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MEMORANDUM

Scott W. Hatfield, PE, CME
Township Engineer
Director of Department of Engineering

TO: Mr. Delbert D. Rife, Planning Board Chairman & Members of the Board

FROM: Scott W. Hatfield, PE, CME, Township Engineer

DATE: December 12, 2018

SUBJECT: Re-Examination of Municipal Stormwater Management Plan and Circulation Plan Element of the Township Master Plan

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As part of the current re-examination of our Municipal Master Plan, being spearheaded by Township Planner, Joseph Augustyn, PP, AICP, we are also required by our Tier A Municipal Stormwater Permit to re-exam our Stormwater Management Plan. This office has performed the required re-examination of this document, which is considered an addendum to the Utility Service Plan Element.

In addition, due to the passage of time and some significant transportation related issues currently affecting our municipal roadways, it was incumbent upon this office to also look closely at the Circulation Plan Element and draft proposed revisions that, in my professional opinion, should be considered by the Planning Board as part of the re-examination process and incorporated into a revised Circulation Plan Element in the near future.

This memorandum will serve to summarize the revisions to these two elements of the Master Plan that are being recommended by this office, which are as follows:

MUNICIPAL STORMWATER MANAGEMENT PLAN

- Incorporate language to encourage the Township to require the registration of privately-owned stormwater management facilities, which will include the payment of an initial registration fee as well as annual fees in an amount to be determined by the Governing Body, which are necessary to cover administrative costs and the cost of inspections.

- Reference the Shared Services Agreement that the Township has entered into with the Burlington County Soil Conservation District to annually inspect municipally-owned stormwater management basins. This Agreement will likely be expanded in 2019 to include privately-owned facilities.

- Remove Trellis Greene from the list of flood-prone areas in Burlington Township. Improvements performed by Developers over the past ten (10) years have served to mitigate the flooding that had historically occurred in this area.

- Update Section 4.4.2. with respect to Total Maximum Daily Load (TMDL's) to be consistent with the information contained on the NJDEP Division of Water Quality webpage.

- Investigate reports of localized roadway flooding that occurs in the western portion of the LaGorce Square residential development during heavy rainfall events that coincide with high tide in the Assiscunk Creek.

- Update the build-out analysis, which may require the services of a consultant.

CIRCULATION PLAN ELEMENT

- Perform general revisions in accordance with draft document prepared by this office. (copy attached)

- Incorporate proposed improvements along Route 130 corridor referenced in County transportation planning documents, prepared by WSP. These documents are referenced in my draft document.

- Emphasize the need to address the increase in large truck traffic on local roads and, where necessary, to perform roadway improvements that will physically separate these trucks from residential areas.

- Emphasize the importance of CR #541 (Burlington-Mt. Holly Rd.) as a retail/commercial corridor and work closely with the County to assure that issues such as safety and access are addressed as future development and re-development occurs, especially in the area south of Route 295.

I will be present at the Planning Board meeting tomorrow evening to provide a brief overview. If there are any questions, please do not hesitate to contact this office.

******END OF MEMORANDUM******

SH/tl

cc: Council Members
Stephen Fazekas, Township Administrator
Jennifer Bupp, Administrative Officer
David Serlin, Esq. Township Attorney
Joseph Augustyn, PP, AICP Township Planner (via email)
Denis Germano, Esq., Planning Board Attorney (via email)

NJPDES Tier A Stormwater Regulation Program

Stormwater Management Plan

Burlington Township

Burlington County, New Jersey

An Addendum to the Public Utilities Service Plan Element of the Township Master Plan

Revised October 10, 2006

Prepared by:

F.X. Browne, Inc.
with assistance from the
Burlington Township Department of Engineering

FXB Project No.
NJ1032-28-001

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1.0 Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for Burlington Township ("the Township") to address stormwater-related issues. The creation of this plan is required by N.J.A.C. 7:14A-25 New Jersey Municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C. 7:8 New Jersey Stormwater Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major development, defined as projects that disturb one or more acres of land. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities. A "build-out" analysis has been included in this plan based upon existing zoning and land available for development. The plan also addresses the review and update of existing ordinances, the Township Master Plan, and consistency with other planning documents to allow for project designs that include low impact development techniques. The final component of this plan is a mitigation strategy to be used when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

2.0 Municipal Stormwater Management Plan Goals

The goals of this MSWMP are to:

- reduce flood damage, including damage to life and property;
- minimize, to the extent practical, any increase in stormwater runoff from any new development;
- reduce soil erosion from any development or construction project;
- assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
- maintain groundwater recharge;
- prevent, to the greatest extent feasible, an increase in nonpoint pollution;
- maintain the integrity of stream channels for their biological functions, as well as for drainage;

- 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
- protect public safety through the proper design and operation of stormwater management facilities.

To achieve these goals, this plan outlines specific stormwater design and performance standards for new development. Additionally, the plan proposes stormwater management controls to address impacts from existing development. Preventative and corrective maintenance strategies are included in the plan to ensure long-term effectiveness of stormwater management facilities. The plan also outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

3.0 Stormwater Primer

Development of land can dramatically alter the hydrologic cycle, increasing stormwater runoff and creating negative impacts downstream. Natural landscapes slow runoff and allow it to infiltrate. A forest, for example, has vegetation that absorbs runoff and allows it to soak into the ground. Vegetation also helps to filter sediments and pollutants. When land is developed and natural landscapes are replaced by impervious surfaces such as roads, buildings, and parking lots, stormwater runoff is increased and is no longer filtered by vegetation. This water becomes direct runoff, which rapidly carries increased sediments and pollutants into streams and lakes. In addition to other negative impacts, sediments can fill in waterways, which increases flooding and may necessitate lake dredging.

Stormwater runoff from developed areas often makes its way through a path of impervious surfaces, from rooftop to gutter to street to storm sewer, for example. This greatly increases the runoff rate, causing the flow in downstream waterways to peak faster and in greater volumes than previously. This phenomenon can lead to an increase in flooding downstream, and can also cause both erosion problems and ecological problems in downstream waterways.

Increases in impervious area can also decrease opportunities for infiltration. By decreasing infiltration, base flow and groundwater recharge are decreased. Base flow is groundwater that slowly moves through the subsurface to recharge a stream. Since this slow flow is decreased, and rapid overland flow is increased, greater fluctuations occur in stream flow rates. These fluctuations can increase soil erosion of waterways, which not only adds sediments and pollutants to the water, but also alters the natural stream channel. These changes can destroy habitats for aquatic life.

Construction activities can also have negative impacts on the water cycle. Runoff from construction sites often carries with it large amounts of soil and construction debris, which should be filtered so that they do not flow into waterways. Construction activities can also compact the soil, leading to increased runoff from the site. Activities that alter the natural topography of a site, such as clearing and grading, can remove depressions from the ground that previously stored runoff and allowed it to infiltrate.

Additionally, land development brings with it a multitude of uses that increase the pollutant load entering waterways. For example, lawn fertilizers, animal wastes, and hazardous fluids from automobiles can easily be transported along impervious surfaces by stormwater runoff.

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

4.0 Burlington Township Water Resources

Burlington Township is a suburban area encompassing approximately 15 square miles in Burlington County, New Jersey. Burlington Township surrounds Burlington City and is bordered by the Delaware River to the north, and the Townships of Florence, Springfield, Westhampton, Willingboro, and Edgewater Park. The population has grown rapidly in recent years, increasing by 63 percent from 1990 to 2000. The 2000 Census population was recorded as 20,294. The Township has a mixture of residential, business, industrial, and business light industrial zones.

The following information was obtained from the Township's Master Plan (1998). The total area of developed land in the Township increased from about 56 percent in 1991 to 72 percent in 1996. In 1975, single family residential homes made up 10 percent of the land use; that number increased to 32 percent by 1997. During that same time period, farm, wooded and vacant lands decreased from 72 percent to 27 percent of the Township's total land use. The number of housing units in 1990 was reported at about 4,700; this number increased to 6,113 by 1997 and to 7,112 in 2000. This population increase and subsequent new development is assumed to have resulted in increased stormwater runoff and pollutant loads to Township waterways.

Figure 1 shows the Township boundaries on the USGS topographic map, Bristol Quadrangle.

4.1 Burlington Township Waterways

Figure 2 depicts the Township waterways. The Township is bordered to the north by the Delaware River. Lakes include Upper Sylvan Lake, which is used as a public swimming beach, and Lower Sylvan Lake, which is used primarily for fishing. Township streams include Anarkin Creek, Assiscunk Creek, Bustleton Creek, Riggs Mill Creek, Pope's Run, Tanner's Run, and Mill Creek which makes up a part of the Township's southern boundary.

At present, none of the above waterways within Burlington Township have been identified by the New Jersey Department of Environmental Protection (NJDEP) as "Category One" waterways. Category One waterways are special waters identified for protection from measurable changes in water quality characteristics because of their clarity, color, scenic setting, or other characteristics of aesthetic value; exceptional ecological significance; exceptional recreational significance; exceptional water supply significance; or exceptional fisheries resources.

Nonetheless, the Township endeavors to assure that any potential impacts to its waterbodies and waterways are properly mitigated and minimized to the maximum extent practicable.

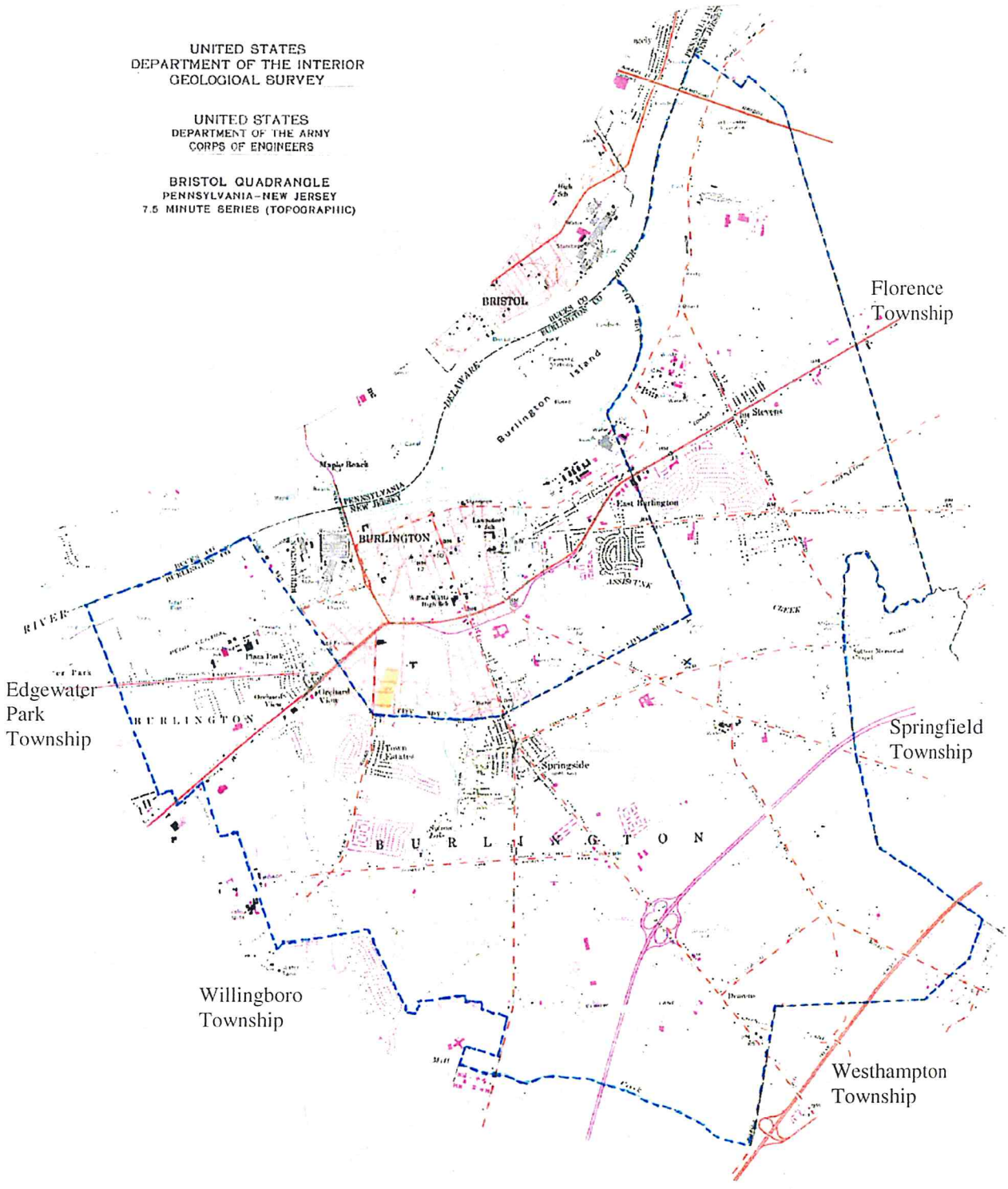

Figure 1 Township Boundary - USGS Topographic Map, Bristol Quadrangle

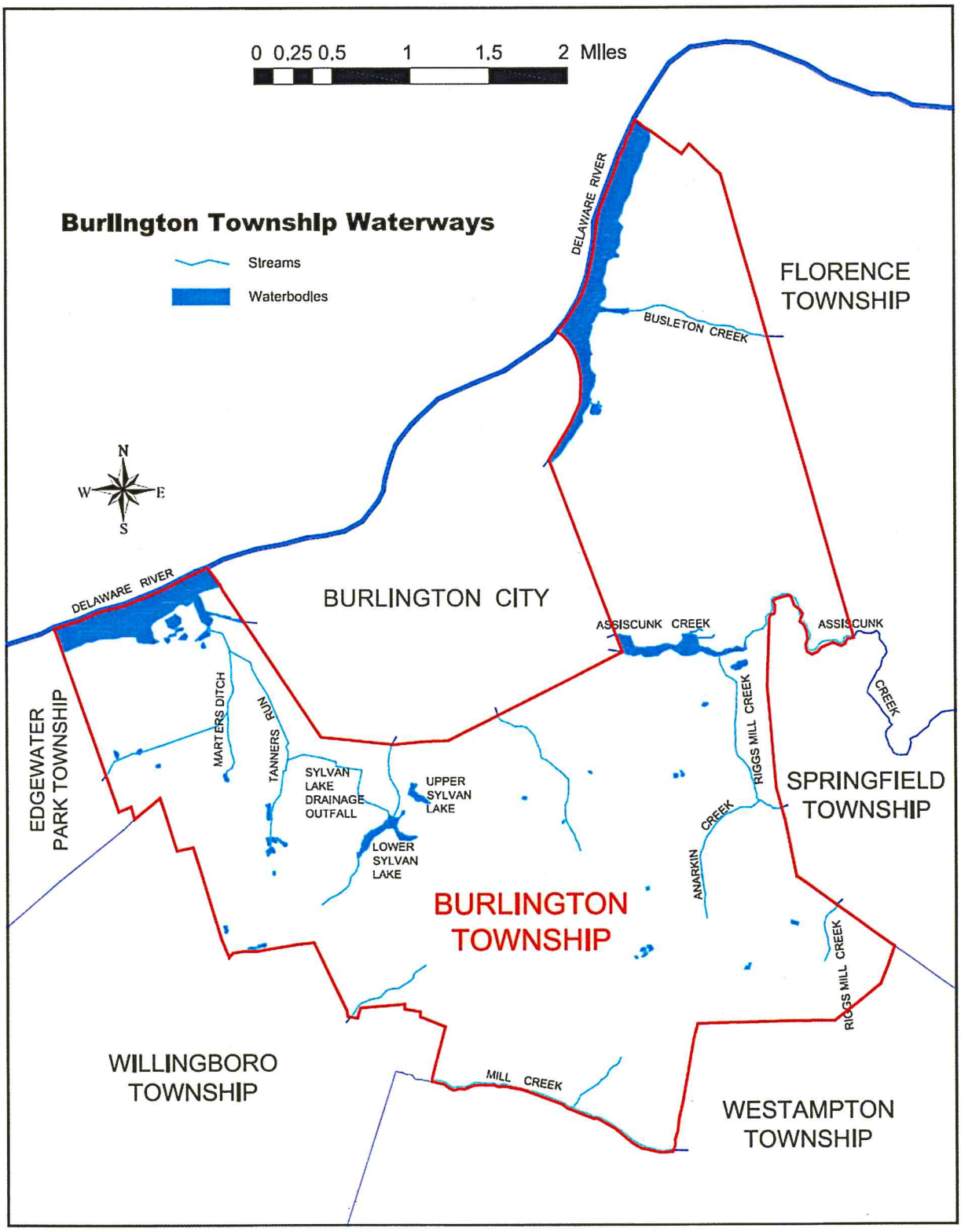

Figure 2 Township Waterways

4.2 Burlington Township Water Quantity

4.2.1 Storm Drainage Study

A comprehensive storm drainage study was compiled in 1980 for Burlington Township by Alaimo Consulting Engineers. This study identified the major problems in the Township's storm drainage system by dividing the Township into 12 drainage basins. The problems identified in this study are the following:

- Lack of stormwater controls
- Inadequate maintenance
- Insufficient easements
- Erosion problems
- Lack of a comprehensive view of stormwater issues

The Township has considered the conclusions of this study in formatting regulations, strategies, and policies to control runoff from developed sites and limit adverse stormwater impacts resulting from development to the maximum extent practicable. These regulations include the current Design and Performance Standards contained in Section 19:12-8 of the Township Land Development Ordinance.

4.2.2 Flooding Issues

The average annual precipitation in Burlington Township is between 44 and 46 inches (Natural Resources Conservation Service). Most of the Township's flood-prone areas are found along the Delaware River and the Assiscunk Creek. The majority of flooding in the Township occurs when precipitation and high tide are concurrent.

The Township identified four main areas where flooding most often occurs. A map of these flood-prone areas is included as Figure 3.

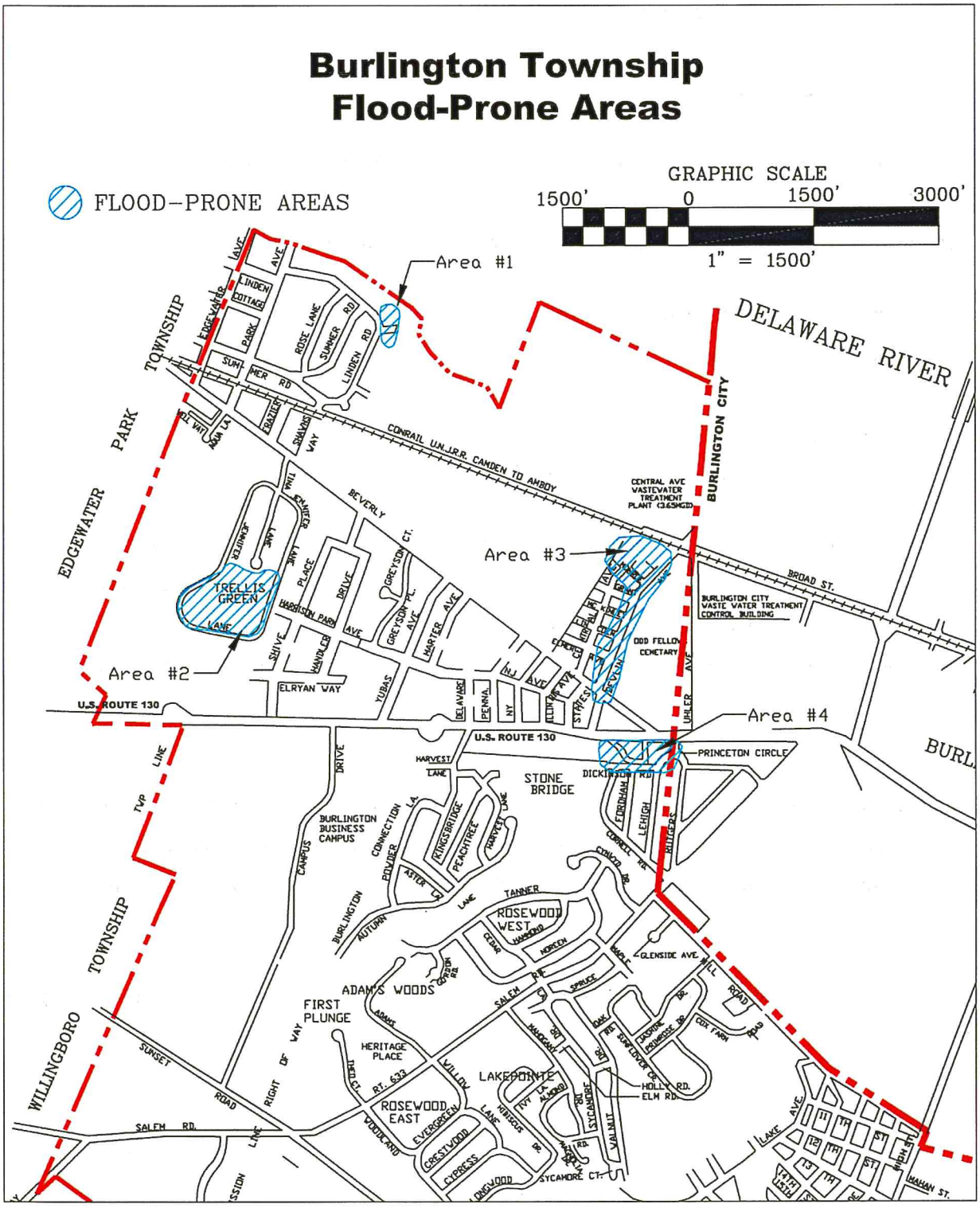

Figure 3 Flood-Prone Areas of Burlington Township

The Township flood-prone areas all lie in the Northwestern portion of the Township near the Delaware River, and are as follows:

Area # 1) Linden Road

This area drains directly to the Delaware River, and is affected by the tidal conditions on the Delaware. No detention facilities exist in this area. Runoff floods the existing recreation site.

Area # 2) Trellis Greene

This area receives undetained runoff from an area of approximately 300 acres primarily in Edgewater Park and Willingboro Townships. Runoff converges in this area and floods an existing recreation site and an area of undeveloped open space, and is then conveyed to Marter's Ditch, which is poorly defined and contains hydraulic restrictions. As part of the proposed development of two residential subdivision projects further downstream along Marter's Ditch, the Township is currently working with a developer to address these problems. The developer hired a drainage consultant to perform a study of Marter's Ditch. Recommendations to improve the hydraulics and decrease the amount of flooding included additional culverts, ditch improvements, and a regional detention basin. The cost of the improvements is the responsibility of the developer. The improvements required NJDEP wetlands and stream encroachment permits, which have been obtained. These improvements are currently under construction.

Area # 3) Devlin Avenue

This area is traversed by Tanner's Run, which is another poorly defined drainage ditch that is adversely affected by backwater from the Delaware River. In addition, a hydraulic restriction created by a NJ Transit railroad culvert compounds the problem.

The Township has met on several occasions with representatives of the NJDEP to discuss the potential for channel improvements between Beverly Road and the Township Sewer Treatment Plant. The NJDEP has indicated that an individual wetlands permit may be required to improve the portion of Tanner's Run that runs parallel with Devlin Avenue.

The Township performed a drainage study of this area and as a result has budgeted funds to perform channel improvements. The improvements recommended in this study are still being

considered; however, the permitting issues may prevent the work from taking place or create substantial modifications to the scope of the work. In addition, there are two County culverts along this stretch of Tanner's Run that would also require improvements. The project is currently on hold pending further discussions with the NJDEP and the County to resolve permitting, environmental, and other issues.

This project is included as an option for the Mitigation Plan, which is discussed further in Section 10 of this document.

Area # 4) Dickinson Avenue and Route 130

The flooding in this area is a result of a hydraulic restriction created by the existing box culvert (8.5' x 2') that runs under Route 130 and drains Tanner's Run to the Delaware River. This culvert was constructed with a reverse slope and presently contains a significant amount of silt. In addition, a trash rack and a utility pipe across the upstream end of the culvert tend to catch debris and create temporary additional restrictions.

The de-silting of this culvert and/or relocation of the utility pipe are included as potential Mitigation Plan Projects; however, this work would also require the approval of the NJDOT.

4.3 Burlington Township Drinking Water and Groundwater

Burlington Township owns and operates the public water supply system in the Township. There is no municipal water utility authority, and municipal water is provided through several groundwater wells which are routed to the Township's Water Treatment Facilities.

There are currently seven wells operating in Burlington Township, with an eighth under construction and scheduled to be completed in 2006. Presently, all of the existing wells are located at two well sites on lands owned by Burlington Township. Wellhead protection is being provided in accordance with NJDEP standards. The two well sites are located on Oxmead Road and Aqua Lane. The Township has a NJDEP Water Allocation Permit to divert 1,130 million gallons per year from the wells currently in operation. The eighth well will be constructed at the intersection of Neck Road and Dulty's Lane on a 1.41-acre parcel that has been dedicated to the Township.

Since the Township owns all properties on which the municipal water wells are located, the Township does not see the need to enact any special wellhead protection standards at this time.

A map of wellhead protection areas is included as Figure 4. A map of the groundwater recharge areas is included as Figure 5.

Information regarding the delineation of wellhead protection areas and tiers was obtained from the New Jersey Geological Survey (2003). The tiers are used to evaluate the risk of well contamination based on the time it takes groundwater to reach the well. Tier 1 is the area with the shortest travel time to the well (2 years or less), and therefore requires the greatest level of protection against groundwater pollution. Tier 3 has a longer travel time (five to twelve years), so pollution in this zone is easier to contain and mitigate. Tier 2 areas have a travel time of two to five years.

