Chapter 4
Watershed Plan Recommendations

4.1 Watershed Plan Recommendations Overview

The recommendations presented in the Nippersink Creek Watershed Plan are divided into two basic categories:

- General Watershed Plan Recommendations that are applicable to the entire Nippersink Creek watershed or large regions of the watershed and,
- Recommendations that are site-specific to the eleven Nippersink Creek subwatersheds located in the Illinois portion of the Nippersink Creek Watershed.

The actual site-specific recommendations for each subwatershed are contained in Chapters:

5.3	Lower Nippersink Creek	11.3	Bailey Woods
6.3	Glacial Park/Tamarack Farms	12.3	Nippersink Headwaters
7.3	Wonder Lake	13.3	North Branch Nippersink
8.3	Silver Creek	14.3	Elizabeth Lake Drain
9.3	Slough Creek	15.3	Hebron Peatlands
10.3	Vander Karr Creek	16.3	Wisconsin Subwatersheds

4.2 Watershed Plan Objectives

In order to begin to implement the Nippersink Creek Watershed Plan, objectives must be established to help identify specific research, implementation projects, or educational outreach activities that need to be accomplished. As the watershed planning process continues, these objectives may evolve. At this point in time, these are the objectives for Nippersink Creek.

Watershed Protection Objectives:

Objective 1:	Maintain, enhance, and promote the environmental quality of Nippersink Creek, and the high quality natural resources it links.
Objective 2:	Protect, through acquisition or conservation easements, existing High Quality and High Functional Value Advanced Identification (ADID) Wetlands.
Objective 3:	Protect, through acquisition or conservation easements, any McHenry County Natural Area Inventory (MCNAI) sites.

Objective 4:	Encourage watershed units of government to adopt a Green Infrastructure Plan to help guide future land use decisions, and reduce the potential for adverse water quality impacts resulting from poorly planned development.
Objective 5:	Encourage watershed units of government to require the implementation of Conservation Design land planning concepts.
Objective 6:	Encourage watershed units of government to update and strengthen existing stormwater, zoning, land use, and/or subdivision ordinances to allow seamless integration of regulations, creating a streamlined process for developers pursuing Conservation Design projects.
Objective 7:	Maximize the effectiveness of the portions of the McHenry County Stormwater Ordinance (MCSWO) that require riparian / wetland buffers, conservation easements, and stormwater Best Management Practices by encouraging McHenry County and local units of governments to adopt and implement a MCSWO enforcement audit / review process.
Objective 8:	Identify, design, fund, and implement Best Management Practices (BMP's) that can address the existing fecal coliform water quality impairment identified downstream of Wonder Lake, as well as those BMP's that will minimize the potential for future water quality impairments to occur as the watershed develops.
Objective 9:	Obtain funding sources to allow watershed units of government to implement stormwater outfall water quality Best Management Practices in developed portions of the watershed, or as part of the reconstruction of major bridge crossings of Nippersink Creek.
Objective 10:	Reduce soil erosion and sediment delivery to Wonder Lake and the Fox Chain of Lakes by encouraging riparian land owners to participate in available conservation cost-share programs.
Objective 11:	Fund and implement an enhanced water quality and biological monitoring program throughout the watershed.
Objective 12:	Pursue the rehabilitation of Wonder Lake by dredging of up to 3 million cubic yards of accumulated sediment; transition to more environmentally shoreline stabilization practices; and obtain regional wastewater treatment capacity for homes within Wonder Lake.
Objective 13:	Initiate discussions with units of governments within the Wisconsin portion of the watershed on jointly developing, funding, and implementing watershed protection / enhancement projects.
Objective 14:	Work with NPDES Phase I dischargers to insure that the highest quality treatment is achieved before wastewater effluent is discharged to any water course in the watershed.
Objective 15:	Prevent further negative impacts of land use change on the watershed's natural resources by minimizing increases in stormwater runoff flow rates and total runoff volume for new developments.

Objective 16: Identify and quantify existing nutrient management planning efforts already implemented by Natural Resource Conservation Service, McHenry County Conservation District, and other agencies.

Objective 17: Provide multiple opportunities for assessing measurable watershed plan implementation milestones, such as whether pollutant loading reductions are being achieved over time; evaluating the effectiveness of proactive watershed protection measures; and whether social behavior has changed because of the implementation of the plan.

4.3 General Watershed Plan Recommendations

Many watersheds that are included on the IEPA 303(d) list as a result of having numerous water quality impairments, typically associated with years of urbanization, poor land use planning, or inadequate environmental protection regulations. In contrast, the Nippersink Creek watershed has only one identified impairment (fecal coliform) in the lower half of the watershed. Identified as coming from an unknown source, this fecal coliform impairment could be the result of wildlife or livestock as easily as it could be from a human related source. An absence of documented impairments typically associated with more urban watersheds signals that Nippersink Creek is still in good shape, largely owing to its largely undeveloped watershed. Simply stated, a potential exists to protect the watershed from future development related impacts before they occur.

It is for this reason that the Nippersink Creek watershed has a significant opportunity to implement a watershed plan that focuses much more on prevention, rather than on having to retrofit a watershed already heavily impacted by development. Efforts to acquire, permanently protect, and restore the stream corridors, wetlands, and other natural features (collectively referred to as Green Infrastructure – see Chapter 17) of the Nippersink Creek watershed will provide perpetual environmental, water quality, and open space benefits to watershed stakeholders.

To implement this strategy, there will be ten main areas of effort:

- Expand water quality and biological monitoring to help better understand the resource, its stressors, and identify both positive and negative trends.
- Identify / quantify existing Nutrient Management Planning efforts.
- Protect / enhance stream corridors and wetlands through acquisitions / easements
- Encourage watershed municipalities to implement Conservation Design
- Change the way we manage stormwater
- Improve effluent quality at existing / expanding / proposed Wastewater Treatment Plants
- Improve controls on Non-Point Source pollution
- Conduct public education and outreach
- Implement a Watershed Manager position
- Measure / Influence Social Behavior

The following section contains General Watershed Recommendations (GWR) that should be implemented throughout the entire Nippersink Creek watershed.

Each General Watershed Recommendation contains the following information:

- **Type:** Education/Outreach; Regulatory; Site Restoration; Monitoring; Permanent Habitat Protection, Water Quality
- **Target Objectives:** Which watershed objective(s) the recommendation addresses.
- **Initial Implementation Cost:** the initial cost, in 2007 dollars to initiate the recommended action, if applicable.
- **Annual Cost:** the long term expected annual cost (in 2007 dollars) to successfully implementation of the recommendation
- **Responsible Party:** Identifies the LEAD agency, entity, or landowner who will ultimately have to execute the recommendation. SUPPORTING parties, such as government agencies, grant sources, etc. may also be identified here.
- **Priority:** A ranking of High, Medium, or Low, where High is represents a recommendation of utmost importance to be pursued immediately and Low represents those recommendations which may take more time and are less critical in terms their impact on meeting the watershed plan goals.

