Lake Hopatcong Watershed Wetland and Riparian Areas Protection Project

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1.0 Introduction

In 2003, the Lake Hopatcong Commission (LHC) was the recipient of a Wetland Protection Project grant from the United States Environmental Protection Agency (USEPA). This funding was provided to prioritize wetlands and wetland buffers for protection and preservation in the 16,215-acre Lake Hopatcong watershed in Sussex and Morris Counties, New Jersey. The goal of the project is to preserve these wetlands and wetland buffers to enhance and protect the water quality of Lake Hopatcong, limit future alterations to the lake's existing hydrology and hydraulics, preserve wildlife habitat, and protect and enhance the overall ecology of the lake and the Upper Musconetcong River.

At 2,686 acres, Lake Hopatcong is the largest inland waterbody in New Jersey. Its sprawling, irregular shoreline surrounds several shallow coves emanating from the main body of the lake. Approximately 59% of the lake's watershed is in the Township of Jefferson, while 20% is in the Borough of Hopatcong, 11% in the Township of Sparta, 5% in the Borough of Mount Arlington, and 5% in the Township of Roxbury. All watershed municipalities border the lake, with the exception of Sparta.

Since the early 1900s, fishing and boating have made Lake Hopatcong a major recreational resource in northwest New Jersey. Development pressures have increased in the lake's watershed over the years as tourists and permanent residents alike have flocked to the area. Today, more than 500,000 people visit Lake Hopatcong each year or live in its watershed, with more than 10,000 registered boats on the lake.

The environmental impacts associated with these development pressures have included degraded water quality, excessive growth of aquatic plants and algae, and loss of wetlands and riparian areas and their associated pollutant removal and wildlife habitat functions. As the watershed has become increasingly and more intensely developed, impacts to wetlands have extended to areas far beyond the lake's shoreline. Today, continuing construction and land clearing in the Lake Hopatcong watershed threatens wetlands and wetland buffers throughout the watershed, along stream corridors and in new areas that were formerly not subject to development pressures.

The importance of wetlands and wetland buffers to maintaining healthy surface water quality has been verified through numerous studies by a variety of environmental agencies, including USEPA (2002), USGS (Kentula, 1996) and NJDEP (2000). Their values include managing floodwater, maintaining baseflow, filtering contaminants, slowing or reducing erosion and providing wildlife habitat. The LHC proposed this Wetland Protection Project to USEPA in recognition of these values and the importance of protecting the remaining wetlands and wetland buffers in critical areas of the Lake Hopatcong watershed, especially in light of continuing development pressures and water quality problems.

However, New Jersey's regulatory landscape has changed significantly in the three years since this grant was awarded to the LHC. Relevant to this project are two major regulations that have been adopted by the State: the new stormwater management rules (N.J.A.C. 7:8) and the Highlands Water Protection and Planning Act (Highlands Act) rules (N.J.A.C. 7:38). Both regulations created new protections for wetlands in the Lake Hopatcong watershed. Under the new stormwater rules, which were adopted in 2004, a 150-300' "special water resource protection area" is established along each bank of all waterways designated "Category One (C1)," the State's highest level of protection. Consistent with the anti-degradation standard established for C1 waters under the NJ Surface Water Quality Standards (N.J.A.C. 7:9B), disturbance or development within this special protection area is strictly limited under the stormwater rules.

The Highlands Act of 2005 created two planning areas in the Highlands region of northwest New Jersey: the Preservation Area and the Planning Area. In the Preservation Area, where the most critical water resources have been identified by the NJ Department of Environmental Protection (NJDEP), the rules restrict development or disturbance within a 300' buffer to all "Highlands open waters," defined as springs, streams, wetlands and surface waterbodies in the Highlands region (N.J.A.C. 7:38-1.4). In addition, NJDEP applies the C1 anti-degradation policies to these Highlands open waters.

These changes in the State's water resource regulations strengthened protections for surface waterbodies and wetlands throughout the Lake Hopatcong watershed, slightly more than half of which lies within the Highlands Preservation Area. These new rules have eliminated much of the threat to the watershed's wetlands and wetland buffer areas that existed in 2003. In essence, all wetlands associated with C1 streams are now protected from most development activities by the stormwater rules, while all delineated wetlands in the Highlands Preservation Area—52% of the Lake Hopatcong watershed—are protected by the Highlands Act rules. In addition, the Borough of Hopatcong's Land Use ordinances restrict development within 25 to 50 feet of any stream. This has largely reduced, if not entirely eliminated, the necessity of identifying and prioritizing wetlands and wetland buffers for protection and preservation, as the majority of wetlands in the watershed are now protected by State law.

