

# The Hudson River Then and Now: A Brief History of Water Quality

by Stephen Stanne and Maude Salinger



This view of the Hudson and Cornwall Bay was taken from Storm King Mountain in the Hudson Highlands. *Courtesy Stephen Stanne*

**O**n September 11, 1609, when Henry Hudson's sailing ship *Half Moon* entered the river later named for its captain, crew member Robert Juet recorded the river's physical characteristics – its depths, shoals, winds, tides and currents. He noted a rich array of fishes, "...they tooke four or five and twentie Mulletts, Breames, Bases, and Barbils..." and trees, "...goodly Oakes, and Wal-nut trees, and Chest-nut trees, Ewe trees, and trees of sweet wood in great abundance..."<sup>1</sup> Native tribes who had settled the shores of the river long ago, called it *Mahicantuck*, translated as "river that flows both ways." Mahicantuck is an apt description of the Hudson River estuary – a long arm of the sea in which saltwater meets fresh water running off the land, moving back and forth by tidal currents.

A sailor would find the river very different today than it was in Henry Hudson's time. Human activities are a lingering threat to the health of the Hudson and streams in its basin. Is the river clean? Swimmable? Will it ever again be what Henry Hudson experienced? We can't dial back four centuries, but we can do our best to restore the Hudson so people can enjoy the benefits of clean water.

## Pollution and Early Clean-Up

*"The river from Troy to the south of Albany is one great septic tank that has been rendered nearly useless for water supply, for swimming, or to support the rich life that once abounded there." Governor Nelson Rockefeller, 1965<sup>2</sup>*

As cities grew within the watershed of the Hudson, their sewage discharges increased, especially at New York City in Westchester County and the Albany Capital District. Untreated sewage, tannery and paper mill discharges, and industrial and commercial chemicals routinely entered the river in these and many other cities. Combined Sewer Overflows (CSOs) also caused untreated or poorly-treated waste to flow into the Hudson. In 1965, New York

State voters passed a billion dollar Pure Waters Bond Act to fund sewage treatment. In 1972, the federal Clean Water Act made clean-up a national priority, providing billions more, and the Hudson benefited.

Water quality has greatly improved since state and federal actions of the 1960s and 1970s made water quality improvement a priority. For example:

- Around Manhattan, 150 million gallons of raw sewage entered the river daily until 1986. When the North River sewage treatment plant began operating off Manhattan in 1986, bacteria concentrations dropped significantly.
- Near Albany, sewage treatment plants did not disinfect their discharges; these organic wastes fed bacteria that in turn depleted the river's oxygen. In the summer of 1970, a study found so little dissolved oxygen that the few fish seen were "swimming slowly at the surface, gulping air, and disturbing an oil film which covered the water surface."<sup>3</sup> After treatment plants came online near Albany, New York State Department of Environmental Conservation (NYSDEC) monitoring programs in the area collected 3,314 fish representing 27 species in the summer of 1975.

In addition to requiring sewage treatment, the Clean Water Act limited discharges from factory waste pipes. North of the City at Tarrytown, the Hudson's color once matched the paint applied to vehicles at a General Motors plant there. In the years following the law's passage, industrial and municipal discharges gradually came into compliance. In recent decades, conditions have improved for fish and other river creatures. At last count, 222 species of fish had been recorded in the Hudson and its watershed.

## River Habitats

Nearly 300,000 acres of tidal wetland and shallow water habitat in New York Harbor have been lost to landfill and dredging since European settlement began. Between Catskill and Albany, nearly

one-third of the river has been filled in, starting in the mid-1800s as engineers created a single, deep shipping channel through a complex of islands, shallows, and wetlands. Railroad construction also greatly altered habitat, burying wetlands and cutting bays and coves off from the river. A permitting system established under the Clean Water Act has slowed the pace of wetlands loss. Unfortunately, few of these historically altered habitats can be restored to their former condition, so protecting what still exists today is a priority.