4.3.1 Water Quality Monitoring (GWR-1)

One of the challenges in assessing current water quality conditions, or more importantly, assessing longer–term trends in water quality, is the lack of water quality data from representative portions of the watershed. There are indications that there are could be low-flow problem reaches in the tributaries, especially those which contain point sources such as wastewater treatment plants, or large concentrations of livestock. It is important that such locations be monitored and assessed for impairments, and corrective action taken, if necessary.

Biological Monitoring

Biological monitoring of the watershed, identifying and assessing the diversity, health, and abundance of aquatic organisms, such as fish, mussels, and aquatic invertebrates, typically only occurred when Illinois Department of Natural Resource (IDNR) fishery biologists conducted basin surveys. The timeframe between these IDNR surveys in a particular watershed could be three to five years, or longer. Due to budget and staffing limitations, only a limited number of locations could be sampled in each survey.

Fortunately, as the McHenry County Conservation District (MCCD) continues to acquire riparian parcels, their biologists have been conducting biological surveys, which are allowing a more comprehensive baseline of biological data to be established. However, there are still many non-MCCD owned stream reaches in the watershed, for which no biological data exists.

The only other major source of biological data in the Nippersink Creek watershed comes from "Anti-Degradation Studies", prepared by wastewater treatment operators seeking to modify or expand their discharge of treated effluent into the creek. While the biological data gathered in these anti-degradation studies adds to the biological database, the lack of any earlier baseline biological data makes it difficult to assess any trends in biotic integrity of the study area in the period leading up to the anti-degradation study.

Water Quality Monitoring

The Illinois Environmental Protection Agency operates seven water quality monitoring stations in the Nippersink Creek watershed, as shown in Table 4.1.

Table 4.1

IEPA Water Quality Sampling Stations in the Nippersink Creek Watershed

Subwatershed	Station	Stream	Location
Lower Nippersink	DTK01	Nippersink Creek	Nippersink Creek at US Route 12
Lower Nippersink	DTK04	Nippersink Creek	Nippersink Creek at Winn Road
Subwatershed	**Station**	**Stream**	**Location**
Glacial Park / Tamarack Farms	DTK02	Nippersink Creek	Nippersink Creek at Barnard Mill Road
Subwatershed	**Station**	**Stream**	**Location**
Bailey Woods	DTK 06	Nippersink Cr.	Nippersink Creek at Allendale Road
Bailey Woods	DTK 03	Nippersink Cr.	Nippersink Creek at IL Route 47
Subwatershed	**Station**	**Stream**	**Location**
North Branch Nippersink	DTKA04	North Branch Nippersink Creek	N. Br. Nippersink at Hill Road
North Branch Nippersink	DTKA03	North Branch Nippersink Creek	N. Br. Nippersink at IL Route 173

In 2004, the United States Geological Survey (USGS), in cooperation with the McHenry County Soil & Water Conservation District, prepared a report on the water quality of Wonder Lake and Nippersink Creek immediately upstream and downstream of Wonder Lake. Two streamflow monitoring stations were installed on Nippersink Creek in 1994, one above (05548105) and one below (055841110)Wonder Lake, to monitor stage and establish a discharge rating using standard USGS protocols. These stations were in operation from July 1994 through June 1997. The USGS National Water-Quality Assessment Program (NAWQA) Program operated the station upstream of Wonder Lake during from 1999 to September 2001. The USGS did not operate the downstream station after 1997.

The Friends of the Fox River (FOFR) conducts a volunteer based water quality monitoring program. Over 600 concerned citizens, teachers, and youth group leaders are members of the FOFR's Watershed Monitoring Network. Members volunteer to collect water quality data, assist at education events, and / or offer their individual expertise or talents. All members are active stewards of the Fox River Watershed.

The hallmark of the Monitoring Network is their water quality monitoring program. Once a year, Network volunteers monitor the water quality of the Fox River and its tributaries at stream monitoring sites throughout the watershed. They collect physical, chemical, and biological data used to assess water quality trends. This data can be the first warning sign of problems in the watershed. The Friends of the Fox River Monitoring Network has six sites in the Nippersink Creek Watershed.

The location of IEPA, USGS, and FOFR water quality sampling sites are shown in Figure 4.1.

An upgraded monitoring program, with a number of additional sampling sites, for the Nippersink watershed is important in providing the following information:

- Base line data-both biological and chemical indicators where there are none. The data would be useful for identifying changes in the watershed and the success of Best Management Plan (BMP) implementation
- To provide data for updating the Fox River Study Group (FRSG) modeling effort for the Nippersink Creek subwatershed. The product of this effort is intended to be a long-term planning tool for evaluating various water resource initiatives in the watershed-including flooding, land use conservation, stormwater management, and evaluation of point-sources.

