MUNICIPAL STORMWATER MANAGEMENT PLAN
MASTER PLAN ELEMENT

BOROUGH OF HIGHLANDS
MONMOUTH COUNTY, NEW JERSEY

Originally Memorialized: May 12, 2005

Originally Adopted: April14, 2005

Amended: August 9, 2007

PREPARED FOR:

BOROUGH OF HIGHLANDS PLANNING BOARD

PREPARED BY:

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March 2005

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The original of this document has been signed and sealed in accordance with N.J.S.A. 45:14A-1 et. seq.

Members of the 2007 Planning Board

Andrew Stockton – Chairman

Micheal Kovic – Vice Chairman

Mayor Richard O'Neil

Frank Nolan – Council Representative

Vacant – Borough Official

Craig Bahrs

Donald Manrodt

Roderic Schoellner

Peter Mullen

Edwin Harrison – Alternate #1

Harry Cefalo – Alternate #2

Robert W. Bucco, Jr., P.E., C.M.E., Board Engineer

Jack Serpico, Esq., Board Attorney

Carolyn Cummings, Board Secretary

Mr. Manrodt offered a motion to move on the adoption of the following Resolution:

A RESOLUTION OF THE BOROUGH OF HIGHLANDS PLANNING BOARD MEMORIALIZING ADOPTION OF AN AMENDMENT TO THE BOROUGH MASTER PLAN MUNICIPAL STORM WATER MANAGEMENT PLAN ELEMENT

WHEREAS, the Planning Board of the Borough of Highlands has been advised that it is necessary to adopt an amendment to the Borough Master Plan, Municipal Stormwater Management Plan Element pursuant to applicable law; and

WHEREAS, the Board and Borough authorized T & M Associates to prepare an amendment to the Master Plan Municipal Stormwater Management Plan Element which amended Plan is annexed hereto and made a part hereof. Said amended Plan was formally presented to the Board and the public at a public session of the Board on August 9, 2007; and

WHEREAS, the Board voted unanimously in favor of the adoption of the annexed amended Plan at the August 9, 2007 meeting; and

WHEREAS, the Board Secretary is hereby directed upon the adoption of this Resolution to transmit a copy hereof to the Clerks of all adjoining Municipalities by certified mail and, to forward an additional copy of this Resolution via certified mail to the Monmouth County Planning Board along with a copy of the annexed amended Plan pursuant to the requirements of the applicable statutes.

NOW, THEREFORE, BE IT RESOLVED by the Planning Board of the Borough of Highlands that it hereby adopts the annexed amended Municipal Stormwater Management Plan Master Plan Element and does further recommend to the Mayor and Council of the Borough that it adopt the appropriate ordinances and regulations in order to implement the various programs and policies identified within said document if required by law.

Seconded by Mr. Mullen and adopted on the following roll call vote:

ROLL CALL:

AYES:	Mr. Manrodt, Mr. Kovic, Mullen, Mr. Harrison, Mr. Cefalo, Mr. Stockton
NAYES:	None
ABSTAIN:	None

DATE: September 13, 2007

CAROLYN CUMMINS, Board Secretary

I certify this to be a true copy of the Resolution adopted by the Borough of Highlands Planning Board on September 13, 2007.

Carolyn Cummins, Board Secretary

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INTRODUCTION

As a result of the publication of the United States Environmental Protection Agency (USEPA) Phase II rules in December 1999, the New Jersey Department of Environmental Protection (NJDEP) promulgated new stormwater regulations to address non-point source pollution entering surface and ground waters of the State of New Jersey. Under these regulations, municipalities were issued a New Jersey Pollutant Discharge Elimination System (NJPDES) Permit that established various statewide basic requirements. One of these requirements is the development and adoption of an amendment to their overall Master Plan to address stormwater pollution associated with major development.

As required by the Municipal Stormwater Regulations (N.J.A.C. 7:14A-25), the Borough of Highlands has developed this Municipal Stormwater Management Plan (MSWMP) to outline their approach to addressing the impacts resulting from stormwater related issues associated with future development, redevelopment, and land use changes. The MSWMP addresses groundwater recharge, stormwater quantity, and stormwater quality impacts through the incorporation of stormwater design and performance standards for new development and redevelopment projects that disturb one or more acres of land or increases impervious cover by more than ¼ acre. The standards are intended to minimize negative or adverse impacts of stormwater runoff such as decreased water quality, increased water quantity and reduction of groundwater recharge that provides base flow to the Borough's receiving bodies of water. In addition to minimizing these impacts, the MSWMP provides long term operation and maintenance measures for existing and proposed stormwater management facilities.

The MSWMP also provides recommendations for ordinance modifications in order to expedite the implementation of stormwater management strategies and includes mitigation strategies to allow the Borough to grant variances or exemptions from proposed design and performance standards set forth by the Municipal Stormwater Regulations (N.J.A.C. 7:8-5.5).

GOALS AND OBJECTIVES

The goals of this MSWMP are:

1. Reduce flood damage, including damage to life and property;
2. Minimize, to the extent practical, any increase in stormwater runoff from any new development;
3. Reduce soil erosion from any development or construction project;
4. Encourage the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
5. Maintain groundwater recharge;
6. Prevent, to the greatest extent feasible, an increase in non-point source pollution;
7. Maintain the integrity of stream channels for their biological function, as well as for drainage;
8. Minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, and other uses of water;
9. Protect public safety through the proper design and operation of stormwater basins;
10. Increase public awareness of stormwater management through public education.

This element of the Borough's *Master Plan* complements other sections of the *Highlands Borough Master Plan*, including the Land Use Plan Element, the Conservation & Community Facilities Plan Element, and the Utilities Plan Element, which addresses the sewer infrastructure and storm drainage systems. Goals and objectives within these elements include:

11. Protect the existing resource base through sensitive design, energy efficiency, sustainable waste management, and to minimize the impact on the local environment;
12. Protect the areas steep slopes;
13. Achieve the stormwater quality standards established by NJDEP;
14. Require buffering around commercial properties to soften the visual and functional

impact of their design and use;

15. Prohibit the construction of parking structures within 400 feet of the waterfront;
16. Improve stormwater management along the bay front, roads and intersections through effective infrastructure, maintenance, and replacement;
17. Encourage the use of indigenous vegetation landscaping, which requires less fertilizer and is more draught tolerant;
18. Encourage the use of Low Impact Design (LID) measures for stormwater management;
19. Protect the natural and economic resources of the Borough's fisheries and shellfish beds and maintain and improve water quality to Sandy Hook Bay.

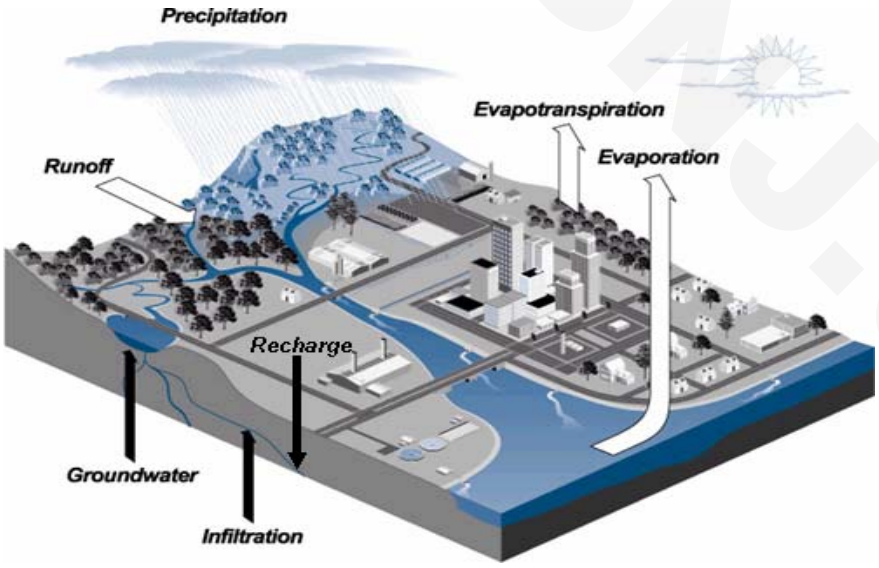
To achieve these goals, the MSWMP outlines specific stormwater design and performance standards for new development and proposes stormwater management controls for addressing impacts from existing developments. Preventive and corrective maintenance strategies are also included to ensure the long-term effectiveness of stormwater management facilities and the MSWMP outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

STORMWATER DISCUSSION

HYDROLOGIC CYCLE

The hydrologic cycle, or water cycle (Figure 1), is the continuous circulation of water between the ocean, atmosphere, and the land. The driving force of this natural cycle is the sun. Water, stored in oceans, depressions, streams, rivers, waterbodies, vegetation and even land surfaces, constantly evaporates due to solar energy. This water vapor then condenses in the atmosphere to form clouds and fog. After water condenses, it precipitates, usually in the form of rain or snow, onto land surfaces and waterbodies. Precipitation falling on land surfaces is often intercepted by vegetation. Plants and trees transpire water vapor back into the atmosphere, as well as aid in the infiltration of water into the soil. The vaporization of water through transpiration and evaporation is called evapo-transpiration. Infiltrated water percolates through the soil as groundwater, while water that flows overland is called surface water. Water flows across or below the surface to reach major water bodies and aquifers and eventually flows to the Earth's seas and oceans. This constant process of evapo-transpiration, condensation, precipitation, and infiltration comprises the hydrologic cycle.

Figure 1: The Hydrologic Cycle



Source: Kern River Connections
http://www.creativille.org/kernriver/watershed.htm

IMPACTS OF DEVELOPMENT AND STORMWATER

As towns and cities develop from rural agricultural communities, the landscape is altered in dramatic ways. Both residential and non-residential development on former agricultural fields and pastures have a great impact on the hydrologic cycle for the specific site. Localized impacts to the hydrologic cycle will ultimately impact the hydrologic cycle of the entire watershed encompassing the development site.

Prior to any land development, native vegetation often intercepts precipitation directly or absorbs infiltrated runoff into their roots. Development often replaces native vegetation with lawns or impervious cover, such as pavement or structures, thereby reducing the amount of evapo-transpiration and infiltration. Regrading and clearing of lots disturbs the natural topography of rises and depressions that can naturally capture rainwater and allow for infiltration and evaporation. Construction activities often compact soil, thereby decreasing its permeability or ability to infiltrate stormwater. Development activities also generally increase the volume of stormwater runoff from a given site.

Connected impervious surfaces and storm sewers (such as roof gutters emptying into a paved parking lot that drains into a storm sewer) allow the runoff to be transported downstream more rapidly than natural areas. This shortens travel time and increases the rainfall- runoff response of the drainage area, causing downstream waterways to peak higher and quicker than natural areas, a situation that can cause or exacerbate downstream flooding, and sedimentation in stream channels. Furthermore, connected impervious surfaces do not allow pollutants to be filtered, or for infiltration and ground water recharge to occur prior to reaching the receiving waters. Increased volume combined with reduced base flows results in a greater fluctuation between normal and storm flows causing greater channel erosion. Additionally, reduced base flows, increased fluctuation, and soil erosion can affect the downstream hydrology, impacting ecological integrity.

Water quantity impacts, combined with land development, often adversely affect stormwater quality. Impervious surfaces collect pollutants from the atmosphere, animal wastes, fertilizers

and pesticides, as well as pollutants from motor vehicles. Pollutants such as hydrocarbons, metals, suspended solids, pathogens, and organic and nitrogen containing compounds, collect and concentrate on impervious surfaces. During a storm event, these pollutants are washed directly into the storm sewers (Figure 2). In addition to chemical and biological pollution, thermal pollution can occur from water collected or stored on impervious surfaces or in stormwater impoundments, which has been heated by the sun. Additionally, large amounts of impervious coverage can result in "heat islands" where the surface temperatures are up to 10 degrees warmer than the surrounding areas. Thermal pollution can affect aquatic habitats, adversely impacting cold water fish. Removal of shade trees and stabilizing vegetation from stream banks also contributes to thermal pollution.

