LIBERTY TOWNSHIP

MUNICIPAL STORMWATER MANAGEMENT PLAN

2005

Prepared for

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STORMWATER MANAGEMENT PLAN

Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for Liberty Township ("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. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities.

A "build-out " analysis has been included in this plan based upon existing zoning and land available for development. The plan also addresses the review and update of existing ordinances, the Township Master Plan, and 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 non-point source pollution;
- maintain the integrity of stream channels for their biological functions, as well as for drainage;
- minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water;
- protect public safety through the proper design and operation of stormwater basins; and
- minimize breeding sites for mosquito species.

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 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.

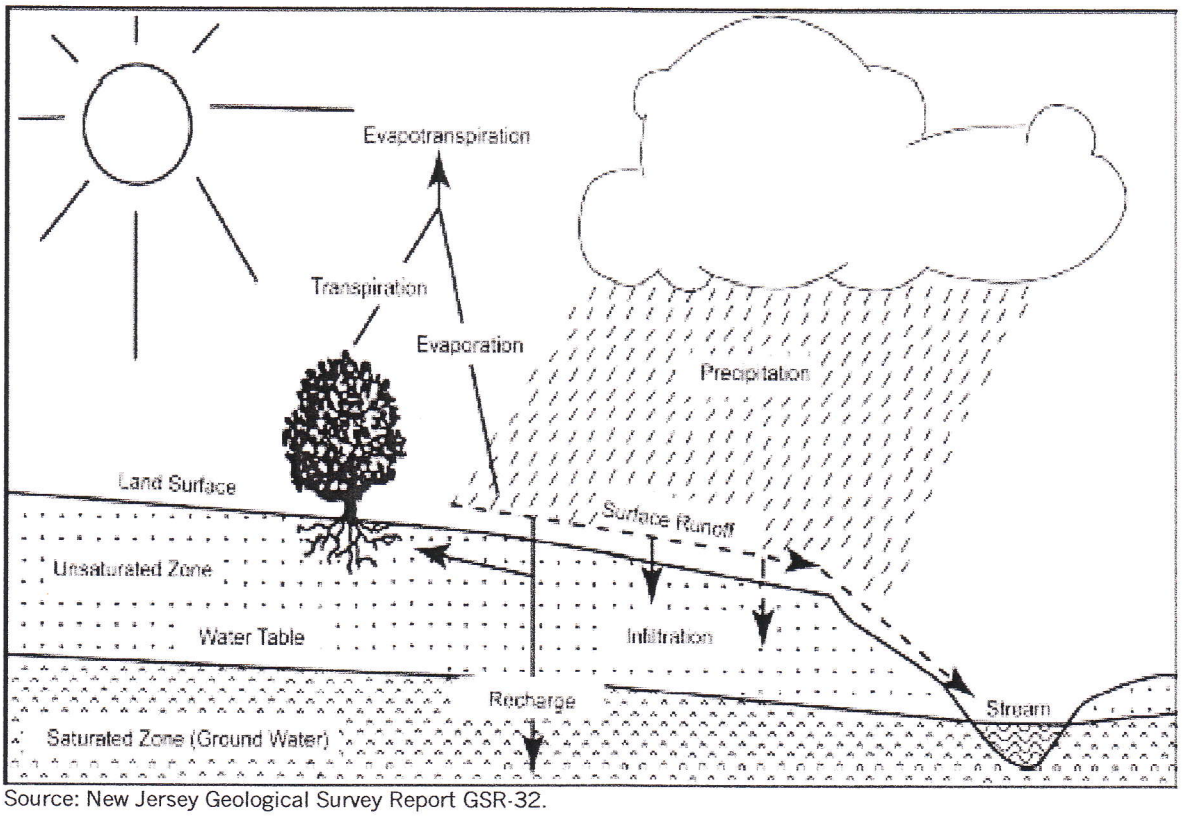
Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site 's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration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

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.

As well as 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.

Groundwater Recharge in the Hydrologic Cycle



Source: New Jersey Geological Survey Report GSR-32.