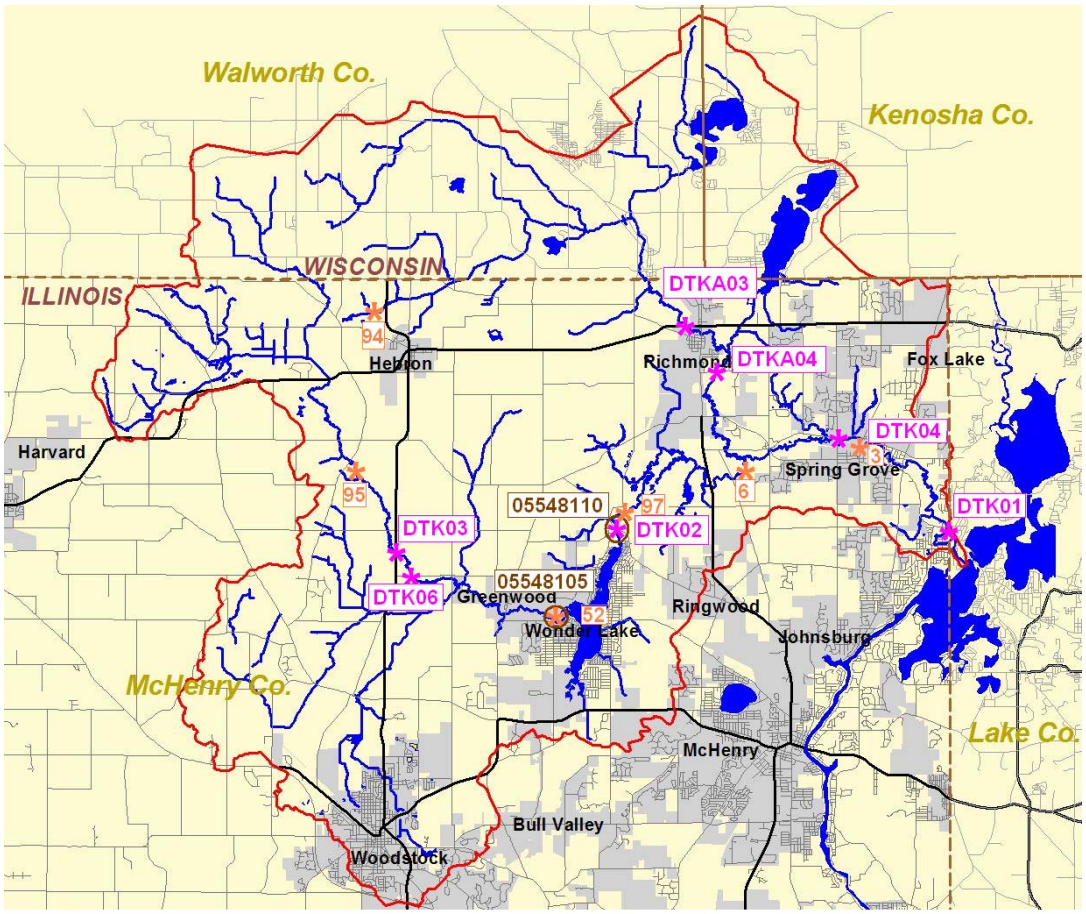
The review of the current water quality and biological monitoring in the watershed suggests that an enhanced monitoring effort driven by the objectives of the watershed plan would complement decision making, plan implementation and updating both in the short term and in the future. Biological monitoring enables realistic assessment of what biota is present, and whether the impaired water bodies are recovering.

The focus of the monitoring plan is to identify trends in pollutant loadings resulting from BMP implementation. The main pollutants of concern were fecal coliform, nutrient, and sediment loads. The proposed monitoring plan includes these parameters in addition to biological indicators. Depending on the available resources, modeling using monitoring data is the most comprehensive procedure for determining pollutant load reductions.

Trends in pollutant load reductions can be detected by factors such as:

- Reduction of stream bank erosion
- Reduction in frequency of exceedences or concentration of fecal coliform bacteria
- Reduction of algae blooms indicating reduced nutrient enrichment, lower turbidity
- Reduction of Total Suspended Solids (TSS) concentrations, signaling reduced sediment loads
- Reduction of phosphorus and nitrogen concentrations
- Improvement in biological indicators

Figure 4.1 Water Quality Sampling Stations in the Nippersink Creek Watershed



Sediment is by far the most critical parameter for assessing BMP performance. Monitoring eroding stream banks or lake shorelines provide an indirect means of quantifying sediment loads. The review of historical aerial photographs can allow a comparison between lateral channel migration / sinuosity at discrete points in time. These changes can be quantified into an average annual rate of the rate of sediment loading due to instream sources. Reduction in TSS is an indicator of decreasing sediment loads, which is in turn an indicator of reductions in nutrient loads, since sediments carry significant amounts of nutrients.

These sediment-bound nutrients can result in algae blooms and excessive growth in streams and lakes. Absence or reduction of extent of algae blooms is an indirect indicator of nutrient loads reductions. Hyperspectral imaging, a newly evolving remote sensing technology, can collect and analyze very narrow bands of light spectrum identify abundance of algae / aquatic vegetation, point source pollution, and turbidity. Real time analysis of the images allows field checks in the rapidly changing water conditions.

Based on the above considerations, Table 4.2 summarizes the recommended minimum monitoring program for the watershed.

Table 4.2 Water Quality Monitoring Plan Recommendations

EXISTING PROGRAMS

Location	Type of Monitoring	Resources & Programs	Objectives & Recommendations	Monitoring Costs
DTK01 Nippersink @ Route 12 DTK02 Nippersink @ Spring Grove DTK03 Nippersink @ Route 47 DTK06 Nippersink @ Allendale DTKA04 N. Br. Nippersink @ Hill DTKA03 N. Br. Nippersink @ Rt.173	Existing water quality stations.	IEPA	**Increase frequency of monitoring to include dry and wet weather.** **Monitor Fecal Coliform to confirm impairments, to localize sources, and to develop a fecal coliform TMDL.** **Monitor 5 storm events per year, for 4-6 hour monitoring period**	IEPA funds this monitoring.
FRWMN Sites: 3, 6, 52, 94, 95, 97	Existing water quality stations.	FRWMN	Continue Volunteer Montoring	Volunteer Effort
Wonder Lake	Continue Tier 3 Monitoring	VLMP / MPOA	Evaluate nutrient enrichment in Lake	IEPA funds this monitoring.

PROGRAM EXPANSIONS	Proposed Monitoring	Resources & Program	Objectives & Recommendations	Monitoring Costs
Fecal Coliform DNA Testing	Ten (10) Grab Samples taken at 5 locations downstream of Wonder Lake: Two samples each site (1 Low Flow Event, 1 High Flow Event)	NCWPC	Identify "unknown" source of 303(d) list Fecal Coliform Impairment	$1,500 annually
Add FRWMN Sites at: North Branch Nippersink, Lower Elizabeth Lake Drain Silver Creek Slough Creek Nippersink Headwaters	Follow FRWMN Protocol for Chemistry / Benthics	FRWMN	Begin Volunteer Montoring at New Sites	$500 annual total for all new sites (Volunteer supplies)
Create New Stream Sampling Site: Silver Creek @ Route 47, Slough Creek @ Route 47 Nippersink Creek @ Route 173 Nippersink Creek @ Alden Road Vander Karr Creek @ Allendale N. Branch Nippersink @ White St.	Grab samples taken at: Low Flow; High Flow. Nutrients, DO, TSS, Chlorides, Fecal. Minimum of Five Composite samples - 4 hour sampling event/storm/season. Biological Monitoring twice per year	NCWPC	Identify impacts of agriculture / development and low-flow conditions	Water Chemistry: $1,500 per site / year, Biological Monitoring: $1,000 per site / year
Wonder Lake	Sediment Analysis	VLMP / MPOA	Evaluate sediment in Lake	$3,000 Total
Reestablish USGS / NAQWA Sream Gaging Stations US & DS of Wonder Lake	Stream Gaging, TSS, Nutrients	USGS / MPOA	Continue Extensive Baseline of WQ data established between 1994 and 2001	$15,000 / year
Hyperspectral Imaging	TSS / Algae Levels, Point Source Detection	NCWPC	Create Baseline of HS imagery	$5,000 / year

