

MUNICIPAL STORMWATER MANAGEMENT PLAN MASTER PLAN ELEMENT

TOWNSHIP OF UNION
UNION COUNTY, NEW JERSEY

Adopted: _____

Final Draft dated: March 10, 2005

PREPARED FOR

UNION TOWNSHIP PLANNING BOARD

PREPARED BY:

ROBERT W. BUCCO, JR., P.E., C.M.E.
UNION TOWNSHIP ENGINEER
Licensed Professional Engineer No. GE 38132

KEITH W. HENDERSON, P.E., P.P.
SENIOR VICE PRESIDENT
Licensed Professional Engineer No. GE 30804
Licensed Professional Planner No. LI 03576



11 Tindall Road
Middletown, New Jersey 07748
(732) 671-6400

March 2005

Members of the 2005 Planning Board

Joseph Florio, Mayor

Anthony Terrezza, Committeeman

Brenda C. Restivo, Mayor's Representative

Robert Gechtman, Chairman

Richard Massarelli, Vice Chairman

Michael J. O'Hara, Secretary

Joseph Cantalupo

Thomas C. Demovic

Jean Perkins

Timothy Moyer

Jason Eitner, Alternate #1

Sonia Hamberg, Alternate #2

Robert W. Bucco, Jr., P.E., C.M.E., Administrative Officer

Daniel McCarthy, Attorney

George Vaccaro, Court Reporter

Diana Rutledge, Secretary and Planning Board Clerk

TABLE OF CONTENTS

INTRODUCTION.....	1
GOALS AND OBJECTIVES	1
STORMWATER DISCUSSION.....	3
HYDROLOGIC CYCLE.....	3
IMPACTS OF STORMWATER.....	4
BACKGROUND.....	6
DEMOGRAPHICS	6
WATERWAYS	10
WATER QUALITY	10
WATER QUANTITY	13
GROUNDWATER RECHARGE	14
EXISTING INFRASTRUCTURE AND TOWNSHIP IMPROVEMENTS	15
DESIGN AND PERFORMANCE STANDARDS.....	18
PLAN CONSISTENCY	20
REGIONAL STORMWATER MANAGEMENT PLANS.....	20
TOTAL MAXIMUM DAILY LOADS.....	20
RESIDENTIAL SITE IMPROVEMENT STANDARDS (RSIS).....	20
SOIL CONSERVATION	20
STORMWATER MANAGEMENT STRATEGIES	21
NONSTRUCTURAL STRATEGIES.....	23
RECOMMENDED MEASURES	23
STRUCTURAL STORMWATER MANAGEMENT.....	26
LAND USE/ BUILD-OUT ANALYSIS	31
MITIGATION PLAN.....	35
MITIGATION PROJECT CRITERIA	35
DEVELOPER MITIGATION PLAN REQUIREMENTS.....	35
REFERENCES	37

LIST OF TABLES

TABLE 1 : POPULATION TRENDS 6
TABLE 2: GENERAL HOUSING CHARACTERISTICS 9

LIST OF FIGURES

FIGURE 1: HYDROLOGIC CYCLE..... 3
FIGURE 2: TOPOGRAPHICAL MAP 8
FIGURE 3: ZONING MAP..... 11
FIGURE 4: TOWNSHIP’S WATERWAYS 12
FIGURE 5: GROUNDWATER RECHARGE AREAS..... 16
FIGURE 6: WELLHEAD PROTECTION AREAS 17
FIGURE 7: EXISTING LAND USE 32
FIGURE 8: HYDROLOGIC UNITS (HUC 14S)..... 33
FIGURE 9: WETLANDS AND WATER LAND USES – CONSTRAINED LAND 34

INTRODUCTION

As required by the Municipal Stormwater Regulations (N.J.A.C. 7:14A-25), the Township of Union has developed this Municipal Stormwater Management Plan (MSWMP) to outline their approach to addressing the impacts resulting from stormwater related issues associated with future development, redevelopment, and land use changes. The MSWMP addresses groundwater recharge, stormwater quantity, and stormwater quality impacts through the incorporation of stormwater design and performance standards for new development and redevelopment projects that disturb one or more acres of land. The standards are intended to minimize negative or adverse impacts of stormwater runoff such as decreased water quality, increased water quantity and reduction of groundwater recharge that provides base flow to the Township's receiving bodies of water. In addition to minimizing these impacts, the MSWMP provides long term operation and maintenance measures for existing and proposed stormwater management facilities.

This MSWMP provides recommendations for ordinance modifications in order to expedite the implementation of stormwater management strategies. The MSWMP also includes mitigation strategies to permit the Township to grant variances or exemptions from proposed design and performance standards that are contained in this plan as set forth by the Municipal Stormwater Regulations (N.J.A.C. 7:8-5.5).

GOALS AND OBJECTIVES

The goals of this MSWMP are:

1. Reduce flood damage, including damage to life and property;
2. Minimize, to the extent practical, any increase in stormwater runoff from any new development;
3. Reduce soil erosion from any development or construction project;
4. Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;

5. Maintain groundwater recharge;
6. Prevent, to the greatest extent feasible, an increase in nonpoint pollution;
7. Maintain the integrity of stream channels for their biological function, as well as for drainage;
8. 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;
9. Protect public safety through the proper design and operation of stormwater basins.

