

Stormwater Management Plan

For

**Borough of Watchung
Somerset County, New Jersey**

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Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the Borough of Watchung (“the Borough”) to address stormwater related impacts. The creation of this plan is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C. 7:8 Stormwater Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major development, defined as projects that disturb one or more acre of land. These standards are intended to minimize the adverse impacts of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides base flow in receiving water bodies.

The plan addresses long-term operation and maintenance measures for existing and future stormwater facilities. The final component of this plan is a mitigation strategy for when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

Goals and Objectives:

- The identity of the Borough of Watchung as a totality and the integrity of its individual neighborhood areas should be preserved, enhanced and created to the maximum extent possible.
- The Development Plan should recognize the physical characteristics of the Borough of Watchung and acknowledge the inherent capabilities and limitations

of the land to host different types of community development at appropriate densities and intensities.

- Conservation of the existing natural resources within the Borough of Watchung should be an integral part of the planning process, with special attention to the constraints of environmentally critical and sensitive areas, including wetlands, 100 year floodplains and lands with a topographic slope of fifteen percent (15%) and greater.
- The Development Plan should strive to improve upon the commercial vitality of the Borough of Watchung and should promote new development of non-residential uses in appropriate locations with appropriate regulations. The overall goal is to promote a strong economy and a balance between residential and non-residential development, so that appropriate retail establishments are provided for the convenience of the Borough residents, job opportunities are available, and a balance tax base is created.

MSWMP Goals

The goals of this MSWMP are to:

- Reduce flood damage, including damage to life and property;
- Protect drinking water supply;
- Minimize, to the extent practical, any increase in stormwater runoff from any new major development;
- Reduce soil erosion from any major development or construction project;
- Assure the adequacy of existing and proposed culverts, bridges and other instream structures;

- Maintain groundwater recharge;
- Prevent, to the greatest extent feasible, an increase in nonpoint source pollution;
- Maintain the integrity of stream channels for their biological functions, as well as for drainage;
- Minimize pollutants in stormwater 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, industrial and other uses of water; and
- Protect public safety through the proper design and operation of stormwater basins.
- promote public education and involvement, via the Stormwater Pollution Prevention Plan as implemented by the Borough (last revised as of August 4, 2021)

The Borough Master Plan was reviewed and the goal/objective applicable to the MSWMP is as follows:

- Conservation of the existing natural resources within the Borough of Watchung should be an integral part of the planning process, with special attention to the constraints of environmentally critical and sensitive areas, including wetlands, 100 year floodplains and lands with a topographic slope of fifteen percent (15%) and greater.

This Master Plan goal/objective is met.

In addition, the Borough's "Stormwater, Steep Slope and Erosion Control Ordinance", "Land Use Regulations" and "Zoning Ordinance", Chapters 118, 119 and

138 respectively, were reviewed. These ordinances in conjunction with the applicable standards of the Borough of Watchung, i.e., Stormwater Control Ordinance and Residential Site Improvement Standards (RSIS), for design and compliance, will insure that development meets the said Master Plan goal/objective.

To achieve MSWMP goals, this plan outlines specific stormwater design and performance standards for new development. The Borough realizes that with the limited buildable area within municipal boundary, that the above goals can only be achieved by one or more of the following; reduce flood damage with adequately designed storm sewer and management systems, culverts and bridges; protect drinking water with well-head protection; minimize increase in stormwater runoff with properly designed stormwater management basins and properly designed stormwater recharge basins; reduce soil erosion by following the guidelines set by the Soil Conservation District; assure adequacy of all culverts and bridges with an on-going review; minimize impervious coverage and encourage groundwater recharge where possible; prevent non-point source pollution, i.e., pet waste, wildlife feeding, yard wastes, illicit connections, et.; maintain integrity of stream channels by requiring top-of-bank buffers and requiring and enforcing NJDEP Letters of Interpretation and transition ones for Freshwater Wetlands; minimize pollutants with enforcement of stormwater ordinances, and requiring Environmental Impact Statements for projects; and protect public safety with proper design and operation of stormwater basins.

Safety Standards for Stormwater Management Basins, as per N.J.A.C. 7:8-6, are incorporated in the Borough's Stormwater Control Ordinance in Section 21.8. In addition, RSIS, outline requirements to protect public safety. Long term operation, maintenance as per N.J.A.C. 7:8-5.8, and enforcement of stormwater management measures are addressed in adopted Stormwater Control Ordinances, as well as, the implementation of the Residential Site Improvement Standards (RSIS) standards via development review. The Borough's Stormwater Control

Ordinance, Section 21.10 reviews in detail, the maintenance and repair for stormwater management measures; and, Section 21.11 reviews the enforcement (Engineering Department and/or Code Enforcement Department) and penalties (fine not exceed Two Thousand (\$2,000) dollars or imprisonment for a period not exceeding ninety (90) days, or a period of community service not exceeding ninety (90) days at the discretion of the Municipal Court for entities found to be in violation of the ordinances. In addition, Sections 18.11, 6-2, 6-3, 10-36 of the Borough Code, addresses enforcement and penalties regarding Illicit Connections, Yard Waste, Wildlife Feeding and Pet Waste.

Stormwater Discussion

Land development can dramatically alter the hydrologic cycle (see Figure 1) of a site and ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or raw that has infiltrated into the ground and return it to the atmosphere through evapotranspiration. Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site. Impervious areas that are connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than under natural conditions.

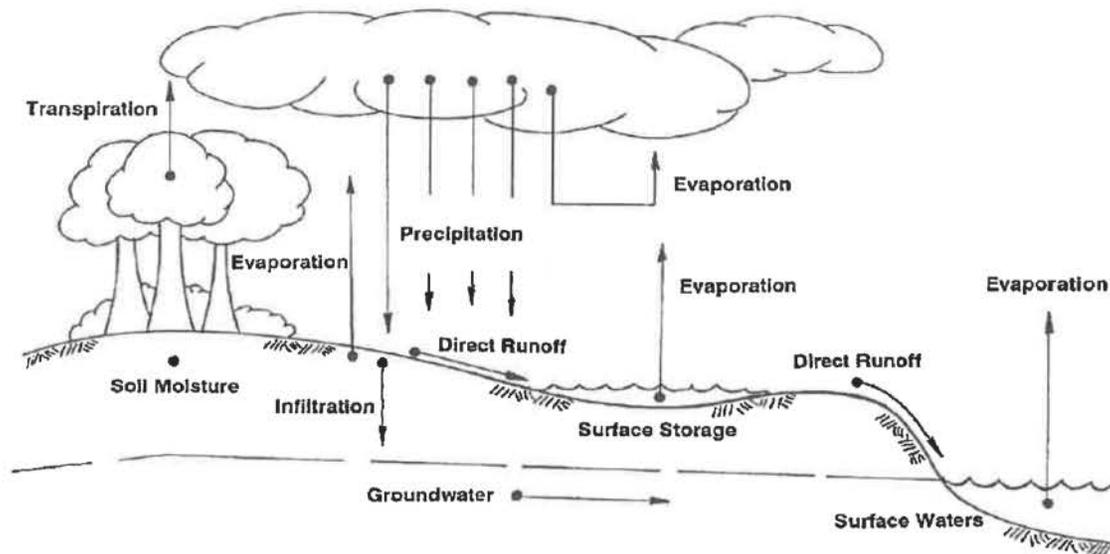
–These increases can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment in the channel. Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area

can also decrease opportunities for infiltration which, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy the habitat from which some species cannot adapt.

In addition to increases in runoff peaks, volumes, and loss of groundwater recharge, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens and nutrients.

In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along stream banks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

Figure 1 – Hydrologic cycle



Background

The Borough encompasses 6.2 square miles in the northeast part of Somerset County, New Jersey. The Borough land use is a mix of residential and highway commercial. There are a number of undeveloped areas located throughout the Borough. Stream and rivers within the Borough are shown in Figure 2 and the topography of the Borough is shown in Figure 3.

According to the 2019 census, the Borough has 6,006 residents. The population rose approximately 0.1% since the 2010 census. This population increase is less than the overall state population increase of 1% and less than the county increase of 1.7% over the same period.

The undeveloped areas that do exist are located throughout the municipality. A large portion of the Borough is constrained by rock outcrops, steep slopes, ditches, environmentally sensitive areas, and lack of sanitary sewers. Streams and rivers within

the Borough are shown in Figure 2 and the topography of the Borough generally falling north and south, as shown in Figure 3.

The Borough is situated along the north side of the Green Brook in the Raritan Basin. It is located in Watershed Management Area (WMA) 9, the lower Raritan, South River and Lawrence Brook.

The Borough contains portions of four (4) Hydrologic Unit Code (HUC14) areas. They are 02030105120010, 02030105120020, 02030105120030 and 02030105120040. HUC14 areas are shown in Figure 4. The term "HU"-14" is from the hydrologic unit code system developed by the United States Geological Service for delineating and identifying drainage areas. The system starts with the largest possible drainage areas and progressively smaller subdivisions of the drainage area are delineated and numbered in a nested fashion. A drainage area with a hydrologic unit code (HUC) designation with 14 numbers, or HUC-14, is one of several sub watersheds of a larger watershed with 11 numbers, or a HUC-11. There are 921 HUC 14 sub watersheds in New Jersey that range in size from .1 to 42 square miles. The average size of a HUC 14 is 8.5 square miles. There are 150 HUC 11 watersheds in New Jersey ranging in size from .1 to 143 square miles with an average size of 51.9 square miles.

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sites throughout New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics.

Based on the AMNET data, there are a number of waterbodies bordering the Borough are moderately impaired. There are five (5) AMNET sites of significance located in and around the municipality, which include Green Brook at Raymond Avenue (AN0421), Green Brook at Apple Tree Road (AN0421B), Green Brook at Clinton Avenue in North Plainfield (AN0423), Stony Brook at West End Avenue in North Plainfield (AN0422) and Stony Brook at Sunlit Drive (AN0422A).

A TMDL is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require an NJPDES permit to discharge, and nonpoint source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems and other BMP's.

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d) (integrated List) is required by the federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Sublist 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants, for which one or more TMDL's are needed. Stony Brook and Green Brook are listed in Sublist 5 (June 22, 2004).

The following waters are listed on Sublist 5:

<u>Waterbody and Location</u>	<u>Site ID#</u>	<u>Impairment</u>
Green Brook at Raymond Avenue	AN0421	Benthic macroinvertebrates
Green Brook at Apple Tree Road	AN0421B	Benthic macroinvertebrates
Green Brook at Clinton Avenue	AN0423	Benthic macroinvertebrates
Stony Brook at West End Ave.	AN0422	Benthic macroinvertebrates
Stony Brook at Sunlit Drive	AN0422A	Benthic macroinvertebrates

A TMDL for fecal coliform was proposed on April 21, 2003 for Segment ID #01403470. Tributaries included in this TMDL are the Green Brook, Stony Brook and West Branch Stoney Brook.

