An Environmental Resource Inventory of the Borough of Hillsdale, New Jersey Bergen County

Version: March 2022

Part I of II

Prepared by the Hillsdale Environmental Commission

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Borough of Hillsdale

Environmental Resource Inventory

Overview

Version 1: Prepared by Fred N. Rubel, M.S., QEP, Member, Hillsdale Environmental Commission. Last updated March 17, 2022. Please contact the Hillsdale Environmental Commission to offer any suggested corrections/changes.

Some interesting facts contained in this inventory of the environmental resources of the Borough of Hillsdale, are:

1. **A Small, Unique Community** – Hillsdale is a densely populated, substantially developed community of only about 2.98 square miles of land, with a population density nearly three times greater than that of the State of New Jersey as a whole - - with New Jersey being the most densely populated state in the nation. Yet, within an active, operating farm (Demarest Farms), and a portion of a regional water supply reservoir, the Woodcliff Lake Reservoir are located within Hillsdale's borders. [See Section A. Regional Relationships] About 5.5% of Hillsdale is open space. [See Section I. "Land Use"]
2. **Air Quality** – Surprisingly, the region in which Hillsdale is located (Bergen County) regularly experiences several days each year of unacceptable air quality. [See Section C. "Air Quality"]
3. **Topography** – The range in ground level elevation in Hillsdale is unusual for such a small community, perhaps exceeding 360 feet. Elevation ranges from about 20 feet above sea level at the shopping complex in Hillsdale's downtown area, to about 380 feet above sea level at the northwest edge of the Borough, northwest of the Garden State Parkway. [See Section E. "Topography"] Hillsdale has no formal vista viewing locations. However, the northwest portion of the Borough offers impressive vistas along various residences and roadways. Unique vistas exist at dead-end streets that abut Demarest Farms. One can view high points beyond the Pascack Valley and the Hudson Valley looking towards New York to the east, and to the New York City skyline, to the southeast. The New York City skyline can also be

seen while driving/walking south along Van Emburgh Avenue/Overlook Drive, in the general area of Demarest Farm. [See Section E. "Topography"]

4. **Trees** –A prominent characteristic of Hillsdale and many of the surrounding communities is an abundance of large, old trees - - this despite the borough being densely populated. Some of the large old trees approach or exceed 100 years of age, with some dating back 150 years or more, to the time of this country's Civil War.[1] Unlike some neighboring communities, Hillsdale allows up to three (3) trees on a property to be cut each calendar year, and except for specific projects that come before and are approved by its Planning Board, the borough does not track or otherwise manage the number of trees removed on properties - - or the borough as a whole. The borough has no provisions to identify and encourage the protection of trees of special significance, which are known as 'heritage trees.' [See Section H. "Vegetation and Wildlife"]
5. **Unexpected Wildlife** - Among the unexpected wildlife that co-inhabits Hillsdale are mink (although rarely seen), and bald eagles - - which have been spotted especially in the area near the Woodcliff Lake Reservoir at various times. [See Section H. "Vegetation and Wildlife"]
6. **Invasive Species** – Surprisingly earthworms that are so common to our area are actually an invasive species. These earthworms are not native to the area. Their presence substantially reduces the layers of leaf litter that are important to the health and viability of forested areas. [See Section H. "Vegetation and Wildlife"]
7. **Special Areas of Ecological Significance** - Vernal pools are locations that have high-value in terms of their ecological significance. These are undeveloped locations that flood for a limited number of months each year thereby creating complex and rich habitats. Hillsdale has two (2) such locations that the NJDEP identifies as possible vernal pools. One is located within an un-built-upon portion of what is known as the Tandy and Allen property (Tandy-Allen Woods), and the other is in the Wood Dale County Park section of the borough. [See Section H. "Vegetation and Wildlife"]

8. **Weather, Air Quality, Groundwater Level Monitoring** - The closest official weather station to Hillsdale is at Teterboro Airport. [See Section B. "Climate"] There is no official government air quality monitoring station in Hillsdale. The closest air quality monitoring station to Hillsdale is in Fort Lee. [See Section C. "Air Quality"] No official government groundwater level monitoring stations have been established in Hillsdale. [See Section G. "Hydrology"]
9. **Points of Interest** – Among the places one might be surprised to learn of being present - - and perhaps even find interesting to explore in Hillsdale [from Section I. "Land Use" of this report], are:
    a. **Hidden Public Walkway** – *A lengthy, narrow public access path* with a considerable number of steeply climbing concrete steps is located at Wiermus Road, west of the Demarest Farm store. The public path provides access to the heights of Royal Park Terrace, above.
    b. **Patterson Bridge** – The Patterson Bridge is a small road overpass that spans Pascack Brook south of Hillsdale Avenue, near Glendale Drive. It is named after David P. Patterson (1840 – 1879), an early founder of what is the present-day borough of Hillsdale. A flood level gauge is located there, as the Pascack Brook has a tendency to flood at this point, despite a recent re-design and reconstruction of the bridge.
    c. **Sapienza Gardens and Nature Preserve** - Named in honor of former Pascack Valley principal Barbara Sapienza, Sapienza Gardens connects open space between Pascack Valley High School and Wood Dale County Park. It is located behind the High School, and is also accessible from St. Nicholas Place, off Kinderkamack Road.
    d. **Walking Trail East of Ann Blanche Smith School** – On the north side of Hillsdale Ave., a short walking trail leads north from behind the baseball cage/dugout, at the *east end of Ann Blanche Smith School*, opening up to residential streets by homes that eventually lead to neighboring Woodcliff Lake.
    e. **Beechwood Nature Trail** – The *Beechwood Park Nature Trail*, is located by Holdrum Street and East Liberty Ave. It is a thickly forested area that includes sitting benches, and a boardwalk path

that rises above sometimes saturated ground beneath. The trail is unique in that it contains three ecological areas - - an uplands portion; a middle grounds portion; and a lowlands portion - - all within a relatively small area, and is indicated to contain a tulip tree (perhaps other similar trees, as well), that predate the U.S. Civil War.

f. **Beechnut Street Mini Trail** – A limited walking trail is present at the *end of Beechnut Street* on the north side of Hillsdale Avenue. Here, Beechnut Street is a narrow and short street with interesting homes on each side, leading to undeveloped land and wetlands that remain from part of the original lands of the Tandy and Allen residential development further north.
g. **Undeveloped Trail, The End of Hillsdale Court** – At the south end of Hillsdale Court, off Hillsdale Avenue, an undeveloped trail leads into undeveloped *wooded lands leading into Washington Township*.
h. **Kenny Cardaci (Memorial) Mini-Park** – This very small, secluded park includes a stream and play equipment for children. It is located on Maple Avenue, near Elm Street.
i. **Joan Angela D'Alessandro Memorial Butterfly Mini-Park** – Located on the grounds of the Hillsdale Train Station, this small butterfly garden is dedicated to the memory of *Joan Angela D'Alessandro,* a Hillsdale child who was abducted and killed in 1973, for which a neighbor was found guilty and convicted.
j. **Jepson Plaza Mini-Park** - This is a small dedicated flower garden, located by the Hillsdale Train Station.
k. **Glendale Park** – This is a small park located on Glendale Drive, off Patterson Street, south of Hillsdale Avenue.
l. **Elfenbein Memorial** - The west baseball field at Ann Blanche Smith School has a small plaque in dedication to the memory of Corporal Ernie Jon Elfenbein who was killed in the Vietnam War.
m. **The Old Hillsdale Graveyard** - Residents recently learned of an abandoned 19th century cemetery at the Hazelwood Ave./Glendale Drive intersection. Research done at the Pascack Historical Society revealed that the cemetery was started in about 1825, and that about 40 burials occurred. Included were some of the Borough's founding

families, such as Demarest, Ackerman, Bogert, Durie and Westervelt, and their servants. The graves of the servants and field hands consisted of stone markers with no identification. The other graves had marked headstones. When discovered, the cemetery was a vacant overgrown lot that had not been maintained. With the help of the Borough Council, Boy Scout Troop 91, and two Hillsdale Eagle Scouts, a joint Eagle Scout project was developed that cleaned out the cemetery, removed the overgrown vegetation and attempted to locate the graves. The cemetery appears to have been abandoned since about 1885. The New Jersey Historical Society performed a 1911 inventory of the site. The inventory included a listing of all headstone inscriptions. The Eagle Scouts and Boy Scouts found 13 or 14 of the unmarked graves. Additional marked stones were located in the surrounding neighborhood. Some of the stones had been used for patio blocks, garden wall blocks, or other similar uses. The Borough assisted with the installation of a fence around the site, plantings, benches, walkways and a sign marking the site. The property is now a pleasant "commemorative park" with an important element of historic preservation.[2]

n. **Former Sanitary Waste Landfill** – *Centennial Field*, located on St. Mary's Street, contains active sports fields. This location was a waste disposal landfill whose operations ceased in 1987[3] and was closed with ongoing monitoring of landfill gas as required by State of New Jersey Department of Environmental Protection rules.

10. **Infrastructure** – There are no publicly accessible electric vehicle charge stations in Hillsdale.[4] Municipal buildings and vehicles rely entirely on traditional sources of fuel (e.g., natural gas, gasoline/diesel), rather than renewable sources of energy (e.g., solar, geothermal).

[END OF NARRATIVE PORTION OF THIS SECTION]

[1] "Field Guide to the Beechwood Nature Trail and Conservancy," Hillsdale Conservation Commission, 1970 indicates a tulip tree is present in the Beechwood Nature Trail that predates the Civil War. A Glen Hook Road residence boasts an oak tree with a 13' circumference at breast height (5' above the ground), which if calculated at an average at 1" per year, indicates an age of about 156 years (= 1865).

[2] "2003 Master Plan, Borough of Hillsdale, Bergen County," by C.P. Statile, PA, Revised December 16, 2003, page H 3.

[3] "Stormwater Management Plan - Borough of Hillsdale," November 17, 2005, by C.P. Statile, PA, page 7.

[4] https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=e41aa50dd8cd45faba8641b6be6097b1

Introduction

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The Association of New Jersey Environmental Commissions ("ANJEC") defines an Environmental Resource Inventory ("ERI") as a narrative containing tables, maps and other visual information about the natural resource characteristics and environmentally significant features of an area. An ERI is also expected to include other-than-natural features of note, such as historic places and any contaminated sites.

An ERI provides baseline documentation for measuring and evaluating resource protection issues. It is an objective index and description of features and their functions, rather than an interpretation or recommendation. Identifying significant environmental resources is the first step in their protection and preservation and in assuring that future development or redevelopment protects public health, safety and welfare.[1]

The ERI is an important tool for governing bodies, environmental commissions, open space committees, planning boards and zoning boards of adjustment. Planning Boards are expected to adopt the ERI as part of the municipal master plan, either as an appendix or as a part of a master plan conservation element. As part of the master plan, the ERI can provide the foundation and documentation for master plan updates, ordinances, legal defense, open space or agricultural protection plans, protection of water resources, and many other municipal functions.

There is not a formal requirement that municipalities prepare an ERI. Two New Jersey statutes, however, give environmental commissions the authority and responsibility for preparing them. The Environmental Commission Enabling Legislation (N.J.S.A. 40:56A) states "A...commission organized under this act shall have the power to conduct research into the use and possible use of the open land areas of the municipality.... It shall keep an index of all open marshlands, swamps

and other wetlands, in order to obtain information on the proper use of such areas, and may from time to time recommend to the planning board, or, if none, to the mayor and governing body of the municipality, plans and programs for inclusion in the municipal master plan and the development and use of such areas."

The *Municipal Land Use Law* (MLUL) (N.J.S.A. 40:55D-1 et seq.) requires municipalities to have a land use plan element in their master plan, "including but not necessarily limited to, topography, soil conditions, water supply, drainage, flood plain areas, marshes, and woodlands...." (N.J.S.A. 40:55D-28b(2)).

The MLUL also states that, "Whenever the environmental commission has prepared and submitted to the planning board and to the board of adjustment an index of the natural resources of the municipality, the planning board or the board of adjustment shall make available to the environmental commission an informational copy of every application for development submitted to either board." (N.J.S.A. 40:55D-27b). Preparing and submitting an ERI helps assure that the environmental commission is entitled to receive copies of development proposals for review and provide comment to the planning board.

An ERI is a dynamic document. Like the municipal master plan, the ERI should be revised and re-adopted periodically to reflect new data and changed conditions. To inform this process, the Hillsdale Environmental Commission is expected to track conditions and information that have changed for consideration during the next ERI update.

The preparation of this version of the ERI for the Borough of Hillsdale was initiated as a volunteer effort by citizen-members of its Environmental Commission ("EC"), with support from various components of the Borough's government.

By preparing an inventory of environmental resources, communities such as ours can better assess and understand our place in an ever-changing world. Assembling a clear inventory of Hillsdale's environmental resources can be expected to benefit

planners, developers, and citizens alike as decisions that might affect the environment we live in are considered.

The organization of this inventory largely follows a format published by ANJEC. Some of the information is incomplete and may benefit from further effort, or may all together be unavailable. Where information is known to be incomplete, or has not yet been obtained for inclusion, "[RESERVED]" may be indicated.

To facilitate future updates, this document has been constructed in a standard format, with individual "stand-alone" chapters, any one of which can be updated at any time. Those who worked on and contributed to individual sections are identified at the beginning of each section.

It is envisioned that a single EC member will serve as the "ERI Lead Person," and will be responsible for reviewing the ERI at least once every 12 months from publication, reporting to the Chairperson of the Environmental Commission as to: the need for any important updates; how best to accomplish the updates; and a target date for completion. The ERI Lead Person will be the prime person working with section authors and those conducting updates, those editing, will provide preliminary approval any initial submissions or revisions, and will be responsible for obtaining full EC member approval of each version of the ERI that is to be published.

[1] "The Environmental Resource Inventory: ERI," ANJEC, (undated), www.anjec.org.

A. Regional Relationships

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Overview

The Borough of Hillsdale is located in northeast New Jersey, about a 25 mile drive from New York City at the George Washington Bridge. At its closest point (Wood Dale County Park and Lincoln Avenue), it is less than 3 miles from the New Jersey border with New York State (Orangetown, New York, in Rockland County).

Source: https://images.app.goo.gl/3EjPJ7ckFjveBMSAA

Hillsdale is bordered by seven (7) New Jersey towns: Ho-Ho-Kus, Park Ridge, River Vale, Saddle River, Washington Township, Westwood, and Woodcliff Lake. Although Hillsdale occupies only about 2.98 square miles of land, it has a population of about 10,405 people,[1] and thus has a population density of 3,492 people per square mile. Hillsdale's population density is nearly three (3) times greater than the population density of the State of New Jersey as a whole, which is the most

densely populated state in the U.S. New Jersey's population density in 2018 was 1,211.3 people/square mile.[2] Nearly 86% of Hillsdale residents are home owners.[3]

A. 1. NJ State Plan and State Strategic Pan Designation

The New Jersey State Development and Redevelopment Plan show Hillsdale to be in Planning Area PA 1, which is the "Metropolitan Planning Area."[4] PA 1 is slated by state planners to "Provide for much of the state's future redevelopment; revitalize cities and towns; promote growth in compact forms; stabilize older suburbs; redesign areas of sprawl; and protect the character of existing stable communities. It is indicated that "Most of these communities are fully developed, or almost fully developed, with little vacant land available for new development. Much of the change in land uses, therefore, will take the form of redevelopment."[5]

The following planning elements for this Planning Area (with original element numbers retained), are relevant to Hillsdale's Environmental Resource Inventory:

1. Land Use - The policy objective for this state Planning Area is "Promote redevelopment and development in Cores and neighborhoods of Centers and in Nodes that have been identified through cooperative regional planning efforts. Promote diversification of land uses, including housing where appropriate, in single use developments and enhance their linkages to the rest of the community. Ensure efficient and beneficial utilization of scarce land resources throughout the Planning Area to strengthen its existing diversified and compact nature."[6]

5. Natural Resource Conservation - The policy objective for this state Planning Area is "Reclaim environmentally damaged sites and mitigate future negative impacts, particularly to waterfronts, scenic vistas, wildlife habitats and to Critical Environmental Sites, and Historic and Cultural Sites. Give special emphasis to improving air quality. Use open space to reinforce neighborhood and community identity, and protect natural linear systems, including regional systems that link to other Planning Areas."[7]

6. Agriculture - The policy objective for this state Planning Area is "Use development and redevelopment opportunities wherever appropriate and economically feasible, to meet the needs of the agricultural industry for intensive

agricultural production, packaging and processing, value-added operations, marketing, exporting and other shipping. Provide opportunities for farms, greenhouses, farmers markets and community gardens."[8] Demarest Farms is an active, operating agricultural farm located in Hillsdale.

7. Recreation - The policy objective for this state Planning Area is "Provide maximum active and passive recreational opportunities and facilities at the neighborhood, local and regional levels by concentrating on the maintenance and rehabilitation of existing parks and open space while expanding and linking the system through redevelopment and reclamation projects."[9]

8. Redevelopment - The policy objective for this state Planning Area is "Encourage redevelopment at intensities sufficient to support transit, a broad range of uses and efficient use of infrastructure. Promote design that enhances public safety, encourages pedestrian activity and reduces dependency on the automobile."[10]

9. Historic Preservation - The policy objective for this state Planning Area is "Encourage the preservation and adaptive reuse of historic or significant buildings, Historic and Cultural Sites, neighborhoods and districts in ways that will not compromise either the historic resource or the area's ability to redevelop. Coordinate historic preservation with tourism efforts."[11]

10. Public Facilities and Services - The policy objective for this state Planning Area is "Complete, repair or replace existing infrastructure systems to eliminate deficiencies and provide capacity for sustainable development and redevelopment in the region. Encourage the concentration of public facilities and services in Centers and Cores."[12]

A. 2. County Master Plan and Open Space Plan

Hillsdale is one of seventy (70) communities in Bergen County. The county seat for Bergen County is Hackensack. A number of Bergen County planning and operational programs are applicable to Hillsdale, including:

- The Bergen County Division of Open Space, Recreation, Floodplain Protection, Farmland & Historic Preservation; and
- Bergen County Floodplain Protection Program

A. 3. New Jersey Physiographic Province

The landscapes and physiography that we see today in New Jersey developed through geological processes that took place over a period of more than one billion years. This produced four distinctive landforms known as physiographic provinces (Figure A.3):

1. The Valley and Ridge Province
2. The Highlands Province
3. The Piedmont Province
4. The Coastal Plain Province.

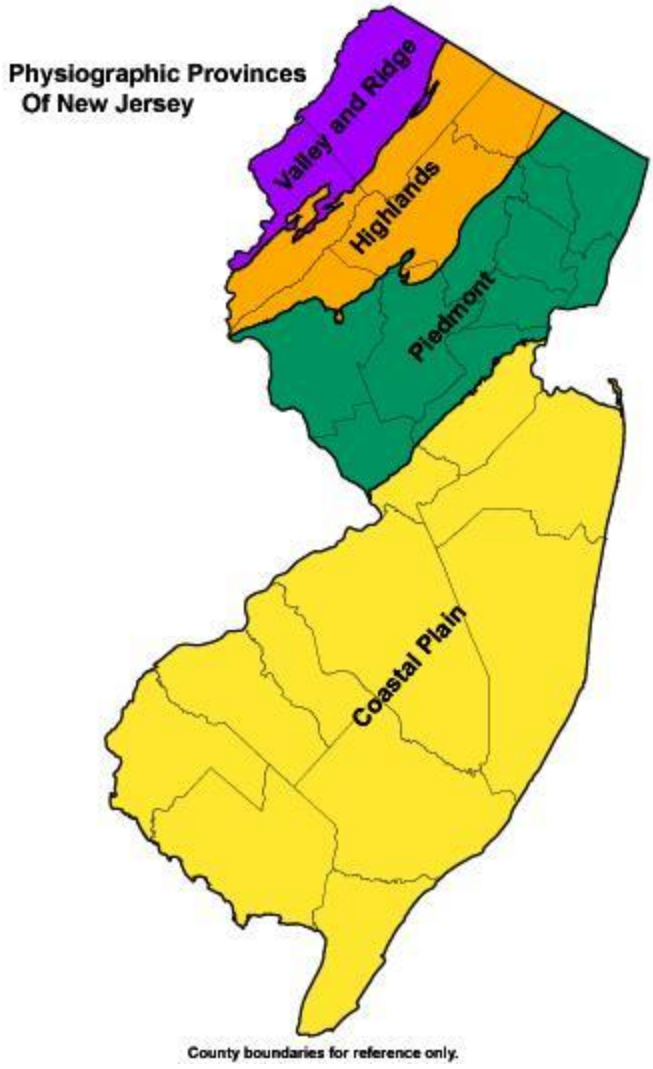

Figure A.3 - Physiographic Provinces of New Jersey[13]

The first three of New Jersey's physiographic provinces fall within the larger classification known as the "Appalachian Highland," a major physiographic region of the United States.

Hillsdale is within the Piedmont Province. The Piedmont Province is underlain by slightly folded and faulted sedimentary rocks of Triassic and Jurassic age (240 to 140 million years old), and igneous rocks of Jurassic age. The Piedmont is chiefly a low rolling plain divided by a series of higher ridges. Its width varies, being as little as 16 miles at the New York border.[14]

A. 4. Regional Plans

The main regional plan within which Hillsdale is located is Bergen County, as discussed in Section A.2, above. Hillsdale is also one of the towns that comprises the "Pascack Valley." There are numerous connections and organizations that seek to promote the common interests of those in Pascack Valley. A formal planning entity specifically for Pascack Valley planning does not exist, per se.

With many residents commuting to NYC, Hillsdale is also part of the greater New York City ("NYC") metropolitan area. However, regional plans for the NYC Metropolitan area do not specifically address Hillsdale. To the extent that additional regional plans beyond that of Bergen County address Hillsdale are identified and are relevant to this Environmental Resource Inventory, they will be identified and their content will be added to this section.

A. 5. Watersheds

Hillsdale is situated in what is designated as "Watershed Management Area 5" (Hackensack, Hudson, and Pascack), by the State of New Jersey.[15] WMA 5 is comprised of three watersheds: Hackensack River Watershed, Hudson River Watershed and Pascack Brook Watershed. Hillsdale is primarily in the Hackensack River and Pascack Brook watershed. A small portion of the western edge of Hillsdale is situated in the Saddle River and Passaic River watershed.[16] Watershed Management Area 5 ("WMA 5") has a drainage area of approximately 165 square miles, which includes parts of Hudson and Bergen Counties.

Although WMA 5 is the most populated of all the WMAs in New Jersey, approximately 50% of the land in the overall watershed is still undeveloped, with more than 30% residential development. The remaining developed land is commercial/industrial use. Much of the lower Hackensack River Watershed is tidal marsh known as the Hackensack Meadowlands. The Meadowlands are home to more than 700 plant and animal species including several rare and threatened species.

The Hackensack Meadowlands Development Commission (HMDC) was created by an act of the New Jersey Legislature in 1968 and was passed into law in January 1969. The act gave the HMDC three mandates; environmental protection, economic development and solid waste management. HMDC district size is 19,730 acres, 32 square miles and is located in the Hackensack River Watershed.[17]

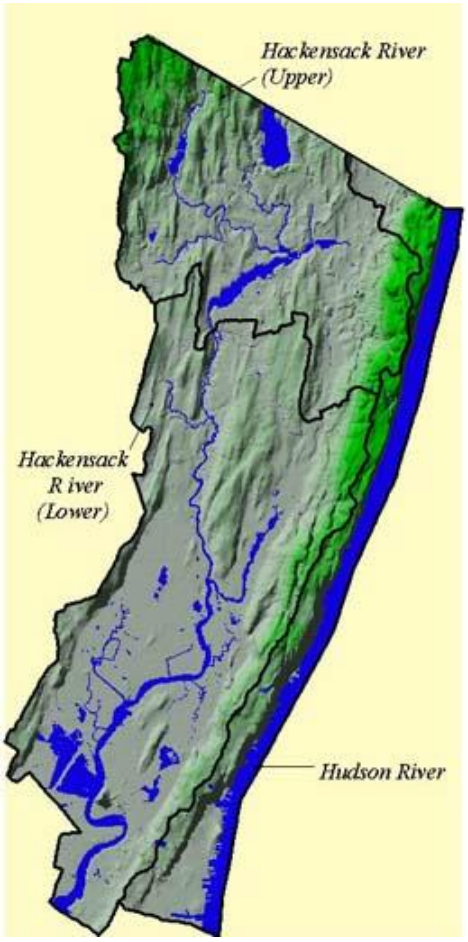

Figure A.5 - Watershed Management Area 5[18]

Also within WMA 5 is the Woodcliff Lake Reservoir, which is owned by Suez Water, the water utility that services Hillsdale. A portion of the reservoir is located within Hillsdale, at the Borough's border with Woodcliff Lake. The reservoir is fed by Pascack Brook and Bear Brook, and is one of several sources of water for Suez.

