Municipal Stormwater Management Plan

for the

Borough of Paramus
Bergen County, New Jersey

Prepared by:

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File No. PA-3210

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To Whom it May Concern:

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

Sincerely,

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Professional Engineer
NJ License No. 34680

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APPENDICES

I. Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the Borough of Paramus (the Borough) to address stormwater-related impacts. The creation of this Plan is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. This Plan contains the required elements described in N.J.A.C. 7:8 Stormwater Management Rules. The Plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major developments. As per the Borough's Stormwater Control Ordinance, a "Major Development" means:

> An individual "development," as well as multiple developments that individually or collectively result in:
>
> 1. The disturbance of one or more acres of land since February 2, 2004;
> 2. The creation of one-quarter acre or more of "regulated impervious surface" since February 2, 2004;
> 3. The creation of one-quarter acre or more of "regulated motor vehicle surface" since March 2, 2021; or
> 4. A combination of 2 and 3 above that totals an area of one-quarter acre or more. The same surface shall not be counted twice when determining if the combination area equals one-quarter acre or more.
>
> Major development includes all developments that are part of a common plan of development or sale (for example, phased residential development) that collectively or individually meet any one or more of paragraphs 1, 2, 3, or 4 above. Projects undertaken by any government agency that 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."

These standards are intended to minimize the adverse impact of stormwater runoff on water quality, water quantity, and the loss of groundwater recharge that provides baseflow in receiving water bodies.

As per Appendix C of the New Jersey Best Management Practices Manual last revised in March of 2020, municipalities with less than one square mile of vacant or agricultural lands are not required to complete a "build-out" analysis. Therefore, this plan does not require a "build-out" analysis as the Borough of Paramus contains 0.285 sq. mi. of vacant land and 0.045 sq. mi. of agricultural land. The Plan also addresses the review and update of existing ordinances, the Borough Master Plan, and other planning documents to allow for project designs that include low-impact development techniques. The Borough Master Plan was last reviewed May 21st, 2015. The final component of this Plan is a proposed mitigation strategy to be reviewed by Paramus's governing body for future variances or exemptions of the design and performance standards. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

This plan utilizes existing regulatory framework and technical guidance documents, along with the Borough of Paramus's Stormwater Control Ordinance. This MSWMP shall be reviewed and updated as necessary and as a component of the reexamination of the Borough's municipal Master Plan every 10 years.

II. Goals

The goals of this MSWMP as well as a brief description of the Borough's strategies to implement the goals are as follows:

- ***Reduce flood damage, including damage to life and property.***

  The Borough has incorporated green infrastructure and several non-structural stormwater strategies into their Zoning and Site Plan ordinances. The purpose of some of these non-structural strategies is to reduce damage to life and property by minimizing flooding. New major developments are reviewed for compliance with the Stormwater Management Rules at N.J.A.C. 7:8. To achieve this reduction the Borough maintains a street sweeping schedule and inspects, cleans, and maintains catch basins and storm drain inlets as required by the Borough's Stormwater Pollution Prevention Plan (SPPP) and New Jersey Pollutant Discharge Elimination System (NJPDES) permit (NJG0148288).

- ***Minimize, to the extent practical, any increase in stormwater runoff from any new development.***

  The Borough is implementing the current Residential Site Improvement Standards (RSIS) which require a reduction in runoff during all rain events for residential developments and commercial developments will be required to follow all regulations in N.J.A.C. 7:8 and 7:15 to minimize any increase in stormwater runoff. Additionally, the Borough is reviewing and updating existing ordinances to incorporate requirements for low-impact development.

- ***Reduce soil erosion from any development or construction project.***

  As per The Standards for Soil Erosion and Sediment Control in New Jersey (SESC) last revised in January of 2014, a "Project" is defined as:

  > Any disturbance of more than 5,000 square feet of the surface area of land (1) for the accommodation of construction for which the State Uniform Construction Code would require a construction permit, except that the construction of a single-family dwelling unit shall not be deemed a 'project' under this act unless such unit is part of a proposed subdivision, site plan, conditional use, zoning variance, planned development or construction permit application involving two or more such single-family dwelling units; (2) for the demolition of one or more structures; (3) for the construction of a parking lot; (4) for the construction of a public facility; (5) for the operation of any mining or quarrying activity; or (6) for the clearing or grading of any land for other than agricultural or horticultural purposes.

  Currently all development projects meeting this definition are required to obtain approval from the Bergen County Soil Conservation District (BCSCD).

- ***Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures.***

  Proposed culverts and bridges and other in-stream structures will be reviewed for compliance with the NJDEP Freshwater Wetlands Protection Act Rules at N.J.A.C. 7:7A and the Flood Hazard Control Act Rules at N.J.A.C. 7:13. Existing in-stream structures are maintained and inspected a minimum of once a year. As part of this inspection, the Borough performs an outfall condition assessment that includes searching for signs of scour and illicit discharge during dry weather conditions as defined within Chapter 3.6: MS4 Outfall Pipe Mapping and Illicit Discharge and Scour Detection and Control of the Tier A Municipal Stormwater Guidance Document.

- *Maintain groundwater recharge.*

  As per N.J.A.C. 7:8-5.4(b)2, groundwater recharge is not required for projects within the "urban redevelopment area" which include areas delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA 1), Designated Centers, Cores or Nodes; designated as CAFRA Centers, Cores, or Nodes; designated as Urban Enterprise Zones; and designated as Urban Coordinating Council Empowerment Neighborhoods. 10.155 sq. mi. (96.71%) of the Borough is categorized as part of a Metropolitan Planning Area (PA 1), therefore the groundwater recharge standard is not applicable. The Borough enforces existing ordinances to limit disturbance associated with development. Through restricting the allowable impervious cover, groundwater recharge can be maintained or increased.

- *Prevent, to the greatest extent feasible, an increase in non-point pollution.*

  Nonpoint source (NPS) pollution is water generated by everyday activities, such as fertilizing lawns, walking pets, changing motor oil or gasoline, and littering. NPS pollution is caused when contaminants deposited on the land surface are washed off and carried into nearby waterways or ground water. To limit the discharge of these common pollutants the Borough has adopted and maintains several ordinances with applicable fines. These ordinances include the following: litter, wildlife feeding, pet waste, and yard waste management. Additionally, the Borough inspects, cleans, maintains, and retrofits existing inlets to reduce litter and prevent blockages within the system.

- *Maintain the integrity of stream channels for their biological functions, as well as for drainage.*

  Biological integrity is the ability to support and maintain a balanced, integrated adaptive assemblage of organisms having species composition, diversity, and functional organization comparable to that of the natural habitat of the region. Changes that result from human activities cause a divergence from biological integrity resulting in a decline in biological condition. The ecology of streams and rivers is intimately linked with and reflective of the watersheds they drain.

  The efficacy of drainage provided by streams is dependent on channel form. Sedimentation and erosion of stream channels associated with stormwater runoff and discharge, result in an increase in severity and frequency of floods as well as the displacement and destruction of habitat for fish and other water dependent species, and a decrease in base flows in watercourses. The most significant effect of stormwater runoff on channel form is the increased frequency of smaller floods that approach or exceed bank-full. Therefore, in highly developed areas, while armoring of channels may provide short-term control of bed and bank erosion, dispersed management of runoff from impervious surfaces may be the most effective approach to controlling erosion and sedimentation of stream channels.

  The Borough seeks to maintain stream channel integrity for both biological and drainage functions through the adoption of the Borough's Stormwater Control Ordinance. This ordinance will govern stormwater quantity, stormwater quality, and groundwater recharge thereby reducing pollutants within the flow which affect biological function and drainage conveyance ability of stream channels. Additionally, the adoption of this ordinance will reduce the introduction of pollutants allowed to reach the Borough's waterways and assist in reducing or preventing TMDL's. During the Borough's outfall condition assessment, a physical inspection is performed for all outfall pipes, signs of scour and illicit discharges are reported and handled in accordance with the Borough's SPPP.

- *Minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the State, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water.*

  The Borough utilizes public education and facility inspections to limit pollutants in stormwater runoff from new and existing developments. During the review process of applications for major development, the Borough enforces their Stormwater Control Ordinance (Ord. 2021-25) as it pertains to Section 363-39 "Stormwater Management Requirements for Major Development" *(Appendix A)*. These requirements include stipulations to satisfy the green infrastructure, groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards identified within the ordinance. As per the Borough's NJPDES permit (NJG0148288) and as specified within the SPPP, private stormwater facilities are inspected annually to ensure functionality and notices are issued to ensure compliance. Additionally, the Borough issues educational material and conducts educational outreach to inform residents concerning the consequences of pollution to the Borough's waterways.

- *Protect public safety through the proper design and operation of stormwater basins.*

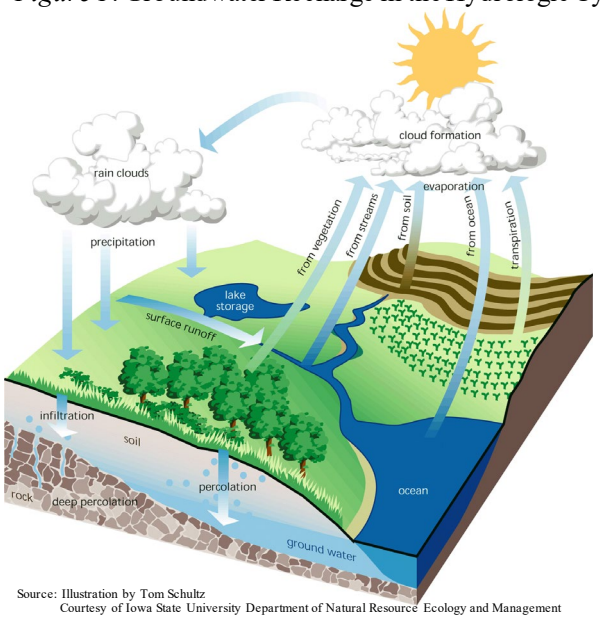
  The Borough reviews applications for major development to ensure that projects meet and comply with the standards within the Stormwater Management Rules at N.J.A.C. 7:8, Safety Standards for Stormwater Management Basins as outlined in N.J.A.C. 7:8-6, The Standards for Soil Erosion and Sediment Control in New Jersey, and the New Jersey Stormwater Best Management Practices Manual. The Borough is currently in the process of implementing a stormwater facility maintenance program to ensure adequate long-term cleaning, operation, and maintenance of all municipally owned or operated stormwater facilities, along with stormwater facilities not owned or operated by the municipality.

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

III. Stormwater Discussion

Land development can dramatically alter the hydrologic cycle *(**Figure 1**)* of a site and, ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or draw that portion that has infiltrated into the ground and return it to the atmosphere through evapotranspiration.

Figure 1: Groundwater Recharge in the Hydrologic Cycle



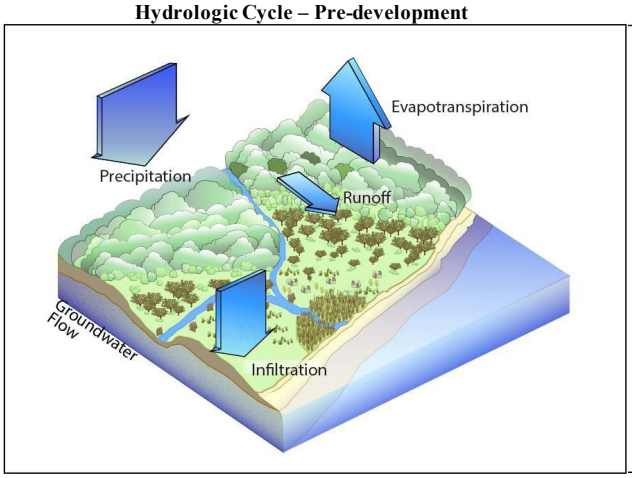
Source: Illustration by Tom Schultz
Courtesy of Iowa State University Department of Natural Resource Ecology and Management

Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site.

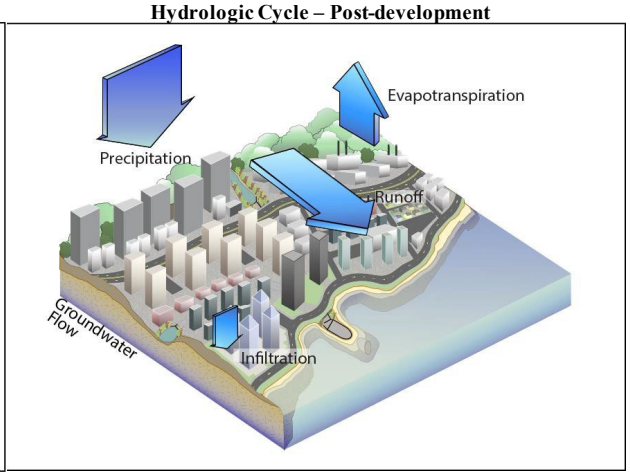
Impervious areas that are connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas *(**Figure 2**)*. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than natural conditions. These increases can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment in the channel.

Figure 2: **Comparing Pre- and Post-Development Hydrologic Cycles**

Hydrologic Cycle – Pre-development



Hydrologic Cycle – Post-development



Source: New Jersey Stormwater Best Management Practices Manual
Chapter 1 Impacts of Development on Runoff

Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area can also decrease opportunities for infiltration which, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy habitat from which some species cannot adapt.

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

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

Additional information regarding stormwater please refer to the NJDEP Stormwater in New Jersey webpage located at https://njstormwater.org/. For additional information regarding stormwater within the Borough of Paramus please visit the municipal website at https://www.paramusborough.org/ or request documentation from the current Superintendent of the Department of Public Works.

IV. Background

Paramus encompasses 10.501-square miles in Bergen County, New Jersey. The Borough is primarily comprised of residential and commercial properties, as depicted on the Zoning Map *(**Figure 3**)*, and is largely built-out with only 0.285 sq. mi. (182.081 acres) of remaining developable open space, equating to approximately 2.71% of Paramus's total area *(**Figure 4**)*. The Borough depends on sanitary sewer systems for nearly all its wastewater management. The Borough is within the Bergen County Utility Authority sewer service area *(**Figure 5**)*. The Borough receives its potable water supply from SUEZ North America, formerly United Water *(**Figure 6**)*. There are no potable public supply wells within the Borough however the municipality contains 2 non-community well protection areas and several public community wellhead protection areas from surrounding municipalities, therefore a wellhead protection area map has been prepared *(**Figure 7**)*. Paramus's waterways are depicted in ***Figure 8*** while ***Figure 9*** depicts the Borough's location on the United States Geological Survey (USGS) Quadrangle Maps.

Paramus is bordered to the west by a 2.22 mile stretch of the Village of Ridgewood, a very small connection to the Borough of Glen Rock boundary, with the remaining western boundary being bordered by a 3.31 miles by the Borough of Fair Lawn, the southern boundary is bordered by a 1.36 mile stretch of the Township of Rochelle Park, 1.63 miles of the Borough of Maywood, while the remaining 0.66 miles of the southern boundary are bordered by the City of Hackensack, to the east by the a 2.88 mile stretch of the Borough of River Edge, a 2.08 mile stretch of the Borough of Oradell, with the remaining 0.57 miles of the eastern bordered being bordered by the Borough of Emerson which extended along 0.78 miles of the northern, 1.61 miles by the Township of Washington, the remaining 0.67 miles being bordered by the Village of Ridgewood. Approximately 10.155 sq. mi. (96.71%) of the Borough contains land within the Metropolitan Planning Area (PA 1, while 0.345 sq. mi. (3.29%) consists of land within a County Park (PA 6) *(**Figure 10**)*.

The Borough' s population increased from 3,688 residents in 1940 to 6,268 in 1950. The population then significantly increased to 23,238 residents in 1960, and again to 28,381 residents in 1970. From 1970 through 1990 the population steadily declined. Since then, the Borough's population has steadily increased from 1990 through 2020, as demonstrated in ***Table 1***. According to the United States Census Bureau, Population division, during the time period from 2015-2019, the number of dwelling units in the Borough was 8,232.

Table 1: **Paramus Resident Population Estimates**

Municipality	Census 1940	Census 1950	Census 1960	Census 1970	Census 1980	Census 1990	Census 2000	Census 2010	Census 2019	Census 2020
Borough of Paramus	3,688	6,268	23,238	28,381	26,474	25,067	25,737	26,342	26,264	26,698
Source: NJSDC 2000 Census Publication, New Jersey Population Trends 1790 to 2000 & U.S. Census Bureau, Population Division, May 2020										

Since Paramus is a primarily developed community, increased stormwater runoff volumes and pollutant loadings have likely impacted the Borough' s waterways. Dwelling units constructed since the 1980s implement some of the new performance standards and best management practices (BMP) to alleviate increased stormwater runoff and pollutant loadings. However past development has likely not addressed groundwater recharge. Approximately 4.552 sq. mi. (43.35%) of the Borough is considered impervious *(**Figure 11**)*.

The State Planning Commission adopted the most recent State Development and Redevelopment Plan in March of 2001, effectively replacing the previous version adopted in 1992. The new State Plan delineates Planning Areas on the basis of natural and constructed characteristics and establishes the State's vision for future development. The State has defined five (5) planning areas which are listed from the most highly to least developed. These Planning Areas are as follows: the Metropolitan Planning Area (PA 1), the Suburban Planning Area (PA 2), Fringe Planning Area (PA 3), Rural Planning Area (PA 4), and the Environmentally Sensitive Planning Area (PA 5).

There are many environmentally sensitive features and landscapes of historic or aesthetic significance that are less than one square mile in extent or whose configuration does not readily permit application of the Policy Objectives of the previously established Planning Areas. Additionally, many sites of historic, cultural, scenic, or environmental sensitivity lie within developed areas or within Metropolitan, Suburban, or Fringe Planning Areas. Therefore, an additional ten planning areas are assigned to Critical Environmental Sites (CES) and Historic and Cultural Sites (HCS). These designations are as follows: Environmentally Sensitive Barrier Island Planning Area (PA 5B); Parkland, Openspace from Cross-Acceptance (PA 6); Federal Park (PA 7); State Park (PA8); New Jersey Meadowlands Area (PA 9); NJ Pinelands (PA 10); Water Bodies (PA 11); Military Bases (PA 12); Highlands Preservation Area (PA 13); and Ellis Island, NY Portions (PA 99).

Approximately 96.71% of the Borough lies within the Metropolitan Planning Area (PA 1). This planning area is designated to areas that are considered Urban Redevelopment Areas and are not subject to groundwater recharge requirements. However, the Borough contains areas designated under Groundwater Recharge Rank A (16 to 23 in/yr), B (11 to 15 in/yr), C (8 to 10 in/yr), D (1 to 7 in/yr), E (0 in/yr), L (hydric soil with no calculated recharge value), and W (wetlands and open water with no calculated recharge value) as shown in ***Figure 12***. Dwelling units constructed since the 1980s implement some of the new performance standards and best management practices (BMP) to alleviate increased stormwater runoff and pollutant loadings. However, past development has likely not addressed groundwater recharge. The remainder of the Borough lies within the County Park Planning Area (PA 6). ***Figure 10*** depicts the planning areas in the Borough of Paramus. Approximately 4.552 sq. mi. (43.35%) of the Borough is considered impervious ***(Figure 11)***.

Table 2 describes the definitions of the surface water classifications. In ***Figure 8***, "category" is shown, which is a compendium of all surface water classification designations for a given water body. Category describes a stream's surface water classification in terms of its general surface water class, its trout water status, and its antidegradation status. The surface waters within Paramus are categorized and located as follows:

- FW2-NT:
  - Beaverdam Brook
    - Beaverdam Brook flows primarily from west to east within the southwestern portion of the municipality from the western boundary to its confluence with the Saddle River.
  - Delford Brook
    - Delford Brook flows primarily east to west within the central portion of the Borough before meeting its confluence with Sprout Brook.

- Delford Brook Unnamed Tributary
    - One small unnamed tributary flows into the Delford Brook along its length in the central portion of the Borough.
- Saddle River
    - The Saddle River flows primarily from north to south, establishing the Borough's western border and is found on Sublist 5 of the New Jersey Integrated List of Impaired Waterways *(see pages 15-16)*.
- Saddle River Unnamed Tributary
    - Two small unnamed tributaries flow into the Saddle River along its length in the western portion of the municipality.
- Saint Andrews Brook
    - Saint Andrews Brook flows primarily south to north in the central portion of the Borough before meeting its confluence with Sprout Brook.
- Sprout Brook
    - Sprout Brook runs primarily from north to south through the center of the Borough to southern limits.
- Sprout Brook Unnamed Tributary
    - Seven unnamed tributaries, with a cumulative length of 2.899 miles, flow into Sprout Brook along its length.

- FW2-NT/SE1:
    - Behnke Brook
        - Behnke Brook flows primarily from north to south within the western portion of the Borough.
    - Coles Brook
        - Coles Brook flows primarily west to east and establishes a portion of the Borough's southern border and is found on Sublist 5 of the New Jersey Integrated List of Impaired Waterways *(see pages 15-16)*.
    - Herring Brook
        - Herring Brook flows primarily from north to south within the southern portion of the Borough.
    - Herring Brook Unnamed Tributary
        - Two small unnamed tributaries, with a cumulative length of 0.493 miles, flow into Herring Brook along its length.
    - Van Saun Mill Brook
        - Van Saun Mill Brook flows primarily from north to south and establishes a stretch of the Borough's eastern boundary and is found on Sublist 5 of the New Jersey Integrated List of Impaired Waterways *(see pages 15-16)*.
    - Van Saun Mill Brook Unnamed Tributary

- Three small unnamed tributaries, with a cumulative length of 0.503 miles, flow into Van Saun Mill Brook along its length.

- FW2-NT (C1):
  - Highland Brook
    - Highland Brook flows primarily from south to north within the northern portion of the municipality.
  - Soldier Brook
    - Soldier Brook flows primarily from south to north within the northern portion of the municipality before meeting its confluence with Highland Brook.

Table 2: **Surface Water Quality Standards Classification**

Category	Definition
Freshwater General Surface Water Class	
FW1	**FW1** means those fresh waters, as designated in N.J.A.C. 7:9B-1.15(j), that are to be maintained in their natural state of quality (set aside for posterity) and not subjected to any man-made wastewater discharges or increases in runoff from anthropogenic activities. These waters are set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resource(s).
FW2	**FW2** means the general surface water classification applied to those fresh waters that are not designated as FW1 or Pinelands Waters. In all FW2 waters the designated uses are: 1. Maintenance, migration and propagation of the natural and established biota; 2. Primary contact recreation; 3. Industrial and agricultural water supply; 4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and 5. Any other reasonable uses.
Trout Water Status - this is for information only and does not affect the water quality criteria for those waters.	
TP	***Trout production*** means waters designated at N.J.A.C. 7:9B-1.15I through (i) for use by trout for spawning or nursery purposes during their first summer.
TM	***Trout maintenance*** means waters designated at N.J.A.C. 7:9B-1.15I through (i) for the support of trout throughout the year.
NT	***Non-trout waters*** means fresh waters that have not been designated in N.J.A.C. 7:9B-1.15I through (h) as trout production or trout maintenance. These waters are generally not suitable for trout because of their physical, chemical, or biological characteristics, but are suitable for a wide variety of other fish species.
Antidegradation	
ONRW	***Outstanding National Resource Waters*** means high quality waters that constitute an outstanding national resource (for example, waters of National/State Parks and Wildlife Refuges and waters of exceptional recreational or ecological significance). Waters classified as FW1 waters and Pinelands waters are Outstanding National Resource Waters.
FW1/Non-degradation	***Non-degradation waters*** means those waters set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, exceptional recreational significance, or exceptional water supply significance. These waters include all waters designated as FW1.
C1	***Category one waters*** means those waters designated in the tables in N.J.A.C. 7:9B-1.15(c) through (i), for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d), for protection from measurable changes in water quality based on exceptional ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resource(s) to protect their aesthetic value (color, clarity, scenic setting) and ecological integrity (habitat, water quality and biological functions).

C2	***Category two waters*** means those waters not designated as Outstanding National Resource Waters or Category One at N.J.A.C. 7:9B-1.15 for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d).
Saline Waters	
SC	***Coastal saline waters*** means the general surface water classification applied to coastal saline waters whose designated uses are listed in N.J.A.C. 7:9B-1.12(g). SE waters have the following designated uses: 1. Shellfish harvesting in accordance with N.J.A.C. 7:12; 2. Primary contact recreation; 3. Maintenance, migration and propagation of the natural and established biota; and 4. Any other reasonable uses.
SE	***Saline estuary waters*** means the general surface water classification applied to saline waters of estuaries.
SE1	***Saline estuary waters*** means saline estuarine waters whose designated uses are listed in N.J.A.C. 7:9B-1.12(d). SE1 waters have the following designated uses: 1. Shellfish harvesting in accordance with N.J.A.C. 7:12; 2. Maintenance, migration and propagation of the natural and established biota; 3. Primary contact recreation; and 4. Any other reasonable uses.
SE2	***Saline estuary waters*** means saline estuarine waters whose designated uses are listed in N.J.A.C. 7:9B-1.12(e). SE2 waters have the following designated uses: 1. Maintenance, migration and propagation of the natural and established biota; 2. Migration of diadromous fish; 3. Maintenance of wildlife; 4. Secondary contact recreation; and 5. Any other reasonable uses.
SE3	***Coastal saline waters*** means saline estuarine waters whose designated uses are listed in N.J.A.C. 7:9B-1.12(f). SE2 waters have the following designated uses: 1. Secondary contact recreation; 2 Maintenance and migration of fish populations; 3 Migration of diadromous fish; 4. Maintenance of wildlife; and 5. Any other reasonable uses
Source: NJDEP Land Use Management, N.J.A.C. 7:9B Surface Water Quality Standards, April 6, 2020	

As of March 4, 2019, the NJDEP proposed reclassifying 749 miles of waterways to category one (C1) status. These include watercourses that are designated for protection from measurable changes in water quality based on exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources to protect their aesthetic value and ecological integrity as stated in ***Table 2*** above. As of 2020, the Borough contains two C1 designated waterways.

64.20% of the Borough of Paramus lies within Watershed Management Area 4 (WMA-4), Lower Passaic and Saddle. Additionally, 35.80% of the eastern part of Paramus is located in WMA-5, Hackensack, Hudson, and Pascack. WMA-4 and WMA-5 are divided into smaller sub-watersheds assigned 14-digit Hydrologic Unit Codes (HUC-14), as demonstrated in ***Table 4*** (***Figure 13***).

Table 4: **Borough of Paramus Sub-Watershed assigned 14-digit Hydrologic Unit Codes (HUC-14)**

WMA	HUC	Sub-Watershed Name	Square Miles	Percent	Acres
4	02030103140080	Saddle River (Ho-Ho-Kus to Ridgewood gage)	0.440	4.19	281.858
4	02030103140060	Saddle River (Lodi gage to Route 4)	5.203	19.55	3329.910
4	02030103140050	Saddle River (Route 4 to Ho-Ho-Kus)	1.098	10.46	702.960
5	02030103170020	Pascack Brook (below Westwood gage)	0.977	9.31	625.537
5	02030103180010	Coles Brook / Van Saun Mill Brook	2.781	26.49	1780.090

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the State's waterways at over 800 sites throughout New Jersey. These sites are sampled for benthic macroinvertebrates by the NJDEP on a 5-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based

on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. WMA-4 includes a total of 26 AMNET sites in the Deepavaal Brook, Diamond Brook, Goffle Brook, Ho-Ho-Kus Brook, Molly Ann Brook, Passaic River, Peckman River, Preakness Brook, Ramsey Brook, Saddle River, and Third River watersheds, in Bergen, Essex, and Passaic Counties. Based on the NJDEP Water Monitoring and Standards, Ambient Biomonitoring Network, Summaries for WMA-4 as of 2012 are as follows: 7.7% (2 sites) "good", 73.1% (19 sites) "fair", and 19.2% (5 sites) "poor". Furthermore, WMA-5 includes a total of 8 AMNET sites in the Dorotockeys Run, Dwars Kill, Hackensack River, Musquapsink Brook, Overpeck Creek, Pascack Brook, Tenakill Brook, and Van Saun Brook watersheds, in Bergen County. Based on the NJDEP Water Monitoring and Standards, Ambient Biomonitoring Network, Summaries for WMA-5 as of 2012 are as follows: 12.5% (1 site) "good", 50.0% (4 sites) "fair", and 37.5% (3 sites) "poor". As of 2020, the Borough contains one active AMNET monitoring point as presented in ***Table 5*** and ***Figure 14***.

Table 5: **Borough of Paramus AMNET Monitoring Points**

WMA	WMA Name	Site Number	Impairment	Water	Location	Active
4	Lower Passaic and Saddle	AN0282	Fair	Saddle River	East Englewood Avenue	✓
Source: NJDEP Bureau of GIS, Ambient Biomonitoring Network (AMNET) of New Jersey, December 2020						

In addition to the AMNET data, the NJDEP and other regulatory agencies collect water quality chemical data on the streams in the state. The NJDEP requires the development of a Total Maximum Daily Load (TMDL) for waterways, or portions thereof, that are found impaired by pollutants. A TMDL is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its designated uses. The allowable load is assigned to the various sources of the pollutant, such as stormwater and wastewater discharges, which require an NJPDES permit to discharge, and nonpoint source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other BMPs. According to the NJDEP, Bureau of Nonpoint Pollution Control, Paramus has three listed TMDLs for the following:

- Fecal coliform levels within the:
    - Coles Brook/Herring Brook/Van Saun Brook;
    - Pascack Brook/Musquapsink Brook; and
    - West Bridge Saddle, Saddle River at Ridgewood, Lodi & Fairlawn, Ramsey Brook at Allendale, Ho-Ho-Kus Brook at Paramus.
- Nickel levels within the:
    - Coles Brook/Van Saun Mill Brook.
- Total phosphorus levels within:
    - Coles Brook/Herring Brook/Van Saun Brook; and
    - Pascack Brook/Musquapsink Brook.

These exceedances are potentially due to stormwater runoff, soil erosion, bank erosion, decomposing plant materials, fertilizer, geese, and wildlife *(**Appendix B**)*.

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) (Integrated List) is required by the federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards and identifies waters that are impaired. Sublist 5 of the Integrated List identifies waters impaired or threatened by pollutants, for which one (1) or more TMDLs are needed. As per Appendix B of the 2016 New Jersey Integrated Water Quality Assessment Report published in December 2019, Sublist 5 lists several low, medium, and high-ranking priority TMDL parameters for stations 01390518, AN0282, and SR001 of Saddle River (Ho-Ho-Kus to Ridgewood gage); 01391200, AN0290, and 01391500 of Saddle River (Lodi gage to Route 4); 01391200, AN0289, NJS11-119, and 01391110 of Saddle River (Route 4 to Ho-Ho-Kus); 01377499, 01377500, MB001, MB002, MB004, MB005, MB006, AN0206, AN0207, FIBI060 of Pascack Brook (below Westwood gage); and AN0211, FIBI062a, and 01378560 of Coles Brook/Van Saun Mill Brook, as shown in *Tables 6* through *10*.

Table 6: **303(d) Sublist 5 Subparts and Priority Ranking for Saddle River (Ho-Ho-Kus to Ridgewood gage)**

WMA	HUC	Parameter	Cycle 1st Listed	Designated Use	Sublist 5 Subpart (A,R,L)	Priority Ranking for TMDL
4	02030103140080	Arsenic	2010	Public Water Supply		Low
4	02030103140080	Biological-Cause Unknown	2016	Aquatic Life General		Low
4	02030103140080	PH	2014	Aquatic Life General		Medium
4	02030103140080	Phosphorus, Total	2010	Aquatic Life General		High
Source: NJDEP Division of Water Monitoring Standards, December 2019						

Table 7: **303(d) Sublist 5 Subparts and Priority Ranking for Saddle River (Lodi gage to Route 4)**

WMA	HUC	Parameter	Cycle 1st Listed	Designated Use	Sublist 5 Subpart (A,R,L)	Priority Ranking for TMDL
4	02030103140060	Arsenic	1998	Public Water Supply		Low
4	02030103140060	Biological-Cause Unknown	2016	Aquatic Life General		Low
4	02030103140060	Phosphorus, Total	2006	Aquatic Life General		High
4	02030103140060	Total Dissolved Solids (TDS)	2004	Public Water Supply		Medium
Source: NJDEP Division of Water Monitoring Standards, December 2019						

Table 8: **303(d) Sublist 5 Subparts and Priority Ranking for Saddle River (Route 4 to Ho-Ho-Kus)**

WMA	HUC	Parameter	Cycle 1st Listed	Designated Use	Sublist 5 Subpart (A,R,L)	Priority Ranking for TMDL
4	02030103140050	Arsenic	1998	Public Water Supply		Low
4	02030103140050	Biological-Cause Unknown	2016	Aquatic Life General		Low
4	02030103140050	PH	2014	Aquatic Life General		Medium
4	02030103140050	Phosphorus, Total	2006	Aquatic Life General		High
Source: NJDEP Division of Water Monitoring Standards, December 2019						

Table 9: **303(d) Sublist 5 Subparts and Priority Ranking for Pascack Brook (below Westwood gage)**

WMA	HUC	Parameter	Cycle 1st Listed	Designated Use	Sublist 5 Subpart (A,R,L)	Priority Ranking for TMDL
5	02030103170020	Arsenic	2004	Public Water Supply		Low
5	02030103170020	Dissolved Oxygen	2010	Aquatic Life General		Low
5	02030103170020	Biological-Cause Unknown	2016	Aquatic Life General		Medium
5	02030103170020	PH	2010	Aquatic Life General		Medium
5	02030103170020	Total Dissolved Solids	2006	Public Water Supply		Medium
Source: NJDEP Division of Water Monitoring Standards, December 2019						

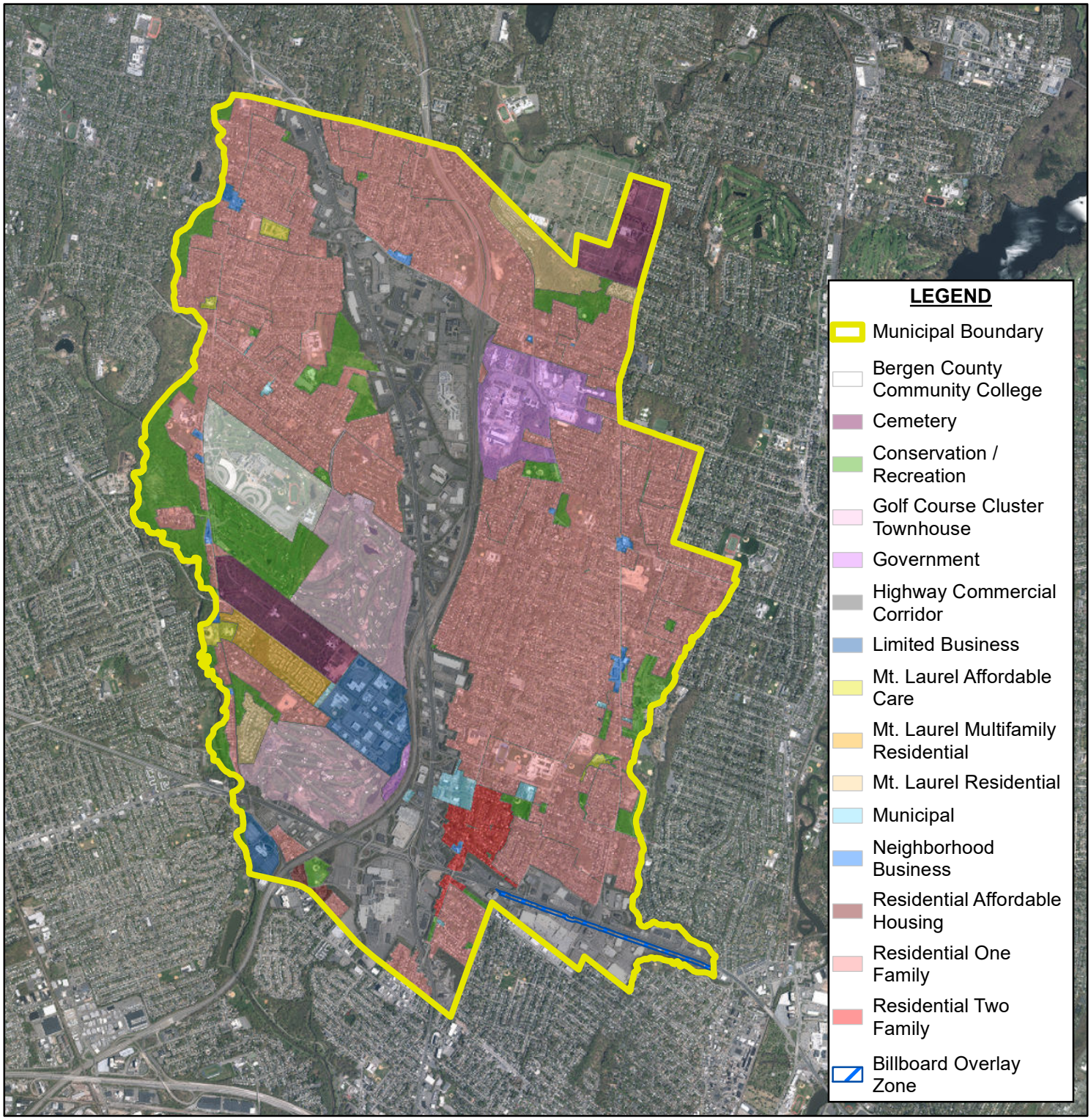
Table 10: **303(d) Sublist 5 Subparts and Priority Ranking for Coles Brook / Van Saun Mill Brook**

WMA	HUC	Parameter	Cycle 1st Listed	Designated Use	Sublist 5 Subpart (A,R,L)	Priority Ranking for TMDL
5	02030103180010	Biological-Cause Unknown	2016	Aquatic Life General		Low
5	02030103180010	Total Dissolved Solids (TDS)	2016	Public Water Supply		Medium
Source: NJDEP Division of Water Monitoring Standards, December 2019						

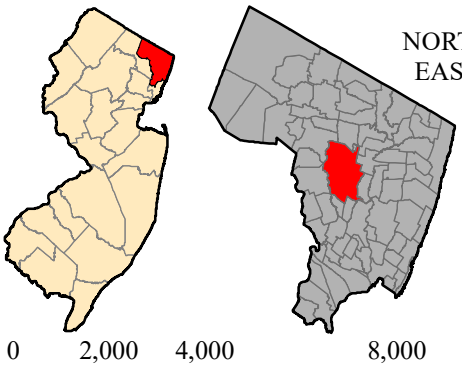
In addition to the aforementioned water quality concerns, the Borough is subject to bank flooding along several watercourses during periods of heavy rain. The surrounding areas fall within the 100-yr and 500-yr floodplains and floodway *(**Figure 15**)*.

Lastly, portions of the Borough contain or lie within wellhead protection areas. A wellhead protection area is divided into three (3) tiers. The 2- year (Tier 1), 5- year (Tier 2) and 12- year (Tier 3) are intended to represent the time of travel (TOT), a groundwater contaminant in the zones could be expected to reach a municipal potable supply well. The NJDEP then prioritizes the investigation and remediation

of contaminated sites within the 2 and 5-year tiers. Wellhead protection areas are shown in Figure 6. The Borough may wish to adopt specific ordinances to further protect wellhead protection areas and minimize the infiltration of pollutants into aquifers.



SOURCE: BOROUGH OF PARAMUS 2020 ZONING DATALAYER



NORTHING: 769,296
EASTING: 610,845

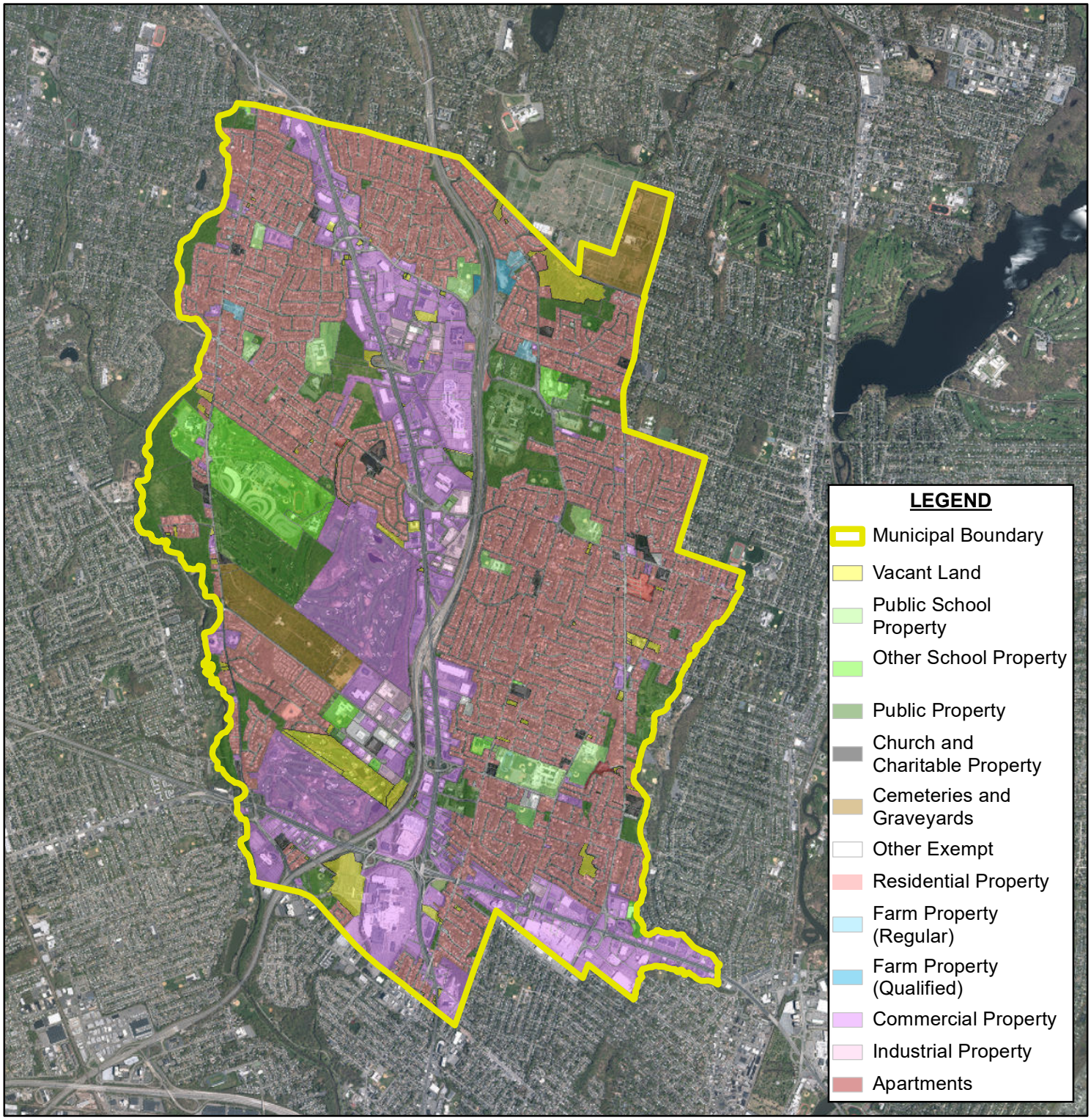
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

ZONING MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

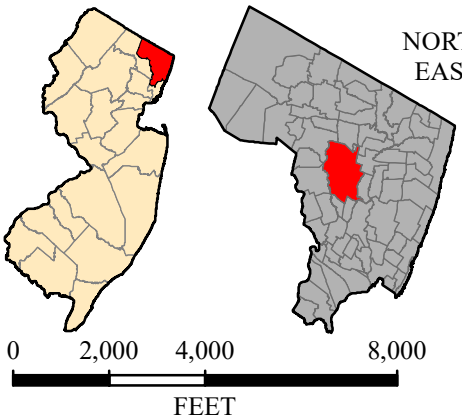
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 3



SOURCE: BERGEN COUNTY TAX PARCEL DATALAYER



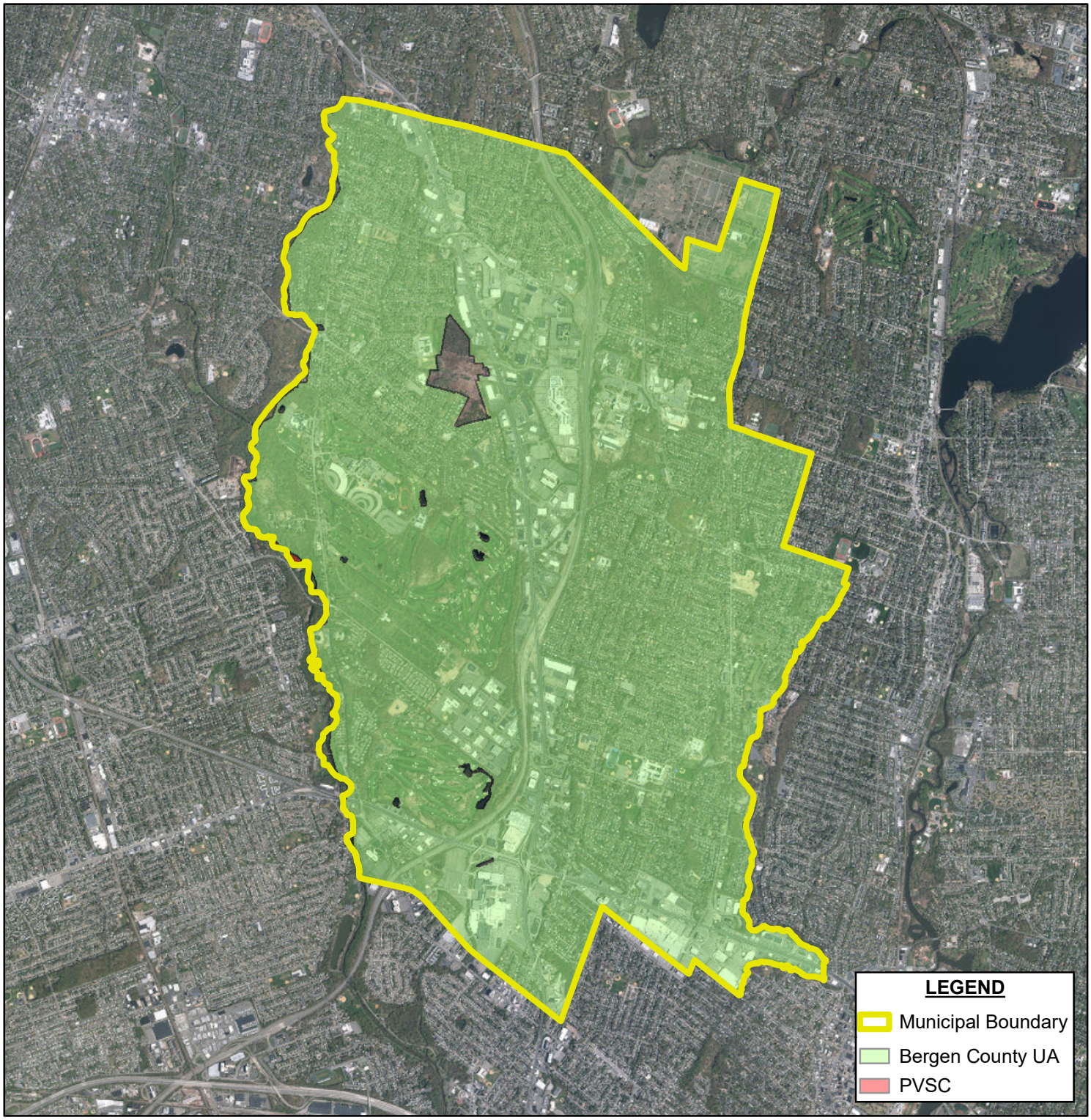
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

LAND USE MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

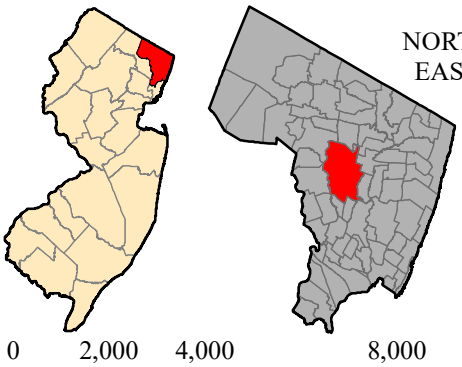
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 4



SOURCE: NJDEP STATEWIDE SEWER SERVICE AREAS DATALAYER



NORTHING: 769,296
EASTING: 610,845

0 2,000 4,000 8,000
FEET

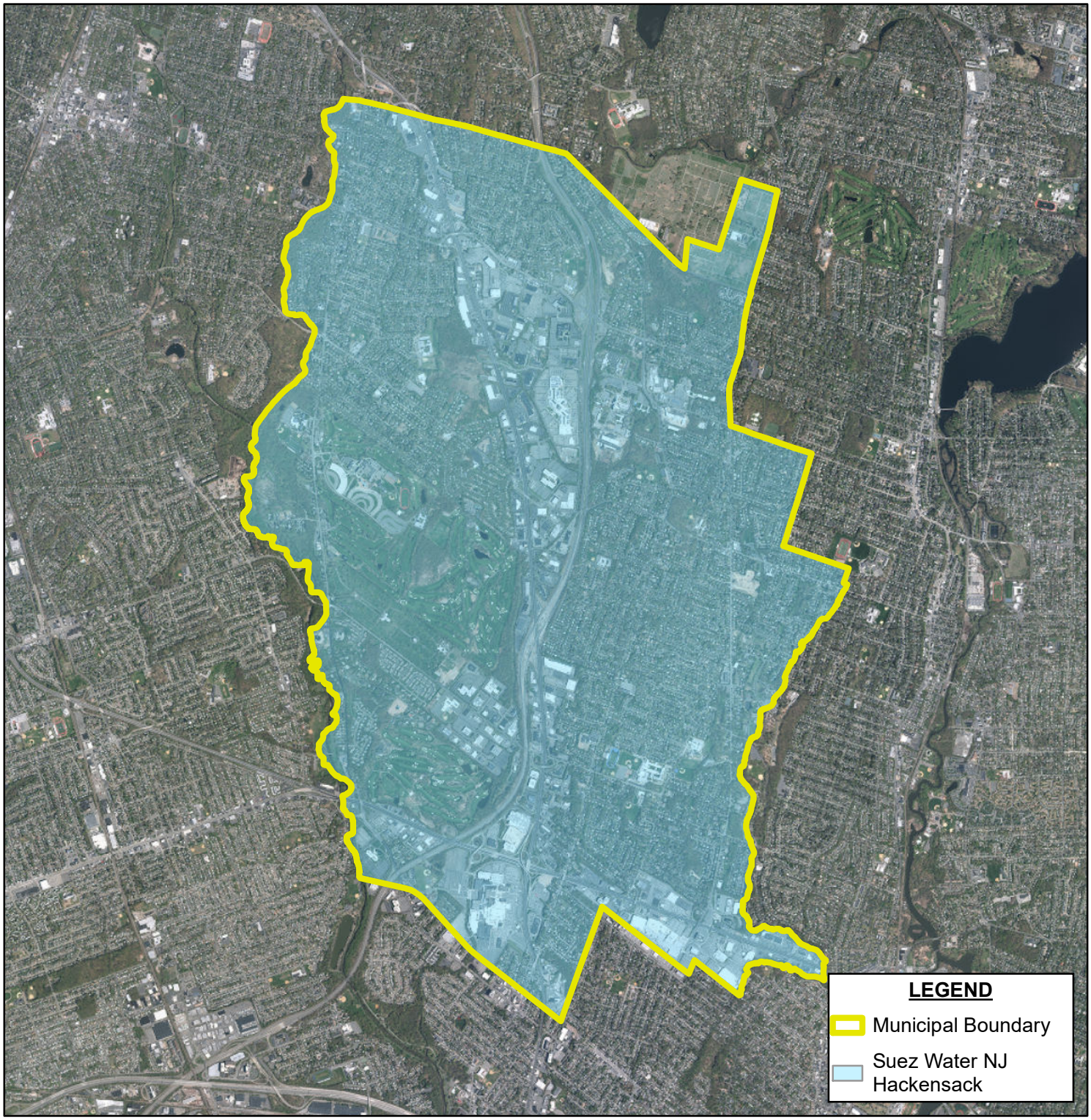
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

SEWER SERVICE AREA MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

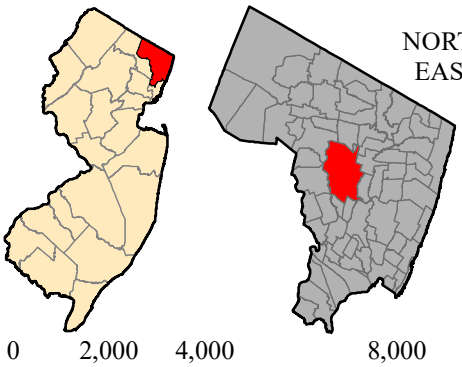
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 5



SOURCE: NJDEP WATER PURVEYOR SERVICE AREA DATALAYER



NORTHING: 769,296
EASTING: 610,845

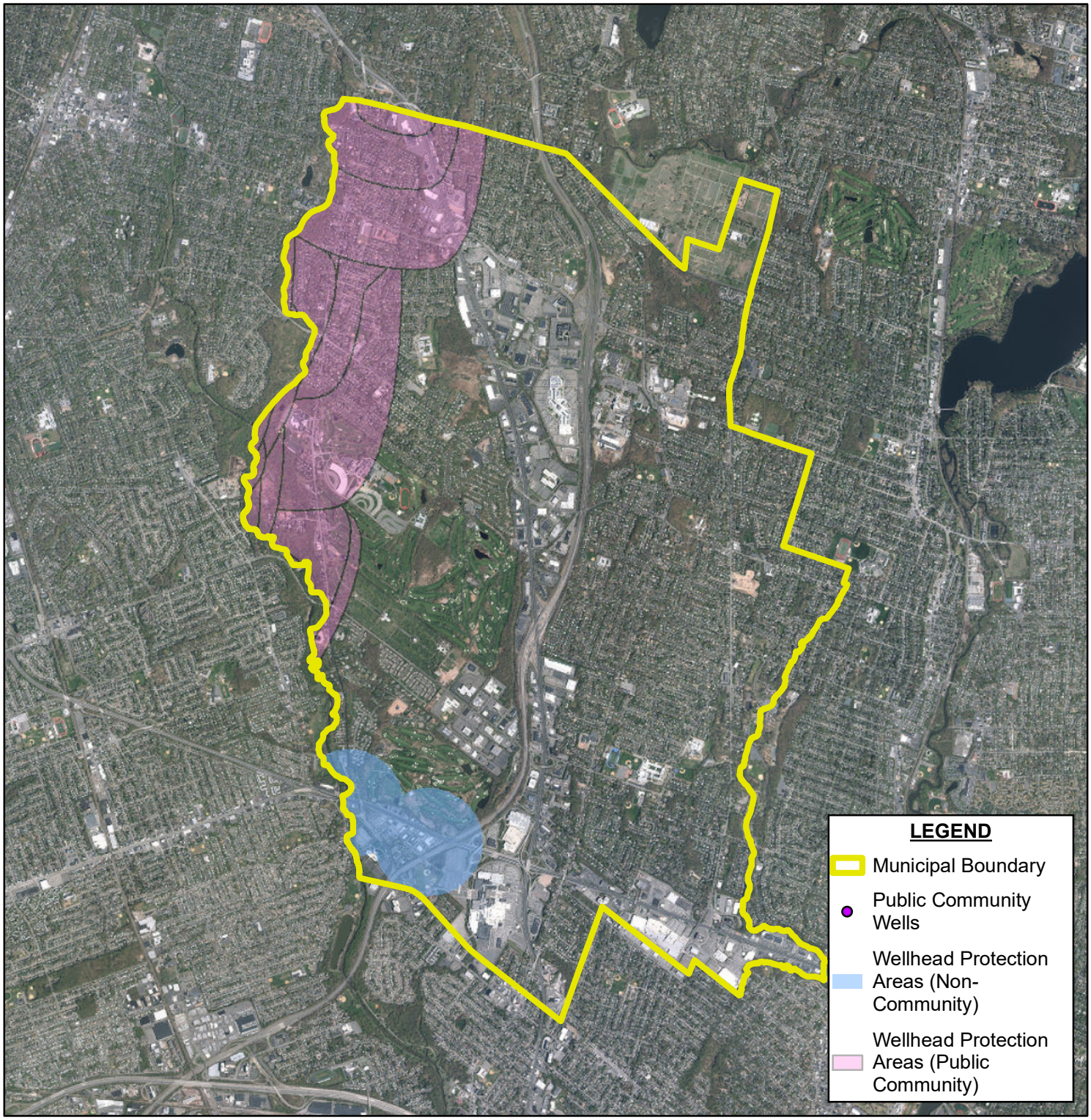
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

WATER PURVEYOR SERVICE AREA MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

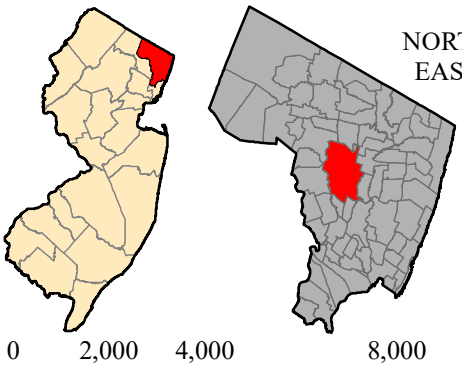
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: JULY 2021	JOB NO. PA-3210 FIGURE 6



SOURCE: NJDEP PUBLIC COMMUNITY WELLS AND WELLHEAD PROTECTION DATALAYERS



NORTHING: 769,296
EASTING: 610,845

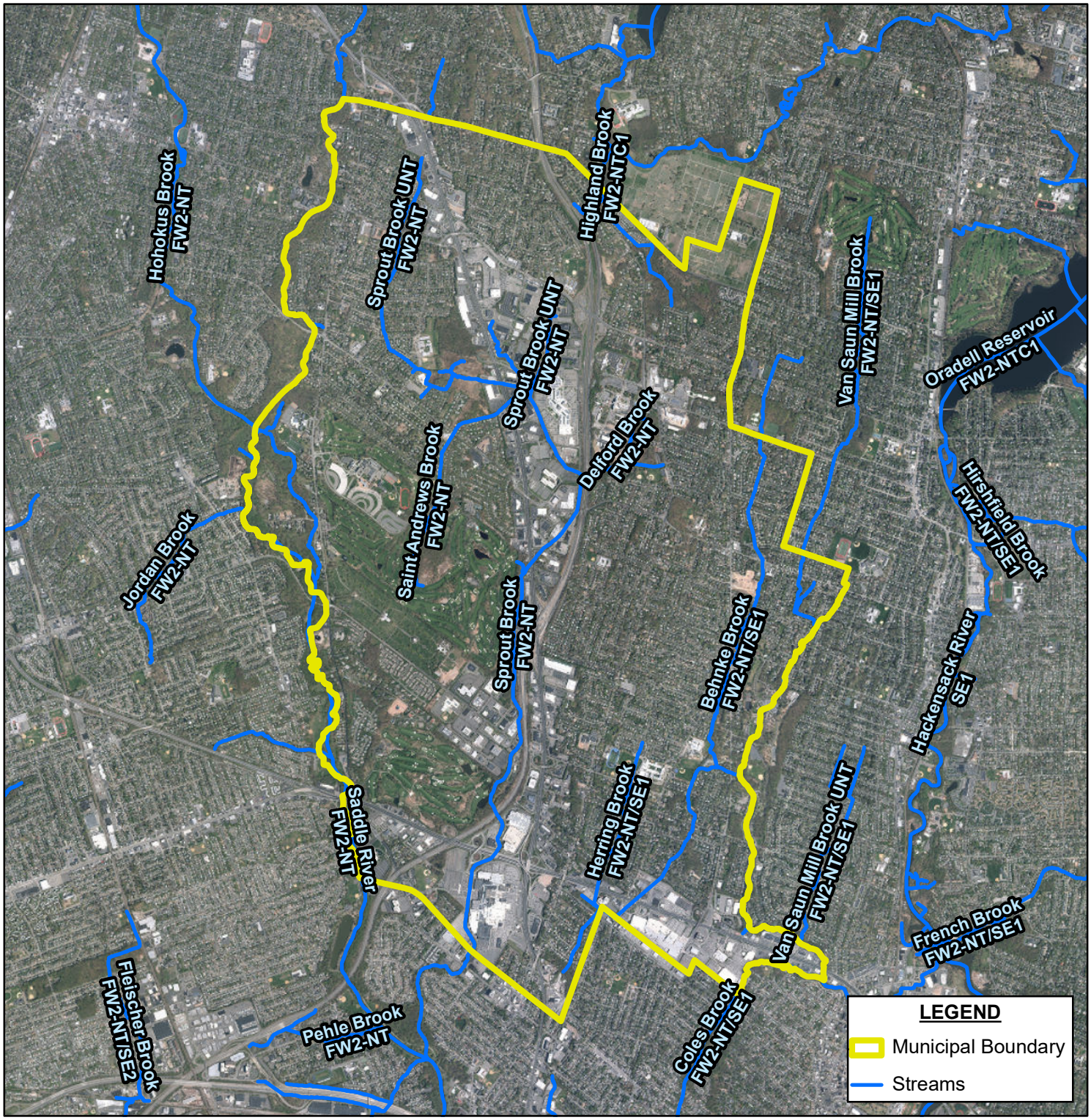
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

WELLHEAD PROTECTION AREA MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

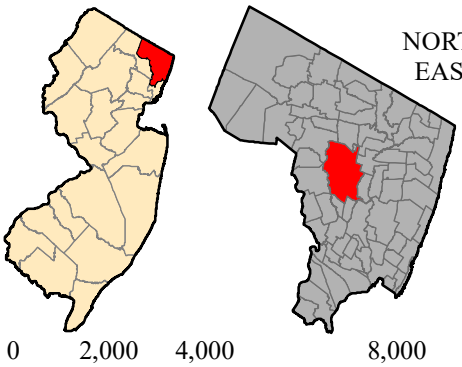
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: JULY 2021	JOB NO. PA-3210 FIGURE 7



