SEQUOIT CREEK WATERSHED MANAGEMENT PLAN

Prepared for

Lake County Stormwater Management Commission

Prepared by

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July 23, 2004

FOREWORD

The Sequoit Creek Watershed Management Plan was developed through a cooperative effort between the Lake County Stormwater Management Commission and representatives of the watershed's stakeholders. Many different entities, ranging from homeowner's associations to municipal governments and county agencies, consistently attended monthly meetings during the planning process. Over 15 public meetings were held to solicit input from the stakeholder committee.

The Sequoit Creek Watershed Management Plan was developed to provide a "blueprint" for reducing flood damages, improving water quality, and protecting natural resources in the watershed. The Plan is intended to assist private citizens and the local, State, and Federal units of government concerned with managing the water resources of this watershed in a cost-effective and environmentally sound manner.

The Plan contains a summary of data collected for the watershed, quantifies water resource-related problems, presents goals and objectives agreed upon by the stakeholder group, and presents a list of recommended actions for effectively managing the watershed's resources in concert with activities such as comprehensive planning, zoning, and transportation planning. The Plan provides a basis for inter-jurisdictional communication and coordination on water resources issues.

This Plan is an advisory document for stakeholders of the watershed, but we encourage stakeholders to endorse the Plan, utilize the document as a reference, and pursue implementation. This document does not contain subwatershed regulatory requirements, but instead provides proactive guidance on opportunities to balance the uses and demands on the watershed's resources to improve the quality of life for future generations.

Lake County Stormwater Management Commission

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THE SEQUOIT CREEK WATERSHED MANAGEMENT PLAN
EXECUTIVE SUMMARY

This report is summarizes the findings and recommendations from the watershed management plan the Stormwater Management Commission (SMC) developed for the Sequoit Creek watershed. The Sequoit Creek watershed is part of the Fox River watershed, one of the four main watersheds in Lake County, Illinois. The Sequoit Creek watershed covers about 14 square miles and is home to a population of about 18,000 residents. The primary goal of developing the watershed management plan was address concerns about flooding problems, water quality conditions, threats to natural resources, diminishing open spaces, and the need to take proactive action to prevent such problems from worsening as the watershed continues to rapidly urbanize. In addition, the Sequoit Creek watershed is unique compared to the other watersheds in the county because of its high-quality lakes and natural resources. SMC therefore identified the Sequoit Creek watershed as a priority for developing a watershed management plan. A watershed management plan specifies actions for achieving this goal. The process of developing the Sequoit Creek watershed management plan involved three main tasks:

- Developing goals and objectives with stakeholder input
- Assessing problems and opportunities
- Developing a watershed action plan

Each of these tasks is discussed below.

Developing Goals and Objectives with Stakeholder Input

To ensure that a broad range of perspectives was incorporated into the watershed management plan development process, the Sequoit Creek Planning Committee (SCPC) was created in March 2001. The committee is composed of representatives of municipalities, other local governments, state and federal governments, and homeowner associations as well as watershed residents and experts in various disciplines.

In partnership with the SMC, SCPC took the lead in developing plan goals and objectives by conducting 12 monthly meetings at various locations in the watershed. The general intent of the meetings was to promote local participation in plan development and encourage expression of a diverse range of opinions.

SCPC dedicated the first two meetings to identifying the watershed goals and objectives of stakeholders and other interested groups. SCPC then conducted the remaining 10 meetings to further refine the goals and objectives and to define specific issues of concern through both public meetings and one-on-one meetings with individual stakeholders. Valuable information was gained through these meetings, including opportunities for protecting the watershed's natural resources and solving some flooding and water quality impairment problems.

During the first meeting, SCPC identified and prioritized four primary goals for the watershed management plan. These goals represent a consensus of the stakeholders based on their experience in the watershed, problems they have encountered, and their perceptions and preferences. In order of priority, the four goals are as follows:

- Reduce runoff and improve water quality
- Minimize flood damages
- Improve education and outreach programs for the public, developers, and community leaders
- Protect and restore natural resources

In the context of a watershed, these goals are closely interconnected. Development without application of best management practices (BMP) tends to create more runoff, which carries increased amounts of pollutants into the streams and lakes. The increased runoff volumes and associated pollutant loads exacerbate existing flooding problems and threaten the water quality of the lakes. The developer of the watershed management plan therefore had to recognize the interconnections among these factors while divising effective means for accomplishing the four primary goals.

Assessing Problems and Opportunities

Assessing current conditions and identifying opportunities for improvement in the watershed were accomplished by analyzing extensive information about the watershed. Municipalities, local governments, SMC, and other stakeholders were the main sources of the information, which included inventories of physical infrastructure such as sewer systems, natural drainage systems, detention ponds, transportation routes, trails and greenways, open spaces, potential flood storage sites, and natural resources (including wetlands, lakes, and threatened and endangered species). Lake County's 1994 framework plan and the 2001 draft framework plan provided guidance on regional land use planning and policy through the year 2020. Additional information collected included hydrologic studies, demographic

data, existing and future land use information, water quality data, flood problem area locations, and shoreline erosion studies. Existing land uses and projected land uses through the year 2020 were identified based on existing zoning maps. A summary of the watershed assessment conducted is provided below.

Flooding. Because of its flat topography, a disproportionate amount of the watershed lies in high flood hazard areas. Flooding is prevalent along the main stem of Sequoit Creek and in depressional areas throughout the watershed. According to the most recent floodplain mapping study, about 1 of every 6 acres of dry land adjacent to the watershed's streams and lakes is expected to be inundated during the 100-year storm event. Additional flooding damage is caused by inundation of land adjacent to isolated depressional areas. Up to 80 buildings in the watershed have experienced flooding, and about 234 parcels of land are located in flood hazard areas. An entire subdivision just north of Loon Lake is located in high flood hazard areas. One critical facility in the watershed, the access road to the Antioch wastewater treatment plant, has experienced flooding. Unless preventive action is taken to mitigate the effects of urbanization, flood-related damage is certain to increase in the future.

Water Quality. The good news is that the water quality of the watershed's lakes and streams is generally good. Most water quality problems in the watershed are caused by runoff and discharges from nonpoint sources such as construction sites, developed and agricultural areas, and faulty septic systems. Fecal coliform bacteria whose principal sources are probably failing or inadequately designed septic systems cause the most serious water quality problem in the lakes. Fecal coliform concentrations exceeding health guidelines result in beach closures. The municipalities of Antioch and Lake Villa are the fastest growing in the watershed; therefore, nonpoint source pollutants associated with construction site runoff and stormwater are likely to increase in these areas unless adequate resources are committed and Watershed Development Ordinance (WDO) requirements are fully enforced. The existing water quality monitoring program in the watershed does not include adequate biological, sediment, and toxicological parameters. Inclusion of these parameters in the program in the future will be important for assessing the effectiveness of the watershed management plan.

Natural Resources. The Sequoit Creek watershed is uniquely endowed with ecologically significant areas such as high-quality wetlands, the Cedar Lake Bog Nature Preserve, lakes, and forest preserves that provide habitat for several threatened and endangered species. A comprehensive inventory of the threatened and endangered species in the watershed has never been completed; consequently, the actual number and distribution of these species in the watershed are unknown. According to available data, the

Sequoit Creek watershed contains about 5 percent of the state's listed threatened and endangered species. Of the listed species present, five are fish and six are birds. Most of these species are located in Sun Lake and the Sun Lake Forest Preserve, West Loon Lake, Deep Lake, the Cedar Lake and Cedar Lake Bog Nature Preserve, the Deep Lake Road low shrub bog, the Petite Lake Road marsh, and the Little Silver Lake shrub bog. Issues of concern in the watershed include invasive species in Cedar Lake, loss of existing habitat through channelization, loss of open land to development, and the potential for continuing water quality degradation.

Open Land. Open land constitutes about 46 percent of the watershed. According to future land use projections, this proportion is expected to decrease to 31 percent in 2020, mainly because of development of existing agricultural land.

Trails and Greenways. Presently no trails or greenways exist in the watershed. The Lake County Department of Transportation (LCDOT) has recently developed a countywide plan to establish a trunk system of trails that local municipalities can connect to once the system is developed. Stakeholders should identify and pursue feasible opportunities to connect watersheds or subwatersheds via these trails.

Developing a Watershed Action Plan

Upon completion of the detailed assessment of the current and projected future condition of the watershed, a set of recommended actions was prepared. This set of actions constitutes the watershed action plan. The action items were selected to achieve the four goals and associated objectives identified by SCPC.

The objectives associated with reducing runoff and improving water quality are to

- Reduce existing pollutant loads to Sequoit Creek from runoff and point sources
- Reduce nutrient, sediment, and fecal coliform loads to Sequoit Creek and lakes in the watershed
- Reduce existing erosion problems throughout the watershed
- Minimize pollutant loads and erosion problems in future developments

The objectives associated with minimizing flood damages are to

- Preserve floodplains
- Reduce flood peaks and runoff volumes
- Improve and maintain drainage systems
- Protect property and critical facilities in flood hazard areas

The objectives associated with improving education and outreach programs for the public, developers, and community leaders are to

- Develop a school program based on the watershed
- Provide watershed information and education resources for community leaders and the public
- Promote stewardship of Sequoit Creek and lakes in the watershed by increasing public participation

The objectives associated with protecting and restoring natural resources are to

- Protect and restore ecologically significant areas
- Protect threatened and endangered species
- Create greenways and trails
- Protect open land

The watershed action plan contains a comprehensive list of recommended actions for achieving the goals and objectives. The list includes (1) programmatic actions that are intended to be applicable throughout the watershed, such as regulatory measures, regular maintenance activities, and educational programs and (2) location-specific actions such as bank stabilization, detention pond retrofitting, stream restoration, septic system upgrades, construction of regional detention facilities and shoreline erosion protection, and floodplain buyouts. Key actions included in the plan call for municipalities to

- Use land use planning as a tool for reducing ground surface imperviousness by limiting development density, incorporating concepts of low-impact development in zoning regulations,

imposing use restrictions on ecologically sensitive areas, preserving aquifer recharge areas, and preserving open space. Both the 1994 framework plan and the 2001 draft framework plan recommend land use planning as the most cost-effective tool for mitigating the unintended consequences of urbanization.

- Implement the National Pollutant Discharge Elimination System (NPDES)-II nonpoint source pollution prevention program. The municipalities of Antioch and Lake Villa have filed notices of intent with the Illinois Environmental Protection Agency to implement measures that will reduce nonpoint source pollutants entering the water bodies in the watershed. At a minimum, the municipalities will implement pollution control measures that include public education, public outreach, and public participation; illicit discharge elimination; good housekeeping; and construction and post construction runoff control. The public education and outreach components of the program will directly address one of the main goals of the watershed management plan.

- Enforce the countywide WDO. The WDO includes effective provisions for addressing nonpoint sources of pollutants such as soil erosion and storm water runoff by implementing BMPs. In addition, the WDO contains comprehensive floodplain management regulations that are intended to reduce future flood damages. Because the WDO contains only minimum countywide standards, the action includes watershed-specific recommendations for amending the WDO to better protect existing and future property from floods. These recommendations include increasing the one-foot flood freeboard for structures adjacent to floodplains; and using drainage easements that are based on full-build out conditions.

Additional action plan items include

- Identifying priority open space for creation and preservation of greenways

- Implementing measures for wetland, stream, and shoreline restoration to improve water quality and habitat

- Conducting detention basin retrofitting that will reduce flood peaks and improve water quality

- Identifying specific opportunities for floodplain buyouts and flood proofing

- Implementing monitoring program improvements that will provide data for use in assessing plan performance and identifying additional protection measures needed

Based on its successful experience in implementing the North Branch watershed management plan, SMC created a "toolbox" of watershed restoration and management techniques that are applicable to the Sequoit Creek watershed. The resources in the toolbox will support selection of the specific techniques for implementing the BMPs recommended in the action plan.

SMC; SCPC; federal, state, and local agencies can assume specific roles and responsibilities during watershed management plan implementation, such as serving regulatory functions, providing funding, and providing technical assistance. Coordination and cooperation among agencies is crucial for successful and timely implementation of the watershed management plan, as is adequate funding. The plan identifies potential sources of funding and provides planning-level cost estimates for a variety of proposed activities.

The watershed management plan is a living document that needs to be periodically updated in order to reflect the many changes occurring in the watershed, include new information, and support implementation of new approaches that have been developed based on prior experience. Plan updating is especially important for an area that is developing as fast as quickly as the Sequoit Creek watershed. The ultimate goal, however, must always be to manage the watershed in a safe, environmentally healthy way that benefits all stakeholders.

