STORMWATER MANAGEMENT PLAN

VILLAGE OF LOCH ARBOUR

MONMOUTH COUNTY

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Appendices

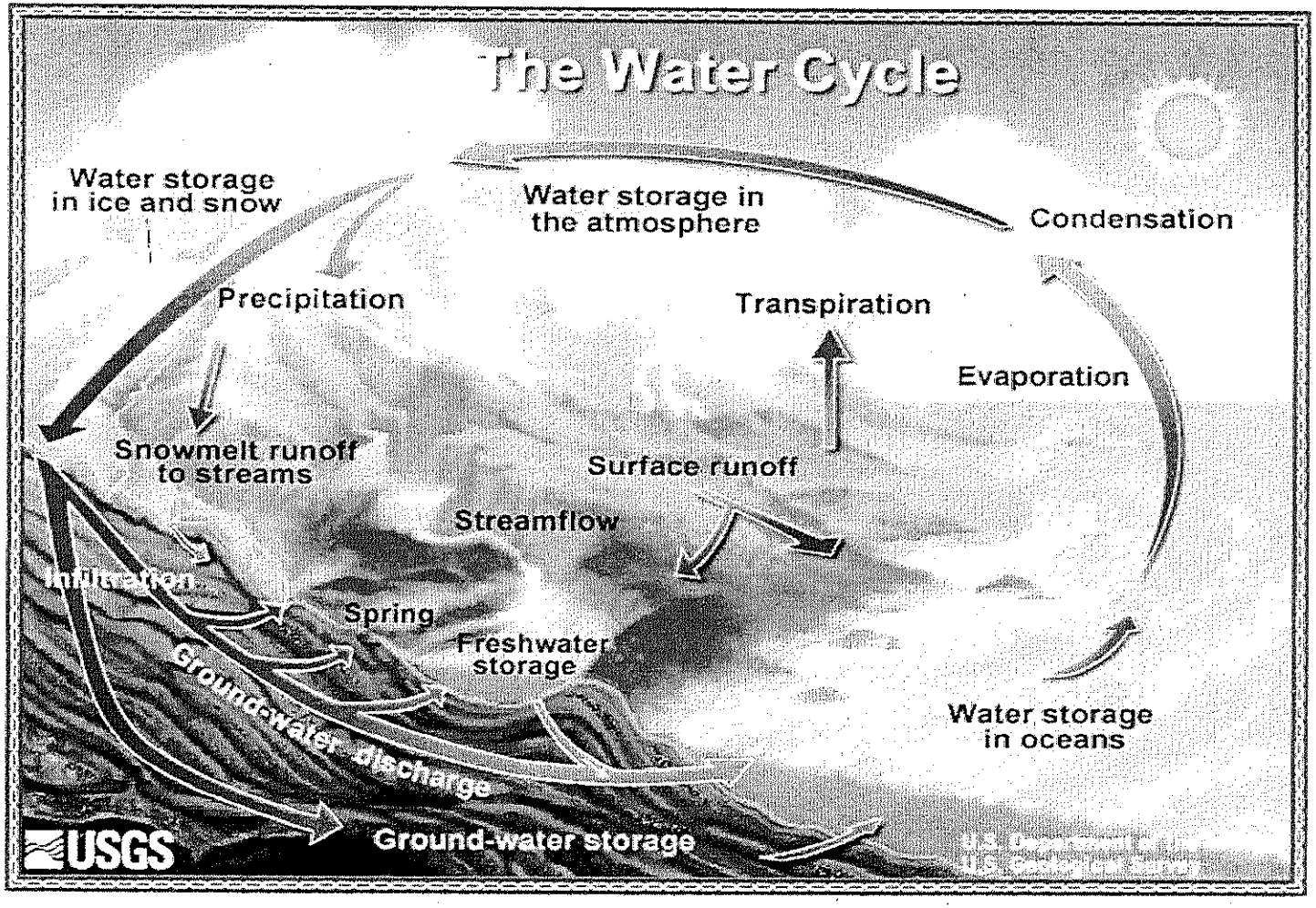
1.0 Introduction

This document has been prepared in accordance with the New Jersey Department of Environmental Protection (NJDEP) *Tier A Stormwater Guidance Document* dated April 2004 in order to establish the Village of Loch Arbour's strategy to address stormwater-runoff impacts. **This plan has been updated to include the adopted municipal stormwater control ordinances for the Village of Loch Arbour.**

1.1 How Does Stormwater Runoff Affect Us?

Stormwater runoff is part of the largest remaining major source of pollutants in our nation's waters and the quality of surface and ground water is directly related to the health of the environment. It is estimated by the New Jersey Department of Environmental Protection, that up to 60 percent of existing water pollution problems are attributable to nonpoint source pollution. Nonpoint source pollution, and particularly, stormwater runoff is difficult to identify, control, and treat. In natural environments, those areas undisturbed by development, native vegetation either directly intercepts precipitation or draws from runoff that has infiltrated into the ground and returns it to the atmosphere through the process of evapotranspiration. A portion of precipitation runs off the land's surface to recharge surface water. Additional rainfall that lands on the ground's surface infiltrates through the soil and provides natural recharge of the groundwater. This process, known as the hydrologic cycle (see attached graphic **identified as Illustration 1**), functions in equilibrium, but is extremely susceptible to impacts resulting from changes to the cycle's processes.

It has been shown that land development can dramatically impact the hydrology of a watershed if stormwater-runoff related impacts are not considered carefully. Development typically alters natural vegetation through the placement of lawns and impervious cover, thereby reducing the watershed's evaporation, transpiration and infiltration rates. Construction activities can compact the soil and reduce its infiltration ability, resulting in increased volumes and rates of stormwater runoff from a site. In the past, development typically involved the construction of impervious areas connected to each other through gutters, channels, and storm sewers. These structures can transport runoff more quickly than natural areas and cause erosion and water quality problems, as well as flooding in areas downstream of development. Often people do not know or understand that there are alternatives to the traditional way of managing their property. For example, homeowners can have a green lawn without massive doses of fertilizers and pesticides; pet owners should deposit pet waste in the trash or in the toilet and not leave it at the curb. Typically, people are unaware that storm drains often discharge directly into water bodies. When people allow motor oil, trash, and animal waste to enter the storm drainage system, they don't realize that it may end up in a nearby lake or the public drinking water supply. Individually these acts may seem insignificant, but their cumulative impact contributes to stormwater/nonpoint source pollution and reduces water quality.



The Hydrologic Cycle

Illustration 1

1.2 Municipal Separate Storm Sewer Systems (MS4) Program

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

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

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

The Village of Loch Arbour had been designated as a Tier A community. As such, the Village is regulated under the NJPDES Stormwater Tier A General Permit. As part of the permit, several SBRs were mandated and an implementation schedule was established. The following minimum standards apply to all Tier A municipalities:

1. Adoption of a municipal stormwater management plan (this document) in accordance with the requirements of N.J.A.C. 7:8-4 (due April 2005).
2. Adoption and implementation of municipal stormwater control ordinances in accordance with N.J.A.C. 7:8-4. The ordinances shall address the control of stormwater from non-residential development and redevelopment projects as well as control aspects of residential development and redevelopment projects that are not pre-empted by the Residential Site Improvement Standards (due April 2006).
3. Ensure that any residential development and redevelopment projects that are subject to the Residential Site Improvement Standards (herein referred to as RSIS) for stormwater management comply with those standards. The RSIS for

stormwater management address general stormwater management system strategies; runoff estimation techniques; runoff collection system design; inlets, catch basins, manholes, and outlets; detention basins and other stormwater facilities; and water quality (started February 2004).

4. Ensure adequate and long-term operation and maintenance of BMPs (April 2004 on municipal properties, April 2006 other).
5. Enforce compliance with the standards set forth in the NJPDES General Permit to control passage of solids and floatable materials through storm drain inlets (April 2005 municipality installed, April 2006 others).

1.3 Stormwater Management Regulations

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

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

The design requirements identified in the Stormwater Management Rules, including groundwater recharge, water quality, and water quantity, must be met for all projects regulated under RSIS. The Stormwater Rules (N.J.A.C. 7:8-4) require that all municipalities within the State of New Jersey adopt a municipal stormwater management plan. The Tier A General Permit mandates that this plan be completed no later than 12 months from the effective date of permit authorization, which is April 1, 2005. Additionally, N.J.A.C. 7:8-4 mandates that stormwater control ordinances be adopted and implemented for all municipalities in the State 12 months from the date of adoption of the Stormwater Management Plan.

2.0 Stormwater Management Plan Goals

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

- Reduce flood damage, including damage to life and property;
- Minimize, to the extent practical, any increase in stormwater runoff from any new development;
- Reduce soil erosion from any development or construction project;
- Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
- Maintain groundwater recharge;
- Prevent, to the greatest extent feasible, an increase in nonpoint source pollution;
- Maintain the integrity of stream channels for their biological functions, as well as for drainage;
- Minimize pollutants in stormwater runoff from new and existing development in order to restore, enhance and maintain the chemical, physical, and biological integrity of the waters of the State, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial and other uses of water;
- **Encourage incorporation of Low Impact Development Strategies into new and future site development plans, to insure nonstructural stormwater management requirements are met;**
- Protect public safety through the proper design and operation of stormwater management basins.

In addition to the minimum goals required by the NJPDES General Permit, consideration should be given to complying with the goals and objectives set forth in the current municipal Master Plan.

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

Floodplain management standards mandated through the National Flood Insurance Program (NFIP) are beneficial in minimizing the risks to new development. However compliance with the minimum standards may not protect existing development from the increased risk of flooding due to new development. This Program encourages local governments to adopt additional measures beyond the minimums that will reduce local flooding and benefit neighboring and downstream locales (Code of Federal Regulations, 44 CFR §60.1(d)). Authority is vested in the local jurisdiction to manage and police

actions in their town. **This can be accomplished through stricter application of soil erosion control measures and increased stream bank setback regulations.**

3.0 Municipal Background

The Village of Loch Arbour is located on the Jersey Shore coastline in the central portion of Monmouth County. The Village contains a land area of approximately 0.10 square miles, **as indicated on Figure 1 (Location Map) in Appendix B. The Village** has the smallest residential population of any town in Monmouth County. Loch Arbour maintains a historic and tranquil character of a residential shorefront community.

