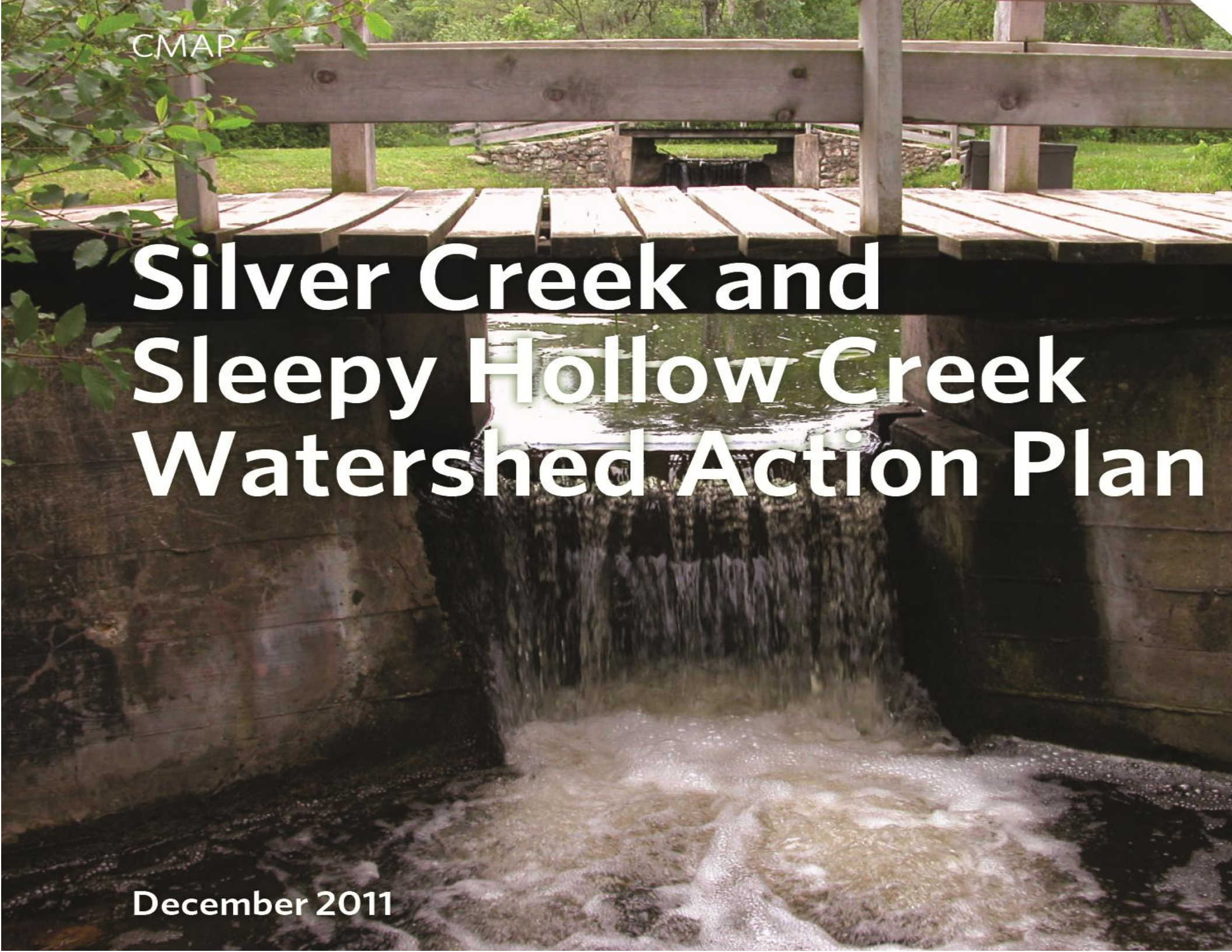
CMAP



Silver Creek and Sleepy Hollow Creek Watershed Action Plan

December 2011

Please note: The Action Plan's policy, project, and education recommendations are represented in bold font throughout the plan.

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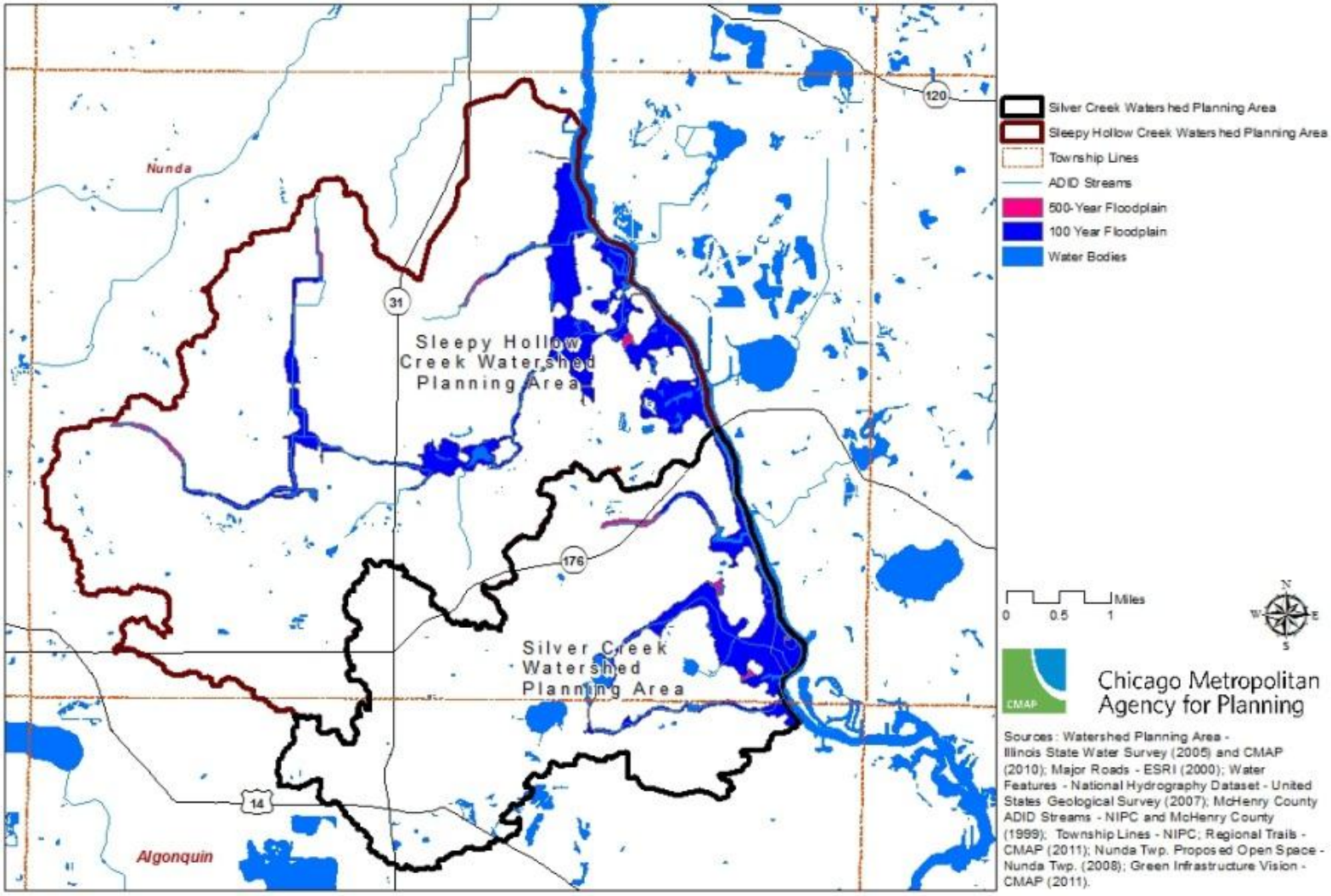
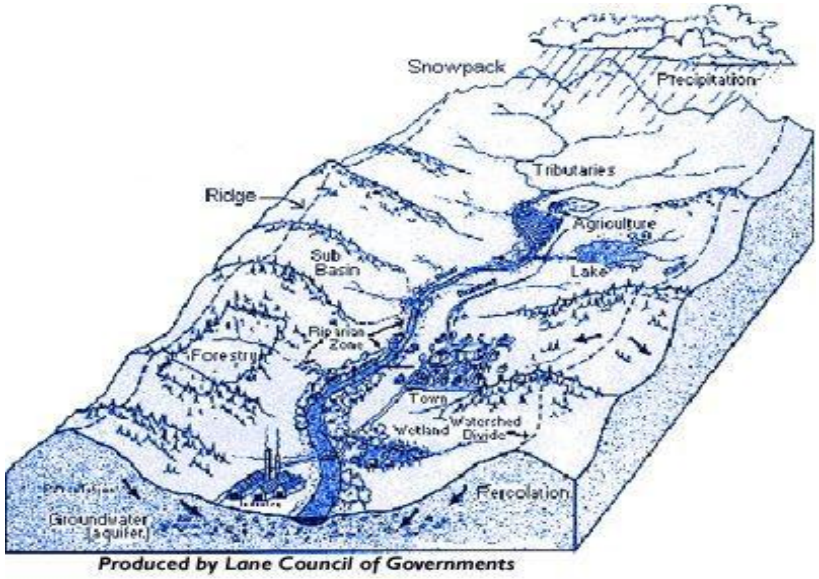


1. Introduction

A watershed is "the total land area and water bodies that drain into a single river or lake system, and/or is the source of groundwater recharge to that river or lake system."[1] (Figure 2) Watershed planning is a collaborative approach among watershed stakeholders that seeks to characterize existing conditions, identify and prioritize water resource issues and recommend strategies to help restore the beneficial uses of impaired waters, as well as to protect and maintain the quality of unimpaired or threatened waters. This planning approach draws on public participation and local input and can also be used to protect and/or restore surface and groundwater, aquatic life, recreational and economic opportunities, and conserve open space.[2] This watershed plan was created following this approach.

Figure 2. Depiction of a watershed boundary



[1] What Is a Watershed?" U.S. EPA, last modified September 19, 2011, accessed November 15, 2011, http://safewater.supportportal.com/link/portal/23002/23015/Article/22163/What-is-a-watershed

[2] Open space and open space reserve are terms generally used to describe a variety of protected or conserved land parcels and water that are in an undeveloped or "open" state.

1.1. Purpose

The Silver Creek and Sleepy Hollow Creek Watershed Action Plan has six main goals: 1) to maintain/achieve healthy surface waters within the adjacent watersheds of Silver Creek and Sleepy Hollow Creek, two tributaries to the Fox River in northern Illinois; 2) to protect the quality of groundwater; 3) to protect the quantity of groundwater; 4) to restore natural areas and increase native species diversity; 5) to increase public awareness and knowledge to motivate needed action to implement the watershed plan; and, 6) to establish an ongoing community participation group to expand watershed planning and protection efforts and support project implementation (*a complete list of goals and management objectives can be found in Appendix A*). The plan inventories existing resources in the watershed planning area, assesses and characterizes critical areas, identifies policy and planning initiative recommendations, identifies a green infrastructure network, identifies Best Management Practices (BMP) to protect and improve water quality, recommends site specific actions and projects, identifies sources of funding for project implementation, and includes education and water quality recommendations.

For planning purposes, one watershed action plan was developed for both watershed planning areas. As such, the Silver Creek and Sleepy Hollow Creek Watersheds will be referred to as the **watershed planning area** in this plan.

1.2. Why You Should Become Involved

Watershed planning provides opportunities for residents of the watersheds to work together to develop local solutions, support local sustainability initiatives, share information, use limited financial resources more effectively, and help raise public awareness on a compendium of water resource protection issues. These include improving stream and lake water quality, protecting groundwater, increasing accessibility to high-quality recreational resources, providing clean drinking water, reducing soil erosion, reducing flooding, supporting economic development, effectively managing stormwater, and restoring aquatic habitat. By working together, residents can implement successful strategies to maintain and restore natural resources within their community. By participating in the planning process that led to the development of this plan, residents of these watersheds can more easily take ownership of the resulting plan and more directly affect the quality-of-life issues that the plan attempts to address.

1.3. History of the Watersheds

The region where Silver Creek and Sleepy Hollow Creek are located was likely encountered by European settlers during the 1830's and 1840's when the first wave of settlement moved into the Northeastern Illinois region. Both Silver Creek and Sleepy Hollow Creek were named by 1872 and appear in the 1872 McHenry County Township (Figure 3) maps.

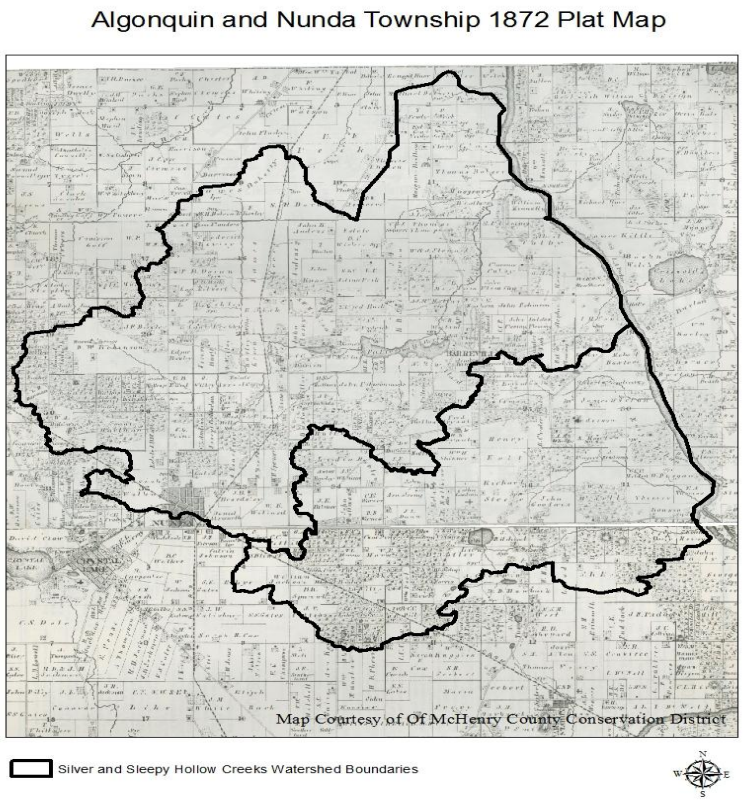
The Silver Creek Watershed includes a number of lakes including Lake Killarney and Silver Lake. Lake Killarney was called Silver Lake until the early 1960's. It was renamed Lake Killarney when Ladd Enterprises developed the property surrounding the lake. Lake Killarney and Silver Lake are connected by a creek running north from Lake Killarney to Silver Lake under Crystal Lake Avenue. Lake Killarney is spring fed and is a source of water for Silver Lake. [3]

Sleepy Hollow Creek was originally named Squaw Creek but renamed Sleepy Hollow Creek approximately ten years ago. Prior to

[3] John Heisler, Nunda Township Supervisor email message to author (s), August 8, 2010.

this, the lower portion of the Sleepy Hollow Creek nearest the Fox River was named Stickney Run after a prominent early settler.[4]

Figure 3. 1872 Plat map of Silver Creek and Sleepy Hollow Creek Watersheds



[4] Ed Collins, McHenry County Conservation District email message to author(s), August 15, 2011.

1.4. Watershed Overview and Location

Silver Creek Watershed Planning Area

The Silver Creek Watershed Planning area lies within the Upper Fox River Basin (Hydrologic Unit Code (HUC) 071200006)[5] and has a drainage area of approximately 11 square miles, including 6.7 linear miles of stream network.[6] The total population in the watershed is approximately 11,661.[7]

The watershed includes the Village of Oakwood Hills, portions of the Villages of Prairie Grove, Cary, the City of Crystal Lake, two townships (Nunda and Algonquin), and portions of unincorporated McHenry County (Figure 4). Table 1 breaks down the amount of square miles each municipality contains within the watershed and the percentage of land each municipality represents.[8] Four lakes greater than 6 acres in size (West Lake, Lake Killarney, Silver Lake, and "Chalet Hills Lake") as well as numerous ponds (including "Fel-

[5] "Hydrologic Unit Codes (HUCs) Explained," USGS, last modified August 30, 2007, accessed November 7, 2011, http://nas3.er.usgs.gov/hucs.asp. Watersheds are delineated by United States Geological Survey (USGS) using a nationwide system based on surface hydrologic features. This system divides the country into 21 **regions** (2-digit), 222 **subregions** (4-digit), 352 **basins** (6-digit), and 2,262 **subbasins** (8-digit). A hierarchical hydrologic unit code (HUC) consisting of 2 digits for each level in the hydrologic unit system is used to identify any hydrologic area. This system has been divided further into smaller units, resulting in two newer levels called **watersheds** (fifth level, 10 digits) and **subwatersheds** (sixth level, 12 digits).

[6] There are other Fox Tributaries in the planning area (e.g. Fel-Pro Creek).

[7] Bureau of the Census. "2010 Census Summary File 1." *2010 Census*, McHenry County, Illinois. Washington, D.C.: Bureau of the Census, 2011. http://www2.census.gov/census_2010/04-Summary_File_1 (accessed November 3, 2011).

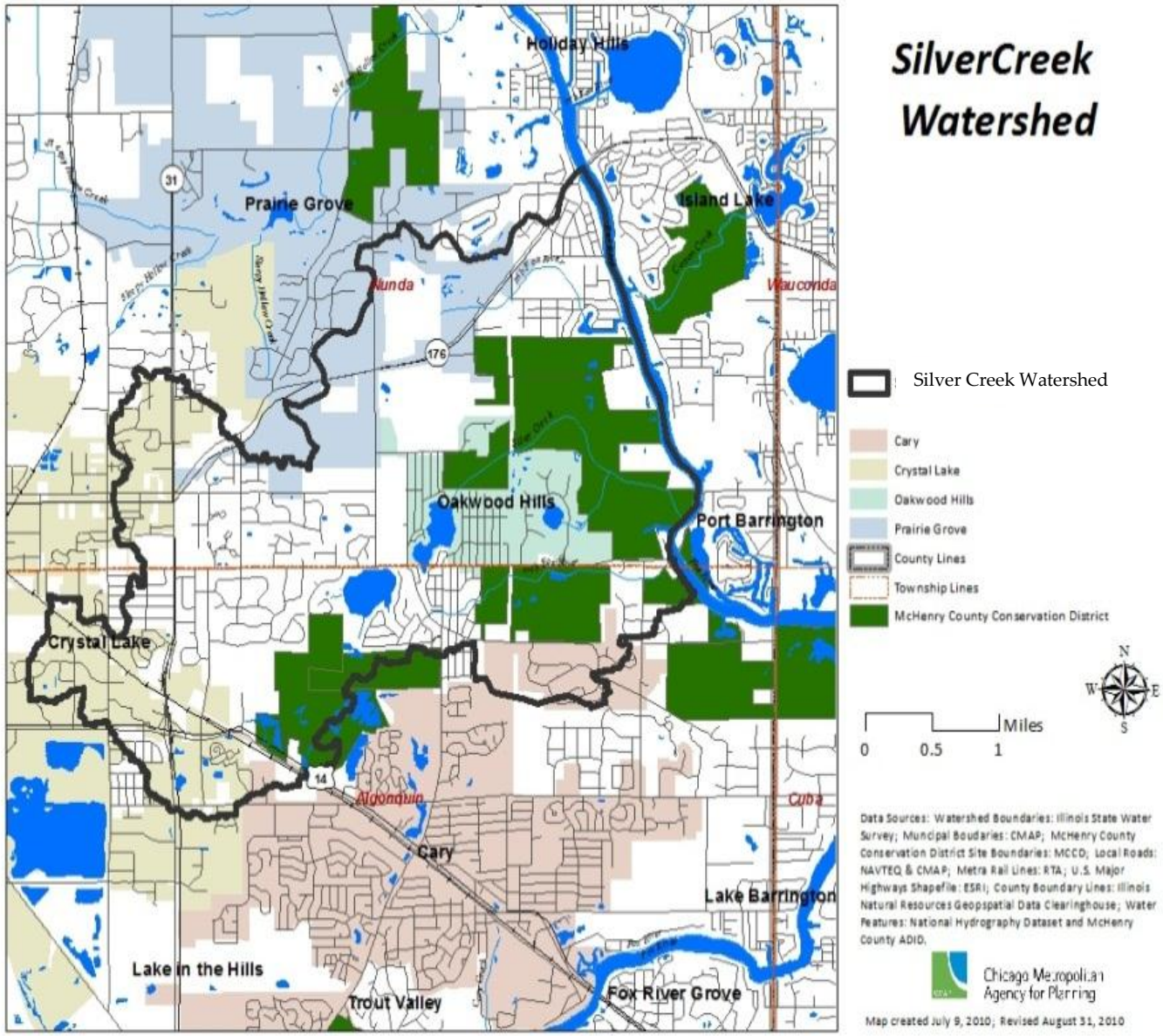
[8] There are other Fox Tributaries in the planning area.

Pro Pond") lie within the watershed. Additionally, McHenry County Conservation District's Silver Creek, Fel-Pro RRR, and The Hollows conservation sites are within the Silver Creek Planning Area. Lastly, a dedicated Illinois Nature Preserve, Oakwood Hills Fen (Village of Oakwood Hills site), is also within this planning area.

Table 1. Number of square miles for each municipality within the Silver Creek Watershed and percentage of land each governmental unit represents

MUNICIPALITY	SQUARE MILES	PERCENTAGE
Village of Oakwood Hills	1.17	10.4%
Village of Prairie Grove	0.09	8.8%
Village of Cary	0.45	4.1%
City of Crystal Lake	1.51	13.4%
Nunda Township	6.80	60.2%
Algonquin Township	4.50	39.8%

Figure 4. Silver Creek Watershed and its municipalities



Sleepy Hollow Creek Watershed Planning Area

The Sleepy Hollow Creek Planning Area, also within the Upper Fox River Basin, has a drainage area of approximately 20 square miles, including 13.8 linear miles of stream network.[9] Thunderbird Lake also lies within the planning area. The watershed is home to two dedicated Illinois Nature Preserves; Wingate Prairie and Sterne's Fen, both owned by the Crystal Lake Park District, Stickney Run (McHenry County Conservation District), and Prairie Ridge Conservation Area (Crystal Lake Park District) are also found within the watershed.

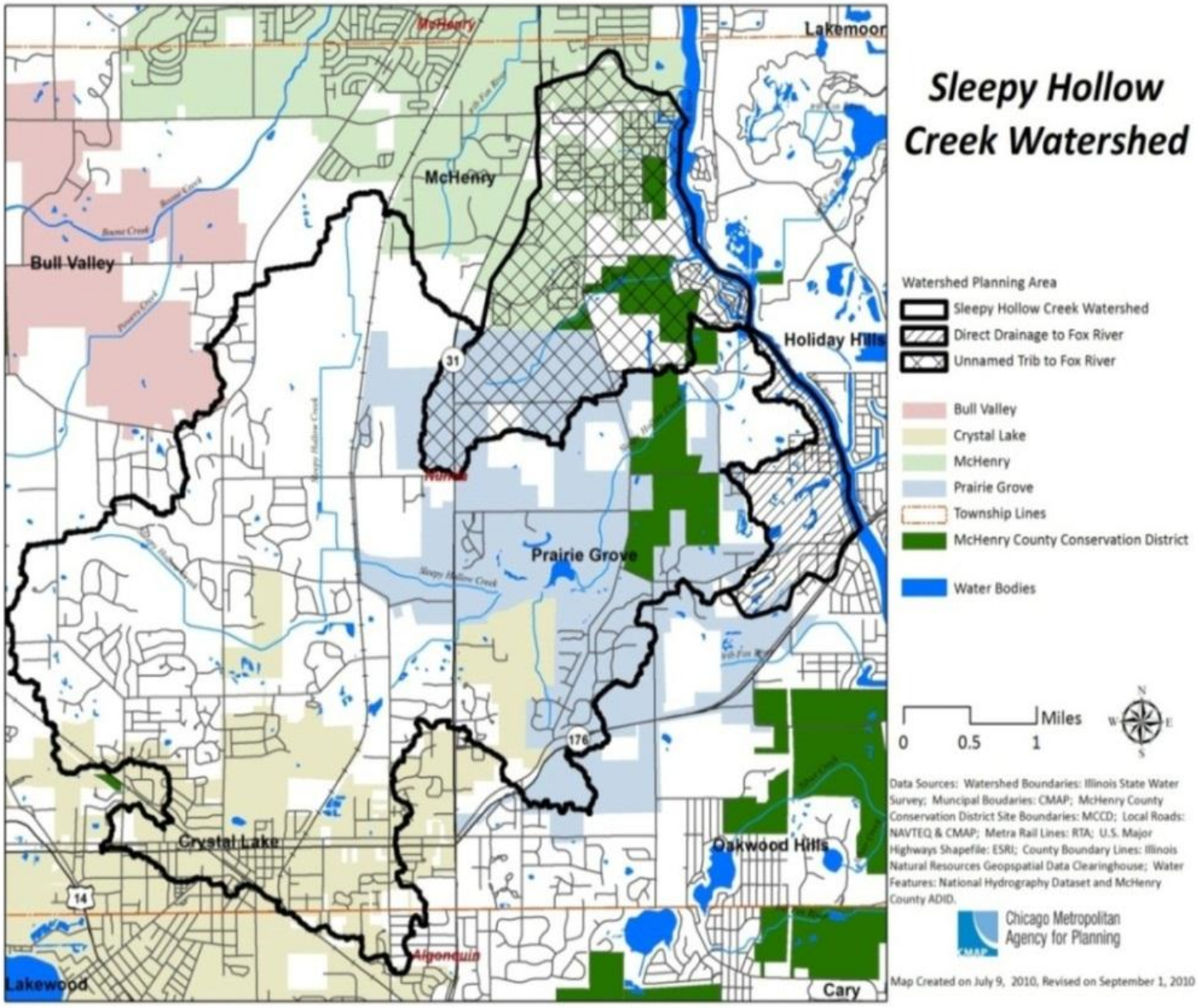
The planning area (Figure 5) covers portions of the City of Crystal Lake and the City of McHenry, encompasses the majority of the Village of Prairie Grove, borders the Village of Bull Valley, and includes portions of unincorporated McHenry County. This planning area is also within Nunda Township. Table 2 breaks down the amount of square miles each municipality contains within the watershed and the percentage of land each municipality represents.[10] The total population in the Sleepy Hollow Creek Watershed is 12,068.[11]

Table 2. Number of square miles for each municipality within the Sleepy Hollow Creek Watershed and percentage of land each governmental unit represents

MUNICIPALITY	SQUARE MILES	PERCENTAGE
City of Crystal Lake	3.1	15.6%
Village of Bull Valley	0.2	0.2%
City of McHenry	1.3	6.7%
Village of Prairie Grove	4.6	23.3%
Nunda Township	19.6	98.9%
Algonquin Township	0.2	1.1%

[9] There are other Fox Tributaries in the planning area.
[10] Bureau of the Census. "2010 Census Summary File 1." *2010 Census*, McHenry County, Illinois. Washington, D.C.: Bureau of the Census, 2011
[11] Bureau of the Census. "2010 Census Summary File 1." *2010 Census*, McHenry County, Illinois. Washington, D.C.: Bureau of the Census, 2011. http://www2.census.gov/census_2010/04-Summary_File_1 (accessed November 3, 2011).

Figure 5. Sleepy Hollow Creek Watershed and its municipalities



1.5. Watershed-Based Plan Components and Plan Guide

The fundamental purpose of the watershed-based plan is to evaluate and recommend the best management practices (BMPs) to be implemented which will help to maintain the beneficial uses in the watershed planning area. The goals and management measures identified by both Sleepy Hollow Creek and Silver Creek stakeholders are aimed at this objective.

The USEPA has identified 9 components that a watershed-based plan should incorporate:

1. Identify causes and sources of pollution that will need to be controlled to achieve pollutant load reductions estimated in the watershed plan.
2. Estimate pollutant reduction loads expected from following implementation of management measures described in #3 below.
3. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions estimated under #2 above and an identification of the critical areas where measures need to be implemented.
4. An estimate of the amount of technical assistance, associated costs, potential funding source and parties that will be relied upon to implement.
5. A public information/education component designed to change social behavior.
6. Develop a plan implementation schedule.
7. Develop a description of interim, measureable milestones.
8. Identify indicators that can be used to determine whether pollutant loading reductions are being achieved over time.
9. Develop a monitoring component to evaluate the effectiveness of the implementation efforts over time.

The plan also explores newer regional planning criteria. These four criteria are as follows:

1. Develop a vision for watershed land use by evaluating the collection of local comprehensive plans and considering the potential cumulative impact on future water quality.
2. Set target pollutant-load reductions for impaired waters taking into account both point- and nonpoint-source pollution [12] sources.
3. Consider groundwater protection from both water quality and water quantity perspectives.
4. Compare municipal codes and ordinances against the Center for Watershed Protection's Code and Ordinance Worksheet.

In order to address the criteria listed above, estimating tools and models were used to assess the relative pollutant load contributions from each subwatershed. Usage of these tools was necessary given the absence of specific water quality or pollutant loading data from the watershed planning area. More information on this process can be found in Chapter 3.

[12] "What is Nonpoint Source Pollution?" U.S. EPA, last modified September 29, 2011, accessed November 3, 2011, http://water.epa.gov/polwaste/nps/whatis.cfm. Nonpoint source pollution (NPS) generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. NPS is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters. It can include excess fertilizers, herbicides and insecticides from agricultural lands and residential areas, oil, grease and toxic chemicals from urban runoff and energy production, salt, pet wastes, faulty septic system, sediment from improperly managed construction sites and eroding streambanks, and atmospheric deposition.

1.6. Watershed Roles and Responsibilities

Stakeholder/Planning Committee

Stakeholders are defined as "a person (or group) that is responsible for making or implementing a management action, who will be affected by the action, or who can aid or prevent its implementation."[13] The Silver Creek and Sleepy Hollow Creek Stakeholder Committee includes community leaders, residents, and representatives of local units of government, environmental groups, park districts, landowners, businesses, conservation districts, and special interest groups. This diverse group provided watershed planning input and increased public awareness of water resource issues within the watershed planning area and will work to promote recommendations in the plan.

Project Lead

The Chicago Metropolitan Agency for Planning (CMAP) is the delegated authority for the region's areawide water quality management plan and works with local partners to outline management strategies for eliminating point- and nonpoint-source pollution, protecting groundwater, and managing wastewater throughout the seven-county region.[14] CMAP facilitated monthly stakeholder meetings, which guided the development of this plan, and provided technical assistance that sought to protect and/or remediate water quality in the watershed planning area. CMAP developed a comprehensive watershed inventory of resources, both man-made and natural in the watershed planning area.

Watershed and Outreach Coordinators

The Environmental Defenders of McHenry County (EDMC) and the Fox River Ecosystem Partnership (FREP) are both partners in this watershed planning process and received grants from CMAP.[15,16] In coordination with CMAP and FREP, EDMC served as the watershed coordinator, convened local stakeholders, and executed an information and outreach campaign during the planning process. FREP supported education and outreach efforts by upgrading their website (subwatersheds webpage), highlighting watershed planning activities in their monthly e-newsletter – "Downstream", and hosting a noon Network in the watershed planning area.

[13] "Nonpoint Source (NPS) Outreach Toolbox," U.S. EPA, last modified May 17, 2011, accessed November 3, 2011, http://www.epa.gov/owow_keep/NPS/toolbox/print/stakeholderguide.pdf.

[14] NIPC. *Areawide Water Quality Management Plan for Northeastern Illinois*. Chicago, IL: CMAP, 1979.

[15] EDMC is a nonprofit environmental education and protection organization incorporated in 1971. Stream and groundwater protection, community planning and sustainable growth, recycling, and educational presentations are strong focuses of the group. See EDMC's website at http://www.mcdef.org/.

[16] FREP is a not-for-profit created in 1996, comprised of local governments, private businesses, not-for-profits and landowners in the Fox River Basin. FREP's vision for the Fox River Basin "is to balance all the uses and demands on our natural resources while preserving and enhancing a healthy environment." See FREP's website at http://foxriverecosystem.org/index.htm.

2. Watershed Resource Inventory and Assessment

The resource and assessment inventory summarizes relevant natural and human resources data for the watershed planning area. It does not enumerate all of the data collected for the combined watersheds, but highlights watershed characteristics that are important to planning and formulating best management practices for the plan.

2.1. Fox River Overview

The watershed planning area drains to the Fox River (Figure 6) and is located in southeastern McHenry County, Illinois, approximately 40 miles northwest of downtown Chicago. According to the 2010 U.S. Census Bureau Report, McHenry County's total population is 308,760 which represents an 18.7% increase in population growth since 2000.[17]

The Fox River is the third largest tributary of the Illinois River stretching 185 miles (115 miles in Illinois) from its headwaters near Waukesha, Wisconsin, to its confluence with the Illinois River in Ottawa. The Fox River Basin covers approximately 2,658 square miles of which 1,720 (65%) are in Illinois. The river basin includes portions of eleven Illinois counties including six (Cook, DuPage, Kane, Lake, McHenry, and Will) that are the most populated in the state and six that are among the top ten fastest growing counties in Illinois (#1: Kendall, #2: Will, #3: Grundy, #5: Kane, #7: McHenry, #8: DeKalb)[18]. An attraction for the population growth in the Fox River Basin is the abundance of recreational opportunities and high quality natural resources associated with the river and its tributaries. However, those same high quality resources are being lost or significantly impaired by development that is often inconsistent with sustainable land and water resources stewardship, and other human activities that are not sufficiently protective of natural resources. Working to restore these watersheds supports healthy local communities and also helps to restore the Fox River. Working to restore the health of the Fox River can be advanced by protecting the watershed planning area.

The Illinois portion of the Fox River Basin contains about 2,300 river and tributary stream miles and 406 lakes, many of the lakes glacially formed.[19] The most noticeable of these lakes form the Chain O' Lakes in northeastern Lake County, comprised of fifteen interconnected lakes with more than 7,500 surface acres of water. Four segments of the Fox River and fourteen glacial lakes are considered to be "biologically significant" with more than 150 state-threatened and endangered species found within the watershed planning area.[20]

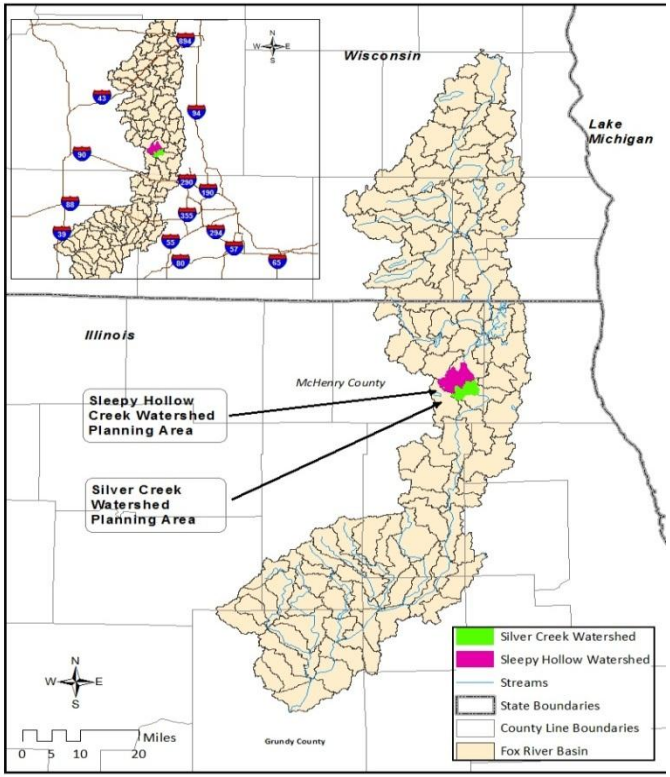
[17] Bureau of the Census. "2010 Census Summary File 1." *2010 Census*, McHenry County, Illinois. Washington, D.C.: Bureau of the Census, 2011. http://www2.census.gov/census_2010/04-Summary_File_1 (accessed November 3, 2011).

[18] Bureau of the Census, Population Division. "Population Estimates for the 100 Fastest Growing U.S. Counties in 2003: April 1, 2000 to July 1, 2004." *Population Estimates Program*, Table CO-EST2003-09 (April 14, 2005). http://www.census.gov/popest/counties/CO-EST2004-09.html(accessed November 3, 2011).

[19] IDNR 1998

[20] IDNR 1997

Figure 6. Location map showing the planning area within the Fox River watershed



2.2. Physical Watershed Characteristics

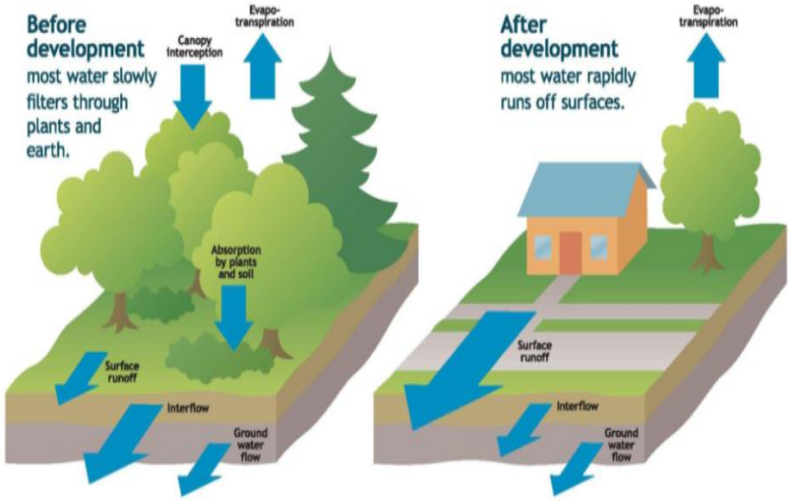
The physical conditions of the watershed planning area must be assessed within the context of a watershed plan. Understanding and analyzing physical conditions help predict how activities within the watershed planning area may improve water quality and groundwater resources. An examination of physical characteristics, including land use practices, specifically correlates to human and ecosystem well-being.

Land Use

Land use decisions have a significant impact on water quality. For example, developed areas include impervious surfaces (non water-absorbing),[21] reduced natural vegetation, and causes considerable change to local hydrology. Stormwater picks up pollutants as it quickly runs across impervious surfaces such as conventional roofs, parking lots, driveways, and lawns. These pollutants are carried into streams and lakes and negatively impact aquatic life. Such a scenario can also contribute to local or regional flooding. Additionally, impervious surfaces reduce or prevent the natural infiltration of rainwater and snowmelt into the ground and thus, reduce natural groundwater recharge. Land use, therefore, is an important consideration in watershed planning. Figure 7 illustrates change in surface runoff before and after typical development.

[21] "Water Science for Schools," USGS, last modified February 8, 2011, accessed November 3, 2011, http://ga.water.usgs.gov/edu/impervious.html. Naturally vegetated areas that have been replaced by roads, buildings, housing developments, and parking lots are described as impervious surfaces.

Figure 7. Surface runoff before and after land use development



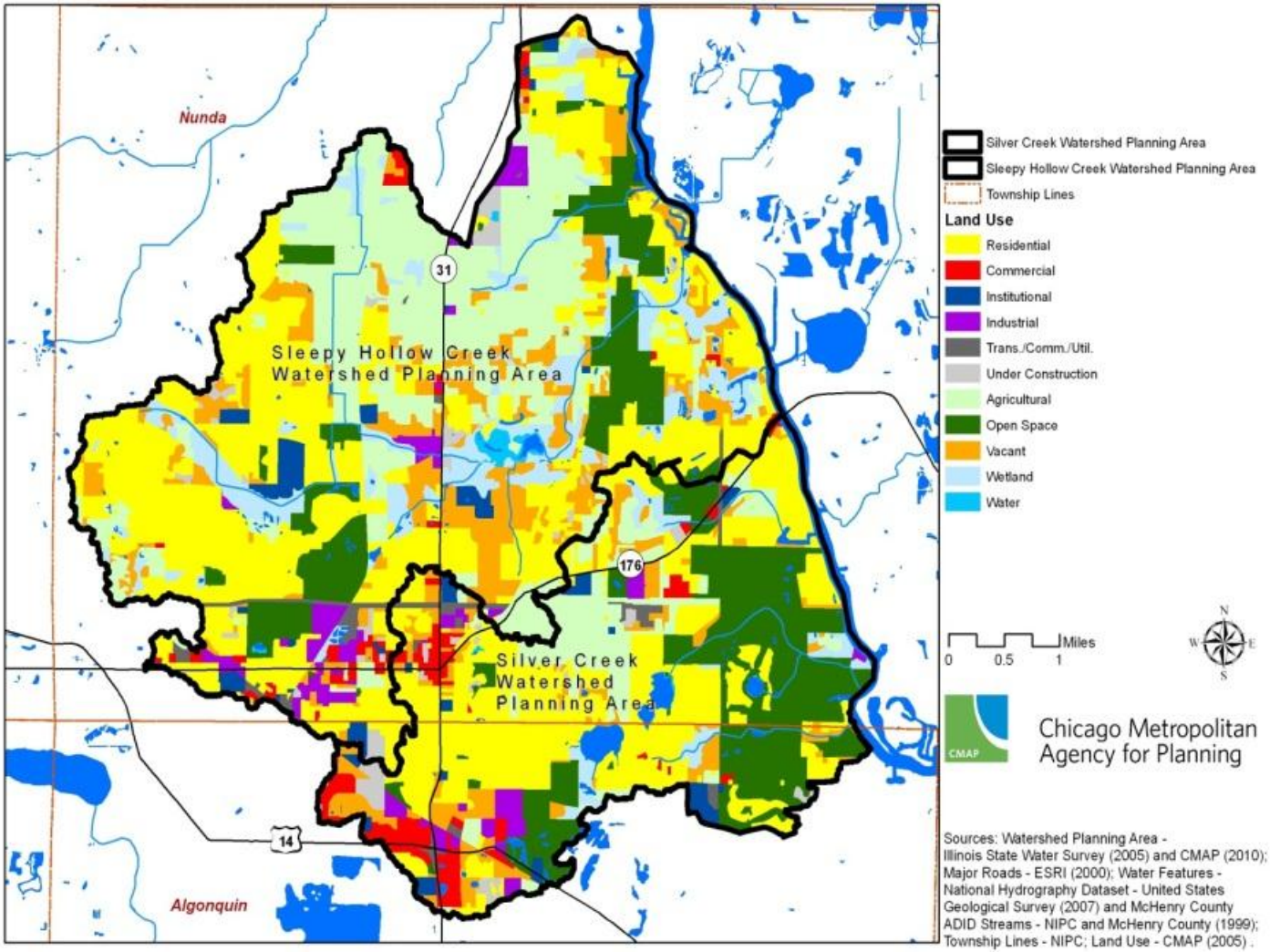
Land use within the planning area is presented in Table 3 and illustrated in Figure 8.[22] Residential land use accounts for 35% of the Sleepy Hollow Creek Watershed and about 37% of the Silver Creek Watershed. Agriculture is the next most common land use in Sleepy Hollow (25%), while open space is the second most common land use in Silver Creek (24.9%).

Table 3. Land use in the watershed planning area

	SQUARE MILES		ACREAGE (ACRES)		PERCENT OF TOTAL WATERSHEDS	
LAND USE	SILVER CREEK	SLEEPY HOLLOW CREEK	SILVER CREEK	SLEEPY HOLLOW CREEK	SILVER CREEK	SLEEPY HOLLOW CREEK
Residential	4.12	6.98	2,640	4,466	36.6%	35.1%
Agricultural	1.19	4.87	762	3,119	10.6%	24.5%
Commercial and Services	0.59	0.26	373	167	5.2%	1.3%
Institutional	0.26	0.41	168	260	2.3%	2.0%
Industrial	0.30	0.46	192	294	2.7%	2.3%
Transportation/ Communication/Utilities	0.17	0.18	110	117	1.5%	0.9%
Under Construction	0.20	0.33	131	208	1.8%	1.6%
Open Space	2.80	1.85	1,793	1,184	24.9%	9.3%
Vacant	0.99	2.37	633	1,516	8.8%	11.9%
Wetland	0.30	1.85	194	1,184	2.7%	9.3%
Water	0.33	0.31	211	200	2.9%	1.6%

[22] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011). Locals are encouraged to contact individual units of government to obtain current planning/zoning data.

Figure 8. Land use in the watershed planning area

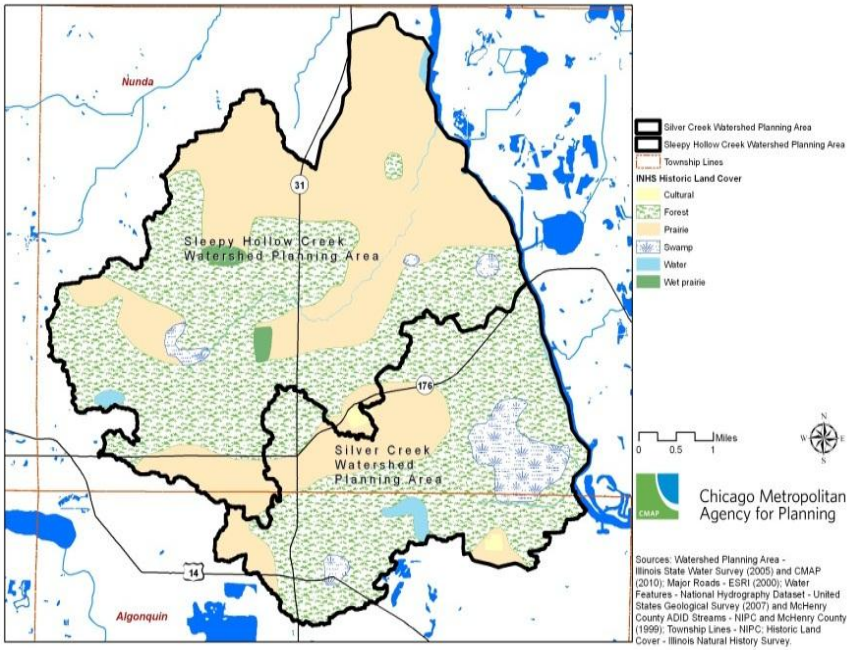


Presettlement Land Cover

Recognizing presettlement land cover conditions is essential in guiding future land management and restoration efforts. Knowing where these landscapes naturally occurred improves an understanding of landscape patterns and supports effective management goals.

The watershed planning area was home to an abundance of natural vegetation including wetlands, woodlands, and prairies. Figure 9 depicts presettlement land cover conditions.

Figure 9. Presettlement land cover



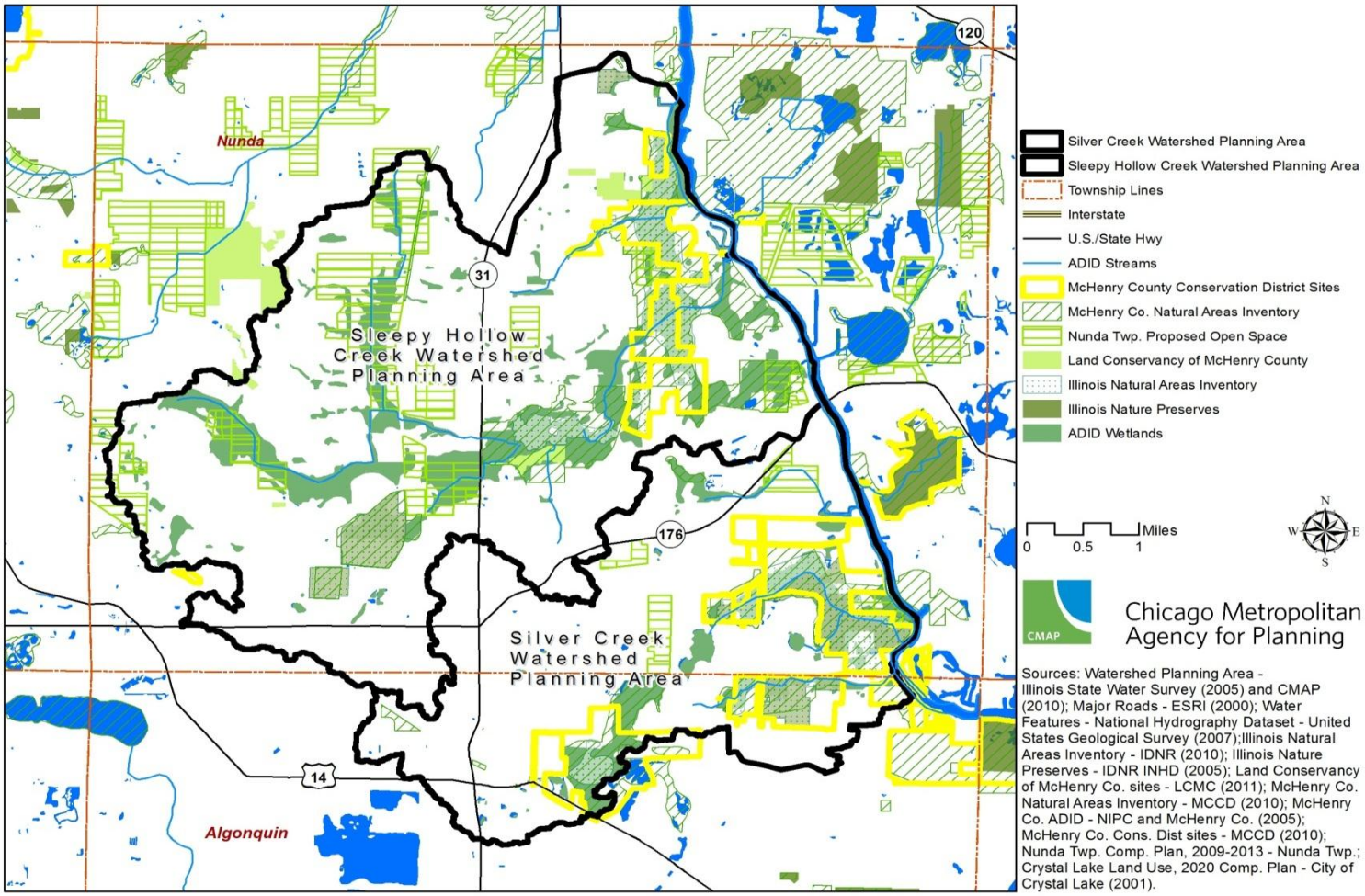
Protected Open Space and Natural Areas

Open space means those undeveloped or minimally developed lands that conserve and protect valuable natural features or processes.[23] It supports ecosystem diversity, enhances property values, contributes to a high quality of life, and is valuable in protecting water quality. The watershed planning area has 128 acres of Land Conservancy of McHenry County District sites; 2,098 acres of McHenry County Conservation District (MCCD) sites; 2,879 acres of McHenry County Natural Areas Inventory (MCNAI) sites; and 1,723 acres of Illinois Natural Areas Inventory (INAI) sites. There are also five dedicated Illinois Nature Preserves totaling 680 acres including Fel-Pro Triple R Fen, Wingate Prairie, Oakwood Hills Fen, Sterne's Fen, and Bates Fen in the Silver Creek Conservation Area (Figure 10).[24]

[23] *Illinois Open Land Trust Act*. *Ill. Comp. Stat*. 525 (1999), § 33, Section 10. http://ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1740&ChapterID=44 (accessed December 28, 2011).

[24] The open space categories used are not mutually exclusive. As an example, MCCD-owned properties include portions of MCNAI sites and INAI sites. Nature preserves are by definition also INAI sites. The Land Conservancy of McHenry County sites include portions of MCNAI sites.

Figure 10. Open space and natural areas

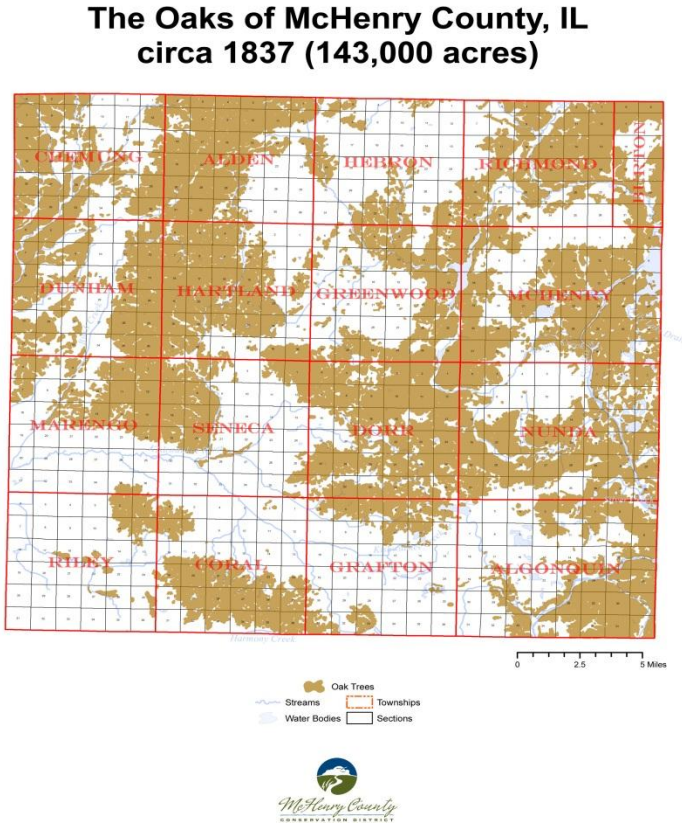


Oak Stands

Prior to European settlement, oak groves covered much of McHenry County. A significant decline in natural vegetation included the loss of oak tree cover. Since 1840, "over 88% of the county's original oak ecosystems are no longer in existence or modified to the extent that they are no longer ecologically sustainable."[25] Figure 11 illustrates the decline in oak stands between 1840 and 2005.[26]

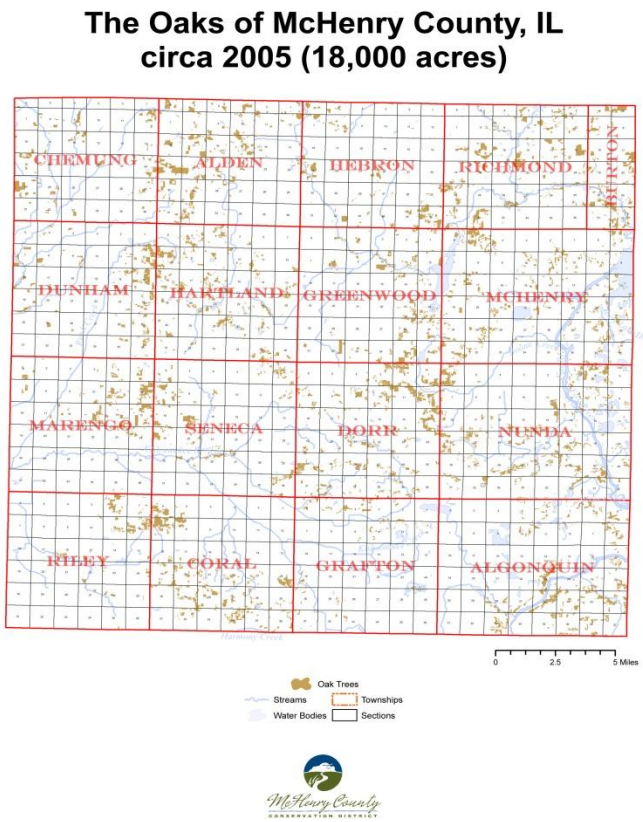
Identification of remaining natural areas, including oak stands, supports conservation efforts and should be used as a tool to preserve important natural landscapes and establish greenways. New conservation opportunities and best management projects aimed at restoring natural vegetation and biodiversity may be identified and implemented in order to provide links between fragmented habitats.

Figure 11. Oak Stand comparison



[25] McHenry County, Illinois, Department of Planning and Development. *McHenry County 2030 Comprehensive Plan*. Woodstock, IL: McHenry County Department of Planning and Development, 2010. http://www.co.mchenry.il.us/departments/planninganddevelopment/Pages/2030Plan.aspx (accessed November 7, 2011).

[26] McHenry County Conservation District. *The Oaks of McHenry County*. Woodstock, IL: MCCD, 2009. http://www.mccdistrict.org/web/assets/publications/brochures/OaksofMcHenryspreads_WC.pdf (accessed October 6, 2011).



Forest Management Plan

The Illinois Department of Natural Resources (IDNR), Office of Resource Conservation, Division of Forestry, works with private landowners to reforest agricultural land and help with managing private woodlots. The Illinois Forestry Development Act (IFDA; 525 ILCS 15), funded in part by the U.S.D.A. Forest Service, provides for this program. The IFDA created the Illinois Forestry Development Council, the Forestry Development Cost Share Program, and the Forestry Development Fund. Timber harvests in the State of Illinois are subject to a 4% harvest fee and that money helps to fund the cost-share component of the program.[27]

Ten acres of woods is the minimum land-area requirement, eleven acres if a home is present on the property, to participate in the program. The program requires a landowner to develop an IFDA-approved management plan. With passage of the IFDA, the Illinois Property Tax Code was amended in order to provide a tax incentive to timber growers. In counties with less than 3,000,000 residents (i.e., all Illinois counties other than Cook), any land being managed in the IFDA is considered as "other farmland". Thus, the land is valued at one-sixth of its equalized assessed value based on cropland.

In northeastern Illinois, the program emphasizes exotic species removal and oak regeneration. Within the planning area, there are three IFDA properties covering about 30 acres.