Because of these regulatory changes, the LHC, in consultation with Princeton Hydro, LLC, the LHC's environmental consultant, decided to somewhat modify the tasks associated with the project scope of work to more accurately reflect the priorities for wetland protection in the watershed. Since the threat of additional wetland destruction and encroachment have largely been removed, the focus has instead been placed on remediating wetlands and buffer areas which have been subject to impairment associated with existing or past development activities. The project workplan tasks have been modified where necessary to reflect the change in focus while remaining consistent with the original project goals: to preserve these wetlands and wetland

buffers to enhance and protect the water quality of Lake Hopatcong, limit future alterations to the lake's existing hydrology and hydraulics, preserve wildlife habitat, and protect and enhance the overall ecology of the lake and the Upper Musconetcong River.

2.0 Lake and Watershed Characteristics

Lake Hopatcong has a total surface area of 1087 hectares (ha), a mean depth of 5.5 meters (m), a maximum depth of 17.7 m and a total outflow of 39.69 x 10^6 m³ per year. The major tributaries to the lake are Beaver Brook and Weldon Brook, both of which flow into Lake Shawnee upstream of Lake Hopatcong. The maximum volume of Lake Hopatcong is 5.56 x 10^7 m³. Based on measured outflow and lake volume, the lake's hydraulic residence time is 623 days. This indicates that total volumetric water exchange occurs only once every 1.7 years. Discharge from Lake Hopatcong is regulated by a spillway located at Hopatcong State Park, Landing N.J. Outflow is to the Musconetcong River, a tributary to the Delaware River.

Lake Hopatcong is a sprawling, irregularly shaped lake. It is composed of a number of shallow coves which emanate from the main body of the lake. Located in the extreme north end of the lake is Woodport Bay, a 156 ha shallow water (x-bar depth 1.5 m) embayment. Flow from this large bay into the main lake is through a narrow passage. This impairs the flushing of Woodport Bay, and contributes to its physical, chemical, and biological features which are at times quite different than those observed in the remainder of Lake Hopatcong.

Along the western shore there are three large coves: Henderson Cove, Byram Cove, and Crescent Cove. Water depth in Henderson and Crescent Coves is typically less than 2.0 meters. Byram Cove is somewhat deeper with average water depth in excess of 2.5 meters. Outflow from Byram Cove and Henderson Cove is fairly unrestricted. In contrast, outflow from Crescent Cove to the main basin of the lake is somewhat restricted primarily as a result of its long, narrow shape.

There are three major coves on the eastern shore: Great Cove, Van Every Cove, and King Cove. Water exchange between the main basin and the coves along the eastern shore is fairly free. Great Cove and Van Every Cove are comparatively deeper than the other coves of the lake. Their banks are relatively steep and depths of greater than 2.5 meters are fairly common. At the southern end of the lake there exists a shallow, narrow cove referred to in this report as Landing Channel. Outflow from Landing Channel is restricted primarily due to its long, narrow configuration, and the small amount of inflow to this embayment.

The main basin of the lake has depths ranging from 6 meters to a maximum of 17.7 meters. The main basin extends essentially from Bertrand Island north to Halsey and Raccoon Islands.

Beaver Brook and Weldon Brook are the primary tributaries of Lake Hopatcong. Other notable tributaries are Jaynes Brook and Mountain Brook, both of which discharge into Henderson Cove. There are a number of small unnamed tributaries which feed the lake. Some of these smaller tributaries are intermittent or of very low flow in the summer.

2.1 Description of Lake Hopatcong Watershed

Lake Hopatcong's watershed encompasses a total area of 5,482.7 hectares (13548.05 acres) exclusive of the lake's surface area. To the east and west of Lake Hopatcong the topography rises abruptly from the lake and forms a series of ridges which parallel the lake's shoreline. The ridgelines delineate the eastern and western boundaries of the watershed. Contained within the eastern part of the watershed are sections of the Township of Jefferson, the Township of Roxbury, and the Borough of Mt. Arlington. The western part of the watershed envelops much of the Borough of Hopatcong. To the north the watershed extends to the Bowling Green Mountain ridgeline. The northwestern fringe of the watershed encompasses a section of the Township of Sparta.

