Chapter 11
Bailey Woods Subwatershed Assessment

This section presents a summary of the characteristics of the Bailey Woods Subwatershed, as well as specific issues and challenges in this subwatershed that must be addressed in the Nippersink Creek Watershed Management Plan.

11.1 Subwatershed Characteristics

The following section provides an overview of the physical characteristics of the subwatershed.

11.1.1 Subwatershed Location

The Bailey Woods subwatershed is located in the northwestern portion of the Nippersink Creek Watershed, and has a drainage area of 7,283 acres (11.4 square miles). As shown on Figure 11.1, the subwatershed is located primarily within Hebron Township, but extends west into the Alden Township and southeast into Greenwood Township.

Figure 11.1 Bailey Woods Creek Subwatershed Location Map

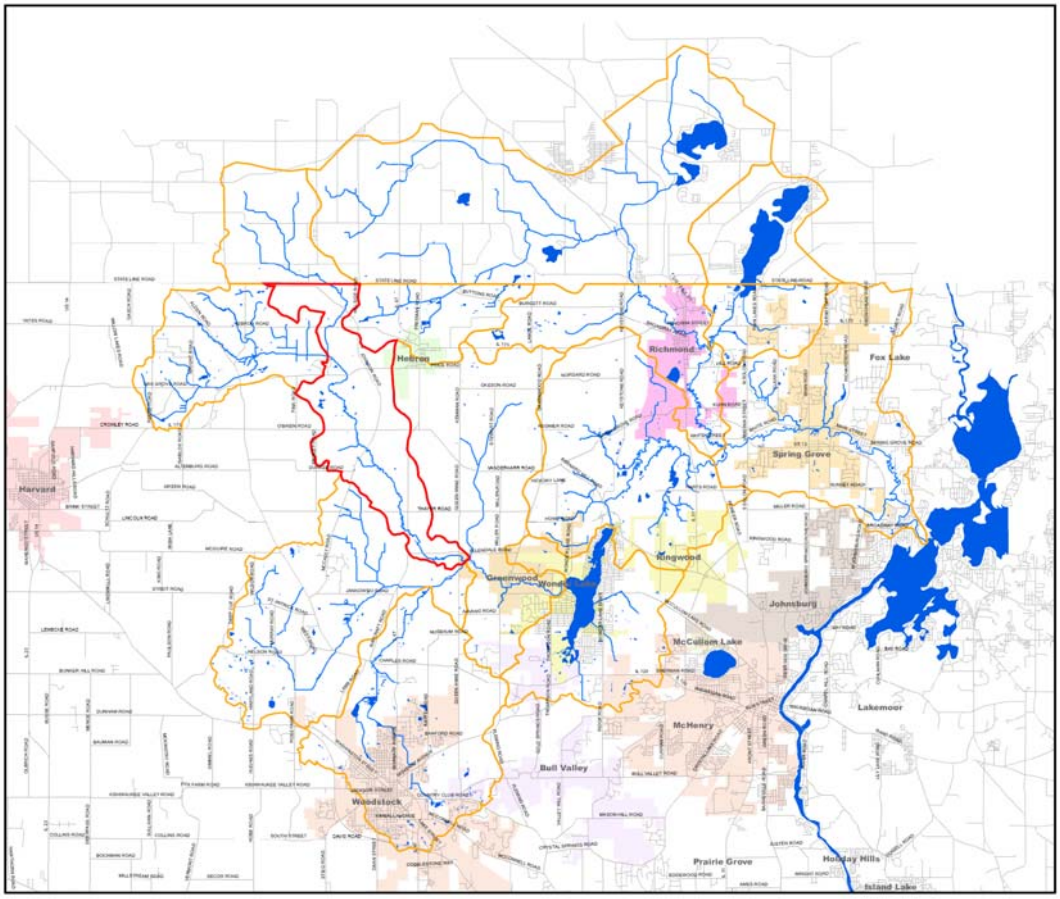
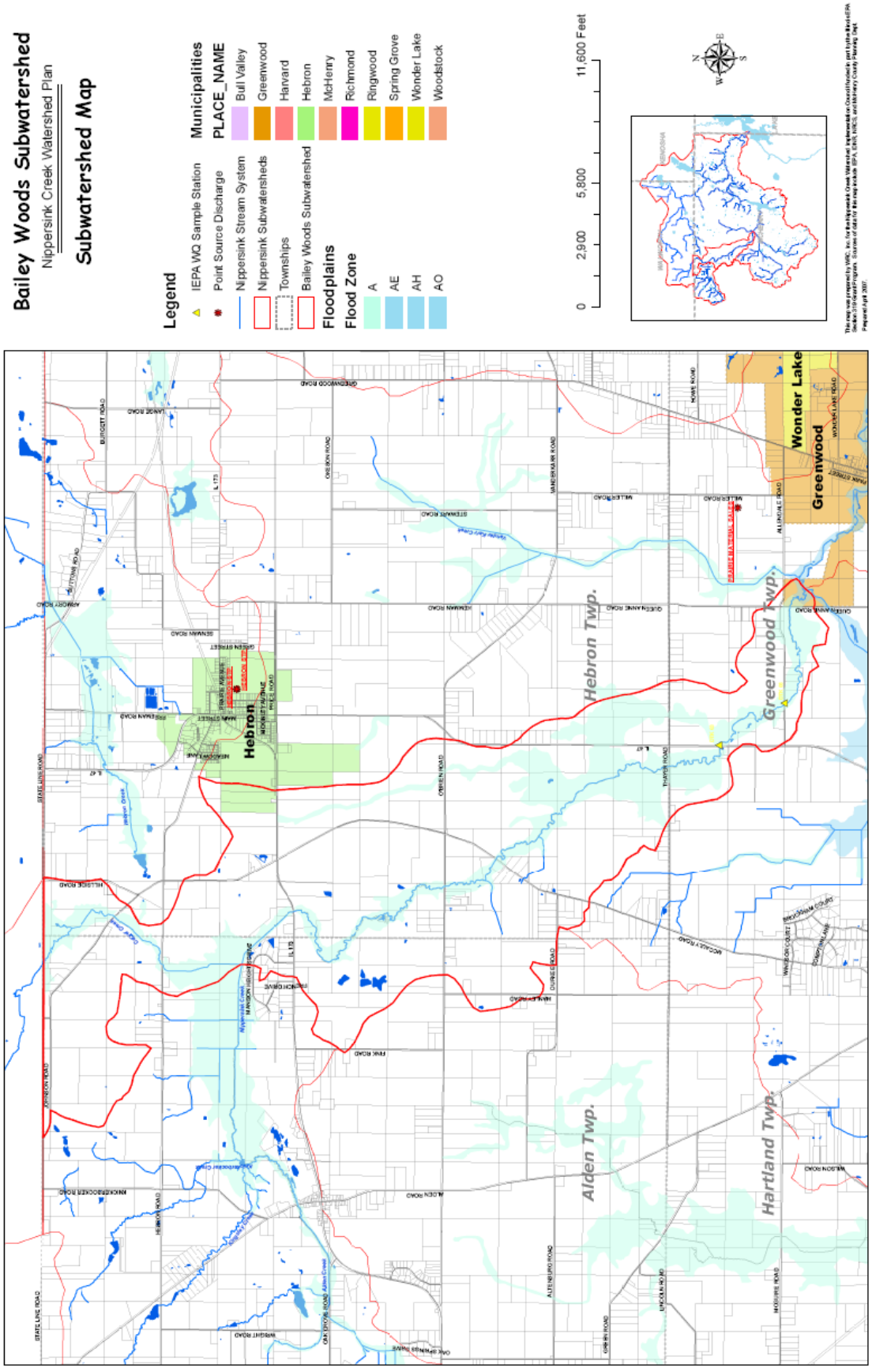