Figure 2: Connected Impervious Surfaces

Rainwater is intercepted by roofing and collected into gutters. The water then discharges from the downspout onto a paved driveway and flows to the gutter and storm drain inlets. Alternatively, the collected water is piped underground directly to the storm sewer.
Photograph source: Titan Gutters

Proper stormwater management will help to mitigate the negative impact of land development and its effect on stormwater. This Plan outlines the Borough's plan to improve stormwater quality, decrease stormwater quantity, and increase groundwater recharge. By managing stormwater, the Borough will improve the quality of aquatic ecosystems and restore some of the natural balance to the environment.

BACKGROUND

The Borough of Highlands encompasses 0.71 square miles or 459 acres of Monmouth County, New Jersey. The Borough of Highlands is a unique community of historical significance. The Borough and surrounding areas sit on the highest sea cliffs on the eastern seaboard. These cliffs were first noted by Italian explorer Giovanni de Verrazano in 1525 and became home to the Twin Lights; the world's only attached twin lighthouses. They are now on both the State and National registers of historic places. The Borough of Highlands is a seashore fishing and recreational community of older suburban single family houses, bounded by the Gateway National Recreation Area and Sandy Hook Bay to the east and north, the Borough of Atlantic Highlands to the northwest, and the Borough of Sea Bright to the southeast. The western and southern borders of the Borough are shared with the Township of Middletown, including the community known as Monmouth Hills. Figure 3 delineates the Borough boundaries on a United States Geological Survey (USGS) quadrangle map.

DEMOGRAPHICS AND LAND USE

The population of the Borough increased between 1960 and 1970 by approximately 11 percent. This is due in great part to the development along the Garden State Parkway. Accordingly, during the 1960's, both Monmouth County's and New Jersey's population also grew. While the County and State population growth rates began to stabilize in the 1970s, Highland's population increased at a significantly faster rate. In 1980, the population reached 5,187 persons, a 32% increase compared to a 9% increase for the County and a 2% increase for the State.

Population growth in the 1970's was followed by a 7% decline from 1980 to 1990, compared to increases at both the County and State levels. From 1990 to 2000, the Borough began to grow again for a total of 5,097 persons, though still not equal to the population of the 1980's. The relatively slow increase in Highlands Borough over the last decade is due to lack of vacant land. Table 1: "Historical Population Growth 1940 - 2000" summarizes the Borough, County and State population trends from 1940 to 2000.

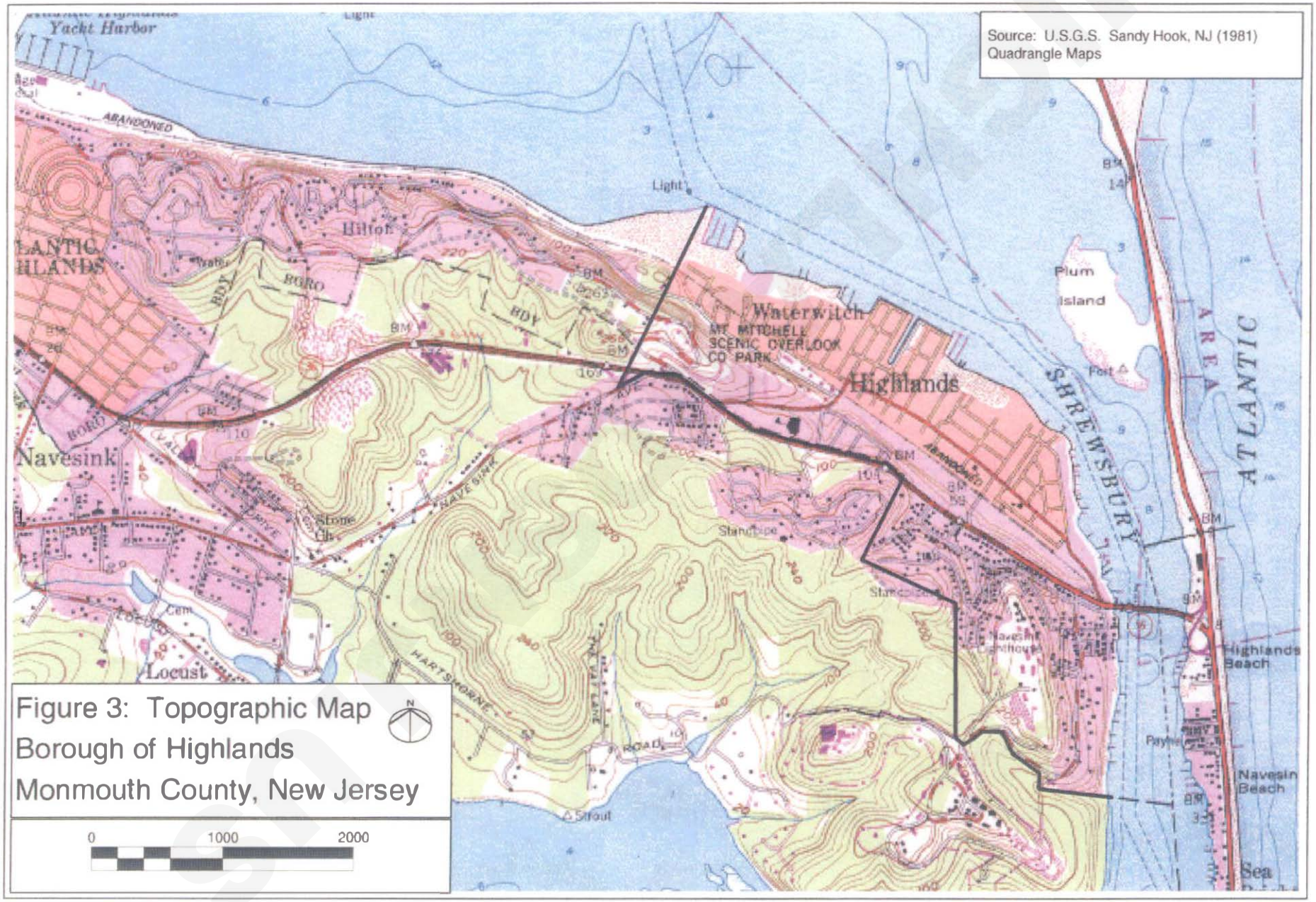


Figure 3: Topographic Map
Borough of Highlands
Monmouth County, New Jersey

Table 1 : Historical Population Growth 1940 – 2000

	BOROUGH		MONMOUTH COUNTY		NEW JERSEY	
Year	Population	Percent Change	Population	Percent Change	Population	Percent Change
1940	2,076	- - -	161,238	- - -	4,160,165	- - -
1950	2,959	43%	225,327	40%	4,835,329	16%
1960	3,536	19%	334,401	48%	6,066,782	25%
1970	3,916	11%	461,849	38%	7,168,164	18%
1980	5,187	32%	503,173	9%	7,364,158	2%
1990	4,849	-7%	553,124	10%	7,730,188	5%
2000	5,097	5%	615,301	11%	8,414,350	9%

SOURCE: US Bureau of Census 1940 – 2000. COMPILED BY: T&M ASSOCIATES

In accordance with the Borough's October 2004 Master Plan, the Borough is predominantly built-out and growth is anticipated to occur as a result of new residential infill housing. As shown in Table 2: General Housing Characteristics, the decrease in the number of total housing units further suggests that the Borough is fully developed and future growth will be limited to residential infill development or increased occupancy rates of rental units.

Table 2: General Housing Characteristics

	1990		2000		Change
	Number	Percent	Number	Percent	Number
Occupancy Status					
Total Housing Units	2,890	100	2,820	100	- 70
Occupied Housing Units	2,275	78.7	2,450	86.9	175
Vacant Housing Units	615	21.3	370	13.1	- 245
Tenure					
Occupied Housing Units	2,275	100	2,820	100	5
Owner- Occupied Housing Units	1,271	56	1,344	47.7	73
Renter- Occupied Housing Units	1,004	44.1	1,106	39.2	102
Vacancy Status					
Vacant Housing Units	615	100	370	100	- 245
Population	4,849	100	5,097	100	248
Households	2,275	100	2,450	100	175
Family Household	1,219	53.6	1,194	48.7	- 25
1 Person Household	884	38.9	1,021	41.7	137
Persons/ Household	2.1	--	2.9	--	0.8

Source: 1990, 2000 US Census

It should also be noted that of the land available for development, less than 26 acres is not impacted by environmental constraints such as the 100-year floodplain or steep slopes (Table3). Therefore, most development in the Borough is redevelopment, rehabilitation of older housing stock, or infill development in established neighborhoods. The Borough revised its *Master Plan* in 2004 and included a map of existing land use (Figure 4). This data is more recent than the NJDEP 1995/1997 land cover data shown in Figure 5. See Figure 6 for the Borough's zoning maps.

Table 3: Existing Land Use

Land Use	***Acres***	***Percent***
Residential		
Single-family Residential	174.0	36.3%
Mobile Home Park	16.0	3.3%
Medium Density Residential	64.6	13.5%
High Density Residential	8.9	1.9%
Commercial		
Marinas	22.2	4.6%
Restaurant/Bar	7.63	1.6%
Retail Sales and Service	19.4	4.0%
Industrial		
Industrial	1.1	0.2%
Public/Quasi-public		
Public Open Space	20.7	4.3%
Public/Quasi Public	28.5	5.9%
Religious	3.7	0.8%
Community Parking Lots	1.35	0.3%
Water		
Riparian Lots	20.2	4.2%
Water (lagoons)	1.2	0.25%
Summary		
Undeveloped	26.5	5.5%
Streets/Rights-of-way	40.5	8.4%
Total Area	480	100.0%
Total Land Area	***459***	***95.5***
Total Water Area	***21.4***	***4.5%***

