A Natural Resources Inventory

for the Town of Washington and Village of Millbrook

2024

Prepared by

Cornell Cooperative Extension Dutchess County

NYS DEC Hudson River Estuary Program in partnership with Cornell University

Town of Washington Climate Smart Communities Task Force

Town of Washington Natural Resources Inventory Task Force

Village of Millbrook Climate Smart Communities Task Force

Village of Millbrook Natural Resources Inventory Task Force

Cover photo by Leslie Heaney

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Acknowledgments

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Additionally, we are uniquely fortunate to have two exemplary scientists: Dr. Shannon LaDeau and Dr. Peter Groffman, Millbrook residents and members of our Climate Smart Communities and Natural Resources Inventory Task Force. Their timely participation, input, review, and oversight was key to this project both in terms of map review and related report data. Thank you, Shannon and Peter.

Appreciation is due to the Village of Millbrook Trustees and the Town of Washington Board, with special recognition for Tim Collopy, Mayor of the Village of Millbrook and Gary Ciferri, Supervisor of the Town of Washington for their foresight, endorsement, and ongoing support of the task force's work and the far-reaching effect it will have between our municipalities. It's a fine example of the village and town working jointly for the good of our land, water and communities.

Thank you to all members of the Joint NRI Task Force: Chair for the Village of Millbrook, Genevieve Glasson, Chair for the Town of Washington, Leslie Heaney and dedicated task force members: Peter Groffman, Mike Herzog, Shannon LaDeau, Richard Phillips, and Margaret Schneible. Without them, this effort would not have been possible.

A special thanks to our passionate Climate Smart Community members for contributing their time and fine skills to this project: Elizabeth Bellin, Adelaide Camillo, and Colleen Howland for participating in our community outreach at the Millbrook Farmers Market and Community Day events; June Glasson for assistance with artwork and marketing materials including logo, brochures, and stickers; and Andrew Heaney and Beatrice Moritz for the use of their beautiful photographs in this NRI.

Our Natural Resources Inventory co-participants from the neighboring Town of Clinton, Jean McAvoy, Jack Persely, and Margaret Pierpont, should be saluted for their collaboration, insights, and dedication to this important project.

This project was carried out through a partnership between Cornell University and the New York State Department of Environmental Conservation Hudson River Estuary Program with funding from the New York State Environmental Protection Fund.

Cornell University

Department of Environmental Conservation | Hudson River Estuary Program

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Chapter 1: Introduction

The Town of Washington completed a Comprehensive Plan in 2015. That plan emphasized the community's commitment to retaining the town's rural nature. The Plan Vision Statement reads,

> "We envision the Town of Washington will remain a rural community with great scenic beauty, a healthy natural environment, and a high quality of life for its residents. We envision protecting our Town by ensuring that our working farms, beautiful historic landscapes, water resources and natural habitats for our plants and animals are preserved for the future."

The Town's 2023 Addendum to the Comprehensive Plan on Hospitality reinforces the Town's commitment to this vision, and both the 2015 and 2023 Addenda recommended that the Town embark on completing a Natural Resources Inventory (NRI).

The Town of Washington and Village of Millbrook's forests, meadows, wetlands, streams, and shorelines are not only habitat for abundant wildlife and fish, but also provide many vital benefits to people. These ecosystems help to keep water and air clean, moderate temperature, filter pollutants, absorb floodwaters, and provide for pollination of agricultural crops. They also present opportunities for outdoor recreation and education and create the scenery and sense of place that is unique to this community.

This NRI identifies and describes the naturally occurring resources located in the Town of Washington and Village of Millbrook, including climate, topography, geology and soils, water resources, and habitat, as well as farmland and conserved or publicly owned lands. By bringing this information together in one place, the NRI can cultivate a better understanding and appreciation of the community's natural resources and support a wide range of planning and conservation applications. The NRI provides a foundation for comprehensive and open space planning, zoning updates, identifying critical environmental areas, climate adaptation strategies, and other municipal plans and policies for the Town and Village. The NRI can also inform local land stewardship and conservation.

How to use the NRI

The NRI is a valuable land use planning tool as well as an educational resource that documents aspects of the Town and Village's environment. The inventory provides an essential tool for the local Building, Land Use, and Zoning Departments by identifying sensitive land, biological, and water resources. It discusses development considerations for the Planning and Zoning Boards, laying a foundation for land-use planning and decision-making, zoning considerations and municipal policy guidance, as well as environmental conservation. In addition, the NRI provides property owners, developers, and their consultants with information they may need when

considering the impact their project may have on natural resources. It can be used to address natural resources during project planning and design and help expedite the review and approval of their endeavors. It can also be used as a general reference for landowners to understand resources that may occur on and around their property and inform land management and stewardship.

Appendix A provides a sample checklist for site resource assessment based on a model created by Hudsonia, Ltd., a non-profit research and educational institute. This checklist can assist local planning and zoning board members to streamline their review of the NRI to locate natural features present on or near a proposed project site. Note that site visits are highly recommended to verify resources present, including features which may not have previously been mapped. Certain projects may warrant further assessment by an expert.

Examples of NRI uses for municipal officials and community groups include:

- Referencing the NRI during environmental reviews, including the state environmental quality review (SEQR) process
    - Use the sample checklist to evaluate natural resources on and near the site,
    - Reference the NRI during SEQR and site plan reviews and evaluate potential impacts on resources extending beyond site boundaries,
    - Use the NRI to enforce existing natural resource protections in the code.
- Updating the Town Comprehensive Plan and Village Master Plan
    - Inventory existing conditions for natural resources,
    - Identify conservation priorities,
    - Inform vision statement and key issues, as well as goals and policies to protect important natural resources.
- Creating an open space plan
    - Identify priority areas for open space conservation.
- Designating Critical Environmental Areas to bring attention to sensitive areas during the SEQR process
- Revising zoning and subdivision regulations
    - Integrate the NRI to purpose, definitions, and delineation of natural features referenced in the code;
    - Use the NRI for conservation analysis in open space subdivisions;
    - Require protection of sensitive resources identified in the NRI.

For landowners, residents, farmers, and developers, the NRI can be used to:

- Identify some of the natural resources on their land,
- Understand the role of their land in the larger landscape, and
- Plan for land management or uses to avoid or minimize impacts to natural resources.

For more examples of how to integrate the NRI into municipal comprehensive plans, zoning, and land use decision-making, refer to *Best Practices for Adopting Conservation Inventories and Plans*.[1]

[1] *Best Practices for Adopting Conservation Inventories and Plans: A Guide for Communities in the Hudson River*

It is important to keep in mind that the NRI is best suited for municipal scale planning but may be used as a screening tool to raise questions or identify the need for additional resource assessment at individual parcels. The maps are not intended to provide site-specific accuracy and should not be used as a primary source for land use decision-making but may identify where further site assessments are needed. The NRI does provide information about the value of natural resources to the community and can aid in understanding the context of individual sites.

The NRI maps are available as PDFs on the Town website and physical copies are available at the Millbrook public library. The PDF maps allow for ease of navigation with the ability to zoom in to an area of interest.

Dutchess County NRI

The Dutchess County Natural Resource Inventory is an excellent companion tool and is available on the Dutchess County Planning Website.[2] The County NRI is in the process of being updated and will include an online, interactive map hosting most of the data layers shown on maps in this NRI. The Dutchess County NRI catalogs the natural resources of the county and interprets the findings.

Online interactive maps

Many of the data sets shown in the NRI maps are available for more detailed viewing through other online interactive maps (in addition to the County NRI web map), including:

- Dutchess County Parcel Access - https://gis.dutchessny.gov/parcelaccess/
- Dutchess County Aerial Access - https://gis.dutchessny.gov/aerialaccess/
- Hudson Valley Natural Resource Mapper - https://www.dec.ny.gov/lands/112137.html
- DECinfo Locator - https://www.dec.ny.gov/pubs/109457.html
- Discover GIS Data NY - https://orthos.dhses.ny.gov/
- National Map - https://www.usgs.gov/programs/national-geospatial-program/national-map
- Web Soil Survey - https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Partners for conservation and land use planning

The following agencies and organizations are potential partners in assisting the Town and Village with advancing natural resource planning, management, and conservation:

- New York State Department of Agriculture and Markets
- New York State Department of Environmental Conservation (DEC)
- New York State Department of State
- Hudson River Valley Greenway
- Cornell Cooperative Extension Dutchess County

Estuary Watershed. New York State Department of Environmental Conservation's Hudson River Estuary Program, Cornell University, and Pace Land Use Law Center. New Paltz, NY, 2023, https://www.dec.ny.gov/docs/remediation_hudson_pdf/nriospadoption.pdf

[2] Dutchess County Natural Resource Inventory. www.dutchessenvironment.com/nri

- Natural Resources Conservation Service
- Lower Hudson Partnership for Regional Invasive Species Management
- Dutchess County Soil and Water Conservation District
- Dutchess County Department of Planning and Development
- Dutchess County Department of Health
- Wappinger Creek Intermunicipal Council
- Dutchess Land Conservancy
- Scenic Hudson
- Hudsonia, Ltd.

Data and methods

Photo 1. Red barn and fence on Fowler Road, Washington (Beatrice Moritz)

The NRI was completed through a technical assistance grant to the towns of Washington and Clinton and the Village of Millbrook provided by the DEC Hudson River Estuary Program (Estuary Program) and Cornell University staff in partnership with Cornell Cooperative Extension Dutchess County (CCEDC). Joint project meetings were held with volunteers from the Town of Clinton but separate NRIs were created for each community. Washington and Millbrook members of the NRI committee included members of the Town and Village Boards, Town Planning Board, Town and Village Conservation Advisory Commissions, Village Shade Tree Commission, and the Village Climate Smart Communities Task Force. Project facilitation and report writing were led by Estuary Program staff members Ingrid Haeckel, Christine Vanderlan, and Anna Palmer. The report is based on a template developed by Estuary Program staff with interpretation of local resources occurring in the Town and Village. Mapping was carried out by Sean Carroll of CCEDC.

The NRI incorporates information from Washington's 2015 *Comprehensive Plan*; Millbrook's 1985 *Master Plan*, the 2004 study *Significant Habitats in the Town of Washington NY (Significant Habitats* report*)* by Hudsonia, the 2010 *Dutchess County Natural Resources Inventory*, the 2000 *Natural Resource Management Plan for the Wappinger Creek*, the 2022 *Natural Resource Characterization and Recommendations Report for the Wappinger Creek Watershed*, the 2011 Village of Millbrook *Sewer and Water Comprehensive Plan*, and the 1992 *Water Supply Protection Program for Dutchess County*, among other plans and studies.

The NRI maps display data from federal, state, and county agencies, as well as local habitat and stream mapping from the *Significant Habitats* report completed by Hudsonia in 2004. The original source and publication year of data sets are included on each map and are described in the report. All maps were produced using ESRI Geographic Information Systems (GIS) software

and data in the NAD 1983 State Plane New York East FIPS 3101 Feet coordinate system. Maps that are were previously published in other studies or reports are included as Figures.

Note that information on the maps comes from different sources, produced at different times, at different scales, and for different purposes. Most of the GIS data were collected or developed from remote sensing data (i.e., aerial photographs, satellite imagery) or derived from paper maps. For these reasons, GIS data often contain inaccuracies from the original data, plus any errors from converting them. Therefore, maps created in GIS are approximate and best used for planning purposes. They should not be substituted for site surveys. Any resource shown on a map should be verified for legal purposes, including environmental review. The NRI is not a substitute for the collection of site-specific data or more detailed local knowledge. Information provided by the maps can be enhanced by local knowledge, and the NRI should be updated every 10 years and as new data become available.

During the NRI process, NRI committee members reached out regularly to Town and Village municipal leaders and citizens for their input and review. The Millbrook Farmers Market gave us an excellent opportunity this past summer to display our maps and engage the community. During the months of June, July, and August, Task Force members hosted a tent at the Farmers Market where we were able to address questions about the NRI maps and our Climate Smart Community efforts to date. NRI tri-fold brochures outlining the program were handed out to the public. Although two out of the three Saturdays were drenched with rain, a lively group of our dedicated volunteers cheerfully greeted friends and market shoppers and collected names of those who wanted to receive updates on our climate action activities.

Notices for these Farmers Market days were posted on our Village of Millbrook Mayor's Monthly Newsletters, the Town of Washington's website and a local email newsletter, the Washington Weekly.

Additionally, in September the NRI Task Force members and NRI Program Team members from NYSDEC and CCE gave a presentation at the Millbrook Firehouse to the Village and Town municipal boards (including Village Trustees, Town Councilpersons, Planning and Zoning Boards) and members of the public. In October, we participated in Community Day at the Village Hall with a display of several maps and NRI materials.

The final NRI draft was circulated to the public and selected reviewers during the Fall of 2023. After addressing comments, the final NRI was published on both the Village of Millbrook and Town of Washington municipal websites in January 2024.

Community Setting (Maps 1, 1b, and 2)

Photo 2. Statue of George Washington in Washington Town Hall (June Glasson)

The Town of Washington is a rural community located in east-central Dutchess County, New York. The Town spans 58.8 square miles and includes the Village of Millbrook within its borders. The population was 4,522 as of the 2020 census. Washington is bordered by the Town of Stanford to the north, the Towns of Union Vale and Dover to the south, the Town of Amenia to the east, and the Towns of Pleasant Valley and Clinton to the west. Most of the town is drained by Wappinger Creek, a major tributary of the Hudson River. Sprout Creek drains the southwest part of the Town and flows into Fishkill Creek, another major tributary of the Hudson. The eastern third of the Town drains east to Wassaic Creek, which flows into the Housatonic River, eventually emptying into Long Island Sound.

Settlement history

The Hudson Valley was settled by Native Americans at least 10,000 years ago following the last ice age.[3] The region including Washington and Millbrook is the ancestral homeland of the Munsee Lenape people. The Munsee Lenape lived along the tributaries and banks of the Hudson River, known as the Muhheacannituck, "the waters that are never still," in the Munsee language. When European settlers arrived in the region, they referred to the native people as the "River Indians." They were rapidly displaced from their homeland in the decades following European arrival in the 17th century. Native people were impacted by European settlement pressure, loss of traditional food resources, deliberate government efforts to remove them, and foreign diseases, against which they had no immunity. Despite tremendous hardship in being forcibly removed from their homeland, Munsee Lenape communities currently reside in Wisconsin, Oklahoma, and Canada. They comprise the Delaware Nation, Delaware Tribe, Stockbridge-Munsee Community Band of the Mohican Indians, Munsee-Delaware Nation, and Six Nations of the Grand River.

European settlement in the Town of Washington began in the 17th century, with early Dutch settlers followed by the English. In 1697, a group of settlers known as the Nine Partners received a patent from the Crown of England for 146,000 acres. Stretching from the Hudson River to the eastern border of New York State, it became known as the Nine Partners Patent. A portion of that patent became known as the Town of Washington. In the subsequent centuries, settlers included Quakers, farmers, bankers, and businesspeople. The Town of Washington was formed as part of the reorganization of Dutchess County in 1788.

The picturesque Village of Millbrook lies like a gem amid the rolling hills and broad meadows of

[3] "First Peoples." New York State Museum. Accessed 28 June 2023 https://www.nysm.nysed.gov/exhibitions/ongoing/first-peoples#

the Town of Washington. It was not officially incorporated as a Village until 1895.

Land use history

Hudson Valley ecosystems have been profoundly influenced by human land uses for millennia. Native Americans cleared fertile river valleys for agriculture and practiced widespread managed burning to promote an open forest understory conducive for hunting.[4] Fire management practices were used intentionally to promote the reproduction of valuable wild crops such as blueberries and are thought to have promoted the expansion of southern oaks-hickory forest communities and other fire-tolerant species.[5]

European settlement from the 16th to the early 19th centuries led to widespread forest clearing for agriculture. Even areas with marginal soils were cleared for pasture. By 1835, 75-80 percent of the land in neighboring Columbia County was cleared for agriculture.[6] Completion of the Erie Canal in 1825 spurred the first westward movement of American settlers, who began abandoning marginal lands in favor of high-quality farmland in the west. Expansion of railroads and industry throughout the 19th century led to the growth of urban population centers. By the early 20th century the trend in farmland abandonment was well underway. Between 1910 and 1992, farms in Dutchess County plummeted from 90 to 20 percent of the land area.[7]

Forests and other natural ecosystems have made a remarkable recovery, but land use history continues to exert strong influences on ecosystems and biodiversity. A study conducted by the Cary Institute in Washington found significant variations in vegetation consistent with prior land uses such as selective timber harvesting, cultivation, and pasture.[8] Other research in Dutchess and Columbia County has found higher diversity of native understory plants and lower prevalence of invasive species in older forests that were likely never fully cleared for agriculture.[9] Land use history is an important factor in the composition, structure, and quality of habitats we see today. Historical aerial photos, descriptions provided in old deeds, as well as information gleaned from stone walls and soils can provide insights into land use history.

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[4] Kudish, M. *The Catskill Forest: A History*. Purple Mountain Press and ColorPage, Fleischmanns and Kingston, NY, 2000, pgs. 47-48.

[5] Ibid.

[6] Vispo, C. *The Nature of the Place: A History of Living with the Land in Columbia County, NY.* Adonis Press, Hillsdale, NY, 2014.

[7] Stanton, B.F. and N.L. Bills. *The Return of Agricultural Land to Forest: Changing Land Use in the Twentieth Century*. Department of Agricultural, Resource, and Managerial Economics, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY, 1992, pg. 38. http://publications.dyson.cornell.edu/outreach/extensionpdf/1996/Cornell_AEM_eb9603.pdf

[8] Glitzenstein, J.S., et al. *Effects of environment and land-use history on upland forests of the Cary Arboretum, Hudson Valley, New York.* Bulletin of the Torrey Botanical Club 117(2), 1990, pgs. 106-122.

[9] Knab-Vispo, C., and C. Vispo. *Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation* Hawthorne Valley Farmscape Ecology Program, in cooperation with Hudsonia, Ltd., Ghent, NY, 2010.

Base Map and Aerial View (Maps 1, 1b, and 2)

The Base Maps (Maps 1 and 1b) are the foundation for the map series. They show municipal boundaries and transportation infrastructure, as well as topographic relief and surface water features. U.S. Route 44 traverses Washington from east to west, providing connections to Pleasant Valley and Amenia. The stretch of U.S. Route 44 east of the split with State Route 82 is also known as Sharon Turnpike. Other major roads include State Route 343, which runs east-west along the southern boundary of the Village of Millbrook; and State Route 82, which meanders a north-south trajectory through the Town. Local roads are also shown and labeled on the maps. Tax parcel data shown in the map series were published in 2022 by Dutchess County.

A note about Town and Village maps:

The Village of Millbrook boundary is shown on all maps to facilitate identification and analysis of Village resources.

Mab numbers with the letter "b" are at the Village scale:

1b. Base Map,
4b. Steep Slopes,
8b. Drinking Water Resources,
11b. Floodplains and Riparian Areas,
13b. Wetlands, and
14b. Habitats.

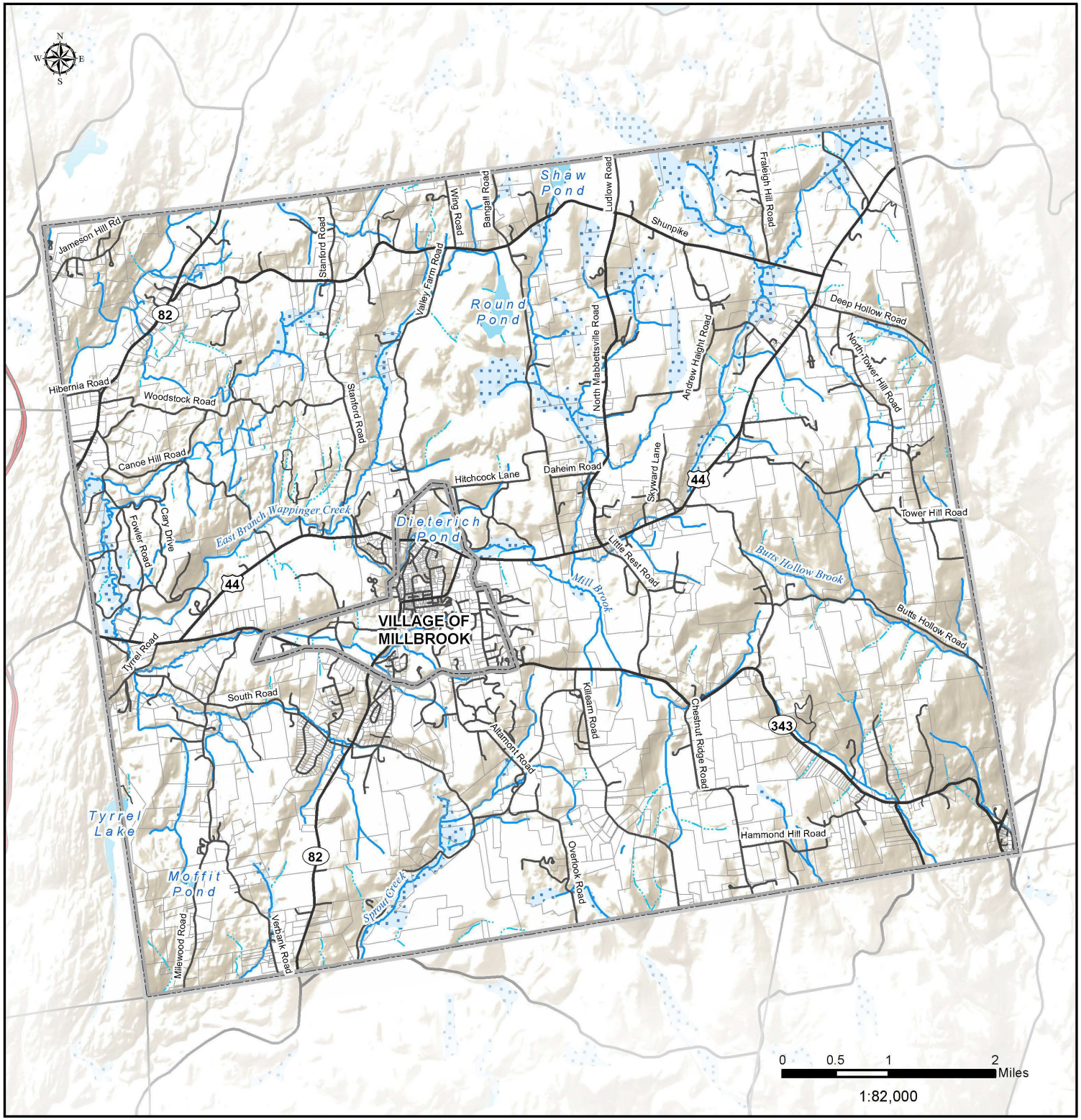
The Aerial View (Map 2) gives a bird's-eye view of the Town of Washington and Village of Millbrook, showing 0.5-foot resolution aerial imagery taken in 2020 by Dutchess County. The aerial imagery was taken in early spring prior to the leaf out of deciduous trees, resulting in a detailed view of vegetation types, land uses, and development. It can serve as a reference for comparison with features shown on other maps in the NRI. For more detailed, interactive viewing of aerial imagery dating back to 1936, users can visit the Dutchess County Aerial Viewer at https://gis.dutchessny.gov/aerialaccess/

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

1. Base Map



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

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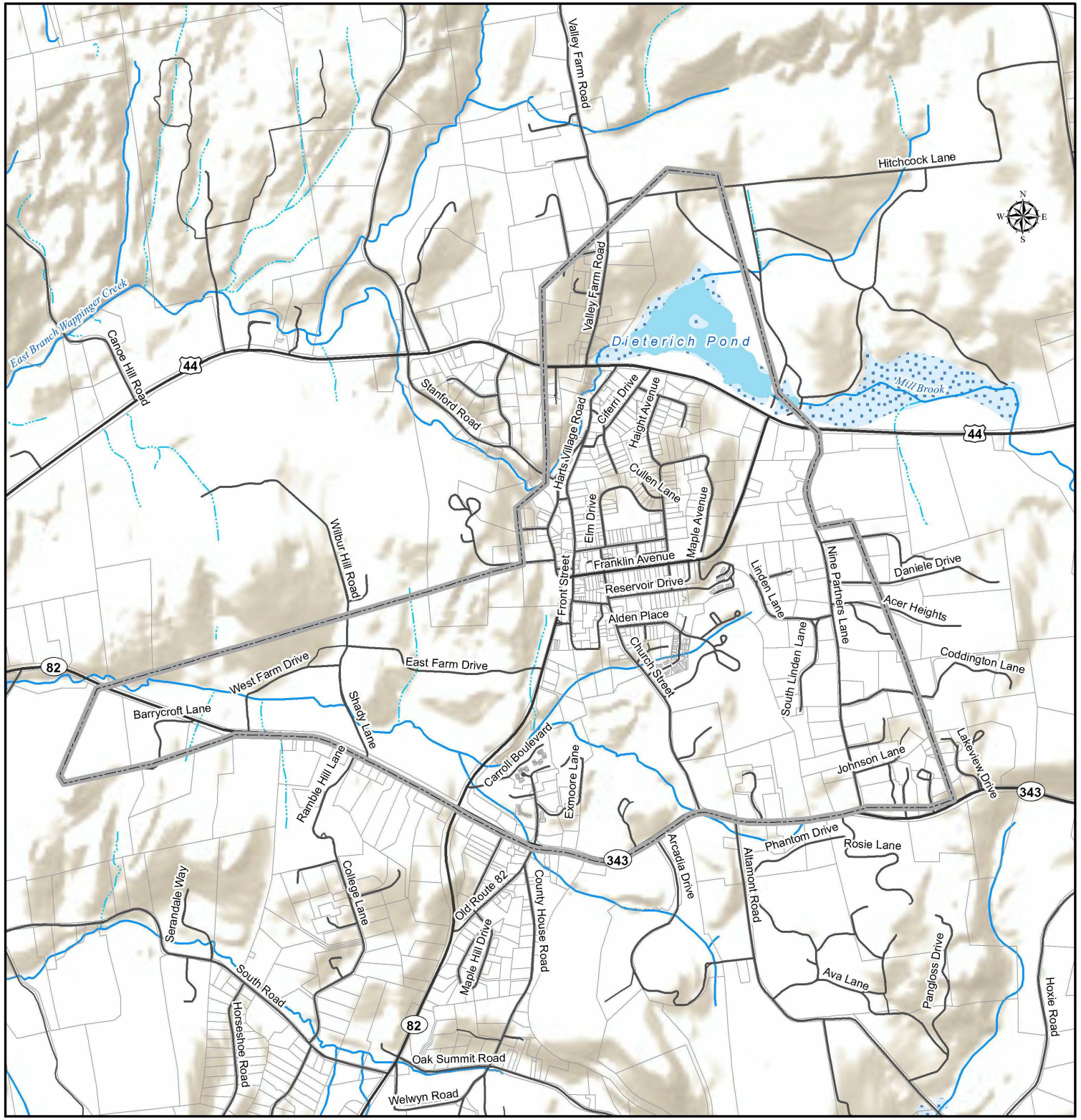
Dutchess County

Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

1b. Base Map



- Millbrook Boundary
- Municipal Boundary
- Parcel Boundary
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

0 0.25 0.5 Miles

1:24,000

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
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NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

2. Aerial Imagery

Washington Boundary

Municipal Boundary

Parcel Boundary

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Aerial Imagery: Dutchess County OCIS, 2020

Prepared by: CCEDC GIS Lab, 2022

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Dutchess County

Chapter 2: Climate

Climate is the long-term average of weather, typically averaged over a period of 30 years. Communities across New York are already experiencing the effects of warming temperatures and altered precipitation regimes.

Washington and Millbrook enjoy a temperate climate, experiencing cold winters with snow and warm to hot summers with a moderate amount of precipitation spread throughout the year. Local data show steady and rapid changes in our climate. New York has experienced particularly rapid changes (compared to natural rates of change during Earth's history) to the regional climate in the last century and this trend is projected to continue this century. Global average temperature has been rising along with increasing levels of insulating greenhouse gases in the atmosphere, driving changes to regional and local climate. Warming atmospheric temperature alters the water cycle, leading to more frequent extreme precipitation events, short-term drought, and severe storms.

Many of the natural resources described throughout this inventory contribute to the community's safety and ability to adapt to the impacts of climate change. Natural areas like forests and wetlands also help to sequester and store carbon, offsetting some of the impacts of local greenhouse gas emissions.

This chapter presents information about key climate variables:

- Temperature
    - Observed changes
    - Projected changes
    - Extreme heat days and heat waves
    - Warming winters
- Precipitation
    - Observed changes
    - Projected changes
    - Flood risk
    - Drought

The National Weather Service NWS calculates normals, which are averages of weather variables over a thirty-year period. Normals are used as a ruler to compare weather day-to-day and to describe predicted future conditions.[10] Local weather normals are available from the closest NWS station in Poughkeepsie, which began recording weather data in 1931. The Cary Institute has a weather station, too, which began recording weather data in 1988.

For projected temperature, extreme heat, and precipitation, this report relies on the Climate Data

[10] "U.S. Climate Normals." National Centers for Environmental Information, National Oceanographic and Atmospheric Administration (NOAA), https://www.ncei.noaa.gov/products/land-based-station/us-climate-normals)

Grapher provided by the New York State Climate Science Clearinghouse.[11]

Temperature

The mean annual temperature in Millbrook reported by the Cary Institute for 1988-2022 is 50°F.[12] This is nearly the same as the normal temperature at Poughkeepsie for the years 1991-2020, 50.5°F, calculated by the National Weather Service.[13]

Observed changes in temperature

In New York, temperatures have risen almost 2.5°F since the beginning of the 1900s with temperatures in the 2000s higher than any other historical period.[14] Since 1970, Dutchess County has seen a 1.7°F increase in average annual temperature (Table 1). This is greater than the global increase in annual temperature during the same period. At Poughkeepsie, the average temperature has risen in every month of the year compared with 1970.[15] Average temperature in the winter has risen 2.4°F 1991-2020.

Table 1. Average Annual Temperature for 30-year Periods at Poughkeepsie, NY, 1971-2020. Source: National Weather Service[16]

Time period	Average Annual Temperature (°F)	Change from prior thirty-year period
1971-2000	48.8	
1981-2010	49.8	+1.0
1991-2020	50.5	+0.7

Projected changes in temperature

Current projections show mean annual temperature in Dutchess County increasing by 5.5 to 9.7°F by the end of this century (Table 2). Because these are based on possible scenarios of emissions of greenhouse gases, and there are uncertainties inherent to modeling future climate, high and low emissions scenarios were modeled.

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[11] Climate Data Grapher. New York Climate Change Science Clearinghouse. New York State Energy Research and Development Authority (NYSERDA), NESCAUM, Cornell University, SUNY College of Environmental Science and Forestry, and the Paleontological Research Institution. https://www.nyclimatescience.org/highlights/data_products

[12] "Weather and Climate," Cary Institute, Millbrook, NY 2023. https://www.caryinstitute.org/science/research-projects/environmental-monitoring-program/weather-climate

[13] National Weather Service, "Average Monthly Temperatures, Normal Comparison, Poughkeepsie, NY." https://www.weather.gov/images/aly/Climate/POU/POU_Temp_Normals_Comparison.png

[14] National Oceanographic and Atmospheric Association, National Centers for Environmental Information. State Climate Summaries 2022: New York. https://statesummaries.ncics.org/chapter/ny/

[15] National Weather Service. "Average Monthly Temperatures, Normal Comparison, Poughkeepsie, NY." https://www.weather.gov/images/aly/Climate/POU/POU_Temp_Normals_Comparison.png

[16] Ibid.

Table 2. Projected Increases in Mean Annual Temperature, Dutchess County, NY, from a base temperature of 48.5 °F (the 1980-2009 mean annual temperature). Source: New York Climate Change Science Clearinghouse

Scenario	**2030s**	**2050s**	**2070s**	**2090s**
High	+3	+5.1	+7.5	+9.7
Low	+2.9	+4	+5	+5.5

Extreme heat days and heat waves

Increasing annual temperatures are predicted to lead to more frequent, intense, and long-lasting heat waves during the summer, posing a serious threat to human health, wildlife, and ecosystems. Extreme heat days are defined as those with maximum temperatures at or above 90°F. In Dutchess County, communities experience an average 8.7 days of extreme heat days in a year. The number of days with temperatures above 90 °F is projected to increase throughout this century (Table 3). Heat waves are defined as periods of three or more consecutive days with maximum temperatures at or above 90°F.

Table 3. Projected Change in Number of days in Dutchess County with Extreme Heat (high temperature of 90°F or above). Source: New York Climate Change Science Clearinghouse

Scenario	**2030s**	**2050s**	**2070s**	**2090s**
High	+11.8	+24.8	+42.6	+60
Low	+10.8	+17.2	+23.6	+26.1

The New York State Department of Health provides an estimate of the vulnerability of people in a community to health effects from heat. The Heat Vulnerability Index was developed by the Department of Health to help local and state public health officials identify and map heat-vulnerable areas and populations. People may be more vulnerable to heat due to their age, job, economic status, language, the local environment (urban heat islands experience higher temperatures and offer fewer areas for respite), or social isolation (living alone). Using the currently available index, compared to other communities in Dutchess County, overall people living in Washington have low vulnerability to heat, while people in Millbrook have moderate vulnerability.[17]

Warming winters

The frequency of heat waves has increased across the contiguous U.S. since the early 1900s, while the frequency of cold waves has decreased since the mid-1960s, but at a significantly faster rate. Winters in the northeastern U.S. have warmed three times faster than have summers, resulting in an increase in the proportion of winter precipitation falling as rain.[18]

[17] *Heat Vulnerability Index, Dutchess County, NY*, Center for Environmental Health, Bureau of Environmental and Occupational Epidemiology New York State Department of Health (DOH). Heat Vulnerability Index, 2017, https://health.ny.gov/environmental/weather/vulnerability_index/docs/dutchess.pdf

[18] *Observed and Projected Climate Change in New York*. New York State Department of Environmental Conservation (DEC), 2021, https://www.dec.ny.gov/docs/administration_pdf/ccnys2021.pdf

Since 1988, Washington and Millbrook have experienced a growing season of 120-180 days.[19] The northeast is projected to experience a longer freeze-free season, lengthening by 2 to 3 weeks. This lengthening of the growing season may offer new opportunities for farmers; however, wetter springs may erode the benefits by limiting the opportunities for early planting.[20]

Precipitation

Precipitation is highly variable year-to-year. The normal annual precipitation at Poughkeepsie for the period 1991-2020 was 41.9 inches.[21] Cary Institute reports the highest annual total precipitation from 1988-2022 was 65.8 inches in 2018; the lowest was 31.4 inches (2001).[22]

Observed changes

Precipitation has become more variable and extreme, whereas total rainfall has changed only marginally. Across the northeast, the proportion of total annual precipitation falling in the heaviest 1 percent of events increased 55 percent from 1958 to 2016.[23] In the 2000s, New York has seen an increase in the number of events of extreme precipitation of 2 inches or more.[24]

Projected changes in precipitation

Precipitation is expected to become increasingly variable year to year and seasonally.[25] Dutchess County is projected to see an increase in annual precipitation starting in the 2050s or 2070s, depending on the emissions scenario.[26] In both low and high emission scenarios, precipitation during the spring is projected to increase, while precipitation in the summer will likely decrease. Precipitation projections are considered less certain since it is difficult to model.[27] Overall, climate models project more dry periods intermixed with heavy rain and decreased snow cover in winter.

Flood risk

Downpours, with intense precipitation occurring over a period of minutes or hours, are likely to increase in frequency and intensity as the climate warms. These events elevate the risk for flooding due to stormwater runoff and/or tributary flooding. Flooding threatens many important assets, like transportation infrastructure, sewage treatment infrastructure, roads, businesses, recreational facilities, and more.[28]

Examples of flooding and infrastructure damage during storm events include washouts of Nine

[19] "Weather and Climate." 2023.
[20] DEC 2021.
[21] National Weather Service. "Poughkeepsie, NY – Annual precipitation (inches), 1931-present." https://www.weather.gov/media/aly/Climate/POU/POU_Annual_Precipitation.pdf (accessed June 12, 2023).
[22] "Weather and Climate." 2023.
[23] DEC 2021.
[24] NOAA 2022.
[25] DEC 2021.
[26] New York Climate Change Science Clearinghouse.
[27] DEC 2021.
[28] Zemaitis, L. *Working Toward Climate Resilience: General Climate Information Prepared for Hudson Valley Communities*. DEC Hudson River Estuary Program, 2018.

Partners, Church, and Stanford Roads during Hurricane Irene and the overflow of the Elm Drive Catch Basin during heavy rain events from May-August 2013. For more specific examples, and areas with flood risk, refer to Floodplains and Riparian Areas in this report and the associated maps (11 and 11b).

In Chapter 4: Water Resources, Map 11: Floodplains and Riparian Areas shows areas that have been mapped by the Federal Emergency Management Agency (FEMA) as at risk of flooding. Wetlands play a key role in mitigating flooding, and Map 12: Wetlands shows wetlands throughout the Town and Village. Wetlands may be contributing to the community's resilience to climate change by capturing, slowing, absorbing, and then slowly releasing water.

The online tool, Neighborhoods at Risk provides information about several physical factors related to vulnerability to climate risks. In Millbrook, 8.1 percent of properties have some level of flood risk based on modeling,[29] while the FEMA flood hazard maps show 7.6 percent of the Village is in the 100-year flood hazard zone.[30] A high percentage of the Village (59.2 percent) lacks tree canopy[31]; and 13 percent of the Village is covered by roofs, driveways, roads, and other impervious surfaces.[32] These characteristics of the built environment increase the level of flood risk.

In Washington, outside of the Village, 11.2 percent of properties have flood risk;[33] 1.8 percent of the town is in the 500-year flood hazard zone.[34] Impervious surfaces cover 1.4 percent of the town.[35]

Drought

Droughts, or prolonged periods of dryness, are a normal occurrence in all of New York, but extreme droughts are less frequent.[36] The state experienced major droughts in the early 1930s

[29] First Street Foundation. FloodFactor Model Methodology https://firststreet.org/research-lab/published-research/flood-model-methodology_overview/, as reported by Headwaters Economics' Neighborhoods at Risk. 2022 Retrieved June 2, 2023 from https://nar.headwaterseconomics.org/

[30] FEMA National Flood Hazard Layer (NFHL). Flood Risk Database (FRD) Technical Reference https://www.fema.gov/national-flood-hazard-layer-nfhl, as reported by Headwaters Economics' Neighborhoods at Risk. 2022. Retrieved June 2 from https://nar.headwaterseconomics.org/

[31] Homer CG, et al. Conterminous United States land cover change patterns 2001–2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing, 162, 184-199, at https://doi.org/10.1016/j.isprsjprs.2020.02.019, as reported by Headwaters Economics' Neighborhoods at Risk. 2020. Retrieved June 2, 2023 from https://nar.headwaterseconomics.org/

[32] Ibid.

[33] First Street Foundation, as reported by Headwaters Economics' Neighborhoods at Risk. 2022. Retrieved June 13, 2023 from https://nar.headwaterseconomics.org/

[34] FEMA 2022.