2.2 Geology

The Lake Hopatcong watershed is located in the New Jersey Highland physiographic province, which is a portion of the Reading Prong of the New England Province. This is the oldest and most resistant rock formation in Morris and Sussex Counties. The watershed is characteristically underlain by hard, crystalline, resistant, Precambrian igneous and metamorphic rocks (Lucey, 1975). The paragneisses tend to be well foliated, well layered, and consist chiefly of biotite-feldspar-quartz gneisses and quartz-oligoclase leucogneisses (Young, 1971). In general, the character of rock in this area can be interpreted as highly metamorphosed marble, granite, and gneiss.

Lake Hopatcong valley is developed along a series of northeast trending fault blocks. Numerous flat top ridges occur throughout the area. Along most of Lake Hopatcong's perimeter, the land rises abruptly, lending a steep slope to most of the immediate topography. The lake's valley is bounded by two ridges which are oriented northeast to southwest, parallel to the fault blocks. The maximum elevations of these ridge tops are approximately 300 to 365 m above mean sea level (MSL). The elevation of the lake itself is approximately 185 m above MSL.

2.3 Soils

The entire watershed was subject to relatively recent Pleistocene Epoch, Wisconsin stage glaciation. Sporadically overlaying the Precambrian bedrock is stratified glacial drift or till composed of clayey material with intermingles sand, gravel, rock fragments, and boulders. The

soil textures thus tend to be variable, and depending on their location in the watershed, range from muck, to sandy loams, to gravelly, to stony loams (SCS, 1975). Soil depths range from 3 m or greater above bedrock, to zero to a few centimeters along the rock outcrop areas. The major soils of the basin are as follows:

Southern end of watershed:	Rockaway stony sandy loam/Hibernia stony loam
Southeastern side of watershed:	Rockaway stony sandy loam
Southwestern side of watershed:	Rockaway stony loam/Rockaway-rock outcrop
Northwestern side of watershed:	Rockaway-rock outcrop
Northeastern side of watershed:	Rockaway stony sandy loam/Rockaway-rock Outcrop
Northern end of watershed:	Rockaway complex/Whitman stony loam

The major soil association is the Rockaway-Rock Outcrop-Whitman Association. These soils tend to be acidic. The U.S. Soil Conservation Service (1975) has defined these soils in terms of composition, permeability, and steepness of slope. These soils occur mainly on ridge tops and side slopes, and Rockaway soils account for approximately 45% of the total composition of the association. The Rockaway soils are coarse textured, well drained, and dominantly steep to very steep. They characteristically have gravelly loam or very stony loam surface layers. Rock outcrops may be totally exposed or covered by a thin soil layer. They are representative of areas where 20-90% of the surface is covered by granite rock. Whitman soils are very poorly drained. They are formed from granitic and gneissic derived material, and are underlain by a shallow fragipan. Overall, this soil association tends to restrict development due to its shallow depth, limited permeability, and usually steep slopes (Sussex County-208 Agency, 1979).

3.0 Project Strategy

The following Task outline describes the criterion used in assessing the wetland and riparian areas of the Lake Hopatcong watershed.

Task 1 – Delineation of Wetlands and Riparian Areas in the Lake Hopatcong Watershed

GIS mapping was used to delineate existing wetland and riparian areas within the Lake Hopatcong Watershed in order to locate areas for site visitation. Wetland data for the map was derived from NJDEP 2002 Land Use/Land Cover GIS files. It was determined that the watershed contains approximately 1,319.6 acres of wetlands. This map is included in Appendix A.

Task 2 – Sensitivity Ranking of Delineated Wetlands, Riparian Areas and Their Buffers

Numerous GIS coverages were examined to determine sensitivity ranking of wetland and riparian areas within the Lake Hopatcong Watershed. Such coverages include: Highlands Act Zones (Preservation or Planning); Steep Slopes (0-5%, 6-15%, >15%); Landscape Data for grassland, wood turtle, emergent wetland, forested wetland and forest (Rank 1, suitable habitat; Rank 2, habitat of priority concern; Rank 3, State Threatened species sighted; Rank 4, State Endangered species sighted; Rank 5, Federally listed species sighted in area); and Surface Water Features (Non C1 buffers or C1/300' buffer). The cumulative ranking based on these GIS coverages is illustrated in the map entitled, Environmentally Sensitive Areas. This map uses a shading system representing the scale of sensitive areas from least to moderate to most sensitive. The Environmentally Sensitive Areas map illustrates that the areas that are moderate to most sensitive are along stream corridors and associated with wetland areas. All maps are presented in Appendix A.