Source: T&M Associates Field Survey

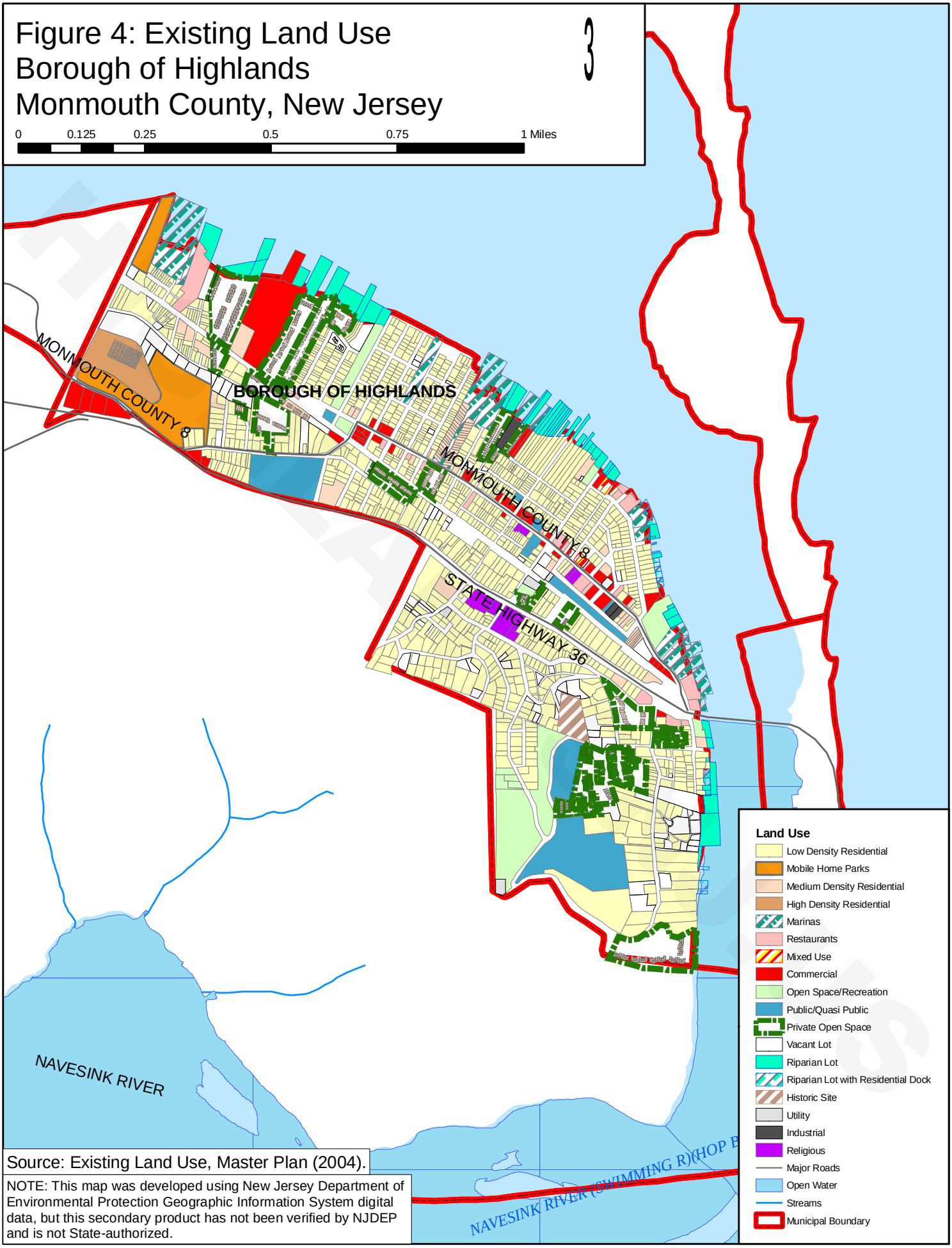
NATURAL RESOURCE PROTECTION

A large portion of the Borough is located in the Coastal Zone. The Coastal Zone Management Program (CZMP), authorized by the Coastal Zone Management Act (CZMA) of 1972, provides the framework stated for development, redevelopment, protection, and restoration strategies that may have significant impact on coastal resources.

Figure 4: Existing Land Use
Borough of Highlands
Monmouth County, New Jersey

3

0 0.125 0.25 0.5 0.75 1 Miles



Source: Existing Land Use, Master Plan (2004).

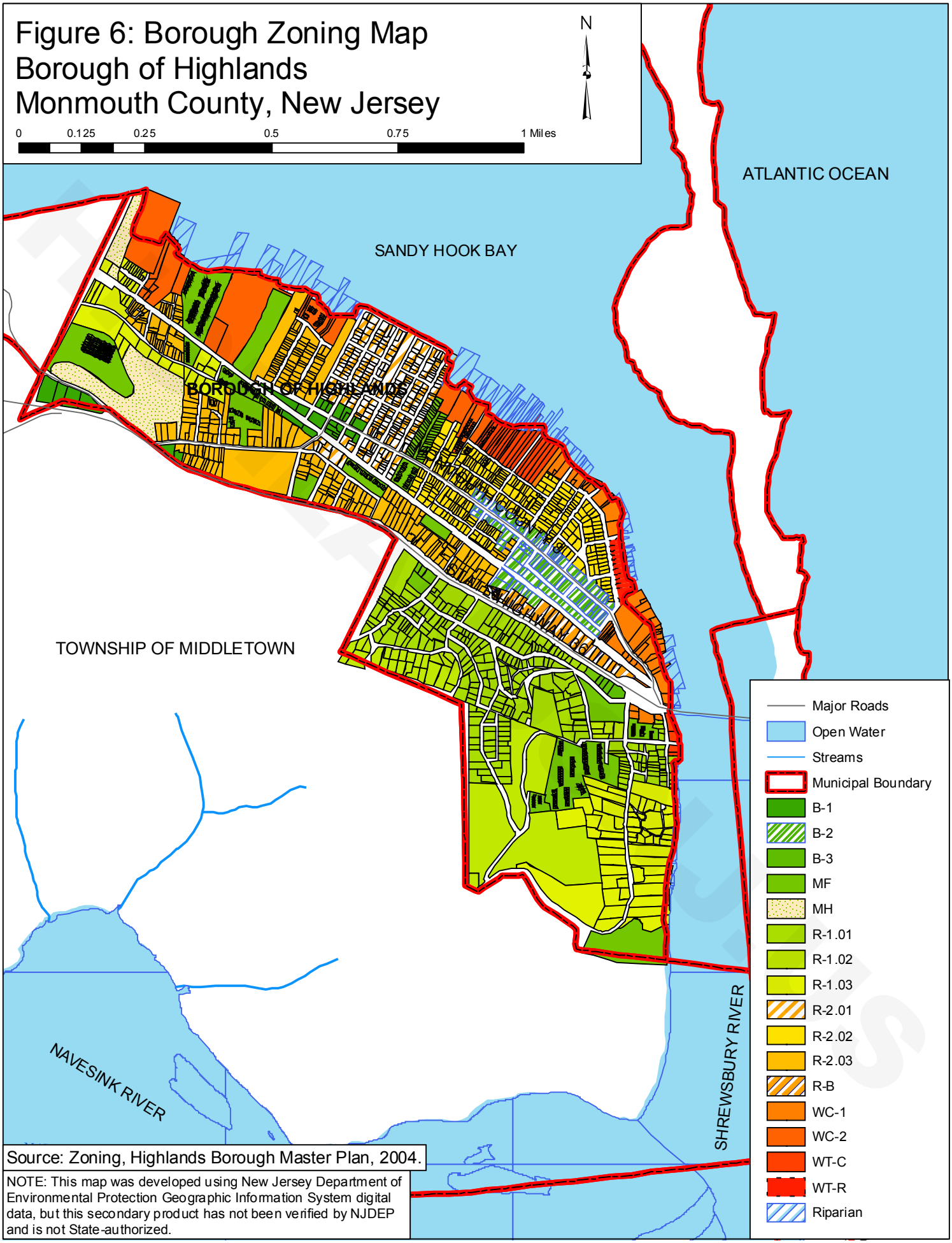
NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Figure 5: Existing Land Cover Map
Borough of Highlands
Monmouth County, New Jersey

Source: Existing Land Use, NJDEP (1995-1997).

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Figure 6: Borough Zoning Map
Borough of Highlands
Monmouth County, New Jersey



Source: Zoning, Highlands Borough Master Plan, 2004.

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

In addition, the Borough designated the coastal plain area as a Critical Environmental Site (CES) and a Historical and Cultural Site (HCS), (Figure 7). According to the State Development and Redevelopment Plan (SDRP), "designating a site as a CES or an HCS means the site is of local, regional or statewide significance and that its protection and enhancement is of primary importance." Their protection and enhancement has been determined to be of primary importance. Any changes proposed by the Borough within the CES or HCS area in Highlands should preserve the natural cultural fabric of which they are a part.

The Borough's Shade Tree Commission also maintains and promotes the care and planting of trees within the Borough. Trees, in addition to providing shade and aesthetic improvements, also increase the infiltration of stormwater into the ground.

WATERWAYS

The Borough's waterways include the Sandy Hook Bay and the Shrewsbury River and Estuary system, part of the Bayshore subwatershed. Figure 8 illustrates the waterways of the Borough. It should be noted that there is a stream between Snug Harbor Avenue and the Highlands Community Center known as Jones Creek, which is presently not shown on the NJDEP's GIS waterway map, however, Monmouth County representatives confirmed its location. The Borough's waterways have always played a vital role in the Borough's history, development, and economy. According to its *Master Plan* the Borough has largely been a fishing community (clams and lobsters) and seasonal community.

The Shrewsbury River drains an area of 27 square miles. The Shrewsbury and Navesink Rivers produce the majority of soft clams in the state. The Oceanic Bridge serves as the boundary line where shell-fishing beds are seasonally opened or closed to shellfish harvesting.

WATER QUALITY

The Ambient Biomonitoring Network (AMNET) was established by NJDEP to monitor and document the health of New Jersey's waterways. AMNET currently has 820 sites in five drainage basins that it monitors for benthic macro-invertebrates on a five-year cycle. Waterways

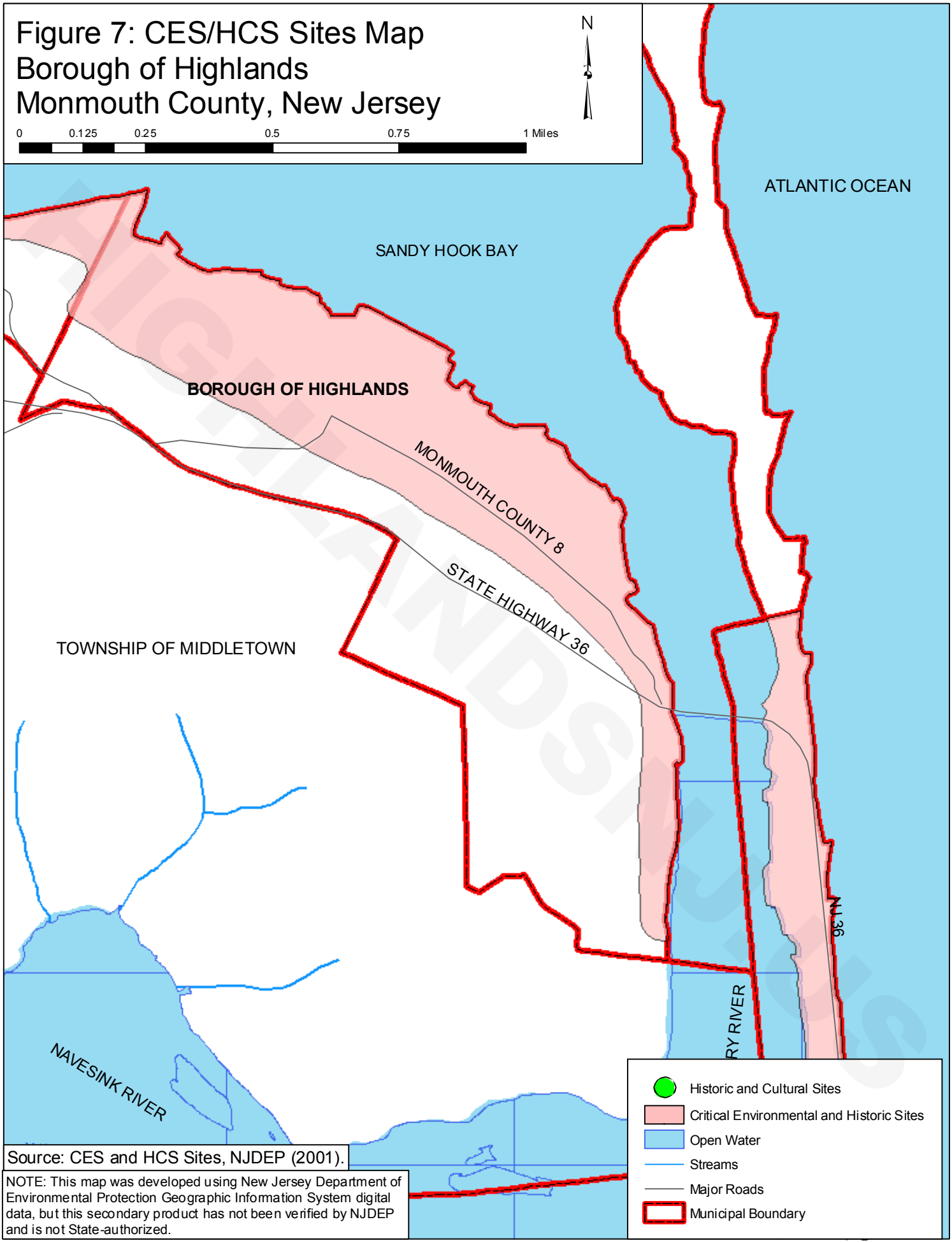


Figure 7: CES/HCS Sites Map
Borough of Highlands
Monmouth County, New Jersey
N
0
0.125
0.25
0.5
0.75
1 Miles
ATLANTIC OCEAN
SANDY HOOK BAY
BOROUGH OF HIGHLANDS
MONMOUTH COUNTY 8
STATE HIGHWAY 36
TOWNSHIP OF MIDDLETOWN
NAVESINK RIVER
NJ 36
Historic and Cultural Sites
Critical Environmental and Historic Sites
Open Water
Streams
Major Roads
Municipal Boundary
Source: CES and HCS Sites, NJDEP (2001).
NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