Loch Arbour Statistics

Population: 280

Area: 0.10 square miles

Mayor: Betty McBain

Trustees:
Jeffrey J. Gill
John Skrletts
Peter Wolf
Ed Lee

The estimated population in **2008** is calculated to be 280 (identical to the 2000 United States Census population of 280), significantly lower than the 380 residents reported in the 1990 census. The primary reason for the decline in residents is due to the lack of available vacant land, and the declining family size observed statewide. Despite the decline in population, the Village still sees an increase in seasonal population during the summer months, as families utilize the beautiful beachfront resort.

The Village of Loch Arbour is surrounded by the municipalities of the Borough of Allenhurst to the north; the Borough of Interlaken to the West; and the City of Asbury Park to the south; as indicated on Figure 2 (Municipal Boundaries) in Appendix B.

The Loch Arbour Planning Board has performed a reexamination of the Master Plan, and incorporated elements preserving the natural resources of the Village, while developing a range of land use ordinances adopted by governing body. The various zoning districts in the Village of Loch Arbour are designated by the Village's land use ordinances, and are identified as follows:

Loch Arbour Village Zone Districts:

Zone	Designation
R	Residential Zone
C	Commercial Zone
B	Beach Zone

Existing land use mappings are indicated on Figure 6 (Existing Land Use/Land Cover Maps) in Appendix B.

3.1 Natural Resources and Sensitive Areas

3.1.1 Natural and Historic Resources

The Village of Loch Arbour lies entirely within the geographic area known as the Outer Coastal Plain, which is that portion of the Atlantic Coastal Plan which lies south and southeast of the Highlands of the Navesink. Loch Arbour is relatively flat, with no unusual topographic features. The low lying areas are formed on unconsolidated and semi-consolidated marine alluvial sediments. These sediments include clay, silt, sand and gravel which were deposited as sea level rose and fell during the end of the Cretaceous Period of the Mesozoic Era and the Tertiary Period of the Cenozoic Era.

The United States Department of Agriculture Soil Conservation Service has delineated the soil types throughout the State, and published a soil survey for each county. The soil survey for Monmouth County has delineated several major soil types for the Village of Loch Arbour. These soils are primarily classified as sand or sandy loam mix, and are designated as Evesboro Sand; Hooksan Sand along beachfront areas; and Klej loamy sand adjacent to the shoreline of Deal Lake.

Natural and environmental features in the Village have been mapped and are included in Appendix B as follows: Land Use and Land Cover; Hydrology and HUC 14 Watershed Map; USGS Quadrangle Map, including topographic contours; Groundwater Recharge Mapping; Wellhead Protection Area Map.

The location of existing potable water wells has been evaluated in the Village. A mapping indicates that no well head protection areas were found, as indicated on Figure 3 (Wellhead Protection Area Maps) in Appendix B.

The history of Loch Arbour as a Village dates to its incorporation in 1958, when it branched off as a part of the Township of Ocean. The Village has always been a community of detached single family dwellings, with the most unique area known as Buena Vista Court, located at the western end of Euclid Avenue. The court consists of fourteen smaller, single family dwellings on lots measuring 25 feet in width and 75 feet in depth surrounding a common courtyard area. Years of historical significance continue to be recognized and wherever possible, the Village has encouraged preservation of historically important properties.

3.1.2 Water Resources

The topography of the Village of Loch Arbour has a natural drainage into Deal Lake and the Atlantic Ocean. The Village lies within the Deal Lake drainage basin, and stormwater runoff discharges directly into Deal Lake, which drains directly to the Atlantic Ocean.

The watershed hydrology of the Village is provided in a mapping of HUC 14 areas indicated on Figure 4 (Hydrology and HUC 14 Watershed Map) in Appendix B.

The Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Rate Maps which identify 100 year and 500 year flood hazard areas and are on file with the Municipal Clerk for public information. These maps help delineate the sensitive environmental areas which extend along the water corridors within and adjacent to the Village.

The Village of Loch Arbour has water frontage along Deal Lake and the Atlantic Ocean. Coastal areas and properties maintained by the Village include the municipal beachfront and municipal beach club known as the 'Loch Arbour Beach Club' which includes a Pavilion, and serves as the focal point for residential beach use and social events during the summer season.

The New Jersey Surface Water Quality Standards (N.J.A.C. 7:9B) establish the designated uses to be attained and specify the water quality (criteria) required to protect the State's waters. Designated uses include potable water, propagation of fish and wildlife recreation, agricultural and industrial supplies, and navigation. These are reflected in use classifications assigned to specific waters. The NJDEP has assigned a special level of protection known as Category One (C1) for a number of waterways within New Jersey. The C1 designation targets water bodies that provide drinking water, habitat for endangered and threatened species, and popular recreational and/or commercial species, such as trout or shellfish. The Category One designation provides increased protection to water bodies to help prevent water quality degradation and discourage development where it would impair or destroy natural resources and environmental quality. There are no C1 waterbodies within the Village of Loch Arbour.

A listing of all Category One waterways may be accessed at the NJDEP website www.nj.gov/dep/cleanwater/c1.html. **Additional information regarding Surface Water Quality Standards (SWQS) may be obtained at the following NJDEP website** www.nj.gov/dep/dwq/sw.htm **or by contacting the Bureau of Water Quality Standards and Assessment at (609) 777-1753.**

The SWQS form the basis for monitoring the degree of impairment of water bodies and for calculating total maximum daily loads (TMDLs). TMDLs are developed on a watershed basis to aid watershed management planning efforts. A TMDL quantifies the amount of a pollutant, known as pollutant loading, a water body can assimilate without violating the states water quality standards. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require a NJPDES permit to discharge, and non point source which includes stormwater runoff from residential and agricultural areas. Provisions for future sources may be made within the form of a 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 Best Management Practices (BMPs). Additional information regarding TMDLs may be obtained at the following NJDEP website www.state.nj.us/dep/watershedmgt/tmdl.htm or by contacting the Division of Watershed Management at (609) 984-0058.

The Federal Clean Water Act mandates that the State submit biennial reports to the USEPA describing the quality of their waters. The reports include the Statewide Water Quality Inventory Report entitled "305(b) Report" which includes the status of principal waters in terms of overall water quality and support of designated uses, as well as strategies to maintain and improve water quality and a List of Water Quality Limited Waters entitled "303(d)" which includes a list of water bodies that are not achieving water quality standards, despite the implementation of technology-based effluent limits. The State must prioritize 303(d)-listed water bodies for Total Maximum Daily Load (TMDL) analyses and identify those high priority water bodies for which they anticipate establishing TMDLs within the next two years.

Table One within this report includes the New Jersey 303(d) list of impaired waters within the Village of Loch Arbour. The complete listing of New Jersey's 303(d) List of Impaired Waters with Priority Ranking may be viewed at the following website: www.state.nj.us/dep/wms/bwqsa/303dlists.html.

Additionally, the Monmouth County Health Department conducts ambient surface water monitoring at 68 representative sites throughout the county. There are no testing locations within the Village of Loch Arbour. Table Two within this report includes the results of the 2007 Ambient Surface Water Monitoring for Deal Lake provided by the Monmouth County Health Department. The testing location for Deal Lake is located within the City of Asbury Park. Historical ambient surface water monitoring results for Deal Lake are included within Table Three of this document. Additional information regarding the Monmouth County Health Department water quality monitoring program can be viewed at the following website: www.visitmonmouth.com/health/environmental/water/water.htm or by contacting the Monmouth County Health Department at (732) 431-7456.

3.1.3 Water Supply and Sewerage Facilities

The Village of Loch Arbour is serviced by the New Jersey American Water Company which provides water service to 21 municipalities in eastern Monmouth County. The water company is located on Shrewsbury Avenue in the Borough of Shrewsbury. The water company obtains its water supplies from the Manasquan Reservoir located in Howell Township, the Glendola Reservoir located in Wall Township **and the Swimming River Reservoir, located in located in Middletown Township and Colts Neck**

Township. The water pressure throughout the Village is adequate and there has been no lack of available water for prospective customers in the Village.

The existing sewage infrastructure in the Village consists of a gravity piping system draining to a sewage pump station located along the westerly perimeter of the main body of Deal Lake in the Borough of Interlaken. The sewage is pumped through a force main to a disposal system operated by the Township of Ocean Sewerage Authority. As a service customer, Loch Arbour is billed a flat rate based upon the total number of residential units and commercial establishments located within the municipality. Based upon compliance with existing zoning regulations, the existing infrastructure is anticipated to be adequate to handle all future expansions.

3.1.4 Environmental Resources

NJDEP Coastal Wetlands Inventory mapping and Freshwater Wetlands Maps outline the approximate boundaries of the freshwater wetlands as taken from information prepared by the United States Department of Interior Fish and Wildlife Service. The boundaries are established in accordance with three parameter requirements of the New Jersey Department of Environmental Protection, hydrology, soil and vegetation.

Wetland areas are classified as an exceptional resource value when they discharge into trout production waters or their tributaries, or if they provide a habitat for a threatened or endangered species. Wetlands are classified as ordinary resource value if they are isolated, not a surface tributary to inland lakes or ponds, and are more than 50 percent surrounded by development. Wetlands of intermediate resource value are classified as all other wetland areas. The significance of the resource value of a wetland area is a function of the transition area requirements. A transition area of 150 feet is required around wetlands of exceptional value, whereas an area of 50 feet is required around wetlands of **intermediate** value.

3.1.5 Open Space Areas (Sensitive Areas)

The Village of Loch Arbour has prepared a land use map which identifies areas of recreational and open space areas in the Village. **The vacant land analysis yields a total of less than ½ of remaining vacant land, representing less than 0.1% of the total land area of the Village.** The Village will make a determination of their ability to preserve both open space and recreational facilities for use by future generations.

3.2 Existing Stormwater Infrastructure

The existing municipal infrastructure consists primarily of various types, sizes and lengths of storm drainage facilities. In 1994, these facilities were mapped on a municipal aerial database, utilizing funds from the Sewage Infrastructure Improvement Act. The maps represent an accurate location of all existing infrastructure, inclusive of drainage

inlets and manholes, pipe type and length, outfall locations and sizes directing stormwater runoff into the receiving waters, and ultimately the Atlantic Ocean.