In addition to water quality problems, the Borough has occasional flooding problems. Flooding occurs on the Green Brook and Stony Brook. During Hurricane Doria in 1973, the Watchung Circle, the Watchung Police Headquarters (in the center of the circle), the Watchung Municipal Building (on the south side of the circle), and commercial building along Somerset Street were damaged by a raging flash flood, which also claimed the lives of five people. In fact, Wetumpka Falls, which had survived terrible floods in 1889 and 1938, was destroyed. Hurricane Floyd in 1999, also damaged the immediate area of the Watchung Circle. The 100-year floodplain is shown in Figure 5.

In conjunction with the USGS, Somerset County operates a flood information system for its 21 municipalities. The areas within the municipality that have historically experienced flooding are: Stony Brook at Sunlit Drive and Brookdale Road, Stony Brook at the Circle, Ross Pond at Washington Road and Green Brook at New Providence Road. The Somerset County Flood Information System (SCFIS) consists of a network of stream and precipitation gages throughout the County. Information from these gages is automatically transmitted to a central location via telephone, radio and satellite. The information is then processed and appropriate actions are taken. These actions include

notifying municipal police, fire and emergency management personnel with flood potential and water level information.

There are several SCFIS stream and precipitation gages near Watchung Borough. There is a combination rain and stream gage in the municipal building parking lot along Stony Brook. In addition, information from nearby gages is available on the United States Geological Survey (USGS) website in real time (<http://waterdata.usgs.gov/nj/nwis>).

The Borough has small amount of developable land. Development is limited due to rock outcrops, steep slopes, ditches, environmentally sensitive areas, and lack of sanitary sewers. The existing Land Use/Land Cover Map, based on 1995/1997 aerial photography, is shown in Figure 6. The existing zoning is shown in Figure 7.

The Borough currently contains fourteen (14) zoning districts: Rural Single-Family Residential (R-R), Single-Family Residential (R-A), Single-Family residential (R-B), Neighborhood Commercial (B-A), Professional Office (B-B), Highway Commercial (B-C), Highway Development (H-D), Limited Industrial/Quarry (L-I), Multi-Family Affordable (R-M-L I), One-Family Residential (R-M-L II), One-Family Residential (R-M-L III), One-Family Residential (R-M-L IV), Multi-Family Housing (R-M-L V), Senior Citizen Affordable (R-M-L VI), and the Village Center Historical Overlay Zone, as shown in Figure 7.

A current aerial photo with parcel lot lines overlain on it is shown in Figure 8. The Borough is within the State Plan Designation PA2 Suburban Planning Area with a portion of the municipality designated as a planned village center. Groundwater recharge rates for native soils in this area are generally between 1 and 19 inches annually. The average annual groundwater recharge rates are shown graphically in Figure 9.

According to the NJDEP, “A Well Head Protection Area (WHPA) in New Jersey is a map area calculated around a Public Community Water Supply (PCWS) well in New Jersey that delineates the horizontal extent of ground water captured by a well pumping at a specific rate over a two-, five- and twelve-year period of time for unconfined wells.... The confined wells have a fifty foot radius delineated around each well serving as the well head protection area to be controlled by the water purveyor in accordance with Safe Drinking Water Regulations (see NJAC 7:10-11.7(b)1).”

WHPA delineations are conducted in response to the Safe Drinking Water Act Amendments of 1986 and 1996 as part of the Source Water Area Protection Program (SWP). The delineations are the first step in defining the sources of water to a public supply well. Within these areas, potential contamination will be assessed and appropriate monitoring will be undertaken as subsequent phases of the NJDEP SWAP.

As shown in Figure 10, a portion of the Borough is not in a well head protection area. The closest area is located in the Borough of North Plainfield.

There are no public potable water supply sources within the Borough. There remain small sections of private residences within the Borough that are supplied potable water by individual wells. However, the majority of the Borough is serviced with potable water by the New Jersey American Water Company. Furthermore, there are no known potable water quality problems within the Borough.

In addition to the rivers and streams that run through and along the Borough, there are a number of wetland areas. These wetland areas, shown in Figure 11, provide flood storage, nonpoint pollutant removal and habitat for flora and fauna.

Design and Performance Standards

The Borough will adopt the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5, via the Stormwater Control Ordinance, to minimize the adverse impact of stormwater runoff on water quality, water quantity and loss of groundwater recharge in receiving waterbodies for residential and commercial site development. Generally, projects meeting the definition of a major development are required to meet the regulations stated under N.J.A.C. 7:8-5. Said regulations address erosion control, groundwater recharge, runoff quantity standards, stormwater runoff quality standards, standards for calculating stormwater runoff and groundwater recharge, structural stormwater management standards, and maintenance requirements, as stated above. The major development must meet the established design and performance standards set forth in the Soil Erosion and Sediment Control Act.

The N.J.A.C. 7:8: Stormwater Management regulations promote stormwater management measures for major developments that minimize the adverse impact of stormwater runoff on water quantity, water quality and the loss of groundwater recharge to receiving waterbodies. In N.J.A.C. 7:8-5.3 and Chapter 2 of the *New Jersey Stormwater Best Management Practices (BMP) Manual 2004 (last revised September 2017)*, stormwater management design techniques are focused on non-structural stormwater management strategies. Non-structural Stormwater Management Strategies, Low Impact Development (LIDs) techniques, are enumerated as follows:

1. "Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;" (N.J.A.C. 7:8-5.3(b)1.)

i.e., preserve forested areas, riparian corridors and high groundwater or aquifer recharge capabilities and any other natural area with significant hydrologic function, specific legal and/or procedural measures to ensure

areas remain preserved in the future and, reestablish wooded and forested areas that were disturbed

2. “Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;” (N.J.A.C. 7:8-5.3(b)2.)

i.e., use vegetative filters and buffers, promote sheet flow over vegetated areas, use level and/or curb cuts at appropriate locations, utilize the minimum pavement widths, vegetate/landscape islands, utilize pervious materials at appropriate locations and locate parking underground or beneath buildings

3. “Maximize the protection of natural drainage features and vegetation;” (N.J.A.C. 7:8-5.3(b)3.)

i.e., preserve forested areas, riparian corridors and high groundwater or aquifer recharge capabilities and any other natural area with significant hydrologic function and take specific legal and/or procedural measures to ensure areas remain preserved in the future

4. “Minimize the decrease in the pre-construction “time of concentration;” (N.J.A.C. 7:8-5.3(b)4.)

i.e., increase sheet flow, disconnect impervious areas, use vegetative stormwater conveyance systems and dense vegetation at appropriate locations, utilize natural features and reduce slopes

5. “Minimize land disturbance including clearing and grading;” (N.J.A.C. 7:8-5.3(b)5.)

i.e., preserve forested areas, riparian corridors and high groundwater or aquifer recharge capabilities and any other natural area with significant hydrologic function and reduce lawn areas

6. “Minimize soil compaction;” (N.J.A.C. 7:8-5.3(b)6.)

i.e., use light weight equipment during construction and minimize disturbed land areas

7. “Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;” (N.J.A.C. 7:8-5.3(b)7.)

i.e., use of native plants will result in lower fertilizer and water needs, will promote infiltration characteristics similar to those of natural area and can attract native wildlife and provide better habitat

8. “Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas;” (N.J.A.C. 7:8-5.3(b)8.)

i.e., use vegetated channels and swales at appropriate locations to increase surface roughness and decrease flow velocities and ensure vegetative conveyance systems are tolerant to higher frequency storms

9. “Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff.” (N.J.A.C. 7:8-5.3(b)9.)

i.e., provide trash receptacles, litter fences, require regular sweepings, provide “pet waste stations,” provide storm drain inlets and trash racks, utilize berms and secondary containment systems (This section is more specifically geared towards commercial and industrial areas or areas with high residential population densities.)

The applicant submitting for review must address the nonstructural stormwater management strategies utilized in the proposed design. If these strategies are not incorporated into the design, the applicant must state reasons for contention. All nonstructural stormwater management strategies must be incorporated to the

“maximum extent practical.” An applicant should demonstrate the design has exhausted all measures to implement the nonstructural strategies prior to the use of the structural methods.

“...nonstructural LID-BMPs are to be given preference over structural BMPs. Where it is not possible to fully comply with the Stormwater Management Rules solely with nonstructural LID-BMPs, they should then be used in conjunction with LID and standard structural BMPs to meet the Rules’ requirements.” (NJ Stormwater BMP Manual 2004, page 2-3)

NJAC 7:8-5.3(a) states:

“To the maximum extent practical, the standards in NJAC 7:8-5.4 and 5.5 shall be met by incorporating nonstructural stormwater management strategies at NJAC 7:8-5.3 into the design. The persons submitting an application for review shall identify the nonstructural strategies incorporated into the design of the project. If the applicant contends that it is not feasible for engineering, environmental, or safety reasons to incorporate any nonstructural stormwater management strategies identified in (b) below [NJAC 7:8-5.3(b)] into the design of a particular project, the applicant shall identify the strategy and provide basis for the contention.”

See Appendix A of the *NJ Stormwater BMP Manual 2004* for Low Impact Development Checklists provided by the NJDEP.

Stormwater Management Regulations Overview

Groundwater Recharge Requirements

Major developments must meet one of two standards for groundwater recharge, per N.J.A.C. 7:8-5.4(a)2.:

- (1) maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site, or
- (2) infiltrate the increase in the stormwater runoff volume from pre-construction to post-construction for the two-year storm.

Stormwater Quality Requirements

For water quality (N.J.A.C. 7:8-5.5), stormwater management measures shall be designed to reduce the post-construction load of *total suspended solids (TSS)* in the stormwater runoff generated by the water quality design storm by *eighty-percent (80%)* of the anticipated load from the major development.

Stormwater Quantity Requirements

To control stormwater runoff quantity impacts (N.J.A.C. 7:8-5.4 3.), a major development must meet one of three design standards:

- (1) demonstrate at no point in time that the post-construction runoff hydrograph exceeds the pre-construction runoff hydrograph,
- (2) demonstrate there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2, 10 and 100-year storm event and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site, or

- (3) demonstrate the post-construction peak runoff rates for the 2, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction runoff rates.

Maintenance, Safety and Ordinances

The design and performance standards include the language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-5.8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. These sections address long-term operation and maintenance measures for existing and future stormwater facilities.

The Stormwater Control Ordinance must be submitted to the county for review and approval within 24 months of the effective date of the Stormwater Management Rules, April 2006 (last amended 2016).