Background

Liberty Township encompasses a 12 square mile area in Warren County, New Jersey. In recent years, the township has been under significant development pressure. The population of the Township has increased from 1,730 in 1980 to 2,493 in 1990, (a 41% increase) to 2,765 in 2000 (an additional 10.9%increase). This population increase has resulted in considerable demand for new development; changes in the landscape have most likely increased stormwater runoff volumes and pollutant loads to the waterways of the municipality. The watershed of Mountain Lake, the largest natural glacial lake in Warren County, lies entirely within the boundaries of Liberty Township.

In 1992 a study of this watershed was prepared by the Warren County Soil Conservation District in cooperation with the Liberty Township Planning Board, the USDA Soil Conservation Service, and the Warren County Planning Board to analyze the contributory runoff to the Lake, and to determine what effect new development would have on the Lake and stream corridors if the area was developed to its maximum allowable amounts under existing development ordinances. Through 1998 and 2001 the Environmental Commission performed a series of studies including; Water Quality Study of Mountain Lake by Amy Greene Assoc., a Bathymetric Map of Mountain Lake by Aquatic Analysts, Inc., Phase I Storm Water Study of Mountain Lake by Aquatic Analysts, Inc. and Phase II NPS Loading of Phosphorous Modeling by Aquatic Analysts, Inc. These studies led up to a Clean

Water Act 319h grant for installation of filtering storm drains at Mountain Lake in 2003. Educational brochures concerning non-point source pollution were developed and distributed to residents. Ordinances controlling use of phosphate fertilizer, prohibiting feeding of waterfowl, and requiring clean up of pet waste have been adopted.

Other watersheds in the Township include the Pequest River and Beaver Brook. The Pequest River, as it runs through Liberty is classified as a Category 1 waterway. Mountain Lake Brook below Mountain Lake is considered moderately impaired based on AMNET data. No TDML has been yet determined.

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 data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics.

A TMDL is the amount of a pollutant that can be accepted by a water body without causing an exceedance of water quality standards or interfering with the ability to use a water body for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require an NJPDES permit to discharge, and non-point source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other BMPs.

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 Township has exhibited severe water quantity problems including flooding and stream bank erosion. This was extremely evident after Hurricane Ivan in 2004 when over six inches of rain fell in less than eight hours. Four homes along Mountain Lake Brook were flooded near the inlet to Mountain Lake. Scouring of streambeds occurred, along with stream bank erosion.

There are three dams in the Township. The Douglas Dam is on an unnamed tributary to Mountain Lake Brook on property managed by Jenny Jump State Park. The Lake Just It dam served historically for a millpond. The dam at Liberty Lake near the headwaters of Mountain lake Brook was breached during Hurricane Floyd in 1996.

Design and Performance Standards

The Township will adopt 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 are included below.

Stormwater management measures for development must be designed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards in N.J.AC 7:8-5:4 and 5.5. To the maximum extent practical, these standards must be met by incorporating nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 into the design as described later in this MSWMP. If these measures alone are not sufficient to meet these standards, structural stormwater management measures at N.J.A.C. 7:8-5.7 necessary to meet these standards must be incorporated into the design.

Minimum design and performance standards to control erosion, encourage and control infiltration and groundwater recharge, and control stormwater runoff quantity impacts of development as follows:

1. The minimum design and performance standards for erosion control are those established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. and implementing rules.
2. The minimum design and performance standards for groundwater recharge are as follows:
    a. The design engineer shall, using the assumptions and factors for stormwater runoff calculations at N.J.A.C. 7:8-5.6, either:

        (1) Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100% of the average annual pre-construction groundwater recharge volume for the site; or
        (2) Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the 2-year storm is infiltrated.

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

        (1) Stormwater from area of high pollutant loading.
        (2) Industrial stormwater exposed to "source material".

    c. The design engineer shall assess the hydraulic impact on the groundwater table and design the site so as to avoid adverse impacts. Potential adverse hydraulic impacts include, but are not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or downgradient of the groundwater recharge area.