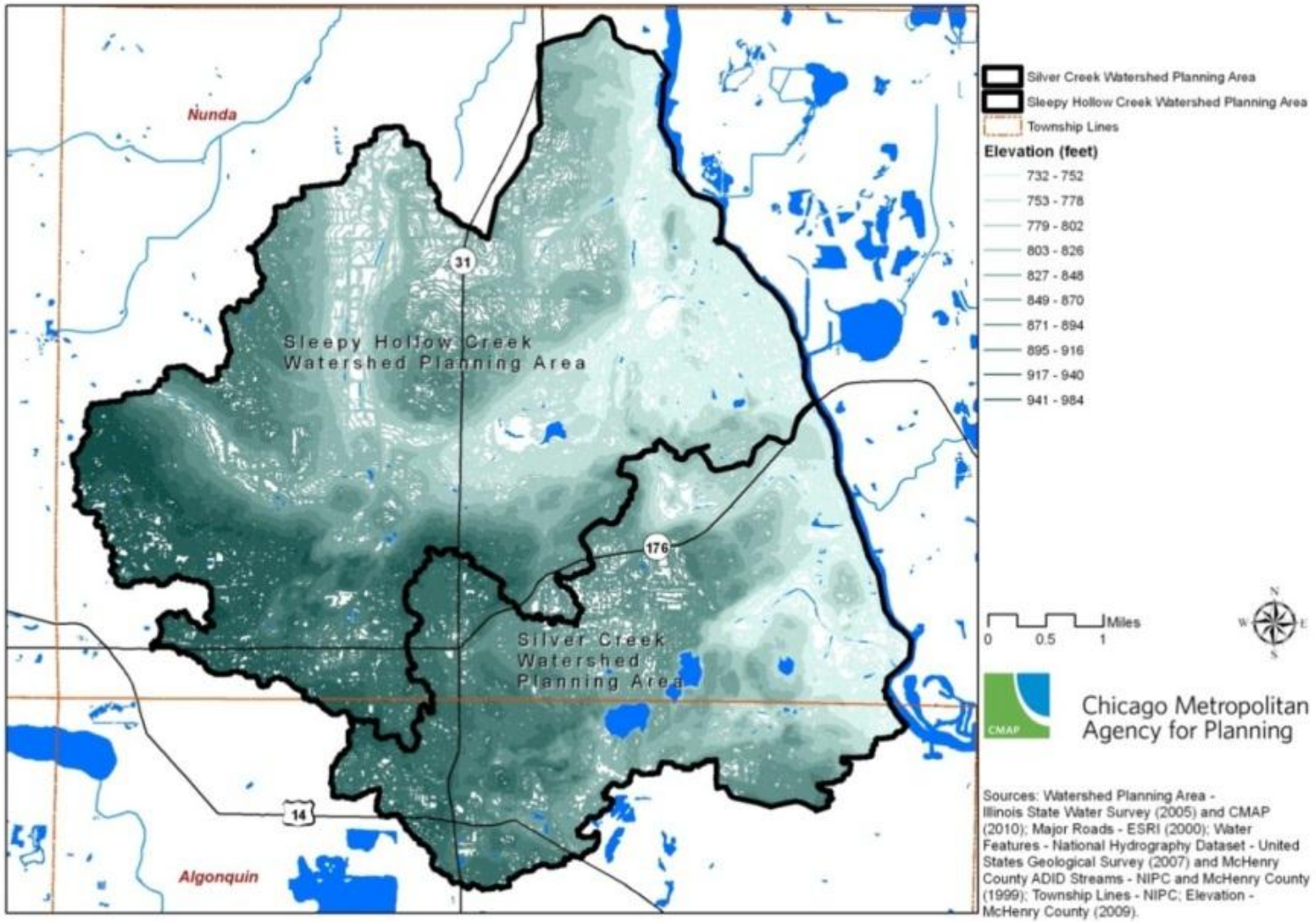
Topography

Elevation within the watershed planning area ranges from a high of 984 feet above mean sea level (AMSL) to a low of 732 feet AMSL for total relief of 252 feet[28] (Figure 12). The highest elevations are generally in the west with lowest elevations along the Fox River to the east and along the main tributary streams that flow eastward accordingly.

[27] IDNR. *Information Sheet: Illinois Forestry Development Act*. Springfield, IL: IDNR, June 2006. http://dnr.state.il.us/conservation/forestry/IFDA/ (accessed November 2, 2011).

[28] CMAP. "Two Foot Topographic Contours." Woodstock, IL: McHenry County, Illinois, 2006.

Figure 12. Topographic elevations within the watershed planning area



Soils

For purposes of this watershed plan, hydric soils, and hydrological soils groups will be discussed. It is important to consider these types of soil classifications as they relate to land use/change, and water quality.

Hydric Soils

According to the Soil Survey Geographic Database, developed by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), hydric soils make up 21 % of the watershed planning area.[29] Hydric soils are developed under sufficiently wet conditions such as flooding, ponding, or saturation for a long enough time period to support the growth and regeneration of hydrophytic vegetation, plants that grow partly or wholly in water. Thus, hydric soils are one indicator of the historic presence of wetlands, and among other matters, are useful in guiding wetland restoration efforts. Figure 13 shows soils that satisfy the characteristics of hydric soils ("All hydric"). Soils can also be classified as "Not hydric," not meeting the hydric soils criteria described above, or "Unknown," lacking sufficient information with which to make a classification.

Hydrologic Soil Groups

Soils may also be described according to their drainage potential and classified as Hydrologic Soil Groups (HSG) as shown in Table 4. HSG soils groups are based on the soil permeability, depth to seasonal high water table, and wetness characteristics. These soil classification systems, including hydrologic groups, are used by planners, municipal officials, builders, and engineers among others to determine site suitability for projects including stormwater planning and design, planning building sites and roads, and onsite wastewater systems.

Group B soils are dominant throughout the planning area at 79% coverage (Figure 14). These soils typically include 10-20% clay, 59-90% sand, and have moderately low runoff potential when thoroughly wet.[30] Conversely, Group B soils are moderately well to well-draining soils and along with Group A soils, indicate rainfall and snowmelt will move relatively easily through these soils and into the groundwater aquifer (or water table). Group C soils coincide with portions of the watershed planning area that are more developed.

Table 4. Hydrologic soil groups

Group A	Soils have a low runoff potential when thoroughly wet. Water is transmitted freely through the soil.
Group B	Soils have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.
Group B/D	The first letter applies to the drained condition and the second to the undrained condition.
Group C	Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted.
Group D	Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted.

[29] USDA NRCS, Soil Survey Staff. *Soil Survey Geographic (SSURGO) Database*. McHenry County, Illinois. Washington, D.C. http://soildatamart.nrcs.usda.gov (accessed September 14, 2011). Hydric soils "formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part" of the soil profile.

[30] USDA NRCS. *National Engineering Handbook*. Washington, D.C.: USDA NRCS, January 2009. http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/manage/?&cid=stelprdb1043063 (accessed November 3, 2011).

Figure 13. Hydric soils within the watershed planning area

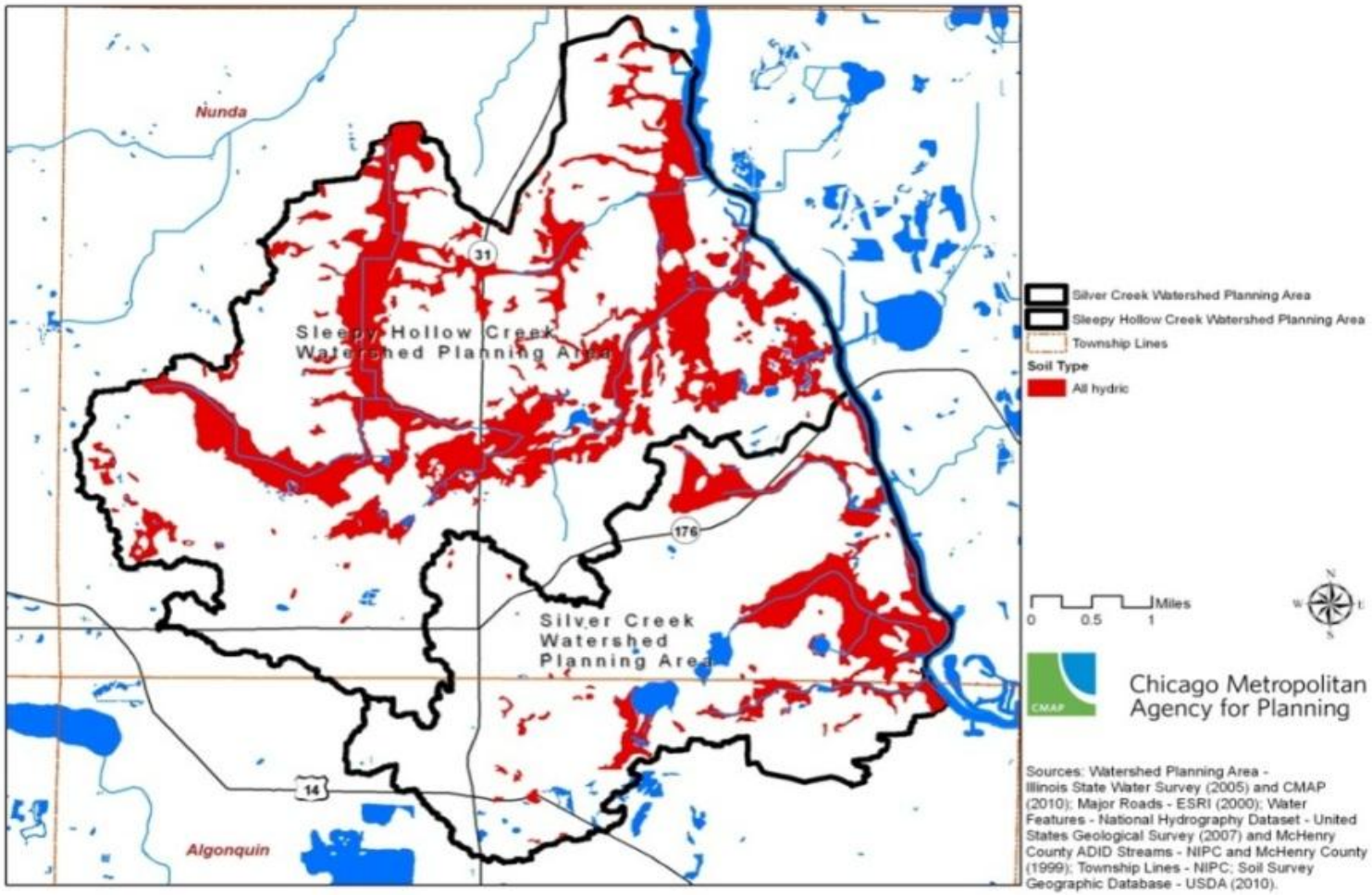
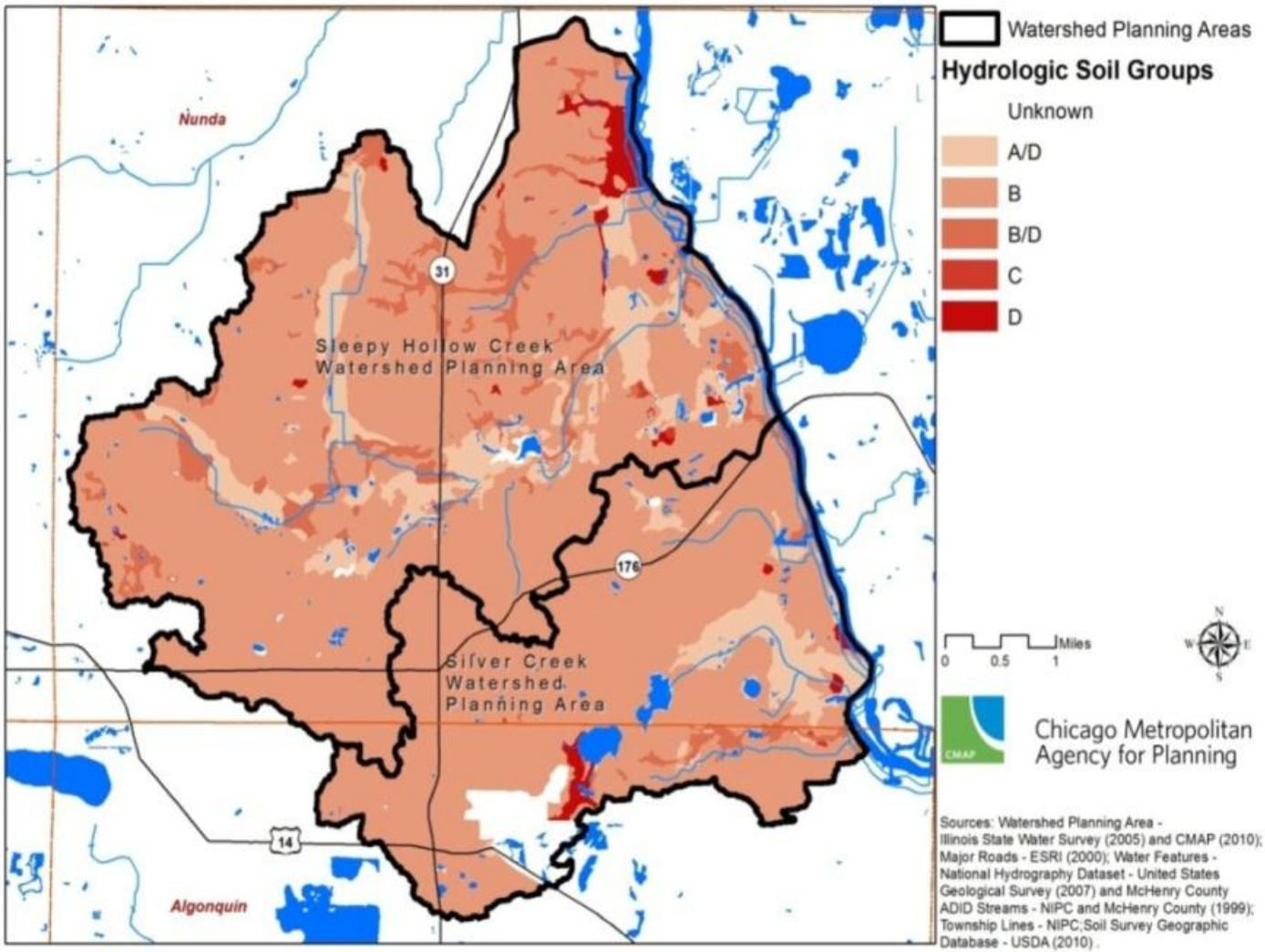


Figure 14. Hydrologic Soil Groups within the watershed planning area



Floodplains and Floodways

A floodplain is defined as "any land area susceptible to being inundated by flood waters from any source."[31] If a natural floodplain is developed for any other use, such use becomes susceptible to flooding. This results in property and crop damage and degraded water quality. Therefore, floodplains and their relationship to land use should be considered in a watershed plan.

Combined, 9.2% of the watershed planning area is within the 100-year floodplain[32] and an additional 0.04% is within the 500-year floodplain.[33] Much of the floodplain exists along the eastern portion of the watershed planning area and adjacent to the Fox River (Figure 15).

A floodway is a subset of the 100-year floodplain. The National Flood Insurance Program defines a floodway as an area "where the water is likely to be deepest and fastest…the area of the floodplain that should be reserved (kept free of obstructions) to allow floodwaters to move downstream."[34] Encroachments in the floodway should be monitored by communities since they lead to increased upstream and downstream flood elevation. Floodways within the watershed planning area tend to be along the lower reaches of Silver Creek and Sleepy Hollow Creek.

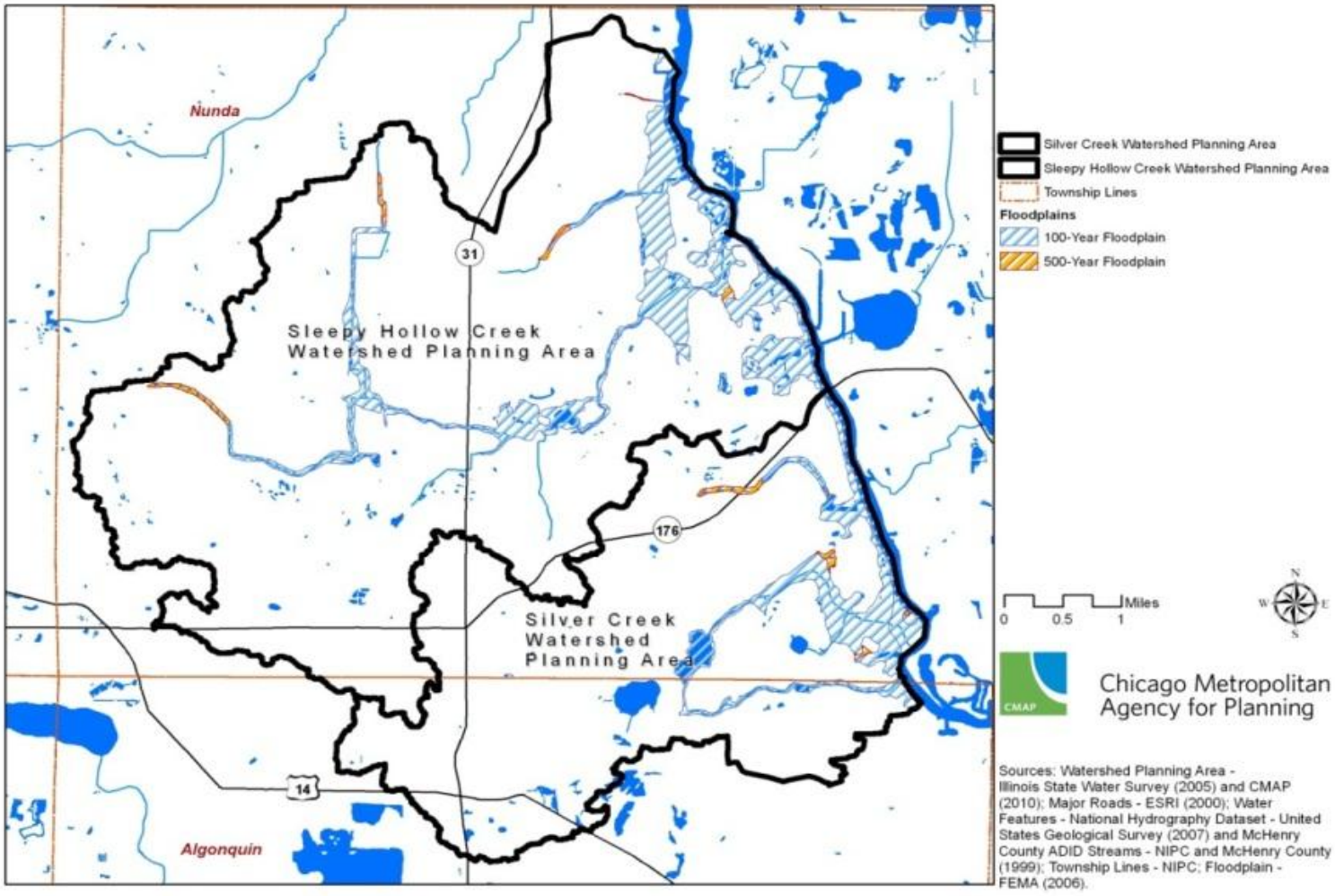
[31] Federal Emergency Management Agency (FEMA), Floodplain Management Requirements, Appendix D: Glossary, August 11, 2010. http://www.fema.gov/pdf/floodplain/nfip_sg_appendix_d.pdf

[32] "Base Flood," FEMA, last modified August 11, 2010, accessed November 3, 2011,http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/base_flood.shtm. A 100 year floodplain is described as a "flood having one percent chance of being equaled or exceeded in any given year."

[33] Base Flood," FEMA, last modified August 11, 2010, accessed November 3, 2011,http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/base_flood.shtm. A 100 year floodplain is described as a "flood having one percent chance of being equaled or exceeded in any given year." A 500 year floodplain is a flood having 0.2% chance of flooding within any given year.

[34] "Floodway," FEMA, last modified August 11, 2010, accessed November 7, 2011,http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/floodway.shtm

Figure 15. 100-and 500-year floodplains in the watershed planning area



Agriculture in the Watershed Planning Area

General Characteristics and Practices

Agricultural land in the watershed planning area accounts for approximately 3,880 acres (Figure 16).[35] More detailed watershed-level statistics do not exist for agricultural land use practices. County-level statistics are available through the U.S. Department of Agriculture's (USDA) 2007 Census of Agriculture. McHenry County is 55% agricultural by land area and of this, 56% is planted in corn and 19% in soybeans.[36] Although row crop agriculture is the predominant agricultural land use in McHenry County, there is also a small amount of animal agriculture. McHenry County accounts for 0.60% of livestock in Illinois with 155,649 head.[37] Figure 17 shows the distribution of land used for livestock and equestrian purposes for Sleepy Hollow Creek and Silver Creek Watersheds, a total of 73 acres.[38]

The Census also collects information on selected agricultural practices. Some of these practices are relevant to the discussion of agricultural impacts to water quality. For McHenry County, a significant number of farmers employ some form of conservation practice: 31% of farms used some form of conservation method for crop production; 12% of farms practiced rotational or management-intensive grazing; and 0.4% of farms grazed livestock on an animal unit month (AUM) basis. [39] Conservation practices include any of the several projects or management practices, like conservation tillage or nutrient management planning, described in the National Resource Conservation Service (NRCS) Illinois Field Office Technical Guides (FOTG's) that are detailed more thoroughly below.[40] Rotational or management-intensive grazing involves systematically moving livestock herds throughout available grazing lands according to a plan that is designed to most efficiently encourage forage growth and livestock health. An AUM is the amount of forage necessary to sustain an animal for a month, varying by the type of animal. An AUM accounting system can be used to calculate the required

[35] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).
[36] USDA NASS. "County Summary Highlights: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 1, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009.
[37] USDA NASS. "County Summary Highlights: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 1, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011).
[38] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).

[39] USDA NASS. "Selected Practices: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 44, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011).
[40] USDA NRCS. *Field Office Technical Guides*. McHenry County, Illinois. Washington, D.C.: USDA NRCS, 2011. http://efotg.sc.egov.usda.gov/efotg_locator.aspx?map (accessed September 13, 2011).

Figure 16. Agriculture within the watershed planning area

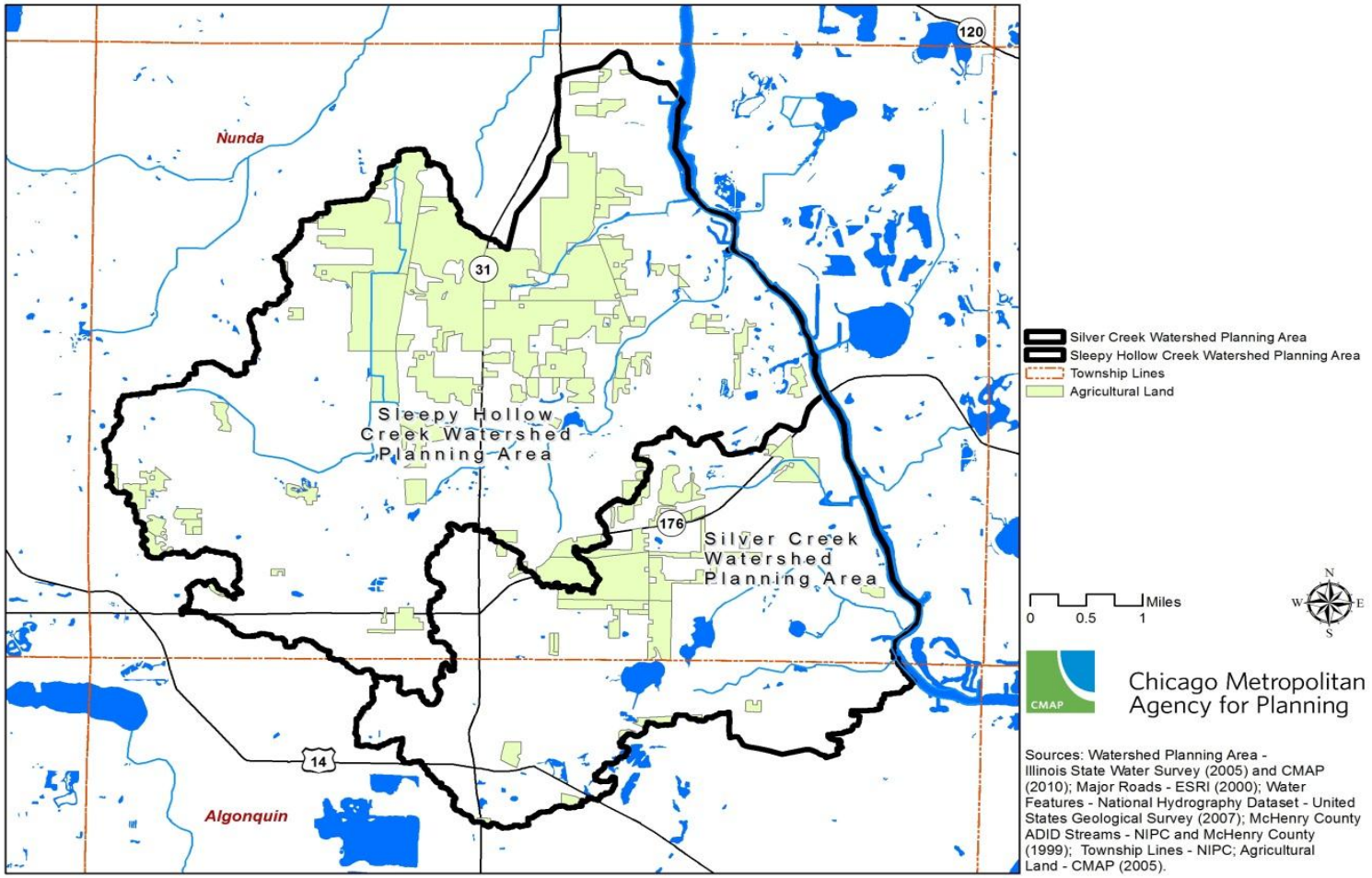
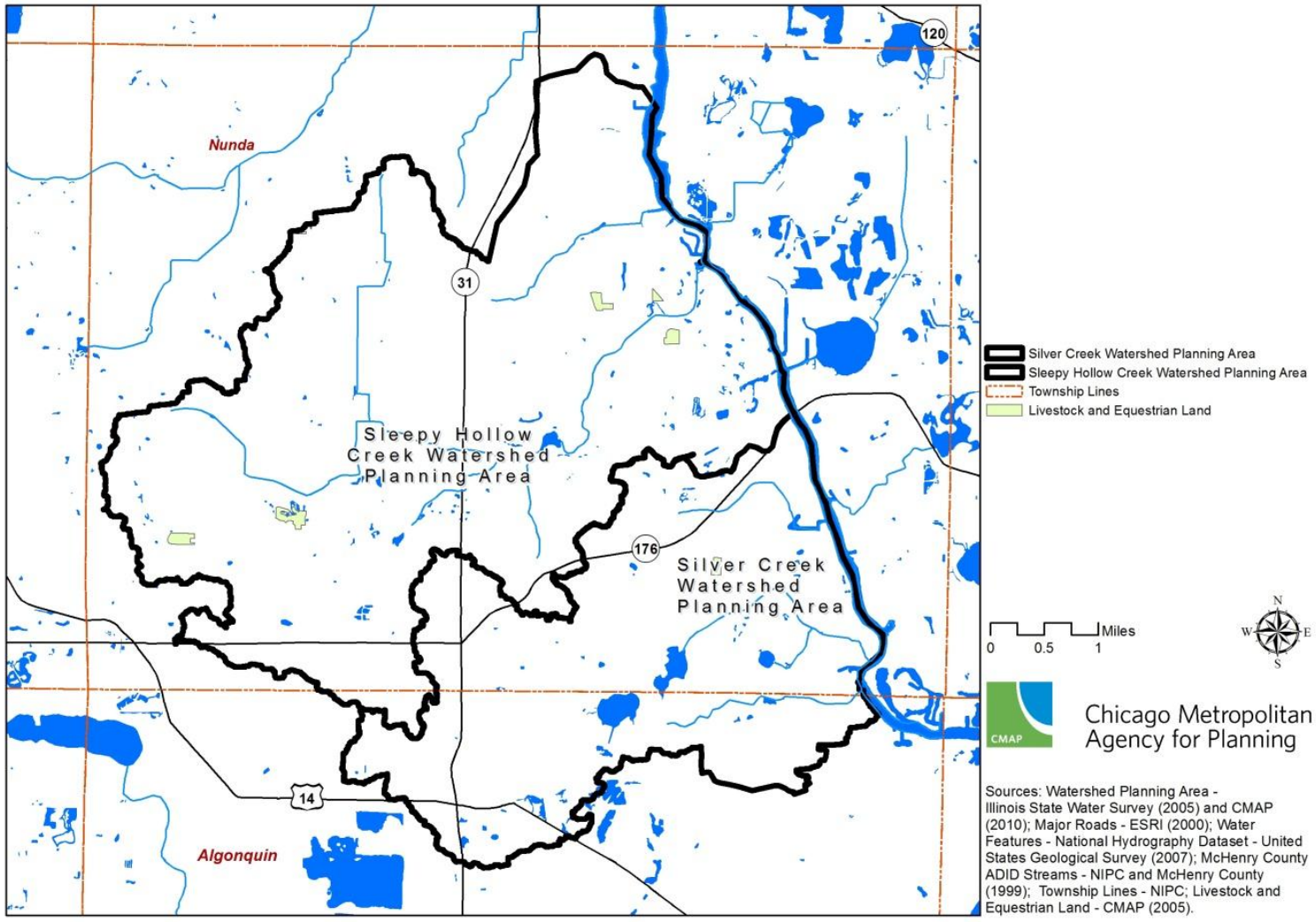


Figure 17. Land used for livestock and equestrian purposes within the watershed planning area



grazing area for a herd, which informs appropriate stocking densities and timing of rotations when farmers are developing grazing patterns.

In addition, 1.3% of agricultural land in McHenry County is enrolled in the Conservation Reserve (CRP), Wetlands Reserve (WRP), Farmable Wetlands, or Conservation Reserve Enhancement Program (CREP) based on the Census.[41] These are voluntary programs for agricultural landowners that provide assistance and incentives to farmers for conserving natural resources on private lands. CRP offers payments to farmers to establish environmentally beneficial plant cover on eligible croplands. The Wetlands Reserve and Farmable Wetlands programs both focus on wetlands, and in the first case, help farmers to protect or restore wetlands on their property, and in the second, enable farmers to prevent degradation of wetlands on land enrolled in CRP. Finally, CREP combines CRP resources with tribal, state and federal authorities for a community-based approach to conservation issues on private lands locally.

Agricultural irrigation can also have direct consequences for water resources given its consumptive nature. Irrigation in Illinois is used to a more limited extent than in other regions. In McHenry County, 3.9% of agricultural land is irrigated.[42] For comparison, at the national level 6.1% of agricultural land is irrigated, while in Illinois, 1.8% of farmland is irrigated.[43] However, a water demand study commissioned by CMAP found that total water withdrawals for agricultural irrigation in northeastern Illinois are not insignificant.[44] Total water withdrawal for McHenry County in 2005 was 50.6 MGD.[45] For the same county and year, total water withdrawal for cropland irrigation was 7.86 million gallons per day (MGD), while estimated water use for livestock was 0.51 MGD.[46] Cropland irrigation and livestock water use therefore accounted for 15% and 1% of total water withdrawals in 2005 in McHenry County respectively.

[41] USDA NASS. "Farms, Land in Farms, Value of Land and Buildings, and Land Use: 2007 and 2002." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 8, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011).

[42] USDA NASS. "Irrigation: 2007 and 2002." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 10, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011).

[43] USDA NASS. "Irrigation: 2007 and 2002." *2007 Census of Agriculture*, United States Summary and State Data, Volume 1, Geographic Area Series, Part 51, Chapter 2, Table 10 Report No. AC-07-A-51. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_US_State_Level/index.asp (accessed September 13, 2011).

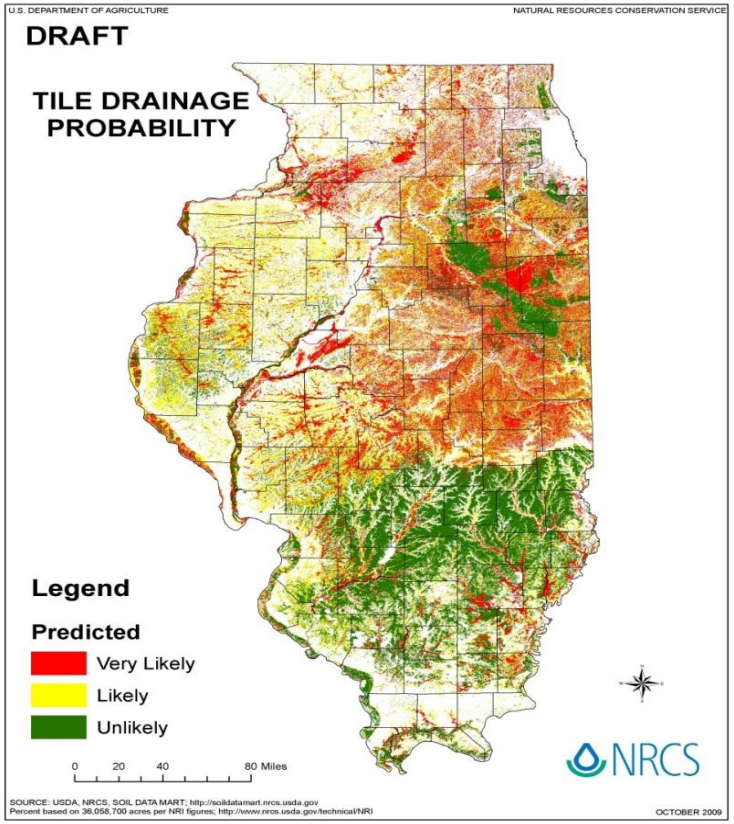
[44] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008. http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

[45] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008. http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

[46] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008. http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

Agriculture in turn is affected by prevalent biophysical conditions in the Sleepy Hollow Creek and Silver Creek Watersheds. Soil conditions in particular can give us an indication of the hydrological character of agricultural land in the watershed planning area, particularly with regard to the likely extent of drainage on agricultural lands. The location and extent of hydric soils and hydrologic soil groups within this watershed, as well as the definitions of these terms, are discussed above. Such soil characteristics inform the overall drainage ability of agricultural lands. The extent of tile drainage is not well-documented at either national or local levels.[47] Drainage classes determined by NRCS are used to estimate the extent of tile drainage in Sleepy Hollow Creek and Silver Creek Watershed. At a statewide level, however, NRCS has performed a similar analysis based on the interpretation of soil groups in the Illinois Drainage Guide. Figure 18 features the results of this analysis by NRCS, depicting the probability of tile drainage for agricultural lands throughout the state of Illinois.[48] Based on this figure, most agricultural lands in McHenry County are either "Likely" or "Very Likely" to have tile drainage.

Figure 18. Probability of tile drainage for agricultural lands throughout Illinois



The likely extent of tile drainage in the watershed planning area is estimated here based on soil drainage classes. NRCS recognizes seven natural drainage classes describing the frequency and duration of wet periods for various soils. The drainage class for soil features is obtained from the SSURGO dataset (Soil Survey

[47] World Resources Institute. *Assessing U.S. Farm Drainage: Can GIS Lead to Better Estimates of Subsurface Drainage Extent?* By Z. Sugg. Washington, D.C.: World Resources Institute 2007. http://pdf.wri.org/assessing_farm_drainage.pdf (accessed September 21, 2011).

[48] "Illinois Suite of Maps: Potential Tile Drainage Extent," USDA NRCS last modified April 11, 2011, accessed September 21, 2011, http://www.il.nrcs.usda.gov/technical/soils/Suite_Maps.html.

Geographic Database).[49] These classes are Excessively Drained, Somewhat Excessively Drained, Well Drained, Moderately Well Drained, Somewhat Poorly Drained, Poorly Drained and Very Poorly Drained.[50] The last three drainage classes indicate soils which limit or exclude crop growth unless artificially drained. Soils with the Somewhat Poorly Drained, Poorly Drained or Very Poorly Drained drainage class occur on 40% of the agricultural land in both watersheds combined. These areas can be taken as an approximation of the likely extent of artificial drainage on currently farmed agricultural lands, given that crop growth on these lands would be impossible or severely impacted without artificial drainage. The extent of soils with these drainage classes is depicted in Figure 19.

Some of these poorly drained areas were likely once wetland areas which are now farmed. There are eight sites identified as "Wetlands Being Farmed" in the CMAP 2005 Land Use Inventory on agricultural lands within watershed planning area (Figure 20).[51] Officially, a Farmed Wetland is a wetland that has been modified to produce agricultural goods and that meets certain hydrologic conditions.[52] The CMAP classification, however, might not meet these criteria. "Wetlands Being Farmed" were identified for the CMAP 2005 Land Use Inventory from any features in the National Wetlands Inventory that are greater than 2.5 acres, on agricultural lands, and verified to be an existing wetland through aerial photography.[53] Farmed wetlands meeting the official definition are often still wet enough to act as valuable wetland habitats that are subject to Swampbuster, the Wetland Conservation provision in the Farm Bill, and Clean Water Act Section 404, which regulates the management of wetland areas. Consequently, these eight wetlands might be potential BMP implementation sites for wetland restoration opportunities given sufficient interest and ability on the part of these private landowners. Additionally, these eight sites might require further investigation to determine whether they meet the official Farmed Wetlands classification.

Like wetlands, HEL are also the focus of specific NRCS conservation efforts. Sodbuster, the Highly Erodible Land Conservation Compliance provision in the Farm Bill (Food Security Act), requires that farmers producing agricultural goods on ground deemed highly erodible land must use a USDA approved conservation system[54] that reduces erosion to the T level.[55] Any HEL currently being farmed in

[49] USDA NRCS, Soil Survey Staff. *Soil Survey Geographic (SSURGO) Database*. McHenry County, Illinois. Washington, D.C. http://soildatamart.nrcs.usda.gov (accessed September 14, 2011).
[50] Soil Conservation Service, Soil Survey Staff. Soil Survey Manual. USDA Handbook 18. Washington, D.C.: USDA NRCS, 1993. http://soils.usda.gov/technical/manual/ (accessed September 14, 2011).
[51] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).
[52] "Highly Erodible Land and Wetland Conservation." *Code of Federal Regulations*. Title 7, Part 12 (1996). http://edocket.access.gpo.gov/cfr_2011/janqtr/pdf/7cfr12.2.pdf (accessed September 14, 2011).
[53] David Clark, Senior Analyst for CMAP, email message to author(s), September 14, 2011.
[54] "Highly Erodible Land Conservation Compliance Provisions," USDA NRCS, accessed October 3, 2011, http://www.nrcs.usda.gov/wps/portal/nrcs/detail/?ss=16&navtype=SUBNAVIGATION&cid=nrcs143_008440&navid=100170150000000&pnavid=100000000000000&position=Welcome.Html&ttype=detail&pname=Highly%20Erodible%20Land%20Conservation%20Compliance%20Provisions%20|%20NRCS.
[55] "Highly Erodible Land Conservation Compliance Provisions," USDA NRCS, accessed October 3, 2011, http://www.nrcs.usda.gov/wps/portal/nrcs/detail/?ss=16&navtype=SUBNAVIGATION&cid=nrcs143_008440&navid=100170150000000&pnavid=100000000000000&position=Welcome.Html&ttype=detail&pname=Highly%20Erodible%20Land%20Conservation%20Compliance%20Provisions%20|%20NRCS

the watershed planning area (Figure 21) might be subject to these provisions. Violations of Swampbuster or Sodbuster can result in the loss of some or all USDA program benefits to the farmer.

Figure 19. Soil drainage classes within the watershed planning area

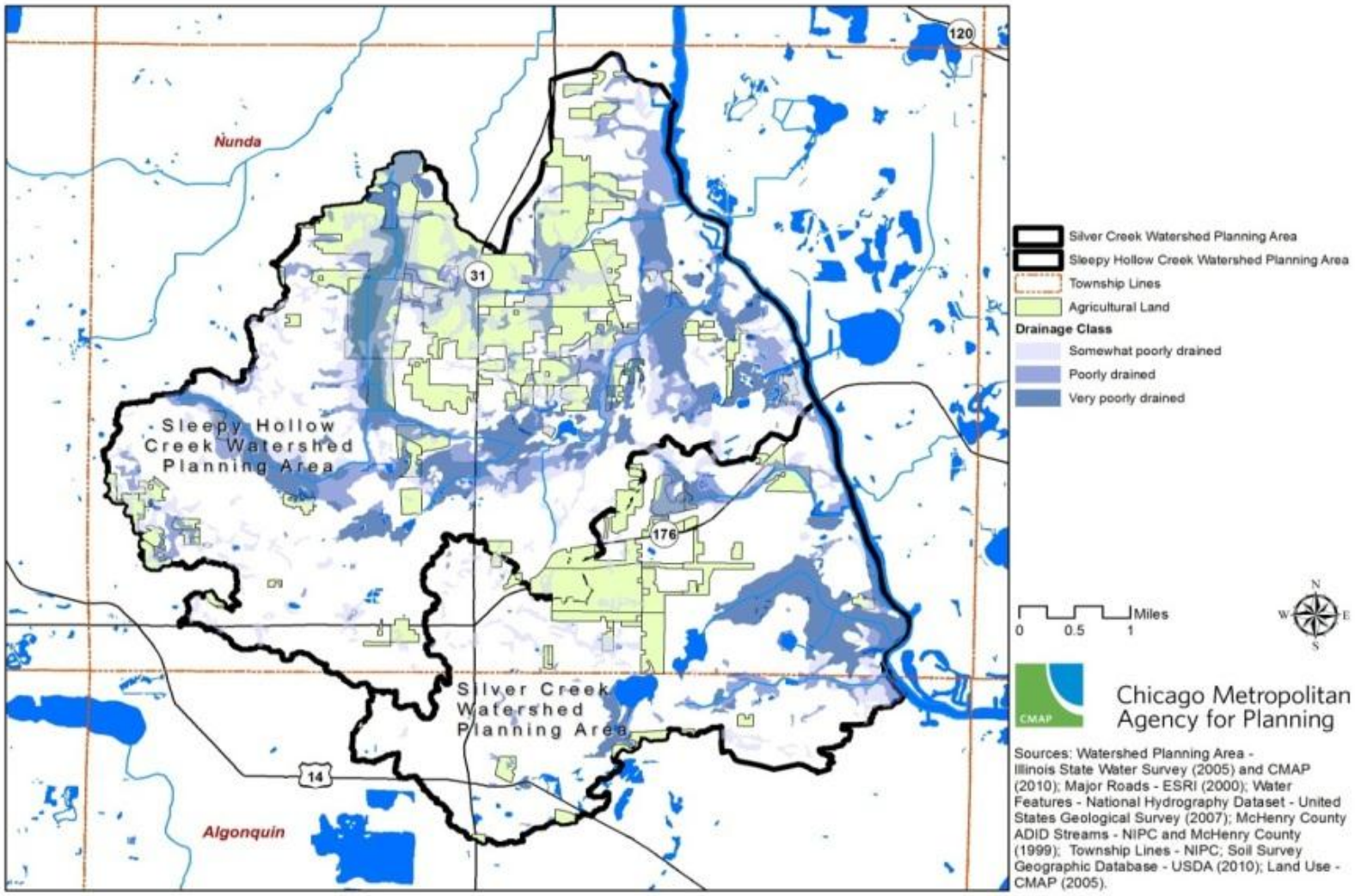


Figure 20. Farmed wetlands within the watershed planning area

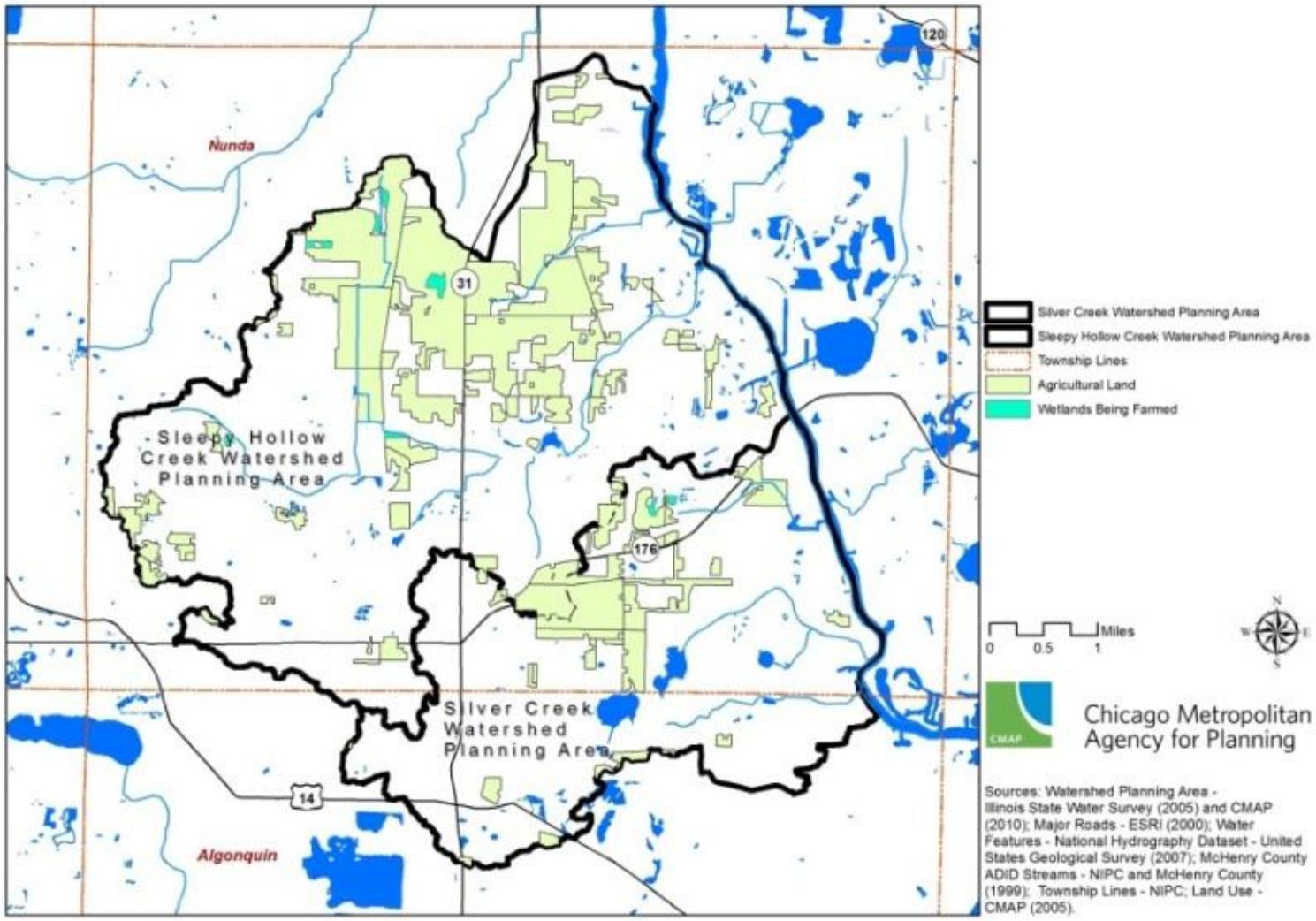
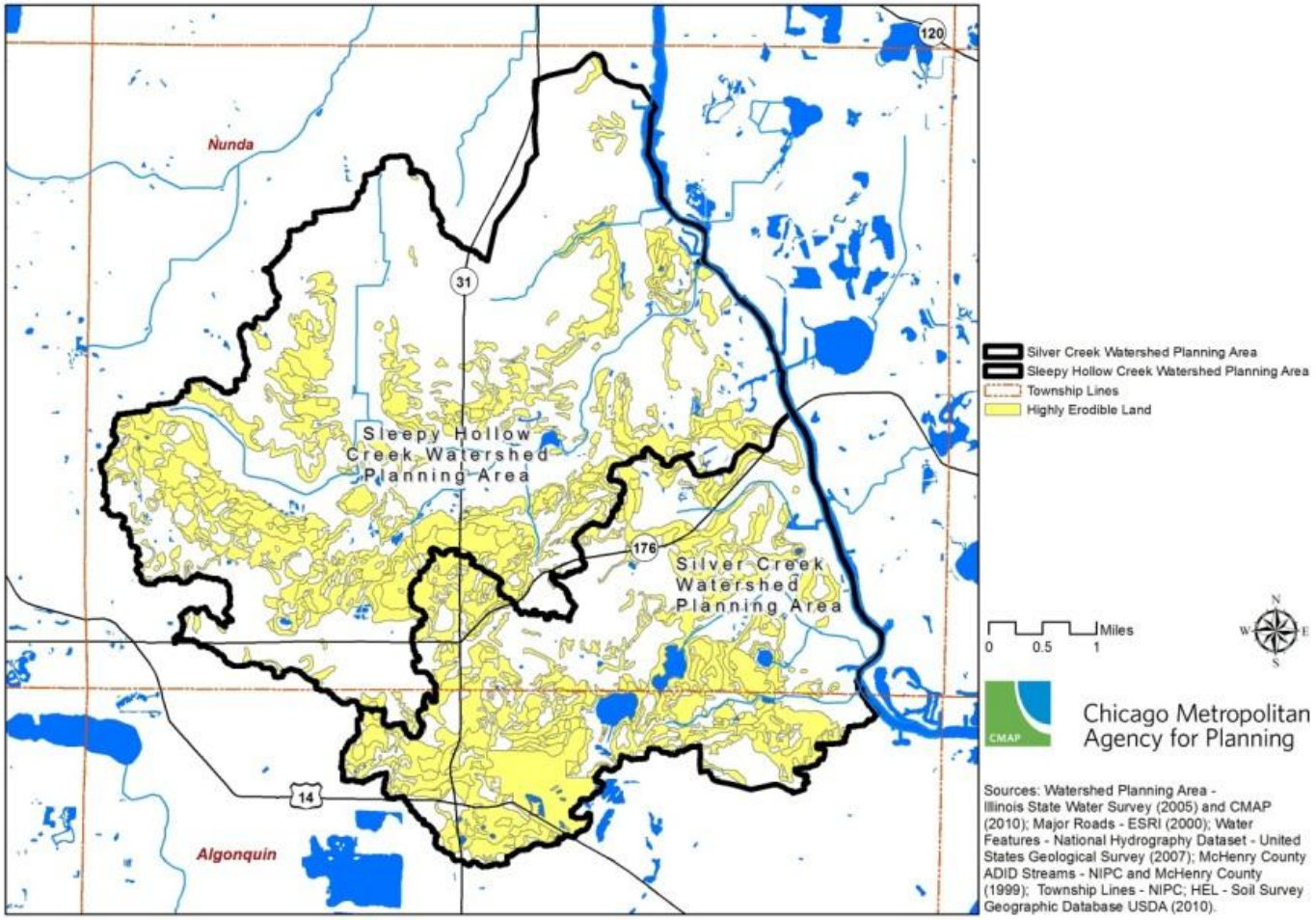


Figure 21. Highly erodible land



Groundwater Resources and Protection

Groundwater Quantity

All of McHenry County is solely dependent on groundwater for its drinking water supply. As such, a safe and adequate groundwater supply is imperative to support public health, a prosperous economy, and the county's rich natural resources.

McHenry County population is forecasted to grow from 304,000 in 2005 to an estimated 589,000 in 2050, an increase of 94 percent.[56] In a response to such forecasts, the County's Water Resources Action Plan: Update on Water Studies identified two groundwater concerns that need to be considered. First, increased groundwater pumping is predicted to lead to groundwater shortages as soon as 2020 in the southeast corner of the county. Secondly, there is a high potential for groundwater contamination as the population increases and human activity puts more stressors on groundwater supplies.[57] In Illinois, groundwater contributes at least 25% of total stream flow. Recent data provide evidence of the relationship between shallow groundwater pumping and natural groundwater discharge to streams. Computer modeling reveals reductions in natural groundwater discharge to streams since predevelopment ranging from as little as 1% to as much as 68% in the Fox River Basin.[58] Therefore, it is imperative that groundwater sustainability be considered in any planning exercise.

McHenry County Groundwater Monitoring

McHenry County is coordinating a comprehensive groundwater research program in order to support water resource planning efforts. As part of this program, McHenry County has a network of observation wells across the County. There are two wells in the watershed planning area. One of these wells is installed in the Silver Creek Conservation Area and the other in the Stickney Run Conservation Area. Real-time aquifer water level data is available via the internet at http://il.water.usgs.gov/data/McHenry/gmaps.php. In addition to water levels, water quality data is being collected from the observation wells.

McHenry County Sensitive Aquifer Recharge Areas

McHenry County developed a Sensitive Aquifer Recharge Area (SARA) map in response to municipal and private reliance on shallow aquifers, as a source of drinking water, population growth, and land-use change. The SARA map incorporates data from the USDA NRCS Soil Surveys and the Illinois State Geological Survey. The map has two primary purposes: 1) to identify areas within the county that are susceptible to aquifer contamination; and 2) to identify areas that may aid in protecting groundwater recharge. The SARA map is designed to guide local land-use planning decisions, support watershed planning efforts, and support efforts to develop a

[56] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008. http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

[57] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[58] CMAP. *Northeastern Illinois Regional Water Supply/Demand Plan*. Chicago, IL: CMAP, March 2010. http://www.cmap.illinois.gov/water-2050 (accessed November 8, 2011).

countywide wellhead protection program and groundwater protection ordinance.

Figure 22 was created using the SARA map and illustrates two thematic classifications within the watershed planning area: A- High Potential for Aquifer Contamination and, B-Moderately High Potential for Aquifer Contamination: [59]

Map Unit A: High Potential for Aquifer Recharge/Contamination: Sand and gravel deposits are more than 20 feet thick (commonly 50 feet thick) and lies within 20 feet of the surface. About 48% of the watershed planning area falls in Unit A.

Map Unit B: Moderately High Potential for Aquifer Recharge/Contamination: Sand and gravel deposits less than 20 feet thick and generally lie within 20 feet of surface and are either at land surface or overlain by the Haeger diamicton or fine-grain deposits. About 17% of the watershed planning area falls in Unit B.

Leaking Underground Storage Tanks

The Illinois Environmental Protection Agency has identified 28 Leaking Underground Storage Tank (LUST) sites within the watershed planning area (Figure 23). Thirteen sites exist within Silver Creek and fifteen sites within the Sleepy Hollow Creek watersheds, respectively. The highest concentration of LUST sites are located near Route 31 (10 sites), which runs north and south through the combined watersheds, while eight are centrally located within the southwest portion of Sleepy Hollow Creek.[60]
As the name suggests, LUST sites are areas contaminated from leaks, spills, and overfills that occurred while underground storage tanks were in use. Contamination is typically related to gasoline, diesel fuel, and other hazardous substances which pose a threat to groundwater, soil, streams and rivers, and lakes.

Groundwater is the sole source of drinking water for the watershed planning area. As such, it is important to remediate LUST sites especially those located within sensitive aquifer recharge areas. LUST sites located near the Fox River, lakes, and streams should also receive remediation priority. Regulations require that LUST sites be cleaned up to protect groundwater water resources. Funding for site remediation is available through Illinois EPA through its Underground Storage Tank Fund.[61]

[59] "Sensitive Aquifer Recharge Areas Map Descriptor: McHenry County, Illinois," McHenry County, Illinois, GIS Department, last modified May 2009, accessed November 7, 2011, http://www.co.mchenry.il.us/departments/Countyboard/PDFDocs/Appendix%202.3.pdf.

[60] The LUST map is based on available data obtained from the IEPA; however, updates to this dataset are recommended. As an example, an Environmental Assessment (EA) was developed for a site located north of Edgewood Road, between the Crystal Lake and McHenry Stations within the Village of Prairie Grove. The EA was developed as part of the proposed Union Pacific Northwest Line Upgrade Project.

[61] "Leaking Underground Storage Tank Program," IEPA, accessed November 2, 2011, http://www.epa.state.il.us/land/lust/index.html.