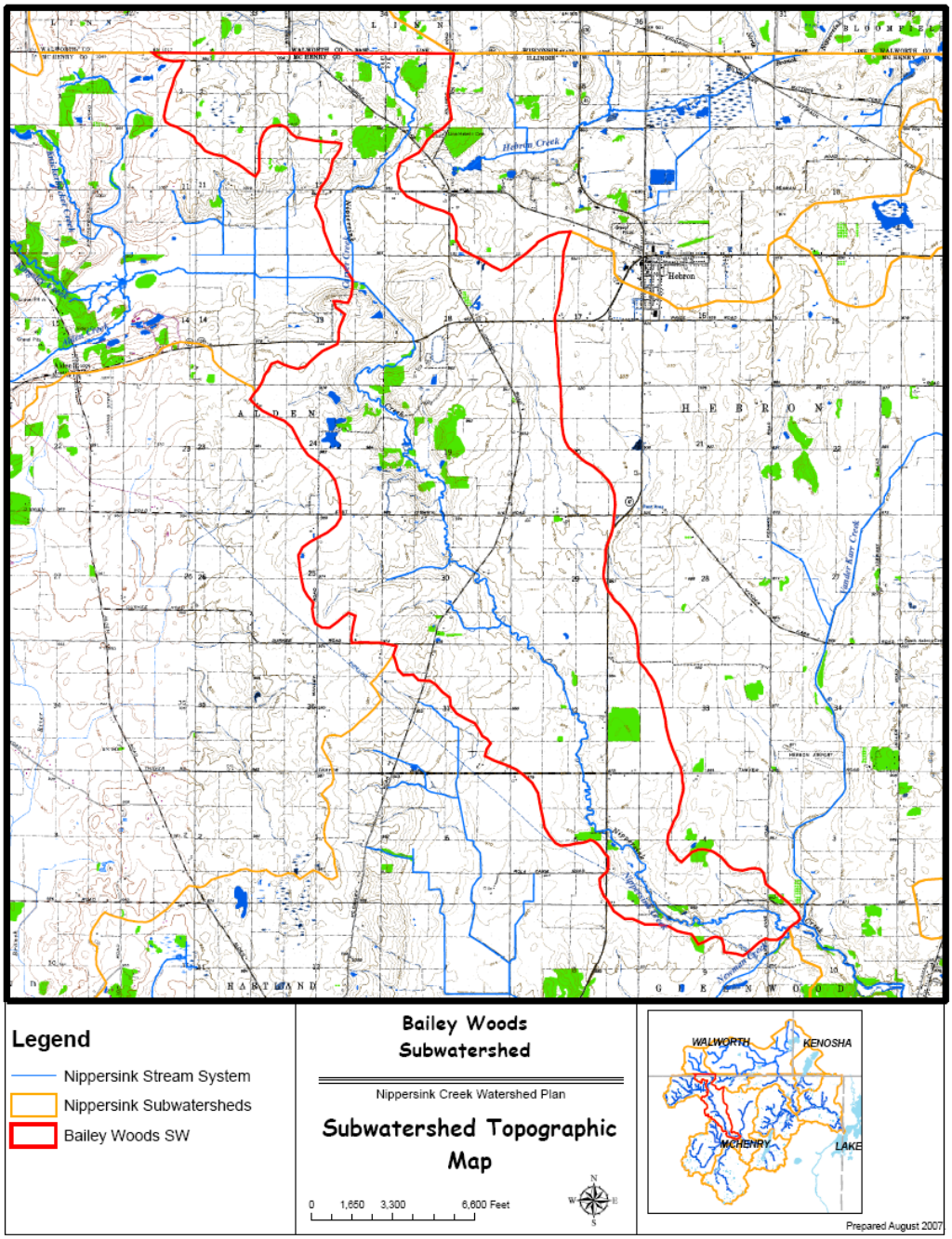
Figure 11.2 Bailey Woods Subwatershed Map



11.1.2 Topography & Geology

The topography of the subwatershed varies greatly. The lower and eastern half of the subwatershed is gently sloping, generally between 0% and 2%. However, Nippersink Creek passes through a relatively deep valley between Johnson Road (on the south) and Illinois Route 173 (on the north), where the topography varies by more than 60 feet from valley ridge to valley floor and slopes range from 5% to more than 10%. The maximum elevation in the subwatershed is 1,022 feet near the Illinois - Wisconsin state line and the minimum elevation is 836 at the subwatershed outlet just east of Queen Anne Road.

