Hastings-on-Hudson

2020 Natural Resources Inventory

Produced by the

Hastings-on-Hudson Natural Resources Inventory Committee

Village of Hastings-on-Hudson
7 Maple Avenue, Hastings-on-Hudson, NY 10706

Credits and Acknowledgements

This document was prepared collaboratively by volunteers from several Village Boards and Commissions, including the Climate Smart Communities Task Force, the Conservation Commission and the Parks and Recreation Commission. The core team of the Hastings-on-Hudson Natural Resources Inventory Committee comprised the following members: Anjali Chen, Brad Dunn, Mary Lambert, Patrick McKenzie, Ion Simonides, Alison Waldron, and Spencer Weart.

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Nicola Armacost, Village Mayor
Mary Beth Murphy, Village Manager
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Cover Photo: A juvenile barred owl found in Hillside Woods in Hastings-on-Hudson, April 2020

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Part A: Introduction

The Village of Hastings-on-Hudson is located on the eastern bank of the Hudson River about 20 miles north of midtown Manhattan. Panoramic views of the Hudson River and Palisades are offered throughout this compact community, which is two square miles in area with a population of 7,912 (in 2018). Because of its setting, the Village has long drawn artists and writers who strive to capture and share its beauty, while its natural habitats and green spaces have continued to attract environmentalists and outdoor enthusiasts committed to preserving the health of the Village's many natural resources.

This Natural Resource Inventory (NRI) documents the Village's natural resources and their condition, building the foundation for a Natural Resource Conservation Plan for the Village of Hastings-on-Hudson. Current threats stemming from climate change, rampant incursions by invasive species, and the ever-growing and ever-hungry deer population have heightened the need for a more considered and thoughtful approach to conservation. For this inventory, we draw from the many recent Village plans and studies that have documented Hastings-on-Hudson's natural resources, outlining strategies for their care and preservation.

This inventory is also based on public input drawn from a range of sources – through public meetings conducted when developing Village Plans, Village-wide surveys of residents on climate and natural resource issues, and through consultations with volunteers from several Village Boards and Commissions. The Hastings-on-Hudson NRI Committee – the core team that prepared the report – was made up of members from the Climate Smart Communities Task Force, the Conservation Commission and the Parks and Recreation Commission of the Village.

What is a Natural Resource Inventory (NRI)?

According to the New York Department of Environmental Conservation's Hudson River Estuary Program[1], a Natural Resource Inventory (NRI) is a compilation of data on existing natural resources, often also including important cultural resources. Natural resources include anything not constructed by people, from the rain falling on our houses to the trees in our parks. An NRI also includes cultural resources such as historical sites and recreation areas that are similarly worth preserving for their value to the community.

The primary purpose of an NRI is to act as a comprehensive source of information for community members and municipal officials, but it is also valuable in assuring that natural resources are taken into account in long-term planning efforts and managing impacts and hazards, including the long-term influences of climate change.

Goals of Hastings-on-Hudson's NRI

This Natural Resource Inventory highlights the natural and cultural features that make Hastings-on-Hudson unique and livable. It identifies emerging threats to these resources, continues and furthers the Village-wide conversation around what we need to do to protect those resources, and

[1] See also: https://www.dec.ny.gov/lands/100925.html

builds the foundation for a Village-wide natural resource conservation plan. This document has the following overall objectives:

- Inventory and map existing natural resources.
- Ensure the protection of natural resources to help mitigate and adapt to climate change.
- Protect environmentally sensitive areas such as wetlands, floodplains, steep slopes, and wildlife habitat areas.
- Provide, expand, and protect outdoor recreational facilities and opportunities.
- Promote responsible land use and development, maintaining the capacity of our natural resources to provide ecological services.
- Preserve biodiversity of species and habitats.
- Preserve lands of distinctive character having local scenic, historical, and heritage value.
- Preserve and enhance the natural and cultural features that uniquely characterize the Village.

How Can a Natural Resource Inventory Be Used?

Identifying the natural resources within the Village of Hastings-on-Hudson is the first step in protecting those resources. Private landowners, government agencies, and conservation organizations can use this knowledge to protect natural resources. The following is a list of some of the approaches available in our region.

Non-Regulatory Tools

- Informal Designations – Planning efforts can raise local awareness of the value and location of important natural resources. Goals for protecting them can be defined in a community's Comprehensive Plan. Natural resource protection can also be addressed in open space and recreation plans or in plans for a particular resource (a range of plans commissioned by the Village of Hastings-on-Hudson are described below).
- Acquisition – Acquisition of land with the goal of resource preservation is another way of protecting natural resources. For example, the Village of Hastings-on-Hudson acquired 48 acres of land in 1941 for conservation (now Hillside Park), and then acquired an adjoining 52 acres in 1993 (that became Hillside Woods), to form our 100-acre urban forest, Hillside Woods and Park.[2]
- Educational Programs – Natural resource education programs also help raise awareness of the importance of natural resources and spur interest in protecting them. Local examples include: the *Hillside Woods Nature Guides Program*, a K-4 outdoor education program at Hillside Elementary school, which is supported by members of the Conservation Commission and which historically educated hundreds of parent guides; K-8 outdoor and environmental education classes offered by the Parks and Recreation Department (Parks & Rec), during the school year and in the Village summer day camp; the *Hastings-on-Hudson Vine Squad*, which educates participants – including high school AP Environmental Studies students – about how to identify and remove invasive vines; naturalist walks sponsored by the Village Parks & Rec and Nature Guides Program; and educational campaigns hosted by the Conservation Commission and Parks and Rec, such as its *State of the Woods* forums and public meetings on the Hillside Woods restoration project, along with providing volunteers opportunities for hands-on woods rehab work sessions.

[2] Hillside Woods and Park, encompassing all 100-acres, is commonly referred to as Hillside Woods.

Regulatory Tools

Local municipalities have many regulatory tools for controlling land use, including:

- Zoning and Subdivision Ordinances – protect the public health, safety, and general welfare.
- Local Wetlands Ordinances – regulate disturbance of wetlands beyond those covered under state and federal laws, such as small or isolated wetlands, and add additional requirements for activities adjacent to wetlands.
- Buffer Requirements – establish minimum distances between a development and a selected natural feature.
- Clustering Requirements – place residential units on a portion of a site to protect a contiguous area of open space or unique feature.
- Performance Zoning – determine whether a land use is permitted based on an assessment of potential impacts, unlike traditional zoning.
- Preservation Overlay Zones – designate geographic areas where more restrictive development regulations are enforced to protect valued natural resources.
- Park Dedications – require developers to contribute land, or cash in lieu of land, to provide for the open space and recreation needs of the residents.
- Transfer of Development Rights—landowners in designated preservation areas may sell development rights to allow increased density in other areas of the community
- Purchase of Development Rights—landowners in designated preservation areas may sell development rights for cash to a government or appropriate organization.

Existing Plans and Initiatives

Many existing state, regional, and local plans include components that address natural resources planning, protection, or management. The Village of Hastings-on-Hudson consults these plans as needed when developing its long-term planning goals. This ensures consistency with current plans while leveraging the existing research and knowledge base. Following their recommendations also keeps the Village eligible for funding for natural resource related projects and programs.

New York State Plans

- **Open Space Conservation Plan** (2016): Since 1992, the Open Space Conservation Plan has served as the blueprint for the State's Open Space Program, guiding the investment of land protection funds from the Environmental Protection Fund, and is updated periodically as required by law. The objectives of this plan are to protect the State's air and water quality and to preserve and nurture its scenic, historical, and cultural resources, while also providing outdoor recreational opportunities. This plan provides a valuable model on which local municipalities can build.

- **Statewide Comprehensive Outdoor Recreation Plan** (SCORP, 2014 - 2019): Developed by the New York State Office of Parks, Recreation and Historic Preservation, the SCORP provides the State a policy related to its recreation and preservation mandate.

- **Strategic Plan for State Forest Management** (2011): New York State's Department of Environmental Conservation outlined this ambitious plan to help towns and municipalities sustainably manage their forests. The goal of the report is to ensure that "state forests will be managed in a sustainable manner by promoting ecosystem health, enhancing landscape

biodiversity, protecting soil productivity and water quality. In addition, State Forests will continue to provide the many recreational, social, and economic benefits valued so highly by the people of New York State. DEC will continue the legacy which started 80 years ago, leaving these lands to the next generation in better condition than they are today."

Westchester County Plans

- **Westchester County Soil and Water Conservation District** (2020 Work Plan): This document outlines County-wide conservation efforts and provides clear guidelines for communities looking to undertake similar efforts.

- **Historic Hudson River Towns:** The Village of Hastings-on-Hudson is a member of the Historic Hudson River Towns (HHRT, originally called Historic River Towns of Westchester County), a consortium of municipalities along the Hudson River including: Peekskill, Cortlandt, Croton-on-Hudson, Briarcliff Manor, Town and Village of Ossining, Mt. Pleasant, Sleepy Hollow, Tarrytown, Irvington, Dobbs Ferry, Hastings-on-Hudson and Yonkers. HHRT is a non-profit organization and works to coordinate comprehensive plans and expand tourism in the region. Westchester County provides technical support and funding for HHRT's tourism efforts.

- **Westchester County Greenway Compact Plan:** Hastings-on-Hudson has adopted the Westchester County Greenway Compact Plan and is a participating community in the Greenway Compact. Westchester County is one of 13 counties that make up the Hudson River Valley Greenway, which was established by the State of New York as a result of the Hudson River Valley Greenway Act of 1991. The Greenway is a voluntary regional cooperation among 242 communities bordering the Hudson River. It was created to facilitate the development of a voluntary regional strategy for preserving scenic, natural, historical, cultural, and recreational resources while encouraging compatible economic development and maintaining the tradition of home rule for land use decision-making. The 1991 Act established the Greenway Council, a New York State Agency to work with local government to enhance local land use planning; create a voluntary regional planning compact for the Hudson River Valley; and provide community planning grants, compact grants, and technical assistance to help communities develop a vision for their future.

- **Hudson River Greenway Water Trail:** The Village of Hastings-on-Hudson is also part of the Hudson River Greenway Water Trail. In 2001, the State granted the Hudson River Valley Greenway money to establish a Hudson River Water Trail stretching from the upriver towns of Hadley and Whitehallto Battery Park at the southern tip of Manhattan. The trail provides access for kayaks, canoes, and small boats along 156 miles of the Hudson River. In Hastings-on-Hudson, Kinnally Cove is a designated site along the Hudson River Greenway Water Trail.

- **Westchester 2025 :** Westchester 2025 is an initiative of the County Planning Department and the Westchester County Planning Board to respond to the challenge of working within the multi-jurisdictional and sophisticated environment of Westchester County, by promoting intergovernmental cooperation and urging participation of County municipalities in regional and sub-regional planning effort, including the promotion of appropriate and sustainable development of land in coordination with transportation and infrastructure. The initiative is

guided by the goals, policies, and strategies of the "Patterns for Westchester" plan adopted in 1996.

- **Sustainable Westchester:** The Village of Hastings-on-Hudson has been part of Sustainable Westchester for many years and has participated in the Sustainable Westchester CCA, the Solarize Campaign, the Waste Reduction and Recycling Program, and, most recently, the HeatSmart Campaign.

Village of Hastings-on-Hudson Plans[3]

- **Hastings-on-Hudson Comprehensive Plan** (2011): Provides a positive vision for a sustainable community that balances financial realities, potential development, natural resource protection, quality of life issues, and more. In addition to setting goals, it offers a variety of specific suggestions for action.

- **Hillside Woods and Park: Tree Inventory and Urban Forest Management Plan** (2019): Outlines a plan to restore and protect the Village's treasured Hillside Woods, which has been degraded by years of deer over-browse and by colonization by invasive plants.

- **Inventory of Government Operations Greenhouse Gas Emissions for the Village of Hastings-on-Hudson** (2019): Provides an energy audit of municipal buildings greenhouse gas (GHG) emissions.

- **Long-Range Plan for Strategic Management of Parks and Recreation Assets, Village of Hastings-on-Hudson** (2016): Includes an inventory of parks and recreation assets, an analysis of their status and condition, and recommendations for preservation and stewardship of these resources for long-term health and use.

- T**he Waterfront Infrastructure Committee Report** (2015): Provides an analysis of the impact of flooding from the Hudson River.

- **Hastings-on-Hudson Street Tree Inventory** (2013): This document reports on the results of a comprehensive street tree inventory commissioned by the Village of Hastings-on-Hudson.

- **Draft Local Waterfront Revitalization Program** (2007): Includes an inventory of resources and recommendations for projects and municipal actions relating to the Village's Hudson River waterfront.

Village of Hastings-on-Hudson Programs in Progress

- **Hudson River Waterfront Alliance**
  The Village joined 33 other Hudson Valley municipalities in the Hudson River Waterfront Alliance to successfully oppose a proposed US Coast Guard rule that would have added 10 new barge anchorage grounds, and 43 anchorage sites from Yonkers to Albany, including the entire Hudson River at Hastings. A village trustee continues to meet regularly with other

[3] For this inventory, the NRI Committee conducted its own study and drew heavily from the Village's recent plans, listed here, that both inventory and plan for the care and management of our many natural resources.

Hudson River Shoreline elected officials to monitor further proposals potentially impacting the Hudson River estuary and the shoreline. The Village adopted a resolution asking the US Army Corps of Engineers to carry out more extensive study prior to adopting plans for storm surge barriers in NY York Harbor and its tributaries.

- **Climate Action Planning Institute**
  The Village of Hastings-on-Hudson, along with 8 other municipalities, has been selected to be part of a collaborative working group whose aim is to complete climate action plans that will outline emissions reduction targets, strategies, and projects.

Existing Data Sets

Many datasets for mapping natural resources are publicly available. Data layers can be downloaded directly from the Cornell University Geographic Information Repository website (http://cugir.mannlib.cornell.edu/), the New York State GIS Clearinghouse website (http://gis.ny.gov/), or from Westchester County GIS (https://gis.westchestergov.com/), which is a particularly good resource for parcel boundary data. The data sources for the maps in this document include: Westchester County GIS, the New York State Geological Survey, the NYS Department of Environmental Conservation, as well as some additional sources (see figure and table captions). Some data sets have limitations, and none of them are guaranteed by their originators to be free of errors. One main limitation is that many are coarse-grained and are not intended to be used to review individual parcels, but rather are intended for larger-scale planning efforts.

Part B: Village of Hastings-on-Hudson Natural Resources

Overview

Hastings-on-Hudson is the first suburban community north of the New York City/Yonkers urban area and is located on the eastern bank of the Hudson River. The natural resources that best characterize Hastings-on-Hudson are the rivers that border it to the east (the Saw Mill River) and to the west (the Hudson River). The Hudson River is central to most scenic views in Hastings-on-Hudson, and it influences the ecology and local environmental conditions. The Village's latitude and proximity to water results in cool winters and warm, humid summers. The River moderates the shore areas, which are slightly cooler in summer and warmer in winter than surrounding uplands. Hastings-on-Hudson is also characterized by steep slopes, rocky soils, and bare rock outcrops, all of which are products of its glacial history.

Due to its geological and hydrological context, its history of environmentalism, and its distance from urban centers, Hastings-on-Hudson supports several distinct ecological communities. Its upland forest and Hudson River habitats are most obvious, but Hastings-on-Hudson also includes riparian habitats, ponds, wetlands, a grassland/shrubland, and many street trees, as well as extensive private lawns and gardens. Each of these habitats supports a characteristic cohort of plants, animals, and fungi.

The following sections introduce the geological and hydrological context of Hastings-on-Hudson, and its different habitats.

Geology and Soils

Geology and Climate Change

The geology of Hastings-on-Hudson is an important natural resource that influences city planning and the local ecosystem, and has a significant impact on how the community is affected by the projected climate changes described below. More specifically, the surficial geology and the distribution of soil types influence the severity and location of flooding, as well as the structural integrity of land throughout the Village. In addition, the interaction between geology and land use greatly affects the volume and speed of stormwater runoff, which in turn has an impact on the amount of pollution being transported into aquifers, wetlands, and waterbodies.

With projected increases in both total volume and intensity of precipitation in the coming years, flooding and stormwater runoff are a prime concern for the Village. Bedrock geology, surface geology, and soil distribution maps can help determine appropriate uses for an area and can indicate locations with an increased risk of flooding or ideal locations for diverting runoff.

Bedrock and Surficial Geology

The Village of Hastings-on-Hudson is located in the Manhattan Prong physiographic province, situated between the Hudson Highlands to the north and the Atlantic Coastal Plain to the south. The Manhattan Prong is composed of Paleozoic metamorphic marbles, quartzites, and schists overlying a complex of Precambrian gneiss. The Paleozoic rocks belong to the Inwood Marble formation, and the basement Precambrian rock to the Fordham Gneiss. The erosion resistant schist, quartzite, and gneiss form distinctive stepped-ledges along the slopes of the north-south oriented ridge which runs through

the Village. The softer and more easily eroded marble forms the topographic lows of the valleys and drainages.

Figure 1: Hastings-on-Hudson bedrock. *Data obtained from New York State Geologic Survey.*

Surficial Geology

The physical features of Hastings-on-Hudson were formed during the most recent glacial maximum, approximately 21,000 years ago, during which the entire Hudson Estuary was scoured by the advance of the Wisconsin ice sheet. The Lower Hudson River and Long Island Sound became a freshwater basin when water from the Great Lakes and Champlain Basins became impounded by dams of glacial material left by the melting ice. The estuary was created when the morainal dam was breached at Verrazano Narrows approximately 13,000 years ago and the ocean flooded the Hudson Valley. Since then, sea-level rise and sedimentation due to erosion from the surrounding uplands have made smaller changes in the landscape.