[35] Homer, Dewitz, and Jin, et al. as reported by Headwaters Economics' Neighborhoods at Risk. 2020. Retrieved June 13, 2023 from https://nar.headwaterseconomics.org/

[36] DEC "Drought." https://www.dec.ny.gov/lands/5011.html . Accessed June 13, 2023.

and early 1960s,[37] which also were the driest multiyear periods in New York. [38] Higher temperatures in the summer and changing patterns of precipitation may lead to more frequent short-term drought in all of New York. More precipitation falling as rain due to warmer winters will mean less streamflow in spring. A greater amount of precipitation falling in extreme events may reduce groundwater recharge. Higher temperatures in spring and summer will increase evaporation. Together, these suggest droughts will occur more frequently. [39]

Coastal storms: hurricanes and nor'easters

New York experiences hurricanes, tropical storms, and nor'easters. The frequency, intensity, and duration of coastal storms and flooding are increasing. Projections of the number of hurricanes and tropical storms are uncertain, but the amount of precipitation and wind speeds are likely to increase. The number of the most intense hurricanes in the Atlantic basin is likely to increase, yet it is uncertain what number of storms will impact New York. Projections of changes to the frequency of nor'easters are not clear.[40]

New York State Climate Policy

New York's Community Risk and Resiliency Act (CRRA) was signed into law in 2014 to advance planning for climate resilience. CRRA requires the State to adopt sea level rise projections and update them every five years. In addition, CRRA requires state agencies to assess potential future climate risks related to sea level rise, storm surge, and flooding when making certain permitting, funding, and regulatory decisions. The 2019 Climate Leadership and Community Protection Act (Climate Act) amended CRRA to expand the list of climate hazards to be considered and the permit programs covered by the law. In fulfillment of CRRA, DEC and the NYS Department of State published model local laws to enhance community resiliency in 2019.[41] This voluntary guidance for municipalities includes a broad array of strategies to increase climate resilience through local land use regulations. In 2020, DEC published guidance for Using Natural Measures to Reduce the Risk of Flooding and Erosion[42] and New York State Flood Risk Management Guidance for implementation of CRRA.[43]

New York State's 2019 Climate Act is among the most ambitious climate laws in the world and requires New York to reduce economy-wide greenhouse gas emissions 40 percent by 2030 and no less than 85 percent by 2050 from 1990 levels.[44] The New York Climate Action Council

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[37] NOAA, National Integrated Drought Information System. New York, https://www.drought.gov/states/new-york#historical-conditions

[38] NOAA, National Centers for Environmental Information, 2022.

[39] Dutchess County. *DMA 2000 Hazard Mitigation Plan, Update.* 2016. pgs 5.4-2.5

[40] DEC 2021.

[41] *Model Local Laws to Increase Resilience*, New York State Department of State (DOS) and DEC, 2019, https://www.dos.ny.gov/opd/programs/resilience/index.html

[42] *Using Natural Measures to Reduce Risk of Flooding and Erosion*, DOS and DEC, 2020, https://www.dec.ny.gov/docs/administration_pdf/crranaturalmeasuresgndc.pdf

[43] *New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act,* New York State DEC, 2020, https://www.dec.ny.gov/docs/administration_pdf/crrafloodriskmgmtgdnc.pdf.

[44] *The Climate Act*, accessed November 2022, https://climate.ny.gov/

approved a final Scoping Plan in December 2022, which provides a road map for how the State will reach its ambitious climate targets to achieve net-zero emissions, increase renewable energy use, and ensure all communities equitably benefit in the clean energy transition.[45]

Washington and Millbrook Certification as Climate Smart Communities

Village of Millbrook
The Village of Millbrook passed a resolution in 2022 to join the NYS DEC Climate Smart Communities initiative and work as a community toward certification. The Village designated Genevieve Glasson as Climate Smart Communities (CSC) Coordinator and Village Trustee, Michael Herzog, as the Village Liaison.

Over the course of the past year the Village of Millbrook has worked on the following CSC actions toward Bronze Certification: a Task Force comprised of four members has been established; conducting a Natural Resources Inventory (in progress); completed a Municipal Greenhouse Gas (GHG) Inventory; a Community Greenhouse Gas Inventory (in progress); CSC Coordinator has completed a Climate Champs Program with Partners for Climate Action; completed review of the DEC CSC Assessment Model and 12 accompanying Pledge Elements; community outreach. Plans for additional CSC actions are on-going. The Village is filing for Bronze Certification targeted for 2024.

Town of Washington
The Town of Washington passed a resolution to designate itself as a Climate Smart Community in March 2022 and was formally designed as such by the DEC in August 2022. A Town of Washington Climate Smart Community Task Force was established along with Town Councilwoman Leslie Heaney as Climate Smart Communities Coordinator in November 2022. Since then, the Town of Washington has worked with Gillian Matthews from the Cornell Cooperative Extension on completing a Climate Smart Communities Program Certification Assessment in September 2023. In addition to this NRI, the Assessment found that the Town has completed three priority actions for their CSC and has earned 120 action points toward Bronze Certification.

[45] *New York State Climate Action Council Scoping Plan,* 2022, https://climate.ny.gov/resources/scoping-plan/

Chapter 3: Physical Setting

The Physical Setting chapter contains five parts, most with corresponding maps:

- Topography and Elevation (Map 3)
- Steep Slopes (Map 4)
- Bedrock Geology (Map 5)
- Surficial Geology (Map 6)
- Soils (Map 7 shows hydrologic soil groups)

Topography (Map 3)

Local topography reflects differences in the underlying geology and is an important factor influencing the location of development. Washington's terrain includes steep hills as well as extensive lowlands. The Town's varied topography offers both outstanding scenic views and challenges for land development and environmental protection.

Elevations in Washington range from 240 feet along Wappinger Creek to 1,360 feet on Tower Hill.

The Topography Map displays 3D digital elevation data from the U.S. Geological Survey. Elevations in Washington range from 240 feet along Wappinger Creek to 1,360 feet on Tower Hill, the highest point in the town. This is one of the greatest ranges in elevation of any town in Dutchess County. The report, *Significant Habitats in the Town of Washington* describes the topography as follows,

> "The eastern part of Washington is characterized by high hills, steep valleys, and deep ravines in the vicinity of Tower Hill, Deep Hollow, Butts Hollow, and Mutton Hollow. In the western part of town, most notably in the Canoe Hills area, there is complex terrain with north-south trending ridges and rock outcrops. Extensive wetland complexes occur in low-lying terrain in the Millbrook Marsh watershed, the Shaw Brook watershed, the Sprout Creek watershed, and in the floodplain of the East Branch of Wappinger Creek."[46]

Elevations in the Village of Millbrook range from 460 to 860 feet above sea level. Route 82 traverses the lower elevation along the southwestern boundary of the Village. The highest elevation is found near the Village's eastern boundary at Nine Partners Road.

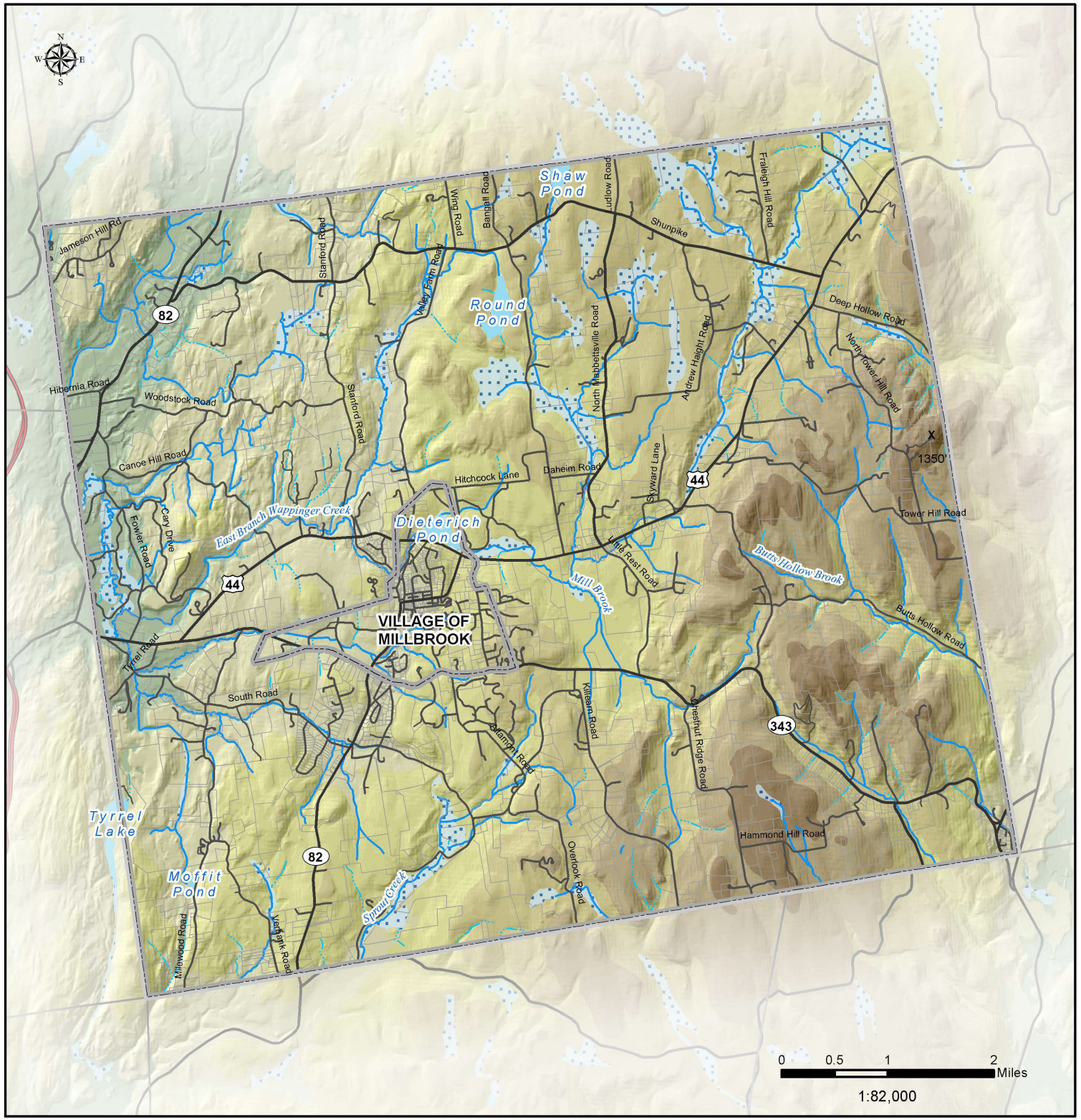
[46] Tollefson, J. and G. Stevens. *Significant Habitats in the Town of Washington*. Report to the Millbrook Tribute Garden, the Dyson Foundation, the Town of Washington, and the Dutchess Land Conservancy, Hudsonia, Ltd., 2004. https://www.hudsonia.org/maps-reports-copy.

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

3. Topography & Elevation



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

X - Town High Point

Elevation (ft)

- 201-400
- 401-600
- 601-800
- 801-1000
- 1001-1200
- 1201-1400

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Elevation (DEM): USGS National Map 3D Elevation, 2017

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Technical Assistance Project is a partnership among the Town of Clinton, the Town of Washinton, the Village of Millbrook, Cornell Cooperative Extension of Dutchess County, and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

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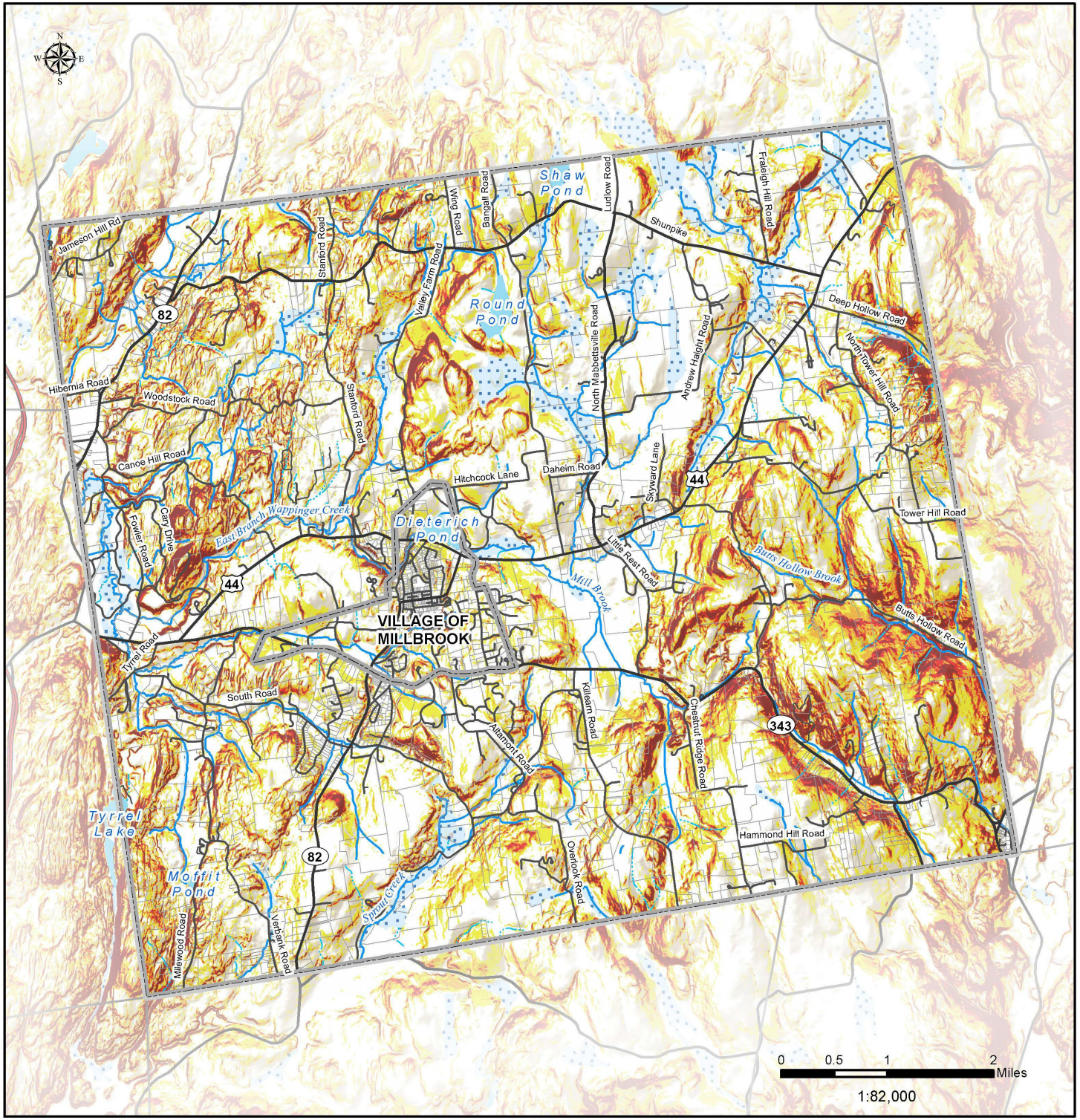
Cornell Cooperative Extension
Dutchess County

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

4. Steep Slopes



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Slope Interval

- 10-15%
- 15-20%
- 20-25%
- >25%

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Steep Slopes: USGS National Map 3D Elevation, 2017

Prepared by: CCEDC GIS Lab, 2022

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NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

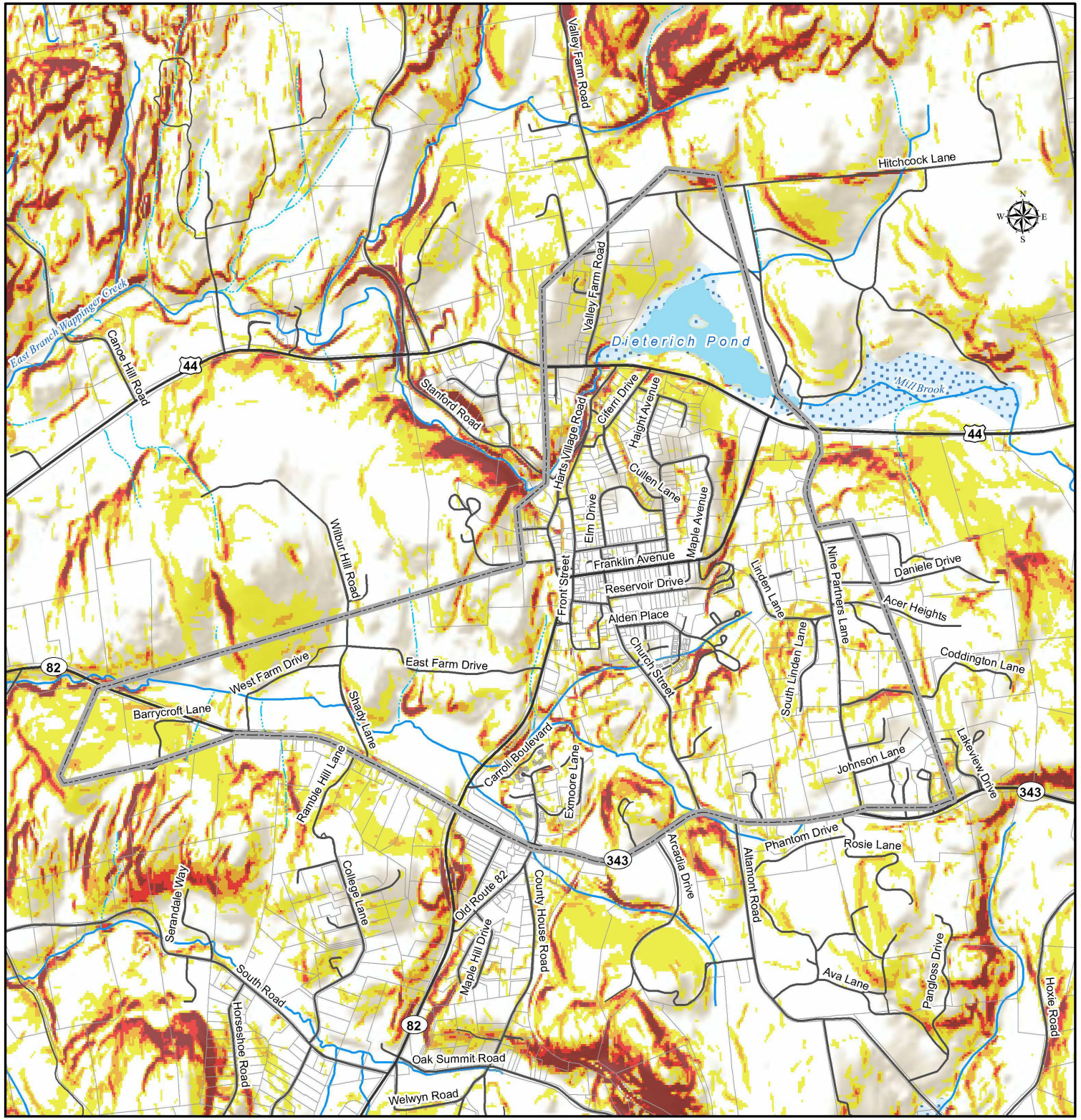
Cornell Cooperative Extension Dutchess County

Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

4b. Steep Slopes



- Millbrook Boundary
- Municipal Boundary
- Parcel Boundary
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Slope Interval

- 10-15%
- 15-20%
- 20-25%
- >25%

0 0.25 0.5 Miles

1:24,000

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Steep Slopes: USGS National Map 3D Elevation, 2017

Prepared by: CCEDC GIS Lab, 2023

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NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Steep Slopes (Map 4)

Steep slopes are environmentally sensitive areas and often provide unique habitat as well as scenic value. In general, slopes greater than 15 percent pose significant limitations to development and are among the most sensitive environmental features in the landscape. Development of steeply sloped landscapes can increase the danger of erosion, landslides, and polluted runoff.[47] Steep slope disturbance can introduce sediment to streams and waterbodies, affecting downstream water quality. Grading and construction on steep slopes can also be expensive, and such sites may not be able to support a properly functioning public or private sewer system.[48] Steep slopes may also be important scenic resources visible from surrounding areas, and their development can obstruct scenic views.

Steep slopes pose significant limitations to development and are among the most sensitive environmental features in the landscape.

Steep slopes may also support significant wildlife habitats. Steep slopes often have thin soils and rocky ledges, which are used for denning, shelter, foraging, and basking by a variety of wildlife species.[49] For more information on these habitats, see *Significant Habitats* report.

Steep slopes shown on the map are derived from 3D digital elevation data from the U.S. Geological Survey. Slope is defined as the vertical change in elevation over a given horizontal distance. For example, a 10 percent slope is one that rises 10 feet over a horizontal distance of 100 feet. The map includes the following slope classes, based on the national Soil Survey Manual:[50]

5 – 10 percent (nearly level to gently sloping)
10 – 15 percent (strongly sloping)
15 – 25 percent (steep)
Over 25 percent (very steep)

Steep slopes (15 percent or greater) appear throughout the Town; in particular, along Butts Hollow Road and Stone Church Brook along State Route 343, and in the Tower Hill Road area. Steep slopes occur on approximately 21 percent of the Town land area, with 11 percent of land in the 20 percent or greater slope range and 5 percent of land in the very steep category (over 25 percent slope).

Areas of Millbrook with slopes of 15 percent or more include the golf course, Millbrook Central School campus, ridges along Front Street, along Nine Partners Road, and south of Sharon

[47] Southern Tier Central Regional Planning and Development Board. *Steep Slopes and Land Use Decisions,* 2021. https://www.stcplanning.org/wp-content/uploads/2020/09/SteepSlopes_LandUse.pdf
[48] Chemung County Environmental Management Council. *Chemung County Natural Resources Inventory.* 2008. https://chemungcountyny.gov/647/Natural-Resources-Inventory.
[49] Tollefson and Stevens, 2004.
[50] Ditzler, C., K. Scheffe, and H.C. Monger (eds.). *Soil Survey Manual*. USDA Handbook 18. Government Printing Office, 2017, Washington, D.C.

Turnpike.

The Town of Washington and Village of Millbrook have limited regulation of steep slopes in local code. Washington excludes slopes exceeding 20 percent from the calculation of buildable land under the Town's open space subdivision regulations (section 340). Millbrook's Design Standard regulations include a general reference to steep slopes in the list of potential lands unsuitable for development (section 201-21), which the Planning Board may require to be set aside during subdivisions.[51]

Bedrock Geology (Map 5)

Geology influences many environmental factors, including topography, groundwater and mineral resources, and the establishment of natural communities.

Bedrock is the solid rock that lies beneath the soil and subsoil. Topography, ecological communities, development patterns, and mineral resources are all influenced by underlying bedrock geology. Geology also affects the quality and quantity of groundwater, migration of pollutants, drainage patterns, and soil characteristics.[52] This section describes the general bedrock geology of Washington, formed millions of years ago. Surficial geology deposits left by receding glaciers ~15,000 years ago following the last ice age are described in the following section. A more in-depth overview of local geology is available in the Dutchess County Natural Resources Inventory.[53]

The Bedrock Geology Map displays information from statewide maps produced by the New York State Museum at a scale of 1:250,000 and is best used as a general reference due to the coarse scale of original mapping and potential for errors in subsequent digital conversion.[54] All of the bedrock in Washington was formed between about 500 and 400 million years ago, in the Cambrian and Ordovician periods of the early Paleozoic Era. They include two of the three major rock groups: sedimentary and metamorphic rocks.

Sedimentary rocks are formed at or near the earth's surface by the accumulation or deposition of mineral or organic particles, and often have distinctive layering or bedding. They include shale, sandstone, limestone, and other carbonate rocks. Carbonate rocks are a class of sedimentary rocks composed primarily of calcium carbonate, such as limestone and dolostone.

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[51] The Village Code is available at https://ecode360.com/MI1586. The Town Code is available at https://washingtonny.org/wp-content/uploads/2023/06/Zoning-Code-Complete-revised-7-22-2022.pdf.

[52] Budnik, R. T., J.R. Walker, and K. Menking. "Chapter 3: The Geology and Topography of Dutchess County." In *Natural Resource Inventory of Dutchess County, NY*, 2010. https://www.dutchessny.gov/Departments/Planning/Natural-Resource-Inventory.htm

[53] Ibid.

[54] Fisher, D. W., Y. W. Isachsen, and V. L. Rickard. *Geologic Map of New York: Hudson-Mohawk Sheet*. New York State Museum and Science Service, Map and Chart Series No. 15, 1970. http://www.nysm.nysed.gov/research-collections/geology/gis.

Metamorphic rocks are derived from sedimentary or igneous rocks that were transformed by heat and pressure into a new kind of rock. Examples in Washington include schist, phyllite, quartzite, and marble, which is a metamorphosed form of carbonate rock.

In addition to major type, bedrock can be classified into rocks formed in the present location (e.g., autochthonous rocks) and bedrock made up of rocks formed far away and transported to the present site (e.g., allochthonous rocks).

The bedrock geology of Washington is dominated by schist, phyllite, and metagraywacke, a type of sandstone. Smaller areas of limestone and marble occur in the central, northeast, and northwest part of town. The *Significant Habitats in the Town of Washington* report notes that most of the bedrock outcrops observed during the field portion of the project were schist, with a large band of quartzite along the western edge of the town.[55] Marble and limestone outcrops appeared to be rare.

The Village of Millbrook is also predominantly underlain by schist, phyllite, and metagraywacke.

Bedrock characteristics are of greater importance for land-use planning purposes than the names of the specific bedrock types. In particular, bedrock geology strongly influences groundwater availability and biodiversity patterns.

Bedrock and groundwater availability

Since groundwater is obtained from fissures and cavities in bedrock, the quantity of water yielded depends on how much the rock is fractured and how well the fractures, crevices, and cavities interconnect. Carbonate rocks form the most productive bedrock aquifers in Dutchess County and can in some cases yield hundreds of gallons-per-minute (gpm) from drilled wells.[56] Carbonate rocks are productive because they dissolve easily, allowing water to flow into the channels and caverns that develop in the rock, but this same quality increases their vulnerability to contamination and transmission of pollution. Locations where carbonate bedrock is overlain by highly permeable glacial outwash sand and gravel deposits have the highest water yields. Water from limestone is generally hard with relatively high levels of dissolved solids.

Carbonate bedrock is rare in Washington, though, and the predominant shales, graywacke, and schist have low porosity and low permeability, with slow movement of groundwater. Wells drilled into shale and greywacke are not reliable sources of groundwater, with volumes yielding an average 16 gpm, and the groundwater is moderately hard.[57] Wells in these areas may also be sulfurous. Mountainous areas underlain by quartzite have even lower well yields, averaging 10 gpm, and the groundwater is soft.[58] See Surficial Geology and Drinking Water Resources for

[55] Tollefson and Stevens, 2004.

[56] Findlay, S. D., et al. "Chapter 5: The Water Resources of Dutchess County." In *Natural Resource Inventory of Dutchess County, NY*, 2010. https://www.dutchessny.gov/Departments/Planning/Natural-Resource-Inventory.htm

[57] Ibid.

[58] Ibid.

more information about groundwater supplies in Washington.

Bedrock and biodiversity

Bedrock strongly influences soil properties, as well as groundwater and surface water chemistry, which in turn influence the establishment of ecological communities. Carbonate bedrock including limestone and certain shales often support rare plants and uncommon habitats. Limestone occurs in the center of Washington east of Millbrook, and in the northwest corner of Town. The northeast corner of Town is underlain by marble. The *Significant Habitats* report notes that most of the bedrock outcrops observed in Washington were not calcareous.[59]

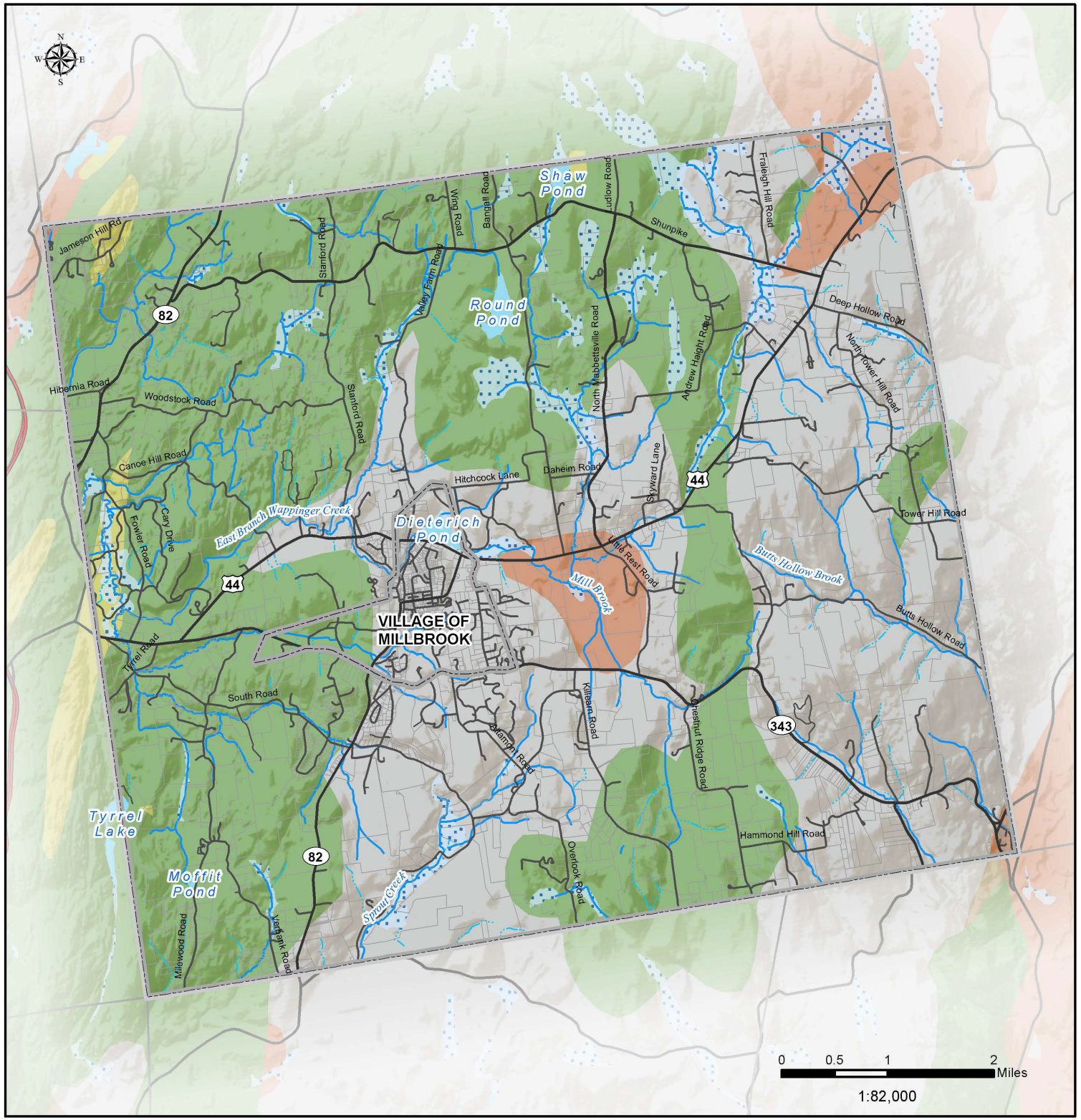
[59] Tollefson and Stevens, 2004.

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

5. Bedrock Geology



- Washington Boundary
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- Wetland

Bedrock Formation

- Oag — Austin Glen Formation (Sedimentary: shale, graywacke)
- Osh — Autochthonous Shale (Sedimentary)
- O€w — Autochthonous Limestone (Sedimentary: carbonate/calcareous)
- €t — Taconic Sequence (Sedimentary/Metamorphic: slate, graywacke, quartzite, and limestone)

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Geology: New York State Museum 1970

Prepared by: CCEDC GIS Lab, 2022

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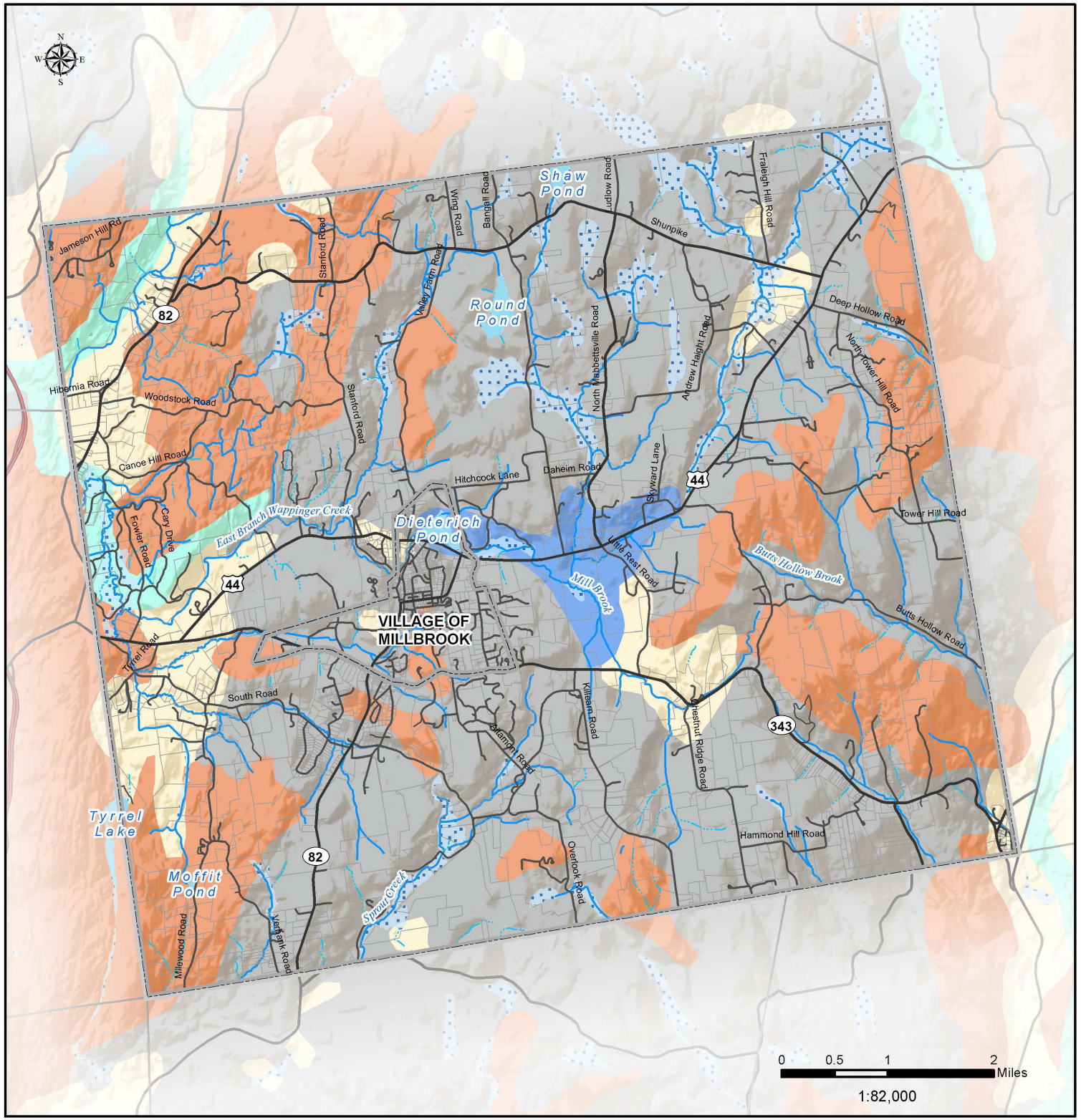
Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

6. Surficial Geology



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Surficial Material

- Thin glacial till over bedrock
- Thick glacial till over bedrock
- Glacial Outwash (water laid sand, gravel, and silt or clay)
- Recent Alluvium
- Lake Sediments

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Geology: New York State Museum 1970

Prepared by: CCEDC GIS Lab, 2022

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Surficial Geology (Map 6)

Surficial geology refers to unconsolidated sediments lying above the bedrock. The weathering of both bedrock and surficial geology deposits along with organic matter, water, and air is responsible for the slow process of soil formation and the properties of these "parent materials" strongly influence resulting soil chemistry, nutrients, and texture.

Surficial deposits are unconsolidated sediments primarily resulting from deposits left behind as glaciers retreated at the end of the last ice age, ~15,000 years ago. They are important sources of sand, gravel, and crushed stone.

Surficial geology is a determining factor in the location of aquifers (see Water Resources) and other water supplies and in the location of valuable sand, gravel, and clay deposits. Protecting these resources where they exist may be important for potential future use. Surficial geology is also important for construction and transportation planning, and for siting potential sources of contamination that could pollute groundwater supplies.

The surficial geology of Washington reflects the retreat of glaciers following the last ice age. A giant ice sheet blanketed the area during the Wisconsin Stage of the Pleistocene Epoch, ~15,000 years ago. Glacial ice, as much as 5,000 feet thick, scoured the landscape and deposited boulders, sand, and gravel in its path. Glacial meltwater turned parts of the Hudson Valley into vast glacial lakes and left behind beaches, deltas, and deposits of silt and clay.

The Surficial Geology Map displays information from statewide maps produced by the New York State Geological Survey.[60] This map, like the one for bedrock geology, was developed at a scale of 1:250,000 and is best used as a general reference.

Glacial till is the predominant surficial material present throughout the Town. Till is more thinly deposited over bedrock in the Town's higher terrain. Most till in Washington is high in clay, which reduces its permeability, limits its usefulness for groundwater supply, and requires septic systems to be carefully designed and separated from wells.[61] Outwash sand and gravel deposits along with more recent alluvial (stream) deposits occur along the East Branch of Wappinger Creek and are the Town's most productive groundwater sources, capable of yields of hundreds of gallons per minute. They are important areas for groundwater recharge, but are also vulnerable to contamination from septic systems, salt, chemical spills, and other sources. Outwash deposits are also valuable sources of sand, gravel, and crushed stone for building and road construction. Lake sediments include silt, clay, and sand deposits that originated in small glacial lake environments around the Mabbettsville hamlet.

Glacial till is also the most common surficial deposit in the Village of Millbrook. There is a substantial sand and gravel deposit in the vicinity of East Farm Drive in the southern section of

[60] Caldwell, D. H., and R. J. Dineen. *Surficial Geologic Map of New York, Hudson-Mohawk Sheet.* New York State Geological Survey, 1987.

[61] Comprehensive Plan, 2012.

the Village. Another deposit of sand and gravel is located along the outlet from Dietrich Pond, west into the Town of Washington.

Soils (Map 7)

Soils determine the suitability of an area for land uses and are the foundation for the establishment of natural communities of plants and animals.

Soils are the foundation for the establishment of natural communities of plants and animals, agricultural production, and ecological processes that support the productivity of plants and water quality. Soils are also significant carbon storage reservoirs, and thus play a role in mitigating and preventing greenhouse gas accumulation in the atmosphere. Soil characteristics including reaction (acidity or alkalinity), drainage, texture, depth to bedrock, and slope inform the establishment of natural communities.[62] Soils also play a fundamental role in determining suitability for land uses. Soil characteristics determine potential for agricultural production as well as vulnerability to flooding, soil erosion or instability, and efficiency at filtering pollutants and wastes.

The *Soil Survey of Dutchess County*[63] was first published in 1939 and updated in 1955, 1972, and 2001. The soil survey includes detailed soil maps for the entire county along with descriptions of soil types and tables of chemical, hydrologic, and structural characteristics of the soils for various human uses. It is important to note that county soil maps are only approximate; any soil unit may contain "inclusions" of up to 2 acres of soil types different from the mapped unit. Field verification is necessary to confirm soil conditions and types on a particular site. *The Natural Resources Inventory of Dutchess County NY* provides an introduction to soils of the county and discusses implications for land use decision-making.[64]

Soils data are most easily viewed online using the United States Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Survey.[65] Appendix B lists soil types found in Washington along with selected soil characteristics, such as map symbol, soil name, depth to bedrock, drainage class, hydrologic soil group, and farmland classification, based on tabular information provided in the county soil survey. These attributes and their relevance to land use planning are described below.

Depth to bedrock influences suitability for septic and other wastewater treatment systems, as

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[62] Heady, L. and G. Stevens. *Biodiversity Assessment Guidebook*, Hudsonia Ltd, 2018.