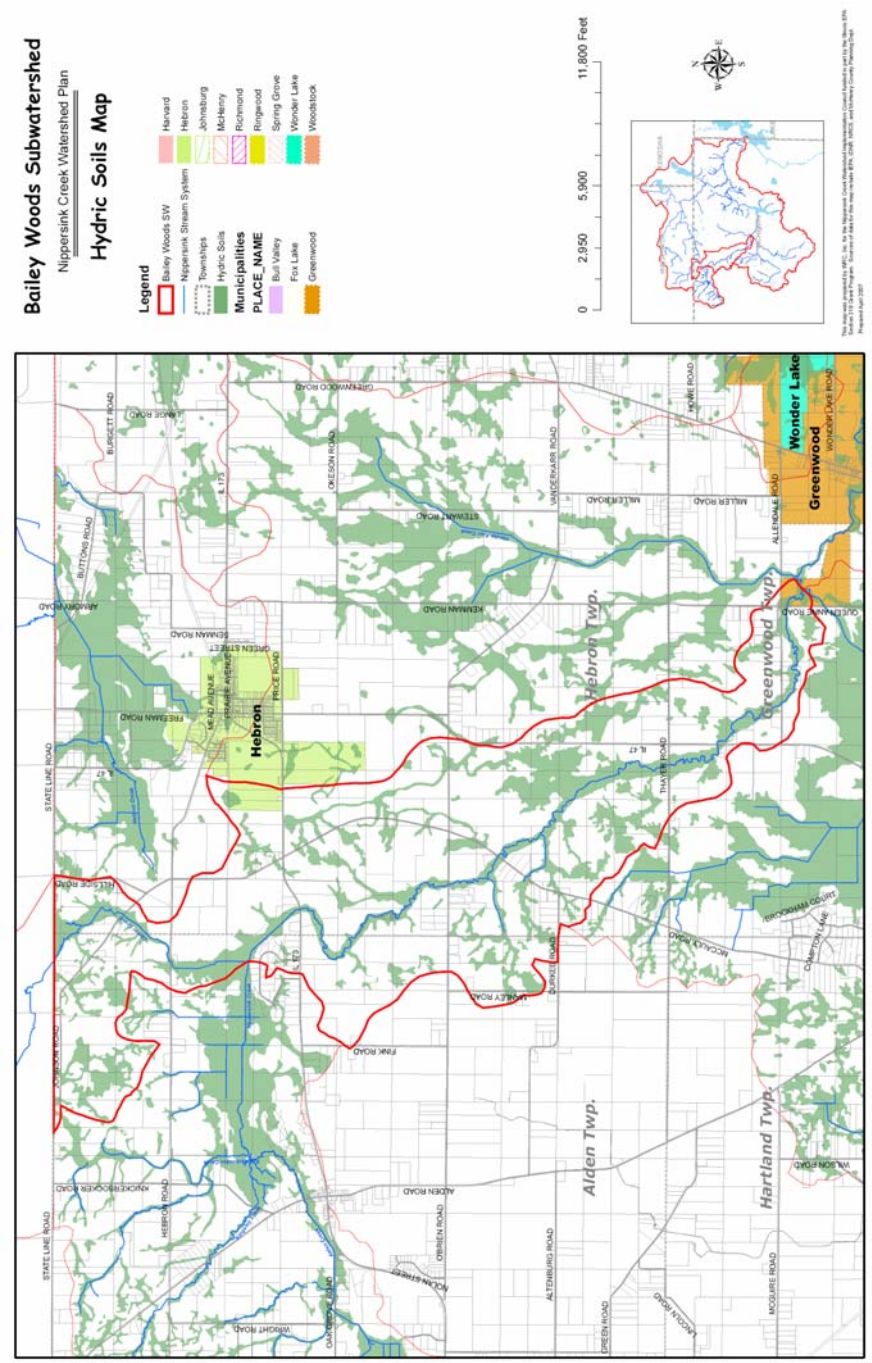
Figure 11.3 USGS Topographic Map of the Bailey Woods Subwatershed



11.1.3 Soil Characteristics

The glacial advances across McHenry County resulted in a wide variety of soil associations. The soils in the subwatershed consist of mostly silty loams soil units on 0% - 2% slopes. Each major grouping of soil associations has potential impact on current and future land uses within the subwatershed. For example, hydric (wetland) soils constitute 2,028 acres, or 28% of the 7,283 acre subwatershed, and indicate those areas that contain functional wetlands, or former / degraded wetland areas that could be restored or enhanced.

Figure 11.4 Hydric Soils Map the Bailey Woods Subwatershed



11.1.4 Pre-settlement Vegetation

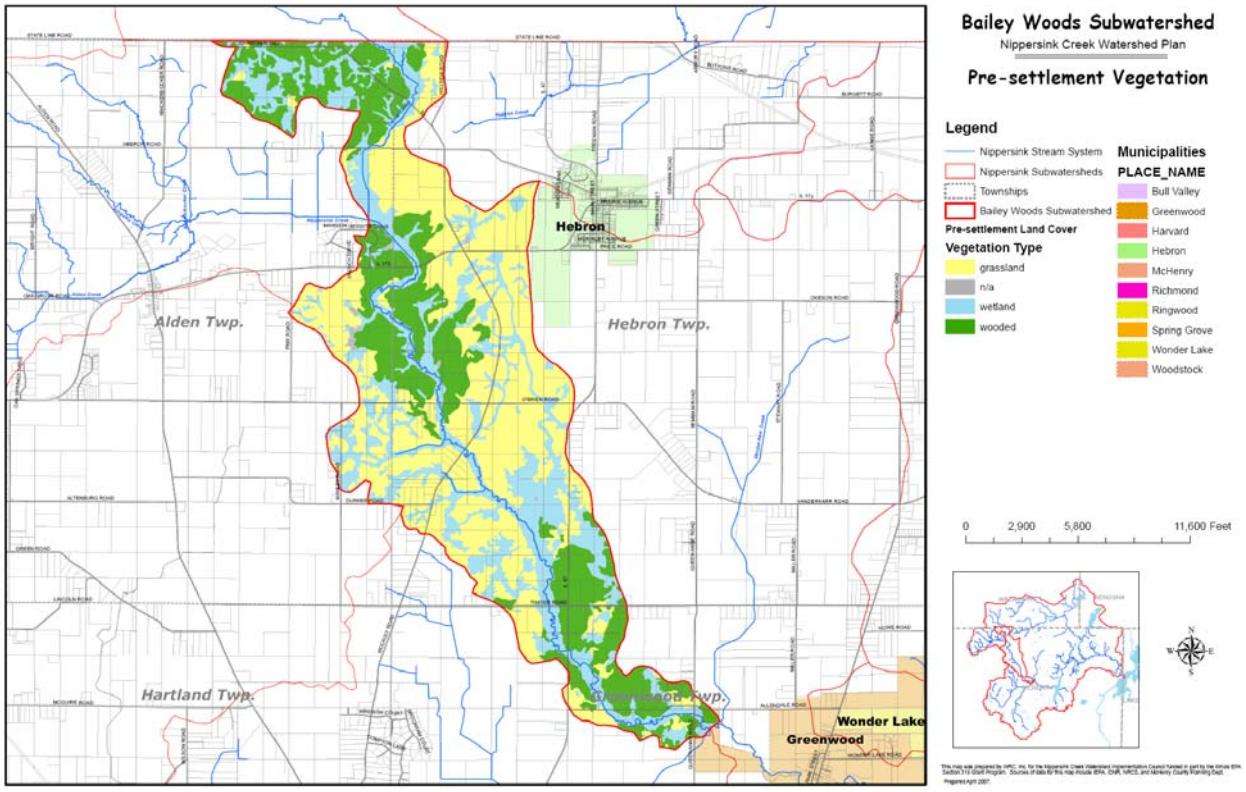
To guide future land management or restoration efforts, it is important to recognize the native plant communities that naturally evolved subsequent to the last glacial advances. Prior to European settlement in the 1830's, the subwatershed was covered by extensive woodland and wetland complexes in the upper, middle, and lower portions of the subwatershed, and prairie throughout the mid-section, as described in Table 11.1, and depicted in Figure 11.5.