SOURCE: NJDEP SURFACE WATER QUALITY STANDARDS DATALAYER



NORTHING: 769,296
EASTING: 610,845

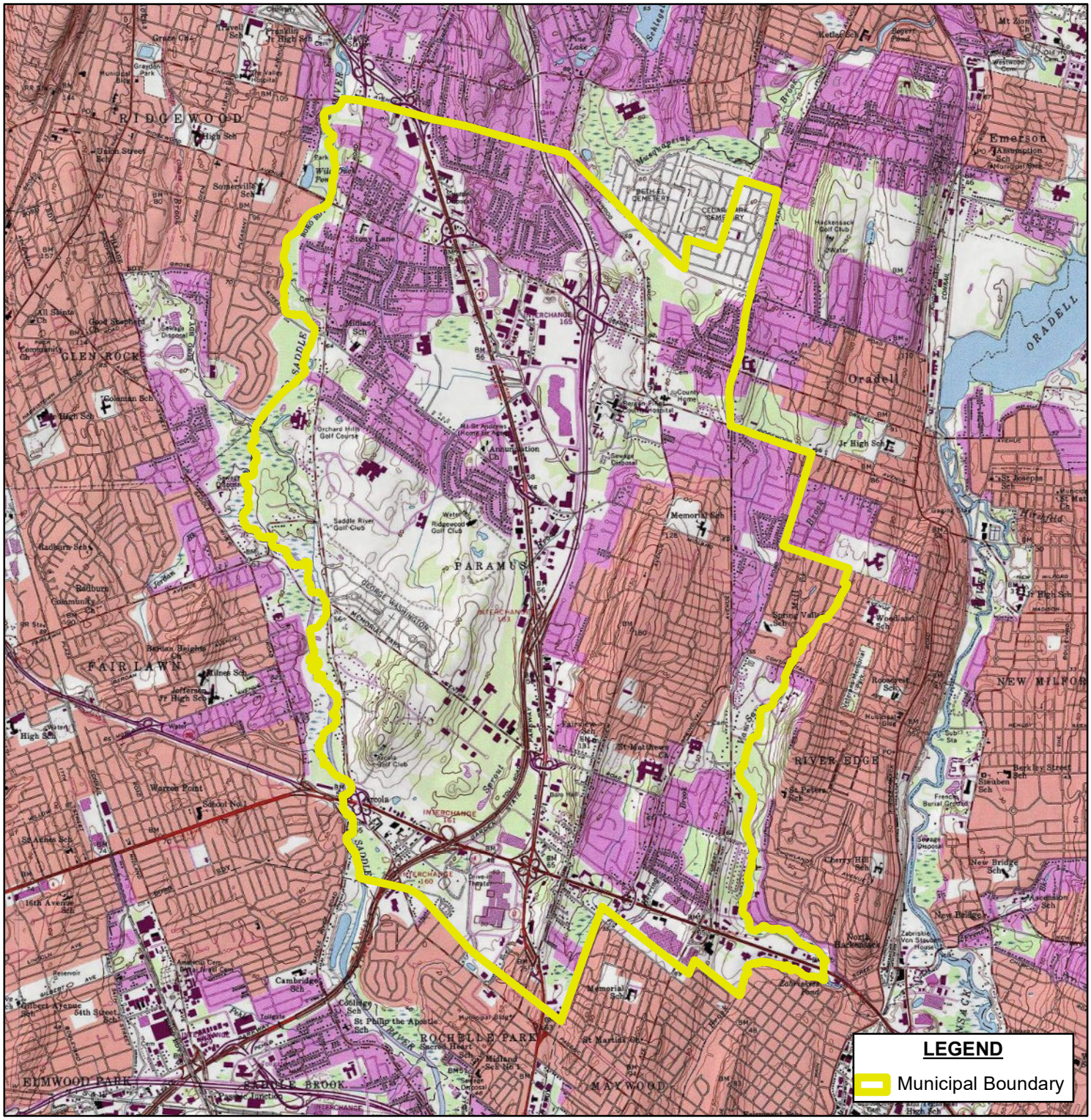
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

SURFACE WATER QUALITY STANDARDS MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

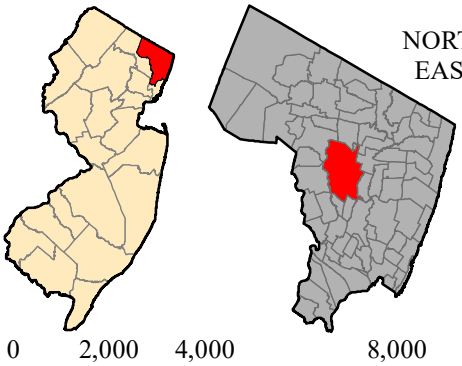
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 8



SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS) HACKENSACK QUADRANGLE



NORTHING: 769,296
EASTING: 610,845

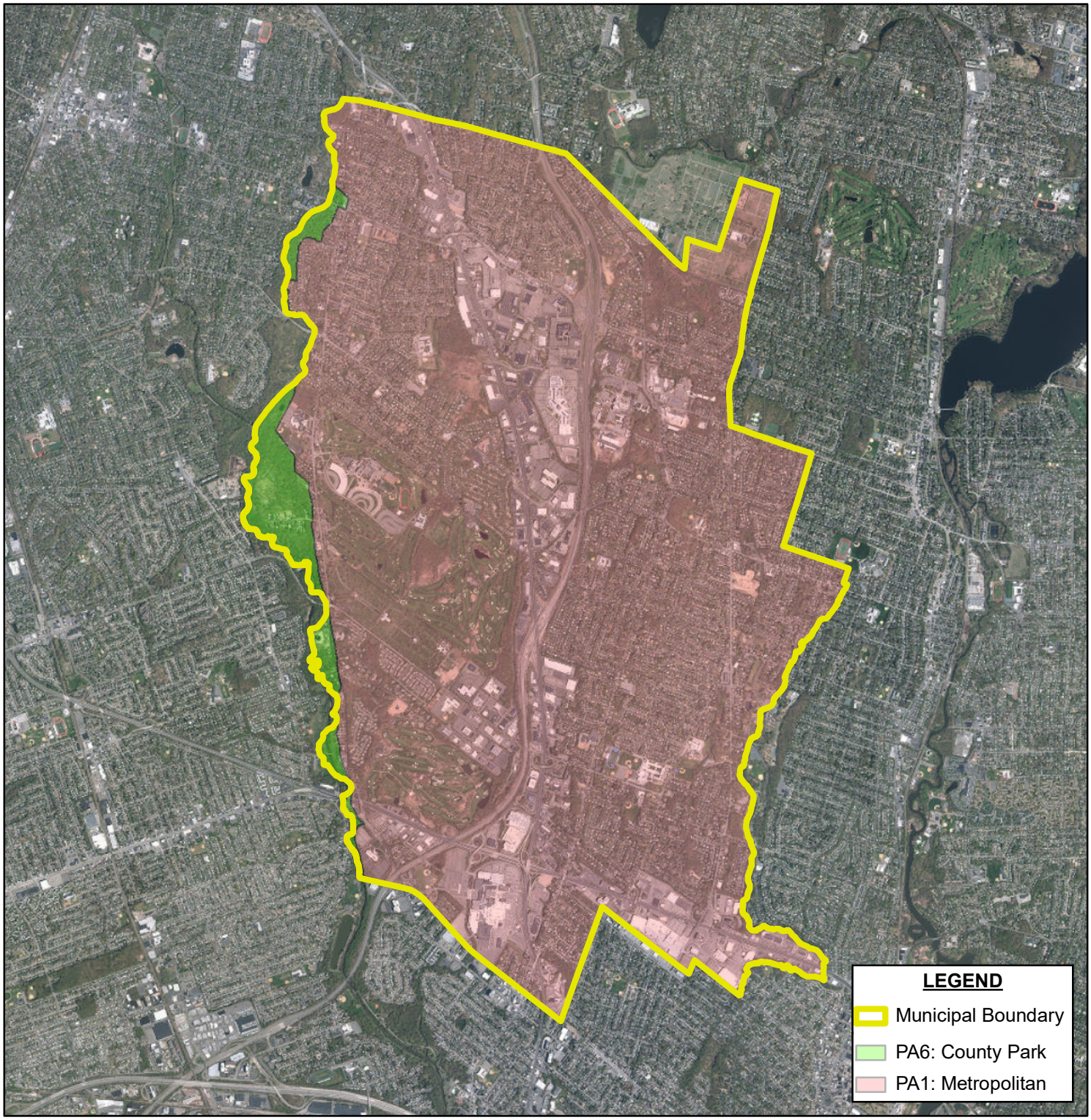
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

USGS TOPOGRAPHIC MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

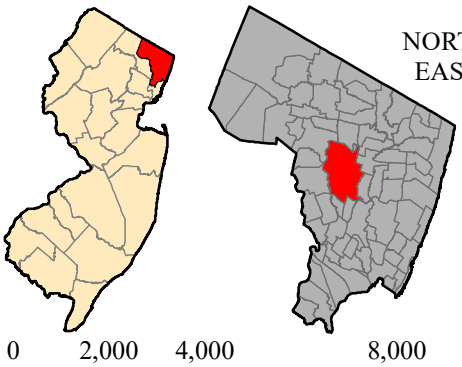
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 9



SOURCE: NEW JERSEY PLANNING MANAGEMENT AREAS DATALAYER



NORTHING: 769,296
EASTING: 610,845

0 2,000 4,000 8,000
FEET

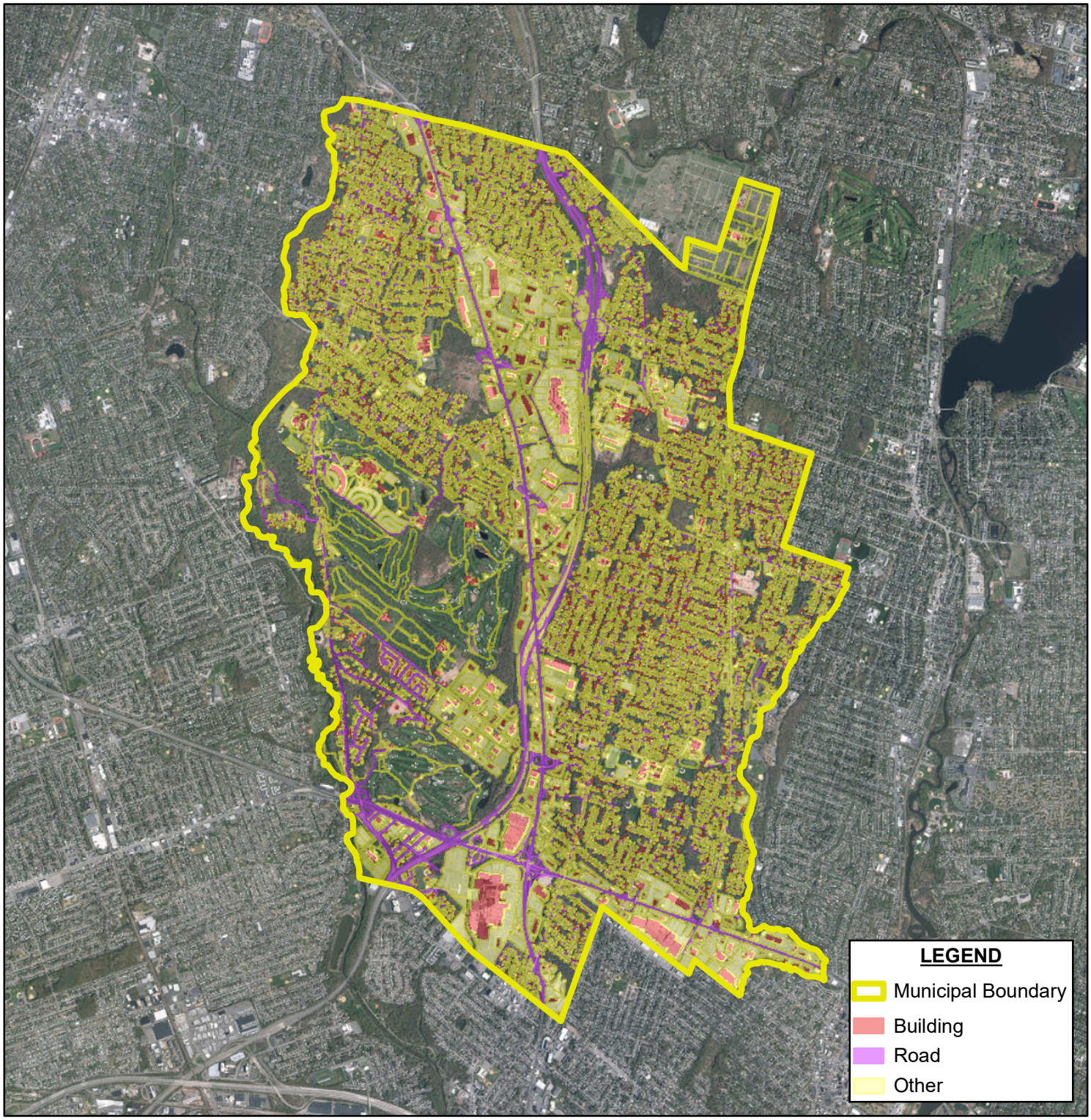
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

STATE PLANNING AREA MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

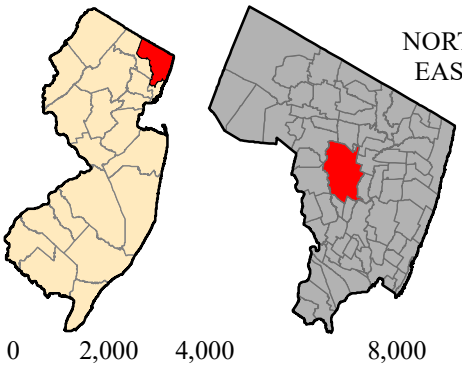
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 10



SOURCE: NJDEP LAND USE/LAND COVER IMPERVIOUS SURFACE 2015 DATALAYER



NORTHING: 769,296
EASTING: 610,845

0 2,000 4,000 8,000
FEET

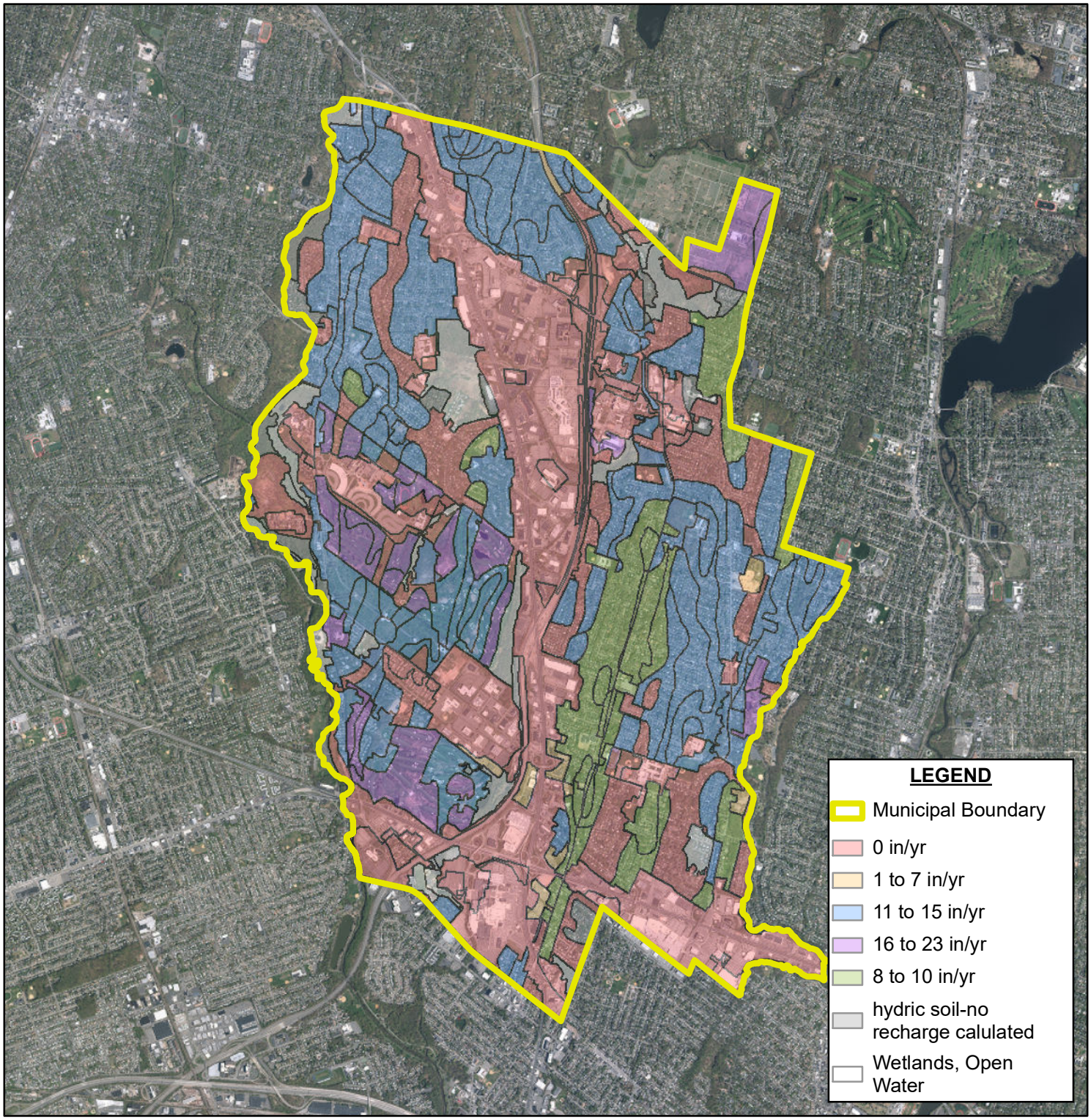
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

LAND USE IMPERVIOUS SURFACE MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

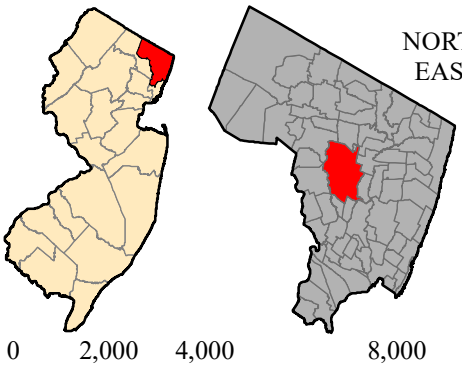
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 11



SOURCE: NJDEPBGIS GROUNDWATER RECHARGE AREA DATALAYER



NORTHING: 769,296
EASTING: 610,845

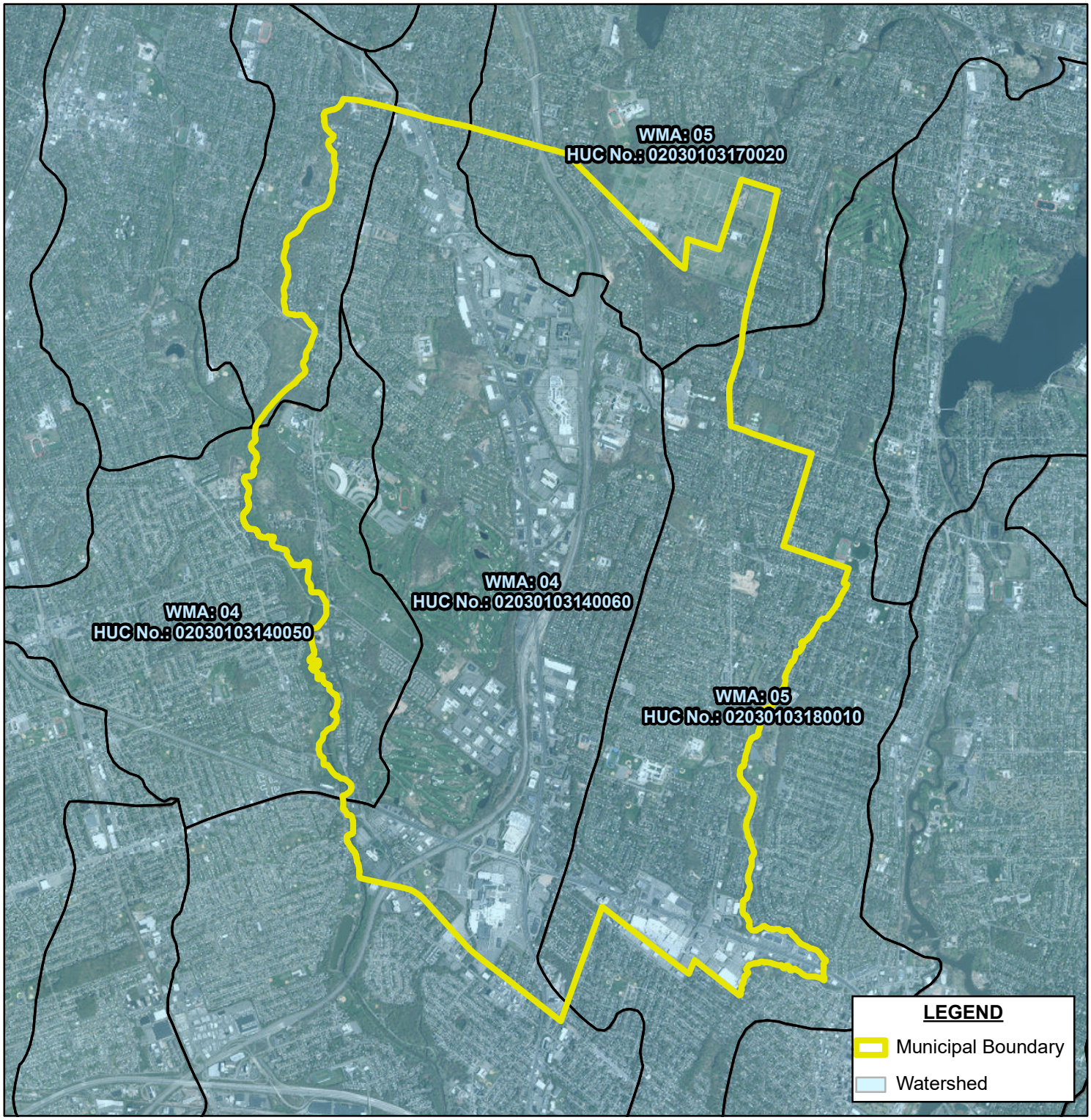
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

GROUNDWATER RECHARGE MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

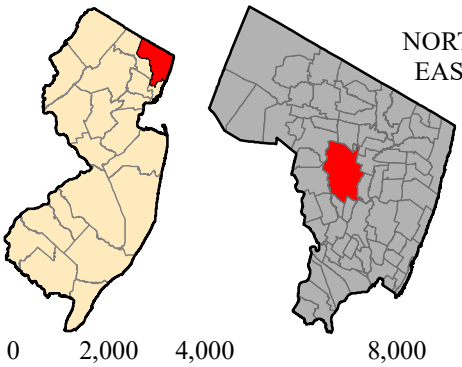
BOROUGH OF PARAMUS

BERGEN COUNTY — NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 12



SOURCE: NJDEP WATERSHED MANAGEMENT AREA DATALAYER



NORTHING: 769,296
EASTING: 610,845

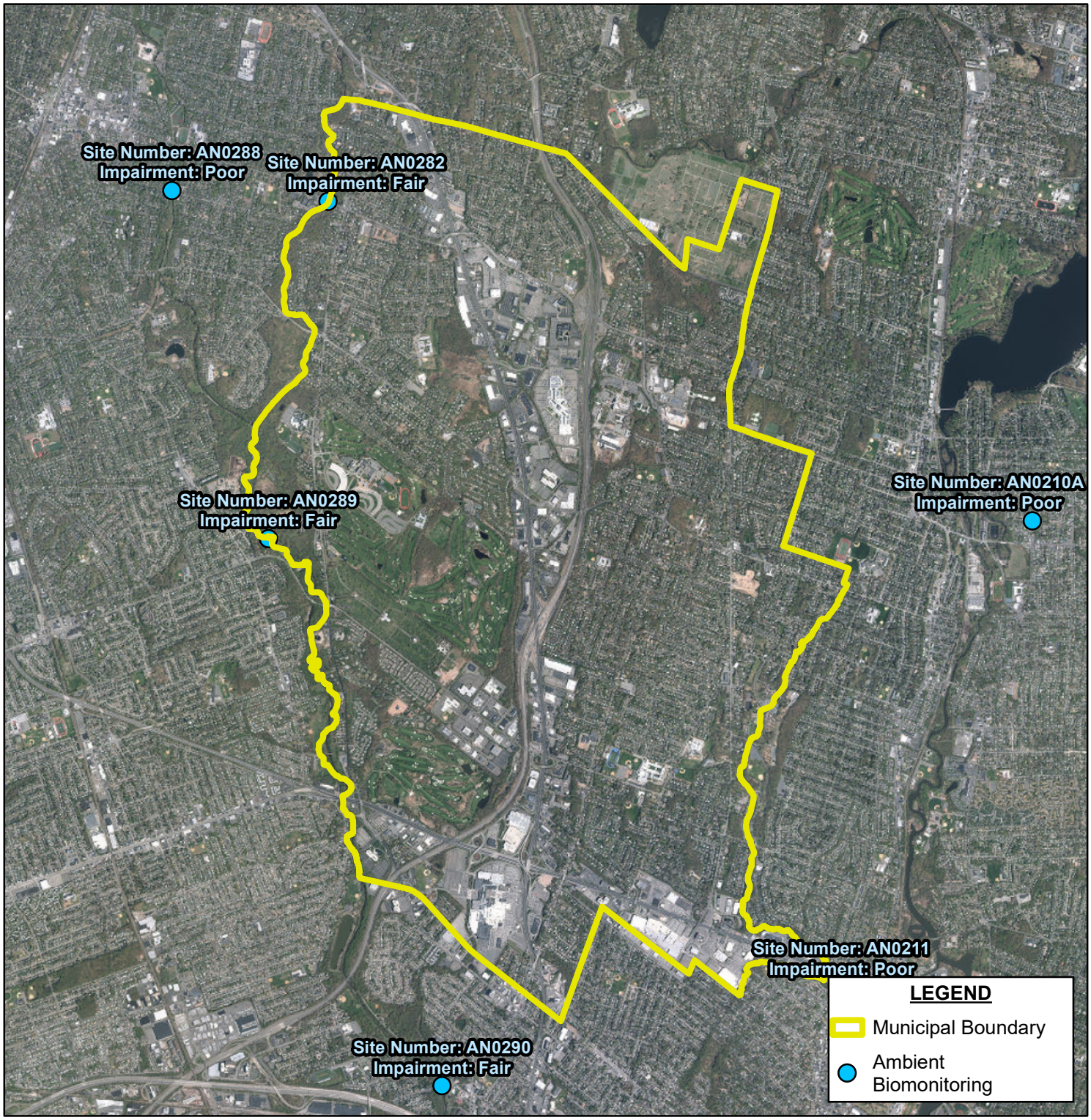
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

WATERSHED MANAGEMENT AREA MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

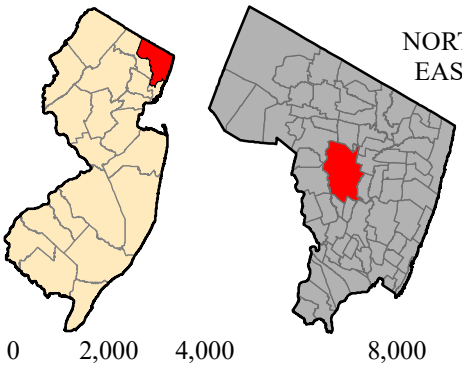
BOROUGH OF PARAMUS

BERGEN COUNTY — NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 13



SOURCE: NJDEP AMBIENT BIOMONITORING NETWORK (AMNET) DATALAYER



NORTHING: 769,296
EASTING: 610,845

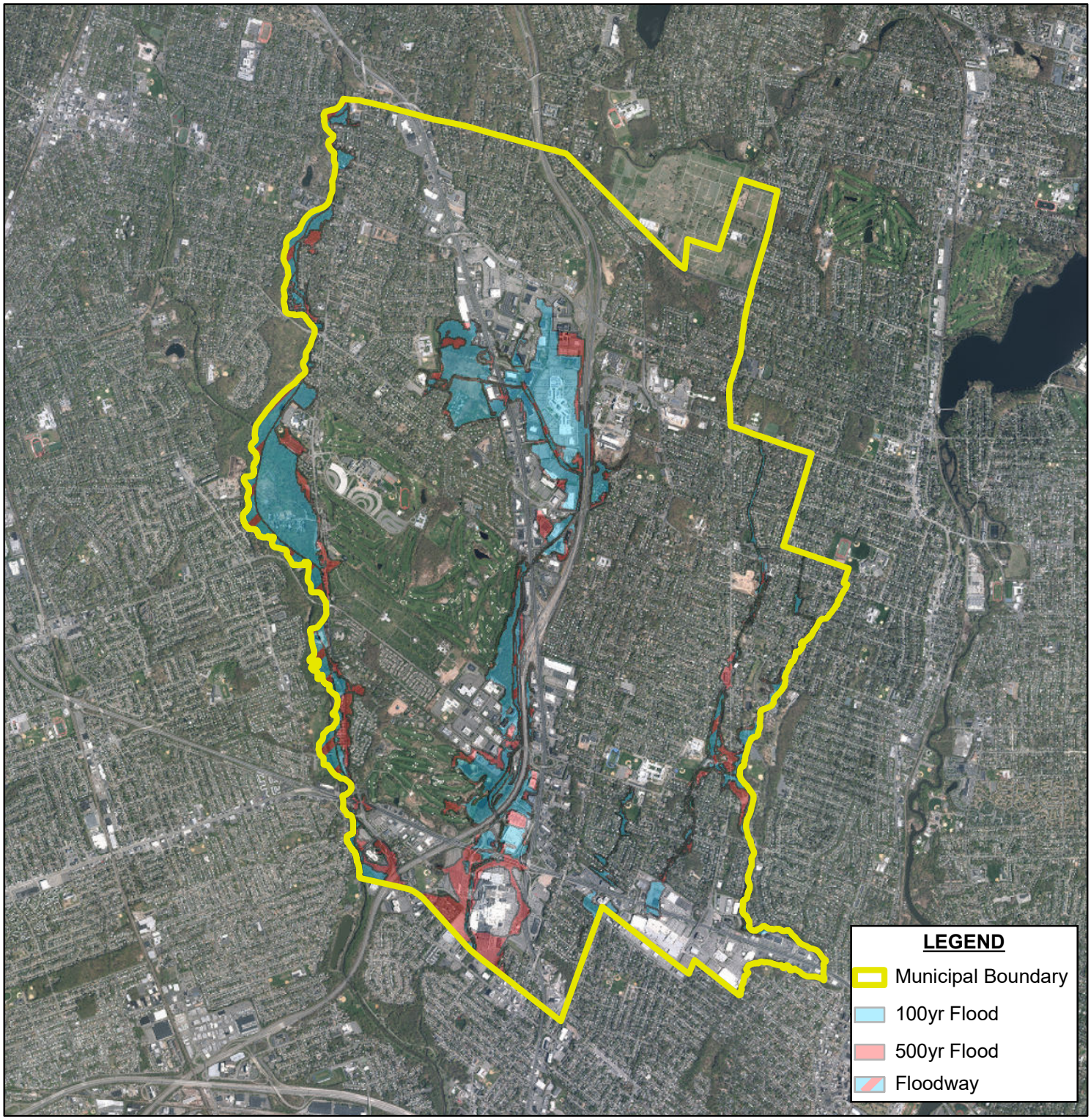
BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

AMBIENT BIOMONITORING NETWORK MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

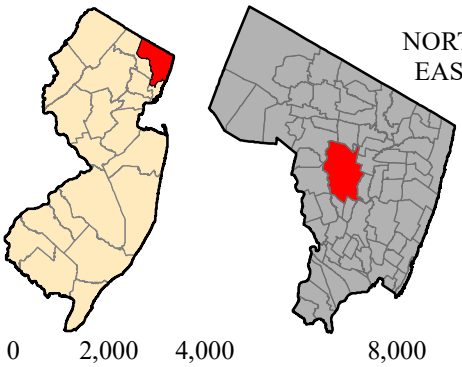
BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: JULY 2021	JOB NO. PA-3210 FIGURE 14



SOURCE: BERGEN COUNTY FEMA FLOOD DATA LAYER



NORTHING: 769,296
EASTING: 610,845

0 2,000 4,000 8,000
FEET

BOSWELL ENGINEERING
330 PHILLIPS AVE., SOUTH HACKENSACK, N.J. 07606

FEMA FLOOD MAP
MUNICIPAL STORMWATER MANAGEMENT PLAN

BOROUGH OF PARAMUS

BERGEN COUNTY NEW JERSEY

DR. BY: JMW CKD. BY: FJR	SCALE: 1 IN = 4,000 FT DATE: MARCH 2021	JOB NO. PA-3210 FIGURE 15

V. Design and Performance Standards

The Borough has reviewed its existing ordinances and adopted the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. The design and performance standards include language for maintenance of stormwater management measures consistent with the Stormwater Management Rules at N.J.A.C. 7:8-5.8 Maintenance Requirements, and the safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins.

The Borough aims for non-structural measures to be considered first and shall include site design and preventive source controls. To confirm the effectiveness of such measures, applicants must verify the control of stormwater quantity impacts as detailed in the Stormwater Management Rules and the Borough's Stormwater Control Ordinance.

The Stormwater Management Rules detail the general standards for structural measures which shall be incorporated as needed to meet the soil erosion, infiltration, and runoff quantity standards as identified in the Borough's Stormwater Control Ordinance. The design standards for the use of structural stormwater management measures are identified within the New Jersey Stormwater Best Management Practices Manual and other designs or practices may only be used upon approval from the Bergen County Soil Conservation District (BCSCD). The design and construction of such facilities must comply with the NJ Soil Erosion and Sediment Control Standards as well as any other applicable State regulations including the Freshwater Wetland Protection Act rules, the Flood Hazard Control Rules, the Surface Water Quality Standards, and the Dam Safety rules. Stormwater runoff quality controls for total suspended solids and nutrient load shall meet the design and performance standards as specified in the Stormwater Management Rules.

The Soil Erosion and Sediment Control Act of 1976 stipulates that any project proposing more than 5,000 square feet of soil disturbance must have a Soil Erosion and Sediment Control (SESC) Plan certified by the local district. Prior to any construction, the Building Department will review the application and, where applicable, require submission to the Bergen County Soil Conservation district to obtain a certification of approval prior to issuance of any construction permits.

In addition to the adoption of the above performance standards, during construction the Borough inspectors will observe the construction of the project to ensure that the stormwater management measures are constructed and function as designed. The Borough assumes responsibility for the operation and maintenance of municipally owned stormwater management facilities. Additionally, as per the Stormwater Control Ordinance, the Borough requires the maintenance of privately owned stormwater facilities and ensures compliance through annual inspections.

Due to Paramus containing lands classified as PA 1 the Borough defers to the New Jersey State Development and Redevelopment Plan adopted March 1, 2001 as it pertains to development and redevelopment.

VI. Plan Consistency

The Borough is not within a Regional Stormwater Management Planning Area; therefore, this Plan does not need to be consistent with any Regional Stormwater Management Plans (RSWMP). As previously stated, according to the NJDEP Bureau of Nonpoint Pollution Control Paramus has three listed TMDLs for fecal coliform, nickel, and total phosphorus *(Appendix B)*. The Borough's MSWMP is consistent with the current reported TMDLs, if any RSWMPs or TMDLs are developed in the future, this MSWMP will be updated as necessary to ensure consistency.

As previously stated, the Borough has incorporated green infrastructure and several non-structural stormwater strategies into their Zoning and Site Plan ordinances. The design of any development that disturbs at least 1 acre of land, increases impervious surface by at least 1/4 acre, creates 1/4 acre or more of "regulated motor vehicle surface"; or a combination of the aforementioned that totals an area of one-quarter acre or more must incorporate nonstructural stormwater management strategies "to the maximum extent practicable." The purpose of some of these non-structural strategies is to reduce damage to life and property by minimizing flooding. New major developments are reviewed for compliance with the Stormwater Management Rules at N.J.A.C. 7:8.

The MSWMP is consistent with the Residential Site Improvement Standards (RSIS) detailed at N.J.A.C. 5:21. The Borough will utilize the most current RSIS during the stormwater management review of residential development. This MSWMP will be updated to be consistent with any future changes to the RSIS.

The Borough's existing ordinances also require new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards as well as the requirements of all other applicable regulations. Any project with over 5,000 square feet of disturbance will require approval from the Bergen County Soil Conservation District. Projects disturbing one or more acres of land will require submission of a Request for Authorization (RFA) to the NJDEP Bureau of Non-Point Pollution Control. Additionally, all projects must be in compliance with the requirements of the Bergen County Storm Water Management Program which are in accordance with the New Jersey County Planning Enabling statutes (N.J.S.A. 40:27-1 et seq.). Approval of construction permits shall not be issued until all required approvals are received from the necessary districts, departments, and agencies.

Due to Paramus containing lands classified as PA 1 the Borough defers to the New Jersey State Development and Redevelopment Plan adopted March 1, 2001 as it pertains to development and redevelopment.

VII. Nonstructural Stormwater Management Strategies

Nonstructural measures are utilized in low impact development to reduce stormwater runoff impacts. The NJDEP Stormwater Management Rules at N.J.A.C. 7:8-2.4 require the design of any development that disturbs at least 1 acre of land, increases impervious surface by at least 1/4 acre, creates 1/4 acre or more of "regulated motor vehicle surface"; or a combination of the aforementioned that totals an area of one-quarter acre or more must incorporate nonstructural stormwater management strategies "to the maximum extent practicable." N.J.A.C. 7:8-2.4(g) identifies the following nonstructural stormwater management strategies:

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 "time of concentration" from pre-construction to postconstruction. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;
5. Minimize land disturbance, including clearing and grading;
6. Minimize soil compaction;
7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides;
8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and
9. Provide other source controls to prevent or minimize the use or exposure of pollutants from development sites in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:
    i. Development design features that help to prevent accumulation of trash and debris in drainage systems;
    ii. Development design features that help to prevent discharge of trash and debris from drainage systems; iii. Development design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and
    iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

The above referenced measures can be grouped into four general categories:

1. Vegetation and Landscaping
2. Minimizing Site Disturbance
3. Impervious Area Management;
4. Time of Concentration Modifications

The Borough's Stormwater Control Ordinance has been updated to incorporate the Stormwater Management Rule amendments for March 2021. All relevant Borough ordinances, including the Zoning Ordinance and the most recent Master Plan reexamination, are under review to update verbiage to encourage the implementation of nonstructural stormwater management measures. This MSWMP has been developed pursuant to N.J.A.C. 7:8-3 and 4. The following assessment of the current ordinances and documents has been prepared for future revisions regarding the four general categories mentioned above:

Vegetation and Landscaping

Existing and proposed vegetation at a land development site can significantly reduce the site's impact on downstream waterways and water bodies. To better manage stormwater runoff as it pertains to vegetation the Borough has identified the following potential improvements.

- All future developments shall be reviewed with a focus on preserving natural vegetative cover. Applications will require a plan showing natural vegetated areas on the pre-developed site and a narrative to be accompanied with photographs describing each area's vegetated and hydrologic characteristics. The Borough is considering the establishment of easements or deed restrictions on specific portions of parcels and lots to prohibit any future disturbance or alteration to vegetated areas.
- Disturbed sites within the Borough shall utilize native plants to reduce potential runoff from fabricated surfaces including pavement and turf fields. The Borough is considering the incorporation of native ground cover requirements for proposed development projects.
- The Borough plans to review the existing impervious surface cover within the municipality to determine where the implementation of vegetative filters located immediately downstream of impervious surfaces such as roadways and parking lots to achieve pollutant removal, groundwater recharge, and runoff volume reduction. Additionally, vegetated buffers may be utilized adjacent to streams, creeks, and other waterways and water bodies can also help mitigate thermal runoff impacts, provide wildlife habitat, and increase site aesthetics.

Minimizing Land Disturbance

The Borough of Paramus's recommendations are similar to those for low impact development. Therefore, for all phases of development, the Borough will consider the New Jersey Geological Survey's recommendations as listed below: The Borough of Paramus will consider reviewing projects for low impact development as per the standards listed below:

1. Do not concentrate flows.
2. Minimize grading.
3. Build within landscape (design around existing topography).
4. Do not alter natural drainage areas.
5. Minimize the amount of imperviousness.
6. Increased structural loads at the site can contribute to ground failures.
7. Changes to existing soil profile, including cuts, fills, and excavations, should be minimized.

The Borough will also refer to the additional information on development found in Appendix A-10 of the New Jersey Department of Agriculture's Soil Erosion and Sediment Control Standards or from either the State Soil Conservation Committee (SSCC) or the New Jersey Geological Survey (NJGS).

Additionally, the Borough will consider the implementation of deed restrictions as it pertains to redevelopment and post-construction to limit the expansion of impervious cover.

Impervious Area Management

Impervious areas within watersheds can have significant impacts on stream health. Increased stormwater runoff often results in degradation of water quality; increased waterway velocities, erosion, and flooding; and nonpoint source pollution. Comprehensive management of impervious cover can help reduce these impacts on watercourses and waterbodies and help to increase surface storage, infiltration and groundwater recharge, lessen stormwater runoff, and reduced storm sewer construction, maintenance, and repair costs. Impervious area management is significant as 4.552 sq. mi. (43.35%) of the Borough is classified as impervious as of 2015 ***(Figure 11)***. With consideration to the overall benefits of impervious surface reduction and the regulations set forth in N.J.A.C. 5:21 RSIS the Borough is considering ordinance modifications discussed below.

During the design process, time of concentration modifications to support low impact development will be considered to avoid or decrease the time of concentration by controlling the site factors that impact the rate of runoff. Specific factors include surface roughness changes, slope reduction, and vegetated conveyance.

Borough Code and Ordinance Analysis

To manage stormwater and protect the public interest, the Borough of Paramus has implemented a number of ordinances and regulations that incorporate nonstructural stormwater management requirements. The Borough Code and Ordinances were reviewed with regard to incorporating nonstructural stormwater management strategies. A summary of the of the pertinent provisions is presented below:

Chapter 371 of the Borough Code, entitled Site Plan Review and Chapter 383 of the Borough Code, entitled Streets and Sidewalks, were reviewed with regard to incorporating nonstructural stormwater management strategies. Several changes will be made to Article VI of Chapter 371, entitled Required Improvements, and Article III, entitled Acceptance of Streets, to incorporate these strategies, as follows:

<u>Section 371-29</u>. Curbing and Sidewalks:

This section requires that Poured-in-place Portland cement concrete or Belgian block curbing is required along the perimeters of any interior planted area and on the interior side of any required planted buffer area. Curbing in any other areas on the site shall also be Poured-in-place Portland cement or Belgian block, except the Portland cement only shall be used on streets. Barrier-free ramps for the handicapped shall be provided as required by law. Additionally, Concrete sidewalks shall be provided along the perimeter of the building adjoining a driveway or parking area, except loading areas, which shall be designed for the purpose of protecting the building and of sufficient size to provide for safe and sufficient ingress and egress for pedestrians going to, from and about the building. The Planning Board may, in its discretion, not require portions of the perimeter to have sidewalks where the same would serve neither of the aforementioned objectives. The applicant may provide or the Planning Board may require a planted area between said perimeter sidewalks and the building or buildings. All concrete sidewalks shall be of Poured-in-place Portland cement. Other materials may be permitted by the Planning

Board for curbs and sidewalks, where determined to be equally or more durable and visually appropriate. Furthermore, the Planning Board may require sidewalks for pedestrian safety in the parking areas of the lot and also to discourage uncontrolled cross-traffic so as to encourage the directing of the flow of traffic within the circulation system, aisles and driveways on the plan. This section will be amended to allow for the use of flush curbing with curb stops or curbing with curb cuts to encourage developers to allow for the discharge of impervious areas into landscaped areas for stormwater management. Also, language will be added to allow for the use of natural vegetated swales for the water quality design storm, with overflow for larger storm events into storm sewers.

Section 371-31. Discarded Materials:

This section describes that discarded material shall be screened and kept within limited confines. Any trash, refuse or discarded material or any combination thereof shall be enclosed and screened in any manner approved by the Planning Board, provided that the same is designed to effectively confine the material within the enclosed area and screen the same from other areas outside the building and is of a material that is not likely to create problems of maintenance, sanitation and nuisance. This section will be amended to provide pollution source control, prohibiting materials or wastes to be deposited upon a lot in such form or manner that they can be transferred off the lot, directly or indirectly, by natural forces such as precipitation, evaporation, or wind. It also requires that all materials and wastes that might result in pollution or a hazard be enclosed in appropriate containers.

Section 371-36. Driveways:

This section describes the construction requirements for driveways within the Borough. **Section 371-36.C** describes that the dimensions of curbline openings, aprons and driveways shall be designed to adequately accommodate the volume and type of vehicles anticipated to be generated by the site development. This section will be amended to encourage developers to design driveways to discharge stormwater to neighboring lawns where feasible to disconnect these impervious surfaces or use permeable paving materials where appropriate.

Section 371-38. Water, Sewage and Drainage Facilities:

This section describes the requirements for water, sewage, and drainage facilities within the Borough. **Section 371-38.C** describes that the Planning Board may require as part of the site plan approval that the applicant or owner dedicate to the Borough of Paramus an easement not greater than 15 feet wide for access to any sewer pipe that is under or to be placed under any portion of the lot under construction for site plan approval. This section will be amended to encourage the use of natural vegetated swales in lieu of gray stormwater infrastructure, including inlets and pipes.

Section 383-24. Sidewalks:

This section describes that there shall be on each side a sidewalk space of not less than 10 feet. Any sidewalks to be laid thereon shall be four feet in width and the inner edge thereof shall be a distance of 36 inches from the property lines. There shall be a pitch of 1/4 inch to the foot between the inner and outer edge thereof toward the center of the street. Additionally, the sidewalk shall be so graded that there shall be a rise of 1/4 inch to the foot from the top of the curb line to the property line or street line. This section will be amended to encourage the use of pervious materials to minimize stormwater runoff and promote groundwater recharge. Furthermore, this section will be amended to require developers to design sidewalks to discharge stormwater to neighboring lawns where feasible to disconnect these impervious surfaces or use permeable paving materials where appropriate.

Section 383-25. Pavement Specifications; Substitutions:

This section describes that before any street, road, avenue or other public place is accepted as a public highway, such street, road, avenue or other public place shall be graded in its entire width, including the sidewalks and the slopes provided in this article, and paved with a hard surface of no less degree of permanency than as set forth below by the owners of the property abutting on said street, road, avenue or other public place: 1) A bituminous concrete pavement shall be required on all streets in the Borough of Paramus. All new street paving shall consist of the following: a) A six-inch thick layer of dense graded aggregate thoroughly compacted; b) A four-inch thick layer of bituminous concrete stabilized base material, thoroughly compacted, equivalent to New Jersey Department of Transportation material specification Mix I-2; c) A two-inch thick layer of bituminous concrete surface course, thoroughly compacted, equivalent to New Jersey Department of Transportation FABC Mix I-5. A tack coat of asphaltic oil or emulsified asphalt shall be applied between the stabilized base and the surface course. The tack coat shall be applied at a rate of 0.10 gallons per square yard. Additionally, Types of pavement not coming within the classification above but which may be considered more or less standard shall be first submitted to the Mayor and Council for approval. This section will be amended to encourage the use of pervious materials to minimize stormwater runoff and promote groundwater recharge.

Ordinance No. 2021-25, entitled Stormwater Management was adopted to repeal and replace Chapter 363, Sections 363-36 through 363-46.1 of the code; several changes have been made to incorporate nonstructural stormwater management strategies, as follows:

Section 363-37. Definitions:

The definition of "Major Development" has been updated to incorporate the creation of one-quarter acre or more of "regulated motor vehicle surface" to include more projects to which these rules apply.

Including the updated definition of major development mentioned above, definitions have been included within this section to clarify and define various areas that pertain to nonstructural stormwater management strategies that

include, but are not limited to, the following: "Regulated Impervious Surface", "Regulated Motor Vehicle Surface", "Green Infrastructure", "New Jersey Stormwater BMP Manual", etc.

Section 363-39. Stormwater Management Requirements for Major Development:

The Borough has adopted changes to apply the total suspended solids (TSS) removal requirement to the runoff from motor vehicles surfaces.

Ordinance No. 2021-25 above was adopted and implemented based on the New Jersey Department of Environmental Protection (NJDEP)'s model ordinance found at Appendix D of the BMP Manual. The Borough is currently considering adopting standards stronger than the statewide minimum requirements following the Watershed Institute Enhanced Model ordinance. The Watershed Institute Enhanced Stormwater Management Ordinance includes the following provisions: A reduced threshold definition for major development; Requirements for major developments to treat runoff from all impervious surfaces for water quality; Requirements for stormwater management for minor developments over 250 square feet; Requirements that address redevelopment; Requirements for Low Impact Development techniques to be utilized; and the inclusion of maintenance reporting requirements. The Borough is also considering adopting a zoning ordinance to specifically address stormwater management requirements for minor development.

The Borough will also be considering a new ordinance to provide protection to the lands surrounding the public well fields. The ordinance standards will limit the use of specific potential hazardous materials within wellhead protection areas. Additionally, Best Management Practice procedures will be implemented for other potential pollutant sources in the wellhead protection areas.

The Borough contains and lies within several wellhead protection areas. A wellhead protection area is divided into three (3) tiers; the 2-year (Tier 1), 5-year (Tier 2), and 12-year (Tier 3); are intended to represent the time of travel (TOT) a groundwater contaminant in the zones could be expected to reach a municipal potable supply well. The NJDEP then prioritizes the investigation and remediation of contaminated sites within the 2 and 5-year tiers. Wellhead protection areas are shown in ***Figure 7***. The wellhead protection area shown is for the wellhead at the Oradell Reservoir. This wellhead is a major draw for United Water and lies in the Borough of Harrington Park. The Borough may also wish to adopt specific ordinances to further protect wellhead protection areas and minimize the infiltration of pollutants into aquifers.

In conclusions, the Borough will refer to the New Jersey Stormwater Best Management Practices Chapter 2 "Low Impact Development Techniques" during the review and adoption process of the amendments mentioned above.

VIII. Land Use/Build-Out Analysis

As previously stated, Appendix C of the New Jersey Best Management Practices Manual last revised in March of 2020 outlines that municipalities with less than one square mile of vacant or agricultural lands are not required to complete a "build-out" analysis. Therefore, this plan does not require a "build-out" analysis as the Borough of Paramus contains 0.285 sq. mi. (182.081 acres) of vacant land and 0.045 sq. mi. (28.637) of agricultural land as depicted in ***Figure 4***.

A record search identified vacant property in the Borough as shown below:

Table 11: **Vacant Properties Within the Borough of Paramus**

Block	Lot	Owner	Parcel Size (Acres)
105	1	DE POL, MICHAEL	0.117
109	2	VAN BAAREN, ANNA M	0.234
212	9	WESTLAND GSP %PROP TAX DEPT	0.091
301	5	WESTLAND G S P,L.P.PROP TAX DEPT	48.61
407	15	VANDER PLAAT PARAMUS LLC	0.115
409	7	COLUMBIA SAVINGS & LOAN ASSOCIATION	0.154
409	9	COLUMBIA SAVINGS & LOAN ASSOCIATION	0.115
410	7	GABBAY, EDWARD	0.154
410	8	RT. 17 & GERTRUDE% SHOTMEYER BROS	0.178
410	9	RT. 17 & GERTRUDE C/OSHOTMEYER BROS	0.138
412	1	ROUTE 17 NORTH REALTY LLC%COACH	0.887
502	7	BURROUGHS-LPM LTD.PARTNERSHIP	0.163
502	8	BURROUGHS-LPM LTD.PARTNERSHIP	0.239
502	9	BURROUGHS-LPM LTD.PARTNERSHIP	3.38
505	2	RAR CONSTRUCTION LLC	0.115
505	10	RAR CONSTRUCTION LLC	0.343
515	12	SANTANA, MANUEL D	0.137
601	7	OSTER S-10 PROPERTIES LLC	0.211
607	13	255 W SPRING VALLEY AVE LLC	0.088
902	11	MULAKU, ENIS & SKENDER	0.002
1001	12	OUTDOOR SYSTEMS, INC.	0.5
1101	3	ALX OF PARAMUS LLC	6.78
1208	7	PFEFFER, MARILYN	0.057
1214	5	34 FARVIEW TER LLC	0.155
1304	19	AKDEMIR, MORRIS	1.35
1602	3	MNEIRJI, ENRIQUE C/O KABBABE	0.548
1602	10	MOUNAYARGI, C.& A.C/O KABBABE	0.687
1704	6	WEEDO, CALVIN C.	0.82

Block	Lot	Owner	Parcel Size (Acres)
1901	3.01	HERMAX ENTERPR%CAPITOL LIGHTING/MAX	0.21
2109	5.01	HOWLAND FOREST INC	6.56
2201	3	UNITED WATER MGMT.SUEZ % ALTUS GRP	0.3
2201	5	OSUNA, VALENTIN	0.76
2202	7	PERIDES, THEODOROS	0.69
2506	4	RAGHUBANS, KHEMRAJ & ROHINI	0.25
2706	8	JAHN, RICHARD & DIANNE	0.046
2708	15	PANDYA, ANIL & BHAVNA	0.078
2710	2	EFJ 158 FOREST LLC	0.56
2804	2	PATEL, DILIP M & DIPTI D	0.57
3215	15	DIONISIO, CONSTANTINO S & (ETAL)	0.299
3303	3	KEPPLER, KENNETH	0.92
3305	11	AMATO, CORRADO A.& PATRICIA M.	0.6
3404	9.04	INTERBUILD HOLDINGS LLC%H ENDER	1.01
3501	3	PERSAUD, RAMESH & ALIEA	1.46
3608	20	335 MAPLEWOOD LLC	0.215
3608	22	341 MAPLEWOOD LLC	0.215
3706	15	MLT PROPERTIES LLC	0.257
3801	18	MANSOORI, MATHIN	0.479
3902	15	SUPER VALUE, INC%DATTILO MANAGEMENT	0.974
3905	1	GIBLIN, TODD M	0.61
3905	7	COLE, ROBET J. & MAXINE	0.216
3905	11	KIM, SEUNGMIN &CHO, YOUNG MI	0.005
4002	12	UNITED WATER MGMT.SUEZ/ ALTUS GRP US	3.06
4103	11	ANDY PROPERTY INVESTMENT LLC	0.661
4103	14	CASAMENTI, ALPHONSE & LISA	0.73
4104	24	MACCHIONE, FRANK A	0.472
4108	6	KUNDRIAT, EDWARD & CAROLINE	0.2447
4301	5	CARLSON FAMILY FOUND.,C/O J NORTON	2.43
4608	1	JEONG, SHIN-HYE	0.236
4701	9.01	REVICKI FARMS LLC	2.933
4705	16.02	SHAH, VINAY & PARU	0.3677
4705	17.01	ABM INVESTMENTS LLC	0.3301
4705	17.02	ABM INVESTMENTS LLC.	0.3668
4705	17.03	ABM INVESTMENTS LLC.	0.386

Block	Lot	Owner	Parcel Size (Acres)
4705	17.04	ABM INVESTMENTS LLC.	0.3861
4710	1	EIGHTH AVENUE LOTS, LLC	0.52
4711	1	SAMMON, BRIGID R.	0.002
4711	2	SAMMON, BRIGID R.	0.103
4711	3	SAMMON, BRIGID R.	0.067
4711	4	SAMMON, BRIGID R.	0.28
4712	1	INCITTI, MAURIZIO & MARIA	0.002
4712	2	INCITTI, MAURIZIO & MARIA	0.015
4712	3	EIGHTH AVENUE LOTS, LLC	0.105
4712	4	THOMSEN, HARRY C/O H. BARNES	0.08
4712	5	KLEIN REALTY CO. C/O H. BARNES	0.095
4712	6	CHEN, SONG QIN & KAREN J.	0.133
4712	7	PARK, SUNG HYUK & JUNG, HEEJUNG	0.143
4712	8	CAMPANELLI, PAUL & LINDA	0.115
4712	9	DESTEFAN(ETALS), MICHAEL	0.098
4809	12.01	PARAMUS ROAD INVESTMENTS LLC	0.3306
4809	12.02	DOWNIE, CHRISTOPHER & ALMAN, ERICA	0.2871
4809	12.04	MORIN, DOMINICK & CHRISTINE	0.2902
5103	6	LIPSHITZ, ELAN & JEAN	0.289
5203	3	PARAMUS PARK%GENL GROWTH PROP	1.17
5304	2	461 PARCEL LLC./C/O GARRISON INVEST	0.99
5508	10.02	MOWLE, MARGARET A TRUSTEE	0.354
5508	10.03	MOWLE, MARGARET A TRUSTEE	0.352
5703	8	SECLEN, PHILLIP	0.275
5811	16	KIM, BYUNG SUK & SUNGYOON	0.08
6004	13	ALAMPI, SANTO T & CRYSTAL	0.241
6017	13	GREY, JR., DONALD D. & TRACY J.	0.498
6610	9	SILBERBERG, NEIL & LISA	0.309
6705	9	AMUNDSON, FRIEND MARK & MARGARET	0.057
6706	9	TUZIO JR, JOSEPH A & LORRAINE	0.115
6707	2	SCHMELZER, JOSEPH A. & DIANA F.	0.131
6806	3.02	YASSA, PETER & MISHRIKY, NARDIN	0.433
6809	5	GREY, JR., DONALD D. & TRACY J.	0.234
6809	6	GREY, DONALD D & TRACY J	0.359
6813	10	THIRD PARAMUS ASSOCIATES LLC	0.326

Block	Lot	Owner	Parcel Size (Acres)
6813	22	STRASSER, WILLIAM I & MARIANNE E	0.215
6916	16	GALKA CINQUE LLC	0.215
7119	8	CROSBY, RUSSELL J & ANNA	0.271
7517	1	UNITED WATER MGMT.%ALTUS GRP USINC	0.1
7601	7	SCHUERMANN, ANTON & AUDREY M	0.299
7604	16	O'NEILL, FINBAR & PAULA	0.196
7604	45	PASCACK ASSOC LLC%ONEKEY LLC	1.87
7706	1.01	SHAMROCK CREEK LLC	44.19

IX. Mitigation Plans

Upon review by the Borough's governing body, Paramus may utilize the following mitigation plan in the future. However, at this time the municipality is not granting variances or waivers from the conditions set forth within the adopted Stormwater Control Ordinance. Approval of the option to utilize a mitigation plan and choice of mitigation plan shall be under the sole discretion of the Borough agency providing review, i.e. Board of Adjustment, Planning Board, Borough Council, and the Borough Engineer.

This mitigation plan is provided for potential future implementation as it pertains to a proposed development that is granted a variance or exemption from the stormwater management design and performance standards. Presented below is a hierarchy of options acceptable for review by the Borough.

Mitigation Project Criteria

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

   The applicant can propose the utilization of one of the following projects to compensate for the deficit of the performance standards resulting from the proposed project. More detailed information on the projects can be obtained from the Borough Engineer. Listed below are specific projects that can be used to address the mitigation requirement.

   Groundwater Recharge

   - Retrofit existing detention basins to provide additional cubic feet of average annual groundwater recharge.
   - Replace existing deteriorated, impervious overflow parking lots with permeable paving to provide additional cubic feet of average annual groundwater recharge.

   Water Quality

   - Retrofit existing stormwater management facilities to provide the removal of 90 percent of total suspended solids (TSS) from the parking lot in question.

   Water Quantity

   - Install stormwater management measures in open spaces within various developments to reduce the peak flow from the upstream development on the receiving stream for the 2, 20, and 100-year storms.

2. If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, the proposed project may provide mitigation that is not equivalent to the impacts for which the variance or exemption is sought, but that addresses the same issue. For example, if a variance is given because the 90 percent TSS requirement is not met, the selected project may address water quality impacts due to applicable TMDLs.

Only a brief description of a potential project is presented here, it is important that the Borough has sufficient information on each project, including size of the project, permit requirements, land ownership, and estimated project costs (i.e., permitting fees, engineering costs, construction costs, and maintenance costs).

The Borough may allow a developer to provide funding or partial funding to the municipality for an environmental enhancement project that has been identified in a Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan. The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.

Appendix A

Stormwater Control Ordinance

BOROUGH OF PARAMUS
COUNTY OF BERGEN
STATE OF NEW JERSEY

ORDINANCE 2021-25

AN ORDINANCE TO REPEAL AND REPLACE PART II, GENERAL LEGISLATION, CHAPTER 363, SEWERS, ARTICLE VII, GOVERNING STORMWATER MANAGEMENT, SUBSECTION 363-36 THROUGH SUBSECTION 363-46.1 OF THE REVISED GENERAL ORDINANCES OF THE BOROUGH OF PARAMUS

BE IT ORDAINED, by the Mayor and Council of the Borough of Paramus, County of Bergen and State of New Jersey, that Part II, General Legislation, Chapter 363, Sewers, Article VII, Governing Stormwater Management, Subsection 363-36 through Subsection 363-46.1 is hereby repealed and replaced as follows:

Section 1. The current text of Part II, General Legislation, Chapter 363, Sewers, Article VII, Governing Stormwater Management, Subsection 363-36 through Subsection 363-46.1 is hereby repealed and replaced as follows:

§363-36. Scope and Purpose:

A. Policy Statement. Flood control, groundwater recharge, and pollutant reduction shall be achieved through the use of stormwater management measures, including green infrastructure Best Management Practices (GI BMPs) and nonstructural stormwater management strategies. GI BMPs and low impact development (LID) should be utilized to meet the goal of maintaining natural hydrology to reduce stormwater runoff volume, reduce erosion, encourage infiltration and groundwater recharge, and reduce pollution. GI BMPs and LID 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.

B. Purpose. The purpose of this ordinance is to establish minimum stormwater management requirements and controls for "major development," as defined below in §363-37.

C. Applicability.

1. This ordinance shall be applicable to the following major developments:

   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 the Borough of Paramus.

D. Compatibility with Other Permit and Ordinance Requirements.

Development approvals issued pursuant to this ordinance are to be considered an integral part of development approvals 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.

§363-37. Definitions:

For the purpose of this ordinance, the following terms, phrases, words and their derivations shall have the meanings stated herein unless their use in the text of this Chapter clearly demonstrates a different meaning. When not inconsistent with the context, words used in the present tense include the future, words used in the plural number include the singular number, and words used in the singular number include the plural number. The word "shall" is always mandatory and not merely directory. 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 Centers, Cores or Nodes" means those areas with boundaries incorporated by reference or revised by the Department in accordance with N.J.A.C. 7:7-13.16.

"CAFRA Planning Map" means the map used by the Department to identify the location of Coastal Planning Areas, CAFRA centers, CAFRA cores, and CAFRA nodes. The CAFRA Planning Map is available on the Department's Geographic Information System (GIS).

"Community basin" means an infiltration system, sand filter designed to infiltrate, standard constructed wetland, or wet pond, established in accordance with N.J.A.C. 7:8-4.2(c)14, that is designed and constructed in accordance with the New Jersey Stormwater Best Management Practices Manual, or an alternate design, approved in accordance with N.J.A.C. 7:8-5.2(g), for an infiltration system, sand filter designed to infiltrate, standard constructed wetland, or wet pond and that complies with the requirements of this chapter.

"Compaction" means the increase in soil bulk density.

"Contributory drainage area" means the area from which stormwater runoff drains to a stormwater management measure, not including the area of the stormwater management measure itself.

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

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

1. A county planning agency or
2. A county water 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 Department of Environmental Protection.

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

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

"Development" means the division of a parcel of land into two or more

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

In the case of development of agricultural land, 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.

"Disturbance" means the placement or reconstruction of impervious surface or motor vehicle surface, or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation. Milling and repaving is not considered disturbance for the purposes of this definition.

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

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

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

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

"Green infrastructure" means a stormwater management measure that manages stormwater close to its source by:

1. Treating stormwater runoff through infiltration into subsoil;
2. Treating stormwater runoff through filtration by vegetation or soil; or
3. Storing stormwater runoff for reuse.

"HUC 14" or "hydrologic unit code 14" means an area within which water drains to a particular receiving surface water body, also known as a subwatershed, which is identified by a 14-digit hydrologic unit boundary designation, delineated within New Jersey by the United States Geological Survey.

"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.

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

"Major development" means an individual "development," as well as multiple developments that individually or collectively result in:

1. The disturbance of one or more acres of land since February 2, 2004;
2. The creation of one-quarter acre or more of "regulated impervious surface" since February 2, 2004;
3. The creation of one-quarter acre or more of "regulated motor vehicle surface" since March 2, 2021; or
4. A combination of 2 and 3 above that totals an area of one-quarter acre or more. The same surface shall not be counted twice when determining if the combination area equals one-quarter acre or more.

Major development includes all developments that are part of a common plan of development or sale (for example, phased residential development) that collectively or individually meet any one or more of paragraphs 1, 2, 3, or 4 above. Projects undertaken by any government agency that 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."

