



07

**Sustainability  
and Climate  
Resiliency**

# 07

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**Topography**

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**Hydrological Systems (Waterbodies + Wetlands)**

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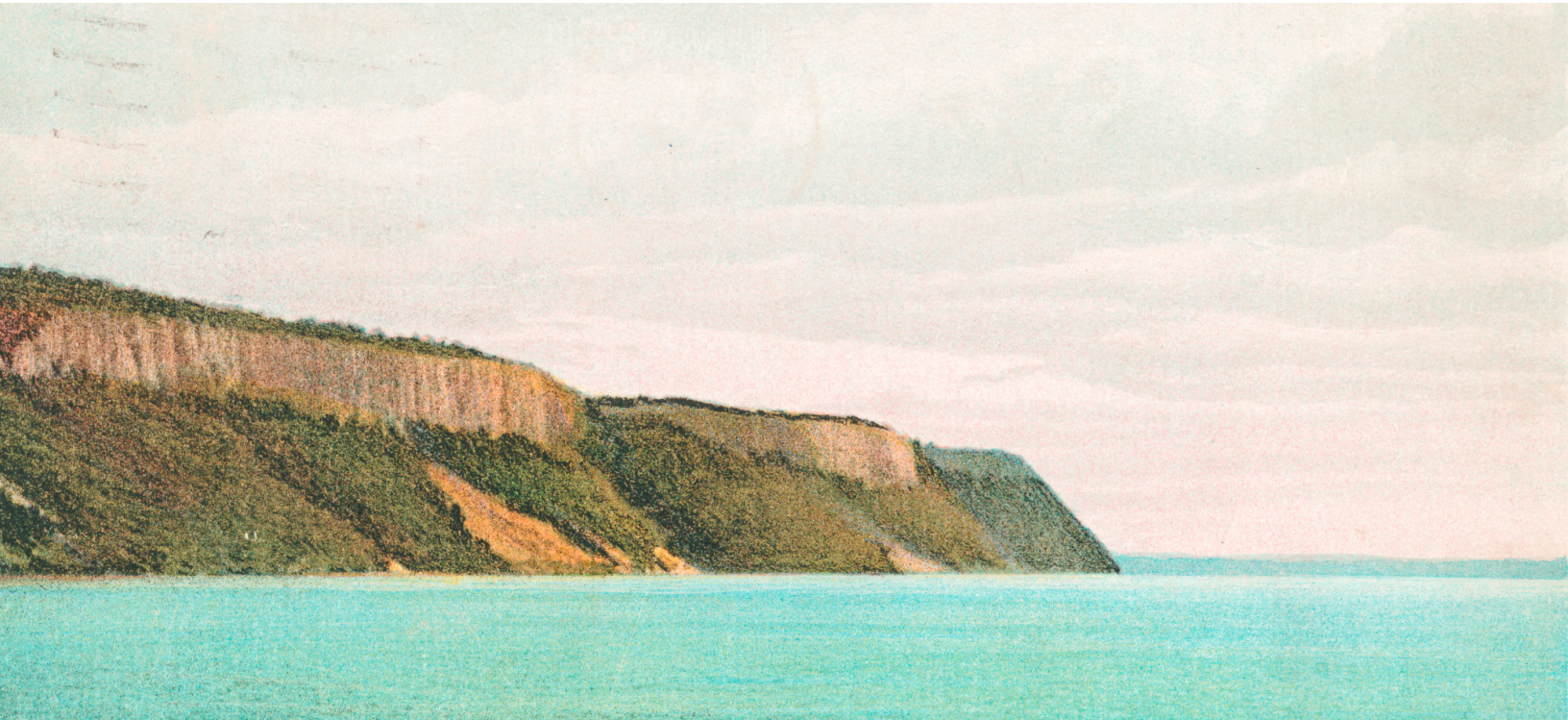
**Flooding**

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**Carbon Emissions**

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**Sustainability and Climate Resiliency  
Vision Goals and Objectives**



**Palisades of the Hudson River, New York; postcard, circa 1898.**  
Source: The Miriam and Ira D. Wallach Division of Art, The New York Public Library

## Introduction

The Town of Orangetown has a wealth of natural features and systems of great scenic, ecological, and climate resilience value.

A topographically defined "green" open space corridor formed by the Palisades Ridge lies to the east, where there are densely wooded steep slopes and grand views of the Hudson River. The corridor has some steep slopes that are unfit for development (greater than 25 percent) located in the major State and County parks, as well as some residential areas. To the west, major waterbodies, including Lake Tappan and the Hackensack River, form a "blue" corridor. Orangetown's County-regulated streams, which include Sparkill Creek, Hackensack River, Naurausaun Brook, Muddy Creek, and Pascack Brook, are lush with vegetation and accessible open spaces along their banks.

Orangetown also has a considerable number of wetlands, many of them recognized by the New York State Department of Environmental Conservation (NYSDEC) and the National Wetlands Inventory. These wetlands provide invaluable ecological services, including

flood mitigation, absorption of excess nutrients, and critical habitats for animal and plant species. Piermont Marsh, the largest riparian marsh in Orangetown, supports significant biodiversity and is habitat for several State-listed endangered flora and fauna.<sup>1</sup> It is also part of the Hudson River Estuary Program.<sup>2</sup>

Orangetown falls within the northwestern forested mountain ecoregion, which is characterized by diverse and distinct vegetation associated with different elevations. The higher elevations of the Clausland Mountain woodlands are characterized by mixed and deciduous vegetation, while the low-lying area surrounding Lake Tappan and Sparkill Creek give rise to wetland conditions. In general, higher elevation woodlands are composed of hardwoods including maple, oak, beech, hemlock, white pine, dogwood, and mountain laurel, and low-lying lands have plants including willow oak, birches, sweet gum, and sour gum.<sup>3,4</sup>

One of the most significant environmental concerns in Orangetown is flooding. An estimated 26.1 percent of the Town's land area is under high flood and associated water quality risks.<sup>4</sup>

- 1 "7.0 Natural and Environmental Resources," *Rockland Tomorrow: Rockland County Comprehensive Plan*. 2011. <http://rocklandgov.com/departments/planning/comprehensive-plan>.
- 2 NYS Department of Environmental Conservation's (DEC) Hudson River Estuary Program promotes the protection and revitalization of the Hudson River estuary through grants, education, and training, community planning, and research and monitoring. Created in 1987 through the Hudson River Estuary Management Act, the program oversees the tidal Hudson, from the mouth of the Hudson in New York Harbor to the Federal Dam in Troy, and its adjacent watershed.
- 3 Town of Orangetown. <https://www.orangetown.com>.
- 4 "Section 5.4.5: Risk Assessment – Landslide," *Rockland County Hazard Mitigation Plan*, 2018. <https://www.rocklandhmp.com>.

Tappan Memorial Park © AKRF





Lake Tappan © AKRF

# Topography

## Town of Orangetown Topographic Context

The Town has a gradient of steep slopes to the east that smooth out to more gentle plains and hills towards the west. The eastern portion has the most significant topographic relief and is located along the Palisades Ridge, which runs along the Hudson River linking Blauvelt and Tallman Mountain State Parks before continuing south into Palisades State Park in New Jersey. From a high point of 675 feet at Clausland Mountain, the Town's elevation drops to sea level along the Hudson River. Views from and of the towering Palisades cliffs are sublime and unique; in fact, there are only a handful of such protrusions in the world.<sup>5</sup> These grand natural features are also highly susceptible to erosion and mudslides.

West of the Clausland Mountain, the rest of the Town largely consists of plains and moderate hills, separated by Lake Tappan that runs northeast/southwest as an impoundment of the Hackensack River.

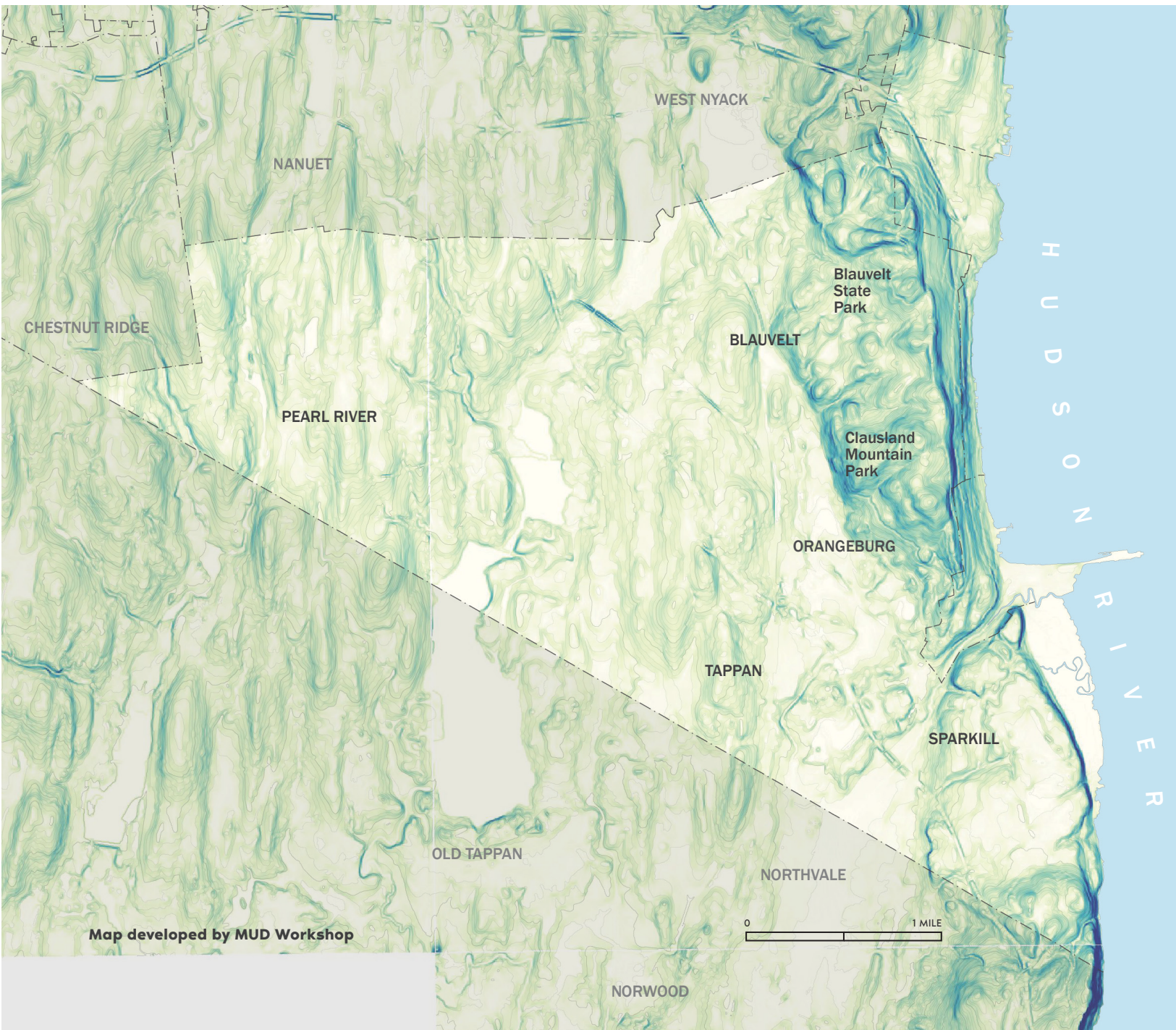
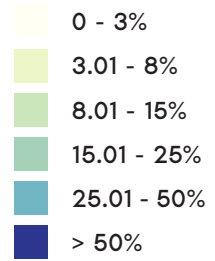
## Town of Orangetown Steep Slope Analysis

The steep slopes of the Clausland Mountain in the eastern portion of Town present development challenges and require erosion prevention measures. Much of these steep slopes are covered with picturesque woodlands suitable for preservation and biotechnical slope stabilization strategies. When disrupted, steep slopes are highly vulnerable to erosion, landslides, and subsidence, which can endanger communities, jeopardize water quality, and damage built structures.<sup>6</sup> It is therefore imperative to categorize and identify slopes

<sup>5</sup> "7.0 Natural and Environmental Resources," *Rockland Tomorrow: Rockland County Comprehensive Plan*. 2011. <http://rocklandgov.com/departments/planning/comprehensive-plan>.