Figure 2: Hastings-on-Hudson surficial geologies. More information on specific types can be found at the New York State Education Department's website (http://www.nysm.nysed.gov/research-collections/geology/gis). *Data obtained from New York State Geologic Survey.*

Soils

Soil types occur in an orderly pattern that is related to the geology, the landforms, relief, climate and the natural vegetation of the area. Areas of a specific soil type may gradually merge into adjoining soil types, but soil properties can also change dramatically over a short distance, influencing the ability of water to permeate the surface and of different species to survive there. In general, soil properties describe the source material of soils, how well soils drain or if they are subject to flooding, and the depth to bedrock beneath the soils. These soil properties, along with other factors, influence and determine the appropriate land use for an area.

The predominant soil type in Hastings-on-Hudson is Urban land-Charlton-Chatfield complex (UIC, UID), comprising 21.40% of the area in the Village. The second most common soil type is

Charlton-Chatfield complex (CrC, CsD) comprising 19.19% of the Village's area, followed by Charlton fine sandy loam (ChB, ChC, ChD, ChE, CIC) comprising 12.10% of the area. The fourth most common soil type is Urban land-Charlton complex (UhB, UhC, UhD) comprising 11.79% of the Village's area, followed by Udorthents (Ub, Uc) comprising 11.50% of the area. Bedrock and areas of shallow soil make up 1.98% of the Village's area. The remaining 22.04% of the area in the Village is made up of 12 additional soil types. Table 1 includes descriptions of all the soil types in Hastings-on-Hudson and the map in Figure 3 shows the coverage of each soil type throughout the Village.

Table 1. Soil Descriptions For Every Soil Type in the Village of Hastings-on-Hudson
Source: USDA Natural Resource Conservation Service Web Soil Survey

Soil Descriptions	
Charlton fine sandy loam (ChB, ChC, ChD, ChE, CIC)	Formed in coarse-loamy glacial melt-out till derived from granite, gneiss, and/or schist. These soils are well drained, very stony, and have a gravelly fine sandy loam texture
Charlton-Chatfield complex (CrC, CsD)	Formed in coarse-loamy glacial melt-out till derived from granite, gneiss, and/or schist. These soils are well drained, very stony, and have a gravelly fine sandy loam texture
Chatfield-Hollis rock outcrop complex (CtC, CuD)	Formed in coarse-loamy glacial melt-out till derived from granite, gneiss, and/or schist. These soils are well drained, extremely stony with a gravelly fine sandy loam texture, and directly overly bedrock
Fluvaquents-Udifluvents complex (Ff)	Formed in alluvium with highly variable texture. These soils are poorly drained, subject to frequent flooding, and have a very gravelly silt loam texture
Hollis-Rock outcrop complex (HrF)	Formed in coarse-loamy glacial melt-out till derived from granite, gneiss, and/or schist. These soils are somewhat excessively drained, very stony with a gravelly fine sandy loam texture, and directly overly bedrock
Knickerbocker fine sandy loam (KnB)	Formed in sandy glaciofluvial deposits or deltaic deposits. These soils are somewhat excessively drained and have a fine sandy loam texture
Paxton fine sandy loam (PnB, PnC)	Formed in coarse-loamy lodgment till derived from gneiss, granite, and/or schist. These soils are well drained with a fine sandy loam texture

Ridgebury complex (RdB, RgB)	Formed in coarse-loamy lodgment till derived from gneiss, granite, and/or schist. These soils are poorly drained and have a gravelly fine sandy loam texture
Riverhead loam (RhE)	Formed in loamy glaciofluvial deposits overlying stratified sand and gravel. These soils are well drained and have a loamy sand texture
Sun loam (Sh)	Formed in loamy till derived primarily from limestone and sandstone, with a component of schist, shale, or granitic rocks in some areas. These soils are very poorly drained and have a loam to gravelly fine sandy loam texture
Sutton loam (SuB)	Formed in coarse-loamy glacial melt-out till derived from gneiss, granite, and/or schist. These soils are moderately well drained and have sandy loam texture
Udorthents (Ub, Uc)	Formed in glaciofluvial deposits, these wet substratum are areas of disturbed soils where the upper soil material has been removed, filled or graded. They are moderately well drained and have a very gravelly loam texture
Urban land (Uf)	Cemented material
Urban land-Charlton complex (UhB, UhC, UhD)	Cemented material and Charlton fine sandy loam
Urban land-Charlton-Chatfield complex (UIC, UID)	Cemented material and very stony Charlton-Chatfield gravelly fine sandy loam
Urban land-Chatfield rock outcrop (UmC)	Cemented material and very stony Chatfield gravelly fine sandy loam overlying bedrock
Urban land-Paxton complex (UpB, UpC, UpD)	Cemented material and Paxton fine sandy loam
Urban land-Riverhead complex (UvB, UvC)	Cemented material and Riverhead loamy sand
Urban land-Woodbridge complex (UwB)	Cemented material and Woodbridge gravelly loam
Woodbridge loam (WdC)	Formed in coarse-loamy lodgment till derived from gneiss, granite, and/or schist. These soils are moderately well drained and have a gravelly loam texture.

Figure 3: Map of soil types in Hastings-on-Hudson. Labels are formal abbreviations (Map Unit Symbols) corresponding to the Map Unit Name best representing the soil type in each polygon, per the official Soil Survey Geographic Database (SSURGO) format. More information, including resources for learning more about individual soil types, can be found through the USDA's Natural Resources Conservation Service website. *Data obtained from the U.S. Department of Agriculture, Natural Resources Conservation Service.*

Slopes

The Village is built on hills characterized by steep slopes and rocky outcroppings. The Steep Slope Ordinance in the Village Code defines steep slopes as any area 1,000 square feet in area with a slope of 15 percent or greater. Steep slopes are found throughout the Village and are disproportionately vulnerable to erosion.

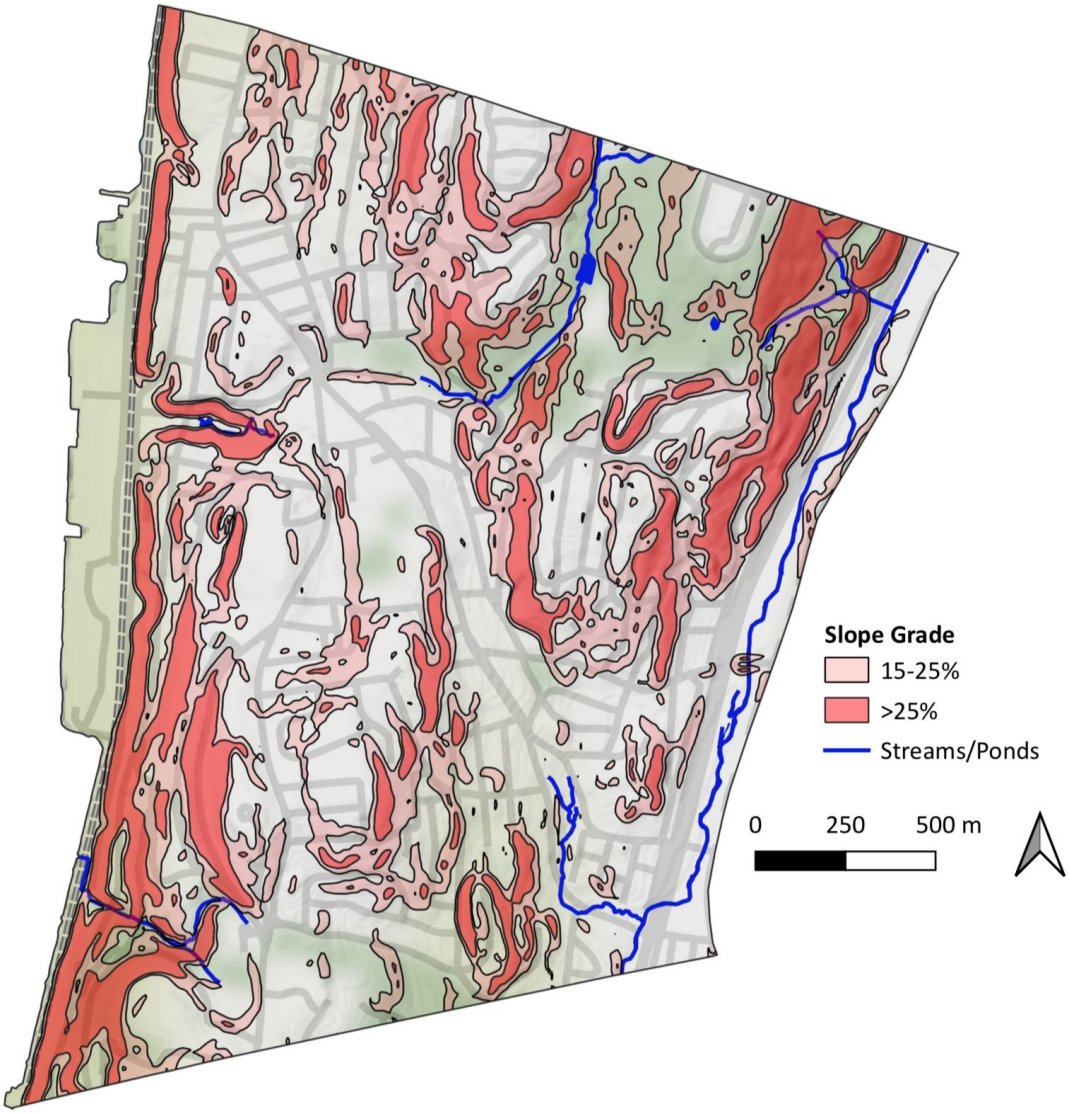


Figure 4: Map of steep slopes in Hastings-on-Hudson. Moderately steep (15-25% grade) slopes are labeled in pink, and very steep slopes (>25%) are labeled in red. Steep slopes are common throughout Hastings-on-Hudson and are concentrated along the Hudson River at the western border of the village and along the Saw Mill river on the eastern border of the village. *Data obtained from Westchester County GIS.*

Rock Ledges

Exposed rocks are abundant in Hastings-on-Hudson. An example may be found at the top of the cliffs behind Hillside Elementary School, where a dwarf alpine eco-community with scrub oak trees, mosses, and lichens thrives. *Silene caroliniana* var. *pensylvanica*, an uncommon wildflower with pink phlox-like flowers, also lives here and blooms early in spring. The rocks themselves have great beauty in their stripings, and some display glacial scrapes and faults.

Man-made ledges are present in several locations in the village, most notably along the eastern rim of Quarry Park and in the backyards of the homes along the east side of Hamilton Avenue. Both of these outcroppings are the result of quarrying stone—marble in the case of Quarry Park and gneiss in what was known as Nichols' Quarry in Hudson Heights.

Rock ledges typically have only a thin layer of soil over them and can be difficult to plant with species that are not specifically adapted to this habitat. While landscaping has changed many of the associated scrub plant communities, the native plant communities adapted to these environments still persist in some places. Scrub oaks have adapted and spread out their root system far and wide, sometimes either finding or creating a fissure in the rock for the taproot. The better-rooted trees are more stable and are more resistant to windthrow.

Ravines and Old River Bluffs

The higher ground sloping toward the Hudson River just east of the railroad tracks is densely vegetated and supports, in many places, very old trees that seem to have outlived their surrounding forest communities. Dry ravines that seem to have been sculpted by water that has since been diverted are found along this edge and support plants and animals in high abundance.

Examples of ravine and bluff habitats are found along the Hubbard Extension Trail and behind the River Glen co-operatives complex. Despite threats from a combination of factors such as the construction of the railroad, stormwater diversions, and other activities, many of the hardwoods remain. Their survival is good for the steep slopes found here, most of which would need to be protected by retaining walls in the absence of tree roots. At the base of these trees, and throughout the ravines, herbaceous plants and shrubs grow abundantly. Many are exotic plants such as porcelain berry and, in particular abundance, Japanese knotweed. However, some are native grapes and native herbs, which support a healthy thicket habitat heavily used by songbirds, including those migrating along the Hudson River corridor. These areas all fall within the State and Westchester County-designated Hudson River Critical Environmental Area.

Water Resources

Groundwater and Aquifers

A low-yield (10-100 gal/min) aquifer runs beneath the Saw Mill River on the east side of the Village.

Watersheds, Streams, and Waterbodies

Although all of Hastings-on-Hudson eventually drains into the Hudson River, the Village is actually composed of two sub-watersheds. The majority of the Village drains directly into the Hudson River, and a smaller area east of a ridge in Hillside Woods drains into the Saw Mill River. The Saw Mill River then eventually carries that water down to the Hudson River in Yonkers.

Surface streams are uncommon in Hastings-on-Hudson as most have been piped and redirected. Some village residences have experienced temporary flooding during storms that generate runoff exceeding storm sewer capacity. Occasionally this has been linked to specific construction projects. The Village has one remaining significant free-flowing stream—Scheckler's Brook[4]—that runs from Hillside Woods to the Hudson River. Smaller remnant streams include one in Hillside Woods that runs to the SawMill River, one near Farragut Parkway, one on the Burke Estate, and Rowley's Brook, which begins at a marshy area east of Broadway, runs under Warburton Avenue at Rowley's Bridge, and empties into the Hudson. It is important to preserve these areas for their aesthetic qualities and their cultural importance, and for their contribution to local biodiversity.

[4] More information from the Hastings Historical Society: https://hastingshistoricalsociety.org/2020/06/22/hastings-hidden-waterway/

The Village has two ponds, only one of which, Sugar Pond in Hillside Woods, is publicly accessible. Sugar Pond is well-known and treasured. It has been a valuable educational and recreational resource for the community and has also supported a healthy, diverse wildlife community. Another pond is located on the Cropsey Institute grounds and is fed by the stream from the Burke Estate and Sugar Pond. This pond is not open to the public.

Floodplains

The Hudson River and the Saw Mill River are both surrounded by land in 100-year and 500-year floodplains—areas that have 1% and 0.2% probabilities of flooding each year, respectively. Floodplains perform important natural functions, including temporary storage of floodwaters, moderation of peak flows, maintenance of water quality, groundwater recharge, and prevention of erosion. Floodplains also provide habitat for wildlife, recreational opportunities, and aesthetic benefits. These characteristics of floodplains and associated wetlands should be preserved and enhanced.

The majority of the Hastings-on-Hudson waterfront to the west of the Metro-North railroad tracks is in the 100-year floodplain, and some portions directly abutting the railroad tracks are in the 500-year floodplain. Almost all of the land abutting the Saw Mill River including lands between the river and Saw Mill River Road and lands extending across the Saw Mill River Parkway are in the 100-year floodplain. There are also relatively minor and scattered tracts of land in the 500-year floodplain along the Saw Mill River, as well as on sections of Broadway, Farragut Parkway and Avenue, and areas of Hillside Woods.

FEMA Maps

FEMA's 2007 Flood Insurance Rate Maps (FIRMs) are the most current in effect for the Village. FEMA's preliminary 2014 FIRMs were contested by New York City, and as a result FEMA has undertaken new storm surge analysis and wave modeling to support revised flood maps as part of the Region II Coastal Restudy. Draft maps are expected in 2022.

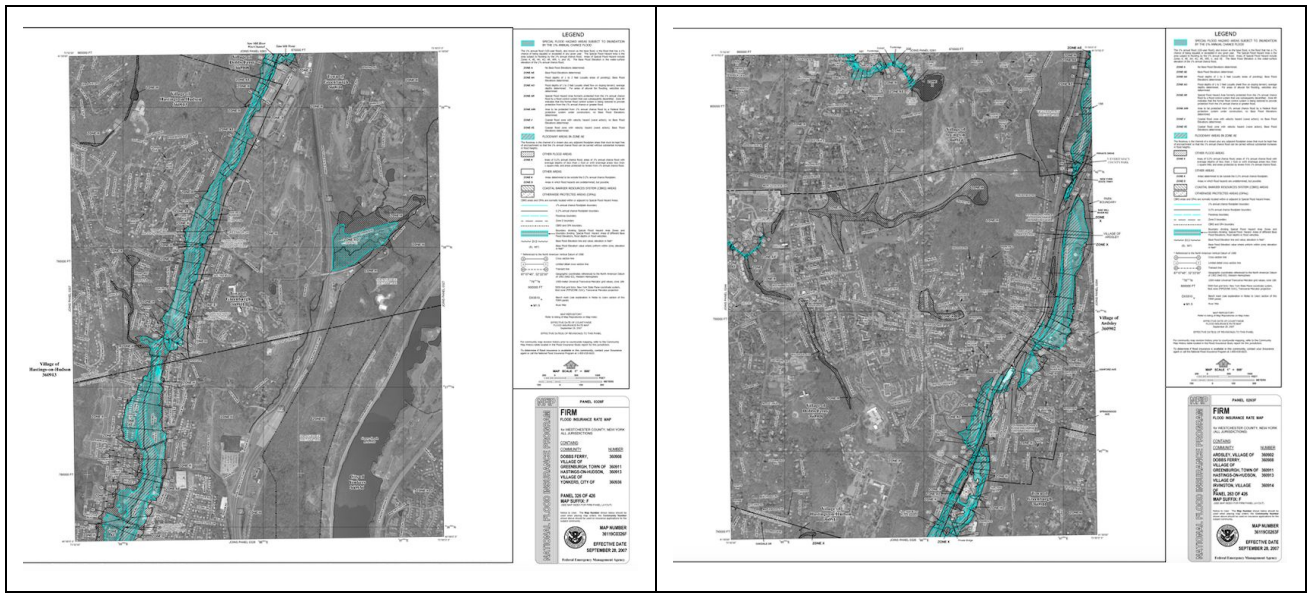


Figure 5: 2007 FEMA maps for Hastings-on-Hudson Saw Mill River area. *Data from FEMA Flood Map Service.*

