

Storm Water Management Plan



SECTION 17 - STORM WATER MANAGEMENT PLAN

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the Township of Cedar Grove to address stormwater-related impacts. The creation of this plan is required by N.J.A.C 7:14A-25 – municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C 7:8 Storm water Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major development, defined as projects that disturb one or more acre of land or result in 1/4 acre of new impervious surface. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities.

MUNICIPAL STORMWATER MANAGEMENT PLAN
TOWNSHIP OF CEDAR GROVE
ESSEX COUNTY, NEW JERSEY

Prepared for
Township of Cedar Grove
515 Pompton Avenue
Cedar Grove, New Jersey 07940

February 28, 2006

OEA #300002

Prepared by



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Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the Township of Cedar Grove ("the Township") to address stormwater-related impacts. The creation of this plan is required by N.J.A.C. 7:14A-25 - Municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C. 7:8 Stormwater Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major development, defined as projects that disturb one or more acre of land or result in $\frac{1}{4}$ acre of new impervious surface. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities.

The plan also addresses the review and update of existing ordinances, the Township Master Plan, and other planning documents to allow for project designs that include low impact development techniques. The final component of this plan is a mitigation strategy for when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

Goals

The goals of this MSWMP are to:

- reduce flood damage, including damage to life and property;
- minimize, to the extent practical, any increase in stormwater runoff from any new development;
- reduce soil erosion from any development or construction project;
- assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
- maintain groundwater recharge;
- prevent, to the greatest extent feasible, an increase in nonpoint pollution;
- maintain the integrity of stream channels for their biological functions, as well as for drainage;
- minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water; and
- protect public safety through the proper design and operation of stormwater basins.

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.

Stormwater Discussion

Land development can dramatically alter the hydrologic cycle (See Figure -1 below) 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. Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site. Impervious areas that are connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than natural conditions. These increases can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment in the channel. Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area can also decrease opportunities for infiltration which, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy habitat from which some species cannot adapt.

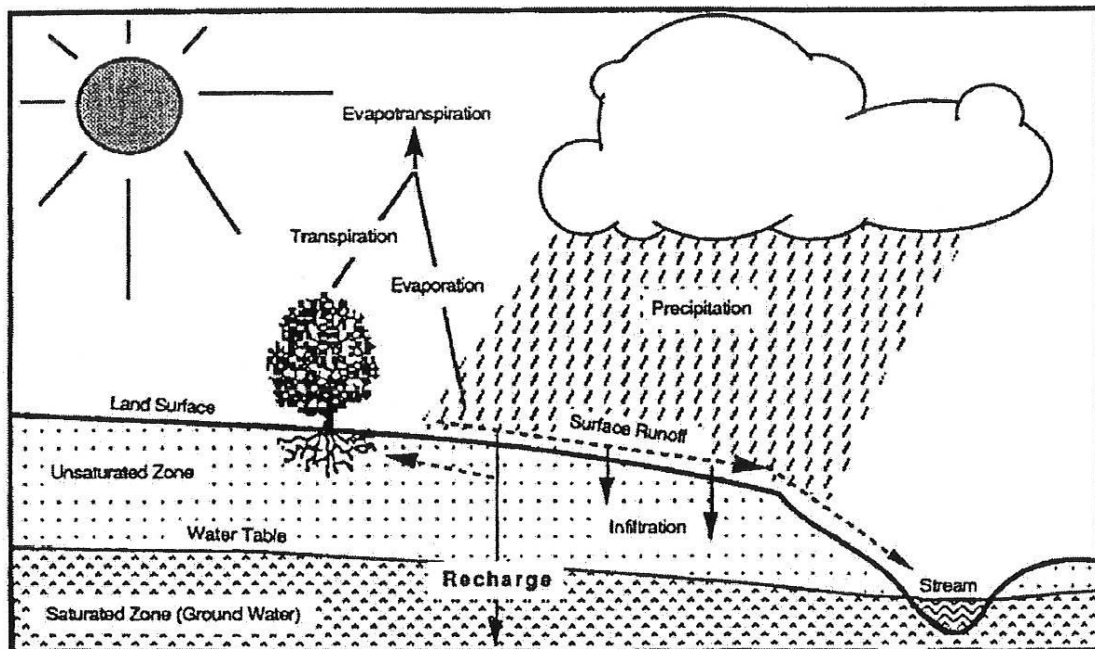


Figure -1 – The Hydrologic Cycle

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.

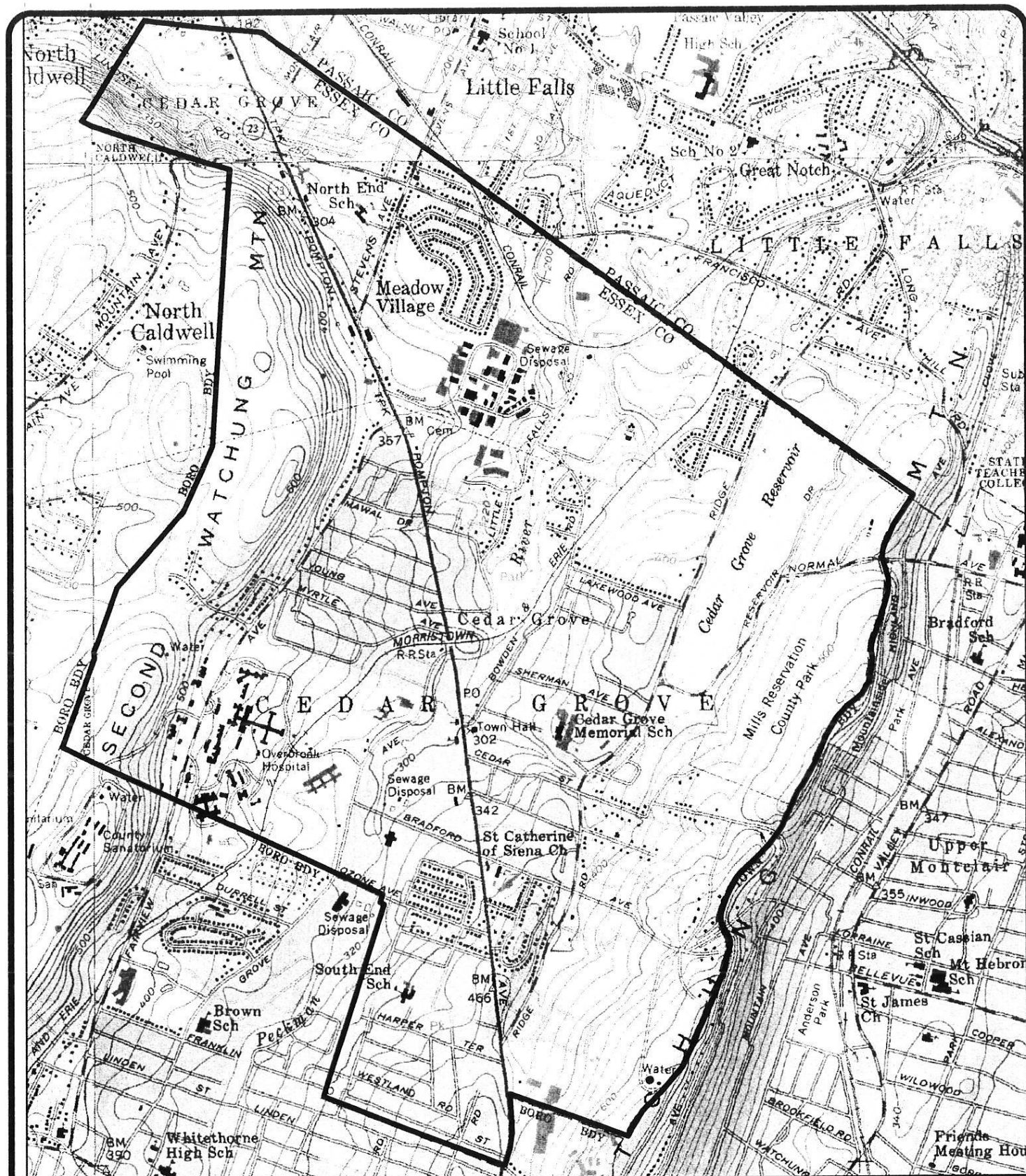
Background

The Township of Cedar Grove is located in the northernmost portion of Essex County, approximately fifteen miles west of New York City and ten mile northwest of Newark. Cedar Grove is bordered by four other municipalities, including Montclair to the east, Verona to the south, North Caldwell to the west and the Township of Little Falls at the Passaic County boundary line to the north. *Figure-2: Boundary on USGS Quadrangle* depicts the Township boundary on the USGS quadrangle maps and provides a spatial representation of the Township and surrounding features.

Cedar Grove occupies an area of 2,880 acres, or 4.5 square miles, and is situated between the First and Second Watchung Mountains. The Watchung Mountains extend in a north-south direction along the eastern and western portions of the Township. The Peckman River extends through the valley between these two mountain chains. The municipality is situated within the Passaic River Basin, a watershed encompassing portions of ten counties in two states. It extends southward from Orange and Rockland Counties in New York State to Somerset County in New Jersey, and westward from Bergen and Essex Counties to Sussex County.

Cedar Grove experienced most of its growth between 1940 and 1960 due to post World War II population growth and out-migration from the City of Newark. Like other Essex County towns, the establishment of train stations followed by widespread automobile ownership and the construction of tract housing facilitated Cedar Grove's transition from a small farming community into a vibrant residential suburb.