The Village of Loch Arbour promotes an annual maintenance schedule including implementation of capital improvement projects, **upgrading storm drainage facilities, as well as inspecting and repairing sanitary sewer facilities**. In addition, the Village will be implementing regulations to insure compliance with the Stormwater Management Rules of the State of New Jersey for all proposed roadway improvement and storm drainage improvement projects undertaken in the Village.

4.0 Design and Performance Standards

The design and performance standards for stormwater management measures for the Village of Loch Arbour include those presented in N.J.A.C. 7:8-5. **Regulatory compliance will be required for** all projects classified as 'major development' disturbing one or more acres or increasing impervious surface by ¼ acres or more, must comply with these new regulations.

4.1 Design Standards

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

- Erosion control – all proposed land disturbance must follow the *Standards for Soil Erosion and Sediment Control in New Jersey*;
- Groundwater recharge – all major development projects that are considered new construction must maintain 100% of the pre-developed groundwater recharge under post-developed conditions or demonstrate that the increase of runoff from pre- to post- for the 2-year, 24-hour Natural Resources Conservation Service (NRCS) Type III storm (consistent with the most recent Technical Paper 40 release or replacement) is infiltrated. Non-structural groundwater recharge measures will be a focus of design;
- Stormwater runoff quantity – all major development projects must demonstrate compliance with one of the following: peak runoff flow rate mitigation, runoff volume mitigation, or hydrograph mitigation; and
- Stormwater runoff quality standards – all major development projects must demonstrate a minimum 80% Total Suspended Solids (TSS) removal rate.

4.1.1 Exemption/Waiver Criteria from Design Standards

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

Redevelopment projects are exempt from the groundwater recharge standards provided that the redevelopment involves disturbance only of previously disturbed areas. Additionally, a 50% TSS removal rate is required for proposed redevelopment projects involving only existing areas of impervious cover. Groundwater recharge requirements do not apply to projects subject to stormwater from areas of high pollutant loading and industrial stormwater exposed to "source material."

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

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

It must be emphasized that utility work, although not subject to certain regulations, must be sensitive to negative impacts on natural resources and water quality.

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

1. The applicant demonstrates that there is a public need for the project that cannot be accomplished by any other means;
2. The applicant demonstrates through an alternatives analysis, that through the use of nonstructural and structural stormwater management strategies and measures, the option selected complies with the above requirements to the maximum extent practicable;
3. The applicant demonstrates that, in order to meet the requirements above, existing structures currently in use, such as homes and buildings would need to be condemned; and
4. The applicant demonstrates that he/she does not own or have rights to areas that would provide opportunities to mitigate for the requirements above that are not achievable on-site.

Additionally, it is important to note that applicants that cannot meet one or more of the design requirements identified above can complete a project by providing a Mitigation Plan as identified in this plan with prior approval from the Village.

4.1.2 Groundwater Recharge

The minimum design and performance standards for groundwater recharge require that the applicant either demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated. Groundwater recharge is prohibited from sites with high pollutant loading or industrial stormwater exposed to "source material." Groundwater recharge is prohibited for these properties and all future identified contaminated properties in accordance with N.J.A.C. 7:8-5.4(a). Adjacent properties also must consider the proximity of contaminated material.

Groundwater recharge rates calculated for the Village of Loch Arbour are provided in a mapping indicated on Figure 5 (Groundwater Recharge Map) in Appendix B.

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

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

4.1.3 Stormwater Runoff Quantity

For all options identified below, the applicant must establish Point(s) of Analysis (POA's) based on natural watershed divisions on the subject site in accordance with Section 5 of the BMP Manual. These POA's must then be analyzed under pre- and post-

construction conditions as discussed below. In order to control stormwater runoff quantity impacts, the design engineer shall complete one of the following:

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

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

Stormwater runoff shall be calculated in accordance with the following:

1. The United States **Department** of Agriculture (USDA) NRCS methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Section 4 of the National Engineering Handbook (NEH-4), dated July 2002, last updated September 8, 2004, and incorporated herein by reference as amended and supplemented (refer to the National Weather Service: http://hdsc.nws.noaa.gov/hdsc/pfds/ for the rainfall frequency data). This methodology is additionally described in Technical Release 55 - Urban Hydrology for Small Watersheds (TR-55), dated June1986, incorporated herein by reference as amended and supplemented; or
2. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations. The rational and modified rational methods are described in "Appendix A-9 Modified Rational Method" in the *Standards for Soil Erosion and Sediment Control in New Jersey*. Refer to the National Weather Service: http://hdsc.nws.noaa.gov/hdsc/pfds/ for the IDF curves

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

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

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

4.1.4 Stormwater Runoff Quality

Per the State of New Jersey regulations, stormwater management measures shall be required for water quality control if one-quarter acre of impervious surface is being proposed on a major development project. Stormwater management measures shall be designed to reduce the post-construction load of Total Suspended Solids in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in this plan. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures. The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollutant Discharge

Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit from this requirement.

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

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

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

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

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

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

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

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

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

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

4.2 Performance Standards

In order to ensure proper operation of all structural and nonstructural stormwater management measures, the Village shall require that all projects considered major development incorporate maintenance plans for proposed stormwater management measures. These plans are essential to the long-term functionality of structural best management practices. All nonstructural BMPs must also be properly maintained to ensure long-term functionality. All maintenance plans shall contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Preventative and corrective maintenance shall be performed to maintain the function of

the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of nonvegetated linings. Specific maintenance guidelines for structural stormwater management measures are available in the NJDEP BMP Manual.

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

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

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

As previously indicated, each year the Village is responsible to submit an Annual Certification Form to NJDEP for their approval. This form requires that the Village certify that all stormwater management facilities are being properly operated and maintained. To ensure this, Loch Arbour will require that all responsible parties submit annual statements documenting the operation and maintenance of their facilities. This will assist the Village in completing the Annual Certification Form as well as provide documentation of all operations and maintenance not conducted by Village personnel on stormwater management facilities. Should the responsible parties not submit annual statement, the Village will assume responsibility for assessing the condition of the stormwater facilities and penalties may be assigned for noncompliance.

5.0 Stormwater Runoff Best Management Practices (BMPs)

It should be noted that although attempts to mimic pre-existing natural conditions may be adequate to satisfy the State stormwater rules, alteration of land always modifies hydrology.

5.1 Nonstructural BMPs/ Low Impact Development (LID)

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

Any land area used as a non-structural stormwater management measure **in a project classified as a major development as defined herein, and utilized** to meet the above identified design standards shall be dedicated to the Village of Loch Arbour, Monmouth County, or the State, subjected to a conservation restriction filed with the County Clerk's office, or subject to NJDEP approved or equivalent restriction that ensures that measure or an equivalent stormwater management measure approved by the reviewing agency is maintained in perpetuity. Additionally, in general, all proposed stormwater management measures must avoid creating concentrated stormwater runoff flows on habitat for threatened and endangered species as documented in the NJDEP's Landscape Project or Natural Heritage Database.

To the maximum extent practicable, the design standards identified in this plan shall be met by incorporating nonstructural stormwater management strategies into the design. **The New Jersey Nonstructural Stormwater Management Strategies Point System (NSPS) provides a tool to assist planners, designers and regulators in determining that the strategies have been used to the "maximum extent practicable" at a major development as required by the Rules. If the NSPS fails to demonstrate such compliance, results shall not be used to disapprove any permit application. Instead, the applicant will be required to demonstrate compliance through other means. This includes the Low Impact Development (LID) Checklist contained in Appendix A of the New Jersey Stormwater Best Management Practices Manual.**

In accordance with the Stormwater Management Rules, nonstructural stormwater management strategies incorporated into site design shall:

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

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

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

Information on the specific nonstructural LID-BMPs recommended for each of these is presented below. Prior to utilizing any of the specific nonstructural LID-BMPs, applicants are urged to review the land development regulations of the municipality and/or agency from which they are seeking development approval. Engineers and site designers should recognize the importance of accurately computing existing or pre-developed runoff at a land development site. While this is an important computation at all

development sites, it is particular important at those sites where nonstructural LID-BMPs will be utilized. This is because, to a large degree, these nonstructural measures will utilize and/or mimic the pre-developed site's rainfall-runoff response. As such, accurate computation of pre-developed hydrologic conditions is vital to successful LID-BMP use. It is recommended that engineers and site designers consult with regulatory entities, such as the State, municipality, or local soil conservation district, regarding pre-developed hydrologic conditions. A pre-design meeting with the Village Engineer or attendance at the Planning Board in concept stage may help to refine concepts before final design.

5.1.1 Vegetation and Landscaping Techniques

The following vegetation and landscaping nonstructural measures should be considered in land development proposed within the Village.

- **Preservation of existing natural vegetated areas**

  This should be considered throughout the design of a land development. There are several areas with significant hydrologic functions including forested areas, riparian corridors, and threatened and endangered species habitat that have been identified within the Village limits. Close attention should be placed on the preservation of natural vegetation in these areas in particular. The maintenance responsibilities for this technique are minimal in that the area should be placed in an easement or deed restricted to ensure that the natural vegetation is not removed.

- **Native ground cover**

  Areas covered with turf grass typically generate more runoff pollution than other types of vegetation. This is especially true when comparing grass areas with naturally wooded areas or forests. Therefore, the amount of lawns and other grass areas at land development sites should be minimized. Instead, alternative vegetation, particularly native plants, should be used to revegetate disturbed site areas. Native ground cover can create infiltration characteristics similar to those of natural areas. Naturally wooded areas or forests should also be restored or reestablished at land development sites where opportunity exists. The use of native plants decreases maintenance in the form of reduced mowing frequency and reduced use of fertilizers, when compared to turf grass.

- **Vegetative Filters/Buffers**

  Native ground cover can provide a vegetated buffer to help filter stormwater runoff and provide locations for runoff from impervious areas to infiltrate. Water flowing as sheet flow across a vegetated area is slowed and filtered prior to infiltrating into the soil. Dense vegetative cover, long flow path lengths, and low surface slopes provide the most effective vegetated filters. Vegetative filters and

buffers can be created by preserving existing vegetated areas over which runoff will flow or by planting new vegetation. Vegetative filters located immediately downstream of impervious surfaces such as roadways and parking lots can achieve pollutant removal, groundwater recharge, and runoff volume reduction. Vegetated buffers adjacent to streams, creeks, and other waterways and water bodies can also help mitigate thermal runoff impacts, maintain stream base flow, provide wildlife habitat, and increase site aesthetics. When upland woods are retained in their natural state, they break the force of falling rain. This prevents the soil from washing away and being carried into streams, wetlands, and potable water supply reservoirs. Wooded hillsides are especially critical in this regard. Removal of ground cover and topsoil during and after construction on steep slopes accelerates runoff and resulting erosion, impacting waters below.