General Watershed Recommendation GWR-1: Implement an expanded water quality and biological monitoring program throughout the Nippersink Creek Watershed

Type: Monitoring
Target Objectives (from Section 4.2): 1, 8, 9, 11, 14, 15, 16
Initial Cost: $ 25,000 (not including USGS gages) / $ 40,000 (including USGS gages)
Annual Cost: $ 20,000
Responsible Party: Nippersink Creek Watershed Planning Committee (NCWPC), Illinois Environmental Protection Agency (IEPA) Fox River Watershed Monitoring Network (FRWMN)
Priority: Highest

4.3.2 Nutrient Management Planning (GWR-2)

Nutrient management involves managing the amount, source, placement, form and timing of the application of plant nutrients and soil amendments. Nutrient management also applies to farm animal operations. The McHenry County Natural Resource Conservation Service (NRCS) already administers such a program, however, a compilation of the extent, specifics, and locations where Nutrient Management Plans have been prepared or implemented in the Nippersink Creek watershed was not available.

The preparation of a database and/or Geographic Information System (GIS) data layer, showing the location and extent of existing Nutrient Management Plans in the Nippersink Creek watershed should be implemented as a recommendation of this plan.

General Watershed Recommendation GWR-2: The preparation of a database and/or Geographic Information System (GIS) data layer, showing the location and extent of existing Nutrient Management Plans in the Nippersink Creek watershed should be implemented as a recommendation of this plan.

Type: Monitoring
Target Objectives (from Section 4.2): 1, 8, 9, 11, 14, 15, 16
Initial Cost: $ 5,000
Annual Cost: $ 500
Responsible Party: USDA Natural Resources Conservation Service (NRCS), McHenry Soil & Water Conservation District (MCSWCD), Nippersink Creek Watershed Planning Committee (NCWPC)
Priority: Highest

4.3.3 Land Acquisition / Easements (GWR-3)

The protection of critical environmental corridors and linkages can be accomplished by protecting the stream corridors, wetlands, and floodplain areas, and linking them with existing open space areas, county parks, and privately owned natural areas. These areas can collectively be referred to as the "Green Infrastructure" of the watershed.

The two primary mechanisms for Land Acquisition and Easements are the ***McHenry County Conservation District***, and ***The Land Conservancy of McHenry County***, respectively. Both of these groups have made a point of focusing on protecting and improving the Green Infrastructure of McHenry County. The McHenry County Conservation District has a long history of recognizing the value and importance of preserving stream corridors and their associated wetlands. This approach is complemented by the efforts of the Land Conservancy of McHenry County in seeking conservation easements on sensitive properties. This approach is the basis of the Green Infrastructure Plan discussed elsewhere in this report. These groups should continue to focus on acquiring and maintaining the riparian corridors of the Nippersink Creek Watershed.

The McHenry County Conservation District (MCCD) currently owns or manages 21,000 acres of land in McHenry County, which equals roughly 5.4% of the County. Of this acreage, 6,283 acres of MCCD land are located within the Nippersink Creek Watershed. In April 2007, McHenry County voters approved a $ 73 million dollar bond referendum to allow MCCD to purchase another 4,500 acres of land.

The Land Conservancy (TLC) of McHenry County is a 501(c)3 not-for-profit land trust that currently owns or holds conservation easements on 1,415 acres of land in McHenry County. While most of the TLC holdings are not located within the Nippersink Creek watershed, the TLC has recently been working with the Village of Spring Grove to identify and protect sensitive natural areas on parcels undergoing development. The TLC also received an Illinois Department of Natural Resources C-2000 grant to prepare an open space management plan for private landowners within the Alden Area of Conservation Concern, a McHenry County Natural Areas Inventory "mega-site", located in the Nippersink Headwaters subwatershed.

Both of these groups should be considered critical partners in implementing the Nippersink Creek Watershed Plan, and any land acquisition / easement / restoration activities they undertake in the Nippersink Creek watershed, even if not specifically identified in the recommendations section of this report, should still be considered as watershed plan implementation projects, and be eligible for Section 319 funding.

General Watershed Recommendation GWR-3: Coordinate with the McHenry County Conservation District, The Land Conservancy of McHenry County, units of government and landowners to ensure permanent protection of environmentally sensitive parcels, and the acquisition of stream corridors and MCNAI / ADID designated sites from willing sellers.

Type: Outreach
Target Objectives (from Section 4.2): 1, 2, 3, 13
Initial Cost: $ 5,000
Annual Cost: $ 1,500
Responsible Party: MCCD, TLC, NCWPC, McHenry County, Municipalities
Priority: High

4.3.4 Conservation Design / Green Infrastructure (GWR-4)

A growing trend in land use planning across the United States is based upon the concept of "land first", which dictates that the natural features of an area of land should be the primary determinant in what type of land use is appropriate for that ground. Under this premise, if a parcel contains sensitive natural areas, stream corridors, wetlands, or woodlands, collectively referred to as "Green Infrastructure", development should be completely avoided within those areas, with adequate buffers provided. As a trade-off, portions of the parcel that are not sensitive can have a higher density. The intent is to minimize the footprint of development, mitigate any potential impacts, and create permanently protected, properly managed open space areas.

This land use planning approach is now routinely called "Conservation Design", "Smart Growth" or "Low Impact Development". Stakeholders in the Nippersink Creek watershed are fortunate in that McHenry County adopted a Conservation Design ordinance in early 2008. This Ordinance incorporates many of the planning concepts need to protect the Green Infrastructure of Nippersink Creek, as discussed in Chapter 17 of this report.

The stated purpose and benefits of the McHenry County Conservation Design Ordinance is:

- Preserve the integrity of the land and its natural functions
- Protect water resources
- Enhance community character and connectivity
- Provide greater design flexibility and affordability

This ordinance will require Conservation Design on any proposed development in unincorporated portions of the County if certain "triggers" are present. Conservation development is allowed everywhere; however, conservation development is <u>required</u> when the site contains sensitive natural resources.

Automatic triggers

- High quality streams, rivers, and lakes
- Designated McHenry Natural Area Inventory Sites

Cumulative triggers

20% or more of the site is covered by:

- Sensitive soils and steep slopes
- Wetlands
- Floodplains
- Native woodlands, savannas, or prairies
- Adjacent to publicly owned natural open spaces, preserves, or trails

Open Space Requirements

Minimum open space percentages for residential development shall vary depending on underlying zoning.