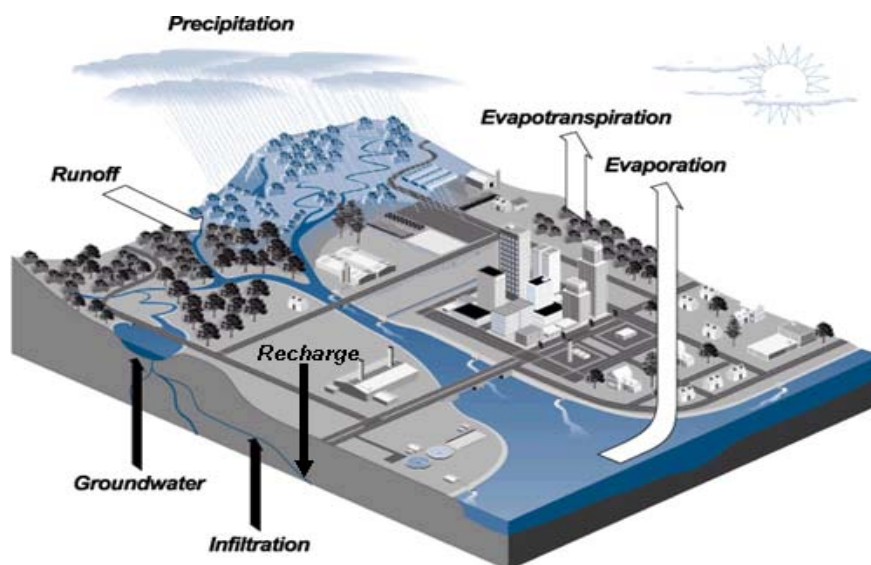
To achieve these goals, the MSWMP outlines specific stormwater design and performance standards for new development and proposes stormwater management controls for addressing impacts from existing developments. Preventive and corrective maintenance strategies are also included to ensure the long-term effectiveness of stormwater management facilities and the MSWMP outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

STORMWATER DISCUSSION

HYDROLOGIC CYCLE

The hydrologic cycle or Water Cycle (Figure 1) is the continuous circulation of water between the ocean, atmosphere, and land. The driving force of this natural cycle is the sun. Water, stored in oceans, depressions, streams, rivers, waterbodies, vegetation and even land surface, continuously evaporates due to solar energy. This water vapor then condenses in the atmosphere to form clouds and fog. After water condenses, it precipitates, usually in the form of rain or snow, onto land surfaces and waterbodies. Precipitation falling on land surfaces is often intercepted by vegetation. Plants and trees transpire water vapor back into the atmosphere, as well as aid in the infiltration of water into the soil. The vaporization of water through transpiration and evaporation is called evapo-transpiration. Infiltrated water percolates through the soil as groundwater, while surface water flows overland. Groundwater and surface water flow to major waterbodies and eventually flows to the Earth's seas and oceans. This constant process of evapo-transpiration, condensation, precipitation, and infiltration comprises the hydrologic cycle.

Figure 1: Hydrologic Cycle



Source: Kern River Connections <http://www.creativille.org/kernriver/watershed.htm>

IMPACTS OF STORMWATER

Prior to any land development, native vegetation often intercepts precipitation directly or absorbs infiltrated runoff into their roots. Development often replaces native vegetation with lawns or impervious cover, such as pavement or structures, thereby reducing the amount of evapotranspiration and infiltration. Regrading and clearing of lots disturbs the natural topography of rises and depressions that can naturally capture rainwater and allow for infiltration and evaporation. Construction activities often compact soil, thereby decreasing its permeability or ability to infiltrate stormwater. Development activities also generally increase the volume of stormwater runoff from a given site.

Connected impervious surfaces and storm sewers (such as roof gutters emptying into paved parking lots that drain into a storm sewer) allows the runoff to be transported downstream more rapidly than natural areas. This shortens travel time and increases the rainfall- runoff response of the drainage area, causing downstream waterways to peak higher and quicker than natural areas, a situation that can cause or exacerbate downstream flooding, erosion, and sedimentation in stream channels. Furthermore, connected impervious surfaces do not allow pollutants to be filtered, or for infiltration and ground water recharge to occur prior to reaching the receiving waters. Increase volume combined with reduced base flows, results in a greater fluctuation between normal and storm flows allowing for greater channel erosion. Additionally, reduced base flows, increased fluctuation, and soil erosion can affect the downstream hydrology of the watershed, impacting the ecological integrity of the watershed.

Water quantity impacts combined with land development often adversely impacts stormwater quality. Impervious surfaces collect pollutants from the atmosphere, animal wastes, fertilizers and pesticides, as well as pollutants from motor vehicle usage. Pollutants such as hydrocarbons, metals, suspended solids, pathogens, and organic and nitrogen counting compounds, collect and concentrate on impervious surfaces. During storm events, these pollutants are washed directly into municipal storm sewer systems. In addition to chemical and biological pollution, thermal pollution can occur from water collected or stored on impervious surfaces or in heated stormwater impoundments. Thermal pollution can affect aquatic habitats, adversely impacting

cold water fish. Removal of shade trees and stabilizing vegetation from stream banks also contributes to thermal pollution.

As towns and cities develop from rural agricultural communities, the landscape is altered in dramatic ways. Both residential and nonresidential development on former agricultural fields and pastures can have a great impact on the hydrologic cycle for the specific site. Localized impacts to the hydrologic cycle will ultimately impact the hydrologic cycle of the entire watershed encompassing that development site.

Proper stormwater management will help mitigate the negative impact of land development and its effects on stormwater. This MSWMP outlines the Township's plan to improve stormwater quality, decrease stormwater quantity, and increase groundwater recharge. By managing stormwater, the Township will improve the quality of aquatic ecosystems and restore some of the natural balance to the environment.

