CHARACTERIZATION AND ASSESSMENT OF THE REGIONAL STORMWATER MANAGEMENT PLANNING AREA FOR THE ROBINSON'S BRANCH WATERSHED

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Completed by the
Rutgers Cooperative Research & Extension
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Under the guidance of Christopher C. Obropta, Ph.D., P.E.

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I. Introduction

The New Jersey Stormwater Management Regulations have been used as a framework to present a functional characterization and assessment of the stormwater processes of the Robinson's Branch Watershed. This characterization and assessment is intended to represent areas of the watershed affected by the improper drainage of stormwater. This will allow for prioritizing the objectives of concerned parties for the purpose of creating solutions.

To identify features and processes within the watershed that could affect the stormwater drainage processes, various methods of analysis have been employed. Extensive field surveys, literature reviews, data collection and the use of Geographical Information System (GIS) were among the techniques used to characterize the watershed.

According to N.J.A.C. 7:8-3.4(a), the regional stormwater management plan shall include a characterization and assessment that covers a series of specific components, including the mapping and analysis of a watershed (See Appendix A). These components have been outlined and presented in this text. Rationale for not including a component is determined by the committee if that component is not found to be appropriate for the regional stormwater management area.

II. Maps

A. Regional Stormwater Management Plan (RSWMP) Boundary

The Robinson's Branch Watershed is located in Union and Middlesex Counties of New Jersey, and is approximately 22 square miles in size. As part of the Watershed Management Area 7, the Robinson's Branch discharges to the Rahway River. The Robinson's Branch Watershed is comprised of over 33 miles of river and more than 90 acres of lakes. The largest bodies of water in the drainage area include the Middlesex Reservoir and Milton Lake.

The Regional Stormwater Management Planning Area Boundary was originally defined through the use of the United States Geological Survey's (USGS) delineation of hydrologic boundaries. These drainage basins are denoted by the use of a 14-digit hydrologic unit code (HUC's) and are delineated from 1:24,000-scale (7.5-minute) USGS quadrangles.

A map representing the regional stormwater boundary of the Robinson's Branch Watershed depicting the upper and lower HUC 14 delineations can be found in Appendix B, Map 1. This boundary is also illustrated on Map 2, Appendix B, over the New Jersey Department of Environmental Protection (NJDEP) 2002 Digital Orthophotos.

B. Land Use/Land Cover

Land use in the Robinson's Branch Watershed is primarily urban, making up almost 80% of the entire land area in the watershed. The bulk of this urban land is developed residential on plots of land from 1/4 to 1/8 of an acre, resulting in a high percentage of impervious area.

The second largest type of land use, as a percentage of the watershed, is wetlands. The foremost area of wetlands is contained in the Ash Brook Swamp Reservation, which provides flood retention areas.

Refer to Map 3 in Appendix B for the map of the Robinson's Branch Watershed's Existing Land Uses. Map 4 in the same appendix depicts the Open Space and Vegetation of the watershed.

According to data collected by the NJDEP, the land use of the Robinson's Branch Watershed is 79% urbanized. Land use information is shown in Table 1. Based on aerial photography taken in 1995, the NJDEP has created a data set describing land use across the state. This land use/land cover information is available in GIS and can be useful in the analysis of a watershed.

Table 1: NJDEP 1995/97 Land Use Data

Land Use	Area (Square Miles)	Percentage of Watershed Area (%)
Agriculture	**0.07**	**0.32**
Barren Land	**0.07**	**0.30**
Forest	**1.81**	**8.20**
Urban	**17.50**	**79.13**
Water	**0.20**	**0.90**
Wetlands	**2.46**	**11.15**
Total	***22.11***	***100***

The **79**% urban land use can further be broken down to several subcategories.

Table 2 describes the different types of urban land within the Robinson's Branch Watershed.

Table 2: NJDEP 1995/97 Urban Land Use Types

Urban Land Use Type	Area (Square Miles)	Percent of Urban Land Use (%)
Residential, Single Unit, Medium Density: Urban/suburban residences on 1/8 to ½ acre lots. Impervious coverage is approximately 30 to 35%.	**8.95**	**51.15**
Residential, Single Unit, Low Density: Residences on ½ to 1 acre lots. Impervious cover is approximately 20 to 25%.	2.16	12.35
Residential, High Density, Multiple Dwelling: Contains either high density single units of multiple dwelling units on 1/8 to 1/5 acre lots. Impervious coverage is approximately 65%.	1.72	9.84
Recreational: Includes areas specifically developed for recreational activities, such as golf courses, picnic grounds, stadiums, and so forth.	1.13	6.44
Residential, Rural, Single Unit: Residences on 1 to 2 acre lots. Generally, impervious cover is between 15 to 20%.	1.11	6.37
Commercial/Services: Areas that contain structures used for the sale of products and services.	1.01	5.76
Other Urban or Built-Up Land: Generally characterized by intensive land uses.	0.60	3.44
Athletic Fields (Schools)	0.29	1.64
Transportation/Communication/Utilities: Generally high percentage of impervious surface coverage.	0.27	1.52
Industrial: May include manufacturing, assembly, or processing of products or power generation. Generally have a high impervious coverage.	0.23	1.31
Mixed Urban or Built-Up Land: Uses considered in mixed urban include primarily residential, commercial/service, industrial and transportation/communication/utility.	0.02	0.09
Military Reservations	0.01	0.08
Total	*17.50*	*100*

C. Projected Land Uses

The nine municipalities that compose the majority of the Robinson's Branch Watershed are at their build out potential as defined by NJDEP in N.J.A.C 7:8-4.2(c)10. According to this definition, if there is a combined total of less than one square mile of vacant or agricultural lands, the municipality is assumed to be at build out. All the municipalities are expected to document this requirement in their respective municipal stormwater plans of 2005.

For purposes of evaluating the impact of the increase in impervious area, the water quantity models evaluated scenarios depicting the resulting water surface elevations using an increase of 10% in the curve number. Curve numbers roughly correlate with the runoff potential of a land use and will increase with additional impervious area. The increase in curve number was used to account for the potential increase in imperviousness from redevelopment and knock down/rebuilds.

D. Soils

The Robinson's Branch watershed may further be characterized by its soils. The dominant soil series in the watershed are the Boonton and Haledon series. The Boonton series is characterized by deep to very deep well drained soils formed in the till on uplands (USDA/NRCS, 2005). Typical slope ranges are from 0 to 50 percent for this soil; however this is not the case in the Robinson's Branch where the maximum slopes are 27%. Most Boonton soils are in areas that have become highly urbanized and undeveloped sites in this soil are usually wooded or idle fields (USDA/NRCS, 2005). The Haledon series consists of very deep, somewhat poorly drained soils found in low positions on the landscape. They are usually formed in glacial till. Slope ranges from 0 to 15 percent. A perched high water table is within 12 inches of the soil surface in the late winter and early spring of most years, or following a period of extended rainfall (USDA/NRCS, 2002a). Much of the Haledon soils are used for housing or urban development. Within the Ash Brook Reservation, soils are predominantly Carlisle muck and Parsippany silts. The Carlisle muck consists of very poorly drained and very deep soils formed in depressions of lake plains, outwash plains, moraines, and floodplains. The ponding duration is known to be long, from October through June, and the typical slopes range from 0 to 2 percent (USDA/NRCS, 2000).

The remaining soils of the watershed are variable. The Parsippany series are mostly found in the central portion of the watershed and follow many of the stream corridors. The Parsippany series consist of deep, poorly drained soils in extinct lake basins and near streams. The Parsippany series are characterized by their slow infiltration rates, shallow water table, resistance to erodibility, and are usually subject to seasonal flooding. Potential for surface water runoff is considered high for this soil series (USDA/NRCS, 2002b). Finally, urban soil complexes exist

throughout the eastern and northern regions of the watershed. Urban soils differ from soils that have formed over centuries and millenniums and thus have a uniform structure and known properties. Rather, urban soils range from being extremely variable in texture and structure to being uniformly heavily compacted soil material (Baumgartl, 1998). The dominant soil series within the Robinson's Branch Watershed are depicted in Figure 1.

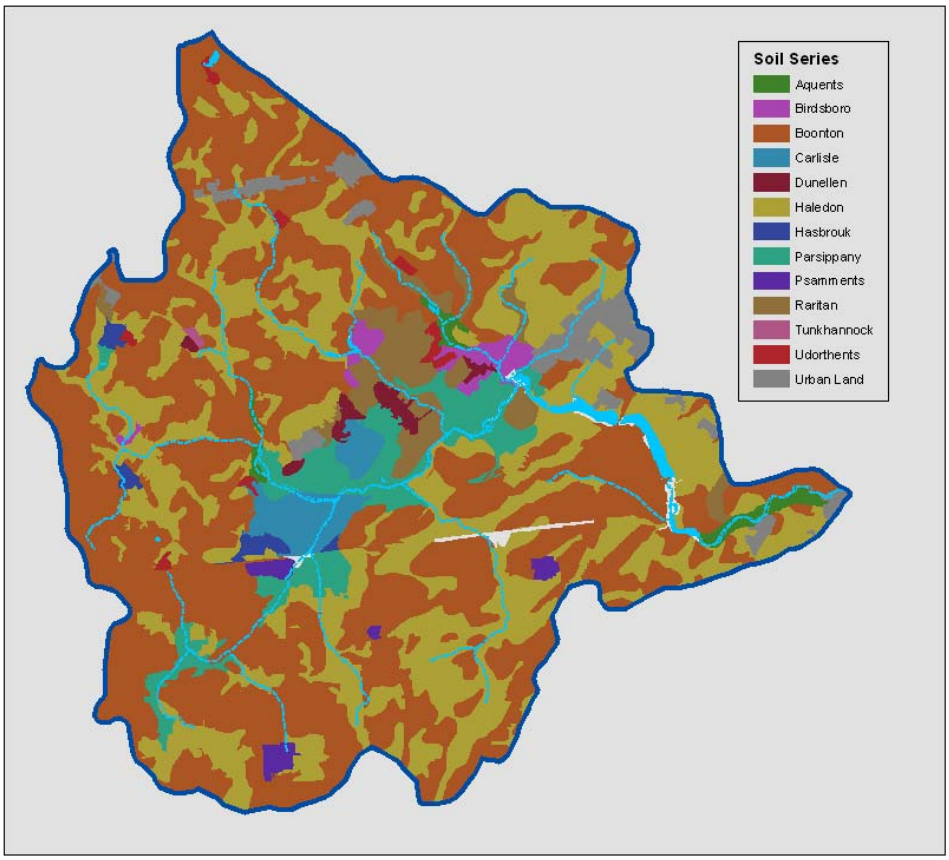

Figure 1: Dominant Soil Series in the Robinson's Branch Watershed

Based upon their various compositions, soils infiltrate water to varying degrees. Their ability to drain water, especially from precipitation, is evaluated by the Natural Resource Conservation Service (NRCS) as the hydrologic soil group. The NRCS categorizes soils that have high infiltration rates, "A" soils, to those that have very slow infiltration rates, or "D" soils, and soils that possess intermediate qualities are classified in a continuum, as described below:

Hydrologic Soil Group A: Soils having high infiltration rates even when thoroughly wet. These soils consist mainly of deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission and therefore a low runoff potential.

Hydrologic Soil Group B: Soils having moderate infiltration rates when thoroughly wet, consisting mainly of moderately deep to deep, moderately well to well-drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Hydrologic Soil Group C: Soils having slow infiltration rates when thoroughly wet, consisting mainly of either soils with a layer that impedes the downward movement of water or soils with moderately fine or fine textures and slow infiltration rates. These soils have a slow rate of water transmission.

Hydrologic Soil Group D: Soils having very slow infiltration rates when thoroughly wet. These are mainly comprised of either clayey soil with high swelling capacity or potential, soils with a high permanent water table, soils with a clay layer at or near the surface, and/or shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission and therefore a high runoff potential.

Dual Hydrologic Groups: Dual hydrologic groups, for example A/D and C/D, quantify soils where the first letter applies to the drained condition and the second to the undrained condition. Only soils that are rated "D" in their natural condition are assigned dual groups (USDA, 2003).

Map 5 in Appendix B shows the soils of the Robinson's Branch Watershed as defined by their hydrologic soil group. Most of the soils underlying the watershed (96%) are classified as hydrologic soil group C, representing a slow capacity to infiltrate water.

Furthermore, each soil type has a related erodibility classification which quantifies the susceptibility of the soil particles to detach and move due to contact with moving water or wind. The USDA/NRCS method to describe the susceptibility of soils to erosion consists of a series of calculations that determine the erodibility of land as a function of land cover and amount of rainfall (New Jersey Water Supply Authority, 2000). The following classifications (USDA/NRCS, 1995) are given to each soil map unit which had these calculations performed:

Highly Erodible Land: Soils that meet the criteria for highly erodible lands.

Potentially Highly Erodible Land: Soil mapping units which exhibit the properties of both highly erodible land and not highly erodible land.

Not Highly Erodible Land: Soil map units that do not meet the criteria for highly erodible land.

Map 6 in Appendix B illustrates the erodibility potential of the soils within the Robinson's Branch Watershed. Much of the Robinson's Branch Watershed shows areas of potentially highly erodibile lands with small areas of highly erodible lands in the northern and eastern portions of the watershed. Lands that are not highly erodible are found along the stream corridors. This erodibility is related to the slow infiltration rates of the surrounding areas and other characteristics of the Haledon soil series.

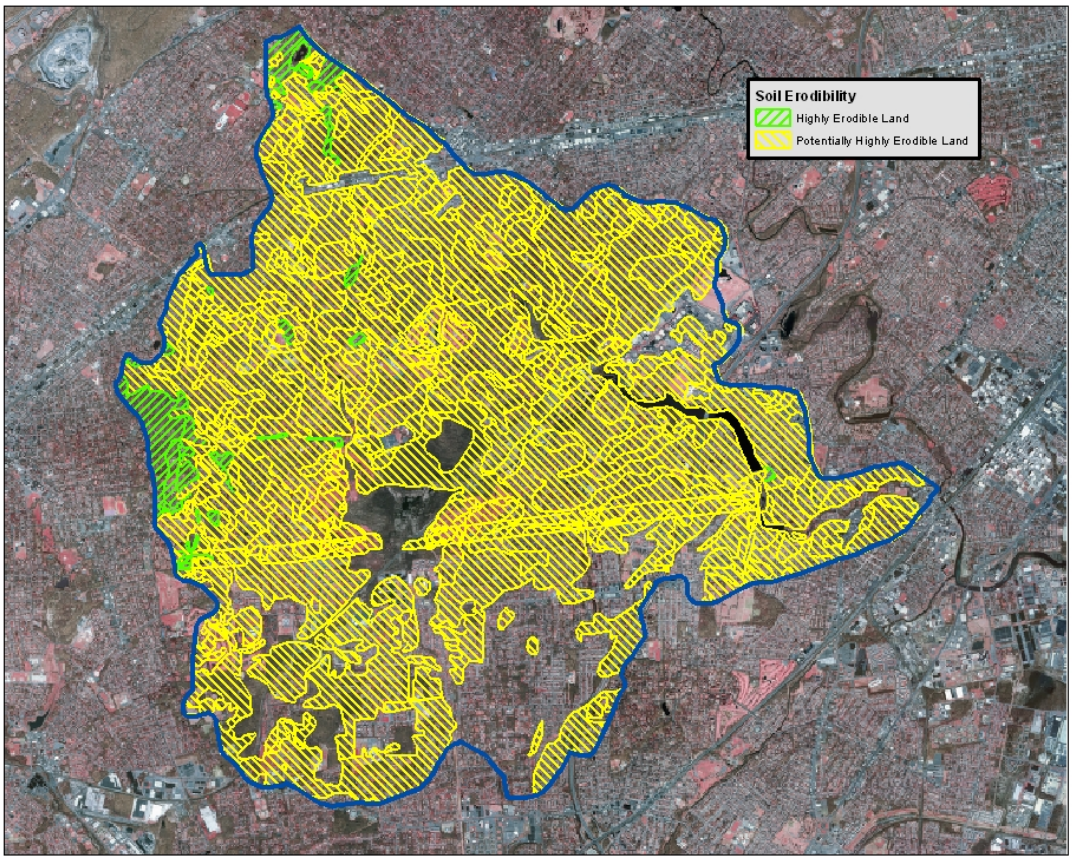

Figure 2: Highly Erodible Soils (left to right)

A – Winding Brook at Inverness Drive, Scotch Plains
B –Terrill Road, Fanwood/Plainfield
C- Terrill Road garage

In addition to soils that erode easily, increased velocity with the rapid introduction of stormwater will erode stream banks at an increased rate. This increase in velocity will occur when stormwater is introduced directly to the stream via stormwater infrastructure without the opportunity to infiltrates where it falls. In the Robinson's Branch Watershed, erosion is likely to occur in areas where the stream buffer is not well-vegetated or some form of channelization has occurred. Example of this may include the impact of road crossings, outfalls, and concrete channels. A key study performed by Killam Associates for the township of Scotch Plains in

January 2001 was used to site areas where erosion is a concern for the township. Field observations by the Rutgers Water Resources Program uncovered many additional areas, three of which are pictured above, within Figure 2, a, b, and c. Table 3 summarizes field observations and analysis of prior studies.

Table 3: Examples of Erosion in the Robinson's Branch Watershed

Area of Erosion	Township
Winding Brook at West Broad Street	Scotch Plains
Winding Brook at Parkwood Drive	Scotch Plains
Winding Brook at Inverness Drive	Scotch Plains
Winding Brook at Raritan Road, downstream from Shackamaxon Lake	Scotch Plains
Branch 22-11 at Cooper Street, and Stoneleigh Drive	Scotch Plains
Branch 22 behind Highlander Drive	Scotch Plains
Pumpkin Patch along Oak Ridge Golf Course	Clark
Milton Lake scalloping	Rahway
Milton Lake Park, downstream, along Lake Road and Lakeside Drive	Rahway
Pumpkin Patch at Amherst bank failure	Woodbridge
Tamaques Pond	Westfield
Pumpkin Patch at Deerwood Drive	Clark

Effects of the erosion include downstream destruction of habitat due to siltation and reduction in water clarity. These considerations will be discussed in the Sections IV and V.
Regional stormwater management planning will effectively locate areas of high infiltration that can be used to decrease the amount of stormwater that is piped to the Robinson's Branch, thus lessening the chances of erosion and stream degradation.

E. Topography

The Robinson's Branch Watershed lies completely within the Piedmont physiographic province. This province can be described as low rolling plains divided by a series of higher ridges. It is generally more rugged with rounded ridges and deep valleys. This province slopes downward from its northwestern boundary with the Highlands until it meets the Coastal Plain on its southeastern boundary. The Robinson's Branch is contained in this southeastern portion, and therefore has a range of elevation from approximately 10 feet above sea level to 150 feet above sea level. The Robinson's Branch Watershed is located just above this boundary, which is also known as the Fall Line, so named because it is marked by a series of waterfalls and rapids all along the east coast.

Primarily level and low-lying, relatively steep slopes are scattered throughout the watershed, with small areas surrounding Milton Lake and periphery of the watershed in Edison and

Fanwood. Based on the 10-meter contour information developed by the New Jersey Geological Survey/Digital Elevation Model (DEM) Data, the range of slopes vary from approximately 0 percent to 27 percent.

Map 7 in Appendix B is the USGS Quadrangle map which contains contour lines that portray the shape and elevation of the land. This map also provides a wealth of information on lakes, rivers, and roads along with a variety of other natural and manmade features.

F. Waterbodies

There are a limited number of impoundments within the drainage basin. The largest waterbody in the watershed is the Clark Reservoir at 75 acres. Below the Clark Reservoir is Milton Lake, which comprises 10 acres of the watershed and is the most downstream waterbody in the drainage basin. Shackamaxon Lake collects water from two branches of Winding Brook and is 7 acres in size. Finally, Brightwood Park Lake exists in the Town of Westfield close to the edge of the watershed; the lake is approximately 5 acres in size. Map 8 in Appendix B illustrates the locations of these waterbodies.

G. Freshwater Wetlands

Based on the NJDEP database, the locations of the wetlands that are contained in the Robinson's Branch Watershed can be viewed on Map 9 in Appendix B. Upon viewing this map, it is immediately obvious that the Ash Brook Reservation provides a large swath of land (615 acres) covered by deciduous wooded wetlands, disturbed wetlands and herbaceous wetlands. The headwaters of Ash Brook to the west of the Reservation also contain many of these same wetland types. This area is a significant environmental resource, providing a large storage of stormwater along with a variety of other benefits.

Many other areas of wetlands can be seen within the Robinson's Branch watershed. A large complex of deciduous wooded wetlands (111 acres) is located south of Inman Avenue and west of Tingley Lane in Edison Township. This area contains lands near properties known to the locals as "the Petty and Sharma" properties and the "Stevens Preserve." Despite the urban setting, isolated wetlands provide important functions in the watershed, including the support of biodiversity, the protection of water quality, the storage of flood waters; and the maintenance of stream flow. They may also provide natural areas for passive recreation, education and aesthetic enjoyment (Ehrenfeld, 2004).

H. Flood Hazard Areas

The NJDEP is in the process of mapping flood hazard areas based on delineations under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq. Under this act, the NJDEP is authorized to regulate the development of land in flood hazard areas and to protect the

encroachment of streams. The area of delineation is based on the water surface elevation produced by the "flood hazard area design flood" used in State Adopted Flood Studies. This is the flood that is expected to result from the 100-year storm discharge increased by 25 percent.

Mr. John Scordato of the NJDEP Dam Safety Division, advised the Water Resources Program on which maps were complete and available. At this time, only sections of the Robinson's Branch Watershed have been surveyed and modeled for the flood hazard storm. The maps are available in paper format only, and can be obtained through the office of Dam Safety at the NJDEP. A digital representation of the flood hazard area is not currently available through the Department.

Map 10 in Appendix B shows the floodplain delineation as prepared by the Federal Emergency Management Agency (FEMA) in their 1996 Q3 data. This data was developed by scanning the current effective map panels of the existing paper Flood Insurance Rate Maps (FIRMs), although the digital layer is not intended to replace the paper FIRMs. However, the agency is currently undergoing a large effort to survey and map the floodplain with increased accuracy.

I. Groundwater Recharge/Wellhead Protection

Groundwater Recharge
GIS coverage of the groundwater recharge data was assembled by the New Jersey Geological Survey (NJGS) and can be found with the Robinson's Branch Watershed boundary in Map 11 in Appendix B.

Groundwater recharge is defined as that water that can penetrate the ground and will reach the groundwater table not considering the underlying geology. The methodology that is employed to calculate the potential recharge of a system is taken from the New Jersey Geological Survey report GSR-32, "A Method of Evaluating Ground-Water-Recharge Areas in New Jersey." (Charles, 1993) Because recharge in New Jersey occurs on land area, soil-water budgets have been used to simulate recharge, as demonstrated in the following equation by Charles et al, 1993:

recharge = precipitation – surface runoff – evapotranspiration – soil moisture deficit.

The soil-water budget estimates recharge volume by subtracting out water that is not going to recharge (surface runoff and evapotranspiration) from precipitation. A deficit in pore storage in the unsaturated zone is defined as the soil-moisture deficit which needs to be accounted for before recharge can occur.

Recharge maps have been developed by the NJGS through the use of county soil surveys overlaid with land use/land cover (LULC) categories. An appropriate recharge-factor and recharge-constant are then read and assigned to each map feature. Finally, recharge (inches/year) is calculated using the recharge factor, recharge constant, basin factor, and a climate-factor (Charles et al., 1993). The climate factor is governed by the location of the municipality and is a ratio of precipitation to potential evapotranspiration (French, 2003). The

basin factor has been developed to calibrate the calculated volume of recharge against watershed baseflow estimates. The factor that has been found to best describe recharge versus baseflow is 1.3 for tested New Jersey basins (Charles et al., 1993). The result of the equation represents the ability of the ground to recharge precipitation where determined through the use of the following equation:

recharge = (recharge factor x climate factor x basin factor) - recharge constant.

Five environmental factors were used in estimating what controls surface runoff and evapotranspiration throughout New Jersey. Available through the National Oceanic and Atmospheric Administration (NOAA), 32 stations based on their placement in the state and record of data, were used for precipitation values. Thirty years of data were considered for the recharge simulations (Charles et al., 1993).

LULC was a consideration in both surface runoff and evapotranspiration categories. Fourteen categories were designed specifically for the NJGS method of calculating recharge, derived from the US Department of Agriculture (USDA) Soil Conservation Service. Land use classification is based on aerial photography taken in 1995 and completed in 1997.

As for soils data, hydrologic group, soil type, soil depth, root barriers, and available water capacities were used for surface runoff and evapotranspiration calculations (Charles et al., 1993). Map 11 in Appendix B shows that for the greater portion of the Robinson's Branch Watershed, infiltration rates were approximately five to ten inches per year. Several small areas of higher recharge are found scattered throughout the watershed. The most significant parcels of the highest recharge are over the three largest golf courses in the watershed (see Map 11A).

Limitations do exist within the recharge calculations. The soils information from one county to the next is often not seamless. Also, boundaries between soil types are not distinct lines, but a gradation to a different soil type. Overall, the LULC, soils, and LULC/soil-group combination of data has a minimum mapping unit of five acres.

Wellhead Protection

The Wellhead Protection Area Map, Map 12 in Appendix B, denotes those areas where groundwater is drawn from in a two, five and twelve year period given a certain pumping rate. The delineation is performed by a qualified hydrologist by using several approved methods outlined by Spayd and Johnson (2003). Wellhead protection area within the Robinson's Branch Watershed covers 65% of the entire land mass within the watershed.

Wellhead protection areas can be used to manage an inventory of potential pollution sources within the wellhead protection area. States that have approved Wellhead Protection Program Plans, including New Jersey, can receive federal funding to implement assorted elements of the program. These management techniques can range from voluntary approaches to regulatory approaches.

J. Environmentally Constrained and Critical Areas

The definition of "Environmentally Constrained" and "Environmentally Critical Areas" are contained in N.J.A.C. 7:8-1.2. Environmentally constrained areas refers to areas where the physical alteration of the land is in some way restricted, such as through regulation, easement or deed restriction. These could include floodplains, threatened and endangered species sites and parks and preserves, among others. An environmentally critical area defines an area that is of significant environmental value, such as stream corridors, large areas of contiguous open space or groundwater recharge areas.

In Appendix B, Map 13 depicts the Environmentally Constrained areas of the Robinson's Branch Watershed. A wetland buffer of 50 feet was prepared to denote the constrained area related to a wetland, as per the Freshwater Wetland regulations (N.J.A.C. 7:7A). In addition, the 100-year floodplain from the FEMA Q3 data layer was included.

NJDEP's Division of Fish and Wildlife has developed The Landscape Project, a planning tool to help land managers, planners and regulatory agencies integrate wildlife protection into their overall land use goals. The Landscape Project establishes accurate boundaries around critical wildlife habitats and then comparatively ranks them to offer prioritization options for varying levels of conservation and management (Niles *et al.*, 2004). The ranking is based upon the presence or absence of animal species of concern, state threatened and endangered species, and federally threatened and endangered species. A rank of three (3) is assigned to patches of land containing one or more occurrences of at least one State threatened species (Niles *et al.*, 2004). Rank four (4) is for those patches that have one or more occurrences of at least one State endangered species and rank five (5) patches contain at least one occurrence of Federally listed threatened or endangered species (Niles *et al.*, 2004). Those lands that ranked three and above (ranks four and five) for any Landscape Project Data were used to represent the Threatened and Endangered Species that occupy lands that fall within the watershed boundary. For the Robinson's Branch Watershed, that meant a very small area of Critical Emergent Wetland Habitat below Milton Lake.

The Wood Turtle Habitat has also been included to represent those areas where this State threatened species has been sighted. NJDEP has created individual datasets for several species determined to be priority species for conservation purposes, which includes the wood turtle (Niles *et al.*, 2004). A priority species is any non-game species that are considered by the NJDEP to be species of special concern as determined by a panel of experts (Niles *et al.*, 2004). The term also includes species of regional concern in regional conservation plans (Niles *et al.*, 2004). The State and Federal Park land information was obtained through the Center for Remote Sensing and Spatial Analysis at Rutgers University. The Union and Middlesex County Park land information was gained through a GIS layer obtained through the Center for Remote Sensing and Spatial Analysis at Rutgers University. Map 13A provides the aerials of the Robinson's Branch Watershed with a single coverage of the Environmentally Constrained Areas in total. The majority of Environmentally Constrained areas in the Robinson's Branch watershed are wetlands.

Map 14 in Appendix B presents the Environmentally Critical Areas. To represent the locations that are of significant environmental value several GIS layers were evaluated. For the large areas of contiguous open space or upland forest, the critical habitat layer was used. In this layer, the NJDEP located all contiguous forest and bisected the areas by major road ways. However, this information is from 1995 land use and development since that time should be considered. Stream corridors are represented by a 25 foot buffer around the streams, using Stream Encroachment Regulations and the Flood Hazard Area Control Act for FW2 non-trout waters. FW2 is a general surface water classification applied to those fresh waters that are not designated FW1 or Pinelands Waters (N.J.A.C. 7:9B-1.4).

The Environmentally Critical Areas map also includes the NJ Department of Community Affairs (DCA) Critical, Environmental and Historic Sites**.** This dataset contains the boundaries of Critical Environmental and Historic Sites (CEHS) which are areas, generally less than one square mile, which include one, or more, environmentally or historically sensitive features recognized by the State Planning Commission (NJDCA, 2004). CEHS locations are submitted by county and local entities. The sites located within Robinson's Branch are identified as critical environmental sites according to NJDCA data and coincide with wetlands. To represent water supplies, the areas of high groundwater recharge for WMA7 (areas Ranked A) were used along with the NJGS Wellhead Protection Areas GIS layer. Steeps slopes (slopes greater than 15% grade) were also calculated from 10 meter Digital Elevation Model grids.

Map 14A provides the aerials of the Robinson's Branch Watershed with a single coverage of the Environmentally Critical Areas in total. The largest portion of Environmentally Critical Areas is made up of the wellhead protection areas. The Robinson' Branch Watershed is relatively flat as there is only a small portion covered with steep slopes. The land uses within the Environmentally Critical Areas are outlined in Table 4.

Table 4: Land Uses with the Environmentally Critical Areas in the Robinson's Branch Watershed

Land Use Type	**Area (Square Miles)**	**Percent of Environmentally Critical Areas (%)**
Agriculture	0.06	0.47
Barren Land	0.04	0.32
Forest	1.3	10.29
Urban	9.3	71.48
Water	0.14	1.10
Wetlands	2.1	16.33

K. Wild and Scenic Rivers

In 1968, Congress created the National Wild and Scenic Rivers System to protect rivers that possess "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values." There are no waterways in the Robinson's Branch watershed that have been assigned this designation.

L. Waterbody Classification: N.J.A.C. 7:9B-1.15

The surface water classifications for the waters of the State of New Jersey can be found in N.J.A.C. 7:9B-1.15. The streams of the Robinson's Branch Watershed have been classified as FW2-NT. FW2 is a general surface water classification applied to those fresh waters that are not designated FW1 or Pinelands Waters (N.J.A.C. 7:9B-1.4). NT refers to the "Non-trout Water" status that waters are designated as per N.J.A.C. 7:9B-1.15(b) through (h) referring to waters that are considered trout production or trout maintenance. Map 15 in Appendix B presents the Waterbody Classification of the Robinson's Branch Watershed.

M. Water Quality Limited Surface Water

One goal of watershed management is to ensure that the existing water quality meets all water quality standards and criteria. Under the Federal Clean Water Act (CWA), Section 303(d) and 305(b), each state is mandated to identify impaired waters where designated uses of the waterway are not supported by the water quality. Pursuant to the CWA, the N.J.A.C. 7:9B Surface Water Quality Standards set the required water quality for each waterbody according to its designated use. The NJDEP then compares measured water quality data to the standards to determine which waterways are impaired and require the development of a Total Maximum Daily Load (TMDL); these relevant water quality standards are displayed in Table 5. Through the TMDL process, the necessary reductions of the pollutant or pollutants will be calculated so that designated uses can be met.

Pursuant to the Federal Clean Water Act, the NJDEP summarized water quality in the State in its biennial report entitled "New Jersey's Water Quality Inventory Report," or 305(b) report. The State also prepared a list of impaired waterbodies to meet 303(d) requirements; this report was entitled "Identification and Setting of Priorities for 303(d) requirements under Section 303(d)(1)(A) of the Federal Clean Water Act" and was most recently submitted in 1998.

Table 5: NJDEP Surface Water Quality Standards N.J.A.C. 7:9B, 2003

Water Quality Parameter	FW2-NT Numerical Criteria
Dissolved Oxygen (24-hour avg.)	5.0 mg/L
Dissolved Oxygen (minimum)	4.0 mg/L
pH	6.5-8.5
Total Phosphorus (streams)	0.1 mg/L
Total Phosphorus (lakes)	0.05 mg/L
Fecal Coliform	200 colonies per 100 mL
Total Dissolved Solids	500 mg/L
Total Suspended Solids	40 mg/L
Nitrate	10 mg/L

In 2002, the USEPA recommended that each state produce an integrated list combining both 305(b) and 303(d). The resulting report is known as the *New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report* (Integrated Report). This report summarizes the Integrated List as it pertains to use classifications set for the waterbodies of New Jersey. The Integrated List is comprised of unique Sublists 1 through 5 and adds a priority recommendation to each impaired reach. Waterbodies are placed on Sublists based on NJDEP's results when they compare observed water quality data to water quality standards. The various Sublists are as follows:

Sublist 1 suggests that the waterbody is meeting water quality standards.

Sublist 2 states that a waterbody is attaining some of the designated uses, and no use is threatened. Furthermore, Sublist 2 suggests that data are insufficient to declare if other uses are being met.

Sublist 3 maintains a list of waterbodies where there exists a lack of data or information to support an attainment determination.

Sublist 4 lists waterbodies where use attainment is threatened and/or a waterbody is impaired; however, a TMDL will not be required to restore the waterbody to meet its use designation.

Sublist 4a includes waterbodies that have a TMDL developed and approved by the USEPA, that when implemented, will result in the waterbody reaching its designated use.

Sublist 4b establishes that the impaired reach will require pollutant control measurements taken by local, state, or federal authorities that will result in full attainment of use.

> **Sublist 4c** states that the impairment is not caused by a pollutant, but is due to factors such as instream channel condition and so forth. It is recommended by the USEPA that this list be a guideline for water quality management actions that will address the cause of impairment.

> **Sublist 5** clearly states that the water quality standard is not being attained and requires a TMDL.

This Integrated Report also includes a schedule of TMDLs and other actions to be undertaken in the following two-year period, a list of waterbodies delisted in 2004, and a Comparison Document, which summarizes changes between the 2002 and 2004 Sublists.

In assembling the Integrated List, the NJDEP reviews all existing and available data as required. The NJDEP is committed to using only data with acceptable quality assurance to develop the Integrated Report (NJDEP, 2004b). Further information regarding the quality assurance needed for data inclusion in the Integrated Report can be found in the General Data Requirements section of *Integrated Water Quality Monitoring and Assessment Methods.*

The Integrated Report considers all data collection, from benthic macroinvertebrate communities, to fish tissue analyses, and surface water quality data. Four active biomonitoring stations exist in the watershed. These biomonitoring stations are four of approximately 800 stations monitored by the NJDEP's Bureau of Freshwater & Biological Monitoring known as the Ambient Biomonitoring Network (AMNET) (NJDEP, 2000). Data collected from these monitoring locations are used to evaluate streams for biological impairment as indicated by New Jersey Impairment Score (NJIS).

Assessment results can be defined as non-impaired, moderately impaired, and severely impaired.

> **Non-impaired** is defined by a benthic community comparable to other undisturbed streams within the region. The community is characterized by maximum taxa richness, balanced taxa groups, and good representation of intolerant individuals.

> **Moderately impaired** describes a macroinvertebrate community whose richness has been reduced, in particular pollutant-intolerant species. There may also be a reduced community balance and numbers of pollutant-intolerant taxa.

> **Severely impaired** refers to a benthic community dramatically different from those in less impaired situations; macroinvertebrates are dominated by a few taxa with many individuals and only pollutant-tolerant individuals are present (NJDEP, 2004).

Table 6 lists these four AMNET locations and their assessment results.

Table 6: AMNET Locations in the Robinson's Branch Watershed

Site ID	Station Name	1993 Result	1999 Result
AN0196	Robinson's Branch tributary at Raritan (Terrell) Road in Scotch Plains Township	Severely Impaired	Moderately Impaired
AN0197	Robinson's Branch tributary at Lamberts Mill Road in Westfield Township	Moderately Impaired	Moderately Impaired
AN0198	Robinson's Branch at Goodman's Crossing in Scotch Plains Township	Moderately Impaired	Moderately Impaired
AN0199	Robinson's Branch at Route 27 in Rahway City	Moderately Impaired	Moderately Impaired

Though data has shown that Robinson's Branch is moderately impaired for benthic community at several locations, following NJDEP protocol, monitored reaches at ANO197 and ANO198 will need further data collection, and are therefore placed on sublist 3 with a notice of "further assessment required." This is due to one of three reasons, as listed in the NJDEP Integrated Water Quality Monitoring and Assessment Methods. These reasons for a moderately impaired, non-Pinelands aquatic life station to require further data collection are as follows:

- the site drains a catchment area of less than 6 square miles;
- the site is located within 450 feet of a dam or impoundment outlet;
- site was assessed during December through March (NJDEP, 2003b).

Stream assessments are dependent on the designated use and the requirements of that use. A stream may be characterized according to the designated uses including aquatic life, recreational (human health and aesthetic quality), drinking water supply, shellfish harvesting, lake trophic status, fish consumption, industrial water supply, and agricultural water supply. Each designated use, therefore, has a specific assessment method and criteria determining the non-attainment, insufficient data, and full attainment status.

In the Robinson's Branch Watershed, surface water quality data collected by the NJDEP and USGS has been used for the Integrated Report. This collection of data has been due to the cooperative agreement between the USGS and various state agencies, such as the NJDEP; the USGS/NJDEP cooperative Ambient Stream Monitoring Network (ASMN) began in 1976 (USGS, 2002). The two USGS water quality monitoring stations in the watershed and their site information is detailed in Table 7; a surface water quality analysis of this data has been prepared is Section IV of this document.

Table 7: USGS Water Quality Monitoring Stations in the Robinson's Branch Watershed

Station ID	Station Description	Years of Data Collection	Number of Samples
01395200	Robinson's Branch Tributary at Scotch Plains, NJ	1997-1998	7
01396003	Robinson's Branch at Central Avenue in Rahway, NJ	1999-2003	13

Table 8 has been derived from the Integrated Report. This table defines the use of the impaired waters and the determined pollutant or water quality problem.

Table 8: Waterbodies in the Robinson's Branch Noted in the Integrated Report

Sublist	Station Name/ Waterbody	Site ID	Parameters	Data Source
1	Robinson's Branch at Scotch Plains, NJ	01395200	Temperature, Dissolved Oxygen, Nitrate, Dissolved Solids, Unionized Ammonia	NJDEP/USGS Data
1	Robinson's Branch at St. Georges Avenue in Rahway, NJ	01396003, 7-ROB-1	Temperature, pH, Dissolved Oxygen, Nitrate, Dissolved Solids, Unionized Ammonia	NJDEP/USGS Data, Metal Recon
3	Robinson's Branch Tributary at Lamberts Mill Road in Westfield, NJ	ANO198	Benthic Macroinvertebrates	NJDEP AMNET
3	Robinsons Branch Tributary at Raritan (Terrell) Rd in Scotch Plains, NJ	ANO197	Benthic Macroinvertebrates	NJDEP AMNET
3	Robinson's Branch at Scotch Plains, NJ	01395200	pH, Total Suspended Solids (TSS)	NJDEP/USGS Data
4	Robinson's Branch at Scotch Plains, NJ	01395200	Fecal Coliform	NJDEP/USGS Data
4	Robinson's Branch at St. Georges Avenue at Rahway, NJ	01396003, 7-ROB-1	Fecal Coliform	NJDEP/USGS Data
5	Robinson's Branch at Scotch Plains, NJ	01395200	Phosphorus	NJDEP/USGS Data
5	Robinson's Branch at St. Georges Avenue at Rahway, NJ	01396003, 7-ROB-1	Phosphorus, Arsenic	NJDEP/USGS Data, Metal Recon
5	Robinson's Branch at Goodmans Crossing in Scotch Plains, NJ	AN0196	Benthic Macroinvertebrates	NJDEP AMNET
5	Robinson's Branch at Route 27 in Rahway, NJ	AN0199	Benthic Macroinvertebrates	NJDEP AMNET

As stated earlier in this section, those waterbodies listed on Sublist 4 have a TMDL that has already been adopted. Sublist 5 waterbodies are not meeting water quality standards, and a TMDL is necessary to determine pollutant removal needed for standards to be met. Map 16 in Appendix B of this report spatially describes the information given above.

N. Stormwater Conveyance

Map 19 in Appendix B presents the 37 delineated subbasins of the Robinson's Branch Watershed. These drainage areas were used to evaluate the stormwater runoff potential presented in Section IV of this report. Based on field surveillance, a sampling of detention basins, and streams that are encased in underground channels are also geographically referenced on this map. This, however, is an incomplete inventory of the stormwater conveyance components.

O. Source Water Areas of Potable Public Surface Waters

The residents of the Robinson's Branch Watershed primarily consume treated surface water purchased from the Elizabethtown Water Company. This water is originally acquired from surface waters outside the Robinson's Branch Watershed.

The Middlesex Reservoir, currently unused as a potable water source, receives drainage from heavily developed land, to include runoff from three highways (i.e., the Garden State Parkway, Raritan Road and Featherbed Lane).

Along with other waterbodies within the Robinson's Branch Watershed, Map 8 in Appendix B depicts the location of the Middlesex Reservoir.

P. Jurisdictional Boundaries

The Robinson's Branch Regional Stormwater Management Planning Area has several agencies responsible for implementing stormwater management. The primary jurisdiction is the municipality. The municipalities and their extent are quantified in Table 9. The boundaries can be viewed on Map 17 in Appendix B. This map also depicts the water purveyor boundaries that, although they do not provide official jurisdiction of stormwater management, can be useful in determining the worth of the drinking water sources.

Other entities that are considered relevant to the stormwater management planning of the Robinson's Branch Watershed cover the entire watershed. These entities include Union and Middlesex Counties, Union and Middlesex County Engineering Departments, the Freehold and Somerset/Union County Soil Conservation Districts, and the Rahway River Association.

Table 9: Municipal Land Area in the Robinson's Branch Watershed

Municipality	County	Total Area of Municipality Square Miles	Area within the Watershed Boundary Square Miles	Percent of Watershed Land Area Contributed by the Municipality %	Percent of Municipality that Includes the Robinsons Branch Watershed %
Clark Township	Union	4.42	3.12	14.1	70.6
Cranford Township	Union	4.91	0.19	0.8	3.8
Edison Township	Middlesex	30.70	4.85	21.9	15.8
Fanwood Borough	Union	1.32	0.38	1.7	29.1
Garwood Borough	Union	0.67	0.04	0.2	5.7
City of Plainfield	Union	5.93	0.55	2.5	9.3
Rahway City	Union	4.08	1.03	4.7	25.3
Scotch Plains Township	Union	9.05	6.44	29.1	71.2
Town of Westfield	Union	6.70	3.43	15.5	51.2
Woodbridge Township	Middlesex	24.49	2.08	9.4	8.5

III. Identification of Physical Characteristics

The physical characteristics of the Robinson's Branch Regional Stormwater Management Planning Area that are pertinent to the management of the stormwater include significant slopes, swales and impoundments. Stream contours are also critically important when determining the hydraulics of the system. Through a combination of GIS, field surveys and data acquisition, the physical characteristics of the Robinson's Branch Watershed have been mapped or modeled.