Figure 22. McHenry County Sensitive Aquifer Recharge Areas within the planning area

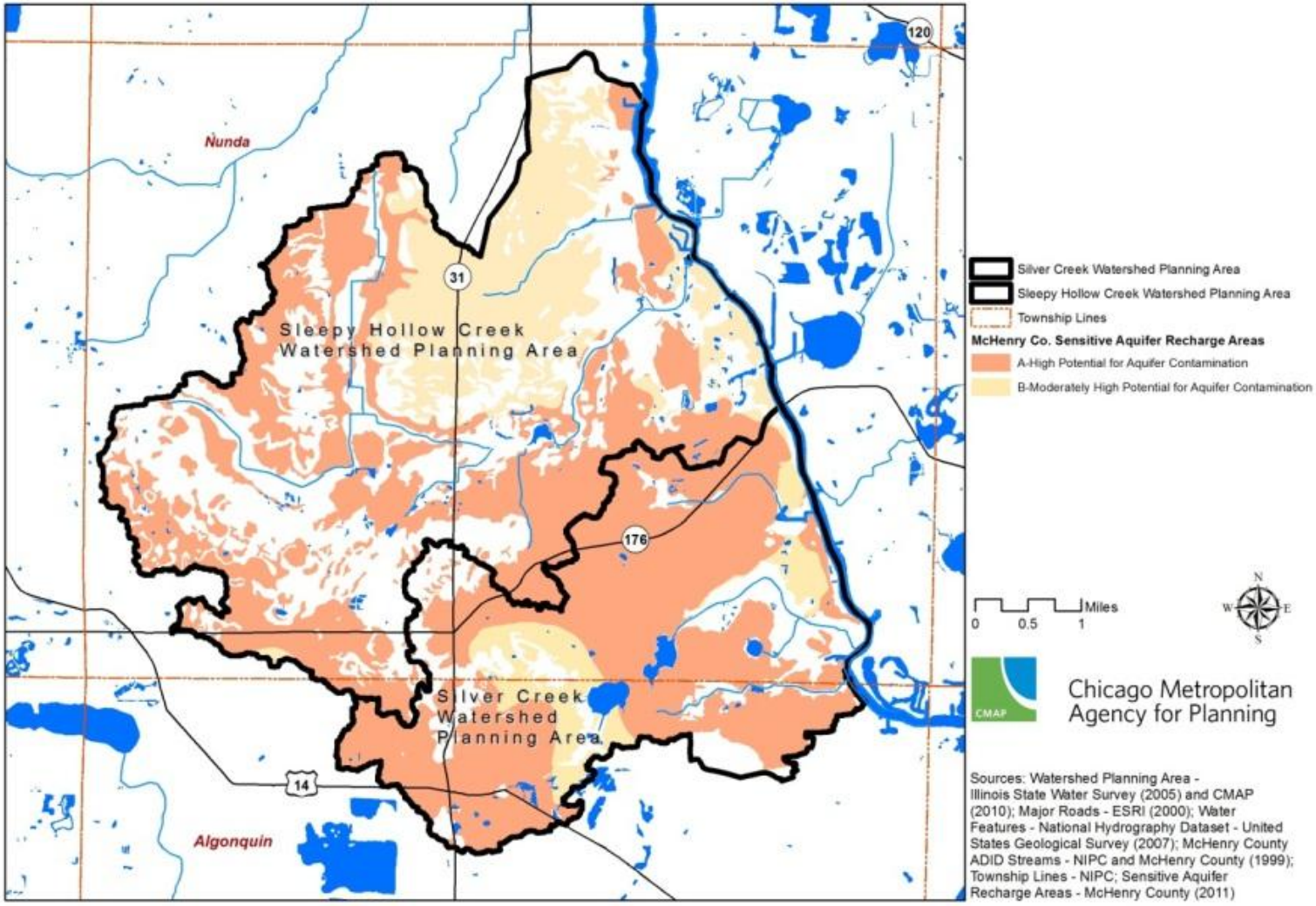
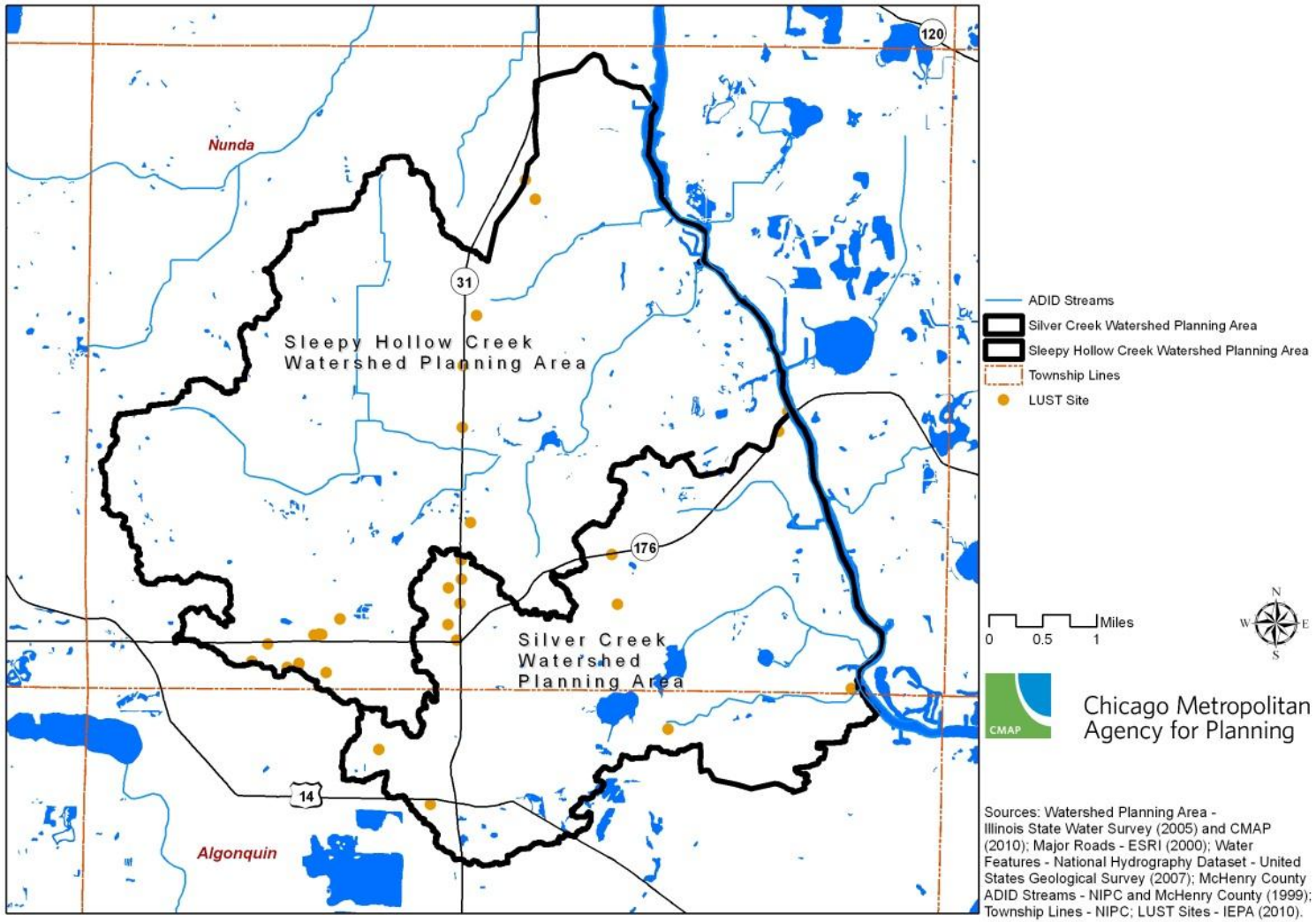


Figure 23. Leaking Underground Storage Tank locations



Wetlands (ADID)

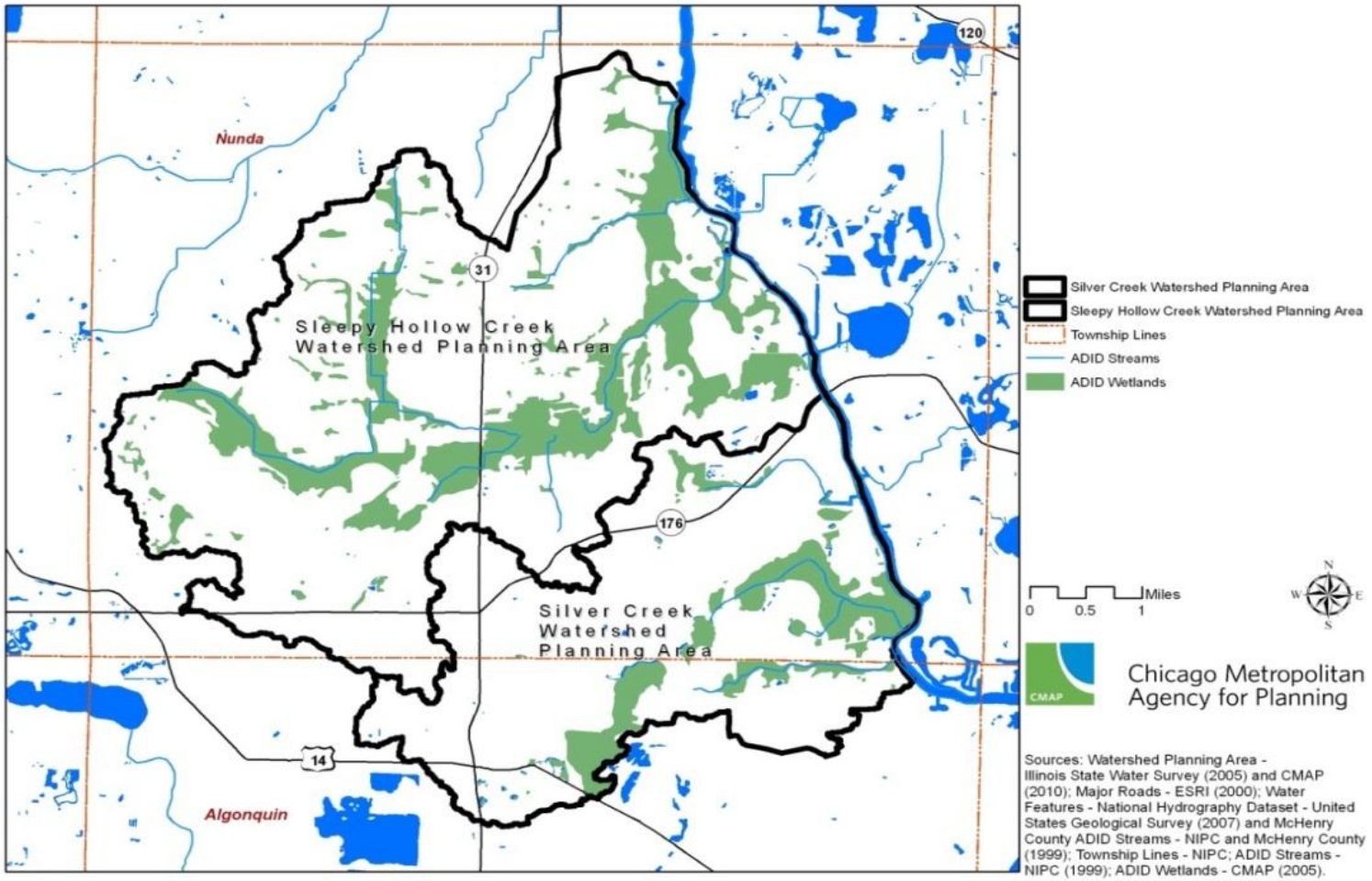
According to McHenry County's Advanced Identification Study (ADID) of wetlands study, less than 1,251 acres of wetlands remain in the watershed planning area (Figure 24).[62] By comparison, the pre-settlement landscape featured a total of 3,723 acres of wetlands. Thus, approximately 2,472 acres of wetlands have been lost or degraded since presettlement. Identifying historic and intact wetlands is necessary for guiding stakeholders in restoration and other planning efforts.

Lakes

A lake assessment, including water quality data and policy and education and outreach recommendations for the watershed action plan will be released to stakeholders early in the Year 2012.

[62] NIPC, U.S. Fish and Wildlife Service and U.S. EPA. *Advanced Identification (ADID) Study, McHenry County, Illinois Final Report*. Chicago, IL: USACE Chicago District, December 1998. http://www.lrc.usace.army.mil/co-r/pdf/mchfinrpt.pdf (accessed November 7, 2011). The US Environmental Protection Agency Region V and the Chicago District of the U.S. Army Corps of Engineers, in consultation with Federal, state and local regulatory and planning agencies completed an ADID of wetlands, lakes and streams in McHenry County, Illinois. ADID is a planning tool to identify significant aquatic resources within McHenry County. The ADID identifies wetlands and other aquatic resources that are in general unsuitable for the discharge of dredged and fill material or require special precautions.

Figure 24. ADID Wetlands



Stream Physical Conditions

In conjunction with CMAP, EDMC, the Fox River Study Group (FRSG), and FREP, planning volunteers conducted an assessment of several streams within the watershed planning area. Streams (or sections thereof) that were assessed included Sleepy Hollow Creek, Stickney Run, Silver Creek, and two neighboring streams that drain to the Fox River.[63] The goal of the assessment was to provide information on the physical conditions of the streams for use in watershed-based plan development. This data may be used to identify additional priority stream restoration projects in the future.

The volunteers documented channel conditions (bank erosion, channel dimensions, bank vegetation), hydraulic structures (e.g., bridges, culverts), point discharges (e.g., pipes, ditches), substrate composition (e.g., gravel, sand, clay), water quality indicators (filamentous algae, oil and grease), types of fish habitat, observations of aquatic plants and animals, and land use/land cover, and vegetation types within the stream corridor. The stream assessment work utilized a field data form (Stream Inventory Report Form, SIRF) modified by CMAP staff, which followed the same stream assessment methodology utilized by the Lake County Stormwater Management Commission.

For the field work, each stream was generally divided into approximate 1,500 – 2,500 foot sections or "reaches" based on relative homogeneity within a reach (e.g., sinuosity, adjacent land use/cover) and identifiable beginning and end points (e.g., road crossings) as initially determined from aerial photos. The stream was always waded in an upstream direction. One SIRF was filled out for each reach. At the beginning and end of each reach, a Global Positioning System (GPS) waypoint and representative photo were taken. A photo and GPS waypoint were also taken at each hydraulic structure, point discharge, debris blockage, and areas exhibiting a high degree of erosion. At three representative locations in each reach, measurements of bank height, bank slope, water depth, and top and bottom channel width were recorded along with a GPS waypoint. All GPS waypoint and photo numbers were recorded on the SIRF. Formal macroinvertebrate and fish surveys were not conducted, though the volunteers did make note of any aquatic or terrestrial organisms they observed.

The digital photos and GPS waypoints were downloaded and the field data was entered into a spreadsheet. The volunteers then submitted all their data to CMAP staff for mapping of several key stream condition aspects, descriptions of which follow below.

Streambank Erosion

While erosion is a natural process, it can be greatly accelerated by changes in hydrology associated with urbanization. Streambank erosion can contribute a large amount of sediment that then settles in slower moving reaches of the stream, negatively impacting aquatic habitat and overall stream health (Figure 25). Eroding banks also lead to losses of stream corridor habitat. The degrees of streambank erosion shown on Figure 27 reflect both the overall prevalence of erosion (proportion of the reach experiencing bank erosion) and the height of the banks. "Low" erosion was indicated by moderately stable banks with infrequent, small areas of erosion mostly healed over, with 5-33% of the reach having areas of low erosion. "Moderate" erosion was indicated by moderately unstable banks with 33-66% of the reach having areas of moderate erosion and with high erosion potential during floods. "High" erosion was evidenced by unstable banks with many eroded areas, frequent "raw" areas along straight sections as well as bends, obvious bank sloughing, and 66-100% of the reach with erosional scars.

[63] Though several streams were assessed, this plan primarily focuses on Silver Creek and Sleepy Hollow Creek.

Some degree of erosion was present in all the assessed reaches of the watershed planning area.

Figure 25. An area of high streambank erosion along the southwest branch of Sleepy Hollow Creek

Sediment Accumulation

Stream channels that are stable have a balance between aggradation (deposition/accumulation on the streambed of additional materials transported from upstream) and degradation (removal of streambed materials caused by the erosional force of water flow). Aggradation is evidenced by silt deposits in pools, embedded riffles, mid-channel bars and islands, enlargement of point bars, and deposition in areas above the streambank (Figure 26). Some degree of sediment accumulation was present in all assessed reaches of the watershed planning area (Figure 28).

Figure 26. An example of mid-channel island

Figure 27. Assessed reaches of Silver Creek and Sleepy Hollow Creek exhibiting low, moderate, or high degree of streambank erosion, based on a 2011 assessment of stream conditions

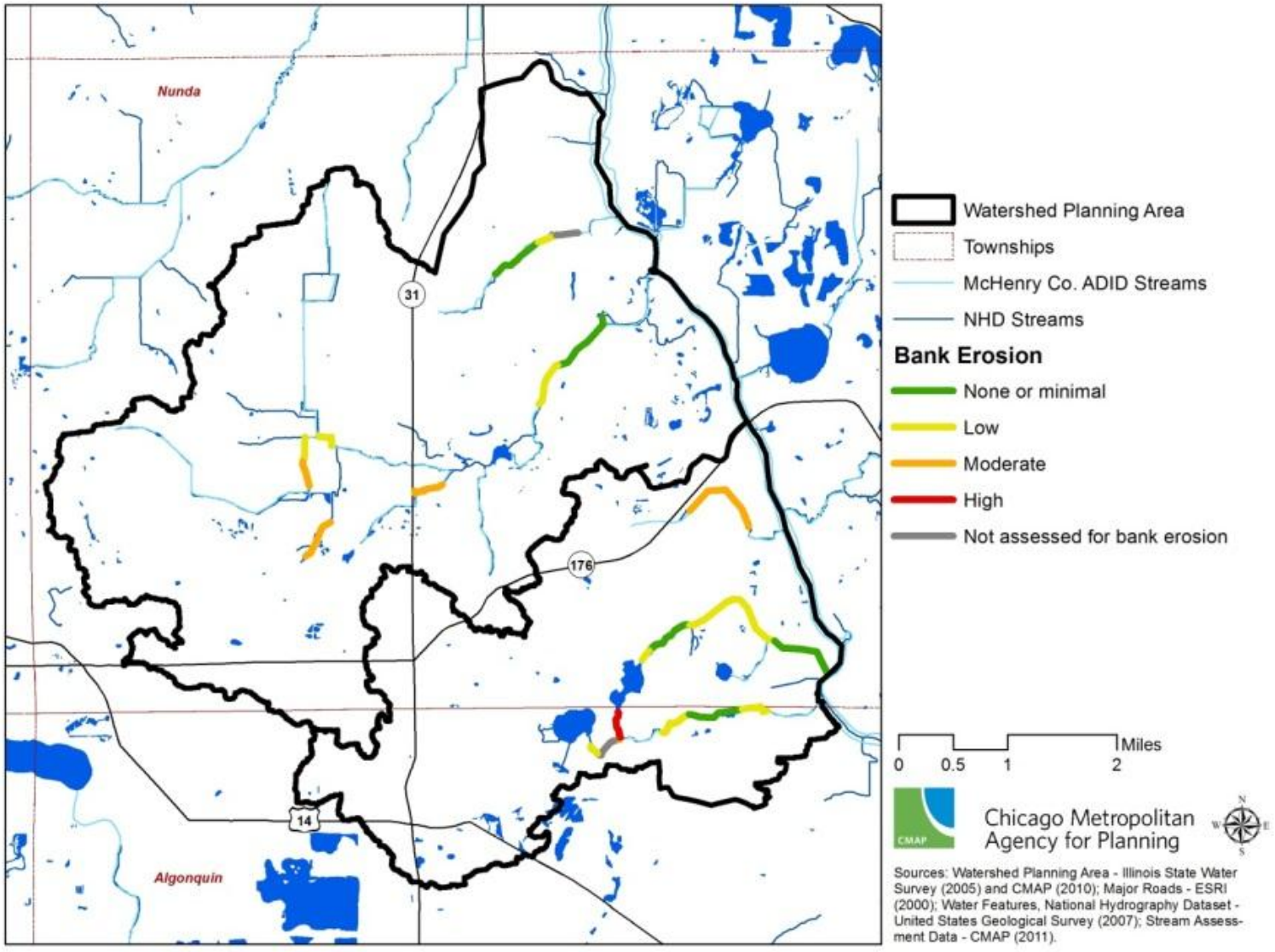
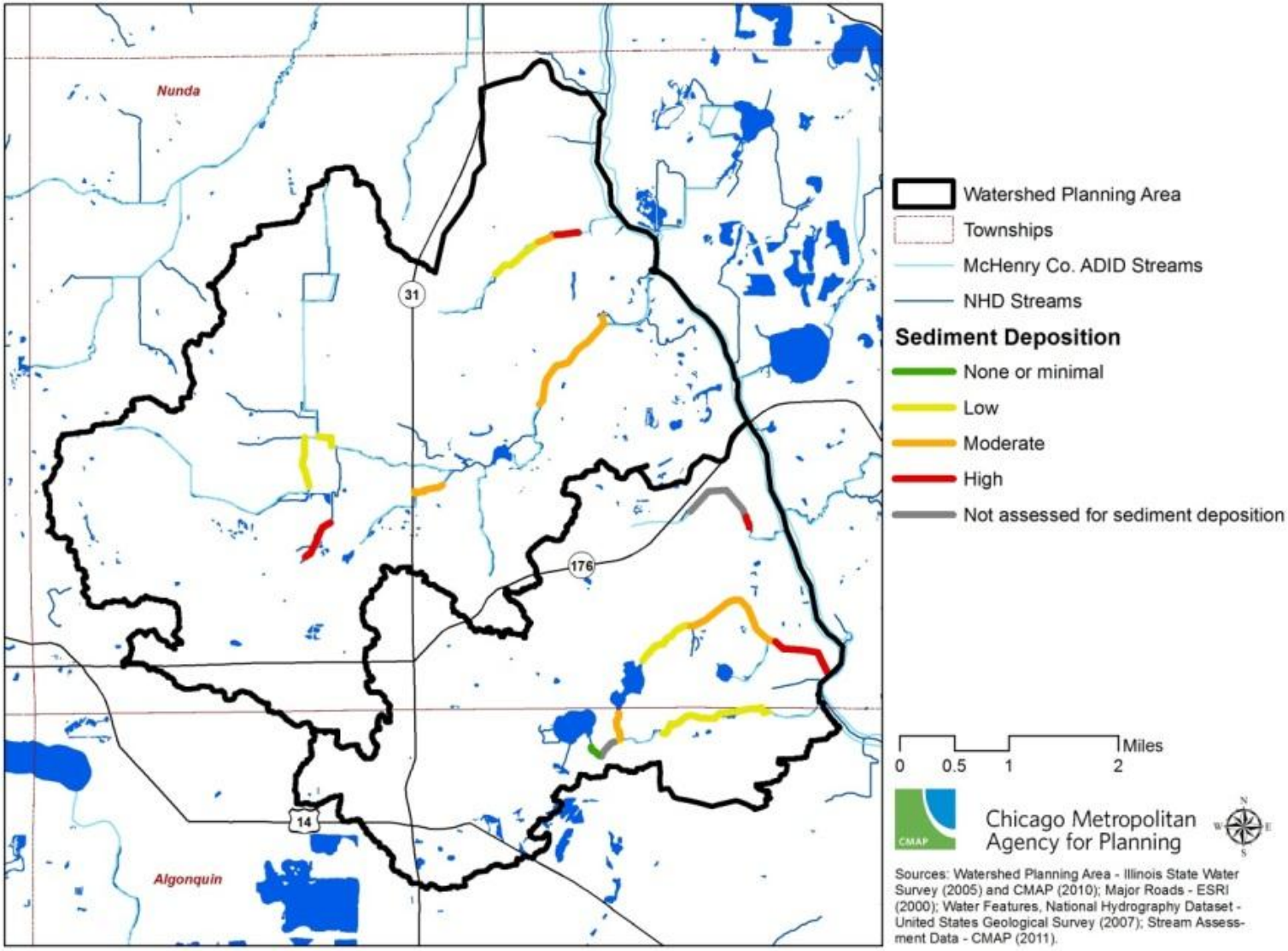


Figure 28. Reaches of Silver Creek and Sleepy Hollow Creek exhibiting low to high sediment accumulate, based on a 2011 assessment of stream conditions



Hydraulic Structures

Hydraulic structures (Figure 29) can alter stream hydrology (including exacerbating local flooding), impact the stability of the stream, and prevent fish migration. Several hydraulic structures (e.g., bridges, railways, culverts, low head dams, weirs) were documented crossing in the watershed planning area (Figure 30). Thus, these locations indicate where projects could potentially be conducted to improve fish migration; repair, replace, or modify culverts or bridges; and stabilize the surrounding stream channel and streambanks. As the watershed planning area becomes more urbanized and transportation networks expand, the number of stream crossings is likely to increase. Thus, the design of new bridges and culverts will also be important to minimize local flooding impacts, erosion problems, and habitat degradation.

Figure 29. Hydraulic structures within the Sleepy Hollow Creek Watershed

Substrate Stability

Highly stable substrates are indicated by the ability to walk in the stream without sinking and typically indicate a gravelly stream bottom. Substrate stability is usually high in natural streams but varies from high stability in riffle areas to lower stability in areas of slower moving water (pools) between riffles. High stability substrate areas are necessary for supporting a variety of fish and aquatic insects. Low to no substrate stability is evidenced in areas with moderate to high silt deposits. These can be the result of soil erosion from upstream land surfaces, streambank erosion, and where the stream passes through naturally soft organic soils. Figure 31 shows the degree of substrate stability in the assessed stream reaches within the watershed planning area.

Figure 30. Map of hydraulic structures along assessed reaches of the watershed planning area network documented during a 2011 stream assessment.

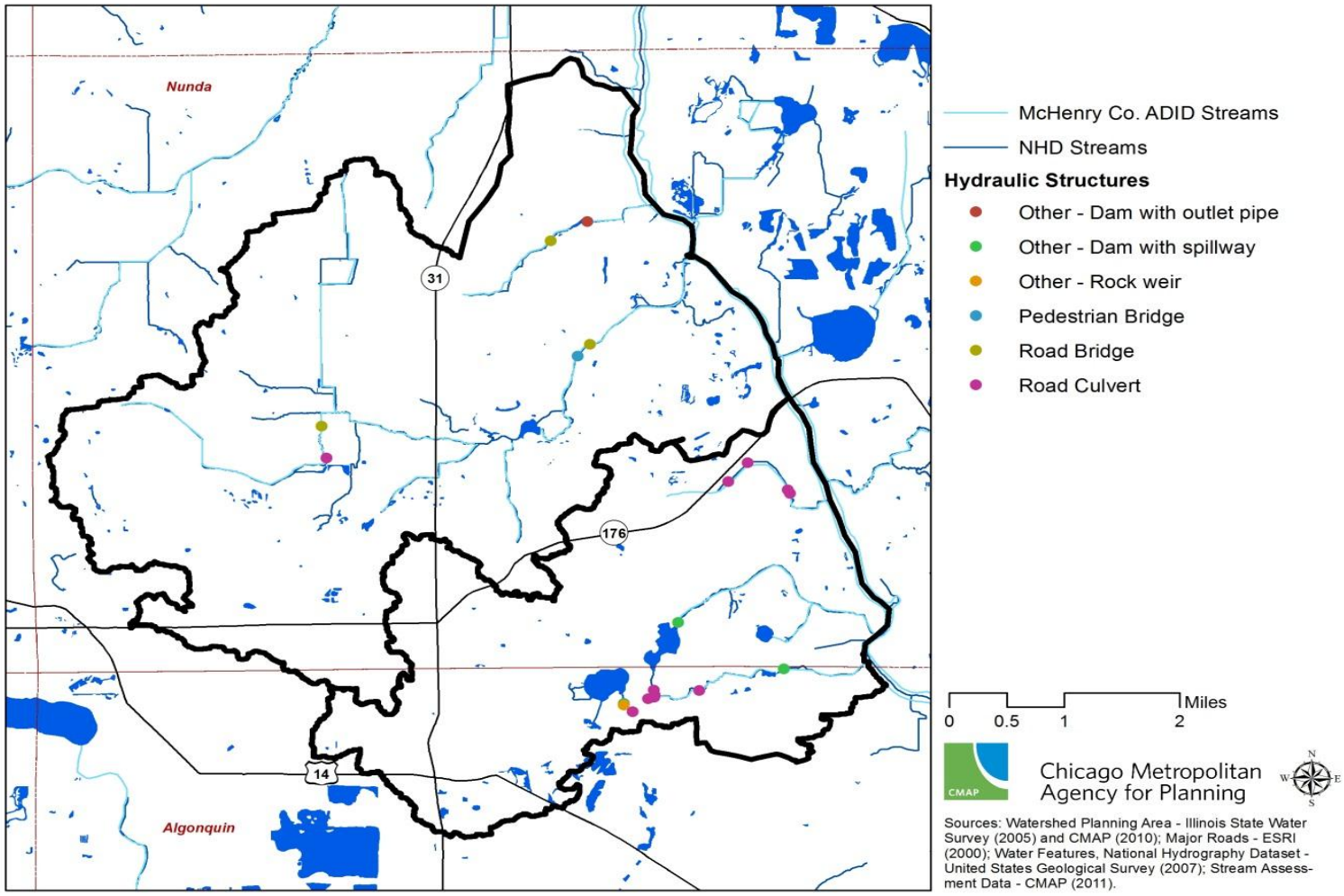
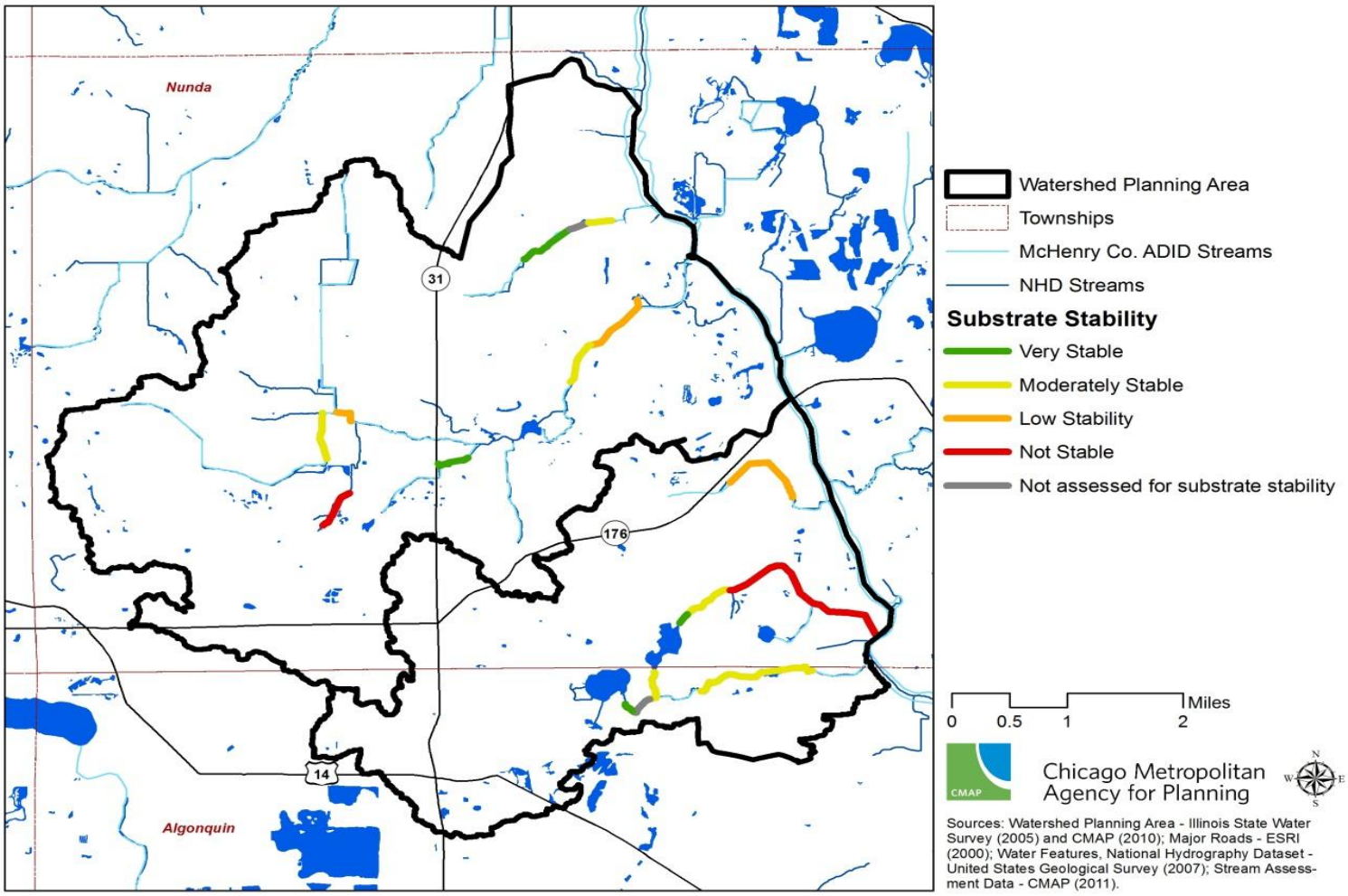


Figure 31. Reaches of Silver Creek and Sleepy Hollow Creek exhibiting low to high substrate stability, based on a 2011 assessment of stream conditions

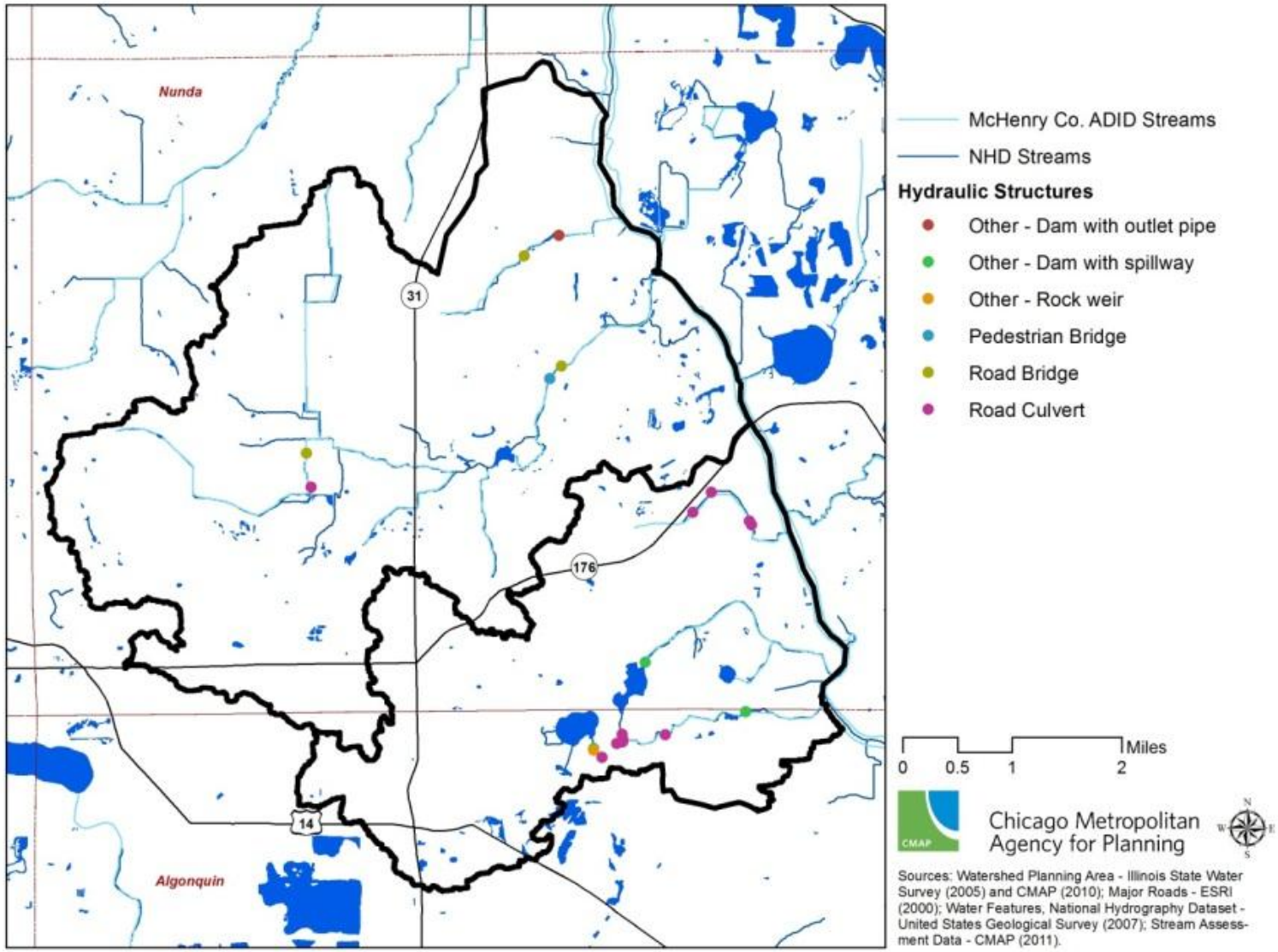


Discharge Locations

Examples of water discharges include various pipes (e.g., storm sewer outfalls, agricultural drain tiles, sump pump drains) as well as open channels, swales, gullies, and other significant tributaries (Figure 32). Numerous locations where water discharges into watershed planning area were documented (Figure 33). These dimensions of the discharges were recorded as well as comments regarding flow, odors, sheens, and color or turbidity.

Figure 32. Examples of water discharges

Figure 33. Map of discharge locations along assessed reaches of the watershed planning area network documented during a 2011 assessment



Fish Assemblages

The MCCD has conducted several fish surveys in Sleepy Hollow Creek in the Stickney Run Conservation Area (latest in 1998), Silver Creek in the Silver Creek Conservation Area (latest in 2002), and Fel-Pro Creek in the Fel-Pro RRR Conservation Area (latest in 2000). In all cases, a 300 foot reach was surveyed using a backpack shocker. The fish species collected and latest date of observation are provided in Table 5.[64] Species that are intolerant of pollution and thus indicative of good water quality and habitat conditions include the lake chubsucker, mottled sculpin, blackchin shiner, spotfin shiner, Iowa darter, and brown trout. The blackchin shiner and Iowa darter are also state threatened species.

Table 5 Fish survey results for Sleepy Hollow, Silver, and Fel-Pro Creeks (from MCCD 2010)

			MOST RECENT SIGHTING		
FAMILY	COMMON NAME	SCIENTIFIC NAME	SLEEPY HOLLOW CREEK	SILVER CREEK	FEL-PRO CREEK
Catostomidae	Lake Chubsucker	*Erimyzon sucetta*	–	–	5/25/2000
Centrarchidae	Bluegill	*Lepomis macrochirus*	7/22/1998	1/28/2002	9/7/2000
Centrarchidae	Green Sunfish	*Lepomis cyanellus*	7/22/1998	1/28/2002	9/7/2000
Centrarchidae	Largemouth Bass	*Micropterus salmoides*	7/22/1998	1/28/2002	9/7/2000
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*	8/9/1996	12/14/1998	5/25/2000
Centrarchidae	Warmouth	*Lepomis gulosus*	–	–	5/25/2000
Cottidae	Mottled Sculpin	*Cottus bairdi*	–	1/28/2002	9/7/2000
Cyprinidae	Blackchin Shiner	*Notropis heterodon*	–	–	5/25/2000
Cyprinidae	Bluntnose Minnow	*Pimephales notatus*	–	2/19/1997	–
Cyprinidae	Common Carp	*Cyprinus carpio*	7/22/1998	4/30/2008	5/25/2000
Cyprinidae	Creek Chub	*Semotilus atromaculatus*	–	1/28/2002	9/7/2000
Cyprinidae	Fathead Minnow	*Pimephales promelas*	7/22/1998	2/15/2000	–
Cyprinidae	Golden Shiner	*Notemigonus crysoleucas*	7/22/1998	–	–
Cyprinidae	Hornyhead Chub	*Nocomis biguttatus*	–	9/26/1988	–
Cyprinidae	Spotfin Shiner	*Notropis spilopterus*	8/9/1996	–	–
Esocidae	Grass Pickerel	*Esox americanus vermiculatus*	8/9/1996	1/28/2002	9/7/2000
Ictaluridae	Black Bullhead	*Ictalurus melas*	7/22/1998	2/19/1997	9/7/2000
Percidae	Iowa Darter	*Etheostoma exile*	–	1/28/2002	–
Percidae	Johnny Darter	*Etheostoma nigrum*	–	1/28/2002	–
Petromyzontidae	American Brook Lamprey	*Lampetra appendix*	–	1/28/2002	–
Salmonidae	Brown Trout	*Salmo trutta*	–	1/28/2002	–
Umbridae	Central Mudminnow	*Umbra limi*	7/22/1998	1/28/2002	9/7/2000
TOTAL SPECIES			11	17	13

[64] Brown, G., MCCD, personal communication, 2011.

Other Biota

Staff from Openlands conducted a survey for mussels at four locations in the headwaters of Sleepy Hollow Creek near Crystal Lake High School in July 2010. No mussels were found either living or as relic shells. Aquatic invertebrates reported were caddisfly and mayfly larvae, *Physella* snails, and millipedes.[65]

In May 2011, in the southwest branch of Sleepy Hollow Creek within the land owned by The Land Conservancy of McHenry County (between Route 31 and the Terra Cotta property), the stream assessment volunteers (including a biology professor) observed numerous aquatic invertebrate species (Figure 34). These included black fly larvae, left-handed snail, water strider, fingernail clam, isopods, midge larvae, crane fly larvae, whirligig beetle, scuds, caddisfly, mayfly larvae, and freshwater sponge.[66]

Figure 34. Freshwater sponge in the southwest branch of Sleepy Hollow Creek.

Note the granular gemmules (reproductive structures). Photo courtesy of Randy and Nancy Schietzelt

[65] Klocek, R. Openlands, *personal communication*, 2011.
[66] Schietzelt, R. and N. Schietzelt, Stream Inventory Report Form, 2011.

Available Stream Assessment Information

Detailed reach information will be provided by CMAP to the Silver & Sleepy Hollow Creeks Watershed Coalition (described in Chapter 7) to help community members identify and prioritize future streambank stabilization projects within the watershed planning area. A similar stream assessment effort is recommended for the reaches that were not assessed.

Hydrologic Structures

Congress authorized the U.S. Army Corps of Engineers (USACE) to create a nation-wide inventory of dams in 1972. Today, the National Inventory of Dams (the Inventory) is a database maintained by USACE that contains information on dams throughout the nation meeting certain criteria. Dams included in the Inventory are those that meet one or more of the following classifications: they are high hazard (i.e., loss of life is likely in the event of dam failure); significant hazard (i.e., loss of life or damage to property or the environment is possible in the event of dam failure); greater than or equal to 25 feet in height and 15 acre-feet in storage; or greater than or equal to 50 acre-feet in storage and 6 feet in height.[67] All dams meeting these criteria are eligible for inclusion in the Inventory, yet in reality, data collection is subject to financial limitations, particularly for those dams unregulated by state or federal agencies.[68]

[67] "CorpsMaps National Inventory of Dams," USACE, last modified January 15, 2009, accessed October 12, 2011, http://geo.usace.army.mil/pgis/f?p=397:1:8757593860658286::NO.
[68] "CorpsMaps National Inventory of Dams," USACE, last modified January 15, 2009, accessed October 12, 2011, http://geo.usace.army.mil/pgis/f?p=397:1:8757593860658286::NO.

Due to security concerns regarding dam hazard information, the Inventory is not available for download by the general public, but can be acquired by government agencies like CMAP. However, although Inventory records for dams in the watershed planning area were obtained, USACE has acknowledged reports of error in the geographic coordinates for dams in the state of Illinois.[69] Dam locations were therefore impossible to map for this watershed planning area. The Illinois Department of Natural Resources Office of Water Resources, which maintains information on dams in the state, is aware of this problem, but with limited funding available for data collection, is not currently able to correct the error.[70] While mapping was not possible, the dimensions and number of dams in the Inventory for Illinois are correct. According to this information, there are two dams in McHenry County on Sleepy Hollow Creek ranging in height from 7 to 10 feet, both 220 acre-feet in storage.[71] The USACE reports that there are no dams listed on Silver Creek in McHenry County.[72]

Wastewater Treatment Plants

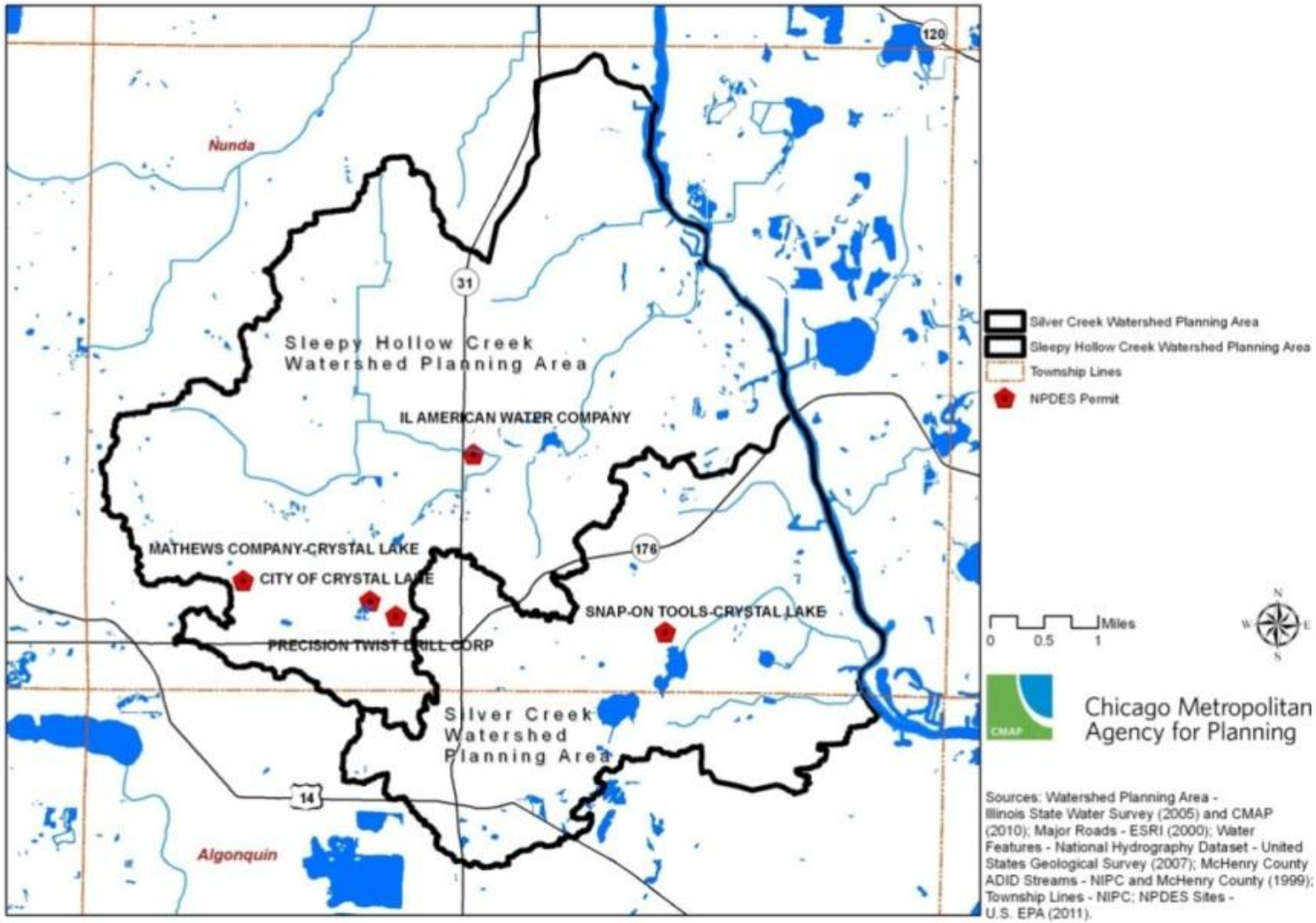
The National Pollutant Discharge Elimination System (NPDES) program supports the overall mission of the Clean Water Act. The program requires all facilities that collect wastewater[73] from industrial, municipal, concentrated animal feeding operations, and other point sources and discharge to surface waters, to obtain a permit from Illinois EPA. The NPDES program plays a key role in protecting water from a level of degradation that would occur if not for the program since it sets discharge limits, requires monitoring and reporting, and limits discharge of specific pollutants including BOD, total suspended solids, ammonia nitrogen, fecal coliform, dissolved oxygen, and phosphorus.

Five permitted point-source[74] facilities discharge within the planning area (Figure 35) including two facilities that discharge into Sleepy Hollow Creek: the City of Crystal Lake wastewater treatment plant (NPDES # IL0053457)[75] and a wastewater treatment plant operated by Illinois American Water and serving the Terra Cotta Subdivision service area (NPDES IL0038202)[76].

[69] Rebecca Ragon, USACE staff, email message to author(s), August 4, 2011.
[70] Paul Mauer, IDNR Senior Dam Safety Engineer, email message to author(s), August 24, 2011.
[71] USACE. *National Inventory of Dams*. Dataset obtained through non-disclosure agreement between USACE and CMAP, July 22, 2011.
[72] Bruce Wallace, Village of Oakwood Hills Plan Commission, email message, November 30, 2011. Though not identified on the USACE report, there are at least two dams in Silver Creek in McHenry County. One is at the outlet of Lake Killarney (about 6' to 8' in height), and the other is at the north end of Silver Lake (about 25" in height) In addition, the Silver Creek and Sleepy Hollow Creek stream assessment revealed the presence of several hydraulic structures.

[73] "Wastewater Treatment Water Use," USGS, last modified February 8, 2011, accessed November 7, 2011, http://ga.water.usgs.gov/edu/wuww.html. Wastewater includes water used by homes, industries, and businesses that must be treated before it is released back into the environment.
[74] U.S. EPA. "Point Source." *NPDES Glossary*. Washington, D.C.: U.S. EPA. http://cfpub.epa.gov/npdes/glossary.cfm?program_id=0#P(accessed November 7, 2011). "A point source is, but not limited to, any pipe, ditch, channel, or conduit from which pollutants are discharged."
[75] NPDES ID no. IL0053457 (For more information, see http://www.epa.state.il.us/public-notices/2007/crystal-lake-wwtp3/index.pdf.)
[76] IEPA. *Public Notice/Fact Sheet of Draft Reissued NPDES Permit to Discharge into Waters of the State*. Springfield, IL: IEPA, December 10, 2008. http://www.epa.state.il.us/public-notices/2008/illinois-american-terra-cotta/index.pdf (accessed November 7, 2011).

Figure 35. NPDES Permits within the watershed planning area



The City of Crystal Lake's wastewater treatment facility (WWTF) has a design average flow of 1.7 million gallons per day (mgd), a design maximum flow of 5.0 mgd, and a pretreatment program.[77] The plant is required to limit and monitor its discharge of suspended solids, fecal coliform, ammonia nitrogen, dissolved oxygen, CBOD, pH and phosphorus. The permit for fecal coliform is in line with the statewide standard discussed in Chapter 3. The permit includes a special condition that effluent samples "must be taken at a point representative of the discharge, but prior to entry into the receiving stream."[78] [79] NPDES permit standards are summarized in Table 6.

Table 6. NPDES permit limits for the City of Crystal Lake's WWTP, load limits lbs/daily average flow (DAF)

PARAMETER	MONTHLY AVERAGE	DAILY MAXIMUM
Flow (MGD)		
CBOD	142 (417)	284 (834)
Suspended Solids	170 (500)	340 (1,001)
Dissolved Oxygen	Shall not be less than 6 mg/L	
pH	Shall be in therange of 6 to 9 Standard Units	
Fecal Coliform	Daily Maximum shall not exceed 400 per 100 mL (May through October)	
Ammonia Nitrogen April - October	17 (50)	43 (125)
November-February	35 (104)	112 (329)
March*	28 (83)	101 (296)
Phosphorus	14 (42)	28 (83)
Chloride		7,089 (20,850)
Barium	28 (83)	57 (167)

* Weekly load limit for March is 72lbs/213 DAF

Illinois American Water's facility has a design average flow of 0.1 mgd and a maximum flow of 0.25 mgd. The plant is required to limit and monitor its discharge for suspended solids, fecal coliform, ammonia nitrogen, dissolved oxygen, CBOD, suspended solids, and *pH.* The permit for fecal coliform is in line with the statewide standard discussed in the Chapter 3. A new wastewater treatment facility will be used for pretreatment at the existing facility until flows at the facility reach 0.1 mgd. The design average flow for the new facility is 1.0 mgd and the design maximum flow is 3.0 mgd. Treatment consists of screening, activated sludge, secondary settling, sand filtration, ultraviolet disinfection (new wastewater treatment plant only), and sludge treatment facilities. The permit standards for the existing and new STP are summarized in Table 7.

[77] "Pretreatment Program," U.S. EPA, last modified January 4, 2011, accessed November 7, 2011, http://cfpub.epa.gov/npdes/home.cfm?program_id=3. A pretreatment program establishes and implements Pretreatment Standards to control pollutants from industrial users which may pass through publicly owned treatment works and interfere with WWTF treatment processes or may contain sewage sludge.

[78] NPDES ID no. IL0038202 (For more information, see http://www.epa.state.il.us/public-notices/2008/illinois-american-terra-cotta/index.pdf.)

[79] "Permit Compliance Systems (PCS)," U.S. EPA, accessed December 20, 2011, http://www.epa.gov/enviro/facts/pcs/search.html. Information found through Envirofacts for NPDES ID number IL0053457.

Table 7. NPDES permit limits for the IAWC Terra Cotta WWTP, load limits lbs/daily average flow (DAF)

PARAMETER	MONTHLY AVERAGE (DAF 0.1 mgd)	MONTHLY AVERAGE (DAF 1.0 mgd)	WEEKLY AVERAGE (DAF 0.1 mgd)	WEEKLY AVERAGE (DAF 1.0 mgd)	DAILY MAXIMUM (DAF 0.1 mgd)	MONTHLY AVERAGE (DAF 1.0 mgd)
CBOD	8.3 (21)	83 (25)			17 (42)	167 (500)
Suspended Solids	10 (25)	100 (300)			20 (50)	200 (600)
Phosphorus		8.3 (25)				
pH	Shall be in the range of 6 to 9 Standard Units					
Fecal Coliform	Monitoring (May through October) (DAF 0.1 mgd) Daily Maximum shall not exceed 400 per 100 mL (May through October) (DAF 1.0 mgd)					
Ammonia Nitrogen: March-May/Sept.-Oct.	1.3 (3.1)	13 (38)	3.2 (7.9)	32 (95)	4.3 (11)	43 (128)
June-Aug.	0.83 (2.1)	8.3 (25)			4.7 (12)	47 (140)
Nov.-Feb.	2.8 (7.1)	28 (85)	2.1 (5.2)	21 (63)	4.3 (11)	43 (130)

Septic Systems

Many residents in the planning area use a septic system to treat wastewater. The U.S. USEPAEPA recognizes onsite wastewater treatment systems as an effective, permanent, and environmentally-sound method of wastewater treatment.[80] Unfortunately, in many cases, these systems, once installed, are forgotten until problems occur. As such, the difference between a system's success or failure is the execution of an effective wastewater management program.

As previously stated, the segment of the Fox River into which Silver Creek and Sleepy Hollow Creek both drain (DT-22) has been assessed and is impaired by fecal coliform. One potential source that can cause fecal coliform contamination is failing or improperly maintained septic systems. For this reason, septic-related policies at the County level were examined. Regular maintenance of septic systems is not required for homeowners with traditional septic systems. However, the County has an ordinance that regulates wastewater and sewage treatment and disposal within the county. Data from the McHenry County Department of Health (MCDOH) does not support the perception that large numbers of failing private sewage disposal systems are discharging directly to waterways within the watershed planning area, nor have these data indicated a correlation between fecal coliform impairment of a surface body of water from onsite waste water treatment systems.[81] Case studies documented by USEPA also support the assertion that bacteria typically do not travel significant distances from properly sited and maintained septic systems.[82] In addition, MCDOH maintains a policy regarding compliant investigations which include septic failure complaints. MCDOH also maintains educational information about septic systems for home owners on its website, and new homeowners are presented with a packet of this educational information. Finally, MCDOH performed a comprehensive review for septic suitability prior to platting in many areas, including a hydrogeological investigation to determine whether the proposed development would impact groundwater.[83]

[80] U.S. EPA. *A Homeowner's Guide to Septic Systems*. Report No. EPA-832-B-02-005. Washington, D.C.: U.S. EPA, March 2005. http://www.epa.gov/owm/septic/pubs/homeowner_guide_long.pdf (accessed November 17, 2011). http://www.epa.gov/owm/septic/pubs/homeowner_guide_long.pdf (accessed November 17, 2011).

[81] Jeff Levato, Field Staff Supervisor, MCDOH, letter to author(s), October 31, 2011.

[82] U.S. EPA. *Onsite Wastewater Treatment Systems Manual*. EPA/625/R-00/008. Washington, D.C.: U.S. EPA, February 2002. http://www.epa.gov/nrmrl/pubs/625r00008/html/625R00008.htm (accessed December 14, 2011).

[83] Jeff Levato, Field Staff Supervisor, MCDOH, letter to author(s), December 2011.

Areas with the greatest densities of septic systems were estimated within the watershed planning area. This estimate was calculated from 1990 U.S. Census data for the number of septic systems within the watershed planning area.[84] Septic systems numbers from 1990 were summed within each subbasin and then updated by multiplying by the fraction of population change between 1990 and 2010.[85] Subbasins were then identified as low, medium, or high priority with regard to septic system density (systems per acre). Only failing septic systems are a possible source of fecal coliform contamination, but a uniform failure rate is assumed in the absence of more detailed information on actual failure rates throughout the watershed planning area.[86] As Figure 36 shows, a significant portion of the watershed planning area was determined by this analysis to utilize septic systems rather than municipal sewers. The subbasins that are identified as high priority encompass primarily unincorporated areas, Cary, Crystal Lake, McHenry and Prairie Grove. If these municipalities (and McHenry County for the unincorporated areas) do not already require or at least encourage regular septic system inspection and maintenance, then developing technical assistance programs and/or enacting policy in local codes or ordinances would be an appropriate and timely priority for these areas.

Additional Septic System Estimates

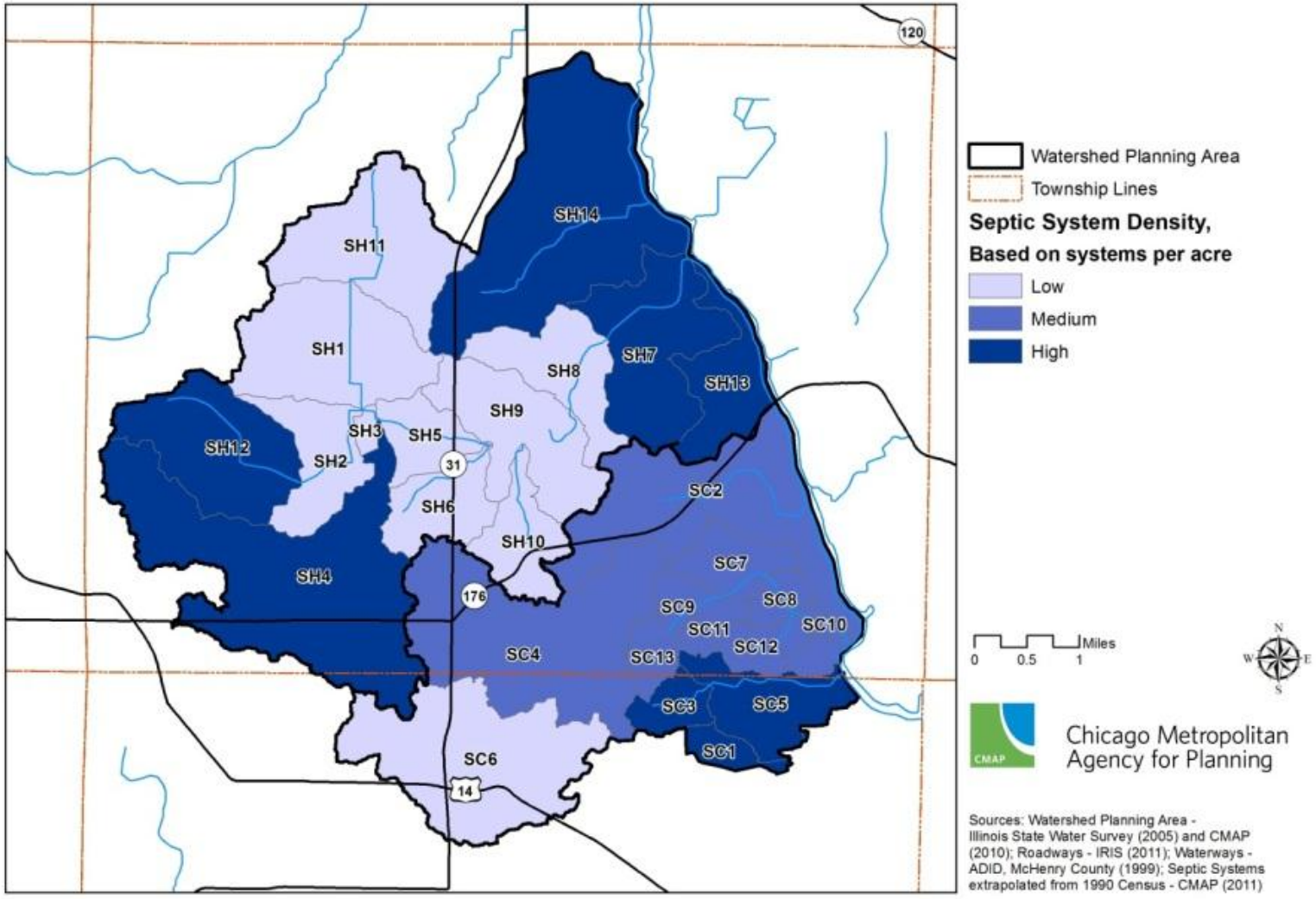
As previously noted, there is limited data available on septic systems in the watershed planning area. As such, septic system estimates were based on septic system estimates were acquired from the 1990 U.S. Census data. Therefore, in an effort to more accurately estimate the number of private septic systems, stakeholders volunteered their time to provide a count of private septic systems in the watershed planning area. Combined the planning area has a total of 4,699 septic systems.

[84] Bureau of the Census. "1990 Census Summary File 3." *1990 Census*, Table H024, Sewage Disposal, Kane and Kendall Counties, Illinois. Washington, D.C.: Bureau of the Census, 1990. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml (accessed November 3, 2011).

[85] U Bureau of the Census. "Summary File 1." *2010 Census*, McHenry County, Illinois. Washington, D.C.: Bureau of the Census, 2010. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml (accessed August 15, 2011).