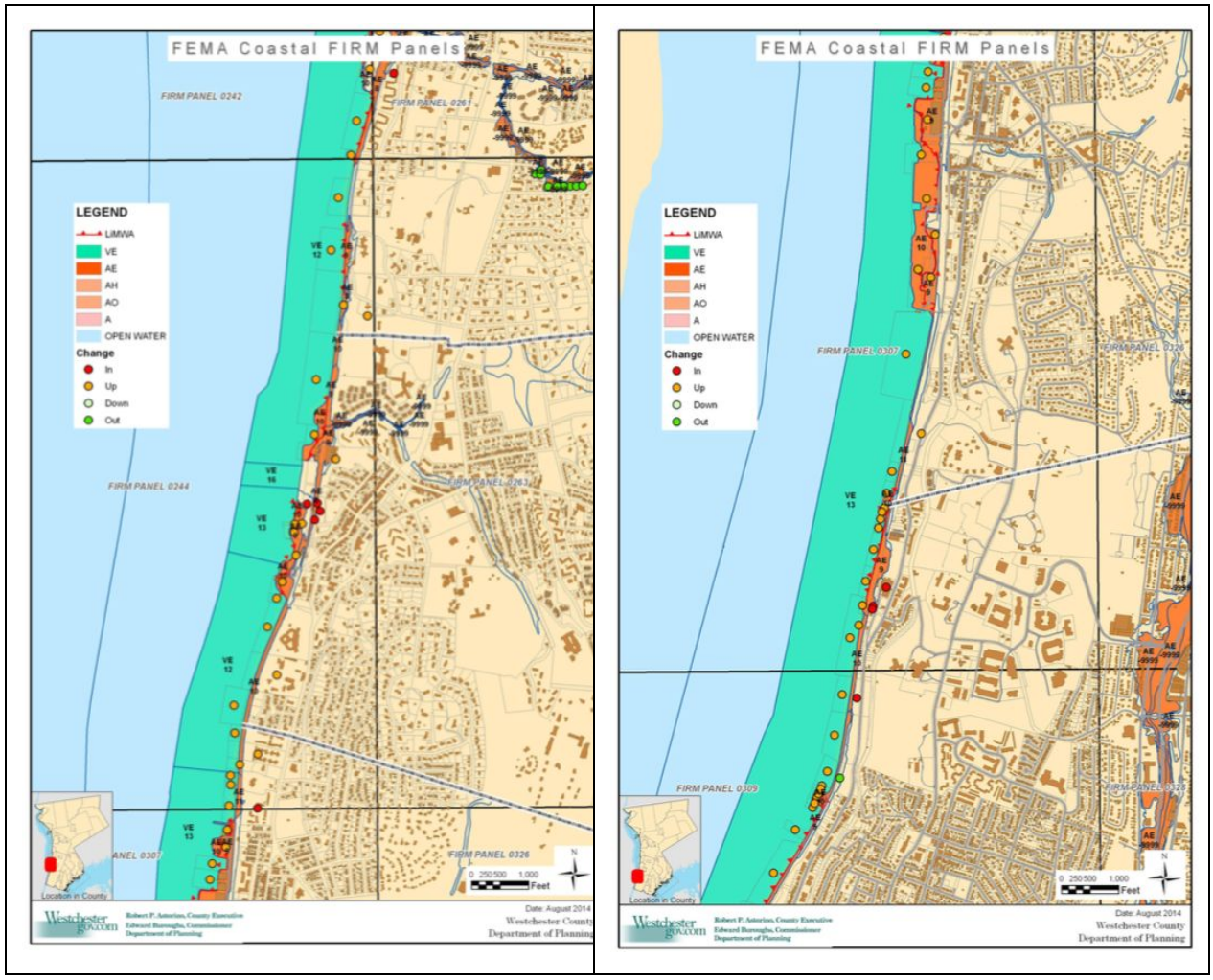
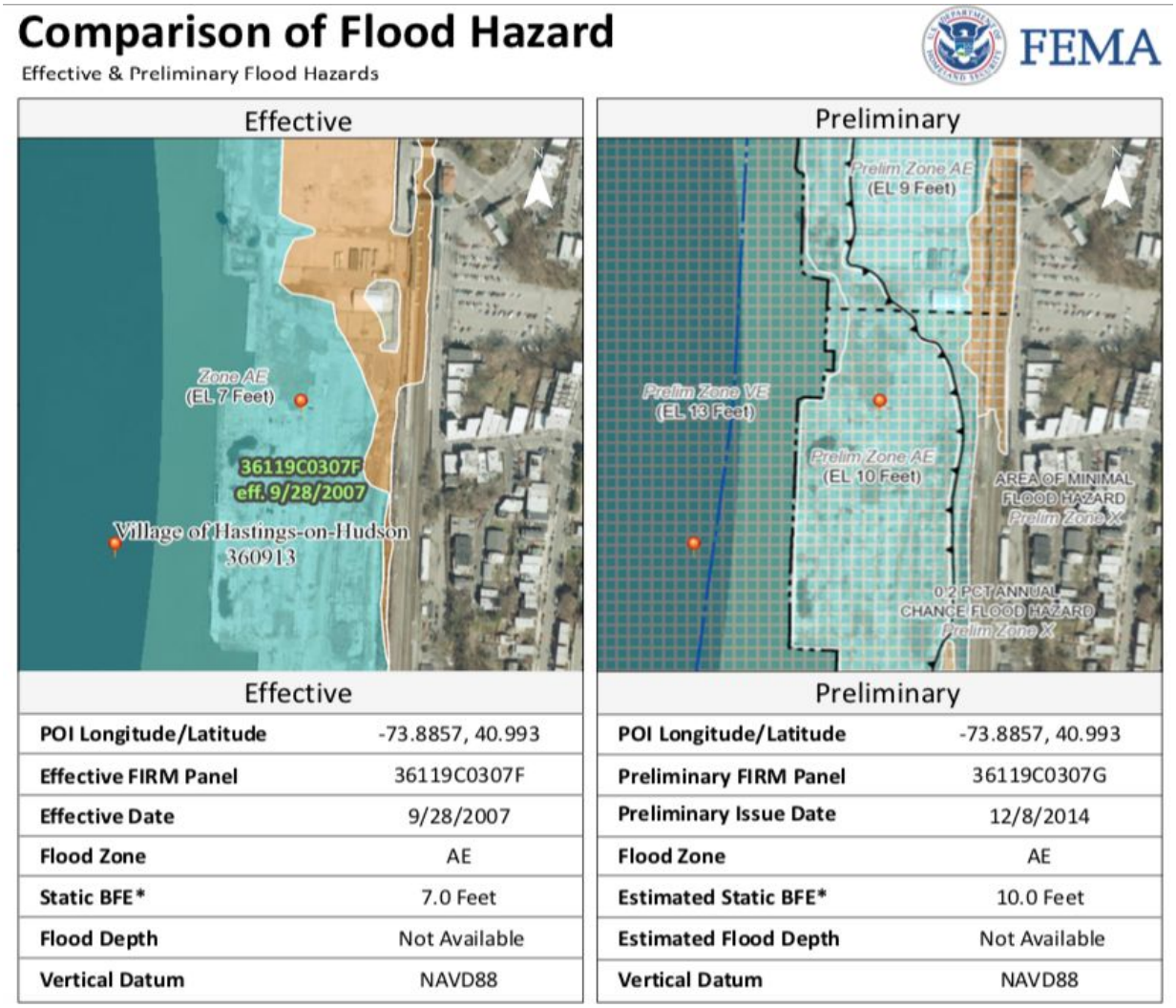


Figure 6: Preliminary 2014 FEMA Maps, Panels 0244, 0307 for Hastings-on-Hudson Waterfront.
Data from [FEMA Flood Map Service](#).



Effective	
POI Longitude/Latitude	-73.8857, 40.993
Effective FIRM Panel	36119C0307F
Effective Date	9/28/2007
Flood Zone	AE
Static BFE*	7.0 Feet
Flood Depth	Not Available
Vertical Datum	NAVD88

Preliminary	
POI Longitude/Latitude	-73.8857, 40.993
Preliminary FIRM Panel	36119C0307G
Preliminary Issue Date	12/8/2014
Flood Zone	AE
Estimated Static BFE*	10.0 Feet
Estimated Flood Depth	Not Available
Vertical Datum	NAVD88

Figure 7: Comparative FEMA maps from 2007 (left) and 2014 (right) for Hastings-on-Hudson Waterfront. *Data from FEMA Flood Map Service.*

In addition to flood elevations, wave action and storm surge are important considerations. Flood hazard identification under the National Flood Insurance Program (NFIP) divides coastal flood hazard areas into two flood zones: Zone VE and Zone AE. The AE Zone is an area subject to inundation by the 1-percent-annual-chance flood event, and subject to wave heights between 1.5 and 3 feet. VE zones are also known as coastal high hazard areas. They are areas subject to high velocity water including waves, and are defined by the 1% annual chance (base) flood limits (also known as the 100-year flood) and wave effects 3 feet or greater. Damages to structures from wave heights between 1.5 and 3 feet are similar to, but sometimes considered less severe than, those in areas where wave heights are greater than 3 feet. Evidence suggests however that design and construction requirements in some portions of coastal AE zones should be more like VE Zone requirements, and International Codes® requires Zone VE construction standards in identified Coastal A Zone areas.

From the 2007 and 2014 FEMA maps, as well as the report comparison of FEMA's 2007 and 2014 maps (Figures 5-7), it is apparent the Hudson River has been upgraded from an AE Zone to a VE Zone. In addition, the area of the AE Zone has also increased in the 2014 maps. The moderate flood risk area (Shaded Zone X) also has a risk of shallow flooding.

In 2014, the Village commissioned a Waterfront Infrastructure Committee (WIC) which issued its report in April 2015. The final WIC Report was drafted with the expectation that FEMA's 2013-2015 preliminary Flood Insurance Rate Maps (FIRMs) would be adopted for the area. As noted in the Report, "even when grade on the BP site is raised five feet per the Consent Decree, at least half the site will still lie within the revised flood plain. Without a significant increase in the elevation of the site, it is unlikely that any development will be permitted within the floodplain." In light of the likely still further increase in flood elevations as well as the new thinking in storm surge analysis and wave modeling expected in the 2022 draft maps, the recommendations of the Waterfront Infrastructure Committee will need to be revisited when the updated FEMA maps are released.

The Village's Flood Damage Prevention Ordinance requires that a proposed development within a special flood hazard area (i.e. 100-year floodplain) obtain a development permit from the Village Building Department prior to construction. The Village has specific mandated provisions for building in flood hazard areas, which are continuously updated as new flood information becomes available.

In the Climate Projections section of this Inventory, flooding related issues are discussed in more detail. In the Appendix, a project plan for restoring a portion of the Village's shoreline at MacEachron Park is included. The Village received a planning and design grant in early 2020 and, assuming the funds become available, work is expected to begin in late 2020.

Wetlands

There are only a few wetlands remaining in the Village and none of them are protected under State and Federal regulations. According to the US Fish and Wildlife Service's National Wetlands Inventory Map, the most extensive wetlands areas in the Village are in Hillside Woods (including the Judson Avenue parcel) and the Saw Mill River corridor. Smaller wetlands can be found throughout the Village including on the Burke Estate, the Andrus Orchard School, and the vernal pond in Hillside Woods. All of these wetlands are important habitat for flora and fauna—especially for amphibians that rely on wetlands for reproduction. Wetlands located on large tracts include the Saw Mill River swamp forest and the wetlands in Hillside Woods. Smaller wetlands are located throughout the Village.

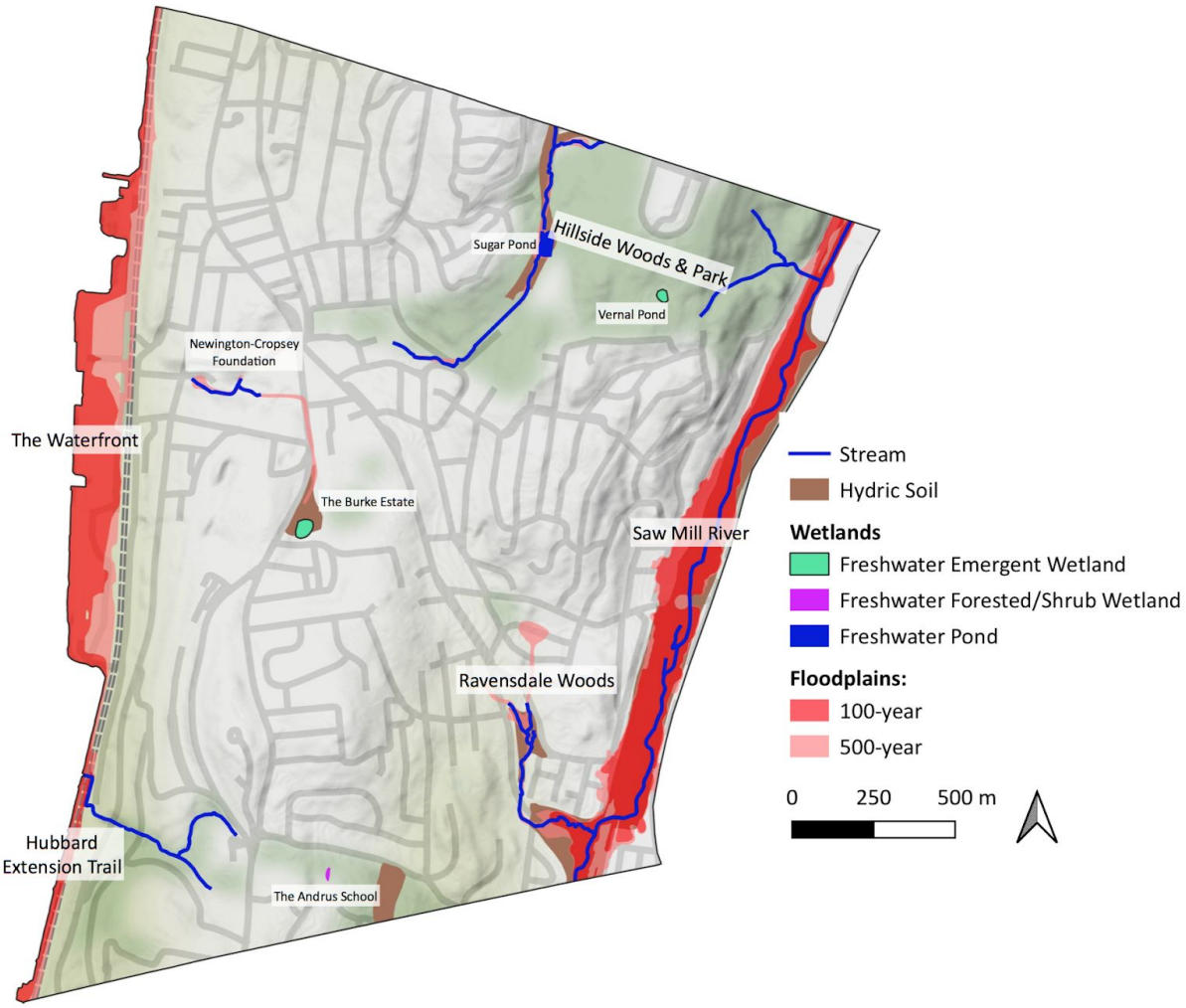


Figure 8: Map of hydric soils, wetlands, and floodplains in Hastings-on-Hudson. *Data obtained from Westchester County GIS (Hydric Soil), the U.S. Department of Agriculture Natural Resources Conservation Service (Hydric Soil), the New York State Department of Environmental Conservation (Wetlands), and the Federal Emergency Management Agency (Floodplains).*

Water Quality and Stormwater Management

Protecting the water quality of the Saw Mill and Hudson Rivers, as well as the streams and watercourses which run into them, should be of utmost concern for the Village. Water quality—not just drinking water, but also the water features that support wildlife and natural habitats—is critical. Water quality regulations may be the single most significant tool available to a community to protect its natural resources and wildlife.

The Hudson River is Hastings-on-Hudson's most significant natural water resource. Activity along the Hudson polluted the water through the early and middle 1900s before new regulations like the Clean Water Act were passed during the late 1900s. Until these regulations took effect, the Hudson had been polluted primarily by sewage and other organic wastes, contributing to bacteria growth and hypoxic conditions in the water, and by mill and factory discharges, causing a buildup of toxins in river-dwelling animals. Today, the rate at which contaminants enter the Hudson is greatly reduced. However, the river is still affected by runoff that carries fertilizers, pesticides, and organic wastes into the water, by periodic sewage overflows, by pollution from antibiotics and hormones, and by new chemicals whose environmental impacts are not well understood.

While there are fewer new contaminants entering the Hudson today, it is still affected by past pollution. Even though contamination by polychlorinated biphenyls (PCBs) stopped in the 1970s, these chemicals are still trapped in sediments today. PCBs can become concentrated among animals at high trophic levels that depend on food from the river, affecting their ability to survive and reproduce. Because of PCBs, the consumption of animals from the Hudson is not recommended, although specific recommendations vary based on species.

Ponds, wetlands, and streams are also important Hastings-on-Hudson water resources that are threatened by erosion and contaminants. Sugar Pond in Hillside Woods exemplifies these issues. Because of the steep slopes and sparse ground cover nearby, the pond is affected by sediment and contaminant influx. Sedimentation is made worse by invasive *Phragmites* that traps these sediments at the entrance and exit of the small stream that feeds the pond. The pond also receives organic wastes from runoff and from animal use, contributing to annual algal blooms that then create hypoxic conditions in the water. Water cleanups, invasive species removal, addition of ground cover in surrounding areas, and use regulations would improve the quality of the Village's water resources.