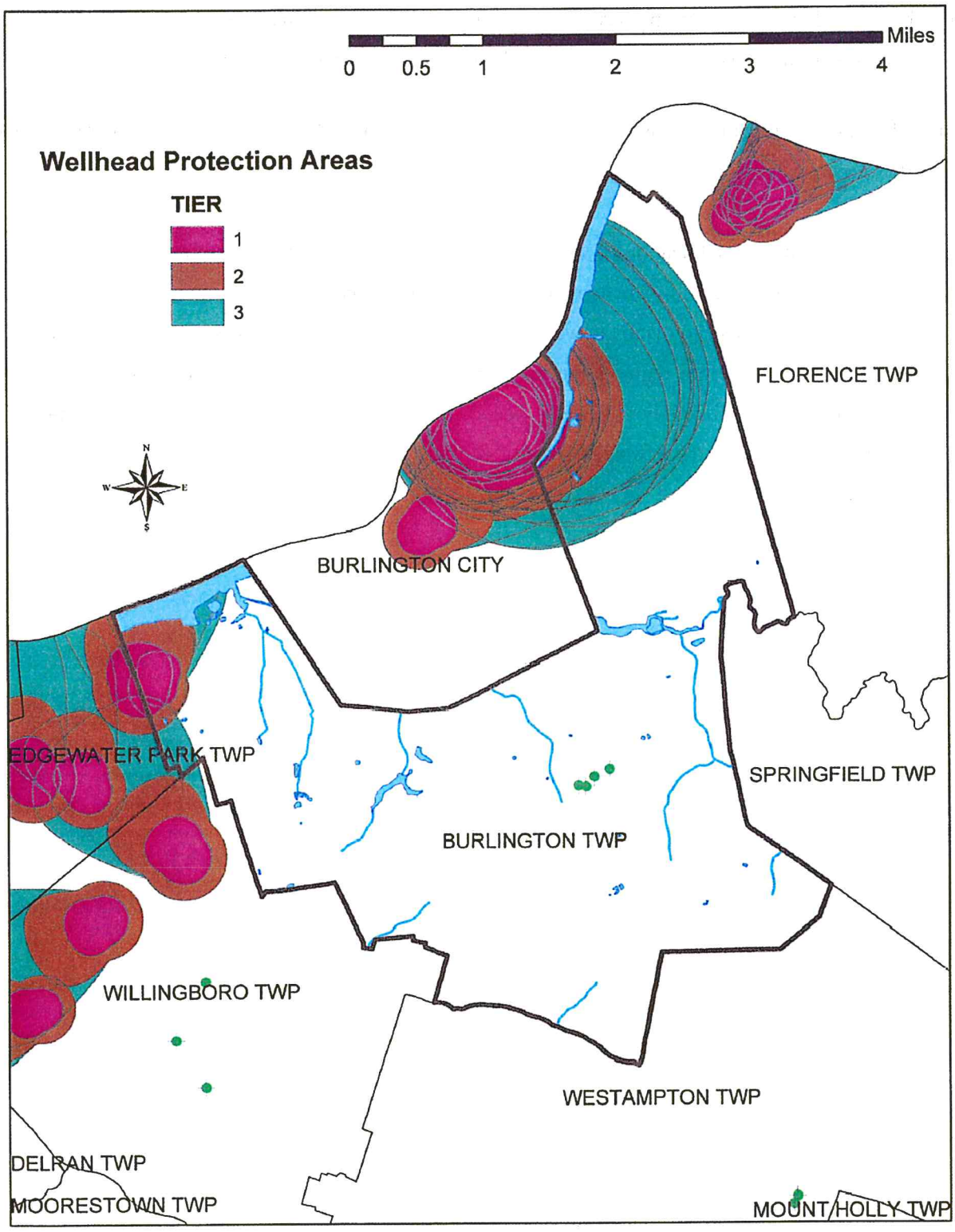

Figure 4 Wellhead Protection Areas

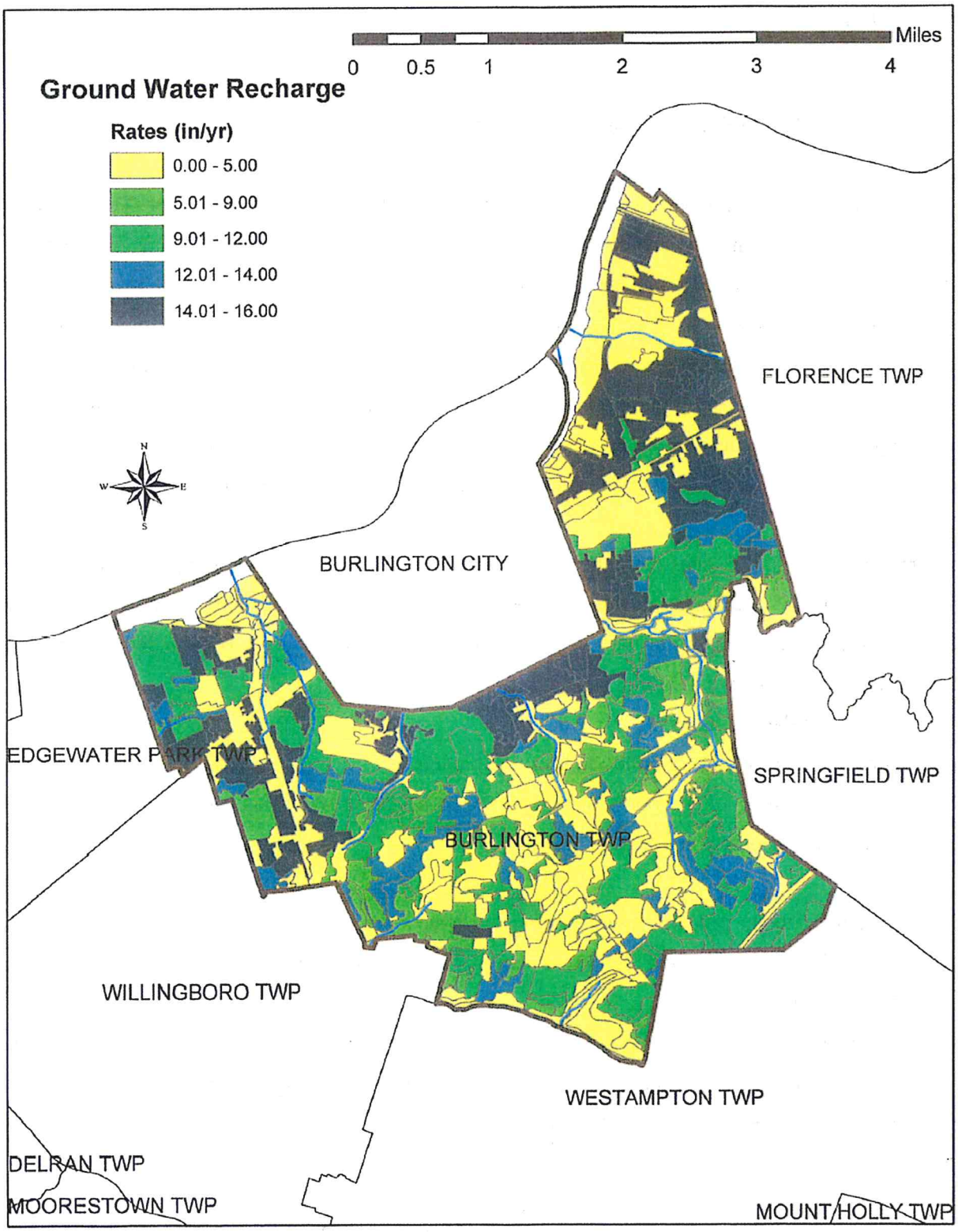

Figure 5 Groundwater Recharge Areas

4.4 Burlington Township Water Quality

4.4.1 Ambient Biomonitoring Network (AMNET)

The NJDEP's Ambient Biomonitoring Network (AMNET) documents the health of New Jersey's waterways based on benthic macroinvertebrate sampling. Benthic macroinvertebrates are bottom-dwelling ("benthic") aquatic creatures without a backbone ("invertebrate") that are small but can be seen without a microscope ("macro"). These creatures include insects, worms, and the larvae of several types of flies. Each of these organisms has its own level of tolerance for pollution, so the creatures living in an area are an indication of the overall health of the waterway. Unlike with chemical testing, this method cannot pinpoint the specific type of pollution affecting a waterway; however, it provides a broader, longer-term view of the aquatic habitat and takes into account all types of pollution.

There are over 800 AMNET sites throughout the state of New Jersey, which are sampled on a five-year cycle. A sampling of macroinvertebrates is collected at each site, and the number and type of each organism is recorded. Streams are then classified as non-impaired, moderately impaired, or severely impaired based on the following information:

- Diversity of the community
- Number and percentage of pollution-sensitive organisms
- An average rating of the pollution sensitivity of all organisms (Each organism is assigned a tolerance rating based on a scale of 1-10.)

Based on AMNET data the following classifications were made for waterways in Burlington Township:

- Assiscunk Creek, the portion which enters Springfield Township, has been classified as Moderately Impaired
- Assiscunk Creek at Neck Road in Burlington Township has been classified as Severely Impaired
- An unnamed tributary (Riggs Mill Creek) to Assiscunk Creek at Oxmead Road in Burlington Township has been classified as Moderately Impaired

4.4.2 New Jersey's Integrated Water Quality Monitoring and Assessment Report

The health of Burlington Township's waterways is reflected in New Jersey's 2004 Integrated Water Quality Monitoring and Assessment Report, or Integrated List, and is broken up into Sublists 1 through 5. All assessed waters are placed on a Sublist based upon the following parameters: 1) the degree of support of designated uses; 2) how much is known about the waterway's water quality status; and 3) the type of impairment preventing use support.

The Total Maximum Daily Load (TMDL) Program, established in 1972 as part of the federal Clean Water Act, is intended to identify waters that do not meet water quality standards, and to establish limits which will allow these waters to attain the water quality standards. A TMDL is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. In order to establish a TMDL, first the water body is tested for water quality. For each pollutant that is present in quantities that exceed the designated water quality standard, a TMDL is established. The water body and associated TMDLs are then placed on a list to indicate that they are impaired waters.

In New Jersey, TMDLs are listed in the New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report (Integrated List). Organizations such as state agencies, local agencies, or watershed partnerships then develop strategies for reducing the pollutants entering the water body to levels at or below the TMDL.

The Integrated List includes Sublists 1-5, described below:
Sublists 1 and 2: include waters that are unimpaired
Sublist 3: includes waters that have limited data availability to determine impairment status
Sublist 4: includes 3 sub-categories, as follows:

- 4A: TMDL(s) have been developed and approved by the US Environmental Protection Agency (EPA), and are expected to result in full attainment of water quality standards.
- 4B: Other pollution control requirements are expected to result in attainment of water quality standards.
- 4C: Waters are impaired by factors other than pollutants; therefore, a TMDL does not need to be developed. For example, waters affected by habitat degradation or stream channeling would be placed on this list.

Sublist 5: includes waters which are impaired and require the development of a TMDL. A waterway should be included on this Sublist if it is determined, in accordance with the state's assessment and listing methodology, that a pollutant has caused, is suspected of causing, or is projected to cause, an impairment. Where more than one pollutant is associated with the impairment of a single waterway, the waterway will remain on Sublist 5 until TMDLs for all pollutants have been completed and approved by the EPA.

For example, Upper Sylvan Lake, which is used for recreation, had, in the past (early 1990's), exhibited high levels of fecal coliform bacteria and therefore was no longer desirable for certain recreational uses. It was determined that a TMDL was needed for this lake for fecal coliform bacteria, and the lake was placed on Sublist 5 of New Jersey's Integrated List.

Below are listed the waters in Burlington Township that are included on Sublist 4A, followed by the pollutants affecting the waterway:

- Lower Sylvan Lake: Phosphorus.

Below are listed the waters in Burlington Township that are included on Sublist 5, followed by the pollutants affecting the waterway:

- Upper Sylvan Lake: Phosphorus and Fecal Coliform
- Assiscunk Creek, along the reach that begins at the Delaware River and stretches through Burlington Township into Springfield Township: Arsenic, Cadmium, Chromium, Lead, Mercury. This waterway has been given a high priority, and is anticipated for TMDL submittal by December 31, 2005.
- Delaware River/Estuary: Metals. The main metals documented along the Delaware River are Arsenic, Cadmium, and Mercury.

Burlington Township is bordered by Zone 2 of the Delaware River Estuary, and Zone 3 is located downstream of the Township. TMDLs were completed for the Delaware River Estuary in Zones 2 and 3 for the following pollutants:

- 1,2 – dichloroethane
- tetrachloroethene

4.4.3 Pollutant Sources for Burlington Township Waters on the Integrated List

The phosphorus and prior sedimentation problems in the Sylvan Lakes are attributable to nonpoint source pollution. The drainage area to the lake consists of 158 acres of forest and 299 acres of residential land. According to NJDEP's TMDL report (2000) for Upper Sylvan Lake, sources of phosphorus to the lake include incoming waters from the Mill Stream tributary, stormwater runoff from the area around the lake, and internal phosphorus release from the lake sediments. The residences in the area are now sewered; therefore, phosphorus input from septic systems is not an issue. There are no known point sources of pollution to the Sylvan Lakes (NJDEP 2000).

TMDLs were completed for the Delaware River Estuary in Zones 2 and 3 for both 1,2-dichloroethane and tetrachloroethene. 1,2-Dichloroethane is used primarily for the production of vinyl chloride which is used to make a variety of plastic and vinyl products including polyvinyl chloride (PVC) pipes, furniture and automobile upholstery, housewares, and automobile parts. Additionally, it is used as a solvent and is added to gasoline to remove lead. Tetrachloroethene is used for dry cleaning of fabrics, metal-degreasing, and the manufacturing of chemicals and various consumer products. The presence of these industrial pollutants in the Delaware River is most likely attributable to point sources such as industrial sites in the nearby cities, including Trenton which lies upstream and Philadelphia which is situated across the river.

4.4.4 Implementation of TMDLs in Burlington Township

The following measures were taken to rehabilitate Upper Sylvan Lake by reducing phosphorus and sediments in the lake and surrounding watershed, according to NJDEP's 2000 TMDL document for the lake:

- All stormwater pipes were removed from the lake and conveyance systems redirected away from the Upper Lake (2 of 4 outfalls were removed in 1993; 2 outfalls were removed in 1995 and were rerouted to Rancocas Creek, Mill Creek watershed).

- The lake was dredged to remove phosphorus-laden sediment from the lake bottom (completed 28 March 1994).

- An aeration system was installed in the lake in August 1994. Dissolved oxygen in the lake bottom has shown significant improvements following this installation.

- An array of erosion controls and stormwater infiltration measures have been implemented to control nonpoint source pollution. Measures included installing new sand courts in a play area; removing pavement and replacing it with sod; installing wood chip mulch in a parking area; implementing cleaning and sweeping; and installing concrete wheel stops, a stone sub-base, and bituminous walkways.

- Public education programs were initiated, including an environmental education curriculum, teacher training, development and installation of environmental kiosks, and planning and construction of nature trails around the lakes. (ongoing).

Improvements made to reduce phosphorus and sedimentation in Lower Sylvan Lake included:

- The lake was dredged to remove nutrient-rich sediments from the lake bottom (2003);

- Public education programs were initiated, including an educational kiosk, environmental education curriculum, teacher training, and development of the Walnut Drive Nature Trail at Lower Sylvan Lake; and

- Stormwater pipes were re-routed to areas downstream of the lake.

As a result, both the upper and lower lakes have been de-listed for sedimentation.

In addition, efforts are being made by the Township to pursue delisting of Upper Sylvan Lake for fecal coliform. Weekly lake sampling for fecal coliform bacteria has been performed by Burlington County Health Department for the 10-week swimming seasons (mid-June through August) from 1997 to Present. According to the NJDEP's TMDL document (2000), sampling procedures "were consistent with the NJDEP-NJDHSS protocols for bathing beaches which are used in the Cooperative Coastal Monitoring Program for ocean and bay bathing beaches." This document also indicates that: "30 samples were taken, only 1 of which exceeded the NJDHSS primary contact standard (N.J.A.C. 8:26-1 et. seq.), indicating that the bathing beach supports swimming."

If phosphorus levels are not adequate to pursue delisting, the Township will use a tiered Best Management Practices (BMP) implementation approach with continued monitoring. The following actions may be taken:

- Cleaning and maintenance of detention basins in the watersheds of both lakes.
- Continued public education efforts.
- Planting of riparian buffers: installation of vegetative filters in public areas that are a minimum of 30 feet wide. Installation of vegetative filters on private lands if necessary. The NJDEP recommends 75 foot wide buffers where practical.

Implementation of these measures is expected to achieve the necessary load reductions. The Township will take these steps one by one with monitoring after each step to determine whether necessary phosphorus reductions have been achieved.

NJDEP will update the Integrated List in 2006. At that time, they will investigate both Upper and Lower Sylvan Lakes to see if their findings support delisting. Burlington Township plans to continue its efforts to meet TMDLs and hopes to have both Upper and Lower Sylvan Lakes delisted by 2006. This issue is further discussed in the section of this report on Plan Consistency.

5.0 Stormwater Design and Performance Standards

Burlington Township will adopt the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 (New Jersey Stormwater Management Rules) to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. The design and performance standards include the language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-5.8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. The NJDEP Model Stormwater Control Ordinance for Municipalities is currently being incorporated into the existing Township ordinances. The ordinances will be submitted to the county for review and approval within 24 months of the effective date of the Stormwater Management Rules, by April 2006. The Township Master Plan is being updated in

2005 and will address inconsistencies in commercial development with respect to stormwater management. During construction, Township inspectors will observe construction operations to ensure that the stormwater management measures are constructed and function as designed.

6.0 Burlington Township Stormwater Management Plan Consistency with State and Regional Stormwater Management Planning

The Township is not within a Regional Stormwater Management Planning Area, and therefore does not need to be consistent with any regional stormwater management plans (RSWMPs). If any RSWMPs affecting the Township are developed in the future, this plan will be updated to be consistent.

Burlington Township requires residential development to comply with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21, which have incorporated N.J.A.C. 7:8 (State Stormwater Management Rules) by reference. The municipality will utilize the most current update of the RSIS in the stormwater management review of areas to which it applies. The Township is in the process of developing and adopting a Stormwater Control Ordinance, consistent with the requirements of N.J.A.C. 7:8, which, in the future, will be applied to all non-residential development. This Municipal Stormwater Management Plan will be updated if necessary to be consistent with any future updates to the RSIS.

The Township's ordinances require all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. The Burlington County Soil Conservation District reviews all projects regulated by these Standards, and supercedes the Township on such matters. During construction, Township inspectors will observe on-site soil erosion and sediment control measures and report any inconsistencies to the Burlington County Soil Conservation District.

In accordance with New Jersey's 2004 Integrated Water Quality Monitoring and Assessment Report, TMDLs are in place for the following Burlington Township waterways, as described in Section 4.4 of this report. The TMDLs are listed below with associated pollutants:

- Lower Sylvan Lake: Phosphorus
- Upper Sylvan Lake: Phosphorus and Fecal Coliform

Stormwater management recommendations from this report and from the Burlington Township Stormwater Management Ordinance will help to further reduce the TMDLs for both lakes.

This plan will be updated to address any future TMDLs that are put in place for any contributing watershed area within the Township.

7.0 Nonstructural Stormwater Management Strategies

7.1 Burlington Township's Zoning Ordinance

Burlington Township's Zoning Ordinance was reviewed to see where nonstructural stormwater management strategies could be incorporated or improved. No revisions have been made to the Zoning Ordinance, but consideration for future changes have been established as described below.