[END OF NARRATIVE PORTION OF THIS SECTION]

[1] 2018 U.S. Census Bureau
[2] Statista, June 2020
[3] World Population Review, June 2020.
[4] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001.
[5] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 188.
[6] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 191.
[7] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 191.
[8] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 191.
[9] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 192.
[10] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 192.
[11] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 192.
[12] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001, page 192.
[13] NJDEP, New Jersey Geological and Water Survey DGS02-7, accessed June 2020.
[14] "Physiographic Province of New Jersey," NJDEP and the New Jersey Geological Survey Circular, 2003 - Reprinted 2006.
[15] The New Jersey State Development and Redevelopment Plan, adopted March 1, 2001.
[16] Master Plan Amendment – Amendment to Utility Plan of Master Plan, Adopted July 2, 2998, Borough of Hillsdale Municipal Stormwater Management Plan, Prepared by Christopher P. Statile, P.E., Borough Engineer, October 2005, Page 4; in 2003 Master Plan, Borough of Hillsdale, Bergen County, New Jersey, by C.P. Statile, P.A., February 2003.
[17] https://www.nj.gov/dep/watershedrestoration/ images/maps/wma05.jpg, accessed September 2020.
[18] https://www.nj.gov/dep/watershedrestoration/images/maps/wma05.jpg, accessed September 2020.

B. Climate

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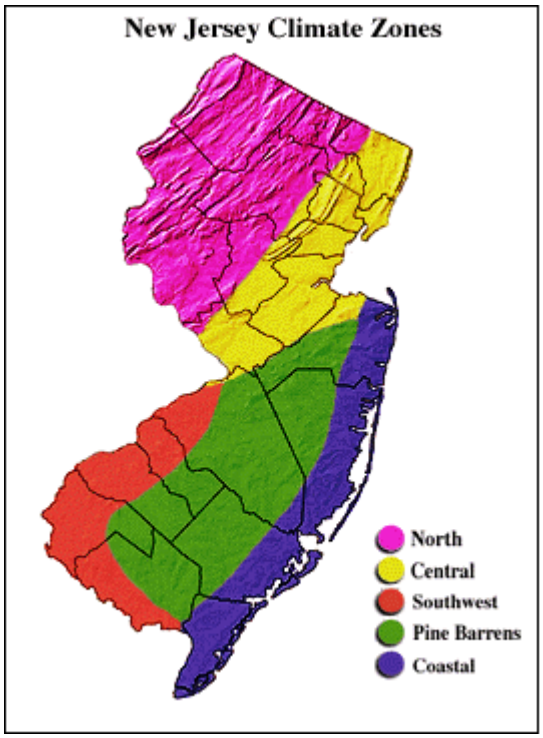
Overview

"Climate" and "weather" are not the same. Weather is a current characterization of the atmosphere (e.g., sunny, hot or cold temperature, winds, rainfall) generally over a short period of time - - usually hours to days, perhaps even weeks or months. Climate, on the other hand portrays overall atmospheric conditions over more extended periods - - generally as observed over an entire year, many years, decades, or even hundreds or thousands of years. The world has six major climate regions: polar, temperate, arid, tropical, Mediterranean and tundra. Hillsdale is located in the temperate region, and during a normal year fully experiences all four seasons. Within New Jersey, there are five distinct climate regions: Northern, Central, Pine Barrens, Southwest, and Coastal.[1] Hillsdale is located within New Jersey's Central climate region. Geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce variations in daily weather between these regions.



New Jersey's Five (5) Climate Zones[2]

During wintertime, the climate of the northern edge of the Central Zone, where Hillsdale is situated, is often a border line between freezing and non-freezing precipitation. In summer, the northern reaches of the Central Zone often mark the boundary between comfortable and uncomfortable sleeping conditions. Areas to the south of the Central Zone tend to have nearly twice as many days with temperatures above 90 degrees Fahrenheit ("F") than the 15-20 commonly observed days in the central portion of the state.[3]

Climate is an important environmental factor. It helps define the 'building season,' home heating and cooling seasons, when planting and agriculture take place, when some recreational activities can occur (e.g., skiing), as well as determining the types of plants, trees, and animals that tend to inhabit an area.

It has been determined that climate throughout the planet is markedly changing from previous norms. In an effort to inform state and local decision-makers in New Jersey, the "2020 New Jersey Scientific Report on Climate Change" was published in June of 2020.[4] The report presents the best available science and existing data regarding the current and anticipated environmental effects of climate change globally, nationally, and regionally. Those undertaking planning at the municipal level in Hillsdale may find this reference to be of interest.

Hillsdale summers tend to be hot, and its winters cold. Precipitation is generally greatest in the spring and late summer/early fall.

The National Weather Service monitoring station that is nearest Hillsdale is located at Teterboro Airport ("KTED") - - latitude 40.86° North Longitude, 74.07° West Latitude, elevation 7 ft. Considerable information regarding climate is available for the areas around Hillsdale, and so by interpolation - - Hillsdale. One such resource is Weatherspark.com ("Weatherspark")[5] and unless otherwise indicated, the following information was obtained from Weatherspark. Weatherspark's web site posts this disclaimer:

> "The information on this site is provided as is, without any assurances as to its accuracy or suitability for any purpose. Weather data is prone to errors, outages, and other defects." "We draw particular cautious attention to our reliance on the MERRA-2 model-based reconstructions for a number of important data series. While having the tremendous advantages of temporal and spatial completeness, these reconstructions: (1) are based on computer models that may have model-based errors, (2) are coarsely sampled on a 50 km grid and are therefore unable to reconstruct the local variations of many

microclimates, and (3) have particular difficulty with the weather in some coastal areas, especially small islands."

Weatherspark provides the following graphic monthly summary of area climate, including variations in sunshine, precipitation, temperature and humidity, based on data at the Teterboro Airport weather station, even including a 'tourism score' for best time to visit:[6]

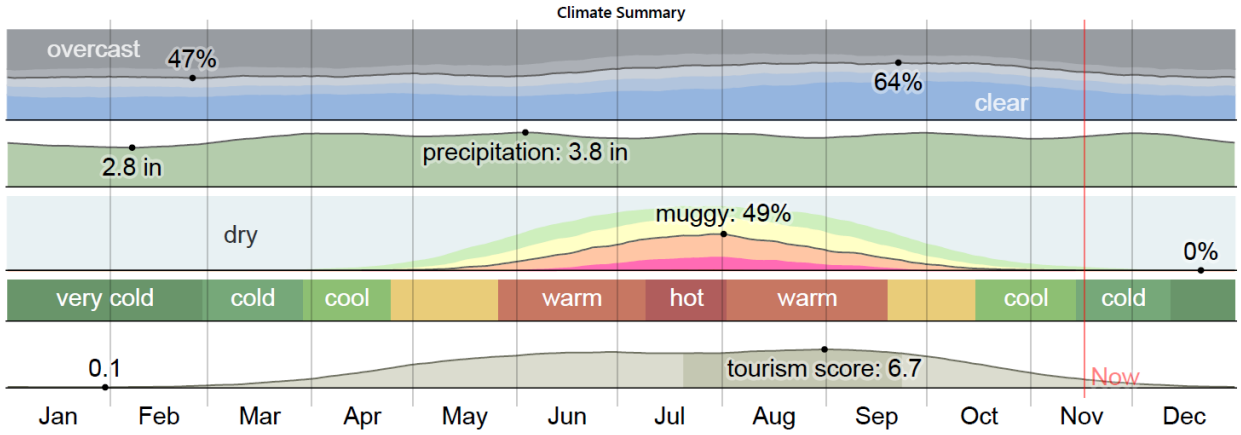


Figure B. Average Annual Climate in the Hillsdale Area[7]

B. 1 Temperature Ranges and Trends

Temperature ranges during the ten year period 2010 through 2019 as measured at the U.S. Weather Service station at Teterboro Airport, are indicated in Table B.1, below.

B. 2. Seasonal Precipitation and Growing Season

With respect to agriculture and planting in Hillsdale, the average first frost date is listed as October 21 to 31, and the average last frost date currently is May 1 through 10.[8]

Rainfall during the ten year period 2010 through 2019 as measured at the U.S. Weather Service station at Teterboro Airport, are indicated in Table B.2 below, and ranged from a low of 34.9 inches per year (2012) to a high of 69.69 inches per year (2011).

Table B.1 – Temperature Ranges 2010 – 2019 (Teterboro Airport)[9]

Year	Annual Mean Temp. (°F)	Temp. Maximum* (°F)	Temp. Minimum* (°F)
2010	56.1	65.1	47.1
2011	56.1	65.1	47.1
2012	57.3	66.3	48.2
2013	54.9	63.8	46.1
2014	54.6	63.5	45.7
2015	55.5	65.0	46.1
2016	56.7	66.1	47.3
2017	56.2	65.0	47.5
2018	56.0	64.5	47.5
2019	55.8	64.6	47.0

* Average of mean monthly maximum or mean monthly minimum temperatures

Table B.2 – Annual Precipitation 2010 – 2019 (Teterboro Airport)[10]

Year	Total Precipitation (Inches)
2010	41.09
2011	69.69
2012	34.90
2013	41.96
2014	49.44
2015	38.71
2016	37.08
2017	40.94
2018	63.44
2019	51.35

B. 3. Frost Line

The frost line is considered to be "The depth of frost penetration in soil and/or the depth at which the earth will freeze and swell."[11] Frost depth data is gathered late morning each day by the North Central River Forecast Center (NCRFC) database of the National Weather Service within the National Oceanic and Atmospheric Administration. Frost depth reports are commonly obtained from frost tube instruments, visual reports from construction or cemetery sites, or other types of electronic probes. Specific data for Hillsdale/northern New Jersey does not exist in this national data base.

Frost conditions are an important factor for hydrologic forecasting as frozen soil limits infiltration of water thereby generating more runoff from rain and snowmelt than soil that is not frozen. Knowing soil frost condition is also important for many activities including agriculture, horticulture, transportation, and construction.[12]

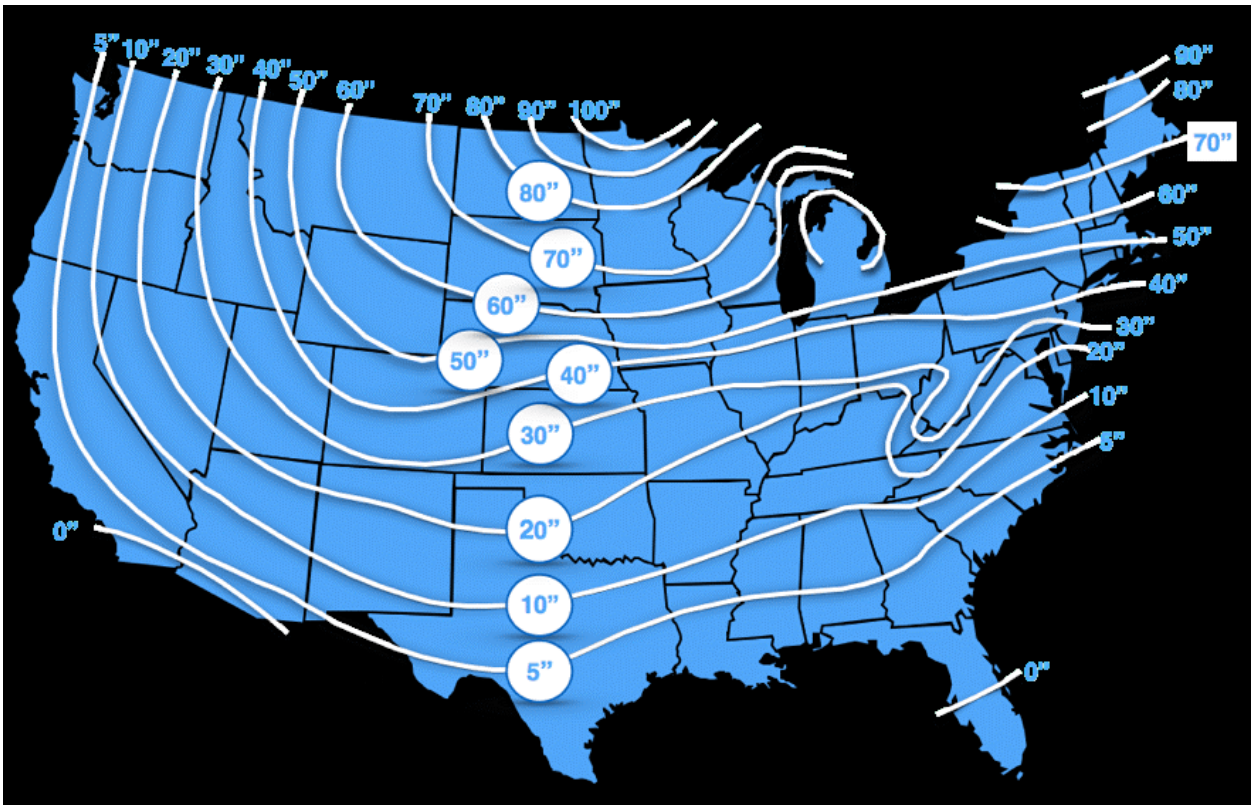


Figure B.3 Generalized Depth of Frost Lines in Different Regions[13]

At the time this document was prepared, Table R301.2(1) of "Residential Code 2015 of New Jersey" listed a frost line depth of three (3) feet with a notation that the local jurisdiction is to specify the specific frost line for determination of the depth of footings below finished grade that is required for construction.[14]

B. 4. Prevailing Air Currents and/Wind Resources

Weather conditions in our area usually come from the west, since regional air flow generally predominates from this direction. The direction of the arrival of significant weather events varies, with colder weather usually arriving from the north, warmer weather from the south, and the wetter weather from the east. Wind experienced at any location is highly dependent on weather conditions and

may be impacted by local topography. Instantaneous wind speed and direction vary more widely than is reflected by hourly averages.

Average hourly wind speed in Hillsdale varies **significantly** on a seasonal basis. The following discusses area-wide hourly average wind vector (speed and direction) at **10 meters** above the ground. The **windier** part of the year lasts for **5.9 months**, from **October 29** to **April 26**, with average wind speeds of more than **6.4 miles per hour**. On a statistical basis, the **windiest** day of the year is **February 26**, with an average hourly wind speed of **8.1 miles per hour**. The **calmer** time of year lasts for **6.1 months**, from **April 26** to **October 29**. The **calmest** day of the year tends to occur **July 31**, with an average hourly wind speed of **4.7 miles per hour**.

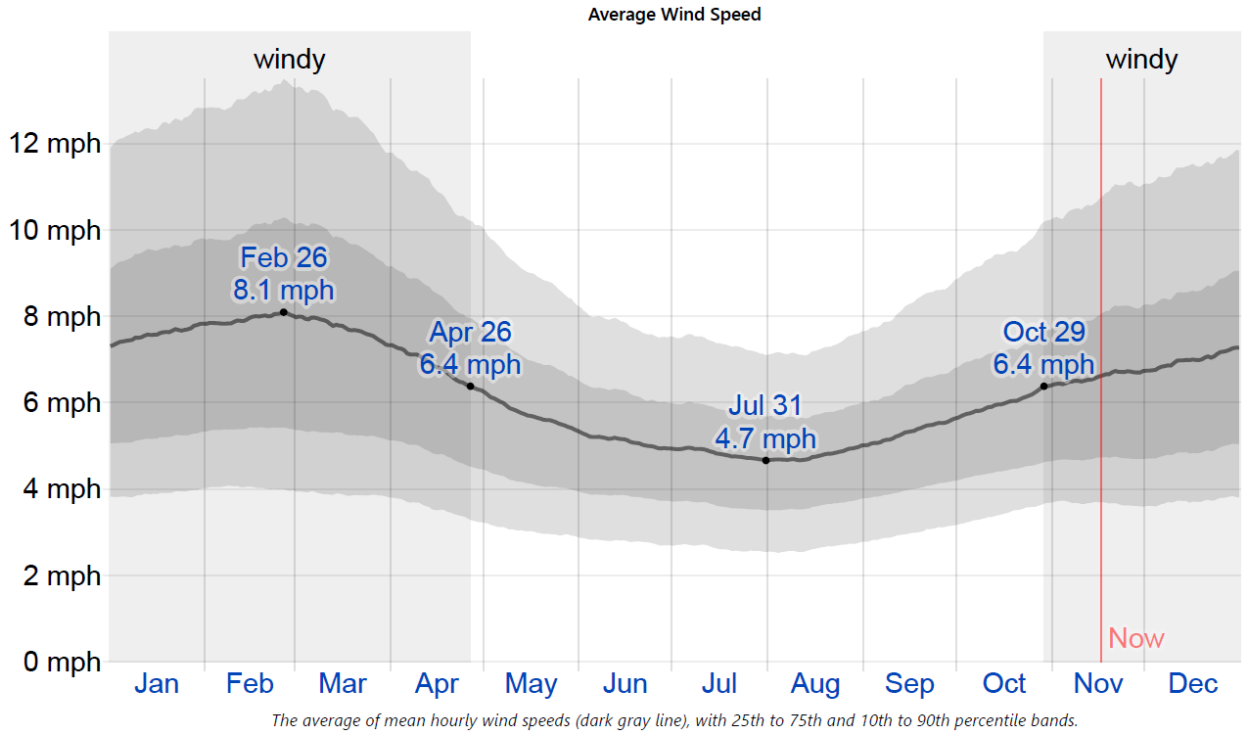


Figure B.4 Average Windspeed, Hillsdale Area[15]

B. 5. Extreme Weather

Extreme weather experienced in Hillsdale have included heat waves, extreme cold, blizzards, hail storms, hurricanes, and tropical storms. Hurricane season in New Jersey officially runs from June 1 through November 30. The peak potential for hurricane and tropical storm activity is mid-August through the end of October.[16]

Maximum Precipitation – Maximum daily precipitation events as measured at the official U.S. Weather Service station at Teterboro Airport, during the ten year period 2010 through 2019, are shown in Table B.5, below, and have ranged from 1.84 inches (January 10, 2016) to 5.50 inches (August 28, 2011).

Table B.5 – Maximum Precipitation Events 2010 – 2019 (Teterboro Airport)[17]

Year	Max Precipitation (Inches)	Date
2010	2.21	March 13
2011	5.40	August 28
2012	2.06	April 27
2013	3.20	June 7
2014	4.29	April 30
2015	2.08	April 20
2016	1.84	January 10
2017	3.23	May 5
2018	3.71	September 25
2019	2.34	October 16

High Temperatures - On July 22, 2011, an all-time record high temperature as recorded at nearby Teterboro Airport was 104° F.[18] During the ten year period 2010 through 2019, maximum daily temperature as measured at the official U.S. Weather Service station at Teterboro Airport, are shown in Table B.5.a, below, and have ranged from 97° F (June 2017) to 104° F (July 22, 2011).

Table B.5.a – Maximum Temperature 2010 – 2019 (Teterboro Airport)[19]

Year	Max Temperature (°F)	Date
2010	103	July 6
2011	104	July 22
2012	103	July 18
2013	100	July 19*
2014	98	August 10
2015	98	July 19
2016	98	August 11
2017	97	June 13*
2018	99	July 1
2019	99	July 21

* Reached on one or more previous days

Low Temperatures - An all-time low temperature recorded at nearby Teterboro Airport was -12° F on January 23, 1976.[20] During the ten year period 2010 through 2019, extreme low daily temperature as measured at the official U.S. Weather Service station at Teterboro Airport, are shown in Table B.5.b, below, and have ranged from 13° F (January 2010 and 2012) to -1° F (February 14, 2016).

Table B.5.b – Extreme Low Temperature 2010 – 2019 (Teterboro Airport)[21]

Year	Extreme Low Temperature (°F)	Date
2010	3	January 31*
2011	13	January 24*
2012	5	January 4
2013	13	February 10*
2014	11	January 4
2015	3	February 20
2016	1	February 14
2017	-1	January 9
2018	6	January 7
2019	2	January 31

* Reached on one or more previous days

Notable Storms - The following are some recent storms of note:

2021/September – "Hurricane Ida's" remnants produced rainfall rates of 3 to 5 inches/hour in Northeast New Jersey on September 2nd. Nearby Waldwick reported a total of 8.59 inches of rainfall as of 6 AM on September 2nd.[22] Hillsdale Mayor Ruocco indicated "The Pascack Brook overflowed its banks and the Glenbrook Park neighborhood took on several feet on water. Several families evacuated with the assistance of our Fire Dept, Police Dept, DPW, and OEM personnel. Some used our Library as a refuge. Our DPW compound took a direct hit with flood waters, and although we moved our equipment out of harm's way beforehand, the garage was flooded. Several streets in the center of town had to be closed but are being reopened as conditions permit. The Kings Shopping center was severely flooded. The SJB property flooded as it usually does in a heavy rainfall, but reportedly no water entered the church or school. The industrial area also became flooded as the Brook overflowed. The town's power grid did well, as there were few incidents of downed wires or trees."[23]

2021/February – Dubbed "Orlena," a winter nor'easter produced strong winds and resulted in 20.5 inches or more of snow falling between the evening of January 31st and by 6 AM on February 2rd.[24] Additional inches of snowfall were added by subsequent snow events during February of 2021.

Photo B.5.a Accumulating Snow, Northwest Hillsdale (Photo: Fred Rubel)

Photo B.5.b Accumulated Snow, Evening at Riverdale Ave. (Photo: Adam Tate)

Photo B.5.c Post-Storm Hillsdale Rd. Looking Toward Hillsdale Ave.
(Photo: Fred Rubel)

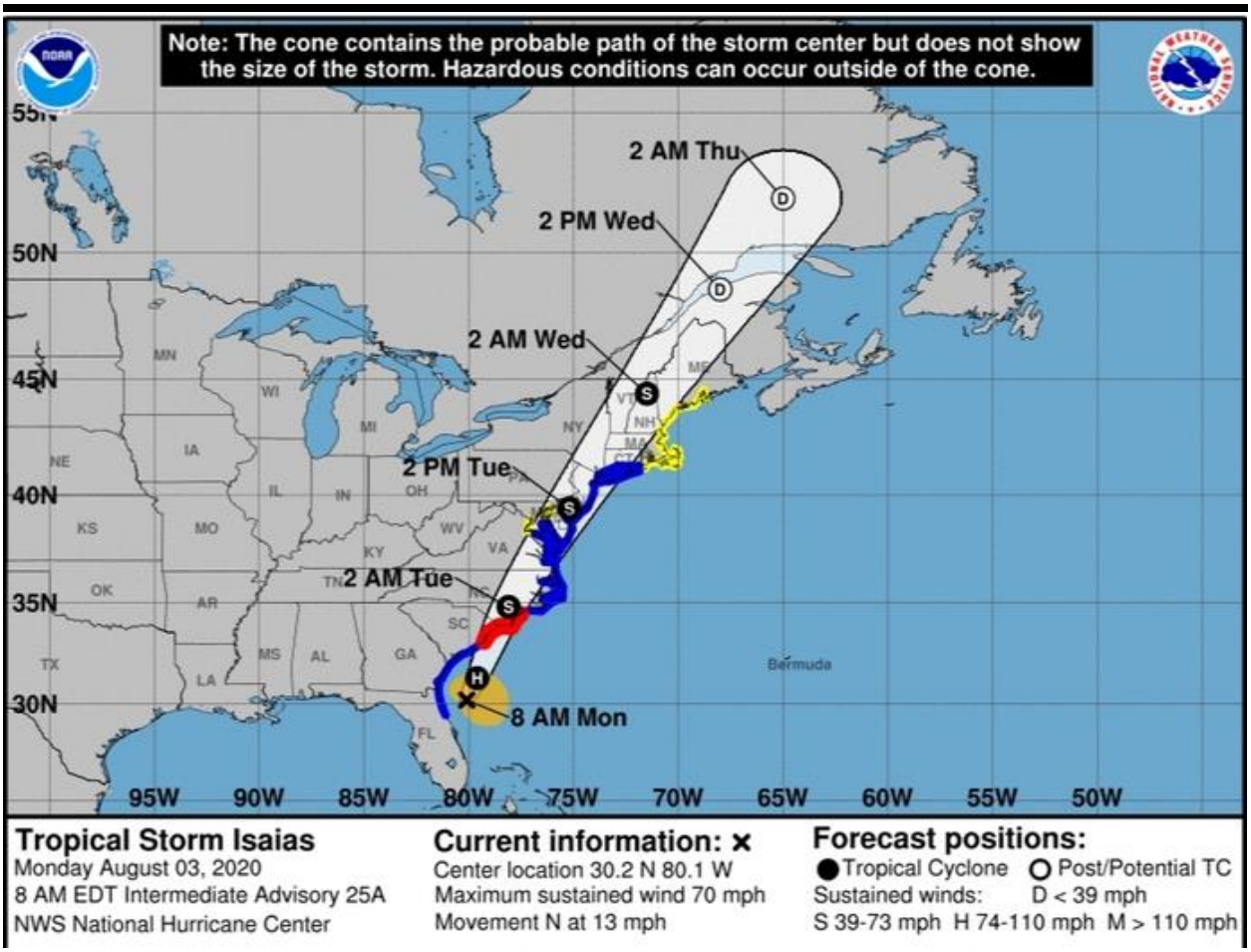
Photo B.5.d Post-Storm Scene at King Court (Photo: Ed Alter)

2020/Christmas Eve – Strong winds (>45 mph) and heavy rains caused tree damage and sporadic power outages.

