Wetlands in the Watersheds of the New York City Water Supply System

New York City Department of
Environmental Protection
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Bureau of Water Supply

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Introduction

The New York City Watershed is a 2,000 square-mile area located both East and West of the Hudson River in upstate New York that supplies high quality drinking water to almost half the population of New York State, which includes 8 million residents of New York City and 1 million residents of Westchester, Putnam, Ulster, and Orange Counties, plus millions of commuters and tourists. The East of Hudson portion of the watershed is located in Westchester, Putnam, and Dutchess Counties, NY and in a small portion of Fairfield County, CT. The West of Hudson Watershed provides the vast majority of New York City's drinking water and is an unfiltered supply. It is located in Delaware, Greene, Schoharie, Sullivan, and Ulster Counties and is further divided into the Catskill and Delaware Watersheds. The Delaware Watershed drains to the East and West Branches of the Delaware River and the Catskill Watershed drains to the Hudson and Mohawk Rivers.

Recognizing the important water quality functions of wetlands, the New York City Department of Environmental Protection (DEP) has undertaken numerous programs to characterize and protect wetlands in the New York City Watershed. In the mid-1990s DEP contracted the U.S. Fish and Wildlife Service (USFWS) to map the wetlands and deepwater habitats in the watershed. The USFWS completed the National Wetlands Inventory (NWI) maps in 1996 by interpreting aerial photography from 1982-1987. The USFWS produced geospatial wetland data, maps, and a report summarizing the findings of the inventory. In order to maintain a current wetlands database, the DEP contracted with USFWS to update the NWI geospatial data in 2005 using 2003 and 2004 aerial photography

This booklet is the first revision of the 1996 report, and is based on the findings of the updated NWI. This booklet also describes wetland landscape settings and provides estimates of wetland gains, losses, and cover type changes as determined through additional joint USFWS-DEP wetland mapping projects in the New York City Watershed. A general overview of the characteristics and functions of wetlands is also provided, along with information on wetland protection and stewardship.

Red maple swamp adjacent to the Little Beaver Kill in the Catskill Watershed. (Photo by C. Falk)

TOP: Forested wetland near the Ashokan Reservoir (Photo by C. Falk); *MIDDLE: Red-eared Sliders and Painted Turtles are frequently found basking and feeding in riparian wetlands. They also lay their eggs and hibernate in soft wetland substrates* (Photo by J. Damrath); *BOTTOM: Reservoirs are included as deepwater habitats in the National Wetlands Inventory. (New Croton Reservoir, Westchester County, NY)* (Photo by D. Gencarelli)

What are Wetlands?

Wetlands occur in areas where there is excess water on a prolonged regular basis. The excess water can be standing water or saturation within a foot below the soil surface. To meet wetland criteria, inundation or saturation must occur most years, and must be of significant duration during the growing season to produce low-oxygen conditions in the soil. These low-oxygen conditions can develop with two weeks of flooding or saturation in the growing season and favor the growth of plants called hydrophytes.

Hydrophytes are plants specially adapted to tolerate the low-oxygen and waterlogged conditions of wetland substrates. For example, many hydrophytes develop air spaces in their tissues that facilitate the diffusion of oxygen to the root system. Another adaptation is the development of extended shallow root systems to increase structural support in waterlogged sediments and to provide root growth above the low-oxygen soil zone. Only a third of all the vascular plants that grow in the United States can tolerate the low oxygen conditions typical of wetlands. While some hydrophytic plant species only grow in wetlands, most can grow in uplands as well. The federal government has compiled a list that classifies hydrophytic species based on their frequency of occurrence in wetlands. For example, species classified as obligate hydrophytes almost always occur in wetlands, while facultative species are equally common in wetlands and uplands.

Oxygen deficiency also affects soil development. Wetland soils are referred to as hydric soils and can be mineral or organic. Mineral soils are comprised mostly of combinations of sand, silt, and clay, whereas organic soils are largely composed of organic matter from decaying plants. Mineral soils in wetlands typically become dull and gray colored due to the loss or chemical transformation of iron in the low-oxygen environment. This results in a gray colored layer just beneath the soil surface, often with small bright spots of accumulated iron oxides. The latter colors are evidence of periodic oxygenation brought about by a fluctuating water table. In some wetlands, plant decomposition is so slowed due oxygen deficiency that organic matter accumulates as muck or peat. Mucks are comprised of fairly well decomposed plant materials in which plant fibers cannot be recognized upon gentle rubbing. Peats are poorly decomposed and contain recognizable plant fragments. The federal government has compiled a list of soil types and properties indicative of prolonged flooding or saturation.

Wetlands can be identified by evidence of three factors:

- **prolonged saturation or flooding**
- **a predominance of hydrophytic vegetation**
- **the presence of hydric soils.**

Dull gray colors can result from low oxygen conditions in wetlands with mineral soils. (Photo by L. Machung)

Wetlands can therefore be identified by evidence of three factors: prolonged saturation or flooding, a predominance of hydrophytic vegetation, and the presence of hydric soils. While multiple definitions of wetlands have been developed for regulatory, mapping, or scientific purposes, they generally converge on these three defining characteristics. For the purpose of conducting the National Wetlands Inventory, the USFWS defines wetlands as *"lands transitional between terrestrial*

and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." (Cowardin et al. 1979). This definition includes both vegetated wetland types such as marshes and swamps, and nonvegetated wetland types such as ponds, shallow river bottoms, and lake shores. This definition does not include deepwater habitats such as lakes and reservoirs where the depth of standing water is greater than 6.6 feet.

Wetland Types

Wetlands occur in a number of settings throughout the landscape. They often occur at the interface of terrestrial and aquatic systems in areas such as floodplains and lake margins, in inland depressions where surface water collects, or along slopes where groundwater is discharged to the soil surface. The type, depth, duration, frequency, and chemical composition of wetland source waters vary widely with landscape setting and largely determine wetland species composition and soil characteristics. Consequently, there are numerous wetland types and several classification systems have been developed to describe them.

Cattails (Typha sp.) *are typical of emergent marshes throughout the New York City Watershed.* (Photo by C. Falk)

The USFWS adopted a classification system for wetlands and deepwater habitats for the purposes of conducting the NWI (Cowardin et. al. 1979). At the highest level, this hierarchical classification divides wetlands into ecological systems. Coastal wetlands associated with salt and brackish waters are included in the marine and estuarine systems. The majority of inland, non-tidal, freshwater wetlands such as those in the New York City Watershed fall within in the palustrine system. Examples of palustrine wetland types include marshes, swamps, bogs, and ponds. The remaining freshwater wetlands are classified in the riverine and lacustrine systems. Riverine wetlands are located within river and stream channels and are typically nonvegetated shores, while lacustrine wetlands are located in the shallow water zone (less than 6.6 feet deep) of lakes and reservoirs and include floating-leaved aquatic beds.

soils. Wet meadows tend to be groundwater-based systems and are often found in depressions or where changes in slope cause groundwater to reach the soil surface. They are typically saturated rather than inundated, although they may have shallow standing water for short periods usually in the spring. Wet meadows vary widely in their species composition, which is largely affected by the chemical composition of the groundwater. They often include a combination of sedges, grasses, and flowering herbaceous species. Those dominated by sedges are referred to as sedge meadows.

Typical marsh species in the watershed include cattails, bulrushes, bur-reeds, reed canary grass, blueflag iris, swamp milkweed, arrow-leaved tearthumb, and smartweeds. Pickerelweed, arrow arum, arrow heads, white water lily, yellow pond lily, and duckweeds often occur in areas of shallow standing water. Species present

THE MAJORITY OF INLAND, NON-TIDAL, FRESHWATER WETLANDS FALL WITHIN THE PALUSTRINE ECOLOGICAL SYSTEM.