The use of vegetative filters decreases the quantity of and therefore the maintenance and inspection requirements for structures such as curbs, stormwater collection systems – pipes, inlets, outfalls, etc. Vegetative filters should be cleaned out after large rainfall events and at least once (1) per year.

5.1.2 Minimizing Site Disturbance

- **Minimizing land disturbance**

Minimizing land disturbance at a development site is a nonstructural LID-BMP that can be used during all phases of a land development project. Additionally, minimizing land disturbance can help reduce post-development site runoff volumes and pollutant loads and maintain existing groundwater recharge rates and other hydrologic characteristics by preserving existing site areas. Minimum disturbance begins during the project's planning and design phases by fitting the development into the terrain, as opposed to changing the terrain to fit the development. Roadway and building patterns that match the existing land forms and limit the amount of required clearing and grading should be chosen. The applicant will ensure compliance by including these requirements in soil erosion and sediment control plans, construction plans, and contract documents.

5.1.3 Impervious Area Management

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

- **Minimizing parking area and driveways**

  Parking area and driveway requirements are mandated by the Village Land Development Ordinances and, in the case of residential areas, the RSIS. The RSIS provides flexibility in selecting parking and driveway size, provided that supporting local data is available. A mix of residential and nonresidential uses at a development site can share parking areas, thereby reducing the total parking area and impervious cover.

- **Unconnected impervious areas**

  This technique includes impervious surfaces that are not directly connected to a site's drainage system. Instead, runoff from an unconnected impervious area is allowed to sheet flow from the impervious area across a downstream pervious surface, where it has the opportunity to re-infiltrate into the soil, thereby reducing the total runoff volume. In most circumstances, impervious areas can be considered unconnected under the following conditions:

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

- **Vegetated Roofs**

  Vegetated roofs, also known as green roofs, are an innovative way to reduce impervious surfaces at development sites. A vegetated or green roof consists of a lightweight vegetated planting bed that is installed on a new or existing roof. Vegetated roofs can be implemented using specialized commercial products. It is important to note that the structural integrity of the roof must be taken into consideration when designing a green roof. The Village Building Code Officials must be consulted prior to use of this technique. Except for periodic limited or as needed fertilization and watering, a meadow-like planting of perennial plants can require minimal maintenance.

5.1.4 Time of Concentration (Tc) Modifications

Changes in peak flow result from changes in the Time of Concentration (Tc) from drainage areas, with longer times yielding smaller peak runoff rates and shorter times causing greater ones. Site factors that affect drainage area time of concentration include precipitation, flow length, flow regime, surface roughness, channel shape, and slope. Typically, land development modifies most of these factors in ways that cause the time of concentration of a drainage area to be shorter (and, therefore the peak runoff rates to be greater) after development than prior to development. However, during site design, it may be possible to minimize this decrease in time of concentration by controlling the various site factors that affect it. Considerations may be given for the factors presented below.

- **Surface roughness changes**

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

- **Slope reduction**

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

- **Vegetated conveyance**

  The use of vegetated conveyance measures such as channels and swales can increase the surface roughness along the Tc flow path and increase the overall Tc. In addition, vegetated channels can provide opportunities for runoff treatment, runoff infiltration, and evapotranspiration. In designing vegetated conveyance measures, care should be taken to protect transitions to and from culverts from

erosion caused by flow acceleration and turbulence. The vegetation must be tolerant of the hydrologic regime associated with the channel.

5.2 Structural Best Management Practices

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

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including environmentally critical areas; wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; and drainage area and drainage patterns.
2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning.
3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant.
4. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at N.J.A.C. 7:8-6 and as identified below.
5. Stormwater management measure guidelines are available in the BMP Manual and as described below. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, ground water recharge and water quality design and performance standards established by this subsection.
6. For all future proposed structural stormwater management measures, the Village Engineer and director of public works must evaluate the ability to clean out the selected structural BMP(s); the expense of replacement equipment, safety, and training for the BMP(s); and the ease of access to maintain the structure(s).

The types of structural BMPs are identified in the BMP Manual; however, this plan details the recommended structural BMPs for use specifically in Loch Arbour. These include the following:

- **Bioretention system**

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

runoff from both residential and nonresidential developments. Effective bioretention system performance requires regular and effective maintenance.

- **Constructed stormwater wetland**

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

- **Dry well**

  A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs of structures. Discharge of this stored runoff from a dry well occurs through infiltration into the surrounding soils. A dry well may be either a structural chamber and/or an excavated pit filled with aggregate. Due to the relatively low level of expected pollutants in roof runoff, a dry well cannot be used to directly comply with the suspended solids and nutrient removal requirements contained in the NJDEP Stormwater Management Rules at N.J.A.C. 7:8. However, due to its storage capacity, a dry well may be used to reduce the total stormwater quality design storm runoff volume that a roof would ordinarily discharge to downstream stormwater management facilities. Dry wells can also be used to meet the groundwater recharge requirements of the NJDEP Stormwater Management Rules. The use of dry wells is applicable only where their subgrade soils have the required permeability rates and groundwater is not shallow. Effective dry well performance requires regular and effective maintenance.

- **Extended Detention Basin**

  An extended detention basin is a facility constructed through filling to create a berm and/or excavation to form a hole that provides temporary storage of stormwater runoff. It has an outlet structure that detains and attenuates runoff inflows and somewhat promotes the settlement of pollutants. An extended detention basin is normally designed as a multistage facility that provides runoff storage and attenuation for both stormwater quality and quantity management.

The adopted TSS removal rate for extended detention basins is 40 to 60 percent, depending on the duration of detention time provided in the basin, which does not meet the requirements of the Stormwater Management Rules exclusively. Extended detention basins can be used in part to address both the stormwater runoff quantity and quality impacts of land development. Extended detention basins are designed for complete evacuation of runoff and normally remain dry between storm events. Extended detention basins may be used at sites where significant increases in runoff are expected from site development. Extended detention basin performance requires regular and effective maintenance. All new stormwater management basins within the Village must, at a minimum, include trash racks, overflow grates, and escape provisions at outlet structures. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets.

- **Manufactured Treatment Device**

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

- **Pervious paving**

Pervious paving materials can be used at some site locations in the Village to replace standard impervious pavement in parking lots and driveways in the Village. For all sites where pervious paving is proposed, care should be taken in

assessing soil conditions, high groundwater conditions, and potential sources of contamination. Further, it is recommended that some form of pre-treatment (i.e. filter strips) be utilized to minimize the chance of clogging the pervious paving. Careful consideration must be given to freezing weather and to drainage and flooding if clogging occurs. Effective pervious paving system performance requires regular and effective maintenance.

- **Sand filter**

  A sand filter consists of a forebay and underdrained sand bed. It can be configured as either a surface or subsurface facility. Runoff entering the sand filter is conveyed first through the forebay, which removes trash, debris, and coarse sediment, and then through the sand bed to an outlet pipe. Sand filters use solids settling, filtering, and adsorption processes to reduce pollutant concentrations in stormwater. The adopted TSS removal rate for sand filters is 80 percent. Sand filters are normally used in highly impervious areas with relatively high TSS, heavy metal, and hydrocarbon loadings such as roads, driveways, drive-up lanes, parking lots, and urban areas.

- **Vegetative filter**

  A structural vegetative filter strip can be employed using native ground cover or other vegetation to provide pollutant removal from stormwater runoff. A vegetative filter is an area designed to remove suspended solids and other pollutants from stormwater runoff flowing through a length of vegetation called a vegetated filter strip. The vegetation in a filter strip can range from turf 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. Vegetated filter strips can be effective in reducing sediment and other solids and particulates, as well as associated pollutants such as hydrocarbons, heavy metals, and nutrients. Effective vegetated filter strip performance requires regular and effective maintenance.

- **Rain Barrel**

  A rain barrel is a rainwater harvesting system that is connected to a down spout tube from a house or building and is a simple retrofit that a homeowner can perform. Rain barrels collect, store and divert rooftop runoff during a rain shower for use during dryer weather. Saving rainwater to use during the dry months using rain barrels is an ancient practice that is again becoming popular. A rain barrel is a perfect reservoir for watering landscapes and ornamental and vegetable gardens. All systems should use covered barrels or cisterns that keep the water

from accumulating leaves (and going septic) and keep the standing water from encouraging mosquito breeding.

6.0 Mitigation Plans

Mitigation is provided as an alternative to allow a variance or deviation from the strict interpretation of the stormwater management plan in conjunction with a major development project where due to unique or unusual circumstances, it is not practical or viable to meet the standards of stormwater management regulations (NJAC 7:8-1.1 et seq.). Mitigation is utilized as an alternative proposal to correct or improve a stormwater condition.

Mitigation Project Criteria

For applications in which stormwater criteria can not be met, the NJDEP regulations allow for the Municipal Planning Board to grant variances subject to specific conditions. The Village may consider granting variances or exemptions for 'major developments,' subject to the following NJDEP and municipal requirements:

a. **The mitigation project must be implemented in the same drainage area or watershed as the proposed development.**

b. **The mitigation project must provide groundwater recharge benefits, or protection from stormwater runoff quality and quantity within previously developed property.**

c. **The mitigation project must be completed for the performance standard for which the variance or exemption is requested and must provide comparable benefits to those being waived should the variance be granted.**

d. **The developer must ensure the long term maintenance of the approved mitigation system, which include the maintenance requirements developed in the NJDEP BMP Manual.**

e. **It shall be the developer's responsibility to prove to the satisfaction of the municipality that should the variance be granted and mitigation approved, there will be no detrimental impact on adjoining properties.**

f. **The developer shall enter into a developer's agreement with the municipality, which addresses all issues related to the construction and maintenance of the mitigation project.**

The Applicant may select one of the following strategies to be developed into potential mitigation projects. It is the developer's responsibility to provide a

detailed study of any proposed mitigation project, and to provide the Village with a proposed mitigation plan for review and approval.