Percentage of Impervious Surface:

Burlington Township's Zoning Ordinance sets limits on the percentage of impervious surface allowed in each zoning district. The Township has decided that a decrease in these limits is not appropriate at this time. The Township may review these limits in the future to determine whether a decrease in impervious surface is appropriate.

Detention Basins and Infiltration Basins:

Detention basins are required by all major developments and site plans unless deemed unnecessary by the Reviewing Board Engineer. Infiltration basins are not permitted unless the applicant can demonstrate by a drainage study prepared by a New Jersey Licensed Professional Engineer that an onsite detention basin is not feasible from an engineering standpoint. In the case that an infiltration basin is permitted, the design must comply with the NJDEP "Best Management Practices for Control of Nonpoint Source Pollution from Stormwater" dated May 2000 as amended. With the future adoption of a Township Stormwater Control Ordinance that will be consistent with the requirements of N.J.A.C. 7:8, the prohibition against infiltration basins will be eliminated. This section is to be revised following completion of the Stormwater Control Ordinance.

Burlington Township recognizes that the Residential Site Improvement Standards (RSIS) supercedes the Township Zoning Ordinance with respect to stormwater management; therefore, the standards set forth in the Township Zoning Ordinance presently apply only to non-residential development.

7.2 Burlington Township Master Plan

The Township's Master Plan was most recently updated in 1998, and another update is scheduled to be completed in 2005. A Master Plan Reexamination Report, written in 2003, included many goals and objectives established by the Township to be incorporated in the updated Master Plan. Objectives are the specific targets to be met as intermediate steps in achieving the Township's long-term goals. Numerous goals and objectives relate to nonstructural stormwater management strategies, and are described below.

7.2.1 Commerce and Industry

Objective: To support increased utilization of existing office, industrial and commercial development. To provide for appropriate manufacturing and heavy industrial uses which are appropriately located and compatible with the Township's environmental resources.

7.2.2 Housing

Goal: To integrate new development with substantial open space areas using Smart Growth techniques that discourage suburban sprawl.

Goal: To encourage infill development and redevelopment as a Smart Growth technique.

7.2.3 Recreation

Objective: To provide family oriented parks and green spaces throughout the Township.

Objective: To continue the maintenance and upgrade of Assiscunk Creek Park as the centralized and dominant park in the Township.

7.2.4 Environment

Goal: To preserve environmentally sensitive areas in their natural state, and to protect natural resources and areas of conservation.

Objective: To protect wetland and floodplain areas by generally mapping these locations and identifying State and Federal preservation requirements.

Objective: To protect surface and subsurface water supplies by promoting control of nonpoint source pollution, and wellhead protection areas.

Objective: To preserve wooded areas for wildlife habitat, and helping manage these and other natural areas throughout the Township.

Objective: To provide strong support for our varied natural resources including forested areas, streams and river frontage which provide many passive recreational opportunities, i.e., fishing, hiking and enjoyment of wildlife and the natural environment. These natural areas must be kept clean and preserved for generations to come. Burlington Township supports initiatives to help increase individuals' awareness and understanding of and involvement with the environment. Environmental education is a continuing process that impacts one's activities from childhood to retirement. Promoting the empowerment of Township residents to better understand and value our natural resources and assuming environmental responsibility are priorities.

Objective: To adopt and implement NJDEP's new stormwater management regulations.

Objective: To promote stormwater management practices that positively affect aquifer recharge areas, floodplains, wetlands, waterways, and properties abutting waterways.

Objective: To provide significant natural space within and around existing development in order to lessen the impact of the built environment.

Objective: To seek appropriate locations for the establishment of greenways linking areas of environmental and recreational importance.

Objective: To promote lake management which supports the maintenance of the aesthetic benefits, environmental integrity, good water quality of lakes, as well as the financial benefit of increased realty value.

7.2.5 Open Space

Goal: To preserve appropriate remaining open space areas throughout the Township.

Objective: To ensure that open space planning plays an important role in developing the character, location, magnitude and timing of growth and development in the Township.

Objective: To utilize a wide array of open space preservation methods and techniques.

Objective: To give priority to preserving large contiguous tracts of forests and lands containing unique areas of environmental sensitivity.

Objective: To promote and encourage the protection of privately owned tracts of open space, wetlands, and forestlands.

7.2.6 Transportation

Objective: To utilize the existing major transportation routes as much as possible, and avoid the expansion of new major arterial roadways.

Objective: To promote pedestrian walkway systems and bicycle pathways throughout the community, particularly connecting residential neighborhoods with nodes of commercial activity and places of employment.

Objective: To encourage the upgrading of existing transportation facilities.

Objective: To identify transportation facilities that will be affected by development on a case-by-case basis.

The Master Plan Reexamination Report also analyzes the changes to goals, objectives, policies, problems, assumptions and recommendations from 1998 to 2003. As such, the following goals have been established for the Township.

7.2.7 Schools

The Township plans to continue coordinating with the Board of Education on the planning of schools, including layout, stormwater management, adequate buffer landscaping, and preservation of natural resources.

7.2.8 Preservation of Open Space

Burlington Township will encourage open space preservation and the use of smart growth techniques.

7.2.9 Preservation of Environmental Resource

Preservation of Township wetlands, flood plains, stream corridors, forested areas and wildlife habitats continues to be considered a critical part of planning for the well being and safety of present and future Township residents. As such, these environmental resources are presently mapped and considered in the

review of all development projects in Burlington Township. Furthermore, the Township implements watershed management techniques and NJDEP regulations in controlling stormwater flows and nonpoint source pollution.

7.3 Municipal Regulations Checklist

The Municipal Regulations Checklist provided in the NJDEP BMP manual was used to identify areas where non-structural stormwater management strategies could be incorporated into local regulations. The checklist identified the following options to be considered by the Township in updating the Zoning Ordinance and/or Master Plan:

7.3.1 Vegetation and Landscaping

A. Preservation of Natural Areas
   1) Restrict residents from enlarging existing turf lawns.
   2) Provide incentives for the use of vegetation as filters from stormwater runoff.

B. Tree Protection Ordinances
   1) If forested areas are present at development sites, require a certain percentage of the stand to be preserved.

C. Landscaping Island and Screening Ordinances
   1) In landscaping islands in parking lots, or between the roadway and sidewalk, require the use of vegetation which is more beneficial for stormwater quality, groundwater recharge, or stormwater quantity, but does not interfere with driver vision at the intersections.

D. Riparian Buffers
   1) Identify or limit cases in which stormwater outfall structures may cross over riparian buffers.

7.3.2 Minimizing Land Disturbance

A. Limits of Disturbance

1) Limit traffic of heavy construction vehicles to certain areas, such as areas of existing roadways and proposed roadways. Require these areas to be identified on construction plans and marked in the field.
2) The Township requires an as-built inspection before issuing a certificate of occupancy, but should consider requiring this inspection to include identification of compacted areas, if they exist within the site.

B. Open Space and Cluster Development

1) Offer flexible site design incentives for developers that utilize open space or cluster design options.
2) Specify a maximum allowable percentage of impervious cover in open space/recreation areas.

7.3.3 Impervious Area Management

A. Streets and Driveways

1) Allow or require street features, such as circles, rotaries, or landscaped islands to receive runoff.
2) Require cul-de-sacs to contain a landscaped island in the center.
3) Allow alternative turn-arounds such as "hammerheads" on short streets in low density residential developments.

B. Parking Areas and Sidewalks

1) Reduce required parking lot ratios.
2) Set parking requirements as a maximum or median rather than minimum requirements.
3) Provide model shared parking agreements.
4) Allow for permeable material to be used in overflow parking areas.
5) Offer incentives for parking areas that reduce impervious cover, rather than providing only surface parking lots.
6) Allow for sidewalks to be constructed with pervious material.

7) Encourage substituting sidewalks with alternate pedestrian networks (e.g. trails through common areas).

C. Unconnected Impervious Areas

1) Require developers to disconnect impervious area to promote pollutant removal and groundwater recharge.
2) Change ordinances to allow the reduction of the runoff volume when runoff from impervious areas is re-infiltrated into vegetated areas.

7.3.4 Vegetated Open Channels

1) Allow or require vegetated open channel conveyance instead of the standard curb and gutter designs.
2) Establish design criteria for vegetated channels.

8.0 Land Use Build-Out Analysis

The term "HUC-14" is from the hydrologic unit code system developed by the United States Geological Service for delineating and identifying drainage areas. The system starts with the largest possible drainage areas and progressively smaller subdivisions of the drainage area are delineated and numbered in a nested fashion. A drainage area with a hydrologic unit code (HUC) designation with 14 numbers, or HUC-14, is one of several sub watersheds of a larger watershed with 11 numbers, or a HUC-11. There are 921 HUC-14 sub watersheds in New Jersey that range in size from .1 to 42 square miles. The average size of a HUC 14 is 8.5 square miles. Visit http://www.state.nj.us/dep/watershedmgt/hucmap.htm for a map showing HUC-14 drainage areas in New Jersey.

A build-out analysis was conducted for Burlington Township to determine the acreage of impervious surface and the associated nonpoint source pollutant loadings for each of the Township's HUC-14 drainage areas based on allowable land use under current zoning. A map showing each HUC-14 drainage area in Burlington Township is presented in Figure 6.

First, the pollutant loadings for existing land use were estimated. A land use map of the Township is included in Figure 7, and standard pollutant loads by land cover are shown in Table 1. Pollutant loads for land designated as recreation/open space were calculated by averaging pollutant loads for forest and low density residential. Nonpoint source pollutant loads under existing land use for Burlington Township were calculated using the standard pollutant loads from Table 1 and the percentages of land use type in each HUC-14 drainage area in Burlington Township. These calculations are presented in Table 2.

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

Table 1. Pollutant Loads by Land Cover

(Source: New Jersey Stormwater Best Management Practices Manual 2004)