TOP: Highbush blueberry (Vaccinium corymbosum) *is common in forested and scrub-shrub wetlands throughout the New York City Watershed.*

BOTTOM: Swamp milkweed (Asclepias incarnata) *is a common emergent wetland plant.*

(Photos by L. Machung)

Wetland types are further classified by features such as vegetated cover or substrate type (for nonvegetated wetlands). Vegetated cover types include aquatic bed, emergent, scrub-shrub, and forested wetlands. Aquatic beds are represented by floating-leaved, submergent, or free floating plants such as water lilies, pondweeds, and duckweeds. Emergent wetlands are characterized by free-standing herbaceous plants including grasses, sedges, and flowering herbs. Scrub-shrub wetlands are dominated by low- to medium-height (less than 20 feet tall) woody plants. Common shrub-dominated wetland communities include shrub swamps, bogs, and fens. Forested wetlands are dominated by trees taller than 20 feet, and are often referred to as wooded swamps or bottomland forests. Wetland types are often named after their dominant plant species, such as water lily bed, cattail marsh, alder swamp, red maple swamp, and hemlock swamp.

Emergent Wetlands

Marshes and wet meadows are common emergent wetland types in the New York City Watershed. Marshes can occur at lake and pond fringes, and in low-lying areas along streams and rivers. They typically have standing water for an extended duration and often have organic

Forested wetlands can include evergreen tree species, such as this hemlock swamp in the Delaware Watershed (Pepacton Reservoir Basin). *Mosses often cover the soil surface in hemlock swamps.*
(Photo by C. Falk)

in wet meadows include tussock and other sedges, asters, goldenrods, soft rush, blue vervain, Joe-Pye-weed, sensitive fern, meadow rue, and rice cutgrass. Common reed, purple loosestrife, and Japanese stiltgrass are invasive species that are dominant in many emergent wetlands throughout the watershed.

Scrub-shrub Wetlands

Scrub-shrub wetlands are dominated by woody plants less than 20 feet tall, including both shrub species and tree saplings. Shrub swamps may occur along pond and lake shores, at the margins of emergent wetlands, in depressions surrounded by uplands, or within riparian corridors. Groundwater can be a significant hydrologic source to scrub-shrub wetlands and strongly influences species composition. Shrubby hydrophytic vegetation is also common on gravel bars within streams.

Speckled and smooth alder, silky and red osier dogwood, winterberry holly, northern arrowwood, nannyberry, spicebush, steeplebush, meadowsweet, highbush blueberry, and swamp azalea are typical shrub species in the New York City Watershed. Willow species such as pussy willow and silky willow are common along pond and lake shores and along fringe and island habitat within streams.

Forested Wetlands

Red maple swamps are the most common forested wetland type in the New York City Watershed. They occur in low-lying areas throughout the landscape. Other trees occurring with red maple in the watershed include yellow birch, hemlock, green ash, and American elm. White pine, black gum, and trembling aspen can also occur in forested wetlands, particularly in the Catskills, but are usually less abundant than the typical species listed above. Characteristic understory shrubs include spicebush, northern arrowwood, silky dogwood, highbush blueberry, swamp azalea, and winterberry. Sweet pepperbush is a common understory shrub in the East of Hudson Watershed. Many herbs are present in red maple swamps such as tussock sedge, skunk cabbage, Jack in the pulpit, jewelweed, clearweed, bugleweed, tearthumbs, and several ferns (sensitive, cinnamon, marsh, wood, and royal).

Hemlock swamps also occur in the watershed and typically have a less diverse assemblage of plants associated with them. Trees such as yellow birch and red maple may also be present. Shrubs and herbs characteristic of acidic conditions caused by hemlock needle decomposition are typically present and include species such as highbush blueberry, swamp azalea, cinnamon fern, Canada mayflower, and goldthread. Mosses and sedges are usually present as well.

Vernal pools are small, isolated depressions within upland forests. They are typically flooded from winter through spring and dry during the summer and, therefore, do not support fish populations. Since there is no fish predation, vernal pools provide important amphibian breeding habitat.

Functions and Values of Wetlands

Wetlands provide many ecological, economic, and cultural benefits. They improve water quality; maintain stream flow; and provide flood water storage, erosion control, fish and wildlife habitat, aquatic productivity, and opportunities for recreation, aesthetic appreciation, and education. The type and extent of functions performed by individual wetlands vary widely with factors such as landscape position and associated hydrologic, soil, and vegetation characteristics. While an individual wetland may not perform all of the above-listed functions, all wetlands function cumulatively on a watershed-scale to provide a suite of benefits that extend to ecosystems well beyond the wetland boundary.

Hydrologic Functions: Flood and Erosion Control and Stream-flow Maintenance

Wetlands located in depressions throughout the landscape collect and detain overland flow from their surrounding catchment areas. Wetlands located along stream and river floodplains intercept overland flow and detain floodwaters. Wetland vegetation dissipates the velocity of flood water and anchors soil, thereby decreasing erosion. By temporarily storing and slowing overland flow and floodwaters, wetlands reduce downstream flooding, erosion, and property damage. Detained waters are then slowly released, which can help to maintain stream flow or recharge groundwater during drier periods. In fact, many

WETLANDS PROVIDE BENEFITS THAT EXTEND TO ECOSYSTEMS WELL BEYOND THE WETLAND BOUNDARY.

Floodplain wetlands store floodwaters from adjacent streams and rivers. Wetland vegetation slows the velocity of floodwaters, which prevents erosion, improves water quality, and decreases downstream flooding. This floodplain wetland is located along Trout Creek, just upstream of the Cannonsville Reservoir. (Photo by M. Reid)

▲

TOP: This streamside scrub-shrub wetland, located along the Platte Kill, just upstream of the Pepacton Reservoir, protects water quality by anchoring the soil, trapping sediments, and reducing the velocity of floodwaters.
(Photo by L. Machung)

MIDDLE: Wetlands provide important habitat for migratory waterfowl species, such as these Hooded Mergansers (Lophodytes cucllatus).
(Photo by J. Damrath)

BOTTOM: The Bog Turtle (Clemmys muhlenbergii) *is a federally threatened, and New York State endangered, wetland-dependent species that is found in the New York City Watershed.*
(NYS DEC photo by Lt. Richard Thomas)

streams within the New York City Watershed originate from wetlands.

Water Quality Protection

Wetlands play an important role in maintaining the quality of surface waters that drain into the reservoirs of the New York City Watershed. Wetlands intercept and filter overland flow from adjacent uplands prior to its reaching the stream or river. As overland flow and floodwaters are detained and slowed within wetlands, suspended sediments and any sorbed nutrients or pollutants settle out of the water column. Nutrients, metals, and other pollutants can also be removed from influent surface or groundwaters through plant uptake, or through chemical transformations in anaerobic wetland sediments. Some wetland types are so efficient at water quality amelioration that artificial wetlands have been constructed to treat storm and wastewater.

Productivity and Carbon Cycling

Some wetland types are among the most productive and diverse ecosystems in the world, rivaling crop lands in their plant productivity. High plant productivity combined with slow rates of decomposition in the low-oxygen conditions of wetland soils leads to significant long- and short-term carbon storage in wetlands. In fact, over a third of the carbon stored in all of the world's soils is in wetlands. Carbon is released to the atmosphere as carbon dioxide when wetlands are drained, and can be released as methane under flooded conditions. Thus, wetlands have the potential to be both sources and sinks of carbon and play a significant role in the global carbon cycle. It has been suggested that wetlands be protected from draining to maintain their carbon storage function to help mitigate global warming.

The carbon produced in wetlands also provides a food source for wildlife and aquatic organisms. Small particles of carbon from decomposing plant materials are released as a material called "detritus" and some as dissolved organic carbon. This material serves as food for many aquatic invertebrates and fishes, which are in turn food for larger predatory fishes and birds. DEP has measured significant organic carbon export from wetlands, particularly from wetlands in the East of Hudson Watershed.

Fish and Wildlife Habitat

Many amphibian, reptile, fish, bird, and mammal species depend on wetlands for all or part of their life cycle for food and water, breeding grounds, and shelter. Wetlands with some standing water, such as marshes, swamps, and vernal pools, are critical for the propagation of

Nearly half of the nation's threatened and endangered species rely directly or indirectly on wetlands for their survival.