<sup>6</sup> Seda Celtek. "Effect of the Slope Angle and Its Classification on Landslide," *European Geosciences Union*. May 2020. <https://nhess.copernicus.org/preprints/nhess-2020-87>.

Figure 7-1  
**Steep Slope Analysis**



beyond which development should be restricted. The Town already has regulations to restrict development on slopes greater than 25 percent: Town Code § 21-7.1 "Conservation Easements" authorizes the Planning Board to require a conservation easement on all real property with slopes exceeding 25 percent. In order to further protect steep slopes, the Town could begin regulating development parameters (e.g., use, size, etc.) for all new development on slopes greater than 8 percent.

For this Comprehensive Plan, a steep slope analysis of the Town of Orangetown was performed, identifying existing areas of concern as well as areas where development activity should be limited. This analysis highlights residential areas located on slopes that exceed 25 percent in the Villages of Grand View-on-Hudson and Piermont, as well as the hamlets of Tappan, South Nyack, and Sparkill. In the 2018 Rockland County Hazard Mitigation Plan, the then-Village of South Nyack (now, hamlet of South Nyack) declared landslide concerns due to development on steep slopes.<sup>7</sup>

The steep slope analysis classifies slopes based on the slope angle's relationship to development. These slope angle classes are standardized in the U.S. Department of Agriculture's soil surveys,<sup>8</sup> scientific literature on slope and landslides,<sup>9</sup> <sup>10</sup> and USGBC LEED steep slope requirements:<sup>11</sup>

- 0-3%** - near level, good to develop
- 3-8%** - gentle slope, fine to develop
- 8-15%** - sloping, begin restricting development
- 15-25%** - significant limitations to development
- 25-50%** - completely avoid development
- 50% and above** - completely avoid development

Slopes of 15-25 percent pose substantial restraints to environmentally responsible development, while slopes of 8-15 percent can already implicate structural safety and environmental concerns; therefore, as a precautionary measure, it is advisable to begin regulating development on slopes in the 8-15 percent range.

## NYSDEC Critical Environmental Areas

In the Town of Orangetown, Critical Environmental Areas require particular attention because recent severe storms have led to increased flooding on the steep slopes in these areas.<sup>12</sup> Critical Environmental Areas (CEAs) are defined by the NYSDEC as geographic areas that possess "exceptional or unique character" meeting one or more of the following

7 "Section 5.4.4: Risk Assessment – Flood," Rockland County Hazard Mitigation Plan, 2018. <https://www.rocklandhmp.com>.

8 "Slope Gradient," U.S. Department of Agriculture. 2016. <https://www.nrcs.usda.gov>.

9 Seda Celtek. "Effect of the Slope Angle and Its Classification on Landslide," European Geosciences Union. May 2020. <https://nhess.copernicus.org/preprints/nhess-2020-87>.

10 Detlef Deumlich. "The Slope Association Type as a Comparative Index for the Evaluation of Environmental Risks," MDPI. September 2021. <https://www.mdpi.com/2073-4441/13/23/3333>.

11 "Steep slope protection," LEED ND: Plan v4 - LEED v4.

12 "Flooding and Water Volume," *Orangetown Environmental Committee Recommendations for the Orangetown Comprehensive Plan*, January 21, 2022. pg. 3. <https://www.orangetown.com>.

## NYSDEC Critical Environmental Areas

conditions: 1) benefits or threatens to human health; 2) a natural setting, such as habitat, forest, open space, and areas of scenic or aesthetic quality; 3) embodies agricultural, cultural, social, historic, archeological, recreational, or educational value; or 4) sensitive ecological, geological, or hydrological conditions that may be adversely affected by any disruption.<sup>13</sup>

The following five areas have been designated by the Town of Orangetown as CEAs:<sup>14 15 16</sup>

- 1 The entire area within the former Village of South Nyack - the entire area is designated as three CEAs: CEA 1 – Hudson River Area; CEA 2 – Run-Off Area; and CEA 3 – Mountainous Area;<sup>17</sup>
- 2 The hamlet of Upper Grandview and environs in Orangetown - exceptional or unique character as a natural setting and geological sensitivity;
- 3 Palisades slope area - protect open space and aesthetic;
- 4 Sparkill Creek area - CEA with several references to its water quality and protection; and
- 5 The pier areas of Piermont (which together comprise the entire Village of Piermont) - protect open space & aesthetic beauty.

Most of the CEAs in the Town of Orangetown have received their designation for open space protection and aesthetic value. Among the CEAs, Upper Grandview and environs, Palisades slope area, South Nyack area, and Sparkill Creek have steep slopes and are areas that require protection and mitigation against flooding and erosion.

Development proposed within a CEA requires a more stringent review process including an Environmental Assessment Form (EAF) or Environmental Impact Statement (EIS). Additionally, the Town Code has set restrictions on blasting,<sup>18</sup> land clearing, and tree removal<sup>19</sup> and requires a permit for new construction, modification, and additions within CEAs.<sup>20</sup>

13 “Critical Environmental Areas,” Hudson River Estuary Program, NYSDEC. [https://www.dec.ny.gov/docs/remediation\\_hudson\\_pdf/ceafactsheet.pdf](https://www.dec.ny.gov/docs/remediation_hudson_pdf/ceafactsheet.pdf).

14 “7.0 Natural and Environmental Resources,” *Rockland Tomorrow: Rockland County Comprehensive Plan*. 2011. <http://rocklandgov.com/departments/planning/comprehensive-plan>.

15 Village of South Nyack. <http://southnyack.ny.gov>.

16 “Critical Environmental Areas,” Hudson River Estuary Program, NYSDEC.

17 “Chapter 5: Community Character,” *Tappan Zee Hudson River Crossing Environmental Impact Statement*. July 2012. <https://www.newnybridge.com/documents/feis/vol1/05-community-character.pdf>.

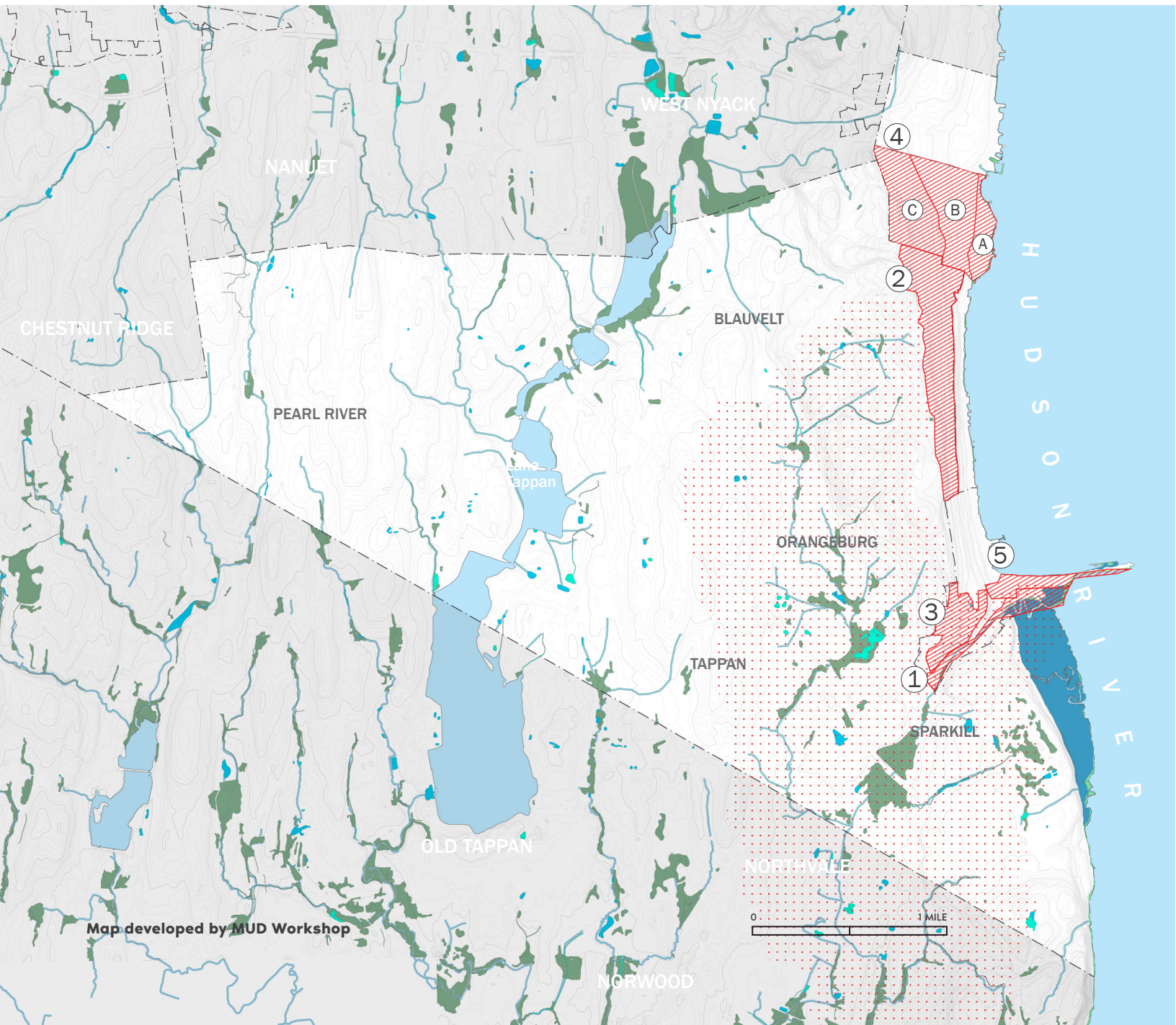
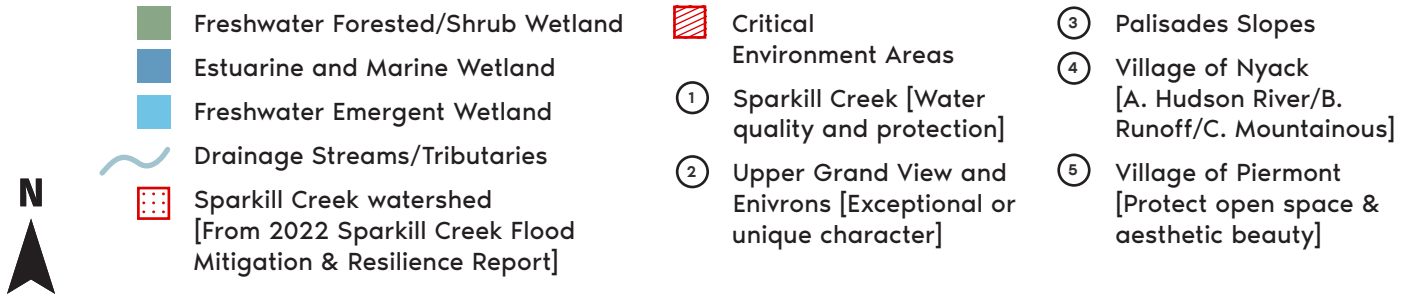
18 “Chapter 13 Explosives,” *Town of Orangetown Town Code*, adopted 1998. <https://ecode360.com/OR0091>.