CHAPTER 1
INTRODUCTION

1.1 SCOPE/APPROACH

The document presents the watershed management plan for the Sequoit Creek watershed, which is experiencing the rapid development typical of many watersheds in northeastern Illinois. The major motivating factors for preparing this plan include concerns about existing problems in the watershed and the effects of future development on water quality, preservation of natural resources, and flood risk. The population of the Sequoit Creek watershed is projected to increase by 60 percent by 2020, while the population of Lake County is expected to increase by 25 percent (NIPC 2000a). In the face of such change, a watershed management plan that can address the associated challenges is needed. At a minimum, the plan must address the following questions:

- What are the anticipated impacts on the water and natural resources of the watershed?
- How will the increased runoff volumes be handled without exacerbating the existing flooding problems in the watershed?
- How can the natural resources be protected?
- How can we reduce existing flood damages and reverse water quality degradation?

This management plan for the Sequoit Creek watershed analyzes existing conditions and projected future conditions in the watershed and provides a framework for addressing these questions.

The following sections discuss (1) the scope and approach for developing the watershed management plan and (2) the process used for plan development.

Authority for stormwater management in Lake County is provided in 55 ILCS 5/5-1062. This enabling legislation was enacted by the State of Illinois in response to major flooding that occurred in October 1986 and August 1987, causing widespread damage and dislocation of residents across northeastern Illinois. In December 1987, Lake County established the Lake County Stormwater Management Planning Committee--a municipal-county partnership made up of six municipal members and six County Board members. Lake County developed and adopted the first comprehensive stormwater management plan (CSP) in June 1990.

SMC's responsibilities for watershed planning are defined in the 1990 CSP as well as the 2002 CSP update. SMC's primary responsibilities as defined in the CSP are to (1) provide a vehicle for

coordinating all jurisdictions in and adjacent to Lake County with an emphasis on managing stormwater on a watershed basis, and (2) create detailed drainage basin plans to solve existing stormwater management problems and guide future development.

One of the principal recommendations of the CSP is use of more detailed, watershed-specific management plans as the main tool for addressing stormwater management problems in Lake County (SMC 1992). A watershed is a natural geographic boundary that can be used for managing natural resources. Planning at the watershed level considers management actions that can minimize the negative impacts of land development on land and water resources.

Development of this Sequoit Creek watershed management plan is part of the process of attaining the countywide goal of comprehensive stormwater management. This watershed management plan is intended to be a working document that will be modified to reflect the most current conditions as the social and economic aspects of the watershed evolve. This plan is technically an amendment to the 2002 Lake County "Comprehensive Stormwater Management Plan" as authorized by 55/ILCS 5/5-1062.

1.2 PLAN DEVELOPMENT

Development of the Sequoit Creek watershed management plan was a collaborative effort involving local residents; the general public; local, state, and federal agencies; and other stakeholders. The process began with establishment of a stakeholder planning committee. Subsequent steps in the process involved development of goals and objectives, data collection, and organization of the watershed management plan document. These steps are described below.

1.2.1 Stakeholder Planning Committee

Goals and objectives for the watershed management plan were developed by involving local, state, and federal government representatives; planning agencies; lake management units; local residents; and experts from a broad range of technical disciplines. The insights of these participants were important in assessing watershed conditions and in developing feasible management recommendations. A Sequoit Creek Planning Committee (SCPC) was formed at the beginning of the project to ensure that a broad range of perspectives was incorporated into the watershed management plan development process. Twelve scheduled meetings were held to solicit input for the plan. Meeting attendees included representatives of municipalities, local and state governments, and public and private agencies. In

addition to assisting with the development of the action plan, it is anticipated that SCPC will play a key role in plan implementation and updating.

1.2.2 Development of Goals and Objectives

The first two SCPC meetings were dedicated to identifying stakeholder goals and objectives for the watershed. The first meeting included a "brainstorming" session during which numerous ideas and concerns about the watershed were presented. A complete list of meeting participants is provided in the meeting minutes in Appendix A. The second SCPC meeting was used to prioritize the goals and objectives identified during the first meeting. The four primary goals developed during these initial meetings are as follows:

- Goal 1: Reduce runoff and improve water quality
- Goal 2: Minimize flood damages
- Goal 3: Improve education and outreach programs for the public, developers, and community leaders
- Goal 4: Protect and restore natural resources

The remaining 10 meetings were held monthly at various locations in the Sequoit Creek watershed. Each meeting focused on a specific issue of concern in the watershed to further refine the goals and objectives identified during the early stages of plan development.

In addition to the SCPC meetings, SMC staff held one-on-one meetings with individual stakeholders to provide them with additional opportunities to present and discuss individual concerns. Chapter 2 of this plan presents the prioritized goals and objectives. The objectives for each goal provide a conceptual framework for devising specific actions. Appendix A of this plan contains SCPC meeting minutes and other communications generated during the course of plan development.

1.2.3 Data Collection

The data needed to objectively assess the condition of the watershed included information on the land uses, infrastructure, drainage network, natural resources, topography, existing problems, stakeholder concerns, and institutional activities. The Northeastern Illinois Planning Commission (NIPC), SMC, the Lake County Soil and Water Conservation District (LCSWCD), and the Lake County Health Department (LCHD) had performed previous data collection and assessment activities. Stakeholders provided detailed information on specific locations with problems in the watershed during SCPC and one-on-one

meetings. Because the NIPC and LCSWCD stream, lake, and detention basin assessments had been completed from 1992 through 1995, SMC conducted additional fieldwork to update the previous data and assessments. The updated data and assessments were used to develop this watershed management plan. The updated stream, lake, and water quality assessments are included in a separate supplement to this report. The updated detention basin inventory is included in Chapter 5.

1.2.4 Organization of the Watershed Management Plan

The watershed management plan is organized in six chapters, including this introduction (Chapter 1). Chapter 2 details the goals and objectives for the plan as the participating stakeholders developed them. The goals and objectives are prioritized and reflect the consensus opinion of the participating stakeholders regarding the future of the watershed.

Chapter 3 describes the physical characteristics of the watershed. Chapter 3 presents information about each lake, including shoreline assessments and biological data. It also includes information about the drainage system, land use, and natural resources present in the watershed. Chapter 4 presents a detailed analysis of the existing and anticipated future conditions of the watershed based on the year 2020 planning horizon. In addition, Chapter 4 identifies existing and anticipated problems based on current knowledge of the development trends in the watershed. The chapter also identifies opportunities that provide the framework for the programmatic and site-specific actions discussed in Chapter 5.

Chapter 5 presents the prioritized action plan. This chapter identifies actions that will address existing conditions as well as actions that will address anticipated conditions based on the year 2020 planning horizon. The chapter also assigns responsibilities for plan implementation. The action plan includes a combination of programmatic and site-specific action items. Programmatic action items are applicable throughout most of the watershed. Site-specific action items are to be implemented at specific locations in the watershed and include items such as bank stabilization, retrofitting of detention basins, and culvert maintenance. The most important action item for accomplishing the goals and objectives of the watershed management plan is proper management of the remaining open lands in the watershed. The goals of reducing flood damages, reversing water quality degradation, and preserving natural resources in the watershed will be impossible to meet if key decisions about land use and land preservation are not made and incorporated into the plan.

Chapter 6 presents conclusions of the watershed management plan. Minutes of all SCPC meetings are included in Appendix A. A separately bound supplement to this report contains the detailed inventory data, detailed water quality assessment results, and a "toolbox" for implementing best management practices (BMP). This supplement is referenced throughout this watershed plan as "supplement."

CHAPTER 2

GOALS AND OBJECTIVES

The SCPC established and prioritized four goals for this watershed management plan to address the issues and opportunities identified by stakeholders. Specific objectives were then identified and prioritized to support the attainment of each goal. For the watershed management plan to be effective, the objectives then had to be linked to specific action items that address the concerns of local residents and other stakeholders within existing constraints. Chapter 4 analyzes the existing and anticipated future problems in the watershed and identifies opportunities used as the framework for developing the action items presented in Chapter 5. Sets of action items were developed to achieve each of the goals and objectives presented below, and some action items can achieve multiple objectives.

GOAL 1: REDUCE RUNOFF AND IMPROVE WATER QUALITY	
Objective 1:	Reduce Existing Pollutant Loads to Sequoit Creek from Runoff and Point Sources to Meet Established Water Quality Standards or Guidelines
Objective 2:	Reduce Nutrient, Sediment, and Fecal Coliform Loads to Sequoit Creek and Lakes
Objective 3:	Reduce Existing Erosion Problems Throughout the Watershed
Objective 4:	Minimize Pollutant Loads and Erosion Problems in Future Developments

GOAL 2: MINIMIZE FLOOD DAMAGES	
Objective 1:	Preserve Floodplain
Objective 2:	Reduce Flood Peaks and Runoff Volumes
Objective 3:	Improve and Maintain Drainage Systems
Objective 4:	Protect Property and Critical Facilities in Flood Hazard Areas

GOAL 3: IMPROVE EDUCATION AND OUTREACH PROGRAMS FOR THE PUBLIC, DEVELOPERS, AND COMMUNITY LEADERS	
Objective 1:	Develop a School Program Based on the Watershed
Objective 2:	Provide Watershed Information and Education Resources for Community Leaders and the Public
Objective 3:	Promote Stewardship of Sequoit Creek and Lakes in the Watershed by Increasing Public Participation

GOAL 4: PROTECT AND RESTORE NATURAL RESOURCES	
Objective 1:	Protect and Restore Ecologically Significant Areas
Objective 2:	Protect Threatened and Endangered Species
Objective 3:	Protect Existing Greenways and Create Trails
Objective 4:	Protect Open Land

CHAPTER 3
WATERSHED CHARACTERISTICS

This chapter discusses characteristics of the Sequoit Creek watershed and their influence on and consideration in the watershed management plan. Specific items discussed include the watershed boundary, soil conditions, drainage characteristics, population and land uses, streams and lakes, and greenways and trails.

3.1 WATERSHED BOUNDARY

The Sequoit Creek watershed is a subwatershed of the Fox River watershed. The watershed has an area of 7,940 acres or 12.4 square miles. The boundary of the Sequoit Creek watershed is shown on Figure 3-1. The watershed boundary was delineated using year 2000, 2-foot-contour topographic maps (Chicago Aerial Survey 1997). This boundary differs from the previous boundary, which was based on U.S. Geological Survey (USGS) 5-foot-contour topographic maps, in that Antioch Lake and Ackerman's Channels (Lake Tranquility) are no longer within the watershed but Redwing Marsh is. The Sequoit Creek watershed was further subdivided into subwatersheds that form the basis for analyzing watershed conditions and developing the prioritized action plan discussed in Chapters 4 and 5, respectively.

3.2 SOIL CONDITIONS

As part of a hydrologic study of the watershed (Consoer Townsend Envirodyne Engineering [CTE] 2000), soil conditions were assessed and combined with land use types to determine runoff parameters for a hydrologic model. The Sequoit Creek watershed is dominated by a significant coverage of hydric soils, wetlands, and lakes in addition to poorly drained Pella, Ashkum, and Wauconda soil types. Soil permeability is an important factor in areas of the watershed served by septic systems. The Great Lakes Geologic Mapping Coalition, which is composed of USGS and the States of Illinois, Indiana, Ohio, and Michigan, selected the Antioch quadrangle (which includes the Sequoit Creek watershed) for mapping as one of the high-priority areas for a program to identify the locations of aquifer recharge areas and shallow aquifers and to obtain geologic information on the vulnerability of shallow aquifers to contamination. Information from this study will be available by 2004. A detailed hydrologic classification of the soils in the watershed is included in the supplement to this watershed management plan.

Figure 3-1 Sequoit Creek Watershed Boundary

3.3 DRAINAGE CHARACTERISTICS

This section discusses the drainage characteristics of the Sequoit Creek watershed in terms of the natural drainage system, the storm sewer system, the agricultural drainage tile network, and detention basins. The Sequoit Creek mainstem and its associated lake and tributary system (see Figure 3-1) form the primary drainage network in the watershed. Manmade modifications to the natural system consist of ditches, channelization, floodplain encroachment, a network of storm sewers, detention basins, culverts, bridges, and agricultural tiles. The natural drainage system and the manmade modifications collect runoff and convey it from the watershed to its primary outlet at Lake Marie. Lake Marie is part of the Chain of Lakes system that drains into the Fox River. A network of storm sewers, detention basins, and drainage ditches serves the urbanized parts of the watershed. Ditches and agricultural tiles drain agricultural areas.

Because the drainage system determines how stormwater moves through the watershed, one of the first tasks in developing the watershed management plan was to compile an inventory of the storm sewer system, agricultural drainage tile network, and detention basins. Each of these watershed features is discussed below.

3.3.1 Natural Drainage System

Topography has a dominant influence on the drainage characteristics of a watershed. Because of the gently sloping to flat terrain that makes up most of the Sequoit Creek watershed, the watershed is without many prominent relief features. The natural drainage system consists of natural streams, lakes, depressions, and swales. The depressions were created during the glacial period, and the most prominent of these depressions are now lakes. The less prominent depressional areas nevertheless serve an important function of storing floodwaters before releasing them slowly into the drainage ways or recharging groundwater.