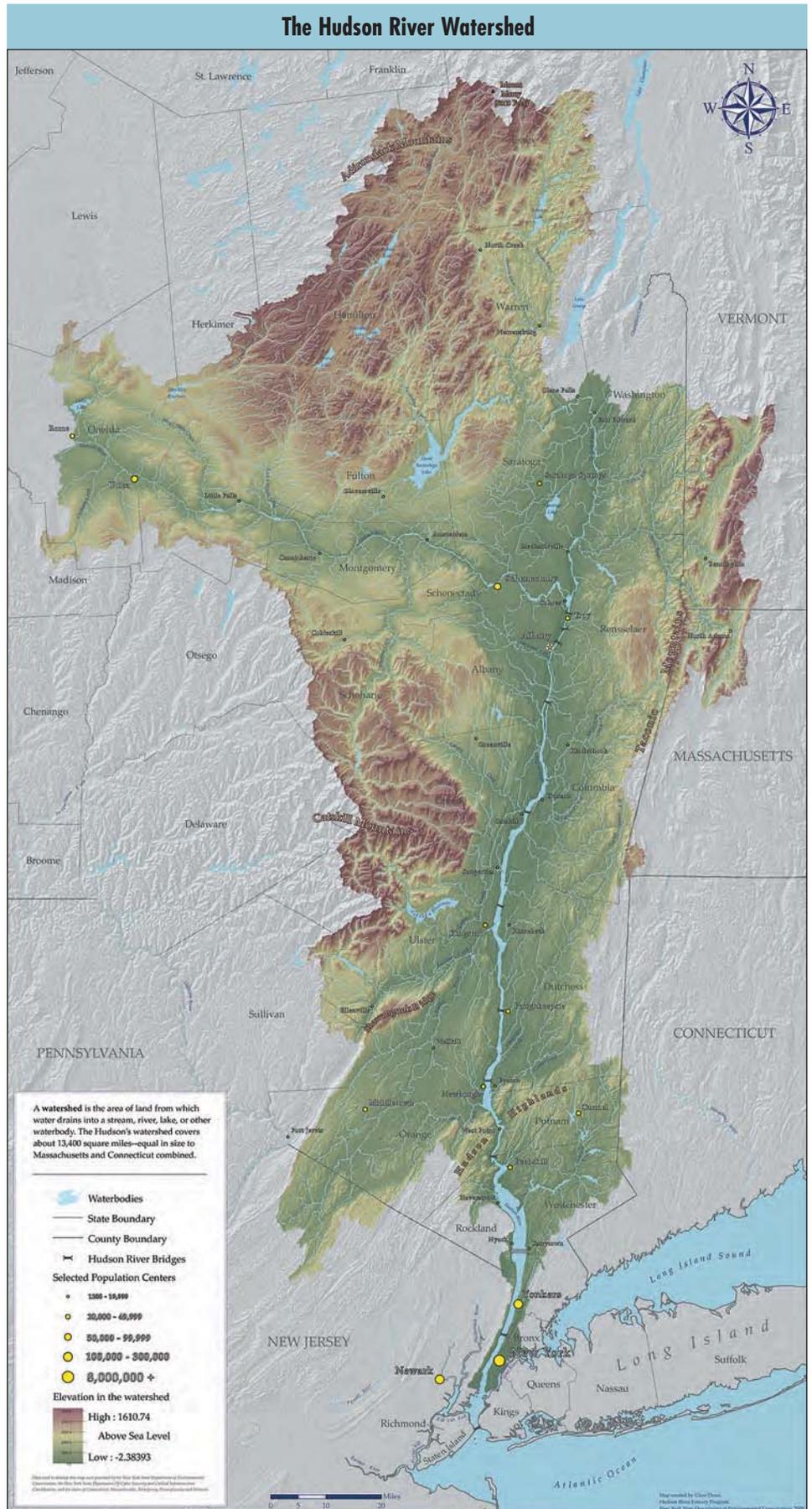
### Management of the Hudson River Estuary

Another boon to river clean-up was the passage in 1987 of the Hudson River Estuary Management Act (ECL 11-0306) which created the Hudson River Estuary Program, administered by NYSDEC. The program focuses on the tidal estuary and its adjacent watershed from the federal dam at Troy to the Verrazano-Narrows Bridge in New York City. The program is guided by the *Hudson River Estuary Action Agenda* which aims to achieve six key benefits the public receives from our work: clean water; resilient communities; a vital estuarine ecosystem; conservation of fish, wildlife, and habitats; preservation of the river's natural scenery; and enhanced opportunities for education, river access, recreation, and inspiration.<sup>4</sup>

Delivering these diverse ecological and human benefits requires an approach that is watershed-wide in scale and addresses the region's streams and tributaries as well as the main stem of the Hudson. The Estuary Program relies on partnerships with federal and state agencies, as well as local municipalities, non-profits, academic and scientific institutions, businesses, trade organizations, landowners and dedicated volunteers to accomplish its mission.