Snapped Trunk of Pine Tree, Glen Hook Rd. (Photo: Fred Rubel)

2020/November – *A tornado warning* was issued due to a strong and turbulent weather front that crossed the area early on the evening of November 15th.[25] Although there were bursts of strong winds, heavy rain, toppled trees, and limited power outages over a wide area that experienced the unstable weather front, a tornado did not materialize in Hillsdale and resulting damage was not wide-spread.

2020/August - *Tropical Storm Isaias* moved up the east coast with substantial winds and rainfall. New Jersey Governor Phil Murphy declared a state of emergency as more than a million people in New Jersey were reported without power, including many in Hillsdale. [26]



(Source: National Hurricane Center)

2012/October – *Hurricane Sandy* was within 50 miles of the coastline before moving ashore in Brigantine as an extratropical cyclone. The storm brought hurricane-force winds, record low pressure. The storm becomes the worst hurricane to affect the state on record, killing 37 and causing nearly $30 billion in damages. Widespread devastation is noted, particularly on Long Beach Island and the Barnegat Peninsula, where the Seaside Heights boardwalk collapses into the ocean. All of New Jersey Transit's commuter rail operations were affected, with some lines out of service for over a month, and inundation of rolling stock stored in NJ Transit's Meadowlands yard. Sandy also causes the worst power outage in state history, blacking out over 2 million households.[27]

2012/August – Heavy rains caused area flash flooding on August 1st.

2011/August - *Hurricane Irene* made landfall for a second time as a tropical storm near Little Egg Inlet along the southeast New Jersey coast at around 5:35 A.M. on August 28, 2011. Irene brought tropical storm force winds, destructive storm surge, and record-breaking freshwater inland flooding across northeast New Jersey that resulted in three deaths, thousands of mandatory and voluntary evacuations along the coast and rivers from surge and freshwater flooding, and widespread power outages that lasted for up to two weeks. Overall, Irene brought an average rainfall total of 7.03 inches with a maximum rainfall total of 9.85 inches in Cranford (Union County), and one source indicating a maximum rainfall total of 11.27 inches in Freehold. A maximum wind gust of 65 mph was reported in Cape May (Cape May County). Irene caused approximately $1 billion in damages in New Jersey and seven deaths in the State.[28]

Aug. 28, 2011: Patterson Street by Friendly's Ice Cream, closed by flooding.
(Photo: Chris Monroe, NorthJersey.com)

2009/August – The remnants of *Hurricane Bill* produced an average rainfall total of 1.77 inches, and a maximum rainfall total of 6.49 inches (Estell Manor, Atlantic County weather station). Maximum wind gusts were below 20 mph. [29]

2004/September – The remnants of *Hurricane Ivan* produced substantial area rainfall, including 5.5 inches of rain recorded in Maplewood. As an extratropical cyclone, the remnants of *Hurricane Frances* dropped 5.25 in (133 mm) of rain in Trenton, and an extratropical storm, former Hurricane Jeanne dropped 5 inches of rainfall across many portions of New Jersey. [30]

[END OF NARRATIVE PORTION OF THIS SECTION]

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[20] https://www.plantmaps.com/new-jersey-record-high-and-low-temperature-map.php, accessed November 14, 2020.
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[27] 'List of New Jersey Hurricanes,' https://en.wikipedia.org/wiki/List_of_New_Jersey_hurricanes, accessed 11/17/2020.

[28] "Bergen County Multi-Jurisdictional All-Hazards mitigation Plan, 2015 Update," p. 3-86, https://www.co.bergen.nj.us/images/Departments__Services/Public_Safety/EMS/All_Hazard_Mitigation_Plan1.pdf

[29] "Bergen County Multi-Jurisdictional All-Hazards mitigation Plan, 2015 Update," p. 3-86, https://www.co.bergen.nj.us/images/Departments__Services/Public_Safety/EMS/All_Hazard_Mitigation_Plan1.pdf

[30] 'List of New Jersey Hurricanes,' https://en.wikipedia.org/wiki/List_of_New_Jersey_hurricanes, accessed 11/17/2020.

C. Air Quality

Version 1: Prepared by Fred N. Rubel, M.S., QEP, Member, Hillsdale Environmental Commission. Last updated March 17, 2022. Please contact the Hillsdale Environmental Commission to offer any suggested corrections/changes.

Overview

The state of New Jersey has monitored air quality since 1965. Air pollution levels have improved significantly over the decades as a result of state, regional and national air pollution reduction efforts.

The AQI (Air Quality Index) - The Air Quality Index ("AQI") was devised by the U.S. Environmental Protection Agency ("EPA") to classify daily air quality. It indicates how clean or polluted the air is, and what associated health effects might be a concern, especially for ground-level ozone and particulate pollution. The AQI number is a 'yardstick' that runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality.

An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level the EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy - - at first for certain sensitive groups of people, then for everyone as AQI values get higher. The AQI has six categories.

Each category corresponds to a different level of health concern. The six levels of health concern and what they mean are:

- "Good" AQI is 0 - 50. Air quality is considered satisfactory, and air pollution poses little or no risk.
- "Moderate" AQI is 51 - 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.

- "Unhealthy for Sensitive Groups" AQI is 101 - 150. Although the general public is not likely to be affected at this AQI range, people with lung disease, older adults and children are at a greater risk from exposure to ozone, whereas persons with heart and lung disease, older adults and children are at greater risk from the presence of particulates in the air.
- "Unhealthy" AQI is 151 - 200. Everyone may begin to experience some adverse health effects, and members of the sensitive groups may experience more serious effects.
- "Very Unhealthy" AQI is 201 - 300. This would trigger a health alert signifying that everyone may experience more serious health effects.
- "Hazardous" AQI greater than 300. This would trigger health warnings of emergency conditions. The entire population is more likely to be affected.

AQI Table - Explanation of Values	
AQI Value	**Level of Health Concern**
0-50	Air Quality - Good
51-100	Air Quality - Moderate
101-150	Air Quality - Unhealthy for Sensitive Groups
151-200	Air Quality - Unhealthy
201-300	Air Quality - Very Unhealthy
301-500	Air Quality - Hazardous

The following is a summary of the Air Quality Index for Bergen County for the 5-year period 2015 to 2019.

5 Year (2015-2019) Air Quality Summary for Bergen County, New Jersey*															
Year	Good Days	Moderate Days	Unhealthy for Sensitive Groups Days	Unhealthy Days	Very Unhealthy Days	Hazardous Days	Max AQI	90th Percentile AQI	Median AQI	Days CO	Days NO2	Days Ozone	Days SO2	Days PM2.5	Days PM10
2019	228	132	5	0	0	0	150	71	44	0	58	96	0	211	0
2018	214	137	12	2	0	0	164	76	45	1	69	96	0	199	0
2017	259	99	7	0	0	0	140	62	42	0	95	139	0	131	0
2016	251	105	9	1	0	0	151	71	42	0	93	142	0	131	0
2015	203	150	12	0	0	0	133	77	47	0	67	107	0	191	0

* From: https://aqs.epa.gov/aqsweb/airdata/download_files.html#Meta Accessed 12/17/2020.

The above summary indicates that air quality overall for the last five years in the Bergen County area has been good to moderate, with the exception of a few days each year that were unhealthy for sensitive groups. Fewer days were unhealthy for the general population. No general population unhealthy days occurred in 2017 or 2019, and no days were classified as very unhealthy or outright hazardous during this five year period.

C. 1 National Clean Air Standards (NAAQS)

The Clean Air Act, which was last amended in 1990, required EPA to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of national ambient air quality standards. ***Primary standards*** provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. ***Secondary standards*** provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

Criteria Air Pollutants[1]

The U.S. EPA has set National Ambient Air Quality Standards ("NAAQS") for six principal pollutants, which are called "criteria" air pollutants to protect public health. Periodically, the standards are reviewed and may be revised. The current standards are listed below. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic

meter of air ($\mu g/m^3$). Monitoring sites report data to EPA for these six criteria air pollutants:

- Ozone (O3)
- Particulate matter (PM10 and PM2.5)
- Carbon monoxide (CO)
- Nitrogen dioxide (NO2)
- Sulfur dioxide (SO2)
- Lead (Pb)

PM_{10} includes particles less than or equal to 10 micrometers in diameter. $PM_{2.5}$ includes particles less than or equal to 2.5 micrometers and is also called fine particle pollution. Table C.1 below displays NAAQS primary and secondary criteria.

Hazardous Air Pollutants (HAPs)/Toxic Air Pollutants

Hazardous air pollutants (HAPs) (also called toxic air pollutants or air toxics) are pollutants that are known or suspected to cause serious health problems such as cancer. There are 188 hazardous air pollutants. Examples of toxic air pollutants include benzene, which is found in gasoline; perchloroethlyene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper. Examples of other listed air toxics include dioxin, asbestos, toluene, and metals such as cadmium, mercury, chromium, and lead compounds. As most of these substances do not relate to NAAQS standards, they are not usually included in basic ambient air quality monitoring, but are accounted for and monitored at permitted source points.

Table C.1 – NAAQS Primary and Secondary Criteria

National Ambient Air Quality Criteria - [Current to December 2020]				
Pollutant	**Type**	**Averaging Time**	**Concentration**	**Criteria**
Carbon Monoxide (CO)	Primary	8 Hours	9 ppm	Not exceeded more than once per year
		1 Hour	35 ppm	
Lead (Pb)	Primary & Secondary	Rolling 3 Month Average	0.15 μ/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)	Primary	1 Hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary & Secondary	1 Year	53 ppb (2)	
Ozone (O_3)	Primary & Secondary	8 Hours	0.070 ppm (3)	Annual 4th highest daily maximum 8-hour concentration averaged over 3 years
Particulate Pollution (PM)	Primary	1 Hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations averaged over 3 years
	Secondary	3 Hours	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the lead standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 μg/m3 as a calendar quarter average) also remain in effect.
(2) The level of the annual nitrogen dioxide standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.
(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.
(4) The previous sulfur dioxide ("SO_2") standards (0.14 ppm 24-hour and 0.03 ppm annual) additionally remain in effect in certain areas, such as: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a State Implementation Plan ("SIP") call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

C. 2. Monitoring Sites/Exceedances

The New Jersey Department of Environmental Protection ("NJDEP") has a limited number of active official air quality monitoring stations in all regions of the state. The closest NJDEP continuous air quality monitoring station to Hillsdale is located in Fort Lee. That station monitors nitrogen dioxide (NO_2), particulate matter that is 2.5 microns and less in size ($PM_{2.5}$), and carbon monoxide (*CO*). Wind speed and direction are also recorded. From March 1 to October 31, ozone (O_3) is monitored at nearby stations in Leonia and Ramapo. In addition to several commercial weather forecast Websites, current air quality monitoring data from air quality monitoring stations is available at the following NJDEP Web site:

https://www.nj.gov/dep/airmon

NJDEP reviews and edits air monitoring data that it collects, and at the end of each calendar quarter it submits that data to the U.S. Environmental Protection Agency's ("EPA") Air Quality System (AQS) database. That data is available for viewing at the following EPA Web site:

https://www.epa.gov/outdoor-air-quality-data

Summary air quality data for Bergen County is available from the U.S. EPA online database at the following Web address:

https://aqs.epa.gov/aqsweb/airdata/download_files.html#Meta

C. 3. Stationary Emissions

The NJDEP maintains the following Website that displays all locations in the area that have been issued air pollution control permits:

https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=76194937cbbe46b1ab9a9ec37c7d709b

Many locations have "minor" air emission source permits in and around Hillsdale. Table C.3 lists the only two "Major" New Jersey emission sources in the general vicinity of Hillsdale. None are in Hillsdale itself. There are also a number of Major emission sources permitted in the vicinity to the north, in New York State. These are regulated by the New York State Department of Environmental Conservation.

Table C.3 - Major (NJ) Stationary Air Pollution Permits in the Vicinity of Hillsdale				
Facility	**Address**	**Distance***	**Location**	**Permit ID**
Westwood Borough SLF (Refuse System)	Harrington Ave., Westwood	<1.5 Miles	Southeast	63738
Bergen County Utility Authority (Sewage Treatment)	30 Wycoff Ave., Waldwick	<4.5 Miles	Northwest	14267

* Approximate distance from Borough Hall, Hillsdale

C. 4. Vehicular Air Pollution/Ozone

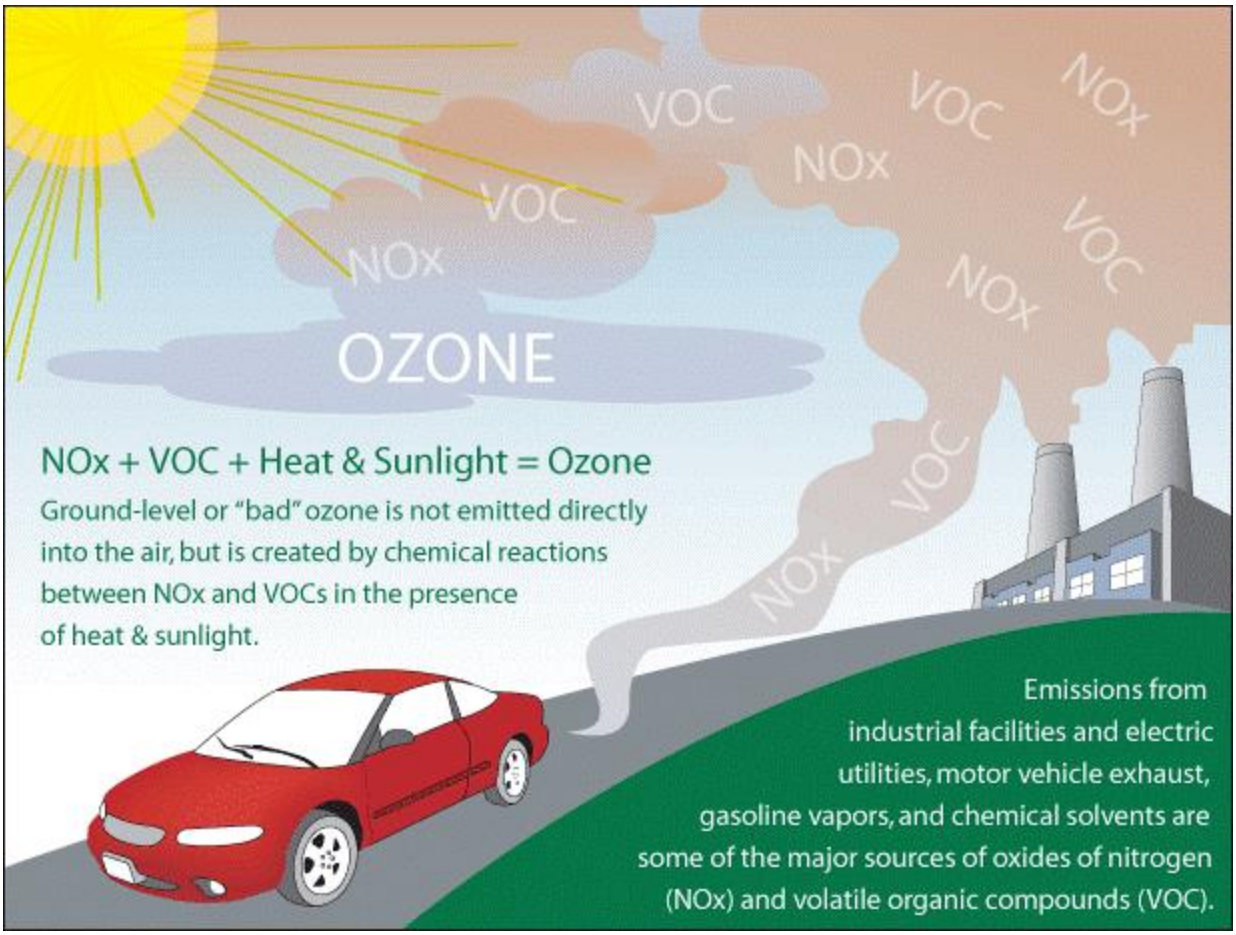
Mobile sources represent the largest source of air pollution in New Jersey. Cars, trucks, buses, off-road construction vehicles, locomotives, marine engines and planes are all considered mobile sources of air pollution. While emissions from individual cars are relatively low, there are millions of diesel and gasoline vehicles travelling in and through New Jersey every day emitting thousands of tons of pollutants including particulate matter, oxides of nitrogen, air toxics and greenhouse gases. It has been calculated that every year, hundreds die prematurely and suffer heart and lung illnesses in New Jersey due to fine particulate matter, commonly called soot.

The NJDEP Bureau of Mobile Sources addresses public health and environmental concerns by regulating air pollution from motor vehicles, engines, and the fuels used to operate them, and by encouraging travel choices that minimize emissions. The NJDEP also implements a statewide, comprehensive Inspection and Maintenance (I/M) emissions testing for motor vehicles.[2] Initiatives are underway at state and local levels to increase the use of locally cleaner electric vehicles in place of gasoline and diesel burning vehicles. The NJDEP maintains a website with information on this program:

https://www.drivegreen.nj.gov/

The presence of ozone in the upper atmosphere is beneficial, since it helps protect life at ground and sea level from the sun's damaging ultraviolet radiation. Certain long-lived chemicals can damage the upper atmosphere ozone layer. Maintaining the upper atmosphere ozone layer is an important consideration for state and Federal environmental protection programs.

Ozone emitted from vehicular traffic and other combustion, however, results in the formation of unhealthful smog in the lower atmosphere, where we breathe. The presence of ozone in the air we breathe is damaging to our lungs. "Ground-level" ozone has a number of adverse effects on humans, as well as animal and plant life. Ground-level ozone forms when the oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in the low levels of the atmosphere react in the presence of sunlight. NOx and VOC emissions come from a multitude of sources, including vehicles, gas pumps, refineries, manufacturing facilities and power plants, as well as consumer products such as household chemicals and paints.[3]



[END OF NARRATIVE PORTION OF THIS SECTION]

[1] https://www.epa.gov/outdoor-air-quality-data/air-data-basic-information#other accessed 12/17/2020.
[2] https://www.state.nj.us/dep/stopthesoot/ accessed 12/21/2020.
[3] https://www.nj.gov/dep/cleanairnj/about.html accessed 12/21/2020.

D. Geology

Version 1: Prepared by Scott Beckman, Ph.D., and Fred Rubel, M.S., QEP, Members, Hillsdale Environmental Commission. Last updated, January 28, 2022. Please contact the Hillsdale Environmental Commission to offer any suggested corrections/changes.

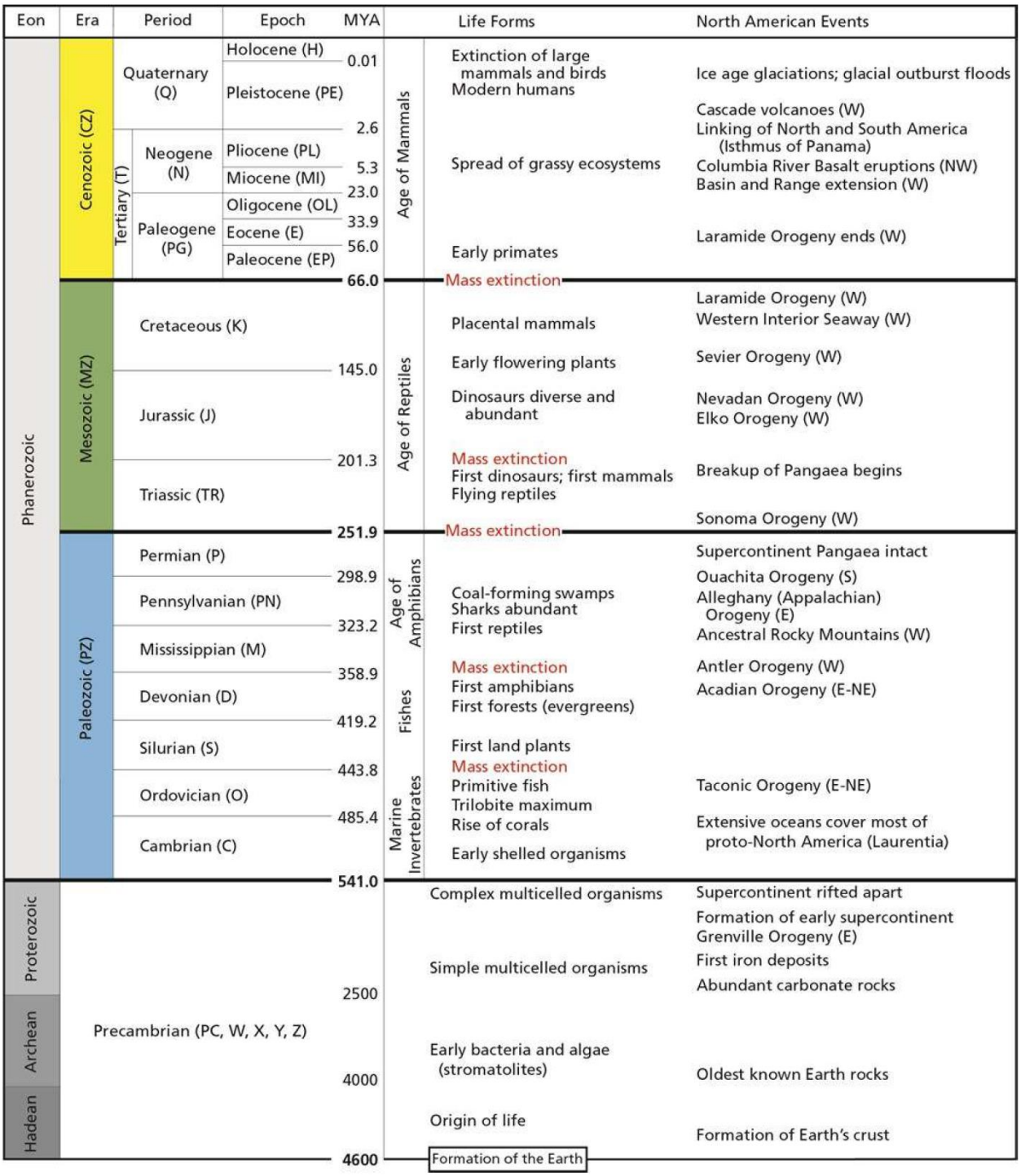
Overview – Geology can be a significant environmental influence for communities. The topography, the types of soils and minerals, and many other features are derived from, or are in many ways otherwise related to a location's geology. The following is a discussion of Hillsdale's geology.

D.1 Geological History – Hillsdale's geological history derives from the geological history of the area in which Hillsdale is located - - and indeed the geological history of our planet in general, which appears in Figure D.1, below. Except where otherwise indicated, this history is primarily excerpted and adapted from "Geology of Bergen County in Brief":[1]

Precambrian – The Precambrian extended from about 4.6 billion years ago (the point at which Earth began to form) to the beginning of the Cambrian Period, 541 million years ago. The Precambrian encompasses the Archean and Proterozoic eons, which are formal geologic intervals that lasted from 4 billion to about 541 million years ago, and the Hadean Eon, that spanned from 4.6 billion to 4 billion years ago. The Precambrian represents more than 80 percent of the total geologic record.[2]

In Bergen County, the earliest geologic event for which there is evidence preserved in rock is the deposition of thousands of feet of sediments. After deep burial, these rocks were subjected to folding, faulting, and compression coupled with increased heat and pressure which produced metamorphic rocks. Molten igneous rock then intruded the metamorphosed sedimentary rock, causing further alteration. These alterations formed metamorphic gneiss, which is a coarsely grained rock in which light and dark colored bands can be distinguished. Besides forming the Highlands, the Precambrian rocks became the 'basement' on which the Piedmont Plain sediments were deposited.

Figure D.1 – Geologic Time Scale (Source: U.S. National Park Service)[3]



Proterozoic Eon – Within the Precambrian, the Proterozoic Eon extended from 2.5 billion to 541 million years ago. Proterozoic rocks have been identified on all the continents and often constitute important sources of metallic ores, notably of iron, gold, copper, uranium, and nickel. During the Proterozoic the atmosphere and oceans changed significantly. Proterozoic rocks contain many definite traces of primitive life-forms, such as the fossil remains of bacteria and blue-green algae as well as the first oxygen-dependent animals.[4]

(1) **Paleozoic Era** – The Paleozoic Era, interval of geologic time began 541 million years ago with the Cambrian explosion, an extraordinary diversification of marine animals, and ended about 252 million years ago with the end-Permian extinction, the greatest extinction event in Earth history. The story of the earliest Paleozoic animals is one of sea life. The terrestrial environment of the early Paleozoic was barren of the simplest of life-forms.[5]

(2) **Mesozoic Era** – The Mesozoic Era is the second of Earth's three major geologic eras. Its name is derived from the Greek term for "middle life." The Mesozoic Era began 252.2 million years ago, following the conclusion of the Paleozoic Era, and ended 66 million years ago, at the dawn of the Cenozoic Era (see the geologic time scale. Figure D.1, above). The major divisions of the Mesozoic Era are, from oldest to youngest: the Triassic Period; the Jurassic Period; and the Cretaceous Period. The ancestors of major plant and animal groups that exist today first appeared during the Mesozoic, but this era is best known as the time of the dinosaurs. Earth's climate during the Mesozoic Era was generally warm, and there was less difference in temperature between equatorial and polar latitudes than there is today. The Mesozoic was a time of geologic and biological transition. During this era the continents began to move into their present-day configurations. A distinct modernization of life-forms occurred, partly because of the demise of many earlier types of organisms. Three of the five largest mass extinctions in Earth history are associated with the Mesozoic: a mass extinction occurred at the boundary between the Mesozoic and the preceding Paleozoic; another occurred within the Mesozoic at the end of the Triassic Period; and a third occurred at the

boundary between the Mesozoic and subsequent Cenozoic, resulting in the demise of the dinosaurs.[6]

Triassic Period – Following the Precambrian Period, and within the Mesozoic Era, the next period from which there is geologic evidence is the Triassic. The Triassic is first period of the Mesozoic Era, and it began 252 million years ago at the close of the Permian Period, and ended 201 million years ago, when it was succeeded by the Jurassic Period.[7] Evidence of the entire Paleozoic Era and the Jurassic Period have thus far been absent in Bergen County. During the Paleozoic there was deposition but only erosional fragments are found in Triassic Sediments. Paleozoic rocks probably also make up a portion of the 'basement" on which Triassic sediments were deposited. Because no rocks from Paleozoic times are found in Bergen County, the specific events in the local geologic history are not well deciphered. Evidence found beyond the borders of Bergen county have to be used to reconstruct the geologic history here during Paleozoic times.