3.3.2 Storm Sewer System

Figure 3-2 presents the storm sewer system in the urbanized areas of the watershed. The storm sewer system is an important infrastructure component because it has a direct impact on flooding and water quality in the areas it serves. Based on existing land uses, about 20 percent of the watershed is served by storm sewers. The portion of the watershed served by storm sewers is expected to increase to 30 percent

Figure 3-2 Storm Sewer System

by 2020. In Antioch, the storm sewer system is more extensive than is shown on Figure 3-2 because approximately half of the system in the older parts of the village has not been mapped; however, mapping of the sewer system will be completed within the next 5 years. Figure 3-2 shows the newer areas of Antioch for which as-built sewer plans are available and areas where sewer field surveys have been conducted (Village of Antioch 1985; Village of Lake Villa 2001).

3.3.3 Agricultural Drainage Tile Network

The agricultural drainage tile network in the Sequoit Creek watershed dates back to the area's initial settlements. For this reason and because the network is a subsurface system, it is the least known component of the drainage system. Knowledge of the condition and locations of the drainage tiles is important, however, because many local flooding problems are associated with failure, inappropriate disconnection, or faulty abandonment of drain tiles. Existing drain tiles can also be used to enhance wetland hydrology when site conditions allow. The limited information depicted on Figure 3-2 was compiled from records maintained by LCSWCD, which obtained the information from property owners on a voluntary basis. The actual drainage tile network is likely to be more extensive than shown on Figure 3-2, particularly in the predominantly agricultural areas of the watershed. The drainage tile network shown on Figure 3-2 can be regarded as a starting point for more comprehensive mapping of the network. For new development, the countywide watershed development ordinance (WDO) requires that existing drainage tiles be identified and connected to an adjacent storm sewer system or an alternative drainage system that can be maintained.

3.3.4 Detention Basins

Detention basins temporarily store stormwater. If they are properly designed and maintained, detention basins can provide benefits such as reducing peak flows and enhancing water quality. Poorly designed or inadequately maintained detention basins can cause flooding, may not provide water quality benefits, or may be unsafe. Updating the inventory of the detention basins in the watershed and documenting the condition of the basins were both necessary for developing the watershed management plan. The existing inventory compiled by NIPC (NIPC 1995) was updated based on subdivision plans and storm sewer information supplied by the Villages of Lake Villa and Antioch and the Lake County Building and Zoning Department. Figure 3-3 shows the distribution of the detention basins in the watershed. Detention basin data collected includes basin types, types and sizes of control structures, signs of erosion,

Figure 3-3 Detention Basins

blockages, conditions of surrounding land, and conditions of receiving streams. The inventory was updated to (1) identify detention basins that might have been missed in NIPC's 1995 survey, (2) identify basin design or maintenance problems, and (3) identify potential opportunities for retrofitting the basins to enhance their performance.

3.4 POPULATION AND LAND USES

Population trends are critical factors in watershed management planning because as the population increases, the needs for housing, public services, and infrastructure also increase. Population growth and development are accompanied by changes in land use, which in turn can have unintended impacts on people and natural resources, such as increased flood damages, degradation of water quality, and loss of habitat by increased runoff. Tables 3-1and 3-2 present watershed demographics for the periods from 1990 to 2000 and 2000 to 2020, respectively. These statistics indicate major population growth in the watershed in the next 20 years. Table 3-2 presents the low, average, and high population growth projections. By 2020, the population of Antioch is projected to triple, while that of Lake Villa is projected to double. If such population increases occur, the resulting impacts on the natural resources and people in the watershed will be substantial.

TABLE 3-1
POPULATION TRENDS IN SEQUOIT CREEK WATERSHED

Community	1990 Census	2000 Census	Change
Antioch	6,105	8,788	44%
Lake Villa	2,857	5,864	105%
Unincorporated Antioch Township	10,951	11,450	5%
Unincorporated Lake Villa Township	9,873	9,329	-6%

Source: U.S. Census Bureau 2000

TABLE 3-2
POPULATION FORECASTS FOR SEQUOIT CREEK WATERSHED (2000 TO 2020)

Community	2000 Census	2020 Population Forecast		
		Low Growth	NIPC Forecast	High Growth
Antioch	8,788	19,806	21,030	22,254
Lake Villa	5,864	12,371	13,094	13,817
Unincorporated Antioch Township	11,450	13,024	13,199	13,374
Unincorporated Lake Villa Township	9,329	9,513	9,533	9,553

Sources: U.S. Census Bureau 2000; Lake County Draft Framework Plan 2003
NIPC forecast endorsed on September 27, 2000, based on the assumption that no new south suburban airport is built.

The Regional Framework Plan low-growth scenario assumes the population growth by 2020 will be 10 percent less than the NIPC forecast. A high growth scenario assumes the population growth by 2020 will be 10 percent more than the NIPC forecast.

Estimates of current land uses and forecasts of future land uses associated with the population growth projections are shown on Figures 3-4 and 3-5, respectively. Table 3-3 summarizes expected changes in land use that will accompany the projected population growth in the watershed from 2003 to 2020.

Land use estimates for 2003 indicate that the predominant land uses in the watershed are as follows: residential (30 percent), agricultural (18 percent), open water (13 percent), and vacant (13 percent). This amounts to approximately 19 percent of the watershed being covered by impervious surfaces, based on the Lake County 2002 land use classification and the NRCS Technical Release 55 (NRCS 1986). Between 2003 and 2020, about 15 percent of the agricultural, open space, wetland, and vacant land is expected to be developed into residential, commercial, and industrial land.

Figure 3-4 Land Use Estimates for 2003

Figure 3-5 Land Use Changes for 2020

TABLE 3-3
PREDICTED LAND USE CHANGES FROM 2003 TO 2020

Land Use	2003		2020		
	Acres	Percentage of Watershed	Acres	Change (Acres)	Percentage Change
Commercial	270	3	330	+60	+22
Industrial	210	3	360	+150	+71
Institutional	290	4	220	-70	-24
Transportation[a]	90	1	93	3	+3
Residential, Sewered	1,600	20	2,345	+745	+47
Residential, Unsewered	830	10	1,080	+250	+30
Agricultural	1,450	18	1,025	-415	-29
Vacant	1,030	13	540	-490	-48
Open Space	240	3	200	-40	-17
Wetlands	920	12	740	-180	-20
Open Water	1,010	13	1,010	0	0
Total	**7,940**	**100**	**7,940**	**0**	**0**

Sources: SMC 2001a and 2002b

[a] Only major roads are considered. The minor road network serving existing development will be expanded to accommodate projected development.

By 2020, the "built" area is expected to increase by 34 percent. To accommodate the increased population and traffic volumes anticipated in Lake County, the Village of Antioch is planning to expand Route 173 to six lanes from Interstate 94 west to US Route 45, and to four lanes from US Route 45 west to Grimm Road (SEC 2003). However, the remainder of the basic road network is expected to remain essentially unchanged for the next 5 to 10 years, except for new roads that will serve new subdivisions in Lake Villa and Antioch (Tetra Tech EM Inc. [Tetra Tech] 2001a, 2001b).

The projected changes in land use will directly impact runoff and water quality in the watershed. In particular, the degree of imperviousness of the ground surface, which correlates to the amount of runoff, will increase significantly.

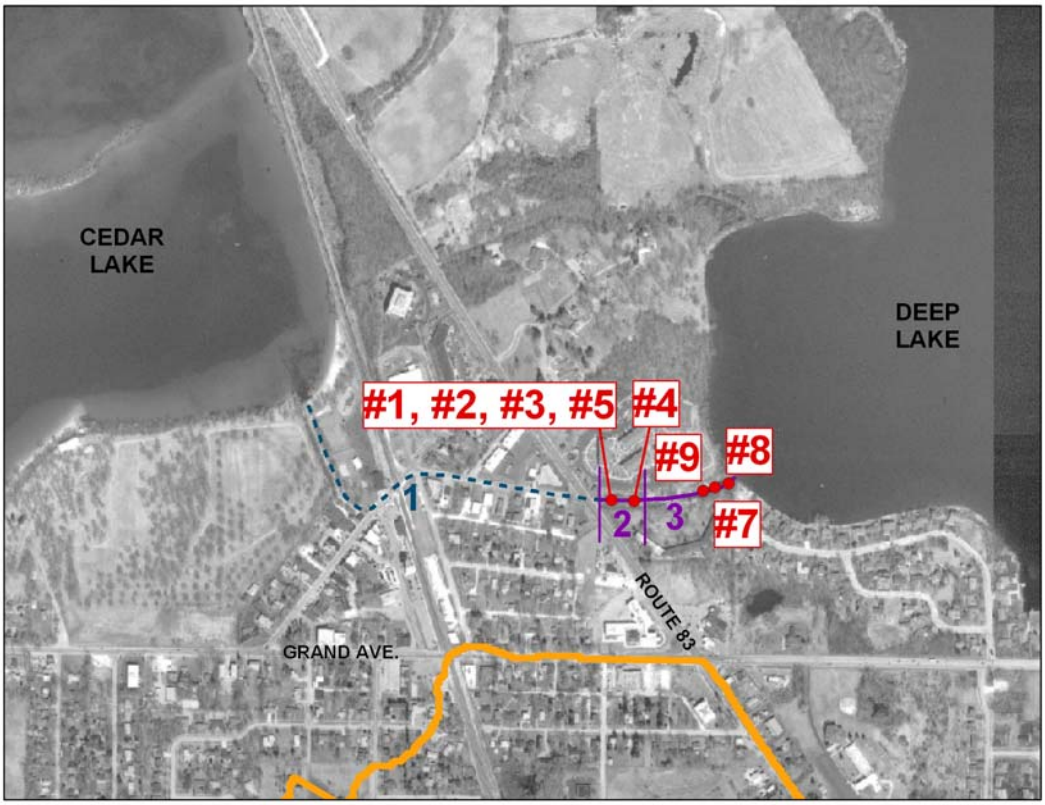
3.5 STREAMS AND LAKES

This section describes the general characteristics of streams and lakes in the Sequoit Creek watershed. These streams and lakes are unique natural resources in Illinois. They provide habitat for a variety of threatened and endangered species; provide recreational benefits such as swimming, fishing, and boating; and function as natural reservoirs for storing floodwaters. This watershed management plan is partially intended to preserve and enhance these unique resources.

3.5.1 Sequoit Creek

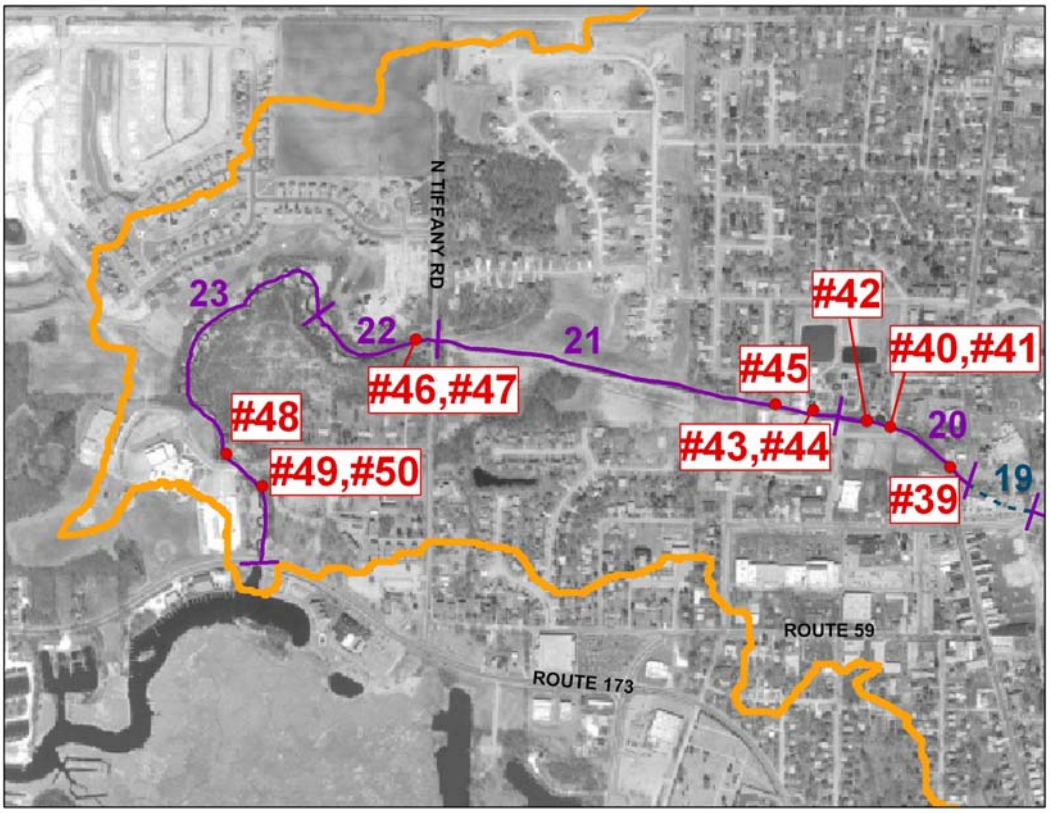
As shown on Figure 3-1, Sequoit Creek is about 6 miles long and has a number of tributaries that total about 6.1 miles in length. The creek flows from south to north. Sequoit Creek is especially important because it drains several of the highest-quality lakes in Illinois, such as Cedar Lake, Deep Lake, Sun Lake, East Loon Lake, West Loon Lake, Little Silver Lake, and Redwing Marsh. The creek has a gentle to moderate slope of about 6 feet per mile. Upstream reaches of the creek run adjacent to urbanized areas of the Village of Lake Villa, which had a population of about 6,000 in 2000 (U.S. Census Bureau 2002). The middle reaches of the creek run adjacent to open spaces containing wetlands and meadows. Downstream reaches of the creek run adjacent to the urbanized areas of the Village of Antioch, which had a population of about 9,000 in 2000 (U.S. Census Bureau 2002). Sequoit Creek has suffered from manmade impacts since the 1900s, including channelization, floodplain encroachment, and piping (the process of enclosing a stream in an underground conduit).