In accordance with U.S. Census data, Cedar Grove's population increased from 5,208 residents in 1940 to 8,022 in 1950. The post-war building boom increased that number exponentially to 14,603 residents by 1960, with a peak of 15,582 by 1970. As in Essex County and much of northeastern New Jersey, loss of industry and out-migration of citizens to south and westerly New Jersey locations in the 1970's and 1980's then led to a population decrease in the Township. Census data indicate a population of 12,600 by 1980 and just 12,053 as of 1990. The numbers have only recently begun to rebound, with year 2000 Census figures indicating a population of 12,300 and recent new construction upping the tally to approximately 12,500 by the current year, 2005. Population projections for the municipality suggest a gradual increase over the next 20 years, to 12,800 residents by 2010,



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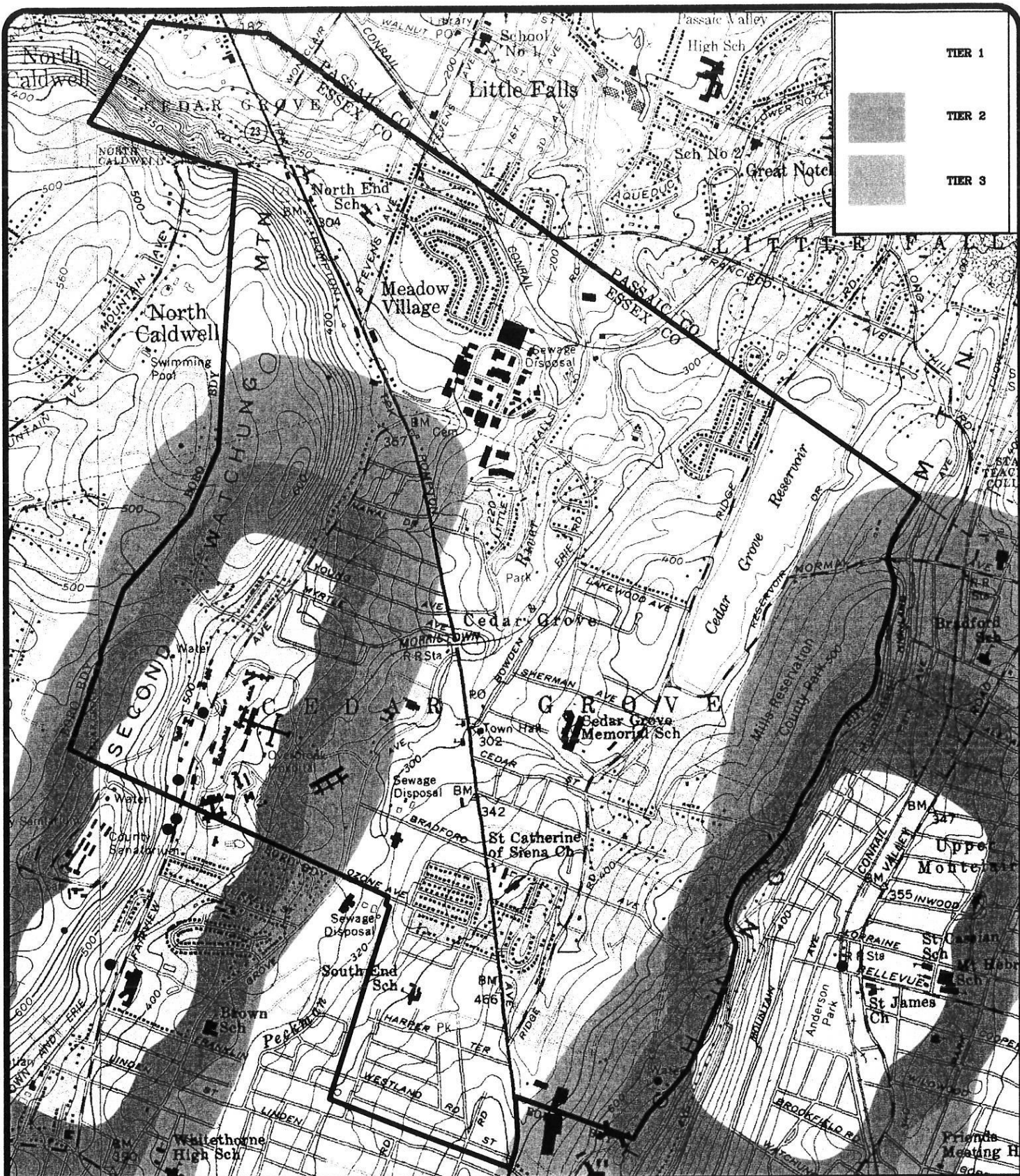
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FIGURE - 2 TOWNSHIP BOUNDARIES SUPERIMPOSED ON USGS

TOWNSHIP OF CEDAR GROVE
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FIGURE - 3 WELLHEAD PROTECTION AREAS SUPERIMPOSED ON USGS

TOWNSHIP OF CEDAR GROVE
ESSEX COUNTY, NEW JERSEY

13,000 by 2020, and 13,200 by 2025 (New Jersey Transportation Planning Authority, Population and Employment Forecasts, 24 February 2003).

Today, Cedar Grove is over 93% developed, with more land devoted to residential development than any other land use category. Detached single-family residential neighborhoods account for over 37% of Cedar Grove's total land area, while multi-family housing occupies roughly 3.6%. Public lands, including open space, schools, parks, and City of Newark Reservoir holdings occupy approximately 27% of the land area. Industrial and other business enterprises take up about 9% of the land area. Light industry is concentrated in the 45 acre Industrial Village and the Peckman Town Plaza, while retail businesses are located almost exclusively along Pompton Avenue.

The Township of Cedar Grove does not derive any of its drinking water from underground wells. As detailed in the Township's Environmental Resource Inventory, dated December 2002, the Essex County Utility Authority has production wells in the Hilltop Reservation area, with the Wellhead Protection Area covering a portion of the Second Watchung Mountain on the westerly side of the municipality. A Montclair well located north of Bellvue Avenue approximately 1900 feet to the east of the Township, with the wellhead protection area encompassing a large portion of the First Watchung Mountain within the Township. The associated wellhead protection areas, also required as part of the MSWMP, are shown in Figure-3.

Land Uses and Land Classification

The land uses within Cedar Grove are very diverse for a relatively small municipality, as evidenced by the (16) zoning districts and over 20 land use/land classification (LULC) codes identified by the NJDEP. Figure-4 illustrates the existing land use in the Township based on 1995/97 GIS information from NJDEP iMap website. In certain locations, this mapping doesn't accurately reflect current conditions, however, the State's mapping is used as a consistent source. The LULC codes identify general uses that are further broken down into subsets. For the presentation purposes of this document, we have taken the liberty of grouping those individual classifications into the general uses where appropriate. The uses depicted in Figure-4 are as follows:

- Barren Land – are identified by the NJDEP as “cleared lands that have no apparent site preparation or any indication of past activities. Such areas vary in shape and size but generally possess little vegetation, exposing the soil or surface material only. Ancillary information also gives no indication of former uses”. The barren lands identified in Cedar Grove are associated with a portion of the Hilltop Redevelopment area.
- Forest - Brushland – are identified by the NJDEP as “forest lands which are predominately between 0 and 20 feet in height. Vegetative communities in these areas may range from early successional species which are only a few years old, to climax or sub-climax communities which are many years old. Also included in this category are old fields that are covered primarily by grasses and some shrubs. Brushland areas represent critical habitat for many species of wildlife in New Jersey”. The majority of the Forest – Brushland areas are identified generally north of the Conrail rail line near the Little Falls border, and in the northwest corner of the Township near Lindsley Avenue. There are isolated pockets depicted in the Morgan's farm area, in the Hilltop Redevelopment area and along a stretch of the Peckman River.

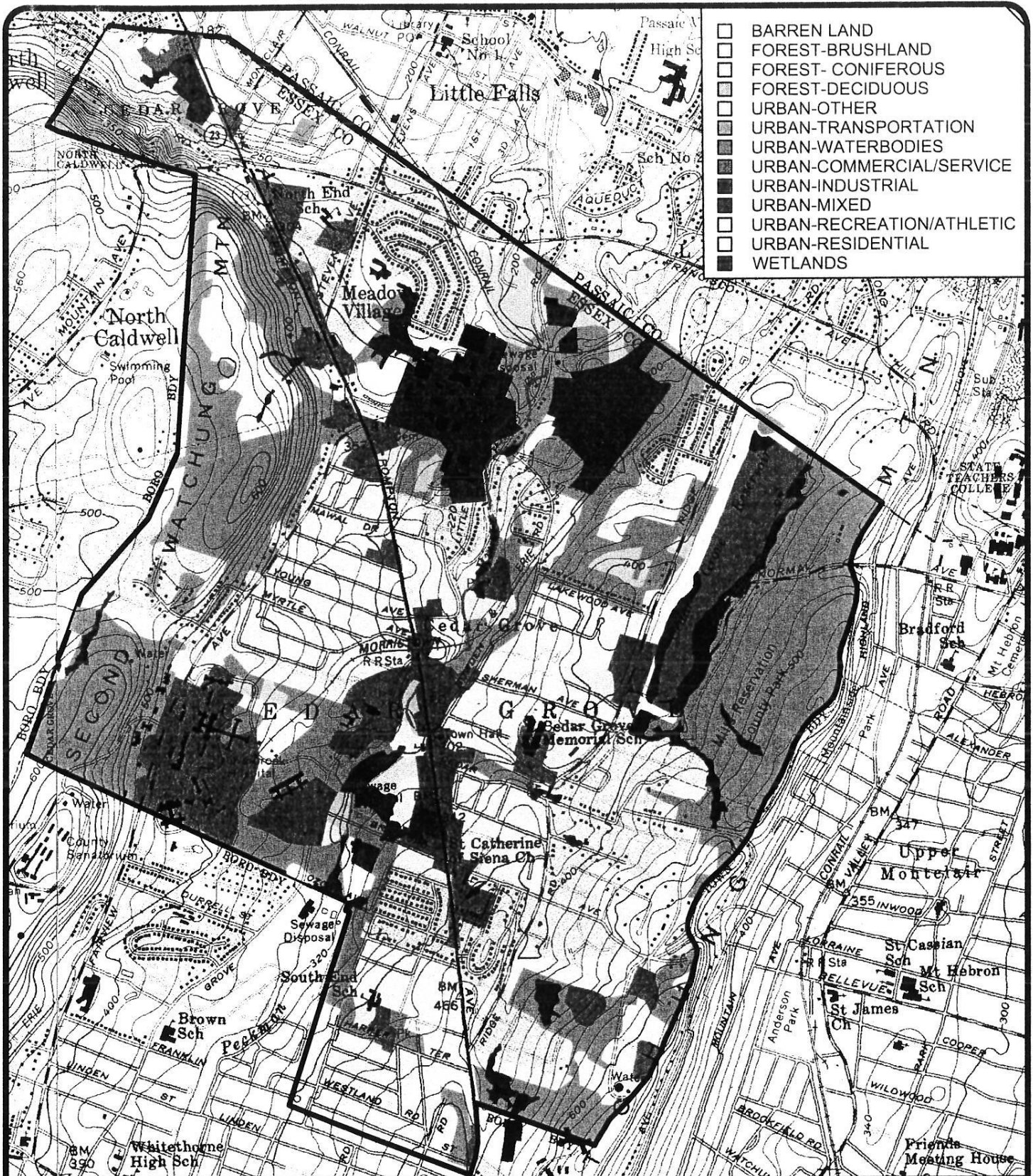
- Forest - Coniferous – is identified by the NJDEP as “forested lands which contain coniferous tree species. The stand must be 20 feet high and must be stocked by at least 75% conifers to be labeled as a coniferous stand”. The separate categories of coniferous forest, as well as those ‘mixed deciduous/coniferous’ forests where coniferous forest canopy dominates has been included in this category. This type of forest is shown within those lands owned by the Newark Watershed north of Lakewood Avenue, as well as the Hilltop Redevelopment area.
- Forest – Deciduous – is identified by the NJDEP as “forested lands that contain deciduous tree species. The average height of the stand is at least 20 feet. Areas with woody vegetation less than 20 feet high should be placed in the Brushland category. A forest stand must have at least 75% canopy coverage from deciduous tree species to be placed in this category”. The separate categories of deciduous forest, as well as those ‘mixed deciduous/coniferous’ forests where deciduous forest canopy is dominant has been included in this category. As shown in Figure-4, this is the predominant open land type within the Township, due in large part to properties owned by Essex County (Hilltop Redevelopment area, Mills Reservation), the Newark Watershed and the area presently being developed as “Park Ridge” along the Second Watchung Mountain.
- Urban - Other – is identified by the NJDEP as “undeveloped, open lands within urban areas. Some structures may be visible, as in the case of abandoned residential or commercial sites that have not yet been redeveloped. Other areas may be brush-covered or grassy. Large, managed, maintained lawns common to some residential areas, and those open areas of commercial/service complexes, educational installations, etc., are also included. Undeveloped, but maintained lawns in urban parks are also part of this category, if a specific recreational use is not evident. In addition, areas that have been partially developed or redeveloped but remain unfinished are included. Also included in this category are cemeteries.” Within Cedar Grove, the property currently being developed at the Pompton Ave/Commerce Drive intersection is identified (K.Hovnanian –Four Seasons site), as well as a portion of the Hilltop Redevelopment Area.
- Urban – Transportation - is identified by the NJDEP as “transportation, communication, and utilities land uses are often associated with the other Urban or Built-up categories, but are often found in other categories. The presence of major transportation routes, utilities such as sewage treatment plants and power lines, and communications facilities greatly influence both the present and potential uses of an area. These areas generally have a high percentage of impervious surface coverage.” Within Cedar Grove, the PSE&G right of way running east/west through town, the existing Lenape hiking trail and the West Essex Bikeway in the northeastern end of town, and the municipal and Essex County hospital wastewater treatment plants fall within this category.
- Urban – Waterbodies – this LULC contains the various categories of State Open Waters typically depicted on USGS mapping, including streams & canals, natural lakes and artificial lakes. Portions of the Peckman River and the Newark Watershed Reservoir are identified.
- Urban – Commercial/Service – The NJDEP ‘Mixed Urban or Built-Up’ designation is described as including “those urban or built-up areas for which uses cannot be separated into individual categories at the mapping scale employed. Areas are identified under the mixed urban category when more than one-third intermixture of another use or uses is evident.” The Commercial/Service label is conferred to those areas where greater than