BACKGROUND

The Township of Union encompasses 9.12 square miles of Union County, New Jersey. It is primarily a residential community that is completely developed. The Township lies on a plain that extends from the eastern base of the Watchung Mountains to the Arthur Kill and Newark bay. The topography of the Township ranges between 40 and 180 feet above mean sea level, with the majority of the Township between 80 and 120 feet above mean sea level. The Township's boundary is delineated on a USGS quadrangle map shown in Figure 2.

DEMOGRAPHICS

The population of Union Township has fluctuated over the past forty years. In 1970, the population was 53,077, however, the population decreased in 1980 to 50,184, and again in 1990 to 50,024. The recent U.S. Census indicated that the Township's population increased to 54,405 in 2000 (See Table 1: Population Trends). The decrease in population is mostly attributed to changing population characteristics including age distribution and family size. As noted in the Township's current Master Plan, its population has stabilized and is not expected to fluctuate greatly in upcoming years.

Table 1 : Population Trends

Year	Union		Union County		New Jersey	
	Population	% Change	Population	% Change	Population	% Change
1930	16,472		305,209		4,041,334	
1940	24,730	33.4	328,344	7.0	4,160,165	0.3
1950	38,004	34.9	398,138	17.5	4,835,329	1.6
1960	51,499	26.2	504,255	21.0	6,066,782	2.6
1970	53,077	3.0	543,116	7.2	6,066,782	1.8
1980	50,184	- 5.5	504,094	-7.7	7,364,823	0.3
1990	50,024	- 0.3	493,819	-2.1	7,730,118	0.5
2000	54,405	8.8	522,541	5.8	8,414,350	0.9
2003 ¹	55,492	2.0				

Source: 1980, 1990, 2000 U.S. Census

¹ Based on new housing units constructed between 2000-2003 and average household size of 2.71 persons. New Jersey Department of Labor and Workforce Development. <http://www.wnjp.in.net/OneStopCareerCenter/LaborMarketInformation/lmi18/index.html>

Figure 2: Topographical Map

The Township's current Master Plan also outlines that the Township has experienced a steady moderate growth over the past forty years. In 1970, there were 17,455 housing units, which increased to 18,356 in 1980, to 19,334 in 1990 and 20,001 in 2000. No substantial change in the amount of growth is anticipated, particularly since growth will be limited due to the depletion of residentially zoned vacant land.

Table 2: General Housing Characteristics

	1990		2000		Change
	Number	Percent	Number	Percent	Number
OCCUPANCY STATUS					
Total Housing Units	19,334	100	20,001	100	667
Occupied Housing Units	18,882	97.7	19,534	97.7	652
Vacant Housing Units	452	2.3	467	2.3	15
Tenure					
Occupied Housing Units	18,882	100	19,534	100	652
Owner- Occupied Housing Units	14,530	77.0	14,942	76.5	412
Renter- Occupied Housing Units	4,352	33.0	4,592	23.5	240
Vacancy Status					
Vacant Housing Units	452	100	467	100	15
Population					
Population	50,024	100	54,405	100	4,381
Households					
Households	18,882	100	19,534	100	
Family Household	13,843	73.3	11,690	59.8	- 2,153
1 Person Household	4,500	23.8	4,656	23.8	156
Persons/ Household	2.58		2.71		0.13

Source: 1990, 2000 U.S. Census

The single largest land use within the Township is single unit residential development, which comprises approximately 69% of the Township's housing units. Two-unit dwellings comprise another 11% of the remaining residential structures. According to the Tax Assessor,

approximately 34 acres or 0.59% of the Township is taxable vacant land. Figure 3 illustrates the Township's Zoning map.

The housing trend shows a healthy increase of 667 units between 1990 and 2000. This trend is expected to continue as obsolete industrial and commercial properties are redeveloped into residential and mixed uses. Since 2000, there has been a slight increase in residential development throughout the Township. Some of these developments include the Union Station Townhome Development, the Autumn Ridge Senior Residential Development, and the Advanced Residential Community.

WATERWAYS

This increase in development most likely resulted in changes to the landscape, and increased the quantity and pollutant loading of stormwater runoff. Waterbodies in Union Township include the Rahway River, Lightning Brook, Maplewood Brook, Irvington Brook, Elizabeth River, and the West Branch of the Elizabeth River. Figure 4 depicts the Township's waterways.

WATER QUALITY

The Ambient Biomonitoring Network (AMNET) was established by the New Jersey Department of Environmental Protection (NJDEP) to monitor and document the health of New Jersey's waterways. AMNET currently has 820 sites in five drainage basins that monitor for benthic macroinvertebrates on a five-year cycle. Waterways are scored based on the data to generate the New Jersey Impairment Score (NJIS) and categorized as severely impaired, moderately impaired, and non-impaired. The NJIS is primarily based on biometrics and benthic macroinvertebrate health. (<http://www.state.nj.us/dep/wmm/bfbm/>)

The Rahway River, Lightning Brook, Maplewood Branch, Irvington Branch, Elizabeth River, and the West Branch of the Elizabeth River are not categorized as Category One waters. However, according to AMNET some are listed as moderately impaired. These include the West Branch of the Elizabeth River, which is moderately impaired by phosphorous, and the Elizabeth River at Lakeview River and Maple Terrace, which is moderately impaired for benthic

Figure 3: Zoning Map

Figure 4: Township's Waterways

macroinvertebrates.

