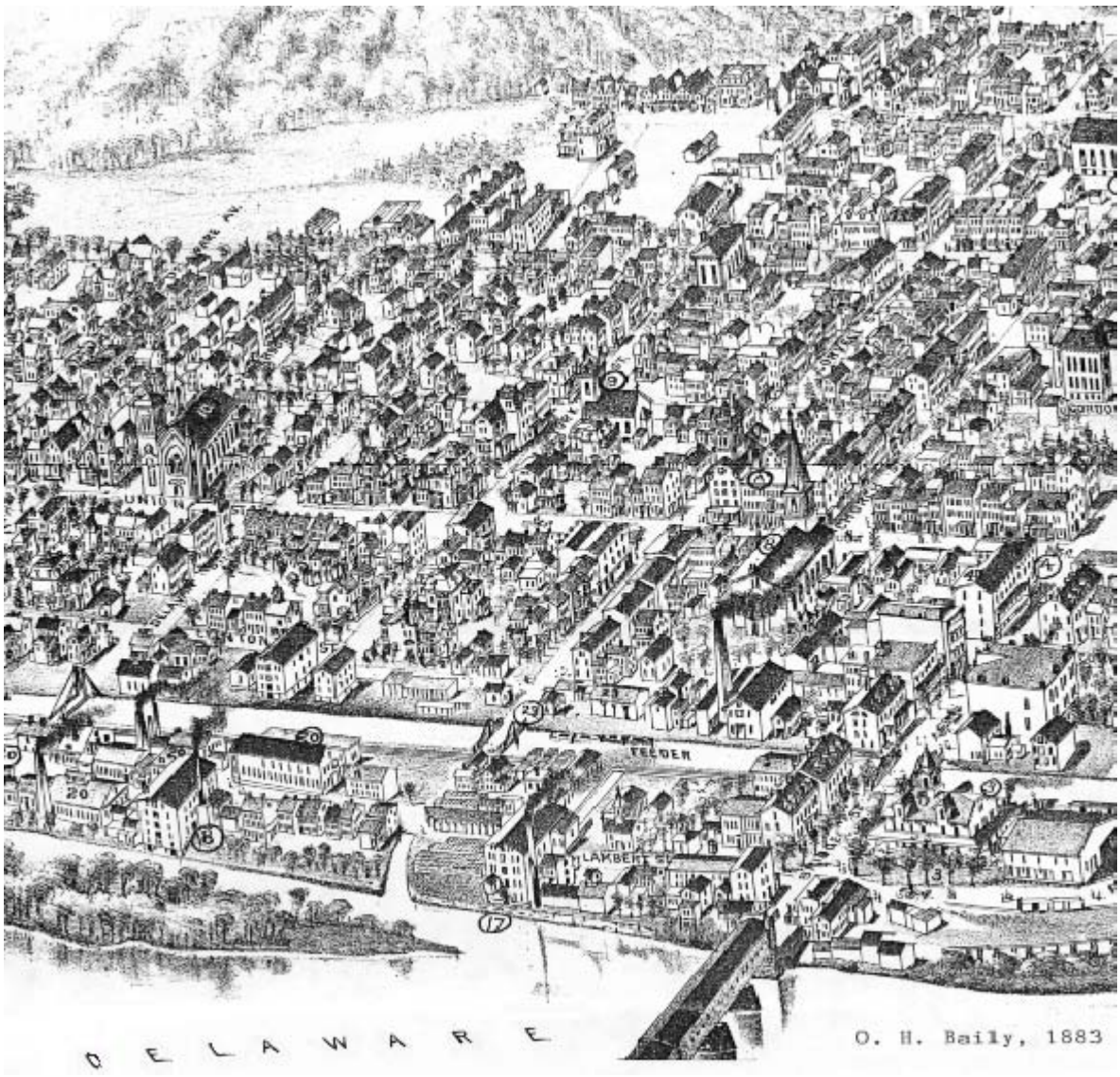

STORMWATER MANAGEMENT PLAN

CITY OF LAMBERTVILLE,
HUNTERDON COUNTY, NEW JERSEY

March 2005

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March 2005

Adopted by the City of Lambertville Planning Board

Adopted pursuant to N.J.A.C. 7:8-4.
Stormwater Management
Municipal Stormwater Management Planning

Members of the Stormwater Committee:

John A. Miller, Chairman
Councilwoman Cynthia L. Ege
Timothy Korzun
Georg Hambach
Paul A. Cronce
Vincent W. Uhl
James J. Meehan
Tali Engoltz

Nestled between the scenic Delaware River and Hunterdon County's rolling hills, Lambertville is an historic small town symbolic of the word "community". Lambertville has a strong downtown, fine residential neighborhoods, abundant natural resources and a dramatic location settled in a place of scenic beauty. Lambertville's residents are people of unusual diversity in outlook and lifestyle who share a set of values about the town - one that seeks to balance prosperity with preservation, tourism with the enjoyment of private and public property, and environmental protection with growth.

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Appendices

1.0 Introduction

This document has been prepared in accordance with the New Jersey Department of Environmental Protection (NJDEP) *Tier B Stormwater Guidance Document* dated April 2004 in order to establish the City of Lambertville's strategy to address stormwater-runoff impacts. It is important to note that this plan will require an update to include a required modification to incorporate the adopted municipal stormwater control ordinances in early 2006.

1.1 How Does Stormwater Runoff Affect Us?

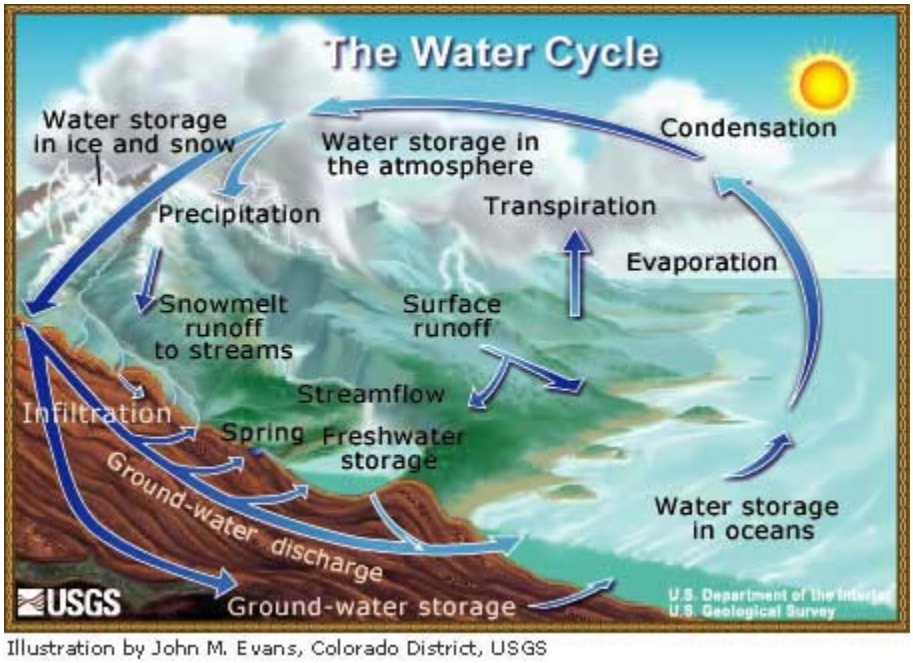


Illustration by John M. Evans, Colorado District, USGS

Stormwater runoff is part of the largest remaining major source of pollutants in our nation's waters and the quality of surface and ground water is directly related to the health of the environment. It is estimated that up to 60 percent of existing water pollution problems are attributable to nonpoint source pollution. Nonpoint source pollution, and particularly, stormwater runoff is difficult to identify, control, and treat. In natural environments, those undisturbed by development, native vegetation either directly intercepts precipitation or draws from runoff that has infiltrated into the ground and returns it to the atmosphere through the process of evapotranspiration. A portion of precipitation runs off the land's surface to recharge surface water. Further, a portion of the rainfall that lands on the ground's surface infiltrates through the soil to the groundwater table and provides natural recharge of the groundwater. This process, known as the hydrologic cycle, functions in equilibrium, but is extremely susceptible to impacts resulting from changes to the cycle's processes.

It has been shown that land development can dramatically impact the hydrology of a watershed if stormwater-runoff related impacts are not considered carefully. Development typically alters natural vegetation through the placement of lawns and impervious cover, thereby reducing the watershed's evaporation, transpiration and infiltration rates. Construction activities can compact the soil and reduce its infiltration ability, resulting in increased volumes and rates of stormwater runoff from a site. In the past, development typically involved the construction of impervious areas connected to each other through gutters, channels, and storm sewers. These structures can transport runoff more quickly than natural areas and cause erosion and water quality problems, as well as flooding in areas downstream of

development. Often people do not know or understand that there are alternatives to the traditional way of managing their property. For example, homeowners can have a green lawn without massive doses of fertilizers and pesticides; pet owners should deposit pet waste in the trash or in the toilet and not leave it at the curb. Typically, people are unaware that storm drains often discharge directly into water bodies. When people allow motor oil, trash, and their pet's waste to enter the storm sewer in their street, they don't realize that it may end up in the lake down the street or in their public drinking water supply. Individually these acts may seem insignificant, but their cumulative impact contributes to stormwater/nonpoint source pollution and reduces water quality.

Lambertville resident Ashbel Welch oversaw construction of the Delaware & Raritan Canal , which commenced late 1830 and was completed in June of 1834. Today, the canal provides drinking water to nearly one million New Jersey residents. The adjacent canal path is used by bikers, those out for a brisk walk or run, and for those who just like to walk down a very pretty walkway.

Protection of the Delaware & Raritan Canal's water quality is a priority of the City of Lambertville's Stormwater Committee.

1.2 Municipal Separate Storm Sewer Systems (MS4) Program

In response to the United States Environmental Protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) Phase II regulations adopted in December 1999, the State of New Jersey developed the Municipal Stormwater Regulation Program. This program addresses pollutants entering our waters from storm drainage systems operated by local, county, state, interstate, and federal government agencies. These systems are referred to as "municipal separate storm sewer systems" or MS4s and are regulated under the New Jersey Pollutant Discharge Elimination System (NJPDES) Rules (N.J.A.C. 7:14A). The NJDEP released four (4) NJPDES Stormwater General Permits for the various MS4s. These include:

1. Tier A Municipal Stormwater General Permit;
2. Tier B Municipal Stormwater General Permit;
3. Public Complex Stormwater General Permit;
4. Highway Agency Stormwater General Permit.

For each General Permit, NJDEP has mandated Statewide Basic Requirements (SBRs), which include minimum standards, measurable goals, and implementation schedules. The minimum standards are one or more actions that must be taken to comply with the requirements of the permit. The measurable goals are the mechanism for reporting to NJDEP the progress that the City has made; those are accomplished primarily through the submittal of an Annual Report and Certification (see Appendix C). The implementation schedule sets the deadlines for permit compliance. All municipalities within the State of New Jersey have been classified as either Tier A or Tier B communities depending on population density as determined in the 2000 United States Census.

The City of Lambertville had been designated as a Tier B community. As such, the City is regulated under the NJPDES Stormwater Tier B General Permit, NJPDES No. NJ0141861. As part of the permit,

several SBRs were mandated and an associated implementation schedule was established (refer to Appendix A of this plan for a copy). The following minimum standards apply to all Tier B municipalities, including the City of Lambertville:

1. Adoption of a municipal stormwater management plan (this document) in accordance with the requirements of N.J.A.C. 7:8-4 (due April 2005).
2. Adoption and implementation of municipal stormwater control ordinances in accordance with N.J.A.C. 7:8-4. The ordinances shall address the control of stormwater from non-residential development and redevelopment projects as well as control aspects of residential development and redevelopment projects that are not pre-empted by the Residential Site Improvement Standards (due April 2006).
3. Ensure that any residential development and redevelopment projects that are subject to the Residential Site Improvement Standards (herein referred to as RSIS) for stormwater management comply with those standards. The RSIS for stormwater management address general stormwater management system strategies; runoff estimation techniques; runoff collection system design; inlets, catch basins, manholes, and outlets; detention basins and other stormwater facilities; and water quality (started February 2004).
4. Ensure adequate and long-term operation and maintenance of BMPs (April 2004 on municipal properties, April 2006 other).
5. Enforce compliance with the standards set forth in Attachment A of the NJPDES General Permit to control passage of solids and floatable materials through storm drain inlets (April 2005 municipality installed, April 2006 others).

1.3 Stormwater Management Regulations

On February 2, 2004 the State of New Jersey adopted the new Stormwater Management Rules (N.J.A.C. 7:8). The revisions to the State's Stormwater Management Rules serve as the first major update to the regulations since their inception in 1983 and detail fundamental changes in the management of stormwater runoff in New Jersey. These rules updated several other regulations including the Residential Site Improvement Standards (N.J.A.C. 5:21), the Freshwater Wetland Protection Act (N.J.A.C. 7:7A), the Flood Hazard Area Control Act (N.J.A.C. 7:13), the Watershed Management Rules (N.JA.C. 7:15), and the New Jersey Dam Safety Standards (N.J.A.C. 7:20).

Lambertville authorities passed a law in 1857 specifically designed to stop loafing on the feeder canal bridge at Bridge Street.

The new Stormwater Management Rules provide a framework and incentives for managing runoff and resolving nonpoint source impairment on a drainage area basis for new development, redevelopment and existing developed areas. Additionally, the rules establish a hierarchy for implementation of stormwater management measures with initial reliance on low impact site design techniques to maintain natural vegetation and drainage before incorporating structural Best Management Practices (herein referred to as BMPs). These new rules also establish runoff control performance standards for groundwater recharge, water quality, and water quantity, establish special area protection measures for pristine and exceptional value waters; provide regulatory consistency among local and State regulatory agencies; and provide safety standards for stormwater management basins.

As of February 2, 2004, the design requirements identified in the Stormwater Management Rules, including groundwater recharge, water quality, and water quantity, must be met for all projects regulated under RSIS. The Stormwater Rules (N.J.A.C. 7:8-4) require that all municipalities within the State of New Jersey adopt a municipal stormwater management plan. The Tier B General Permit mandates that this plan be completed no later than 12 months from the effective date of permit authorization, which is April 1, 2005. Additionally, N.J.A.C. 7:8-4 mandates that stormwater control ordinances be adopted and implemented for all municipalities in the State no later than 12 months from the date of adoption of the Stormwater Management Plan. A model ordinance prepared by NJDEP has been included in Appendix E of this document. The Hunterdon County Toolbox Committee has formed a subcommittee to develop a model stormwater ordinance specific to its municipalities. The Lambertville Stormwater Committee will evaluate the product of the County for adoption to comply with the above referenced date.

2.0 Stormwater Management Plan Goals

Several minimum goals for Tier B municipal stormwater management plans were identified in the NJDEP Guidance document and include:

- 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 source 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;
- Protect public safety through the proper design and operation of stormwater management basins.

How the above goals are met is detailed in Section 9.0 of this document titled “Plan Consistency and Recommended Stormwater Control Ordinances.”

In addition to the minimum goals required by the NJPDES General Permit, as referenced in the City of Lambertville Reexamination of the Master Plan (May 2, 2001), the following goals are set forth in this Stormwater Management Plan for consideration in developing education program and ordinances:

1) Preserve the historic integrity of the City.

2) Encourage new public park areas throughout the City for passive and active recreational areas.

3) Facilitate access to a variety of housing to meet the income, aesthetic and other personal requirements of the City's present and future population.

4) Seek long term solutions to problems of parking and traffic congestion, particularly truck traffic.

5) Encourage a greater diversity of personal service retail opportunities in appropriate areas throughout the City and encourage a balance of residential as well as commercial uses in the central business district.

6) Promote commercial, light industrial and office uses in appropriate areas throughout the City.

7) Preserve and protect environmentally sensitive areas, including but not limited to, flood plains, wetlands, and steep slopes.

8) Maintain a healthy balance of land use development and open space in order to protect existing public access and encourage future public access to the riverfront while preserving its natural assets.

9) Encourage the development of a capital improvement plan.

10) Encourage tree planting and maintenance of existing trees in order to enhance neighborhood quality.

11) Strive to preserve the natural, scenic, historic, and aesthetic aspects of the community and its environment.

The "William Barnet" made the first steamboat trip from Lambertville to Easton on the Delaware River in 1852. The 36-mile trip took 10 hours and 40 minutes, including stopping, starting and being hung up on a reef. Actual running time was 8 hours.

12) Promote the development of recreational opportunities for young people.

13) Encourage the formation of cooperative agreements with the County or adjoining municipalities for the provision of needed services in the regional area.

14) Foster regional planning with adjoining municipalities to achieve common objectives in a complementary - rather than competitive - manner.

15) In accordance with the American Disabilities Act (ADA), promote equal access for all people to facilities and structures throughout the City.

16) Encourage the development of community design goals so that new development is compatible with the surrounding character of buildings, streetscape and structures, and the preservation of property values.

17) Adopt State recycling goals as City goals for recycling.

To contribute to the achievement of the above goals, this plan outlines specific stormwater design and performance standards for new development and redevelopment. 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 protect public safety.

Major floods on the Delaware River occurred in October 1903, August 1955 and May 1972. Of these floods, the one occurring in August 1955 was the most devastating and costly in recent times. This flood, the magnitude of which occurs at an interval of approximately 150 years, caused extensive damage in Lambertville. For example, the Lambertville-New Hope Bridge was closed for 4 weeks due to structural weaknesses and the impact of storm debris. This steel bridge was a replacement for the wooden structure that had been completely destroyed by the flood of 1903. Businesses and factories in Lambertville also sustained major damage in 1955.

Lambertville was also impacted by floodwaters resulting from the break-up of a major ice-jam on the Delaware River in January 1996, and again from intense rainfall in the upstream Delaware River watershed from Tropical Storm Ivan (river flooding recurrence interval of 40-70 years) in September 2004. Rising waters inundated the Lewis family property on Holcombe Island and flooded the basements of houses along Lambert Lane and portions near Swan Creek south of Bridge Street, including South Union Street. Flooding of Alexauken and Swan Creeks normally results when the waters of the Delaware River rise and overflow into its tributaries. In addition, Alexauken and Swan Creeks are subject to localized flooding and flash floods, which can result in high channel velocities, streambank scour, and bank erosion.

Floodplain management standards mandated through the National Flood Insurance Program (NFIP) minimize the risks to new development. However, compliance with the minimum standards may not protect existing development from the increased risk of flooding due to new development. The NFIP encourages local governments (State, County, and Municipal) to adopt additional measures that will reduce local flooding and benefit neighboring and downstream locales (Code of Federal Regulations, 44 CFR §60.1(d)). Authority is vested in the local jurisdiction to manage and police actions in its town. The Stormwater Committee intends to examine additional protections for the City's residents through floodplain management.

3.0 Municipal Background

The City of Lambertville is located in the southwest corner of Hunterdon County along the Delaware River, about 18 miles upstream from the State Capital Trenton, New Jersey. With a population of 3,868 in 2002 (adjusted from the 2000 United States Census) the City of Lambertville is considered by many to be more of a small town than a city. Lambertville's population trend is anticipated to change (1980: 4,044; 1990: 3,927; 2000: 3,868) as the County estimates a total build-out by 2020 with a population projection of 4,377. It is designated as a Sewer Service Area, Planning Area 4b, Rural/Environmentally Sensitive Areas under the New Jersey Preliminary State Plan – Cross Acceptance III. Approximately 1.14 square miles in area, Lambertville is bounded on its north side by Alexauken Creek, by the Delaware River to the west, and south and east by the crest of the bluffs overlooking the Delaware River.

Lambertville Statistics – **1849**

Population: 4,183

Area: 1.21 square miles

Governor: Daniel Hanes (D)

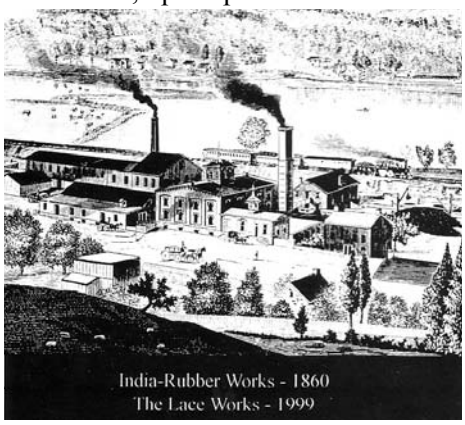
Mayor: Samuel D. Lilly, M.D.

About two-thirds of Lambertville lies within the lowlands of the Delaware River. A peninsula, demarcated by Alexauken and Island Creeks and known locally as Holcombe Island (or commonly Lewis Island), abuts the river on the northwest edge of Lambertville. The Delaware and Raritan Canal lies approximately two blocks east of Holcombe Island and the Delaware River. The primary residential area of Lambertville is located in the region immediately east of the canal. East of Main Street, the elevation rises to the three bluff areas of the city (Appendix B, Figure B2) known as Music Mountain, which is North of NJ Route 179, Connaught Hill which is between NJ Route 179 and Swan Creek, and Cottage Hill which is South of Swan Creek. The City has a common boundary with West Amwell Township on the east side of all three bluff areas. Alexauken Creek forms the boundary with Delaware Township to the North of the City.

From 1996 through 1999, the Lambertville Planning Board made significant changes to the Master Plan, many of these to protect the natural resources of the City, and developed a wide range of land use ordinances that were adopted by City Council. The zoning districts in the City of Lambertville are designated by the City's land use ordinances, specifically, Article IX, Section 400 of the Zoning Ordinances:

R - C	Residential - Conservation	O	Office
R - L	Residential Low Density	CBD	Central Business District
R - 1	Residential 1	C - 2	Highway Commercial
R - 2	Residential 2	C - 3	General Commercial
R - 3	Townhouse Residential	P & R	Parks and Recreation

It was determined through the 2004 Cross-Acceptance III process that the City of Lambertville met the 2001 Statewide Goals to conserve the state's natural resources; protect the environment; prevent and clean-up pollution and preserve and enhance the historic, cultural and scenic, open space and recreational values. In conserving the state's natural resources, which include policies on water resources, special resources, open lands and natural systems, the City has addressed these issues with the Waterfront Plan that imposes design guidelines on construction in the parts of the revised Central Business District adjacent to the Delaware River (between the river and the canal). Also, development sensitive regulations are embodied in the reduced density of the Parks and Recreation zone. For the goal of protecting the environment, preventing and cleaning-up pollution that includes policies on brownfields (old industrial sites), the City promotes redevelopment thereby recognizing the benefits of preserving limited open space. The redevelopment process has revitalized vacant/abandoned and underused sites. To preserve and enhance the historic, cultural and scenic, open space, and recreational values, the Planning Board has adopted a Historic Preservation Plan Element and City Council has adopted a Historic Preservation Ordinance. The Reexamination Report (2001) recognizes the Scenic Byways designation and improvements by NJDOT to Route 29 (Main Street) and Wild and Scenic River designation to the Lower Delaware River.


India-Rubber Works - 1860
The Lace Works - 1999

3.1 Lambertville's Resources and Sensitive Areas

3.1.1 Lambertville's Historic and Cultural Resources

Lambertville has a rich history of life on the water including ferry crossings, commerce via the canal and shad fisheries. George Washington's army crossed the Delaware River from Pennsylvania to New Jersey into Lambertville on the way to the Battle of Monmouth in 1778. Lambertville attracts visitors to its numerous shops and restaurants in part due to the presence of its water resources.

John Emmanuel Coryell moved to Lambertville in 1732 and purchased John Purcell's Tract of 200 acres (The Ferry Lot). On January 7, 1733, this tract became "Coates Ferry."

The City of Lambertville recognizes that clean water recreation attracts residents and visitors alike. Tourism and environmental education benefits are provided in our riverside town in hosting the Shad Festival featuring the Delaware River. The Shad Festival, held in late April of every year, with attendance over the two day festival exceeding 30,000 people, centers upon the annual return of American Shad and River Herring due to improved water quality in the Delaware River. Events like this are culturally and economically significant to the region where river centered recreation and tourism is of increasing economic importance.

3.1.2 Lambertville's Water Resources

Lambertville's quality of life is tied closely to quality of the River and its tributary streams. Waterfront homes are highly valuable where the water quality is good. If water quality deteriorated, negative effects would be realized in terms of rising water treatment costs including expenses related to delivery of alternative water supply sources, increased incidence of waterborne illness, increased trash, nuisance vegetation and decaying organic matter, stresses to aquatic life, loss of riverside home value, and loss of economic benefits from recreation and tourism. It is in the best interest of the City to actively protect the water quality of all the water bodies within its incorporation and join regional protection efforts as well. The locations of water bodies are included in Appendix B, Figure B1.

The Delaware River Basin Commission has upgraded the Lower Delaware River to Special Protection Waters status, with the Scenic and Recreational River segment along the City likely future designation as Outstanding Basin Waters (Fall of 2005). The City passed a resolution in favor of the adoption. Since the backup source of public water for the City is the D&R Feeder Canal, which in turn is mostly supplied from the Delaware River, it makes sense for Lambertville to support all protections afforded by additional antidegradation regulations associated with the new designation. The City of Lambertville was early in support of the Delaware Wild and Scenic classification and notes that numerous river towns have supported the recently expanded DRBC efforts. Water quality goals of upstream municipalities help reinforce the City's goals of protecting water quality.

The Delaware River between Lambertville and New Hope used to freeze solid so that people could cross on foot or by horse or mule-drawn sleigh. They did this to avoid paying toll on the bridge. Sometimes the ice gave way and pedestrians and animals had to be rescued from the frigid waters.

Lambertville's young people skated all over the river in January 1910 from above the bridge nearly to the falls.

Contributing to the health of the Delaware River, two named and two unnamed tributaries flow through the corporate boundaries of the City. These are Alexauken and Swan Creeks and locally named Ely and Weeden Street Creeks. Alexauken Creek is currently on Sublist 1 & 2, while Swan Creek is on Sublist 3 of the New Jersey Integrated Water Quality Monitoring List (Integrated List), where all parameters reference benthic macroinvertebrates (there are no waterways on Sublist 5). Ely and Weeden Creeks are not referenced on the Integrated List. NJDEP Ambient Biomonitoring Network (AMNET) sites exist on Alexauken and Swan Creeks as identified in Appendix B, Figure B1. The AMNET data, collected once every five (5) years, indicate that the Alexauken Creek is Unimpaired (score of 30 in both sampling rounds out of a possible 30, although the third round will have a score of 21: moderately impaired) and Swan Creek was listed as Moderately Impaired (first round score of 21 and second round score of 18 out of a possible 30). The Alexauken Creek is Category One (C1) and Swan Creek is proposed for C1 at the time of this plan's adoption. There are no TMDLs or Regional Stormwater Management Plans existing or currently under development for any tributaries to the Delaware River within the City of Lambertville.

Chemical monitoring of the Alexauken Creek has been conducted for eight years and macroinvertebrate sampling was done in 1995, 1996, 1997**,** 1999 and 2001. These data, beyond the scope of AMNET, also indicate that Alexauken Creek retains very high water quality. Data collected from Swan and Alexauken Creeks, as well as the Brookville Creek in Stockton, were incorporated into a Watershed Planning Project initiated on the Lockatong and Wickecheoke Creeks by the Kingwood Environmental Commission. The purpose of this project was to develop baseline geographical and biological data from these tributaries of the Delaware River. The Delaware Riverkeeper Network is performing additional water monitoring projects on other Delaware River tributaries. Homeowners in Rock Creek Woods, a townhouse community in the City (featured in Section 5.1.1, BMP #3 and 5.2, BMP #19), in 2004 began to monitor the water quality of both branches of Swan Creek, using a macroinvertebrate biological sampling protocol.

The City of Lambertville is interested in the active preservation and protection of Alexauken Creek, the City's northern boundary. Alexauken Creek runs southwest from its headwaters in West Amwell, Delaware and East Amwell Townships, ultimately draining through the City of Lambertville and crossing under the Delaware & Raritan Canal into the Lower Delaware Wild and Scenic River Area. Based on its connection to the federally protected Delaware River, its value as habitat for threatened and endangered (T&E) fish and bird species and the relatively undeveloped nature of its watershed, the creek was adopted as Category One (C1) in July 2004. Visitors to the City enjoy the Delaware River and the Delaware and Raritan Canal path, and safeguarding the health of the Alexauken Creek will continue to provide highly prized resource recreation.

Specific to the City of Lambertville, the Alexauken Creek sustained extensive stream bank damage in the early 1970s with the massive Route 202 bridge construction project. The course of the stream was altered by the construction, and large amounts of fill impinged upon the stream, creating artificially high and steep banks along the portion of the stream, which parallels Alexauken Creek Road between Routes 29 and 202. Deterioration of the bank adjacent to the American Legion Field, a short distance downstream, led to the remedial dumping of trap rock in that area. Erosion of a high bank along the Alexauken Creek has already resulted in the condemnation of a single-family residence within the City limits.

A 319 (h) grant (non-point source pollution control) application submitted by bordering West Amwell Township for a Watershed Protection Plan for the Alexauken Creek Watershed (which is Trout

Maintenance) is currently under consideration by NJDEP and the City of Lambertville is a partner by resolution and has offered to actively participate in this grant. The Alexauken creek flows through a region facing growing development pressures. Proper watershed management would also help to ensure that flooding in Lambertville is not exacerbated by new development in the watershed. If funded, the plan will recommend specific measures necessary to protect and maintain the water quality and ecological integrity of the streams within the watershed and, where possible, to improve water quality and limit nonpoint source pollutant loading to restore the ecological community to a more pristine status. In addition, at an appropriate time during development of the plan, West Amwell and its partners will assess the feasibility of initiating a regional stormwater management planning process similar to East Amwell Township's current regional stormwater planning efforts. Since Lambertville is at the confluence of the Alexauken Creek and the Delaware River, and thus will benefit from the success of this regional effort, it is in Lambertville's interest to support initiatives to improve water quality, reduce flooding and protect regional ecology as provided in this partnership.

3.1.3 Lambertville's Water Supply and Sewerage Facilities

There are no existing Public Community Water Supply (PCWS) wells located within the City. However, approximately 20% of the residents of Lambertville obtain water from wells including most houses on Music Mountain, all houses on Connaught Hill, and many houses on Cottage Hill. There are also two public non-community wellhead protection areas in Lambertville as noted in Appendix B, Figure B4. The United Water Company (formerly the Lambertville Water Company) provides water for the remainder of Lambertville's residents using water stored at the municipal reservoir off Route 518 in West Amwell, approximately 0.5 miles from the City's eastern boundary. Swan Creek is currently nominated for C-1 designation and the City is in favor of reclassifying the tributaries that flow to the reservoir. Protection for clean water is economically beneficial and important for health and safety. It costs little to treat, and extends the life of treatment infrastructure.

Samuel C. Worman left $2,000 in his will so that his executors could purchase and have erected a public drinking fountain "for use of man and beast" in the City of Lambertville. The Worman Memorial Fountain on York Street was dedicated in August of 1918.

About 2,000 separate sewage sources in Lambertville alone, mostly residential, tie into the Lambertville Sewerage Authority. While this represents a substantial portion of the City, notable areas without sewer service include most of Music Mountain, the area around the old High School, and the area around the upper part of South Franklin Street plus Weeden Street. A complicating factor in these regions has to do with the fact that soils and underlying bedrock there pose severe limitations on the use of septic systems. On Music Mountain, there are septic systems installed in less-than-ideal substrate near private wells for drinking water. A Septic and Well Overlay District is indicated on Figure B3 in Appendix B and may be helpful as a reference in the upcoming ordinance development and adoption. This District alerts the applicant and City boards that care is required to protect existing wells and septic systems.

3.1.4 Lambertville's Environmental Resources

In Lambertville, several substantial areas of wetlands are identified on the NJDEP's Freshwater Wetlands maps. Wetland types identified on these maps include:

1. Palustrine hardwood forest along the Delaware River south of Swan Creek;

2. Palustrine hardwood forest at the northern end of Holcombe (Lewis) Island and along several channels running through the island;
3. Palustrine forested wetlands along Alexauken Creek between the Delaware River and Route 29.

In addition to these wetlands, smaller areas of forested wetlands occur along several tributary streams running down Music Mountain, along the rear of Ely Field adjacent to the elementary school, and along Swan Creek. It is important to note that the New Jersey Freshwater Wetland maps offer only a coarse approximation of the presence or absence of freshwater wetlands. Almost all the wetlands areas in Lambertville that are not directly adjacent to the Delaware River are in deciduous wooded areas, usually along stream banks. A formal, onsite delineation is necessary to clearly establish the presence or absence and extent of freshwater wetlands on a particular property.

According to the NJDEP Landscape Project and the Natural Heritage Grid Map and Priority Sites, habitat exists within the City for numerous threatened and endangered species. Forest within the City provide habitat for the state threatened Coopers Hawk. Resident priority bird species include the Gray Catbird, Red-Eyed Vireo and Wood Thrush. There is grassland habitat suitable for Eastern Box Turtle, and forested wetland habitat suitable for Fowler's Toad, both not threatened or endangered but species of special concern (NJDEP). Holcombe Island is dominated by a wooded floodplain along the Delaware River and contains three State-listed Endangered Plant Species. The steep, wooded, diabase hillsides contain three State-listed Endangered Plant Species. Threatened and endangered species habitats within Lambertville are identified on Figures B5-7 in Appendix B of this plan for reference.

Lambertville will participate in the Sourland Mountains Smart Growth Planning and Management Project spearheaded by the Sourland Planning Council. The purpose of the grant is to identify policies and land use strategies for conservation, which can be implemented in a coordinated manner among the participating municipalities and other agencies, as appropriate. The policies will be structured to promote sustainable development, protect or improve environmental quality, conserve natural resources, improve intergovernmental coordination, and preserve the quality of community life in an environmentally sensitive area

3.1.5 Lambertville's Sensitive Areas

Currently, there are nine (9, discounting the NJ DOT ROUTE 29 & BRIDGE STREET PROJECT) contaminated sites within the City as identified in the "Known Contaminated Sites in New Jersey Report" last updated in 2001. The "Known Contaminated Sites in New Jersey Report" is a municipal listing of sites where contamination of soil and/or groundwater is confirmed at levels greater than the applicable cleanup criteria or standards. Remedial activities are underway or required at the sites with an on-site source(s) of contamination and at locations where the source(s) of contamination is unknown. Sites with completed remedial work that require engineering and/or institutional controls have reporting measures in place to ensure the effectiveness of past actions, and some include maintenance and/or monitoring. Sites are identified on Figure B3 in Appendix B for reference. It is important to take note of these sites, as they will impact the selection of Best Management Practices for stormwater runoff in the immediate vicinity of areas of contaminated soils and groundwater.

Figure B4 in Appendix B provides an overview of the Groundwater Recharge rates as determined from the New Jersey Geologic Survey for the City (reference New Jersey Geological Survey Report GSR-32 –

a Method for Evaluating Groundwater Recharge Areas in New Jersey). These groundwater recharge rates range from 1 to 9 inches/year in the lowland areas of the City up to 23 inches/year in some of the less developed upland areas of the City. The lower recharge rates in the lowland areas of the City reflect land use and extensive impervious cover in these areas.

The Stormwater Committee has the following thoughts and input to the NJGS Groundwater Recharge rates determinations:

1. The lowland areas of the City may possibly allow for greater rates of groundwater recharge or infiltration given the underlying soils.
2. The high calculated recharge rates for some of the City's upland areas may in fact be very difficult to achieve given the shallow depths to relatively low permeability bedrock in these areas.
3. Great Care will need to be taken in sitting groundwater recharge facilities anywhere in the City given the:
    a. Density of development;
    b. Potential for impacts from recharge facilities to basements, septic systems, and wells;
    c. Potential for failures particularly in the upland areas of the City where depths to bedrock are shallow.

There are areas of steep slopes within the City boundaries. The areas are identified on Figure B2 in Appendix B of this plan, and include:

1. Hillsides east of Main Street and Ely Field;
2. Cliffs on both sides of Highway 179, including the area north of upper York Street
3. Cliffs north of Quarry Road;
4. Cliffs east of the Laceworks and Route 29, from the south boundary of the city to Swan Street;
5. Scattered patches on Cottage Hill and Music Mountain.

The following are Open Space areas in Lambertville. Items1-6 are significant in terms of vegetation and wildlife, while Items 7-10 are designated as City parks.

1. Holcombe Island and the flood plain of lower Alexauken Creek plus the contiguous natural area south of the Delaware and Raritan Canal;
2. Steep slopes immediately east of Ely Field and the contiguous area north of Highway 179;
3. Steep slopes and upland on Connaught Hill between Highway 179 and Quarry Street;
4. Steep slopes and wetland south of Swan Creek and north of Brunswick Avenue;
5. Upland immediately south of Brunswick Avenue at the City limits;
6. Steep slopes and upland east of Route 29 at the southern City limits (Sourlands);
7. The American Legion ball field on the north edge of town, east of North Union Street and south of Alexauken Creek;
8. Ely Field along Main Street;
9. Mary Sheridan Park;
10. Cavallo Park (rented from State) at the end of South Union Street.

A referendum held during the 2004 General Election authorized the City of Lambertville to exercise an additional collection for open space preservation for the 22-acre property, owned by Win Buchanan on Music Mountain. This property will provide recreational and scenic viewshed benefits as well as protect a large portion of steep slopes prone to erosion with disturbance and increased runoff and potential flooding. The acquisition of this property is exceptionally consistent with the goals presented in this Stormwater Management Plan.

3.2 Existing Stormwater Infrastructure

The City of Lambertville has three (3) stormwater detention basins in the upland area. The basins are part of the Lambert Hill townhouse development (under construction) and will be owned and maintained by a homeowners association. There also exists a basin on the former JCP&L facility off of Route 29, maintained by the Riverwalk complex. The Diamond Silver office complex (noted on Figure B3 in Appendix B as site 3) has two (2) Stormceptors, a structural stormwater BMP. These Stormceptors require cleanout and maintenance and this is to be performed by the owner of the facility. As such, the City currently performs no maintenance for stormwater detention basins and structural BMPs, but will request that the facility managers provide yearly reporting on maintenance activities. The City will need to guarantee through the Annual Report and Certification that proper maintenance is conducted. The Stormwater Committee will request that the managers of these facilities become familiar with the municipal permit requirements. Future ordinances will address the process for new facilities and reinforce operation and maintenance responsibilities. In the pending municipal ordinances, the City will require maintenance and access easements as part of development approval to allow the City to ensure future care of stormwater facilities.

There are approximately 16 miles of roadways owned and maintained by the City of Lambertville. The Public Works Department will continue to maintain the storm sewer system within the City's jurisdiction. The City will ask for cooperation from the New Jersey Department of Transportation to coordinate with its Highway Agency Stormwater General Permit. The City should be knowledgeable on what the State is doing to satisfy their NJPDES permit for the 3 miles of State roads. Each existing City owned roadway has an associated stormwater collection system and it is the duty of the municipality to properly maintain this network. The storm sewer system in the City of Lambertville is complex. Segments of the system flow to the Alexauken Creek, the Delaware & Raritan Canal, Swan Creek, directly to the Delaware River, and other perennial, intermittent, or ephemeral watercourses. Lambertville has several drainage projects in various stages of implementation. Most of the work is planned for the upland section of the City, which to the present has no drainage systems.

A localized flood control project, completed in 2001, included the installation of a large diameter diversion pipe following Delaware Avenue to relieve storm flows adjacent to the Lambertville Elementary School and downstream properties. A diversion structure captures high flow and conveys through a subsurface seven (7) foot diameter pipe crossing under Main Street (Route 29) along the alignment of Delaware Avenue. Ely Field performs as a detention facility during high flow events. The junction at the eastern end of Delaware Avenue makes the transition to two (2) tunnels that pass under the D&R Canal where the flow discharges to Island Creek and the Delaware River. This system requires frequent clearing of debris at the diversion structure.