In the latter part of Triassic Period a widespread earth movement affected this general area. The Highlands as a whole were uplifted, while the areas to the east of the Highlands were relatively depressed. Following this uplift a series of discontinuous intermontane basins were formed all the way from Nova Scotia to North Carolina. The present Piedmont region of New Jersey formed the northern end of one of these basins and extended from southeastern New York to New Jersey, southwest across Pennsylvania and Maryland into Virginia. Because of the characteristic red color and general absence of organic matter of the sediments, the depositional environment is interpreted to have been an arid climate with seasonal torrential rains. Debris was carried from the higher areas and spread in broad alluvial fans over the adjacent plains. The sediments deposited during this time have been referred to as the Newark Group.

The first formation in the Newark Group to be deposited was the Stockton Formation, a light colored arkosic sandstone and conglomerate with

interbedded red sandstone and shale. The composition and size of the material indicate that there was rapid stream erosion in the mountains and rapid deposition in layers across the basin.

Deposition of the Brunswick Formation in the Newark Group followed the Stockton Formation. The Brunswick Formation is usually a soft red shale with some interbedded sandstone, but in Bergen County it is mostly a coarse-grained sandstone with some conglomerate.

Adjacent to the Ramapos, beds of Triassic border conglomerate and pebble bearing sandstone are found replacing the Brunswick Formation and interfingering with the finer grained sandstone. Fan-like accumulations were formed by sediment laden streams flowing at high velocities where they debouched upon a low plain. Exposures of this material can be seen near Oakland. There is an absence of gneissic material in the conglomerate which might be expected in an alluvial fan so close to the gneissic outcrops of the Highlands. This indicates that Paleozoic sediments covered the Highlands gneiss during the time of erosion and deposition of Newark sediments.

Associated with the Triassic sediments are two types of igneous rock, basalt and diabase, which are commonly known as traprock. Basalt is a hard, fine grained, dense textured, extrusive igneous rock which is formed by the solidification of lava flows. There is a record of three or more periods of volcanic activity when lava was spread widely over the area. The bottom of the lava flows cooled quickly and, as a result, the rock is fine grained and dense while at the top of the flow it is porous and spongy due to escaping bubbles of steam and other gases as the lava cooled and solidified. Since the rock is more resistant to erosion than the sandstone and shale, it was not worn down as fast as the surrounding rock, it therefore forms the higher ridges of the Watchung Mountains.

Diabase, the chemical and mineralogical equivalent of basalt, is coarser grained and, as a sill, has a salt and pepper look because the crystals are

bigger, resulting from slower cooling deep beneath the land surface during Triassic times. Because the Palisades diabase is intrusive rather than extrusive, there are features present which are not found in the Watchungs. The magma was injected parallel to the bedding of the Triassic sedimentary strata, forming an igneous body called a sill. The rock near the top and bottom contacts of the sill are of a glassy texture which formed when the hot magmatic material came in contact with the cooler sides; solidification took place so quickly that crystals could not develop.

At the close of the Triassic, movement along a series of northeast-southeast fractures brought the deposition to a close. The fractures divided the earth's crust into a succession of long and narrow blocks which were tilted to the northwest. Subsequent erosion has leveled the blocks and etched out the Palisades and the Watchungs.

Because of the arid climate prevailing during red bed deposition, plants are not plentiful but can be found in the darker gray beds formed under wore favorable conditions during the wetter, but still semi-arid, cycles of the Triassic climate. Vertebrates were evolving rapidly in terms of geologic time, and much evidence can be found for their existence. In 1910, a fossil phytosaur, Rutiadon (a carnivorous armor-covered reptile), was found at the bottom of the Palisades in the Stockton Formation at Fort Lee. Very few finds have been made in Bergen County, though dinosaur tracks probably are abundant but have not been discovered because rock surfaces are rarely exposed in an area that is so densely populated. Fish and small shells are found in the Triassic lake bed deposits - - but as yet none have been found in Bergen County.

<u>Jurassic Period</u> – In Bergen County during the Jurassic, a peneplain - - a nearly featureless plain developed by erosion of a more rugged terrain - - was gradually formed.

(3) **Cenozoic Era** - This third of the major eras of Earth's history, began about 66 million years ago and extends to the present. It was the interval of time during which the continents assumed their modern configuration and geographic positions and during which Earth's flora and fauna evolved toward those of the present. This Era reflects the sequential development and diversification of life on Earth from the Paleozoic (ancient life) Era through the Mesozoic (middle life) Era. The Cenozoic is the youngest of the three major subdivisions of the fossiliferous part of Earth's history.[8]

Pleistocene Epoch – The most recent of three Periods during the Cenozoic Era is the Quaternary Period. Within the Quaternary Period, the Pleistocene Epoch is the older and major of two epochs. The Pleistocene was an epoch during which a succession of glacial and interglacial climatic cycles occurred. The base of the Gelasian Stage (2,588,000 to 1,800,000 years ago) marks the beginning of Pleistocene, which is also the base of the Quarternary Period. It is coincident with the bottom of a marly layer resting atop a sapropel called "MPRS 250" on the southern slopes of Monte San Nicola in Sicily, Italy, and is associated with the Gauss-Matuyama geomagnetic reversal. The Pleistocene ended 11,700 years ago. It is preceded by the Pliocene Epoch of the Neogene Period and is followed by the Holocene Epoch.[9]

The Pleistocene Epoch is best known as a time during which extensive ice sheets and other glaciers formed repeatedly on the landmasses and has been informally referred to as the "Great Ice Age." The timing of the onset of this cold interval, and thus the formal beginning of the Pleistocene Epoch, was a matter of substantial debate among geologists during the late 20th and early 21st centuries. By 1985 a number geological societies agreed to set the beginning of the Pleistocene Epoch about 1,800,000 years ago, a figure coincident with the onset of glaciation in Europe and North America. Modern research, however, has shown that large glaciers had formed in other parts of the world earlier than 1,800,000 years ago. This fact precipitated a debate among geologists over the formal start of the

Pleistocene, as well as the status of the Quaternary Period, that was not resolved until 2009.

Four (4) main glacial ages and three (3) interglacial ages covered parts of the world during the Pleistocene Epoch. Three glacial advances reached New Jersey. In the last glacial stage, the Wisconsin (ice advancing from the north and northwesterly direction), covered all of Bergen County, depositing an unsorted mixture of boulders, pebbles, sand and clay, called till. Stratified drift, composed of layered and sorted sand, gravel, and silt, was deposited by streams fed by water from the melting glaciers.

It is probable that glacial ice began its retreat from the Hillsdale area within a few centuries of 15,000 years ago. Geological field studies concluded that after the ice began its retreat up the Hackensack River valley, sedimentation began in the kettle bog at Beechwood Park in Hillsdale.[10]

Low steep sided hills of stratified drift called kames and eskers are scattered throughout Bergen County. Kames are terraces or flat-topped hills formed when the glacier melts and leaves patches of sediment which fill former crevasses and holes in the ice or are laid down by streams flowing along the ice margins. Eskers are long winding ridges formed by streams that flowed in tunnels beneath the ice or along crevasses presumably after the ice became almost stagnant.

In 1902 Salisbury reported a single esker to be present in Hillsdale, having a north-south alignment (probably within the Beechwood Nature Trail).[11]

Prior to invasion of the ice the topography was not as even as it is today. Gradually, low areas were covered by glacial deposits as can be seen in the banks of the Hackensack and Passaic Rivers which are filled with glacial debris.

Other characteristic effects of glaciers are also evident. Striations and grooves of various sizes are found at the top of the Palisades where the outcrops are flat. These marks were gauged into the bedrock by rock debris being carried in the ice on the bottom of the glacier.

One of the most visible remnants of the glacier is a large glacial erratic located in the center of Glen Rock, at the intersection of Rock Road and Doremus Avenue. An erratic is a boulder transported by ice and resting on bedrock of different composition than that of the erratic. The boulder at this location is composed of gneiss resting on the Brunswick Formation and was probably carried from the Highlands approximately ten to twenty miles to the north. The boulder in Glen Rock is the largest erratic found from the Triassic, and one of the largest in the State, measuring 42 x 22 x 11 feet.

Bolder at Glen Rock (Photo: Beatrice Murch, Buenos Aires, Argentina)

This 570-ton boulder served as a trail marker for the Lenni Lenape people according to the Glen Rock Historical and Preservation Society, is a World War I memorial, and is the burial site of a time capsule that will be opened in 2044 for Glen Rock's 150th anniversary.[12]

D.2 Bedrock Characteristics – The bedrock of Bergen County is primarily sedimentary in nature. Figure D.2.a displays the bedrock geology of New Jersey as a whole, including Bergen County. Figure D.2.b is a display of the bedrock geology of Hillsdale.

D.3 Surficial Geology – Figure D.3 is a map that displays the surface geology of Hillsdale. It indicates that although other types are present, the surficial geology of Hillsdale is primarily Netcong Till, with Late Wisconsinan glacial deposits.

D.4 Mineral Resources – At less than 3 square miles in size, and being a substantially built-out suburban community, neither mineral exploration or mineral extraction takes place in Hillsdale.

D.5 Depth to Bedrock – Hillsdale has a particularly varying topography. As such, the depth to bedrock can be expected to fluctuate, depending on location within the Borough. For example, outcrops of bedrock are apparent in the northwest ("Hills") area of Hillsdale. Depth to bedrock in the downtown area is indicated to be 60 to 80 feet below grade.[13] Where depth-to-bedrock is critical information, prudence dictates that the actual depth to bedrock be determined for any specific site.

Figure D.2.a - Bedrock Geology of New Jersey, Including Bergen County

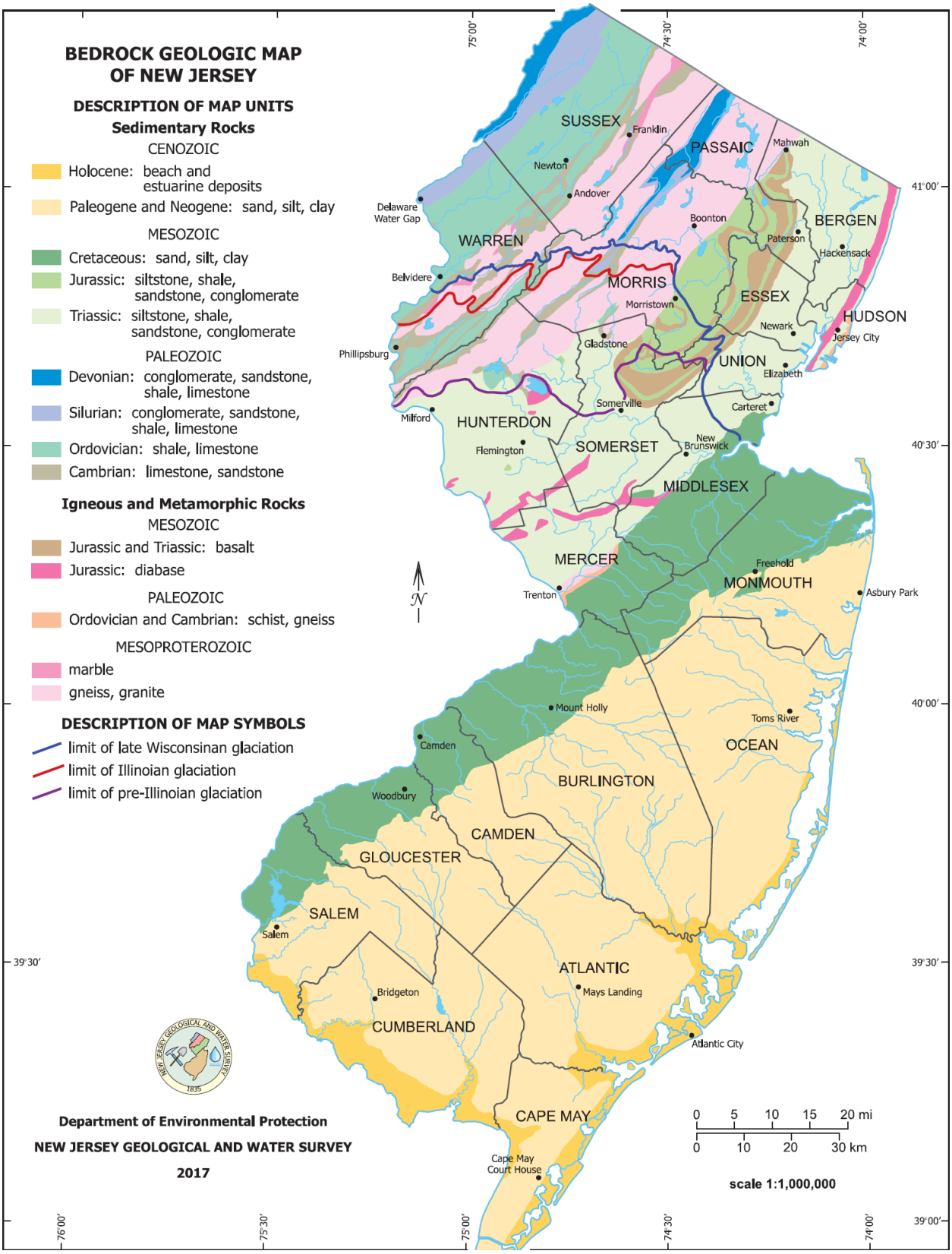


Figure D.2.b

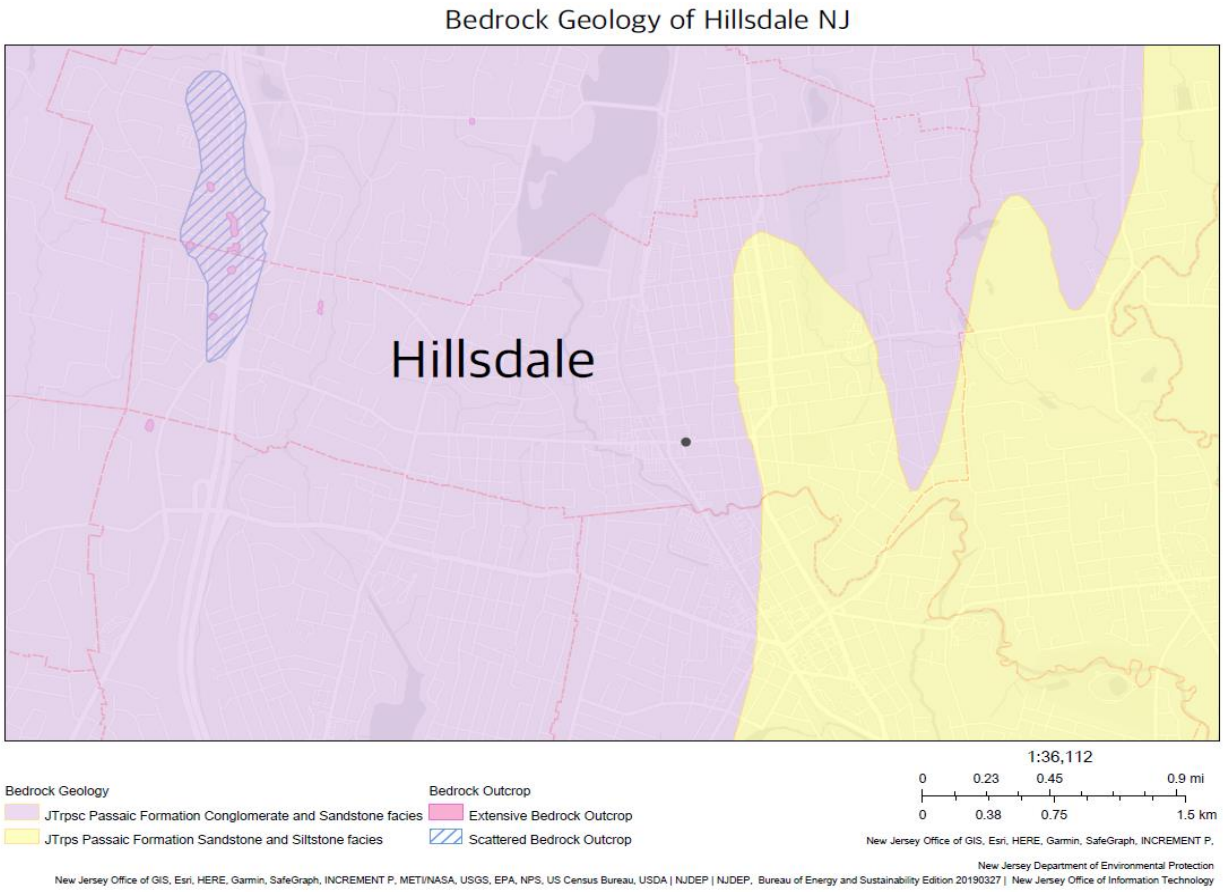
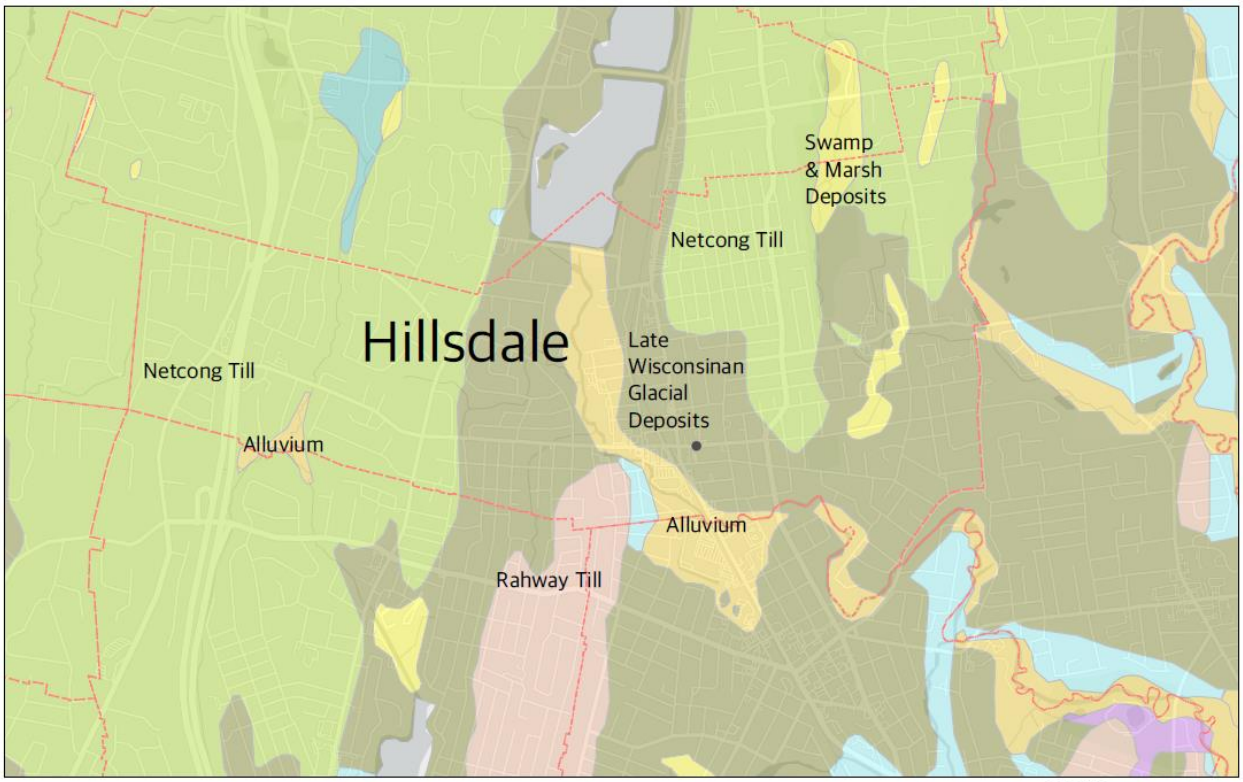

Bedrock Geology of Hillsdale NJ
Hillsdale
1:36,112
0 0.23 0.45 0.9 mi
0 0.38 0.75 1.5 km
Bedrock Geology
JTrpsc Passaic Formation Conglomerate and Sandstone facies
JTrps Passaic Formation Sandstone and Siltstone facies
Bedrock Outcrop
Extensive Bedrock Outcrop
Scattered Bedrock Outcrop
New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, INCREMENT P,
New Jersey Department of Environmental Protection
New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA | NJDEP | NJDEP, Bureau of Energy and Sustainability Edition 20190327 | New Jersey Office of Information Technology

Figure D.3

Surface Geology of Hillsdale New Jersey



D.6 Faults, Earthquake Epicenters and Landslide Hazard – Figure D.6 is a map showing fault lines in the area, as well as earthquake epicenters. The closest fault line to Hillsdale is the Ramapo fault line. This significant crack in the earth's crust is the longest fault in the Northeast. The fault line is visible at ground level and likely extends as deep as nine miles below the surface. The Ramapo fault line begins in Pennsylvania and extends into New Jersey, trending northeast through Hunterdon, Somerset, Morris, Passaic, and Bergen counties before terminating in New York's Westchester County.[14] Although scientists disagree as to how active this roughly 200 million-year-old fault is, many earthquakes are believed to have occurred on or near it.

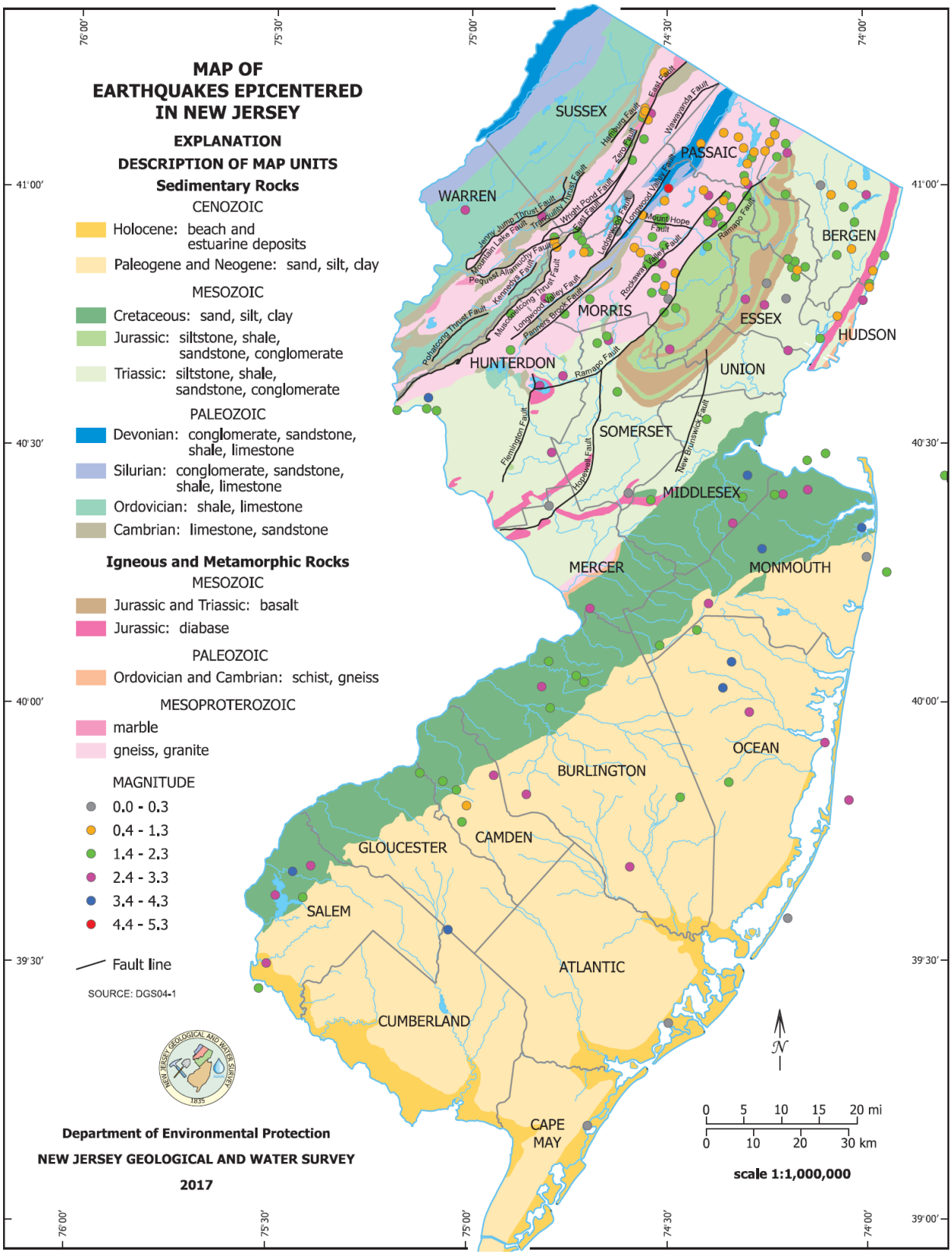
During the past 230 years or so, New Jersey has been at the epicenter of nearly 170 earthquakes, according to data compiled by the New Jersey Geological Survey, within the New Jersey Department of Environmental Protection. The largest known quake struck in 1783, somewhere west of New York City, perhaps in Sussex County. It is typically listed as 5.3 in magnitude, although that is an estimate since, as seismologists point out, the concept of magnitude - - measuring the relative size of an earthquake - - was not introduced until 1935 by Charles Richter and Beno Gutenberg. Smaller east-west faults exist across the northeast-trending Ramapo Fault, and are believed to be more active faults in the area.