Table 11.1 Pre-Settlement Land Cover Conditions

Cover Type	Area	Percent of Subwatershed
Grasslands	3,107 acres	43%
Wooded	1,965 acres	27%
Wetlands	2,190 acres	30%
n/a	21 acres	< 0.3%

Source: MCCD Soils Analysis using GIS data

Figure 11.5 Pre-settlement Vegetation of the Bailey Woods Subwatershed



11.1.5 Subwatershed Drainage Features

Streams

The principal stream in the Bailey Woods Subwatershed is Nippersink Creek. Nippersink Creek extends from the downstream outlet of the subwatershed upstream (north) to the Nippersink confluence with Carver Creek, just north of Illinois Route 173. Carver Creek drains the northeast portion of the subwatershed, and receives the discharge from the Zenda Headwaters branch of the Nippersink originating in Wisconsin.

Because the landscape in the Bailey Woods subwatershed has been heavily modified for agriculture, there are currently only two small ephemeral streams which empty into Nippersink Creek. They are located on the west side of the Nippersink channel, between Durkee Road and O'Brien Road.

Channelization Analysis of aerial photography indicates that Nippersink Creek, as it flows through this subwatershed, has not been subjected to extensive channelization. Only about 7% of the main stem of Nippersink Creek appears to have been channelized (0.74 miles). The channelization is located at the extreme upstream end of the subwatershed, just below the confluence between Nippersink and Carver Creeks. If channelization on Nippersink occurred further downstream of this area in the past, the stream appears to have recovered significantly, as the aerial photos indicate good sinuosity / meandering of the stream channel al the way down to the subwatershed outlet, east of Queen Anne Road.

Stream Channel Condition While there is little documented information regarding the stream condition of Nippersink Creek in the Bailey Woods subwatershed, the McHenry County Natural Area Inventory (MCNAI) database indicates that the Bailey Woods / Nichols Valley MCNAI site is suffering from "bank erosion" as one of its management problems.

Manmade Drainage Systems

There are no known storm sewer systems within the subwatershed. Developed areas are drained via overland swales, roadside ditches and culverts installed along road right-of-ways. There are also no known detention basins within the subwatershed.

Agricultural Tile Systems

Due to the predominantly agricultural nature of the subwatershed, it is likely that there are extensive underground drain tile systems to increase productivity of the area's rich soil. These systems were likely installed more than 50 years ago by private property owners and therefore there is little documented information about there size and exact location, although their distribution can be general determined by inspection of a combination of aerial photographs, hydric soils and topography.

Based on preliminary observations as part of this subwatershed assessment, it appears that there are several small to medium size agricultural drain tile networks. These tile systems provide subsurface drainage to many farmed parcels that are adjacent to the tributary streams in the subwatershed, as well as the low lying area east of Alden Sedge Meadow.

Identifying agricultural drain tile networks is important in watershed planning because current local flooding and drainage problems can often be linked to damage or age-related failure of drain tile systems. From a watershed preservation / restoration perspective, it is important to identify functional drain tile systems to determine opportunities for their removal or reconfiguration for the purposes of restoring valuable wetland habitat, and water quality benefits. There is little doubt that many of the depressional and low lying areas in the subwatershed that are serviced by drain tiles today for agriculture were once wetland habitats that supported a very diverse ecosystem.

Floodplains

The true floodplain system within the subwatershed has not been mapped to date. Existing FEMA floodplain maps depict the floodplain of Nippersink Creek through the subwatershed as "Zone A", meaning that a floodplain analysis has not been done to accurately determine the elevation or spatial limits of the 100-year floodplain.

11.1.6 Population

Population data in watershed planning is critical because of there is a direct correlation between the number of people residing in a watershed and the degree of impacts to the quality and quantity of the watershed's natural resources. In 1990, the US Census data indicated that about 645 people lived in the subwatershed, which equated to 57 persons per square mile. According to the 2000 US Census, the population increased to 740 people, or about 65 persons per square mile. While this represents an increase 15%, the overall growth in the subwatershed to date is considered slow, as the population only increased by about 95 people.