[63] Faber, M. *Soil Survey of Dutchess County, New York.* United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with Cornell University Agricultural Experiment Station, 2001. https://www.caryinstitute.org/sites/default/files/public/downloads/lesson-plans/DutchessSoilSurvey.pdf

[64] Walker, J., E. Hoxsie, and P. Groffman. "Chapter 2: The Soils of Dutchess County." In *The Natural Resource Inventory of Dutchess County, NY*, 2010. https://www.dutchessny.gov/Departments/Planning/Natural-Resource-Inventory.htm

[65] Web Soil Survey, https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

well as the siting of buildings and roads. Shallow soils (<20 inches to bedrock) are often associated with steep slopes, increasing susceptibility to erosion. Shallow soils are also less capable of filtering pollutants draining to surface and groundwater supplies.

Soil drainage class (dominant condition) indicates the possible presence of wetlands and is a particularly important factor to consider in the evaluation of proposed development. Somewhat poorly drained soils are good indicators of possible wetland areas and poorly drained and very poorly drained soils are indicators of probable wetland areas, and in most cases coincide with hydric soil classification.[66] These soil drainage classes are shown on the Wetlands Map (Map 12). In well drained and excessively well drained soils, water that is added moves through and out of the soil very quickly. These are usually soils with coarse texture, e.g., large sand grains.

Hydric soils form under conditions of saturation, flooding, or ponding that last long enough during the growing season to result in anaerobic (no oxygen) conditions near the soil surface. Soils classified as hydric are commonly referred to as wetland soils, and largely correspond to poorly and very poorly drained soil classes.

Hydrologic soil group (HSG) indicates the runoff potential of soils. Map 7 shows the hydrologic soil groups in Washington and Millbrook. HSG A soils are the most granular and least likely to produce runoff, HSG B soils are sandy-silt, HSG C soils tend toward silt, while HSG D soils are mostly clay-rich or lie in areas coincident with the water table. See the aquifer recharge rates and septic system density section below for more information.

Soil reaction refers to the acidity or alkalinity of the soil, expressed in pH values. Soil chemistry exerts a strong influence on plant and animal communities, and can be a useful predictor for certain habitats, from acidic bogs to calcareous wet meadows.[67] Soils developing over calcium-rich bedrock such as limestone often support disproportionately high numbers of rare plants, animals, and natural communities.

Photo 3. A field of corn in the Mabbettsville area, Washington (Andrew Heaney)

Farmland classification identifies the location and extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops. Prime farmland soils are defined by the USDA and New York State and considered the most productive soils for farming. Farmland Soils of Statewide Importance are soils that do not meet all criteria for Prime Farmland. Though not as productive as Prime Farmland, if managed properly, these soils can produce fair to good yields. Prime farmland soils are relatively limited in extent and scattered throughout the Town of Washington, without any noteworthy concentrations.

[66] Kiviat, E. and G. Stevens. *Biodiversity Assessment Manual for the Hudson River Estuary Corridor.* DEC, 2001.

[67] Kiviat and Stevens, 2001.

Statewide important farmland soils are more widespread and account for 33 percent of all soils in Washington. They are most common in valleys and at lower elevations. Farmland soils are shown on Map 18 (Agricultural Resources).

General soils overview

The following general soil descriptions are taken from the county soil survey. As noted above, within each major soil group, smaller areas, or inclusions, of different soils may be found. There are 38 soil types or series found in the Town of Washington. The most common soils are the Nassau-Cardigan complex (about 23 percent of the Town's area), the Dutchess-Cardigan complex (about 18.5 percent of the Town's area), Hoosic gravelly loam (about 10 percent of the Town's area), and Stockbridge silt loam (about 8.5 percent of the Town's area). General characteristics of these soils are summarized below but should not be substituted for site-specific analysis.

Nassau-Cardigan complex (very rocky). Formed from glacial till, this soil contains about 40 percent shallow, somewhat excessively drained Nassau soils, 40 percent moderately deep, well-drained Cardigan soils, and 20 percent other soils including rock outcrops. In locations where slopes exceed 15 percent, these ratios shift to 45 percent Nassau, 30 percent Cardigan, and 25 percent other soils. Because of the different soils within this complex that may be found on a particular site, depth to bedrock and depth to water table may be quite variable. While this soil series is generally moderately permeable (Hydrologic Group C), site specific conditions may vary due to the mix of soils present in this complex. Construction limitations may include shallow depth to bedrock and rock outcrops, moderate to severe erosion hazard depending on slope percentage, and frost action (freezing and thawing of soil moisture). For the placement of septic fields, limitations are shallow depth to bedrock and areas of rock outcrops. In addition, a water pollution hazard exists because the soil is not deep enough to filter effluent.

Dutchess-Cardigan complex. Also formed from glacial till, this complex includes about 40 percent Dutchess soils, 30 percent Cardigan, and 30 percent other soils including rock outcrops. Depth to bedrock is generally greater than 60 inches, except in and near rock outcrops. The soil is generally permeable (Hydrologic Group B), however, because of the intricate pattern of soil types included in this group, construction limitations may be present depending on specific site conditions. Construction limitations may include a shallow depth to bedrock and rock outcrops, moderate to severe erosion hazard depending on slope percentage, and frost action. For the placement of septic fields, depth to bedrock in areas of Cardigan soils and rock outcrops, as well as slow percolation in areas of Dutchess soils are the main concern.

Hoosic gravelly loam. Formed in glacial outwash along alluvial deposits adjacent to major streams, these are very deep, highly permeable soils (Hydrologic Group A). Permeability in Hoosic soils is moderately rapid or rapid in the subsoil and very rapid in the substratum. These soils have few construction limitations but have poor filtering capacity for installation of septic tank absorption fields, posing risk for groundwater pollution. Specially designed septic systems are necessary in places.

Stockbridge silt loam. Formed in glacial till deposits, these are very deep, gently sloping, and well drained soils. These soils have few construction limitations. Slow percolation is the main

limitation for installation of septic tank absorption fields. Modifying a conventional system by extending the length of the distribution lines will allow onsite sewage disposal in most places.

Aquifer recharge rates and septic system density[68]

Annual aquifer recharge rates along with rainfall data can be used to identify available groundwater capacity and develop recommendations for sustainable septic system density. A 2006 study, *Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations*,[69] identifies 40 inches of average annual rainfall in most of the Town of Washington and associated annual aquifer recharge rates for the four Hydrologic Soil Group (HSG) classes, which can be used to calculate water budgets and identify available groundwater capacity for parcels or larger areas. The same study applied these recharge rates to septic system density models, to suggest minimum average sustainable septic system placement for locations where municipal wastewater is unavailable and domestic wells are in use. The recharge rates and recommendations for septic system density are provided in Table 4.

Table 4. Aquifer Recharge Rates and Recommended Average Septic System Density for Hydrologic Soil Groups

Hydrologic Soil Group (HSG)	Annual aquifer recharge rate	Average recommended septic system density
A	18.2 inches/year	1.3 acres
B	13.3 inches/year	1.8 acres
C	6.8 inches/year	3.3 acres
D, B/D, C/D	3.8 inches/year	5.9 acres

These average densities do not apply where central water or central wastewater services are available. In addition, some clustering can be accommodated where nearby compensatory acreage is available. However, in general, sufficient local recharge must be available to dilute septic system discharges to ensure long-term proper functioning of domestic wells and septic systems. Where HSG soils admit greater recharge (HSG A and B), septic system densities can increase to between 1.3 and 1.8 acres per septic system, but where clayey HSG C soils are present, septic system density should decrease to approximately 3.3 acres per system to ensure that enough local recharge is available to provide appropriate wastewater dilution. Few septic systems are installed successfully in HSG D soils, but where they are attempted, their net density should be thinned to more than 5.9 acres per septic system, on average. Note that these recommendations only apply where wells and septic systems are both in use; greater septic system densities can be supported based on site specific design capacity and where community water systems are in place, such as the Village of Millbrook.

[68] This section adapted from text by Russel Urban-Mead for the Town and Village of Rhinebeck Natural Resources Inventory, 2022.

[69] Chazen Companies. *Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations*. Prepared for Dutchess County Water & Wastewater Authority, 2006.

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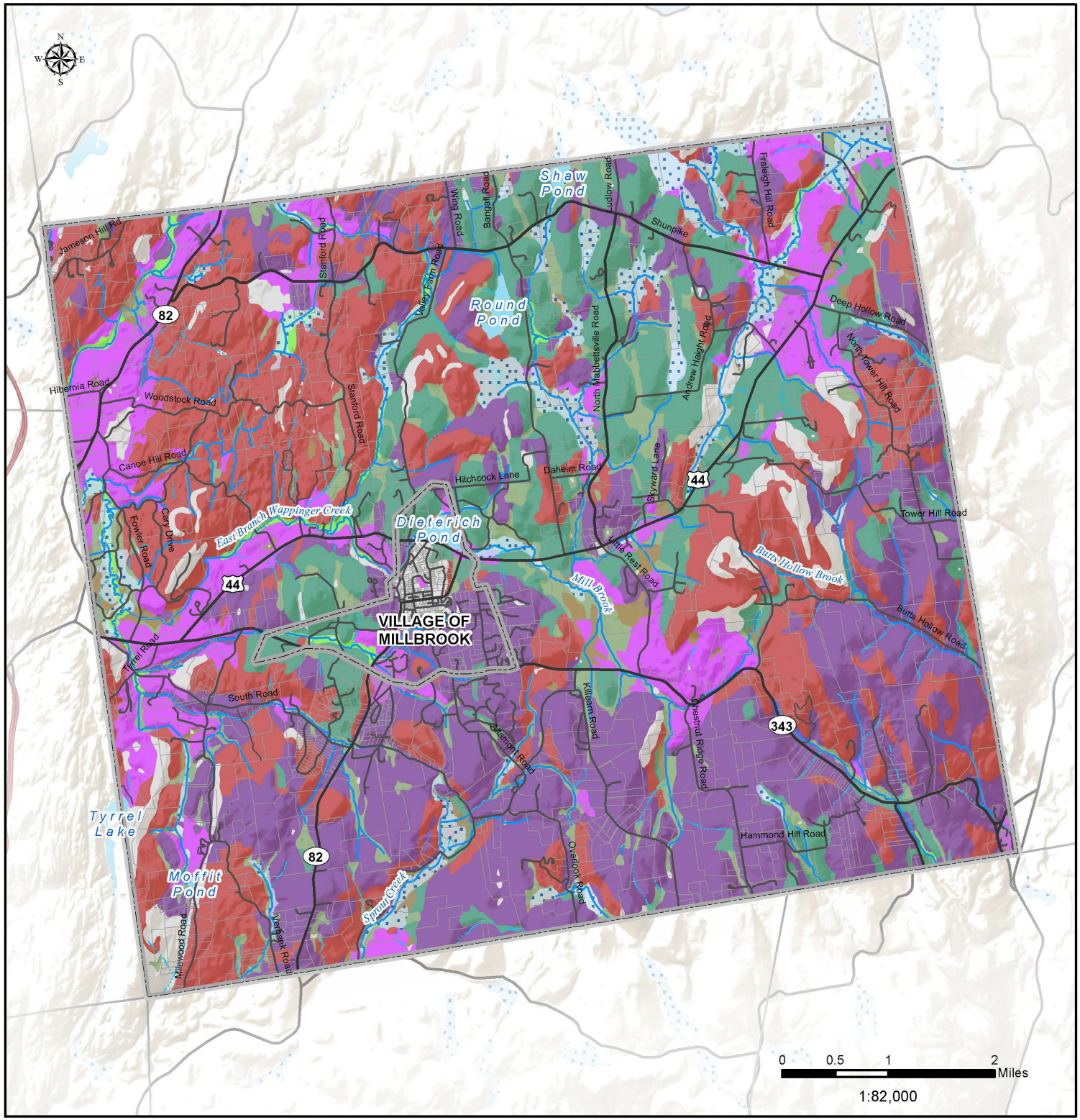
7. Hydrologic Soil Groups



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Hydrologic Soil Group

- A
- A/D
- B
- B/D
- C
- C/D
- D
- No data

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Hydrologic Soil Group: USDA Web Soil Survey

Prepared by: CCEDC GIS Lab, 2022

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Chapter 4: Water Resources[70]

All residents of Washington and Millbrook rely on groundwater for their drinking water, making the abundance, safety, and protection of water an issue of vital importance. This chapter describes the water resources of the Town and Village and contains maps and figures that demonstrate where groundwater and surface water are found, information about how they are being replenished, and land use considerations for maintaining and improving water quality. Some key water resource maps contained in this chapter include:

- Drinking Water Resources (Map 8)
- Watersheds (Map 9)
- Water Quality Classifications (Map 10)
- Floodplains & Riparian Areas (Map 11)
- Wetlands (Map 12)

To maintain clean water, collective impacts on water resources must be considered during the local decision-making process. Although impacts to surface and groundwater can be from a single source, often many smaller, diffuse sources of pollution, such as nonpoint source pollution, can be responsible for degraded water quality.

Drinking Water Resources (Map 8)

Groundwater is a resource of utmost importance in the Town and Village as it is the source of drinking water for the entire population. Groundwater is water that occurs below the ground surface, in the spaces between sand, sediments, and bedrock formations (see Figure 1). Groundwater is recharged by rain and snow that seeps through the unsaturated zone. The area where water fills the aquifer is the saturated zone, the top of which is the water table.

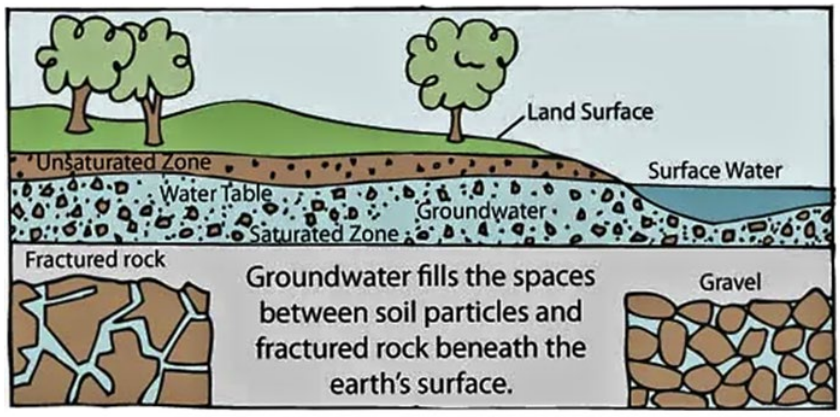


Figure 1. What is Groundwater?
Source: Groundwater Foundation (2022)

[70]This chapter draws directly upon information presented in Findlay, S., Burns D., Urban-Mead, R., and Lynch, T. "Chapter 5: The Water Resources of Dutchess County." in *Natural Resource Inventory of Dutchess County, NY*, 2010. Available: https://www.dutchessny.gov/Departments/Planning/Docs/nrichapfive.pdf

People access groundwater by drilling wells into aquifers to pump the water for consumption. The depth of these wells can be shallow, say 20 feet, or as deep as hundreds of feet underground. The Town of Washington's residents almost exclusively rely on groundwater from on-site private domestic wells as the source of drinking water.[71] The Village's 1,400 residents rely on the municipally owned public water system that is supplied by a series of infiltration galleries which capture some shallow groundwater and are also directly supplemented by surface water drawn in from the Shaw and Mill Brook.[72]

Groundwater and surface water are connected by the water cycle and interact at many places throughout the landscape.[73] The strength and speed of the connection between depends on many factors including the soils, surficial geology, bedrock geology, weather, the extent of human water use, and land use practices (see Bedrock Geology and Surficial Geology in this NRI). The areas where the connection between groundwater and surface water in the Town are some of the strongest, and most relevant to people, can be found in Map 8 which displays the most productive sand and gravel aquifers and their recharge areas labeled 1-3 in order of sensitivity, which are described in the 1992 Horsley, Witten Hegemann, Water Supply Protection Program report as follows:[74]

> The areas along Mill Brook and Shaw Brook are especially important because this recharge zone feeds the aquifer that is the source of the municipal water supply for the Village of Millbrook. It is important to protect wells, infiltration galleries, and other drinking water sources from potentially contaminating land uses.

- Zone 1 - Primary Recharge–permeable sand and gravel deposits
- Zone 2 - Secondary Recharge- less permeable deposits, upgradient from the sand and gravel aquifer, contributes directly to recharge through infiltration and groundwater flow
- Zone 3 - Tertiary Recharge- contributing area around streams that will subsequently seep into the sand and gravel aquifer through infiltration

Zone 1 water can infiltrate directly from the surface to the aquifer, carrying contaminants with it. In Zones 2 and 3, the extent to which contaminants are filtered as water passes depends on how porous and biological and chemically active the soil is. Where the soil is sandy or porous, water flows more quickly below the surface, and fewer contaminants are removed. Therefore, it is important to identify and act on threats to aquifers to ensure a steady supply of groundwater that can be used as clean drinking water. Map 8 shows the location of important high-yielding aquifers, contribution areas that recharge aquifers, and the sensitive source watershed catchment

[71] *2010 US Estimated Private Domestic Wells*. Environmental Protection Agency. Map Service. https://epa.maps.arcgis.com/home/item.html?id=626c197d3b864db9b668b4eecd0693e4

[72] Annual Drinking Water Quality Report for 2022 The Village of Millbrook Water System, Village of Millbrook Water, Available:https://cdn.townweb.com/villageofmillbrookny.com/wp-content/uploads/2023/05/Millbrook-AWQR-2022.pdf

[73] Winter, T.C., et al. *Ground Water and Surface Water: A Single Resource*. USGS Report 1139, 1998, https://pubs.er.usgs.gov/publication/cir1139

[74] Horsley Witten Hegemann, Inc. "Task 1 Delineation of Aquifer Protection Areas." *Water Supply Protection Program for Dutchess County, New York*. Prepared for Dutchess County Water & Wastewater Authority. 1992. pp1-2.

area for the Village of Millbrook's water system.

Aquifers most capable of supporting high yielding wells generally consist of sand and gravel. These deposits lie along some of the county's major stream and river valleys, a result of glaciers leaving behind deposits after the latest glacial period. In some places these glacial outwash deposits overlie limestone bedrock formations. Some bedrock formations in Dutchess County consist of carbonates (limestone, marble, or dolomite); these formations tend to be more fractured than other bedrock formations, so they can support high-capacity wells capable of withdrawing hundreds of gallons per minute.[75] In Washington and Millbrook the most productive, and the most vulnerable, aquifers areas are found along the Shaw Brook, Mill Brook, East Branch Wappinger Creek, and Wappinger Creek (see Map 8).

Photo 4. Pond surrounded by grass and forest, Overlook Drive, Washington (Beatrice Moritz)

Public Water Supply Systems[76]

In NYS, the definition of a Public Water System (PWS) is an entity that provides water to the public for human consumption. Any system with at least 5 service connections or that regularly serves at least 25 individuals daily for at least 60 days of the year is considered a PWS and is categorized as one of the following types: community and non-community (including non-transient non-community and transient non-community).

Community Water System (CWS): CWS are defined as water systems that serve the same people year-round (e.g., in homes or businesses). Examples include public municipally owned (cities, towns, or villages) water systems, or privately-owned water suppliers that maintain their own drinking water systems for subdivisions or other residentially focused projects. There are two community water systems:

- Millbrook Village (NY1302770), owned by the Village.
- Great Oak Properties (NY1322771) in the Town of Washington supplies groundwater for up to 90 people and is operated by Daniele Apartments.

[75] Findlay, S., Burns D., Urban-Mead, R., and Lynch, T. "Chapter 5: The Water Resources of Dutchess County." in *Natural Resource Inventory of Dutchess County, NY*, 2010. Page 24-25 Available: https://www.dutchessny.gov/Departments/Planning/Docs/nrichapfive.pdf

[76] "Drinking Water Program: Frequently Asked Questions." DOH, 2018, https://www.health.ny.gov/environmental/water/drinking/faq_def.htm

Transient Non-Community Water System (TNC): A non-community water system that serves different people for more than six months out of the year. Rest stops, parks, convenience stores and restaurants with their own water supplies are examples of transient non-community water systems. There are nine TNCs in the Town and Village, serving an estimated 850 people.

Non-Transient Non-Community Water System (NTNC): a non-community water system that serves the same people more than six months per year, but not year-round. Schools, colleges, hospitals, and factories with their own water supplies are examples of non-transient non-community water systems. There are four NTNCs in the Town and Village serving about 435 people.

Table 5 shows basic attributes of the Village's community water system along with other public water systems that deliver drinking water to residential communities, educational facilities, camps, schools, businesses, and public facilities throughout the Town. Data was retrieved from the NYS Department of Health and the EPA's Safe Drinking Water Information System (SDWIS) and Consumer Confidence Report Databases (CCR).[77], [78], [79]

Table 5. Master List of Public Water Systems in the Town of Washington and Village of Millbrook

System Number-PWSID	Water System Name	Population Served	Public Water System Type	Source Type
NY1302770	Millbrook Village	1,400*	C	Groundwater under the influence of surface water
NY1330725	Orvis Sandanona Shooting Grounds	525	TNC	Groundwater
NY1316167	Dutchess Day School	194	NTNC	Groundwater under influence of surface water
NY1319036	Evangelical Free Church/Upton C.S.	155	NTNC	Groundwater
NY1330409	The Market At Mabbettsville	100	TNC	Groundwater
NY1322771	Great Oak Properties	90	C	Groundwater
NY1330171	Cary Institute of Ecosystem Studies	55	NTNC	Groundwater
NY1330636	Cary Institute of Ecosystem - Day Camp	50	TNC	Groundwater
NY1330089	Dutchess County Farm & Home Center	31	NTNC	Groundwater

[77] EPA's Safe Drinking Water Information System (SDWIS) search for Millbrook and Washington. Available at: https://enviro.epa.gov/enviro/sdw_form_v3.create_page?state_abbr=NY

[78] EPA's Consumer Confidence Report (CCR) Available at: https://ordspub.epa.gov/ords/safewater/f?p=ccr_wyl:102

[79] NYS DOH, Dutchess County Contact Report 2023. Available at: https://www.health.ny.gov/environmental/water/drinking/pws_contacts/dutc_contacts.htm

System Number-PWSID	Water System Name	Population Served	Public Water System Type	Source Type
NY1330416	Millbrook Vineyards	27	TNC	Groundwater
NY1316619	Charlottes	25	TNC	Groundwater
NY1313004	Cottonwood Motel	25	TNC	Groundwater
NY1330408	Mabbettsville Expressmart Inc.	25	TNC	Groundwater
NY1316622	Washington Town Park	25	TNC	Groundwater
NY1330756	Wings Castle	25	TNC	Groundwater

*For this water system, this is the number of customers reported by the Village of Millbrook in its Annual Drinking Water Quality Report (2022).

Village's public Community Water System and source watershed

The Village of Millbrook's municipal water treatment facility located in the Town of Washington is a critical place where ground and surface water interact. The facility is located approximately one mile east of the Village along NYS Route 44. The Village owns and maintains a community public water system and distribution system that serves approximately 1,400 customers through 720 connections (as of 2022).[80] The source water for Millbrook Village (NY1302770) is ground water under the direct influence of surface water pumped from a series of infiltration galleries installed within a gravel aquifer adjacent to Shaw Brook and Mill Brook in the Town. Two vertical turbine pumps with a combined rated capacity of 250 gallons per minute are located at infiltration galleries installed 12-15 feet deep within a gravel aquifer. The infiltration galleries function like a horizontal drain that is positioned below the water table so that it collects the groundwater percolating through the soil. Analysis indicates that as much as 75 percent of total discharge to the public water system comes from surface water in the nearby brooks.[81] Raw water is pumped to the water treatment plant, which enters a 45,000-gallon tank under the building. The supply capacity is 374,400 gallons per day.[82] The raw water is chemically treated to make it safe for human consumption before being pumped to a 500,000-gallon elevated storage tank on Haight Ave. In 2021 the Village invested in a new water treatment facility, including a new filtration system.[83] This filtration system completes a $1.9 million upgrade to the Village's water system that began in 2018. This upgrade included refurbishing the water storage tank.

[80] Annual Drinking Water Quality Report, Village of Millbrook Water Department, 2022. Available at: https://villageofmillbrookny.com/wp-content/uploads/2022/05/MillbrookWaterProject.pdf

[81] Horsley Witten Hegemann, Inc. "Task 3 Wellhead and Surface Water Intake Protection Areas- Delineation" *Water Supply Protection Program for Dutchess County, New York*. Prepared for Dutchess County Water & Wastewater Authority. 1992. pp3-36.

[82] R.S. Lynch & Company, Inc. *Comprehensive Sewer and Water Plan*. 2011. https://cdn.townweb.com/villageofmillbrookny.com/wp-content/uploads/2022/05/Task3-SewerandWaterCompPlan6-9-11.pdf

[83] RE Water Treatment Facility" Village of Millbrook Press Release January 5th 2021. Available at: https://cdn.townweb.com/villageofmillbrookny.com/wp-content/uploads/2022/05/New-Water-Plant-announcement-to-public.pdf

The source watershed for the infiltration galleries is outlined in yellow on Map 8. New York State Department of Health (DOH) delineated this watershed in 2004 through the Source Water Assessment Program using topography (high points and ridgelines). The recharge area and protective Public Health Law Watershed Rules and Regulations are also defined in the New York Codes, Rules and Regulations (NYCRRR) Title 10 §112.5, which created a regulatory reference map dated April 1992 (see Figure 2 below).[84] The catchment area is oblong, extending about 11 square miles into the Town from Shaw Pond to the North and the headwaters of Mill Brook to the South. It includes the entire geographic land areas that drain to the infiltration galleries that serve the Village.

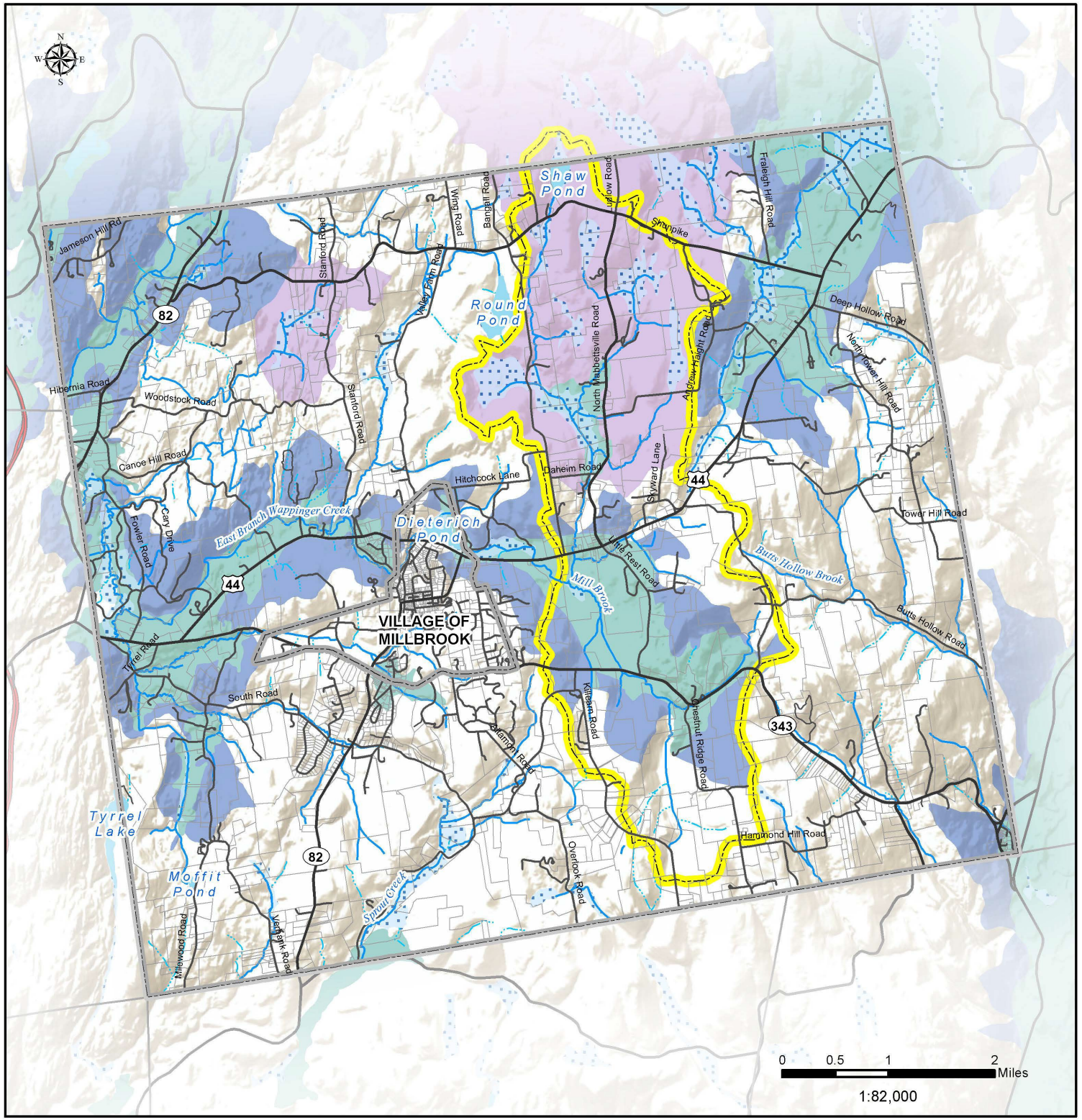
[84]10 NYCCR §112.5 "Village of Millbrook" 1992. https://govt.westlaw.com/nycrr/Document/I4fdd2da5cd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

8. Drinking Water Resources



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Aquifer Recharge Areas

- 1- Primary Recharge– permeable deposits, directly overlying aquifer
- 2- Secondary Recharge– less permeable deposits, up gradient from aquifer, contributes to recharge through infiltration and groundwater flow
- 3- Tertiary Recharge - contributing area around streams that will subsequently seep into aquifer through infiltration

- Village of Millbrook Drinking Water Source Watershed

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Aquifer Recharge Areas: Water Supply Protection Program for Dutchess County, 1992
Drinking Water Source Watershed: NYSDOH, 2004

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

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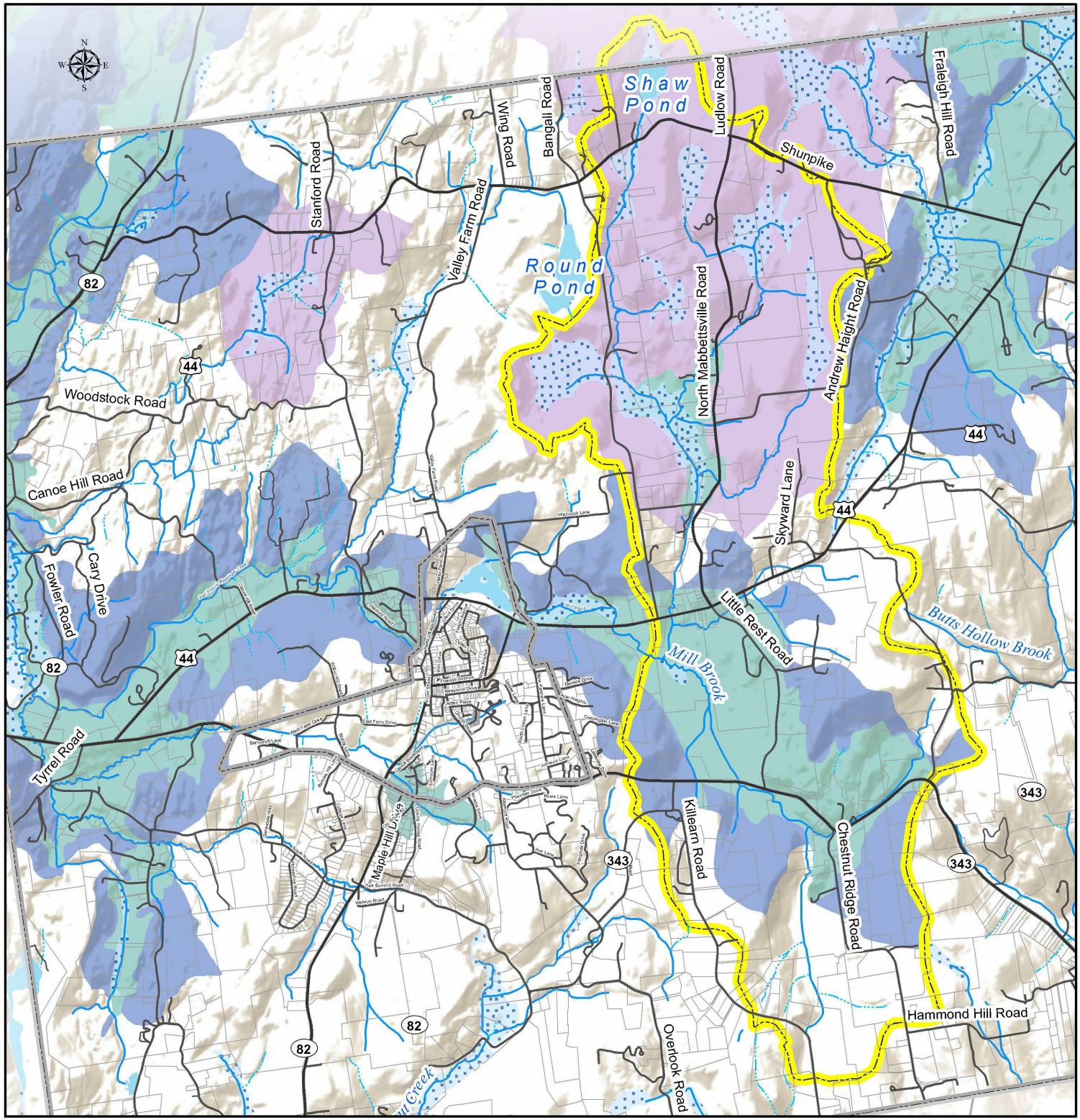
Dutchess County



Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

8b. Drinking Water Resources

- Millbrook Boundary
- Municipal Boundary
- Parcel Boundary
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Aquifer Recharge Areas

- 1- Primary Recharge– permeable deposits, directly overlying aquifer
- 2- Secondary Recharge– less permeable deposits, up gradient from aquifer, contributes to recharge through infiltration and groundwater flow
- 3- Tertiary Recharge - contributing area around streams that will subsequently seep into aquifer through infiltration
- Village of Millbrook Drinking Water Source Watershed

0 0.5 1 Miles

1:58,000

DATA SOURCES

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Roads: Dutchess County OCIS, 2019
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Cornell Cooperative Extension Dutchess County

The concentrated population of the Village, and the dependence of this population on the public community water system, makes it especially important to avoid the siting of potentially contaminating land uses in the source watershed highlighted in yellow on Map 8.

The Village could receive guidance on ways to update watershed protection suitable for this source by enrolling in the Drinking Water Source Protection Program (DWSP2).[85] DWSP2 is a locally led, state-supported program that empowers municipalities to take action to protect their CWS public water sources. The DWSP2 process would likely include a review of ways the Village may wish to update the existing Watershed Rules and Regulations and the watershed inspection program contained in that regulation. The Water Quality Improvement Project (WQIP) program is a competitive reimbursement grant program that funds projects directly addressing documented water quality impairments or protecting a public drinking water source.[86]

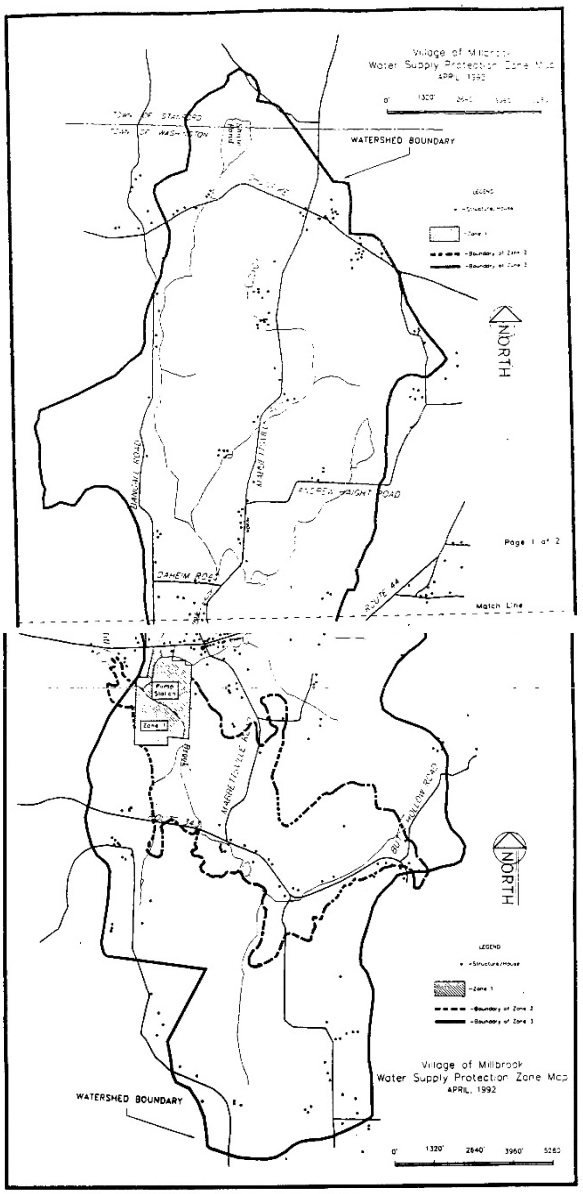


Figure 2. Village of Millbrook - Water Supply Protection Zone Map, April 1992

[85] "Drinking Water Source Protection Program (DWSP2)." DEC. https://www.dec.ny.gov/chemical/115250.html.

[86] "Water Quality Improvement Project (WQIP) Program." DEC. https://www.dec.ny.gov/pubs/4774.html

Town Aquifers and Protection Overlay District

An Aquifer Protection Overlay District (AQ) exists in the Town of Washington Zoning Law Section 314, which created a district with a reference map dated December 27, 1989 (see Figure 3 below). The Town's 1989 Aquifer Overlay Zoning Map identifies high yield sand and gravel aquifer areas. The AQ establishes a review process for proposed uses within the Town's aquifer areas to prohibit or control certain uses and activities which may be incompatible with the goal of long-term groundwater protection. The AQ prohibits disposal wells, recharge basins

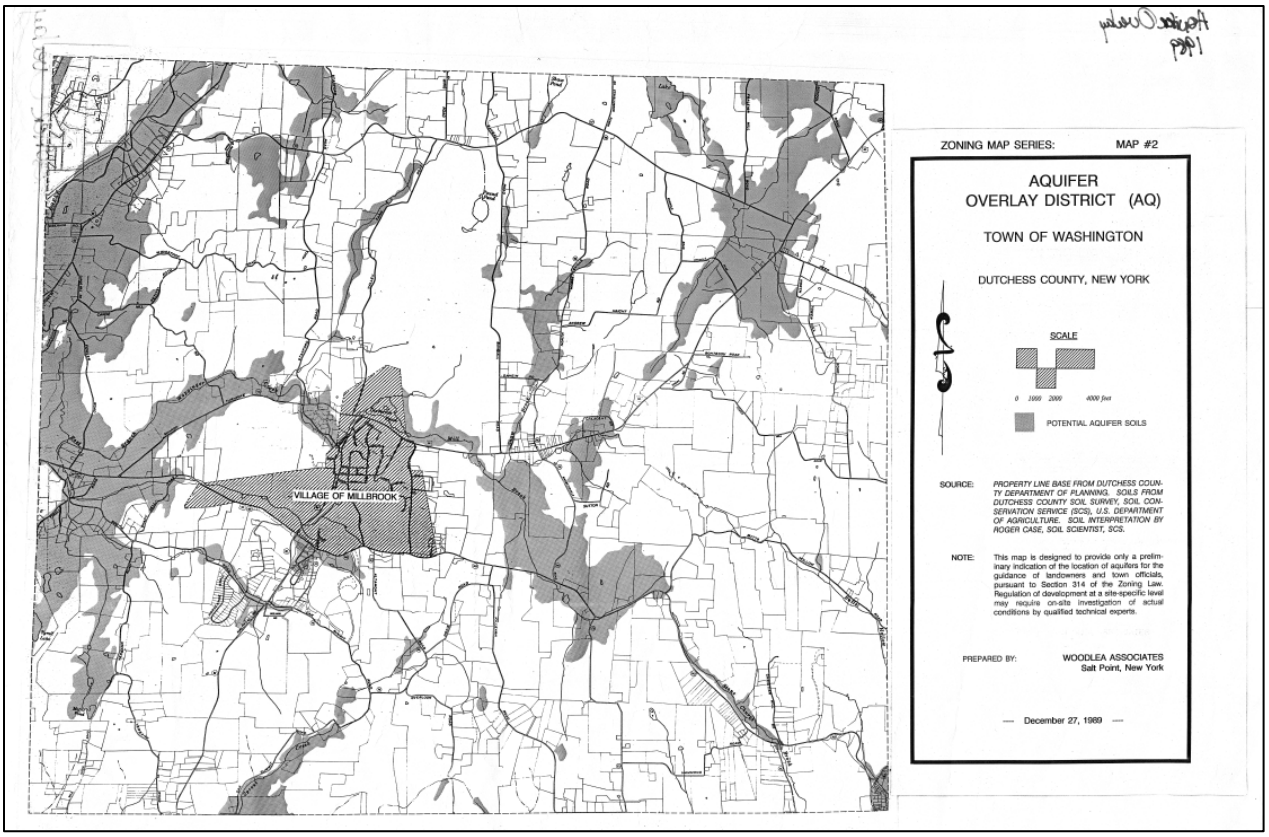


Figure 3. Town of Washington Aquifer Overlay District

(stormwater), snow disposal, and animal waste disposal, and restricts several other uses. In addition, actions undertaken within Millbrook's public water supply watershed must comply with any standards, rules, or regulations promulgated by the NYS Commissioner of Health under Public Health Law.[87] In the case of any conflict in such standards, the more restrictive standard shall apply.[88]

[87] 10 NYCCR §112.5 "Village of Millbrook" 1992. https://govt.westlaw.com/nycrr/Document/I4fdd2da5cd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

[88] Town of Washington Zoning Code.