In the Village, as for many communities in Westchester County, the biggest threat to water quality is contaminated stormwater runoff, known as non-point source pollution. This type of pollution is created by impervious surfaces and development in floodplains and wetlands. Non-point pollution will be made worse by continued climate change, which will bring more frequent and severe storms as well as rising seawater levels. Stormwater runoff is the excess rain or melted snow that cannot be absorbed by the soil. It flows off roofs and over yards, driveways, parking lots, and streets. It becomes non-point source pollution when it picks up contaminants along the way, such as trash, fertilizer, bacteria, and car oils and flows into streams and reservoirs. In the Village it eventually enters either the Hudson River or the Saw Mill River. Since the stormwater is not pre-treated before flowing into the water bodies, stormwater runoff has been identified by the United States Environmental Protection Agency (EPA) as a major contributor to pollution of watercourses, water bodies and wetlands.

Impervious surfaces increase the amount of non-point pollution entering the Village's water bodies. These surfaces prevent rainfall from percolating into the ground, resulting in a dramatic increase in the volume of stormwater runoff. Development also has a significant impact on the ability of the soil to store rainwater, thus increasing the volume of runoff generated during a storm. Development in floodplains and wetlands further increases the amount of stormwater flowing into the Village's water bodies. Floodplains and wetlands normally collect the stormwater, releasing it slowly into the river system and groundwater aquifers. Development within these areas not only reduces the floodplain's ability to store floodwaters, but increases the chances of damage to structures and property.

Stormwater management is the use of structural or nonstructural practices that are designed to reduce stormwater runoff and mitigate its adverse impacts on property, natural resources and the environment. The Village adopted a local law related to Stormwater Management in 2007 to establish minimum stormwater management requirements and controls, and to be in compliance with Federal and New York State stormwater management requirements. The law requires that no application for approval of land development activity shall be reviewed until the appropriate approving authority has received a Stormwater Pollution Prevention Plan (SWPPP). The Village produces an annual Stormwater Management Report documenting its actions related to stormwater management which is posted on the Village website.

As part of the Lower Hudson River Watershed, the Village entered into an inter-municipal agreement with 15 municipalities, in February 2007, to work toward compliance with the most recent State and Federal stormwater management regulations. As part of the agreement, the municipalities agreed to cooperate on addressing common issues relating to the Hudson River such as flooding, stormwater management, improving water quality, increasing public access and recreational opportunities, improving aesthetics, and restoring native vegetation.

Hastings-on-Hudson's drinking water is provided by Suez North America, which purchases it from the New York City Water System. The water is pumped from the Delaware and Catskill River systems, which are upstate and west of the Hudson. Recent water quality reports suggest that our water meets New York state requirements regulating levels of lead and other contaminants in water.

Habitats and Wildlife

The Hudson River Estuary

The north-south orientation of the Hudson River Valley makes it a critical link in the migratory patterns of birds, insects, and fish. Anadromous fish (e.g., sturgeon and shad) whose life cycles include use of both freshwater and saltwater habitats must pass through the Hastings-on-Hudson portion of the Hudson on their way to the Atlantic Ocean and back to their spawning grounds in the upper freshwater reaches of the Hudson. Migratory birds and monarch butterflies follow the north-south orientation of the River to link up with, and then follow, the Atlantic coastline south in the Autumn. They then reverse the process in Spring on cross-continental migrations. Recent studies of these migration patterns have underscored the importance of all remaining natural areas in the Lower Hudson Estuary during these seasons. While birds remain abundant, good quality habitat is becoming scarce. At some point, available habitat during migration may become a limiting factor for migratory species. To combat this, an ongoing collaborative effort among Hastings and nearby Rivertowns to create north-south oriented "pollinator pathways" aims to preserve continuous stretches of suitable habitats for migratory species.

The Hastings-on-Hudson portion of the Hudson River is narrow and about 25 feet deep before it drops off to a greater depth in the shipping channel. In fact, the waterfront maintains access to a deepwater port. The deepwater wildlife community occurs where depth is greater than six feet. Abundant animal life in deepwater is fed by organic material produced by the surrounding watershed. There are three major types of deepwater animal life: benthic invertebrates (usually stationary), fish, and fish-eating predators. The bottom dwellers, or benthics, live on the river bottom where they feed on organic detritus and other animals. Common microscopic life includes amoebae, foraminifera, and bacteria. Larger invertebrates include wormlike animals that burrow in the mud; mollusks, such as clams, snails, and mussels; and arthropods, such as insects, barnacles, shrimp, and crab. The composition of benthic species in a water sample is often used as an indication of relative pollution levels, because negative impacts to benthic populations have been correlated with exposure to pollution. It is likely that the benthic community in the Hastings-on-Hudson portion of the river has been affected by toxic pollution from the former industrial waterfront sites.

The Hudson River fish community is composed of anadromous fish including shad, herring, alewife, striped bass, tomcod, both Atlantic and shortnose sturgeons, and eel (catadromous). Occasionally, marine fish, including menhaden, goosefish, bluefish, weakfish, and sculpins are present. Fish-eating

predators include humans, raptors (e.g., eagles and ospreys), diving birds (e.g., cormorants, loons, and ducks), reptiles, other fish, and occasional marine mammals.

Shallows, mudflats, and shore communities are found near the low tide mark. In the Village, the vast majority of these habitat types were filled in over many years. Although remnant pockets of these communities can still be found, for the most part, they do not currently support healthy vegetation—the basis for any wildlife community.

There are no tidal marshes remaining in Hastings-on-Hudson, however, across the River, Piermont Marsh is a NYS Department of State (DOS)-designated "Significant Coastal Fish and Wildlife Habitat." The Piermont Marsh is a part of the Hudson River Estuarine Research Reserve and an emblematic example of that type of riverside ecological community. On the Hastings-on-Hudson side of the river, it may be possible to recreate a tidal marsh. One potential location is Kinnally Cove, where non-vegetated mudflats do occur at very low tides when appreciable areas of the river bottom are exposed. This exposure to oxygen is beneficial in negating the anaerobic conditions common in submerged mud. These shallow areas are of particular biological importance for young fish and plankton.

The Saw Mill River

The Saw Mill River is bordered by the Saw Mill River Parkway and the former Putnam Railroad Right-of-Way (now South County Trail), and yet it continues to function as a valuable wildlife habitat. Box and snapping turtles, foxes, birds, and fish all survive and reproduce near or in the river. While its linear configuration limits some species, it provides a much-needed habitat corridor through densely populated Westchester County. The Saw Mill River and Hillside Woods complement each other: the Hastings-on-Hudson segment of the Saw Mill River is healthier and more diverse than other sections of the river because Hillside Woods provides a nearby source of stable habitat, and Hillside Woods is more diverse than it would otherwise be because the Saw Mill River connects it to other nearby habitats.

The Saw Mill River swamp forest is an excellent example of its biome type, providing high aesthetic, recreational, educational and biodiversity value. The River itself is often used for recreational fishing, and the South County Trailway, which runs along the River, provides regional access for walkers, joggers and cyclists.

Hudson River Coastal and Shoreline Habitat

Our waterfront west of the railroad tracks has been a focal point of industry over the last few hundred years thanks to easy access to transportation along the Hudson. The low, flat piece of land that extends into the river is susceptible to flooding and has a long history of contamination by manufacturing facilities that it supported. Although this section of the waterfront is of recent origin, geologically speaking, and is polluted, it is not a biological desert. The southern portion of our waterfront supports a variety of animals and plants, including water-loving birds and the locally uncommon saltmarsh fleabane.

The steep slopes immediately east of the railroad tracks that flank the Hudson consist, in places, of dry gorges covered with vines that once may have contained streams and waterfalls. Many of these slopes are secured by enormous mature hardwoods, such as, oaks, tulip trees, basswood, and elms. In other areas, residents use debris to try to control erosion and slope failure. Above these slopes, many houses in Hastings-on-Hudson seem to perch on rocky ledges.

Stream and Riparian Habitat

Hastings has several streams, which cross into Hillside Woods, the Burke Estate, Ravensdale Woods, and the Rowley's Bridge Trail. These provide important habitats for water-loving plants, birds, and invertebrates. They also support dense vegetation nearby, which benefits from a consistent source of water. This brush habitat provides cover and food for animals, and it helps keep the soil in place. In Hillside Woods, the stream that enters Sugar Pond is bordered by ferns, trout lilies, and skunk cabbage, as well as shrubs such as witch-hazel and winged euonymus. Understory warblers such as ovenbirds, waterthrushes, and common yellowthroats can be found here, as well several species of thrushes. Other animals such as deer and snakes can often be found along the stream as well. The stream at Rowley's Bridge is less enclosed and is bordered by ferns, honey locust, and boxelder trees, and a large population of invasive Japanese knotweed. This riparian area supports many native birds such as orioles, yellow warblers, catbirds, and blue jays, and it offers scenic views of the Hudson River.

Ponds and Wetland Habitat

Hastings has only two ponds: Sugar Pond in Hillside Woods, and a small pond on the grounds of the Cropsey Home and Studio. Of these, Sugar Pond is most accessible for humans (it is on public land) and for wildlife, which benefits from the context of Hillside Woods. Animals ranging from salamanders to ducks have reproduced in Sugar Pond. Fish spawn in the pond, although populations have occasionally been augmented by stocking. Herons, egrets, and kingfishers have been seen feeding, and migratory birds thrive in the intact understory nearby. However, in recent years Sugar Pond has shown signs of eutrophication—the pond is shrinking due to increased sedimentation. It is experiencing episodic algal blooms and has encroachment by *Phragmites Australis*, also known as common reed, which crowds out native plants and encourages the buildup of silts.[5] Silt buildup also occurs because of upstream erosion brought on by the overbrowsed understory. There are downstream effects of these changes: For example, the encroachment of *Phragmites* and the hypoxic conditions introduced by algal blooms harm native animal and plant life in and around the pond. Anecdotal evidence also suggests that bullfrog populations are down, suggesting that there has already been an impact on animal life.

In addition to ponds, wetland habitats such as Vernal Pond in Hillside Woods are an important breeding habitat for amphibians—animals that are at risk around the world due primarily to habitat destruction and disease. As stated previously, it is important to preserve these areas for their aesthetic qualities, for the link they provide to our natural history, and for their contribution to local biodiversity.

Forests

Hastings-on-Hudson is dominated by forest habitats, featuring a mature forest in Hillside Woods and several other forest fragments such as Pulver's Woods and the Hubbard Extension Trail. As recently as 25 years ago the parks had a thriving native understory, which was home to a diverse cohort of species and which nurtured the next generation of trees. However, the forest habitats are degrading due to overuse and, especially, over-browsing by white-tailed deer, which have recently destroyed much of the native plant life under 6 feet. The destruction of these small plants threatens the whole woods, as the next generation of trees is being consumed before they can mature. An entire

[5] Massari, Alexa J., and Wentzell, Bianca M., *An Assessment of Pond Health at Sugar Pond in Hastings-on-Hudson*, St. Thomas Aquinas College, New York, 2019.

community of species—plants and otherwise—that rely on having an intact, native understory is at risk. Aside from deer overpopulation, Hillside Woods is threatened by disturbances related to overuse and misuse (including pollution and vandalism) by people, and by a changing climate that might soon be unsuitable for the present set of species.

Overuse and over-browsing by deer exacerbate threats posed by invasive species in the forest. The preference of deer for native plants offers a competitive advantage to invasive plants, while understory thinning has tipped the scales further against native species, crowding out native flora and threatening fauna that relied on native plants for food and shelter. Invasive species that have become established include a variety of trees (e.g. Norway maples, ailanthus), vines (e.g. bittersweet, porcelain berry), shrubs (e.g. winged euonymus and privet), and herbaceous plants (e.g. garlic mustard, Japanese stiltgrass, mile-a-minute weed) (Figure 9). Forest damage has also combined with distribution shifts due to climate change and invasion by non-native species to assist the introduction of new diseases and pests such as the hemlock wooly adelgid, emerald ash borer, and beech leaf disease (Figure 14, below).

Other downstream effects of understory thinning by deer are also apparent. The non-native earthworm population has exploded partly due to deer overabundance, contributing to a near collapse of the ground litter food web. Erosion is happening more quickly since understory plants are less abundant, and the newly exposed bare dirt is easily swept out of place by water and wind. The erosion leads to exposed roots on slopes and increased mortality rates among large trees, which, with less soil to hold their roots in place, are more susceptible to being toppled by strong winds. Remaining trees are then more susceptible to toppling as well, with fewer big trees to buffer them from the wind. Erosion also contributes to the rapid accumulation of sediments in Sugar Pond, threatening the native plants and animals it supports.

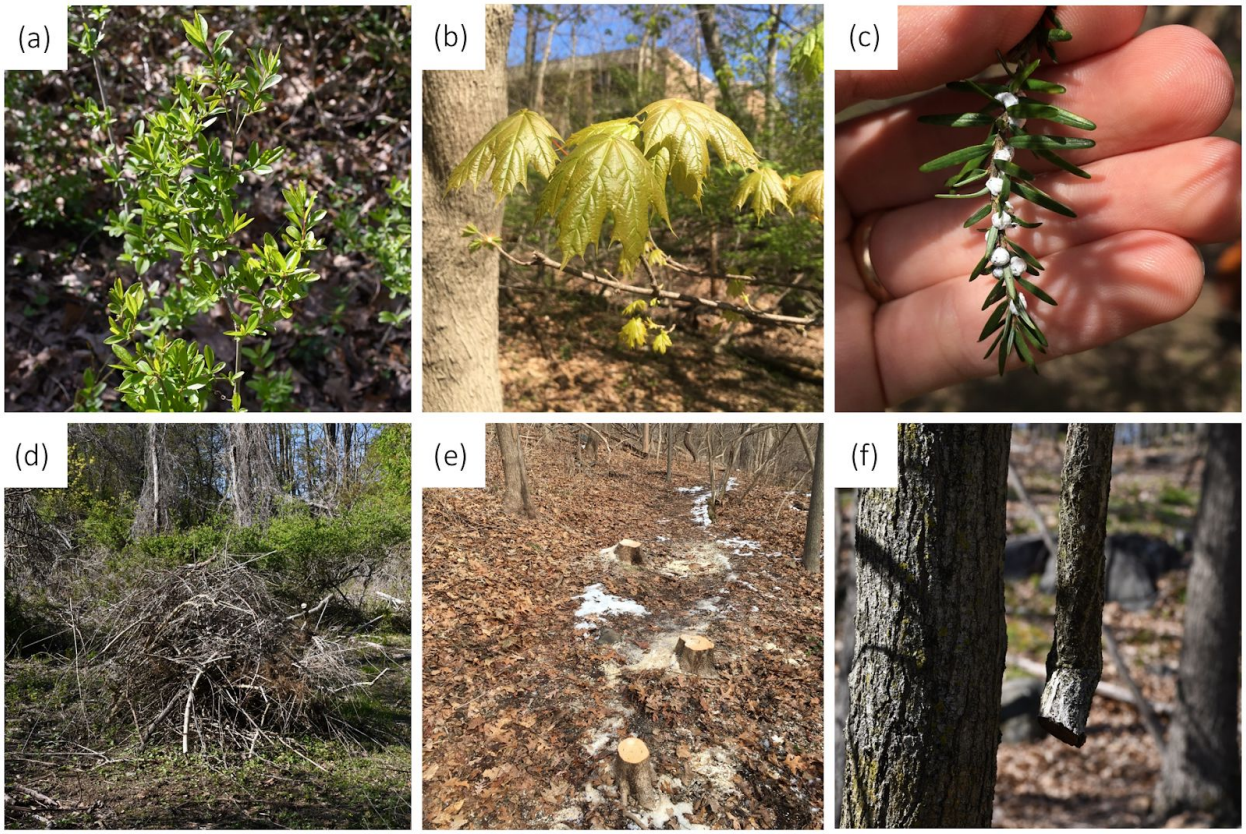


Figure 9: (a-c) Some invasive species in Hillside Woods, 2019-2020. a) Privet; b) Norway maple; c) hemlock wooly adelgid. (d-f) Some ongoing restoration efforts. d) Brush pile of removed privet; e) stumps from cut Norway maples; f) cut bittersweet vine.

Despite the threats, our forests continue to sustain many old native trees and a variety of native shrubs and herbaceous plants (although in relatively low abundance). The forest understories used to be healthy with dogwood, wild azalea, blueberries, viburnum, other shrubs, and wildflowers, but many areas are now either browsed down to the soil or are dominated by invasive species. Wildlife is still well-represented in our forests, although probably less abundantly than if the forest were healthy. Our forests also continue to support wildflowers, ferns, and shrubs in low abundance (Figure 10).

The Appendix to this Inventory describes an extensive plan that the Village of Hastings-on-Hudson has developed to restore the Hillside Woods to health.

Figure 10: Some species found in Hillside Woods. a) wild pink; b) yellow trout lily; c) flowering dogwood; d) barred owl; e) coyote; f) garter snake. 2019-'20.

Grasslands and Shrublands

Hastings-on-Hudson's natural areas are dominated by forests, but the Village does have several grassy areas in its parks, most of which are manicured. Examples of these can be found in Draper Park, Fulton Park, and Riverview Park.

Hastings-on-Hudson also has one large grassland/shrubland area. At the southern section of the waterfront, near the beginning of the Rowley's Bridge Trail, a history of industrial uses and environmental remediation has left behind a large undeveloped area. While this landscape is highly artificial, it is now covered in a variety of native and invasive plants, and it is teeming with animal life such as birds and rabbits. Young honey locust trees and pussy willow are among the native plant species, while autumn olive and wild teasel are among the non-native species. Nitrogen-fixing plants are overrepresented here and were probably planted to return nutrients to the soil. The grassland supports an assemblage of birds unlike any other habitat in Hastings, with relatively high abundances

of red-winged blackbirds and song sparrows, yellow warblers, swallows, Baltimore orioles, and shorebirds. Raptors flying along the Hudson, including vultures, red-tailed hawks, ospreys, and bald eagles, are often seen here, as are water birds including geese, gulls, and cormorants. Rare birds like orchard orioles and bobolinks can be found here as well. Many of these birds, including yellow warblers, orioles, killdeer, geese, great blue herons, and red-winged blackbirds, appear to nest here through the summer.