Funding is an important element of the revitalization of the Hudson. One source of funding, New York State's Environmental Protection Fund (EPF), includes a line item for the Hudson as well as water quality improvement projects. The EPF increased from \$25 million when it was created in the 1990s, to \$300 million in the 2016-17 state budget, the highest level in the fund's history. Another source of funding comes from state Environmental Bond Acts. Several New York State Bond Acts have provided substantial grants to support water quality

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The Hudson River watershed covers nearly 13,400 square miles. The federal lock and dam at Troy, 135 miles north of New York Harbor, marks the northern limit of tidal influence in the Hudson estuary. The salt front – the leading edge of diluted seawater – typically pushes upriver to the Newburgh-Beacon Bridge by late summer.

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improvements, including millions invested in municipal facilities and infrastructure, brownfield cleanups, and open space programs since 1965. The state also assists with individual grants to municipalities for seasonal disinfection of wastewater discharges and the development and implementation of Long-Term Control Plans to address CSOs.

The entire stretch of the Hudson estuary was designated a “No Discharge Zone” in 2003, prohibiting discharge of vessel waste from the Troy Dam to the Battery in Manhattan. As part of this designation, 15 pump-out stations along the river are now available to recreational boaters.

### Legacy Contaminants – The PCB Cleanup

In 2008, a contaminant reduction model was developed under the Contaminant Assessment and Reduction Project (CARP), in partnership with the NY-NJ Harbor and Estuary Program, to assess priorities for clean-up by addressing dioxins, heavy metals, DDT and PCBs in water and river sediments. The model identified PCB pollution in the river as the number one chemical contaminant issue.

Between 1947 and 1977, General Electric (GE) released about 1.3 million pounds of toxic polychlorinated biphenyls (PCBs) into the river from plants in Fort Edward and Hudson Falls. After 1977, PCBs continued to enter the Hudson from subsurface contamination beneath the Hudson Falls plant, adding to the burden of earlier discharges in the river bottom. However, it wasn't until 2002 that the US Environmental Protection Agency (USEPA) settled on a cleanup plan with GE. Years of sampling, feasibility studies, and design work followed before sediment removal began in 2009. Completed in 2015, the cleanup dredged approximately 2.75 million cubic yards of PCB-contaminated sediments, containing 150 tons of PCBs, from a 40-mile stretch of river between Fort Edward and Troy.