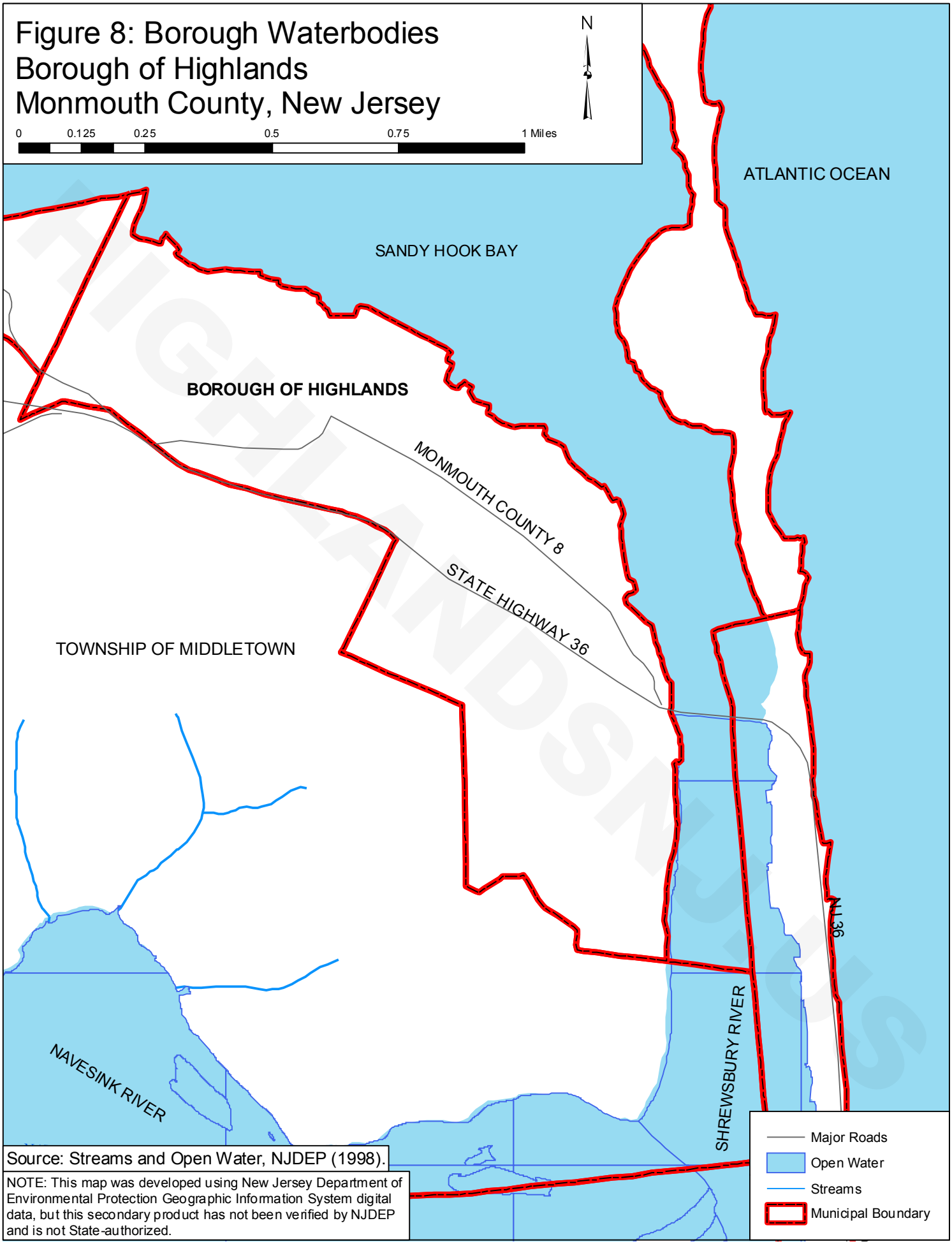


Figure 8: Borough Waterbodies
Borough of Highlands
Monmouth County, New Jersey
N
0
0.125
0.25
0.5
0.75
1 Miles
ATLANTIC OCEAN
SANDY HOOK BAY
BOROUGH OF HIGHLANDS
MONMOUTH COUNTY 8
STATE HIGHWAY 36
TOWNSHIP OF MIDDLETOWN
NAVESINK RIVER
SHREWSBURY RIVER
NJ 36
Major Roads
Open Water
Streams
Municipal Boundary
Source: Streams and Open Water, NJDEP (1998).
NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

are scored based on the data to generate the New Jersey Impairment Score (NJIS) and then categorized as severely impaired, moderately impaired, and non-impaired. The NJIS is based on biometrics and benthic macro-invertebrate health. (http://www.state.nj.us/dep/wmm/bfbm/). None of the Borough's waterways have been included in the AMNET reports.

In addition to biological health, chemical data are gathered by the NJDEP and other organizations, and used to determine the health of waterways. The water quality data are used by NJDEP to determine if Total Maximum Daily Loads (TMDL) are required for the given waterbody. A TMDL is the quantity of a pollutant that can enter a waterbody without exceeding water quality standards or interfering with the ability to use the waterbody for its designated usage. Point and non-point source pollution, surface water withdrawals and natural background levels are included in the determination of a TMDL, as required by Section 303(d) of the Clean Water Act. Point source pollution includes, but is not limited to NJPDES permitted discharges, while non-point source pollution can include stormwater runoff from agricultural lands or impervious surfaces. TMDLs determine the allowable load from each source, with a factor of safety, for the pollutant entering the waterbody. TMDLs are used to either limit further deterioration of waterbodies, or to improve current water quality.

Some of the strategies of TMDL implementation may include: the identification of various sources of pollution, stormwater treatment, implementation of updated ordinances, restriction of impervious surfaces, retrofitting stormwater systems, disconnection of impervious surfaces, and use of other best management practices (BMPs). The Shrewsbury River and Estuary are listed on New Jersey's 2004 Integrated List of Waterbodies, Sublists 1 and 5 as noted in Table 4 below. (http://www.state.nj.us/dep/wmm/sgwqt/wat/ index.html). The Estuary is listed for total coliform, fecal coliform, and dissolved oxygen impairments in different locations, while the Shrewsbury River is listed for PCBs and Dioxin in fish. There are no established or proposed TMDLs for waterways in the Borough, currently. Tributaries of the Shrewsbury River do have established TMDLs upstream of Highlands, while the section of the Shrewsbury south of the Rt. 36 Bridge is listed as a Category One waterbody (http://www.nj.gov/dep/cleanwater/ c1_waters_list.pdf). It is important to note, however, according to the Division of Watershed

Management of the NJDEP there are no specific stormwater TMDL established, and as such are not governed by this MSWMP.

Table 4: 2004 Integrated List of Water Bodies in the Borough Vicinity

Sublist	Station Name/Waterbody	Site ID	Parameters	Data Source
5	Shrewsbury River	Shewsbury River	Fish-PCB, Fish-Dioxin	NJDEP Fish Tissue Monitoring
5	Shrewsbury River Estuary	R59, Shrewsbury/Navesink Estuary-1 thru 3, 8	Total Coliform	NJDEP Coastal Monitoring, Shellfish Monitoring
1	Shrewsbury River Estuary	Shrewsbury/Navesink Estuary-1 thru 3	Dissolved Oxygen, Fecal Coliform	NJDEP Coastal Monitoring, Shellfish Monitoring
5	Shrewsbury River Estuary	Shrewsbury/Navesink Estuary-8	Dissolved Oxygen	NJDEP Coastal Monitoring, Shellfish Monitoring
1	Shrewsbury River Estuary	Shrewsbury/Navesink Estuary-8	Fecal Coliform	NJDEP Coastal Monitoring, Shellfish Monitoring

Source: NJ Integrated List http://www.state.nj.us/dep/wmm/sgwqt/wat/integratedlist/integratedlist2004.html

Impacts from agriculture, development and urban runoff are believed to have contributed to non-point sources of pollution in the Shrewsbury River. These impacts include siltation of rivers, streams and ponds, increased nutrient levels in water bodies and increased bacterial levels. Bacteria from agriculture and urban runoff have contaminated many shellfish-harvesting beds in the downstream reaches of the Shrewsbury River. According to NJDEP, water quality improves as one proceeds downstream along the Shrewsbury River.

According to the NJDEP *Sanitary Survey of the Shrewsbury River Estuary* report from May 2000, the Shrewsbury River is a "productive estuary" with hard clams in moderate to heavy densities. The Shrewsbury and Navesink Rivers are also home to the only commercial soft clam production areas in the state. The Shrewsbury River is currently listed as *Special Restricted* for the purpose of shellfishing. This grading system is described in the National Shellfish Sanitation Program (NSSP) *Guide for the Control of Molluscan Shellfish,* 1997, classifying waters as *Approved, Seasonally Approved, Special Restricted, or Seasonal Special Restricted.* The *Special Restricted* classification requires a special permit for the commercial harvest of shellfish when the beds are "open," and that any shellfish harvested be purified through depuration or relay prior to consumption. In addition, the Shrewsbury/Navesink/Sandy Hook/Raritan Bay complex has had infrequent fish kills due to decreased levels of dissolved oxygen. According to the *2004*

Shellfish Growing Water Classification Charts, sections of the eastern Shrewsbury River and the Navesink River from the Oceanic Bridge to the Shrewsbury River, have the improved status of *Seasonally Approved*, due to the improvement in water quality. NJDEP *Sanitary Survey of the Shrewsbury River Estuary* also notes that marina facilities can have a negative affect on shellfish beds, therefore there is a buffer zone around marinas where the waters are considered *Prohibited*.