Examples of manmade modifications to the creek are shown in the photographs presented below. The purple numbers represent reaches of the creek that were surveyed in 2001, the blue numbers represent reaches that were not surveyed, and the red numbers represent points where photographs were taken. Sequoit Creek's most upstream reach is enclosed in an underground storm sewer pipe that runs from Cedar Lake to Route 83, as shown in Photograph 1 below (dashed line denotes underground pipe and solid line denotes aboveground creek).



Photograph 1

The creek's downstream reach in Antioch runs through a large, underground pipe as shown in Photograph 2 (dashed line on right-hand side of photo). Other manmade modifications of the creek include channelization and construction of bridges and culverts. Artificial modifications such as these have diminished the ability of the creek to support aquatic life and convey floodwaters. The impacts of such past actions are now being recognized, and watershed stakeholders are looking for better ways to manage the creek and associated natural resources.



Photograph 2

Because the creek is hydrologically connected to several lakes, its water quality and that of the lakes are interdependent. In general, the nutrient and solids concentrations of the creek tend to improve or decrease downstream because the lakes act as sinks and dilution occurs due to increased flow.

Sequoit Creek discharges to Lake Marie near the head of the Chain O'Lakes. A watershed management plan that achieves reductions of pollutants in the Sequoit Creek watershed will therefore benefit the Chain O'Lakes as well (NIPC 1995). Development of an effective management plan for the watershed required that the condition of Sequoit Creek be objectively assessed. Such an effort began in 1992, during which NIPC performed a detailed, reach-by-reach assessment of the creek. NIPC's 1992 stream assessment for the watershed is described in the "Sequoit Creek Watershed Management Project: Stream Condition Report" (NIPC 1992). This assessment was updated in 2001. In addition, principally LCHD and Illinois Environmental Protection Agency (IEPA) have performed ongoing water quality monitoring along the creek. The detailed results of the monitoring are included in the supplement to this report, and the main findings of the monitoring are discussed in Chapter 4.

3.5.2 Lakes

The Sequoit Creek watershed includes eight lakes as shown on Figure 3-1. These are Cedar, Deep, Sun, East Loon, West Loon, Little Silver, and McGreal Lakes, and Redwing Marsh. As described in Section 3.5.1, Sequoit Creek and the lakes are interlinked. The general characteristics of the lakes in the Sequoit Creek watershed are described below. To assess the condition of the lakes, LCSWCD conducted a lake shoreline assessment in 1992. LCHD completed intensive shoreline assessments and mapping of all eight lakes from 2001 to 2003. In addition, ongoing, in-lake monitoring by IEPA and LCHD has provided data that allowed assessments of water quality trends of the lakes since 1985. The assessments have helped identify both problems and opportunities for preserving the lakes as natural resources. The pollutant of concern for most lakes is nutrients. The enrichment of water bodies such as lakes by nutrients is called eutrophication. Degrees of eutrophication typically range from oligotrophic water (maximum transparency, low nutrient loads) through mesotrophic (moderately eutrophic), to hypereutrophic water (minimum transparency, high nutrient loads). Eutrophication of a lake normally contributes to its slow evolution into a bog or marsh and ultimately to dry land. Eutrophication and the resulting aging process may be accelerated by human activities. Another concern is water clarity. Lakes are assessed using Secchi disks to determine depth of visibility. Secchi disks are disks divided into quadrants of alternating white and black colors. They are lowered into a water body until they are no longer visible. The depth at which they become invisible is recorded as a measure of water clarity. IEPA guidelines state that visibility should be greater than 2 feet for swimming use and greater than 6.6 feet for aquatic life. (IEPA 2000) The findings of the assessment are discussed in Chapter 4. Detailed information from the 1992 lake shoreline assessment, such as the locations of hydraulic structures, is provided in the "Sequoit Creek Watershed Management Project: Shoreline Inventory" (LCSWCD No Date). In addition, a supplement to this plan contains both the detailed results of the shoreline assessment and monitoring data.

3.5.2.1 Cedar Lake

Cedar Lake is the largest lake in the watershed and has a surface area of 302 acres, a maximum depth of 44 feet, and an average depth of about 7.9 feet. Surrounding Cedar Lake are residential areas to the north, railroad tracks to the east, recreational and residential land to the south, and open space with institutional facilities to the west. The three largest land types draining into the Cedar Lake subwatershed are forest and grassland (17 percent), residential (15 percent), and public and private open space (9 percent).

Cedar Lake is a stratified lake. Stratification results in two or more water layers of differing characteristics, such as temperature or density. Stratification also applies to other characteristics such as dissolved oxygen, suspended sediments, and visibility. For example, average temperatures in Cedar Lake range from 23.5 ^{o}C at the surface to 12.1 ^{o}C at the bottom. This temperature stratification can result in anoxic conditions and nutrient loading in the hypolimnion (deepest layer) of the lake. Anoxic conditions sometimes occur because the hypolimnion is too dark for plants to grow and the temperature gradient prevents oxygen exchange with the air from reaching the hypolimnion. Bacteria consume the available oxygen, and no new dissolved oxygen is available. Phosphorus and nitrogen are also released from sediments during stratification and anoxic conditions. These nutrients build up in the hypolimnion and lead to nutrient enrichment. During fall turnover, they are released into the rest of the lake, often causing a spike in nutrient concentrations and algal blooms.

Cedar Lake is considered by IDNR to be a biologically significant water body because it contains various state threatened and endangered plants and fish (IDNR 1990 and 1991). Twenty-eight plant species were present in Cedar Lake in 2003. Three of the most commonly found species were Eurasian water milfoil, sago pondweed, and largeleaf pondweed. Eurasian water milfoil was the most frequently sampled aquatic plant species, occurring in 66 percent of all samples. Eurasian water milfoil is invasive but can be controlled by the milfoil weevil (*Euhrychiopsis elcontei*). Although weevils were present in 2003, the milfoil density was not observed to decrease as it had in 1995 and 1998. Ten species of fish were recorded in 2003, including one state endangered species. Cedar Lake contains some potentially problematic invasive species, notably zebra mussels that were discovered in 2003. Several invasive species of shoreline plants were also observed in 2003, among them purple loosestrife, reed canary grass, common reed, honeysuckle, and buckthorn. These species tended to be concentrated along the east and southwest shorelines and along the island shorelines.

No specific management group has been in charge of Cedar Lake, and in general not many management activities are performed on the lake. Cedar Lake is not stocked with game fish. The aquatic herbicides glyphosate and 2,4-D were applied in 2002 and 2003, respectively, to the area owned by Cedar Lake Park to control Eurasian water milfoil and spatterdock. A 10 horsepower restriction prevents boaters with large engines from using the lake, although this restriction is not followed by all residents (LCHD 2003b).

3.5.2.2 Deep Lake

Deep Lake covers about 226 acres and has a maximum depth of 48 feet and an average depth of about 17.5 feet. It is one of the largest lakes in the watershed and is the third deepest lake in Lake County. Residential property, natural areas, and a golf course surround Deep Lake.

Like Cedar Lake, Deep Lake is stratified. The average temperature at the surface is 23.2 ºC, while the average temperature at the bottom is 8.4 ºC. Monitoring data indicate that Deep Lake is clear, with Secchi disk measurements well above IEPA's swimming guideline of 2.0 feet. In addition, water clarity has been improving since 1987.

The Illinois Department of Natural Resources (IDNR) considers Deep Lake to be a biologically significant water body because it contains various endangered plants and fish (IDNR 1990 and 1991). Twenty-five plant species were present in Deep Lake in 2003, and only two of those species were non-native. However, Eurasian water milfoil was the dominant species and was present at 94 percent of the sites sampled. Although no milfoil weevils were observed in the lake in 2003, the weevils were observed in previous years, and milfoil damage was observed in 2003.

Eurasian water milfoil has been managed at Deep Lake for a number of years. The Deep Lake Improvement Association (DLIA) manages Deep Lake and lake-related issues in the immediate surrounding areas. In 1989, the DLIA conducted harvesting to reduce plant mass in a portion of the lake, and from 1998 to 2003 the lake was managed for plant density. Originally, invasive species (primarily Eurasian water milfoil) were targeted with herbicide, but recently native species have been targeted as well. In 1998, a variety of herbicides were used, but since 2001 Reward has been used throughout the lake unless the property owner requests the use of granular 2,4-Dichlorophenoxyacetic acid (2,4-D) instead.

Several invasive plant species were found along the Deep Lake shoreline in 2003, including Canada thistle, common reed, reed canary grass, honeysuckle, and buckthorn. These invasive species were present along 60 percent of the shoreline.

Fish have been stocked in Deep Lake every few years dating back at least to 1990. In 1990, northern pike, largemouth bass, and walleye were stocked. After that, fish were stocked in Deep Lake in 1995,

1997, 1998, 2001, and 2003. In each year, the fish species stocked were crappie, largemouth bass, or walleye. A 10-horsepower limit exists for all boats launched from the public launch; however, residents are exempt from this requirement (LCHD 2004). Fish stocking can have detrimental effects on lake ecosystems. It is important to consider the species of fish already present in the lake when determining what types of fish to stock. Game fish will often eat each other or smaller native fish if an inadequate food supply is present. This can contribute to the reduction of threatened or endangered species populations that may already be at risk from degraded water quality. In addition, fish should not be stocked into degraded ecosystems.

3.5.2.3 Sun Lake

Sun Lake is located in the Lake County Forest Preserve and is surrounded by extensive wetlands. Sun Lake is one of the smaller lakes in the Sequoit Creek watershed. It has an area of 25 acres, an average depth of 9.5 feet, and a maximum depth of 19 feet. The lake has an unconsolidated bottom and is completely ringed by cattails. Sun Lake could not be accessed during the 2001 inventory, and 1992 lake shoreline assessment notes were not compiled for the lake because it is natural, lacks a defined shoreline, and has an extensive cattail fringe. Sun Lake is a stratified lake based on dissolved oxygen profile samples collected in 1992 by IEPA and in 1992 and 1993 by LCHD. Secchi disk measurements were taken during all the sampling events, and Sun Lake was found to have good clarity, with measurements never dropping below 5.5 feet.

LCHD performed an aquatic plant assessment at Sun Lake in 2001. The survey found 15 aquatic plant species, two of which were invasive exotic species. Eurasian water milfoil was the dominant species in Sun Lake and occurred at 74 percent of the sites sampled. The milfoil weevil was also observed to be present and doing moderate damage. Aquatic plants covered 65 percent of the lake in 2001. Two invasive species (purple loosestrife and reed canary grass) were observed along the shoreline. These invasive species were present along 100 percent of the shoreline. No state listed threatened or endangered plant species were observed during the survey. Thirteen species of birds were observed around Sun Lake, and two of those species were state listed threatened or endangered species. Because Sun Lake is within LCFPD property, no boating and only bank fishing are allowed. No management or fish stocking information was available for Sun Lake (LCHD 2003).

3.5.2.4 East Loon Lake

East Loon Lake is located in the middle of the Sequoit Creek watershed and is connected to West Loon Lake by a canal. Sequoit Creek flows through East Loon Lake. East Loon Lake occupies 187 acres and has a maximum depth of 26 feet and an average depth of about 6.8 feet. The lake is surrounded by private open land to the northwest and residential areas in all other directions. Monitoring data indicate that East Loon Lake is stratified. The data also show that East Loon Lake has poor clarity compared to other lakes in the watershed. Secchi measurements taken in East Loon Lake have often been below 6.6 feet. East Loon Lake is eutrophic (U.S. Environmental Protection Agency [EPA] 2000b; LCHD 2001b; IEPA 2001a).

East Loon Lake is managed by the Loon Lakes Management Association (LLMA). The lake is managed for the excessive Eurasian water milfoil density through aquatic plant harvesting. The purpose of harvesting is to reduce the density of the exotic species and allow native species to increase their growth. It also improves the recreational function of the lake by making it easier for boaters to navigate. LLMA does not perform any other aquatic plant management on East Loon Lake, but some individuals and private homeowner associations use herbicide treatments on their property.