Lambertville performs street sweeping weekly on all streets in the lowland areas of the City. The street sweeping makes a substantial improvement to the runoff entering the canal and also clears the storm drains to prevent localized flooding. The street sweeping, funded by the taxpayers of the City, starts in April every year and continues to the end of December, weather permitting. Lambertville, although not required of a Tier B community, sees the high value of continuing with the street sweeping program.

3.3 Infrastructure Operation and Maintenance

Section 4.2 Performance Standards of this document specifies the operation and maintenance standards required for applications that meet the definition "major development".

4.0 Design and Performance Standards

It is important to note that the City's stormwater management design and performance standards are subject to change pending the abovementioned reclassification of the Lower Delaware River, Alexauken Creek Watershed Protection Plan grant, and Swan Creek proposed change in designation. This plan in no way limits the jurisdiction and restrictions imposed by the DRBC, DRCC, NJDEP, NJWSA, NPS, DHS-FEMA or other local, county, state, or federal regulations.

The design and performance standards for stormwater management measures for the City of Lambertville include those presented in N.J.A.C. 7:8-5 and will be required for all major development projects as defined in Section 9.0 – Applicable Definitions of this plan.

4.1 Design Standards

Stormwater management measures for major development shall be designed to meet the following standards, as required under N.J.A.C. 7:8-5:

- Erosion control – all proposed land disturbance must follow the *Standards for Soil Erosion and Sediment Control in New Jersey* and be conducted in a manner consistent with the policies and procedures of the Hunterdon County Soil Conservation District and the City of Lambertville *(projects with 5,000 sf or more of disturbance must apply to the Hunterdon County Soil Conservation District for a letter of adequacy; or RFA for an acre or more of disturbance)*;
- Groundwater recharge – all major development projects that are considered new construction must maintain 100% of the pre-developed groundwater recharge under post-developed conditions or demonstrate that the increase of runoff from pre- to post- for the 2-year, 24-hour Natural Resources Conservation Service (NRCS) Type III storm (consistent with the most recent Technical Paper 40 release or replacement) is infiltrated. It is important to note that Lambertville has a unique challenge in complying with the groundwater recharge requirements in the upland area of the City given the shallow depths to relatively low permeability bedrock in these upland areas. Further, the small lot sizes and density of development throughout the City mandates the need to have distance requirements between groundwater recharge facilities like dry wells and residential wells, septic systems, and building structures. Non-structural BMPs highlighted in Section 5.1 that encourage groundwater recharge measures will be a focus in the upland areas of the City;

- Stormwater runoff quantity – all major development projects must demonstrate compliance with one of the following: peak runoff flow rate mitigation, runoff volume mitigation, or hydrograph mitigation; and
- Stormwater runoff quality standards – all major development projects must demonstrate a minimum 80% Total Suspended Solids (TSS) removal rate and nutrient removal to the maximum extent practicable.

4.1.1 Exemption/Waiver Criteria from Design Standards

It is important to note that there are several types of major development projects that are exempt from some or all of the requirements identified above or for which a waiver from strict compliance with the above requirements can be obtained. These include the below identified project types.

Redevelopment projects are exempt from the groundwater recharge standards provided that the redevelopment involves disturbance only of previously disturbed areas. However, since soils in the lowland areas of the City have high infiltration rates, if appropriate, redevelopment should consider recharge as an option. Additionally, a 50% TSS removal rate is required for proposed redevelopment projects involving only existing areas of impervious cover. Groundwater recharge requirements do not apply to projects subject to stormwater from areas of high pollutant loading and industrial stormwater exposed to "source material." The "Sensitive Areas Map" (Appendix B, Figure B3) should be consulted for potential areas that require caution.

Additionally, the following linear development projects are exempt from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements:

1. The construction of an underground utility line provided that the disturbed areas are properly revegetated upon completion;
2. The construction of an aboveground utility line provided that the existing conditions are maintained to the maximum extent practicable; and
3. The construction of a public pedestrian access, such as a sidewalk or trail with a maximum width of 14 feet, provided that the access is made of permeable material that permit recharge.

It must be emphasized that utility work, although not subject to certain regulations, must be sensitive to negative impacts on natural resources and water quality. Also, subsurface utility lines that may alter or divert groundwater must be identified and properly designed and constructed.

A waiver from strict compliance from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements may be obtained for the enlargement of an existing public roadway or railroad, or the construction or enlargement of a public pedestrian access, provided that all of the following conditions are met:

1. The applicant demonstrates that there is a public need for the project that cannot be accomplished by any other means;
2. The applicant demonstrates through an alternatives analysis, that through the use of nonstructural and structural stormwater management strategies and measures, the option selected complies with the above requirements to the maximum extent practicable;

3. The applicant demonstrates that, in order to meet the requirements above, existing structures currently in use, such as homes and buildings would need to be condemned; and
4. The applicant demonstrates that he/she does not own or have rights to areas that would provide opportunities to mitigate for the requirements above that are not achievable on-site.

Additionally, it is important to note that applicants that cannot meet one or more of the design requirements identified above, can complete a project identified in the City Mitigation Plan with prior approval from the City. Section 6.0 – Future Proposed Mitigation Plan outlines the theme of this future document.

4.1.2 Groundwater Recharge

The minimum design and performance standards for groundwater recharge, as previously identified above, require that the applicant either demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated. As discussed above, groundwater recharge is prohibited from sites with high pollutant loading or industrial stormwater exposed to "source material." As there are known contaminated sites within the City (see Section 3.1.5), groundwater recharge is prohibited for these properties and all future identified contaminated properties in accordance with N.J.A.C. 7:8-5.4(a) 2iii. Adjacent properties also must consider the proximity of contaminated material. The Stormwater Committee will consider buffer requirements when formulating the ordinances for 2006.

All groundwater recharge analyses must be conducted using the New Jersey Groundwater Recharge Spreadsheet available through the *New Jersey Stormwater Best Management Practices Manual* (herein referred to as the BMP Manual, online at www.njstormwater.org). The professional engineer (or qualified hydrogeologist or geologist) shall assess the impacts on the groundwater table and design the site so as to avoid adverse hydrogeologic impacts. There are several potential adverse hydrogeologic impacts, including, but not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or down gradient of the groundwater recharge area. The Groundwater Recharge Spreadsheet must be employed with professional judgment as to interpretation of the results.

For all structural and nonstructural infiltration measures, it is necessary to determine soil characteristics, the permeability (hydraulic conductivity) of the underlying soils and bedrock (where bedrock is shallow), and depth to groundwater on a subject property prior to designing infiltration measures. The applicant's professional must demonstrate the hydraulic viability of any proposed structural groundwater recharge measure through hydraulic testing. In order to meet the requirements for groundwater recharge, the applicant is strongly encouraged to design nonstructural stormwater BMPs identified in Section 5.1 of this plan wherever feasible. Should nonstructural measures not satisfy the full groundwater recharge requirements, alternatively or in combination with the nonstructural measures, the applicant can utilize the structural techniques described in Section 5.2 of this plan.

4.1.3 Stormwater Runoff Quantity

For all three options identified below, the applicant must establish Point(s) of Analysis (POAs) based on natural watershed divisions on the subject site in accordance with Section 5 of the BMP Manual. These POAs must then be analyzed under pre- and post-construction conditions as discussed below. In order to control stormwater runoff quantity impacts, the design engineer shall complete one of the following:

1. Hydrograph Mitigation - demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;
2. Runoff Volume Mitigation - demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2, 10, and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;
3. Peak Runoff Flow Rate Mitigation - design stormwater management measures so that the post-construction peak runoff rates for the 2, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed under all phases of the project.

Please note that any application for a new agricultural development that meets the definition of major development shall be submitted to the Hunterdon County Soil Conservation District for review and approval in accordance with the requirements of this section and the *Standards for Soil Erosion and Sediment Control in New Jersey* for stormwater runoff quantity and erosion control.

Stormwater runoff shall be calculated in accordance with the following (see Appendix D):

1. The United States NJDEP of Agriculture (USDA) NRCS methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Section 4 of the National Engineering Handbook (NEH-4), dated July 2002, last updated September 8, 2004, and incorporated herein by reference as amended and supplemented (refer to the National Weather Service: http://hdsc.nws.noaa.gov/hdsc/pfds/ for the rainfall frequency data). This methodology is additionally described in Technical Release 55 - Urban Hydrology for Small Watersheds (TR-55), dated June1986, incorporated herein by reference as amended and supplemented; or
2. The Rational Method for peak flow and the Modified Rational Method (**highly discouraged**) for hydrograph computations. The rational and modified rational methods are described in

"Appendix A-9 Modified Rational Method" in the *Standards for Soil Erosion and Sediment Control in New Jersey*. Refer to the National Weather Service: http://hdsc.nws.noaa.gov/hdsc/pfds/ for the IDF curves

For the purpose of calculating runoff coefficients, there is a presumption that the pre-construction condition of a site is a wooded land use with good hydrologic condition. Alternatively, a runoff coefficient or a groundwater recharge land cover for an existing condition may be used on all or a portion of the site if the design engineer verifies that the hydrologic condition has existed on the site or portion of the site for at least five (5) years without interruption prior to the time of application. If more than one land cover has existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations. In addition, there is the presumption that the site is in good hydrologic condition (if the land use type is pasture, lawn, or park), with good cover (if the land use type is woods), or with good hydrologic condition and conservation treatment (if the land use type is cultivation.)

When computing pre-construction stormwater runoff, the design engineer shall account for all significant land features and structures, such as ponds, wetlands, depressions, hedgerows, or culverts that may reduce pre-construction stormwater runoff rates and volumes. Additionally, when computing stormwater runoff from all design storms, the design engineer shall consider the relative stormwater runoff rates and/or volumes of pervious and impervious surfaces separately to accurately compute the rates and volume of stormwater runoff from the site. To calculate runoff from unconnected impervious cover, urban impervious area modifications as described in the NRCS Technical Release-55 (TR-55), Urban Hydrology for Small Watersheds or other methods described in the BMP Manual may be employed. If the invert of the outlet structure of a stormwater management measure is below the Flood Hazard Design Flood elevation of the Delaware River or its associated tributaries, the design engineer shall take into account the effects of tailwater in the design of structural stormwater management measures. In all locations of proposed disturbance, offsite stability and capacity must be considered and confirmed as part of the drainage and stormwater management analysis.

As compaction during construction activities influences the infiltration rate of the soils, the design engineer must account for not only the proposed change in land use, but also the alterations effect on the post-development surface runoff. Included in Appendix D of this document is a study titled "Impact of Soil Disturbance During Construction on Bulk Density and Infiltration in Ocean County, New Jersey." Although tests were conducted in the New Jersey coastal plain, changes in the Hydrologic Soil Group are expected from compaction due to construction and site modification. The engineer must fully explain in his/her design report how TR-55 parameters were developed.

Runoff quantity can be controlled using both nonstructural (Section 5.1) and structural BMPs (Section 5.2) as discussed in this plan. For design guidance on the various BMPs to satisfy the requirements of 4.1.4 above, the applicant's professionals should refer to the BMP Manual.

4.1.4 Stormwater Runoff Quality

Per the State of New Jersey regulations, stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a major development project. However, the Lambertville Stormwater Committee will contemplate lowering the

threshold. Stormwater management measures shall be designed to reduce the post-construction load of Total Suspended Solids in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1 in Appendix D of this plan. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures. The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit from this requirement.

For purposes of TSS reduction calculations, Table 2 in Appendix D of this plan presents the presumed removal rates for certain BMPs designed in accordance with the *New Jersey Stormwater Best Management Practices Manual*. Alternative removal rates and calculation methods may be considered if the design engineer provides documentation demonstrating the capability of the alternative rates and methods to the City Engineer. A copy of any City approved alternative rate or method of calculating the removal rate shall be provided to NJDEP as required under N.J.A.C. 7:8-5.5.

If more than one BMP in series is necessary to achieve the required 80 percent TSS reduction requirement, the applicant shall utilize the following formula to calculate TSS reduction:

$R = A + B – (A \times B) / 100$ where
R = total TSS percent load removal from application of both BMPs, and
A = the TSS percent removal rate applicable to the first BMP
B = the TSS percent removal rate applicable to the second BMP

If there is more than one onsite drainage area, the 80 percent TSS removal rate shall apply to each drainage area, unless the runoff from the sub-areas converge onsite. Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction stormwater runoff nutrient load from the developed site generated during the water quality design storm. In achieving a reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural measures that optimize nutrient removal while still achieving the performance standards identified above.

Currently, the Alexauken Creek is a tributary within the City of Lambertville that is classified as Category One (C-1) in the New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B, therefore special water resource protection areas are mandated. It is important to note, however, that Category One watercourses are being updated continuously by the NJDEP and the classification of surface waters within the City limits are subject to change.

Special water resource protection areas are mandated for all Category One watercourses in the State identified on either USGS or Soil Survey maps and perennial or intermittent streams that drain into these watercourses. These areas shall be established for the protection of water quality, aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries significance of those established Category One waters. Since the Alexauken Creek meets this designation, the City will be responsible for ensuring that the requirements of the special water resource protection areas are upheld. A Stream Corridor Protection Plan and Ordinance is hereby proposed in order to better enforce these requirements. The requirements for these areas are as follows:

In 1874 a Lambertville gentleman took 100 white catfish and a number of suckers from the Delaware River for the purpose of stocking the streams of California.

1. All major development projects shall preserve and maintain a 300-foot special water resource protection area on each side of the waterway, measured perpendicular to the waterway from the top of bank outwards, or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided.

2. Encroachment within a designated 300-foot special water resource protection area shall only be allowed where previous development or disturbance has occurred (for example, active agricultural use, parking area or maintained lawn area). The encroachment will only be allowed where sufficient documentation has been provided to ensure that the functional value and overall condition of the special water resource protection area will be maintained. In no case shall the remaining special water resource protection area be reduced to less than 150 feet as measured perpendicular to the top of bank of the waterway or centerline of the waterway where the bank is undefined. NJDEP will review all encroachments proposed under this item.

3. All stormwater must be discharged outside of the special water resource protection area and must comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey." It is important to note that stormwater can sheet flow through the special water resource protection area.

4. If stormwater discharged outside of the special water resource protection area cannot comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," then stabilization measures may be placed within the special water resource protection area, provided that these stabilization measures are not placed within 150 feet of the waterway. Additionally, the stormwater discharged must achieve a 95 percent TSS post construction removal rate and temperature must be addressed to ensure no impact on the receiving stream. A conceptual project design meeting shall be held with NJDEP and Hunterdon County Soil Conservation District staff to identify necessary stabilization measures.

Specific recommendations for water quality compliance are included in Section 5.0 of this plan. For detailed design guidance for the BMPs mentioned, refer to the BMP Manual.

4.2 Performance Standards

In order to ensure proper operation of all structural and nonstructural stormwater management measures, the City shall require that all projects considered major development incorporate maintenance plans for proposed stormwater management measures. These plans are essential to the long-term functionality of structural best management practices. All nonstructural BMPs must also be properly maintained to ensure long-term functionality. All maintenance plans shall contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of nonvegetated linings. Specific maintenance guidelines for structural stormwater management measures are available in the NJDEP BMP Manual.

If a person other than the developer (for example, a public agency or homeowners' association) is responsible for maintenance, the plan shall include documentation of such person's agreement to assume this responsibility, or of the developer's obligation to dedicate a stormwater management facility to that person or entity. In no instance shall the responsibility for maintenance be assigned or transferred to the owner of an individual property in a residential development or project, unless the owner owns the entire residential development or project. If the person responsible for maintenance identified above is not a public agency, the maintenance plan and any future revisions shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

The person or entity responsible for maintenance (herein referred to as the responsible party) shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders. Additionally, the responsible party shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed. All maintenance records and the maintenance plan shall be retained by the responsible party and made available, upon request by any public entity with administrative, health, environmental or safety authority over the site. Nothing in this section shall preclude the City of Lambertville from requiring the posting of a performance or maintenance guarantee in accordance with N.J.S.A. 40:55D-53. Remedies for noncompliance will be advanced during the ordinance phase of the Stormwater Committee's work.

During construction for all major development projects, City inspectors will be onsite to observe the construction of the project to ensure that the stormwater management measures are constructed and function as designed. After construction, the City will regularly follow up with the person responsible for maintenance of the stormwater management structures associated with all major development projects.

As previously indicated, each year the City is responsible to submit an Annual Certification Form to NJDEP for their approval. This form requires that the City certify that all stormwater management facilities are being properly operated and maintained. To ensure this, Lambertville will insist that all responsible parties submit annual statements documenting the operation and maintenance of their

facilities. A letter shall be sent certified mail every April to the City of Lambertville detailing what maintenance had been performed during the year. This will assist the City in completing the Annual Certification Form as well as provide documentation of all operations and maintenance not conducted by City personnel on stormwater management facilities. Should the responsible parties not submit annual statements, the City will assume responsibility for assessing the condition of the stormwater facilities and penalties may be assigned for noncompliance.

5.0 Stormwater Runoff Best Management Practices (BMPs)

It should be noted that although attempts to mimic pre-existing natural conditions may be adequate to satisfy the State stormwater rules, alteration of land always modifies hydrology. The following BMPs are highlighted as possible measures to minimize the inherent impacts of development. **This section is a guide and does not replace the NJDEP BMP Manual**.

5.1 Nonstructural BMPs/ Low Impact Development (LID)

With the increasing emphasis on nonpoint source pollution and concerns over the environmental impacts of land development, it has become necessary to develop effective alternatives to the centralized conveyance and treatment strategy that has been the basis for much of the historical stormwater management systems and programs in the State. New strategies must be developed to minimize and even prevent adverse stormwater runoff impacts from occurring and then to provide necessary treatment closer to the origin of those impacts. Such strategies, known collectively as Low Impact Development or LID, seek to reduce and/or prevent adverse runoff impacts through sound site planning and both nonstructural and structural techniques that preserve or restore the site's natural or pre-developed hydrologic response to precipitation. Rather than responding to the rainfall-runoff process like centralized structural facilities, low impact development techniques interact with the process, controlling stormwater runoff and pollutants closer to the source and providing site design measures that can significantly reduce the overall impact of land development on stormwater runoff.

Any land area used as a non-structural stormwater management measure to meet the above identified design standards shall be dedicated to the City of Lambertville, Hunterdon County, or the State, subjected to a conservation restriction filed with the County Clerk's office, or subject to NJDEP approved or equivalent restriction that ensures that measure or an equivalent stormwater management measure approved by the reviewing agency is maintained in perpetuity. Additionally, in general, all proposed stormwater management measures must avoid creating concentrated stormwater runoff flows on habitat for threatened and endangered species as documented in the NJDEP's Landscape Project or Natural Heritage Database (see Section 3.1.4 above).

To the maximum extent practicable, the design standards identified in Section 4.1 above shall be met by incorporating nonstructural stormwater management strategies into the design. The person(s) submitting an application for review shall identify the nonstructural strategies incorporated into the design of the project and shall complete a Low Impact Development Checklist as provided in the BMP Manual (a sample is included in Appendix E of this report) to be included in the application to the City for review. In accordance with the Stormwater Management Rules, nonstructural stormwater management strategies incorporated into site design shall:

1. Protect areas that provide water quality benefits and areas particularly susceptible to erosion and sediment loss;
2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;
3. Maximize the protection of natural drainage features and vegetation;
4. Minimize the decrease in the "time of concentration" from pre-construction to post-construction.
5. Minimize land disturbance including clearing and grading;
6. Minimize soil compaction;
7. Provide low-maintenance landscaping that encourages precipitation retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;
8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and
9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:
    i. Site design features that help to prevent accumulation of trash and debris in drainage systems;
    ii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and
    iii. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the *Standards for Soil Erosion and Sediment Control in New Jersey*.

While the nonstructural stormwater management strategies listed above represent a wide range of both objectives and practices, Strategies 1 through 8 can be directly addressed through the use of specific nonstructural LID-BMPs that can be grouped into four general categories:

- Vegetation and Landscaping;
- Minimizing Site Disturbance;
- Impervious Area Management; and
- Time of Concentration Modifications.

Information on the specific nonstructural LID-BMPs recommended for each of these is presented below. Prior to utilizing any of the specific nonstructural LID-BMPs described below, applicants are urged to review the land development regulations of the municipality and/or agency from which they are seeking development approval. Engineers and site designers should recognize the importance of accurately computing existing or pre-developed runoff at a land development site. While this is an important computation at all development sites, it is particular important at those sites where nonstructural LID-BMPs will be utilized. This is because, to a large degree, these nonstructural measures will utilize and/or mimic the pre-developed site's rainfall-runoff response. As such, accurate computation of pre-developed hydrologic conditions is vital to successful LID-BMP use. It is recommended that engineers and site designers consult with regulatory entities, such as the State, municipality, or local soil conservation district, regarding pre-developed hydrologic conditions. A pre-design meeting with the City Engineer or attendance at the Planning Board in concept stage may help to refine concepts before final design.

5.1.1 Vegetation and Landscaping Techniques

There are three (3) key types of vegetation and landscaping nonstructural measures that should be considered in land development proposed within the City.

- **Best Management Practice #1:** Preservation of existing natural vegetated areas

  Description/Implementation: This should be considered throughout the design of a land development, despite the fact that Lambertville is mostly built-out. As indicated in Section 3.1.4 – Lambertville's Environmental Resources above, there are several areas with significant hydrologic functions including forested areas, riparian corridors, and threatened and endangered species habitat that have been identified within the City limits. Close attention should be placed on the preservation of natural vegetation in these areas in particular.

  As woodlands in the floodplain provide the food, cover, water, and space that wildlife requires and are considered to be one of the most productive wildlife areas known, likely owing to their complex vegetative structure and multiple habitat features. These ecosystems become even more important when connected to larger upland woods.

  Maintenance Responsibilities: The maintenance responsibilities for this technique are minimal in that the area must be placed in an easement or deed restricted to ensure that the natural vegetation is not removed.

- **Best Management Practice #2:** Native ground cover

  Description/Implementation: As indicated in Section 1.0 above, areas covered with turf grass typically generate more runoff pollution than other types of vegetation. This is especially true when comparing grass areas with naturally wooded areas or forests. Therefore, the amount of lawns and other grass areas at land development sites should be minimized. Instead, alternative vegetation, particularly native plants, should be used to revegetate disturbed site areas. Native ground cover can create infiltration characteristics similar to those of natural areas. Naturally wooded areas or forests should also be restored or reestablished at land development sites where opportunity exists.

  Maintenance Responsibilities: The use of native plants decreases maintenance in the form of reduced mowing frequency and reduced use of fertilizers, when compared to turf grass.

- **Best Management Practice #3:** Vegetative Buffer

  Description/Implementation: Native ground cover can provide a vegetated buffer to help filter stormwater runoff and provide locations for runoff from impervious areas to infiltrate. Water flowing as sheet flow across the vegetated area is slowed and filtered prior to infiltrating into the soil. Dense vegetative cover, long flow path lengths, and low surface slopes provide the most effective vegetated filters. Vegetative buffers can be created by preserving existing vegetated areas over which runoff will flow or by planting new vegetation. If located immediately downstream of impervious surfaces such as roadways and parking lots, they can achieve pollutant

removal, groundwater recharge, and runoff volume reduction. Vegetated buffers adjacent to streams, creeks, and other waterways and water bodies can also help mitigate thermal runoff impacts, maintain stream base flow, provide wildlife habitat, and increase site aesthetics. When upland woods are retained in their natural state, they break the force of falling rain. This prevents the soil from washing away and being carried into streams, wetlands, and potable water supply reservoirs. Wooded hillsides are especially critical in this regard. Removal of ground cover and topsoil during and after construction on steep slopes accelerates runoff and resulting erosion, impacting waters below.

City of Lambertville Case Study - Rock Creek Woods (RCW) is a 46-unit townhouse community in the City. The property is located off Quarry Street between Quarry Street-Rocktown Road and Route 518. Approval to build was received from the City in 1987, and construction began in 1988 and was completed in 1996. Both branches of Swan Creek run through the property very close to the townhouse units and infrastructure. The South Branch is passes through the United Water Lambertville reservoir and parallels Route 518. The North Branch parallels Rocktown Road and joins the South Branch at the confluence on the Rock Creek Woods property before passing under Route 29 through the Central Business District on the way down to the Delaware River. After rains in early October 1996 and Tropical Storm Floyd in 1999 severely eroded several areas on the stream bank, the RCW homeowners began to take measures to prevent further erosion. In 2002, homeowners expanded the width of the stream bank buffer, installed matting and plants on three steep slopes and instructed the landscape contractor to stop mowing on the stream bank. While not considered in the design of the development, the RCW residents have realized the benefits or riparian buffers.

Maintenance Responsibilities: Vegetative buffers require very little maintenance and it is best to only enter the area to remove non-natural debris from flood events. Invasive species control, only immediately after enhancement of the buffer by planting, will help native plant species establish. The buffer must be placed in an easement or deed restricted to ensure that the buffer is not removed.

5.1.2 Minimizing Site Disturbance

- **Best Management Practice #4:** Minimizing land disturbance

Description/Implementation: Minimizing land disturbance at a development site is a nonstructural LID-BMP that can be used during all phases of a land development project. Additionally, minimizing land disturbance can help reduce post-development site runoff volumes and pollutant loads and maintain existing groundwater recharge rates and other hydrologic characteristics by preserving existing site areas. Minimum disturbance begins during the project's planning and design phases by fitting the development into the terrain, as opposed to

changing the terrain to fit the development. Roadway and building patterns that match the existing land forms and limit the amount of required clearing and grading should be chosen.

Maintenance Requirements: The applicant will ensure compliance by including these requirements in soil erosion and sediment control plans, construction plans, and contract documents. The defined limit of disturbance must be surveyed and delineated by orange snow fence (or equal) prior to disturbance and clearing activities. An as-built of disturbance may be required post-construction, with possible enforcement actions to include comprehensive restoration of areas that were to be protected.

5.1.3 Impervious Area Management

Reductions in impervious area translate into more surface storage, infiltration and groundwater recharge, less stormwater runoff, and reduced storm sewer construction, maintenance, and repair costs. It is important to note that all reductions in the amount and dimensions of impervious surfaces at a land development site must also recognize safety and the level of use of the impervious surfaces. There are three (3) impervious area management techniques that may be considered for major development projects proposed within the City.

- **Best Management Practice #5:** Minimizing parking area and driveways

  Description/Implementation: Parking area and driveway requirements are mandated by the City Land Development Ordinances and, in the case of residential areas, the RSIS. The RSIS provides flexibility in selecting parking and driveway size, provided that supporting local data is available. A mix of residential and nonresidential uses at a development site can share parking areas, thereby reducing the total parking area and impervious cover. The RSIS also allows a reduction in the standard 18-foot parking space length provided that room is provided for overhang by the vehicle. The overhang area can then be vegetated to further reduce (and possibly help disconnect) impervious surfaces. Non-residential uses can follow suit in the City as well. At all development sites, consideration should be given to constructing some or all driveways and parking areas from pervious paving material. This is particularly true for overflow parking areas as well as driveways (and other access roadways) that are used relatively infrequently by maintenance and emergency vehicles. Parking can also be located underground or beneath buildings, which can help reduce the site's overall impervious coverage.

  Maintenance Requirements: Should pervious paving materials be utilized as part of this BMP there is some maintenance required to ensure the long-term operation of the BMPs that serve this technique. Refer to Best Management Practice #16 for more details.

- **Best Management Practice #6:** Unconnected impervious areas

  Description/Implementation: This technique includes impervious surfaces that are not directly connected to a site's drainage system. Instead, runoff from an unconnected impervious area is allowed to sheet flow from the impervious area across a downstream pervious surface, where it has the opportunity to re-infiltrate into the uncompacted soil, thereby reducing the total runoff

volume. In most circumstances, impervious areas can be considered unconnected under the following conditions:

1. All runoff from the unconnected impervious area must be sheet flow.
2. Upon entering the downstream pervious area, all runoff must remain as sheet flow.
3. Flow from the impervious surface must enter the downstream pervious area as sheet flow or, in the case of roofs, from downspouts equipped with elongated splash pads, level spreaders, or dispersion trenches that reduce flow velocity and induce sheet flow in the downstream pervious area. Concentration from pipe discharge is difficult to disperse.
4. All discharges onto the downstream pervious surfaces must be stable and non-erosive.
5. The shape, slope, and vegetated cover in the downstream pervious area must be sufficient to maintain sheet flow throughout it length. Maximum slope of the downstream pervious area is 8 percent. However, site conditions will dictate proper design.
6. The maximum roof area that can be drained by a single downspout is 600 square feet. This will be necessary to confirm by architectural plans with roof drainage area delineation.

Maintenance Requirements: There is minimal maintenance required with this BMP, however, some repair may be necessary of eroded surfaces.

- **Best Management Practice #7: Vegetated Roofs**
  Not recommended by the Stormwater Committee

Description/Implementation: Vegetated roofs, also known as green roofs, are an innovative way to reduce impervious surfaces at development sites. A vegetated or green roof consists of a lightweight vegetated planting bed that is installed on a new or existing roof. Vegetated roofs can be implemented using specialized commercial products. It is important to note that the structural integrity of the roof must be taken into consideration when designing a green roof. The City Building Code Officials must be consulted prior to use of this technique.

Maintenance Requirements: Except for periodic limited or as needed fertilization and watering, a meadow-like planting of perennial plants can require minimal maintenance.

5.1.4 Time of Concentration (Tc) Modifications

Changes in peak flow result from changes in the Time of Concentration (Tc) from drainage areas, with longer times yielding smaller peak runoff rates and shorter times causing greater ones. Site factors that affect a drainage area's time of concentration include precipitation, flow length, flow regime, surface roughness, channel shape, and slope. Typically, land development modifies most of these factors in ways that cause the time of concentration of a drainage area to be shorter (and, therefore the peak runoff rates to

be greater) after development than prior to development. However, during site design, it may be possible to minimize this decrease in time of concentration by controlling the various site factors that affect it. Considerations for three (3) factors are presented below.

- **Best Management Practice #8:** Surface roughness changes

  Description/Implementation: Based upon hydraulic theory, surface roughness coefficients used in sheet flow computations are based on the land cover of a drainage area, with areas of dense vegetation having generally higher coefficients (and longer times of concentration) than smoother surfaces such as paved or grassed areas. Site designers should preserve existing native vegetation or use native plants with varied topography to restore disturbed areas as discussed above in order to increase surface roughness and time of concentration, and consequently reduce the peak flows from a drainage area.

  Maintenance Requirements: Not applicable.

- **Best Management Practice #9:** Slope reduction

  Description/Implementation: Ground slope is an important factor in determining a drainage area's time of concentration and peak discharge. Reducing slopes in graded areas can help minimize Tc reductions and peak flow increases. In addition, terraces and reduced slope channels with grade breaks can be constructed on a sloping area to provide additional travel time. Terraces can also be used to redirect runoff to flow along rather than across the slope, decreasing the slope and increasing the flow length and, subsequently, the time of concentration. Care should also be taken to ensure that the grading of vegetated areas is sufficient to allow for positive drainage as required by local or state regulations, particularly adjacent to buildings and other structures.

  Maintenance Requirements: Not applicable.

- **Best Management Practice #10:** Vegetated conveyance

  Description/Implementation: The use of vegetated conveyance measures such as channels and swales can increase the surface roughness along the Tc flow path and increase the overall Tc. In addition, vegetated channels can provide opportunities for runoff treatment, runoff infiltration, and evapotranspiration. In designing vegetated conveyance measures, care should be taken to protect transitions to and from culverts from erosion caused by flow acceleration and turbulence. The vegetation must be tolerant of the hydrologic regime associated with the channel. Great care must be given to vegetated conveyance systems with steep grades. All swales must be stabilized with erosion control fabric as installation progresses.

Maintenance Requirements: Maintenance of vegetated conveyance involves mowing at least once (1) per year to inhibit woody vegetation growth and removal of any debris at least once (1) per year and after any storm event larger than 1 inch of rainfall.

At the time this plan was prepared, no actual quantitative values had been assigned to nonstructural BMPs by NJDEP. NJDEP is currently in the process of establishing a point system for the use of these techniques and projects designed will then be required to have a minimum number of points before approval will be granted.

5.2 Structural BMPs

As mentioned previously, wherever possible, all major development projects proposed in the City should utilize nonstructural stormwater management measures to meet the requirements of the Stormwater Management Rules. When structural measures are required, the following standards apply:

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including environmentally critical areas; wetlands; flood-prone areas; existing eroded areas; steep slopes; areas that would require blasting or large scale excavation; shallow bedrock; depth to seasonal high water table; stream corridors; soil type, permeability and texture; existing septic systems and wells; and drainage area and drainage patterns. Some of these possible restrictions can be found in Appendix B, Municipal Background Mapping.
2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. All systems must include an emergency bypass that safely permits stable discharge for excess storm flows or surcharge due to the system not performing optimally.
3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant.
4. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at N.J.A.C. 7:8-6 and as identified below.
5. Stormwater management measure guidelines are described below. The NJDEP BMP Manual must be consulted for additional design information. Other stormwater management measures may be utilized provided the design engineer fully demonstrates that the proposed measure and its design proper construction will accomplish the required water quantity, ground water recharge and water quality design and performance standards established by this subsection.
6. For all future proposed structural stormwater management measures, the City Engineer and director of public works must evaluate the ability to clean out the selected structural BMP(s) and assess if the tools owned by the municipality are sufficient to perform maintenance; the expense of replacement manufacturers equipment and purchase of tools, worker safety, and training for the BMP(s); and the ease of access to maintain the structure(s).
7. All structural BMPs must have a well developed sequence of installation and have stabilized drainage areas before put into operation. The City Engineer will include an inspection of the BMP on his/her final punch list review and will note if the facility needs to be cleaned or parts need replacement before accepting the system. The BMP will be in full working condition before a certificate of occupancy is issued.

There are nine (9) types of structural BMPs identified in the BMP Manual; however, this plan details the recommended structural BMPs for use specifically in Lambertville. These include the following:

- **Best Management Practice #11:** Bioretention system

Description/Implementation: A bioretention system consists of a soil bed planted with native vegetation located above an underdrained sand layer. It can be configured as either a bioretention basin or a bioretention swale. Stormwater runoff entering the bioretention system is filtered first through the vegetation and then the sand/soil mixture before being conveyed downstream by the underdrain system. Runoff storage depths above the planting bed surface are typically shallow. **The adopted TSS removal rate for bioretention systems is 90 percent.** Bioretention systems can be used to filter runoff from both residential and nonresidential developments. Bioretention systems are most effective if they receive runoff as close to its source as possible. They can vary in size and can receive and treat runoff from a variety of drainage areas within a land development site. They can be installed in lawns, median strips, parking lot islands, unused lot areas, and certain easements. The elevation of the Seasonal High Water Table (SHWT) is critical to ensure proper functioning of the bioretention basin, and must be evaluated to ensure that the SHWT is at least 1 foot below the bottom of the bioretention basin's underdrain system during non-drought conditions. Additionally, for areas within the Well and Septic Districts of Lambertville, an isolation distance or impermeable bottom layer may be required to be installed to ensure no stormwater runoff interferes with nearby systems.

Maintenance Requirements: Effective bioretention system performance requires regular and effective maintenance. All bioretention system components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation after every storm exceeding 1 inch of rainfall and at least four (4) times annually. Sediment removal should take place when the basin is thoroughly dry. Vegetation should be trimmed and grass should be mowed at least once a month during the growing season. Vegetated areas should be inspected for a decrease in vegetative cover as well as invasive species. Corrective action must be taken within one (1) month to ensure proper operation of the bioretention system. All structural components must be thoroughly inspected for cracking, subsidence, spalling, erosion, and deterioration at least once per year and should be reviewed after every storm exceeding 1 inch of rainfall. The maintenance plan for a bioretention system must indicate the approximate time it would normally take to drain the maximum design storm runoff volume below the ground surface in the bioretention system. If significant increases or decreases in the normal drain time are observed or if the 72 hour maximum is exceeded, the system's planting soil bed, underdrain system, and both groundwater and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the system. Additionally, the planting soil bed at the bottom of the swale should be inspected after every storm exceeding 1 inch of rainfall.

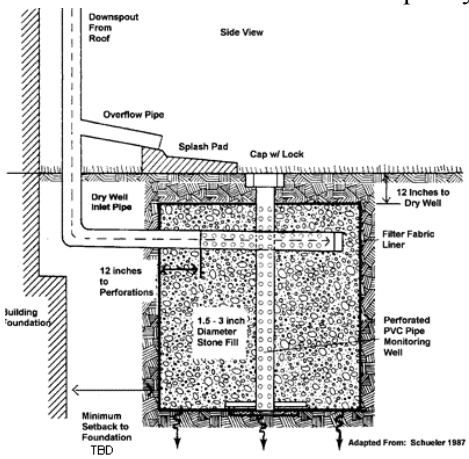
- **Best Management Practice #12:** Constructed stormwater wetland

Description/Implementation: Constructed stormwater wetlands are designed to maximize the removal of pollutants from stormwater runoff through settling and both uptake and filtering by vegetation. Constructed stormwater wetlands temporarily store runoff in relatively shallow pools that support conditions suitable for the growth of wetland plants. **The adopted TSS removal rate for constructed stormwater wetlands is 90 percent.** Constructed stormwater wetlands are used to remove a wide range of stormwater pollutants from land development sites as well as provide wildlife habitat and aesthetic features. The minimum drainage area to a constructed stormwater wetland is 10 acres to 25 acres, depending on the type of wetland. Constructed stormwater wetlands should not be located within natural wetland areas, since they will typically not have the same full range of ecological functions. It is important to note that a constructed stormwater wetland must be able to maintain its permanent pool level. Experienced professionals and contractors with prior familiarity in building constructed stormwater wetlands are recommended as part of the design team.

Maintenance Requirements: Effective constructed stormwater wetland performance requires regular and effective maintenance. All constructed stormwater wetland components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation after every storm exceeding 1 inch of rainfall and at least four (4) times annually. Mowing and/or trimming of vegetation must be performed at least once a month during the growing season. The vegetative cover should be maintained at 85 percent. If vegetation has greater than 50 percent damage, the area should be reestablished in accordance with the original specifications after a professional assessment of the vegetation loss has been conducted. The assessment may include modifications to the original specifications to alleviate the vegetation loss as appropriate. All structural components must be thoroughly inspected for cracking, subsidence, spalling, erosion, and deterioration at least once per year and should be visually observed at all inspections of the constructed wetland system. The maintenance plan for the constructed wetland must indicate the approximate time it would normally take to drain the maximum design storm runoff and return the various wetland pools to their normal standing water levels. If significant increases or decreases in the normal drain time are observed, the wetland's outlet structure, forebay, and groundwater and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the wetland.

- **Best Management Practice #13:** Dry well

Description/Implementation: A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs of structures. Discharge of this stored runoff from a dry well occurs through infiltration into the surrounding soils. A dry well may be either a structural chamber and/or an excavated pit filled with aggregate. Due to the relatively low level of expected pollutants in roof runoff, a dry well cannot be used to directly comply with the suspended solids and nutrient removal requirements contained in the NJDEP Stormwater Management Rules at N.J.A.C. 7:8. However, due to its storage capacity, a dry well may be used to reduce the total stormwater quality design storm runoff volume that a roof would ordinarily discharge to downstream stormwater management facilities. Dry wells can also be used to meet the groundwater recharge requirements of the NJDEP Stormwater Management Rules. The use of dry wells is applicable only where their subgrade soils have the required permeability rates and groundwater is not shallow (bottom of structure ≥ two feet above SHWT). Like other BMPs that rely on infiltration, dry wells are not appropriate for areas where high pollutant or sediment loading is anticipated due to the potential for groundwater contamination. As noted above, this structure cannot be utilized for sites with known contamination. Dry wells are not assigned any TSS removal rate and pre-treatment is required for any stormwater runoff including rooftop stormwater runoff directed to these units since leaf matter and roofing material will lead to clogging of the system. All drywells must be designed with a stabilized overflow to compensate for improper functioning of the system. Installation of drywells must be performed carefully since sediment capture will fail the system.