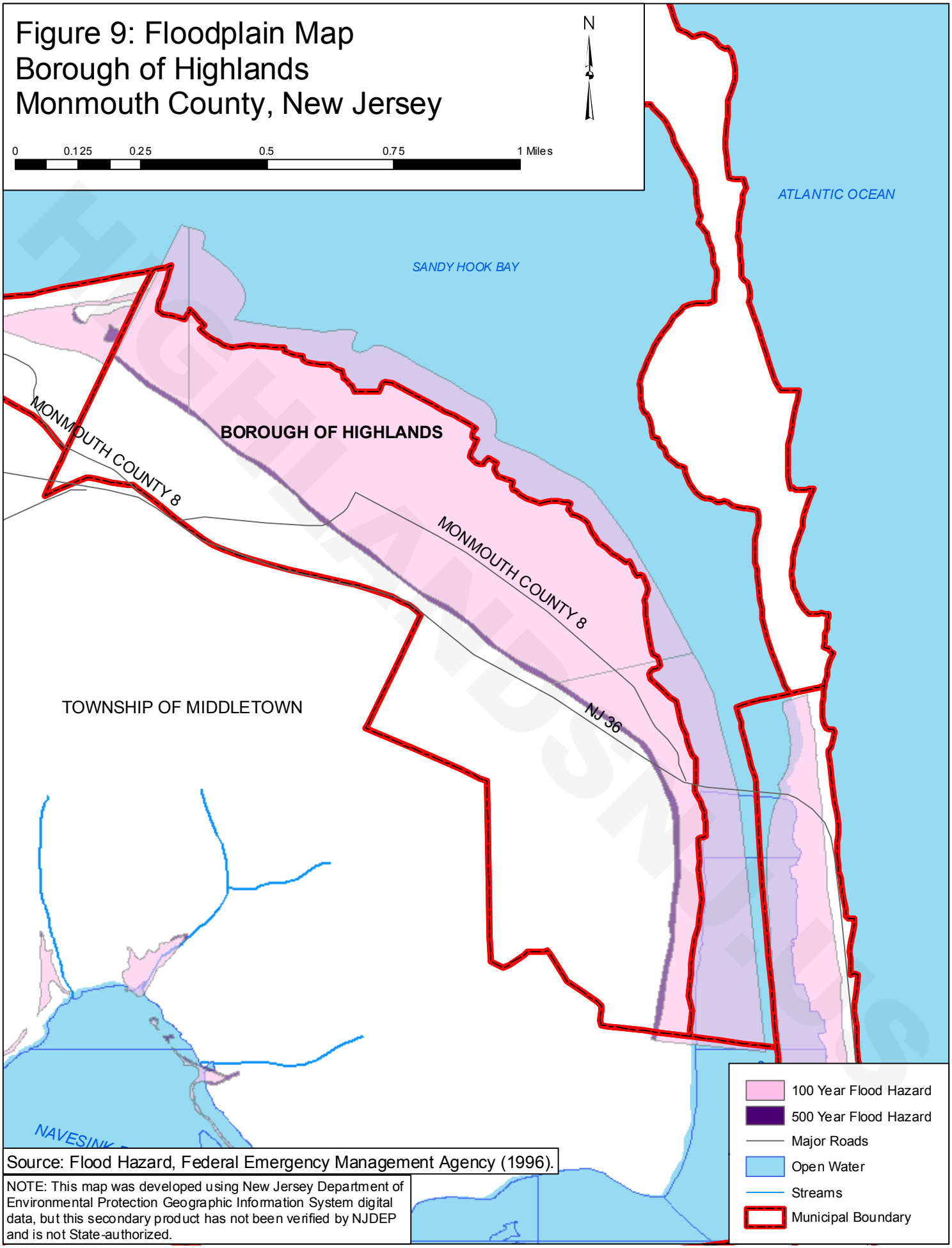
In addition to state monitoring, other groups including the Monmouth County Health Department monitor these waterways. The Monmouth County Health Department monitors the Shrewsbury River at two sites, upstream of Highlands in Rumson. At these sites, fecal coliform, pH, TSS, turbidity, ammonia, and phosphorous are monitored. At the Rt. 520 site, the Shrewsbury had above standard phosphorous levels, above standard ammonia levels and an average pH of 8.2 (or slightly alkali) between March 2001 and March 2004. In the second Rumson site, at the end of Avenue of Two Rivers South, the river had slightly above standard ammonia and phosphorous levels and an average neutral pH of 7.71 over that same time period. It should also be noted that the Borough experiences beach closings for a few days every year. These beaches are closed due to high bacterial counts in the Snug Harbor area, due to failing upstream infrastructure.

The Monmouth Coastal Watershed Partnership, in cooperation with the Monmouth County Planning Board compiled an *Issues List* for the Bayshore Subwatershed in 2001. This list indicates that the Bayshore area has noted issues with erosion, sedimentation, stormwater infrastructure, and public awareness. As previously mentioned the Bayshore subwatershed also has issues with water quality and natural resource management for habitat and wetlands.

WATER QUANTITY

In addition to increased hazards from flooding, increasing the volume of stormwater runoff to a stream can cause increased erosion. A large portion of the Borough lies within the 100-year floodplain of the Shrewsbury River as shown in Figure 9. This area includes the Borough northeast of Shore Drive to the river and is prone to flooding. In addition, the intersection of Highland Avenue and South Peak Street also floods. This is due to either an undersized culvert

Figure 9: Floodplain Map
Borough of Highlands
Monmouth County, New Jersey



Source: Flood Hazard, Federal Emergency Management Agency (1996).

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

or sedimentation of the culvert.

GROUNDWATER RECHARGE

Increases in development of vacant sites have increased impervious surface areas. Impervious surface areas are portions of the development site covered with either structure and/or pavement that prevents the underlying soil from absorbing rainwater. Instead of entering the soil, rainwater from rooftops and pavement flows onto the adjacent ground, where it is partially absorbed into the ground (depending upon hydrologic soil classifications) or into drainage facilities and streams. The greater the amount of impervious surface, the greater volume of stormwater runoff that drains away from a given site. Greater volumes of stormwater can result in high water elevations in some locations along streams and can exacerbate streambed erosion, and potentially cause downstream siltation. These dynamics alter the floodplain and have negative impacts on both the stream and river ecosystems.

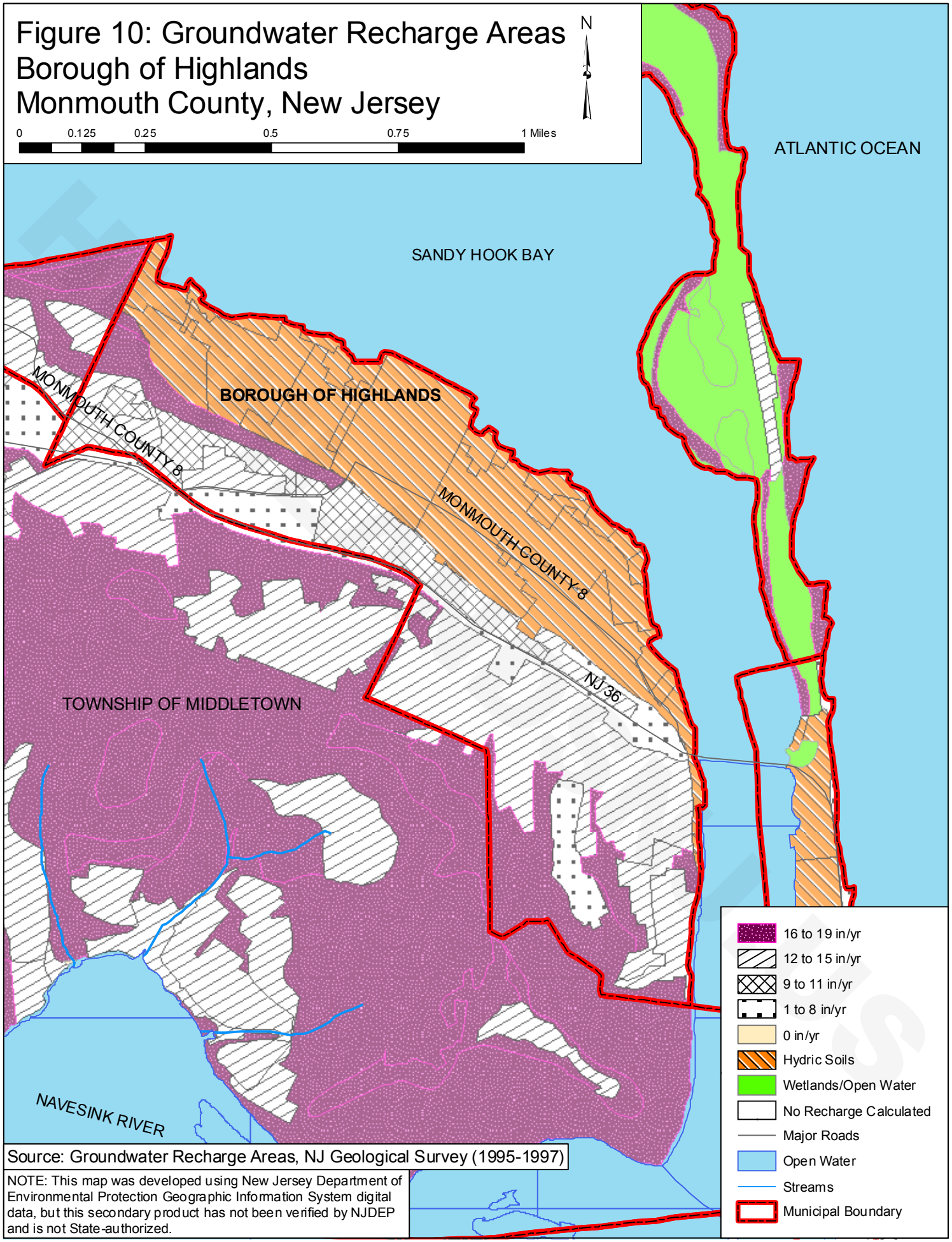
The Borough is located within an urban Metropolitan Planning Area as delineated on the State Plan Policy Map (SPPM). Per N.J.A.C. 7:8-5.4 (a) 2ii and N.J.A.C 7:8-1-2 there are conditions under which the Groundwater Recharge requirements for the Stormwater Management Rules do not apply for Metropolitan Planning Areas. "Previously developed" lands within urban areas are exempt from these requirements. "Previously developed" means any area on a site that is occupied by structures, been filled or graded. Areas that were deforested, but have reestablished woody vegetation are not considered "previously developed." In addition, only the areas within a given site that meet these criteria are exempt from the groundwater recharge requirements. It is possible to have a site that has partial areas of exemption, and other areas that are required to meet the requirements.

In addition to the Metropolitan Planning Area designation, much of the Borough is located in a slump block area that is known for landslides. Groundwater recharge is not recommended in these areas. According to the USGS, slope saturation is the primary cause of landslides. Saturation can occur from intense rain or snowmelt, changes in the groundwater levels, or sea level changes along coastlines. The USGS recommends stabilizing the slopes by preventing

groundwater from rising in the landslide mass.

The Borough's water source is directly affected by the reduction of groundwater recharge, since the Borough draws water from the Swimming River Reservoir and the Glendola Reservoir. New Jersey American Water Company provides water to the Borough since the Borough wells are sealed, and no longer in use. One of the wells is currently used for water quality monitoring. Figure 10 illustrates the Borough's groundwater recharge areas. Figure 11 delineates the Borough's well locations, but indicates that there are no wellhead protection areas.

Figure 10: Groundwater Recharge Areas
Borough of Highlands
Monmouth County, New Jersey



Source: Groundwater Recharge Areas, NJ Geological Survey (1995-1997)