In addition to biological health, chemical data are gathered by the NJDEP and other organizations, and used to determine the health of waterways. The data are then used to determine which waters require the development of Total Daily Maximum Loads (TMDLs). A TMDL is the carrying capacity of a waterbody for a given pollutant. This is the quantity of pollutants that can enter a waterbody without exceeding water quality standards or interfering with the ability to use the waterbody for its designated usage. Point and non-point pollution, surface water withdrawals and natural background levels are included in the determination of a TMDL, as required by section 303(d) of the Clean Water Act. Point source pollution includes, but is not limited to NJPDES permitted discharges, while non-point source pollution may include stormwater runoff from agricultural lands or impervious surfaces. TMDLs determine the allowable load from each source, with a factor of safety, of the pollutant entering the waterbody. TMDLs can be used to prevent further deterioration of a waterbody, or to improve the current water quality.

Union Township presently has two established TMDLs for fecal coliform from nonpoint source pollution. The first TMDL is for 4.2 river miles of the West Branch of the Elizabeth River, and the second is listed for 5.7 river miles of the Elizabeth River at Ursino Lake in Elizabeth. In addition to these impairments, according to Sublist 5 of the 2004 Integrated List of Waterbodies lists, the Elizabeth River at Ursino Lake in Elizabeth impaired by phosphorous and dissolved solids. However, no TMDLs have been established for these impairments. It is also important to note, that there are no established stormwater TMDLs, and as such are not governed by this MSWMP.

WATER QUANTITY

In addition to the above water quality issues, stormwater often causes water quantity issues. There are several flood prone areas in Union Township. This flooding is due to inadequately sized natural and man-made stormwater conveyances.

In severe storm events several areas of the Township flood. The 1978 Flood Insurance Rate Map, developed by the U.S. Department of Housing and Urban Development Federal Insurance Administration, lists the following streets as flood prone during a 100 year storm event:

- Several areas along the Rahway River, Elizabeth River, and the Vauxhall Branch
- Connecticut Farms Section bounded by West Chestnut St., Rt. 22, Gelb Ave., Brighton St., and Elmwood Avenue
- Sections of Jeanette Ave., Balmoral Ave., Stecher Ave., Morrison Ave., and Tyler Ave. on the Southwest Branch of the Elizabeth River
- Union Ave along Lightning Brook
- Sections of Burnet Ave near the Vauxhall Branch
- Sections of Stuyvesant Avenue along the Irvington Branch
- Robert Street along the Elizabeth River
- Sections of Huguenot Ave., Arnet Ave., and Potter Ave. along the Lehigh Valley Branch

These areas were flooded during Hurricane Floyd in September of 1999, which was considered in excess of the 100-year storm.

GROUNDWATER RECHARGE

Hydrologic conditions have changed, since the design of the stormwater conveyance system. Impervious coverage has proportionately increased with development. This imperviousness allows for a greater volume of water to reach these conveyances faster than the intended design rates. This causes the system to backup and flood. The high amount of impervious area also decreases ground water recharge, and base stream flows. Combined the effects have negative impacts on the stream and river ecosystems of the Township.

The vast majority of the Township is located within an urban Metropolitan Planning Area as delineated on the State Plan Policy Map (SPPM). Per N.J.A.C. 7:8-5.4 (a)2ii and N.J.A.C 7:8-1-2 there are conditions under which the Groundwater Recharge requirements for the Stormwater Management Rules do not apply for Metropolitan Planning Areas. “Previously developed” lands

within urban areas are exempt from these requirements. “Previously developed” means any area on a site that is occupied by structures, been filled or graded. Areas that were deforested, but have reestablished woody vegetation are not considered “previously developed.” In addition, only the areas within a given site that meet these criteria are exempt from the groundwater recharge requirements. It is possible to have a site that has partial areas of exemption, and other areas that are required to meet the requirements. A map of the groundwater recharge areas is illustrated in Figure 5.

The Township’s current wellhead protection areas are delineated in Figure 6. These water supply wells are owned and operated by Elizabethtown Water. These protection areas may change if Elizabethtown Water reactivates its deep well field located in Joe Collins Park off of Liberty Avenue.

EXISTING INFRASTRUCTURE AND TOWNSHIP IMPROVEMENTS

The Township currently has an existing stormwater drainage system. This system includes a network of inlet catch basins and storm sewer pipes. The Township has initiated rehabilitation of this system, along with other stormwater management improvements. The Township recently constructed a flood control project along Franklin Street in the Vauxhall section of the Township. This project consisted of the construction of a floodwall and earthen berm to protect the community from both the 50 and 100-year storm events.

Figure 5: Groundwater Recharge Areas

Figure 6: Wellhead Protection Areas

DESIGN AND PERFORMANCE STANDARDS

The Township shall adopt applicable design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to reduce the negative impact of stormwater runoff on water quality and quantity, and loss of groundwater recharge in receiving waterbodies. The section of this MSWMP, entitled Stormwater Management Strategies, indicates actions appropriate for various types of development in Union Township. Ultimately, design and performance standards will be created to contain the necessary language to maintain stormwater management measures consistent with the applicable stormwater management rules, N.J.A.C. 7:8-5.8 - Maintenance Requirements. This includes language for safety standards consistent with N.J.A.C. 7:8-6 - Safety Standards for Stormwater Management Basins. Ordinances must be submitted to the Union County Division of Engineering for review and approval within 12 months of adoption of the MSWMP.