East Loon Lake is considered by IDNR to be a biologically significant water body because it contains various state threatened and endangered plants and fish (IDNR 1990 and 1991). The preliminary data from an aquatic plant assessment performed by LCHD in 2003 suggest high plant diversity. No threatened or endangered plant species were recorded during the survey. Eurasian water milfoil was the most frequently occurring species surveyed, while the occurrence of native species was much lower. Plant densities on East Loon Lake are far above the target of 30 to 40 percent coverage, mostly because of the dense coverage of Eurasian water milfoil. Invasive species (purple loosestrife, buckthorn, and reed canary grass) were present along the shoreline of East Loon Lake, but most infestations were considered light. East Loon Lake does not appear to contain zebra mussels yet; however, no formal mussel surveys were conducted on the lake in 2003. Fish species were surveyed by IDNR in 2003 and appear to be in good condition and to have an even distribution of size classes. The main fish species present in East Loon Lake are typically largemouth bass, northern pike, black crappie, and blue gill. In past years, five state threatened and endangered fish species have also been found at the lake. These species were not recorded in 2003 at East Loon Lake, but were recorded in 2002 at West Loon Lake and are assumed to still be present. No fish stocking information is available for East Loon Lake (LCHD 2003c).

3.5.2.5 West Loon Lake

West Loon Lake is also located in the middle of the Sequoit Creek watershed just west of East Loon Lake. West Loon Lake is connected to East Loon Lake by a small canal that is about 50 feet wide and 2 feet deep. Residential areas surround the lake except on the western shoreline, which is bordered by railroad tracks. West Loon Lake occupies 166 acres and has a maximum depth of 38 feet and an average depth of about 14.8 feet. Secchi disk and total suspended solids measurements indicate that West Loon Lake has good clarity, and monitoring data indicate that West Loon Lake is mesotrophic.

IDNR considers West Loon Lake to be a biologically significant water body because it contains various state threatened and endangered plants and fish (IDNR 1990 and 1991). LCHD conducted an aquatic plant survey of West Loon Lake in 2003. The preliminary data indicate that West Loon Lake has high aquatic plant diversity. They also indicate that it has high aquatic plant density. Sago pondweed was the most frequently found species, with *Chara*, Illinois pondweed, vallisneria, water star grass, and American pondweed also present in significant proportions. Only one state threatened species was found at West Loon Lake in 2003, although three state threatened and endangered species have been recorded by IDNR in past years. Eurasian water milfoil was found almost as frequently as sago pondweed. LLMA performs lake management activities in the form of harvesting Eurasian water milfoil at West Loon Lake. Harvesting activities are specifically targeted at areas that have problems with Eurasian water milfoil; areas of the lake that support native vegetation are not harvested. LLMA does not perform any other lake management activities at West Loon Lake, but some individuals and private homeowner associations use herbicide treatments. West Loon Lake was reported as having average wildlife habitat for a residential area. However, it seems to be home to a diverse population of bird species, including two state threatened and endangered species. Invasive shoreline plants (purple loosestrife, buckthorn, and reed canary grass) were present on approximately one-third of the properties assessed, and most infestations were classified as light. A mussel survey was also conducted in 2003. A high number of native mussel species were found, as well as the invasive zebra mussel. IDNR conducted a fish survey in 2003 that suggests that the main fish species (largemouth bass, northern pike, black crappie, and blue gill) are in good condition and have an even distribution of size classes. Three state endangered fish species and one state threatened fish species were observed during this survey. No information on fish stocking policies is available for West Loon Lake (LCHD 2003d).

3.5.2.6 Little Silver Lake

Little Silver Lake is the most downstream lake in the Sequoit Creek watershed. The lake occupies 42 acres and has a maximum depth of 20.5 feet and an average depth of about 10 feet. The lake is surrounded by single-family homes to the north and natural wetland areas in all other directions. Cropland is also located southwest of the lake. Little Silver Lake is stratified according to data collected by LCHD in 1992 and 1993. Clarity in Little Silver Lake is very good. Its average Secchi disk measurement in 2002 was 138 inches, making it the sixth clearest of 63 lakes monitored for transparency by IEPA's Volunteer Lake Monitoring Program (NIPC 2003). Monitoring data indicate that Little Silver Lake is mesotrophic and has good water quality (LCHD 2001b; IEPA 2001b).

Little Silver Lake has been managed by the Little Silver Lake Improvement Association (LSLIA) since the 1970s. At that time, the LSLIA managed the lake through the application of copper sulfate and 2,4-D, and the use of a weed cutter. The weed cutter was used to manage white water lily populations, but the weed cutting was abandoned approximately 10 years ago. The weed cutter is still in use by a few homeowners. Individual homeowners also apply herbicide to their property in some areas even though LSLIA has discontinued the use of herbicides. No information on fish stocking policies is available.

Little Silver Lake is considered to be a biologically significant water body because it contains various state threatened and endangered plants and fish. Additional information about Silver Lake is contained in the "Little Silver Lake Watershed Management Plan" report SMC (2001). LCHD conducted an aquatic plant survey for Little Silver Lake in 2003. The survey recorded 23 species of aquatic plants, one of which was state threatened and two of which were exotic species. White water lily was the dominant species recorded at Little Silver Lake. Coontail and Eurasian water milfoil had a high frequency of occurrence, but were found only in low densities. During the aquatic plant survey, invasive species (Canada thistle, reed canary grass, honeysuckle, purple loosestrife, and buckthorn) were observed along 40 percent of the shoreline. In 2003, 13 fish species were observed during a wildlife assessment at Little Silver Lake, including one state endangered and one state threatened species. A very diverse avian population is present at Little Silver Lake because over half of the shoreline is undeveloped and composed of wetland, woodland, and buffer areas. Over 50 species of birds were observed in 2003 including 4 state threatened or endangered species. LCHD is nominating Little Silver Lake for Natural Area Inventory status due to the diverse wildlife population and the presence of threatened and endangered species (LCHD 2004b).

3.5.2.7 McGreal Lake

McGreal Lake is the only manmade lake within the Sequoit Creek watershed. The lake was constructed in 1955 about 1 mile southeast of the Village of Antioch. McGreal Lake is located in the northeast corner of the Sequoit Creek watershed and is linked to other lakes in the watershed by a series of detention basins and drainage ways that extend from McGreal Lake to Little Silver Lake. McGreal Lake is about the same size as Sun Lake. The lake has a surface area of 25 acres, a maximum depth of 8 feet, and an average depth of only 4 feet. McGreal Lake is not stratified. Secchi disk measurements indicate that McGreal Lake is eutrophic and has poor clarity.

LCHD conducted an aquatic plant survey at McGreal Lake in 2002. Thirteen plant species were recorded. Curlyleaf pondweed, Eurasian water milfoil, and coontail were the dominant plant species recorded, and sago pondweed was also present in high abundance. Eurasian water milfoil occurred with 45 percent frequency at sampling sites. However, it appeared to be experiencing significant damage from the milfoil weevil, which was also present in high density. Eight invasive shoreline species were also documented during the aquatic plant survey. These species were observed along 86 percent of the shoreline. Reed canary grass, one of the invasive species, was dense in wetland areas of the shoreline. A large variety of wildlife species were observed at McGreal Lake during a 2002 wildlife assessment. Three state threatened or endangered bird species were recorded. In the past, McGreal Lake has contained largemouth bass, bluegill, and green sunfish. Largemouth bass and mixed panfish have been stocked at McGreal Lake historically, but no recent fish data is available for this lake. No management association exists for this lake; management is left to individual homeowners. No motorboats are allowed on the lake, and limited numbers of any kind of boat are allowed on the lake simultaneously (LCHD 2003a).

3.5.2.8 Redwing Marsh

Redwing Marsh is located just south of Highway 173. Most of the lake is surrounded by natural wetlands, but a newly constructed residential area lines the eastern shoreline south of 173. LCHD conducted an aquatic plant survey at Redwing Marsh in 2003. Preliminary data indicate very few aquatic plants and low plant diversity. Coontail was the dominant plant present during the survey. In addition, the water quality is low, and the marsh is considered too shallow to support many fish species. There was a resident carp population, which was suspected of keeping the plant population from expanding. The waterfowl population was also found to be lacking, possibly due to the proximity of major roads.

Scattered purple loosestrife plants were noted along the shoreline. Redwing Marsh is owned and managed by the Lake County Forest Preserve District (LCHD 2004a).

3.6 NATURAL RESOURCES

The abundance of natural resources in the Sequoit Creek watershed makes it unique in Illinois. This section discusses threatened and endangered species and ecologically significant areas in the Sequoit Creek watershed.

3.6.1 Threatened and Endangered Species

According to IDNR, 28 state-listed threatened or endangered species have been observed in the Sequoit Creek watershed: 14 plants and 14 animals (Chicago Wilderness 2000; IDNR 2001b). Of the state-listed animals, five are fish, seven are birds, and two are mammals. Table 3-4 lists the threatened and endangered species that have been observed in the watershed and their state status. Collectively, these species have been observed at the following sites in the watershed:

- Sun Lake and Sun Lake Forest Preserve
- East Loon Lake
- West Loon Lake
- Deep Lake
- Cedar Lake and Cedar Lake Bog Nature Preserve
- Deep Lake Road Low Shrub Bog
- Petite Lake Road Marsh
- Little Silver Lake

TABLE 3-4
STATE-LISTED THREATENED AND ENDANGERED SPECIES
OBSERVED IN THE WATERSHED

Scientific Name	Common Name	Status	
		Threatened	Endangered
Plants			
Beckmannia syzigachnel	American slough grass		Y
Bidens beckii	Water marigold		Y
Carex disperma	Short-leaved sedge[a]		Y
Drosera rotundifolia	Round-leaved sundew		Y
Epilobium strictum	Downy willow herb	Y	
Galium labradoricum	Bog bedstraw	Y	
Potamogeton gramineus	Grass-leaved pondweed	Y	
Potamogeton praelongus	Whitestem pondweed		Y
Potamogeton robbinsii	Fernleaf pondweed		Y
Potamogeton strictifolius	Stiff pondweed		Y
Rhynchospora alba	Beaked rush[a]	Y	
Ribes hirtellum	Northern gooseberry[a]		Y
Sarracenia purpurea	Pitcher plant		Y
Vaccinium macrocarpon	Large cranberry		Y
Fish			
Etheostoma exile	Iowa darter		Y
Fundulus diaphanous	Banded killifish	Y	
Notropis anogenus	Pugnose shiner		Y
Notropis heterodon	Blackchin shiner	Y	
Notropis heterolepis	Blacknose shiner		Y
Birds			
Chlidnonias niger	Black tern		Y
Gallinula chloropus	Common moorhen	Y	
Grus canadensis	Sandhill crane	Y	
Ixobrychus exilis	Least bittern	Y	
Pandion haliaetus	Osprey		Y
Podilymbus podiceps	Pied-billed grebe	Y	
Rallus elegans	King rail		Y
Mammals			
Sciurus carolinensis	Gray squirrel		Y
Tamias striatus	Eastern chipmunk		Y

Sources: IDNR 2001; and Chicago Wilderness 2000
Note:
[a] Included in Chicago Wilderness 2000 but not in IDNR 2001b

Figure 3-6 shows the locations of these sites within the watershed. An LCHD web site (http://www.co.lake.il.us/health/ehs/lakethreatened.htm) lists the threatened and endangered species and provides pictures of them for easy reference.

At the request of IDNR, this watershed management plan does not identify the specific location where each threatened or endangered species was observed in the watershed (IDNR 2002a). The lack of this information minimizes the potential for the public to collect threatened and endangered species. However, Table 3-5 shows the numbers of threatened and endangered plant and animal species that have been observed at each site to illustrate the distribution of such species in the watershed.

TABLE 3-5
DISTRIBUTION OF STATE-LISTED THREATENED AND ENDANGERED SPECIES ACROSS THE WATERSHED

Observation Site	Endangered		Threatened		Total State-Listed Species
	Animals	Plants	Animals	Plants	
Sun Lake and Sun Lake Forest Preserve	2	1	1	0	3 animals and 1 plant
East Loon Lake	3	1	2	0	5 animals and 1 plant
West Loon Lake	4	4	2	0	6 animals and 4 plants
Deep Lake	3	3	2	0	5 animals and 3 plants
Cedar Lake and Cedar Lake Bog Nature Preserve	2	6	2	3[a]	4 animals and 9 plants[a]
Deep Lake Road Low Shrub Bog	0	2[b]	0	0	2 plants[b]
Petite Lake Road Marsh	0	0	0	2	2 plants
Little Silver Lake	1	1	1	0	2 animals and 1 plant

Sources: IDNR 2001b; Chicago Wilderness 2000

Notes:

[a] Three plants included in Chicago Wilderness 2000; two plants included in IDNR 2001b
[b] Two plants included in Chicago Wilderness 2000; no plants included in IDNR 2001b

According to the U.S. Fish and Wildlife Service (USFWS), no federally listed endangered or threatened species had been documented in the watershed as of January 2002 (USFWS 2002). However, at a March 2002 watershed planning meeting, a resident of the watershed indicated that he had observed an eastern prairie fringed orchid (*Plantanthera leucophaea*), a federally listed species, near Little Silver Lake. After the meeting, the presence of this species in the watershed was confirmed by a qualified professional and reported to the appropriate agencies.