50%, but less than 66% of the use can be identified as Commercial/Service based on the processes the NJDEP utilized to develop the LULC codes. These areas are generally located adjacent to the Pompton Avenue (SR23) corridor, the Township's M-2 Office/Warehouse and SL/C Senior Living districts, Board of Education properties, and Essex County facilities (Hilltop Redevelopment Area, training facility, hospital).

- Urban – Industrial – similar to the 'Commercial/Service' category, the 'Industrial' areas are those in which more than 50% but less than 66% of the land uses can be identified as industrial uses. In addition, inclusion of those areas where light and heavy industry are comprised of land uses where manufacturing, assembly or processing of products takes place. The Canfield Park area off Commerce Drive and a portion of the M-2 Office/Warehouse zoning district are the principle locales within Cedar Grove that have been identified by the NJDEP.
- Urban – Mixed – this category contains those areas within Cedar Grove that do not fall within the Industrial or Commercial/Service categories, based on the NJDEP sampling methodology. That area within the M-2 Zoning District not identified as either Commercial/Service or Industrial have been included in the land use, along with the area surrounding the Jenkin's Brush property along Pompton Avenue.
- Urban – Recreational/Athletic – the NJDEP has listed those areas which have been specifically developed for recreational activities, if these areas are open to the general public. The areas noted as recreational land may charge user fees to the public, such as public golf courses; or, they may be free to the public, such as ball fields on public school grounds, per the NJDEP definition. For the purposes of this document, the State mapping has included those public parks and athletic fields associated with the public schools within the mapping.
- Urban – Residential – As noted in the Background section, residential uses comprise the largest, single land use within Cedar Grove at 37% of the total land area. The residential category includes all densities of residential uses as well as single-family residences, multiple-unit dwellings and mobile homes. It should be noted that the actual residential land uses in Cedar Grove have expanded in the interim years since the 1995 LULC analysis was performed by the NJDEP.
- Wetlands – the NJDEP LULC includes multiple separate wetlands designations for interior wetlands that would apply to Cedar Grove. Managed wetlands associated with stormwater management structures and areas previously filled to provide recreational facilities are included in the wetlands designation of Figure-4. For presentation purposes, all of these separate categories have been depicted as wetlands. The wetlands land cover in Cedar Grove is scattered throughout the municipality, with the largest concentration surrounding the Cedar Grove Reservoir.

The Township zoning map is included as Appendix C at the end of this report.

- ☐ BARREN LAND
- ☐ FOREST-BRUSHLAND
- ☐ FOREST- CONIFEROUS
- ☐ FOREST-DECIDUOUS
- ☐ URBAN-OTHER
- ☐ URBAN-TRANSPORTATION
- ☐ URBAN-WATERBODIES
- ☐ URBAN-COMMERCIAL/SERVICE
- ☐ URBAN-INDUSTRIAL
- ☐ URBAN-MIXED
- ☐ URBAN-RECREATION/ATHLETIC
- ☐ URBAN-RESIDENTIAL
- ☐ WETLANDS



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FIGURE - 4 TOWNSHIP 1995 LAND USES SUPERIMPOSED ON USGS

TOWNSHIP OF CEDAR GROVE
ESSEX COUNTY, NEW JERSEY

The Peckman River

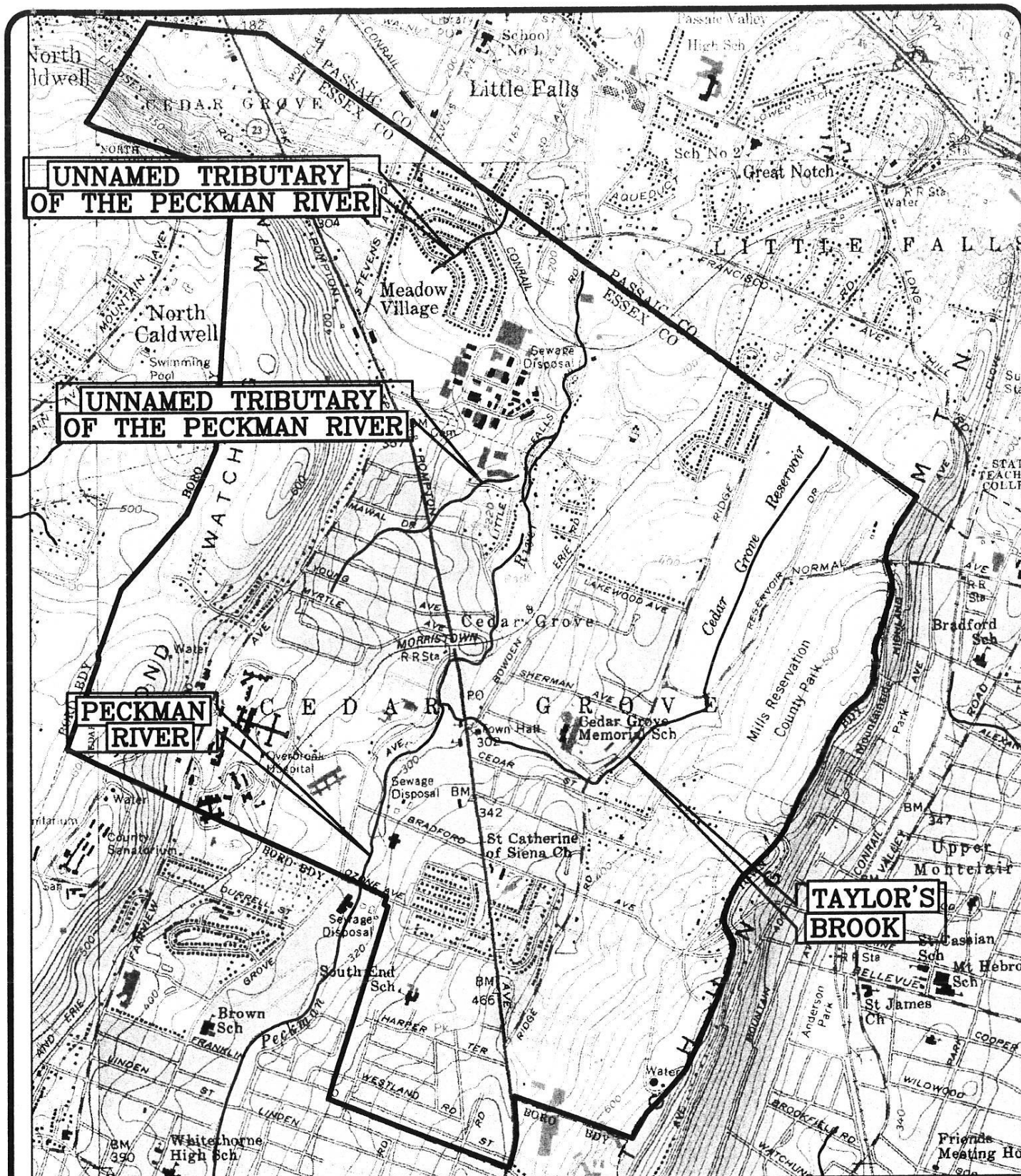
The main area of stormwater related concern in the Township is the Peckman River. The Peckman River Watershed has been the subject of an Army Corps of Engineers Flood Control and Ecosystem Restoration Project since 2000. A copy of the Section 905(b) WRDA 86 Analysis has been included as an appendix to this Plan. Excerpts from that document have been interspersed into the body of the text in this portion of the plan. The Peckman River originates in the Town of West Orange and flows northeasterly through the Borough of Verona, the Township of Cedar Grove, the Township of Little Falls, and the Borough of West Paterson to its confluence with the Passaic River. The elevation change along the river is approximately 260 feet with the majority of the drop occurring within Cedar Grove. The only other named waterways in the Township are Taylor's Brook, which originates along the southeastern side of the Second Watchung Mountain and is joined by the outfall of the Cedar Grove Reservoir to the Peckman River, and an un-named tributary of the Peckman River that emanates from southwestern side of the First Watchung Mountain and flows to the Peckman River. Neither of these features have been designated a Class 1 waterways. The Township Waterways are illustrated in Figure-5.