19 “Chapter 21 Land Development Regulations,” *Town Code*, amended 1999. <https://ecode360.com/26863402>.

20 “Chapter 43 Zoning,” *Town Code*. Section 10.223.(g), amended 1994. <https://ecode360.com/26866922>.



**Figure 7-2**  
**Hydrology, Wetlands, and Environmentally Sensitive Areas**



Map developed by MUD Workshop



Grandview overlooking the Hudson River and the Tappan Zee Bridge © AKRF

# Hydrological Systems (Waterbodies + Wetlands)

## Waterbodies

### Lake Tappan

Formed by the convergence of the Hackensack River and Naurausaun Brook, Lake Tappan is surrounded by large areas of adjacent green space including Kaufmann Campgrounds, Manhattan Woods Golf Course, Blue Hill Golf Course, Rockland Psychiatric Center, and Veterans Memorial Park.<sup>21</sup> The lake is an engineered reservoir supplying drinking water to Rockland County, parts of New Jersey, and the New York City metropolitan area. The reservoir is owned and managed by Veolia, a private utility company, and comes under NYSDEC protection. There are wheelchair accessible docks along Lake Tappan. However, recreational activities are limited, and a permit from Veolia is required for fishing, birding, and hiking.

### Hudson River

In terms of historical impact on development, commerce, and scenic beauty, the most prominent water resource in Orangetown is the Hudson River. The Hudson River is central to the Town's geographic identity and is a resource for recreation and tourism, offering water activities (including the South Nyack boat launch) and stunning viewsheds. Ecologically, the

<sup>21</sup> "Orangetown Environmental Committee Recommendations for the Orangetown Comprehensive Plan," January 21, 2022.

river is critical for nutrient cycling, primary production, and habitat diversity. The Hudson River Estuary is an essential part of the North Atlantic coastal ecosystem.

## County-Regulated Streams

The Rockland County Stream Control Act (1976) identified five County-regulated streams in the Town of Orangetown: Sparkill Creek, Hackensack River, Nauraushaun Brook, Muddy Creek, and Pascack Brook. These streams require permits and carry restrictions on development and related activities within their 100-year floodplain. All County-regulated streams in Orangetown face water quality challenges to various extents. Major causes of water pollution include, but are not limited to, development predating stormwater regulations (especially surrounding Sparkill Creek), sediment and contaminants from steep slope erosion, poor drainage due to disturbed natural hydrology, and surface pollutants from impermeable surfaces that get carried with run-off.

### Sparkill Creek

Another significant waterbody is Sparkill Creek, which spans the southeastern section of the Town with an associated system of floodplains and wetlands. Sparkill Creek's 11.1-square mile watershed area is managed by at least four organizations, including Rockland County, the Town of Orangetown, and the Sparkill Creek Watershed Alliance, amongst others. This watershed area faces flooding, water pollution, and sediment accumulation issues.

### Hackensack River

The Hackensack River is a NYSDEC Class A drinking water stream. The Hackensack River is classified by the NYSDEC as a "moderately impacted" stream, with monitoring results indicating compromised water quality.<sup>22</sup> The biological community's pristine state is disrupted, restraining fish, shellfish, and wildlife reproduction, but usually does not compromise survival. Water quality has improved since 2006.

### Nauraushaun Brook

Nauraushaun Brook is a NYSDEC Class A drinking water stream. Nauraushaun Brook is classified as a "moderately impacted" stream.<sup>23 24</sup> There are parts of the brook that have become a swamp due to drainage issues.<sup>25</sup>

### Muddy Creek

Muddy Creek flows north-south through Pearl River and is part of open areas set aside by the Town for recreation purposes. It is classified by NYSDEC as a "moderately impacted" stream.

### Pascack Brook

Pascack Brook is a tributary of the Hackensack River flowing through Pearl River and is set aside by the Town for recreational purposes. Pascack Brook is classified as a "moderately impacted" stream. In Orangetown, Pascack Brook flows through and is associated with Pascack Brook Town Park, a natural area offering fishing, walking, and other passive recreational activities.

22 "Fact Sheet on Assessment of Water Quality Impact in Streams and Rivers." NYSDEC. [https://www.dec.ny.gov/docs/water\\_pdf/bapnarrative18.pdf](https://www.dec.ny.gov/docs/water_pdf/bapnarrative18.pdf).

23 Ibid.

24 "Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State," NYSDEC Division of Water. April 2021. [https://www.dec.ny.gov/docs/water\\_pdf/sop20821biomonitoring.pdf](https://www.dec.ny.gov/docs/water_pdf/sop20821biomonitoring.pdf).

25 Rochel Leah Goldblatt, "Nanuet: Officials say there's no easy fix for overgrown Nauraushaun Brook," *LoHud*. September 24, 2019.

## Minor Tributaries

Orangetown has numerous minor tributaries branching off from the major rivers and streams that are part of the hydrological drainage system. These tributaries serve important ecological functions by connecting different watersheds, thus enhancing floodplain connectivity, contributing to groundwater recharging, forming passageways for nutrient transport, and providing unique habitats and spawning sites for aquatic organisms.<sup>26</sup> Minor tributaries also give rise to a broad network of bankside vegetation and trees that offer erosion protection and climate resiliency.<sup>27</sup>

## Wetlands, Marshes, Estuaries

Orangetown has several NYSDEC-designated wetlands that are concentrated on the northern portion of Lake Tappan, the intersection of NY State Route 303 and the Town's northern border, and on either side of the PIP closest to the Town's southeastern border. There is also a variety of wetlands and marshes recognized in the National Wetlands inventory, including Piermont Marsh, one of the four marshes in the Hudson River Estuary Program. Wetlands in auto-dominated suburban areas are particularly valuable, counteracting the greatly increased rate and volume of runoff from impervious paved surfaces. Together with other water retention strategies, preserving and reconstituting wetlands can often provide a level of flood control comparable to costly dredge operations and levees.

### NYSDEC Wetlands

Wetlands larger than 12.4 acres are protected and mapped by the NYSDEC. Any construction activity that may impact these wetlands is regulated, whether it is situated within the wetland itself or its 500-foot buffer. NYSDEC wetlands are located around the northern portion of Lake Tappan as well as near a section of the PIP by the southeastern Town boundary.

### National Wetlands Inventory (NWI) Wetlands

#### NWI Wetlands and Deepwater Habitats: Category Definitions

The NWI Wetland categories found in the Town of Orangetown include: estuarine and marine deepwater, estuarine and marine wetland, freshwater emergent wetland, freshwater forested/shrub wetland, freshwater pond, lake, and riverine. Freshwater emergent wetland can be found in the hamlet of Palisade along the PIP, while estuarine and marine deepwater and wetlands are located at Piermont Marsh and along the Hudson River. Piermont Marsh is a tidal/freshwater wetland, one of only four such features in New York State. Piermont Marsh includes brackish tidal marshes, shallows, and intertidal flats. It is part of the Hudson River Estuary Program, which aims to maintain water quality, protect habitats, provide water recreation, adapt to climate change, and conserve natural landscapes.

**Figure 7-3** illustrates the general location of wetland habitat categories in the Town of Orangetown. The figure is based on the following NWI wetland habitat definitions:

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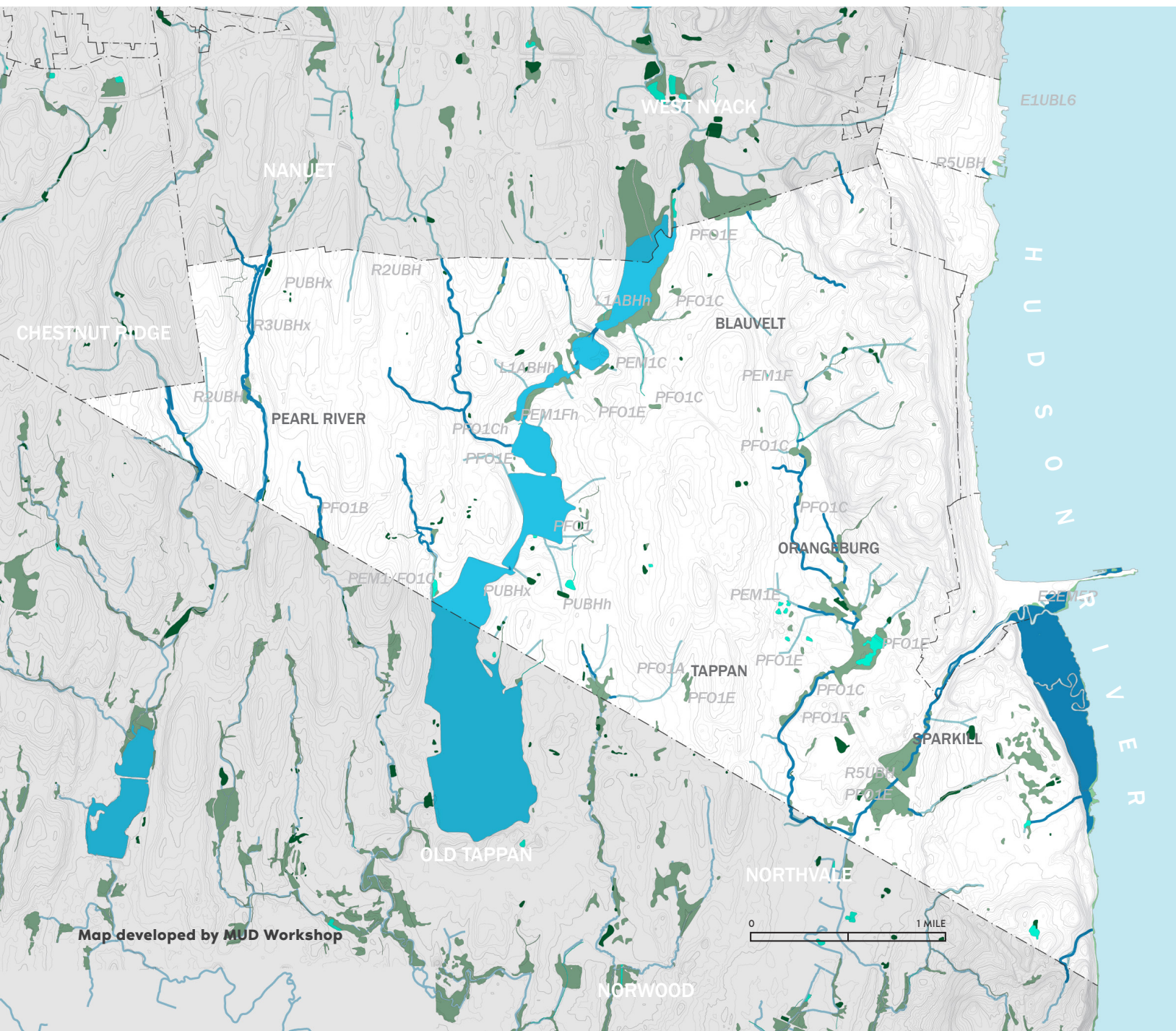
26 Gabriele Consoli. "Tributary effects on the ecological responses of a regulated river to experimental floods," *Science Direct*. 2022. <https://www.sciencedirect.com/science/article/pii/S0301479721021848>.

27 Stephen Philip Rice; et al., "The Ecological Importance of Tributaries and Confluences." *River Confluences, Tributaries, and the Fluvial Network*, 2008. <http://dx.doi.org>.