3. In order to control stormwater runoff quantity impacts, the design engineer shall sue the assumptions and factors for stormwater runoff calculations at N.J.A.C. 7:8-5.6 to complete the following:

    a. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post construction runoff hydrographs for the 2, 10, and 100 year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

    b. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2, 20, and 100 year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site; or

    c. Design stormwater management measures so that the post-construction peak runoff rates for the 2, 10, and 100 year storm events are 50, 75, and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed.

Stormwater runoff quality standards will be as follows:

1. Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 % of the anticipated load from the developed site, expressed as an annual average.
2. If there is more than one onsite drainage area, the 80% TSS removal rate shall apply to each drainage area, unless the runoff from the sub-areas converge on site in which case the removal rate can be demonstrated through a calculation using a weighted average.
3. Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction nutrient load of the anticipated load from the developed site in stormwater generated from the water quality design storm. In achieving reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural measures that optimize nutrient removal while still achieving the performance standards in N.J.A. C. 7:8-5.4 and N.J.A.C. 7.8-5.5.
4. Special water resource protection areas shall be established along all waters designated Category One at N.J.A.C. and perennial or intermittent streams that drain into or upstream of Category One waters within the associated HUC 14 drainage. These areas shall be established for the protection of water quality, aesthetic value, exceptional water quality significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries

significance of those established Category One waters. These areas shall be designated and protected as follows:

a. The applicant shall preserve and maintain a special water resource protection area in accordance with one of the following:

   (1) A 300-foot special water resource protection area, measured perpendicular to the waterway from the top of bank or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided.
   (2) Encroachment within the designated special water resource protection area shall only be allowed where previous development or disturbance has occurred. The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable. In no case shall the remaining special water protection area be reduced to less than 150 feet as measured perpendicular to the waterway.

b. All stormwater shall be discharged outside of but may flow through the special water resource protection area and shall comply with the Standard for Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq.

c. If stormwater discharged outside of and flowing through the special water resource protection area cannot comply with the Standard for Off-Site Stability, then the stabilization measures in accordance with the requirements of the above standards may be placed within the special ware resource protection area, provided that:

   (1) Stabilization measures shall not be placed within 150 feet of the waterway;
   (2) Stormwater associated with discharges allowed by this paragraph shall achieve a 95% TSS post-construction removal rate;
   (3) Temperature shall be addressed to ensure no impact on the receiving waterway;
   (4) The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable; and
   (5) A conceptual project design meeting shall be held with the appropriate Township staff and Soil Conservation District staff to identify necessary stabilization measures.

(6) All encroachments under this section shall be subject to review and approval by the Department.

Standards for Structural Stormwater Management Measures:

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including, for example, wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability, and texture; drainage area and drainage patterns; the presence of solution prone carbonate rocks (limestone) and sinkhole prone areas; environmentally sensitive areas; and habitat for threatened and endangered species.
2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intakes to the outlet structure as appropriate, and shall have parallel bars with one inch spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third the width of the diameter of the orifice or one-third of the weir. In addition, the design of trash racks must comply with the requirements outlined below.
3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant. Measures that are consistent with the relevant portions of the Residential Site Improvement Standards at N.J.A.C. 5:21-7.3, 7.4, and 7.5 shall be deemed to meet this requirement.
4. At the intake to the outlet from the stormwater management basin, the orifice size shall be a minimum of two and one-half inches in diameter.
5. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins presented herein.
6. Stormwater management basins shall be designed to minimize the collection of standing water to reduce the potential conditions for mosquito breeding.

Long Term Operation and Maintenance of Stormwater Management Measures

The design engineer must prepare a maintenance plan for the stormwater management measures incorporated into the design of a major development. This maintenance plan must contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name address, and telephone number of the person or persons responsible for preventative and corrective maintenance, including replacement. Maintenance guidelines for stormwater management measures are available in the *New Jersey Stormwater Best Management Practices Manual.* If the maintenance plan identifies a person other than the developer, such as a homeowners' organization, as having the responsibility for maintenance, the plan must include documentation of such person's agreement to assume this responsibility, or of the

developer's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

Responsibility for maintenance will not be assigned or transferred to the owner or the tenant of an individual property in a residential development or project, unless such owner or tenant leases the entire residential development or property. The maintenance plan and any future revisions must be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

Preventative and corrective maintenance must be performed as needed, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

The person responsible for maintenance must:

- Maintain a detailed log of all preventative and corrective maintenance of the development, including a record of all inspections and copies of all maintenance-related work orders.
- Evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.
- Retain and make available, upon request by a public entity, the maintenance plan and all associated documentation including the maintenance log and effectiveness evaluation as described above.