The following ordinances must be adopted by the Borough and meet the minimum requirements set forth in the Tier A Municipal Stormwater General Permit (NJ0141852). If these ordinances already exist then they must be reviewed and updated where necessary.

Those ordinances are as follows, but are not limited to:

1. *Pet Waste Ordinance* – Chapter 10.36.1 of the Watchung Code of Ordinances requires owners and keepers to immediately and properly dispose of their pet's solid waste. Information provided by NJDEP to be distributed with pet licenses regarding said ordinance;

2. *Litter Ordinance* – Chapter 6-1 of the Watchung Code of Ordinances regulates litter disposal in accordance with NJDEP model ordinance for litter control;
3. *Improper Disposal of Waste Ordinance* –Chapter 4-9 of the Watchung Code of Ordinances will be updated to prohibit spilling, dumping or disposing of any materials other than stormwater into the municipal separate storm sewer system;
4. *Wildlife Feeding Ordinance* – will prohibit feeding of non-confined wildlife in any public park or property owned/operated by the municipality;
5. *Illicit Connection Ordinance* – will prohibit illicit connections to the municipal separate storm sewer system.

During construction, Borough inspectors will observe the construction of the project to ensure that the stormwater management measures are constructed and function as designed. Operation and Maintenance Manuals will be required for BMPs to ensure long-term maintenance strategies.

Plan Consistency

The Borough is not within a Regional Stormwater Management Planning Area and does not need to be consistent with any regional stormwater management plans (RSWMPs). However, the Borough is a member of the Green Brook Flood Control Commission. There is a TMDL for fecal coliform proposed for tributaries within the Borough as mentioned above. In the event that this TMDL is adopted, this plan shall be updated for consistency. If any RSWMPs or other TMDLs are developed in the future, this Municipal Stormwater Management Plan will be updated to be consistent.

The Borough is within the Raritan Basin and much information on the basin and about its characteristics has been developed as part of the Raritan Plan. Additional information concerning this plan can be found at: <http://www.raritanbasin.org>. The Borough supports the Raritan Plan.

The Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. The Borough will utilize the most current update of the RSIS in the stormwater review of residential areas. This Municipal Stormwater Management Plan will be updated to be consistent with any future updates of the RSIS.

The Borough's Stormwater Management Ordinance requires all new major development and major redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction, Borough inspectors will observe on-site soil erosion and sediment control measures and report any inconsistencies to the local Soil Conservation District.

All pertinent design calculations for stormwater management facilities should adhere to the new design rainfall depths for Somerset County as revised by the Natural Resources Conservation Service as of September 2004 accordingly:

NRCS 24 Hour Design Storm Rainfall Depths

As Revised August 2012

NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

Rainfall amounts in Inches

County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

The MSWMP has been reviewed and is consistent with and requires all new development and redevelopment plans to comply with, the Somerset County smart Growth Strategic Plan, and the State Plan, as follows:

1. Encourage the protection and conservation of all water resources.
2. Encourage the protection of potable water resources.

3. Promote preservation and improvement of surface water quality.
4. Encourage the preservation and improvement of groundwater quality and quantity.
5. Promote and protection of water-oriented wildlife habitat.
6. Promote the preservation, restoration and enhancement of wetlands and streams, rivers, lakes, bays and oceans.
7. The Borough is designated a Village Center by State Plan implementation, and encourages development which protects and preserves water resources and environmentally sensitive areas.

By utilizing the Borough's Zoning Ordinance, Section 138; and the Land Development Ordinance, Section 119, development can only proceed with an extension of the existing water, sanitary and storm infrastructure, and maintaining the Borough's environmentally sensitive land.

The Borough's Stormwater Management Ordinance, and Land Development Ordinance, are consistent with, and require all new development and redevelopment plans to comply with, the applicable objectives of the Borough's Master Plan, which is as follows:

- Conservation of the existing natural resources within the Borough of Watchung should be an integral part of the planning process, with special attention to the constraints of environmentally critical and sensitive areas, including wetlands, 100 year floodplains and lands with a topographic slope of fifteen percent (15%) and greater.

Nonstructural Stormwater Management Strategies

The Borough has reviewed and evaluated the Master Plan including land use plan elements and development regulations to address compliance with nonstructural stormwater management strategies. The Borough has provided a list of the sections in the Land Use and Zoning Ordinances that are to be modified to incorporate said strategies.

Article V of the Borough Code, entitled *Development Regulations and Standards* was reviewed with regard to incorporating nonstructural stormwater management strategies. Several areas are recommended for review and revision to Article V in order to incorporate nonstructural stormwater management strategies.

Article V Section 26-96.1.g. General Design Standards: *Guidelines* It is recommended that a new section be incorporated into the existing Article stating all development shall implement to the maximum extent practical the nonstructural stormwater management strategies as outlined in NJAC 7:8-5.3(b) and Section 4.E. of the Stormwater Control Ordinance.

Article V Section 26-96.4: Supplement Design Standards in PO District requires front yard landscaping and a landscaped strip to be provided along side and rear property lines. It is recommended this section be revised to require the use of native vegetation provided in accordance with the New Jersey Best Management Practices Manual, dated February 2004, latest revision.

Article V Section 26-96.5: Public or Common Private Open Space Design requires the incorporation of shrubbery. It is recommended this section be revised to require the use of native vegetation within said areas. This section also promotes designs that will invite and attract the public. It is also recommended this portion be revised to promote the use of nonstructural stormwater management strategies within these open space areas.

Article V 26-96.6.a. Buffer Design provides for buffer to consist of fences, walls or landscaping to minimize adverse impacts or nuisance on the site. It is recommended this section be revised to promote the use of native vegetation for buffer areas and permit the use of walls and fences in conjunction with native vegetation only if the use of landscape buffering alone is exhausted and no longer deemed a practical application as determined by the Board Engineer.

Article V 26-96.7.b. Landscape Design requires that natural features such as trees, hilltops and views, natural terrain, open waters, natural drainage ridge lines and natural drainage channels shall be preserved. It is recommended that the word trees be expanded to forested areas.

Article V 26-96.7.d. Landscape Design states landscaping should provide a variety and mixture of plantings. It is recommended this section be revised to require the use of native vegetation material.

Article V 26-97.1.t. Street Design Standards: *Curbing* addresses the Borough curb standards. It is recommended this section to be revised to permit the use of flush curb to promote disconnected impervious stormwater runoff.

Article V 26-98.1.j. Off-Street Circulation, Parking and Loading provides all parking and loading areas abutting mixed use/residential areas shall be landscaped about their periphery with shrubs, trees and/or

ground cover. It is recommended this section be revised to incorporate the use of native vegetation.

Article V 26-98.1.b.5. Off-Street Parking: *Curbing* requires curbing around the perimeter of parking lots and all loading areas. It is recommended this section be revised to state that flush curbing shall be permitted along the perimeter of parking lots and loading areas to promote the use of disconnected impervious and open channel swales to convey stormwater runoff.

Article V 26-98.1.c.1. Off-Street Parking: *Other Design Criteria* requires that landscaping in parking and loading areas be shown on the landscaping plan and should be sufficiently detailed to indicate species, size and spacing. It is recommended this section be revised to indicate the required use of native landscaping materials.

Article V 26-98.1.c.3. Off-Street Parking: *Other Design Criteria* requires all parking areas to be effectively screened on any side which abuts or faces any premises situated in any residential zone or existing residential use by buffering screen. It is recommended this section be revised to promote the use of native vegetation for buffer areas and permit the use of walls and fences in conjunction with native vegetation only if the use of landscape buffering alone is exhausted and no longer deemed a practical application as determined by the Board Engineer.

Article V 26-99.3 Storm Drainage Facilities It is recommended that a section be inserted before item 26-99.3.a. stating that all developments meeting definition of a major development in accordance with the Section 2: Definitions of the Stormwater Control Ordinance shall meet the requirements set forth in said ordinance. It recommended a statement be inserted that *all* proposed development within the Borough should address all nonstructural stormwater management strategies as outlined in N.J.A.C. 7:8-5.3(b) and Section 4.E. of the Stormwater Control Ordinance to the maximum extent practical. It is recommended that a statement be inserted requiring the applicant to provide to the Board Engineer a statement identifying the nonstructural stormwater management strategies implemented and provide a basis for contention if not implemented to the maximum extent practical.

Article V 26-99.3 Stormwater Drainage Facilities It is recommended a section be inserted after the item as recommend in 9 above and before item 26-99.3.a. of this section stating that all development shall be designed in accordance with the New Jersey Best Management Practices (BMP) Manual dated February 2004, latest revision.

Article V 26-99.3.b. Stormwater Drainage Facilities requires that all streets shall be provided with catch basins and pipes where the same may be necessary for proper surface drainage. It is recommended this section be revised to indicate that flush curb, open channel swales and vegetated filters shall be implemented where applicable and deemed appropriate by the Board Engineer.

Article V 26-99.3.c.2.(l) Stormwater Drainage Facilities requires that concrete headwalls and precast flared end sections shall include precast, cast in place or grouted rip-rap energy dissipaters at the discharge point. It is recommended to revise this section to require that conduit outlet protection or energy dissipaters be provided in accordance with the most current Standards for New Jersey Soil Erosion and Sediment Control.

Article V Section 26-99.3.c.2.(m) Stormwater Drainage Facilities requires that all development be graded and swaled to secure proper drainage away from all buildings and to prevent the collection of stormwater in pools. It is recommended that this section be expanded to include the preservation of natural features.

Article V Section 26-99.3.c.2.(o) Stormwater Drainage Facilities addresses the dedication of stormwater management facilities, detention/retention ponds, in a drainage right-of-way easement. It is recommended this section be revised to include all structural BMPs be dedicated in a drainage right-of-way easement dedicated to the municipality.

Article V Section 26-99.3.c.2.(q) Stormwater Drainage Facilities:
Vegetation requires all drainage ditches, swales, channels, diversion dikes and berms shall be stabilized with vegetation. It is recommended this section be revised to incorporate the use of native vegetation material.

The Borough would like to advise that although the Borough enforces a maximum allowable impervious coverage requirement for each respective zone, the applicant and/or developer satisfying the percent impervious requirement is **not** relieved of the responsibility to comply with the nonstructural stormwater management strategies and associated stormwater ordinance.

Review of the implementation of nonstructural stormwater management strategies shall be up to the discretion of the Planning Board or Zoning Board of Adjustment based upon the advice of the Board Engineer to determine if nonstructural stormwater management strategies have been implemented to the maximum extent practical. If the Board deems the proposed development as not implementing the nonstructural stormwater management strategies to the maximum extent practical, the Board shall request additional measures be taken to further incorporate nonstructural stormwater management strategies to the maximum extent practical.