A map of the slopes within the Robinson's Branch Watershed can be found in Appendix B, Map 18. Steep slopes, greater than 15% can be found in small sections distributed around the periphery of the watershed. Generally, these areas do not comprise a large percentage of the land area in the watershed, but should be noted due to the potential for erosion in these headwater areas.

The Robinson's Branch Watershed has several areas of stormwater detention/retention. Field surveys and aerial photogrammetry served to identify additional areas of detention. The

Stormwater Conveyance map, Map 19 in Appendix B, shows where some areas of detention were determined.

A key component to identifying the physical characteristics of the watershed was collecting the stream cross sectional data. After obtaining a digital elevation model of the topography of the watershed with a resolution of ten meters, it was necessary to refine the contours of the stream reaches. The first step was to collect previously surveyed cross sectional data. This was done by contacting John Scordato of the NJDEP Bureau of Dam Safety and Flood Control and Vince Mazzei of the Land Use Regulation Program. These individuals assisted the Water Resources Program in obtaining a print out of previously run hydraulic models with surveyed cross sections that were performed for the state for earlier purposes of flood control or bridge construction. These fragments of cross sections could be used to run discrete hydraulic models for specified areas within the Robinson's Branch Watershed.

IV. Water Quality, Groundwater Recharge, Water Quantity Hydrologic and Hydraulic Model or Analysis

Water Quality

2004 Integrated List of Impaired Waterbodies

As discussed previously, the *2004 Integrated List of Impaired Waterbodies* has enabled watershed managers to prioritize water quality problems according to high quality, readily available data with multiple data points and oftentimes a series of parameters. As demonstrated previously, the benthic community has been monitored twice in the past 12 years at several locations in the watershed. These four stations comprise a third of the AMNET stations in WMA 7. Throughout WMA 7, between 1994 and 1999, a pronounced downward trend to marginal levels was seen in habitat scores, whereas, an upward trend was seen in NJIS scores. This trend reflects degraded water quality or other physiochemical factors in-stream that are affecting the biotic integrity, which is further lowered by marginal habitat in areas of WMA 7 (NJDEP, 2000).

The Robinson's Branch at Goodman's Crossing (ANO196) benthic community monitoring site is the one station in the Robinson's Branch watershed that saw an increase in number of species, and habitat, and thus, overall assessment result. Improvement in macroinvertebrate community was seen at the Robinson's Branch at Terrell Road (ANO197) site, though overall assessment remained "moderately impaired". TMDLs will be required for the Robinson's Branch at Goodman's Crossing (ANO196) and the Robinson's Branch at Route 27 (ANO199). Turbid flow and an increase in trash was noted in the 1999 Benthic Macroinvertebrate Data form at the Robinson's Branch at Route 27 in Rahway; a photo of the Robinson's Branch just upstream of ANO199 is shown in Figure 3.

Figure 3: The Robinson's Branch Watershed Upstream of Route 27

The Robinson's Branch at Scotch Plains USGS/NJDEP water quality monitoring station 01395200 has shown acceptable water quality for temperature, dissolved oxygen, nitrate, dissolved solids, and unionized ammonia. Further data collection is required for pH and TSS. Based on data from 01395200, a fecal coliform TMDL has been approved for the Robinson's Branch at Scotch Plains; this information is detailed more fully below. Finally, a TMDL will be needed to quantify the necessary load reduction in phosphorus so that this reach of the Robinson's Branch can meet water quality standards.

The Robinson's Branch is also sampled at St. Georges Avenue in Rahway (USGS/NJDEP 01396003) and has shown acceptable water quality for temperature, pH, dissolved oxygen, nitrate, dissolved solids, and unionized ammonia. Based on available data at this station, a fecal coliform TMDL has been developed and is detailed more fully in the following sections of this document. However, known impairments do exist at this location. Both phosphorus and arsenic have exceeded allowable water quality standards at this location, which should be addressed in the TMDL process. It should also be noted that this station is at the same location as ANO199, shown above.

Aquatic Life TMDL Development in the Watershed

Biological assessments have become an important tool for managing water quality to meet the goals of the Clean Water Act (i.e., to maintain the chemical, physical, and biological integrity of the nation's water). For the Robinson's Branch Watershed, TMDLs will be required to address the biological impairments that were observed at two reaches in the watershed as determined by benthic macroinvertebrate sampling conducted at AN0196 and AN0199. Currently, the NJDEP is working on creating a protocol to develop TMDLs for biological impaired waterways. The first step in developing these TMDLs is to identify the stressor that is causing the biological impairment.

Although biological assessments are a critical tool for detecting impairment, they do not identify the cause or causes of the impairment. In response to this issue, the USEPA developed a process, known as the Stressor Identification (SI) process, to accurately identify any type of stressor or combination of stressors that might cause biological impairment (see Figure 4). The SI process involves the critical review of available information, the formation of possible stressor scenarios that may explain the observed impairment, the analysis of these possible scenarios, and the formation of conclusions about which stressor or combination of stressors are causing the impairment. The SI process is iterative, and in some cases additional data may be needed to identify the stressor(s). In addition, the SI process provides a structure or a method for assembling the scientific evidence needed to support any conclusions made about the stressor(s). When the cause of a biological impairment is identified, the stakeholders are then in a better position to locate the source(s) of the stressor(s) and is better prepared to implement the appropriate management actions to improve the biological condition of the impaired waterway.

Once the stressor is identified, TMDLs can be developed for that stressor in each of these reaches in Robinsons Branch.

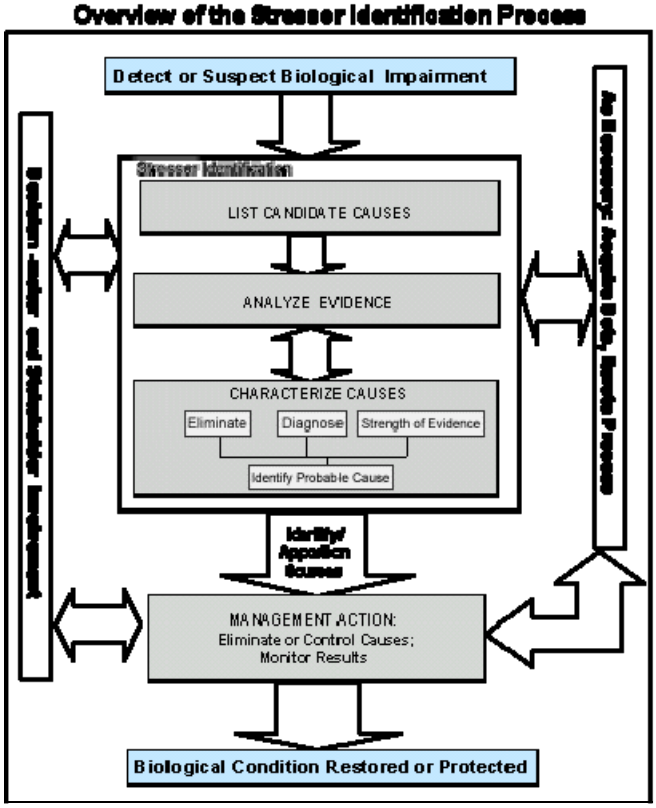

Figure 4: Overview of the Stressor Identification Process

Pathogen TMDL Development in the Watershed

As stated earlier, the Robinson's Branch and its tributaries have known fecal coliform impairments. Fecal coliform is measured by number of organisms per volume of water and is an

important indicator of sanitary quality. Excessive numbers of fecal coliform organisms may indicate the presence of fecal waste in the stream and perhaps other dangerous organisms. Since modernization of the wastewater treatment process, problems such as fecal coliform in-stream have been greatly reduced. However, fecal coliform is still an important indicator of water quality. Potential sources of fecal coliform in-stream include combined sewer overflows, stormwater outfalls, wildlife waste, illegal sewer connections, and failing septic tanks. Fecal coliform in the Robinson's Branch has already begun to be addressed by the TMDL process.

In September of 2003, the USEPA approved these two TMDLs in a document known as the *Total Maximum Daily Loads for Fecal Coliform to Address 48 Streams in the Raritan Water Region*. The Robinson's Branch at Scotch Plains (USGS 01395200) TMDL will address 3.3 miles of stream, whereas, the Robinson's Branch at Route 27 in Rahway (USGS 01396003) TMDL will address 20.7 miles of stream. Figure 5 displays the fecal coliform TMDLs that have been approved in WMA 7 and stream reaches that are impaired by the results of the monitoring station data (NJDEP, 2003b).

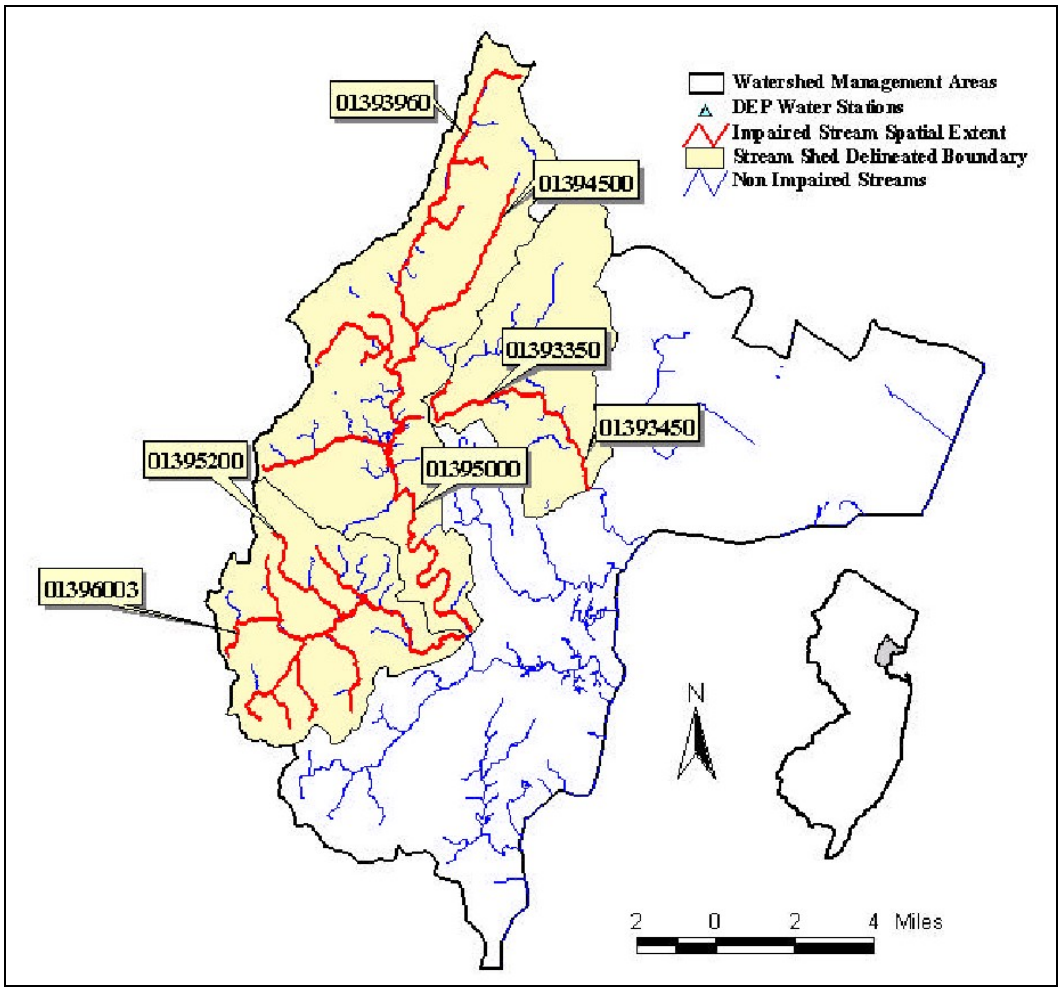

Figure 5: Fecal Coliform Impaired Waterbodies of WMA 7 (NJDEP, 2003b)

In calculating the necessary reductions in fecal coliform so that water quality standards will be met, the two stations with similar data were grouped when calculating the TMDL. Based on these calculations, fecal coliform load to the Robinson's Branch will have to be reduced by **96%** (NJDEP, 2003b).

The TMDL has documented some sources of fecal coliform that may be contributing to bacterial problems in the watershed. The NJDEP has noted that golf courses in the watershed have attracted large geese populations which contribute to the fecal coliform load; see Figure 6 for a map of golf courses in the watershed. Furthermore, the Ash Brook Reservation is home to wildlife, which contributes to this impairment. Strategies for improvement from the NJDEP TMDL document include the following:

- Organize local community-based goose management programs;
- Implementation of Phase II stormwater regulations will manage some stormwater sources (NJDEP, 2003b).

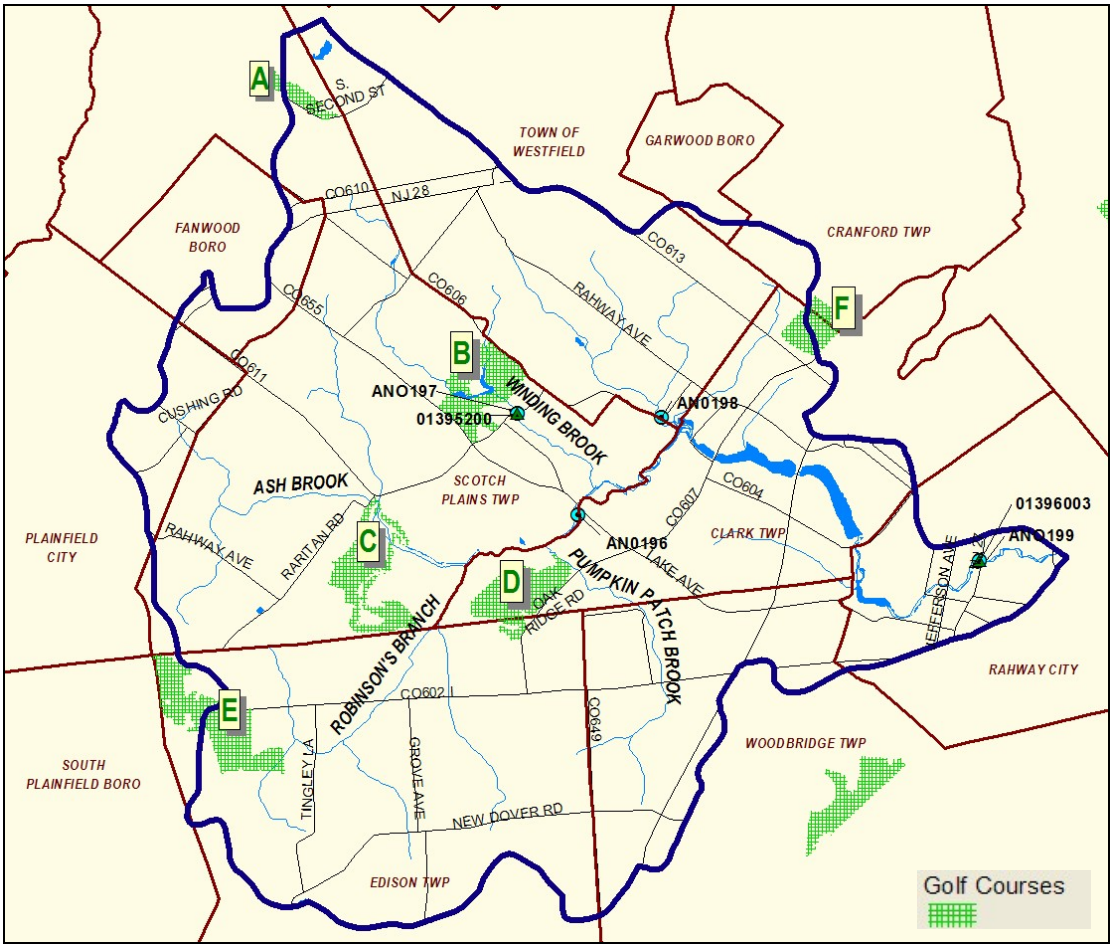

Figure 6: Golf Courses of the Robinson's Branch Watershed (NJDEP, 2003a)

A-Shady Rest Golf Course, Scotch Plains; B- Shackamaxon Golf Course, Scotch Plains; C-Ash Brook Golf Course, Scotch Plains; D-Oak Ridge Country Club, Clark and Edison; E-Plainfield Country Club, Edison; F-Hyatt Hills Golf Complex, Clark

Chemical TMDL Development in the Watershed

According to the NJ TMDL Development 2-Year Timeline developed in June of 2004, no other TMDLs are scheduled for either station in the Robinson's Branch Watershed.

Phosphorus Data Analysis

Phosphorus is a recurring issue in the watershed. Applicable numerical water quality criterion for total phosphorus in FW2 streams is 0.1 mg/L. First and foremost, a station must have a minimum of 8 samples to be considered for the Integrated Report; however, on a case-by-case basis, four samples or more may be considered. The NJDEP Water Quality Assessment Protocol recommends that if 10% or less of the samples exceeds the surface water quality standards or if exceedences are due to natural conditions, the waterbody be noted for full attainment of the parameter. A station may be noted as not attaining surface water quality standards under the following two conditions:

- Less than 10% of the samples exceed applicable water quality standards, but degrading water quality trends (such as dissolved oxygen) are likely to be exceeded in more than 10% of samples within 2 years, or
- More than 10% of samples exceed surface water quality standards and/or at least 2 samples exceed surface water quality standards (NJDEP, 2003b).

Data collected at USGS 01395200 and USGS 0136003 is insufficient according to NJDEP protocol, however, there must be additional phosphorus data at these two locations for these sites to be considered for the Integrated Report. The additional sampling results may be included in the AMNET surveys, USGS Metal Reconnaissance Network, or may not yet be available online (http://waterdata.usgs.gov/nwis).

Phosphorus data points collected at both USGS stations are displayed in Figure 7 and Figure 8, plotted against the surface water quality standard for total phosphorus.

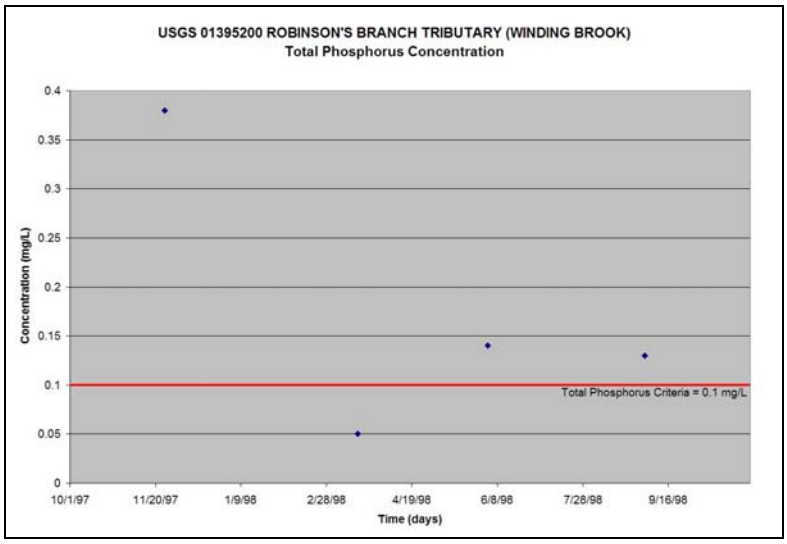

Figure 7: Total Phosphorus Concentration, USGS 01395200, Winding Brook

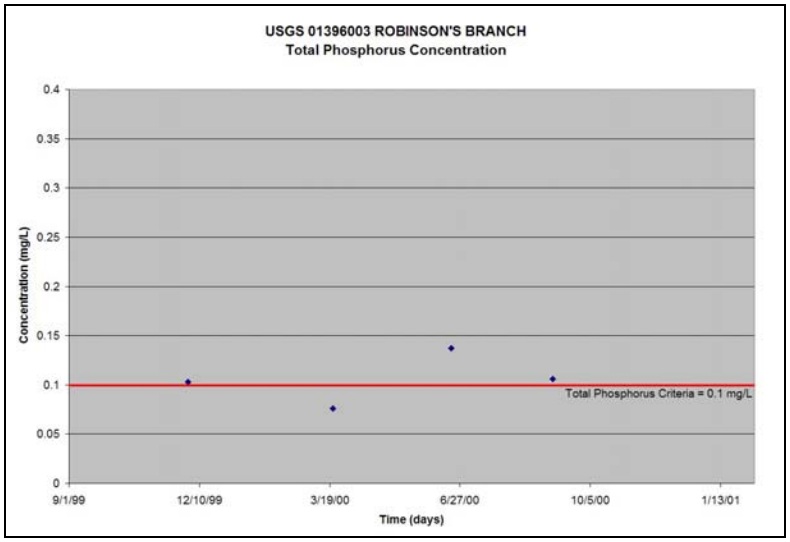

Figure 8: Total Phosphorus Concentration, USGS 01396003, Robinson's Branch

As discussed in *A Technical Report for the Characterization and Assessment of Watershed Management Area 7*, total phosphorus is a common impairment across WMA 7. In the Rahway River at two separate monitoring locations, it was confirmed that summer water quality sampling showed significantly higher total phosphorus and ammonia nitrogen concentrations than during other times of the year (Hatch Mott MacDonald and Najarian Associates, 2003).

Aerial Loading Analysis

In the Robinson's Branch Watershed, as in other watersheds, the quality of the water is affected by both point and nonpoint sources. Point sources are regulated by the NJDEP and must meet stringent water quality standards. Stormwater sewers, however, have long been considered non-point sources because the origin of the stormwater and accompanying pollutants is typically a large land area. Stormwater, which is water that flows overland as a result of a storm event, is often discharged through manmade stormwater conveyance facilities directly into streams and can carry high levels of pollutants including nutrients, pathogens, metals, and organic chemicals. NJDEP currently regulates municipal separate sewer systems (MS4s) as point sources through a general New Jersey Pollutant Discharge Elimination System (NJPDES) permit program. The effect of non-point source (NPS) pollution and storm sewer pollution on water quality is vital to the understanding of the watershed and to the development of a cogent watershed restoration plan.

As a portion of the water quality analysis, an Aerial Load Analysis was conducted on the Robinson's Branch Watershed using the Army Corps of Engineers' HEC-GeoHMS hydrological modeling software to delineate the watershed into 37 subbasins that represent areas draining to significant tributaries or significant reaches of the stream. Figure 9 represents the subbasin delineation used for the purpose of aerial loading evaluations. The subbasins are numbered from east to west and are the same as the delineations used for the hydrologic analysis.

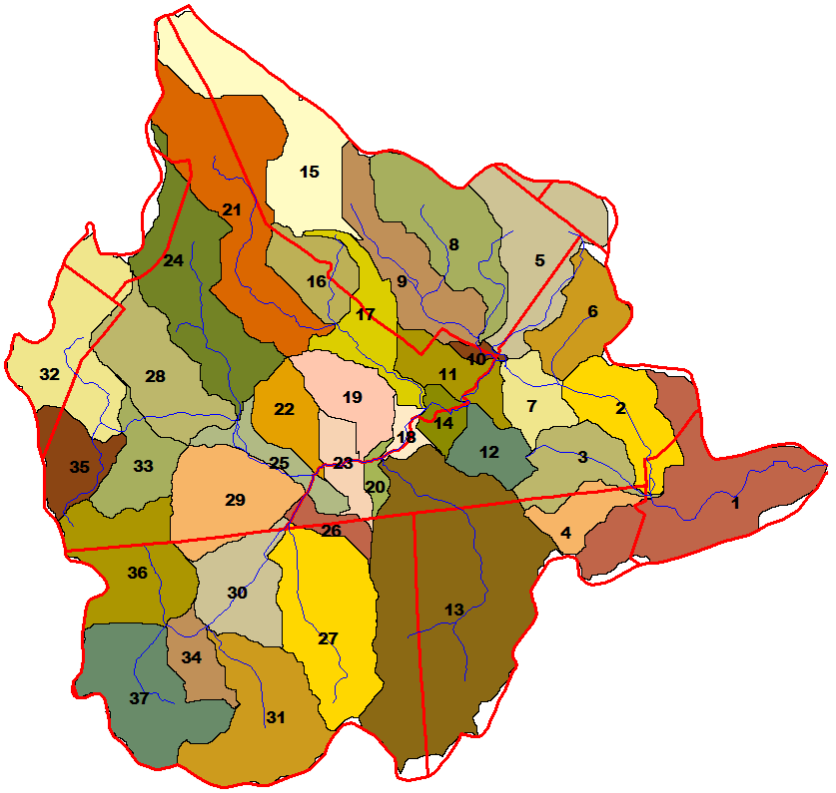

Figure 9: Robinson's Branch Subbasin Delineation

The Aerial Load Analysis was based on aerial pollutant export loading coefficients, UL_c. These coefficients were used to estimate pollutant loads for various land uses within the Robinson's Branch Watershed. The pollutant export loading coefficient for each pollutant and each land use are shown in Appendix D. These values were compiled from the New Jersey Stormwater Best Management Practices Manual and from current literature sources (NJDEP, 2004b). The parameters that were evaluated as a part of this process are as follows: total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS), ammonia nitrogen (NH_3-N), lead, zinc, copper, biochemical (biological) oxygen demand (BOD), chemical oxygen demand (COD), and nitrite plus nitrate (NO_2 + NO_3). The land use maps for each subbasin are from the 1995/97 NJDEP GIS layer. Annual NPS loads for each subbasin were then calculated using the loading equation:

$$Load = UL_c \times Area$$

Load is in units of pounds of pollutant per year (lbs/yr), UL_c is in units of pounds per acre per year (lbs/acre/yr) for each specific land use, and *Area* is in acres for each specific land use. The loading equation provides an approximation for annual NPS loads on a subbasin basis. This allows for the comparison of pollutant loading between subbasins and provides a method by which to prioritize subbasins for restoration and/or preservation. Table 10 presents estimated pollutant loading from land use within the subbasin, normalized to area.

Table 10: Pollutant Loading Normalized to Area (Basin Coefficient)

	TP	TN	TSS	NH3-N	LEAD	ZINC	COPPER	BOD	COD	NO2+NO3
	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac	lb/yr/ac
1*	1.37	14.64	139.38	0.83	0.57	0.48	0.54	29.33	205.18	1.89
2	0.96	10.70	109.21	0.61	0.59	0.44	0.46	25.54	128.46	1.48
3	1.13	12.10	127.78	0.68	0.67	0.48	0.52	28.30	132.67	1.66
4	1.12	12.03	121.53	0.80	0.89	0.60	0.62	31.77	148.55	1.86
5	1.25	13.37	135.91	0.64	0.62	0.54	0.54	27.70	133.12	1.65
6	1.41	15.00	149.58	1.11	1.09	0.83	0.75	36.75	277.81	2.26
7	1.05	11.52	116.05	0.59	0.42	0.36	0.41	23.48	144.98	1.42
8	1.35	14.48	137.73	0.70	0.42	0.40	0.49	26.85	164.43	1.74
9	1.07	11.52	118.99	0.68	0.63	0.47	0.49	26.56	148.56	1.57
10	0.81	8.97	118.97	0.45	0.76	0.62	0.45	23.88	84.70	1.14
11	0.92	9.90	109.07	0.43	0.36	0.30	0.35	20.21	89.20	1.12
12	1.24	13.31	133.94	0.64	0.40	0.37	0.44	25.38	149.46	1.58
13*	1.25	13.40	130.54	0.68	0.47	0.41	0.48	26.50	152.31	1.66
14	1.11	12.12	119.43	0.64	0.54	0.42	0.48	26.48	135.20	1.61
15*	1.24	13.36	130.75	0.74	0.55	0.45	0.50	28.03	174.72	1.72
16	1.15	12.03	126.10	0.76	0.86	0.58	0.62	30.84	130.56	1.78

17	0.89	9.29	109.60	0.50	0.63	0.43	0.45	23.25	84.42	1.22
18	1.12	12.24	124.59	0.56	0.53	0.45	0.48	25.46	112.48	1.50
19	0.56	6.64	79.86	0.30	0.36	0.25	0.27	17.26	56.80	0.84
20	0.78	8.60	97.80	1.00	1.70	0.96	0.86	41.68	120.74	2.20
21	1.16	12.21	126.56	0.72	0.69	0.51	0.54	28.12	152.98	1.66
22	0.59	6.72	85.44	0.39	0.41	0.30	0.28	17.34	105.82	0.84
23	0.36	5.09	63.50	0.50	0.91	0.50	0.46	25.66	54.88	1.23
24	0.92	9.44	115.83	0.41	0.41	0.32	0.35	19.63	85.30	1.02
25	0.46	5.50	73.71	0.49	0.92	0.52	0.46	24.75	56.33	1.16
26*	0.66	7.69	86.27	0.70	1.11	0.64	0.60	31.21	91.12	1.63
27	1.15	12.43	125.80	0.66	0.63	0.50	0.52	19.54	132.79	1.63
28	0.63	6.00	96.75	0.19	0.33	0.24	0.25	12.95	43.35	0.46
29	0.56	6.12	83.91	0.54	1.01	0.57	0.52	26.47	61.09	1.25
30	0.92	10.43	107.21	0.62	0.65	0.49	0.47	26.11	135.52	1.49
31	1.03	11.34	113.72	0.62	0.50	0.39	0.44	24.81	140.36	1.49
32	0.99	10.73	112.59	0.44	0.30	0.28	0.35	20.14	99.13	1.17
33	0.45	4.42	81.31	0.03	0.17	0.13	0.14	8.96	1.68	0.18
34	0.57	7.09	78.90	0.22	0.18	0.18	0.20	15.16	48.03	0.76
35	0.56	5.94	85.52	0.24	0.43	0.28	0.28	15.86	34.88	0.66
36	0.74	7.41	101.13	0.50	0.82	0.50	0.49	23.67	71.72	1.12
37*	0.55	6.52	79.23	0.55	0.89	0.52	0.48	26.11	77.71	1.30

Note 1: *denotes subbasins of concern

Since each of the subbasins varies in size, the loading results presented in Table 11 were not normalized and consider the extent of the lands that contribute to the loading.

Table 11: Pollutant Loading from Total Subbasin

	Area	TP	TN	TSS	NH3-N	LEAD	ZINC	COPPER	BOD	COD	NO2+NO3
	Acres	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr
1*	780	1067	11418	108713	649	441	374	422	22879	160037	1478
2	344	329	3683	37577	209	202	151	157	8787	44200	510
3	282	320	3415	36067	193	188	136	148	7989	37449	468
4	154	173	1858	18772	124	137	92	95	4908	22945	288
5	567	707	7586	77109	364	349	304	305	15718	75529	937
6	278	392	4165	41539	307	302	230	207	10205	77148	628

7	180	189	2072	20876	106	75	64	73	4223	26081	256
8	484	656	7013	66717	340	204	193	236	13008	79646	842
9	423	454	4877	50390	287	266	197	209	11247	62915	663
10	29	23	259	3437	13	22	18	13	690	2447	33
11	220	202	2177	23995	94	80	66	77	4447	19624	247
12	176	219	2344	23586	112	71	65	78	4469	26320	279
13*	1652	2063	22130	215655	1116	784	673	797	43772	251617	2745
14	95	105	1147	11304	61	51	40	45	2506	12796	152
15*	620	771	8284	81064	457	341	282	313	17376	108327	1067
16	237	272	2851	29886	179	205	138	146	7309	30942	422
17	283	252	2626	30997	141	178	121	128	6575	23875	345
18	66	74	808	8221	37	35	30	32	1680	7422	99
19	247	138	1642	19748	74	89	63	66	4268	14045	207
20	50	39	430	4890	50	85	48	43	2084	6037	110
21	859	993	10492	108717	619	597	441	465	24151	131407	1429
22	202	119	1358	17259	78	83	60	56	3503	21376	170
23	143	52	726	9058	71	130	72	65	3660	7829	175
24	660	605	6227	76420	268	268	210	234	12949	56273	672
25	162	75	890	11918	80	149	84	75	4001	9108	187
26*	91	60	697	7819	63	101	58	54	2829	8259	148
27	628	725	7808	79019	413	397	312	329	12276	83413	1026
28	441	277	2644	42632	84	144	106	109	5706	19100	202
29	430	239	2630	36056	233	432	246	225	11373	26252	536
30	329	302	3426	35232	205	214	160	155	8580	44533	491
31	572	588	6491	65092	353	285	225	250	14200	80338	850
32	547	544	5870	61617	240	163	153	189	11020	54253	642
33	236	106	1042	19156	6	39	31	34	2110	396	42
34	161	91	1140	12678	35	29	29	32	2436	7718	122
35	234	131	1388	19979	57	100	65	66	3706	8148	154
36	494	365	3663	50008	245	407	249	240	11705	35464	555
37*	528	288	3444	41867	291	472	275	254	13798	41062	686

Note 2: *denotes subbasin of concern

This data provides watershed managers with an estimation of the potential pollutant contribution from a particular subbasin. This data is useful primarily for preliminary observations and

assessments because of the generalities inherent in the 1995/97 land use maps and the land use based pollutant load estimations. The analysis does, however, provide a starting point for targeting sensitive areas for restoration.

SUBBASINS OF CONCERN

The thirty seven subbasins were ranked in order of the nonpoint source pollution contributed, on an aerial basis and in total. These rankings were performed without weighting the various contaminants differently, simply determining the relative quantity of input. Once all subbasins were ordered according to pollutant contribution, the lowest ranking basins were then evaluated for their land use and potential for remediation. Table 12 shows how the subbasins have been modeled as contributing to the nonpoint source pollution within the entire watershed.

Table 12: Aerial Loading Subbasin Ranking

	Load	Coefficient
Rank	Sub-basin	Sub-basin
1	13*	6
2	21	1*
3	1*	4
4	15*	16
5	27	21
6	5	15*
7	31	5
8	8	20
9	24	8
10	37	3
11	9	13*
12	36	27
13	6	26*
14	32	9
15	29	14
16	2	12
17	30	18
18	3	30
19	16	2

The following five subbasins have been determined to be areas of concern due to their ranking based on their related basin loading coefficient, overall loading, field surveillance, and potential for remediation. These five basins, shown in Figure 10, represents a concentration of land use that contributes to non-point source pollutant loading, and with subbasin #37, an area of land that does not have high loadings and with conservation presents the potential for filtering and infiltrating stormwater.

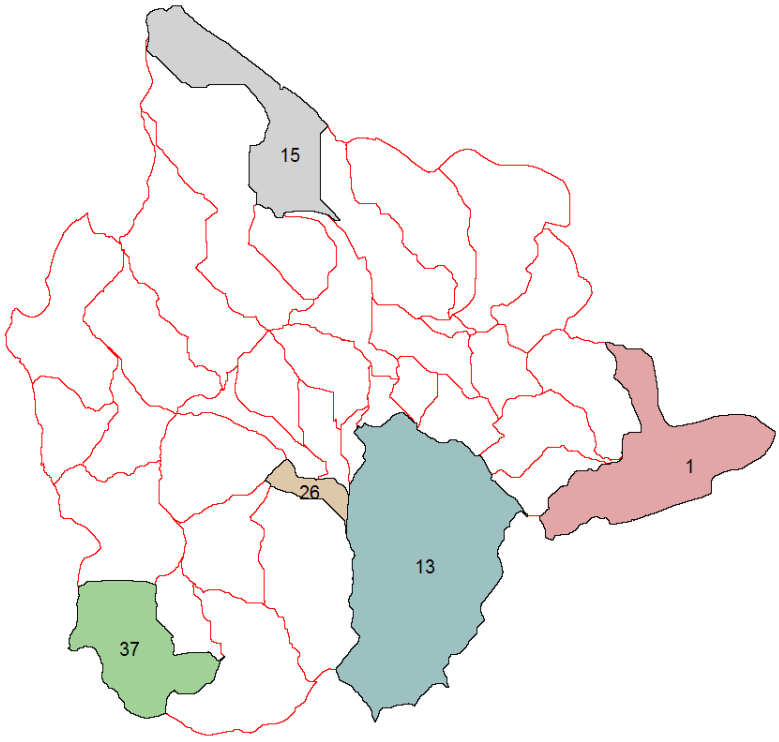

Figure 10: Subbasins of Concern Regarding NPS Loading

#1 Robinson's Branch drainage area to outlet in Rahway

This subbasin is characterized by a large amount of high and medium density residential development(Table 13). This type of land use relates to a moderate loading of total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS). Also, this subbasin has a significant percentage of the land committed to commercial land use. The one hundred acres of commercial land use and over eighty acres of mixed urban areas help to contribute to the loadings of the trace metals.

Table 13: Subbasin land use for #1, outlet basin in Rahway

Land Use	Acres	Percent
High/Med Residential	784.9	75.4%
Low/Rural Residential	12.8	1.2%
Commercial	101.1	9.7%
Industrial	0.0	0.0%
Mixed Urban	84.1	8.1%
Agriculture	0.0	0.0%
Forest, Water, Wetlands	57.9	5.6%
Barren Land	0.0	0.0%
Total	1040.9	100.0%

Another important attribute of Subbasin #1 is that this subbasin experiences the final flows of the entire watershed before the Robinson's Branch joins the Rahway River. With heavier flows and increased velocities, contributions from erosion

#13 Pumpkin Patch drainage area in Woodbridge (Colonia) and Clark

The Pumpkin Patch subbasin is a large drainage area with residential use that ranges from high density to low and rural density. These aspects of land use contribute to high TP, TN and TSS loading, as well as a significant source of NH3. The land use in this subbasin also contributes some of the highest loads of the trace metal lead, zinc and copper due to the mixed urban and commercial uses. Table 14 shows the breakdown of land use in this subbasin.

Table 14: Subbasin Land Use for Pumpkin Patch subbasin #13

Land Use	Acres	Percent
High/Med Residential	1395.5	68.2%
Low/Rural Residential	131.1	6.4%
Commercial	60.5	3.0%
Industrial	0.0	0.0%
Mixed Urban	248.3	12.1%
Agriculture	5.5	0.3%
Forest, Water, Wetlands	204.7	10.0%
Barren Land	0.0	0.0%
Total	2045.6	100.0%

#15 Upper Westfield drainage area

This subbasin is contained in a heavily developed suburban area that creates typical runoff containing high levels of TSS, TN and TP. As can be viewed from Table 15, almost 90% of this basin is covered with residential development which allows for erosion, geese habitat and fertilizer use, among other pollutants transferred by stormwater.

Table 15: Subbasin Land Use for Subbasin #15

Land Use	Acres	Percent
High/Med Residential	2785.3	87.1%
Low/Rural Residential	37.6	1.2%
Commercial	67.0	2.1%
Industrial	4.0	0.1%
Mixed Urban	86.4	2.7%
Agriculture	0.0	0.0%
Forest, Water, Wetlands	217.1	6.8%
Barren Land	2.0	0.1%
Total	3199.5	100.0%

#26 Central Watershed, Clark and Edison drainage area

In the northeastern section of Edison and the southwestern section of Clark, there is a small subbasin composed primarily of high/medium residential development. With this development dominating the mixed urban and wetland areas, a relatively high level of TSS is a concern in this subbasin. The location of the watershed makes this a target for bank stabilization.

Table 16: Subbasin Land Use for Subbasin #26

Land Use	Acres	Percent
High/Med Residential	718.0	85.8%
Low/Rural Residential	0.0	0.0%
Commercial	0.0	0.0%
Industrial	0.0	0.0%
Mixed Urban	33.1	4.0%
Agriculture	0.0	0.0%
Forest, Water, Wetlands	73.8	8.8%
Barren Land	11.6	1.4%
Total	836.5	100.0%

#37 Southwest Watershed, Edison

With some of the lowest pollutant loadings in the watershed, this subbasin has a significant representation of the wetlands in the watershed. With low residential and commercial development, the pollutant loading for TP, TN, TSS, and the trace metals are among the lowest in the watershed.

Table 17: Subbasin Land Use for Southwest Watershed, Edison

Land Use	Acres	Percent
High/Med Residential	96.3	13.6%
Low/Rural Residential	67.5	9.5%
Commercial	20.4	2.9%
Industrial	0.0	0.0%
Mixed Urban	193.6	27.3%
Agriculture	0.0	0.0%
Forest, Water, Wetlands	330.7	46.6%
Barren Land	1.4	0.2%
Total	709.8	100.0%

Field Reconnaissance: Lakes and Streams

Field reconnaissance was used to assess the physical characteristics of the waterways within the Robinson's Branch Watershed. Observations included numerous areas of streambank erosion, eutrophication/algal growth, and large areas of connected imperviousness that contribute to the increased velocity of the stream and also contributes to lower water quality. Specific observations are presented in Section IX C.

Groundwater Recharge

The sustainability of the groundwater resource clearly depends on use and recharge. Recharge is heavily dependent on precipitation amounts which are beyond the control of this plan, but average approximately forty five inches per year in New Jersey. Assessment of the recharge capability provides critical guidance to attain confidence in the ability of the groundwater to provide for the base flows of the streams and service to wells.

At this point in time, potable water for the residents of the Robinson's Branch Watershed depends almost entirely on treated surface water. This may be more costly to treat, but it is traditionally less expensive to acquire than groundwater. Therefore, there is not a significant demand on the aquifer underlying the Robinson's Branch Watershed.

No USGS observation wells exist in the boundary of the Regional Stormwater Management Plan for the Robinson's Branch. However, one well exists that would measure ground water levels that are likely hydraulically connected to that water being recharged from the Robinson's Branch land area. The data from this well, which is located in Union County Park, can be viewed in the graph shown in Figure 11. This time series shows the relative stability of the ground water levels in this area. The low dip in the levels around 1964 correlate with a severe drought the area was experiencing at that time.