Nothing in this section precludes the municipality in which the development is located from requiring the posting of a performance or maintenance guarantee in accordance with N.J.S.A. 40:55D-53.

Safety Standards for Stormwater Management Measures

The safety standards for stormwater management basins measures of N.J.A.C. 7:8-6, as outlined below, protect public safety through the proper design and operation of stormwater management basins.

All stormwater management structures must satisfy the following requirements for trash overflow grate and escape provisions:

(a) Trash racks must be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets in accordance with the following:

1. The trash rack must have parallel bars, with no greater than six inch spacing between the bars;
2. The trash rack must be designed so as not to adversely affect the hydraulic performance of the outlet pipe structure;
3. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per sec0nd under the full range of stage and discharge. Velocity is

to be computed on the basis of the net area of opening through the rack; and

4. The trash rack must be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 lbs/square foot.

(b) If an outlet structure has an overflow grate, the grate must comply with the following requirements:

1. The overflow grate must be secured to the outlet structure but removable for emergencies and maintenance;
2. The overflow grate spacing must be no greater that two inches across the smallest dimension; and
3. The overflow grate must be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 lbs/square foot.

(c) Stormwater management basins must include escape provisions as follows:

1. If a stormwater management basin has an outlet structure, escape provisions must be incorporated in or on the structure. Escape provisions include the installation of permanent ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. With the prior approval of the reviewing agency pursuant to N.J. A. C. 7:8-6.4(a), a freestanding outlet structure may be exempted from this requirement;
2. In new stormwater management basins the maximum interior slope for an earthen dam, embankment, or berm must not be steeper than three (3) horizontal to one (1) vertical.

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 municipality 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, Township inspectors will observe on-site soil erosion and sediment control measures and report any inconsistencies to the local Soil Conservation District.

Nonstructural Stormwater Management Strategies

Nonstructural stormwater management strategies focus on: 1) limiting impervious surfaces and /or the impact from these surfaces, 2) minimizing land disturbance during construction, and 3) implementing pollution prevention activities. Specific elements of the plan and ordinances to be evaluated include parking areas, curbing, set backs, minimum lawn areas, landscaping, and zoning ordinances in general. Strategies to be included are the following:

1. Protect areas providing water quality benefits and susceptible to erosion and sediment loss.
2. Minimize impervious cover and break up the flow of runoff.
3. Maximize the protection of natural drainage features and vegetation.
4. Minimize the decrease in the pre-construction "time of concentration".
5. Minimize the land disturbance including clearing and grading.
6. Minimize soil compaction.
7. Provide landscaping that includes native species and minimizes the use of fertilizers.
8. Provide vegetated systems discharging into and through stabile vegetated areas.
9. Provide preventative source controls to minimize the release of pollutants into runoff.

Chapters 72, 90, and 105 of the Liberty Township Combined Land Use Code were reviewed with regard to incorporating nonstructural stormwater management strategies and the following is a list of the sections that can be modified to incorporate nonstructural stormwater management strategies.

Section 90-12: Soil erosion and sediment control: Additional language should be added to address the re-establishment of vegetation and slope stabilization in area where development does occur in addition to language that requires soil compaction to be minimized.

Section 90-13: Surface water run off control: Should be updated to include all requirements outlined in N.J.A.C.7:8-5.

Section 90-15 (5): Buffering: This section should be amended to require the use of native vegetation, which needs less fertilizer and watering than non-native species. Language should also be added to allow buffer area to be used for stormwater management by disconnecting impervious surfaces and treating run-off from these surfaces.