[86] U.S. EPA. *Onsite Wastewater Treatment Systems Manual*. EPA/625/R-00/008. Washington, D.C.: U.S. EPA, February 2002. http://www.epa.gov/nrmrl/pubs/625r00008/html/625R00008.htm (accessed December 14, 2011). A uniform failure rate of 5% is assumed for this analysis. Among 28 states listed in Table 1-3 of this document, U.S. EPA estimates failure rates ranging from as low as 0.5% to greater than 50%. Of these 28 states, 11 failure rates are less than or equal to 5%, while the remaining 17 are greater than 5%. It is important to note that in reality, failure rates are likely not uniform throughout the watershed planning area. Systems in older areas along waterways, for example, likely have higher failure rates (posing a greater risk to water quality) than systems more recently installed in newer areas. Systems in older areas would therefore benefit from additional septic maintenance. A uniform failure rate also does not take into account the septic systems in the watershed planning area which were sited using the current soil-based standards applicable in the area.

Figure 36. Septic system density within the watershed planning area



Additional Watershed Resource Data Availability Status

Throughout this watershed process, CMAP and partners worked together to provide the most up to date available data. For some requests, however, data were not available (Table 8). These data may become available for the future planning process.

Table 8. Data availability for resource inventory in the Action Plan

DATA REQUEST	CURRENT STATUS
Depressional storage locations and opportunities	Data not available
Description of man-made drainage networks (field tiles, storm sewers)	Data not available
Septic system inspection data	Data not available
Total length of drainage ditches, length of ditch erosion, length of ditch bed erosion, length of sediment accumulation, length of debris jabs, length of needed buffers	Data not available

3. Water Quality and Modeling Results

3.1. Illinois Integrated Water Quality Report

The Illinois Integrated Water Quality Report (the Report) and Section 303 (d) List (the List) comprise a major source of information available for assessing stream health and identifying sources of impairment on the part of watershed planning initiatives statewide. These documents are released every two years by the Illinois Environmental Protection Agency (IEPA), with the most recent Report issued in 2010. The purpose of the Report is to provide water quality data for both surface and groundwaters and to fulfill Section 303 (d) of the federal Clean Water Act and the Water Quality Planning and Management regulation at 40 CFR Part 130 for the State of Illinois.[87]

This watershed plan focuses on the surface water data as it relates to Silver Creek and Sleepy Hollow Creek Watersheds. The Report seeks to assess the extent to which water bodies support a set of recognized designated uses. Each designated use has a related standard for which the designated use for that stream is protected. In Illinois, there are seven designated uses; however, only four of those uses apply to the watershed planning area and the segment of the Fox River into which the watersheds drain. These include Aquatic Life, Fish Consumption, Primary Contact, and Aesthetic Quality. A stream is considered not fully supporting for a designated use if the stream does not meet the related standard. These standards are derived from several types of information including biological data, water chemistry, in stream habitat, and toxicity data. Table 9 shows the three tier rating system associated with each standard.

[87] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume I: Surface Water*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

Table 9. Illinois water quality report's rating system

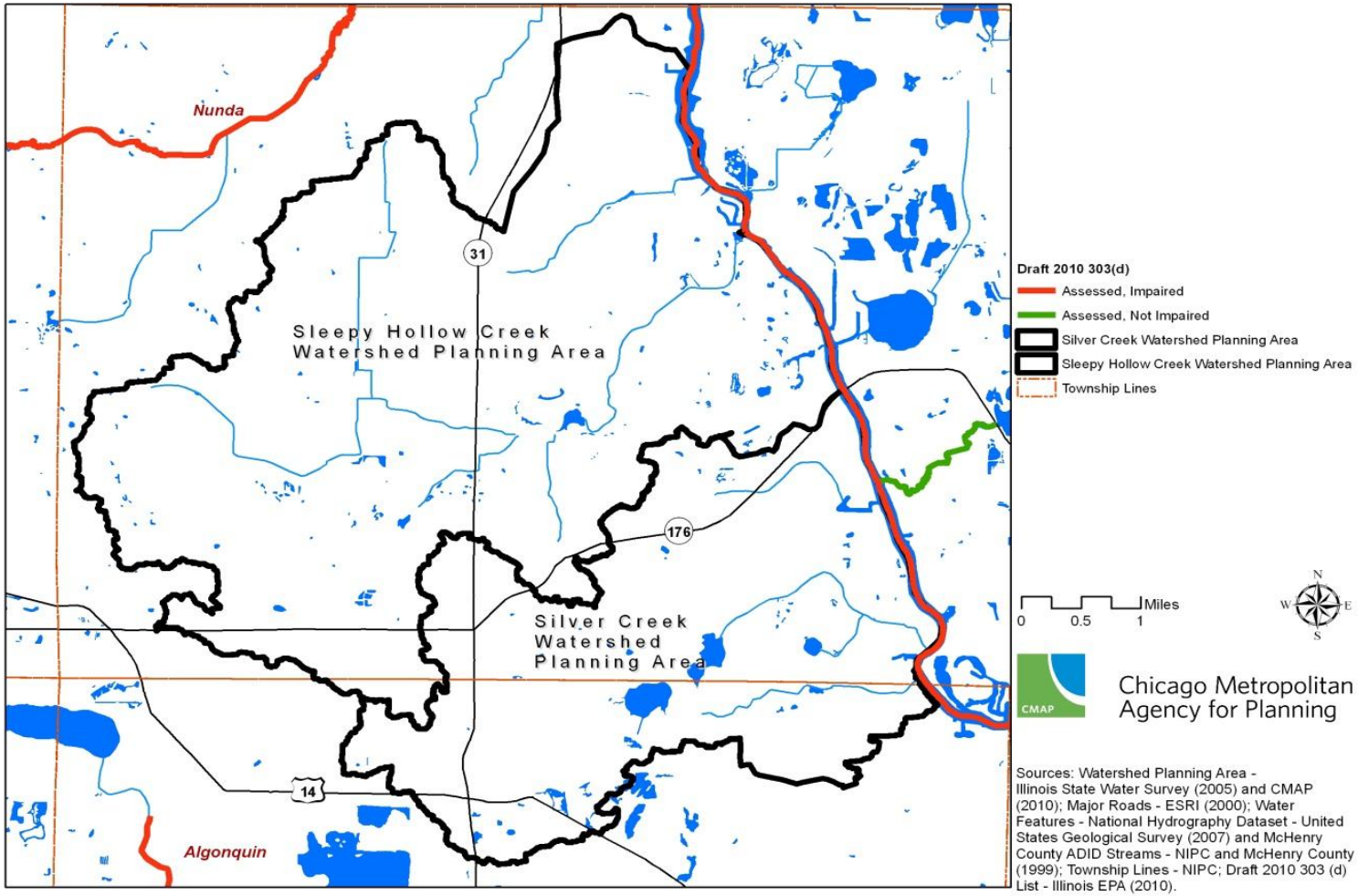
RATING	GENERAL CONDITION	RELATIONSHIP TO STANDARD	IMPAIRED?
Fully Supporting	Good	Meets standard	No
Not Supporting	Fair	Does not meet standard	Yes
Not Supporting	Poor	Does not meet standard	Yes

Any waters found to be not fully supporting of any of the seven designated uses are said to be impaired and placed on the List. Removing water bodies from the List is a main objective of watershed planning projects like that for Sleepy Hollow Creek and Silver Creek Watersheds. The following sections summarize the available information from the Report relevant to these efforts.

3.2. Assessments and Designated Uses

Neither Silver Creek nor Sleepy Hollow Creek have been assessed for water quality impairments in the Report. However, the segment of the Fox River into which the streams both drain (DT-22) has been assessed. Table 10 summarizes the designated uses of the DT-22 segment of the Fox River into which both the Silver Creek and Sleepy Hollow Creek streams drain. The table also provides the assessment status, impairment status and impairment causes and sources. Figure 37 shows the assessed Fox River segment (DT-22) and its impairment status. This segment was determined as Not Supporting for Aquatic Life, Fish Consumption and Primary Contact uses. Aesthetic Quality designated uses were not assessed.

Figure 37. Assessed segment of the Fox River into which the planning area drains



It should be noted that water quality in the Fox River at stream segment DT-22 is largely a reflection of various land-use activities within the entire upstream river basin. While it is neither possible nor the intention of this plan to remediate segment DT-22, it is possible that the planning area makes some sort of contribution to eliminating one or more of the main-stem-river impairments. Implementing BMPs throughout the planning area, therefore, will ensure that this contributing watershed does its part to protect both local and downstream water quality.

Table 10. Impairment causes, sources and status for the Fox River segment DT-22

USE ATTAINMENT	ATTAINMENT	IMPAIRMENT STATUS	CAUSES OF IMPAIRMENT	SOURCES OF IMPAIRMENT
582 Aquatic Life	Assessed	Not Supporting	84 Alteration in streamlittoral vegetative covers 138 Chloride 163 Copper 319 Other flow regime alterations 371 Sedimentation and siltation 479 Aquatic algae	58 Impacts from hydrostructure flow regulation or modification 157 Habitat modification other than hydro-modification 142 Dam or impoundment
583 Fish Consumption	Assessed	Not Supporting	348 Polychlorinated biphenyls	49 Highway, road or bridge runoff (non-construction related) 177 Urban runoff or storm sewers
585 Primary Contact	Assessed	Not Supporting	400 Fecal coliform	140 Source Unknown
586 Secondary Contact	Not Assessed	–	–	–
590 Aesthetic Quality	Not Assessed	–	–	–

Assessment data collected for this segment of the Fox are useful for this discussion, nonetheless, because they suggest that protective actions might be necessary in order to also keep both Silver Creek's and Sleepy Hollow Creek's waters from becoming 303(d)-listed were they to be assessed. The sections below examine in more detail the three designated uses for which the Fox River segment DT-22 was assessed, including how IEPA defines the designated use, the standard for each and the assessment data with which the impairment determination was made.

Designated Use: Aquatic Life

IEPA relies on biological, water quality and stream habitat data to determine the extent to which a stream supports aquatic life. These data are used to create two indices used in making this assessment. These indices include (1) the fish Index of Biotic Integrity (fIBI), and (2) the Macroinvertebrate Biotic Index (MBI) for small organisms including larval insects, insect nymphs, crustaceans, mollusks, worms, and others collectively known as benthos or benthic macroinvertebrates. Table 11 comprehensively states these standards and interpretation related to these indices.

Table 11. IEPA's Designated Use: Aquatic Standards[88]

BIOLOGICAL INDICATOR[1]			
Fish Index of Biotic Integrity(fIBI)	≤ 20	20 < IBI < 41	≥ 41
Macroinvertebrate Index of Biotic Integrity (mIBI)	≥ 8.9	5.9 < mIBI < 8.9	≤ 5.9
Impairment Status	Severe Impairment	Moderate Impairment	No Impairment
Designated Use Support	Not Supporting	Not Supporting	Fully Supporting
Resource Quality	Poor	Fair	Good

Table 12 shows the scores for the Aquatic Life biological indicator standards for this segment used in determining its impairment status in the Report. The scores for the segment of the Fox River into which both streams drain (DT-22) indicate that this water body is Not Supporting (Fair) for the Aquatic Life designated use.

Table 12. Designated Use: Aquatic life scores for the segment of the Fox River into which the streams drain

	FOX RIVER
Station ID	**IL_DT-22**
Fish Index of Biotic Integrity (fIBI)	**30**
Macroinvertebrate Biotic Integrity (MBI)	**6.8**
Impairment Status	**No Impairment**
Designated Use Support	**Not Supporting**
Resource Quality	**Fair**

IEPA found the sources of impairment for the Aquatic Life designated use to be impacts from hydrostructure flow modification or regulation, habitat modification other than from hydro-modification, and the presence of a dam or impoundment. Hydrostructures are structures built on or in waterbodies like dams or impoundments which lead to physical changes in a stream. Other such modifications leading to changes in stream habitat or hydrology include the widening, deepening or channelization of a stream, streambank hardening, poorly designed stream barriers like bridges, dams, culverts, and construction in and along riparian buffers and wetlands. Increased impervious surface from new construction or development in the watershed planning area can also contribute to habitat modification through increased runoff and loadings of nonpoint-source pollutants draining to the stream, and through changes in a stream's hydrograph. It is this latter aspect that leads to streambed and streambank erosion (i.e., deepening and widening of the channel) as the stream makes natural fluvial-geomorphic adjustments to a new flow regime.

[88] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume I: Surface Water*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

These sources in turn lead to the specific causes impairing the Aquatic Life designated use in this stream segment. IEPA found specific causes to include the alteration in stream-side or littoral vegetative covers, chloride, copper, flow regime alterations, sedimentation and siltation, and aquatic algae. Although hydrologic modifications are implemented with the goals of better controlling flooding, aiding in navigation, and improving drainage, such modifications can also ultimately cause impacts that result in the loss of suitable habitat for fish and wildlife. Hydromodification can change the amount and direction of natural water flow, increasing erosion and consequent sediment loadings. Channelization can alter water temperature and sediment transport patterns, while hardened, unvegetated streambanks can worsen habitat degradation and carry pollutants like nutrients and sediment from upstream to downstream farther than they would otherwise travel. Dam construction and maintenance can alter river hydrology and degrade water quality, including lowering dissolved oxygen levels. Dams also collect sediment and silt over time. While some erosion of streambanks and shorelines is a natural occurrence, excessive erosion from the hydromodifications described here leads to sediment levels which can cover underwater aquatic vegetation and contribute to increased cloudiness and nutrient concentrations in the stream.

In addition, IEPA identified habitat modification through processes other than hydromodification as another source of impairment in DT-22. For example, increased impervious surface in the watershed planning area is not a hydromodification, but impacts aquatic habitat. Increased impervious surface leads to increased runoff and loadings of nutrients, sediment and other nonpoint-source pollutants, and higher water temperatures. Runoff from impervious surfaces in the watershed planning area is a likely source of copper and chloride contamination, identified by IEPA as additional causes impairing the Aquatic Life designated use. Both copper and chloride are micronutrients essential at low concentrations for all life, including in aquatic habitats. However, at higher concentrations, both of these contaminants can have harmful effects on aquatic habitat. Copper is toxic to aquatic life at high concentrations, while chlorides can reduce plant growth, lower dissolved oxygen concentrations, interfere with reproduction, and reduce stream biodiversity.[89,90]

Designated Use: Fish Consumption

Segment DT-22 of the Fox River was also found to be Not Supporting for the Fish Consumption designated use. IEPA found the specific cause of impairment for Fish Consumption in this segment to be Polychlorinated Biphenyl (PCB) contamination. Table 13 contains the guidelines used in the Report for determining impairment status for Fish Consumption from PCB's.[91] The degree of use support is Not Supporting (Fair), given that the Illinois Department of Public Health (IDPH) has annually issued restricted fish consumption advisories. For 2011, these restrictions included Carp, Channel Catfish and Freshwater Drum in the Fox River in Lake, LaSalle, Kane, Kendall and McHenry Counties due to PCB

[89] "2007 Update of Ambient Water Quality Criteria for Copper," U.S. EPA, last modified September 29, 2011, accessed October 5, 2011, http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/pollutants/copper/fs-2007.cfm.

[90] "Chloride Found at Levels that Can Harm Aquatic Life in Urban Streams of the Northern U.S.—Winter Deicing a Major Source," USGS last modified September 16, 2009, accessed October 5, 2011, http://www.usgs.gov/newsroom/article.asp?ID=2307.

[91] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume I: Surface Water*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

contamination.[92][93] PCB's are a class of man-made organic chemicals which were manufactured in the United States until 1979.[94] Due to their nonflammability, chemical stability, high boiling point, and electrical insulating properties, PCB's were used for a multitude of industrial applications.[95] PCB exposure is harmful to human health because it has been found to cause cancer and to adversely affect immune, reproductive, neurological and endocrine health.[96]

Table 13. IEPA guidelines used to determine the impairment status for fish consumption

DEGREE OF USE SUPPORT	STANDARDS
Fully Supporting (Good)	PCBs are less than 0.06 mg/kg and chlordane is less than 0.16 mg/kg in fish tissue inthe two most recent years of samples for each species collected since 1985; and, mercury is less than 0.06 mg/kg in fish tissue in the two most recent years of samples for each species collected since 1985 and those samples include at least one predator species of a "large size class" in two different years.
Not Supporting (Fair)	A waterbody-specific "restricted consumption" fish consumption advisory is in effect; or, mercury is greater than or equal to 0.06 mg/kg in fish tissue of any species, in at least one of the two most recent years of samples collected in 1985 or later.
Not Supporting (Poor)	A "no consumption" (i.e., "Do Not Eat") fish consumption advisory, for one or more fish species, is in effect for the general human population; or, a commercial fishing ban is in effect.

[92] "2011 Sports Fish Consumption Advisory," IDPH, last modified January 21, 2011, accessed September 27, 2011, http://www.idph.state.il.us/public/press11/1.21.11FishAdv.htm.
[93] All fish mentioned are bottom feeders, which implies that the sediments may be contaminated.
[94] "Polychlorinated Biphenyls (PCBs) Laws and Regulations," U.S. EPA, last modified October 12, 2010, accessed September 27, 2011, http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/laws.htm.
[95] "Polychlorinated Biphenyls (PCBs) Basic Information," U.S. EPA, last modified December 29, 2010, accessed September 27, 2011, http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm.
[96] "Polychlorinated Biphenyls (PCBs) Basic Information," U.S. EPA, last modified December 29, 2010, accessed September 27, 2011, http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm..

IEPA found the source of PCBs impairing the Fish Consumption designated use to be highway, road or bridge runoff that is non-construction related, as well as urban runoff or storm sewers. Runoff flowing over areas containing PCBs becomes contaminated with this and other pollutants. For example, PCBs can enter waterways from runoff flowing over poorly maintained hazardous waste sites that contain PCBs; and sites where electrical transformers containing PCBs have leaked.[97] While no longer manufactured in the U.S., PCB's can also still be found in a number of products manufactured before the ban took effect in 1979. These products include: transformers and capacitors; electrical equipment including voltage regulators and switches; oil used in older motors and hydraulic systems; capacitors from older electrical devices or appliances; some adhesives and tapes; some oil-based paint; certain plastics; and numerous other pre-ban industrial and electrical products.[98] Thus if runoff comes into contact with these products, for example, when they have been improperly disposed of, there is the risk that PCB contamination can enter the water body to which this runoff drains.

Designated Use: Primary Contact

Primary contact is defined by Illinois Water Quality Standards as "any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing." IEPA primarily uses

[97] "Polychlorinated Biphenyls (PCBs) Basic Information," U.S. EPA, last modified December 29, 2010, accessed September 27, 2011, http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm.
[98] "Polychlorinated Biphenyls (PCBs) Basic Information," U.S. EPA, last modified December 29, 2010, accessed September 27, 2011, http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm.

fecal coliform bacteria data to determine whether or not a stream is supporting this designated use. Fecal coliform is a type of bacteria that is generally found in human and animal feces, and is used in this context as an indicator of bacteriological impairment.[99] Because IEPA uses fecal coliform as an indicator, water samples are not analyzed for other specific pathogens or viral contamination. The IEPA standard for fecal coliform states that "the geometric mean of all fecal coliform bacteria observations (a minimum of five samples over the most recent five year period) collected May through October may not exceed 200 colony forming units per 100 mL or 10% of all fecal coliform bacteria (samples) observed may not exceed 400 colony forming units per 100 mL."[100] Table 14 articulates the standards for the Primary Contact designated use. Fecal coliform data on which the Report's assessment of the Fox River segment DT-22 is based was collected by IEPA and the Fox River Study Group (FRSG).[101]

Table 14. IEPA guidelines used to determine Designated Use: Primary Contact

DEGREE OF USE SUPPORT	STANDARDS
Fully Supporting (Good)	No exceedances of the fecal coliform bacteria standard in the last five years and the geometric mean of all fecal coliform bacteria observations <200/100 ml, and <10% of all observations exceed 400/100 ml.
Not Supporting (Fair)	One exceedance of the fecal coliform bacteria standard in the last five years (when sufficient data is available to assess the standard) OR The geometric mean of all fecal coliform bacteria observations in the last five years <200/100 ml, and >10% of all observations in the last five years exceed 400/100 ml OR The geometric mean of all fecal coliform bacteria observations in the last five years >200/100 ml, and <25% of all observations in the last five years exceed 400/100 ml.
Not Supporting (Poor)	More than one exceedance of the fecal coliform bacteria standard in the last five years (when sufficient data is available to assess the standard) OR The geometric mean of all fecal coliform bacteria observations in the last five years >200/100 ml, and >25% of all observations in the last five years exceed 400/100 ml.

Table 15. ISWS Fecal Coliform Data in reference to the state water quality standard

WATER QUALITY STANDARD	DATA COLLECTED BY IEPA	DATA COLLECTED BY FRSG	IEPA IMPAIRMENT STANDARD	REDUCTION NEEDED
Geometric Mean (#/100mL)	55	33	200	–
% of Samples > 400 (#/100 mL)	14.0%	7.7%	10.0%	–

Given these results, the Report finds that the segment of the Fox River into which both streams drain is Not Supporting (Fair) for the primary contact designated use. A reduction in fecal coliform in this segment of the Fox River is needed to meet the standard for the percent of samples greater than 400 #/100 mL. Stakeholders in the watershed planning area elected to adopt this water quality standard

[99] "Monitoring and Assessment: Fecal Bacteria," U.S. EPA, last modified June 29, 2011, accessed August 15, 2011, http://water.epa.gov/type/rsl/monitoring/vms511.cfm.

[100] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume I: Surface Water*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

[101] Howard Essig, IEPA, email message to author(s), January 31, 2011. Preliminary monitoring data for the Fox River, collected by IEPA and the Fox River Study Group (FRSG), 2011.

for setting target load reductions when monitoring data collected for these tributaries.

In addition, a Total Maximum Daily Load (TMDL) analysis is currently under development for fecal coliform in the Fox River segment DT-22. TMDL's are a calculation to determine the maximum amount of a pollutant that a water body can receive while still meeting water quality standards for that pollutant.[102] A TMDL is also a plan for mitigating a source of impairment that stakeholders can implement to improve water quality in a watershed. Recommendations made in this plan to address fecal coliform can therefore complement the efforts to develop and implement a TMDL for fecal coliform in the Fox River segment DT-22 currently underway.

3.3. Threats to Designated Use Attainment

Fecal Coliform Critical Area Analysis

While this assessment demonstrates that fecal coliform is a cause of Primary Contact use impairment in DT-22, the specific location (s) contributing to fecal coliform contamination are unknown. The IEPA has identified potential sources of fecal coliform impairment to be urban runoff and storm sewers, and runoff from forests, grasslands and parks. Best professional judgment suggests that leakage from failing septic systems is another potential source of fecal coliform contamination. It is important to note that runoff from forests, grasslands and parks contains a naturally-occurring, background level of fecal coliform because wildlife are a component of both natural and man-made landscapes. This plan does not recommend eradication of wildlife like water fowl and sea gulls, although some fecal coliform contamination from wildlife can certainly be prevented. For example, naturalizing detention basins discourages the presence of Canada Geese. Rather the emphasis in this plan is on human-managed fecal coliform sources. For forests, grasslands and parks, this likely means waste which pet owners fail to pick up.

Runoff is the nonpoint source mechanism by which fecal coliform contamination arrives in nearby water bodies. Urban runoff carries fecal coliform and other pollutants, and can be a source of contamination when it empties into storm sewers and discharged untreated into streams. The volume of urban runoff is determined by the amount of impervious surface area (e.g., parking lots, rooftops or streets). As impervious surface area increases, runoff from urban areas generally increases, while water quality generally decreases. Water flowing over impervious urban surfaces picks up fecal coliform from pet waste, in addition to a variety of pollutants including oil and toxic chemicals from cars, sediment, road salts, and pesticide and nutrient runoff from lawns and gardens. Similarly, runoff from agricultural areas, forests, grasslands and parks can be source of contamination because it can also carry fecal coliform from pets, livestock or wildlife. Failing septic systems in both urban and rural areas can also contaminate water with fecal coliform from runoff over locations of failing septic systems. All three of these sources, however—impervious surface cover, agricultural areas, forests, grasslands and parks, and areas with failing septic systems—are spatially dispersed throughout the planning area. Given the limited spatial resolution of data collected, IEPA data cannot determine the specific location(s) from which fecal coliform may be entering the Fox River.

This plan includes recommendations that address runoff generally and aim to increase stormwater infiltration to limit these sources of current and future fecal coliform contamination. Additionally, this plan includes recommendations to address proper septic system

[102] "What is a TMDL?" IEPA, accessed October 6, 2011, http://www.epa.state.il.us/water/tmdl/what-is-a-tmdl.html.

maintenance to limit potential fecal coliform contamination from failing septic systems.

Nutrient and Sediment Loading

Little data are available for the Silver Creek of Sleepy Hollow Creek tributaries themselves. Sierra Club volunteers measured a number of water quality parameters in samples taken from Silver Creek on a monthly basis from December 2001 to November 2002. The State of Illinois has yet to set water quality standards associated with nutrients in streams and rivers, except for phosphorus at points where streams enter a lake or reservoirs greater than twenty surface acres.[103] This particular water quality standard does not apply to Silver Creek or Sleepy Hollow Creek, or Fox River segment DT-22. However, for water quality parameters for which there are no numeric water quality standards, USEPA does offer statistically-derived water quality guidelines for parts of the country termed "Ecoregions."[104] These guidelines are for use by states in developing water quality standards consistent with section 303(c) of CWA and represent the 25th percentile of observed water quality measurements for samples collected in this region. The 25th percentile is the value at which 25% of sample concentrations are below this value and 75% are above it. The watershed planning area lies in Level III Subecoregion 53, the "Southeastern Wisconsin Till Plains," which reaches into northern Illinois and belongs to the larger Ecoregion VII, "Mostly Glaciated Dairy Region." The TN and TP guidelines for streams and rivers in Subecoregion 53 are summarized in Table 16. Because the USEPA does not offer ecoregional guidelines for TSS, this guideline comes instead from similarly-derived statistical guidelines that are issued by Illinois EPA and recommended for streams and rivers in Illinois.[105] Stakeholders in Silver Creek and Sleepy Hollow Creeks elected to adopt these water quality standards for setting target load reductions when monitoring data collected for these tributaries can be compared with these standards.

Table 16. Water quality target load reductions

POLLUTANT	GUIDELINE FOR AQUATIC QUALITY
Total Nitrogen	**1.59 (mg/L)**
Total Phosphorus	**0.08 (mg/L)**
Total Suspended Solids	**116.00 (mg/L)**

3.4. Groundwater Quality Data

Groundwater quality data were obtained from the Illinois Environmental Protection Agency (IEPA) for community water supply (CWS) wells on both sand & gravel and shallow-bedrock aquifers in the Silver Creek and Sleepy Hollow Creek Watersheds.[106] These data reflect raw water samples, rather than treated water samples. Routine operator sampling is most frequently performed

[103] *Phosphorus*. *Ill. Adm. Code* 35, Subtitle C, Chapter 1, Part 302 Subpart B, Section 205. http://water.epa.gov/scitech/swguidance/standards/wqslibrary/upload/2006_09_05_standards_wqslibrary_il_il_5_c302.pdf (accessed September 7, 2011).

[104] U.S. EPA. *Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion VII*. Report no. EPA 822-B-00-018. Washington, D.C.: U.S. EPA, 2000. http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2007_09_27_criteria_nutrient_ecoregions_rivers_rivers_7.pdf (accessed September 29, 2011).

[105] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume I: Surface Water*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

[106] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.

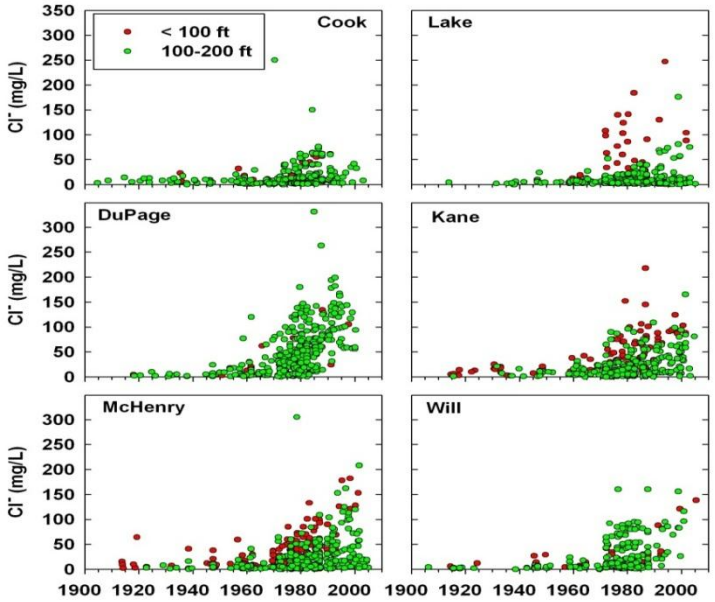
only for treated-drinking water. However since the 1980's, IEPA has sampled all CWS wells at least once for baseline raw water quality data, while a set of 350 wells are sampled every two years as part of the Ambient Monitoring Network.[107]

See Table 17 for the mean concentration, standard deviation, minimum observed value, maximum observed value and number of observations for each inorganic contaminant among wells in this watershed. This table also lists the Maximum Contaminant Levels (MCL) or Secondary Maximum Contaminant Levels (SMCL) as it applies to each contaminant presented here.[108,109] MCL standards are enforced drinking water regulations, while SMCL standards are recommended levels for preserving aesthetic characteristics like appearance, smell, and taste. None of the mean concentrations for any of the inorganic contaminants tested for in these watersheds (or in any individual well within this watershed) exceeded an existing MCL. The only exceedence observed in the data occurs for iron, which exceeds its SMCL.

Chlorides in particular have become a groundwater quality concern given a persistent trend of rising chloride concentrations in shallow wells throughout the region.[110] Chlorides can also impart an undesirable salty taste to drinking water at high levels. Consequently, a SMCL of 250 mg/L chloride (or parts per million, ppm) has been established.[111] Road salt, septic-system effluent, and water-softener brine waste are major sources of chlorides in urban areas. A recent study found chloride concentrations to be increasing in shallow public wells in the six counties studied in northeastern Illinois. Among shallow public wells in this area, 43% were found to be increasing at a rate greater than 1 mg/L of chloride per year and an additional 15% were found to be increasing at a rate greater than 4 mg/L of chloride per year.[112] Figure 38 from the same study shows mean chloride concentrations for public wells in northeastern Illinois by county for the period 1900 to 2005.[113] The majority of these measurements do not exceed the current SMCL of 250 mg/L, but are much higher than 10 mg/L, the median chloride concentration for Chicago-area wells in 1960.[114,115]

Figure 38. Chloride concentrations for public wells in Northeastern Illinois at a county level, 1990 to 2005[116]

[107] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.
[108] "*Primary Drinking Water Standards*. *Ill. Adm. Code* 35, Part 611. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-27419/ (accessed November 14, 2011).
[109] "Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals," U.S. EPA, last modified January 7, 2011 , accessed September 1, 2011, http://water.epa.gov/drink/contaminants/secondarystandards.cfm.
[110] Kelly, Walter R. "Long-Term Trends in Chloride Concentrations in Shallow Aquifers near Chicago." *Ground Water* Vol. 46, No. 5: (September–October 2008): 772–781.
[111] *Primary Drinking Water Standards*. *Ill. Adm. Code* 35, Part 611. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-27419/ (accessed November 14, 2011).
[112] Kelly, Walter R. "Long-Term Trends in Chloride Concentrations in Shallow Aquifers near Chicago." *Ground Water* Vol. 46, No. 5: (September–October 2008): 772–781.
[113] Figure obtained from Walter R. Kelly, Groundwater Geochemist, Illinois State Water Survey (ISWS), email message to author(s), August 25, 2011.
[114] *Primary Drinking Water Standards*. *Ill. Adm. Code* 35, Part 611. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-27419/ (accessed November 14, 2011).
[115] Kelly, Walter R. "Long-Term Trends in Chloride Concentrations in Shallow Aquifers near Chicago." *Ground Water* Vol. 46, No. 5: (September–October 2008): 772–781.
[116] Figure obtained from Walter R. Kelly, Groundwater Geochemist, Illinois State Water Survey (ISWS), email message to author(s), August 25, 2011.



For Silver Creek and Sleepy Hollow Creeks Watersheds specifically, the data presented here show mean concentrations of 52 mg/L and 93 mg/L chloride respectively (Table 17). These results reflect the regional trend described above; the mean chloride concentrations for both watersheds are below the SMCL of 250 mg/L, but they are higher than 10 mg/L, the median 1960 chloride concentration for regional wells.[117,118] Other studies support this finding of rising chloride levels in McHenry County shallow groundwater as well.[119,120]

IEPA also collects data on organic contaminants. No synthetic organic contaminants (SOC's) were detected in any of the wells in either of the watersheds.[121] Table 18 contains statistical data for volatile organic contaminants (VOC's) for these two watersheds. [122] Only xylenes were detected in wells in Silver Creek Watershed, however, at a much lower mean concentration than its MCL. In Sleepy Hollow Creek Watershed, five VOC's were detected, all with mean concentrations lower than their corresponding MCL's.

Data presented here for all VOC's are for raw water samples, as for inorganic contaminants above. Unlike for inorganic contaminants, however, finished drinking-water samples are likely to have similar VOC levels as raw water samples because conventional water treatment does nothing to remove them. A new law passed in Illinois

[117] *Primary Drinking Water Standards*. *Ill. Adm. Code* 35, Part 611. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-27419/ (accessed November 14, 2011).

[118] Kelly, Walter R. "Long-Term Trends in Chloride Concentrations in Shallow Aquifers near Chicago." *Ground Water* Vol. 46, No. 5: (September–October 2008): 772–781.

[119] Baxter and Woodman, Inc. "Chlorides and Agricultural Chemicals: Problem Assessments and Corrective Actions." *Illinois Groundwater Resources Management Plan*, Report 5. Woodstock, IL: McHenry County, Illinois, Department of Planning and Development, November 2006. http://www.co.mchenry.il.us/departments/waterresources/Pages/ManagementPlan.aspx (accessed November 7, 2011).

[120] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[121] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.

[122] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.

in 2010, P.A. 96-1366/ SB 3070 or the MCL Prevention Law, oversees concentrations of Carcinogenic VOC's in finished drinking water.[123] The six CVOC's affected by this law are benzene, carbon tetrachloride, 1,2-dichlorethane, tetrachloroethylene, trichloroethylene and vinyl chloride. The MCL Prevention Law is designed to prevent concentrations of these CVOC's in public water supplies from reaching regulated MCL's. The law requires that if facilities detect one of the CVOC's regulated by this law at a concentration of 50% or more of that CVOC's MCL in finished drinking water, then under certain circumstances, that facility must submit a response plan to prevent exceedence of the MCL, and to lower the concentration of the CVOC below its detectable limit.[124]

The only detection of a CVOC subject to this law occurs in Sleepy Hollow Creek Watershed for trichloroethylene. While the mean concentration for trichloroethylene in this watershed is only 41% of its MCL (5 ppb), 22 of 135 observations for trichloroethylene from 1985 to 2011 in this watershed exceeded the MCL, while an additional 14 samples were over 50% of the MCL. Following July 28, 2010, when the law was passed, there were 6 exceedences of the MCL, and no additional samples that were over 50% of the MCL. The public water systems in these cases might have been required to take action according to the law's stipulations given these exceedences.

[123] *EPA—Carcinogenic Compounds*. *Ill. Comp. Stat*. 810 (2010), § 5/1-101. http://ilga.gov/legislation/BillStatus.asp?DocTypeID=SB&DocNum=3070&GAID=10&SessionID=76&LegID=50631 (accessed September 15, 2011).
[124] *EPA—Carcinogenic Compounds*. *Ill. Comp. Stat*. 810 (2010), § 5/1-101. http://ilga.gov/legislation/BillStatus.asp?DocTypeID=SB&DocNum=3070&GAID=10&SessionID=76&LegID=50631 (accessed September 15, 2011).

Table 17. Groundwater quality statistics for inorganic contaminants, watershed planning area

WATERSHED	CONTAMINANT	STANDARD TYPE	STANDARD LEVEL	MEAN	STANDARD DEVIATION	MINIMUM OBSERVATION	MAXIMUM OBSERVATION	NUMBER OF OBSERVATIONS	UNIT
SC	Antimony	MCL	6	0.00	0.00	0.00	0.00	5	ppb
SC	Arsenic	MCL	10	0.61	1.61	0.00	5.10	10	ppb
SC	Barium	MCL	2,000	105.00	11.00	84.00	130.00	15	ppb
SC	Beryllium	MCL	4	0.00	0.00	0.00	0.00	15	ppb
SC	Cadmium	MCL	5	0.40	1.55	0.00	6.00	15	ppb
SC	Chloride	SMCL	250	93.36	72.47	9.90	208.00	9	ppm
SC	Chromium	MCL	100	0.00	0.00	0.00	0.00	15	ppb
SC	Cyanide	MCL	200	1.00	3.16	0.00	10.00	10	ppb
SC	Fluoride	MCL	4,000	110.00	120.00	0.00	360.00	11	ppb
SC	Iron	SMCL	300	962.00	590.00	110.00	1,700.00	15	ppb
SC	Manganese	SMCL	50	31.67	24.30	0.00	91.00	15	ppb
SC	Mercury	MCL	2	0.01	0.03	0.00	0.10	9	ppb
SC	Nickel	No MCL or SMCL	-	0.00	0.00	0.00	0.00	7	ppb
SC	Nitrate	MCL	10	0.01	0.03	0.00	0.10	72	ppm
SC	Selenium	MCL	50	0.00	0.00	0.00	0.00	11	ppb
SC	Sodium	No MCL or SMCL	-	56.02	28.81	4.00	91.00	15	ppm
SC	Sulfate	SMCL	250	71.98	22.28	12.70	92.00	11	ppm
SC	Thallium	MCL	2	0.00	0.00	0.00	0.00	5	ppb
SC	Zinc	SMCL	5,000	11.47	30.72	0.00	100.00	15	ppb
SH	Antimony	MCL	6	0.00	0.00	0.00	0.00	17	ppb
SH	Arsenic	MCL	10	1.72	2.57	0.00	9.00	32	ppb
SH	Barium	MCL	2,000	129.00	104.00	31.00	734.00	46	ppb
SH	Beryllium	MCL	4	0.11	0.73	0.00	4.92	46	ppb
SH	Cadmium	MCL	5	0.47	1.44	0.00	6.00	46	ppb
SH	Chloride	SMCL	250	51.56	83.41	0.00	264.00	19	ppm
SH	Chromium	MCL	100	0.39	1.51	0.00	7.00	46	ppb
SH	Cyanide	MCL	200	0.437	2.474	0.00	14.00	32	ppb
SH	Fluoride	MCL	4,000	385.00	240.00	120.00	790.00	32	ppb
SH	Iron	SMCL	300	1,565.53	850.12	0.00	4,000.00	47	ppb
SH	Manganese	SMCL	50	37.89	39.04	0.00	140.00	46	ppb
SH	Mercury	MCL	2	0.006	0.03	0.00	0.13	32	ppb
SH	Nickel	No MCL or SMCL	-	0.00	0.00	0.00	0.00	28	ppb
SH	Nitrate	MCL	10	0.005	0.02	0.00	0.10	176	ppm
SH	Selenium	MCL	50	0.03	0.18	0.00	1.00	32	ppb
SH	Sodium	No MCL or SMCL	-	39.93	49.78	5.00	293.00	46	ppm
SH	Sulfate	SMCL	250	50.20	39.76	0.00	116.00	32	ppm
SH	Thallium	MCL	2	0.30	1.23	0.00	5.06	17	ppb
SH	Zinc	SMCL	5,000	470	1,485.00	0.00	7,700.00	46	ppb

Table 18. Groundwater quality statistics for VOC's, watershed planning area

WATERSHED	CONTAMINANT	MCL (PPB)	MEAN (PPB)	STANDARD	MINIMUM	MAXIMUM	SUBJECT TO MCL PREVENTION LAW
SC	1,1,1-Trichloroethane	200	0.00	0.00	0	0.00	—
SC	1,1,1-Trichloroethane	200	0.00	0.00	0	0.00	—
SC	1,1-Dichloroethylene	7	0.00	0.00	0	0.00	—
SC	1,2,4-Trichlorobenzene	70	0.00	0.00	0	0.00	—
SC	1,2-Dichloroethane	5	0.00	0.00	0	0.00	Yes
SC	1,2-Dichloropropane	5	0.00	0.00	0	0.00	—
SC	Benzene	5	0.00	0.00	0	0.00	Yes
SC	Carbon Tetrachloride	5	0.00	0.00	0	0.00	Yes
SC	Chlorobenzene	100	0.00	0.00	0	0.00	—
SC	Chloromethane	No MCL	0.00	0.00	0	0.00	—
SC	Cis-1,2-Dichloroethylene	70	0.00	0.00	0	0.00	—
SC	Dichloromethane	5	0.00	0.00	0	0.00	—
SC	Ethylbenzene	700	0.00	0.00	0	0.00	—
SC	Methyl Tert-Butyl Ether	No MCL	0.00	0.00	0	0.00	—
SC	O-Dichlorobenzene	600	0.00	0.00	0	0.00	—
SC	P-Dichlorobenzene	75	0.00	0.00	0	0.00	—
SC	Styrene	100	0.00	0.00	0	0.00	—
SC	Tetrachloroethylene	5	0.00	0.00	0	0.00	Yes
SC	Toluene	1,000	0.00	0.00	0	0.00	—
SC	Trans-1,2-Dichloroethylene	100	0.00	0.00	0	0.00	—
SC	Trichloroethylene	5	0.00	0.00	0	0.00	Yes
SC	Vinyl Chloride	2	0.00	0.00	0	0.00	Yes
SC	Xylenes (total)	10,000	0.11	0.47	0	2.10	—
SH	1,1,1-Trichloroethane	200	0.00	0.00	0	0.00	—
SH	1,1,1-Trichloroethane	200	0.00	0.00	0	0.00	—
SH	1,1-Dichloroethylene	7	0.00	0.00	0	0.00	—
SH	1,2,4-Trichlorobenzene	70	0.00	0.00	0	0.00	—
SH	1,2-Dichloroethane	5	0.00	0.00	0	0.00	Yes
SH	1,2-Dichloropropane	5	0.00	0.00	0	0.00	—
SH	Benzene	5	0.00	0.00	0	0.00	Yes
SH	Carbon Tetrachloride	5	0.00	0.00	0	0.00	Yes
SH	Chlorobenzene	100	0.00	0.00	0	0.00	—
SH	Chloromethane	No MCL	0.00	0.00	0	0.00	—
SH	Cis-1,2-Dichloroethylene	70	4.90	5.21	0	25.00	—
SH	Dichloromethane	5	0.00	0.00	0	0.00	—
SH	Ethylbenzene	700	0.00	0.00	0	0.00	—
SH	Methyl Tert-Butyl Ether	No MCL	0.75	0.46	0	1.90	—
SH	O-Dichlorobenzene	600	0.00	0.00	0	0.00	—
SH	P-Dichlorobenzene	75	0.00	0.00	0	0.00	—
SH	Styrene	100	0.01	0.16	0	1.88	—
SH	Tetrachloroethylene	5	0.00	0.00	0	0.00	Yes
SH	Toluene	1,000	0.02	0.19	0	2.20	—
SH	Trans-1,2-Dichloroethylene	100	0.00	0.00	0	0.00	—
SH	Trichloroethylene	5	2.09	3.66	0	15.00	Yes
SH	Vinyl Chloride	2	0.00	0.00	0	0.00	—
SH	Xylenes (total)	10,000	0.00	0.00	0	0.00	—

3.5. Prioritizing Policy and Project Recommendations

Critical Areas Analysis

The preceding discussion has provided an overall characterization of water quality issues in Silver Creek and Sleepy Hollow Creek Watersheds for both surface water and groundwater. The following discussion now focuses on identifying critical areas based on computer modeling results for surface waters at a subwatershed level in the watershed planning area to inform localized plan implementation activities. Critical areas are defined as those subwatersheds within the planning area which is a source of contamination for a given impairment is present at a concentration relatively higher than that found in the watershed planning area in general.[125] Prioritizing recommended projects and policies for implementation is generally performed according to the financial ability and political will of the implementer. The impact that a given recommendation will have on environmental quality in the watershed planning area is another, secondary consideration. By helping to identify areas within a watershed which are thought to generate a disproportionately high pollutant load, stakeholders have another tool for prioritizing recommended projects and policies based on the relative need for mitigation throughout the planning area.

While pollutant load reductions demonstrate the mitigation capacity of a particular project or policy, critical areas instead demonstrate those locations within the planning area which are likely most in need of attention. A project or policy could potentially have a large pollutant load reduction, signaling a large impairment mitigation capacity, but might be implemented in an area which is relatively unimpaired compared with other subwatersheds. If, however, stakeholders must choose among a larger set of possible project or policy options due to realistic financial or planning constraints, such a scenario might not result in the efficient use of time, money and energy in implementing plan recommendations on the ground. This critical areas analysis is therefore presented as a second decision-making tool which stakeholders may use to further prioritize projects and policies aimed at mitigating fecal coliform contamination and nutrient and sediment loading, following the top prioritization of those projects and policies most likely to be successfully implemented in the short term (i.e., within 5 years of plan approval).

Unfortunately, specific water quality or pollutant loading data do not exist at a subwatershed or watershed level for and the Silver Creek and Sleepy Hollow Creek Watersheds. This is why the data presented from the Integrated Draft Report focuses on the stream into which the Silver Creek and Sleepy Hollow Creek tributaries drain, Fox River segment DT-22. Given the absence of specific assessment data from these watersheds themselves, the following critical areas analysis instead relies on estimation and modeling results to suggest areas which are likely generating disproportionately large pollutant loadings.

First, an analysis is presented to show the estimated percentage of impervious cover at a subwatershed level for both current land use and future projected land use. The critical areas in this case are those subwatersheds projected to develop the greatest percentages of impervious cover. Second, fecal coliform contamination is estimated using the L-THIA model, and nutrient and sediment runoff are estimated using the STEPL model, to calculate unit-area loadings for each of these pollutants. Critical areas for fecal coliform

[125] CMAP and IEPA. *Guidance for Developing Watershed Action Plans in Illinois*. Chicago, IL: CMAP, 2007. http://www.epa.state.il.us/water/watershed/publications/watershed-guidance.pdf (accessed August 15, 2011).

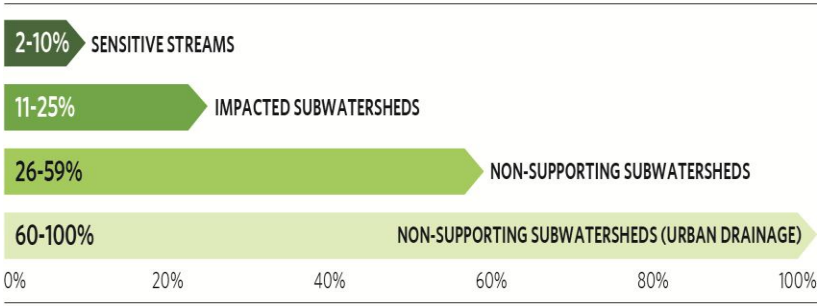
contamination and nutrient and sediment runoff are defined here as subwatersheds demonstrating the largest unit-area loadings for these pollutants. If any further level of prioritization of specific project recommendations is desired on the part of watershed stakeholders beyond projects and policies deemed most likely to be successfully implemented in the short term, then these critical areas can further aid in the selection of project recommendations most likely to reduce pollutant runoff in subwatersheds generating disproportionately high fecal coliform, nutrient or sediment loadings.

3.6. Current and Projected Imperviousness

The percentage imperviousness was examined based on current and future projected land use throughout the planning area to identify subwatersheds most vulnerable to negative impacts from impervious surface area, both now and in the future. The degree of impervious area within a watershed contributes both directly and indirectly to potential stream impairments. Runoff from increased impervious area can lead to habitat modification impairing aquatic life. Urban runoff and runoff from highways, roads and bridges were identified as sources of PCB contamination impairing the Fish Consumption designated use. In addition, although the specific source(s) for fecal coliform contamination impairing the Primary Contact designated use could not be determined, Section 3.3discusses urban runoff as a potential source of fecal coliform contamination.

Given the impact that the degree of impervious area can have on water resources, the Chesapeake Stormwater Network[126] has developed an Impervious Cover Model which correlates impervious cover in a watershed with stream quality. As the percent impervious area in a watershed increases, stream quality tends to decrease. Specific thresholds for percent impervious area in each subwatershed are displayed according to this model (Figure 39).

Figure 39. Impact of impervious cover on a watershed's health, in percentage



Current imperviousness in each subwatershed was determined from the National Land Cover Dataset, which includes an imperviousness component.[127] Cell values in this layer represent the fraction of imperviousness for that cell. This layer was converted to actual impervious area per grid cell by multiplying the fraction of imperviousness of the cell by the area of the cell. The impervious area grid cells were then summed within each subwatershed. Finally, the impervious area in each subwatershed was divided by the subwatershed's total area to calculate percent impervious area.

[126] Chesapeake Stormwater Network. *The Reformulated Impervious Cover Model: Implications for Stream Classification, Subwatershed Management and Permitting*. Technical Bulletin No. 3. Baltimore, MD: Chesapeake Stormwater Network, 2008. http://www.chesapeakestormwater.net/all-things-stormwater/tag/technical-bulletin (accessed September 15, 2011).

[127] USGS Multi-Resolution Land Characteristics Consortium (MRLC). *National Land Cover Dataset*. Sioux Falls, SD: USGS MRLC, 2001. http://www.mrlc.gov/index.php (accessed August 15, 2011).

Projected imperviousness was estimated for each planning area at a subwatershed level using future land use specified in municipality and county comprehensive planning maps. Municipal and county comprehensive planning maps were georeferenced in ArcGIS to enable digitizing. Comprehensive plans used in this analysis include those from Cary, Crystal Lake, McHenry, Prairie Grove, Nunda Township and McHenry County. All developed land uses—those excluding open space, agriculture, agricultural residential and water bodies—were digitized and assigned to one of seven simplified land use categories for this analysis. These land use categories were then associated with a fraction of impervious surface area.[128] See Table 19 for land use categories and impervious runoff coefficients used in this analysis. Given ambiguity among comprehensive plans regarding precise definitions of low and medium density residential housing, the average of the coefficients for low and medium density residential land uses was calculated and applied to both of these land use types. In addition, because different types of developed land uses are associated with different amounts of impervious land cover, the future imperviousness results cannot necessarily be readily inferred from a qualitative comparison with existing land cover or comprehensive plan maps. For example, a given subwatershed might have both open space and industrial land uses, but its projected imperviousness might still be impacted with regard to stream health because industrial land uses are associated with a greater fraction of impervious land cover than other developed land uses such as residential housing. This is why comprehensive plan maps were georeferenced and digitized to perform a quantitative analysis.

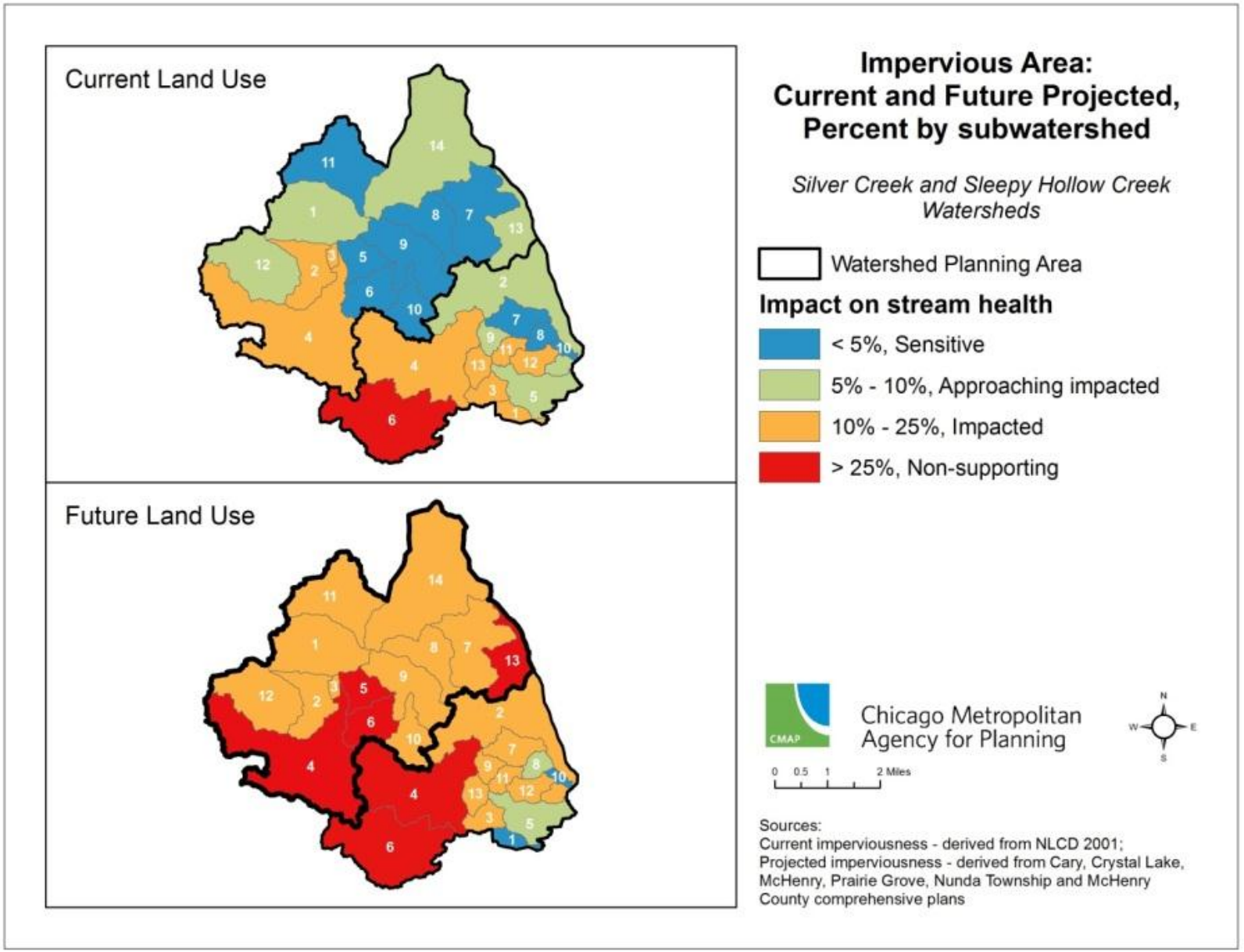
Table 19. Relationship between watershed impervious cover (%) and stream classification

LAND USE	FRACTION IMPERVIOUS LAND COVER
Low density residential	0.285
Medium density residential	0.285
High density residential	0.514
Commercial	0.562
Office/industrial park	0.659
Institutional	0.280
Industrial	0.759

The digitized future land use features were then clipped to the watershed boundary and intersected with the watershed's subwatersheds. Once intersected, the fraction of impervious land cover could be multiplied by the area for each of the digitized future land use features within each subwatershed to give the actual impervious land cover for that future land use feature. The areas of impervious land cover for each of these features was then summed within each subwatershed and divided by that subwatershed's total area to give the percent. Figure 40 displays the results of both the current and projected imperviousness analyses.

[128] Wayne County, MI, Rouge Program Office. *Determination of Impervious Area and Directly Connected Impervious Area*, by Ed Kluitenberg. Wayne County, MI: Rouge Program Office, 1994. www.rougeriver.com/pdfs/modeling/RPO-MOD-SR35.pdf (accessed August 9, 2011).

Figure 40. Current and projected imperviousness within the watershed planning area



Based on current land use for the Sleepy Hollow Creek and Silver Creek planning areas, only subwatershed 6 in Silver Creek is identified as Nonsupporting, while 9 other subwatersheds in the two planning areas are identified as Impacted according to the thresholds developed by the Chesapeake Stormwater Network. No subwatersheds in either planning area are projected to reach 60% imperviousness in the future scenario. It is important to note that this analysis of projected imperviousness is not intended as a literal characterization of on-the-ground development over the next several years. Because the analysis was performed by manually georeferencing and digitizing comprehensive plan pdf files, there is some uncertainty (i.e., generalization) built into the resulting map. Changes in impervious land cover cannot be determined on a parcel by parcel basis from this analysis, which is why the results are summarized by subwatershed and presented as a percentage of subwatershed total area rather than as a concrete number of acres of future impervious land cover. Rather these results are intended only to identify those subwatersheds that are *most likely* to become impacted or nonsupporting in the future with regard to impervious land cover's impact on stream health.

With this caveat in mind, Table 20 identifies the subwatersheds that are currently Nonsupporting or Impacted and the municipality that is primarily present within each subwatershed. Tables 21 and 22 summarize the changes in imperviousness according to this analysis for each subwatershed, demonstrating from which and to which category each subwatershed is projected to move. Consequently, critical areas for imperviousness are identified to be those subwatersheds moving from the Sensitive or Approaching Impacted categories, to the Impacted or Nonsupporting categories. For Silver Creek and Sleepy Hollow Creek Watersheds, this includes subwatersheds 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14.

Table 20. Municipal impact on subwatersheds

SUBWATERSHED	MUNICIPALITY
Sleepy Hollow Creek 2	**Unincorporated**
Sleepy Hollow Creek 3	**Unincorporated**
Silver Creek 1	**Crystal Lake**
Silver Creek 3	**Cary**
Silver Creek 4	**Unincorporated**
Silver Creek 6*	**Unincorporated**
Silver Creek 11	**Crystal Lake**
Silver Creek 12	**Oakwood Hills**
Silver Creek 13	**Oakwood Hills**

*Only currently Nonsupporting subwatershed; all others are Impacted.

Table 21. Silver Creek subwatersheds projected category changes

	FROM CURRENT...			
TO FUTURE...	SENSITIVE	APPROACHING IMPACTED	IMPACTED	NONSUPPORTING
SENSITIVE	10	–	1	–
APPROACHING IMPACTED	8	5	–	–
IMPACTED	7	2, 9	3, 11, 12, 13	–
NONSUPPORTING	–	–	4	6

Table 22. Sleepy Hollow Creek subwatersheds projected category changes

	FROM CURRENT...			
TO FUTURE...	SENSITIVE	APPROACHING IMPACTED	IMPACTED	NONSUPPORTING
SENSITIVE	–	–	–	–
APPROACHING IMPACTED	–	–	–	–
IMPACTED	7, 8, 9, 10, 11	1, 12, 14	2, 3	–
NONSUPPORTING	5, 6	13	4	–

3.7. Modeling Results

Fecal Coliform – L-THIA Model Results

Fecal coliform was identified in the Report as a cause of impairment for the Primary Contact designated use in the segment of the Fox River into which these watersheds drain, although the source(s) were unknown. Given that DT-22 is the Fox River segment immediately downstream of Silver Creek and Sleepy Hollow Creek, some contribution of fecal coliform may well be coming from these watersheds. Modeling allows for the investigation of fecal coliform contamination in these watersheds in the absence of specific assessment data for the tributaries themselves. Model results can also help to identify potential sources of fecal coliform contamination. For example, land use in an area modeled to have disproportionately large fecal coliform unit-area loadings can be examined to evaluate the most likely sources contributing to the fecal coliform contamination. If the highest unit-area fecal coliform loadings occur in subwatersheds dominated by urban areas or animal agriculture, recommendations can be made to target pet waste pickup and stormwater management or manure management respectively.