Beavers are wetland-dependant species that create or modify wetlands through damming. Their lodges provide shelter within impounded wetlands.
(Photo by Photo by J. Schwartz)

frogs and salamanders. Breeding, egg-laying, and the development of tadpoles into adults take place in shallow waters, especially where fish are absent. Eighty percent of breeding birds and over 50% of migratory birds are dependent upon wetlands. Migratory birds such as ducks, geese, and songbirds will often stop in freshwater wetlands on their route to and from breeding grounds to feed on insects, seeds, water plants, and fish. Migrant birds may also find protection from strong winds and the elements in trees and dense reeds and grasses found in wetlands. Mammals commonly found in wetlands include beavers and muskrats. Beavers often create or modify wetland habitats through damming. Other mammals such as black bears and white-tailed deer use wetlands for food and refuge. Almost all important sport fish species are known to utilize wetlands for spawning and nursery grounds. Wetlands and riparian habitats provide shade to adjacent streams, maintaining cool water temperatures for species such as brook and brown trout. Besides laying eggs in wetlands, these fish may also feed on invertebrate species.

Nearly half of the Nation's threatened and endangered species rely directly or indirectly on wetlands for their survival. Among them is the bog turtle. Found within New York State, this minuscule turtle uses rivulets and small depressions made by tussock sedges to lay its eggs and find food. Currently, the bog turtle is federally threatened and listed as endangered in New York due to illegal collection and loss of wetland habitat from development.

Recreation

The rich and diverse habitats provided by wetlands support fishing, hunting, and a variety of nonconsumptive recreational uses. Trout fishing is extremely popular with residents and visitors to the New York City Watershed. Because wetlands support so many waterfowl and mammal species, they are important and popular hunting grounds. Flooded wetlands, such as the Great Swamp in Putnam and Dutchess Counties, offer opportunities for canoeing, while drier wetlands offer hiking opportunities. With their abundance of cover types, such as open water, emergent, scrub-shrub, and forested areas, wetlands are also aesthetically valuable. The myriad of plant and animal species in wetlands is appreciated by birdwatchers, photographers, hunters, boaters, and hikers. Because of their diversity and ecological importance, wetlands offer unique opportunities for environmental education and appreciation.

Mapping the Status, Trends, and Landscape Settings of Watershed Wetlands

National Wetlands Inventory maps are non-regulatory and provide information on the extent, distribution and characteristics of wetlands as determined through aerial photograph interpretation. They can be viewed online at **www.fws.gov/wetlands/data/mapper.html** or on Google earth at **www.fws.gov/wetlands/Data/GoogleEarth.html**.

The NWI data for the New York City Watershed are based on interpretation of 1:40,000 color infrared aerial photography taken in May 2003 for the West of Hudson Watersheds and in March/April 2004 for the East of Hudson Watershed. Interpretation of photography of this scale generally allows for detection of wetlands down to one acre in size. Smaller wetlands in forested settings such as vernal pools often escape detection, although other small conspicuous wetland types such as ponds in open fields can often be detected. Some wetland types may escape detection, even if greater than one acre in size. Types that are difficult to interpret include drier-end wetlands that aren't saturated or flooded at the time that the aerial photography was taken; forested evergreen wetlands, whose canopy can block detection of saturated or flooded conditions; and forested wetlands on slopes that may be missed due to shading from steep topography or due to their narrow width. Thus, field verification is necessary when site-specific information is required.

Overall, 33,892 acres of deepwater habitats and 24,920 acres of palustrine wetlands were identified by the NWI for the New York City Water Supply Watershed.

Wetlands, such as this shrub swamp in the West Branch Reservoir Basin (Putnam County) are highly productive and diverse ecosystems.
(Photo by L. Machung)

Gains and losses of vegetated wetlands and ponds were assessed for three time periods for the East of Hudson Watershed (1968-1984, 1984-1994, and 1994-2004) and for two time periods for the West of Hudson Watershed (the mid-1980s to the mid-1990s and the mid-1990s to 2004). Vegetated wetlands and ponds were analyzed separately, as ponds may not provide the same suite of functions as vegetated wetlands. The USFWS completed these trends analyses by comparing aerial photography from each time period to document gains, losses, and cover type changes. Because this

analysis is based on interpretation ranging in scale from 1:58,000 to 1:24,000, it is subject to similar constraints described for the NWI mapping procedure, but nevertheless yields a useful estimate of recent changes in wetland abundance.

The landscape settings of the NWI wetlands were summarized from a wetland characterization and preliminary functional assessment project completed in 2004 through a contract with the USFWS. As part of this project, the USFWS attached descriptors of landscape positions and water flow path to the NWI wetlands to predict functions that the wetlands may be providing on a watershed scale. Landscape descriptors indicate whether the wetland is associated with a waterbody such as a river, stream, or lake. The water flow path modifiers describe any surface water connections apparent from the aerial photography. Wetlands were identified as throughflow if they have stream inflow and outflow, outflow if the wetland is the origin of a stream, and isolated if there is no discernible surface water connection to a waterbody.

Overall, 33,892 acres of deepwater habitats and 24,920 acres of palustrine wetlands were identified by the NWI for the New York City Water Supply Watershed. The majority of the wetlands are located along streams throughout the watershed, though some are located outside of the riparian corridor. Between 1968 and 2004, there was an estimated net loss of 192 acres of vegetated wetlands and a net gain of approximately 250 acres of ponds in the East of Hudson portion of the New York City Watershed. Approximately 92 acres of vegetated wetlands were lost and 625 acres of new ponds were created in the Catskill and Delaware Watersheds from the mid-1980s to 2004. The rate of both wetland loss and pond construction declined throughout the watershed. The following sections provide a breakdown on the current status and recent trends of wetlands for the East of Hudson, Catskill, and Delaware Watersheds.

Wetlands can occur along slopes where groundwater intercepts the soil surface, such as at this wetland in the Cannonsville Reservoir Basin
(Photo by C. Falk)

East of Hudson Watershed

The East of Hudson portion of the New York City Watershed occupies 387 square miles. Given its proximity to New York City, this watershed is the most developed of the three watersheds. Wetlands and deepwater habitats occupy just over 12% of the watershed.

Deepwater habitats represent 14,938 acres or 6% of the watershed. While nearly 70% of the deepwater habitats are reservoirs (Amawalk, Bog Brook, Cross River, Croton Falls, East Branch, Kensico, Middle Branch, Muscoot, New Croton, Titicus, and West Branch), many lakes, such as Lake Mahopac, Lake Carmel, Peach Lake, and Putnam Lake, are located throughout the watershed as well.

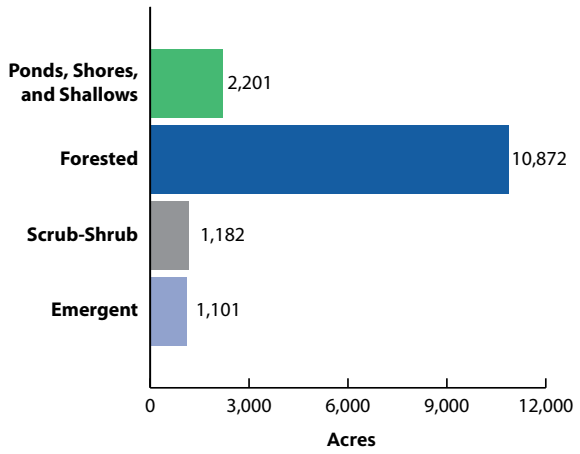
Palustrine wetlands occupy approximately 15,355 acres, which amounts to 6.2% of the land surface. Vegetated wetlands represent 86% of the watershed's wetlands, while the rest are ponds, shallow water habitats, and their associated shores. Forested wetlands are, by far, the most abundant wetland type, totaling 11,000 acres and accounting for 71% of the watershed's wetlands. Ponds are the next most abundant type, comprising 14% of the wetlands, followed by scrub-shrub (7.7%) and emergent (7.2%) types.

Not surprisingly, the majority (77%) of vegetated wetlands occur along streams, with just over a quarter located in the headwaters (i.e., along the upper reaches of streams) and half along the lower stream reaches. An estimated 10% of vegetated wetlands are outflow wetlands, where they are surrounded by uplands and have stream flow originating from within the wetland. Eight percent of vegetated wetlands are located along lakes, and 5% are mapped as isolated, lacking any discernible surface connection to streams or waterbodies. The majority of ponds are located in the upper reaches of the watershed along headwater streams (39%), or surrounded by uplands and serving as the source of stream flow (outflow systems) (19%). Nearly 13% of ponds are mapped as isolated.