Figure 7-3  
**Wetland Existing Conditions**



- Estuarine and Marine Deepwater (E1)
- Estuarine and Marine Wetland (E2)
- Freshwater Emergent Wetland (PEM)
- Freshwater Forested/Shrub Wetland (PFO, PSS)
- Freshwater Pond (PUB, PAB)
- Lake (L)
- Riverine (R)
- Drainage Streams/Tributaries



<b>Estuarine and Marine Deepwater (E1)</b>	Deepwater tidal habitats and adjacent tidal wetlands that are semi-enclosed but have access to the open ocean, in which ocean water mixes with freshwater runoff from land. These habitats are located below extreme low water and continuously submerged.
<b>Estuarine and Marine Wetland (E2)</b>	Deepwater tidal habitats and adjacent tidal wetlands that are semi-enclosed but have access to the open ocean, in which ocean water mixes with freshwater runoff from land. These habitats are flooded and exposed by tides and include the associated splash zone.
<b>Freshwater Emergent Wetland (PEM)</b>	PEM wetlands include low-salinity tidal wetlands and non-tidal wetlands dominated by emergent perennial plants and low-salinity wetlands.
<b>Freshwater Forested/Shrub Wetland (PFO, PSS)</b>	Low-salinity tidal wetlands and non-tidal wetlands characterized by woody vegetation that is 6 meters tall or taller as well as shrubs and scrub 6 meters or less.
<b>Freshwater Pond (PUB, PAB)</b>	Include non-tidal and low-salinity tidal wetlands and deepwater dominated by plants that generally grow on or below the surface of the water and have vegetative cover less than 30 percent.
<b>Lake (L)</b>	Includes wetlands and deepwater habitats that are situated in a topographic depression or a dammed river channel, lacks significant vegetation covering, and has a total area of at least 20 acres.
<b>River (R)</b>	Includes all wetlands and deepwater habitats contained within a channel not dominated by vegetation.

## Ecological Role

In conclusion, the Town of Orangetown is home to a rich system of waterbodies and wetlands that have an invaluable ecological role and mitigate impacts of climate change. Wetlands, in particular, are important to Orangetown because they act as natural detention basins to reduce flooding risks, provide shoreline erosion control, and maintain water quality by absorbing nutrient and pollutant runoff. Many of these hydrological features, however, are near transportation infrastructure and impervious paved surfaces of wide roadways and parking lots. Waterbodies and wetlands can be further protected for better water quality and mitigating flood impact.



A frozen Hudson River from Piermont © AKRF

# Flooding

As highlighted earlier in this chapter, flooding is the most significant environmental concern for Orangetown. It is aggravated by overwhelmed stormwater infrastructure, increasing areas of impervious surfaces (especially near hydrological bodies), and development that predates stormwater regulations (especially on steep slopes).<sup>28</sup> There are numerous residential areas and other active land uses situated within flood zones adjacent to the Hudson River, as well as near lakes, creeks, and marshes in Orangetown. Flooding in developed areas contributes to pollutants entering and degrading the Town's waterbodies. Much of floodwater is untreated and carries with it surface pollutants and debris, such as traces of gasoline, lawn care chemicals, microplastics, and street litter, into waterbodies including Sparkill Creek, wetlands along the PIP, and other sensitive ecosystems.<sup>29</sup>

As shown in **Figure 7-4**, the areas under high risk include:

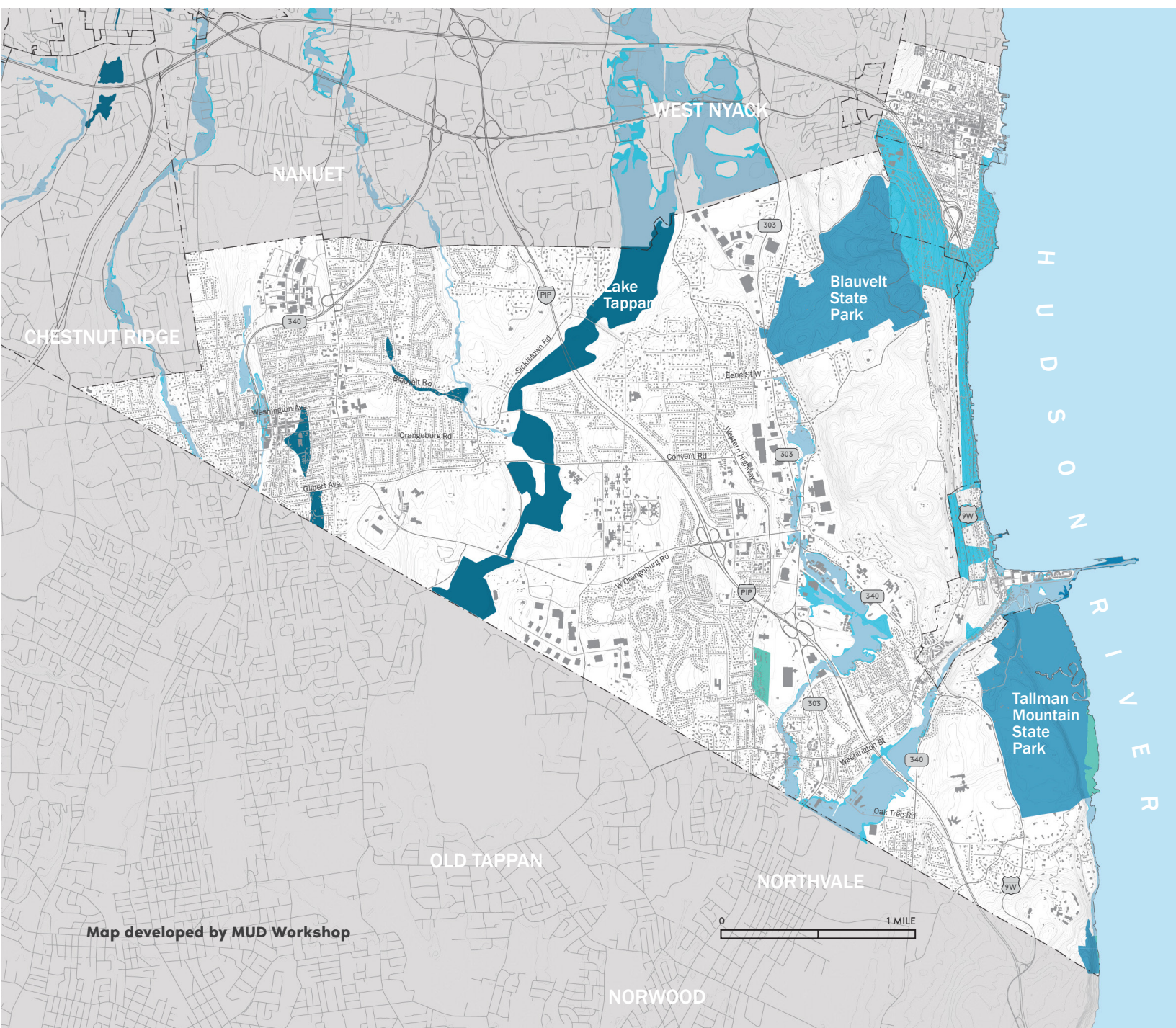
- Sparkill Creek
- Highway infrastructure such as NY State Route 303
- Areas in the hamlets of Sparkill and Tappan
- Village of Piermont
- Muddy Brook
- Pascack Creek

<sup>28</sup> "Orangetown Environmental Committee Recommendations for the Orangetown Comprehensive Plan," January 21, 2022.

<sup>29</sup> *ibid.*

**Figure 7-4**  
**FEMA Flood Zones**

- A: 100-year Floodplain, areas with a 1% annual chance of flooding.
- AE: 100-year Floodplain
- ANI: Lakes
- D: Areas with possible but undetermined flood hazards.
- VE: Areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action.
- X500: Areas of 500-year flood inundated by 0.2% annual chance flooding



Map developed by MUD Workshop



Uses at risk include:

- Infrastructure including roadways and other utilities such as the Rockland County Sewer along Sparkill Creek
- Businesses along Oak Tree Road
- Residential areas along Sparkill Creek, South Nyack, Piermont, and Grand View-on-Hudson

The 2018 Rockland County Hazard Mitigation Plan (HMP) provides the land area and population impacted as well as financial loss incurred by incidents of 100-year and 500-year floods in the Town of Orangetown. According to the HMP estimations, a 1 percent flood event in Orangetown would impact 26.1 percent of land, 1.2 percent of the population, and cost \$181,745,000 for total replacement of affected building stock. A 0.2 percent flood event in Orangetown would impact 27.4 percent of land, 2.8 percent of the population, and cost \$336,204,000 for total replacement of affected building stock.<sup>30</sup> While **Figure 7-4** does not show 26.1 percent of Orangetown’s land being impacted by flooding, the analysis in the HMP arrived at these statistics using finite assessment methods and parameters.<sup>31</sup>

The Town of Orangetown experiences the following types of flooding:<sup>32</sup>

- Riverine Flooding** Along a channel, which can happen along the Hudson River and other rivers and streams.
- Shallow Flooding** In flat areas where a lack of channels means water cannot drain away easily. Much of shallow flooding is caused by urban drainage issues and an abundance of paved surfaces.
- Storm Surge** As an estuarine river that enters the ocean, the Hudson River is at risk for storm surge moving up the river from the ocean due to hurricanes. The Village of Piermont was one of the Rockland County municipalities that sustained the greatest damage in Superstorm Sandy.
- Flash Flooding** Rapid flow of high water into a normally dry area, or rapid water level rise in a stream due to severe storm.<sup>33</sup> Flash floods are more likely to occur where rivers are narrow and steep, especially in urban environments with extensive impervious surfaces and overdevelopment. In the Town of Orangetown, there were flash flood incidents in 2014, in which vehicles became trapped in high water on NY State Route 303 in Tappan and required water rescues. Areas near steep slopes surrounding Sparkill Creek are prone to flash flooding.

30 “Section 5.4.4.- Flood,” *Rockland County Hazard Mitigation Plan (HMP)*, 2018. <https://www.rocklandhmp.com>.

31 As stated in the Rockland County HMP, Section 5.4.4. Flood: “To estimate the population exposed to the 1- and 0.2-percent flood events, the floodplain boundaries were overlaid upon the 2010 U.S. Census population data in GIS (U.S. Census 2010). The 2010 Census blocks with their centroid in the flood boundaries were used to calculate the estimated population exposed to this hazard... Census blocks do not follow the boundaries of the floodplain and can grossly over or underestimate the population exposed when using the centroid or intersect of the Census block with these zones. The limitations of these analyses are recognized, and as such the results are only used to provide a general estimate.”

32 “7.0 Natural and Environmental Resources,” *Rockland Tomorrow: Rockland County Comprehensive Plan*. 2011. <http://rocklandgov.com/departments/planning/comprehensive-plan>.

33 “Section 5.4.4.- Flood,” HMP.