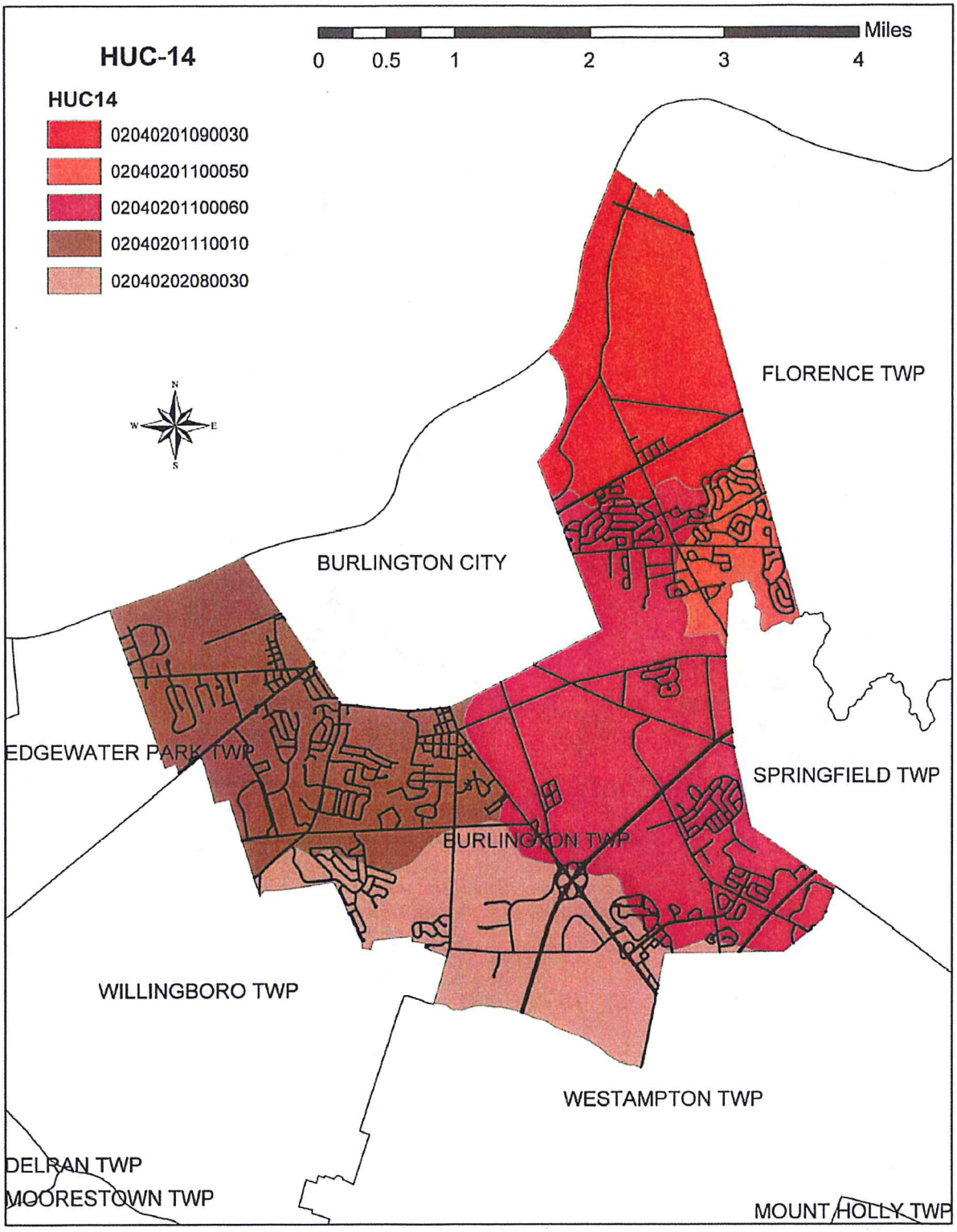

Figure 6 HUC 14 Drainage Areas

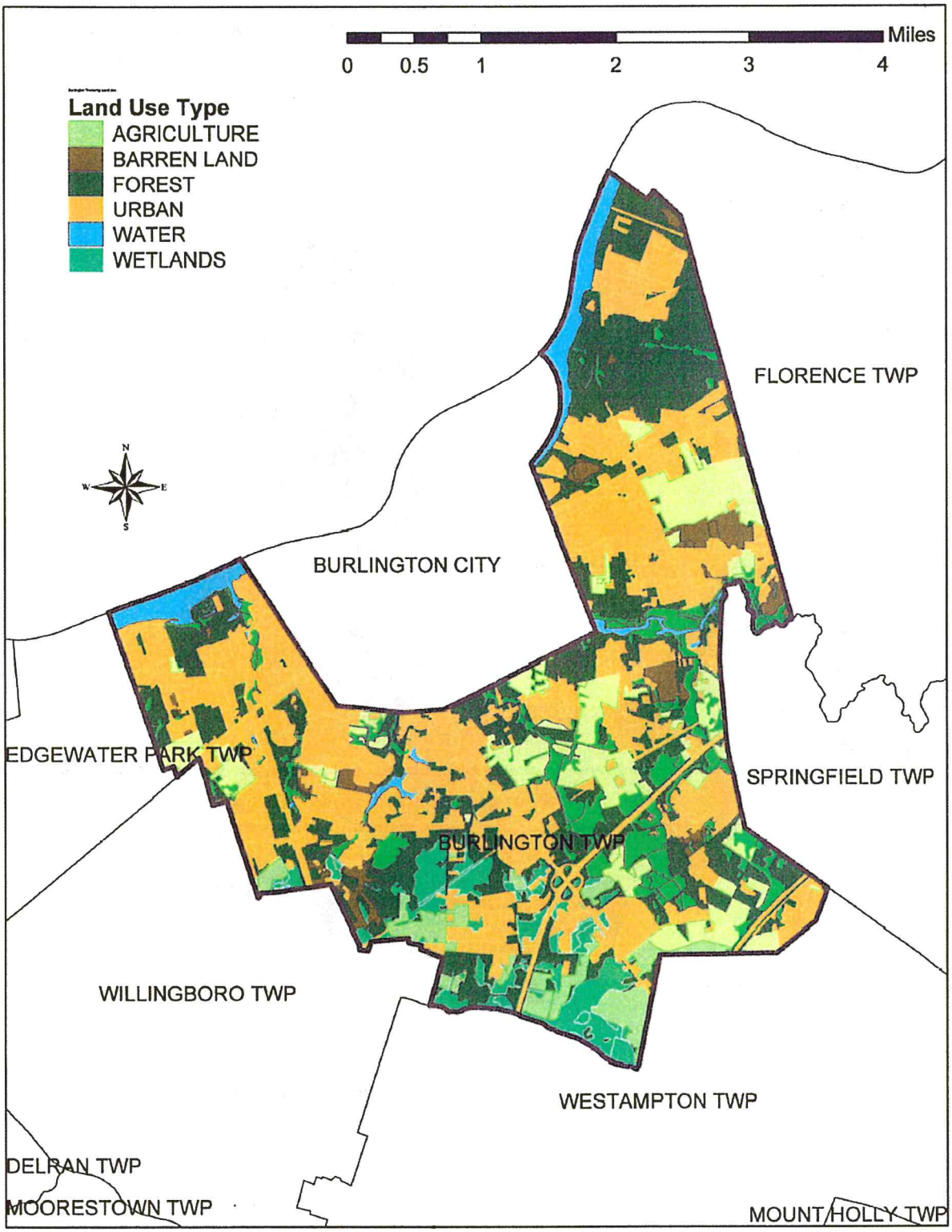

Figure 7 Land Use Map

HUC14	Land Use	Area (acres)	Pollutant Load					
			Total Phosphorus		Total Nitrogen		Total Suspended Solids	
			(lb/acre/yr)	(lb/yr)	(lb/acre/yr)	(lb/yr)	(lb/acre/yr)	(lb/yr)
2040201090030	Urban	478.7	1.0	478.7	10.0	4787	120.0	57442
	Agriculture	208.9	1.3	271.6	10.0	2089	300.0	62667
	Forest	703.2	0.1	70.3	3.0	2109	40.0	28126
	Water	153.7	0.1	15.4	3.0	461	40.0	6146
	Wetland	0.0	0.1	0.0	3.0	0	40.0	0
	Barren Land	66.1	0.5	33.0	5.0	330	60.0	3963
	TOTAL	1610.5		**869**		**9,777**		**158,346**
2040201100050	Urban	60.7	1.0	60.7	10.0	607	120.0	7280
	Agriculture	287.2	1.3	373.4	10.0	2872	300.0	86161
	Forest	87.4	0.1	8.7	3.0	262	40.0	3496
	Water	5.9	0.1	0.6	3.0	18	40.0	236
	Wetland	22.5	0.1	2.2	3.0	67	40.0	900
	Barren Land	3.3	0.5	1.6	5.0	16	60.0	198
	TOTAL	467.0		**447**		**3,843**		**98,272**
2040201100060	Urban	897.9	1.0	897.9	10.0	8979	120.0	107750
	Agriculture	939.8	1.3	1221.7	10.0	9398	300.0	281932
	Forest	1123.1	0.1	112.3	3.0	3369	40.0	44924
	Water	24.9	0.1	2.5	3.0	75	40.0	997
	Wetland	34.4	0.1	3.4	3.0	103	40.0	1378
	Barren Land	25.1	0.5	12.6	5.0	126	60.0	1509
	TOTAL	3045.3		**2,250**		**22,050**		**438,489**
2040201110010	Urban	1046.9	1.0	1046.9	10.0	10469	120.0	125630
	Agriculture	442.4	1.3	575.1	10.0	4424	300.0	132724
	Forest	592.1	0.1	59.2	3.0	1776	40.0	23686
	Water	140.9	0.1	14.1	3.0	423	40.0	5635
	Wetland	5.4	0.1	0.5	3.0	16	40.0	215
	Barren Land	0.0	0.5	0.0	5.0	0	60.0	0
	TOTAL	2227.7		**1,696**		**17,109**		**287,890**
2040202080030	Urban	303.4	1.0	303.4	10.0	3034	120.0	36410
	Agriculture	394.4	1.3	512.7	10.0	3944	300.0	118320
	Forest	926.8	0.1	92.7	3.0	2781	40.0	37074
	Water	2.5	0.1	0.3	3.0	8	40.0	101
	Wetland	3.4	0.1	0.3	3.0	10	40.0	137
	Barren Land	15.3	0.5	7.6	5.0	76	60.0	917
	TOTAL	1,646		**917**		**9,853**		**192,958**

Table 2. Nonpoint Source Pollutant Loads for Existing Land Use

Second, the area of land available for development or redevelopment was calculated for each zoning district by subtracting the constrained lands from the total land area. Constrained lands include wetlands, waterways, and land preserved by the Township as open space or recreational land. The Township Zoning Map is included as Figure 8. Figure 9 depicts the wetlands and waterways in the Township, and Figure 10 depicts the preserved open space and recreational lands. Full build-out conditions refers to the theoretical situation where all available land within the township, excluding constrained lands, is developed. Nonpoint source pollutant loads under full build-out conditions were calculated and are included in Table 3.

The two HUC-14 drainage areas containing the greatest percentage of agricultural lands (2040201100050 and 2040201100060) showed a decrease in pollutant loads for total suspended solids (TSS) when full build-out was projected. This is due to the fact that agricultural lands contribute a higher amount of TSS than other land uses. Although TSS may decrease when agricultural lands are converted to residential lands, the amount of impervious surface will greatly increase, leading to increased stormwater runoff. This runoff, if not managed properly, can result in greater soil erosion, thus increasing sediment loads. Additionally, converting agricultural land to residential land typically results in higher metal and petroleum hydrocarbon pollutant loads.

The projected amount of impervious surface at full build-out is included in Table 4, based on the maximum lot coverage indicated in the Township's Zoning Ordinance for each zoning district. The percentage of impervious surface per HUC-14 under full build-out is projected to range from approximately 30 percent in predominantly residentially-zoned areas to 60 percent in the HUC-14 drainage basin with the largest area of industrial zoning. However, this analysis does not include roadways, and therefore underestimates the amount of impervious surface in each zone. Land reserved for open space and recreation may contain impervious surfaces such as tennis and basketball courts; since no impervious surface restriction is placed on these areas, 20 percent impervious surface was assumed.