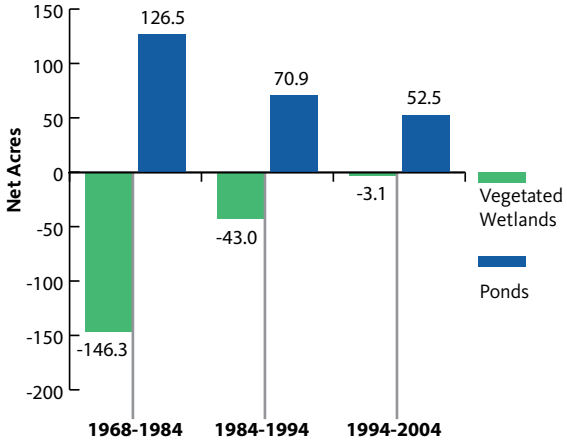
Analyses of wetland trends have shown that the rate of vegetated wetland loss has declined since 1968. From that year to the present, there was a net loss of approximately 192 acres of vegetated wetlands in the East of Hudson Watershed. The majority of the loss occurred between 1968 and 1984, when approximately 9.1 acres were lost per year. The rate slowed to 4.3 acres per year from 1984 to 1994, while an estimated 3.1 acres of vegetated wetlands were lost from 1994 to 2004, equivalent to 0.31 acres per year.

Pond acreage increased by a net of approximately 250 acres since 1968. Approximately half of this gain occurred from 1968 to 1984 when ponds were constructed at an estimated rate of 7.9 acres per year. The rate of pond construction slowed over the next two time periods to a net of 7.1 acres per year from 1984 to 1994 and then to 5.2 acres per year from 1994 to 2004. Conversion to ponds was the leading cause of vegetated wetland loss in all time periods analyzed. Much of this conversion was attributable to residential development.

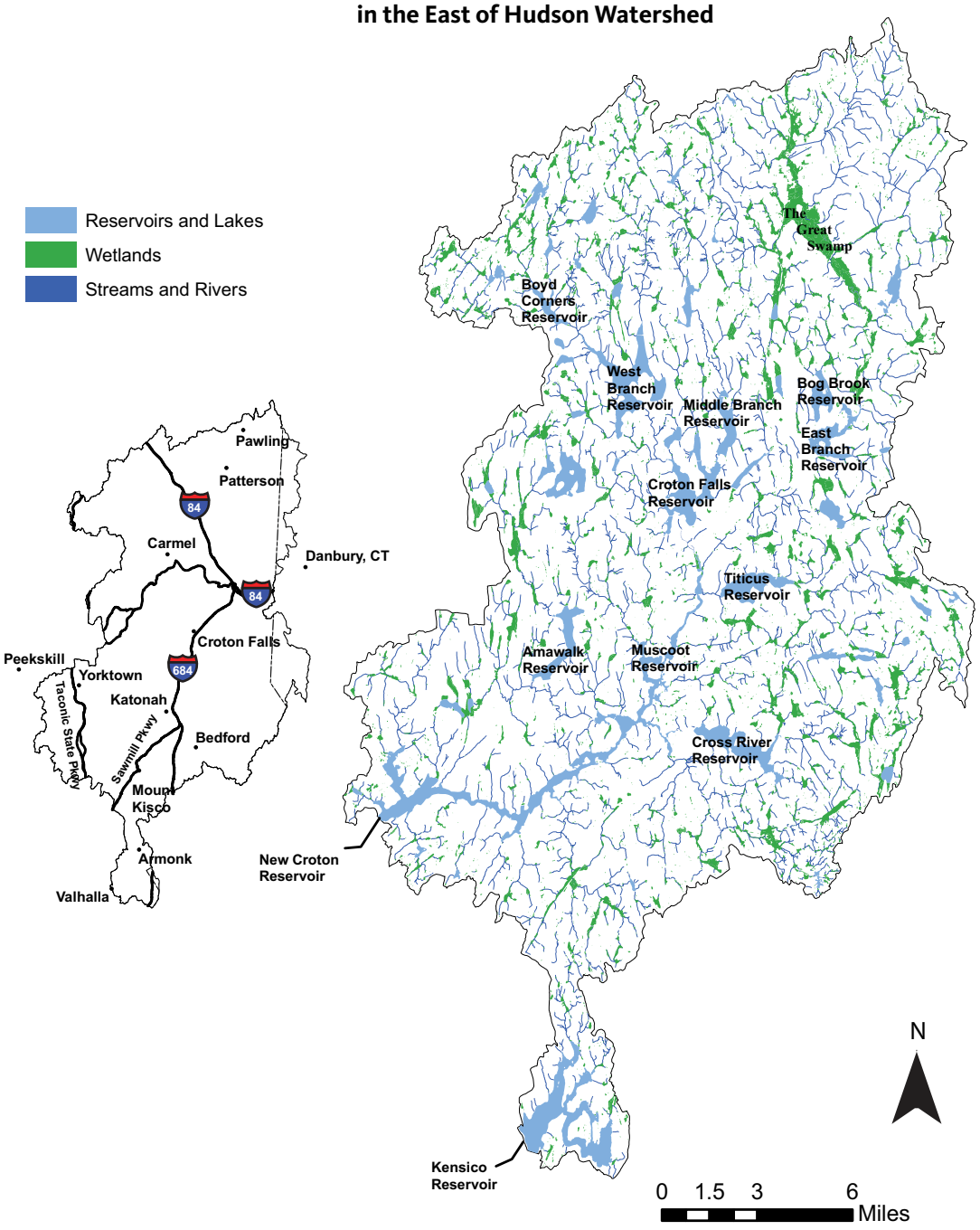
East of Hudson Watershed Wetlands



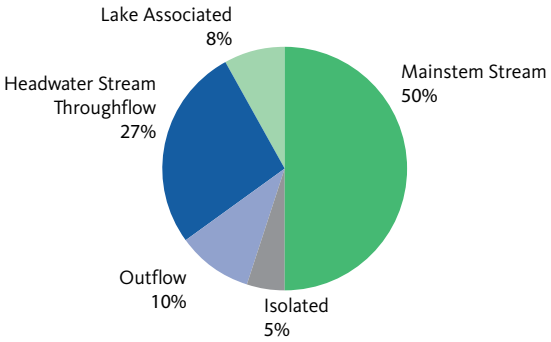
East of Hudson Wetland Trends



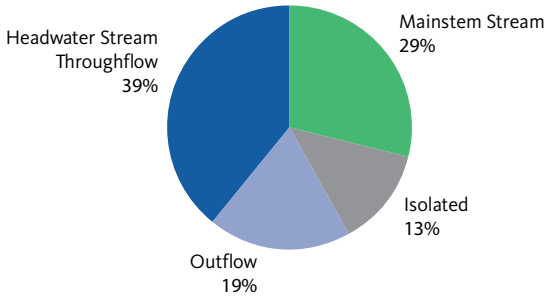
General Distribution of Wetlands and Deepwater Habitats in the East of Hudson Watershed



East of Hudson Vegetated Wetlands: Landscape Settings



East of Hudson Watershed Ponds: Landscape Settings



Catskill Watershed

The Catskill Watershed encompasses 571 square miles in the eastern Catskill Mountains. Wetlands and deepwater habitats cover slightly less than 4% of the land surface. Most of the Catskill Watershed is upland, comprised largely of forests, with villages and agricultural land, particularly in the northern Schoharie Reservoir basin, scattered throughout.