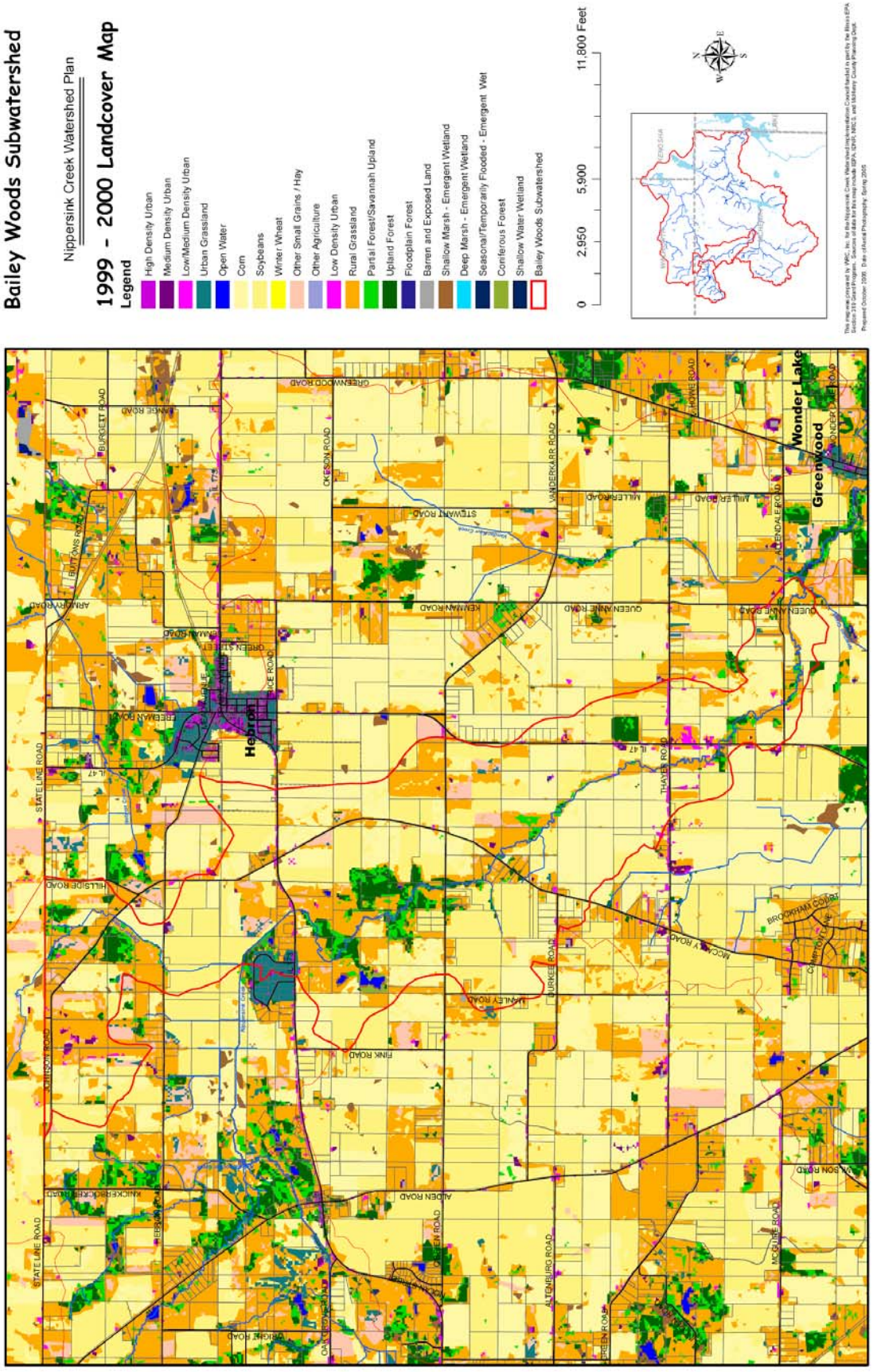
11.1.7 Land Cover

Often, the terms Land Cover and Land Use are used interchangeably. However, there are differences. Land Cover refers to the vegetation, structures, or other features that cover the land. On the other hand, Land Use (as discussed in Section 11.1.8) refers to how land is used by humans. Land cover data for the Bailey Woods Subwatershed is available from the Illinois Department of Natural Resources using LANDSAT data collected in 1999. The dominant land cover, according to this data, was agriculture, which accounted for roughly 90% of the subwatershed area (croplands + rural grasslands).

Table 11.2 1999 Land Cover for the Bailey Woods Subwatershed

Land Cover Description	Total Acres	Percent of Subwatershed
Barren & Exposed Land	2.7	0.0%
Corn, Soybeans, Other Small Grains & Hay (row crop)	4,692.3	64.4%
Winter Wheat	0.9	0.0%
Rural Grassland	1829	25.1%
Low Density Urban	75.9	1.0%
Medium Density Urban	24	0.3%
High Density Urban	0	0.0%
Urban Grassland	69.7	1.0%
Shallow Marsh – Emergent Wetland	28.7	0.4%
Partial Forest /Savannah Upland	216.4	3.0%
Upland Forest	308.4	4.2%
Floodplain Forest	1.43	0.0%
Coniferous Forest	15.4	0.2%
Deep Marsh / Emergent Wetland	0	0.0%
Open Water	15.8	0.2%
TOTAL	**7,280.63**	**100.0%**

Figure 11.6 1999-2000 Land Cover Map for the Bailey Woods Subwatershed



11.1.8 Land Use / Existing Watershed Development

According to the 2005 McHenry County Land Use / Zoning map, 91% of the subwatershed is zoned agriculture, while about 9% is either already developed or zoned for development in the near future.

Table 11.3 McHenry County 2005 Land Use in the Bailey Woods Subwatershed

Land Cover Description	Total Acres	Percent of Subwatershed
Vacant	1.2	0.0%
Vacant; Zoned Residential	50.4	0.7%
Vacant; Zoned Commercial	0	0.0%
Vacant; Zoned Office	0	0.0%
Vacant; Zoned Industrial	0	0.0%
Agricultural	6,659.5	91.4%
Single Family Residential	278.1	3.8%
Multi-Family Residential	0	0.0%
Commercial	0.9	0.0%
Office	0	0.0%
Industrial	0	0.0%
Mixed Use	0	0.0%
Mining	0	0.0%
Open Space	104	1.4%
Institutional	4.1	0.1%
Right of Way	185.3	2.5%
TOTAL	**7,283.5**	**100.0%**

Developed land accounted for about 10.7%, consisting almost entirely of unincorporated, large lot rural residential development. To date, municipal expansion into the subwatershed has been almost non-existent, as nearly 99% of the subwatershed was classified as unincorporated in 2005.