The high imperviousness of the Peckman River watershed has significantly decreased groundwater recharge, decreasing base flows in the watershed during dry weather periods. The Peckman River Basin is subject to frequent flooding from intense thunderstorms and heavy rainfall. These storms can deposit large amounts of precipitation in the watershed, producing significant runoff, which quickly surpasses the capacity of the river channel, and bridge and culvert openings. Some of the most significant floods in the Basin have occurred as the direct result of hurricanes and tropical storms (Doria in 1971 and Floyd in 1999).

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based on the AMNET data. The Peckman River has been identified as moderately impaired. The mitigating measures that have been undertaken by the major point source discharges to the Peckman River in Cedar Grove have improved the water quality to the point where the stocking of trout in this stretch of the waterway has been an ongoing occurrence. There is no information available regarding the tributaries that flow through the Township to the Peckman River.

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

The Army Corps report outlines various ecological restoration opportunities along the Peckman River corridor from Verona Park Lake to it's tributary with the Passaic River. The majority of the restoration opportunities involve reducing continued environmental degradation by evaluating the existing instream features, minimizing streambank erosion through stabilization, and by enhancing the riparian buffer zone.



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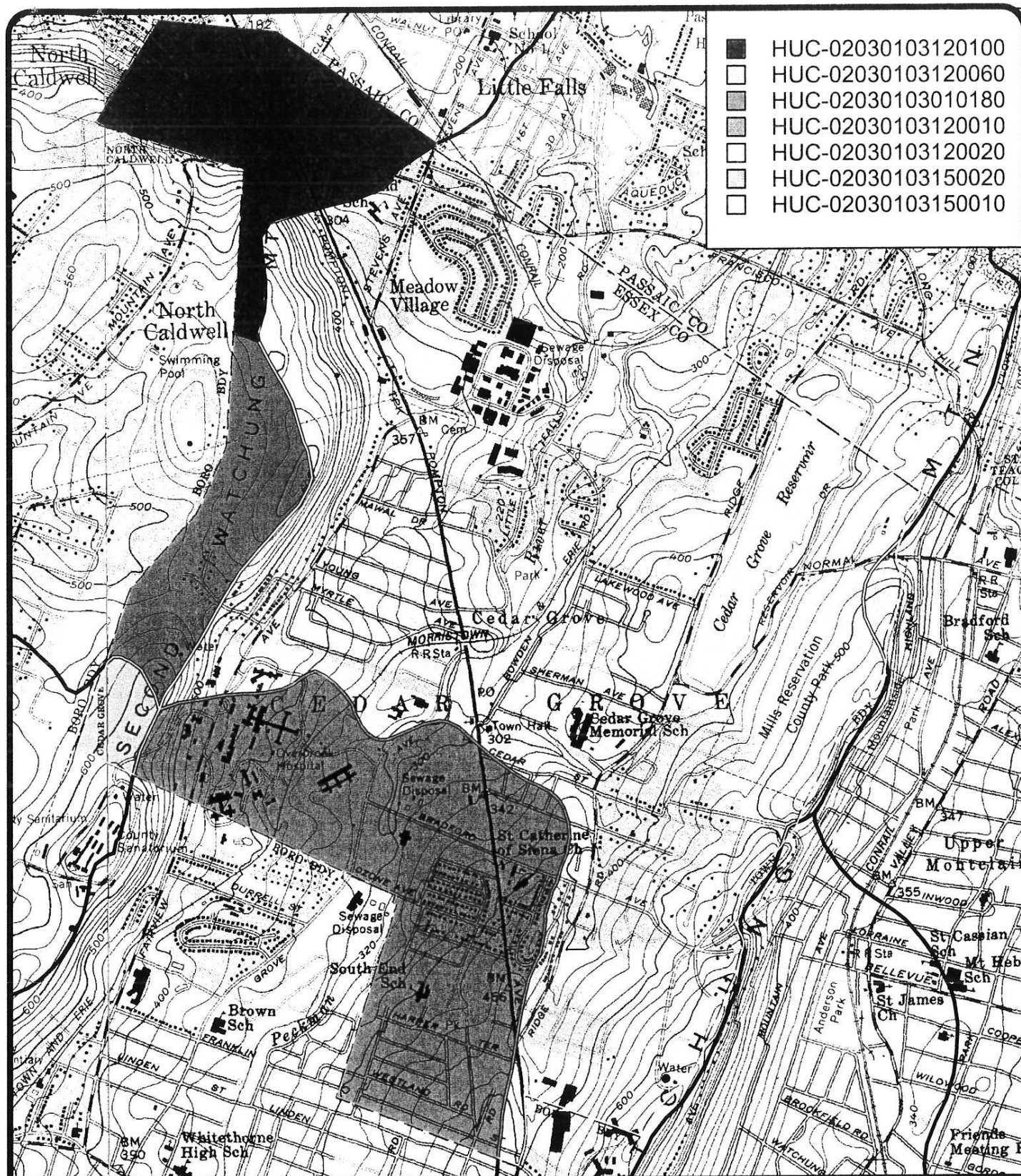
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FIGURE - 5 TOWNSHIP WATERWAYS SUPERIMPOSED ON USGS

TOWNSHIP OF CEDAR GROVE
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APPENDIX A – PECKMAN RIVER BASIN – ARMY CORPS OF
ENGINEERS REPORT



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FIGURE - 6 HYDROLOGIC UNITS SUPERIMPOSED ON USGS

TOWNSHIP OF CEDAR GROVE
ESSEX COUNTY, NEW JERSEY

Design and Performance Standards

The Township has completed the Stormwater Management Ordinance which contains 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, water quantity and loss of groundwater recharge in receiving water bodies for residential and commercial site development. Generally, projects meeting the definition of a major development (one acre of disturbance or ¼ acre of new net impervious surface) are required to meet the regulations stated under N.J.A.C. 7:8-5. These regulations address erosion control, groundwater recharge, runoff quantity standards, stormwater runoff quality standards, standards for calculating stormwater runoff and groundwater recharge, structural stormwater management standards, and maintenance requirements, as stated above. Any major development must meet the established design and performance standards set forth in the Soil Erosion and Sediment Control Act.

Major developments must also meet one of two standards for groundwater recharge (N.J.A.C. 7:8-5.4(a)2.): (1) maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site or (2) infiltrate the increase in the stormwater runoff volume from pre-construction to post-construction for the two-year storm.

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

To control stormwater runoff quantity impacts (N.J.A.C. 7:8-5.4a.3), a major development must meet one of three design standards: (1) demonstrate at no point in time that the post-construction runoff hydrograph exceed the pre-construction runoff hydrograph, (2) demonstrate there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2, 10, 100-year storm event and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site, and (3) demonstrate the post-construction peak runoff rates for the 2, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction runoff rates. However, for stormwater water runoff quantity requirement (3), stream encroachment standards (N.J.A.C. 7:13-2.8) will require for the 100-year storm event 75 percent of the pre-construction peak runoff rates. The design and performance standards include the language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-5.8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. These sections address long-term operation and maintenance measures for existing and future stormwater facilities.

The Stormwater Management Ordinance must be submitted to Essex County for review and approval within 24 months of the effective date (April 2004) of the Stormwater Management Rules, or by April 2006. The Cedar Grove Ordinance will be forwarded to Essex County for review and comment prior to that date. The following ordinances must be adopted/amended by the Township and meet the minimum requirements set forth in the Tier A Municipal Stormwater General Permit (NJ0141852). Those ordinances are as follows, but are not limited to:

1. The Township already has in effect a Pet Waste Ordinance (91-11 – Dogs & 91-25 - Cats) which requires pet owners and keepers to immediately and properly dispose of their pet's solid waste. The ordinance should be amended to include the required information provided by NJDEP to be distributed with pet licenses regarding said ordinance;
2. The Township's Littering Ordinance (Chapter 168) – should be reviewed to ensure it meets the minimum standards set forth in the State Litter Statute (N.J.S.A. 13:1E-99.3);
3. The current Garbage, Rubbish & Refuse Ordinance (Chapter 146), as well as the Brush, Grass, and Weeds Ordinances (Chapter 100) – should be amended to include the requisite language prohibit spilling, dumping or disposing of any materials other than stormwater into the municipal separate storm sewer system;
4. Wildlife Feeding Ordinance – The Township should adopt an ordinance that will prohibit feeding of non-confined wildlife in any public park or property owned/operated by the municipality;
5. Illicit Connection Ordinance – The Township should adopt an ordinance that will prohibit illicit connections to the municipal separate storm sewer system. Currently, Chapter 217-2 of the Township Code prohibits the discharge of any sanitary sewage, industrial wastes or other polluted waters into any natural outlet within the Township except where suitable treatment has been provided.

The Township's Stormwater Management Ordinance to be adopted contains 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 the language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-5.8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. The ordinances should be submitted to the county for review and approval within 24 months of the effective date of the Stormwater Management Rules, or by April 2006.

During construction, Township inspectors should observe the construction of the project to ensure that the stormwater management measures are constructed and function as designed.

Plan Consistency

The Township is not within a Regional Stormwater Management Planning Area and no TMDLs have been developed for waters within the Township; therefore this plan does not need to be consistent with any regional stormwater management plans (RSWMPs) nor any TMDLs. If any RSWMPs or TMDLs are developed in the future, this Municipal Stormwater Management Plan will be updated to be consistent. The Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. The Township will utilize the most current update of the RSIS in the stormwater management review of residential areas. This Municipal Stormwater Management Plan will be updated to be consistent with any future updates to the RSIS. The Township's Stormwater Management Ordinance requires all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction, the

Hudson-Essex-Passaic Soil Conservation District inspectors will observe on-site soil erosion and sediment control measures and address any inconsistencies.