Several critical facilities are located in the 100- and 200-year floodplains. Some of these include the Blauvelt Post Office, John Paulding Engine Co #1, O & R Tappan Gate Station (gas), Pearl River EMS, Volunteer Fire Association of Tappan, and Orangetown Wastewater Treatment Plan. The Town has also identified locations vulnerable to flooding: NY State Route 303 at Mountainview Ave, Sparkill Creek, Van Terrace, Oak Tree Road at Corporate Drive, Oak Tree Road at Van Wort Drive, Brightwood Avenue Pearl River.<sup>34</sup>



**Sparkill Firehouse after Hurricane Irene**



**Oak Tree Road after Hurricane Irene**<sup>35</sup>

The steep terrain of the Clausland Mountain, combined with the area's land use patterns, results in flooding issues for Sparkill Creek and intermittent streams in the Clausland Mountain area.<sup>36</sup> Sparkill Creek, along with its associated floodplain and wetlands, requires protection. The areas abutting the creek have development encroachments (developments that predate stormwater regulation) that contribute to excessive runoff. This runoff in turn compromises the watershed's drainage and environmental conditions, leading to flash flooding after severe storm events, such as Hurricane Irene. The 2022 Sparkill Creek Flood Mitigation & Resilience Report identified eight High Risk Areas (HRAs) along the course of Sparkill Creek and impacted critical infrastructure within the HRAs, such as bridges, power stations, and pump stations, that require site-specific strategies for flood mitigation.<sup>37</sup>

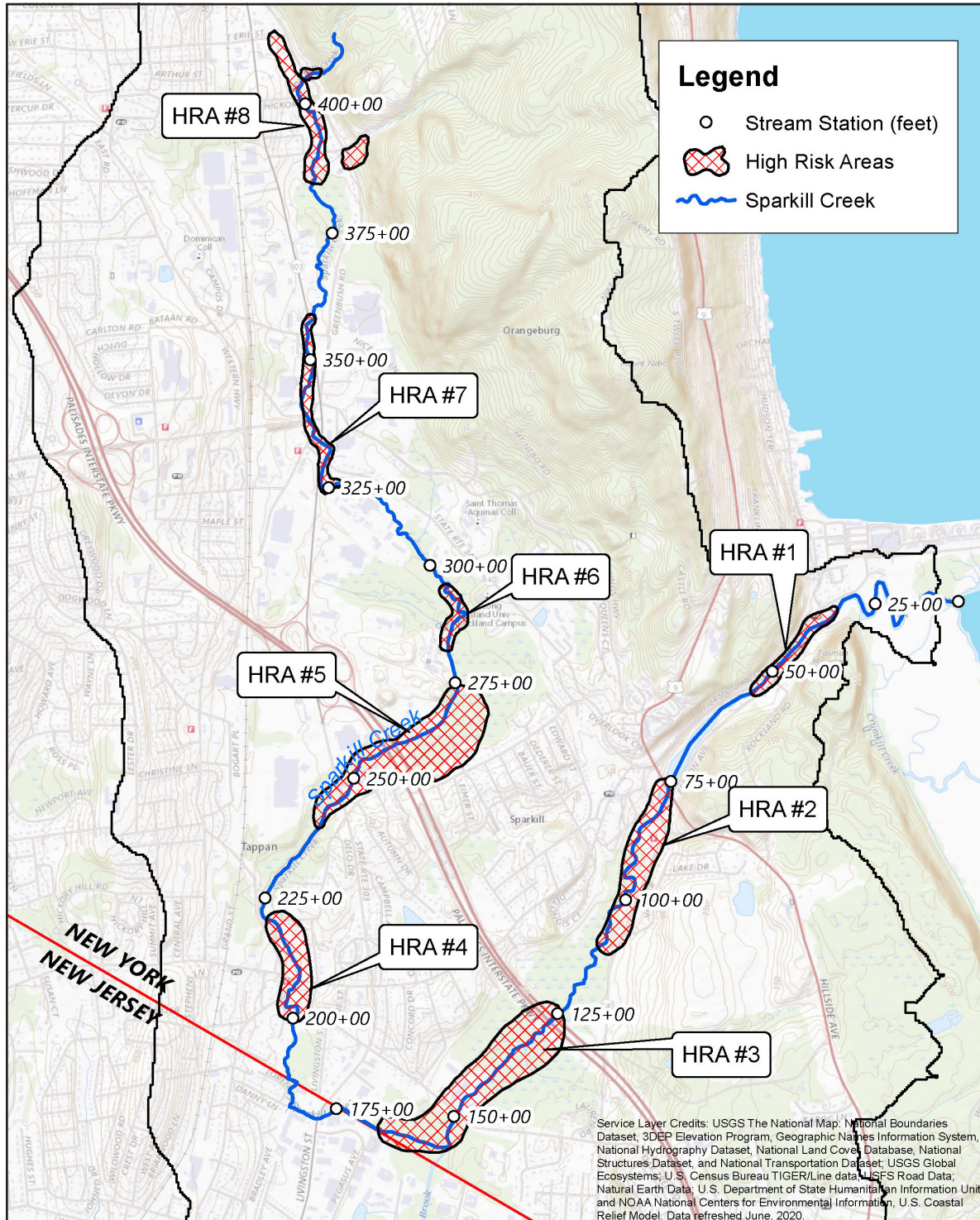
<sup>34</sup> "Chapter 9.14 - Orangetown," *Rockland County HMP*. 2018.

<sup>35</sup> Town of Orangetown "Sparkill Flooding Notes" <https://www.orangetown.com/document/sparkill-flooding-notes/>

<sup>36</sup> "Environmental Constraints," "Land Use and Zoning," *Town of Orangetown Comprehensive Plan*. May 2003. <https://www.orangetown.com/document/comprehensive-plan>.

<sup>37</sup> NYSDEC and NYS Office of General Services, *Sparkill Creek Flood Mitigation & Resilience Report*.

Figure 7-5  
High Risk Areas along the Sparkill Creek



Source: NYSDEC, Sparkill Creek Flood Mitigation and Resilience Report, Jan 2022

## Stormwater

Like the rest of the U.S. Northeast, stormwater infrastructure in Orangetown becomes overwhelmed during severe storm events with overflows from the Hamlets and Villages of Sparkill, Orangeburg, Nyack, and Piermont discharged into the Hudson River.<sup>38</sup> This excessive stormwater volume also causes damaging floods. The streams in Orangetown, especially Sparkill Creek, flood recurrently, which will become more prevalent due to increased severe storm events brought on by climate change.<sup>39</sup>

Destructive stormwater volume and velocity are the legacy of an era in which development that predated stormwater management plans neglected watershed protection. NYS stormwater management policy cannot simply be applied to new construction and development, as the current issues are inherited from preexisting development. Relevant improvement strategies include retrofitting existing public stormwater systems with green infrastructure (GI), requiring more robust landscaping and stormwater controls in development, incentivizing environmentally sustainable development, increasing ground permeability by decreasing the area of paved surfaces (including parking lots), and transitioning to and requiring permeable pavement.

The Town of Orangetown currently has a complete stormwater management plan approved by the EPA and NYSDEC. The Town has also been actively involved in implementing NYSDEC regulations by updating local laws and maintaining Stormwater Consortium of Rockland County membership. Other Town Code sections relevant to flooding include, Chapter 41 "Watercourse Diversion and Pollution," Chapter 30C "Stormwater Management," Chapter 30D "Sediment and Erosion Control Stormwater Management," and Chapter 14B, an NFIP Flood Damage Prevention Ordinance, which can also benefit from detailed updates.<sup>40</sup> <sup>41</sup> The Town has utilized its stormwater management plan and relevant Town Code in the planning, design, and construction of multiple projects, such as the public-private partnership culvert replacement project over Sparkill Creek at Innovative Plastics, located at 400 NY State Route 303, Orangeburg. Additionally, the Town has replaced the Oak Tree Road Bridge in Tappan and is in the planning stage, with funding secured, for the replacement of the Mountainview Avenue culvert in Orangeburg.

## Water Quality

Originating on Clausland Mountain, Sparkill Creek's eleven square mile watershed is approximately 47 percent urban, 45 percent forested, and 8 percent wetland.<sup>42</sup> NYSDEC designated a portion of Sparkill Creek on the 303D list of impaired waterways, citing fecal coliform and oxygen demand. Rockland County Department of Health has delineated

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38 "Orangetown Environmental Committee Recommendations for the Orangetown Comprehensive Plan," January 21, 2022.

39 "Section 5.4.6 - Severe Storm," *Rockland County HMP*. 2018.

40 Authorized by the New York State Constitution, Article IX, Section 2, and Environmental Conservation Law, Article 36.

41 "Chapter 9.14 - Orangetown," *Rockland County HMP*. 2018.

42 "Sparkill Watershed Report Card," Rockland County Department of Environmental Resources. <https://rocklandgov.com/files/2513/5394/1881/Sparkill.pdf>.

general groundwater protection zones; however, the Town has not yet implemented regulations for these zones, but could consider doing so in the future.<sup>43</sup>

## Impervious Surfaces

The impervious surfaces in Orangetown, including roadways, parking lots, and buildings, are concentrated in its Villages and Hamlets as shown in **Figure 7-6**. Many of these impervious areas are located within inundation zones, near waterbodies, and are contiguous with protected areas. This proximity leads to contaminated runoff flowing directly into these environmentally sensitive areas. Increasing impervious surface cover disrupts watershed hydrology and places the Town's hydrological system at risk. Impervious surfaces are a concern that breaches multiple categories, including flooding, water pollution, and wetland maintenance. Aged impervious surfaces may contain contaminants that require safe removal processes.<sup>44</sup> Therefore, where paved surfaces are required, the Town should utilize, incentivize, and require permeable pavements.

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43 "7.0 Natural and Environmental Resources," *Rockland Tomorrow: Rockland County Comprehensive Plan*. 2011. <http://rocklandgov.com/departments/planning/comprehensive-plan>.