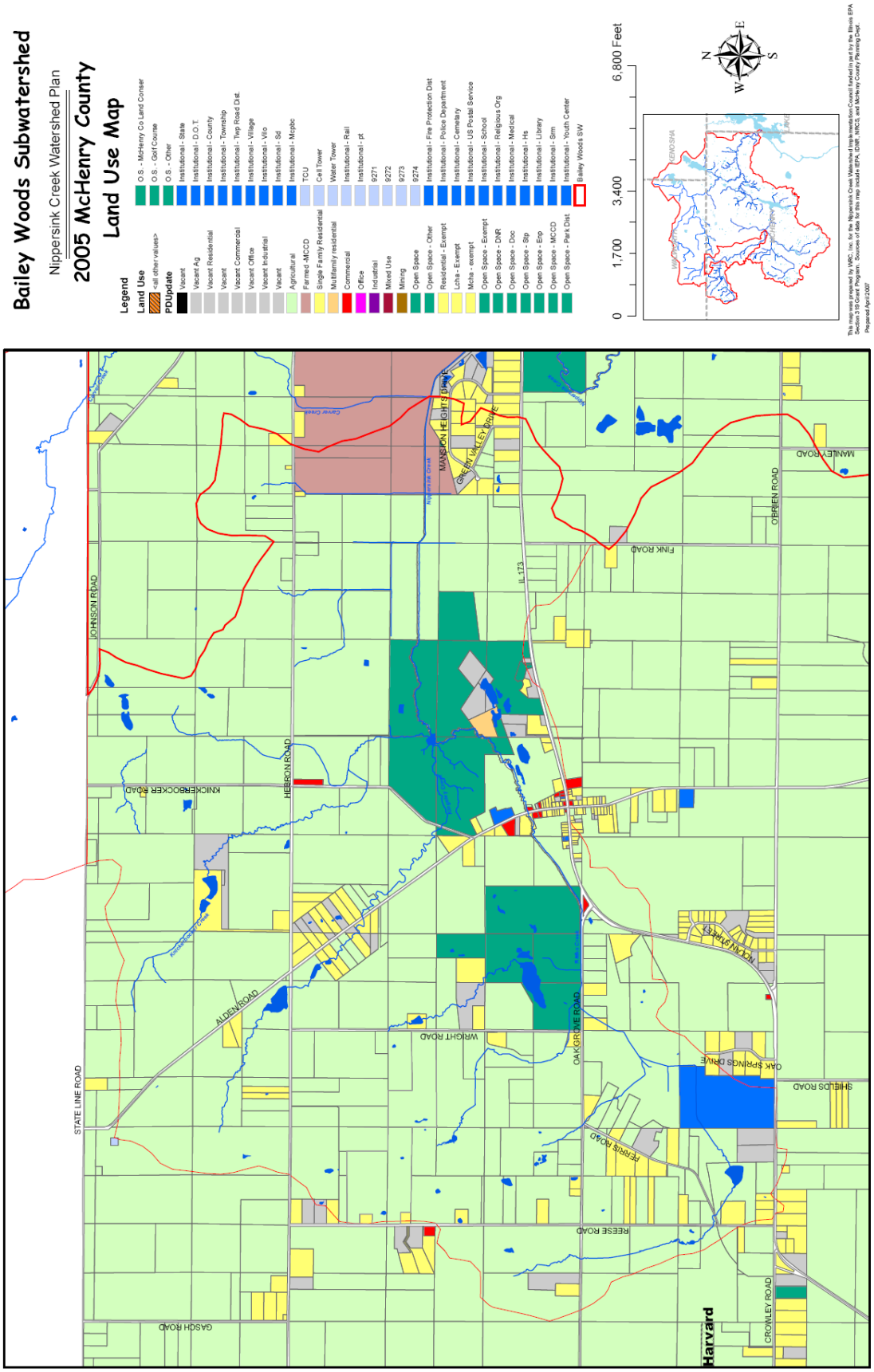
Table 11.4 Municipal Areas in the Bailey Woods Subwatershed

Municipality	Area (acres)	Percent of Subwatershed
Village of Greenwood	32	0.4%
Village of Hebron	72	1.0%
Unincorporated	7,179	98.6%

There are no permitted point source discharges in the subwatershed.

An analysis of GIS roadway data indicates that there are 17.98 miles of roads in the subwatershed. This is approximately 61 acres of pavement.

Table 11.7 McHenry County 2005 Land Use in Bailey Woods Subwatershed



11.1.9 Natural Resources

McHenry County Conservation District Property

The McHenry County Conservation District (MCCD) currently owns 739 acres of land within the subwatershed. There are four McHenry County Conservation District Sites within the subwatershed, representing over 10% of the subwatershed.

Table 11.5 MCCD Properties in the Bailey Woods Subwatershed

Name	Area (acres)
Alden Sedge Meadow (east)	219
Bailey Woods - North	180
Bailey Woods – East	163
Willobank Farm	177
Total	**739**

McHenry County Natural Areas Inventory

There are two McHenry County Natural Area Inventory (MCNAI) Sites within the subwatershed, representing nearly about 9% of the subwatershed area.

Table 11.6 McHenry County Natural Areas Inventory Sites in the Bailey Woods Subwatershed

MCNAI Site ID #	Name	Area (acres)
HEB01	Bailey Woods / Nichols Valley	641
HEB06	Route 47 Heronry	41
	Total	**682**

The Bailey Woods/Nichols Valley MCNAI site contains a Mesic Silt Loam Woodland, a Mid Order Low Gradient Stream (Nippersink Creek), and a Sedge Meadow.

Wetlands

McHenry County completed an Advanced Identification (ADID) Wetland Study in 1998. This study identified a total of 579 acres of wetlands, or 11% of the subwatershed. Of these wetlands, 434.4 acres (75%) were determined to be of High Quality or High Functional Value, rating an ADID classification.

Table 11.7 Wetlands in the Bailey Woods Subwatershed

ADID Code	Wetland Type	# of Wetlands	Total Acres
FW	Farmed Wetlands	29	78.7
HFVW	High Functional Value Wetlands	1	31.8
HQL	High Quality Lakes	0	0
HQW	High Quality Wetlands	5	402.6
L	Lakes	0	0
W	Other Wetlands (lower quality)	30	65.6
	Total	**65**	**578.7**

Of most significance is the nearly 6.8 mile long stretch of Nippersink Creek designated as High Quality Wetland between Queen Anne Road and Illinois Route 173. The highest quality portion of this wetland complex is found within the Bailey Woods / Nichols Valley MCNAI site just south Illinois Route 173.

Threatened & Endangered Species

The McHenry County Natural Area Inventory database did not reveal the presence of any threatened or endangered species of plants and animals in the subwatershed.

Existing Greenways

While there are no formal greenways established in the subwatershed, the land owners have done a fairly good job of preserving the active portion of the Nippersink Creek stream corridor. Only about one mile of Nippersink Creek is permanently protected on MCCD property. This represents only 10% of Nippersink Creek in the subwatershed, meaning that 90% is located on private property. There are no records of any of these properties containing conservation easements to protect the Nippersink stream corridor from encroachment by agricultural or other land disturbance activities.

11.2 Analysis of Subwatershed Data and Problem Identification

11.2.1 Water Quality Data & Identified Problems

The Illinois Environmental Protection Agency (IEPA) is the lead agency in Illinois that monitors and regulates water quality in our rivers, lakes, and streams.

The IEPA has determined that the designated uses for Nippersink Creek are to support:

- Aquatic Life
- Fish Consumption
- Primary Contact
- Secondary Contact
- Aesthetic Quality.

The IEPA periodically produces a 303(d) list, which identifies waterways that are not achieving certain designated uses. In the 2006 IEPA 303(d) list, below Wonder Lake, Nippersink Creek is identified as being in Full Support of its Aquatic Life and Fish Consumption Designated Uses, which is notable for a stream in northeastern Illinois. Upstream of Wonder Lake (including this subwatershed), Nippersink Creek is identified as being in Full Support of its Fish Consumption Designated Use, however, the Aquatic Life Designated Use was not assessed.

Nippersink Creek, upstream of Wonder Lake, as well as the segment of the Creek that flows through Wonder Lake, was not listed as impaired. However, the reach of Nippersink Creek downstream of Wonder Lake, extending all the way downstream to its confluence with the Fox River, is listed as "impaired" due to fecal coliform entering the stream water from an as yet unidentified source.