"Motor vehicle" means land vehicles propelled other than by muscular power, such as automobiles, motorcycles, autocycles, and low speed vehicles. For the purposes of this definition, motor vehicle does not include farm equipment, snowmobiles, all-terrain vehicles, motorized wheelchairs, go-carts, gas buggies, golf carts, ski-slope grooming machines, or vehicles that run only on rails or tracks.

"Motor vehicle surface" means any pervious or impervious surface that is intended to be used by "motor vehicles" and/or aircraft, and is directly exposed to precipitation including, but not limited to, driveways, parking areas, parking garages, roads, racetracks, and runways.

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

"New Jersey Stormwater Best Management Practices (BMP) Manual" or "BMP Manual" means the manual maintained by the Department providing, in part, design specifications, removal rates, calculation methods, and soil testing procedures approved by the Department as being capable of contributing to the achievement of the stormwater management standards specified in this chapter. The BMP Manual is periodically amended by the Department as necessary to provide design specifications on additional best management practices and new information on already included practices reflecting the best available current information regarding the particular practice and the Department's determination as to the ability of that best management practice to contribute to compliance with the standards contained in this chapter. Alternative stormwater management measures, removal rates, or calculation methods may be utilized, subject to any limitations specified in this chapter, provided the design engineer demonstrates to the municipality, in accordance with §363-39.F. of this ordinance and N.J.A.C. 7:8-5.2(g), that the proposed measure and its design will contribute to achievement of the design and performance standards established by this chapter.

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

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

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

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

"Regulated impervious surface" means any of the following, alone or in combination:

1. A net increase of impervious surface;
2. The total area of impervious surface collected by a new stormwater conveyance system (for the purpose of this definition, a "new stormwater conveyance system" is a stormwater conveyance system that is constructed where one did not exist immediately prior to its construction or an existing system for which a new discharge location is created);
3. The total area of impervious surface proposed to be newly collected by an existing stormwater conveyance system; and/or
4. The total area of impervious surface collected by an existing stormwater conveyance system where the capacity of that conveyance system is increased.

"Regulated motor vehicle surface" means any of the following, alone or in combination:

1. The total area of motor vehicle surface that is currently receiving water;
2. A net increase in motor vehicle surface; and/or quality treatment either by vegetation or soil, by an existing stormwater management measure, or by treatment at a wastewater treatment plant, where the water quality treatment will be modified or removed.

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

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"Stormwater management measure" means any 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.

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

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

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

"Tidal Flood Hazard Area" means a flood hazard area in which the flood elevation resulting from the two-, 10-, or 100-year storm, as applicable, is governed by tidal flooding from the Atlantic Ocean. Flooding in a tidal flood hazard area may be contributed to, or influenced by, stormwater runoff from inland areas, but the depth of flooding generated by the tidal rise and fall of the Atlantic Ocean is greater than flooding from any fluvial sources. In some situations, depending upon the extent of the storm surge from a particular storm event, a flood hazard area may be tidal in the 100-year storm, but fluvial in more frequent storm events.

"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.

"Water control structure" means a structure within, or adjacent to, a water, which intentionally or coincidentally alters the hydraulic capacity, the flood elevation resulting from the two-, 10-, or 100-year storm, flood hazard area limit, and/or floodway limit of the water. Examples of a water control structure may include a bridge, culvert, dam, embankment, ford (if above grade), retaining wall, and weir.

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

"Wetlands" or "wetland" means an area that is inundated or saturated by surface water or 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.

§363-38. Design and Performance Standards for Stormwater Management Measures:

A. Stormwater management measures for major development shall be designed to provide erosion control, groundwater recharge, stormwater runoff quantity control, and stormwater runoff quality treatment as follows:

1. The minimum standards for erosion control are those established under the Soil and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules at N.J.A.C. 2:90.

2. The minimum standards for groundwater recharge, stormwater quality, and stormwater runoff quantity shall be met by incorporating green infrastructure.

B. 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.

§363-38.1 Nonstructural Stormwater Strategies:

A. Standards for nonstructural management measures.

1. Buffers. Buffer areas are required along all lot and street lines separating residential uses from arterial and collector streets, separating a nonresidential use from either a residential use or residential zoning district line, and along all street lines where loading and storage areas can be seen from the street. The buffer area shall use native vegetation, which requires less fertilization and watering than nonnative species. Buffer areas may be used for stormwater management by disconnecting impervious surfaces and treating runoff from these impervious surfaces. Preservation of natural wood tracts and limiting land disturbance for new construction shall be incorporated where practical.

2. Curbs and gutters. Curb cuts or flush curbs with curb stops are encouraged where practical to allow vegetated swales to be used for stormwater conveyance and to allow for the disconnection of impervious areas where practical.

3. Drainage systems. An existing ordinance may require that all streets be provided with inlets and pipes where the same are necessary for proper drainage. The use of natural vegetated swales in lieu of inlets and pipes is encouraged where practical.

4. Driveways and accessways. The use of pervious paving materials to minimize stormwater runoff and promote groundwater recharge should be considered for driveways and accessways where practical. Consideration should be given for subsurface soil conditions. The use of crowned driveways is also encouraged to promote dis-connectivity between impervious surfaces and allow grass areas to promote groundwater recharge.

5. Natural features. Natural features, such as trees, brooks, swamps, hilltops, and views, are to be preserved whenever possible, and that care be taken to preserve selected trees to enhance soil stability and landscape treatment of the area. In addition, forested areas shall be maintained to ensure that leaf litter and other beneficial aspects of the forest are maintained in addition to the trees.

6. Nonconforming uses, structures or lots. The existing ordinance may allow an applicant/owner of an existing use to propose additions or alterations that exceed the permitted building and/or lot coverage percentages. The applicant should mitigate the impact of the additional impervious surfaces unless the stormwater management plan for the development provided for these increases in impervious surfaces. This mitigation effort must address water quality, flooding and groundwater recharge.

7. Off-site and off-tract improvements. Any off-site and off-tract stormwater management and drainage improvements shall conform to the "Design and Performance Standards" described herein and in the Borough Code.

8. Off-street parking and loading. Where practical, parking lots with more than 10 spaces and all loading areas should allow for flush curb with curb stop or curbing with curb cuts to encourage developers to allow for the discharge of impervious areas into landscaped areas for stormwater management. The use of natural vegetated swales for the water quality design storm, with overflow for larger storm events into storm sewers, should be utilized where practical. A developer may demonstrate that fewer spaces would be required, provided that area is set aside for additional spaces if necessary. Pervious paving could be provided for overflow parking areas.

9. Performance standards. Pollution source control must be evaluated in order to prohibit materials or wastes from being deposited upon a lot in such form or manner that they can be transferred off the lot, directly or indirectly, by natural forces such as precipitation, evaporation or wind. Materials and wastes that might create a pollutant or a hazard shall be enclosed with appropriate measures/devices.

10. Shade trees. The existing ordinance requires shade trees to be planted along the street on which the building fronts. In addition to this section, the Borough may have a Tree Preservation Ordinance that restricts and

otherwise controls the removal of mature trees throughout the Borough. This chapter should recognize that the preservation of mature trees and forested areas must be considered in the management of environmental resources, particularly watershed management, air quality, and ambient heating and cooling. A critical disturbance area that extends beyond the driveway and building footprint where clearing of trees cannot occur shall be depicted on the plan minimizing land disturbance. Identification of forested areas and the percentage of wooded areas be protected from disturbance shall also be provided.

11. Sidewalks. Sidewalks should be designed to discharge stormwater to neighboring lawns where feasible to disconnect these impervious surfaces or use permeable paving materials where appropriate.

12. Soil erosion and sediment control. The applicant shall comply with the New Jersey Soil Erosion and Sediment Control Standards and/or the Borough's Soil Movement Ordinance as applicable and should incorporate procedures to retain and protect natural vegetation; minimize and retain water runoff to facilitate groundwater recharge; and install diversions, sediment basins, and similar required structures prior to any on-site grading or disturbance.

B. Further guidance on the implementation of these strategies can be found in the New Jersey Department of Environmental Protection Stormwater Best Management Practices Manual, April 2004, as amended.

§363-39. 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 §363-45.

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

C. The following linear development projects are exempt from the groundwater recharge, stormwater runoff quality, and stormwater runoff quantity requirements of §363-39. P, Q and R:

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 green infrastructure, groundwater recharge, stormwater runoff quality, and stormwater runoff quantity requirements of §363-39. O, P, Q and R 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 stormwater management measures, the option selected complies with the requirements of §363-39. O, P, Q and R to the maximum extent practicable;
3. The applicant demonstrates that, in order to meet the requirements of §363-39. O, P, Q and R, 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 §363-39. D.3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate the requirements of §363-39. O, P, Q and R that were not achievable onsite.

E. Tables 1 through 3 below summarize the ability of stormwater best management practices identified and described in the New Jersey Stormwater Best Management Practices Manual to satisfy the green infrastructure, groundwater recharge, stormwater runoff quality and stormwater runoff quantity standards specified in §363-39. O, P, Q and R. When designed in accordance with the most current version of the New Jersey Stormwater Best Management Practices Manual, the stormwater management measures found at N.J.A.C. 7:8-5.2 (f) Tables 5-1, 5-2 and 5-3 and listed below in Tables 1, 2 and 3 are presumed to be capable of providing stormwater controls for the design and performance standards as

outlined in the tables below. Upon amendments of the New Jersey Stormwater Best Management Practices to reflect additions or deletions of BMPs meeting these standards, or changes in the presumed performance of BMPs designed in accordance with the New Jersey Stormwater BMP Manual, the Department shall publish in the New Jersey Registers a notice of administrative change revising the applicable table. The most current version of the BMP Manual can be found on the Department's website at:

https://njstormwater.org/bmp_manual2.htm.

F. Where the BMP tables in the NJ Stormwater Management Rule are different due to updates or amendments with the tables in this ordinance the BMP Tables in the Stormwater Management rule at N.J.A.C. 7:8-5.2(f) shall take precedence.

Table 1:
Green Infrastructure BMPs for Groundwater Recharge, Stormwater Runoff Quality, and/or Stormwater Runoff Quantity

Best Management Practice	Stormwater Runoff Quality TSS Removal Rate (percent)	Stormwater Runoff Quantity	Groundwater Recharge	Minimum Separation from Seasonal High-Water Table
Cistern	0	Yes	No	
Dry Well[a]	0	No	Yes	2
Grass Swale	50 or less	No	No	2[e] 1[f]
Green	0	Yes	No	
Manufactured Treatment Device[a] [g]	50 or 80	No	No	Dependent upon the device
Pervious Paving System[a]	80	Yes	Yes[b] No[c]	2[b] 1[c]
Small-Scale Bioretentio	80 or 90	Yes	Yes[b] No[c]	2[b] 1[c]

Small-Scale Infiltration	80	Yes	Yes	2
Small-Scale Sand	80	Yes	Yes	2
Vegetative Filter Strip	60-80	No	No	--

(Notes corresponding to annotations [a] through [g] are found under Table 3)

Table 2:
Green Infrastructure BMPs for Stormwater Runoff Quantity (or for Groundwater Recharge and/or Stormwater Runoff Quality with a Waiver or Variance from N.J.A.C. 7:8-5.3)

Best Management Practice	Stormwater Runoff Quality TSS Removal Rate (percent)	Stormwater Runoff Quantity	Groundwater Recharge	Minimum Separation from Seasonal High-Water Table
Bioretention System	80 or 90	Yes	Yes[b] No[c]	2[b] 1[c]
Infiltration Basin	80	Yes	Yes	2
Sand Filter[b]	80	Yes	Yes	2
Standard Constructed Wetland	90	Yes	No	N/A
Wet Pond[d]	50-90	Yes	No	N/A

(Notes corresponding to annotations [b] through [d] are found under Table 3)

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Table 3:
BMPs for Groundwater Recharge, Stormwater Runoff Quality, and/or Stormwater Runoff Quantity only with a Waiver or Variance from N.J.A.C. 7:8-5.3

Best Management Practice	Stormwater Runoff Quality TSS Removal Rate (percent)	Stormwater Runoff Quantity	Groundwater Recharge	Minimum Separation from Seasonal High-Water Table
Blue Roof	0	Yes	No	N/A
Extended Detention Basin	40-60	Yes	No	1
Manufactured Treatment Device[h]	50 or 80	No	No	Dependent upon the device
Sand Filter[c]	80	Yes	No	1
Subsurface Gravel Wetland	90	No	No	1
Wet Pond	50-90	Yes	No	N/A

Notes to Tables 1, 2, and 3:

(a) subject to the applicable contributory drainage area limitation specified at §363-39. O.2;
(b) designed to infiltrate into the subsoil;
(c) designed with underdrains;
(d) designed to maintain at least a 10-foot-wide area of native vegetation along at least 50 percent of the shoreline and to include a stormwater runoff retention component designed to capture stormwater runoff for beneficial reuse, such as irrigation;
(e) designed with a slope of less than two percent;
(f) designed with a slope of equal to or greater than two percent;
(g) manufactured treatment devices that meet the definition of green infrastructure at §363-37;
(h) manufactured treatment devices that do not meet the definition of green infrastructure at §363-37.

G. An alternative stormwater management measure, alternative removal rate, and/or alternative method to calculate the removal rate may be used if the design engineer demonstrates the capability of the proposed alternative stormwater management measure and/or the validity of the alternative rate or method to the municipality. A copy of any approved alternative stormwater management measure, alternative removal rate, and/or alternative method to calculate the removal rate shall be provided to the Department in accordance with §363-41. B. Alternative stormwater management measures may be used to satisfy the requirements at §363-39. O only if the measures meet the definition of green infrastructure at §363-37. Alternative stormwater management measures that function in a similar manner to a BMP listed at Section O.2 are subject to the contributory drainage area limitation specified at Section O.2 for that similarly functioning BMP. Alternative stormwater management measures approved in accordance with this subsection that do not function in a similar manner to any BMP listed at Section O.2 shall have a contributory drainage area less than or equal to 2.5 acres, except for alternative stormwater management measures that function similarly to cisterns, grass swales, green roofs, standard constructed wetlands, vegetative filter strips, and wet ponds, which are not subject to a contributory drainage area limitation. Alternative measures that function similarly to standard constructed wetlands or wet ponds shall not be used for compliance with the stormwater runoff quality standard unless a variance in accordance with N.J.A.C. 7:8-4.6 or a waiver from strict compliance in accordance with §363-39. D is granted from §363-39. O.

H. Whenever the stormwater management design includes one or more BMPs that will infiltrate stormwater into subsoil, 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 or other subsurface structures within the zone of influence of the groundwater mound, or interference with the proper functioning of the stormwater management measure itself.

I. Design standards for stormwater management measures are as follows:

1. Stormwater management measures shall be designed to take into account the existing site conditions, including, but not limited to, 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. Stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure, as appropriate, and shall have parallel bars with one-inch spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third the width of the diameter of the orifice or one-third the width of the weir, with a minimum spacing between bars of one inch and a maximum spacing between bars of six inches. In addition, the design of trash racks must comply with the requirements of §363-43.C;
3. 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. Stormwater management BMPs shall be designed to meet the minimum safety standards for stormwater management BMPs at §363-43; and
5. The size of the orifice at the intake to the outlet from the stormwater management BMP shall be a minimum of two and one-half inches in diameter.

J. Manufactured treatment devices may be used to meet the requirements of this subchapter, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department. Manufactured treatment devices that do not meet the definition of green infrastructure at §363-37 may be used only under the circumstances described at §363-39. O.4.

K. Any application for a new agricultural development that meets the definition of major development at §363-37 shall be submitted to the Soil Conservation District for review and approval in accordance with the requirements at §363-39. O, P, Q and R and any applicable Soil Conservation District guidelines for stormwater runoff quantity and erosion control. For purposes of this subsection, "agricultural development" means land uses normally associated with the production of food, fiber, and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacture of agriculturally related products.

L. If there is more than one drainage area, the groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards at §363-39.P, Q and R shall be met in each drainage area, unless the runoff from the drainage areas converge onsite and no adverse environmental impact would occur as a result of compliance with any one or more of the individual standards being determined utilizing a weighted average of the results achieved for that individual standard across the affected drainage areas.

M. Any stormwater management measure authorized under the municipal stormwater management plan or ordinance shall be reflected in a deed notice recorded in the Bergen County Clerk's Office located at: 1 Bergen County Plaza, Hackensack, New Jersey 07601. A form of deed notice shall be submitted to the municipality for approval prior to filing. The deed notice shall contain a description of the stormwater management measure(s) used to meet the green infrastructure, groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards at §363-39. O, P, Q and R and shall identify the location of the stormwater management measure(s) in NAD 1983 State Plane New Jersey FIPS 2900 US Feet or Latitude and Longitude in decimal degrees. The deed notice shall also reference the maintenance plan required to be recorded upon the deed pursuant to §363-45. B.5. Prior to the commencement of construction, proof that the above required deed notice has been filed shall be submitted to the municipality. Proof that the required information has

been recorded on the deed shall be in the form of either a copy of the complete recorded document or a receipt from the clerk or other proof of recordation provided by the recording office. However, if the initial proof provided to the municipality is not a copy of the complete recorded document, a copy of the complete recorded document shall be provided to the municipality within 180 calendar days of the authorization granted by the municipality.

N. A stormwater management measure approved under the municipal stormwater management plan or ordinance may be altered or replaced with the approval of the municipality, if the municipality determines that the proposed alteration or replacement meets the design and performance standards pursuant to §363-39 of this ordinance and provides the same level of stormwater management as the previously approved stormwater management measure that is being altered or replaced. If an alteration or replacement is approved, a revised deed notice shall be submitted to the municipality for approval and subsequently recorded with the Office of the Clerk of the County of Bergen and shall contain a description and location of the stormwater management measure, as well as reference to the maintenance plan, in accordance with M above. Prior to the commencement of construction, proof that the above required deed notice has been filed shall be submitted to the municipality in accordance with M above.

O. Green Infrastructure Standards:

1. This subsection specifies the types of green infrastructure BMPs that may be used to satisfy the groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards.

2. To satisfy the groundwater recharge and stormwater runoff quality standards at §363-39. P and Q, the design engineer shall utilize green infrastructure BMPs identified in Table 1 at §363-39. F. and/or an alternative stormwater management measure approved in accordance with §363-39. G. The following green infrastructure BMPs are subject to the following maximum contributory drainage area limitations:

3. To satisfy the

Best Management Practice	Maximum Contributory Drainage Area
Dry Well	1 acre
Manufactured Treatment Device	2.5 acres
Pervious Pavement Systems	Area of additional inflow cannot exceed three times the area occupied by the BMP
Small-scale Bioretention Systems	2.5 acres
Small-scale Infiltration Basin	2.5 acres
Small-scale Sand Filter	2.5 acres

stormwater runoff quantity standards at §363-39. R, the design engineer shall utilize BMPs from Table 1 or from Table 2 and/or an alternative stormwater management measure approved in accordance with §363-39. G.

4. If a variance in accordance with N.J.A.C. 7:8-4.6 or a waiver from strict compliance in accordance with §363-39.D is granted from the requirements of this subsection, then BMPs from Table 1, 2, or 3, and/or an alternative stormwater management measure approved in accordance with §363-39.G may be used to meet the groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards at §363-39.P, Q and R.

5. For separate or combined storm sewer improvement projects, such as sewer separation, undertaken by a government agency or public utility (for example, a sewerage company), the requirements of this subsection shall only apply to areas owned in fee simple by the government agency or utility, and areas within a right-of-way or easement held or controlled by the government agency or utility; the entity shall not be required to obtain additional property or property rights to fully satisfy the requirements of this subsection. Regardless of the amount of area of a separate or combined storm sewer improvement project subject to the green infrastructure requirements of this subsection, each project shall fully comply with the applicable groundwater recharge, stormwater runoff quality control, and stormwater runoff quantity standards at §363-39. P, Q and R, unless

the project is granted a waiver from strict compliance in accordance with §363-39. D.

P. Groundwater Recharge Standards.

1. This subsection contains the minimum design and performance standards for groundwater recharge as follows:
2. The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at §363-40, either:

   i. 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

   ii. 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.

3. This groundwater recharge requirement does not apply to projects within the "urban redevelopment area," or to projects subject to 4 below.

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

   i. 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

   ii. 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.

Q. Stormwater Runoff Quality Standards.

1. This subsection contains the minimum design and performance standards to control stormwater runoff quality impacts of major development. Stormwater runoff quality standards are applicable when the major development results in an increase of one-quarter acre or more of regulated motor vehicle surface.

2. Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm as follows:

   i. Eighty percent TSS removal of the anticipated load, expressed as an annual average shall be achieved for the stormwater runoff from the net increase of motor vehicle surface.
   ii. If the surface is considered regulated motor vehicle surface because the water quality treatment for an area of motor vehicle surface that is currently receiving water quality treatment either by vegetation or soil, by an existing stormwater management measure, or by treatment at a wastewater treatment plant is to be modified or removed, the project shall maintain or increase the existing TSS removal of the anticipated load expressed as an annual average.

3. 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. Every major development, including any that discharge into a combined sewer system, shall comply with 2 above, unless the major development is itself subject to a NJPDES permit with a numeric effluent limitation for TSS or the NJPDES permit to which the major development is subject exempts the development from a numeric effluent limitation for TSS.
4. 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 4, below. The calculation of the volume of runoff may take into account the implementation of stormwater management measures.

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Table 4: Water Quality Design Storm Distribution

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Time (Minutes)	Cumulative Rainfall (Inches)	Time (Minutes)	Cumulative Rainfall (Inches)	Time (Minutes)	Cumulative Rainfall (Inches)
1	0.00166	41	0.1728	81	1.0906
2	0.00332	42	0.1796	82	1.0972
3	0.00498	43	0.1864	83	1.1038
4	0.00664	44	0.1932	84	1.1104
5	0.00830	45	0.2000	85	1.1170
6	0.00996	46	0.2117	86	1.1236
7	0.01162	47	0.2233	87	1.1302
8	0.01328	48	0.2350	88	1.1368
9	0.01494	49	0.2466	89	1.1434
10	0.01660	50	0.2583	90	1.1500
11	0.01828	51	0.2783	91	1.1550
12	0.01996	52	0.2983	92	1.1600
13	0.02164	53	0.3183	93	1.1650
14	0.02332	54	0.3383	94	1.1700
15	0.02500	55	0.3583	95	1.1750
16	0.03000	56	0.4116	96	1.1800
17	0.03500	57	0.4650	97	1.1850
18	0.04000	58	0.5183	98	1.1900
19	0.04500	59	0.5717	99	1.1950
20	0.05000	60	0.6250	100	1.2000
21	0.05500	61	0.6783	101	1.2050
22	0.06000	62	0.7317	102	1.2100
23	0.06500	63	0.7850	103	1.2150
24	0.07000	64	0.8384	104	1.2200
25	0.07500	65	0.8917	105	1.2250
26	0.08000	66	0.9117	106	1.2267
27	0.08500	67	0.9317	107	1.2284
28	0.09000	68	0.9517	108	1.2300
29	0.09500	69	0.9717	109	1.2317
30	0.10000	70	0.9917	110	1.2334
31	0.10660	71	1.0034	111	1.2351
32	0.11320	72	1.0150	112	1.2367
33	0.11980	73	1.0267	113	1.2384
34	0.12640	74	1.0383	114	1.2400
35	0.13300	75	1.0500	115	1.2417
36	0.13960	76	1.0568	116	1.2434
37	0.14620	77	1.0636	117	1.2450
38	0.15280	78	1.0704	118	1.2467
39	0.15940	79	1.0772	119	1.2483
40	0.16600	80	1.0840	120	1.2500

5. 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:

   $R = A + B - (A \times B) / 100$,

   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.

6. 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 green infrastructure BMPs that optimize nutrient removal while still achieving the performance standards in §363-39. P, Q and R.
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. The Flood Hazard Area Control Act Rules at N.J.A.C. 7:13-4.1(c)1 establish 300-foot riparian zones along Category One waters, as designated in the Surface Water Quality Standards at N.J.A.C. 7:9B, and certain upstream tributaries to Category One waters. A person shall not undertake a major development that is located within or discharges into a 300-foot riparian zone without prior authorization from the Department under N.J.A.C. 7:13.
9. Pursuant to the Flood Hazard Area Control Act Rules at N.J.A.C. 7:13-11.2(j)3. i, runoff from the water quality design storm that is discharged within a 300-foot riparian zone shall be treated in accordance with this subsection to reduce the post-construction load of total suspended solids by 95 percent of the anticipated load from the developed site, expressed as an annual average.
10. This stormwater runoff quality standards do not apply to the construction of one individual single-family dwelling, provided that it is not part of a larger development or subdivision that has received preliminary or final site plan approval prior to December 3, 2018, and that the motor vehicle surfaces are made of permeable material(s) such as gravel, dirt, and/or shells.

R. Stormwater Runoff Quantity Standards.

1. This subsection contains the minimum design and performance standards to control stormwater runoff quantity impacts of major development.
2. In order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at §363-40, complete one of the following:

   i. 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;

   ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 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;

   iii. 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; or

   iv. In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with 2.i, ii and iii above is required unless the design engineer demonstrates through hydrologic and hydraulic analysis that the increased volume, change in timing, or increased rate of the stormwater runoff, or any combination of the three will not result in additional flood damage below the point of discharge of the major development. No analysis is required if the stormwater is discharged directly into any ocean, bay, inlet, or the reach of any watercourse between its confluence with an ocean, bay, or inlet and downstream of the first water control structure.

3. The stormwater runoff quantity standards shall be applied at the site's boundary to each abutting lot, roadway, watercourse, or receiving storm sewer system.

§363-40. Calculation of Stormwater Runoff and Groundwater Recharge:

A. Stormwater runoff shall be calculated in accordance with the following:

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

i. The USDA Natural Resources Conservation Service (NRCS) methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Chapters 7, 9, 10, 15 and 16 Part 630, Hydrology National Engineering Handbook, incorporated herein by reference as amended and supplemented. This methodology is additionally described in *Technical Release 55 - Urban Hydrology for Small Watersheds* (TR-55), dated June 1986, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the Natural Resources Conservation Service website at:

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044171.pdf

or at United States Department of Agriculture Natural Resources Conservation Service, 220 Davison Avenue, Somerset, New Jersey 08873; or

ii. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations. The rational and modified rational methods are described in "Appendix A-9 Modified Rational Method" in the Standards for Soil Erosion and Sediment Control in New Jersey, January 2014. This document is available from the State Soil Conservation Committee or any of the Soil Conservation Districts listed at N.J.A.C. 2:90-1.3(a)3. The location, address, and telephone number for each Soil Conservation District is available from the State Soil Conservation Committee, PO Box 330, Trenton, New Jersey 08625. The document is also available at:

http://www.nj.gov/agriculture/divisions/anr/pdf/2014NJSoilErosionControlStandardsComplete.pdf.

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 above at §363-40. A.1.i and the Rational and Modified Rational Methods at §363-40. A.1. ii. 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 has existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations. In addition, there is the presumption that the site is in good hydrologic condition (if the land use type is pasture, lawn, or park), with good cover (if the land use type is woods), or with good hydrologic condition and conservation treatment (if the land use type is cultivation).

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

4. In computing stormwater runoff from 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* or other methods may be employed.

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

B. Groundwater recharge may be calculated in accordance with the following:

The New Jersey Geological Survey Report GSR-32, A Method for

Evaluating Groundwater-Recharge Areas in New Jersey, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the New Jersey Stormwater Best Management Practices Manual; at the New Jersey Geological Survey website at:

https://www.nj.gov/dep/njgs/pricelst/gsreport/gsr32.pdf

or at New Jersey Geological and Water Survey, 29 Arctic Parkway, PO Box 420 Mail Code 29-01, Trenton, New Jersey 08625-0420.

§363-41. Sources for Technical Guidance:

A. Technical guidance for stormwater management measures can be found in the documents listed below, which are available to download from the Department's website at:

http://www.nj.gov/dep/stormwater/bmp_manual2.htm.

1. Guidelines for stormwater management measures are contained in the New Jersey Stormwater Best Management Practices Manual, as amended and supplemented. Information is provided on stormwater management measures such as, but not limited to, those listed in Tables 1, 2, and 3.

2. Additional maintenance guidance is available on the Department's website at:

https://www.njstormwater.org/maintenance_guidance.htm.

B. Submissions required for review by the Department should be mailed to:

The Division of Water Quality, New Jersey Department of Environmental Protection, Mail Code 401-02B, PO Box 420, Trenton, New Jersey 08625-0420.

§363-42. Solids and Floatable Materials Control Standards:

A. Site design features identified under §363-39.F above, or alternative designs in accordance with §363-39.G above, to prevent discharge of trash and debris from drainage systems 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 §363-42.A.2 below.

1. Design engineers shall use one 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:

   i. 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; or

   ii. 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 system floors used to collect stormwater from the surface into a storm drain or surface water body.

   iii. For curb-opening inlets, including curb-opening inlets in combination inlets, 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.

2. The standard in A.1. above does not apply:

   i. Where each individual clear space in the curb opening in existing curb-opening inlet does not have an area of more than nine (9.0) square inches;

ii. Where the municipality agrees that the standards would cause inadequate hydraulic performance that could not practicably be overcome by using additional or larger storm drain inlets;

iii. 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 (4.625) inches long and one and one-half (1.5) inches wide (this option does not apply for outfall netting facilities); or
b. A bar screen having a bar spacing of 0.5 inches.

Note that these 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(b)1).

iv. Where flows are conveyed through a trash rack that has parallel bars with one-inch (1 inch) spacing between the bars, to the elevation of the Water Quality Design Storm as specified in N.J.A.C. 7:8; or

v. 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.

§363-43. 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 BMPs. This section applies to any new stormwater management BMP.

B. The provisions of this section are not intended to preempt more stringent municipal or county safety requirements for new or existing stormwater management BMPs. Municipal and county stormwater management plans and ordinances may, pursuant to their authority, require existing stormwater management BMPs to be retrofitted to meet one or

more of the safety standards in §363-43.C.1, 363-43.C.2, and 363-43.C.3 for trash racks, overflow grates, and escape provisions at outlet structures.

C. 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 BMP to ensure proper functioning of the BMP outlets in accordance with the following:

   i. The trash rack shall have parallel bars, with no greater than six-inch spacing between the bars;
   ii. The trash rack shall be designed so as not to adversely affect the hydraulic performance of the outlet pipe or structure;
   iii. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per second under the full range of stage and discharge. Velocity is to be computed on the basis of the net area of opening through the rack; and
   iv. The trash rack shall be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 pounds per square foot.

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:

   i. The overflow grate shall be secured to the outlet structure but removable for emergencies and maintenance.
   ii. The overflow grate spacing shall be no less than two inches across the smallest dimension
   iii. 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 pounds per square foot.

3. Stormwater management BMPs shall include escape provisions as follows:

   i. If a stormwater management BMP 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 BMPs. With the prior

approval of the municipality pursuant to §363-43.C, a free-standing outlet structure may be exempted from this requirement;

ii. Safety ledges shall be constructed on the slopes of all new stormwater management BMPs 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* §363-43.E for an illustration of safety ledges in a stormwater management BMP; and

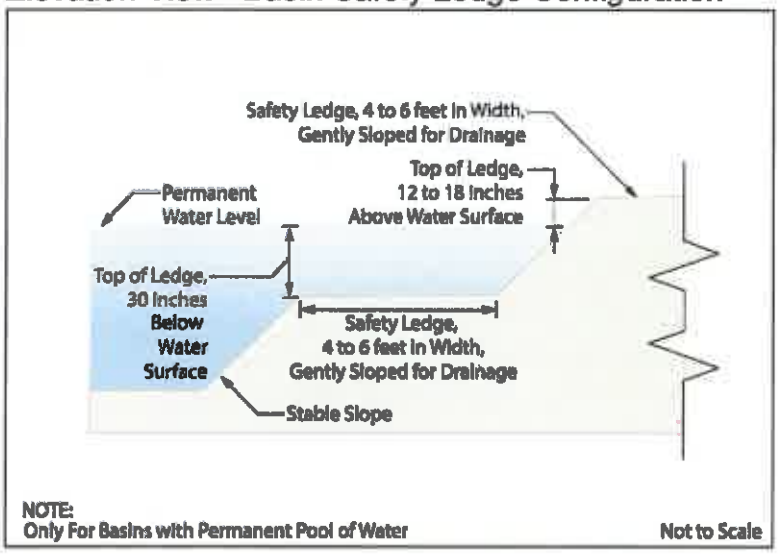
iii. In new stormwater management BMPs, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than three horizontal to one vertical.

D. Variance or Exemption from Safety Standard.

A variance or exemption from the safety standards for stormwater management BMPs may be granted only upon a written finding by the municipality that the variance or exemption will not constitute a threat to public safety.

E. Safety Ledge Illustration.

Elevation View –Basin Safety Ledge Configuration



§363-44. Requirements for a Site Development Stormwater Plan:

BOROUGH OF PARAMUS
COUNTY OF BERGEN
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ORDINANCE 2021-25

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 §363-44.C below as part of the submission of the application for approval.

2. The applicant shall demonstrate that the project meets the standards set forth in this ordinance.

3. The applicant shall submit six (6) copies of the materials listed in the checklist for site development stormwater plans in accordance with §363-44.C of this ordinance.

B. Site Development Stormwater Plan Approval.

The applicant's Site Development project shall be reviewed as a part of the review process by the municipal board or official from which municipal approval is sought. That municipal board or official shall consult the municipality's review engineer 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. Submission of Site Development Stormwater Plan.

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 surroundings should be submitted. 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 Plans.

   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 will occur in the natural terrain and cover, including lawns and other landscaping, and seasonal high groundwater elevations. A written description of the site plan and justification for proposed changes in natural conditions shall also be provided.

4. Land Use Planning and Source Control Plan.

   This plan shall provide a demonstration of how the goals and standards of §363-38 through §363-40 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:

i. Total area to be disturbed, 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.

ii. 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.

   i. Comprehensive hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in §363-39 of this ordinance.

   ii. When the proposed stormwater management control measures depend on the hydrologic properties of soils or require certain separation from the seasonal high-water table, 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 §363-45.

8. Waiver from Submission Requirements.

   The municipal official or board reviewing an application under this ordinance may, in consultation with the municipality's review engineer, waive submission of any of the requirements in §363-44.C.1 through §363-44.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.

§363-45. Maintenance and Repair:

A. Applicability.

Projects subject to review as in §363-36.C of this ordinance shall comply with the requirements of §363-45.B and §363-45.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). The plan shall contain information on BMP location, design, ownership, maintenance tasks and frequencies, and other details as specified in Chapter 8 of the NJ BMP Manual, as well as the tasks specific to the type of BMP, as described in the applicable chapter containing design specifics.

3. If the maintenance plan identifies a person other than the property owner (for example, a developer, a public agency or homeowners' association) as having the responsibility for maintenance, the plan shall include documentation of such person's or entity's agreement to assume this responsibility, or of the owner's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

4. 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. The individual property owner may be assigned incidental tasks, such as weeding of a green infrastructure BMP, provided the individual agrees to assume these tasks; however, the individual cannot be legally responsible for all of the maintenance required.

5. If the party responsible for maintenance identified under §363-45.B.3 above is not a public agency, the maintenance plan and any future revisions based on §363-45.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.

6. Preventative and corrective maintenance shall be performed to maintain the functional parameters (storage volume, infiltration rates, inflow/outflow capacity, etc.). of the stormwater management measure, including, but not limited to, 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 non-vegetated linings.

7. The party responsible for maintenance identified under §363-45.B.3 above shall perform all of the following requirements:

   i. 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;
   ii. evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed; and
   iii. 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 §363-45.B.6 and B.7 above.

8. The requirements of §363-45.B.3 and B.4 do not apply to stormwater management facilities that are dedicated to and accepted by the municipality or another governmental agency, subject to all applicable municipal stormwater general permit conditions, as issued by the Department. ***In such event, a two-year maintenance bond, as required by N.J.S.A. 40:55D-53 shall be required, in accordance with Section C, below.***

9. 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. Nonpayment of such bill may result in a lien on the property.

C. Nothing in this subsection 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.

§363-46. Zero Increase in Stormwater Runoff:

A. Scope and purpose.

1. Purpose. It is the purpose of this section to establish minimum stormwater management requirements and controls for the discharge of surface water from construction, including, but not limited to, new dwellings, all enlargement of or addition to existing structures and site work not defined in §363-36C.

2. Applicability. This section shall be applicable to all minor site plans and development, including applications for building permits for the construction of a new structure, or enlargement of or addition to an existing structure, in which the completed improvements shall result in an increase of impervious area of 500 square feet or more.

B. Stormwater requirements.

1. The property owner or developer/contractor shall not cause surface water runoff from one lot to another which affects the proper use of any other lot, or causes excessive water accumulation on, or damage to, any other lot, or any structure thereon. The property owner or developer/contractor shall construct such swales, drains, walls or other drainage facilities as are necessary to prevent water runoff from interfering with the use of or damage to any other lot, or any structure thereon.

2. All applications for a building permit or site work permit for properties to which this section applies shall contain a grading plan prepared by a professional engineer which includes topography, elevations and drainage patterns providing for a zero increase or reduction in stormwater runoff as a result of the completed project.

3. The Borough Engineer or his designated representative shall review each application for a building permit or soil movement permit for properties to which this section applies and approve same as providing for a zero increase in stormwater runoff for the completed project.

4. No building permit or site work permit shall be issued for any project to which this section applies when, in the opinion of the Borough Engineer, the applicant fails to provide for a zero increase in stormwater runoff.

5. The movement of any soil or property shall not result in any increase in the amount of, rate or a change in the direction of stormwater runoff of the lot and shall not restrict or prevent the current flow of stormwater from adjacent lots across the subject lot.

6. At the time of the application for a building permit for any project to which this section applies, the applicant shall deposit funds in escrow to cover or defray the cost of the Borough Engineer's review of the application relative to stormwater runoff and/or other site-work-related items.

7. Prior to the issuance of a certificate of occupancy or approval for construction performance in accordance with this section the applicant's professional engineer shall certify, in writing, that the construction and/or landscaping was performed in accordance with the grading plans and that there is a zero increase in stormwater runoff.

C. Design guidelines. An application for a building permit for any project to which this section applies, shall include an underground dry well or similar system designed to adequately handle stormwater runoff generated on impervious areas discharged into the system. The following are minimum requirements for the dry well or similar system design:

1. The dry well shall be designed to fully retain at least a ten-year, sixty-minute duration storm runoff generated on the additional impervious area.

2. Drainage calculations, signed and sealed by a licensed professional civil engineer, shall be submitted for applications which, in the opinion of the Borough Engineer, may alter the preexisting stormwater discharge pattern which exits from the site in question. The stormwater

discharge rate and total volume to neighboring properties must be maintained or reduced during or following soil movement.

3. If an area larger than the additional impervious surface is discharged into the dry well, the dry well shall be designed to retain the runoff generated on the total area connected to the dry well.

4. The dry well invert shall be at a minimum two feet above the seasonal high-water table.

5. The dry wells should be inspected once a year and cleaned as necessary. Maintenance procedures are to be shown on the grading plan or as a separate document.

6. Applications which propose the use of groundwater infiltration shall be accompanied by a soil log with the site's seasonal high-groundwater elevation, certified by a licensed professional civil engineer. In lieu of a soil log, the applicant's engineer may perform a percolation test.

7. The percolation test and the installation of the groundwater infiltration system must be witnessed by the Borough Engineer or his representative. The applicant's engineer shall contact the Borough Engineer a minimum of 48 hours prior to the test and construction of the infiltration system to schedule an inspection.

D. Sump discharge.

1. Discharge flow generated by sump pumps is to be mitigated by the installation of dry wells, the connection to a storm sewer and/or use of one's own property for discharge of the water, so long as such discharge does not adversely affect or flow into any adjacent property.

2. The discharge location of basement sump pumps must be shown on the grading plan.

E. Any costs associated with compliance of zero increase in stormwater or sump pump discharge regulations are to be borne by the applicant and/or developer.

F. Severability and construction. This section shall be construed consistent with the purpose stated in Section 1 hereof. Any ambiguities in this section shall be construed in accordance with the purpose of this section. If any

part of this section is invalidated by a court of competent jurisdiction, the remainder of this section shall be saved to the full extent possible. This section repeals provisions of the Paramus Code only where stated herein; otherwise, this section is amendatory and supplementary to existing provisions of the Paramus Code.

G. Repealer. All ordinances or parts thereof inconsistent herewith are hereby repealed to the extent of such inconsistency. All ordinances are hereby amended to be consistent with this section, and all ordinances, including this one, shall be construed consistent with the express purpose of this section.

§363-47 Penalties:

Any person(s) who erects, constructs, alters, repairs, converts, maintains, or uses any building, structure or land in violation of this ordinance shall, upon conviction, be subject to the penalties provided by §1-15 of the Code of the Borough of Paramus.

§363-48 Enforcement:

This article shall be enforced by the Police Department, the Superintendent of DPW or his designee, and the Borough Engineer.

§363-49 Severability:

Each section, subsection, sentence, clause and phrase of this Ordinance is declared to be an independent section, subsection, sentence, clause and phrase, and the finding or holding of any such portion of this Ordinance to be unconstitutional, void, or ineffective for any cause, or reason, shall not affect any other portion of this Ordinance.

§363-50 Effective Date:

This Ordinance shall be in full force and effect from and after its adoption and any publication as required by law.

Section 2. Any article, chapter, section, paragraph, subsection, clause, or other provision of the Borough Code inconsistent with the provisions of this ordinance is hereby repealed to the extent of such inconsistency.

BOROUGH OF PARAMUS
COUNTY OF BERGEN
STATE OF NEW JERSEY

ORDINANCE 2021-25

Section 3. In case, for any reason, any portion or provision of this Ordinance shall be held to be unconstitutional or invalid, the same shall not affect any other portion or provision of this Ordinance, except so far as the portion or provision so declared unconstitutional or invalid shall be severed from the remainder or any portion thereof.

Attest:

ANNEMARIE KRUSZNIS, RMC
Borough Clerk

Approved:

RICHARD A. LABARBIERA
Mayor

Introduced: May 11, 2021
Adopted: May 25, 2021

Appendix B

Department of Environmental Protection

Division of Watershed Management

Adoption of the Amendment to the Northeast Water Quality Management Plan to Establish a Total Maximum Daily Load for Nickel in the Hackensack River

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATERSHED MANAGEMENT

ADOPTION OF THE AMENDMENT TO THE NORTHEAST WATER QUALITY MANAGEMENT PLAN TO ESTABLISH A TOTAL MAXIMUM DAILY LOAD FOR NICKEL IN THE HACKENSACK RIVER

Public Notice

Take notice that on April 27,2000, pursuant to the provisions of the New Jersey Water Quality Planning Act, N.J.S.A. 58:11A-1 et seq., and the Statewide Water Quality Management Planning Rules (N.J.A.C. 7:15-3.4), an amendment to the Northeast Water Quality Management Plan was adopted by the Department of Environmental Protection (Department). This amendment established a Total Maximum Daily Load (TMDL) for Nickel in the Hackensack River.

Total Maximum Daily Loads (TMDLs) represent the assimilative or carrying capacity of the receiving water taking into consideration point and nonpoint sources of pollution, as well as surface water withdrawals. A TMDL is developed as a mechanism for identifying all the contributors to surface water quality impacts and setting goals for load reductions for specific pollutants as necessary to meet surface water quality standards. TMDLs are required, under Section 303(d) of the federal Clean Water Act, to be developed for waterbodies that cannot meet water quality standards after the implementation of technology-based effluent limitations. TMDLs may also be established to help maintain or improve water quality in waters that are not impaired. A TMDL establishes waste load allocations and load allocations for point and nonpoint sources, respectively.

Regulations concerning TMDLs are contained in USEPA's Water Quality Planning and Management Regulations (40 CFR 130).

Where TMDLs are required to address documented surface water quality impairment, such changes are to be made to the varying sources contributing to the water quality problem in order to reduce the total pollutant load received by the waterbody. Load reduction goals established through TMDLs are achieved through the issuance of wasteload allocations (WLAs) for points source discharges, load allocations (LAs) for nonpoint source discharges, and a margin of safety. Since nonpoint source pollution, by definition, does not come from discrete, identifiable sources, load allocations would consist of the identification of categories of nonpoint sources that contribute to the parameters of concern. The load allocation would also include specific load reduction measures for those categories of sources, to be implemented through best management practices (BMPs) including local ordinances for stormwater management and nonpoint source pollution control, headwaters protection practices, or other mechanisms for addressing the priority issues of concern.

USEPA established a TMDL for Nickel in the Hackensack River effective December 27, 1999 pursuant to 40 CFR 130.7 (d), see volume 65 of the Federal Register, page 2398, dated January 14, 2000. Under N.J.A.C. 7:15-7(l), TMDLs established by USEPA are considered part of the appropriate areawide WQM plan.

Table 1. TMDL/WLAs/LAs for nickel in the Hackensack River.

Source:	**Existing load (lbs/day)**	**WLA/LA (lbs/day)**
Bergen County Utilities Authority [NJPDES Permit #NJ0020028]	11.3	2.2[1]
North Bergen Sewage Treatment Plant (STP) [NJPDES Permit #NJ0034339]	0.28	0.38[2]
Secaucus STP [NJPDES Permit #NJ0025038]	0.04	0.06[3]
Combined Sewage Overflows	0.10	0.10
Storm Water	0.81	0.81
∑WLAs……	……	3.55
Atmospheric……..	1.06	1.06
Boundary (Background)	0.37	0.37[4]
TMDL……	……	4.98

[1] The WLA of 2.2 lbs/day is established at an effluent concentration of 3.6 μg/l (total recoverable) and flow of 75 mgd. If the effluent flow is 109 mgd, the WLA is 3.3 lbs/day with an effluent concentration of 3.6 μg/l.

[2] Based on design flow of 10 mgd and means effluent concentration of 4.6 μg/l (total recoverable).

[3] Based on design flow of 10 mgd and mean effluent concentration of 1.5 μg/l (total recoverable).

[4] Calculated at the boundary condition of the Hackensack River upstream at the Oradell Dam.

_____

Lance R. Miller
Director
Division of Watershed Management
Department of Environmental Protection

_____

Date

Appendix C

Amendment to the
Northeast Water Quality Management Plan

Total Maximum Daily Loads for
Fecal Coliform to Address 32 Streams in the
Northeast Water Region

Amendment to the Northeast Water Quality Management Plan

Total Maximum Daily Loads for Fecal Coliform to Address 32 Streams in the Northeast Water Region

Watershed Management Area 3
(Pompton, Pequannock, Wanaque, and Ramapo Rivers)
Watershed Management Area 4
(Lower Passaic and Saddle Rivers)
Watershed Management Area 5
(Hackensack River, Hudson River, and Pascack Brook)
Watershed Management Area 6
(Upper & Middle Passaic, Whippany, and Rockaway Rivers)

Proposed:	January 21, 2003
Established:	March 28, 2003
Approved (by EPA Region 2):	July 29, 2003
Adopted:	June 6, 2013

New Jersey Department of Environmental Protection
Division of Watershed Management
P.O. Box 418
Trenton, New Jersey 08625-0418

Contents

Figures

Tables

1.0 Executive Summary

In accordance with Section 305(b) of the Federal Clean Water Act (CWA), the State of New Jersey developed the *2002 Integrated List of Waterbodies*, addressing the overall water quality of the State's waters and identifying impaired waterbodies for which Total Maximum Daily Loads (TMDLs) may be necessary. The *2002 Integrated List of Waterbodies* identified several waterbodies in the Northeast Water Region as being impaired by pathogens, as indicated by the presence of fecal coliform concentrations in excess of standards. This report, developed by the New Jersey Department of Environmental Protection (NJDEP), establishes 32 TMDLs addressing fecal coliform loads to the waterbodies identified in Table 1.

Table 1 Fecal coliform-impaired stream segments in the Northeast Water Region, identified in Sublist 5 of the 2002 Integrated List of Waterbodies, for which fecal coliform TMDLs are being established.

TMDL Number	WMA	Station Name/Waterbody	Site ID	County(s)	River Miles
1	3	Macopin River at Macopin Reservoir	01382450	Passaic	1.8
2	3	Wanaque River at Highland Avenue	01387010	Passaic	1.5
3	3	Ramapo River Near Mahwah	01387500	Passaic and Bergen	17.7
4	4	Passaic R. below Pompton R. at Two Bridges	01389005	Passaic	1.83
5	4	Preakness Brook Near Little Falls	01389080	Passaic	8.9
6	4	Deepavaal Brook at Fairfield	01389138	Essex	6.3
7	4	Passaic River at Little Falls	01389500	Passaic and Essex	15.0
8	4	Peckman River at West Paterson	01389600	Passaic and Essex	7.7
9	4	Goffle Brook at Hawthorne	01389850	Passaic and Bergen	10.5
10	4	Diamond Brook at Fair Lawn	01389860	Passaic and Essex	2.5
11	4	WB Saddle River at Upper Saddle River	01390445	Bergen	2.4
12	4	Saddle River at Ridgewood	01390500	Bergen	24.0
13	4	Ramsey Brook at Allendale	01390900	Bergen	6.4
14	4	HoHoKus Brook at Mouth at Paramus	01391100	Bergen	6.2
15	4	Saddle River at Fairlawn	01391200	Bergen	5.0
16	4	Saddle River at Lodi	01391500	Bergen	3.8
17	5	Hackensack River at River Vale	01377000	Bergen	10.0
18	5	Musquapsink Brook at River Vale	01377499	Bergen	7.3
19	5	Pascack Brook at Westwood	01377500	Bergen	6.6
20	5	Tenakill Brook at Cedar Lane at Closter	01378387	Bergen	10.2
21	5	Coles Brook at Hackensack	01378560	Bergen	11.1
22	6	Black Brook at Madison	01378855	Morris	2.4
23	6	Passaic River near Millington	01379000	Morris and Somerset	5.2
24	6	Dead River near Millington	01379200	Somerset	21.9
25	6	Passaic River near Chatham	01379500	Somerset, Union, Essex, and Morris	25.2
26	6	Canoe Brook near Summit	01379530	Essex	17.6
27	6	Rockaway River at Longwood Valley	01379680	Sussex and Morris	11.6
28	6	Rockaway River at Blackwell Street	01379853	Morris	3.5
29	6	Beaver Brook at Rockaway	01380100	Morris	17.0
30	6	Stony Brook at Boonton	01380320	Morris	13.1
31	6	Rockaway River at Pine Brook	01381200	Morris	6.8

TMDL Number	WMA	Station Name/Waterbody	Site ID	County(s)	River Miles
32	6	Passaic River at Two Bridges	01382000	Morris and Essex	14.1
Total River Miles:					305.0

These thirty-two TMDLs will serve as management approaches or restoration plans aimed at identifying the sources of fecal coliform and for setting goals for fecal coliform load reductions in order to attain applicable surface water quality standards (SWQS).

As stated in N.J.A.C. 7:9B-1.14(c) of the New Jersey Surface Water Quality Standards, "Fecal coliform levels shall not exceed a geometric average of 200 CFU/100 ml nor should more than 10 percent of the total sample taken during any 30-day period exceed 400 CFU/100 ml in FW2 waters." Nonpoint and stormwater point sources are the primary contributor to FC loads in these streams and can include storm-driven loads transporting fecal coliform from sources such as geese, farms, and domestic pets to the receiving water. Nonpoint sources also include steady-inputs from sources such as failing sewage conveyance systems and failing or inappropriately located septic systems. Because the total point source contribution other than stormwater (i.e. Publicly-Owned Treatment Works, POTWs) is an insignificant fraction of a percent of the total load, these fecal coliform TMDLs will not impose any change in current practices for POTWs and will not result in changes to existing effluent limits.

Using ambient water quality data monitoring conducted during the water years 1994-2000, summer and all season geometric means were determined for each Category 5 listed segment. Given the two surface water quality criteria of 200 CFU/100 ml and 400 CFU/100 ml in FW2 waters, computations were necessary for both criteria and resulted in two values for percent reduction for each stream segment. The higher (more stringent) percent reduction value was selected as the TMDL and will be applied to nonpoint and stormwater sources as a whole or apportioned to categories of nonpoint and stormwater sources within the study area. The extent to which nonpoint and stormwater sources have been identified and the process by which they will become identified will vary by study area based on data availability, watershed size and complexity, and pollutant sources. Implementation plans for activities to be established in these watersheds are addressed in this report.

Each TMDL shall be proposed and adopted by the Department as an amendment to the appropriate area wide water quality management plan(s) in accordance with N.J.A.C. 7:15-3.4(g).

This TMDL Report is consistent with EPA's May 20, 2002 guidance document entitled: "Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992," (Suftin, 2002) which describes the statutory and regulatory requirements for approvable TMDLs.

2.0 Introduction

Sublist 5 (also known as List 5 or, traditionally, the 303(d) List) of the State of New Jersey's proposed *2002 Integrated List of Waterbodies* identified several waterbodies in the Northeast Water Region as being impaired by pathogens, as evidenced by the presence of high fecal coliform concentrations. This report establishes 32 TMDLs, which address fecal coliform loads to the identified waterbodies. These TMDLs serve as management approaches or restoration plans aimed toward reducing loadings of fecal coliform from various sources in order to attain applicable surface water quality standards for the pathogen indication. Several of these waterbodies are listed in Sublist 5 for impairment cause by other pollutants. These TMDLs address only fecal coliform impairments. Separate TMDL evaluations will be developed to address the other pollutants of concern. The waterbodies will remain on Sublist 5 until such time as TMDL evaluations for all pollutants have been completed and approved by the United States Environmental Protection Agency (USEPA).

3.0 Background

3.1. 305(b) Report and 303(d) List

In accordance with Section 305(b) of the Federal Clean Water Act (CWA) (33 U.S.C. 1315(B)), the State of New Jersey is required to biennially prepare and submit to the United States Environmental Protection Agency (USEPA) a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report.

In accordance with Section 303(d) of the CWA, the State is also required to biennially prepare and submit to USEPA a report that identifies waters that do not meet or are not expected to meet surface water quality standards (SWQS) after implementation of technology-based effluent limitations or other required controls. This report is commonly referred to as the 303(d) List. The listed waterbodies are considered water quality-limited and require total maximum daily load (TMDLs) evaluations. For waterbodies identified on the 303(d) List, there are three possible scenarios that may result in a waterbody being removed from the 303(d) List:

> **Scenario 1:** A TMDL is established for the pollutant of concern;
> **Scenario 2:** A determination is made that the waterbody is meeting water quality standards (no TMDL is required); or
> **Scenario 3:** A determination is made that a TMDL is not the appropriate mechanism for achieving water quality standards and that other control actions will result in meeting standards

Where a TMDL is required (Scenario 1), it will: 1) specify the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards**;** and 2) allocate pollutant loadings among point and nonpoint pollutant sources.

Recent EPA guidance (Suftin, 2002) describes the statutory and regulatory requirements for approvable TMDLs, as well as additional information generally needed for USEPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations. The Department believes that this TMDL report, which includes thirty-two TMDLs, addresses the following items in the May 20, 2002 guideline document:

1. Identification of waterbody(ies), pollutant of concern, pollutant sources and priority ranking.
2. Description of applicable water quality standards and numeric water quality target(s).
3. Loading capacity – linking water quality and pollutant sources.
4. Load allocations.
5. Wasteload allocations.
6. Margin of safety.
7. Seasonal variation.
8. Reasonable assurances.
9. Monitoring plan to track TMDL effectiveness.
10. Implementation (USEPA is not required to and does not approve TMDL implementation plans).
11. Public Participation.
12. Submittal letter.

3.2. Integrated List of Waterbodies

In November 2001, USEPA issued guidance that encouraged states to integrate the 305(b) Report and the 303(d) List into one report. This integrated report assigns waterbodies to one of five categories. In general, Sublists 1 through 4 include waterbodies that are unimpaired, have limited assessment or data availability or have a range of designated use impairments, whereas Sublist 5 constitutes the traditional 303(d) List for waters impaired or threatened by a pollutant for which one or more TMDL evaluations are needed. Where more than one pollutant is associated with the impairment for a given waterbody, that waterbody will remain in Sublist 5 until one of the three possible delisting scenarios are completed. In the case of an Integrated List, however, the waterbody is not delisted but moved to one of the other categories.

Following USEPA's guidance, the Department chose to develop an Integrated Report for New Jersey. New Jersey's proposed *2002 Integrated List of Waterbodies* is based upon these five categories and identifies water quality limited surface waters in accordance with N.J.A.C. 7:15-6 and Section 303(d) of the CWA. These TMDLs address fecal coliform impairments, as listed on Sublist 5 of the State of New Jersey's proposed *2002 Integrated List of Waterbodies.*

3.3. Total Maximum Daily Loads (TMDLs)

A Total Maximum Daily Load (TMDL) represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern,

natural background and surface water withdrawals. A TMDL quantifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point and nonpoint sources in the form of wasteload allocations (WLAs), load allocations (LAs), and a margin of safety. A TMDL is developed as a mechanism for identifying all the contributors to surface water quality impacts and setting goals for load reductions for pollutants of concern as necessary to meet the SWQS.

Once one of the three possible delisting scenarios, noted above, is completed, states have the option to remove the waterbody and specific pollutant of concern from Sublist 5 of the *2002 Integrated List of Waterbodies* or maintain the waterbody in Sublist 5 until SWQS are achieved. The State of New Jersey will be removing the waterbodies for fecal impairment from Sublist 5 once these TMDLs are approved by USEPA.

4.0 Pollutant of Concern and Area of Interest

The pollutant of concern for these TMDLs is pathogens, the presence of which is indicated by the elevated concentration of fecal coliform bacterial. Fecal coliform concentrations have been found to exceed New Jersey's Surface Water Quality Standards (SWQS) published at N.J.A.C. 7-9B et seq. As reported in the proposed *2002 Integrated List of Waterbodies*, the New Jersey Department of Environmental Protection (NJDEP) identified waterbodies as being impaired by fecal coliform. The Northeast Water Region listings for fecal coliform impairment are identified in Table 2. Also identified in Table 2 are the river miles and management response associated with each listed segment. All of these waterbodies have a high priority ranking, as described in the *2002 Integrated List of Waterbodies*.

Table 2 Abridged Sublist 5 of the 2002 Integrated List of Waterbodies, listed for fecal coliform impairment in the Northeast Water Region.

TMDL No.	WMA	Station Name/Waterbody	Site ID	River Miles	Management Response
1	3	Macopin River at Macopin Reservoir	1382450	**1.8**	establish TMDL
	3	Pequannock River at Macopin Intake Dam	1382500	**19.1**	none; Re-assessment shows non-impairment
	3	Wanaque River at Wanaque	1387000	**0.6**	water quality monitoring needed to identify if an impairment exists
2	3	Wanaque River at Highland Ave.	1387010	**1.5**	establish TMDL
3	3	Ramapo River near Mahwah	1387500	**17.7**	establish TMDL
4	4	Passaic River below Pompton River at Two Bridges	1389005	**1.8**	establish TMDL
5	4	Preakness Brook Near Little Falls	1389080	**8.9**	establish TMDL
6	4	Deepavaal Brook at Fairfield	1389138	**6.3**	establish TMDL
7	4	Passaic River at Little Falls	1389500	**15.0**	establish TMDL
8	4	Peckman River at West Paterson	1389600	**7.7**	establish TMDL
9	4	Goffle Brook at Hawthorne	1389850	**10.5**	establish TMDL
10	4	Diamond Brook at Fair Lawn	1389860	**2.5**	establish TMDL

TMDL No.	WMA	Station Name/Waterbody	Site ID	River Miles	Management Response
	4	Passaic River at Elmwood Park	1389880	**13.8**	CSO influence
11	4	WB Saddle River at Upper Saddle River	1390445	**2.4**	establish TMDL
12	4	Saddle River at Ridgewood	1390500	**24.0**	establish TMDL
13	4	Ramsey Brook at Allendale	1390900	**6.4**	establish TMDL
14	4	HoHoKus Brook at Mouth at Paramus	1391100	**6.2**	establish TMDL
15	4	Saddle River at Fairlawn	1391200	**5.0**	establish TMDL
16	4	Saddle River at Lodi	1391500	**3.8**	establish TMDL
17	5	Hackensack River at River Vale	1377000	**10.0**	establish TMDL
18	5	Musquapsink Brook at River Vale	1377499	**7.3**	establish TMDL
19	5	Pascack Brook at Westwood	1377500	**6.6**	establish TMDL
20	5	Tenakill Brook at Cedar Lane at Closter	1378387	**10.2**	establish TMDL
	5	Hackensack River at New Milford	1378500	**1.1**	water quality monitoring needed to identify if an impairment exists
21	5	Coles Brook at Hackensack	1378560	**11.1**	establish TMDL
22	6	Black Brook at Madison	1378855	**2.4**	establish TMDL
23	6	Passaic River near Millington	1379000	**5.2**	establish TMDL
24	6	Dead River Near Millington	1379200	**21.1**	establish TMDL
25	6	Passaic River near Chatham	1379500	**25.2**	establish TMDL
26	6	Canoe Brook near Summit	1379530	**17.6**	establish TMDL
27	6	Rockaway River at Longwood Valley	1379680	**11.6**	establish TMDL
28	6	Rockaway River at Blackwell Street	1379853	**3.5**	establish TMDL
29	6	Beaver Brook at Rockaway	1380100	**17.0**	establish TMDL
30	6	Stony Brook at Boonton	1380320	**13.1**	establish TMDL
31	6	Rockaway River at Pine Brook	1381200	**6.8**	establish TMDL
	6	Whippany River at Morristown	1381500	**6.6**	TMDL completed in 1999
	6	Whippany River near Pine Brook	1381800	**6.6**	TMDL completed in 1999
32	6	Passaic River at Two Bridges	1382000	**14.1**	establish TMDL

These thirty-two TMDLs will address 305 river miles or approximately 87% of the total river miles impaired by fecal coliform (352 total FC impaired river miles) in the northeast watershed region. Based on the detailed county hydrography stream coverage, 847 stream miles, or 47% of the stream segments in the northeast region (1800 total miles) are directly affected by the 32 TMDLs due to the fact that the implementation plans cover entire watersheds; not just impaired waterbody segments.

Table 2 identifies six segments for which TMDLs will not be developed at this time based on investigations following the *2002 Integrated List of Waterbodies* proposal. These segments, which are identified as requiring a management response other than "establish TMDL," are discussed in Appendix A along with the listing Sublist to which they will be moved.

These include: #01382500, Pequannock River at Macopin Intake Dam, #01387000, Wanaque River at Wanaque, #01378500, Hackensack River at New Milford, #01381500, Whippany

River at Morristown, #01381800, Whippany River near Pine Brook, and #01389880, Passaic River at Elmwood Park. For each of these segments an explanation of the management response is provided in Appendix A.

4.1. Description of the Northeast Water Region and Sublist 5 Waterbodies

4.1.1. Watershed Management Area 3

Watershed Management Area 3 (WMA 3) includes watersheds that receive water from the Highlands portion of New Jersey. The Pequannock, Wanaque and Ramapo Rivers all flow into the Pompton River. The Pompton River is, in turn, a major tributary to the Upper Passaic River. WMA 3 contains some of the State's major water supply reservoir systems including the Wanaque Reservoir, the largest surface water reservoir in New Jersey. There are four watersheds in WMA 3: Pompton, Ramapo, Pequannock and Wanaque River Watersheds. WMA 3 lies mostly in Passaic County but also includes parts of Bergen, Morris, and Sussex Counties.

The **Pequannock River Watershed** is 30 miles long and has a drainage area of 90 square miles. The headwaters are in Sussex County and the Pequannock River flows east, delineating the Morris/Passaic County boundary line. The Pequannock River joins the Wanaque River and flows to the Pompton River in Wayne Township. Some of the major impoundments within this watershed are Kikeout Reservoir, Lake Kinnelon Reservoir, Clinton Reservoir, Canistear Reservoir, Oak Ridge Reservoir, and Echo Lake Reservoir. The great majority of the land within this watershed is forested and protected for water supply purposes and parklands.