44 Ibid.

View of the Hudson River from Grand View © AKRF

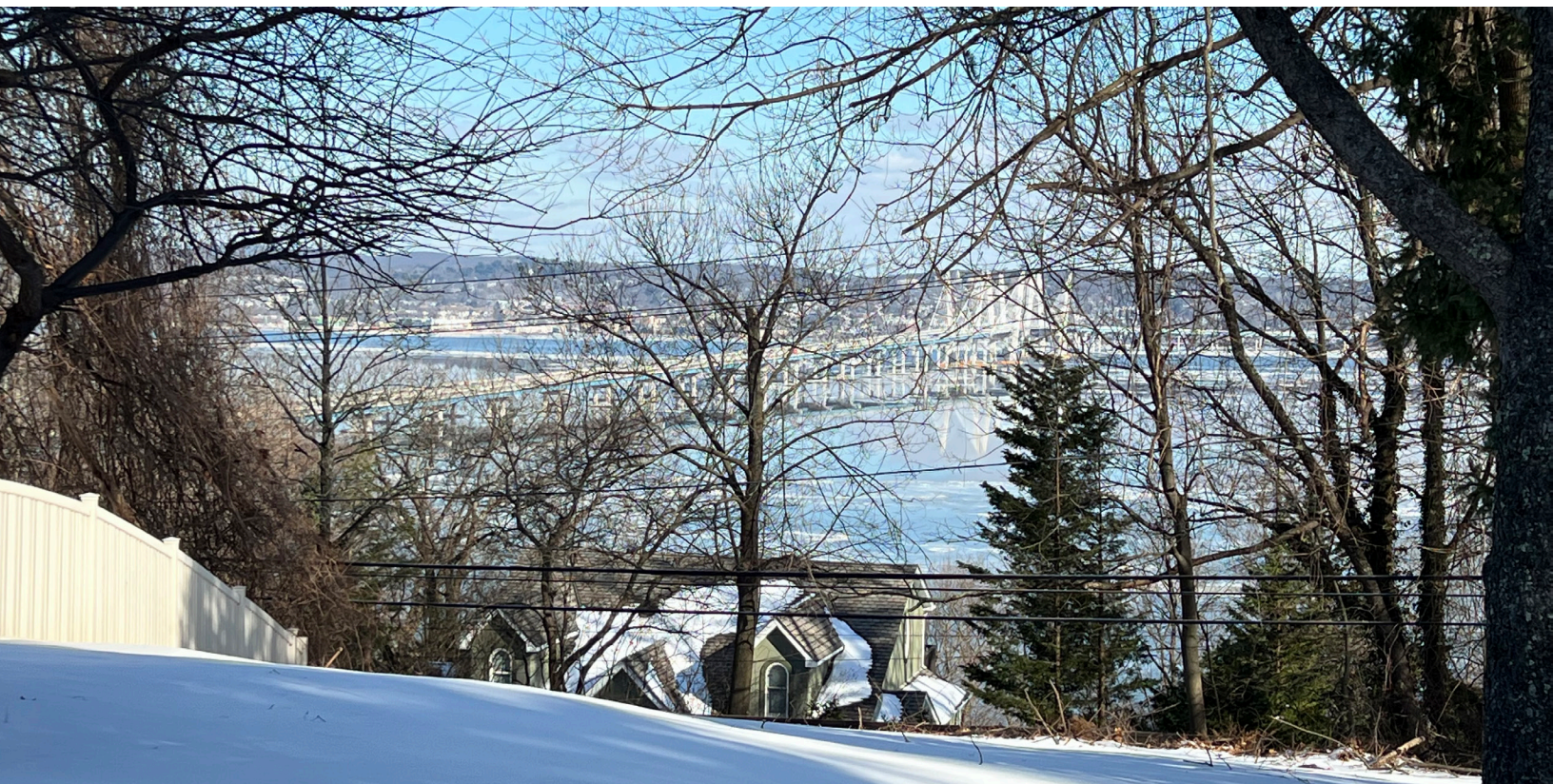
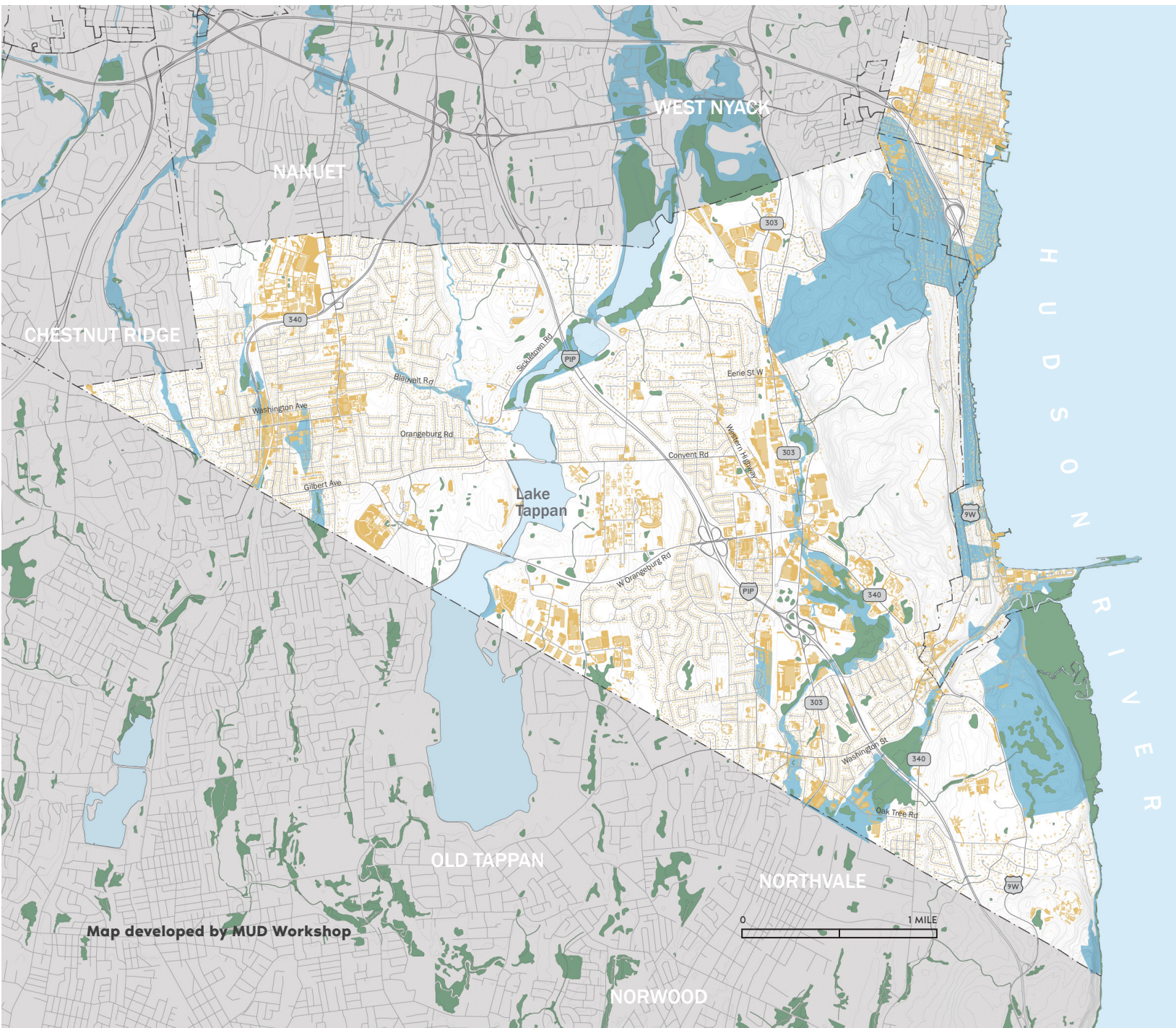


Figure 7-6  
**Impervious Surfaces, Wetlands,  
and Flood Zones**

- Wetlands
- Flood Zones
- Impervious Surfaces



Map developed by MUD Workshop



Commercial corridor in downtown Pearl River © AKRF

# Carbon Emissions

## Electric Grid Transition

Because residential and commercial sectors consume the bulk of the energy supply in Orangetown, energy sustainability and resilience strategies adopted by the Town will have a powerful impact. In 2020, Orangetown joined the Rockland Community Power Community Choice Aggregation (CCA), an energy program that enables residents and small businesses to pool together local electricity demand and purchase renewable energy at a lower cost than non-renewable electricity supply. The Town is working with Joule Community Power (Joule) and, along with the five other municipalities participating in the CCA program, chose Constellation Energy as their default supplier.<sup>45</sup>

However, currently the Town is defaulting to the CCA “standard” fossil fuel-based supply, with the option for residents and businesses to switch to the CCA 100 percent renewable supply. The Town should consider incentivizing and encouraging all residents and businesses to transition to 100% renewable energy.

## Green Mobility

The carbon emissions from transportation accounts for approximately 35.2 percent of the Town of Orangetown’s total greenhouse gas (GHG) emissions.<sup>46</sup> As such, enhancing green mobility can be considered a priority for the Town to improve environmental health and

# 35.2%

of the Town’s greenhouse gas emissions land is due to carbon emissions from transportation.

<sup>45</sup> New York State Energy Research and Development Authority (NYSERDA) allows municipalities to establish Community Choice Aggregation (CCA) programs for buying or generating electricity for residents and businesses within their communities.

<sup>46</sup> NY Climate Smart Communities *Mid-Hudson Regional Greenhouse Gas Emissions Inventory* Table 26. “Rockland County; Total Emissions by Municipality and Sector.”

address NYS emissions targets. There are currently seven electric vehicle (EV) charging stations in Orangetown, and existing studies recommend increasing infrastructure for green vehicles and non-vehicular modes of mobility.

Another significant way to address carbon emissions is to improve green mobility infrastructure. As seen in the sidewalks map in **Figure 7-7**, the Town of Orangetown's system of sidewalks is discontinuous between and within hamlets. This presents an opportunity to form a more consolidated network of pedestrian access, connecting places of interest between homes, shops, schools, workplaces, cultural venues, etc., which would make walking and other non-vehicular modes of transit a more viable and practical option for the Town's residents and visitors. Along with reducing GHG emissions from vehicular transportation, sidewalks also provide space for recreation and exercise, thus contributing to healthier communities.<sup>47</sup> Moreover, studies show trends in property value increase for properties situated in walkable areas.<sup>48</sup>



**E Central Avenue in walkable Pearl River © MUD Workshop**

The 2018 Orangetown Bike Study recommends a robust local cycling network consisting of multimodal trails, non-vehicular routes, and off-road paths. The Town would benefit greatly from prioritizing the implementation of bike lanes and additions to the bike network. Beyond recreation, this bike path system can connect places of commerce, retail, and cultural establishments that people frequent, making biking a tenable and practical mode of transportation not only for leisure, but also for everyday errands and commuting. Walking and biking can be made more accessible and attractive by improving sidewalk and bike route connectivity and safety, as well as planting street trees and otherwise improving streetscapes.<sup>49</sup>

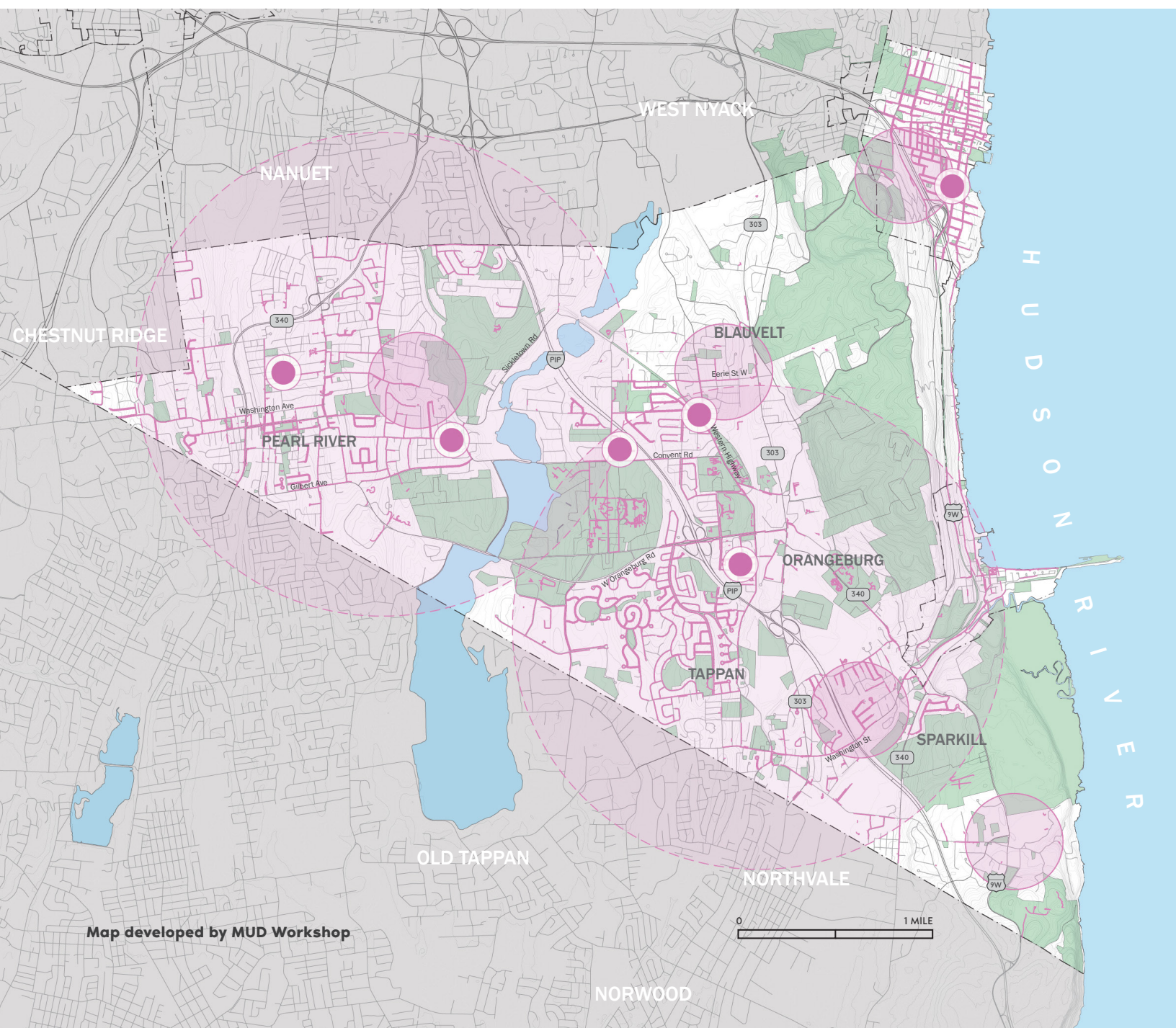
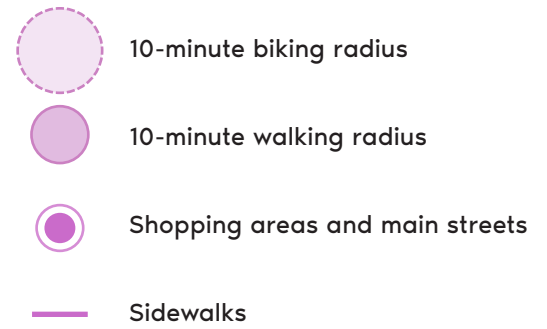
<sup>47</sup> "Orangetown Environmental Committee Recommendations for the Orangetown Comprehensive Plan," January 21, 2022.