The location of a natural landslide hazard has not been reported for any location within Hillsdale. Although some areas of Hillsdale are steeply sloped, they generally consist of stable, sedimentary rocks with fairly stable soils.

D.7 Geology Cross Sections – A number of sources of geological cross sections likely exist within Hillsdale, including engineering investigations, more recent well drilling permits filed, as well as any site remediation studies. As geological cross sections are likely to be highly site-specific, none are provided here.

D.8 Natural Geologic Hazards – Beyond generalized geologic features that lend to the possibility of earthquake (see Figure D.6, below) currently, natural geologic hazards have not been designated and are not known to be in Hillsdale.

Figure D.6 Fault Lines Near Bergen County and Earthquake Epicenters



[END OF NARRATIVE PORTION OF THIS SECTION]

[1] "Geology of Bergen County in Brief," New Jersey Geological Survey, New Jersey Department of Environmental Protection, Bureau of Geology and Topography, Carol S. Lucey, December 1971.
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[10] "Late Wisconsin-Holocene History of the Lower Hudson Region: New Evidence from the Hackensack and Hudson River Valleys," Stephen P. Averill, Richard R. Pardi, Walter S. Newman, Robert J. Dineen, in Field Studies of New Jersey Geology and Guide to Field Trips, W. Manspeizer, Editor, 1980, Newark, NJ, Rutgers University College of Arts and Sciences, Geology Department, New York State Geological Association, pp. 160 – 186.
[11] "Late Wisconsin-Holocene History of the Lower Hudson Region: New Evidence from the Hackensack and Hudson River Valleys," Stephen P. Averill, Richard R. Pardi, Walter S. Newman, Robert J. Dineen, in Field Studies of New Jersey Geology and Guide to Field Trips, W. Manspeizer, Editor, 1980, Newark, NJ, Rutgers University College of Arts and Sciences, Geology Department, New York State Geological Association, p. 171.
[12] https://www.flickr.com/photos/leonandloisphotos/4677474532 accessed 1/19/2022.
[13] "Remedial Investigation Report," Alexander Cleaners Site, by H2M Associates, Inc., July 2016, p. 4.
[14] "Living on the Fault Line," Wayne J. Guglielmo, New Jersey Monthly, June 15, 2010.

E. Topography

Version 1: Prepared by Fred N. Rubel, M.S., QEP, Member, Hillsdale Environmental Commission. Last updated May 2021. Please contact the Hillsdale Environmental Commission to offer any suggested corrections/changes.

Overview

Topography refers to the variation in ground level elevation. Topography can be an important physical determinant as to what environmental resources may exist in a community. For example, topography can be a factor in determining vegetation, habitats, and the course of water resources present in a community. Areas of steep slope present a potential for significant soil runoff and potential structural instability. Topography needs to be a consideration when construction takes place, especially if steep slopes are present.

Substantial variations in topography can also present interesting vistas. Varying topography also influences such features as sewage disposal and stormwater drainage.

The topography of Hillsdale includes areas with relatively high elevations along the western cusp of the Pascack Valley, as well as lowlands near the main business district along Broadway that receive and convey the gathering flow of the Pascack Brook.

E.1 Elevations

Hillsdale's topography exhibits substantial variation. Its highest elevations are along the northwest portion of the Borough where elevation rises to more than 360 feet above sea level. At its lowest points, elevation in the Borough dips to 40 feet or less above sea level.[1]

E.2 Steep Slopes

Steep slopes are not generally found in areas that coincide with wetlands or flood plains. Steep slopes may support large specimen trees and wildlife habitat that is somewhat different from other areas of town.

Steep slopes present concerns for possibly excessive erosion and rapid storm water runoff. Such locations often consist of shallow soils, visible rock outcroppings, and groundwater seeps may be present.

Hillsdale is a substantially built-out community, which makes significant development in areas with steep slopes unlikely to arise often. Hillsdale's Master Plan identifies areas in the Borough with slopes of 20 percent or greater in a map entitled "Steep Slopes Map." For convenience of reference, that map is also included here.

Hillsdale's Master Plan indicates that majority of steep slopes occur west of the Garden State Parkway and the Musquapsink Brook. They are also present in the center of the Borough along the Woodcliff Lake Reservoir, in the Industrial zone, and behind a Shoprite super market on Broadway. The Mater Plan also indicates that small areas of steep slopes are present near Hillsdale's southern border with Washington Township, near the Boulevard South section. In addition, steep slopes in the eastern section of Hillsdale occur in small isolated locations, with the largest grouping of steep slopes in this area being in the Edgewood Country Club golf course near Hillsdale's border. A linear section of steep slopes are indicated to be along the portion of the Pascack Brook that forms the Westwood border, and a small section of Woodale Park has steep slopes.[2]

E.3 View Sheds

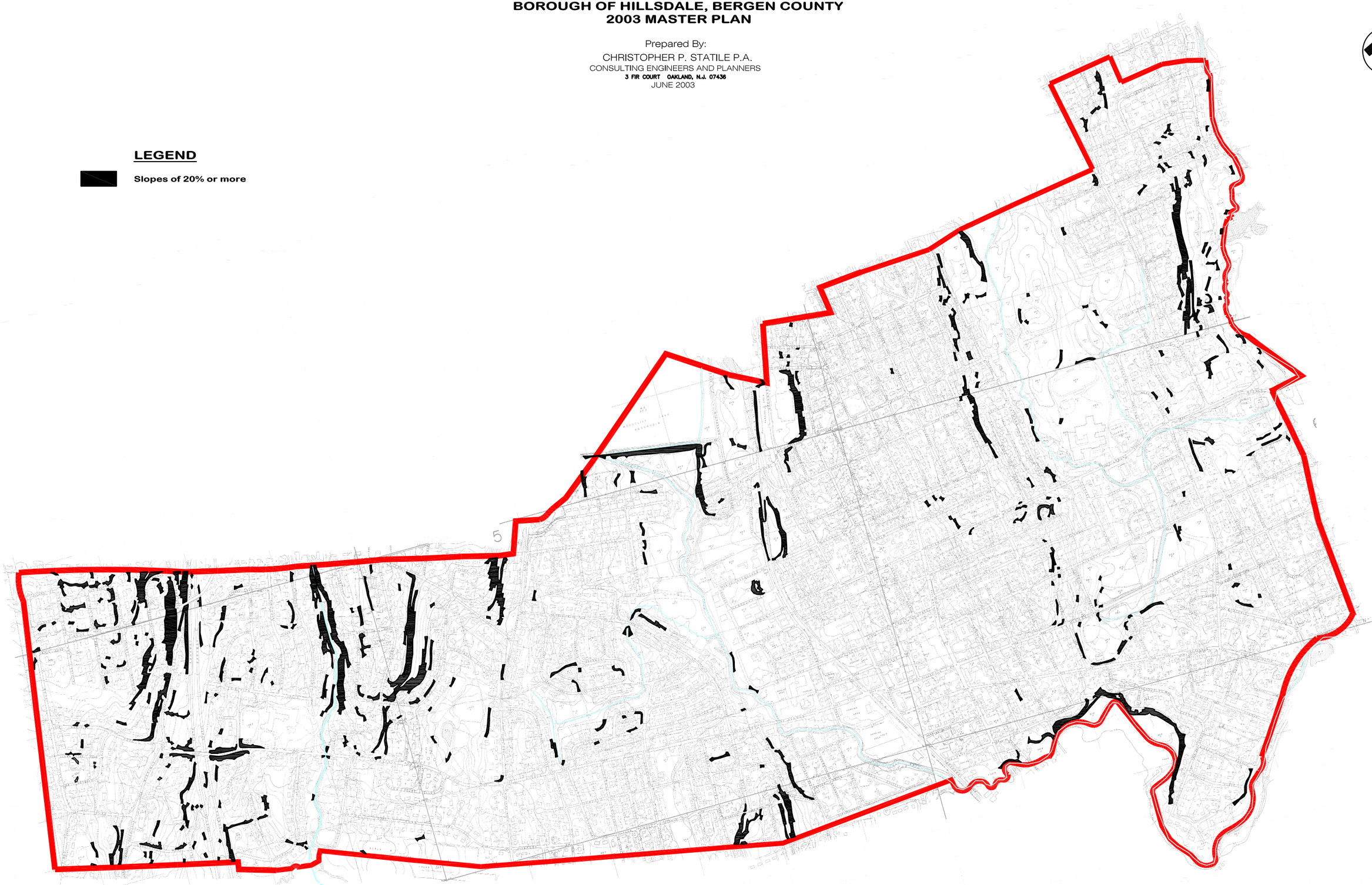
Hillsdale has no sites formally designated for viewing unique vistas. The northwest portion of the Borough, however, offers impressive vistas that can be seen from various residences and roadways. Unique vistas can be seen at dead-end streets that abut Demarest Farm. One can view high lands beyond the east side of the Pascack Valley to New York to the east (Photo E.3.a, below). A view of the New York City skyline can be glimpsed to the southeast (Photo E.3.b, below). The New York City skyline can also be seen while driving/walking along Wiermus Road, in the area of Demarest Farm.

BOROUGH OF HILLSDALE, BERGEN COUNTY
2003 MASTER PLAN

Prepared By:
CHRISTOPHER P. STATILE P.A.
CONSULTING ENGINEERS AND PLANNERS
3 FIR COURT OAKLAND, N.J. 07436
JUNE 2003

LEGEND

Slopes of 20% or more



SOURCE: U.S.G.S. MAPS, BOROUGH OF HILLSDALE

STEEP SLOPES MAP

Photo E.3.a – A View Overlooking the Pascack Valley to the East, from Sunrise Drive, West of Horizon Terrace (Photo by Fred Rubel)

Photo E.3.b – A View of the NYC Skyline, Looking Southeast from the end of Horizon Terrace by Demarest Farm (Photo by Fred Rubel)

[END OF NARRATIVE PORTION OF THIS SECTION]

[1] Google Earth, accessed 1/15/2021. Elevations also taken by iPhone App ("Compass") in the street at 104 Alpine Terrace, and at the Plaza at Hillsdale shopping center parking lot on 1/15/2021.

[2] "2003 Master Plan, Borough of Hillsdale, Bergen County,' by C.P. Statile, PA, Revised December 16, 2003.

F. Soils

Version 1: Prepared by Fred N. Rubel, M.S., QEP, Member, Hillsdale Environmental Commission. Last updated, March 18, 2022. Please contact the Hillsdale Environmental Commission to offer any suggested corrections/changes.

Overview

Information about a community's soils is a basic element of an Environmental Resource Inventory. It can be useful from the standpoint of land-use and preservation of resources. In Bergen County the soils formed in four general types of parent material. These include material deposited by glacial action, called glacial till; unconsolidated sediments from glacial outwash and ancient lake materials that overlie rocks of the Precambrian or Triassic age; recent alluvial sediments derived from eroded glacial till or outwash slopes; and mixed deposits of fill material consisting of rock fragments, sand, silt, clay, inorganic substances, and organic material.[1]

As a practical matter, for purposes of local garden soil testing, Hillsdale homeowners can have their soil tested for relevant factors by the Rutgers Soil Testing Lab in one of two ways:[2]

1. Buy obtaining a Soil Testing Kit from the Cooperative Extension county office (purchase includes fee for fertility analysis); or
2. By downloading the appropriate forms under the most suitable category, and then sending the soil samples with testing fees. The Sampling Instructions provide all details about taking the soil samples and submitting them to the laboratory. A Soil Test Questionnaire needs to be filled out and sent with each sample.

The following information on soil types, including a soils map for the Borough, is obtained primarily from Hillsdale's Master Plan[3] and is reproduced here for ease of reference. The original source of the soil-type data being reported in Hillsdale's Master Plan is from "Soil Survey of Bergen County, New Jersey," prepared by the United States Department of Agriculture (March 1995).

Consistent with expected professional practices, those intending to undertake construction at a particular site are advised to sample and evaluate specific site soils, rather than rely on the general soil information and map contained here.

F.1 Soil Associations

The soil associations identified in Hillsdale are indicated in the manner in which soil types are presented in the following section.

F.2 Soil Types

Attached is a Soils Map that displays the predominant soils present throughout Hillsdale. A description of each soil type follows:

Boonton – Urban land complex, gently rolling (BUC)

This soil unit consists of sloping, moderately well drained Boonton soils and areas of Urban land. The Boonton soil and the Urban land are so well mixed or so small that it was not possible to map them separately. Urban land contains sites in which the surface is covered by impervious improvements, such as paved areas and buildings. Most areas of this soil type are improved with single family dwellings. There are moderate limitations affecting lawns, ornamental shrubs and trees. Downslope water movement may be a hazard for dwellings with basements.

Boonton – Urban land complex, hilly and very hilly (BUD and BUE)

This soil unit consists of sloping, moderately well drained Boonton soils and areas of Urban land. The Boonton soil and the Urban land are so well mixed or so small that it was not possible to map them separately. Urban land contains sites in which the surface is covered by impervious improvements, such as paved areas and buildings. Most areas of this soil type are improved with single family dwellings. There are severe limitations affecting lawns and moderate limitations affecting ornamental shrubs and trees. Downslope water movement may be a hazard for dwellings with basements.

Carlisle Muck (Ca)

This soil unit is almost level and drains poorly. Carlisle muck is prone to flooding and has a high potential for frost action. Most areas of this soil type are oval or elongated and range from 5 to 90 acres in size. The seasonal high water table may be at the surface or directly below the surface for seven months out of the year.

The frequent flooding, seasonal high water table and low strength are the major development limitations. Carlisle muck is well suited to habitat for wetland wildlife.

Dunellen Loam, 8 to 15 Percent Slopes (DuC)
This soil type is gently rolling and well drained. It is typically located on the side slopes of broad plains or stream terraces. Specific areas are long and oval or irregularly shaped and range in size from 5 to 165 acres. Most areas are used for woodlands or recreational facilities. The slope and frost potential for this soil type limit community and recreational development. The soil has a rapid permeability so the effluent from waste disposal systems can contaminate groundwater. Downslope movement of water along the top of the subsoil is a hazard for dwellings with basements. This soil type is suited to habitat for upland wildlife. There are minimal limitations affecting woodland management.

Dunellen Urban Land Complex, Nearly Level & Undulating (DVA, DVB)
This soil type includes nearly level and well drained Dunellen soil and areas of Urban land. The Dunellen soil and Urban land occur in areas so well mixed or small that it was not practical to map them separately. Urban land includes area where the surface is covered by impervious structures, such as parking lots, patios, walkways and buildings. Most areas of this soil type are used for single family homes. The limitations affecting lawns and landscaping are minimal.

Dunellen - Urban land complex, rolling and hilly (DVC and DVD)
This soil type includes nearly level and well drained Dunellen soil and areas of Urban land. The Dunellen soil and Urban land occur in areas so well mixed or small that it was not practical to map them separately. Most areas of this soil type are used for single family homes. The downslope movement of water on the top of the subsoil or substratum can be a hazard for dwellings with basements.

Fluvaquents (FL)
These soils flood frequently. Fluvaquents consist of nearly level and somewhat poorly drained to very poorly drained soils on floodplains. The hazard of water erosion is severe, but new material is deposited regularly when floodwaters subside. Fluvaquents have a high frost potential. The frequent flooding and seasonal high water table limit community and recreational development. The soils

have a good potential as a wetland wildlife habitat. Woodland management generally is not possible in these areas due to severe soil limitations.

Haledon gravelly loam, 3 to 8 percent (HaB)
This soil type generally is appropriate for ponds and recreation development. It is gently sloping or undulating and drains poorly. Typically, these soils are located in narrow drainageways or at the base of glacial ridges. Specific areas tend to be long and narrow and range in size from 5 to 60 acres. Many of the areas of this soil type are used as woodland. Smaller areas are the remainders of larger sites that have been filled and developed.

Haledon - Urban land complex, undulating (HUB)
These soils are gently sloping or undulating and drain poorly. Typically, these soils are located in narrow drainageways or at the base of glacial ridges. Specific areas tend to be long and narrow and range in size from 5 to 180 acres. Many of the areas of this soil type are used as woodland. Smaller areas are the remainders of larger sites that have been filled and developed. Downslope water movement can be a hazard for homes with basements.

Otisville gravelly loamy sand (OtE)
These soils are steep and excessively drained. Permeability is rapid, and the runoff is medium. The erosion risk is slight or moderate, and the available water capacity is very low. Most areas of this soil unit are either wooded or non-wooded areas that support native herbaceous weeds. These soils do not support wildlife habitat well.

Pascack silt loam (PoA)
These soils are fairly level and drain poorly. Most areas are long and narrow or broad and oval. They range in size from 5 to 100 acres. The seasonal high water table limits lawns and landscaping and sites used for recreational development. These soils are well suited to habitat for upland wildlife, but the seasonal high water table also limits woodland management.

Preakness silt loam (Pr)
This soil ranks as level to nearly level and is poorly to very poorly drained. The Preakness soils also flood frequently. Individual areas of this soil unit are long and irregularly shaped or oval. These soils have a slow surface runoff and a slight

erosion risk. The water capacity that is available is moderate. The seasonal high water table is quite frequently at the surface or within a depth of 6 inches from fall through spring. There is a high frost potential. Some of the areas comprised of this soil are open wetlands and many others are used as woodlands. The seasonal high water table, frost potential and flooding limit community and recreational development.

Riverhead Sandy Loam, 3 to 8 percent slopes (RaB)
These soils are gently sloping or undulating and drain well. They are located on convex outwash plains and stream terraces. Specific sites have an irregular shape and range in size from 5 to 65 acres. Most of the areas of this soil type are woodlands or recreational sites. These soils have a very rapid permeability, which limit onsite sewage disposal systems. The slope provides a barrier to small commercial buildings and the moderate frost potential limits local roads and streets. The soil is well suited for upland wildlife habitat.

Riverhead Sandy Loam, 8 to 15 percent slopes (RaC)
These soils are sloping to rolling and well drained. They are located on convex outwash plains and stream terraces. Specific sites are long with an irregular shape. Many of the areas range in size from 5 to 170 acres. The very rapid permeability and the 8 to 15 percent slopes limit community and recreational development. The moderate frost potential limits local roads and streets. The soil is well suited for upland wildlife habitat. There are few limitations to woodland management. Many of the areas of this soil type are woodland or recreation sites. Some have been cleared and support native herbaceous weeds and shrubs.

Udorthents, wet substratum (Ue)
This soil unit is located on upland stream terraces, in drainage ways, in areas of marine and estuarine deposits and on floodplains. The areas generally range in size from 5 to 180 acres and slopes range from 0 to 5 percent. Many of these Udorthents sites have been disturbed (filled and smoothed) to a depth of at least 3 feet. It is assumed that the original soils were deep and poorly to very poorly drained. Most areas are used for playgrounds, ball fields or other recreational facilities. Other areas are open space.

Udorthents, wet substratum – Urban land complex (Uf)
These soils are in areas of low marine and estuarine deposits, on upland stream terraces and on floodplains. The Udorthents and Urban land are located on areas so intricately mixed or so small that it was not practical to map them individually. Urban land areas consist of developed sites. Most of these soil units are smaller than 20 acres although a few are larger, ranging up to 580 acres in size. The Udorthents have been filled to at least 3 feet, and smoothed and paved. It is assumed that the original soils were deep, poorly to very poorly drained and subject to flooding or prolonged ponding. Most areas of this soil unit are used for residential, commercial or industrial development.

Urban Land (UR)
These soils are almost level or gently sloping. Specific areas are irregularly shaped and range in size from 5 acres to 750 acres. Slopes range from 1 to 5 percent. Urban Land consists of areas that have been cut and filled, or areas in which over 85 percent of the surface is covered by impervious improvements. Many sites are improved with commercial or industrial buildings. Some sites are used for schools.

Urban Land soils are poorly drained, and produce high stormwater runoff. Main locations of "Urban Land" soils in Hillsdale are the downtown area, along and adjacent to portions of Broadway, and potions of Hillsdale Avenue.

Wethersfield gravelly loam, 3 to 8 percent slopes (WeB)
These areas are gently sloping and drain well. Individual sites are irregularly shaped and range from 5 to 130 acres in size. Surface runoff is at a medium rate, and the erosion risk is slight or moderate. Slow water permeability in the substratum is the major limitation affecting community and recreational development. These soils are suited for upland wildlife habitat. Moderate limitations affect woodland management.

Wethersfield gravelly loam, 8 to 15 percent slopes (WeC)
These soils slope strongly and are well drained. The majority of these areas range from 5 to 200 acres. There is a moderate potential for frost. The 8 to 15 percent slopes and the slow permeability in the substratum limit community and recreation development. These soils are suited for upland wildlife habitat. Moderate limitations affect woodland management.

Wethersfield gravelly loam, 15 to 25 percent slopes (WeD)
These soil areas are well drained and irregular in shape. Specific sites range in size from 5 to 30 acres. The 15 to 25 percent slope and slow permeability limit community and recreational development. Most areas of this soil type are wooded or used for recreation facilities. The soil is well suited to upland wildlife habitat.

Wethersfield gravelly loam, 25 to 35 percent slopes (WeE)
These soils are steep and well drained. They are located on the sides of high, long glacial till ridges. Specific sites are irregularly shaped and range in size from 5 to 30 acres. Surface water runoff is rapid and the erosion hazard is severe. There is a moderate frost potential. The steep slope and slow permeability limit community and recreational development. Most areas of this soil type are wooded or used for recreation facilities. The soil is well suited to upland wildlife habitat.

Wethersfield - Urban land complex, undulating (WUB)
These soils contain the well-drained Wethersfield and areas of Urban land. The Wethersfield soil and the Urban land occur as areas so well mixed or small that it was not possible to map them separately. Urban lands are areas where the surface is covered by impervious improvements, such as driveways, buildings and patios. Most areas of this soils unit are improved with single family dwellings. The slow permeability affects community and recreational development. The Wethersfield soil provides an appropriate habitat for plants that provide cover and food to small animals and birds.

Wethersfield - Urban land complex, gently rolling, hilly and very hilly (WUC, WUD, WUE)
These soils contain the well-drained Wethersfield and areas of Urban land. The Wethersfield soil and the Urban land occur as areas so well mixed or small that it was not possible to map them separately. Urban lands are areas where the surface is covered by impervious improvements, such as driveways, buildings and patios. Most areas of this soils unit are improved with single family dwellings. The slope and the slow permeability affects community and recreational development. The Wethersfield soil provides an appropriate habitat for plants that provide cover and food to small animals and birds.

The following map of soil types is from Hillsdale's Master Plan.