Land Use/Build-Out Analysis

Since the Borough of Watchung has a combined total of more than one square mile of vacant lands, the Borough is required to do a build-out analysis. A detailed land use analysis for the Borough was conducted. Figure 6 illustrates the existing land use in the Borough based on 1995/97 GIS information from NJDEP. Figure 4 illustrates the HUC14s within the Borough. The Borough zoning map is shown in Figure 7. Figure 11 illustrates the constrained lands within the Borough. The build-out calculations for impervious cover are shown in Table C-1. As expected when developing agricultural and forestlands, the build-out of these HUC14s will result in a significant increase in impervious surfaces.

It should be noted that the majority of the vacant land within the Borough is constrained by rock outcrops, steep slopes, ditches, environmentally sensitive areas, and lack of sanitary sewers, and therefore, undevelopable.

Table C-1: Build-Out Calculations

HUC14	Zone	Total Area (Ac.)	Wetlands Area (Ac.)	Developable Area (Ac.)	Allowable Imperv. (%)	Build-Out Imperv. (Ac.)
02030105120010	B-A Neighborhood Commercial	5.04	0.00	5.04	70%	3.53
	L-I Limited Industrial / Quarry	91.56	0.63	90.93	80%	72.75
	R-M-L-II One-Family Residential	2.14	0.91	1.23	17.5%	0.22
	R-M-L-III One-Family Residential	8.41	0.00	8.41	17.5%	1.47
	R-M-L-V Multi-Family Housing	3.74	0.00	3.74	17.5%	0.66
	R-R Rural Single-Family Residential	604.61	21.43	583.18	25%	145.80
Total		715.50	22.97	692.53		224.41
02030105120020	B-A Neighborhood Commercial	11.95	0.92	11.03	70%	7.72
	B-C Highway Commercial	17.27	2.96	14.32	80%	11.45
	H-D Highway Development	134.25	30.69	103.56	80%	82.85
	L-I Limited Industrial / Quarry	129.76	26.69	102.87	80%	82.29
	R-M-L-II One-Family Residential	19.30	3.48	15.82	17.5%	2.77
	R-R Rural Single-Family Residential	204.55	11.56	192.99	25%	48.25
Total		617.08	76.60	440.58		235.33
02030105120030	B-A Neighborhood Commercial	43.51	8.08	35.43	70%	24.80
	B-B Professional Office	9.91	4.33	5.58	70%	3.91
	H-D Highway Development	68.82	0.18	68.64	80%	54.91
	L-I Limited Industrial / Quarry	2.17	0.01	2.16	80%	1.73
	R-A Single-Family Residential	105.88	1.21	104.67	25%	26.17
	R-B Single-Family Residential	162.10	5.56	156.54	30%	46.96
	R-M-L-I Multi-Family Affordable	21.59	0.00	21.59	17.5%	3.78
	R-M-L-III One-Family Residential	2.29	0.00	2.29	17.5%	0.40
	R-M-L-IV One-Family Residential	37.98	1.53	36.45	17.5%	6.38
	R-M-L-VI Senior Citizen Affordable	24.84	4.73	20.11	17.5%	3.52
	R-R Rural Single-Family Residential	2,120.88	170.38	1,950.49	25%	487.62
Total		2,599.97	187.93	2,368.63		660.18
02030105120040	R-R Rural Single-Family Residential	19.36	0.00	19.36	25%	4.84
Total		19.36	0.00	19.36		4.84
GRAND TOTAL		3,851.92	310.37	4,213.64		900.36

Table C-2 presents the pollutant loading coefficients by land cover as indicated in the NJDEP Best Management Practice Manual.

Table C-2: Pollutant Loads by Land Cover

Land Cover	Total Phosphorus Load (lb/acre/yr)	Total Nitrogen Load (lb/acre/yr)	Total Suspended Solid Load (lb/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agriculture	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/ Transitional Area	0.5	5	60

The pollutant loads for each zoning district within the four HUC14s at full build-out are presented in Table C-3.

Table C-3: Non-Point Source Loads at Build-Out

HUC14	Zone	Zoning Build-out	Develop. (acres)	TP (lb/acre/yr)	TP (lb/yr)	TN (lb/acre/yr)	TN (lb/yr)	TSS (lb/acre/yr)	TSS (lb/yr)
02030105120010	B-A Neighborhood Commercial	Commercial	5.0	2.1	11	22	111	200	1,007
	L-I Limited Industrial / Quarry	Industrial	90.9	1.5	138	16	1,455	200	18,187
	R-M-L-II One-Family Residential	Med. Density Res.	1.2	1.4	2	15	18	140	172
	R-M-L-III One-Family Residential	Med. Density Res.	8.4	1.4	12	15	126	140	1,177
	R-M-L-V Multi-Family Housing	High Density Res.	3.7	1.4	5	15	56	140	524
R-R Rural Single-Family Res.	Agriculture	563.2	1.3	758	10	5,832	300	174,955	
Total			692.5		924		7,598		196,022
02030105120020	B-A Neighborhood Commercial	Commercial	11.0	2.1	23	22	243	200	2,206
	B-C Highway Commercial	Commercial	14.3	2.1	30	22	315	200	2,863
	H-D Highway Development	Commercial	103.6	2.1	217	22	2,278	200	20,712
	L-I Limited Industrial / Quarry	Industrial	14.3	1.5	21	16	229	200	2,863
	R-M-L-II One-Family Residential	Med. Density Res.	102.9	1.4	144	15	1,543	140	14,402
R-R Rural Single-Family Res.	Agriculture	193.0	1.3	251	10	1,930	300	57,897	
Total			440.6		687		6,538		100,943
02030105120030	B-A Neighborhood Commercial	Commercial	5.6	2.1	12	22	123	200	1,116
	B-B Professional Office	Commercial	68.6	2.1	144	22	1,510	200	13,728
	H-D Highway Development	Commercial	2.2	2.1	5	22	47	200	432
	L-I Limited Industrial / Quarry	Industrial	104.7	1.5	157	16	1,675	200	20,934
	R-A Single-Family Residential	Low Density	158.5	0.6	94	5	783	100	15,654
	R-B Single-Family Residential	Med. Density Res.	21.6	1.4	30	15	324	140	3,023
	R-M-L-I Multi-Family Affordable	High Density Res.	2.3	1.4	3	15	34	140	320
	R-M-L-III One-Family Residential	Med. Density Res.	36.4	1.4	51	15	547	140	5,103
	R-M-L-IV One-Family Residential	Med. Density Res.	20.1	1.4	28	15	302	140	2,816
	R-M-L-VI Senior Citizen Affordable	High Density Res.	1950.5	1.4	2731	15	29,257	140	273,069
R-R Rural Single-Family	Agriculture	2368.5	1.3	3079	10	23,685	300	710,560	
Total			2368.5		6334		58,287		1,046,756
02030105120040	R-R Rural Single-Family Res.	Agriculture	19.4	1.3	25	10	194	300	5,807
Total			19.4		25		194		5,807
GRAND TOTAL			3,621.00		7970		72,617		1,349,528

Applicants for major development will be expected to mitigate the impacts of development on stormwater at their own site or other sites within the subject watershed that it controls. No variances and exemptions from the standards shall be granted.

It should also be noted that there is little or no land area within the Borough at strategic downstream locations and owned by the municipality or other governmental agencies that would even allow for a flood control or water quality enhancement project if mitigation were to be allowed in the plan by the municipality. The lack of available lands for such purposes can be seen from the Aerial photo Map provided in Figure 8. It is more practical for any new major development to provide on-site stormwater facilities rather than implementing a municipal system that would disrupt the existing built environment.

Recommended Implementing Stormwater Control Ordinances

The Borough will implement the following ordinances:

- Illicit Connection Ordinance.
- Improper Waste Disposal Ordinance.
- Litter Ordinance.
- Pet Waste Ordinance.
- Wildlife Feeding Ordinance.
- Yard Waste Ordinance.
- The Stormwater Control Ordinance will be implemented in accordance with NJAC 7:8-4.

Zoning	HUC14	Area (Square Feet)
B-A	02030105120010	219401.17
L-I	02030105120010	3988413.08
R-M-L-II	02030105120010	93298.63
R-M-L-III	02030105120010	366263.96
R-M-L-V	02030105120010	163085.33
<u>R-R</u>	<u>02030105120010</u>	<u>26336900.12</u>
B-A	02030105120020	520736.82
B-C	02030105120020	752398.76
H-D	02030105120020	5848029.66
L-I	02030105120020	5652235.77
R-M-L-II	02030105120020	840803.45
<u>R-R</u>	<u>02030105120020</u>	<u>8910017.73</u>
B-A	02030105120030	1895300.21
B-B	02030105120030	431581.69
H-D	02030105120030	2997680.94
L-I	02030105120030	94647.22
R-A	02030105120030	4612268.41
R-B	02030105120030	7061115.56
R-M-L-I	02030105120030	940570.82

R-M-L-III	02030105120030	99681.98
R-M-L-IV	02030105120030	1654537.62
R-M-L-VI	02030105120030	1081960.30
R-R	02030105120020	92385343.50
R-R	02030105120040	843177.32
		3851.92

Mitigation Plans

This mitigation plan is provided for a proposed development that is granted a variance or exemption from the stormwater management design and performance standards. However, approval of variances or exemptions from N.J.A.C. 7:8 are a last resort and all non-structural and structural BMPs should be explored prior to a variance or exemption being granted. Non-structural BMPs are highly recommended and shall be the initial design technique utilized. It is up to the discretion of the Borough Engineer, Board and professionals to ensure all BMP options are explored prior to granting a variance or exemption. The Borough Engineer shall be consulted to determine availability of mitigation projects. All mitigation projects are subject to approval of the Borough Engineer, Governing Body and Borough Planning and/or Zoning Board.

Mitigation Project Criteria

The mitigation project must be implemented within the same area that would contribute to the receptor impacted by the project. 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 municipality, and should be selected to provide the most benefit relative to an existing

stormwater problem in the same category (quality, quantity or recharge). 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.

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 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.

It must be demonstrated that implementation of the mitigation project will result in no adverse impacts to other properties. Mitigation projects that address stormwater runoff quantity can provide storage for proposed increases in runoff volume, as opposed to a direct peak flow reduction.

The project must provide additional groundwater recharge benefits, or protection from stormwater runoff quality and quantity from previously developed property, which does not currently meet the design and performance standards as outlined in the Municipal Stormwater Management Plan. The developer must ensure the long-term maintenance of the project, including the maintenance requirements under Chapters 8 and 9 of the NJ Stormwater BMP Manual.