Nonstructural Stormwater Management Strategies

This office has reviewed the Township ordinances, and has provided the following list of the sections in the Township land use and zoning ordinances that should be modified to incorporate nonstructural stormwater management strategies. These are the ordinances identified for revision. Once the ordinance texts are completed, they should be submitted to the county review agency for review and approval within [24 months of the effective date of the Stormwater Management Rules]. A copy will be sent to the Department of Environmental Protection at the time of submission.

The State has recently introduced the New Jersey Nonstructural Stormwater Management Strategies Point System in order assist design professionals in determining whether a major development is utilizing the non-structural strategies to the 'maximum extent practicable'. All major development should be evaluated utilizing this 'matrix' to aid in determining whether any potential project satisfies the SWM Rules for non-structural management strategies outright, or whether additional proofs would be required to substantiate the apparent lack of non structural management activities.

The Township Code has multiple chapters that interrelate with the Stormwater Management Ordinance. Chapter 268 of the Township Code, entitled Zoning, and Chapter 234, entitled Subdivision of Land are both being reviewed with regard to incorporating nonstructural stormwater management strategies. Upon review and acceptance by the Governing Body, several changes to these Chapters may be required to incorporate these strategies.

The following sections speak to non-structural controls within the existing Municipal ordinances;

Chapter 234-20: Installation of Improvements describes essential improvements. Language should be added to this chapter to require that any off-site and off-tract stormwater management and drainage improvements must conform to the "Design and Performance Standards" described in this plan and provided in the Stormwater Management Ordinance to be adopted.

Chapter 234-20.D. Sidewalks describes the sidewalk requirements for the Township. Sidewalks are required along all streets, unless the Planning Board finds that one of several conditions are met, which may preclude sidewalks on both, or one side of the road. Sidewalks are to be a minimum of four feet wide and constructed of concrete. Language should be added to this chapter 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.

Chapter 234-25: Street Specifications describes the requirements for streets in the Township. The Township, in the Master Plan dated 1991 with re-examination reports of December 1997 and May 2000, has several street classifications, ranging from "Arterial," which has a minimum right-of-way of 80 feet, to "Marginal Access," which has a minimum right-of-way of 60 feet. Street paving widths are a function of the number of units served, whether on-street parking is permitted, whether on-site topographical constraints allow design flexibility, and are generally in accordance with the Residential Site Improvement

Standards. Depending on these factors, paving width for secondary local streets has a range from 20 to 32 feet.

Chapter 234-28(C): Natural Features requires that natural features, such as trees, brooks, hilltops, and views, be preserved whenever possible. This chapter also includes the provision that the Planning Board may require the reservation of 5% to 10% of the project area for recreational purposes.

Chapter 246: Trees restricts, mitigates and otherwise controls the removal of mature trees throughout the Township. This ordinance recognizes that the preservation of mature trees and forested areas is a key strategy in the management of environmental resources, particularly watershed management, air quality, and ambient heating and cooling. Chapter 246-7(A) contains a detailed set of "critical footprint area" that extends 20 feet beyond the driveway and building footprint where clearing of trees cannot occur. This complies with minimizing land disturbance, which is a nonstructural stormwater management strategy.

This chapter may be amended to describe the required spacing and desired species of shade trees associated with any subdivision or site plan applications.

Chapter 268 Zoning contains numerous references to required buffer areas 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 landscape requirements for these buffer areas in the existing chapter do not recommend the use of native vegetation. The language of these chapters should be amended to require the use of native vegetation, which requires less fertilization and watering than non-native species. Additionally, language should be included to allow buffer areas to be used for stormwater management by disconnecting impervious surfaces and treating runoff from these impervious surfaces. This chapter currently requires the preservation of natural wood tracts and limits land disturbance for new construction.

Chapter 268-17: Off-street Parking Requirements details off-street parking and loading requirements. All parking lots and all loading areas are required to have concrete or granite block curbing around the perimeter of the parking and loading areas. As detailed in this chapter, any parking lot over 15,000 square feet is required to have landscaped islands a minimum of (6) feet wide constructed at the ends of parking bays. This chapter currently includes requirements for providing water quality protection as required by the Township Engineer and/or reviewing Board. Additional language should be included in this portion of the ordinance referencing compliance with the Stormwater Management Ordinance for those projects meeting the definition of a major development.

This chapter allows the reviewing Board discretion to whether a developer can reduce the required number of parking spaces by one half by demonstrating that the availability of contiguous rear yard thoroughfares or contiguous parking plazas make adequate parking available on adjacent sites. The use of parking plazas and contiguous rear thoroughfares to minimize access to parking areas through main public streets is encouraged. This option allows for the minimization of new impervious surfaces. Guidance on minimum parking space requirements based on the number of dwelling units and/or gross floor area of the projected uses is detailed.

The water quality protection portion of this chapter should be amended to 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. Also, language may

be added to allow for use of natural vegetated swales for the water quality design storm, with overflow for larger storm events into storm sewers.

Chapter 268, Article IX: Planned Developments provides for a cluster development option to preserve remaining open space, to prevent development on environmentally sensitive areas, and to aid in reducing the cost of providing streets, utilities and services in residential developments. This cluster option is an excellent tool for reducing impervious cover in the form of roads and driveways. The option allows for smaller lots with smaller front and side yard setbacks than traditional development options. It also minimizes the disturbance of large tracts of land, which is a key nonstructural stormwater management strategy. Cluster Developments are further broken down into Residential and Planned Retirement Community Developments. Residential cluster developments require not less than 40% of the tract area of a residential cluster development shall be dedicated to contiguous, natural, undeveloped open space. This language promotes the retention of undisturbed, native vegetation.

The Planned Retirement cluster option currently requires that not less than 40% of the total tract be reserved as common open space. This cluster option does require that of the tract area dedicated to common open space and recreation facilities, at least 1/2 (or 20% of the tract area) shall consist of natural, undeveloped open space. This language promotes the use of native vegetation, which requires less fertilization and watering than non-native ornamental plants. Although the cluster option requires public concrete sidewalks to be installed along all streets per RSIS, the option indicates paths in open space to be unpaved, decreasing the impervious area. Open space shall also be designed to preserve natural features such as woodlands and rock outcroppings, and to protect and/or buffer environmentally sensitive areas on the tract.

Stormwater Runoff is addressed by the Township's Storm Water Management Ordinance, which is (included as Appendix B of this report) updated to include all requirements outlined in N.J.A.C. 7:8-5. These changes were presented earlier in this document. This ordinance will be introduced by the governing body, referred to the Planning Board, and adopted in a Public Hearing in the near future.

Changes should be evaluated for Article VII of the Township Code entitled "District Regulations". The Township has 9 types of residential districts. Each district has a maximum percent lot coverage, ranging from 5 percent for the R-5A District, which has a minimum lot size of five acres for detached single-family homes, to 50 percent for the SL/C-PRC Districts, which have a minimum lot size of 10 acres for planned residential retirement communities and long-term care facilities such as nursing homes. The Township has 6 types of nonresidential districts. Each of these districts has a maximum percent total lot coverage, ranging from 60% for the O, RC, M-1, and M-2 districts to 'No Restriction' for the GF District. The Township should evaluate the maximum allowable impervious cover for each zone to determine whether a reduction in impervious cover is appropriate. Also, based on the proposed Stormwater Management Ordinance (attached as Appendix B), if a developer is given a variance to exceed the maximum allowable percent imperviousness, the developer must mitigate the impact of the additional impervious surfaces. This mitigation effort must address water quality, flooding, and groundwater recharge as described in the Stormwater Management Ordinance. A detailed description of how to develop a mitigation plan is included in this Municipal Stormwater Pollution Prevention Plan.

Land Use/Build-Out Analysis

As the Township of Cedar Grove is currently 93%± developed, the Township, at 4.5 total square miles clearly does not have 1 square mile (640 acres) of vacant or agricultural lands. Accordingly, a build-out analysis is not required. Figure-4 illustrates the existing land use in the Township based on 1995/97 GIS information from NJDEP. The Township zoning map is enclosed as Appendix C at the end of this report.

Mitigation Plans

This mitigation plan is provided for a proposed development that is granted relief from the stormwater management design and performance standards from the proposed Stormwater Management ordinance. Presented is a hierarchy of options.

Mitigation Project Criteria

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

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

Groundwater Recharge

- Reconstruct lawn inlets within those areas of the Township where Type 'B' or better soils exist with sump bottoms to provide additional annual groundwater recharge and the collection of solids. Given the topography of the Township and historical groundwater intrusion problems into residential dwellings, consideration should be given to reconstructing these structures in areas that will not impact adjacent residential properties.

The area of the Township determined to be most conducive to groundwater recharge by the Township's Environmental Commission is that area between Pompton Avenue and the Peckman River, in the Commerce Drive area, where the Township's Environmental Inventory dated December 2002 indicates glacial deposits of the Boonton soil series are prevalent.

- Retrofit the Canfield-Morgan farm complex with drywells to recharge stormwater runoff.
- Retrofit the North End School (subject to Board of Education approval) with drywells for roof runoff where appropriate.

Water Quality

- Retrofit the existing parking area at the Municipal Building to provide the removal of 80 percent of total suspended solids. Due to site constraints, the retrofit BMP must

be installed underground and cannot reduce the existing limited number of parking spaces.

- Retrofit the Township Department of Public Works outfalls to provide for the removal of 80 percent of total suspended solids.
- Disconnect the impervious surfaces in the Community Park Pool parking lot by introducing vegetated filter strips within the parking lot, and installing the requisite underdrain system to connect to the storm system on site.
- Retrofit existing headwall discharges to receiving bodies with appropriately sized water quality structures.
- Retrofit existing upstream headwalls and embankments identified within the Township's 'Stormwater Outfall Condition' list (being updated by the Engineering Department) with trash grates and streambank stabilization measures similar to the recently completed Hilltop Drive project.
- Provide goose management measures, including public education at the various Community Park and Board of Education facilities.