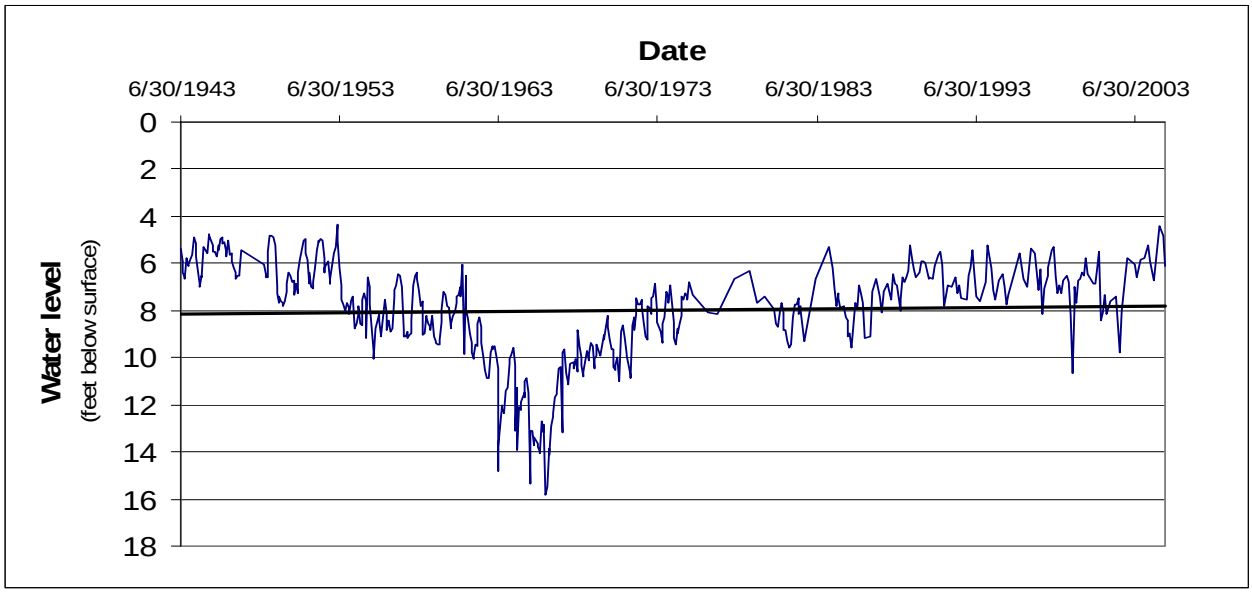

Figure 11: Groundwater level at the USGS Union County Park Observation Well

Refer to Groundwater Recharge Map of the Robinson's Branch Watershed, Map #11 in Appendix B. This GIS layer was overlaid on the land use to determine areas within the watershed that could provide recharge to the aquifer.

Field reconnaissance and GIS provides information leading to the accurate assessment of the recharge capabilities of the watershed. Many areas of significant groundwater recharge have been identified. The area containing the Oak Ridge Golf Course on the southwestern boundary of the Ash Brook Reservation presents a large tract of land that recharges eleven to seventeen inches of precipitation a year. The area of the Shackamaxon Golf Course is also denoted as an area of high recharge potential.

The main concern surrounding groundwater recharge in the Robinson's Branch Watershed is that the majority of the lands in the municipalities have relied heavily on stormwater conveyance via street curbing directly to storm sewers. These storm sewers occasionally outfall to concrete channels, a widely accepted stormwater conveyance practice used in the past in Westfield. This routing of stormwater bypasses the potential of infiltration by directing the stormwater over only impervious surfaces, reducing the slow acquisition of the water for use as the stream baseflow and sending fresh water downstream quickly. The reservoir in Clark is the key to freshwater storage in the watershed, although groundwater is an important resource that should be sustained for the increased water needs of the future.

Water Quantity

For the purposes of identifying critical areas subject to flood according to different design storms, and to evaluate environmentally sound and cost effective measures to minimize damages under certain conditions, hydrologic and hydraulic models were developed for the Robinson's Branch Watershed by the Water Resources Program. An approach using two models, The Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS), and the Hydrologic Engineering Center's River Analysis System (HEC-RAS), both developed by the United States Army Corps of Engineers, was used to identify surface runoff originating in different areas of the watershed, routing stream flow and producing water surface elevation profiles for select areas under various hypothetical storm events.

This model delineated the Robinson's Branch Watershed to a total of 37 subbasins. For each individual subbasin in the Robinson's Branch watershed, a composite curve number and initial abstraction were estimated using the SCS (Soil Conservation Service) curve number infiltration loss method and similarly time lags were estimated using the Snyder unit hydrograph method for runoff transform.

The curve number is a critical parameter representing the infiltration/runoff capacity of the area using the land use profile, hydrologic soil group and available soil moisture. The 1995 land use land cover data coverage available from the NJDEP GIS database, and the NRCS SSURGO soils were used to determine average soil moisture condition curve numbers for each land use and soil combination in the Robinson's Branch Watershed. The composite (area weighted average) curve numbers were obtained using spatial analysis techniques and spatial databases within GIS.

One of the many reasons for the field surveillance and subsequent modeling study was to identify the critical areas subject to flooding for different storm events and to assess opportunities to reduce flooding impacts through various storm water management strategies. The results of the steady state simulation for different design storms defined areas subject to flooding throughout the various segments of the Robinson's Branch Watershed. Areas identified in the field as problem drainage areas were classified as critical areas of concern and were the focus of the initial analyses. For this initial analysis, nine subbasins were selected covering the upper and lower reaches of the watershed where flooding impacts have the greatest impact on private property. In the selection of subbasins for analysis, those subbasins discharging to the Robinson's Branch through a major lakes were not considered. The discharge from these areas is controlled by outlet structures, and any storm water management strategies would have minimal effect on volume discharge or time of concentration. Figure 12 shows the subbasins as delineated for the initial hydrologic analysis.

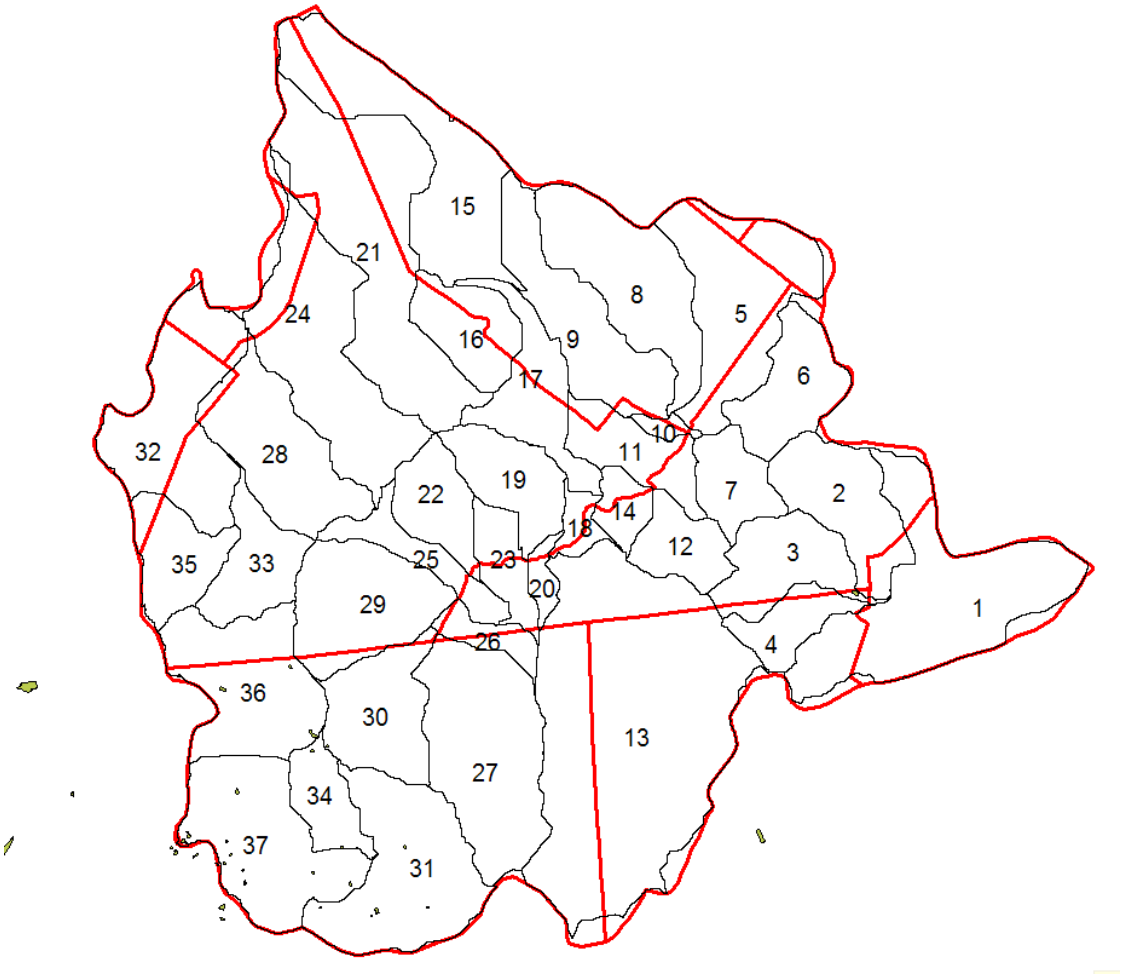

Figure 12: Subbasin Delineation Employed for Initial Hydrologic Analysis

The basins were qualified by total area, peak flows and discharge volumes. The nine basins with critical water quantity issues were selected for further stormwater management analysis (Figure 13). These nine basins are described in Table 18.

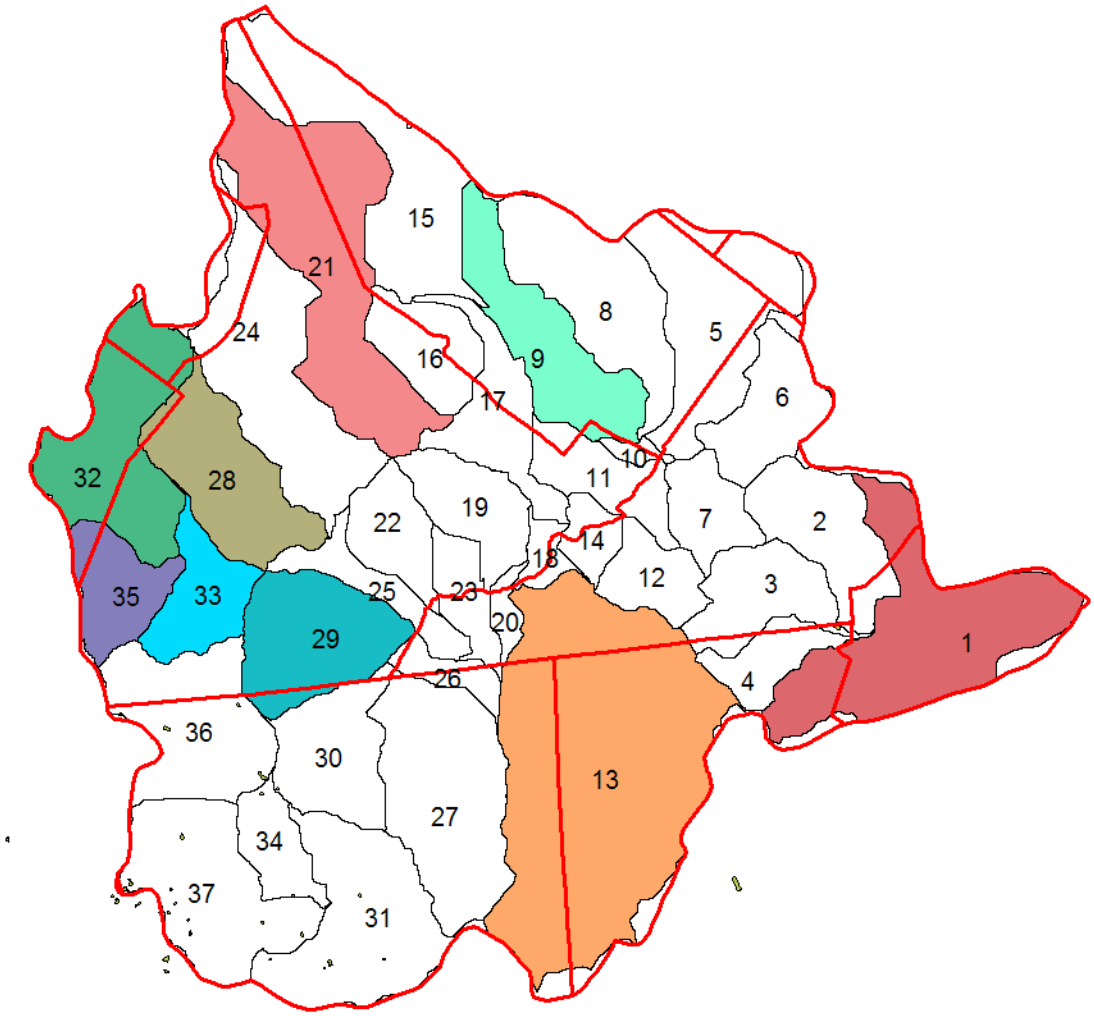

Figure 13: Selected Subbasins for Stormwater Management Analysis

Table 18: Selected Subbasins for hydrologic analysis

Watershed	Drainage Area (sq. mi.)	Description
1	1.2	Drains south section of Rahway and Colonia section of Woodbridge into the confluence with the Rahway

9	0.7	Drains central Westfield into Clark
13	2.6	Pumpkin Patch, Woodbridge, NW Edison and SW Clark, drains through the NE border of the Oak Ridge Golf Course to the Main Branch of the Robinson's Branch
21	1.3	Winding Brook. Drains some of Westfield, but mostly Scotch Plains, into area by Shackamaxon Golf Course
28	0.7	Ash Brook, Scotch Plains, heavy residential, Cooper Ave Bridge, drains to former zoo before Ash Brook Reservation
29	0.7	Ash Brook, From residential, to AB Golf Course to AB Reservation, into Main Stem
32	0.9	Drains lower Fanwood, Plainfield and subbasin crosses over Scotch Plains border. NW headwaters of the Ashbrook, contains detention area on Cushing and Terrill flooding
33	0.4	Ash Brook, tributary, Scotch Plains
35	0.4	SW headwater of the Ash Brook, contains Fox Hill flooding area

For the stormwater management analysis, two different scenarios were defined in each of these nine watersheds. For scenario one, the area weighted curve number was increased by 10% and peak flow and volume discharges were recalculated. For scenario two, the area weighted curve number was decreased by 10%, and peak flow and volume discharges were recalculated. For the analysis of the Robinson's Branch Watershed, it was assumed that a 10% change in the curve number was a practically achievable goal. For scenario one, the increase in the curve number represents an increase in the percentage of impervious surfaces in the selected subbasins should future residential or commercial development occur. Respectively, in scenario two, the decrease in curve number simulates the implementation of stormwater management strategies in the selected subbasins that would effectively control surface runoff reducing peak flows and volumes.

These scenarios were simulated by modifying the area weighted curve number for each selected subbasin within the HEC-HMS hydrologic model. A curve number is a hydrologic parameter given to parcels of land after combining the qualities of the soil, land use and antecedent moisture. The curve number for each parcel is representative of the runoff. A composite curve number calculated using the area weighting procedure, is then used to characterize the runoff properties of the subbasin. HEC-HMS then simulates runoff and calculates peak flow discharge and volume.

Since the goal of the Robinson's Branch watershed flow model was to simulate the impact of flooding according to standard design storms, the SCS hypothetical storm precipitation method was selected. The SCS hypothetical storm method implements four synthetic rainfall distributions developed by the Natural Resources Conservation Service (NRCS) from observed precipitation events. Each distribution contains rainfall intensities arranged to maximize the peak runoff for a given total storm depth (U.S. Army Corps of Engineers, 2001).

A type III storm that represents the Atlantic coastal areas of the United States was selected. Storm depths corresponding to the 2, 10, and 100 year storms were entered as model parameters. Table 19 summarizes the average 24-hour rainfall depths for Union and Middlesex Counties for the different design storms.

Table 19: Mean Average Union and Middlesex County Rainfall Depths for Standard Design Storms

TYPE III STORM	24-HR RAINFALL (INCHES)
2-Year Storm	3.35
10-Year Storm	5.15
100-Year Storm	8.65

Table 20, 20 and 21 show the peak flows and volumes generated by HEC-HMS for the selected subbasins. The analysis was generated for the 2-year, 10-year and 100-year design storms for the existing conditions in the selected sub watersheds and the 10% increase and 10% decrease in the curve numbers. The tables also show the percent change in the peak flows and volume of runoff for each scenario with respect to the existing conditions in the watershed.

Table 20: Peak flows and volumes for different scenarios for a 2-year storm

				Decrease 10%		Existing Conditions		Increase 10%	
Watershed	Area Weighted CN	CN + 10%	CN - 10%	Peak Flow (cfs)	Total Vol (Ac-ft)	Peak Flow (cfs)	Total Vol (Ac-ft)	Peak Flow (cfs)	Total Vol (Ac-ft)
1	86	95	78	206.97	84.24	316.51	124.22	437.81	175.36
9	81	89	73	86.62	35.40	137.88	52.878	199.16	74.805
13	85	93	76	335.96	161.70	518.25	240.17	730.64	340.4
21	83	91	74	157.89	76.19	246.97	113.72	353.33	161.27
28	83	92	75	105.43	41.88	164.48	62.089	233.18	87.63
29	87	95	78	153.21	47.86	233.45	70.298	319.01	98.873
32	86	94	77	146.20	57.18	224.81	84.37	313.29	119.04
33	85	94	77	89.36	24.90	137.17	36.606	189.58	51.449
35	87	96	78	96.91	26.67	146.86	39.099	198.64	54.936
				Percent Change				Percent Change	
				34.61	32.18			27.71	29.16
				37.18	33.05			30.77	29.31
				35.17	32.67			29.07	29.44
				36.07	33.00			30.10	29.48
				35.90	32.55			29.46	29.15
				34.37	31.92			26.82	28.90
				34.97	32.23			28.24	29.12
				34.86	31.98			27.65	28.85
				34.01	31.79			26.07	28.83

Table 21: Peak flows and volumes for different scenarios for a 10-year storm

				Decrease 10%		Existing Conditions		Increase 10%	
Watershed	Area Weighted CN	CN + 10%	CN - 10%	Peak Flow (cfs)	Total Vol (Ac-ft)	Peak Flow (cfs)	Total Vol (Ac-ft)	Peak Flow (cfs)	Total Vol (Ac-ft)
1	86	95	78	443.39	174.83	580.51	227.85	580.51	287.43
9	81	89	73	207.74	79.834	278.8	104.87	278.80	132.82
13	85	93	76	740.43	344.57	977.86	451.34	977.86	571.54
21	83	91	74	362.94	167.69	483.59	220.29	483.59	279.34
28	83	92	75	238.94	90.605	316.83	118.5	316.83	149.7
29	87	95	78	326.41	98.709	424.98	128.3	424.98	161.41
32	86	94	77	318.23	120.02	417.99	156.5	417.99	197.44
33	85	94	77	194.98	52.267	254.87	67.983	254.87	85.555
35	87	96	78	204.48	54.627	264.95	70.908	264.95	89.117
				Percent Change				Percent Change	
				23.62	23.27			17.63	20.73
				25.49	23.87			20.60	21.04
				24.28	23.66			19.08	21.03
				24.95	23.88			20.12	21.14
				24.58	23.54			19.35	20.84
				23.19	23.06			16.72	20.51
				23.87	23.31			18.13	20.74
				23.50	23.12			17.49	20.54
				22.82	22.96			16.03	20.43

Table 22: Peak flows and volumes for different scenarios for a 100-year storm

Watershed	Area Weighted CN	CN + 10%	CN - 10%	Decrease 10% Peak Flow (cfs)	Decrease 10% Total Vol (Ac-ft)	Existing Conditions Peak Flow (cfs)	Existing Conditions Total Vol (Ac-ft)	Increase 10% Peak Flow (cfs)	Increase 10% Total Vol (Ac-ft)
1	86	95	78	950.17	372.54	1104.2	439.72	1217.6	507.13
9	81	89	73	482.95	181.51	571.55	215.54	647.86	249.7
13	85	93	76	1624.9	749.85	1904.2	888.33	2129.1	1027.7
21	83	91	74	821.53	374.21	969.14	444.32	1094.5	514.88
28	83	92	75	533.37	199.5	625.73	236.15	700.58	272.9
29	87	95	78	694.44	209.3	802.36	246.6	877.55	283.88
32	86	94	77	689.65	258.07	803.21	304.76	889.34	351.62
33	85	94	77	421.67	112.39	488.53	132.52	537.55	152.67
35	87	96	78	431.49	115.2	496.52	135.6	540.04	155.97

Percent Change		Percent Change	
13.95	15.28	21.96	26.54
15.50	15.79	25.45	27.31
14.67	15.59	23.68	27.04
15.23	15.78	24.94	27.32
14.76	15.52	23.87	26.90
13.45	15.13	20.87	26.27
14.14	15.32	22.45	26.61
13.69	15.19	21.56	26.38
13.10	15.04	20.10	26.14

Table 23 shows the average percentage changes in the peak flow and volume of runoff from the sub watersheds for 10% increase and decrease of curve number for all the three design storms.

Table 23: Flow and volume change with alteration of curve number

Storm Event	Decrease in CN by 10% Peak Flow (cfs)	Decrease in CN by 10% Total Volume (ac ft)	Increase in CN by 10% Peak Flow (cfs)	Increase in CN by 10% Total Volume (ac ft)
2-Year Storm (3.35 inches over 24 hours)	-35.2%	-32.4%	39.8%	41.1%
10-Year Storm (5.15 inches over 24 hours)	-24.0%	-23.4%	22.5%	26.2%
100-Year Storm (8.65 inches over 24 hours)	-14.3%	-15.4%	11.0%	15.4%

Table 23 shows that for a 2-year design storm of 3.35 inches of rainfall over a 24 hour period, with a reduction of 10% in the curve number for the selected sub watersheds, the peak flow decreased by an average of 35.2% and the volume of runoff decreased by and average of 32.4% Also with the increase of 10% curve number for the selected subbasins, the peak flow increased

by an average of 39.8% and the volume of runoff increased by an average of 41.1%. For a 10-year design storm, the reduction of 10% in the curve number resulted in the reduction of an average of 24% of the peak flows and 23.4% of the volumes of runoff, whereas, the increase in 10% of the curve number resulted in the average increase of peak flows by 22.5% and increase of the volume of the runoff by 26.2%. Finally, for a 100-year design storm, the reduction in the curve number resulted in the average reduction of peak flow by 14.3% and volume of the runoff by 15.4%, whereas the increase of 10% of the curve number increased the peak flow and volume by and average of 11% and 15.4%, respectively.

From these scenarios it can be concluded that any changes in these watersheds that affect runoff have a significant impact during storms of lower intensities than the storms of higher intensities. The simulations show that stormwater management in these subbasins can significantly reduce peak flow rates and volumes discharging to Robinson's Branch that contribute to flooding concerns during smaller storms events. It is these smaller, more frequent storms that contribute the majority of the rainfall in the state of New Jersey over a given year.

The peak flow generated from HEC-HMS can then be imported into the HEC-RAS model. This model will be able to produce water surface elevations for all the available cross sections within the river reach given. Table 24, 25 and 26 show the changes in surface elevations at different locations in the Robinson's Branch Watershed for an 10% increase and reduction of the curve number for all the selected watersheds for the 2-year, 10-year and 100-year design storms, respectively.

Table 24: Water surface elevations for a 2-year storm

			Water Surface Elevation in Feet			% change	% change to higher
Stream	Location	Municipality	2yr_lowCN	2yr_regCN	2yr_highCN	from lower CN	CN
Winding Brook	Hetfield Avenue	Scotch Plains	125.67	126.43	127.28	0.60	0.67
Winding Brook	W. Broad Street	Scotch Plains	123.56	124.52	125.22	0.77	0.56
Winding Brook	Inverness	Scotch Plains	98.86	99.62	100.36	0.76	0.74
Winding Brook	Raritan Road	Scotch Plains	59.21	59.8	60.4	0.99	0.99
Robinsons1	Leigh Valley Rail Road Brdge	Scotch Plains	58.34	59.78	61.39	2.41	2.62
Robinsons1	Lake Avenue	Scotch Plains	55.83	57.63	59.01	3.12	2.34
Robinsons1	Cerral Avenue	Scotch Plains	53.13	54.9	56.31	3.22	2.50
Branch 22	Sleepy Hollow Lane Bridge	Scotch Plains	105.57	106.22	106.82	0.61	0.56
Branch 22	Cooper Street Bridge#2	Scotch Plains	87.25	88.3	89.43	1.19	1.26
Branch 22	Cooper Street Bridge#1	Scotch Plains	86.18	86.98	87.7	0.92	0.82
Branch 22	Clover Lake Bridge	Scotch Plains	70.45	71.5	72.56	1.47	1.46
Pumpkin Patch	Hawthorne 1S	Clark	68.9	69.37	69.73	0.68	0.52
Pumpkin Patch	Inman	Clark	66.53	67.36	68.13	1.23	1.13
Pumpkin Patch	Brookside	Woodbridge	55.11	56.01	56.82	1.61	1.43
Pumpkin Patch	Oakridge	Woodbridge	54.39	55.14	55.74	1.36	1.08

Table 25: Water surface elevations for a 10-year storm

Stream	Location	Municipality	Water Surface Elevation			% change from lower CN	% change to higher CN
			10yr_lowCN	10yr_regCN	10yr_highCN		
Winding Brook	Hetfield Avenue	Scotch Plains	127.33	129.46	129.75	1.65	0.22
Winding Brook	W. Broad Street	Scotch Plains	125.28	126.16	127.53	0.70	1.07
Winding Brook	Inverness	Scotch Plains	100.42	101.13	101.75	0.70	0.61
Winding Brook	Raritan Road	Scotch Plains	60.47	61.03	61.54	0.92	0.83
Robinsons1	Leigh Valley Rail Road Brdge	Scotch Plains	61.52	63.09	64.35	2.49	1.96
Robinsons1	Lake Avenue	Scotch Plains	59.12	60.34	61.33	2.02	1.61
Robinsons1	Cerral Avenue	Scotch Plains	56.41	57.36	58.02	1.66	1.14
Branch 22	Sleepy Hollow Lane Bridge	Scotch Plains	106.85	107.45	108.84	0.56	1.28
Branch 22	Cooper Street Bridge#2	Scotch Plains	89.49	90.57	94.2	1.19	3.85
Branch 22	Cooper Street Bridge#1	Scotch Plains	87.73	89.28	89.77	1.74	0.55
Branch 22	Clover Lake Bridge	Scotch Plains	72.61	73.69	74.7	1.47	1.35
Pumpkin Patch	Hawthorne 1S	Clark	69.74	70.13	70.54	0.56	0.58
Pumpkin Patch	Inman	Clark	68.14	68.77	69.32	0.92	0.79
Pumpkin Patch	Brookside	Woodbridge	56.85	57.62	58.3	1.34	1.17
Pumpkin Patch	Oakridge	Woodbridge	55.77	56.19	56.25	0.75	0.11

Table 26: Water surface elevation for a 100-year storm

Stream	Location	Municipality	Water Surface Elevation in Feet			% change from lower CN	% change to higher CN
			100yr_lowCN	100yr_regCN	100yr_highCN		
Winding Brook	Hetfield Avenue	Scotch Plains	129.87	129.96	129.98	0.07	0.02
Winding Brook	W. Broad Street	Scotch Plains	128.36	128.68	128.93	0.25	0.19
Winding Brook	Inverness	Scotch Plains	104.1	104.36	104.51	0.25	0.14
Winding Brook	Raritan Road	Scotch Plains	62.36	62.85	63.27	0.78	0.66
Robinsons1	Leigh Valley Rail Road Brdge	Scotch Plains	66.62	67.95	68.93	1.96	1.42
Robinsons1	Lake Avenue	Scotch Plains	63.1	64.17	64.96	1.67	1.22
Robinsons1	Cerral Avenue	Scotch Plains	59.16	59.86	60.41	1.17	0.91
Branch 22	Sleepy Hollow Lane Bridge	Scotch Plains	109.5	109.7	109.83	0.18	0.12
Branch 22	Cooper Street Bridge#2	Scotch Plains	94.83	95.36	95.69	0.56	0.34
Branch 22	Cooper Street Bridge#1	Scotch Plains	91.85	93.33	94.62	1.59	1.36
Branch 22	Clover Lake Bridge	Scotch Plains	76.55	77.26	77.17	0.92	-0.12
Pumpkin Patch	Hawthorne 1S	Clark	71.24	71.62	71.91	0.53	0.40
Pumpkin Patch	Inman	Clark	70.14	70.49	70.68	0.50	0.27
Pumpkin Patch	Brookside	Woodbridge	59.53	59.97	60.29	0.73	0.53
Pumpkin Patch	Oakridge	Woodbridge	57.69	58.32	58.6	1.08	0.48

From the above tables, it can be concluded that the changes in the water surface elevation were more significant during smaller storm events than during the larger events when changes in these six sub watersheds alters runoff discharging to the Robinson's Branch. The difference in water surface elevation was relatively consistent during each storm event, but as the water surface elevation was much lower during smaller storm events, this difference was much more dramatic and in some cases can eliminate nuisance flooding during the smaller storms. This again adds more depth to the argument that storm water management could have a significant impact in the reduction of the flooding in the Robinson's Branch Watershed for smaller storm events, which, as mentioned above, contribute the majority of the rainfall for a given year in the State of New Jersey.

V. Regulations and Programs

Each of the municipalities in the Robinson's Branch Watershed is required to comply with the requirements of the Statewide General Tier A New Jersey Pollutant Discharge Elimination System (NJPDES) permit for their municipal separate storm sewer system (MS4). The General MS4 NJPDES permit requires each municipality to develop a municipal storm water management plan (MSWMP) and a stormwater control ordinance. Furthermore, each municipality must assure that all development complies with the Residential Site Improvement Standards. See Appendix E for a summary of the Statewide Basic Minimum Requirements for the General (Tier A) MS4 NJPDES permit.

The requirements for the MSWMP include completing a build out analysis, calculating pollutant loads that would result from build out, and incorporate nonstructural stormwater management strategies into municipal development codes. Since all of the municipalities have less than one square mile of vacant or agricultural lands, they are exempt from these requirements. A pollutant loading analysis for the existing build out conditions of the watershed has been performed as part of this report.

Additionally, the General MS4 NJPDES permit requires each municipality to adopt and implement several key ordinances that will promote the use of stormwater as a resource. These ordinances include the following:

-Stormwater Control Ordinance:
A sample ordinance can be found at:
http://www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/bmpfeb2004pdfs/feb2004appdxd.pdf

-Yard waste:
A sample ordinance can be found at:
http://www.njstormwater.org/tier_A/pdf/containerized%20yard%20waste%20ordinance.pdf

-Illicit Connection
A sample ordinance can be found at:
http://www.njstormwater.org/tier_A/pdf/illicit%20connection%20ordinance.pdf

-Wildlife Feeding
A sample ordinance can be found at:
http://www.njstormwater.org/tier_A/pdf/wildlife%20feeding%20ordinance.pdf

-Improper Disposal of Waste
A sample ordinance can be found at:
http://www.njstormwater.org/tier_A/pdf/improper%20disposal%20of%20waste%20ordinance.pdf

-Litter Control
A sample ordinance can be found at:
http://www.njstormwater.org/tier_A/pdf/litter%20ordinance.pdf

-Pet Waste
A sample ordinance can be found at:
http://www.njstormwater.org/tier_A/pdf/pet%20waste%20ordinance.pdf

Additional considerations for ordinances that would benefit water quality and regulate water quantity could include a steep slope ordinance, a stream corridor/no fill ordinance, and an ordinance that will address the increase in impervious area that comes with "knock-down/rebuilds."
These ordinances should include low-impact development type language that allows for better use of stormwater as a resource.

Total Maximum Daily Loads (TMDLs)

As discussed previously, a TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint pollution, natural conditions, and surface water withdrawals. A TMDL is a mechanism for identifying and quantifying all contributors to surface water quality in a drainage basin and setting goals for reductions needed to meet surface water quality standards (NJDEP, 2004).

Refer to Section IV of this report for the specific parameters being addressed with TMDL implementation in the Robinson's Branch Watershed. The final Regional Stormwater Management Plan for this watershed will incorporate all considerations regarding any TMDLs, proposed or implemented.

VI. Information not available

The needs of the watershed and the information available about the watershed will determine the analysis and structure of the final regional stormwater management plan. Information that can be obtained without consuming undue resources of the committee must be used to provide the plan within the boundaries that have been originally set. However, for the purposes of accurately

representing the watershed for the intended purposes, several pieces of information would have been helpful.

This information includes higher resolution cross sectional data that covers the entire watershed. Discrete cross sections of the watershed that were obtained from the NJDEP were able to provide stream contours for use in hydraulic modeling, but due to the low resolution of the digital elevation model, accurate cross sectional data was unable to be obtained digitally. Spot surveying of bridges was necessary, but surveying of the entire watershed was beyond the scope of this project. An increase in the resolution of DEM would serve to capture more defined topography of the watershed for use in the hydrologic model. The ten meter DEM that is readily available from the USGS proved helpful for the hydrologic model, but increased resolution is required for channel contours. Two foot contours could potentially help to represent the stream contours for channel routing, and were available for Rahway in Union County. Middlesex County is also anticipating the acquisition of higher resolution contours in the near future. Since the watershed covers both Union and Middlesex Counties, coverage was incomplete.

A digital representation of the stormwater conveyance system would have provided information on sewersheds that may not follow the subbasins as defined by the topography. It is expected that these drainage patterns for the stormwater infrastructure would closely follow the topography of the land, making the cost of acquisition difficult to justify.

A digital representation of the flood hazard areas based on delineations made by the NJDEP under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50. The flood hazard areas are delineated given a storm depth equal to 125% of the 100-year design storm for the county. These maps are currently being developed in hard copy by the NJDEP, and it is anticipated that they will eventually be available digitally.

VII. Geographical Information System

As per 7:8-3.4 (b): *The Department encourages the use of existing information to the extent that it is available to minimize the cost of data acquisition, such as information available on the Department's Geographical Information System website or as developed through a watershed planning process.*

The process of map production for the Robinson's Branch Regional Stormwater Management Plan was achieved through the use of GIS data layers found on the NJDEP's website, http://www.state.nj.us/dep/gis/newmapping.htm.

This project has also benefited from GIS data sharing between the RCRE Water Resources Program and the Union County Department of GIS, and the data made available through the Rutgers Center for Remote Sensing and Spatial Analysis (CRSSA).

VIII. Determination of Inclusion in Watershed Boundary

As per 7:8-3.4 (c): *The characterization and assessment shall include information on locations and activities outside the regional stormwater management planning area that drain into the planning area.*

With the topographic and stormwater conveyance that has been obtained by the committee, and field verification by the Water Resources Program, it appears that the watershed boundary represents the watershed accurately and that there are no areas outside the boundary that contribute stormwater to the watershed.

IX. Rank of Water Quality Impacts

According to 7:8-3.4 (d): *Using the modeling or other information obtained under(a) through (c) above, the stormwater-related water quality impacts of existing land uses and projected land uses assuming full development under existing zoning shall be identified and ranked*

A. Inventory Pollutant Sources to the Robinson's Branch Watershed

The highly urbanized nature of the watershed has resulted in significant pollutant loads to the Robinson's Branch. As discussed earlier in this report, the Robinson's Branch Watershed was subdivided into 37 subbasins, and an aerial loading analysis was performed for each of these sub-watersheds. Based upon these calculations, the high density residential, commercial and industrial land uses provide the most significant loads to the Robinson's Branch. The residential areas and corporate complexes are believed to contribute significant nutrient loads and pesticide loads due to lawn maintenance activities. Additionally, the roadways and highways located within the watershed provide ideal surfaces for accumulation and build up of pollutants from atmospheric deposition and the high level of auto emissions. These pollutants can severely impact the water quality of Robinson's Branch.

Sediment, the number one pollutant throughout the country, has a high potential to impair the Robinson's Branch. Sources of sediment include road grit, sanding of icy impervious surfaces in the winter, stream bank erosion due to the flashy hydrologic nature of the Robinson's Branch and its tributaries, land disturbance from new development and redeveloping areas, and the inability of invasive species to provide the root structure needed to prevent soil erosion.

Fecal coliform is also a pollutant that is suspected to impair the water quality of the waterways in the Robinson's Branch Watershed. Sources of fecal coliform include Canada geese population, pet waste, wildlife (deer, raccoons, etc.) and illicit discharges of human waste.

Furthermore, a significant amount of debris/floatables are found in this watershed. The high level of imperviousness in the watershed provides an avenue for debris to collect and be easily conveyed into the Robinson's Branch and its tributaries.

All of the above pollutants can be transported to the waterways in the Robinson's Branch Watershed by stormwater runoff. Pollutants of concern include nutrients (phosphorus and nitrogen), sediment (total suspended solids), pathogens, toxics, and debris. These pollutants either individually or in combination may contribute to the impairment of the aquatic community in the Robinson's Branch Watershed. Listed in Section IX C are specific water quality issues that have been identified in the watershed.

B. Affected Uses

Although many of the traditional pollutants such as TSS and phosphorus discussed above primarily affect the surface waters, the infiltration of contaminated stormwater or the leaching of contaminants already in the system by precipitation could eventually affect the quality of the groundwater.

The Clark Reservoir (a.k.a. Middlesex Reservoir) has the potential to provide a drinking water source in the future. Surface waters of the Robinson's Branch have been explored for the prospect of providing a drinking water source, but no plans are in place. In both instances, efforts to manage stormwater runoff quality will play a significant role in the feasibility and cost of the final treatment.

C. Identification and Rank of Pollutants and Sources

The quality of the stormwater entering the stream system in the Robinson's Branch Watershed is highly dependent on the route that it takes to get there. With the high impervious nature of the watershed, roads are cleaned, the lawns are diluted of their chemicals and animal waste, and sediment is released to the streams. These factors, along with many others, contribute phosphorus, total suspended solids, fecal coliform and pathogens, and a variety of pollutants that affect the uses of the waterways of the Robinson's Branch.

Using the 2004 Integrated List of Impaired Waterbodies, it can be seen that phosphorus and arsenic are pollutants of concern. Impairments that occur for benthic macroinvertebrates do not specify the pollutant that is affecting the ecosystem, however, total suspended solids from erosion and silt carried by stormwater is a primary concern.

Table 27 provides a specific list of concerns regarding water quality that has been determined through the use of the *NJDEP 2004 Integrated List of Impaired Waterbodies*, and field surveillance studies performed by the Water Resources Program. Hydrologic and hydraulic models were used as references, with the theory of the models providing insight into the processes of the watershed.

Table 27: Water Quality Impacts

	Concerns	Township	Notes
#1	Middlesex Reservoir	Clark	Quality of Runoff received, address many sources according to land use and drainage, sedimentation
#2	Fecal Coliform Impairments	All municipalities	TMDL calls for 96% reduction in fecal load to the Robinson's Branch and tributaries
#3	Phosphorus Impairments	All municipalities	TMDL is not yet developed and is not on schedule to be developed
#4	Arsenic Impairment	All municipalities	TMDL not proposed at this time. Address potential contribution of stormwater inputs.
#5	Milton Lake	Clark	Floatables, erosion of banks, geese population
#6	Clark Township Department of Public Works Garage	Clark	Address runoff to reservoir
#7	Union County Roads Department	Scotch Plains	Address runoff to Winding Brook
#8	Kiwanis Park	Rahway	Turbidity and floatables
#9	Hetfield Avenue at Broad Street (Brookside Park, Westfield Memorial Field)	Westfield	Geese (flooding also an issue in this area)
#10	Pond at Tamaques Park	Westfield	Eutrophication, temperature, and large goose population

X. Rank of Water Quantity Impacts

As per 7:8-3.4 (e): *Using the model or other information obtained under (a) through (c) above for stormwater-related water quantity impacts and stormwater-related groundwater recharge impacts of existing and projected land uses*

A combination of the hydrologic, hydraulic modeling effort and the field reconnaissance surveys provided valuable information on areas within the Robinson's Branch that experience flooding. Some of these areas of concern have been ranked below in Table 28. Land use that increases impervious cover is a concern with regard to increasing the water quantity and velocity.

Table 28 ranks the water quantity concerns, flooding and otherwise, with consideration of threat to public health, safety, and welfare; risk of loss of or damage to water supplies; and risk of damage to the biological integrity of water bodies (as per N.J.A.C. 7:8 3.4 (e)).

Discrete HEC-RAS modeling has been performed to further define the frequency and extent of flooding related to existing land uses and future changes in land uses. These model results will aid stakeholders in prioritizing subwatersheds for implementation of flood control practices bases on the basic theories of hydrology.

The Pumpkin Patch Brook is a tributary to the Robinson's Branch which is experiencing frequent flooding episodes. Over the years, the Pumpkin Patch Brook has been channelized and residential homes encroaching in the floodway. Going back to the early 1970's, flooding has been recorded at many areas where the stream is crosses by roadways. These areas include Wheatsheaf Road and Oakridge Road in Clark, Tussel Lane (a private road, see Figure 14) in Scotch Plains, and Deerwood Drive in Clark.

Figure 14: Robinson's Branch Flooding at Tussel Lane, Scotch Plains

Many other areas at risk of flooding are listed in Table 28. Flooding on Terrill Road, Rahway Road, West Broad Street, Lambert's Mill Road and Carriage Road prove to be regular problems that are affecting the welfare of the local population. Increase upstream connected impervious area, channelized streams, and minimal detention contribute to the increase in the volume and velocity of the streams in the Robinson's Branch Watershed.

The detention area at Cushing Road provides storage for a large volume of stormwater. But with residents complaining of frequent flooding, the detention storage area appears inadequate.

In the lower subbasins of the watershed, the stream experiences serious constrictions that promote flooding, erosion and downcutting. The most serious areas exist in Rahway, immediately downstream of Milton Lake, and then again immediately before the outlet to the Rahway River. In some cases, it is suspected that fill material has contributed to the constriction that is limiting flow at this section of the Robinson's Branch.

Wetlands that supply areas for infiltration and stormwater storage are at a minimum in the Robinson's Branch Watershed. For this reason, it is clearly important to focus on the land use of the wetlands that exist at this point in time. Areas such as the wetlands located south of Inman Avenue in Edison are able to mitigate some of the flooding problems caused elsewhere in the watershed. Additional development in these areas could alter the hydrology, creating additional flooding difficulties in the watershed.

Table 28: Water Quantity Impacts

	Concerns	Township	Notes
#1	Pumpkin Patch Flooding	Clark and Woodbridge	Including Oak Ridge Road and Wheatsheaf Road, Tussel Lane, and Deerwood Lane
#2	Terrill Road Flooding	Fanwood, Plainfield and Scotch Plains	Includes upstream after discharge from Fanwood Nature Center and the intersection of Terrill and Raritan Roads
#3	Rahway Road Flooding	Scotch Plains	In the area of the intersection with Fox Hill
#4	West Broad Street Flooding	Scotch Plains	White Oak Road to Hetfield Avenue and crossing at Hetfield Avenue
#5	Lambert's Mill Road flooding	Westfield and Scotch Plains	Between Tamaques Reservation and Middlesex(Clark) Reservoir
#6	Carriage Road flooding	Scotch Plains	Downstream of Shackamaxon Lake, before confluence with main branch
#7	Cushing Road detention area	Plainfield	Heavy flows to detention in wooded area
#8	Robinson's Branch main stem immediately before outlet	Rahway	Constriction and backwater effect
#9	Downstream of Milton Lake	Rahway	Constriction due to fill material at the end of West Milton Avenue
#10	Wetlands south of Inman Avenue	Edison	Additional development in area could alter the hydrology of the wetlands, thereby creating flooding problems in the area

XI. Resources

Baumgartl, T., 1998, Physical soil properties in specific fields of application especially in anthropogenic soils. Soil and Tillage Research 47 pp. 51-59.

Charles, E.G., Behroozi, Cyrus, Schooley, Jack, and Hoffman, J.L., 1993, A method for evaluating ground-water-recharge areas in New Jersey: N.J. Geological Survey Report GSR-32, Trenton, 95p.

Dalton, Richard, 2003, New Jersey Geological Survey (NJGS) Information Circular: Physiographic Provinces of New Jersey. State of New Jersey, Trenton, NJ.

Ehrenfeld, JR, 2004, The expression of multiple functions in urban forested wetlands, Wetlands, 24 (4): 719-733.