Task 3 – Analysis of Potential Risks

Potential risks to the Lake Hopatcong watershed are of four main types: 1. prior development-related, 2. existing and future development-related, 3. volume-based, and 4. impairments due to invasive species.

Task 4 – Prioritization of Delineated Wetlands and Riparian Areas for Future Preservation and Protection Programs

Based upon GIS mapping outcomes and input from the LHC, visits were made to sites for protection and remediation potential. These sites are illustrated in the map entitled Problem Areas and is presented in Appendix A. Site visits occurred from July to August 2006. At each site, in depth notes were taken by Princeton Hydro staff as well GPS coordinates and photographs (see Appendix B). A total of 18 sites were visited and prioritized and are summarized in the table below.

Table 1. Potential sites for wetland protection and remediation.

Site #	Site Name	Site Location	
		Municipality	**Street**
ST-1	Ashley Cove	Jefferson	Espanong and Ripplewood
ST-2	JP's Pizzeria	Jefferson	Brady Road
ST-3	Benedict's Lagoon	Jefferson	East Shore Road
ST-4	Memorial Park	Mt Arlington	Memorial Park off Howard Blvd
ST-5	Howard Boulevard	Jefferson	Howard Boulevard
ST-6	Oneida and Mountainview	Mt Arlington	Oneida and Mountainview
ST-7	Ingram Cove	Hopatcong	Johnson Ave
ST-8	Dupont Ave	Hopatcong	Dupont Ave
ST-9	Maxim Road	Hopatcong	Maxim Road
ST-10	Lakeside and Sharp	Hopatcong	Lakeside & Sharp
ST-11	Ford Avenue	Hopatcong	Ford Avenue
ST-12	Edith Decker School	Mt Arlington	Howard Blvd
ST-13	Quarry Stream	Jefferson	Prospect Point Road
ST-14	First Bridge of Three Rivers Drive	Jefferson	3 Rivers Drive
ST-15	End of Three Rivers Drive	Jefferson	End of 3 Rivers Drive/ end of Swan Lane
ST-16	End of Canal at Firemen's Field	Jefferson	Lakeside Park at Swan Lane and Rt 15
ST-17	Entrance to Canal at Diamond Drive	Jefferson	End of Diamond Drive
ST-18	Open Space Property adjacent to Liffy Island	Jefferson	End of Jerry Drive

Task 5 – Schedule of Implementation and Identification of Potential Funding Sources

Table 2. Potential Funding Sources for future wetland and riparian area implementation projects.

Name of Funding	Source of Funding	Website
Conservation on Private Lands Matching Grants	National Fish and Wildlife Foundation/ USDA	www.nfwf.org/programs/nrcsnacd.htm
Conservation Technical Assistance	NRCS	www.nrcs.usda.gov/NRCSProg.html
Emergency Watershed Protection Program	NRCS	www.nrcs.usda.gov/programs/ewp/
Five Star Restoration Program	EPA	www.epa.gov/owow/wetlands/restore/5star/
Community-based Restoration Program	NOAA	www.nmfs.noaa.gov/habitat/restoration
Nonpoint Source Implementation Grants	EPA	www.epa.gov/owow/NPS
Planning Assistance to States Program, Section 22 of the Water Resources Development Act	USACOE	www.lrd.usace.army.mil/gl/22.htm
Taking Wing	USDA Forest Service	www.fs.fed.us/biology/wildlife/takingwing/index.html
Watershed Protection and Flood Prevention	NRCS	www.nrcs.usda.gov/programs/watershed/
Wetlands Program Development Grants	EPA	www.epa.gov/owow/wetlands/grantguidelines/
Wetlands Reserve Program	NRCS	www.nrcs.usda.gov/programs/wrp/
Wildlife Habitat Incentive Program	NRCS	www.nrcs.usda.gov/programs/whip/

4.0 References

Kentula, M.E. N.D. Restoration, Creation and Recovery of Wetlands: Wetland restoration and creation. United State Geological Survey Water Supply Paper 2425, National Water Summary on Wetland Resources.

New Jersey Department of Environmental Protection. December 2000. Living with the Future in Mind: Goals and Indicators for New Jersey's Quality of Life, First Annual Update to the Sustainable State Project Report 2000. Indicator 30: Freshwater Wetland Impacts. <http://www.state.nj.us/dep/dsr/sustainable-state/30.htm>

Appendix A:
Watershed Maps

Appendix B:
Problem Area Descriptions and Photographs