Figure 3-6 Ecologically Significant Areas

Accounts of threatened and endangered species in the watershed have resulted primarily from incidental observations documented and reported to IDNR and USFWS by a qualified professional. The numbers of documented threatened and endangered species in the watershed may not accurately reflect the total numbers of such species present for the reasons stated below.

- Focused surveys have not been conducted for all state and federal threatened and endangered species that could occur in the watershed. For example, several federally listed species could be present in the watershed based on their habitat requirements. These species include the bald eagle (*Haleaeetus leucocephalus*) and eastern massasauga snake (*Sistrurus c. catenatus*) (USFWS 2002).
- Observations of threatened and endangered species in the watershed may have gone unconfirmed and unreported to IDNR and USFWS.

To obtain a more accurate list of the threatened and endangered species in the watershed, species accounts should be confirmed by a qualified professional and reported to the appropriate agency. In addition, focused surveys should be conducted for all state and federal threatened and endangered species that could occur in the watershed.

3.6.2 Ecologically Significant Areas

For this watershed management plan, ecologically significant areas are classified as follows:

- Natural areas
- Managed areas
- Wetland areas
- Fox River Biodiversity Inventory sites

This section describes the ecologically significant areas and their status in the Sequoit Creek watershed. Many of the ecologically significant areas in the watershed belong to more than one of the categories listed above because of similarities in the selection criteria for the categories.

3.6.2.1 Natural Areas

Designated natural areas in the watershed are listed below and are shown on Figure 3-6 (IDNR 2002):

- Sun Lake

- West Loon Lake
- East Loon Lake
- Deep Lake
- Cedar Lake

Sun, East and West Loon, and Deep Lakes qualify as natural areas because they contain specific suitable habitat for endangered and threatened species. Cedar Lake qualifies as a natural area because it (1) contains a high-quality natural community, (2) contains specific suitable habitat for endangered or threatened species, and (3) is a state-dedicated nature preserve (IDNR 2002).

The Lake County Forest Preserve District owns Sun Lake, and West Loon Lake is privately owned. Much of East Loon Lake is privately owned; however, the Lake County Forest Preserve District recently purchased a portion of the lake. Most of Deep Lake is privately owned, with the Village of Lake Villa holding the northern portion. IDNR owns a small portion of Cedar Lake, the southeast corner of Cedar Lake is owned by the Village of Lake Villa, and the rest is privately owned (Tetra Tech 2002a).

3.6.2.2 Nature Preserves

Only very high-quality natural lands qualify as Illinois nature preserves. One nature preserve, the Cedar Lake Bog Nature Preserve, is located in the Sequoit Creek watershed. The location of this nature preserve is shown on Figure 3-6.

3.6.2.3 Forest Preserves

Three Lake County forest preserves, the Sun Lake Forest Preserve, Redwing Marsh Forest Preserve, and Sequoit Creek Forest Preserve, are located in the Sequoit Creek watershed. The locations of these forest preserves are shown on Figure 3-6.

3.6.2.4 Wetland Areas

Wetlands are among the most productive natural ecosystems on earth. Federal regulations define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for

life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 Code of Federal Regulations [CFR] 323.2.c).

In 1990, a multi-agency comprehensive inventory of wetlands was conducted for Lake County. The result was the Lake County Wetland Inventory (LCWI). In 1992, EPA initiated a program involving Advanced identification (ADID) studies to identify wetlands and other waters with high functional value in Lake County based on habitat, stormwater storage capacity, and water quality. Figure 3-7 shows the wetland areas identified in the Sequoit Creek watershed during the LCWI. Thirteen of the identified wetlands were determined to be ADID sites (Dreher and others 1992). Table 3-6 summarizes the functional values and approximate acreages of the ADID sites in the watershed. These ADID sites cover approximately 1,691 acres, or about 2.64 square miles. Hence, the ADID areas make up a significant portion (approximately 21 percent) of the 15-square-mile watershed. In addition to the designated ADID sites, a number of the other wetlands and waters identified during the LCWI (see Figure 3-7) may be classified as high-quality aquatic resource (HQAR) based on site-specific studies. HQARs are defined in the Lake County WDO. Given the regional scarcity and high functional values of the HQARs, impacts to these areas associated with proposed developments should be avoided.

Figure 3-7 ADID Sites

TABLE 3-6
ADVANCED IDENTIFICATION AREAS IN THE SEQUOIT CREEK WATERSHED

ADID Site in Figure 3-7	Biological Value	Water Quality and Hydrology Values	Approximate Acreage
6	Presence of state threatened or endangered species (bird); high-quality wildlife habitat	Shoreline/Bank Stabilization Sediment/Toxicant Retention Nutrient Removal/Transformation	291
12	None identified	Shoreline/Bank Stabilization Sediment/Toxicant Retention Nutrient Removal/ Transformation	13
14	Presence of state threatened or endangered species	Shoreline/Bank Stabilization Sediment/Toxicant Retention Nutrient Removal/Transformation	160
17	Presence of state threatened or endangered species; INAI site	Shoreline/Bank Stabilization Sediment/Toxicant Retention Nutrient Removal/ Transformation	710
22	Presence of high-quality plant community	Stormwater Storage Sediment/Toxicant Retention	23
26	Presence of high-quality wildlife habitat	Stormwater Storage Sediment/Toxicant Retention	15
27	Presence of high-quality wildlife habitat	Stormwater Storage Sediment/Toxicant Retention	12
28	Presence of high-quality plant community	Stormwater Storage Sediment/Toxicant Retention	7
29	Presence of state threatened or endangered species	Shoreline/Bank Stabilization Sediment/Toxicant Retention Nutrient Removal/Transformation	404
38	Presence of state threatened or endangered species; INAI site; high-quality plant community	Shoreline/Bank Stabilization Sediment/Toxicant Retention	17
188	Presence of state threatened or endangered species	Shoreline/Bank Stabilization Sediment/Toxicant Retention	330
		TOTAL	1,691

Source: Dreher and others 1992

Note:

INAI = Illinois Natural Areas Inventory

3.7 OPEN LANDS

For this watershed management plan, the following land types are identified as open (undeveloped) lands: open space (local park, recreational, and conservation), agricultural, vacant (forested and grassland), and wetlands. Land use projections for the watershed indicate that the total percentage of open lands will decrease from 46 percent in 2003 to 31 percent in 2020 (SMC 2001a and 2002b). Table 3-7 summarizes the percentages of open space, agricultural land, vacant land, and wetlands comprising open lands in the watershed in 2003 and projected for 2020.

TABLE 3-7
OPEN LAND IN THE WATERSHED

Land Use	Percentage of Watershed in 2003	Percent of Watershed in 2020
Open space (local park, recreational, and conservation)	3	2
Agricultural	18	13
Vacant	13	7
Wetlands	12	9
Total Open Land	46	31
Water	13	13

Sources: SMC 2001a, 2002b

The projected reduction in the amount of open land will result from increased residential, commercial, and industrial development. Opportunities for protecting open land are discussed in Chapters 4 and 5.

In addition to the open lands in the watershed, open water (lakes and streams) account for about 1,010 acres or 13 percent of the watershed. This percentage is not expected to change over time. Therefore, open lands and open water taken together covered 59 percent of the watershed in 2003 and are projected to cover 44 percent of the watershed in 2020.

3.8 GREENWAYS AND TRAILS

According to the "Northeastern Illinois Regional Greenway Plan" (RGP), a greenway is defined as follows (NIPC and Open Lands Project 1997c):

> Greenways vary greatly in scale, from narrow ribbons of undeveloped landscape that run through urban and suburban development, to wide corridors that incorporate diverse natural and cultural features. A greenway can be land- or water-based. It can incorporate both public and private property, but always provides benefits for the larger community. Some greenways are primarily recreational corridors, while others function almost exclusively for environmental protection and are not necessarily intended for substantial human passage. Some greenways run along stream corridors, shorelines or wetlands; others follow old railway tracks or other land-based features.
>
> Greenways differ in their location and function, but overall, a greenway network will protect natural and cultural resources, provide recreational opportunities, improve and sustain hydrologic functions, and enhance the natural beauty and the quality of life in neighborhoods and communities.

The RGP identifies the following watershed sites as existing greenways and public preserves: the Redwing Marsh Forest Preserve, the Sun Lake Forest Preserve, the Cedar Lake Bog Nature Preserve, and the open space bordering Cedar Lake to the south. There are currently no trails through the Sequoit Creek watershed. Trails are intended to provide recreational opportunities and to connect the public to natural resources. Trails are often established near greenways and may be either land-based (roadside or cross-country) or water-based in design. According to the Lake County Division of Transportation, a countywide plan to establish a trunk system of trails to which local municipalities can establish connections was completed and approved by the County Board in June 2002. Stakeholders in the watershed should identify and implement feasible opportunities to connect open spaces and greenways in the watershed to these trails. Opportunities for developing greenways to connect the natural areas in the watershed are discussed in Chapter 4.

CHAPTER 4
WATERSHED ANALYSIS AND PROBLEMS

This chapter analyzes the existing and future conditions of the watershed within the year 2020 planning horizon. The analysis includes current problems, anticipated future impacts of development, and opportunities for preventive actions to mitigate the anticipated impacts. The watershed data collected during various watershed assessments are used to link the problems identified in this management plan to their associated sources and causes. In particular, land use and the degree of ground surface imperviousness are used as analytical tools to predict impacts on the natural resources of the watershed. The opportunities for preventive action discussed in this chapter form the framework for the action items presented in Chapter 5. Specifically, this chapter discusses water quality monitoring in the watershed, water quality problems, flood damages and risk, and natural resources and habitat.

4.1 WATER QUALITY MONITORING

IEPA, LCHD, and NIPC have been monitoring water quality in the watershed for more than 20 years. IEPA conducted water quality assessments in the watershed in 1990 and 2000 to evaluate the ability of the water bodies to support their designated individual beneficial uses, which include aquatic life, and primary (e.g. swimming) and secondary (e.g. boating) contact recreation. IEPA's 2000 assessment of Illinois water bodies is summarized in the "Illinois Water Quality Report 2000," which was written to comply with Section 305(b) of the Clean Water Act. Section 305(b) requires each state to biannually submit a report to U.S. EPA on the quality of the state's surface and groundwaters. The report must describe the state's process for determining water quality and the degree to which each of the assessed waters meets its predefined designated uses. If any of the designated uses of a water body are not met, the state must include in the report potential causes and sources of impairment. In addition, these potential causes and sources of impairment must be reported in the Section 303(d) list. The water bodies in the Sequoit Creek watershed that were assessed in 2000 include Cedar, Deep, East Loon, West Loon, and Little Silver Lakes. Each lake was assessed based on its ability to support aquatic life, primary and secondary contact recreation, and overall use. The overall use assessment was based on an aggregation of the individual use assessment findings. This procedure involves assigning 'weights' to the individual uses and adding them up to obtain the 'overall' use index. In using this procedure, a water body may therefore be assessed as 'fully supportive' for overall use because it has a high aggregate score, even though the water body may fail to support one or two individual uses. This means that a water body assessed as fully supportive may still be impaired to the extent of not supporting some individual uses such as recreation. In the IEPA 2000 assessment, Cedar, Deep, East Loon, West Loon, and Little Silver

Lakes were all designated as fully supportive of aquatic life, swimming, and overall use. For recreational use, Cedar, East Loon, and Little Silver Lakes were designated as only partially supportive because of macrophyte impairment, whereas Deep and West Loon Lakes were designated as fully supportive (IEPA 2000). Although Cedar, East Loon, and Little Silver Lakes only partially support recreational use, the presence of macrophytic vegetation is necessary to support many of the state-listed threatened and endangered species that inhabit these lakes.

The IEPA 2000 assessment suggests that, in general, the water quality of the lakes in the Sequoit Creek watershed had improved compared to 1990, when the first Illinois water quality report was issued. In 1990, Sequoit Creek and Cedar, Deep, East Loon, and West Loon Lakes were assessed, and each lake was found to be at least partially impaired for aquatic life and swimming uses. The most significant causes of lake impairment included nutrients, siltation, organic enrichment, low dissolved oxygen levels, high suspended solids levels, and noxious aquatic plants. The most significant sources of lake impairment included land development, urban runoff, septic systems, shoreline erosion, and in-place contamination. The sources of Sequoit Creek impairment included storm runoff, municipal point sources, and combined sewer overflows (NIPC 1995).

IEPA has never formally assessed McGreal Lake, Sun Lake, or Redwing Marsh. LCHD water quality data for McGreal and Sun Lakes suggest that IEPA water use assessments would have shown these lakes to be fully supportive of general use. LCHD conducted water quality monitoring on all Sequoit Creek lakes between 2001 and 2003 and performed IEPA lake use assessments.