Federal Emergency Management Agency National Flood Insurance Program, 1996, Q3 Flood Data, Disc 18 New Jersey, Puerto Rico, Virgin Islands.

French, Mark, 2003, Ground-Water Recharge for New Jersey Project Overview: New Jersey Geologic Survey DGS02-3 <http://www.nj.gov/dep/njgs/geodata/dgs02-3/readme.htm>

Hatch Mott MacDonald, 2003, Setting of the Metropolitan Watershed of New Jersey: A Technical Report for the Characterization and Assessment of Watershed Management Area 7; Part 1.

Hatch Mott MacDonald and Najarian Associates, revised 2003, Surface Water Quality, Pollutant Loadings, and Critical Resources Assessment: A Technical Report for the Characterization and Assessment of Watershed Management Area 7; Part 2.

Killam Associates, January 2001, Stream Erosion Study, Township of Scotch Plains, Volume 1 Final Report, Millburn, NJ.

New Jersey Department of Community Affairs (NJDCA) Office of Smart Growth, 2004, Critical Environmental and Historic Sites (polygons) of the NJ State Development and Redevelopment Plan, adopted March 1, 2001.
<http://www.nj.gov/dca/osg/resources/maps/cehsmetadata.shtml>

New Jersey Department of Environmental Protection (NJDEP), 1994, Ambient Biomonitoring Network, Arthur Kill, Passaic, Hackensack, and Wallkill River Drainage Basins, 1993 Benthic Macroinvertebrate Data, Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), 2000, 1999 Benthic Macroinvertebrate Water Monitoring Report, Bureau of Freshwater and Biological Monitoring, Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), revised 2003a, NJDEP Statewide Golf Course Shapefile, Division of Science, Research, and Technology, Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), 2003b, Integrated Water Quality Monitoring and Assessment Methods, Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), 2003c, Total Maximum Daily Loads for Fecal Coliform to Address 48 Streams in the Raritan Water Region, Division of Watershed Management, Trenton, NJ.

New Jersey Department of Environmental Protection (NJDEP), 2004, New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report, Trenton, NJ.

New Jersey Geological Survey, 2000, NJDEP Digit Hydrologic Unit Code delineations for New Jersey (DEPHUC14). http://www.state.nj.us/dep/gis/digidownload/metadata/statewide/dephuc14.htm

New Jersey Water Supply Authority, 2000, Methodologies for Basic Soil Analyses: A Methodology for Defining and Assessing Soils in the Raritan River Basin. NJWSA, Somerville, NJ.

Niles, L.J., M. Valent, P. Winkler, and P. Woerner, 2004, New Jersey's Landscape Project, Version 2.0. NJDEP, Division of Fish and Wildlife, Endangered and Nongame Species Program, Trenton, NJ.

Reiser, R.G., Watson, K.M., Chang, M., and Nieswand, S.P., 2002, Surface-Water Data and Statistics from U.S. Geological Survey Data-Collection Networks in New Jersey on the World Wide Web: USGS Fact Sheet FS-109-02.

Soil Conservation Service, 1986, Urban hydrology for small watersheds. Technical Report 55. USDA, Springfield, VA.

Spayd, Steven E., and Johson, Stephen W., 2003, Guidelines for Delineation of Well Head Protection Areas in New Jersey, New Jersey Department of Environmental Protection, Trenton, NJ.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), 2000, Official Series Description – Carlisle Series. Official Soil Series Descriptions. <http://ortho.ftw.nrcs.usda.gov/osd/dat/C/CARLISLE.html>, 7/13/2005.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), 1995, Soil Survey Geographic (SSURGO) Data Base: Data Use Information. Miscellaneous Publication Number 1527. USDA, Washington, DC.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), 2000, Official Series Description – Carlisle Series. Official Soil Series Descriptions. <http://ortho.ftw.nrcs.usda.gov/osd/dat/C/CARLISLE.html>, 7/13/2005.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), 2002a, Official Series Description – Haledon Series. Official Soil Series Descriptions. <http://ortho.ftw.nrcs.usda.gov/osd/dat/H/HALEDON.html>, 7/13/2005.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), 2002b ,Official Series Description – Parsippany Series. Official Soil Series Descriptions. <http://ortho.ftw.nrcs.usda.gov/osd/dat/P/PARSIPPANY.html>, 7/13/2005.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), 2005, Official Series Description – Boonton Series. Official Soil Series Descriptions. <http://ortho.ftw.nrcs.usda.gov/osd/dat/B/BOONTON.html>, 7/13/2005.

United States Geological Survey (USGS) "A Land Use and Land Cover Classification System for Use with Remote Sensor Data", Professional Paper 964, 1976.

U.S Army Corps of Engineers, November 2002, HEC-RAS River Analysis System: User's Manual. Available at http://www.hec.usace.army.mil/software/hecras/documents/userman/index.html. Last accessed October 2004. CPD-76.

U.S Army Corps of Engineers, November 2001, HEC-HMS User's Manual.

U.S Army Corps of Engineers, November 2002, HEC-RAS User's Manual.

U.S Army Corps of Engineers, November 2000, HEC-GeoRAS An extension for support of HEC-RAS using ArcView.

U.S. Department of the Interior, U.S. Geological Survey, New Jersey Water Science Center, Water Level Data UID 390119, http://nj.usgs.gov/gw/recent_watertable.html.

United States Environmental Protection Agency, 2000, Stressor Identification Guidance Document, EPA-822-B-00-025.

Woodward, D.A., Conaway, G., Plummer, a., Quan, Q.D., Van Mullen, J., Hawkins, R.H., Rietz, D., 2001, Curve Numbers, Recent Developments, USDA Agricultural Research Service.

Appendix A: N.J.A.C. 7:8-3, Stormwater Management Rules

ENVIRONMENTAL PROTECTION

(a)

LAND USE MANAGEMENT
WATERSHED MANAGEMENT

✱ Stormwater Management

Adopted Repeal and New Rules: N.J.A.C. 7:7E-8.7, 7:8 and 7:13-2.8
Adopted Amendments: N.J.A.C. 7:7A-4.3 and 5.11, 7:15-3.4 and 3.5 and 7:20-1.3

Proposed: January 6, 2003 at 35 N.J.R. 119(a) (see also 35 N.J.R. 1328(a) and 4220(a)).

Adopted: January 5, 2004 by Bradley M. Campbell, Commissioner, Department of Environmental Protection.

Filed: January 6, 2004 as R.2004 d.48, **with substantive and technical changes** not requiring additional public notice and comment (see N.J.A.C. 1:30-6.3).

Authority: N.J.S.A. 12:5-3, 13:1D-1 et seq., 13:9A-1 et seq., 13:19-1 et seq., 40:55D-93 to 99, 58:4-1 et seq., 58:10A-1 et seq., 58:11A-1 et seq. and 58:16A-50 et seq.

DEP Docket Number: 34-02-12/109.

Effective Date: February 2, 2004.

Expiration Dates: August 3, 2006, N.J.A.C. 7:7A;
January 7, 2008, N.J.A.C. 7:7E;
February 2, 2009, N.J.A.C. 7:8;
June 30, 2005, N.J.A.C. 7:13;
April 30, 2004, N.J.A.C. 7:15;
April 28, 2005, N.J.A.C. 7:20.

The Department of Environmental Protection (Department) is adopting new Stormwater Management rules proposed on January 6, 2003 at 35 N.J.R. 119(a). The Department is also amending the stormwater management provisions of the following rules in order to coordinate with and cross-reference the new Stormwater Management rules: the Freshwater Wetlands Protection Act Rules at N.J.A.C. 7:7A; the Coastal Zone Management Rules at N.J.A.C. 7:7E; the Flood Hazard Area Control Act rules at N.J.A.C. 7:13; the Water Quality Management Planning rules at N.J.A.C. 7:15; and the Dam Safety Standards at N.J.A.C. 7:20. Based on comments received on the January 6, 2003 proposal, the Department determined that the originally proposed definition of "major development" could have been misinterpreted to mean that projects possessing preliminary local approval before the new rules took effect would be considered exempt from all stormwater review, rather than exempt from the additional requirements imposed by the new rule. Implementation of the new rules under this exemption would not have provided the protection of waterbodies in the State from the impacts of stormwater runoff and nonpoint source pollution. Therefore, it was necessary to repropose the definition of "major development" and add a new applicability provision to ensure Department review of stormwater management has occurred in order for a project to be grandfathered. (See 35 N.J.R. 4220(a); September 15, 2003.) The Department is concurrently adopting the September 15, 2003 proposal of a new definition of "major development" and new applicability provision elsewhere in this issue of the New Jersey Register.

The Stormwater Management rules govern the development standards for State, municipal, and regional stormwater management requirements, plans and ordinances. In accordance with the Stormwater Management Act, N.J.S.A. 40:55D-93 to 99 and the Municipal Stormwater Regulation Program rules adopted elsewhere in this issue of the New Jersey Register, every municipality in the State is required to prepare a stormwater management plan and a stormwater management ordinance(s) to implement that plan.

The adopted Stormwater Management rules provide a framework and incentives for managing runoff and resolving nonpoint source impairment on a drainage area basis for new and existing development; establish a hierarchy for implementation of stormwater management measures with initial reliance on low impact site design techniques to maintain natural vegetation and drainage before incorporating structural best management practices; establish new runoff control performance standards for groundwater recharge, water quality and water quantity; establish special area protection measures for pristine and exceptional value waters; provide regulatory consistency among regulatory agencies at the local and State level; and provide safety standards for stormwater management basins.

As part of its comprehensive Stormwater Management Program, the Department is also adopting amendments to New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A. Those amendments include establishment and implementation of the Municipal Stormwater Regulation Program. Under that Program, potentially all of New Jersey's 566 municipalities, all 21 counties, the New Jersey Department of Transportation, State highway authorities, and many other State, interstate, and Federal agencies will be required to obtain a NJPDES permit for their stormwater discharges. See separate notice of adoption for N.J.A.C. 7:14A elsewhere in this issue of the New Jersey Register.

Summary of Hearing Officer's Recommendations and Agency Responses:

Public hearings on this proposal were held on the following dates and locations: February 13, 2003, Morris County Frelinghuysen Arboretum, Morristown; February 20, 2003, Collingswood Senior Community Center, Collingswood; and February 25, 2003, Department headquarters building, Trenton. Ms. Elizabeth Semple, Senior Policy Advisor, Division of Watershed Management, served as the hearing officer.

Ms. Semple recommended that the Department adopt the stormwater management rules proposed on January 6, 2003 and the stormwater management rule revisions proposed on September 15, 2003 with modifications described below in the Summary of Public Comments and Agency Responses.

The hearing records are available for inspection in accordance with applicable law by contacting:

New Jersey Department of Environmental Protection
Office of Legal Affairs
Attn. DEP Docket Number 34-02-12/109
PO Box 402
Trenton, New Jersey 08625-0402

Summary of Public Comments and Agency Responses:

The following people submitted written and/or oral comments on the proposed repeal and new Stormwater Management Rules, N.J.A.C. 7:8. The number in parentheses after each comment corresponds to the number identifying the respective commenters below.

1. A Illegible, Rob
2. Aasum, Mark
3. Accetta, Jacqueline
4. Addison, Doreen
5. Adler, John H., New Jersey Senate
6. Affrunti, Pat
7. Aheam, Matt
8. Ahles, Ray, New Jersey General Assembly
9. Ailey, Asher
10. Alama, Pauline
11. Alaya, Cristina
12. Aldom, Terence
13. Allen, Judith A., Delaware Township
14. Allen, Terri
15. Allessio, Renee
16. Altman, Tracye
17. Alvarado, Yeseni
18. Amendolic, Debra
19. Ammiano, Michael
20. Ammiano, Lisa
21. Amon, James C., D&R Canal Commission
22. Andersen, Thomas S., Du Pont
23. Anderson, Alma
24. Anderson, Dennis
25. Anderson, Jamie
26. Andrews, Robert
27. Andrews, Margaret
28. Anfuso, Timothy, Colts Neck Planning Board
29. Angarone, Nicholas
30. Arerhe , Jay
31. Argentina, Debra
32. Armstrong, Virginia M.
33. Arnold, Mary
33A. Arochas, Nora
34. Ashton, N.L.
35. Assante, Jamie M.
36. Astarta, M.
37. Auentyuon, Anne
38. Auentyuon, J.
39. Autran, Roland
40. B Illegible, Dave
41. B Illegible, R.
42. B Illegible, Sandra
43. Baier, Michael, Dept of Community Affairs
44. Bain, Elizabeth
45. Baker, Alfred (Mrs.)
46. Baker, David G., Borough of Lincoln Park
46A. Baker, David N., Village of Ridgewood
47. Baker, Marie
48. Bakun, George, Conocophillips Company Bayway Refinery
49. Baldwin, Donnamarie
50. Baldwin, Edward J.

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Responses by DEP to Public Comment

minimum rather than four to six feet width. To provide a choice will invariably result in the narrower width. (833)

RESPONSE TO COMMENTS 912 THROUGH 917: The safety criteria of N.J.A.C. 7:8-6.2(c)2 are based upon the report entitled "Recommendations for Public Safety Regulations," dated August 1994 from the Stormwater Detention Facility Advisory Council, and are consistent with the safety provisions in the RSIS at N.J.A.C. 5:21-7.5(f)6. The Department believes that it should discuss any substantial changes to these criteria with the Site Improvement Advisory Board before proposing such changes for public comment.

918. COMMENT: N.J.A.C. 7:8-6.1(c)2 is too restrictive. If the intent is to provide wet ponds with a wetlands function, a long gradually sloping shelf for the establishment of emergents is required. This shelf needs to be established from just above the water level at anywhere from a 1:10 to 1:20 slope to a depth of two to 2.5 feet. Establishment of a wetland shelf of emergents around the ponds edge also provides habitat for predators of mosquito larva and hinders the use of the pond by geese, a problem in New Jersey. The county would prefer the establishment of a performance standard dependent on the particular function of the pond. (1099)

RESPONSE: The intent of N.J.A.C. 7:8-6.1(c) is not to provide a wetlands function in a wet pond, but to address safety concerns.

919. COMMENT: The slope requirement in basins at N.J.A.C. 7:8-6.1(c)3 should be clarified. Does this section prohibit the use of properly designed and protected retaining walls in detention/retention basins? Walls should be allowed since they can provide attractive accents to basins as well as reducing the area of disturbance necessary for the construction of stormwater facilities. (596, 731, 1070, 1118)

RESPONSE: The slope requirement at N.J.A.C. 7:8-6.2(c)3 is for earthen dams, embankments, or berms, and does not prohibit the use of a non-earthen retaining wall as part of the stormwater basin.

920. COMMENT: The regulations should prohibit the construction of concrete low flow channels that tend to flush out the initial heavily polluted stormwater. Instead, the regulations should encourage the use of pervious low flow channels, such as paver blocks or gabion mattress low flow channels, which will allow for the planting of natural faltering vegetation instead of smooth concrete low flow channels. (21)

RESPONSE: The use of concrete low flow channels is not prohibited under the rules. The use of a concrete low flow channel is typically used in an extended dry detention basin, which must be utilized in a treatment train with other devices in order to meet the 80 percent TSS removal criteria. An extended detention basin typically removes pollutants due to settling by detaining flow over a period of time, which is controlled by the outlet structure. Other BMPs, such as a wet pond or a constructed wetlands, do not have concrete low flow channels. The use of vegetation or other types of low flow devices at the bottom of a stormwater BMP depends on the type of BMP proposed.

921. COMMENT: The commenter allows underground perforated pipe systems in a stone trench, wrapped with filter fabric. These systems have worked for many years in sandy soil areas. Are these systems permissible in your regulations? (875)

RESPONSE: Underground perforated pipes can be utilized to address the performance standards. Additionally, there is specific guidance in the BMP Manual for pretreatment of underground infiltration basins, including perforated pipes.

922. COMMENT: The Department should require the county to use perforated pipe, loose joints, and in general less concrete in new construction of roadside ditches. Water that gets into unperforated pipe with tight joints has no chance of recharging into the ground. The rules should consider further measures to assist with recharge. (3, 481)

RESPONSE: The use of perforated pipes is not specifically required through these regulations, but may be one of the ways in which the design and performance standards for stormwater runoff quantity, stormwater runoff quality, and groundwater recharge can be addressed, depending on site-specific conditions. N.J.A.C. 7:8-5.4(a)2i provides groundwater recharge performance standards for new major development, which requires groundwater recharge on a site to be maintained. The rules provide the flexibility to utilize many different measures to address groundwater recharge, such as nonstructural stormwater management strategies required at N.J.A.C. 7:8-5.2(a) and 5.3(a), surface infiltration basins, and subsurface infiltration facilities.

923. COMMENT: Can you improve upon an existing detention basin which, because of improper maintenance, may now be classified as wetlands? Is this a goal that will be permitted by the proposed stormwater management regulations, and how does this correlate to land use and regulations? (808, 842)

RESPONSE: The requirements regarding existing detention basins that have become wetlands are outside the scope of these rules. New stormwater management structures, such as basins or constructed wetlands, are required to be maintained regularly, including the keeping of maintenance logs.

924. COMMENT: The Department should prevent pollution from foreign chemicals such as fluoride, which increases osteoporosis and fractures in the elderly (as well as hypothyroidism in all ages) (605)

RESPONSE: The discharge of chemicals such a fluoride is regulated by another program and is outside of the scope of this rule.

925. COMMENT: Fertilizers, herbicides, pesticides should be banned for sale in New Jersey. (928)

RESPONSE: The banning of the sale of fertilizers, herbicides, and pesticides are outside the scope of this rule.

926. COMMENT: The county's practice of acquiring wider rights-of-way (ROWs) as a condition for allowing land sales or transfers, and requiring landowners to grade their ROW to the county's specifications, exacerbates a condition that the Department does little to correct: runoff and erosion from road ROWs, including severely eroded roadsides and accumulations of sediment in the roads. This problem would not be corrected under the new regulations, which allow the county to disturb up to one acre of soil without a permit. The Department should reduce the allowable soil disturbance without permit in county road department building projects to 5,000 square feet, which is the soil conservation district's threshold. (481)

RESPONSE: The one-acre threshold is consistent with the NJPDES stormwater permit requirements adopted elsewhere in this issue of the New Jersey Register. The Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., already provides a basis for comprehensive and coordinated Statewide control of sediment in stormwater during construction, including projects that are not subject to this chapter.

927. COMMENT: When will the Category One designation take effect on the Papakating River? Other commenters indicated that the Millstone River, Stony Brook, and Lake Carnegie are not currently designated nor proposed as Category One; however, the Millstone River and Stony Brook are publicly nominated for Category One designation. Please clarify that these areas continue to be designated as FW2. (414, 808, 842)

RESPONSE: The designation of specific waters within the State as Category One occurs through the adoption of Surface Water Quality Standards (N.J.A.C. 7:9B) and its associated processes, and are not designated through the stormwater rules.

928. COMMENT: Putting buffers around waterways and using MS4s around the State will not completely address the need to protect waterways and recharge aquifers. Clean-up of hazardous wastes is a must and "beneficial sludge" that is non-compliant must stop being land applied. Handing over the responsibility to municipalities or developers for protecting water quality is not the answer. (1200)

RESPONSE: The Department agrees with the commenter that the remediation of contaminated sites and proper handling of sludge are also critical components to protecting and restoring water quality. However, the beneficial use of sludge and site remediation practices are governed by other rules and are not included in this proposal. The Department is not handing the responsibility to maintain water quality to developers and municipalities as suggested by the commenter, but is prescribing new design and performance standards at the State and the local level to enhance water resource protection. The requirement to develop a municipal stormwater management plan and adopt a stormwater control ordinance under the NJPDES Phase II Municipal Stormwater Permitting Program is intended to promote consistency in stormwater management requirements across all levels of government.

Summary of Agency-Initiated Changes:

The Department has made the following agency-initiated modifications to the rules upon adoption:

1. At N.J.A.C. 7:8-1.2, the definition of the term "stormwater" was amended to add the words ", or conveyed by snow removal equipment" to be consistent with a change made in the definition of the same term in the NJPDES Stormwater Regulation Program rules adopted elsewhere in this issue of the New Jersey Register.

2. At N.J.A.C. 7:8-1.3, the words "Nonpoint Source Program" were replaced with the words "Division of" in the address to update the contact information for the rules.

3. At N.J.A.C. 7:8-5.5(c), Table 2, the words "Forested Buffer" and its TSS Percent Removal Rate of "70" is being removed. The percent TSS removal rate for the vegetated filter strip of "50 " is revised to "60-80," to

combine the forested buffer and the vegetated filter strip. The forested buffer is a vegetated filter comprised of forested area, and the combination into one best management practice clarifies this BMP.

4. In the last sentence of N.J.A.C. 7:8-5.6(a)2, the phrase "good condition" was changed to "good hydrologic condition" to provide consistency in terminology.

5. At N.J.A.C. 7:8-5.9(a)1iv, "Forested buffers" is being removed for consistency with the removal of the Forested Buffer BMP in Table 2 at N.J.A.C. 7:8-5.5(c). Subparagraphs (a)1v through xi are recodified as (a)1iv through x.

Federal Standards Statement

Executive Order No. 27(1994) and N.J.S.A. 52:14B-1 et seq. (as amended by P.L. 1995, c.65) require State agencies which adopt, readopt, or amend State regulations that exceed any Federal standards or requirements to include in the rulemaking document a Federal standards analysis. There are no current, analogous Federal requirements for stormwater management planning; however, there are several Federal programs concerning stormwater runoff and nonpoint source pollution control. These are discussed below.

Clean Water Act

The Federal Clean Water Act (33 U.S.C. §§1251 et seq.) requires permits under Section 402 of that Act (33 U.S.C. §1342) for certain stormwater discharges. The Department's requirements to obtain such permits are set forth in the New Jersey Pollutant Discharge Elimination System Rules, N.J.A.C. 7:14A, rather than in these Stormwater Management rules being adopted.

Section 319 of the Clean Water Act (33 U.S.C. §1329) authorizes a Federal grant-in-aid program to encourage states to control nonpoint sources. The Department developed a management program for nonpoint source control under which the Department issues grants to local, regional, State, and interstate agencies as well as to nonprofit organizations to, for example, develop or monitor best management practices to control stormwater.

Coastal Zone Management Act

Under Section 6217(g) of the Coastal Zone Management Act Reauthorization and Amendments of 1990 (CZARA), P.L. 101-508, the U.S. Environmental Protection Agency (EPA) has published "Guidance Specifying Management Measures For Sources of Nonpoint Pollution In Coastal Waters" (CZARA 6217(g) Guidance). States may opt to participate or not participate in overall coastal zone management program, with no penalty for non-participation other than the loss of Federal grants for this program. No mandatory Federal standards or requirements for nonpoint sources pollution control are imposed. The CZARA 6217(g) Guidance includes management measures for stormwater runoff and nonpoint source pollution control from land development as well as many other source types. The Department has developed a coastal zone management program, including a component addressing coastal nonpoint pollution control. The Stormwater Management rules at N.J.A.C. 7:8 are one means by which the Department implements its nonpoint pollution control program.

The Department has determined that the adopted rules do not contain any standards or requirements that exceed the standards or requirements imposed by Federal law. Accordingly, Executive Order No. 27(1994) and N.J.S.A. 52:14B-1 et seq. (P.L. 1995, c.65) do not require any further analysis.

Full text of the adopted new rules and amendments follows (additions to proposal indicated in boldface with asterisks ***thus***; deletions from proposal indicated in brackets with asterisks *[thus]*):

CHAPTER 7A
FRESHWATER WETLANDS PROTECTION ACT RULES

7:7A-4.3 Conditions that apply to all general permit authorizations

(a) (No change.)

(b) The following conditions apply to all activities conducted under the authority of a general permit:

1.-9. (No change.)

10. If activities under the general permit meet the definition of "major development" at N.J.A.C. 7:8-1.2, the Stormwater Management Rules at N.J.A.C. 7:8 apply.

11.-16. (No change.)

(c)-(f) (No change.)

7:7A-5.11 General permit 11—Outfalls and intake structures

(a)-(e) (No change.)

(f) Stormwater discharged from an outfall authorized under general permit 11 shall be managed in accordance with the Stormwater Management Rules at N.J.A.C. 7:8.

(g)-(j) (No change.)

CHAPTER 7E
COASTAL ZONE MANAGEMENT

SUBCHAPTER 8. RESOURCE RULES

7:7E-8.7 Stormwater management

If a project or activity meets the definition of "major development" at N.J.A.C. 7:8-1.2, then the project or activity shall comply with the Stormwater Management rules at N.J.A.C. 7:8.

CHAPTER 8
STORMWATER MANAGEMENT

SUBCHAPTER 1. GENERAL PROVISIONS

7:8-1.1 Scope and purpose

(a) This chapter establishes general requirements for stormwater management plans and stormwater control ordinances, as well as content requirements and procedures for the adoption and implementation of regional stormwater management plans and municipal stormwater management plans under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq.; the Water Quality Planning Act, N.J.S.A. 58:11A-1 et seq.; the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.; and the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.; and implementing rules.

(b) This chapter establishes design and performance standards for stormwater management measures required by rules pursuant to the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.; the Coastal Area Facility Review Act, N.J.S.A. 13:19-1 et seq.; the Wetlands Act of 1970, N.J.S.A. 13:9A-1 et seq.; the Waterfront Development Law, N.J.S.A. 12:5-3; the Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et seq.; and the Dam Safety Act, N.J.S.A. 58:4-1 et seq.

(c) This chapter establishes safety standards for stormwater management basins pursuant to N.J.S.A. 40:55D-95.1.

(**Agency Note:** N.J.A.C. 7:8-1.2 below includes the definition of "major development" as reproposed at 35 N.J.R. 4220(a) and adopted elsewhere in this issue of the New Jersey Register.)

7:8-1.2 Definitions

The following words and terms, when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise.

[“Agricultural development” means land uses normally associated with the production of food, fiber and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacture of agriculturally related products.]

“CAFRA Planning Map” means the geographic depiction of the boundaries for Coastal Planning Areas, CAFRA Centers, CAFRA Cores and CAFRA Nodes pursuant to N.J.A.C. 7:7E-5B.3.

“CAFRA Centers, Cores or Nodes” means those areas within boundaries accepted by the Department pursuant to N.J.A.C. 7:8E-5B.

“Compaction” means the increase in soil bulk density.

“Core” means a pedestrian-oriented area of commercial and civic uses serving the surrounding municipality, generally including housing and access to public transportation.

“County review agency” means an agency designated by the County Board of Chosen Freeholders to review municipal stormwater management plans and implementing ordinance(s). The county review agency may either be:

1. A county planning agency; or

2. A county water resources association created under N.J.S.A. 58:16A-55.5, if the ordinance or resolution delegates authority to approve, conditionally approve, or disapprove municipal stormwater management plans and implementing ordinances.

“Department” means the Department of Environmental Protection.

"Designated Center" means a State Development and Redevelopment Plan Center as designated by the State Planning Commission such as urban, regional, town, village, or hamlet.

"Design engineer" means a person professionally qualified and duly licensed in New Jersey to perform engineering services that may include, but not necessarily be limited to, development of project requirements, creation and development of project design and preparation of drawings and specifications.

"Development" means the division of a parcel of land into two or more parcels, the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any building or structure, any mining excavation or landfill, and any use or change in the use of any building or other structure, or land or extension of use of land, for which permission is required under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq.

In the case of development on agricultural land, development means: any activity that requires a State permit; any activity reviewed by the County Agricultural Boards (CAB) and the State Agricultural Development Committee (SADC), and municipal review of any activity not exempted by the Right to Farm Act, N.J.S.A. 4:1C-1 et seq.

"Drainage area" means a geographic area within which *[water]* *stormwater runoff*, sediments, *[and]* *or* dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

"Environmentally constrained area" means the following areas where the physical alteration of the land is in some way restricted, either through regulation, easement, deed restriction or ownership such as: wetlands, floodplains, threatened and endangered species sites or designated habitats, and parks and preserves. ***Habitats of endangered or threatened species are identified using the Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program.***

"Environmentally critical area" means an area or feature which is of significant environmental value, including, but not limited to: stream corridors; natural heritage priority sites; habitats of endangered or threatened species; large areas of contiguous open space or upland forest; steep slopes; and well head protection and groundwater recharge areas. ***Habitats of endangered or threatened species are identified using the Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program.***

"Empowerment Neighborhoods" means neighborhoods designated by the Urban Coordinating Council "in consultation and conjunction with" the New Jersey Redevelopment Authority pursuant to N.J.S.A. 55:19-69.

"Erosion" means the detachment and movement of soil or rock fragments by water, wind, ice or gravity.

"Impervious surface" means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water.

"Infiltration" is the process by which water *[that]* seeps into the soil from precipitation.

"Lead planning agency" means one or more public entities having stormwater management planning authority designated by the regional stormwater management planning committee pursuant to N.J.A.C. 7:8-3.2*, **that serves*** as the primary representative of the committee.

"Major development" means any "development" that provides for ultimately disturbing one or more acres of land or increasing impervious surface by one-quarter acre or more. 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."

"Municipality" means any city, borough, town, township, or village.

"Node" means an area designated by the State Planning Commission concentrating facilities and activities which are not organized in a compact form.

"Nutrient" means a chemical element or compound, such as nitrogen or phosphorus, which is essential to and promotes the development of organisms.

"Person" means any individual, corporation, company, partnership, firm, association, political subdivision of this State and any state, interstate or Federal agency.

"Pollutant" means any dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, refuse, oil, grease, sewage sludge, munitions, chemical wastes, biological materials, medical wastes, radioactive substance (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. §§2011 et seq.)), thermal waste, wrecked or discarded equipment, rock, sand, cellar dirt, industrial, municipal, agricultural, and construction waste or runoff or other residue discharged directly or indirectly to the land, groundwaters or surface waters of the State, or to a domestic treatment works. "Pollutant" includes both hazardous and nonhazardous pollutants.

"Recharge" means the amount of water from precipitation that infiltrates into the ground and is not evapotranspired.

"Sediment" means solid material, mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

"Site" means the lot or lots upon which a major development is to occur or has occurred.

"Soil" means all unconsolidated mineral and organic material of any origin.

"State Development and Redevelopment Plan Metropolitan Planning Area (PA1)" means an area delineated on the State Plan Policy Map and adopted by the State Planning Commission that is intended to be the focus for much of the State's future redevelopment and revitalization efforts.

"State Plan Policy Map" is defined as the geographic application of the State Development and Redevelopment Plan's goals and Statewide policies, and the official map of these goals and policies.

"Stormwater" means water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, or is captured by separate storm sewers or other sewage or drainage facilities***, or conveyed by snow removal equipment***.

"Stormwater runoff" means water flow on the surface of the ground or in storm sewers, resulting from precipitation.

"Stormwater management basin" means an excavation or embankment and related areas designed to retain stormwater runoff. A stormwater management basin may either be normally dry (that is, a detention basin or infiltration basin), retain water in a permanent pool (a retention basin), or be planted mainly with wetland vegetation (most constructed stormwater wetlands).

"Stormwater management measure" means any structural or nonstructural strategy, practice, technology, process, program, or other method intended to control or reduce stormwater runoff and associated pollutants, or to induce or control the infiltration or groundwater recharge of stormwater or to eliminate illicit or illegal nonstormwater discharges into stormwater conveyances.

"Stormwater management planning agency" means a public body authorized by legislation to prepare stormwater management plans.

"Stormwater management planning area" means the geographic area for which a stormwater management planning agency is authorized to prepare stormwater management plans, or a specific portion of that area identified in a stormwater management plan prepared by that agency.

"Tidal Flood Hazard Area" means a flood hazard area, which may be influenced by stormwater runoff from inland areas, but which is primarily caused by the Atlantic Ocean.

"Urban Coordinating Council Empowerment Neighborhood" means a neighborhood given priority access to State resources through the New Jersey Redevelopment Authority.

"Urban Enterprise Zones" means a zone designated by the New Jersey Urban Enterprise Zone Authority pursuant to the New Jersey Urban Enterprise Zones Act, N.J.S.A. 52:27H-60 et seq.

"Urban Redevelopment Area" is defined as previously developed portions of areas:

1. Delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA1), Designated Centers, Cores or Nodes;
2. Designated as CAFRA Centers, Cores or Nodes;
3. Designated as Urban Enterprise Zones; and

4. Designated as Urban Coordinating Council Empowerment Neighborhoods.

"Waters of the State" means the ocean and its estuaries, all springs, streams, wetlands, and bodies of surface or groundwater, whether natural or artificial, within the boundaries of the State of New Jersey or subject to its jurisdiction.

"Wetlands" or "wetland" means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

7:8-1.3 Program information

Questions or submissions regarding this chapter should be directed to the *[Nonpoint Source Program,]* ***Division of*** Watershed Management, New Jersey Department of Environmental Protection, PO Box 418, Trenton, New Jersey 08625.

7:8-1.4 Severability

If the provisions of any section, subsection, paragraph, or clause of this chapter shall be judged invalid by a court of competent jurisdiction, such order or judgment shall not affect or invalidate the remainder of any section, subsection, paragraph, or clause of this chapter.

7:8-1.5 Relationship to other regulatory programs

(a) Nothing in this chapter shall be construed as preventing the Department or other agencies or entities from imposing additional or more stringent stormwater management requirements necessary to implement the purposes of any enabling legislation including those measures necessary to achieve the Surface Water Quality Standards at N.J.A.C. 7:9B.

(b) If a stormwater management measure is used as a soil erosion or sediment control measure, the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., shall also apply.

(c) These stormwater requirements are the Department's standards referenced by the stormwater management provisions of the Residential Site Improvement Standards at N.J.A.C. 5:21-7.

(**Agency Note:** The following section, N.J.A.C. 7:8-1.6, Applicability to major development, reflects the adoption of this section, proposed at 35 N.J.R. 4220(a), published elsewhere in this issue of the New Jersey Register.)

7:8-1.6 Applicability to major development

(a) Except as provided in (b) below, all major development shall comply with the requirements of this chapter.

(b) The following major development shall be subject to the stormwater management requirements in effect on February 1, 2004, copies of which are available from the Department at the address specified in N.J.A.C. 7:8-1.3:

1. Major development which does not require any of the Department permits listed in (c) below and which has received one of the following approvals pursuant to the Municipal Land Use Law (N.J.S.A. 40:55D-1 et seq.) prior to February 2, 2004:

i. Preliminary or final site plan approval;

ii. Final municipal building or construction permit;

iii. Minor subdivision approval where no subsequent site plan approval is required;

iv. Final subdivision approval where no subsequent site plan approval is required; or

v. Preliminary subdivision approval where no subsequent site plan approval is required;

2. Major development which has received one of the approvals pursuant to the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., in (b)1 above prior to February 2, 2004 and has secured at least one of the applicable permits listed in (c) below from the Department by February 2, 2004, and provided that the permit included a stormwater management review component; and

3. Major development undertaken by any government agency, which does not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., provided that the project has secured at least one of the applicable Department permits listed in (c) below prior to February 2, 2004, and provided that the permit included a stormwater management review component.

(c) For the purposes of this section, the term "permit" shall include transition area waivers under the Freshwater Wetlands Protection Act. In order to qualify under (b)2 or 3 above, the major development must have obtained at least one Department permit granted under the following statutes and, provided that the permit included a stormwater management review component, prior to February 2, 2004:

1. Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.;
2. Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et seq.;
3. Coastal Area Facility Review Act, N.J.S.A. 13:19-1 et seq.; or
4. Waterfront and Harbor Facilities Act, N.J.S.A. 12:5-3;

(d) An exemption provided by (b) above shall expire with the expiration, termination or other loss of duration or effect of either of the qualifying local approval or Department permit, whichever comes first. The expiration of local approvals under (b)1 above shall be governed by local ordinance. In the event there are multiple qualifying Department permits under (c) above, the expiration date is governed by that permit which expires last provided that the permit is still in effect. Once the exemption expires, the major development shall be subject to all requirements of this chapter upon reapplication for that permit and all subsequent permits or local approval(s) under the Municipal Land Use Law.

(e) An exemption under (b) above is limited to the land area and the scope of the project addressed by the qualifying approval(s) and permit(s). Exemptions under this section shall be deemed void if revisions are made to the qualifying approval or permit in (b) above, including approvals under the Municipal Land Use Law, unless upon application, the Department determines that each revision would have a de minimis impact on water resources. In making this determination, the Department shall consider the extent of any impacts on water resources resulting from the revision, including, but not limited to:

1. Increases in stormwater generated;
2. Increases in impervious surface;
3. Increases in stormwater pollutant loading;
4. Changes in land use;
5. New encroachments in special water resource protection areas; and
6. Changes in vegetative cover.

(f) In case of conflict with the Coastal Permit Program rules at N.J.A.C. 7:7-4.4(a)4, the requirements of this chapter shall supersede.

SUBCHAPTER 2. GENERAL REQUIREMENTS FOR STORMWATER MANAGEMENT PLANNING

7:8-2.1 Scope

This subchapter provides general principles applicable to all stormwater management plans and stormwater control ordinances, including the goals of stormwater management planning, the process for identification of stormwater management planning agencies, and stormwater management plan requirements.

7:8-2.2 Goals of stormwater management planning

(a) All stormwater management plans and stormwater control ordinances shall be designed to:

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. Assure 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 nonpoint pollution;
7. Maintain the integrity of stream channels for their biological functions, as well as for drainage;
8. Minimize pollutants in stormwater runoff from new and existing development in order 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

9. Protect public safety through the proper design and operation of stormwater management basins.

7:8-2.3 Stormwater management planning agencies

(a) The following entities may be stormwater management planning agencies provided they are authorized under their enabling legislation to prepare stormwater management plans:

1. A municipality;
2. A county;
3. A county water resources agency or association;
4. A designated planning agency under N.J.A.C. 7:15;
5. A Soil Conservation District*, **in coordination with the State Soil Conservation Committee***;
6. The Delaware River Basin Commission;
7. The Pinelands Commission;
8. The Delaware and Raritan Canal Commission;
9. The New Jersey Meadowlands Commission;
10. The Department; or
11. Other regional, State or interstate agencies.

7:8-2.4 Stormwater management plan requirements

(a) A stormwater management plan shall include structural and nonstructural stormwater management strategies necessary to meet the stormwater management goals of this chapter.

(b) A regional stormwater management plan shall comply with the requirements of this subchapter and N.J.A.C. 7:8-3.

(c) A municipal stormwater management plan shall comply with the requirements of this subchapter and N.J.A.C. 7:8-4.

(d) A stormwater management plan shall incorporate the safety standards for stormwater management basins at N.J.A.C. 7:8-6.

(e) In developing a stormwater management plan and identifying appropriate stormwater management measures thereunder, each stormwater management planning agency shall consider the physical characteristics and ecological resources of the stormwater management planning area.

(f) A stormwater management plan and any stormwater management ordinance shall be coordinated with any other stormwater management plans related to the same river basin or drainage area.

7:8-2.5 Exemptions

A municipality or other entity conducting stormwater management planning under this chapter may petition the Department at the address provided at N.J.A.C. 7:8-1.3 for an exemption to the requirements of this chapter by submitting documentation to demonstrate that, if granted, the exemption will not result in an increase in flood damage, water pollution*, **including threats to the biological integrity,*** or constitute a threat to the public safety.

SUBCHAPTER 3. REGIONAL STORMWATER MANAGEMENT PLANNING

7:8-3.1 Scope

(a) This subchapter describes stormwater management planning and implementation at the regional level, including plan elements; planning process; characterization; development of drainage area-specific objectives and standards; selection of stormwater management measures; strategy for implementing the measures and evaluating the effectiveness of the regional stormwater management plan; plan review, adoption, amendment or revision; and implementation and periodic evaluation of the plan.

(b) A regional stormwater management plan shall address stormwater-related water quality, groundwater recharge and/or water quantity impacts of new and existing land uses in a regional stormwater management planning area. A regional stormwater management planning area shall consist of one or more ***continuous*** drainage areas. For example, a drainage area could be *[a]* ***an area defined by*** a hydrologic unit code 14 (HUC14) as defined by the United States Geological Survey.

7:8-3.2 Regional stormwater management planning committee and lead planning agency

(a) A regional stormwater management planning committee (the committee) shall be established for the purposes of creating a regional stormwater management plan.

(b) A person or entity seeking to establish a regional stormwater management committee shall solicit participation from municipalities, interstate agencies, regional agencies, counties, designated planning agencies under N.J.A.C. 7:15, Soil Conservation Districts, regional environmental commissions, ***Pinelands Commission, mosquito control and extermination commissions,*** public water supply and wastewater treatment utilities and agencies, lake associations, watershed associations, the watershed management planning area public advisory committee, environmental organizations, businesses, the Department and other appropriate State and Federal agencies and, members of the general public in the drainage area(s) to be addressed by the proposed plan. *The **solicitation for members of the general public to be part of the regional stormwater management planning committee can be performed through notices in local paper.***

(c) The regional stormwater management planning committee shall designate a lead planning agency, which shall be recognized as the primary contact for the committee. The regional stormwater management planning committee, through the lead planning agency, shall:

1. Prepare the regional stormwater management plan;
2. Coordinate the regional stormwater management planning process with any applicable watershed management area planning process;
3. Provide opportunities for public participation throughout the regional stormwater management planning process; and
4. Perform other activities appropriate to facilitate the regional stormwater management planning process, including mediation, public information, *[and]* providing technical assistance*,* and ***seeking and providing*** grants or other financial assistance*, **as available,*** to municipalities and/or local or regional agencies pursuant to N.J.S.A. 40:55D-99 or other applicable authority.

(d) A request for recognition as a regional stormwater management planning committee shall be submitted to the Department at the address listed in N.J.A.C. 7:8-1.3 by the lead planning agency, and include the following information:

1. A draft work plan and schedule for completing a regional stormwater management plan;
2. A copy of the mailing list used to solicit participation, including the entities identified in (b) above;
3. A copy of the letter of invitation to participate in the committee;
4. A copy of each response to the letter of invitation; and
5. In cases where no response from a public entity to the letter of invitation is received within 60 days, the group shall send a follow-up request by certified mail, return receipt requested, and submit proof of such follow-up.

(e) The Department shall respond in writing within 45 days of the receipt of a complete request for recognition as a regional stormwater management planning committee. The Department shall either approve the application, request additional information or deny the request for recognition. Denials will include a justification for the decision.

The Department shall base approval or denial on the information submitted in the draft work plan and schedule for plan completion, completion of the requirements to involve and notify impacted parties, and whether there are other competing or overlapping requests for recognition for the same regional stormwater management planning area.

7:8-3.3 Regional stormwater management plan and elements

(a) A regional stormwater management plan shall incorporate, at a minimum, the following elements:

1. Identification of the lead planning agency and a description of the structure and members of the committee;
2. A statement of authority to develop and implement a stormwater management plan from *[each]* public *[entity that is]* ***entities, as appropriate,*** represented on the regional stormwater management planning committee;
3. A characterization and assessment of the regional stormwater management planning area prepared in accordance with N.J.A.C. 7:8-3.4;

4. A statement of drainage area-specific water quality, groundwater recharge, and water quantity objectives established under N.J.A.C. 7:8-3.5;

5. The drainage area-specific stormwater-related water quality, groundwater recharge and water quantity design and performance standards established under N.J.A.C. 7:8-3.6;

6. The stormwater management measures selected in accordance with N.J.A.C. 7:8-3.7 and a summary of the rationale for the selection of each measure;

7. A description of the strategy for implementing the selected stormwater management measures for the regional stormwater management planning area and for evaluating the effectiveness of the regional stormwater management plan in accordance with N.J.A.C. 7:8-3.8, including a long-term monitoring program; and

8. To the extent elements of the plan do not represent the consensus of the committee, the plan shall identify and provide a discussion of the majority and minority positions.