Velocity Reduction

- Provide the requisite end of pipe treatments to existing discharges as contained in the Township's 'Stormwater Outfall Condition' list (currently being updated by the Township Engineering Department). Treatments include the installation or reconstruction headwalls and flared end sections and the installation or refurbishment of scour holes or rip rap stabilization pads.
2. If a suitable site cannot be located in the same drainage area as the proposed development, as discussed above, the mitigation project may provide mitigation that is not equivalent to the impacts for which the relief is sought, but that addresses the same issue. Figure-6 – Hydrologic Unit Code (HUC) depicts the separate drainage areas within the Township as determined by the USGS and shown on NJDEP iMap. The United States Geological Survey (USGS) defines a hydrologic unit as "A geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the U. S. Geological Survey on State Hydrologic Unit Maps. Each hydrologic unit is assigned a hierarchical hydrologic unit code consisting of 2 digits for each successively smaller drainage basin unit". For those projects that lie within a HUC that drains away from the township, coordination with the adjacent municipalities may be required for the completion of any mitigation projects.

The Township is cognizant that there may be limited opportunities for groundwater recharge in any of the undeveloped areas of the municipality, or on Township owned properties. The municipality 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, engineering and permitting, and the cost associated with the long-term maintenance requirements of the mitigation measure.

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**US Army Corps
of Engineers®**
New York District

Peckman River Basin, New Jersey

Flood Control and Ecosystem Restoration Project

FACT SHEET

DESCRIPTION: The Peckman River Basin is located in Essex and Passaic Counties, New Jersey. A tributary to the Passaic River, the Peckman River originates in the Town of West Orange and flows northeasterly through the towns of Verona, Cedar Grove, and Little Falls to its confluence with the Passaic River in West Paterson. Extensive development in the Basin has led problems of flooding and ecosystem degradation. The Basin experiences frequent flooding from intense thunderstorms and heavy rainfall. These storms can deposit large amounts of precipitation in the watershed, producing significant runoff, which quickly surpasses the capacity of the river channel, and bridge and culvert openings. Significant degradation of the ecology of the Basin has occurred as a result of extensive erosion at specific locations along the river. The current state of the river ecosystem reflects the type of long-term degradation often associated with heavily urbanized watersheds. The development of the watershed has reduced the water-holding capacity of the landscape and altered the natural flow dynamics within the river system. As a result, the habitat suitability and ecological complexity of the river have been moderately impaired.

AUTHORIZATION: The U.S. House of Representatives, Committee on Transportation and Infrastructure, authorized a study of the Peckman River and Tributaries, New Jersey, by Resolution dated 21 June 2000. Initial Planning efforts were performed in accordance with Section 205 of the Continuing Authorities Program (CAP).

STATUS: A favorable reconnaissance report was completed in July 2001. The report recommended a feasibility study to develop alternatives for flood control and ecosystem restoration in the Peckman River Basin. A Feasibility Cost Sharing Agreement (FCSA) was executed on March 14, 2002 between the Corps and the New Jersey Department of Environmental Protection (NJDEP). FY2004 funds will be utilized to augment existing mapping and survey data and to initiate engineering, economic and environmental analyses.

STUDY COSTS TO DATE:

Estimated Federal Cost:	\$2,200,000
Estimated Non-Federal Cost:	<u>\$2,200,000</u>
Total	\$4,400,000

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District: NJ #8, Congressional Member: William Pascrell

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Peckman River Basin New Jersey

Section 905(b) WRDA 86 Analysis Flood Control and Ecosystem Restoration

1.0 Study Authority

The U. S. Army Corps of Engineers, New York District (the District) is authorized to study flood control opportunities for areas along the Peckman River, New Jersey. This study was conducted under the authority of U.S. House of Representatives, Committee on Transportation and Infrastructure Resolution Docket 2644 adopted on June 21, 2000. This report was completed at the request of the New Jersey Department of Environmental Protection (NJDEP) by letter dated 29 November 2001. The NJDEP is the District's potential feasibility cost-sharing partner. This authority states:

Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Chief of Engineers on the Passaic River Mainstem project, New Jersey and New York, published as House Document 163, 101st Congress, 1st Session, and other pertinent reports to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of water resources development, including flood control, environmental restoration and protection, stream bank restoration, and other allied purposes for the Peckman River and tributaries, New Jersey.

2.0 Study Purpose

The purpose of this analysis is to conduct a Section 905(b) preliminary analysis for flood protection and ecosystem restoration opportunities along the Peckman River and evaluate the Federal interest in flood damage reduction and ecosystem restoration within the



Peckman River Basin in New Jersey. Federal interest (*i.e.*, participation) in a project requires a demonstration of economic feasibility, which is established by determining whether the benefits to the national economy exceed the annual economic costs.

The objectives of this phase of the planning process are to: (1) determine if the water resources problem(s) warrant Federal participation in feasibility studies; (2) define the Federal interest; (3) complete an Section 905(b) preliminary analysis; (4) prepare a Project Management Plan (PMP); (5) assess the level of interest and support from non-Federal entities; and (6) negotiate and execute a Feasibility Cost Sharing Agreement (FCSA).

3.0 Location of Project/Congressional District

The Peckman River Basin (the Basin) is located in Passaic and Essex Counties, New Jersey. Figure 1 shows the location of the Basin. The drainage area is approximately 9.8 square miles and is one of the major sub-watersheds of the Passaic River. The Peckman River originates in the Town of West Orange, New Jersey, and flows northeasterly through the Borough of Verona, the Township of Cedar Grove, the Township of Little Falls, and the Borough of West Paterson to its confluence with the Passaic River. The elevation change along the river is approximately 260 feet with the majority of the drop occurring within Cedar Grove.

The majority of the watershed is heavily urbanized (71%). Residential housing developments comprise the largest sub-category (50%). Undeveloped areas consist of forested areas, reservoirs, and wetlands along the river corridor (29%).



[insert Figure 1 – Basin Map]



Great Notch Brook is a major tributary to the Peckman River, entering the river just downstream of New Jersey State Highway 46. Great Notch Brook is subject to extremely rapid runoff from higher elevations in the eastern side of the watershed. Two other small tributaries enter the river in Cedar Grove.

The downstream portion of the Peckman River in West Paterson is within close proximity to Dowling Brook, which is also a tributary to the Passaic River. During extreme flooding events, diversion of flow from the Peckman River across West Paterson to Dowling Brook has been reported.

The study area is located in New Jersey's 8th Congressional District (Congressman William Pascrell - D).

4.0 Prior Studies, Reports, and Existing Water Projects

Prior Studies and Reports

Numerous reports and studies by the Corps and others were reviewed as part of this investigation. The following is a list of documents reviewed and utilized in this report as they relate to a potential Peckman River project.

U.S. Army Corps of Engineers, New York District studies and reports:

- Detailed Project Report for the Peckman River, Township of Little Falls, under Section 205 of the 1948 Flood Control Act (September 1981);
- Report for Flood Protection Feasibility, Main Stem Passaic River (December 1987);



- General Design Memorandum (GDM), Passaic River Flood Damage Reduction Project (September 1995);
- Passaic River Buyout Study (September 1995);
- Passaic River Basin Historical Flood Damage Report: Rockaway and Passaic Rivers (circa 1980);
- Report on the Flood of August 1973 (circa 1974);
- Tropical Storm Floyd, September 16, 1999, Post-Flood Report (July 2000);

Other agencies' studies, reports, and documents:

- Natural Resources Conservation Service (NRCS), Peckman River Streambank Restoration, Emergency Watershed Protection, Borough of West Paterson, Passaic County, Engineering Report (March 1999);
- Federal Emergency Management Agency (FEMA), Flood Insurance Administration (FIA), Flood Insurance Studies (FIS) for Verona (Aug/1979), Cedar Grove (Aug/1979), Little Falls (Feb/1981), and West Paterson (Jun/1981);
- New Jersey Department of Environmental Protection (NJDEP), Flood Hazard Area Maps (circa 1975);
- Passaic County, Bridge Reconstruction Plans: Lackawanna Avenue (1994) and McBride Avenue (2000), West Paterson;
- NJDEP, Bureau of Water Monitoring, Ambient Biomonitoring Network;



- FEMA, FIA, Repetitive Loss Data for West Paterson and Little Falls;

Most Relevant Studies

Information from the following documents was deemed the most significant to the problem identification and plan formulation:

Detailed Project Report for the Peckman River, Township of Little Falls, under Section 205 of the 1948 Flood Control Act (September 1981).

A reconnaissance level evaluation of the Peckman River in West Paterson, Little Falls, Cedar Grove, and Verona was conducted in 1981. Part of the evaluation included a determination as to whether a study of flood protection for Little Falls alone would be more favorable than pursuing a basin-wide solution. Nine flood control alternatives (6 structural; 3 non-structural) were considered for the basin, primarily in the Township of Little Falls. West Paterson was determined to be subject to flooding from the Passaic River and was therefore not considered for flood protection because it was contained within the authorized study area for the Passaic River Flood Damage Reduction Study. Cedar Grove and Verona were deemed not to warrant flood protection due to limited flood damages.

It was concluded at that time that structural and non-structural alternatives for flood control on the Peckman River in Little Falls were not in the Federal interest based on benefit-cost ratios that ranged from a low of 0.10 to a high of 0.27. However, the basis of the hydrologic and hydraulic (H&H) analysis used in this report is unclear. As will be discussed later, the reliability of available H&H data has been enhanced by the installation of a USGS gage in Verona, which has recorded stream flow data from 1979 to the present.



General Design Memorandum (GDM), Passaic River Flood Damage Reduction Project
(September 1995).

The purpose of the GDM was to refine the analysis and design of the Passaic River Flood Control Project Recommended Plan, which included the construction of a flood tunnel for diversion of Passaic River flood waters. Implementation of the Recommended Plan was expected to significantly reduce Passaic River flooding in areas of West Paterson that are subject to inundation from flood waters from both the Passaic and Peckman Rivers.

In the GDM, the FIS's, and the Detailed Project Report of 1981, the Passaic River was assumed to be the primary source of flooding for West Paterson; therefore, preliminary indications were that a reduction in flooding from the Passaic River would significantly reduce flooding in West Paterson. No detailed analysis was performed on how the Passaic River Project would have affected Peckman River flooding within West Paterson due to the reduction in backwater influence.

Although the specific dependence or independence of Passaic River and Peckman River flooding events has not been analyzed in this appraisal, the Peckman River H&H data developed for this report indicates it is a more significant source of flooding in West Paterson and Little Falls than previously considered in the Passaic River GDM, the FIS's, or the Detailed Project Report of 1981.