Groundwater Recharge mitigation includes rehabilitation of existing detention or retention basins; installation of permeable pipe underdrains; and encouraging infiltration of runoff to groundwater recharge.

Water Quality and Water Quantity mitigation includes rehabilitation of culverts and/or ditches in major watershed basins; desilting and desnagging of stream corridors; rehabilitation of existing ponds, lakes and waterways; installation of structural BMP's within the municipal drainage system and/or at outfall locations; and encouraging total suspended solid and nutrient load reduction.

Stream Corridor Protection mitigation includes stream bank stabilization; vegetative enhancement; and restoration of floodplain areas.

7.0 Stream Corridor Protection Plans

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

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

1. The forests and wetlands within stream corridors provide a buffer against pollution impacts to the stream. The benefits of such buffers (a.k.a. filter strips or buffer strips) include:

    (a) Removal of sediment and pollutants in overland flow by providing opportunities for filtration, deposition, infiltration, absorption, adsorption, decomposition and volatilization;
    (b) Reduction of sheet, bank and streambed erosion by stabilization of the stream bank ground surface;
    (c) Displacement of activities from the waters edge that represent potential sources of non-point source pollutant generation, spill accidents and illegal dumping;
    (d) Shade surface waters so that waters are not excessively warmed.

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

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

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

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

Adequate protection of stream corridors will eliminate some of these water quality problems by removing sediments, organic matter, and other pollutants from runoff and waste water before entering stream, and displacing potential pollutants from the stream corridor.

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

8.0 Land Use/Build Out Analysis

The Village of Loch Arbour is 0.10 square miles in overall size, **99.9%** of which is developed land, as confirmed by the **Monmouth County Planning Board during the** 2004 Cross-Acceptance III process. As such, the Village meets the exemption criteria from the requirement for a land use/build out analysis under the NJPDES General Permit.

9.0 Plan Consistency

Regional Stormwater Management Plans – A Regional Stormwater Management Plans (RSWMP) is being developed for waters within the Deal Lake Watershed (see Section 11.0). The municipal stormwater management plan will be updated to insure consistency with the Regional plan.

Total Maximum Daily Loads (TMDL's) – The New Jersey Department of Environmental Protection (NJDEP) has established TMDL's for waterbodies within the Village. These parameters are provided in Table No. 1, located in Appendix C of this report, identified as New Jersey's 303(d) List of Impaired Waters. The water bodies include Deal Lake. The Village will update this plan to be consistent with any stormwater TMDL's as they are established by NJDEP.

Residential Site Improvement Standards (RSIS) – The Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards found at N.J.S.A. 5:21. The Village will utilize the most current update of the RSIS in the stormwater management review of site development applications or residential areas.

Soil Erosion and Sediment Control Standards – The Municipal Land Development Ordinance requires all new development and redevelopment to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction activities, municipal inspectors shall cooperate with the Freehold Soil Conservation District, and observe on-site soil erosion and sediment control measures as a part of construction administration.

Monmouth County Growth Management Guide – The Monmouth County Growth Management Guide establishes a series of goals and objectives designed to enhance the quality of life for residents of Monmouth County. This plan is consistent with those objectives, which include:

- **Encouraging the protection of the County's unique, diverse, natural and scenic natural resources;**
- **Promoting the protection of non-renewable natural resources;**
- **Encouraging the protection and conservation of all water resources;**
- **Promoting the preservation and improvements of coastal water resources;**
- **Promoting the preservation and improvements of surface water quality;**
- **Encouraging the preservation and improvements of groundwater quality and quantity, and;**
- **Promoting the preservation, restoration, and enhancement of wetlands and stream corridors in order to protect the adjacent water bodies, such as streams, rivers, lakes, bays and oceans.**

State Development or Redevelopment Plan (SDRP) – This Municipal Stormwater Management Plan is consistent with the State Plan by preserving and protecting the established residential character of the Village, preserving and upgrading the existing utility infrastructure, providing adequate open space facilities, and preserving and protecting valuable natural resources and features within the Village.

10.0 Recommendations and Goals

The following goals have been identified and met as summarized below:

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

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

- **Reduce soil erosion from any development or construction project** – The Village's Stormwater Management Plan identifies that the *Standards for Soil Erosion and Sediment Control in New Jersey* be followed for all major development projects. Further, the Village will mandate mitigation measures for projects that cannot strictly comply with the Stormwater Rules or the Village's ordinances for stormwater thus retrofits to existing stormwater management features can be employed to reduce erosion from existing development and redevelopment projects.

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

- **Maintain groundwater recharge** – By mandating that all major development projects complete Groundwater Recharge Spreadsheet analyses, it will be possible

for the Village to identify the pre-developed and post-developed groundwater recharge conditions. Through the use of BMPs for infiltration, the existing groundwater recharge conditions will be maintained post-development. The Village will mandate mitigation measures to compensate for any shortfall due to thorough documented on-site limitations to recharge.

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

- **Maintain the integrity of stream channels for their biological functions, as well as for drainage** – The Village intends to support the goals of the Special Protection Waters implementation through the administration of the Municipal Stormwater General Permit. By requiring vegetative buffer strips along all tributaries for sediment control, stream bank and streambed erosion control, nutrient and pollutant removal, stream temperature control, protection of aquatic species, and wildlife habitat, the Village will enhance this goal.

- **Minimize pollutants in stormwater runoff from new and existing development in order to restore, enhance and maintain the chemical, physical, and biological integrity of the waters of the State, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial and other uses of water** - By mandating that all major development projects meet an 80% Total Suspended Solids removal rate, nonpoint pollution is mitigated to a greater extent. Further, the Village will mandate mitigation measures for projects that cannot strictly comply with the Stormwater Rules or the Village's ordinances for stormwater. Retrofits to existing stormwater management features can be employed to reduce nonpoint pollution from existing development and redevelopment projects.

  As a Tier A Municipality, Loch Arbour is required to develop and implement a Local Public Education Program to educate residents and businesses about the impact of their activities on stormwater quality and on the steps they can take to lessen these impacts. The municipal education program will be conducted to satisfy at least the minimum standards and will include all of the SBA and/or BMP topics required.

The Local Public Education Program will include a storm drain inlet labeling project and will include the distribution of materials describing the hazards of dumping materials into storm drains and the labeling of all stormdrains along municipal streets with sidewalks and all storm drains within plazas, parking areas, and maintenance yards operated by the municipality.

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

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

11.0 Regional Stormwater Management Plan (RSWMP) Participation

The Village of Loch Arbour, through its representation as a member of the Deal Lake Commission, is participating in the development of a Regional Stormwater Management Plan for the Deal Lake Watershed.

The Commission will develop a water resource management strategy that identifies solutions to problems best managed on a regional scale. This process will address flooding, water quality and water quantity issues that may be generated by future development throughout the watershed.

The RSWMP will proactively pursue the improvement of tributaries flowing into Deal Lake, through a reduction in non-point source pollution, soil erosion, stream bank and bed erosion and localized flooding. This regional plan will be consistent with management goals established in the Deal Lake Total Maximum Daily Load (TMDL) by the New Jersey Department of Environmental Protection.

Upon completion of the RSWMP, the Village of Loch Arbour will review the Municipal Stormwater Management Plan for consistency with the goals and objectives of the regional plan, and make modifications where necessary.

Appendix A

NJPDES Tier A Municipal Stormwater General Permit

New Jersey Department of Environmental Protection
Bureau of Nonpoint Pollution Control
Division of Water Quality
PO Box 029
Trenton, NJ 08625-0029
Phone: (609) 633-7021
Fax: (609) 984-2147

AUTHORIZATION TO DISCHARGE
R9 -Tier A Municipal Stormwater General Permit

Facility Name:
LOCH ARBOUR VILLAGE

PI ID #: 203115

Facility Address:
550 MAIN ST
LOCH ARBOUR VILLAGE, NJ 07711-1239

NJPDES #: NJG0153516

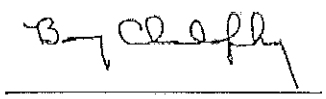
Type of Activity: Stormwater Discharge General Permit Authorization-New

Owner:
LOCH ARBOUR VILLAGE
550 MAIN ST
LOCH ARBOUR, NJ 07711

Operating Entity:
LOCH ARBOUR VILLAGE
550 MAIN ST
LOCH ARBOUR, NJ 07711

Issuance Date:	Effective Date:	Expiration Date:
03/29/2004	04/01/2004	02/28/2009

Your Request for Authorization under NJPDES General Permit No. NJ0141852 has been approved by the New Jersey Department of Environmental Protection.



Date: 03/29/2004

Barry Chalofsky, P.P., Chief
Bureau of Nonpoint Pollution Control
Division of Water Quality
New Jersey Department of Environmental Protection

Appendix B

Municipal Background Mapping

Municipal Background Mapping

The following list of figures is provided in compliance with the Stormwater Management Plan background mapping requirements for the Village of Loch Arbour, Monmouth County, New Jersey:

List of Figures

The office of Leon S. Avakian, Inc., Municipal Engineer for the Village of Loch Arbour, would like to acknowledge and thank Dr. Steven Souza and key personnel from the environmental consulting firm of Princeton Hydro, based in Ringoes, New Jersey, for their assistance in the preparation of the maps provided.