BOROUGH OF HILLSDALE, BERGEN COUNTY
2003 MASTER PLAN

Prepared By:
CHRISTOPHER P. STATILE P.A.
CONSULTING ENGINEERS AND PLANNERS
3 FIR COURT OAKLAND, N.J. 07436
JUNE 2003

LEGEND

BUC Boonton- Urban land complex, gently rolling
BUD Boonton- Urban land complex, hilly
BUE Boonton- Urban land complex, very hilly

Ca Carlisle muck

DuC Dunellen loam, 8 to 15 percent slopes
DVA Dunellen- Urban land complex, nearly level
DVB Dunellen- Urban land complex, undulating
DVC Dunellen- Urban land complex, rolling
DVD Dunellen- Urban land complex, hilly

FL Fluvaquents

HaB Haledon gravelly loam, 3 to 8 percent slopes
HUB Haledon- Urban land complex, undulating

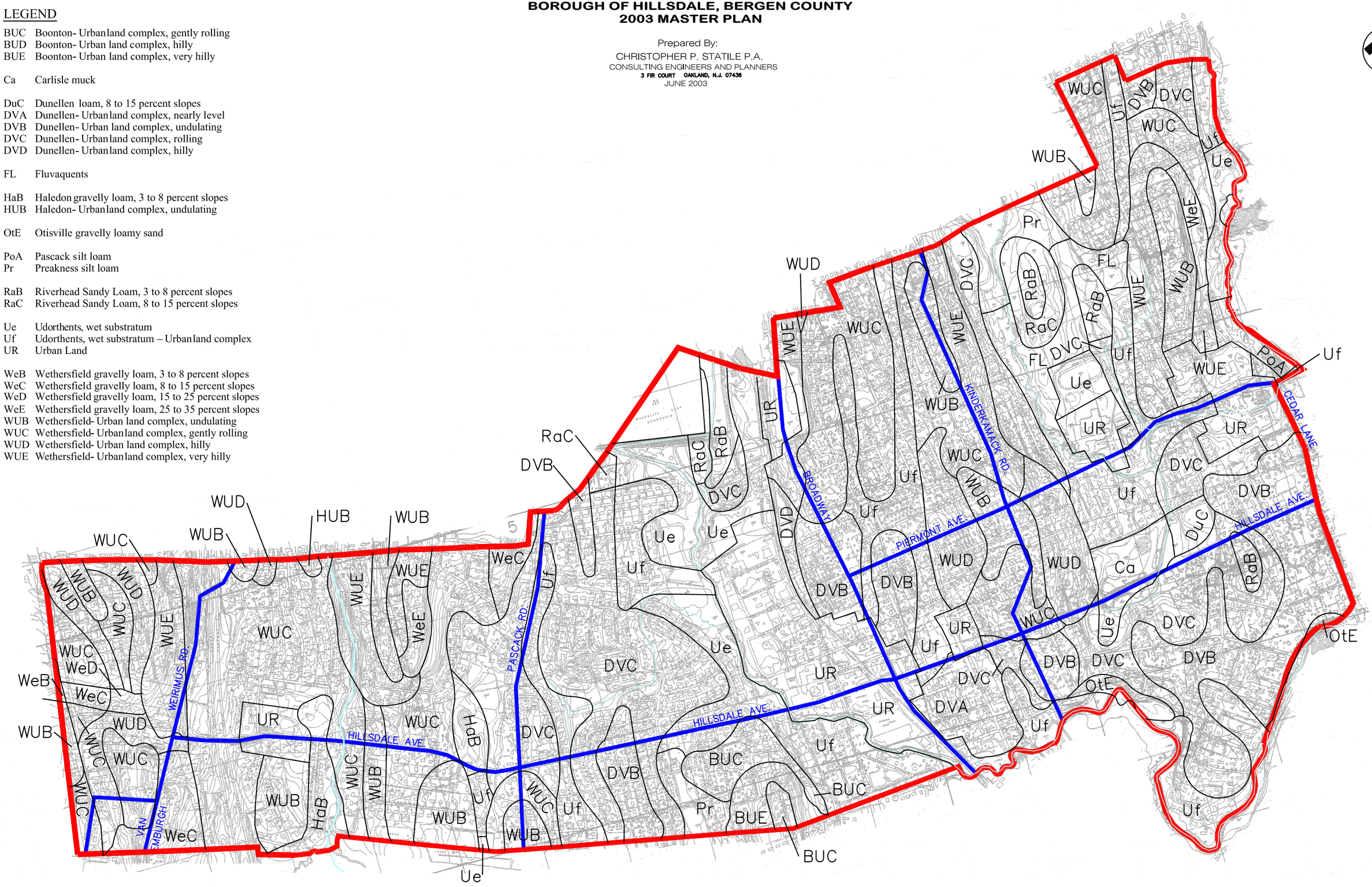
OtE Otisville gravelly loamy sand

PoA Pascack silt loam
Pr Preakness silt loam

RaB Riverhead Sandy Loam, 3 to 8 percent slopes
RaC Riverhead Sandy Loam, 8 to 15 percent slopes

Ue Udorthents, wet substratum
Uf Udorthents, wet substratum – Urban land complex
UR Urban Land

WeB Wethersfield gravelly loam, 3 to 8 percent slopes
WeC Wethersfield gravelly loam, 8 to 15 percent slopes
WeD Wethersfield gravelly loam, 15 to 25 percent slopes
WeE Wethersfield gravelly loam, 25 to 35 percent slopes
WUB Wethersfield- Urban land complex, undulating
WUC Wethersfield- Urban land complex, gently rolling
WUD Wethersfield- Urban land complex, hilly
WUE Wethersfield- Urban land complex, very hilly



SOILS MAP

SOURCE: SOIL SURVEY OF BERGEN COUNTY, N.J., SHEET NO. 8 OF 12.

F.3 Seasonal High Water

The first depth at which soil becomes fully saturated with water is known as the water table (see Figure F.3, below). The groundwater table refers to depth below ground surface. The "seasonal high water table" is the point at which the groundwater table is highest, and nearest the surface during the course of the annual cycle. This is important for structural purposes, and also because Tables 1, 2, and 3 of Hillsdale's 'Use of Green Infrastructure for Major Developments' Ordinance (No. 21-01) specify minimum separation distances required between the seasonal high water table and various stormwater control infrastructure features.

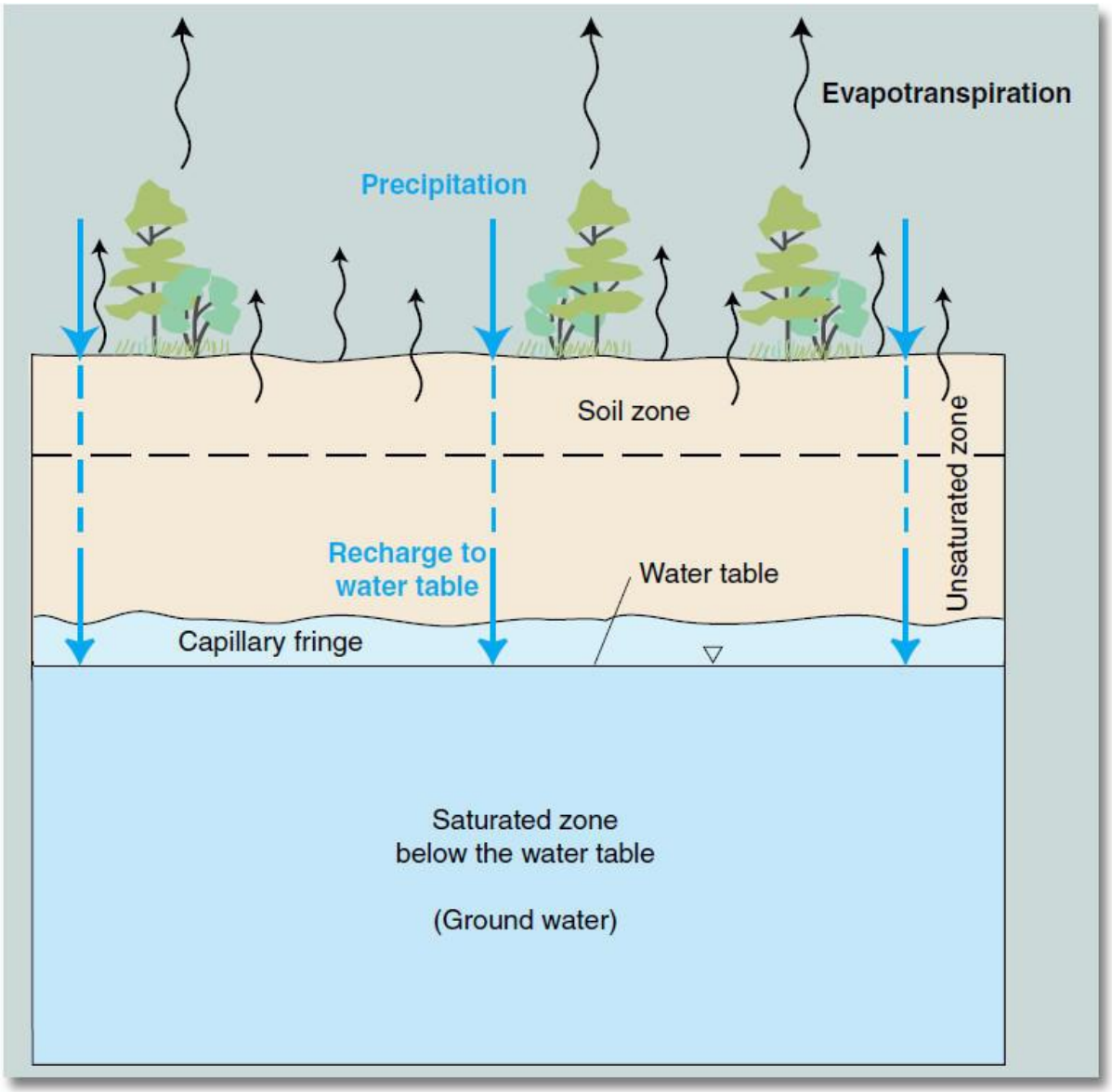


Figure F.3 – Groundwater Table[4]

Not being coastal, Hillsdale's surface waters and groundwater are not subject to tidal variation, a factor that can in some instances influence the level of surface water and ground water. Water tables rise and fall mainly depending on precipitation - - and precipitation usually tracks with seasons of the year. During the late winter and early spring any accumulated snow starts to melt. Spring rainfall is often plentiful in the region in which Hillsdale is located. Under these conditions water on the surface infiltrates into the ground and the water table rises.

As plants and trees become active and start to grow again in the spring, and precipitation gives way to hot, dry summers, the water table often falls, including due to evapotranspiration (the evaporation of water from leaves of trees and plants). Often the fall season results in rains, which again raises the level of the water table beneath the ground's surface.

The most reliable method of obtaining the actual depth to the water table at any point in time is to measure the water level in a shallow well with a measuring tape. If no open shallow wells are available, surface geophysical methods can sometimes be used, depending on surface accessibility for placing electric or acoustic probes.[5]

Ground table elevation itself can vary substantially by location, particularly due to difference in elevation, underlying geological strata, and permeability of surface soils.

Databases containing depth-to water measurements can also be helpful, although they don't always have current or specific location data:

- The U.S. Geological Service ("USGS") National Water Information System (NWIS) has depth-to-water measurements made in the present and the past. The NWIS Mapper provides a convenient way to find any data for an area. No groundwater monitoring site was present in Hillsdale within the USGS NWIS Mapper data base.[6]
- The National Groundwater Monitoring Network is a compilation of groundwater monitoring wells from federal, state, and local groundwater networks across the nation. Their Data Portal can be used to zoom in to an area of interest, and click on any sites identified. Although Hillsdale is indicated to have "early Mesozoic basin aquifers," there are no actual

groundwater monitoring sites were listed as being present in Hillsdale within the National Groundwater Monitoring Network data base.[7]

- The State of New Jersey Department of Environmental Protection ("NJDEP") maintains drillers' logs that have water-levels recorded when wells are drilled. Hydrologic consultants often have reports that contain water-level data from shallow boreholes.

Specific information regarding the depth to the *seasonally high water table* in Hillsdale was not readily available. A property at 137 Broadway, at the corner of Orchard Street (the former Alexander Cleaners site), sits at an elevation of 70 feet above mean sea level, and provides some information regarding depth to the groundwater table at that location. The site is approximately 60' x 140' (0.2 acre) in size. Groundwater monitoring were installed there and in the immediate vicinity on behalf of the NJDEP to assess site contamination. Documents include the depth to groundwater over time and are displayed in Table F.6 below. Again, this is for that specific location and its immediate vicinity. It demonstrates that depth to the groundwater table at any point in time can vary substantially (1.5 to 4.6 feet) even within a small area.

Table F.3 - Depth to Water Table - Alexander Cleaners Site[8]

Time Period	Depth (feet) to Water Table*
April 2005	4.0 to 5.5
April 6 & 7, 2016	5.3 to 9.8
April 14, 2020	4.7 to 9.2
April 20, 2020	4.6 to 9.2

* Below top of well casing.

F.4 Hydric Soils

The following general information regarding hydric soils was obtained from the United States Department of Agriculture, Natural Resource Conservation Service ("NRCS"). Hydric soils are defined by the NRCS as soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions (*lacking oxygen*) in the upper part.[9] Hydric soils are associated with areas that are routinely wet and flooded, and may be important for land-use planning, conservation planning, and assessment of potential wildlife

habitat. Wetland locations in Hillsdale (see Chapter "N"), can be expected to contain such soils.

Hydric soil lists have a number of agricultural and nonagricultural applications. A combination of the hydric soil, hydrophytic vegetation, and hydrology properties define wetlands as described in the National Food Security Act Manual (Soil Conservation Service, 1994) and the Corps of Engineers (COE) Wetlands Delineation Manual (Environmental Laboratory, 1987) and COE Regional Supplements. An area that meets the hydric soil definition must also meet the hydrophytic vegetation and wetland hydrology definitions in order for it to be correctly classified as a jurisdictional wetland.

Field Indicators

Field Indicators are soil characteristics which are documented to be strictly associated only with hydric soils. Field Indicators are an efficient on-site means to confirm the presence of hydric soil. The Field Indicators are designed to identify soils which meet the hydric soil definition without further data collection. Some hydric soils exist for which no Field Indicators have yet been recorded and documented, and to identify these soils as hydric, evidence must be gathered to demonstrate that the definition is met. Additional Field Indicators are being developed and tested.

The concept of hydric soils includes soils developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation. Soils that are sufficiently wet because of artificial measures are included in the concept of hydric soils. Also, soils in which the hydrology has been artificially modified are hydric if the soil, in an unaltered state, was hydric. Some series, designated as hydric, have phases that are not hydric depending on water table, flooding, and ponding characteristics.

Hydric Soils Lists

Lists of hydric soils were created in the National Soil Information System (NASIS) database with selection criteria developed by the National Technical Committee for Hydric Soils. These criteria are selected soil properties that are documented in Soil Taxonomy (Soil Survey Staff, 1999) and were designed

primarily to generate a list of potentially hydric soils from the National Soil Information System (NASIS) database.

The national list of hydric soils is maintained in a computer file and is updated yearly. The most current national electronic list of hydric soils may be obtained directly from this website. State lists of hydric soils are also available electronically from this site or as hardcopy from the NRCS Conservationist for the State of New Jersey. The NRCS also maintains lists of map units that contain, or may, in some delineations, contain hydric soils. Detailed lists are available by contacting the NRCS Conservationist for the State of New Jersey and are recommended for preliminary use only in making wetland determinations. Field Indicators must be used for all on-site determinations of hydric soils.

F.5 Alluvial Soils

The most recent Holocene sediments in Bergen County are stream alluvium, freshwater marsh and swamp deposits, and tidal marsh sediments. The alluvial sediments are sandy and gravelly material eroded from the glacial drift redeposited on flood plains along the stream valleys. Recent alluvial sediments consist of material that eroded from the glacial outwash and lakebed sediments and was redeposited in the flood plains along stream valleys. Some areas of remnant lakes and ponds were filled in with organic material and mineral sediments. Carlisle soils formed in these highly organic materials.[10] A natural sandbar that developed in Pascack Brook, dubbed "Paradise Island" (Block 1303, Lot 25), is a prime example of alluvial soil located in Hillsdale.

F.6 Permeability

The NJDEP Provides a variety of guidance for determining soil permeability, including to assist with management of stormwater infiltration (e.g., Appendix E of "NJ Stormwater BMP Manual," September 2009).[11] Qualitative differences in soil permeability are described above in the Section F.2 of this chapter.

F.7 Erodibility

Sediment is a common term for eroded soil, which is the most massive pollutant of surface waters. Growing populations and standards of living have resulted in construction of more houses, shopping centers, highways, waterways, and other facilities that involve clearing of vegetation and massive movement of soil. These

activities expose the soil directly to the erosive actions of rain and flowing water. As a result, an enormous amount of soil is lost from these sites causing high turbidity to the water that carries it and damaging the site where it is finally deposited. The 'Universal Soil Loss Equation,' commonly known as the USLE, is used to estimate erosion rates and evaluating various conservation practices for controlling erosion and sedimentation (deposition).[12] Hillsdale is mostly an already built-out community. While specific construction project issues may arise, specific information regarding erosion issues was not identified. A further generic discussion of this topic follows.[13]

The determination of soil erosion and sedimentation ('erodibility') by water are complex processes. Soil erosion and sedimentation by water include detachment from the soil mass, transport downslope, and subsequent deposition. Soil is detached by raindrop impact and runoff shear forces, but human activities that loosen and pulverize soil often promote accelerated erosion. Downslope transportation of eroding soil particles is primarily by channelized runoff.

Three distinct forms of erosion are generally seen in the upland areas: Sheet erosion; Rill erosion; and Gully erosion.

Sheet erosion, also known as interrill erosion, takes place uniformly between rills or gullies. Sheet erosion results primarily from raindrop impact. The erosive potential of rain depends on its raindrop size, fall velocity and total mass at impact. Unless the soil surface is protected against raindrop impact by vegetation, mulches, or other cover, these raindrops can detach great quantities of soil and cause serious unnoticed interrill erosion.

Rill erosion is much more noticeable than interrill erosion. It is primarily the result of soil detachment by concentrated runoff, it causes intensive soil movement from a limited part of the land surface. Rills, which are small channels that can be easily smoothed, may first develop due to topographic variations, tillage marks, or random irregularities on the land surface. Rills carry both runoff from interrill areas and the rain that falls directly on them. Rill erosion increases rapidly as the slope steepens or lengthens and runoff rate increases.

Gully erosion is massive removal of soil by large concentrations of runoff. Gullies often start as rills and enlarge until they cannot be crossed by vehicles such as

trucks and tractors. If permitted to form, gullies may yield tremendous volumes of sediment.

The quantity and size of material transported is the result of runoff velocity and turbulence, and these increase as the slope steepens and the flow increases. The larger the eroding material, the greater must be the flow velocity and turbulence to transport it. When the velocity or turbulence decreases, some of the eroded sediment may deposit. The largest and densest particles settle first while the finer particles are carried farther downslope or downstream.

F.8 Interpretations for Use/Limitations

a. Septic – Historically, sewage disposal in Hillsdale was by individual on-site septic systems. Since 1967 all sewer waste from Hillsdale is collected and directed to the Bergen County Utilities Authority ("BCUA"). Trunk sewers collect and convey the waste to the BCUA treatment plant in Little Ferry, where it is discharged to the Hackensack River following treatment.[14] While specific construction project issues may arise, specific information regarding sewage disposal via septic system in the Borough of Hillsdale was not identified.

b. Lawns and Landscaping – The initial "Overview" section of this chapter contains information of possible interest regarding local garden soil testing for relevant factors by the Rutgers Soil Testing Lab. While specific construction project issues may arise, information regarding lawns and landscaping in the Borough of Hillsdale was not identified.

c. Local Roads and Streets - While specific construction project issues may arise, information regarding unusual road and street issues in the Borough of Hillsdale was not identified.

d. Foundations - While specific construction project issues may arise, information regarding unusual general foundation issues within Hillsdale was not identified.

F.9 NJ Department of Agriculture Soils Classifications

Soil classifications are described above in the Section F.2 of this chapter.

[END OF NARRATIVE PORTION OF THIS SECTION]

[1] Soil Survey of Bergen County New Jersey, U.S. Department of Agriculture, Soil Conservation Service, March 1995, p. 3.
[2] https://njaes.rutgers.edu/soil-testing-lab/how-to.php, accessed 2/15/2021.
[3] "2003 Master Plan, Borough of Hillsdale, Bergen County,' by C.P. Statile, PA, Revised December 16, 2003.
[4] https://prd-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/styles/full_width/public/thumbnails/image/wss-cycle-groundwater-basic-diagram.jpg, accessed 2/11/2021.
[5] https://www.usgs.gov/faqs/how-can-i-find-depth-water-table-a-specific-location?qt-news_science_products=0#qt-news_science_products, accessed 2/11/2021.
[6] https://maps.waterdata.usgs.gov/mapper/index.html, accessed 2/11/2021.
[7] https://cida.usgs.gov/ngwmn/index.jsp, accessed 2/11/2021.
[8] Data primarily from Table 1 of "Remedial Investigation Report, Alexander Cleaners Site, 137 Broadway, Hillsdale Borough, Bergen County, New Jersey, Program Interest No. 015123, July 2016, H2M Architects and Engineers, Prepared for the NJDEP.
[9] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961, accessed 2/11/2021.
[10] Soil Survey of Bergen County New Jersey, U.S. Department of Agriculture, Soil Conservation Service, March 1995, pp. 3 and 73.
[11] https://www.nj.gov/dep/stormwater/bmp_manual/appendix_e_soil_testing_criteria.pdf
[12] The Standards for Soil Erosion and Sediment Control in New Jersey, The New Jersey Department of Agriculture, State Soil Conservation Committee, 7th Edition, January 2014, Revised July 2017.
[13] The Standards for Soil Erosion and Sediment Control in New Jersey, The New Jersey Department of Agriculture, State Soil Conservation Committee, 7th Edition, January 2014, Revised July 2017.
[14] "2003 Master Plan, Borough of Hillsdale, Bergen County,' by C.P. Statile, PA, Revised December 16, 2003. Page U 1.

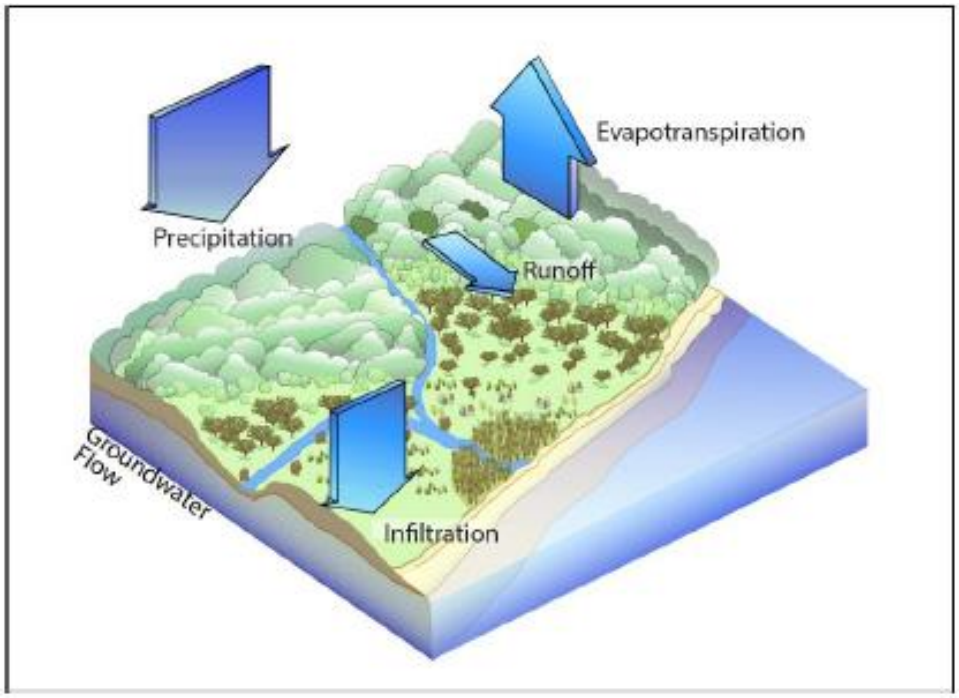
G. Hydrology

Version 1: Prepared by Fred N. Rubel, M.S., QEP, Member, Hillsdale Environmental Commission. Last updated, March 18, 2022. Please contact the Hillsdale Environmental Commission to offer any suggested corrections/changes.

Overview

Water is everywhere on earth - - almost. It is in the atmosphere in the form of water vapor, and is sometimes visible in the form of clouds, rain, snow, or hail. Water is present in our streams, rivers and lakes. It is in the ground, in mountain snows, in the oceans, and a great deal of it is locked up in the earth's polar ice caps. When it is absent, we begin to recognize that - - as a desert or a drought. Rarely do we consider that all the water in the world is part of a cycle - - but it is. The hydrologic cycle refers to the constant movement of water above, on, and below the earth's surface in a never-ending cycle. The hydrologic cycle can be seen as rain falls to the land surface. Some evaporates, some sinks into the soil, and some runs off into surface-water bodies such as lakes, rivers, and the ocean (see "Overview" figure, below). Rain that falls on land evaporates, or runs off. Water that soaks into the soil may find its way down to the water table - the top of the saturated zone beneath the ground's surface. This is called infiltration. Once it reaches the water table, the water is called groundwater. Groundwater either moves through the shallow part of the ground (horizontally near the ground's surface as interflow) and discharges to a surface water body - a stream, a lake, or the ocean - or continues to flow downward to other, deeper water-saturated zones called aquifers. When precipitation runs over the land's surface and into stream channels, this is called overland flow or runoff. Overland flow also occurs when rainfall exceeds the infiltration capacity - the rate at which water can be absorbed by the soil. The water in a stream can be derived from direct precipitation, overland flow, and in some cases, groundwater discharge. Evaporation takes place at the surface of streams, lakes, and the ocean, and on the land surface, returning water to the atmosphere. Vegetation draws water up through its root systems and returns much of it to the atmosphere (transpiration). Evaporated and transpired water (evapotranspiration) condenses, forms clouds and

ultimately returns to the ground in the form of precipitation to continue the hydrologic cycle.[1]



Overview of The Hydrologic Cycle[2]

The vast majority of the water supply in Hilldale is provided by Suez Water of North America. Few residences obtain their water supply from beneath the ground on their property, pumped for their use through their private wells.