The entire Town is underlain by aquifers, both sand and gravel aquifers and bedrock aquifers. In general, the bedrock aquifers are lower yield while some parts of the sand-and-gravel aquifers can support high yield wells. Sustainable well water withdrawal rates are governed by the porosity of sand and gravel aquifers or the irregular fractures in bedrock aquifers. The region receives approximately 40 inches of precipitation annually which continuously replenishes these aquifers. With exception of the Village wastewater treatment system, most properties return pumped well water back to the ground via on-site septic systems, substantially offsetting the withdrawal volumes to help avoid aquifer overuse or local depletion. Average aquifer recharge rates are 18.2 inches annually in areas with Hydrologic Soil Group A soils, 13.3 inches per year in areas with HSG B soils, 6.8 inches annually through HSG C soils, and 3.8 inches annually in remaining areas with Hydrologic Soil Group D soils, ensuring continued aquifer recharge over all Town aquifers on an annual basis.[89]

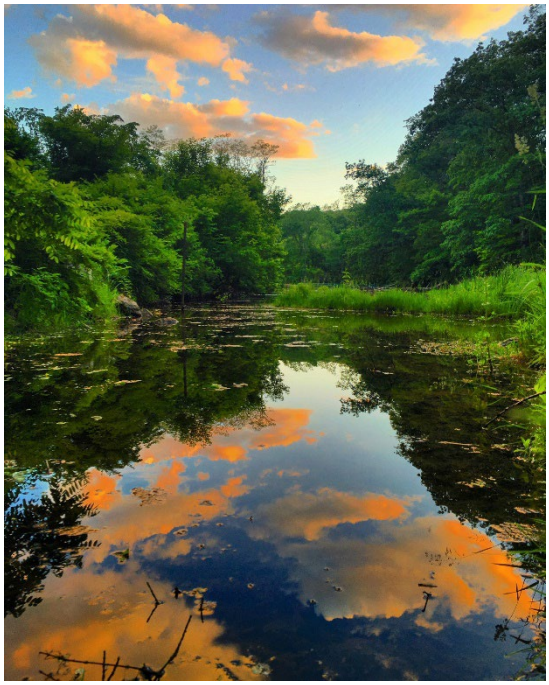


Photo 5. Millbrook Pond (Beatrice Moritz)

Inconsistencies across existing maps and regulations

There are inconsistencies between the Town of Washington Zoning Code Section 314 and the NYS Public Health Law protecting the Village's public water supply through NYCCR Title 10 Section 112.5. The Town AQ identifies high yield aquifer areas, but not contributing zones that are also important to protect. The Village of Millbrook protection zones includes the land area which contributes water to the Shaw/Mill Brook upstream of the Village water treatment plant. The 2022 Town of Washington Hospitality Report recommends updating the code to be consistent with the Village's definition of protection zones.[90]

[89] Randall, A. *Mean Annual Runoff, Precipitation, and Evapotranspiration in The Glaciated Northeastern United States, 1951-80: USGS Open File Report 96-395* 1996. https://pubs.er.usgs.gov/publication/ofr96395.

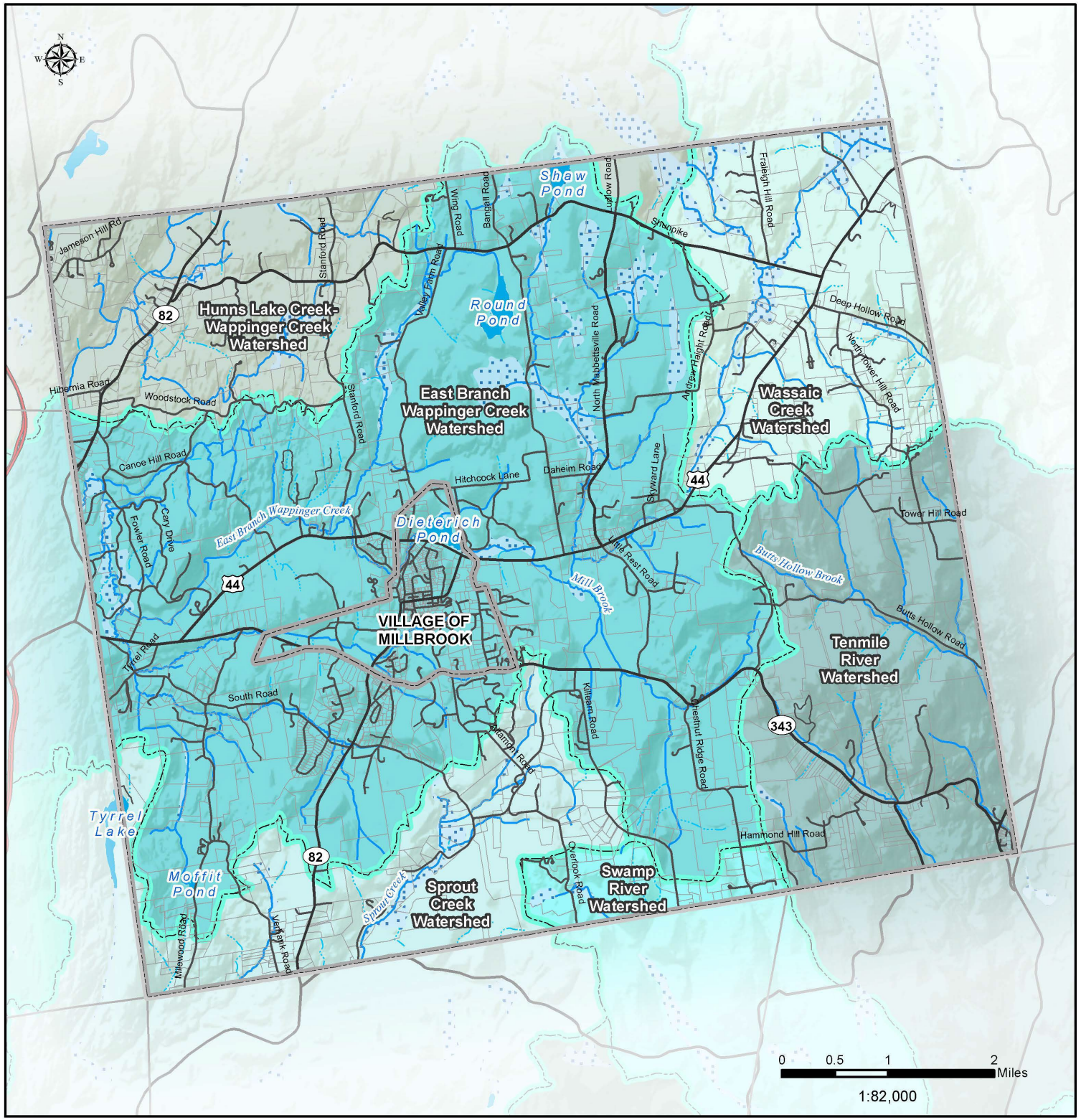
[90] Stolzenburg, N.., *Town of Washington, NY Hospitality Evaluation Report.* Community Planning and Environmental Associates, Berne, NY, 2022. Page 5 notes inconsistency of aquifer protection maps- https://washingtonny.org/wp-content/uploads/2023/07/Condensed-Comprehensive-Plan-Addendum-re-Hospitality.pdf "

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

9. Streams & Watersheds



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Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Watersheds: National Hydrography Dataset, 2012

Prepared by: CCEDC GIS Lab, 2022

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Cornell Cooperative Extension Dutchess County

Watersheds (Map 9)

Central to the information in this document is the concept of watershed. A watershed is the area of land from which water drains into a stream, river, lake, or other waterbody. Precipitation flows over and through the landscape into intermittent streams, creeks, rivers, aquifers, wetlands, and floodplains. The watershed concept helps to evaluate the impact of land use practices on water quality by specifying areas of land, streams, and aquifers that either are, or are not, connected.

Watersheds are divided by high points on the land, such as ridges, mountains, and hills. Ridges and hills that separate two watersheds are called the drainage divide. Larger watersheds contain many nested smaller subwatersheds or catchments (see Figure 4). For example, the Mill and Shaw Brook sub-watersheds are nested within the greater East Branch Wappinger Creek watershed, which is in turn nested within the Wappinger Creek watershed or basin.

Nested Watersheds

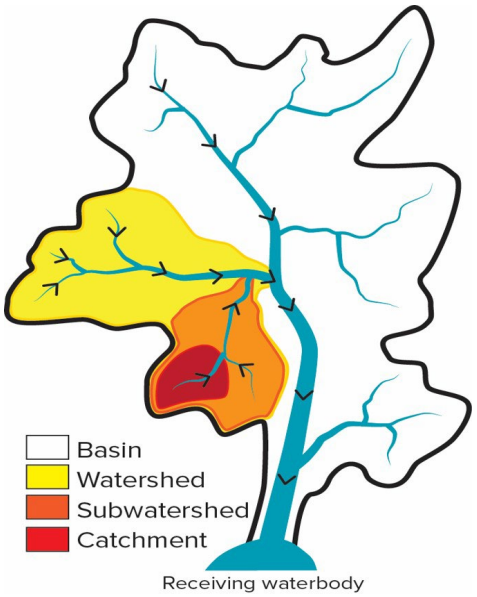


Figure 4. Nested Watersheds. Source: NYS DEC

Healthy watersheds have immense value to both humans and the natural environment and provide several ecosystem services that directly benefit the Town and Village and cost less than the alternatives. [91] A healthy watershed can be characterized by several key features such as:

- a balanced and sustainable water cycle
- natural flood control mechanisms, such as wetlands and floodplains, that absorb and retain water during heavy rain events
- effective nutrient cycling, with a balance between natural (rainfall) and human (fertilizer) sources of nutrients and "sinks" for these nutrients such as plants and soils that prevent the movement of nutrients to streams or lakes where they can stimulate overgrowth of algae (eutrophication)

A **balanced water cycle** means that water is replenished and distributed evenly throughout the watershed, and enough water is available to support the needs of people, plants, and animals.

A **sustainable water cycle** means that human activities do not degrade or disrupt the natural systems responsible for water storage, movement, and filtration.

[91] "The Economic Benefits of Protecting Healthy Watersheds." US Environmental Protection Agency, 2015. https://www.epa.gov/sites/production/files/2015-10/documents/economic_benefits_factsheet3.pdf

- limited impervious surface so precipitation has access to soils with the capacity to absorb and filter rainwater, reducing erosion and sedimentation
- the ability to support a diverse range of wildlife, including fish, amphibians, birds, and mammals, and provide habitat for native plant species.

The Streams and Watersheds Map (Map 9) displays high resolution information collected by Hudsonia in 2004 in the *Significant Habitats in the Town of Washington* report including streams that are classified as perennial (flowing year-round) or intermittent (seasonal flow). Perennial streams are distributed widely throughout the Town of Washington. Intermittent streams are most common in the hillier terrain on the eastern and western edges of the town.[92] Intermittent streams run only after precipitation events or during certain times of the year. They are often the first ones to be buried, ditched, filled, etc. Current stormwater drainage patterns and conveyance attempt to recreate these ephemeral stream routes, and often lead to localized flooding. Intermittent streams are important to the overall watershed, and account for a high percentage of total stream miles like small and intermittent ones. They are part of the headwater stream network. See Chapter 5: Biodiversity for further discussion of stream habitat values.

Watersheds and major streams

Most of the Town and the entire Village are drained by Wappinger Creek, a major tributary of the Hudson River.[93] Sprout Creek, which drains the southwest part of town, flows into Fishkill Creek, another major tributary of the Hudson.[94] The eastern third of town drains eastward to Wassaic Creek and Tenmile River which flows into the Housatonic River in Connecticut, eventually emptying into Long Island Sound.

Healthy watersheds save money by:

- providing clean and plentiful water resources for a variety of uses,
- recharging groundwater,
- trapping sediments and nutrient pollution from fertilizers and septic systems,
- minimizing the need for public infrastructure and water treatment,
- regulating water flow and reducing erosion and flooding,
- enhancing climate change resiliency by sequestering carbon, and
- managing water more effectively during droughts and floods.

Map 9 displays standard watershed boundaries based on data from the United States Geologic Survey (USGS) National Hydrography Dataset. Watershed boundaries, or hydrologic units, define the land areas that contribute to the flow of a particular stream. The USGS maintains a nationally consistent Watershed Boundary Dataset, organized by nested Hydrologic Unit Codes (HUC), to classify these hydrologic systems. In this map, the boundaries are represented at the standardized 12-digit HUC scale, which is a suitable ecological scale for comprehending and overseeing surface water resources. The USGS StreamsStats tool can

[92] Tollefson, J., & Stevens, G. 2004.

[93] The Hudson River Estuary Program provides technical assistance, grants, and training to municipalities and non-profits within the Hudson River estuary watershed. The Hudson River Watershed Alliance also provides numerous resources.

[94] Tollefson and Stevens, 2004.

Photo 6. Bubbling brook, Washington (Andrew Heaney)

delineate watersheds at a finer scale where desired.[95] The following section provides descriptions of HUC-12 watersheds in the Town.

Wappinger Creek Watershed

The Wappinger Creek and its tributaries drain approximately 210 square miles, roughly one-fourth of Dutchess County.[96] Several reports have studied the Wappinger Creek Watershed because it is a significant natural resource. [97] Roughly sixty percent of the land in the Town and the entire Village land area are in the Wappinger Creek Watershed.[98] The watershed has been further divided into subwatersheds. The Town intersects two subwatersheds within the larger Wappinger Creek basin. These are: East Branch Wappinger Creek and Hunns Lake Creek-Wappinger Creek. The 2022 *Watershed Characterization and Recommendations Report for the Wappinger Creek Watershed* undertaken by the Village of Wappingers Falls in partnership with the Wappinger Creek Watershed Intermunicipal Council (WIC) describes natural features in the basin, sources of pollution, issues, and recommendations.[99] The 2022 Characterization study breaks down point (coming from a discernible, confined and discrete conveyance, like a pipe) and non-point (more diffuse) sources of pollution by subwatershed. For the Town and Village, relevant analysis, and conclusions for the East Branch subwatershed, which drains over half of the Town and the entire Village, are provided in a box below.

The East Branch Wappinger Creek Subwatershed encompasses 33.6 square miles. Subwatershed land use consists of 30 percent agriculture, 54 percent forest, 7 percent wetlands and waterbodies, and 9 percent developed land. Waters of the East Branch Wappinger Creek originate at the confluence of Shaw Brook and Mill Brook. The Shaw Brook stream runs south and west into the Mill Brook stream. The aquifer that supplies the Village's water supply is traversed by the Shaw Brook and the Mill Brook streams. The Millbrook Sewage Treatment Plant discharges

[95] U.S. Geological Survey, 2019, The StreamStats program, online at https://streamstats.usgs.gov/ss/

[96] Findlay, et al., 2010.

[97] *Natural resource management plan for the Wappinger Creek Watershed.* Prepared by the Dutchess County Environmental Management Council, Dutchess County Soil and Water Conservation District, Wappinger Creek Watershed Planning Committee, and Dutchess County Water Quality Strategy Committee. 2000. https://www.dec.ny.gov/docs/water_pdf/wapingercreekws.pdf

[98] Findlay et al., 2010.

[99] *Watershed Characterization and Recommendations Report for the Wappinger Creek Watershed.* Prepared by KC Engineering and Land Surveying, for The Village of Wappinger Falls. 2022. Available: https://hudsonwatershed.org/wp-content/uploads/Wappinger-Creek-Watershed-Characterization-Recommendations-Report-Final-June-2022.pdf

municipal wastewater into the East Branch Wappinger Creek below Dieterich Pond.

Fishkill Creek Watershed

Ten percent of the Town drains to the Fishkill Creek, via the Sprout Creek, which drains the southwest part of town.[100] A management plan for the Fishkill Creek watershed was prepared in 2005 for the Fishkill Creek Watershed Committee which includes sections on Sprout Creek in

Key Issues and Recommendations for the East Branch of the Wappinger Creek subwatershed, 2022 Wappinger Creek Report

Issues affecting water quality

Total Sediment Load - This subwatershed releases a total sediment load of 49.0 pounds per acre from land cover sources. Of the total land cover sediment load, 58 percent comes from agricultural lands and 27 percent from streambanks.

Total Phosphorus Load - This subwatershed releases a total phosphorus load of 0.05 pounds per acre from land cover sources. Of the total land cover phosphorus load, 73 percent comes from agricultural lands and 13 percent from developed lands.

Livestock – This subwatershed releases a model estimated yearly phosphorus load of 2,257 pounds from farm animal operations.

Water Quality - This subwatershed recorded a median phosphorus concentration of 0.044 mg/L exceeding the New York ambient guidance value of 0.02 mg/L to protect recreational use of waters during the 2017-2018 watershed sampling. The phosphorus contribution can be attributed to agricultural and livestock operations and failing septic systems. It can be assumed that the Millbrook sewage treatment plant located in the central portion of the subwatershed is also a possible phosphorus contributor with a yearly estimated load of 1,875 pounds.

Key recommendations

Identify the farms that would be candidates for conservation easements, or conversion of cropland to hay.

Develop a Comprehensive Nutrient Management Plan, with phosphorus indexing, for farms.

Encourage farmers to implement best management practices that focus on manure storage facilities, pasture practices, stream stabilization projects and calf facilities.

Amend the State Pollution Discharge Elimination System (SPDES) permit for the Millbrook sewage treatment plant to incorporate a phosphorus permit limit.

Work with NYSDEC to complete assessments of unassessed streams (stream segments where there is insufficient water quality information available to assess the support of designated uses).

[100] Tollefson and Stevens, 2004

the Town of Washington.[101] 4,742 people in the Town are in the Fishkill Creek Watershed with a population density of 80 persons per square mile.[102]

Photo 7. Fog on the water (Beatriz Moritz)

Tenmile River Watershed
The eastern third of the town flows into the Tenmile River watershed, via Stone Church Brook and Butts Hollow Creek. The 2021 Ten Mile River Watershed Management Plan has information pertinent to the eastern part of the Town.[103] This plan notes the relatively large area of dairy farms in Town of Washington (752 acres).[104] Agricultural activities can increase nutrient and sediment pollution of water.

Because the Town of Washington is dominated by higher elevations than surrounding towns, the Town's Comprehensive Plan notes that: Except for a small area traversed by the Wappinger Creek, Washington does not receive waters draining from other towns. Instead, storm waters flow out of the Town into nine other municipalities in Dutchess County. This gives Washington both an advantage and a responsibility in terms of water quality and flood conditions. Likewise, most of Washington's surface waters and aquifers are not subject to contamination from land uses outside the Town, but land uses within the Town of Washington can affect flooding, water quality, and water supplies.[105]

Watershed land cover and land use

There is a strong relationship between watershed land use/cover and water quality in streams, wetlands, and other waterbodies. Each time the use and cover of an area change, it can affect the hydrology of the landscape. Land and water are connected through the interactions of water, soil, organisms, and chemical components. Land cover is closely linked to the health of a watershed and the quality of its surface and subsurface waters. Watersheds with a high percentage of forest cover are generally associated with higher water quality and can lead to reduced costs associated with treating drinking water for consumption. Expanding impervious surfaces in a watershed such as roofs, pavement, roads, and other development is conversely associated with stream

[101] Foord, D., LiCausi, S., Buono, V., & Newman, B. *Natural Resource Management Plan for the Fishkill Creek Watershed.* 2005 https://hudsonwatershed.org/wp-content/uploads/2013/01/fishkillcreekmgtplan1.pdf
[102] Ibid. pages 64-65
[103] *Ten Mile River Watershed Management Plan*. Prepared by the Housatonic Valley Association. 2021 https://hvatoday.org/wp-content/uploads/2022/01/2021_10_1_FullTMRWBP_Draft.pdf
[104] Ibid. page 77
[105] Town of Washington. *2015 Town of Washington Comprehensive Plan*, [adopted December 10, 2015.] Page 26 Available: https://washingtonny.org/wp-content/uploads/2023/07/Condensed-Comprehensive-Plan-Addendum-re-Hospitality.pdf

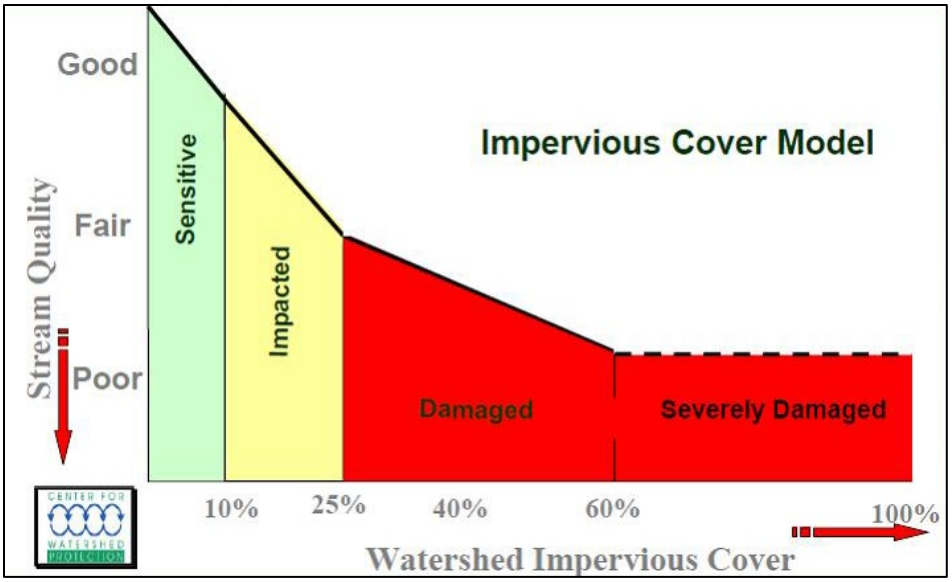


Figure 5. Percent Impervious Cover and Stream Quality. Source: Center for Watershed Protection.

degradation.[106] Even low amounts of impervious cover can result in impacts. Research by the Center for Watershed Protection generally found degraded streams when impervious cover in their watersheds reaches 10 percent (see Figure 5 below). Research undertaken in Dutchess County found impacts on nutrient levels in streams in watersheds with less than 5 percent impervious cover, correlated with inputs resting chiefly from low-density exurban expansion.[107] Table 6 summarizes streams, tree canopy cover, and existing impervious surfaces for each subwatershed in the Town and Village.

[106] National Research Council, Committee on Reducing Stormwater Discharge Contributions to Water Pollution. 2008. Urban Stormwater Management in the United States. Water Science and Technology Board, Division of Earth and Life Studies of the National Research Council. National Academies Press, Washington D.C., pp 529. http://www.epa.gov/npdes/pubs/nrc_stormwaterreport.pdf

[107] Cunningham, M. et al. "The Suburban Stream Syndrome: Evaluating Land Use and Stream Impairments in the Suburbs." *Physical Geography*, vol. 30, no. 3, May 2009, pp. 269–284, https://doi.org/10.2747/0272-3646.30.3.269

Table 6. Watershed and Subwatersheds in the Town of Washington, which encompasses the Village of Millbrook (Numbers reflect the entirety of the subwatershed, including areas outside of the Town and Village)

Watershed (HUC 10)	Subwatershed (HUC 12)	Total Acreage	% Forest Cover 2016	% Impervious Surface 2016	Important Tributary Streams
Wappinger Creek (0202000802)	East Branch of the Wappinger Creek (020200080203)	21,321	56	1.6	Mill Brook, Shaw Brook
	Hunns Lake Creek-Wappinger Creek (020200080204)	25,634	54	1.2	unnamed tribs
Fishkill Creek (0202000803)	Sprout Creek (020200080304)	35,049	55	3.8	Sprout Creek
Tenmile River (0110000505)	Tenmile River (011000050506)	26,942	64	1.8	Butts Hollow Brook, Stone Church Brook, and the headwaters to Wells Brook
	Wassaic Creek (011000050504)	23,947	52	1.3	unnamed headwaters to Wassaic Creek
	Swamp River (011000050505)	30,591	64	2	Stony Brook

Water Quality Classifications and Assessment (Map 10)

New York State DEC's Protection of Waters Program is responsible for formulating and enforcing regulations to preserve the state's water resources.[108] DEC's regulatory decisions hinge on its letter-based water quality classification system, which assigns each waterbody a classification and standard designation that dictates permissible activities.[109]
The classification indicates the optimal purpose or "best use" of a particular stream or waterbody.[110] Here's a brief breakdown of the primary water quality classifications:[111]

[108] Protection of Waters Program, DEC. https://www.dec.ny.gov/permits/6042.html
[109] "Water Quality Standards and Classifications," DEC. https://www.dec.ny.gov/chemical/23853.html
[110] "Surface Water and Groundwater Quality Standards," DEC. https://www.dec.ny.gov/regs/2485.html
[111] 6 NYCRR 701 Classifications-Surface Waters and Ground Waters https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=I06849fe0b5a111dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

- Class AA, A: drinking water supply, primary contact recreation (swimming), secondary contact recreation (boating), and fishing
- Class B: primary and secondary contact recreation and fishing
- Class C: fishing, fish propagation, and non-contact activities
- Class D: fishing

Some classes have an additional standard of "(T)" indicating that it may support a trout population or "(TS)" may support trout spawning.[112] Waterbodies with classifications of AA, A, B, and C(T), C(TS) are considered "protected" and are regulated by DEC.

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) is a dataset, managed by DEC that provides an inventory of the state's surface water quality.[113] DEC reports the water quality assessments to the public through the WI/PWL, providing narrative assessments of the state's waterbodies. Hyperlinks to WI/PWL factsheets for each stream segment and waterbody in Washington and Millbrook are provided in Table 7. The factsheets can also be accessed through the DECinfo Locator.[114]

Water quality monitoring and assessment

DEC manages various programs that collect and evaluate water quality data on different types of waters in the state. Obtaining a waterbody assessment can help with identifying next steps for protecting healthier streams or restoring and improving impacted streams. DEC's approach ensures quality assurance and control, and provides vital information for grant opportunities, project prioritization, compliance, enforcement, and strategic planning guiding actions to protect and enhance streams.

The DEC uses the Consolidated Assessment and Listing Methodology (CALM) to assess the quality of water relative to the DEC water quality standard.[115] After evaluating valid water quality data, a waterbody or water segment is assigned one of five categories summarized below:

- Impaired— failure to support Best Use(s).
- Minor Impacts— potential impact to Best Use(s)
- Fully Supported— no impact to Best Use(s)
- Needs Verification— unconfirmed, unless a use is Impaired/Confirmed
- Unassessed— water quality data unavailable or insufficient

Water quality assessments are reported through WI/PWL, and the CWA Section 303 (d) List of Impaired/TMDL Waters. Statewide monitoring initiatives include the Rotating Integrated Basin Study (RIBS) which monitors waters in different basins every five years and the Stream Biomonitoring program. The Stream Biomonitoring program uses aquatic macroinvertebrate

[112] Title 6, NYCRR 701.25 Classifications-Surface Waters and Ground Waters Trout waters (T or TS) https://govt.westlaw.com/nycrr/Document/I4ed867e4cd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

[113] Water Inventory/Priority Waterbodies List - https://data.ny.gov/Energy-Environment/Waterbody-Inventory-Priority-Waterbodies/uctu-y9hj

[114] DECinfo Locator- https://www.dec.ny.gov/pubs/109457.html.

[115] Consolidated Assessment and Listing Methodology NYS Department of Environmental Conservation. 2021, pg 8 https://www.dec.ny.gov/docs/water_pdf/calmmay2021.pdf

samples as indicators of water quality because they have been shown to be sensitive to pollution and habitat quality. Results from DEC's most recent Aquatic Biomonitoring of the Shaw Brook, (last monitored on July 25, 2017), and the Mill Brook (last monitored September 13, 2007), found the condition of both were considered Slightly Impacted, which denotes good water quality.[116] Refer to the Division of Waters Data Monitoring Portal to access current and historical stream and lake monitoring data.[117]

Table 7. Streams and Ponds in the Town of Washington and Village of Millbrook listed on WI/PWL

Stream or Waterbody Name (Segment ID)	**NYS DEC Class**	**Standard Managed/ Protected to Support Best Uses**	**Water Quality Use Assessment**	**Pollutants**	**Notes about location of segment**
Wappinger Creek, Middle, and Minor Tribs (1305-0014)	B (T)	Fishing, swimming and other contact recreation	Stressed-Needs Verification[118]	pH	Portion of the Wappinger creek flowing through the north-western corner of the Town
East Branch Wappinger Creek, Lower and Tribs (1305-0022)	B (T)	swimming and other contact recreation	Fully Supported-Needs Verification	Dissolved Oxygen, Nitrite, pH	This is the only segment with data in the village
East Branch Wappinger Creek, Upper, and Tribs (1305-0023)	A (T)	Source of drinking water,	Impaired-Needs Verification	Iron	Stream and tribs above the Village of Millbrook
		Fishing, swimming and other contact recreation	Stressed-Needs Verification	pH	
Sprout Creek, Upper and Tribs (1304-0022)	C (T)	Fishing	Fully Supported-Needs Verification	Dissolved Oxygen, pH	In the southwest corner of the Town, along Oak Summit Road
Wells Stream and Tribs (1601-0023)	A	Source of drinking water,	Stressed-Needs Verification	Ammonia, Chloride, pH	In the southeastern corner of the Town, near Higher Ground Frame Lane and Hammond Hill Road
		Fishing, swimming and other contact recreation	Stressed-Needs Verification	pH	
Tenmile River, Upper, and minor Tribs	C	Fishing and non-contact recreation	No Known Impact		Includes Stone Church Brook and Butts

[116] DEC "Fact Sheet on Assessment of Water Quality Impact in Streams and Rivers" https://www.dec.ny.gov/docs/water_pdf/bapnarrative18.pdf

[117] NYS DOW Data Monitoring Portal- https://www.arcgis.com/apps/webappviewer/index.html?id=692b72ae03f14508a0de97488e142ae1

[118] Additional monitoring is needed to determine whether "best use" is in fact impacted or impaired.

Stream or Waterbody Name (Segment ID)	NYS DEC Class	Standard Managed/ Protected to Support Best Uses	Water Quality Use Assessment	Pollutants	Notes about location of segment
(1601-0012)					Hollow Creek
Wassaic Creek and Tribs (1601-0024)	C(T)	Fishing	Stressed-Needs Verification	pH	In the northeastern corner of the town near Bontecou Lake
Mill River and tribs (1601-0017)	unassessed				
Shaw Pond (1305-0026)	unassessed				
Round Pond (1305-0024)	unassessed				
Dieterich Pond (1305-0025)	unassessed				

New York State stream regulations

Title 5, Article 15, of the New York Environmental Conservation Law (ECL) pertains to the Protection of Water program and enforces regulations detailed in NYCRR Part 608.[119] Water with classifications C(T), C(TS) and all types of B and A streams are collectively referred to as "protected streams".[120] The bed and banks of protected streams, defined as the areas immediately adjacent to and sloping toward the stream are subject to provisions that require a DEC permit for activities that excavate, fill, or disturb these beds or banks. See Map 10 for the DEC stream classifications in the Town.

While state regulations provide a level of protection to the bed and banks of mapped protected streams, numerous class C and D streams as well as stream buffer areas along all streams lack these disturbance protections and present an opportunity for local protection efforts, such as zoning setbacks or watercourse protection laws. Local stream protection efforts can play an important role in comprehensive watershed protection.

Local stream protections

The Town has a local wetlands and watercourses protection law, adopted in 2011, which protects and regulates activities in and near wetlands, potable water sources, and watercourses. Permitting is overseen by the Town Planning Board, in consultation with the Conservation Advisory Commission (CAC). Town of Washington Zoning Law Section 396 includes a 100-foot wetland

[119] 6 NYCRR 608 "Use and Protection of Waters" https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=If9aaad50b5a011dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

[120] 6 NYCRR 608.1 "Definitions-(aa)Protected stream" https://govt.westlaw.com/nycrr/Document/I4ec1ab83cd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)

buffer for wetlands that are one acre or larger in area, and a 50-foot buffer for wetlands between ¼ and one acre.[121] For perennial watercourses there is a 100-foot buffer "controlled area," and a 50-foot buffer for intermittent watercourses. Other pertinent zoning code sections include Section 316, Aquifer Protection Overlay and other Environmental Preservation District Regulations, including Section 335 Erosion and Sedimentation Control. [122], [123] As mentioned in the Drinking Water section getting the Town's Aquifer Protection Overlay Zone and Village of Millbrook's Water Supply Protection Zone maps are inconsistent. The inconsistency stems back to the Village's need to protect a watershed area of the Shaw/Mill Brooks while Town's priority is protecting sand and gravel aquifers. Discrepancies pose challenges to the legal compliance and comprehensive protection of drinking water resources. Updating maps and ensuring that consistency is maintained is essential for legal compliance and informed decision-making to effectively safeguard drinking water resources in the Town and Village.

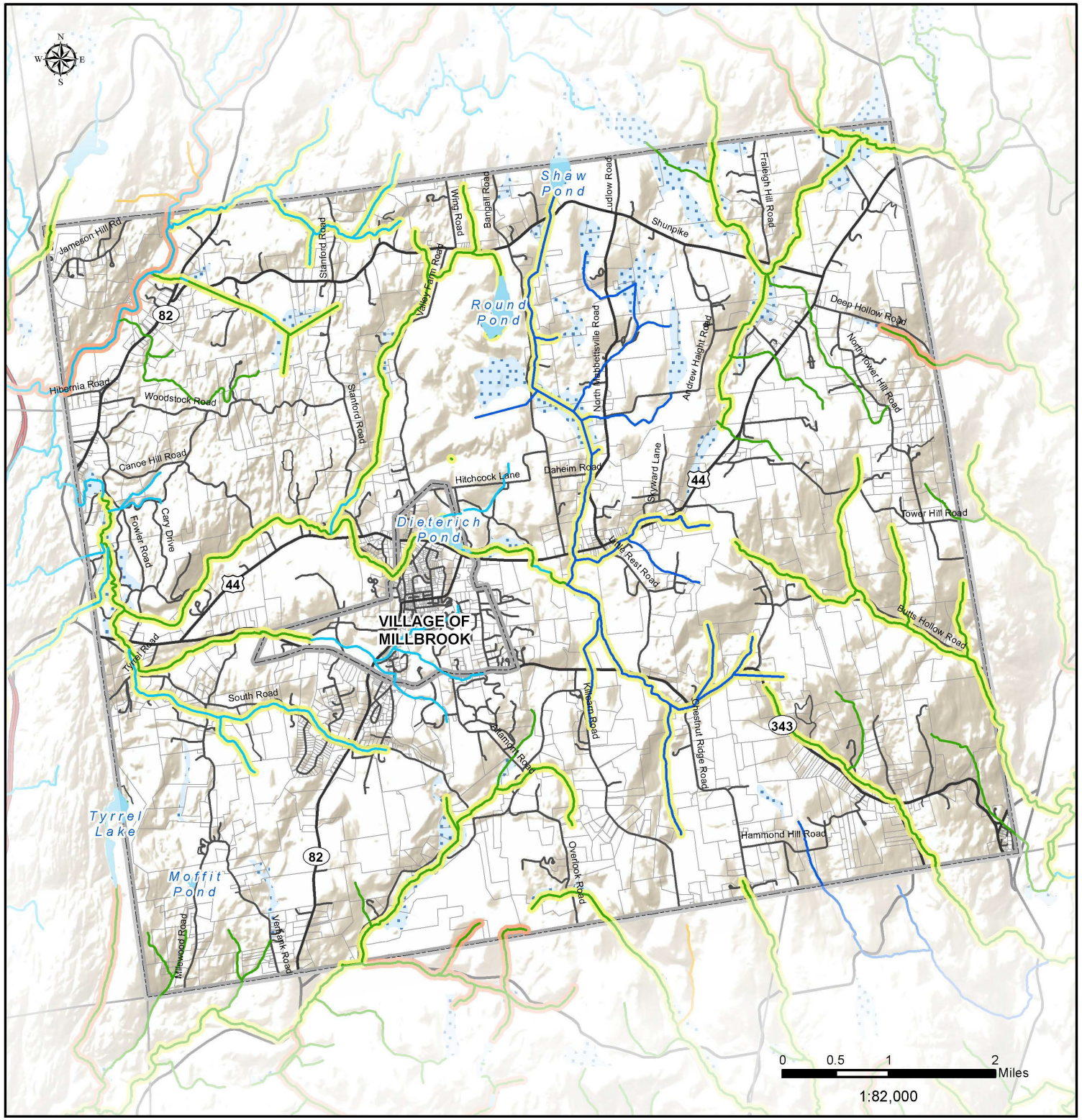
[121] Zoning Code of the Town of Washington as amended through 2007. Section 396, Page 44 Available: https://washingtonny.org/wp-content/uploads/2023/06/Zoning-Code-Complete-revised-7-22-2022.pdf
[122] Ibid.
[123] Ibid.