Maintenance Requirements: Effective dry well performance requires regular and effective maintenance. A dry well should be inspected after every storm exceeding 1 inch of rainfall and at least four (4) times annually. The maintenance plan must indicate the approximate time it would normally take to drain the maximum design storm runoff volume from the dry well. If significant increases in the normal drain time are observed or if it exceeds the 72-hour maximum, appropriate measures must be taken to comply with the drain time requirements and maintain the proper functioning of the dry well.

- **Best Management Practice #14:** Extended Detention Basin

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

basin, which does not meet the requirements of the Stormwater Management Rules exclusively. Extended detention basins can be used in part to address both the stormwater runoff quantity and quality impacts of land development. Extended detention basins are designed for complete evacuation of runoff and normally remain dry between storm events. Extended detention basins may be used at sites where significant increases in runoff are expected from site development. In addition, standard detention basins may be retrofitted or converted to extended detention by increasing the time over which the basin releases the stormwater quality design storm runoff volume, provided that erosion and flood control volumes and outflow rates are not adversely altered. It must be stressed that extended detention basins have a limited effectiveness in removing both particulate and soluble pollutants may limit their use for water quality treatment. Basins must be stabilized before receiving concentrated flows. Variation in designs that incorporate forebays, non-turf vegetation, eliminate low-flow channels and underdrains, and extend flow path (reduce short circuit) are strongly encouraged.

Maintenance Requirements: Extended detention basin performance requires regular and effective maintenance. All extended detention basin components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation after every storm exceeding 1 inch of rainfall and at least four (4) times annually. Sediment removal should take place when the basin is thoroughly dry. Grass (although other vegetation is preferred) should be mowed at least once a month during the growing season. The vegetative cover should be maintained at 85 percent and corrective action must be taken should the vegetation become more than 50 percent damaged. All structural components must be thoroughly inspected for cracking, subsidence, spalling, erosion, and deterioration at least once (1) per year and should be visually observed at each inspection of the extended detention basin. The maintenance plan must indicate the approximate time it would normally take to completely drain the maximum design storm runoff volume from the basin. If significant increases or decreases in the normal drain time are observed, the basin's outlet structure, underdrain system, and both groundwater and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the basin.

Safety Requirements: All new stormwater management basins within the City must, at a minimum, include trash racks, overflow grates, and escape provisions at outlet structures. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets. Stormwater management basins shall include escape provisions as follows:

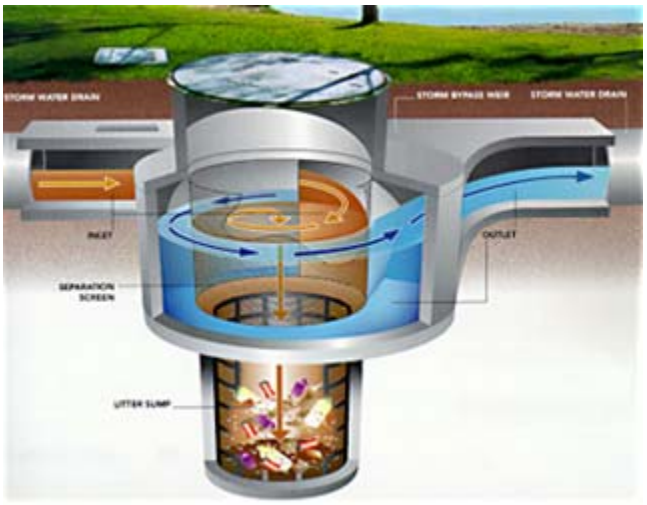
1. If a stormwater management basin has an outlet structure, escape provisions shall be incorporated in or on the structure. Escape provisions include the installation of permanent ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. With the prior approval of the reviewing

agency pursuant to N.J.A.C. 7:8-6.3(a), a freestanding outlet structure may be exempted from this requirement.

2. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located approximately two and one-half feet below the permanent water surface, and the second step shall be located one to one and one-half feet above the permanent water surface. See N.J.A.C. 7:8-6 Appendix A for an illustration of safety ledges in a stormwater management basin.
3. In new stormwater management basins, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than three horizontal to one vertical.

- **Best Management Practice #15:** Manufactured Treatment Device

Description/Implementation: A manufactured treatment device is a pre-fabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff. Manufactured treatment devices may be used to meet the requirements of the Stormwater Management Rules, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology (NJCAT) and certified by NJDEP. Other manufactured treatment devices not certified under the NJCAT program may be utilized if they are approved by NJDEP prior to their use. Other pollutants, such as nutrients, metals, hydrocarbons, and bacteria can be included in the verification/certification process if the data supports their removal efficiencies. Manufactured treatment devices are intended to capture sediments, metals, hydrocarbons, floatables, or other pollutants in stormwater runoff before being conveyed to a storm sewer system, additional stormwater quality treatment measure, or waterbody. A manufactured treatment device is adequate for small drainage areas that contain a predominance of impervious cover that is likely to contribute high hydrocarbon and sediment loadings, such as small parking lots and gas stations. For larger sites, multiple devices may be necessary. Devices are normally used for pretreatment of runoff before discharging to other, more effective stormwater quality treatment facilities. **The City Engineer and Director of Public Works must be consulted about each manufactured treatment device proposed and consideration should be given to maintenance, training, and future costs to the City before approval.** It is strongly recommended that the applicant for new development/redevelopment have a meeting with the above or concept plan presentation to the Planning Board prior to initiating design of any manufactured treatment device.



Maintenance Requirements: The maintenance of manufactured treatment devices depends on the manufacturer's guidance. All manufacturer maintenance requirements must be followed to ensure proper operation of these BMPs. Manufactured Treatment Devices must not be used as a BMP during construction activities.

- **Best Management Practice #16:** Pervious paving

Description/Implementation: Pervious paving materials can be used at some site locations in the City to replace standard impervious pavement in parking lots and driveways in the City. For all sites where pervious paving is proposed, care should be taken in assessing soil conditions, high groundwater conditions, and potential sources of contamination. Further, it is recommended that some form of pre-treatment (i.e. filter strips) be utilized to minimize the chance of clogging the pervious paving. All design criteria identified in the BMP Manual should be followed if this technique is selected. Also, the use of pervious paving materials shall be discussed with City officials and the Hunterdon County Soil Conservation District prior to use on a project site. Careful consideration must be given to freezing weather and to drainage and flooding if clogging occurs.

Maintenance Requirements: Effective pervious paving system performance requires regular and effective maintenance. The surface course of all pervious paving systems must be inspected at least once a year for cracking, subsidence, spalling, deterioration, erosion, and the growth of unwanted vegetation. Care must be taken when removing snow from the pervious paving surface courses and pervious paving surface courses can be damaged by snowplows or loader buckets that are set too low to the ground. This is particularly true for permeable paver systems where differential settlement of pavers has occurred. Sand, grit, or cinders should not be used on pervious paving surface courses for snow or ice control. If mud or sediment is tracked onto the surface course of a pervious paving system, it must be removed as soon as possible. Removal should take place when the surface course is thoroughly dry. The surface course of a porous paving system must be vacuum swept at least four (4) times a year. A high pressure hosing should follow this. All dislodged sediment and other particulate matter must be removed and properly disposed. Maintenance of permeable pavers should be consistent with the manufacturer's recommendations. Grass should be mowed at least once a month during the growing season. Vegetated areas should be inspected at least annually. The vegetative cover should be maintained at 85 percent. The maintenance plan must indicate the approximate time it would normally take to drain the maximum design storm runoff volume below the pervious paving system's surface course. If significant increases or decreases in the normal drain time are observed, the various system components and groundwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the system. It shall be the applicant's obligation to insure that all pervious paving designs are carefully and thoroughly developed, installed and maintenance is assured.

- **Best Management Practice #17:** Sand filter

  Description/Implementation: A sand filter consists of a forebay and underdrained sand bed. It can be configured as either a surface or subsurface facility. Runoff entering the sand filter is conveyed first through the forebay, which removes trash, debris, and coarse sediment, and then through the sand bed to an outlet pipe. Sand filters use solids settling, filtering, and adsorption processes to reduce pollutant concentrations in stormwater. **The adopted TSS removal rate for sand filters is 80 percent.** Sand filters are normally used in highly impervious areas with relatively high TSS, heavy metal, and hydrocarbon loadings such as roads, driveways, drive-up lanes, parking lots, and urban areas. However, due to their relatively high sediment removal capabilities, sand filters are not generally recommended in pervious drainage areas where high coarse sediment loads and organic material such as leaves can quickly clog the sand bed. Where such loadings cannot be avoided, effective pretreatment is absolutely required. Since sand filters can be located underground, they can also be used in areas with limited surface space. However, subsurface systems must permit unlimited access for full sand bed replacement.

  Maintenance Requirements: Effective sand filter performance requires regular and effective maintenance. All sand filter components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation after every storm exceeding 1 inch of rainfall and at least four (4) times annually. Such components may include inlets and diversion structures, forebays, sand beds, and overflows. Sediment removal should take place when all runoff has drained from the sand bed and the sand is reasonably dry. In addition, runoff should be properly drained or pumped from forebays with permanent pools before removing sediment. In surface sand filters with turf grass bottom surfaces, mowing and/or trimming of vegetation must be performed on a regular schedule based on specific site conditions. Grass should be mowed at least once a month during the growing season. Vegetated areas must also be inspected at least annually. The filter bottom must be inspected for unwanted underbrush and tree growth at least once a year. Inspections of vegetation health, density, and diversity should be performed during both the growing and non-growing season. All structural components must be thoroughly inspected for cracking, subsidence, spalling, erosion, and deterioration at least once per year. A visual observation of all structural components should be part of every inspection of the sand filter. The maintenance plan must indicate the approximate time it would normally take to drain the maximum design storm runoff volume below the top of the filter's sand bed. If significant increases or decreases in the normal drain time are observed, the filter's sand bed, underdrain system, and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the filter. The infiltration rate of the sand bed should be retested at least once per year.

- **Best Management Practice #18:** Vegetative filter

  Description/Implementation: Similar to BMP #3 described above, a structural vegetative filter strip can be employed using native ground cover or other vegetation to provide pollutant removal from stormwater runoff. A vegetative filter is an area designed to remove suspended solids and other pollutants from stormwater runoff flowing through a length of vegetation called a vegetated filter strip. The vegetation in a filter strip can range from turf (not recommended) and native

grasses to herbaceous and woody vegetation, all of which can either be planted or indigenous. It is important to note that all runoff to a vegetated filter strip must both enter and flow through the strip as sheet flow, therefore steep slopes should be avoided. Failure to do so can severely reduce and even eliminate the filter strip's pollutant removal capabilities and may be a source for total suspended solid (TSS) due to erosion. The TSS removal rate for vegetative filters will depend upon the vegetated cover in the filter strip. Vegetated filter strips can be effective in reducing sediment and other solids and particulates, as well as associated pollutants such as hydrocarbons, heavy metals, and nutrients. The pollutant removal mechanisms include sedimentation, filtration, adsorption, infiltration, biological uptake, and microbacterial activity only if the soil medium is not compacted. Vegetated filter strips with planted or indigenous woods may also create shade along water bodies that lower aquatic temperatures, provide a source of detritus and large woody debris for fish and other aquatic organisms, and provide habitat and corridors for wildlife. Depending upon their TSS removal rate, vegetated filter strips can be used separately or in conjunction with other stormwater quality practices to achieve an overall pollutant removal goal.

Maintenance Requirements: Effective vegetated filter strip performance requires regular and effective maintenance. All vegetated filter strip components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation after every storm exceeding 1 inch of rainfall and at least four (4) times annually. Such components may include vegetated areas and stone cutoffs and, in particular, the upstream edge of the filter strip where coarse sediment and/or debris accumulation could cause inflow to concentrate. Sediment removal should take place when the filter strip is thoroughly dry. Grass should be mowed at least once a month during the growing season. Vegetated areas must be thoroughly inspected at least once per year with removal of exotics and invasives. Visual observations should be noted at the time of each inspection of the filter. If concentrated flows start to form a gully, stabilization measures must be installed immediately. The vegetative cover should be maintained at 85 percent. All areas of the filter strip should be inspected for excess ponding after significant storm events. The maintenance plan must indicate the approximate time it would normally take for the filter strip to drain the maximum design storm runoff volume and begin to dry. If significant increases or decreases in the normal drain time are observed or if the 72 hour maximum is exceeded, the filter strip's planting soil bed, vegetation, and groundwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the filter strip.

- **Best Management Practice #19:** Rain Barrel

Description/Implementation: A rain barrel is a rainwater harvesting system that is connected to a down spout tube from a house or building and is a simple retrofit that a homeowner can perform. Rain barrels collect, store and divert rooftop runoff during a rain shower for use during dryer weather. Saving rainwater to use during the dry months using rain barrels is an ancient practice that is again becoming popular. With the rising price of municipal water and drought restrictions facing much of

the country during the summer months, more and more homeowners are turning to rainwater. Since Lambertville is dominated by small lots, a rain barrel is a perfect reservoir for watering landscapes and ornamental and vegetable gardens. Harvesting systems vary from the simple use of barrels and gravitation to high tech systems using cisterns, pumps, and flow controls. For new development applications, rain barrels although encouraged, will not get credit for rainwater storage.

City of Lambertville Case Study - Rock Creek Woods (previously mentioned in BMP #3) has three (3) townhouses that have employed rain barrels. In addition to having a source for homeowner irrigation needs, a swale between buildings, previously unstable due to erosion caused by downspout drainage, now has dense lawn cover as point discharge has been reduced.

Maintenance Requirements: All systems should use covered barrels or cisterns that keep the water from accumulating leaves (and going septic) and keep the standing water from encouraging mosquito breeding. Some rain barrels need to be emptied and moved indoor during the winter due to freezing damage.

6.0 Future Proposed Mitigation Plan

A municipal mitigation plan, to be adopted by City ordinance in early 2006, will be available to an applicant for a proposed development and implemented only when a variance or exemption from the stormwater management design and performance standards is necessary due to specific and proven site constraints. The mitigation project must provide additional groundwater recharge benefits, or protection of stormwater runoff quality and quantity from previously developed properties that do not currently meet the design and performance standards outlined in this Municipal Stormwater Management Plan. The developer must ensure the long-term maintenance requirements are met for both the application and the mitigation.

The City will allow a developer to provide funding or partial funding for an environmental enhancement project that has been identified in the Mitigation Plan. The funding must be equal to or greater than the cost to implement the mitigation, including costs associated with purchasing the property or easement for mitigation, and the cost associate with the long-term maintenance requirements of the mitigation measure. The mitigation project must be proposed by the applicant after reviewing the options provided in the Mitigation Plan. The applicant's burden of proof for relief will be outlined in the future proposed Mitigation Plan.

Since groundwater recharge in the City will likely be severely limited in the bluff areas as a result of shallow bedrock, it is apparent that mitigation options must be considered for all major development projects to compensate for non-compliance with the groundwater recharge component of the Stormwater Management Rules, N.J.A.C. 7:8. There may also be unforeseen conditions not anticipated by the

Stormwater Committee that may require reasonable relief to the applicant (i.e. redevelopment). Since the Delaware and Raritan Canal runs through the City and the Delaware and Raritan Canal Commission (DRCC) must review all stormwater measures proposed for projects within 1,000 feet of the Canal as well as for projects along watercourses directly discharging to the Canal, it is recommended that the applicant also consult with the DRCC on the mitigation project selection. Certain projects might also require the involvement of the New Jersey Water Supply Authority (NJWSA).

Although the City of Lambertville Stormwater Committee has not refined the Mitigation Plan, certain sites may provide opportunities for upgrades of water quality treatment. These preliminary sites include:

- The Lambert Hill townhouse development extended detention basins – replant with different vegetation for pollutant removal, provide pre-treatment for TSS removal enhancement (forebay or manufactured treatment device), and removed the underdrain;
- A variety of water quality improvements to D&R Canal – this needs to be coordinated with the NJWSA and DRCC, but may include revegetation of canal banks and education of maintenance personnel on mowing practices;
- Stabilize the erosion locations noted on mapping in Appendix B, Figure B3;
- Correct storm sewer drainage problems noted by public works and presented in Appendix B, Figure B3;
- Perform a detailed water quality analysis and determine what pollutants drain into the canal by delineating the contributing drainage area upstream of the United Water Lambertville withdraw to the reservoir. The study will utilize the model WinSLAMM or approved equal.

Due to upstream development in West Amwell and Lambertville, the ephemeral channel on Ed Clossen's property (Homestead Market) has widened and is unstable. The Stormwater Committee understands that there is an agreement to enhance the channel stability. This location may be added to the Mitigation Plan if this situation is not corrected by the involved parties.

7.0 Stream Corridor Protection Plans

Stream Corridor Protection Plans will be developed for Category One (C-1) waters within the City's boundaries. A stream corridor is composed of several essential elements, the stream channel itself and the associated wetlands, flood plains and forests. These elements function as an integrated ecological and hydrologic system. Stream corridors are not static but dynamic in terms of function, structure and location.

The benefits of stream corridors for streams and the related ecological habitat are well researched and analyzed. Stream corridors, if maintained in their natural condition with minimum disturbance, are instrumental in performing the following functions:

1. The forests and wetlands within stream corridors provide a buffer against pollution impacts to the stream. The benefits of such buffers (a.k.a. filter strips or buffer strips) include:
   (a) Removal of sediment and pollutants in overland flow by providing opportunities for filtration, deposition, infiltration, absorption, adsorption, decomposition and volatilization;

(b) Reduction of sheet, bank and streambed erosion by stabilization of the stream bank ground surface;
(c) Displacement of activities from the waters edge that represent potential sources of non-point source pollutant generation, spill accidents and illegal dumping;
(d) Shade surface waters so that waters are not excessively warmed.

There are several studies that have observed the efficiency of filter strips in controlling farming related pollutants being carried through runoff to streams. Filter strips have found to be effective in reducing the amount of solids and liquid nutrients originating through farming activities.

2. Maintain the genetic diversity within native plant and animal populations by providing a contiguous migration corridor, especially in urban areas where streams and associated forests are often the only suitable habitat areas remaining after urbanization. Stream Corridors also provide a source of food for the aquatic ecosystem. A large percentage of New Jersey's endangered species rely on stream corridors and wetlands for survival.

3. Wetland areas and floodplains help prevent flood related damage to surrounding communities by providing flood storage capacity; help recharge ground water aquifers; and help maintain the surface water level of the stream channel during low rainfall periods.

The destruction or the improper use of one or more elements in a stream corridor can lead to the deterioration of the entire system and can result in significant regional environmental degradation. Problems could include water quality degradation, stream bank erosion, excessive sedimentation in streams and lakes, flooding and loss of wild life and plant habitat. The sensitivity of stream corridors to human interference is heightened when features such as steep slopes and highly erodible soils are present within the corridor (common in Lambertville).

Adequate protection of stream corridors will eliminate some of these water quality problems by removing sediments, organic matter, and other pollutants from runoff and waste water before entering stream, and displacing potential NPSs such as underground oil storage tanks from the stream corridor. A sample Riparian Buffer Conservation Zone Model Ordinance has been added in Appendix E for review. West Amwell Township, Lambertville's upstream neighbor, is considering enactment of a stream protection ordinance that will accomplish the mission stated in the Master Plan.

Establishment of proper maintenance standards for stream corridors is critical. The effectiveness of stream corridors in buffering the streams to maintain water quality and performing other functions depends on the defined width for the stream corridor (the area encompassing the critical environmental components and a buffer) as well as the permitted uses within the corridor. Although a buffer strip is defined as an undisturbed naturally vegetated zone, the term "undisturbed" should not be taken in its most stringent definition.

8.0 Land Use/Build Out Analysis

As previously indicated in Section 3.0 - Municipal Background, the City of Lambertville is just over one square mile in overall size and is almost completely built-out as confirmed by the Hunterdon County

Planning Board State Plan Cross-Acceptance III (2005) process and by Appendix B, Figure B9 exhibiting the NJDEP 1995/97 Land Use/Land Cover Map of the municipality. As such, the City meets the exemption criteria from the requirement for a land use/build out analysis under the NJPDES General Permit.

9.0 Plan Consistency and Recommended Stormwater Control Ordinances

As stated in Section 2.0 above, the following goals were identified and were met as summarized below:

- **GOAL: Reduce flood damage, including damage to life and property** – By requiring that all major development projects address stormwater quantity in accordance with the new Stormwater Management Rules and the requirements identified in Sections 4 and 5 above, the City should be able to reduce increased flood damage to a great extent. Further, the City will mandate mitigation measures for projects that cannot strictly comply with the Stormwater Rules or the City's ordinances for stormwater, retrofits to existing stormwater collection systems and stormwater quantity control devices can be employed to further reduce existing non-Delaware River flood damage.

  The City will examine a relatively new policy being promoted in the world of floodplain management called No Adverse Impact (NAI), advocated by the Association of State Floodplain Managers (ASFPM). The policy insures that the action of one property owner does not adversely impact the rights of other property owners. NAI is a good neighbor policy that makes sure that proposed changes don't impose on others as measured by increased flood peaks, flood stage, flood velocity and erosion and sedimentation. This concept is consistent with the individual rights of property owners and home rule rights of municipalities. We will ask cooperation and partnership with upstream neighboring municipalities (West Amwell and Delaware Townships).

  Implementation of NAI can include mitigation measures such as low impact development, which minimizes disturbance; open space preservation; compensatory floodplain storage; wetland protection, restoration, and creation; and stream buffering. One NAI practice is to stop filling in headwater streams. The filling of source water areas not only compromises water supplies – it increases and speeds up runoff. An area that was previously not prone to flooding, when filled and piped, can become vulnerable to flash floods. Headwater streams are least protected by the NFIP minimum standards and New Jersey regulations, but play a large role in buffering storm runoff.

- **GOAL: Minimize, to the extent practical, any increase in stormwater runoff from any new development** – By mandating the use of various nonstructural stormwater management techniques as discussed in Section 5.1 above, the City shall minimize the increase in stormwater runoff from new development. Additionally, requiring projects to meet the stormwater runoff quantity control requirements of the new rules further decreases the potential for stormwater runoff concerns from new development projects in the City.

- **GOAL: Reduce soil erosion from any development or construction project** – The City's Stormwater Management Plan identifies that the *Standards for Soil Erosion and Sediment*

Control in New Jersey be followed for all major development projects. Further, the City will mandate mitigation measures for projects that cannot strictly comply with the Stormwater Rules or the City's ordinances for stormwater thus retrofits to existing stormwater management features can be employed to reduce erosion from existing development and redevelopment projects.

The City's Environmental Commission (EC) will play an increasingly active role in monitoring construction sites. The EC has been discussing additional procedures at the time this plan was first adopted. Certain improvements may include monitoring the sequence of construction and renewed focus on implementation of the steep slope ordinance. This plan was reviewed by the Hunterdon County Soil Conservation District before initial adoption and incorporated much of the recommendations.

- **GOAL: Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures** – The City has identified locations where storm sewers are inadequate. Stream bank instability areas have also been identified. These locations will likely be good candidates for the Mitigation Plan.

- **GOAL: Maintain groundwater recharge** – By mandating that all major development projects complete Groundwater Recharge Spreadsheet analyses, it will be possible for the City to identify the pre-developed and post-developed groundwater recharge conditions. Through the use of BMPs for infiltration, the existing groundwater recharge conditions will be maintained post-development. The City will mandate mitigation measures to compensate for any shortfall due to thorough documented on-site limitations to recharge.

- **GOAL: Prevent, to the greatest extent feasible, an increase in nonpoint pollution** – By strongly encouraging the use of LID and preservation, the City is working to minimize nonpoint pollution. Additionally, since the City is mandating that all major development projects meet a 80% Total Suspended Solids removal rate, nonpoint pollution is mitigated to an even greater extent. Further, the City will mandate mitigation measures for projects that cannot strictly comply with the Stormwater Rules or the City's ordinances for stormwater. Retrofits to existing stormwater management features can be employed to reduce nonpoint pollution from existing development and redevelopment projects.

Through enforcement of existing City regulations on pet waste, wildlife feeding and litter, additional benefits will be realized along the Delaware and Raritan Canal including nutrient control, pathogen control, bank erosion control, and debris control in the water supply. Lambertville's streetsweeping program is already reduces nonpoint source pollution.

- **GOAL: Maintain the integrity of stream channels for their biological functions, as well as for drainage –** The biological function of all the Delaware River's

tributaries within the City boundaries will be fully assessed under the DRBC Special Protection Waters data collection on the Lower Delaware. The City intends to support the goals of the Special Protection Waters implementation through the administration of the Municipal Stormwater General Permit. By requiring (through future ordinance) vegetative buffer strips along all Delaware tributaries for sediment control, stream bank and streambed erosion control, nutrient and pollutant removal, stream temperature control, protection of aquatic species, and wildlife habitat, the City will enhance this goal.

- **GOAL: 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** - By mandating that all major development projects meet an 80% Total Suspended Solids removal rate, nonpoint pollution is mitigated to a greater extent. Further, the City will mandate mitigation measures for projects that cannot strictly comply with the Stormwater Rules or the City's ordinances for stormwater. Retrofits to existing stormwater management features can be employed to reduce nonpoint pollution from existing development and redevelopment projects.

  As a Tier B Municipality under N.J.A.C. 7:14A, Lambertville is required to develop and implement a Local Public Education Program to educate residents and businesses about the impact of their activities on stormwater quality and on the steps they can take to lessen these impacts. Lambertville's Education Program will be conducted to satisfy at least the minimum standards and will include all of the SBA and/or BMP topics required.

  Lambertville has decided to mail the educational brochure (provided by the New Jersey Department of Environmental Protection) to residents and businesses with the trash and recycling pickup notice (annually in January). These are mailed annually. In addition, this brochure and other educational materials will be made available year-round at appropriate municipal buildings and other public facilities. The City believes that tailoring the mailing in the future to emphasize the unique features of the town will help the residents understand the good stewardship role they can play.

  Lambertville will fulfill the "Annual Event" requirement at Shad Fest, which occurs on the last weekend in April each year. Shad Fest has historically been well attended by both residents of and visitors to Lambertville and the surrounding communities. At Shad Fest, volunteers will distribute educational materials as well as other appropriate items such as magnets, bookmarks, pencils, buttons, etc. to increase public awareness about stormwater quality. In addition, volunteers will answer questions and promote best management practices including proper waste and pet-waste disposal, proper fertilizer/pesticide application techniques, and composting and yard waste recycling. Volunteers will also encourage community participation in local events including the Storm Drain Inlet Labeling Project.

  Members of the Lambertville Stormwater Committee have initiated contact with the local Future Farmers of America (FFA) chapter to discuss participation in the municipality's Storm Drain Labeling Project. Other organizations such as local watershed groups and school groups will also

be contacted and encouraged to become involved in this required component of the Local Public Education Program. The Storm Drain Inlet Labeling Project will include the distribution of materials describing the hazards of dumping materials into storm drains and the labeling of all stormdrains along municipal streets with sidewalks and all storm drains within plazas, parking areas, and maintenance yards operated by the municipality. The program will also develop a long-term maintenance plan for the labels.

Through these and other outreach efforts to residents, Lambertville will fulfill not only its Local Public Education requirements, but will also improve public awareness, promote better stormwater management practices, and encourage community involvement and environmental stewardship.

- **GOAL: Protect public safety through the proper design and operation of stormwater management basins** – Public safety will be protected as the City is mandating all new stormwater management basins be designed in accordance with the public safety requirements of the Stormwater Management Rules.

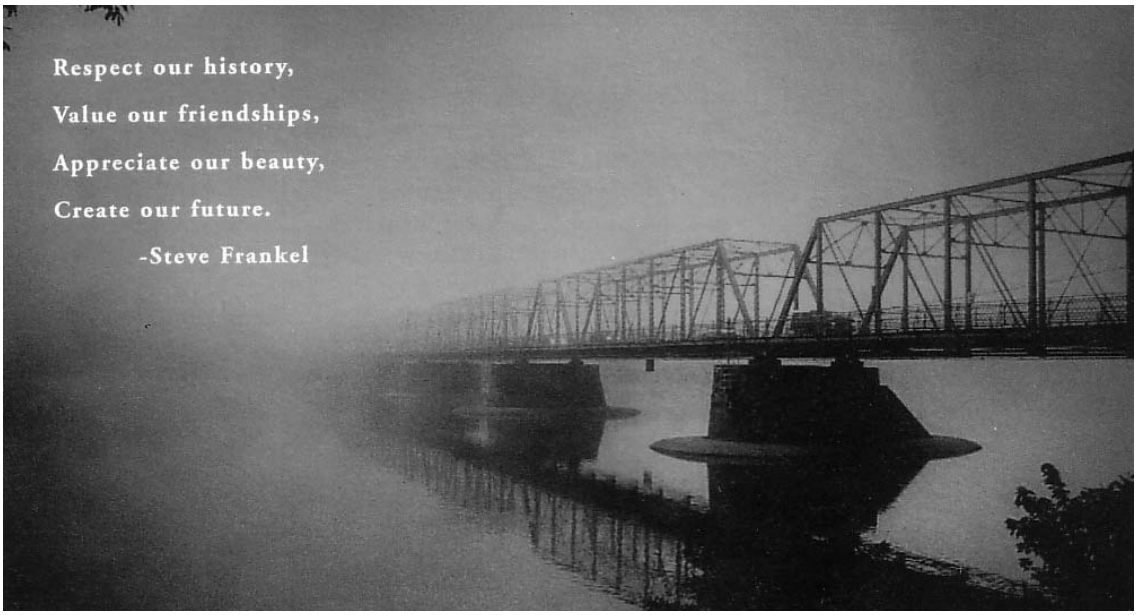
Please note this part of the plan will be updated upon complete review for consistency with the City's Master Plan and Land Development Ordinance.

Preliminarily, it appears that the Land Development Ordinance and City Code should be updated to include the following stormwater control ordinances:

- Ordinance 2004-12 – an ordinance amending the City of Lambertville Zoning Ordinance of 1971, as amended thought April 2001, entitled "An Ordinance to Modify and Amend Article V Entitled 'Additional Requirements and Performance Standards' to implement drainage regulations and potable well testing procedures" This ordinance was adopted in June of 2004 to provide interim stormwater management standards for land disturbance equaling or exceeding 3,000 square feet. This ordinance does not meet all minimum standards of the State stormwater management rules and thus must be modified or replaced.

- The Stormwater Committee will consider recommendation of an ordinance for yard waste dumping along the canal and tributaries to the Delaware River. Since enforcement is difficult, public education will also heighten the awareness for increased compliance.

- The Stormwater Committee will consider recommendation of an ordinance for illicit connections to the stormsewer system. Since the Delaware & Raritan Canal is a drinking water source for approximately one million New Jersey residents, and a backup water supply for the City of Lambertville, pollutants entering the canal through illegal discharges have a direct consequence on the water suppliers and ultimately the users.


Respect our history,
Value our friendships,
Appreciate our beauty,
Create our future.
-Steve Frankel

10.0 Applicable Definitions

"Best Management Practice(s)" (or BMP) The use of both nonstructural and structural stormwater management measures including effective low impact development.

"City of Lambertville" also as municipality, City or Lambertville in this document.

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

"Disturbance" means any activity involving the clearing, excavating, storing, grading, filling or transporting of soil or any other activity, which causes soil to be exposed to the danger of erosion.

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

"Impervious surface" means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water. Impervious surfaces include areas such as paved parking lots and concrete sidewalks.

"Low Impact Development" Low Impact Development or LID, seek to reduce and/or prevent adverse runoff impacts through sound site planning and both nonstructural and structural techniques that preserve or closely mimic the site's natural or pre-developed hydrologic response to precipitation. Rather than responding to the rainfall-runoff process like centralized structural facilities, low impact development techniques interact with the process, controlling stormwater runoff and pollutants closer to the source and providing site design measures that can significantly reduce the overall impact of land development on stormwater runoff. As such, low impact development promotes the concept of designing with nature.

"Major development projects" include those projects that disturb one (1) or more acres of land or increase impervious surfaces by 0.25 acres or more. Disturbance includes the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation. Projects undertaken by any government agency which otherwise meet the definition of "major development" but which do not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., are also considered "major development."

"Nonpoint source pollution" refers to all sources that cannot be identified as a point discharge. These include stormwater surface runoff and agricultural runoff, among others.

"Redevelopment" refers to alterations that change the "footprint" of a site or building in such a way that results in the disturbance of one acre or more of land. The term is not intended to include such activities as exterior remodeling, which would not be expected to cause adverse stormwater quality impacts and offer no new opportunity for stormwater controls. The NJDEP does not consider pavement resurfacing projects that do not disturb the underlying or surrounding soil, remove surrounding vegetation, or increase the area of impervious surface to be "redevelopment projects."

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

"Time of Concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed.

"Total Suspended Solids" refers to particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles. Differentiated from total dissolved solids (TDS) by a standardized filtration process, the dissolved portion passing through the filter.

"Water Quality Design Storm" refers to the rainfall event used to analyze and design structural and nonstructural stormwater quality measures (known as Best Management Practices or BMPs). As described in the Stormwater Management Rules, the NJDEP stormwater quality design storm has a total rainfall depth of 1.25 inches and a total duration of two hours. During its duration, the rain falls in a nonlinear pattern as depicted in Table 2 in Appendix D. This rainfall pattern or distribution is based on Trenton, New Jersey rainfall data collected between 1913 and 1975 and contains intermediate rainfall intensities that have the same probability or recurrence interval as the storm's total rainfall and duration. As such, for times of concentration up to two hours, the stormwater quality design storm can be used to compute runoff volumes, peak rates, and hydrographs of equal probability. This ensures that all stormwater quality BMPs, whether they are based on total runoff volume or peak runoff rate, will provide the same level of stormwater pollution control.

APPENDICES

Appendix A: NJPDES Tier B Stormwater General Permit SBRs

NEW JERSEY POLLUTANT DISCHARGE ELIMINATION SYSTEM

Permit Number: NJ0141861
P.I. ID# 50577

Final: Tier B Municipal Stormwater Master General Permit

Permittee:
Division Of Water Quality
401 E State Street
Trenton, New Jersey 08625

Co-Permittee:

Property Owner:

Location Of Activity:
NJPDES Master General Permit Program Interest
401 E State Street
Trenton, New Jersey 08625

Authorization(s) Covered Under This Approval	Issuance Date	Effective Date	Expiration Date
R10 -Tier B Municipal Stormwater General Permit	02/02/2004	03/03/2004	02/28/2009

By Authority of:

Commissioner's Office

DEP AUTHORIZATION
Barry Chalofsky, P.P., Chief
Bureau of Nonpoint Pollution Control
Division of Water Quality

(Terms, conditions and provisions attached hereto)

Tier B Municipal Stormwater General Permit
(NJ0141861)

PART I
NARRATIVE REQUIREMENTS:

A. Authorization Under this Permit

1. Permit Area

a. This permit applies to all areas of the State of New Jersey.

2. Eligibility

a. This permit may authorize all new and existing stormwater discharges to surface water and groundwater from small municipal separate storm sewer systems (MS4s) owned or operated by municipalities assigned to Tier B under N.J.A.C. 7:14A-25.3(a)2 (Tier B Municipalities), except as provided in A.5 below.

b. After the Effective Date of Permit Authorization (EDPA), the permit authorizes the following new and existing non-stormwater discharges from small MS4s owned or operated by Tier B Municipalities except if identified by the municipality as a significant contributor of pollutants to or from the MS4. If any of the following discharges are identified as a significant contributor, the Tier B Municipality shall contact the Department so appropriate actions may be taken:

i. Water line flushing and discharges from potable water sources

ii. Uncontaminated ground water (e.g., infiltration, crawl space or basement sump pumps, foundation or footing drains, rising ground waters)

iii. Air conditioning condensate

iv. Irrigation water (including landscape and lawn watering runoff)

v. Flows from springs, riparian habitats and wetlands, water reservoir discharges and diverted stream flows

vi. Residential car washing water, and residential swimming pool discharges

vii. Sidewalk, driveway and street wash water

viii. Flows from fire fighting activities

ix. Flows from rinsing of the following equipment with clean water:

- Beach maintenance equipment immediately following their use for their intended purposes; and
- Equipment used in the application of salt and de-icing materials immediately following salt and de-icing material applications. Prior to rinsing with clean water, all residual salt and de-icing materials must be removed from equipment and vehicles to the maximum extent practicable using dry cleaning methods (e.g., shoveling and sweeping). Recovered materials are to be returned to storage for reuse or properly discarded.

Rinsing of equipment in the above situations is limited to exterior, undercarriage, and exposed parts and does not apply to engines or other enclosed machinery.

3. Authorization

a. In order to obtain authorization under this permit (except for automatic renewal of authorization under A.4 below) a complete Request for Authorization (RFA) shall be submitted in accordance with the requirements of this permit. Upon review of the RFA, the Department may, in accordance with N.J.A.C. 7:14A-6.13, either:

i. Issue notification of authorization under this permit, in which case, authorization is deemed effective the first day of the following month of the date of the notification of authorization;

ii. Deny authorization under this permit and require submittal of an application for an individual permit; or

iii. Deny authorization under this permit and require submittal of an RFA for another general permit.

b. For discharges from a small MS4 authorized by this permit, the Tier B Municipality is exempt from N.J.A.C. 7:14A-6.2(a)2. This exemption means that the discharge of any pollutant not specifically regulated in the NJPDES permit or listed and quantified in the NJPDES application or RFA shall not constitute a violation of the permit.

c. Authorization under this permit shall cease to be effective under N.J.A.C. 7:14A-6.13(f), (h), (j) and (o), where applicable.

4. Automatic Renewal of Authorization

a. Authorization under this permit will be automatically renewed when this general permit is reissued as provided by N.J.A.C. 7:14A-6.13(d)9 and 25.8(c) so long as the discharge authorized under the general permit continues to be eligible. The Department shall issue a notice of renewed authorization to the Tier B Municipality.

b. If the Tier B Municipality is aware of any information in the most recently submitted RFA that is no longer true, accurate, and/or complete, the Tier B Municipality shall provide the correct information to the Department within 90 days of the effective renewal authorization notice.

5. Stormwater Discharges Not Authorized

a. This permit does not authorize "stormwater discharge associated with industrial activity" as defined in N.J.A.C. 7:14A-1.2. Types of facilities that a Tier B Municipality may operate and that are considered to be engaging in "industrial activity" include but are not limited to certain landfills and recycling facilities, certain transportation facilities (including certain local passenger transit and air transportation facilities), certain facilities handling domestic sewage or sewage sludge, steam electric power generating facilities, and construction activity that disturbs five acres or more (see N.J.A.C. 7:14A-1.2 for the full definition of "stormwater discharge associated with industrial activity"). Any municipality that operates an industrial facility with such a discharge must submit a separate request for authorization (RFA) or individual permit application for that discharge. An RFA submitted for the Tier B Municipal Stormwater General Permit does not qualify as an RFA for such a discharge.

i. Deadlines to apply for a NJPDES permit for "stormwater discharge associated with industrial activity" are set forth in N.J.A.C. 7:14A-24.4(a)1. If such a discharge is from a facility (other than an airport, powerplant, or uncontrolled sanitary landfill) that is owned or operated by a municipality with a population of less than 100,000, the municipality shall submit the RFA or individual permit application by March 3, 2004. If such a discharge is from any other industrial facility, N.J.A.C. 7:14A-24.4(a)1 specifies earlier deadlines to apply.

b. This permit does not authorize "stormwater discharge associated with small construction activity" as defined in N.J.A.C. 7:14A-1.2. In general, this is the discharge to surface water of stormwater from construction activity that disturbs at least one but less than five acres (see N.J.A.C. 7:14A-1.2 for the full definition). Any municipality that operates a construction site with such a discharge must submit a separate RFA or individual permit application for that discharge. An RFA submitted for the Tier B Municipal Stormwater General Permit does not qualify as an RFA for such a discharge.

c. This permit does not authorize any stormwater discharge that is authorized under another NJPDES permit. A municipality does not have to implement measures contained in this NJPDES permit for stormwater discharges at facilities owned or operated by that municipality that are regulated under a separate NJPDES stormwater permit authorizing those discharges.

d. This permit does not authorize stormwater discharges from projects or activities that conflict with an adopted areawide or Statewide WQM plan.