(b) The regional stormwater management plan may also include:

1. Innovative stormwater measures and strategies such as nonpoint source pollutant trading, mitigation strategies, or special protection measures; and

2. A stream corridor protection plan to address protection of areas adjacent to waterbodies. For waterbodies subject to N.J.A.C. 7:8-5.5(h), the plan shall provide, at a minimum, protections equivalent to those provided at N.J.A.C. 7:8-5.5(h) and demonstrate that the functional value and overall condition of the special water resource protection area will be maintained or enhanced.

7:8-3.4 Characterization and assessment of the regional stormwater management planning area

(a) The regional stormwater management plan shall include a characterization and assessment that addresses the following components, unless the committee determines that a component is not appropriate for the regional stormwater management planning area and provides a rationale for not including the component:

1. Maps showing the following information. Maps developed on a Geographical Information System shall meet the Digital Data standards in N.J.A.C. 7:1D unless a rationale for a different format is provided.

i. The regional stormwater management planning area boundary;

ii. Existing land uses;

iii. Projected land uses assuming full development under existing zoning;

iv. Soil mapping units based on the detailed soil maps in County Soil Surveys published by the U.S. Department of Agriculture or, in areas for which County Soil Surveys are not available, on information obtained from Soil Conservation Districts;

v. Topography based on the U.S. Geological Survey Topographic Map, 7.5 minute quadrangle series, or other sources of information depicting topography in similar or greater detail;

vi. Water bodies based on detailed map sheets in County Soil Surveys published by the U.S. Department of Agriculture; the U.S. Geological Survey Topographic Map, 7.5 minute quadrangle series; or other sources of information depicting water bodies in similar or greater detail;

vii. Coastal wetlands based on maps prepared by the Department under the Wetlands Act of 1970, N.J.S.A. 13:9A-1 et seq., and freshwater wetlands based on maps prepared by the Department under the Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et seq.;

viii. Flood hazard areas based on delineations made by the Department under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq. For a water body for which the Department has not delineated the flood hazard area, a map of the flood hazard area prepared in accordance with N.J.A.C. 7:13 is acceptable;

ix. Groundwater recharge areas and well head protection areas based on maps prepared by the Department *[under N.J.S.A. 58:11A-13]* or ordinances of an affected municipality;

x. Environmentally constrained areas and environmentally critical areas;

xi. River areas designated under the New Jersey Wild and Scenic Rivers Act, N.J.S.A. 13:8-45 et seq., or the Federal Wild and Scenic Rivers Act, 16 U.S.C. §§1278 et seq.;

xii. For each waterbody in the regional stormwater management planning area, identification of the waterbody or waterbody segment, the drainage area, and the classification of the waterbody pursuant to N.J.A.C. 7:9B-1.15;

xiii. Each waterbody designated as a water quality limited surface water pursuant to N.J.A.C. 7:15-6;

xiv. Man-made stormwater conveyance, storage and discharge systems, including municipal separate storm sewer outfall pipes and the drainage areas as appropriate for these outfall structures; and

xv. *[Potable]* ***Source water areas of potable public*** surface water ***supply*** intakes and public water supply reservoirs ***available on the Department's webpage at www.nj.gov/dep/swap***;

2. A map showing jurisdictional boundaries within the regional stormwater management planning area of municipal, county, and other agencies with responsibility for implementing stormwater management;

3. Identification of the physical characteristics of the regional stormwater management planning area pertinent to stormwater management, such as slopes, swales and impoundment areas as necessary for completing the analysis in N.J.A.C. 7:8-3.4(a)4;

4. A water quality, groundwater recharge and water quantity hydrologic and hydraulic model or analysis of the regional stormwater management planning area which addresses existing land uses and projected land uses assuming full development under existing zoning and taking into account permanently preserved lands;

5. An identification and evaluation of existing municipal, county, State, Federal, and other stormwater-related groundwater recharge, water quality and water quantity regulations and programs shall be conducted, including, where applicable, programs to develop total maximum daily loads (TMDLs) in accordance with N.J.A.C. 7:15-7; and

6. A summary of information that has been identified as useful for purposes of stormwater management planning but that is not available for technical, financial, or other reasons.

(b) The Department encourages the use of existing information to the extent that it is available to minimize the cost of data acquisition, such as information available on the Department's Geographical Information System website (www.state.nj.us/dep/gis) or as developed through a watershed planning process.

(c) The characterization and assessment shall include information on locations and activities outside the regional stormwater management planning area that drain into the planning area (for example, stormwater originating in an adjacent drainage area that is transferred to the stormwater management planning area).

(d) Using the modeling or other information obtained under (a) through (c) above, the stormwater-related water quality impacts of existing land uses and projected land uses assuming full development under existing zoning shall be identified and ranked in accordance with the following process:

1. Inventory existing and potential stormwater-related pollutant sources and stormwater-related pollutants in the regional stormwater management planning area.

i. Stormwater-related pollutant sources include, for example, urban and suburban development, roads, storm sewers, agriculture, mining, and waterfront development.

ii. Stormwater-related pollutants include, for example, nutrients, pathogens, hydrocarbons, metals, pesticides, sediments, and suspended solids;

2. For surface water bodies and/or segments thereof and aquifers and/or portions thereof in the regional stormwater management planning area, identify and describe the existing or designated uses that are or may be adversely affected by stormwater-related pollutants, and to the extent feasible, identify the source(s) of the pollutant. The use of the report and list prepared by the Department to comply with Federal Clean Water Act, Section 303(d) and 305(b) (33 U.S.C. §§1313(d) and 1315(b)) and underlying data, including biological assessments, is encouraged; and

3. Identify and rank the most significant existing and potential stormwater-related pollutants and, for each pollutant, identify and rank the sources.

(e) Using the modeling or other information obtained under (a) through (c) above for stormwater-related water quantity impacts and stormwater-related groundwater recharge impacts of existing and

projected land uses assuming full development under existing zoning, the most significant existing and potential stormwater-related water quantity problems, including flooding, erosion, mosquitoes, base-flow reduction, groundwater depletion, and associated ecosystem impacts, shall be identified and described. The problems shall be ranked based on consideration of threat to public health, safety, and welfare as evidenced by history of or potential for flood damage; risk of loss of or damage to water supplies; and risk of damage to the biological integrity of water bodies.

7:8-3.5 Drainage area-specific water quality, groundwater recharge and water quantity objectives

(a) The regional stormwater management plan shall identify drainage area-specific water quality, groundwater recharge and water quantity objectives that are consistent with the goals of stormwater management planning at N.J.A.C. 7:8-2.3, and address each of the stormwater-related pollutant sources and pollutants ranked under N.J.A.C. 7:8-3.4(d) and the water quantity and groundwater recharge problems ranked under N.J.A.C. 7:8-3.4(e). The objectives shall address the elimination, reduction, or minimization of stormwater-related impacts associated with new and existing land uses. The objectives developed for the regional stormwater management plan may take into consideration environmental, social, and economic factors.

(b) Notwithstanding (a) above, the drainage area-specific objectives for major development shall provide, at a minimum, the protection that would be achieved through the application of N.J.A.C. 7:8-5, Design and Performance Standards for Stormwater Management Measures.

(c) If a TMDL has been established pursuant to N.J.A.C. 7:15 for a waterbody or waterbody segment in the regional stormwater management planning area, drainage area-specific objectives shall incorporate the loading reductions established in the TMDL for stormwater sources of pollution. In addition, if a waterbody or waterbody segment in the regional stormwater management planning area is on the Department's list prepared to comply with Federal Clean Water Act, Section 303(d) (33 U.S.C. §1313(d)) for one or more designated uses by stormwater runoff, then drainage area objectives shall be included that address the pollutants or pollution for which the waterbody is threatened or impaired.

7:8-3.6 Drainage area-specific design and performance standards

(a) The regional stormwater management plan shall identify drainage area-specific design and performance standards in order to meet the drainage area-specific water quality, groundwater recharge and water quantity objectives identified under N.J.A.C. 7:8-3.5.

(b) Drainage area-specific design and performance standards may include performance standards for control of stormwater quantity, erosion, groundwater recharge and stormwater quality, as well as design standards for particular structural and nonstructural stormwater management strategies.

(c) The design and performance standards for stormwater management measures for major development described in N.J.A.C. 7:8-5 shall be incorporated into the regional stormwater management plan. Alternative drainage area-specific design and performance standards may be developed provided the alternative standard is at least as protective as would be achieved under N.J.A.C. 7:8-5 when considered on a regional stormwater management planning area basis.

(d) For structural stormwater management measures, drainage area-specific design and performance standards shall conform to the general standards at N.J.A.C. 7:8-5.7.

(e) Drainage area-specific design and performance standards do not have to be uniform throughout a drainage area provided the drainage area, when considered in its entirety, satisfies N.J.A.C. 7:8-5.

7:8-3.7 Selection of stormwater management measures

(a) The regional stormwater management plan shall identify stormwater management measures necessary to achieve the drainage area-specific water quality, groundwater recharge and water quantity objectives developed in accordance with N.J.A.C. 7:8-3.5, and design and performance standards developed in accordance with N.J.A.C. 7:8-3.6.

(b) Stormwater management measures in the following categories shall be considered and selected, as appropriate:

1. Stormwater management measures for new land uses;

2. Stormwater management measures for existing land uses, including, for example, retrofit measures for the modification of existing structural stormwater management measures or other structures affecting stormwater runoff; elimination of illicit or illegal discharges; prevention or minimization of the exposure of pollutants to stormwater; and control of floatables;

3. Stormwater management measures that enhance, protect, and/or preserve land or water areas possessing characteristics or features that provide for flood control, maintenance or improvement of water quality, or conservation of natural resources (for example, land use controls, local and regional open space plans and taxes, buffer zones, redirecting, recharging or minimizing stormwater discharges, pretreatment and/or end-of-pipe treatment); and

4. Public education programs that address stormwater quantity and quality.

(c) A written rationale shall be provided for each selected stormwater management measure, including an analysis of feasibility, benefits and costs, estimated percent pollutant load reduction and anticipated performance longevity;

(d) Each selected stormwater management measure shall include, as appropriate, a program for preventative and corrective maintenance, including a long-term implementation schedule and identification of the entity responsible for implementation and maintenance.

7:8-3.8 Strategy for implementing and evaluating effectiveness of stormwater management measures

(a) The regional stormwater management plan shall include a strategy for implementing the stormwater management measures. The lead planning agency or another entity designated by the committee shall be responsible for coordination and tracking of the implementation of the regional stormwater management plan, including the long-term monitoring program.

(b) The implementation strategy shall:

1. Identify agencies and/or entities necessary to implement the measures and conduct the long-term monitoring program;

2. Identify the respective measures and/or monitoring each agency and/or entity will implement and the enabling mechanisms by which the measures will be implemented, including, for example, new or amended municipal ordinances or interagency agreements;

3. Establish a schedule for the implementation of the measures based on priority, including specific milestones for all mechanisms identified under (b)2 above;

4. Provide an estimate of short term and long term implementation costs to be incurred; and

5. Identify existing and potential private, local, State, and Federal funding sources to implement the regional stormwater management plan.

(c) The implementation strategy shall include a long-term monitoring program that will provide information about land use, water quality, water quantity, groundwater resources and riparian and aquatic habitat condition, as appropriate. Information for the monitoring program may include data obtained through watershed management, local, county, State, interstate, and/or Federal monitoring programs, including volunteer monitoring programs.

(d) The implementation strategy shall include a procedure for evaluating and then updating as necessary, at least every five years, the effectiveness of the implemented measures in achieving the objectives and design and performance standards established in the regional stormwater management plan.

7:8-3.9 Regional stormwater management plan review, adoption, and amendment and/or revision

(a) Upon completion of a regional stormwater management plan, the lead planning agency shall submit the plan to the Department and, if applicable, to the designated water quality management planning agency as an amendment to the areawide water quality management plan(s) in accordance with the Water Quality Management Planning Rules at N.J.A.C. 7:15.

(b) In reviewing a regional stormwater management plan submitted under (a) above, the Department shall determine whether the plan conforms to the requirements of this chapter. The Department will

disapprove, return for additional information or proceed with a proposed amendment in accordance with N.J.A.C. 7:15-3.4(g).

(c) Modifications to an adopted regional stormwater management plan shall be processed as an amendment or revision in accordance with N.J.A.C. 7:15-3.4(b)5 or 3.5(b)5, as applicable.

7:8-3.10 Implementation of adopted regional stormwater management plan

(a) Once the regional stormwater management plan has been adopted pursuant to N.J.A.C. 7:8-3.9, implementation responsibilities are as follows:

1. The Department will use the adopted regional stormwater management plan as the basis for reviewing the stormwater management aspects of projects or activities regulated pursuant to Coastal Permit Program rules, N.J.A.C. 7:7; the Freshwater Wetland Protection Act rules, N.J.A.C. 7:7A; the Coastal Zone Management rules, N.J.A.C. 7:7E; the Flood Hazard Area Control Act rules, N.J.A.C. 7:13; the New Jersey Pollutant Discharge Elimination System rules, N.J.A.C. 7:14A; and the Dam Safety Standards, N.J.A.C. 7:20. The requirements of this chapter are considered to be the minimum stormwater standards. Additional requirements may be imposed as necessary under the respective programs.

2. Each municipality in the regional stormwater management planning area shall incorporate the applicable provisions of the regional stormwater management plan into a new or amended municipal stormwater management plan and ordinances.

3. In accordance with the Residential Site Improvement Standards at N.J.A.C. 5:21-7, if a stormwater management plan for the region has been approved by the Department, stormwater management systems must conform with that plan.

4. The Department shall not issue a permit for a project or activity that conflicts with an Areawide Water Quality Management Plan pursuant to N.J.A.C. 7:15-3.1.

SUBCHAPTER 4. MUNICIPAL STORMWATER MANAGEMENT PLANNING

7:8-4.1 Scope

This subchapter describes stormwater management planning and implementation at the municipal level, including plan elements, county review and technical assistance, the schedule for adoption of the plan and ordinances, and variance or exemption from design and performance standards for stormwater management measures.

7:8-4.2 Municipal stormwater management plan and elements

(a) A municipal stormwater management plan shall address stormwater-related water quality, groundwater recharge and water quantity impacts of major development, and may also address stormwater-related water quality, water quantity and groundwater recharge impacts of existing land uses. For purposes of this subchapter, major development is limited to projects that ultimately disturb one or more acres of land.

(b) A municipal stormwater management plan and stormwater control ordinance(s) shall conform with applicable regional stormwater management plan(s).

(c) A municipal stormwater management plan shall, at a minimum:

1. Describe how the municipal stormwater management plan will achieve the goals of stormwater management planning set forth at N.J.A.C. 7:8-2.3;

2. Include maps showing water bodies based on Soil Surveys published by the U.S. Department of Agriculture; the U.S. Geological Survey Topographic Map, 7.5 minute quadrangle series; or other sources of information depicting water bodies in similar or greater detail;

3. Map groundwater recharge areas and well head protection areas based on maps prepared by the Department under N.J.S.A. 58:11A-13 or a municipal ordinance;

4. Describe how the municipal stormwater management plan incorporates design and performance standards in N.J.A.C. 7:8-5 or alternative design and performance standards adopted as a part of a regional stormwater management plan or water quality management plan;

5. Describe how adequate long-term operation as well as preventative and corrective maintenance (including replacement) of the selected stormwater management measures will be ensured;

6. Describe how the plan will ensure compliance with Safety Standards for Stormwater Management Basins at N.J.A.C. 7:8-6;

7. Describe how the municipal stormwater management plan is coordinated with the appropriate Soil Conservation District and any other stormwater management plans, including any adopted regional stormwater management plan, prepared by any stormwater management planning agency related to the river basins or drainage areas to which the plans and/or ordinances apply;

8. Evaluate the extent to which the municipality's entire master plan (including the land use plan element), official map and development regulations (including the zoning ordinance) implement the *[principals]* ***principles*** expressed in N.J.A.C. 7:8-5.3(b). This evaluation shall also be included (with updating as appropriate) in the reexamination report adopted under N.J.S.A. 40:55D-89;

9. Include a map of the municipality showing:

i. Projected land uses assuming full development under existing zoning; and

ii. The hydrologic unit code 14 (HUC 14) drainage areas as defined by the United States Geological Survey; and an estimate, for each HUC 14 drainage area, of the total acreage in the municipality of impervious surface and associated future nonpoint source pollutant load assuming full build out of the projected land uses.

10. At the option of the municipality, document that it has a combined total of less than one square mile of vacant or agricultural lands rather than provide the information required in (c)8 and 9 above. Agricultural lands may be excluded if the development rights to these lands have been permanently purchased or restricted by covenant, easement or deed. Vacant or agricultural lands in environmentally constrained areas may be excluded if the documentation also includes an overlay map of these areas at the same scale as the map under (c)10i below.

i. Documentation shall include an existing land use map at an appropriate scale to display the land uses of each parcel within the municipality. Such a map shall display the following land uses: residential (which may be divided into single family, two-to-four family, and other multi-family), commercial, industrial, agricultural, parkland, other public uses, semipublic uses, and vacant land;

11. In order to grant a variance or exemption from the design and performance standards in N.J.A.C. 7:8-5, include a mitigation plan that identifies what measures are necessary to offset the deficit created by granting the variance or exemption. The mitigation plan shall ensure that mitigation is completed within the drainage area and for the performance standard for which the variance or exemption was granted; *[and]*

12. Include a copy of the recommended implementing stormwater control ordinance(s) requiring stormwater management measures*[.]**; **and***

13. The municipal stormwater management plan may also include a stream corridor protection plan to address protection of areas adjacent to waterbodies. For waterbodies subject to N.J.A.C. 7:8-5.5(h), the plan shall provide, at a minimum, protections equivalent to those provided at N.J.A.C. 7:8-5.5(h) and be approved by the Department.*

7:8-4.3 Schedule for adoption of municipal stormwater management plan and ordinances

(a) A municipality shall adopt a municipal stormwater management plan as an integral part of its master plan and official map in accordance with the schedule in (a)1 or 2 below, whichever is sooner. The requirements in N.J.A.C. 7:8-4.2(c)8 and 9 are not operative until *[(the date 24 months from the effective date of this subchapter)]* ***February 2, 2006****.

1. By the deadline established in a New Jersey Pollutant Discharge Elimination System permit obtained by the municipality for a municipal separate storm sewer system under N.J.A.C. 7:14A; or

2. By the next reexamination of the master plan under N.J.S.A. 40:55D-89, if a grant for 90 percent of the costs for the preparation of the municipal stormwater management plan has been made available to a municipality by the Department;

(b) Within one year after the municipality adopts the municipal stormwater management plan, the municipality shall adopt stormwater control ordinance(s) to implement the adopted plan and shall submit the adopted municipal stormwater management plan and ordinance(s) to the county review agency for approval. The adopted municipal stormwater management plan and ordinance(s) shall not take effect without approval by the county review agency.

(c) The municipality shall amend the municipal stormwater management plan and stormwater control ordinance(s) as necessary and submit the amended plan and amended ordinance(s) to the county review agency for approval.

(d) The municipality shall reexamine the municipal stormwater management plan at each reexamination of the municipality's master plan in accordance with N.J.S.A. 40:55D-89.

(e) Within one year of the adoption of a regional stormwater management plan as an amendment to the Areawide Water Quality Management Plan, or an amendment thereto, each municipality within the regional stormwater management planning area shall amend their respective municipal stormwater management plans and stormwater control ordinance(s) to implement the regional stormwater management plan.

7:8-4.4 County review process

(a) A municipality shall submit a copy of the adopted stormwater management plan and stormwater control ordinance(s) to the county review agency and the Department.

(b) In reviewing the adopted municipal stormwater management plan and ordinance(s), the county review agency shall consider whether the plan and ordinance(s) conform with the requirements of this chapter.

(c) In accordance with N.J.S.A. 40:55D-97, it is the county review agency's responsibility to review and approve, conditionally approve (specifying the necessary amendments to the plan and ordinance(s)) or disapprove the adopted municipal stormwater management plan and ordinance(s) within 60 calendar days of receipt of the plan and ordinance(s). If the county review agency does not approve, conditionally approve, or disapprove the plan or ordinance(s) within 60 calendar days, the plan and ordinance(s) shall be deemed approved. The county review agency shall issue a written decision to the municipality, with a copy to the Department.

(d) A municipal stormwater management plan and ordinance(s) approved under (c) above shall take effect immediately. A municipal stormwater management plan and ordinance(s) conditionally approved under (c) above shall take effect upon adoption by the municipality of the amendments specified by the county review agency.

(e) Within 30 days of the effective date of the municipal stormwater management plan and ordinance(s) under (d) above, the municipality shall place the plan and ordinance(s) on its website and notify the Department, the Soil Conservation District and State Soil Conservation Committee, or:

1. Submit a copy of the approved municipal stormwater management plan and ordinance(s) to the Department; and

2. Provide notice of such approval to the Soil Conservation District and the State Soil Conservation Committee and, upon request, submit a copy of the approved plan and ordinance(s).

7:8-4.5 Reservation of rights

The Department reserves the right to review stormwater management plans and ordinances for compliance with this subchapter and make recommendations to correct any deficiencies.

7:8-4.6 Variance or exemption from the design and performance standards for stormwater management measures

A municipality may grant a variance or exemption from the design and performance standards for stormwater management measures set forth in its approved municipal stormwater management plan and stormwater control ordinance(s), provided the municipal plan includes a mitigation plan in accordance with N.J.A.C. 7:8-4.2(c)11 and the municipality submits a written report to the county review agency and the Department describing the variance or exemption and the required mitigation.

SUBCHAPTER 5. DESIGN AND PERFORMANCE STANDARDS FOR STORMWATER MANAGEMENT MEASURES

7:8-5.1 Scope

(a) This subchapter establishes design and performance standards for stormwater management measures for(a) major development intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies.

(b) The standards specified in this subchapter do not apply to major development if alternative design and performance standards that are at least as protective as would be achieved through this subchapter when considered on a regional stormwater management area basis are applicable under a regional stormwater management plan *[or]* adopted in accordance with this chapter or a water quality management plan adopted in accordance with N.J.A.C. 7:15.

7:8-5.2 Stormwater management measures for major development

(a) Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards at N.J.A.C. 7:8-5.4 and 5.5. To the maximum extent practicable, these standards shall be met by incorporating nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 into the design. If these measures alone are not sufficient to meet these standards, structural stormwater management measures at N.J.A.C. 7:8-5.7 necessary to meet these standards shall be incorporated into the design.

(b) The development shall incorporate a maintenance plan under N.J.A.C. 7:8-5.8 for the stormwater management measures.

(c) Stormwater management measures shall avoid adverse impacts of concentrated flow on habitat for threatened and endangered species as documented in the ***Department's Landscape Project or*** Natural Heritage Database established under N.J.S.A. 13:1B-15.147 through 15.150, particularly *Helonias bullata* (swamp pink) and/or *Clemmys muhlnebergi* (bog turtle).

(d) The following linear development projects are exempt from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements at N.J.A.C. 7:8-5.4 and 5.5:

1. The construction of an underground utility line provided that the disturbed areas are revegetated upon completion;

2. The construction of an aboveground utility line provided that the existing conditions are maintained to the maximum extent practicable; and

3. The construction of a public pedestrian access, such as a sidewalk or trail with a maximum width of *[10]* *14* feet, provided that the access is made of permeable material.

(e) A waiver from strict compliance from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements at N.J.A.C. 7:8-5.4 and 5.5 may be obtained for the enlargement of an existing public roadway or railroad, or the construction or enlargement of a public pedestrian access, provided that the following conditions are met:

1. The applicant demonstrates that there is a public need for the project that cannot be accomplished by any other means;

2. The applicant demonstrates through an alternatives analysis, that through the use of nonstructural and structural stormwater management strategies and measures, the option selected complies with the requirements of N.J.A.C. 7:8-5.4 and 5.5 to the maximum extent practicable;

3. The applicant demonstrates that, in order to meet the requirements at N.J.A.C. 7:8-5.4 and 5.5 existing structures currently in use, such as homes and buildings would need to be condemned; and

4. The applicant demonstrates that it does not own or have other rights to areas, including the potential to obtain through condemnation lands not falling under (e)3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate for requirements of N.J.A.C. 7:8-5.4 and 5.5 that were not achievable on-site.

7:8-5.3 Nonstructural stormwater management strategies

(a) ***To the maximum extent practicable, the standards in N.J.A.C. 7:8-5.4 and 5.5 shall be met by incorporating nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 into the design.*** The person 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 into the design of a particular project, the applicant shall identify the *[measure]* ***strategy*** and provide a basis for the contention.

(b) Nonstructural stormwater management strategies incorporated into site design shall:

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" ***from pre-construction to post-construction***. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;

5. Minimize land disturbance including clearing and grading;

6. Minimize soil compaction;

7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;

8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and

9. Provide other *[preventative]* 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. These source controls include, but are not limited to:

i. Site design features that help to prevent accumulation of trash and debris in drainage systems;

ii. Site design features that help to prevent discharge of trash and debris from drainage systems;

iii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and

iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

(c) Any land area used as a non-structural stormwater management measure to meet the performance standards in N.J.A.C. 7:8-5.4 and 5.5 shall be dedicated to a government agency, subjected to a conservation restriction filed with the appropriate County Clerk's office, or subject to Department approved or equivalent restriction that ensures *[the maintenance of]* that measure ***or an equivalent stormwater management measure approved by the reviewing agency is maintained*** in perpetuity.

(d) Guidance for nonstructural stormwater management strategies is available in the New Jersey Stormwater Best Management Practices Manual available from the Department through the address listed at N.J.A.C. 7:8-1.3.

7:8-5.4 Erosion control, groundwater recharge and runoff quantity standards

(a) This section contains minimum design and performance standards to control erosion, encourage and control infiltration and groundwater recharge, and control stormwater runoff quantity impacts of major development.

1. The minimum design and performance standards for erosion control are those established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. and implementing rules.

2. The minimum design and performance standards for groundwater recharge are as follows:

i. The design engineer shall, using the assumptions and factors for stormwater runoff ***and groundwater recharge*** calculations at N.J.A.C. 7:8-5.6, either:

(1) Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or

(2) Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated.

ii. This groundwater recharge requirement does not apply to projects *[that qualify as]* ***within the*** "urban redevelopment*[.]*****area,***" ***or to projects subject to (a)2iii below.***

iii. The following types of stormwater shall not be recharged:

(1) Stormwater from areas of high pollutant loading. High pollutant loading areas are areas in industrial and commercial developments where solvents and/or petroleum products are loaded/unloaded, stored, or applied, areas where pesticides are loaded/unloaded or stored; areas where hazardous materials are expected to be present in greater than 'reportable quantities' as defined by the United States Environmental Protection Agency (EPA) at 40 CFR 302.4; areas where recharge would be inconsistent with Department approved remedial action work plan or landfill closure plan; and areas with high risks for spills of toxic materials, such as gas stations and vehicle maintenance facilities; and

(2) Industrial stormwater exposed to "source material." "Source material" means any material(s) or machinery, located at an industrial facility, that is directly or indirectly related to process, manufacturing or other industrial activities, which could be a source of pollutants in any industrial stormwater discharge to groundwater. Source materials include, but are not limited to, raw materials; intermediate products; final products; waste materials; by-products; industrial machinery and fuels, and lubricants, solvents, and detergents that are related to process, manufacturing, or other industrial activities that are exposed to stormwater.

iv. The design engineer shall assess the hydraulic impact on the groundwater table and design the site so as to avoid adverse hydraulic impacts. Potential adverse hydraulic impacts include, but are not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or downgradient of the groundwater recharge area.

3. In order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at N.J.A.C. 7:8-5.6, complete one of the following:

i. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10 and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area; *[or]*

iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed*[. The percentages shall not be applied to post-construction stormwater runoff into tidal flood hazard areas if the increased volume of stormwater runoff will not increase flood damages below the point of discharge]*; ***or***

iv. In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with (a)3i, ii and iii above shall only be applied if the increased volume of stormwater runoff could increase flood damages below the point of discharge.

(b) Any application for a new agricultural development that meets the definition of major development at N.J.A.C. 7:8-1.2 shall be submitted to the Soil Conservation District for review and approval in accordance with the requirements of this section and any applicable Soil Conservation District guidelines for stormwater runoff quantity and erosion control. ***For purposes of this section, "agricultural development" means land uses normally associated with the production of food, fiber and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacture of agriculturally related products.***

7:8-5.5 Stormwater runoff quality standards

(a) Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site. ***The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit from this requirement.*** The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1 below. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

Table 1: Water Quality Design Storm Distribution

Time (Minutes)	Cumulative Rainfall (Inches)	Time (Minutes)	Cumulative Rainfall (Inches)
0	0.0000	65	0.8917
5	0.0083	70	0.9917
10	0.0166	75	1.0500
15	0.0250	80	1.0840
20	0.0500	85	1.1170
25	0.0750	90	1.1500
30	0.1000	95	1.1750
35	0.1330	100	1.2000
40	0.1660	105	1.2250
45	0.2000	110	1.2334
50	0.2583	115	1.2417
55	0.3583	120	1.2500
60	0.6250		

(b) For purposes of TSS reduction calculations, Table 2 below presents the presumed removal rates for certain BMPs designed in accordance with the New Jersey Stormwater Best Management Practices Manual*[, which]**. ***The BMP Manual** may be obtained from the address identified in N.J.A.C. 7:8-1.3 *or found on the Department's website at www.njstormwater.org. The BMP Manual and other sources of technical guidance are listed in N.J.A.C. 7:8-5.9(a)**. TSS reduction shall be calculated based on the removal rates for the BMPs in Table 2 below. Alternative removal rates and methods of calculating removal rates may be used if the design engineer provides documentation demonstrating the capability of these alternative rates and methods to the review agency. Where the Department is not the review agency, a copy of any approved alternative rate or method of calculating the removal rate shall be provided to the Department at the address at N.J.A.C. 7:8-1.3.

(c) If more than one BMP in series is necessary to achieve the required 80 percent TSS reduction for a site, the applicant shall utilize the following formula to calculate TSS reduction:

$R = A + B - (AXB)/100$

Where

R = total TSS *percent* load removal from application of both BMPs, and

A = the TSS *percent* removal rate applicable to the first BMP

B = the TSS *percent* removal rate applicable to the second BMP

Table 2: TSS Removal Rates for BMPs

Best Management Practice	TSS Percent Removal Rate
Bioretention Systems	90
Constructed Stormwater Wetland	90
*[Forested Buffers	70]*
Extended Detention Basin	40-60
Infiltration Structure	80
Manufactured Treatment Device	See N.J.A.C. 7:8-*[5.7(c)]**5.7(d)*
Sand Filter	80
Vegetative Filter Strip	*[50]**60-80*
Wet Pond	*[60]**50*-90

(d) If there is more than one onsite drainage area, the 80 percent TSS removal rate shall apply to each drainage area, unless the runoff from the subareas converge on site in which case the removal rate can be demonstrated through a calculation using a weighted average.

(e) Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction nutrient load of the anticipated load from the developed site in stormwater runoff generated from the water quality design storm. In achieving reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural measures that optimize nutrient removal while still achieving the performance standards in N.J.A.C. 7:8-5.4 and 5.5.

(f) Additional information and examples are contained in the New Jersey Stormwater Best Management Practices Manual, which may be obtained from the address identified in N.J.A.C. 7:8-1.3.

(g) In accordance with the definition of FW1 at N.J.A.C. 7:9B-1.4, stormwater management measures shall be designed to prevent any increase in stormwater runoff to waters classified as FW1.

(h) Special water resource protection areas shall be established along all waters designated Category One at N.J.A.C. 7:9B and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC 14 drainage. These areas shall be established for the protection of water quality, aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries significance of those established Category One waters. These areas shall be designated and protected as follows:

1. The applicant shall preserve and maintain a special water resource protection area in accordance with one of the following:

i. A 300-foot special water resource protection area ***shall be provided on each side of the waterway***, measured perpendicular to the waterway from the top of bank outwards or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided.

ii. Encroachment within the designated special water resource protection area under (h)1i above shall only be allowed where previous development or disturbance has occurred (for example, active agricultural use, parking area or maintained lawn area). The encroachment shall only be allowed where applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable. In no case shall the remaining special water resource protection area be reduced to less than 150 feet as measured perpendicular to the ***top of bank of the*** waterway ***or centerline of the waterway where the bank is undefined***. All encroachments proposed under this subparagraph shall be subject to review and approval by the Department.

2. All stormwater shall be discharged outside of but may flow through the special water resource protection area and shall comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. (see N.J.A.C. 2:90-1.3).

3. If stormwater discharged outside of and flowing through the special water resource protection area cannot comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., (see N.J.A.C. 2:90-1.3), then the

stabilization measures in accordance with the requirements of the above standards may be placed within the special water resource protection area, provided that:

i. Stabilization measures shall not be placed within 150 feet of the waterway;

ii. Stormwater associated with discharges allowed by this paragraph shall achieve a 95 percent TSS post construction removal rate;

iii. Temperature shall be addressed to ensure no impact on receiving waterway;

iv. The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable;

v. A conceptual project design meeting shall be held with the appropriate Department staff and Soil Conservation District staff to identify necessary stabilization measures; and

vi. All encroachments proposed under this section shall be subject to review and approval by the Department.

4. A stream corridor protection plan may be developed by a regional stormwater management planning committee as an element of a regional stormwater management plan*, **or by a municipality through an adopted municipal stormwater management plan***. If a stream corridor protection plan for a waterway subject to this subsection has been approved by the Department, then the provisions of the plan shall be the applicable special water resource protection area requirements for that waterway. A stream corridor protection plan for a waterway subject to this subsection shall maintain or enhance the current functional value and overall condition of the special water resource protection area as defined above in (h)1i. In no case shall a stream corridor protection plan allow reduction of the Special Water Resource Protection Area to less than 150 feet as measured perpendicular to the waterway subject to this subsection.

5. This subsection does not apply to the construction of one individual single family dwelling that is not part of a larger development on a lot receiving preliminary or final subdivision approval on or before *[(effective date of the rule)]* ***February 2, 2004***, provided that the construction begins on or before *[(five years from effective date of the rule)]* ***February 2, 2009***.

7:8-5.6 Calculation of stormwater runoff ***and groundwater recharge***

(a) Stormwater runoff shall be calculated in accordance with the following:

1. The design engineer shall calculate runoff using one of the following methods:

i. The USDA Natural Resources Conservation Service (NRCS) methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Section 4, National Engineering Handbook (NEH-4), dated July 2002, incorporated herein by reference as amended and supplemented. This methodology is additionally described in Technical Release 55—Urban Hydrology for Small Watersheds (TR-55), dated June 1986, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the Natural Resources Conservation Service website at http://www.wcc.nrcs.usda.gov/water/quality/common/neh630/4content.html or at Natural Resources Conservation Service, 220 Davison Avenue, Somerset, New Jersey 08873; (732) 537-6040; or

ii. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations. The rational and modified rational methods are described in "Appendix A-9 Modified Rational Method" in the Standards for Soil Erosion and Sediment Control in New Jersey, July 1999. This document is available from the State Soil Conservation Committee or any of the Soil Conservation Districts listed at N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number or each Soil Conservation District is available from the State Soil Conservation Committee, P.O. Box 330, Trenton, NJ 08625, 609-292-5540.

2. For the purpose of calculating runoff coefficients ***and groundwater recharge***, there is a presumption that the pre-construction condition of a site or portion thereof is a wooded land use with good hydrologic condition. ***The term "runoff coefficient" applies to both the NRCS methodology at N.J.A.C. 7:8-5.6(a)1i and the Rational and Modified Rational Methods at N.J.A.C. 7:8-5.6(a)1i.*** A runoff coefficient ***or a groundwater recharge land cover*** for an existing condition may be used on all or a portion of the site if the design engineer verifies that the hydrologic condition has existed on the site or portion of the site for at least five years without interruption prior to the time of *[calculation]* ***application. If more than one land cover has existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations***. In addition, there is the presumption that the site is in good hydrologic condition (if the land use type is pasture, lawn, or park), with good cover (if the land use type is woods), or with good ***hydrologic*** condition and conservation treatment (if the land use type is cultivation).

3. In computing pre-construction stormwater runoff, the design engineer shall account for all significant land features and structures, such as ponds, wetlands, depressions, hedgerows, or culverts, that may reduce pre-construction stormwater runoff rates and volumes.

4. In computing stormwater runoff from *[a]* ***all*** design storm***s***, the design engineer shall consider the relative stormwater runoff rates and/or volumes of pervious and impervious surfaces separately to accurately compute the rates and volume of stormwater runoff from the site. To calculate *[the water quality storm]* ***runoff from unconnected impervious cover***, urban impervious area modifications as described in the NRCS Technical Release-55, Urban Hydrology for Small Watersheds ***or other methods*** may be employed.

5. If the invert of the outlet structure of a stormwater management measure is below the flood hazard design flood elevation as defined at N.J.A.C. 7:13, the design engineer shall take into account the effects of tailwater in the design of structural stormwater management measures.

(b) Groundwater recharge may be calculated in accordance with the following:

1. The New Jersey Geological Survey Report GSR-32 A Method for Evaluating Groundwater-Recharge Areas in New Jersey, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the New Jersey Stormwater Best Management Practices Manual; at the New Jersey Geological Survey website at http://www.state.nj.us/dep/njgs/; or at New Jersey Geological Survey, 29 Arctic Parkway, PO Box 427, Trenton, NJ 08625-0427; (609) 984-6587.

7:8-5.7 Standards for structural stormwater management measures

(a) Standards for structural stormwater management measures are as follows:

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including, for example, ***environmentally critical areas;*** wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; drainage area and drainage patterns; and the presence of solution-prone carbonate rocks (limestone).

2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure as appropriate, and shall have parallel bars with one-inch spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third the width of the diameter of the orifice or one-third the width of the weir*, **with a minimum spacing between bars of one inch and a maximum spacing between bars of six inches***. In addition, the design of trash racks must comply with the requirements of N.J.A.C. 7:8-6.2(a).

3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant. Measures that are consistent with the relevant portions of the Residential Site Improvement Standards at N.J.A.C. 5:21-7.3, 7.4 and 7.5 shall be deemed to meet this requirement.

4. At the intake to the outlet from the stormwater management basin, the orifice size shall be a minimum of two and one-half inches in diameter.

5. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at N.J.A.C. 7:8-6.

*[(c)]**(b)* Stormwater management measure guidelines are available in the New Jersey Stormwater Best Management Practices Manual. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, groundwater recharge and water quality design and performance standards established by this subchapter.

*[(d)]**(c)* Manufactured treatment devices may be used to meet the requirements of this subchapter, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department.

7:8-5.8 Maintenance requirements

(a) The design engineer shall prepare a maintenance plan for the stormwater management measures incorporated into the design of a major development.

(b) The maintenance plan shall contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Maintenance guidelines for stormwater management measures are available in the New Jersey Stormwater Best Management Practices Manual. If the maintenance plan identifies a person other than the developer (for example, a public agency or homeowners' association) as having the responsibility for maintenance, the plan shall include documentation of such person's agreement to assume this responsibility, or of the developer's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

(c) Responsibility for maintenance shall not be assigned or transferred to the owner or tenant of an individual property in a residential development or project, unless such owner or tenant owns or leases the entire residential development or project.

(d) If the person responsible for maintenance identified under (b) above is not a public agency, the maintenance plan and any future revisions based on (h) below shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

(e) Preventative and corrective maintenance shall be performed *[as needed]* ***to maintain the function of the stormwater management measure***, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of nonvegetated linings.

(f) The person responsible for maintenance identified under (b) above shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

(g) The person responsible for maintenance identified under (b) above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

(h) The person responsible for maintenance identified under (b) above shall retain and make available, upon request by *[a]* ***any*** public entity ***with administrative, health, environmental or safety authority over the site***, the maintenance plan and the documentation required by *[(g)]**(f)* and *[(h)]**(g)* above.

(i) Nothing in this section shall preclude the municipality in which the major development is located from requiring the posting of a performance or maintenance guarantee in accordance with N.J.S.A. 40:55D-53.

7:8-5.9 Sources for technical guidance

(a) Technical guidance for stormwater management measures can be found in the documents listed at (a)1 and 2 below, which are available from Maps and Publications, Department of Environmental Protection, 428 East State Street, PO Box 420, Trenton, New Jersey, 08625; telephone (609) 777-1038.

1. Guidelines for stormwater management measures are contained in the New Jersey Stormwater Best Management Practices Manual, 2002 as amended. Information is provided on stormwater management measures such as:

i. Bioretention systems;
ii. Constructed stormwater wetlands;
iii. Dry wells;
[iv. Forested buffers;]
*[v.]**iv.* Extended detention basins;
*[vi.]**v.* Infiltration structures;
*[vii.]**vi.* Manufactured treatment devices;
*[viii.]**vii.* Pervious paving;
*[ix.]**viii.* Sand filters;
*[x.]**ix.* Vegetative filter *[strip]*; and
*[xi.]**x.* Wet pond.

2. The New Jersey Department of Environmental Protection Stormwater Management Facilities Maintenance Manual, as amended.

(b) Additional technical guidance for stormwater management measures can be obtained from the following:

1. The "Standards for Soil Erosion and Sediment Control in New Jersey" promulgated by the State Soil Conservation Committee and incorporated into N.J.A.C. 2:90. Copies of these standards may be obtained by contacting the State Soil Conservation Committee or any of the Soil Conservation Districts listed in N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, PO Box 330, Trenton, New Jersey 08625, 609-292-5540;

2. The Rutgers Cooperative Extension Service, 732-932-9306; and

3. The Soil Conservation Districts listed in N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, PO Box 330, Trenton, New Jersey 08625, 609-292-5540.

SUBCHAPTER 6. SAFETY STANDARDS FOR STORMWATER MANAGEMENT BASINS

7:8-6.1 Scope

(a) This subchapter sets forth requirements to protect public safety through the proper design and operation of stormwater management basins. This subchapter applies to any new stormwater management basin.

(b) The provisions of this subchapter are not intended to preempt ***more stringent*** municipal or county safety requirements for new or existing stormwater management basins. Municipal and county stormwater management plans and ordinances may, pursuant to their authority, require existing stormwater management basins to be retrofitted to meet one or more of the safety standards in N.J.A.C. 7:8-*[6.3(a)2]**6.2(a)2*, (b) and (c)1 for trash racks, overflow grates, and escape provisions at outlet structures.