Critical areas for fecal coliform have been identified for these planning areas using the Long-Term Hydrologic Impact Analysis (L-THIA) model. Nutrients and sediment unit-area loadings in the next section are instead modeled with the slightly more complex Spreadsheet Tool for Estimating Pollutant Load (STEPL) model. L-THIA takes into account a more limited number of variables; however, L-THIA models fecal coliform while STEPL does not.[129] It is important to note that model results for fecal coliform could not be compared with the water quality standards in section 3.3; the L-THIA model used in this analysis only provides an annual average for fecal coliform loading in a subwatershed, but the state water quality standard for fecal coliform presented in section _ relates only to fecal coliform concentrations from samples collected in May through October.[130] Finally, the results presented here for fecal coliform are conservative, since the L-THIA model likely underestimates fecal coliform loading.

Fecal coliform loading is calculated by multiplying a constant in units of bacteria per volume by the total volume of water passing over a particular land use.[131] As such, the loadings modeled by L-

[129] To download and use the L-THIA or STEPL model, or for more detailed technical documentation, please see https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/tool.htm or http://it.tetratech-ffx.com/steplweb/models$docs.htm respectively.

[130] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume I: Surface Water*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).

[131] The unit-area pollutant load analyses performed using L-THIA and STEPL both utilize the CMAP 2005 Land Use Inventory, the highest resolution, most current regional land use data available. Despite highly specific, spatially explicit land uses detailed in the 2005 Inventory, both the L-THIA and STEPL models use more simplified land use categories. L-THIA

THIA constitute only nonpoint sources of contamination, including those for fecal coliform. The L-THIA model employed here uses minimum observed values for fecal coliform that are derived from the existing literature. Therefore, model outputs will be low compared to other forms of estimation that use maximums or averages.[132] For the purposes of this plan, the nonpoint source component of fecal coliform contamination is more relevant, since wastewater treatment plant point sources must disinfect effluent during the period where sample counts determine a stream's use attainment or impairment status.

The L-THIA model was run at a subwatershed level for the Silver Creek and Sleepy Hollow Creek Planning Areas. As model output, L-THIA estimates runoff volume, runoff depth, and nonpoint-source pollutant loadings. Model inputs for L-THIA include (1) county in which the watershed planning area is located; (2) the percentages of each land use within each subwatershed; and (3) the dominant hydrologic soil group for land within each subwatershed. Indicating the county allows L-THIA to use observed, long-term climate data at a local level to model precipitation events. L-THIA estimates runoff volume and nonpoint-source pollutant loadings based on Event Mean Concentrations (EMC) specific to unique combinations of land uses and pollutant types.[133] EMC values are determined by taking water quality measurements at various points in time during a runoff event, and averaging these measurements by the flow rates corresponding to the sample concentrations. The default EMC values used in the L-THIA model are based on a study by the Texas Natural Resource Conservation Commission.[134] L-THIA uses EMC values to calculate total annual pollutant loadings by multiplying the total annual runoff depth for a land use by the area of that land use, as well as by the appropriate EMC value and converting units when necessary.[135]

To assess relative contributions of pollutants among the 27 subwatersheds in the Silver Creek and Sleepy Hollow Creek Planning Areas, average annual loadings from L-THIA are converted to annual unit-area loads, meaning that the total load for each pollutant is divided by the subwatershed area to calculate pounds of pollutant per acre per year. Unit-area loads provide a more meaningful point of comparison than average annual loads because they account for varying area size among subwatersheds. Larger subwatersheds are expected to contribute more pollutants overall as a function of their greater area, but if the unit-area load for a subwatershed is larger than others, then that subwatershed's

includes the land use categories "agricultural," "commercial," "forest," "grass/pasture," "industrial," "low density residential" and "water/wetlands." STEPL includes the land use categories "urban," "cropland," "pastureland," "forest," "water/wetlands" and "feedlots." STEPL also allows for additional input information including numbers of livestock and septic systems, as well as more detailed urban land use categories. The coefficient applied by L-THIA to agricultural land use assumes the presence of some livestock.

[132] Larry Theller, GIS specialist, Purdue University Department of Agricultural and Biological Engineering, email to author(s), September 21, 2011.

[133] "How L-THIA Estimate NPS Pollutant Loadings using Event Mean Concentration," Purdue University, accessed November 7, 2011, https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/documnt/how_lthia_estimate_nps_using_emc.htm.

[134] Texas Natural Resource Conservation Commission. *Characterization of Nonpoint Sources and Loadings to the Corpus Christi Bay National Estuary Program Study Area*, by Charles Baird and Marshall Jennings. Report No. CCBNEP-05. Corpus Christi, TX: Texas Natural Resource Conservation Commission, 1996. http://www.cbbep.org/publications/virtuallibrary/ccbnep05.pdf (accessed August 15, 2011).

[135] Ibid.

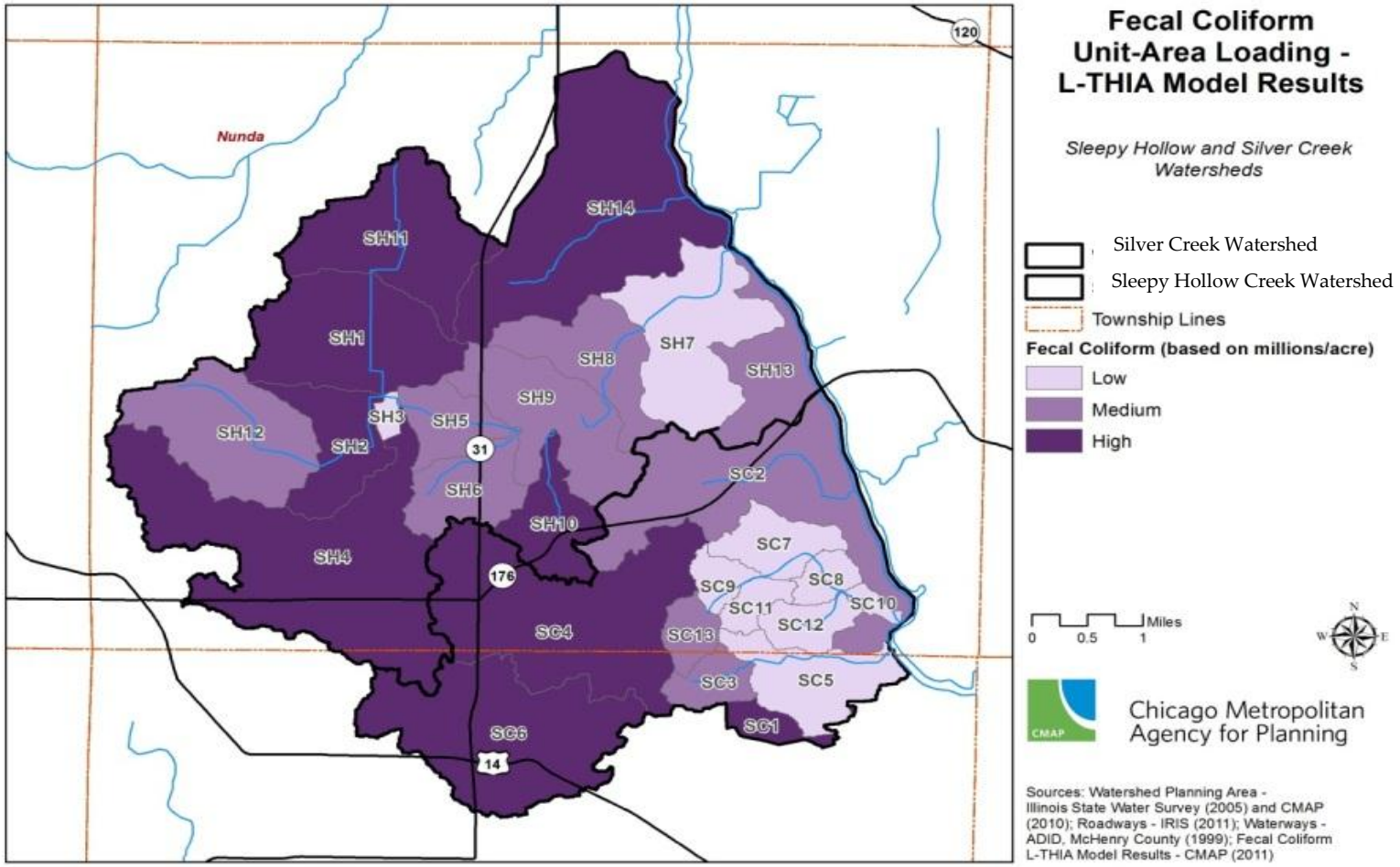
pollutant contribution is assumed to be disproportionately large. Figure 41 shows unit- area loads for fecal coliform by subwatershed within the planning area.

This figure can help to assess which sources of fecal coliform contamination might be most likely in this watershed based on the geographic overlap of likely sources with likely high unit-area loads, helping to guide efforts at mitigating contamination from this pollutant. While some fecal coliform likely does originate from all sources discussed in this plan, the subwatersheds in this map with the highest unit-area loads reflect primarily agricultural areas (subwatersheds SH1, SH11, SH14, and part of SC4), and the developed areas of Crystal Lake, Prairie Grove, Cary and unincorporated land in Silver Creek (subwatersheds SH2, SH4, SH10, SC1, SC4 and SC6).[136] See Section 3.3 Fecal Coliform Critical Areas Analysis for a discussion of specific fecal coliform sources related to agricultural areas and other land use types. In addition, subwatersheds SH4, SH14 and SC1 are also estimated to have among the highest septic system density in these planning areas based on the septic system analysis map in the Resource Inventory.[137] Leakage from failing septic systems might therefore be another possible source of fecal coliform contributing to the disproportionately large unit-area loadings modeled by L-THIA. Consequently, these results suggest that urban runoff from Crystal Lake and unincorporated areas; agricultural live stock; areas used for equestrian purposes; and leakage from failing septic systems might contribute fecal coliform contamination to the watershed planning area.

[136] Fecal coliform loading is calculated in L-THIA using an EMC for fecal coliform from agricultural land that is a conservative, average value based on several published studies. This single value attempts to describe a variety of agricultural activities and practices. For example, fecal coliform can originate from both land with livestock and land fertilized with manure. However, not all agricultural lands support livestock or get fertilized with manure. Therefore, the value used for modeling fecal coliform in L-THIA may not accurately reflect the fecal coliform runoff resulting from the management activities occurring on a specific agricultural land parcel; rather, this value is intended as a general method for approximating fecal coliform loads from agricultural land in the absence of more localized data on fecal coliform contamination originating throughout the watershed.

[137] See Chapter 2 (Septic Systems) in the Resource Inventory for more information on assumptions and methods used in creating the septic system analysis map.

Figure 41. Fecal Coliform estimates



These likely sources could be targeted locally for recommendations to reduce fecal coliform loading.

Nutrients and Sediment—STEPL Model Results

As noted previously, little data are available for nutrient and sediment concentrations in the planning area. The Spreadsheet Tool for Estimating Pollutant Load (STEPL) model is therefore used in lieu of monitoring data to estimate unit-area loadings for nutrients and sediment in the planning area at a subwatershed level. STEPL calculates pollutant loadings based not only on land uses and soil types like L-THIA, but also based on population, animals and land management practices.[138] Similarly to the EMC values used by L-THIA, annual nutrient loading is calculated in STEPL by multiplying the runoff volume by the pollutant concentrations in the runoff for each subwatershed.[139] Additionally, annual sediment loading is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio, which is the ratio of sediment drained to the receiving basin to the total amount of sediment moved by erosion.[140]

Water quality monitoring data are lacking for the watershed planning area with which to calibrate the model and validate model results. Consequently, nitrogen, phosphorus and sediment are displayed spatially in the aggregate via one map rather than three separate maps. The analysis presented here is therefore intended as a preliminary, relative view of pollutant loads likely generated throughout the watershed planning area. Once monitoring data are available in the future, a more detailed assessment of nitrogen, phosphorus and sediment dynamics can be performed to more accurately understand actual pollutant loads. The method for aggregating these metrics is detailed below and is similar to the general process employed in identifying critical areas above. This method has been applied to bundle factors contributing to water quality in other watershed planning documents as well.[141,142]

To view TN, TP and TSS in the aggregate, each subwatershed receives three scores, one for each pollutant's unit-area load. Silver Creek and Sleepy Hollow Creek Planning Areas are evaluated in this analysis as one, combined watershed composed of 27 subwatersheds. Scores are based on ranking the subwatersheds from the lowest unit area pollutant load to the highest. A score of one for each pollutant corresponds to the subwatershed with the lowest unit-area load, while a score of 27 corresponds to the subwatershed with the highest unit area load. The aggregated total rank for each subwatershed is calculated by summing the three ranks for each individual pollutant. Subwatersheds with the highest total rankings

[138] "STEPL (Spreadsheet Tool for Estimating Pollutant Load) Region 5 - Load Estimation Model," U.S. EPA, last modified August 5, 2011, accessed October 3, 2011, http://it.tetratech-ffx.com/steplweb/default.htm. See footnote 130 for more information on land use categories used by the model.

[139] "STEPL (Spreadsheet Tool for Estimating Pollutant Load) Region 5 - Load Estimation Model," U.S. EPA, last modified August 5, 2011, accessed October 3, 2011, http://it.tetratech-ffx.com/steplweb/default.htm. See footnote 117 for more information on land use categories used by the model.

[140] "STEPL (Spreadsheet Tool for Estimating Pollutant Load) Region 5 - Load Estimation Model," U.S. EPA, last modified August 5, 2011, accessed October 3, 2011, http://it.tetratech-ffx.com/steplweb/default.htm. See footnote 117 for more information on land use categories used by the model.

[141] Mill Creek Subwatershed Stakeholder Advisory Group. *Mill Creek Subwatershed Management Plan*, by Elizabeth Riggs. Ann Arbor, MI: Huron River Watershed Council, 2006. http://www.michigan.gov/documents/deq/ess-nps-wmp-mill-creek_209206_7.pdf (accessed August 18, 2011).

[142] White River Resource Conservation & Design, Inc. *Defining Critical Areas: Hogan Creek Watershed Project, Upper Anderson River Watershed Project and Tanners Creek Watershed Project*, by Kris Vance. PowerPoint presentation. Salem, IN: White River Resource Conservation & Design, Inc., 2011. https://engineering.purdue.edu/watersheds/webinars/IWLA2011/CriticalAreas/DefiningCriticalAreasVance.pdf (accessed August 18, 2011).

are then recognized to have disproportionately high unit area loads across several pollutants. Here, as in the critical areas analysis, the scores delineating the subwatersheds into high, medium and low unit area load groups should be taken as a relative rather than an absolute measure. Figure 42 shows the overall scores for nutrients and sediment among subwatersheds based on unit-area loads within planning area.

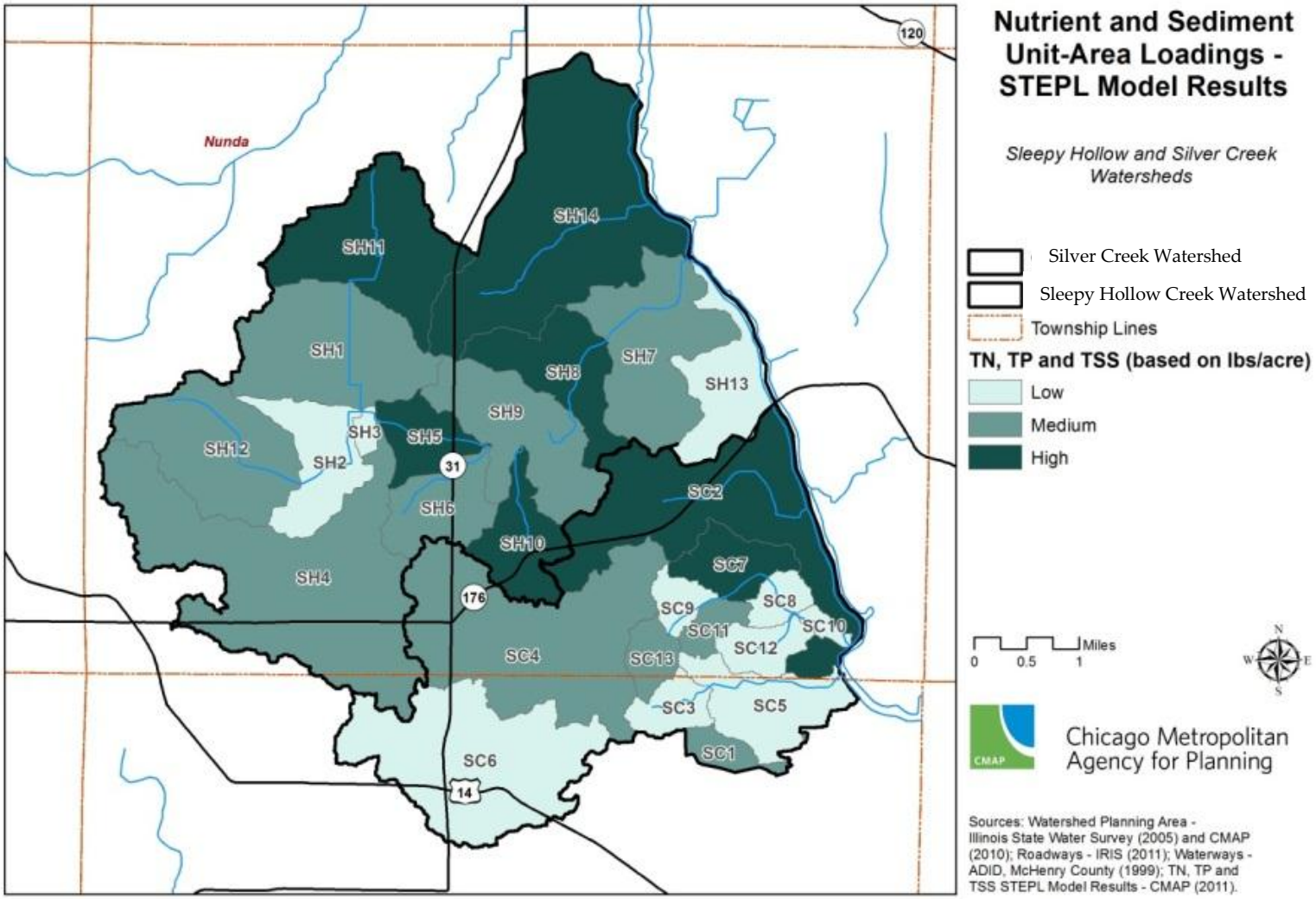
The STEPL model results for TN, TP and TSS when viewed in the aggregate show subwatersheds SH5, SH8, SH10, SH11, SH14, SC2 and SC7 to generate the highest unit-area loads. These subwatersheds overlap with the subwatersheds in Sleepy Hollow Creek that have the most agricultural land (see the distribution of agricultural land in Figure 16). Agricultural activities in Sleepy Hollow Creek are therefore implicated for generating a disproportionately large contribution of the nutrient and sediment loads in this planning area as predicted by STEPL. However, more investigation into the sources of nutrient and sediment runoff is warranted for subwatersheds SC2 and SC7 in the Silver Creek Planning Area. Nutrient and sediment runoff from nonnative turf-grass lawns in urban areas might be contributing more to these disproportionately high loads than agriculture, given that these two subwatersheds are covered largely with unincorporated, primarily residential development. Ideally, aquatic and water quality monitoring data should be collected throughout the watershed planning area. Such data can be used in conjunction with model results to identify pollutant sources at a subwatershed level to guide nutrient and sediment runoff mitigation efforts. In the meantime, these STEPL model results are instructive in terms of where emphasis should be placed with regard to land-use appropriate BMPs. It is also important to note that the STEPL model does not capture land in transition and that construction sites can contribute significantly to pollutant loading. With significant development anticipated in the watershed planning area, proper soil erosion/sediment control practices are also critical.

Water Quality Monitoring Recommendations

As stated throughout the plan, neither Silver Creek nor Sleepy Hollow Creek have been assessed by the IEPA for water quality status. Only the segment of the Fox River into which both streams drain has been assessed. Absent this information, this watershed plan relied on estimation and modeling results to determine potential areas within the watershed planning area that likely generate larger pollutant loadings. Therefore, this plan recommends that regular monitoring should be implemented throughout the watershed planning area by 2016. The Silver & Sleepy Hollow Creeks Watershed Coalition should partner with the Fox River Study Group (FRSG) and Illinois State Water Survey (ISWS) to develop a more robust water quality monitoring scheme with a goal of achieving an improved understanding of the sources of fecal coliform and other pollutants within the watershed planning area. For example, developing a better baseline understanding of fecal coliform pollution will allow for evaluation of the effectiveness of implementation efforts over time. To that end, water samples that indicate a positive change or trend towards lower fecal coliform concentrations and ultimately, compliance with the water quality standard, will provide the best criteria to measure success.

After monitoring data are collected and analyzed with conclusive results as to where and from what origin the pollutants are coming from, the Silver & Sleepy Hollow Creeks Watershed Coalition can reevaluate the plan's recommendations and make appropriate adjustments to the plan.

Figure 42. Nutrient and sediment loading model results



4. Existing Protections and Ordinance Review and Recommendations

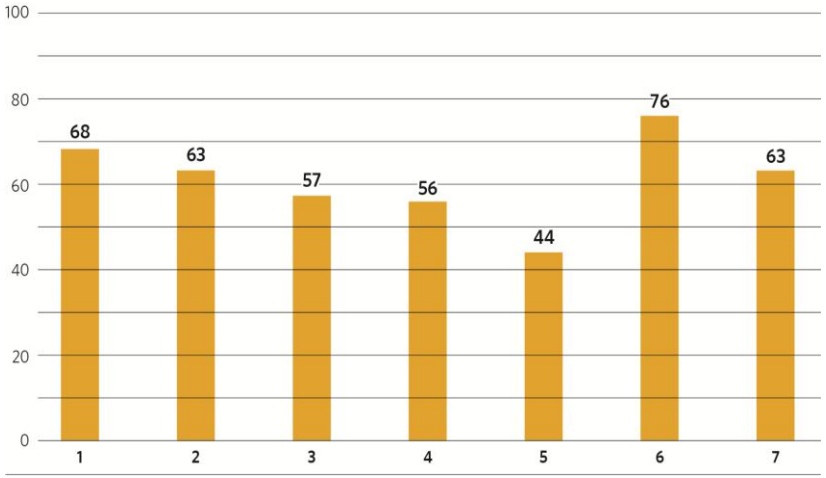
4.1. Center for Watershed Protection's Code and Ordinance Protection Worksheet and Recommendations

An assessment of local government policies, regulations, and ordinances was conducted to determine how development occurs in each community and how local policies help shape the community and contribute towards the health of the watershed planning area. As part of the assessment, local governments were guided through a comparison of their local ordinances against model policies outlined by the Center for Watershed Protection (CWP).[143] The assessment also identified the next step, a site planning roundtable, in which local governments would convene to reform key development policies.

Seven of the nine local governments participated in the CWP ordinance review process including: the cities of Crystal Lake and McHenry; the villages of Prairie Grove, Bull Valley, Oakwood Hills; Nunda Township; and, McHenry County. The Village of Cary and Algonquin Township did not participate.

The worksheet was subdivided into three categories including: residential streets; lot development; and conservation of natural areas, the total number of points for the entire worksheet was 100. As a rule, scores lower than 80 reveal that some reform of local development policies may need to occur. Participant scores ranged from 44 to 76 out of 100 possible points, averaging 61. The results are shown in Figure 43; however, local governments are not uniquely identified by name but by number at the request of stakeholders. Individual community results are available to communities to help guide development of future ordinances and planning initiatives.

Figure 43. Center for Watershed Protection's code and ordinance worksheet results out of total possible points, local governments represented by number



Residential Streets and Parking Lots

Within the residential streets category, scores ranged from 10 to 27 out of 40 possible points, averaging 18. The residential streets category focused on principles related to parking lots, roads, and driveways. Local governments could improve in this category by reducing the number of parking spaces and roadway widths that are required for development. This would support the plan's goal to maintain/achieve healthy surface waters since it would reduce the amount of pollutants washed off from impervious surfaces into a waterbody.

[143] "Better Site Design Publications," Center for Watershed Protection, accessed November 7, 2011, http://www.cwp.org/documents/cat_view/77-better-site-design-publications.html.

Lot Development

The lot development category focused on principles related to lot size, development density, and lot shape. Within this category, scores ranged from 16 to 28 out of 36 possible points, averaging 24. Possible advancements in this category include ordinance updates that include allowances for stormwater management BMPs and reduction in impervious cover in order to decrease the speed and increase the filtration of run-off prior to entering waterways. Additionally, reduced setbacks, smaller lots, and cluster development designs that maximize and preserve open space are additional measures that governmental entities can encourage within existing regulations. Improvement within this category would not only decrease the rate of urban runoff from impervious surfaces, but encourage groundwater infiltration thereby supporting the plan's goal to protect groundwater quantity.

Conservation of Natural Lands

The final category, conservation of natural areas, focused on ordinance requirements that either promoted or in some cases impeded natural area protection. Scores ranged from 13 to 22 out of 24 possible points, averaging an overall range of 18. Improvements in this category focus on long term protection, management, and restoration of natural areas and consideration of upland / woodland areas including oak stands. Local governmental units may wish to consider mandatory no-development buffer codes for critical areas such as wetlands, floodplains, lakes, streams, and rivers. Such areas may serve dual functions of providing recreational areas while reducing stormwater run-off. Improvements within this category could support the plan's goal to protect and restore natural areas and increase native species diversity within the watershed planning area.

It should be noted that many local governments within the watershed planning area have taken steps to contribute towards natural resource protections within their ordinances. As an example, McHenry County has adopted a conservation design ordinance and is currently working to develop a Unified Development Ordinance (UDO) that will revise and update existing development ordinances.[144] The UDO will only apply to unincorporated areas of McHenry County.

To enhance the urban tree canopy, local governments are encouraged to adopt programs for tree protection and maintenance on public properties and rights-of-way, in addition to preserving trees on private property and requiring replacement when trees are removed or damaged during development. See Section 5.3 for a more detailed discussion on oak tree protection.

The Village of Oakwood Hills has expressed the need to revise its municipal ordinances to include additional water quality protections and to develop a Lakeshore Protection Ordinance.[145] The City of Crystal Lake has a tree preservation ordinance aimed at minimizing storm water runoff, providing buffers, and promoting development aimed at preserving native vegetation.[146] The City has also adopted the "Crystal Lake Unified Development Ordinance" (UDO). The ordinance's aim is to protect and preserve open space and natural

[144] "McHenry County Unified Development Ordinance," accessed November 7, 2011, http://www.camiros.com/mchenrycoUDO/.
[145] "Lakeshore Protection Ordinance," Village of Oakwood Hills, Illinois, accessed November 7, 2011, http://www.oakwoodhills.org/index.asp?Type=B_BASIC&SEC={1C336BA8-1656-4085-BFD7-A3D7B08C714D}.
[146] "Tree Preservation," City of Crystal Lake, Illinois, accessed November 7, 2011, http://www.crystallake.org/index.aspx?page=231.

resources during development.[147] It is also working to amend its comprehensive plan to make more informed land-use decisions.[148] The City of Crystal Lake is also working to adopt a green infrastructure plan (see Section 4.5 titled "City of Crystal Lake's Green Infrastructure Plan). The City is also a certified community under the McHenry County Stormwater Management Ordinance and implements its own stormwater ordinance.[149]

4.2. Green Practices Survey

Local governments responded to a CMAP survey, titled *Green Practices for Local Governments*, that was designed to identify their current practices and indicate their interest in other practices available. CMAP aimed to use that information to conduct outreach, offer technical assistance, facilitate peer review, and provide educational resources.

The survey included five green practices: water conservation and protection; energy; air quality; waste reduction; reuse and recycling; and green building practices. Water conservation and protection focused on practices using rain barrels, rain gardens, permeable paving, using organic weed killer, and reducing water consumption. The energy category focused on green roofs, conducting energy audits, and expanding and/or maintaining tree cover. The air quality category focused on practices including landscape waste and using environmentally friendly building materials. Waste reduction focused on practices including conducting waste audits, developing more efficient recycling programs, and managing hazardous waste. Lastly, the green building practices addressed using Leadership in Energy and Environmental Design (LEED) Certificated Programs. Survey participants included the cities of Crystal Lake and McHenry, the villages of Oakwood Hills, Prairie Grove, Cary, McHenry County, the MCCD, and the Cary and Crystal Lake Park Districts.

Survey results, as shown in Table 23, revealed that many communities within the watershed planning area already have an array of best management practices in place. As an example, 89% of the jurisdictions are currently utilizing some type of rain garden/vegetated swale on their property while 78% are currently promoting natural landscaping. More than half of the participants requested education about organic weed killers and fertilizers. However, only 22% of the participants have policies or incentives aimed at reducing water use.

[147] "Crystal Lake Unified Development Ordinance," City of Crystal Lake, Illinois, accessed November 7, 2011, http://www.crystallake.org/index.aspx?page=328.

[148] "Comprehensive Plan," City of Crystal Lake, Illinois, accessed November 7, 2011, http://www.crystallake.org/index.aspx?page=125.

[149] *Stomwater Management*. *City of Crystal Lake Code*, Chapter 595 (2005). http://www.crystallake.org/Modules/ShowDocument.aspx?documentid=234 (accessed November 7, 2011).

Table 23. Green practices for local governments currently underway within the watershed planning area

MUNICIPALITIES	RAIN BARRELS	RAIN GARDENS	PERMEABLE PAVING	ORGANIC WEED KILLERS	NATURAL LANDSCAPING	USES ON PUBLIC PROPERTY
Bull Valley						
Cary		X			X	X
Crystal Lake	X	X	X		X	X
McHenry		X			X	X
Oakwood Hills		X				
Prairie Grove	X	X	X	X	X	X
COUNTIES						
McHenry County	X	X	X	X	X	X
DISTRICT						
Cary Park District	X	X	X	X	X	X
Crystal Lake Park District	X	X	X	X	X	X
McHenry Co. Cons. District	X	X	X	X	X	X

4.3. National Pollutant Discharge Elimination System (NPDES) Phase II

As a result of the 1987 amendments to the Clean Water Act, the U.S. Environmental Protection Agency addresses stormwater runoff under its NPDES Storm Water Program in two phases. The Phase I program, which applied to medium and larger sized municipal storm sewer systems, began in 1990 and was successfully implemented. Phase II's implementation program began in early 2003 and expands upon the Phase I program. It applies to small municipal separate storm sewers (MS4s). Phase II requires operators of small construction sites, to implement programs and practices that control stormwater pollution from stormwater runoff.

The Phase II MS4 stormwater management program must include six minimum control measures:

1) public education and outreach,
2) public participation and involvement,
3) illicit discharge detention and elimination,
4) construction site runoff control,
5) post-construction runoff control, and
6) pollution prevention and good housekeeping.

Stormwater runoff from rain and melted snow carries pollutants including oils, greases, road salt, and other pathogens into our rivers and streams. It can also increase erosion. Such pollution can degrade water quality, harm aquatic life, contaminate public drinking water supplies, and make recreational activities, including swimming unsafe. Therefore, it is vital that water quality be protected from stormwater runoff from both large and small separate stormwater sewer systems through programs which advocate watershed planning and implementation on a watershed basis such as the Phase II (MS4s) program. NPDES Phase II permittees within the watershed planning area that comply with the six minimum control measures are shown in Table 24.

Table 24. Local governments in compliance with Phase II requirements

MUNICIPALITIES	MS4 PERMITTEE	PERMIT NUMBER	DATE OF ORIGINAL PERMIT ISSUANCE
Bull Valley	No	–	–
Cary	Yes	ILR400310	10/19/2004
Crystal Lake	Yes	ILR400179	9/20/2004
McHenry	Yes	ILR400385	9/27/2004
Oakwood Hills	Yes	ILR400512	10/4/2004
Prairie Grove	No	–	–
TOWNSHIPS			
Algonquin Township	Yes	ILR400002	11/1/2004
Nunda Township	Yes	ILR400100	9/27/2004
COUNTIES			
McHenry County	Yes	ILR400264	9/27/2004

4.4. Nunda Township Proposed Open Space Plan

In 2004, Nunda Township created the *Nunda Township Proposed Open Space Plan*.[150] It was officially adopted in April 2007 by township voters. The purpose of this plan is to preserve the landscape diversity, rural character, and quality of life in Nunda Township. The Plan proposes to achieve this through the acquisition of scenic vistas, farmland protection, the preservation and protection of wetlands and high-quality natural areas, floodplains, wildlife habitat, and groundwater recharge soils.

The key planning principles of the open space plan are to protect groundwater resources from pollution draining through permeable soils, buffering sensitive natural habitats so that they are sustainable over time, and protecting future recreational and trail use, as well as, local agricultural land where feasible.

The entire Sleepy Hollow Creek Watershed lies within the boundaries of Nunda Township and 92% of the Silver Creek Watershed lies within the township's boundaries as well. A map depicting proposed areas for open space preservation within the Open Space Plan can be found in Figure 44 and description of each area in Table 25.

[150] "Township Open Space," Nunda Township, Illinois, accessed November 7, 2011, http://www.nundatownship.com/Supervisor/OpenSpace.htm.

Figure 44. Parcels identified in the Nunda Township Proposed Open Space Plan

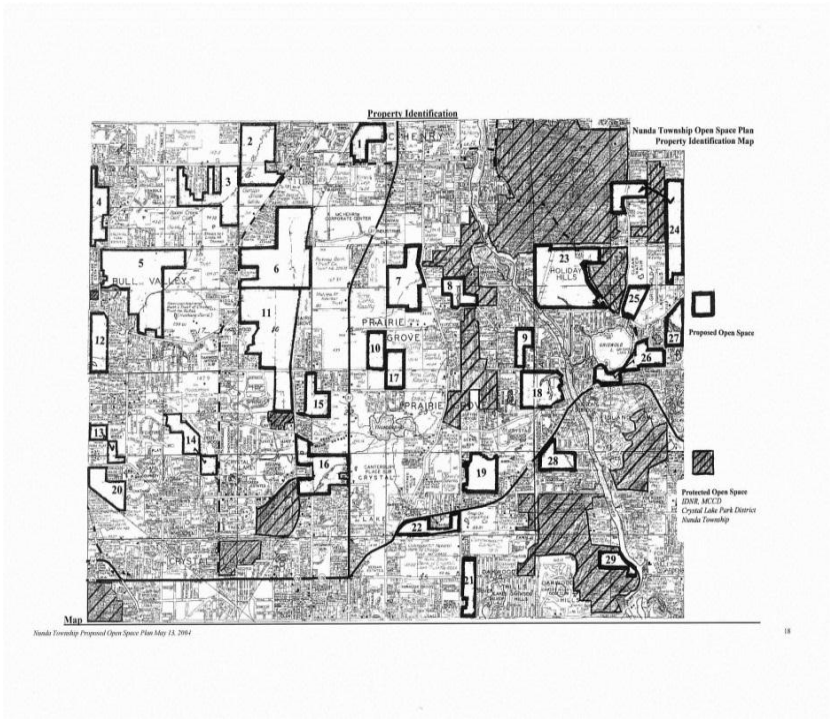


Table 25. A description of parcels identified within the Nunda Township Proposed Open Space Plan

PARCEL NUMBER	PARCEL DESCRIPTION
#6 & #11	Currently a sod farm. Sleepy Hollow Creek Corridor, Natural Areas Inventory Site, hydric soils, highly permeable soils, ADID wetlands, flood plain. #6 and #11 combined will provide a large corridor of open space and provide a buffer to the north branch of Sleepy Hollow Creek. Bordered to the west by Walkup Rd. and adjacent to the McHenry County Conservation District Prairie Trail. This property follows the CN & W railroad tracks. Note: These areas were identified as priority conservation opportunities by stakeholders.
#8	Natural Ares Inventory Site, hydric soils, highly penneab1e soils, flood plain. This property is adjacent to land owned by The McHenry County Conserva-tion District, and will help to preserve the rural character of Barreville Rd.
#10	Some hydric soils, high functional value ADID wetland. Ideal for farmland preservation. This property would provide open space in an area which is zoned for dense development. Bordered to the north by Gracy Rd., just east of Route 31.
#13	Hydric soils, ADID wetland. Bordered to the south by Hillside Rd., between Oak Ridge and Cherry Valley Rds.
#14	Farm Land without buildings.
#15	High recreational value near an area slated for dense development. Bordered to the north by Edgewood Rd., to the west by the Nunda Township offices.
#16	Sleepy Hollow Corridor, hydric soils, high functional value ADID wetland. This property is adjacent to the McHenry County Conservation Trail and Sterne's Woods, and is critical to preserving the scenic value of Hillside Rd. This property lies both east and west of Terra Cotta Ave, at Hillside Rd.
#18	Natural Areas Inventory Site, hydric soils, flood plain. Bordered to the north by Wright Rd. just west of the Fox River
#21	High recreational value near a densely developed area of Oakwood Hills. Bordered to the north by North Park Dr., to the: west by Valley View Rd.
#22	Possible farmland recreational potential. This property surrounds Prairie Grove School and would therefore provide an open space buffer around the school. Bordered to the north by Route 176.
#28	Ideal for farmland preservation, highly permeable soils. Bordered to the north by Route 176 just east of the Fox River.

4.5. Crystal Lake Green Infrastructure Plan

The City of Crystal Lake has developed, though not yet adopted, a Green Infrastructure Plan.[151] Crystal Lake's Green Infrastructure Plan identifies a variety of green resource areas and provides logical links among these to establish a green infrastructure system. Objectives for the future include active recreation and habitat connections. The plan specifically identifies the watershed planning area as an important resource protection opportunity.

4.6. McHenry County Conservation Design Standards and Procedures

In September 2009, McHenry County amended the County subdivision ordinance to include *Conservation Design Standards and Procedures.*[152] Requirements of the addendum are applied if a site contains or abuts a sensitive natural resource area. Sites within 100 feet of a designated McHenry County Natural Area Inventory (MCNAI) site, high quality designated sites or sites with high quality habitat automatically trigger the ordinance. Sites within 200 feet of resources, whose cumulative area equals 20 percent of the total area, also automatically trigger the ordinance. These areas may include, but are not limited to, sites with regulatory wetlands, floodplains, kettle holes, woodlands or wetlands, and excessive permeability. This plan recommends that conservation design principles be implemented throughout the watershed planning area to ensure goals of this watershed plan.

4.7. McHenry County Stormwater Management Ordinance

In January 2004, McHenry County adopted the McHenry County Stormwater Management Ordinance (SMO).[153] The ordinance is applied Countywide (in both incorporated and unincorporated areas) and sets the minimum requirements for watershed development within the County. The goals of adopting the SMO were: to provide a consistent equitable level of regulation; to protect and preserve the quality and environmental values of land and water resources in McHenry County; to encourage development in a manner that promotes orderly, sustainable, and cost effective utilization of land and water resources; to assure that development does not increase flood and drainage hazards; to assure that development does not create unstable conditions susceptible to erosion or reduced water quality; and to protect the hydrologic, hydraulic, water quality, and other beneficial functions of streams; lakes, wetlands, floodplains, and flood prone areas.

4.8. McHenry County Water Resources Action Plan

In June 2007, McHenry County completed the *McHenry County Water Resources Action Plan* (WRAP)[154] to address local water resources

[151] City of Crystal Lake, Illinois, Planning and Economic Development Department. *Green Infrastructure Vision*. Crystal Lake, IL: City of Crystal Lake, Illinois, Planning and Economic Development Department, March 2011. http://www.crystallake.org/Modules/ShowDocument.aspx?documentid=3616 (accessed November 7, 2011).

[152] "Conservation Design Standards," McHenry County, IL, accessed December 30, 2011, http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/ConservationDesignStandards.pdf

[153] *Stormwater Management*. *County of McHenry, Illinois, County Code*, (2011). http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/Ordinances/SMO%20as%20amended%2003-15-2011.pdf (accessed December 30, 2011).

[154] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010.

issues, including groundwater quality and quantity, and to maintain a sustainable water supply. The plan was distributed in October 2009 and adopted unanimously by the McHenry County Board on October 18, 2011. It outlines a holistic, coordinated, and comprehensive approach to address water resources planning within the county and its municipalities. This plan includes recommendations for: groundwater management and planning; potable water; water quality; wastewater reuse; wellhead protection; water pollution; water conservation; natural resource protections, and a host of other water resource related topics. Municipalities are strongly encouraged to apply principles and evaluate key strategies outlined in the WRAP to ensure protection of local water resources.

4.9. McHenry County Public Health Ordinance

In December 2002, the McHenry County Board and the McHenry County Board of Health approved the McHenry County Health Ordinance to provide environmental health protection for residents within both incorporated and unincorporated areas of the County. The Ordinance includes specific provisions for septic systems and is known as the *McHenry County Private Sewage Treatment and Disposal Ordinance*.[155] It contains stringent requirements for onsite septic systems including oversight of the design, construction and operation of public wells, as well as public health nuisances that could affect the health of the watershed planning area.

http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[155] *Wastewater and Sewage Treatment and Disposal for McHenry County. McHenry County, County Code,* Article X (2007). http://www.co.mchenry.il.us/departments/health/pdfDocs/ENV/septic/Article%20X%20FINAL%202007.pdf (accessed December 8, 2011).

4.10. Agricultural Protections

A suite of voluntary programs currently exists that are designed to protect the quality of our soil, water, air, plants and wildlife on agricultural ground. Many of these programs are available through the McHenry-Lake County Soil and Water Conservation District (SWCD) and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Generally, these programs target improving soil and water quality, reducing soil erosion and flooding, and increasing the amount and quality of wildlife habitat, which supports the plan's goals to protect and restore natural areas and increase native species diversity. SWCD and NRCS employees work with eligible producers and landowners to identify the resource concerns on their ground and then implement a conservation plan that addresses one or more of those concerns. The producers can receive financial assistance from a program toward the implementation of practices that address the concerns. A brief description of some of these programs is below.

Environmental Quality Incentive Program (EQIP)

The EQIP is a NRCS voluntary program. EQIP offers assistance through contracts with landowners and producers lasting two to ten years, where practices aimed at conserving natural resources and improving soil, water, and other related resources on agricultural lands are implemented; sometimes to help producers meet federal, tribal, state, and local environmental regulations. Agricultural lands include crop land, grazing land, and confined animal operations.

Wildlife Habitat Incentive Program (WHIP)

WHIP is a NRCS voluntary program aimed at non-industrial private forest land and agricultural land owners interested in improving wildlife habitat on their land. The program aspires to restore, protect, and enhance fish and wildlife species through practices such as establishing corridors for migrating wildlife and invasive species removal. Contracts with producers last up to 10 or 15 years,

depending on the habitat type being improved. Through this program, the NRCS administers both technical and 75 percent cost share assistance to improve wildlife habitat. More information may be obtained by contacting the local NRCS office.

Wetland Reserve Program (WRP)

The WRP provides technical and financial assistance by NRCS for landowners interested in protecting, enhancing, or restoring wetlands located on their property. Landowners engaged in this program receive funding to restore wetlands to their highest functional level and establish long-term conservation. The program offers three enrollment options: 1) Permanent Easement – the USDA pays 100 percent of both an easement value and restoration costs; 2) 30-Year Easement – the United States Department of Agriculture (USDA) pays 75 percent of both the easement value and restoration costs; the easement expires after 30 years; and 3) Restoration Cost-Share Agreement – the USDA pays up to 75 percent of restoration costs. The agreement is aimed at restoring or enhancing wetlands functions without placing it into an easement. More information may be obtained by contacting the NRCS or the U.S. Department of Agriculture.

Conservation Reserve Enhancement Program (CREP)

CREP is used to retire land from production while promoting wildlife restoration, groundwater and surface water protection, and protection of environmentally sensitive lands. This combination federal-state program provides financial incentive to landowners and producers to stop farming land that has state or national significance for 15 years, with the option of continuing in a longer term or permanent easement. These lands include threatened and endangered species or impact potable water supplies. The federal side is administered by the USDA-Farm Service Agency. CREP begins when a state or local non-government entity recognizes and identifies an agricultural-related environmental issue that has state or national significance. These parties would then develop a project proposal to address the issue. Eligible parties must enter into a 15 year CREP contract to keep the land out of agricultural production. A cost-share of up to 50% of the eligible costs to install the practice is provided through this program with other incentives potentially available. More information about this program may be obtained by contacting the USDA-Farm Service Agency.

Streambank Stabilization Restoration Program

The Streambank Stabilization Restoration Program's aim is to limit streambank erosion by implementing cost effective bio-engineering and vegetative techniques at a suitable location. The program's partners include the Illinois Department of Agriculture (IDOA), NRCS, and Illinois Soil and Water Conservation Districts (SWCD). The program provides cost-share assistance that may be used for labor, equipment, and materials. Proposals are sponsored by the local soil and water conservation district. Grant recipients must agree to maintain streambank stabilization practices for at least 10 years.

Illinois Department of Agricultural Livestock Management Facilities Program

The Livestock Management Facilities Program supports the Live Management Facilities Act[156] which protects both citizens' and livestock farmers' rights to have a clean environment. It acknowledges the importance of farming and places the responsibility on farmers to ensure a clean environment to its neighbors. The program allows the public to request public information meetings when a new waste-handling or livestock-management facility is proposed. A farmer requesting to build a new

[156] *Livestock Management Facilities Act*. *Ill. Comp. Stat*. 510 (1996), § 77/. http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1720&ChapterID=41 (accessed November 7, 2011).

facility must publish a Notice of Intent and engage in a five step process that reviews the farmer's proposal. Detailed process criteria are outlined by the Illinois Department of Agriculture (IDOA) and include requiring setbacks from local residences and aquatic resources and developing a waste-management plan.

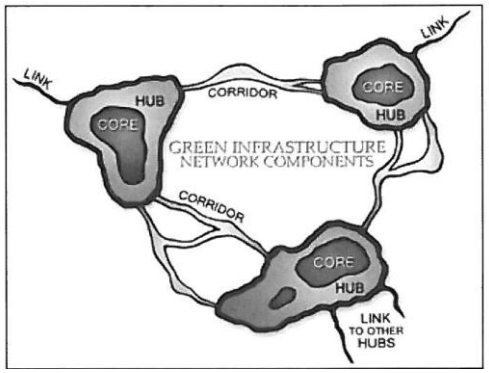
5. Water Resource Policy Recommendations

This plan outlines policies and planning initiatives that are recommended for local government agencies to adopt or expand on to improve water quality, protect groundwater resources, and increase native species diversity. What follows is a summary of these recommendations with much more detail provided in Appendix B.

5.1. Green Infrastructure Network

Green infrastructure is a strategically planned, interconnected network, of natural areas and open spaces that conserves ecosystem-service functions that society values (Figure 45). For example, the green infrastructure network naturally manages stormwater, protects and improves surface and groundwater quality, provides for biodiversity, recreational resources, aesthetic values, and reduces flooding to name a few services. The basis of a green infrastructure network includes natural-landscape elements like rivers, wetlands, lakes, woodlots and trees, and other natural community types, etc. that 'work' together synergistically. Additional element linkages can be added to the network based on other working lands, sites, recreational trails, etc. This approach supports the watershed plan's overall goals and management objectives.

Figure 45. Example of a green Infrastructure network and its components



The following section uses a green infrastructure approach for developing watershed-wide policy and planning/programming recommendations. A proposed network was developed integrating input from stakeholders and from currently proposed McHenry County green infrastructure planning considerations. [157] To facilitate this process, the entire watershed was organized into three tiers: open space reserve, undeveloped land, and developed land. The purpose is to group certain characteristics, functions, and areas together so that similar policy and planning recommendations can be applied. The network is not meant to be inclusive of every possible landscape feature. A detailed description of each tier is described on the following page. Figure 46 illustrates the green infrastructure network.

[157] "Green Infrastructure," McHenry County, Illinois, accessed November 7, 2011,http://www.co.mchenry.il.us/departments/planninganddevelopment/Pages/GreenInfrastructure.aspx.

Open Space Reserve (Green Infrastructure Network)

The Open Space Reserve includes areas recommended for protection by acquisition or conservation easements. This tier represents the green infrastructure network. These areas represent the most important in supporting water quality protection and should be managed for this and other resource-conservation purposes. This class includes current and proposed legally protected open space with the goal of expanding permanent protection to all other categories through land acquisition and/or conservation easement where possible and realistic. The goal of this network is to assure continued flood water storage, protect wetlands, provide habitat in the stream corridor and preserve ecosystem values and functions,[158] while minimizing stormwater run-off and non-point source pollution. The end result would be a network of open space hubs and corridors throughout the watershed planning area.

The lands identified in Figure 46 constitute an overlay of various resources that are supportive of the stream network and the overall water quality. The layers that were used to create the Open Space Reserve tier are listed below.

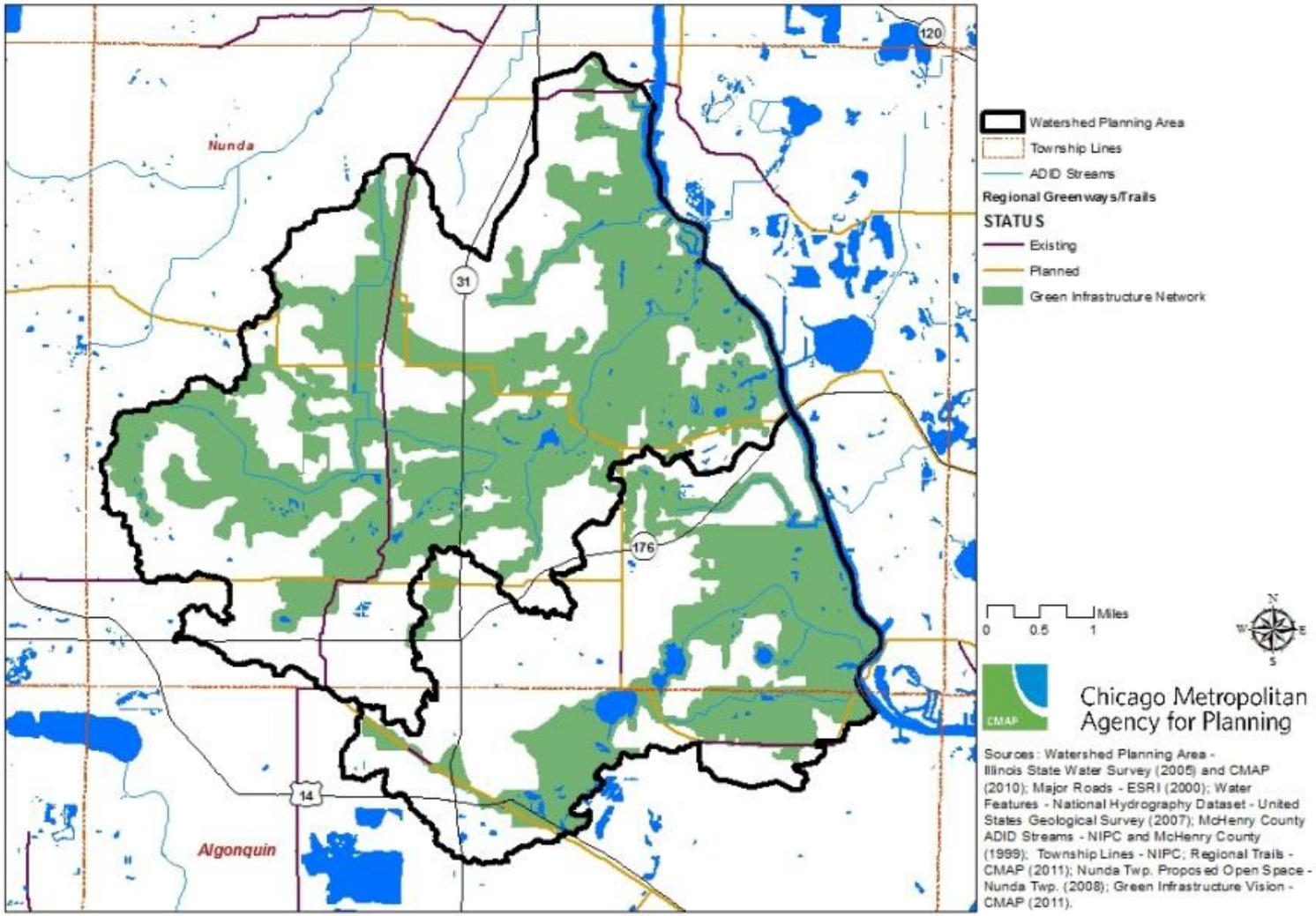
Similar to McHenry County's proposed green infrastructure network, the stream network includes a 200 foot buffer around streams, 100-year floodplains, wetlands, and lakes. The 100-year floodplain is from the Federal Emergency Management Agency's, digitized Flood Insurance Rate maps. Wetlands were generated from the U.S. Fish and Wildlife Service's National Wetlands Inventory.

The waterbodies, including lakes and streams, are within the 200 foot buffer thus ensuring their protection and connection to the green infrastructure network. Ensuring the connectivity of these water bodies would support better water quality and habitat preservation. An undeveloped floodplain helps contain flooding, aids in the absorption and filtration of water, and helps to minimize erosion and siltation in the waterway.

- Existing regional bikeways
- Existing Open Space
- Land Conservancy of McHenry County
- Illinois Nature Preserves (200 ft. buffer)
- IDNR State Open Space
- CMAP Land Use Inventory- Recreation
- CMAP Land Use Inventory- Golf Courses
- Youth camps, park district, municipal park areas, and private open space (McHenry County)
- MCCD conservation areas (200ft buffer)
- CMAP land use inventory-recreational areas
- Oak stands (100ft buffer)
- Programmed, planned, and future trails
- McNAI (200ft buffer)
- INAI (200ft buffer)
- 100-year Floodplain/500-year Floodplain (source: FEMA)
- McHenry County ADID (200ft buffer)
- NHD Streams (200ft buffer)

[158] "The Conservation Foundation," The Conservation Foundation, accessed December 20, 2011, http://www.theconservationfoundation.org/

Figure 46. Watershed planning area green infrastructure network



Open Space Reserve Recommendations

While significant parts of the watershed planning area's Open Space Reserve are in public ownership, there are many opportunities for additional protection and conservation of lands that may have considerable ecological benefits for the watershed planning area. Priority should be given to interconnections between the currently protected lands[159] or hubs, to form a continuous network, preferably using the Silver Creek and Sleepy Hollow Creek 100-year floodplain as the connector. Where this is not possible, existing greenways and trails should be utilized for making the necessary connections.

Direct acquisition, conservation easements, and purchase/transfer of development rights may be the most effective means of open space protection for lands in this category. Land trust agencies, such as The Land Conservancy of McHenry County and public agencies such as the MCCD may be the most suitable bodies to acquire and/or preserve lands in the Open Space Reserve. As an example, the Land Conservancy of McHenry County's Agricultural Conservation Easement Program seeks to acquire conservation easements on McHenry County lands through the purchase or donation by landowners.[160]

Local units of government may choose alternative measures for protection of lands included in the Open Space Reserve. Such measures include ordinances as detailed in the following section.

[159] The Conservation Foundation," The Conservation Foundation, accessed December 20, 2011, http://www.theconservationfoundation.org/.
[160] "The Conservation Foundation," The Conservation Foundation, accessed December 20, 2011, http://www.theconservationfoundation.org/

Open Space Protection Ordinances

Model ordinances, for the conservation of open space, generally specify base density, i.e. number of dwelling units per acre permitted under the residential zoning category; acreage of open space left in natural, undisturbed or re-vegetated condition; and setbacks, among other development criteria. Such ordinances usually require minimum open space acreage based on densities. For example, in a development where the density is 1 dwelling/acre the open space requirement may be 35% of the buildable area. In some ordinances, the open space is required to be contiguous with specific guidelines on use and management.[161]

Farmland Preservation Ordinances

Farmland preservation is mostly accomplished through emphasis on minimum acreage, such as 10 or 20 acre lots. When this approach is adopted, it is important to ensure that a majority of the lot is dedicated to agricultural uses. Buffers that separate agricultural uses from non-agricultural activities are also specified, 100 feet or more, with maintenance responsibilities tied to the non-agricultural developer. In the event that farmland is subdivided, ordinances generally require a specific percentage of land be placed in a conservation easement or other deed restriction that prohibits development for residential purposes.[162]

[161] For more information on Open Space Ordinance see USEPA Open Space Model Ordinance: http://www.epa.gov/owow/NPS/ordinance/mol3.htm#topofpage, Calvert County, MD Open Space Development Ordinance: http://www.epa.gov/owow/NPS/ordinance/documents/calvertcty.pdf, and Open Space Ordinance from Hamburg County, MI: http://www.epa.gov/owow/NPS/ordinance/documents/calvertcty.pdf
[162] For more information, see "Farmland Preservation Ordinances from Maine," Maine State Planning Office, accessed December 29, 2011, http://www.maine.gov/spo/landuse/techassist/ag_ordinances.htm

In unincorporated McHenry County, A-1 Agricultural Zoning limits housing densities to one home per 40 acres. Property owners with this zoning must go through a formal rezoning process to develop at a higher density. Many choose instead to annex into an adjacent municipality where higher densities are expected.

In 2001, the Kane County Board adopted the Kane County Agricultural Conservation Easement and the Farmland Protection Program to, among other reasons, protect water supply, floodplains, and promote responsibly managed growth patterns.[163] Kane County's program does not address farmland preservation from a zoning perspective, but rather implements a Purchase of Development Rights program in which a public agency purchases easements on farmlands to permanently restrict development potential.[164] This has been successful and communities in the watershed planning area are encouraged to adopt a similar approach.

Undeveloped Land Recommendations

Because sites in the Undeveloped Land category are yet to be developed, there is an opportunity to incorporate advanced conservation planning strategies including land preservation and conservation site design. As part of this strategy, oak stands, steep slopes, proposed and potential trails and greenways, and lands with hydric, peat, muck, and excessive permeability soils should be considered for preservation. Recommended BMPs to mitigate negative impact to areas zoned for development include: maintaining natural flow paths; reduced setbacks and frontages; preserving and restoring stream buffers; preserving highly permeable soils; reforestation and native landscaping; reduced imperious surface cover; permeable pavement; and rain water harvesting.