Street Trees

Street trees are the urban forest, providing essential shelters for native animals including squirrels, birds, and insects, which rely on them for connecting to non-contiguous habitats such as our local parks. In addition, street trees can help maintain healthy soil for sustaining nearby plant life and, when planted together, they conserve moisture in the soil.

An inventory of street trees was conducted in Hastings-on-Hudson in 2013 to assess species diversity, health, and maintenance priority levels of street trees. The report surveyed 1,217 planting spaces and 1,036 trees, amounting to a total of 71 species. Of the surveyed trees, maples were highly represented (38.71%). The next most common genus surveyed was *Pyrus*, a genus of ornamental pear trees (10.42%). Also among the most common street trees were trees from the genera *Gleditsia* (5.41%) and *Robinia* (2.12%), which are both important native plant groups that deliver nitrogen from the air into the soil in a form that is usable for other plants. The two most abundant species surveyed were Norway maple (22.20%) and Callery pear (10.33%), which are both introduced and invasive in the area. The planted Norway maples probably bolster the invasion of this species into local forests such as Hillside Park, Pulver's Woods, and the waterfront surrounding the Hubbard Extension Trail. Although most inventoried trees (>90%) were found to be in good condition, the report did indicate that the Village's street trees are aging and that new planting will soon need to take place to offset tree mortality. Finally, the report suggested the need for greater street tree diversity, since the Hastings-on-Hudson tree community is dominated by maples. A main conclusion of the report is that future street tree planting should prioritize local, native species that are not yet well represented among Hastings-on-Hudson street trees. This finding should encourage updates to the Village's Tree Preservation Ordinance, which currently regulates the removal of trees but does not yet make recommendations about new tree plantings.

Residential Areas: An Overlooked Habitat

Like fish that are unaware of the water they swim in, the authors of natural resource inventories can fail to notice their most important and ubiquitous habitat: their own backyards. In Hastings-on-Hudson the residential plots occupy most of the land area and support a surprising variety of wildlife. Most obviously, many species of both woodland and grassland birds have taken up residence; migrating birds also make use of the resources. These resources notably include insects in great variety, from the inevitable mosquitoes to passing monarch butterflies (residents are beginning to make plantings specifically amenable to butterflies). Various small rodents and bats are often overlooked, along with snakes and occasionally other small reptiles. But chipmunks are easily observed and gardeners are only too aware of ravenous rabbits and groundhogs, to say nothing of the deer. Racoons contest ownership of the storm drains with rats; opossums are more welcome. Squirrels are everywhere. The arrival of foxes and coyotes has been noted above, a black bear was sighted in June 2020, and other immigrants from upstate are not inconceivable in the future. As for flora, rugged terrain and a casual attitude towards landscaping among many Village residents leaves substantial marginal areas open to whatever native or invasive species can find them. The Village has begun to encourage deliberate conversion of gardens and other areas to native species. On the other

hand, it is a centuries-old problem that gardeners introduce foreign species that turn invasive. To mention only two, residents persist in planting the Norway maples whose destructiveness was noted above, and more recently bamboo has begun to wander from residential areas into other habitats. There is, therefore, much to consider and manage in our own yards and neighborhoods. While this is largely up to individual landowners, educational efforts and possible regulation of free-ranging pets, lawn fertilizers, and pesticides could make a serious difference.

Climate and Threats

Climate Projections

Global climate change has local consequences and it is incumbent upon all municipalities, no matter how small, to do their part to mitigate its impacts. The most urgent work is to reduce our own emissions of the "greenhouse gases" (GHGs) that cause global warming. The main sources of emissions include motorized vehicles, heating of buildings, and the electricity we use if generated by fossil-fuel plants (most village residents have chosen a 100% renewable electricity supplier). There are additional emissions from numerous less familiar sources such as the production of cement used in our constructions, trash incineration, and the release of methane gas from wastes. An inventory of GHG emissions in Westchester County estimated that motorized vehicles are the source of 38 percent of greenhouse gas emissions, 30 percent come from residential energy use, 29 percent from non-residential energy use, and three percent from waste.

All scientific bodies that have studied the matter agree that GHG emissions are responsible for the warming seen in the past century and that warming will continue in step with future emissions. According to the New York State Department of Environmental Conservation, New York is already experiencing climate change in a number of ways, including:

- Average temperatures in the state are 2 degrees Fahrenheit higher than they were as recently as 1970.
- New York's winter temperatures are almost 5 degrees higher than in 1970.
- Plants in New York now bloom as much as 8 days earlier in the spring than they did in 1970.
- Birds that traditionally breed in New York have moved their ranges northward by as much as 40 miles in the past two decades.
- Tropical diseases such as West Nile disease are appearing further north.

The Village is particularly vulnerable to climate change because of the two rivers flowing through it — the Hudson and Saw Mill rivers. Roughly two miles of the Hastings-on-Hudson waterfront land lies adjacent to the Hudson River, underscoring flooding concerns. As the temperature rises the sea level will rise, resulting in the permanent inundation of low-lying areas and wetlands along the Hudson River. At the same time, it is predicted that storms will become more intense and frequent; already storm surges have brought flooding along the Hudson, and downpours have brought inundations in the Saw Mill floodplain; 100-year floods are now predicted to occur on average every ten years.

In the spring of 2020, the Village of Hastings-on-Hudson conducted a Climate Vulnerability Assessment Survey, to which over 10% of the adult population in the Village responded. Residents expressed most concern about the following climate-related threats: hurricanes, heat waves, changed seasonal patterns, extreme hot days, insect infestation and invasive species, and river flooding. Climate models and trends specific to the Village supported these concerns as realistic. An analysis

of data provided by Temperate, a climate-forecasting tool from ICLEI-Local Governments for Sustainability, showed that the three top climate concerns can be categorized as severe storms and flooding; heat waves and extreme heat; and insect infestation and invasive species.

Climate Threats

Hurricanes and Flooding

Hurricanes have repeatedly struck our region, and while scientists cannot say with certainty whether they will become more frequent, there is an emerging consensus that the strongest hurricanes will become both more frequent and more intense. An increase in intensity is likely for our devastating Nor'easters as well. Damage from both high winds and flooding can be extensive. Local downpours that bring flooding have also become more common world-wide because the warmer atmosphere is holding and is transporting more water. The expansion of impermeable surfaces noted above adds to the Village's vulnerability. Sudden flooding is a particular threat to our Saw Mill River floodplain, which, despite extensive work to channel the watercourse, has seen repeated closures of the Saw Mill River Parkway. Extended rainfall from ordinary storm fronts can cause temporary problems, and Hurricane Irene in 2011 transformed the parkway into a river suitable for canoeing.

Figure 11: Flooding on the Saw Mill Parkway after Hurricane Irene in 2011, in Hastings-on-Hudson.

A warning sign was our experience with Superstorm Sandy (2012), that wrought hurricane level damage throughout our region (Figure 12). Events like this, previously considered to be a once-per-500-years event, are now estimated to be a once-per-century event, and, if warming continues at the present rate, could soon be once-per-decade. Another harbinger was "Snowtober" (October 2011), a heavy snowfall that brought down trees that had not yet shed their leaves. These are examples of what has been called "global weirding," as a supercharged climate system enters a state unlike any known in human experience.

Superstorm Sandy (2012) "Snowtober" (2011)

Figure 12: Damage caused by Superstorm Sandy in 2012 and Snowtober in 2011, in Hastings-on-Hudson.

Hudson River Estuary Flooding

As mentioned above, flooding of the Hudson River Estuary due to sea-level rise will be a major concern. The planet's ice caps are melting faster than scientists predicted a few decades ago, and our region is unusually susceptible. Changes in the Atlantic Ocean caused by global warming are adding to long-standing regional geological subsidence so that sea level in the northeastern U.S. is rising 3 to 4 times faster than the global average. According to the U.S. government's 2018 National Climate Assessment[6], the sea-level rise in our region is uncertain but will probably be 2 to 6 feet by the end of the century. In the worst case scenario (no stronger international policies to restrict greenhouse gas emissions, and the ice caps melting at the high end of projections), sea level could rise upwards of 11 feet. Even the lowest likely amount of sea-level rise will mean that occasional storm surges gravely damage our waterfront. These unavoidable threats will require extensive community discussion about alternatives for adaptation, including disaster preparation, defensive construction, and retreat to higher ground.

The effects of sea level rise on the Village's waterfront is apparent through a review of Scenic Hudson's Sea Level Rise Mapper (Figure 13). This tool shows the estimated water depth in each location for each increment of sea level rise. According to the Mapper, with a sea level rise of six feet, much of the waterfront property west of the railroad, as well as some of the land to the east of the railroad (in the northern stretch of the Village), would be under water.

[6] See https://nca2018.globalchange.gov for more information.

Figure 13: Hastings-on-Hudson Waterfront with a six foot sea level rise.
Data from Scenic Hudson's Sea Level Rise Mapper

Heat Waves

Increases in average temperatures, especially pronounced in winter and at night, are the local manifestation of global warming. According to the National Climate Assessment, by 2050 average temperatures in the Northeast will increase 4 to 5°F with more days of extreme heat (heat waves); beyond that the rise in temperature could be moderate or catastrophic depending on global policy choices about curbing emissions. The impacts on human health (especially premature deaths among infants, ill people, and the elderly who cannot survive hot nights without air conditioning) will also have parallels in the natural world.

Around the globe, changing seasons are starting to interfere with natural cycles geared to survival under the older climate. For example, migration and nesting times of birds are losing synchronization with the emergence of the insects they feed upon. And, as gardeners in the Village know, warming has made it easier to grow some plants but harder to grow others.

Invasive Species

Warming redoubles the threat that invasive species bring to our biomes. Species introduced from other continents have been a problem for centuries, but now even native species are on the move. As discussed previously, an impending issue the Village faces is similar to the recent devastation of

forests all across the Western United States by pine bark beetles, which are no longer suppressed by severe winters. The southern pine beetle is moving north and has reached New Jersey. Destructive pests like the hemlock woolly adelgid and the emerald ash borer have already arrived. Control of these pests is difficult to impossible, and we can anticipate damage or death among these and other tree species (Figure 14). Of course warming encourages some plants, and we anticipate the arrival of kudzu, "the vine that ate the South." This notoriously fast-growing weed will make control of invasive vines, already difficult and costly, an even greater problem.

Figure 14: Common invasive pests no longer suppressed by severe winters, seen here on trees in Hastings-on-Hudson.

Climate change also promotes some pests and diseases that attack humans. Our tick population, already dangerous as the carrier of the debilitating Lyme Disease, will become more numerous as the winters get warmer. Still worse are *Anopheles* species, notably the Asian Tiger Mosquito, common farther south, which has already been spotted in New York State. It is a vicious biter and carries tropical diseases including Dengue ('breakbone fever'), LaCrosse encephalitis and West Nile virus, as well as heartworm in animals. Mosquito control efforts will need to be redoubled.

Aquatic invasive species are also an issue in areas along rivers and streams or around ponds. The presence of invasive species can have negative impacts on enjoyment of these areas by creating conditions less favorable for swimming or boating. They may also impact fish health and water quality, with negative effects on biodiversity overall. Many invasive aquatic species currently threaten the Hudson River, including animals such as grass carp and zebra mussels, and plants such as hydrilla, water chestnuts, and didymo (a species of diatom).

Although not invasive but native, some species including white-tailed deer and Canada Geese are also adapting in ways that pose problems (see section on *Changes in Population of Native Species* below).

Additional Threats

Changes in Population of Native Species
An obvious current problem arises from the process, common in much of the industrialized world, of wildlife adaptation to the suburban environment. Especially serious and prominent has been the population explosion of white-tailed deer in Hillside Woods and elsewhere, discussed above. On the other hand, the recent arrival in Hastings-on-Hudson of coyotes and foxes has driven some domestic cats indoors, which should substantially decrease predation of our birds and small mammals.

Open spaces along the waterfront, the Saw Mill River, and on athletic fields have become a temporary haven for Canada Geese, even in winter. A large population of geese can create a mess with their feces and can alarm patrons with their aggression, making these spaces less enjoyable for their intended uses.

Even setting aside climate change, natural ecosystem fluctuations will raise unexpected problems. For example, decades ago our native racoons and recently our newly arrived coyotes suffered rabies epidemics that made them a threat to both people and pets.

Erosion
The combination of its steep slopes, over-browse by deer, and positioning along the Hudson River makes Hastings particularly susceptible to erosion. Winds move along the Hudson Valley by "forced channeling" of its walls, and by pressure imbalances caused as air enters the valley. The Village's proximity to the Hudson leaves it exposed to these winds, accelerating erosion. Riverbank erosion by water is also a threat, particularly as flooding frequency increases. The rate of erosion is then exacerbated by deer browsing, leaving bare ground that is easily stripped of soil, and by steep slopes that accelerate the movement of the soil. Erosion can cause damage to property by moving soil from the base of structures and by increasing tree mortality by exposing their roots. It also affects natural habitats, again by contributing to tree mortality, but also by increasing sediment drift into ponds, streams, and wetlands, which disrupts the plant and animal communities that inhabit them.

Commercial Development
In Hastings-on-Hudson, unlike some other municipalities, development is not a major threat to natural resources. Commercial agriculture was replaced by housing a century ago and the long-term economic trend has been de-industrialization. However, private recreational open spaces are potentially attractive as commercial development as well as residential subdivisions. The Village should endeavor to preserve these areas as open spaces and avoid the loss of any municipally owned recreational open spaces.

The 2020 Climate Vulnerability Survey polling found most citizens are aware of the value of our environment and are committed to mitigating climate change in particular. When asked how much of a threat climate change poses to the Village on a scale of 1 to 5, where 1 = minimal and 5 = significant threat, about 70% answered 4 or 5.

Loss of Buffer Areas
Many of the natural areas and features within our parks are fragile and depend on adjacent areas to remain viable and healthy. When development encroaches upon parkland, either directly or indirectly, the environmental quality of the resources within the park may be threatened. The Village

should actively consider the need to buffer parks and protect their ecosystems by strategically acquiring adjacent land or by effectively regulating land use around the park. The fragile resources within parks can only withstand intensive use and be enjoyed if the quality of the surrounding environment remains high.

Climate Change Initiatives

The Village of Hastings-on-Hudson is a part of many regional, national and international climate initiatives.

Climate Mayors
The Village joined the national Climate Mayors organization to promote local actions and coordinate municipal responses at the national level to climate change in 2017.

ICLEI and Global Covenant of Mayors
The Village joined Global Covenant of Mayors and ICLEI-Local Governments for Sustainability (formerly the International Council on Local Environmental Initiatives) to learn about best practices and access tools and resources to mitigate and adapt to climate change. The Board of Trustees passed a resolution pledging commitment to the Paris Agreement on Climate Change.

Clean Energy Communities
The Village was designated by NYSERDA as a Clean Energy Community (CEC) in March 2017 in recognition of completing five high impact actions which are geared to reducing the carbon footprint of both village-owned and managed- properties and resources as well as those of residents. Since then the Village has completed two more high impact actions.

Climate Smart Communities
The Village was designated by NYS as a Climate Smart Community (CSC) in 2010, with the goal of mitigating and adapting to climate change and reducing its carbon footprint. The Village secured Bronze designation in March 2020.

Cultural Resources

Historical Resources

The Village has a number of historical resources that reflect its development from a small 17th-century rural village to a contemporary New York City suburb. Many of its historical resources were built in the 19th and early 20th centuries during a time of large-scale development and rapid population growth. These resources include a variety of public facilities, dwellings, districts, and vestiges of an industrial history. Currently, four sites are officially listed on the National and State Registers of Historic Places:

- Cropsey House (1830s);
- Draper Observatory Cottage (1850s);
- Prototype House (1936); and
- The Old Croton Aqueduct State Historic Park (1837).

Listing on the State and National Registers provides these properties with protection from adverse impacts caused by government projects, as well as eligibility for grants, loans, and historic tax credits.

The Hastings Historical Society has created a *Museum in the Streets Walking Tour* through the Village where signs provide historical information on 34 stops along the route. The signs feature photographs from the Historical Society's collection. The Tour highlights early residences, places of business, and other points of historical interest from the early days of Hastings-on-Hudson.

The Old Croton Aqueduct

The backbone of Hastings-on-Hudson is the Old Croton Aqueduct (OCA), an unpaved trail that is now a New York State Historic Park. The island of Manhattan, surrounded by brackish rivers, had a limited supply of fresh water available which dwindled as the city grew after the American Revolutionary War. Rapid population growth and encroachment led to the pollution of the limited local fresh water sources. In 1837, construction began on one of the grandest American engineering projects of the century: bringing the Croton River's clean, plentiful water to New York City in a 41-mile long brick-lined masonry tunnel. The gravity-powered aqueduct dropped 13 inches per mile. Topography varied along the route. Most of the work was done by cut-and-cover trenching; across lowlands, the Aqueduct was supported on arched bridges or enormous earth and stone embankments. Every mile or so, a circular ventilating tower was built to keep the water fresh. When completed, the Aqueduct carried fresh water from the Croton Dam, across the Harlem River on the High Bridge to Manhattan Island, down Manhattan's West Side, into a Receiving Reservoir (now under the Great Lawn of Central Park), and on to the Distributing Reservoir on Fifth Avenue (now the location of the New York Public Library).

The capacity of the Old Croton Aqueduct could not keep up with the growth of New York City, and construction on a New Croton Aqueduct began in 1884 a few miles to the east. This newer aqueduct continues to supply about 10 percent of New York City's water. The old aqueduct remained in service until 1965.