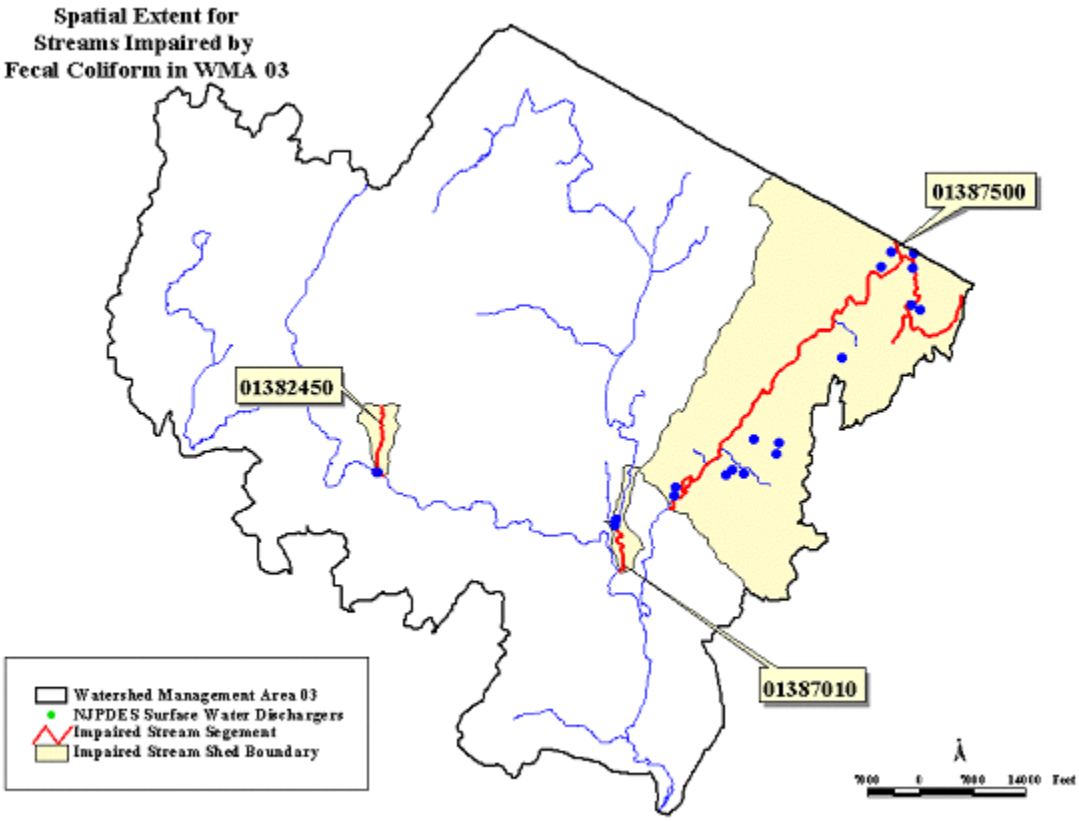
The **Ramapo River and Pompton River Watersheds** comprise a drainage area of about 160 square miles; 110 square miles of which are in New York State. The Ramapo River flows from New York into Bergen County and enters the Pequannock River to form the Pompton River in Wayne Township. The Ramapo River is 15 miles long on the New Jersey side. The Pompton River, a tributary to the Passaic River, is 7 miles long. Some of the major impoundments within this watershed include Point View Reservoir #1, Pompton Lakes, and Pines Lake. Over one-half of this watershed is undeveloped; however, new development is extensive in many areas.

The **Wanaque River Watershed** has a total drainage area of 108 square miles. The headwaters of the river lie within New York State as a minor tributary to Greenwood Lake (located half in New Jersey and half in New York). The New Jersey portion lies in West Milford, Passaic County. The Wanaque River joins up with the Pequannock River in Riverdale Township. The Wanaque River is 27 miles in length. Some of the major impoundments and lakes with this watershed are the Wanaque Reservoir, Greenwood Lake, Arcadia Lake and Lake Inez. Most of the land in this watershed is undeveloped, consisting of vacant lands, reservoirs, parks and farms.

Sublist 5 Waterbodies in WMA 3

Three river segments of the thirty-two impaired segments addressed in this report, the Macopin River (#01382450), Wanaque River (#01387010), and Ramapo River (#01387500) are located in WMA 3. The spatial extent of each segment is identified in Figure 1. River miles, watershed sizes and land use\land cover by percent area associated with each segment are listed in Table 3.

Figure 1 Spatial extent of Sublist 5 segments for which TMDLs are being developed in WMA 3



Segment #01382450, the Macopin River at Macopin Reservoir, has a watershed area of approximately 1.1 mi^2. Water quality from stations #01382410 and #01382450 were used in assessing the status and spatial extent of bacterial contamination. The length of the impaired stream segment is approximately 1.8 miles and is located on the Macopin River upstream of the confluence of the Macopin and the Pequannock Rivers. A total of 1.9 stream miles (based on county hydrologic stream coverage) are located within its watershed and will be included in the implementation plan.

Table 3 River miles, Watershed size, and Anderson Landuse classification for three Sublist 5 segments, listed for fecal coliform, in WMA 3.

	Segment ID		
	1382450	**1387010**	**1387500**
Sublist 5 impaired river miles (miles)	1.8	1.5	17.7
Total river miles within watershed and included in the implementation plan (miles)	1.9	4.0	87.8
Watershed size (acres)	711	708	26084
Landuse/Landcover			
Agriculture	0.00%	0.00%	0.43%
Barren Land	0.15%	0.17%	0.78%
Forest	89.74%	29.65%	51.20%
Urban	4.11%	55.19%	37.64%
Water	1.97%	4.71%	3.05%
Wetlands	4.04%	10.29%	6.89%

Segment #01387010, the Wanaque River at Highland Avenue at Wanaque, is located on the Wanaque River from the inlet of the Wanaque River at Inez Lake to the confluence of the Wanaque and Pequannock Rivers. Water quality from stations #01387014 and #01387041 were used in assessing the spatial extent of bacterial contamination. The stream segment length is approximately 1.5 miles with a watershed area of approximately 708 acres or 1.1 mi^2.

Segment #01387500, the Ramapo River near Mahwah, is located on the Ramapo River between the NJ-NY borders to the inlet at Pompton Lake. Water quality from station #01387500 was used to assess the spatial extent of bacterial contamination. The impaired stream segment length is approximately 17.7 miles. A total of 87.8 stream miles are located within its watershed and will be included in the implementation plan. The total drainage area for this segment is approximately 26084 acres or 40.8 mi^2.

4.1.2. Watershed Management Area 4

Watershed Management Area 4 (WMA 4) includes the Lower Passaic River (from the Pompton River confluence downstream to the Newark Bay) and its tributaries, including the Saddle River. The WMA 4 drainage area is approximately 180 square miles and lies within portions of Passaic, Essex, Hudson, Morris and Bergen Counties.

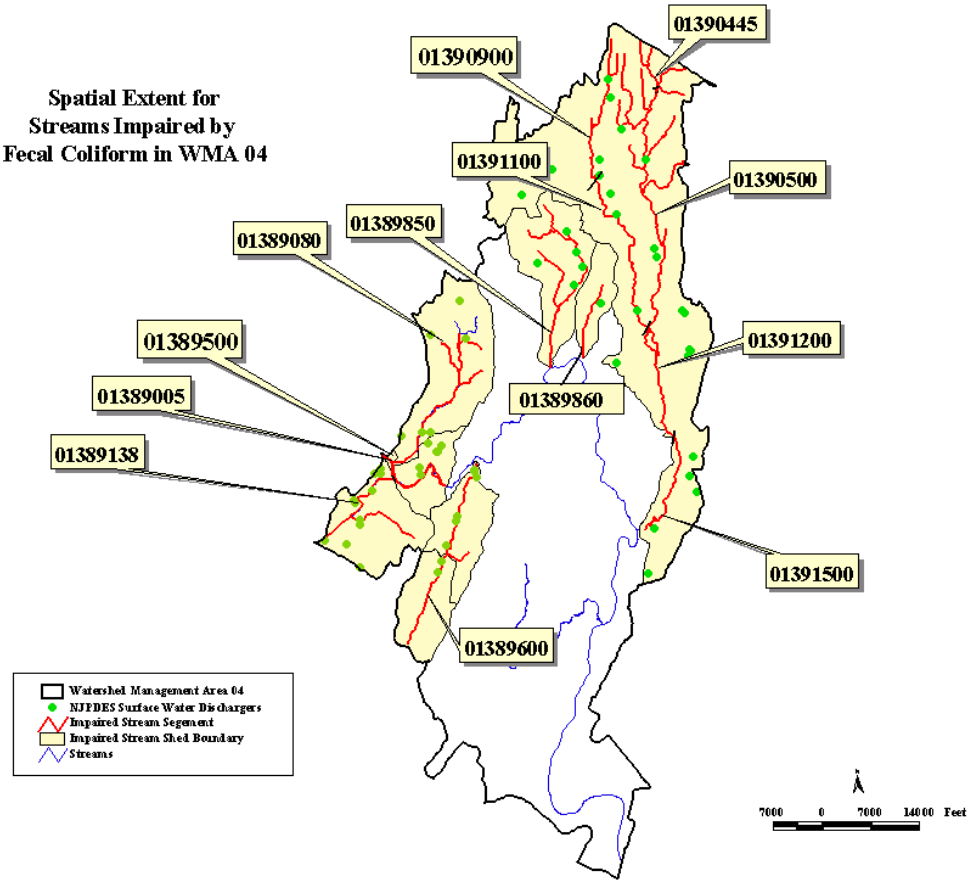
Two watersheds comprise WMA 4: the Lower Passaic River Watershed and Saddle River River Watershed. The **Lower Passaic River Watershed** originates from the confluence of the Pompton River downstream to the Newark Bay. This 33-mile section meanders through Bergen, Hudson, Passaic, and Essex Counties and includes a number of falls, culminating with the Great Falls at Paterson. This watershed has a drainage area of approximately 129 square miles. The major tributaries to this section of the Passaic River are the Saddle River,

Preakness Brook, Second River, and Third River. The Saddle River is one of the larger tributaries to the Lower Passaic River. The **Saddle River Watershed** has a drainage area of approximately 51 square miles. Land in this watershed is extensively developed and contains many older cities and industrial centers including Newark, Paterson, Clifton, and East Orange.

Sublist 5 Waterbodies inWMA 4

Thirteen of the thirty-two TMDLs in the Northeast region are located in WMA 4. Included are several segments of the Saddle River (#01390500, #01391200 and #01391500), West Branch of the Saddle River (#01390445), Ramsey Brook (#01390900), Hohokus Brook (#01391100), the Passaic River (#01389005 and #01389500), Preakness Brook (#01389080), Deepavaal Brook (#01389138), Diamond Brook (#01389860), Goffle Brook (#01389850), and the Peckman River (#01389600). Several of these stream segments are geographically located in close proximity, thus, when these segments were found to contain similar levels of bacteria contamination (geometric means value), water quality data from these segments were grouped when calculating the TMDL. The spatial extent of each segment is identified in Figure 2. River miles, watershed sizes and land use\land cover by percent area associated with each segment are listed in Table 4.

Figure 2 Spatial extent of Sublist 5 segments for which TMDLs are being developed in WMA 4



Given the proximity and similarity in impairment of several stations in the Saddle River watershed, six segments were grouped for the purposes of this report. These segments include: the West Branch Saddle River at Upper Saddle River (#01390445), Saddle River at Ridgewood (#01390500), Ramsey Brook at Allendale (#01390900), Hohokus Brook at Paramus (#01391100), Saddle River at Fairlawn (#01391200), and the Saddle River at Lodi (#01391500). These stream segments extend from the New York-New Jersey border to the confluence of the Saddle and Passaic Rivers and is contained within a 32933 acres, or 51.5 mi^2, watershed. The combined six stream segments total a length of 45.7 miles. The implementation plan will address all of streams located in this watershed (97.3 miles). Stations #01390445, #01390470, #01390510, #01390518, #01390900, #01391100, #01391490, and #01391500 were used to assess the status and spatial extent of bacterial contamination.

Table 4 River miles, Watershed size, and Anderson Landuse classification for thirteen Sublist 5 segments, listed for fecal coliform, in WMA 4.

	Segment ID		
	1390445, 1390500, 1390900, 1391100, 1391200, 1391500	**1389005,1389500, 1389080, 1389138,1389600**	**1389850,1389860**
Sublist 5 impaired river miles (miles)	45.7	29.8	10.5
Total river miles within watershed and included in the implementation plan (miles)	97.3	56.1	13.3
Watershed size (acres)	32933	14450	7590
Landuse/Landcover			
Agriculture	0.51%	0.12%	0.07%
Barren Land	0.20%	0.79%	0.27%
Forest	10.59%	20.81%	7.96%
Urban	81.89%	69.81%	88.51%
Water	1.06%	1.59%	0.46%
Wetlands	5.75%	6.88%	2.74%

Five Sublist 5 segments, the Passaic River below Pompton River at Two Bridges (#01389005), Passaic River at Little Falls (#1389500), Preakness Brook near Little Falls (#1389080), Deepavaal Brook at Fairfield (#01389138) and Peckman River at West Paterson (#01389600) were grouped based on similarities in geography and bacterial concentrations. Water quality from stations #01389500, #01389080, #01389138, #01382000, and #01389600 were used to assess the status and spatial extent of bacterial contamination. The combined length of the impaired stream segments is approximately 29.8 miles. A total of 56.1 stream miles are located within its watershed and will be included in the implementation plan. The total drainage area for this segment is approximately 14450 acres, or 22.6 mi^2.

Stream segments #01389850 and #01389860 were also grouped in calculating the TMDL percent reduction. Segment #01389850, Goffle Brook at Hawthorne, consists of the entire length of Goffle Brook to the confluence of Goffle Brook with the Passaic River. Segment #01389860, Diamond Brook at Fair Lawn, consists of the entire length of Diamond Brook to the confluence of Diamond Brook with the Passaic River. Water quality from stations #01389850 and #01389860 were used in assessing the status and spatial extent of bacterial contamination for these segments. The length of the impaired #01389850 stream segment is approximately 10.5 miles in a watershed area of approximately 5658 acres or 8.8 mi^2. A total of 13.3 river miles are in the watershed and will be included in the implementation plan. The length of the impaired #01389860 stream segment is approximately 2.5 miles in a watershed area of approximately 1932 acres or 3.0 mi^2.

4.1.3. Watershed Management Area 5

Watershed Management Area 5 (WMA 5) includes parts of Hudson and Bergen Counties and has a watershed area of approximately 165 square miles. WMA 5 is comprised of three watersheds: Hackensack River Watershed, Hudson River Watershed and Pascack Brook Watershed. The Hackensack River originates in New York State and flows south to the Newark Bay. New Jersey's portion of the river is 31 miles long. The Hackensack River Watershed is approximately 85 square miles. Major tributaries include the Pascack Brook, Berry's Creek, Overpeck Creek, and Wolf Creek. The **Pascack Brook Watershed** has a drainage area of approximately 51 square miles.

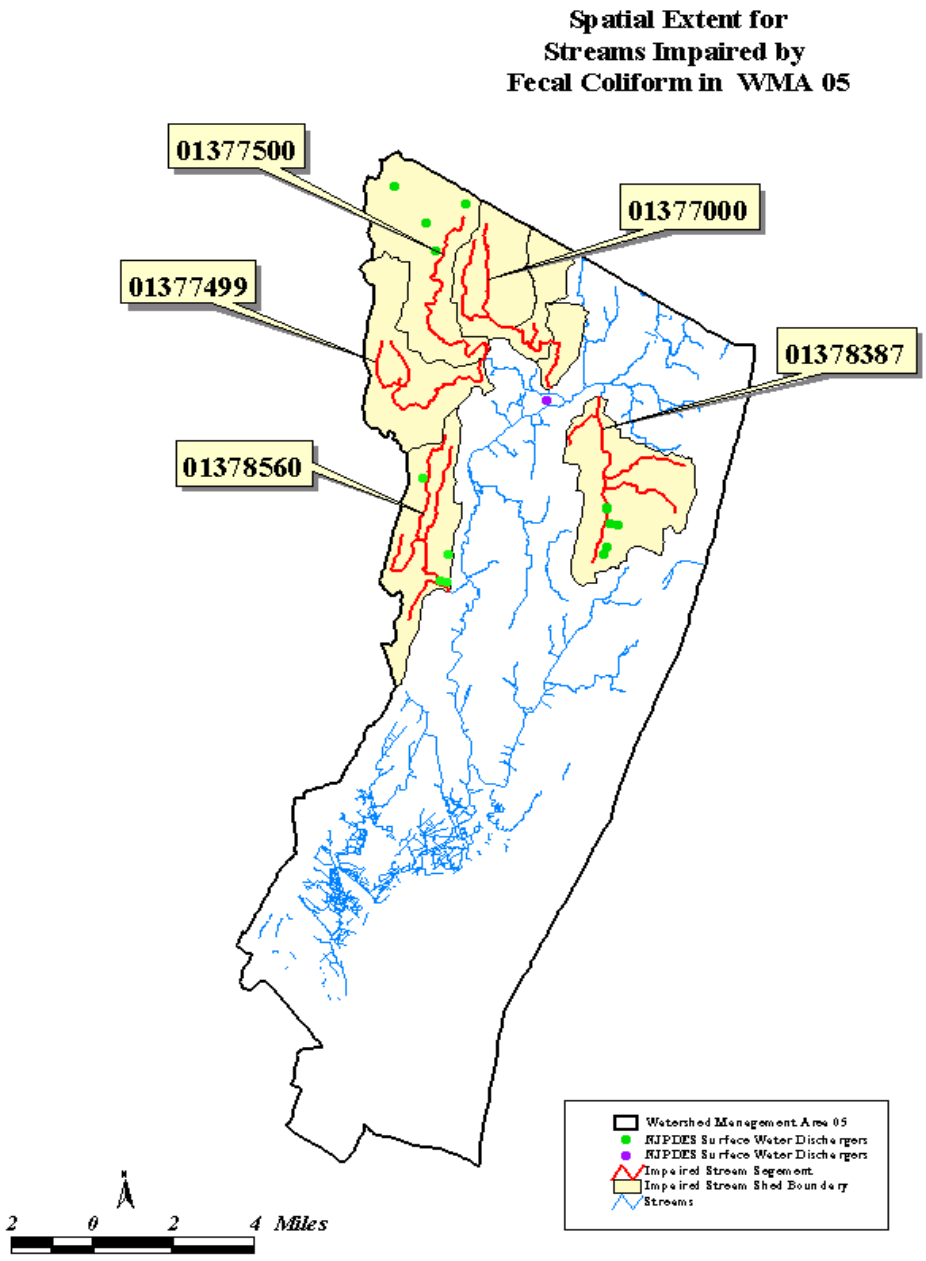
The New Jersey portion of the Hudson River is 315 miles long and begins in New York State at Lake Tear of the Clouds on the southwest side of Mount Marcy, New York's highest peak. The New Jersey portion of the **Hudson River Watershed** is approximately 29 square miles. The Hudson River forms the boundary between New Jersey and New York States.

Although WMA 5 is the most populated of all the WMAs, approximately 50% of the land is still undeveloped, with more than 30% residential development. The remaining developed land is commercial/industrial use. Much of the lower **Hackensack River Watershed** is tidal marsh known as the Hackensack Meadowlands. The Meadowlands are home to more than 700 plant and animal species including several rare and threatened species

Sublist 5 Waterbodies in WMA 5

Five of the thirty-two TMDLs in this report are located in WMA 5. Included are segments in the Hackensack River (#01377000), Pascack Brook (#01377500), Musquapsink Brook (#01377499), Tenakill Brook (#01378387), and Coles Brook (#01378560). The spatial extent of each segment is identified in Figure 3. River miles, watershed size and land use\land cover by percent area associated with each segment are listed in Table 5.

Figure 3 **Spatial extent of Sublist 5 segments for which TMDLs are being developed in WMA 5**



Hackensack River at River Vale, (segment #01377000) flows across the New Jersey/New York State line in River Vale/Old Tappan and extends to the inlet of the Oradell Reservoir. Water quality from stations #01377000 and #01376970 (Hackensack River at Old Tappan) were used in assessing the status and spatial extent of bacterial contamination for this segment. The length of the impaired stream segment is approximately 10.0 miles in a

watershed area of approximately 5912 acres or 9.2 mi^2, however a total of 20.3 river miles are located in the watershed and will be included in the implementation plan.

Table 5 River miles, Watershed size, and Anderson Landuse classification for five Sublist 5 segments, listed for fecal coliform, in WMA 5.

	Segment ID			
	1377000	**1377499, 1377500**	**1378387**	**1378560**
Sublist 5 impaired river miles (miles)	10.0	13.8	10.2	11.1
Total river miles within watershed and included in the implementation plan (miles)	20.3	33.3	10.8	14.8
Watershed size (acres)	5902	10430	5626	4241
Landuse/Landcover				
Agriculture	0.07%	0.95%	0.17%	0.00%
Barren Land	0.42%	0.30%	0.13%	0.18%
Forest	13.85%	11.53%	11.32%	4.98%
Urban	65.52%	79.72%	84.43%	91.80%
Water	12.09%	2.31%	0.44%	0.19%
Wetlands	8.05%	5.18%	3.51%	2.84%

Pascack Brook at Westwood, segment #01377500, and Musquapsink Brook at River Vale segment #01377500, were also grouped based on similarities in geography and extent of bacterial contamination. Water quality from stations #01377499 and #01377500 were used in assessing the status and spatial extent of bacterial contamination for these segments. The combined length of the impaired stream segments is approximately 13.8 miles in a watershed area of approximately 10429 acres or 16.3 mi^2, however a total of 33.3 river miles are located within the watershed and will be included in the implementation plan.

Tenakill Brook at Cedar Lane at Closter, segment #01378387, consists of the entire length of Tenakill Brook upstream of USGS station #01378387. Water quality from this station #01378387 was used in assessing the status and spatial extent of bacterial contamination for this segment. The length of the impaired stream segment is approximately 10.2 miles in a watershed area of approximately 5625 acres or 8.8 mi^2. A total of 10.8 river miles are included in this watershed and will be included in the implementation plan

Coles Brook at Hackensack, segment #01378560, consists of the entire length of Coles Brook upstream of USGS station #01378560. Water quality from station #01378560 was used in assessing the status and spatial extent of bacterial contamination for this segment. The length of the impaired stream segment is approximately 11.1 miles in a watershed area of approximately 4240 acres or 6.6 mi^2. A total of 14.8 river miles are included in this watershed and will be included in the implementation plan.

4.1.4. Watershed Management Area 6

Watershed Management Area 6 (WMA 6) represents the area drained by waters from the upper reaches of the Passaic River Basin including the Passaic River from its headwaters in Morris County to the confluence of the Pompton River. Extensive suburban development and reliance upon ground water sources for water supply characterize WMA 6. WMA 6 lies in portions of Morris, Somerset, Sussex and Essex counties and includes the Upper & Middle Passaic River, Whippany River and Rockaway River Watersheds.

The **Upper Passaic River Watershed** is approximately 50 miles long and consists of a drainage area approximately 200 square miles in portions of Somerset, Morris, and Essex Counties. This section of the Passaic River is a significant source of drinking water for a much of northeastern New Jersey. Major tributaries to the Upper Passaic River include the Dead River, Rockaway River, Whippany River, and Black Brook. The Great Swamp National Wildlife Refuge is located within the Upper Passaic River Watershed. Approximately one-half of this watershed is undeveloped or vacant, with the remainder primarily residential and commercial; however, this watershed is facing significant development in the vacant areas. This watershed is subject to frequent flooding.

The **Middle Passaic River Watershed** includes Great Piece Meadows and Deepavaal Brook. The Great Piece Meadows is a freshwater wetland with a drainage area of approximately 12 square miles and is prone to flooding. Various owners privately own the Great Piece Meadows.

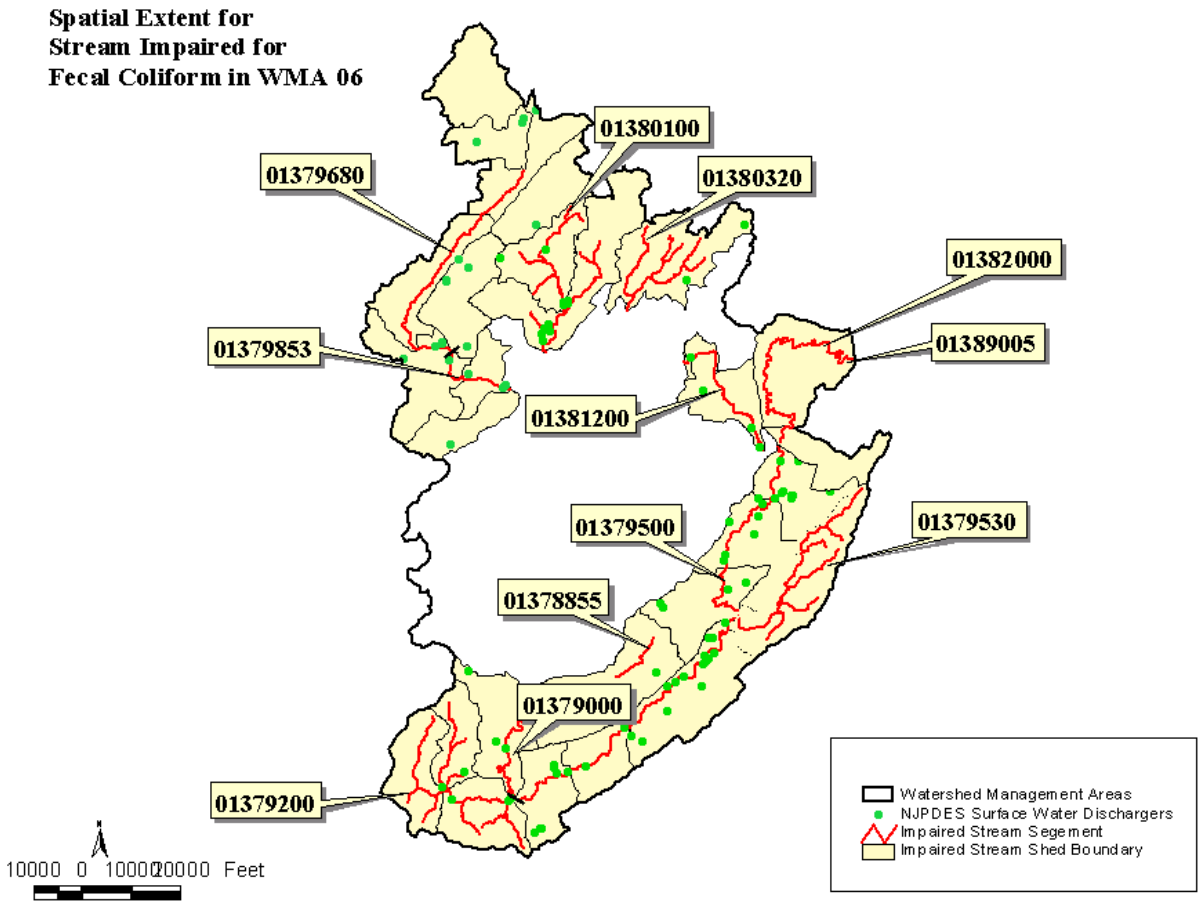
The **Rockaway River Watershed** has a drainage area of approximately 133 square miles and is approximately 37 miles long. The Rockaway River flows east to its confluence with the Whippany River at Pine Brook. Major tributaries include Stone Brook, Mill Brook, Beaver Brook, and Den Brook. The land use patterns in this area are complex and include vacant areas, parklands, residential development and industrial/commercial uses.

The **Whippany River Watershed** drains approximately 69 square miles and is located entirely within Morris County. The river is approximately 18 miles long and flows to the Passaic River. Two major tributaries are Black Brook and Troy Brook. The population is centered in Morristown, Parsippany-Troy Hills, Hanover Township and East Hanover Township.

Sublist 5 Waterbodies WMA 6

Eleven of the thirty-two TMDLs in this report are located in WMA 6. Included are segments in the Black Brook (#01378855), Dead River (#01379200), Passaic River (#01379000, #01379500, and #01382000), Rockaway River (#01379680, #01379853, and #01381200), Canoe Brook (#01379530), Beaver Brook (#01380100), and Stony Brook (#01380320). The spatial extent of each segment is identified in Figure 4. River miles, watershed size and land use\land cover by percent area associated with each segment are listed in Table 6.

Figure 4 Spatial extent of Sublist 5 segments for which TMDLs are being developed in WMA 6



Five segments, the Black Brook at Madison (#01378855), Passaic River near Millington (#01379000), Dead River near Millington (#01379200), the Passaic River near Catham (#01379500), and Canoe Brook near Summit (#01379530), comprise a large portion of the Passaic River headwater region and were grouped based on geographical similarities and bacterial geometric mean concentrations. Water quality from stations #01378855, #01379000, #01379200, #001379500, and #01379530 were used to assess the status and spatial extent of bacterial contamination. The combined length of the impaired stream segments is approximately 71.0 miles. A total of 204.8 stream miles are located within its watershed and will be included in the implementation plan. The total drainage area for this segment is approximately 66,759 acres, or 104.3 mi^2.

Table 6 River miles, Watershed size, and Anderson Landuse classification for eleven Sublist 5 segments, listed for fecal coliform, in WMA 6.

	Segment ID					
	1378855,1379000, 1379200,1379500, 1379530	**1379680 1379853**	**1380100**	**1380320**	**1381200**	**1382000**
Sublist 5 impaired river miles (miles)	71.0	15.1	16.9	13.1	6.8	14.9
Total river miles within watershed and included in the implementation plan (miles)	204.8	105.8	43.0	25.0	18.4	53.0
Watershed size (acres)	66759	39246	14528	7864	4861	11019
Landuse/Landcover						
Agriculture	2.23%	0.36%	0.16%	2.00%	1.44%	0.52%
Barren Land	0.90%	1.23%	2.66%	0.36%	1.62%	0.51%
Forest	19.21%	55.51%	63.14%	62.92%	13.07%	11.83%
Urban	51.57%	27.70%	17.22%	21.24%	66.79%	42.42%
Water	1.45%	3.75%	7.08%	4.03%	2.14%	3.00%
Wetlands	24.65%	11.44%	9.74%	9.46%	14.94%	41.72%

Rockaway River at Longwood Valley, (#01379680), and Rockaway River at Blackwell St. (#01379853) were grouped based on similarities in geography and bacterial contamination. Water quality from stations #01379680, #01379700 and #01379853 were used in assessing the spatial extent of bacterial contamination for these segments. The combined length of the impaired stream segments is approximately 15.1 miles in a watershed area of approximately 39246 acres or 61.3 mi^2. A total of 105.8 river miles are located within the watershed and will be included in the implementation plan.

Beaver Brook at Rockaway, segment #01380100, consists of the entire Beaver Brook to the confluence of Beaver Brook and the Rockaway River. Water quality from station #01380100 was used to assess the status and spatial extent of bacterial contamination. The impaired stream segment length is approximately 16.9 miles. A total of 43.0 stream miles are located within its watershed and will be included in the implementation plan. The total drainage area for this segment is approximately 14528 acres or 22.7 mi^2.

Segment #01380320, Stony Brook at Boonton, consists of the entire Stony Brook to the confluence of Stony Brook and the Rockaway River. Water quality from station #01380100 was used to assess the status and spatial extent of bacterial contamination. The impaired stream segment length is approximately 13.1 miles. A total of 25.0 stream miles are located within its watershed and will be included in the implementation plan. The total drainage area for this segment is approximately 7864 acres or 12.3 mi^2.

Segment #01381200, Rockaway River at Pine Brook, is located on the downstream portion of the Rockaway River between the outlet of the Boonton Reservoir and the confluence of the

Rockaway and the Whippany Rivers. Water quality from station #01381200 was used to assess the status and spatial extent of bacterial contamination. The impaired stream segment length is approximately 6.8 miles. A total of 18.4 stream miles are located within its watershed and will be included in the implementation plan. The total drainage area for this segment is approximately 4861 acres or 7.6 mi^2.

Segment #01382000, Passaic River at Two Bridges, is located on the Passaic River between the confluence of the Whippany and Passaic Rivers to the confluence of the Passaic and Pompton Rivers. Water quality from station #01382000 was used to assess the status and spatial extent of bacterial contamination. This segment was not grouped with other segments based on its relatively lower bacterial concentrations compared with those found in up and downstream on the Passaic River. The impaired stream segment length is approximately 14.9 miles in a drainage area of approximately 11019 acres or 17.2 mi^2. A total of 53.0 stream miles are located within its watershed and will be included in the implementation plan.

4.2. Data Sources

The Department's Geographic Information System (GIS) was used extensively to describe northeast watershed characteristics. In concert with USEPA's November 2001 listing guidance, the Department is using Reach File 3 (RF3) in the 2002 Integrated Report to represent rivers and streams. The following is general information regarding the data used to describe the watershed management area:

- Land use/Land cover information was taken from the 1995/1997 Land Use/Land cover Updated for New Jersey DEP, published 12/01/2000 by Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), delineated by watershed management area.
- 2002 Assessed Rivers coverage, NJDEP, Watershed Assessment Group, unpublished coverage.
- County Boundaries: Published 11/01/1998 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), "NJDEP County Boundaries for the State of New Jersey." Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/stco.zip
- Detailed stream coverage (RF3) by County: Published 11/01/1998 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA). "Hydrography of XXX County, New Jersey (1:24000)." Online at: http://www.state.nj.us/dep/gis/digidownload/zips/strm/
- NJDEP 14 Digit Hydrologic Unit Code delineations (DEPHUC14), published 4/5/2000 by Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS) Online at: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/dephuc14.zip
- NJPDES Surface Water Discharges in New Jersey, (1:12,000), published 02/02/2002 by Division of Water Quality (DWQ), Bureau of Point Source Permitting - Region 1 (PSP-R1).

5.0 Applicable Water Quality Standards

5.1. New Jersey Surface Water Quality Standards for Fecal Coliform

As stated in N.J.A.C. 7:9B-1.14(c) of the New Jersey SWQS, the following are the criteria for freshwater fecal coliform:

> "Fecal coliform levels shall not exceed a geometric average of 200 CFU/100 ml nor should more than 10 percent of the total sample taken during any 30-day period exceed 400 CFU/100 ml in FW2 waters".

All of the waterbodies covered under these TMDLs have a FW1 or FW2 classification (NJAC 7:9B-1.12). The designated use, i.e. surface water uses, both existing and potential, that have been established by the Department for waters of the State, for all of the waterbodies in the Northeast Water Region is as stated below:

In all FW1 waters, the designated uses are:
1. Set aside for posterity to represent the natural aquatic environment and its associated biota;
2. Primary and secondary contact recreation;
3. Maintenance, migration and propagation of the natural and established aquatic biota; and
4. Any other reasonable uses.

In all FW2 waters, the designated uses are:
1. Maintenance, migration and propagation of the natural and established aquatic biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
5. Any other reasonable uses.

5.2. Pathogen Indicators in New Jersey's Surface Water Quality Standards (SWQS)

A subset of total coliform, fecal coliform, originates from the intestines of warm-blooded animals. Therefore, because they do not include organisms found naturally in soils, fecal coliform is preferred over total coliform as a pathogen indicator. In 1986, USEPA published a document entitled *"Implementation Guidance for Ambient Water Quality Criteria for Bacteria – 1986"* that contained their recommendations for water quality criteria for bacteria to protect bathers from gastrointestinal illness in recreational waters. The water quality criteria established levels of indicator bacteria *Escherichia coli* (*E. coli*) for fresh recreational water and enterococci for fresh and marine recreational waters in lieu of fecal coliforms. Historically, the New Jersey has listed water bodies for exceedances of the fecal coliform criteria.

Therefore, the Department is obligated to develop TMDLs for Sublist 5 water bodies based upon fecal coliform, at least until New Jersey has the transition to *E. coli* and enterococci in the Department's SWQS and until sufficient data have been collected to either develop a TMDL or to support a proposal to move the waterbodies to one of the other four categories.

6.0 Source Assessment

In order to evaluate and characterize fecal coliform loadings in the waterbodies of interest in these TMDLs, and thus propose proper management responses, source assessments are warranted. Source assessments include identifying the types of sources and their relative contributions to fecal coliform loadings, in both time and space variables.

6.1. Assessment of Point Sources other than Stormwater

All point sources of fecal coliform other than stormwater for these TMDLs are listed in Appendix B. These point sources include all municipal wastewater treatment plants (Major and Minor Industrial discharges) as will as industrial treatment plants that also treat domestic wastewater (Major and Minor Industrial discharges that have limits for bacterial quality indicators in their permits). Municipal treatment plants and industrial treatment plants that may include domestic wastewater in their effluent are required to disinfect effluent prior to discharge and to meet surface water quality criteria for fecal coliform in their effluent. In addition, New Jersey's urface Water Quality Standards at N.J.A.C. 7:9B-1.(c)4 reads "No mixing zones shall be permitted for indicators of bacterial quality including, but not limited to, fecal coliforms and enterococci". This mixing zone policy is applicable to both municipal and industrial treatment plants.

Since POTWs and industrial treatment plants routinely achieve essentially complete disinfection (less than 20 CFU/100ml), the requirement to disinfect is, in effect, more stringent than the fecal coliform effluent criteria. The percent of the total point source contribution is an insignificant fraction of the total load. Consequently, these fecal coliform TMDLs will not impose any change in current practices for POTWs and industrial treatment plants and will not result in changes to existing effluent limits. The methodology used in this report is inappropriate for use in areas affected by combined sewer overflows (CSOs) or in areas influenced by tidal action. Therefore, stream segments falling into these two categories will be excluded from the discussion of TMDLs in this report.

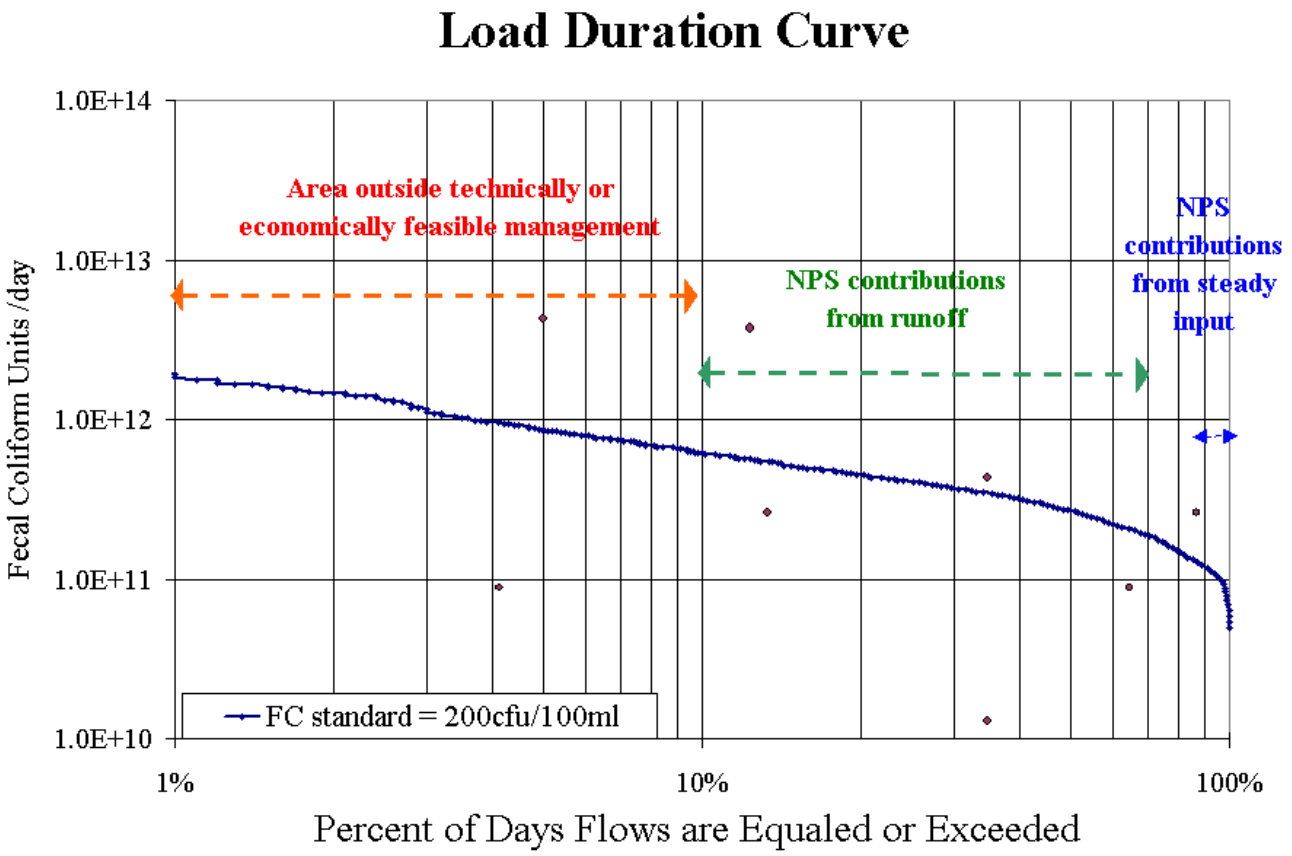
6.2. Assessment of Nonpoint and Stormwater Sources

Nonpoint and stormwater sources include storm-driven loads such as runoff from various land uses that transport fecal coliform from sources such as geese, farms, and domestic pets to the receiving water. Domestic pet waste, geese waste, as well as loading from storm water detention basins will be addressed by the Phase II MS4 program. Nonpoint sources also include steady-inputs from "illicit" sources such as failing sewage conveyance systems, sanitary sewer overflows (SSOs), and failing or inappropriately located septic systems. When

"illicit" sources are identified, appropriate enforcement measures will be taken to eliminate them.

When streamflow gauge information is available, a load duration curve (LDC) is useful in identifying and differentiating between storm-driven and steady-input sources. As an example, Figure 5 represents a LDC using the 200 CFU/100 ml criterion.

Figure 5 Example Load Duration Curve (LDC)



The load duration curve method is based on comparison of the frequency of a given flow event with its associated water quality load. A LDC can be developed using the following steps:

1. Plot the Flow Duration Curve, Flow vs. % of days flow exceeded.
2. Translate the flow-duration curve into a LDC by multiplying the water quality standard, the flow and a conversion factor, the result of this multiplication is the maximum allowable load associated with each flow
3. Graph the LDC, maximum allowable load vs. percent of time flow is equaled or exceeded
4. Water quality samples are converted to loads (sample water quality data multiplied by daily flow on the date of sample).
5. Plot the measured loads on the LDC.

Values that plot below the LDC represent samples below the concentration threshold whereas values that plot above represent samples that exceed the concentration threshold. Loads that plot above the curve and in the region between 85 and 100 percent of days in which flow is exceeded indicate a steady-input source contribution. Loads that plot in the region between 10 and 70 percent suggest the presence of storm-driven source contributions. A combination of both storm-driven and steady-input sources occurs in the transition zone between 70 and 85 percent. Loads that plot above 99 percent or below 10 percent represent values occurring during either extreme low or high flows conditions and are thus considered to be outside the region of technically and economically feasible management. In this report, LDCs are used only for TMDL implementation and not in calculating TMDLs.

7.0 Water Quality Analysis

Relating pathogen sources to in-stream concentrations is distinguished from quantifying that relationship for other pollutants given the inherent variability in population size and dependence not only on physical factors such as temperature and soil characteristics, but also on less predictable factors such as re-growth media. Since fecal coliform loads and concentrations can vary many orders of magnitude over short distances and over time at a single location, dynamic model calibrations can be very difficult to calibrate. Options available to control non-point sources of fecal coliform typically include measures such as goose management strategies, pooper-scooper ordinances, and septic system maintenance. However, the effectiveness of these control measures is not easily measured. Given these considerations, detailed water quality modeling may not provide adequate insight or guidance toward the development of implementation plans for fecal coliform reductions.

As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a waterbody can receive without violating water quality standards (40 C.F.R. 130.2). The loadings are required to be expressed as either mass-per-time, toxicity, or other appropriate measures (40 C.F.R. 130.2(i)). For these TMDLs, the load capacity is expressed as a concentration set to meet the state water quality standard. For bacteria, it is appropriate and justifiable to express the components of a TMDL as percent reduction based on concentration. The rationale for this approach is that:

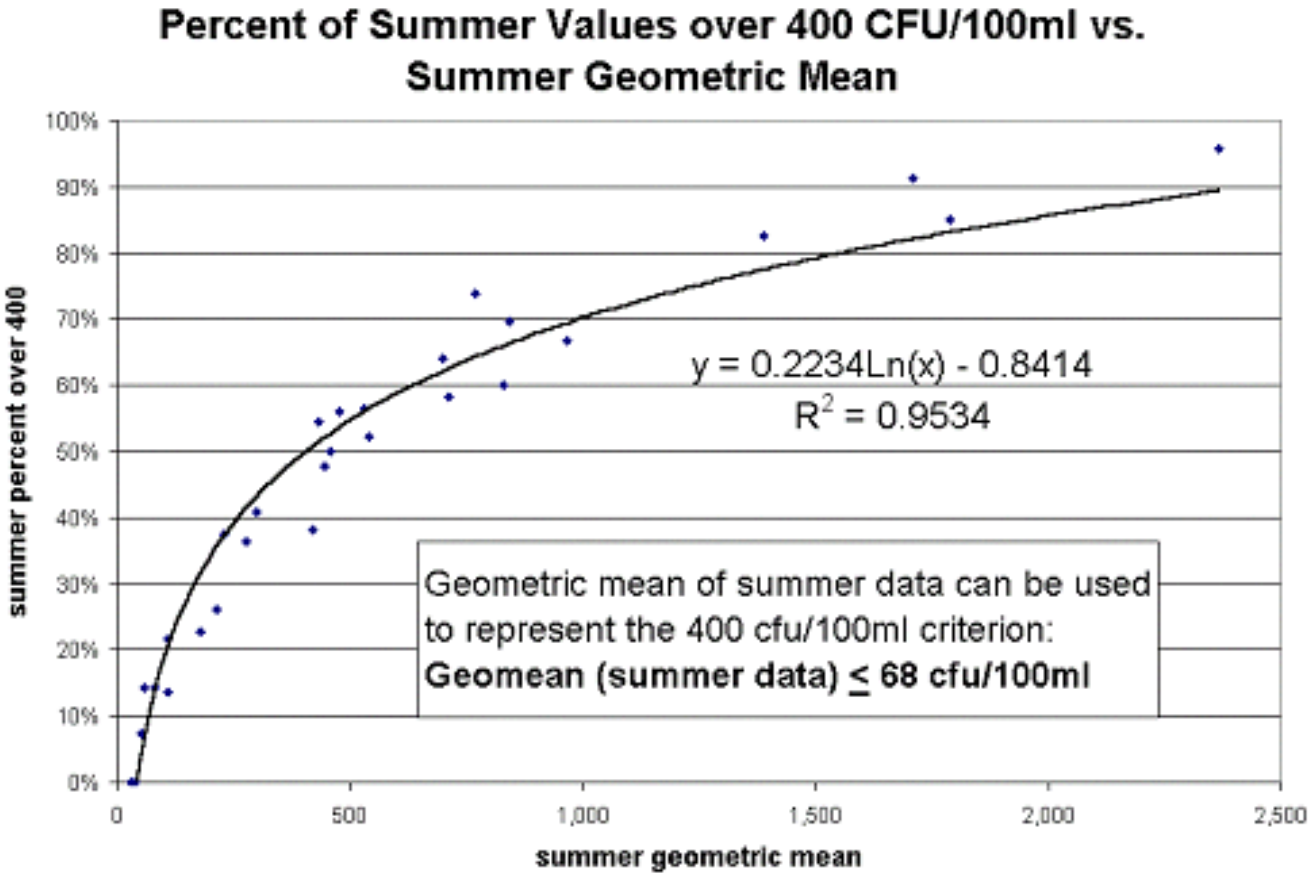
- expressing a bacteria TMDL in terms of concentration provides a direct link between existing water quality and the numeric target;
- using concentration in a bacteria TMDL is more relevant and consistent with the water quality standards, which apply for a range of flow and environmental conditions; and
- follow-up monitoring will compare concentrations to water quality standards.

Given the two criteria of 200 CFU/100 ml and 400 CFU/100 ml in FW2 waters, computations were necessary for both criteria and resulted in two percent reduction values. The higher

percent reduction value was applied in the TMDL so that both the 200 CFU/100 ml and 400 CFU/100 ml criteria were satisfied.

To satisfy the 200 CFU/100ml criteria, the geometric mean of all available data between water years 1994-2000 was compared to an adjusted target concentration. The adjusted target accounts for an explicit margin of safety and is equal to 200 minus the margin of safety. A calculation incorporating all available data is generally conservative since most samples are taken during the summer when fecal coliform is generally higher. A geometric mean of summer data was used to develop a percent reduction to satisfy the 400 CFU/100 ml criteria. A summer geometric mean can be used to represent the 400 criteria by regressing the percent over 400 CFU/100 ml against the geometric mean (Figure 6). Thus, each datapoint on Figure 6 represents all the data from one individual monitoring station. Sites with 20 or more summer data points were used to develop this regression, in order to make use of more significant values for percent exceedance. The resulting regression has an r-squared value of 0.9534. Solving for X when Y is equal to 10% yields a geometric mean threshold of 68 CFU/100ml. This means that, using summer data, a geometric mean of 68 can be used to represent the 400 CFU/100ml criterion. Since the geometric mean is a more reliable statistic than percentile when limited data are available, 68 CFU/100ml was used to represent the 400 CFU/100ml criterion for all sites. The inclusion of all data from summer months (May through September) to compare with the 30-day criterion is justified because summer represents the critical period when primary and secondary contact with water bodies is most prevalent. A more detailed justification for using summer data can be found in Section 7.1,"Seasonal Variation and Critical Conditions."

Figure 6 **Percent of summer values over 400 CFU/100ml as a function of summer geometric mean values**



$y = 0.2234\text{Ln}(x) - 0.8414$ Equation 1

$R^2 = 0.9534$

Geometric mean, and summer geometric mean, and percent reductions were determined at each location for both criteria using Equations 2 through 4. To satisfy the 200 CFU/100ml criteria, equations 2 and 3 were applied. Equations 2 and 4 were used in satisfying the 400 CFU/100ml criteria.

$$GeometricMean\ for\ 200CFU\ criteria = \sqrt[n]{y_1 y_2 y_3 y_4 \ldots . y_n} \quad \text{Equation 2}$$

where:
y = sample measurement
n = total number of samples

$$200CFU\ criteria Percent\,\text{Re}duction = \frac{(Geometric mean - (200 - e))}{Geometric mean} \times 100\% \quad \text{Equation 3}$$

$$400CFU\ criteria Percent\,\text{Re}duction = \frac{(Summer Geometric mean - (68 - e))}{Summer Geometric mean} \times 100\% \quad \text{Equation 4}$$

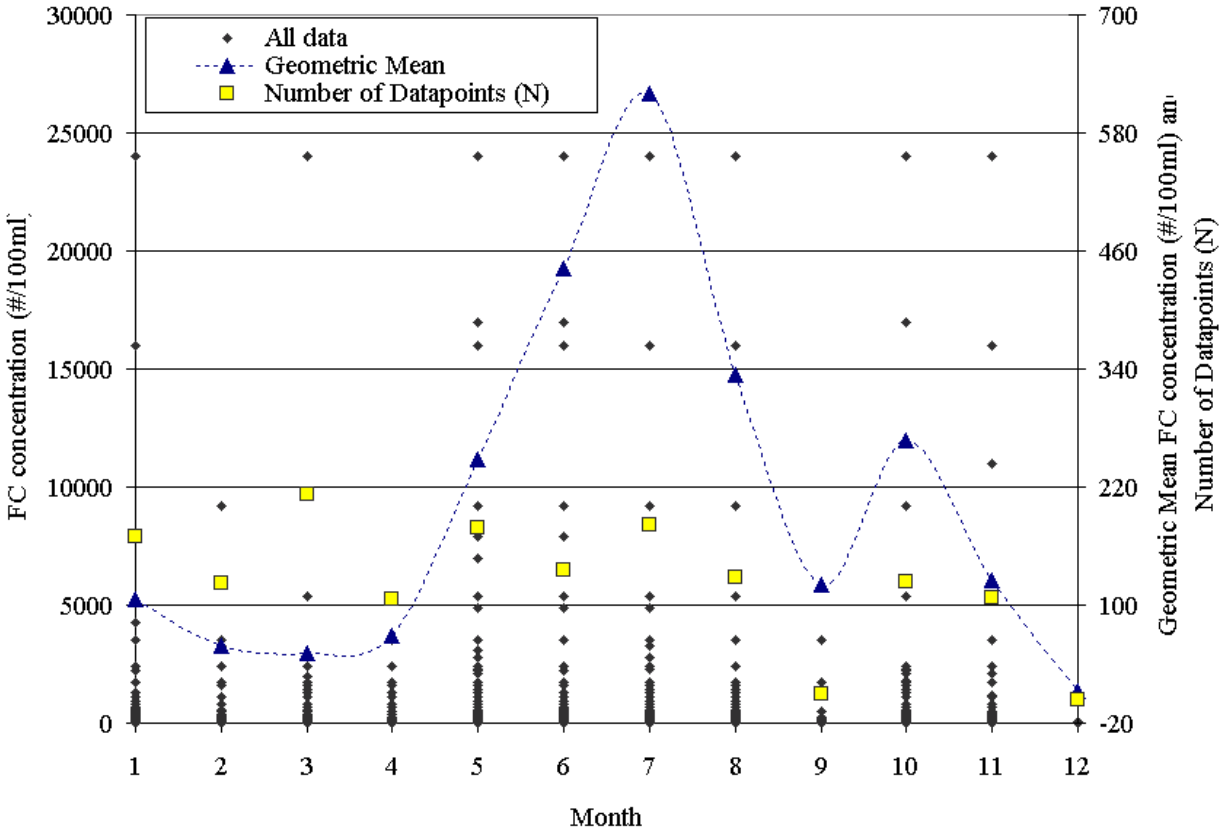
where:
e = (margin of safety)

This percent reduction can be applied to nonpoint and stormwater sources as a whole or be apportioned to categories of nonpoint and stormwater sources within the study area. The extent to which nonpoint and stormwater sources have been identified and the process by which they will become identified will vary by study area based on data availability, watershed size and complexity, and pollutant sources.

7.1. Seasonal Variation/Critical Conditions

These TMDLs will attain applicable surface water quality standards year round. The approach outlined in this paper is conservative given that in most cases fecal coliform data were collected during the summer months, a time when in-stream concentrations are typically the highest. This relationship is evidenced when calculating, on a monthly basis, the geometric mean of fecal coliform data collected statewide. Statewide fecal coliform geometric means during water years 1994-1997 were compared on a monthly basis and are shown in Figure 7. The 1994-1997 period was chosen for this analysis so that the significance of the number of individual datapoints for any given month was minimized. During the 1994-1997 period year-round sampling for fecal coliform was conducted by sampling four times throughout the year. Following 1997, the fecal coliform sampling protocol was changed to five samples during a 30-day period in the summer months. As evident in Figure 7, higher monthly geometric means are observed between May and September with the highest values occurring during mid-summer. This relationship is also evident when using the entire 1994-2002 dataset or datasets from individual water years. Given this relationship, summer is considered the critical period for violating fecal coliform SWQS and, as such, sampling during this period is considered adequate for meeting year round protections and designated uses.

Figure 7 **Statewide monthly fecal coliform geometric means during water years 1994-1997 using USGS/NJDEP data.**



7.2. Margin of Safety

A Margin of Safety (MOS) is provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)). For these TMDLs calculations, both an implicit and explicit Margin of Safety (MOS) are incorporated. Implicitly, a MOS is inherent in the estimates of current pollutant loadings, the targeted water quality goals (New Jersey's SWQS) and the allocations of loading. This was accomplished by taking conservative assumptions throughout the TMDL evaluation and development. Examples of some of the conservative assumptions include treating fecal coliform as a conservative substance, applying the fecal coliform criteria to stormwater sources, and applying the fecal coliform criteria to the stream during all weather conditions. Fecal coliforms decay in the environment (i.e. outside the fecal tract) relatively rapidly, yet this analysis assumes a linear relationship between fecal load and instream concentration. Furthermore, it is generally recognized that fecal contamination from stormwater poses much less risk of illness than fecal contamination from sewage or septic system effluent (Cabelli, 1989). Finally, much of the fecal coliform is flushed into the system during rainfall events and passes through the system in a short time. Primary and secondary recreation generally occur during dry periods.

An explicit MOS is provided by incorporating a confidence level multiplier associated with log-normal distributions in the calculation of the load reduction for both the 200 and 400 standards. Using this method, the 200 and 400 targets are reduced based on the number of data points and the variability within each data set. For these TMDLs, a confidence level of 90% was used in calculating the MOS. As a result, and as identified in Appendix C, the target value will be different for each stream segment or grouped segments. The explicit margin of safety is calculated using the following steps:

1- FC data (x) will transformed to Log form data (y),
2- the mean of the Log- transformed data (y) is determined, $\bar{y}$
3- Determine the standard deviation of the Log-transformed data, S_y using the following equation:

$$S_y = \sqrt{\frac{\sum_i (y_i - \bar{y})^2}{N-1}}$$

4- Determine the Geometric mean of the FC data (GM)
5- Determine the standard deviation of the mean (standard error of the mean), $s_{\bar{y}}$, using the following equation:

$$s_{\bar{y}} = \frac{s_y}{\sqrt{N}}$$

6- For the 200 standard ($x_{standard}$), $y_{standard} = \text{Log}(200) = 2.301$, thus for a confidence level of 90%, the target value will be the lower confidence limit (n= -1.64), $y_{target} = y_{std} - n \cdot s_{\bar{y}}$, for example, the 200 criteria: $y_{target} = 2.301 - n^* s_{\bar{y}}$
7- The target value for x, $x_{target} = 10^{y\ target}$
8- The margin of safety (e) therefore will be $e = x_{standard} - x_{target}$
9- Finally, the load reduction = $\frac{GM - x_{target}}{GM} \cdot 100\%$, for example the 200 criteria will be defined as: $\frac{(GM - (200 - e))}{GM} \cdot 100\%$

The 400 criteria would be defined as: $\frac{(GM - (68 - e))}{GM} \cdot 100\%$

8.0 TMDL Calculations

Because these TMDLs are calculated based on ambient water quality data, the allocations are provided in terms of percent reductions. In the same way, the loading capacity of each stream is expressed as a function of the current load:

$LC = (1 - PR) \times L_o$, where

LC = loading capacity for a particular stream;
PR = percent reduction as specified in Tables 7-10;

L_o = current load.

8.1. Wasteload Allocations and Load Allocations

For the reasons discussed previously, these TMDLs do not include WLAs for traditional point sources (POTWs, industrial, etc.). WLAs are hereby established for all NJPDES-regulated point sources (including NJPDES-regulated stormwater), while LAs are established for all stormwater sources that are not subject to NJPDES regulation, and for all nonpoint sources. Both WLAs and LAs are expressed as percentage reductions for particular stream segments.

Table 7 identifies the required percent reduction necessary for each stream segment or group of segments to meet the fecal coliform SWQS. The reductions reported in these tables include a margin of safety factor and represent the higher percent reduction (more stringent) required of the two criteria. Reductions that are required under each criteria are located in Appendix C. In all cases, the 400 CFU/100ml criteria was the more stringent of the two criteria, thus values reported in Table 7 were equal to the percent required to meet the 400 CFU/100ml criteria.

Table 7 TMDLs for fecal coliform-impaired stream segments in the Northeast Water Region as identified in Sublist 5 of the 2002 Integrated List of Waterbodies. The reductions reported in this table represent the higher, or more stringent, percent reduction required of the two fecal colifom criteria.

TMDL No.	WMA	Station Name/Waterbody	Sublist 5 Segment	Summer Geometric Mean CFU/100ml	MOS as a percent of the target conc.[1]	Percent Reduction (LA) without MOS	Percent Reduction (LA) with MOS	Wasteload Allocation (WLA) as a Percent Reduction, with MOS
1	3	Macopin River at Macopin Reservoir	01382450	59	46%	-16%	**37%**	**37%**
2	3	Wanaque River at Highland Avenue	01387010	208	53%	67%	**85%**	**85%**
3	3	Ramapo River near Mahwah	01387500	431	44%	84%	**91%**	**91%**

TMDL No.	WMA	Station Name/Waterbody	Sublist 5 Segment	Summer Geometric Mean CFU/100ml	MOS as a percent of the target conc.[1]	Percent Reduction (LA) without MOS	Percent Reduction (LA) with MOS	Wasteload Allocation (WLA) as a Percent Reduction, with MOS
4	4	West Branch Saddle River at Upper Saddle R.	01390445	1,144	30%	94%	**96%**	**96%**
5	4	Saddle River at Saddle River	01390500					
6	4	Saddle River at Ridgewood Ave at Ridgewood	01390900					
7	4	Hohokus Brook at Mouth at Paramus	01391100					
8	4	Saddle River at Rochelle Park	01391200					
9	4	Saddle River at Lodi	01391500					
10	4	Passaic R. below Pompton R. at Two Bridges	01389005	652	30%	90%	**93%**	**93%**
11	4	Passaic River at Little Falls	01389500					
12	4	Preakness Brook near Little Falls	01389080					
13	4	Peckman River at West Paterson	01389600					
14	4	Deepavaal Brook at Fairfield	01389138					
15	4	Diamond Brook at Fair Lawn	01389860	1,544	47%	96%	**98%**	**98%**
16	4	Goffle Brook at Hawthorne	01389850					
17	5	Hackensack River at River Vale	01377000	294	34%	77%	**85%**	**85%**
18	5	Musquapsink Brook at River Vale	01377499	709	54%	90%	**96%**	**96%**
19	5	Pascack Brook at Westwood	01377500					
20	5	Tenakill Brook at Cedar Lane at Closter	01378387	159	91%	57%	**96%**	**96%**
21	5	Coles Brook at Hackensack	01378560	1,093	68%	94%	**98%**	**98%**
22	6	Black Brook at Madison	01378855	1,370	29%	95%	**96%**	**96%**
23	6	Passaic River near Millington	01379000					
24	6	Dead River Near Millington	01379200					
25	6	Passaic River near Chatham	01379500					
26	6	Canoe Brook near Summit	01379530					
27	6	Rockaway River at Longwood Valley	01379680	373	54%	82%	**92%**	**92%**
28	6	Rockaway River at Blackwell Street	01379853					
29	6	Beaver Brook at Rockaway	01380100	362	43%	81%	**89%**	**89%**
30	6	Stony Brook at Boonton	01380320	214	32%	68%	**78%**	**78%**
31	6	Rockaway River at Pine Brook	01381200	571	28%	88%	**91%**	**91%**
32	6	Passaic River at Two Bridges	01382000	276	33%	75%	**83%**	**83%**

[1] MOS as a percent of target is equal to: $\frac{e}{200 CFU/100ml}$ or $\frac{e}{68 CFU/100ml}$ where "e" is defined as the MOS in Section 7.2

8.2. Reserve Capacity

Reserve capacity is an optional means of reserving a portion of the loading capacity to allow for future growth. Reserve capacities are not included at this time. The loading capacity of each stream is expressed as a function of the current load (Section 8.0), and both WLAs and LAs are expressed as percentage reductions for particular stream segments (Section 8.1). Therefore, the percent reductions from current levels must be attained in consideration of any new sources that may accompany future development.