Proper inspection and maintenance are critical components for the successful performance of a stormwater management system. The Township is presently preparing a Stormwater Pollution Prevention Plan (SPPP) to address inspection and maintenance for existing stormwater infrastructures throughout the Township. Also included in the SPPP plan is the development of a Local Public Education Program to educate property owners on methods to reduce nonpoint stormwater pollution such as proper waste disposal, solids and floatable controls, fertilizer and pesticide use, etc. New Development and redevelopment projects will be required to develop and submit a detailed operation and maintenance plan for each best management practice (BMP) established in accordance with the N.J.A.C. 7:8 - 5.8. Recommendations for proper maintenance procedures are available in the NJDEP's *Best Management Practices (BMPs) Manual*. Copies of the maintenance plan(s) will be filed with the Township Department of Public Works.

During construction, Township personnel will observe construction of the project to ensure that the appropriate stormwater management measures are constructed and function as designed. Township personnel will conduct periodic inspections after significant storms to ensure the system is functioning properly and to identify maintenance needs, if any. After this, annual

checks will be done to identify any additional maintenance needs required. This may include clearing of blockages from inlets and/or outlet structures, removal of unhealthy vegetation or accumulated debris/materials.

Township ordinances shall indicate that the inspection of systems is permissible on private property, provided the necessary easements are in place, upon giving reasonable notice. Ordinances shall also indicate a time frame for maintenance procedures to occur upon receiving notice from the Township that maintenance is required. Additionally, prior to construction, Developers shall submit a maintenance plan describing the required long-term maintenance of any BMP that is proposed for construction. This plan will be reviewed on a case-by-case basis to determine the extent of Township responsibility in terms of the long term maintenance and operation of the BMPs.

PLAN CONSISTENCY

REGIONAL STORMWATER MANAGEMENT PLANS

Currently, there are no Regional Stormwater Management Plans (RSWMP) developed for waters within the Township. Therefore, the MSWMP does not need to be consistent with any such plans at this time. The MSWMP will be updated to be consistent with any RSWMP that are established in the future.

TOTAL MAXIMUM DAILY LOADS

There are two established TMDLs in Union Township including two established TMDLs for fecal coliform. This MSWMP will be consistent with established TMDLs for fecal coliform. The TMDL requires the reduction in non-point sources including sources from stormwater runoff. It is important to note, however, that these are not stormwater specific TMDLs, and as such they are not governed by this MSWMP. The MSWMP will be updated to be compliant with any TMDLs issued in the future.

RESIDENTIAL SITE IMPROVEMENT STANDARDS (RSIS)

This Municipal Stormwater Management Plan is consistent with regulations established under the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. This MSWMP will be updated to remain consistent with any future updates of RSIS. Additionally, the Township shall use the latest update of RSIS during its reviews of residential area development for stormwater management.

SOIL CONSERVATION

The Township's Stormwater Management Control Ordinance will require that all new development and redevelopment projects comply with the Soil Erosion and Sediment Control Standards of New Jersey. Township inspectors will observe on-site soil erosion and sediment control measures as part of construction site inspections. The inspectors will report any inconsistencies or deficiencies to the Somerset-Union Soil Conservation District.

STORMWATER MANAGEMENT STRATEGIES

The Township has reviewed its Master Plan and Ordinances. This MSWMP plan provides a list of sections of the Township's land use and zoning ordinances that are to be recommended for revision to incorporate the Nonstructural Strategies for stormwater management.

Upon completion of the draft ordinances revisions, they will be submitted to Union County for review and approval prior to local adoption. A copy will also be sent to the NJDEP at the same time of submission.

- ❑ **Section 170-239E.2: Transitional Buffers:** Buffers are required in transitional zones in all zones except residential. This ordinance should be updated to include the use of native vegetation.
- ❑ **Riparian Buffers:** The Township currently defers to NJDEP definitions and requirements for Riparian buffers. The Township should update this ordinance to include an allowable maintenance and activities, and creation of a conservation easement.
- ❑ **ARTICLE XIX Performance Standards of Chapter 170** should be amended to include the design and performance criteria described herein.
- ❑ **Section 170-238F: Drainage:** This section requires all streets requiring storm drainage use storm pipes and catch basins. This section should be updated to include the use of other methods that allow for infiltration and meet the design standards specified herein. Section 10 requires all preexisting roof leaders be directed to the gutter or stormwater conveyance. Section 11 requires the connection of any new roof leaders, via underground piping, to storm drainage systems. These sections should be altered to require the runoff to infiltrate the soil via seepage pits and dry wells, and meet the design standards specified herein. Additionally, methods for long-term maintenance should be included.

- ❑ **Section 170-238G: Stormwater Control Measures:** This section lays out the Township's stormwater control measures. The Township currently requires the duplication (as near as possible) of pre-construction stormwater conditions, following construction in all zones except single and two-family residential not constructed as part of a major subdivision. This section should be updated to comply with the standards specified in this plan.
- ❑ **Sections 170-90& 170-239 Curb & Gutter:** Both sections require all paved areas to be surrounded by curbing of either concrete or Belgian block. These ordinances should be updated to allow for the use of curb cuts or flush cut curbs and curb stops on a case-by-case basis as determined by the Township Engineer.
- ❑ **Section 170-239 O: Landscaping and Screening Ordinances:** The Township currently has ordinances requiring landscape islands and screening around parking lots, between roads and sidewalks. These ordinances should be updated to recommend the use of native vegetation and nonstructural strategies over the use of structural screen strategies.
- ❑ **Section 170-118. Nonconforming Lots:** This section defines a nonconforming lot, or a lot that does not meet the land area requirements of its zone. It requires the application of all other ordinances based on intended use. This should be updated to include the application of the stormwater management and control ordinances also.
- ❑ **Section 170-238.A.8 Subdivisions: Cul-de-sacs:** This section states the minimum radius and dimension of cul-de-sacs, as well as a requirement for utility easement and planting strips. This should be updated to encourage the use of native vegetation and nonstructural stormwater conveyances.
- ❑ **Section 170-238.E Subdivisions: Natural Features:** This section recommends the preservation of natural features. It should be updated to include conservation easements or stream corridor buffers.