Suez derives its water through its co-ownership of the Wanaque South project with NJDWSC, the Suez Water system (previously United Water New Jersey-UWNJ) consists of four reservoirs in the Hackensack River Basin, four surface water diversions (the Wanaque-South project and intakes on the Saddle River, Hirschfeld Brook and Sparkill Creek), and a series of groundwater wells. The combined storage of the four reservoirs is approximately 13.9 billion gallons. The total safe yield of this water supply system is 126.5 million gallons per day.[3]

G.1 Groundwater

Groundwater is a component of the hydrologic cycle, and it turns out that a vast amount of water is present below ground. Groundwater is not usually seen, but it is nevertheless present and constantly moving beneath the ground. Groundwater is a major contributor to flow in many streams and rivers, and has a strong influence on

river and wetland habitats for plants and animals. People have been using groundwater for thousands of years and continue to use it today, largely for drinking water and irrigation.[4]

1. **Aquifers** – Much of Bergen County, including Hillsdale, is situated above what is called the Newark Basin Aquifer.[5]
2. **Direction and Rate of Groundwater Movement** – Because there is not a predominant use of groundwater in the Borough, there is no central point where the dominant direction and rate of flow of groundwater is monitored in Hillsdale. Geology, topography and types of groundcover can vary substantially from point to point. While the direction of groundwater flow can generally be expected to be consistent with the trajectory of surface water movement, actual direction and rate of groundwater flow can be highly location-specific, and may vary from the expected general direction.
3. **Groundwater Recharge Areas and Rates** – With the use of groundwater not being dominant to the area, studies of groundwater recharge and rates have not been reported for Hillsdale.
4. **Prime Groundwater Recharge Areas** – For the reason explained above, prime groundwater recharge areas have not been established in Hillsdale.
5. **Depth to Groundwater** – The U.S. Geological service does not have any groundwater level monitoring stations within Bergen County that provide ongoing data on the depth to groundwater.[6] A limited amount of site-specific information on the depth to groundwater is contained in Section F.3 of this Environmental Resource Inventory in connection with well monitoring at the Alexander Cleaners contamination site. In the past, the Borough maintained four groundwater monitoring wells at Centennial Field, which was the Borough's sanitary landfill until 1987.[7]
6. **Public Community and Non-Community Wellhead Protection Areas** – A Well Head Protection Area ("WHPA") in New Jersey is an area modeled around an unconfined Public Community Water Supply ("PCWS") well that delineates the horizontal extent of groundwater captured by a well pumping at a specific rate over two-, five- and twelve-year periods of time *for unconfined wells*. It also can be defined as a fifty foot radius around each *confined* PCWS well, which corresponds to the 'water purveyor controlled wellhead area' definition in New Jersey's Safe Drinking Water Regulations [N.J.A.C. 7:10-11.7(b)1]. The WHPA delineations are derived from the Federal Safe Drinking Water Act Amendments of 1986 and 1996, as part of its Source Water Area Protection Program (SWAP). Determination of a

WHPA is the first step in defining and protecting sources of water for a public supply well. Within the boundaries of these areas potential contamination will be assessed and appropriate monitoring will be undertaken in subsequent phases. Due to security consideration, PCWS well features are not available for direct download but may be requested from the New Jersey Department of Environmental Protection ("NJDEP").[8] While there are a number of privately owned individual water supply wells in Hillsdale, there are no public community water supply wells located in Hillsdale. A single, small Tier 1 Well Head Protection Area designated by the State, is located within the Borough. This area is limited to vacant, wooded lands immediately below the Woodcliff Lake Dam which are owned by Suez of North America, and does not have the potential for development.[9]

7. **Areas Served by Individual Onsite Wells** – As indicated above, a small number of properties in Hillsdale (approximately 30) rely on individual wells for their water supply. This includes properties located by: Beechwood Drive, Brook Place, Buff Lane, Center Drive, Coles Crossing, Craig Road, Douglas Avenue, Glen Hook Road, Glendale Drive, Hazelwood Avenue, Homestead Avenue, Horizon Terrace, Maple Avenue, Mellville Road, Park Avenue, Riverdale Avenue, Sebastian Court, Sierra Court, Steven Avenue, Sycamore Avenue, and Wierimus Road.[10]
8. **Groundwater Quality, Including Known Contaminated Sites and Remediation Areas** – An area of groundwater localized around the former Alexander Cleaners store at 137 Broadway at the corner of Orchard Street, has been contaminated by dry cleaner fluid, perchloroethylene. A more complete discussion of this is contained in Section "M" of this Environmental Resource Inventory ("Contaminated Sites and Sources of Pollution").
9. **Permitted Groundwater Discharges** – It is hoped that additional information on this topic will be added to this Environmental Resource Inventory over time.
10. **Areas Served by Individual Onsite Septic Systems** – Publicly-owned sewage conveyances and treatment has been in place in Hillsdale for many years (since the late 1960's) which is expected to have eliminated the use of any onsite septic systems.

G.2 Surface Water – For technical and managerial reasons the NJDEP divides the state of New Jersey into five (5) water regions: the Northeast, the Raritan, the Northwest, the Lower Delaware, and the Atlantic Coastal water region (see Figure G.2, below). These are then further subdivided, as shown.

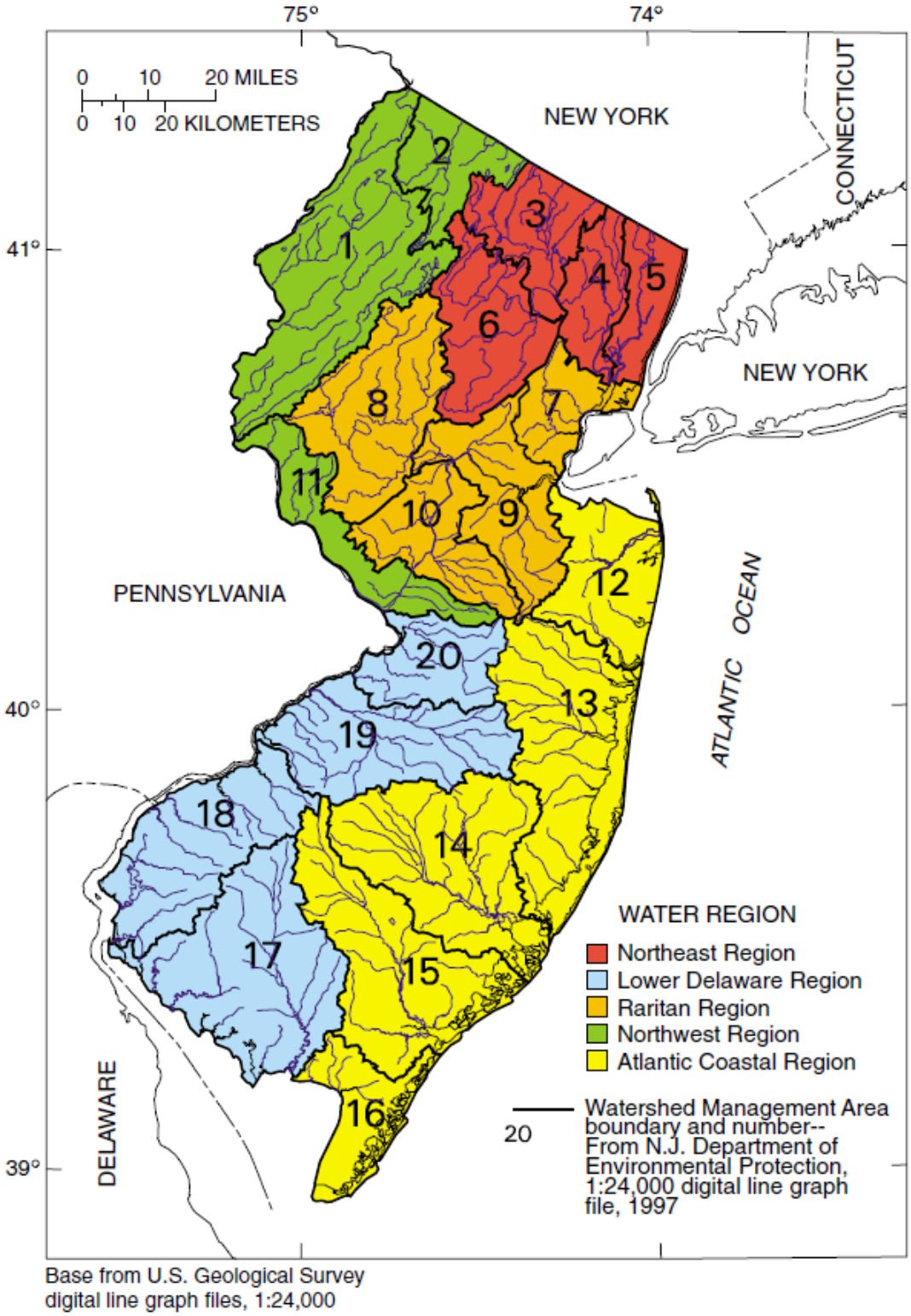


Figure G.2 - The Water Regions of New Jersey[11]

Figure G.2, above, shows that each water region is divided into three to five "watershed-management areas," each of which encompasses a particular group of major rivers. Each watershed management area consists of many smaller watersheds. The following pertains specifically to the surface waters of Hillsdale.

1. Types, Locations and Names of Surface Waters – Surface water bodies within the Borough of Hillsdale are shown in Figure G.2.a, below, and include:

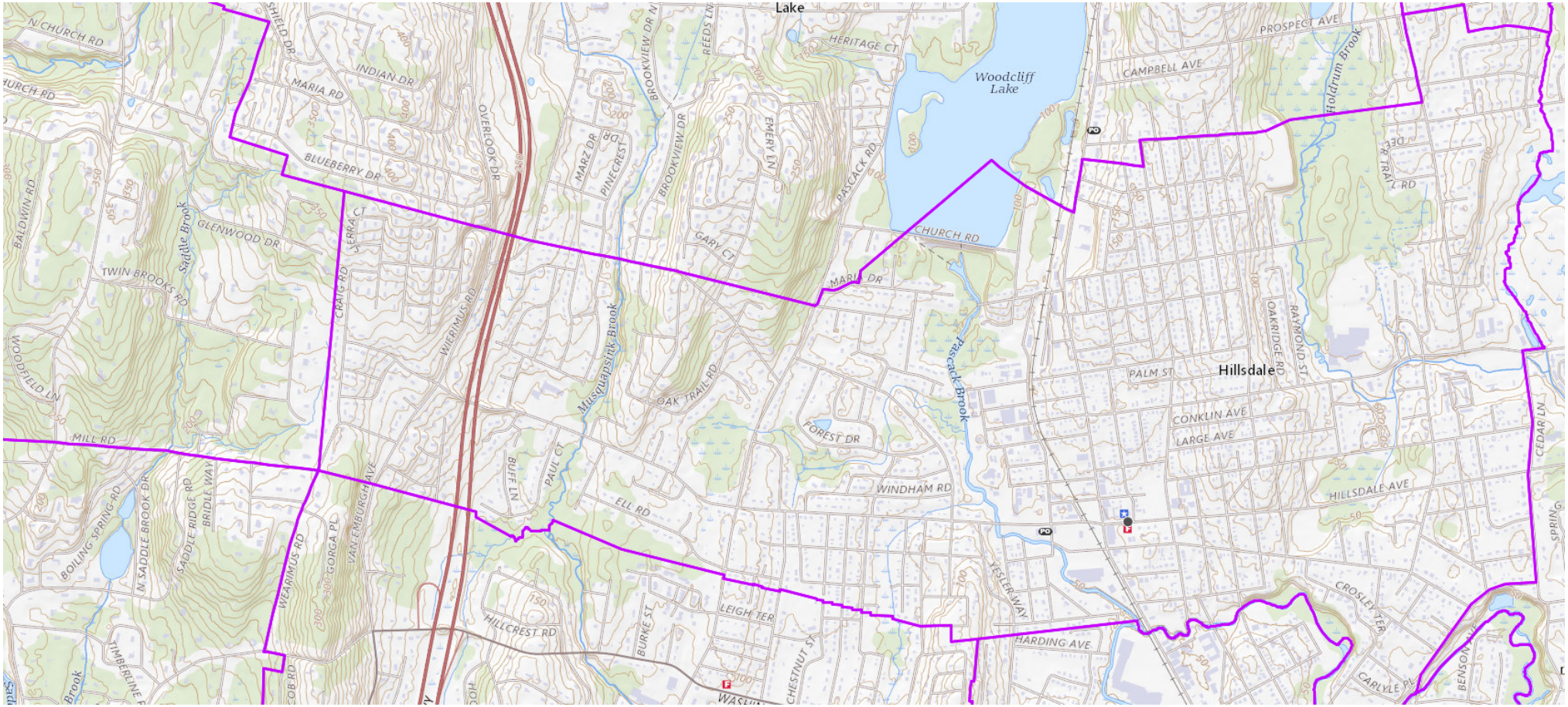
Woodcliff Lake Reservoir – The Woodcliff Lake reservoir is primarily in Woodcliff Lake, with the southern end of the reservoir extending into Hillsdale near Hillsdale's northwest border. The reservoir is impounded by an earthen dam with a cement core. Bascule gates control the water surface elevation and storage volume. The Hillsdale portion of the reservoir is located north of Church Road and west of Reservoir Road. The Reservoir is owned and operated by Suez Water of North America, and its waters are classified as **FW2-NT(C1),** HUC 020301031700010[12] (see below for an explanation of water quality classification). It is hoped that over time, additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

Pascack Brook – Pascack Brook is a tributary to the Hackensack River. It is fed by runoff from the Woodcliff Lake reservoir north of Hillsdale. Its waters are classified as **FW2-NT(C1)**, HUC 02030103170010. Pascack Brook flows east along and then crosses beneath Hillsdale Avenue where it passes by the Hillsdale Public Library, and crosses beneath the Paterson Street Bridge and continues on into Westwood. A water flow monitoring station for the Pascack Brook exists in Park Ridge.[13] The Friends of Pascack Brook, Incorporated (Westwood), sponsors annual springtime fishing contests in the brook, and includes the Hillsdale portion of the Brook that is seasonally stocked with trout by the NJDEP. It is hoped that over time, additional information regarding Pascack Brook will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

Hillsdale Brook – This stream is located by Hillsdale House, off Piermont Ave. Its water quality designation is **FW2-NT(C1)**, HUC 02030103170030. It is located generally within the Glen Dale County Park, flowing southeasterly into River Vale Township.[14] It is hoped that in the future, additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

NJ Floodmapper

Figure G.2.a. Streams and Waterways of Hillsdale



Musquapsink Brook – The Musquapsink Brook, which has a water quality designation of **FW2-NT(C1)**, HUC 02030103170010, flows south, and runs by the Ann Blanche School. From its headwaters in the Borough of Woodcliff Lake, it is about 7.3 river miles to its confluence with Pascack Brook of which it is a tributary at the border of Westwood and River Vale. Its watershed is predominantly classified as "urbanized," presenting a concern for degradation of stream health, and threatening the "Category One" waters into which it flows.[15] The largest surface water body in the drainage area is Schlegel Lake, in Washington Township (27.0 acres).[16] From Schlegel Lake it continues until its flow enters the Oradell Reservoir - - which provides drinking water for an estimated 800,000 residents of Bergen and Hudson counties. A map of the Musquapsink Brook watershed was prepared as part of a 2012 watershed restoration and protection plan and is provided on the next page as Figure G.2.b. It is hoped that over time, additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

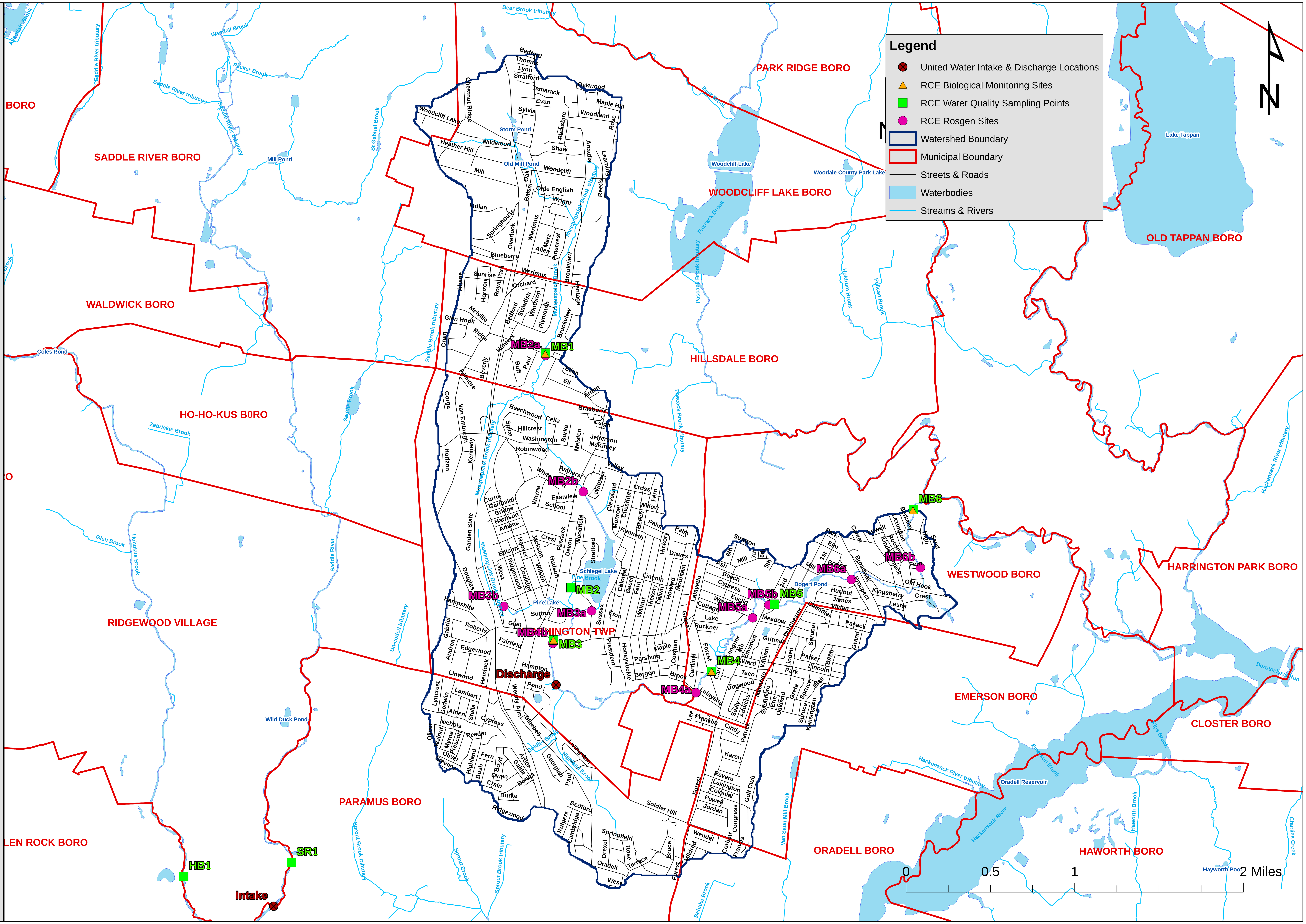
Tandy Brook – Located by Forest Drive, east of Pascack Road, Tandy Brook is a small drainage stream located in Hillsdale that flows into Pascack Brook. It is hoped that over time, additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

Holdrum Brook – Holdrum Brook is located by the Stonybrook Swim Club. It has been designated **FW2-NT(C1)**, HUC 02030103170030. Holdrum Brook runs southerly along the extreme eastern boundary of the Borough, generally through the golf course and senior citizens housing complex.[17] It is hoped that over time, additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

2. Direction of Flow – The flow of surface waters within the Borough of Hillsdale is generally to the east and to the south, which is consistent with the general topography of the area.

3. **Watershed (HUC 11) and Subwatershed (HUC 14) Boundaries** – Hillsdale lies in the Northeast Water Region, (Region 5) watershed (see Figure G.2, above).

Musquapsink Brook Watershed Restoration & Protection Plan: OVERVIEW MAP



4. Surface Water Quality Standards (Especially C1, FW1, FW2, etc.) – Surface waters with a "**C1**" classification are to be protected from any measurable change in water quality because of their exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources. Surface waters designated with a **"FW1"** designation are also known as nondegradation waters are set aside for posterity because of their unique ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources. Nondegradation waters are not to be subject to any manmade wastewater discharges. Activities that might alter existing water quality in **FW1** waters are prohibited.[18] There are no waters designated **FW1** in Hillsdale. Musquapsink Brook, however, a tributary to the Pascack Brook, is classified as "**FW2-NT(C1)**." "**FW2**" refers to freshwater bodies that are used for primary and secondary contact recreation; industrial and agricultural water supply; maintenance, migration, and propagation of natural and established biota; public potable water supply after conventional filtration treatment and disinfection; and any other reasonable uses. "**NT**" is a designation for freshwaters that are not suitable for trout production or trout maintenance due to their physical, chemical, or biological characteristics. "**NT**" streams may support other fish species. The "**C1**" designation is for protection from measurable changes in water quality based on exceptional water supply significance as a tributary to the Oradell Reservoir, a significant water supply.[19]

5. Regulated Riparian Buffers – Riparian buffers are lands and vegetation within and adjacent to a regulated water, with the exception of man-made lagoons, stormwater management basin, or oceanfront barrier islands, spits or peninsulas along the Atlantic Ocean. Riparian buffers are undeveloped areas adjacent to streams that are either within the 100-year floodplain, contain hydric soils, contain streamside wetlands and associated transition areas, or are within a 150-foot or 300-foot wildlife passage corridor on both sides of a stream. Riparian buffers are important natural filters of stormwater runoff that protect aquatic environments from excessive sedimentation, pollutants, and erosion, and provide shelter, food, and shade for many aquatic animals, which is important to stream temperature.

Because the streams within the Musquapsink Brook Watershed are designated as "C1," New Jersey regulations require a 300 foot buffer on either side of the waterway. Approximately 1,444 acres of land are designated as riparian area in the Musquapsink Brook Watershed using the 300 foot buffer rule. Riparian zones are instrumental in water quality improvement for both surface runoff and water flowing into streams through subsurface or groundwater flow. The decrease of riparian areas in the Musquapsink Brook Watershed due to urbanization has contributed to poor surface water quality conditions and increased streambank erosion.[20]

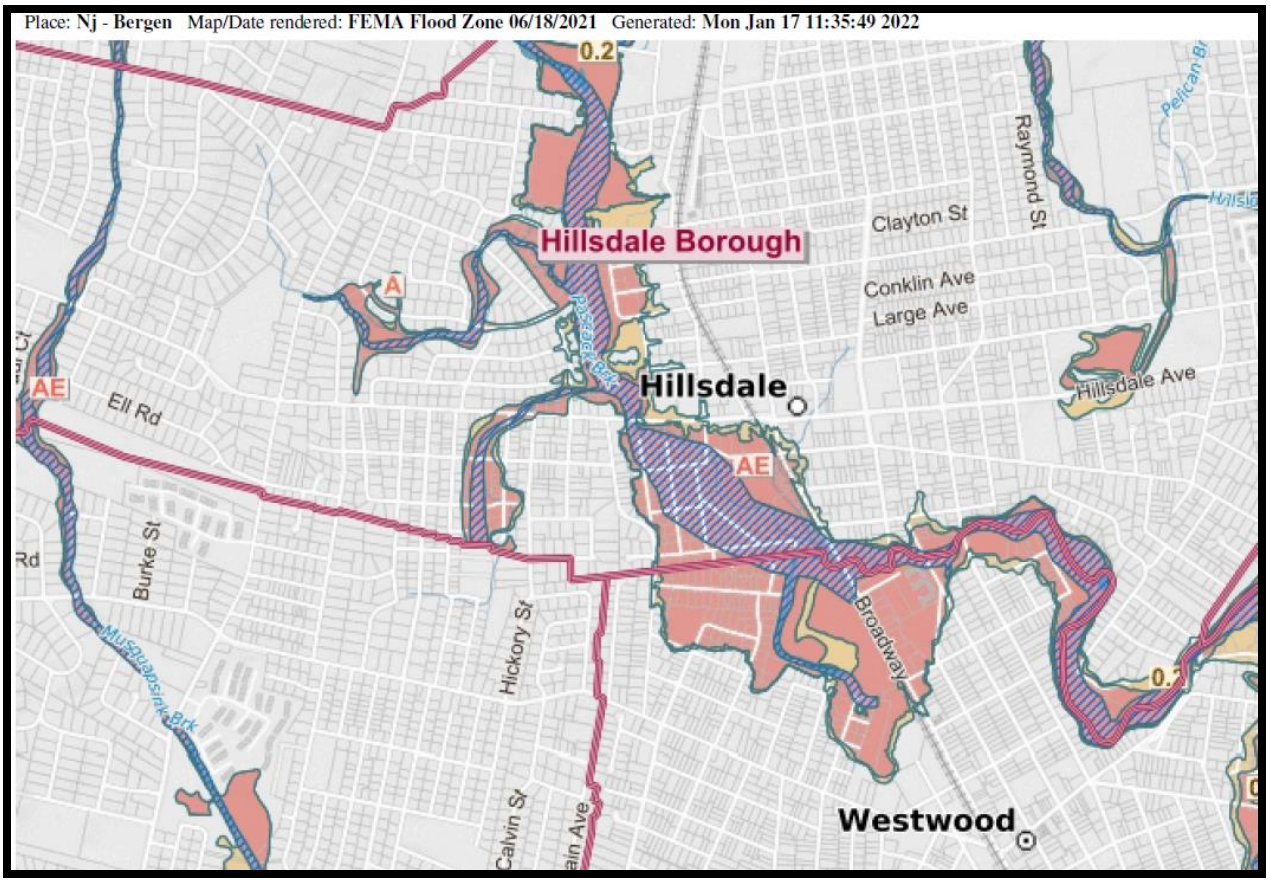
6. **Regulated Flood Hazard Areas (NJDEP, FEMA)** – The Federal Emergency Management Agency (FEMA), creates and periodically updates insurance rate maps that identify properties within various flood zones. A generalized ("Propertyshark") flood map for Hillsdale is included here (see Figure G.6, below).