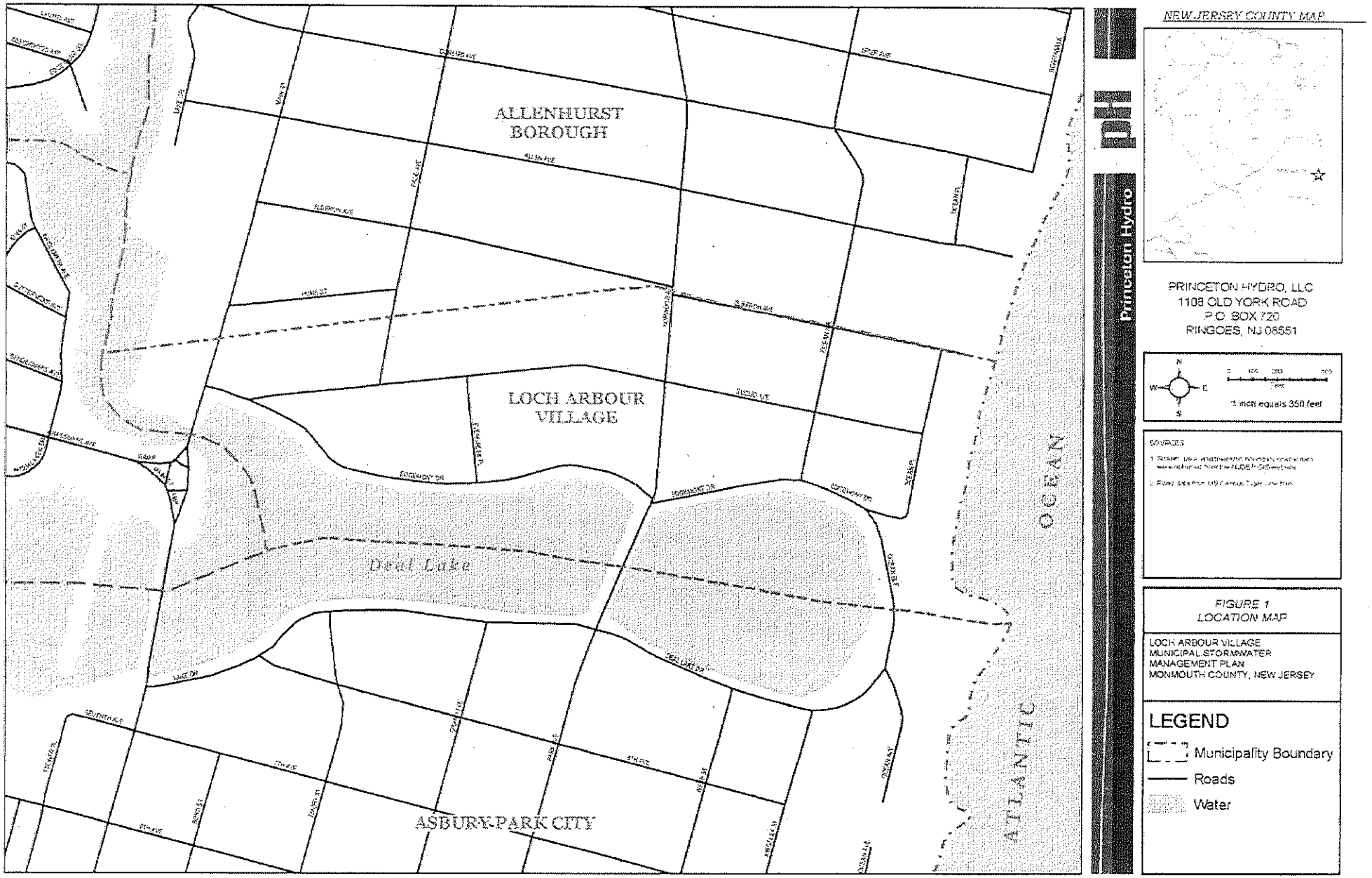

ALLENHURST
BOROUGH
LOCH ARBOUR
VILLAGE
Deal Lake
ASBURY PARK CITY
ATLANTIC
OCEAN
Princeton Hydro
NEW JERSEY COUNTY MAP
PRINCETON HYDRO, LLC
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
1 inch equals 350 feet
SOURCES
FIGURE 1
LOCATION MAP
LOCH ARBOUR VILLAGE
MUNICIPAL STORMWATER
MANAGEMENT PLAN
MONMOUTH COUNTY, NEW JERSEY
LEGEND
Municipality Boundary
Roads
Water

Figure 1

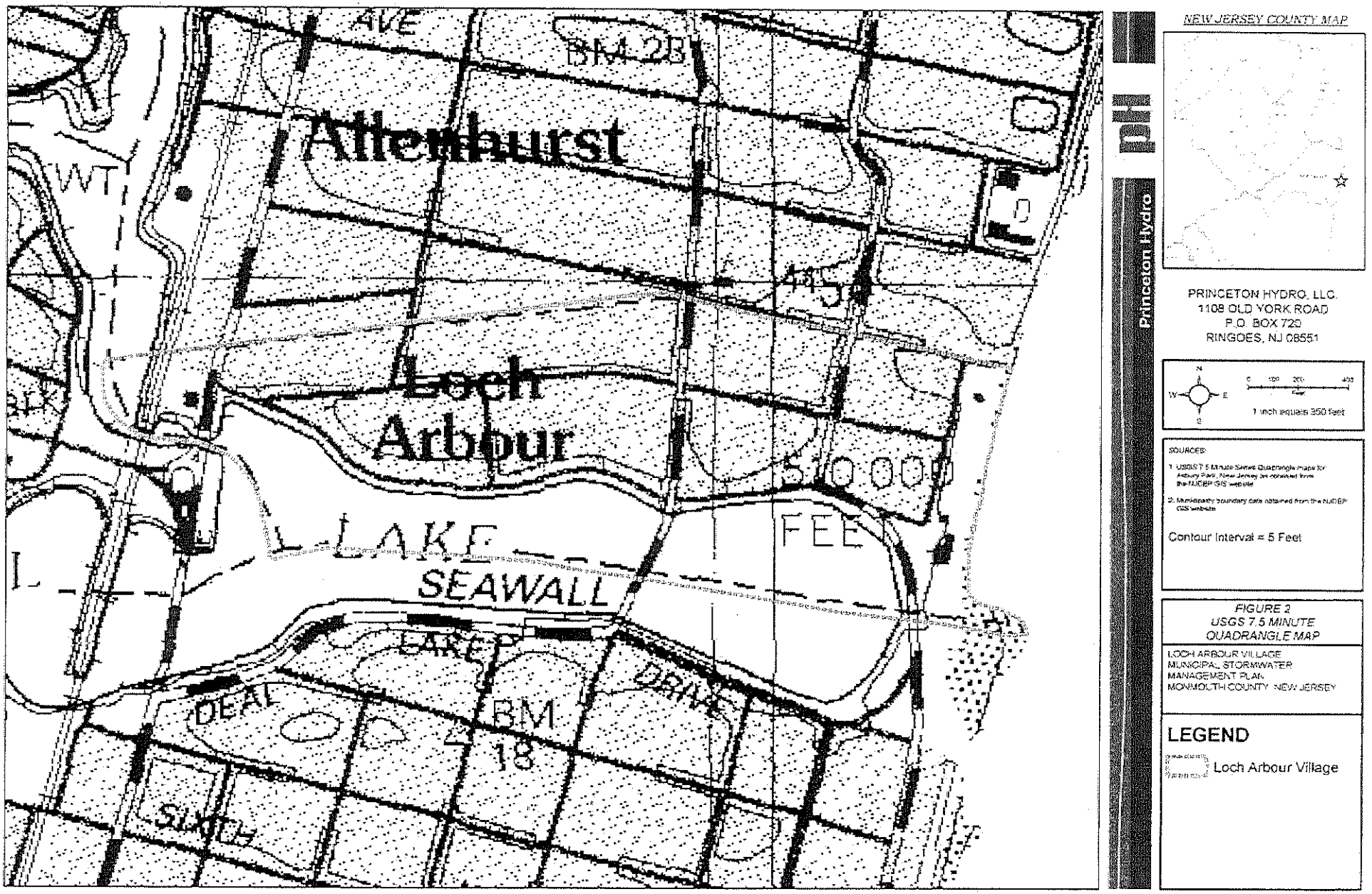

Atlantic
Loch
Arbour
LAKE
SEAWALL
DEAL
BM
18
BM 28
NEW JERSEY COUNTY MAP
PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
1 inch equals 350 feet
SOURCES:
Contour Interval = 5 Feet
FIGURE 2
USGS 7.5 MINUTE
QUADRANGLE MAP
LOCH ARBOUR VILLAGE
MUNICIPAL STORMWATER
MANAGEMENT PLAN
MONMOUTH COUNTY, NEW JERSEY
LEGEND
Loch Arbour Village