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

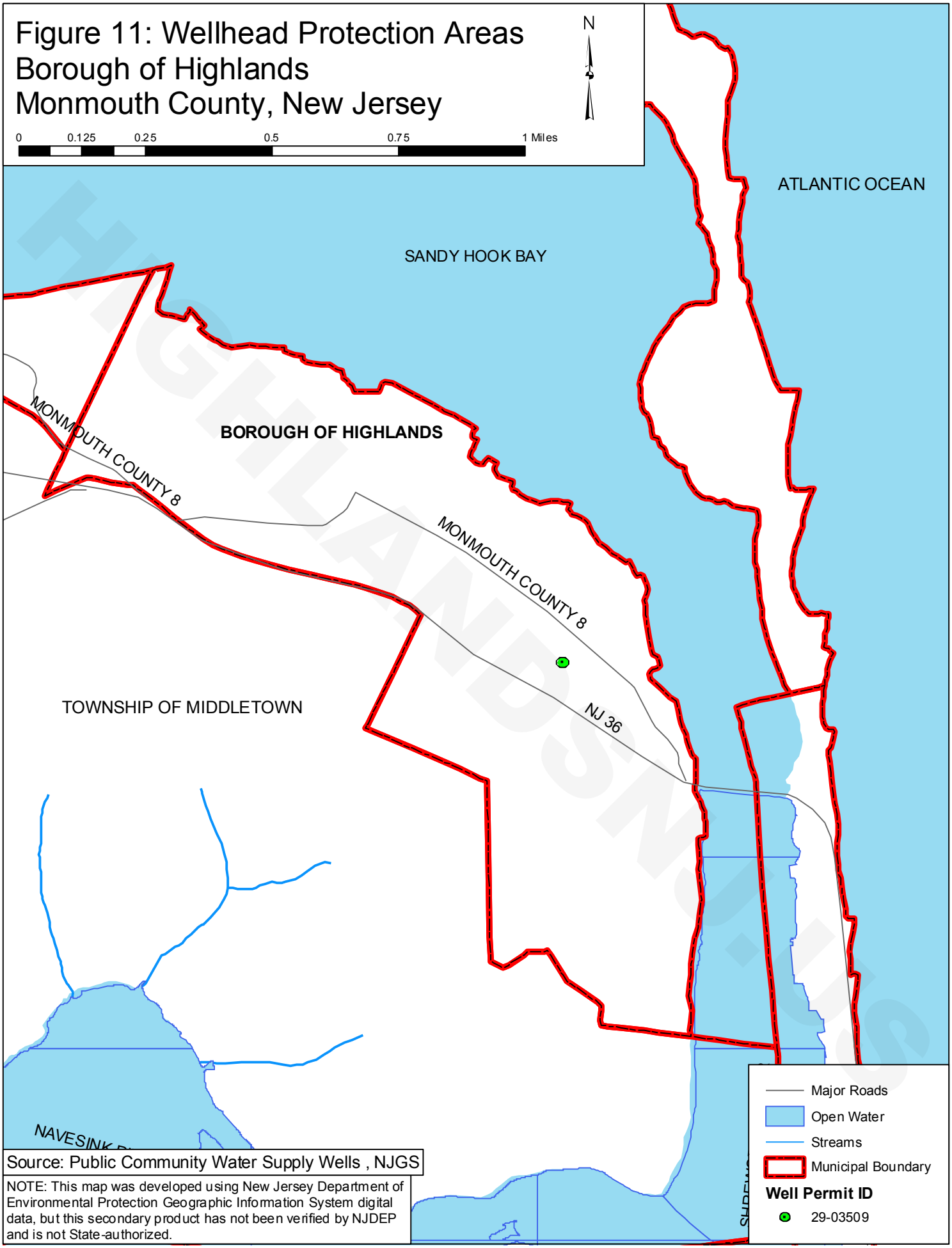


Figure 11: Wellhead Protection Areas
Borough of Highlands
Monmouth County, New Jersey
N
0
0.125
0.25
0.5
0.75
1 Miles
ATLANTIC OCEAN
SANDY HOOK BAY
BOROUGH OF HIGHLANDS
MONMOUTH COUNTY 8
MONMOUTH COUNTY 8
NJ 36
TOWNSHIP OF MIDDLETOWN
NAVESINK
Major Roads
Open Water
Streams
Municipal Boundary
Well Permit ID
29-03509
Source: Public Community Water Supply Wells , NJGS
NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

DESIGN AND PERFORMANCE STANDARDS

The Borough has adopted applicable design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to reduce the negative impact of stormwater runoff on water quality and quantity, and loss of groundwater recharge in receiving waterbodies. These design and performance standards contain the necessary language to maintain stormwater management measures consistent with the applicable stormwater management rules, N.J.A.C. 7:8-5.8 - Maintenance Requirements. This ordinance also includes language for safety standards consistent with N.J.A.C. 7:8-6 - Safety Standards for Stormwater Management Basins. The Stormwater Management and Control Ordinance was submitted to the Monmouth County Planning Board for review and approval along with this adopted Municipal Stormwater Management Plan (MSWMP).

It should be noted that a number of the structural and nonstructural strategies require water to be retained for long periods of time. These requirements may increase the promulgation of mosquito breeding habitats. New development and redevelopment activities should be coordinated with the Monmouth County Mosquito Extermination Commission so that proposed structural and nonstructural strategies are properly maintained.

Proper inspection and maintenance are critical components for the successful performance of a stormwater management system. The Borough prepared a Stormwater Pollution Prevention Plan (SPPP) to address inspection and maintenance of existing stormwater infrastructures throughout the Borough including catch basin cleaning and annual inspections of the stormwater pump stations. Also included in the SPPP is the development of a Local Public Education Program to educate property owners on methods to reduce non-point source stormwater pollution such as proper waste disposal, solids and floatable controls, fertilizer and pesticide use, wildlife feeding, etc. In addition, the Borough's SPPP outlines modifications to existing Borough programs, and introduces new programs to aid in the Borough's stormwater management effort. These programs include catch basin labeling, improved street sweeping, and employee training.

New development and redevelopment projects are required to develop and submit a detailed operation and maintenance plan for each best management practice (BMP) established in accordance with the N.J.A.C. 7:8 - 5.8. Recommendations for proper maintenance procedures are available in the NJDEP's *New Jersey Stormwater Best Management Practices Manual* (BMP Manual). Copies of the maintenance plan(s) will be filed with the Borough Department of Public Works.

Borough personnel will observe construction of the project to ensure that the appropriate stormwater management measures are constructed and function as designed. Borough personnel will conduct periodic inspections after significant storms to ensure the system is functioning properly and to identify maintenance needs, if any. For privately owned and operated stormwater management systems, the Owner shall conduct inspections as needed. After this, annual checks will be done to identify any additional maintenance needs required. This may include clearing of blockages from inlets and/or outlet structures, removal of unhealthy vegetation or accumulated debris/materials.

The Borough Stormwater Management and Control Ordinance indicates that the inspection of systems is permissible on private property upon giving reasonable notice. The Ordinance also indicates a time frame for maintenance procedures to occur upon receiving notice from the Borough that maintenance is required. Additionally, the ordinance requires Maintenance Plans for privately owned stormwater management systems which, at a minimum, include information such as contact information for the responsible party, schedule of required maintenance, estimated costs of maintenance, etc. in accordance with State regulations.

PLAN CONSISTENCY

REGIONAL STORMWATER MANAGEMENT PLANS

Currently, there are no adopted Regional Stormwater Management Plans (Regional Plans) developed for waterbodies located within the Borough's boundaries. This plan will be updated to be consistent with any Regional Plans that are established in the future. Highlands shall take part in the development of any proposed Regional Plans that may affect waterbodies within or adjacent to the Borough.

TOTAL MAXIMUM DAILY LOADS

There are currently no established or proposed stormwater TMDLs for waterbodies within the Borough. This plan will be updated to be consistent with any future stormwater TMDLs established by the NJDEP.

RESIDENTIAL SITE IMPROVEMENT STANDARDS (RSIS)

This MSWMP is consistent with regulations established under the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21, and will be updated to remain consistent with any future updates of RSIS. Additionally, the Borough will use the latest update of RSIS during its reviews of residential area development for stormwater management.

SOIL CONSERVATION

The Borough's Stormwater Management Control Ordinance will require that all new development and redevelopment projects comply with the Soil Erosion and Sediment Control Standards of New Jersey. In cooperation with the Freehold Soil Conservation District, Borough personnel will observe on-site soil erosion and sediment control measures as part of the construction site inspections and contact the district for enforcement and follow-up.

The Freehold Soil Conservation District requires the use of the most recent design storm rainfall data for stormwater calculations. The National Oceanographic and Atmospheric Administration

(NOAA), the agency that develops statistical estimates of rainfall amounts, has increased its estimates for the majority of storm events, particularly the larger events. The following table indicates the old and new twenty-four hour rainfall amounts in inches for Monmouth County.

Table 5: NRCS 24 Hour Design Storm Rainfall Depth (inches) – September 2004

Storm Period	1 yr.		2 yr.		5 yr.		10 yr.		25 yr.		50 yr.		100 yr.	
	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New	Old	New
Monmouth County	2.8	**2.9**	3.4	**3.4**	4.4	**4.4**	5.3	**5.2**	6.0	**6.6**	6.5	**7.7**	7.5	**8.9**

Source: NOAA, New Jersey Department of Agriculture

MONMOUTH COUNTY GROWTH MANAGEMENT GUIDE

The Monmouth County Growth Management Guide, adopted in December 1995, sets forth a series of goals and objectives designed to enhance the quality of life for residents of Monmouth County. This plan is consistent with those objectives, which include:

2. Encouraging the protection of the County's unique, diverse, natural and scenic natural resources;
3. Promoting the protection of non-renewable natural resources;
4. Encouraging the protection and conservation of all water resources;
5. Promoting the preservation and improvements of costal water resources;
6. Promoting the preservation and improvements of surface water quality;
7. Encouraging the preservation and improvements of groundwater quality and quantity; and
8. Promoting the preservation, restoration, and enhancement of wetlands and stream corridors in order to protect the adjacent water bodies, such as streams, rivers, lakes, bays and oceans.

This plan is consistent with the County Growth Management Guide by encouraging the protection of stream corridors and encouraging flood control and ground water recharge where

possible and through the implementation of the principals of non-structural and structural strategies. This Plan is also consistent with the County Growth Management Guide, by preserving and protecting valuable natural features within the Borough.

STATE DEVELOPMENT OR REDEVELOPMENT PLAN (SDRP)

This plan is consistent with the plans and policies of the SDRP, which was adopted in 2001. The SDRP places non-environmentally constrained areas in the Borough in the Metropolitan Planning Area (PA1). Exceptions to the PA1 designation are wetlands and floodplain areas that are located within Borough's park lands in the County Park (PA2), and State Park (PA-8) Planning Areas. According to the State Plan, most of the communities within the PA1 planning area are fully developed or almost fully developed with little vacant land available for new development. This Plan is consistent with the State Plan by preserving and protecting the established residential character of the Borough, preserving and upgrading the existing utility infrastructure, providing adequate open space facilities, and preserving and protecting valuable natural features within the Borough.

STORMWATER MANAGEMENT STRATEGIES

The Borough has reviewed its Master Plan (2004) and its pertinent development ordinances for consistency with the new stormwater regulations. Based on its review the Borough generally found that revisions to the following ordinance sections would provide minimal benefit since the Borough is almost fully developed and minimal "major development[1]" is anticipated.

- **Chapter 21-63: Off-tract Improvements:** This section states the requirements for off-tract improvements within the Borough, including outlining off-tract drainage applications, and installation.

- **Chapter 21-65 Design Specifications:**
  - **C: Buffers:** This section describes the buffer requirements between residential and non-residential uses.
  - **D: Curbs:** This section requires the construction of curbs on both sides of new streets in accordance to NJDOT standards.
  - **F: Easements:** This section outlines the requirements for conservation easements along drainage and storm water rights-of-way in developments and for ponds, marshes, swamps and streams or other water courses, slump blocks, or other natural features for which preservation is desirable.
  - **N: Off street Parking:** This section states the requirements for parking lots.
  - **U: Steep Slopes and Slump Blocks:** This section requires the approval of the Borough Engineer prior to disturbance in slopes between 20–35% grades, and allows for no disturbance for slopes exceeding 35% grade. These slopes also have a buffer zone. The areas in or adjacent to slump blocks require further investigation and reporting.
  - **V: Stormwater Drainage:** This section describes the requirements for storm drainage within the Borough.

[1] Major Development – means any development that provides for ultimately disturbing one or more acres of land. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation. Projects undertaken by any government agency which otherwise meet the definition of 'major development' but which do not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., are also considered "major development."

NONSTRUCTURAL STRATEGIES

This MSWMP encourages the use of low impact design methods and recommends the practical use of the following non-structural strategies for all major developments in accordance with the NJDEP BMP Manual:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.
2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.
3. Maximize the protection of natural drainage features and vegetation.
4. Minimize the decrease in the pre-construction "time of concentration."
5. Minimize land disturbance including clearing and grading.
6. Minimize soil compaction.
7. Provide vegetated open-channel conveyance systems that discharge into and through stable vegetated areas.
8. Provide preventative source controls.

In addition, the NJDEP BMP Manual requires an applicant seeking approval for a major development to specifically identify which and how these nonstructural strategies have been incorporated into the development's design. Finally, for each of those nonstructural strategies that were not able to be incorporated into the development's design due to engineering, environmental, or safety reasons, the applicant must provide a basis for this contention.

Recommended Measures

Recommendations in the BMP Manual may be implemented through the use of:

- **Vegetated Filter Strips**

  Vegetated filter strips are best utilized adjacent to a buffer strip, watercourse or drainage swale since the discharge will be in the form of sheet flow, making it difficult to convey the stormwater downstream in a normal conveyance system (swale or pipe).