7:8-6.2 Requirements for trash racks, overflow grates and escape provisions

(a) A trash rack is a device designed to catch trash and debris and prevent the clogging of outlet structures. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets in accordance with the following:

1. The trash rack shall have parallel bars, with no greater than six-inch spacing between the bars;

2. The trash rack shall be designed so as not to adversely affect the hydraulic performance of the outlet pipe or structure;

3. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per second under the full range of stage and discharge. Velocity is to be computed on the basis of the net area of opening through the rack; and

4. The trash rack shall be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 lbs./ft sq.

(b) An overflow grate is designed to prevent obstruction of the overflow structure. If an outlet structure has an overflow grate, the grate shall comply with the following requirements:

1. The overflow grate shall be secured to the outlet structure but removable for emergencies and maintenance;

2. The overflow grate spacing shall be no greater than two inches across the smallest dimension; and

3. The overflow grate shall be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 lbs./ft sq.

(c) Stormwater management basins shall include escape provisions as follows:

1. If a stormwater management basin has an outlet structure, escape provisions shall be incorporated in or on the structure. Escape provisions include the installation of permanent ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. With the prior approval of the reviewing agency pursuant to N.J.A.C. 7:8-*[6.4(a)]* *6.3*, a free-standing outlet structure may be exempted from this requirement;

2. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located approximately two and one-half feet below the permanent water surface, and the second step shall be located one to one and one-half feet above the permanent water surface. See N.J.A.C. 7:8-6 Appendix A for an illustration of safety ledges in a stormwater management basin; and

3. In new stormwater management basins, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than three horizontal to one vertical.

7:8-*[6.4]* *6.3* Variance or exemption from safety standards

A variance or exemption from the safety standards for stormwater management basins may be granted only upon a written finding by the appropriate reviewing agency (municipality, county or Department) that the variance or exemption will not constitute a threat to public safety.

CHAPTER 13
FLOOD HAZARD AREA CONTROL

SUBCHAPTER 2. PROJECT STANDARDS

7:13-2.8 Stormwater management

If a project or activity meets the definition of "major development" at N.J.A.C. 7:8-1.2, then the project or activity shall comply with the Stormwater Management rules at N.J.A.C. 7:8.

CHAPTER 15
WATER QUALITY MANAGEMENT PLANNING

SUBCHAPTER 3. PLAN ASSESSMENT, AMENDMENT AND ADOPTION

7:15-3.4 Water quality management plan amendment procedures

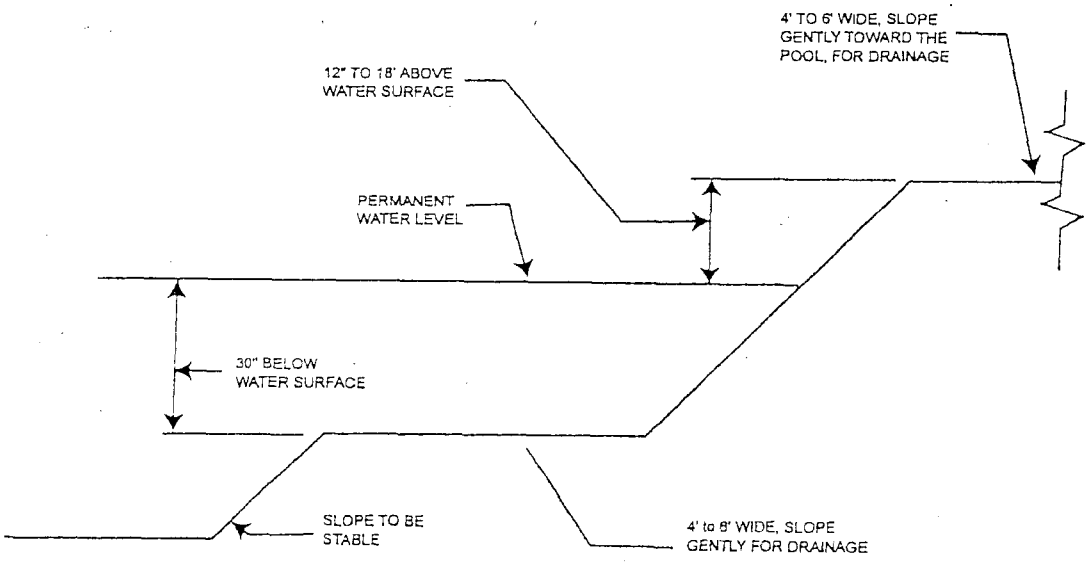
(a) (No change.)

(b) Procedures for amendment of the Statewide WQM Plan are as follows:

1. Water quality related provisions in present and future rules adopted by the Department shall be considered to be part of the Statewide WQM Plan. Such provisions may not be adopted, amended, or repealed through the WQM plan amendment process under (b)6 below.

2. Priority systems, intended use plans and project priority lists for wastewater facilities that are developed by the Department and accepted by the United States Environmental Protection Agency (USEPA) pursuant to USEPA regulations, or that otherwise are developed by the Department under N.J.A.C. 7:22, shall be considered to be part of the Statewide WQM Plan. Such priority systems and project priority lists shall be adopted or revised in accordance with USEPA regulations and N.J.A.C. 7:22, as appropriate, and shall not be adopted or revised through the WQM plan amendment process under (b)6 below.

Appendix A: Illustration of safety ledges in a new detention basin. Depicted is an elevational view.



NOTE: NOT DRAWN TO SCALE

NOTE: FOR BASINS WITH PERMANENT POOL OF WATER ONLY

3. Statewide Sludge Management Plans, District Sludge Management Plans and sludge management rules that are promulgated or approved by the Department pursuant to N.J.S.A. 13:1E-1 et seq. shall be considered to be part of the Statewide WQM Plan. Such plans and rules shall be promulgated, revised, updated or approved in accordance with N.J.S.A. 13:1E-1 et seq., and shall not be promulgated, revised, updated, or approved through the WQM plan amendment process under (b)6 below.

4. Lists of water quality limited segments, lists of segments where TMDLs will be developed, and project priority lists for TMDL development which are developed by the Department under N.J.A.C. 7:15-6 shall be adopted as amendments to the Statewide WQM Plan. TMDLs developed in accordance with N.J.A.C. 7:15-7 shall be adopted as amendments to the relevant Areawide WQM Plan(s). However, such lists, and TMDLs shall be adopted or revised in accordance with N.J.A.C. 7:15-6 or 7:15-7, as appropriate, and shall not be adopted or revised through the WQM plan amendment process under (b)6 below. The Department may also publish a draft amendment as an Interested Party Review document or as a pre-proposal prior to formal proposal of the amendment.

5. A regional stormwater management plan prepared in accordance with N.J.A.C. 7:8-3 shall be submitted only by a lead planning agency as a proposed amendment to the applicable areawide WQM plan. In addition, the following changes to an adopted regional stormwater management plan shall be processed as amendments to applicable areawide WQM Plans under this section:

i. The addition, deletion or modification to any of the drainage area-specific water quality, groundwater recharge or water quantity objectives identified under N.J.A.C. 7:8-3.5;

ii. The addition, deletion or modification to any drainage area-specific design or performance standard developed under N.J.A.C. 7:8-3.6;

iii. Any modification to a regional stormwater management plan that the Department or designated planning agency determines is likely to have a significant environmental, social, or economic impact; or

iv. Any modification that the applicant requests be processed as an amendment.

6. Components of the Statewide WQM Plan other than (b)1 through 5 above may be amended by using the procedure specified in (g) below, except that the Commissioner shall render the final decision identified in (g)9 below.

(c)-(f) (No change.)

(g) Except as provided in (h) below, the Department procedure for amendment of areawide WQM plans is as follows:

1.-2. (No change.)

3. The Department shall notify the applicant and the applicable designated planning agency, if any, in writing of its decision under (g)2 above. If the Department's decision is to proceed further with the amendment request under (g)2iii above, then this notification shall include the public notice that shall be given for the proposed amendment. If the proposed amendment is a regional stormwater management plan, the Department shall also notify the Department of Community Affairs and the Department of Agriculture. The applicant shall request written statements of consent under (g)4 below, and shall give public notice by publication in a newspaper of general circulation at the applicant's expense. The Department shall maintain a list identifying the newspaper that shall be used for this purpose in each planning area. The public notice shall also be published in the New Jersey Register. In cases where such Department decisions include a requirement for a non-adversarial public hearing, the public notice shall provide at least 30 days notice of the hearing.

4.-11. (No change.)

(h)-(l) (No change.)

7:15-3.5 Water quality management plan review, revision, and certification

(a) (No change.)

(b) The Department and the designated planning agencies shall prepare revisions to Statewide and areawide WQM Plans under this section whenever such revisions are necessary to:

1.-2. (No change.)

3. Revise schedules for submission of wastewater management plans under N.J.A.C. 7:15-5.23(g);

4. Provide for the following substantive changes in Statewide and areawide WQM plans where the Department determines no significant individual or cumulative impacts will occur to environmentally sensitive areas or other natural resources (such as water supplies) due to the proposed revision (individually or in combination with past revisions in the area), that the changes are consistent with N.J.A.C. 7:15-3.6 and 3.7, and that certain directly affected municipal and county agencies and other interests as identified by the Department have been provided an opportunity to review and comment on the proposed revision:

i.-iv. (No change.)

v. Expansion of a future sewer service area to contiguous lots, where the expansion involves less than 100 acres, contributes less than 8,000 gallons per day of additional wastewater flow, and does not create a significantly new pattern of sewered development such that a significant potential or incentive is created for additional revisions or amendments to open new areas to sewered development; or

5. Provide for any modification in an adopted regional stormwater management plan that does not require an amendment under N.J.A.C. 7:15-3.4(b)5.

(c)-(f) (No change.)

CHAPTER 20
DAM SAFETY STANDARDS

SUBCHAPTER 1. APPLICATION PROCEDURE; DESIGN CRITERIA FOR DAM CONSTRUCTION; DAM INSPECTION PROCEDURE

7:20-1.3 Permit-by-rule

(a) All dams must be designed, constructed, operated, maintained or removed in compliance with the rules in this subchapter except as set forth below:

1. Owners and operators of Class IV dams (see N.J.A.C. 7:20-1.8, Dam classification) are not required to file documents with nor obtain a permit from the Department, but must meet the following requirements, in addition to those set forth elsewhere in this subchapter:

i. (No change.)

ii. All necessary local approvals must be obtained;

iii. A New Jersey licensed professional engineer must design the Class IV Dam to meet all technical requirements of this subchapter; and

iv. If the Class IV dam is designed or constructed for stormwater management purposes, the dam shall comply with the Stormwater Management Rules at N.J.A.C. 7:8.

2. (No change.)

(b)-(c) (No change.)

(a)

LAND USE MANAGEMENT
WATERSHED MANAGEMENT
Stormwater Management
Definition of "Major Development"; Applicability to Major Development
Adopted New Rules: N.J.A.C. 7:8-1.2 and 1.6

Proposed: September 15, 2003 at 35 N.J.R. 4220(a).
Adopted: January 9, 2004 by Bradley M. Campbell, Commissioner, Department of Environmental Protection.
Filed: January 9, 2004 as R.2004 d.61, **with technical changes** not requiring additional public notice and comment (see N.J.A.C. 1:30-6.3).

Authority: N.J.S.A. 13:1D-1 et seq., 13:9A-1 et seq., 13:19-1 et seq., 40:55D-93 through 99, 58:4-1 et seq., 58:10A-1 et seq., 58:11A-1 et seq. and 58:16A-50 et seq.
DEP Docket Number: 20-03-08/417.
Effective Date: February 2, 2004.
Expiration Date: February 2, 2009.

The Department of Environmental Protection (Department) is adopting new Stormwater Management rules proposed on September 15, 2003 at 35 N.J.R. 4220(a). Particularly, the Department is adopting a new definition of "major development" and a new section at N.J.A.C. 7:8-1.6, Applicability to major development. On January 6, 2003, the Department proposed repeal and new Stormwater Management rules, N.J.A.C. 7:8. (See 35 N.J.R. 119(a).) The adoption of the new Stormwater Management rules appears elsewhere in this issue of the New Jersey Register. These new rules are incorporated within the new Stormwater Management Rules.

Based on comments received on the January 6, 2003 proposal of the Stormwater Management rules, the Department determined that the originally proposed definition of "major development" could have been misinterpreted to mean that projects possessing preliminary local approval, before the new rules took effect, would be considered exempt from all stormwater review, rather than exempt from the additional requirements imposed by the new rule. Implementation of the new rules under this exemption would not have provided adequate protection to waterbodies in the State from the impacts of stormwater runoff and nonpoint source pollution. Additionally, the Department determined that to qualify for grandfathering from the new rules, it was appropriate to require that, in addition to the enumerated local approvals, a project also have one enumerated Department permit that included stormwater management review component. Therefore, it was necessary to repropose the definition of "major development" and propose a new applicability provision to ensure adequate review of stormwater management has occurred in order for a project to qualify for continued treatment under the previous rules and that grandfathered approvals have a limited term. (See 35 N.J.R. 4220(a); September 15, 2003.)

The comment period on the reproposal closed on November 14, 2003. Comments were received from 327 interested persons.

Summary of Public Comments and Agency Responses:

The following people submitted written comments on the reproposed definition of "major development" and proposed new section at N.J.A.C. 7:8-1.6, Applicability to major development. The number in parentheses after each comment corresponds to the number identifying the respective commenters below.

List of Commenters

1. Akers, Fred
2. Alexandrini, Leanne
3. Allen, Francine
4. Allen, Kenneth
5. Allen, Peter
6. Allen, Julia
7. Anthony, Paul R.W.
8. Argentina, Debra
9. Armstrong, James
10. Armstrong, James C.
11. Aures, Bonita
12. Auth, Joan
13. Bailey, Robert
14. Baker, Marie
15. Balint, Christine
16. Barnett, Daniel
17. Bartholomew, Claude
18. Beckwith, Anita
19. Bellach, William
20. Best, Theodore V.
21. Boiyai, Melani
22. Boras, Jo & Leonard
23. Brenke, Richard
24. Brennenstuhl, James
25. Brine, Charles
26. Brinker, Erica
27. Brown, Jessica
28. Bryson, Jennifer
29. Bucquet, Caroline
30. Burani, Sergio
31. Buriani, Michael
32. Burns, Marilyn
33. Butrym, Michael
34. Cabri, Henry
35. Cannata-Nowel, Anita
36. Cantilli, John
37. Capozucca, John
38. Carley, Bryan
39. Carlough, Bob
40. Carluccio, Tracy; for the Delaware River Keeper
41. Carringer, Nancy
42. Case, Steve
43. Cheung, Danny
44. Chiang, Rodney
45. Chin, Alina
46. Christian, Mary Jo
47. Clougherty, Jill
48. Cohen, Martin
49. Colby, Richard
50. Colgan, Deborah
51. Colosi, Joseph
52. Colson, Linda for the Cape Accountability Civic Group
53. Connell, Joyce
54. Conner, Mike
55. Connolly, William M., Director, for the Department of Community Affairs Division of Codes and Standards
56. Cooper, Neil
57. Covington, Katharine
58. Croce, Michael
59. Crum, Daniel
60. Curtis, Marie A., for the New Jersey Environmental Lobby
61. D'Alessio-Cole, Cheryl
62. Dambra, John
63. Darrow, Michael
64. Deckelnick, Joe
65. Decker, George
66. DeFiglio, Judith
67. Denzer, Joan
68. Desjardins, Donna
69. DeWeese, Robin
70. Dey, Stephen P.; for the New Jersey State Board of Agriculture
71. DiLodovico, Anthony
72. Dockery, Dan
73. Donnici, Anthony
74. Dooley, Brian
75. Dreyling, Chris
76. Ducate, Janice
77. Duggan, Frances
78. Dumais, Susan
79. Dungan, Christian
80. Dunne, Loretta
81. Easton, Kathy
82. Eckstein
83. Edelmann, Carolyn Foot
84. Egenton, Michael for the New Jersey State Chamber of Commerce
85. Elbin, Susan
86. Ember, Steve
87. Eng, Sherman
88. Epstein, Susan
89. Erwin, Jane
90. Etter, Ron
91. Fair, Abigail for the Association of New Jersey Environmental Commissions
92. Farkas, Daniel Evans
93. Farri, Virginia
94. Federoff, Valadimir
95. Fenster, Steven
96. Finch, Kathy
97. Flanagan, Carol
98. Foester, Judith
99. Ford, Peter
100. Freireich, Jeffrey; for the Kushner Companies
101. Frey, Wilma
102. Fritsch, Wayne
103. Ftera, Constance
104. Fulmer, Noah
105. Garry, Lorrain Gagl
106. Gioielli, Lawrence
107. Giorgio, Heather
108. Goad, Brian
109. Goldberg, Rosalyn
110. Goldsholl, Bernard
111. Graham, Stephen J.; for the Gill St. Bernard's School
112. Grahn, Charlene
113. Grambor, Roberta
114. Grambor, Robert
115. Grant, Gordon P.
116. Graver, Robert
117. Grayzel, Jeffrey
118. Greene, Karen Patter
119. Griber, Penelope A.; for the D.W. Smith Associates, LLC
120. Halpin, Matthew S.; for the New Jersey Society of Municipal Engineers
121. Hamfeldt, Art
122. Handelman, Mary Ellen; Secretary to the Department of Community Affairs Division of Codes ad Standards Site Improvement Advisory Board
123. Hanna, Steve
124. Harrison, Charles
125. Hartley, Lorraine
126. Haselton, Kerry
127. Hawkins, George for the Stony Brook Millstone Watershed Association
128. Healy, James
129. Heiser, Christopher
130. Hellerman, George
131. Henderson, Amy
132. Henriquez, Pamela

Section 319 of the Clean Water Act authorizes a Federal grant-in-aid program to encourage states to control nonpoint sources. The Department developed a management program for nonpoint source control under which the Department issues grants to local, regional, State, and interstate agencies as well as to nonprofit organizations to, for example, develop or monitor best management practices to control stormwater.

Coastal Zone Management Act

Under Section 6217(g) of the Coastal Zone Management Act Reauthorization and Amendments of 1990 (CZARA), P.L. 101-508, the U.S. Environmental Protection Agency (EPA) has published "Guidance Specifying Management Measures For Sources of Nonpoint Pollution In Coastal Waters" (CZARA 6217(g) Guidance). States may opt to participate or not participate in overall coastal zone management program, with no penalty for non-participation other than the loss of Federal grants for this program. No mandatory Federal standards or requirements for nonpoint sources pollution control are imposed. The CZARA 6217(g) Guidance includes management measures for stormwater runoff and nonpoint source pollution control from land development as well as many other source types. The Department has developed a coastal zone management program, including a component addressing coastal nonpoint pollution control. The Stormwater Management Rules at N.J.A.C. 7:8 are one means by which the Department implements its nonpoint pollution control program.

The Department has determined that the adopted definition and rule do not contain any standards or requirements that exceed the standards or requirements imposed by Federal law. Accordingly, Executive Order No. 27(1994) and N.J.S.A. 52:14B-1 et seq. (P.L. 1995, c.65) do not require any further analysis.

Full text of the adoption follows (additions to proposal indicated in boldface with asterisks ***thus***; deletions from proposal indicated in brackets with asterisks *[thus]*):

CHAPTER 8
STORMWATER MANAGEMENT

SUBCHAPTER 1. GENERAL PROVISIONS

7:8-1.2 Definitions

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

. . .

"Major development" means any "development" that provides for ultimately disturbing one or more acres of land or increasing impervious surface by one-quarter acre or more. 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."

. . .

7:8-1.6 Applicability to major development

(a) Except as provided in (b) below, all major development shall comply with the requirements of this chapter.

(b) The following major development shall be subject to the stormwater management requirements in effect on *[(the date one day prior to the effective date of this rule)]* ***February 1, 2004***, copies of which are available from the Department at the address specified in N.J.A.C. 7:8-1.3:

1. Major development which does not require any of the Department permits listed in (c) below and which has received one of the following approvals pursuant to the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., prior to *[(the effective date of this rule)]* ***February 2, 2004***:

i. Preliminary or final site plan approval;

ii. Final municipal building or construction permit;

iii. Minor subdivision approval where no subsequent site plan approval is required;

iv. Final subdivision approval where no subsequent site plan approval is required; or

v. Preliminary subdivision approval where no subsequent site plan approval is required.

2. Major development which has received one of the approvals pursuant to the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., in (b)1 above prior to *[(the effective date of this rule)]* ***February 2, 2004*** and has secured at least one of the applicable permits listed in (c) below from the Department by *[(the effective date of this rule)]* ***February 2, 2004***, and provided that the permit included a stormwater management review component; and

3. Major development undertaken by any government agency, which does not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., provided the project has secured at least one of the applicable Department permits listed in (c) below prior to *[(the effective date of this rule)]* ***February 2, 2004***, and provided that the permit included a stormwater management review component.

(c) For the purposes of this section, the term "permit" shall include transition area waivers under the Freshwater Wetlands Protection Act. In order to qualify under (b)2 or 3 above, the major development must have obtained at least one Department permit granted under the following statutes and, provided that the permit included a stormwater management review component, prior to *[(the effective date of this rule)]* ***February 2, 2004***:

1. Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.;
2. Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1 et seq.;
3. Coastal Area Facility Review Act, N.J.S.A. 13:19-1 et seq.; or
4. Waterfront and Harbor Facilities Act, N.J.S.A. 12:5-3.

(d) An exemption provided by (b) above shall expire with the expiration, termination or other loss of duration or effect of either of the qualifying local approval or Department permit, whichever comes first. The expiration of local approvals under (b)1 above shall be governed by local ordinance. In the event there are multiple qualifying Department permits under (c) above, the expiration date is governed by that permit which expires last provided that the permit is still in effect. Once the exemption expires, the major development shall be subject to all requirements of this chapter upon reapplication for that permit and all subsequent permits or local approval(s) under the Municipal Land Use Law.

(e) An exemption under (b) above is limited to the land area and the scope of the project addressed by the qualifying approval(s) and permit(s). Exemptions under this section shall be deemed void if revisions are made to the qualifying approval or permit in (b) above, including approvals under the Municipal Land Use Law, unless upon application, the Department determines that each revision would have a de minimis impact on water resources. In making this determination, the Department shall consider the extent of any impacts on water resources resulting from the revision, including, but not limited to:

1. Increases in stormwater generated;
2. Increases in impervious surface;
3. Increases in stormwater pollutant loading;
4. Changes in land use;
5. New encroachments in special water resource protection areas; and
6. Changes in vegetative cover.

(f) In case of conflict with the Coastal Permit Program Rules at N.J.A.C. 7:7-4.4(a)4, the requirements of this chapter shall supersede.

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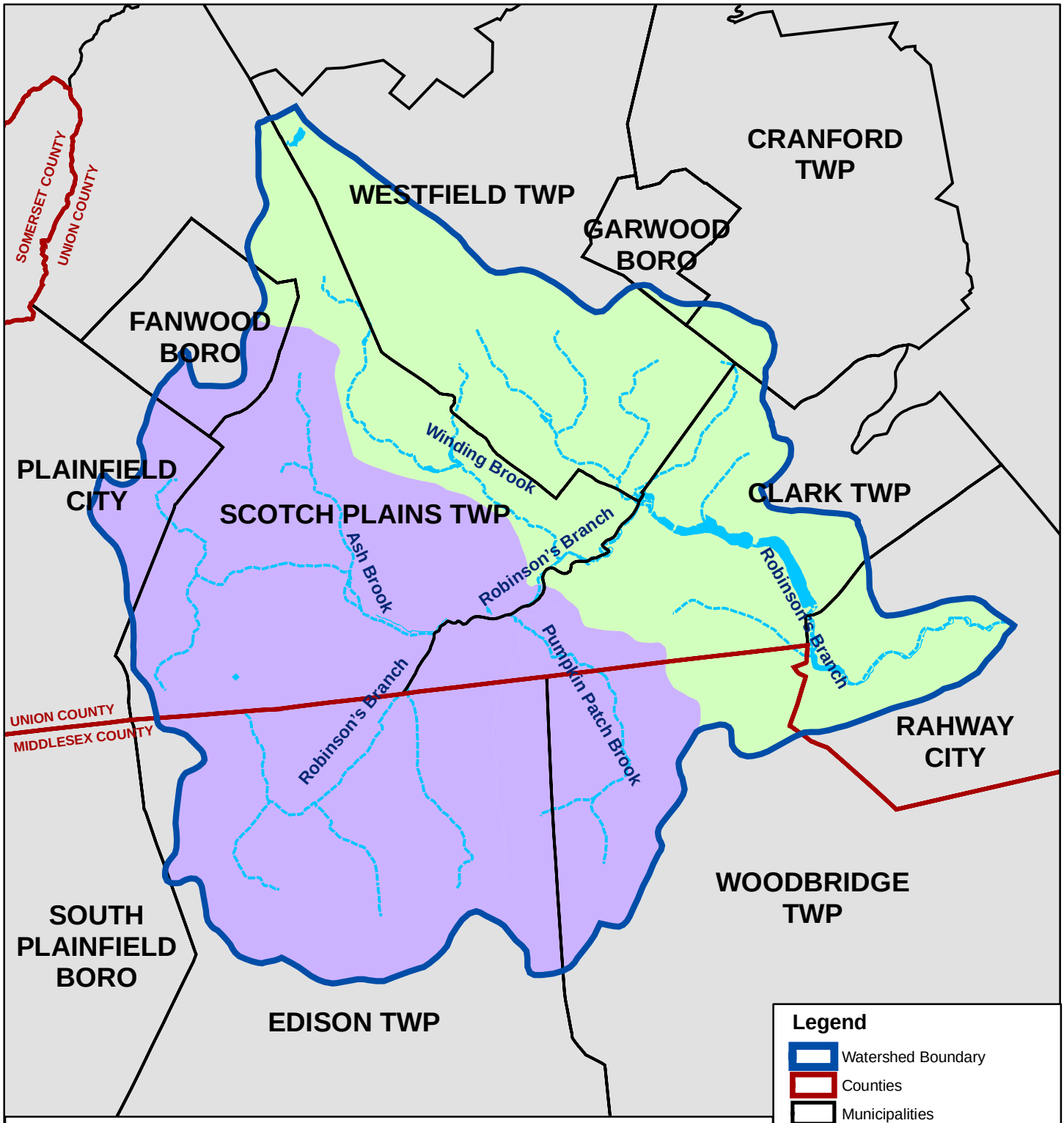

MAP 1 - REGIONAL STORMWATER MANAGEMENT PLANNING AREA BOUNDARY
Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM

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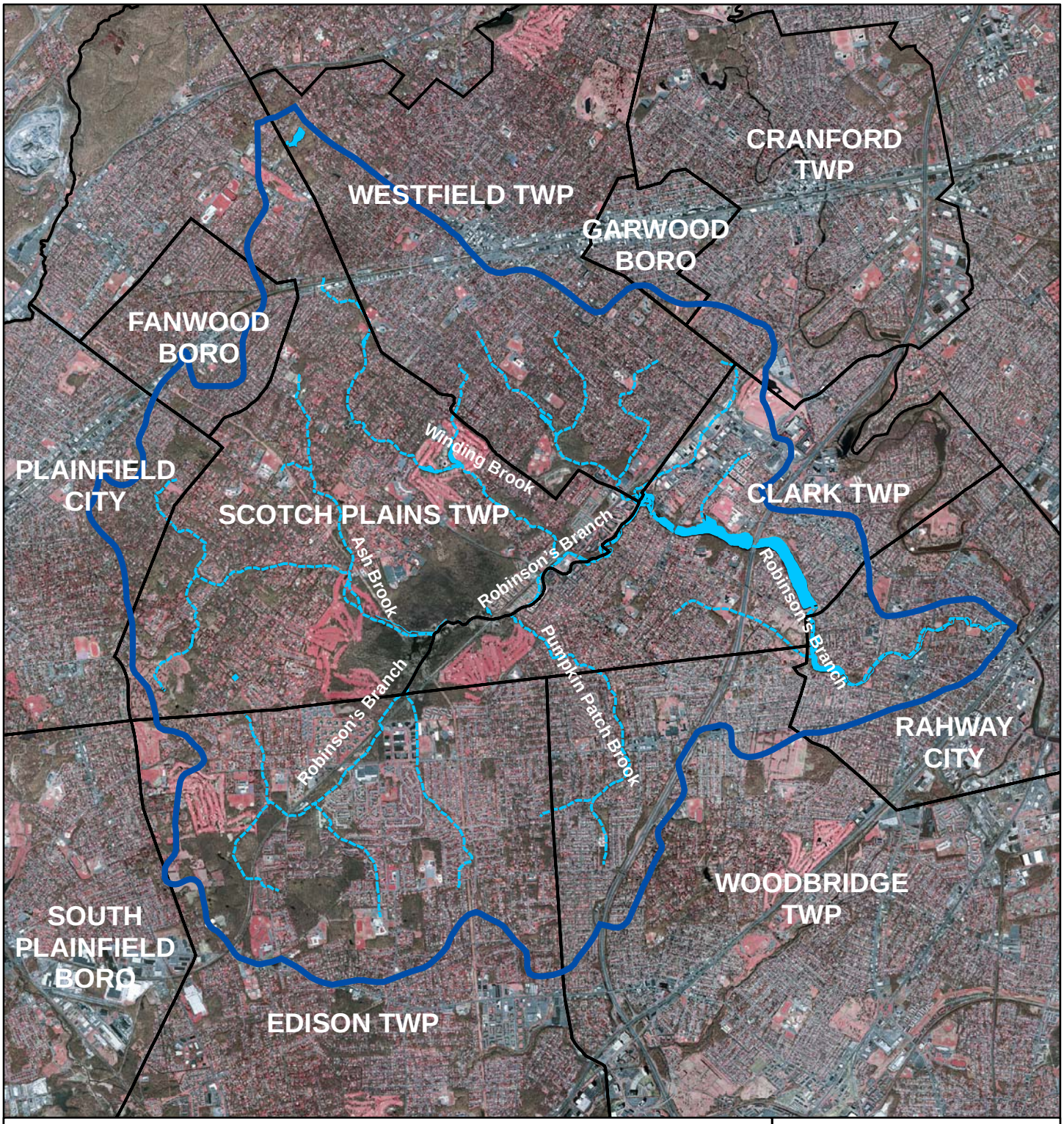

MAP 2 - AERIAL PHOTO

Robinsons Branch Regional Stormwater Management Plan

Data Source: NJDEP 2002 Digital Orthophotos; NJDEP 1996 GIS Data CD-ROM

Legend

- Watershed Boundary
- Municipalities
- Rivers & Streams
- Lakes

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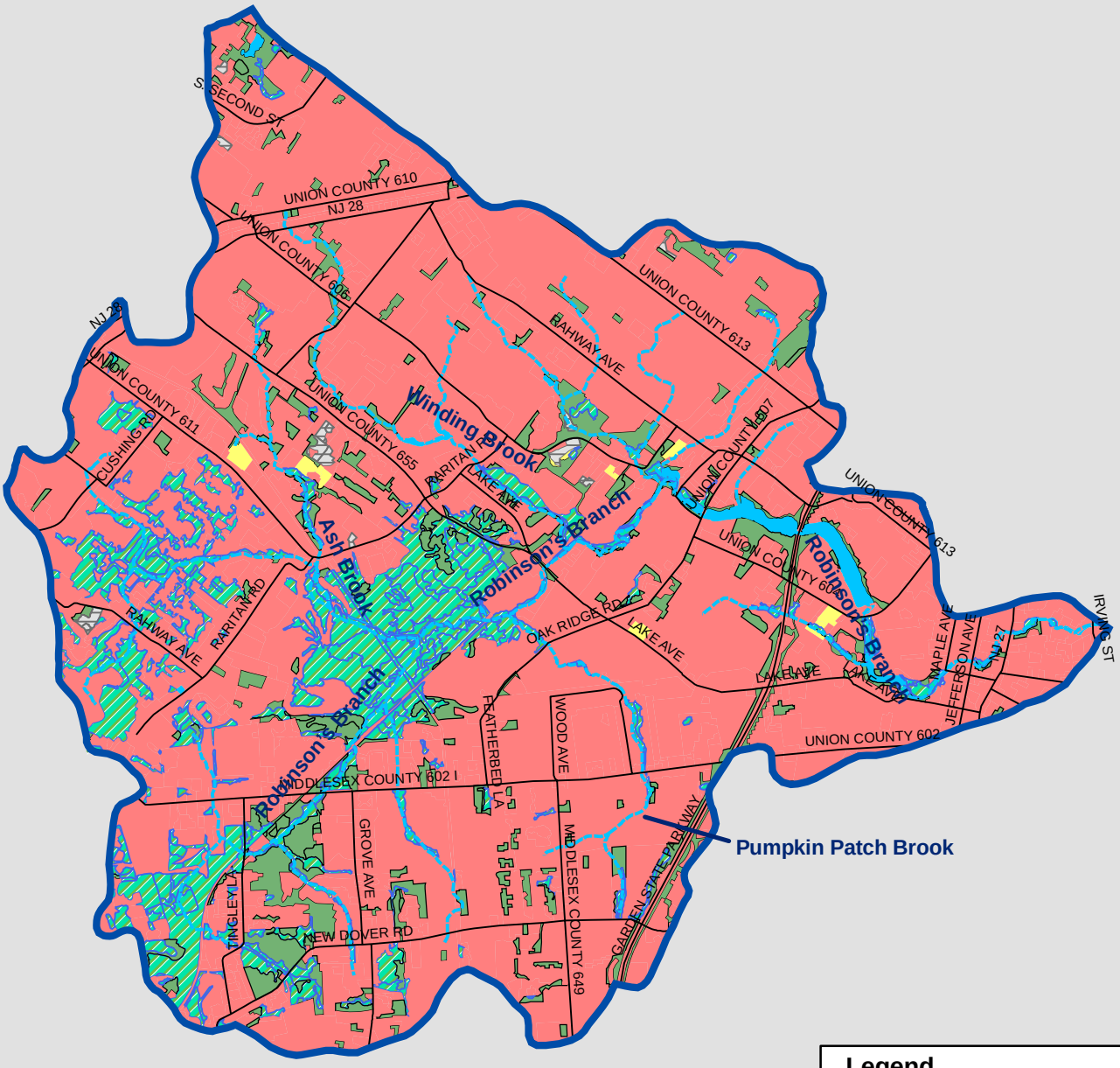

Legend

- Watershed Boundary
- Major Roads
- Rivers & Streams
- Agriculture
- Barren Land
- Forest
- Urban
- Water
- Wetlands

MAP 3 - EXISTING LAND USES

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1995/1997 Land Use/Land Cover; NJDEP 1996 GIS Data CD-ROM

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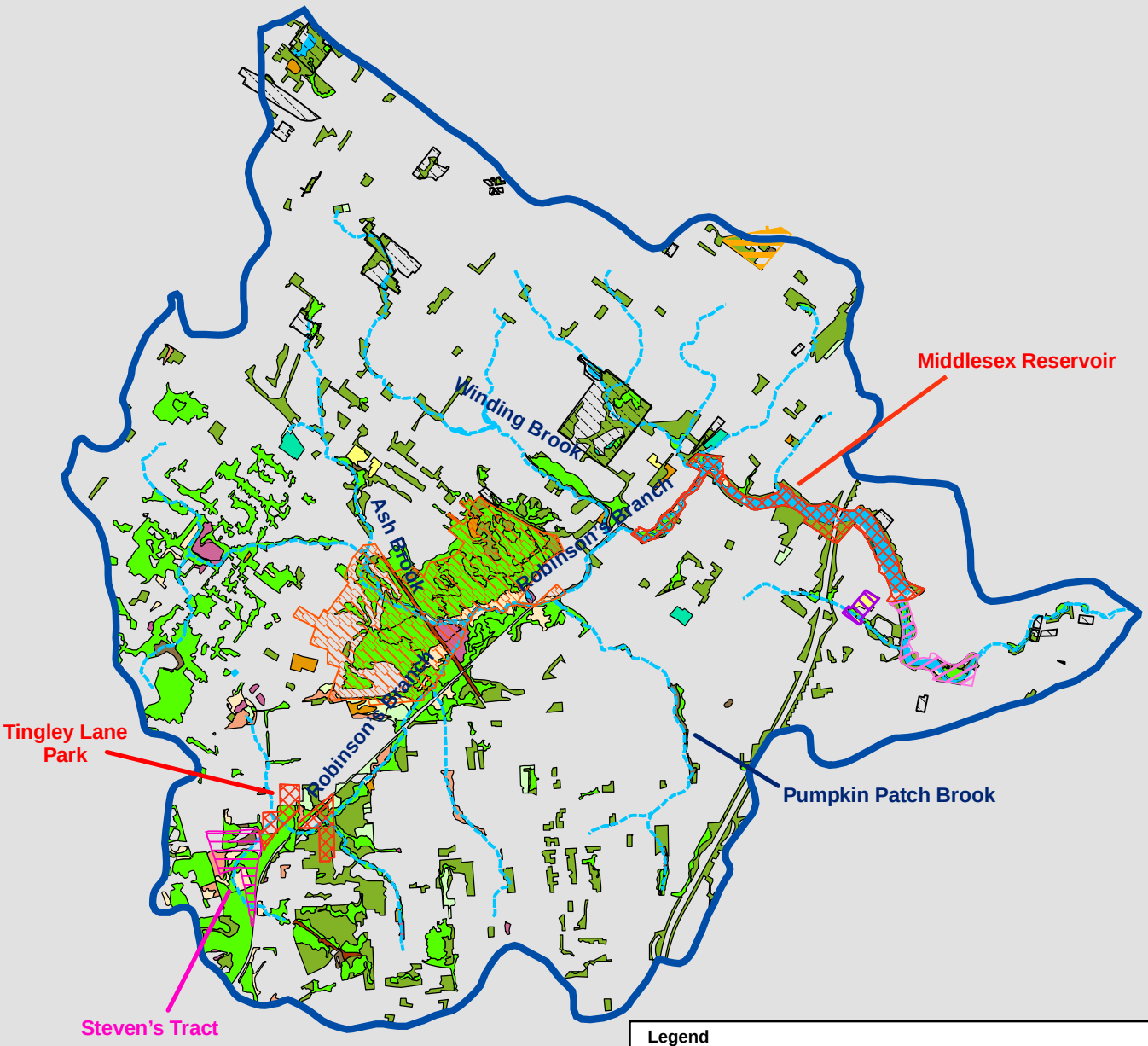

Legend

- Watershed Boundary
- Rivers & Streams
- Lakes
- Federally-Owned Open Space
- State-Owned Open Space
- Municipal Parks

County Parks

- Ash Brook Reservation
- Milton Lake Park
- Peter J. Esposito Park
- Unami Park

Vegetation

- Coniferous Forest
- Cropland & Pastureland
- Deciduous Brush/Shrubland
- Deciduous Forest
- Deciduous Scrub/Shrub Wetlands
- Deciduous Wooded Wetlands
- Disturbed Wetlands
- Herbaceous Wetlands
- Managed Wetlands
- Mixed Deciduous/Coniferous Brush/Shrubland
- Mixed Forest
- Old Field
- Orchards/Vineyards/Nurseries/Horticultural Areas
- Wetland Rights-of-Way

MAP 4 - VEGETATION & OPEN SPACE MAP
Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1995/1997 Land Use/Land Cover; NJDEP 1996 GIS Data CD-ROM; CRSSA Open Space Data (08/2001); Union County Office of GIS 2005 Open Space Data

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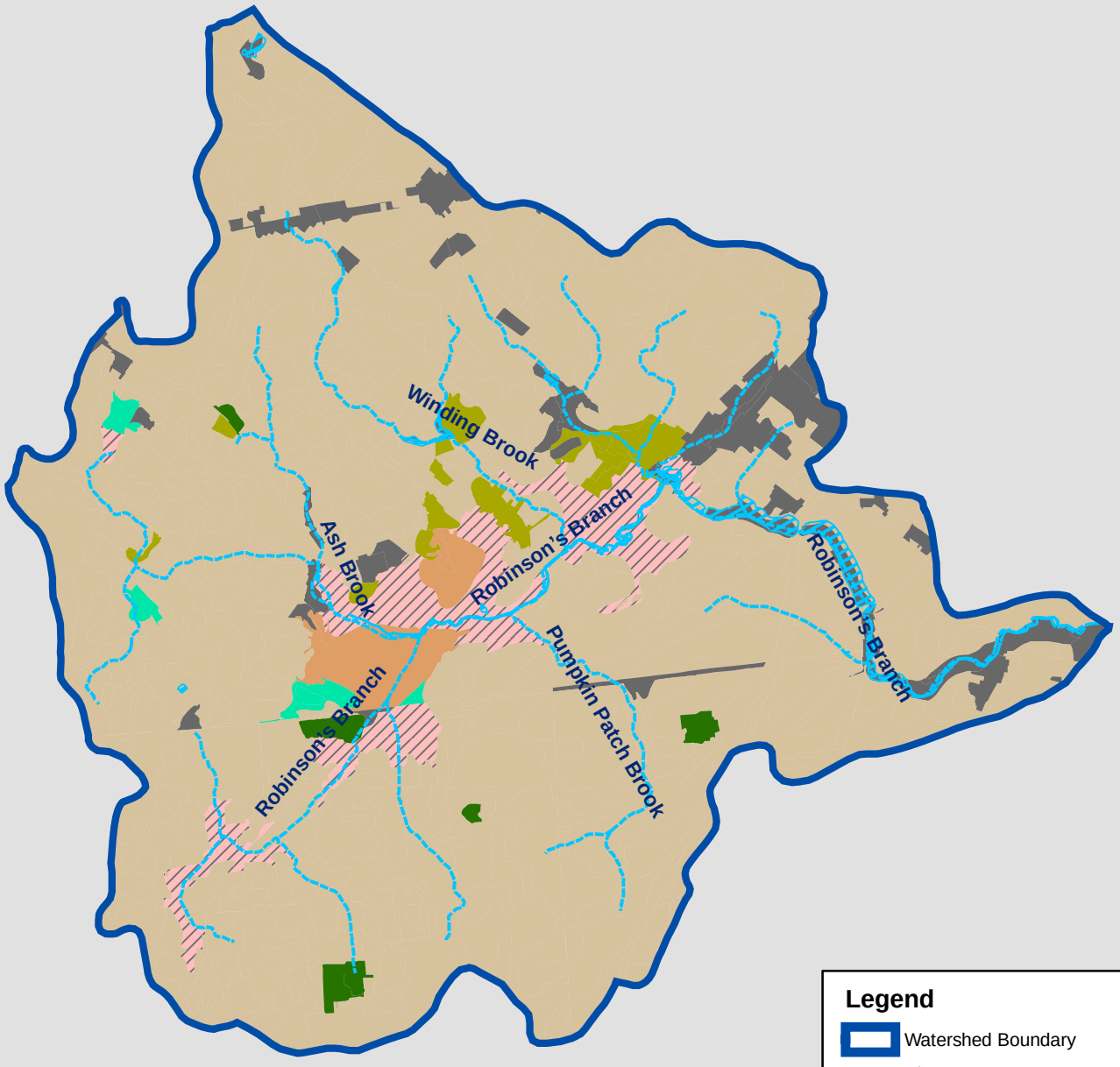

Legend

- Watershed Boundary
- Rivers & Streams
- Lakes

Hydrologic Soil Group

- Unclassified
- A: High Infiltration Rate
- A/D
- B: Moderate Infiltration Rate
- C: Slow Infiltration Rate
- C/D
- D: Very Slow Infiltration Rate

MAP 5 - HYDROLOGIC SOIL GROUP MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJGS 2000 Groundwater Recharge Data; NJDEP 1996 GIS Data CD-ROM