Based on IEPA's water body use assessments, no water bodies in the Sequoit Creek watershed are included on the Illinois 303(d) list. The 303(d) list consists of water bodies not supporting their designated uses in accordance with Section 303(d) of the Clean Water Act. However, sediment and toxicity data were not collected for IEPA's water body use assessments, and the assessments did not include LCHD water quality data. LCHD did collect sediment sampling data, which is included, along with comments from the Sierra Club, in a supplement to this plan. As discussed in Section 4.2, some water quality samples collected in the watershed by LCHD failed to meet IEPA water quality guidelines or standards. Therefore, the IEPA assessments did not provide a complete picture of water quality conditions in the water bodies assessed.

Monitoring data have been invaluable to the preparation of this plan, specifically in identifying water quality problems for each water body. To evaluate the success of the prioritized action plan in addressing

existing and future problems, the current monitoring program will have to be continued and improved. Potential improvements of the monitoring program are summarized below.

- Data collection using appropriate biologic indices that are measured structurally and functionally based on aquatic community characteristics. For example, the use of the macroinvertebrate biotic index (MBI) for Sequoit Creek would be an appropriate monitoring tool.

- Sampling and analysis of fish tissue to assess lake toxicity and to establish reference conditions for future assessments. Presently, the degree of toxicity in the lakes is not known. Because of the projected population growth in the watershed, the potential is high for increased lake toxicity from urban runoff.

- Continuation of IEPA sediment sampling in streams and lakes. Sediment samples should be analyzed for heavy metals and other contaminants that are good indicators of impacts from development activities.

Although IEPA's assessments of the overall water quality of the water bodies in the Sequoit Creek watershed were positive, water quality concerns remain. Section 4.2 discusses these water quality concerns and presents strategies for addressing the concerns. The discussion is based on a comprehensive evaluation of physical, chemical, and biological data for the water bodies in the watershed; these data were compiled as a necessary step in developing this watershed management plan. These data and the associated detailed assessments are included in a separate supplement to this plan.

4.2 WATER QUALITY PROBLEMS IN STREAMS AND LAKES

This section discusses water quality problems in Sequoit Creek and in the lakes of the watershed. By the year 2020, the network of storm sewers is expected to grow dramatically to keep pace with the rapidly urbanizing watershed. The increased imperviousness of the ground surface that accompanies urbanization will increase runoff volumes as well as pollutant loads. As naturalized areas are paved over, water that previously was absorbed into the ground after a rainfall and released slowly will instead flow off of roofs, parking lots, streets, and other impervious surfaces into the storm sewers. This not only increases overall runoff volumes, but it contributes to the "flashiness" of the system, with large volumes of stormwater entering the sewer system all at once. Pollutants such as sediment, oil, and grease that are commonly found on roadways would otherwise be trapped and held in vegetated areas but instead are carried by the stormwater into the sewer system.

Another problem associated with increased urbanization is detrimental impacts from street salting. Salt can enter the environment by washing off roadways or salt storage areas. Chloride ions move with water, so virtually all chloride ions that enter the soil and groundwater will eventually reach surface waters. Aquatic organisms can suffer both acute and chronic toxicity from salt-laden runoff entering waterways. Chronic effects can be seen at lower concentrations than acute effects and can cause changes in the population size and composition of aquatic communities. High salt concentrations can lead to stratification of water bodies, potentially resulting in anoxic conditions and internal nutrient loading. Small lakes with large watersheds and lakes that drain major roadways are most susceptible to problems from street salting. Street salting can also reduce soil stability and break down metals that are harmful to aquatic organisms when washed into the water. Runoff from streets can cause changes in terrestrial plant community structure and diversity. Cattails and common reed, species that are salt tolerant, invade roadside areas and outcompete more salt-sensitive species. Animals are also affected by street salting. Birds can be poisoned by road salt during winters when water is not readily available. Mammals and other animals can be affected by loss or reduced vigor of habitat due to street salting.

New developments require new roads to service the homes. This increase in road surface leads to a commensurate increase in street salting during the winter. Lakes whose watersheds are experiencing more intense development pressures often have water quality issues relating to street salting. Salt breaks down into sodium and chloride ions in water. Conductivity is the ability of water to transmit an electrical current and is related to the number of ionized particles in the water. Salty (soft) water generally has higher concentrations of dissolved solids and fresh (hard) water generally has lower concentrations of dissolved solids. As chloride ions are washed into the lakes from surrounding areas, conductivity is intermittently increased. This can have harmful impacts on aquatic life. Aquatic organisms are generally adjusted to a specific concentration of salt and dissolved solids. Water flow between an organism's cells and the environment is regulated by total dissolved solids (TDS). TDS is a measure of the number of dissolved particles in the water (including chloride ions and nutrients such as nitrogen and phosphorus) and is also related to street salting. Deep, East Loon, and Little Silver Lakes are all experiencing development within their watersheds. These lakes also experienced an increase in conductivity within the last 5 years.

4.2.1 Sequoit Creek

Existing water quality problems in Sequoit Creek involve nutrients, fecal coliform, and bank erosion. Figure 4-1 shows water quality sampling locations in the Sequoit Creek watershed. Figure 4-2 shows existing water quality problems in the watershed. Monitoring data indicate that nutrients are the primary contaminants of concern along Sequoit Creek, with several ammonia-nitrogen (NH_3), nitrate (NO_3), and total phosphorus (TP) concentrations exceeding IEPA water quality target concentrations. In particular, NH_3 concentrations exceeded the target concentration most frequently. Ammonia problems have been documented at Location A as shown on Figure 4-1. This reach of Sequoit Creek is known as "Stink Creek" due to historical sewage overflows and storm and sanitary sewer cross connections that discharged to this area. Although the overflows and cross connections have been corrected, water quality is still an issue in this reach, and the nickname has remained. Some high chlorophyll-a concentrations have also occurred in the reach south of East Loon Lake (Location B on Figure 4-1). Chlorophyll-a is an indicator of algae growth, which results from high nutrient loads. Pollutant concentrations do not display a consistent pattern along the creek, possibly because of the attenuating effects of the lakes and wetland systems. However, the pollutant concentrations downstream of the Antioch wastewater treatment plant (WWTP) are consistently higher than those in other upstream reaches. In addition, the WWTP is the largest continuous source of pollutant loading to the creek. Nonpoint sources intermittently contribute large pollutant loads after rain events, but contribute much lower loads during low flow periods (even though concentration may be elevated). The source of nutrients in the upstream reaches is runoff from nonpoint sources–specifically, lawns, farmlands, and residential areas. The land use and pollutant data show that the subwatersheds that contribute runoff to "Stink Creek" have high pollutant loads. Furthermore, future development is likely to increase these pollutant loads. In reaches 21 through 23 downstream of the Antioch WWTP, the main sources of nutrients are discharges from the WWTP and Sequoit Acres Industrial Park, sanitary sewer overflows (SSO), and runoff from the heavily urbanized area of Antioch.

IDNR considered the habitat quality at the most downstream reaches (Location G on Figure 4-1) to be poor, primarily because no trees were present in the riparian zone, lawns were mowed down to the banks, very fine and flocculent sediment was present, numerous algae and vascular plants were observed, and a slight sewage smell was noted. The MBI, which is a measure of the tolerance of the macroinvertebrate community to oxygen-demanding contaminants, is lower in reaches 21 through 23 than in the upstream reaches, reflecting the impact of the poor water quality on the ability of the creek to support aquatic life.

Figure 4-1 Water Quality Sampling Locations

Figure 4-2 Existing Water Quality Problem Areas

Bank erosion was observed along the meandering portions of reaches 10 and 11. Reach 11 was the only reach along the entire length of Sequoit Creek where a debris load was observed. In both 1992 and 2001, logs, vegetation, and other debris deflected flow into the creek banks, causing bank instability and reducing stream conveyance.

Erosion is also high along reach 23 because of the reach's high sinuosity and high flow rate. In addition, a high school parking lot lines the downstream end of the reach's western bank, which increases runoff and contributes to erosion problems. Undercutting was prevalent along most of the reach. Moderate erosion was observed along reach 22, which is sinuous and has moderate flow rates. Signs of erosion and armoring were observed in the vicinity of the sawmill pond along reach 20 and near the Antioch WWTP outfall along reach 21.

Corrective actions to address the problems in Sequoit Creek may include the following:

- Restoring the reaches that are eroding.
- Retrofitting outfalls that cause local erosion and bank instability. Identification of stormwater outfalls is included in the National Pollutant Discharge Elimination System (NPDES)-II program.
- Mapping the storm sewer system in the old parts of Antioch. Mapping of the storm sewer system is required for compliance with the NPDES-II program.

Preventive actions may include the following:

- Improving habitat through stream restoration
- Creating vegetative buffers and restoring floodplain, channel banks, and riparian areas
- Implementing measures that would reduce flow rates contributing to channel erosion and bank instability (for example, limiting release rates into Sequoit Creek from new developments)
- Implementing zoning to encourage low-impact development that reduces ground surface imperviousness
- Preserving open lands

4.2.2 Cedar Lake

Existing water quality problems in Cedar Lake include shoreline erosion and fecal coliform bacteria that cause beach closings.

Fecal coliform concentrations in Cedar Lake have exceeded Illinois Department of Public Health (IDPH) guidelines for beach closure eight times since 1988. Figure 3-4 shows that the subwatershed draining Cedar Lake contains residential areas to the north and in the southeast. Elevated fecal coliform concentrations in Cedar Lake are likely caused by septic system failures reported on the northern and southeastern shores and by waterfowl waste. According to a sample of records obtained from the LCHD septic system monitoring database, about 50 percent of complaints reported to LCHD in 1999 from the Antioch and Lake Villa townships were confirmed septic system failures.

In addition to concerns about fecal coliform loads, monitoring data indicate increasing sediment loads to Cedar Lake. The year 2020 land use pattern shown on Figure 3-5 indicates that some of the existing vacant and agricultural areas southwest and south of the lake will be developed into industrial, residential, and institutional areas. Thus, the new developments may cause increased sediment and nutrient loads in the runoff. The Cedar Lake watershed has not experienced intense development during the last few years. Average conductivity in Cedar Lake increased only 2 percent between 1998 and 2003. The most recent LCHD water quality data for Cedar Lake can be found in the *2003 Summary Report of Cedar Lake* (LCHD 2003b).

The LCHD completed a shoreline assessment for Cedar Lake in 2003. The shoreline assessment revealed that 58 percent of the shoreline has been developed. The most common shoreline types are buffer, wetland, and woodland. Only about 5 percent of the shoreline was found to be eroding, mainly because the slope of the shoreline is very flat and because only a short length of the shoreline contained lawn that had been mowed to the water's edge. Light boat traffic also contributes to the low amount of shoreline erosion. Slight erosion is occurring along woodland and lawn shorelines. This accounts for 80 percent of the erosion. The other 20 percent is moderate to severe and is composed of buffer areas occurring on the south side of the island and the western shoreline (LCHD 2003b). The western shoreline of Cedar Lake is experiencing severe erosion that results in undercutting and slumping. Residences have lawns that extend to the lake, with only narrow buffers separating them from the lake. Ongoing development in Lake Villa Township and incorporated Lake Villa may contribute sediment loads to the lake.

Corrective actions to address the problems may include restoring eroding shorelines and constructing shoreline protection in these areas.

Preventive actions may include the following:

- Making preservation of water quality and habitat in the Cedar Lake subwatershed a priority. IDNR considers Cedar Lake to be a biologically significant water body because it contains various endangered plants and fish.
- Initiating a program to replace failing septic systems, construct new systems, and improve existing systems by carrying out maintenance and inspections.
- Initiating or enhancing existing outreach efforts to educate residents about maintenance and operation of septic systems in order to reduce fecal coliform loads.
- Continuing fecal coliform monitoring and reporting on the effectiveness of actions taken to reduce fecal coliform loads.
- Initiating a program to mitigate potential sediment and nutrient loads. Such a program would need to focus on the existing and anticipated developments in subwatersheds located south of Cedar Lake and west of Cedar Lake Road. Opportunities are available to apply concepts of low-impact development that would reduce runoff rates and provide water quality benefits.
- Creating riparian buffers along the shoreline to reduce bank erosion.
- Increasing communication among homeowners, homeowner associations, and lake management associations.

More specific recommendations are available in the LCHD 2003 Summary Report of Cedar Lake.

4.2.3 Deep Lake

Existing water quality problems in Deep Lake include fecal coliform bacteria, nutrients, and shoreline erosion.