B. Requests for Authorization Requirements

1. Deadline for Requesting Authorization for an Existing Discharge

a. An RFA for the existing discharges from the small MS4 owned or operated by a Tier B Municipality must be submitted to the Department on or before March 3, 2004, except as provided below.

i. If a municipality receives notice from the Department that it has been reassigned from Tier A to Tier B, the deadline to submit an RFA is 90 days after the receipt of that notice.

ii. The Department may, in its discretion, accept an RFA submitted after the foregoing deadline; however, the municipality may still be held liable for violating the deadline to apply in accordance with N.J.A.C. 7:14A-25.8 and for discharging pollutants without a valid NJPDES permit in accordance with N.J.A.C. 7:14A-2.1(d).

2. Deadline for Requesting Authorization for a New Discharge

a. An RFA for discharges from a new small MS4 owned or operated by a Tier B Municipality must be submitted to the Department at least ninety (90) days prior to the operation of the new MS4 system.

i. A Tier B Municipality that already has authorization to discharge from a small MS4 under the Tier B Municipal Stormwater Permit does not need to submit an additional RFA for the expansion of an existing small MS4.

ii. A new small MS4 is a small MS4 that did not exist on March 3, 2004 and results in a new discharge to surface or ground waters of the State.

3. Requesting Authorization

a. A separate RFA shall be submitted by each Tier B Municipality applying for authorization under this permit.

b. A single RFA is required for the entire stormwater discharge from the small MS4 owned or operated by and located within a single municipality. Multiple RFAs are not required for multiple municipal operations (e.g., municipally owned and operated maintenance facilities, garages, and/or offices).

4. Contents of the Request for Authorization

a. A completed RFA shall include all of the following information regarding the Tier B Municipality and shall be completed using the Department's RFA form:

i. The name of the municipality that owns and operates the small MS4, county it is located in, and the address of the main municipal office (e.g., city hall, town hall, or municipal building).

ii. The name and mailing address of the Municipal Stormwater Program Coordinator who will submit any reports or certifications required by the permit and to whom the Department shall send all correspondence concerning the permit.

iii. A certification acknowledging the best management practices, measurable goals, and other requirements specified in the permit.

iv. A map showing the boundaries of any "combined sewer area" that a Tier B Municipality wants to exclude from the Stormwater Program under Part I, Section E. A "combined sewer area" is an area that is excluded because all stormwater discharges that are from that area (and operated by the municipality) are discharges to combined (or sanitary) sewer systems.

v. Additional information may be required by the Department to be included as part of the RFA if the Department determines that such additional information (including other data, reports, specifications, plans, permits, or other information) is reasonably necessary to determine whether to authorize the discharge under this permit.

5. Where to Submit

a. A completed and signed RFA shall be submitted to the Department at the address specified on the Department's RFA form.

C. Definitions

1. The following definitions apply to this permit.

a. "EDPA" means Effective Date of Permit Authorization.

b. "MS4" means a municipal separate storm sewer system.

c. "Municipality" means a "municipality" as defined in the Municipal Land Use Law at N.J.S.A. 40:55D-5, that is, any city, borough, town, township, or village.

d. "Municipal separate storm sewer" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

i. Owned or operated by the United States, an interstate agency, a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe organization, or a designated and approved management agency under section 208 of the CWA that discharges to surface water or groundwater;

ii. Designed and used for collecting or conveying stormwater;

iii. Which is not a combined sewer;

iv. Which is not part of a POTW; and

v. Which is not either of the following:

- A separate storm sewer(s) that is at an industrial facility, and that collects or conveys stormwater discharges associated with industrial activity that occurs at that facility; or

- A separate storm sewer(s) that is at a construction site, and that collects or conveys stormwater discharges associated with small construction activity that occurs at that site.

e. "Small municipal separate storm sewer system" or "small MS4" means all municipal separate storm sewers (other than "large" or "medium" municipal separate storm sewer systems as defined in N.J.A.C. 7:14A-1.2) that are:

i. Owned or operated by municipalities described under N.J.A.C. 7:14A-25.1(b);

ii. Owned or operated by county, State, interstate, or Federal agencies, and located at public complexes as described under N.J.A.C. 7:14A-25.2(a)2;

iii. Owned or operated by county, State, interstate, Federal, or other agencies, and located at highways and other thoroughfares as described under N.J.A.C. 7:14A-25.2(a)3; or

iv. Owned or operated by county, State, interstate, Federal, or other agencies, and receive special designation under N.J.A.C. 7:14A-25.2(a)4.

f. "Solid and floatable materials" means sediment, debris, trash, and other floating, suspended, or settleable solids.

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

D. Special Conditions

1. Sharing of Responsibilities

a. A Tier B Municipality may share with one or more other entities (for example, a watershed association or another municipality) the responsibility for implementing any of the Statewide Basic Requirements (SBRs), or Additional Measures (AMs) required by this permit pursuant to N.J.A.C. 7:14A-25.8(e).

b. The Tier B Municipality is responsible for compliance with this permit if the other entity fails to implement the measure(s), or component(s) thereof. In the annual reports the municipality must submit under Part I, Section H.2, the municipality shall specify that it is relying on another entity to satisfy some of the Tier B Municipality's NJPDES permit obligations.

c. If the municipality is relying on another entity regulated under the NJPDES permit program to satisfy all of that Tier B Municipality's NJPDES permit obligations, including that municipality's obligation to file these annual reports, the municipality shall notify the Department of this reliance in writing.

E. Stormwater Program

1. Stormwater Program

a. Tier B municipalities are required to develop, implement, and enforce a stormwater program that must include the SBRs that are listed in Part I, Section F and the AMs, if any, required by Part I, Section G.1 of the permit.

b. For any projects or activities which the municipality contracts out to private contractors after the EDPA, the awarded contract must contain conditions that the contractor must conduct such projects or activities in such a manner that is in compliance with the municipality's stormwater program and this permit's conditions. The municipality is responsible for any violations of this permit resulting from a contractor's noncompliance.

F. Statewide Basic Requirements (SBRs)

1. Stormwater quality issues related to new development, redevelopment and existing development are to be addressed through the implementation of the following Statewide Basic Requirements (SBRs). The permit specifies the BMPs that will be implemented for those SBRs.

a. Additional information is provided and each of the SBRs and related BMPs are described in more detail in the Department's Tier B Municipal Stormwater Permit Guidance Document.

2. Post-Construction Stormwater Management in New Development and Redevelopment

a. Minimum Standard - To prevent or minimize water quality impacts, the Tier B Municipality shall develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects (including projects operated by the municipality itself) that disturb one acre or more, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the municipality's small MS4. The municipality shall in its post-construction program:

i. Adopt and reexamine a municipal stormwater management plan (or adopt amendments to an existing municipal stormwater management plan) in accordance with N.J.A.C. 7:8-4.

ii. Adopt and implement a municipal stormwater control ordinance or ordinances in

accordance with N.J.A.C. 7:8-4. The ordinance(s) will control stormwater from non-residential development and redevelopment projects.

iii. Ensure that any residential development and redevelopment projects that are subject to the Residential Site Improvement Standards for stormwater management (N.J.A.C. 5:21-7) comply with those standards (including any exception, waiver, or special area standard that was approved under N.J.A.C. 5:21-3).

iv. Where necessary to implement the municipal stormwater management plan, the municipal stormwater control ordinance(s) will also:

- Control aspects of residential development and redevelopment projects that are not pre-empted by the Residential Site Improvement Standards; and
- Set forth special area standards approved by the Site Improvement Advisory Board for residential development or redevelopment projects under N.J.A.C. 5:21-3.5.

v. Ensure adequate long-term operation and maintenance of BMPs.

vi. This post-construction program shall also require compliance with standards set forth in Attachment A of the permit to control passage of solid and floatable materials through storm drain inlets.

vii. This post-construction program shall require compliance with the applicable design and performance standards established under N.J.A.C. 7:8 for major development, unless:

- Those standards do not apply because of a variance or exemption granted under N.J.A.C. 7:8; or
- Alternative standards are applicable under an adopted areawide or Statewide Water Quality Management Plan adopted in accordance with N.J.A.C. 7:15.

b. Measurable Goal – Tier B Municipalities shall certify annually that they have developed, implemented, and are actively enforcing a program to address stormwater runoff from new development and redevelopment projects that discharge into the Tier B Municipality's small MS4 in accordance with the minimum standard.

c. Implementation

i. Upon the effective date of permit authorization, Tier B Municipalities shall for new development and redevelopment projects:

- Ensure that any residential development and redevelopment projects that are subject to the Residential Site Improvement Standards for stormwater management (N.J.A.C. 5:21-7) comply with those standards (including any exception, waiver, or special area standard that was approved under N.J.A.C. 5:21-3).

- Ensure adequate long-term operation and maintenance of BMPs on property owned or operated by the municipality.

ii. Within 12 months from the effective date of permit authorization, Tier B Municipalities shall:

- Adopt a municipal stormwater management plan (or adopt amendments to an existing municipal stormwater management plan) in accordance with N.J.A.C. 7:8-4;

- Comply with the standards set forth in Attachment A of the permit to control passage of solid and floatable materials through storm drain inlets for storm drain inlets the municipality installs within the Tier B Municipality's small MS4.

iii. Within 12 months from the adoption of the municipal stormwater management plan, Tier B Municipalities shall adopt a stormwater control ordinance(s) to implement that plan, and shall submit the adopted municipal stormwater management plan and ordinance(s) to the appropriate county review agency for approval.

iv. Tier B Municipalities shall enforce stormwater control ordinance(s) when approved in accordance with N.J.A.C. 7:8-4.

v. Within 24 months from the effective date of permit authorization Tier B Municipalities shall:

- Ensure adequate long-term operation and maintenance of BMPs on property not owned or operated by the municipality;

- Enforce, through the stormwater control ordinance(s) or a separate ordinance, compliance with the standards set forth in Attachment A of the permit to control passage of solid and floatable materials through storm drain inlets for storm drain inlets not installed by the Tier B Municipality.

3. Local Public Education

a. Local Public Education Program

i. Minimum Standard – The Local Public Education Program shall ensure that the annual mailing of the informational brochure and the annual educational event are conducted as required below. The Annual Report and Certification shall summarize how the Tier B Municipality distributed educational information and how the educational activities, including the educational event, will be conducted to satisfy this minimum standard. The following SBR and/or BMP topics shall be included in the Local Public Education Program:

- Stormwater/Nonpoint Source Education – impact of stormwater discharges on surface and ground waters of the State and steps that the public can take to reduce pollutants in stormwater runoff.

- Storm Drain Inlet Labeling – hazards of dumping materials into the storm drain, and fact that storm drains are usually connected to water bodies and do not receive treatment.

- Fertilizer/Pesticide Education –proper application, storage and disposal of

pesticides and fertilizers, and the benefits of using native or well adapted vegetation that requires little or no fertilization.

- Waste Disposal Education – identification, proper handling and proper disposal of wastes (including the locations of hazardous waste collection facilities in the area) and the hazards associated with illicit connections and improper disposal of waste.

Tier B Municipalities shall provide for the duplication and annual mailing (or other means of delivery) to all residents and businesses within the municipality of the informational brochure provided by the Department. The informational brochure covers all the topics above. The Department may periodically provide the Tier B Municipality with an updated brochure for duplication and distribution.

As part of this program, Tier B Municipalities shall also conduct each year, at minimum, one education effort in the form of an "event." An event may be an activity established primarily to satisfy this requirement or may be part of a bigger existing event such as municipal festivals, county fairs, or an Earth Day, Arbor Day or 4th of July celebration. During this event, the informational brochure shall also be made available to the public.

ii. Measurable Goal - Tier B Municipalities shall certify annually that that they have met the Local Public Education Program minimum standard and shall provide the date(s) of the annual mailing (or other means of delivery) and annual event, including a description of the event.

iii. Implementation - Within 12 months from the effective date of permit authorization, Tier B Municipalities shall have developed and begun implementing the Local Public Education Program minimum standard.

b. Storm Drain Inlet Labeling

i. Minimum Standard - Tier B Municipalities shall establish a storm drain inlet labeling program and label all storm drain inlets that are along municipal streets with sidewalks, and all storm drain inlets within plazas, parking areas, or maintenance yards that are operated by the municipality. The program shall establish a schedule for labeling, develop a long term maintenance plan, and when possible, coordinate efforts with watershed groups and volunteer organizations.

ii. Measurable Goal - Tier B Municipalities shall certify annually that a storm drain inlet labeling program has been developed or is being implemented, and shall identify the number of storm drain inlets labeled within the year.

iii. Implementation - Within 12 months from the effective date of permit authorization, Tier B Municipalities shall develop a labeling program for the storm drain inlets identified in the minimum standard. Tier B Municipalities must either:

- Label a minimum of 50% of the storm drain inlets within 36 months from the EDPA; and label all remaining storm drain inlets on or before 60 months from EDPA; or

- Divide the municipality into two sectors for the purposes of storm drain inlet labeling. Prepare a map of the two sectors. Label the storm drain inlets in one sector within 36 months from the EDPA; and label all remaining storm drain inlets on or before 60 months from EDPA.

G. Additional and Other Measures

1. Additional Measures

a. Additional Measures (AMs) are non-numeric or numeric effluent limitations that are expressly required to be included in the stormwater program by an adopted areawide or Statewide Water Quality Management Plan (WQM plan). AMs may modify or be in addition to SBRs. AMs may be required by a TMDL approved or established by USEPA, a regional stormwater management plan, or other elements of adopted areawide or Statewide WQM plans.

b. The Department will provide written notice of the adoption of an AM to each Tier B Municipality whose stormwater program will be affected, and will list each adopted AM in the permit by making a minor modification to the permit. The AMs, other than numeric effluent limitations, will specify the BMPs that must be implemented and the measurable goals for each BMP. The AMs will also specify time periods for implementation.

2. Other Stormwater Control Measures

a. Tier B Municipalities may also implement other stormwater control measures as allowed by statute. These activities are outside the scope of the Tier B stormwater program.

H. Deadlines and Certifications

1. Statewide Basic Requirements

a. Each SBR contained in Part I, Section F of the permit has a specific implementation schedule based on the effective date of permit authorization. Each SBR shall be implemented in accordance with that schedule. Tier B Municipalities shall certify in the Annual Report and Certification the status of the implementation of each SBR and the date implementation was completed, as appropriate.

2. Annual Report and Certification

a. Tier B Municipalities shall complete an Annual Report (on a form provided by the Department) summarizing the status of compliance with this permit including measurable goals and the status of the implementation of each SBR contained in Part I, Section F of the permit. This report shall include a certification that the municipality is in compliance with this permit, except for any incidents of noncompliance. Any incidents of noncompliance with permit conditions shall be identified in the Annual Report and Certification. A copy of each Annual Report and Certification shall be kept at a central location and shall be made available to the Department for inspection.

i. If there are incidents of noncompliance, the report shall identify the steps being taken to remedy the noncompliance and to prevent such incidents from recurring.

ii. The Annual Report and Certification shall be signed and dated by the Tier B Municipality, and shall be maintained for a period of at least five years. This period may be extended by written request of the Department at any time.

b. The Annual Report and Certification shall be submitted to the Department pursuant to the following submittal schedule:

i. Submit an Annual Report and Certification: on or before July 1, 2005 and every 12 months thereafter.

I. Standard Conditions

1. The following general conditions are incorporated by reference. The Tier B Municipality is required to comply with the regulations, which were in effect as of the March 3, 2004.

a. General Permits N.J.A.C. 7:14A-6.13
b. Penalties for Violations N.J.A.C. 7:14-8.1 et seq.
c. Incorporation by Reference N.J.A.C. 7:14A-2.3
d. Toxic Pollutants N.J.A.C. 7:14A-6.2(a)4i
e. Duty to Comply N.J.A.C. 7:14A-6.2(a)1 & 4
f. Duty to Mitigate N.J.A.C. 7:14A-6.2(a)5 & 11
g. Inspection and Entry N.J.A.C. 7:14A-2.11(e)
h. Enforcement Action N.J.A.C. 7:14A-2.9
i. Duty to Reapply N.J.A.C. 7:14A-4.2(e)3
j. Signatory Requirements for Applications and Reports N.J.A.C. 7:14A-4.9
k. Effect of Permit/Other Laws N.J.A.C. 7:14A-6.2(a)6 & 7 & 2.9(c)
l. Severability N.J.A.C. 7:14A-2.2
m. Administrative Continuation of Permits N.J.A.C. 7:14A-2.8
n. Permit Actions N.J.A.C. 7:14A-2.7(c)
o. Reopener Clause N.J.A.C. 7:14A-6.2(a)10, 16.4(b) & 25.7(b)
p. Permit Duration and Renewal N.J.A.C. 7:14A-2.7(a) & (b)
q. Consolidation of Permit Process N.J.A.C. 7:14A-15.5
r. Confidentiality N.J.A.C. 7:14A-18.2 & 2.11(g)
s. Fee Schedule N.J.A.C. 7:14A-3.1
t. UIC Corrective Action N.J.A.C. 7:14A-8.4
u. Additional Conditions Applicable to UIC Permits N.J.A.C. 7:14A-8.9
v. UIC Operating Criteria N.J.A.C. 7:14A-8.16

2. Operation And Maintenance

a. Need to Halt or Reduce not a Defense N.J.A.C. 7:14A-2.9(b)
b. Proper Operation and Maintenance N.J.A.C. 7:14A-6.12

3. Monitoring And Records

a. Monitoring N.J.A.C. 7:14A-6.5
b. Recordkeeping N.J.A.C. 7:14A-6.6
c. Signatory Requirements for Monitoring Reports N.J.A.C. 7:14A-6.9

4. Reporting Requirements

a. Planned Changes N.J.A.C. 7:14A-6.7
b. Reporting of Monitoring Results N.J.A.C. 7:14A-6.8
c. Noncompliance Reporting N.J.A.C. 7:14A-6.10 & 6.8(h)
d. Hotline/Two Hour & Twenty-four Hour Reporting N.J.A.C. 7:14A-6.10(c) & (d)
e. Written Reporting N.J.A.C. 7:14A-6.10(e) &(f) & 6.8(h)
f. Duty to Provide Information N.J.A.C. 7:14A-2.11, 6.2(a)14 & 18.1
g. Compliance Schedules N.J.A.C. 7:14A-6.4
h. Transfer N.J.A.C. 7:14A-6.2(a)8 & 16.2

5. Copies of the NJPDES rules may be purchased by contacting West Group, St. Paul, Minnesota,1-800-808-WEST.

J. Additional Conditions

1. Agency and Public Review

a. The Tier B municipality shall keep records required by this general permit for at least five years from the date of the record. The municipality shall submit these records to the Department if requested.

b. Upon review by an authorized representative, the Department may notify the Tier B Municipality at any time that the stormwater program does not meet one or more of the minimum requirements. Within 30 days after receiving such notification (unless otherwise specified by the Department), the stormwater program shall be revised to adequately address all deficiencies, and written certification of such revisions shall be submitted to the Department.

c. Tier B Municipalities shall make records required by this permit available to the public at reasonable times during regular business hours (see N.J.A.C. 7:14A-18 for confidentiality provisions).

2. Other Laws

a. In accordance with N.J.A.C. 7:14A-6.2(a)7, this permit does not authorize any infringement of State or local law or regulations, including, but not limited to the Pinelands rules (N.J.A.C. 7:50), N.J.A.C. 7:1E (Department rules entitled "Discharges of Petroleum and other Hazardous Substances"), the New Jersey Register of Historic Places Rules (N.J.A.C. 7:4), and all other Department rules. No discharge of hazardous substances (as defined in N.J.A.C. 7:1E-1.6) resulting from an onsite spill shall be deemed to be "pursuant to and in compliance with [this] permit" within the meaning of the Spill Compensation and Control Act at N.J.S.A. 58:10-23.11c.

3. Operations and Maintenance Manual

a. In accordance with N.J.A.C. 7:14A-6.12(c), for a discharge authorized by this permit, the Tier B Municipality is exempt from the requirement to prepare an operations and maintenance manual.

Attachment A
DESIGN STANDARD - STORM DRAIN INLETS

This standard applies to storm drain inlets installed as part of new development and redevelopment projects (public or private) that disturb one acre or more. For exemptions to this standard see "Exemptions" below.

Grates in Pavement or Other Ground Surfaces

Design engineers shall use either of the following grates whenever they use a grate in pavement or another ground surface to collect stormwater from that surface into a storm drain or surface water body under that grate:

1. The New Jersey Department of Transportation (NJDOT) bicycle safe grate, which is described in Chapter 2.4 of the NJDOT Bicycle Compatible Roadways and Bikeways Planning and Design Guidelines (April 1996).

2. A different grate, if each individual clear space in that grate has an area of no more than seven (7.0) square inches, or is no greater than 0.5 inches across the smallest dimension.

   (In regard to whether the different grate must also be bicycle safe, the Residential Site Improvement Standards include requirements for bicycle-safe grates.)

Examples of grates subject to this standard include grates in grate inlets, the grate portion (non-curb-opening portion) of combination inlets, grates on storm sewer manholes, ditch grates, trench grates, and grates of spacer bars in slotted drains. Examples of ground surfaces include surfaces of roads (including bridges), driveways, parking areas, bikeways, plazas, sidewalks, lawns, fields, open channels, and stormwater basin floors.

Curb-Opening Inlets (Including Curb-Opening Inlets in Combination Inlets)

Whenever design engineers use a curb-opening inlet, the clear space in that curb opening (or each individual clear space, if the curb opening has two or more clear spaces) shall have an area of no more than seven (7.0) square inches, or be no greater than two (2.0) inches across the smallest dimension.

Exemptions

Hydraulic Performance Exemptions

1. New Development and Redevelopment Projects - Where the review agency determines that this standard would cause inadequate hydraulic performance that could not practicably be overcome by using additional or larger storm drain inlets that meet these standards.

2. Retrofitting of existing storm drain inlets - Where the review agency determines that this standard would cause inadequate hydraulic performance.

Alternative Device Exemptions

1. Where flows from the water quality design storm as specified in N.J.A.C. 7:8 are conveyed through any device (e.g., end of pipe netting facility, manufactured treatment device, or a catch basin hood) that is designed, at a minimum, to prevent delivery of all solid and floatable materials that could not pass through one of the following:

    a. A rectangular space four and five-eighths inches long and one and one-half inches wide (this option does not apply for outfall netting facilities); or

    b. A bar screen having a bar spacing of 0.5 inches.

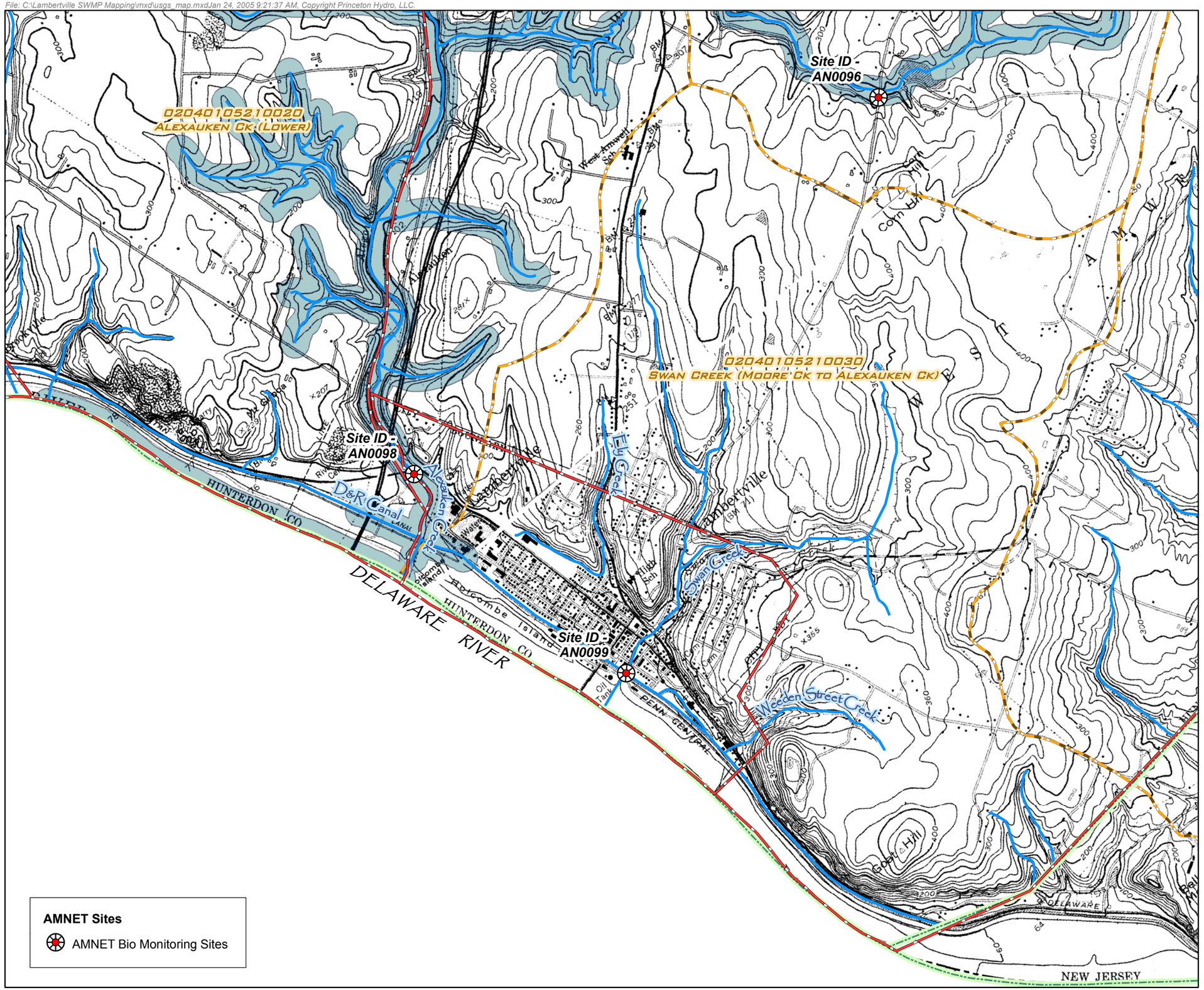
2. Where flows are conveyed through a trash rack that has parallel bars with one-inch (1") spacing between the bars, to the elevation of the water quality design storm as specified in N.J.A.C. 7:8.

Note - The preceding exemptions do not authorize any infringement of requirements in the Residential Site Improvement Standards for bicycle-safe grates in new residential development (N.J.A.C. 5:21-4.18(b)2 and 7.4(a)).

Historic Places Exemption

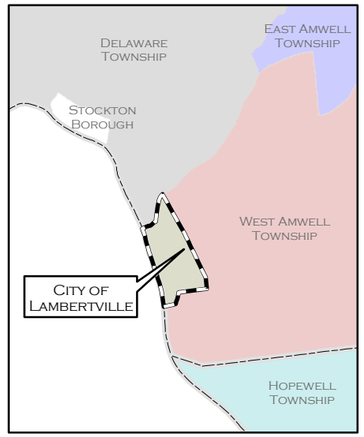
Where the Department determines, pursuant to the New Jersey Register of Historic Places Rules at N.J.A.C. 7:4-7.2(c), that action to meet this standard is an undertaking that constitutes an encroachment or will damage or destroy the New Jersey Register listed historic property.

Appendix B: Municipal Background Mapping



Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 500 1,000 2,000
1 inch equals 2,000 feet

SOURCES:

1. Municipal Boundary and C1 buffer coverage as obtained from Hunterdon County Planning Board.
2. USGS 7.5 minute series Quadrangles shown for Stockton NJ-PA and Lambertville PA-NJ.
3. Streams coverage as obtained from NJDEP GIS website.

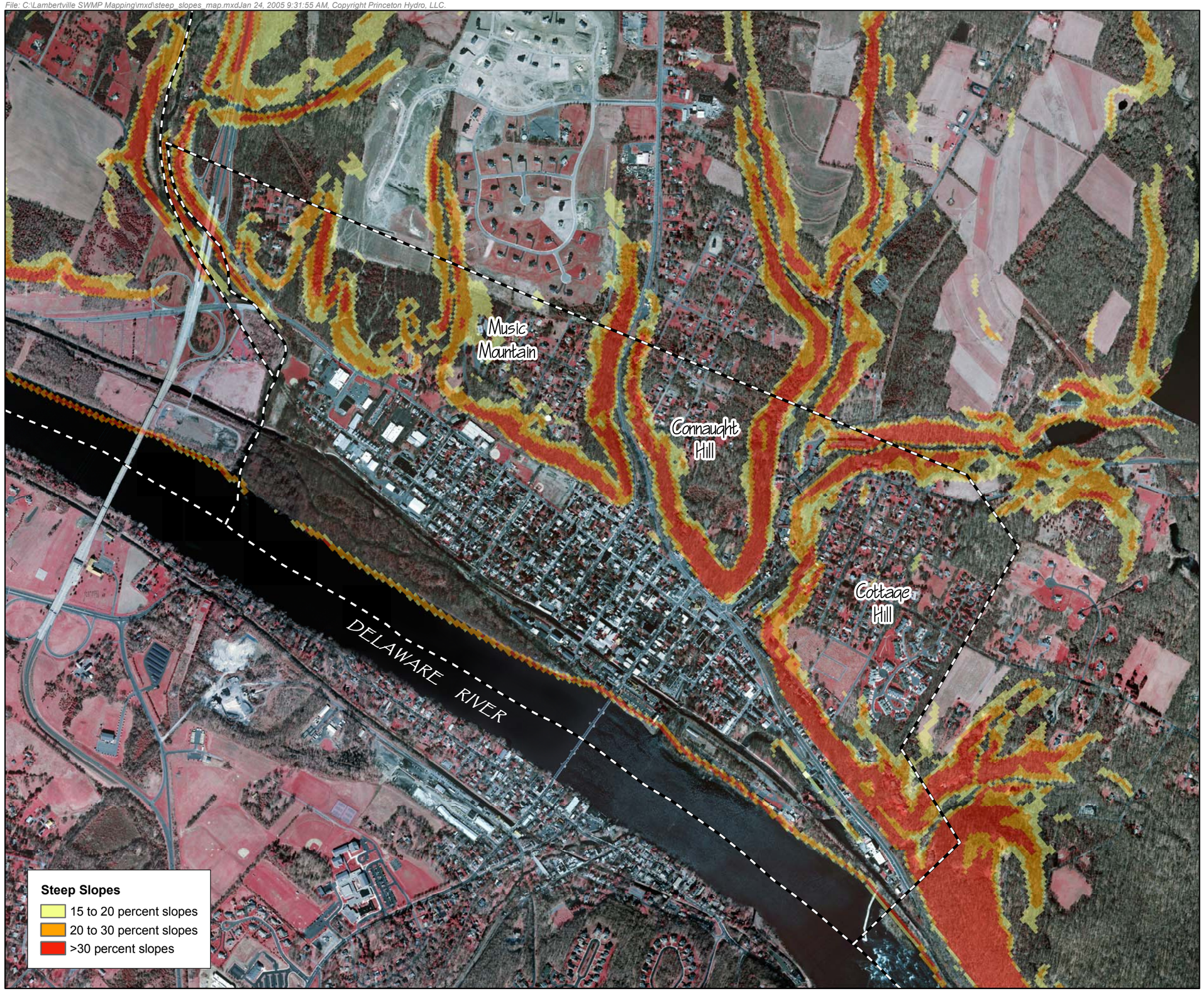
APPENDIX B: Figure B1:

USGS QUADRANGLE MAP

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

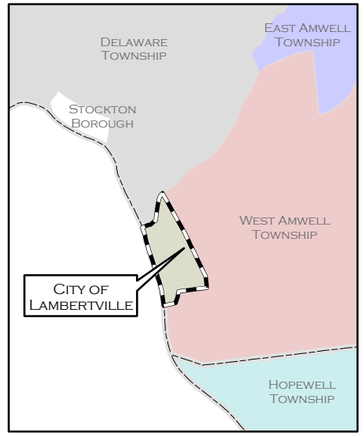
Legend

- Municipal Boundary
- County Boundary
- Streams
- HUC 14 Boundary
- 300 ft C1 Buffer



pH Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Elevation information as interpolated from 10 m DEM for WMA 11 as obtained from NJDEP GIS website.
3. 2002 Aerial orthophotographs obtained from NJGIN website.

APPENDIX B: Figure B2:
STEEP SLOPES MAP

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend

Municipal Boundary

Problem Parking Lots
Label, Description

A, CVS Complex (Dumpsters)
B, PNC Complex (Dumpsters)
C, River Horse Complex (Dumpsters)
D, Lambertville Station Complex (Dumpsters)
E, River Walk Complex (Dumpsters)

DELAWARE RIVER

Areas of Concern

- Known Contaminated Sites
- Classification Exception Area
- Well and Septic Overlay District
- Erosional Concern Areas
- Problem Catchbasins
- Problem Parking Lots

KNOWN CONTAMINATED SITES

ID NUMBER, NAME, ADDRESS

* 1, MOBIL SERVICE STATION LAMBERTVILLE, 83 BRIDGE ST
2, STEFANS AUTOMOTIVE REPAIR, 168 RTE 29 (ED TOWLES GARAGE)
3, KOMAR MANUFACTURING COMPANY INCORPORATED, 24 ARNETT AVE
* 4, SUNOCO SERVICE STATION LAMBERTVILLE CITY, BRIDGE & N MAIN STS
5, LAMBERTVILLE SEWER AUTH SWAN STREET PUMP, SWAN ST
6, LAMBERTVILLE COAL GAS JCP&L, 201 S MAIN & FERRY ST
7, ADVANCED CERAMETRICS INCORPORATED, 245 MAIN ST N
8, 58 BELVIDERE AVE, 58 BELVIDERE AVE
9, STEPHEN AUTO REPAIR, 5 RTE 165

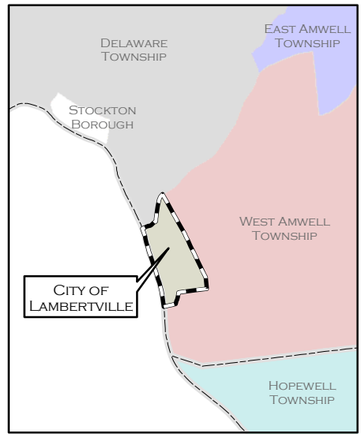
* TO BE REMOVED IN NEXT UPDATE TO LIST, AS PER DISCUSSION WITH NJDEP

Problem Catchbasins
Label, Description

1, 10 Cherry Street (1 catchbasin)
2, 272 North Union Street (1 catchbasin)
3, 250 North Union Street (3 catchbasins)
4, Intersection of Lambert Lane and Coryell Street (1 catchbasin)
5, 25 Lambert Lane (1 catchbasin)
6, 20 South Union Street (3 catchbasins)

Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Known Contaminated Sites (2001) and Classification Exception Areas and Public Non-community Water Supply Well Head Protection Areas as obtained from NJDEP GIS website.
3. Well and Septic overlays as interpreted from Lambertville Sewer Authority and United Water Lambertville mapping.

APPENDIX B: Figure B3

SENSITIVE AREAS MAP

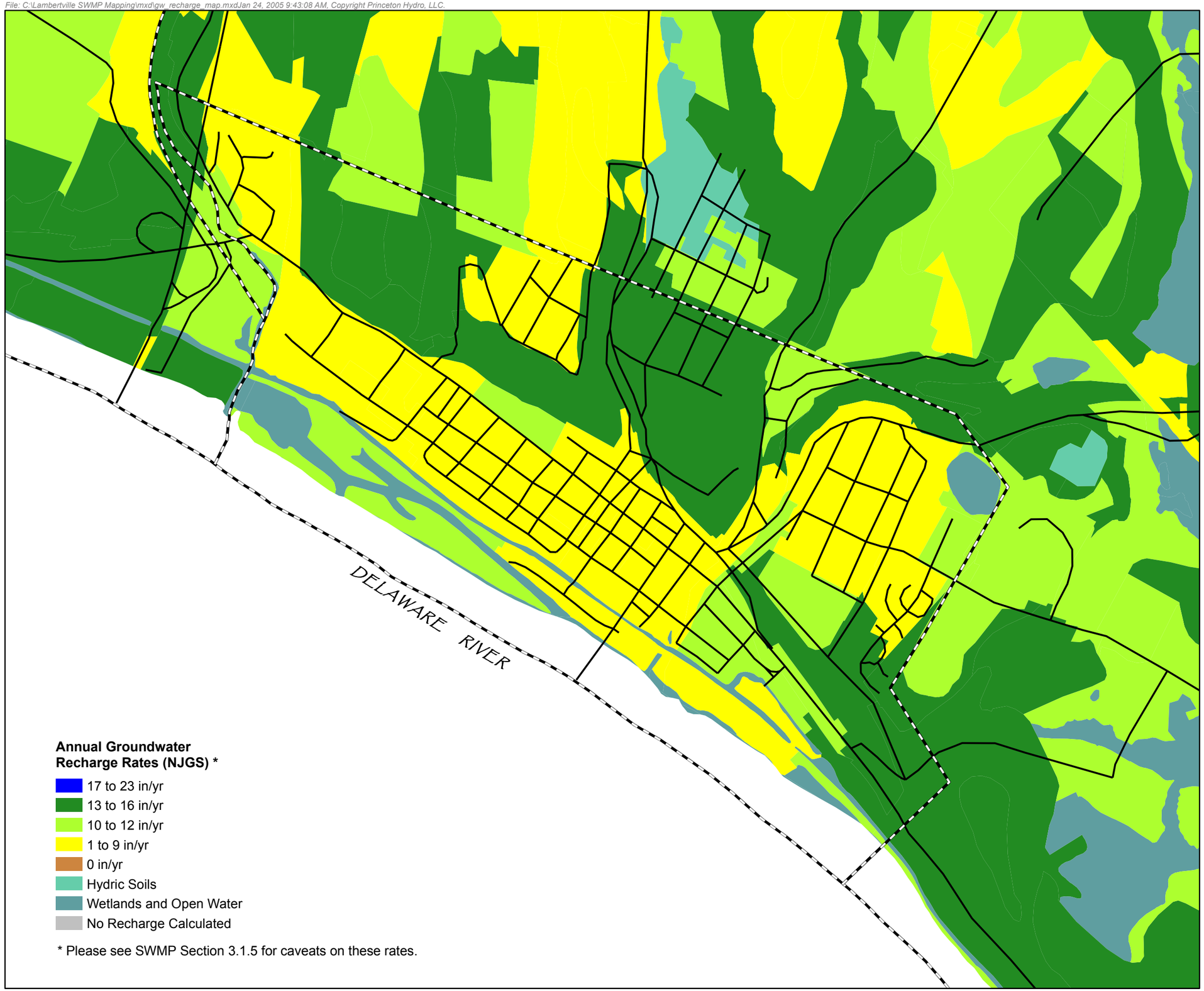
STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend

- Municipal Boundary

Public Non-community Water Supply
Well-head Protection Areas

- 2-year
- 5-year
- 12-year



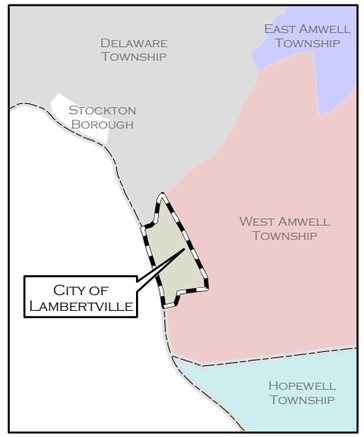
Annual Groundwater Recharge Rates (NJGS) *

- 17 to 23 in/yr
- 13 to 16 in/yr
- 10 to 12 in/yr
- 1 to 9 in/yr
- 0 in/yr
- Hydric Soils
- Wetlands and Open Water
- No Recharge Calculated

* Please see SWMP Section 3.1.5 for caveats on these rates.

Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Groundwater Recharge information as obtained from NJGS (New Jersey Geologic Service) GIS website.
3. Road information shown is Tiger Line files from Census 2000.

APPENDIX B: Figure B4:
GROUNDWATER RECHARGE MAP

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend

- Municipal Boundary
- Roads

DELAWARE RIVER

Emergent Wetland
- Suitable Habitat (1)
- Priority Species (2)
- State Threatened (3)
- State Endangered (4)
- Federal T and E (5)

Forest
- Suitable (1)
- Priority Species (2)
- State Threatened (3)
- State Endangered (4)
- Federal T and E (5)

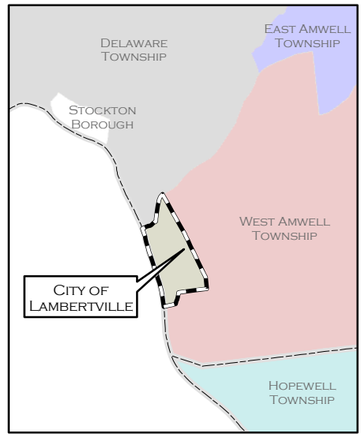
Forested Wetland
- Suitable (1)
- Priority Species (2)
- State Threatened (3)
- State Endangered (4)
- Federal T and E (5)

Grassland
- Suitable (1)
- Priority Species (2)
- State Threatened (3)
- State Endangered (4)
- Federal T and E (5)

pH

Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000

1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Threatened and Endangered Species Landscape Data as obtained from NJDEP GIS website.
3. Road information shown is Tiger Line files from Census 2000.

APPENDIX B: Figure B5:
THREATENED AND ENDANGERED LANDSCAPE DATA

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend
- Municipal Boundary
- Roads

DELAWARE RIVER

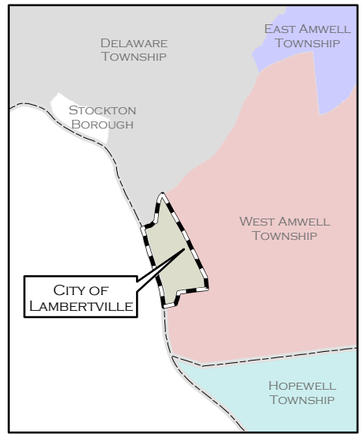
Natural Heritage Priority Sites
September 2001 Version
Critical Habitat for Rare Species and Natural Communities

Standard Site (usually < 3200 acres in size)
- B1 Standard Site (Outstanding Significance)
- B2 Standard Site (Very High Significance)
- B3 Standard Site (High Significance)
- B4 Standard Site (Moderate Significance)
- B5 Standard Site (General Biodiversity Interest)

Macrosite (usually > 3200 acres in size)
- B1 Macrosite (Outstanding Significance)
- B2 Macrosite (Very High Significance)
- B3 Macrosite (High Significance)
- B4 Macrosite (Moderate Significance)
- B5 Macrosite (General Biodiversity Interest)

pH Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

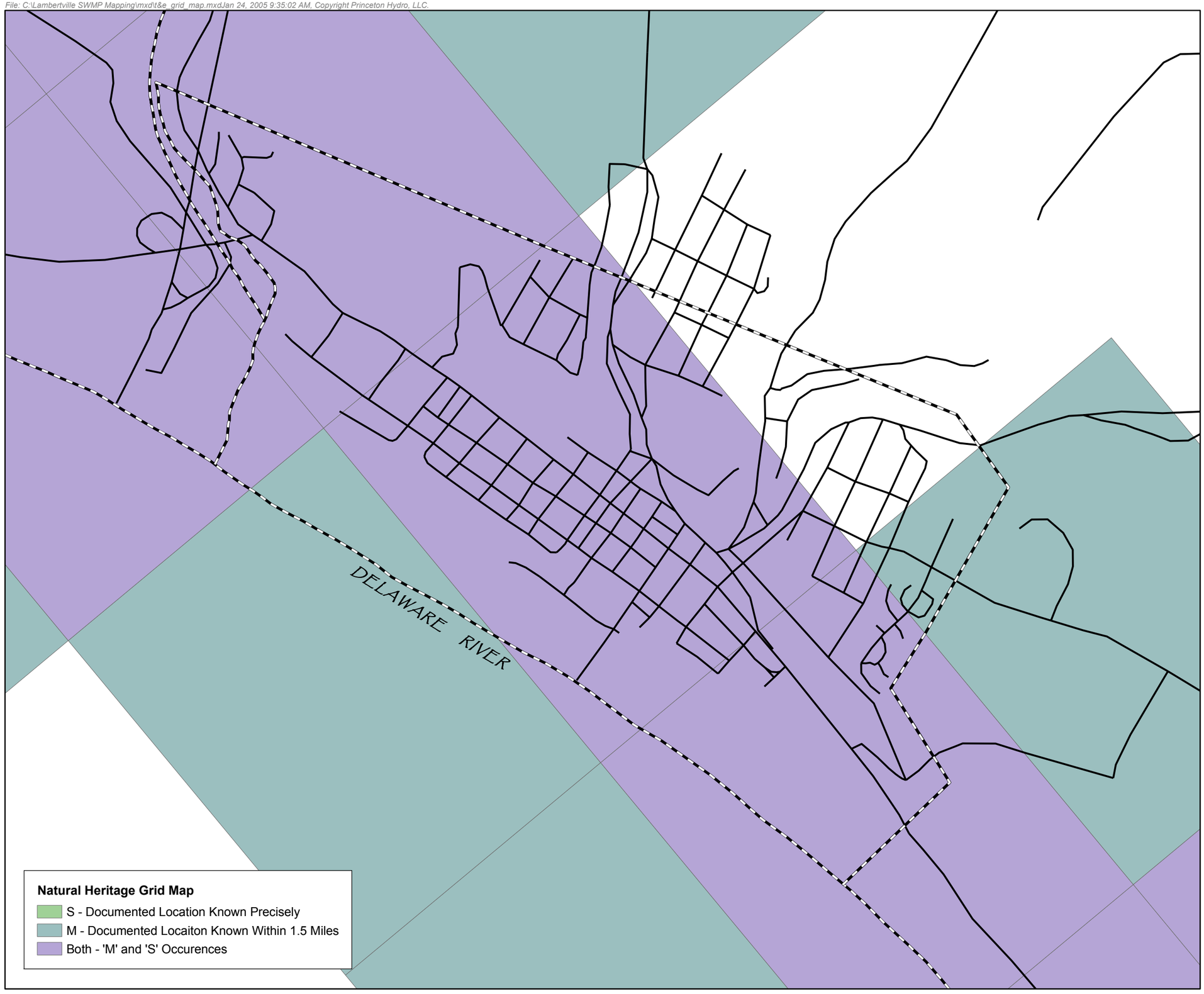
1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Threatened and Endangered Species Natural Heritage Priority information as obtained from NJDEP GIS website.
3. Road information shown is Tiger Line files from Census 2000.

APPENDIX B: Figure B6:
NATURAL HERITAGE PRIORITY SITES

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

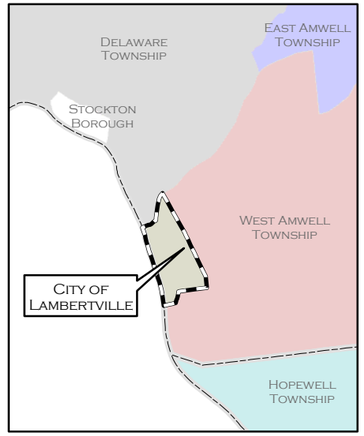
Legend

- Municipal Boundary
- Roads



Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Threatened and Endangered Species Natural Heritage Grid information as obtained from NJDEP GIS website.
3. Road information shown is Tiger Line files from Census 2000.

APPENDIX B: Figure B7:

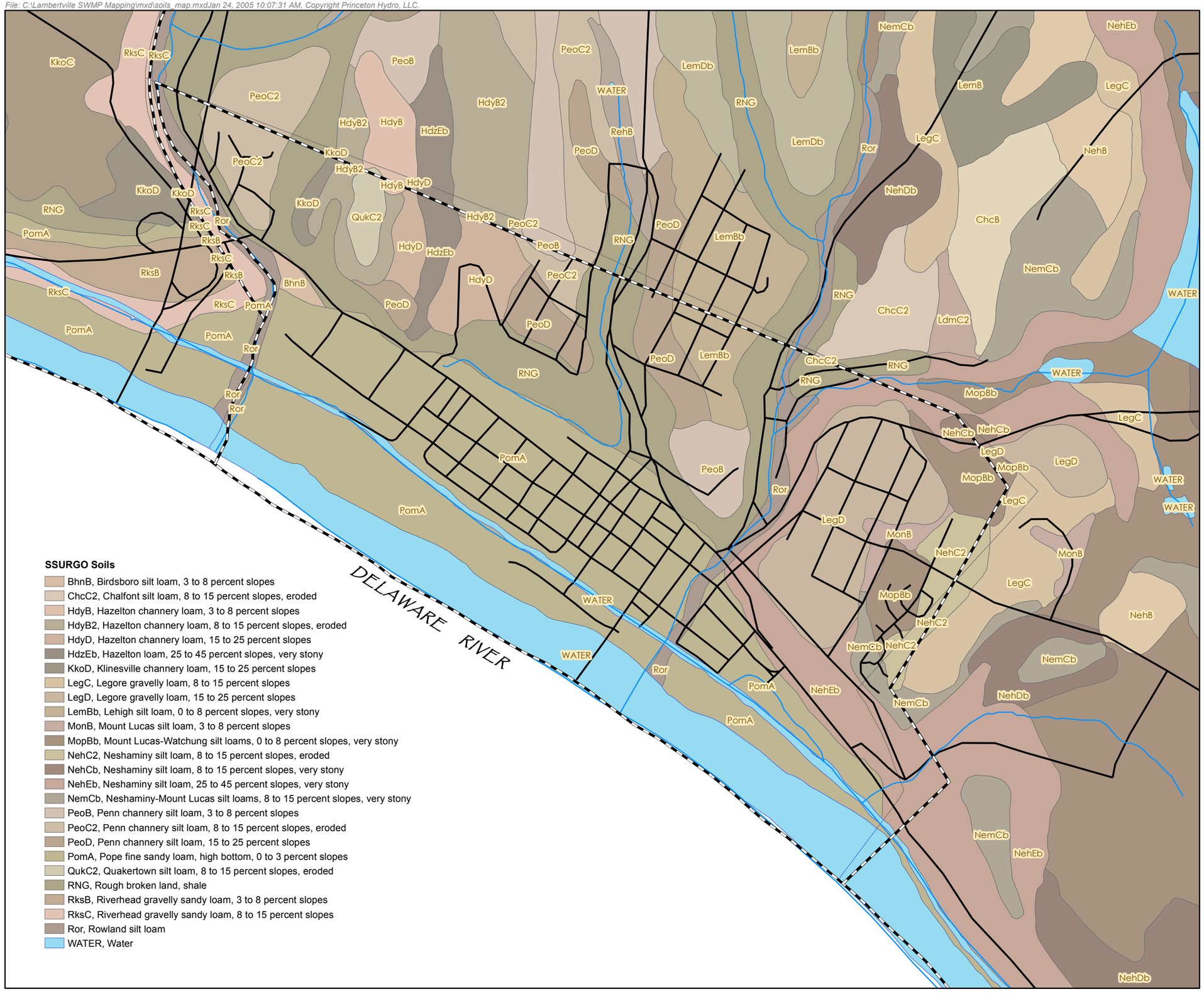
NATURAL HERITAGE GRID MAP

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend

Municipal Boundary

Roads

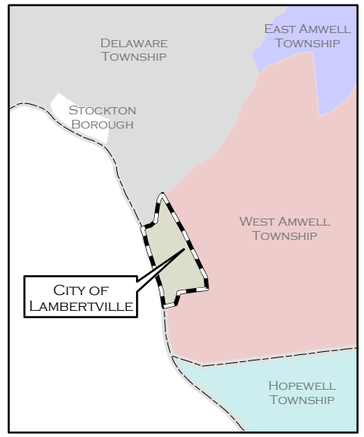


SSURGO Soils

- BhnB, Birdsboro silt loam, 3 to 8 percent slopes
- ChcC2, Chalfont silt loam, 8 to 15 percent slopes, eroded
- HdyB, Hazelton channery loam, 3 to 8 percent slopes
- HdyB2, Hazelton channery loam, 8 to 15 percent slopes, eroded
- HdyD, Hazelton channery loam, 15 to 25 percent slopes
- HdzEb, Hazelton loam, 25 to 45 percent slopes, very stony
- KkoD, Klinesville channery loam, 15 to 25 percent slopes
- LegC, Legore gravelly loam, 8 to 15 percent slopes
- LegD, Legore gravelly loam, 15 to 25 percent slopes
- LemBb, Lehigh silt loam, 0 to 8 percent slopes, very stony
- MonB, Mount Lucas silt loam, 3 to 8 percent slopes
- MopBb, Mount Lucas-Watchung silt loams, 0 to 8 percent slopes, very stony
- NehC2, Neshaminy silt loam, 8 to 15 percent slopes, eroded
- NehCb, Neshaminy silt loam, 8 to 15 percent slopes, very stony
- NehEb, Neshaminy silt loam, 25 to 45 percent slopes, very stony
- NemCb, Neshaminy-Mount Lucas silt loams, 8 to 15 percent slopes, very stony
- PeoB, Penn channery silt loam, 3 to 8 percent slopes
- PeoC2, Penn channery silt loam, 8 to 15 percent slopes, eroded
- PeoD, Penn channery silt loam, 15 to 25 percent slopes
- PomA, Pope fine sandy loam, high bottom, 0 to 3 percent slopes
- QukC2, Quakertown silt loam, 8 to 15 percent slopes, eroded
- RNG, Rough broken land, shale
- RksB, Riverhead gravelly sandy loam, 3 to 8 percent slopes
- RksC, Riverhead gravelly sandy loam, 8 to 15 percent slopes
- Ror, Rowland silt loam
- WATER, Water

Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. Soils information obtained from USDA website.
3. Road information shown is Tiger Line files from Census 2000.

APPENDIX B: Figure B8:

SOILS MAP

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend

- Municipal Boundary
- Roads
- Streams

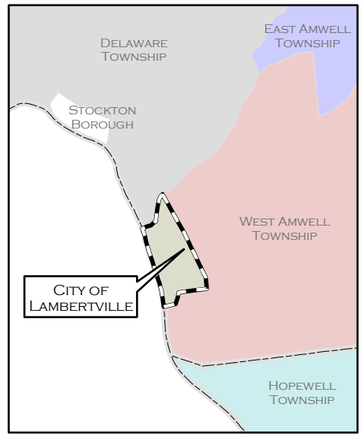
DELAWARE RIVER

1995/97 Land Use / Land Cover

- AGRICULTURE
- BARREN LAND
- FOREST
- WATER
- WETLANDS
- ATHLETIC FIELDS (SCHOOLS), 1804
- COMMERCIAL/SERVICES, 1200
- INDUSTRIAL, 1300
- INDUSTRIAL/COMMERCIAL COMPLEXES, 1500
- MILITARY RESERVATIONS, 1211
- MIXED RESIDENTIAL, 1150
- MIXED URBAN OR BUILT-UP LAND, 1600
- OTHER URBAN OR BUILT-UP LAND, 1700
- RECREATIONAL LAND, 1800
- RESIDENTIAL, HIGH DENSITY, MULTIPLE DWELLING, 1110
- RESIDENTIAL, RURAL, SINGLE UNIT, 1140
- RESIDENTIAL, SINGLE UNIT, LOW DENSITY, 1130
- RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY, 1120
- TRANSPORTATION/COMMUNICATIONS/UTILITIES, 1400

Princeton Hydro

MUNICIPAL PROXIMITY MAP



Produced by:
City of Lambertville
Stormwater Committee

Adopted:
March 2005

Feet
0 250 500 1,000
1 inch equals 1,000 feet

SOURCES:

1. Municipal Boundary as obtained from Hunterdon County Planning Board.
2. 1995/97 Land use / Land cover information obtained from NJDEP GIS website.
3. Road information shown is Tiger Line files from Census 2000.

APPENDIX B: Figure B9:
LAND USE / LAND COVER MAP

STORMWATER MANAGEMENT PLAN
CITY OF LAMBERTVILLE
HUNTERDON COUNTY, NEW JERSEY

Legend

Municipal Boundary

Roads

Appendix C: Annual Report and Certification, Tier B Matrix and Lambertville Stormwater Committee Agendas

Annual Report and Certification
Tier B Municipal Stormwater General Permit

Municipality Information

Municipality: _____ County: _____

NJPDES # :NJG _____PI ID #: _____

Date: _____ Effective Date of Permit Authorization (EDPA): _____

Post-Construction Stormwater Management in New Development and Redevelopment

Are you ensuring that any residential development and redevelopment projects that are subject to the Residential Site Improvement Standards for stormwater management comply with those standards? Y ( ) N ( )

Are you ensuring adequate long-term operation and maintenance of BMPs on property that you own or operate? Y ( ) N ( )

For storm drain inlets that you install, are you complying with the standards set forth in Attachment A of the permit to control passage of solid and floatable materials? Y ( ) N ( )

Have you forwarded a copy of the proposed municipal stormwater management plan required by the permit to the county planning board at least 20 days prior to the date of your public hearing on that plan? Y ( ) N ( )

Date forwarded: _____

[for purposes of this annual report, "municipal stormwater management plan" means a new municipal stormwater management plan, as well as amendments to an existing municipal stormwater management plan]

Have you adopted a municipal stormwater management plan in accordance with N.J.A.C. 7:8-4? Y ( ) N ( )

Date adopted: _____

Status of this plan (if not adopted): _____
_____
_____
_____
_____
_____
_____
_____
_____

Have you transmitted, within 30 days after adoption, a copy of your adopted municipal stormwater management plan to the county planning board for its information and files? Y ( ) N ( )

Date transmitted: _____

Have you forwarded a copy of the proposed municipal stormwater control ordinance(s) required by the permit to the county planning board at least 10 days prior to the date of your public hearing on the ordinance(s)? Y ( ) N ( )

Date forwarded: _____

Have you adopted a municipal stormwater control ordinance(s) in accordance with N.J.A.C. 7:8-4? Y ( ) N ( )

Date adopted: _____

Status of this ordinance(s) (if not adopted): _____
_____
_____
_____
_____
_____

Have you submitted your adopted municipal stormwater management plan and stormwater control ordinance(s) to the appropriate county review agency for approval? Y ( ) N ( )

Date submitted: _____

Are your adopted municipal stormwater management plan and stormwater control ordinance(s) approved and in effect? Y ( ) N ( )

Effective date: _____

Ordinance number(s): _____

Status of adopted plan and ordinance(s) (if not in effect): _____
_____
_____
_____
_____
_____

Have you:

Placed your approved municipal stormwater management plan and stormwater control ordinance(s) on your website, and notified the Department, the Soil Conservation District and State Soil Conservation Committee? Y ( ) N ( ) N/A ( )

Date you notified the Department: _____

OR

Submitted your approved municipal stormwater management plan and stormwater control ordinance(s) to the Department, and provided notice to the Soil Conservation District and State Soil Conservation Committee? Y ( ) N ( ) N/A ( )

Date submitted to the Department: _____

Are you enforcing your approved municipal stormwater control ordinance(s)? Y ( ) N ( )

Have you granted any variances or exemptions from the design and performance standards for stormwater management measures set forth in your approved municipal stormwater management plan and stormwater control ordinance(s)? Y ( ) N ( )

If yes, does your approved municipal stormwater management plan include a mitigation plan in accordance with N.J.A.C. 7:8-4.2(c)11? Y ( ) N ( )

Did you submit a written report to the county review agency and the Department describing the variance or exemption and the required mitigation? Y ( ) N ( )

Date(s) report(s) submitted to the Department: _____
_____
_____
_____
_____

For storm drain inlets not installed by you, are you enforcing compliance with the standards set forth in Attachment A of the permit to control passage of solid and floatable materials? Y ( ) N ( )

If yes, specify whether such compliance is enforced through your stormwater control ordinance(s) or through a separate ordinance (and provide the separate ordinance number): _____
_____
_____
_____
_____

Are you ensuring adequate long-term operation and maintenance of BMPs on property that you do not own or operate? Y ( ) N ( )

If yes, briefly indicate how this being accomplished (e.g., ordinance requiring operation and maintenance by private entity; operation and maintenance by you or other governmental entity):
_____
_____
_____
_____
_____
_____
_____

Have you reexamined your approved municipal stormwater management plan at each reexamination of your master plan in accordance with N.J.A.C. 7:8-4? Y ( ) N ( )

Date reexamination report adopted: _____

Annual Report and Certification

Tier B Municipal Stormwater General Permit

Municipality Information

Municipality: _____ County: _____

NJPDES # :NJG _____PI ID #: _____

Date: _____ Effective Date of Permit Authorization (EDPA): _____

Local Public Education

Local Public Education Program

Have you developed a Local Public Education Program? Y ( ) N ( )

Date development of program completed: _____

Date of Annual Distribution of Educational Brochure: _____

Method of Distribution: _____

_____

_____

_____

_____

_____

Date of Annual Event: _____

Description of Event: _____

_____

_____

_____

_____

_____

Storm Drain Inlet Labeling

Have you established a storm drain inlet labeling program? Y ( ) N ( )

Have you divided your municipality into two sectors for the purpose of storm drain inlet labeling?
Y ( ) N ( )

If "yes," circle number of sectors labeled to date: 0 1 2

If "no," please circle approximate percentage of storm drain inlets labeled to date:

25% 50% 75% 100% other (specify) _____%

Have you developed a long term maintenance plan for the storm drain inlet labels? Y ( ) N ( )

Are you implementing your long-term maintenance plan? Y ( ) N ( )

Annual Report and Certification

Tier B Municipal Stormwater General Permit

Municipality Information

Municipality: _____County: _____

NJPDES # :NJG _____PI ID #: _____

Date: _____ Effective Date of Permit Authorization (EDPA): _____

Sharing of Responsibilities

For each of the following, indicate if you are relying on another entity to satisfy all or part of any permit requirements. For those you checked "yes," please give additional information on or with the appropriate Annual Report and Certification form (attach sheet if needed).

Statewide Basic Requirement	Relying on another entity? "**yes**"	"**no**"
Ensure compliance with RSIS for stormwater management		
Municipal stormwater management plan		
Municipal stormwater control ordinance		
Long term operation and maintenance of BMPs (post-construction)		
Storm drain inlet design standard (post-construction)		
Local Public Education Program		
Storm Drain Inlet Labeling Program		

Annual Report and Certification

Tier B Municipal Stormwater General Permit

Municipality Information

Municipality: _____ County: _____

NJPDES # :NJG _____ PI ID #: _____

Date: _____ Effective Date of Permit Authorization (EDPA): _____

Incidents of Noncompliance

For any incidents of noncompliance, identify the steps being taken to remedy the noncompliance and to prevent such incidents from recurring.

Annual Report and Certification

Tier B Municipal Stormwater General Permit

Municipality Information

Municipality: _____ County: _____

NJPDES # :NJG _____ PI ID #: _____

Date: _____ Effective Date of Permit Authorization (EDPA): _____

Annual Certification

"I certify under penalty of law that this Annual Report and Certification and all attached documents were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate this information. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering this information, the information in this Annual Report and Certification and all attached documents is, to the best of my knowledge and belief, true, accurate and complete.

"I certify that the municipality is in compliance with the NJPDES Tier B Municipal Stormwater General Permit No. NJ0141861 except for any incidents of noncompliance which are identified herein. For any incidents of noncompliance, the Annual Report identifies the steps being taken to remedy the noncompliance and to prevent such incidents from recurring.

"I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

Signature: _____ **Date:** _____

Print or Type Name: _____

Print or Type Title: _____

WHO MUST SIGN?

Either a principal executive officer or a ranking elected official; or duly authorized representative.

A principal executive officer or ranking elected official of the municipality may assign his or her signatory authority for this Certification to a duly authorized representative, which is a named individual or a title of a position having overall responsibility for the operation of municipal stormwater facilities or municipal environmental matters, by submitting a letter to the Bureau of Permit Management stating said authority and naming the individual or position. The duly authorized representative is the Municipal Stormwater Program Coordinator only if the Coordinator has overall responsibility for the operation of municipal stormwater facilities or municipal environmental matters.

City of Lambertville
Stormwater Committee

June 9, 2004 – First Meeting

MEETING AGENDA

A. Introduction
   1. Committee Members
   2. Why are we here? Mandatory, not voluntary compliance. Review New Stormwater Rules
   3. What is our committee's function?
   4. What is ahead?
      a. Hand out Summary of Statewide Basic Requirements (SBRs, lots of acronyms, so get used to them)
      b. April 1st 2004 is our EDPA
      c. Annual Report and Certification (this gets serious)
      d. Coordination with County and Soil Conservation District
   5. What are the best dates to meet?

B. Documents and Guidance
   1. NJDEP Website (www.njstormwater.org)
   2. Pass out CD
      a. On CD: Annual Certification, BMP Manual, Educational Brochure, Guidance Document, Model Ordinances, RSIS link, Sample Permit, Sample Stormwater Management Plan, Storm Drain Labeling, PowerPoint presentation (John Miller to EC)
      b. Will add to CD as we progress
   3. Municipal Stormwater Guidance Document (for entire process)

C. Required Process and Components
   1. Stormwater Management Plan (first major task)
      a. Know our water resources: Alexauken Creek, Swan Creek, D&R Canal (drinking water for New Jersey and Lambertville), and Delaware River, and the threats. C-1s are coming….
      b. Mapping
      c. Groundwater Recharge (thanks for coming Vince)
      d. Mitigation Plan (very important, Paul is expert on existing problems)
      e. Stream Corridor Protection Plan (when Alexauken and Swan Creeks become C-1)
      f. Maintenance!!!!!
   2. Ordinances (we need to look at before starting Plan)
      a. City Master Plan and existing ordinances review/revisions
      b. Need to adopt new to comply
   3. Other Requirements include: Annual Event (Shad Fest is no-brainer) and Education, inlet labeling, etc.

D. Scary – Yes! But we will have fun too….

E. Adjournment

City of Lambertville
Stormwater Committee

July 20, 2004 – Second Meeting

MEETING AGENDA

A. Recap of First Meeting

B. State Funding to City of Lambertville ($5,000?)

C. Alexauken will become C-1 on August 2, 2004

D. Review of Proposal

E. Review Sample Stormwater Management Plan
   a. Confusion on what is due and when (Guidance Document vs. Sample Plan)
   b. Components of Plan
   c. Stream Corridor and Mitigation Plans

F. Review Model Ordinances

G. Next meeting date: August 17, 2004
   a. Do we have copies of Lambertville Master Plan?
   b. Review existing Master Plan (when is next 6 year cycle scheduled review?)
   c. Review existing Lambertville Ordinances (Sections 522, 600, 608, etc.)

City of Lambertville
Stormwater Committee

August 17, 2004 – Third Meeting

MEETING AGENDA

A. Recap of First and Second Meetings.

B. Proposal Review (if we have). Table of Contents annotation for Stormwater Management Plan.

C. Alexauken Creek is now C-1. Swan Creek letter to be sent by Planning Board and City Council.

D. Review existing Master Plan (next 6 year cycle review is 2008). Review Cross-Acceptance III checklist. What do we need to change?

E. Review existing Lambertville Ordinances (Sections 522, 600, 608, etc.) What do we need to change?

City of Lambertville
Stormwater Committee

October 19, 2004 – Forth Meeting
City Hall

6:00 Meeting with Cindy Ege, Tali Engoltz and John Miller

6:30 Meeting with Vince Uhl and John Miller

MEETING AGENDA
7:30 PM

A. Problem Areas and Mitigation Plan

1. Existing Problem Areas. (Paul and Jim)
2. Mitigation Plan sites. (Paul, Jim, Vince and John)
3. Anything identified by NJWSA? (John)
4. Localized and river flooding. Go better than NFIP? (John et al)

B. Maintenance and good housekeeping

1. Where are existing BMPs (Diamond Silver and where else)? Who takes care of these facilities? Do we currently provide oversight? (Paul)
2. Street sweeping. Why did we start this? (Paul)
3. Stormwater inlets (CVS onsite and Alexander Ave work). Do we want new opening restriction for private properties? (Paul, et al)
4. BMPs on municipal property? (Paul and Jim)
5. Status of permanent withdraw from canal to reservoir. (Paul and Jim)
6. Will LSA consider stormwater utility? Other towns? (Paul and Jim)

C. Education and municipal rules

1. Website posting of SMP. (Cindy)
2. Education and inlet labeling. (Cindy and Tali)
3. Ordinances for canal (feeding waterfowl and pooper scooper). Do we already have? (Cindy)
4. We have seen E/S new construction violations, what to do? (All)

D. Data

1. Location of private wells. (Vince)
2. State Plan mention in SWP. Goal 2 – incorporate watershed plans. Goal 4 – Water Supply and Streams. (Tim and Georg)
3. Population within City. (Tim and Georg)
4. Smartgrowth and Redevelopment. Where will that happen in City? (Tim and Georg)
5. Delaware a SPW? (John)

E. Next Steps

1. Our committee's responsibilities. (John)
2. Hopewell SMP. (John)
3. Next Meeting Nov 16th. Need draft SMP complete. (John)
4. Talking to Lou Toboz on Water Resource text boxes: Ashbel Welsh, canal, floods, and fishing. (John)

City of Lambertville
Stormwater Committee

December 21, 2004 - Fifth Meeting
City Hall - 7:30 PM

MEETING AGENDA

A. Draft Stormwater Management Plan (December 1, 2004)

1. Has been submitted to Hunterdon County Planning Board and Soil Conservation
2. Asked NJWSA and DRCC to comment (canal water supply) and help with Mitigation Ideas
3. L'ville EC has CD to review
4. City Clerk Lori has hard copy
5. Need to reach out to Zoning Board

B. Draft Checklist for County Review

1. Provided by NJDEP to County
2. Minor additions have been made per this document

C. Additions to SMP

1. Mapping
    a. HUC14 to be added
    b. Well and septic overlays need more work
2. Policy
    a. Need more detail on O&M and enforcement
    b. Mitigation Plan – will have to but in much more on procedures, selection process, scale of project, legal, etc.
    c. Well and septic overlay districts
    d. Drainage projects – need more description
3. Consistency (going into next phase)
    a. Need review of Master plan
    b. Need review of ordinances
    c. Waterfront plan
    d. City Code (is enforcement in here?)

D. Next Steps

1. Planning Board special meeting in January (not re-organizational meeting)
    a. Public notice
    b. Contact reporters beforehand
2. City consultant review – when?
3. Planning Board approval
4. City Council introduction
5. City Council adoption by April 1, 2005

E. Public Education and Drain Labeling

1. Brochure and event by April 2005 (Shad Fest will be ok)
2. Drain Labeling to be completed by 2009, but we can conduct existing labeling survey now
3. No word from FFA

City of Lambertville
Stormwater Committee

January 18, 2005 - Sixth Meeting
City Hall - 7:30 PM

MEETING AGENDA

A. Draft Stormwater Management Plan

1. New draft County checklist from NJDEP
2. Comments from Hunterdon County expected
3. Met with Dave Burd and John Hencheck
4. Revised mapping and text per committee's edits
5. Adoption discussion
6. Add copy to Library and update Lori's copy before January 26th

B. Public Education

1. Progress with education program
2. Mailing of brochure
3. Ideas for Shad Fest
4. Drain labeling survey

C. Special Meeting, January 26th

1. Article in Beacon
2. What do we want to cover in presentation?
3. PowerPoint? What else?
4. Who will participate in presentation?
5. Invites

D. Other issues

1. MLUC workshop
2. Assignments to committee members

City of Lambertville
Stormwater Committee

February 15, 2005 - Seventh Meeting
City Hall - 7:30 PM

MEETING AGENDA

A. Special Meeting of Planning Board held January 26, 2005

1. Presentation to public
2. Article in Beacon
3. Zoning Board chair attended
4. Requested comments by February 15, 2005 (tonight)

B. Draft Stormwater Management Plan

1. Current draft incorporates County comments (Sue and Melanie)
2. Sent revised plan to County
3. Visit on February 1, 2005 from NJDEP, case manager and enforcement
4. DRBC adopted temporary SPW for Lower Delaware
5. Comments from Chris Testa of HCSCD
6. Comments from NJDEP (Sandy Blick, Watershed Management)
7. Comments from Lambertville's boards (EC?)
8. Public comments

C. Public Education

1. Mailing of brochure
2. Shad Fest, May 21 and 22, 2005
3. Drain labeling survey
4. Public Ed plans also due April 1, 2005

D. Other issues

1. MLUC workshop on Thursday, February 17, 2005 (in two days)
2. NJDEP apparently working on draft mitigation plan
3. Support for Special Resource Area along Wild and Scenic Lower Delaware?
4. Meeting to have hearing on plan and adopt (March 2, 2005?)

Appendix D: Stormwater Design Information

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

New Jersey 40.3657°N 74.9413°W 200 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 2
G.M. Bonnin, D. Todd, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Tue Nov 30 2004

Confidence Limits | Seasonality | Location Maps | Other Info. | Grids | Maps | Help | Docs

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.41	0.65	0.82	1.13	1.42	1.71	1.88	2.37	2.88	3.34	3.88	4.32	5.03	5.71	7.67	9.48	12.01	14.34
5	0.48	0.77	0.98	1.39	1.78	2.16	2.38	2.98	3.64	4.21	4.90	5.40	6.22	6.97	9.15	11.07	13.82	16.38
10	0.54	0.86	1.09	1.58	2.05	2.50	2.76	3.48	4.29	4.94	5.73	6.29	7.21	7.98	10.31	12.28	15.19	17.89
25	0.60	0.96	1.22	1.81	2.41	2.98	3.30	4.19	5.25	6.00	6.92	7.55	8.61	9.39	11.87	13.87	16.93	19.78
50	0.66	1.04	1.32	1.99	2.69	3.36	3.73	4.79	6.08	6.91	7.91	8.59	9.76	10.53	13.10	15.09	18.22	21.16
100	0.70	1.12	1.41	2.16	2.98	3.75	4.19	5.43	6.99	7.89	8.96	9.69	10.98	11.71	14.33	16.28	19.43	22.45
200	0.75	1.19	1.50	2.33	3.27	4.15	4.65	6.11	7.99	8.95	10.10	10.85	12.28	12.94	15.57	17.45	20.59	23.65
500	0.81	1.27	1.60	2.55	3.66	4.71	5.30	7.10	9.48	10.51	11.72	12.53	14.14	14.66	17.24	18.97	22.02	25.11
1000	0.85	1.33	1.68	2.71	3.96	5.15	5.83	7.91	10.75	11.82	13.06	13.90	15.66	16.03	18.52	20.10	23.06	26.14

Text version of table

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Impact of Soil Disturbance During Construction on Bulk Density and Infiltration in Ocean County, New Jersey

By

Ocean County Soil Conservation District
Schnabel Engineering Associates, Inc.
USDA Natural Resources Conservation Service

March 2001 (Rev. 06/01/01)*

Abstract

A study was conducted of undisturbed and disturbed urban soils in Ocean County, New Jersey to investigate the impact on soil infiltration rates due to modification and compaction during construction operations, to examine if the effects are significant enough to alter the Hydrologic Soil Group (HSG) classification or Runoff Curve Number, and to provide additional guidance in the use of TR-55 for the design of structural stormwater management practices.

In soils highly disturbed by heavy equipment and in pasture in good hydrologic condition, measurements of bulk density and infiltration rates were conducted both *in situ* and on reconstituted samples prepared by the USDA, NRCS National Soil Mechanics Center. The results show that as soil bulk density increases to 1.65 g/cm^3, infiltration rates of the soil decrease rapidly. When the bulk density increases above 1.65 g/cm^3, infiltration rates decline slowly, approaching zero. The measured infiltration rates for disturbed soils with high bulk densities were significantly lower than expected. NRCS Technical Release 55 (TR-55) provides guidance for estimating the runoff for undisturbed and uncompacted disturbed conditions, but not for the compacted condition. Recommendations have been made for further research to allow the development of additional guidance for estimating Runoff Curve Numbers from vegetated disturbed soils in Ocean County.

The measured infiltration rates of undisturbed wooded and pastured soil were higher than expected. It is recommended that additional data be obtained and analyzed to determine if the USDA NRCS Runoff Curve Numbers accurately reflect the runoff from undisturbed soils in Ocean County.

* A typographical error between Table 2 and the data in the Appendix and other tables and graphs was corrected.

An Investigation of the Effects of Soil Disturbance on Bulk Density and Infiltration in Ocean County, New Jersey March 2001

Introduction

Ocean County Soil Conservation District (OCSCD) personnel have observed that runoff from many recently constructed housing developments exceeds estimates made using the procedures contained in NRCS Technical Release 55, (TR-55), Urban Hydrology for Small Watersheds. In addition, OCSCD personnel have observed lawn areas that remain saturated for extended periods of time even though the underlying soils are sandy in texture. This led to an investigation by OCSCD to determine whether these observations have any basis in fact. OCSCD received the assistance of the USDA Natural Resources Conservation Service (NRCS) and obtained the services of Schnabel Engineering Associates in conducting this study.

Objective

The objectives of the study are to investigate the impacts on soil infiltration rates due to modification and compaction during construction operations, to examine if the effects are significant enough to alter the Hydrologic Soil Group (HSG) classification or Runoff Curve Number, and to provide additional guidance in the use of TR-55 for the design of structural stormwater management practices.

Background

Saturated yards, pools of standing water in crawl spaces, and the premature death of landscape plants are common in some recently constructed large housing developments. Lawns will not grow without placement of sod and installation of irrigation systems. Even brief irrigation causes runoff into the street and/or ponding. However, if the lawns are not watered at least every second day during hot weather, they suffer from drought. Iron stains on the sidewalks indicate the formation of ferrous iron oxide in the lawn areas and its subsequent precipitation as ferric iron oxide as the seepage water flows over the concrete and is exposed to air. While front yards usually have positive drainage to the street, many less sloping backyards have surface inlets connected to shallow perforated drains running out to the curb to remove excess water. These curb drains may seep for a week or more after a rain, even when irrigation systems are turned off. On compacted soils, these indicators of surface and lateral subsurface flow occur regularly on soils considered to be porous, well drained to excessively drained, with a water table deep below the surface.

The primary method of site preparation on most recent housing developments involves extensive clearing and grading with significant cuts and fills. High soil density is desired to eliminate settlement cracking of foundations.

A less prevalent method of construction, although more common in the 1950 s, is to build an individual house on a separate lot where the limit of disturbance is confined to that footprint alone. When construction is confined to areas selectively cleared and to limited grading, the size of the equipment is usually reduced and there is less soil disturbance.

Typically most stormwater management designs rely solely on structural practices to reduce adverse impacts of urban development. These practices are dependent on accurate design data, particularly the

land use/soil information for both pre- and post-development conditions. Infiltration practices that mimic natural pre-development hydrology are seldom used. Presently, there are few incentives to leave areas undisturbed to establish a rain garden or to utilize such areas for infiltration to reduce the total volume of runoff and provide water quality benefits. The ability of healthy soils to accept rainfall at the point of impact is an essential component of any stormwater management design, and the condition of the soil following land disturbance has a profound impact on the runoff, infiltration, and groundwater recharge. Soil management can provide greater opportunities to enhance the overall stormwater management design by incorporating infiltration into the design to mimic natural hydrologic conditions.