Figure 2

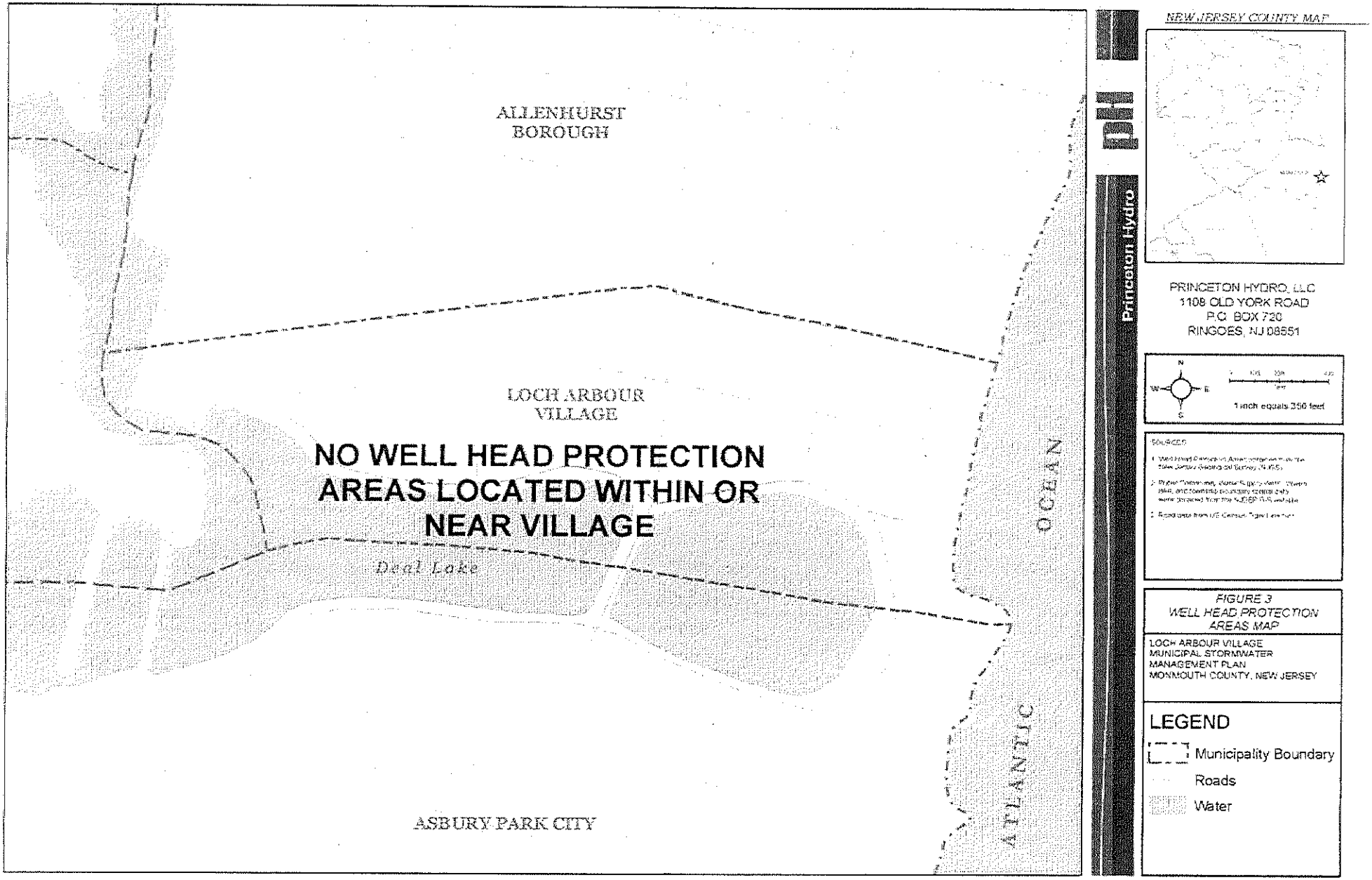

ALLENHURST
BOROUGH
LOCH ARBOUR
VILLAGE
NO WELL HEAD PROTECTION
AREAS LOCATED WITHIN OR
NEAR VILLAGE
Deal Lake
ASBURY PARK CITY
ATLANTIC
OCEAN
Princeton Hydro
NEW JERSEY COUNTY MAP
PRINCETON HYDRO, LLC
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
1 inch equals 350 feet
SOURCES:
FIGURE 3
WELL HEAD PROTECTION
AREAS MAP
LOCH ARBOUR VILLAGE
MUNICIPAL STORMWATER
MANAGEMENT PLAN
MONMOUTH COUNTY, NEW JERSEY
LEGEND
Municipality Boundary
Roads
Water

Figure 3

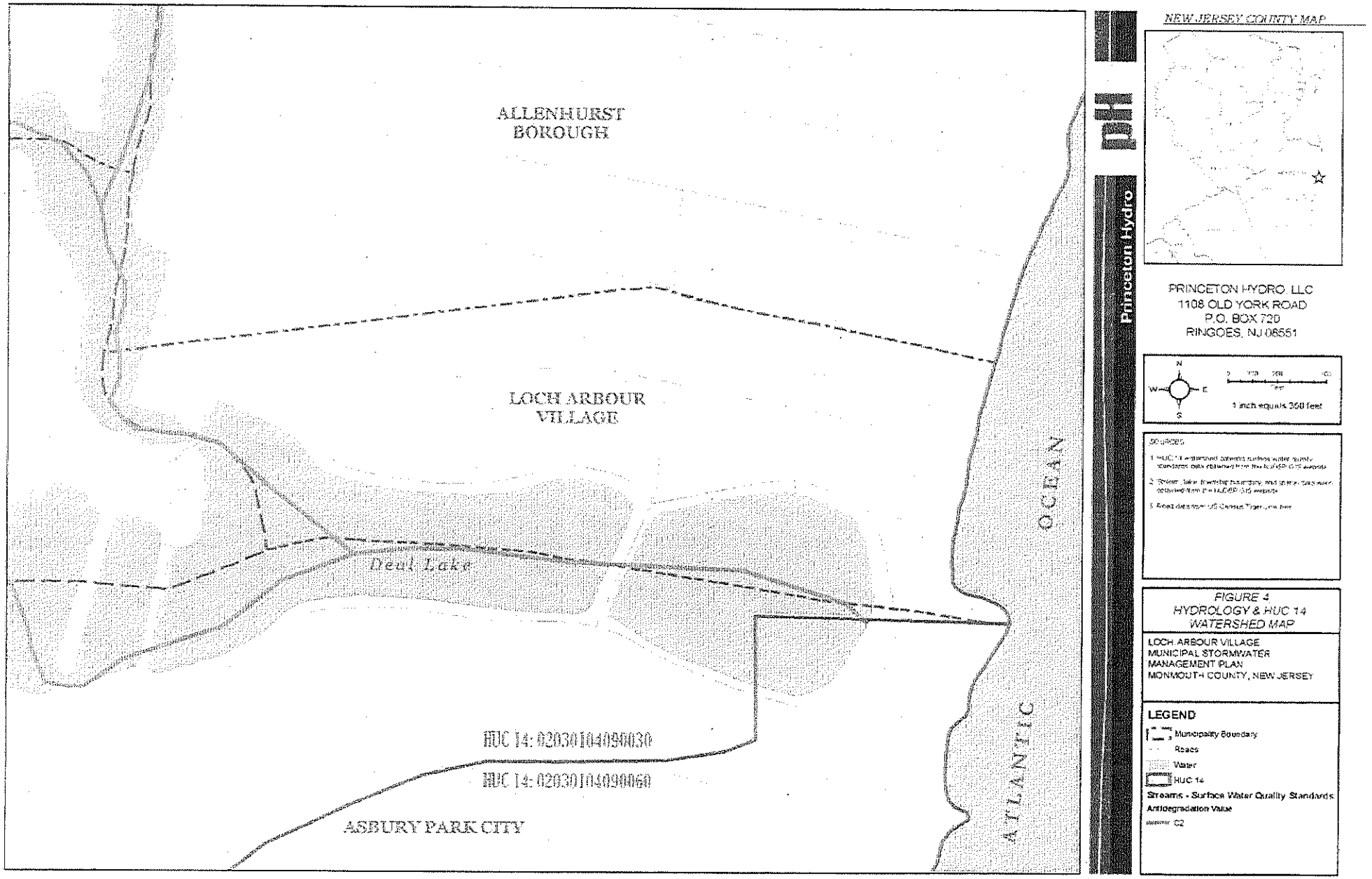

ALLENHURST
BOROUGH
LOCH ARBOUR
VILLAGE
Deal Lake
OCEAN
ATLANTIC
HUC 14: 02030104090030
HUC 14: 02030104090060
ASBURY PARK CITY
NEW JERSEY COUNTY MAP
PRINCETON HYDRO, LLC
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
1 inch equals 350 feet
FIGURE 4
HYDROLOGY & HUC 14
WATERSHED MAP
LOCH ARBOUR VILLAGE
MUNICIPAL STORMWATER
MANAGEMENT PLAN
MONMOUTH COUNTY, NEW JERSEY
LEGEND
Municipality Boundary
Roads
Water
HUC 14
Streams - Surface Water Quality Standards
Antidegradation Value
C2

Figure 4

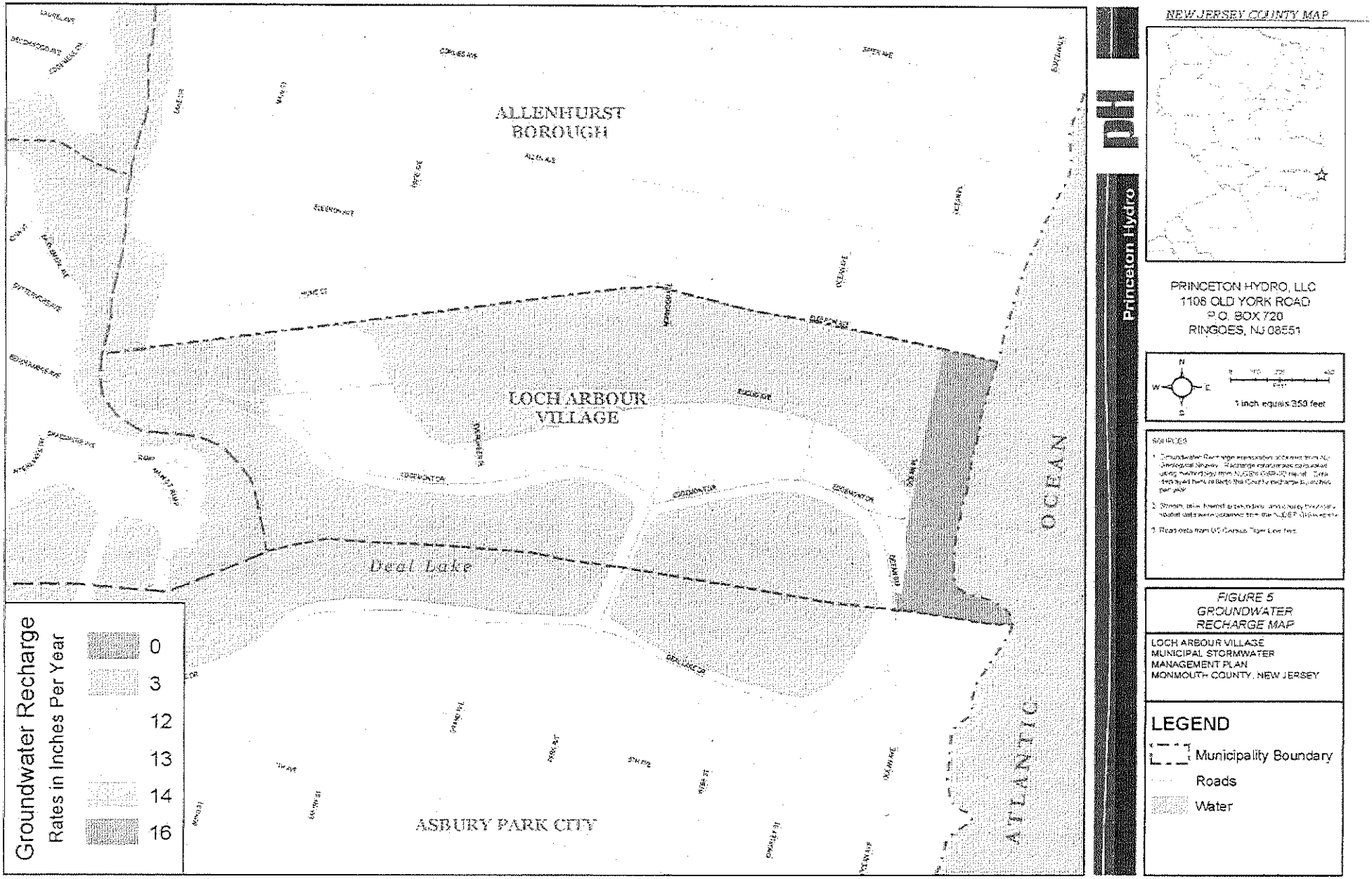

ALLENHURST BOROUGH
LOCH ARBOUR VILLAGE
Deal Lake
ASBURY PARK CITY
ATLANTIC OCEAN
Groundwater Recharge
Rates in Inches Per Year
0
3
12
13
14
16
NEW JERSEY COUNTY MAP
Princeton Hydro
PRINCETON HYDRO, LLC
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
N
W
E
S
1 inch equals 350 feet
SOURCES
FIGURE 5
GROUNDWATER
RECHARGE MAP
LOCH ARBOUR VILLAGE
MUNICIPAL STORMWATER
MANAGEMENT PLAN
MONMOUTH COUNTY, NEW JERSEY
LEGEND
Municipality Boundary
Roads
Water