9.0 Follow - up Monitoring

The NJDEP's primary surface water quality monitoring unit is the Office of Water Monitoring Management. In association with the Water Resources Division of the U.S. Geological Survey, the NJDEP have cooperatively operated the Ambient Stream Monitoring Network (ASMN) in New Jersey since the 1970s. The ASMN currently includes approximately 115 stations that are routinely monitored on a quarterly basis. Bacteria monitoring, as part of the ASMN network, are conducted five times during a consecutive 30-day summer period each year. The data from this network has been used to assess the quality of freshwater streams and percent load reductions. Although other units also perform monitoring functions, the ASMN will remain a principal source of FC monitoring.

10.0 Implementation

When bacterial sources are easily identifiable, measures outlined in section 10.2, Source Categories and Best Management Practices (BMPs), will be applied to reduce bacterial loading to meet SWQ standards. When bacterial sources are not easily identifiable, load duration curves will be used in conjunction with bacterial source tracking, if necessary, to identify pathogen sources.

Much of the stormwater discharged to the surface waters in question is discharged through "small municipal separate storm sewer systems" (small MS4s) that are proposed to be regulated under the Department's proposed Phase II NJPDES stormwater rules for the Municipal Stormwater Regulation Program. Under those proposed rules and associated draft general permits, nearly all municipalities (and various county, State, and other agencies) in the Northeast Region will be required to implement various control measures that should substantially reduce bacteria loadings, including measures to eliminate "illicit connections" of domestic sewage and other waste to the small MS4, adopt and enforce a pet waste ordinance, prohibit feeding of unconfined wildlife on public property, clean catch basins, perform good housekeeping at maintenance yards, and provide related public education and employee training. The WLAs and LAs in Table 7 are not themselves "Additional Measures" under proposed N.J.A.C. 7:14A-25.6 or 25.8.

Sections 10.2 and 10.4 identify BMPs and monitoring measures that in some respects are in addition to the control measures required in these general permits. These BMPs and monitoring measures are also not "Additional Measures" under proposed N.J.A.C. 7:14A-25.6 or 25.8. However, the Department will seek to have these BMPs and monitoring measures implemented through means other than requirements in these general permits. Also, in the future, the Department may propose and adopt WQM plan amendments that identify one or more of these BMPs (or other BMPs) and monitoring measures as "Additional Measures" for some or all of the permittees under these general permits.

10.1. Load Duration Curve (LDC)

As explained in Section 6.2, a LDC can be a beneficial tool as a first step in identifying potential pathogen sources. LDCs for listed segments in the Northeast region are located in Appendix D. In each case, thirty (30) years of USGS gage flow data (water years 1970-2000), from the listed station, were used in generating the curve. When a recent 30-year period was not available at the listed station, an adjacent station was selected based on station correlation information in US Geological Survey Open File Report 81-1110 (USGS, 1982). When an adjacent station was used in the manner, flows were adjusted to the station of interest based on a ratio of watershed size. LDCs were not developed for stations in which a satisfactory correlation could not be found.

10.2. Source Categories and Best Management Practices

The TMDLs developed in this report were developed with the assistance of stakeholders in WMAs 3, 4, 5 and 6 as part of the Department's ongoing watershed management efforts. Through the creation of the watershed management planning process over the past several years, Public Advisory Committees (PACs) and Technical Advisory Committees (TACs) were created in all 20 WMAs. Whereas the PACs serve in an advisory capacity to the New Jersey Department of Environmental Protection, and examined and commented on a myriad of issues in the watersheds, the TACs were focused on the scientific, ecological, and engineering issues relevant to the mission of the PAC. The Department in collaboration with the Northeast TACs narrowed the scope of the primary sources of fecal contamination to the following:

Non-Human Sources of Fecal Coliform

- Canada geese
- Pet Waste
- Stormwater basins
- Direct stormwater discharges to waterbodies
- Farms, zoos and livestock

Human Sources of Fecal Coliform

- Malfunctioning or older improperly sized septic systems

- Failing sewage conveyance systems
- Improper garbage storage and disposal

10.3. Management Strategies

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint and stormwater sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint and stormwater source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993). A combination of best management practices and direct remedies of illicit sources that are found through track-down monitoring will be used to implement these TMDLs.

10.3.1. Short-Term Management Strategies

Short-term management strategies include existing projects dubbed "Action Now" that are on the ground projects funded by the Department to address fecal and other NPS impairments to an impaired waterbody. These projects include stream bank restoration projects, ordinance development and catchbasin cleanouts. Funding sources include Clean Water Act 319(h) funds and State sources. Since 1998, 319(h) funds have provided approximately $3 million annually.Priority is given to funding projects that address TMDL implementation, development of stormwater management plans and projects that address impairment based on Sublist 5 listed waterbodies.

An example of such a project is a two-year project evaluating stormwater quality in a low-density residential area located in Hanover Township, Morris County. As part of the study, catch basin cleaning and public education and outreach were conducted. The outreach program targeted homeowners, landscapers and pet owners and was based on enhancing awareness and effecting behaviors that would reduce specific potential sources of NPS contaminants.

10.3.2. Long–Term Management Strategies

While short-term management measures will begin to reduce sources of fecal coliform in the Northeast Water Region, additional measures will be needed to verify and further reduce or eliminate these sources. Some of these measures may be implemented now, where resources are available and sources have already been identified as causing the fecal impairment. Both short-term and long-term management strategies that address fecal reduction related to these identified sources may be eligible for future Departmental funding.

Source Categories for Long-Term Management Strategies

1) Canada Geese

Geese are migratory birds that are protected by the Migratory Bird Treaty Act of 1918 and other Federal and State Laws. Resident Canada geese are those birds that do not migrate, but are protected by this and other legislation. The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS)-Wildlife Services program reports that the 1999 estimated population of non-migratory geese in New Jersey was 83,000. Geese and other pest waterfowl have been identified as one of several primary sources of pathogen loading to impaired water bodies in the Northeast Region. Geese may produce up to 1½ pounds of fecal matter a day.

Canada Goose Damage Management Plan

Because geese are free to move about and commonly graze and rest on large grassy areas associated with schools, parks, golf courses, corporate lawns and cemeteries, solutions are best developed and conducted at the community level through a community-based goose damage management program. USDA's Wildlife Services program recommends that a community prepare a written Canada Goose Damage Management Plan that may include the following actions:

- Initiate a fact-finding and Communication Plan
- Enact and Enforce a No Feeding Ordinance
- Conduct Goose Damage Control Activities such as Habitat Modification
- Review and Update Land Use Policies
- Reduce or Eliminate Goose Reproduction (permit required)
- Hunt Geese to Reinforce Nonlethal Actions (permit required)

Procedures such as handling nests and eggs, capturing and relocating birds, and the hunting of birds require a depredation permit from either the USDA APHIS Wildlife Services or U.S. Fish and Wildlife Services. Procedures requiring permits should be a last resort after a community has exhaustedthe other listed measures. The Department's draft guide *Management of Canada Geese in Suburban Areas, March 2001,* which may be found at www.state.nj.us/dep/watershedmgt under publications, provides extensive guidance on how to modify habitat to serve as a deterrent to geese as well as other prevention techniques such as education through signage and ordinances.

2) Stormwater Detention Basins and Impoundments

Stormwater detention basins may act as sources of fecal coliform due to the accumulation of geese and pet waste in basins. Under certain conditions, coliform will increase in numbers in basins. As a result, significant quantities of fecal coliform can be discharged during storm events.

Impoundments created by small dams across streams have been a measure commonly used for flood control by municipalities in New Jersey. In addition to flood control, the impoundments were often incorporated into public parks in order to provide recreational opportunities for residents. Many of the impoundments are surrounded by mowed turf areas, which in combination with open water serve as an ideal habitat for geese and an

attraction for pet walking. Specific management measures to reduce fecal coliform inputs to these waterbodies include:

- Development of Stormwater Management Plan
- Establishment of Riparian Buffers and "no mow" zones
- No feed ordinances for all waterfowl and wildlife and signage
- Retrofit of detention/retention basins to achieve water quality control
- Conduct regularly scheduled stormwater basin cleanout and maintenance, storm sewer inlet cleanouts and street sweeping programs

3) Pet Waste

Specific management measures to reduce pet waste include:

- Adoption of pet waste disposal i.e. pooper scooper ordinances
- Signage in parks and other public recreation areas
- Provide plastic bags dispensers in public recreation areas

4) Agricultural

Agricultural activities are potential sources of fecal coliform. Possible contributors are direct contributions from livestock permitted to traverse streams and stream corridors, manure management from feeding operations, use of manure as a soil fertilizer/amendment. Implementation of conservation management plans and best management practices are the best means of controlling agricultural sources of fecal coliform. Several programs are available to assist farmers in the development and implementation of conservation management plans and best management practices.

Agricultural Conservation Programs

The Natural Resource Conservation Service is the primary source of assistance for landowners in the development of resource management pertaining to soil conservation, water quality improvement, wildlife habitat enhancement, and irrigation water management. The USDA Farm Services Agency performs most of the funding assistance. All agricultural technical assistance is coordinated through the locally led Soil Conservation Districts. There are a number of USDA farm programs currently addressing NPS pollution. A few of these include:

- **The Environmental Quality Incentive Program (EQIP)** is designed to provide technical, financial, and educational assistance to farmers/producers for conservation practices that address natural resource concerns, such as water quality. Practices under this program include integrated crop management, grazing land management, well sealing, erosion control systems, agri-chemical handling facilities, vegetative filter strips/riparian buffers, animal waste management facilities and irrigation systems.

- **The Conservation Reserve Program (CRP)** is designed to provide technical and financial assistance to farmers/producers to address the agricultural impacts on water quality and to maintain and improve wildlife habitat. CRP practices include the establishment of filter strips, riparian buffers and permanent wildlife habitats. This program provides the basis for the Conservation Reserve Enhancement Program (CREP).

- **The Wetland Reserve Program (WRP)** is designed to address the restoration of previously farmed wetlands. Easements are purchased for a 10-year, 30-year, or permanent duration.

- **Integrated Crop Management** is a best management practice designed to reduce the application of fertilizers and herbicides using soil samples and education to control nutrient and pesticide application to cropland.

- **The Farmland Preservation Program (FPP)** is designed to strengthen the agricultural industry and preserve important farmlands to enhance the economy and quality of life in the Garden State. Four different programs are available: The eight-year Program, where landowners voluntarily restrict non-agricultural development on their land for 8 years. In exchange, participants are eligible for cost-sharing grants for soil and water conservation projects, as well as other statutory benefits and protections. The Easement Purchase Program, where landowners sell the development rights on their land to the County Agriculture Development Board (CADB), non-profit organizations or directly to the State. Compensation for this sale is based upon the appraised value of the development rights on the land. The landowner retains ownership of the land and is eligible for cost-sharing grants for soil and water conservation projects and other benefits. The Fee Simple Program, where farms are acquired by the State Agriculture Development Committee (SADC, which is in but not of, the NJDA) based upon their fair market value and auction them off to private owners, after agricultural deed restrictions have been placed on the land. Lastly, there is the Easement Donation Program, where landowners donate their development easements to the SADC or the CADB. All of these programs have been in place since 1983.

- **The Soil & Water Conservation Cost-Sharing Program** is available to participants in a Farmland Preservation Program pursuant to the Agriculture Retention and Development Act. A Farmland Preservation Program (FPP) means any voluntary FPP or municipally approved FPP, the duration of which is at least 8 years, which has as its principal purpose as long term preservation of significant masses of reasonably contiguous agricultural land within agricultural development areas. The maintenance and support of increased agricultural production must be the first priority use of the land. Eligible practices include erosion control, animal waste control facilities, and water management practices. Cost sharing is provided for up to 50% of the cost to establish eligible practices.

- **The State Conservation Cost Share Program (CCSP)** is administered by the State Soil Conservation Committee and is integrated with the federal Environmental Quality Incentives Program (EQIP). It provides technical and financial assistance to producers for prevention and control of nonpoint sources of pollution. Cost sharing is provided for up to 75%, and in some cases 90% of the cost of installing approved conservation practices. Applications are approved based upon their environmental benefits and water quality enhancements.

- **Conservation Reserve Enhancement Program (CREP).** The New Jersey Departments of Environmental Protection and Agriculture, in partnership with the Farm Service Agency and Natural Resources Conservation Service, has recently submitted a proposal to the USDA to offer financial incentives for agricultural landowners to voluntarily implement conservation practices on agricultural lands. The NJ Conservation Reserve Enhancement Program (NJ CREP) will be part of the USDA's Conservation Reserve Program (CRP). The enrollment of farmland into CREP in New Jersey is expected to improve stream health through the installation of water quality conservation practices on New Jersey farmland. Following are some highlights of the New Jersey CREP proposal:

    - 30,000 acres of agricultural land are targeted for conservation, with 4,000 acres of agricultural land targeted for permanent conservation easement. Farmland enrolled but not permanently preserved will be under rental contract for 10-15 years
    - Conservation practices under the program are riparian buffers, filter strips, contour buffer strips, and grass waterways.
    - Water quality benefits of the program are expected to assist in achieving biologically healthy streams.
    - Permanent preservation of 4,000 acres of CREP lands will aid in reaching open space preservation goals.
    - The proposal is for a $100 million program representing a 3:1 Federal/State match, with New Jersey providing $23 million and USDA – Commodity Credit Corporation committing $77 million.

5) Stormwater Management

The Department has recently proposed Stormwater Management Rules and NJPDES Phase II Municipal Stormwater Regulation Rules that will establish standards and a regulatory program for stormwater management. Stormwater general permits issued by the Municipal Stormwater Regulation Program will address stormwater pollution

6) Malfunctioning and Older Improperly Sized Septic Systems; Illicit Connections of Domestic Sewage

Malfunctioning and older improperly sized septic systems contribute to fecal coliform loading in two ways: the system may fail hydraulically, where there is surface break out; or

hydrogeologically, under conditions when soils are inadequate to filter pathogens. Specific management measures include the implementation of the NJPDES Municipal Stormwater Regulation Program, Sanitary Surveys, Septic System Management Programs and future sewer service area designations for service to domestic treatment works.

Sanitary surveys are conducted in an effort to evaluate the water quality of natural surface waters and identify those components that affect water quality, including geographic factors and pollution sources. The focus of the sanitary survey is to identify nonpoint and stormwater source contribution of fecal coliform within the watershed. It is accomplished by sampling for various types of fecal indicators (fecal coliform, enterococcus, fecal streptococcus, *E. coli* and coliphage) during wet and dry weather conditions. Where potential problems with septic systems are identified, as described below, a trackdown study may be warranted. This could lead to an analysis of alternatives to address any identified inadequacies, such as rehabilitation of septic systems or connection to a sewage treatment system, as appropriate.

10.4. Potential Sources of Fecal Impairment to Impaired Water Bodies

In an effort to locate pathogen sources to streams listed in this report, each stream segment was walked and potential sources noted based on the source categories listed in Section 10.2. The information gathered during those site visits is listed below by their respective WMA. The below are not considered to be a list of comprehensive sources, rather they will be used in conjunction with additional site visits, LDCs, and as appropriate, bacterial source tracking to identify actual pathogen sources.

10.4.1. Watershed Management Area 3

Macopin River at Macopin Reservoir (Site ID #01382450)

Potential sources noted within this watershed include detention basins at the upper end of Echo Lake, stables (Echo Lake Stables) located on east Echo Lake Road near Echo Lake above Macopin Gorge, and potential septic source located on Route 23 (City of Newark).

Wanaque River at Highland Avenue (Site ID #01387010)

Canada Geese were observed at a number of locations within this watershed. These areas include: the Wanaque Athletic Fields, Lake Inez, Lower Twin Lake (large geese population), and Skyland Lake. Possible problem stormwater detention basins were noted specifically at Pompton Lakes, Lake Inez and Skyland Lake. Potential failing septics noted at Dupont Village and Wanaque; these areas in the process of being sewered. . Possible pet sources observed at Lower Twin Lake and Skyland Lake.

Ramapo River near Mahwah (Site ID #01387500)

Potential sources in failing septic systems located in Oakland. Almost all Oakland is on septic systems, many failing and solid rock below ~3-feet. Stormwater outfalls present where Masonicus Brook and Mahwah Rivers converge. Canada geese observed at Ramapo College atlethic fields, and other recreational fields. Horse farms located across from Ramapo College. Crystal Lake (bathing beach) has been closed several times due to high fecal concentrations.

10.4.2. Watershed Management Area 4

Passaic River below Pompton River at Two Bridges (Site ID #01389005)

This entire segment is highly developed with many stormwater outfalls, however, much of this area was developed prior to the practice of constructing detention basins. This area may benefit from stormwater management retrofits. Sources upstream on the Pompton River at Packanack Lake (Site ID #01388600) include potential failing septic systems in the Hoffman Grove section of Wayne (110 homes potential); open manure storage observed on Black Oak Ridge Road and Cross Road. Canada Geese observed at Wayne Municipal Park (Sheffield Fields), Packanack Lake Country Club, Pompton Lakes crossroads at golf driving range, Old MacDonald Park, Pequannock Park (directly above testing site), and Kehum Park.

Preakness Brook near Little Falls (Site ID #01389080)

Potential sources include: animal agriculture from Van Pien Dairy Farm, pet sources from Tintle Park, wildlife and geese sources from Preakness Golf Course, High School on Valley Road, High Mountain Golf Course, Wetland area,

Deepavaal Brook at Fairfield (Site ID #01389138)

Geese were observed at Mountain Ridge Golf Course and Green Brook Country Club.

Passaic River at Little Falls (Site ID #01389500)

Geese observed at the Passaic County Golf Course on River Road and island middle of Passaic River. Potential human source from a significant homeless population. Several stormwater pipes observed to discharge directly to the river.

Peckman River at West Paterson (Site ID #01389600)

Geese and wildlife were observed in several areas including: town parks, reservoir lands, golf course, and Essex County park. Other potential sources included pet waste from residential areas located adjacent to the river and stormwater pipes discharging directly to river north of the golf course.

Goffle Brook at Hawthorne (Site ID #01389850)

Site visit confirmed over 200 geese, 150 ring-billed and laughing gulls, 75 ducks and 100 pigeons, and pets at Goffle Brook Park. Potential source includes failing septic systems in upper reach.

Diamond Brook at Fair Lawn (Site ID #01389860)

Geese, wildlife, pet wildlife observed at the Passaic County Park System. Geese observed at the Vander Plat Park fields. Garbage, including disposable diapers, observed behind Pathmark on Hemlock Ave. Geese observed at Fair Lawn Memorial Cemetery.

WB Saddle River at Upper Saddle River (Site ID #01390445)

Stormwater, Geese, and wildlife noted as potential sources.

Saddle River at Ridgewood (Site ID #01390500)

Potential septic system impact from homes located directly beside the river on Old Stone Church Road. Gulls, cormorants (16) and over 80 geese observed at Otto C. Pehle Section of Saddle River Park. Pets, wildlife observed throughout the watershed and potential impact from Wild Duck Pond Park.

Ramsey Brook at Allendale (Site ID #01390900)

Wildlife (geese, deer, foxes, and dogs) observed at Crestwood Park. Geese and other wildlife observed at Apple Ridge golf course, Ramsey Country Club golf course, Lake Street at Ramsey, and Napolekao Pond. Potentially failing septics in Mahwah.

HoHoKus Brook at the mouth of the Saddle River, Paramus (Site ID #01391100)

Potential failing septic systems in HoHoKus and Wyckoff. Geese observed or apparent at Whites' Pond, Saddle River Park, Glen Rock Section (50 geese observed), Dunkerhook Park, and Wild Duck Pond. Dog walking observed at Saddle River Park, Glen Rock Section and Dunkerhook Park. Poultry farm observed and appears to be an enclosed operation

Saddle River at Fairlawn (Site ID #01391200)

Wildlife (150 geese, 75 seagulls, 25 doves) observed at Saddle River park, Wild Duck Pond area. No-feed signs posted (dog and waterfowl both), however, people observed still feeding waterfowl. At the Saddle River Park at Rochelle Park, no geese were observed but physical signs apparent and ducks appear to be fed. Geese observed at Bergen County Golf Courses and Ridgewood Country Club.

Saddle River at Lodi (Site ID #01391500)

Geese and pet walking observed at the Main St. Cemetery.

10.4.3. Watershed Management Area 5

Hackensack River at River Vale (Site ID #01377000)

Geese observed at Golf Course, Open Spaces, and County Park. Septic Systems in Old Tappan recently converted to sewers.

Musquapsink Brook at River Vale (Site ID #01377499)

Canada Geese observed at elementary school ballfields and nearby cemeteries. No septics are located in this area. Pumping from the Saddle River and discharging to the Musquapsink Brook represents a potential source of FC.

Pascack Brook at Westwood (Site ID #01377500)

No septics are located in this area. Potential sources included: Woodcliff Lake Reservoir, Corporate Parks in Montvale (source of geese droppings to Bear Brook which feeds into Pascack Brook), waste management transfer station, geese around the Woodcliff Lake, stormdrains discharge into Woodcliff Lake, and street sweeping materials from DPWs for Park Ridge, Hillsdale, and Westwood.

Tenakill Brook at Cedar Lane at Closter (Site ID #01378387)

Potential sources include: failing septics in Alpine, geese and waterfowl at Tenakill Middle School ballfields, Alpine Country Club, Tenafly Park, Demarest Nature Center, and Demarest Park/Duck Pond. The municipal park is located adjacent to Demarest Duck pond along Tenakill Brook and is subjected to geese and other waterfowl depositing droppings on turf areas within the park. Demarest Duck Pond is also the receiving body for stormwater outfalls that capture runoff from nearby roads, residential areas and commercial areas. Dredging of Demarest Duck Pond is slated for completion during 2003. Demarest Borough is committed to the shoreline restoration and nonpoint source improvement to the pond and park area and has sought additional funding to stabilize 1,600 linear feet of degraded shoreline around Demarest Duck Pond along Tenakill Brook with a 20 foot wide native vegetative buffer. The Environmental Commission has already implemented several small restoration projects along Tenakill Brook and is an active participant in the Department's Watershed process.

Coles Brook at Hackensack (Site ID #01378560)

No septics or agriculture are located in this watershed. Geese/Waterfowl, disposable diapers, and dog waste observed at Van Saun Park. Potential sources of pet waste include Oradell, River Edge, Paramus, and Emerson residential areas. Geese observed at the Emerson Golf Course, Paramus Middle School alongside Bkanky Brook (feeds into Coles Brook). Zoo observed, however, recently tied to sanitary sewer.

10.4.4. Watershed Management Area 6

Black Brook at Madison (Site ID #01378855)

The headwaters of this segment include the Fairmount Country Club where geese are a contributing factor. At Green Village Packing Company on Britten Road in Green Village, residents have reported that the company has, in recent years, dumped its animal wastes and scraps into local woods. Following complaints, the company has been shipping them out via truck. Recent complaints are that the trucks leak. Other potential sources include: Miele Kennel, Rolling Knolls Landfill, Britten Road, Chatham, and wildlife (deer and geese)

Passaic River Near Millington (Site ID #01379000)

This segment is directly adjacent to the Great Swamp Wildlife Refuge, thus wildlife are a potential source. Geese populations were observed at the following locations: AT&T Corporation grounds off Madisonville Road, Somerset County Environmental Education Center ponds, Southard Park, Basking Ridge Golf Course, northeast of the intersection of White Bridge Road and Carlton Road, at the Southwest corner of the intersection of White Bridge Road and Pleasant Plains Road, east of Pleasant Plains Road, north of White Bridge Road; east of the Passaic River, north of Stone House Road; and south of White Bridge Road, east of Pleasant Plains Road in Long Hill Township. The majority of this watershed contains urbanized landuse that has many detention basins, pets, and deer. Other potential sources include: Somerset County horse stables and horse trails through Lord Stirling Park and livestock populations at the southwest corner of the intersection of White Bridge Road and Carlton Road; east of the Passaic River, north of Stone House Road; and east of Pleasant Plains Road between White Bridge Road and Sherwood Lane.

Dead River Near Millington (Site ID #01379200)

Potential sources in this watershed include: Geese (New Jersey National Golf Course, Pleasant Valley road near King George Road where a large geese population of approximately 1000 was observed), pets, livestock and pastures present.

Passaic River Near Chatham (Site ID #01379500)

The following potential sources in this watershed include: geese (at Canoe Brook Country Club, Brook Lake Country Club and Cedar Ridge Country Club), wildlife, failing septics, pets, detention basins, and landfills (Bradley Loren Landfill, Florham Park Borough Waste Landfill, Vitto Marchetto Sanitary Landfill, Passaic Township Sanitary Landfill)

Canoe Brook Near Summit (Site ID #01379530)

Geese are suspected at Essex Fells Country Club, Crestmont Country Club, East Orange Golf Club and Summit Municipal Golf Course. Wildlife, especially deer, and pets are also thought to contribute a bacteria load.

Rockaway River at Longwood Valley (Site ID #01379680)

Wildlife and failing septics noted as potential sources.

Rockaway River at Blackwell Street (Site ID #01379853)

Potential sources include Hurd Park (goose population, no riparian buffer), and landfills.

Beaver Brook near Rockaway (Site ID #01380100)

This watershed contains several lake communites; many of which are on septic systems. Thus the potential for failing septics exist throughout the watershed. A portion of this watershed is designated as wildlife management area or reservoir protection area, thus, wildlife contribution is a potential. Geese observed at Rockaway Township recreational field located off of Old Beach Glen.

Stony Brook at Boonton (Site ID #01380320)

Canada geese observed at the picnic area of Pyramid Mountain Natural Historic Area, and at Rockaway Valley athletic fields off of Rockaway Valley Road, in Caterbury, and on Hill Road. Livestock operations are located off of Hill Road abutting a tributary to the impaired segment, near intersection of Kingsland and Rockaway Valley, and at intersection of Birchwood and Valley.

Rockaway River at Pine Brook (Site ID #01381200)

Potential sources include: Sharkey Landfill, Ecology Lake Club Sanitary Land Fill, Knoll East County Club Golf Course, wildlife, and geese.

Passaic River at Two Bridges (Site ID #01382000)

Wildlife and leaking septics noted as potential sources.

10.5. Pathogen Indicators and Bacterial Source Tracking

Advances in microbiology and molecular biology have produced several methodologies that discriminate among sources of fecal coliform and thus more accurately identify pathogen sources. The numbers of pathogenic microbes present in polluted waters are few and not readily isolated nor enumerated. Therefore, analyses related to the control of these pathogens must rely upon indicator microorganisms. The commonly used pathogen indicator organisms are the coliform groups of bacteria, which are characterized as gram-negative, rod-shaped bacteria. Coliform bacteria are suitable indicator organism because they

are generally not found in unpolluted water, are easily identified and quantified, and are generally more numerous and more resistant than pathogenic bacteria (Thomann and Mueller, 1987).

Tests for fecal organisms are conducted at an elevated temperature (44.5°C), where the growth of bacteria of non-fecal origin is suppressed. While correlation between indicator organisms and diseases can vary greatly, as seen in several studies performed by the EPA and others, two indicator organisms *Esherichia coli* (*E. coli*) and enterococci species showed stronger correlation with incidence of disease than fecal coliform (USEPA, 2001). Recent advances have allowed for more accurate identification of pathogen sources. A few of these methods, including, molecular, biochemical, and chemical are briefly described in the following paragraph.

Molecular (genotype) methods are based on the unique genetic makeup of different strains, or subspecies, of fecal bacteria (Bowman et al, 2000). An example of this method includes "DNA fingerprinting" (i.e., a ribotype analysis which involves analyzing genomic DNA from fecal *E. coli* to distinguish human and non-human specific strains of *E. coli*.). Biochemical (phenotype) methods include those based on the effect of an organism's genes actively producing a biochemical substance (Graves et al., 2002; Goya et al 1987). An example of this method is multiple antibiotic resistance (MAR) testing of fecal *E. coli.* In MAR testing, *E. coli* are isolated from fecal samples and exposed to 10-15 different antibiotics. In theory, *E. coli* originating from wild animals should show resistance to a smaller number of antibiotics than *E. coli* originating from humans or pets. Given this general trend, MAR patterns or '"signatures" can be defined for each class of *E. coli* species. Chemical methods are based on finding chemical compounds associated with human wastewater, and useful in determining if the sources are human or non-human. Such methods measure the presence of optical brighteners, which are contained in all laundry detergents, and soap surfactants in the water column. Unlike the optical brightener method, the measurement of surfactants may allow for some quantification of the source.

BST methods have already been successfully employed at the NJDEP in the past decade. Since 1988, the Department's Bureau of Marine Water Monitoring has worked cooperatively with the University of North Carolina in developing and determining the application of RNA coliphage as a pathogen indicator. This research was funded through USEPA and Hudson River Foundation grants. These studies showed that the RNA coliphages are useful as an indicator of fecal contamination, particularly in chlorinated effluents and that they can be serotyped to distinguish human and animal fecal contamination. Through these studies, the Department has developed an extensive database of the presence of coliphages in defined contaminated areas (point human, non-point human, point animal, and non-point animal). More recently, MAR and DNA fingerprinting analyses of *E. coli* are underway in the Manasquan estuary to identify potential pathogen sources (Palladino and Tiedemann, 2002). These studies along with additional sampling within the watershed will be used to implement the necessary percent load reduction.

10.6. Reasonable Assurance

With the implementation of follow-up monitoring, source identification and source reduction, the Department is reasonably assured that New Jersey's Surface Water Quality Standards will be attained for fecal coliform. Activities directed in the watersheds to reduce fecal coliform loading shall include options, included but not limited to education projects that teach best management practices, approval of projects funded by CWA Section 319 Nonpoint Source (NPS) Grants, recommendations for municipal ordinances regarding feeding of wildlife and pooper-scooper laws, and stormwater control measures.

The fecal coliform reductions proposed in these TMDLs assume that existing NJPDES permitted municipal facilities will continue to meet New Jersey's Surface Water Quality Standard requirements for disinfection. Any future facility will be required to meet water quality standards for disinfection.

11.0 Public Participation

The Water Quality Management Planning Rules NJAC 7:15-7.2 require the Department to initiate a public process prior to the development of each TMDL and to allow public input to the Department on policy issues affecting the development of the TMDL. Accordingly the Department shall propose each TMDL as an amendment to the appropriate areawide water quality management plan. As part of the public participation process for the development and implementation of the TMDLs for fecal coliform in the Northeast Water Region, the NJDEPs, Division of Watershed Management, Northeast Bureau worked collaboratively with a series of stakeholder groups throughout New Jersey as part of the Department's ongoing watershed management efforts.

The Department's watershed management process was designed to be a comprehensive stakeholder driven process that is representative of members from each major stakeholder group (agricultural, business and industry, academia, county and municipal officials, commerce and industry, purveyors and dischargers, and environmental groups). As stated previously, through the creation of this watershed management planning process over the past several years Public Advisory Committees (PACs) and Technical Advisory Committees (TACs) were created in all 20 WMAs. Whereas the PACs serve in an advisory capacity to the Department, and examined and commented on a myriad of issues in the watersheds, the TACs were focused on scientific, ecological, and engineering issues relevant to the mission of the PAC.

The Northeast Bureau discussed with the WMA 3, WMA 4, WMA 5 and WMA 6 TAC members the Department's TMDL process through a series of presentations and discussions that culminated in the development of the 32 TMDLs for Streams Impaired by Fecal Coliform in the Northeast Water Region. The below paragraphs outline public involvement.

- Integrated Listing Methodology presentations were made by the Northeast Bureau within the DWM to the Northeast TACs throughout the month June; requesting that they review the Integrated List and submit comments to the Department by the September deadline. Presentations were made to WMA 5 TAC on June 18, 2002; WMA 6 TAC on June 20, 2002; WMA 3 TAC on June 21, 2002; and WMA 4 TAC on June 27, 2002.
- Expedited Fecal Coliform and Lake TMDL presentations were given at the September TAC meetings. The finalized Sublist 5 list was also disseminated. The TACs were briefed about the executed Memorandum of Agreement between the Department and EPA Region 2 with the imminent timeline. The TACs were asked to review sites and think about sources for discussion at the October TAC meetings at which time the Northeast Bureau would bring maps with municipalities and impaired stream segments and other features to facilitate the conversation.
- At the October TAC meetings (WMA 5: October 15, 2002; WMA 3 October 19, 2002; WMA 4 October 24, 2002 and WMA 6 October 28, 2002) TAC members were asked to identify based on their local knowledge potential sources of impairment. Draft copies of the Northeast Fecal TMDL report were distributed for informational purposes only. TAC members were advised that the formal comment period would be during the New Jersey Register Notice, but that the Department was interested in their input on policy issues affecting the development of the TMDL.
- At the November and December TAC meetings, the draft Fecal TMDL Report was distributed for informal comments prior to the NJR Notice.

Additional public participation and input was received through the NJ EcoComplex. The Department contracted with Rutgers NJ EcoComplex (NJEC) in July 2001. The role of NJEC is to provide comments on the Department's management strategies, including those related to the development of TMDL values. NJEC consists of a review panel of New Jersey University professors who provide a review of the technical approaches developed by the Department. The New Jersey Statewide Protocol for Developing Fecal TMDLs was presented to NJEC on August 7, 2002 and was subsequently reviewed and approved. The statewide approach was also presented the Passaic TMDL Workgroup in May 2002 for their input and approval. The New Jersey's Statewide Protocol for Developing Lake and Fecal TMDLs was presented by the Northeast Bureau at the SETAC Fall Workshop on September 13, 2002 and met with their approval.

11.1. AmeriCorps Participation

AmeriCorps is a national service initiative that was started in 1993 and is the domestic Peace Corps. The New Jersey Watershed Ambassadors Program is a community-oriented AmeriCorps environmental program designed to raise awareness about watershed issues in New Jersey. Through this program, AmeriCorps members are placed in watershed management areas across the state to serve their local communities. Watershed Ambassadors monitor the rivers of New Jersey through River Assessment Teams (RATs) and Biological Assessment Teams (BATs) volunteer monitoring programs.

Representatives from the Department in conjunction with the Watershed Ambassadors conducted RATs surveys on each of the impaired segments. These visual assessments were conducted from October to December 2002.

11.2. Public Participation Process

In accordance with N.J.A.C. 7:15–7.2(g), these TMDLs are hereby proposed by the Department as an amendment to the Northeast Water Quality Management Plan. N.J.A.C. 7:15-3.4(g)5 states that when the Department proposes to amend the areawide plan on its own initiative, the Department shall give public notice by publication in a newspaper of general circulation in the planning area, shall send copies of the public notice to the applicable designated planning agency, if any, and may hold a public hearing or request written statements of consent as if the Department were an applicant. The public notice shall also be published in the New Jersey Register.

Notice of these TMDLs was published January 21, 2003 pursuant to the above noted Administrative Code, in order to provide the public an opportunity to review the TMDLs and submit comments. The Department has determined that due to the level of interest in these TMDLs, a public hearing will be held. Public notice of the hearing, provided at least 30 days before the hearing, was published in the New Jersey Register and in two newspapers of general circulation and will be mailed to the applicable designated planning agency, if any, and to each party, if any, who was requested to issue written statement of consents for the amendment.

All comments received during the public notice period and at any public hearings will become part of the record for these TMDLs. All comments will be considered in the establishment of these TMDLs and the ultimate adoption of these TMDLs. When the Department takes final agency action to establish these TMDLs, the final decision and supporting documentation will be sent to U.S.E.P.A. Region 2 for review and approval pursuant to 303(d) of the Clean Water Act (33 U.S.C. 1313(d)) and 40 CFR 130.7.

References

Bowman, A.M., C. Hagedorn, and K. Hix. 2000. Determining sources of fecal pollution in the Blackwater River watershed. p. 44-54. *In* T. Younos and J. Poff (ed.), Abstracts, Virginia Water Research Symposium 2000, VWRRC Special Report SR-19-2000, Blacksburg.

Cabelli, V. 1989. Swimming-associated illness and recreational water quality criteria. Wat. Sci. Tech. 21:17.

Alexandria K. Graves, Charles Hagedorn, Alison Teetor, Michelle Mahal, Amy M. Booth, and Raymond B. Reneau, Jr. Antibiotic Resistance Profiles to Determine Sources of Fecal Contamination in a Rural Virginia Watershed. Journal of Environmental Quality. 2002 31: 1300-1308.

National Research Council. 2001. Assessing the TMDL Approach to water quality management. National Academy Press, Washington, D.C.

New Jersey Department of Environmental Protection. 1998. Identification and Setting of Priorities for Section 303(d) Water Quality Limited Waters in New Jersey, Office of Environmental Planning

New Mexico Environmental Department. 2002. TMDL for Fecal Coliform on three Cimarron River Tributaries in New Mexico.
Online at: http://www.nmenv.state.nm.us/swqb/CimarronTMDL.html

Palladino, M. A., and Tiedemann, J. (2001) Differential Identification of *E. coli* in the Manasquan River Estuary by Multiple Antibiotic Resistance Testing and DNA Fingerprinting Analysis. Monmouth University, NJ

Goyal, S.M. 1987. Methods in Phage Ecology. pp. 267-287. In: Phage Ecology, S.M. Goyal, C.P. Gerba and G. Bitton (Eds.) John Wiley and Sons, New York.

Saunders, William and Maidment, David. 1996. A GIS Assessment of Nonpoint Source Pollution in the San Antonio- Nueces Coastal Basin. Center for Research in Water Resources. Online Report 96-1:

Stiles, Thomas C. (2001). A Simple Method to Define Bacteria TMDLs in Kansas. Presented at the WEF/ASIWPCA TMDL Science Issues Conference, March 7, 2001.

Thomann, R.V. and J.A. Mueller. 1987. Principles of Surface Water Quality Modeling and Control, Harper & Row, Publishers, New York.

USEPA. 1986. Implementation Guidance for Ambient Water Quality Criteria for Bacteria. EPA-823-D-00-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-92-002. Washington, DC.

USEPA. 1997. Compendium of tools for watershed assessment and TMDL development. EPA841-B-97-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 2001. Protocol for Developing Pathogen TMDLs. EPA841-R-00-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

U.S. Geological Survey. 1982. Low - Flow Characteristics and Flow Duration of New Jersey Streams. Open-File Report 81-1110.

Appendix A: Explanation of stream segments in Sublist 5 of the *2002 Integrated List of Waterbodies* for which TMDLs will not be developed in this report.

Data to support removing River Segments from List 5 to List 1 for Fecal Coliform.

- Pequannock River at Macopin Intake Dam, Station #01382500

Re-assessments of data from station #01382500, the Pequannock River at Macopin Intake Dam, indicate that the water quality standards are met at this location. Measurements taken between 2/22/1994 and 7/17/00 at Station #01382500, show a geometric mean of 34 CFU/100 ml, and that 7.8% of values are over 400 CFU/100ml.

River segments to be moved from Sublist 5 to Sublist 3 for fecal coliform.

- Wanaque River at Wanaque, #01387000;
- Hackensack River at New Milford, #01378500

Two segments listed on Sublist 5, station #01387000, the Wanaque River at Wanaque (WMA 3), and station #01378500 the Hackensack River at New Milford (WMA 5), were included on Sublist 5 based on their listings on previous 303(d) lists with no recent data to assess their current attainment status. Therefore, TMDLs will not be developed for these locations until and unless recent data indicated violations of the surface water quality standards.

River segments to be moved from Sublist 5 to Sublist 4 for fecal coliform.

- Whippany River at Morristown, #01381500;
- Whippany River near Pine Brook, #01381800

Two segments, #01381500, the Whippany River at Morristown, and #01381800, the Whippany River near Pine Brook, were included as part of the Whippany River Watershed Fecal Coliform TMDL adopted on 4/16/2000 and published in the New Jersey Register on 6/5/2000. Upon adoption of this TMDL Report, the Department will remove these two waterbodies for fecal coliform from Sublist 5 to move them to Sublist 4 as identified in the below table.

Sublist 5 river segments listed for fecal coliform for which TMDLs will not be developed in this report.

- Passaic River at Elmwood Park, #01389880

The Passaic River at Elmwood Park, segment #01389880, is located in an area affected by combined sewer overflows (CSOs). CSOs are sewage systems that use a single pipe to transport both stormwater runoff from rainstorms and sewage from households, businesses

and industries to sewage treatment plants. During dry weather, combined sewers send all wastewater to the STPs. During wet weather, stormwater quickly fills the combined sewers, which carry both sanitary sewage and runoff from streets, parking lots, and rooftops. The overflows carry bacteria from the untreated sewage as well as other pollutants in the stormwater. Additional potential FC sources were identified during a site visit on October 24, 2002 and include geese (at park on River Road across from High School), homeless populations, and dog pounds/shelters.

The methodology employed in this report is not appropriate for use in areas affected CSOs, thus, this stream segment will be addressed with a separate management approach.

List of Sublist 5 segments to be moved to Categories 1, 3 or 4 based upon reassessment of data, the need for current data, or the prior completion of a TMDL report.

WMA	Station Name/Waterbody	Site ID	New Sublist Listing	Explanation
03	Pequannock River at Macopin Intake Dam	01382500	Sublist 1	Re-assessment shows non-impairment
03	Wanaque River at Wanaque	01387000	Sublist 3	Updated monitoring needed
04	Passaic River at Elmwood Park	01389880	No change	CSO influence
05	Hackensack River at New Milford	01378500	Sublist 3	Updated monitoring needed
06	Whippany River at Morristown	01381500	Sublist 4	TMDL completed in 1999
06	Whippany River near Pine Brook	01381800	Sublist 4	TMDL completed in 1999

Appendix B: Municipal POTWs Located in the TMDLs' Project Areas

WMA	Station #	NJPDES	Facility Name	Discharge Type	Receiving waterbody
3	1387500	NJ0027774.001A	Oakland Boro - Oakwood Knolls	MMI	Ramapo River via storm sewer
3	1387500	NJ0080811.001A	Oakland Twp - Riverbend	MMI	Ramapo River
3	1387500	NJ0021253.001A	Ramapo BOE - Indian High	MMI	Pond Creek (Ramapo River)
3	1387500	NJ0053112.001A	Oakland Boro - Chapel Hill Estates	MMI	Ramapo River via pond and storm sewer
3	1387500	NJ0021342.001A	Oakland Boro Skyview-Highbrook STP	MMI	Caille Lk via unnamed tributary & storm sewer
3	1387500	NJ0021946.001A	US Army - Nike Base	MMI	Darlington Brook via unnamed tributary
3	1387500	NJ0030384.001A	Oakland BOE - Manito Ave	MMI	Caille Lake via unnamed tributary and storm sewer
3	1387500	NJ0030384.001V	Oakland BOE - Manito Ave	MMI	Caille Lake via unnamed tributary and storm sewer
4	1389600	NJ0025330.001A	Cedar Grove Twp STP	MMJ	Peckman River
4	1389600	NJ0024490.004A	Verona Twp	MMJ	Peckman River
4	1389600	NJ0021687.001A	Essex County Hospital	MMJ	Peckman River
4	1389080	NJ0028002.001A	Wayne Twp - Mountain View	MMJ	Singac Brook (Preakness)
4	1389080	NJ0021261.001A	NJDHS-NJ Development Center	MMI	Passaic River
6	1379200	NJ0022845.001A	Harrison Brook STP	MMJ	Dead River
6	1379500	NJ0020427.001A	Caldwell Boro STP	MMJ	Passaic River via unnamed tributary
6	1379500	NJ0024511.001A	Livingston Twp	MMJ	Passaic River
6	1379500	NJ0025518.001A	Florham Park SA	MMJ	Passaic River
6	1379500	NJ0024937.001A	Molitor Water Pollution	MMJ	Passaic River
6	1379500	NJ0021636.001A	New Providence Boro	MMJ	Passaic River
6	1379500	NJ0024937.002A	Molitor Water Pollution	MMJ	Passaic River
6	1379500	NJ0027961.001A	Berkeley Heights	MMJ	Passaic River
6	1379500	NJ0020427.SL3A	Caldwell Boro STP	MMJ	Sludge Application
6	1379500	NJ0020427.SL3B	Caldwell Boro STP	MMJ	Sludge Application
6	1379500	NJ0020427.SL3M	Caldwell Boro STP	MMJ	Sludge Application
6	1381200	NJ0022349.001A	Rockaway Valley SA	MMJ	Rockaway River
6	1381200	NJ0024970.001A	Parsippany-Troy Hills SA	MMJ	Whippany River
6	1378855	NJ0020290.001A	Chatham Township - Main	MMI	Black Brook
6	1379200	NJ0021083.001A	Veterans Adm Medical Center	MMI	Harrisons Brook via unnamed tributary
6	1379200	NJ0022497.001A	Warren Twp SA - Stage 4	MMI	Dead River
6	1379200	NJ0050369.001A	Warren Twp SA - Stage 5	MMI	Dead River
6	1379500	NJ0020281.001A	Chatham Hill STP	MMI	Passaic River
6	1379500	NJ0052256.001A	Chatham Township - Chatham Glen	MMI	Passaic River

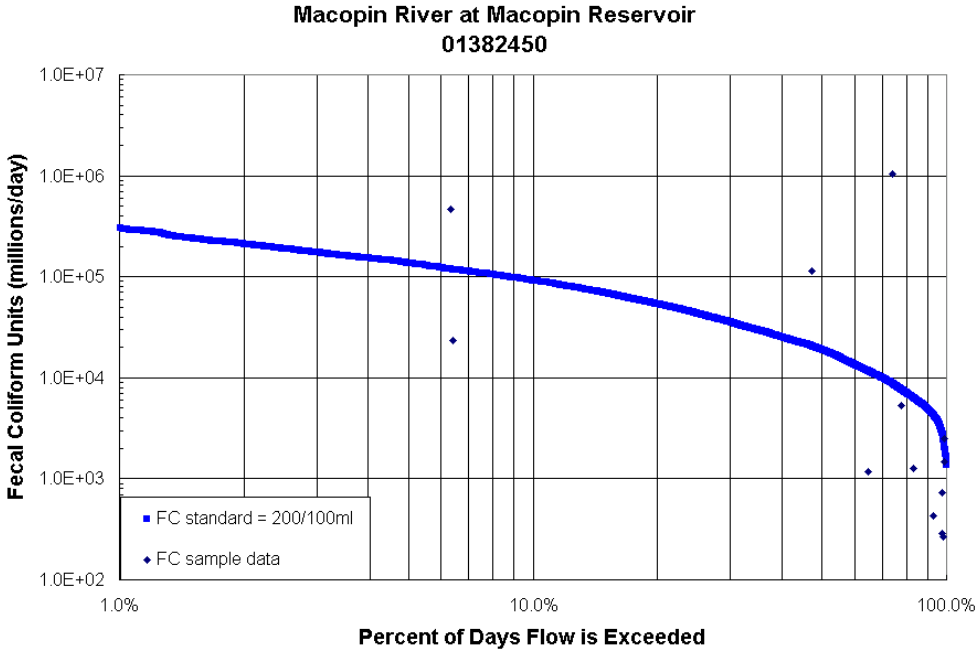
6	1379500	NJ0022489.001A	Warren Twp SA - Stage 1 & 2	MMI	Passaic River
6	1379500	NJ0024465.001A	Long Hill Twp STP - Stirling Hills	MMI	Passaic River
6	1379500	NJ0021938.001A	US Army - Nike Base	MMI	Passaic River
6	1380320	NJ0022276.001A	Stonybrook School	MMI	Untermeyer Lake via storm sewer
6	1379680	NJ0021091.001A	Jefferson Twp High - Middle School	MMI	Edison Brook
6	1379680	NJ0026867.001A	Jefferson Twp - White Rock	MMI	Mitt Pond (Russia Brook)
6	1379853	NJ0026603.001A	Randolph Twp BOE - High School	MMI	Mill Brook via unnamed tributary
6	1379853	NJ0032808.001A	Rockaway Townsquare Mall	MMI	Green Pond Brook

Appendix C: TMDL Calculations

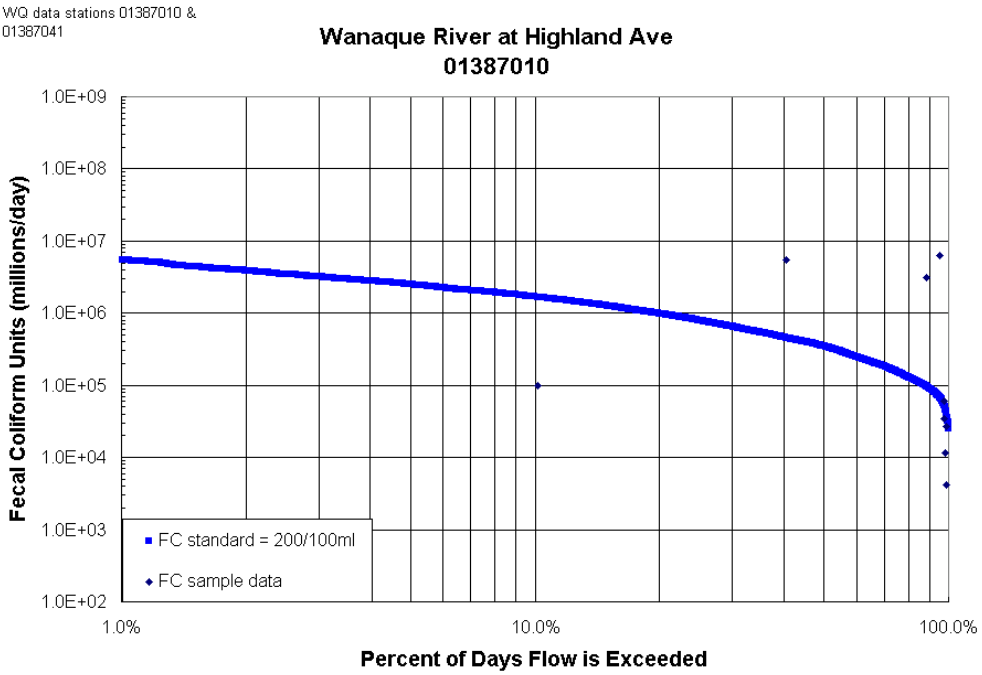
WMA	Station Names	303(d) Category 5 Segments	Water Quality Stations	Load Allocation (LA) and Margin of Safety (MOS)								Wasteload Allocation (WLA)
				200 FC/100ml Standard				400 FC/100ml Standard				
				Geometric mean CFU/100ml	MOS as a percent of the target concentration	Percent reduction without MOS	Percent reduction with MOS	Summer geometric mean CFU/100ml	MOS as a percent of the target concentration	Percent reduction without MOS	Percent reduction with MOS	
3	Macopin R at Echo Lake, Macopin R at Macopin Reservoir	01382450	01382410, 01382450	59	46%	-240%	-85%	59	46%	-16%	37%	37%
3	Wanaque R at Highland Avenue, Wanaque R at Pompton Lakes	01387010	01387010, 01387041	160	53%	-25%	42%	208	53%	67%	85%	85%
3	Ramapo R near Mahwah	01387500	01387500	291	44%	31%	61%	431	44%	84%	91%	91%
4	West Branch Saddle R at Upper Saddle River, Saddle R at Saddle River, Saddle R at Ridgewood Ave, Saddle R at Grove St., Ramsey Bk at Allendale, Hohokus Bk at Paramus, Saddle R at Rochelle Park, and Saddle R at Lodi	01390445, 01390500, 01390900, 01391100, 01391200, 01391500	01390445, 01390470, 01390510, 01390518, 01390900, 01391100, 01391490, 01391500	1,157	30%	83%	88%	1,144	30%	94%	96%	96%
4	Passaic R below Pompton R at Two Bridges, Passaic R at Little Falls, Preakness Bk, near Little Falls, Peckman R at W. Patterson, and Deepavaal Bk at Fairfield	01389005, 01389500, 01389080, 01389600, 01389138	01389500, 01389080, 01389600, 01389138	583	30%	66%	76%	652	30%	90%	93%	93%
4	Goffle Bk at Hawthorne, Diamond Bk at Fair Lawn	01389850, 01389860	01389850, 01389860	1,515	47%	87%	93%	1,544	47%	96%	98%	98%

WMA	Station Names	303(d) Category 5 Segments	Water Quality Stations	Load Allocation (LA) and Margin of Safety (MOS)								Wasteload Allocation (WLA)
				200 FC/100ml Standard				400 FC/100ml Standard				
				Geometric mean CFU/100ml	MOS as a percent of the target concentration	Percent reduction without MOS	Percent reduction with MOS	Summer geometric mean CFU/100ml	MOS as a percent of the target concentration	Percent reduction without MOS	Percent reduction with MOS	
5	Hackensack R. at Rivervale	01377000	01377000, 01376970	248	34%	19%	46%	294	34%	77%	85%	85%
5	Pascack Br at Westwood and Musquapsink Br at Rivervale	01377499, 01377500	01377499, 01377500	709	54%	72%	87%	709	54%	90%	96%	96%
5	Tenakill Br at Cedar Lane at Closter	01378387	01378387	159	91%	-26%	88%	159	91%	57%	96%	96%
5	Coles Br at Hackensack	01378560	01378560	1,093	68%	82%	94%	1,093	68%	94%	98%	98%
6	Black Brook at Madison, Passaic R nr Millington, Dead R nr Millington, Canoe Brook nr Summit, Passaic R nr Catham	01378855, 01379000, 01379200, 01379530, 01379500	01378855, 01379000, 01379200, 01379530, 01379500	675	29%	70%	79%	1,370	29%	95%	96%	96%
6	Rockaway R at Longwood Valley, Rockaway R at Berkshire Valley, Rockaway R at Blackwell St.	01379680, 01379853	01379680, 01379700, 01379853	253	54%	21%	64%	373	54%	82%	92%	92%
6	Beaver Brook at Rockaway	01380100	01380100	362	43%	45%	68%	362	43%	81%	89%	89%
6	Stony Brook at Boonton	01380320	01380320	214	32%	7%	37%	214	32%	68%	78%	78%
6	Rockaway R at Pine Brook	01381200	01381200	281	28%	29%	49%	571	28%	88%	91%	91%
6	Passaic R at Two Bridges	01382000	01382000	227	33%	12%	41%	276	33%	75%	83%	83%

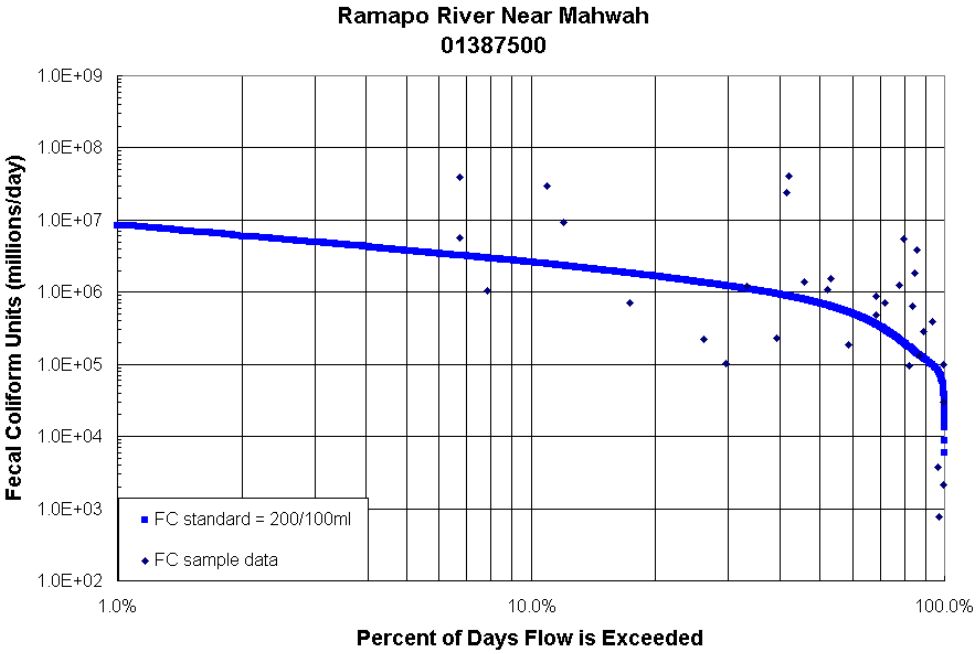
Appendix D: Load Duration Curves for each listed waterbody



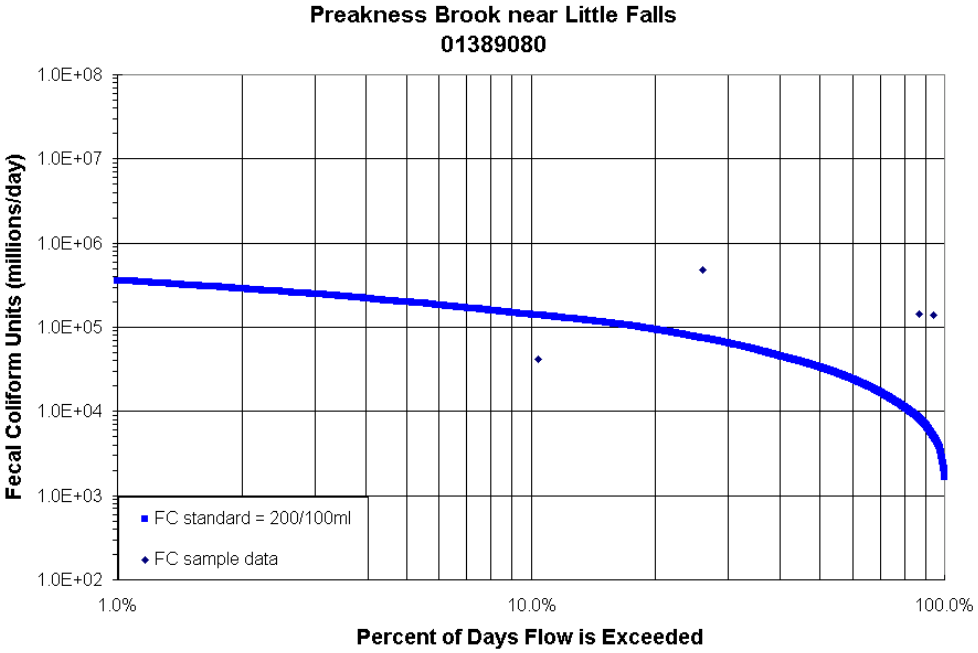
Load Duration Curve for Macopin River at Macopin Reservoir. Fecal coliform data from USGS station # 01382450 during the period 10/1997 through 8/2000. Water years 1970-2000 from USGS station # 01388500 (Pompton River at Pompton Plains NJ) were used in generating the FC standard curve.



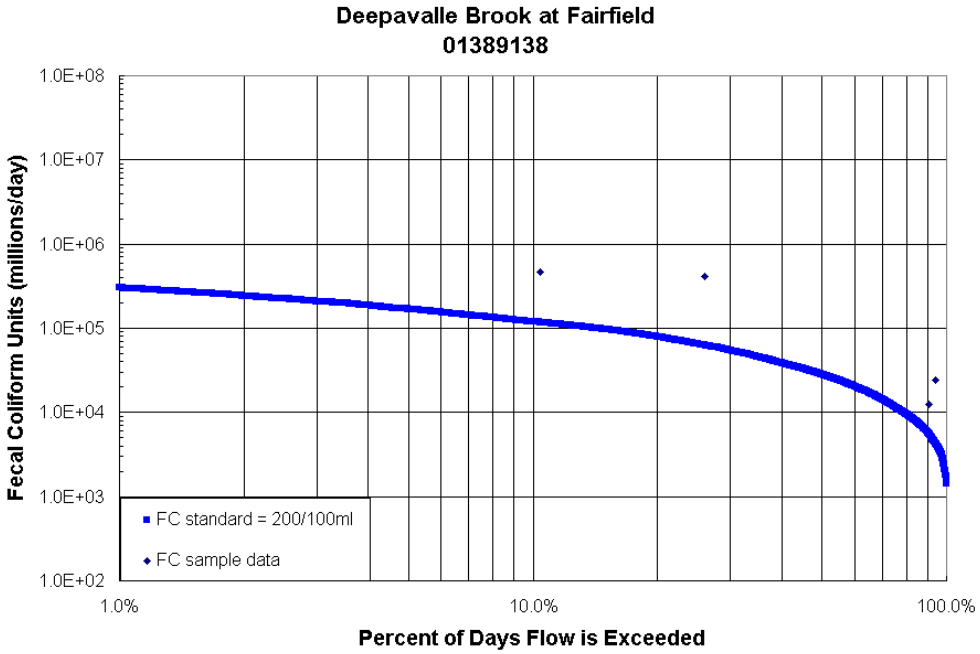
Load Duration Curve for Wanaque River at Highland Ave. Fecal coliform data from USGS station # 01387010 & 01387041 during the period 1/27/97 through 8/9/99. Water years 1970-2000 from USGS station # 01388500 (Pompton River at Pompton Plains NJ) were used in generating the FC standard curve.



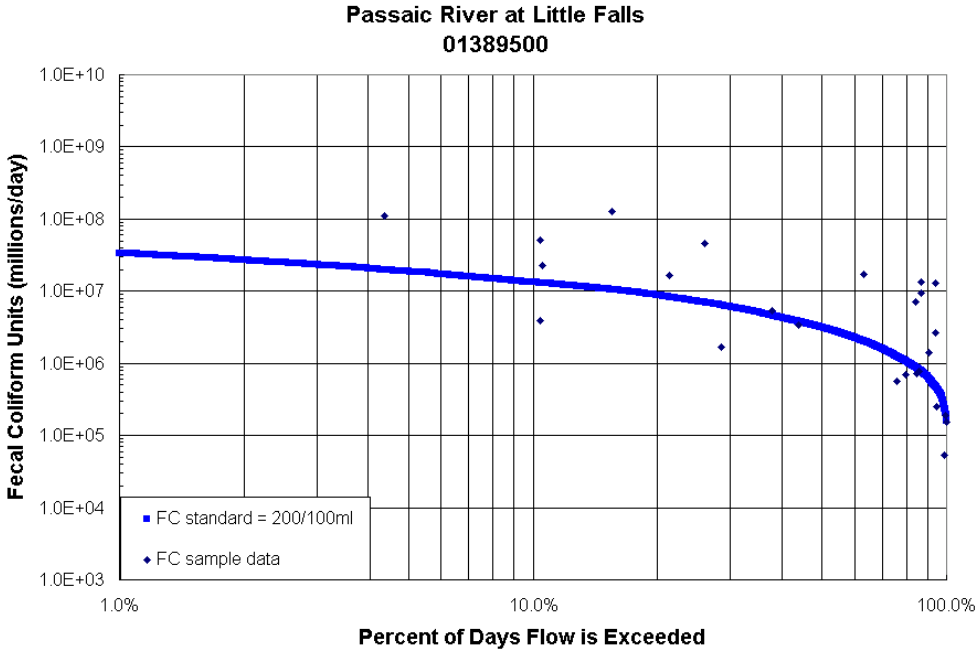
Load Duration Curve for Ramapo River Near Mahwah. Fecal coliform data from USGS station # 01387500 during the period 2/24/94 8/3/00. Water years 1970-2000 from USGS station # 01387500 (Ramapo River Near Mahwah) were used in generating the FC standard curve.