Specifically, low impact development (LID) practices should be implemented where feasible. LID is a land development approach for managing stormwater that emphasizes maintaining natural flow paths, preserving and restoring stream buffers, preserving highly permeable soils, reforestation and native landscaping, reducing impervious surface cover, rain water harvesting, and reducing setbacks and frontages. The objective of LID design is to reduce surface run-off and pollutant loading through on-site stormwater retention. This is a proactive approach that reduces future impact of built areas while striving to maintain a natural movement of water throughout the watershed planning area. Additional water quality benefits may result from reducing the development footprint by focusing on clustered development designs to create compact, walkable and mixed use neighborhoods. This may allow for greater protection of contiguous open space and natural drainage.[165]

Undeveloped land areas identified within the green infrastructure network should be protected and restored where feasible.

[163] *Adopting and Implementing the Kane County Agricultural Conservation Easement and Farmland Protection Program. Kane County, IL, County Code*, Ordinance No. 01-67. http://www.openlands.org/farmland-protection/toolshed/helpful-documents/doc_view/368-kane-County-agricultural-conservation-easement-and-farmland-protection-ordinance.html (accessed December 29, 2011).

[164] CMAP. *Agricultural Preservation Strategy Report*. Chicago, IL: CMAP, 2008. http://www.cmap.illinois.gov/strategy-papers/agricultural-preservation (accessed December 29, 2011).

[165] "Low Impact Development," U.S. EPA, last modified March 18, 2011, accessed November 9, 2011, http://www.epa.gov/owow/NPS/lid/. For more information, see "Stormwater Management," Center for Watershed Protection, accessed November 9, 2011, http://www.cwp.org/your-watershed-101/stormwater-management.html.

Developed Land Recommendations

Lastly, the "Developed Land" tier represents sites where watershed protection and restoration measures may be appropriate. Redevelopment or infill development in the watershed planning area may present great opportunities for retrofitting existing sites with stormwater BMPs. This can be achieved through overlay zones that encourage the use of stormwater BMPs for such sites. Other community or neighborhood programs such as rain barrel cost share, rain garden programs, and conversion of turf areas to native vegetation in public spaces present educational opportunities in addition to potential water quality improvements as a result of reduced stormwater run-off. The CWP offers a variety of resources that articulate stormwater retrofit opportunities.[166] In addition, USEPA offers information on stormwater management best practices.[167] It is recommended that communities within the watershed planning area consult these resources before any retrofit activity.

The policies described below are additional measures that local units of government may adopt in developed land or lands zoned for development to maintain and enhance water quality through the filtering and minimization of pollutants.

Pet Waste Ordinance

Pet waste ordinances are fairly common in northeastern Illinois communities. Such ordinances require pet owners to remove and properly dispose of any excreta deposited by her/his pet on public or private property. Proper disposal can be achieved either through the placement of waste in designated receptacles or containers that are regularly emptied by the municipality, or by flushing the waste. Some ordinances require pet owners to carry a suitable container or instrument for the removal of waste at all times when walking their animals.[168] Fines up to $500 are sometimes levied on 'repeat offenders.' While enforcing such an ordinance by a municipal entity comes with some difficulties, self-policing might be an effective approach. Communities in the watershed planning area that do not currently have pet waste regulations are encouraged to adopt such ordinances.[169]

Natural Lawn Care & Sustainable Landscape Practices

Maintaining turfgrass through conventional methods requires large amounts of fuel, fertilizers and pesticides, some of which runs off to local waterbodies leading to an increase in nonpoint-source pollutant loads. Communities in the watershed planning area are encouraged to pursue the reduction of pesticides and other potentially toxic substances into water resources by promoting less intensive maintenance, natural lawn care practices and other sustainable methods at the household and community level. Outreach efforts may be directed at a wide local audience, including landscape professionals and municipalities, residents, lawn product retailers,

[166] Center for Watershed Protection. "Urban Stormwater Retrofit Practices." *Urban Subwatershed Restoration Manual*, Manual 3. Ellicott City, MD: Center for Watershed Protection, August 2007. http://www.cwp.org/categoryblog/92-urban-subwatershed-restoration-manual-series.html (accessed November 7, 2011).

[167] "Stormwater Management Best Practices," U.S. EPA, last modified August 16, 2011, accessed November 8, 2011, http://www.epa.gov/oaintrnt/stormwater/best_practices.htm.

[168] *Pet Waste Disposal*. *City of Sugar Land, TX, City Code*, Chapter 3, Section 13 (2008). http://www.sugarlandtx.gov/utilities/stormwater/animal_waste.asp (accessed December 29, 2011).

[169] For a model pet waste ordinance, visit the Association of New Jersey Environmental Commissions at: http://www.anjec.org/pdfs/ModelOrd-PetWaste.pdf

and business and institutional property owners through programs such as Healthy Lakes.[170]

Green Infrastructure Planning Recommendations

In summary, this plan recommends that a range of integrated protection strategies be used by local governments. Some of these include: conservation development; land acquisition; establishing greenway and trail connections; establishing conservation easements; and, ecological restoration. As such, local governments within the watershed planning area and open space protection organizations are asked to adopt the Silver Creek and Sleepy Hollow Creek green infrastructure network map as part of their comprehensive plan updates. In addition, these organizations should develop and adopt local policies to protect oak stands, headwater streams, isolated wetlands, and threatened and endangered species that lie outside of the network as well.

Green Infrastructure Planning Recommendations: Local governments should adopt the green infrastructure network map and include it as part of their comprehensive plan updates and develop policies to protect important natural resources identified in the network.

5.2. Future Conservation Opportunity Areas

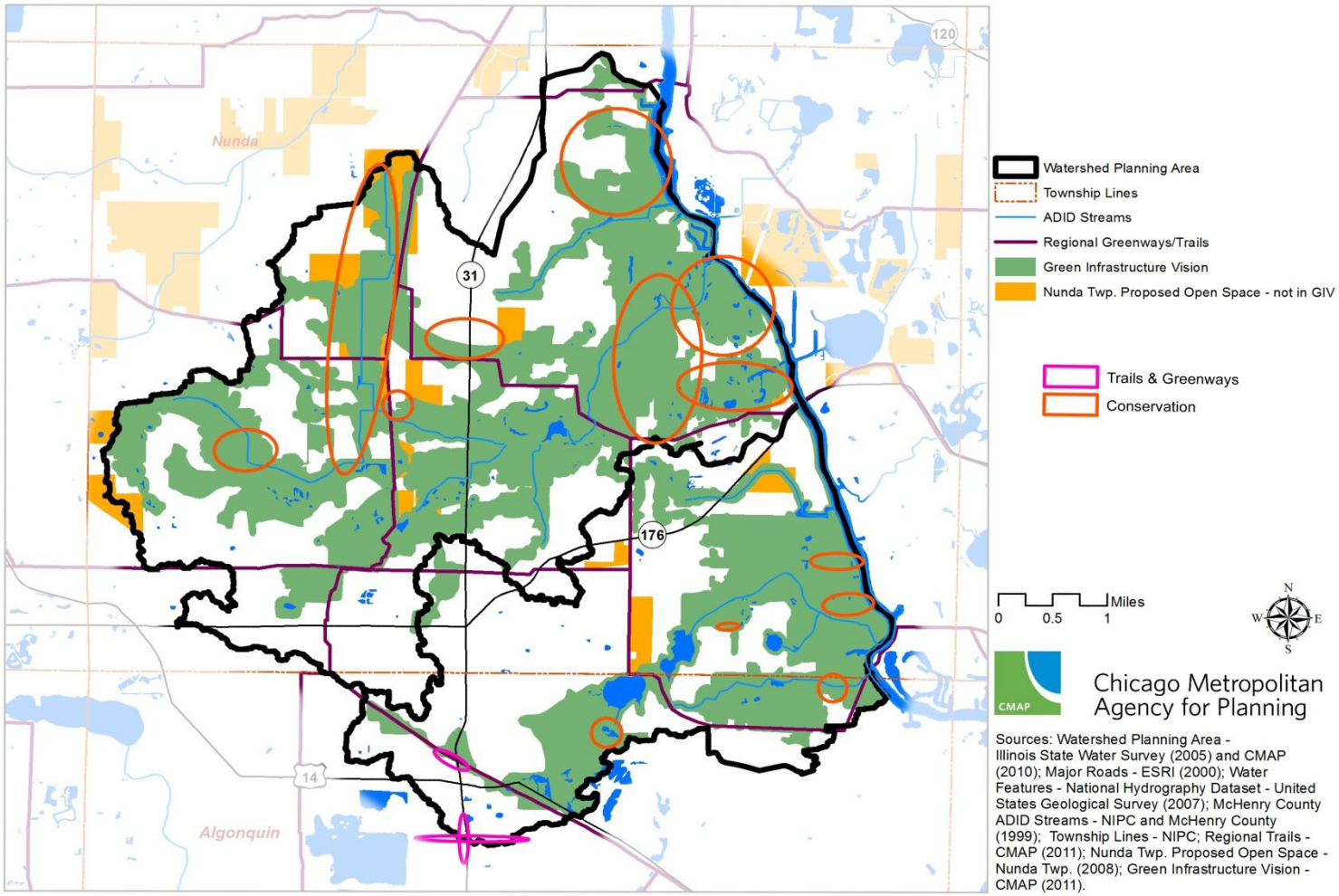
Future conservation opportunity areas identified by stakeholders are shown in Figure 47. This map includes Nunda Township Proposed Open Space Plan areas that are outside of the proposed green infrastructure network and other priority areas proposed for conservation by stakeholders. A description of the areas provided by Nunda Township can be found in Section 4.4. **It is recommended that where feasible, unprotected areas within the green infrastructure network should be considered conservation priorities. A goal would be to expand permanent protection to areas throughout the watershed planning area in the future through land acquisition and/or conservation easements where possible and realistic.**

The Illinois Department of Natural Resources (IDNR) has developed a comprehensive wildlife conservation plan called the "Illinois Wildlife Action Plan"[171] in an effort to provide stewardship of all wildlife species in Illinois. The plan gives special attention to species in the greatest need of conservation. The Illinois Wildlife Action Plan identifies specific conservation opportunity areas classified by available data and conservation partners as high importance for conserving species in greatest need of conservation. Portions of the watershed planning area are within the Illinois Wildlife Action Plan's Lake-McHenry Wetland Complex Conservation Opportunity Area. The Illinois Wildlife Action Plan will support future grants, direct habitat programs, guide the management of IDNR sites and land acquisitions, and facilitate partner projects with federal, local and not-for-profit conservation organizations and private landowners.

[170] This program is collaboration among CMAP, Illinois-Indiana Sea Grant and the University of Illinois at Chicago. For more information, see http://www.lawntolake.org/GreatLakes/index.htm

[171] This program is collaboration among IDNR and the U.S. Fish and Wildlife Service. For more information, see http://dnr.state.il.us/ORC/WildlifeResources/theplan/PDFs/COA_PDFs/LakeMcHenryWetlandComplex.pdf

Figure 47. Future conservation opportunity areas identified by planning participants



5.3. Oak Stand Replenishment and Protection

As discussed in Chapter 2, McHenry County is home to diverse environmental features including a stock of naturally occurring oak trees. These trees stabilize the soil with their root systems, conserve energy, foster air quality by removing carbon dioxide, improve groundwater infiltration, since they slow runoff allowing more time for infiltration, slow and reduce stormwater runoff, and provide food and a natural habitat for wildlife. They also increase property values, add interest to urban landscapes, and provide welcome shade for humans and animals. Oak trees are unique in that they support a higher diversity of insects than any other tree species and can't easily be replaced once damaged or destroyed. Despite these valuable attributes, there has been a significant decline in the number of oak trees within the county over time. This is a result of "residential development, invasive species, and a lack of an integrated countrywide approach to protecting and maintaining these characteristic McHenry County ecosystems."[172]

Recommendation: This plan recommends two approaches to protect oak tree communities within the watershed planning area:

- **Local governments and the public should support long term replacement programs aimed at protecting oak trees.**
- **Local governments should develop and enforce oak stand protection ordinances.**

As an example, the program Project Quercus,[173] an oak replacement program aimed at promoting, replanting, and preserving oak trees throughout the county should be supported by locals currently not participating in the program. The program is run by a consortium of public and private organizations and is coordinated by the Land Conservancy of McHenry County. It encourages and educates residents on suitable planting areas and soil considerations, management techniques, seeding oaks, and restoring native vegetation. Locally, the Village of Cary has implemented a tree replacement and planning program aimed at replacing trees that are diseased or damaged.[174] In addition, the McHenry County's Conservation Design Ordinance has provisions for oak stand protections.[175]

Community tree preservation ordinances generally reflect a locality's needs and goals ranging from the preservation of old growth to reduction of tree loss during construction and/or tree replacement when losses cannot be avoided. Ordinance provisions can include off-site reforestation or setting aside wooded areas as preserves. Conducting a tree inventory is an important first step prior to drafting an ordinance so that a community may assess available tree

[172] McHenry County Conservation District. *The Oaks of McHenry County*. Woodstock, IL: MCCD, 2009. http://www.mccdistrict.org/web/assets/publications/brochures/OaksofMcHenryspreads_WC.pdf (accessed October 6, 2011).

[173] "Project Quercus," Land Conservancy of McHenry County, accessed November 7, 2011, http://www.conservemc.org/what-we-do/oak-conservation-project-quercus.html.

[174] "Parkway Tree Planting and Removal," Village of Cary, Illinois, accessed November 7, 2011, http://www.caryillinois.com/publicworks/treeplanting.html.

[175] Conservation Design Standards," McHenry County, IL, accessed December 30, 2011, http://www.co.mchenry.il.us/departments/planninganddevelopment/Documents/ConservationDesignStandards.pdf

resources and design the ordinance accordingly.[176] As with most ordinances, fostering community support is critical for effective implementation.[177]

In an effort to develop and enforce oak stand protection ordinances, the Morton Arboretum has developed a Community Trees Program.[178] It helps local officials develop and review ordinances and guidelines that are aimed at protecting trees and ensuring their care. The program facilitates tree stewardship among the public, public officials, volunteers, and civic leaders. There are also neighboring examples that local governments may consider in an effort to establish oak tree preservation ordinances. For example, the Village of Lakewood has developed and implemented an ordinance that "requires the planting of replacement nut-producing native trees like oaks and hickories."[179]

5.4. Groundwater Protection

All communities in the watershed planning area are totally dependent on adequate and safe groundwater for drinking water supply. However, scientific studies point to potential future groundwater shortages in southeastern McHenry County. Impacts to streams and other groundwater-dependent natural resources from groundwater withdrawals are a concern as well. Most areas in the watershed planning area are also highly susceptible to groundwater contamination from industrial chemicals and other sources of pollution. Chlorides from road salts and water softeners are a growing concern for groundwater resources and surface water as well. Failing septic systems can also introduce pollutants into groundwater, streams, and lakes.

Communities in the watershed planning area face the common challenge of balancing growth and protecting highly valued natural resources that provide numerous benefits. Using our land and water in more sustainable ways will help protect drinking water supply, streams, lakes, and other natural resources for generations to come.

Groundwater Quantity and Quality

With regional population projected to grow 38% by 2050, demand scenarios indicate growth in water use ranging from 36 – 64% under business-as-usual scenarios.[180] Such growth in water demand is not thought to be sustainable. For example, at current withdrawal rates, the deep-bedrock aquifer is being mined and over pumping of the shallow aquifer is beginning to capture streamflow where it has been studied in the Fox River Basin.

In an effort to address water supply demand issues, a regional water supply planning initiative culminated with the publication of *Water*

[176] "A Guide To Developing A Community Tree Preservation Ordinance," Minnesota Shade Tree Advisory Committee, accessed December 29, 2011, http://www.mnstac.org/RFC/preservationordguide.htm.

[177] North Carolina State University Cooperative Extension. *Developing Successful Tree Ordinances*. North Carolina State University Cooperative Extension, 2006. http://www.ces.ncsu.edu/forestry/pdf/ag/ag693.pdf (accessed December 29, 2011).

[178] "Community Trees Program," Morton Arboretum, accessed November 7, 2011, http://www.mortonarb.org/community-greening.html.

[179] "'Living With Trees' Award Winners," Land Conservancy of McHenry County, accessed November 7, 2011. http://www.conservemc.org/what-we-do/oak-conservation-project-quercus/living-with-trees/living-with-trees-award-winners.html.

[180] CMAP. *Northeastern Illinois Regional Water Supply/Demand Plan*. Chicago, IL: CMAP, March 2010. http://www.cmap.illinois.gov/water-2050 (accessed November 8, 2011).

2050: Northeastern Illinois Water Supply/Demand Plan in March 2010.[181] Water 2050 was informed by the most detailed water demand study ever conducted for the region.[182] This study quantified the impacts of regional water demand scenarios on the deep-bedrock aquifer underlying the eleven-county planning area, the shallow aquifer system beneath the Fox River Basin, and the Fox River itself. In addition, according to the 2006 McHenry County Groundwater Resources Management Plan, the portions of southeastern McHenry County, where the watershed planning area is located, have either been identified as an area of concern or in need of monitoring for potential groundwater shortages by 2030. Therefore, in order to avoid supply / demand imbalances and offer some protection to other users of water (e.g., aquatic ecosystems), implementing the promise of *Water 2050* has the potential to keep water demand relatively flat – 7% growth – as compared to projected population growth.

On the groundwater quality side of the resource management issue, the Illinois EPA has concluded that the state's groundwater quality is being degraded.[183] In concert with that conclusion and as discussed in the water quality chapter, chloride concentrations are trending upwards in shallow wells throughout the six-county region. Thus, there are ample reasons for groundwater-dependent communities and private-well owners to work collaboratively and recommend that measures be implemented to improve protection (i.e., quality) and conservation (i.e., quantity) of local groundwater resources.

Fortunately, the watershed planning area already has some model polices in place to protect groundwater resources. For example, McHenry County has developed a model groundwater protection ordinance. The ordinance is not a "one-size-fits all, but rather a compilation of the best available information for consistent groundwater protection."[184]

Recommendations for Groundwater Protection

- **Local governments within the watershed planning area should consider adopting policies from *the McHenry County Water Resources Action Plan to* address their needs.**
- **Local governments should also adopt similar and consistent water conservation ordinances, utilizing the CMAP 2010 Model Water Use Conservation Ordinance as a reference.[185]**
- **Local governments should adopt policies consistent with the recommendations of *Water 2050: The Northeastern Illinois Regional Water Supply/Demand Plan.*[186]**

[181] CMAP. *Northeastern Illinois Regional Water Supply/Demand Plan*. Chicago, IL: CMAP, March 2010. http://www.cmap.illinois.gov/water-2050 (accessed November 8, 2011).
[182] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008.
[183] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List DRAFT, Volume II: Groundwater*. Springfield, IL: IEPA, 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed September 15, 2011).
[184] McHenry County, Illinois, Department of Planning and Development. *Groundwater Protection Program*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, October 2009. http://www.co.mchenry.il.us/departments/waterresources/Pages/GroundwaterProtectionProgram.aspx (accessed November 7, 2011).
[185] CMAP. Model Water Use Conservation Ordinance. Chicago, IL: CMAP, 2010. http://www.cmap.illinois.gov/regional-water-supply-planning (accessed December 29, 2011).

- **Local governments should implement informational campaigns on the importance and mechanisms of water conservation.**

Wellhead Protection Programs

Implementing an Illinois EPA Source Water Assessment Program (SWAP)[187] is one proactive approach to protecting groundwater resources. It involves implementing a five step "multi-barrier approach" aimed at protecting water quality. The first step entails organizing a local committee and includes working with a municipal/public water supplier. Step two involves mapping the protection sensitive area (s). The remaining three steps include: conducting a contaminant source inventory; developing management and protection strategies; and planning for the future utilizing contingency. Additional protections could include adopting maximum setback zones to provide a 1,000 foot radial area of protection around delineated recharge areas. As such, this watershed plan recommends implementation of wellhead protection programs to protect groundwater resources.

Recommendation: Appropriate authorities (in most cases municipalities) within the watershed planning area should establish voluntary local protection programs such as wellhead protection plans.

[186] CMAP. *Northeastern Illinois Regional Water Supply/Demand Plan*. Chicago, IL: CMAP, March 2010. http://www.cmap.illinois.gov/water-2050 (accessed November 8, 2011).
[187] "Source Water Assessment and Protection Program," IEPA, accessed November 7, 2011, http://www.epa.state.il.us/water/groundwater/source-water-assessment/.

Class III Special Groundwater Classification

There are many resources that make the watershed planning area special including the presence of fens such as the Oakwood Hills Fen Nature Preserve (Figure 49). According to the Illinois Natural Areas Inventory, only 353.84 acres of high quality fens remain in Illinois.[188] These fens are very rare and are best described as "wetlands whose unique assemblage of plants and animals are dependent upon an uninterrupted and unaltered flow of cold, highly mineralized water from the ground."[189]

Fens support a diverse population of plants and animals because they are fed by alkaline rich groundwater, providing unique hydrological conditions for a suite of unusual native plants and animals able to thrive in such an environment. In addition, like all wetland systems, they help reduce flooding, are important in maintaining nearby water tables and influencing the recharge of local aquifers, and improve water quality.

Given their uniqueness, this plan recommends that Class III Special Resource Groundwater designations, stipulated by Illinois statue, be used as a tool to help protect groundwater recharge areas associated with groundwater-dependent wetlands (fens) and other aquatic ecosystems.[190]

[188] Ed Collins, McHenry County Conservation District email message to author(s), December 1, 2011. It is difficult to identify fens on broad scale maps since they are usually enmeshed in larger wetland communities and can be only an acre or two in size. As such, a map identifying high quality fens within the Silver Creek and Sleepy Hollow Creek Watersheds is not included in the plan.
[189] Byers, Steve. "Fens: More than 'Peat with Calcareous Seepage…'" *Illinois Audubon*. (Fall 2000): 8-13.
[190] *Class III: Special Resource Groundwater*. *Ill. Adm. Code* 35 (1997), Subtitle F, Chapter 1, Part 620, Section 230.

The Illinois Pollution Control Board (IPCB) determines that these areas are "demonstrably unique..or..vital for a particularly sensitive ecological system ... or … groundwater that contributes to a dedicated nature preserve."[191] This designation can be used by local decision makers to implement practices that help protect groundwater recharge areas associated with groundwater-dependent wetlands (fens) and other aquatic ecosystems.[192]

Locally, communities are implementing groundwater protection measures to protect fen groundwater recharge areas. For example, the villages of Bull Valley and Crystal Lake[193] have adopted ordinances aimed at minimizing harmful impacts to natural recharge functions.

Recommendations:

- **Establish Class III groundwater protection for groundwater-dependent natural areas.**
- **Develop a "model" ordinance to make Class III groundwater protection an effective tool for maintaining quality and quantity of groundwater feeding natural sites.**
- **Develop Class III groundwater quality standards.[194]**

Figure 49. Village of Oakwood Hills Fen Nature Preserve

Chloride Management

Chloride inputs from the traditional use of road salts and application rates have a negative impact on vegetation, surface water and groundwater. Damage to vegetation occurs when deicing salt is applied to roads and resultant highway runoff infiltrates into the ground. When deicing chemicals wash off and into the soil, they are absorbed by plant roots causing harm or death, and change the soil profile too. High chloride concentrations in surface waters or

http://www.ilga.gov/commission/jcar/admincode/035/035006200B02300R.html (accessed November 7, 2011).

[191] *Class III: Special Resource Groundwater*. *Ill. Adm. Code* 35 (1997), Subtitle F, Chapter 1, Part 620, Section 230. http://www.ilga.gov/commission/jcar/admincode/035/035006200B02300R.html (accessed November 7, 2011).

[192] *Class III: Special Resource Groundwater*. *Ill. Adm. Code* 35 (1997), Subtitle F, Chapter 1, Part 620, Section 230. http://www.ilga.gov/commission/jcar/admincode/035/035006200B02300R.html (accessed November 7, 2011).

[193] *Conservation Developments*. *City of Crystal Lake, Illinois, City Code*, Article 5, Section 5. http://www.crystallake.org/index.aspx?page=367 (accessed December 30, 2011).

[194] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

wetlands can negatively impact aquatic life and are a common cause of impairment of aquatic life. Chloride concentrations are found to be increasing in shallow groundwater throughout the region and thus, pose a long-term threat to the cost of treatment for potable-human use.

While the traditional use of road salts contributes to chloride contamination, chlorides from water softener discharges (i.e. private-well owners who typically employ an onsite wastewater treatment system and public – people that live on public water and sewer systems who use water softeners) may also contribute to contamination. However, water softener discharges and the impact from these discharges have not been quantified in isolation from other sources of contamination.

Specifically, chloride contamination can negatively impact fen health, especially sensitive vegetation supported by fens. To illustrate, a study, conducted at the fen complex located at Sterne's Woods Park by Panno et al. (1999) [195] determined that changes in water quality or biodiversity in the fen were due to salt usage and development. The study revealed that high chloride concentrations, attributed by water softener and road salt use, were due largely to nearby changes in development, including a roadway and residential development. Concentrations of chloride in this area were as much as 7.5 times greater than concentrations found elsewhere within the fen. "Consequently, sensitive vegetation, including the *Scirpus acutus* (Hardstem Bulrush) was replaced by *Typha angustifolia* (Narrowleaf Cattail), an invasive species.[196]

There are several proactive approaches to mitigate chloride contamination from road salt applications. First, communities should adopt recommendations from McHenry County's Water Resources Action Plan[197] for groundwater protection. Second, locals should adopt "sensible salting" practices and policy recommendations as outlined on the "McHenry County Snow and Ice Control: Field Handbook for Snowplow Operators" and the Salt Institute's, "Snowfighter's Handbook: A Practical Guide for Snow and Ice Removal."[198] Some of these include:

- Seek legislative change prohibiting over application by private contractors and operators on commercial and industrial lots.
- Adopt storage and handling ordinances that ensure proper salt, storage, handling and transport.
- Provide proper training to road salt applicators and staff and increase public awareness.
- Require all operators to have an approved storage and handling policy in place.
- Require operator certification.
- Require that storage of all deicing materials be permitted and inspected.

[195] Baxter and Woodman, Inc. "Chlorides and Agricultural Chemicals: Problem Assessments and Corrective Actions." *Illinois Groundwater Resources Management Plan*, Report 5. Woodstock, IL: McHenry County, Illinois, Department of Planning and Development, November 2006.

[196] Baxter and Woodman, Inc. "Chlorides and Agricultural Chemicals: Problem Assessments and Corrective Actions." *Illinois Groundwater Resources Management Plan*, Report 5. Woodstock, IL: McHenry County, Illinois, Department of Planning and Development, November 2006. http://www.co.mchenry.il.us/departments/waterresources/Pages/ManagementPlan.aspx (accessed November 7, 2011).

[197] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[198] Salt Institute. *Snowfighter's Handbook*. Alexandria, VA: Salt Institute, 2007. http://www.saltinstitute.org/content/download/484/2996 (accessed November 7, 2011).

- Entities, including the Illinois Department of Transportation (IDOT), and the Illinois Tollway Authority, should coordinate snow deicing practices to conform to best management practices.

Recommendation: Appropriate entities should consider the above guidance measures as they relate to salting practices within the watershed planning area.

Water Softeners

Communities that are dependent on groundwater often need a water softener, a device that reduces the hardness of water by replacing and/or exchanging certain elements in the water. A water softener either regenerates by a timer or a meter. The timer is set to a certain number of days and will regenerate no matter the water usage. A meter monitors the water use and regenerates overnight when a certain amount of water has been consumed (known as demand-initiated). Maintaining that water use habits are the about same among households, it can be assumed that a timer-based water softener uses more water than a demand initiated water softener. As such, the plan recommends that community members within planning area do the following:

- Adopt alternative water softening technologies such as electrodialysis or membrane filtration.
- Install demand-initiated water softeners.
- Reconfigure plumbing to use less sodium chloride in their septic systems and use the bypass switch on the water softener when it is not needed.[199]

[199] Salt Institute. *Snowfighter's Handbook*. Alexandria, VA: Salt Institute, 2007. http://www.saltinstitute.org/content/download/484/2996 (accessed November 7, 2011).

- Lastly, the MCDOH can take the lead in making recommendations or creating new guidelines.

Recommendation: Appropriate entities should consider the above guidance measures as they relate to salting practices within the watershed planning area.

5.5. Pharmaceuticals and Personal Care Products

One potential threat to water quality is a broad collection of chemicals that make their way into rivers and lakes via the use of pharmaceuticals and personal care products (PPCPs).[200] PPCPs are thought to have been around for decades, but given the scale of human population and the ability of modern analytical instruments to detect such bioactive chemicals, trace quantities of these substances are now found in surface waters. PPCPs include prescription and over-the-counter drugs (for people and animals alike), fragrances, cosmetics, and certain cleaning products (e.g. antibacterial soaps that contain Triclosan). PPCPs get into drinking water supplies and other waterbodies because they are not completely absorbed by our bodies, but rather excreted, then passed through conventional wastewater treatment systems and discharged into waterbodies. While scientists have yet to confirm adverse human health effects from PPCPs in the environment, many of these substances are thought to be endocrine disrupters.

Another pathway for PPCPs entering the environment is through disposal of unused PPCPs down the toilet. While perhaps a common method of disposal for some, using the toilet as a trash receptacle is highly inappropriate. Currently, McHenry County endeavors to

[200] "Pharmaceuticals and Personal Care Products (PPCPs)," U.S. EPA, last modified October 27, 2010, accessed November 7, 2011, http://www.epa.gov/ppcp/.

work with communities to develop a Personal Pollution Prevention program. As such, this plan recommends the following:

Recommendation: McHenry County should work with local governments to foster their own individual Personal Pollution Prevention programs [201] to mitigate environmental impacts from improperly disposed pharmaceuticals. This includes establishing drop-off location (s) and collection events for proper disposal of unwanted pharmaceuticals within the watershed planning area.

5.6. Water Efficiency/Conservation

The regional water supply plan, Water 2050, describes a number of strategies for achieving greater water-use efficiency and conservation. One efficiency strategy, for example, includes reducing water use by toilets, showers, and faucets, through installation of high-efficiency fixtures (i.e. WaterSense-labeled products). Conservation, on the other hand, involves a behavioral change. For example, a homeowner can choose to water their lawn no more than two days a week instead of the more customary three or four times; or not water lawns at all. These types of approaches, including installing high-efficiency features should be promoted throughout the watershed planning area.

Both water efficiency and conservation strategies need to be coupled with an outreach and education campaign. This component will be covered in more detail in the plan. To complement outreach and education, there are model ordinances available to help guide new ordinance development or updates to existing municipal and county ordinances including CMAP's Model Water Use Conservation Ordinance.[202]

Recommendation: Residents and local governments within the watershed planning area should install high-efficiency fixtures and reduce the amount of water used to water household and municipal lawns.

CMAP Model Water Use Conservation Ordinance

Municipalities can formally promote water efficiency and conservation practices through the adoption of all or a portion of CMAP's Model Water Use Conservation Ordinance. The 2010 model ordinance is an update of the 1980 Model Water Use Conservation Ordinance completed by the Northeastern Illinois Planning Commission (NIPC) and provides draft language that may be directly incorporated into local ordinances and codes and addresses conservation measures by different water-use sectors: Residential, and Commercial/Industrial/Institutional (CII). For the latter sector, the ordinance does not address the specifics of operations which are mostly unique to CII processes; rather it takes a more general approach covering basic measures applying to most activities in these sectors.

Ordinance items are organized by water use classification: indoors and landscape, with additional sections covering key topics such as variances, water waste, pricing, violations, and information and outreach. More information about ordinance items, examples, and additional resources are provided in the "Commentary" and "In Practice" and "Learn More" sections, respectively of the model ordinance. Where possible, local examples are highlighted and

[201] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[202] CMAP. *Model Water Use Conservation Ordinance*. Chicago, IL: CMAP, 2010. http://www.cmap.illinois.gov/water-2050 (accessed November 7, 2011).

calculations of water savings that demonstrate conservation program benefits are included.

Of particular importance to this watershed plan is the adoption of the model ordinance's indoor water efficiency strategies such as:

- Plumbing Fixtures and Fixture Fittings
- Appliances-Dishwashers and Clothes Washers
- Water Recycling Systems

Furthermore the model ordinance is an outcome of *Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan* adopted on January 26, 2010 by the Northeastern Illinois Regional Water Supply Planning Group. *Water 2050* is an outcome of Governor Blagojevich's Executive Order 2006-1. The plan includes 13 water conservation and efficiency measures and concludes that unless the region demonstrates a commitment to water use conservation and demand management, imbalances in supplies and demand may occur in the future. Additionally, as stated above, water use is intricately linked to water quality.

More locally, McHenry County recently adopted the McHenry County Water Resources Action Plan which dedicates an entire section to water conservation. This document, along with its recommendations, should be used to promote water conservation and efficiency throughout the watershed planning area. [203] **Recommendation: All communities within the watershed planning area should adopt applicable policies of the McHenry County Water Resources Action Plan and portions or all of CMAP's Model Water Use Conservation Ordinance.**

WaterSense Partnership

One of the first steps towards becoming a more water efficient municipality is to become a WaterSense Promotional Partner. WaterSense is a voluntary, nationally recognized program sponsored by the U.S. Environmental Protection Agency (USEPA) that promotes water conservation and efficiency.[204] Similar to the ENERGYSTAR program, there are two main branches of the WaterSense Program. The first is product labeling in which products such as toilets, faucets, and showerheads are rated for compliance with WaterSense standards. If compliant, the fixture is then labeled as a WaterSense product. This typically means that the product uses approximately 20% less water than its conventional product. Table 26 provides a chart of all the current WaterSense products.

[203] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[204] "Water Sense," U.S. EPA, last modified November 2, 2011, accessed November 7, 2011, http://www.epa.gov/WaterSense/index.html.

Table 26. Examples of Water Sense products

WaterSense current and future products, Fall 2011

CURRENT PRODUCTS	FUTURE PRODUCTS
Toilets	Water softeners
Bathroom sink faucets and accessories	Pre-rinse spray valves
Showerheads	
Urinals	
Landscape irrigation controllers	

The second branch offers a variety of voluntary partnerships. The promotional partnership is most appropriate for utilities, municipalities, and local units of government.[205] As the name infers, a promotional partner promotes the use of WaterSense products and water conservation and efficiency in general. The degree to which a utility or municipality "promotes" WaterSense is entirely up to that partner and their available resources. The only requirement is that partners provide an annual report (1 page form) of activities. Typical promotion activities include displaying WaterSense logo on a website, requiring WaterSense products for any rebate program, participation in Fix-a-Leak Week (March 11-19), or using public information materials provided to partners to communicate water conservation messages to residents.

The WaterSense Program is free and easy to sign up and participate in. The benefits include providing a starting point to launch a public information campaign by providing access to promotional materials like bill inserts, magnet designs, press releases, public service announcements, etc. The program gives your municipality or utility national attention on the WaterSense website and provides a WaterSense logo for outreach materials and the municipal website. WaterSense partners are part of a network with other communities/utilities where they can learn what others are doing in this region and the rest of country. Additionally the partnership provides a unifying message for the region and the nation about the importance of water conservation and efficiency. For more information about the costs for Watersense labeled toilets please visit: http://epa.gov/watersense/products/toilets.html.

Recommendation: All communities within the watershed planning area should become WaterSense Promotional Partners.

Wastewater and Graywater Reuse

Wastewater reuse is defined by the USEPA as "reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, and replenishing a groundwater basin (referred to as groundwater recharge)."[206] A common type of recycled water is water that has been reclaimed from municipal wastewater (sewage).

This plan supports a McHenry County recommendation that calls for wastewater treatment plants to use alternative disposal options

[205] "Water Sense Promotional Partners," U.S. EPA, last modified November 2, 2011, accessed November 7, 2011, http://www.epa.gov/WaterSense/partners/promotional.html.

[206] "Water Recycling and Reuse: The Environmental Benefits," U.S. EPA, last modified September 20, 2011, accessed November 7, 2011, http://www.epa.gov/region9/water/recycling/.

including irrigation of golf courses and open space.[207] This will reduce use of limited groundwater for irrigation. Furthermore, land application of reclaimed wastewater, versus discharge to a nearby stream, will be protective of surface water quality. Some nearby municipalities, the Village of Huntley and Lakewood, are currently implementing alternative wastewater disposal methods.

Graywater is another potential water conservation approach. The USEPA describes graywater as "reusable wastewater draining from residential, commercial and industrial bathroom sinks, bath tubs and showers, and clothes washers. Research shows that "showers/tubs, bathroom sinks, and washing machines can comprise anywhere between 50 to 80 percent of residential water use. It is also estimated that toilet flushing alone can account for almost 30 percent of indoor household water use."[208] As such, graywater reuse can support water conservation efforts and complement existing water supplies. Graywater is reused onsite, typically for landscape irrigation."[209] It can also be used indoors for toilet flushing.

Restrictions for graywater use are defined by the National Science Foundation along with other state code restrictions. Currently, the Illinois Plumbing Code[210] and Private Sewage Disposal Licensing Act prohibits graywater discharge to the surface of the ground. Since it is untreated sewage, it may include pathogenic organisms. As such, all potential impacts on groundwater, natural environments, and surface water should be measured before such a system is implemented. This plan recommends that legislation be modified to allow the use of graywater systems in Illinois. If legislation is modified, this plan recommends the following:

Recommendation: County and local governments within the watershed planning area should:

- **Adopt polices consistent with recommendations of the McHenry County Water Resources Action Plan.**[211]
- **Create a model ordinance for adoption by county and local government to guide local implementation of graywater use systems.**
- **Consider performance-based standards for graywater use and a system of oversight and monitoring to ensure standards are met.**
- **Provide general education materials to the public about graywater use.**

[207] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[208] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

[209] Water Recycling and Reuse: The Environmental Benefits," U.S. EPA, last modified September 20, 2011, accessed November 7, 2011, http://www.epa.gov/region9/water/recycling/..

[210] *Illinois Plumbing Code, Water Supply and Distribution*. *Ill. Adm. Code* 77, Chapter 1, Subchapter r, Part 890, Sections 1110-1240. http://www.ilga.gov/commission/jcar/admincode/077/07700890sections.html (accessed November 7, 2011).

[211] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010. http://www.co.mchenry.il.us/departments/waterresources/Pages/ApprovedWRAP.aspx (accessed November 7, 2011).

- **Encourage the use of graywater in new construction to reduce water demand for toilet flushing and landscape irrigation.**

- **Support local storage of graywater use systems.**

Conservation Design

Conservation Design is a density neutral design strategy that incorporates similar stormwater treatments, while focusing on physical site design in which development is "clustered" to allow for a larger contiguous common open space.[212] These practices would decrease the rate of urban runoff from impervious surfaces and encourage groundwater infiltration thereby supporting the plan's goal to protect groundwater quantity. As such, promoting conservation design practices, is a proactive approach to reduce the future impact of built areas while maintaining the natural movement of water throughout the watershed planning area.

Ensuring the restoration and ongoing management of designated natural areas is an important consideration. It is recommended that preparation of short- and long-term management plans be required for designated natural areas. Further, vegetative performance criteria, qualified ownership and management entities, conservation easement provisions, and revenue sources for management activities should be clearly spelled out. The McHenry County Conservation Design Ordinance includes provisions for the long-term management of common areas and natural landscapes.

LID is a land development approach to managing stormwater similar to conservation design that includes such practices as permeable pavement, native landscaping, and rain water harvesting to reduce runoff and pollutant loadings by managing stormwater as close to the source as possible. Perhaps the most distinct difference between LID practices and traditional stormwater systems (sewers, pipes, gutters, etc.) is the view of stormwater as a resource rather than a waste product. LID practices can be used throughout the watershed planning area from high density urban settings to low density areas and across a variety of land uses. LID can also be used to retrofit existing sites as well as complete redevelopment sites.[213]

Light Imprint is another similar land development strategy focused on creating compact, walkable, and mixed-use neighborhoods while incorporating stormwater management and natural drainage.[214]

Some local governments within the county have already adopted policies that support conservation design practices. As an example, McHenry County has adopted a Conservation Development Ordinance, described in Chapter 4. The City of Woodstock has also adopted conservation design standards to protect natural resources through flexible land development techniques.[215] The City of Crystal

[212] CMAP. *Conservation Design Strategy Report*. Chicago, IL: CMAP, August 2008. http://www.cmap.illinois.gov/strategy-papers/conservation-design (accessed November 8, 2011).

[213] "Low Impact Development," U.S. EPA, last modified March 18, 2011, accessed November 9, 2011, http://www.epa.gov/owow/NPS/lid/. For more information, see "Stormwater Management," Center for Watershed Protection, accessed November 9, 2011, http://www.cwp.org/your-watershed-101/stormwater-management.html.

[214] "Light Imprint New Urbanism," Congress for New Urbanism, accessed November 9, 2011, http://www.cnu.org/node/1209.

[215] Conservation Design Standards," City of Woodstock, Illinois, accessed December 30, 2011, http://www.woodstockil.gov/vertical/Sites/%7B7B45EC48-D164-43E3-ACA3-4CC6ED948AFB%7D/uploads/%7BFC05A7EF-B519-4E91-A597-53A7ABAFFEE7%7D.PDF

Lake includes conservation development provisions within its unified development ordinance.

Recommendation: All communities within the watershed planning area should adopt policies that support conservation design, LID, and Light Imprint principles in new developments and redevelopment, throughout the watershed planning area.[216]

5.7. Golf Courses

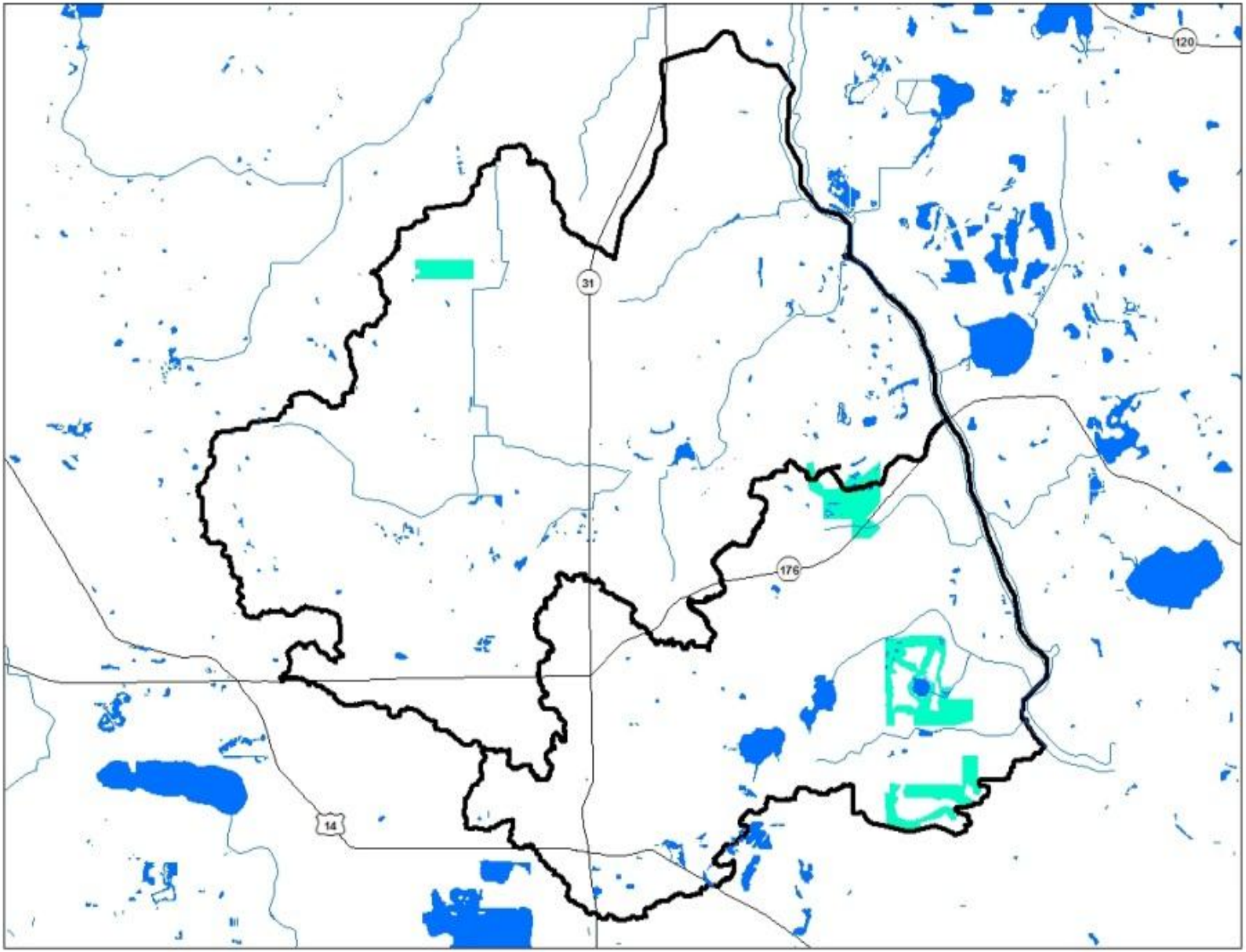
There are 0.76 square miles of golf courses within the watershed planning area (Figure 50). Typically, golf course landscapes consist primarily of turf grass and would not include stream buffers to help protect water quality. Furthermore, golf course management strategies such as the application of pesticides and herbicides can have an additional negative effect on water quality.

The Audubon Cooperative Sanctuary Program is an award winning education and certification program that empowers golf courses to protect the natural features and heritage of the courses while improving water quality.

Recommendation: Local golf course management teams should work towards becoming certified under the Audubon Cooperative Sanctuary Program.[217]

[216] Additional conservation design recommendations are included in the Green Infrastructure Network discussion.
[217] "Audubon Cooperative Sanctuary Program for Golf Courses," Audubon International, accessed November 9, 2011, http://acspgolf.audubonintemational.org/.

Figure 50. Golf courses within the planning area



6. Nonpoint Source Pollution Control Implementation

This chapter recommends best management practices (BMPs) (Table 27) and identifies site specific projects aimed at meeting the goals of the watershed plan, reducing nonpoint source pollution, improving habitat, and protecting groundwater resources. Unlike point source pollution that comes from a single and identifiable source, nonpoint source pollution is caused by rainfall or snowmelt moving across the land as stormwater runoff, picking up pollutants along the way that are carried into local streams and lakes. Pollution can enter bodies of water through stormwater drainage systems as well.

In urban areas, stormwater picks up pollutants as it quickly runs across impervious (non water-absorbing) surfaces such as conventional roofs, parking lots, driveways, and lawns. Pollutants from urban stormwater runoff can include motor oils, pet waste, household chemicals, and lawn chemicals such as fertilizers. Stormwater runoff increases community flooding and can worsen the erosion of stream and lake edges as well, increasing downstream pollution and harming aquatic life. In more rural or agricultural areas, pollutants can include fertilizers, pesticides, animal waste, and eroding soil.

The BMPs recommended in this section represent some of the best available practices recommended for reducing nutrients, sediment, chlorides, and bacteria from entering the waterways. The following BMP summaries are typical BMPs and are provided as a reference. The summary is not meant to be an all-inclusive list, but only a guide.

Table 27. Recommended BMPs to implement within the watershed planning area to improve water quality

URBAN BMPS	AGRICULTURAL/RURAL BMPS
Bioretention (Rain Garden)	Buffer/Filter Strips
Constructed Wetland/ Naturalized Detention Basin	Cover Crops
Filtration Basin	Conservation Tillage
Vegetated Swale/Bioswales	Grassed Waterways
Green Roofs	Nutrient/Waste Management
Streambank and Lakeshore Stabilization and Restoration	Water and Sediment Control Basins
Naturalized Stream and Lake Buffers	Streambank and Lakeshore Stabilization and Restoration
Pervious Pavement / Permeable Pavers	Wetland Restoration
Rain Barrels/Cisterns	
Restore Wetlands, Oak Woodlands, and Other Natural Areas	

The following sections provide additional information on recommended BMPs. A summary of site specific projects is also provided in Section 6.8.

6.1. Agricultural Best Management Practices

There are many BMPs available for implementation in agricultural areas. The NRCS Field Office Technical Guides (FOTG) documents conservation practices applicable to the State of Illinois as well as standards and specifications for these practices.[218] Practice standards

[218] "USDA NRCS. *Field Office Technical Guides*. McHenry County, Illinois. Washington, D.C.: USDA NRCS, 2011. http://efotg.sc.egov.usda.gov/efotg_locator.aspx?map (accessed September 13, 2011).

describe the conservation practice and where it applies, while practice specifications describe the detailed, site-specific requirements for implementing or installing a practice. Many of the broad conservation practices and BMPs that are discussed in this plan are thoroughly outlined in the NRCS Illinois FOTGs. Here, a broad set of conservation practices are described.

Many agricultural BMPs focus on livestock management. Better management of manure in agricultural areas can help to reduce nutrient and fecal coliform runoff contributing to water resource degradation. Developing a farm-wide manure management plan might involve such practices as excluding livestock from water bodies with fencing or stream crossings and from areas containing hydric soils, along with the construction of alternative water sources to prevent contamination from manure entering water bodies. Similarly, diverting clean water away from areas covered with manure on farms can help to reduce contamination from runoff. To address sediment runoff caused by livestock, heavy use area protection helps to prevent erosion by creating foundations to support animals and soil where animals gather for watering and feeding.

Efforts are underway to address horse manure management within McHenry County. On March 30, 2011, the University of Illinois Extension developed a project that offers alternative hauling services for horse owners within McHenry County. The project is called Changing Manure Streams."[219] Traditionally, horse manure is picked up from garbage haulers and dumped into a landfill. The project will now allow horse manure to be taken to a compost facility. Efforts in this regard can reduce negative water quality impacts to local streams, including Silver Creek and Sleepy Hollow Creek.

Developing a nutrient management plan coupled with soil testing can help to prevent excess nutrient application and runoff into lakes and streams. A nutrient management plan allows farmers to adopt integrated strategies for monitoring and controlling the farm, placement, timing and amount of fertilizer applications and other soil amendments. Similarly, integrated pest management (IMP) seeks to apply a systems approach to agricultural management to reduce dependence on synthetic inputs, possibly improving water quality through less pesticide runoff. For example, IPM relies on the close observation of the lifecycle of pests and their interaction with the ecosystem to detect crop damage. When detected, further crop damage is prevented through the use of mechanical trapping, natural predators, growth regulators, chemical mating disruptors, and possibly the judicious use of chemical pesticides.

Altering cropping practices is yet another technique that can help significantly reduce nutrient and sediment runoff. Prescribed or rotational grazing can be used to control the location, intensity, frequency, duration, and season of grazing, which can help to improve water quality and filtration and prevent erosion. Cover cropping, that is, maintaining a crop cover or crop residue in agricultural fields, increases nutrient retention in soil and prevents erosion. Green manure is cover cropping designed to add nutrients to soil and reduce required fertilizer application. In this case, the cover crop is grown for a specified amount of time and then plowed under. The related practice of conservation tillage (with variations including no-till and strip-till methods) leaves soil totally or partially untilled and covered with some amount of crop residue which prevents erosion and increases soil moisture. However, a higher reliance on herbicide with conservation tillage to control weeds may

[219] "New Extension project will aid horse owners in manure hauling," University of Illinois Extension, last modified March 30, 2011, accessed November 7, 2011, https://webs.extension.uiuc.edu/cefj/news/news20524.html.

lead to more chemical runoff, so this practice might be best limited to those lands with the greatest risk of erosion.

Recommendation: Cropland management practices such as rotational grazing, cover cropping and/or conservation tillage should be implemented to control erosion and reduce required nutrient applications.

Additionally, many BMPs not specific to agriculture are still complementary to agricultural land use and appropriate for implementation by private landowners. The NRCS FOTGs contain practice standards and specifications for many of these BMPs as well.[220] Upland erosion control relies on practices that slow and filter water prior to drainage into a water body. Examples of upload erosion control include: grass waterways; terracing; buffer and filter strip creation; and installation or retrofitting of water and sediment control basins. Streambank or lake shore erosion can be prevented using: barge-applied rip rap; longitudinal peaked stone toe protection; critical area seeding and bank re-shaping; tree revetments; root wad installation; stream barbs; bendway weirs; rock riffles; and grade stabilization structures to prevent streambank failure. Wetland protection, restoration or construction can improve water quality since wetlands act to filter water and can remove some particulate and dissolved contaminants such as sediment and nutrients. Finally, conservation easements are voluntary, legally enforceable land preservation agreements between landowners and a government agency. Conservation easements maintain open space and its associated environmental benefits by excluding development on protected lands.

[220] "USDA NRCS. *Field Office Technical Guides*. McHenry County, Illinois. Washington, D.C.: USDA NRCS, 2011. http://efotg.sc.egov.usda.gov/efotg_locator.aspx?map (accessed September 13, 2011).

Therefore, this plan recommends specifically that agricultural landowners in the watershed planning area should:

- Implement livestock exclusion fencing to separate livestock from direct contact with streams. Developing an alternative water source could facilitate this exclusion. Heavy use area protections should also be established to reduce erosion from livestock.

- Adopt integrated nutrient and/or pest management plans if they have not already done so that help to reduce nutrient and pesticide runoff to streams in the watershed planning area.

- Implement cropland management practices such as rotational grazing, cover cropping and/or conservation tillage to control erosion and reduce required nutrient applications.

- Implement general best management practices like upland erosion controls, streambank or lake shore protection, and/or wetland protection/restoration to protect water quality, in addition to agriculture-specific BMPs discussed above.

Recommendation: Agricultural landowners should implement general best management practices as discussed above.

6.2. Stormwater Retrofits

Traditionally, stormwater management includes managing both the quality and quantity of stormwater that is collected from a piped network and transported into a nearby waterbody. Though stormwater drain networks are designed to move water away from developed areas, they may actually generate more pollutants that are delivered to the stream.

Stormwater retrofitting is one available method to reduce the amount of pollutant loading to a receiving waterbody. It includes a series of structural stormwater practices specifically designed to reduce and/or remove pollutants. This option involves conducting an analysis of existing facility characteristics and re-engineering these facilities for additional storage and water quality treatment.

The CWP, whose primary mission is to promote efforts and create solutions aimed at achieving clean water, has established a series of manuals on urban stormwater restoration including the *Urban Subwatershed Restoration Manual No. 3: Urban Stormwater Retrofit Practices*.[221] Table 28 identifies typical opportunities for storage retrofit that may be implemented throughout the watershed planning area. Table 29 identifies technologies for urban stormwater retrofits.

Table 28. Typical opportunities for stormwater storage retrofits

TYPE	DESCRIPTION
Add Storage to Existing Ponds	Add water quality treatment storage to an existing pond that lacks it by excavating new storage on the pond bottom, raising the height of the embankment, modifying riser elevations/dimensions, converting unneeded quantity control storage into water quality treatment storage and/or installing internal design features to improve performance.
Storage Above Roadway Culverts	Provide water quality storage immediately upstream of an existing road culvert that crosses a low gradient, non-perennial stream without wetlands. Free storage is created by adding wetland and/or extended detention treatment behind a new embankment just upstream of the existing roadway embankment.
New Storage Below Outfalls	Flows are split from an existing storm drain or ditch and are diverted to a stormwater treatment area on public land in the stream corridor. Works best for storm drain outfalls in the 12-to 3-inch diameter range that are located near large open spaces, such as parks, golf courses and floodplains.
Storage in Conveyance System	Investigate the upper portions of the existing stormwater conveyance system to look for opportunities to improve the performance of existing swales, ditches and non-perennial streams. This can be done either by created in-line storage cells that filter runoff through swales and wetlands or by splitting flows to off-line treatment areas in the stream corridor.
Storage in Road Right of ways	Direct runoff to a depression of excavated stormwater treatment area within the right of way of a road, highway, transport or power line corridor. Prominent examples include highway cloverleaf, median and wide right of way areas.
Storage near large parking lot	Provide stormwater treatment in open spaces near the down gradient outfall of large parking lots.

Source: Center for Watershed Protection

[221] Most recently summarized in Center for Watershed Protection. "Urban Stormwater Retrofit Practices." *Urban Subwatershed Restoration Manual*, Manual 3. Ellicott City, MD: Center for Watershed Protection, August 2007. http://www.cwp.org/categoryblog/92-urban-subwatershed-restoration-manual-series.html (accessed November 7, 2011).

Table 29. Technologies for urban stormwater retrofits

TYPE	DESCRIPTION
Extended Detention	This option relies on 12 to 24 hour detention of stormwater runoff after each rain event within a pond, with portions of the pond drying out in between storm events. Extended detention (ED) allows pollutants to settle out and can also provide downstream channel protection.
Wet ponds	Wet ponds consist of a permanent pool of standing water. Runoff from each storm eventers the pond and partially displaces pool water from previous storms. The pool also acts as a barrier to re-suspension of sediments and other pollutants removed during prior storms.
Constructed Wetlands	Constructed wetlands are shallow depressions that receive stormwater for treatment. Runoff from each new storm displaces runoff from previous storms, and long residence time increases pollutant removal.
Bioretention	Bioretention is an innovative urban stormwater practice that uses native forest ecosystems and landscape processes to enhance stormwater quality. Bioretention areas capture sheet flow from impervious areas and treat the stormwater using a combination of microbial soil processes, infiltration, evapotranspiration, and plants.
Filtering Practices	Filter practices function by filtering runoff through an engineered media and collecting treated runoff in an under drain. The media may consist of sand, soil, compost, or a combination of these.
Infiltration Practices	An infiltration trench is a rock-filled chamber with no outlet that receives stormwater runoff. Stormwater runoff passes through some combination of pretreatment measures, such as a swale or sediment basin, before entering the trench were it infiltrates into the soil.
Swales	Swales are a series of engineered, vegetated, open channel practices that are designed to treat and attenuate stormwater runoff for a specified water quality volume.
Other Retrofit Treatment	These on-site practices provide treatment of roof runoff using rain gardens, rain barrels, green roofs, cistern, stormwater planters, dry wells, or permeable pavers.

Source: Center for Watershed Protection

This plan offers several stormwater management recommendations. Stormwater networks should be retrofitted throughout the watersheds planning area, where feasible, to reduce nutrient loading within the watershed planning area using the practices and technologies outlined above. Furthermore, an engineering study should be conducted to determine the amount of detention that should be placed in a watershed relative to the amount of development or impervious surface. This would help determine the amount of sustainable hydrology in the watershed planning area. Additionally, an inventory should be conducted of all detention and retention sites to identify which subwatershed units are served with stormwater management facilities. Such an inventory would aid in determining future stormwater retrofit opportunities.

Recommendation: Appropriate entities should consider the above stormwater management recommendations.

6.3. Street Sweeping

This plan recommends a number of management options to reduce urban nonpoint source pollutant loadings to the watershed planning area and improve groundwater quality. One option includes boosting the frequency of street sweeping.