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

10. Water Quality Classifications



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Stream Classification

- A - water supply, primary and secondary contact recreation and fishing
- B - primary and secondary contact recreation and fishing
- C - fishing, suitable for fish propagation and survival
- D - fishing
- Trout Waters
- Trout Spawning Waters

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Water Quality Classification: NYSDEC 2010

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

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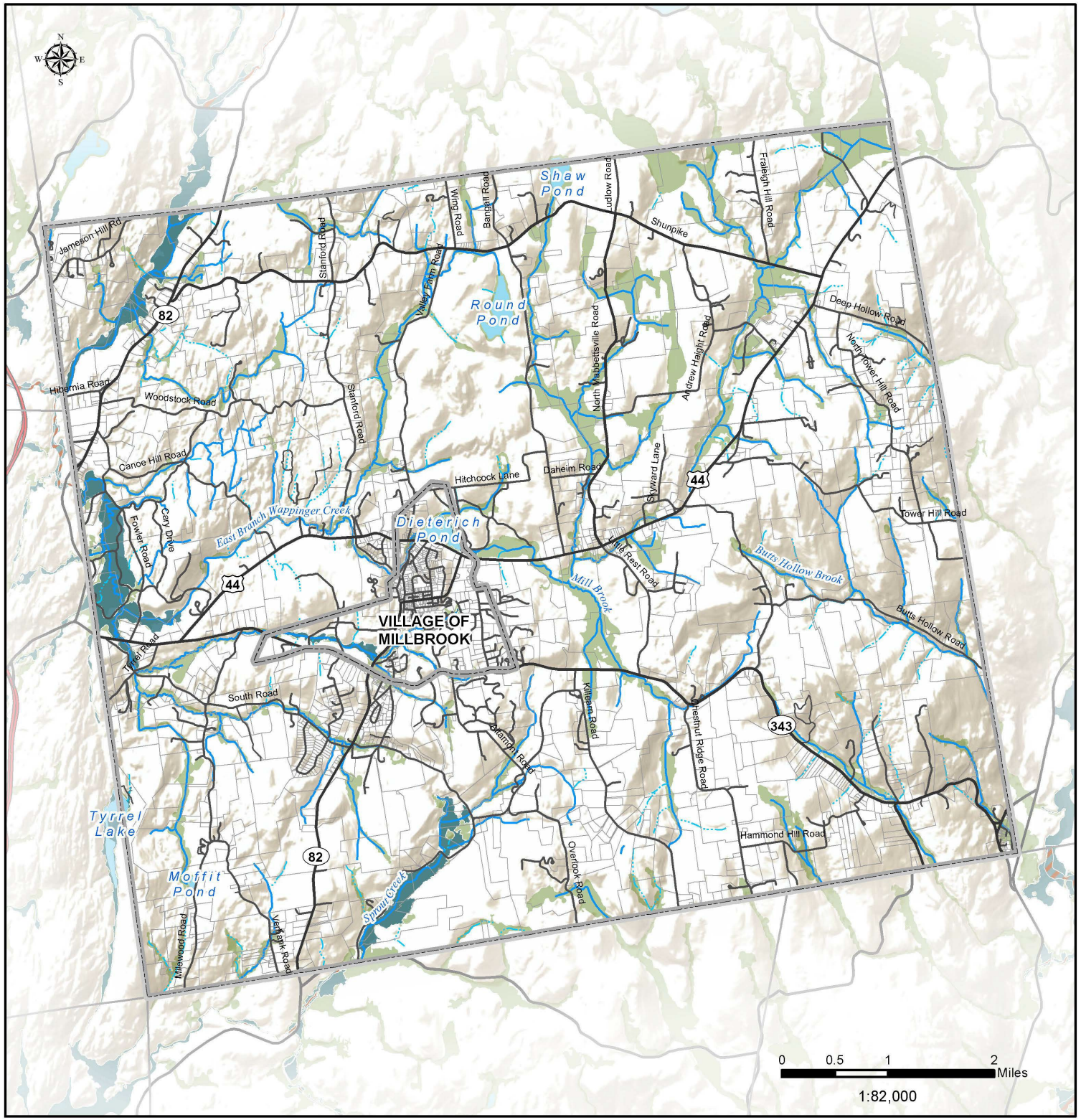
Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

11. Floodplains & Riparian Areas



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Riparian Area

FEMA Flood Hazard Zones

- Floodway
- 1% annual chance (100-year flood)

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Flood Areas: FEMA DFIRM (Effective May 2012)
Riparian Areas: New York Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2022

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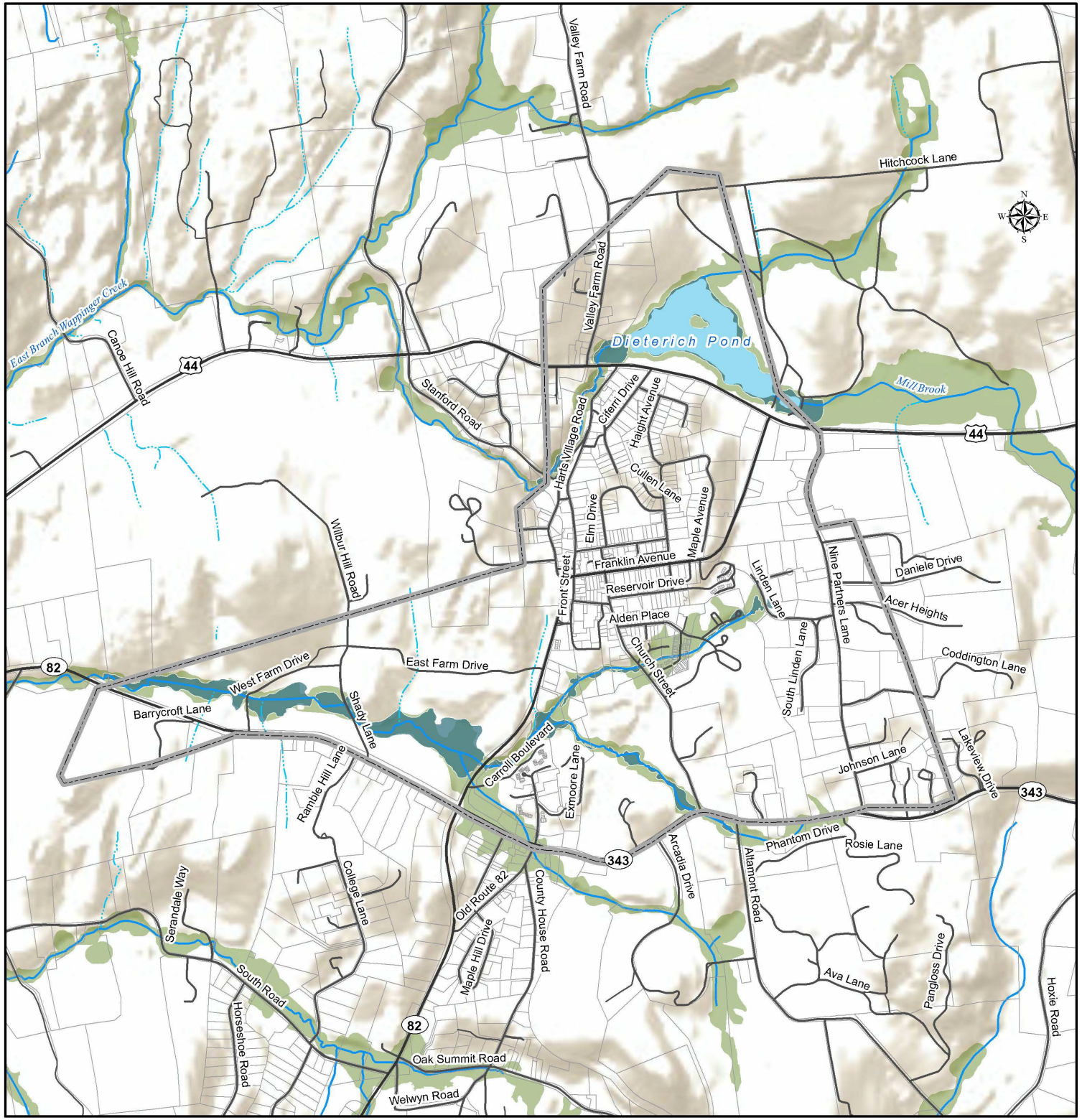

Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

11b. Floodplains & Riparian Areas

- Millbrook Boundary
- Municipal Boundary
- Parcel Boundary
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland
- Riparian Area

FEMA Flood Hazard Zones

- 1% annual chance (100-year flood)
- .2% annual chance (500-year flood)

0 0.25 0.5 Miles

1:24,000

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Flood Areas: FEMA DFIRM (Effective May 2012)
Riparian Areas: New York Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2023

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Floodplains & Riparian Areas (Map 11)

Floodplains provide space for waterbodies to expand in times of rapid rain or snowmelt. Undeveloped floodplains are important safety zones, protecting people and development from damaging flood waters.

The Floodplains & Riparian Areas Map 11 shows approximate floodplains mapped by the Federal Emergency Management Agency (FEMA). Floodplains are low-lying areas, often next to streams and rivers that become inundated during heavy precipitation or snowmelt events. Floodplains are an integral and dynamic part of streams and rivers providing the space these waterbodies need to expand, contract, and change course over time. During heavy rains, the water runs off from the land into the river system, the water in the river rises, eventually it exceeds the channel, and it flows out onto its floodplains where it slows and spreads out. Floodplains are connected to streams but can extend far from a stream or river and are not necessarily found alongside them.

Undeveloped floodplains serve as an important safety zone protecting people and development from the damaging waters of a flood. While flooding is a natural occurrence, flood damage commonly occurs when development is situated in a floodplain. Floods are the most common and expensive hazard in New York State in terms of human hardship and economic loss, particularly to communities that lie within flood-prone areas or floodplains of a major water source.[124]

The Wappinger Creek basin has experienced frequent flood events in the past. The majority of these flooding events have been caused by severe coastal storms and hurricanes. Dutchess County completed a County-Wide Hazard Mitigation Plan following requirements of the Federal Disaster Management Act (DMA). The plan includes Jurisdictional Annexes for each municipality describing the major flood events experienced between 2008 and 2016 (see Tables 8 and 9).[125], [126] Washington and Millbrook are subject to riverine flooding, flash flooding, ice jam flooding, and dam failure flooding.[127]

The Jurisdictional Annex for the Town of Washington in the Hazard Mitigation Plan documents that the Town experienced losses from one presidentially declared major disaster (Hurricane Irene) and other widespread flooding hazards between 2008 and 2016. The Jurisdictional Annex for the Village of Millbrook documents that the Village also experienced presidentially declared major disaster losses from Hurricane Irene as well as from remnants of Tropical Storm Lee and

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[124] *Hazard Mitigation Plan - Dutchess County, New York*. 2016: https://www.dutchessny.gov/Departments/Emergency-Response/Hazard-Mitigation-Plan.htm

[125] Town of Washington Jurisdictional Annex Section 9.23. *Hazard Mitigation Plan - Dutchess County, New York*. 2016. Dutchess County Department of Emergency Response. Available: https://www.dutchessny.gov/Departments/Emergency-Response/Docs/Section-9-23-Washington-T.pdf

[126] Village of Millbrook Jurisdictional Annex Section 9.25. *Hazard Mitigation Plan - Dutchess County, New York.* 2016. Dutchess County Department of Emergency Response. Available: https://www.dutchessny.gov/Departments/Emergency-Response/Docs/Section-9-25-Millbrook-V.pdf

[127] For more information from FEMA use the following resources: Emergency Declarations for other Hazards can be retrieved from-www.fema.gov/data-visualization/disaster-declarations-states-and-counties; FEMA Geospatial Resource Center-www.gis-fema.hub.arcgis.com/; FEMA- National Risk Index- www.hazards.fema.gov/nri/map

Hurricane Sandy, in addition to other widespread flooding events between 2008-2016.

Table 8. Flood-Related Hazards Documented in Town of Washington, Dutchess County Hazard Mitigation Plan (2015).

Dates of Event	**Event Type**	**FEMA Declaration #**	**County Designated?**	**Summary of Damages/Losses**
March 11-13, 2011	Heavy Rainfall, Snowmelt, Ice Jams	N/A	N/A	Roads Flooded. 3/11/11 - 7 men, 7 hours; Damaged bridge headwall and road required replacement on Shady Dell Rd; Butts Hollow Rd washed out – 8 hours, 3 men, and 10 loads of stone to fill; Kennels Rd washed out – 4 loads fine stone, grader and loader required; Killearn Rd and Hammond Hill Rd – pipes plugged, backhoe needed to clean out pipes and 4 loads of fine stone
Aug. 26 – Sept. 5, 2011	Hurricane Irene	DR-4020	Yes	9/27-10/1/2011 - Bridge wall broken; roads washed out

Table 9. Flood-Related Hazards Documented in the Village of Millbrook, Dutchess County Hazard Mitigation Plan (2015).

Dates of Event	Event Type	FEMA Declaration #	County Designated?	Summary of Damages/Losses
March 11-13, 2011	Heavy Rainfall, Snowmelt, Ice Jams	N/A	N/A	Tree damage and debris removal; excessive flows strained wastewater treatment facility; DPW overtime
Aug. 26 – Sept. 5, 2011	Hurricane Irene	DR-4020	Yes	Tree damage and debris removal; road raised and washout, fence repair, storm drain over capacity, fire dispatched to pump out basement; Road washouts on Nine Partners Lane, Church Street and Standford Road; flooding at water treatment plant in Mabbettsville; Fencing around water treatment plant and bandshell roof damaged due to fallen trees, propane tank at plant compromised; Overtime for DPW and Police – volunteer fire pumped basements for 36 hours
September 5- 8, 2011	Remnants of Tropical Storm Lee	DR-4031	No	Tree damage and debris removal, stormwater over capacity; DPW overtime
Oct. 27 – Nov. 8, 2012	Hurricane Sandy	DR-4085	No	Major rain event caused scattered tree damage and excessive stormwater flows; Overtime for DPW and Police – volunteer fire pumped basements for 48 hours
May to August 2013	Storm Water Emergency, Heavy Rain Event, Storm Water Flooding	N/A	N/A	Catch basin on Elm Drive exceeded capacity and overflow caused damage to private properties – driveway washout, fence repair, landscape and pool damage, debris removal; DPW overtime

FEMA Flood Hazard Areas

Locations within the "100-year" (1% annual chance) flood zone have at least a 1 in 4 (25%) chance of flooding over the course of a 30-year mortgage.

FEMA has developed detailed maps of floodplains called special flood hazard areas to support the National Flood Insurance Program. These Flood Insurance Rate Maps (FIRM) are used to determine federal flood insurance rates and to develop local land use controls that comply with FEMA's requirements. FIRMs are the closest proximation available to identify floodplain locations but have limitations.

The FIRMs show special flood hazard areas that are mapped based on flood frequency according to the extent of land expected to have a 1 percent or greater chance of being inundated in any given year, often referred to as the '100-year floodplain.' The '0.2 percent annual chance flood hazard' is the land areas that have a 0.2 percent annual chance of being flooded corresponding to the '500-year floodplain.' The flood hazard maps for Dutchess County have an effective date of 2012.

Washington has a relatively small portion of land area, 1.1 percent, situated within FEMA's flood hazard zones defined as the 100 and 500-year floodplains. About 7.8 percent of Millbrook's land area is within these designated floodplains.[128] Modeling shows that a somewhat larger area, 8.1 percent of the land area in Millbrook has some level of flood risk.[129] FEMA flood maps are updated periodically, and staying informed about changes in your area is important. Visit the FEMA Flood Map Service Center to view and obtain your community's current flood maps and other flood hazard mapping products.[130]

New York State provides direction for construction in floodplains but does not limit floodplain development.[94] The federal government has no legal authority to regulate local land use. However, communities that adopt flood damage prevention law in accordance with FEMA guidelines can qualify for federal flood insurance and many kinds of disaster assistance. FEMA requires that local laws for flood damage prevention contain specific standards for any development in federally mapped Special Flood Hazard Areas (generally the 100-year floodplain). In partnership with federal and local governments, DEC's Bureau of Flood protection and Dam Safety provides technical assistance to communities for administration of local floodplain regulations.

The Town of Washington regulates buffers adjacent to streams including 100 feet from the bank of perennial streams and 50 feet from the bank of an intermittent stream channel.[131] Millbrook Flood Damage Prevention code contains a permitting process for development in special flood hazard areas.[132]

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[128] Village of Millbrook Jurisdictional Annex, *Dutchess County Hazard Mitigation Plan* 2016.

[129] First Street Foundation. 2022.

[130] The FEMA Flood Map Service Center is available at https://msc.fema.gov/portal/home.

[131] Town of Washington Code, Section 396: Wetlands & Watercourses. 2012. https://www.washingtonny.org/document-center/wetlands-information/1071-wetlands-and-watercourse-legislation/file.html

[132] Village of Millbrook GL Ch. 115 Flood Damage Prevention. 2012. Available: https://ecode360.com/10853779

FEMA mapping is a valuable tool, but it is important to note that flood hazard areas are only estimates based on the data and modeling technology available at the time of mapping, and they typically omit floodplains located along smaller streams. Due to the unpredictable nature of some kinds of floods, they often omit areas subject to flooding from localized drainage problems, including undersized culverts, ice jams, sheet flooding down a slope, and erosion hazards due to infrastructure. Climate change is furthermore changing precipitation patterns and increasing flood frequency in New York.[133] See Chapter 2: Climate for more information.[134]

Riparian areas

Riparian areas are land areas adjacent to streams, ponds, wetlands, and other waterbodies and generally include the floodplain. Riparian buffers are strips of vegetated land adjacent to a body of water. Well-vegetated riparian buffers intercept stormwater runoff, filter sediment, and nutrients, and help attenuate flooding. Forested buffers provide organic matter that supports the in-stream food web and shade that helps maintain cool water temperatures. Natural buffers also support unique and diverse habitats and often serve as wildlife travel corridors (See Figure 6). Refer to the referenced guides for more information about the numerous functions, design, establishment, and recommended the management of riparian forest buffers.[135,136]

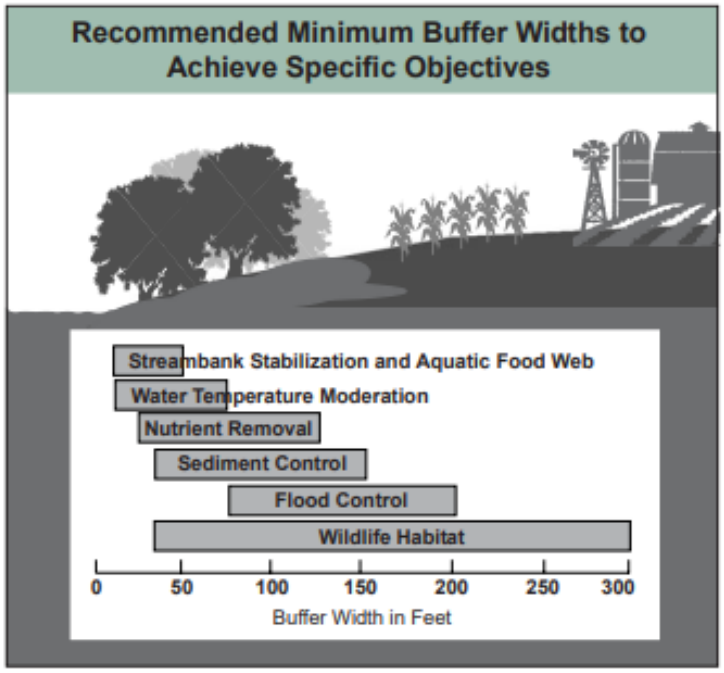


Figure 6. Recommendations for Minimum Buffer Widths to Achieve Specific Objectives

Source: Alliance for the Chesapeake Bay 2004

The riparian buffer areas shown were

[133] Horton, R., et al. "Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information." New York State Energy Research and Development Authority (NYSERDA), 2014, Albany, NY. www.nyserda.ny.gov/climaid

[134] Flood Risk Factor Online Tool- www.riskfactor.com/county/dutchess-county ny/36027_fsid/flood#flood_risk_overview; Look up disasters for your County here- www.usatoday.com/story/news/investigations/2023/01/17/california-flooding-just-latest-natural-disaster-where-worst/11032443002/

[135] Bentrup, G. *Conservation Buffers Design Guidelines for Buffers, Corridors, and Greenways*. Gen. Tech. Rep. SRS-109., National Agroforestry Center, U.S. Department of Agriculture, Forest Service, Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station. 2008, Available: www.fs.usda.gov/nac/buffers/docs/conservation_buffers.pdf .

[136] Chesapeake Bay Program. *Riparian Forest Buffers Linking Land and Water: The Conservation and Restoration of Streamside Forests in the Chesapeake Bay Watershed*. Gen. Tech. Rep. 903-R-99-002 Chesapeake Bay Program, Annapolis, MD, July 2004, Available: https://d38c6ppuviqmfp.cloudfront.net/content/publications/cbp_12999.pdf

mapped by the New York Natural Heritage Program for the Statewide Riparian Opportunity Assessment to highlight important streamside areas that influence stream dynamics and health.[137] They are delineated around streams based on digital elevation data, known wetlands, and modeling estimates for the 50-year flood height. The riparian areas overlap with FEMA floodplain data in parts of the map but also include mapping along smaller streams omitted from the FIRM modeling. They can provide a starting point to inform land use strategies and stream protection efforts, but field visits are necessary to verify conditions for site-level planning or conservation actions.

In riparian areas that do not have an ecologically effective buffer, it may be possible to reestablish native vegetation, the Hudson Estuary Trees for Tribs Program offers free consultation and native trees and shrubs for qualifying streamside buffer planting projects in the estuary watershed[138]. In agricultural areas the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) offers support for riparian buffers, filter strips, wetlands, and pollinator plantings through various incentive programs. [139]

[137] Conley, A., T. Howard, and E. White. *New York State Riparian Opportunity Assessment*. New York Natural Heritage Program, State University of New York College of Environmental Science and Forestry, 2018, Albany, NY. https://www.nynhp.org/projects/statewide-riparian-assessment/

[138] "Hudson River Estuary Trees for Tribs Program." NYS DEC Hudson River Estuary Program. http://www.dec.ny.gov/lands/43668.html

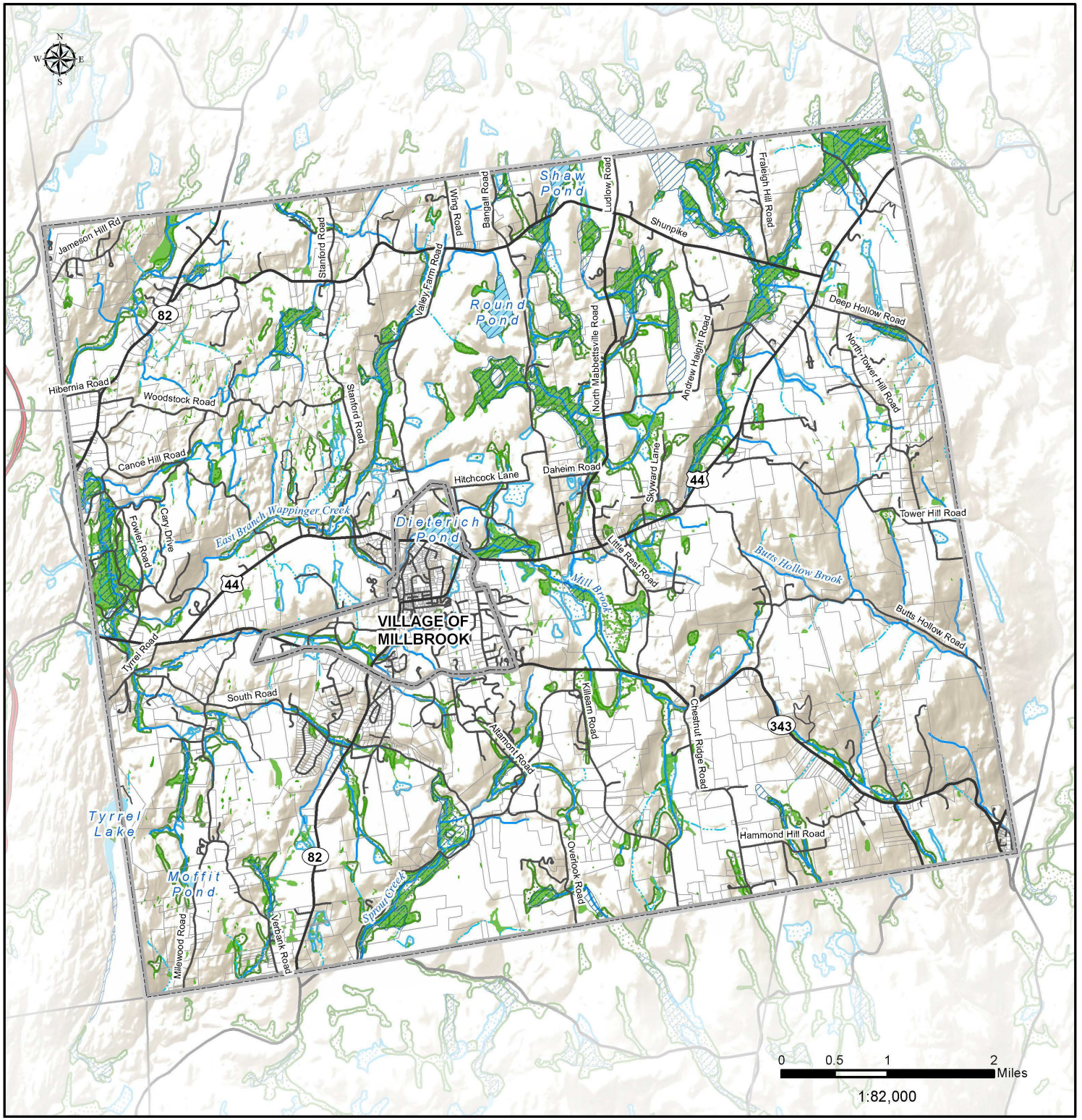
[139] USDA NRCS NY Main Webpage: https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/new-york

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

12. Wetlands



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- DEC Regulatory Wetland
- Wetland (Hudsonia)
- Probable wetland area
- Possible wetland area

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002 & Hudsonia, Ltd. 2007
Probable & Possible Wetlands: USDA Soil Conservation Service 1979

Prepared by: CCEDC GIS Lab, 2022

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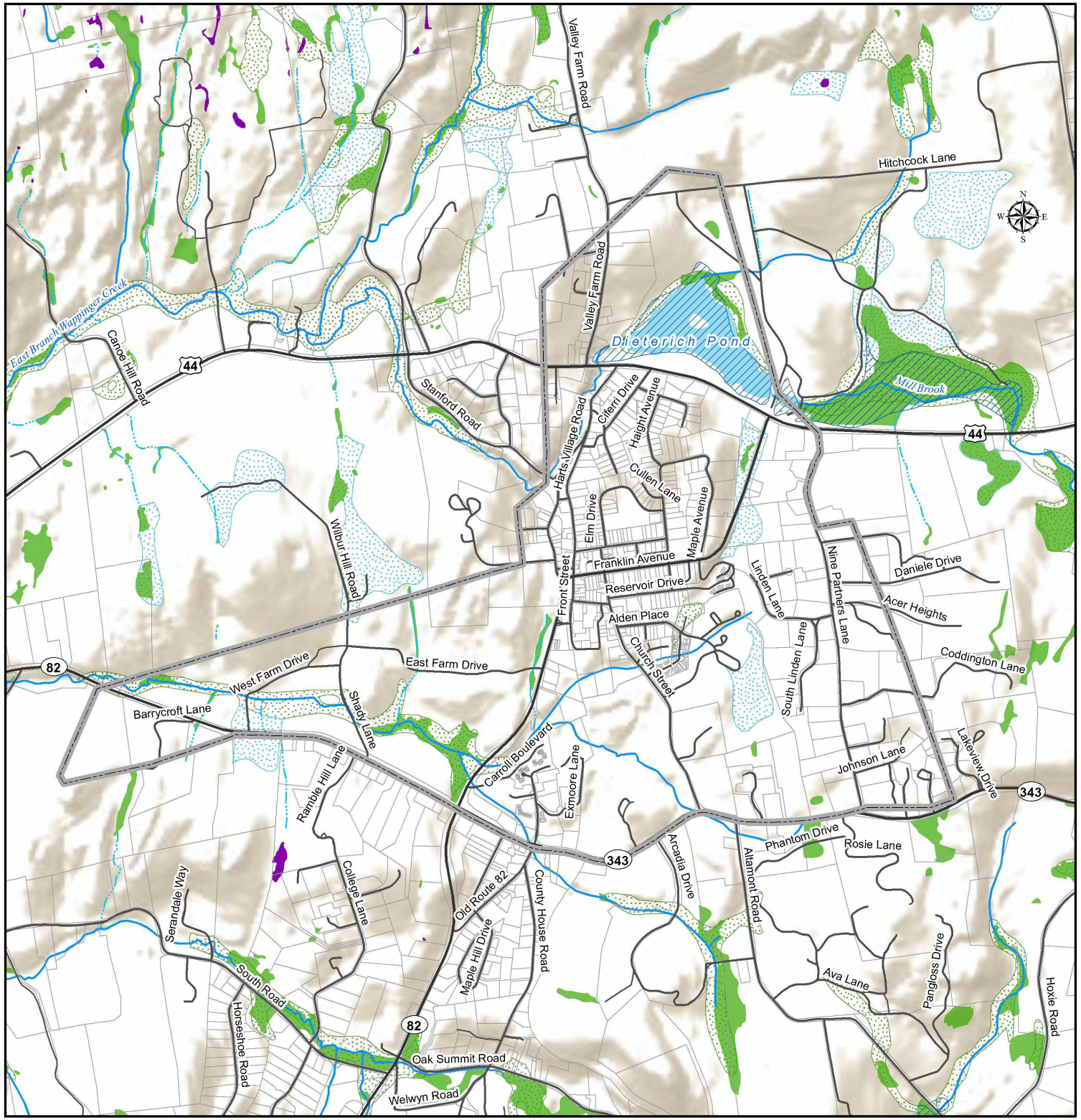
Cornell Cooperative Extension
Dutchess County



Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

12b. Wetlands

- Millbrook Boundary
- Municipal Boundary
- Parcel Boundary
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Known Vernal Pool
- DEC Regulatory Wetland
- Wetland (Hudsonia)
- Probable wetland area
- Possible wetland area

0 0.25 0.5 Miles

1:24,000

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Vernal Pools, Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002 & Hudsonia, Ltd. 2007
Probable & Possible Wetlands: USDA Soil Conservation Service 1979

Prepared by: CCEDC GIS Lab, 2023

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NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Wetlands (Map 12)

Wetlands:

- provide critical habitat
- control flooding
- reduce damage from storm surge
- recharge groundwater
- filter and purify surface water
- store carbon
- provide recreational opportunities

Wetlands are areas saturated by surface or groundwater sufficient to support distinctive vegetation adapted for life in saturated soil conditions.[140] There are many types of freshwater wetlands in the Town, including wet meadows, emergent marsh, forested and shrub swamps, vernal pools, floating and submerged vegetation, and open water. These ecosystems are ecosystems characterized by water-saturated soils and vegetation adapted to growing in waterlogged conditions. They often occur where the water table is near or at the surface for at least part of the year and serve as a transitional zone between dry uplands and areas dominated by water.

Different kinds of wetlands can exist depending on location, topography, geology, and hydrology. Wetlands do not always have to be wet and are not always situated along water bodies. Wetlands can persist as near permanent (rarely dry), intermittent (often seasonally dry) or ephemeral (only occasionally full). While many wetlands form along the floodplains of rivers, streams, and lakes, some are not located in direct proximity to open waterbodies at all.[141] These geographically isolated wetlands in non-floodplain or upland landscape settings often occur in depressions in the landscape and are influenced by groundwater flow and precipitation patterns.[142]

The net loss of wetlands in the region has been great, almost certainly more than 50% since European settlement.[5]

Wetlands play a critical role in the health of watersheds, forming a part of the natural system of land and water that helps make human communities livable.[143] They absorb the forces of floods and prevent loss of upland soil to erosion, store sediments, and filter pollutants from water before it reaches downstream areas[144]. Wetlands provide habitats for a wide range of animal and plant species and offer unique opportunities for people to

[140] "Wetlands," DEC. https://www.dec.ny.gov/lands/305.html

[141] Zucker, L, and Lau, L. 2009, pp. 1–13, *An Analysis of the Size and Distribution of Geographically Isolated, Small Wetlands in the Hudson River Estuary Watershed*. Available: https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/d/5327/files/2014/10/Isolated_Small_Wetlands-17hvvar.pdf

[142] Alexander, L., et al. US EPA, 2015, pp. 1-408. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence.* Available: https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=296414

[143] *Planner's Guide to Wetland Buffers for Local Governments*. Environmental Law Institute, 2008, Washington, DC. Available: www.eli.org/sites/default/files/eli-pubs/d18_01.pdf

[144] See fact sheet *Wetland Conservation: What does the Hudson Valley have to lose?* for more information on the benefits of wetlands in the Hudson River Estuary. Available: https://www.dec.ny.gov/docs/remediation_hudson_pdf/wetlandsfs.pdf

experience nature.[145] See Biodiversity for more information about biodiversity and habitat value of wetlands.

Wetland buffers are areas of land that lie adjacent to and surround wetlands.

Wetlands provide many ecosystem services, as described above, but these functions cannot be sustained without care for the uplands adjacent to wetlands—wetland buffers. When upland buffers surrounding wetlands are encroached on by development, including buildings, lawns, and pavement, habitat quality and other values are often degraded. For more information about well-designed buffers, see Floodplains & Riparian Areas. Additional context about local, state, and federal regulations about wetland buffers are included in the Wetlands Law sub-section below.

Detailed descriptions of wetlands and practices for conserving them are available in the *Significant Habitats* report.[146] Wetlands make up 9 percent of the Town land area. Wetland complexes – sets of interconnected wetlands – are found throughout the Town. Wetland complexes primarily occur in the low-lying terrain of the Hunns-Lake Wappinger Creek, the Wassaic Creek, and the Sprout Creek watersheds. The floodplain of the East Branch Wappinger Creek Watershed also contains large wetlands including an extremely valuable complex of fen, swamp, and marsh to the west of Little Rest Road and west of Fowler Road further downstream.[6]

In the Village of Millbrook there are marsh wetlands found around Dietrich Pond, which is a constructed pond. Wetlands are also present along the unnamed tributaries of the East Branch Wappinger Creek floodplain flowing throughout the Village.

The Wetlands Map presents the best available information about wetlands in the Town and Village. It is common for maps to have limitations or inaccuracies, particularly when it comes to complex and dynamic natural ecosystems such as wetlands. It is important to recognize these limitations when using maps for decision-making purposes and to supplement them with additional data and information, whenever possible. The *Significant Habitats* report provides more detailed descriptions of wetlands.[6] An online interactive version of Map14: Habitats is available.[147] Note that habitat boundaries can change over time and there is no substitute for site visits and on-the-ground field observations.

The Wetlands Map can be used for predicting the location of potential wetlands. The individual layers included on Map 12 are described below:

- DEC Regulatory Wetland - Wetlands larger than 12.4 acres, unless designated "of unusual local importance." Note that the NYS Freshwater Wetlands layer is symbolized differently on the Wetlands Map (Map 12) than on other maps in this NRI. It is labeled as DEC Regulatory Wetland and is symbolized by hashed blue lines. All the other maps in this NRI feature the NYS Freshwater Wetlands symbolized by a dotted light blue symbol.

[145] Kiviat, E., and Stevens, G., Hudsonia Ltd, 2001, pp. 1-373, *Biodiversity Manual for the Hudson River Estuary Corridor.*

[146] Tollefson and Stevens, 2004

[147] Hudsonia Ltd., Ecologically Significant Habitats in the Town of Washington, NY. Online Interactive Map Available: https://marist.maps.arcgis.com/home/webmap/viewer.html?layers=98d805a38e7343da836fb68f4dfcfd11

New York State's wetland maps often underestimate wetland areas and omit smaller and drier wetlands, and do not accurately reflect the full extent of wetland habitats. In particular, vernal pools, wet meadows, and swamps are often under-represented on maps[148]

- Wetland (Hudsonia) - This bright green Wetlands layer combines the fourteen wetland habitat types identified in the *Significant Habitats* report [6]. The study concluded that wetlands make up 9 percent of the Town. For information about each of wetland habitat types and the species that depend on them, refer to Biodiversity.
- Probable wetland areas & Possible wetland areas – "Probable wetlands" are those soils classified in the Natural Resources Conservation Service soil survey as very poorly drained or poorly drained, and "possible wetlands" are those classified as somewhat poorly drained soils. Soil drainage classes can be used to predict locations of wetlands. (See Soils for further discussion about soil properties.)

See Biodiversity for further information about the types of wetlands found in Washington and Millbrook.

Photo 8. Field and blue sky Bontecou Road (Andrew Heaney)

Wetland protection

Freshwater wetlands are regulated in several different ways.

Federal Law

US Army Corps of Engineers regulates wetlands with a continuous surface-water connection to navigable waterways under the Clean Water Act.

NYS Freshwater Wetlands Regulations

DEC State-regulated freshwater wetlands are the state-protected wetlands according to Article 24 of the Environmental Conservation Law.[149] It used to only apply to those 12.4 acres or larger or having "unusual local importance". The state regulatory maps show only those wetlands that are currently mapped or officially proposed for addition to the wetland maps.[150] The law also regulates a typically 100-foot buffer zone around these wetlands, and the law is administered by the DEC.

Upcoming Changes to NYS Freshwater Wetlands Regulations - Beginning in 2025, the NYS Freshwater Wetlands Act will no longer rely on state freshwater wetland maps to determine jurisdiction. The state is creating new wetland maps that will be for educational purposes.

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[148] *Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's.* Huffman & Associates, Inc. 2000. Prepared for DEC. Available: http://www.dec.ny.gov/docs/wildlife_pdf/wetstattrend2.pdf

[149] Article 24 of the Environmental Conservation Law Title 23 of Article 71. "Freshwater Wetlands" 1997. Available: https://www.dec.ny.gov/docs/wildlife_pdf/wetart24a.pdf

[150] NYS DEC "Freshwater Wetlands Mapping" https://www.dec.ny.gov/lands/5124.html

In 2028, the size threshold for regulated wetlands becomes 7.4 acres (down from 12.4 acres). Any freshwater wetland of 7.4 acres or larger will be regulated by the state.

Wetlands smaller than 7.4 acres in size will be regulated if they have unusual importance, defined as a freshwater wetland, regardless of size, that possesses certain characteristics, as determined by the NYS Department of Environmental Conservation. Characteristics include:

1. in a watershed with significant flooding,
2. in an urban area,
3. supports rare plants
4. habitat for the essential behavior of endangered, threatened, special concern, species of greatest conservation need,
5. class 1 wetland,
6. previously designated a wetland of Unusual Local Importance (ULI),
7. productive vernal pools,
8. wetlands in floodways,
9. previously mapped wetlands,
10. wetlands of regional or local significance, or significant for protecting the state's water quality.

DEC is beginning the process of developing the regulations to carry out the updated law.

Photo 9. Pond and hillside, Bontecou Road, Washington (Andrew Heaney)

Local Law

Town of Washington Zoning Ordinance Section 396 Wetlands and Watercourse Law creates a permit process for activities in all wetlands larger than a quarter acre. All wetlands between 1/4-one acre have an additional fifty-foot buffer of regulated area, and for wetlands greater than one acre, the regulated area is within one hundred feet of the wetland.

Chapter 5: Biodiversity

Biodiversity (from "biological diversity") refers to the variety of life on Earth at all its levels, from genes to ecosystems.

> "The concept of biodiversity, or biological diversity, encompasses all of life and its processes, including ecosystems, biological communities, populations, species, and genes, as well as their interactions with each other and with the non-biological components of their environment, such as soil, water, air, and sunlight. Protecting native biodiversity is an important component of any effort to maintain healthy, functioning ecosystems that sustain the human community and the living world around us."[151]

This chapter begins by describing the ecological context of Washington and Millbrook and areas that have been identified as important for biodiversity from a regional perspective. It then provides information about habitats that have been mapped in the Town and Village, some of the species of plants and animals recorded locally, and invasive species common in the Hudson Valley. It includes the following maps:

- Regional Forests (Map 13)
- Habitats (Maps 14 and 14b)
- Large Forests (Map 15)
- Stream Habitats (Map 16)
- Important Biodiversity Areas (Map 17)

Information about biodiversity, such as what species of plants or animals occur in a particular location, is limited and incomplete. The areas and features shown on the maps and described in this report are not the only places that are important for biodiversity.