<sup>48</sup> "How Much Does Walkability Increase the Value of a Home?" Redfin, February 11, 2020. <https://www.redfin.com/news/how-much-does-walkability-increase-home-values/>

<sup>49</sup> Orangetown Bike Study. 2018. <https://www.orangetown.com>.



Figure 7-7  
**Walking and Biking Distances in  
Relation to Major Shopping Areas**



Map developed by MUD Workshop





Central Avenue Field in Pearl River © AKRF

# Sustainability and Climate Resiliency Vision Goals and Objectives

The existing conditions highlight Town initiatives as well as environmental challenges and assets that can be leveraged to improve Orangetown's resilience into the future. To address stormwater and flooding issues, the Town has completed a culvert replacement project through a public-private partnership at Innovative Plastics in Orangeburg, replaced the Oak Tree Road Bridge in Tappan, planned the replacement of the Mountainview Avenue culvert in Orangeburg, and constructed an extensive green infrastructure project at the Rockland Homes for Heroes in Tappan. These are compelling local precedents that can be built upon to further strengthen the Town's stormwater management and flood resilience.

In terms of environmental challenges, the steep slopes assessment shows that the Palisades Ridge is of great scenic value but it is also the source of erosion hazards and flooding concern. As such, the Town could consider bolstering its development guidelines to protect and stabilize steep slopes.

Orangetown's hydrological system consists of a rich network of wetlands and several waterbodies, namely streams, impacted by moderate water quality concerns. The Town should consider protecting and reconstituting wetlands, and improving water quality by systemically addressing root causes of pollution.

Flooding, especially flash flooding, already is and will become an even more pressing issue due to climate change. In addition to retrofitting existing infrastructure, the Town should consider reducing impervious surfaces. Altogether, protecting and reconstituting the wetlands system, designating additional environmentally sensitive zones such as CEAs, establishing urban forestry and landscaping regulations, stabilizing and regulating development of steep slopes, and increasing permeable ground surface will aid in addressing the Town of Orangetown's flooding, slope erosion, and water quality concerns across the board. In addition, the Town could approach improving carbon emissions by switching to the 100% renewable energy CCA option, as well as favoring compact and infill development which in turn encourages pedestrians, biking, and other green mobility options, and reduces energy consumption, among other benefits.

## Proposed Implementation Strategies and Actions

### Goal: Promote Sustainable Development and Plan for Climate Resiliency.

- Establish a Climate Working Group to seek funding for and to develop a Climate Action Plan.

Orangetown is not only registered with and applying for bronze-level certification with the NYS Climate Smart Community program, but also it is designated as a Clean Energy Community by the NYS Energy Research and Development Authority (NYSERDA). The Town could consider pursuing higher certifications for both programs.

The Town should also consider establishing a climate working committee to seek funding and oversee the development of a Climate Action Plan (CAP). At a minimum, the CAP would lay out a road map and targets for limiting community greenhouse gas (GHG) emissions, switching 100 percent of the Town's energy supply to renewable sources, providing green transportation alternatives as tenable and convenient mobility modes, defining climate mitigation, promoting environmental stewardship and sustainability, reducing our vulnerability to climate impacts, enhancing quality of life and livability of neighborhoods, boosting opportunities for climate-smart businesses and job creation, and improving public health and equity for all community members.

The CAP should be a living document which maps out a long-term vision, and also has the flexibility to accommodate and adapt to the evolving environmental context and climate threats. One of the ways in which it could do so is by annual reviews wherein the climate working committee tracks the success and effectiveness of the CAP's strategies and makes updates where needed.

The CAP should also consider regional and municipal collaboration at the forefront for all major infrastructure projects, be they regional or local. Additionally, all new projects at the local level would benefit from reviews with a resiliency and climate change lens. For instance, given Orangetown's proximity to the Hudson River, all projects should consider sea level rise, net zero runoff, limited pervious surface, and other parameters. Finally, the CAP should establish a clear timeline with milestones, actions, and guidance for land use and zoning regulations.

- Mitigate the harmful impacts of flood events through development regulations and preventative measures, including steep slope ordinances.

There are many residential areas and other active land uses situated within floodplains bordering the Hudson River, streams, lakes, and marshes. Runoff from developed areas carries pollutants, such as gasoline, lawn care chemicals, and microplastics, which enter waterbodies, compromising water quality. Areas along the Town's watercourses, and especially Sparkill Creek, have been encroached upon by development that predates stormwater regulation. This lack of suitable infrastructure leads to excessive runoff compromising the watershed's drainage and flash flooding after severe storm events.

In Orangetown, steep slopes require circumspect management due to recent storm events causing increased flash flooding on such slopes, which are especially sensitive when situated within Critical Environmental Areas (CEAs).<sup>50</sup> It is therefore imperative to review the effectiveness of the Town's current Zoning Code and introduce flood mitigation measures. To protect steep slopes and reduce flooding, the Town should consider imposing ridgeline overlay zoning districts that regulate the number, height, placement, impacts, and design of structures located on ridgeline property.<sup>51</sup> Other steep slope protection strategies, some of which were also included in the 2003 Comprehensive Plan, include:

- 1 Begin limiting and regulating development on slopes between 8 percent and 15 percent, with more stringent regulations for slopes between 15 percent and 25 percent.
- 2 Introducing extra protective measures for buildings located on slopes exceeding 25 percent.
- 3 Utilizing the natural terrain to minimize erosion when developing in slopes greater than 8 percent.

<sup>50</sup> "Orangetown Environmental Committee Recommendations for the Orangetown Comprehensive Plan", January 21, 2022.

<sup>51</sup> *New York State Standards and Specifications for Erosion and Sediment Control* (Blue Book) <https://www.dec.ny.gov/chemical/29066.html>.

- 4 Regrading that is cohesive with natural slopes and refrains from “cut and fill” (although soils found on Clausland Mountain may require cuts and fills as great as 33 percent).<sup>52</sup>
- 5 New planting and replanting that comprises indigenous and climate resilient vegetation.

Other flood mitigation strategies can include:

- 1 Developing and implementing a program of vegetated buffer zones and biotechnical slope stabilization methods with an emphasis on native planting.<sup>53</sup>
- 2 Strictly limiting the addition of impervious surfaces, particularly when near hydrological bodies.
- 3 Identifying and developing mitigation plans for areas at high risk of flooding, including improving public infrastructure.<sup>54</sup>
- 4 Limiting any new development in areas with high risk of flooding.
- 5 Floodproofing and elevating wastewater pump stations, sewer treatment plants, and utilities infrastructure involving electrical equipment.
- 6 Enlarging and enhancing floodplains in key areas.
- 7 Regularly maintaining culverts to keep inlets free of debris.
- 8 Widening channelized sections of key waterbodies.
- 9 Replacing undersized stream crossings.
- 10 Initiating timely road closures to prevent vehicular incidents when flooding occurs.<sup>55</sup>
- 11 Collaborating with the Rockland County Drainage Agency (RCDA) to create flood mitigation strategies and manage County regulated streams.<sup>56</sup>
- 12 Establishing drainage districts for each of the Town’s drainage areas including Sparkill Creek, Hackensack Creek, Muddy Creek, Cherry Brook, and Pascack Brook.<sup>57</sup>

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<sup>52</sup> 2003 Orangetown Comprehensive Plan.

<sup>53</sup> Gray, Donald, *Biotechnical and Soil Bioengineering Slope Stabilization*.

<sup>54</sup> NYS Floodplain Management <https://www.dec.ny.gov/lands/24267.html>.

<sup>55</sup> NYSDEC and NYS Office of General Services, *Sparkill Creek Flood Mitigation & Resilience Report*.

<sup>56</sup> 2003 Orangetown Comprehensive Plan.

<sup>57</sup> 2003 Orangetown Comprehensive Plan.

- Review and update local regulations to promote resilient construction practices, manage stormwater, and reduce flooding.

The Town should consider enhancing development guidelines to reduce pollutants in stormwater runoff. Town Code Chapter 30D "Sediment and Erosion Control Stormwater Management" effectively addresses construction and post-construction runoff by requiring State Pollutant Discharge Elimination System (SPDES) general permits for construction activity. To further enhance the discharge accountability of developments, the Town should consider adopting a "net zero" runoff policy for all developments and consulting the NYS Stormwater Design Manual to codify resilient construction practices and develop specific protocol for construction sites.<sup>58</sup> The Town follows NYS code in requiring compliance with the most up-to-date stormwater control measures for proposed building applications with greater than one acre of disturbance. This minimum acreage from NYS code is not sufficient to protect smaller environmentally sensitive parcels, and the Town could consider extending compliance and Stormwater Pollution Prevention Plan (SWPPP) requirements to sites under one acre. Furthermore, the Department of Environmental Management and Engineering, the Planning Board, and the Town Board can consider providing guidelines for:

- 1 Regulating the size of construction envelopes.
- 2 Limiting the amount of cut and fill.
- 3 Adopting low-impact development methods that maintain a site's natural hydrology.
- 4 Retaining vegetation and natural landscapes.
- 5 Encouraging use of resilient and repurposed construction materials.
- 6 Employing bioretention methods, permeable paving, and/or vegetated swales instead of paved gutters for new development and redevelopment projects.

- Map stormwater conveyance including drainage areas, outfalls, and discharge points for all of Orangetown's municipalities.

The Town, in collaboration with Rockland County, should consider mapping stormwater conveyance, drainage areas, outfalls, and discharge points for all of its municipalities. Developing a GIS-based stormwater network geodatabase would allow for improved stormwater analysis and data-driven management strategies. This geodatabase could be updated when new infrastructure is built and when inaccuracies in existing data require

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58 NYSDEC "Stormwater Permit for Construction Activity." <https://www.dec.ny.gov/chemical/43133.html>.

correction. To take on this effort, the Town could consult NYS Department of Transportation literature including “Methodology for the Identification and Survey of Stormwater Outfalls,”<sup>59</sup> “Guidance on Outfall Mapping,”<sup>60</sup> and ESRI’s Water System Mapping guide.<sup>61</sup>

- Improve water quality by addressing root causes of contamination, protecting wetlands and watersheds, and aiding their ecological role.

To control and improve Sparkill Creek's water quality, the Town should consider creating a riparian buffer (of a suggested 500 feet on either side of Sparkill Creek), which limits development (e.g., strip malls and warehouses are not advised, but permeable parking lots could be introduced) and requiring zero runoff on all new projects and construction sites, irrespective of size. The existing Sparkill Creek Critical Environment Area covers the areas adjacent to the creek tributary from NY State Route 340 to Piermont Marsh, and can be expanded to include more of the watershed. Green Infrastructure (GI) could also be a required component with each new development activity within this riparian buffer, eventually resulting in an integrated network of GI within the buffer zone. Furthermore, water-course monitoring, clean-up, and environmental protection efforts could be coordinated with the Sparkill Creek Watershed Alliance. Another major waterbody without water quality protection measures is Lake Tappan, a drinking water reservoir owned and managed by Veolia. Currently, there are no regulations protecting the lake’s watershed and runoff area. It is therefore critical to introduce protective measures such as measuring and limiting runoff, and defining land uses surrounding Lake Tappan.