The Borough Engineer must be contacted to obtain a list of potential mitigation projects to compensate for the deficit from the performance standards resulting from the proposed project. More detailed information on the mitigation projects shall be obtained from the Borough Engineer. The Borough maintains the right to update the mitigation project list and is not held accountable for time frames or to construct any of the mitigation projects or potential mitigation projects addressing groundwater recharge, water quality and water quantity.

Mitigation projects are environmental enhancement projects that provide groundwater recharge, control flooding or control nonpoint source pollution. The

Borough Engineer shall be contacted for availability, description and any other necessary information pertaining to mitigation projects.

Mitigation projects are subject to the approval of the Borough Engineer, Governing Body and Borough Planning and/or Zoning Board. Each project is approved upon an individual basis considering the extent of the variance, waiver or exception granted. Mitigation projects may require cooperation with outside agencies such as the Freehold Soil Conservation District, Middlesex County Mosquito Commission, Army Corp of Engineers, NJDEP, etc.

The municipality may require a developer to provide funding or partial funding to the municipality for an environmental enhancement project that has been identified in a MSWMP, or towards the development of a RSWMP. Funding quantities are subject to the approval of the Borough Engineer, Governing Body and Borough Planning and/or Zoning Board. Funding quantities will include costs or partial costs, including those associated with purchasing a property or easement for mitigation, and those associated with the long-term maintenance requirements of the mitigation measure.

The Borough invites all public for input regarding possible mitigation projects. As a result of public education and involvement promoted through the Stormwater Pollution Prevention Plan, it is anticipated that the public will be knowledgeable of stormwater issues and will work towards preventing stormwater quality, quantity and groundwater recharge problems within the Borough.

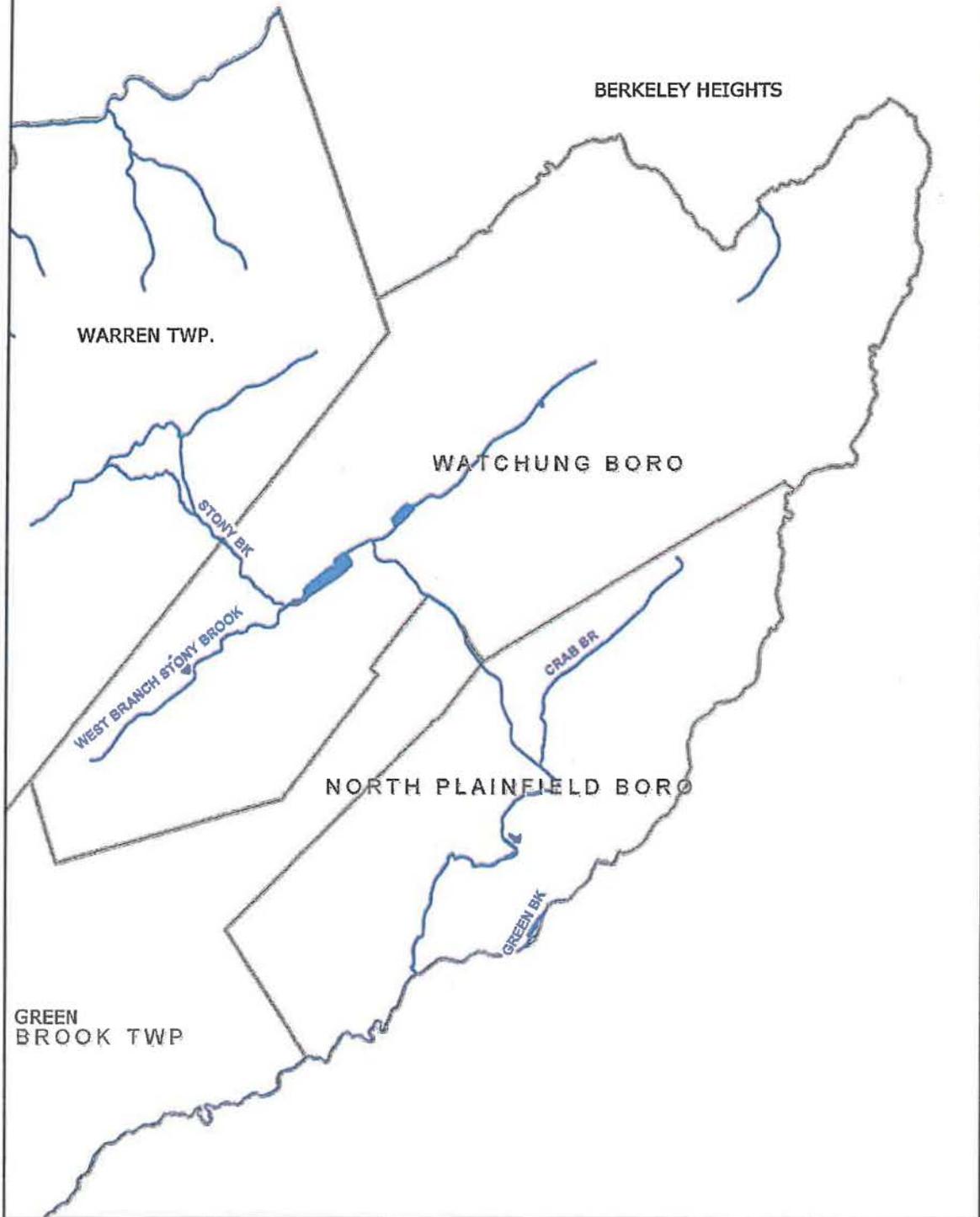
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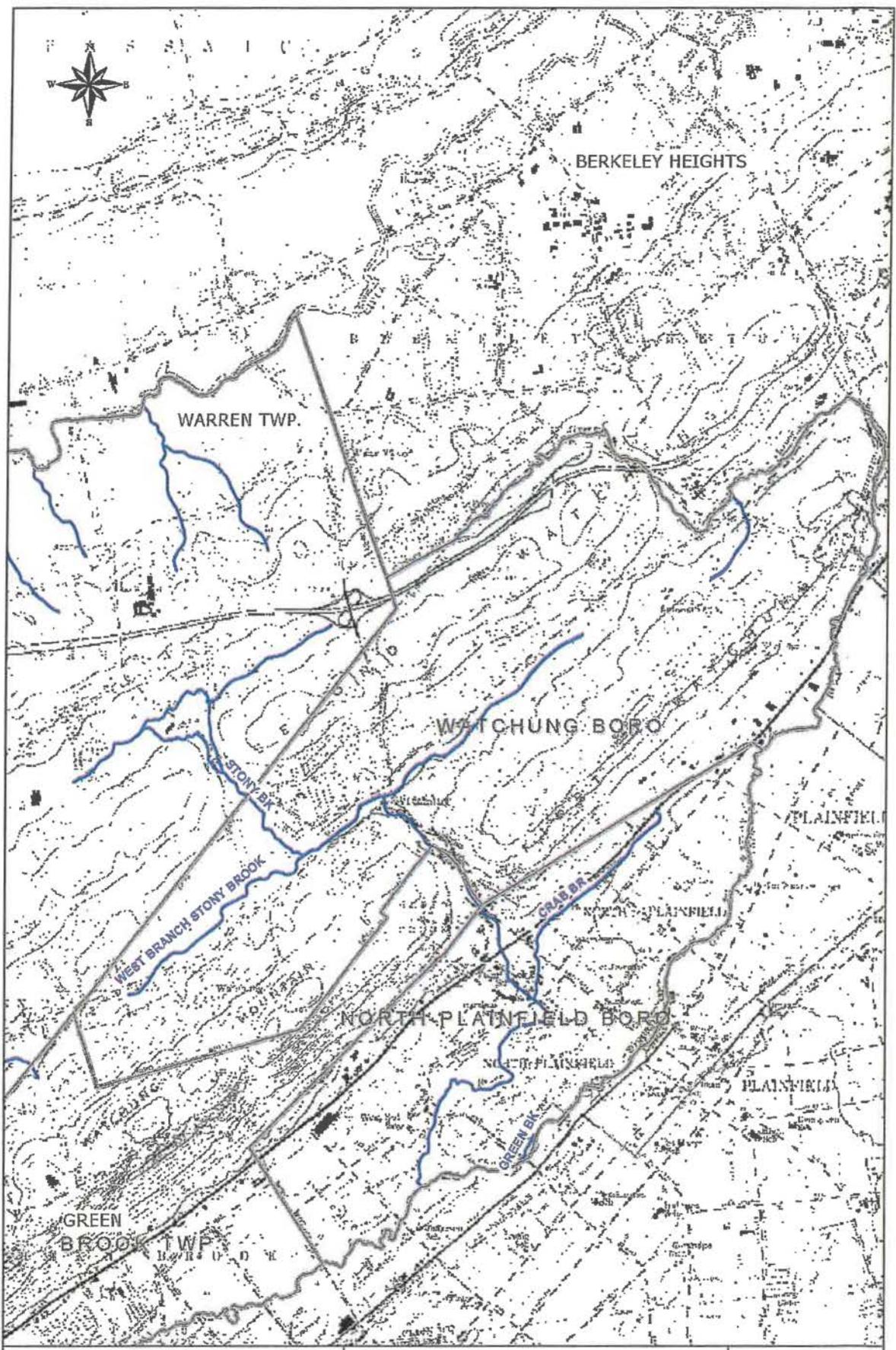
0 1,500 3,000 6,000 Feet

Prepared By: Somerset County, May 2004

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.