In August of 2019 FEMA issued new or revised Flood Insurance Rate Map (FIRM) panels for Hillsdale. A copy of that letter is attached here lists Letter of Map Change (LOMC) actions [i.e.. Letters of Map Amendment (LOMAs) and Letters of Map Revision based on Fill (LOMR-Fs)] for properties/structures in Hillsdale as of that date.

7. **Wetlands** – Wetlands are commonly referred to as swamps, marshes, or bogs. Many wetlands in New Jersey do not fit this description. Previously considered land that is useless other than for filling in or disposal, wetlands are now recognized as having vital ecological and socioeconomic value, such as by:[21]

- Protection of drinking water by filtering out chemicals, pollutants, and sediments that would otherwise clog and contaminate our waters.
- Soaking up runoff from heavy rains and snow melts, providing natural flood control. Wetlands release stored flood waters to streams during droughts.
- Providing critical habitat for a major portion of the State's fish and wildlife, including endangered, commercial and recreational species.
- Providing high quality open space for recreation and tourism.

FIGURE G.6 Generalized Flood Map - Hillsdale (Source: Property Shark)



Federal Emergency Management Agency

Washington, D.C. 20472

RECEIVED
AUG 23 2019
MUNICIPAL CLERK

AUG 2 1 2019

The Honorable John Ruocco
Mayor, Borough of Hillsdale
380 Hillsdale Avenue
Hillsdale, New Jersey 07642

Case No: 16-02-0443V
Community: Borough of Hillsdale, Bergen County, New Jersey
Community No.: 340043
Effective Date: August 29, 2019
LOMC-VALID

Dear Mayor Ruocco:

On August 28, 2019, the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issued new or revised Flood Insurance Rate Map (FIRM) panels within your community. This letter identifies the Letter of Map Change (LOMC) actions [i.e., Letters of Map Amendment (LOMAs) and Letters of Map Revision-based on Fill (LOMR-Fs)] for properties and/or structures located in your community that are still valid as of the effective date shown above. Any revalidation letters previously issued for your community have been superseded as of the effective date listed above.

All effective LOMCs within your community have been reviewed, including LOMCs located in areas not revised during this FIRM update. LOMAs and LOMR-Fs for which the original determination has not been superseded by new or revised information will remain in effect until superseded by a subsequent LOMC or by a revision to the FIRM panel on which the property and/or structure is located.

The enclosed table lists the FEMA case number, issue date, project identifier, and FIRM panel number for the LOMCs revalidated by this letter. Please refer to the original determination document to obtain the details of the outcome for the properties and/or structures included in the determination (such as flood zone, base flood elevations, property elevations, etc).

Letters of Map Revision (LOMRs) previously issued for FIRM panels that were revised by the recent map update for your community have either been incorporated into the revised FIRM or have been superseded by the revised FIRM. LOMRs issued for FIRM panels that were not revised by the recent map update for your community are not included on the enclosed table and will remain in effect until superseded by a revision to that FIRM panel.

If there is a LOMC not on the enclosed list that you feel should have been revalidated, we encourage you to submit the LOMC for re-determination. When requesting a re-determination, we ask that a cover letter be sent along with a copy of the original determination letter to: LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Re-determinations may also be requested online at https://www.fema.gov/online-lomc.

Because these revalidated LOMCs will not be reprinted or distributed to primary map users, such as local insurance agents and mortgage lenders, your community will serve as a repository for this information. We encourage you to disseminate the information reflected by this LOMC-VALID letter throughout your community so that interested persons, such as property owners, local insurance agents, and mortgage lenders, may benefit from the information.

Copies of previously issued LOMCs, if needed, may be obtained from your community's map repository, FEMA's Map Service Center website located at https://msc.fema.gov, or by contacting the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA-MAP (1-877-336-2627).

For additional information or questions relating to LOMCs not listed on the enclosed table, or mapping in general, please contact the FMIX at the number provided above.

Sincerely,

Luis V. Rodriguez, P.E., Director
Engineering and Modeling Division
Federal Insurance and Mitigation Administration

cc: LOMC Subscription Service Subscribers
Community Map Repository
Michelle E. Wood, Construction Official, Borough of Hillsdale

REVALIDATED LETTERS OF MAP CHANGE FOR THE BOROUGH OF HILLSDALE, NJ

Case No: 16-02-0443V **Community No.: 340043**

August 29, 2019

Case No.	Date Issued	Identifier	FIRM Panel Number
NJ 1423	1/12/1996	LOT 1101, LOT1-530 HILLSDALE AVENUE	34003C0093H
03-02-1684A	8/28/2003	LOTS 17 THROUGH 20, BLOCK 27, HILLSDALE MANOR -- 324 SAINT MARY STREET	34003C0093H
05-02-0073A	2/2/2005	IMPERIAL ESTATES SECTION 2B, BLOCK 909, LOT 12 -- 70 QUEEN COURT	34003C0093H
05-02-0084A	2/23/2005	IMPERIAL ESTATES SECTION 2B, BLOCK 909, TAX LOT 11 -- 74 QUEENS COURT	34003C0093H
05-02-0841A	10/27/2005	40 FERNWOOD AVENUE -- TAX BLOCK 715, LOT 15	34003C0093H
06-02-B270A	5/18/2006	BLOCK 1305, LOT 7 -- 10 MAGNOLIA AVENUE	34003C0181H
06-02-B434A	5/31/2006	BLOCK 903, LOT 13 -- 16 SHERWOOD DRIVE	34003C0093H
06-02-B649A	9/12/2006	BLOCK 903, LOT 21 -- 208 FOREST DRIVE	34003C0093H
07-02-0326A	3/29/2007	BLOCK 905, LOT 19 -- 94 FOREST DRIVE	34003C0093H
07-02-0527A	5/17/2007	BLOCK 909, LOT 10 -- 78 QUEEN COURT	34003C0093H
08-02-0284A	1/29/2008	BLOCK 1101, LOT 5 -- 450 HILLSDALE AVENUE	34003C0093H
09-02-0237A	12/23/2008	LOT 3, BLOCK 8-07, SECTION 2, SADDLEWOOD HILLS -- 12 SHERWOOD DRIVE	34003C0093H
09-02-1093A	8/27/2009	BLOCK 714, LOTS 1 & 2 -- 52 BEECH STREET	34003C0093H
10-02-0684A	3/12/2010	LOT 1, BLOCK 8-07, SECTION 2, SADDLE WOOD HILLS -- 172 FOREST DRIVE	34003C0093H
10-02-1518X	5/28/2010	LOT 7, BLOCK B, HILLSDALE -- 434 HILLSDALE AVENUE	34003C0093H
10-02-1174A	7/13/2010	LOT 7 BLOCK 808 - 224 SADDLEWOOD DRIVE	34003C0093H
10-02-2322A	11/18/2010	LOT 19, BLOCK 908, SECTION 2B, IMPERIAL ESTATES -- 5 PAWN PLACE	34003C0093H
11-02-1944A	6/16/2011	LOT 18, BLOCK 176H, COUNTRY VIEW ESTATES -- 159 PIERMONT AVENUE	34003C0094H
12-02-1541A	8/22/2012	182 FOREST DRIVE	34003C0093H
13-02-1525A	7/30/2013	GLENVIEW, BLOCK 4-04, LOT 3 -- 43 HILLSDALE COURT	34003C0089H

REVALIDATED LETTERS OF MAP CHANGE FOR THE BOROUGH OF HILLSDALE, NJ

Case No: 16-02-0443V **Community No.: 340043**

August 29, 2019

Case No.	Date Issued	Identifier	FIRM Panel Number
13-02-2006A	11/21/2013	SADDLEWOOD HILLS, SECTION 3, LOT 10 -- 157 WINDHAM ROAD	34003C0093H
14-02-1667A	6/2/2014	LOT 18, BLOCK 908/2B, IMPERIAL ESTATES SUBDIVISION - 81 QUEEN COURT	34003C0093H
14-02-2178A	8/13/2014	LOT 17, BLOCK 908/2B, IMPERIAL ESTATES SUBDIVISION - 85 QUEEN COURT	34003C0093H
15-02-1745A	9/16/2015	GLEN-VIEW, BLOCK 4-04, LOT 4 -- 33 HILLSDALE COURT	34003C0089H
16-02-0212A	12/4/2015	943 HILLSDALE AVENUE	34003C0089H
16-02-0245A	12/4/2015	BRIARWOOD AND GLEN ESTATES, LOT 6 -- 10 FERNWOOD AVENUE	34003C0093H
17-02-0096A	11/16/2016	BEAVER TRAIL ESTATES, SECTION 1, BLOCK 902, LOT 58 -- 93 QUEEN COURT	34003C0093H
17-02-0627A	1/30/2017	MAP NO. 2, ELLEN PATERSON, BLOCK E, LOTS 31-32 -- 21 NEW STREET	34003C0093H

Until the 1970's and 1980's the value of wetlands were not generally appreciated. By then more than half of the nation's wetlands were destroyed. Even today, the value of wetlands continues to be inadequately recognized, and appreciated.

Wetlands may appear dry for much of the year, but be wet in the spring or during storm events. To determine what is and what is not wetlands, the New Jersey Department of Environmental Protection ("NJDEP") requires that the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands be used to determine the presence and extent of freshwater wetlands.[22] The 1989 Federal manual uses a three parameter approach and requires that a wetland include hydric soils, wetland hydrology, and hydrophytic vegetation. Detailed information regarding this, including exceptions to this approach, are contained in the 1989 Federal Manual. Details on delineating freshwater wetlands in NJ can be found on our Delineating Freshwater Wetlands webpage.

A "Letter of Interpretation" or "LOI" means a document "...issued by the Department under N.J.A.C.7:7A-4, indicating the presence or absence of wetlands, State open waters, or transition areas; verifying or delineating the boundaries of freshwater wetlands, State open waters, and/or transition areas; or assigning a wetland a resource value classification."

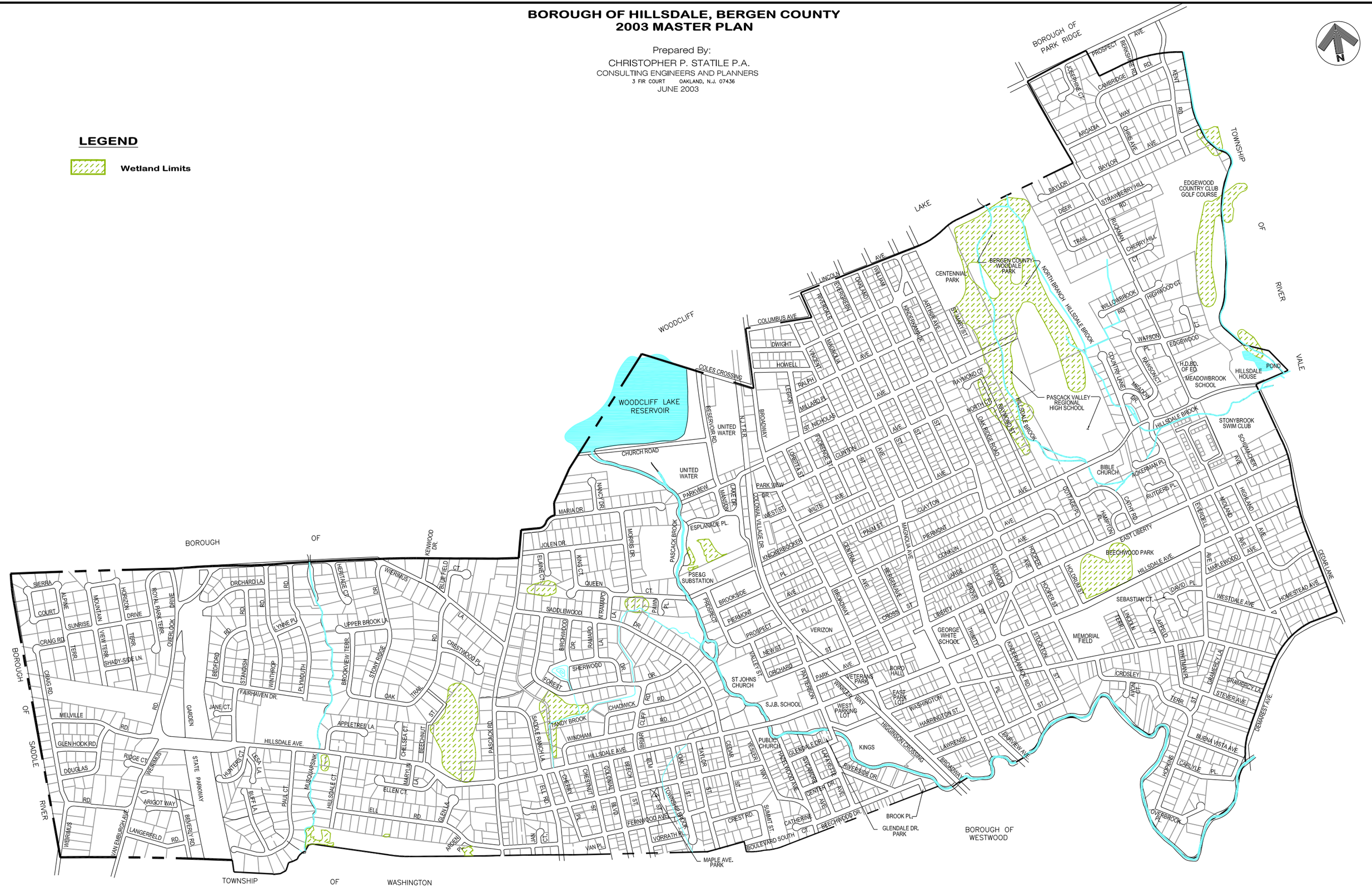
a. **Identifying Vegetation, Soils, Hydrology** – Refer to "Section F" of this document for information on soils in Hillsdale. It is hoped that over time, additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.
b. **Types: Saltwater, Freshwater, Vernal Pools, Engineered** – Hillsdale has no saltwater wetlands. Several locations in Hillsdale have been identified as freshwater wetlands habitat and protected buffer (see "Freshwater Wetlands" figure below from the 2003 Hillsdale Master Plan), including within the nine (9) undeveloped acres[23] ("Tandy Woods") adjoining the Tandy-Allen residential development north of Hillsdale Avenue.
c. **Resource Value: Exceptional, Intermediate, Ordinary** – Section H of this document indicates that two locations in Hillsdale may be vernal pools, a type of wetland of exceptional value. One is located in the Tandy-Allen Woods near Pascack Road off Hillsdale Avenue, and a second is located in a portion of Wood Dale Park, off Lincoln Ave., by Ruckman Road near Piermont Avenue. It is hoped that additional information will be developed and added to this section of Hillsdale's Environmental Resource Inventory.

BOROUGH OF HILLSDALE, BERGEN COUNTY
2003 MASTER PLAN

Prepared By:
CHRISTOPHER P. STATILE P.A.
CONSULTING ENGINEERS AND PLANNERS
3 FIR COURT OAKLAND, N.J. 07436
JUNE 2003

LEGEND

Wetland Limits



SOURCE: U.S.C.O.E. FRESHWATER WETLANDS NATIONAL INVENTORY MAP

FRESHWATER WETLANDS MAP

8. **Percent Impervious Cover** – Hillsdale is fairly densely populated and developed. As a result a substantial percentage overall of impervious cover exists.

9. **Intakes and Outfalls** – Beyond the structures associated with the Woodcliff lake Reservoir and numerous stormwater discharge outfalls, there are no significant water intakes or outfalls known to be present that are associated with surfaces waters that pass through Hillsdale.

10. **Discharges** – As indicated above, beyond the numerous stormwater discharges, there are no known significant outfalls that directly discharge wastewater to the surfaces waters that pass through Hillsdale.

11. **Dams and Weirs** – Woodcliff Lake is a dammed impoundment along Pascack Brook. A portion of this dammed reservoir is located in Hillsdale. The reservoir has a drainage area of 19.4 square miles and storage capacity of 0.871 billion gallons.[24]

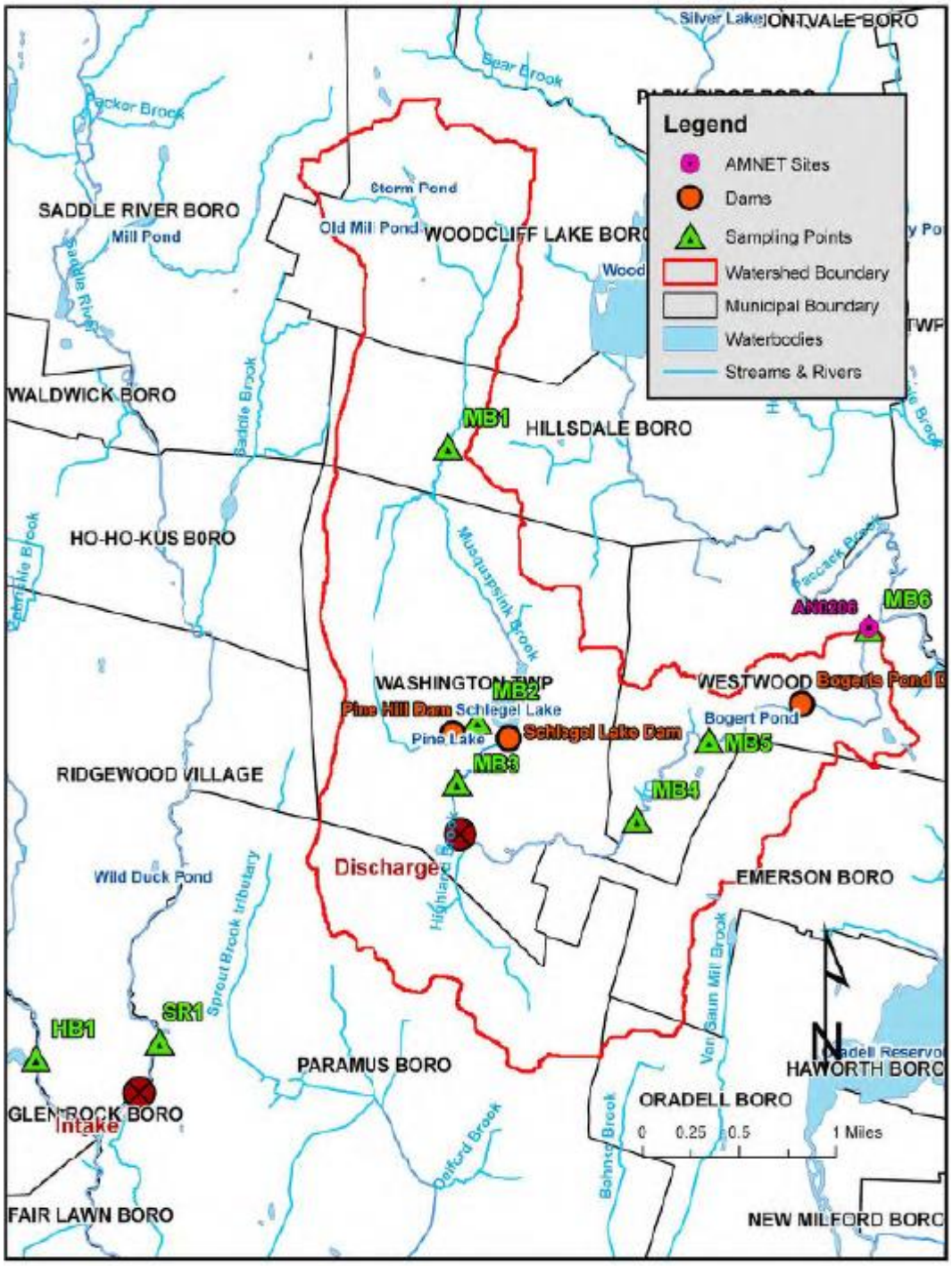
12. **Monitoring and Sampling Locations** – A water quality sampling station (MB1) exists by Hillsdale Avenue in Hillsdale for the Musquapsink Brook (see Figure G.2.12, below).

13. **Fish Consumption Advisories** – The NJDEP established a threshold of 0.18 µg/g, for mercury in fish tissue based on a "one meal per week" consumption restriction for high risk populations.[25] This threshold is based on the water quality target concentration established in the NJDEP statewide mercury Total Maximum Daily Load ("TMDL"), which was approved by the U.S. EPA on September 25, 2009. The TMDL report is available on the Department's website at:

http://www.state.nj.us/dep/wms/bears/tmdls.html

The mercury threshold for unlimited consumption for the high-risk population cannot be attained, based upon the expected mercury concentration in fish tissue that is attributed solely to natural sources that cannot be reduced. Because of these natural sources it is likely that fish consumption advisories for mercury will continue to be necessary in New Jersey to protect high risk populations even after all anthropogenic sources of mercury (due to human activity) have been eliminated.

Figure G.2.12 – Water Sampling Station, Musquapsink Brook, Hillsdale[26]



For recreational purposes the State of New Jersey stocks Pascack Brook along Hillsdale Avenue with trout. Some large fish are present in the Woodcliff Lake Reservoir. Beyond this, local fish populations are not known to be consumed in a

significant manner in Hillsdale, and the waters within Hillsdale have not been the subject of fish consumption advisories.

14. **Impaired Waters -** Under Section 305(b) of the Federal Clean Water Act states must submit to the United States Environmental Protection Agency ("U.S. EPA") on a biennial basis, a Statewide Water Quality Inventory Report or "305(b) Report" that describes the status of principal waters in terms of overall water quality and support of designated uses, as well as strategies to maintain and improve water quality. This is known as The Integrated List of Waters ("Integrated List", "305(b) Report", or "Water Quality Inventory**").** The Integrated Reports describe attainment of the designated uses specified in New Jersey's Surface Water Quality Standards (N.J.A.C. 7:9B), which include: aquatic life; recreation; drinking, industrial, and agricultural water supply; fish consumption; and shellfish harvest for consumption. These 305(b) reports are used by Congress and the U.S. EPA to establish program priorities and funding for federal and state water resource management programs.

Since 2001, the U.S. EPA has recommended that states integrate their Water Quality Inventory Report (required under Section 305(b) of the Federal Clean Water Act (Act)) with their List of Water Quality Limited Segments (required under Section 303(d) of the Act). New Jersey submitted its first Integrated Water Quality Assessment Report ("Integrated Report") in 2002. New Jersey's Integrated Report identifies the use assessment results for all waters of the State, grouped into sub-watershed or other hydrologically-based assessment units.

Assessment units that do not attain applicable surface water quality standards or fully support applicable designated uses require the development of a total maximum daily load ("TMDL") are placed on the 303(d) List of Water Quality Limited Waters. Sources and causes of pollutants causing use impairment are identified, where known. Use assessment results are shown as "fully supporting," "not supporting," or "insufficient information." Waters that do not support the applicable designated uses are placed on the 303(d) List along with the pollutant causing non-support.[27]

Musquapsink Brook – Since 2012 the NJDEP's Integrated Water Quality Monitoring and Assessment Report has listed the Musquapsink Brook as not attaining water quality standards specified for total phosphorus and bacterial contamination. The NJDEP listed the Musquapsink Brook on New Jersey's 303(d) list of impaired waters. Total maximum daily loads (TMDLs) have been developed by the United States Environmental Protection Agency requiring a 10.9% reduction in total phosphorus loadings (most likely the result of lawn fertilizer runoff), and a 96% reduction in fecal coliform loadings in the watershed. Sources of the pollutants more generally are characterized as including urban runoff and habitat modification.[28]

[END OF NARRATIVE PORTION OF THIS SECTION]

[1] "New Jersey Stormwater Best Management Practices Manual," 2016 NJDEP, page 1.
[2] "New Jersey Stormwater Best Management Practices Manual," 2016 NJDEP, page 1.
[3] New Jersey Water Supply Plan, 2017 – 2022, State of New Jersey Department of Environmental Protection, Appendix C, "Major Surface Water Systems of New Jersey," page C3.
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~ End of Part 1 of 2 ~

Environmental Resource Inventory

Hillsdale, New Jersey

(Continued See: Part 2 of 2)