NONSTRUCTURAL STRATEGIES

This MSWMP recommends the practical use of the following nonstructural strategies for all major developments in accordance with the NJDEP's *Best Management Practices (BMPs) Manual*:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.
2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.
3. Maximize the protection of natural drainage features and vegetation.
4. Minimize the decrease in the pre-construction "time of concentration."
5. Minimize land disturbance including clearing and grading.
6. Minimize soil compaction.
7. Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.
8. Provide preventative source controls.

In addition, the NJDEP *BMP Manual* further requires an applicant seeking approval for a major development² to specifically identify which and how these nonstructural strategies have been incorporated into the development's design. Finally, for each of those nonstructural strategies that were not able to be incorporated into the development's design due to engineering, environmental, or safety reasons, the applicant must provide a basis for this contention.

RECOMMENDED MEASURES

Recommendations in NJDEP's BMP manual may be implemented through the use of:

- **Vegetated Filter Strips**

Vegetated filter strips are engineered stormwater conveyance systems that treat small

² Major Development – means any development that provides for ultimately disturbing one or more acres of land or increases impervious surface by one-quarter acre or more. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

drainage areas. Generally, a vegetated filter strip consists of a level spreader and planted vegetation. The level spreader ensures uniform flow over the vegetation that filters out pollutants, and promotes infiltration of the stormwater.

Vegetated filter strips are best utilized adjacent to a buffer strip, watercourse or drainage swale since the discharge will be in the form of sheet flow, making it difficult to convey the stormwater downstream in a normal conveyance system (swale or pipe).

- **Stream Corridor Buffer Strips**

Buffer strips are undisturbed areas between development and the receiving waters. There are two management objectives associated with stream and valley corridor buffer strips:

- To provide buffer protection along a stream and valley corridor to protect existing ecological form and functions; and
- To minimize the impact of development on the stream itself (filter pollutants, provide shade and bank stability, reduce the velocity of overland flow).

Buffers only provide limited benefits in terms of stormwater management; however, they are an integral part of a system of best management practices.

- **The Stabilization of Banks, Shoreline and Slopes**

The root systems of trees, shrubs and plants effectively bind soils to resist erosion. Increasing the amount of required plant material for new and redeveloped residential and non-residential sites should be encouraged throughout the Township. Planting schemes should be designed by a certified landscape architect to combine plant species that have complementary rooting characteristics to provide long-term stability.

- **Pond Configuration**

Many ponds are shallow and suffer from eutrophic conditions. This leads to large amount of weed and algae growth that depletes the amount of dissolved oxygen in the water. Through proper design, increases in water temperature during summer months can be minimized.

The configuration of a pond will affect its temperature. The length-to-width ratio should be maximized to prevent the occurrence of large open areas of water that cannot be shaded by vegetation. The positioning of deciduous and coniferous trees along the edges of a pond, channel or wetland can assist in mitigating undesirable increases in water temperature and contribute to the maintenance of dissolved oxygen levels by inhibiting the growth of algae.

- **Deterrence of Geese and Deer**

Maintaining or planting dense woody vegetation around the perimeter of a pond or wetland is the most effective means of deterring geese from taking over and contaminating local lakes and ponds. Minimizing the amount of land that is mowed will limit the preferred habitat for geese. Also, the planting of deer resistant vegetation adjacent to waterbodies is a means of deterring deer by minimizing food sources.

- **Fertilizers**

The use of fertilizers to create the “perfect lawn” is an increasingly problem in many residential areas. Fertilizer run-off increases the level of nutrients in water bodies and can accelerate eutrophication³ in the lakes and rivers and continue on to the coastal areas. The excessive use of fertilizers causes nitrate contamination of groundwater and may lead to levels in drinking water that is far above recommended safety levels. Good fertilizer maintenance practices can help in reducing the amount of nitrates in the soil and thereby lower its content in the water. Initially, the Township should

work with the NJDEP to educate both homeowners and professional lawn maintenance and landscaping companies of the impacts of the overuse of fertilizers and the negative impacts of fertilizers. This discussion should include other techniques to create a “green lawn” without over fertilizing. Almost as important of the use of fertilizer is the combination of over fertilizing and over watering lawns. In many cases this leads to nutrient rich runoff, which ultimately may terminate into a nearby stream, lake or other water body. If fertilizer is applied correctly, the natural characteristics of the underlying soils will absorb or filter out the nutrients in the fertilizer.

STRUCTURAL STORMWATER MANAGEMENT⁴

In Chapter 9 of its *Stormwater Management Best Management Practices* (BMP) manual, the Department of Environmental Protection identifies several structural stormwater management options. The Township recommends the following structural devices. Specifically, the Township encourages the use of structural stormwater management systems in a manner that maximizes the preservation of community character:

- **Bioretention Systems**

A bioretention system consists of a soil bed planted with native vegetation located above an underdrained sand layer. It can be configured as either a bioretention basin or a bioretention swale. Stormwater runoff entering the bioretention system is filtered first through the vegetation and then the sand/soil mixture before being conveyed downstream by the underdrain system. Runoff storage depths above the planting bed surface are typically shallow. The adopted Total Suspended Solids (TSS) removal rate for bioretention systems is 90 percent.