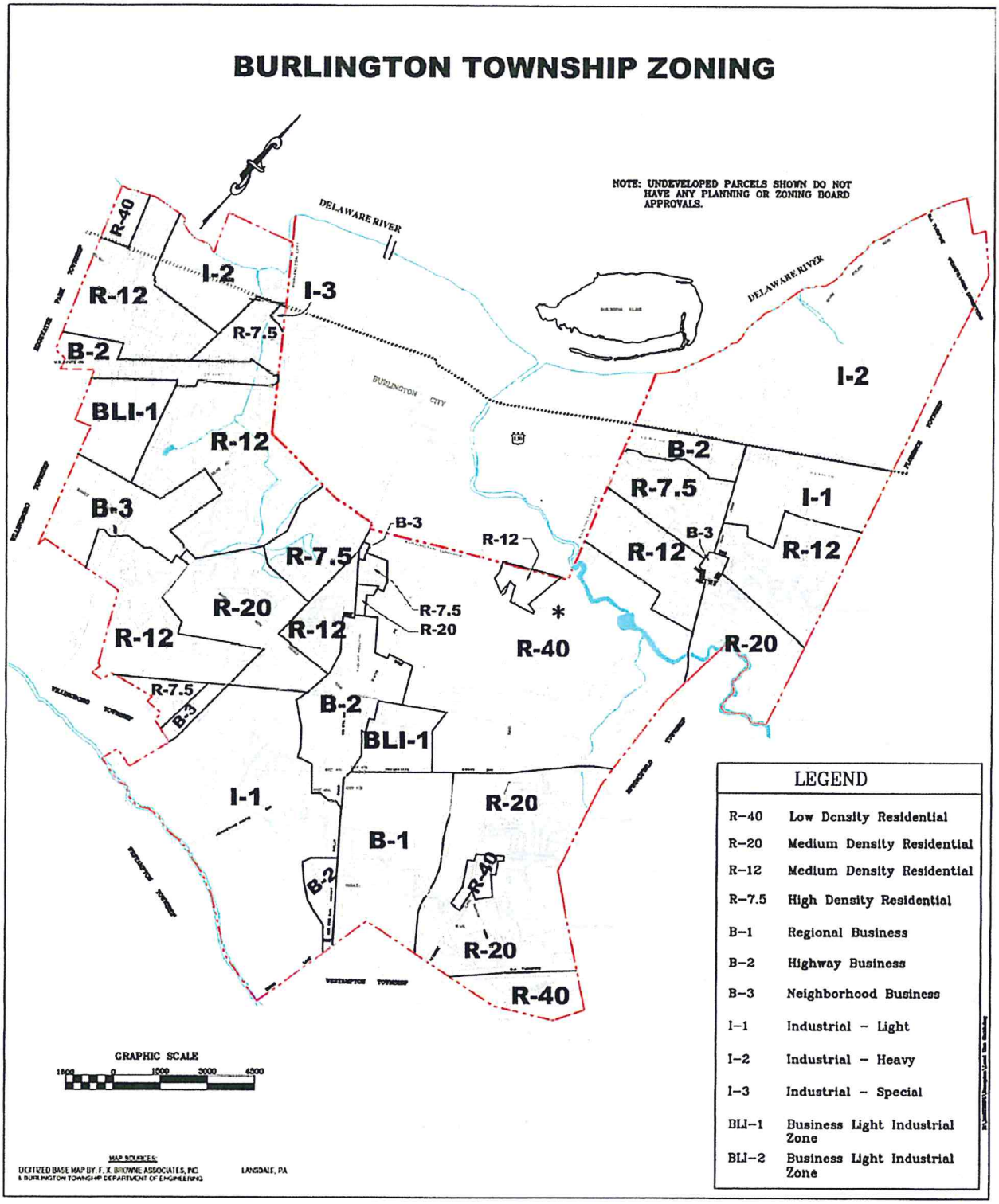

Figure 8 Township Zoning Map

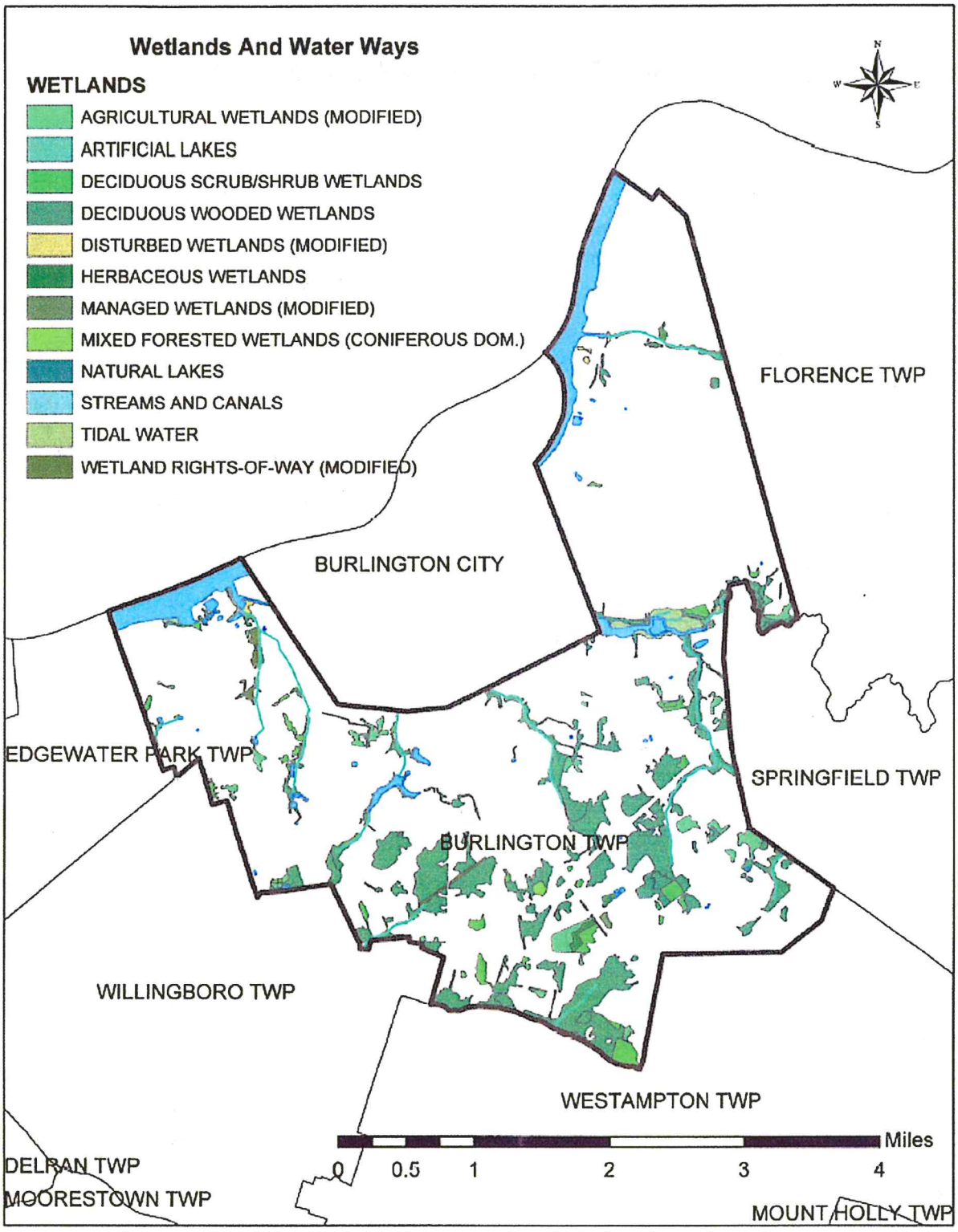

Figure 9 Wetlands and Waterways

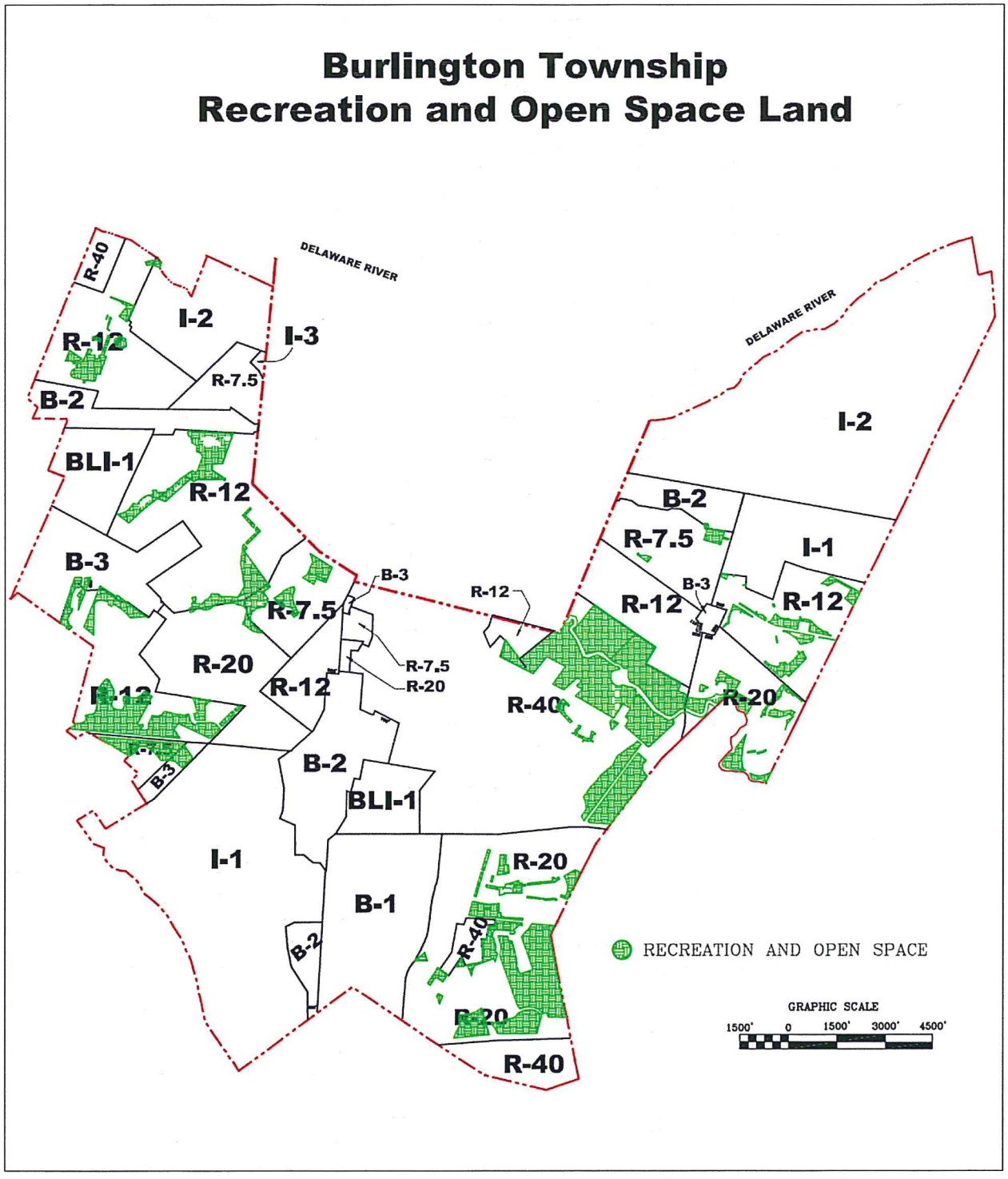

Figure 10 Open Space and Recreational Lands

HUC14	Zoning/ Land Use	Developable Area (acres)	Pollutant Load					
			Total Phosphorus		Total Nitrogen		Total Suspended Solids	
			(lb/acre/yr)	(lb/yr)	(lb/acre/yr)	(lb/yr)	(lb/acre/yr)	(lb/yr)
2040201090030	R-12	22	1.4	31	15	334	140	3,121
	R-7.5	10	1.4	14	15	150	140	1,398
	B-2	69	2.1	146	22	1,527	200	13,880
	I-1	222	1.5	333	16	3,548	200	44,354
	I-2	1,241	1.5	1,861	16	19,850	200	248,127
	Wetland[1]	34	0.1	3	3	102	40	1,360
	Open Space[2]	8	0.3	2	4	32	70	560
	TOTAL	1,606		**2,390**		**25,543**		**312,799**
2040201100050	R-40	7	0.6	4	5	37	100	746
	R-20	142	1.4	199	15	2,130	140	19,883
	R-12	197	1.4	276	15	2,955	140	27,580
	Wetland[1]	68	0.1	7	3	204	40	2,720
	Open Space[2]	62	0.3	19	4	248	70	4,340
	TOTAL	476		**505**		**5,575**		**55,269**
2040201100060	R-40	934	0.6	560	5	4,669	100	93,372
	R-20	374	1.4	523	15	5,606	140	52,324
	R-12	230	1.4	322	15	3,454	140	32,238
	R-7.5	173	1.4	242	15	2,597	140	24,236
	B-1	155	2.1	326	22	3,414	200	31,032
	B-2	187	2.1	393	22	4,115	200	37,413
	B-3	7	2.1	15	22	158	200	1,434
	I-1	43	1.5	65	16	694	200	8,674
	I-2	5	1.5	8	16	83	200	1,035
	BLI-1	63	2.1	132	22	1,387	200	12,605
	Wetland[1]	538	0.1	54	3	1,614	40	21,520
	Open Space[2]	313	0.3	94	4	1,252	70	21,910
	TOTAL	3,023		**2,735**		**29,042**		**337,793**
2040201110010	R-40	55	0.6	33	5	277	100	5,545
	R-20	180	1.4	251	15	2,693	140	25,134
	R-12	728	1.4	1,019	15	10,915	140	101,876
	R-7.5	216	1.4	303	15	3,247	140	30,306
	B-2	134	2.1	282	22	2,952	200	26,833
	B-3	196	2.1	411	22	4,309	200	39,177
	I-2	231	1.5	346	16	3,688	200	46,102
	I-3	5	1.5	7	16	78	200	972
	BLI-1	150	2.1	314	22	3,289	200	29,904
	Wetland[1]	170	0.1	17	3	510	40	6,800
	Open Space[2]	127	0.3	38	4	508	70	8,890
	TOTAL	2,191		**3,022**		**32,467**		**321,539**
2040202080030	R-20	75	1.4	105	15	1,130	140	10,544
	R-12	136	1.4	191	15	2,044	140	19,075
	R-7.5	17	1.4	24	15	261	140	2,435
	B-1	119	2.1	249	22	2,613	200	23,752
	B-2	94	2.1	198	22	2,075	200	18,860
	B-3	49	2.1	103	22	1,081	200	9,830
	I-1	583	1.5	875	16	9,330	200	116,620
	Wetland[1]	547	0.1	55	3	1,641	40	21,880
	Open Space[2]	76	0.3	23	4	304	70	5,320
	TOTAL	1,697		**1,823**		**20,478**		**228,316**

[1] Wetland area includes areas where Wetlands and Recreation/Open Space overlap.

[2] Pollutant loads for Open Space lands were estimated by averaging pollutant loads for forest and low density residential.

Table 3. Nonpoint Source Pollutant Loads for Build-Out Land Use

HUC14	Zoning/Land Use	Developable Area (acres)	Maximum Lot Coverage (from Zoning Ordinance)	Impervious Area (acres)	Total % Impervious
2040201090030	I-2	1,241	60%	744	59%
	B-2	69	50%	35	
	I-1	222	60%	133	
	R-7.5	10	50%	5	
	R-12	22	40%	9	
	Recreation/Open Space*	8	20%	2	
	Wetland**	34	0%	0	
	TOTAL	1,606		928	
2040201100050	R-12	197	40%	79	32%
	R-20	142	40%	57	
	R-40	7	40%	3	
	Recreation/Open Space	62	20%	12	
	Wetland	68	0%	0	
	TOTAL	476		151	
2040201100060	R-7.5	173	50%	87	34%
	R-12	230	40%	92	
	BLI-1	63	50%	32	
	B-2	187	50%	94	
	R-40	934	40%	373	
	B-1	155	60%	93	
	R-20	374	40%	149	
	B-3	7	50%	4	
	I-1	43	60%	26	
	I-2	5	60%	3	
	Recreation/Open Space	313	20%	63	
	Wetland	538	0%	0	
	TOTAL	3,023		1,015	
2040201110010	R-40	55	40%	22	41%
	I-2	231	60%	138	
	R-12	728	40%	291	
	R-7.5	216	50%	108	
	B-2	134	50%	67	
	BLI-1	150	50%	75	
	B-3	196	50%	98	
	R-20	180	40%	72	
	I-3	5	60%	3	
	Recreation/Open Space	127	20%	25	
	Wetland	170	0%	0	
	TOTAL	2,191		900	
2040202080030	B-1	119	60%	71	35%
	B-2	94	50%	47	
	I-1	583	60%	350	
	B-3	49	50%	25	
	R-7.5	17	50%	9	
	R-20	75	40%	30	
	R-12	136	40%	54	
	Recreation/Open Space	76	20%	15	
	Wetland	547	0%	0	
	TOTAL	1,697		601	

* For Recreation/Open Space land, 20% allowable impervious surface was assumed.

** Wetland area includes areas where Wetlands and Recreation/Open Space overlap.

Note: Roads were not included in analysis.

Table 4. Percentage of Impervious Surface for Build-Out Land Use

9.0 Plan Strategies

Strategies have been developed for Burlington Township to meet the stated goals and objectives of the Stormwater Management Plan. The Plan Strategies section includes specific goals, the rationale behind such goals, and actions which can be used to achieve these goals. The following types of actions are included:

- Structural and non-structural projects
- Policy recommendations
- Land use planning

9.1 Reduce adverse stormwater impacts through impervious area management.

9.1.1 Increase the benefits of BMPs using maintenance and retrofits to reduce impacts from impervious areas.

The reason for establishing this goal is that existing stormwater basins may not be providing the intended benefits because they have not be properly designed or maintained.

This goal can be achieved through the following actions:

- Provide education for owners of BMPs to inform them of proper maintenance techniques. Require owners to maintain private BMPs and provide Township maintenance inspections to ensure compliance with any existing maintenance agreement. If necessary, amend existing ordinances and regulations to give the Township the authority to enforce maintenance requirements of private BMPs, to the maximum extent permitted by the NJDEP Stormwater Management Rules.
- Identify areas where retrofits would be appropriate to improve the effectiveness of BMPs. Examples include naturalizing detention basins or modifying outlet structures to provide water quality benefits. Several retrofit options are described in the Mitigation Plan.

9.1.2 Require commercial and residential redevelopment projects to reduce the post-development runoff rate and volume to a specified percentage below the pre-development rate.

The reason for establishing this goal is that much of the Burlington Township watershed was developed prior to the adoption of stormwater control regulations. To account for the previous lack of stormwater controls, redevelopment projects should require a reduction in peak runoff rates and volumes.

This goal can be achieved through the following action:
Amend existing ordinances to stipulate a 10% reduction in total runoff volume for the 100-year storm event from pre to post-construction for redevelopment projects, if required by the Reviewing Board Engineer, based upon site (soil, groundwater and land cover) conditions and previously identified adverse impacts related to the existing site conditions, for those sites which exceed the maximum permitted impervious coverage.

9.2 Preserve and improve habitats and open space land.

9.2.1 Preserve, restore and manage riparian buffers along lakes and streams.

The reason for establishing this goal is that riparian buffers provide shoreline stabilization, water quality, and habitat benefits.

This goal can be achieved through the following actions:
Reestablish riparian buffers on public property, and when possible, establish easements to allow restoration on private property. Restoration methods should be determined based on the needs at the particular location. Seed mix and plantings should be native species, and invasive species should be removed. However, the use of herbicides should be avoided where possible.

9.2.2 Preserve and restore stream banks.

The reason for establishing this goal is that streambank erosion and channel widening reduce the health of aquatic habitats and degrade water quality in streams and lakes.

This goal can be achieved through the following actions:

The Township should assess its streambanks, prioritize stream sections in need of restoration, and perform streambank restoration projects. Depending on the causes and severity of erosion at a particular location, one or more of the following streambank restoration measures should be considered: velocity controls such as J-hook vanes, cross vanes, W-weirs, Root wad revetments, Boulder revetments or rip-rap; riparian vegetation plantings; removal of invasive species; channel realignment; modification of culverts; in-stream habitat structures; or bioengineering techniques.

9.2.3 Preserve and restore wetland areas.

The reason for establishing this goal is that wetland areas provide habitat for native flora and fauna, provide water quality benefits by filtering pollutants from stormwater, and provide flood control by storing stormwater runoff.

This goal can be achieved through the following actions:
Preserve ordinary and extraordinary resource value wetlands to the maximum extent practicable by purchasing private land, designating public land as undeveloped open space, and acquiring easements.

9.3 Improve the water quality of streams and lakes in the Township.

9.3.1 Reduce the amount of pollutants in stormwater runoff including nitrogen, phosphorus, and fecal coliform.

The reason for establishing this goal is that the Sylvan Lakes are included on NJDEP's Integrated List for TMDLs, and the Township wishes to have these lakes delisted. Lower Sylvan Lake has a TMDL established for phosphorus, and Upper Sylvan Lake is pending establishment of a TMDL for phosphorus and fecal coliform.

This goal can be achieved through the following actions:

- Strictly enforce pet waste ordinances.
- Develop a monitoring program to identify sources of fecal coliform.

- Install or retrofit existing BMPs at selected locations to reduce the pollutant loading from developments that have no effective water quality treatment for stormwater runoff. For example, the Township can install native plantings in existing detention basins for a minimal cost.
- Continue public education efforts to educate the public about non-point source pollution, its effect on lakes and streams, and ways that it can be reduced.

9.4 Increase community involvement in meeting the Township's watershed management goals.

9.4.1 Coordinate and improve the efforts of state, local, and community organizations in environmental education and volunteering.

The reason for establishing this goal is that, by coordinating the activities of various organizations, the Township can help to combine resources and create new opportunities for volunteer groups.

This goal can be achieved through the following actions:

- Utilize the Township's Environmental Commission and School Board Liaison Activities to encourage environmental education activities in schools and integrate environmental education into community events.

10.0 Burlington Township Stormwater Mitigation Plan

10.1 Stormwater Mitigation

This mitigation plan is provided for a proposed development that is granted a variance or exemption from the design and performance standards of the municipal stormwater management plan.

The developer is responsible for obtaining all necessary permits to perform mitigation work. Each streambank stabilization project will require a stream encroachment permit, and some projects may also

require a wetland permit and/or the approval of County and/or State agencies. Streambank stabilization projects near County culverts will require the County Engineer's approval prior to implementation. The developer must provide detailed mitigation plans to the Township, and must receive Township approval before beginning mitigation work.

10.2 Mitigation Project Options

10.2.1 Option 1

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

The applicant can select one or more of the following projects listed to compensate for the deficit from the performance standards resulting from the proposed project. A partial list of suggested projects is included below. More detailed information on these projects, or additional project options, may be obtained by contacting the Burlington Township Engineering Department.

A) Retrofit existing detention basin(s). A schematic of a naturalized basin is included in Figure 11. Locations and recommendations for detention basin improvements are included in Table 5. Latitude and longitude coordinates are provided using the North American Datum of 1983 (NAD83) system. Naturalize the detention basin(s) by provide one or more of the following:

1. **Eliminate the concrete or stone-lined low flow channel, if applicable.**
    a. Benefits
        i. Water Quality – Removing these channels and planting vegetation will slow the rate of runoff, cool the water, and allow for greater pollutant removal from small storm events.
    b. Implementation

i. Remove any existing concrete or stone from the basin, and replace it with a meandering vegetated swale. Plant the area with appropriate indigenous wetland plantings. See the recommendations below for indigenous plantings.