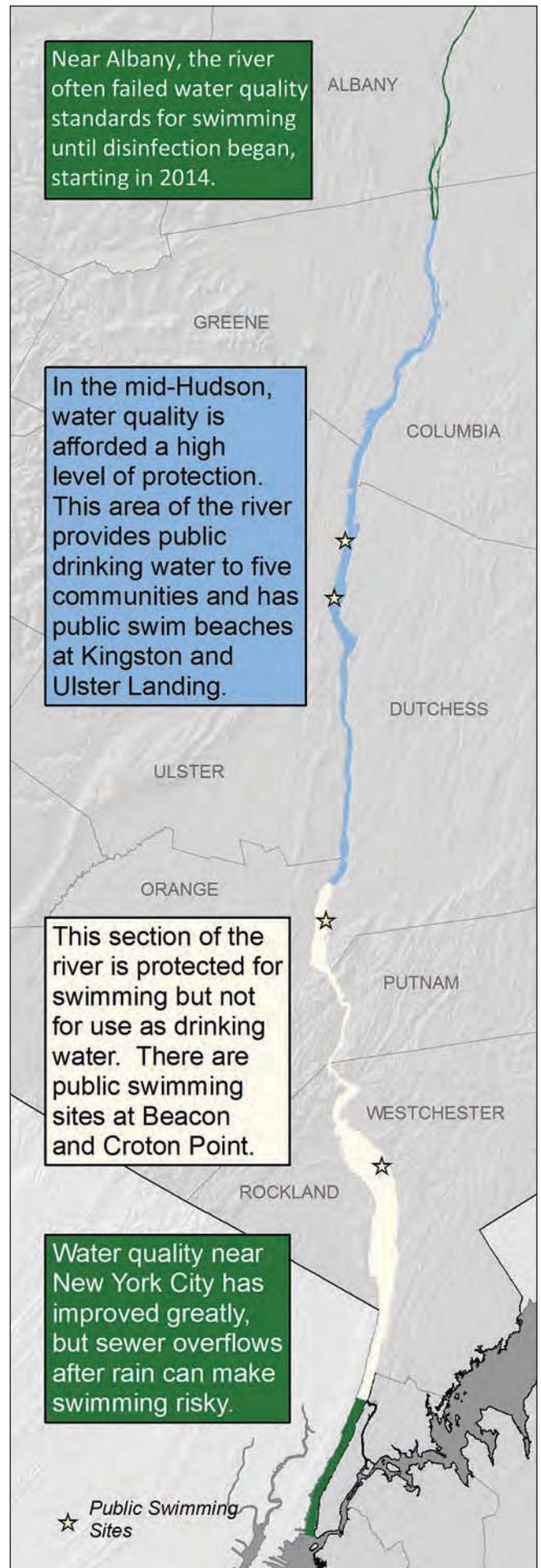
The USEPA has initiated a five-year review of the cleanup effort to ensure that implemented remedial actions are protective of human health and the environment. In August of 2016, NYSDEC challenged the effectiveness of USEPA's remedy and officially requested a reevaluation, citing that unacceptably high concentrations of PCBs remain in river sediment. The result of this request is pending as of this writing.

### CSOs and Water Quality Improvements

CSOs continue to be a major source of contaminants to the Hudson River. Annually, CSO discharges into the Albany Pool area total 1.2 billion gallons, while 27 billion gallons discharge into New York City waters. However, communities with CSOs are required by the state to develop long-term control plans, and almost all communities along the estuary have done so. Implementation of these long-term control plans will reduce the future contaminant loading to the river from many of these CSO areas.

In 2012, NYSDEC and New York City signed an agreement to develop ten waterbody-specific, long-term control plans, plus a citywide plan. This agreement should reduce CSO discharges into New York City waters by approximately 8.4 billion gallons a year.

In 2008, NYSDEC partnered with the Capital District Regional Planning Commission to address more than 100 CSOs in the Capital District, contributing more than \$2 million for planning and engineering studies. Updated permits now require municipalities in this area to achieve the goal of swimmable water quality. Grants totaling over \$15 million have provided funding to help meet permit requirements



Right: While water quality in all parts of the estuary is regulated to safeguard boating and fishing, additional protections vary from place to place. Poughkeepsie is one of five river communities with water systems that draw directly from the Hudson.

NYSDEC/Hudson River Estuary Program

## The Hudson

- The Hudson River flows from the Adirondack Mountains to New York Harbor. Lake Tear of the Clouds, located high on Mt. Marcy, New York's tallest peak, is considered to be the Hudson's source. However, the name Hudson River first appears on maps in Newcomb, where the outlet from Henderson Lake joins Calamity Brook.
- Measured from Lake Tear of the Clouds, the Hudson is 315 miles long. It is widest at Haverstraw Bay – about three and a half miles from Haverstraw across to Croton-on-Hudson – and deepest at West Point – 175 feet. In shallow reaches, engineers maintain a channel 32 feet deep to allow large vessels to get to Albany.
- At the base of the Troy Dam, the river's surface is only five feet above sea level. From this point south, the waters of the Hudson rise and fall to the rhythm of tides originating in the Atlantic Ocean. The tides cause the river to flow two ways: its current alternates between an ebb running south toward the sea and a flood running north toward Troy.

in sections of the river that do not currently meet the swimmable standard. The Rensselaer Sewer District began disinfection in 2013, and disinfection came online at two large Albany plants in 2014. The Albany Pool plan, announced early in 2014, is expected take 15 years to implement and cost \$136 million. The plan includes \$5.8 million for green infrastructure projects and \$2.13 million for tributary enhancements.<sup>5</sup>