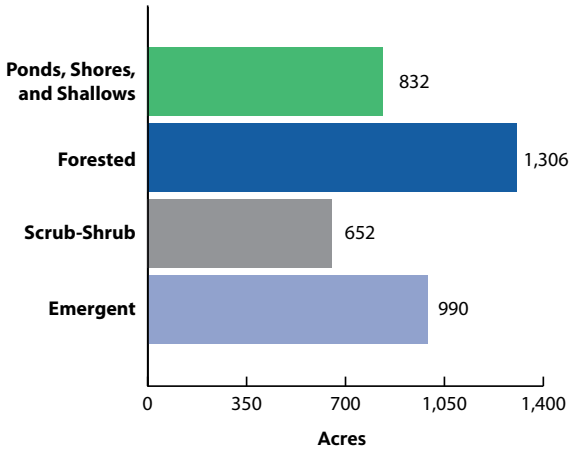
Deepwater habitats cover 9,643 acres, representing 2.6% of the watershed. The Ashokan and Schoharie Reservoirs comprise the majority of the deepwater habitat acreage, though numerous smaller lakes, typically impoundments, are located throughout the Catskill watershed. Esopus Creek is the main tributary to the Ashokan Reservoir. Stony Clove Creek, Beaver Kill, Little Beaver Kill and Woodland Creek are among the major tributaries to Esopus Creek. Schoharie Creek is the main tributary to the Schoharie Reservoir. Its tributaries include the Batavia Kill, the East Kill, and the West Kill, while the Manor Kill and Bear Kill flow directly into the reservoir.

Palustrine wetlands occupy 3,780 acres, or 1% of the land area, in the Catskill Watershed. Forested wetlands are most abundant, comprising 34% of the palustrine wetlands, but emergent wetlands (26%), ponds (22%) and scrub-shrub (17%) wetlands are common as well.

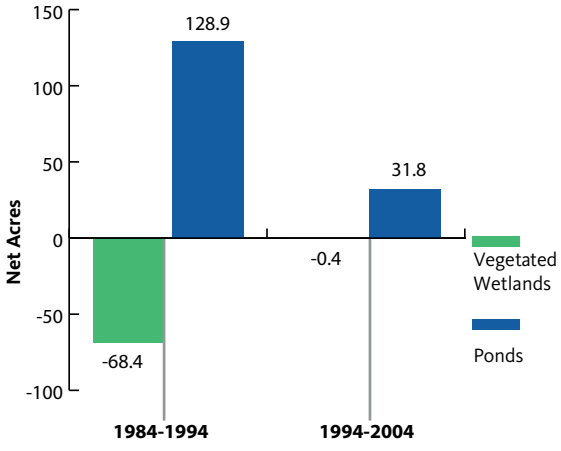
Sixty-seven percent of vegetated wetlands are located along the stream corridors in the Catskill Watershed, with 29% located along headwater streams in the upper reaches. Fifty-one percent of ponds are located along the stream corridors, mostly along headwater streams. Sixteen percent of vegetated wetlands and 20% of ponds are in outflow positions, where stream flow originates from within the wetland or pond. Twenty-nine percent of ponds were mapped as isolated as opposed to 7.7% of vegetated wetlands. The remaining 8.7% of vegetated wetlands are adjacent to reservoirs and lakes.

From the mid-1980s to 2004, the Catskill Watershed experienced a net loss of approximately 69 acres of vegetated wetlands, and a net gain of roughly 161 acres of ponds. Much of this occurred from the mid-1980s to 1994 in the Schoharie Reservoir basin, where 64 acres of vegetated wetlands were converted to ponds and a total of 130 acres of ponds were gained. For the Catskill Watershed, the annual rate of vegetated wetland loss declined from 6.8 acres per year from the 1980s to the 1990s to less than 0.1 acre per year from 1994 to 2004. The annual rate of pond gain slowed from 12.9 acres per year from the mid-1980s to the mid-1990s to 3.2 acres per year from the mid-1990s to 2004.

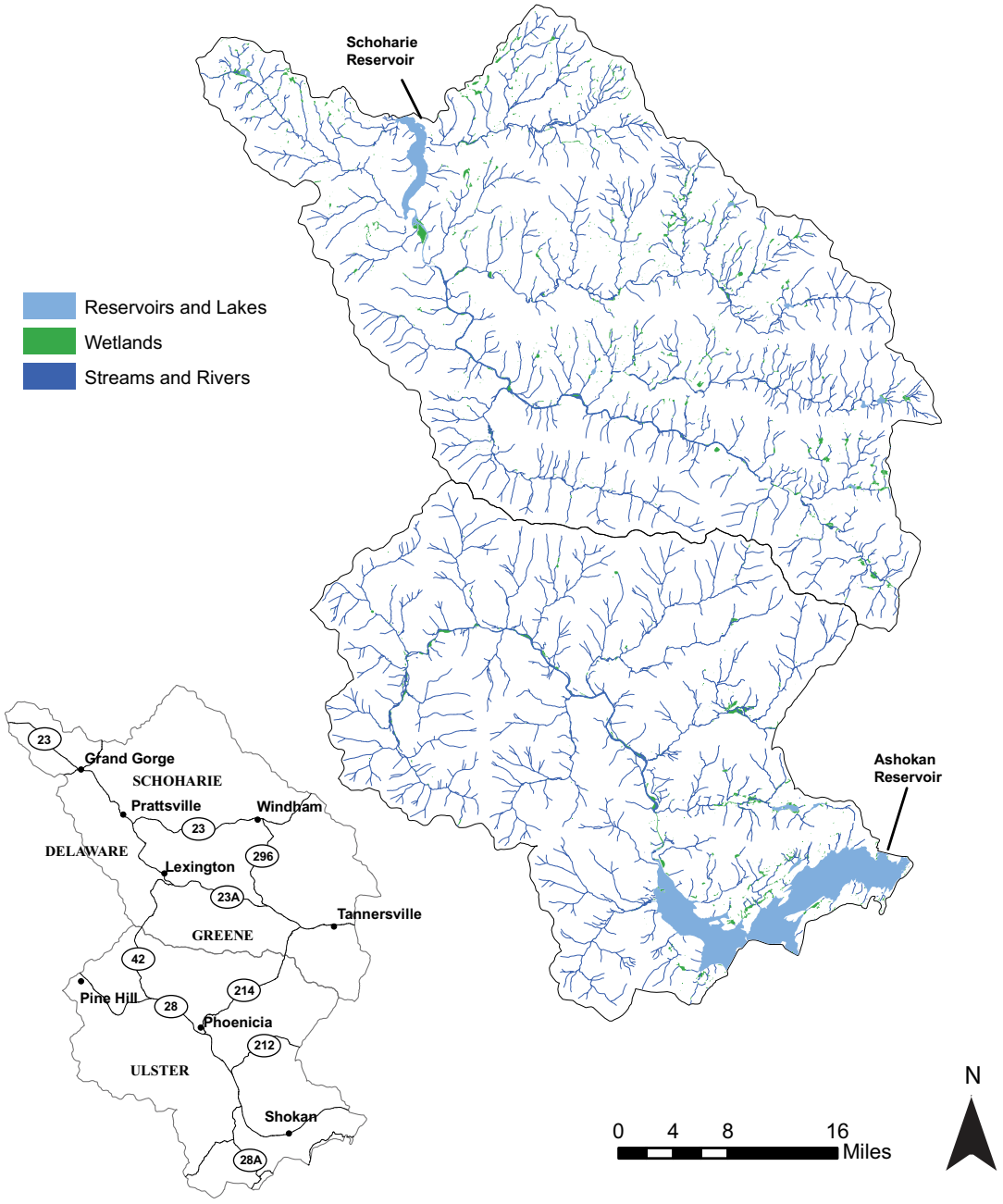
Catskill Watershed Wetlands



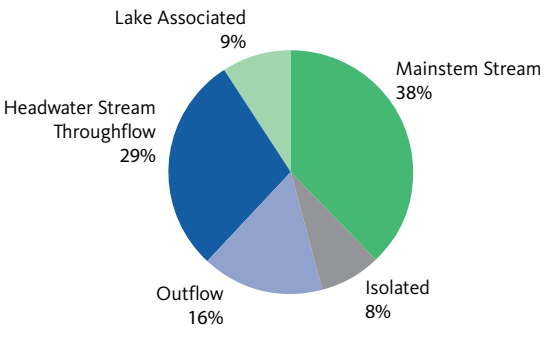
Catskill Wetland Trends



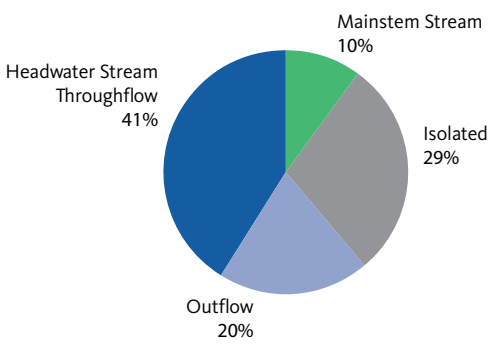
General Distribution of Wetlands and Deepwater Habitats in the Catskill Watershed



Catskill Watershed Vegetated Wetlands: Landscape Settings



Catskill Watershed Ponds: Landscape Settings



Delaware Watershed

The Delaware Watershed is the largest watershed within the New York City Water Supply System. It occupies 1,013 square miles and includes four reservoir basins: Cannonsville, Pepacton, Neversink, and Rondout. It is largely forested, particularly in the Neversink and Rondout basins. The Cannonsville and Pepacton basins contain more agricultural land than the other basins. Wetlands and deepwater habitats cover 2.3% of the land surface.