Section 90-15 (7) (a): Paving materials: Language should be added allowing use of pervious paving materials to minimize stormwater run-off and promote ground water recharge.

Section 90-16 (3): Surface and storm water drainage facilities: Language that promotes the use of natural vegetated swales to decrease flow velocity and allow for infiltration instead of pipes and inlets should be added. Design criteria for vegetated channels should be incorporated in this section.

Land Use/Build-Out Analysis

A detailed land use analysis for the Township was prepared. All maps are located in the appendix at the end of the plan. Map # 12, prepared by Eric K. Snyder & Associates for the Municipal Master Plan, illustrates the 2003 land use in the Township. Map # 9 illustrates the five major HUC 14s (NJ DEP 14 Digit Hydrologic Unit Code delineations for New Jersey) within the Township.

- Beaver Brook- below Hope Village
- Mountain lake Brook
- Pequest River- below Furnace Brook
- Pequest River – Drag Strip – below Bear Swamp
- Pequest River- Furnace Brook to Cemetery Road

Map # 10 shows the current Zoning of Liberty Township, however, the majority of the Township is the Preservation Area determined by the Highlands Water Protection and Planning Act, shown on Map # 11. Current zoning and the Township's Master Plan will change within approximately two years, to come into compliance with the Highlands Council Master Plan and the new regulations

The build out calculations for impervious cover are shown on page 14, in the table Liberty Township Calculations for HUC 14s. The Calculations for the HUC 14s were prepared by the Warren County Planning Department. As expected when developing agricultural and forested lands, the build out will result in a significant increase in impervious surfaces.

The next step is to determine the non-point source pollutant loadings resulting from build-out. The table on page 15 presents the pollutant loading coefficients by land cover for three major pollutants; Phosphorous, Nitrogen, and Suspended Solids. The total suspended solids loads due to stormwater runoff may decrease due to the conversion of agricultural lands to low density residential, but the percentage of impervious cover increases dramatically. If increases in stormwater runoff flows, due to the increase of impervious surfaces, are not managed properly, these high flows will increase stream bank erosion, thereby increasing sediment loads to the receiving waters.

Non-point Source Pollutant Loads for the five HUC 14s are presented in the table on page 16.

Liberty Township Calculations for HUC 14s

HUC14 and Zone		ACRES	Existing Impervious (%)	Existing Impervious (Acres)	Critical Areas (Acres)	Developed Areas (Acres)
02040105100040 - Beaver Brook (below Hope Village)						
R3		482.622	0.80%	3.876	138.014	36.835
Totals		482.622	0.80%	3.876	138.014	36.835
02040105090040 - Mountain Lake Brook						
B1		3.105	11.95%	0.371	0.068	3.037
MFD		125.725	0.42%	0.526	75.591	2.631
R2		1,357.381	2.76%	37.491	203.180	260.864
R3		1,139.238	0.38%	4.274	533.949	32.205
R4		266.107	10.44%	27.771	195.562	98.184
Totals		2,891.556	2.44%	70.433	1,008.350	396.921
02040105090060 - Pequest R (below Furnace Brook)						
MFD		7.261	0.00%	0.000	2.089	0.000
R2		301.822	2.67%	8.064	48.198	42.294
R3		86.552	0.62%	0.538	23.077	2.870
Totals		395.635	2.17%	8.602	73.364	45.164
02040105090010 - Pequest R (Drag Strip--below Bear Swamp)						
AG		404.405	1.75%	7.093	356.217	19.491
B1		68.845	7.94%	5.465	19.305	23.691
B3		21.995	55.75%	12.263	6.401	15.439
I-1		45.495	1.59%	0.725	8.216	0.021
R2		868.064	3.65%	31.708	155.249	203.410
R3		647.040	1.28%	8.293	209.783	50.306
Totals		2,055.844	3.19%	65.547	755.171	312.358
02040105090030 - Pequest R (Furnace Bk to Cemetary Road)						
B-1		94.946	12.67%	12.029	64.305	34.722
B-2		102.353	0.68%	0.694	64.156	3.162
I-1		30.947	2.88%	0.892	2.881	6.951
I-2		47.767	0.10%	0.047	6.623	16.352
R2		895.506	2.90%	25.997	216.627	157.910
R3		703.629	1.03%	7.230	319.430	58.439
Totals		1,875.148	2.50%	46.889	674.022	277.536

Pollutant Loads by Land Cover

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

Source: NJDEP Stormwater BMP Manual 2004.