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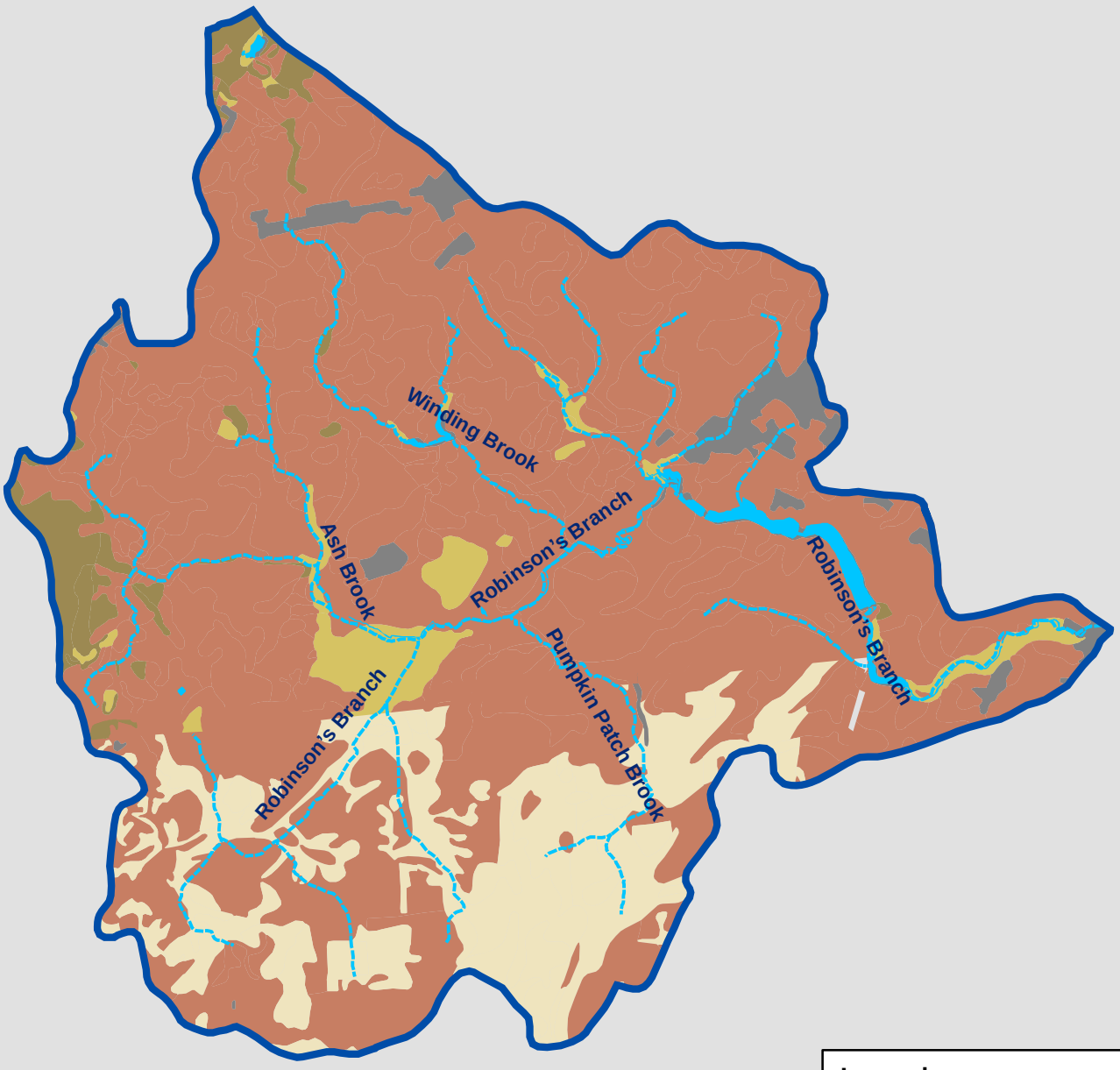

Legend

- Watershed Boundary
- Rivers & Streams
- Lakes
- Unclassified

Soil Erodibility

- Urban Land/Water
- Highly Erodible Land
- Not Highly Erodible Land
- Potentially Highly Erodible Land

MAP 6 - SOIL ERODIBILTY MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: USDA NRCS Soil Survey Geographic (SSURGO) Data for Union and Middlesex Counties; NJDEP 1996 GIS Data CD-ROM

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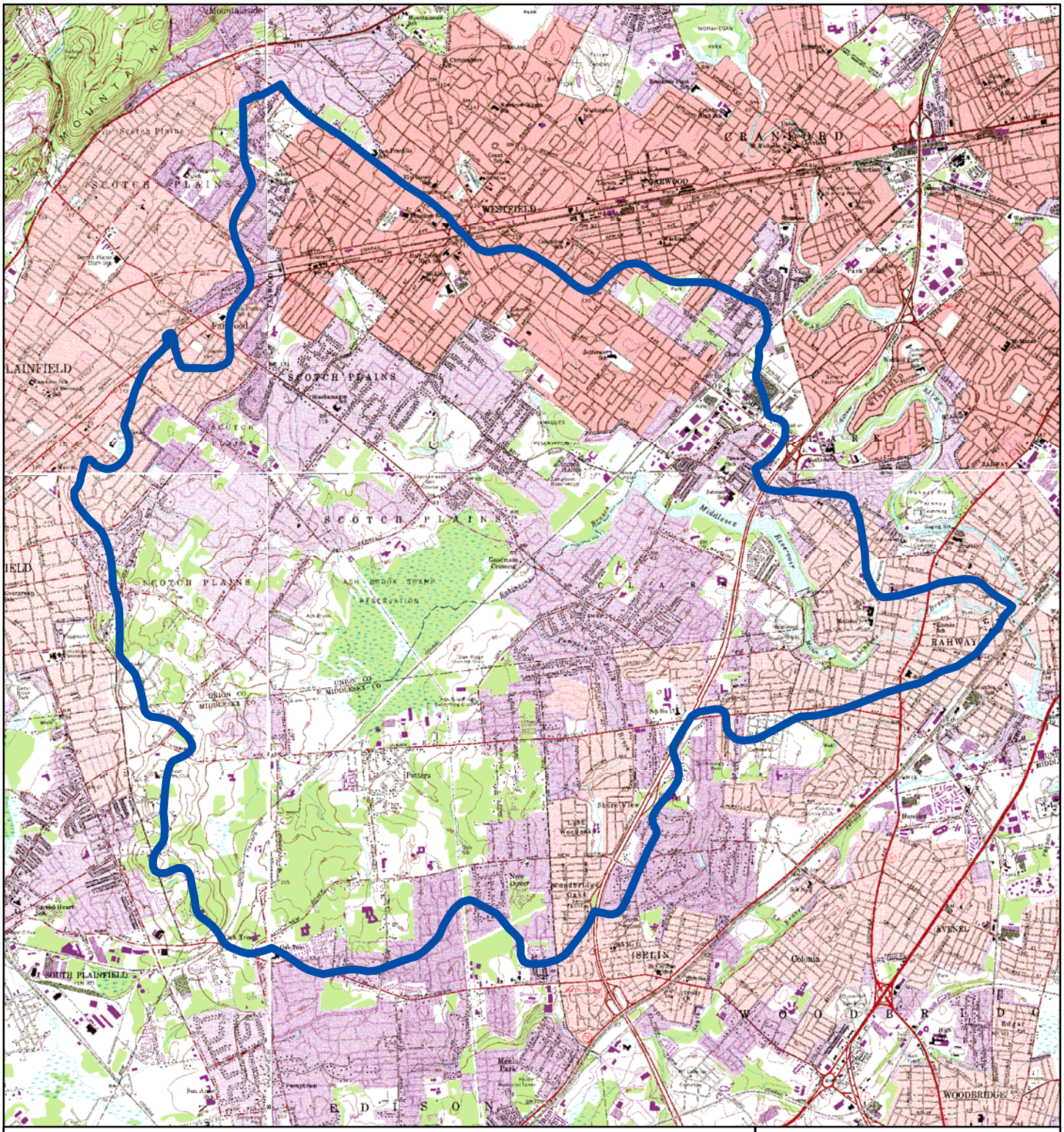

MAP 7 - USGS QUADRANGLE MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; USGS 7.5' Topographic Quadrangles, Chatham-NJ, Perth Amboy-NJ-NY, Plainfield-NJ, Roselle-NJ

Legend

Watershed Boundary

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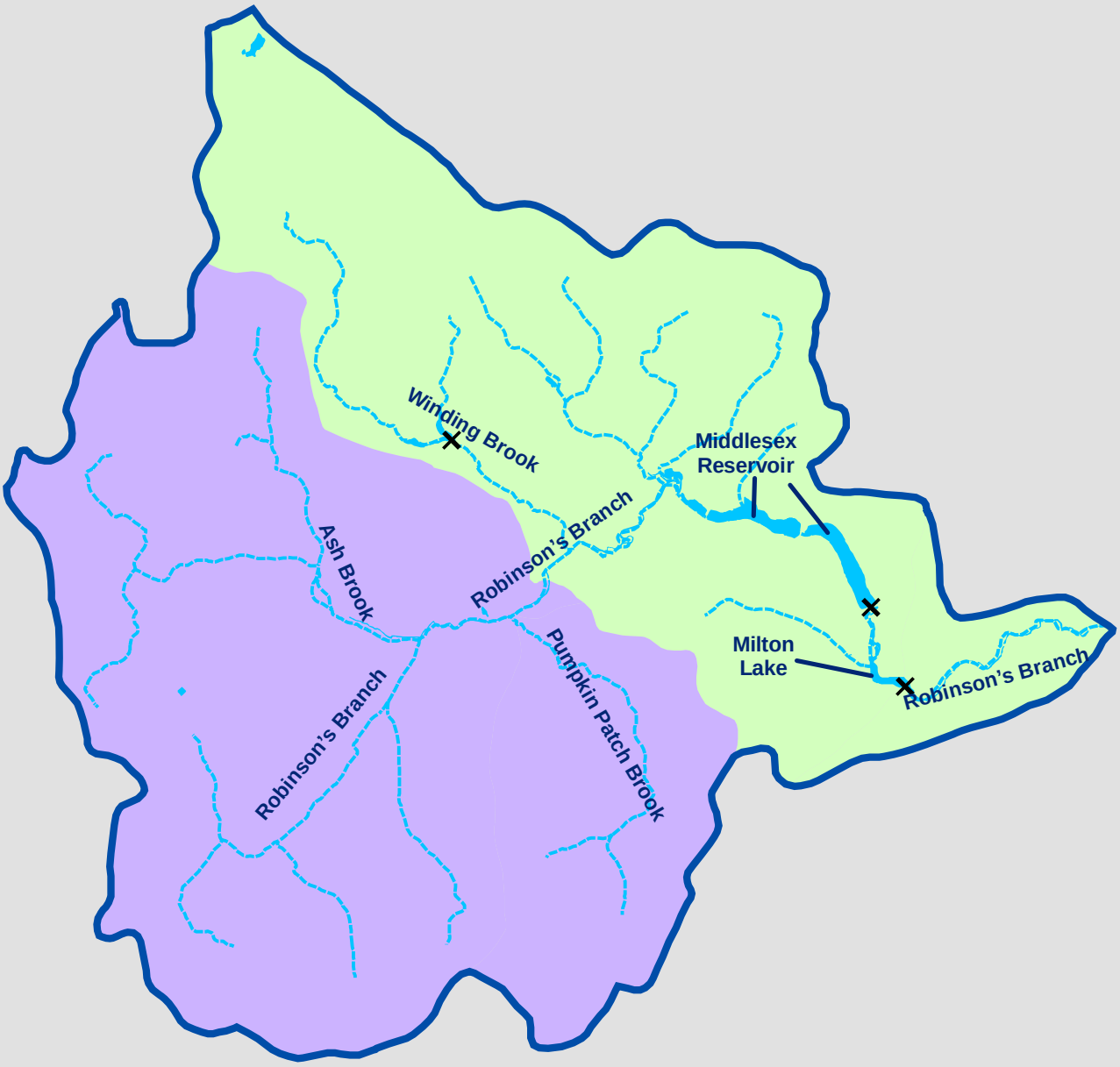

Legend

- Watershed Boundary
- Rivers & Streams (Labeled)
- Lakes (Labeled)
- Dams

Subwatersheds

- Upper (02030104050070)
- Lower (02030104050080)

MAP 8 - WATERBODIES MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1995/1997 Land Use/Land Cover; NJDEP 1996 GIS Data CD-ROM

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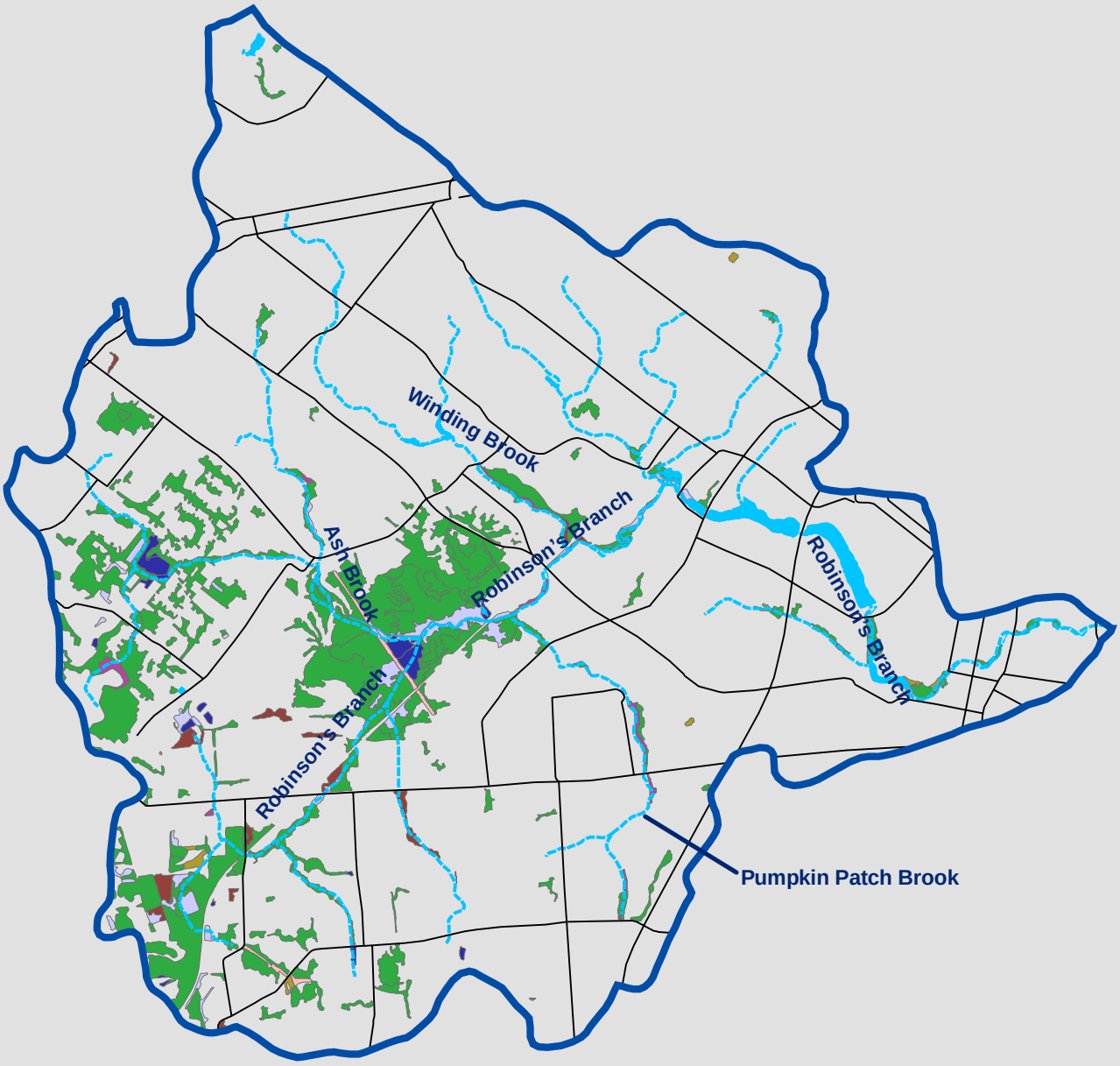

Legend

- Watershed Boundary
- Major Roads
- Rivers & Streams
- Lakes
- Deciduous Scrub/Shrub Wetlands
- Deciduous Wooded Wetlands
- Disturbed Wetlands
- Herbaceous Wetlands
- Managed Wetlands in Built-Up Maintained Rec Area
- Managed Wetlands in Maintained Lawn Greespace
- Wetland Rights-of-Way

MAP 9 - WETLANDS MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1995/1997 Land Use/Land Cover; NJDEP 1996 GIS Data CD-ROM

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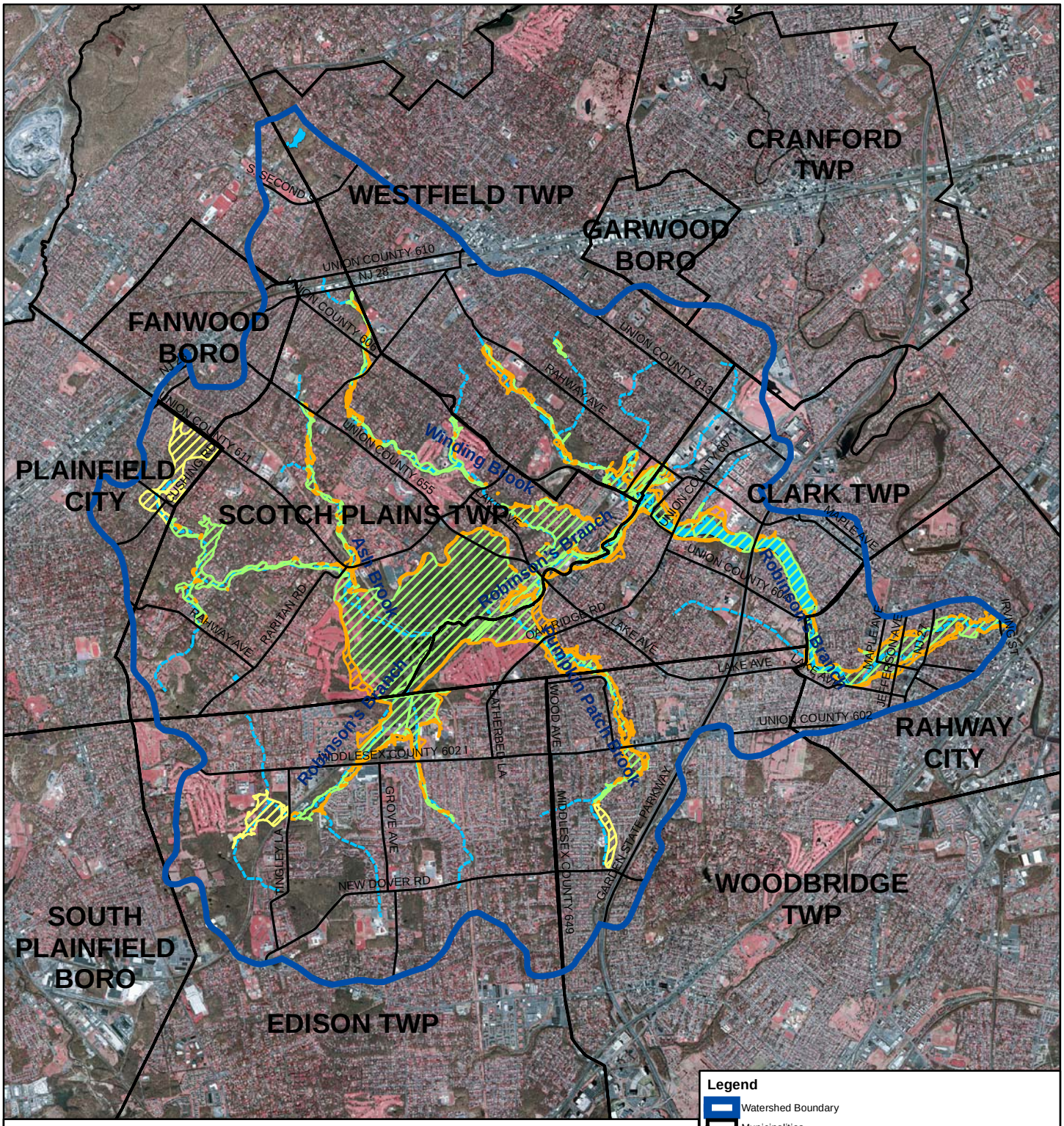

Legend

- Watershed Boundary
- Municipalities
- Major Roads
- Rivers & Streams
- Lakes

Flood Zone

- A (Areas of 100-Year Flood; No Base Flood Elevation Determined)
- AE (Areas Subject to Inundation by 100-Year Flood Events)
- X500 (Areas Subject to Inundation by 500-Year Flood Events)

MAP 10 - FLOODPLAIN AREA MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; FEMA 1996 Q3 Flood Data

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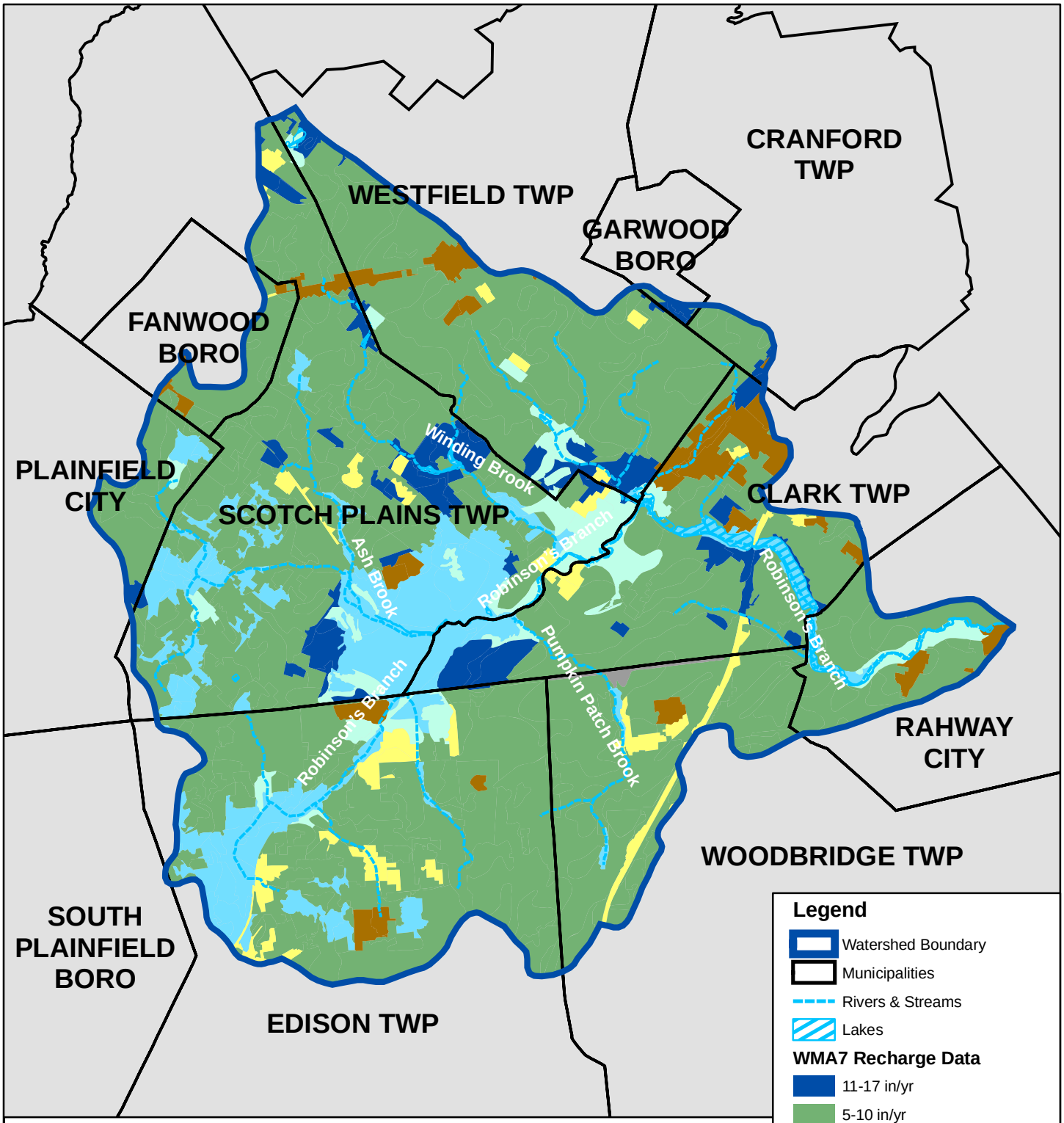

MAP 11 - GROUNDWATER RECHARGE MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJGS 2000 Groundwater Recharge Data; NJDEP 1996 GIS Data CD-ROM

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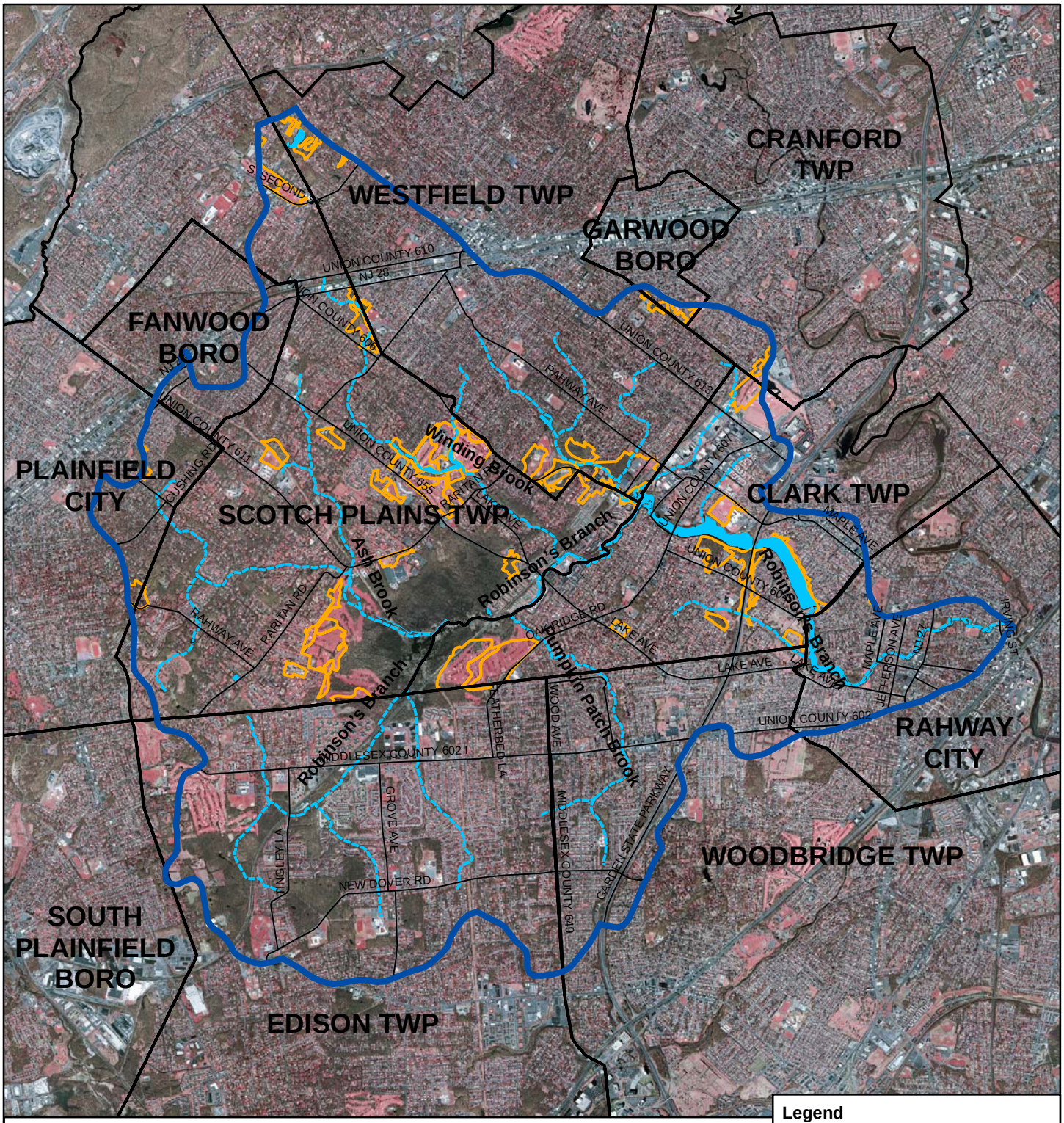

MAP 11A - HIGH GROUNDWATER RECHARGE AREAS MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 2002 Digital Orthophotos; NJGS 2000 Groundwater Recharge Data; NJDEP 1996 GIS Data CD-ROM

Legend

- Watershed Boundary
- Municipalities
- Major Roads
- Rivers & Streams
- Lakes
- Areas with High Ground Water Recharge

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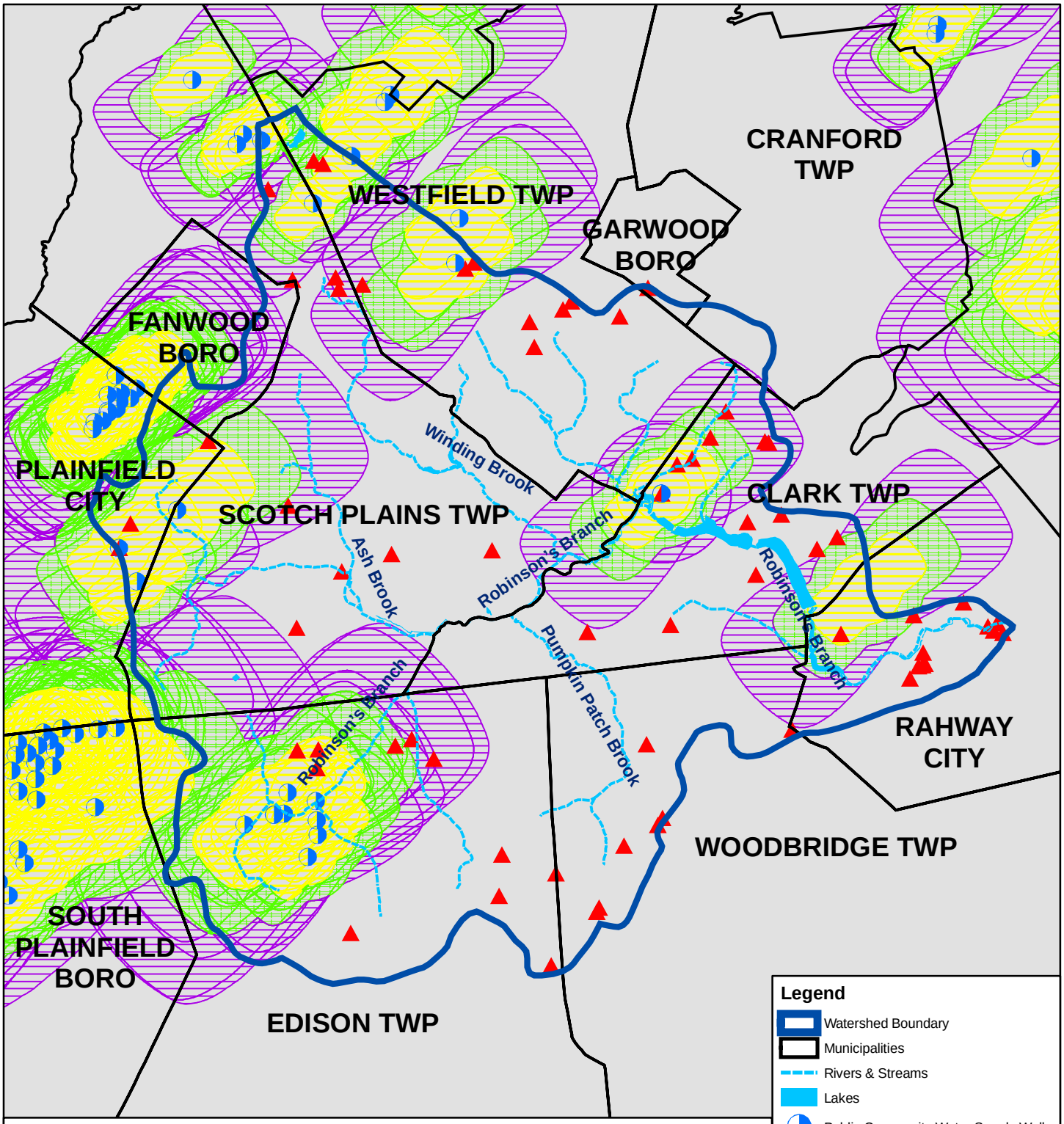

MAP 12 - WELLHEAD PROTECTION AREAS MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; NJDEP WHPA 2002; NJGS PCWS 1997; NJDEP KCS List 2001

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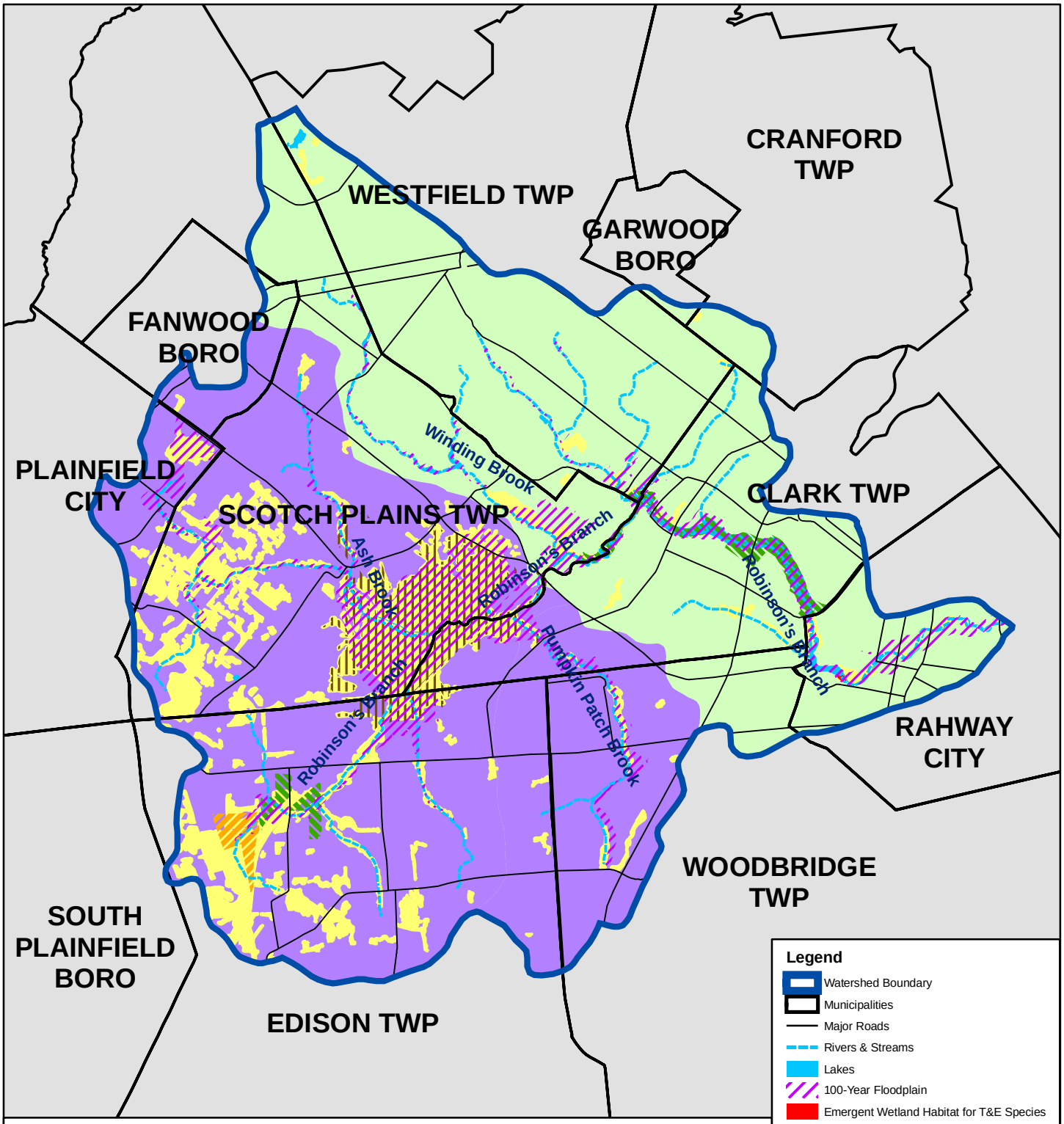
F: 732-932-8644



MAP 13 - ENVIRONMENTALLY CONSTRAINED AREAS MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; 1995/1997 NJDEP Land Use/Land Cover; CRSSA Open Space Data (08/2001); NJDEP Landscape Project 2001; FEMA 1996 Q3 Flood Data

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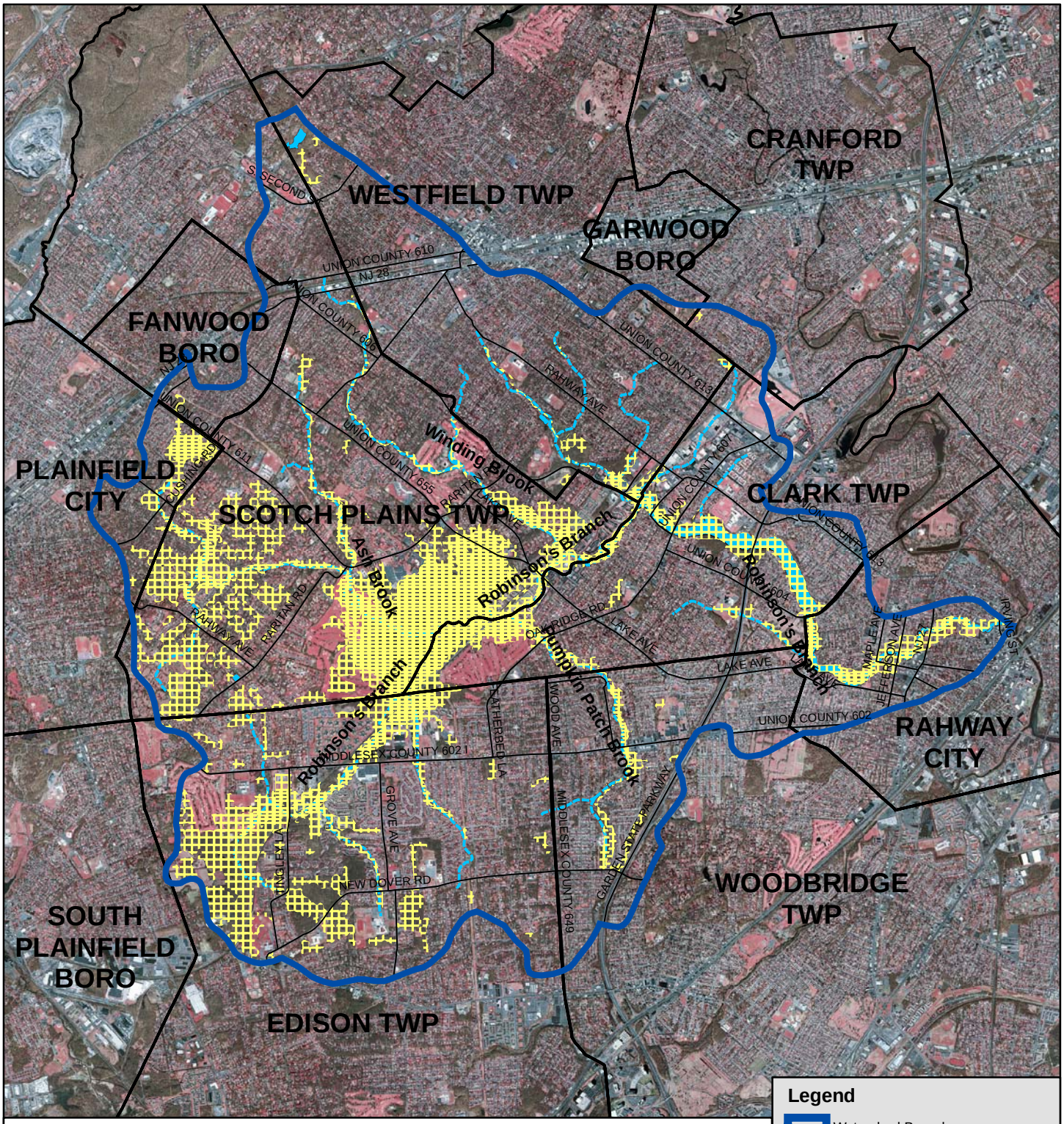

MAP 13A - ENVIRONMENTALLY CONSTRAINED AREAS AERIAL MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 2002 Digital Orthophotos; NJDEP 1996 GIS Data CD-ROM; 1995/1997 NJDEP Land Use/Land Cover; CRSSA Open Space Data (08/2001); NJDEP Landscape Project 2001

Legend

- Watershed Boundary
- Municipalities
- Major Roads
- Rivers & Streams
- Lakes
- Environmentally Constrained Areas

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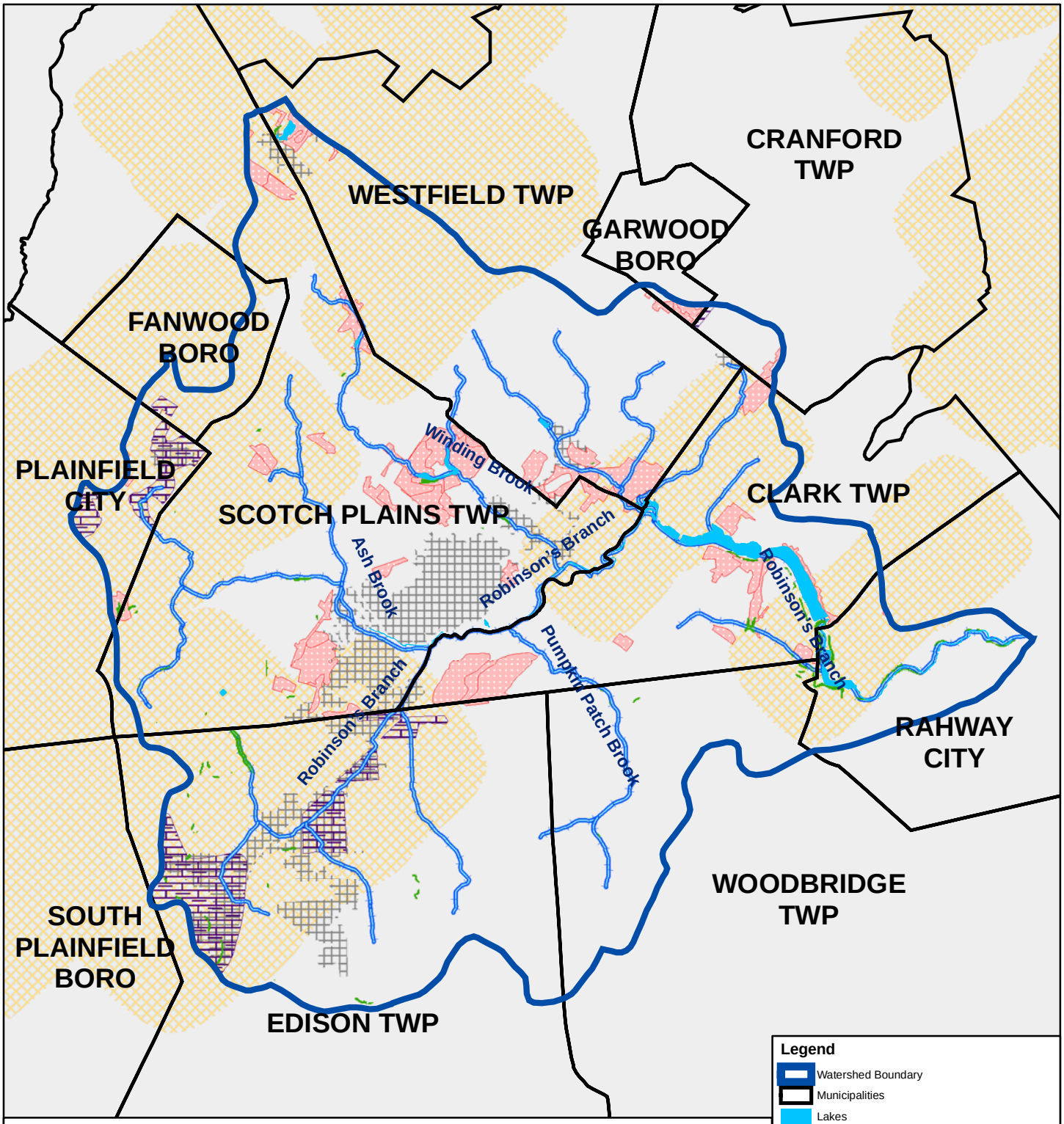