Methodology

Both bulk density and infiltration tests were conducted at eight locations in Ocean County. At each site a soil pit was dug to provide a soil description and to collect bulk density data from all layers within 20 inches of the ground surface. After evaluation of the bulk density results, infiltration measurements were conducted in the densest layer. Three replications of all bulk density and infiltration measurements provide the basis for the mean values presented herein.

The bulk density data were collected using the Core Method for Determining Bulk Density 30-2, Method of Soil Analysis, Physical and Mineralogical Properties, Including Statistics of Measurement and Sampling, Agronomy No. 9 Part 1, American Society of Agronomy. The procedure is briefly described as follows:

With this method, a cylindrical metal sampler is pressed or driven into the soil to the desired depth and carefully removed to preserve a known volume of sample as it existed *in situ.* The sample is dried at 105° C and weighed. Bulk density is the oven-dried mass divided by the field volume of the sample. The calculation of bulk density is on a whole soil basis.

Samples were taken using a 3 X 3 Uhland sampler and heated in a laboratory oven until a constant weight was obtained. After the surface was sampled, successive layers were removed so sampling could take place on a level surface. To gain access to the lower depths, a pit about 30 inches square was dug by carefully removing the soil in level layers so that three samples could be accurately obtained from each depth. The sampler had over-cuts of about one inch below and _ above, which were trimmed off after the sample was removed from the sampling tool.

The measurement of infiltration was conducted in conformance with the procedure outlined in ATSM D-3385 - 75 Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer with a single exception. The method calls for an outer ring of 24 in diameter and an inner ring of 12 inches. The soils were so dense that it was not possible to hammer the larger ring to the required depth. Therefore, the 12 diameter ring was used as the outside ring and the 3 diameter bulk density sampler was substituted as the inside ring. The difference in diameter of the outer ring was considered to have adequately restricted the lateral flow away from the inner ring. By digging down to the dense layer, not only was the infiltration of that layer determined, but also its saturated permeability. The length of time to obtain a constant rate varied but all had nearly leveled within a few hours.

The sites selected for testing represent a range of soil conditions, from undisturbed woods, pasture in good condition, to highly disturbed or modified. The sites identified as Subdivision Lawn 1 , Garage Lawn , Subdivision Lawn 2 and Athletic Field are representative of highly disturbed sites where significant grading of the original topography by heavy construction equipment has taken place. The Cleared Woods site has been cleared and the duff layer removed by heavy equipment but has

not undergone any significant grading. In order to compare the typical large tract construction to a less intensive type, the single house site was selected. This location is representative of the lot-by-lot construction where overall topography changes are minimal and light construction equipment is used. Pasture was particularly included since the runoff attributes of this land use are assumed in TR-55 as characteristic of the pervious lawn areas used in determining CN s for residential areas.

Data and Results

The results of the testing conducted at each location are summarized in Tables 1 and 2. The bulk density and permeability data presented in Table 1 are the mean of the three replications in a layer within 20 inches of the soil surface at each of the seven locations. Table 2 indicates the original soil series and the HSG, as identified in the soil survey and listed in TR-55. The assigned HSG for the Athletic Field was based on the soil texture in conformance with Appendix A of TR-55. This location was mapped as a sand pit in the Ocean County Soil Survey and, therefore, did not have a HSG designation. The *minimum* infiltration rates for row crops corresponding to each HSG are referenced in Appendix A of TR-55. Group A has a rate greater the 0.3 in/hr, Group B has a rate between 0.15 and 0.3 in/hr, Group C has a rate between 0.05 and 0.15 in/hr, and Group D has a rate less than 0.05 in/hr.

Appendix A of this report contains the detailed logs of the soil profiles recorded at each site, a description of the site condition and a complete listing of the bulk density and infiltration test results. Appendix B contains the results of tests conducted at the NRCS National Soil Mechanics Center located in Lincoln, Nebraska. Samples from each of the test sites were sent to the lab for index and permeability tests. The index test includes gradation analysis and determination of the liquid and plastic limits for classification of the sample in conformance with the Unified Soil Classification System. Maximum dry densities and optimum moisture contents were determined using the Standard Proctor Method. At optimum moisture, cores were packed to the approximate density of the field condition. Without drying the cores, measurements of hydraulic conductivity were conducted.

Table 1.

Permeability Measurements of Sampled Layers within 20 of Soil Surface		
Site	Bulk Density (g/cm^3)	Permeability (in/hr)
Woods	1.42	15
Pasture	1.47	9.9
Single House	1.67	7.1
Subdivision Lawn 1	1.79	0.14
Garage Lawn	1.82	0.04
Cleared Woods	1.83	0.13
Subdivision Lawn 2	2.03	0.03
Athletic Field	1.95	0.01

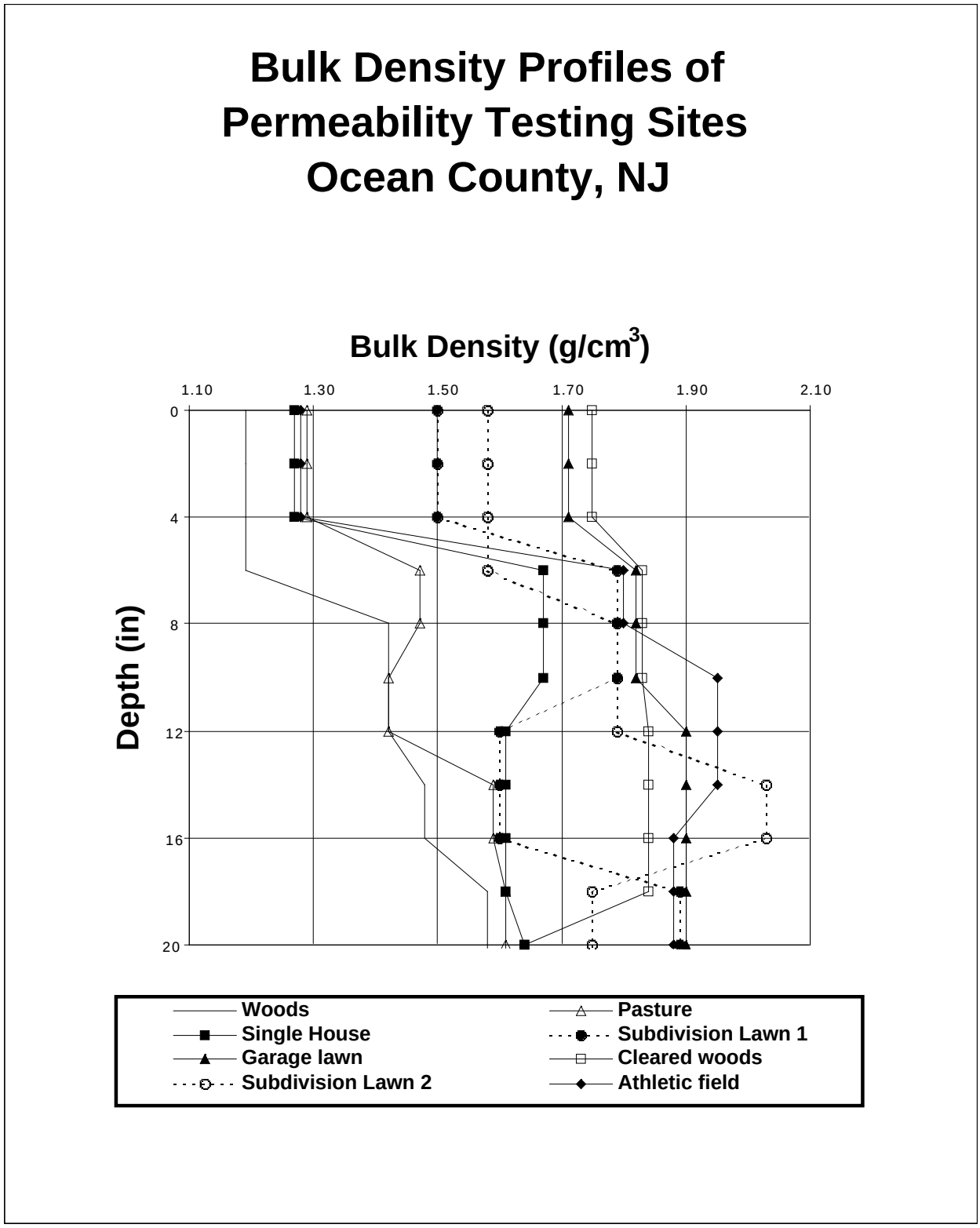
Table 2.

Site	Level of Disturbance	Soil Series as shown in the soil survey	HSG in TR-55 as assigned by soil survey	Field Measured Permeability (in/hr)	Field Estimated HSG[2]
Woods	Undisturbed	Downer	B	15	A
Pasture	Somewhat Disturbed	Downer	B	9.9	A
Single House	Somewhat Disturbed	Downer	B	7.1	A
Subdivision Lawn 1	Disturbed	Lakewood	A	0.14	C
Garage Lawn	Disturbed	Urban land	A[1]	0.04	D
Cleared Woods	Disturbed	Downer	B	0.13	C
Subdivision Lawn 2	Disturbed	Downer	B	0.03	D
Athletic Field	Disturbed	Sand Pit	A[1]	0.01	D

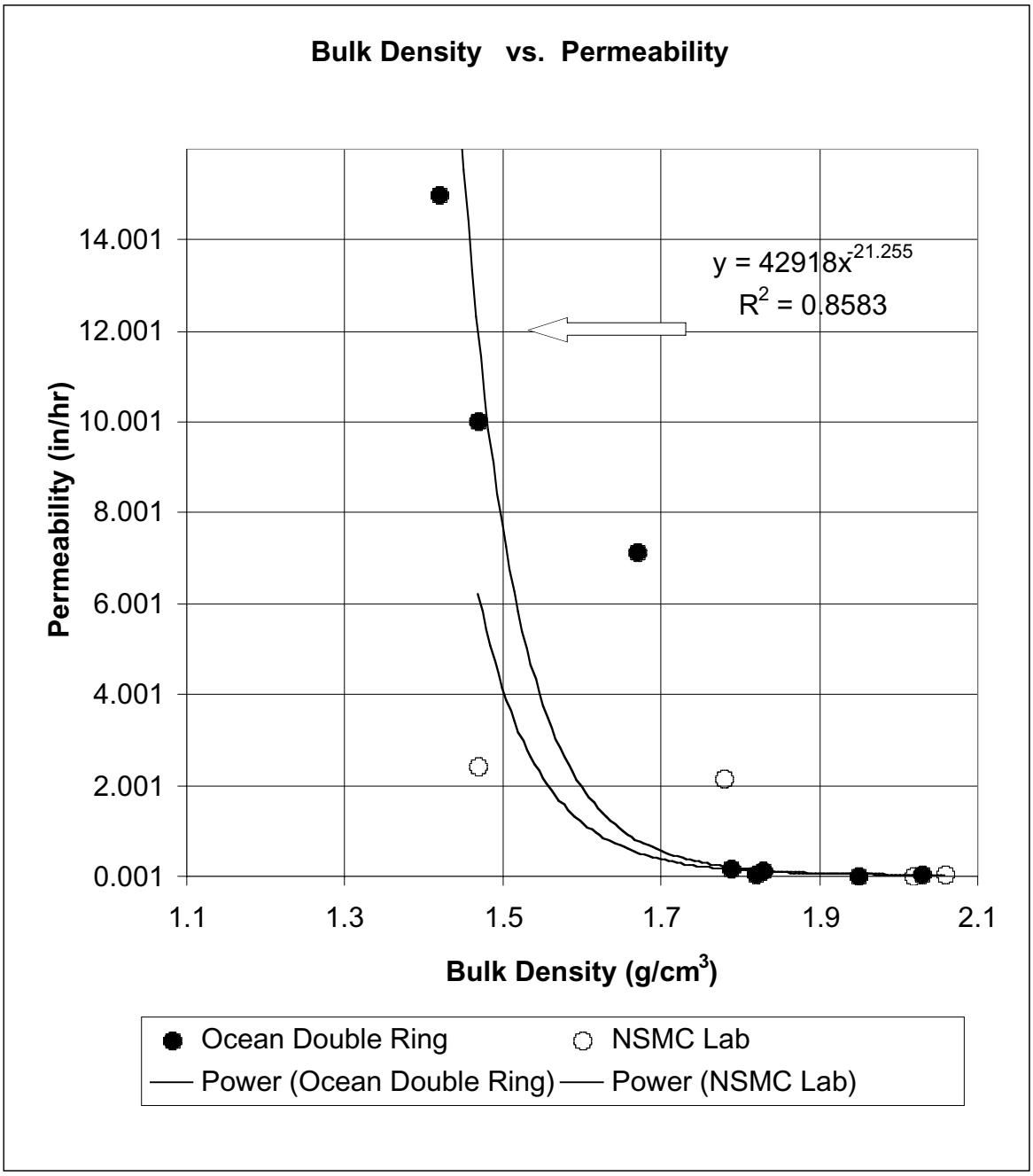
[1] HSG assigned based on soil texture in conformance with Appendix A of TR-55.
[2] Based on water transmission rates for row crops in TR-55, Appendix A.

The following graphs summarize the sites sampled in Ocean County. Graph 1 shows the distribution of bulk density with depth in the sites sampled. In the graded condition, the soil is more dense in all layers, especially just below the topsoil that was applied after most grading activities and loosened during seedbed preparation. Graph 2 relates permeability rate to bulk density for the specific layers sampled in Table 1.

Graph 1.


Bulk Density Profiles of
Permeability Testing Sites
Ocean County, NJ
Bulk Density (g/cm3)
1.10
1.30
1.50
1.70
1.90
2.10
Depth (in)
0
4
8
12
16
20
Woods
Pasture
Single House
Subdivision Lawn 1
Garage lawn
Cleared woods
Subdivision Lawn 2
Athletic field

Graph 2.



There is general agreement in the shape and relative trends of the data from both the lab and *in-situ* tests. As soil bulk density increases to 1.65 g/cm^3, the infiltration rate decreases rapidly. When the bulk density increases above 1.65 g/cm^3, infiltration rate declines slowly, approaching zero. Unless the soil surface becomes crusted or covered with an impermeable surface such as concrete, this permeability becomes the limiting factor for infiltration into the soil profile. Thus the permeability measurements were used to develop the following technique to estimate infiltration rates of densities not specifically measured. For example, using the formula from the *in-situ* data above [Permeability = (42198)(Bulk Density)$^{-21.255}$] it can be estimated that soil with a bulk density of less than 1.75 g/cm^3 would be expected to have an infiltration rate of greater than 0.3 in/hr.

Discussion

The amount of surface runoff is dependent on a complex interrelationship between the soil surface, the soil profile, and the land cover. The soil surface can be the limiting factor for infiltration if a crust on the surface restricts movement of water into the soil profile. The soil profile can be the limiting factor for infiltration if its rate of permeability is less than the rate at which the water can enter the soil. For example, a soil that has a restrictive layer within 20 inches is considered shallow, with a limited pore space volume in which to store water. The land cover can influence either factor. For example, an impervious surface such as concrete will prevent any water from entering the soil profile. Over the long term, vegetation will increase the permeability of the soil profile by providing preferential flow paths in decomposed root channels.

The NRCS Runoff Curve Number procedure accounts for this interrelationship by assigning Runoff Curve Numbers (CN s) to unique combinations of Hydrologic Soil Groups (HSG s), land cover, land treatment, and hydrologic condition. The soil characteristics have a major impact on the infiltration, permeability, and moisture holding capacity of the soil. To partially account for this, a soil series is assigned to a HSG by soil scientists and published in TR-55. It is based upon an evaluation of infiltration, structure, permeability, and especially texture.

In naturally developed soils, when a layer has a high bulk density, such as a dense pan or bedrock, it is usually restrictive to roots and water. Such soils commonly have a perched zone of saturation above the dense layer. When the dense layer or bedrock perches water within 20 inches of the surface, it is similar to any soil that has an apparent water table within 20 inches of the surface. A soil that has an unrestricted thickness of less than 20 inches is considered shallow with a limited pore space volume in which to store water. Therefore, it is assigned the highest runoff classification, HSG D. When these restrictive features occur below the 20-inch depth, they are not considered to contribute to additional runoff because the soil does not become filled with water over the impervious or saturated layer during most storms. In many disturbed soils, the dense layer is immediately below the surface layer that was loosened during seedbed preparation. So little water is stored in the profile that, although it can be depleted by plant consumption during the interval between rains, the soil profile fills up very quickly during a storm and increased runoff occurs.

The CN procedure recognizes that land cover, land treatment, and hydrologic condition also have an impact on the infiltration, permeability, and moisture holding capacity of the soil, resulting in a set of overlapping CN s with respect to HSG s. Thus sand (HSG A) that is bare could produce more runoff than sandy clay loam (HSG C) that is pastured.

The original work that was used for defining the HSG s, as shown in Appendix A of TR-55, was by Musgrave, as reported in 1955. Appendix E of TR-55 cites the reference. Musgrave described these HSG s in terms of minimum infiltration rates with row crops on wet soils . These ranges provide a full continuum and do not overlap. It should be noted that these rates are specific to a unique land cover. Thus, for other land covers, different infiltration rates would be expected for defining the HSG classification. For a vegetated condition, the infiltration rates for defining A, B, C, and D classifications would be higher than for row crops. Likewise, for a bare soil condition, the rates would be lower. The results of this study show that the field measured permeability rate for each disturbed and now vegetated site is lower that the infiltration rate determined by Musgrave for row crops. This is opposite of what would be expected at vegetated sites without soil disturbance. While based on row crop infiltration rates Subdivision Lawn 1

and Subdivision Lawn 2 appear to be in the C HSG, actually they may be in the D group. The field measured permeability rate for the Cleared Woods site with a bare soil cover also indicates a C HSG based on the row crop infiltration values. Since it is at the low end of the range, this may in fact be a proper classification even though it is in a bare condition. The undisturbed and somewhat disturbed sites including Woods , Pasture , and Single House had field measured permeability rates in the range of 7.1 to 15 inches per hour. Even considering that the rates should be higher than for the row crop condition, the measured rates are still significantly higher than expected.

Applying the textural-based HSG classification guidance from Appendix A of TR-55 to the disturbed sites tested in Ocean County would indicate that all of the soils still could be classified as A or B. The results show that the level of disturbance at these sites has produced significant compaction and has altered the HSG classification, likely to a D condition. Therefore, it is clear that the classification of a disturbed and compacted soil based on texture alone is not adequate and additional guidance is needed for planners and designers to properly model hydrologic changes due to land use conversion.

The first edition of TR-55, issued in 1975, briefly discussed the impacts of soil compaction by heavy equipment, bare ground with little established sod, and the mixing of surface and subsurface soils. It indicated that any one of these conditions could cause a soil normally in HSG A or B to be classified in group B or C, respectively. It is understood that this guidance was removed from the current edition of TR-55 due to lack of supporting data; however, the results of our study suggest that the impact of soil disturbance in urban areas may be greater than described by this earlier guidance.

The USDA NRCS Soil Quality Institute has developed the following table that shows a relationship between soil bulk density and root growth and has included it in Soil Quality — Urban Technical Note 2. This relationship is very similar to the relationship that we have observed between bulk density and infiltration. The values of soil bulk density that severely restrict root growth correspond very closely to those measured values that severely impede infiltration.

Table 3.

General relationship of soil bulk density to root growth based on soil texture (Adapted from NRCS Soil Quality Institute, 2000)			
Soil Texture	Ideal bulk density (g/cm^3)	Bulk densities that may affect root growth (g/cm^3)	Bulk densities that restrict root growth (g/cm^3)
Sands, loamy sands	< 1.60	1.69	>1.80
Sandy loams, loams	< 1.40	1.63	>1.80
Sandy clay loams	< 1.40	1.60	>1.75
Loams, clay loams	< 1.40	1.60	>1.75
Silts, silt loams	< 1.30	1.60	>1.75
Silt loams, silty clay loams	< 1.10	1.55	>1.65
Sandy clays, silty clays, clay loams (35-45% clay)	< 1.10	1.49	>1.58
Clays (>45% clay)	< 1.10	1.39	>1.47

Further examination of this relationship and the data from this study reveals that both the bulk densities that restrict root growth for sandy soils and those observed at sandy sites with very low permeability rates are greater than 1.8 g/cm^3.

The amount of vegetative cover is the determining factor for the hydrologic conditions of open space in urban areas as defined in Table 2-2a of TR-55. The applicable portion of this table follows.

Table 4.

Hydrologic Condition of Open Space	Runoff Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
Poor	68	79	86	89
Fair	49	69	79	84
Good	39	61	74	80

It is recognized that a good root system is required to sustain good vegetative cover. Even when the soil has been converted to a lawn the soil remains compacted, reducing pore space. These post-developed lawns generate significantly more runoff than estimated using TR-55. TR-55 assumes that the lawns for urban and residential districts in Table 2-2a are in good hydrologic condition. Good condition implies average to better than average ground cover conditions. The findings of this study indicate that the compacted soil conditions of the lawns and athletic fields are not in good hydrologic condition. The measured values of soil bulk density that severely impede infiltration correspond very closely to those that severely restrict root growth. Thus the relationship between soil bulk density and root growth, shown in Table 3 and the results of this study can be combined into Table 5. By assuming that both the hydrologic conditions in TR-55 and the bulk densities shown in Soil Quality — Urban Technical Note 2 envelop the typical conditions, it is possible that the results of the two studies can be used to determine the hydrologic condition of open space in urban areas from bulk density (Table 5). Additional study is needed to confirm this relationship because hydrologic condition refers to the ground cover of the vegetation and not the infiltration rate.

Table 5.

General relationship of maximum soil bulk density within 20 of the surface to hydrologic condition of open space in urban areas based on soil texture			
Soil Texture	Bulk Densities for Hydrologic Condition of Open Space in Urban Areas (g/cm^3)		
	Good	Fair	Poor
Sands, loamy sands	< 1.60	1.60 - 1.80	> 1.80
Sandy loams, loams	< 1.40	1.40 - 1.80	> 1.80
Sandy clay loams	< 1.40	1.40 - 1.75	> 1.75
Loams, clay loams	< 1.40	1.40 - 1.75	> 1.75
Silts, silt loams	< 1.30	1.30 - 1.75	> 1.75
Silt loams, silty clay loams	< 1.10	1.10 - 1.65	> 1.65
Sandy clays, silty clays, clay loams (35-45% clay)	< 1.10	1.10 - 1.58	> 1.58
Clays (>45% clay)	< 1.10	1.10 - 1.47	> 1.47

Recommendations

Recommendation 1: Perform additional study of rainfall and runoff data from undisturbed watersheds in the coastal plain of New Jersey.

Discussion: The relatively high measured permeability rates at the undisturbed and somewhat disturbed sites raise the question of whether the CN s in TR-55 accurately reflect the runoff from undisturbed woods and pasture in the coastal plain of New Jersey. Although a study conducted in 1981 indicated that the CN s for woods in the Pinelands are adequate, the data collected as part of this study indicate that more study is needed.

Recommendation 2: Conduct further research to allow the development of additional guidance for the determination of the HSG and hydrologic condition for compacted urban sites based on the expected method of construction and degree of site modification.

Discussion: Currently there is limited guidance available for the determination of the HSG, and hence the CN, for disturbed soils where significant compaction has occurred. Appendix A of TR-55 provides a texture-based means for classification that applies to disturbed but not compacted soils. This study indicates that construction techniques that significantly alter the site topography with heavy equipment do result in significant compaction, thus reducing the permeability rate of the soil. While an after the fact procedure may be developed based on site-measured bulk densities and/or permeability rates, what would be most useful to planners and designers would be a qualitative procedure based on the expected method of construction and degree of site modification. The effects of significant compaction likely can be reflected by a shift to the HSG D condition. Also, there may be an opportunity to use the soil bulk density to reflect the hydrologic condition of open space in urban areas. At this time, the determination of how to account for an expected increase in runoff due to compaction should be made on a site-by-site basis considering the extent of disturbance, degree of topographic alteration, and expected method of construction.

Recommendation 3: Continue OCSCD s storm water management basin monitoring that has been initiated and expand it to include basins in highly disturbed sites.

Discussion: The results of this study will provide valuable total site runoff data from a variety of developed urban sites. These site-scale data are needed to verify that small plot data are properly interpreted and used to develop procedures and criteria.

Recommendation 4: Evaluate other aspects of the NRCS procedures for estimating peak discharge before permanent changes are made to procedures and criteria.

Discussion: The results of this study indicate that soil modification and compaction associated with current construction techniques do alter a soil s pre-developed HSG classification. Implementation of a change in HSG for the developed condition will impact both the predicted volume and the rate of runoff. While this study focused on the impacts on runoff volume, it is important to recognize that the NRCS procedures for estimating peak discharges include other aspects that need to be evaluated including the dimensionless unit hydrograph and the ability of undisturbed areas to serve as infiltration buffers.

Recommendation 5: Conduct additional analysis to develop construction guidelines and specifications that would minimize and remediate the impact of urbanization on runoff.

Discussion: This study indicates the effects of urbanization on runoff. However, little information exists as to specific soil remediation techniques and what level of soil restoration will likely result. Developers, planners and units of government need to know the effectiveness of restoration techniques so that informed land-use planning choices can be evaluated.

Appendix A Infiltration Sampled Sites

Woods

Described and Bulk Density samples taken 10/10/97
Infiltration measured using single rainfall simulator ring as inner ring on 9/27/99
Woods neither grazed nor harvested by heavy equipment.

Oi 2-1 inches; hemic organic soil materials.
Oa 1-0 inches; sapric organic soil materials; many fine roots forming a roots mat, a grub was present
A 0-1 inches; dark gray (10YR 4/1) loamy sand; common medium roots.
A/B 1-7 inches; yellowish brown light (10YR 5/8) light sandy loam: 12-14% clay: friable: common medium roots.
Bt1 7-15 inches; yellowish brown(10YR5/8) sandy loam: friable: few medium roots.
Bt2 15-22 inches; yellowish brown(10YR5/8) gravelly sandy loam: friable.
C 22-48 inches; dark yellowish brown (10YR4/6) gravelly coarse sand: single grain: loose

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 — 3	1.17	1.14	1.25	1.19
5 — 8	1.44	1.38	1.43	1.42
9 — 12	1.44	1.40	1.58	1.48
14 — 17	1.55	1.66	1.53	1.58
Infiltration Rate (in/hr)				
4 — 7	15			15

Pasture

Described and sampled for Bulk Density 10/10/99.
Infiltration Sampled 10/14/99
Ap1 0-6 inches;very dark grayish brown (10YR 3/2) loamy sand: weak fine granular structure: friable: many fine roots: common earthworms.
Ap2 6-12 inches; very dark grayish brown (10YR 3/2) loamy sand: weak fine granular structure: friable: few fine roots: common earthworms.
Bt 12-24 inches; yellowish brown (10YR 5/8) sandy loam with 5% rounded quartoze gravel: weak medium subangular structure: friable.
C 24-36 inches; yellowish brown (10YR 5/8) loamy sand: single grain: friable.

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 - 3	1.29	1.34	1.24	1.29
6 —9	1.50	1.38	1.52	1.47
9 — 12	1.39	1.50	1.37	1.42
13 — 16	1.55	1.59	1.63	1.59
16 — 19	1.61	1.63	1.60	1.61
Infiltration Rate (in/hr)				
8-13	8.0	15.6	6.1	9.9

Single House
Described and sampled for Bulk Density 9/1/99
Infiltration measured 9/27/99
0-6 inches; dark brown (10YR 3/3) loamy fine sand: weak medium granular structure: friable: many fine and medium roots.
6-13 inches; yellowish brown (10YR 5/6) loamy coarse sand: massive parting to single grain or just single grain: loose: few roots.
13-19 inches; Ab very dark grayish brown (10YR 3/2): loamy fine sand: massive parting to single grain: friable: many fine and medium roots: many ant eggs and ant nests.
19-24 inches; Btb yellowish brown (10YR 5/8): light sandy loam: weak medium subangular structure: friable: few medium roots.

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 - 3	1.26	1.24	1.25	1.25
6 - 9	1.63	1.70	1.68	1.67
12 - 15	1.52	1.62	1.68	1.61
16 - 19	1.62	1.57	1.64	1.61
20 - 23	1.57	1.69	1.68	1.64
Infiltration Rate (in/hr)				
3 - 7	8.6	6.6	6.3	7.1

Subdivision Lawn 1
Infiltration measured 9/22/99
Water ponded within the soil to the surface.
0-6 inches; very dark gray (10YR3/1) loamy coarse sand: loose non-sticky non-plastic; many fine roots
6 —11 inches; yellowish brown (10YR 5/6) loamy coarse sand; massive: non-sticky: non-plastic
11 —17 inches; very dark grayish brown (10YR 3/2) loamy coarse sand; massive parting to single grain: single layer of 2-3 trap rock at the bottom of layer as if old construction entrance. Pieces of old sod.
17-36 inches; light olive brown (2.5Y 5/4) loamy sand: massive and brittle parting first to coarse platy and then to single grain
36-39 inches;very dark grayish brown (10YR3/2) loamy sand: non-sticky: non-plastic: remnants of old sod.
39-57 inches; yellowish brown (10YR 5/4) loamy sand: non-sticky: non-plastic.
57-60 inches; Ab black (10YR 2/1) sand: massive structure parting to single grain: original surface with old tree roots.
60-85 inches; Eb light brownish gray (10YR 6/2) sand: single grain
85-93 inches; Bwb brown (10YR 4/3) loamy sand: single grain
93-110 inches; Cb yellowish brown (10YR 5/6) sand: single grain

The original soil before any fill was the Lakewood series, HSG A. The surface is continuously saturated. The sidewalk in the site is on the upper 1/3 of the slope 20-40 from the top of slope. The concrete is darkly stained, even in the nose slope position with precipitation of iron oxides as water flows across the top of the sidewalk.

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 - 6	1.54	1.46	1.50	1.50
6 - 11	1.77	1.77	1.81	1.79
11 - 17	1.65	1.51	1.65	1.60
17 - 20	1.85	1.91	1.90	1.89
Infiltration Rate (in/hr)				
5 - 9	0.17	0.20	0.06	0.14

Garage Lawn

Described and Bulk Density samples taken 5/21/98

Infiltration measured 9/27/99

Site is vegetated with sod and irrigated. The area around the county parking garage is fill varying in thickness from less than 12 to about 48 . An old house was on the site and had to be torn down before the garage could be built. Hammonton-like fill materials bury an Atsion soil in place. The upper 6 of soil was saturated.

0-3 inches; sod layer not sampled

3-6 inches; very dark grayish brown (10YR 3/2) sandy loam: wet: many fine roots to depth of 6 .

6-31 inches; brown (10YR 4/3) sandy loam: gravelly sandy loam: loamy sand and gravelly loamy sand with pieces of china, wood, rags, blacktop and rocks and brick.

31 inches; surface of original Atsion soil,

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
3 — 6	1.59	1.77	1.77	1.71
5 — 8	1.84	1.82	1.79	1.82
9 — 12	1.88	1.90	1.91	1.90
14 — 17	1.90	1.89	1.91	1.90
Infiltration Rate (in/hr)				
5 — 9	0.01	0.04	0.07	0.04

Cleared Woods

Bulk Density samples taken 7/6/99and profile described 2/12/01.

Infiltration measured 9/27/99

This site was cleared of trees and stumps and the duff layer was removed. No site grading was performed. The site commonly has standing pools of water in shallow depressions for extended periods

E 0-2 inches; grayish brown (10YR 5/2) loamy sand, no roots; frozen.

B/E 2-9 inches; yellowish brown (10YR 5/4) loamy sand; massive parting to single grain; no roots.

Bt 9-16 inches; dark yellowish brown(10YR 4/4) gravelly sandy loam: massive parting to single grain; friable: few medium and coarse tree roots.

B/C 16-24 inches; yellowish brown (10YR 5/6) gravelly loamy sand: friable; no roots.

C1 24-36 inches; yellowish brown (10YR 5/4) loamy sand: single grain: loose

C2 36-48 inches; light yellowish brown (10YR 6/4) sand: single grain: loose

C3 48-60 inches; pale brown (10YR 6/3) very gravelly sand: single grain: loose; moist

C4 60-96 inches; pale brown (10YR 6/3) loamy sand; single grain; loose; moist.

C5 96-100 inches; light gray (10YR 7/2) medium sand; with coarse common distinct yellowish brown (10YR 5/4) and few medium distinct yellowish brown (10YR 5/8) iron accumulations; single grain: loose; abrupt boundary; moist.

C6 100-108 inches; pale brown (10YR 6/3) very gravelly sand: single grain: loose

C7 108-120 inches; yellow (10YR 7/3) sandy loam: massive parting to moderate medium subangular blocky structure; dry.

Estimated seasonal high water table > 10 feet.

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 - 3	1.80	1.69	1.75	1.75
6 - 9	1.81	1.82	1.85	1.83
12 - 15	1.82	1.80	1.90	1.84
18 - 21	1.53	1.65	1.72	1.64
Infiltration Rate (in/hr)				
5 — 9	0.09	0.16	1.51 *	0.13

* Outlier not used in average.

Subdivision Lawn 2
Infiltration measured 9/27/99

0 - 6 inches; dark gray (10YR3/2) loamy sand: thin sod on top of this layer with many fine roots from the sod extending into this layer.
6 - 8 inches; dark gray (10YR 3/2) loamy sand with stratified layers of yellowish brown10YR 5/6) sand with few large root fragments 1-11/2 dia. The bottom of this layer ranges to 12 .
8 - 12 inches; dark grayish brown (10YR4/2) sandy loam: massive: dense: hard, few medium roots. Few strong brown (7.5YR 5/8) iron accumulations as soft masses along root channels and macropores where water is probably moving as unsaturated flow.
12 - 12 inches; (1mm thick) strong brown (7.5YR 5/8) loamy sand with iron accumulations as soft masses as a thin ribbon just below the compacted zone: loose.
12 - 24 inches; yellowish brown (10YR 5/6) loamy sand: loose no roots.

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 — 3	1.60	1.53	1.62	1.58
7 — 10	1.95	1.67	1.77	1.79
13 — 16	2.07	1.96	2.07	2.03
18 — 21	1.85	1.73	1.67	1.75
Infiltration Rate (in/hr)				
9 — 13	0.03	0.03	0.74 *	0.03

* Outlier not used in average.

Athletic Field
Described and Bulk Density samples taken 11/26/97
Infiltration Measured 9/29/1999
Site is vegetated with sod and irrigated.
0 - 5 inches; very dark gray (10YR 3/1) loamy sand: single grain: friable: many fine roots
5 - 18 inches; yellowish brown (10YR 5/6) light sandy loam: massive: dense: hard: no roots.
18 — 36 inches,yellowish brown (10YR 5/6) loamy sand: friable.

Sampled Depth (in)	Sample 1	Sample 2	Sample 3	Average
Bulk Density (g/cm^3)				
0 — 3	1.28			1.28
5 — 8	1.83	1.80	1.76	1.80
9 — 12	1.96	1.97	1.91	1.95
14 — 17	1.87	1.90	1.86	1.88
Infiltration Rate (in/hr)				
6 — 10	0.01	0.01	0.01	0.01

Appendix B.

New Jersey Permeability Test Sites

Summary of Index and Permeability Tests

Sample	Site	Percent Passing										USCS	LL	PI	BD Field	Max DD	Water opt	Gs	D @ test	Wc @ test	Comp Perm
No.	Name	0.002	0.005	0.02	0.05	#200	#140	#40	#10	#4	3/4"	Class			g/cm^3	g/cm^3	%	g/cm^3	g/cm^3	%	cm/sec
00-203	Woods	5	6	13	16	16	17	64	93	96	100	SM	NP	NP	1.58	1.83	11.5	2.64			
00-204	Subdivision Lawn 2	8	9	17	22	23	23	61	90	94	100	SM	NP	NP	1.80	2.00	9.0	2.66			
00-205	Pasture	6	6	15	18	18	19	59	93	97	100	SM	NP	NP	1.47	2.00	8.5	2.68	1.47	9.5	1.7E-03
00-206	Single House					7	8	39	75	84	100	SW-SM	NP	NP	1.67	1.92	8.5	2.65			
00-207	Subdivision Lawn 1					7	7	54	95	99	99	SP-SM	NP	NP	1.78	1.78	10.5	2.66	1.78	10.5	1.5E-03
00-208	Garage Lawn					7	8	32	64	76	97	SP-SM	NP	NP	1.82	2.06	8.1	2.64	2.06	8.1	4.1E-05
																					7.1E-05
00-209	Cleared Woods	9	10	16	22	24	27	60	81	86	99	SM	14	2	1.83	2.04	9.0	2.68			
00-210	Athletic Field	9	13	16	20	20	21	73	91	94	100	SM	16	3	1.95	1.92	11.0	2.66	2.02	10	2.2E-07

BD Field: Bulk Density, Field Test
Max DD: Maximum Dry Density using Standard Proctor Test
Water opt: Water Content at which Maximum Dry Density was obtained
Gs: Particle Density
D @ test: Density of repacked sample when tested
Wc @ test: Water Content of tested repacked sample
Comp Perm: Computed Permeability

This study was conducted by:

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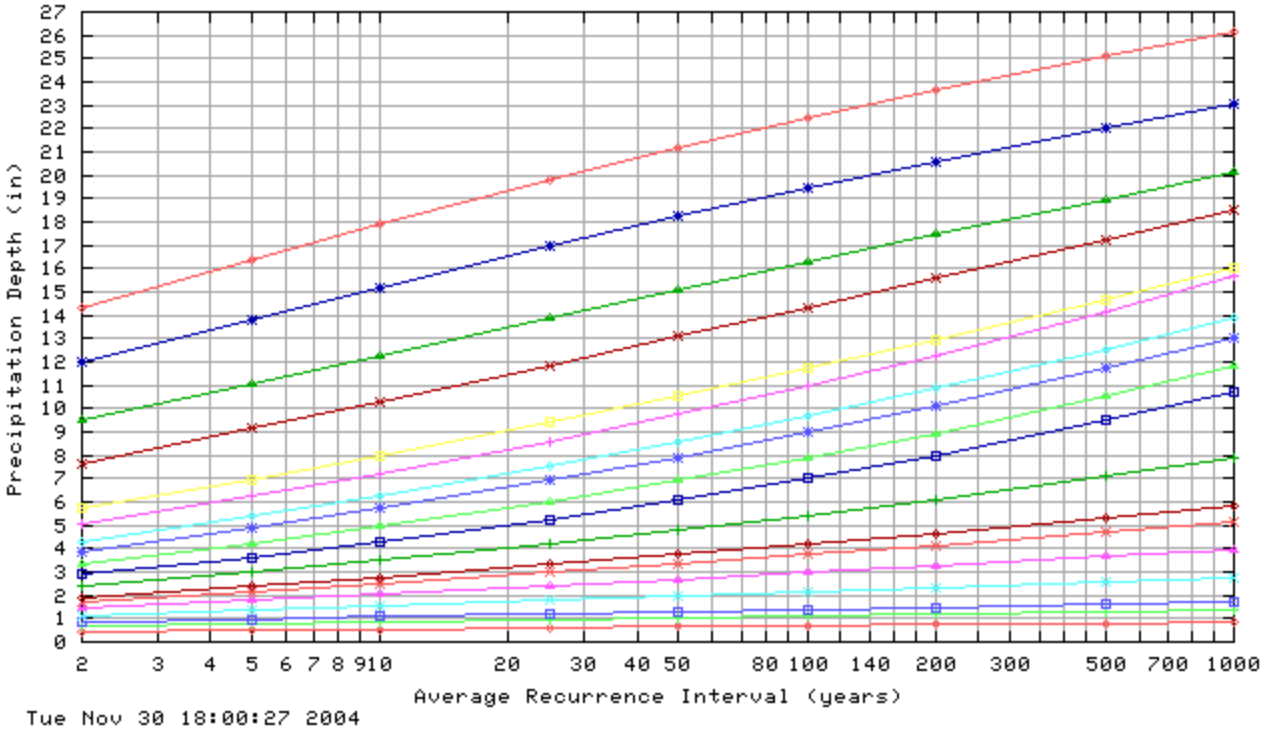
Additional contributions by the following were most appreciated:

Alan Perry, Bill Slack, Alfred Galvan, Chuck Collins, Mike Marcella, and Kerry Jennings, Ocean County Soil Conservation District

Ed Jakubowski, Senior Staff Scientist, Schnabel Engineering Associates, Inc.