The Illinois Environmental Protection Agency maintains two water quality sampling stations in the BWSW. They are listed in the table below:

Table 11.8 IEPA Water Quality Sampling Stations in the Bailey Woods Subwatershed

Station	Stream	Location
DTK 06	Nippersink Cr.	Nippersink Creek at Allendale Road
DTK 03	Nippersink Cr.	Nippersink Creek at IL Route 47

The Fox River Watershed Monitoring Network, administered by the not-for-profit Friends of the Fox River, maintains three volunteer stream monitoring sites on Nippersink Creek. Unfortunately, none of the monitoring sites is located in the Bailey Woods Subwatershed.

11.2.2 Flooding Problems

There are no known flooding problems in the subwatershed. The existing FEMA 100 Year Floodplain Map suggests that as many as 11 dwellings are in the floodplain, however the floodplain in this subwatershed is classified as an Unstudied Zone A Floodplain. Analysis of the actual flood discharges and floodplain hydraulics would likely show that none of the adjacent dwellings are actually in the Nippersink Creek Floodplain or the floodplain of its two small tributaries.

11.2.3 Projected Development & Growth

Future development and land use change in the subwatershed is likely to be dominated by the conversion of agricultural land to large lot, rural residential type of development. This development will likely continue in the subwatershed at a slow to moderate pace. There is significant uncertainty about how much new development will encroach into the northeast area of the subwatershed as part of Hebron's recent annexations along Illinois Route 173. Further annexation and development west of the current Hebron corporate boundary will spread new development onto agricultural land that drains toward Nippersink Creek.

11.2.4 Natural Area Protection / Preservation Issues

McHenry County Natural Area Inventory Sites

The Bailey Woods / Nichols Valley (MCNAI HEB01) site, has been identified by the MCCD as being impacted by stream bank erosion, siltation, water table alteration, brush encroachment, Garlic Mustard, Reed Canary Grass, and illegal waste dumping.

Wetlands

In the subwatershed, only 579 acres of wetland remain, compared to an estimated 2,028 acres that existed before settlement. That means that 71% of the wetlands have already been lost and can no longer provide the valuable functions described above. Therefore, it is critical that the remaining wetland resources in the subwatershed be protected and managed so that stakeholders can gain the benefits these wetlands provide.

There are four High Habitat Quality wetland complexes that lie along the main stem of Nippersink Creek in the BWSW. Many of these wetlands need either protection and / or restoration to maintain the high quality characteristics that make the wetlands so valuable to the watershed.

Specifically, ADID Wetlands N233, N385, N419, and N610 are all high quality wetlands along the Nippersink Creek stream corridor which have no form of permanent protection in place. About 25% of high quality ADID wetland N257 is protected within the Bailey Woods MCCD property.

11.3 Subwatershed-Specific Recommendations to Protect Water Resources

The following section discusses the Best Management Practices (BMP's) identified for this subwatershed that should be implemented to address existing or potential water quality impairments. The location of each recommended BMP project is presented in Figure 11.8.

Pollutant Loading Modeling, as discussed in Chapter 3, identified current and future pollutant loadings, based upon land use, soils, slopes, etc., and quantified these loadings. The results of this Pollutant Loading modeling were then used to identify the types of BMP's that should be implemented to create a loading reduction of those pollutants. Table 11.9 presents a summary of the recommended BMP projects, as well as the expected pollutant loading reductions expected if the BMP's are implemented, and function as intended.

Table 11.10 presents detailed cost and logistical information on each of the recommended BMP projects. Below is a summary list of recommendations for the subwatershed to help stakeholders and decision makers meet the Goals and Objectives set forth for Nippersink Creek. Background information regarding how each type of recommendation addresses watershed concerns and/or impairments (existing or future) can be found in Chapter 4.

Type:	Education / Outreach; Regulatory; Site Restoration; Monitoring; Permanent Habitat Protection, Water Quality
Target Goals:	Which watershed plan goals the recommendation is intended to address.
Initial Implementation Cost:	The initial cost, in 2007 dollars to initiate the recommended action, if applicable.
Initial Outreach 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 the BMP recommendations, based upon the nature / urgency of the existing / potential impairment; the availability of willing landowners)/ partners; short-term vs. long-term development pressure; and whether the project is a new effort, or a retrofit of an existing practice.

The project cost estimates contained in this report should be considered preliminary, and are only presented to identify the potential magnitude of cost, from a watershed scale perspective. No site-specific investigation, analysis, or design of any recommended project, from which accurate cost information could be obtained, was completed as part of the preparation of the 2008 Nippersink Creek Watershed Plan.

If a watershed stakeholder decides to apply for grant funding assistance to implement any of the recommended projects presented in this report, they should first undertake any additional studies / research needed to determine an updated / accurate project cost. They should not solely rely on the cost estimates presented in the NCWP report as the basis for their grant request.

Note: The following acronyms for responsible parties identified in Table 11.10 are presented below:

NCWPC	Nippersink Creek Watershed Planning Committee
NRCS	Natural Resource Conservation Service
SWCD	McHenry County Soil and Water Conservation District
MCCD	McHenry County Water Conservation District
TLC	The Land Conservancy of McHenry County
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
MCDOT	McHenry County Department of Transportation
MCDEF	McHenry County Defenders