Ecological context

Hudson River Estuary Watershed

The Village and most of the Town are part of the Hudson River Estuary watershed, an area encompassing fifteen New York State counties bordering the Hudson River Estuary[152] from the federal dam at Troy to the river's confluence with the ocean. "The entire Hudson River Estuary corridor is a significant biodiversity area within the context of New York State and the New England and mid-Atlantic portions of the U.S."[153] While it accounts for 13.5 percent of the total

[151] Tollefson and Stevens, 2004, pg. 6

[152] An estuary is a partially enclosed body of water, and its surrounding coastal habitats, where saltwater from the ocean mixes with fresh water from rivers or streams.

[153] Penhollow, M.G., P.G. Jensen and L.A. Zucker. *Hudson River Estuary Wildlife and Habitat Conservation Framework: An Approach for Conserving Biodiversity in the Hudson River Estuary Corridor.* New York Cooperative Fish and Wildlife Research Unit, Cornell University and DEC, Hudson River Estuary Program,

land area of the state, the Hudson Valley contains nearly 85 percent of the bird, mammal, amphibian, and reptile species found in New York.[154] The streams that flow through Washington and Millbrook flow to the Hudson River and help support important coastal habitats downstream.

Wappinger Creek – Significant Coastal Fish and Wildlife Habitat

The tidal portion of Wappinger Creek, from where it meets the Hudson to the first dam in Wappingers, is designated a Significant Coastal Fish and Wildlife Habitat. Conditions in the watershed of the East Branch of Wappingers Creek in Washington and Millbrook, support the habitats in the tidal portion downstream.[155]

Harlem Valley Calcareous Wetland Significant Biodiversity Areas (SBA)

The southeast corner of Washington is part of the Harlem Valley Calcareous Wetlands Significant Biodiversity Area.[156] The *Hudson River Estuary Wildlife and Habitat Conservation Framework*[157] describes key plant and animal habitats in the estuary watershed and highlights "Significant Biodiversity Areas," areas with a high concentration of biodiversity or unusual ecological features. Calcareous means rich in calcium, and the presence of this mineral in soils and waters often supports unusual biological communities and rare species. These conditions are limited in the Hudson Valley. Wetland communities in the Harlem Valley Calcareous SBA include red maple-hardwood swamp, floodplain forest, fens, and shallow emergent marsh. High quality examples of these habitats support numerous wetland-dependent species. Some of the best bog turtle habitat in the Hudson River Valley is found in this area.

Regional Forests (Map 13)

The Nature Conservancy (TNC) and New York Natural Heritage Program (NYNHP) have identified "matrix forests," those large enough to withstand major natural disturbances, maintain important ecological processes, and support populations of forest-interior wildlife and plants.[158] The matrix forests are some of the largest intact areas of forest in northeastern North America, and are considered globally significant. "Forest linkage zones" are intact natural corridors that connect the matrix forests. A linkage zone is shown on Map 13 in the Towns of Clinton, Hyde Park, Rhinebeck, and Stanford, shaded light green. It is considered a linkage between a matrix forest west of the Hudson River in Esopus to another surrounding Mount Washington in Massachusetts.

The Regional Forests Map shows only matrix forests and linkages; for other forests, see the maps

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Ithaca, NY, 2006.

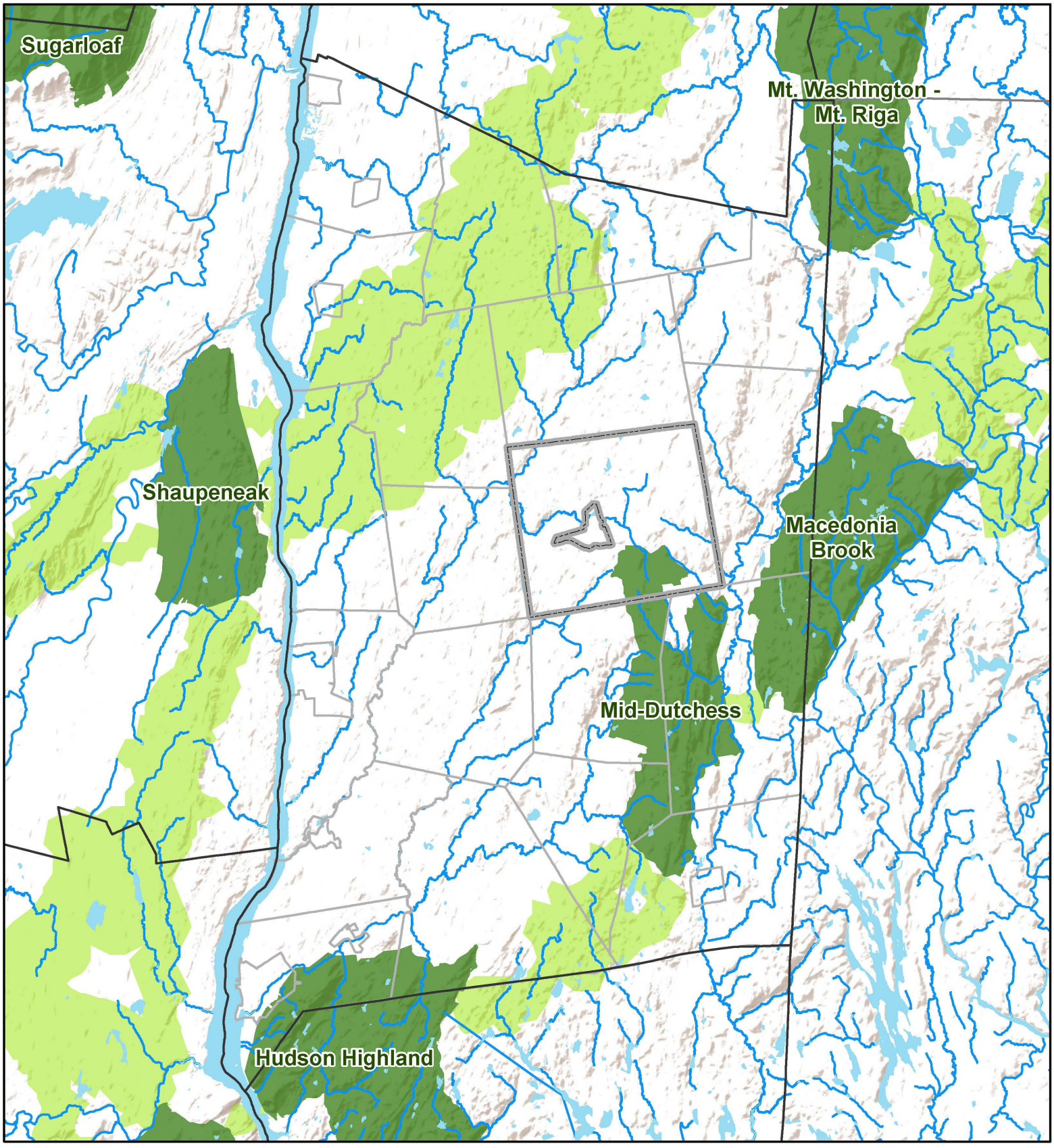
[154] Ibid.

[155] *Coastal Fish and Wildlife Rating Form: Wappinger Creek*, NYS DOS, Albany, NY, revised 2012.

[156] The designation Significant Biodiversity Area does not have any regulatory implications. It is for planning purposes only.

[157l] Penhollow, et al., 2006

[158] Anderson, M. and S. Bernstein (editors). *Planning methods for ecoregional targets: Matrix forming ecosystems.* The Nature Conservancy, Conservation Science Support, Northeast & Caribbean Division, 2003, Boston, MA.



Washington Boundary
Municipal Boundary
Matrix Forest Block
Waterbody
Stream
Forest Linkage Zone

0 5 10 Miles

1:350,000

The Dutchess County Natural Resources Inventory (NRI) Technical Assistance Project is a partnership among the Town of Clinton, the Town of Washington, the Village of Millbrook, Cornell Cooperative Extension of Dutchess County, and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

Town of Washington

Including Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

13. Regional Forests

Prepared by: CCEDC GIS Lab, 2023

WARNING: This map is not a substitute for land surveys or legal documents.
No accuracy or completeness guarantee is implied or intended.

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Streams and Waterbodies: National Hydrography Dataset
Matrix Forest Blocks & Linkages: The Nature Conservancy & NY Natural Heritage Program, 2006

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension
Dutchess County

of Large Forests (15) and Habitats (14). Connected forests allow a wide range of wildlife to move safely to find mates and the resources they need. Forest linkages such as these may be vital to the ability of many species to migrate as climate changes.

Forests in southern Washington, east of Overlook Road and west of Mutton Hollow Road in the area of Chestnut Ridge, are part of the Mid-Dutchess matrix forest block which totals approximately 28,000 acres. This is shown in dark green on the Regional Forests Map. Within this matrix forest, there are three distinct patches of forest in the Town, two with core areas of approximately 500 acres in size, and one that extends into Union Vale of over 1,000 acres of core forest. Core forests are shown on Map 15: Large Forests.

Habitats (Maps 14 and 14b)

A habitat is the place where a plant, animal, or other organism lives. Habitat can also be defined as the place where a biological community - an interacting group of various living things in a common location - occurs. Habitats are an appropriate feature to include in local planning: they are readily identifiable, and thus easy to incorporate into planning and decision making. Habitats must be considered not as discrete entities, but as parts of larger, interconnected systems. Many species use multiple habitats. Habitats in proximity may be considered together, as a habitat complex. Washington and Millbrook have some types of habitats that are common and widespread, others are less common, and some are rare.

The Habitats Maps (14 and 14b) display the habitats mapped by scientists with Hudsonia. Jenny Tollefson and Gretchen Stevens analyzed remote images (such as aerial photos) and verified the habitats they identified through numerous field visits, publishing the report *Significant Habitats in the Town of Washington, Dutchess County, New York*[159] in 2004. The Habitat Maps are suitable for general land use planning but not appropriate for detailed planning, site design, or for determining state or federal regulatory jurisdiction. Boundaries of all habitats depicted here are approximate. Habitats were mapped based on aerial photographs from 2000; these data remain the best published source of information about habitats throughout the Town and Village. Detailed descriptions of habitats and practices for conserving them are available in the report by Tollefson and Stevens. That report also contains additional maps that are not reproduced here.

There are significant areas in Washington of continuous habitat uninterrupted by developed areas or roads. Within each habitat type, there is great variability in terms of the types of plants and animals (species composition), condition, quality, age, and other features. This report, the *Significant Habitats* report, and other source material can alert residents and others to where habitats occur or are likely to occur in Washington and Millbrook. Often, additional information will be required to support decision-making. Some types of habitats are difficult to identify without verifying them in the field, including crest, ledge, and talus, springs and seeps, intermittent and ephemeral streams, and intermittent woodland pools. In some cases, these habitats may occur in locations that are not shown on the map.

[159] Tollefson and Stevens, 2004

In their work in the Town of Washington, Tollefson and Stevens identified twenty-seven different habitat types considered ecologically important for one or more of the following reasons:

1. Habitats that are rare or declining in the region.
2. Habitats that support rare species and other species of conservation concern.
3. High-quality examples of common habitats (e.g. those that are especially large, isolated from human activities, old, or lacking harmful invasive species).
4. Complexes of connected habitats that, by virtue of their size, composition, or configuration, have significant biodiversity value.
5. Habitat units that provide landscape connections between other important habitat patches.

Brief descriptions of these habitats and their occurrence are described in Tables 10 and 11; more details are provided in the *Significant Habitats* report. Used in combination with the tables that follow, the Habitat map can be used to identify large areas of habitats and the types of habitats that may be impacted by proposed activities or which call for special consideration in project planning.

Upland habitats

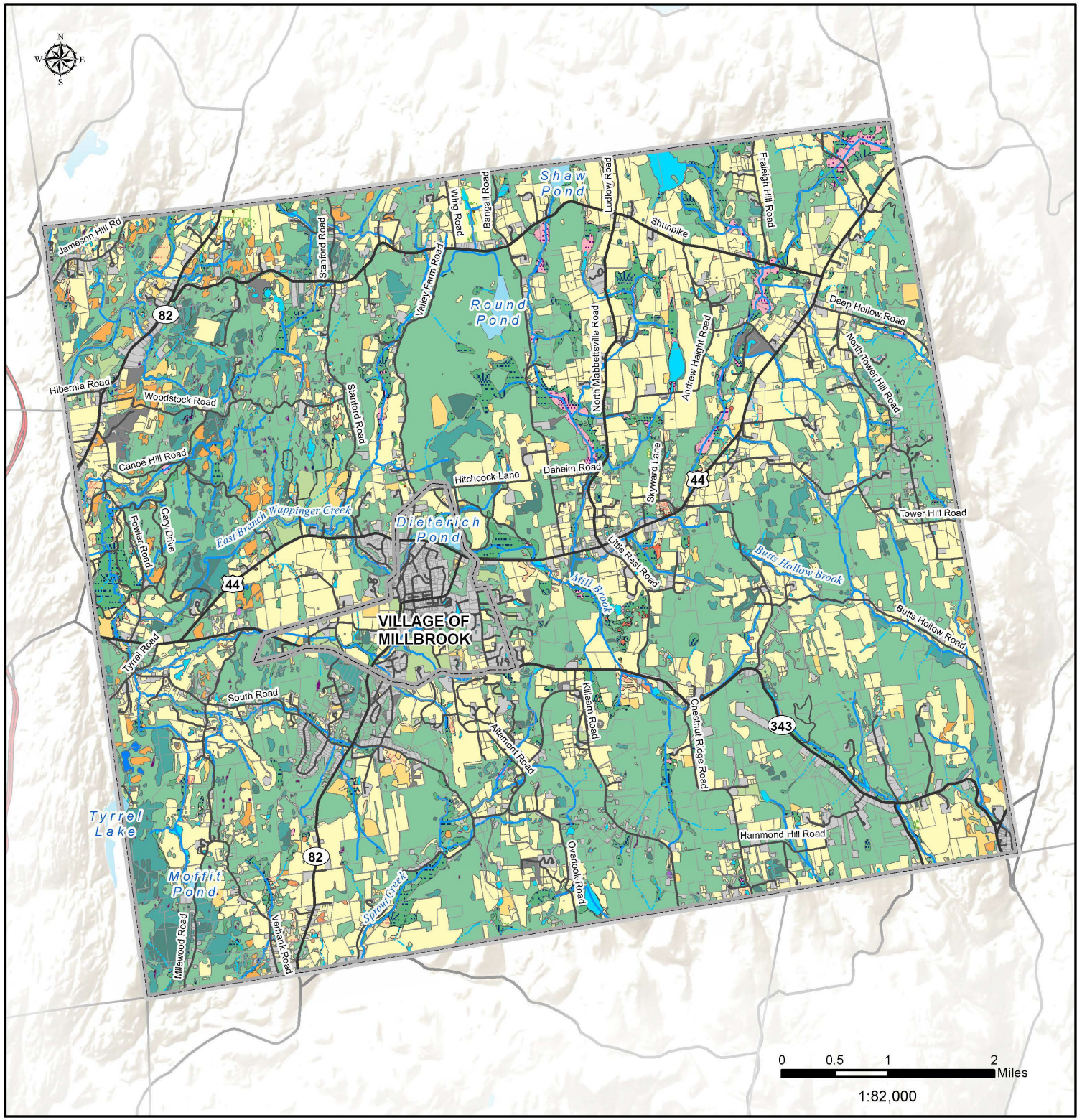
Forests are the most common type of habitat in Washington, with upland meadows such as hayfields, pastures, croplands, and abandoned fields also widespread. Many areas of exposed bedrock in the Town and some areas in the Village provide for crest, ledge, and talus, a habitat that is rarer in the Hudson Valley. Areas under more intense management, or with a history of disturbance such as orchards, plantations, large expanses of lawn, also have habitat value. The descriptions and notes on occurrence of upland habitats in Table 10 are drawn from the *Significant Habitats* report.

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

14. Habitats



Washington Boundary
Municipal Boundary
Parcel Boundary

Taconic State Parkway
Major Road
Local Road

Perennial Stream
Intermittent Stream

Upland Habitats

- Upland Hardwood Forest
- Upland Mixed Forest
- Upland Conifer Forest
- Red Cedar Woodland
- Upland Shrubland
- Upland Meadow
- Orchard/Plantation
- Cultural
- Waste Ground (e.g. gravel mine)
- Developed

Wetland Habitats

- Hardwood & Shrub Swamp
- Acidic Bog
- Intermittent Woodland Pool
- Buttonbush Pool
- Kettle Shrub Pool
- Marsh
- Wet Meadow
- Calcareous Wet Meadow
- Fen
- Circumneutral Bog Lake
- Constructed Pond
- Open Water

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Habitats: Hudsonia, Ltd. 2004

Prepared by: CCEDC GIS Lab, 2023

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

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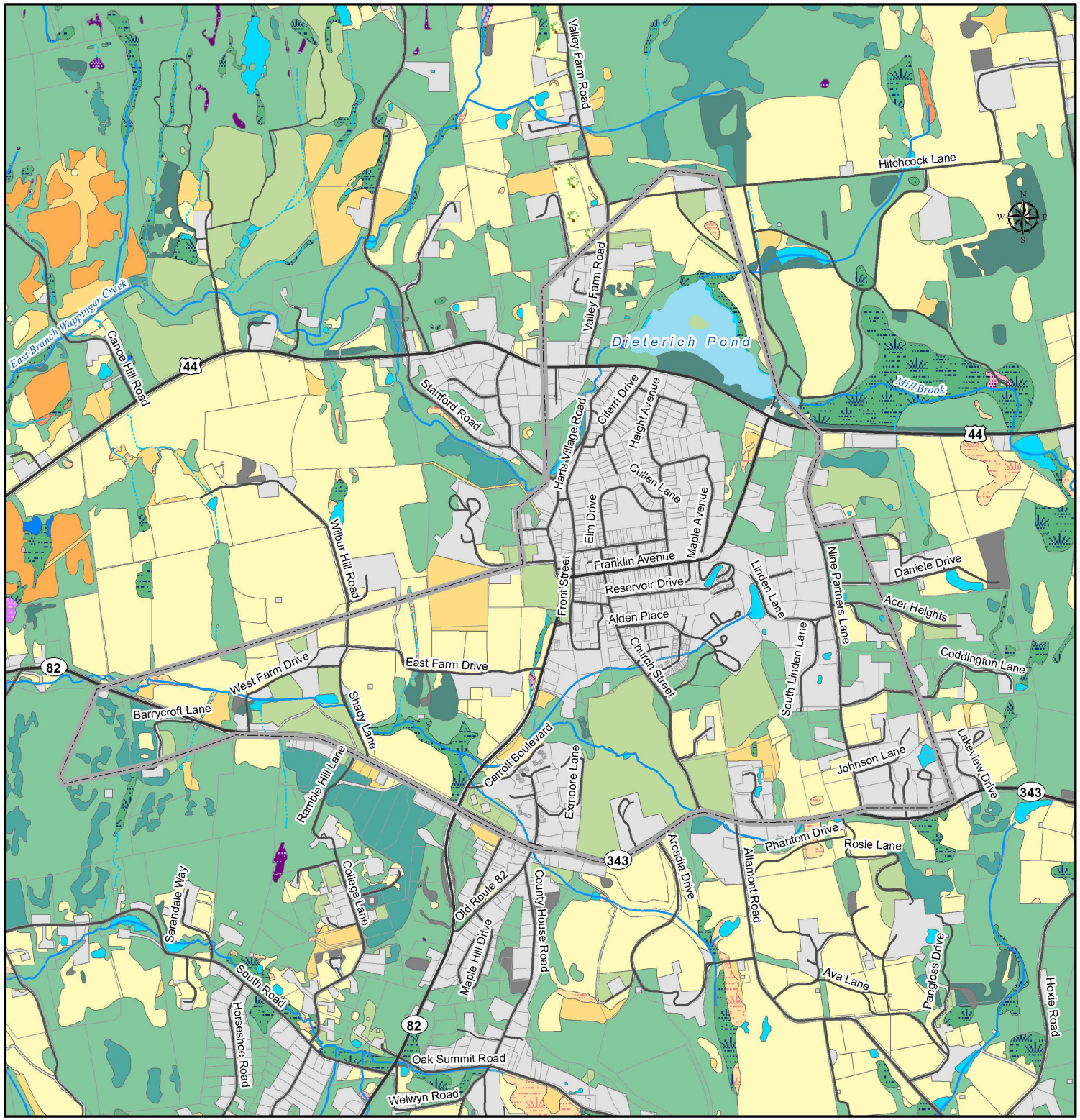

Village of Millbrook

Dutchess County, NY

Natural Resources Inventory - 2023

14b. Habitats

- Millbrook Boundary
- Parcel Boundary
- Perennial Stream
- Major Road
- Local Road
- Intermittent Stream

Upland Habitats

- Upland Hardwood Forest
- Upland Mixed Forest
- Upland Conifer Forest
- Red Cedar Woodland
- Upland Shrubland
- Upland Meadow
- Orchard/Plantation
- Cultural
- Waste Ground (e.g. gravel mine)
- Developed

Wetland Habitats

- Hardwood & Shrub Swamp
- Acidic Bog
- Intermittent Woodland Pool
- Buttonbush Pool
- Kettle Shrub Pool
- Marsh
- Wet Meadow
- Calcareous Wet Meadow
- Fen
- Circumneutral Bog Lake
- Constructed Pond
- Open Water

0 0.25 0.5 Miles

1:24,000

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Habitats: Hudsonia, Ltd. 2004

Prepared by: CCEDC GIS Lab, 2023

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NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Table 10. Upland Habitats in the Town of Washington and Village of Millbrook

Habitat type	Description	Occurrence
hardwood forest	non-wetland forest dominated by hardwood trees (conifers make up < 25% of canopy).	most widespread habitat type in Washington, highly variable
mixed forest	non-wetland forest with a mix of hardwoods and conifers (conifers make up 25-75% of canopy).	found throughout town, rarely > 30 acres
conifer forest	non-wetland forest dominated by conifer trees (>75% of canopy).	found throughout town, usually < 30 acres
red cedar woodland	widely spaced red cedar overstory interspersed with grassy patches	range in size from 1 - 22 acres, concentrated in west Washington; a few high quality, large red cedar woodlands
shrubby oldfield or upland shrubland	open (non-forested) area with shrubs making up > 20% of ground cover.	found throughout town, range in size of less than one acre to >40 acres
upland meadow	open area dominated by herbaceous vegetation (shrubs and saplings < 20% ground cover; may have scattered trees) and either unmowed or mowed up to a few times a year, such as a hayfield; includes pasture, cropland, abandoned fields.	second most common type of habitat in Washington, less intensively managed meadows uncommon
crest/ledge/talus	partially or fully-exposed bedrock on a summit or knoll (crest) or slope (ledge). Talus occurs where rock fragments accumulate at the base of ledges and cliffs.	occur in many parts of Washington, large expanses on knolls and ridges on east and west edges of town, a few locations in Millbrook. For location information, see the *Significant Habitats* report.
orchard/plantation	actively maintained or recently abandoned fruit orchards, tree farms, or plant nurseries.	several Christmas tree farms and a winery
cultural	open area (may have scattered trees) mowed frequently or otherwise managed in an intensive way (lawn, playing field, golf course, garden, park, cemetery).	multiple different kinds of cultural lands
waste ground	land that has been severely altered by human activity but lacks pavement or structures. Gravel mines, quarries, dumps, wetland fill, abandoned lots, or construction sites. Places where soil has been removed, and sometimes replaced with fill.	

Large meadows, shrublands, young forest

Recently disturbed sites, such as hayfields, abandoned farm fields, or forest clearings, can provide important habitat for species that require grassland, shrubland, and young forest habitats. Meadows are the second most extensive type of upland habitat in Washington, and sizeable meadows are found in the Village of Millbrook. Most of the open meadows are managed intensively. Grassland or meadow habitat can support a variety of life, including rare plants, butterflies, reptiles, and birds, in addition to providing agricultural uses and scenic vistas.

Shrublands and young forests are transitional habitats characterized by few or no mature trees, with a diverse mix of shrubs and/or tree saplings, along with openings where grasses and wildflowers grow. They can occur in recently cleared areas and abandoned farmland and are sometimes maintained along utility corridors by cutting or herbicides.

These habitats are important for many wildlife species declining throughout the region because former agricultural areas have grown into forests, and natural forest disturbances that trigger young forest growth, such as fires, have been suppressed. Records of breeding birds suggest that valuable meadows, shrublands, and young forests occur in Washington. The quantity and quality of meadows and other open habitats for wildlife have rapidly decreased in the Northeast during the last century due to increased human population, changes in agricultural technology, and abandonment of family farms. This continuing trend threatens populations of birds that have adapted to the agricultural landscape.

The 2000-2005 NYS Breeding Bird Atlas documented breeding by four grassland bird species of conservation concern in the Washington and Millbrook area, including Species of Greatest Conservation Need. Records from the Breeding Bird Atlas support the presence of 12 species of conservation concern that prefer young forest and shrubland habitat.

Meadows, pasture, shrubland, and young forest are transitional and relatively short-lived. They typically require periodic maintenance (e.g. mowing, grazing, flooding, or burning) to avoid becoming more densely vegetated and eventually becoming forest.

Photo 10. Pond with reeds, Bontecou Road (Andrew Heaney)

Wetland habitats

Wetlands are described in Chapter 4 and shown on Map 12. Table 11 provides information about the types and occurrence of wetlands in Washington and Millbrook, drawing from the *Significant Habitats* report.

The most extensive type of wetland is hardwood and shrub swamp, with some large

examples. Many wetlands are much smaller, less than an acre to a few acres in size. Three rare types of wetlands - a circumneutral bog lake, shrub pools, and an acidic bog occur in Washington. Of open water bodies, the majority are constructed ponds, and natural lakes or ponds with undeveloped shorelines are rare. A large number (almost 200) of intermittent woodland pools have been identified. Several springs and seeps have been mapped, and there are likely more.

Table 11. Wetland Habitats in the Town of Washington and Village of Millbrook.

Habitat Type	**Description**	**Occurrence**
hardwood & shrub swamp	wetland (identified by predominance of hydrophytic vegetation) dominated by trees and/or shrubs. (conifers make up < 25% of canopy)	most extensive wetland type in Washington; range from <1 to 75 acres in size; two calcareous swamps were mapped in the northeast corner of town
acidic bog	wetland perennially wet, very nutrient poor, dominated by shrubs of the heath family and carpets or floating mats of peat mosses and other vegetation	the only known occurrence of an acidic bog in the town is the constructed Fern Glen bog on the grounds of the Cary Institute of Ecosystem Studies
intermittent woodland pool	small, isolated, seasonally flooded pools, generally with an open basin, surrounded by forest; provide crucial nursery and breeding habitat for a group of forest amphibians which use the pools for breeding	nearly 200 intermittent woodland pools have been mapped in Washington.
buttonbush pool/kettle shrub pool	seasonally or permanently flooded shrubby pools dominated by buttonbush with kettle shrub pools located in glacial kettles; part of the critical habitat of the Blanding's turtle (NY Threatened, NY Species of Greatest Conservation Need – high priority)	one buttonbush pool and two kettle shrub pools have been mapped in Washington
marsh	wetland dominated by hydrophytic herbaceous (non-woody) vegetation that stays saturated/flooded most of the time	most are less than 3 acres and continuous with hardwood and shrub swamps and open water. A marsh in the Mill Brook wetland complex comprised nearly 100 acres
wet meadow; calcareous wet meadow	area of seasonally saturated or flooded soils dominated by hydrophytic herbaceous vegetation; calcareous wet meadow…a wet meadow strongly influenced by calcareous groundwater or soils favoring establishment of a calcicolous plant community. calcareous wet meadows occur adjacent to fens, they should be considered potential habitat for the bog turtle (US Threatened, NY Endangered, Species of Greatest Conservation Need-high priority)	widely distributed throughout Washington; often part of meadows and shrubby old fields; >30 calcareous wet meadows mapped in Washington
fen	shrub and herb dominated wetland fed by calcareous groundwater; any high-quality fen could be habitat for bog turtle	26 fens in Washington; zero mapped in Millbrook

Habitat Type	Description	Occurrence
circumneutral bog lake	spring-fed, calcareous waterbody with floating peat mats supporting vegetation of acidic bogs and surrounding vegetation typical of calcareous marshes	Round Pond is the only circumneutral bog lake documented in the town.
constructed pond	human created body of water with a mostly managed shoreline (bordered by developed or cultural areas)	most of the nearly 500 open water bodies in town are constructed
open water	body of water (natural or manmade) with a mostly undeveloped shoreline	approximately 30, tend to be smaller than 2 acres
spring/seep	places where groundwater discharges to the surface at a single point (spring) or diffusely (seep)	likely numerous but only a few have been mapped
intermittent stream	stream that has flow at least part of the year, including man-made ditches	33 miles
perennial stream	stream that generally flows year-round	107 miles

Large forests (Map 15)

Forests vary in their ability to support native species and withstand or recover from external stressors such as fragmentation, severe storms, and invasive species. Large forests are a conservation priority for the Hudson Valley region. The Hudson Valley Forest Condition Index[160] provides information about the relative condition of patches of forest of 100 acres and larger. The Index incorporates a variety of factors relating to health, condition, and habitats (such as whether the forest patch includes a high percentage of wetlands or the presence of brook trout in streams in the forest).

The Town of Washington has forests ranking at the high end (95-99 percentile, which equals the top 2-5 percent) and the low end (0-20 percentile), relative to all the forests in the Hudson Valley. Each patch shown on the Large Forests Map (Map 15) represents a continuous patch of forest unfragmented by major roads, railroads, and non-forest habitat, with a minimum forest size of 100 acres. Each patch is color coded based on its relative score. High quality forests are good potential candidates for protection or other conservation efforts.

Core forests

Core forests are interior forest areas surrounded by at least a 100-meter-wide buffer of edge forest habitat.[161] Interior forest areas support a unique array of plants and animals that are easily

[160] Conley, A. K., E. Cheadle, and T. G. Howard. *Updating Forest Patches and a Patch Assessment for the Hudson Valley.* New York Natural Heritage Program, State University of New York College of Environmental Science and Forestry, 2019, Albany, NY. www.nynhp.org/forest-patches

[161] Core forests were mapped using the large forest patches identified for the Forest Condition Index, described earlier in this section.

disturbed by human activity generally associated with more open habitats (e.g. agricultural fields, meadow, roads, and developed areas). Core forest is especially important for sensitive wildlife including many forest songbirds, which avoid nesting near areas with human disturbance.

Although the value of individual forest patches for wildlife depends on landscape context and other factors, core forests that are at least 500 acres in size are more likely to provide enough suitable habitat to support a diversity of interior forest species. Avoiding further fragmentation of core forests will help conserve the integrity and habitat value of ecologically significant forest patches.

Large core forests can be found throughout Washington, and further details are available by viewing the Forest Condition Index layer in the Hudson Valley Natural Resources Mapper: [162]

- In the southwest corner of town, extending into Pleasant Valley and LaGrange, a large intact forest of 3,150 acres scores in the highest 5 percent of forest cores in the Hudson Valley. In Pleasant Valley, DEC owns 917 acres of this forest patch, and manages it as the Taconic Hereford Multiple Use Area. This forest is notable for its large size, having a very large intact core, and being in an area where species encounter relatively few barriers to movement (roads, agriculture, or developed areas).
- Another forest scores in the top 10 percent: located east of Valley Farm Road, it includes Round Pond and a stream that flows to Millbrook. It is notable among forests in the valley for having a high percentage of intact core area, low density of buildings, and relatively low stressors to forest health (such as roads and impervious surfaces).
- As mentioned earlier in the chapter, forests in southern Washington, east of Overlook Road and west of Mutton Hollow Road, in the area of Chestnut Ridge, are part of the Mid-Dutchess matrix forest block which totals approximately 28,000 acres. There are three distinct patches of matrix forest in the Town, two with core areas of approximately 500 acres in size, and one that extends into Union Vale of over 1,000 acres of core forest (and that ranks in the 80-90 percentile in the Forest Condition Index).
- The Village of Millbrook has few forests greater than 100-acres, and those forests extend beyond the Village boundary. Millbrook has very little core forest.

All or nearly all the forests in Washington and Millbrook were cleared or logged at one time. In the *Significant Habitats* report, Tollefson and Stevens describe two distinctly older forests in the Town, and there may be others that have not been documented:

- "At the Millbrook School 'ski hill,' a 100-150-year-old forest with trees in the range of 12-25 inches in diameter (30-65 cm) was dominated by oaks and sugar maple with shagbark hickory, pignut hickory, American beech, and yellow birch (Kiviat 1994)."
- "On the west side of town, a cove on the Rockefeller University property contained a mature forest with large eastern hemlock, sugar maple, and tulip trees."[163]

[162] Hudson Valley Natural Resources Mapper. Accessed June 23, 2023. https://gisservices.dec.ny.gov/gis/hvnrm/
[163] Tollefson and Stevens, 2004

Wildlife records reflect the abundance of high-quality forest interior habitat in Washington. The records of scarlet tanagers and wood thrush breeding suggest large forests are offering quality interior habitat.

There are major threats to the health of forests in this region, including pests/pathogens, invasive species, and the over-abundant white-tailed deer populations. For example, Hudson Valley forests have been significantly impacted in the recent decades by the spread of hemlock wooly adelgid and emerald ash borer, which are expected to eventually kill most large eastern hemlock and white ash trees in the region. Deer browse preferences often facilitate the competitive edge of invasive plant species over native tree and understory regeneration. The resulting decline in forest understory development has cascading effects on other wildlife populations and threatens the long-term regeneration of forests.

Stream Habitats (Map 16)

Streams, their floodplains, adjacent wetlands, and other "riparian" or streamside habitats provide important ecosystem services including clean water, flood management, and recreational opportunities like fishing and kayaking. In addition, they provide some of the most productive wildlife habitat in the region. The Stream Habitats Map shows the best available mapping for perennial and intermittent streams and riparian areas. All streams are important for biodiversity. This report highlights some streams or parts of streams that are known to be important for species of conservation concern; however, other streams are also important for biodiversity, and are part of the interconnected freshwater system.

The beginnings of streams, referred to as headwaters, are often intermittent or ephemeral. Intermittent streams only flow during certain times of the year, fed by groundwater and runoff from rainfall and snowmelt. Some headwaters are ephemeral, only flowing after rainfall. Perennial streams and rivers flow year-round, with most water fed by smaller upstream intermittent and ephemeral streams or groundwater. The vast network of intermittent streams in the landscape provides many of the same functions and values as larger perennial streams. Intermittent streams provide seasonal refuge and spawning habitat for small fish and provide habitat for aquatic insects and

Stream habitats

Streams share some common habitat features. Many streams have alternating deep and shallow areas called pools and riffles. The deep, slow water in pools provides shelter and resting areas for fish. Shallow, swift water in the riffles adds oxygen to the water and provides fish with spawning and feeding areas. The fast-moving water between riffle areas and pools is called a run. Some streams also form natural meanders or curves that slow down the water and absorb energy. These curves produce erosion such as cut banks and depositional areas like gravel bars where sediments are deposited. Large woody material such as logs, trees, and branches, is an important component of in-stream habitat that supports the capture of sediment, gravel, and organic matter, prevents streambank erosion, and decreases water temperature – all factors that enhance habitat for fish and other organisms.

other macroinvertebrates that drift downstream to feed larger fish and organisms. They also support nutrient cycling and flood control processes.

The Stream Habitats Map includes many intermittent streams mapped for the *Significant Habitats* study, but it is likely that some intermittent streams remain unmapped.

Significant aquatic habitat areas in Washington and Millbrook include trout and trout spawning waters, and streams important to migratory fish.

Trout and trout spawning waters

Trout are valuable indicators of healthy aquatic ecosystems because of their high water quality and habitat requirements. They typically inhabit clear, cool, well-oxygenated streams and lakes and depend on clean gravel areas for spawning. DEC's Water Quality Standards provide a starting point for identifying trout or trout-spawning stream habitat and suggest there is coldwater habitat suitable for trout. The reach of the Wappinger Creek in the Town has suitable waters for trout spawning and is also an important area for migratory fish. The East Wappinger Creek also has reaches that are suitable for brook trout habitat and is an important stream for migratory fish. See Water Quality Classifications and Assessment for more information.

Important areas for American eel

NYNHP identifies areas along Crum Elbow Creek and Wappinger Creek as important for migratory fish (based on DEC Bureau of Fisheries surveys and other studies completed in New York since 1980). These data highlight stream reaches providing important passage for American eel traveling between ocean and freshwater habitats. Routes were modeled from tributary stream reaches with documented eel presence to the Atlantic Ocean, where this species spawns. Important areas near the mouth of Hudson River tributaries also include other migratory fish species.

Dams and culverts

The quality of stream habitats is reduced due to the presence of barriers such as dams and poorly designed or installed culverts.[164] There are 30 dams recorded within the Town and Village.[165] Information about each dam is available on the DEC info Locator including hazard descriptions and other select attributes.[166] The Hudson River Estuary Program has funded the planning, engineering and implementation of dam removal and culvert replacement projects in the Hudson River Estuary watershed to restore habitat connectivity and stream restoration. Dam locations in the Stream Habitats Map are provided by the New York State Inventory of Dams.[167] Assessments by the DEC Hudson River Estuary Program in trial watersheds indicate that two to three times as

[164] See *Aquatic Connectivity Identifying Barriers to Organisms and Hazards to Communities* for more information. Available.: https://www.dec.ny.gov/docs/remediation_hudson_pdf/culvertfactsheet19.pdf

[165] See Dam Inventory Layer on the Hudson Valley Natural Resource Mapper https://gisservices.dec.ny.gov/gis/hvnrm/

[166] See more about Dam Safety: https://www.dec.ny.gov/lands/4991.html

[167] While the DEC tries to maintain an accurate inventory, this data should not be relied upon for emergency response decision-making.

many barriers exist than are logged in the NYS Inventory of Dams.

Poorly designed and undersized culverts are barriers to aquatic organisms and hazards to communities during storms. Streams are linear habitats for aquatic and semi-aquatic species such as American eel, herring, stream salamanders, turtles, and crayfish. Road crossings can fragment streams into small pieces, preventing organisms from accessing critical habitats. Culverts also may be infrastructure liabilities and flooding hazards for communities. During storms, undersized or improperly installed culverts can become clogged with debris or overwhelmed, leading to road flooding, stream bank erosion, or even washout of the whole road.
The Town and Village have at least 44 documented culverts according to the data provided from the North Atlantic Aquatic Connectivity Collaborative (NAACC) a network focused on improving aquatic habitat connectivity across the Northeast region. Culverts were assigned a passability score that describes how much of a barrier the structure is to aquatic organisms, ranging from severe barrier to no barrier. Map 16: Stream Habitats displays the culvert scores as small colored circles, with red indicating severe barriers, and blue indicating no barrier.

Photo 11. Culvert on Stanford Road, Washington (Beatrice Moritz)

Riparian areas

Riparian areas are areas adjacent to perennial streams, ponds, wetlands, and other waterbodies and include streambanks and floodplains, shown in green on Map 16, Stream Habitats.

Riparian corridors support unique, diverse habitats and serve as wildlife corridors. Forested riparian buffers provide organic matter that support the in-stream food web and shade that keeps water cool. Riparian areas are important travel ways for animals that move throughout our landscape; undeveloped riparian areas offer paths in areas otherwise unfavorable to their movement. Beyond the stream channel and banks, riparian areas and floodplains support unique soil and vegetation that are strongly influenced by proximity to water and frequent flooding. Riparian trees are especially important for providing shade, bank stabilization, woody debris, and

nutrients that benefit fish and other aquatic life. When inundated, floodplains also provide important fish breeding and nursery habitat areas. Many other wildlife species also depend on riparian and floodplain habitats and use them as travel corridors.