Liberty Township Non-point Source Pollution Loads at Build-Out

HUC 14 and Zone	Land Cover	Developable Area (Acres)	TP (Lbs/acre/yr)	TP (Lbs/yr)	TN (Lbs/acre/yr)	TN (Lbs/yr)	TSS (Lbs/acre/yr)	TSS (Lbs/yr)
0204105100040 Beaver Brook below Hope Village								
R3	Low Density	344.6	0.6	206.8	5	1,723.0	100	34,460
Totals		344.6		206.8		1,723.0		34,460
02040105090040 Mountain Lake Brook								
B1	Commercial	3.0	2.1	6.3	22	66.0	200	600
MFD	High Density	50.1	1.4	70.0	15	750.1	140	7,001
R2	Med. Dens.	1,096.5	1.4	1,535.1	15	16,447.5	140	153,510
R3	Low Density	605.3	0.6	363.2	5	3,026.5	100	60,530
R4	High Density	70.5	1.4	98.7	15	1,057.5	140	9,870
Totals		1,825.4		2,073.3		21,347.6		231,511
0240105090060 Pequest River below Furnace Brook								
MFD	High Density	5.2	1.4	7.3	15	78.0	140	728
R2	Med. Dens.	253.6	1,4	733.0	15	3,804.0	140	35,504
R3	Low Density	317.1	0.6	190.3	5	1,585.5	100	31,710
Totals		575.9		930.6		5,467.5		67,942
0204010590010 Pequest River- Drag Strip- below Bear Swamp								
AG	Agricultural	48.2	1.3	62.7	10	482.0	300	14,460
B1	Commercial	49.5	2.1	103.9	22	1,089.0	200	9,900
B3	Commercial	15.6	2.1	32.8	22	343.2	200	3,120
I1	Industrial	37.3	1.5	55.9	16	596.8	200	7,460
R2	Med. Dens.	712.8	1.4	997.9	15	10,692	140	99,792
R3	Low Density	473.3	0.6	283.9	5	2,366.5	100	47,330
Totals		1,336.7		1,537.1		15,569.5		182,062
0240105090030 Pequest River –Furnace Brook to Cemetery Road								
B1	Commercial	30.6	2.1	64.3	22	637.2	200	6,120
B2	Commercial	38.2	2.1	80.2	22	840.4	200	7,640
I1	Industrial	28.1	1.5	42.1	16	449.6	200	5,620
I2	Industrial	41.1	1.5	61.7	16	657.6	200	8,220
R2	Med. Dens.	678.9	1.4	950.4	15	10,183.5	140	95,046
R3	Low Density	384.2	0.6	230.5	5	1,921	100	38,420
Totals		1,201.1		1,429.2		14,067.7		161,066

Grand Totals:	5, 283.7 developable acres	6,177.0 lbs TP/yr	58,175.3 lbs TN/yr	677,041 lbs TSS/yr

Mitigation Plans

A mitigation plan is required to grant a variance or exemption from the design and performance standards of the MSWMP.

Mitigation Project Criteria

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

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

Groundwater Recharge

- Retrofit a site and detention basin to provide additional annual groundwater recharge.

- Replace an existing impervious parking lot with permeable paving to provide additional average annual groundwater recharge.

Water Quality

- Retrofit an existing stormwater management facility to provide the removal of 80 percent of the total suspended solids from parking lot runoff.

Water Quantity

- Install stormwater management measures in an open space area to reduce the peak flow from the upstream development.

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

Water Quality

- Re-establish a vegetative buffer (minimum 30 feet wide) along a section of shoreline of Mountain Lake as a goose control measure and to filter stormwater runoff from the high goose traffic areas.

- Provide goose management measures, including public education at Mountain Lake.

- Install filters in catch basins

- Install grit separators