Orangetown's rich system of wetlands also require further protection, as many of them have been disrupted by transportation infrastructure such as expanding roadways, sprawling parking lots, and other impervious surfaces. *The Sparkill Creek Flood Mitigation & Resilience Report*, released January 2022, estimates that approximately 50 to 60 percent of the wetlands in NYS have been lost to draining, filling, and other types of alteration.<sup>62</sup> Recently, the NYSDEC marshland near the intersection of NYS Route 303 and Oak Tree Road was filled in to accommodate development.

As such, the Town should consider the following strategies that expand on existing Town Code protections for waterbodies, watercourses, and wetlands:

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59 NYS DOT *Methodology for the Identification and Survey of Stormwater Outfalls* <https://www.dot.ny.gov/divisions/engineering/environmental-analysis/water-ecology/stormwater-management>.

60 NYS DOT “Guidance on Outfall Mapping.” <https://www.dot.ny.gov/divisions/engineering/environmental-analysis/repository/OutfallGuidance.pdf>.

61 ESRI Water System Mapping. <https://www.esri.com/en-us/industries/water-utilities/segments/small-systems>.

62 “Flood Mitigation & Resilience Report – Sparkill Creek SD115.” (January 2022). NYSDEC. [https://www.dec.ny.gov/docs/water\\_pdf/sparkillpt1.pdf](https://www.dec.ny.gov/docs/water_pdf/sparkillpt1.pdf).

- 1 Implementing regulations for general Groundwater Protection Zones, as delineated by Rockland County Department of Health.<sup>63</sup>
- 2 Strictly defining watercourses and wetlands; introducing watercourse overlay districts to establish buffer zones; setting appropriate widths for such buffer zones; and establishing zoning standards for development, construction, and human activities within these buffer zones.<sup>64</sup>
- 3 Designating and registering wetlands, streams, and other waterbodies as Critical Environmental Areas with NYS. These areas should include identified aquifer recharge zones.
- 4 Developing a Town wetlands protection ordinance that adheres to federal guidelines for regulating landscaping chemicals and pollution from run-off, as well as promoting alternatives to toxic landscaping chemicals.
- 5 Coordinating with the Palisades Interstate Parkway and NYS Thruway Authority to minimize the use of road salt on these highways.
- 6 Complementing State laws by regulating smaller wetlands that do not qualify for protection under NYSDEC regulations.<sup>65</sup> The Town should consider disregarding the minimum area requirement of 12.4 acres under NYSDEC regulations, and preserve all wetlands and waterbodies with very limited exceptions by permit.

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63 *Rockland Tomorrow: Rockland Country Comprehensive Plan (2011)*

64 NYS Department of State (DOS), *Guidebook on Watershed Plans*

65 The NYSDEC Freshwater Wetlands Program only protects wetlands larger than 12.4 acres.







Grass-covered athletic grounds in Pearl River © MUD Workshop

- Establish a green infrastructure and structural retrofitting program to reduce phosphorus, nitrogen, and pathogen loading.

Both the quantity and quality of stormwater runoff can be controlled to a considerable degree by introducing green infrastructure (GI) systems, which employ plant and soil systems to infiltrate, evapotranspire, and reuse stormwater where it falls. Depending on the context, there are a range of GI approaches that can be applied to collect, clean, and permeate stormwater. These approaches include the utilization of green roofs, tree trenches, rain gardens, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains.

The Town has constructed a green infrastructure project at the Rockland Homes for Heroes, which sets a compelling precedent. Located in Tappan, the project featured the development of a 3.6-acre bioretention and stormwater wetland, which acts as a water treatment basin for the surrounding 151-acre drainage area. The project eliminates impervious surfaces, reduces runoff quantity, encourages infiltration, and improves Sparkill Creek's water quality. The Town removed approximately 25,000 cubic yards of asphalt and constructed a bioretention and stormwater wetland that is approximately 5 acre-feet in volume, which treats and stores a drainage area of around 20 acres.<sup>66</sup> As such,

<sup>66</sup> Town of Orangetown "Homes For Heroes Green Infrastructure Bio-Retention & Stormwater Wetlands Project" [https://www.orangetown.com/wp-content/uploads/H4H\\_GIP.pdf](https://www.orangetown.com/wp-content/uploads/H4H_GIP.pdf)

the Home for Heroes is a zero-runoff site that provides robust water filtration through its ecological performance. Furthermore, the Town has installed rain gardens at multiple locations including the Highway Drop-Off Center, Orangeburg Library, and completed the culvert replacement project at Innovative Plastics. Building on these efforts, the Town could consider the following to further manage the quantity and quality of stormwater runoff:

- 1 Requiring all new off-street parking to use permeable surfaces. Where possible, redeveloping existing impermeably-paved parking lots with permeable surfaces, and removing paving from vacant land. The NYS Stormwater Management Design Manual can be a reference for design specifications.
- 2 Reassessing rules for minimum parking requirements to verify that they reflect the true requirement; consider reducing off-street parking minimums.
- 3 Requiring the use of permeable paving for overflow parking and snow removal areas.
- 4 Including GI practices and infrastructure in Complete Street design specifications and referring to NYS Stormwater Management Design Manual for planning and implementation.
- 5 Providing assistance with and facilitating NYS GI Grant applications.<sup>67</sup>
- 6 Educating and encouraging property owners to incorporate GI features for capturing stormwater.
- 7 Developing requirements for runoff from sidewalks and streets in urban areas to be directed into below-grade drainage systems. Where possible, grading sidewalks and roadways to drain into landscaped areas rather than onto hardscape.
- 8 Requiring all new subdivisions to include stormwater treatment for new roads in accordance with NYS requirements.
- 9 Considering setting limits to impervious surface area on any lot, so that a portion of the overall permitted land coverage is permeable, and ensuring that permeable areas are maintained as such.

The Town of Orangetown should consider expanding their existing Municipal Separate Storm Sewer System (MS4) public awareness program to include a wider range of stakeholders and educate them about the impacts of phosphorus, nitrogen, and pathogens on waterbodies. Educational programs and strategies can include establishing programs such as “Adopt a Catch Basin,” more actively advertising the Stormwater Consortium of Rockland County’s trainings and seminars, encouraging community cleanups, hosting local outreach workshops with compact curriculums, and conducting walking tours of Orangetown stormwater infrastructure. Beyond existing MS4 public programs, local education programs can be formed through partnerships with the Stormwater Consortium of Rockland County, Orangetown Department of Environmental Management and Engineering, Orangetown Environmental Committee, Office of Parks and Recreation, local schools and school districts, and community organizations.

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67 NYSDEC “Green Infrastructure Funding Sources” <https://www.dec.ny.gov/chemical/108961.html>.



Tallman Mountain State Park © AKRF

- Expand on existing stormwater public awareness programs to include a wider range of stakeholders and educational information.

At a minimum, the educational materials should include:

- 1 Impacts of stormwater discharges on waterbodies.
- 2 Pollutants of concern and their sources.
- 3 Actions to reduce pollutants in stormwater runoff.
- 4 Hazards associated with illicit discharge and improper disposal of waste.
- 5 Ways to report illicit discharges and water quality issues.

As of 2012, Orangetown’s transportation sector generated approximately 35.2 percent of the Town’s total GHG emissions, while industrial processes accounted for 9.2 percent.<sup>68</sup> The hamlet of Orangeburg is especially affected by truck deliveries and light industrial use, as residents have reported concerns over the proliferation of warehouses and increasing

<sup>68</sup> NY Climate Smart Communities *Mid-Hudson Regional Greenhouse Gas Emissions Inventory*, Table 26. “Rockland County; Total Emissions by Municipality and Sector”.

## - Reduce carbon emissions and promote healthier air quality.

truck volumes that exacerbates traffic, noise, and vehicle emissions. However, this is not a localized condition, as 44 percent of Orangetown residents who responded to the Comprehensive Plan online survey believe that there is excessive truck and vehicular traffic in their neighborhood. The Town could examine the following GHG reduction approaches:

- 1 Creating and enforcing regulations to limit air pollution coming from light industrial zoned areas, especially those close to residential neighborhoods.
- 2 Setting clear targets and providing timeline and guidelines for reducing GHG emissions.
- 3 Limiting truck traffic and deliveries during peak hours by incentivizing businesses to choose overnight or off-hour deliveries.
- 4 Rerouting truck traffic from residential areas and schools to major highways and roads.
- 5 Creating connected, safe and walkable communities with generous pedestrian infrastructure (sidewalks, crosswalks, pedestrian lights, landscaping), and public transportation (bus stops and shelters) on NY State Route 303 and throughout Orangetown.
- 6 Relocating commuter parking to existing developed areas with safe, sheltered bus stops to encourage the use of public transportation.
- 7 Encouraging the installation of electric vehicle (EV) charging stations in public areas.
- 8 Beginning with schools and businesses, advertising and enforcing efforts to limit the use of engine idling within the Town.
- 9 Limiting the use of gasoline powered leaf blowers.

EV charging stations in a Sparkill parking lot © MUD Workshop



- Limit the use of fossil fuels as a source of energy supply and incentivize the use of green building technologies for new development projects and retrofits.

In 2012, Orangetown’s commercial sector produced 25.5 percent of the Town’s total GHG emissions, and the residential sector was responsible for 21.1 percent.<sup>69</sup> These commercial and residential sectors generated close to 50 percent of the Town’s GHG in order to fulfill heating, cooling, lighting, and other needs. As such, the Town should consider prioritizing renewable sources for electricity and encouraging green building technologies that would decrease overall residential and commercial energy usage. The Town can consider updated energy supply and infrastructure as well as green building strategies, including:

- 1 Fully participating in the next phase of the Rockland Community Power CCA program by adopting the 100 percent NY-sourced renewable electricity option as the default supply for its residents and small businesses.
- 2 Building on the success of the Town’s Community Choice Aggregation Program and providing additional Town incentives for green energy such as fast-tracked approvals and tax incentives.
- 3 Exploring efficient alternatives to the aging existing electrical grid infrastructure, which has limited ability to take advantage of modern technologies. These alternatives should promote micro-grid Community-Distributed Generation of electricity, such as Community Solar installations, as a means to both protect critical infrastructure and to lower the stress on the existing utility infrastructure. Leading upgrades and retrofits by updating all municipal buildings for high energy efficiency and switching 100 percent of energy supply to renewable sources. Incentivizing businesses and institutional buildings to follow.
- 4 Requiring the use of green building technologies for heating and cooling for all new construction and redevelopment.
- 5 Continuing to enforce the recently adopted NYStretch Code for development, and improving the energy efficiency of building systems, including heating, cooling, and lighting.
- 6 Encouraging building performance code certifications such as Energy Star and/or LEED for new construction over a certain size.

<sup>69</sup> NY Climate Smart Communities *Mid-Hudson Regional Greenhouse Gas Emissions Inventory*, Table 26. “Rockland County; Total Emissions by Municipality and Sector”.



Solar panels at the North Middletown Road and NYS Route 304 interchange, Pearl River © AKRF

- Rigorously enforce Town Code §43-4.2 to limit light pollution.

Orangetown's Town Code §43-4.2 sets out requirements for constraining exterior artificial lighting; however, its enforcement is limited and the requirements are widely ignored in both commercial and residential areas. The Town should consider promoting awareness around the negative effects of light pollution and educate the public about methods to tackle and reduce it. The Town should also consider stricter enforcement by limiting light pollution in building applications through the Architecture and Community Appearance Board of Review (ACABOR).