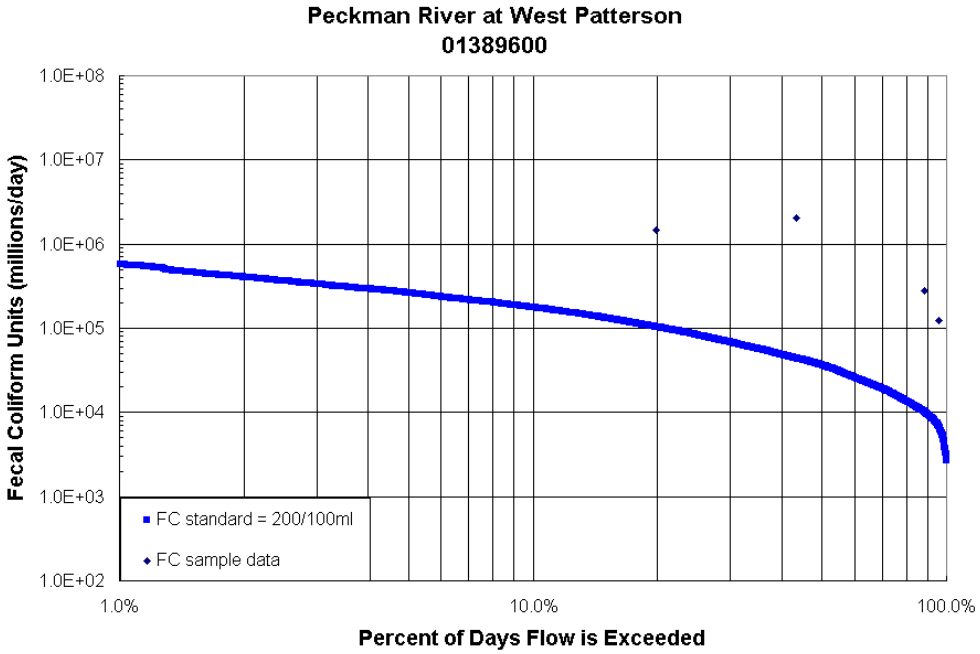
Load Duration Curve for Preakness Brook Near Little Falls. Fecal coliform data from USGS station # 01389080 during the period 4/16/98 through 9/23/98. Water years 1970-2000 from USGS station # 01389500 (Passaic River at Little Falls) were used in generating the FC standard curve.



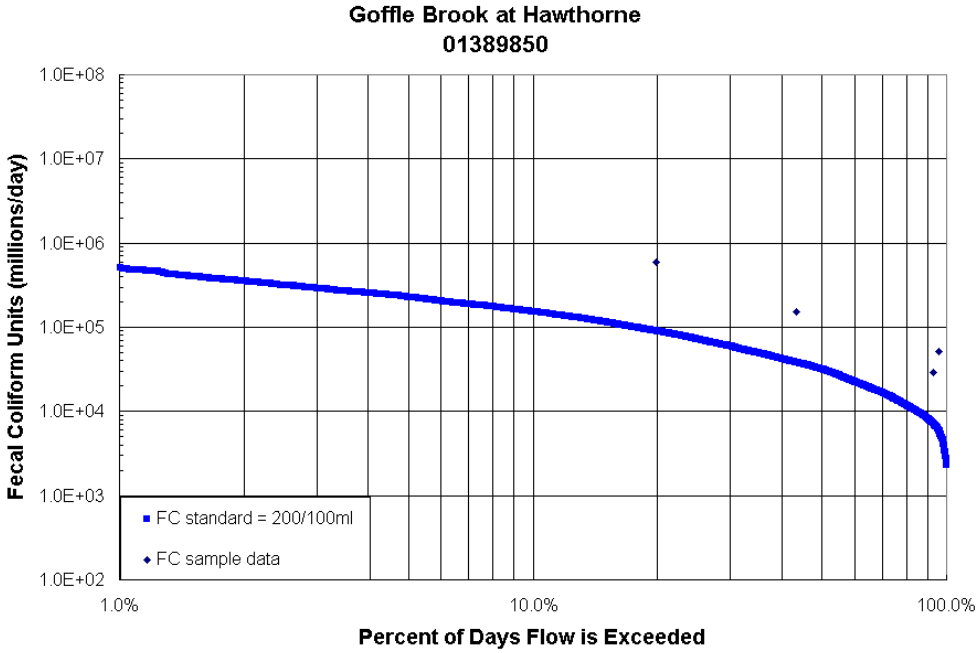
Load Duration Curve for Deepavalle Brook at Fairfield. Fecal coliform data from USGS station # 01389138 during the period 4/16/98 through 9/23/98. Water years 1970-2000 from USGS station # 01389500 (Passaic River at Little Falls) were used in generating the FC standard curve.



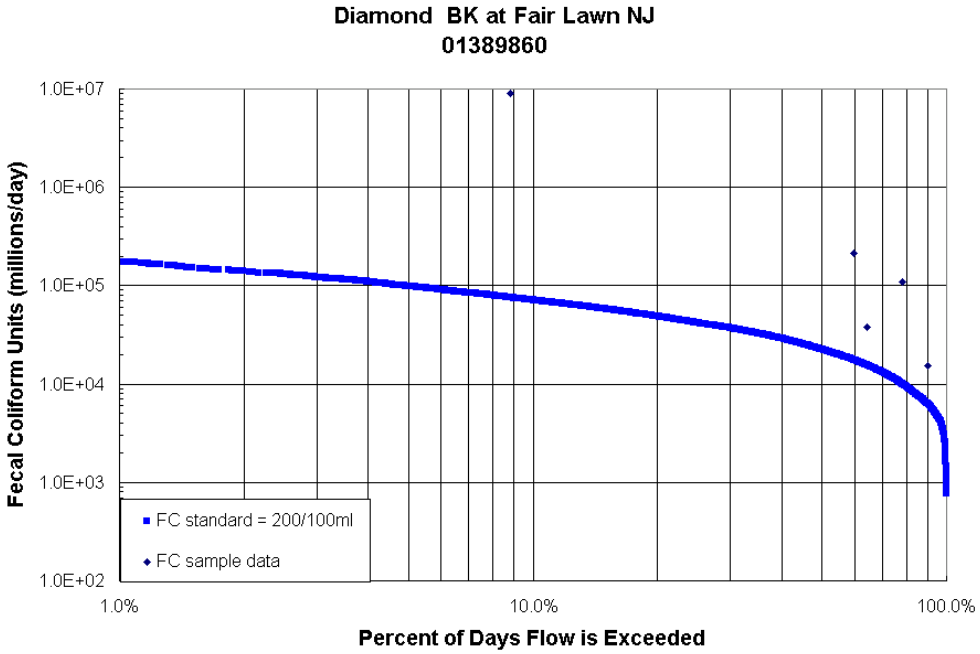
Load Duration Curve for the Passaic River at Little Falls. Fecal coliform data from USGS station # 01389500 during the period 2/18/94 through 9/23/98. Water years 1970-2000 from USGS station # 01389500 (Passaic River at Little Falls) were used in generating the FC standard curve.



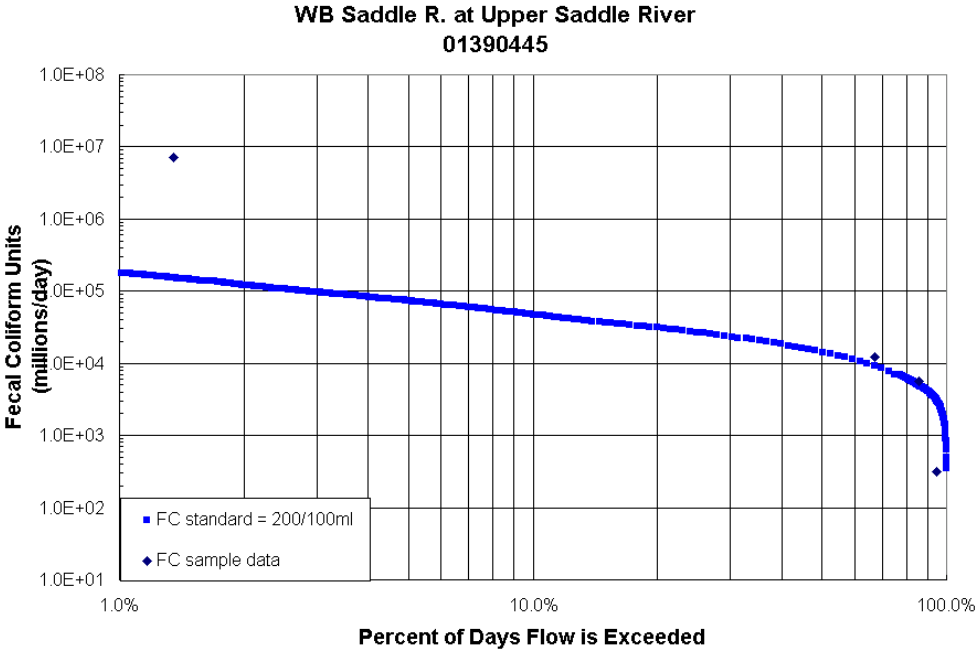
Load Duration Curve for Peckman River at West Patterson. Fecal coliform data from USGS station #01389600 during the period 4/23/98 through 9/24/98. Water years 1970-2000 from USGS station # 01388500 (Pompton River at Pompton Plains NJ) were used in generating the FC standard curve.



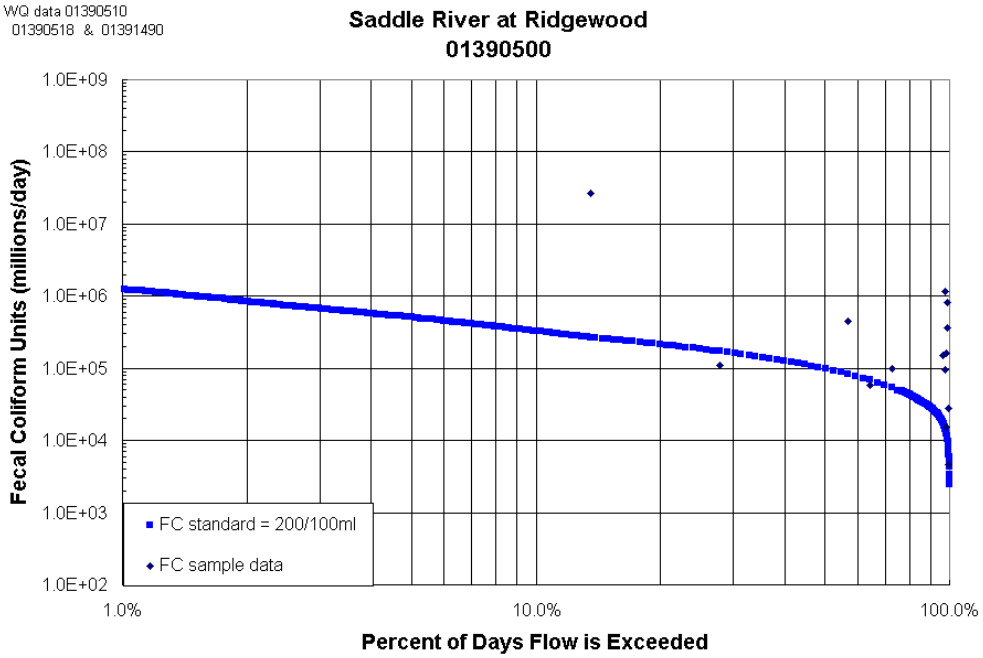
Load Duration Curve for Goffle Brook at Hawthorne. Fecal coliform data from USGS station # 01389850 during the period 4/23/98 through 9/24/98. Water years 1970-2000 from USGS station # 01388500 (Pompton River at Pompton Plains NJ) were used in generating the FC standard curve.



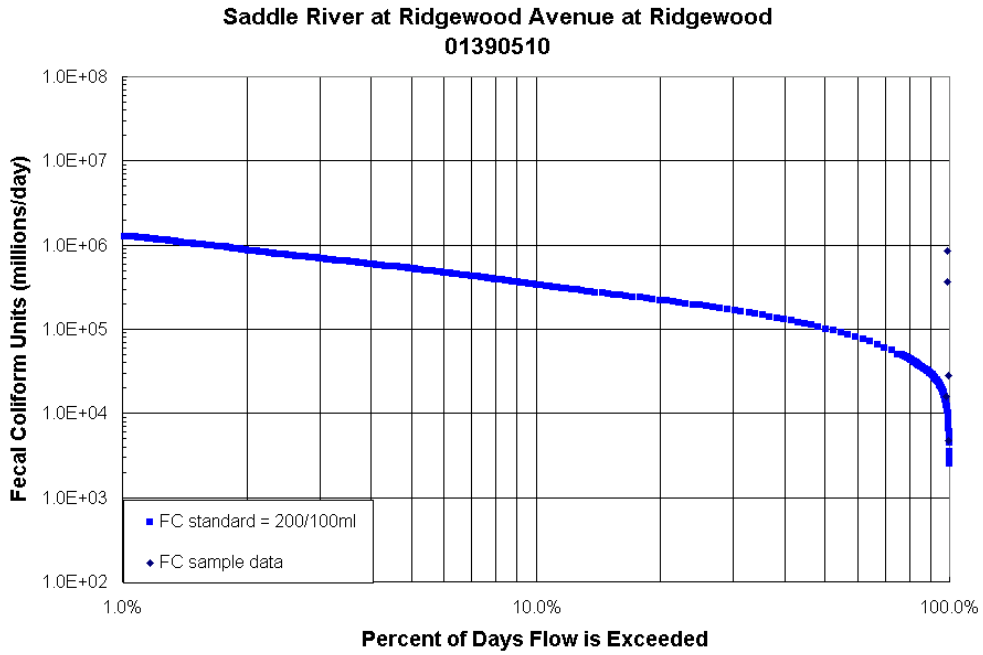
Load Duration Curve for Diamond Bk at Fair Lawn. Fecal coliform data from USGS station # 01389860 during the period 6/29/00-7/27/00. Water years 1970-2000 from USGS station # 01388500 (Pompton River at Pompton Plains NJ) were used in generating the FC standard curve



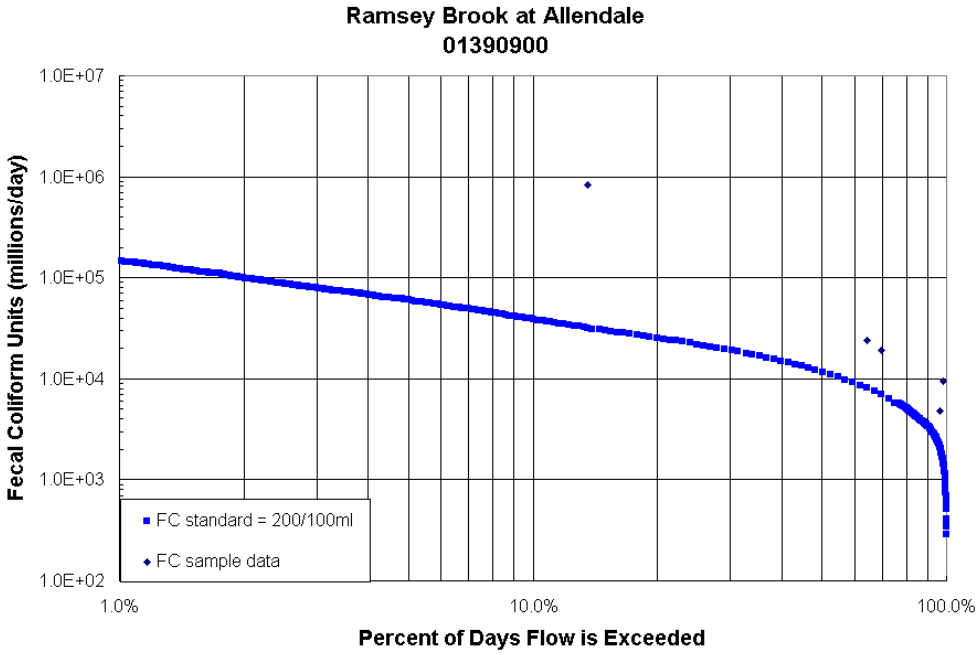
Load Duration Curve for WB Saddle R at Upper Saddle River. Fecal coliform data from USGS station # 01390445 during the period 11/4/99 through 8/7/00. Water years 1970-2001 from USGS station # 01390500 (Saddle River at Ridgewood) were used in generating the FC standard curve.



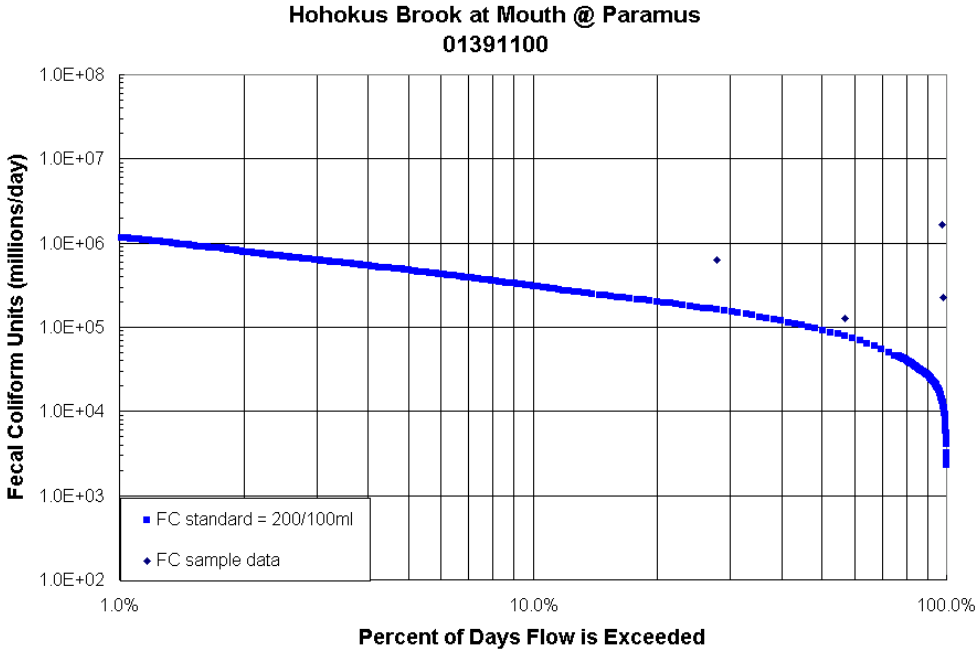
Load Duration Curve for Saddle R at Ridgwood. Fecal coliform data from USGS station # 01390510,01390518, & 01391490.during the period 11/6/97-8/9/99. Water years 1970-2001 from USGS station # 01390500 (Saddle River at Ridgewood) were used in generating the FC standard curve.



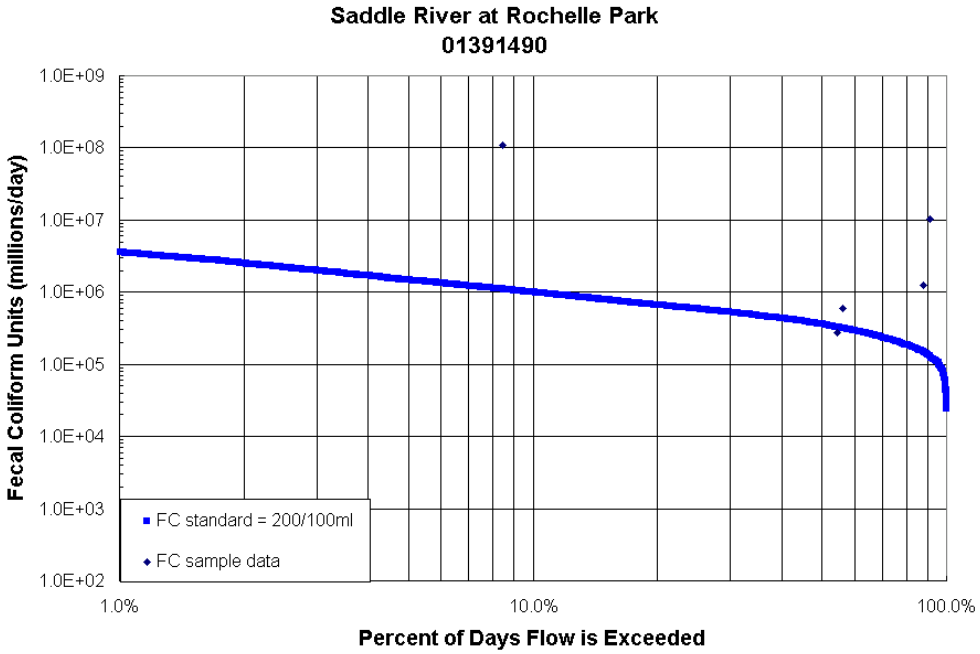
Load Duration Curve for Saddle River at Ridgewood Avenue at Ridgewood. Fecal coliform data from USGS station # 01390510 during the period 7/13/99 through 8/9/99. Water years 1970-2001 from USGS station # 01390500 (Saddle River at Ridgewood) were used in generating the FC standard curve.



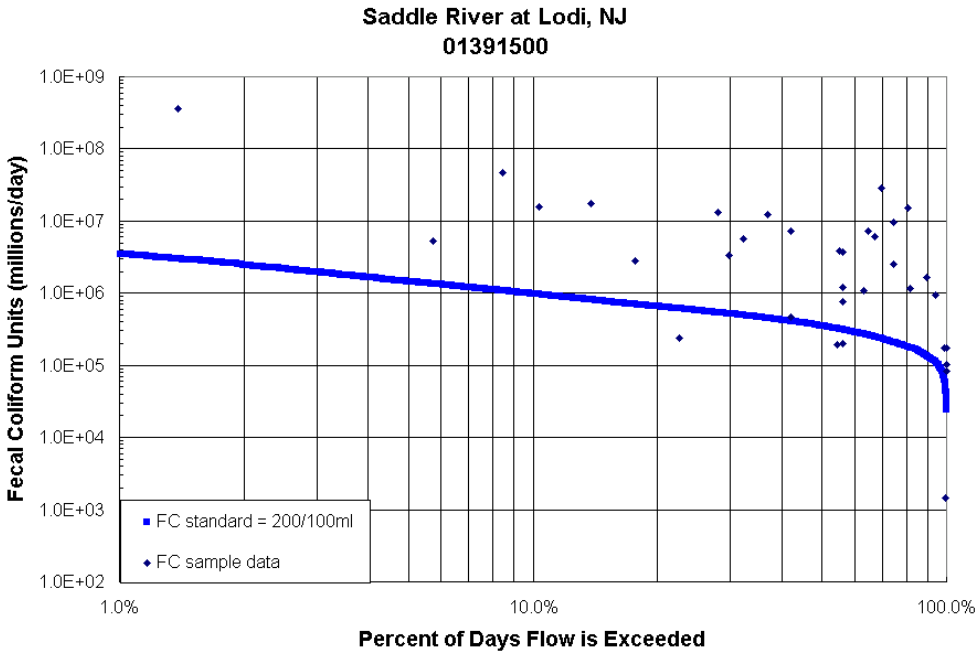
Load Duration Curve for Ramsey Brook at Allendale. Fecal coliform data from USGS station # 01390900 during the period 11/6/97 through 9/1/98. Water years 1970-2000 from USGS station # 01390500 (Saddle River at Ridgewood) were used in generating the FC standard curve.



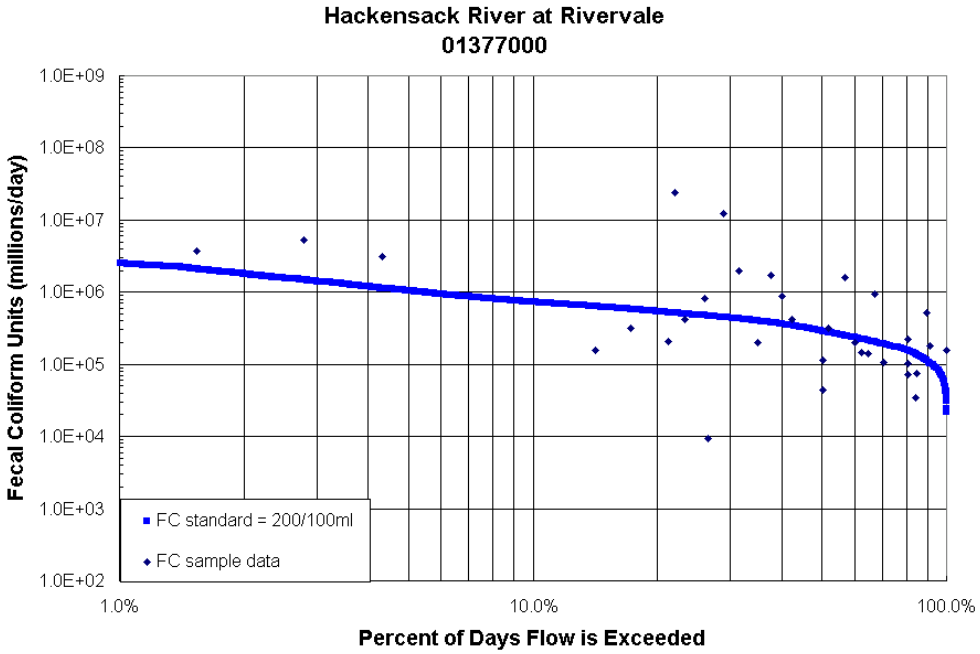
Load Duration Curve for Hohokus Brook at Mouth@ Paramus. Fecal coliform data from USGS station # 01391100 during the period 4/23/98 through 9/24/98. Water years 1970-2000 from USGS station # 01390500 (Saddle River at Ridgewood) were used in generating the FC standard curve.



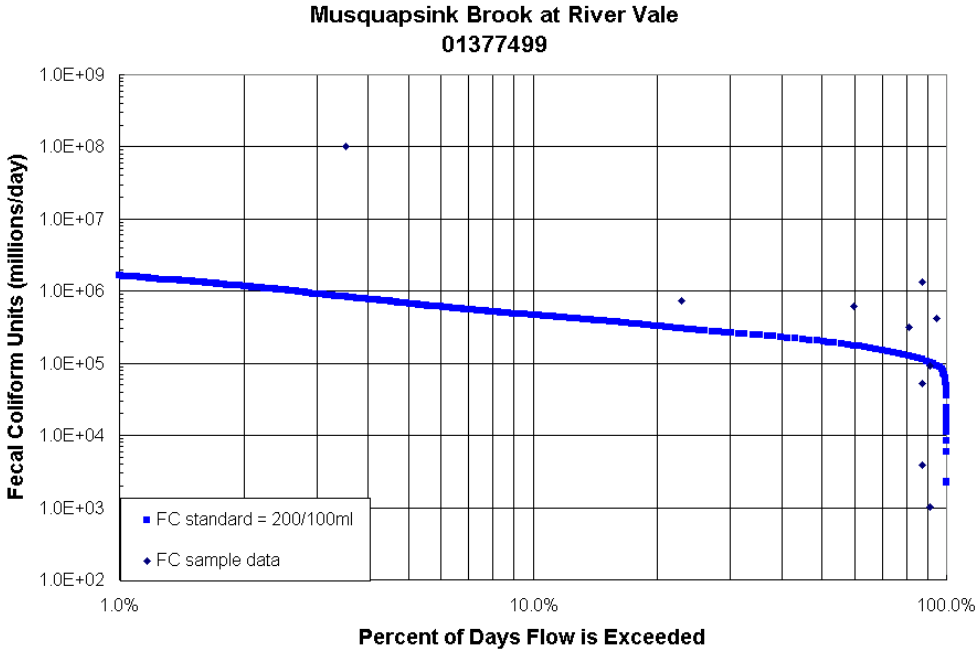
Load Duration Curve for Saddle River at Rochelle Park. Fecal coliform data from USGS station # 01391490 during the period 11/6/97 through 9/16/98. Water years 1970-2001 from USGS station # 01391500 (Saddle River at Lodi) were used in generating the FC standard curve.



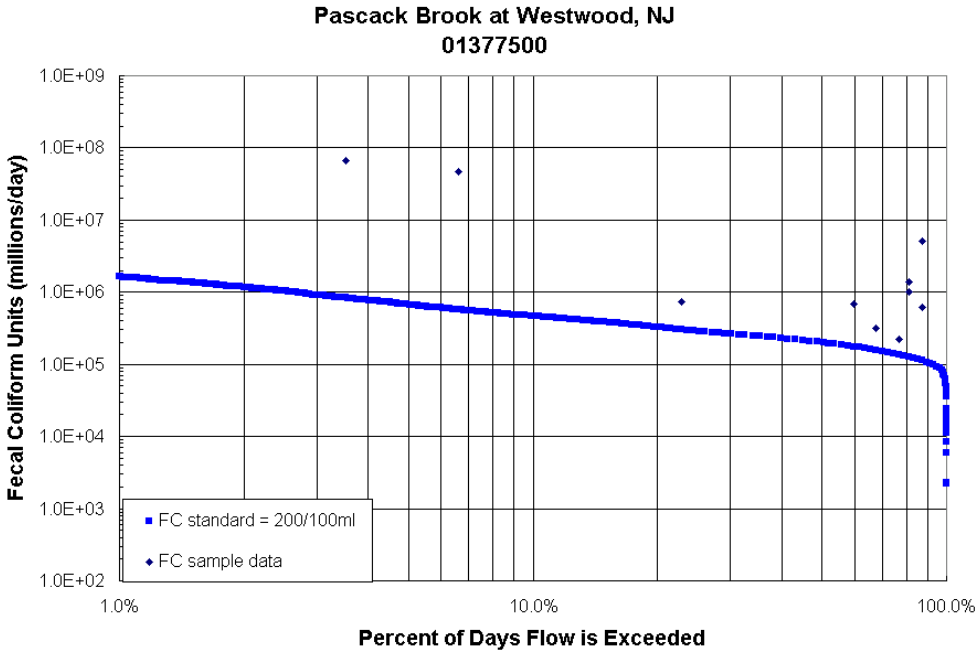
Load Duration Curve for Saddle River at Lodi. Fecal coliform data from USGS station # 01391500 during the period 2/22/94 through 9/13/00. Water years 1970-2000 from USGS station # 01391500 (Saddle River at Lodi) were used in generating the FC standard curve.



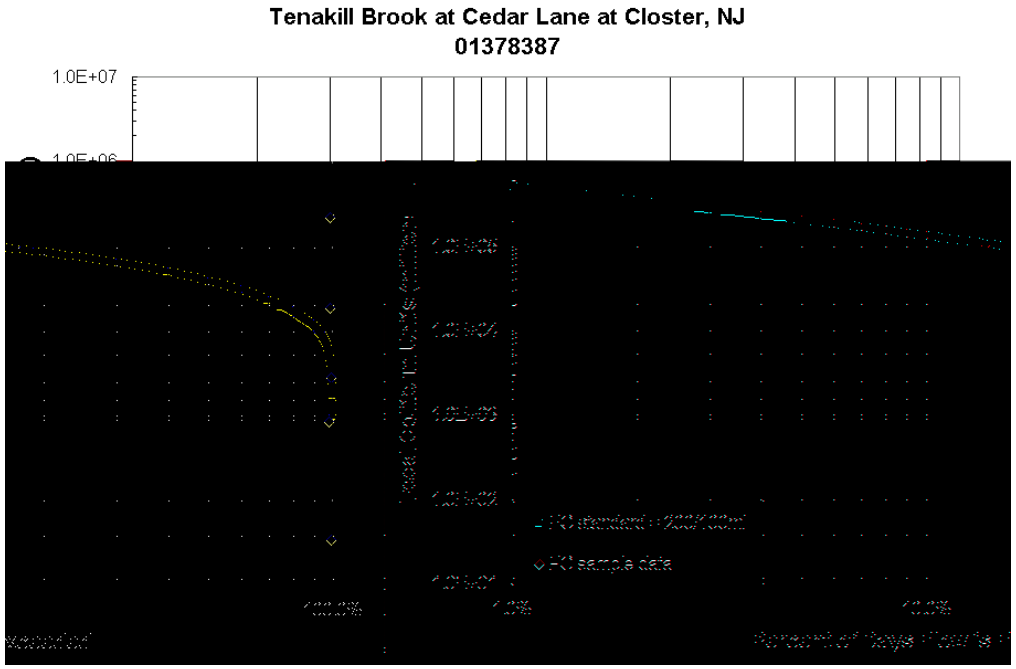
Load Duration Curve for the Hackensack River at Rivervale. Fecal coliform data from USGS station # 01377000 during the period 2/17/94 through 8/3/00. Water years 1970-2000 from USGS station # 01377000 (Hackensack River at Rivervale) were used in generating the FC standard curve.



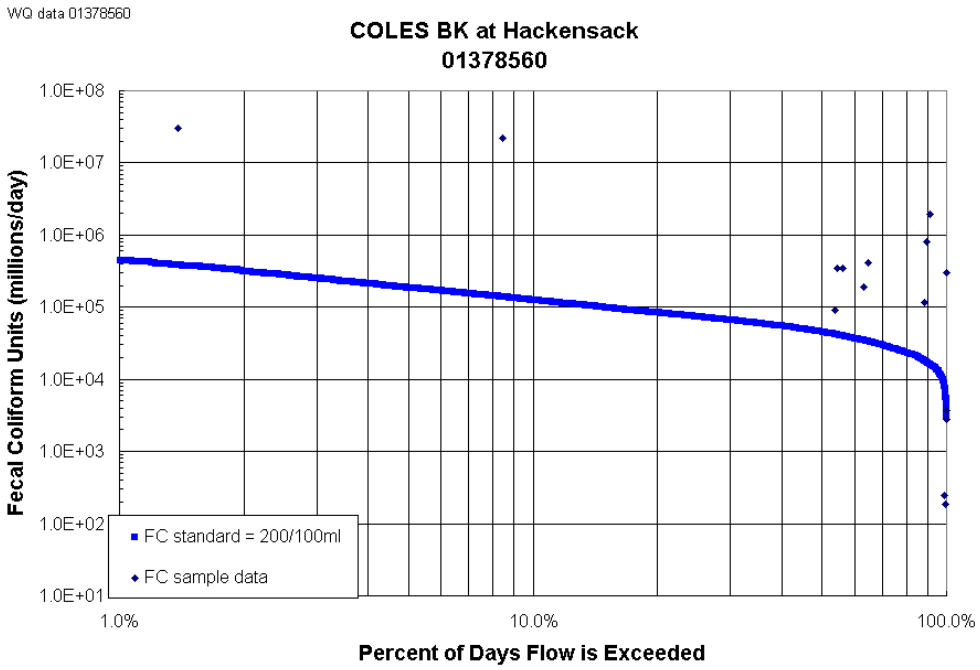
Load Duration Curve for Musquapsink Brook at River Vale. Fecal coliform data from USGS station # 01377499 during the period 7/13/99 through 9/7/00. Water years 1970-2000 from USGS station # 01377499 (Musquapsink Brook at River Vale) were used in generating the FC standard curve.



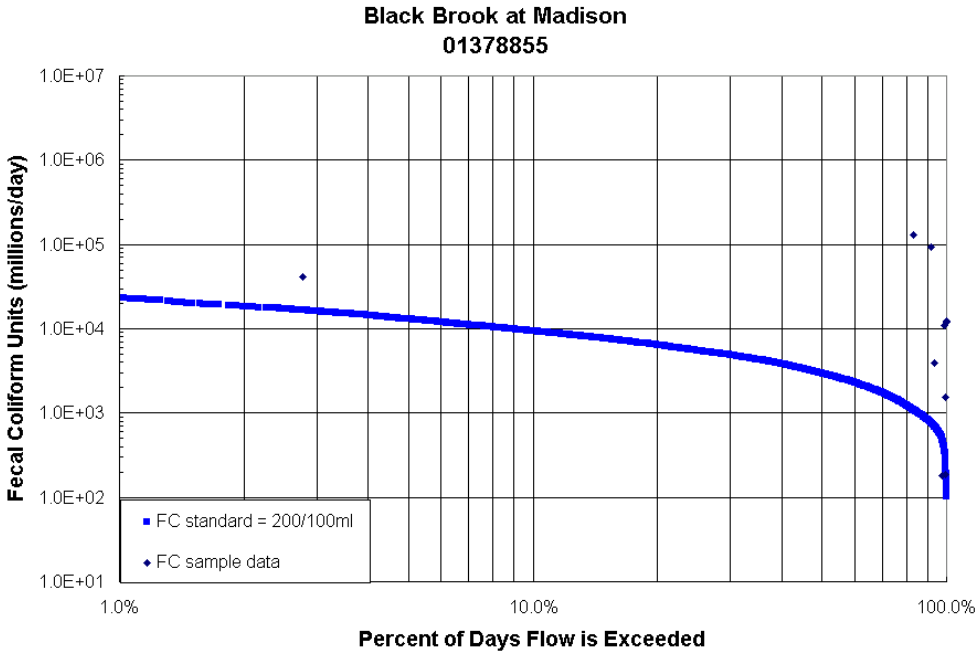
Load Duration Curve for Pascack Brook at Westwood. Fecal coliform data from USGS station # 01377500 during the period 6/1/98 through 9/6/98. Water years 1970-2000 from USGS station # 01377500 (Pascack Brook at Westwood) were used in generating the FC standard curve.



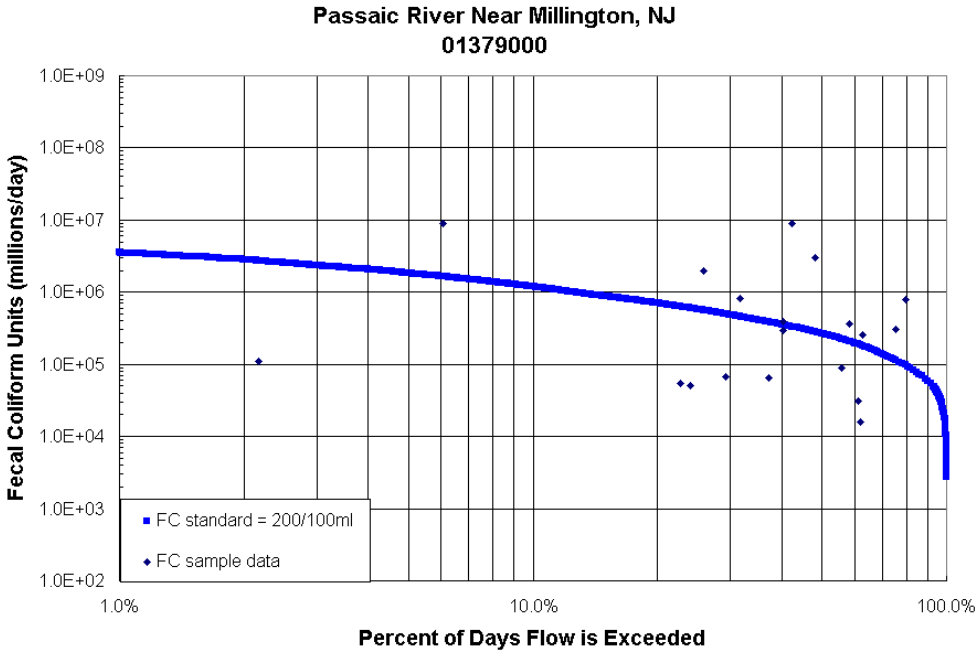
Load Duration Curve for Tenakill Brook at Cedar Lane at Closter. Fecal coliform data from USGS station # 01378387 during the period 7/13/99 through 8/9/99. Water years 1970-2001 from USGS station # 01390500 (Saddle River at Ridgewood) were used in generating the FC standard curve.



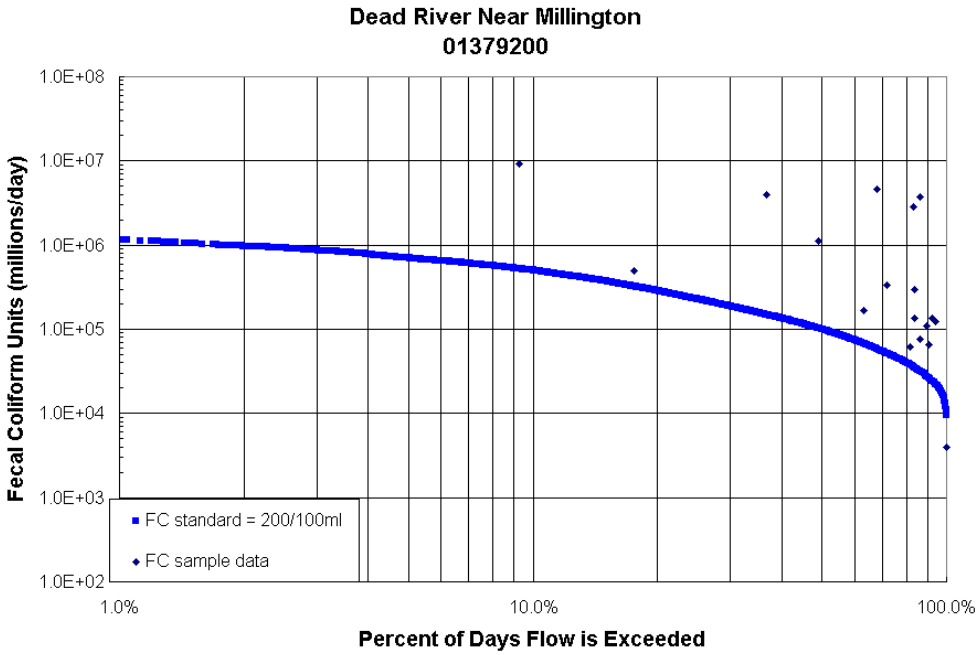
Load Duration Curve for the COLES BK at Hackensack. Fecal coliform data from USGS station # 01378560 during the period 11/5/97 through 8/23/00. Water years 1970-2001 from USGS station # 01391500 (Saddle River at Lodi) were used in generating the FC standard



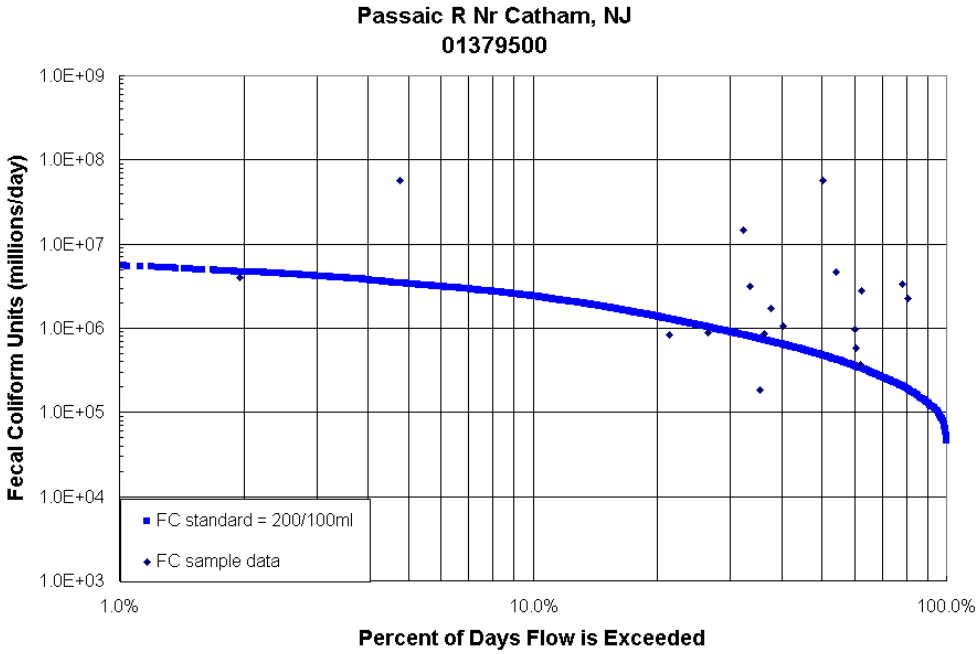
Load Duration Curve for Black Brook at Madison. Fecal coliform data from USGS station # 01378855 during the period 11/18/97 through 9/1/99. Water years 1970-2000 from USGS station # 01380500 (Rockaway River above Reservoir at Boonton) were used in generating the FC standard curve.



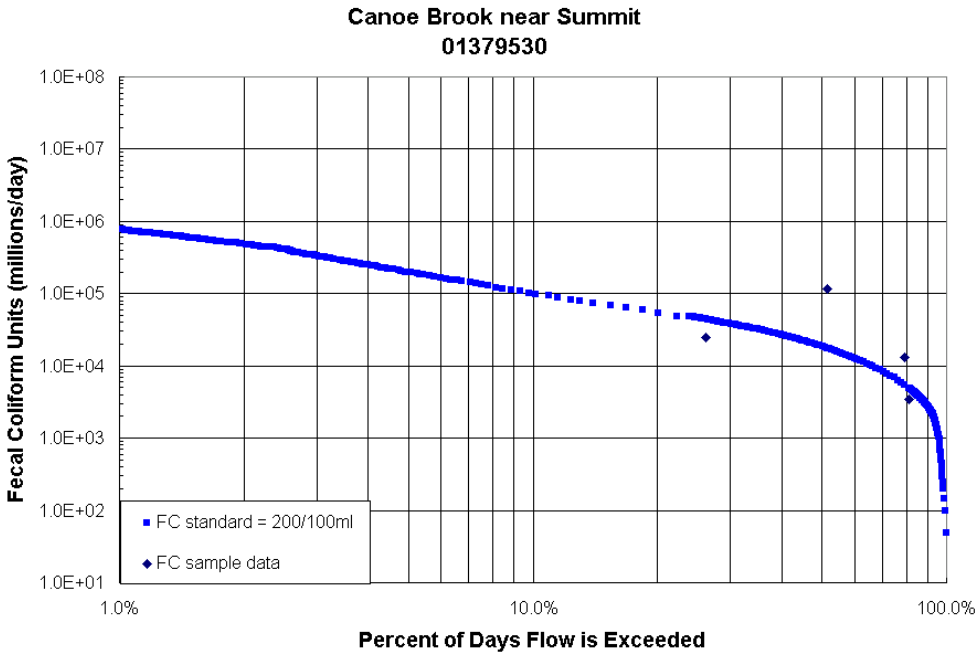
Load Duration Curve for the Passaic R Nr Millington. Fecal coliform data from USGS station # 01379000 during the period 10/1997 through 8/2000. Water years 1970-2000 from USGS station # 01379000 (Passaic R Nr Millington) were used in generating the FC standard curve.



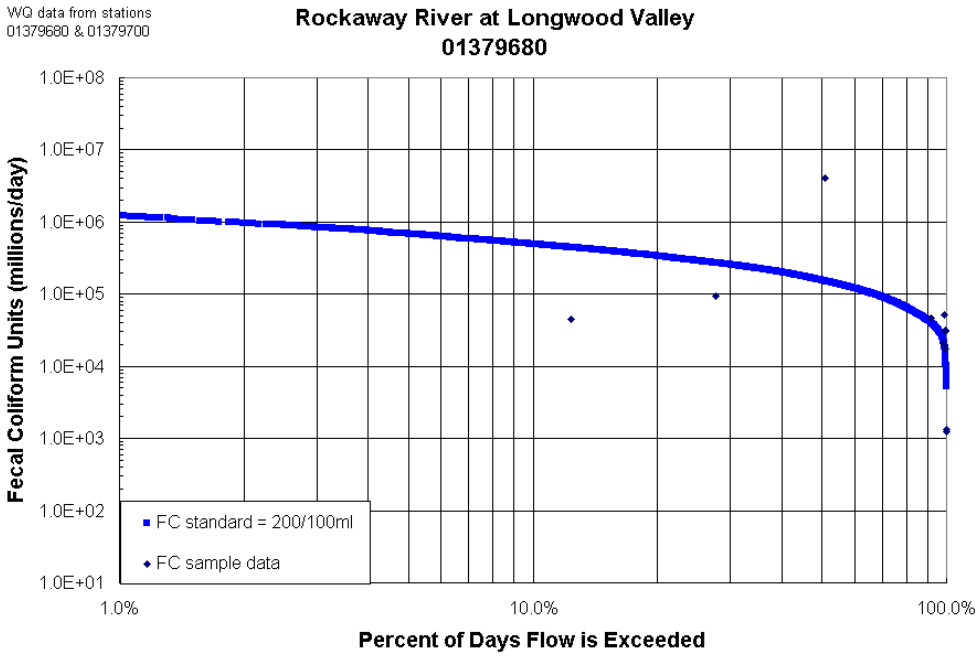
Load Duration Curve for the Dead River Near Millington. Fecal coliform data from USGS station # 01379200 during the period 10/1997 through 8/2000. Water years 1970-2000 from USGS station # 01379500 (Passaic R Nr Catham) were used in generating the FC standard curve.



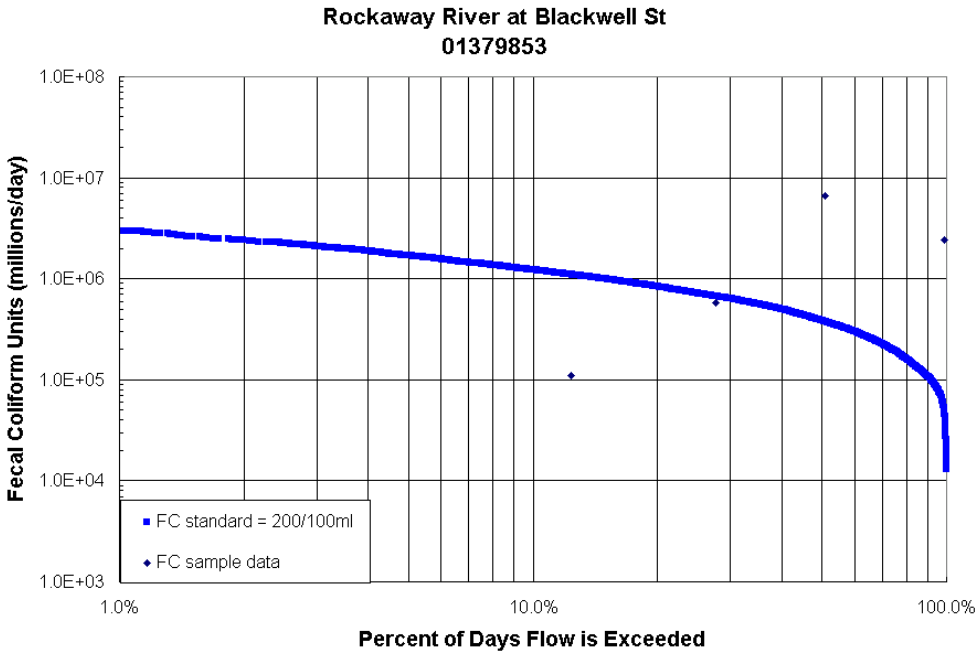
Load Duration Curve for the Passaic R Nr Catham. Fecal coliform data from USGS station # 01379500 during the period 10/1997 through 8/2000. Water years 1970-2000 from USGS station # 01379500 (Passaic R Nr Catham) were used in generating the FC standard curve.



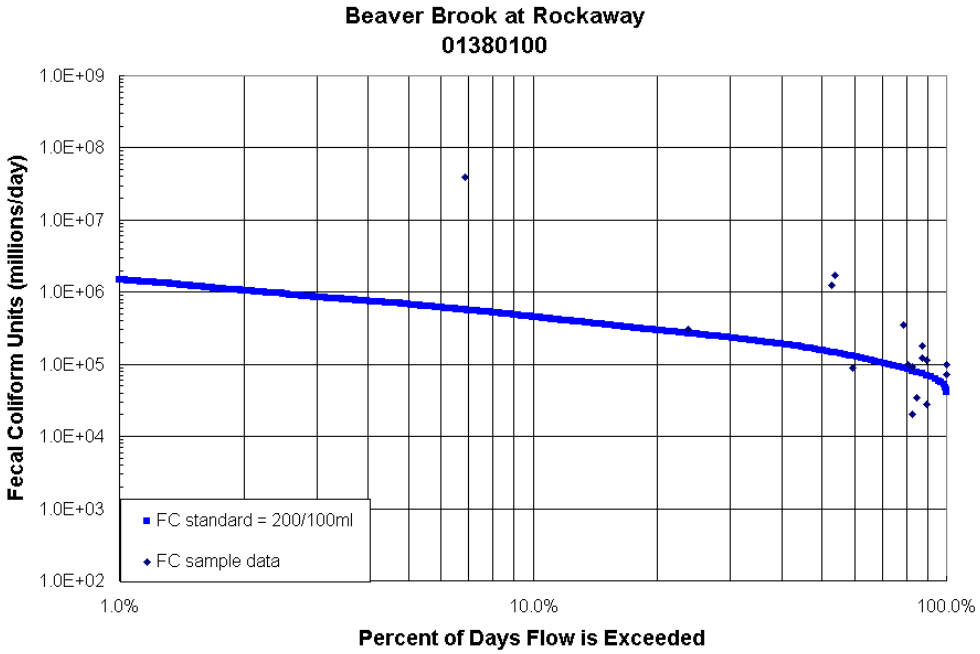
Load Duration Curve for Canoe Brook near Summit. Fecal coliform data from USGS station # 01379530 during the period 4/23/98 through 9/16/98. Water years 1970-2000 from USGS station # 01379530 (Canoe Brook near Summit) were used in generating the FC standard curve.



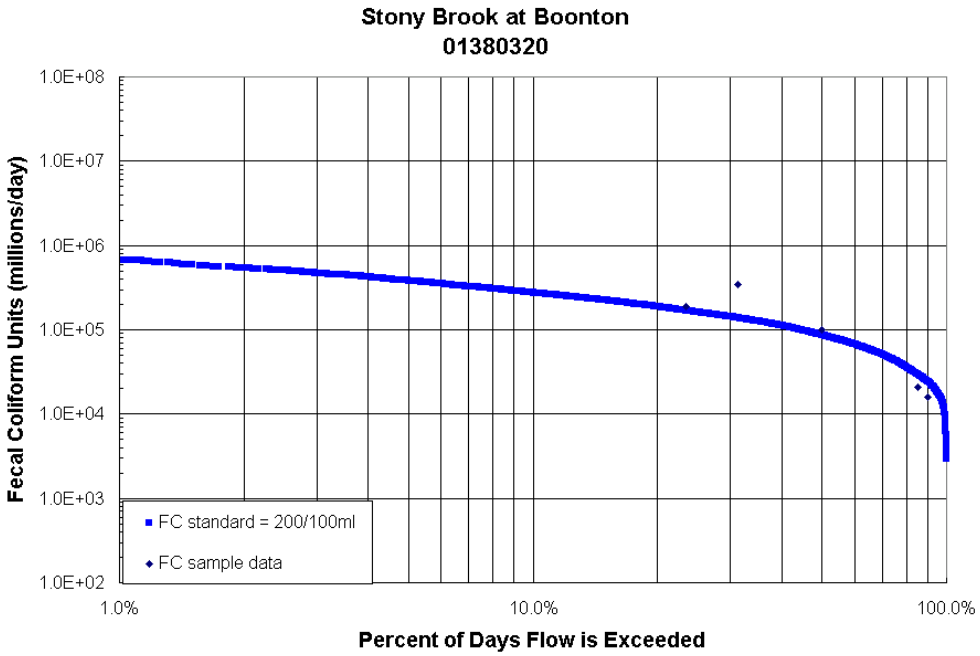
Load Duration Curve for Rockaway River at Longwood Valley. Fecal coliform data from USGS station # 01379680 & 01379700 during the period 1/27/97 through 9/2/99. Water years 1970-2000 from USGS station # 01380500 (Rockaway River above Reservoir at Boonton) were used in generating the FC standard curve.



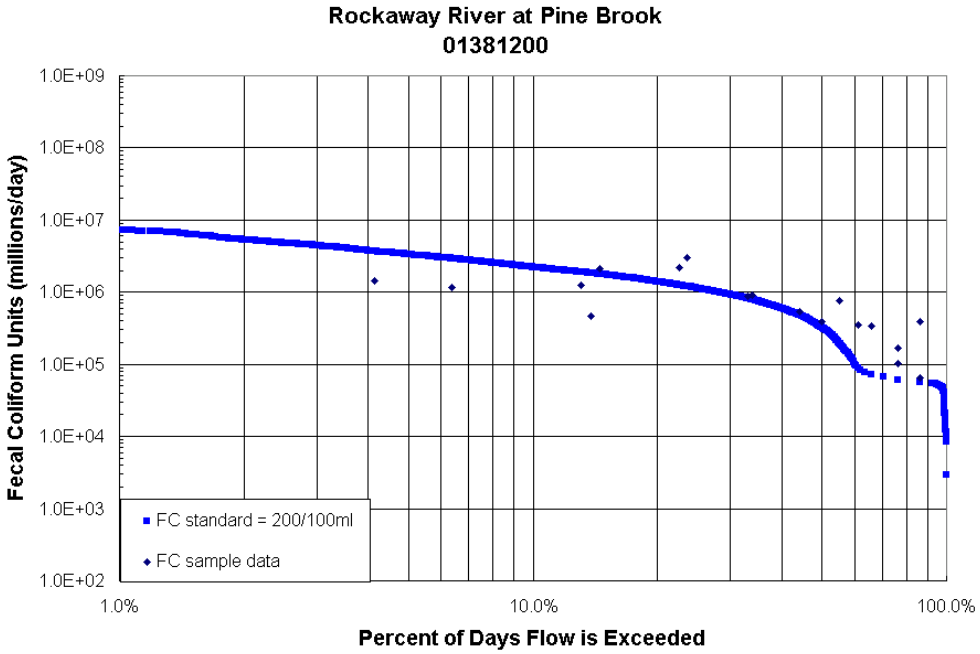
Load Duration Curve for Rockaway River at Berkshire Valley. Fecal coliform data from USGS station # 01379853 during the period 4/15/98 through 9/22/98. Water years 1970-2000 from USGS station # 01380500 (Rockaway River above Reservoir at Boonton) were used in generating the FC standard curve.



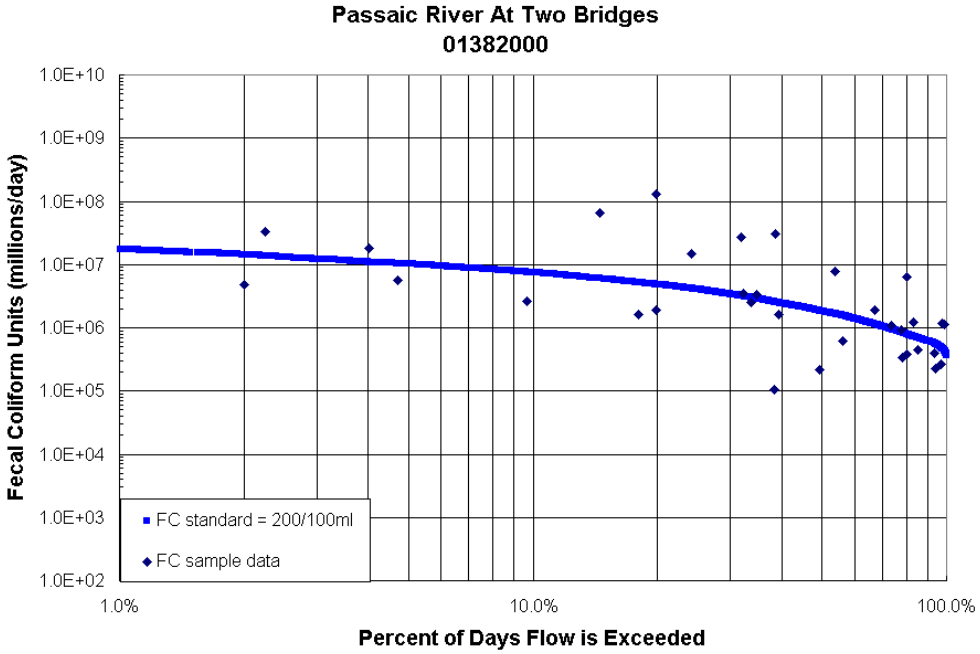
Load Duration Curve for the Beaver Brook At Rockaway. Fecal coliform data from USGS station # 01380100 during the period 11/13/97 through 8/7/2000. Water years 1970-2000 from USGS station # 01381500 (Whippany River at Morristown, NJ) were used in generating the FC standard curve.



Load Duration Curve for Stony Brook At Boonton. Fecal coliform data from USGS station # 01380320 during the period 12/13/99 through 9/7/00. Water years 1970-2000 from USGS station # 01380500 (Rockaway River above Reservoir at Boonton) were used in generating the FC standard curve.



Load Duration Curve for the Rockaway R at Pine Brook. Fecal coliform data from USGS station # 01381200 during the period 10/1997 through 8/2000. Water years 1970-2000 from USGS station # 01381000 (Rockaway River below Reservoir at Boonton, NJ) were used in generating the FC standard curve.



Load Duration Curve for the Passaic River at Two Bridges. Fecal coliform data from USGS station # 01382000 during the period 1/27/94 through 810/2000. Water years 1970-2000 from USGS station # 01381900 (Passaic R at Pine Brook, NJ) were used in generating the FC standard curve.

Appendix D

Amendment to the
Northeast Water Quality Management Plan

Total Maximum Daily Loads for
Phosphorus to Address Three (3)
Stream Segments in the
Northeast Water Region

Watershed Management Area 5
(Hackensack and Pascack Watersheds)

Amendment to the Northeast Water Quality Management Plan

Total Maximum Daily Loads for Phosphorus to Address Three (3) Stream Segments in the Northeast Water Region

Watershed Management Area 5 (Hackensack and Pascack Watersheds)

Proposed: July 5, 2005
Established: August 31, 2005
Approved: September 30, 2005
Adopted:

New Jersey Department of Environmental Protection
Division of Watershed Management
P.O. Box 418
Trenton, New Jersey 08625-0418

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1.0 Executive Summary

In accordance with Section 305(b) and 303(d) of the Federal Clean Water Act (CWA), the State of New Jersey, Department of Environmental Protection (Department) developed the *2004 Integrated List of Waterbodies* addressing the overall water quality of the State's waters and, in Sublist 5, identifying the list of impaired waterbodies. On October 4, 2004, the Department adopted the *2004 Integrated List of Waterbodies* as an amendment to the Statewide Water Quality Management Plan, pursuant to the Water Quality Planning Act at N.J.S.A.58:11A-7 and the Statewide Water Quality Management Planning rules at N.J.A.C. 7:15-6.4(a). In the Northeast Water Region, Watershed Management Area (WMA) 5, the *2004 Integrated List of Waterbodies* Sublist 5 identifies the three stream segments in Table 1 as impaired with respect to phosphorus, as indicated by the presence of phosphorus concentrations in excess of standards. A TMDL is required to be developed for each of the impairments listed on Sublist 5. A TMDL is developed to identify all the contributors of a pollutant of concern and the load reductions necessary to meet the Surface Water Quality Standards (SWQS) relative to that pollutant. TMDLs are established to address the phosphorus impairment in the waterbodies identified in Table 1.

Table 1 Impaired stream segments identified on the *2004 Integrated List of Waterbodies* to be addressed in this TMDL report.

Impairment Number	WMA	Station Name/Waterbody	Site ID	Sublist	Proposed Action
1	5	Coles Brook at Hackensack	01378560	5	Establish TMDL
2	5	Pascack Brook at Westwood	01377500, 5-PAS-1	5	Establish TMDL
3	5	Musquapsink Brook at River Vale	01377499	5	Establish TMDL

This TMDL report includes implementation strategies to achieve SWQS for phosphorus, including an additional measure, which will be included in the municipal stormwater permits for municipalities within the affected watersheds, to adopt a low phosphorus fertilizer ordinance. The TMDLs in this report were proposed and will be adopted by the Department as amendments to the appropriate area-wide water quality management plans in accordance with N.J.A.C. 7:15-3.4(g). This TMDL report was developed consistent with the United States Environmental Protection Agency's (USEPA's) May 20, 2002 guidance document entitled: "Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992," (Sutfin, 2002) which describes the statutory and regulatory requirements for approvable TMDLs.