Street cleaning can help to improve water quality by reducing pollutants (sediment, trash, road salt, and trace metals) in stormwater runoff. Typically, when it rains, water washes into sewers or into other stormwater management structures, such as a detention basin where the water is then treated to varying degrees. By removing pollutants and debris from roadways on a regular basis before they are carried away by stormwater, water quality can be improved. The frequency of sweeping depends on weather conditions, traffic patterns, resources, and a host of other conditions. The optimal frequency should be determined for each government body. However, there are suggested guidelines ranging from nine times a year to biweekly based on the type of street.[222] Furthermore, innovative sweeping practices and schedules may reduce the need for other structural stormwater controls while remaining cost effective.[223]

Table 30 provides an example of the amount of nutrients that could be removed due to increased street sweeping. It should be noted however that the effectiveness of these practices depends on urban density.

[222] Minnesota Department of Transportation. *Resource for Implementing a Street Sweeping Best Practice*. Report no. 2008 RIC06. St. Paul, MN: Minnesota Department of Transportation, 2008. http://www.lrrb.org/PDF/2008RIC06.pdf (accessed November 8, 2011).

[223] "Parking Lot and Street Cleaning," U.S. EPA, last modified May 24, 2006, accessed November 8, 2011, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=99

Table 30. Estimated pollutant removal rate based on street sweeping practices [224] [225]

	TSS	TP	TN
Street sweeping[1]			
Mechanical sweeping, monthly	9%	3%	3%
Regenerative air/vacuum, monthly	22%	4%	4%
Mechanical sweeping, weekly	13%	5%	6%
Regenerative air/vacuum, weekly	31%	8%	7%
Stormdrain cleanout program			
Annual	18%	<1%	3%
Semi-annual	35%	2%	6%
Use of phosphate-free fertilizer[2]	—	23%	—
Hotspot facility management			
Industrial good housekeeping practices	40%	49%	8%
Vehicle washing ordinances	Could approach 100%		

Sources:

1 Center for Watershed Protection. Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin. Ellicott City, MD: Center for Watershed Protection, September 2008. http://www.worldsweeper.com/Street/Studies/ CWPStudy/CBStreetSweeping.pdf (accessed November 8, 2011). Removal rates are the estimated fraction of the on-street load picked up by sweepers.

2 Ibid. The removal rate is an estimate of the reduction in annual phosphorus loading from medium-density residential areas (i.e., the event mean concentration in runoff is reduced by 23 percent). See additional research from Dane County, Wisconsin at http://www.danewaters.com/management/PhosphorusControlPresentation.aspx.

[224] Center for Watershed Protection. *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin*. Ellicott City, MD: Center for Watershed Protection, September 2008. http://www.worldsweeper.com/Street/Studies/CWPStudy/CBStreetSweeping.pdf (accessed November 8, 2011). Removal rates are the estimated fraction of the on-street load picked up by sweepers.

[225] Center for Watershed Protection. *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin.* Ellicott City, MD: Center for Watershed Protection, September 2008. http://www.worldsweeper.com/Street/Studies/CWPStudy/CBStreetSweeping.pdf (accessed November 8, 2011). The removal rate is an estimate of the reduction in annual phosphorus loading from medium-density residential areas (i.e., the event mean concentration in runoff is reduced by 23 percent). See additional research from Dane County, Wisconsin at http://www.danewaters.com/management/PhosphorusControlPresentation.aspx.

6.4. Stream and Riparian Restoration

Stream restoration is a technique used to improve the physical, chemical, and biological functions of the stream prior to disturbance. Physical improvements may include a reduction in stream bank erosion. Chemical improvements may include improved water quality. On the other hand, biological improvements may include a more expansive and diverse habitat, such as wildlife, fish, and aquatic insects. In most cases, efforts are made to restore a stream to a pre-disturbed state. Unfortunately, this is rarely achieved given the large scale amount of degradation, due to human activities, and the increased volume of flow due to watershed development. However, even in cases where pre-disturbed conditions cannot be achieved, any section of the stream network that has been channelized, lacks a natural stream corridor, or flows past a wetland that has been drained is a potential candidate for stream restoration. Specifically, stream restoration efforts may include stabilizing streambanks where appropriate, reestablishing riparian buffers to tackle issues including erosion control, and providing incentives for local stakeholders to establish buffer zones near streambanks.

6.5. Permeable Pavement

There are many benefits associated with using permeable pavement versus traditional pavement. A traditional pavement is designed to

provide a solid ground for large vehicles and heavy loads. However, when it rains, water hitting traditional pavement will eventually flow into a water body and contribute towards increased flooding and erosion. In contrast, a permeable paver system is best described as a self-draining system. Much like traditional pavement, it provides a solid ground surface for large vehicles and heavy load. Permeable pavement however, is designed to have voids in the surface of the pavers thereby allowing rainfall and runoff to drain through it. This increases infiltration of the soil beneath it, improves water quality, recharges shallow groundwater aquifers, and decreases flood damage.

6.6. Green Practices

Green practices help keep water where it falls, capturing and cleaning stormwater to reduce the amount of pollution entering streams and lakes. Green practices also promote infiltration and groundwater recharge. There are a variety of green practices used to address water resource management and provide water quality benefits. Some include rain water harvesting, rain gardens, and native landscaping. This list is by no means exhaustive, but these and other BMPs (Table 27) should be implemented throughout the watershed planning area.

Rainwater Harvesting

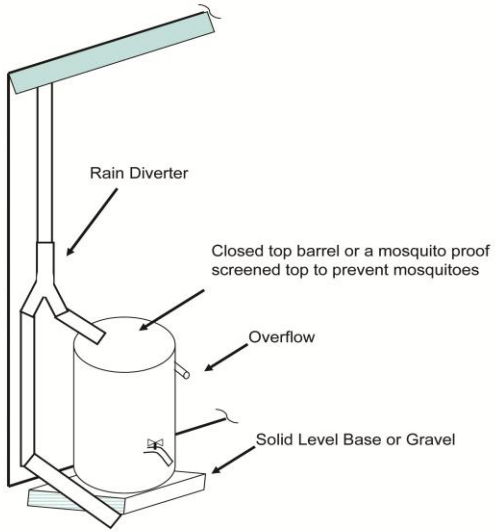
The practice of rainwater harvesting involves capturing, diverting, and storing rainwater collected from the rooftops of homes for later use as shown in Figure 51.[226] There are a variety of techniques used to capture rainwater including rain barrels and cisterns. Rainwater harvesting provides naturally softened water that has few contaminants. The benefits of rainwater harvesting include a reduction in stormwater runoff, erosion, and the demand on water supply.

Locally, many communities are engaged in rainwater harvesting. As an example, the City of Crystal Lake has developed an incentive program that offers a $25 utility credit to water or sewer customers who purchase a rain barrel from a participating local retailer.[227] The program encourages water conservation practices and supports the reduction of stormwater runoff. The City also passed an ordinance in March of 2011 that regulates the installation of rain barrels. Practices such as these should be implemented throughout the watershed planning area.

[226] Rain Barrels and Cisterns," Low Impact Development Center, Inc., accessed November 8, 2011, http://www.lid-stormwater.net/raincist_specs.htm.

[227] City of Crystal Lake, Illinois. *City of Crystal Lake Rain Barrel Incentive*. Woodstock, IL. http://crystallake.org/Modules/ShowDocument.aspx?documentid=4078 (accessed November 8, 2011).

Figure 51. Depiction of a rain barrel



Rain Gardens

A rain garden may simply appear to be an attractive garden; however, it acts as a "small bioretention cell."[228] It cleans and reduces stormwater, infiltrates clean water, and reduces nitrogen and phosphorus levels and sediment loads found in stormwater.

Many local governments and organizations within the watershed planning area recognize the importance of rain gardens and promote this practice. As an example, the City of Crystal Lake recently installed its first community rain garden on the front lawn of its municipal complex.[229] This was part of the City's pilot project aimed at educating homeowners on how to contribute to both groundwater recharge and improved water quality. Additionally, McHenry County has a demonstration rain garden and a demonstration xeriscape at its administration building to show the benefits of natural landscaping. FREP has also launched a Rain Garden Initiative for Kane County.[230] This project will create a demonstration rain garden at a location within the county and a web page to include resources highlighting projects and activities related to rain gardens. This plan recommends that a similar type of initiative be promoted within the watershed planning area.

For communities interested in promoting rain gardens, the State of Illinois established an Illinois Rain Garden Program in 2005. It is funded by the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and provides funding for rain gardens.

Native Landscaping

Native landscaping involves landscaping with plants that were native to a particular region before other plants were introduced. Native plants have typically adapted to the climate of the region, soil, and geography of their community. They are hardy, have high survival rates in the winter and summer, require little or no irrigation or fertilization, and are resistant to most pests and

[228] "Rain Barrels and Cisterns," Low Impact Development Center, Inc., accessed November 8, 2011, http://www.lid-stormwater.net/raincist_specs.htm.

[229] "Crystal Lake uses rain garden to help maintain groundwater reserves," TribLocal.com Crystal Lake, last modified May 11, 2011, accessed November 8, 2011, http://triblocal.com/crystal-lake/2011/05/11/crystal-lake-uses-rain-garden-to-help-maintain-groundwater-reserves/.

[230] "Rain Garden Initiative," Fox River Ecosystem Partnership, accessed November 8, 2011, http://foxriverecosystem.org/rain_gardens.htm.

diseases. They also promote biodiversity and require fewer pesticides than typical lawns.

Many communities and entities within the watershed planning area actively promote the use of native landscaping including the Village of Prairie Grove, McHenry County, both the Cary Park District, and the Crystal Lake Park District, and the MCCD. More specifically, the MCCD has several sites where native landscaping practices are utilized including the Lost Valley Visitor Center in Glacial Park. Crystal Lake Park District has a native plant garden at the Nature Center. Such practices should be promoted throughout the watershed planning area.

6.7. Wetland Restoration

Wetlands are closely linked to improved water quality, since they aid in treating stormwater runoff, decreased flood, and reduce sediment concentrations and nutrient loading.

Wetlands have been lost due to agriculture and development. Various types of wetlands including wet prairies and marshes are often filled and replaced with existing open water wetlands. In turn, this may lead to a lack of diversity of wetland types.

Wetland restoration is the process of returning a historical wetland to its naturally functioning condition. Restoration of wetlands can improve water quality, decrease stormwater runoff, and create new wildlife habitat. Restored wetlands can be constructed with trails allowing easy public access, and can provide educational opportunities through public through tours, signage, and other techniques. It is important to note that they require long term maintenance activities including prescribed mowing, herbiciding, and burning amongst other activities.

6.8. Urban Best Management Project Recommendations

Stakeholders were encouraged to submit project recommendations for inclusion in the plan. A total of 23 short-term projects (Table 31) were submitted and organized covering a wide variety of best management practices. They were selected through stakeholder meetings, meetings with municipal representatives, field observations, and best professional judgment based on opportunities along the stream corridors. These projects are aimed at reducing nonpoint source pollution and achieving the watershed plan's goals.

Site specific project recommendations are based on estimated pollution load reduction benefits, costs, and their implementation potential. Short term projects were selected based on the following:

- Lead implementer, local, and municipal support;
- Supports Silver Creek's and Sleepy Hollow Creek's watershed goals;
- Results from the Silver Creek and Sleepy Hollow Creek stream assessment; and
- Ability to address aquatic life and fish consumption impairments in downstream segment of the Fox River.

Short term projects are expected to be implemented in 1-5 years following plan completion. Project implementation will depend on the availability of funding and the support of land owners and other project partners.

As requested by IEPA, all submitted projects were organized into 5 categories: Urban, Hydrologic, Agriculture, Livestock, and Other.

Table 31. Short-term nonpoint source projects summary

IEPA PROJECT CATEGORY	NUMBER OF PROJECTS	GENERAL DESCRIPTION
Hydrologic	13	Stream channel and stream corridor restoration projects to stabilize banks from erosion.
Other	2	Various improved management practices including project signage to reduce nutrient runoff and accumulation and improve habitat for aquatic life.
Urban	8	Retrofits to existing stormwater management infrastructure to address pollutant loading and increased runoff volume in developed areas.
Total	23	

After the short-term projects were selected, CMAP contracted with Hey and Associates to calculate pollutant load reduction and cost estimates for each project (Table 32). Sediment, total suspended solids, phosphorus, fecal coliform, and nitrogen reductions were considered in the estimates. It should be noted that some lead implementers will need to further develop project proposals. This will likely affect and potentially increase the estimated/preliminary project costs due to a number of reasons including unforeseen variable costs such as site conditions and implementation timelines.

Pollutant Load Reductions

Upon implementation, it is estimated that the proposed projects (Figure 52) will reduce sediment by 189 tons per year, total suspended solids by 38,866 pounds per year, phosphorus by 39,054 pounds per year, fecal coliform by 1.87E + 13 counts, and nitrogen by 865 pounds per year.

Funding Opportunities and Sources

Among other considerations, financial and technical assistance is needed to successfully implement recommended BMPs and projects. Funding will need to come from a variety of sources. A table, outlining potential funding sources, eligibility requirements, and specific activities funded is included in Appendix E.

Figure 52. Short-term project recommendations for the planning area

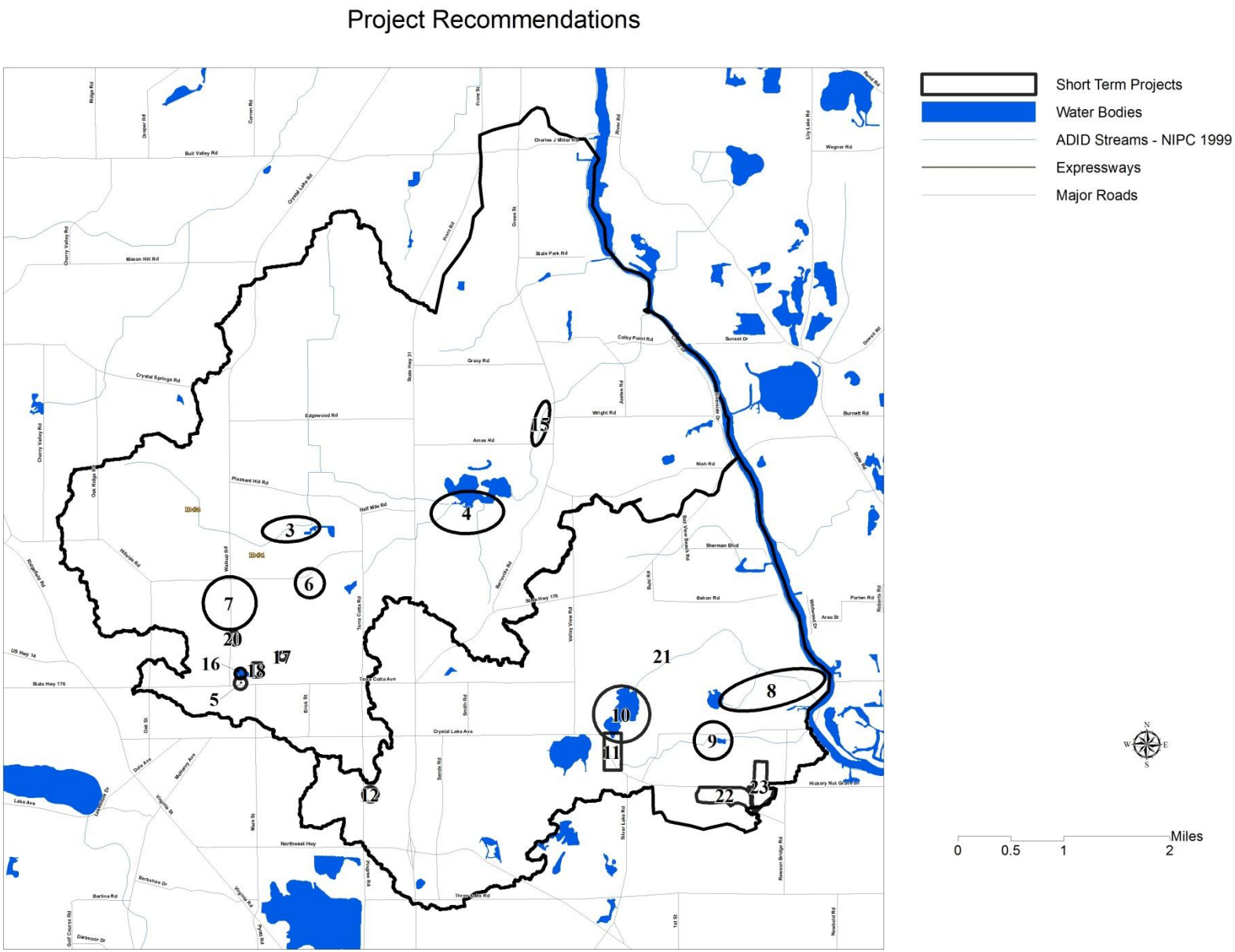


Table 32. Summary of short-term projects

IEPA CATEGORY	BEST MANAGEMENT PRACTICE	LEAD IMPLEMENTER	UNIT	AMOUNT	MAP ID #	COST	SEDIMENT (TONS/YR)	TSS (LBS/YR)	PHOSPHORUS (LBS/YR)	FECAL COLIFORM (COUNTS)	NITROGEN (LBS/YR)
Hydrologic	Prairie Ridge Conservation Area and Educational Trails East of Prairie Ridge H.S.	Crystal Lake Park District	Acres	60	3	$351,698		6,949	54.5	4.16E+12	88.01
Hydrologic	Wetland Restoration on the southside of Thunderbird Lake	Land Conservancy of McHenry County	Acres	44.6	4	$291,649	NA	NA	NA	NA	NA
Urban	Install Permeable Pavement at Nature Center, 330 N. Main Street	Crystal Lake Park District	SF	40,000	18	$474.60		441.48	0.15	1.54E+12	6.91
Urban	Install Permeable Pavement at View Street, Corner of View and Lorraine St.	Crystal Lake Park District	SF	8,300	17	$103,840		91.61	0.03	3.20E+11	1.43
Urban	Install Permeable Pavement at Veterans Acres Park's Skate Shack	Crystal Lake Park District	SF	5,000	5	$64,266		55.19	0.02	1.93E+11	0.86
Urban	Install Permeable Pavement at Veterans Acres Park, 431 N. Walkup Ave.	Crystal Lake Park District	SF	75,000	19	$878,945		827.78	0.29	2.90E+12	12.96
Urban	Install Permeable Pavement at Rotary Shelter Lot, 431 N. Walkup Ave.	Crystal Lake Park District	SF	11,000	20	$135,906		121.41	0.04	4.25E+11	1.90
Urban	Stabilize existing trails and develop a new trail at Sterne's Woods	Crystal Lake Park District	LF	5,600	6A	$108,578		37.20	0.02	6.98E+11	0.93
Hydrologic	Reduce invasive species through controlled herbicide application and burns & increase diversity of species (Sterne's Woods)	Crystal Lake Park District	Acres	30-40	6B	$232,444					
Urban	Develop a Natural Wetland System at Crystal Lake Stormwater Detention Pond	City of Crystal Lake	Acres	7 to 8	7	$75,306		2,547.66	4.50	3.50E+12	69.61
Hydrologic	Restore a wetland community at the Silver Creek Conservation Area	McHenry County Conservation District	Acres	35	8	$127,339	NA	NA	NA	NA	NA
Hydrologic	Restore a wetland at Fel-Pro Creek (Regrade man-made berm to sedge meadow, revegetate)	McHenry County Conservation District	Acres	10	9	$169,993	NA	NA	NA	NA	NA
Hydrologic	Restoration along Fel-Pro Creek (remove invasives, revegetate with native species)	McHenry County Conservation District	Acres	12	9	$169,993	NA	NA	NA	NA	NA
Hydrologic	Lakeshore stabilization and retrofit (Silver Lake)	Village of Oakwood Hills	LF	8,263	10	$70,786	43.86		70.19	0.00	175.46
Hydrologic	Streambank stabilization of Crystal Lake Road to Silver Lake	Algonquin Township	LF	2,152	11	$457,599	22.84		36.56	0.00	91.39
Urban	Naturalize existing detention basin to improve water quality from subdivision and Pingree Road	Crystal Lake Park District	Acres	1.5	12	$30,683		20,563.00	66.45	5.00E+12	52.00
Hydrologic	Dredging at culvert under Ames Road, remove fallen debris, restore/stabilize the streambank	Village of Prairie Grove	LF	1,320	15	$300,011	42.04		67.27	0.00	168.17
Hydrologic	Wetland and pond restoration, shoreline stabilization, establish learning areas, interpretive signage at Veteran Acres Pond	Crystal Lake Park District	Acres	5	16	$530,532					
Hydrologic	Stabilize the eroded gulley that has formed at the outlet pipe (36 inch pipe) from a sledding hill and silt deposited in the Oakwood Hills Fen	Village of Oakwood Hills	LF	1,200	21	$398,580	80.00		68.00		136.00
Hydrologic	Retrofit includes adding natives, reshaping pond detention features and increasing infiltration zones and features at Foxford Hills Golf Course	Cary Park District	Acres	50	22	$243,671		3,615.70	18.10	—	29.70
Hydrologic	Bio-engineered treatments and infiltration and native restoration situation north east of Crystal Lake RD, Foxford Hills Golf Course	Cary Park District	Acres	43	23	$349,780		3,615.70	18.10	—	29.70
Other	Crystal Lake Park District Nature Center Exhibit- Veteran Acres Park, Crystal Lake	Crystal Lake Park District			*	$10,000	NA	NA	NA	NA	NA
Other	Establish an interpretive sign at Wingate Prairie	Crystal Lake Park District	Acres	33.5	*	$10,000	NA	NA	NA	NA	NA

Project Snap Shots

Detailed short-term project descriptions are provided below. The project description numbers correspond to the location numbers in Table 32 (i.e., MAP ID # column) .

Project # 1 - Prairie Ridge Conservation Area and Educational Trails (Map ID # 3) - Working in partnership with Prairie Ridge High School and the EDMC, the Crystal Lake Park District will develop interpretive learning trails in and around the conservation area with emphasis on restoring native vegetation on the school property. The project will also handle stormwater onsite and encourage biodiversity. Planning, implementation and long term maintenance of the property will be coordinated with the school and become a student project in the environmental education department. The Crystal Lake Park District would be the expected lead in pursuing wetland restoration at this project site.

Figure 53. Prairie Ridge Conservation Area

Project #2 - Thunderbird Lake Wetland Restoration (Map ID # 4) The 44.6 acre site located on the south side of Thunderbird Lake is an excellent candidate for wetland restoration. The project would include buckthorn removal and reed canary grass management, drain tile removal, seeding and active management using fire and herbicides to minimize invasives. The site handles some of the urban runoff from a nearby development. As such, the project would provide a natural water quality buffer between the development and the high quality Thunderbird Lake Illinois Natural Inventory Site. The Land Conservancy of McHenry County would be the expected lead in pursuing wetland restoration and streambank stabilization at this project site.

Figure 54. Wetland restoration at Thunderbird Lake location map

Project # 3-7 – Permeable Pavement - Crystal Lake Park District (Map ID # 5, 17, 18, 19, 20) - There are several opportunities to replace five separate parking lots (two asphalt paved and three compacted screenings) with permeable pavement on property owned by the Crystal Lake Park District in Crystal Lake, Illinois (Figure 55-59). The proposed lots will aid in groundwater recharge, remove roadway pollutants, and manage stormwater runoff. The **first lot** is located at the Nature Center, 330 N. Main Street, and is approximately 40,000 square feet. The **second site** is located at the Skate Shack and is approximately 5,000 square feet. The **third lot** is the Main Lot, located 431 N. Walkup Avenue, and approximately 75,000 square feet. **Lot Four** is the Rotary Shelter, 431 N. Walk up Road, and is approximately 11,000 square feet. Lastly, **lot five** is the View Street Lot located on the corner of View and Lorraine Street, and is approximately 8,300 square feet. Interpretive signs will be provided at each location. The Crystal Lake Park District would be the project lead for each project.

Figure 55. Nature Center

Figure 56. Skate Shack

Figure 57. Main Lot

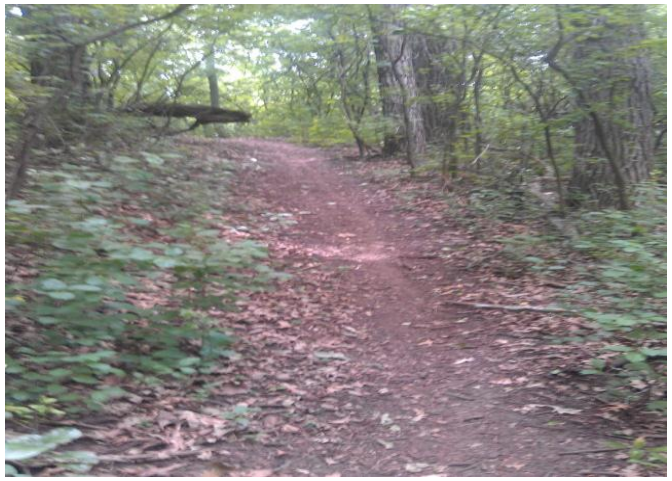
Figure 58. Rotary Shelter

Figure 59. View Street

Project # 8 - Natural Area Restoration at Sterne's Fen (Map ID # 6A) The purpose of this project is to stabilize existing trails around the Sterne's Fen to prevent erosion and sedimentation into the fen and protect the fen, seeps, and headwaters. The project is located 5617 E. Hillside Road, Crystal Lake, IL and is 5600 linear feet (Figure 60). A new trail will be developed that will double as a firebreak for burn management. Interpretive signage would be developed and installed to discuss the unique features of the fen and how it is a key component of the watershed. The Crystal Lake Park District would be the expected lead in pursuing the project.

Project 9 – Wetland Restoration at Sterne's Fen (Map ID #6B) The project site is located in the Sterne's Fen and will address excessive sedimentation. Proposed improvements include improving the hydrology of the Sterne's Fen by reducing invasive species through controlled herbicide application and burns. The project (Figure 60) will improve water filtration, increase the diversity of species and protect threatened and endangered species.

Figure 60. Sterne's Fen Trail



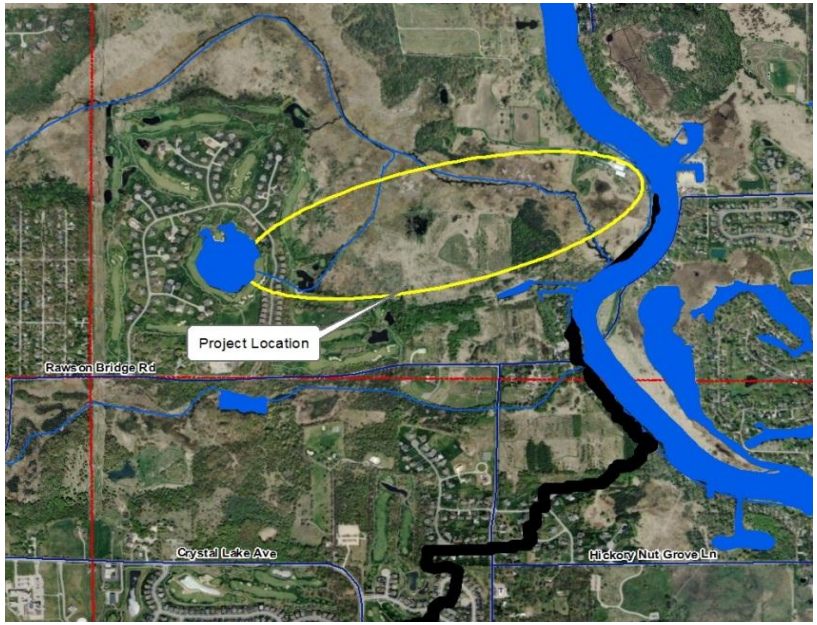
Project # 10 - Detention Basin Retrofit in Crystal Lake, IL (Map ID# 7) - This project includes retrofitting an existing stormwater detention pond into a natural wetland at the City of Crystal Lake's Wastewater Treatment Plant # 3 (Figure 61). Currently, the project site is an open wetland (cattails, scrub trees, nonnative plants, etc.). The site is upstream from Sleepy Hollow Creek. It includes restoration into a natural wetland of the stormwater detention pond at the Crystal Lake WWTP. The project is approximately 7 to 8 acres in size. A natural wetland would help control or minimize sedimentation into the adjacent creek, which becomes Sleepy Hollow Creek. Potential pollutants would be filtered and nutrient loading could be reduced, thereby improving water quality. Stormwater volume would also be minimized.

The land south and west of the treatment plant and the detention pond could be attached to this project. The City of Crystal Lake would be the expected lead in pursuing detention basin naturalization at this project site.

Figure 61. Aerial view/photo Crystal Lake stormwater retrofit site

Project 11 - Silver Creek Conservation Area Wetland Restoration - (Map ID #8) - This project would entail the removal of drain tiles and invasive trees and brush species in the Silver Creek Watershed (Figure 62). The project includes a 35 acre wetland and will also include filling in a ditch and revegetating the area with native species. It is anticipated that the MCCD is likely to serve as the project lead.

Figure 62. Location of Silver Lake wetland restoration site

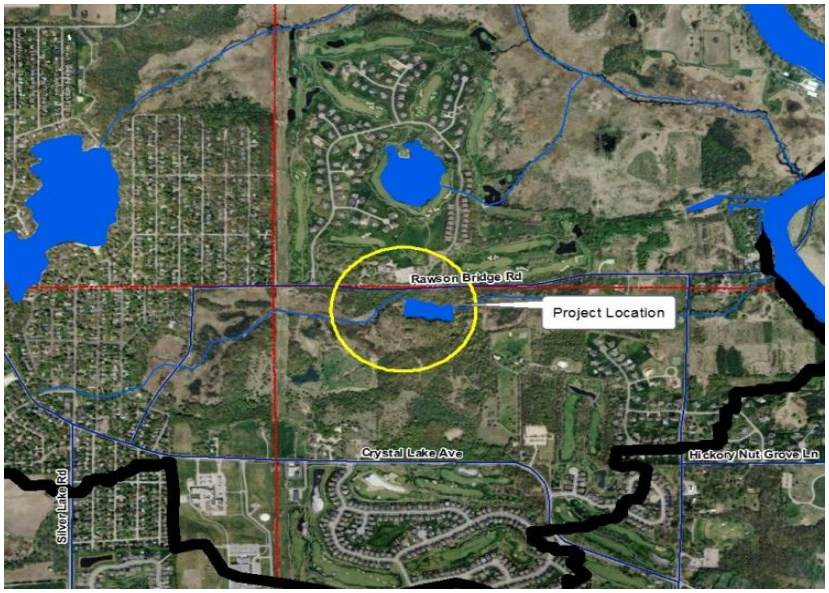


Project 12 - Fel-Pro Creek Restoration A – (Project location #9) – As the lead implementer, the MCCD will work to restore approximately 12 acres of wetlands along Fel-Pro Creek in the Silver Creek Watershed (Figure 63). The project will remove invasive trees and revegetate the wetland with native species. The MCCD would be the expected lead in pursuing the project.

Project 13 Fel-Pro Creek Restoration B – (Project Location #9) - Approximately 10 acres of wetland are proposed for restoration at Fel-Pro Creek in the Silver Creek Watershed (Figure 63). The project is aimed at restoring hydrology since wetland soils will be placed back to their original location. The project will also remove invasive trees, regrade out a manmade berm, and the wetland area will be

reseeded with native vegetation. The MCCD would be the expected lead in pursuing the project.

Figure 63. Fel-Pro Creek restoration sites 9A and 9B



Project 14 - Lakeshore Protection – Silver Lake and Oakwood Hills (Map ID # 10) - Lakeshore stabilization and retrofitting is necessary at various points around Silver Lake NE corner bordered by Crystal Lake Avenue) and Silver Lake (Figure 64). This project would reduce re-suspension of sediments; introduce techniques to stabilize and re-vegetate soils along the lakeshore; remove treated timbers (used as bank stabilization) and their pollutants; aid in fecal coliform reduction (from geese inhibitor stabilization techniques); and reduce nutrients in the lake utilizing vegetative techniques. The Village of Oakwood Hills would be the expected lead in pursuing the project.

Project 15 - Silver Lake Stream Channel Stabilization – (Map ID # 11) - Silver Lake requires dredging due to sediment from the bank sloughing. As such, streambank stabilization is necessary to remediate this problem. The bank channel is located from the east side of Crystal Lake Road to Silver Lake (Figure 64). The channel connects to Silver Lake from Lake Killarney, and from Silver Lake drains through Oakwood Hills Fen (Illinois Nature Preserve) directly to the Fox River. Algonquin Township would be the expected lead in pursuing the project.

Figure 64. Silver Lake lakeshore protection and streambank channelization project sites

Project 16 - Feinberg Park Detention Basin Retrofit (Map ID # 12)
This project would entail a detention basin retrofit to replace turf grass on the sites' slopes and basin bottom with native vegetation. The project site is located east of Pingree Road, between Route 14 and Route 176 and serves stormwater runoff from the surrounding neighborhood and Pingree Road (Figure 65). The project will reduce nutrient and sediment loads and improve groundwater quality. The project is approximately 1.5 acres in size. The Crystal Lake Park District would be the expected lead in pursuing detention basin naturalization at the project site.

Figure 65. Feinberg stormwater detention basin site

Project 17 - Dredging/Stream Channel Stabilization (Map ID #15)
This project entails dredging sediment within culverts under Ames Road and within the Village of Prairie Grove (Figure 66). Work also includes removal of fallen trees and limbs within the stream; streambank restoration and/or stabilization; removal of invasive species along the streambank; and, planting native species if necessary to stabilize the bank. The reach begins at Ames Road and ends at Barreville Road, and is approximately ½ mile of which approximately ¼ mile is identified for the proposed project. The Village of Prairie Grove would be the expected lead in pursuing the project.

Figure 66. Culverts under Ames Road

Project 18 –Wetland and Pond Restoration, Veteran Acres Park (Map ID # 16)

As part of this project, the Crystal Lake Park District will renovate native plantings around the perimeter of the pond to enhance water quality and stabilize the shoreline. The project also includes removal of invasives, extension of an existing walking trail, and interpretive learning areas with signage (Figure 67). The existing pond is fed by spring, seep, and storm water discharge. A major renovation was completed in 1999 to establish sediment basins, wetlands, and native plantings around the shoreline. Increased runoff has caused a need for additional native vegetation, shoreline erosion control and perhaps expanding the capacity of the pond. The Crystal Lake Park District would be the expected lead in pursuing the project.

Figure 67. Veteran Acres Park

Project 19 – Bank Stabilization and Stormwater Retrofit – (Map ID #21)

There is a deeply/severely eroded drainage channel on North Park Avenue (36" pipe) in the Village of Oakwood Hills. There is also a six to eight inch pipe under the sledding hill (Figure 68). A very deep eroded gully has formed at the outlet of the pipe from the sledding hill and silt is being deposited downstream in the Oakwood Hills Fen. This project would address sedimentation and reduce the amount of pollutants discharged in the fen. The Village of Oakwood Hills would be the expected lead in pursuing the project.

Figure 68. Erosion at the Oakwood Hills stormwater channel

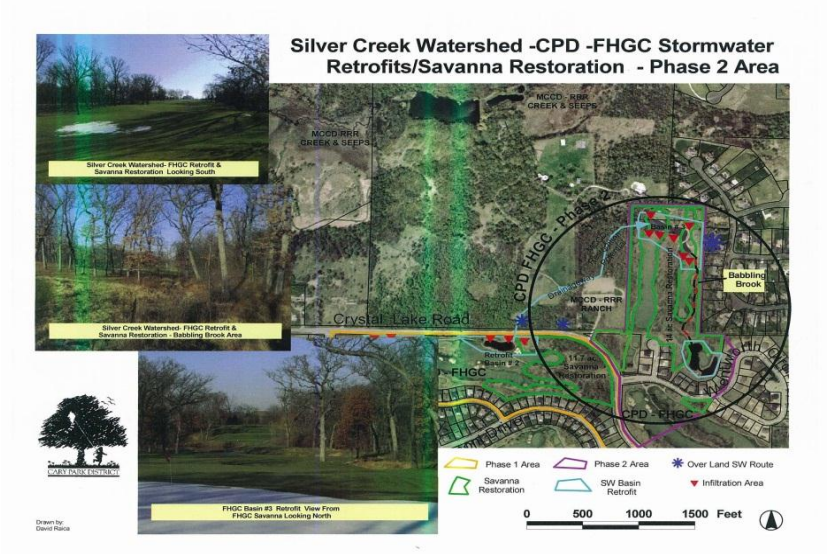
Project 20 - Foxford Hills Golf Course (FHGC) Detention Basin Retrofit (Phase 1) (Map ID # 22) - This project includes a stormwater retrofit located south of Crystal Lake Road within a 50 acre course and residential area (Figure 69). The project will increase large event storage capacity, aid infiltration, and reduce peak overflows. Native habitat enhancements to the adjacent existing 12 acre Oak- Hickory Savanna along the southern side of Crystal Lake Road would also reduce nutrient loading. Enhancements include reshaping the stormwater basins, adding new native vegetation, and increasing bio-engineered infiltration zones and features. Interpretative education signage would be installed along the highly visible and traveled Crystal Lake Road and Cary Community Trail and Greenway corridor. The Cary Park District would be the expected lead at the project site.

Figure 69. Phase I Detention Basin Retrofit

Project 21 – Stormwater Detention Basin Retrofit (Map ID 23) The proposed stormwater retrofit is located north of Crystal Lake Road, within a 43 acre area course and residential area in Cary, Illinois (Figure 70). The project would increase large event storage capacity, aid infiltration, and reduce peak overflows. Native habitat enhancements to the adjacent existing 14 acre Oak- Hickory Savanna would also reduce nutrient loading. Enhancements include reshaping the stormwater basins, adding new native vegetation, and increasing bio-engineered infiltration zones and features. A current FHGC signature course feature – the "Babbling Brook"- would be lined to eliminate a current annual 2.5 million gallon local well water draw. Interpretative education signage would be installed along the highly visible and traveled Crystal Lake Road and Cary Community

Trail and Greenway corridor. The Cary Park District would be the expected lead in pursing the project.

Figure 70. Phase II Detention Basin Retrofit



Project 22 – Nature Center Watershed Exhibit

This project entails the development of an exhibit to educate the public on methods to maintain/achieve healthy surface waters, protect groundwater, and protect the watershed planning area (Figure 71). The project will be located in the Crystal Lake Park District Nature Center, located in Veteran Acres Park, 330 N. Main Street, Crystal Lake, IL. The Nature Center is a heavily visited destination. Thousands of visitors use the facility every year, including school groups, scouting organizations, and the general public. The exhibit would be highly visible and integrate well with the other exhibits and nature based programming. The exhibit will be a major focus of the Nature Center and will be used for hands-on formal and informal education. A traveling component of the exhibit will be available for use by schools and other public venues. The Crystal Lake Park District would be the expected lead in pursing this project.

Figure 71. Crystal Lake Park District's proposed exhibit location

Project 23 – Wingate Prairie Signage

This project entails raising public awareness about the protection and role Wingate Prairie plays in protecting water quality in Sterne's Fen and the watershed planning area. Wingate Prairie represents 33.5 acres of the remaining 59 acres of gravel hill prairie in Illinois (Figure 72). The calcium rich waters of the Sterne's Fen are a direct result of groundwater from the prairie traveling northward in the watershed planning area. This interpretive signage program will provide educational information for hikers in the prairie. Detailed information about the prairie and fen and their role in the watershed planning area will be displayed. Elements of the watershed planning

area display being developed at the Nature Center (near the trail head) will be incorporated into the trail signage. The Crystal Lake Park District would be the expected lead in pursing this project.

Figure 72. Wingate Prairie

6.9. Long-Term and Additional Planning Recommendations

After the short-term projects were identified from all of the submissions, the remaining projects were classified as long-term, expecting implementation in 5-10 years from plan completion. These projects are located in Appendix C and D. Please note that the long- and short-term projects outlined in the plan do not represent all the opportunities for water quality improvement projects in the watershed planning area. As more data and resources become available, additional projects that are not currently listed in the watershed plan should be considered by the Silver Creek and Sleepy Hollow Creek Watershed Stakeholder Group during the next planning cycle. It will be important that these additional projects directly correspond and reflect the plan's goals as stated in Chapter 1 of this plan.

7. Public Information, Education and Outreach

Education and outreach initiatives are an essential component of any watershed protection effort. Planning participants have identified increasing public awareness and knowledge of watershed protection practices as a priority watershed plan goal. Education and outreach activities can help raise awareness of the threats to local water resources, provide information on watershed plan recommendations, and help motivate changes in behavior to improve water quality and watershed health. Future outreach campaigns developed by stakeholders should include strategies to communicate information to different audiences including residents, community leaders, businesses, and other groups.

Education must start with the basics. For example, although the general public has heard the term "watershed," individuals are not always able to define it or explain how each person's actions can have an impact on it. This chapter summarizes some existing outreach tools available for stakeholders to help develop future successful outreach campaigns designed to achieve the watershed plan goals. This chapter also identifies and recommends priority education topics, outreach activities, and education partners to help implement these activities. Recommendations were identified with the input of local stakeholders.

7.1. Resources for Watershed Information and Outreach Campaigns

There are many resources available to assist in developing an effective watershed education and outreach campaign. USEPA's *Getting in Step: a Guide for Conducting Watershed Outreach Campaigns* (2003) and CMAP and IEPA's *Guidance for Watershed Action Plans in Illinois* (2007) are two recommended sources. Not-for-profit organizations provide information, outreach materials, volunteer opportunities, and other resources applicable to watershed protection. These organizations include the CWP and a wide range of local organizations such as the EDMC, Lou Marchi Total Recycling Institute, The Land Conservancy of McHenry County, MCCD, McHenry County Farm Bureau's Ag in the Classroom Program, the McHenry County Schools Environmental Education Program (MCSEEP), The Wildflower Preservation & Propagation Committee, and many others.

7.2. Tools to Conduct a Successful Education Campaign

Establishing a Sense of Place

People will feel more connected and protective of a place, in this case local watersheds, if they know when they are in that place and why it is special. There are many features within the watershed planning area including rich and rare ecosystems, a regional trail, vast scenic landscapes, and rural character that help make these watersheds a special place. Outreach activities should be designed to help foster a sense of place among community members and visitors.

Identifying the Audience

Before any of the following education and outreach strategies are employed, the target audience(s) must be identified. Different strategies will be used for different audiences. For example, if the goal is to reduce fecal coliform in the watershed planning area, then targeting residents that have pets might be an effective strategy. The target audience should be broken down into the smallest segment possible to achieve the best results, then creating a message that resonates with the target audience and inspires them to act.

Stakeholders have identified the following priority target audiences for future outreach campaigns: Riparian land owners, lake community residents, other land owners, homeowner associations, governments (elected, staff, planning commissioners), businesses, schools/students, farmers, golf course owners, environmental groups, faith-based organizations, hunting & fishing groups, recreational groups, community service organizations, developers, landscapers, programs targeted at children and parents, scout groups, garden centers, homeschool organizations, and 4-H Clubs.

Understanding the Audience

Knowing some information about the target audience (s) is essential. Campaign audiences have varied values and beliefs, and they will not necessarily be the same as those implementing the watershed plan. The following is a list questions that are important to know about the target audience(s), before education and outreach activities begin:

- What does the audience know already?
- What are their existing beliefs and perceptions?
- How does the audience receive messages and information?
- What will make the audience change their behavior?
- Other important factors include: Education, age, culture, and religion.

It is also necessary to understand the audience(s). What causes the audience (s) to engage in the behaviors that need to be changed? How can this be conveyed to the audience (s) effectively? How can the audience (s) be motivated to change? Surveys, focus groups, and even simple observations can lead to a greater understanding of the audience and a successful campaign.

Barriers

Another component to establishing a successful education and outreach campaign is anticipating problems and road blocks. Barriers are just that: problems that might prevent residents from changing their behavior. Often barriers include time and/or resources. A barrier can also be that a person is simply not aware of the effect of their actions. Costs, a lack of time, and physical ability may also act as barriers.

For example, a recent survey conducted in the nearby Nippersink Watershed[231] identified some barriers to changing behaviors that can help protect and improve water quality. Approximately, 87.5% of respondents indicated that a lack of information about a practice influenced their ability to change their lawn care or storm water practices at least a little. The need to learn new skills, cost, and the time involved for these practices were also obstacles to changes in resident behavior. An effective outreach campaign will address identified barriers to change. For example, if you're trying to get people to test their soil before they apply lawn fertilizer, you can make it easier for them. Sponsor a soil test day and supply free soil test kits including a demonstration of their use.

Social Norms

Related to the example just cited are social norms. Social norms are the behavioral expectations and cues within a group of people. It is a social norm, for example, that we maintain our lawns with grass species that are mowed to a certain height frequently. Through education and outreach, new examples need to be created showing the different, desired action. Then one by one, new social norms can

[231] "Nippersink Creek Watershed," Nippersink Creek Watershed Planning Committee, accessed December 30, 2011, http://nippersink.org/.

be established. People are more likely to change their behavior if they see someone else benefitting from the new behavior.

Creating the Message

Messages must be clear and contain specific calls to action. They are designed to raise awareness, educate or motivate action. Campaigns should inform and suggest acceptable behaviors. People are more likely to change their behaviors when they see other people modeling the behavior first. Messages need to capture the audience's attention. For example, communicating ways a behavior can save individuals time and money can be an effective way to motivate change.

What is needed to get the audience's attention will vary by different segments of the audience. Insights to this information may have been gleaned when identifying the audience, through information such as demographics or may be indicated by the message itself. Be clear and concise. Consider what behavior you are trying to change and what behavior should replace it.

Formatting the Message

How the message is distributed to the audience can make or break an outreach campaign. The packaging of a message can help foster relationships and a sense of community, build understanding, and motivate people to action or it can be expensive and time consuming while producing little results. The target audience(s) should dictate which format should be used to convey the message. Formats can change over the course of the campaign. For example, a campaign could start out raising general awareness with public service announcements (PSAs) and once the audience understands the problem, brochures could be distributed to further inform residents about what they can to do to contribute to the solution. According to the USEPA's Getting in Step guide, if the budget is small, the frequency in which your audience hears or sees the message is important.

7.3. Activities During the Watershed Planning Process

A variety of education and outreach activities took place during the creation of this plan. These activities have laid the groundwork for a successful education and outreach campaign.

Community input is critical to develop a watershed plan that integrates local priorities and concerns. If stakeholders are involved in creating and implementing the plan, research shows that the watershed will have a higher level of long-term support and success. As part of the watershed planning effort, monthly public input meetings were held and over 130 local residents, community leaders, representatives of government agencies, non-profit organizations, businesses, and others participated. Thousands more community members were reached through regular coverage of planning activities and events in local papers, e-mail alerts, and tabling at 5 community events. PowerPoint presentations were developed and utilized to share information about the watershed planning effort with municipal staff, elected officials, and commission members at their regular meetings. A planning overview was presented to elected officials and/or commissioners in Cary, Crystal Lake, McHenry, Nunda Township Planning Commission, Oakwood Hills, Prairie Grove, and the McHenry County Natural and Environmental Resources Committee.

Nine public programs were provided including watershed planning presentations, a tour of a local wastewater treatment plant, a river cleanup day, and three restoration and natural areas tours. Public meetings were also held at night and input was solicited at weekend events.

Planning documents and information were posted on the FREP website at http://foxriverecosystem.org/silver-sleepy.htm.

Outreach materials were also developed for the planning effort. Two-thousand brochures were developed and distributed that provide information about each watershed, the watershed planning effort, nonpoint source pollution, and ways community members can help to protect the watershed planning area. Two displays and pdf posters were also developed with similar information. The displays could be loaned out to libraries and other groups within the watershed planning area. A final brochure was produced that includes this information as well as plan recommendations.

Planning recommendations were presented at community events on weeknights and weekends to receive additional input including the McHenry County Green Living Expo, a free public event in Crystal Lake.

It will be important to build on this foundation of increased public awareness of the watershed planning area and watershed protection by conducting outreach campaigns addressing the specific recommendations of the watershed plan.

7.4. Recommended Education and Outreach Activities

There are a number of communication tools available to help to support outreach campaigns, including the use of websites, brochures and other printed materials, interpretive signage, public service announcements, and social media. A description of each of these follows:

Website

Websites are an excellent way of quickly connecting to a large audience. A mix of scientific and general information about the watersheds can be located all in one place. Information can be updated frequently to include upcoming events, new study information, and links to resources. Visitors can easily provide feedback and new information.

Brochures and Other Printed Materials

Printed materials are a popular format for conducting education and outreach activities. People can refer to printed materials again and again. The current brochures should continue to be distributed. New brochures could be developed or adapted to cover additional topics including BMPs for homeowners such as rain gardens, information on proper salt and fertilizer use, detention basin retrofits for local governments, and information on how to reduce fecal coliform pollution. Printed educational materials could also be included in utility bills, homeowner association, and other community newsletters, library displays, etc.

Interpretive Signs

Interpretive signs communicate specific messages to viewers. These messages can be written to change behavior, educate, or evoke an emotion in the reader. They are mounted so they are visible to all viewers and can be constructed of many different materials. Interpretive signs can be used to educate viewers on a number of water quality issues: the purpose of detention ponds, no mow zones, establishing native plants, being a good neighbor to wetlands, etc.

Public Service Announcements

A public service announcement (PSA) can be an inexpensive way to reach a variety of people. PSAs can be broadcast on radio, television or even on websites. In addition to the USEPA's PSA on lawn care, local college students and broadcasting classes can be used to assist in the creation of a PSA. PSAs are often aired for no charge on local cable access channels or radio stations, although time slots may not be ideal.

Social Media

Social media like Twitter and Facebook can be used to reach new audiences, share information on upcoming programs and events, and build a network of people committed to protecting and restoring the watershed planning area.

Organization

Watershed planning participants identified a priority goal to develop an ongoing community participation group to support plan implementation and continue planning efforts.

A new group has formed to address this goal called the Silver and Sleepy Hollow Creeks Watershed Coalition. Over a dozen participants from the watershed planning effort are already participating, representing a broad range of constituent groups including local government staff and elected officials, businesses, residents, and nonprofit organizations. The coalition will provide leadership across the watershed planning area to help raise public awareness of the watershed plan, promote plan implementation, and promote watershed protection education and outreach activities.

Identified priorities include: building partnerships among local groups and individuals to implement plan recommendations, sponsoring watershed protection education and outreach programs, identifying additional future projects and other opportunities to protect water quality and watershed health, encouraging local governments to adopt a resolution of support for implementation of plan recommendations, and supporting surface water and groundwater monitoring activities.

In 2012, the Coalition will begin monitoring water quality in Silver Creek and Sleepy Hollow Creek in partnership with the FRSG. Watershed signs will be developed to place along roadsides to raise public awareness of the watershed planning area. The coalition also plans to host educational programs.

Ideally, the Coalition would meet quarterly at a minimum. More frequent meetings could be warranted depending on current activities such as applying for grant funding or urgent watershed issues. The Coalition could be supported by dues collected from interested parties. The planning process reviewed and considered similar successful models from the DuPage River Salt Creek Workgroup and the Lower DuPage River Watershed Planning processes.

In terms of staffing, the Coalition would be best served by hiring a watershed coordinator to organize and lead this effort. The watershed coordinator would provide a focused, local approach to watershed planning, taking into consideration regional activities and opportunities. The ideal candidate will be familiar with available resources, grant writing, and fostering collaborative partnerships/efforts. The coordinator would establish a presence with each of the watershed municipal governments as well as with other partners to promote the goals and priorities in the watershed plan. Outreach partners can include schools, conservation organizations and other nonprofits, children's clubs, MCCD, park districts, governments, faith-based organizations, businesses, SWCD/NRCS, other watershed groups, chambers of commerce, and

libraries. Grant support for the watershed coordinator position is not the preferred funding option due to lack of financial stability.

7.5. Outreach Priorities and Activities for Targeted Audiences

Stakeholders identified the following priority topics for education and outreach activities.

Table 33. Education and Outreach Priorities

Green Infrastructure	Biological and water quality monitoring
Lake and Stream Management	Buffer strips
Nutrient Management	Native landscaping
Water conservation	Promote soils testing
Reduced salt use	Reducing the use of lawn chemicals
Non-phosphorus fertilizers	Alternatives to coal tar sealants
Green Infrastructure	Encouraging rainwater harvesting (rain barrels)
Septic System inspection and maintenance	Proper disposal of pharmaceuticals and household hazardous waste
Proper pet waste disposal	
Waste management	Encouraging native landscaping including buffers along lake shores and streambanks

7.6. Program Activities For Targeted Audiences

Landowners/Homeowners Associations

Native Landscaping

Natural Garden in Your Yard Program

The Natural Garden in Your Yard Program's aim is to encourage homeowners to transform their traditional lawns into native plant gardens. The program was established in 2005 by the Wildflower Preservation & Propagation Committee. The program provides mentors, reference materials, a gardening network, and discounts on native plants purchased at the organization's native plant sale. The organization also conducts annual natural landscaping seminars. This program should be promoted throughout the watershed planning area by the Silver & Sleepy Hollow Creeks Watershed Coalition and other organizations. Main program contact: The Wildflower Preservation & Propagation Committee,[232] 815-337-9502.

Native Plant Sale Resources

The Wildflower Preservation and Propagation Committee also hosts an annual Native Plant Sale with over 150 species available. Local garden centers also offer native plants for sale. Communities and organizations should help raise public awareness of these resources.

Native Landscaping Workshops

Currently, McHenry County's trained staff conducts Snow and Ice Operations workshops. Stakeholders believed the County should

[232] "A Natural Garden In Your Yard," The Wildflower Preservation and Propagation Committee, accessed December 30, 2011, http://thewppc.org/yard.html.

develop and promote workshops on other issues that address water quality including native landscaping techniques.

Rain Garden Demonstration Projects

Rain garden demonstration projects are excellent ways to illustrate the ease and importance of integrating sustainable green practices within the watershed planning area. As an example, the City of Crystal Lake developed a rain garden demonstration project on the front lawn of its municipal building to demonstrate an efficient way to improve and protect surface water and groundwater resources. In addition, McHenry County has authorized installation of a rain garden in front of the County's Administration Building. The project will include educational signage and includes xeriscaping.[233] Demonstration projects such as these should be implemented throughout the watershed planning area. Main program contacts include: The McHenry-Lake Soil & Water Conservation District, 815-338-0099, Ext. 3234 ; McHenry County Water Resources, 815-334-4000; and Illinois American Water Association, 800-422-2782 ext. 235.

Conservation@Home

Another successful example of a public outreach program promoting native landscaping is the Conservation@Home program established by the Conservation Foundation in Naperville. It encourages and recognizes individual property owners who are creating or protecting their yards in an environmentally friendly manner that conserves water. The program recognizes the importance of native plants and their effects on water resources. As part of the program, homeowners are personally visited by professionals who offer advice on native landscaping. Conservation@Home is appropriate for outreach to municipalities, park districts, homeowners and homeowner associations through seminars, workshops, one-on-one conversations and the distribution of printed materials. Main program contacts include: The Conservation Foundation, 630-553-0687, ext. 302 or236.

Educational Program

MCCD is working to develop a watershed resources education program at the Lost Valley Visitor Center. A new educational DVD, Waters of McHenry County, is available as well. It is recommended these resources also be made available at the Prairieview Education Center.

Recommendation: **The Silver & Sleepy Hollow Creeks Watershed Coalition and other conservation groups should promote programs, including the Natural Garden in Your Yard Program, native landscaping workshops, native plant sales, and rain garden demonstration projects, in partnership with local governments, throughout the watershed planning area.**

Pet Waste Disposal

This watershed plan recommends that a pet waste campaign be conducted, in partnership with local governments throughout the watershed planning area, to encourage dog owners to pick up after their pets and dispose of waste properly. Outreach costs could be shared equally among participants.

[233] For memo from the McHenry County Director of Planning and Development regarding rain garden installation and funding, see http://www.co.mchenry.il.us/departments/Countyboard/MtgDocs/201105/052311ms/5_1memo.pdf

[234] For contact information, see http://www.mchenryswcd.org/

[235] For contact information, see http://www.amwater.com/ilaw

[236] Conservation@Home," The Conservation Foundation, accessed December 30, 2011, http://www.theconservationfoundation.org/what-we-do/conservationhome.html

McHenry County's flyer entitled "Proper Disposal of Animal Waste"[237] should be included and distributed as part of this campaign. The flyer is aimed at defining the impacts of pet waste on water quality. It provides details on how each resident may calculate their community's "P" (Pooh) Index and outlines steps on what do to reduce pet waste pollution. For more information on proper pet waste disposal, please visit the North Central Texas Council of Governments website at, http://www.nctcog.org/envir/features/2007/jan/education.asp.

Recommendation: McHenry County and local governments within the watershed planning area should conduct a pet waste disposal campaign.

Septic System Inspection and Maintenance

Currently, the MCDOH educates homeowners on septic system maintenance. As part of this education process, the MCDOH provides educational materials on septic system use and maintenance including: *Do's and Don'ts for Septic System Maintenance* and *Everything You Wanted to Know about Your Septic System*.

The MCDOH should conduct a campaign geared towards septic system maintenance. As part of this campaign, septic systems should be inspected regularly. In addition, septic system workshops educating homeowners on septic system maintenance should be conducted. Also, a video should be developed of the workshop and placed on the MCDOH's website and a link to this site should be placed on McHenry County's website to educate homeowners about their septic system.

The MCDOH should also consider promoting an onsite wastewater treatment month similar to safe drinking water month. [238]

Besides, the above recommendations, the USEPA has designed several items geared towards septic system maintenance. First, the USEPA provides a video entitled "Homeowner's Guide to Septic Systems" that may be used to educate homeowners. Secondly, the agency has designed a colorful utility bill insert for use by wastewater and water supply utilities that may be customized for use and distribution throughout the watershed planning area. Lastly, the USEPA has designed magnets that may be customized to list what items should not be dumped down the drain and remind homeowners of the next septic system service date. Main program contacts include: The USEPA[239] and the MCDOH 815, 334-4510.[240]

Recommendation: The MCDOH should conduct a septic system maintenance campaign.

[237] Proper Disposal of Pet Waste," McHenry County, Division of Water Resources, accessed December 30, 2011, http://www.co.mchenry.il.us/departments/Countyboard/PDFDocs/Dog%20Waste.pdf

[238] McHenry County, Illinois, Division of Water Resources. *Water Resources Action Plan*, by Cassandra McKinney. Woodstock, IL: McHenry County, Illinois, Division of Water Resources, 2010.

[239] Septic Systems Program Publications (Education and Outreach)," U.S. EPA, last modified December 30, 2011, http://cfpub.epa.gov/owm/septic/septic.cfm?page_id=263&sort=name&view=doctype_results&document_type_id=5.

