land in the Adirondacks to be flooded for state-owned reservoirs that would be constructed to regulate stream flow, provide for the water supply, and generate water for canals. In 1915, the Machold Storage Law allowed for the creation of river regulating districts, subject to review and approval by the Conservation Department's Water Power and Control Commission. In 1922, the Hudson River Regulating District was formed and a plan was outlined for controlling the flow of the Hudson through sixteen storage reservoirs on the Cedar, Hudson, Indian, Sacandaga, and Schroon Rivers and other tributaries, with a total capacity of more than 80 billion cubic feet and an estimated $30+ million cost. A modified plan was approved in June 1923. The largest reservoir—to be created by damming the Sacandaga at Conklingville—would occupy 42.3 square miles (about the same area as Lake George) and would store nearly half the water for the district. It included a 400-foot concrete spillway, the largest siphon spillway built to date, with the capacity for handling a flow 50% greater than the 1913 flood, even if the reservoir were full at flood's start.

On March 27, 1930, the seventeenth anniversary of high water during the 1913 flood, the gates were closed on the new Conklingville Dam and the Sacandaga Reservoir (later renamed Great Sacandaga Lake) began to fill. Had the storage capacity of Great Sacandaga Lake existed in 1913, the Hudson's flood height at Albany could have been lowered by three feet, and the city's water treatment plant would have been spared. Since then, there have been other floods on the Hudson due to ice dams, but not even the flood of 1996 equaled the results—both negative and positive—of the Great Flood of 1913. ■

THE ARCHIVES CONNECTION

Much information about the 1913 flood damage in various New York cities can be found in local newspapers on microfilm. I consulted newspapers in the public libraries of Buffalo, Rochester, Syracuse, Albany, and New York City for dates from March 21 until mid-April 1913.

A treasure trove of scrapbooks and images of flooding and fire in Troy is preserved at the Rensselaer County Historical Society in Troy.

The New York State Archives in Albany has photographs depicting 1913 Hudson River flooding, documents related to the regulation of the Hudson River and the creation of Sacandaga Reservoir, and relevant engineering journals and public health reports.

Additional resources can be found at http://trudyebell.com/1913flood.php. My new blog, "Our National Calamity," is at http://nationalcalamityeaster1913flood.blogspot.com/ .

RENSSELAER COUNTY HISTORICAL SOCIETY, TROY, NEW YORK

The New York Central freight yard and roundhouse in Troy were left in ruins after the floodwaters receded. Dun's Review *estimated that half the business losses suffered by New York State were in Troy.*