MAP 14 - ENVIRONMENTALLY CRITICAL AREAS MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; NJDEP Landscape Project 2001; NJDEP 10m Digital Elevation Grid, 2002; NJ State Development & Redevelopment Plan, 2001; NJDEP WHPA 2002

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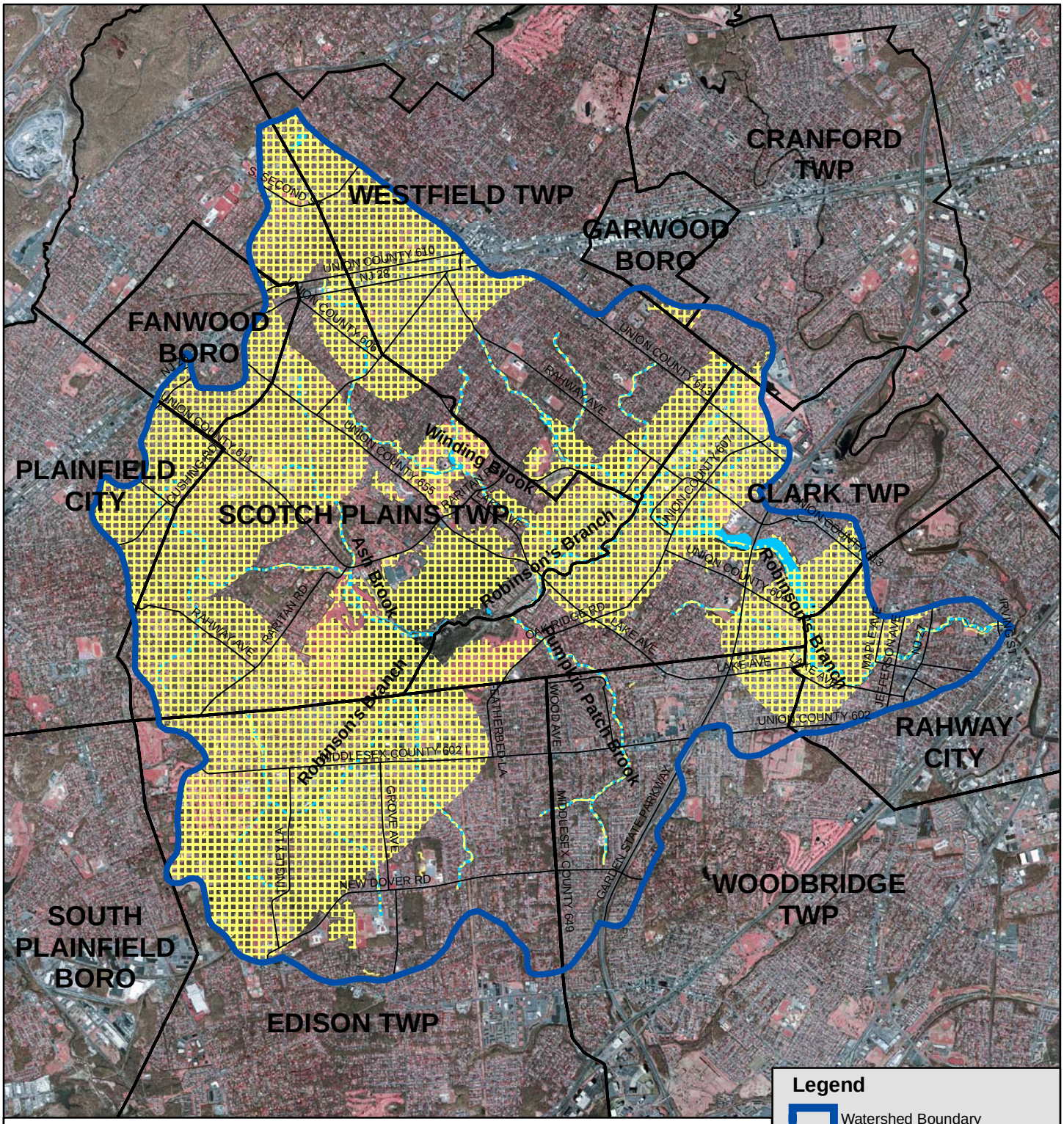

MAP 14A - ENVIRONMENTALLY CRITICAL AREAS AERIAL MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 2002 Digital Orthophotos; NJDEP 1996 GIS Data CD-ROM; NJDEP Landscape Project 2001; NJDEP 10m Digital Elevation Grid, 2002; NJ State Development & Redevelopment Plan, 2001; NJDEP WHPA 2002

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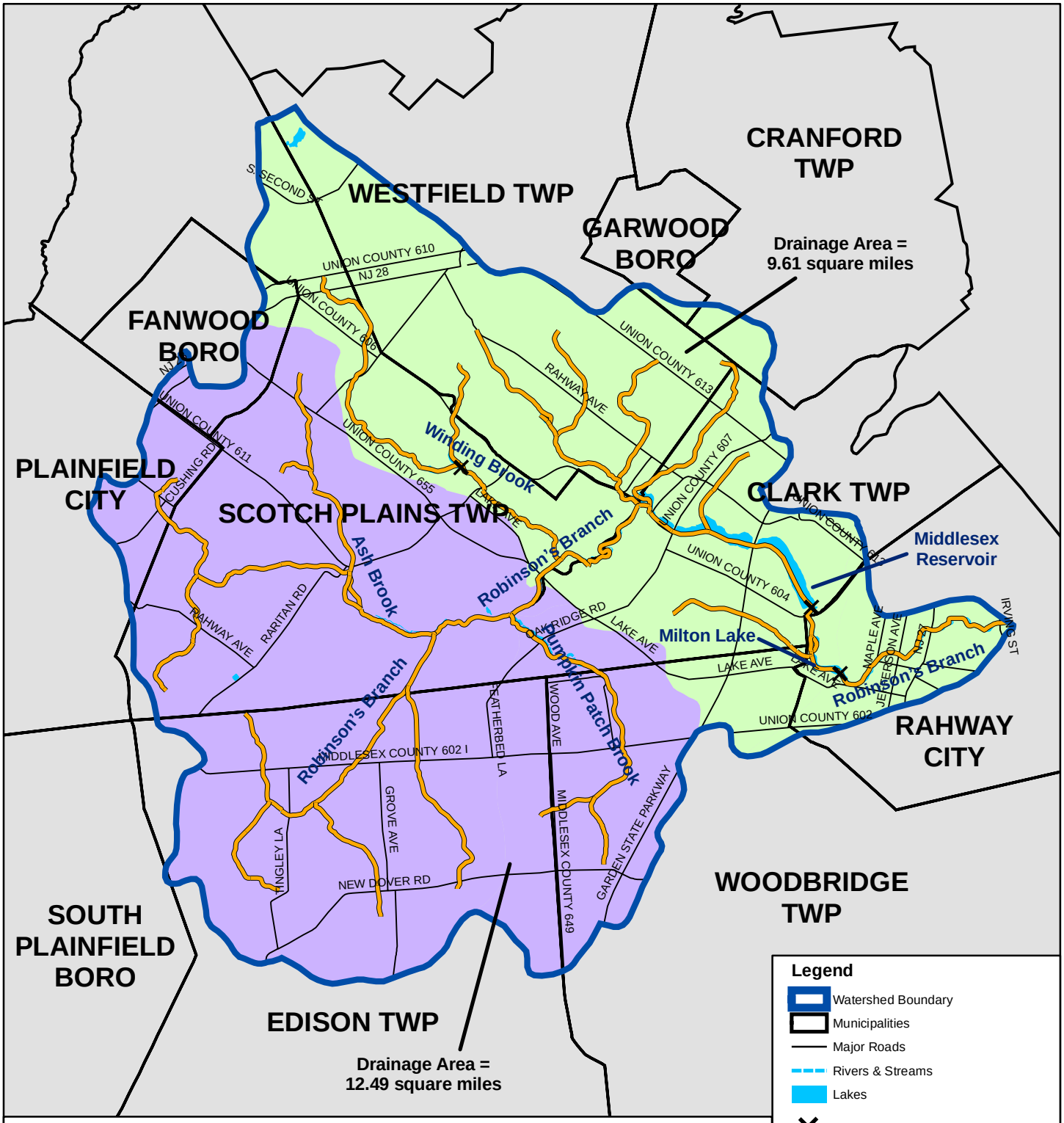

MAP 15 - WATERBODY CLASSIFICATION MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; NJDEP Surface Water Quality Standards 2003

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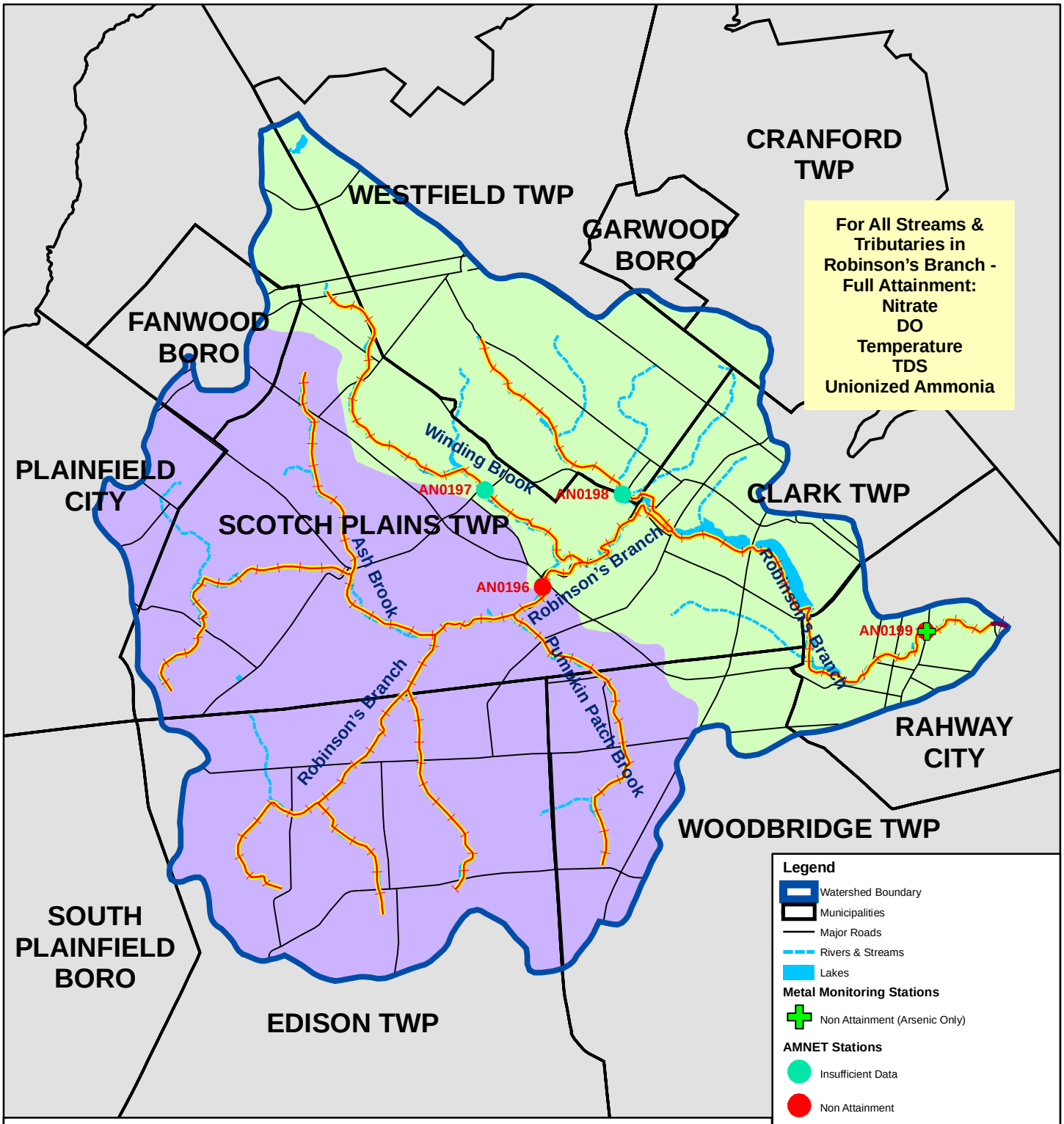

MAP 16 - 2004 IMPAIRED WATERBODIES MAP

Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; NJDEP 2004 List of Impaired Waterbodies

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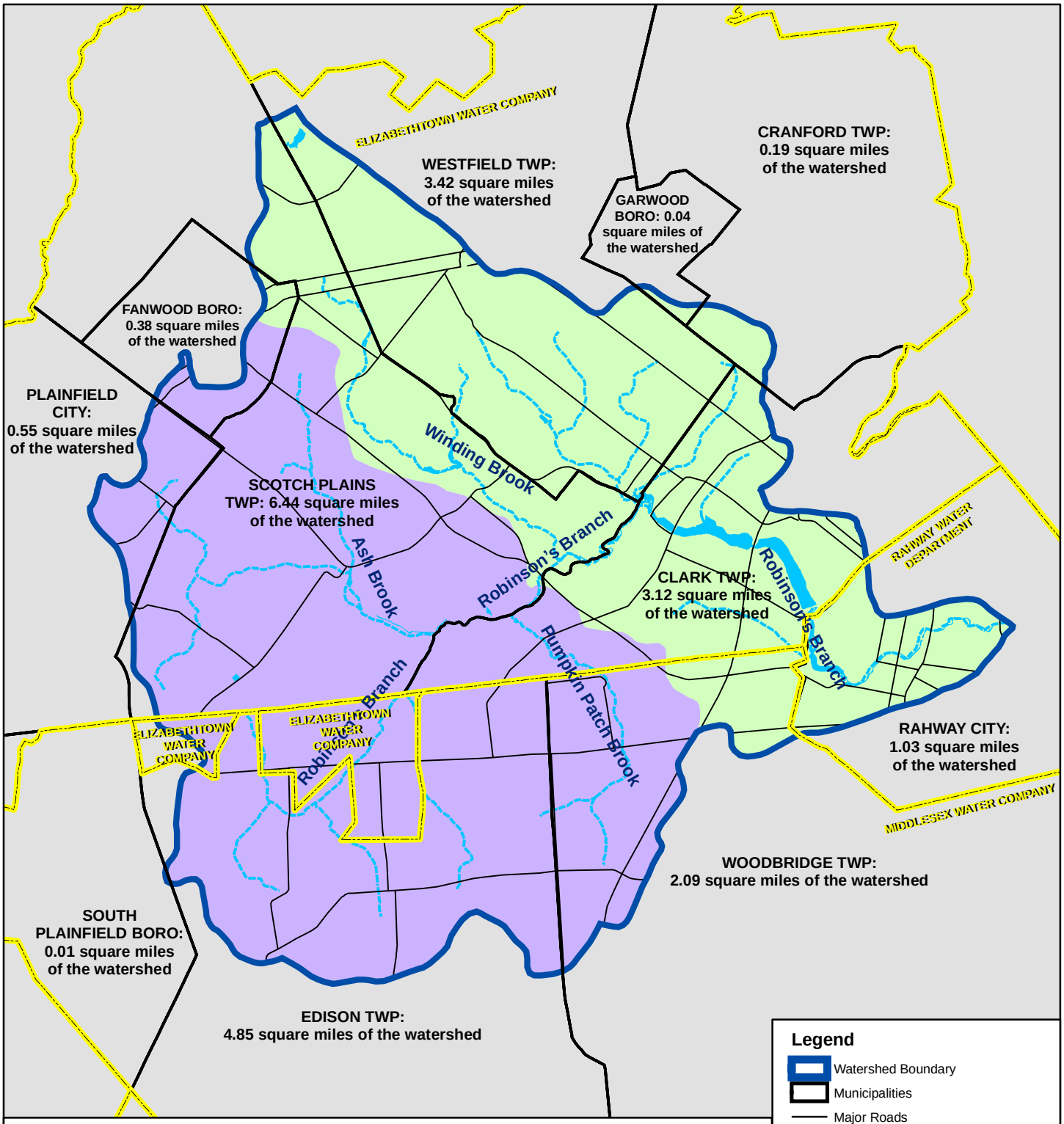

MAP 17 - JURISDICTIONAL BOUNDARIES OF THOSE AGENCIES RESPONSIBLE FOR STORMWATER MANAGEMENT
Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; NJDEP Water Purveyor Service Areas 1998

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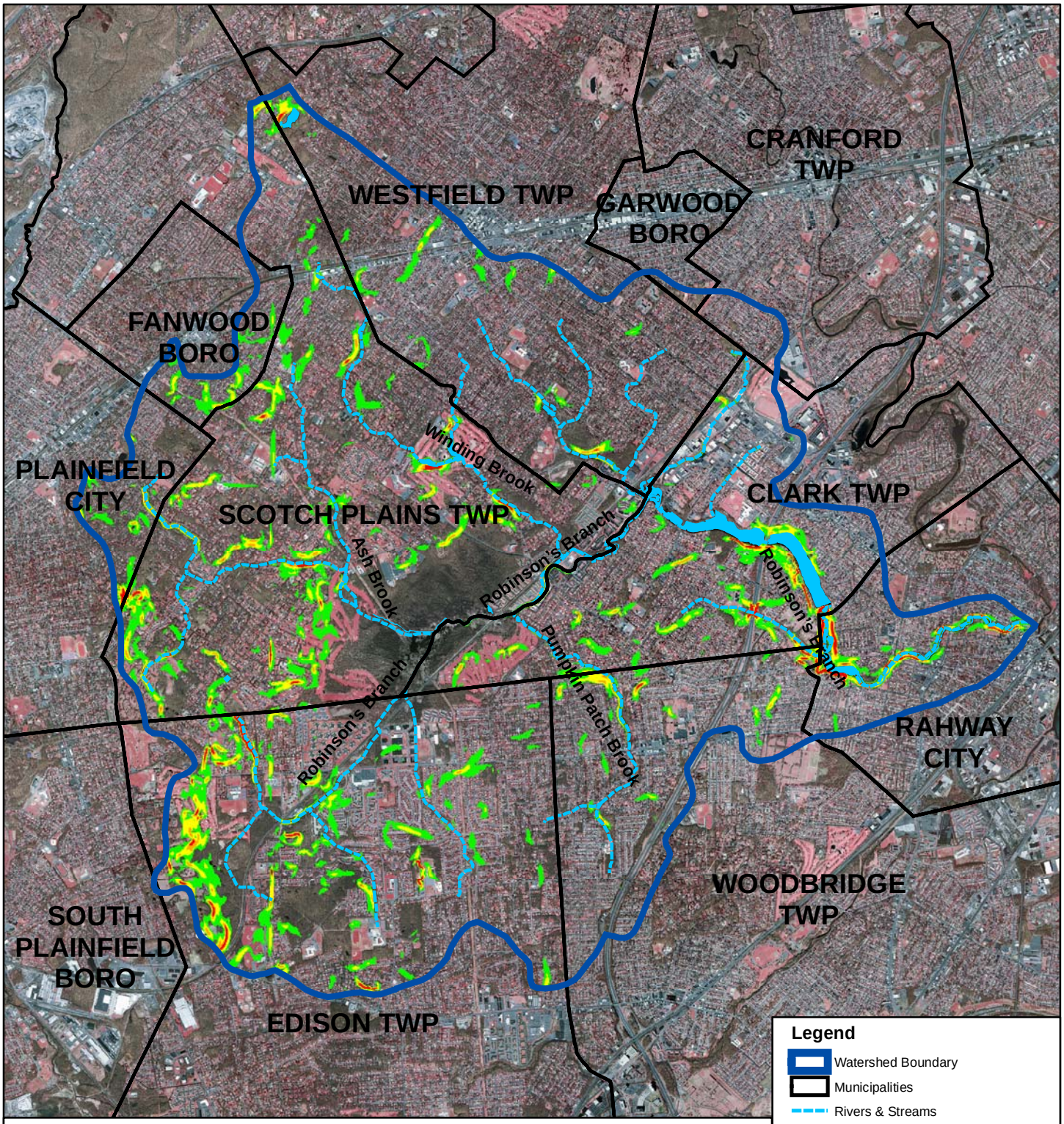
F: 732-932-8644



MAP 18 - SLOPES MAP

Robinson's Branch Regional Stormwater Management Plan

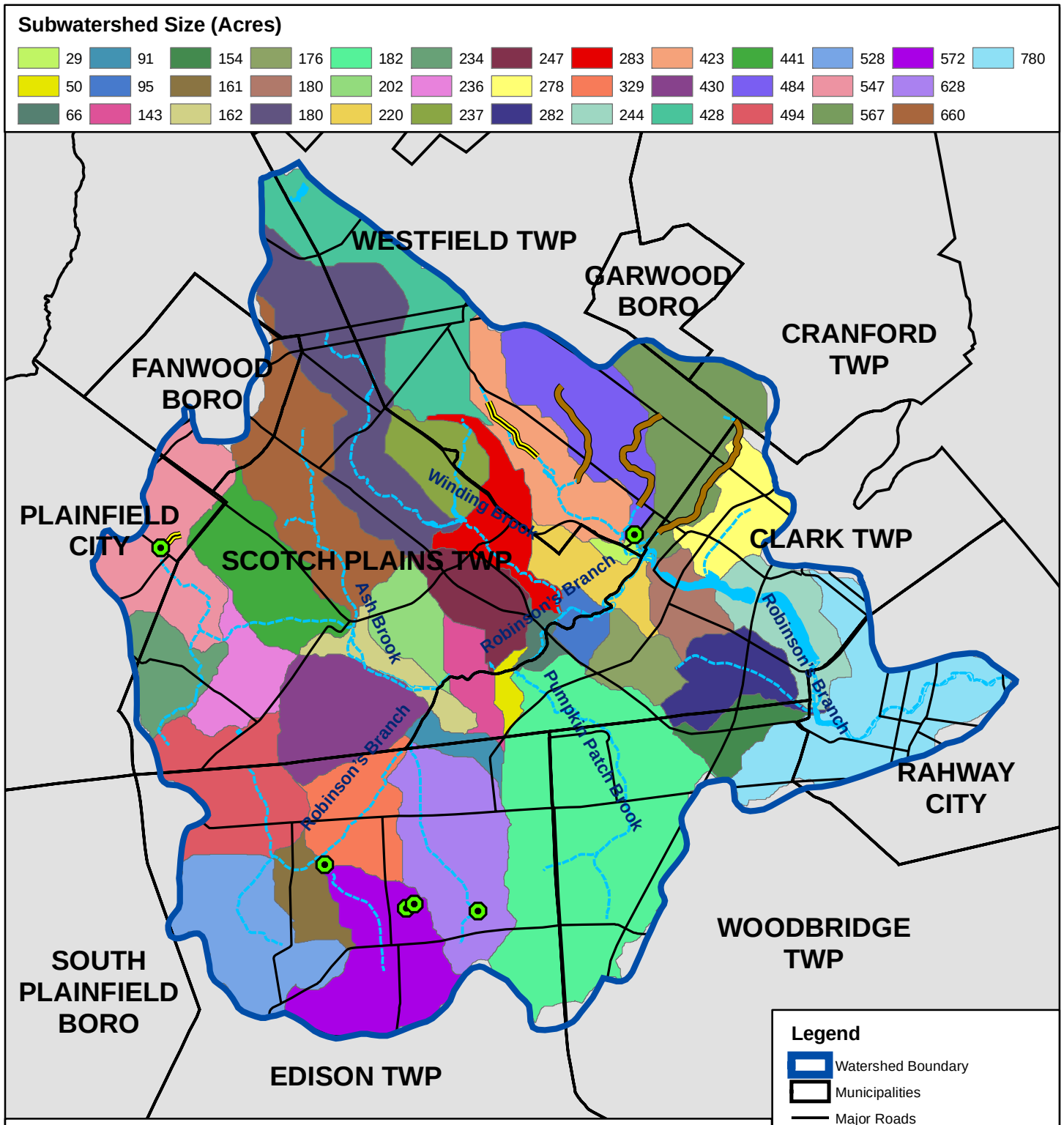
Data Source: NJDEP 2002 Digital Orthophotos; NJDEP 1996 GIS Data CD-ROM; NJDEP 10m Digital Elevation Grid, 2002

NEW JERSEY AGRICULTURAL EXPERIMENT STATION
RUTGERS COOPERATIVE RESEARCH & EXTENSION

Rutgers University
RCRE Water Resources Program
14 College Farm Road
New Brunswick, NJ 08901
T: 732-932-9011
F: 732-932-8644

N W E S

0 4,400 Feet



MAP 19 - MAN-MADE STORMWATER CONVEYENCE, STORAGE, & DISCHARGE SYSTEMS
Robinson's Branch Regional Stormwater Management Plan

Data Source: NJDEP 1996 GIS Data CD-ROM; GPS Mapping Completed by RCRE Water Resources Program 2004; Subwatersheds delineated by HEC-RAS model
* RCRE Water Resources Program acknowledges that this stormwater conveyance map is incomplete.

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RUTGERS COOPERATIVE RESEARCH & EXTENSION

Rutgers University
RCRE Water Resources Program
14 College Farm Road
New Brunswick, NJ 08901
T: 732-932-9011
F: 732-932-8644

Appendix C:

NJDEP Known Contaminated Sites List within the Robinson's Branch Watershed

Status	Date of Status Reporting	Name	NJ Site ID	Address	Municipality	Lead Agency	Level of Remediation
ACTIVE	2001	1391 TERRILL RD	NJL800501546	1391 TERRILL RD	SCOTCH PLAINS TOWNSHIP	BFO-N	C1
ACTIVE	2001	412 HAZEL AVENUE	NJL000059931	412 HAZEL AVE	GARWOOD BOROUGH	BFO-N	C1
ACTIVE	2001	EXXON SERVICE STATION CLARK TOWNSHIP	NJD981481328	741 RARITAN RD	CLARK TOWNSHIP	BUST	C2
ACTIVE	2000	12 HILLTOP AVE	NJL800457269	12 HILLTOP AVE	CLARK TOWNSHIP	BFO-N	
ACTIVE	2000	KARNAK CHEMICAL CORPORATION	NJD002443752	330 CENTRAL AVE	CLARK TOWNSHIP	BFO-S	C2
ACTIVE	2000	38 FOLEY AVE	NJL800552937	38 FOLEY AVE	EDISON TOWNSHIP	BFO-S	C1
ACTIVE	2000	41 MIDWOOD AVE	NJL800499527	41 MIDWOOD AVE	EDISON TOWNSHIP	BFO-S	C1
ACTIVE	2000	45 PRESCOTT TURNPIKE	NJL800186041	45 PRESCOTT TPK	CLARK TOWNSHIP	BFO-N	C1
PENDING	2000	459 GROVE STREET	NJL000060210	459 GROVE ST	WESTFIELD TOWN	BFO-N	C1
ACTIVE	2000	ST GERTRUDE ROMAN CATHOLIC CEMETARY	NJL600235279	53 INMAN AVE	WOODBRIDGE TOWNSHIP	BUST	C2
ACTIVE	2000	85 FAIR HILL DR	NJL800613887	85 FAIR HILL DR	WESTFIELD TOWN	BFO-N	C1
ACTIVE	2000	EXXON SERVICE STATION WOODBRIDGE TWP	NJD986595601	GS PWY & SYCAMORE RD	WOODBRIDGE TOWNSHIP	BUST	C2
ACTIVE	2000	ELIZABETHTOWN WATER COMPANY ELKS WELL	NJL000034579	OLD RARITAN RD	CLARK TOWNSHIP	BFO-CA	C3
ACTIVE	1999	1171 INMAN AVENUE	NJL600048003	1171 INMAN AVE	EDISON TOWNSHIP	BUST	C2
ACTIVE	1999	MOBIL SERVICE STATION SCOTCH PLAINS TWP	NJD986608883	2239 NORTH AVE	SCOTCH PLAINS TOWNSHIP	BUST	C2
ACTIVE	1999	AMOCO SERVICE STATION WESTFIELD TOWN	NJD986613073	416 SOUTH AVE	WESTFIELD TOWN	BUST	C2

Status	Date of Status Reporting	Name	NJ Site ID	Address	Municipality	Lead Agency	Level of Remediation
ACTIVE	1999	68 LEFFERTS LANE	NJL800381790	68 LEFFERTS LN	CLARK TOWNSHIP	BFO-N	
ACTIVE	1999	EXXON SERVICE STATION WOODBRIDGE TWP	NJD986599256	78 GS PWY S	WOODBRIDGE TOWNSHIP	BUST	C2
ACTIVE	1999	784 GARDEN STREET	NJL000060970	784 GARDEN ST	RAHWAY CITY	BFO-N	C1
ACTIVE	1999	973 WOODMERE DR	NJL800606212	973 WOODMERE DR	WESTFIELD TOWN	BFO-N	C1
NFA-A	1998	GULF SERVICE STATION CLARK TOWNSHIP	NJC876017765	1208 RARITAN RD	CLARK TOWNSHIP	BUST	C2
ACTIVE	1998	COSMAIR INCORPORATED	NJL500045034	200 TO 222 TERMINAL AVE	CLARK TOWNSHIP	BFO-N	C2
ACTIVE	1998	TORCON INCORPORATED	NJL800463861	215 GROVE ST E	WESTFIELD TOWN	BUST	C2
ACTIVE	1998	CHARLIE BROWNS RESTAURANT	NJL000057034	2376 NORTH AVE	SCOTCH PLAINS TOWNSHIP	BFO-N	C1
ACTIVE	1998	7 RAMSEY ROAD	NJL800002594	7 RAMSEY RD	EDISON TOWNSHIP	BFO-S	C1
ACTIVE	1998	SHELL SERVICE STATION WOODBRIDGE TWP	NJD986594174	82 GS PWY S	WOODBRIDGE TOWNSHIP	BUST	C2
ACTIVE	1998	870 TO 890 SAINT GEORGES AVENUE	NJL840000442	870 TO 890 SAINT GEORGES AVE	RAHWAY CITY	BFO-N	C2
PENDING	1998	ASHBROOK GOLF COURSE	NJL600053896	RARITAN RD	SCOTCH PLAINS TOWNSHIP	BUST	C2
ACTIVE	1997	SERVICE STATION RAHWAY CITY	NJD075148403	1019 SAINT GEORGES AVE	RAHWAY CITY	BFO-N	C1
ACTIVE	1997	28 DENMAN AVE	NJL800585259	28 DENMAN AVE	CLARK TOWNSHIP	BFO-N	
ACTIVE	1997	412 EVERSON PL	NJL800539025	412 EVERSON PL	WESTFIELD TOWN	BFO-N	C1
ACTIVE	1997	MARTINE AVENUE LANDFILL	NJL900001413	MARTINE AVE	SCOTCH PLAINS TOWNSHIP	BFO-CA	C3
ACTIVE	1996	MAPLE CREST SERVICE STATION	NJD986601128	1144 SOUTH AVE	WESTFIELD TOWN	BFMCR	C2
PENDING	1996	21 JANINA AVENUE	NJL800400236	21 JANINA AVE	EDISON TOWNSHIP	CEHA	C1
ACTIVE	1995	7 SEMINARY AVE	NJL800409781	7 SEMINARY AVE	RAHWAY CITY	BFO-N	

Status	Date of Status Reporting	Name	NJ Site ID	Address	Municipality	Lead Agency	Level of Remediation
PENDING	1995	FRANK MILLMAN DISTRIBUTORS INCORPORATED	NJL600042105	8 PROGRESS ST	EDISON TOWNSHIP	BUST	C2
PENDING	1995	TEXACO SERVICE STATION WOODBRIDGE TWP	NJD986580769	GS PWY	WOODBRIDGE TOWNSHIP	BUST	B
ACTIVE	1995	ELIZABETHTOWN WC WESTFIELD WELLFIELD	NJL000034710	WESTFIELD & SOUTH AVES & ELM ST	WESTFIELD TOWN	BFO-CA	C3
ACTIVE	1994	UNION COUNTY VOTECH	NJL800325615	1776 RARITAN RD	SCOTCH PLAINS TOWNSHIP	BUST	B
ACTIVE	1994	RAHWAY COAL GAS (ETG)	NJD981082944	219 TO 245 CENTRAL AVE	RAHWAY CITY	BCM	C3
ACTIVE	1994	4A AUTOMOTIVE	NJL000036749	2590 PLAINFIELD AVE	SCOTCH PLAINS TOWNSHIP	BUST	B
PENDING	1994	39 LOCUST GROVE DRIVE	NJL000070839	39 LOCUST GROVE DR	CLARK TOWNSHIP	BFO-CA	C1
ACTIVE	1994	55 MERCURY AVENUE	NJL800353815	55 MERCURY AVE	WOODBRIDGE TOWNSHIP	BFO-S	C1
ACTIVE	1994	GOSSELIN ENTERPRISES	NJL800044208	660 NEW DOVER RD	EDISON TOWNSHIP	BFO-S	C2
PENDING	1993	AMOCO SERVICE STATION CLARK TOWNSHIP	NJL600027825	104 WESTFIELD AVE	CLARK TOWNSHIP	BUST	C2
PENDING	1993	MARSHALLS CLEANERS	NJL800236960	1110 ST GEORGES AVE	RAHWAY CITY	BFO-S	C2
ACTIVE	1993	1133 BOYNTON AVENUE	NJL800443038	1133 BOYNTON AVE	WESTFIELD TOWN	BFO-N	C2
PENDING	1993	1610 COACH STREET	NJL800462756	1610 COACH ST	RAHWAY CITY	BFO-N	C1
PENDING	1993	276 HAMILTON STREET	NJL000075705	276 HAMILTON ST	RAHWAY CITY	BFO-CA	C2
PENDING	1993	322 RAHWAY RD	NJL800615122	322 RAHWAY RD	EDISON TOWNSHIP	BFO-S	C1
ACTIVE	1993	MILLER PONTIAC CADILLAC	NJD011686060	477 WEST MILTON AVE	RAHWAY CITY	BUST	B

Status	Date of Status Reporting	Name	NJ Site ID	Address	Municipality	Lead Agency	Level of Remediation
		CORPORATION GULF SERVICE STATION					
PENDING	1993	WESTFIELD TOWN	NJD986616597	800 CENTRAL AVE	WESTFIELD TOWN	BUST	C2
ACTIVE	1993	ASHBROOK FARM LANDFILL	NJD980755334	RAHWAY RD & INMAN AVE	EDISON TOWNSHIP	BFO-CA	C3
ACTIVE	1993	ELIZABETHTOWN WC WATCHUNG AVENUE WELL	NJL000034736	WATCHUNG AVE	PLAINFIELD CITY	BFO-CA	C3
PENDING	1992	AT&T TECHNOLOGIES INCORPORATED	NJD001882687	100 TERMINAL AVE	CLARK TOWNSHIP	BFO-N	C2
PENDING	1992	AMOCO SERVICE STATION RAHWAY CITY	NJC876017948	1010 ST GEORGES AVE	RAHWAY CITY	BUST	C2
PENDING	1992	1055 SLEEPY HOLLOW LN	NJL800557407	1055 SLEEPY HOLLOW LN	PLAINFIELD CITY	BFO-N	C1
PENDING	1992	UNION COUNTY ROAD DEPARTMENT	NJD986570778	2371 SOUTH AVE	SCOTCH PLAINS TOWNSHIP	BUST	C2
ACTIVE	1992	TORSIELLO & SONS	NJL000055814	27 PROGRESS ST	EDISON TOWNSHIP	BUST	C2
PENDING	1992	AMOCO SERVICE STATION PLAINFIELD CITY	NJD981486921	504 TERRILL RD	PLAINFIELD CITY	BUST	C2
ACTIVE	1992	KEMCO CORPORATION	NJD986609964	990 INMAN AVE	EDISON TOWNSHIP	BFO-S	C2
ACTIVE	1991	16 MOSES DRIVE	NJL000064055	16 MOSES DR	RAHWAY CITY	BFO-N	C1
ACTIVE	1991	POLYCHROME CORPORATION	NJD064266000	160 TERMINAL AVE	CLARK TOWNSHIP	BER-A	C2
ACTIVE	1991	1636 TO 1640 IRVING STREET	NJL800468209	1636 TO 1640 IRVING ST	RAHWAY CITY	BFO-N	
ACTIVE	1991	CLARK TOWNSHIP DEPT PUBLIC WORKS GARAGE	NJL600247613	315 WESTFIELD AVE	CLARK TOWNSHIP	BUST	B

Status	Date of Status Reporting	Name	NJ Site ID	Address	Municipality	Lead Agency	Level of Remediation
ACTIVE	1990	VACCAROS BAKERY	NJL600198071	537 INMAN AVE	WOODBRIDGE TOWNSHIP	BUST	B
ACTIVE	1988	1451 RARITAN ROAD	NJL800337826	1451 RARITAN RD	SCOTCH PLAINS TOWNSHIP	BFO-S	C1

Lead Agencies:

BEECRA	*Bureau of Environmental Evaluation, Cleanup and Responsibility Assessment*
BFO-IN	*Bureau of Field Operations - Initial Notice Section*
BFO-N	*Bureau of Field Operations - Northern*
BFO-CA	*Bureau of Field Operations - Case Assignment Section*
BSM	*Bureau of Site Management*
BUST	*Bureau of Underground Storage Tanks*

Levels of Remediation:

B	*A single-phase remedial action in response to a single contaminant category affecting only soils. Example remediations include drum removal, fencing, and temporary capping.*
C	*Ranges from 1 to 3 and may include an unknown and/or uncontrolled source or discharge. May involve groundwater contamination. There may not be a determinable timeframe for conclusion of remedial action. Examples of C1 cases include unregulated storage tank leaks.*
D	*A multi-phase remedial action in response to multiple, unknown and/or uncontrolled sources or releases affecting multiple medium which includes known contamination of groundwater. Contamination is unquantifiable, and therefore, no determinable timeframe for conclusion of remedial activities is known (NJDEP Known Contaminated Site List for NJ, 2001).*
NA	*Not available*

Appendix D: Aerial Loading Source Analysis

Loading Coefficients

NJDEP 1995/97 Land Use Type	**Aerial Loading Source Analysis: Loading Rate Coefficients**										
	TP (lbs/ac/yr)	*TN (lbs/ac/yr)*	*TSS (lbs/ac/yr)*	*NH3-N (lbs/ac/yr)*	*LEAD (lbs/ac/yr)*	*ZINC (lbs/ac/yr)*	*COPPER (lbs/ac/yr)*	*CADMIUM (lbs/ac/yr)*	*BOD (lbs/ac/yr)*	*COD (lbs/ac/yr)*	*NO2+NO3 (lbs/ac/yr)*
High/Med Residential	1.4	15	140	0.65	0.2965	0.335	0.453	N/A	25.6	152.6	1.7
Low/Rural Residential	0.6	5	100	0.02	0.217	0.172	0.19	N/A	N/A	N/A	0.1
Commercial	2.1	22	200	1.9	0.955	0.873	0.784	0.002	42.1	662.6	3.1
Industrial	1.5	16	200	0.2	1.409	1.598	0.93	0.003	31.4	N/A	1.3
Mixed Urban	1	10	120	1.75	3.215	1.743	1.529	0.0025	67.2	184.8	3.55
Agriculture	1.3	10	300	N/A	0.071	0.089	0.027	N/A	15.45	N/A	N/A
Forest, Water, Wetlands	0.1	3	40	N/A	0.009	0.018	0.027	N/A	9.2	2	0.3
Barren Land	0.5	5	60	N/A	N/A	0.002	N/A	N/A	3.1	N/A	N/A
N/A: Data not available from sources used.											
The loading coefficients used in this table have been provided by the NJDEP in the "New Jersey Stormwater Best Management Practices Manual," February 2004.											

Appendix E: Statewide Basic Minimum requirements for the General (Tier A) MS4 NJPDES Permits

NJPDES Municipal Stormwater Regulation Program
Summary of Statewide Basic Requirements (SBRs)
Tier A Municipal Stormwater Permit (NJ0141852)
(Please refer to final permit for details on SBRs)

Statewide Basic Requirement	Implementation Schedule	
Stormwater Pollution SPPP describes the municipality's stormwater program, which includes **Prevention Plan** details on the implementation of required SBRs. **(SPPP)**	12 months from effective date of permit authorization (EDPA)	
Public Notice Comply with applicable State and local public	Upon EDPA	
Post-Construction Stormwater	**Management in New Development and Development**	
Stormwater Management Plan	Adopt stormwater management (SWM) plan in accordance with N.J.A.C. 7:8-4	Complete 12 mos. from EDPA
Stormwater Control Ordinance	Adopt and implement stormwater control ordinance in accordance with N.J.A.C. 7:8-4	Adopt ordinance 12 months from SWM plan adoption.
Residential Site Improvement Standards	Ensure compliance with Residential Site Improvement Standards for stormwater~nanagement (N.J.A.C. 5:21-7), including any exception, waiver, or special area standard approved under N.J.A.C. 5:21-3.	Upon EDPA
BMP Operation and Maintenance	Ensure adequate long-term operation and maintenance of BMPs.	EDPA for BMPs on municipal property, 24 months for BMPs elsewhere.
Storm Drain Inlets Design Standard for New Construction	New storm drain inlets must meet the design standards specified in Attachment C of the permit.	12 months from EDPA if municipally installed. Otherwise 24 mos. from EDPA
Local Public Education		
Local Public Education Program	Copy and distribute educational brochure (provided by the Department) annually to residents and businesses, and conduct a	Start 12 months from EDPA
Storm Drain Labeling	Label all municipal storm drain inlets that are next to sidewalks, or within plazas, parking areas or maintenance yards.	Within 60 months from EDPA
Improper Disposal of Waste		

Pet Waste Ordinance to	Adopt and enforce an ordinance requiring owners and keepers immediately and properly dispose of their pet's solid waste. Distribute information with pet licenses regarding the ordinance and the environmental benefits of proper disposal of pet waste.	Complete 18 mos. and ongoing
Litter Ordinance State litter	Adopt and enforce a litter ordinance, or enforce the existing statute (N.J.S.A. 13:1E-99.3).	Complete 18 mos. and ongoing
Improper Waste disposal Disposal Ordinance	Adopt and enforce an ordinance prohibiting spilling, dumping or of any materials other than stormwater into the MS4.	Complete 18 mos. from EDPA and ongoing