- **Stream Corridor Buffer Strips**

  Buffer strips are undisturbed areas between development and the receiving waters. There are two management objectives associated with stream and valley corridor buffer strips:

  - To provide buffer protection along a stream and valley corridor to protect existing ecological form and functions; and
  - To minimize the impact of development on the stream itself (filter pollutants, provide shade and bank stability, reduce the velocity of overland flow).

  Buffers only provide limited benefits in terms of stormwater management; however, they are an integral part of a system of best management practices.

- **The Stabilization of Banks, Shoreline and Slopes**

  The root systems of trees, shrubs and plants effectively bind soils to resist erosion. Increasing the amount of required plant material for new and redeveloped residential and non-residential sites should be encouraged throughout the Borough. Planting schemes should be designed by a certified landscape architect to combine plant species that have complementary rooting characteristics to provide long-term stability.

- **Fertilizers**

  The use of fertilizers to create the "perfect lawn" is an increasingly common problem in many residential areas. Fertilizer run-off increases the level of nutrients in water bodies accelerating eutrophication[2] in lakes and rivers, and ultimately the coastal areas. The excessive use of fertilizer causes nitrate contamination of groundwater. Good fertilizer maintenance practices help in reducing the amount of nitrates in the soil and thereby lowers its content in the water. Initially, the Borough should work with the NJDEP to educate homeowners of the impacts of the overuse of fertilizers. This discussion should include other techniques to create a "green lawn" without over fertilizing. Almost as important as the use

[2] Eutrophication – The normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestrial state and disappears.

of fertilizer, is the combination of over fertilizing and over watering lawns. In many cases this leads to nutrient rich runoff, which ultimately migrates to a nearby stream, lake or other water body. If fertilizer is applied correctly, the natural characteristics of the underlying soils will absorb or filter out the nutrients in the fertilizer.

STRUCTURAL STORMWATER MANAGEMENT[3]

In Chapter 9 of its BMP Manual, the NJDEP identifies several structural stormwater management options. The Borough recommends the following structural devices. These structural methods should only be used after all non-structural strategies are deemed impracticable or unsafe. Specifically, the Borough encourages the use of structural stormwater management systems in a manner that maximizes the preservation of community character:

- **Bioretention Systems**

  A bioretention system consists of a soil bed planted with native vegetation located above an underdrained sand layer. It can be configured as either a bioretention basin or a bioretention swale. Stormwater runoff entering the bioretention system is filtered first through the vegetation and then the sand/soil mixture before being conveyed downstream by the underdrain system. Runoff storage depths above the planting bed surface are typically shallow. The adopted Total Suspended Solids (TSS) removal rate for bioretention systems is 90%.

- **Constructed Stormwater Wetlands**

  Constructed stormwater wetlands are wetland systems designed to maximize the removal of pollutants from stormwater runoff through settling and both uptake and filtering by vegetation. Constructed stormwater wetlands temporarily store runoff in relatively shallow pools that support conditions suitable for the growth of wetland plants. The adopted removal rate for constructed stormwater wetlands is 90%.

[3] Definitions provided in the NJDEP – Stormwater Best Management Practices Manual at: http://www.njstormwater.org/tier_A/ bmp_manual.htm

- **Dry Wells**

  A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs of structures. Discharge of this stored runoff from a dry well occurs through infiltration into the surrounding soils. A dry well may be either a structural chamber and/or an excavated pit filled with aggregate. Due to the relatively low level of expected pollutants in roof runoff, a dry well cannot be used to directly comply with the suspended solids and nutrient removal requirements contained in the NJDEP Stormwater Management Rules at N.J.A.C. 7:8. However, due to its storage capacity, a dry well may be used to reduce the total stormwater quality design storm runoff volume that a roof would ordinarily discharge to downstream stormwater management facilities. Care should be taken with the location and size of dry wells due to potential impacts on basements and foundations.

- **Extended Detention Basins**

  An extended detention basin is a facility constructed through filling and/or excavation that provides temporary storage of stormwater runoff. It has an outlet structure that detains and attenuates runoff inflows and promotes the settlement of pollutants. An extended detention basin is normally designed as a multistage facility that provides runoff storage and attenuation for both stormwater quality and quantity management. The adopted TSS removal rate for extended detention basins is 40 to 60%, depending on the duration of detention time provided in the basin.

- **Infiltration Basins**

  An infiltration basin is a facility constructed within highly permeable soils that provides temporary storage of stormwater runoff. An infiltration basin does not normally have a structural outlet to discharge runoff from the stormwater quality design storm, but may require an emergency overflow for extraordinary storm events. Instead, outflow from an infiltration basin is through the surrounding soil. An infiltration basin may also be combined with an extended detention basin to provide additional runoff storage for both stormwater quality and quantity management. The adopted TSS removal rate for infiltration basins is 80%.

- **Manufactured Treatment Devices**

  A manufactured treatment device is a pre-fabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff. The TSS removal rate for manufactured treatment devices is based on the NJDEP certification of the pollutant removal rates on a case-by-case basis. Other pollutants, such as nutrients, metals, hydrocarbons, and bacteria can be included in the verification/certification process if the data supports their removal efficiencies. Any such device should be consistent with current Borough equipment selection/approved Borough device.

- **Pervious Paving Systems**

  Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers. Pervious paving systems are divided into three general types. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. Porous paving and permeable paver with storage bed systems treat the stormwater quality design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures. Care must be taken with the use of pervious systems to avoid subgrade instability and frost related deterioration. Pervious paving systems also require significant maintenance to maintain their designed porosity.

- **Sand Filters**

  A sand filter consists of a forebay and underdrained sand bed. It can be configured as either a surface or subsurface facility. Runoff entering the sand filter is conveyed first through the forebay, which removes trash, debris, and coarse sediment, and then through the sand bed to an outlet pipe. Sand filters use solids settling, filtering, and adsorption processes to reduce pollutant concentrations in stormwater. The adopted TSS removal rate for sand filters is 80%.

- **Vegetative Filters**

  A vegetative filter is an area designed to remove suspended solids and other pollutants from stormwater runoff flowing through a length of vegetation called a vegetated filter strip. The vegetation in a filter strip can range from turf and native grasses to herbaceous and woody vegetation, all of which can either be planted or indigenous. It is important to note that all runoff to a vegetated filter strip must both enter and flow through the strip as sheet flow. Failure to do so can severely reduce and even eliminate the filter strip's pollutant removal capabilities. The total suspended solid (TSS) removal rate for vegetative filters will depend upon the vegetated cover in the filter strip.

- **Wet Ponds**

  A wet pond is a stormwater facility constructed through filling and/or excavation that provides both permanent and temporary storage of stormwater runoff. It has an outlet structure that creates a permanent pool and detains and attenuates runoff inflows and promotes the settlement of pollutants. A wet pond, also known as a retention basin, can also be designed as a multi-stage facility that provides extended detention for enhanced stormwater quality design storm treatment and runoff storage and attenuation for stormwater quantity management. The adopted TSS removal rate for wet ponds is 50 to 90% depending on the permanent pool storage volume in the pond and the length of the retention time provided by the pond.

Table 6, below, summarizes the approximate TSS removal rates for these structures. Final TSS removal rates should be calculated for each structure based on its final design parameters.

Table 6: TSS Removal Rates for BMPs

Best Management Practice (BMP)	Adopted TSS Removal Rate (%)
Bioretention System	90
Constructed Stormwater Wetland	90
Dry Well	Volume Reduction Only
Extended Detention Basin	40-60*
Infiltration Structure	80
Manufactured Treatment Device	See N.J.A.C 7:8-5.7(d)
Pervious Paving System	Volume Reduction Or 80 (with infiltration bed)
Sand Filter	80
Vegetative Filter	60-80
Wet Pond	50-90*

*Based on volume and detention time
Source: NJDEP BMP Manual, Apr. 2004.

Each of these structures has advantages and disadvantages to manage stormwater. As previously noted, Highlands is a fully developed community and anticipates the majority of new construction as residential infill development that will disturb less than one (1) acre of land.

LAND USE/ BUILD-OUT ANALYSIS

The entire Borough of Highlands is less than one (1) square mile of land, therefore the Borough is exempt from the NJDEP regulations requiring the development of a buildout analysis, which would indicate the potential for development within the Borough (Table 3). Refer to Figure 4 for a copy of the Borough's Existing Land Use Map.

Figure 12 illustrates the Hydrologic Units (HUC-14s) located within the Borough and Figure 13 shows the environmentally constrained lands. Figure 13 also shows the limited freshwater wetlands located along the Borough boundary.