## Looking Ahead

Investments in clean water infrastructure over the past few decades have dramatically improved water quality. On many days, in many places throughout the Hudson River Estuary, water quality is excellent for swimming. In 2014, nearly 6,500 people swam in organized public swim events in the Hudson River Estuary and New York Harbor, and thousands more swam at public beaches or other water access points. After periods of dry weather, the Hudson River Estuary is safe for swimming in many locations. But after rain, the water is more likely to be contaminated, especially in areas affected by combined sewer overflows and street water runoff.<sup>6</sup>

While there has been much improvement in recent years, the water quality in the Hudson Valley will never be as unblemished as it was when the region was a wilderness. Human influence is pervasive and threats remain. In the watershed, water resource recovery infrastructure and separated/combined sewer overflows along the estuary and its tributaries require significant investments to continue to improve water quality for the future. On a larger scale, climate change and changing weather patterns are affecting all aspects of water management, including the impact of sea-level rise on water resource recovery infrastructure in shoreline communities.

The good news is that investments toward improved water quality are being made. This year's state budget boosted critical funding to help the state confront an emerging water infrastructure crisis. The state made available an additional \$200 million for grants to municipalities for drinking water and wastewater system improvements through the Water Infrastructure Improvement Act. These grants will leverage over \$2 billion in local investments while creating an estimated 33,000 construction jobs. Since 2011, Governor Cuomo has provided more than \$680 million through "New York Works" funding for direct environmental projects such as dam

repairs, coastal resiliency, water resource recovery upgrades, and park investments. These funds have also provided for recreational infrastructure; for plugging of abandoned oil and gas wells; grants for municipal brownfield cleanups; and water quality improvement projects for water resource recovery systems.<sup>7</sup>

We don't have to turn back the clock to have a drinkable, swimmable, and fishable Hudson. By protecting and restoring streams that replenish the estuary and nourish its web of life, and through continued investment in water resource management strategies, we can continue on the path of restoring the water resources critical to the health and wellbeing of the state's residents.

## About the Hudson River Estuary Program

The New York State Department of Conservation's Hudson River Estuary Program helps people enjoy, protect and revitalize the Hudson River and its valley. The program was created in 1987 and extends from the Troy Dam to upper New York Harbor. It is guided by an Action Agenda, which is updated every five years. The program achieves real progress through a collaborative approach that includes:

- Grants and restoration projects
- Education, research and training
- Natural resource conservation and protection
- Community planning assistance

Implementation of the Action Agenda relies on partnerships with federal and state agencies, as well as local municipalities, non-profits, academic and scientific institutions, businesses, trade organizations, landowners and dedicated volunteers. The Hudson River Estuary Management Advisory Committee (HREMAC) provides guidance to the program, helps the state define goals and evaluate progress, and provides a communication bridge to a wider group of partners and stakeholders. Numerous government partners participate as *ex-officio* members of the committee and help deliver our Action Agenda results.

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## Endnotes

- 1 *Juet's Journal of Hudson's 1609 Voyage*, from the 1625 Edition of Purchase his Pilgrimes, by Robert Juet; Transcribed by Brea Barthel for the New Netherland Museum, [www.halfmoonreplica.org](http://www.halfmoonreplica.org)
- 2 *The Knickerbocker News and Union Star*, Nov. 6, 1971. 'Septic Tanks': Cleanup Job Slowed as Costs Rise
- 3 Quirk, Lawler & Matusky Engineers, 1971 p. 54. Environmental Effects of the Hudson River, Albany Steam Station Discharge
- 4 *Hudson River Estuary Action Agenda 2015-2020*, [www.dec.ny.gov/lands/5104.html](http://www.dec.ny.gov/lands/5104.html)
- 5 [www.dec.ny.gov/chemical/95122.html](http://www.dec.ny.gov/chemical/95122.html)
- 6 *Riverkeeper, How's The Water? 2015: Fecal Contamination in the Hudson and Its Tributaries*, [www.riverkeeper.org](http://www.riverkeeper.org)
- 7 [www.ny.gov](http://www.ny.gov)