Figure 5

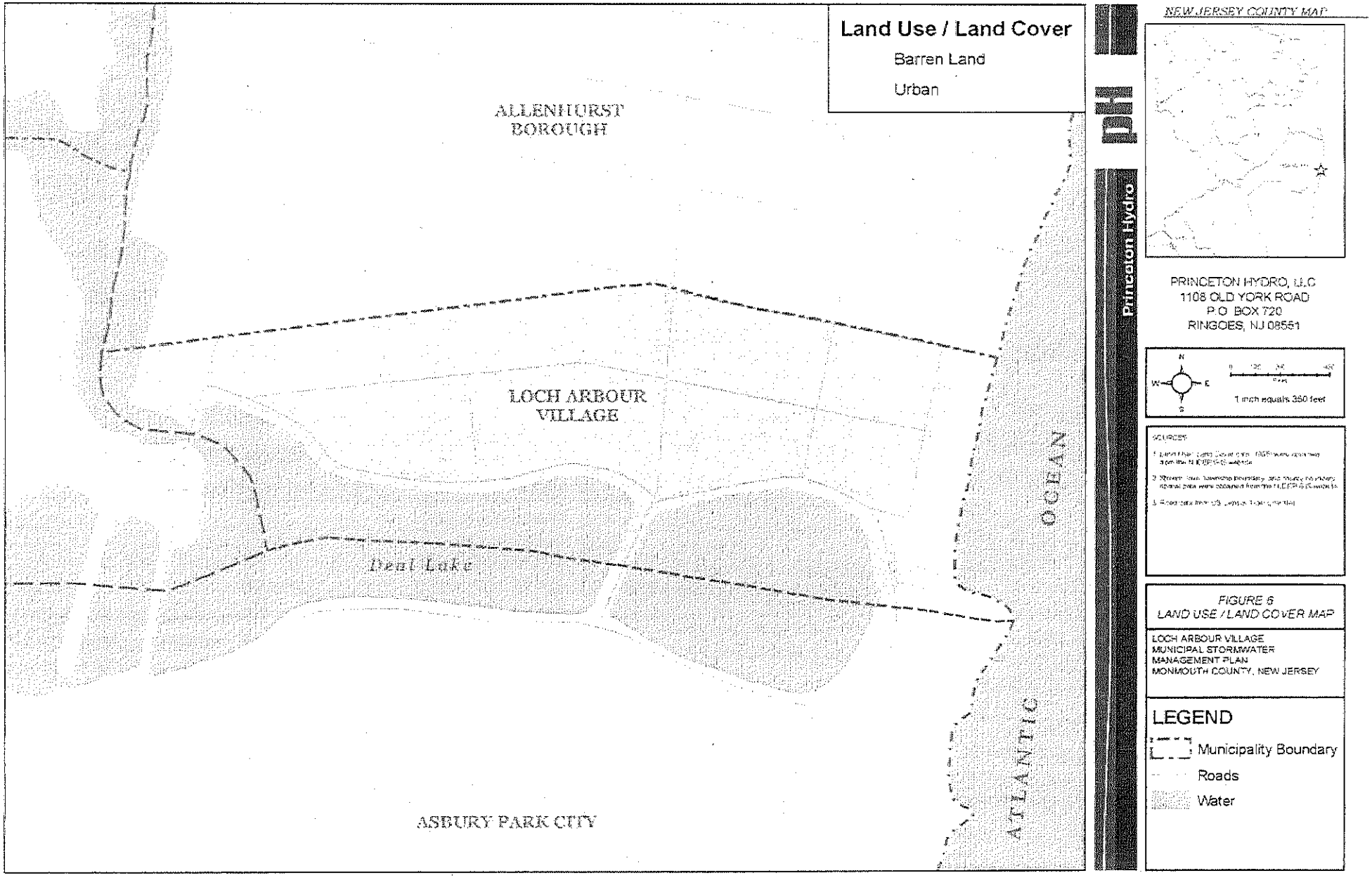

Land Use / Land Cover
Barren Land
Urban
ALLENHURST BOROUGH
LOCH ARBOUR VILLAGE
Deal Lake
ASBURY PARK CITY
ATLANTIC OCEAN
NEW JERSEY COUNTY MAP
PRINCETON HYDRO, LLC
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
1 inch equals 350 feet
FIGURE 6
LAND USE / LAND COVER MAP
LOCH ARBOUR VILLAGE
MUNICIPAL STORMWATER
MANAGEMENT PLAN
MONMOUTH COUNTY, NEW JERSEY
LEGEND
Municipality Boundary
Roads
Water

Figure 6

Appendix C

Water Quality Monitoring Tables

TABLE NO. 1

New Jersey's 303(d) List of Impaired Waters with Priority Ranking

December, 2006

WMA	Assessment Unit ID	Assessment Unit Name	Parameter	Ranking
12	02030104090030-01	Deal Lake	pH	M
12	Deal Lake-12	Deal Lake-12	Pathogens	H

TABLE NO. 2 - MONMOUTH COUNTY HEALTH DEPARTMENT
AMBIENT SURFACE WATER MONITORING – STREAMS

Showing results for: DEAL LAKE, ASBURY

Site	Collection Date	Fecal	Enterococci	Ecoli	Turbidity	Total Suspended Solids	pH	Specific Conductivity	Disolved Oxygen	Total Phospherous	Salinity ppt	Temperature C	Nitrate Nitrogen	Total Kjeldahl Nitrogen	Ammonia	SWQS
1	11/15/2007	70				9.2	8.44	408.1	12.12			10.7	0.5	1.28	0.17	FW2-NT
1	11/15/2007									0.09						FW2-NT
1	9/18/2007	590				5.2	9.27	175.7		0.2		20.6	1.83	1.83	0.15	FW2-NT
1	5/8/2007	20				16.4	9.25	4264	12.84	0.22		17	0.5	1		FW2-NT

TABLE NO. 3 - MONMOUTH COUNTY HEALTH DEPARTMENT
AMBIENT SURFACE WATER MONITORING – HISTORICAL DATA

Showing results for: DEAL LAKE, ASBURY

Site	Collection Date	Fecal	Ammonia	Phosphorus	Ph	Tot. Suspended Solids	Turbidity	SWQS	Salinity ppt	Temp. C
1	12/7/2006	390			7.6	10.8	7.3	FW2-NT	1.1	8.8
1	9/13/2006	90	0.22	0.048	8.46	9.2	5.85	FW2-NT	6	19.6
1	6/27/2006	610			7.34	19.2	16.2	FW2-NT	0.9	25.4
1	3/16/2006	30	3.4	0.08	7.79	8.8	7.97	FW2-NT	2.2	8.3
1	12/12/2005	110			6.73	10.4	7.63	FW2-NT	0.5	2
1	9/28/2005	10	0.14	0.26	9.83	87	52.9	FW2-NT	5.4	21.9
1	6/28/2005	1100			8.05	6	12.5	FW2-NT	2.3	
1	3/22/2005	10	0.68	0.059	7.04	6.8	6.36	FW2-NT	2.1	9.1
1	12/8/2004	360		0.09	7.52	6	6.82	FW2-NT	0.1	10.1
1	9/15/2004	250			9.56	40	32.3	FW2-NT	1	23.8
1	6/3/2004	30	0.1	0.09	9.2	11.2	10.2	FW2-NT	0.7	29.7
1	3/18/2004	10			7.09	7.2	5.99	FW2-NT		
1	11/17/2003	140			7.9	6.8	6	FW2-NT		
1	9/29/2003	530	< 0.1	0.06	9.1	10.8	12.2	FW2-NT		
1	6/26/2003	70			7.66	12	10.4	FW2-NT		

Site	Collection Date	Fecal	Ammonia	Phosphorus	Ph	Tot. Suspended Solids	Turbidity	SWQS	Salinity ppt	Temp. C
1	3/26/2003	450	0.42	0.08	7.53	8.4	6.9	FW2-NT		
1	12/3/2002	60			7.4	4	7.5	FW2-NT		
1	10/9/2002	170	< 0.05	0.11	8.98	25.2	19.3	FW2-NT		
1	6/4/2002	30			7.3	16	16.2	FW2-NT		
1	4/17/2002	20						FW2-NT		
1	3/5/2002	990	0.45	0.07	7.7	7		FW2-NT		
1	12/11/2001	450			7.67	16		FW2-NT		
1	10/2/2001	1750	< 0.07	0.11	7.9	14		FW2-NT		
1	6/5/2001	20			6.95	14		FW2-NT		
1	3/13/2001	30	1	0.07	7.35	8		FW2-NT		
1	12/5/2000	< 10						FW2-NT		
1	10/3/2000	210	0.19	0.09				FW2-NT		
1	6/6/2000	1520						FW2-NT		
1	3/21/2000	50	3.6	0.05				FW2-NT		
1	12/7/1999	1270						FW2-NT		
1	10/5/1999	300	0.19	0.114				FW2-NT		
1	6/8/1999	160						FW2-NT		
1	3/2/1999	50	0.4	0.12				FW2-NT		