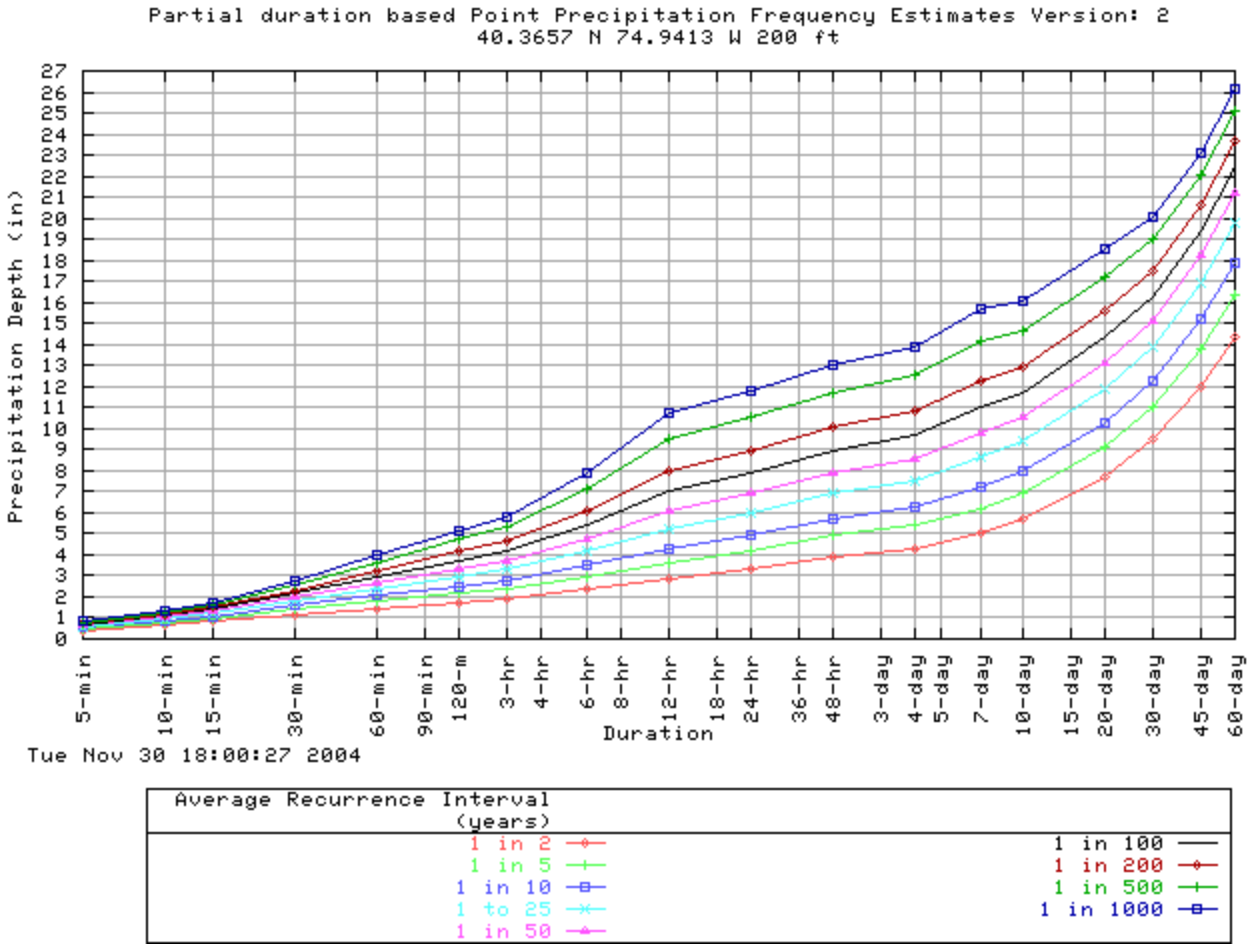
March 2001

Partial duration based Point Precipitation Frequency Estimates Version: 2
40.3657 N 74.9413 W 200 ft



Tue Nov 30 18:00:27 2004

Duration			
5-min	120-m	48-hr	30-day
10-min	3-hr	4-day	45-day
15-min	6-hr	7-day	60-day
30-min	12-hr	10-day	
60-min	24-hr	20-day	



Confidence Limits -

*** Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.45	0.72	0.90	1.25	1.56	1.89	2.09	2.63	3.20	3.61	4.21	4.67	5.40	6.11	8.14	9.98	12.62	15.02
5	0.53	0.85	1.08	1.53	1.96	2.38	2.64	3.31	4.04	4.55	5.30	5.84	6.68	7.44	9.72	11.64	14.52	17.14
10	0.59	0.95	1.20	1.74	2.26	2.76	3.07	3.85	4.76	5.33	6.19	6.79	7.73	8.52	10.95	12.92	15.96	18.73
25	0.67	1.06	1.35	2.00	2.66	3.28	3.66	4.64	5.81	6.46	7.46	8.14	9.21	10.00	12.61	14.59	17.78	20.71
50	0.72	1.15	1.46	2.19	2.97	3.69	4.14	5.30	6.74	7.42	8.51	9.25	10.44	11.22	13.91	15.88	19.14	22.18
100	0.78	1.23	1.56	2.39	3.29	4.13	4.65	6.02	7.74	8.47	9.65	10.42	11.75	12.49	15.22	17.16	20.43	23.54
200	0.83	1.31	1.66	2.58	3.62	4.58	5.17	6.78	8.88	9.62	10.87	11.69	13.14	13.80	16.55	18.41	21.68	24.82
500	0.90	1.42	1.78	2.84	4.07	5.22	5.92	7.92	10.60	11.31	12.66	13.55	15.18	15.67	18.37	20.05	23.22	26.36
1000	0.95	1.49	1.87	3.03	4.43	5.74	6.54	8.88	12.09	12.73	14.14	15.06	16.84	17.19	19.79	21.30	24.36	27.48

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

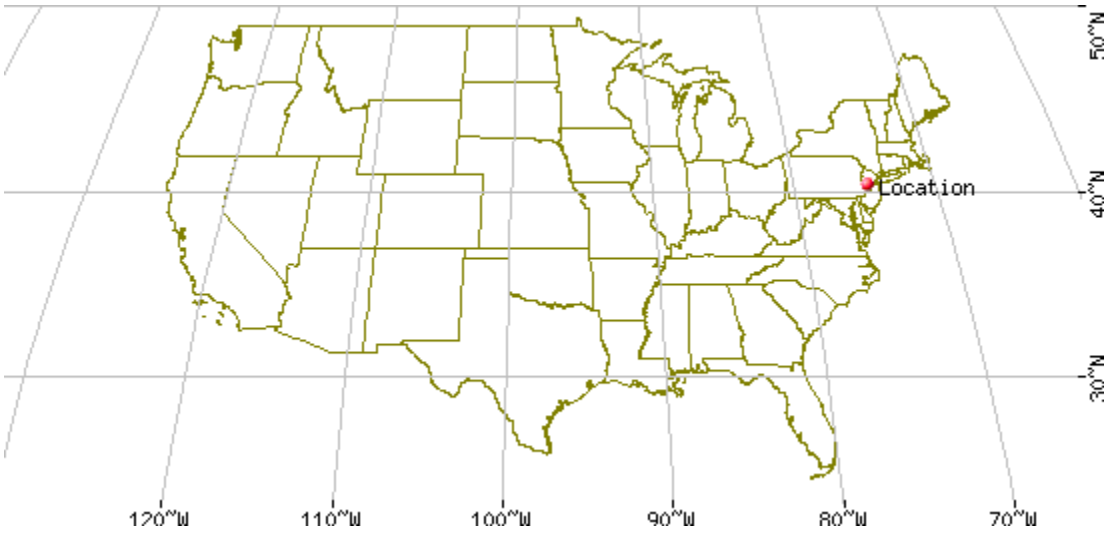
*** Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

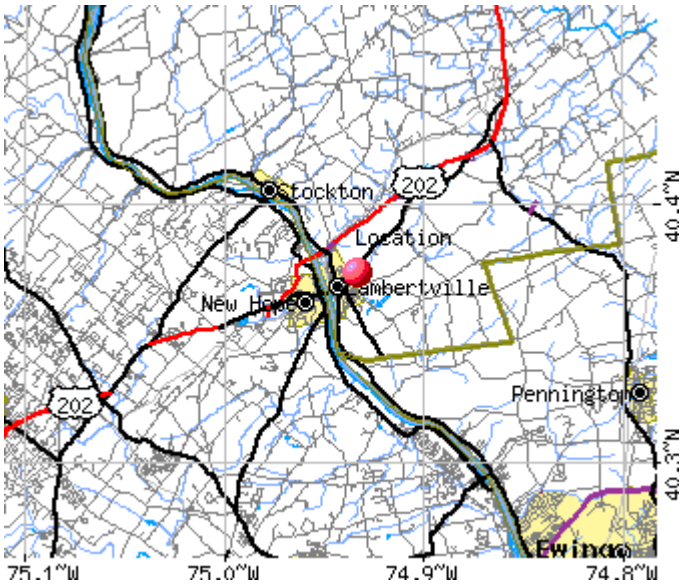
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.37	0.59	0.74	1.03	1.29	1.55	1.70	2.14	2.62	3.11	3.58	4.01	4.69	5.35	7.22	8.99	11.47	13.72
5	0.44	0.70	0.88	1.26	1.61	1.95	2.14	2.69	3.30	3.91	4.51	5.01	5.80	6.51	8.60	10.48	13.19	15.66
10	0.48	0.78	0.98	1.42	1.85	2.26	2.48	3.12	3.87	4.58	5.26	5.82	6.70	7.45	9.68	11.62	14.48	17.10
25	0.54	0.87	1.10	1.62	2.16	2.67	2.95	3.73	4.69	5.53	6.32	6.95	7.97	8.74	11.13	13.11	16.10	18.88
50	0.58	0.93	1.18	1.78	2.41	2.99	3.31	4.23	5.38	6.31	7.18	7.87	9.00	9.77	12.24	14.22	17.31	20.17
100	0.62	0.99	1.26	1.92	2.65	3.32	3.69	4.75	6.10	7.16	8.09	8.83	10.07	10.82	13.35	15.30	18.45	21.36
200	0.66	1.05	1.32	2.06	2.89	3.65	4.07	5.29	6.87	8.05	9.04	9.83	11.20	11.88	14.45	16.35	19.50	22.46
500	0.71	1.12	1.41	2.23	3.21	4.09	4.57	6.04	7.98	9.33	10.38	11.24	12.77	13.33	15.89	17.68	20.80	23.78
1000	0.74	1.16	1.46	2.36	3.44	4.43	4.96	6.64	8.90	10.38	11.46	12.39	14.00	14.47	16.98	18.68	21.73	24.71

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.
** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

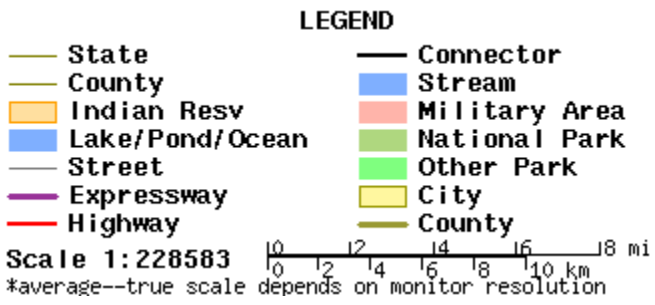
Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources **Tiger Map Server**.

Please read disclaimer for more information.



Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available
from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information
about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study,
please refer to our documentation.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (40.3657/-74.9413). Digital ASCII data can be obtained directly from **NCDC**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910

(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Table 1. NJDEP 1.25-Inch/ 2-Hour Stormwater Quality Design Storm
Cumulative and Incremental Rainfall Distributions

Time (minutes)	Cumulative Rainfall (inches)	Incremental Rainfall (inches)
0	0.0000	0.0000
5	0.0083	0.0083
10	0.0166	0.0083
15	0.0250	0.0084
20	0.0500	0.0250
25	0.0750	0.0250
30	0.1000	0.0250
35	0.1330	0.0330
40	0.1660	0.0330
45	0.2000	0.0340
50	0.2583	0.0583
55	0.3583	0.1000
60	0.6250	0.2667
65	0.8917	0.2667
70	0.9917	0.1000
75	1.0500	0.0583
80	1.0840	0.0340
85	1.1170	0.0330
90	1.1500	0.0330
95	1.1750	0.0250
100	1.2000	0.0250
105	1.2250	0.0250
110	1.2334	0.0084
115	1.2417	0.0083
120	1.2500	0.0083

Table 2. TSS Removal Rates for BMPs

Best Management Practice (BMP)	Adopted TSS Removal Rate (%)
Bioretention System	90
Constructed Stormwater Wetland	90
Dry Well	Volume Reduction Only
Extended Detention Basin	40 to 60
Manufactured Treatment Device	Requires NJDEP approval
Pervious Paving System	Volume Reduction or 80
Sand Filter	80
Vegetative Filter	60-80

NEW JERSEY DEPARTMENT OF AGRICULTURE
STATE SOIL CONSERVATION COMMITTEE
Chapter 251, PL 1975 as amended,
Engineering Policies- Technical Bulletin

Technical Bulletin: 2004-4.0	**Effective Date:** January 1, 2005
Subject: NRCS revisions to 24 hr design storm depths	**From:** Hunter Birckhead, P.E., Section Chief

1.01 PURPOSE

To distribute the revised 24 hr NRCS design rainfall depth tables for use in runoff modeling with NRCS procedures such as TR-55 and TR-20

1.02 SUMMARY

The National Oceanographic and Atmospheric Administration (NOAA) is responsible for developing statistical estimates of rainfall amounts for various return periods. Based on recent updates by NOAA, these changes have been incorporated by NRCS into their 24 hr design storm depth tables and have been released for use in New Jersey.

The attached table provides the previous and revised 24hr rainfall depths for each county in New Jersey for the 1, 2, 5, 10, 25, 50 and 100 year return periods. These new depths are to be used in calculating stormwater runoff effective immediately.

NRCS 24 hr Design Storm Rainfall Depths Revised September 2004 (revised)

SSCC - NJDA - SCD

Storm Period	1 yr		2 yr		5yr		10yr		25yr		50yr		100yr	
County	old	*new*	old	*new*	old	*new*	old	*new*	old	*new*	old	*new*	old	*new*
Atlantic	2.8	*2.8*	3.5	*3.3*	4.5	*4.3*	5.5	*5.2*	6.2	*6.6*	6.8	*7.6*	7.6	*8.9*
Bergen	2.7	*2.8*	3.3	*3.3*	4.3	*4.3*	5.3	*5.1*	5.7	*6.3*	6.5	*7.3*	7.5	*8.4*
Burlington	2.8	*2.8*	3.4	*3.4*	4.4	*4.3*	5.3	*5.2*	6.0	*6.4*	6.6	*7.6*	7.4	*8.8*
Camden	2.8	*2.8*	3.4	*3.3*	4.4	*4.3*	5.3	*5.1*	5.9	*6.3*	6.6	*7.3*	7.4	*8.5*
Cape May	2.9	*2.8*	3.5	*3.3*	4.6	*4.2*	5.6	*5.1*	6.3	*6.4*	6.9	*7.5*	7.7	*8.8*
Cumberland	2.8	*2.8*	3.4	*3.3*	4.5	*4.2*	5.4	*5.1*	6.0	*6.4*	6.8	*7.5*	7.5	*8.8*
Essex	2.7	*2.8*	3.3	*3.4*	4.3	*4.4*	5.3	*5.2*	5.7	*6.4*	6.4	*7.5*	7.5	*8.7*
Gloucester	2.8	*2.8*	3.4	*3.3*	4.4	*4.2*	5.3	*5.0*	5.9	*6.2*	6.6	*7.3*	7.4	*8.5*
Hudson	2.7	*2.7*	3.3	*3.3*	4.3	*4.2*	5.3	*5.0*	5.7	*6.2*	6.4	*7.2*	7.5	*8.3*
Hunterdon	2.6	*2.9*	3.2	*3.4*	4.2	*4.3*	5.0	*5.0*	5.7	*6.1*	6.5	*7.0*	7.3	*8.0*
Mercer	2.7	*2.8*	3.3	*3.3*	4.3	*4.2*	5.2	*5.0*	5.8	*6.2*	6.4	*7.2*	7.5	*8.3*
Middlesex	2.7	*2.8*	3.3	*3.3*	4.3	*4.3*	5.2	*5.1*	5.9	*6.4*	6.4	*7.4*	7.5	*8.6*
Monmouth	2.8	*2.9*	3.4	*3.4*	4.4	*4.4*	5.3	*5.2*	6.0	*6.6*	6.5	*7.7*	7.5	*8.9*
Morris	2.6	*3.0*	3.3	*3.5*	4.3	*4.5*	5.2	*5.2*	5.7	*6.3*	6.5	*7.3*	7.5	*8.3*
Ocean	2.8	*3.0*	3.5	*3.4*	4.5	*4.5*	5.4	*5.4*	6.2	*6.7*	6.6	*7.9*	7.5	*9.2*
Passaic	2.6	*3.0*	3.3	*3.5*	4.3	*4.4*	5.4	*5.3*	5.7	*6.6*	6.5	*7.5*	7.6	*8.7*
Salem	2.8	*2.8*	3.3	*3.3*	4.4	*4.2*	5.3	*5.0*	5.9	*6.2*	6.6	*7.3*	7.4	*8.5*
Somerset	2.7	*2.8*	3.3	*3.3*	4.3	*4.3*	5.2	*5.0*	5.7	*6.2*	6.5	*7.2*	7.5	*8.2*
Sussex	2.6	*2.7*	3.2	*3.2*	4.2	*4.0*	5.0	*4.7*	5.7	*5.7*	6.6	*6.6*	7.5	*7.6*
Union	2.7	*2.8*	3.3	*3.4*	4.3	*4.4*	5.3	*5.2*	5.8	*6.4*	6.4	*7.5*	7.5	*8.7*
Warren	2.6	*2.8*	3.2	*3.3*	4.1	*4.2*	4.9	*4.9*	5.6	*5.9*	6.5	*6.8*	7.2	*7.8*

Appendix E: Low Impact Development Checklist, Model Stormwater Control Ordinance and Riparian Buffer Conservation Zone Model Ordinance

New Jersey Stormwater Best Management Practices Manual

February 2004

APPENDIX A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: _____

County: _____ Date: _____

Review board or agency:_____

Proposed land development name: _____

Lot(s): _____ Block(s): _____

Project or application number: _____

Applicant's name: _____

Applicant's address: _____

_____

Telephone: _____ Fax: _____

Email address: _____

Designer's name: _____

Designer's address: _____

_____

Telephone:_____ Fax:_____

Email address:_____

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

_____

Do regulations include nonstructural requirements? Yes: _____ No: _____

If yes, briefly describe: _____

_____

_____

List LID-BMPs prohibited by local regulations: _____

_____

_____

Pre-design meeting held? Yes: _____ Date: _____ No: _____

Meeting held with: _____

_____

_____

Pre-design site walk held? Yes: _____ Date: _____ No: _____

Site walk held with: _____

_____

_____

Other agencies with stormwater review jurisdiction:

Name: _____

Required approval: _____

Name: _____

Required approval: _____

Name: _____

Required approval: _____

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: _____ No: _____

If yes, was this inventory a factor in the site's layout and design? Yes: _____ No: _____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: _____ If yes, specify % of site: _____

Native ground cover? Yes: _____ No: _____ If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: _____ If yes, specify % of site: _____

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: _____ No: _____ If yes, specify % of site: _____

Native ground cover? Yes: _____ No: _____ If yes, specify % of site: _____

Vegetated buffers? Yes: _____ No: _____ If yes, specify % of site: _____

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: _____ No: _____

Reduce runoff pollutant loads through runoff treatment: Yes: _____ No: _____

Maintain groundwater recharge by preserving natural areas: Yes: _____ No: _____

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: _____ No: _____

If yes, were these inventories factors in the site's layout and design? Yes: _____ No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: _____ No: _____

If yes, how: _____

_____

Restrict temporary site disturbance during construction? Yes: _____ No: _____

If yes, how: _____

_____

Consider soils and slopes in selecting disturbance limits? Yes: _____ No: _____

If yes, how: _____

_____

C. Specify percentage of site to be cleared: _____ Regraded: _____

D. Specify percentage of cleared areas done so for buildings: _____

For driveways and parking: _____ For roadways: _____

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

_____

_____

_____

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: _____ HSG B: _____ HSG C: _____ HSG D: _____

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: _____ HSG B: _____ HSG C: _____ HSG D: _____

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

_____

_____

_____

I. Does the site include Karst topography? Yes: _____ No: _____

If yes, discuss measures taken to limit Karst impacts:

_____

_____

_____

_____

_____

_____

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: _____ Proposed: _____

B. Specify maximum site impervious coverage allowed by regulations: _____

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking		
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: _____ Regulations: _____

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: _____ Regulations: _____

F. Specify percentage of total site impervious cover created by buildings:

By driveways and parking: _____ By roadways: _____

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

_____

_____

_____

_____

H. Specify percentage of total impervious area that will be unconnected:

Total site: _____ Buildings: _____ Driveways and parking: _____ Roads: _____

I. Specify percentage of total impervious area that will be porous:

Total site: _____ Buildings: _____ Driveways and parking: _____ Roads: _____

J. Specify percentage of total building roof area that will be vegetated: _____

K. Specify percentage of total parking area located beneath buildings: _____

L. Specify percentage of total parking located within multi-level parking deck: _____

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: _____ Vegetated swale: _____ Natural channel: _____

Stormwater management facility: _____ Other: _____

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

_____

_____

_____

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: _____

_____

_____

Increase overland flow roughness: _____

_____

_____

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: _____

Specify the spacing between the trash receptacles: _____

Compare trash receptacles proposed with those required by regulations:

Proposed: _____ Regulations: _____

B. Pet Waste Stations

Specify the number of pet waste stations provided: _____

Specify the spacing between the pet waste stations: _____

Compare pet waste stations proposed with those required by regulations:

Proposed: _____ Regulations: _____

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: _____

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: _____ Regulations: _____

Litter collection: Proposed: _____ Regulations: _____

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

_____

_____

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: _____ Location: _____

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.		
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.		
3.	Maximize the protection of natural drainage features and vegetation.		
4.	Minimize the decrease in the pre-construction time of concentration.		
5.	Minimize land disturbance including clearing and grading.		
6.	Minimize soil compaction.		
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.		
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.		
9.	Provide preventative source controls.		

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

_____

_____

_____

_____

_____

_____

_____

_____

New Jersey Stormwater Best Management Practices Manual

April 2004

A P P E N D I X D

Model Stormwater Control Ordinance for Municipalities

Important note: *This sample ordinance is provided to assist municipalities in the development of municipal stormwater control ordinances and the incorporation of design and performance standards into municipal stormwater management plans. It is provided for information purposes only. It is important that current regulations are carefully reviewed before any portion of this draft ordinance is adopted.*
This model ordinance does not include a section on fees. The Department expects that the review of development applications under this ordinance would be an integral part of the municipal review of subdivisions and site plans. As a result, the costs to municipalities of reviewing development applications under this ordinance can be defrayed by fees charged for review of subdivisions and site plans under N.J.S.A. 40:55D-8.b.

Notes are provided in italics throughout this model stormwater control ordinance, and are not intended to be adopted as part of the ordinance.

An editable Word version of this model ordinance is available athttp://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm.

Section 1: Scope and Purpose

A. Policy Statement

Flood control, groundwater recharge, and pollutant reduction through nonstructural or low impact techniques shall be explored before relying on structural BMPs. Structural BMPs should be integrated with nonstructural stormwater management strategies and proper maintenance plans. Nonstructural strategies include both environmentally sensitive site design and source controls that prevent pollutants from being placed on the site or from being exposed to stormwater. Source control plans should be developed based upon physical site conditions and the origin, nature, and the anticipated quantity or amount of potential pollutants. Multiple stormwater management BMPs may be necessary to achieve the established performance standards for water quality, quantity, and groundwater recharge.

Note: Municipalities are encouraged to participate in the development of regional stormwater management plans, and to adopt and implement ordinances for specific drainage area performance standards that address local stormwater management and environmental characteristics.

B. Purpose

It is the purpose of this ordinance to establish minimum stormwater management requirements and controls for "major development," as defined in Section 2.

C. Applicability

1. This ordinance shall be applicable to all site plans and subdivisions for the following major developments that require preliminary or final site plan or subdivision review:

   a. Non-residential major developments; and

   b. Aspects of residential major developments that are not pre-empted by the Residential Site Improvement Standards at N.J.A.C. 5:21.

2. This ordinance shall also be applicable to all major developments undertaken by [*insert name of municipality*].

D. Compatibility with Other Permit and Ordinance Requirements

Development approvals issued for subdivisions and site plans pursuant to this ordinance are to be considered an integral part of development approvals under the subdivision and site plan review process and do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. In their interpretation and application, the provisions of this ordinance shall be held to be the minimum requirements for the promotion of the public health, safety, and general welfare. This ordinance is not intended to interfere with, abrogate, or annul any other ordinances, rule or regulation, statute, or other provision of law except that, where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, the more restrictive provisions or higher standards shall control.

Section 2: Definitions

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application. The definitions below are the same as or based on the corresponding definitions in the Stormwater Management Rules at N.J.A.C. 7:8-1.2.

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

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

"Compaction" means the increase in soil bulk density.

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

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

A county planning agency; or

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

"Department" means the New Jersey Department of Environmental Protection.

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

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

"Development" means the division of a parcel of land into two or more parcels, the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any building or structure, any mining excavation or landfill, and any use or change in the use of any building or other structure, or land or extension of use of land, 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.

"Drainage area" means a geographic area within which stormwater, sediments, or dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

"Environmentally critical areas" means 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 Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program.

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

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

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

"Infiltration" is the process by which water seeps into the soil from precipitation.

"Major development" means any "development" that provides for ultimately disturbing one or more acres of land. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

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

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

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

"Person" means any individual, corporation, company, partnership, firm, association, [*insert name of municipality*], or political subdivision of this State subject to municipal jurisdiction pursuant to the Municipal Land Use Law , N.J.S.A. 40:55D-1 et seq.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(1) Delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA1), Designated Centers, Cores or Nodes;

(2) Designated as CAFRA Centers, Cores or Nodes;

(3) Designated as Urban Enterprise Zones; and

(4) Designated as Urban Coordinating Council Empowerment Neighborhoods.

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

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

Section 3: General Standards

A. Design and Performance Standards for Stormwater Management Measures

1. Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards in Section 4. To the maximum extent practicable, these standards shall be met by incorporating nonstructural stormwater management strategies into the design. If these strategies alone are not sufficient to meet these standards, structural stormwater management measures necessary to meet these standards shall be incorporated into the design.

2. The standards in this ordinance apply only to new major development and are intended to minimize the impact of stormwater runoff on water quality and water quantity in receiving water bodies and maintain groundwater recharge. The standards do not apply to new major development to the extent that alternative design and performance standards are applicable under a regional stormwater management plan or Water Quality Management Plan adopted in accordance with Department rules.

   Note: Alternative standards shall provide at least as much protection from stormwater-related loss of groundwater recharge, stormwater quantity and water quality impacts of major development projects as would be provided under the standards in N.J.A.C. 7:8-5.

Section 4: Stormwater Management Requirements for Major Development

A. The development shall incorporate a maintenance plan for the stormwater management measures incorporated into the design of a major development in accordance with Section 10.

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

C. The following linear development projects are exempt from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements of Sections 4.F and 4.G:

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

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

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

D. A waiver from strict compliance from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements of Sections 4.F and 4.G may be obtained for the enlargement of an existing public roadway or railroad; or the construction or enlargement of a public pedestrian access, provided that the following conditions are met:

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

2. The applicant demonstrates through an alternatives analysis, that through the use of nonstructural and structural stormwater management strategies and measures, the option selected complies with the requirements of Sections 4.F and 4.G to the maximum extent practicable;

3. The applicant demonstrates that, in order to meet the requirements of Sections 4.F and 4.G, existing structures currently in use, such as homes and buildings, would need to be condemned; and

4. The applicant demonstrates that it does not own or have other rights to areas, including the potential to obtain through condemnation lands not falling under D.3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate the requirements of Sections 4.F and 4.G that were not achievable on-site.

E. Nonstructural Stormwater Management Strategies

1. To the maximum extent practicable, the standards in Sections 4.F and 4.G shall be met by incorporating nonstructural stormwater management strategies set forth at Section 4.E into the design. The applicant shall identify the nonstructural measures incorporated into the design of the project. If the applicant contends that it is not feasible for engineering, environmental, or safety reasons to incorporate any nonstructural stormwater management measures identified in Paragraph 2 below into the design of a particular project, the applicant shall identify the strategy considered and provide a basis for the contention.

2. Nonstructural stormwater management strategies incorporated into site design shall:

   a. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;

   b. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;

   c. Maximize the protection of natural drainage features and vegetation;

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

   e. Minimize land disturbance including clearing and grading;

   f. Minimize soil compaction;

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

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

   i. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site, in order to prevent or minimize the release of those pollutants into stormwater runoff. Such source controls include, but are not limited to:

(1) Site design features that help to prevent accumulation of trash and debris in drainage systems, including features that satisfy Section 4.E.3. below;

(2) Site design features that help to prevent discharge of trash and debris from drainage systems;

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

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

3. Site design features identified under Section 4.E.2.i.(2) above shall comply with the following standard to control passage of solid and floatable materials through storm drain inlets. For purposes of this paragraph, "solid and floatable materials" means sediment, debris, trash, and other floating, suspended, or settleable solids. For exemptions to this standard see Section 4.E.3.c below.

a. Design engineers shall use either of the following grates whenever they use a grate in pavement or another ground surface to collect stormwater from that surface into a storm drain or surface water body under that grate:

(1) The New Jersey Department of Transportation (NJDOT) bicycle safe grate, which is described in Chapter 2.4 of the NJDOT Bicycle Compatible Roadways and Bikeways Planning and Design Guidelines (April 1996); or

(2) A different grate, if each individual clear space in that grate has an area of no more than seven (7.0) square inches, or is no greater than 0.5 inches across the smallest dimension.

Examples of grates subject to this standard include grates in grate inlets, the grate portion (non-curb-opening portion) of combination inlets, grates on storm sewer manholes, ditch grates, trench grates, and grates of spacer bars in slotted drains. Examples of ground surfaces include surfaces of roads (including bridges), driveways, parking areas, bikeways, plazas, sidewalks, lawns, fields, open channels, and stormwater basin floors.

b. Whenever design engineers use a curb-opening inlet, the clear space in that curb opening (or each individual clear space, if the curb opening has two or more clear spaces) shall have an area of no more than seven (7.0) square inches, or be no greater than two (2.0) inches across the smallest dimension.

c. This standard does not apply:

(1) Where the review agency determines that this standard would cause inadequate hydraulic performance that could not practicably be overcome by using additional or larger storm drain inlets that meet these standards;

(2) Where flows from the water quality design storm as specified in Section 4.G.1 are conveyed through any device (e.g., end of pipe netting facility, manufactured treatment device, or a catch basin hood) that is designed, at a minimum, to prevent delivery of all solid and floatable materials that could not pass through one of the following:

(a) A rectangular space four and five-eighths inches long and one and one-half inches wide (this option does not apply for outfall netting facilities); or

(b) A bar screen having a bar spacing of 0.5 inches.

(3) Where flows are conveyed through a trash rack that has parallel bars with one-inch (1") spacing between the bars, to the elevation of the water quality design storm as specified in Section 4.G.1; or

(4) Where the New Jersey Department of Environmental Protection determines, pursuant to the New Jersey Register of Historic Places Rules at N.J.A.C. 7:4-7.2(c), that action to meet this standard is an undertaking that constitutes an encroachment or will damage or destroy the New Jersey Register listed historic property.

4. Any land area used as a nonstructural stormwater management measure to meet the performance standards in Sections 4.F and 4.G shall be dedicated to a government agency, subjected to a conservation restriction filed with the appropriate County Clerk's office, or subject to an approved equivalent restriction that ensures that measure or an equivalent stormwater management measure approved by the reviewing agency is maintained in perpetuity.

5. Guidance for nonstructural stormwater management strategies is available in the New Jersey Stormwater Best Management Practices Manual. The BMP Manual may be obtained from the address identified in Section 7, or found on the Department's website at www.njstormwater.org.

F. Erosion Control, Groundwater Recharge and Runoff Quantity Standards

1. This subsection contains minimum design and performance standards to control erosion, encourage and control infiltration and groundwater recharge, and control stormwater runoff quantity impacts of major development.

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

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

(1) The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at Section 5, either:

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

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

(2) This groundwater recharge requirement does not apply to projects within the "urban redevelopment area," or to projects subject to (3) below.

(3) The following types of stormwater shall not be recharged:

(a) Stormwater from areas of high pollutant loading. High pollutant loading areas are areas in industrial and commercial developments where solvents and/or petroleum products are loaded/unloaded, stored, or applied, areas where pesticides are loaded/unloaded or stored; areas where hazardous materials are expected to be present in greater than "reportable quantities" as defined by the United States Environmental Protection Agency (EPA) at 40

CFR 302.4; areas where recharge would be inconsistent with Department approved remedial action work plan or landfill closure plan and areas with high risks for spills of toxic materials, such as gas stations and vehicle maintenance facilities; and

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

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

c. In order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at Section 5, complete one of the following:

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

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

(3) Design stormwater management measures so that the post-construction peak runoff rates for the 2, 10 and 100 year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed. The percentages shall not be applied to post-construction stormwater runoff into tidal flood hazard areas if the increased volume of stormwater runoff will not increase flood damages below the point of discharge; or

(4) In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with (1), (2) and (3) above shall only be applied if the increased volume of stormwater runoff could increase flood damages below the point of discharge.

2. Any application for a new agricultural development that meets the definition of major development at Section 2 shall be submitted to the appropriate Soil Conservation District for review and approval in accordance with the requirements of this section and any applicable Soil Conservation District guidelines for stormwater runoff quantity and erosion control. For the purposes of this section, "agricultural development" means land uses normally associated with the production of food, fiber and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacturing of agriculturally related products.

G. Stormwater Runoff Quality Standards

1. Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff by 80 percent of the anticipated load from the developed site, expressed as an annual average. Stormwater management measures shall only be required for water quality control if an additional 1/4 acre of impervious surface is being proposed on a development site. The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollution Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit from this requirement. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

Table 1: Water Quality Design Storm Distribution

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

2. For purposes of TSS reduction calculations, Table 2 below presents the presumed removal rates for certain BMPs designed in accordance with the New Jersey Stormwater Best Management Practices Manual. The BMP Manual may be obtained from the address identified in Section 7, or found on the Department's website at www.njstormwater.org. The BMP Manual and other sources of technical guidance are listed in Section 7. TSS reduction shall be calculated based on the removal rates for the BMPs in Table 2 below. Alternative removal rates and methods of calculating removal rates may be used if the design engineer provides documentation demonstrating the capability of these alternative rates and methods to the review agency. A copy of any approved alternative rate or method of calculating the removal rate shall be provided to the Department at the following address: Division of Watershed Management, New Jersey Department of Environmental Protection, PO Box 418 Trenton, New Jersey, 08625-0418.

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

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

   Where

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

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

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

Table 2: TSS Removal Rates for BMPs

Best Management Practice	TSS Percent Removal Rate
Bioretention Systems	90
Constructed Stormwater Wetland	90
Extended Detention Basin	40-60
Infiltration Structure	80
Manufactured Treatment Device	See Section 6.C
Sand Filter	80
Vegetative Filter Strip	60-80
Wet Pond	50-90

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

5. Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction nutrient load of the anticipated load from the developed site in stormwater runoff generated from the water quality design storm. In achieving reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural

measures that optimize nutrient removal while still achieving the performance standards in Sections 4.F and 4.G.

6. Additional information and examples are contained in the New Jersey Stormwater Best Management Practices Manual, which may be obtained from the address identified in Section 7.

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

8. Special water resource protection areas shall be established along all waters designated Category One at N.J.A.C. 7:9B, and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC14 drainage area. These areas shall be established for the protection of water quality, aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries significance of those established Category One waters. These areas shall be designated and protected as follows:

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

      (1) A 300-foot special water resource protection area shall be provided on each side of the waterway, measured perpendicular to the waterway from the top of the bank outwards or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided. (2) Encroachment within the designated special water resource protection area under Subsection (1) above shall only be allowed where previous development or disturbance has occurred (for example, active agricultural use, parking area or maintained lawn area). The encroachment shall only be allowed where applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable. In no case shall the remaining special water resource protection area be reduced to less than 150 feet as measured perpendicular to the top of bank of the waterway or centerline of the waterway where the bank is undefined. All encroachments proposed under this subparagraph shall be subject to review and approval by the Department.

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

   c. If stormwater discharged outside of and flowing through the special water resource protection area cannot comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act , N.J.S.A. 4:24-39 et seq., then the stabilization measures in accordance with the requirements of the above standards may be placed within the special water resource protection area, provided that:

      (1) Stabilization measures shall not be placed within 150 feet of the Category One waterway;

      (2) Stormwater associated with discharges allowed by this section shall achieve a 95 percent TSS post-construction removal rate;

      (3) Temperature shall be addressed to ensure no impact on the receiving waterway;

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

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

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

d. A stream corridor protection plan may be developed by a regional stormwater management planning committee as an element of a regional stormwater management plan, or by a municipality through an adopted municipal stormwater management plan. If a stream corridor protection plan for a waterway subject to Section 4.G(8) has been approved by the Department of Environmental Protection, then the provisions of the plan shall be the applicable special water resource protection area requirements for that waterway. A stream corridor protection plan for a waterway subject to G.8 shall maintain or enhance the current functional value and overall condition of the special water resource protection area as defined in G.8.a.(1) above. In no case shall a stream corridor protection plan allow the reduction of the Special Water Resource Protection Area to less than 150 feet as measured perpendicular to the waterway subject to this subsection.

e. Paragraph G.8 does not apply to the construction of one individual single family dwelling that is not part of a larger development on a lot receiving preliminary or final subdivision approval on or before February 2, 2004 , provided that the construction begins on or before February 2, 2009.

Section 5: Calculation of Stormwater Runoff and Groundwater Recharge

A. Stormwater runoff shall be calculated in accordance with the following:

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

a. The USDA Natural Resources Conservation Service (NRCS) methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in the NRCS National Engineering Handbook Section 4 – Hydrology and Technical Release 55 – Urban Hydrology for Small Watersheds; or

b. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations.

2. For the purpose of calculating runoff coefficients and groundwater recharge, there is a presumption that the pre-construction condition of a site or portion thereof is a wooded land use with good hydrologic condition. The term "runoff coefficient" applies to both the NRCS methodology at Section 5.A.1.a and the Rational and Modified Rational Methods at Section 5.A.1.b. A runoff coefficient or a groundwater recharge land cover for an existing condition may be used on all or a portion of the site if the design engineer verifies that the hydrologic condition has existed on the site or portion of the site for at least five years without interruption prior to the time of application. If more than one land cover have existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations. In addition, there is the presumption that the site is in good hydrologic condition (if the land use type is pasture, lawn, or park), with good cover (if the land use type is woods), or with good hydrologic condition and conservation treatment (if the land use type is cultivation).