Watchung Borough Waterways

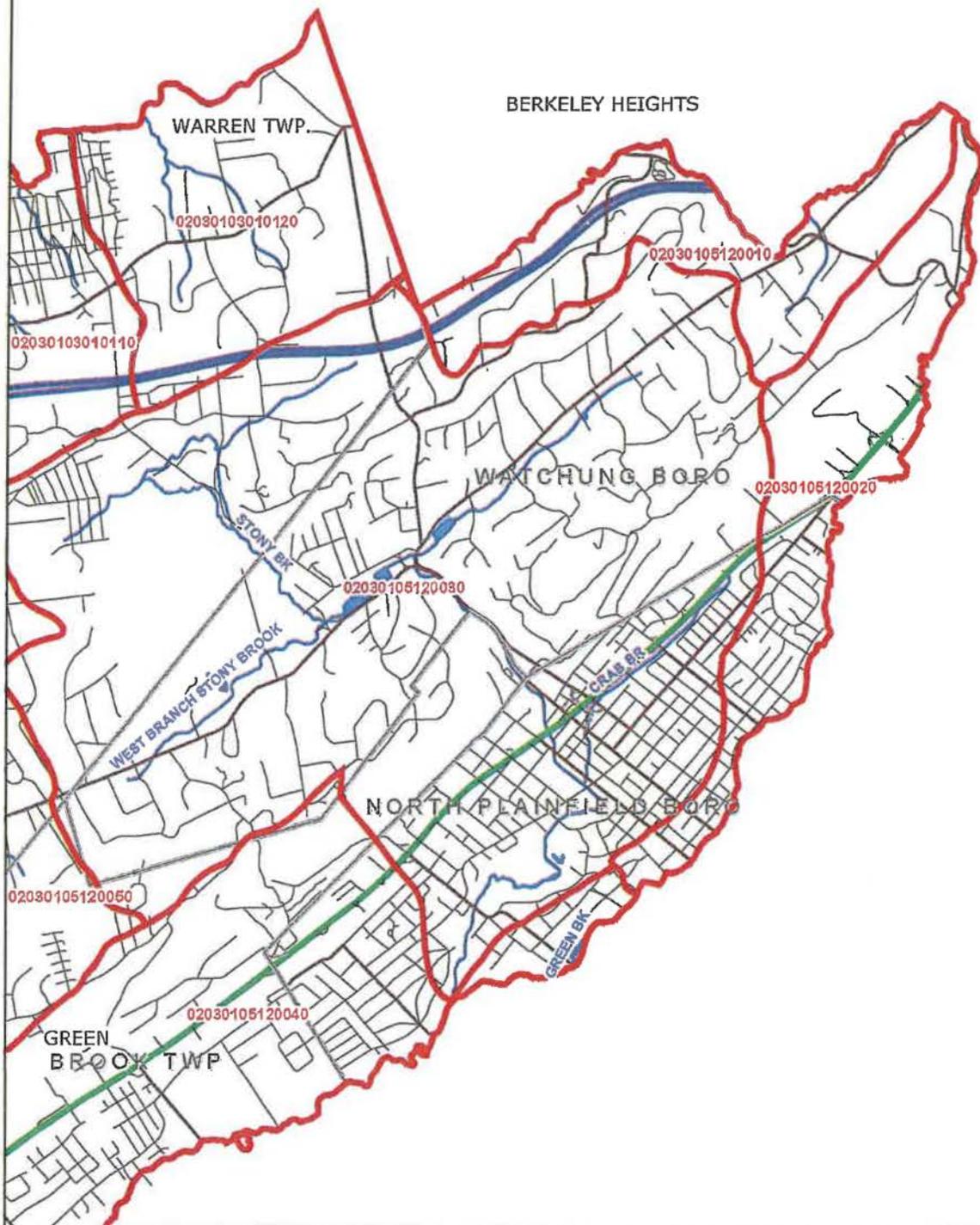
Figure 2



Prepared By: Somerset County, May 2004
 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 NHDSP and is not state-submitted.

**Watchung Borough
 USGS Quadrangle Map**

Figure 3



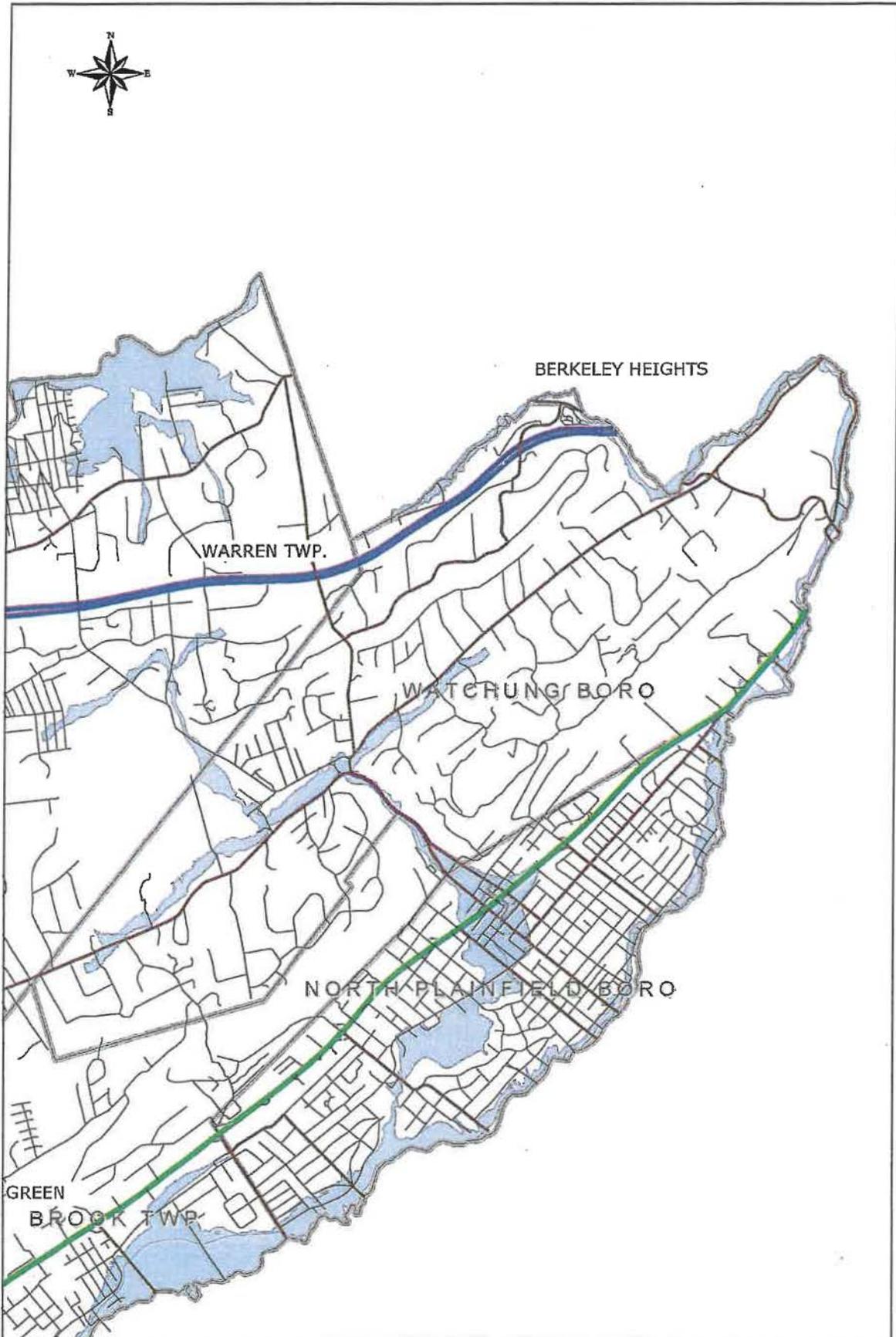
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Prepared By: Somerset County, May 2004

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Watchung Borough Hydrologic Unit Code 14 (HUC14) Areas

Figure 4



0 1,500 3,000 6,000 Feet

Prepared By: Somerset County, May 2004

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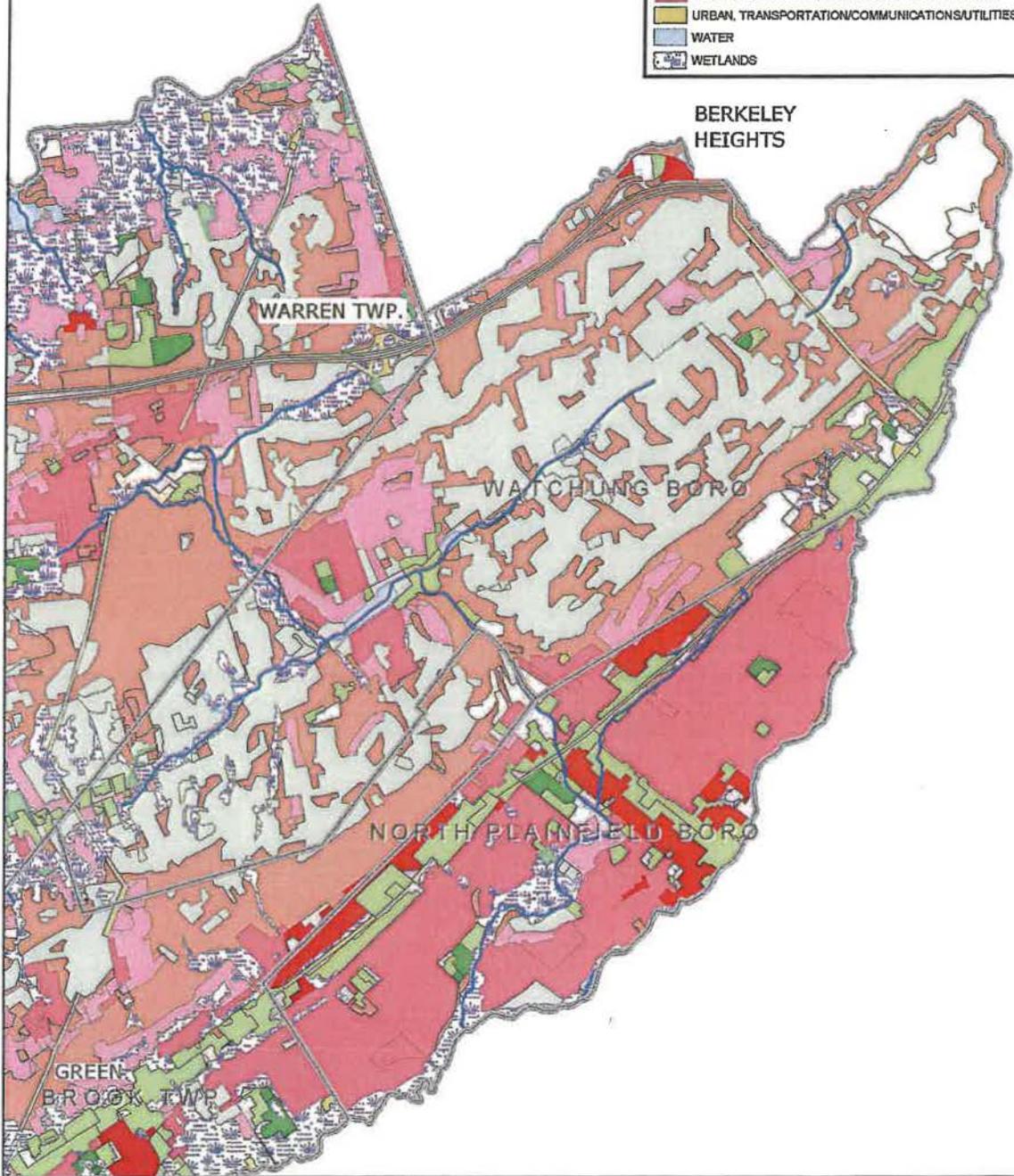
**Watchung Borough
100-Year Frequency Flood Plain**