Floodplain forests

Floodplain forests are a subset of floodplain habitats that host a unique assemblage of plants and animals adapted to regular disturbance. The Hawthorne Valley Farmscape Ecology Program maps and describes these locally-rare habitats in their 2010 report titled, *Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation.*[168] Notable concentrations of these natural floodplains in the Town can be found along the East Branch Wappinger Creek and along Mill Brook. Floodplain forests are shown in forest green on Map 16: Stream Habitats.

Even though the floodplain forests along Wappinger Creek are relatively small and disconnected from each other, Claudia Knab-Vispo and Conrad Vispo report "the sheer length of Wappinger Creek makes it a potential ecological corridor crossing much of the county, and every bit of ancient or recently reforested floodplain forest currently present in this corridor might be particularly valuable because of its role in facilitating the connectedness of a large area."[169]

[168]Knab-Vispo, Claudia, and Conrad Vispo. *Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation.* Hawthorne Valley Farmscape Ecology Program, in cooperation with Hudsonia, Ltd., Ghent, NY, 2010. Available: https://hvfarmscape.org/sites/default/files/fep_floodplain_forest_report_nov_2010.pdf

[169] Ibid.

Town of Washington

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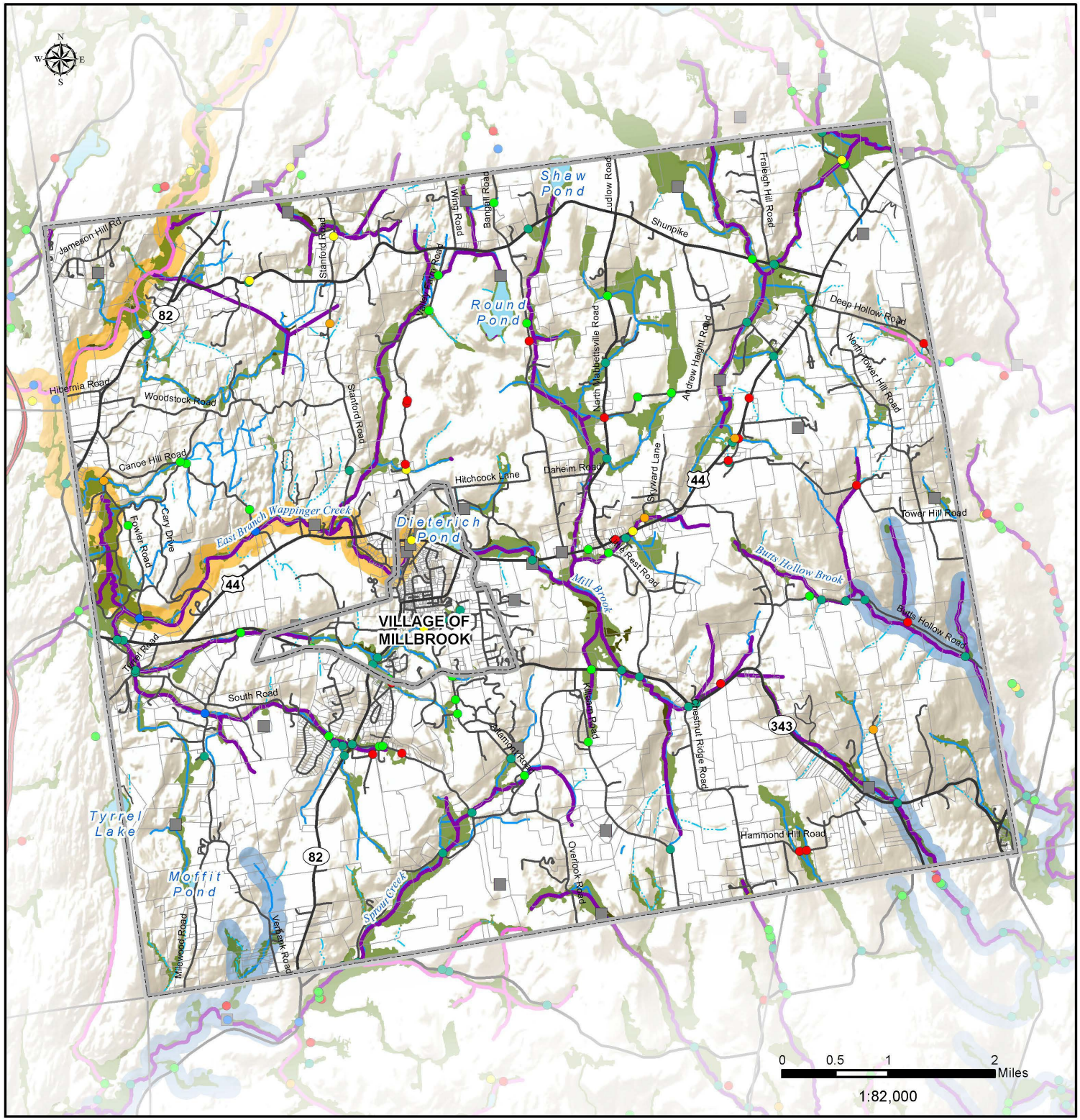
16. Stream Habitats



Washington Boundary
Municipal Boundary
Parcel Boundary
Taconic State Parkway
Major Road
Local Road

Waterbody
Perennial Stream
Intermittent Stream

Culvert Passability Score

- Severe barrier
- Significant barrier
- Moderate barrier
- Minor barrier
- Insignificant barrier
- No barrier
- Dam

Stream Classification Standard

- Trout Habitat
- Trout Spawning

- Floodplain Forest
- Riparian Area
- Important Area for American Eel
- Important Area for Coldwater Fish

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Culverts: NAACC: 2020
Dams: NYSDEC, 2015
Streams & Waterbodies: Hudsonia, Ltd. 2004
Stream Classification Standard: NYSDEC: 2010
Floodplain Forests: Farmscape Ecology Program, 2010
Riparian Areas & Important Areas: New York Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2023

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Technical Assistance Project is a partnership among the Town of Clinton, the Town of Washinton, the Village of Millbrook, Cornell Cooperative Extension of Dutchess County, and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

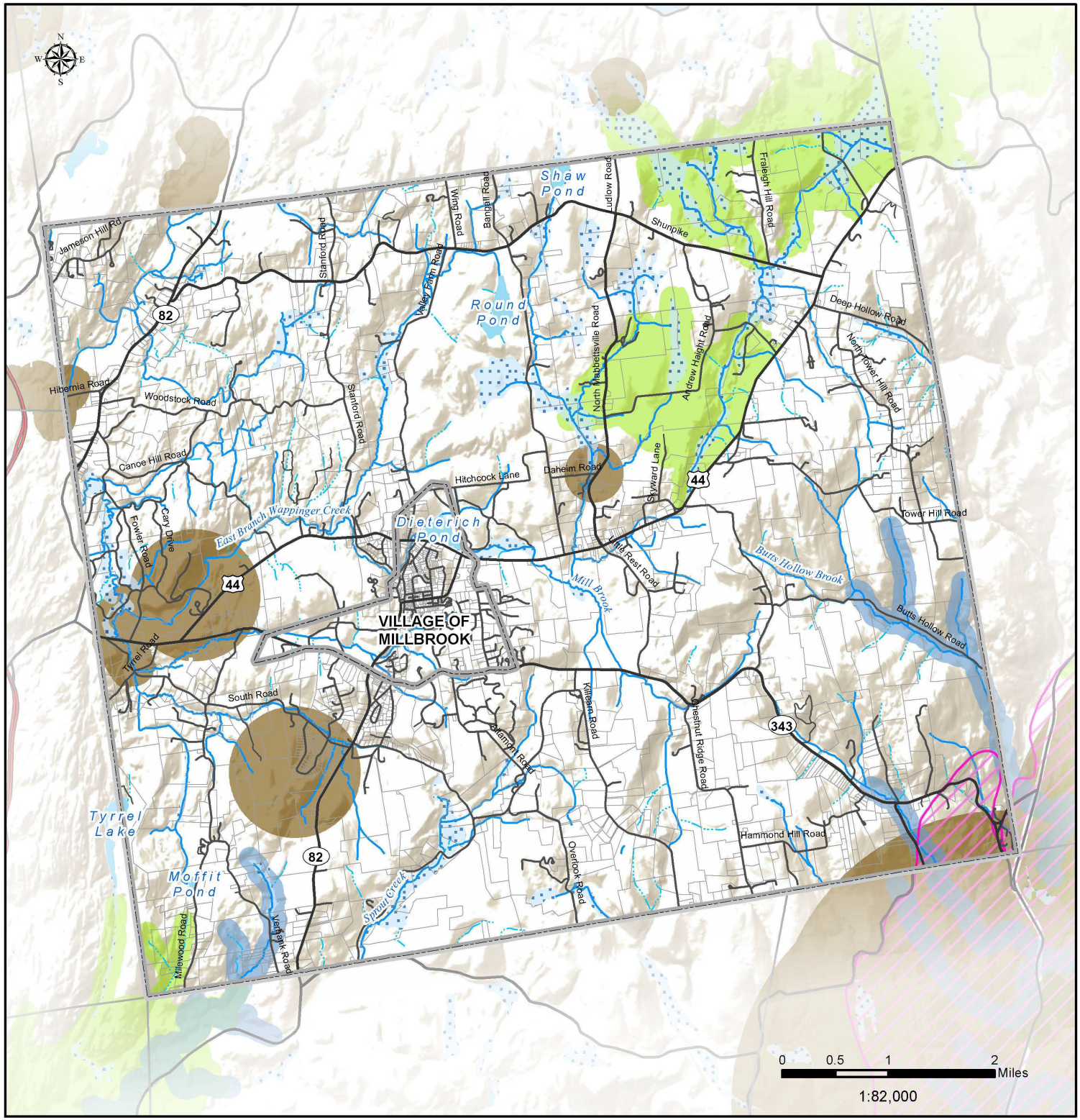
Cornell Cooperative Extension
Dutchess County

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

17. Important Biodiversity Areas



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

- Harlem Valley Calcareous Wetlands Significant Biodiversity Area (SBA)
- Important Coldwater Stream Habitat
- Important Area for Rare Terrestrial Animals
- Important Area for Rare Wetland Animals

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Significant Biodiversity Areas: NYSDEC, 2006
Important Areas: NY Natural Heritage Program, 2018

Prepared by: CCEDC GIS Lab, 2023

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

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NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

Important Biodiversity Areas (Map 17)

Important Areas for rare animals and plants

NYNHP has identified Important Areas for sustaining populations of rare animals and rare plants based on existing records and the species' habitat requirements. These Important Areas, shown on Map 16, Stream Habitats, and Map 17, Important Biodiversity Areas, include the specific locations where species have been observed, as well as areas critical to maintaining the species' habitat. Considering these areas in proactive planning may aid the long-term survival and persistence of species.

Note that the Important Areas are based on the best available information, but do not represent a comprehensive inventory of all resources or habitats. NYNHP is continually adding new information to its databases. Lands outside of the mapped Important Areas may also support rare animals and plants and significant ecosystems or provide ecological benefits.

NYNHP has documented known important areas in Washington for the following species:

- Pied-billed grebe (NY Threatened, Species of Greatest Conservation Need, Audubon Priority Bird List, protected at the federal level by the Migratory Bird Treaty Act) is a rare to uncommon bird, associated with complexes of large wetlands. Wetland alteration and destruction is the greatest threat to Pied-billed grebe, diminishing the available habitat or impacting sources of food.[170]
- Blanding's turtle (NY Threatened, Species of Greatest Conservation Need-high priority) is a long-lived, shy, gentle turtle. Blanding's turtles may move between multiple sites across a large area. Blanding's turtles use a variety of habitats, ponds, shorelines, uplands, and vernal pools. They are vulnerable to vehicle strikes when they move between their hibernation sites near ponds and wetlands and nesting sites in upland areas. According to DEC, "[l]oss of adult females by vehicle strikes is likely the most significant cause of population declines across the species' range."[171] Since Blanding's turtles mature late and their populations depend on adults reproducing throughout their relatively long lifespan, the loss of even a single female can have a major impact on a population."[172] Further information is available in the online conservation guide.[173]
- Bog turtle (US Threatened, NY Endangered, Species of Greatest Conservation Need – high priority) is threatened at the federal level and endangered in New York. It is one of the smallest turtles, with a total length of about 4 inches. It uses open-canopy wet meadows, sedge meadows, and calcareous fens. In the Hudson Valley, they live in wetlands that are isolated as well as wetlands that are part of wetland complexes. The

[170] New York Natural Heritage Program (NYNHP). Online Conservation Guide for *Podilymbus podiceps*. Available from: https://guides.nynhp.org/pied-billed-grebe/. 2023. Accessed July 28, 2023.
[171] DEC "Blanding's Turtle" https://www.dec.ny.gov/animals/7166.html accessed July 28, 2023
[172] Ibid.
[173] Online Conservation Guide for *Emydoidea blandingii*. https://guides.nynhp.org/blandings-turtle/

Hudson Valley is in the northern end of the bog turtle's geographic range. Bog turtles occur in small local populations, and their habitats tend to be small, too, making them very vulnerable. They are threatened by habitat loss, fragmentation, and degradation as well as higher predation by human-subsidized predators, invasive species, collection (for the pet trade), and vehicle strikes.[174]

- Eastern box turtle (NY Special Concern, Species of Greatest Conservation Need – high priority) occurs in a variety of habitats. They primarily use well drained forests and open deciduous forests, but are also found in field edges, shrublands, marshes, bogs, and stream banks. The Lower Hudson Valley is the northern limit of the range of box turtle. Stewardship of species at northern range edges is particularly important as climate changes and suitable habitat shifts north. Box turtles are threatened by habitat loss and fragmentation, vehicle strikes, and the pet trade.[175]

- Wood turtle (NY Special concern, Species of Greatest Conservation Need – high priority) lives primarily along low gradient perennial streams and may spend time in adjacent forests and meadows. Wood turtle occurs along stream corridors and is threatened by habitat loss, stream degradation, nest predation, and the pet trade.[176]

- Timber rattlesnake (New York Threatened, Species of Greatest Conservation Need – high priority) – was once common throughout the state, but for many decades, rattlesnakes were persecuted and killed indiscriminately. Today, they are found in isolated populations in southeastern New York, the Southern Tier and the eastern periphery of the Adirondack Park.[177] They live in forested areas (deciduous or mixed forests) with hilly terrain, den in crevices or talus, and use open areas with rocky surfaces for basking, birthing, and shedding.[178] Timber rattlesnakes are threatened by loss of habitat, habitat fragmentation, road mortality, illegal collecting, persecution, and disease. They migrate from their winter denning sites up to several miles.[179]

Photo 12. Great blue heron (Beatrice Moritz)

- New England cottontail (NY Special Concern, Species of Greatest Conservation Need – high priority) is the only native cottontail east of the Hudson River in New York and its range has been greatly reduced in the state due to forest maturation, habitat loss, and

[174] NYNHP. Online Conservation Guide for *Glyptemys muhlenbergii*. Available from: https://guides.nynhp.org/bog-turtle/ 2023. Accessed July 28, 2023.

[175] NYNHP. Online Conservation Guide for *Glyptemys muhlenbergii*. Available from: https://guides.nynhp.org/bog-turtle/. 2023. Accessed August 1, 2023.

[176] NYNHP, Online Conservation Guide for *Glyptemys insculpta*. Available from: https://guides.nynhp.org/wood-turtle/. 2023 Accessed August 1, 2023.

[177] NYNHP. Online Conservation Guide for *Crotalus horridus*. Available from: https://guides.nynhp.org/timber-rattlesnake/ 2023. Accessed August 1, 2023.

[178] "Timber Rattlesnake" DEC. https://www.dec.ny.gov/animals/7147.html. Accessed August 1, 2023.

[179] NYNHP. Online Conservation Guide for *Crotalus horridus*. Available from: https://guides.nynhp.org/timber-rattlesnake/ 2023. Accessed August 1, 2023.

competition with the more abundant Eastern cottontail. It prefers open woods, disturbed areas, shrubby areas, thickets, and marshes.[180]

- Migratory fish. American eel (NY Species of Greatest Conservation Need, high priority). The portions of the streams in Washington and Millbrook that are known to provide important passage for American eel are shaded pale orange on the Stream Habitats map. The important areas include both upstream habitat and areas adjacent to the stream that support the health and integrity of stream habitats. American eel is in decline throughout much of its range, and though eels are able to bypass certain dams, culverts, and other aquatic barriers, they rely on connected, free-flowing streams to complete their life cycle and return to the Atlantic Ocean to spawn.
- Brook trout, wild (NY Species of Greatest Conservation Need) Brook trout generally live in small-to moderate-sized streams, lakes, and ponds, wherever cool (below 72 degrees Fahrenheit) water is available. They tend to prefer colder water than rainbow and brown trout, and they are often found in the headwaters of streams.[181]

The areas are shown on the maps for categories of animals (aquatic animals, terrestrial animals, migratory fish) rather than species to protect those that may be vulnerable to collecting or other harm. A complete list of animals of conservation concern documented in the Town of Washington is provided in Tables 12 and 13.

Important area for coldwater fish

NYNHP identifies streams with important coldwater habitat likely to support native brook trout and adjacent areas contributing to habitat quality, including Butts Hollow Brook, Stone Church Brook, areas draining to Wells Brook which begins south of the town boundary, and an unnamed stream flowing into Sprout Creek. Note the map does NOT indicate areas with public fishing rights, and many areas are unsuitable for recreational trout fishing due to small fish populations and small fish size.

[180] NYNHP. Online Conservation Guide for *Sylvilagus transitionalis*. 2023. Available from: https://guides.nynhp.org/new-england-cottontail/.

[181] "DEC Fishing for Stream Trout" https://www.dec.ny.gov/outdoor/62477. Accessed August 1, 2023

Wildlife (no map)

Tables 12 and 13 list species of conservation concern that have been recorded in the Town of Washington and the Village of Millbrook. The information comes from a number of sources: the NYNHP biodiversity databases, the NYS Fish Atlas, the 1990-1999 New York Amphibian and Reptile Atlas (NYARA), the 2000-2005 New York State Breeding Bird Atlas (NYBBA), and from staff at the DEC.[182] Species from the NYBBA are included in the table if they were documented in Atlas blocks that are at least 50 percent within the Town.

The tables are not a comprehensive list of species found in Washington and Millbrook. Table 12 only includes species listed in New York as:

Photo 12. Great blue heron (Beatriz Moritz)

- endangered at the state (NY) and/or federal (US) level: any native species in imminent danger of extirpation or extinction in New York State.
- threatened: any native species likely to become an endangered species within the foreseeable future in New York State.
- special concern: Species of special concern warrant attention and consideration but current information, collected by the DEC, does not justify listing these species as either endangered or threatened.
- Species of Greatest Conservation Need (SGCN): SGCN are species identified in the State Wildlife Action Plan that are experiencing some level of population decline, have identified threats that may put them in jeopardy, and need conservation actions to maintain stable population levels or sustain recovery (NYSDEC 2015). High priority

[182] NYNHP databases are available online: https://www.nynhp.org/; 1990-1999 New York Amphibian and Reptile Atlas - https://dec.ny.gov/nature/animals-fish-plants/amphibians-reptiles/herp-atlas-project; 2000-2005 New York State Breeding Bird Atlas: https://extapps.dec.ny.gov/cfmx/extapps/bba/

Photo 13. Bald eagle

Photo 15. Deer, fawn

Photo 14. Snapping turtle

SGCN are species in need of timely management or they are likely to reach critical population levels in New York within 10 years.

Table 13 also includes Hudson River Valley Priority Bird species listed by Audubon New York. Audubon New York identified the Hudson River Valley priority birds by assessing continental, national, and regional bird planning initiatives in addition to state and federal priority designations.

For each species, the table lists generalized primary habitat types, but for conservation and planning purposes, it is important to recognize that many species utilize more than one kind of habitat. More information on rare animals, plants, and ecological communities can be found at http://guides.nynhp.org. Additional rare species and habitats may occur in Washington or Millbrook.

Table 12. Species of Conservation Concern: Mammals, Reptiles, Amphibians, Fish, and Insects documented in the Town of Washington and Village of Millbrook.

Common Name	Scientific Name	General Habitat	Conservation Status				Data Source
			Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
Mammals							
New England Cottontail	*Sylvilagus transitionalis*	shrubland	xx	x			NYNHP
Reptiles							
Blanding's Turtle	*Emydoidea blandingii*	forest, wetland	xx		NY		NYNHP
Bog Turtle	*Glyptemys muhlenbergii*	wetland	xx		US	NY	NYNHP
Snapping Turtle	*Chelydra serpentina*	wetland, stream, forest, lake	x				NYARA
Spotted Turtle	*Clemmys guttata*	wetland	xx	x			NYARA
Wood Turtle	*Clemmys insculpta*	stream	xx	x			NYARA
Amphibians							
Four-toed Salamander	*Hemidactylium scutatum*	wetland	xx				NYARA
Fish							
American Eel	*Anguilla rostrata*	stream	xx				NYDEC
Brook Trout	*Salvelinus fontinalis*	stream	x				NYDEC
Insects							
No Records							

Table 13. Species of Conservation Concern: Birds documented in the Town of Washington and Village of Millbrook.

			Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson Valley Priority	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
American Bittern	*Botaurus lentiginosus*	wetland	x	x	x			NYBBA
American Goldfinch	*Spinus tristis*	young forest, shrubland	x					NYBBA
American Kestrel	*Falco sparverius*	meadow	x	x				NYBBA
American Redstart	*Setophaga ruticilla*	forest	x					NYBBA
American Woodcock	*Scolopax minor*	young forest, shrubland	x	x				NYBBA
Baltimore Oriole	*Icterus galbula*	forest	x					NYBBA
Black-and-white Warbler	*Mniotilta varia*	forest	x					NYBBA
Black-billed Cuckoo	*Coccyzus erythropthalmus*	young forest, shrubland	x	x				NYBBA
Black-throated Blue Warbler	*Dendroica caerulescens*	forest	x	x				NYBBA
Black-throated Green Warbler	*Dendroica virens*	forest	x					NYBBA
Blue-Winged Warbler	*Vermivora pinus*	young forest, shrubland	x	x				NYBBA
Bobolink	*Dolichonyx oryzivorus*	grassland	x	xx				NYBBA
Broad-winged Hawk	*Buteo platypterus*	forest	x					NYBBA
Brown Thrasher	*Toxostoma rufum*	young forest, shrubland	x	xx				NYBBA
Chestnut-sided Warbler	*Setophaga pensylvanica*	young forest, shrubland	x					NYBBA
Chimney Swift	*Chaetura pelagica*	urban	x					NYBBA
Cooper's Hawk	*Accipiter cooperii*	forest	x		x			NYBBA
Eastern Kingbird	*Tyrannus tyrannus*	young forest, shrubland	x					NYBBA
Eastern Meadowlark	*Sturnella magna*	grassland	x	xx				NYBBA

			Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson Valley Priority	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
Eastern Towhee	*Pipilo erythrophthalmus*	young forest, shrubland	x					NYBBA
Eastern Wood-Pewee	*Contopus virens*	forest	x					NYBBA
Field Sparrow	*Spizella pusilla*	young forest, shrubland	x					NYBBA
Least Flycatcher	*Empidonax minimus*	forest	x					NYBBA
Louisiana Waterthrush	*Seiurus motacilla*	forest	x	x				NYBBA
Northern Flicker	*Colaptes auratus*	forest	x					NYBBA
Northern Goshawk	*Accipiter gentilis*	forest	x	x	x			NYBBA
Osprey	*Pandion haliaetus*	open water, wetland	x		x			NYBBA
Pied-billed Grebe	*Podilymbus Podiceps*	wetland	x	x		NY		NYNHP
Prairie Warbler	*Dendroica discolor*	young forest, shrubland	x	x				NYBBA
Purple Finch	*Carpodacus purpureus*	forest	x					NYBBA
Purple Martin	*Progne subis*	wetland	x					NYBBA
Red-shouldered Hawk	*Buteo lineatus*	forest	x	x	x			NYBBA
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	forest	x					NYBBA
Savannah Sparrow	*Passerculus sandwichensis*	grassland	x					NYBBA
Scarlet Tanager	*Piranga olivacea*	forest	x	x				NYBBA
Sharp-shinned Hawk	*Accipter striatus*	forest	x		x			NYBBA
Willow Flycatcher	*Empidonax trailli*	young forest, shrubland	x					NYBBA
Wood Thrush	*Hylocichla mustelina*	forest	x	x				NYBBA
Worm-eating Warbler	*Helmitheros vermivorum*	forest	x	x				NYBBA

			Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson Valley Priority	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
Yellow-billed Cuckoo	*Coccyzus americanus*	young forest, shrubland	x					NYBBA
Yellow-throated Vireo	*Vireo flavifrons*	forest	x					NYBBA

Invasive species

Invasive species are non-native species that can cause harm to the environment, the economy, or human health. Invasive species are one of the greatest threats to New York's biodiversity. They cause or contribute to:

- habitat degradation and loss
- the loss of native fish, wildlife, and tree species
- the loss of recreational opportunities and income
- crop damage and diseases in humans and livestock and
- pose risks to public safety.

The Lower Hudson Partnership for Invasive Species Management provides information about invasive species present in the Hudson Valley, their identification, and management. The species listed on this page are already common in the Hudson Valley. For species considered Tier 1 and 2, the partnership requests people notify them of sightings of these species using a reporting form available online at https://www.lhprism.org/hudson-valley-species.

Table 14. Invasive Species Common in the Hudson Valley

Terrestrial	Aquatic	Forest Pests
Burning bush	Brittle naiad	Asian jumping worms
Common buckthorn	Brazilian elodea-Tier 2	Beech leaf disease
Japanese barberry	Chinese mystery snails	Emerald ash borer
Japanese stiltgrass	Curly-leaf pondweed	Hemlock woody adelgid
Multiflora rose	Eurasian watermilfoil	Spotted lanternfly- Tier 1 species
Oriental bittersweet	Hydrilla-Tier 2	
Tree of heaven	Water chestnut	
Wild parsnip	Zebra mussels	
Wineberry	Fanwort- Tier 2	
Yellow iris		

Recognizing that different invasive species pose different levels and types of threats, and there is variation in how widely established invasive species are in the region, Lower Hudson PRISM has categorized the species present in the lower Hudson Valley. Information about individual species and management recommendations, including non-chemical methods for a number of species, are available online from the New York Invasive Species Info website (https://nyis.info/species-information/), which is maintained by Cornell Cooperative Extension and NOAA SeaGrant.

Chapter 6: Land Use

The Land Use Section is divided into four parts, many with corresponding maps:

- Zoning
- Regulated Facilities
- Agricultural Resources
- Conservation and Public Lands

Zoning

> "The power to enact local laws [including zoning] is granted by the State Constitution. The scope of this power and the procedures for implementing it are set out in the Municipal Home Rule Law. A local law has the same status as an act of the State Legislature."
>
> *- NYS Department of State*

Cities, towns, and villages in New York State are authorized by state statutes to regulate land use by enacting what is commonly referred to as zoning. Zoning governs the way land in a municipality is used and developed with the goal of carrying out the municipality's long-range land use objectives. Zoning regulates property uses and the siting and density of development. Typically, zoning laws divide the community into land use districts and establish building restrictions regarding building height, lot area coverage, the dimension of structures, and other aspects of building and land use. The Town of Washington and Village of Millbrook zoning maps are shown as insets below and are available online.[183,184] Town and Village zoning districts are listed respectively in Table 16 and 17.

Examining the zoning maps in relation to the NRI resource maps can provide insight into potential development scenarios that could affect the existing natural resource base, ecology, and other significant features.

In addition to base zoning districts, the Town and Village have established some overlay zones, which supplement the requirements of the underlying districts. They include the Agricultural Protection and Aquifer Protection Overlay districts in the Town, and the Thorne Center Overlay district in the Village.

The following Town of Washington zoning districts offer some specific natural resource protections:

[183] Town of Washington Zoning Map, 2017, https://www.dutchessny.gov/Departments/Planning/Docs/washington.pdf

[184] Village of Millbrook Zoning Map, 2020, https://www.dutchessny.gov/Departments/Planning/Docs/Millbrook.pdf

Agricultural Protection Overlay District
The purposes of this district include: to preserve agricultural land and working farms; prevent conflicts between incompatible land uses; and maintain the rural, natural, and scenic qualities of the Town, among others. The regulations allow some additional uses and create a special permit process for farmworker housing and agriculture-related service or commercial uses. Conservation Density Subdivisions are encouraged, and a cluster plan may be required for residential subdivisions within this district. Siting standards are also established to maximize the area remaining for agricultural use and to buffer new residences from neighboring agricultural uses.

Aquifer Overlay District
This district is intended to preserve and maintain the quality and quantity of groundwater found in aquifers, and thereby protect this water supply source for the Town. The regulations establish development standards to protect groundwater and restrict certain uses. In addition, actions undertaken within Millbrook's public water supply watershed must comply with any standards, rules, or regulations promulgated by the NYS Commissioner of Health under Section 1100 of the Public Health Law.

Potential Environmental Preservation Districts
Town code includes provisions for the creation of Environmental Preservation Districts, a type of floating district that the Town Board has yet to enact. Floating districts are unmapped overlay zones with defined characteristics and may be created by application to the Town Board. The regulations would require any building permit or other land use permit aside from exempted uses to go through the site plan approval process. The regulations would also establish a list of Type 1 Actions for projects within the districts (requiring a Full Environmental Assessment Form) pursuant to NYS SEQR.

The Town of Washington provides more information on these districts under Article III of the zoning code.[185] The Village of Millbrook does not have any specific natural resource protection districts or overlay zones. Millbrook's zoning code is available in Chapter 230 of village code.[186]

[185] Town of Washington Zoning District Regulations, https://www.washingtonny.org/document-center/building-zoning/town-code/1379-zoning-code-complete-revised-7-22-2022/file.html
[186] Village of Millbrook zoning code, https://ecode360.com/10855096

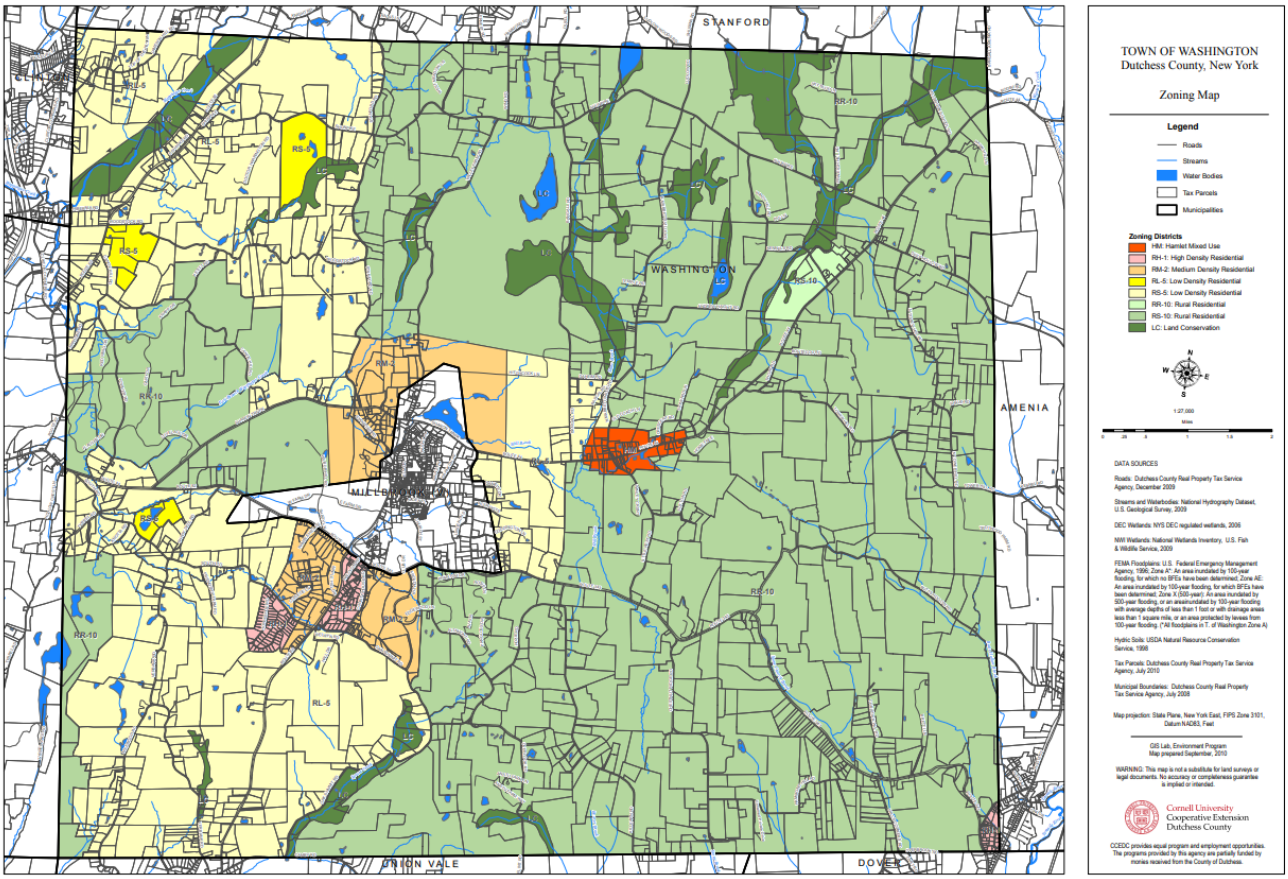

Figure 6. Zoning Map, Town of Washington

Table 15. Zoning Districts in the Town of Washington

Code	**Description**	**Color on Zoning Map**
HM	Hamlet Mixed Use	red-orange
RH-1	High Density Residential	pink
RM-2	Medium Density Residential	pale orange
RL-5 and RS-5	Low Density Residential	yellow and pale yellow
RR-10 and RS-10	Rural Residential	mint green and green
LC	Land Conservation	dark green

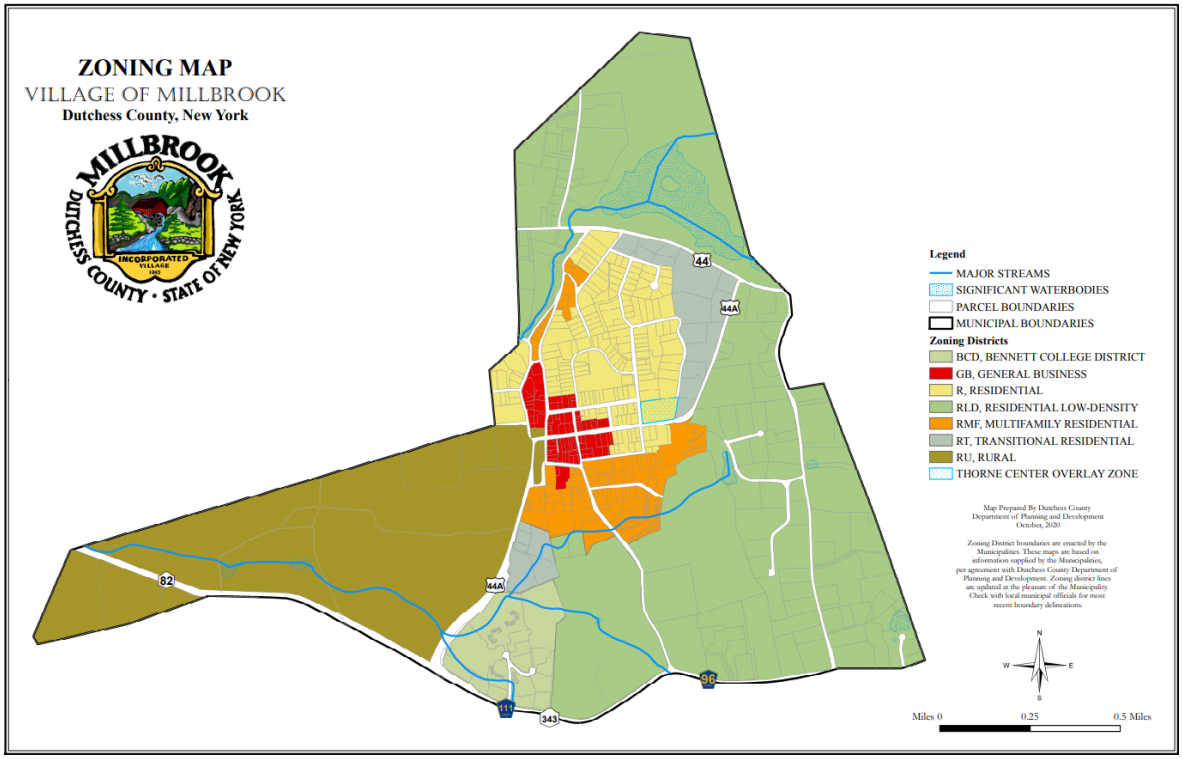

Figure 7. Zoning Map, Village of Millbrook

Table 16. Zoning Districts in the Village of Millbrook

Code	**Description**	**Color on Zoning Map**
BCD	Bennett College District	pale green
GB	General Business	red
R	Residential	yellow-green
RLD	Residential Low-Density	green
RMF	Multifamily Residential	orange
RT	Transitional Residential	gray-green
RU	Rural	olive green

Centers and Greenspaces

The Centers and Greenspaces map (Figure 8) was prepared by Dutchess County as part of a county-wide initiative to promote smart growth principles and avoid strip-and-sprawl development patterns, including:[187]

- Reinforce existing centers and main streets
- Mix uses to promote walking and biking
- Connect major centers with transit services
- Locally identify priority growth areas for close-in expansion and conversion of strip districts or subdivisions into new centers
- Employ a range of protection measures for farmland and natural wildlife areas
- Adopt policies that support agriculture
- Plan for continuous greenspace systems
- Locally identify priority greenspaces for future public or private conservation.

Note that the figure and following descriptions of the centers and greenspaces were developed by Dutchess County in 2015. In the figure, the circles indicate existing centers.

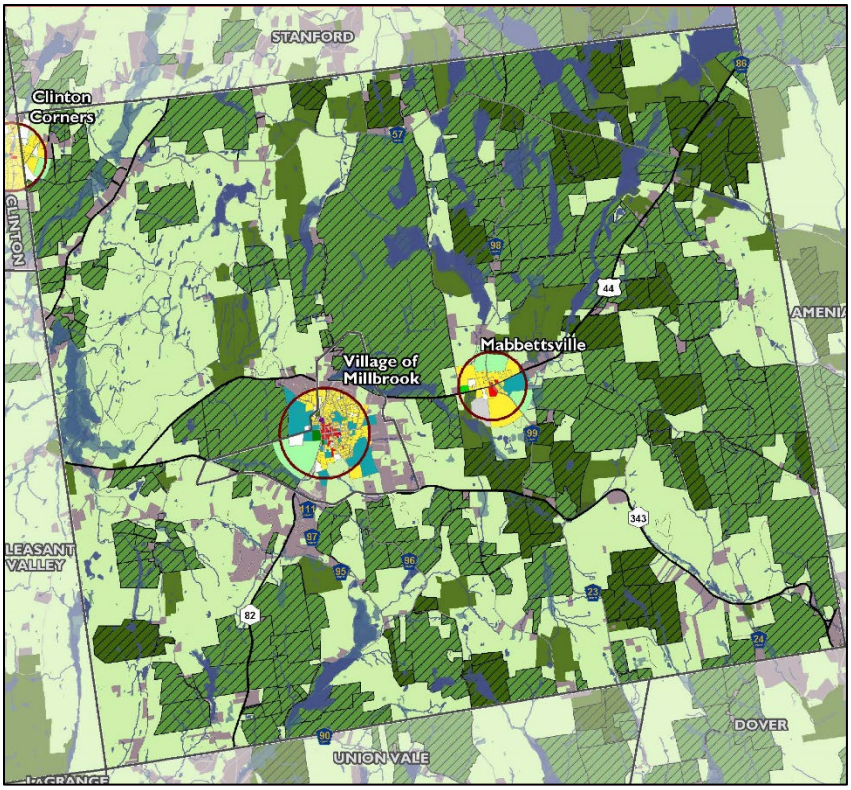

Figure 8. Centers and Greenspaces, Town of Washington and Village of Millbrook. Source: Dutchess County (2015).