- **Constructed Stormwater Wetlands**

Constructed stormwater wetlands are wetland systems designed to maximize the

³ Eutrophication – The normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestrial state and disappears.

⁴ Definitions provided in the NJDEP – Stormwater Best Management Practices Manual at: http://www.njstormwater.org/tier_A/bmp_manual.htm

removal of pollutants from stormwater runoff through settling and both uptake and filtering by vegetation. Constructed stormwater wetlands temporarily store runoff in relatively shallow pools that support conditions suitable for the growth of wetland plants. The adopted removal rate for constructed stormwater wetlands is 90 percent.

- **Dry Wells**

A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs of structures. Discharge of this stored runoff from a dry well occurs through infiltration into the surrounding soils. A dry well may be either a structural chamber and/or an excavated pit filled with aggregate. Due to the relatively low level of expected pollutants in roof runoff, a dry well cannot be used to directly comply with the suspended solids and nutrient removal requirements contained in the NJDEP Stormwater Management Rules at N.J.A.C. 7:8. However, due to its storage capacity, a dry well may be used to reduce the total stormwater quality design storm runoff volume that a roof would ordinarily discharge to downstream stormwater management facilities.

- **Extended Detention Basins**

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

- **Infiltration Basins**

An infiltration basin is a facility constructed within highly permeable soils that provides temporary storage of stormwater runoff. An infiltration basin does not normally have a structural outlet to discharge runoff from the stormwater quality

design storm. Instead, outflow from an infiltration basin is through the surrounding soil. An infiltration basin may also be combined with an extended detention basin to provide additional runoff storage for both stormwater quality and quantity management. The adopted TSS removal rate for infiltration basins is 80 percent. It should be noted that a dry well is a specialized infiltration facility intended only for roof runoff.

- **Manufactured Treatment Devices**

A manufactured treatment device is a pre-fabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff. The TSS removal rate for manufactured treatment devices is based on the NJDEP certification of the pollutant removal rates on a case-by-case basis. Other pollutants, such as nutrients, metals, hydrocarbons, and bacteria can be included in the verification/certification process if the data supports their removal efficiencies.

- **Pervious Paving Systems**

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers. Pervious paving systems are divided into three general types: Porous Paving, Permeable Pavers with storage beds, and Permeable Pavers without storage beds. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. Porous paving and permeable paver with storage bed systems treat the stormwater quality design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures.

- **Sand Filters**

A sand filter consists of a forebay and underdrained sand bed. It can be configured as either a surface or subsurface facility. Runoff entering the sand filter is conveyed first through the forebay, which removes trash, debris, and coarse sediment, and then through the sand bed to an outlet pipe. Sand filters use solids settling, filtering, and adsorption processes to reduce pollutant concentrations in stormwater. The adopted TSS removal rate for sand filters is 80 percent.

- **Vegetative Filters**

A vegetative filter is an area designed to remove suspended solids and other pollutants from stormwater runoff flowing through a length of vegetation called a vegetated filter strip. The vegetation in a filter strip can range from turf and native grasses to herbaceous and woody vegetation, all of which can either be planted or indigenous. It is important to note that all runoff to a vegetated filter strip must both enter and flow through the strip as sheet flow. Failure to do so can severely reduce and even eliminate the filter strip's pollutant removal capabilities. The total suspended solid (TSS) removal rate for vegetative filters will depend upon the vegetated cover in the filter strip.

- **Wet Ponds**

A wet pond is a stormwater facility constructed through filling and/or excavation that provides both permanent and temporary storage of stormwater runoff. It has an outlet structure that creates a permanent pool and detains and attenuates runoff inflows and promotes the settlement of pollutants. A wet pond, also known as a retention basin, can also be designed as a multi-stage facility that also provides extended detention for enhanced stormwater quality design storm treatment and runoff storage and attenuation for stormwater quantity management. The adopted TSS removal rate for wet ponds is 50 to 90 percent depending on the permanent pool storage volume in the pond and, where extended detention is also provided, the duration of detention time provided in the pond. It should be noted, however, that wet ponds may be breeding

grounds for mosquitoes.

Each of these structures has advantages and disadvantages to manage stormwater. As previously noted, Union is a fully developed community and anticipates the majority of new construction to be residential infill development and redevelopment.

LAND USE/ BUILD-OUT ANALYSIS

Figure 7 illustrates the existing land use in the Township based on the 1995/1997 GIS information from the NJDEP. As shown, the Township has less than one square mile of developable or vacant land. Also, as stated previously there are approximately 34 acres of vacant land available for development within the Township, according to the Tax Assessor. Therefore, this MSWMP does not include a Land Use/Build-Out Analysis. Figure 8 illustrates the Hydrologic Units (HUC-14s) and Figure 9 shows the constrained lands.

Figure 7: Existing Land Use

Figure 8: Hydrologic Units (HUC 14s)

Figure 9: Wetlands and Water Land Uses – Constrained Land

MITIGATION PLAN

This mitigation plan is provided for proposed development or redevelopment projects that seek a variance or exemption from the stormwater management design and performance standards set forth in this MSWMP and N.J.A.C. 7:8-5.