2. Plant a variety of indigenous vegetation.

a. Benefits

i. Water Quality – Vegetation will help to slow the flow through the basin and filter pollutants.

ii. Volume Control – Plants will increase the evapotransipration from the basin.

b. Implementation

i. Develop a planting plan by selecting native plants that are appropriate for the size, shape, depth, and hydrology of the basin. Planting plugs should be used rather than seed, although seed mix can be used in conjunction with plugs.

ii. The person responsible for implementing the planting plan shall also be responsible for ensuring that plants become established within the basin. A maintenance plan should be developed and agreed to with the Township.

3. Add a sediment forebay

a. Benefits

i. Water Quality – The forebay will allow sediment to settle out of the water. The forebay will increase ease of maintenance by preventing buildup of sediment in the main basin area.

b. Implementation

i. The sediment forebay should be placed at the outfall of the incoming storm pipe.

ii. The size of the sediment forebay will depend on the site constraints. In general, the sediment forebay should be designed to handle approximately 10% of the required detention basin volume.

iii. Access to the forebay should be incorporated into the design to allow for maintenance.

4. Modify the outlet structure to retain small storms.

a. Benefits

i. Water Quality – Increased detention time will allow the vegetation more time to treat the water and will allow sediments to settle out.

ii. Groundwater Recharge – Increased retention time will facilitate infiltration in basins which have appropriate soils.

iii. Volume control – Increased retention time will allow for increased evapotranspiration.

b. Implementation

i. Creating a two-stage release will increase pollutant removal of small storms while also accommodating larger storm flows. Outlet structure modifications will depend upon the existing outlet structure and the hydraulics of the basin. As an example, a 3-inch or 4-inch orifice plate can be added over the existing outlet pipe to slow the flow exiting the basin. A riser can then be added to act as an emergency spillway and handle larger storm flows. Flow calculations will need to be completed to ensure that the hydraulics of the modified outlet structure are adequate to handle storm flows.

5. Add soil berms to create meander through the basin.

a. Benefits

i. Water Quality – Berms will increase the travel time through the basin for small storm flows, allowing sediments to settle out. Berms will also increase the amount of contact with vegetation, helping to facilitate filtering of pollutants by the vegetation.

ii. Groundwater Recharge – Increased travel time through the basin will facilitate infiltration in basins which have appropriate soils.

iii. Volume control – Increased travel time through the basin and increased contact with vegetation will allow for increased evapotranspiration

b. Implementation

i. The height and length of the berm will vary depending on the particular site. In general, the berm height should be between 18 and 36-inches high.

ii. An appropriate volume must be maintained within the basin. Any fill added to the basin will reduce its capacity and additional regrading may be needed to either deepen or widen the basin to maintain the required volume.

B) Retrofit existing detention basin outlet structures with hinged trash racks meeting the alternative Device Exemption requirements in Attachment "C" of the Township Municipal Stormwater General Permit.

C) Install streambank stabilization and/or other stream improvement measures at various culverts. Locations and recommendations for stream improvements are included in Table 6. Please note that Streambank stabilization projects near County culverts will require the County Engineer's approval prior to implementation. Latitude and longitude coordinates are provided for most locations using the NAD83 system.

Detention Basin No.	Location	Recommended Improvement	Coordinates (NAD83)	
			Latitude	Longitude
1	Trellis Green development between Tina Lane and Jennifer Lane	Add a hinged trash rack at the outlet. Fix slight erosion around the outlet. Naturalize the basin.	North 40°03.787'	West 074°53.294'
2	Trellis Green development along Tina Lane	Add hinged trash racks at outlets. Remove riprap pile at downstream end of outlet pipes.	North 40°03.702'	West 074°53.376'
3	Harrison Park Ave. between Yubas Ave. and Grayson Place	Naturalize the basin. Vegetation would attract birds that surrounding homes could observe. Add trash rack if one is not present.	North 40°03.828'	West 074°52.931'
4	Grayson Place and Beverly Road	Naturalize the basin. Add a hinged trash rack.	North 40°04.000'	West 074°53.007'
5	Burlington Center Mall (Mount Holly Rd. and Elbow Lane)	Naturalize the basin.	North 40°02.455'	West 074°49.732'

Table 5. Recommended Detention Basin Improvements

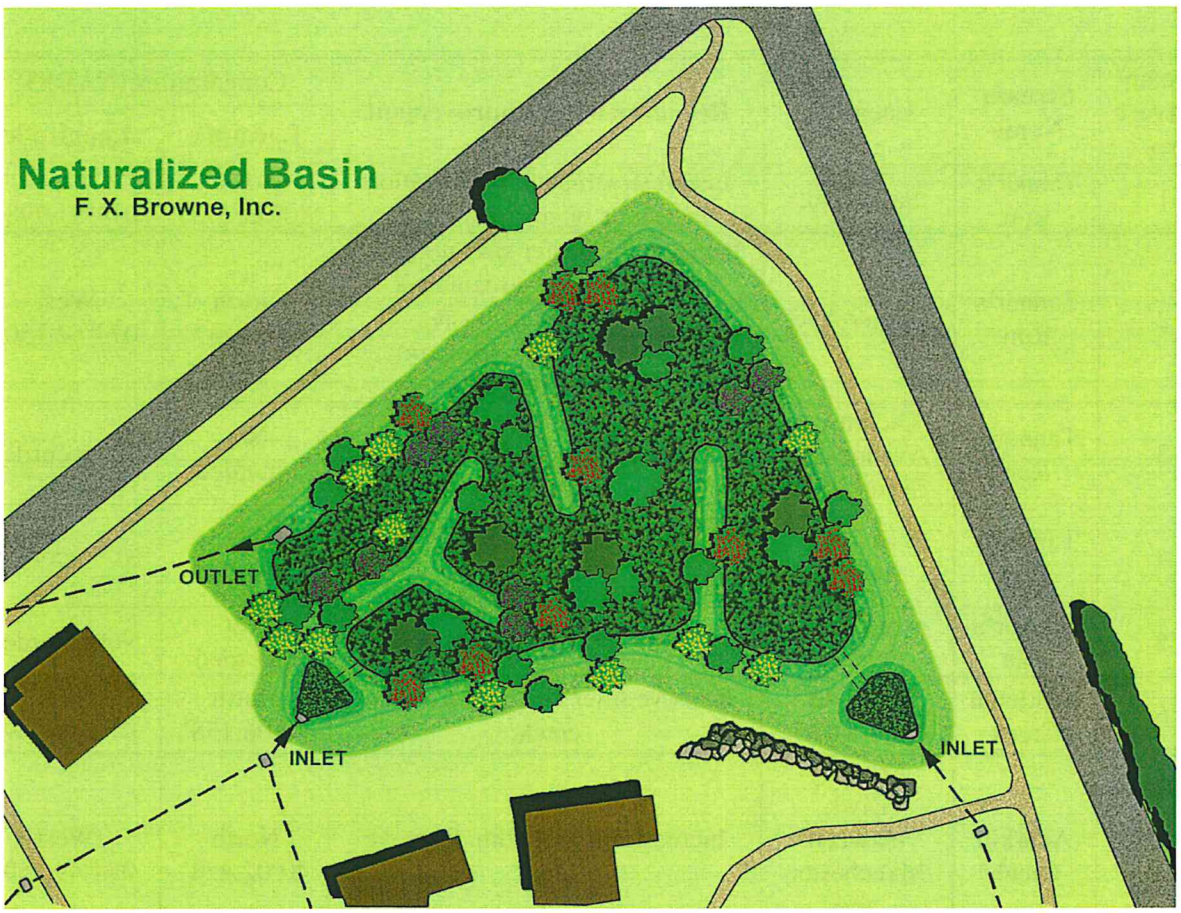

Figure 11. Naturalized Detention Basin

Stream/ Culvert No.	Stream Name	Location	Recommended Improvement	Coordinates (NAD83)	
				Latitude	Longitude
1	Tanner's Run	Salem Rd.	Install streambank stabilization measures on upstream side.	North 40°03.732'	West 074°51.998'
2	Tanner's Run	Tanner Ave.	Increase the buffer size along the stream. Install streambank stabilization measures downstream and upstream. Remove English Ivy.	North 40°03.747'	West 074°52.150'
3	Tanner's Run	Dickinson Avenue and Route 130	De-silt culvert and/or relocate utility pipe (requires NJDOT approval).	Not recorded	Not recorded
4	Tanner's Run	Devlin Avenue	Channel improvements between Beverly Road and the Township Wastewater Treatment Plant.	Not recorded	Not recorded
5	Tanner's Run	near Devlin Avenue	Culvert improvements.	Not recorded	Not recorded
6	Bustleton Creek	River Rd. (Route 656)	Remove litter and tires from the creek.	North 40°06.158'	West 074°49.769'
7	Anarkin Creek	Bromley Blvd. between Manchester and Hamshire	Increase buffer width. Remove litter.	North 40°02.428'	West 074°49.159'
8	Riggs Mill Creek	Jacksonville Rd. and Mill Lane	Install streambank stabilization measures downstream and upstream.	North 40°03.593'	West 074°48.904'
9	Riggs Mill Creek	Old York Rd. near Mill Lane	Install streambank stabilization measures downstream.	North 40°04.114'	West 074°48.981'

Table 6. Recommended Stream/Culvert Improvements

10.2.2 Option 2

If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, the mitigation project may provide mitigation that is not equivalent to the impacts for which the variance or exemption is sought, but that addresses the same issue. For example, if a variance is given because the 80 percent TSS requirement is not met, the selected project may address water quality

impacts due to a fecal impairment. Listed below are specific projects that can be used to address the mitigation option.

A) Sylvan Lakes- provide measures to reduce TMDLs identified by the NJDEP. Measures can include:
   i) re-establishing a vegetative buffer along lake shorelines, a minimum of 30 feet wide,
   ii) installing additional aquatic habitats, and
   iii) providing goose control measures.

10.2.3 Option 3

If none of the above options are feasible, the developer may provide funding or partial funding to the municipality for an environmental enhancement project identified in this Plan or approved by the Township. The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.

11.0 References

2003 Master Plan Reexamination Report, Township of Burlington. Alaimo Group, December 8, 2003.

Application for Sylvan Lakes Riparian Buffer Plantings, Burlington Township. June 2004.

A Comprehensive Storm Drainage Study for Burlington Township. Richard A. Alaimo Association of Consulting Engineers. May 1980.

Guidelines for Delineation of Wellhead Protection Areas in New Jersey. New Jersey Geological Survey Open File Report OFR 03-1, New Jersey Department of Environmental Protection, 2003. <http://www.njgeology.org/whpaguide.pdf>

New Jersey Stormwater Best Management Practices Manual. New Jersey Department of Environmental Protection. February 2004.

Report on the Establishment of Total Maximum Daily Load (TMDL) For Phosphorus in the Lower Sylvan Lake, Burlington Township, Burlington County, NJ. New Jersey Department of Environmental Protection. June 12, 2000.

The Zoning Ordinance of the Township of Burlington. Ordinance Codification Service, Suite 101, 300 Chester Avenue, Moorestown, NJ. January 1995.

New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)). State of New Jersey, Department of Environmental Protection, Water Assessment Team. June 2004.

Natural Resources Conservation Service, United States Department of Agriculture. Average Annual Precipitation Map, 1961-1990. April 1998.

Appendix A

Glossary of Terms

ACCESS STREET: The lowest order street in the hierarchy of streets; it conducts traffic between individual dwelling units and higher order streets.

ACCESSORY BUILDING, STRUCTURE OR USE: Subordinate to the principal building, structure or use and located on the same lot.

ADVERSE EFFECT: Development, designs, situations, existing features on a developer's property, or any nearby property, creating, imposing, aggravating or leading to impractical, unsafe, unsatisfactory or non-complying conditions.

AMBIENT BIOMONITORING NETWORK (AMNET): New Jersey DEP program that documents the health of New Jersey's waterways by classifying streams based on benthic macroinvertebrate monitoring results.

AQUIFER: A permeable geologic formation capable of storing and yielding groundwater to wells and springs.

AS-BUILT: Drawing or certification of conditions as they were actually constructed.

BANK STABILIZATION: Methods of securing the structural integrity of earthen stream channel banks with structural supports to prevent bank slumping and undercutting of riparian trees, and overall erosion prevention. Techniques include the use of willow stakes, imbricated riprap, or brush bundles.

BASE FLOW: The portion of stream flow that is not due to storm runoff, and is supported by groundwater seepage into a channel.

BASIN: The largest single watershed management unit for water planning, that combines the drainage of a series of subbasins. Often basins have a total area of more than a thousand square miles.

BEST MANAGEMENT PRACTICE (BMP): A structural or non-structural device designed to temporarily store or treat urban stormwater runoff in order to mitigate flooding, reduce pollution and provide other amenities. (Also called STORMWATER PRACTICE.)

BIOCHEMICAL OXYGEN DEMAND (BOD): The quantity of dissolved oxygen used by microorganisms (e.g., bacteria) during the biochemical oxidation of matter (both organic and oxidizable inorganic matter) over a specified period of time.

BIORETENTION: A water quality practice that utilizes landscaping and soils to treat urban stormwater runoff. Bioretention systems collect stormwater in shallow depressions before filtering it through a fabricated vegetated planting soil media.

BUFFER: An area adjacent to a shoreline, wetland or stream where development is restricted or prohibited.

BUILD-OUT ANALYSIS: An impact assessment of the current zoning criteria of a municipality that predicts the amount of growth that will occur within the municipality in the future under the existing designations. The municipality can use the information generated in a build-out analysis to estimate the financial effects on government services and infrastructure that will be required to meet the growth demands.

CHANNEL: A natural stream that conveys water; a ditch or channel excavated for the flow of water.

CLEAN WATER ACT (CWA): More formally referred to as the Federal Water

Pollution Control Act, the Clean Water Act constitutes the basic federal water pollution control statute for the United States. Enforceable provisions of the CWA include technology-based effluent standards for point sources of pollution, a state-run control program for nonpoint pollution sources, a construction grants program to build or upgrade municipal sewage treatment plants, a regulatory system for spills of oil and other hazardous wastes, and a Wetlands preservation program (Section 404).

CLUSTER OR OPEN SPACE DEVELOPMENT: Development designs that incorporate open space into a development site. These areas can be used for either passive or active recreational activity or preserved as naturally vegetated land.

COMBINED SEWER OVERFLOW (CSO): Excess flow (combined wastewater and stormwater runoff) discharged to a receiving water from a combined sewer network when the capacity of the sewer network and / or treatment plant is exceeded, typically during storm events.

COMPACTION: An increase in soil bulk density.

CONDUIT: Any channel intended for the conveyance of water, whether open or closed.

CONSERVATION EASEMENT: Voluntary agreements that allow an individual to set aside private property to limit the type or amount of development on their property. Easements relieve property owners of the burden of managing these areas by shifting responsibility to a private organization or government agency better equipped to handle maintenance and monitoring issues.