The trail that winds its way through Hastings-on-Hudson (and the neighboring towns and villages to the south and north) is about 4 to 6 feet above the roof of the water tunnel and is virtually as old as the Aqueduct. It was created for reasons of security—to prevent local opponents of this massive, intrusive construction from attempting to sabotage the water supply—and to facilitate workers' access to the water conduit. While not intended for recreational purposes, it quickly started being used that way.

In 1968, New York State purchased from the city the land and structures that constituted the Westchester County section of the Old Croton Aqueduct, between Croton Gorge Park and the Yonkers-New York City line. This 26.2-mile portion of the total 41-mile Aqueduct route became Old Croton Aqueduct State Historic Park, a recreational and cultural resource. Tree-lined and grassy, traversing local villages and varied landscapes, the trail offers the pleasures of nature and glimpses of historic and architectural treasures along the way. Twenty-two miles are a designated part of the Hudson River Valley Greenway Trail, and sections are being incorporated into Westchester County's RiverWalk. The Old Croton Aqueduct was designated as a National Historic Landmark in 1992, and its preservation is the mission of the private non-profit, Friends of the Old Croton Aqueduct.

The portion of the OCA that runs through Hastings-on-Hudson includes a ventilator (where the trail crosses Pinecrest Drive), provides sweeping views of the Hudson River, runs parallel to the soon-to-be-completed Quarry Park, and passes near the homestead of Hudson River School painter Jasper Cropsey and the studio of the 20th-century sculptor Jacques Lipchitz. It also passes by the Village's Community Gardens, Zinsser Park, and many historical homes. It is used in every season, for jogging, walking, biking, and cross-country skiing, as well as for getting to school, walking dogs, and running errands.

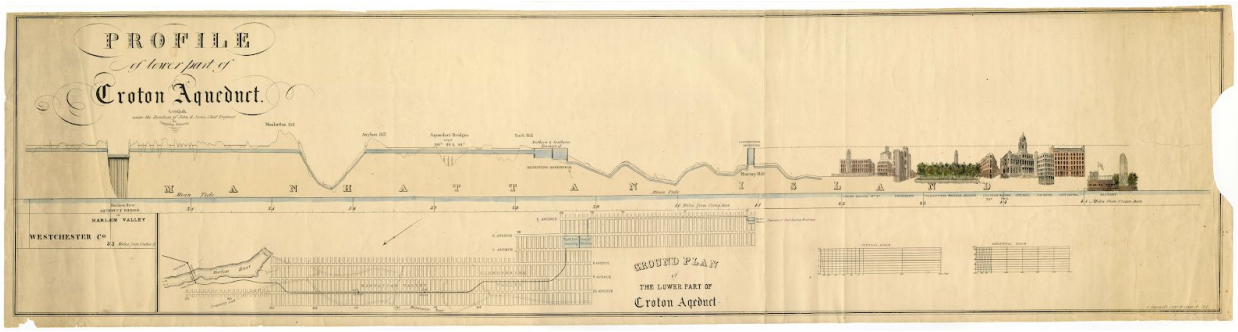


Figure 15: Profile and ground plan of the lower part of Croton Aqueduct (1842)

The Hastings Historical Society and Draper Observatory Cottage

The Hastings Historical Society has been called the Village's "most valuable historical resource." Founded in 1971, it has a membership of 530 people. The Society is housed in the Observatory Cottage built by astronomer Henry Draper. From the mid-1860s until 1882, the Cottage played a major role in astronomy in the United States, particularly in astrophotography, and was the site of the first high-quality photographs of the Moon. In its day it was visited by many leading astronomers and other dignitaries. Designated a National Historic Landmark, it particularly attracts visitors with interests in the history of astronomy. The Hastings Historical Society has carefully documented much of the history of Hastings-on-Hudson and its many local historical sites. The society is an advocacy group for historical resources in the Village and has no regulatory power over any additions, demolitions or alterations that are not sensitive to existing historical structures.

James Cropsey Home and Studio

The Cropsey Home and Studio, featured by the National Park Service as part of its Hudson River Valley National Heritage Area, is a significant tourist destination with tours by appointment. In 1885, Jasper Cropsey moved to this Gothic Revival-style villa on a hill overlooking the Palisades. The home was originally constructed in 1835, and Cropsey added to it a spacious studio with skylights and a massive inglenook fireplace. It was here that he painted sun-filled, meticulously rendered landscapes—often of Hudson River scenes—until his death. The house, which Cropsey dubbed "Ever Rest," is owned and managed by the nonprofit Newington-Cropsey Foundation. Period wallpapers and curtains enhance the décor, which includes furniture designed by the artist. There is also a large selection of Cropsey's paintings, watercolors, drawings, and prints as well as samples of his painting implements and other personal effects. The nearby Gallery of Art (free tours by appointment) features paintings from all phases of Cropsey's career hung in the manner of a 19th-century picture gallery.

The Quarry

The old marble quarry, located just south of Washington Avenue, southwest of Draper Park, and adjacent to the Old Croton Aqueduct, was the site of Hastings' first industry. The first quarryman

was Van Brugh Livingston, who began cutting and selling the stone in 1828. In 1834, the site was sold to George Harvey, an English watercolorist and friend of Washington Irving, who played a key role in the design and construction of Sunnyside, Irving's home. In 1836, an inclined railway was built to carry the marble down to a wharf on the Hudson River, where it was loaded onto sloops. The white marble from the Hastings-on-Hudson Quarry was highly prized; in the mid 19th century it was used in the construction of the Marble Collegiate Church in Manhattan and the Custom House in Charleston, South Carolina, as well as in many local landmarks. In 1936, the Quarry was bought by Hastings-on-Hudson philanthropists Arthur and Alice Langmuir and was transformed into a widely acclaimed and richly landscaped park and bird sanctuary. It was later allowed to deteriorate into a waste dump, but it is currently being restored to a park.

Scenic Resources

The federal government designated the Hudson River an American Heritage River in recognition of its distinctive and nationally important natural, economic, scenic, historical, cultural, and recreational resources. The river has inspired writers and artists, and the two-mile stretch along Hastings-on-Hudson is a particularly scenic segment, roughly a mile wide at this location. The Village's side features broad views across the water of a spectacular geological feature, the Palisades cliffs.

View corridors from Warburton Bridge, Steinschneider parking lot, Fulton Park, Village Hall, Hastings Library, and Washington Avenue offer splendid vistas of the Hudson River and the Palisades. There is currently an extensive application process for building within the View Preservation District, which is an overlay zone that does not affect the underlying uses. The purpose of the View Preservation District is to protect important views within the Village. Applications must go through both the Planning Board and Zoning Board of Appeals.

The Old Croton Aqueduct State Historic Park and Trail also features large segments with River views. Riverview Park, Fulton Park, Draper Park, the Rowley's Bridge Trail, and MacEachron Waterfront Park all have river views and the village's private boating club (Tower Ridge Yacht Club) as well as the Hudson Valley Tennis club each feature river views.

Much of the Village is built on slopes, enabling scenic river views from numerous residences, including several apartment complexes.

Figure 16: View of the Hudson River including the old water tower, a historical landmark whose preservation is under discussion.

Recreation Resources[7]

The Village of Hastings-on-Hudson's Parks & Recreation Department currently manages about 140 acres of developed parkland and recreational facilities along with another approximately 30 acres of undeveloped parkland including Quarry Park, which is currently in the process of being restored, as well as the northern section of the old industrial waterfront area, which is planned for development.[8]

A significant portion of this acreage is comprised of Hillside Woods, a 52.0-acre woodland habitat with an extensive network of hiking trails, and Hillside Park, a 48.0-acre tract which includes woodland trails, Sugar Pond (featuring both fishing and ice skating), Chemka Pool, the municipal tennis courts, and a sizeable parking facility (capable of accommodating 50 vehicles) to serve all of the above cited parks and recreational facilities.

Figure 17: Map of parks and open spaces in Hastings-on-Hudson. Hastings-on-Hudson has ample open space, concentrated around the borders of the village. *Data obtained from Westchester Department of Planning.*

A complete and detailed accounting of all the Village's parks and recreation facilities is provided below (Table 2), all of which largely meet or exceed New York state guidelines for parks and recreation based on acreage and population density. Among our developed assets are 8 pocket parks

[7] See the Parks and Rec Department's *Long-Range Plan for Strategic Management of Parks and Recreation Assets,* completed in 2016, for more details on the Village's Parks and Recreational Assets.

[8] Approximately 70% of Hastings-on-Hudson's roughly 1,250 acres is occupied by residential properties or commercial properties, 5% by the Hastings-on-Hudson Union Free School District, 10% by various non-taxable institutional properties (such as churches, municipal buildings, and the Andrus on Hudson nursing home), and the remaining 15% by the park land and other facilities of the Village Parks and Recreation Department.

which total 1.6 acres; 4 play lots which total 6.5 acres; and 6 neighborhood parks which total 31.3 acres. The recreational needs of the Village's younger population are being met by facilities and playing fields owned and operated by the Hastings-on-Hudson Union Free School District, whose two large outdoor athletic facilities are located on the roughly 8-acre tract of land along Chauncey Lane (Reynolds Field) and the 22-acre tract of land along Farragut Avenue (lower and upper Burke Estate). Both are walking distance from the middle school/high school complex on Farragut Avenue and are centrally located in relation to the Village's housing areas.

Table 2: Village of Hastings-on-Hudson Parks & Recreational Facilities (2020)

Name of Park/Facility	*Size in Acres*	*Type*	*Description & Features*
Senior Citizens Vest Pocket Park	0.1	Pocket Park	Benches, chess tables
Wagner Park	0.1	Pocket Park	Benches
Cliff Street	0.1	Pocket Park	Grass
Villard Park	0.2	Pocket Park	Benches
Former Getty Station	0.2	Pocket Park	Grass
Reynolds Field Entrance	0.2	Pocket Park	Woodland Trail
Veteran's Memorial	0.3	Pocket Park	Grass
Broadway Triangle	0.4	Pocket Park	Grass
MacEachron Park	1.3	Play Lot	Picnic areas, playground equipment, benches, views of river
Fulton Park	1.6	Play Lot	Benches
Dan Rile Memorial Park	1.6	Neighborhood	Trailways
Riverview Park	1.8	Play Lot	Landscaped viewing areas over- looking Hudson River & Palisades
Lefurgy Park	1.8	Neighborhood	Undeveloped
New 9A Parcel	1.8	TBD	Open space
Pulver's Woods	2.9	Neighborhood	Trailways
Kinnally Cove	3	Play Lot	Picnic tables, benches & kayak launch, wooden boardwalk
Quarry Park	5.1	Neighborhood	Under development

Waterfront North	6.3	Neighborhood	Undeveloped; NW corner of former Atlantic Richfield property, + esplanade along Hudson, 1.75 acres tbd
Zinsser Park	7.4	Neighborhood w/ Play Field	Softball and baseball fields; batting cage; picnic area; play ground; community gardens (w/ 75 plots)
Uniontown Field	7.9	Neighborhood w/ Play Field	Little League baseball field; batting cage; asphalt basketball court; picnic area; play ground
Draper Park	9.9	Neighborhood	Picnic areas
Graham Park	14	TBD	Undeveloped
Hillside Woods	48	Village Park	Natural woodland with hiking trails
Hillside Park	52	District Park	Includes Chemka Pool, public tennis courts; Sugar Pond (fishing & ice skating)
Waterfront South	TBD	TBD	Cleaned but still privately owned and awaiting development
Reynolds Field (owned/controlled by School District)	8	Neighborhood w/ Play Field	Multi-purpose athletic field used by HS football team; 400m 6-lane running track; 4 asphalt tennis courts & 1 basketball court; playground
Burke Estate (owned/controlled by School District)	22	Neighborhood w/ Play Field	HS athletic fields including two baseball diamonds overlapping 3 (2 full-sized and 1 smaller) multi- purpose fields
James V. Harmon Community Center	N/A	Building	Meeting, function rooms, storage facilities and offices of Parks Dept., IT Dept., WHOH, Youth Advocate program, and Food Pantry
Chemka Pool	N/A	Facility; tennis courts, pool are part of Hillside Park	Spray pool, training pool, L-shaped main pool with lap lanes and free swimming
Public Tennis Courts	N/A	Facility; tennis courts, pool are part of Hillside Park	Four asphalt courts set within Hillside Park

Land Use and Land Cover

Land Use

Hastings-on-Hudson is essentially fully developed, although there are opportunities for redevelopment and limited areas for development. There are only a few vacant parcels throughout the Village, concentrated on the Waterfront and in the Downtown. The Village has intentionally incorporated 'Smart Growth Principles' into land-use policies and regulations, as follows:

1. Promote mixed land uses

The Hastings-on-Hudson Village Code identifies several districts as mixed use. By putting residential, commercial and recreational uses in close proximity to one another, alternatives to driving, such as walking or biking, become viable. Mixed use can enhance the vitality and perceived security of an area by increasing the number and activity of people on the street. It attracts pedestrians and helps revitalize community life by making streets, public spaces, and pedestrian-oriented retail become places where people meet. The chapter on the Downtown in the 2011 Comprehensive Plan speaks to the benefit of mixed use in the Downtown. There are six specific districts outlined in the Village Code where this principle is captured. See:

- Mixed-Use Planned Development District (MUPDD) (Section 295-72.3)
- Multifamily Residence/Office (MR-O) Districts (Section 295-72.1)
- Multifamily Residence/Commercial (MR-C) Districts (Section 295-72.2)
- Central Commercial (CC) Districts (Section 295-76)
- Limited Industry (LI) Districts (Section 295-75)
- Central Office (CO) Districts (Section 295-74)

2. Promote compact building design and cluster development

The Comprehensive Plan identified large tracts located within the Village's Gateways as representing important viewsheds along major roadways and also indicated that these parcels contain important natural resources which should be protected and preserved. The plan makes the case that the use of clustering for future development will help to preserve the natural and scenic qualities of these parcels and preserve the character of the gateways to the Village. The Village added a 'Gateway Cluster Overlay District' to its Code so as to encourage clustering on the large parcels located in theVillage gateways. The Village Code also contains provisions allowing for 'Conservation of Clustered Housing' and a "Mixed Use Planned Development District", both of which are also designed to achieve these goals.

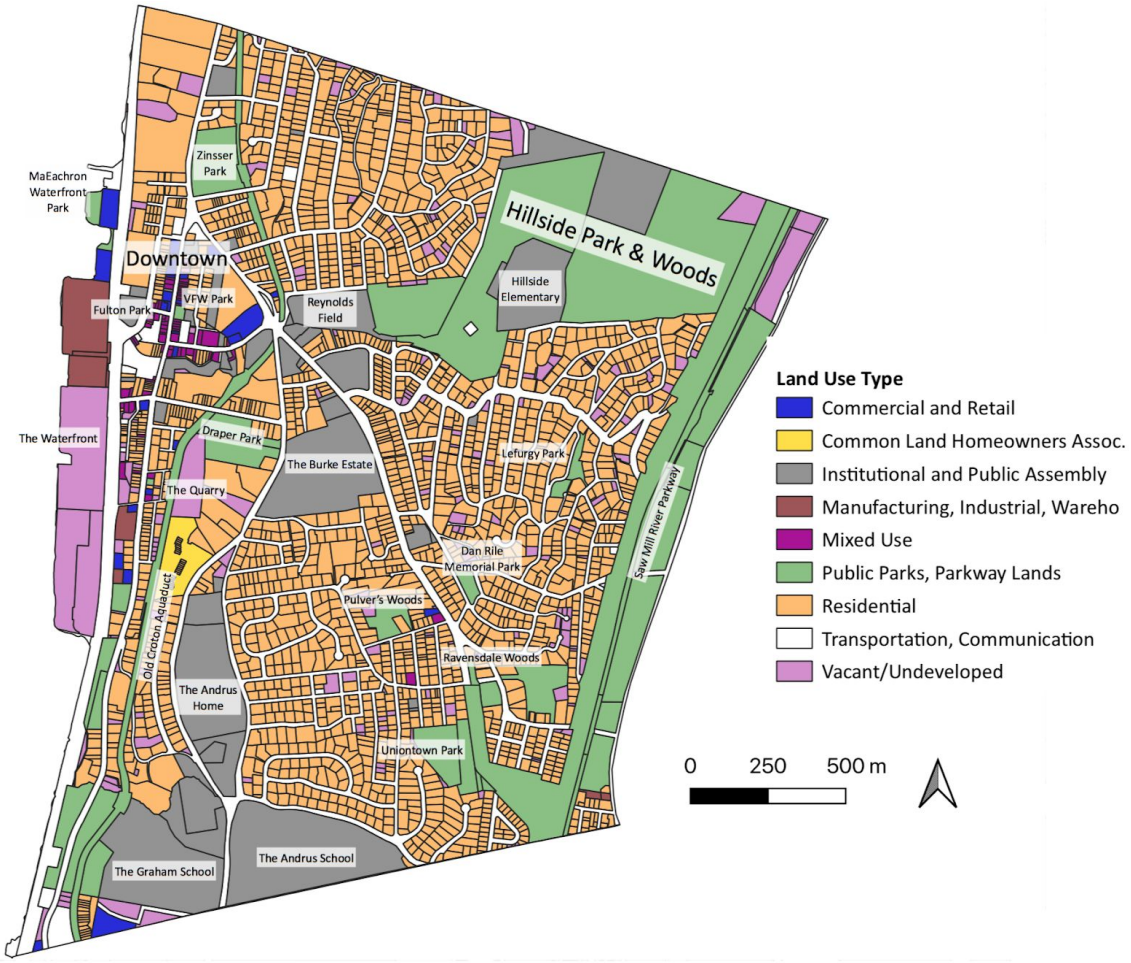


Figure 18: Map of current land uses in Hastings-on-Hudson. *Data obtained from Westchester Department of Planning.*

3. Promote diversity of housing opportunities

The Village Code identifies a diversity of housing options for residents of the Village. The Village seeks to provide quality and affordable housing for people of all income levels and actively promotes affordable housing through an 'Affordable Housing Set-aside'. The Village also allows different forms of housing within neighborhoods, such as attached housing, accessory units, or multi-family dwellings. This creates an opportunity for the community to slowly increase density without radically changing the landscape. It also enables seniors and lower income families to remain in the Village, which in turn promotes economic diversity. The Village has an active Affordable Housing Committee that has identified a number of properties for affordable housing and has overseen the development of multiple affordable housing units over the past 10 years.