- Ranges from 40% for R1 to 70% for E5
- Common open space is preferred.
- Deed restricted open space also is allowed.

Density bonuses may be offered for designs that exceed minimum standards (not to exceed 20%):

- Open space beyond minimum percentage
- Creative access and trail linkages
- Innovative wastewater reclamation system
- Restoration of degraded habitats
- Preservation of historic buildings
- Mix of housing types, especially affordable housing

The adoption of this ordinance by McHenry County will make a significant difference in how development occurs in the unincorporated portions of the Nippersink Creek watershed. It correlates well with many of the Objectives of this plan, and the implementation strategies.

However, a concern remains that this ordinance only applies to unincorporated (non-municipal) portions of the watershed. If watershed municipalities do not move towards implementing Conservation Design or Green Infrastructure Planning, a potential exists for traditional land use development to radiate outwards from existing municipalities, as developers choose to annex rather than comply with the County Conservation Design Ordinance.

Fortunately, the City of Woodstock has adopted Conservation Design Standards under its Unified Development Ordinance. These standards, available on the City website http://www.woodstockil.gov/, could provide a template for other Nippersink Creek watershed municipalities wishing to move in this direction.

General Watershed Recommendation GWR-4: Coordinate with municipal governments to mandate Conservation Design practices / Green Infrastructure concepts for land use planning.

Type: Outreach / Regulatory
Target Objectives (from Section 4.2): 1, 2, 3, 4, 5, 6, 7, 15
Initial Cost: $ 5,000
Annual Cost: $ 1,500
Responsible Party: Nippersink Creek Watershed Planning Committee, McHenry County Defenders, McHenry County. Nippersink Municipalities
Priority: High

4.3.5 Changing the Way We Manage Stormwater (GWR-5)

In addition to the permanent protection of the stream corridor along Nippersink Creek through the implementation of Smart Growth / Conservation Design / Low Impact Development, the other issue, no less critical, will be to preserve the quality and quantity of the water flowing in the stream. To accomplish this, a fundamental change must occur in the way stormwater management is designed and constructed for developments in the Nippersink Creek Watershed.

In short, current stormwater and development standards are intended to simplify the design, construction and maintenance of stormwater facilities and control peak flows for only the large storm events, such as the 100-year storm. A study completed by Kane County in 2003 concluded that at the watershed scale, the 0.15 cubic feet per second (cfs) per acre release rate required by the Kane County Stormwater Ordinance does an adequate job of protecting downstream properties from floods with a 5- through 100-year frequency.

However, a watershed developing using traditional stormwater management design in its developments would actually experience up to a 66% increase in peak flows for the more frequent floods (1- to 2-year events). The science of fluvial geomorphology has demonstrated that it is these flood events, which occur on average every 1 to 2 years that effectively control the stability of a stream channel (physical characteristics). Thus, a 60+% increase in these channel forming peak flows, as will occur under the current regulatory environment, has the potential to do considerable harm to the channel stability of high-quality reaches of Nippersink Creek, and particularly to steeper gradient headwater streams.

To mitigate the effects of increases in stormwater discharges resulting from land development, it is recommended that new developments implement stormwater conservation techniques into their design. Conservation Design, a major component of Low Impact Development (LID), includes a wide range of stormwater design elements. This approach to stormwater is fairly straight forward:

- collect stormwater runoff as close to its point of origin as possible, and
- retain it for infiltration into the soil or evapotranspiration by the site's vegetation.

Examples include: green roofs, rain gardens, rain barrels or cisterns, bio-swales, infiltration trenches, and native vegetative buffers on undisturbed soil. A secondary benefit to this type of approach is that water quality of the remaining runoff that is discharged is usually improved without the need for structural BMP devices at development stormwater outlets. This is because the distributed stormwater system approach can be designed to treat the "first flush" of runoff, which is the first 0.5 – 0.75 inch of stormwater runoff that contains the highest concentration of pollutants. The result is that developments utilizing this type of stormwater management usually discharge little, if any, runoff to the receiving stream for the most frequent storm events (1 inch or less).

Detention Basin Retrofits

A majority of the detention facilities in the Nippersink Creek watershed were constructed as either dry bottom detention basins or traditional wet "ponds". Both are typically characterized by mowed turf grass on steep side slopes. Dry bottom ponds frequently feature a concrete low-flow channel to carry so called "nuisance" flow from the storm outfall directly to the detention basin outlet structure. Dry-bottom basins that do not have this concrete low flow structure are typically landscaped with turf grass in the bottom. Mowed turf grass does not usually hold up to frequent wetting and drying caused by runoff from upstream impervious areas and the result is that the bottom of the turf grass detention basin becomes an unsightly and "mud hole". Neither of the concrete low flow design nor the "mud hole" design provide any significant water quality benefits and are generally unappealing in terms of aesthetics.

Dry bottom basins are good candidates for retrofitting with native vegetation and micro-topography, which will improve water quality, increase stormwater residence times, provide wetland / riparian habitat functions, and improve the economic and aesthetic value of land designated for stormwater management. These dry bottom detention basins should be reconstructed to include wetland micro- pools and native wet prairie and/or wetland vegetation in the bottom to increase pollutant removal efficiency through increase settling and pollutant uptake by the vegetation.

Traditional stormwater "wet ponds" can also be modified to provide wetland / riparian habitat and improve aesthetic value through the installation of native vegetation along the side slopes and shoreline edge. One common problem with traditional wet ponds is that over time the shoreline edge become eroded due to wave action against unnaturally steep slopes with turf grass ground cover. Even ponds with shoreline rip-rap usually experience shoreline erosion over time, as the ponds are almost always constructed on structurally weak hydric soils that cause rip-rap shore protection to slide or settle into the basin, leaving the pond edge exposed to erosion. A solution to fix these problems in existing ponds is to install and propagate native emergent wetland vegetation along the pond shoreline to dissipate the energy of wave action.

Installation of Structural BMP Devices in the Existing Storm Sewer Network

Urban impervious surfaces, such as parking lots and streets, contribute the most concentrated pollutant loads in the watershed. This is especially true in urban areas that were developed without stormwater detention or water quality facilities to temporarily detain runoff or treat it prior to discharge into the stream. These older storm sewer system networks were designed as a series of concrete inlets and catch basins connected together by a system of pipes which increased in size from upstream to downstream to carry additional stormwater runoff as the areas draining into the sewers increased.