[240] For contact information, see http://www.co.mchenry.il.us/departments/health/Pages/MCDHContacts.aspx

Green Practices

Presentations

Green practices workshops and educational programs conducted by the McHenry-Lake County SWCD should be expanded within the watershed planning area. Topics might include a series of presentations covering: soil testing/ fertilizer, benefits of native plants, establishing no mow zones, detention ponds – their purpose and management, rain barrels/rain gardens, etc. The Silver & Sleepy Hollow Creeks Watershed Coalition, MCCD, EDMC, and other conservation groups can also provide these workshops. Main program contacts include: The McHenry-Lake Soil & Water Conservation District, 815-338-0099[241] and The Silver & Sleepy Hollow Creeks Watershed Coalition, 815-338-0393.

Coordinated Conservation Outreach Efforts

McHenry County currently offers information on rain barrels, rain gardens, native landscaping, and proper lawn watering techniques.[242] The County should continue to develop, update, and expand its educational programs and develop a coordinated outreach campaign to educate homeowners and business owners[243] on methods to conserve outdoor water use. Main program contacts include: McHenry County Water Resources, 815-334-4000.

[241] For contact information, see http://www.mchenryswcd.org/.
[242] For more information, see http://www.co.mchenry.il.us/departments/waterresources/Pages/WaterLinks-General.aspx
[243] For contact information, see http://www.co.mchenry.il.us/departments/waterresources/Pages/WRBrochures.aspx

The Environmental Defenders of McHenry County

EDMC is a citizen organization dedicated to the preservation and improvement of the environment. EDMC offers environmental education programs on topics such as groundwater resource protections, provides stream cleanup and natural area restoration volunteer opportunities, and sponsors canoe/kayak outings. EDMC also has issues committees to support education and advocacy efforts including the Water Resources Protection Committee. Main program contact: 815-338-0393.

Recommendation: The Silver and Sleepy Hollow Creeks Coalition, EDMC and other organizations should coordinate with the McHenry-Lake SWCD and McHenry County to present workshops on a variety of green practices topics.

Volunteer Opportunities

River Sweep

A river sweep is a coordinated, periodic clean-up of area waterways. The purpose is to create a connection between people and the river by having volunteers remove trash and debris from the river. A community-coordinated river sweep can involve a number of stakeholders, from students to corporations. The river sweep can also help develop a stewardship program to restore natural areas by removing invasive species. Funding for supplies is available through the IEPA Streambank Cleanup and Lakeshore Enhancement (SCALE) grant program.

It is also possible to undertake an ongoing Adopt-a-Stream model, something like the Adopt-a-Highway model. Adopt-A-Stream programs are an excellent public outreach tool to involve citizens of all ages and abilities. Individual organizations such as businesses,

schools, and churches can commit to "adopt" part of a stream to study, clean up, monitor, protect, and/or restore.

Watershed communities and local organizations should also promote existing natural area restoration volunteer programs such as those offered through MCCD and local park districts to raise public awareness of local natural resources and increase community participation in restoration efforts. Volunteer restoration opportunities should be expanded throughout the watershed planning area.

The Land Conservancy of McHenry County

The Land Conservancy protects McHenry County's prairies, wetlands and woodlands by working with private landowners, communities and other partners. Conservation is accomplished through direct acquisition of property (through purchase or donation), or the establishment of conservation easements. The Land Conservancy also founded Project Quercus to explore options to protect, preserve and regenerate the oak woods. Main program contact: 815-337-9502.

Monitoring and Restoration

The Silver & Sleepy Hollow Creeks Watershed Coalition will be working with the Fox River Study Group to initiate a monitoring program with volunteers. This program should be expanded in the future.

There are several groups working to support monitoring and stream/natural area restoration in the County:

- The Silver & Sleepy Hollow Creeks Watershed Coalition will begin volunteer stream water quality monitoring in 2012 in partnership with the FRSG / 815-338-0393.
- The EDMC hosts periodic stream cleanups. www.mcdef.org/ 815-338-0393.
- The MCCD provides county-wide volunteer water monitoring training and can loan equipment. They can also provide other natural area restoration opportunities - www.mccdistrict.org / 815-338- 6223.
- Friends of the Fox coordinates a watershed monitoring network. They can provide supplies and expertise for stream monitoring. Main program contact: Dave Rigby, Education Outreach Coordinator, drigby@freindsofthefoxriver.org
- The Crystal Lake Park District offers volunteer restoration opportunities within the watershed planning area - http://www.crystallakeparks.org/ 815.459.0680.
- Adopt-A-Stream Programs Information from EPA http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=20.
- The Land Conservancy of McHenry County provides volunteers an opportunity to participate in stewardship work days and community oak tree plantings. Main program contact: 815-337-9502.

Recommendation: The Silver & Sleepy Hollow Creeks Watershed Coalition should partner with the Fox River Study Group to initiate a volunteer stream monitoring program within the watershed planning area. The Coalition should also partner with organizations, schools, businesses, and other groups to develop an "adopt" a stream program.

Events Conferences

The Coalition could promote its message about improving water quality and watershed health by attending and distributing information at existing events/conferences and by hosting their own events. This will provide an opportunity for the Coalition to collect additional information on local water quality concerns, raise awareness of the watershed plan, and gauge public understanding and support for watershed plan recommendations. Existing annual community events include the Natural Landscaping Seminar, Cary Days, earth day programs including the county-wide event at Prairieview Education Center, Garden Fest, and the Bioneers Conference/Green Living Expo. Coalition-sponsored public education events could include programs developed in partnership with local homeowner associations, park districts, MCCD, governments, businesses, and other community organizations. Program examples include watershed tours, environmental fairs, listening sessions, watershed festivals, and natural landscaping seminars. In an effort to pool resources, share ideas, and provide technical assistance, the Coalition might also pursue coordinating a session at a larger regional conference. Professionals are encouraged to attend workshops and conferences hosted by government agencies or nonprofit water-quality groups. Main program contact includes: The Silver & Sleepy Hollow Creeks Watershed Coalition, 815-338-0393.

Goverment Officials/Decision Makers

Outreach to local governments should include conducting workshops and providing education materials to elected officials, staff, and planning commissioners. Outreach priorities include water conservation, waste management, water softeners, native landscaping, groundwater protection, naturalized detention basins, conservation development, developing effective watershed protection ordinances, and other BMPs. Below is additional information on some of these specific priorities for local governments.

Water Conservation

WaterSense Program

Encourage partnerships with WaterSense, a USEPA Partnership Program. As a partner, the organization will have access to tools and resources to promote and educate residents on the need for water efficiency. Using water more efficiently makes sense for consumers, communities, and the environment. Water efficiency measures, as part of broader conservation efforts, can help reduce water and wastewater infrastructure costs and ensure resources for future generations. WaterSense makes it easier to identify water-efficient products and practices.[244] Main program contact includes: The USEPA, 866-987-7367.

McHenry County also has brochures and websites to encourage water conservation. [245] Main program contacts include: McHenry County Water Resources, 815-334-4560.[246]

Recommendations: Local conservation organizations and communities should sponsor workshops and provide printed educational materials. Topics should include native landscaping and practices to conserve water for lawn care professionals and

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[244] Water Sense," U.S. EPA, last modified November 2, 2011, accessed November 7, 2011, http://www.epa.gov/WaterSense/index.html

[245] Water Conservation Basics," McHenry County, Division of Water Resources, accessed December 30, 2011, http://www.co.mchenry.il.us/departments/Countyboard/Documents/Indoor-Outdoor%20Water%20Conservation.pdf

[246] For more information, see http://www.co.mchenry.il.us/departments/waterresources/Pages/index.aspx

landscaping companies, pollution prevention practices for commercial and industrial activities, and conservation design for developers.

The Coalition and other local organizations should form partnerships with businesses to provide discounted products such as phosphorus free fertilizers, alternatives to coal tar sealants, or rain barrels.

Waste Management

McHenry County's own Solid Waste Manager, MCDOH, and McHenry County Water Resources should continue to develop, update, and expand available educational materials regarding the proper disposal of medications,[247] personal care products, and hazardous waste.[248] Links to County education materials should be placed on local government websites throughout the watersheds planning area. Main program contact includes: McHenry County, 815-334-4560.

The Lou Marchi Total Recycling Institute publishes the McHenry County Official Green Guide annually. Full of new recycling and reusing information, it includes a Green Living section on where to buy green products locally and online. The Institute also provides education on related solid waste topics. Main program contact includes: The Lou Marchi Total Recycling Institute, 815-479-7817.[249]

Recommendation: The Silver & Sleepy Hollow Creeks Watersheds Coalition should partner with McHenry County to support expanded distribution of waste management educational materials, including the McHenry County Official Green Guide, throughout the watershed planning area. Links to these materials should also be posted on the Coalition's website.

Water Softeners

Water is generally considered "hard" if it contains a lot of magnesium, calcium, iron, and other minerals. It can clog pipes and causes lime scale deposits in household water systems. Groundwater acquires many of these metals from surrounding soil and rock.

To alleviate this problem, oftentimes, a water softener unit is installed to soften water, by removing the minerals that cause it to be hard. Water softeners can produce chronic toxic symptoms in aquatic animals and plants. This plan recommends that, where applicable, local governments who have municipal water softeners in place notify individual residents receiving public water supply to disconnect their older water softeners. This may be done through bill inserts, on the local government's website, or through local newspapers.

Recommendation: Applicable local governments should initiate contact with residents who now receive their water from a public water supplier to disconnect older water softeners once used in association with a private well.

[247] Unused and Expired Medicines," McHenry County, Division of Water Resources, accessed December 30, 2011, http://www.co.mchenry.il.us/departments/Countyboard/Documents/MedDisfinal.04.09.pdf

[248] Household Hazardous Waste," McHenry County, Division of Water Resources, accessed December 30, 2011, http://www.co.mchenry.il.us/departments/waterresources/pdfDocs/HazWastealternativefinal_000.pdf

[249] "Lou Marchi Total Recycling Institute," McHenry County College, accessed December 30, 2011, http://www.mchenry.edu/recycling/

Policy, Codes, and Ordinance Review

By utilizing the USEPA's "Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scale," and "Managing Wet Weather with Green Infrastructure," municipalities can increase awareness and receive guidance about the process of removing barriers, revising and creating codes, and ordinances, and providing incentives to better protect water quality. This process can be formally facilitated by agencies like CMAP or structured as a peer-to-peer roundtable. Topics may include: restoring wetlands; maintaining natural drainage areas for water quality and water supply benefits and reduced flooding; deicing practices and products; etc. Main program contact includes: CMAP,[250] (CMAP) 312-454-0400.

Recommendation: Local governments should facilitate roundtable discussions in an effort to review local ordinances to better protect water quality.

Business Owners

Reduced Salt Use

Reducing salt used on roads has been identified in the plan as a priority to mitigate water quality impacts and protect groundwater resources. Currently, McHenry County's trained staff conducts Snow and Ice Operations workshops. This plan encourages businesses (e.g. commercial applicators) and local governments to attend workshops/seminars conducted by McHenry County's trained staff on road salt use.

Recommendations:

- **McHenry County should conduct a campaign to encourage participation in the Snow and Ice Operators workshops.**

Agriculture

Natural Resources Conservation Service (NRCS) Conservation Programs

NRCS's natural resources conservation programs help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty. The Coalition could help encourage landowners to utilize NRCS programs that promote agricultural best management practices. Main program contacts include: The US Department of Agriculture, Natural Resources Conservation Service[251] and the McHenry-Lake Soil & Water Conservation District, 815-338-0099, Ext. 3.[252]

Soil Erosion & Sediment Control

Expertise is provided by McHenry-Lake County SWCD to agencies (Illinois EPA, United States Army Corps of Engineers) and local governments (county and municipal governments) as part of a cooperative agreement. Main program contacts include: The

[250] "Chicago Metropolitan Agency for Planning," CMAP, accessed December 20, 2011, http://www.cmap.illinois.gov/.

[251] For contact information, see http://www.nrcs.usda.gov

[252] For contact information, see http://www.mchenryswcd.org/.

McHenry-Lake Soil & Water Conservation District, 815-338-0099, Ext. 3.[253]

Children/Students

Curricula and Training

The Chicago Wilderness Corporate Council's Teaching Academy is a program that provides technical assistance to teachers to help prepare localized curricula relevant to natural resources in the area. Project WET Curriculum and Activity Guide contains 91 multidisciplinary water-related activities for students in grades K to 12. The guide features cross-reference and planning charts, a glossary and background material on activity development and field testing.

McHenry County Schools Environmental Education Program (MCSEEP) is a countywide provider of diverse, comprehensive environmental education. MCSEEP K-12 program uses a wide variety of educational methods to educate children and school staff about the environment and stewardship of resources. In addition to instructional materials for kindergarten through 12th grade, the program includes teacher workshops, a curriculum library, and a website that details current available resources. The program topics cover issues related to waste, trees, water, soil, alternative energy, biodiversity, climate change, sustainability, and green careers.

McHenry County also provides water resource education materials for children.

This plan recommends the expansion of existing programs that implement water science curriculums in classrooms and training opportunities for teachers be promoted. Efforts in this regard will increase teachers' capacity to incorporate concepts of water science in their environmental education classrooms. The plan also recommends that funding be increased to support these programs. Main program contacts include: The Chicago Wilderness Corporate Council, Teaching Academy, 312-580-2137[254], Project WET, 866-337-5486[255], MCSEEP, 815-334-4405,[256] and McHenry County Water Resources, 815-334-4000.[257]

Recommendation: MCSEEP should develop a specific lesson focusing on watershed education. The coalition should work with MCSEEP to support funding for such a program.

The Watershed Quilt Program

The Nature Quilt Project is a grassroots project inspired by the Nature Quilt Project in Macomb, Illinois. The local version of the project builds on recommendations of the recent Aux Sable Creek Watershed Plan that recommends introducing the concepts of watersheds and stormwater in the classroom as well as working on programs with children such as precipitation monitoring, runoff tracing, stream monitoring and analysis, and habitat assessments.

The project's mission is to raise awareness of the assets, opportunities and challenges in local natural areas to gain a better understanding of the interconnectedness between people and the natural world around them through children's education. The

[253] For contact information, see http://www.mchenryswcd.org/

[254] For contact information, see http://www.chicagowilderness.org/

[255] For more information, see http://www.projectwet.org/

[256] For more information, see http://www.co.mchenry.il.us/departments/mcseep/Pages/index.aspx

[257] For more information, see http://www.co.mchenry.il.us/departments/waterresources/Pages/WaterLinks-Children.aspx

program does this through promoting outdoor environmental education, environmental literacy, the arts, cultural discovery and activism demonstrating the ability of children to make a positive difference in addressing global environmental challenges. Main program contact includes: The Aux Sable Creek Watershed, Watershed Quilt Project, 815-690-3658.[258]

Recommendation: The Coalition should work to implement the Watershed Quilt Program in the watershed planning area.

Envirothon Competition

The Envirothon is an engaging opportunity for high school students to learn about the environment. This program combines classroom curriculum with field experiences. It demonstrates the role that individuals have on various environmental issues including forestry and wildlife management, water quality, and soil erosion. At the completion of the year-long learning process, the Envirothon conducts a series of competitions where students are tested on five subjects: soil, aquatics, wildlife, forestry and a specific environmental issue, which changes from year to year. The Illinois Envirothon competition is co-sponsored by the Association of Illinois Soil & Water Conservation Districts (AISWCD), local Soil & Water Conservation Districts (SWCD) and cooperating conservation partners. Main program contact includes: McHenry-Lake County Soil & Water Conservation District, 815-338-0099, Ext. 3.[259]

Recommendation: Local schools within the planning area should participate in the Envirothon program.

[258] For more information, see www.auxsablecreekwatershed.org/watershedquiltproject.htm

[259] For more information, see http://www.mchenryswcd.org/education.htm/

8. Monitoring Success

Although there is considerable merit in producing a watershed plan, protecting and improving water quality in the watershed planning area will be a result of implementing the plan's various project, program, planning, and policy recommendations in a cohesive way. Improving water quality will happen over time and with considerable effort by all with a stake in watershed health now and for future generations, including watershed residents, local governments, agencies, organizations, and the business community.

8.1. Interim Measureable Milestones

Since implementation of all recommendations will require resources, such as government staff time or funding, one means for measuring progress includes the number of grant applications submitted by those with an identified lead role for project or policy change implementation. Among the sources of funding available, the annual Clean Water Act Section 319 Nonpoint Source Management grant program administered by Illinois EPA is a primary source of support for implementing plan recommendations. CMAP's Local Technical Assistance Program is another potential source of support where CMAP staff expertise is brought to bear on formal requests for comprehensive planning and/or ordinance review/update assistance.

A measurable milestone for monitoring plan implementation progress is development of at least ten grant applications by watershed stakeholders (i.e., lead implementers) for project implementation within the 5-year/short-term planning timeframe. Stakeholders will convene at least twice per year to gauge progress and discuss evolving needs and planned activities.

8.2. Criteria to Measure Success

Measuring the watershed plan's success hinges on how many of the policy, project, and education / outreach recommendations are implemented. A summary of criteria for each category is a follows.

Project Recommendations

All short-term project recommendations are designed to be implemented within five years. Success will be measured by those with lead roles having implemented the project recommendations identified in Table 32. It should be noted that implementation of any of these projects is based on a variety of factors including, but not limited to, securing appropriate funding and participation from willing landowners and local governments.

Policy Recommendations

In addition to project recommendations, the watershed plan also describes numerous policy recommendations. As this plan was written on the premise of a 5-year planning cycle, identified parties are encouraged to consider and implement the plan's policy recommendations by the end of 2016. To help facilitate these efforts, CMAP or other consultants can provide assistance to communities for those recommendations that are related to comprehensive plans and ordinances, such as incorporating the Model Water Use Conservation Ordinance. Furthermore the Silver Creek and Sleepy Hollow Creeks Watershed Coalition should work with local communities to support this effort.

Success will be measured by number of policy recommendations adopted by each municipality within the 5-year planning timeframe.

Education and Outreach Recommendations

The outreach and education recommendations will be an on-going effort with partnering agencies, homeowners associations, and other relevant groups that are active within the watershed planning area. The pace of implementation of the outreach and education recommendations would be greatly increased by the hiring of at least a part-time watershed coordinator.

Success will be measured by the number of outreach and education recommendations implemented by each municipality within the 5-year planning timeframe.

8.3. Funding Sources

Plan implementation is largely based on the availability of funding for projects and other plan recommendations. Appendix E describes possible funding sources that may be used to move forward with implementation.

8.4. Monitoring to Evaluate Effectiveness Over Time

Monitoring plan effectiveness over time can be measured a variety of ways. First, stakeholders agreed upon a number of goals for which evaluation measures were identified. Thus, stakeholders should review how well goals are being met via the evaluation measures described in Appendix A.

Secondly, a number of groundwater protection measures are laid out in the plan. Some evaluation measures for achieving greater groundwater protection and species diversity are as follows.

- **The number of ongoing County water monitoring programs to include ongoing water quality/water level monitoring in sensitive groundwater dependent natural areas within the watersheds such as fens.**
- **The number of study and monitoring programs (including bioassessment) established to identify aquatic ecosystems in the watershed planning area that may be at risk due to groundwater withdrawals.**
- **The number of homeowners conducting septic system maintenance.**
- **Number of dollars spent on groundwater quality and groundwater quantity projection projects.**

Lastly, the ultimate measure for evaluating plan effectiveness over time is water quality improvement (or maintaining already good water quality) as quantified by water chemistry, biological data, and removal from the Section 303(d) List of impaired waters (i.e. mainstem of the Fox River). As such, evaluation measures for protecting or achieving improved water quality include:

- **Fish IBI and macroinvertebrate IBI scores that are indicative of good water quality at a minimum or improve over time.**
- **An increased number of drop-off locations for pharmaceuticals.**
- **Ambient water quality that meets standards or guidelines at a minimum for parameters including sedimentation, phosphorus, nitrogen, suspended solids, and fecal coliform.**

Monitoring Water Quality Going Forward

To date, the FRSG has proposed to analyze a stream sample from both Silver Creek and Sleepy Hollow Creek as part of their monthly monitoring in the Fox River Watershed. Each sample will be analyzed for fecal coliform, BOD, TSS, TKN, Ammonia N, Nitrate N, Organic N, Chlorophyll a, estimated biomass, Total P, Dissolved P, Chloride and Turbidity (NTU). A sampling team will be provided with equipment so that the pH, conductivity, and temperature can be measured in the field. Volunteers from the watershed planning area have already been identified to collect and deliver water samples to FRSG. The Silver Creek and Sleepy Hollow Creek Watershed Coalition should work closely with this and other organizations to expand monitoring and study throughout the watershed planning area as funding and resources become available. Monitoring will provide baseline data, help measure successes, and identify future priority project recommendations.

8.5. Next Steps

With the initial planning cycle closing at the end of 2011 with approval of the new watershed plan, attention will turn to implementation in 2012 and beyond. Full plan and executive summary documents will be printed and distributed during the first quarter of 2012. Access to these documents will also be available via the CMAP and Coalition websites. CMAP will approach local governments and request a resolution of support for the watershed plan recommendations. CMAP and the EDMC will maintain contact with the new Silver & Sleepy Hollow Creeks Watershed Coalition and support implementation efforts where possible.

9. Appendices

The appendix titles that follow on subsequent pages include:

Appendix A. Goals and Management Objectives

Appendix B. Additional Policy and Planning Recommendations

Appendix C. Map of Long Term Project Recommendations

Appendix D. Long Term Project Recommendations

Appendix E. Funding Sources

Appendix F. Links to General Outreach Resources

Appendix G. Acronyms

Appendix A. Goals and Management Objectives

Table 34. Goals and Management Objectives Identified by Stakeholders

GOAL	MANAGEMENT OBJECTIVES	INDICATORS
Maintain/achieve healthy surface waters (aka meet designated use criteriafor aquatic life, fish consumption, and primary contact)	Establish/gather baseline information on the chemical, biological, and physical characteristics of the watersheds' streams, lakes, and wetlands	Water quality measures (e.g., Secchi transparency, phosphorus, nitrogen, dissolved oxygen, temperature, chlorides, endocrine disruptors) Habitat measures (including substrate types, sedimentation, cover) Biological measures/indices (fish IBI, macroinvertebrate IBI, Floristic Quality Index, # of intolerant fish species, # of mussels/species, Biologically Significant Streams rating)
	Sustain ongoing monitoring of the chemical, biological, and physical characteristics of the watersheds' streams, lakes, and wetlands	Number of streams, lakes, and wetland monitored; frequency of monitoring
	* Review Discharge Monitoring Reports (DMRs) to check if NPDES permit requirements are being met	Number of DMRs reviewed; number of parameters in/out of compliance
	Reduce nutrient and sediment loads to the watersheds' streams, lakes, wetlands, and the Fox River	Water quality measures: Secchi transparency, phosphorus, nitrogen, suspended solids, chlorophyll a Sedimentation Erosion control projects implemented
	Reduce bacteria loads to the watersheds' streams, lakes, and the Fox River	Fecal coliform (FC) and/or E. coli concentrations
	Adopt/enforce ordinances	Number of ordinances adopted; number of enforcement actions
	Develop agricultural conservation plans	Number of agricultural conservation plans developed
	Educate homeowners on no-phosphorus fertilizers	Number of homeowners using no-phosphorus fertilizers; number of retail outlets selling no-phosphorus fertilizers; water quality measures (phosphorus)
	Educate local officials and the public on coal tar sealant's impacts on water quality	Number of ordinances adopted; number of homeowners and contractors using alternative asphalt sealants; number of retail and wholesale outlets selling alternative asphalt sealants
	Secure funding for project implementation	Number of dollars spent on surface water quality protection projects; number of projects implemented
	Support provisions of the Illinois Wildlife Action Plan	
	Establish drop-off location(s) and/or collection events for proper disposal of unwanted phamaceuticals (medications) within the watershed	Number of drop-off locations and/or collection events; pounds of medications collected
	Encourage use of green practices for protecting water quality (e.g., rain barrels, rain gardens, rainwater harvesting, natural landscaping, permeable pavers)	
	Encourage conversion of expanses of turfgrass to native vegetation to increase pollutant filtration	
	Adopt policies and implement best practices for snow and ice removal and for snow and deicing materials storage (see McHenry Co. Water Resources Action Plan)	
	Review the McHenry Co. Water Resources Action Plan for specific policy recommendations and management actions to consider including in the Silver & Sleepy Hollow Creek Watershed Action Plans	
Protect groundwater quality	Gather baseline information on groundwater quality in the watershed	Groundwater quality measures (e.g., nitrates, chloride, metals)
	Sustain ongoing monitoring of groundwater quality in the watershed	Number of locations and frequency of groundwater quality monitoring
	Adopt/enforce ordinances	Number of ordinances adopted; number of enforcement actions
	Educate homeowners on septic system maintenance	Number of homeowners conducting septic system maintenance
	Secure funding for project implementation	Number of dollars spent on groundwater quality protection projects; number of projects implemented
	Develop wellhead protection plans, adopt maximum setback zones, and delineate the 5-year capture zones for community wells	
	Within the capture zones for community wells, delineate the recharge zones for groundwater dependent natural areas	
	Convert water softeners from a timer based recharge system to a volume based recharge system to reduce salt (chloride) use	
	Adopt policies and implement best practices for snow and ice removal and for snow and deicing materials storage (see McHenry Co. Water Resources Action Plan)	Water quality measures (e.g., chloride)
	Promote pollution prevention practices for commerical and industrial activities	
	Review the McHenry Co. Water Resources Action Plan for specific groundwater quantity related policy recommendations and management actions to consider including in the Silver & Sleepy Hollow Creek Watershed Action Plans	

Protect groundwater quantity	Gather baseline information on groundwater quantity (supply) and demand in the watershed	Groundwater quantity and demand measures (e.g., total groundwater discharge to streams, well hydrographs, aquifer pumping rates)
	Sustain ongoing monitoring of groundwater quantity and demand in the watershed	
	Encourage practices that support sustainable use of groundwater	Number of practices implemented
	Adopt/enforce water use conservation ordinances	Number of ordinances adopted; number of enforcement actions
	Secure funding for project implementation	Number of dollars spent on groundwater quantity protection projects; number of projects implemented
	Restrict mass grading of development sites to maintain infiltration during construction	
	Support revision of Illinois' plumbing code to allow non-potable uses of graywater (e.g., irrigation of sod farms)	
	Encourage conversion of expanses of turfgrass to native vegetation to increase infiltration	
	Promote open space planning and funding for land acquisition/easements to preserve and protect groundwater recharge areas	
	Within lands held in public trust, identify recharge areas within farmed acres and prioritize for restoration to natural areas	
	Within private cropland, identify recharge areas and prioritize for protection from development	
	Utilize treated wastewater for irrigation and groundwater recharge	
	Require conservation design for new development and conservation design principals in re-development.	
	Develop drought preparedness plans	
	Encourage use of green practices for conserving water quanity (e.g., rain barrels, rain gardens, vegetated swales, rainwater harvesting, natural landscaping, permeable pavers)	
	Participate in the Northwest Water Planning Area Alliance	
	Review the McHenry Co. Water Resources Action Plan for specific groundwater quantity related policy recommendations and management actions to consider including in the Silver & Sleepy Hollow Creek Watershed Action Plans	
Protect and restore natural areas and increase native species diversity (both terrestrial and aquatic plants a nd animals)	Establish landowner incentives (e.g., cost-share program) to establish riparian buffers and restore/increase native vegetation in existing buffers	Number of new buffer zones created Number of buffer zones dominated by native plants
	Maintain the number of wetland acres currently in the watershed, add wetland acres, and implement wetland restoration projects	Numbers of current wetland acres; number of new wetland acres; number of wetland restoration projects
	Participate in Northeast Illinois Invasive Plant Partnership (NIIPP)	Number of watershed organizations/agencies/ individuals participating
	Adopt/enforce effective ordinances	Number of ordinances adopted; number of enforcement actions
	Adopt a watershed-wide green infrastructure plan	Number of resolutions adopting green infrastructure plan
	Monitor fish, herpetile, macroinvertebrate, and aquatic plant populations in the watersheds' streams, lakes, and wetlands	Fish Index of Biotic Integrity (fIBI) in streams Macroinvertebrate Index of Biotic Integrity (mIBI) in streams Headwater Index of Biotic Integrity (hIBI) in headwater streams Numbers and species of frogs Floristic Quality Index (FQI) in lakes and wetlands
	Stabilize eroding streambanks and shorelines	Linear feet of streambanks and shorelines stabilized
	Support efforts to restore more natural flow conditions in streams (reduce the quick rise and fall — the "flashiness" — of stream flows)	Stream hydrographs; stream "flashiness" index (Richards-Baker Flashiness Index)
	Secure funding for project implementation.	Number of dollars spent on protection and restoration projects; number of projects implemented
	Support provisions of the Illinois Wildlife Action Plan	
	Support programs and funding for ongoing study and monitoring (water levels, bioassessment) to identify aquatic ecosystems that may be at risk due to groundwater withdrawals.	
	Establish programs to protect aquatic ecosystems identified as at-risk from groundwater withdrawals	
	Identify and protect recharge areas contributing groundwater to lakes, streams, and wetlands	
	Utilize the Class III Special Resource Groundwater designation for protecting sensitive ecological systems (e.g., fens)	Number of Class III groundwater zones established for all groundwater dependent McHenry Co. Natural Areas Inventory (NAI) sites
	Support funding for ongoing management of natural areas	

Increase public awareness, knowledge, and implementation of watershed protection practices	Conduct survey(s) to gather information on the target audience(s) to help guide the development of an outreach and education plan	Number of surveys sent/conducted; number of surveys returned
	Include educational materials in community mailings and e-mails (e.g., municipal, district, county, association, library, & neighborhood newsletters; utility bills)	Number of mailings; number of households/persons reached through mailings
	Hold volunteer watershed cleanup action days	Number of clean-up events; number of participants
	Offer public education programming through park and conservation districts and departments, libraries	Number of programs
	Create a traveling watershed education display	Number of locations/events where watershed display used
	Reduce the number of violations of county stormwater regulations	Number of violations of county stormwater regulations recorded each year
	Hold planning commissioner workshops	Number of planning commissioner workshops; number of participants
	Ensure all municipalities have effective BMP ordinances and put them into practice	Municipal BMP ordinances & enforcement
	Support efforts to develop watershed specific curriculum and help fund efforts to expand such programs in schools	Number of local schools using the curriculum; number of students participating
	Utilize social media	
	Get teachers and their students involved in watershed study and protection efforts	
	Install watershed informational and educational signs (e.g., stream name signs at bridges)	
Establish an ongoing community participation group to expand watershed planning and protection efforts and support project implementation	Encourage and promote watershed planning and protection through community and individual participation	Number of stakeholder groups and individuals that continue to participate in plan implementation Number of watershed meetings held
	Establish ongoing volunteer restoration programs/work days	Number of work days; number of participants
	Work with local officials to enforce/adopt ordinances	Number of local officials worked with; number of ordinances adopted; number of enforcement actions

* Management objective for Sleepy Hollow Creek

Appendix B. Additional Policy and Planning Recommendations

Table 35. Additional Policy and Planning Recommendations Identified by Stakeholders

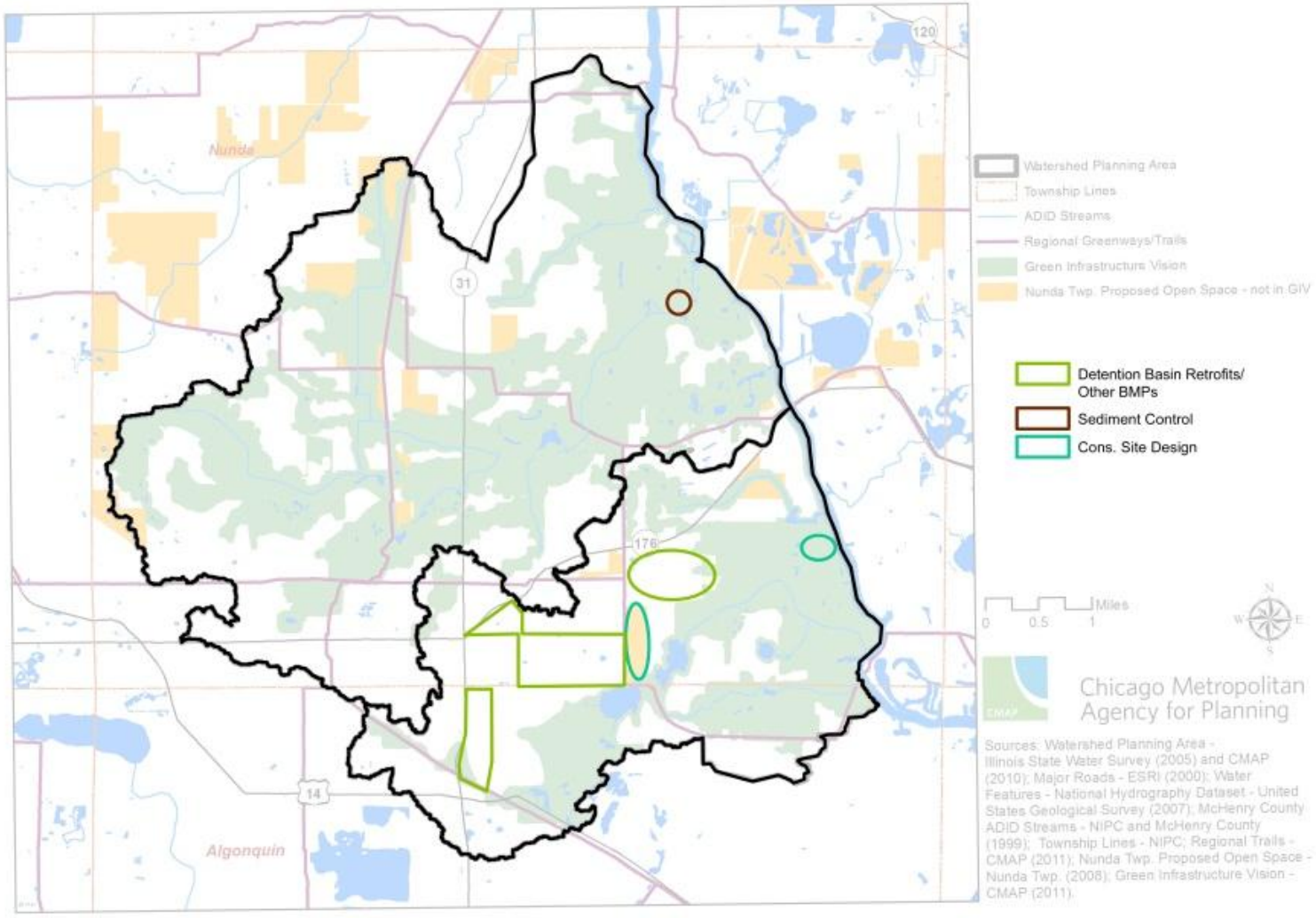
WATERSHED GOAL	STATEMENT OF GENERAL POLICY AND RELATED ACTIONS	KEY IMPLEMENTER(S)
Maintain/achieve healthy surface waters (meet designated use criteria for aquatic life, fish consultation, and primary contact	Establish drop-off location(s) and/or collection events for proper disposal of unwanted pharmaceuticals (medications) within the watershed	Municipalities, County, Townships
	Develop and/or support existing green practices through educational workshops (e.g. rain barrels, rain gardens, rainwater harvesting, natural landscaping, permeable pavement).	Municipalities, County, Townships, Homeowners (support practices)
	Participate in chloride management programs for snow and ice removal and deicing materials and storage (e.g. McHenry County's sensible salting program).	Commercial and Industrial Businesses, Municipalities, County, Townships
	Expand wastewater treatment technologies to reduce nutrient loads from effluent discharged into streams (e.g. polishing wetlands).	Wastewater Treatment Plants (municipal & private)
	Conduct nutrient management programs (e.g. regular soil testing).	Farmers, Municipalities, County, Townships
	Exclude livestock from direct stream access	Farmers, Municipalities, County, Townships
	Support education programs on coal tar sealants and adopt ordinances that support proper alternative uses	Homeowners, Contractors, Wholesale Outlets, Municipal Officials, County, Township, Businesses
	Establish/gather baseline information and sustain ongoing monitoring on the chemical, biological, and physical characteristics of the watersheds' streams, lakes, and wetlands	
	Reduce nutrient and sediment loads to the watersheds' streams, lakes, wetlands, and the Fox River	
	Develop agricultural conservation plans	
	Educate homeowners on no-phosphorus fertilizers	
Protect groundwater quality	Participate in chloride management programs for snow and ice removal and deicing materials and storage (e.g. McHenry County's sensible salting program).	Commercial and Industrial Businesses, Municipalities, County, Township
	Adopt maximum setback zones, develop a wellhead protection plan, and delineate the 5-year recapture zones for community-wells.	Municipalities, County
	Establish and participate in septic system homeowner education program (oversight by the McHenry County Department of Health)	Homeowners, Commercial and Industrial Businesses, Municipalities, County, Townships
	Encourage wastewater systems that reuse and/or recharge wastewater to prevent groundwater degradation	Wastewater Treatment Plants (private, public)
	Adopt alternative water softening technologies	Municipalities, County, Townships
	Expand funding for groundwater quality monitoring	Municipalities, County
	Adopt technologies that reduce groundwater chloride contamination	Municipalities, County, Commercial and Industrial Businesses
	Promote pollution prevention practices for commercial and industrial activities	
	Collect information and support ongoing monitoring of groundwater quality in the watersheds	
	Educate homeowners on septic system maintenance	

Protect groundwater quantity	Adopt water conservation ordinances and include key considerations in local comprehensive plans	Municipalities, County, Townships
	Adopt McHenry County's Unified Development Ordinance	
	Become a WaterSense Partner	Municipalities, County, Townships, Commercial and Industrial Businesses
	Require conservation design requirements for new development and conservation design principles in re-development.	Municipalities, County
	Encourage stormwater management retrofits to maximize groundwater recharge.	Homeowners, Developers, Municipalities, County, Commercial and Industrial Businesses
	Encourage practices that support sustainable use of groundwater	
	Collect information and support ongoing study of groundwater quantity in the watersheds	
	Promote open space planning and funding for land acquisition/easements to preserve and protect groundwater recharge areas	
	Within lands held in public trust, identify recharge areas within farmed acres and prioritize for restoration to natural areas	
	Support water reuse opportunities	
	Develop drought preparedness plans	
	Participate in the Northwest Water Planning Area Alliance	
Protect and restore natural areas and increase native species diversity	Utilize the Class III Special Resource Groundwater designation for protecting sensitive ecological systems (e.g. fens)	—
	Adopt and enforce an oak stand protection ordinance	Municipalities
	Establish landowner incentives (e.g. cost share program) to establish riparian buffers and restore/increase native vegetation in existing buffers	Municipalities, County, Landowners
	Establish Environmental Corridors (Green Infrastructure Framework) and include recommendations in comprehensive plans	Municipalities, County
	Support provisions of the Illinois Wildlife Action Plan	Homeowners, Developers, Municipalities, County, Townships, Commercial and Industrial Businesses
	Maintain the number of wetland acres currently in the watershed, add wetland acres, and implement wetland restoration projects	
	Participate in Northeast Illinois Invasive Plant Partnership (NIIPP)	
	Monitor fish, herpetile, macroinvertebrate, and aquatic plant populations in the watersheds' streams, lakes, and wetlands	
	Stabilize eroding streambanks and shorelines	
	Support efforts to restore more natural flow conditions in streams (reduce the quick rise and fall — the "flashiness" — of stream flows)	
	Support programs and funding for ongoing study and monitoring (water levels, bioassessment) to identify aquatic ecosystems that may be at risk due to groundwater withdrawals.	
	Identify and protect recharge areas contributing groundwater to lakes, streams, and wetlands	
	Establish programs to protect aquatic ecosystems identified as at-risk from groundwater withdrawals	Municipalities, County
Increase public awareness, knowledge, and implementation of watershed protection practices.	Develop educational materials on watershed related topics and partner with communities on educational programs.	Municipalities, County
	Coordinate with the County to develop and/or distribute water conservation educational materials and host workshops	Municipalities, Townships, County
	Educate local farm owners on farming practices that are protective of the watersheds and promote available programs to producers.	Farmers, Farm Bureau
	Hold volunteer watershed cleanup action days	Municipalities, Townships, County
	Develop and partner with communities to conduct workshops for planning commissioners and other target audiences to support green practices (e.g. rain barrels, rain gardens, rainwater harvesting, natural landscaping, permeable pavement)	Municipalities, County, Townships, Commercial and Industrial Businesses
	Conduct survey(s) to gather information on target audience(s) to help guide the development of outreach and education campaigns	
	Include educational materials in community mailings and e-mails (e.g., municipal, district, county, association, library, & neighborhood newsletters; utility bills)	
	Offer public education programming through park and conservation districts and departments, libraries	
	Support efforts to develop watershed-specific curriculum and help fund efforts to expand such programs in schools	
	Utilize social media	
	Install watershed informational and educational signs (e.g., stream name signs at bridges)	

Establish an ongoing community participation group to expand watershed planning and protection efforts and support project implementation	Establish Site-planning roundtables to enforce/adopt ordinances.	Municipalities, County
	Establish ongoing volunteer restoration programs/workdays	Municipalities, Townships, County
	Encourage and promote watershed planning and protection through community and individual participation	
Additional priorities	Secure funding for project implementation and monitoring	
	Encourage the use of green practices (e.g., rain barrels, rain gardens, vegetated swales, rainwater harvesting, natural landscaping, permeable pavement)	
	Require conservation design for new development and conservation design principals in re-development.	
	Adopt a green infrastructure plan for the watershed planning area	
	Adopt/enforce effective BMP ordinances to protect watershed health	
	Adopt provisions of the McHenry County Water Resources Action Plan	

Appendix C. Map of Long Term Project Recommendations

Figure 73. Long-Term best management projects identified by stakeholders



Appendix D. Long Term Project Recommendations

Table 36. Watershed-wide long term projects and general plan recommendations[260]

CATEGORY	BEST MANAGEMENT PRACTICE	RECOMMENDATION
WWTP	Wastewater Reuse Study	Wastewater Reuse Feasibility Study at the Crystal Lake Wastewater Treatment Plant (WWTP)
Urban	Detention Basin Inventory	Conduct inventory of all detention basin sites
Urban	Stormwater Detention Analysis	Perform an analysis to determine the amount of detention that should be in the watershed relative to the amount of development or impervious surface.
Urban	Detention Engineering Study	Study to determine sustainable hydrology in the watershed
Urban	Monitoring	Expand monitoring existing wells/add more monitoring wells near Crystal Lake WWTP # 3 and other areas across the watersheds
Urban	Stormwater Management	Establish more projects to improve the MS4 program
Urban	Groundwater Protection	Establish chloride management program - establish a funding source (City of Crystal Lake)
Education	Forums/Newsletters	Increase support, public awareness, and funding for restoration and management of natural areas
Urban	Monitoring	Install automated water quality monitoring equipment downstream of turf farms to determine levels of phosphorus, nutrient, pesticide, and herbicide runoff. Then develop recommendations for nutrient herbicide, pesticide use at these facilities based on results.
Urban	Monitoring	Water quality monitoring upstream and downstream of Rt. 31 (runoff from highways)
Education	Forums/Newsletters	Encourage golf courses to utilize zero phosphorus, organic lawn management, pest management
Education	Brochure	Create a homeowner brochure aimed at nonuse of phosphorous fertilizers
Urban	Monitoring	Well water monitoring - (test kits to be administered by Nunda Township)
Urban	Detention Retrofit	Explore options to provide funds to retrofit detention ponds with emergent and shoreline vegetation (fund administered by Nunda Township)
Urban	Detention Basin Inventory	Fund open space acquisition to provide for homeowner detention needs (e.g. retrofit, repair)
Hydraulic	Stream Stabilization	Remediate "flashiness" on subwatershed stream that flow into Sleepy Hollow Creek between Oak and Walkup Road
Hydraulic	Stream Stabilization	Stabilize approximately 75 to 100 feet of stream, which discharges into Sleepy Hollow Creek along Rt. 31 at Crystal Lake Lift Station No. 22.

[260] An additional long term project recommendation within the urban category includes lakeshore stabilization around Lake Kilarney (NE portion bordered by Crystal Lake Avenue).

Appendix E. Funding Sources

Table 37. Sources of funding for plan implementation[261]

PROGRAM	FUNDING AGENCY	TYPE	FUNDING AMOUNT	ELIGIBILITY	ACTIVITIES FUNDED	WEBSITE
WATER QUALITY						
Capitalization Grants for Clean Water State Revolving Funds	U.S. EPA/Office of Wastewater Management	Loan revolving fund	No limit on wastewater funds; Drinking water up to 25% of available funds	Local government, Individuals, Citizen groups, Not-for-profit groups	Wastewater treatment; Nonpoint source pollution control; Watershed management; Restoration & protection of groundwater, wetlands/riparian zones, and habitat.	http://www.epa.gov/owm/cwfinance/index.htm
Non-point Source Management Program (319 grants)	Illinois EPA	Matching Grant (60% funded)	No set limit on awards	Local government, Businesses, Individuals, Citizen & environment groups	Controlling or eliminating non-point pollution sources; Stream bank restoration; Pesticide and fertilizer control.	http://www.epa.state.il.us/water/financial-assistance/non-point.html
Illinois Green Infrastructure Grant Program for Stormwater Management	Illinois EPA	Matching Grant Minimum Local MatchCSO: 15%; Retention and Infiltration: 25%; Green Infrastructure Small Projects: 25%	Up to: CSO: $3M or 85% of project costs; Retention and Infiltration: $750,000 or 75% of project costs; Green Infrastructure Small Projects: $75,000 or 75% of project costs	Any entity that has legal status to accept funds from the state of Illinois, including state and local governmental units, nonprofit organizations, citizen and environmental groups, individuals and businesses	Green infrastructure best management practices (BMPs) for stormwater management to protect or improve water quality.	http://www.epa.state.il.us/water/financial-assistance/igig.html
Sustainable Agriculture Grant Program	Illinois Department of Agriculture	Matching Grant (60% funded)	—	Organizations, governmental units, educational institutions, non-profit groups, individuals	Practices are aimed at maintaining producers' profitability while conserving soil, protecting water resources and controlling pests through means that are not harmful to natural systems, farmers or consumers.	http://www.agr.state.il.us/Environment/conserv/index.html
Streambank Stabilization and Restoration Program	Illinois Department of Agriculture	Matching grant (amount funded not specified)	—	Landowners, Citizen groups, Not-for-profit groups	Naturalized streambank stabilization in rural and urban communities, work with SWCD	http://www.agr.state.il.us/Environment/conserv/index.html
Conservation Innovation Grants	Natural Resources Conservation Service	Matching grant (50% funded)	Up to $75,000 under State Component	Landowners, Organizations	Projects targeting innovative on-the-ground conservation, including pilot projects and field demonstrations.	http://www.il.nrcs.usda.gov/programs/cig/
HABITAT						
Partners for Fish and Wildlife Habitat Restoration Program	Department of Interior, U.S. Fish and Wildlife Service	Cost-share (50% funded)	up to $25,000	Private landowners	Voluntary restoration or improvements of native habitats for fish and wildlife; Restoration of former wetlands, native prairie stream and riparian areas and other habitats.	http://www.fws.gov/policy/640fw1.html
Bring back the Natives Grant Program	National Fish and Wildlife Foundation	Matching Grant (33% funded)	Varies with project ($50,000-$75,000)	Not-for-profit groups, Universities, Local governments	Restoration of damaged or degraded riverine habitats and native aquatic species through watershed restoration and improved land management.	http://www.nfwf.org/AM/Template.cfm?Section=charter_programs_list&CONTENTID=18473&TEMPLATE=/CM/ContentDisplay.cfm
Wildlife Habitat Incentives Program	U.S. Department of Agriculture	Grant, Matching Grant (at least 75% funded)	—	Private landowners, Not-for-profit groups	Establishment and improvement of fish and wildlife habitat on private land.	http://www.nrcs.usda.gov/programs/whip/
Native Plant Conservation Initiative	National Fish and Wildlife Foundation	Matching Grant (50% funded)	$10,000-$50,000	Community and watershed groups, Nonprofit groups Educ. institutions, Conservation districts, Local governments	"On-the-Ground" projects that involve local communities and citizen volunteers in the restoration of native plant communities.	http://www.nfwf.org/programs/npci.htm
WETLANDS						
Wetlands Reserve Program	USDA NRCS	Direct contracts with landowners; Easement (100%); Cost Share and 30 year easements (75%)	No set limit on awards	Individual Citizen groups, Not-for-profit groups	Wetlands restoration or protection through easement and restoration agreement	http://www.nrcs.usda.gov/programs/wrp/states/il.html
Wetlands Program Development Grants	U.S. EPA	Matching Grant (75% funded)	No set limit on awards	Not-for-profit groups; Local government	Developing a comprehensive monitoring and assessment program; Improving the effectiveness of compensatory mitigation; Refining the protection of vulnerable wetlands and aquatic resources	http://www.epa.gov/owow/wetlands/grantguidelines
Northeastern Illinois Wetlands Conservation Account	U.S. Fish and Wildlife Service/ The Conservation Fund	Grant/Matching Grant (50% match strongly suggested)	Average of ~$38,000	A partnership of: Governmental agencies; Not-for-profit conservation groups; Private landowners	Restoration of former wetlands; Enhancement and preservation of existing wetlands; Creation of new wetlands Wetlands education and stewardship	http://www.conservationfund.org/node/133
Small Grants Program	North American Wetlands Conservation Council	Matching Grant	Up to $75,000	A partnership of: Governmental agencies, Not-for-profit conservation groups; Private landowners	Long-term acquisition, restoration, enhancement of natural wetlands	http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm
Wetland Restoration Fund	Openlands	Grant	$5,000-$100,000	Local government; Not-for-profit groups; Citizen groups; Other organizations	Wetlands and other aquatic ecosystem restorations within the six-county Chicago region on land under conservation easement or owned by a government agency	
Five Star Restoration Program	National Fish and Wildlife Foundation	Matching Grant (50% funded)	One-year projects: $10,000-$25,000; Two-year projects: $10,000 -$40,000	Any public or private entity that can receive grants	Seeks to develop community capacity to sustain local natural resources for future generations by providing modest financial assistance to diverse local partnerships for wetland and riparian habitat restoration	http://www.nfwf.org/AM/Template.cfm?Section=Charter_Programs_List&Template=/TaggedPage/TaggedPageDisplay.cfm&TPLID=60&ContentID=17901
PRIVATE						
Tellabs	Tellabs Foundation	Grant	At least $10,000	Not-for-profit groups	Environmental protection and improvement programs; Organizations which protect the environment	http://www.ivp.tellabs.com/about/foundation.shtml
GVF Core Program	Grand Victoria Foundation	Grant/Matching Grant	Varies with scope of project, size of organization, other funding	Not-for-profit groups	Preservation and restoration of natural lands and waterways	www.grandvictoriafdn.org

[261] Additional funding sources include grants from the Illinois Department of Natural Resources (OSLAD) http://www.dnr.state.il.us/ocd/newoslad1.htm and Conservation Stewardship Programs http://www.dnr.state.il.us/stewardship/

Appendix F

Links to General Outreach Resources:

McHenry County Resources Education Materials

http://www.co.mchenry.il.us/departments/waterresources/Pages/WRBrochures.aspx

Winter Snow and Ice Handbooks, Presentation and other information

http://www.co.mchenry.il.us/departments/waterresources/Pages/WinterSnowandIceOperators.aspx

McHenry County Water Resources

http://www.mchenryh2o.com

Other Educational Materials

Children: http://www.co.mchenry.il.us/departments/waterresources/Pages/WaterLinks-Children.aspx

General: http://www.co.mchenry.il.us/departments/waterresources/Pages/WaterLinks-General.aspx

Municipalities: http://www.co.mchenry.il.us/departments/waterresources/Pages/WaterLinks-Municipalities.aspx

Teachers: http://www.co.mchenry.il.us/departments/waterresources/Pages/wLinks_Teachers02.aspx

Pet waste

http://www.co.mchenry.il.us/departments/Countyboard/Documents/Dog%20Waste.pdf

Rain gardens

http://www.co.mchenry.il.us/departments/Countyboard/Documents/RaingardenXeriscapingfinal1.04.20.09.pdf

Medication disposal

http://www.co.mchenry.il.us/departments/Countyboard/Documents/MedDisfinal.04.09.pdf

Household Hazardous Waste:

http://www.co.mchenry.il.us/departments/waterresources/pdfDocs/HazWastealternativefinal_000.pdf

Lawn Care

http://www.co.mchenry.il.us/departments/waterresources/pdfDocs/LawnCare_000.pdf

Lake Management Resources

http://water.epa.gov/type/lakes/lakestipsfull.cfm
http://water.epa.gov/type/lakes/shoreland.cfm

Green Infrastructure Planning Resources

Chicago Wilderness Green Infrastructure Vision: Bringing Nature to People
http://www.chicagowilderness.org/GIV.phpChicago

Chicago Wilderness Ecological Planning and Design Directory
http://www.chicagowilderness.org/resources.php

US Environmental Protection Agency (USEPA)
Municipal Handbook: Managing Wet Weather with Green Infrastructure Handbook Series

http://cfpub.epa.gov/npdes/greeninfrastructure/munichandbook.cfm

Center for Neighborhood Technology – National Green Values Calculator……..The National Green Values™ Calculator is a tool for quickly comparing the performance, costs, and benefits of Green Infrastructure, or Low Impact Development (LID), to conventional stormwater practices.
http://greenvalues.cnt.org/national/calculator.php

Residential Deicing

http://www.co.mchenry.il.us/departments/waterresources/pdfDocs/ResidentDeicingfinal_000.pdf

Volunteer Recruitment Resources:

United Way of Greater McHenry County Volunteer Center
http://www.volunteermchenryCounty.org

Oak Tree Restoration

http://www.conservemc.org/what-we-do/oak-conservation-project-quercus.html

Appendix G. Acronyms

ADID	Advanced Identification Wetland Study
AUM	Animal Unit Month
BMP	Best Management Practice
BOD	Biological Oxygen Demand
CMAP	Chicago Metropolitan Agency for Planning
CREP	Conservation Reserve Enhancement Program
CWP	Center for Watershed Protection
DAF	Daily Average Flow
DMR	Discharge Monitoring Report
EDMC	Environmental Defenders of McHenry County
EQIP	Environmental Quality Incentive Program
FHGC	Foxford Hills Golf Course
FOTG	Field Office Technical Guides
FREP	Fox River Ecosystem Partnership
GPS	Global Position System
HEL	Highly Erodible Lands
IEPA	Illinois Environmental Protection Agency
IFDA	Illinois Forestry Development Act
IPCB	Illinois Pollution Control Board
LEED	Leadership in Energy and Environmental Design
LID	Low Impact Development
LUST	Leaking Underground Storage Tank
MCCD	McHenry County Conservation District
MCDOH	McHenry County Department of Health
MCNAI	McHenry County Natural Areas Inventory
MGD	Million Gallons Per Day
MS4	Municipal Storm Sewer System
NPS	Nonpoint Source Pollution
NRCS	Natural Resources Conservation Service
PPCP	Pharmaceuticals and Personal Care Products
SARA	Sensitive Aquifer Recharge Area Map
SMCL	Secondary Maximum Contaminant Levels
SSURGO	Soil Survey Geographic
STP	Sewage Treatment Plant
SWCD	Soil and Water Conservation District
SWPPP	Stormwater Pollution Prevention Program
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
UDO	Unified Development Ordinance
USDA	United States Department of Agriculture
USLE	Universal Soil Loss Equation
Watershed Planning Area	Silver Creek Watershed and Sleepy Hollow Creek Watersheds
WHIP	Wildlife Habitat Incentive Program
WRAP	Water Resources Action Plan
WRP	Wetland Reserve Program
WWTF	Wastewater Treatment Facility

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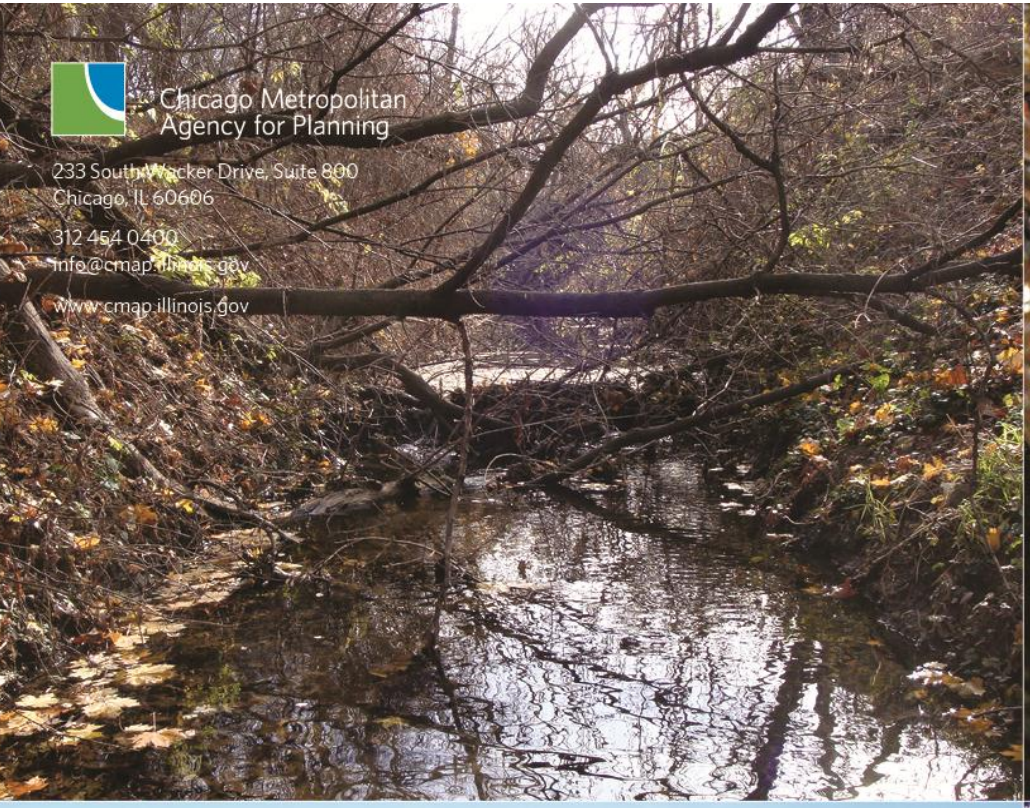
About CMAP

The Chicago Metropolitan Agency for Planning (CMAP) is the region's official comprehensive planning organization. Its GO TO 2040 planning campaign is helping the region's seven counties and 284 communities to implement strategies that address transportation, housing, economic development, open space, the environment, and other quality of life issues. See **www.cmap.illinois.gov** for more information.

Cover images courtesy of the Stream Team volunteers



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