4. Foster distinctive, attractive communities with a strong sense of place

The Village Code identifies view preservation districts whose purpose is to protect and preserve the character of the community, to preserve and enhance property values, and to promote improved visual relationships between the Village and the Hudson River and the Palisades. In addition, The *Design Guidelines for the Central Commercial District*, implemented by the Architectural Review Board, refers to a set of principles and standards that mandates 'Preserving the Character of the Village and the Historic Downtown.'

5. Preserve open space, farmland, natural beauty, and important natural areas
The Village of Hastings-on-Hudson is committed to preserving open space—meaning natural areas that provide important community space, woodlands and wetlands, habitat for plants and animals, and recreational opportunities. Protecting open space provides many economic benefits, including increasing local property value (thereby increasing property tax bases) and providing tourism dollars. Open space ensures the continued protection of animal and plant habitat, places of natural beauty, and working lands by removing development pressure and redirecting new growth to existing communities. Preservation of open space benefits the environment by combating air pollution, mitigating noise, controlling wind, providing erosion control, and moderating temperatures. The *Design Guidelines for the Central Commercial District* mandates preserving open spaces.

6. Promote Walkable Neighborhoods
The Village of Hastings-on-Hudson is committed to walking and bicycling as intermodal transportation alternatives and has worked to preserve and maintain existing trailways while advocating for and developing new ones to connect them. The *Design Guidelines for the Central Commercial District* mandates 'Enhancing the Downtown Pedestrian Experience.' In addition, the Board of Trustees adopted the Complete Streets Policy in 2014, and the Village has advocated with the County and State for shared roadways in such projects as the NYSDOT Ravensdale Bridge replacement and Route 9 Project. The Ravensdale Bridge replacement will allow bicyclists and pedestrians access over the Saw Mill River Parkway via the Ravensdale Road Bridge directly to the South County Trailway, while the Route 9 Project seeks to implement bicycle and pedestrian access along its entire length through the Rivertowns to link up with the recently completed Mario M. Cuomo Bridge that crosses the Hudson River. Similarly, the Board of Trustees negotiated funding for and has managed the restoration of the Quarry Park Trail linking the Old Croton Aqueduct Trail to the Hudson River Waterfront. The Village also created a Transportation Working Group and Safe Routes to School Committee that have made a series of recommendations to improve walkability. These recommendations have been adopted and implemented by the Village Board of Trustees.

7. Strengthen and direct development toward existing community centers, hamlets, or urban areas
The Village of Hastings-on-Hudson hired a Downtown Advocate to promote the Downtown and has developed a number of policies that encourage development in the downtown area. *The Design Guidelines for the Central Commercial District* promotes and directs development to the existing Village center.

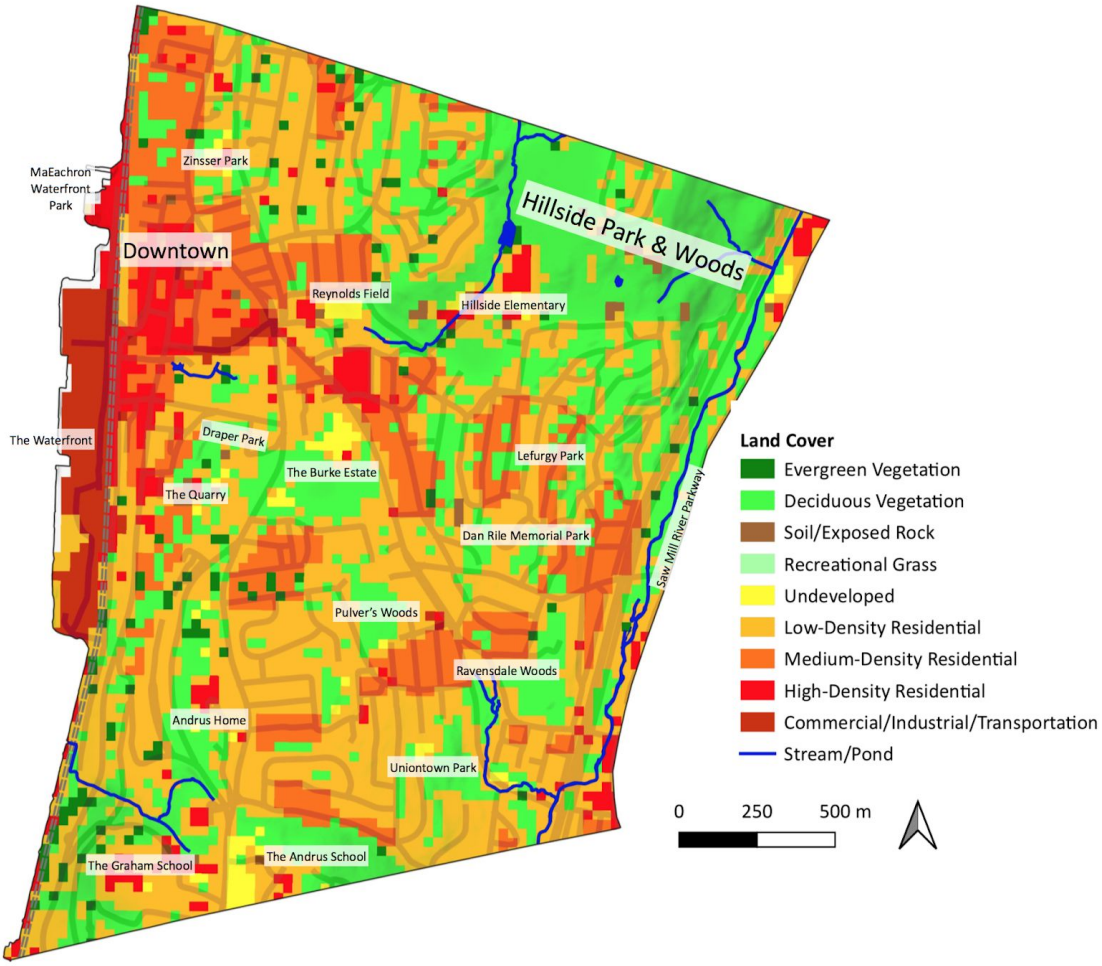


Figure 19: Map of land cover in Hastings-on-Hudson. *Data obtained from Deborah Parker, GIS Specialist; from original map by Francesca Pozzi, Research Associate, CIESIN.*

8. Promote density that facilitates non-car transportation options

The Village of Hastings-on-Hudson is committed to encouraging more dense development in the downtown area where walking, cycling and use of public transportation are easiest to access. This is evident in a number of Village zoning provisions, as well as in *The Design Guidelines for the Central Commercial District*, which encourages density that promotes walking, cycling, and use of public transportation, and in other initiatives that relate to circulation such as the Route 9A Study.

Zoning

Proactive, careful zoning is important for guiding development in a way that preserves natural resources: a tract can be zoned in a way that specifically protects its natural resources or in a way that could leave it vulnerable to development.

Consistent with this concept, the Village's Comprehensive Plan (2011) recommends that design standards are written into the Zoning Code requiring developers to maintain existing natural features. An example of this would be preserving wetlands and landscaping that is sensitive to native vegetation and natural rock outcroppings. The plan also suggests that developments exceeding a certain size should require detailed environmental reports to ensure that important resources are identified.

In Hastings-on-Hudson, many large tracts are zoned in ways that are inconsistent with their use (as can be seen comparing the zoning and land-use maps, Figures 20 and 18). The Village's Comprehensive Plan also notes that some open spaces in Hastings-on-Hudson are privately owned and are zoned so that future development could "severely alter the overall character and quality of life of the Village." Most of this zoning has not changed since the publication of the Comprehensive Plan.

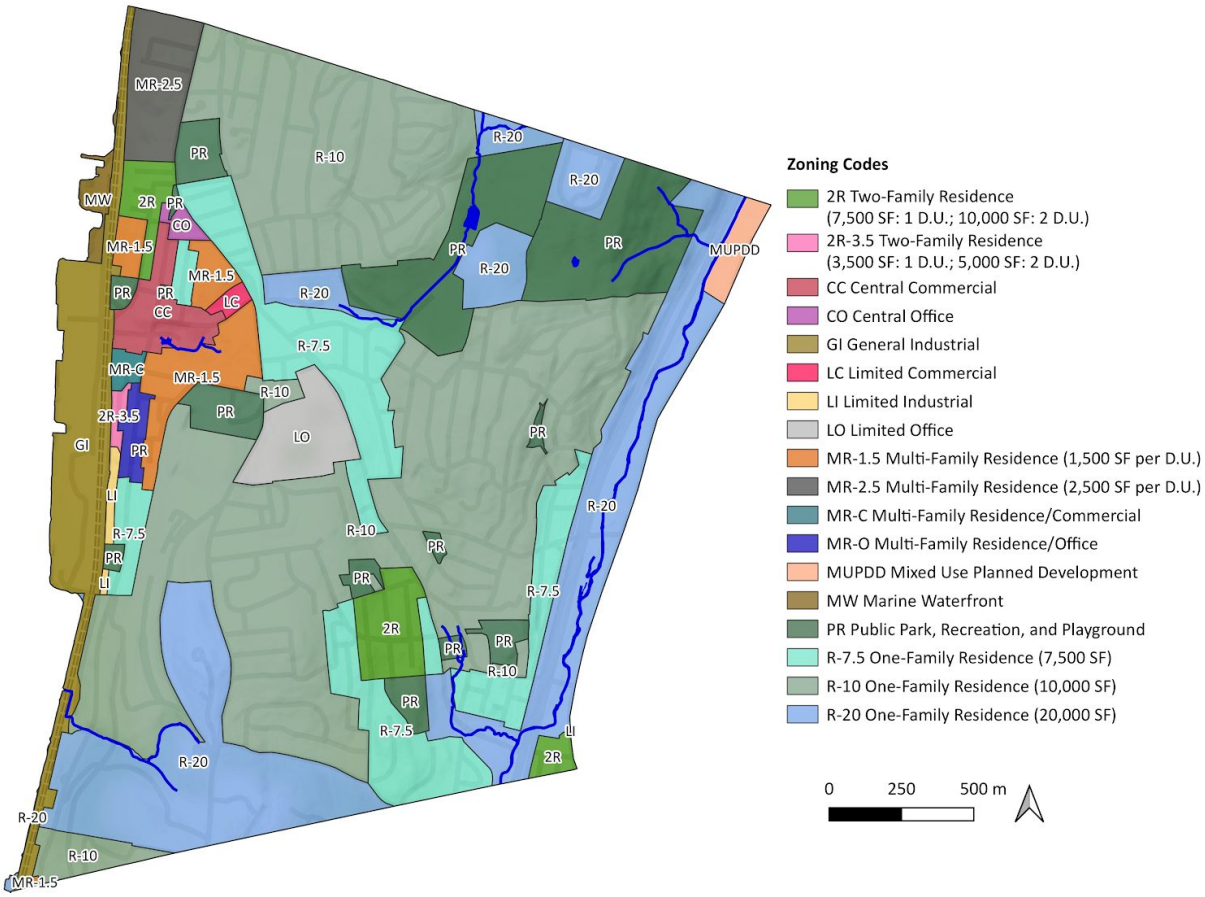


Figure 20: Zoning map of Hastings-on-Hudson. More details on zoning codes, and on zoning practice in the Village, can be found in the Comprehensive Plan adopted in 2011. *Data obtained from Westchester County GIS.*

Part C: Conclusion

Hastings-on-Hudson and its residents are committed to the protection of the Village's many natural resources, which is evident both in their active involvement in the care and continued heavy use of these resources and in the outpouring of support for natural resource protection ventures large and small (such as the restoration of Hillside Woods and Park, trail maintenance, preserving and maintaining open space, and other such projects).

The Village, with resident support, is actively engaged in developing and implementing various plans to protect its natural resources: Hillside Woods and Park, Quarry Park, Rowley's Bridge Trail and Extension, MacEachron Park, and the heavily-used Old Croton Aqueduct Trail are all subject to restoration and ongoing maintenance.

Yet it is increasingly clear that there is a need for more active dialog and conservation measures, given emerging threats. Climate change is a growing, multi-faceted threat causing a range of ecosystem shifts affecting our natural habitats. It creates chain reactions of negative impacts such as those caused by invasive species. The overpopulation of deer has been devastating not only to woodland habitats but also to home gardens, while heavy use by residents of our many beloved open spaces puts stress on our trails and in our woods. Identifying community priorities and making informed land-use decisions is more important than ever.

The Natural Resource Inventory Committee hopes that the process of creating this Inventory, as well as the completed Inventory itself, which covers the entirety of the Village and parts of our ecosystem that cross municipal boundaries, will be helpful on a variety of fronts: in informing future municipal plans, developing ordinances or overlay zones and in assessing development projects. The Committee also hopes the Inventory will function as a tool for county or regional planning and project assessment. Maintaining the integrity and health of our ecosystems is critical to both mitigating and adapting to climate change. With follow-up planning, including regular updates, the Committee believes this NRI will serve as the foundation for an overarching natural resource conservation strategy that plans for the long-term sustainability of all of Hastings-on-Hudson's environmental and ecological treasures.

Part D: Examples of Current Village Natural Resources Protection Plans

Hillside Woods and Park Restoration

An Urban Forest Management Plan

We feature the Village's plan to restore and protect Hillside Woods as a model of how Hastings-on-Hudson and its residents have come together to address threats to a beloved natural resource. We believe that the Hillside Woods Forest Management Plan—currently in its early stages—provides us with the opportunity to not just restore the woods, but to set a new precedent for maintenance of our other natural areas. The framework for research and community input will help us refine and more effectively implement conservation plans in the future. Incorporating the lessons we learn will allow us to better conserve and steward the many natural resources of our Village documented in this Natural Resource Inventory.

Background

Hillside Woods and Park is a contiguous 100-acre protected area technically composed of two adjacent land parcels: Hillside Park (48 acres) and Hillside Woods (52 acres). These parcels have different histories of ownership and land use. The 48-acre Hillside Park, which envelopes Hillside Elementary School, Chemka Pool, the Village tennis courts, and Sugar Pond, was acquired by the Village in 1941. Hillside Woods was acquired later, in 1993, through a community effort that exemplifies the Village's commitment to protecting its natural areas. But without a formal system for monitoring the health of the woods in place, the deteriorating conditions of the woods (including the harmful impacts of deer browsing) and the gradual changes in the abundance and diversity of species went unnoticed.

To draw attention to the issue, and to consolidate expert advice and community input, the Village hosted a series of well-attended panel presentations and guided walk-throughs of the woods in April 2017, which laid the groundwork for the Village to begin the restoration and management of the Woods.

The Village then applied for and received a grant from the NYS Department of Environmental Conservation's Urban and Community Forestry Program to conduct a tree inventory in the woods and to write a sustainable forest management plan. The Village hired Land Beyond the Sea, Ecological Design (LBS Ecological) to undertake that work, resulting in the publication of a report in early 2019 that provided a roadmap for restoring Hillside Woods to a healthy forest and woodland ecosystem (relevant plan details are excerpted from the report here and edited for easy review).

Tree Inventory and Management Plan

Tree Inventory: For the purposes of devising an effective forest management plan, Hillside Woods and Park was broken into stands, numbered 1-4. Each stand is biologically and geographically distinct. Stands are described in detail in the following Forest Stand Analysis Section, and the plan on how to address the restoration was built in reference to the four different Stands. A hazard tree

inventory was also completed, with recommendations for trees that needed to be taken down as soon as possible.

Species Name	*Percent Population*	*Percent Leaf Area*	*IV*
Norway maple	20.9	20.7	41.6
Northern red oak	15.1	16.7	31.8
American beech	11.7	13.5	25.2
Black oak	11.0	12.7	23.6
Black birch	11.1	7.7	18.8
Tulip tree	6.1	11.0	17.1
White oak	7.6	6.7	14.4
Red maple	5.3	4.0	9.3
Sugar maple	3.0	2.5	5.5
Black cherry	2.2	0.9	3.1

Stand 1 – Oak/Maple forest type (mixed oak)
Stand 2 – Oak/Beech forest type (beech, maple, red oak, white oak)
Stand 3 – Successional Northern Hardwoods forest type
Stand 4 – Central Hardwoods forest type

Appendix Figure 1: Forest Stands 1-4 (from left to right), in Management Plan, of Hillside Woods & Park, 2019.

Forest Stand Analysis - Stand 1 - Oak/Maple - 18.5 acres
Stand 1 is an oak/maple forest. Oak/maple forests are typically found on south- and west-facing slopes. Soils may have calcareous materials at depth. Dominants are red, black, and white oak, and occasionally white pine. Black oak is an indicator of this ecological community type. Pignut or Shagbark hickory, and red maple are usually present. Flowering dogwood and chokecherry are often abundant in the understory.