MITIGATION PROJECT CRITERIA

To grant a variance or exemption from the stormwater regulations, new development and redevelopment plan applications must propose a mitigation project located within the same drainage basin as the proposed development/redevelopment. Proposed mitigation projects must provide for additional groundwater recharge benefits, protection from stormwater runoff quantity or quality from previously developed property that does not currently meet the design and performance standards outlined in this MSWMP. Mitigation projects should also be as close in terms of hydrology and hydraulics to the proposed development/redevelopment as possible.

Projects must be proposed on an equivalent basis. Developers must propose a mitigation project similar in kind to the variance or exemption being requested. Proposed mitigation projects cannot adversely impact the existing environment.

DEVELOPER MITIGATION PLAN REQUIREMENTS

Proposed mitigation projects shall have Mitigation Plans submitted to the Township for review and approval prior to granting final approval for site development. Developers should include the following in a Mitigation Plan:

- Mitigation Project Name, Owner name and address, Developer name and address, Mitigation Project Location, Drainage Area, Cost Estimate;
- Proposed mitigation strategy and impact to sensitive receptor. What is being impacted, mitigated, and how;
- Legal authorization required for construction and maintenance;
- Responsible Party including: required maintenance, who will perform the maintenance, proposed cost of maintenance, and how it will be funded;

- All other permits required for construction of the mitigation project;
- Cost estimate of construction inspection; and
- Reason a waiver or exemption is required and supporting evidence.

Due to the lack of vacant or developable land, it is anticipated that the majority of the mitigation projects proposed will result in retrofitting/rehabilitation of existing stormwater facilities and natural infrastructures. Therefore, the Applicant may select one of the following strategies to be developed into a potential mitigation project. More detailed information may be available from the Township or the Township's Engineer office. It is the developer's responsibility to provide a detailed study of any proposed mitigation project, and provide the Township with a proposed mitigation plan for review and approval.

Groundwater Recharge

- Recharge Basin construction or rehabilitation.
- Utilization of perforated storm sewer pipe.

Water Quality

- Pump Station Upgrades (i.e. pumps and generators).
- Grease control along the West Branch of the Elizabeth River.

Water Quantity

- Storm sewer cleaning and dredging.
- Sections of the following streets are prone to flooding. Mitigation projects for these streets are possible: Connecticut Farms Area bounded by West Chestnut St., Rt. 22, Gelb Ave, and Elmwood Ave.

REFERENCES

Linsley, Ray K., Franzini, Joseph B., Freyber, David L, and George Tchobanoglous. *Water resources Engineering*. 4th ed. New York, New York: Irwin McGraw-Hill, 1992

New Jersey Department of Environmental Protection, Division of Watershed Management. *Amendment to the Lower Raritan/ Middlesex Water Quality Management Plan, Mercer County Water Quality Management Plan, Monmouth County Water Quality Management Plan, Northeast Water Quality Management Plan, Upper Raritan Water Quality Management Plan, and Sussex County Water Quality Management Plan Total Maximum Daily Loads for Fecal Coliform to Address 48 Streams in the Raritan Water Region*. Proposed Apr 21, 2003.

New Jersey Department of Environmental Protection, Division of Watershed Management *New Jersey Stormwater Best Management Practices Manual* April 2004.

New Jersey Department of Environmental Protection, Division of Watershed Management. *Tier A Municipal Guidance Document: NJPDES General Permit No. NJ0141852*. April 2004.

Township of Union. *Reexamination Report of the Master Plan and Land Development Regulations, Township of Union*, 1998.

Township of Union. *Union Township Master Plan*. Nov. 1997

United States Census Bureau. Profile of General Demographic Characteristics: 1990, 1990

United States Census Bureau. Profile of General Demographic Characteristics: 2000, 2000.

United States Census Bureau. 1990 Summary Tape File (STF 1), 1990.

United States Department of Housing and Urban Development, Federal Insurance Administration. *Flood Insurance Map: Township of Union, New Jersey, Union County*. Aug. 1, 1978.

Kern River Connections. The Hydrologic Cycle.
<<http://www.creativille.org/kernriver/watershed.htm>>

New Jersey Administrative Code N.J.A.C. 7:14A-25: NJPDES Stormwater Rules. Jan. 5, 2004.

New Jersey Administrative Code, N.J.A.C. 7:8, Stormwater Management Rules, Feb. 2, 2004.

New Jersey Department of Environmental Protection. *The Ambient Biomonitoring Network Watershed Management Area 12, 13, 14, 15, and 16, Atlantic Region*. March 2001.
(<http://www.state.nj.us/dep/wmm/bfbm/>).

New Jersey Department of Environmental Protection. List of Category One Streams, Lakes and Reservoirs <http://www.nj.gov/dep/cleanwater/c1_waters_list.pdf. >

New Jersey Department of Environmental Protection. Division of Watershed Management. Total Maximum Daily Loads. <<http://www.state.nj.us/dep/watershedmgt/tmdl.htm>> Sept. 1, 2004.

New Jersey Department of Environmental Protection. Division of Watershed Management. <<http://www.state.nj.us/dep/watershedmgt/index.htm>> Dec. 15, 2004.

New Jersey Department of Environmental Protection. Stormwater and Nonpoint Source Pollution, <www.njstormwater.org> August 30, 2004.

New Jersey Department of Environmental Protection. Sub-list 1-5, New Jersey's 2004 Integrated List of Water Bodies <<http://www.state.nj.us/dep/wmm/bfbm/>>, June 22, 2004

New Jersey Department of Labor and Workforce Development. "Residential Housing Units Authorized by Building Permits."

<http://www.wnjp.in.net/OneStopCareerCenter/LaborMarketInformation/lmi18/index.html>