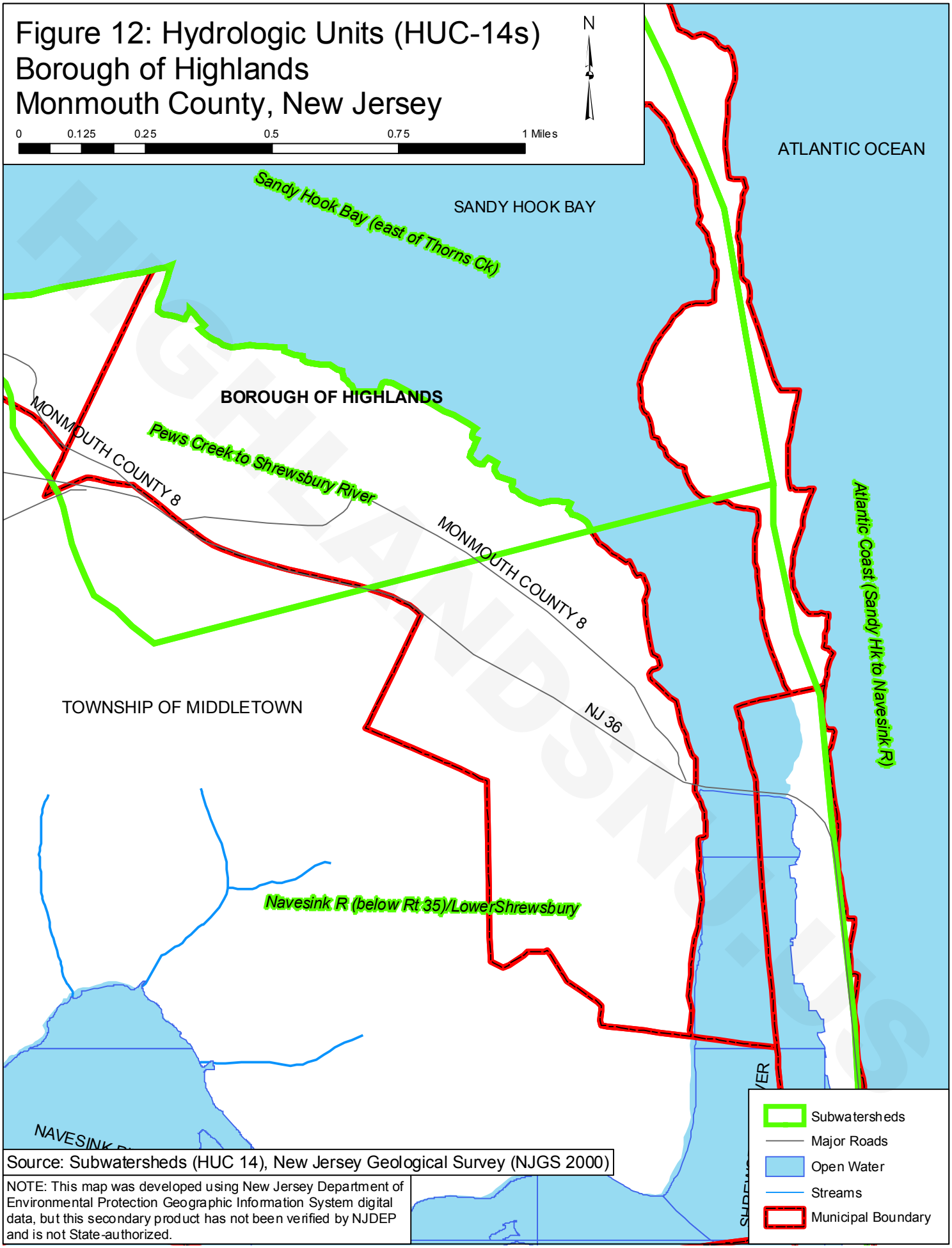
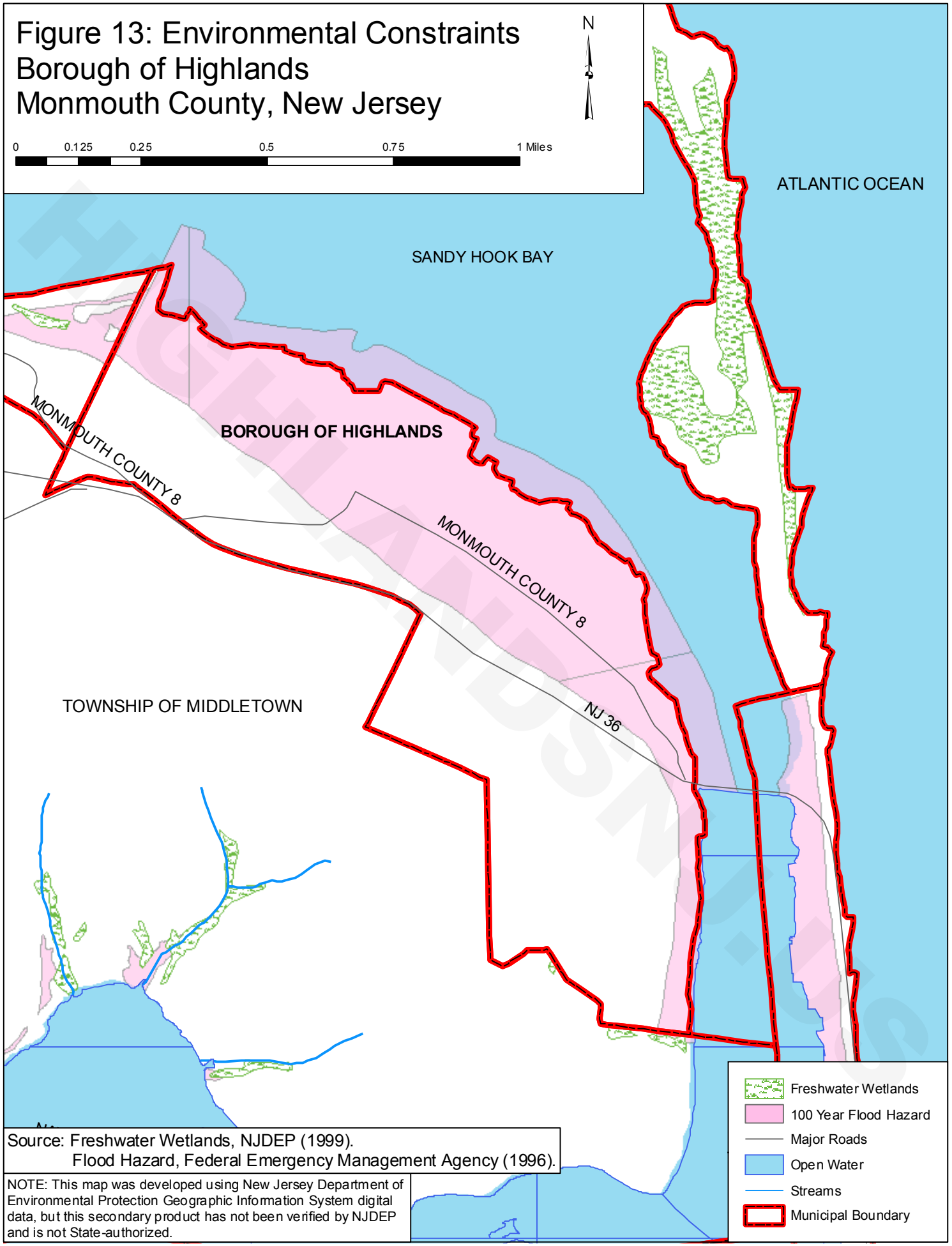


Figure 12: Hydrologic Units (HUC-14s)
Borough of Highlands
Monmouth County, New Jersey
N
0 0.125 0.25 0.5 0.75 1 Miles
ATLANTIC OCEAN
SANDY HOOK BAY
Sandy Hook Bay (east of Thorns Ck)
BOROUGH OF HIGHLANDS
Pews Creek to Shrewsbury River
MONMOUTH COUNTY 8
MONMOUTH COUNTY 8
Atlantic Coast (Sandy Hk to Navesink R)
TOWNSHIP OF MIDDLETOWN
NJ 36
Navesink R (below Rt 35)/LowerShrewsbury
NAVESINK
Subwatersheds
Major Roads
Open Water
Streams
Municipal Boundary
Source: Subwatersheds (HUC 14), New Jersey Geological Survey (NJGS 2000)
NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Figure 13: Environmental Constraints
Borough of Highlands
Monmouth County, New Jersey



Source: Freshwater Wetlands, NJDEP (1999).
Flood Hazard, Federal Emergency Management Agency (1996).

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

MITIGATION PLAN

This mitigation plan is provided for proposed development or redevelopment projects that seek a variance or exemption from the stormwater management design and performance standards set forth in this MSWMP and N.J.A.C. 7:8-5.

MITIGATION PROJECT CRITERIA

To grant a variance or exemption from the stormwater regulations, new development and redevelopment plan applications must propose a mitigation project affecting the same sensitive receptor and located within the same drainage basin as the proposed development/redevelopment. Proposed mitigation projects must provide for additional groundwater recharge benefits, protection from stormwater runoff quantity or quality from previously developed property that does not currently meet the design and performance standards outlined in this MSWMP. Mitigation projects should also be as close in terms of hydrology and hydraulics to the proposed development/redevelopment as possible.

Projects must be proposed on an equivalent basis. Developers must propose a mitigation project similar in kind to the variance or exemption being requested. Proposed mitigation projects cannot adversely impact the existing environment.

The proposed mitigation project must be completed for the performance standard for which the variance or exemption is requested. Performance standards must ensure the long-term maintenance of the approved mitigation system, which include the maintenance requirements under Chapters 8 and 9 of the NJDEP BMP Manual. The Borough does not anticipate granting variances or exemptions for “major developments” until a detailed mitigation plan is developed and approved. The Borough will consider granting variances or exemptions for "major developments" subject to the following NJDEP and local requirements:

1. The Developer shows that literal compliance is technically impractical or presents a substantial economic hardship.

2. The project must be within the same area that would contribute to the receptor impacted by the project. Note that depending on the specific performance standard waived, the sensitive receptor and/or the contributory area to that receptor may be different. If there are no specific sensitive receptors that would be impacted as the result of the grant of the waiver/exemption, then the location of the mitigation project can be located anywhere within the Borough, and should be selected to provide the most benefit relative to an existing stormwater problem in the same category (quality, quantity or recharge).

3. Legal authorization must be obtained to construct the project at the location selected. This includes the maintenance and any access needs for the project in the future.

4. The project should be close to the location of the original project, and if possible, be located upstream at a similar distance from the identified sensitive receptor. This distance should not be based on actual location, but on a similar hydraulic distance to the sensitive receptor. For example, if the project for which a waiver is obtained discharges to a tributary, but the closest location discharges to the main branch, it may be more beneficial to identify a location discharging to the same tributary.

5. For ease of administration, if sensitive receptors are addressed, it is preferable to have one location that addresses any and all of the performance standards waived, rather than one location for each performance standard.

6. It must be demonstrated that implementation of the mitigation project will result in no adverse impacts to other properties or the environment.

7. Mitigation projects that address stormwater runoff quantity can provide storage for proposed increases in runoff volume, as opposed to a direct peak flow reduction.

DEVELOPER MITIGATION PLAN REQUIREMENTS

Proposed mitigation projects shall have Mitigation Plans submitted to the Borough for review

and approval prior to granting final approval for site development. Developers should include the following in a Mitigation Plan:

- Mitigation Project Name, Owner name and address, Developer name and address, Mitigation Project Location, Drainage Area, Cost Estimate;
- Proposed mitigation strategy and impact to sensitive receptor. Descriptions should include what is being impacted, how it is impacted, what is being mitigated and how;
- Sensitive Receptor: Identify the sensitive receptor(s) related to the performance standard from which a waiver is sought. Demonstrate that the mitigation site contributes to the same sensitive receptor;
- Legal authorization required for construction, maintenance, and access;
- Responsible Party including: a schedule of required maintenance or maintenance plan, who will perform the maintenance, proposed cost of maintenance, and how it will be funded;
- All other permits required for construction of the mitigation project;
- Cost estimate of construction inspection; and
- Reason a waiver or exemption is requested and supporting evidence.

Due to the lack of vacant or developable land, it is anticipated that the majority of the mitigation projects proposed will result in retrofitting/rehabilitation of existing stormwater facilities and natural infrastructures. Below are some areas for possible mitigation projects within the Borough. More detailed information may be available from the Borough or the Borough Engineer's office. It is the developer's responsibility to provide a detailed study of any proposed mitigation project, and provide the Borough with a proposed mitigation plan for review and approval.

Water Quantity

- Improvements to Stormwater Pump Stations located on North Street and Valley Street.

Water Quality

- Installation of structural BMPs on the Borough's stormwater system and discharges.
- Elimination of Inflow/Infiltration (I/I) problems located throughout the Borough.
- Dredging or repair of the culvert at the intersection of South Peak Street and Highland Avenue.

Groundwater Recharge

- Elimination of Inflow/Infiltration (I/I) problems located throughout the Borough.

RECOMMENDATIONS

The following are additional recommendations associated with this Stormwater Management Plan Element of the *Master Plan*:

- ***Recommendation A: Educate residents on the impacts of the overuse of fertilizers and good fertilizer maintenance practices.***

  As stated in the Stormwater Management Strategies section above, the overuse of fertilizers has a significant detrimental impact on surface water bodies and groundwater. The Borough should work with the NJDEP to educate residents on these impacts and encourage residents to use techniques to create a "green lawn" without over-fertilizing and/or to convert lawn areas to other kinds of vegetation that do not require fertilization and other chemical treatments. Many lawn services also "overspray" fertilizer onto roadways and adjacent properties. The Borough should investigate methods to minimize the application of fertilizers beyond property lines.

- ***Recommendation B: Seek to continue to ensure the inspection, monitoring, and maintenance of all stormwater management facilities and develop strategies for all existing and future maintenance and improvements.***

  Stormwater facilities require regular maintenance to ensure effective and reliable performance. Failure to perform the necessary maintenance can lead to diminished performance, deterioration and failure. In addition, a range of health and safety problems, including mosquito breeding and the potential for drowning, can result from improperly maintained facilities. To minimize these risks, the Borough should implement a procedure for regular inspection, monitoring, and maintenance of Borough owned stormwater facilities.

  The Borough should also continue evaluate and identify maintenance and/or improvement needs and continue the procedures for regular inspection and maintenance of existing and proposed privately owned stormwater facilities described in their SPPP and Stormwater

Management and Control Ordinance. Additionally, the Borough should encourage the use of low impact design methods and non-structural strategies that require less maintenance.

- ***Recommendation C: Encourage existing storm drains to be replaced with bicycle safe grates and Campbell Foundry Model #N-2-ECO inlet heads (or equal) to prevent floatable and solid debris from entering the storm water conveyance system.***

Typical roadway debris, such as bottles and cans, can easily enter stormwater conveyance systems through typical inlet openings. This debris is then transported downstream into the receiving water bodies. By replacing existing storm drain inlets with new inlet grates and inlet heads, which have a maximum opening size of 2-inches by 4-inches, the amount of debris entering the stream can be reduced, improving water quality.

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