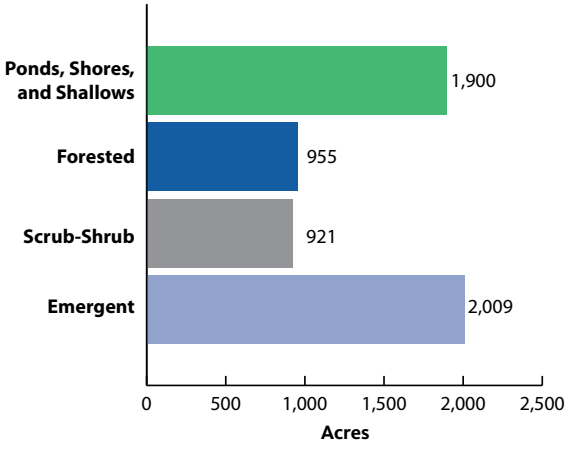
Deepwater habitats, the majority of which are reservoirs, occupy 9,311 acres, or 1.4% of the watershed. Major rivers and streams include the East and West Branches of the Delaware River, the Neversink River, and Rondout Creek, draining into the Pepacton, Cannonsville, Neversink, and Rondout Reservoirs, respectively.

The Delaware Watershed contains 5,785 acres of palustrine wetlands, representing 0.9% of the land surface. Emergent wetlands and ponds are the most abundant types, accounting for 35 and 33% of the wetlands, respectively. Forested and scrub-shrub wetlands each account for approximately 16% of the wetlands.

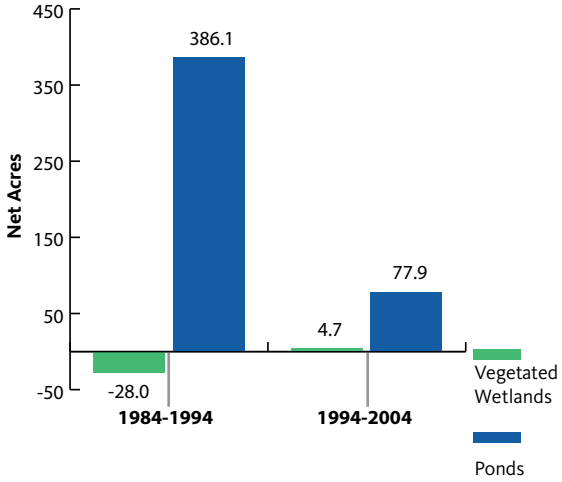
From a landscape perspective, 76% of vegetated wetlands and 49% of ponds are situated along streams in the Delaware Watershed, with the majority located along headwater streams. Approximately 12% of vegetated wetlands and 18% of the ponds are outflow wetlands, providing surface flow downstream. One-third of the ponds and 8% of the vegetated wetlands were mapped as isolated. The remaining 4% of vegetated wetlands are adjacent to reservoirs and lakes.

There was a net loss of approximately 23 acres of vegetated wetlands and a net gain of 464 acres of ponds in the Delaware Watershed from the mid-1980s to 2004. The majority of the wetland loss occurred in the Cannonsville and Pepacton basins from the mid-1980s to the mid- 1990s, during which time 41 acres of vegetated wetlands were converted to ponds. This conversion was somewhat offset by a nearly 17-acre gain in vegetated wetlands in the same basins. During the same time period, there was a net gain of 386 acres of ponds in the Delaware Watershed, nearly all of which occurred in the Cannonsville and Pepacton basins. From the mid-1990s to 2004, there was a net gain of 4.7 acres of vegetated wetlands, largely due to succession of ponds to vegetated wetlands. The rate of pond gain declined to 7.8 acres per year, for a net gain of 78 acres of ponds.