CONVEYANCE SYSTEM: Drainage facilities, both natural and human-made, which collect, contain, and provide for the flow of surface water and urban runoff from the highest points on the land down to a receiving water. The natural elements of a conveyance system include swales and small drainage courses, streams, rivers, lakes, and wetlands. The human-made elements of a conveyance system include gutters, ditches, pipes, channels, and most retention/detention facilities.

CRUSHED STONE: Aggregate consisting of angular particles produced by mechanically crushing rock.

DAM: A barrier to confine or raise water for storage or diversion, to create a hydraulic head, to prevent gully erosion, or for retention of soil, sediment or other debris.

DETENTION: The temporary storage of storm runoff in a stormwater practice with the goal of controlling peak discharge rates and providing gravity settling of pollutants.

DETENTION BASIN: A structure constructed for the purpose of temporary storage of stream flow or surface runoff and gradual release of stored water at controlled rates.

DEVELOPMENT: 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, by any person, 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 of agricultural lands, development means: any activity that requires a State permit; any activity reviewed by the County Agricultural Board (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.

DISCHARGE: 1. Outflow; the flow of a stream, canal, or aquifer. 2. Rate of flow, specifically fluid flow; a volume of fluid passing a point per unit of time, commonly

expressed as cubic feet per second, cubic meters per second, gallons per minute, gallons per day, or millions of gallons per day.

DISCONNECTED IMPERVIOUS SURFACES: The practice of interrupting impervious surfaces to allow for the infiltration and filtration of precipitation. An example of this is a residential subdivision in which each dwelling's roof top drains through a vegetative strip before reaching the road surface.

DISSOLVED OXYGEN (DO): Oxygen which is present (dissolved) in water and available for use by fish and other aquatic animals. If the amount of dissolved oxygen in the water is too low, aquatic animals will suffocate.

DISTURBED AREA: An area in which the natural vegetative soil cover has been removed or altered and, therefore, is susceptible to erosion.

DIVERSION: A channel, embankment, or other human-made structure constructed to divert water from one area to another.

DRAINAGE AREA: All land and water area from which runoff may run to a common (design) point. (Also called a WATERSHED)

DREDGING: A method for deepening streams, swamps, or other waters by scraping and removing solid materials from the bottom.

(UNITED STATES) ENVIRONMENTAL PROTECTION AGENCY (EPA): The federal agency responsible for implementing the federal laws designed to protect the environment in the United States.

ENVIRONMENTALLY CRITICAL AREAS: An area or feature which is of significant environmental value, including but not limited to: stream corridors; natural heritage priority sites; habitat 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 New Jersey DEP's Landscape Project as approved by the Endangered and Nongame Species Program.

EROSION: The detachment and movement of soil or rock fragments by water, wind, ice or gravity.

EXTENDED DETENTION (ED): A stormwater design feature that provides for the gradual release of a volume of water (0.25 - 1.0 inches per impervious acre) over a 12 to 48 hour interval time to increase settling of urban pollutants, and protect channels from frequent flooding.

FLOODPLAIN: Any lowland that borders a stream and is inundated periodically by its waters.

FOREBAY: An extra storage area provided near the inlet of a BMP to trap incoming sediments before they accumulate in the BMP structure. (Also called a SEDIMENT FOREBAY)

GRADING: The cutting and/or filling of the land surface to a desired slope or elevation.

GREENWAY: An interconnected series of open space and recreational areas that are protected from development.

GROUNDWATER: (1) Water that flows or seeps downward and saturates soil or rock, supplying springs and wells. (2) Water stored underground in rock crevices and in the pores of geologic materials that make up the earth's crust.

GROUNDWATER RECHARGE: the amount of water from precipitation that infiltrates into the ground and is not evapotranspired.

GROUNDWATER TABLE: The level below which the soil is saturated (the pore spaces

between the individual soil particles are filled with water). Above the groundwater table, water in the soil does not fill all pore spaces.

HABITAT: A place where a biological organism lives. The organic and non-organic surroundings that provide life requirements such as food and shelter.

HEAVY METALS: Metals of relatively high atomic weight, including but not limited to chromium, copper, lead, mercury, nickel, and zinc. These metals are generally found in minimal quantities in stormwater, but can be highly toxic even at trace levels.

HUC-14 DRAINAGE AREAS: Sub-watershed drainage areas defined by the United States Geological Service hydrologic unit code system for delineating and identifying drainage areas.

HYDROLOGIC CYCLE: The circular flow or cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Runoff, surface water, groundwater, and water infiltrated in soils are all part of the hydrologic cycle.

IMPERMEABLE: Properties that prevent the movement of water through a material.

IMPERVIOUS SURFACE: Material which resists or blocks the passage of water.

INFILTRATION: The penetration of water through the ground surface into subsurface soil. The infiltration rate is expressed in terms of inches per hour. Infiltration rates will be slower when the soil is dense (e.g., clays) and faster when the soil is loosely compacted (e.g., sands). Can also refer to seepage of groundwater into sewer pipes through cracks and joints.

INFILTRATION BASIN: A stormwater management facility constructed within highly permeable soils that provides temporary storage of runoff during rain events. Outflow from an infiltration basin is through the surrounding soil.

INLET: 1. A drainage passway. 2. A short, narrow waterway connecting a bay, lagoon, or similar body of water with a large parent body of water. 3. An arm of the sea (or other body of water) that is long compared to its width and may extend a considerable distance inland.

INTEGRATED LIST: New Jersey's 2004 Integrated Water Quality Monitoring and Assessment Report, or Integrated List, which includes data from both the federal 305(b) and 303(d) lists.

LANDOWNER: Any individual, corporation, association, trust or any other legal entity having legal title to the land.

LOW-IMPACT DEVELOPMENT (LID): A comprehensive land planning and engineering design approach with the goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds. LID designs maximize the amount of natural features and vegetation at a site, in order to allow stormwater to be infiltrated on site and recharge the groundwater rather than being conveyed to detention facilities or storm sewers.

LOT: A parcel of undivided land.

MAJOR DEVELOPMENT: Any "development" that provides for ultimately disturbing one or more acres of land. Disturbance refers to the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

MASTER PLAN: A composite of one or more written or graphic proposals for the development of a municipality, as set forth and adopted by the planning board pursuant to N.J.S.A. 40:55D-28.

MAXIMUM EXTENT PRACTICABLE: The implementation of BMPs for a particular site when considering various factors to include

physical conditions, economic viability, project size and location within the watershed; and such other factors as may be considered by the Reviewing Board.

MINOR SUBDIVISION: A subdivision of land that does not involve (1) the creation of more than 3 lots, including the remainder of the original lot; (2) planned development as defined in the Municipal Land Use Law; (3) any new street; or (4) extension of any off-tract improvement.

MITIGATION: Action taken to avoid, reduce the severity of, or eliminate an adverse impact.

MUNICIPALITY: Any city, borough, town, township, or village.

NJDEP: New Jersey Department of Environmental Protection. State agency in charge of protecting environmental resources in New Jersey.

NONPOINT SOURCE (NPS) POLLUTION: Pollution that cannot be traced to a specific origin, but seems to flow from many different sources. NPS pollutants are generally carried off the land by stormwater or snowmelt runoff.

NPDES: National Pollutant Discharge Elimination System. This permit program controls water pollution by regulating industrial and municipal point sources that discharge pollutants directly into waters of the United States.

NUTRIENTS: Elements or substances, such as nitrogen or phosphorus, that are necessary for the growth and development of living things. Large amounts of these substances reaching water bodies can lead to reduced water quality and eutrophication by promoting excessive aquatic algae growth. Some nutrients can be toxic at high concentrations.

OUTFALL: The point of discharge for a river, drain, or pipe.

PEAK DISCHARGE (FLOW RATE): The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.

PERCOLATION: The downward movement of water through the soil.

PERMEABILITY: The quality of a soil horizon that enables water or air to move through it.

PHASE II REGULATIONS: Also known as Phase II New Jersey Pollutant Discharge Elimination System Stormwater Regulation Program Rules (N.J.A.C. 7:14A). These Rules are intended to address and reduce pollutants associated with existing stormwater runoff. The Rules establish a regulatory program for existing stormwater discharges as required under the Federal Clean Water Act.

POLLUTANT: 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, ground waters or surface waters, or to a domestic treatment works. "Pollutant" includes both hazardous and nonhazardous pollutants.

POLLUTANT LOADING: The total quantity of pollutants in stormwater runoff.

POROUS PAVEMENT: An alternative to conventional pavement whereby runoff is diverted through a porous asphalt layer and into an underground reservoir. The stored runoff then gradually infiltrates into the subsoil.

PRETREATMENT: Techniques employed in stormwater practices to provide initial storage or filtering to help trap coarse materials before they enter the system.

REDEVELOPMENT: New development activities on previously developed land.

REGIONAL STORMWATER MANAGEMENT PLANS (RSWMPs): A regional stormwater management plan addresses stormwater-related water quality and water quantity impacts of new and existing land uses in a drainage area, and is developed on a drainage area basis, and is not limited to on-site stormwater management measures.

(NEW JERSEY) RESIDENTIAL SITE IMPROVEMENT STANDARDS (RSIS): A set of rules that control all matters concerning the construction, alteration, addition, repair, removal, demolition, maintenance, and use of any site improvements constructed by a developer in connection with residential development. The RSIS are intended to ensure public health and safety.

RETENTION: The amount of precipitation on a drainage area that does not escape as runoff. The difference between total precipitation and total runoff.

RETROFIT: The installation of a new stormwater practice or the improvement of an existing one in a previously developed area.

REVIEWING BOARD ENGINEER: The engineer employed by a Reviewing Board having jurisdiction over an application for development.

RIP-RAP: Broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves or streamflow); also applies to brush or pole mattresses, or brush and stone, or similar materials used for soil erosion control.

RIPARIAN BUFFER: The area from the streambank in the floodplain to, and including, an area of trees, shrubs, and herbaceous vegetation located upslope from the body of water.

RUNOFF: That portion of the precipitation on a drainage area that is discharged from the area in the stream channels. Types include surface runoff, ground water runoff or seepage.

SEDIMENT: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

SEDIMENTATION: The process of soil and silt settling and building up on the bottom of a creek, river, lake, or wetland.

SHEET FLOW: Water, usually stormwater runoff, flowing in a thin layer over the ground surface.

SITE: the lot or lots upon which a major development is to occur or has occurred.

SMART GROWTH: A development trend that focuses on restoring community and vitality to center cities and older suburbs and reducing sprawl. Smart growth is more town-centered, is transit and pedestrian oriented, and has a greater mix of housing, commercial and retail uses than traditional development.

SPRAWL DEVELOPMENT: Expansion of low-density development into previously undeveloped land.

STABILIZATION: Provision of adequate vegetative and/or structural measures to prevent erosion from occurring.

STAKEHOLDER: Any agency, organization, or individual that is involved in or affected by

the decisions made in the development of a watershed plan.

STORM DRAIN (or STORM SEWER SYSTEM): Above- and below-ground structures for transporting stormwater to streams or outfalls for flood control purposes.

STORM FLOW: The portion of stream flow that is due to stormwater runoff.

STORMWATER HOT SPOTS: Land-uses or activities that generate highly contaminated runoff. Examples include fueling stations and airport de-icing facilities.

STORMWATER INFILTRATION SYSTEMS: Stormwater practices that are designed to percolate runoff into the underlying soil.

STORMWATER MANAGEMENT: Programs designed to maintain or return the quality and quantity of stormwater runoff to pre-development levels.

STORMWATER MANAGEMENT BASIN: 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).

(NEW JERSEY) STORMWATER MANAGEMENT RULES (N.J.A.C. 7:8): New Jersey state regulations that describe the required components of regional and municipal stormwater management plans and establish the stormwater management design and performance standards for new (proposed) development.

STORMWATER PRACTICE: A structural or non-structural device designed to temporarily store or treat stormwater runoff in order to mitigate flooding, reduce pollution and provide other amenities (Also known as a BMP).

STORMWATER RUNOFF: Excess precipitation that is not retained by vegetation, surface depressions, or infiltration, and thereby collects on the surface and drains into a surface water body.

STREAM CORRIDOR: The land area around a stream, including the stream itself and the floodplain.

SUBDIVISION: A new development that splits an existing tract, parcel or lot into two or more parts.

SUBWATERSHED: A smaller geographic section of a larger watershed unit with a drainage area of between 2 and 15 square miles, and whose boundaries include all the land area draining to a point where two second order streams combine to form a third order stream.

SWALE: A natural depression or wide shallow ditch used to temporarily store, route, or filter runoff.

TOTAL MAXIMUM DAILY LOAD (TMDL): A tool for establishing the allowable loadings of a given pollutant in a surface water resource to meet predetermined water quality standards.

TOXIC: Related to or caused by a poison, hazardous waste, or toxin.

TOTAL SUSPENDED SOLIDS (TSS): The total amount of particulate matter which is suspended in the water column.

URBAN RUNOFF: Stormwater that passes through and out of developed areas to a stream or other body of water.

VARIANCE: Permission to depart from the literal requirements of a zoning ordinance, pursuant to N.J.S.A. 40:55D-40b, 70c, and 70d.

VEGETATED FILTER STRIP: A vegetated section of land designed to accept runoff as overload sheet flow from upstream development. It may consist of any natural vegetated form, from grass meadow to small forest. The dense vegetative cover facilitates pollutant removal. A vegetated filter strip differs from a natural buffer in that the strip is designed and constructed specifically for the purpose of pollutant removal. A filter strip differs from a grassed swale in that a swale is a concave vegetated conveyance system, whereas a filter strip has a fairly level surface.

VEGETATED OPEN CHANNEL CONVEYANCE: An earthen conveyance system in which the filtering action of grass and soil are utilized to remove pollutants from urban stormwater. Also known as GRASSED SWALES.

VELOCITY: The distance that water travels in a given direction in a stream during an interval of time.

WATER QUALITY: A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

WATERS OF THE STATE: the ocean and its estuaries, all springs, streams, wetlands, and bodies of surface or ground water, whether natural or artificial, within the boundaries of the State of New Jersey or subject to its jurisdiction.

WATERSHED: All the land area that contributes runoff to a particular point along a waterway. (Also known as a DRAINAGE BASIN)

WATERWAY: A navigable body of water, such as a river, channel, or canal.

WELLHEAD PROTECTION: An area of restricted development surrounding a public water system, in efforts to protect the water supply from contaminants.

WETLAND: Land on which water covers the soil or is present either at or near the surface of the soil or within the root zone, all year or for varying periods of time during the year, including during the growing season. Wetlands are identified by determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Human-made wetlands include constructed stormwater wetlands (see STORMWATER WETLAND) designed to treat stormwater runoff, and artificial wetlands created to comply with mitigation requirements.

WETLAND MITIGATION: The construction of artificial wetlands in order to comply with a regulatory requirement to replace wetland areas destroyed or impacted by proposed land disturbances.

ZONING ORDINANCE: A set of regulations and requirements that govern the use, placement, spacing and size of buildings and lots within a specific area or in a common class (zone).

ZONING OFFICER: The terms "Zoning Officer, Inspector of Buildings, Building Inspector, Administrative Officer or Official" shall mean the person or persons who are charged with the enforcement of municipal ordinances.