[187] "Centers and Greenspaces," Dutchess County, https://www.dutchessny.gov/Departments/Planning/Centers-Greenspaces.htm

Millbrook grew into a village after its railroad station was built in 1870 between the two much earlier settlements of Hart's Village and Mechanic. The station and tracks are now gone, but Millbrook retains its village green at the southern entrance, an inviting main street character, and walkable access to the Town and Village Halls, Library, Post Office, schools, and commercial services. It remains an exemplary village model in many ways, most of all because it has avoided the all-too-typical commercial strip along its entrance road. The Town Comprehensive Plan recommends that any new commercial uses, compact residential development, or affordable housing be placed in the Village to strengthen its primary center and protect the Town's surrounding rural qualities.

Mabbettsville, home to the 29-acre Town Park, is designated as a mixed-use hamlet district in the zoning code. It is intended as an area of mixed residential and non-residential uses in which the historic character is preserved, pedestrian activity is encouraged, and suburban strip shopping plazas are discouraged. The Town Comprehensive Plan proposes no significant changes to existing land uses, settlement patterns, or infrastructure in the Mabbettsville area.

The Centers and Greenspaces map identifies 12 areas of continuous greenspaces with agricultural and natural land over 1,000 acres in size in the Town of Washington. Greenspaces include approximately 11,200 acres of unbuildable area including stream corridors, State and Federal wetlands with their buffers, floodplains, and steep slopes of 20 percent or more. These unbuildable areas may act as biodiversity connectors between greenspaces.

Regulated Facilities

State and federal agencies regulate many types of facilities to maintain environmental quality and public health. The New York State Department of Environmental Conservation (DEC) has created an online web map, the DECinfo Locator, which provides digital access to regularly updated DEC documents and public data about the environmental quality of specific sites. Please refer to the DECinfo Locator to view locations of these regulated facilities in Washington. Understanding the sites of potential contamination in relation to other maps in the Natural Resource Inventory can provide insight into threats (i.e. pollution) to natural resources and other significant features in Washington and Millbrook.

> The DECinfo Locator is an online map that links to DEC databases to share information about environmental quality, monitoring, and permits. It is available at https://www.dec.ny.gov/pubs/109457.html.

Inactive Landfill - The Millbrook landfill, located on Sharon Turnpike, is about one acre in size and was used for disposal of municipal waste from 1935-1985. It was evaluated for placement on the State Superfund Site list but did not qualify. A Phase II Investigation concluded that there is no evidence for the disposal of hazardous waste at this site. See the DEC's Environmental Remediation Database record for more information.[188]

Transfer Station - A transfer facility is a facility where waste is received, consolidated, and then transported to a subsequent facility for processing, treatment, further transfer, or disposal. Often, residents or local haulers bring waste to transfer facilities, where the waste is consolidated and then transferred to larger facilities. The Town of Washington Transfer Station is located at 711 Route 343. The Station's annual report may be viewed using the DECinfo Locator.

Active or Reclaimed Mine - There is only one active sand and gravel mine in the Town of Washington at the time of writing, located off Route 82 and Canoe Hill Road.[189] Six additional reclaimed sand and gravel mines are documented in the Town.

SPDES Permit Sites - New York's State Pollutant Discharge Elimination System (SPDES) program is intended to control surface wastewater and stormwater discharges in accordance with the Clean Water Act. Permits are required for constructing or using an outlet or discharge pipe (i.e. a "point source") discharging wastewater to surface waters or ground waters of the state and disposal systems such as a sewage treatment plant.[190] There is a single SPDES permit in the Village of Millbrook where the Millbrook Sewage Treatment Plant discharges to the East Branch of the Wappinger Creek.

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[188] "Millbrook Village Landfill." DEC Environmental Remediation Database, https://www.dec.ny.gov/cfmx/extapps/derexternal/haz/details.cfm?ProgNo=314043

[189] "Mining and Reclamation." DEC, https://www.dec.ny.gov/lands/5020.html.

[190] "State Pollutant Discharge Elimination System (SPDES) Permit Program." DEC, https://www.dec.ny.gov/permits/6054.html.

Petroleum Bulk Storage Facility - These locations are regulated under the NYS Petroleum Bulk Storage (PBS) program, which applies to facilities that store more than 1,100 gallons of petroleum in aboveground and underground storage tanks.[191] Examples of these sites in Washington include gas stations, schools, municipal facilities, and some farms.

Agricultural Resources (Map 18)

Understanding the distribution of agricultural resources and working farms should be an important consideration in local planning and development processes. Growing food locally can benefit the economy, the environment, and the health and welfare of the community. In addition, farms often support valuable wildlife habitats and water resources. Local farms are also important contributors to scenic beauty and open space in the community.

The 2015 Town of Washington Comprehensive Plan notes that the amount of farmland in the Town has remained relatively stable over the past three decades, though the nature of farming has changed, with a shift to both larger production farms and smaller specialty farms. The Plan notes concern that the current concentration of farmland ownership among fewer than 50 property owners suggest a risk to the Town's agricultural land base, as often the high costs of ownership drives farmers to consider selling or subdividing land.

The Agricultural Resources Map shows the distribution of farmland soils, designated agricultural districts, and properties with agricultural assessments in the Town of Washington and Village of Millbrook.

Agricultural Soils - Farming often relies on the availability of high-quality soils. High quality soils require smaller inputs of fertilizer and nutrients, leading to lower costs, higher production rates, and less environmental impact. Prime Farmland Soils are defined by the US Department of Agriculture and New York State as the most productive soils for farming.[1] Prime farmland soils are relatively limited in extent and scattered throughout the Town of Washington, without any noteworthy concentrations. There are 4,642 acres of Prime Farmland Soils in the Town representing 12.3 percent of all soils. An additional 569 acres are classified as Prime if Drained, which may include wetland areas.

Farmland Soils of Statewide Importance are soils that do not meet all criteria for Prime Farmland. Though not as productive as Prime Farmland, if managed properly, these soils can produce fair to good yields. Statewide important farmland soils occur throughout the Town. There are 12,491 acres of farmland soils of statewide importance in Washington, representing 33.2 percent of all soils. Prime and Statewide Important Farmland Soils are present throughout

[191] "Bulk Storage of Chemicals, Petroleum, and Liquefied Natural Gas." DEC, https://www.dec.ny.gov/chemical/287.html.

the Town but are most common in valleys and at lower elevations.

Agricultural Districts - New York State enacted the Agricultural Districts Law in 1971 to provide basic "right to farm" protections to keep agricultural land in production. Participation in agricultural districts is voluntary and benefits landowners by reducing tax liability and protecting farmers against overly restrictive local laws and private nuisance suits involving agricultural practices. Farm owners in agricultural districts can receive real property assessments based on the value of their land for agricultural production rather than on its development value. Agricultural properties in Washington are within Agricultural District #21. The Town of Washington (including Village of Millbrook) has more farmland acreage in an agricultural district than any other municipality in Dutchess County, with 24,797 acres total, which is 66 percent of the Town's total land area.[192] From 2008 to 2022, the amount of land in the agricultural district in Washington grew by 8 percent.

The NYS Agricultural Districts Law allows for state review of local laws affecting farms located within an agricultural district. In cases where a local law is determined to be unreasonable, the NYS Department of Agriculture and Markets will work with the local government to develop mutually acceptable alternatives.

Agricultural Assessment - New York State Agricultural Districts Law provides for a reduction in property taxes for land in agricultural production. The agricultural assessment is based on the following qualifications:

- Minimum of seven acres farmed by a single operation. Total acreage of less than seven acres may still qualify if gross sales are at least $50,000 per year.
- Lands have been in production for the preceding two years.
- Farm operation grosses an average of $10,000 or more in sales per year.

At the time of writing, there are 17,461 acres of land in Washington receiving an agricultural assessment, which is 46.4% of the Town.

Farming in the Town of Washington - As of 2022, over 40 percent of the Town's agricultural area was dedicated to production agriculture, 21 percent was beef and livestock operations, and approximately 15 percent was horse farms. Table 18 provides a summary of farm enterprises in Washington.

[192] Cornell Cooperative Extension of Dutchess County, 2022, *Washington, New York Community Profile: Agriculture and Farms*, https://ccedutchess.org/agriculture/2022-town-agricultural-profiles.

Table 17. Farm Enterprises by Area in the Town of Washington

Farm Enterprise Category	Acres	Percent
Production Agriculture (hay, corn, and field crops)	10,244	43.4%
Beef and Livestock	5,006	21.2%
Horses	3,489	14.8%
Buffer (vacant, residential, or open space parcels that border farm property and/or could be developed for farming operations)	2,115	9.0%
Specialty Crops (e.g., Christmas trees, orchards, vegetable farms, flowers)	1,055	4.5%
Dairy	752	3.2%
Other	1,680	7.1%

Examples of farms in Washington include:
- AKM Farm
- Evergreen Christmas Tree Farm
- Millbrook Vineyards and Winery
- Stonewood Farm
- Walbridge Farm
- Yellowframe Farm
- Hitchcock Cattle Corp
- Millbrook Beef and Dairy
- Thorndale Farm
- Rally Farm

Forestry Lands - Approximately 67 percent of Washington is forested,[193]The ability of private forest landowners to periodically harvest timber or other forest products provides an important source of income that can help landowners avoid subdivision of land or conversion to non-forest uses. Working forests also contribute to the local economy and demand very little in the way of community services in return for the property taxes their owners pay. DEC's *Municipal Guide to Forestry in New York State* offers guidance to encourage local governments to actively support and promote multiple forest uses and stewardship of the land.[194]

To encourage the long-term management of woodlands to produce forest products, the State of New York in 1974 enacted the 480-a Forest Tax Law to qualifying owners. Any tract of forest land is eligible if it consists of at least 50 contiguous acres, exclusive of any portion not devoted to the production of forestry. Participants must commit land to the production of forest crops and to follow a management plan, prepared by a forester and approved DEC, for the next succeeding ten years beginning each year that they receive a tax exemption. The Agricultural and Forestry

[193] Calculation based on 2016 National Land Cover Database classes for woody vegetation.
[194] Daniels, K.H. 2005. A Municipal Official's Guide to Forestry. A joint publication of the New York Planning Federation, Department of Environmental Conservation, and Empire State Forest Products Association. Albany, NY. Available at: http://www.dec.ny.gov/docs/lands_forests_pdf/guidetoforestry.pdf

Resources Map shows tax parcels enrolled in the 480-a program at the time of writing in 2020. A total of 11 parcels were enrolled, with 1,556 acres committed to the program. More information about the 480-a program is available from DEC.

About 9,400 acres or 25 percent of the Town of Washington land area was enrolled in the 480-A program in 2023. These parcels are outlined on Map 15, Large Forests. Additional properties may be managed for forestry without enrollment in 480-a. All private, non-industrial, forest landowners who are looking for introductory management and technical advice are eligible for a free visit with a DEC forester. More information about DEC's Forest Stewardship Program is available at https://www.dec.ny.gov/lands/4972.html.

Conservation and Public Lands (Map 19)

Conserved lands and publicly accessible open spaces provide substantial environmental, social, economic, and health benefits. Conserved lands offer long-term habitat protection, help manage water and air quality, and support community resilience to climate change. In response to global climate and biodiversity crises, nations around the world have signed an agreement to conserve 30 percent of land and water by 2030. New York has also committed to the 30 by 30 goal to promote biodiversity and preserve land and water. Currently, about 14.6 percent of the Town of Washington (including Millbrook) is publicly owned or preserved under conservation easement.

The Conservation and Public Lands Map can help Washington and Millbrook consider how projects adjacent to parks, open space, and trails may impact the value residents gain from these areas, as well as ways to maintain habitat connectivity with preserves and other protected lands. This map can also help identify opportunities to grow and connect parks, preserves, and trails as new projects arise.

A total of 5,510 acres of conservation easements and publicly owned lands were mapped in the Town of Washington and Village of Millbrook. These properties were identified from parcel data and information provided by local land trusts. The NY Protected Areas Database (NYPAD) was also used as a reference. NYPAD is a spatial database of lands protected, designated, or functioning as open space, natural areas, conservation lands, or recreational areas created by the NYNHP. Conservation and public lands are classified based on ownership and summarized in Table 19.

Dutchess Land Conservancy (DLC) is a non-profit conservation organization dedicated to preserving the rural character, important resources, and open lands of Dutchess County. Most of the protected land in the Town of Washington is privately owned, subject to conservation easements held by DLC.

Table 18. Conservation and Public Land in the Town of Washington by Ownership Type

Ownership Type	**Acreage**	**Percent of Town**
Private Ownership Subject to Conservation Easement	5,294	14.1%
Town/Village	156	0.4%
Non-Profit Conservation Organization	60	0.2%
Total	**5,510**	**14.6%**

Conserved lands include properties owned outright by a private or public entity and managed for purposes of conservation or recreation and properties where development is restricted through conservation easements.

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

18. Agricultural Resources

- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Parcel receiving Dutchess County Agricultural Value Assessment

Farmland Soil Class

- Prime farmland
- Farmland of statewide importance
- Prime farmland if drained

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Agricultural Value Assessment: Dutchess County Real Property 2020
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Farmland Soils: USDA Web Soil Survey

Prepared by: CCEDC GIS Lab, 2022

WARNING: This map is not a substitute for land surveys or legal documents. No accuracy or completeness guarantee is implied or intended.

The Dutchess County Natural Resources Inventory (NRI) Technical Assistance Project is a partnership among the Town of Clinton, the Town of Washinton, the Village of Millbrook, Cornell Cooperative Extension of Dutchess County, and Cornell University Department of Natural Resources, with funding from the Environmental Protection Fund through the New York State Department of Environmental Conservation Hudson River Estuary Program.

NEW YORK STATE | Department of Environmental Conservation | Hudson River Estuary Program

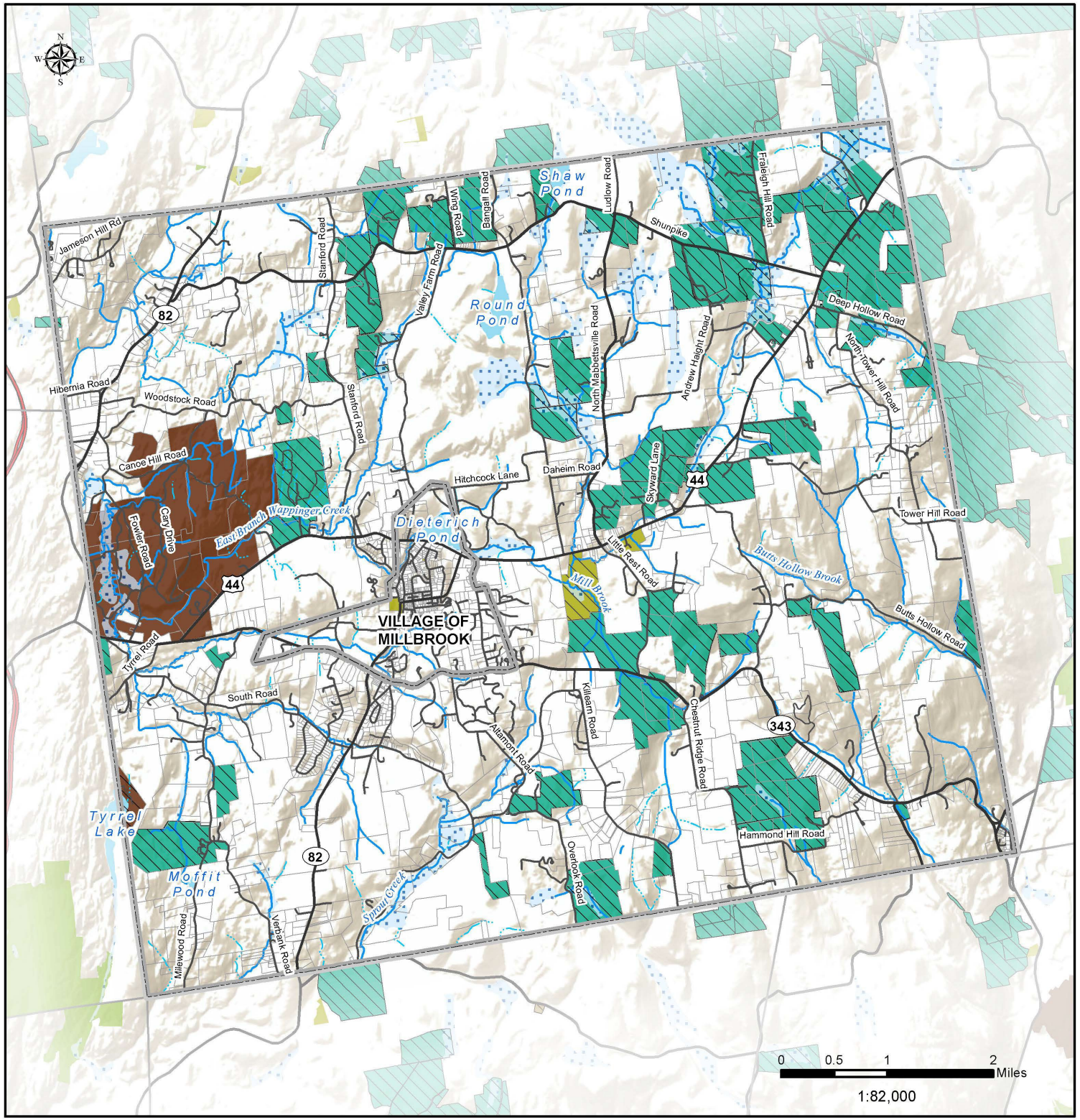
Cornell Cooperative Extension Dutchess County

Town of Washington

Dutchess County, NY

Natural Resources Inventory - 2023

19. Conservation & Public Land



- Washington Boundary
- Municipal Boundary
- Parcel Boundary
- Taconic State Parkway
- Major Road
- Local Road
- Waterbody
- Perennial Stream
- Intermittent Stream
- Wetland

Public and Protected Land

- Nonprofit Organization
- Town/Village property
- Conservation Easement
- No Public Access

DATA SOURCES

Municipal Boundaries: Dutchess County Real Property, 2022
Parcel Boundaries: Dutchess County Real Property, 2022
Roads: Dutchess County OCIS, 2019
Streams & Waterbodies: Hudsonia, Ltd. 2004
Wetlands: NYSDEC Regulatory Freshwater Wetlands, 2002
Conservation Lands: NYPAD 2017, Scenic Hudson 2020, Winnakee Land Trust 2020, & Dutchess Land Conservancy 2023

Prepared by: CCEDC GIS Lab, 2022

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NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Cornell Cooperative Extension Dutchess County

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Appendix A: Sample Checklist for Site Resource Assessment

SAMPLE CHECKLIST FOR SITE RESOURCE ASSESSMENT USING DESKTOP INFORMATION SOURCES

Project: _____ Form completed by: _____ Date: _____

Location: _____

Checklist

	Yes	No	Not sure	Information source (s)
Physical Setting – See NRI, Chapter 3				
Are there steep slopes (>15%) on or near the site?				
Are there shallow soils (<20 inches) or bedrock exposed at the surface?				
What soil groups are present on the site? Circle which groups are present. A B C D				
Are hydric soils present on the site?				
Does the proposed density of new development exceed recommendations based on hydrologic soil groups present on the site?				
Other notes about bedrock, surficial geology, soils:				
Water Resources – See NRI, Chapter 4				
Is there a mapped unconsolidated aquifer on the site?				
Is the site within or near the source watershed for a public drinking water system?				
Are there intermittent or perennial streams on or near the site?				
If yes, are the streams classified as “trout” or “trout spawning” or “sensitive coldwater” streams?				
Is there a mapped flood zone or riparian buffer zone on the site?				
Are there mapped wetlands or wetland soils on or adjoining the site?				
Have wetlands been delineated onsite, surveyed, and mapped onto a site-specific plan or subdivision plat?				
Biodiversity – see NRI, Chapter 5				

Is the site within a Significant Biodiversity Area? If so, provide the name.				
If there is forest on the site, is it part of a large forest (100 acres or greater); forest linkage or matrix forest?[1] Circle all that apply.				
If there is meadow on the site, is it part of a large ($\geq$ 10 ac) meadow?				
Are there other unusual or sensitive habitats on the site? If so, name them here:				
Are there state-mapped Important Areas for plants or animals on or adjoining the site?				
Land use – see NRI, Chapter 6				
Is the site within a Center or Greenspace as mapped by Dutchess County?				
Is the site within an overlay district? If so, name the overlay district here:				
Are there Prime Farmland Soils or Farmland Soils of Statewide Importance on the site?				
Is the site located in an agricultural district?				
Are there protected lands adjacent to or near the site?				

Follow-Up Questions

	Yes	No
Streams, Floodplains, Wetlands, and Aquifers		
If there are streams or wetlands on or near the site, have the proposed development features been located to preserve broad, undisturbed buffer zones along the streams and around the wetlands?		
If there is a mapped flood zone or riparian zone on the site, have the proposed development features been located outside of those zones?		
If there is a mapped unconsolidated aquifer on the site, does the proposed development avoid or minimize impervious surfaces in the aquifer area?		
Are stormwater management measures for the proposed project designed to preserve pre-construction patterns and volumes of surface water runoff from the site?		
Forests		
If there is a large forest on (or partially on) the site, have the proposed development features been located to minimize fragmentation of the forest?		
Meadows		
If there is a large meadow on (or partially on) the site, have the proposed development features been located to minimize fragmentation of the meadow?		
Habitat Connectivity		
Have the proposed development features been located to preserve broad connectivity between onsite and offsite habitats?		
Farmland		
If there are good farmland soils on the site, have the proposed development features been located to minimize encroachment on those soils or fragmentation of the farmland soil areas?		

Summary Results of Desktop Assessment

High priority and sensitive resources on or near the site:

_____

_____

_____

_____

Site Visit Observations

Date of site visit: _____ By whom: _____ (list all people attending the site visit)

Recommendations

Date of site visit: _____ By whom: _____ (list all people attending the site visit)

Appendix B: Soils Table

Soils in the Town of Washington								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
BeC	Bernardston silt loam, 8 to 15 percent slopes	>60	Well drained	predominantly nonhydric	C/D	Strongly acid	Farmland of statewide importance	Severe
BeD	Bernardston silt loam, 15 to 25 percent slopes	>60	Well drained	predominantly nonhydric	C/D	Strongly acid	Not prime farmland	Severe
Cc	Catden muck, 0 to 2 percent slopes	>60	Very poorly drained	hydric	B/D	Not rated	Not prime farmland	Slight
ChB	Charlton fine sandy loam, 3 to 8 percent slopes	>60	Well drained	predominantly nonhydric	B	Strongly acid	All areas are prime farmland	Moderate
ChC	Charlton fine sandy loam, 8 to 15 percent slopes	>60	Well drained	nonhydric	B	Strongly acid	Farmland of statewide importance	Severe
ChD	Charlton fine sandy loam, 15 to 25 percent slopes	>60	Well drained	nonhydric	B	Strongly acid	Not prime farmland	Severe
ChE	Charlton loam, 25 to 45 percent slopes	>60	Well drained	predominantly nonhydric	B	Strongly acid	Not prime farmland	Severe
CrB	Charlton-Chatfield complex, undulating, rocky	20-40	Well drained	predominantly nonhydric	B	Strongly acid	All areas are prime farmland	Moderate
CrC	Charlton-Chatfield complex, rolling, rocky	20-40	Well drained	predominantly nonhydric	B	Strongly acid	Farmland of statewide importance	Severe
CrD	Charlton-Chatfield complex, hilly, rocky	20-40	Well drained	predominantly nonhydric	B	Strongly acid	Not prime farmland	Severe
CtC	Chatfield-Hollis complex, rolling, very rocky	<20	Well drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Severe

Soils in the Town of Washington								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
CtD	Chatfield-Hollis complex, 15 to 35 percent slopes, very rocky	<20	Well drained	predominantly nonhydric	B	Very strongly acid	Not prime farmland	Severe
CuB	Copake gravelly silt loam, undulating	>60	Well drained	predominantly nonhydric	A	Neutral	All areas are prime farmland	Moderate
CwA	Copake channery silt loam, fan, 0 to 3 percent slopes	>60	Well drained	predominantly nonhydric	A	Neutral	All areas are prime farmland	Slight
DuB	Dutchess silt loam, 3 to 8 percent slopes	>60	Well drained	predominantly nonhydric	B	Moderately acid	All areas are prime farmland	Moderate
DuC	Dutchess silt loam, 8 to 15 percent slopes	>60	Well drained	predominantly nonhydric	B	Moderately acid	Farmland of statewide importance	Severe
DuD	Dutchess silt loam, 15 to 25 percent slopes	>60	Well drained	predominantly nonhydric	B	Moderately acid	Not prime farmland	Severe
DwB	Dutchess-Cardigan complex, undulating, rocky	20-40	Well drained	predominantly nonhydric	B	Moderately acid	All areas are prime farmland	Moderate
DwC	Dutchess-Cardigan complex, rolling, rocky	20-40	Well drained	predominantly nonhydric	B	Moderately acid	Farmland of statewide importance	Severe
DwD	Dutchess-Cardigan complex, hilly, rocky	20-40	Well drained	predominantly nonhydric	B	Moderately acid	Not prime farmland	Severe
DxB	Dutchess-Cardigan-Urban land complex, undulating, rocky	20-40	Well drained	predominantly nonhydric	Not rated	Moderately acid	Not prime farmland	Moderate
DxC	Dutchess-Cardigan-Urban land complex, rolling, rocky	20-40	Well drained	predominantly nonhydric	Not rated	Moderately acid	Not prime farmland	Severe
FcD	Farmington-Galway complex, hilly, very rocky	<20	Somewhat excessively drained	predominantly nonhydric	D	Slightly acid	Not prime farmland	Severe

Soils in the Town of Washington								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
Ff	Fluvaquents-Udifluvents complex, frequently flooded	>60	Poorly drained	partially hydric	A/D	Slightly acid	Not prime farmland	Slight
Fr	Fredon silt loam	>60	Somewhat poorly drained	predominantly hydric	B/D	Neutral	Prime farmland if drained	Slight
GfC	Galway-Farmington complex, rolling, rocky	<20	Well drained	predominantly nonhydric	C	Neutral	Farmland of statewide importance	Moderate
GsA	Georgia silt loam, 0 to 3 percent slopes	>60	Moderately well drained	predominantly nonhydric	C	Slightly acid	All areas are prime farmland	Slight
GsB	Georgia silt loam, 3 to 8 percent slopes	>60	Moderately well drained	nonhydric	C	Slightly acid	All areas are prime farmland	Moderate
GsC	Georgia silt loam, 8 to 15 percent slopes	>60	Moderately well drained	predominantly nonhydric	C	Slightly acid	Farmland of statewide importance	Severe
Ha	Halsey mucky silt loam	>60	Very poorly drained	hydric	B/D	Neutral	Not prime farmland	Slight
HeB	Haven loam, undulating	>60	Well drained	predominantly nonhydric	B	Strongly acid	All areas are prime farmland	Moderate
HoC	Hollis-Chatfield-Rock outcrop complex, rolling	>60	Somewhat excessively drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Severe
HoD	Hollis-Chatfield-Rock outcrop complex, hilly	>60	Somewhat excessively drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Severe
HoE	Hollis-Chatfield-Rock outcrop complex, steep	>60	Somewhat excessively drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Severe
HoF	Hollis-Chatfield-Rock outcrop complex, very steep	>60	Somewhat excessively drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Severe

Soils in the Town of Washington								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
HsA	Hoosic gravelly loam, nearly level	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Slight
HsB	Hoosic gravelly loam, undulating	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Slight
HsC	Hoosic gravelly loam, rolling	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Moderate
HsD	Hoosic gravelly loam, hilly	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Not prime farmland	Severe
HsE	Hoosic gravelly loam, 25 to 45 percent slopes	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Not prime farmland	Severe
HtA	Hoosic channery loam, fan, 0 to 3 percent slopes	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Slight
HtB	Hoosic channery loam, fan, 3 to 8 percent slopes	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Moderate
HuB	Hoosic-Urban land complex, undulating	>60	Not rated	predominantly nonhydric	Not rated	Strongly acid	Not prime farmland	Not rated
Ln	Linlithgo silt loam	>60	Somewhat poorly drained	predominantly nonhydric	B/D	Slightly acid	Prime farmland if drained	Slight
MnA	Massena silt loam, 0 to 3 percent slopes	>60	Somewhat poorly drained	predominantly nonhydric	C/D	Neutral	Prime farmland if drained	Slight
MnB	Massena silt loam, 3 to 8 percent slopes	>60	Somewhat poorly drained	predominantly nonhydric	C/D	Neutral	Prime farmland if drained	Moderate

Soils in the Town of Washington								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
NwB	Nassau-Cardigan complex, undulating, very rocky	<20	Well drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Moderate
NwC	Nassau-Cardigan complex, rolling, very rocky	<20	Well drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Severe
NwD	Nassau-Cardigan complex, hilly, very rocky	<20	Somewhat excessively drained	predominantly nonhydric	D	Very strongly acid	Not prime farmland	Severe
NxE	Nassau-Rock outcrop complex, steep	Not rated	Not rated	predominantly nonhydric	Not rated	Very strongly acid	Not prime farmland	Not rated
NxF	Nassau-Rock outcrop complex, very steep	>60	Somewhat excessively drained	predominantly nonhydric	D	Very strongly acid	Not prime farmland	Severe
Pc	Natchaug muck, 0 to 2 percent slopes	>60	Very poorly drained	hydric	B/D	Neutral	Not prime farmland	Slight
Pg	Pawling silt loam	>60	Moderately well drained	predominantly nonhydric	B/D	Slightly acid	All areas are prime farmland	Slight
Ps	Pits, gravel	Not rated	Not rated	predominantly nonhydric	Not rated	Not rated	Not prime farmland	Not rated
PwC	Pittstown silt loam, 8 to 15 percent slopes	>60	Moderately well drained	predominantly nonhydric	C	Strongly acid	Farmland of statewide importance	Severe
SkB	Stockbridge silt loam, 3 to 8 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	All areas are prime farmland	Moderate
SkC	Stockbridge silt loam, 8 to 15 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	Farmland of statewide importance	Severe
SkD	Stockbridge silt loam, 15 to 25 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	Not prime farmland	Severe
SkE	Stockbridge silt loam, 25 to 45 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	Not prime farmland	Severe

Soils in the Town of Washington								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
SmC	Stockbridge-Farmington complex, rolling, rocky	<20	Well drained	predominantly nonhydric	C	Neutral	Farmland of statewide importance	Severe
Su	Sun silt loam	>60	Poorly drained	predominantly hydric	C/D	Neutral	Farmland of statewide importance	Slight
Ud	Udorthents, smoothed	>60	Well drained	nonhydric	A	Slightly acid	Not prime farmland	Slight
Ue	Udorthents, wet substratum	>60	Somewhat poorly drained	nonhydric	B	Slightly acid	Not prime farmland	Slight
Ur	Urban land	Not rated	Not rated	nonhydric	Not rated	Not rated	Not prime farmland	Not rated
W	Water	Not rated	Not rated	nonhydric	Not rated	Not rated	Not prime farmland	Not rated
We	Wappinger loam	>60	Well drained	predominantly nonhydric	B	Slightly acid	All areas are prime farmland	Slight
Wy	Wayland silt loam	>60	Poorly drained	predominantly hydric	C/D	Neutral	Not prime farmland	Slight

Soils in the Village of Millbrook								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
DwB	Dutchess-Cardigan complex, undulating, rocky	20-40	Well drained	predominantly nonhydric	B	Moderately acid	All areas are prime farmland	Moderate
DwC	Dutchess-Cardigan complex, rolling, rocky	20-40	Well drained	predominantly nonhydric	B	Moderately acid	Farmland of statewide importance	Severe
DwD	Dutchess-Cardigan complex, hilly, rocky	20-40	Well drained	predominantly nonhydric	B	Moderately acid	Not prime farmland	Severe
DxB	Dutchess-Cardigan-Urban land complex, undulating, rocky	20-40	Well drained	predominantly nonhydric	Not rated	Moderately acid	Not prime farmland	Moderate
DxC	Dutchess-Cardigan-Urban land complex, rolling, rocky	20-40	Well drained	predominantly nonhydric	Not rated	Moderately acid	Not prime farmland	Severe
Ff	Fluvaquents-Udifluvents complex, frequently flooded	>60	Poorly drained	partially hydric	A/D	Slightly acid	Not prime farmland	Slight
GsB	Georgia silt loam, 3 to 8 percent slopes	>60	Moderately well drained	nonhydric	C	Slightly acid	All areas are prime farmland	Moderate
GsC	Georgia silt loam, 8 to 15 percent slopes	>60	Moderately well drained	predominantly nonhydric	C	Slightly acid	Farmland of statewide importance	Severe
Ha	Halsey mucky silt loam	>60	Very poorly drained	hydric	B/D	Neutral	Not prime farmland	Slight
HsA	Hoosic gravelly loam, nearly level	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Slight
HsB	Hoosic gravelly loam, undulating	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Slight

Soils in the Village of Millbrook								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
HsC	Hoosic gravelly loam, rolling	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Moderate
HsD	Hoosic gravelly loam, hilly	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Not prime farmland	Severe
HsE	Hoosic gravelly loam, 25 to 45 percent slopes	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Not prime farmland	Severe
HtA	Hoosic channery loam, fan, 0 to 3 percent slopes	>60	Somewhat excessively drained	predominantly nonhydric	A	Strongly acid	Farmland of statewide importance	Slight
HuB	Hoosic-Urban land complex, undulating	>60	Not rated	predominantly nonhydric	Not rated	Strongly acid	Not prime farmland	Not rated
MnA	Massena silt loam, 0 to 3 percent slopes	>60	Somewhat poorly drained	predominantly nonhydric	C/D	Neutral	Prime farmland if drained	Slight
MnB	Massena silt loam, 3 to 8 percent slopes	>60	Somewhat poorly drained	predominantly nonhydric	C/D	Neutral	Prime farmland if drained	Moderate
NwB	Nassau-Cardigan complex, undulating, very rocky	<20	Well drained	predominantly nonhydric	D	Strongly acid	Not prime farmland	Moderate
NwD	Nassau-Cardigan complex, hilly, very rocky	<20	Somewhat excessively drained	predominantly nonhydric	D	Very strongly acid	Not prime farmland	Severe
NxE	Nassau-Rock outcrop complex, steep	Not rated	Not rated	predominantly nonhydric	Not rated	Very strongly acid	Not prime farmland	Not rated
SkB	Stockbridge silt loam, 3 to 8 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	All areas are prime farmland	Moderate
SkC	Stockbridge silt loam, 8 to 15 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	Farmland of statewide importance	Severe
SkD	Stockbridge silt loam, 15 to 25 percent slopes	>60	Well drained	predominantly nonhydric	C	Neutral	Not prime farmland	Severe

Soils in the Village of Millbrook								
Symbol	**Soil Name**	**Depth to Bedrock (inches)**	**Drainage Class (dominant condition)**	**Hydric Classification**	**Hydrologic Group**	**Reaction**	**Farmland Classification**	**Potential Erosion Hazard (Road Trail)**
Su	Sun silt loam	>60	Poorly drained	predominantly hydric	C/D	Neutral	Farmland of statewide importance	Slight
Ud	Udorthents, smoothed	>60	Well drained	nonhydric	A	Slightly acid	Not prime farmland	Slight
Ue	Udorthents, wet substratum	>60	Somewhat poorly drained	nonhydric	B	Slightly acid	Not prime farmland	Slight
Ur	Urban land	Not rated	Not rated	nonhydric	Not rated	Not rated	Not prime farmland	Not rated
W	Water	Not rated	Not rated	nonhydric	Not rated	Not rated	Not prime farmland	Not rated

Glossary

alluvial deposit: material deposited by a river or stream, consisting of clay, silt, sand, or gravel.

aquifer: a body of permeable rock which contains or transmits groundwater.

biodiversity: the variety and variability of life on Earth.

calcareous: rich in calcium.

carbon sequestration: the removal of carbon from the atmosphere by biological (stored in living material such as wood), chemical captured by weathering of certain types of rocks) or physical (conversion of formerly living material into oil deposits) processes. These processes can be natural or technological.

circumneutral: having a pH at or near 7.0 (approximately 6.6-7.3).

culvert: structure allowing passage of water under a road or other obstacle to drainage.

DEC: NYS Department of Environmental Conservation.

diadromous (of a fish): migrating between salt water and fresh water in its life cycle.

ecosystem: a community of living organisms and the physical environment with which they interact.

ecosystem services: benefits provided to humans by the environment, such as pollination of food crops, reduced flooding by wetlands, reduced air conditioning costs by tree shading, etc.

effluent: a liquid discharged as waste.

estuary: a partially enclosed coastal body of water where freshwater from rivers and streams mixes with salt water from the ocean.

eutrophication: excessive plant growth in a water body (usually a pond or small lake) in response to excess nutrient availability (usually from human or animal waste or fertilizer)

FIRM: Flood Insurance Rate Map.

floodplain: low-lying areas next to rivers or streams subject to flooding.

fragmentation: dividing large unbroken areas of habitat into smaller, more isolated remnants.

GIS: Geographic Information System.

greenhouse gas: a gas (such as carbon dioxide or methane) in the atmosphere that absorbs heat resulting from sunlight radiated off the earth's surface. This is called the greenhouse effect.

habitat: the place or environment where an organism normally spends all or part of its life, defined by the biological (plants and animals) and non-biological (soil, bedrock, water,

temperature, etc,) components.

habitat connectivity: the degree to which linked habitat corridors exist to allow the movement or migration of plant or animal species.

headwaters: the upper reaches of a stream, near its origin.

Hudsonia: a not-for-profit organization which protects the natural heritage of the Hudson Valley and beyond, by making accurate conservation science accessible to those deciding the future of our landscape.

invasive species: organisms (plants, animals, and pathogens) that are not native to the ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health.

macroinvertebrates: any animal lacking a backbone and large enough to see without the aid of a microscope.

mitigation (of climate change): actions taken to reduce the emissions of greenhouse gases or to increase their capture, reducing the degree of global climate change.

natural community: an assemblage of interacting plant and animal populations that share a common environment.

net-zero: a state in which human-caused greenhouse gas emissions are balanced by human-caused greenhouse gas removals over a specified time period.

nitrates: a form of nitrogen; nitrogen is an essential nutrient for all life, but in excess amounts can cause major water quality problems.

pathogens: organisms, such as certain bacteria and viruses, which cause disease.

permeable: allowing the passage of fluids.

phosphorus: an element that is essential to all life; usually the available amount of phosphorus in a water body controls the pace of the production of algae and aquatic plants. Excess phosphorous in a water body can degrade water quality and lead to eutrophication and the growth of harmful algae.

pollination: the transfer of pollen to a stigma, ovule, flower or plant to allow fertilization.

resiliency: having the ability to withstand or recover following a major disturbance or event such as a flood.

seep: where groundwater percolates to the surface too slowly to be considered a spring.

SEQR: State Environment Quality Review.

siltation: the deposition or accumulation of fine sediments in a water body.

soil profile: a cross-section of soil layers, whose physical, chemical and biological characteristics differ from one another.

till: unstratified glacial deposit, consisting of a mixture of clay, sand, gravel, and boulders.

TSS: total suspended solids

tributary: a stream that flows into a larger stream, river, or lake.

watershed: the area of land from which water drains into a stream, river, lake or other water body.

Winnakee Land Trust: works with private land owners to conserve some of the Hudson Valley's most critical and vulnerable habitats and open spaces.