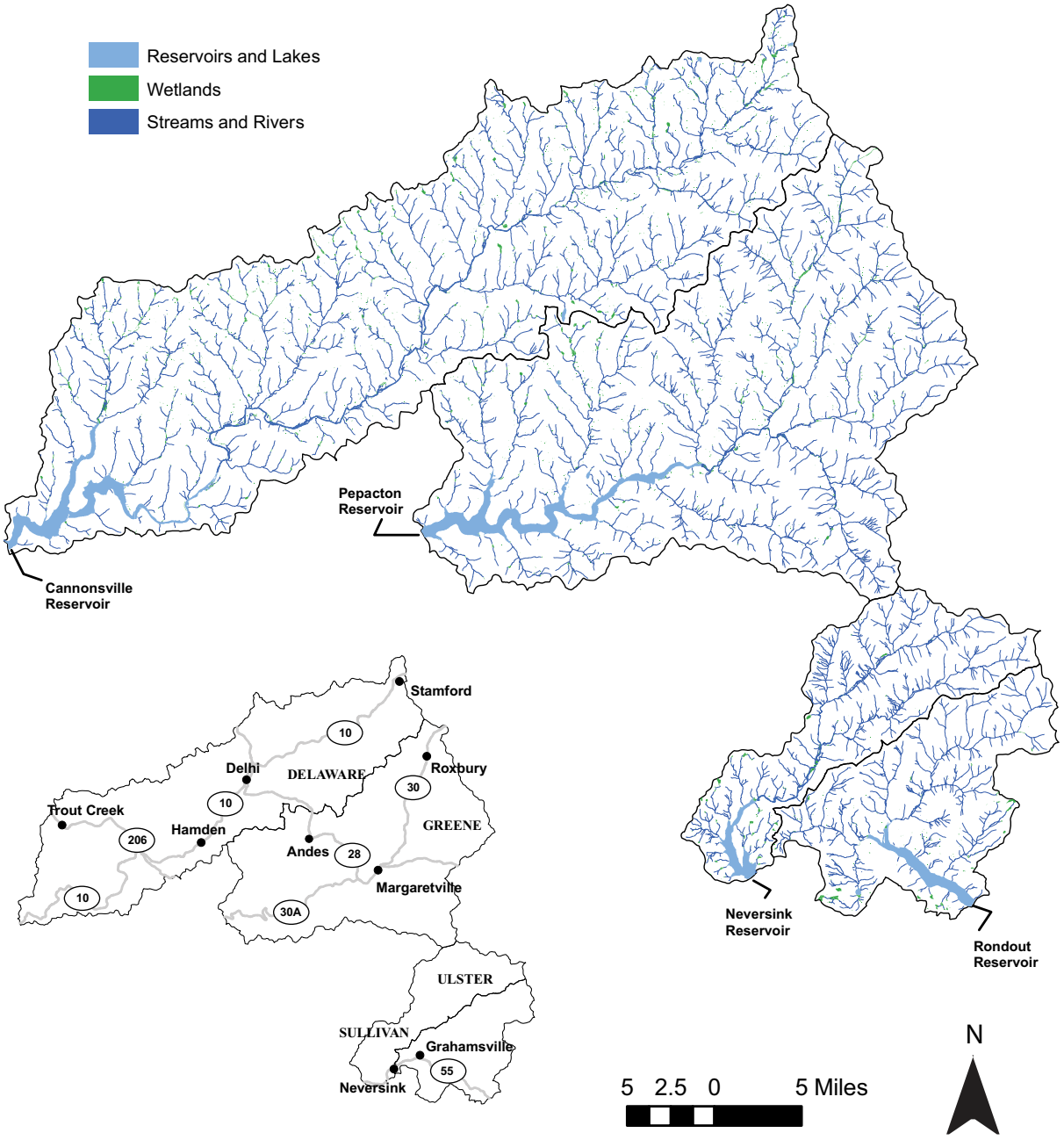
Delaware Watershed Wetlands



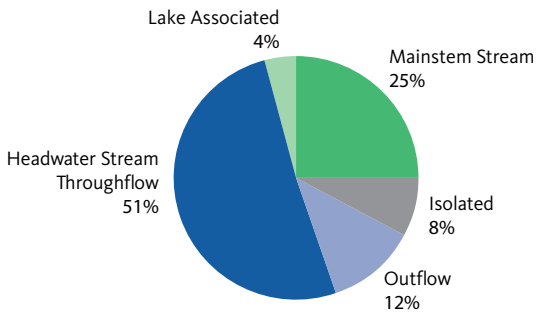
Delaware Watershed Wetland Trends



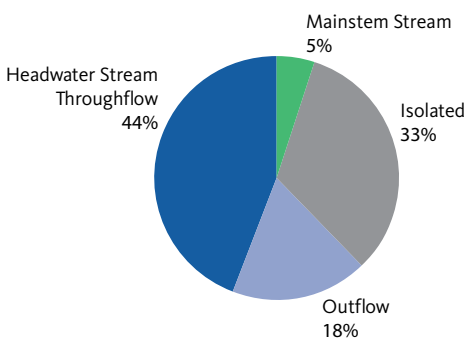
General Distribution of Wetlands and Deepwater Habitats in the Delaware Watershed



Delaware Watershed Vegetated Wetlands: Landscape Settings



Delaware Watershed Ponds: Landscape Settings



Protecting Wetlands

The decline in the rate of wetland loss measured in the New York City Watershed mirrors national trends and is largely attributable to increased wetland protection. However, wetlands continue to be threatened. Examples of threats to wetlands include 1) filling for the construction of residential, industrial, and commercial facilities, 2) excavating, flooding, or channelizing for navigation or flood control projects, 3) draining and clearing for agricultural production, and 4) direct or indirect discharge of pollutants. Protecting wetlands from these threats is especially important, since wetlands occupy a small proportion of the landscape yet provide many functions. Regulatory protection of wetlands is provided federally under provisions of the Clean Water Act, in New York State by the Freshwater Wetlands Act, and through local ordinances in some municipalities. Additionally, DEP administers regulations in the New York City Watershed that include protections for wetlands, and implements numerous other programs that benefit the protection and management of wetlands.

Regulatory Protection

Following is a general description of federal, State, and municipal wetland regulations. For specific information on regulatory requirements, contact the appropriate agency listed in the Wetland Resource Guide section of this booklet.

Despite regulatory protection, wetlands continue to be impacted through unauthorized fills. (Photo by J. Damrath)

Federal Regulations

Federal regulation of wetlands is primarily through the Clean Water Act, which prohibits the discharge of dredged or fill material into "waters of the United States" without a permit from the U.S. Army Corps of Engineers. These permits usually require mitigation in the form of wetland creation or restoration for unavoidable impacts. The term "waters of the United States" includes wetlands, though the scope of included wetlands has changed due to recent judicial interpretations of the Clean Water Act.

The Clean Water Act regulations authorize nationwide permits, which are general permits for certain activities deemed to have minimal adverse impacts on the environment. Proposed activities that meet the criteria established for the nationwide permits do not require an individual, project-specific permit from the U.S. Army Corps of Engineers, though notification is often required before construction can be undertaken. It should be noted that all wetlands in the East of Hudson Watershed of the New York City Water Supply were designated as "Critical Resource Waters" meaning that individual, project-specific permits are required for many activities.

State Regulations

In New York State, freshwater wetlands are regulated under the Freshwater Wetlands Act, which is administered by the New York State Department of Environmental Conservation (DEC). The scope of the Freshwater Wetlands Act is generally limited to wetlands that are 12.4 acres or larger. The Act also regulates a 100-foot-wide buffer area adjacent to the wetland's edge. The Act does provide for regulation of smaller wetlands deemed to be of "unusual local importance," should they meet specific criteria set forth in the regulations. It should be noted that all wetlands, regardless of size, adjacent to reservoirs in the East of Hudson Watershed have been designated to be of "unusual local importance" and therefore subject to regulation under the Act. Like the Clean Water Act, the Freshwater Wetlands Act regulates dredging and filling of wetlands, along with additional activities, such as draining, grading, clearing, and pollution, that substantially impair wetland function.

In order to be regulated in New York State, wetlands must be included on the State's existing Freshwater Wetlands Maps, which were largely completed for the watershed between 1984 and 1988, with the exception of the map for Dutchess County, which was completed in 1994. The New York State Freshwater Wetlands Maps include 18,165 acres of regulated freshwater wetlands in the East of Hudson portion of the New York City

THE CLEAN WATER ACT PROHIBITS THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO "WATERS OF THE UNITED STATES" WITHOUT A PERMIT FROM THE U.S. ARMY CORPS OF ENGINEERS.

Unauthorized ditching in a forested wetland in the Catskill Watershed
(Photo by J. Damrath)

Stream restoration project on the Batavia Kill (Catskill Watershed).
(Photo by Photo by J. Grieser)

Watershed, 2,065 acres for the Catskill Watershed, and 2,867 acres for the Delaware Watershed. Acreage discrepancies with the NWI maps are attributable several factors, including differences in source photography and mapping methodology, as well as to the differing criteria for inclusion of wetlands on State and federal maps. Additionally, nearly 7,000 acres of the regulated wetlands East of Hudson were included through recent amendments in 2004 and 2006, which relied heavily on field verification. The official New York State Freshwater Wetlands Maps can be viewed online through the DEC's Environmental Resource Mapper at www.dec.ny.gov/imsmaps/ERM/viewer.html.

Municipal Regulations

Wetland protection can also be achieved through municipal regulation. All of the 25 municipalities in the East of Hudson Watershed have enacted wetland regulations, while one of the 50 municipalities in the Catskill and Delaware Watersheds has adopted a local wetlands ordinance. While regulations can vary widely among municipalities, local ordinances can often afford the most protection, as they are not constrained by the jurisdictional limits of the federal regulations or the 12.4-acre size threshold of the State regulations.

New York City Watershed Rules and Regulations

DEP reviews proposed projects in the watershed to ensure compliance with the above federal, State, and local laws, as well as with New York City's Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources. Examples of projects that require review and approval by DEP under the Watershed Rules and Regulations include the installation of wastewater and subsurface sewage treatment systems and the construction of certain impervious surfaces. The Watershed Rules and Regulations include provisions prohibiting these activities within specified distances of wetlands included on the New York State Freshwater Wetlands Maps for the New York City Watershed. These regulations also require the preparation of stormwater pollution prevention plans for certain land development projects to prevent the discharge of untreated stormwater into watercourses and DEC-mapped wetlands.

Non-Regulatory Wetland Protection Strategies

DEP has many programs in place aimed at protecting and improving water quality in the New York City Watershed. DEP's Land Acquisition, Watershed Agricultural, Forestry, and Stream Management Programs result in increased wetland awareness, restoration, and protection. DEP also has a reference wetlands monitoring program to facilitate better understanding of the characteristics and functions of wetlands in the watershed.

Land Acquisition

DEP's Land Acquisition Program protects undeveloped, environmentally sensitive watershed lands through fee acquisition and conservation easements. Fee acquisition involves the full transfer of ownership of property. The presence of wetlands greater than five acres in size is one of many criteria used by DEP to target vacant parcels for acquisition. Through the use of conservation easements, a landowner can sell specific development rights while retaining the right to use the land for other agreed-upon purposes. As of June 2009, DEP has protected 143,212 acres of land in the New York City Watershed through ownership or easement.