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

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

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

B. Groundwater recharge may be calculated in accordance with the following:

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

Section 6: Standards for Structural Stormwater Management Measures

A. Standards for structural stormwater management measures are as follows:

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

2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure as appropriate, and shall have parallel bars with one-inch (1") spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third (1/3) the width of the diameter of the orifice or one-third (1/3) the width of the weir, with a minimum spacing between bars of one-inch and a maximum spacing between bars of six inches. In addition, the design of trash racks must comply with the requirements of Section 8.D.

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

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

5. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at Section 8.

B. Stormwater management measure guidelines are available in the New Jersey Stormwater Best Management Practices Manual. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, groundwater recharge and water quality design and performance standards established by Section 4 of this ordinance.

C. Manufactured treatment devices may be used to meet the requirements of Section 4 this ordinance, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department.

Section 7: Sources for Technical Guidance

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

1. Guidelines for stormwater management measures are contained in the New Jersey Stormwater Best Management Practices Manual, as amended. Information is provided on stormwater management measures such as: bioretention systems, constructed stormwater wetlands, dry wells, extended detention basins, infiltration structures, manufactured treatment devices, pervious paving, sand filters, vegetative filter strips, and wet ponds.

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

B. Additional technical guidance for stormwater management measures can be obtained from the following:

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

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

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

Section 8: Safety Standards for Stormwater Management Basins

A. This section sets forth requirements to protect public safety through the proper design and operation of stormwater management basins. This section applies to any new stormwater management basin.

Note: The provisions of this section are not intended to preempt more stringent municipal or county safety requirements for new or existing stormwater management basins. Municipal and county stormwater management plans and ordinances may, pursuant to their authority, require existing stormwater management basins to be retrofitted to meet one or more of the safety standards in Sections 8.B.1, 8.B.2, and 8.B.3 for trash racks, overflow grates, and escape provisions at outlet structures.

B. Requirements for Trash Racks, Overflow Grates and Escape Provisions

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

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

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

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

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

2. An overflow grate is designed to prevent obstruction of the overflow structure. If an outlet structure has an overflow grate, such grate shall meet the following requirements:

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

   b. The overflow grate spacing shall be no less than two inches across the smallest dimension.

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

3. For purposes of this paragraph 3, escape provisions means the permanent installation of ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. Stormwater management basins shall include escape provisions as follows:

   a. If a stormwater management basin has an outlet structure, escape provisions shall be incorporated in or on the structure. With the prior approval of the reviewing agency identified in Section 8.C a free-standing outlet structure may be exempted from this requirement.

   b. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Such safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located approximately two and one-half feet below the permanent water surface, and the second step shall be located one to

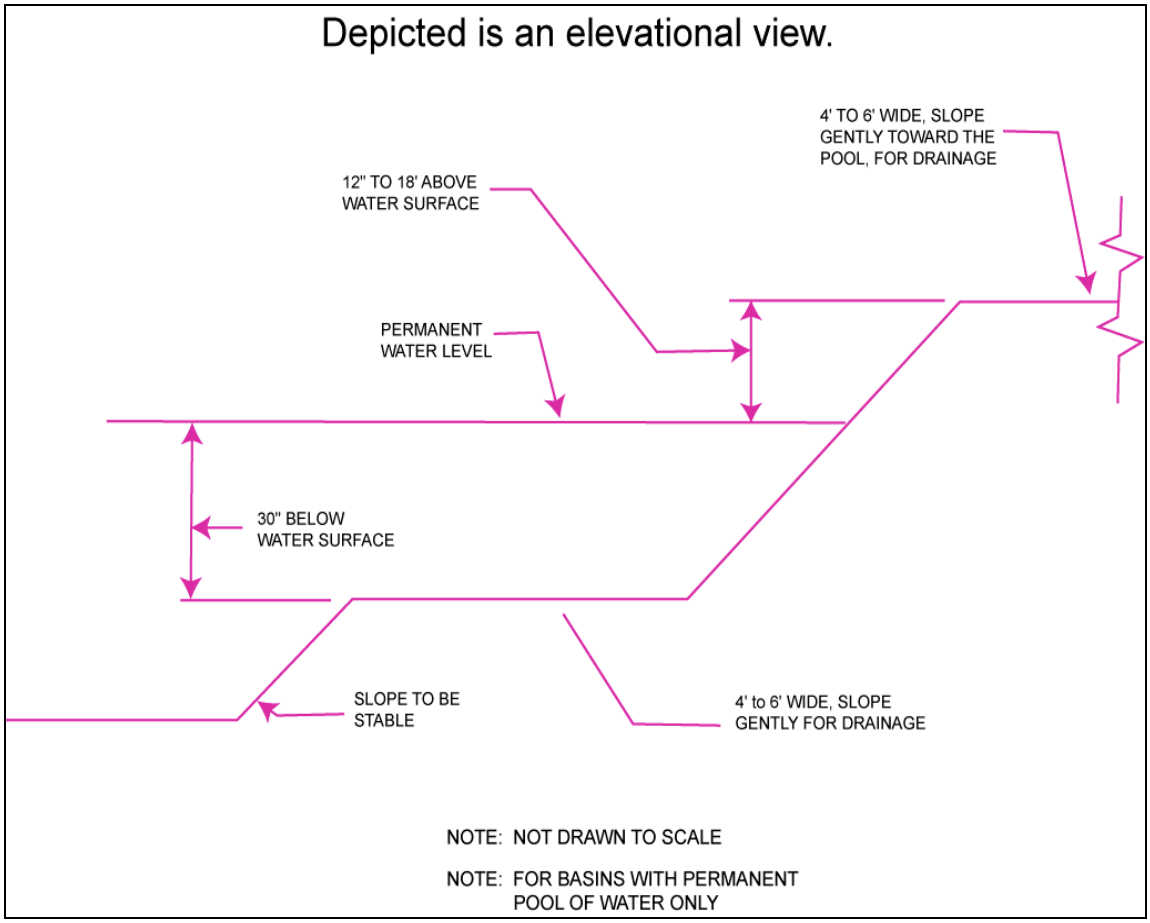
one and one-half feet above the permanent water surface. See Section 8.D for an illustration of safety ledges in a stormwater management basin.

c. In new stormwater management basins, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than 3 horizontal to 1 vertical.

C. Variance or Exemption from Safety Standards

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

D. Illustration of Safety Ledges in a New Stormwater Management Basin



Section 9: Requirements for a Site Development Stormwater Plan

A. Submission of Site Development Stormwater Plan

1. Whenever an applicant seeks municipal approval of a development subject to this ordinance, the applicant shall submit all of the required components of the Checklist for the Site Development Stormwater Plan at Section 9.C below as part of the submission of the applicant's application for subdivision or site plan approval.

2. The applicant shall demonstrate that the project meets the standards set forth in this ordinance.

3. The applicant shall submit [*specify number*] copies of the materials listed in the checklist for site development stormwater plans in accordance with Section 9.C of this ordinance.

B. Site Development Stormwater Plan Approval

The applicant's Site Development project shall be reviewed as a part of the subdivision or site plan review process by the municipal board or official from which municipal approval is sought. That municipal board or official shall consult the engineer retained by the Planning and/or Zoning Board (as appropriate) to determine if all of the checklist requirements have been satisfied and to determine if the project meets the standards set forth in this ordinance.

C. Checklist Requirements

The following information shall be required:

1. Topographic Base Map

The reviewing engineer may require upstream tributary drainage system information as necessary. It is recommended that the topographic base map of the site be submitted which extends a minimum of 200 feet beyond the limits of the proposed development, at a scale of 1"=200' or greater, showing 2-foot contour intervals. The map as appropriate may indicate the following: existing surface water drainage, shorelines, steep slopes, soils, erodible soils, perennial or intermittent streams that drain into or upstream of the Category One waters, wetlands and flood plains along with their appropriate buffer strips, marshlands and other wetlands, pervious or vegetative surfaces, existing man-made structures, roads, bearing and distances of property lines, and significant natural and manmade features not otherwise shown.

2. Environmental Site Analysis

A written and graphic description of the natural and man-made features of the site and its environs. This description should include a discussion of soil conditions, slopes, wetlands, waterways and vegetation on the site. Particular attention should be given to unique, unusual, or environmentally sensitive features and to those that provide particular opportunities or constraints for development.

3. Project Description and Site Plan(s)

A map (or maps) at the scale of the topographical base map indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural facilities for stormwater management and sediment control, and other permanent structures. The map(s) shall also clearly show areas where alterations occur in the natural terrain and cover, including lawns and other landscaping, and seasonal

high ground water elevations. A written description of the site plan and justification of proposed changes in natural conditions may also be provided.

4. Land Use Planning and Source Control Plan

   This plan shall provide a demonstration of how the goals and standards of Sections 3 through 6 are being met. The focus of this plan shall be to describe how the site is being developed to meet the objective of controlling groundwater recharge, stormwater quality and stormwater quantity problems at the source by land management and source controls whenever possible.

5. Stormwater Management Facilities Map

   The following information, illustrated on a map of the same scale as the topographic base map, shall be included:

   a. Total area to be paved or built upon, proposed surface contours, land area to be occupied by the stormwater management facilities and the type of vegetation thereon, and details of the proposed plan to control and dispose of stormwater.

   b. Details of all stormwater management facility designs, during and after construction, including discharge provisions, discharge capacity for each outlet at different levels of detention and emergency spillway provisions with maximum discharge capacity of each spillway.

6. Calculations

   a. Comprehensive hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in Section 4 of this ordinance.

   b. When the proposed stormwater management control measures (e.g., infiltration basins) depends on the hydrologic properties of soils, then a soils report shall be submitted. The soils report shall be based on onsite boring logs or soil pit profiles. The number and location of required soil borings or soil pits shall be determined based on what is needed to determine the suitability and distribution of soils present at the location of the control measure.

7. Maintenance and Repair Plan

   The design and planning of the stormwater management facility shall meet the maintenance requirements of Section 10.

8. Waiver from Submission Requirements

   The municipal official or board reviewing an application under this ordinance may, in consultation with the municipal engineer, waive submission of any of the requirements in Sections 9.C.1 through 9.C.6 of this ordinance when it can be demonstrated that the information requested is impossible to obtain or it would create a hardship on the applicant to obtain and its absence will not materially affect the review process.

Section 10: Maintenance and Repair

A. Applicability

1. Projects subject to review as in Section 1.C of this ordinance shall comply with the requirements of Sections 10.B and 10.C.

B. General Maintenance

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

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

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

4. If the person responsible for maintenance identified under Section 10.B.2 above is not a public agency, the maintenance plan and any future revisions based on Section 10.B.7 below shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

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

6. The person responsible for maintenance identified under Section 10.B.2 above shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

7. The person responsible for maintenance identified under Section 10.B.2 above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

8. The person responsible for maintenance identified under Section 10.B.2 above shall retain and make available, upon request by any public entity with administrative, health, environmental, or safety authority over the site, the maintenance plan and the documentation required by Sections 10.B.6 and 10.B.7 above.

9. The requirements of Sections 10.B.3 and 10.B.4 do not apply to stormwater management facilities that are dedicated to and accepted by the municipality or another governmental agency.

   (Note: It may be appropriate to delete requirements in the maintenance and repair plan that are not applicable if the ordinance requires the facility to be dedicated to the municipality. If the municipality does not want to take this responsibility, the ordinance should require the posting of a two year maintenance guarantee in accordance with N.J.S.A. 40:55D-53. Guidelines for developing a maintenance and inspection program are provided in the New Jersey Stormwater Best Management Practices Manual and the NJDEP Ocean County Demonstration Study, Stormwater Management Facilities Maintenance Manual, dated June 1989 available from the NJDEP, Watershed Management Program.)

10. In the event that the stormwater management facility becomes a danger to public safety or public health, or if it is in need of maintenance or repair, the municipality shall so notify the responsible person in writing. Upon receipt of that notice, the responsible person shall have fourteen (14) days to effect maintenance and repair of the facility in a manner that is approved by the municipal engineer or his designee. The municipality, in its discretion, may extend the time allowed for effecting maintenance and repair for good cause. If the responsible person fails or refuses to perform such maintenance and repair, the municipality or County may immediately proceed to do so and shall bill the cost thereof to the responsible person.

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

Section 11: Penalties

Any person who erects, constructs, alters, repairs, converts, maintains, or uses any building, structure or land in violation of this ordinance shall be subject to the following penalties: [*Municipality to specify*].

Section 12: Effective Date

This ordinance shall take effect immediately upon the approval by the county review agency, or sixty (60) days from the receipt of the ordinance by the county review agency if the county review agency should fail to act.

Section 13: Severability

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

RIPARIAN BUFFER CONSERVATION ZONE MODEL ORDINANCE

October 2004

I. INTENT AND PURPOSE

The governing body of *[municipality]* finds that riparian lands adjacent to streams, lakes, or other surface water bodies that are appropriately vegetated provide important environmental protection and resource management benefits. It is necessary to protect and maintain the beneficial character of riparian areas by implementing specifications for the establishment, protection, and maintenance of vegetation along the surface water bodies within the jurisdiction of *[municipality]*, consistent with the interest of landowners in making reasonable economic use of parcels of land that include such designated areas. The purpose of this Ordinance is to designate Riparian Buffer Conservation Zones, and to provide for land use regulation therein in order to protect the streams, lakes, and other surface water bodies of *[municipality]*; to protect the water quality of watercourses, reservoirs, lakes, and other significant water resources within *[municipality]*; to protect the riparian and aquatic ecosystems of *[municipality]*; and to provide for the environmentally sound use of the land resources of *[municipality]*. The specific purposes and intent of this Ordinance are to:

A. Restore and maintain the chemical, physical, and biological integrity of the water resources of *[municipality]*;
B. Prevent excessive nutrients, sediment, and organic matter, as well as biocides and other pollutants, from reaching surface waters by optimizing opportunities for filtration, deposition, absorption, adsorption, plant uptake, biodegradation, and denitrification, which occur when stormwater runoff is conveyed through vegetated buffers as stable, distributed sheet flow prior to reaching receiving waters;
C. Provide for shading of the aquatic environment so as to moderate temperatures, retain more dissolved oxygen, and support a healthy assemblage of aquatic flora and fauna
D. Provide for natural organic matter (fallen leaves and twigs) and large woody debris (fallen trees and limbs) that provide food and habitat for small bottom dwelling organisms (insects, amphibians, crustaceans, and small fish), which are essential to maintain the food chain;

E. Increase stream bank stability and maintain natural fluvial geomorphology of the stream system, thereby reducing stream bank erosion and sedimentation and protecting habitat for aquatic organisms;
F. Maintain base flows in streams and moisture in wetlands;
G. Control downstream flooding; and
H. Conserve the natural features important to land and water resources, e.g., headwater areas, groundwater recharge zones, floodways, floodplains, springs, streams, wetlands, woodlands, and prime wildlife habitats.

II. STATUTORY AUTHORITY

The municipality of *[municipality]* is empowered to regulate land uses under the provisions of the New Jersey Municipal Land Use Law, N.J.S.A 40:55D-1 *et seq.*, which authorizes each municipality to plan and regulate land use in order to protect public health, safety and welfare by protecting and maintaining native vegetation in riparian areas. *[Municipality]* is also empowered to adopt and implement this Ordinance under provisions provided by the following legislative authorities of the State of New Jersey:

A. Water Pollution Control Act, N.J.S.A. 58:10A *et seq.*
B. Water Quality Planning Act, N.J.S.A. 58:11A-1 *et seq.*
C. Spill Compensation and Control Act, N.J.S.A. 58:10-23 *et seq.*
D. Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 *et seq.*
E. Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 *et seq.*

III. DEFINITIONS

Administrative Authority means the Planning Board or Board of Adjustment or Construction Office with all of the powers delegated, assigned, or assumed by them according to statute or ordinance.

Applicant means a person applying to the Planning Board, Board of Adjustment or the Construction Office proposing to engage in an activity that is regulated by the provisions of this ordinance, and that would be located within a regulated Riparian Buffer Conservation Zone.

Category One (C1) Waters are those waters, designated in the Surface Water Quality Standards at N.J.A.C. 7:9B-1.15, which have been identified for protection from degradation in water quality characteristics because of their clarity, color, scenic setting, and other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources.

Floodway shall have the meaning ascribed to this term by the Flood Hazard Area Control Act (N.J.S.A. 58:16A-50 *et seq.*) and regulations promulgated there under published at N.J.A.C. 7.13 *et seq.*, and any supplementary or successor legislation and regulations from time to time enacted or promulgated.

Intermittent Stream means surface water drainage channels with definite bed and banks in which there is not a permanent flow of water. Streams shown as a dashed line on either the USGS topographic quadrangle maps or the USDA County Soil Survey Maps of the most recent edition that includes hydrography are included as intermittent streams.

Lake, pond, or reservoir means any impoundment, whether naturally occurring or created in whole or in part by the building of structures for the retention of surface water, excluding

sedimentation control and stormwater retention/detention basins and ponds designed for treatment of wastewater.

Perennial stream means a stream that flows continuously throughout the year in most years. These streams appear as a blue line on USGS topographic quadrangle maps or on USDA County Soil Survey Maps.

Riparian Buffer Conservation Zone (RBCZ) means an area of land or water within or adjacent to a Surface Water Body within the municipality and designated on the Riparian Buffer Conservation Zone Map promulgated by *[municipality]* in accordance with Section IV of this Ordinance.

Riparian Buffer Conservation Zone Management Plan means a plan approved by the Engineer of *[municipality]*. The plan shall be prepared by a landscape architect, professional engineer or other qualified professional, and shall fully evaluate the effects of any proposed activity/uses on any RBCZ. The plan shall identify existing conditions, all proposed activities, and all proposed management techniques, including any measures necessary to offset disturbances to any affected RBCZ.

Surface Water Body means any perennial stream, intermittent stream, lake, pond, or reservoir, as defined herein. In addition, any state open waters identified in a letter of interpretation issued by the New Jersey Department of Environmental Protection Land Use Regulation Program shall also be considered surface water bodies.

IV. ESTABLISHMENT OF RIPARIAN BUFFER CONSERVATION ZONES

A. Riparian Buffer Conservation Zones (RBCZs) shall be delineated as follows:

1. In the case of Category One (C1) waters, the RBCZ shall equal the Special Water Resource Protection Area, and shall be measured as defined at N.J.A.C. 7:8-5.5(h). Special Water Resource Protection Areas are established along all waters designated as C1 at N.J.A.C. 7:9B and perennial or intermittent streams that drain into or upstream of the C1 waters as shown on the USGS quadrangle map or in the County Soil Surveys within the associated HUC 14 drainage.
2. For areas that are not Special Water Resource Protection Areas, the RBCZ shall be measured from the top of bank of an intermittent or perennial stream, or centerline if bank is not defined, or lake, pond or reservoir at bank-full flow or level, and shall extend 75 feet horizontally outward from the perpendicular. Where steep slopes (in excess of 10 percent) are located within the designated widths, the RBCZ shall be extended to include the entire distance of this sloped area.
3. For areas adjacent to surface water bodies for which the Floodway has been delineated, the RBCZ shall cover the entire Floodway area, or the area described in Section IV.A.1. or IV.A.2., whichever area has the greatest extent. Floodway delineations shall be based upon the State's adopted floodway delineations. However, requests for alterations to the adopted delineations can be provided to the New Jersey Department of Environmental Protection for consideration if site specific information is available.

B. An RBCZ is an overlay to the existing zoning districts. The provisions of the underlying district shall remain in full force, except where the provisions of the RBCZ differ from the provisions of the underlying district, in which case the provision which is more restrictive, and less permissive, to a landowner or applicant shall apply. These provisions are intended to modify the type of land use, siting of structures, and engineering of all proposed development on parcels located within the RBCZ. These provisions apply to land disturbances resulting

from or related to any activity or use requiring application for any of the following permits or approvals:

- Building permit
- Zoning variance
- Special exception
- Conditional use
- Subdivision/land development approval

C. A map of the RBCZs of the entire municipality of *[municipality]*, including all land and water areas within its boundaries, which designates Surface Water Bodies, is included as part of this Ordinance, and is appended as *[municipality to insert Figure # here]*. Maps of the municipality on which these designations have been overlain shall be on file and maintained by the offices of the Clerk of *[municipality]*. This map conforms to all applicable laws, rules and regulations applicable to the creation, modification and promulgation of zoning maps.

D. It shall be the duty of the Engineer of [municipality], every second year after the adoption of this Ordinance, to propose modifications to the map delineating Riparian Buffer Conservation Zones required by any naturally occurring or permitted change in the location of a defining feature of a surface water body occurring after the initial adoption of the RBCZ map, to record all modifications to the RBCZ map required by decisions or appeals under Section XI, and by changes made by the New Jersey Department of Environmental Protection in surface water classifications or Floodway delineations. Floodway delineations shall be based upon the State's adopted floodway delineations. However requests for alterations to the adopted delineations can be provided to the Department for consideration if site specific information is available.

E. The applicant or designated representative shall be responsible for the initial determination of the presence of an RBCZ on a site, and for identifying the area on any plan submitted to the *[municipality]* in conjunction with an application for a construction permit, subdivision, land development, or other improvement that requires plan submissions or permits. This initial determination shall be subject to review and approval by the municipal engineer, governing body, or its appointed representative, and, where required, by the New Jersey Department of Environmental Protection.

F. The municipal Master Plan provides the legal basis for zoning and land use regulation at the local level. The technical foundation for local RBCZs in this municipality should be incorporated into the Master Plan. A technical report on the need for Riparian Buffer Conservation Zones in *[municipality]* may be adopted as part of the Master Plan (N.J.S.A 40:55D-28b(11)). The technical report should include the following information:

1. A statement setting forth the rationale and need to protect RBCZs.
2. Reference to the methods used to designate and delineate RBCZs.

V. USES PERMITTED IN RIPARIAN BUFFER CONSERVATION ZONES

A. For Category One (C1) RBCZs, permitted uses are governed by N.J.A.C. 7:8-5.5(h), unless otherwise exempt.

B. Any other RBCZ area shall remain in a natural condition or, if in a disturbed condition, including agricultural activities, at the time of adoption of this ordinance, may be restored to a natural condition. There shall be no clearing or cutting of trees and brush, except for

removal of dead vegetation and pruning for reasons of public safety or for the replacement of invasive species with indigenous species, altering of watercourses, dumping of trash, soil, dirt, fill, vegetative or other debris, regrading or construction. The following uses are permitted either by right or after review and approval by the municipality in RBCZs. No new construction, development, use, activity, encroachment, or structure shall take place in an RBCZ, except as specifically authorized in this Section. The following uses shall be permitted within an RBCZ:

1. Open space uses that are primarily passive in character shall be permitted by right to extend into an RBCZ, provided near stream vegetation is preserved. These uses do not require approval by the Zoning Enforcement Officer or compliance with an approved RBCZ Management Plan. Such uses include wildlife sanctuaries, nature preserves, forest preserves, fishing areas, game farms, fish hatcheries and fishing reserves, operated for the protection and propagation of wildlife, but excluding structures, and passive recreation areas of public and private parklands, including unpaved hiking, bicycle and bridle trails, provided that said trail have been stabilized with pervious materials.
2. Fences, for which a permit has been issued by the Construction Code Office, to the extent required by applicable law, rule or regulation, are permitted.
3. Crossings by farm vehicles and livestock, recreational trails, roads, railroads, storm water lines, sanitary sewer lines, water lines and public utility transmission lines, provided that the land disturbance is the minimum required to accomplish the permitted use, shall be permitted, subject to approval by the Zoning Enforcement Officer, provided that any applicable State permits are acquired, and provided that any disturbance is offset by buffer improvements in compliance with an approved RBCZ Management Plan.
4. Stream bank stabilization or riparian reforestation, which conform to the guidelines of an approved RBCZ Management Plan, or wetlands mitigation projects that have been approved by the Department of Environmental Protection, are permitted to extend into an RBCZ, subject to approval by the Zoning Enforcement Officer and subject to compliance with an approved RBCZ Management Plan.

VI. PERFORMANCE STANDARDS FOR RIPARIAN BUFFER CONSERVATION ZONES

A. All encroachments proposed into Category One (C1) RBCZs shall comply with the requirements at N.J.A.C. 7:8-5.5(h) and shall be subject to review and approval by the New Jersey Department of Environmental Protection.
B. For all other RBCZs, the following conditions shall apply:
   1. All new major and minor subdivisions and site plans shall be designed to provide sufficient areas outside of the RBCZ to accommodate primary structures, any normal accessory uses appurtenant thereto, as well as all planned lawn areas.
   2. Portions of lots within the RBCZ must be permanently restricted by deed or conservation easement held by *[municipality]* to prevent clearing of vegetation within the RBCZ. A complete copy of the recorded conservation restriction that clearly identifies the deed book and pages where it has been recorded in the office of the clerk of the applicable county or the registrar of deeds and mortgages of the applicable county must be submitted to the municipality. The applicant shall not commence with the project or activity prior to making this submittal and receiving actual approval of the plan modification and receipt of any applicable permits from the Department of

Environmental Protection. The recorded conservation restriction shall be in the form approved by the municipality and shall run with the land and be binding upon the property owner and the successors in interest in the property or in any part thereof. The conservation restriction may include language reserving the right to make *de minimus* changes to accommodate necessary regulatory approvals upon the written consent of the municipality, provided such changes are otherwise consistent with this chapter. The recorded conservation restriction shall, at a minimum, include:

a. A written narrative of the authorized regulated activity, date of issuance, and date of expiration, and the conservation restriction that, in addition, includes all of the prohibitions set forth at N.J.S.A. 13:8B-2b(1) through (7);
b. Survey plans for the property as a whole and, where applicable, for any additional properties subject to the conservation restrictions. Such survey plans shall be submitted on the surveyor's letterhead, signed and sealed by the surveyor, and shall include metes and bounds descriptions of the property, the site, and the areas subject to the conservation restriction in New Jersey State Plane Coordinates, North American Datum 1983, and shall depict the boundaries of the site and all areas subject to the conservation restriction as marked with flags or stakes onsite. All such survey plans shall be submitted on paper and in digital CAD or GIS file on a media and format defined by the municipality. The flags or stakes shall be numbered and identified on the survey plan; and
c. A copy or copies of deeds for the property as a whole that indicate the deed book and pages where it has been recorded in the office of the clerk of the applicable county or the registrar of deeds and mortgages of the applicable county.

3. Any lands proposed for development which include all or a portion of an RBCZ shall as a condition of any major subdivision or major site plan approval, provide for the vegetation or revegetation of any portions of the RBCZ which are not vegetated at the time of the application or which were disturbed by prior land uses, including for agricultural use. Said vegetation plan shall utilize native tree and plant species in accordance with an approved Riparian Buffer Conservation Zone Management Plan, described in Section X.
4. Minimum front, side, and rear setbacks required for building lots which exist as of the date of adoption of this ordinance, but have not obtained a building permit, may extend into the RBCZ, provided that a deed restriction and/or conservation easement is applied which prohibits clearing or construction in the RBCZ.
5. All stormwater shall be discharged outside of but may flow through an RBCZ and shall comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey", established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 *et seq.* (See N.J.A.C. 2:90-1.3.)
6. If stormwater discharged outside of and flowing through an RBCZ cannot comply with the Standard For Off-Site Stability cited in Section VI.E., then the stabilization measures in accordance with the requirements of the above standards may be placed within the RBCZ, provided that:
   a. Stabilization measures shall not be placed closer than 50 feet from the top of the bank at bank-full flow or level of other surface water bodies.
   b. The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall conditions of the RBCZ will be maintained to the maximum extent practicable;

c. A conceptual project design meeting shall be held with the appropriate municipal staff and Soil Conservation District staff to identify necessary stabilization measures; and
d. All encroachments proposed under this section shall be subject to review and approval by the Administrative Authority.

VII. NONCONFORMING STRUCTURES AND USES IN RIPARIAN BUFFER CONSERVATION ZONES

Nonconforming structures and uses of land within the RBCZ are subject to the following requirements:

A. Legally existing but nonconforming structures or uses may be continued.
B. Any proposed enlargement or expansion of the building footprint within a Category One (C1) RBCZ shall comply with the standards in N.J.A.C. 7:8-5.5(h).
C. For all other RBCZs:
   1. The existing building footprint or uses shall not be expanded or enlarged.
   2. Discontinued nonconforming uses may be resumed any time within one year from such discontinuance but not thereafter when showing clear indications of abandonment. No change or resumption shall be permitted that is more detrimental to the RBCZ, as measured against the intent and purpose under Section I, than the existing or former nonconforming use. This one-year time frame shall not apply to agricultural uses that are following prescribed Best Management Practices for crop rotation. However, resumption of agricultural uses must be strictly confined to the extent of disturbance existing at the time of adoption of this ordinance.

VIII. USES PROHIBITED IN RIPARIAN BUFFER CONSERVATION ZONES

A. Any use within a Category One (C1) RBCZ shall comply with the standards in N.J.A.C. 7:8-5.5(h).
B. For other RBCZs, any use or activity not specifically authorized in Section V or Section VII shall be prohibited within the RBCZ. By way of example, the following activities and facilities are prohibited:
   1. Removal or clear-cutting of trees and other vegetation or soil disturbance such as grading.
   2. Storage of any hazardous or noxious materials.
   3. Use of fertilizers, pesticides, herbicides, and/or other chemicals in excess of prescribed industry standards or the recommendations of the Soil Conservation District.
   4. Roads or driveways, except where permitted in compliance with Section V.
   5. Motor or wheeled vehicle traffic in any area, except as permitted by this Ordinance.
   6. Parking lots.
   7. Any type of permanent structure, except structures needed for a use permitted by Section V.
   8. New subsurface sewage disposal areas.
   9. Residential grounds or lawns, except as otherwise permitted pursuant to this Ordinance.

IX. ACTIVITIES PERMITTED IN STREAM BUFFER CONSERVATION ZONES IN THE CASE OF NO REASONABLE OR PRUDENT ALTERNATIVE OR EXTREME HARDSHIP

A. For Category One (C1) RBCZs, requests for exemptions must be authorized by the New Jersey Department of Environmental Protection.
B. For other RBCZs, hardship variances may be granted by the Zoning Board of Adjustment in cases of a preexisting lot (existing at the time of adoption of this ordinance), when there is insufficient room outside the RBCZ for uses permitted by the underlying zoning and there is no other reasonable or prudent alternative to placement in the RBCZ, including obtaining variances from setback or other requirements that would allow conformance with the RBCZ requirements, and provided the following demonstrations are made:
   1. An applicant shall be deemed to have established the existence of an extreme economic hardship, as distinguished from mere inconvenience, if the subject property is not capable of yielding a reasonable economic return if its present use is continued or if it is developed in accordance with provisions of this ordinance and that this inability to yield a reasonable economic return results from unique circumstances peculiar to the subject property which:
      a. Do not apply to or affect other property in the immediate vicinity;
      b. Relate to or arise out of the characteristics of the subject property because of the particular physical surroundings, shape or topographical conditions of the property involved, rather than the personal situations of the applicant; and
      c. Are not the result of any action or inaction by the applicant or the owner or his predecessors in title. The necessity of acquiring additional land to locate development outside the RBCZ shall not be considered an economic hardship unless the applicant can demonstrate that there is no adjacent land that is reasonably available.
   2. An applicant shall be deemed to have established compelling public need if the applicant demonstrates, based on specific facts, that:
      a. The proposed project will serve an essential public health or safety need;
      b. The proposed use is required to serve an existing public health or safety need; or
      c. There is no alternative available to meet the established public health or safety need.
   3. A variance can only be granted if it is shown that the activity will not be materially detrimental or injurious to other property or improvements in the area in which the subject property is located and will not endanger public safety; and the exception granted is the minimum relief necessary to relieve the hardship.
C. If the above demonstrations are made, then the encroachment of impervious surfaces (structures or pavement) otherwise permitted by the underlying zoning is permitted to the extent of 750 square feet total. Said encroachment is not permitted closer than 50 feet from the top of the bank at bank-full flow or level of the surface water bodies.
D. If such an exception is granted, the applicant shall rehabilitate an environmentally degraded RBCZ area within or adjacent to the same site, and at least equivalent in size to the RBCZ reduction permitted, or, if not possible, rehabilitate or expand an RBCZ area at least equivalent in size within a nearby site and, if available, within the same watershed. Rehabilitation shall include reforestation, stream bank stabilization and removal of debris, in accordance with an RBCZ Management Plan.

X. RIPARIAN BUFFER CONSERVATION ZONE MANAGEMENT PLAN

A. Within any RBCZ, no construction, development, use, activity, or encroachment shall be permitted unless the effects of such development are accompanied by preparation, approval, and implementation of a Riparian Buffer Conservation Zone Management Plan.
B. The landowner, applicant, or developer shall submit to *[municipal contact],* or its appointed representative, a Riparian Buffer Conservation Zone Management Plan prepared by an environmental professional, professional engineer or other qualified professional which fully evaluates the effects of any proposed uses on the RBCZ. The Riparian Buffer Conservation Zone Management Plan shall identify the existing conditions including:
   1. Existing vegetation;
   2. Field delineated surface water bodies;
   3. Field delineated wetlands;
   4. The 100-year floodplain;
   5. Flood Hazard Areas, including Floodway and Flood Fringe areas, as delineated by the New Jersey Department of Environmental Protection;
   6. Soil classifications as found on Soil Surveys;
   7. Existing subdrainage areas of site with HUC-14 (Hydrologic Unit Code) designations; and
   8. Slopes in each subdrainage area segmented into sections of slopes less than or equal to ten (10) percent; above ten percent but less that 20 percent; and greater than twenty (20) percent.

   The proposed plan shall describe all proposed uses/activities, and fully evaluate the effects of all proposed uses/activities in an RBCZ, and all proposed management techniques, including proposed vegetation and any other measures necessary to offset disturbances to the RBCZ. A discussion of activities proposed as well as management techniques proposed to offset disturbances and/or enhance the site to improve the RBCZ's ability to function effectively as an RBCZ shall also be included with the RBCZ Management Plan submittal to *[municipality]*.
C. The Plan shall be reviewed and must be approved by the Engineer of *[municipality]*, in consultation with the Environmental Commission, as part of the subdivision and land development process.
D. The Riparian Buffer Conservation Zone Management Plan should include management provisions in narrative and/or graphic form specifying:
   1. The manner in which the area within the RBCZ will be owned and by whom it will be managed and maintained.
   2. The conservation and/or land management techniques and practices that will be used to conserve and protect the RBCZ, as applicable.
   3. The professional and personnel resources that are expected to be necessary, in order to maintain and manage the RBCZ.
   4. A revegetation plan, if applicable, that includes: three (3) layers of vegetation, including herbaceous plants that serve as ground cover, understory shrubs, and trees that form an overhead canopy. Vegetation selected must be native and consistent with the soil, slope and moisture conditions of the site. The revegetation plan shall be prepared by a qualified professional such as a landscape architect or engineer, and shall be subject to the approval of the Municipal Engineer, in consultation with the Environmental Commission. Dominant vegetation in the Riparian Buffer Conservation Zone Management Plan shall consist of plant species that are suited to the stream buffer

environment. The Engineer of *[municipality]* may require species suitability to be verified by qualified experts from the Soil Conservation District, Natural Resources Conservation Service, New Jersey Department of Environmental Protection, US Fish and Wildlife Service and/or State or Federal forest agencies.

E. A Riparian Buffer Conservation Zone Management Plan is not required where the RBCZ is not being disturbed and conservation easements/deed restrictions are applied to ensure there will be no future clearing or disturbance of the RBCZ.

F. Performance of the Riparian Buffer Conservation Zone Management Plan shall be guaranteed for [Municipality to insert length of time. Minimum of two years suggested.] by a surety, such as a bond, cash or letter of credit, which shall be provided to the *[municipality]* prior to the *[municipality]* issuing any permits or approving any uses relating to the applicable use or activity.

XI. BOUNDARY INTERPRETATION, APPEALS PROCEDURES, INSPECTIONS, CONFLICTS, SEVERABILITY

A. When a landowner or applicant disputes the boundaries of an RBCZ, or the defined bank-full flow or level, the landowner or applicant shall submit evidence to *[municipal contact]* that describes the RBCZ, presents the landowner or applicant's proposed RBCZ delineation, and presents all justification for the proposed boundary change. For Category One (C1) RBCZs, the landowner or applicant must first obtain approval from the New Jersey Department of Environmental Protection. The applicant shall submit evidence to *[municipal contact]* that describes the RBCZ, presents the landowner or applicant's proposed RBCZ delineation, and presents all justification for the proposed boundary change. A decision from the Department must be included with the evidence submitted for municipal review.

B. Within 45 days of a complete submission of Section XI.A above, the Engineer of *[municipality]*, or appointed representative, shall evaluate all material submitted and shall make a written determination, a copy of which shall be submitted to *[municipal contact]* and the landowner or applicant. Failure to act within the 45-day period shall not be interpreted to be an approval of the proposed boundary change.

C. Any party aggrieved by any such determination or other decision or determination under Section XI.B. may appeal to the *[municipal contact]* under the provisions of this ordinance. The party contesting the location of the RBCZ boundary shall have the burden of proof in case of any such appeal.

D. Any party aggrieved by any determination or decision of the *[municipal contact]* under this Ordinance may appeal to the *[governing body]* of *[municipality]*. The party contesting the determination or decision shall have the burden of proof in case of any such appeal.

E. Inspections:

1. Lands within or adjacent to an identified RBCZ shall be inspected by the *[municipal representative]* when:
   a. A subdivision or land development plan is submitted;
   b. A building permit is requested;
   c. A change or resumption of a nonconforming use is proposed;
   d. A discontinued nonconforming use is resumed more than a year later, as described in Section VII. The party contesting the discontinued use shall have the burden of proof to demonstrate when the use was discontinued.

2. The RBCZ may also be inspected periodically by representatives from *[municipality]* if excessive or potentially problematic erosion is present, other problems are discovered, or at any time when the presence of an unauthorized activity or structure is brought to the attention of municipal officials or when the downstream surface waters are indicating reduction in quality.

F. Conflicts: All other ordinances, parts of ordinances, or other local requirements that are inconsistent or in conflict with this ordinance are hereby repealed to the extent of any inconsistency or conflict, and the provisions of this ordinance apply.

G. Severability:
   1. Interpretation: This Ordinance shall be so construed as not to conflict with any provision of New Jersey or Federal law.
   2. Notwithstanding that any provision of this Ordinance is held to be invalid or unconstitutional by a court of competent jurisdiction, all remaining provisions of the Ordinance shall continue to be of full force and effect.
   3. The provisions of this Ordinance shall be cumulative with, and not in substitution for, all other applicable zoning, planning and land use regulations.

XII. ENFORCEMENT

A prompt investigation shall be made by the appropriate personnel of *[municipality]*, of any person or entity believed to be in violation hereof. If, upon inspection, a condition which is in violation of this Ordinance is discovered, a civil action in the Special Part of the Superior Court, or in the Superior Court, if the primary relief sought is injunctive or if penalties may exceed the jurisdictional limit of the Special Civil Part, by the filing and serving of appropriate process. Nothing in this Ordinance shall be construed to preclude the right of *[municipality]*, pursuant to N.J.S.A 26:3A2-25, to initiate legal proceedings hereunder in Municipal Court. The violation of any section or subsection of this Ordinance shall constitute a separate and distinct offense independent of the violation of any other section or subsection, or of any order issued pursuant to this Ordinance. Each day a violation continues shall be considered a separate offense.

XIII. EFFECTIVE DATE

This Ordinance shall take effect upon final adoption and publication in accordance with the law on *[date]*.