Historically, these systems offered virtually no water quality benefits except for a modest amount of small fines removal, if the catch basins were cleaned on a frequent basis. In other parts of the U.S. where urban areas are located directly adjacent to high quality water resources such as the Great Lakes, self-contained, structural water quality devices have been installed to capture pollutants before they are discharged into the receiving water body. The same practices should be implemented in the Nippersink Creek Watershed. There are numerous water quality devices developed in recent years that have been specifically designed for installation within an existing storm sewer network. These are typically installed near the downstream end of the sewer network, just above the sewer outfall to the receiving stream. Larger storm sewer networks may require several structures distributed throughout the sewer network.

Encourage the Installation of Rain Gardens and Rain Barrels

Rain Gardens are simple, easy to build, landscape features that can be implemented as components of a large scale development, or individually by private landowners. Rain Gardens are created in existing or excavated depressions and planted with deep-rooted, native vegetation. Properly constructed and maintained, these small stormwater features can effectively trap and retain as much as 99% of the pollutants associated with urban stormwater runoff. There are many resources available both on-line and in the greater Chicagoland area to help homeowners design and install their own rain garden landscapes. Individually, these systems can provide localized pollutant removal, but if installed in large enough numbers, have the potential to reduce peak storm flows and total runoff volumes on a subwatershed scale as well. These drainage features can be an attractive amenity to any residence while providing incremental benefits in stormwater pollutant and runoff volume reduction.

Stakeholder municipalities in the Nippersink Creek watershed should develop a public outreach plan to encourage private landowners to install rain gardens on their properties and provide technical assistance & information to assist landowners with designing such features or finding a knowledgeable landscape professional who can design & build one for them.

Another valuable BMP is the use of rain barrels or cisterns to capture rainwater from roof tops and storing it in containers for future uses, such as water for landscaping. While the rain barrel concept can be very effective with residential landowners, it could even be applied to much larger applications such as existing commercial buildings. In these cases, a large tank could be attached to the side of a building and collect all or part of the rain falling on the roof. This tank could then be attached to an underground landscape sprinkler system and used to water the property's landscaping instead of using valuable drinking water. Many cities across the United States have successfully implemented rain garden or rain barrel programs and if implemented aggressively, they can have a measurable positive impact on runoff and pollutant load reduction in existing developed areas. The City of Woodstock initiated a bid process to construct rain gardens in the summer of 2007.

General Watershed Recommendation GWR-5: Encourage units of governments and developers to implement stormwater management design in all new developments to maximize groundwater recharge and maintain water quality in the watershed's streams.

Type: Outreach / Regulatory
Target Objectives (from Section 4.2): 1, 4, 6, 8, 9, 15
Initial Cost: $ 5,000
Annual Cost: $ 1,500
Responsible Party: Nippersink Creek Watershed Planning Committee, McHenry County, Nippersink Municipalities
Priority: High

4.3.6 Minimize the Impacts of Wastewater Treatment (GWR-6)

As the population of the Nippersink Creek watershed continues to grow, the need to provide wastewater service for new residents will increase. The Illinois Environmental Protection Agency (IEPA) has stated "***Any discharge of treated wastewater to surface waters has the potential to cause the quality of the receiving water to become degraded. Therefore, systems that do not discharge should be considered and must be deemed not feasible before a discharging system can be considered.***"
Examples of non-discharging systems are golf course, agricultural land and other types of spray irrigation. Increases in direct discharges of wastewater into Nippersink Creek and its tributaries should be avoided or minimized to prevent degradation of this high quality stream. The following hierarchy of wastewater treatment alternatives is therefore recommended:

No-Discharge Wastewater Treatment Systems - Systems which utilize land treatment of wastewater are preferred.

- In areas of low density development and suitable soils (neither too tight nor too permeable), homes on individual or combined septics with sufficiently-sized septic fields are appropriate.
- For denser subdivision developments, wastewater treatment followed by land application of wastewater should be employed. Sufficient land must be set aside for proper wastewater application rates given the soil permeability, slope and depth to the water table. These types of systems are currently being employed by two developments on the west side of Wonder Lake.
- These systems provide the benefit of groundwater recharge, important in this watershed where residents are entirely dependent on groundwater as a drinking water source. These systems preserve the open land needed for wastewater application. This land can exist as golf courses; private or common open space; agricultural lands or natural lands.

Improved Wastewater Treatment at Discharging Sewage Treatment Plants - Systems should be designed to minimize the discharge of oxygen-demanding waste (BOD), total suspended solids, ammonia, total phosphorus and total nitrogen. Given the presence of sensitive fish and mussels in Nippersink Creek, ammonia is of special concern. **Municipalities in the watershed should go beyond the minimum effluent standards established by the Illinois EPA for all pollutants, if advanced treatment is technically and economically feasible.** For example, the **V**illages of Richmond and Hebron were among the first treatment plants in the state discharging to a stream that agreed to install treatment processes to remove phosphorus from their effluent. **To their credit, this was done prior to the establishment of the state's current interim effluent standard for phosphorus.**

- Systems should include treatment that addresses the presence of organic wastewater contaminants (OWC's) such as drugs, hormones, detergents and disinfectants. New science indicates that relatively small concentrations of these types of chemicals can interfere with the development of fish and other aquatic life. Activated carbon has been shown to have a high rate of removal of endocrine disrupting compounds, and UV, ozone treatment and membrane systems are being studied in Europe.
- The addition of created wetlands to which wastewater is discharged prior to its ultimate flow into a stream is recommended to add time to the treatment process which would help in the further breakdown of OWCs, the uptake of nutrients and equilibration to ambient temperature. The Village of Wonder Lake's proposed new sewage treatment plant (at the Thatcher Meadows development) will include a constructed wetland prior to discharge to Dutch Creek.

Offsets to Any Increase in Loading of Pollutants from Expanded Wastewater Discharges - Any increases in wastewater discharges should be offset by other efforts to limit pollution entering Nippersink Creek. These could include:

- **Wastewater Reuse -** Opportunities to divert treated wastewater from discharge include wastewater reuse for irrigation needs during the growing season (on golf courses, parks, farmland, etc), for industrial uses and for non-potable uses. The Village of Richmond's Reuse Ordinance is an example that should be emulated by other communities in the watershed.

General Watershed Recommendation GWR-6: Encourage the use of appropriate alternative wastewater treatment technologies, and encourage the creative re-use of treated wastewater effluent.