2.0 Introduction

In accordance with Section 303(d) of the Federal Clean Water Act (CWA) (33 U.S.C. 1315(B)), the State of New Jersey is required biennially to prepare and submit to the USEPA a report that identifies waters that do not meet or are not expected to meet SWQS after implementation of technology-based effluent limitations or other required controls. This report is commonly referred to as the 303(d) List. In accordance with Section 305(b) of the CWA, the State of New Jersey is also required biennially to prepare and submit to the USEPA a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report. The *Integrated List of Waterbodies* combines these two assessments and assigns waterbodies to one of five sublists. Sublists 1 through 4 include waterbodies that are generally unimpaired (Sublist 1 and 2), have limited assessment or data availability (Sublist 3), are impaired due to pollution rather than pollutants or have had a TMDL or other enforceable management measure approved by EPA (Sublist 4). Sublist 5

constitutes the traditional 303(d) list for waters impaired or threatened by one or more pollutants, for which a TMDL may be required.

A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern, natural background and surface water withdrawals. A TMDL quantifies the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards and allocates that loading capacity to known point and nonpoint sources in the form of Waste Load Allocations (WLAs) for point sources, Load Allocations (LAs) for nonpoint sources, and a margin of safety (MOS).

This report establishes three TMDLs that address phosphorus impairment in 25.7 impaired river miles with respect to the waterbodies identified in Table 2. These TMDLs include management approaches to reduce loadings of phosphorus from various sources in order to attain applicable surface water quality standards for phosphorus. With respect to the phosphorus impairment, the waterbodies will be moved to Sublist 4 following approval of the TMDLs by EPA. Two of the waterbodies found in Table 2 have additional impairments other than total phosphorus. Pascack Brook at Westwood (01377500) is listed for Arsenic and Mercury, and Musquapsink Brook at River Vale (01377499) is listed for Arsenic. These additional impairments will be addressed in future TMDL reports.

Recent EPA guidance (Sutfin, 2002) describes the statutory and regulatory requirements for approvable TMDLs, as well as additional information generally needed for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations. The Department believes that the TMDLs in this report address the following items in the May 20, 2002 guideline document:

1. Identification of waterbody(ies), pollutant of concern, pollutant sources and priority ranking.
2. Description of applicable water quality standards and numeric water quality target(s).
3. Loading capacity – linking water quality and pollutant sources.
4. Load allocations.
5. Waste load allocations.
6. Margin of safety.
7. Seasonal variation.
8. Reasonable assurances.
9. Monitoring plan to track TMDL effectiveness.
10. Implementation (USEPA is not required to and does not approve TMDL implementation plans).
11. Public Participation.

3.0 Pollutant of Concern and Area of Interest

Pollutant of Concern

The pollutant of concern for these TMDLs is total phosphorus. For the segments in the Northeast Water Region - WMA 5 identified in Table 2, phosphorus concentrations were found to exceed New Jersey's SWQS, found at N.J.A.C. 7-9B. The three impaired segments were assigned a Medium priority ranking in the *2004 Integrated List of Waterbodies* Sublist 5.

Table 2 Waterbodies listed for phosphorus impairment in the Northeast Water Region - WMA 5 for which TMDLs are proposed

TMDL Number	WMA	Station Name/Waterbody	Site ID	County(s)	Impaired River Miles
1	5	Coles Brook at Hackensack	01378560	Bergen	11.8
2	5	Pascack Brook at Westwood	01377500, 5-PAS-1	Bergen	6.6
3	5	Musquapsink Brook at River Vale	01377499	Bergen	7.3
Total Impaired River Miles:					**25.7**

Applicable Water Quality Standards

The impaired segments addressed in this document are classified as Fresh Water 2 (FW2). As stated in N.J.A.C. 7:9B-1.14(c) of the SWQS for FW2 waters, the standards for phosphorus are as follows:

> Phosphorus, Total (mg/l):
>
> i. Lakes: Phosphorus as total P shall not exceed 0.05 in any lake, pond, reservoir, or in a tributary at the point where it enters such bodies of water, except where site-specific criteria are developed pursuant to N.J.A.C. 7:9B-1.5(g)3.
>
> ii. Streams: Except as necessary to satisfy the more stringent criteria in paragraph i. above or where site-specific criteria are developed pursuant to N.J.A.C. 7:9B1.5(g)3, phosphorus as total P shall not exceed 0.1 in any stream, unless it can be demonstrated that total P is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

Also as stated in N.J.A.C. 7:9B-1.5(g)2:

> Nutrient policies are as follows:
>
> Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

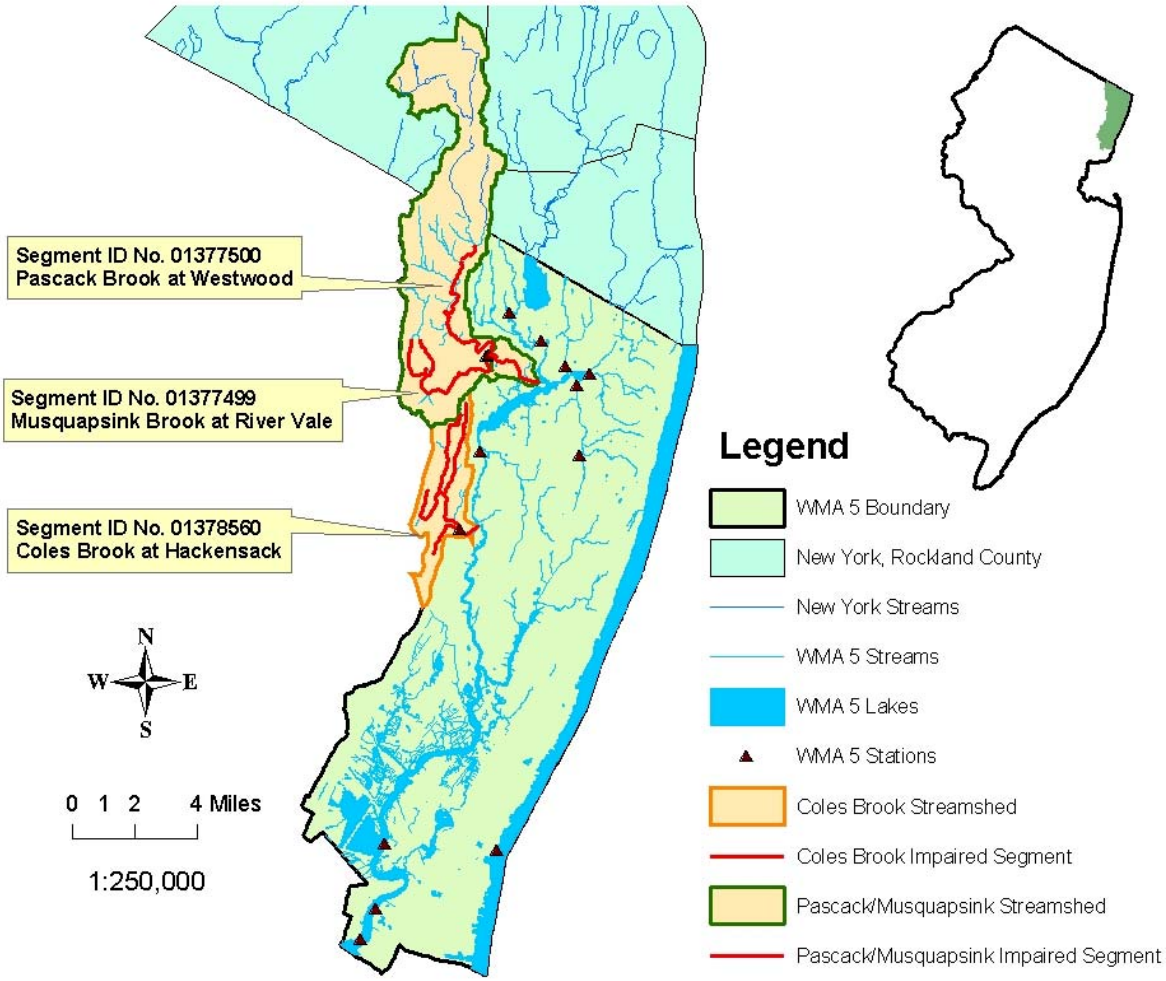
In all FW2 waters, the designated uses are (NJAC 7:9B-1.12):

> 1. Maintenance, migration and propagation of the natural and established aquatic biota;
> 2. Primary and secondary contact recreation;
> 3 Industrial and agricultural water supply;
> 4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
> 5. Any other reasonable uses.

Area of Interest

These TMDLs will address 25.7 impaired river miles within the Northeast Water Region, Watershed Management Area 5. Based on the detailed county hydrography stream coverage, 67.61 overall stream miles in New Jersey and New York are affected by the TMDLs due to the fact that the implementation plans cover entire watersheds, not just impaired waterbody segments. The spatial extent of the impaired segments and the affected drainage areas are depicted in Figure 1.

Figure 1 Spatial extent of impaired segments and affected drainage areas: WMA 5



Watershed Management Area 5 - Hackensack, Hudson, Pascack

Watershed Management Area 5 (WMA 5) has a drainage area of approximately 165 square miles, which includes parts of Hudson and Bergen Counties. WMA 5 is comprised of three watersheds: Hackensack River Watershed, Hudson River Watershed and Pascack Brook Watershed. The Hackensack River originates in New York State and flows south to the Newark Bay. New Jersey's portion of the river is 31 miles long. The Hackensack River Watershed is approximately 85 square miles. Major tributaries include the Pascack Brook, Berry's Creek, Overpeck Creek, and Wolf Creek. The Pascack Brook Watershed has a drainage area of approximately 51 square miles.

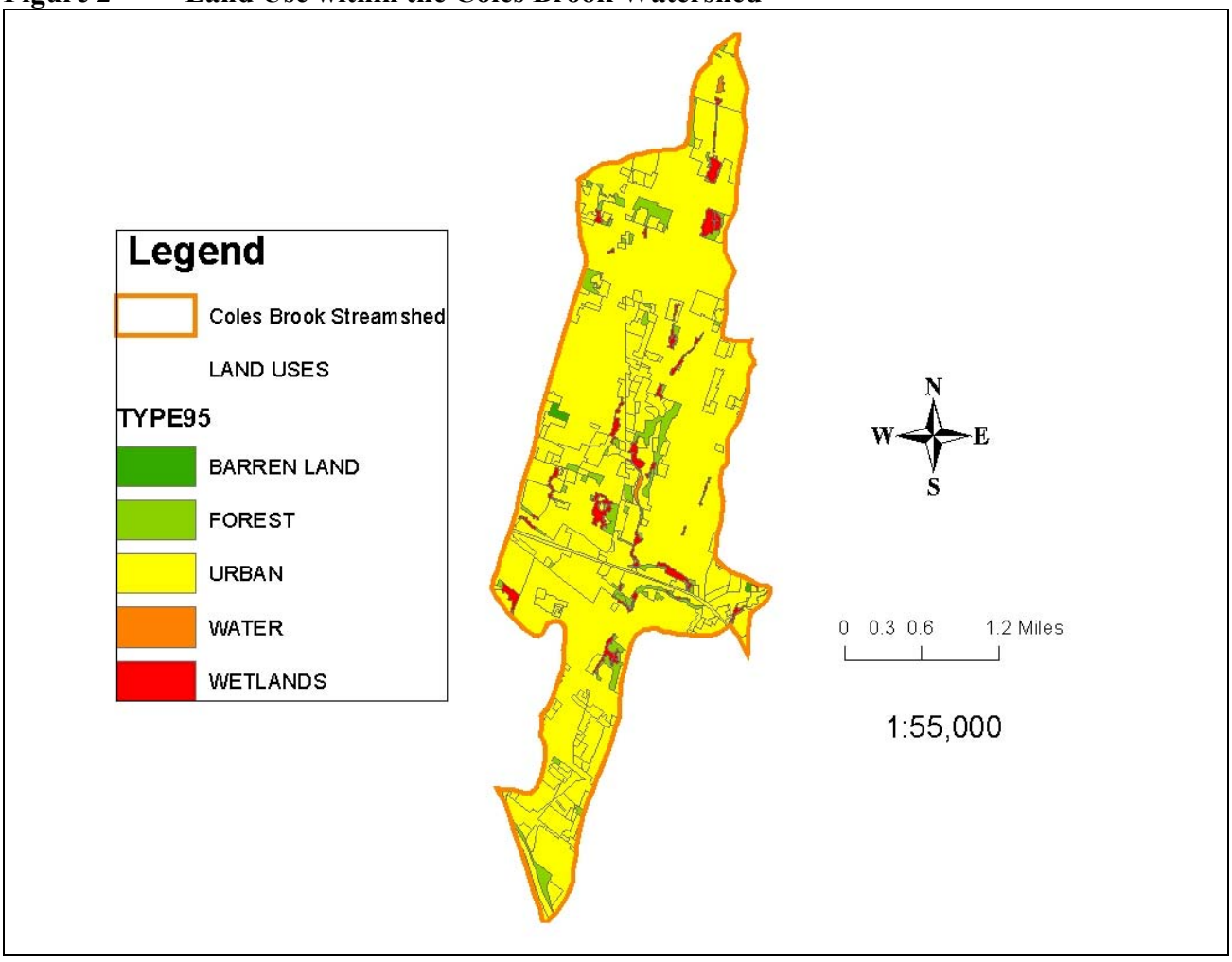
The Hudson River is 315 miles long and begins in New York State at Lake Tear of the Clouds on the southwest side of Mount Marcy, New York's highest peak. The Hudson River Watershed is approximately 29 square miles. The Hudson River forms the boundary between New Jersey and New York States.

Although WMA 5 is the most populated of all the WMAs, approximately 50% of the land is still undeveloped. More than 30% of the developed land is residential development. The remaining developed land is commercial/industrial use. Much of the lower Hackensack River Watershed is tidal marsh known as the Hackensack Meadowlands. This are is home to more than 700 plant and animal species including several rare and threatened species. The Hackensack Meadowlands Development Commission (HMDC) was created by an act of the New Jersey Legislature that became law in January 1969. The act gave the HMDC three mandates, environmental protection, economic development, and solid waste management. The HMDC district size is 19,730 acres, or 32 square miles. Land use in the affected drainage areas is predominantly urban and is presented in Tables 3 and 4, and depicted in Figures 2 and 3.

Table 3 River miles, Watershed size, and Area by Anderson Land Use Classification for Coles Brook

River miles and drainage area	Coles Brook at Hackensack 01378560
Sublist 5 impaired river miles	11.8
Total river miles within watershed and included in the implementation plan	15.5
Watershed size (acres)	4382
Landuse/Landcover (acres)	
Medium / high density residential	2986.8
Low density / rural residential	105.7
Commercial	495.6
Industrial	24.0
Mixed urban / other urban	417.4
Agriculture	0
Forest, wetland, water	341.7
Barren	10.7
Total	4381.9

Figure 2 Land Use within the Coles Brook Watershed



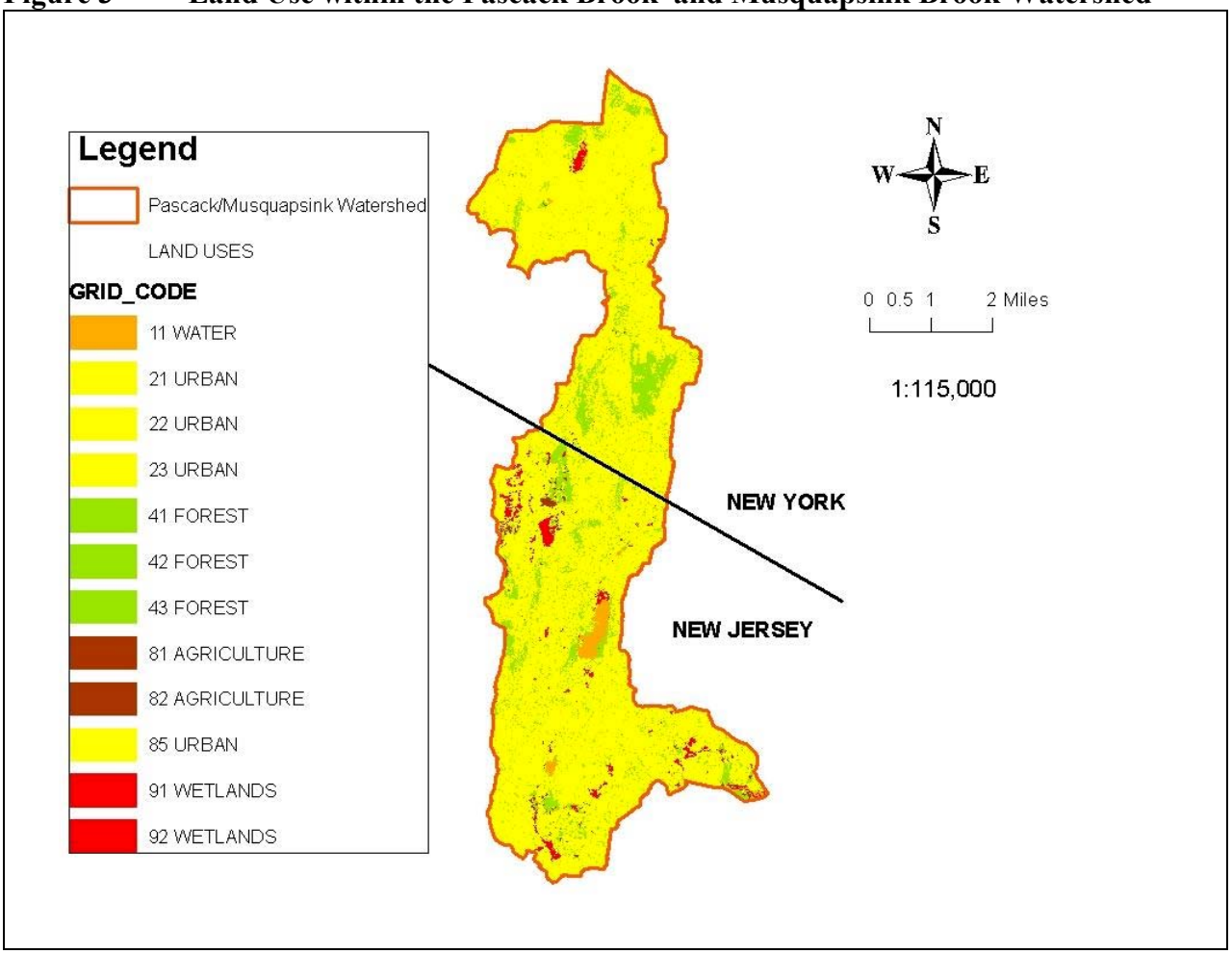
The Coles Brook impaired stream segment is classified as FW2-NT/SE1.

The information for Pascack Brook at Westwood and Musquapsink Brook at River Vale are, at times, addressed in the same figures and tables in this TMDL document. The monitoring station for Pascack Brook at Westwood (01377500) accurately characterizes the flows and water quality at Musquapsink Brook due to the Pascack station location directly below the confluence of the two streams. For this reason, the two impairments are addressed as one in certain areas of this document.

Table 4 River miles, Watershed size, and Area by USGS Land Use Classification for Pascack Brook and Musquapsink Brook

River miles and drainage area	Pascack Brook at Westwood, Musquapsink Brook at River Vale 01377500 (5-PAS-1), 01377499
Sublist 5 impaired river miles	13.9
Total river miles within watershed and included in the implementation plan	52.11
Watershed size (acres)	19101
Land use/Land cover (acres)	
Medium / high density residential	1743.4
Low density / rural residential	12669.7
Commercial	715.6
Industrial	0
Mixed urban / other urban	979.6
Agriculture	99.5
Forest, wetland, water	2893.1
Barren	0
Total	19100.9

Figure 3 Land Use within the Pascack Brook and Musquapsink Brook Watershed



The Pascack Brook and Musquapsink Brook impaired stream segments are classified as FW2-NTC1.

Data Sources

The Department's Geographic Information System (GIS) and GIS coverages for New York were used to describe characteristics of the affected drainage area and in developing this document. The following is general information regarding the data used:

- Land use/Land cover was taken from: "NJDEP 1995/97 Land use/Land cover Update for New Jersey (by WMA)", published 12/01/2000 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), and delineated by watershed management area.

- "NJDEP 2004 Integrated Report Results for Non-Tidal Rivers", published 6/2004 by NJDEP, Watershed Assessment Group (WAT). Online at:
http://www.state.nj.us/dep/gis/digidownload/images/ir2004/ir_river_conventionals2004.gif

- Detailed stream coverage of New Jersey: Published 11/01/1998 by the NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA). "NJDEP Streams of New Jersey (1:24000)." Online at:
http://www.state.nj.us/dep/gis/strmshp.html

- NJDEP 14 Digit Hydrologic Unit Code delineations for New Jersey (DEPHUC14), published 4/5/2000 by Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS). Online at:
http://www.state.nj.us/dep/gis/digidownload/zips/statewide/dephuc14.zip

- NJDEP Digital Elevation Grid for New Jersey (10 meter) published 10/01/2004 by NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS). Online at:
http://www.nj.gov/dep/gis/wmalattice.html

- "NJPDES Surface Water Discharges in New Jersey, (1:12,000)", published 09/12/2002 by NJDEP, Environmental Regulation (ER), Division of Water Quality (DWQ), Bureau of Point Source Permitting - Region 1 (PSP-R1). Online at:
http://depnet/gis/digidownload/images/statewide/njpdesswd.gif

- "NJDEP 2004 Integrated Report Stations on Non-Tidal Rivers (Conventionals and Toxics)", published 6/2004 by NJDEP, Water Assessment Team (WAT). Online at:
http://www.state.nj.us/dep/gis/digidownload/images/ir2004/ir_stations_river2004.gif

- "NJDEP Head of Tide Points for Watercourses of New Jersey", published 1986 by NJDEP, Office of Environmental Analysis (OEA), Coast Survey Ltd. (CTD). Online at:
http://www.state.nj.us/dep/gis/digidownload/zips/statewide/hot.zip

- "NJDEP Surface Water Quality Standards of New Jersey", published 11/2003 by NJDEP, Division of Landuse Management, Bureau of Freshwater & Biological Monitoring. Online at:
http://www.state.nj.us/dep/gis/digidownload/zips/statewide/swqs.zip

- "Hydrological Features of New Jersey Feature Map Service, New Jersey State Plane NAD83", published 2005 by New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). Online at: Live Data and Maps (ArcIMS Feature Service) - Server=http://njgin.state.nj.us; Service=NJ_Hydrology_FS; ServiceType=feature

- "Municipal, County and State Boundaries of New Jersey Feature Map Service, New Jersey State Plane NAD83", published 2004 by New Jersey Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS). Online at: Live Data and Maps (ArcIMS Feature Service) - Server=http://njgin.state.nj.us; Service=NJ_GovtBounds_FS; ServiceType=feature

- "Water Quality Management Areas", created 3/2002 by NJDEP, Water Assessment Team (WAT). Unpublished.

- "Dams in New Jersey", created 6/2003 by NJDEP, Division of Watershed Management (DWM). Unpublished.

- Hydrography (Census 2000) shapefiles downloaded from Cornell University Geospatial Information Repository (CUGIR) - Streams and lakes located in New York State, (Shapefile: 2001). http://cugir.mannlib.cornell.edu/browse_map/browse_map.html

National Land Cover Data (NLCD) for New York, last updated in July 2000, and for New Jersey, last updated in March 2000. The data was produced under the direction of the USGS as part of the Multi-Resolution Land Characterization (MRLC) Regional Land Cover Characterization Project. The data used the NLCD Land Cover Classification Systems to categorize land use. http://edcsgs9.cr.usgs.gov/pub/data/landcover/states/

- High Resolution Digital Ortho-imagery 2000-2001 for Hudson Valley/Catskill Region in New York State downloaded from New York State GIS Clearinghouse. http://www.nysgis.state.ny.us/gateway/mg/high_res.htm

- New York State Digital Elevation Models (DEM) in the format of ASCII DEM was downloaded for the Sloatsburg and Nyack areas from Cornell University Geospatial Information Repository (CUGIR). This information was published by the USGS in August 1998. http://cugir.mannlib.cornell.edu/browse_lis/dem_list.html

- New York State, Rockland County Boundaries, (Shapefile: 2001) http://cugir2.mannlib.cornell.edu/buckets/Display.jsp?id=7385

- New Jersey Environmental Management System (NJEMS)

4.0 Source Assessment

In order to evaluate and characterize phosphorus loadings in the waterbodies of interest in these TMDLs, and thus propose proper management responses, source assessments are critical. Source assessments include identifying the types of sources and their relative contributions to phosphorus loadings, in both time and space variables.

For the purposes of TMDL development, point sources include domestic and industrial wastewater treatment plants that discharge to surface water, as well as surface water discharges of stormwater subject to regulation under the National Pollutant Discharge Elimination System (NPDES). This includes facilities with individual or general industrial stormwater permits and Tier A municipalities and Federal, interstate agency, state and county facilities regulated under the New Jersey Pollutant Discharge Elimination System (NJPDES) municipal stormwater permitting program.

There are no point sources, other than stormwater, that could contribute phosphorus to the impaired waterbodies. Stormwater point sources like nonpoint sources, derive their pollutant load from runoff from land surfaces and load reduction is accomplished through BMPs. The distinction is that stormwater point sources are regulated under the Clean Water Act. Stormwater point sources are or will be addressed through the management practices required through the discharge permits. The Tier A municipalities located in the affected streamsheds are identified in Appendix 3.

For the purposes of TMDL development, potential nonpoint sources include stormwater discharges that are not subject to regulation under NPDES, including Tier B municipalities, which are regulated under the NJPDES municipal stormwater permitting program, and direct stormwater runoff from land surfaces, as well as malfunctioning sewage conveyance systems, failing or inappropriately located septic systems, and direct contributions from wildlife, livestock and pets. There are no Tier B municipalities within the affected streamsheds.

The phosphorus loads in the affected watersheds are contributed by stormwater point sources and nonpoint sources. These loads are effectively estimated using loading coefficients for land uses present in the watersheds. Watershed loads for total phosphorus were, therefore, estimated using the Unit Areal Load (UAL) methodology, which applies pollutant export coefficients obtained from literature sources to the land use patterns within the watershed, as described in USEPA's Clean Lakes Program guidance manual (Reckhow, 1979b). Land use was determined using the Department's GIS system from the 1995/1997 land use coverage for the Coles Brook impaired watershed. The Department reviewed phosphorus export coefficients from an extensive database (Appendix 1) and selected the land use categories and values shown in Table 5. In order to apply a uniform coverage for the entire Pascack Brook and Musquapsink Brook impaired watershed, land use was determined using the USGS 2000 National Land Cover Data (NLCD) for both New York and New Jersey. The NLCD classification of land use types is different from the Department's 1995/1997 land use classification. Adjustments were made to assign an appropriate TP Export Coefficient for each type of NLCD land use, shown in Table 5.

Table 5: Phosphorus export coefficients (Unit Areal Loads)

Land use/Land cover	LU/LC codes[1]	USGS Grid_code	UAL (kg TP/ha/yr)
Mixed density residential	1100	n/a	1.2
Medium / high density residential	1110, 1120, 1150	22	1.6
Low density / rural residential	1130, 1140	21	0.7
Commercial	1200	23	2.0
Industrial	1300, 1500	n/a	1.7
Mixed urban / other urban	other urban codes	85	1.0

[1] LU/LC code is an attribute of the land use coverage that provides the Anderson classification code for the land use. The Anderson classification system is a hierarchical system based on four digits. The four digits represent one to four levels of classification, the first digit being the most general and the fourth digit being the most specific description.

Land use/Land cover	LU/LC codes[1]	USGS Grid_code	UAL (kg TP/ha/yr)
Agricultural	2000	81, 82	1.5
Forest, wetland, water	1750, 1850, 2140, 2150, 4000, 5000, 6000, 7430, 8000	11, 41, 42, 43, 91, 92	0.1
Barren land	7000	32	0.5

Units: 1 hectare (ha) = 2.47 acres, 1 kilogram (kg) = 2.2 pounds (lbs), 1 kg/ha/yr = 0.89 lbs/acre/yr

5.0 Water Quality Analysis

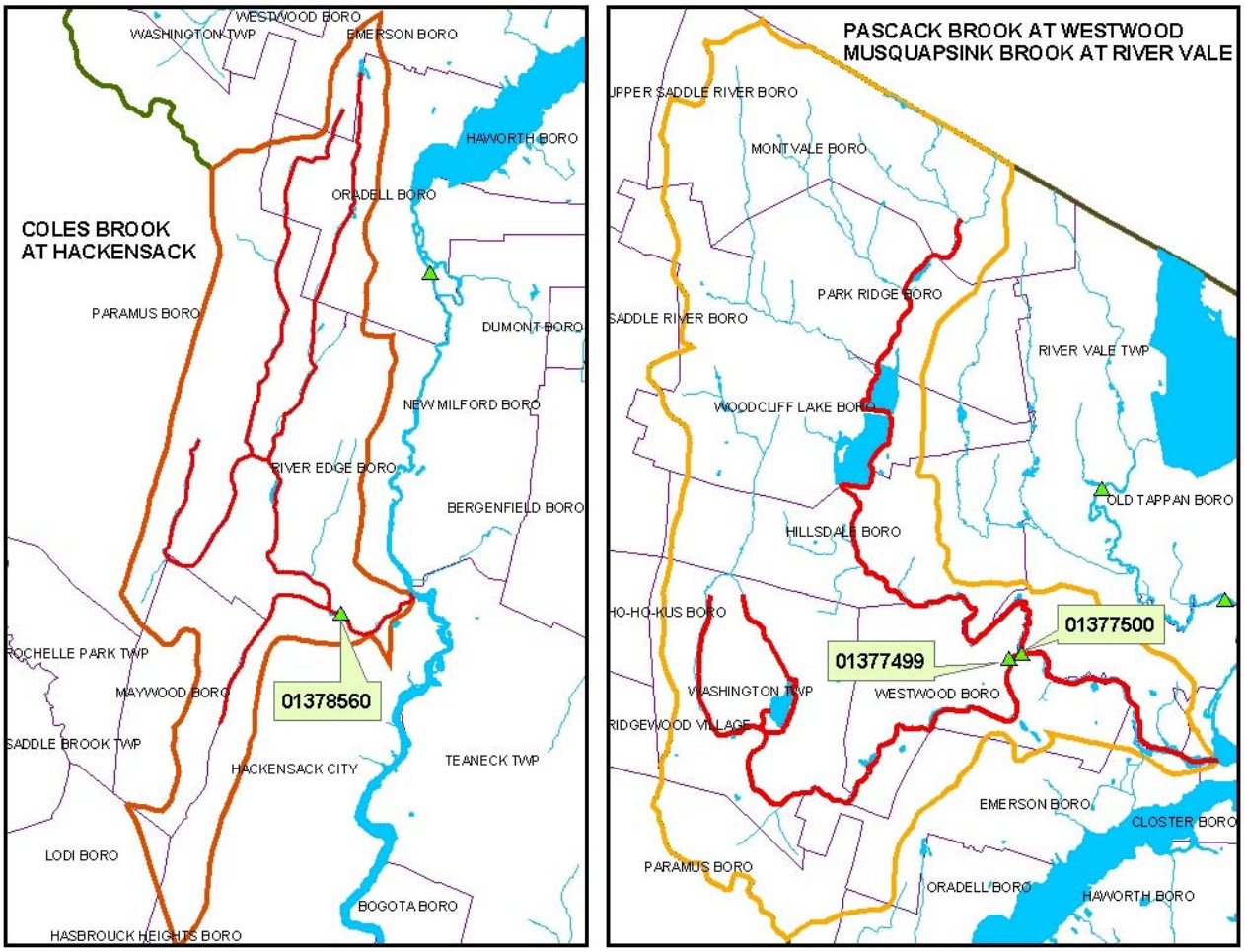
The data set used in this TMDL was generated by the USGS/NJDEP ambient monitoring program and the Department's supplemental monitoring project identified as the Existing Water Quality (EWQ) monitoring program. The USGS data spanned from November 1997 thru August 2003. The EWQ monitoring was conducted from August 2000 to August 2004. The sampling locations for the evaluated data are found in Figure 4. A summary of total phosphorus sampling data is found in Table 6 below. The full data set can be found in Appendix 2. Due to incomplete flow data available, some of the values within Appendix 2 were calculated by developing a stage/discharge relationship at the Coles Brook and Pascack Brook sampling sites. The calculated flow values were then used to perform the regression analyses in Section 6.0.

The information for Pascack Brook at Westwood and Musquapsink Brook at River Vale are, at times, addressed in the same figures and tables in this TMDL document. The monitoring station for Pascack Brook at Westwood (01377500) accurately characterizes the flows and water quality at Musquapsink Brook due to the Pascack station location directly below the confluence of the two streams. For this reason, the two impairments are addressed as one in certain areas of this document.

Table 6 Summary of Total Phosphorus sampling data

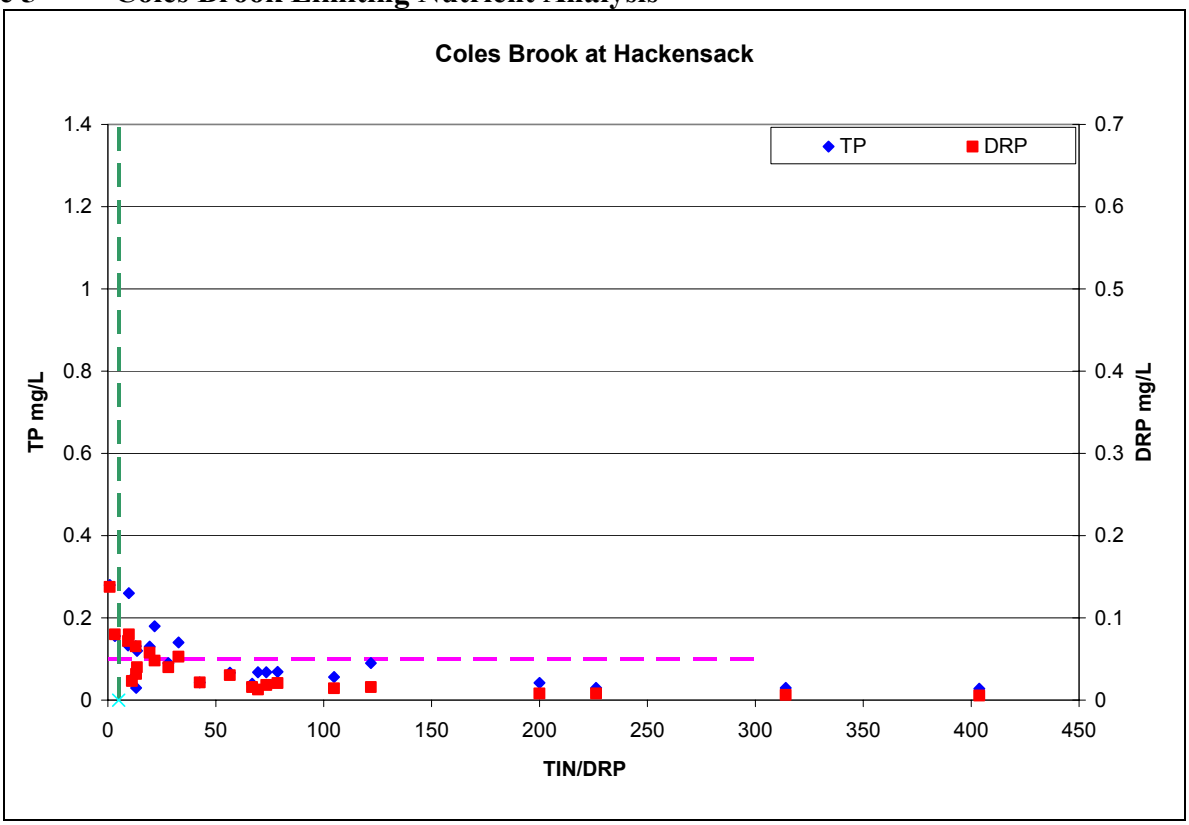
Water Quality Sample Locations	Site Number	# of samples	Average (mg/L)	% exceeding 0.1 mg/L
Coles Brook at Hackensack	01378560	24	0.10	37.5%
Pascack Brook at Westwood	01377500, 5-PAS-1	16	0.07	25%
Musquapsink Brook at River Vale	01377499	8	0.24	37.5%

Figure 4 Location of Monitoring Sites



The Department's March 2003 guidance document, entitled *"Technical Manual for Phosphorus Evaluations (N.J.A.C. 7:9B-1.14(c)) for NJPDES Discharge to Surface Water Permits"*, recommends considering ratios of nitrogen and phosphorus to suggest whether phosphorus is the limiting nutrient. When the ratio of total inorganic nitrogen (TIN) to total orthophosphate (TOP) or dissolved reactive phosphorus (DRP) is smaller than or equal to 5, then phosphorus is generally not limiting the system. This document may be downloaded from the Department's web page at www.state.nj.us/dep/dwq/techmans/phostcml.pdf. Figures 5-7 depict the relationship of these two key nutrients at each station. At these stations, when the total phosphorus exceeded 0.1 mg/L and the DRP < 0.05 mg/L, the ratio TIN/DRP exceeded 5. This suggests that phosphorus is the limiting nutrient and the 0.1 mg/l criterion applies. Detailed discussion of the nitrogen-phosphorus relationship is found in Appendix 4.

Figure 5 Coles Brook Limiting Nutrient Analysis



TIN = dissolved nitrite, nitrate and ammonia. TIN calculated as: a sum of dissolved ammonia (P00608) & dissolved nitrite and nitrate (P00631) or a sum of total ammonia (P00610) and total nitrite & nitrate (P00630)
DRP = dissolved reactive phosphorus: orthophosphorus (P00671) if available, or 80% dissolved phosphorus (P00666)

Figure 6 Pascack Brook Limiting Nutrient Analysis

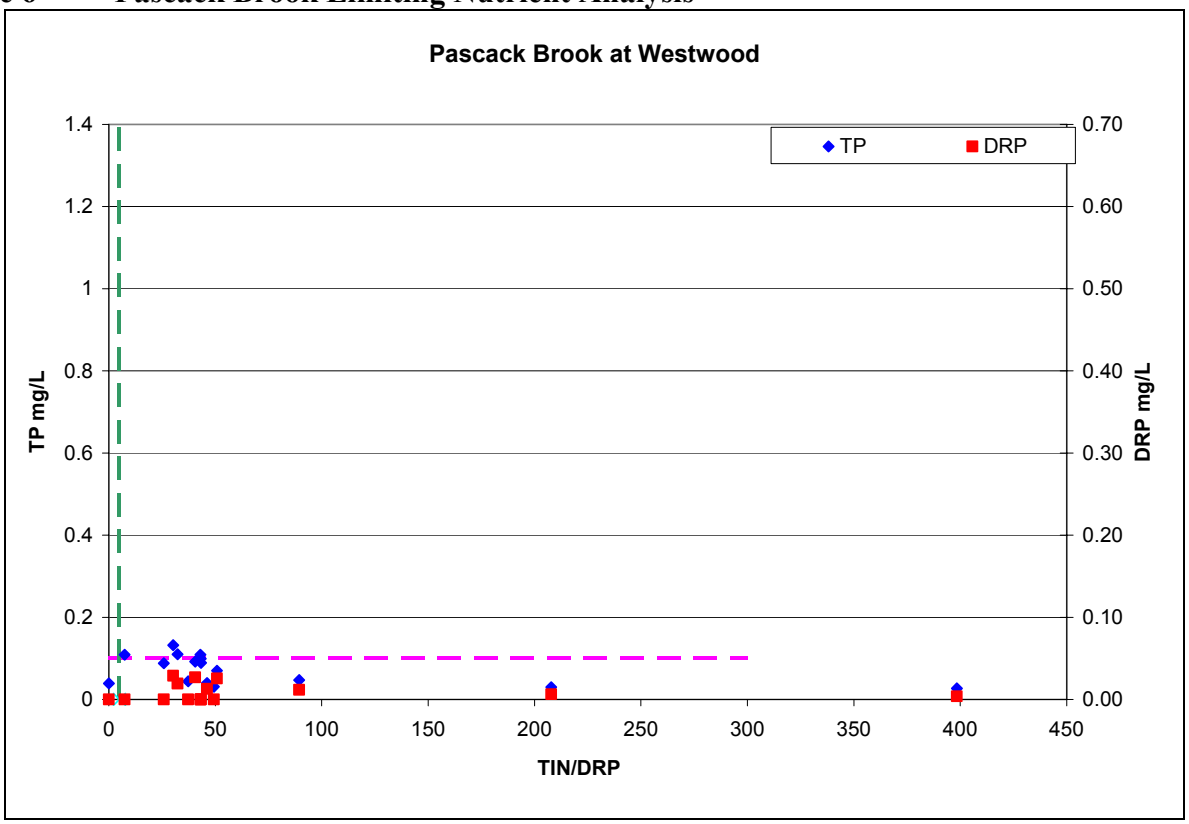
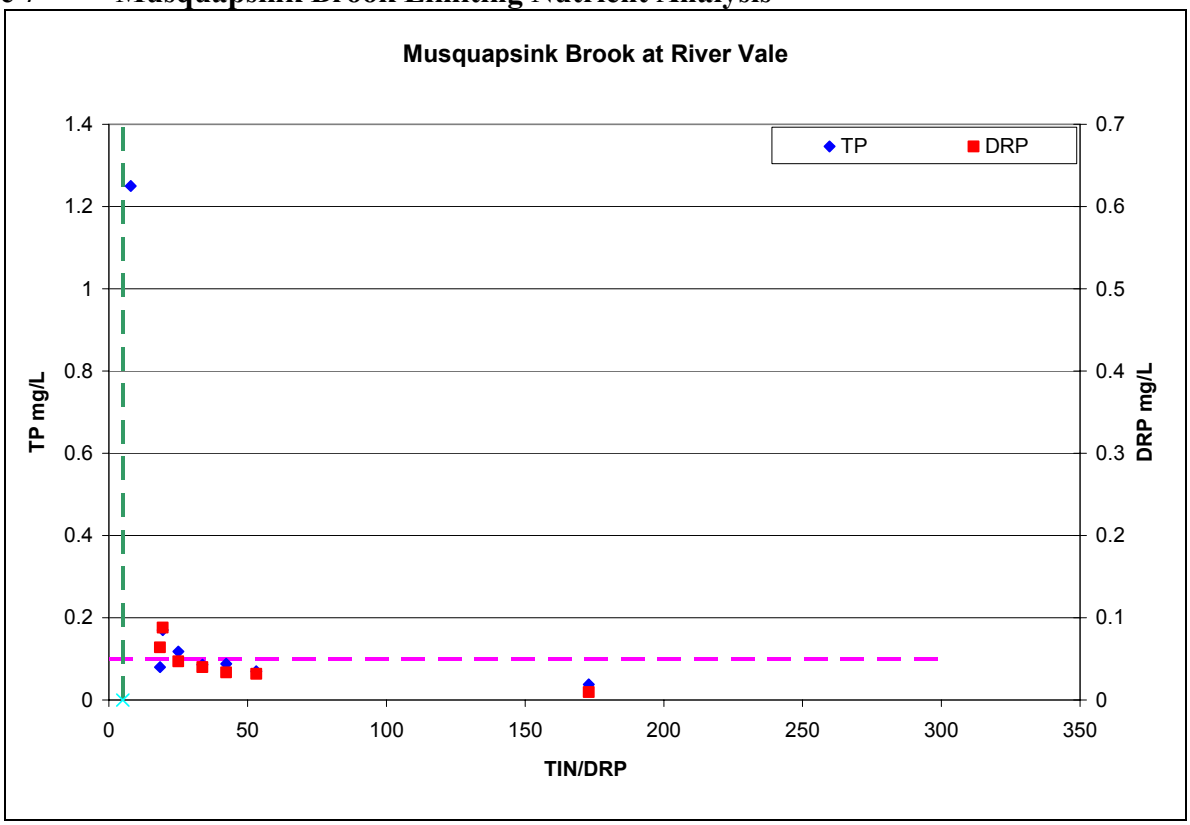


Figure 7 Musquapsink Brook Limiting Nutrient Analysis



Seasonal Variation/Critical Conditions

The application of a flow-integrated regression technique for determining loading reductions for impaired segments works well in watersheds that exhibit most of the loading exceedances from nonpoint and stormwater point sources of pollution. The analytical technique used to calculate these TMDLs represents the entire range of flows and all seasons for which the total phosphorus data were collected. Since the technique uses data from annual monitoring programs, seasonal variation and critical conditions are incorporated into the analysis by assessing the loadings over the entire range of flows. Therefore, the method implicitly represents all seasonal meteorological and hydrological conditions. The loading reduction calculated to attain SWQS will do so under all conditions, according to the data available. In this way, the TMDL addresses seasonal variation and critical conditions.

6.0 TMDL Calculations

A regression technique, derived from a load duration method (Stiles 2002), was developed by the Department for data-limited TMDLs where nonpoint and stormwater point sources are predominant. For this technique, linear regression is used to develop a flow-integrated relationship between measured pollutant concentrations and the associated flows at a single monitoring site. The method, known as the Flow-Integrated Reduction of Exceedances (FIRE), provides an accurate estimation of the load that will not cause an exceedance of the water quality standard. The FIRE method is applied over the entire range of flows, eliminating the need to establish a single target flow to estimate an average annual loading reduction. For this approach, calculated phosphorus loads based on actual data are plotted against corresponding flows. The regression relationship between the load and flow for exceedances of the SWQS is established and the regression line drawn. The target load line corresponding with the TP concentration of 0.1 mg/L is plotted on the same graph with the linear exceedance regression line. For this technique, a zero-intercept for the regression line is assumed. The zero intercept is within the 95 percent confidence interval, so the zero intercept cannot be rejected as the point of origin. In addition, given the predominance of nonpoint sources, at zero flow there would be zero load. Given a common intercept, the difference between the slopes of the two lines gives the percent load reduction needed to attain SWQS. The resultant percent reduction is the same whether the y-axis is expressed as pounds per day, pounds per year, or as metric units of kilograms per day or per year.

A Margin of Safety (MOS) must be provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)). A MOS accounts for uncertainty in the loading estimates, physical parameters and the model itself. The MOS, as described in USEPA guidance (Sutfin, 2002), can be either explicit or implicit (i.e., addressed through conservative assumptions used in establishing the TMDL). For this TMDL calculation, an explicit MOS has been incorporated as described below.

A percent loading reduction that includes a margin of safety is estimated by taking the difference between the upper 95 percent confidence limit of the slope of the exceedance regression line and the slope of the target loading. The margin of safety component is the difference between the exceedance regression line and the 95 percent confidence limit for the regression.

The regression results for the impaired segments are presented in Table 7 and 8, and Figure 8 and 9 below.

Table 7 **Coles Brook at Hackensack (01378560) Regression Analysis**

Results from Regression Analysis		
Target Loading Slope	=	**0.5390**
Exceedance Regression Slope	=	**0.7940**
Upper 95% Confidence Limit of Exceedance Regression Slope	=	**0.9927**

To achieve SWQS of 0.1 mg/L TP, the required reductions are as follows:

Required TP Load Reduction based on the regression line

$$(1-\frac{0.539}{0.7940})x100\% = 0.3212x100\% = 32.12\%$$

The portion of the reduction attributed to MOS is calculated as follows:

$$\text{MOS} = (1-\frac{0.794}{0.9927})x100\% = 0.2002x100\% = 20.02\%$$

Figure 8 Percent Reduction for the Coles Brook at Hackensack Using Regression Method

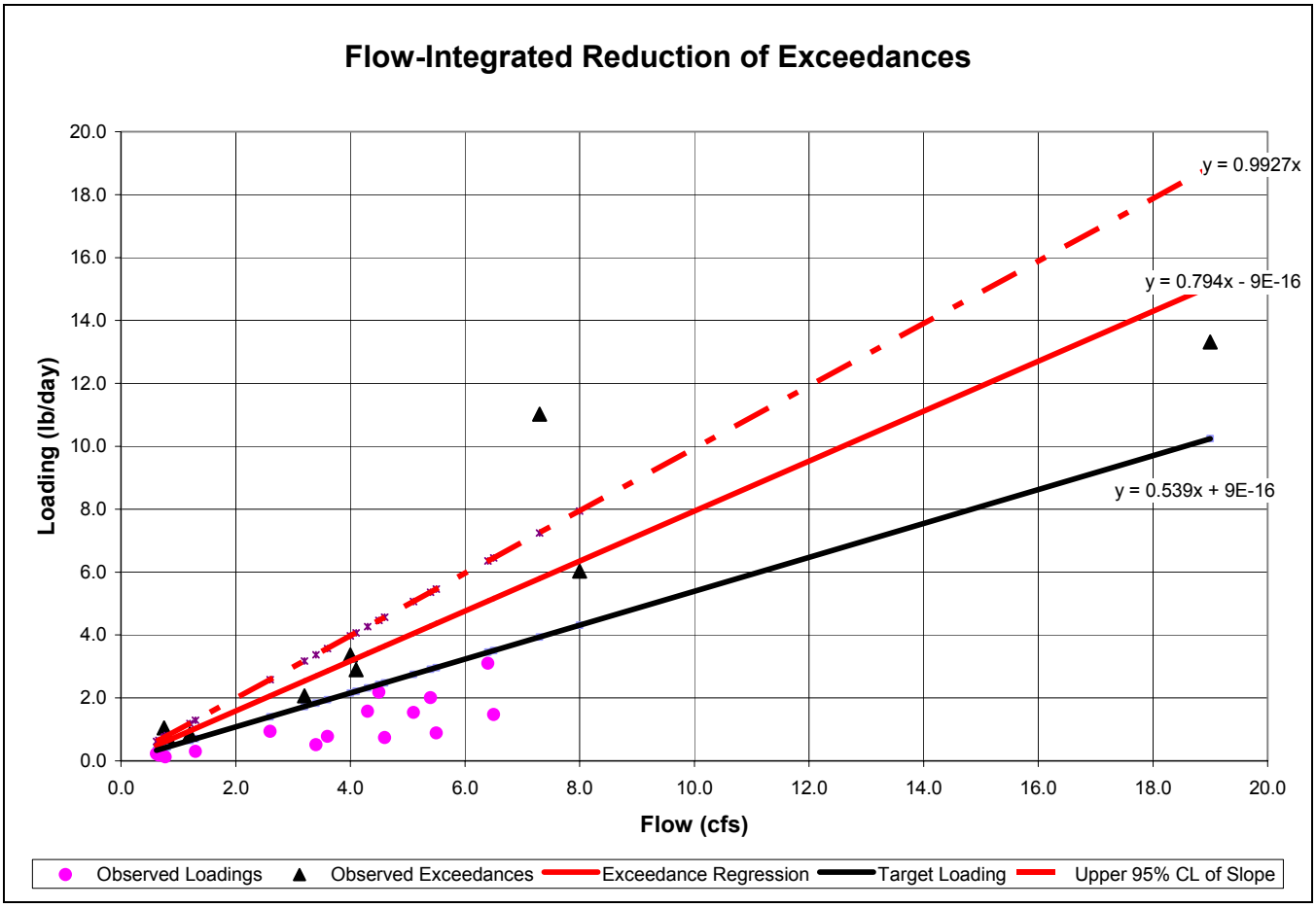


Table 8 Pascack Brook (01377500) and Musquapsink Brook (01377499) Regression Analysis

Results from Regression Analysis		
Target Loading Slope	=	**0.5390**
Exceedance Regression Slope	=	**0.6051**
Upper 95% Confidence Limit of Exceedance Regression Slope	=	**0.6824**

To achieve SWQS of 0.1 mg/L TP, the required reductions are as follows:

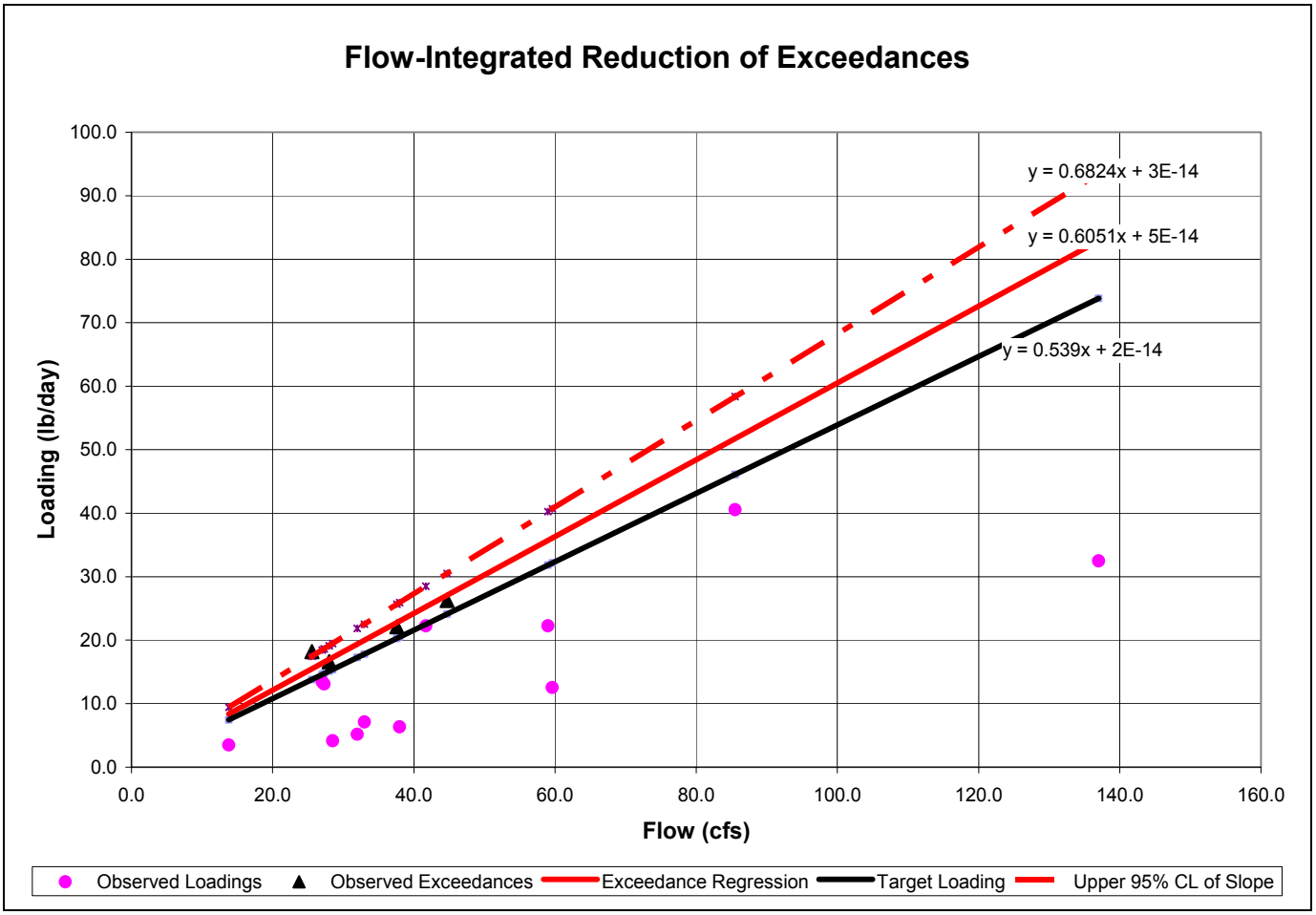
Required TP Load Reduction based on the regression line

$$(1-\frac{0.539}{0.6051})x100\% = 0.1092x100\% = 10.92\%$$

The portion of the loading reduction attributed to MOS is:

$$\text{MOS} = (1-\frac{0.6051}{0.6824})x100\% = 0.1132x100\% = 11.32\%$$

Figure 9 Percent Reduction for Pascack Brook and Musquapsink Brook Using Regression Method



To determine the TMDL for each stream segment, the target load is calculated as shown above. The load that corresponds to the MOS is calculated and then subtracted from the target load. The result is the allocable load. Loads from some land uses, specifically forest, wetland, water and barren land, are not adjustable. There are no measures that can reasonably be applied to runoff from these sources to reduce the loads generated. As a result, existing loads from these sources are equal to the future loads. Therefore, in order to achieve the TMDL, the load reduction from land uses for which reduction measures can reasonably be applied must be increased proportionally. The procedure to do this is described in more detail in Appendix 5.

Wasteload Allocations and Load Allocations

WLAs are established for all point sources, while LAs are established for nonpoint sources, as these terms are defined in "Source Assessment." There are no point sources, other than stormwater point sources in the affected streamsheds. Both WLAs and LAs are expressed as percent reductions for particular stream segments, and are differentiated as discussed below.

Stormwater discharges can be a point source or a nonpoint source, depending on NJPDES regulatory jurisdiction, yet the suite of measures to achieve reduction of loads from stormwater discharges is the same, regardless of this distinction. Stormwater point sources receiving a WLA are distinguished from

stormwater generating areas receiving a LA on the basis of land use. This distribution of loading capacity between WLAs and LAs is consistent with recent EPA guidance that clarifies existing regulatory requirements for establishing WLAs for stormwater discharges (Wayland, November 2002). Stormwater discharges are captured within the runoff sources quantified according to land use, as described previously. Distinguishing between regulated and unregulated stormwater is necessary in order to express WLAs and LAs numerically; however, "EPA recognizes that these allocations might be fairly rudimentary because of data limitations and variability within the system" (Wayland, November 2002, p.1). Therefore allocations are established according to source categories as shown in Table 9. This demarcation between WLAs and LAs based on land use source categories is not perfect, but it represents the best estimate defined as narrowly as data allow. The Department acknowledges that there may be stormwater sources in the residential, commercial, industrial and mixed urban runoff source categories that are not NJPDES-regulated. Nothing in these TMDLs shall be construed to require the Department to regulate a stormwater source under NJPDES that would not already be regulated as such, nor shall anything in these TMDLs be construed to prevent the Department from regulating a stormwater source under NJPDES.

Table 9 Distribution of WLAs and LAs among source categories

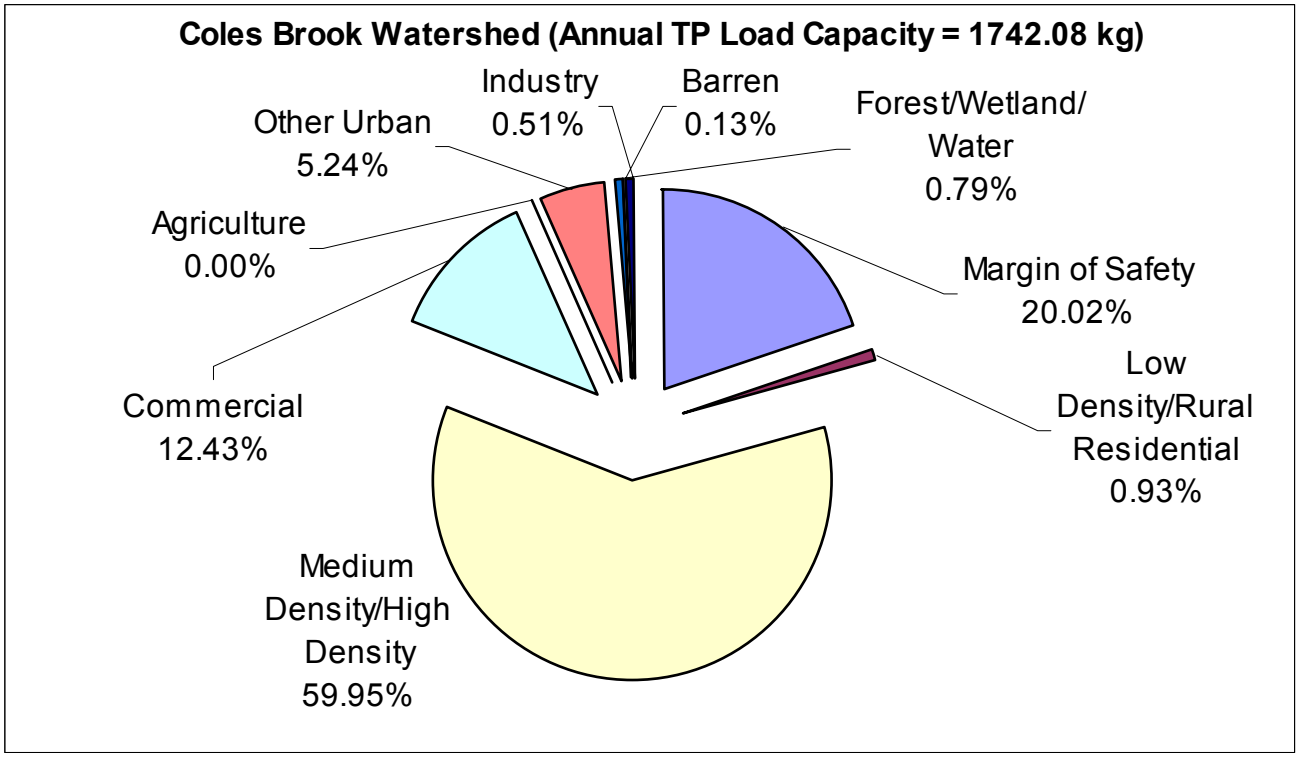
Source Category	**TMDL Allocation**
Nonpoint and Stormwater Sources	
Medium / high density residential	WLA
Low density / rural residential	WLA
Commercial	WLA
Industrial	WLA
Mixed urban / other urban	WLA
Agricultural	LA
Forest, wetland, water	LA
Barren land	LA

Wasteload allocations and load allocations for sources within the drainage area of the impaired segment are presented in Tables 10 and 11, and in Figures 10 and 11.