Figure 5



Legend

-  Municipal Boundaries
-  Streams
- Land Use**
-  AGRICULTURE
-  BARREN LAND
-  FOREST
-  URBAN, ATHLETIC FIELDS (SCHOOLS)
-  URBAN, COMMERCIAL/SERVICES
-  URBAN, INDUSTRIAL
-  URBAN, MIXED URBAN OR BUILT-UP LAND
-  URBAN, RECREATIONAL LAND
-  URBAN, RESIDENTIAL, HIGH DENSITY, MULTIPLE DWELLING
-  URBAN, RESIDENTIAL, RURAL, SINGLE UNIT
-  URBAN, RESIDENTIAL, SINGLE UNIT, LOW DENSITY
-  URBAN, RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY
-  URBAN, TRANSPORTATION/COMMUNICATIONS/UTILITIES
-  WATER
-  WETLANDS



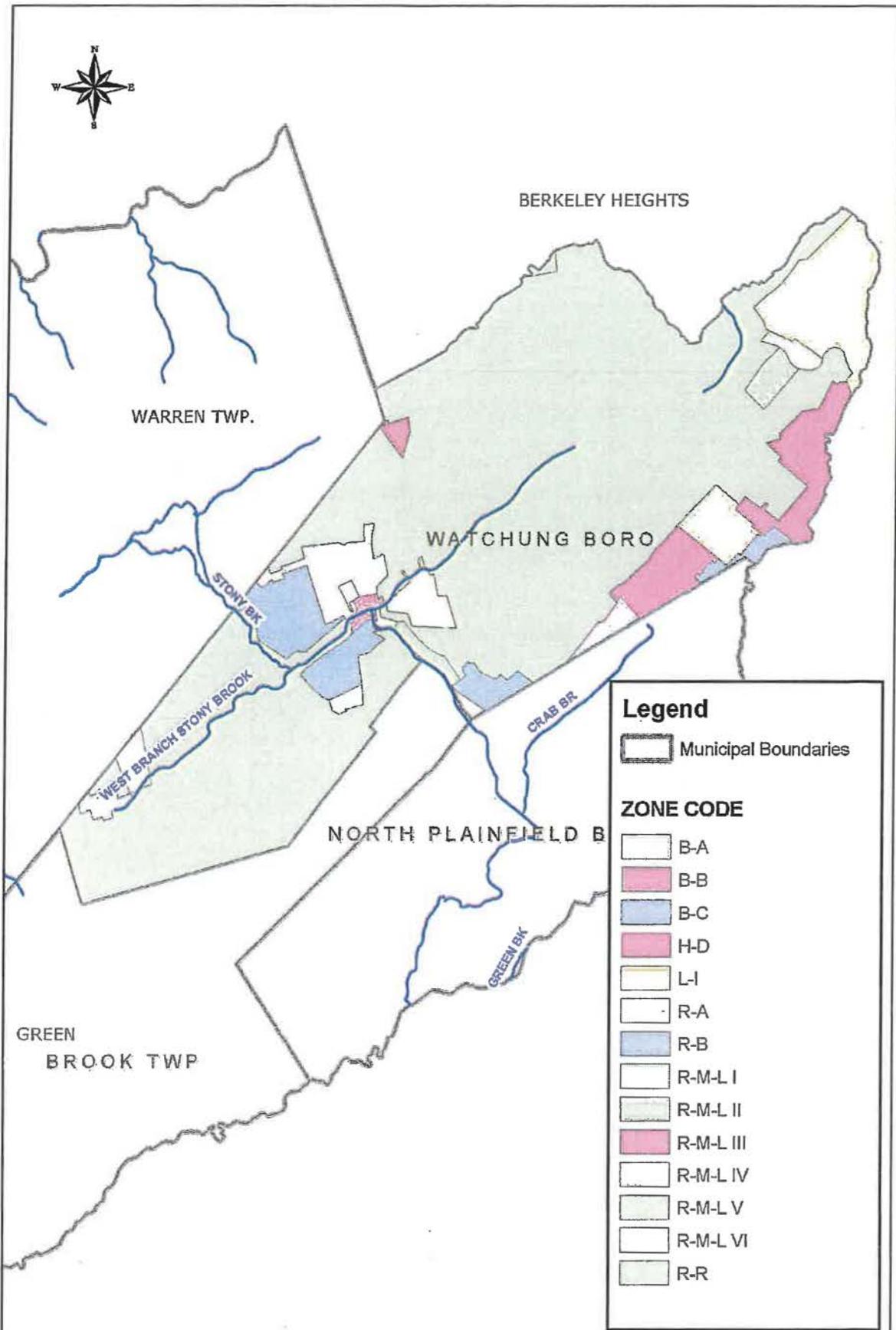
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Prepared By: Somerset County, May 2004

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-authored.

**Watchung Borough
Existing Land Use**

Figure 6

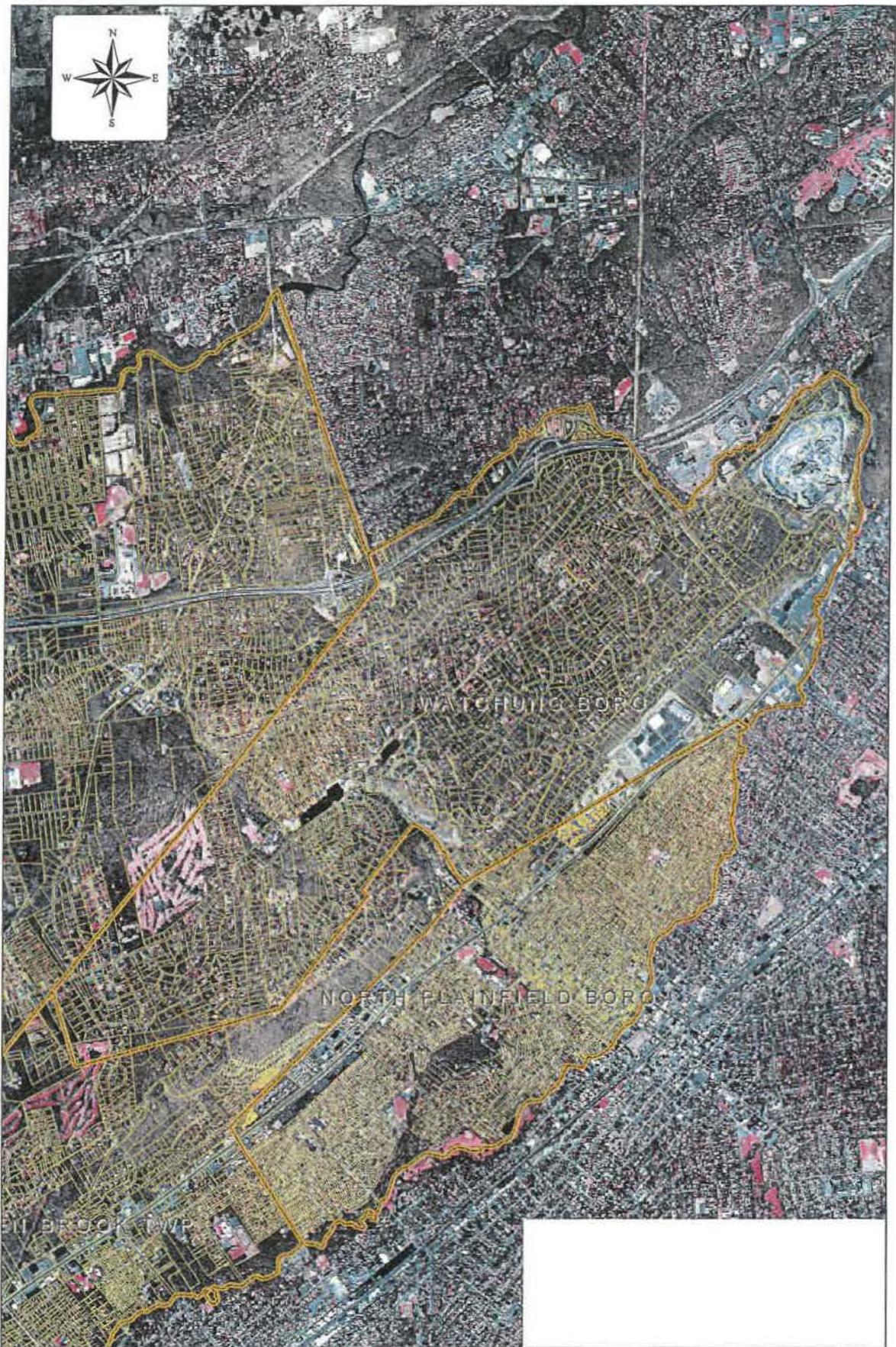


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Prepared By: Somerset County, May 2004
 This map was developed using New Jersey Department of Environmental Protection's Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Watchung Borough Zoning