Type: Outreach / Regulatory
Target Objectives (from Section 4.2): 1, 14
Initial Cost: $ 5,000
Annual Cost: $ 1,500
Responsible Party: Nippersink Creek Watershed Planning Committee, Nippersink Municipalities, Illinois Environmental Protection Agency, Sierra Club
Priority: High

4.3.7 Improved Controls on Non-point Source Pollution (GWR-7)

Units of government within the watershed can aim to offset increases in wastewater effluent discharge by better controlling non-point pollution reaching the creek from their area. Among the controls towns can employ are:

- a ban on the use of phosphorus-containing fertilizer
- efforts to minimize road salt usage including deicing measures, calibrated spreaders, alternative deicers
- retrofits of storm drain outlets to capture pollutants (biological or mechanical)
- repair of problematic streambank erosion
- installation of streamside buffers of native vegetation
- restoration efforts which enhance habitat in the riparian corridor via wetland restorations, stream de-channelization, riffle and pool restoration, etc.

General Watershed Recommendation GWR-7: Conduct outreach to encourage the implementation of Water Quality Best Management Practices throughout the watershed.

Type: Outreach / Regulatory
Target Objectives (from Section 4.2): 1, 8, 10, 15
Initial Cost: $ 5,000
Annual Cost: $ 1,500
Responsible Party: Nippersink Creek Watershed Planning Committee, McHenry County, Nippersink Municipalities. McHenry County Division of Transportation, Illinois Department of Transportation, Township Highway Departments.
Priority: High

4.3.8 Conducting Public Education and Outreach (GWR-8)

Given the proactive nature of this plan, much of the implementation will be focused on protecting and enhancing stream buffers, wetlands, and other sensitive natural areas that help protect Nippersink Creek. Most of these recommended projects are located on private lands, meaning there will need to be extensive outreach and education to the private landowners. Other opportunities exist to build on existing environmental curriculum in area schools.

General Watershed Recommendation GWR-8: Expand existing watershed public awareness / educational curriculum programs in the Nippersink Watershed.

Type: Regulatory
Target Objectives (from Section 4.2): 1, 8, 10, 15
Initial Cost: $ 10,000
Annual Cost: $ 2,500
Responsible Party: McHenry County Defenders, Friends of the Fox River, School Districts, McHenry County Soil & Water Conservation District
Priority: High

4.3.9 Implementing a Part-time Watershed Manager Position (GWR-9)

To successfully implement a large scale watershed plan, a significant amount of time and effort must be spent on working with watershed stakeholders to gain buy-in, finalizing specific project designs, preparing and submitting grant applications and regulatory permits, and overseeing the actual implementation of the project.

Very often, watershed planning efforts make assumptions that the actual coordination and implementation of the watershed plan will be undertaken by existing government units, agencies, not-for-profit groups, or committed volunteers. The reality is that due to budget, staffing, and workload constraints, most government, agency, and not-for-profit employees are already hard pressed to complete their normal work duties. Expecting this level of effort from volunteers, who are often exhausted from their efforts in helping prepare the watershed plan, is not likely.

The Nippersink Creek watershed, at 200 square miles overall, is at the larger of watershed implementation efforts Combined with this size is the fact that the vast majority of the watershed is rural, the normal complement of municipal planners, public works engineers, and other professionals who could normally be counted on to provide technical assistance and oversight, cannot occur. With over 155 recommended projects in the Illinois portion of the watershed, it will be necessary to implement numerous projects during every Section 319 grant cycle. For these reasons, it is recommended that funding be secured to allow a part-time Watershed Manager position to be established.

The duties of a watershed manager would include:

- Conducting initial outreach with landowners / stakeholders who have been targeted with Best Management Practices
- Coordinating with project partners to ensure coordination between local cost-share match revenue timing and grant submittal / contract approval.
- Preparing Grant Applications for implementation projects
- Coordinating with regulatory agencies to facilitate permitting
- Overseeing implementation of BMP projects
- Managing grant paperwork / submittal of progress reports
- Collecting water quality / biological data as part of expanded monitoring program.

General Watershed Recommendation GWR-9: Hire a P/T watershed manager.

Type: Education / Outreach / Implementation
Target Objectives (from Section 4.2): 1, 8, 10, 15
Initial Cost: $ 40,000
Annual Cost: $ 40,000
Responsible Party: Nippersink Creek Watershed Planning Committee, McHenry County Soil & Water Conservation District
Priority: Highest

4.3.10 Social Science Research (GWR-10)

Social science research should be conducted within the Wonder Lake watershed to examine social factors relevant to efforts to maintain water quality. The efforts should be conducted in three stages. The first stage should involve a survey of watershed residents to determine baseline information on values, attitudes, knowledge, and behaviors of watershed residents. The second stage should utilize these findings to assist in the implementation of the watershed master plan, as well as the design and delivery of education and outreach programs. The third stage of the research should again utilize a survey of watershed residents and additional information to evaluate outcomes of the outreach and educational efforts.

General Watershed Recommendation GWR-10: Conduct a university administered watershed survey / social science study to assess watershed implementation efforts.

Type: Education / Outreach / Implementation

Target Objectives (from Section 4.2): 1, 17

Initial Cost: $ 75,000 ($ 25,000 annually for 3 years – before / during / after watershed plan implementation.)

Annual Cost: $ 0

Responsible Party: Nippersink Creek Watershed Planning Committee, Illinois State University

Priority: Highest

4.4 Summary of Watershed Implementation Cost

Table 4.3 contains a summary of the watershed plan implementation cost, including the costs identified in the preceding General Watershed Recommendations (Section 4.3), as well as the subwatershed specific projects identified in each subwatershed report.

Table 4.3 Watershed Plan Implementation Cost Summary

General Watershed Recommendation Costs

	Initial	Outreach	Annual
GWR 1 - Monitoring	$45,000		$20,000
GWR 2 - Nutrient Management Planning	$5,000		$500
GWR 3 - Land Acquisition / Easements	$5,000		$1,500
GWR 4 - Conservation Design	$5,000		$1,500
GWR 5 - Stormwater	$5,000		$1,500
GWR 6 - Wastewater	$5,000		$1,500
GWR 7 - Non-Point	$5,000		$1,500
GWR 8 - Education / Outreach	$10,000		$2,500
GWR 9 - Watershed Manager	*		*
GWR 10 - Social Science Research	$75,000		$0
General Watershed Recommendation Cost Total	**$160,000**	**$0**	**$30,500**