Table 11.8 Bailey Woods Subwatershed Site Recommendation Map

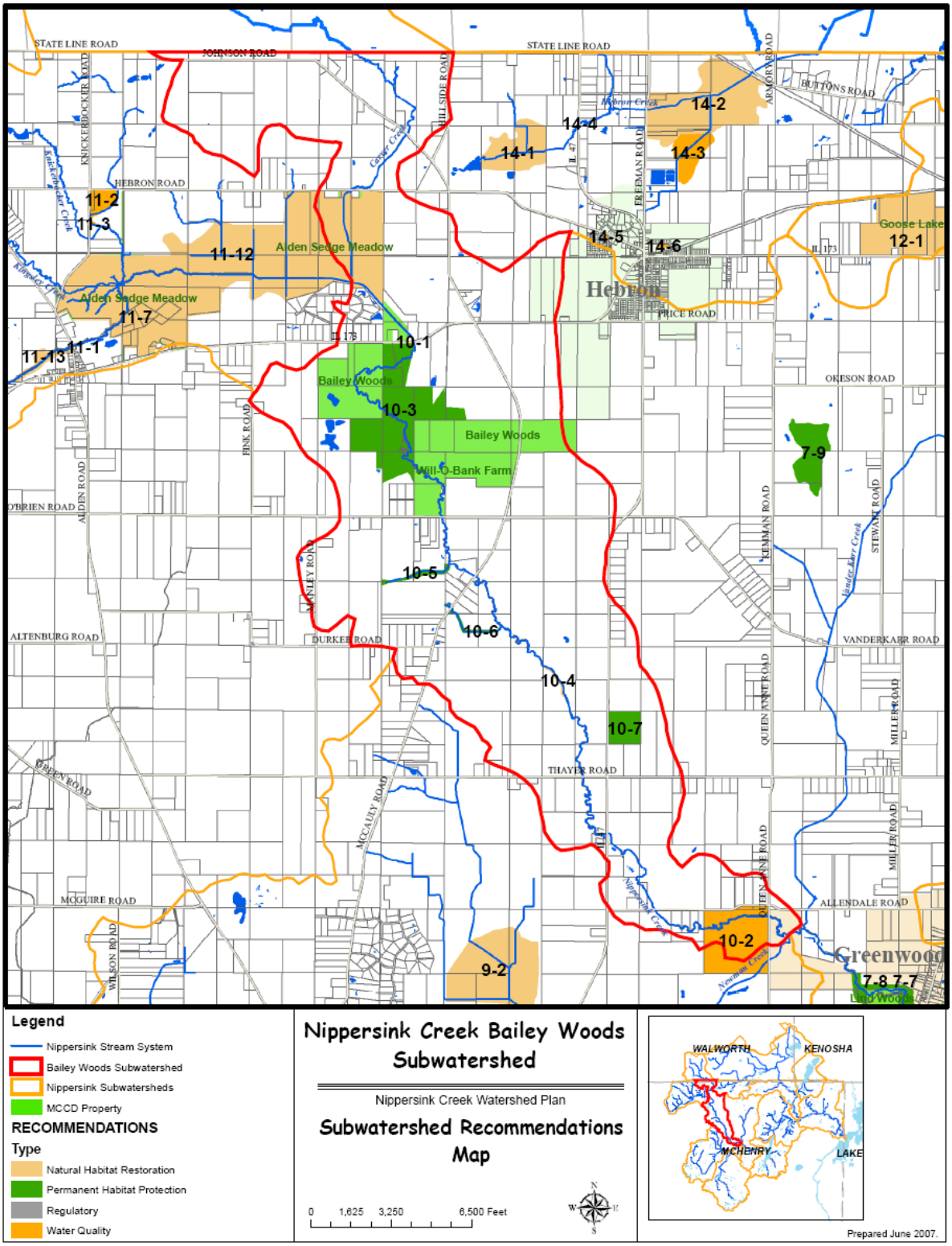


Table 11.9 BMP Selection & Associated Pollutant Load Reduction for the Bailey Woods Subwatershed

BMP	Type of BMP	Project Locations**	BMP		Removal Efficiency***			(lbs/year)****			Percentage Reduction		
			Size	Unit	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS
Natural Habitat Protection	Site-specific	10-4	400	acres	30%	35%	60%	2,602	246	264	8.2	9.6	16.5
Conservation Development Practices	Site-specific	10-2, 10-3, 10-5, 10-6, 10-7	13	acres	52%	58%	64%	147	13	9	0.5	0.5	0.6
Regulatory*	Watershed-Specific	Subwatershed	1	Water-shed	5%	5%	5%	1,579	128	80	5	5	5
Nutrient Management	Watershed-specific	Subwatershed wide	728	acres	70%	28%	-	11,049	359	-	35	14	-
Stream Buffers	Site-specific	10-1, 10-4, 10-5, 10-6	48	acres	36%	95%	95%	375	80	50	1.2	3.1	3.1
Total								15,750	827	403	49.9	32.3	25.2

*Regulatory programs are assumed to have nominal pollutant reduction rates of 5%.

** Project locations and details are described in the corresponding chapter.

*** TN = total Nitrogen; TP = total Phosphate; TSS = total suspended solids or Sediment.

**** The unit of “TSS” is “Tons/year”.

Table 11.10 Recommended Projects in the Bailey Woods Subwatershed

SUB WATERSHED	RECOMMENDATION #	TARGET GOAL	DESCRIPTION	RESPONSIBLE PARTY	ACRES	UNIT COST	INITIAL IMPLEMENTATION COST	INITIAL OUTREACH COST	ANNUAL MAINTENANCE COST	PRIORITY
Bailey Woods	10-1	Water Quality	Government Outreach to install BMP's to treat roadway runoff prior to discharge into North Branch Nippersink Creek	NCWPC / MCHENRY DOT			$50,000	$1,000	$2,500	E
Bailey Woods	10-2	Water Quality	Landowner / Government Outreach to mandate Conservation Design for land development on parcel east of Queen Anne Road and south of Allendale Road	NCWPC / VILLAGE OF GREENWOOD / TLC	158.4	$500	$79,186	$1,000	$3,959	B
Bailey Woods	10-3	Permanent Habitat Protection	Landowner Outreach to secure Conservation Easements to protect privately owned sections of Bailey Woods / Nichols Valley MCNAI Site	NCWPC / TLC / MCDEF	236.9	$1,500	$355,313	$1,500	$23,688	C
Bailey Woods	10-4	Natural Habitat Restoration	Landowner Outreach to establish minimum 100 foot Stream Buffer on either side of creek	NCWPC / TLC / MCDEF	3.7	$3,000	$11,232	$500	$374	D
Bailey Woods	10-5	Permanent Habitat Protection	Landowner Outreach to establish Conservation Easement / Stream Buffer along tributary stream corridor	NCWPC / TLC / MCDEF	12.9	$3,000	$38,847	$500	$1,295	D
Bailey Woods	10-6	Permanent Habitat Protection	Landowner Outreach to establish Conservation Easement / Stream Buffer along tributary stream corridor	NCWPC / TLC / MCDEF	9.2	$3,000	$27,591	$500	$920	D
Bailey Woods	10-7	Permanent Habitat Protection	Landowner Outreach to establish Conservation Easement for Rt 47 Heronry MCNAI Site	NCWPC / TLC / MCDEF	39.3	$1,500	$59,009	$1,000	$3,934	C
				SW TOTALS	**460.5**		**$621,177**	**$6,000**	**$36,670**	

PRIORITY

- **A Projects that have cooperating partners, can move to implementation quickly. Implementation Timeframe 1 to 3 years**
- **B Projects subject to imminent development pressure, Implementation Timeframe 1 to 2 years**
- **C Projects needed to protect sensitive areas. Timeframe 1 to 2 years**
- **D Restoration projects, Timeframe 1 to 5 years**
- **E Retrofit Projects, Timeframe 1 to 5 years**
- **F Existing Pollution Potential, Timeframe 1 to 2 years**
- **G Policy / Opportunity Review Project, Timeframe 1 to 3 years**