Table 10 TMDL calculations for the Coles Brook at Hackensack (01378560)

	Coles Brook Watershed			
	Current kg TP/yr (lbs/yr)	**Reduced kg TP/yr (lbs/yr)**	**% of Current Load**	**% Reduction**
Impaired Stream Calculated Load	2566.41 (5657.97)	n/a	100%	n/a
Loading capacity (LC)	n/a	1742.08 (3840.63)	67.88%	n/a
Load allocation (LC-MOS)	n/a	1393.32 (3071.75)	54.29%	n/a
Point Sources other than Stormwater	n/a			
Nonpoint and Stormwater Sources	**kg TP/yr (lbs/yr)**	**kg TP/yr (lbs/yr)**	**% of LC**	**% Reduction**
Medium / high density residential	1933.94 (4263.60)	1044.40 (2302.51)	59.95%	46.00%
Low density / rural residential	29.94 (66.00)	16.17 (35.65)	0.93%	46.00%
Commercial	401.13 (884.34)	216.62 (477.57)	12.43%	46.00%
Industrial	16.48 (36.33)	8.90 (19.62)	0.51%	46.00%
Mixed urban / other urban	168.93 (372.43)	91.23 (201.13)	5.24%	46.00%
Agricultural	0	0	0%	46.00%
Forest, wetland, water	13.83 (30.49)	13.83 (30.49)	0.79%	0%
Barren land	2.17 (4.78)	2.17 (4.78)	0.12%	0%
Margin of Safety (MOS)	n/a	348.76 (768.88)	22.63%	n/a
TOTAL	2566.41 (5657.97)	1742.08 (3840.63)	100.00%	32.12%

Figure 10 Phosphorus allocations for the Coles Brook at Hackensack (01378560)



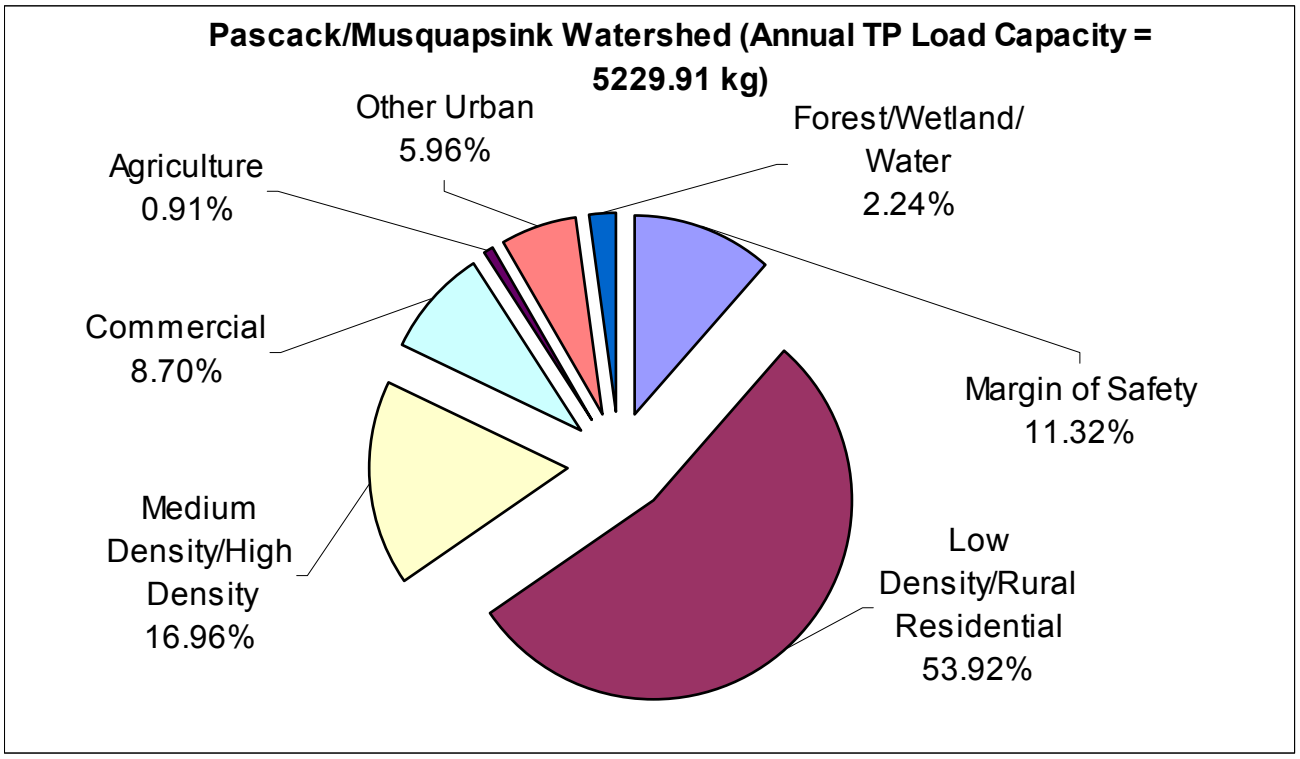
Where portions of the Pascack Brook watershed are located in New York State, the TP TMDL calculations below should be used as guidance for developing a load reduction level. New York State shall separately evaluate the headwaters' contributory TP load to the stream in detail. The TMDL for Pascack Brook requires the TP stream concentration meet the SWQS of 0.1 mg/l where the headwaters of the impaired segment enter New Jersey.

Table 11 TMDL calculations for Pascack Brook (01377500) and Musquapsink Brook (01377499)

	Pascack/Musquapsink			
	Current kg TP/yr (lbs/yr)	**Reduced kg TP/yr (lbs/yr)**	**% of Current Load**	**% Reduction**
Impaired Stream Calculated Load	5871.02 (12943.38)	n/a	100%	n/a
Loading capacity (LC)	n/a	5229.91 (11529.98)	89.08%	n/a
Load allocation (LC-MOS)	n/a	4637.88 (10224.78)	79.00%	n/a
Point Sources other than Stormwater	n/a			
Nonpoint and Stormwater Sources	**kg TP/yr (lbs/yr)**	**kg TP/yr (lbs/yr)**	**% of LC**	**% Reduction**
Medium / high density residential	1128.87 (2488.73)	886.95 (1955.39)	16.96%	21.43%
Low density / rural residential	3589.07 (7912.54)	2819.90 (6216.82)	53.92%	21.43%
Commercial	579.16 (1276.83)	455.04 (1003.19)	8.70%	21.43%
Industrial	0	0	0%	21.43%
Mixed urban / other urban	396.44 (874.00)	311.48 (686.70)	5.96%	21.43%
Agricultural	60.39 (133.14)	47.45 (104.61)	0.91%	21.43%
Forest, wetland, water	117.09 (258.14)	117.09 (258.14)	2.24%	0%
Barren land	0	0	0%	0%
Margin of Safety (MOS)	n/a	592.03 (1305.20)	11.32%	n/a
TOTAL	5871.02 (12943.38)	5229.91 (11529.98)	100.00%	10.92%

Figure 11 Phosphorus allocations for the Pascack Brook at Westwood (01377500) and

Musquapsink Brook at River Vale (01377499)



Reserve Capacity

Reserve capacity is an optional means of reserving a portion of the loading capacity to allow for future growth. Reserve capacities are not included at this time. The loading capacity of each stream is expressed as a function of the current load, and both WLAs and LAs are expressed as percentage reductions for particular stream segments. Therefore, the percent reductions from current levels must be attained in consideration of any new sources that may accompany future development.

7.0 Follow-up Monitoring

The Water Resources Division of the U.S. Geological Survey and the Department have cooperatively operated the Ambient Stream Monitoring Network (ASMN) in New Jersey since the 1970s. The ASMN currently includes approximately 115 stations that are routinely monitored on a quarterly basis. A second ambient monitoring network, NJDEP's Supplemental Ambient Surface Water Network (100 stations), has improved spatial coverage for water quality monitoring in New Jersey. The data from this these networks have been used to assess the quality of freshwater streams and percent load reductions. The ambient networks, as well as targeted studies, will be the means to determine the effectiveness of TMDL implementation and the need for additional management strategies.

8.0 Implementation Plan

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint and stormwater sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint and stormwater source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993).

The Department recognizes that TMDLs alone are not sufficient to restore impaired stream segments. The TMDL establishes the required pollutant reduction targets while the implementation plan identifies some of the regulatory and non-regulatory tools to achieve the reductions, matches management measures with sources, and suggests responsible entities for non-regulatory tools. This provides a basis for aligning available resources to assist with implementation activities. Projects proposed by the State, local government units and other stakeholders that would implement the measures identified within the impaired watershed are a priority for available State (for example, CBT) and federal (for example, 319(h)) funds. In addition, the Department's ongoing watershed management initiative will develop detailed watershed restoration plans for impaired stream segments in a priority order that will identify more specific measures to achieve the identified load reductions.

The stormwater facilities subject to regulation under NPDES in this watershed must be assigned WLAs. The WLAs for these point sources are expressed in terms of the required percent reduction for nonpoint sources and are applied to the land use categories that correspond to the areas regulated under industrial and municipal stormwater programs. The BMPs required through stormwater permits, including the additional measure discussed below, are generally expected to achieve the required load reductions. The success of these measures will be assessed through follow up monitoring. As needed through adaptive management, other additional measures may need to be identified and included in stormwater permits. Follow up monitoring or watershed restoration plans may determine that other additional measures are required, which would then be incorporated into Phase II permits. Additional measures that may be considered include, for example, more frequent street sweeping and inlet cleaning, or retrofit of

stormwater management facilities to include nutrient removal. A more detailed discussion of stormwater source control measures follows.

On February 2, 2004 the Department promulgated two sets of stormwater rules: The Phase II New Jersey Pollutant Discharge Elimination System (NJPDES) Stormwater Rules, N.J.A.C. 7:14A and the Stormwater Management Rules, N.J.A.C. 7:8

Municipal Stormwater Regulation Program

The Phase II NJPDES rules for the Municipal Stormwater Regulation Program require municipalities, highway agencies, and regulated "public complexes" to develop stormwater management programs consistent with the NJPDES permit requirements. The stormwater discharged through "municipal separate storm sewer systems" (MS4s) is regulated under the Department's Phase II NJPDES stormwater rules. Under these rules and associated general permits, Tier A municipalities are required to implement various control measures that should substantially reduce phosphorus loadings in the impaired watersheds. These control measures include adoption and enforcement of a pet waste disposal ordinance, prohibiting the feeding of unconfined wildlife on public property, cleaning catch basins, performing good housekeeping at maintenance yards, and providing related public education and employee training. These basic requirements will provide for a measure of load reduction from existing development. As the Phase II stormwater rules are a federal mandate, New York has also developed a municipal stormwater program.

Each impaired watershed was assessed for the applicability of a mandatory low phosphorous fertilizer ordinance to aid in the reduction of phosphorus loading from nonpoint sources. If the watershed contained a high percentage of agricultural land uses, it was determined that the greatest nonpoint source reductions would be achieved through the implementation of agricultural BMPs, and therefore the low phosphorus fertilizer ordinance for urban land uses was not required as an additional measure. However, in those sub-watersheds which contained a small percentage of agricultural land uses, and a high percentage of urban land uses, it was determined that the low phosphorus fertilizer ordinance was necessary in order to effectively reduce the phosphorus load originating from the urban land uses.

In the impaired watersheds covered by these established TMDLs, it was determined that the low phosphorus fertilizer ordinance was required based on the guidelines provided above.

Therefore, all municipalities with contributory drainage area into the impaired stream segments will be required to adopt an ordinance as an additional measure that prohibits the outdoor application of fertilizer other than low phosphorus fertilizer, consistent with a model ordinance provided by the Department. Fertilizer does not include animal or vegetable manure or compost. This model ordinance has been posted on www.njstormwater.org. The additional measure is as follows:

Low Phosphorus Fertilizer Ordinance

Minimum Standard – Municipalities listed in Appendix 3 shall adopt and enforce an ordinance, consistent with a model ordinance provided by the Department, to prohibit the outdoor application of fertilizer other than low phosphorus fertilizer, except:

Any application of fertilizer at a commercial farm that is exempted by the Right to Farm Act, N.J.S.A. 4:1C-1 et seq.

Any application of fertilizer needed for establishing new vegetation after land disturbance 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.

Measurable Goal - Municipalities listed in Appendix 3 shall certify annually that they have met the Low Phosphorus Fertilizer Ordinance minimum standard.

Implementation - Within 6 months from adoption of the TMDL, municipalities listed in Appendix 3 shall have fully implemented the Low Phosphorus Fertilizer Ordinance minimum standard.

Stormwater Management Rules

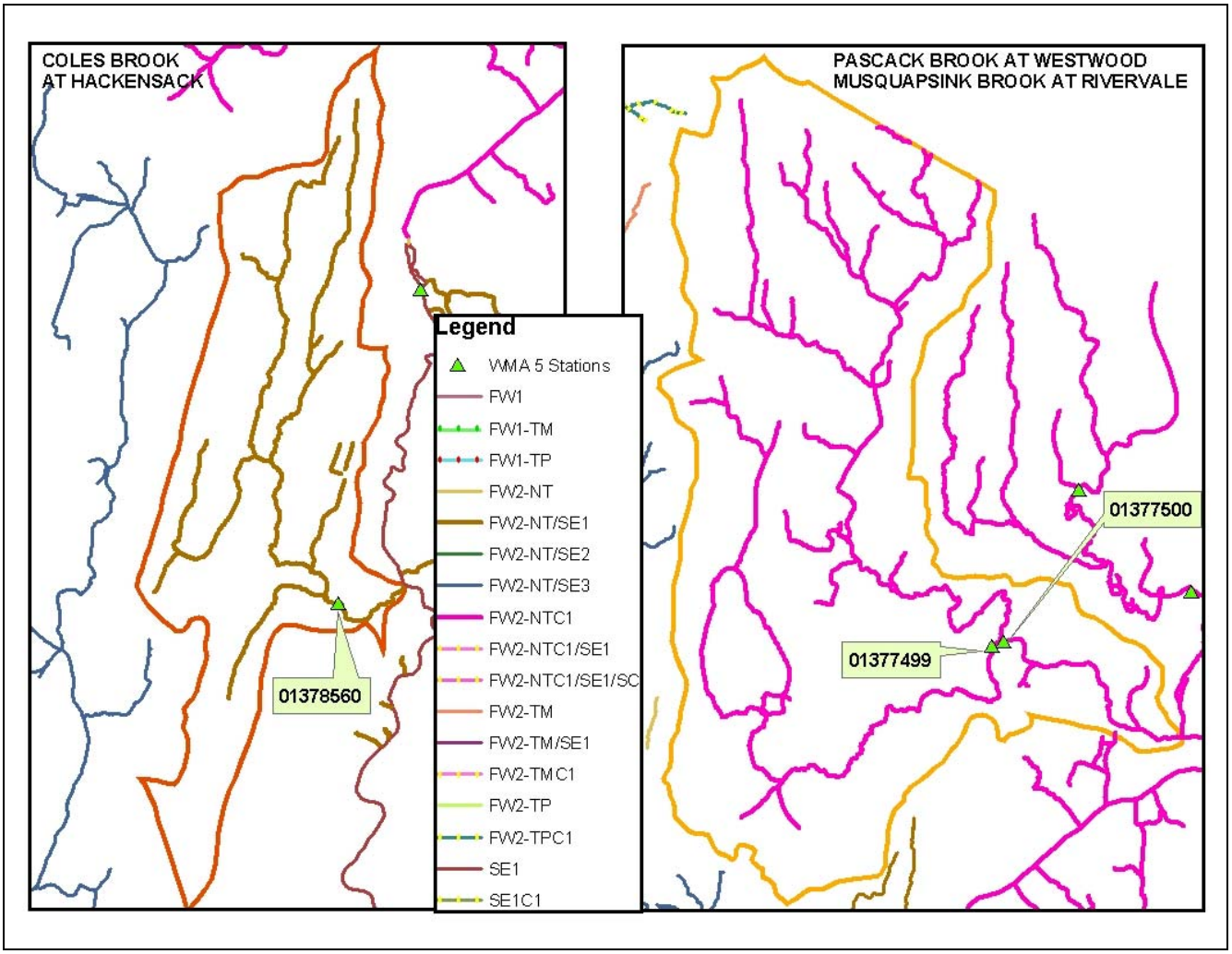
The Stormwater Management Rules have been updated for the first time since their original adoption in 1983. These rules establish statewide minimum standards for stormwater management in new development, and the ability to analyze and establish region-specific performance standards targeted to the impairments and other stormwater runoff related issues within a particular drainage basin through regional stormwater management plans. The Stormwater Management Rules are currently implemented through the Residential Site Improvement Standards (RSIS) and the Department's Land Use Regulation Program (LURP) in the review of permits such as freshwater wetlands, stream encroachment, CAFRA, and Waterfront Development.

The Stormwater Management Rules focus on the prevention and minimization of stormwater runoff and pollutants in the management of stormwater. The rules require every project to evaluate methods to prevent pollutants from becoming available to stormwater runoff and to design the project to minimize runoff impacts from new development through better site design, also known as low impact development. Some of the issues that are required to be assessed for the site are the maintenance of existing vegetation, minimizing and disconnecting impervious surfaces, and pollution prevention techniques. In addition, performance standards are established to address existing groundwater that contributes to baseflow and aquifers, to prevent increases to flooding and erosion, and to provide water quality treatment through stormwater management measures for TSS and nutrients.

As part of the requirements under the municipal stormwater permitting program, municipalities are required to adopt and implement municipal stormwater management plans and stormwater control ordinances consistent with the requirements of the stormwater management rules. As such, in addition to changes in the design of projects regulated through the RSIS and LURP, municipalities will also be updating their regulatory requirements to provide the additional protections in the Stormwater Management Rules within approximately two years of the issuance of the NJPDES General Permit Authorization.

Furthermore, the New Jersey Stormwater Management Rules establish a 300-foot special water resource protection area (SWRPA) around Category One (C1) waterbodies and their intermittent and perennial tributaries, within the HUC 14 subwatershed. In the SWRPA, new development is typically limited to existing disturbed areas to maintain the integrity of the C1 waterbody. C1 waters receive the highest form of water quality protection in the state, which prohibits any measurable deterioration in the existing water quality. Figure 12 shows the category one (C1) waterways in the Pascack Brook/Musquapsink Brook Watershed. Definitions for surface water classifications, detailed segment description, and designated uses may be found in various amendments to the Surface Water Quality Standards at www.state.nj.us/dep/wmm/sgwqt/sgwqt.html.

Figure 12 Category One Waterways within Coles Brook, Pascack Brook, and Musquapsink Brook



Segment Specific Measures

Source assessment within the impaired watersheds was conducted previously by the Department for the recently completed fecal coliform TMDLs and as part of the March 2005 Draft *Watershed Characterization and Assessment Report* prepared by Malcolm Pirnie for the Bergen County Department of Health Services. The findings confirm most of the sources will respond to the municipal stormwater management program basic measures and the additional measure established through this TMDL report. Corporate lawns and goose populations were identified as sources that need to be addressed beyond these measures. Goose management programs and corporate stewardship programs to effect alternative landscaping practices that minimize goose habitat and the need for fertilizer are the implementation measures identified to respond to these sources.

Coles Brook (Site ID # 01378560)

Based on the documented land uses in this watershed, total phosphorus loads are primarily contributed by runoff from high/medium residential properties and commercial lands. More specific sources include geese, pet waste, and fertilization of lawns and golf courses. According to data collected by United Water, headwaters and tributaries of the Pascack Brook show no signs of

phosphorus as being a concern until at least 1.0 mile downstream of Woodcliff Lake. Since the predominant land use downstream of Woodcliff Lake is residential, targeted programs should be developed and implemented to educate homeowners on stormwater management and the proper application of fertilizers. Since this watershed area is sewered, onsite wastewater treatment systems are not a potential source of pollution in this watershed. No agriculture is located in this watershed. Geese/waterfowl, disposable diapers, and dog waste were observed at Van Saun Park. Geese were observed at the Emerson Golf Course, Paramus Middle School alongside Behnke Brook (feeds into Coles Brook) and at commercial complexes. A zoo was observed but is serviced by sanitary sewers. Community based goose management programs are recommended as an implementation measure.

Musquapsink Brook at River Vale (Site ID #01377499) and Pascack Brook at Westwood (Site ID #01377500)

Canada Geese were observed at elementary school ballfields and nearby cemeteries in the Musquapsink Brook watershed. For Pascack Brook, a potential source of phosphorus is the Canada goose populations at Washington Lake, now known as Schlegel Lake in Washington Township. Schlegel Lake is a private waterbody, owned by the surrounding homeowners. Other sources included: Woodcliff Lake Reservoir, Corporate Parks in Montvale (source of geese droppings to Bear Brook which feeds into Pascack Brook). A goose management strategy should be developed for Schlegel Lake, for athletic fields and cemeteries, and commercial complexes that maintain large areas of grass. These areas provide habitat areas for Canada geese. A goose management strategy will reduce both fecal coliform and phosphorus load generated by the goose population. Efforts to reduce eutrophication in Schlegel Lake will benefit the overall watershed and the potable water supply to which the Musquapsink Brook flows. Commercial complexes with large area of grass also need to be fertilized; an inventory of the commercial facilities should be prepared and a targeted plan to promote alternative landscaping strategies should be implemented.

Current Implementation Projects

The Hackensack Riverkeeper, Inc. was awarded a 319(h) grant on February 9, 2001 to restore approximately 750 linear feet of Coles Brook. The subject area is located adjacent to Staib Park, Bergen County, New Jersey. The restoration project included:

- A decrease in impervious surfaces, which currently abut the riparian area;
- An increase in buffer area, which acts as a filtration for storm water runoff;
- In-stream bioengineering, which helps prevent further and future stream bank erosion;
- Bank stabilization through vegetative management;
- Erosion control; and
- A public stewardship and awareness program for local residents, schools, industries, and government officials.

Also, the Bergen County Department of Parks was awarded a 319(h) grant in 2002 to perform erosion control work on Van Saun Brook.

Priority Stream Segment Restoration Plans

In addition to the generic and specific, current and future implementation measures identified above, the Department, through its watershed management program, is undertaking the development of watershed restoration plans for priority stream segments. These restoration plans will identify specific measures and the means to accomplish them, beyond those identified in this TMDL report, that will assist in

attainment of the required load reductions. Due to the number of TMDLs recently generated, the Department must prioritize which stream segments will be the focus of initial consideration. The Department's nutrient policy states that, "Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the water unsuitable for the designated uses (N.J.A.C. 7:9B-1.5(g)3)." With respect to nutrient TMDLs, the initial priority will be given to those streams where use impairments exist in the impaired stream or downstream lakes, beyond simple exceedance of the water quality criterion. Other priority considerations include:

- Headwater area;
- Proximity to drinking water supply;
- Proximity to recreation area;
- Possibility of adverse human health conditions;
- Proximity to a lake intake;
- Existence of eutrophication;
- Phosphorus is identified as the limiting nutrient;
- Existence of use impairments;
- Ability to create a measurable change;
- Probability of human source;
- Stream Classifications;
- High success level.

9.0 Reasonable Assurance

Commitment to carry out the activities described in the implementation plan to reduce phosphorus loads provides reasonable assurance that the SWQS will be attained for phosphorus in the (name of watershed/WMA or Water region). Reasonable Assurance for the implementation of these TMDLs has been considered for point and nonpoint sources for which phosphorus load reductions are necessary. Moreover, stormwater sources for which WLAs have been established will be regulated as NJPDES point sources. Follow-up monitoring will identify if the strategies implemented are completely, or only partially successful. It will then be determined if other management measures can be implemented to fully attain the SWQS or if it will be necessary to consider other approaches, such as use attainability.

10.0 Public Participation

The Water Quality Management Planning Rules at NJAC 7:15-7.2 requires the Department to initiate a public process prior to the development of each TMDL and to allow public input to the Department on policy issues affecting the development of the TMDL. Further, the Department shall propose each TMDL as an amendment to the appropriate area-wide water quality management plan in accordance with procedures at N.J.A.C. 7:15-3.4(g).

Outreach was performed in the form of presenting the TMDL process and method used in this document at the WMA 5 TAC meeting on May 17th, 2005. Printed, detailed maps of the three impaired segments were distributed. In addition, electronic maps showing the spatial extent of the impaired segments and a PowerPoint presentation describing the TMDL process and method used were posted online at http://www.state.nj.us/dep/watershedmgt/tmdl_segments.htm on June 1st, 2005 and public comment was solicited.

Amendment Process

In accordance with N.J.A.C. 7:15–7.2(g), these TMDLs were proposed by the Department as an amendment to the Northeast WQMP. Notice proposing these TMDLs was published on July 5, 2005 in the New Jersey Register and in newspapers of general circulation in the affected area in order to provide the public an opportunity to review the TMDLs and submit comments. In addition, a public hearing was held on the established TMDLs on August 9, 2005 with an informal presentation from 7:00 to 7:30pm, and the public hearing from 7:30 to 9:00pm at the Bergen County Dept. of Health Services, Community Services Building, 327 East Ridgewood Avenue, Paramus, New Jersey 07652-4895. Notice of the proposal and the hearing was provided to affected municipalities. The Department considered all timely comments prior to making a decision to adopt these TMDLs. The outcome of the public participation process is described in Appendix 6.

11.0 References:

BASIN - New Jersey, Version 1.0. December 2004. Prepared by Tetra-Tech, Inc.

Eisenreich, S.J. and J. Reinfelder. 2001. The New Jersey Air Deposition Network: Interim Report. Department Environmental Sciences, Rutgers University.

Kratzer, Todd W., Flow-Integrated Load Reduction Estimation Technique for TMDLs, Water Environment Federation, June 2005.

National Research Council, Assessing the TMDL Approach to water quality management. National Academy Press, Washington, D.C. 2001

New Jersey Department of Environmental Protection. 2003. *'Technical Manual for Phosphorus Evaluation for NJPDES Discharge to Surface Water Permits",* Division of Water Quality, N.J.A.C. 7:9b-1.14(c).

New Jersey Department of Environmental Protection. 2004. Surface Water Quality Standards. Water Monitoring and Standards.

New Jersey Department of Environmental Protection. 2004. New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report. Water Monitoring and Standards.

New Jersey Department of Environmental Protection. 1998. Identification and Setting of Priorities for Section 303(d) Water Quality Limited Waters in New Jersey, Office of Environmental Planning

Stiles, T., Cleland, B., Martin, C., Sullivan, A., May 2002. TMDL Development Using Load Duration Curves. Presented at an Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) TMDL "Brown Bag" seminar.

Sutfin, C.H. May, 2002. Memo: EPA Review of 2002 Section 303(d) Lists and Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992. Office of Wetlands, Oceans and Watersheds, U.S.E.P.A.

Thomann, R.V. and J.A. Mueller. 1987. Principles of Surface Water Quality Modeling and Control, Harper & Row, Publishers, New York.

U.S.E.P.A. 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-92-002. Washington, DC.

U.S.E.P.A. 1997. Compendium of tools for watershed assessment and TMDL development. EPA841-B-97-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

U.S.E.P.A., 1999. Protocol for Developing Nutrient TMDLs. Watershed Branch, Assessment and Watershed Protection Division, Washington, DC.

U.S.E.P.A., 2003. Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Section 303(d) and 305(b) of the Clean Water Act.

Vollenweider, R.A., and J. Kerekes, 1982. Eutrophication of Waters: Monitoring, Assessment and Control. Organization for Economic Cooperation and Development (OECD), Paris. 156 p.

Wayland, R.H. III. November 22, 2002. Memo: Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs. Office of Wetlands, Oceans and Watersheds, U.S.E.P.A.

Watershed Management Area 5 Characterization and Assessment – Draft Report March 2005. Prepared by Malcolm Pirnie.

Appendix 1: Database of Phosphorus Export Coefficients

In December 2001, the Department concluded a contract with the USEPA, Region 2, and a contracting entity, TetraTech, Inc., the purpose of which was to identify export coefficients applicable to New Jersey. As part of that contract, a database of literature values was assembled that includes approximately four-thousand values accompanied by site-specific characteristics such as location, soil type, mean annual rainfall, and site percent-impervious. In conjunction with the database, the contractor reported on recommendations for selecting values for use in New Jersey. Analysis of mean annual rainfall data revealed noticeable trends, and, of the categories analyzed, was shown to have the most influence on the reported export coefficients. Incorporating this and other contractor recommendations, the Department took steps to identify appropriate export values for these TMDLs by first filtering the database to include only those studies whose reported mean annual rainfall was between 40 and 51 inches per year. From the remaining studies, total phosphorus values were selected based on best professional judgment for eight land uses categories.

The sources incorporated in the database include a variety of governmental and non-governmental documents. All values used to develop the database and the total phosphorus values in this document are included in the below reference list.

Export Coefficient Database Reference List

Allison, F.E., E.M. Roller, and J.E. Adams, 1959. Soil Fertility Studies in Lysimeters Containing Lakeland Sand. Tech. Bull. 1199, U.S. Dept. of Agriculture, Washington, D.C. p. 1-62.

Apicella, G., 2001. Urban Runoff, Wetlands and Waterfowl Effects on Water Quality in Alley Creek and Little Neck Bay. TMDL Science Issues Conference, WEF Specialty Conference.

Athayde, D. N, P. E. Shelly, E. D. Driscoll, D. Gaboury and G.B. Boyd, 1983. Results of the Nationwide Urban Runoff Program: Final Report. USEPA Water Planning Division. Washington, DC.

Avco Economic Systems Corporation, 1970. Storm Water Pollution from Urban Land Activity. Rep.11034 FKL 07/70, Federal Water Qual. Adm., U.S. Dept. of Interior, Washington, D.C. p. 325.

Bannerman, R., K. Baun, M. Bohm, P. E. Hughes, and D. A. Graczyk, 1984. Evaluation of Urban Nonpoint Source Pollution Management in Milwaukee, County, Eisconsin, Report No. PB84-114164, U.S. Environmental Protection Agency, Region V, Chicago, IL.

Bengtson, R.L. and C.E. Carter, 1989. Simulating Soil Erosion in the Lower Mississippi Valley with the CREAMS Model. From: Application of Water Quality Models for Agricultural and Forested Watersheds, edited by D.B. Beasley and D.L Thomas. Southern Cooperative Series Bulletin No. 338.

Broadbent, F.E., and H.D. Chapman, 1950. A Lysimeter Investigation of Gains, Losses and Balance of Salts and Plant Nutrients in an Irrigated Soil. Soil Sci. Soc. Amer. Proc. 14:261-269.

Carter, Gail P., 1998. Estimation of Nonpoint Source Phosphorus and Nitrogen Loads in Five Watersheds in New Jersey's Atlantic Coastal Drainage Basin. Surveying and Land Information Systems, Vol. 58, no 3. pp167-177.

CH2M Hill, 2000. Technical Memorandum 1, Urban Stormwater Pollution Assessment, prepared for North Carolina Department of Environment and Natural Resources, Division of Water Quality.

Claytor, R.A. and T.R. Schueler, 1996. “Design of Stormwater Filtering Systems,” The Center for Watershed Protection, Prepared for Chesapeake Research Consortium, Inc.

Corsi, S.R., D.J. Graczyk, D.W. Owens, R.T. Bannerman, 1997. Unit-Area Loads of Suspended Sediment, Suspended Solids, and Total Phosphorus From Small Watersheds of Wisconsin. USGS FS-195-97.

Delaware Valley Regional Planning Commission, 1977. Average Pollutant Concentrations Associated with Urban Agriculture and Forest Land Use. Working Paper 5.01-1, Extent of NPS Problems.

Eck, P., 1957. Fertility Erosion Selectiveness on Three Wisconsin Soils. Ph. D. Thesis, Univ. of Wisconsin, Madison, WI.

F.X. Brown, Inc., 1993. Diagnostic-Feasibility Study of Strawbridge Lake. FXB Project Number NJ1246-01.

Frink, C.R., 1991. Estimating Nutrient Exports to Estuaries. Journal of Environmental Quality. 20:717-724.

Horner, R., B. W. Mar, L. E. Reinelt, J. S. Richey, and J. M. Lee, 1986. Design of monitoring programs for determination of ecological change resulting from nonpoint source water pollution in Washington State. University of Washington, Department of Civil Engineering, Seattle, Washington.

Horner, R.R., 1992. Water Quality Criteria/Pollutant Loading Estimation/Treatment Effectiveness Estimation. In R.W. Beck and Associates. Covington Master Drainage Plan. King County Surface Water Management Division., Seattle, WA.

Horner, Richard R., Joseph J. Skupien, Eric H. Livingston, and H. Earl Shaver, 1994. Fundamentals of Urban Runoff Management: Technical and Institutional Issues. Prepared by the Terrene Institute, Washington, DC, in cooperation with the U.S. Environmental Protection Agency. EPA/840/B-92/002.

Johnston, W.R., F. Ittihadieh, R.M. Daum, and A.F. Pillsbury, 1965. Nitrogen and Phosphorus in Tile Drainage Effluent. Soil Sci. Soc. Amer. Proc. 29:287-289.

Knoblauch, H.C., L. Kolodny, and G.D. Brill, 1942. Erosion Losses of Major Plant Nutrients and Organic Matter from Collington Sandy Loam. Soil Sci. 53:369-378.

Loehr, R.C., 1974. Characteristics and comparative magnitude of non-point sources. Journal of WPCF 46(11):1849-1872.

Lopes, T.J., S.G. Dionne, 1998. A Review of Semivolatile and Volatile Organic Compounds in Highway Runoff and Urban Stormwater. U.S. Geological Survey, U.S. Department of Interior.

Marsalek, J., 1978. Pollution Due to Urban Runoff: Unit Loads and Abatement Measure, Pollution from Land Use Activities Reference Group. International Joint Commission, Windsor, Ontario.

McFarland, Anne M.S and L. M. Hauck, 2001. Determining Nutrient Export Coefficients and Source Loading Uncertainty Using In-stream Monitoring Data. Journal of the American Water Resources Association, pp. 223, 37. No. 1, February.

Menzel, R. G., E. D. Rhoades, A. E. Olness, and S. J. Smith, 1978. Variability of Annual Nutrient and Sediment Discharges in Runoff from Oklahoma Cropland and Rangeland. Journal of Environmental Quality, 7:401-406.

Mills, W.B., D.B. Porcella, M.J. Ungs, S.A. Gherini, K.V. Summers, L. Mok, G.L. Rupp, G.L. Bowie, 1985. Water Quality Assessment – A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water – Part I and II. EPA-600/6-85-002A&B.

Minshall, N.E., M.S. Nichols, and S.A. Witzel, 1969. Plant Nutrients in Base Flow of Streams in Southwestern Wisconsin. Water Resources. 5(3):706-713.

Mundy, C., M. Bergman, 1998. Technical Memorandum No. 29, The Pollution Load Screening Model: A tool for the 1995 District Water Management Plan and the 1996 Local Government Water Resource Atlases, Department of Water Resources, St. Johns River Water Management District.

NCDWQ, 1998. Neuse River Basinwide Water Quality Plan, Chapter 5, Section A.

Nelson, M.E., 1989. Predicting Nitrogen Concentrations in Ground Water An Analytical Model. IEP, Inc.

Northeast Florida Water Management District, 1994. St. Marks and Wakulla Rivers Resource Assessment and Greenway Protection Plan. Appendix 4.

Northern Virginia Planning District Commission, 1979. Guidebook for Screening Urban Nonpoint Pollution Management Strategies. Prepared for the Metropolitan Washington Council of Governments.

Novotny, V., H. Olem, 1994. Water Quality: Prevention, Identification, and Management of Diffuse Pollution. Van Nostrand Reinhold, NY

Omernik, J. M., 1976. The influence of land use on stream nutrient levels, US EPA January. EPA-60/3-76-014

Omni Environmental Corporation, 1991. Literature Search on Stormwater Pollutant Loading Rates. Literature cited from DVRPC 1977; Wanielista et al. 1977; Whipple and Hunter 1977; NVPDC 1980; USEPA 1983; Mills et al. 1985; Nelson 1989; Walker et al. 1989.

Omni Environmental Corporation, 1999. Whippany River Watershed Program Stormwater Model Calibration and Verification Report.

Overcash, M. R., F. J. Humenik, and J. R. Miner, 1983. Livestock Waste Management, Vol. II, CRC Press, Inc., Boca Raton, Florida.

Pacific Northwest Environmental Research Laboratory, 1974. Relationships Between Drainage Area Characteristics and Non-Point Source Nutrients in Streams. Prepared for the National Environmental Research Center, August 1974.

Panuska, J.C. and R.A. Lillie, 1995. Phosphorus Loadings from Wisconsin Watersheds: Recommended Phosphorus Export Coefficients for Agricultural and Forested Watersheds. Research Management Findings, Bureau of Research, Wisconsin Department of Natural Resources, Number 38.

Pitt, R.E., 1991. Nonpoint Source Water Pollution Management. Dep. Civil Eng., Univ. Alabama, Birmingham, AL.

Polls, Irwin and Richard Lanyon, 1980. Pollutant Concentrations from Homogeneous Land Uses. Journal of the Environmental Engineering Division.

Prey, J., D. Hart, A. Holy, J. Steuer, J. Thomas, 1996. A Stormwater Demonstration Project in Support of the Lake Superior Binational Program: Summary. Wisconsin Dept. of Natural Resources. (http://www.dnr.state.wi.us/org/water/wm/nps/tpubs/summary/lakesup.htm)

Rast, W. and G.F. Lee, 1978. Summary Analysis of the North American (U.S. Portion) OECD Eutrophication Project: Nutrient Loading -- Lake Response Relationships and Trophic State Indices., EPA-600/3-78-008.

Reckhow, K.H., M.N. Beaulac and J.T. Simpson, 1980. Modeling of Phosphorus Loading and Lake Response Under Uncertainty: A Manual and Compilation of Export Coefficients. Report No. EPA 440/5-80-011. U.S. EPA, Washington, D.C.

Ryding, S. and W. Rast, 1989. The Control of Eutrophication of Lakes and Reservoirs. Man and the Biosphere Series, United Nations Educational Scientific and Cultural Organization, Paris, France.

Schueler, T.R., 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Prepared for the Metropolitan Washington Council of Governments.

Sonzogni, W.C. and G.F. Lee, 1974. Nutrient Sources for Lake Mendota - 1972. Trans. Wisc. Acad. Sci. Arts Lett. 62:133-164.

Uchrin, C.G. and T.J. Maldanato, 1991. Evaluation of Hydrocarbons in Urban Runoff and in Detention Basins. Water Writes. Water Research Institute, Division of Coastal and Environmental Studies, Rutgers University.

United States Geological Survey, U.S. Department of the Interior, 1998. Comparison of NPDES Program Findings for Selected Cities in the United States, USGS Fact Sheet, January

USEPA, 1987. Guide to Nonpoint Source Pollution Control. U.S. EPA, Criteria and Standards Division, Washington D.C.

USEPA, 1993. Urban Runoff Pollution Prevention and Control Planning (handbook). EPA/625/R-93/004.

USEPA, 2000. Watershed Analysis and Management (WAM) Guide for Tribes. (http://www.epa.gov/owow/watershed/wacademy/wam/)

Uttormark, P.D., J.D. Chapin, and K.M. Green, 1974. Estimating nutrient loadings of lakes from non-point sources. U.S. Environmental Protection Agency, Washington, D.C. 112 p. (WRIL 160609). EPA-660/3-74-020.

Walker, J.F., 1989. Spreadsheet Watershed Modeling for Nonpoint Source Pollution Management in a Wisconsin Basin, Water Resources Bulletin, Vol. 25, no. 1, pp. 139-147.

Wanielista, M.P., Y.A. Yousef, and W.M. McLellon, 1977. Nonpoint Source Effects on Water Quality, Journal Water Pollution Control Federation, Part 3, pp. 441-451.

Washington State Department of Ecology, 2000. Stormwater Management Manual for Western Washington: Volume I Minimum Technical Requirements. Publication No. 99-11.

Weidner, R.B., A.G. Christianson, S.R. Weibel, and G.G. Robeck, 1969. Rural Runoff as a Factor in Stream Pollution. J. Water Pollution. Con. Fed. 36(7):914-924.

Whipple, W. and J.V. Hunter, 1977. Nonpoint Sources and Planning for Water Pollution Control. Journal Water Pollution Control Federation. pp. 15-23.

Whipple, W., et al., 1978. Effect of Storm Frequency on Pollution from Urban Runoff, J. Water Pollution Control Federation. 50:974-980.

Winter, J.G. and H.C. Duthie, 2000. Export Coefficient Modeling to assess phosphorus loading in an urban watershed. Journal of American Water Resources Association. Vol. 36 No. 5.

Zanoni, A.E., 1970. Eutrophic Evaluation of a Small Multi-Land Use Watershed. Tech. Completion Rep. OWRR A-014-Wis., Water Resources Center, Univ. of Wisconsin, Madison, WI.

Appendix 2: Database of Sampling Results

		Total or Dissolved NH3-P00610 or P00608	Total or dissolved NO3+NO2-P00630 or P00631	Ortho P or 80% of total dissolved phosphorus-P00671 or P00666	TP - P00665		Discharge Inst. Flow, P00061	
Sample Date	**Station ID**	**NH_3**	**$NO_3 + NO_2$**	**DRP**	**TP**	**TIN/DRP**	**Flow, cfs**	**Data Source**
11/23/1998	1377499	0.03	1.15	0.064	0.08	18.44	n/a	USGS
2/4/1999	1377499	0.18	1.52	0.032	0.07	53.13	n/a	USGS
5/6/1999	1377499	0.03	1.68	0.088	0.17	19.43	n/a	USGS
8/24/1999	1377499	0.03	7.62	0.968	1.25	7.90	n/a	USGS
11/18/1999	1377499	0.06	1.36	0.0336	0.088	42.26	n/a	USGS
2/8/2000	1377499	0.04	1.62	0.0096	0.038	172.92	n/a	USGS
5/23/2000	1377499	0.19	0.99	0.0472	0.118	25.00	n/a	USGS
9/7/2000	1377499	0.03	1.32	0.04	0.086	33.75	n/a	USGS
11/5/1997	1377500	0.03	0.56	0.01	0.04	46.09	33.0	USGS
2/9/1998	1377500	0.03	1.3	0.01	0.03	207.81	32.0	USGS
5/19/1998	1377500	0.14	1.16	0.03	0.07	50.78	59.0	USGS
9/10/1998	1377500	0.03	0.59	0.02	0.11	32.29	28.0	USGS
11/22/1999	1377500	0.03	1	0.01	0.047	89.41	13.8	USGS
2/8/2000	1377500	0.03	1.5	0.00	0.027	398.44	28.5	USGS
5/25/2000	1377500	0.13	0.96	0.03	0.092	40.55	27.0	USGS
9/6/2000	1377500	0.05	0.82	0.03	0.132	30.21	25.6	USGS
11/13/02	1377500	0.038	0.542	0.078	0.109	7.44	37.6*	EWQ
2/24/03	1377500	0.173	1.13	0.035	0.044	37.23	137.0	EWQ
6/9/03	1377500	0.146	0.862	0.039	0.088	25.85	85.5	EWQ
9/8/03	1377500	0.053	1.03	0.025	0.089	43.32	27.3	EWQ
12/2/2003	1377500	0.133	1.2	0.027	0.031	49.37	38.0	EWQ
3/1/04	1377500	0.064	1.46	Non-Detect	0.039	Non-Calc	59.6*	EWQ
5/18/04	1377500	0.127	1.04	0.027	0.099	43.22	41.7*	EWQ
8/19/04	1377500	0.112	1.05	0.027	0.109	43.04	44.7*	EWQ
11/5/1997	1378560	0.03	1.04	0.016	0.04	66.88	3.6	USGS
2/3/1998	1378560	0.03	1.78	0.008	0.03	226.25	4.6	USGS
5/18/1998	1378560	0.21	1.74	0.016	0.09	121.88	6.4	USGS
8/4/1998	1378560	0.2	0.84	0.048	0.18	21.67	0.81	USGS
11/4/1998	1378560	0.03	0.39	0.032	0.03	13.13	0.77	USGS
1/25/1999	1378560	0.07	1.05	0.04	0.09	28.00	4.5	USGS
5/5/1999	1378560	0.03	0.51	0.04	0.12	13.50	3.2	USGS
8/4/1999	1378560	0.44	0.34	0.08	0.26	9.75	0.75	USGS
11/3/1999	1378560	0.03	0.09	0.1376	0.28	0.87	7.3	USGS
2/23/2000	1378560	0.07	1.53	0.008	0.042	200.00	6.5	USGS
5/2/2000	1378560	0.13	1.38	0.0144	0.056	104.86	5.1	USGS
8/23/2000	1378560	0.03	1.69	0.0304	0.067	56.58	2.6	USGS
11/1/2000	1378560	0.07	0.85	0.0216	0.043	42.59	1.3	USGS
2/13/2001	1378560	0.06	1.95	0.0064	0.03	314.06	5.5	USGS
5/3/2001	1378560	0.15	1.2	0.0184	0.068	73.37	4.3	USGS
8/13/2001	1378560	0.12	0.73	0.0656	0.131	12.96	4.1	USGS
11/14/2001	1378560	0.09	0.17	0.0232	0.052	11.21	0.66	USGS
3/13/2002	1378560	0.05	0.84	0.0128	0.068	69.53	0.62	USGS

5/28/2002	1378560	0.27	1.46	0.0528	0.14	32.77	8*	USGS
8/7/2002	1378560	0.08	0.59	0.072	0.133	9.31	1.2	USGS
11/14/2002	1378560	0.03	0.23	0.08	0.156	3.25	4	USGS
2/3/2003	1378560	0.101	2.16	0.0056	0.028	403.75	3.4	USGS
5/29/2003	1378560	0.215	1.42	0.0208	0.069	78.61	5.4	USGS
8/6/2003	1378560	0.195	0.92	0.0576	0.13	19.36	19	USGS

Footnote: * - These values were calculated by developing a stage/discharge relationship at this site. The values were then used to perform the regression analysis.

Appendix 3: Tier A Municipalities in Affected Drainage Areas

NJPDES Permit No.	Facility/Municipality Name	Discharge Type	Receiving Waterbody	Additional Measures
NJG0150061	Emerson Boro	Tier A Municipal Stormwater General Permit	Coles & Musquapsink	Low phosphorus ordinance
NJG0154504	Hackensack City	Tier A Municipal Stormwater General Permit	Coles Brook	Low phosphorus ordinance
NJG0151718	Harrington Park Boro	Tier A Municipal Stormwater General Permit	Pascack Brook	Low phosphorus ordinance
NJG0148202	Hillsdale Boro	Tier A Municipal Stormwater General Permit	Pascack & Musquapsink	Low phosphorus ordinance
NJG0150118	Lodi Boro	Tier A Municipal Stormwater General Permit	Coles Brook	Low phosphorus ordinance
NJG0152561	Maywood Boro	Tier A Municipal Stormwater General Permit	Coles Brook	Low phosphorus ordinance
NJG0153761	Montvale Boro	Tier A Municipal Stormwater General Permit	Pascack Brook	Low phosphorus ordinance
NJG0150525	Oradell Boro	Tier A Municipal Stormwater General Permit	Coles & Musquapsink	Low phosphorus ordinance
NJG0148288	Paramus Boro	Tier A Municipal Stormwater General Permit	Coles & Musquapsink	Low phosphorus ordinance
NJG0154539	Park Ridge Boro	Tier A Municipal Stormwater General Permit	Pascack Brook	Low phosphorus ordinance
NJG0150142	River Edge Boro	Tier A Municipal Stormwater General Permit	Coles Brook	Low phosphorus ordinance
NJG0152927	River Vale Twp	Tier A Municipal Stormwater General Permit	Pascack Brook	Low phosphorus ordinance
NJG0150541	Saddle River Boro	Tier A Municipal Stormwater General Permit	Pascack & Musquapsink	Low phosphorus ordinance
NJG0147729	Washington Twp	Tier A Municipal Stormwater General Permit	Pascack & Musquapsink	Low phosphorus ordinance
NJG0148462	Westwood Boro	Tier A Municipal Stormwater General Permit	Pascack & Musquapsink	Low phosphorus ordinance
NJG0149900	Woodcliff Lake Boro	Tier A Municipal Stormwater General Permit	Pascack & Musquapsink	Low phosphorus ordinance
n/a	Clarkstown (NY)	n/a	Pascack Brook	n/a
n/a	Orangetown (NY)	n/a	Pascack Brook	n/a
n/a	Ramapo (NY)	n/a	Pascack Brook	n/a

Appendix 4: Phosphorus Criterion Applicability Determination

This discussion is taken from the New Jersey Department of Environmental Protection's 2003 report, *Technical Manual for Phosphorus Evaluation for NJPDES Discharge to Surface Water Permits,* Division of Water Quality, N.J.A.C. 7:9b-1.14(c).

Is Phosphorus Limiting?

The limiting nutrient can be evaluated using available nutrient concentrations by using the following thresholds to exclude phosphorus as the limiting nutrient (The acronyms TIN and DRP refer to biologically-available forms of nitrogen and phosphorus, respectively: TIN = dissolved nitrite, nitrate and ammonia; DRP = dissolved reactive phosphorus):

IF [DRP] $\geq$ 0.05 mg/l

OR TIN/DRP $\leq$ 5

THEN phosphorus can be excluded as the limiting nutrient

Figures A and B below show examples of how to plot pairs of TP and DRP data along a TIN/DRP axis to visually evaluate the phosphorus limitation thresholds at a particular location. By making the TP range twice the DRP range, the thresholds of 0.1 mg/l TP and 0.05 mg/l DRP coincide, simplifying the interpretation. Episodes when TP > 0.1 mg/l AND DRP $\leq$ 0.05 mg/l and TIN/DRP $\geq$ 5 can be identified by seeing TP in the upper right quadrant while DRP is in the lower right quadrant. If phosphorus cannot be excluded as the limiting nutrient for more than 10% of the samples that exceed the 0.1 mg/l threshold (a minimum of 2 samples), then the 0.1 mg/l criterion is applicable.

Figure A: Example of site where 0.1 mg/l criterion is applicable and exceeded

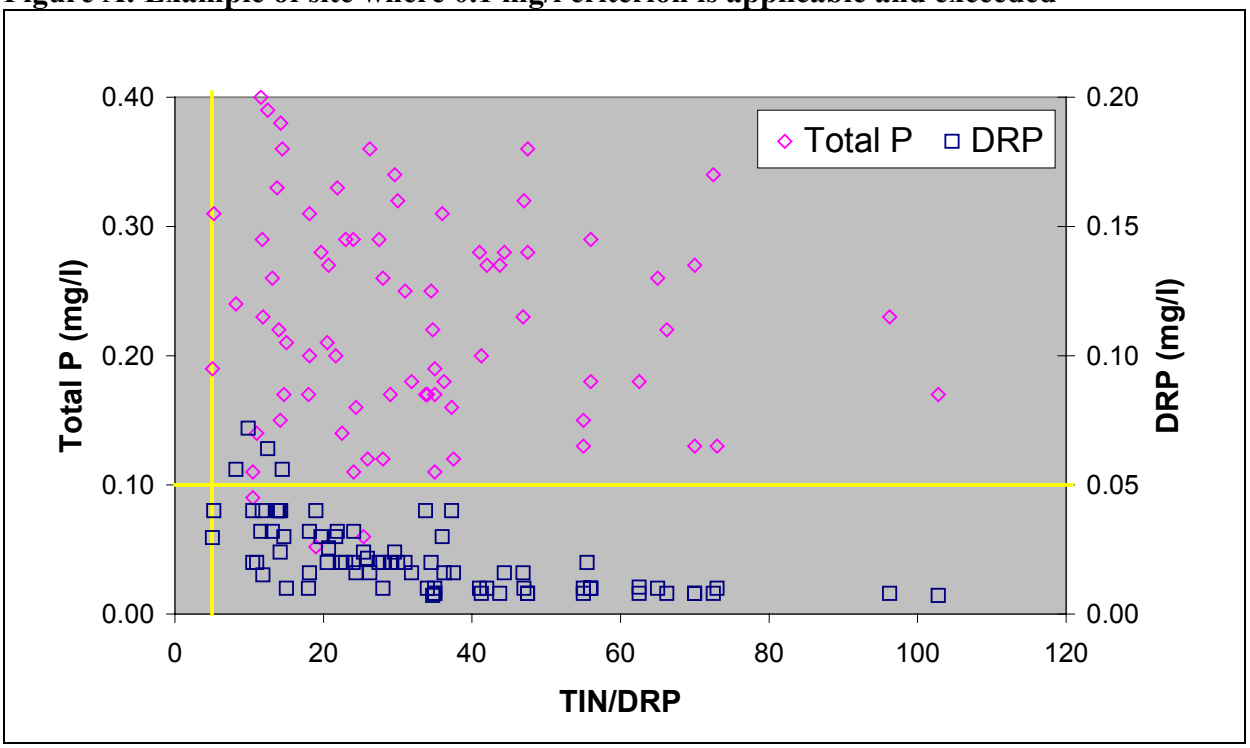
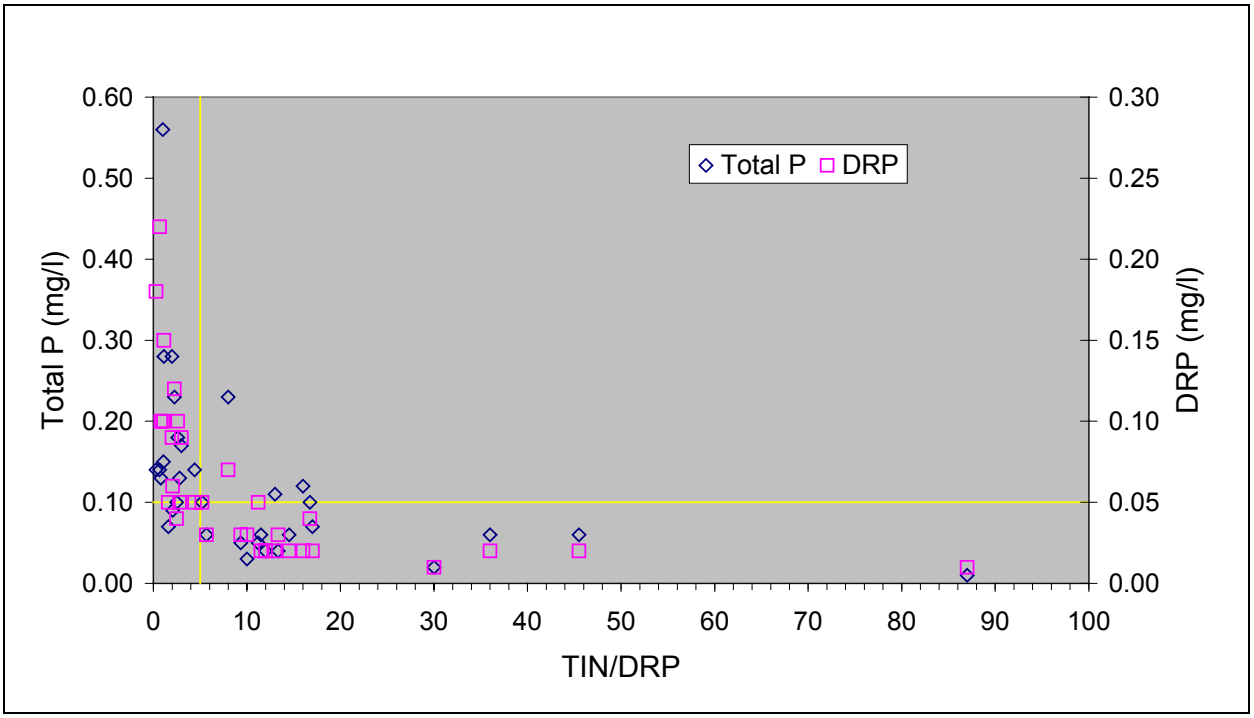


Figure B: Example of site where phosphorus is not limiting algal growth when 0.1 mg/l threshold is exceeded



Appendix 5: Methodology for Applying Percentage reductions to Land Use Loadings

The outputs of the FIRE method establish a percent reduction needed to meet the target load (that which will attain the applicable SWQS) and a margin of safety. These values are then applied to the existing land use loadings within the impaired streamshed to determine the load allocations for various land uses.

Existing loads are determined as follows. GIS is used to determine the area in acres of each of the land uses in the impaired watershed. The loading coefficients identified in the TMDL report are applied to the acres of land use to calculate an existing load for each land use in the impaired streamshed. Existing loads for point sources, other than stormwater point sources (essentially, wastewater treatment plants), if any, in the impaired streamshed are calculated using the average flow and concentration data from the discharge monitoring reports for the facilities. This load is added to the existing TP load calculated from land use.

To calculate the overall target load the percent reduction (the difference between the target load and the exceedance regression) as determined through FIRE is applied to the total existing load. The load associated with the margin of safety as determined through FIRE (the difference between the 95% confidence interval and the exceedance regression) is then removed from the overall target load (target loading line), leaving a reduced amount of loading now available to allocate. The load from any discharges is determined by taking the full permitted flow and assigning an effluent concentration. This load is also removed from the potential allocable load leaving a further reduced amount of allocable load for land uses.

There are a number of land uses from which a reduction in current load cannot be taken. These land uses include Forest, Water, Wetlands, and Barren land. The current loads for these land uses as calculated for existing load are carried over entirely as a component of the future load allocations. Therefore, for these land uses, the existing load and future load are equal. The sum of the non-reduced land use loads is then removed from the reduced allocable land use load leaving the final allocable land use load to be allocated among the land uses that are amenable to load reduction (urban and agricultural). This final allocable land use load is then applied to each land use category in proportion to the amount of each land use in the watershed.

The final percent reduction is calculated by comparing the final WLA or LA for each land use to the existing loads of those land uses. Because of the adjustments made in removing the loads associated with the MOS, the non-reduced land use loads, and discharges, the percent reduction associated with the final allocable land use load is higher than that which appears as an output to FIRE.

Example:

Land- Use	Existing Load	Percent Reduction	Allocation
Agriculture	100	88.85%	11.15
Barren	15	0%	15.00
Commercial	300	88.85%	33.45
Forest	125	0%	125.00
Low Density	40	88.85%	4.46
High Density	250	88.85%	27.88
Other Urban	15	88.85%	1.67
Water	100	0%	100.00
Wetlands	30	0%	30.00
Discharger A	25	0%	25.00
MOS			95.87
TOTAL	**1000**		**469.5**

Output from FIRE

Margin of Safety		**= 20.42%**
Target Loading		**= 46.95%**

Target Load

Target Load = 0.4695 * Existing Load
= 0.4695 * 1000
Target Load = 469.5 lb/yr

Margin of Safety

MOS = 0.2042* Target Load
= 0.2042* 469.5 lb/yr
= 95.87 lb/yr

Allocable Load

AL = Target Load – MOS
= 469.5 –95.87
= 373.63 lb/yr

Allocable Land Use Load

ALUL = AL- Future Discharge Load
= 373.6 – 25
= 348.63 lb/yr

SUM of Non Reducable Land Use Loads

Non Reduceable Land use Load = Existing Forest + Water & Wetlands Load + Barren Land Load
= 125 + 100 + 30 + 15
= 270 kg/yr

Final Allocable Land use Load

Final Allocable Land use Load = Allocable Land use Load – Non Reduce-able Land use Load
= 348.6 – 270
= 78.6 lb/yr

Final Percent Reduction

Final Percent Reduction = 1 – (Final allocable Land use load / Sum of existing load of Reduce-able land uses)
= 1 – (78.6/ 15+250+40+300+100)
= 1 – (78.6/705)
= 0.8885
= 88.85 %

Appendix 6: Response to Comments

This constitutes the New Jersey Department of Environmental Protection's (Department) response to comments raised during the comment period for the Total Maximum Daily Loads (TMDLs) for Total Phosphorus to Address 3 Streams in the Northeast Water Region's Watershed Management Area (WMA) 5, which were proposed July 5, 2005. These TMDLs were proposed as an amendment to the Northeast Water Quality Management Plan and include management approaches to reduce loadings of total phosphorus from various sources in order to attain applicable surface water quality standards for total phosphorus.

The notice proposing the TMDLs was published on July 5, 2005 in the New Jersey Register, the Express Times, and the Star Ledger. The TMDL documents were made available at the Department, upon request by mail, and on the Department's website. The Department conducted a non-adversarial public hearing on August 9, 2005 at the Bergen County Dept. of Health Services, Community Services Building in Paramus, New Jersey. The public comment period ended on August 24, 2005.

Three verbal comments were received during the non-adversarial public hearing. The comments were received from:

1. Raymond Cywinski for United Water New Jersey. (1)
2. Arnold Vernick of the Technical Advisory Committee for WMA 5. (2)
3. Raymond Cywinski, Chairman of the Technical Advisory Committee for WMA 5. (3)

In attendance at the public hearing were Don Suess, Alia Benzecey, Tony DeCandia, Arnold Vernick, Raymond Cywinski, Touray Holland, Pat Kehrberger, Linda Morehouse, Chris Szegun, Jakob Franke, Christie Hirt, Lori Charkey and Mark Becker.

Department initiated changes to the document include the following:

1. The New Jersey Environmental Management System (NJEMS), which contains NJPDES permitted facility information evaluated during TMDL development, has been added to the document under "Data Sources".
2. Priority ranking and impairments not addressed by these TMDLs have been identified in the text.

3. Addition of an addendum demonstrating the methodology to convert the percent reductions obtained from applying FIRE to percent reductions per land use category.
4. Addition of an explanation regarding selection of municipalities that will be required to adopt a low phosphorus fertilizer ordinance.
5. Addition of an existing loads column to the tables identifying the allocation of the TMDL for each segment.

A summary of comments to the proposal and the Department's Responses to those comments follow. The numbers in brackets at the end of each comment corresponds to the verbal commenters listed above.

Comment 1.
United Water New Jersey strongly supports the July 5, 2005 proposed amendment to the Northeast Water Quality Management Plan for the Hackensack and Pascack Watersheds. United Water New Jersey looks forward to working with the NJDEP and New York State DEC and Pascack and Musquapsink watershed municipalities in developing and implementing watershed best management practices designed to reduce the phosphorus levels in the streams. (1)

Response 1.
The Department thanks the commenter for their support.

Comment 2.
Under certain conditions United Water New Jersey diverts water from the Saddle River to the Musquapsink Brook. Monitoring conducted by United Water New Jersey of the diverted water from the Saddle River shows elevated levels of phosphorus at times far in excess of the Surface Water Quality Standard (SWQS). During the months of June through September of 1999, diversions from the Saddle River showed phosphorus concentrations of over 3.0 to 7.0 milligrams/liter. Unless the proper effluent limitations for phosphorus are enforced for the Village of Ridgewood and Northwest Bergen Utilities Authority wastewater treatment plants, the reduction in loadings in the Pascack and Musquapsink will need to be lowered more than proposed to meet the SWQS. (1)

Response 2.
After reviewing the existing water allocation permits for the Saddle River, the Department has been unable to verify that conditions exist as stated in the comment. The Department would need more detailed information including sample data, diversion locations, and the dates of the occurrence(s) to fully evaluate the comment. The Department believes that the technical approach used to establish the loading capacity adequately considers the uncertainties (gaps and variability) in the data, the ability to model and predict concentration response relative to loadings, and the predictability of achieving a load reduction from applying a given management measure. The inclusion of both an implicit and explicit Margin of Safety (MOS) as part of the TMDL calculation is a reflection of the uncertainties and provides for reasonable assurance that the standard will be met.

Comment 3.
The Musquapsink Brook and Pascack Brook TMDLs are premature. There is a need for more data to document the quality of Musquapsink Brook, particularly in relationship to the diversion of water from the Saddle River. Does the diversion coincide with the time that the data was collected? (2)

Response 3.
The data collected and used by the Department is believed to be a representative characterization of the stream water quality and sufficient for development of TMDLs. Collection of additional data would

serve to delay implementation of measures to improve water quality. Assessment of effectiveness of the measures proposed through the ambient water quality network will determine if these measures need to be supplemented by additional measures.

Comment 4.
The Pascack Brook data needs to be collected before the confluence with Musquapsink Brook. Each of the two streams should be evaluated separately. (2)

Response 4.
The Department's *Integrated Water Quality Monitoring and Assessment Method* explains the relationship between monitoring location and spatial location delineation. As stated in the TMDL report, the monitoring station for Pascack Brook at Westwood (01377500) accurately characterizes the flows and water quality at Musquapsink Brook due to the Pascack station location directly below the confluence of the two streams. This approach provides a valid scope for assessing these impairments.

Comment 5.
The map of Pascack Brook shows that the impaired section ends at the New York State line. This is not addressed and should be clarified or corrected. (2)

Response 5.
The Pascack Brook TMDL requires the SWQS to be met at the State border. The Department is committed to working with the New York State Department of Environmental Conservation to address source reductions that may be needed within the New York portion of the watershed.

Comment 6.
Considering the TMDL document says 50 percent of WMA 5 is undeveloped, why is there no reserve capacity considered? (3)

Response 6.
Under this TMDL, the means identified for source reduction apply to new as well as existing development within the impaired watersheds. New development is expected to contribute a de minimus load relative to the existing land use it replaces. This is because new development, where applicable, must comply with municipal ordinances and measures to control the increased stormwater associated with the increased impervious cover of the developed area. The Stormwater Management Rules (N.J.A.C. 7:8) set forth the required components of regional and municipal stormwater management plans, and establish the stormwater management design and performance standards for new (proposed) development. The design and performance standards for new development include groundwater recharge, runoff quantity controls, runoff quality controls, and Category One buffers. Details of the performance standards can be found in Subchapter 5 of the Stormwater Management Rules and were created to address concerns of new development's affect on stream water quality. This is expected to effectively avoid increases in storm driven sources, thereby preventing the water quality problems that are attributed to the existing development and obviating the need for a reserve capacity.

Comment 7.
Municipalities have different implementation capabilities. Will the Department allow trading for the reduction of loading where one municipality that can get a larger reduction can credit another municipality for the excess reduction? (3)

Response 7.
The Department would consider trading proposals developed by affected municipalities.

Comment 8.
In the TMDL document, “Bkanky Brook” should be spelled as “Behnke Brook.” (3)

Response 8.
The Department appreciates the comment and has corrected the spelling.