Figure 7



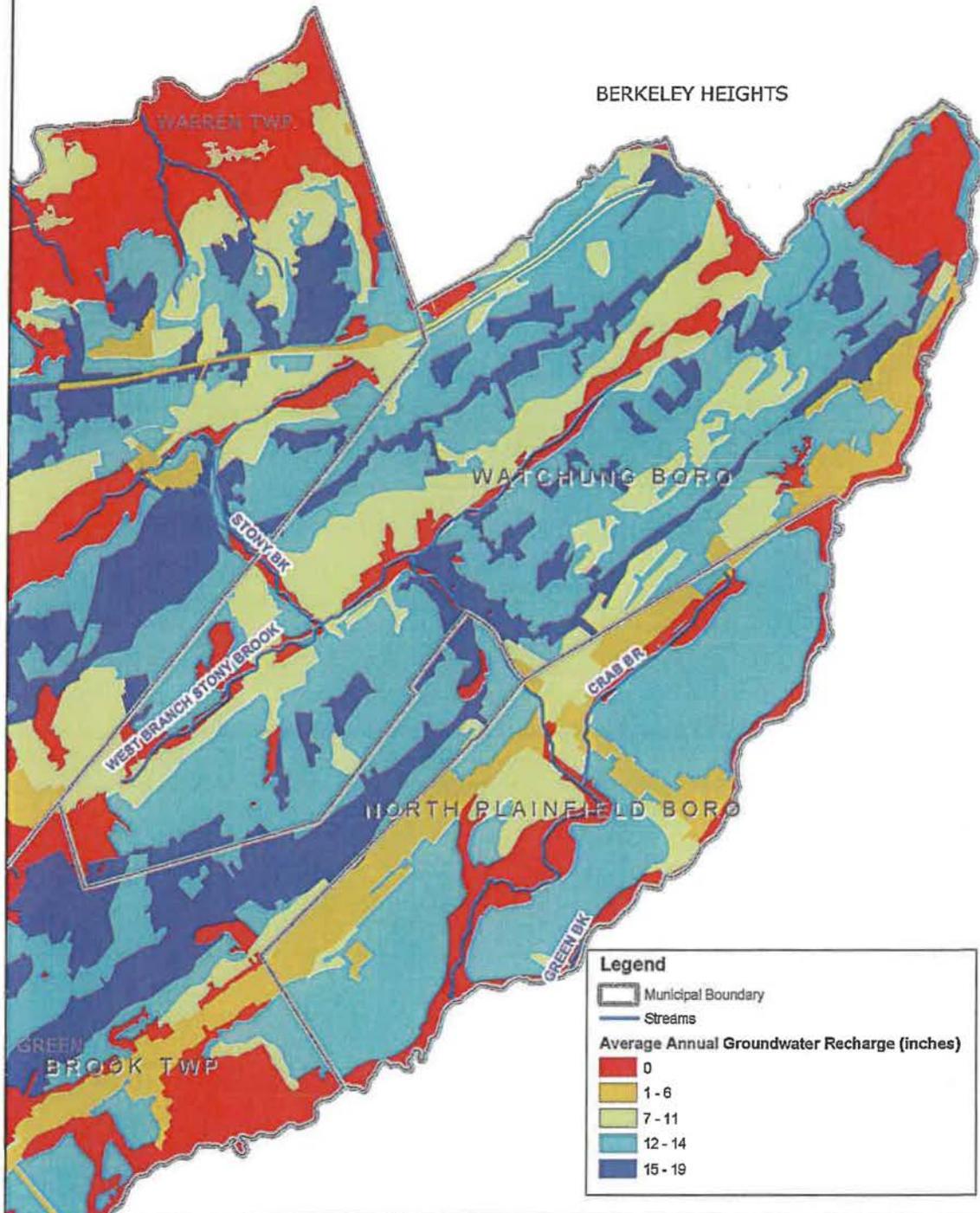
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Feet

Prepared By: Somerset County, May 2004

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-warranted.

**Watchung Borough
Aerial Photo with Parcels**

Figure 8



0 1,500 3,000 6,000 Feet

Prepared By: Somerset County, May 2004

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.

**Watchung Borough
Groundwater Recharge**

Figure 9

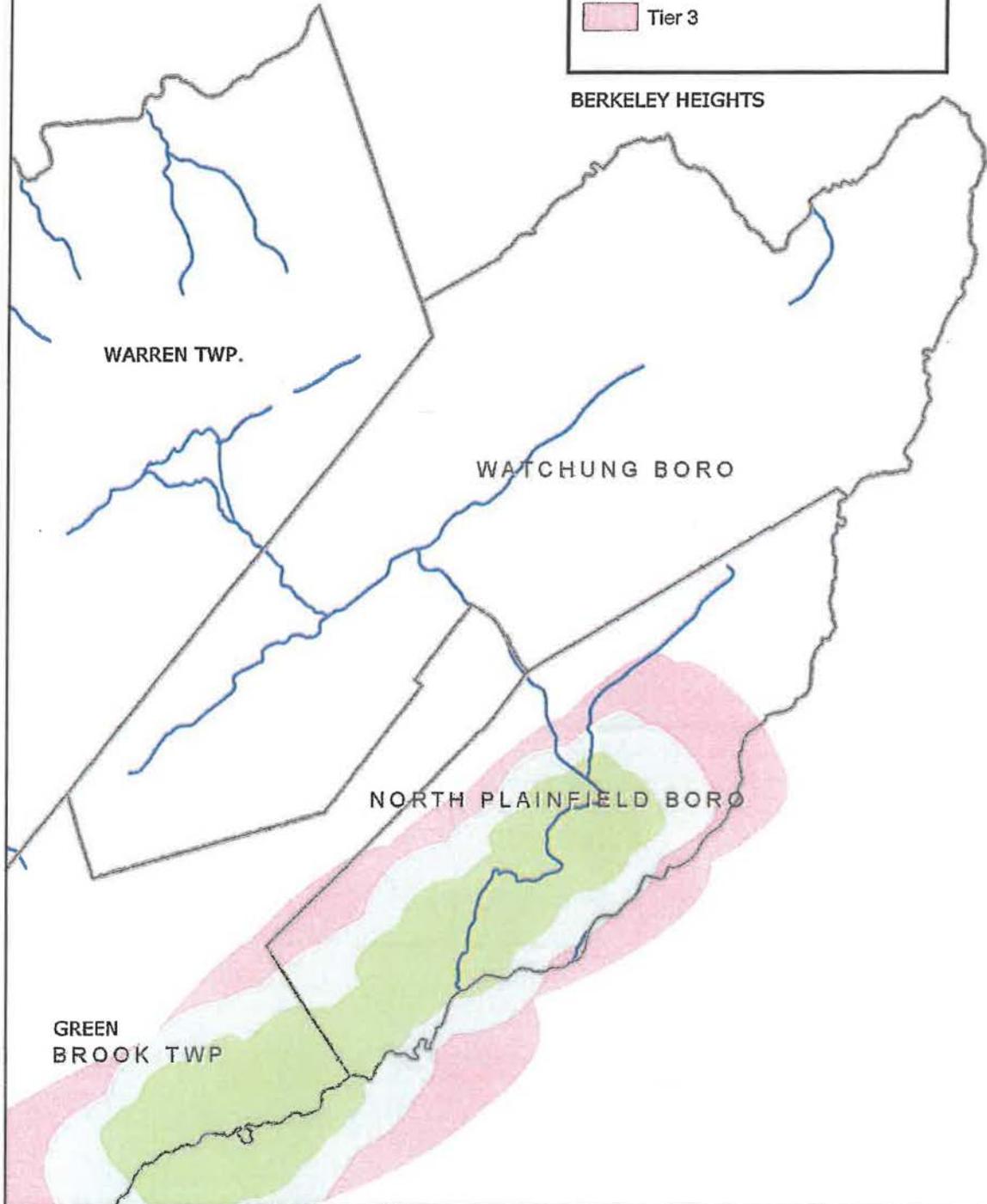


Legend

- Municipal Boundaries
- Streams

Well Head Protection Areas

- Tier 1
- Tier 2
- Tier 3



0 1,500 3,000 6,000 Feet

Prepared By: Somerset County, May 2004

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.

**Watchung Borough
Well Head Protection Areas**

Figure 10



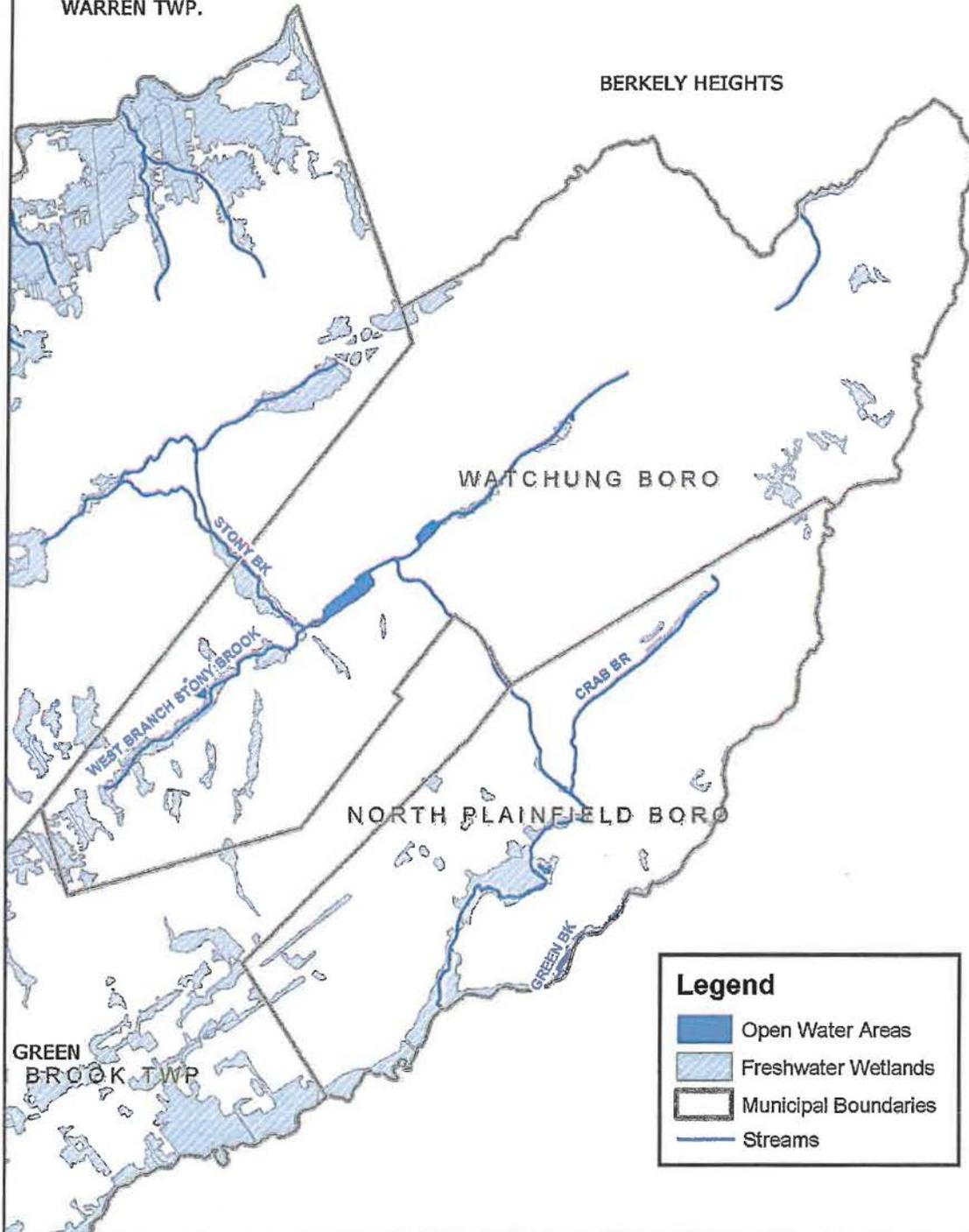
WARREN TWP.

BERKELY HEIGHTS

WATCHUNG BORO

NORTH PLAINFIELD BORO

GREEN
BROOK TWP



Legend

-  Open Water Areas
-  Freshwater Wetlands
-  Municipal Boundaries
-  Streams

0 1,500 3,000 6,000
Feet

Prepared By: Somerset County, May 2004
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-subsidized.

**Watchung Borough
Wetlands and Water**

Figure 11