Existing Water Projects

There are no existing Corps water resource projects in the Basin. However, there are two locally-sponsored water resource projects in the planning stages or underway at the writing of this report:



Clearing and Snagging of the Peckman River

The NJDEP is providing approximately \$300,000 for clearing and snagging of the Peckman River (approximately \$60,000 per township). Due to various restrictions regarding stream impacts of such a project, vehicles in the stream bed, etc., this program is generally limited to the removal of large debris and trees.

Verona Lake Dredging Project

Essex County is sponsoring a dredging project for Verona Lake in Verona Lake Park. The cost of the project is approximately \$1,000,000. The purpose of the project is primarily for water quality improvement of the lake.

5.0 Plan Formulation

As part of this investigation, the District has coordinated with interested Federal, state, and local entities to identify problems and opportunities for flood damage reduction in the Peckman River Basin. In addition, a literature search and review was conducted to identify available information regarding water resources issues in the Basin. Field reconnaissance was conducted to: (1) identify opportunities for flood damage reduction, and (2) identify potential ecosystem restoration/enhancement opportunities for further study.

Plan formulation was conducted using a five-part process. First, a profile of existing conditions was developed, including a preliminary hydrologic and hydraulic analysis of the Basin, and the identification of problems related to flooding. Second, planning objectives and constraints were specified. Third, opportunities to address flooding problems were identified. Fourth, selected sites were evaluated for potential Federal interest. Finally, discussions were held with potential non-Federal sponsors to determine their interest in participating in feasibility phase investigations.



Federal Planning Requirements

Principles and Guidelines

The formulation process used in this preliminary analysis is consistent with the national objectives as stated in the *Planning Guidance Notebook* (Corps Engineering Regulation 1105-2-100, April 2000). In accordance with the *Planning Guidance Notebook*, plans must contribute to the National Economic Development (NED) consistent with protecting the nation's environment. Plans to address the needs in the study area must be formulated to maximize NED benefits while providing a complete, effective, efficient, and acceptable plan of protection. These objectives impose general planning constraints within any study area:

- Completeness is defined in ER 1105-2-100 as,

The extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.

- Effectiveness is defined as,

The extent to which the alternative plans contribute to achieve the planning objectives.

- Efficiency is defined as,

The extent to which an alternative plan is the most cost-effective means of achieving the objectives.

- Acceptability is defined as,



The extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies.

Planning Objectives and Constraints

Section 905(b) Preliminary Analysis Objectives

The objectives of flood control and ecosystem restoration measures are:

- To reduce the flood hazard and associated urban flood damages in the Basin;
- To preserve, maintain and, to the extent possible, enhance the resources of the existing natural and social environment in the project area;
- To preserve to the extent possible existing open space areas and associated recreational opportunities in the project area;
- To provide protection to hospitals, municipal buildings, emergency response facilities and transportation corridors and thus improve public health and safety during any future flood disasters; and
- To provide a plan that is compatible with future flood control and economic development opportunities.

Constraints

Flood control alternatives that satisfy area needs and objectives are partially limited by economic, environmental, and technical constraints. The list of constraints is as follows:



- Improvements for flood control purposes shall have benefits in excess of estimated costs;
- Plans cannot unreasonably impact environmental resources;
- The projects must be technologically feasible and cost effective, using proven technology;
- Identified alternatives are within the authority of the Corps and the non-Federal sponsor to implement;
- There is a reasonable assurance that a public entity (*i.e.*, state or local unit of government) is capable and willing to participate as a non-Federal partner in a cost-shared feasibility study.

5.1 Existing Conditions

Critical Ecological Resources

The Peckman River is classified by the NJDEP (New Jersey Administrative Code 7:9B) as fresh water-category 2, non-trout production (FW2-NT). However, the presence of trout has been established upstream of Route 46. In fact, the NJDEP has been considering reclassification of the river upstream of Route 46 as trout maintenance. Whether or not the river is reclassified, any proposed flood control alternatives upstream of Route 46 must be evaluated based on potential impacts to the existing river habitat.

Existing Geological Data

A review of the USGS Bedrock Map of Northern New Jersey (1996) and local well records reveal that the Peckman River generally runs along the boundary between the



Orange Mountain Basalt of the First Watchung Mountain and the Feltville Formation, which consists of sand-stone, siltstone and silty mudstone. In Little Falls and West Paterson, bedrock is generally 25 to 40 feet below grade.

Problem Description

Causes of Flooding

Flooding in the Peckman River Basin results primarily from two sources: flash flooding from rapid runoff in the Peckman River watershed and backwater flooding from the Passaic River. Backwater flooding occurs in association with high Passaic River flows; however, due to the significant differences in drainage areas (130 square miles vs. 9.8 square miles) and flood timing, this event has rarely been coincidental with Peckman River flooding.

Flash Flooding

The Basin experiences frequent flooding from intense thunderstorms and heavy rainfall. These storms can deposit large amounts of precipitation in the watershed, producing significant runoff, which quickly surpasses the capacity of the river channel, and bridge and culvert openings.

Tropical Storms

Some of the most significant floods in the Basin have occurred as the direct result of hurricanes and tropical storms (Doria in 1971 and Floyd in 1999). However, as noted in the Detailed Project Report of 1981, Hurricane Doria had an exceedance frequency of only 4.3%, or a 23-year event. Based on current USGS data, Tropical Storm Floyd had an exceedance frequency of only 3.6%, or approximately a 28-year event. The frequency of these events indicates that a storm of the magnitude of Tropical Storm Floyd is likely



within the project life. Likewise, a storm of much greater magnitude will likely result in severe damage throughout the watershed.

Development

Development in the watershed is increasing runoff potential and floods. Due to the relatively steep grade of the river bed from West Orange to the Passaic River, and the high flow velocities in the river, erosion problems have affected most municipalities. Many areas that previously were not subject to flooding or had experienced only minor flooding during extreme events are now reporting increased flood depths and damages during severe events, such as Tropical Storm Floyd.

Damage Centers

Municipalities in the study area were contacted during this investigation to determine the severity of their flooding problems associated with the Peckman River and its tributaries. Municipal engineers, public works personnel, and local elected officials were interviewed. Based on the interviews and historical data, the most significant flooding problems in the Peckman River Basin were identified in the Borough of West Paterson and the Township of Little Falls. Approximately 220 homes and businesses are located within the 100-year flood plain for the Peckman River in the primary damage center of Little Falls and West Paterson (based on a preliminary delineation of the revised Peckman River flood elevations), as shown in Figure 2.



[insert Figure 2 – 100-yr floodplain]



During Tropical Storm Floyd, which was estimated to be a 28-year event, hundreds of homes and businesses were affected by flooding in West Paterson and Little Falls. In West Paterson, the business district north of State Highway 46 was one of the hardest hit areas, with over 3 feet of flood water. In Little Falls, businesses south of Route 46 were inundated with over 4 feet of water and the Jackson Park residential area suffered extensive flooding from flood waters diverting from the Peckman River towards the west into the Passaic River. Almost all of Tropical Storm Floyd flood damages to areas within the Peckman River Basin were a result of Peckman River flooding; flooding from the Passaic River was of a much lesser magnitude.

Past Flood Damage

Within recent history, one of the most damaging floods of record in the Basin resulted from Tropical Storm Floyd on September 16, 1999, which caused an estimated \$6.5 million (Sep 1999 price level) in flood-related losses to towns in the Basin. However, a flood in May 1968 reportedly caused over \$10 million damage (Sep 1999 price level) to the Basin. In addition, historical data from 1945 indicated a significantly higher peak flow on the river during a storm on July 23rd of that year (originally estimated at 4,100 cfs at Ozone Avenue in Verona). Unfortunately, no damage estimates were available. Hurricane Doria in August 1971 was estimated to have 23-year recurrence frequency and caused an estimated \$1.2 million (Sep 1999 price level) in flood-related damages.

Expected Future Conditions without Flood Protection

Under without-project future conditions, the damage centers in West Paterson and Little Falls will continue to be subject to flooding. The flood damage potential may be reduced by nonstructural measures, particularly the acquisition of flood-prone structures. However, due to the commercial nature of much of the flood prone areas in the two communities, acquisition is not a reasonable alternative because it would be cost



prohibitive. Furthermore, continued development in central and upper portions of the Basin could increase the volume of runoff and exacerbate the flooding in West Paterson and Little Falls and other floodprone areas. Although much of the basin is highly urbanized, development can be expected to continue, possibly in areas that may be subject to flooding.

Needs and Opportunities

Flood Protection

Evaluation of flooding problems in the Peckman River Basin has identified the Borough of West Paterson and the Township of Little Falls as the most significant problem areas in the Basin. These problem areas are at or near the confluence of the Peckman and Passaic Rivers. Plan formulation for this preliminary analysis focused on flooding problems and opportunities in this area. However, future, more detailed H&H analyses may indicate other flood prone areas within the watershed that could benefit from a flood protection project.

As stated earlier in this report, the frequency of a storm of the magnitude of Tropical Storm Floyd would indicate that a storm of similar or greater magnitude may be likely during the project life. In addition, continued development of the watershed could result in even greater damages than experienced in 1999.

Ecosystem Degradation

Significant degradation of the ecology of the Peckman River Basin has occurred as a result of extensive erosion at specific locations along the river. Although not the focus of this preliminary analysis, there is strong support among local public and private stakeholders for ecosystem restoration/enhancement and/or bank stabilization in the



Basin. Therefore, opportunities for environmental enhancement have been identified for possible future consideration by the District and/or local sponsor under other authorities.

The current state of the river ecosystem reflects the type of long-term degradation often associated with heavily urbanized watersheds. The development of the watershed has reduced the water-holding capacity of the landscape and altered the natural flow dynamics (*i.e.*, intensity, duration, and frequency) within the river system. As a result, the habitat suitability and ecological complexity of the river have been moderately impaired. The concern is that increased flows will continue to degrade in-stream habitat and increase streambank erosion causing further sediment deposition into the river as well as potential damage to adjacent structures.

Observations along much of the river indicate that the streambanks are subjected to high levels of erosion, particularly during storm events. Of primary interest to this investigation are the areas where erosion is considered moderate to severe. Continued erosion within these areas will result in further degradation of the streambed and existing water quality through increased turbidity and temperature coupled with a decrease in dissolved oxygen levels. In addition, excess sediment loads will reduce the habitat suitability of the streambed for aquatic macroinvertebrates and fish. Trout are especially sensitive to sediment load increases.