* Watershed Manager Cost accounted for in SW Outreach Cost Total

SubWatershed Specific Costs

Subwatershed	SW Acres	SW Acres Treated	% of SW Treated	Initial Cost	Outreach Cost	Annual Cost
Lower Nippersink	12,432	1,118.4	9.0%	$1,960,371	$22,500	$51,860
Glacial Park / Tamarack Farms	12,588	404.6	3.2%	$1,183,656	$10,000	$38,448
Wonder Lake	7,884	79.0	1.0%	$9,626,931	$10,500	$178,722
VanderKarr Creek	12,231	285.2	2.3%	$695,847	$9,000	$26,767
Silver Creek	12,010	678.3	5.6%	$1,931,427	$11,500	$45,348
Slough Creek	11,876	714.6	6.0%	$1,444,415	$7,500	$69,910
Bailey Woods	7,283	460.5	6.3%	$621,177	$6,000	$36,670
Nippersink Headwaters	6,600	1,398.7	21.2%	$2,111,817	$10,000	$33,861
North Branch Nippersink	6,757	1,003.3	14.8%	$1,883,207	$19,500	$29,650
Lower Elizabeth Lake Drain	3,080	172.0	5.6%	$260,571	$4,500	$14,143
Hebron Peatlands	3,751	371.4	9.9%	$903,640	$5,500	$49,600
Wisconsin Subwatershed				$0	$5,000	$0
	96,492	**6,686.0**	**6.9%**			
Subwatersheds Cost Total				**$22,623,057**	**$121,500**	**$574,979**
TOTAL WATERSHED PLAN IMPLEMENTATION COST				**$22,783,057**	**$121,500**	**$605,479**

4.5 Project Funding / Implementation

Funding

By virtue of its relatively undeveloped watershed, and the existence of a county-wide Stormwater Management Ordinance and a Conservation Design Ordinance for unincorporated areas, much of the stream buffer / wetland protection endorsed by this plan will, by virtue of these ordinances, occur as development occurs. The potential also exists for progressive developers to recognize the potential of restored / managed natural areas within their developments as an attractive marketing tool, and fund that type of work as part of their site development activities.

For watershed recommendations in existing developed areas (such as in Lower Nippersink Creek or Silver Creek, for example), municipalities should strive to establish a budget for implementing the recommendations, ideally according to their prioritization ranking and the milestones set forth in the watershed plan.

By and large, the majority of funding for watershed protection must be a local effort. While the plan acknowledges that municipal and private funding sources in the watershed are limited and already stretched thin to address gray infrastructure costs and other municipal needs (police, fire, etc.), stakeholders must realize that the funding needed to implement the recommendations herein is really an investment in the environmental resources that will be needed to sustain their quality of life for the future. The costs for watershed protection and the small number of remedial activities now will certainly be less than the costs that will be incurred in the future, when delayed actions will create the need for more numerous and expensive remedial measures.

There are several state and federal grant programs that could be used to maximize the effectiveness of local funds. For example, the Illinois EPA 319 Grant Program provides up to 60% matching funds for the design and implementation of non-point source pollution control projects, such as the water quality projects identified in this watershed plan. The grant cycle for this program requires project applications be completed and submitted to the IEPA by August 1st of each year, and if the project is selected, funds usually become available the spring of the following year.

Another grant program available is the Illinois Department of Natural Resource's C-2000 Grant Program. This grant program is geared toward the preservation and restoration of the watershed's natural resources, such as streams, wetlands, woodlands and prairies. The C-2000 program (or its equivalent DNR grant program in the future) provides up to 100% match for projects fitting its criteria. The ecological restoration projects identified in the watershed plan would be prime candidates for IDNR C-2000 funding. This program requires grant application submittals in February and, if awarded, funding usually becomes available in the following November/December each year.

Implementation

The critical path in moving from planning watershed projects to actually implementing them is, like so many other things, money. Having a USEPA /.IEPA approved watershed plan that identifies existing and potential future water quality impairments, as well as identifies appropriate watershed management Best Management Practices, creates the possibility of applying for, and hopefully, receiving funding from the USEPA Section 319 program.

The major impediment that often stands in the way of watershed plans moving towards successful implementation is generating the 40% local match required for USEPA Section 319 grants. However, in the Nippersink Creek Watershed, a number of unique factors currently exist that could provide a significant source of the 40% local match.

1) As the updated Nippersink Creek watershed plan was being finalized in February 2008, an effort was underway with the Village of Wonder Lake and McHenry County to create a Special Service Area (SSA) taxing District to fund a $ 5.9 million Phase 1 restoration project for Wonder Lake. This proposed Wonder Lake restoration project, identified within this plan as Subwatershed Recommendation 6-5, would remove approximately one million cubic yards of accumulated sediment from Wonder Lake. This Phase 1 effort to remove the 1 million cubic yards of sediment would be the only phase funded by an SSA.
2) The outcome of the SSA process should be determined by June 2008. If the SSA is approved, the lake restoration project would likely follow this approximate timeline:
    - Regulatory permit process / engineering – Summer 2008
    - Receipt of regulatory permits – Fall / Winter 2008
    - Preparation of project bidding documents & project bidding - Fall / Winter 2008
    - Construction of Sediment Dewatering Facility – Spring 2009
    - Start of Dredging Project – Summer 2009
    - Completion of Phase 1 Dredging – Fall 2011
3) As part of the investigations undertaken to prepare the Wonder Lake Restoration Plan, it was determined that a total volume of 3 million cubic yards of sediment has been deposited in Wonder Lake since it was formed in 1929. To fully restore the lake, as much of this accumulated volume should be removed from the lake as possible. To move beyond the one million cubic yards of sediment dredging that would be funded by the creation of the SSA; additional (non-SSA) funding sources would need to be found to fund subsequent phases.
4) One potentially viable means of generating additional dredging revenue would be to develop a resale potential for the dried sediment generated by the Phase 1 dredging. Preliminary testing of Wonder Lake sediments by the University of Illinois has confirmed a high degree of sediment fertility, and a suitable composition of organics, sand, and peat, all characteristics identified with a marketable topsoil / soil amendment product.

5) If a resale market is established for the dewatered sediment, the intent would be to use the revenue from those sales to conduct additional dredging, moving towards the ultimate goal of three million yards of sediment removal from Wonder Lake. Using the same unit costs assigned to the proposed Phase 1 dredging, removing all three million yards of sediment from Wonder Lake could result in a local cost of roughly $ 17.7 million ($ 5.9 million from the SSA for Phase 1, and $ 11.8 million from sediment sales.) over the next ten years.
6) Properly timed and coordinated, these locally derived funds could potentially be matched (at 40%) to up to $ 26 million (at 60%) in Federal USEPA 319 funds to implement virtually the entire watershed plan, both upstream and downstream of Wonder Lake.
7) Having an identified, potentially long-term source of local cost-share match provides the ability to implement Nippersink Creek Watershed Plan identified Best Management Plan practices at little or no out-of-pocket expense for the landowner of the target area. This would be expected to be a significant selling point in gaining stakeholder / landowner acceptance.