Tree Condition: Overall, the canopy trees are healthy in this forest stand. There is, however, very little regeneration of canopy tree seedlings occurring due to deer browse and invasive plant pressure. There was an average occurrence of physical defects, fungal infection, and pest damage. The occurrence of these health concerns will be on the rise in this stand as trees begin to compete for resources. The understory trees in this stand are in a similar state to the overstory trees, they still exist yet are not regenerating. In a number of years this lack of regeneration will cause a failure in the forest once a tipping point is reached, where the canopy dies off and is not replaced. The shrub and herbaceous layers of the stand are also degraded and in many places are non-existent due to regeneration issues.

Tree Size/Age: Trees are growing in two major canopy classes: overstory trees, averaging 60-80 feet in height, and understory trees, averaging 30-50 feet. There is limited growth in vegetation levels below 30 feet, for reasons noted above in the Tree Condition section. Trees range in age from 30-100 years.

A very sparse understory is found throughout Stand 1.

Forest Stand Analysis - Stand 2 - Oak/Beech - 21.9 acres

Oak/beech forests typically occur on sites of deep, rich, well-drained soil with minimal disturbance. Stable talus slopes below terrace bluffs and above moist floodplains are the most common sites. Since these areas provide rich soil for agriculture, most of them have been cleared and cultivated in the past, leaving few mature stands of this type. Beech is the distinctive species of this type, but it usually is not as abundant as white oak, red oak, and sugar maple. Willow oak, yellow poplar, and shagbark hickory may also be present. Sugar maple usually dominates the understory along with dogwood, deciduous holly, hornbeam, and hophornbeam. Shrubs are infrequent, but woody vines such as grape and poison ivy are abundant.

Tree Condition: Canopy and understory trees showed some signs of decline, especially the black birch and other understory trees, which are competing for what little resources remain in the understory. Some larger trees had fungal growth and missing branches, but overall were in good condition. There is little to no regeneration in this stand, and even beech (a tree species that deer do not usually consume) is being browsed heavily. Shrub and herbaceous layers of the forest were also very heavily browsed by deer, and numerous invasive plants are established. Not all deer problems arise from deer-browse alone. Saplings have been rubbed by deer and have broken due to the rubs.

Tree Size/Age: The overstory trees here are tall and impressive, but not as old as they may seem. Growth was fast in this stand. Based on historical photos and a stump that was examined, trees are around 80 years of age.

Forest Stand Analysis - Stand 3 - Successional Northern Hardwoods - 16.8 acres

Successional northern hardwood forests have more than 60% canopy cover of trees and occur on sites that have been cleared or otherwise disturbed. Dominant trees are usually two or more of the following: red maple, white pine, white ash, gray birch, quaking aspen, big-tooth aspen, and, less frequently, sugar maple and white ash. Tree seedlings and saplings may be of more shade tolerant species. Shrubs and ground cover species may be those of old fields or forest openings.

Tree Condition: Canopy trees are healthy in this forest stand, but, as in the forest as a whole, there is little to no regeneration. There was an average occurrence of physical defects, fungal infection and

pest damage. The occurrence of these health concerns will rise in this stand as trees begin to compete for resources. The understory trees are being outcompeted by invasive trees and shrubs, and there is little regeneration due to deer and invasive plant pressure.

Tree Size/Age: Trees are growing in two major canopy classes: overstory trees averaging 60-70 feet in height, and understory trees averaging 30-50 feet. There is limited growth in vegetation levels below 30 feet, as regeneration is failing and the forest is unable to replace itself as the canopy opens, deer browse, and invasives outcompete natives.

Forest Stand Analysis - Stand 4 – Central Hardwoods - 30.8 acres
Central hardwood habitats are among the richest in North America for herbaceous plants and shrubs. The tree flora is less diverse, dominated by only a few species. Widespread dominants are white oak (*Quercus alba*), red oak (*Q. rubra*), black oak (*Q. velutina*), bitternut hickory (*Carya cordiformis*), and shagbark hickory (*C. ovata*). Flowering dogwood (*Cornus florida*) often occurs in the understory, along with sassafras (*Sassafras* spp.) and hop hornbeam (*Carpinus* spp.). The shrub layer is distinct, often with evergreens, and wildflowers are common. Intact wetter sites feature American elm (*Ulmus americana*), tulip tree (*Liriodendron tulipifera*), and sweetgum (*Liquidambar styraciflua*).

Tree Condition: Tree health in this stand is declining overall, with diversity in the forest diminishing as invasive plants are gaining dominance. The major health issue is invasion by non-native species such as Norway maple, and lack of regeneration being caused by deer browse and invasive brush/shrubs.

Tree Size/Age: Trees grow large in this section, with many well over 100 feet tall. The age of the trees in this section range from 30-120 years, and the area contains some of the oldest and most undisturbed forested areas in Hillside Woods & Park.

Throughout stand 4 there is an intact canopy yet almost no regeneration on the forest floor.

Plan Recommendations: The Forest Management Plan outlining the steps that need to be taken to restore the health of the woods was completed in early 2019 and outlines three major elements:

- Remove invasives and undesirable plants with a Timber Stand Improvement plan (the plan offers extensive information and systematic instructions on how to get the work done effectively).
- Build deer exclusion fences, with a plan for doing it in subsections to manage expenses (the plan makes specific recommendations on a tiered approach describing which Stand to start with, how, when, etc.).
- Plant native trees, shrubs, and herbaceous plant species to restore diversity and aid in the regeneration of the forest, while protecting them from both deer and invasive species (again, the plan offers detailed guidance on types of plants to plant by area of the woods).

The Forest Management Plan also recommends the Village hire an arborist, improve park access with a kiosk to engage the community more effectively, install better signage, improve and update the trail system, and educate the community about the condition of the woods to both help in the overall restoration effort and act as stewards going forward.

Current Status

In fall 2019, the Village began the work of invasive plant removal, alongside citizen volunteers, and Mayor Armacost raised the funds needed for the longer-term project through a combination of State and County funding commitments.

The beginning of 2020 saw the launching of an exciting citizen-led campaign to Protect Our Woods, which was due to kick off on April 18th as part of the 50th anniversary celebrations of Earth Day. Unfortunately the community events were disrupted by the Covid-19 pandemic. The Village and its residents are looking forward to making more progress on restoration of the Woods as soon as possible.

Rowley's Bridge Trail Restoration

Linking to RiverWalk, the Old Croton Aqueduct and Quarry Trail

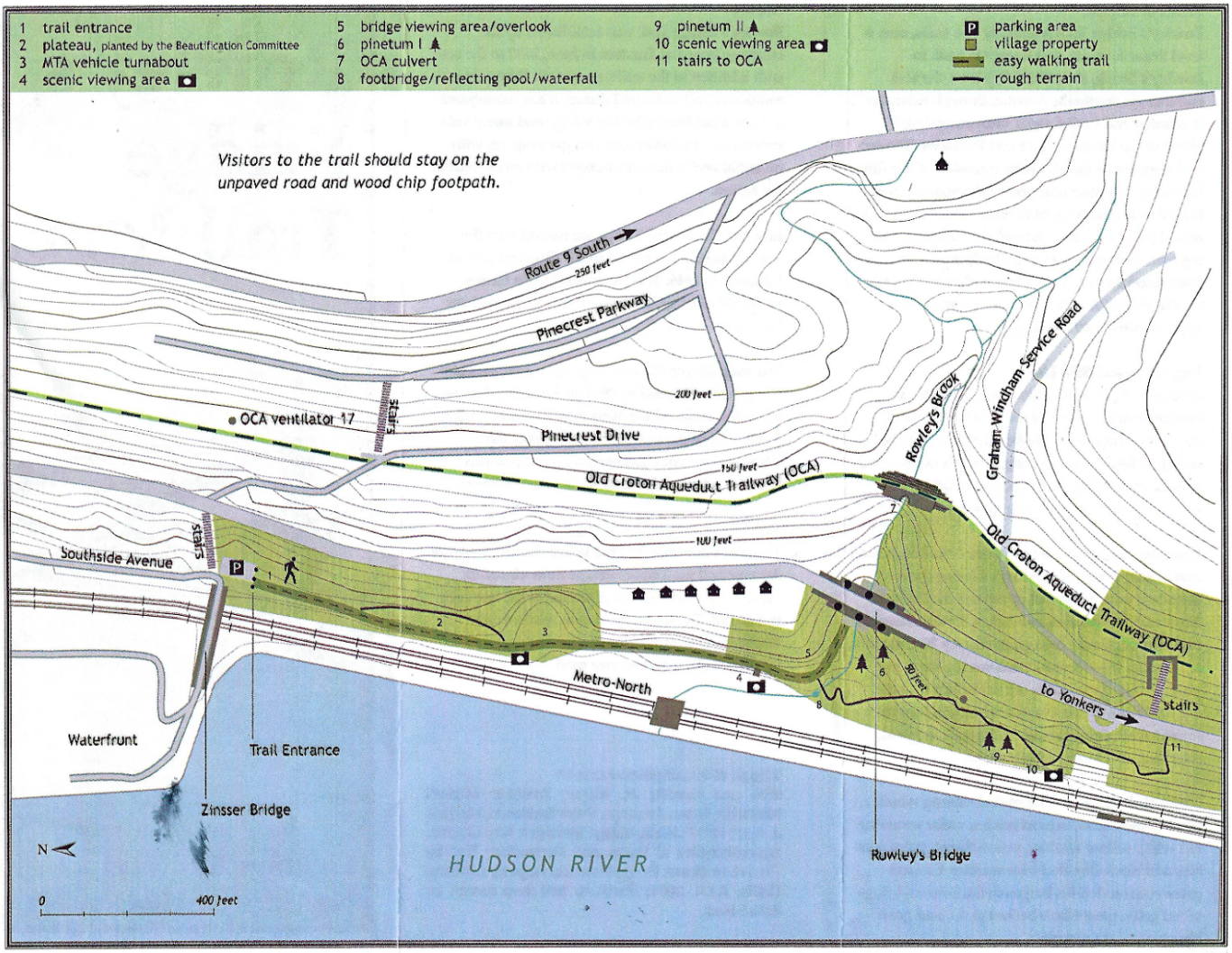
Background and Introduction: Plans to restore the Rowley's Bridge Trail and Extension are underway. The trail, when restored, could be integrated with the 51.5-mile Westchester RiverWalk that will span 14 communities along the Hudson. The Rowley's Trail and Extension already forms a walkable loop between the Old Croton Aqueduct (OCA) trail and the new Quarry Trail off Southside Avenue to the north, and, to the south, the Graham Windham School Service Road that is directly across from the Rowley's Trail Extension trailhead (Appendix Figure 3).

The Proposed Plan: The restoration would include significant improvements to the existing trail and would strengthen the linking of trail networks in the area.

Proposed Repairs and Enhancements:

- Rebuild access steps to trail entry points with a substantial stone stairway and railings.
- Reinforce and restore trail, including improved erosion control measures.
- Restore Rowley's Brook's natural flow path (which was impeded by fallen trees) while ensuring bridges are of sufficient height to accommodate stormwater conditions.
- Clean trails of debris and trash; remove graffiti from existing benches.
- Restore and create new pathways from Rowley's Bridge Trail to other existing trails.
- Revitalize the volunteer Friends of Rowley's Trail to monitor and nurture the trail and surrounding land.
- Develop a maintenance plan and engage the Parks & Recreation team to assist; organize volunteer events to assist in restoration and maintenance.
- Revise the RBT map and pamphlet and install boxes to distribute them at both trailheads.

Appendix Figure 2: Rowley's Bridge Trail Extension



Appendix Figure 3: Map showing Rowley's Bridge Trail in relation to the Hudson River.

MacEachron Park Restoration

Stabilizing Eroding Shoreline and Improving Storm and Tidal Flooding Resiliency

Introduction: In recent years, Village residents have expressed concern over the erosion along the shoreline of MacEachron Park. The Park, Hastings-on-Hudson's only waterfront park, requires improvements to preserve public enjoyment of the river. In June and July of 2019, Village officials consulted the NYS DEC to obtain technical expertise regarding the optimal approach for stabilizing the Park's shoreline. This advice helped the Village formulate a successful grant application to develop a plan for addressing those issues.

Background: Thousands of residents and visitors use MacEachron Park each year. Residents of Hastings-on-Hudson and surrounding villages, towns and cities visit the park to relax and recharge, enjoying unobstructed views of the Palisades, the Manhattan skyline, and the new Mario M. Cuomo bridge. Parents and caregivers bring children to play on the playground equipment. Park amenities include numerous benches and picnic tables. The park is the site of concerts that attract thousands of people from across the state, while many faith and community groups hold their services and picnics in the park. In protecting the park, the project protects the recreation and enjoyment of the natural scenery for all these users, while providing more direct access to the water.

Environmental Concerns: The riprap along the edge of MacEachron Park has deteriorated and is no longer protecting the Park from the Hudson River's erosional forces (see Appendix Figure 4 below). The shoreline's declining condition is likely due to human impacts, wave action, storm events, and upland stormwater runoff. Areas of lower elevation at the two ends of the park are particularly affected, as they are more susceptible to erosion from runoff. The preservation plan will identify the sources of the runoff eroding the park and will put in place stormwater management improvements to prevent erosion and improve water quality. Such improvements might include green infrastructure, such as a bioswale along the edge of the adjacent parking lot if appropriate. The project will consider the interaction between suggested stormwater management improvements and the experience of park users. The plan will also address the shoreline's ability to sustain itself over time with sea-level rise, storm surges, frequent flooding, and other impacts of climate change. MacEachron Park is a buffer, and the shoreline must accommodate the flooding and draining which is natural for a tidal estuary. The Village does not intend to impede this flooding, which is important for resiliency.

Appendix Figure 4: Erosion along the Hudson River shoreline at MacEachron Park.

Proposed Plan: Options will be identified in the process of developing a design plan, and may include using the riprap already in place. The existing large rocks appear to be in good condition and, as the park consists of consolidated fill that is difficult to keep in place, a layered approach may be most effective with smaller materials added on the shore side in order to disrupt the free flow of the waves pulling sand back into the river. Nature-based elements to mix with these structural elements could include tidal wetland vegetation able to grow in MacEachron Park's soil. In addition to securing the soil, tidal wetland plantings would improve water quality and provide essential habitats. A detailed assessment of existing conditions will allow treatment to be localized, in order to create complexity in the shoreline.

To enhance access to the water, a physical access point will be included in the design and park users will be focused on this point. To protect the remaining shoreline from the erosive forces of human activity, plant materials and signage advising of the sensitivity of the edge will be employed to discourage people from walking along the park land edge. Community and stakeholder engagement is being actively solicited to ensure that residents have an opportunity to voice their concerns and contribute to the design solution.

Quarry Park Restoration

An Historic Jewel in the Making

Background and Introduction: The site of Hastings-on-Hudson's newest public park has a storied history. It was the location of the Village's first industry – quarrying – in the 1830s, a business that supplied marble to projects all along the Eastern seaboard until it was forced to close in 1871. The site was restored by a prominent local resident into a beloved park in the 1930s, only to fall into disuse in later decades. Beginning in 1964, it served as a village dump for many years. This still-impressive site is now being restored as a public park to be enjoyed by the people of Hastings-on-Hudson, many of whom have fond memories of having played in the quarry as children. Interpretive signage describing the rich history of the site will be placed in several locations in Quarry Park.

Adjacent to both Draper Park and one of the most heavily used parts of the Old Croton Aqueduct, Quarry Park will provide pedestrians access to the Hudson River at the waterfront. It will do so via the Quarry Railroad Trail (Appendix Figure 5), which is the only pedestrian path to the Hudson River along the entire length of the Aqueduct. Pedestrians will be able to directly access the Trail, with its cascading stone steps, walk beneath the Quarry Railroad Bridge (an Historic Landmark), pass through the tall brick tunnel beneath Warburton Avenue, and enjoy magnificent views of the Hudson River and the Palisades as they descend down to the Hastings-on-Hudson waterfront.

Below are some of Quarry Park's key attributes:

- Open space, circumscribed by majestic rocky cliffs, adjoining residential areas in southwest Hastings-on-Hudson, with stunning views of the Hudson River and the Palisades.
- A quiet, walk-in/walk-out area with no access by cars, no permanent lighting or buildings.
- A naturalistic park with an impressive "sense of place."
- Special location, contiguous to Draper Park and the Draper Observatory Cottage, the Old Croton Aqueduct, and the Quarry Railroad Trail to Warburton Avenue and the waterfront, promoting walkability across wide swaths of the Village.
- A haven for wildlife.

Appendix Figure 5: View of the Hudson River from the Quarry Railroad Trail

The Reclaimed Park: Quarry Park will highlight an exciting natural terrain, wild rather than restrained, naturalistic in style rather than manicured, to be enjoyed by everyone from children to seniors. It will welcome passersby strolling the Aqueduct, people who come to enjoy the lovely Hudson River views, parents getting outdoors with their kids, garden enthusiasts, bird watchers and hikers. In short, it will be open to everyone who would enjoy this unique place, appreciate its history, and take in its natural beauty.

The landscaping plan (Appendix Figure 6) includes the planting of approximately 50 native trees and 1,100 native flowering bushes, as well as walkways through the park and three entrances along the Old Croton Aqueduct. It will feature a pre-existing elevated wooded knoll and trails into Quarry Park from the foot of Draper Park, and access to the Quarry Railroad Trail, which follows the path of the old incline railroad that brought marble from the 19th century active quarry to be loaded onto sloops on the Hudson River. This rail-to-trail also connects to a staircase at Warburton Avenue, promoting foot access to and from the downtown commercial district.

Appendix Figure 6: Quarry Park design prepared by Mathews Nielsen Landscape Architects

Current Status: Remediation of the site was necessary, given that it was previously used for household waste disposal. Such efforts are currently underway: large objects have been removed and a soil cap is being put in place to be followed by a planting soil layer. The project will conform to plans previously approved by the New York State Department of Environmental Conservation. Barring construction delays, it is anticipated that planting will occur during the 2020 fall planting season and that Quarry Park will be open to the public by 2021.