Streambank erosion and channel migration directly threaten several public facilities and roadways located along the river. In addition, many of the streambanks throughout the corridor are dominated by a non-native plant (*i.e.*, Japanese knotweed) that does not have the stabilizing capacity nor the wildlife value of other more appropriate native shrub and tree species.



Hydrologic and Hydraulic Characteristics of the River Basin

Background

The first aspect of assessing the flooding potential of a river is to identify or develop H&H data. This is usually done using a recent study. In many cases, the hydrologic and hydraulic data generated by FEMA to develop the FIRM is sufficient for this level of analysis. However, a comparison of the USGS Log Pearson Type III frequency analysis or peak flows on the Peckman River and the frequency-discharge curve presented in the West Paterson FIS indicated that the results of the H&H analysis in the FIS may be outdated. The USGS analysis of Tropical Storm Floyd indicates that the storm had an exceedance probability of approximately 3.6%, or a 28-year event. Based on West Paterson FIS data, Tropical Storm Floyd had an exceedance probability less than 0.07%, or greater than a 1,500-year event. As shown in Table 1, there is a significant difference between the hydrologic data developed by USGS and FEMA. It should be noted that the existence of the USGS gage on the Peckman River post-dates the flood insurance studies. Therefore, stream gage data was not available for the development of the FIS hydrology.

Table 1 Peckman River Frequency-Discharge Comparison (at the confluence with the Passaic River)		
Frequency	FEMA-FIS⁽¹⁾ (cfs)	USGS⁽²⁾ (cfs)
1-year (approx)	200	890
10-year	1220	3580
50-year	1800	5780
100-year	2200	6980
500-year	3400	10530
Notes: ⁽¹⁾ From the West Paterson FIS. ⁽²⁾ Transferred from the Ozone Avenue (Verona) gage to Little Falls/West Paterson using $Q_{unk}=(A_{unk}/A_{kn})^{0.75} \times Q_{kn}$.		

Interviews with residents, business owners, and local officials regarding reported flood heights seemed to confirm the fact that the hydrologic information and flood stage frequencies included in the FIS's were suspect. Therefore, updated hydrologic and hydraulic data was needed before an assessment of flooding could be made for this



preliminary analysis. The summary of the methodology used to establish the updated H&H characteristics of the basin for this analysis are described in the following paragraphs.

Stage-Discharge

Flood stage-discharge data within the historic damage centers was the first component needed for the H&H analysis. Unfortunately, no Peckman River-specific stage-discharge data for the 10, 50 and 500-year flood events were provided in the West Paterson FIS due to the controlling flood elevations from the Passaic River. Only stage-discharge data for the 100-year flood (or the "Base Flood") was provided in tabular form. To overcome this lack of data, a range of stage-discharge curves (10-year through 500-year) for reaches of the river in West Paterson were developed by extrapolating the 10-, 50-, and 500-year Peckman River water-surface profiles from upstream of the controlling influence of the Passaic River downstream through West Paterson. Flood marks obtained by FEMA following Tropical Storm Floyd and descriptive flooding heights (as provided by residents and business owners) were used to approximate an additional Tropical Storm Floyd water surface profile.

From the water surface profiles developed using the above methodology, stage-discharge curves were developed for five (5) river station from upstream of Route 46 in Little Falls to the downstream of the McBride Avenue Bridge in West Paterson. Due to the relatively low FEMA discharges, in comparison to the USGS flows, the stage-discharge curves were extrapolated to include the highest flows.

Frequency-Discharge

An estimation of the frequency of flooding required the assessment of peak flows through the historic damage centers along the river. A discharge-frequency analysis (Log Pearson Type III) of the Peckman River was obtained from the USGS. This analysis included



peak river discharge data from the gage at Ozone Avenue in Verona from 1979 through 1999.

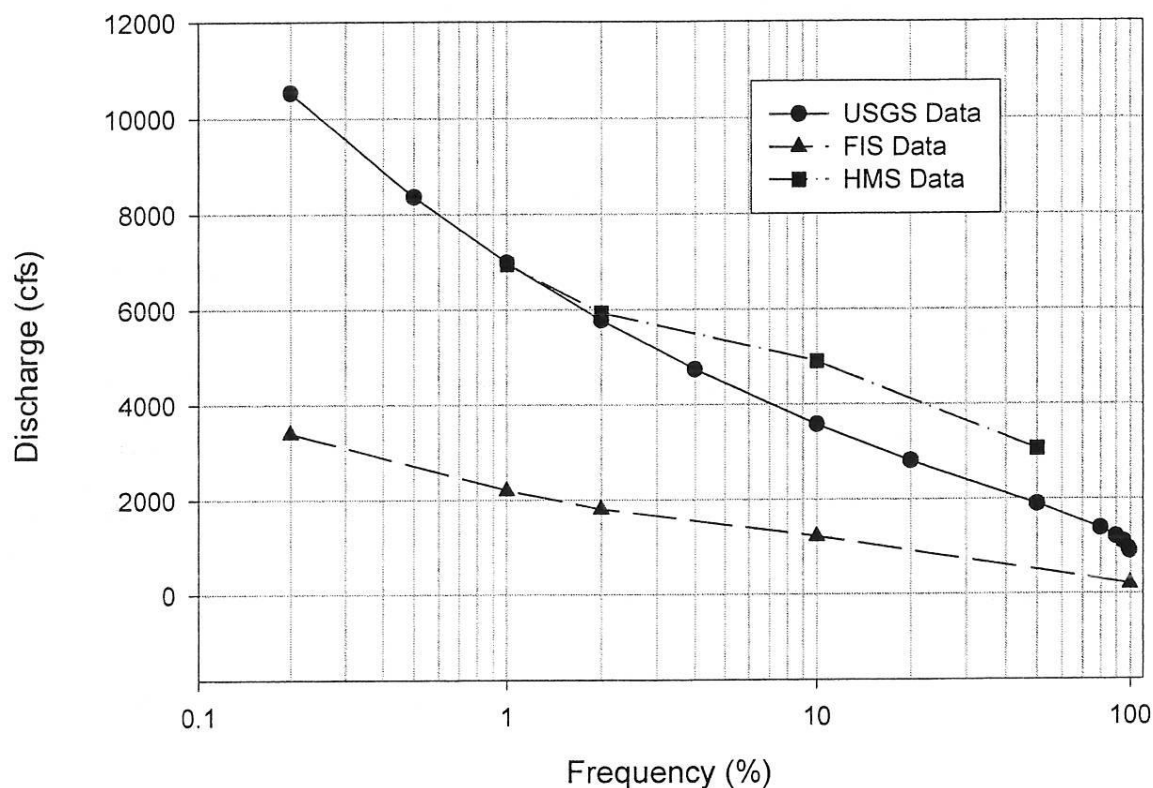
Due to the previously indicated disparity between the USGS and FEMA data, a means of verification was desired. The USGS data for the Peckman River was compared to data for the Third River in New Jersey, which was similar in size (9.8 square miles vs. 7.7 square miles) and development characteristics. The results of the Peckman River analysis closely correlated to the analysis of the Third River in New Jersey, including Tropical Storm Floyd flows (estimated to be a 28-year event on the Peckman River and approximately a 25-year event on the Third River).

A second comparison was made using HEC-1 (U.S. Army Corps of Engineers Hydrologic Engineering Center's Flood Hydrograph Package) data developed as part of the Main Stem Passaic River Feasibility Study (1987). As part of that study, the District developed a HEC-1 model of the Passaic River Basin. Although not modeled separately from the Passaic River, three nodes from the Peckman River Basin were included in the Passaic River model. Using the HEC-1 parameters for the Peckman River Basin nodes from the Main Stem Study, a preliminary HEC-HMS (Hydrologic Modeling System) model of the Peckman River Basin was developed and a separate frequency analysis conducted using rainfall frequency amounts for New Jersey provided by the NRCS. Rainfall from Tropical Storm Floyd was also analyzed.

As shown in Figure 3, the results of the HEC-HMS model closely correlate to the USGS Log Pearson analysis at the upper end of the curve; however, the HMS model resulted in higher peak flows below the 50-year event. Nevertheless, this helped confirm that peak flows on the river are probably significantly higher than those originally published over 20-years ago in the FIS.



Figure 3
Peckman River
Peak Discharges
FIS/USGS*/HEC-HMS
 (*transfer equ.)



The result of the analysis indicate that peak flows on the Peckman River are most likely significantly higher than those used in previous analyses. Without a more detailed hydrologic analysis of the Basin, it was determined that the USGS data represents the most recent and most reliable hydrologic data for the watershed. Therefore, the results of the USGS frequency analysis were extrapolated downstream to Little Falls and West Paterson using the NJDEP Transfer Equation shown below, for use in this analysis. The results of the extrapolation are shown in Table 2.

$$Q_{\text{unknown}} = \left[\text{Area}_{\text{unknown}} / \text{Area}_{\text{known}} \right]^{0.75} \times Q_{\text{known}}$$



Table 2 Peckman River Frequency-Discharge Curve (estimated from USGS frequency analysis)			
USGS Gage Discharge* (cfs)	Estimated Annual Exceedance Probability	Approximate Recurrence Interval	Peak Flow Transferred to Route 46 (cfs)
500	0.995	~1-yr	880
1050	0.5	2-yr	1860
2000	0.1	10-yr	3510
3200	0.02	50-yr	5690
3870	0.01	100-yr	6860
5840	0.002	500-yr	10350
* Ozone Avenue (Verona) stream gage.			

Flood depth-frequency relationships for the historic damage centers were developed by combining the estimated stage-discharge and frequency-discharge data described above. This data was used to determine the frequency of anticipated flood damages. Reduction of these damages are the objective of flood control alternatives discussed later in the report.

Correlation with Passaic River Flooding

Based on the higher peak Peckman River flows identified for this analysis, it may now be assumed that there is a significantly greater Peckman River influence on West Paterson flooding than originally thought. Furthermore, additional data included in the Main Stem Passaic River Feasibility Study indicates that the 500-year flood elevation on the Passaic River is lower than the elevation used by FEMA in the FIS's. Nevertheless, the fact remains that portions of West Paterson subject to flooding from the Peckman River are also subject to flooding from the Passaic River. The dependence or independence of Peckman and Passaic flooding events is based on many factors, including storm size, frequency, location, duration, etc. The level of dependence or independence cannot be reasonably determined at this level of analysis. However, more detailed analyses conducted during the feasibility phase of the project should incorporate a correlation analysis to determine the overall effectiveness of flood protection for areas subject to flooding from both rivers.