Watershed Forestry Program

The Watershed Forestry Program is a partnership between DEP, the U.S. Forest Service (USFS), and the upstate forestry community to maintain well managed forests in the watershed. Administered by WAC, the forestry program provides funding to watershed landowners for the development of forest management plans by trained foresters. It provides training to foresters, loggers, and landowners to implement BMPs to properly manage sensitive areas such as wetlands and riparian buffers to protect water quality.

DEP has several programs in place to protect and improve water quality in the New York City Watershed, many of which result in increased wetlands awareness and protection.

Watershed Agricultural Programs

The Watershed Agricultural Program is a voluntary partnership between watershed farmers and DEP that develops and implements pollution prevention plans (whole farm plans) to manage nonpoint sources of agricultural pollution. Wetland areas are identified in the development of farm plans, and best management practices (BMPs) are recommended for their protection. Under the administrative leadership of the Watershed Agricultural Council (WAC), whole farm plans have been developed for over 95% of the commercial farms and 70 small farms in the watershed.

DEP partners with the New York State Department of Agriculture and Markets and the U.S. Department of Agriculture (USDA) to implement the Conservation Reserve Enhancement Program (CREP) in the watershed. The CREP allows watershed landowners to retire environmentally sensitive agricultural lands from production and helps establish streamside buffers by providing annual rental payments and cost-sharing for the implementation of BMPs. Over 1,900 acres of riparian buffers containing over 160 acres of NWI wetlands have been established by CREP in the watershed.

Forest Management Program

DEP's Forest Management Program, in collaboration with the USFS, is developing a management plan for forests on City-owned lands in the watershed. The major objective of the forest management plan will be to enhance the forest's capability to protect water quality. The plan will include conservation management practices for sensitive areas such as wetlands.

Stream Management Program

The mission of DEP's Stream Management Program is to restore stream stability and ecosystem integrity by encouraging long-term stewardship of streams and floodplains in the Catskill and Delaware Watersheds. DEP has partnered with County Soil and Water Conservation Districts, Cornell Cooperative Extension of Ulster County, and local stakeholders to develop and implement stream management plans for Catskill and Delaware mainstem rivers. Stream management plans describe the roles that wetlands play for water quality, habitat, and flood mitigation functions, include wetlands on stream corridor maps, and identify priority stream restoration areas that often include wetlands. To view stream management plans, their recommendations, and for local contact information, visit www.catskillstreams.org.

Wetlands Monitoring

DEP has a reference wetlands monitoring program in place to characterize and assess the functions of wetlands in the New York City Watershed. DEP has sampled the vegetation, soils, water levels, and water quality at 6 wetlands in the East of Hudson Watershed, and at 22 wetlands West of Hudson. The monitoring program provides information on the species composition, soil characteristics, water table dynamics, and water quality of the reference wetlands. Reference wetland monitoring and NWI mapping provide information on the types, status, distribution, characteristics, and functions of watershed wetlands that guides DEP's regulatory and non-regulatory protection programs.

TOP: Wet meadow in the Neversink Reservoir Basin.
(Photo by C. Falk)

BOTTOM: DEP reference wetland in winter (Pepacton Reservoir Basin).
(Photo by L. Machung)

What Can You Do?

Numerous opportunities exist for citizens, not-for-profit organizations, and the business community to improve the status of wetlands through protection, creation, restoration, and other management efforts. Suggested strategies include the following:

- Continue to educate yourself on the importance of wetlands. Attend wetland educational forums offered by private organizations or public agencies.
- Increase public awareness by communicating the importance of wetlands to friends, family members, company executives, and policy-making government officials.
- Become active in local issues. Support local strategies to protect and restore wetlands. Participate in the public review of wetland permit applications in your municipality.
- Seek non-wetland sites for development projects and avoid wetland impacts during project construction.
- Avoid construction in wetland buffers to protect the wetland area from adjacent land uses and to protect the habitat of animals that rely on wetland and nearby upland areas.
- Avoid gardening and landscaping with invasive plants that can invade nearby wetland areas.
- Explore programs that offer economic incentives such as tax breaks or cost sharing to protect or restore wetlands on your property. Contact the appropriate County Soil and Water Conservation Districts listed in the Wetland Resource Guide to learn more about these programs.
- Donate wetlands or funds to purchase wetlands to private land trusts or public agencies.
- Purchase federal and state duck stamps to support wetland acquisition. Ninety-eight cents of every dollar generated by the sales of Federal Duck Stamps supports the acquisition of wetland habitat for protection in the National Wildlife Refuge System.

Wetland Resource Guide

For information on federal, State, and watershed wetland regulations and programs, contact the following agencies:

Federal

U.S. Army Corps of Engineers
Regulatory Branch
New York District
Jacob K. Javits Federal Building
26 Federal Plaza
New York, NY 10278-0090
(917) 790-8510

U.S. Environmental Protection Agency Region II
Wetlands Protection Section
290 Broadway, 24th Floor
New York, NY 10007-1866
(212) 637-3801

EPA Wetlands Helpline
(800) 832-7828

EPA Wetlands link:
www.epa .gov/owow/wetlands/

U.S. Fish and Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 10345
(607) 753-9334

State

New York State Department of Environmental Conservation
Division of Fish, Wildlife and Marine Resources
625 Broadway
Albany, NY 12233-4750
(518) 402-8924

NYSDEC Region 3
21 S. Putt Corners Road
New Paltz, NY 12561
(845) 256-3000

NYSDEC Region 4 Sub-Office
65561 State Hwy. 10
Stamford, NY 12167-9503
(607) 652-7741

New York City Department of Environmental Protection

Bureau of Water Supply
Regulatory and Engineering Programs Section
465 Columbus Avenue
Valhalla, NY 10595
(914) 742-2028

Watershed Lands and Community Planning
Natural Resources Management
71 Smith Avenue
Kingston, NY 12401
(845) 340-7849
www.nyc.gov/dep

Delaware County

County Planning Department
1 Page Avenue, PO Box 367
Delhi, NY 13753
(607) 746-2944

Soil and Water Conservation District
44 West Street, Suite 1
Walton, NY 13856
(607) 865-7161

Dutchess County

Department of Planning and Development
27 High Street
Poughkeepsie, NY 12601
(845) 486-3600

Soil and Water Conservation District
Farm and Home Center
2715 Route 44
Millbrook, NY 12545
(845) 677-8011

Greene County

Economic Development, Tourism and Planning Department
411 Main Street
Catskill, NY 12414
(518) 719-3290

Soil and Water Conservation District
907 County Office Building
Cairo, NY 12413
(518) 622-3620

Putnam County

Department of Planning, Development, and Public Transportation
841 Fair Street
Carmel, NY 10512
(845) 878-3480

Soil and Water Conservation District
841 Fair Street
Carmel, NY 10512
(845) 878-7918

Schoharie County

Planning and Development Agency
349 Mineral Springs Road
Cobleskill, NY 12043
(518) 234-3751

Soil and Water Conservation District
173 S. Grand Street, Room 11
Cobleskill, NY 12043
(518) 234-4092

Sullivan County

Division of Planning and Environmental Management
Government Center
100 North Street
Monticello, NY 12701
(845) 807-0527

Soil and Water Conservation District
64 Ferndale-Loomis Road
Liberty, NY 12754
(845) 292-6552

Ulster County

Planning Board
244 Fair Street, Box 1800
Kingston, NY 12402
(845) 340-3340

Soil and Water Conservation District
652 Route 299, Suite 103
Highland, NY 12528
(845) 883-7162

Westchester County

Department of Planning
Soil and Water Conservation District
148 Martine Avenue, Room 432
White Plains, NY 10601
(914) 995-4423

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Acknowledgments

This booklet is the culmination of many collaborative projects between the New York City Department of Environmental Protection and the U.S. Fish and Wildlife Service. Ralph Tiner, Regional Wetland Coordinator for the USFWS's Northeast Region, served as the project manager and was the senior author of all reports summarizing the findings of the various NWI projects in the New York City Watershed. Much of the text in this document is based on the first edition of this booklet, which he wrote (see Tiner, 1996).

Cover Photo: DEP wetland research site in the Delaware Watershed (Pepacton Reservoir Basin).
(Photo by C. Falk)

2009