A water quality assessment indicated that the water quality in Deep Lake is good. The lake exhibits a trend of slightly declining pollutant concentrations. However, some water quality concerns remain. Four beach closings occurred at Deep Lake between 1988 and 1992 because of high fecal coliform concentrations. In addition, ammonia concentrations in the lake have exhibited an increasing trend since 1988. Figure 3-4 suggests that one source of the existing fecal coliform loads is failing septic systems in the unsewered residential areas south of the lake. Except for some vacant areas to the west and east, the subwatershed draining into Deep Lake is predominantly residential. Runoff from the residential areas

contributes nutrients as well as fecal coliform loads. Year 2020 land use projections indicate that there will be new developments on the remaining vacant lots and that the part of the subwatershed adjacent to the western shoreline will be converted from institutional to residential land. Because residential areas typically contribute higher sediment and fecal coliform loads than institutional areas, the existing water quality problems may be exacerbated if proactive measures are not taken. Deep Lake experienced a 17 percent increase in conductivity between 1998 and 2003. If development continues, conductivity will increase further. The most recent LCHD water quality data for Deep Lake can be found in the *2003 Summary Report of Deep Lake* (LCHD 2004).

LCHD completed a shoreline assessment in 2003. The shoreline assessment determined that 48 percent of the Deep Lake shoreline is developed. The major developed shoreline types are seawall, woodland, and rip rap. Woodland and wetland were the most common shoreline types on the lake when the undeveloped areas were taken into account. Ninety percent of Deep Lake's shoreline exhibited no erosion. Almost half of the manicured lawn was experiencing slight erosion even though lawn made up a very small part of the overall shoreline composition (LCHD 2004). The Tetra Tech shoreline assessment revealed severe erosion along most of the developed southern and eastern shorelines of Deep Lake. These shorelines are steep and susceptible to sloughing, undercutting, and erosion. Both artificial and natural shoreline protection techniques have been applied with mixed success. The western shoreline is undeveloped, gently sloped, and protected by natural vegetation.

Corrective actions to address the problem may include restoring unstable, eroding banks and beaches.

Preventive actions may include the following:

- Using wider riparian buffers, as the existing, 100-foot-wide buffers appear to be inadequate
- Preserving open spaces around the lake
- Initiating a program to replace failing septic systems, construct new systems, and improve existing systems by carrying out maintenance and inspections
- Initiating or enhancing existing outreach efforts to educate residents about maintenance and operation of septic systems in order to reduce fecal coliform loads
- Continuing fecal coliform monitoring and reporting on the effectiveness of actions taken to reduce fecal coliform loads
- Beginning community outreach efforts to reduce fertilizer and herbicide use for lawn care

- Increasing communication among homeowners, homeowner associations, and lake management associations

More specific recommendations are available in the LCHD *2003 Summary Report of Deep Lake*.

4.2.4 Sun Lake

Nutrients pose a water quality concern in Sun Lake.The Sun Lake water quality assessment indicated that Sun Lake has good water quality, but recent lake water samples contained elevated concentrations of Kjeldahl nitrogen and NH_3. Figure 3-4 shows that the subwatershed draining into Sun Lake is predominantly open space owned by the Forest Preserve District of Lake County. In addition, a wetland complex surrounds the lake. Therefore, the primary sources of the nutrients appear to be flow from Deep Lake, which does have some nutrient problems, and internal nutrient loading (see Section 4.2.3). The most recent LCHD water quality data for Sun Lake can be found in the *2001 Summary Report of Sun Lake* (LCHD 2003). LCHD conducted a shoreline assessment at Sun Lake in 2001. No erosion was found in any part of the shoreline because 100 percent of the shoreline was wetland. However, as discussed in Section 3.5.2.3, invasive species were present along 100 percent of the shoreline. These species were present in relatively high densities (LCHD 2003).

- No specific measures are recommended for Sun Lake because the lake and its watershed are already protected from development. A large buffer of wetlands that will help to remove pollutants originating from its watershed surrounds the Lake. The water quality of Sun Lake will likely improve if the recommendations for improving upstream water quality in Deep and Cedar lakes are implemented.

4.2.5 East Loon Lake

Existing water quality problems in East Loon Lake include nutrients and fecal coliform bacteria that cause beach closings.

Nutrient and fecal coliform concentrations are higher in East Loon Lake than in the other lakes in the watershed. TP concentrations as high as eight times the IDPH guideline of 0.05 milligram per liter (mg/L) were detected in lake water samples. Elevated concentrations of nutrients in East Loon Lake are caused by runoff from residential land where fertilizers and herbicides have been applied and by waterfowl waste. Septic system failures reported along the southern shore of East Loon Lake and waterfowl waste are also the causes of the elevated fecal coliform concentrations in the lake. Fecal coliform concentrations detected in the lake have exceeded IDPH guidelines for beach closure seven times since 1988. Figure 3-4 shows dense residential areas close to and along the eastern shoreline of

East Loon Lake. The residential areas contain older homes. In addition, the subwatershed draining into the lake from the east is predominantly residential and is larger than the subwatersheds of the other lakes. Monitoring of East Loon Lake beaches was discontinued in 1993. Existing and projected developments may increase sediment and nutrient loads to the lake, as shown on Figure 3-5. East Loon Lake experienced a 22 percent increase in conductivity between 1998 and 2003. This trend will most likely continue with increased development. The most recent LCHD water quality data for East Loon Lake can be found in the *2003 Summary Report of East Loon Lake* (LCHD 2003c).

The presence of shoreline protection along the eastern side of the lake suggests that shoreline erosion has posed a concern. LCHD conducted a shoreline survey in 2003. Almost no erosion was observed along the East Loon Lake shoreline. Most of the erosion that was occurring was classified as slight and existed along manicured lawns that did not contain buffers. A portion of the developed shoreline contained buffers, and a third of the shoreline consisted of undeveloped wetlands. These factors, along with flatter topography, are credited with minimizing erosion at East Loon Lake (LCHD 2003c).

Corrective actions to address the problems may include the following:

- Constructing shoreline protection along unprotected shorelines
- Conducting inspections to verity that effective erosion prevention measures are used in ongoing developments
- Constructing sanitary sewers wherever it is economical to do so

Preventive actions may include the following:

- Making preservation of water quality and habitat in the East Loon Lake subwatershed a priority. IDNR considers East Loon Lake to be a biologically significant water body because it contains various endangered plants and fish.
- Initiating a program to replace failing septic systems, construct new systems, and improve existing systems by carrying out maintenance and inspections.
- Initiating or enhancing existing outreach efforts to educate residents about maintenance and operation of septic systems in order to reduce fecal coliform loads.
- Resuming fecal coliform monitoring and reporting on the effectiveness of actions taken to reduce fecal coliform loads.
- Monitoring the performance of shoreline protection measures.

- Increasing communication among homeowners, homeowner associations, and lake management associations.

More specific recommendations are available in the LCHD *2003 Summary Report of East Loon Lake*.

4.2.6 West Loon Lake

Existing water quality problems in West Loon Lake include nutrients and fecal coliform bacteria that cause beach closings.

Fecal coliform concentrations in West Loon Lake have exceeded IDPH guidelines for beach closure 19 times since 1988. Figure 3-4 shows that residential areas cover the entire shoreline of the lake. Therefore, the elevated fecal coliform concentrations in the lake are caused by septic system failures as well as by waterfowl waste. Septic system failures have been reported all along the western and southern shores of the lake. Monitoring data indicate that nutrients are also a problem. Conductivity at West Loon Lake remained relatively constant between 1998 and 2003, increasing only 0.1 percent. The most recent LCHD water quality data for West Loon Lake can be found in the *2003 Summary Report of West Loon Lake* (LCHD 2003d).

Figure 3-5 indicates that the land uses in the subwatershed draining into the lake will remain unchanged through 2020. The subwatershed draining into West Loon Lake is located in unincorporated Lake County in both Lake Villa and Antioch Townships. The predominant land use in the subwatershed is residential. The future land use scenario suggests that existing nutrient loads will not increase dramatically. Some significant open spaces and agricultural areas near the lake offer opportunities for future open space preservation.

Shoreline erosion is not a concern at West Loon Lake. LCHD conducted a shoreline assessment of West Loon Lake in 2003. The survey found that 100 percent of West Loon Lake's shoreline was developed and consisted mostly of beach and buffer strips. Almost no erosion was observed at West Loon Lake, and the erosion that was documented was categorized as slight. The areas that did have minor erosion were in areas of manicured lawn and seawall (LCHD 2003d).

Corrective actions to address the problems may include repairing and upgrading existing septic systems.

Preventive actions may include the following:

- Making preservation of water quality and habitat in the West Loon Lake subwatershed a priority. IDNR considers West Loon Lake to be a biologically significant water body because it contains various endangered plants and fish.

- Initiating a program to replace failing septic systems, construct new systems, and improve existing systems by carrying out maintenance and inspections.

- Initiating or enhancing existing outreach efforts to educate residents about maintenance and operation of septic systems in order to reduce fecal coliform loads.

- Resuming fecal coliform monitoring and reporting on the effectiveness of actions taken to reduce fecal coliform loads.

- Beginning outreach efforts to educate residents about how to reduce fertilizer and herbicide applications and how to safely store such chemicals. Because the present land use pattern is expected to remain relatively constant in the foreseeable future, the strategy for improving water quality should focus on such outreach efforts.

- Continuing ongoing programs to improve water quality such as those included in the WDO

- Preserving the remaining open lands in the subwatershed.

- Increasing communication among homeowners, homeowner associations, and lake management associations.

More specific recommendations are available in the LCHD *2003 Summary Report of West Loon Lake*.

4.2.7 Little Silver Lake

Existing water quality problems in Little Silver Lake include nutrients and sediment.

Water samples collected regularly in Little Silver Lake have not revealed any consistent water quality problems, but homeowners near Little Silver Lake are concerned about sediment loadings to the lake as a result of new developments and agricultural runoff in the area, and nutrient concentrations have been increasing as the developed land area increases. In addition, older homes in the area rely on septic systems that could contribute to fecal coliform loads, but no lake water samples have been collected for fecal coliform analysis. The projected land use pattern indicates that the subwatershed draining into the lake will remain generally undeveloped. However, the desirability of “lake front” property will most likely result in development of the v acant land around the lake in the near future. As indicated on Figure 3-5, ongoing and any future development in the Little Silver Lake subwatershed may increase nutrient and sediment loads to the lake. Conductivity in Little Silver Lake increased by 27 percent between 1999 and 2003. This increased conductivity is associated with development and will continue to increase as

development occurs. The most recent LCHD water quality data for Little Silver Lake can be found in the *2003 Summary Report of Little Silver Lake* (LCHD 2004b).

Residents of the Little Silver Lake subwatershed have adopted a watershed plan to reduce nutrient and sediment loads to the lake. Implementation of that plan will need to be coordinated with the implementation of this Sequoit Creek watershed management plan. The Little Silver Lake watershed plan is available as a separate document in a supplement to this plan (J.F. New & Associates, 2000). An executive summary of the Little Silver Lake Watershed plan is included in Appendix B.

Erosion is not a problem at Little Silver Lake. LCHD conducted a shoreline assessment in 2003 and found that approximately 45 percent of the shoreline is developed. The main categories of developed shoreline were buffer, rip rap, and seawall. The undeveloped sections of shoreline consisted of wetland, woodland, and buffer. The survey found that 99 percent of the shoreline was experiencing no erosion. The very small amount of erosion that was happening existed in manicured lawns (LCHD 2004b). More specific recommendations are available in the LCHD *2003 Summary Report of Little Silver Lake*.

4.2.8 McGreal Lake

The existing water quality problem in McGreal Lake is high nutrient loads.

LCHD sampling efforts have shown that nutrients are a problem in McGreal Lake. The lake is eutrophic, and half the samples collected contained TP concentrations exceeding IEPA target water quality guidelines. Figure 3-4 indicates that the subwatershed draining to McGreal Lake is predominantly residential. Therefore, the nutrient problem in McGreal Lake is probably caused by runoff from residential lands where fertilizers and herbicides have been applied. The nutrient problem is magnified in McGreal Lake because the lake is manmade and shallow and its water is constantly mixed because of its small volume relative to the runoff volumes. Future residential development may increase nutrient loads to the lake. The most recent LCHD water quality data for McGreal Lake can be found in the *2002 Summary Report of McGreal Lake* (LCHD 2003a).

LCHD conducted a shoreline assessment of McGreal Lake in 2002. The assessment concluded that approximately 54 percent of the shoreline is developed. The major shoreline type along the developed portion of the lake was buffer, with a small percentage of the developed shoreline consisting of manicured lawn. The major types of undeveloped shoreline were shrub, wetland, and woodland. Twenty-four

percent of the McGreal Lake shoreline was experiencing erosion. However, 20 percent of the shoreline was experiencing only slight erosion, and 4 percent was experiencing moderate erosion. Most of the erosion was occurring along manicured lawns, while a smaller portion was occurring along buffer strips (LCHD 2003a).

Preventive actions to address the nutrient problem may include the following:

- Encouraging use of vegetative buffers around the lake during new construction
- Conducting community outreach efforts to reduce fertilizer and herbicide applications
- Encouraging conservation tillage practices
- Increasing communication among homeowners, homeowner associations, and lake management associations

More specific recommendations are available in the LCHD 2003 Summary Report of McGreal Lake.

4.2.9 Redwing Marsh

The most recent LCHD water quality data for Redwing Marsh can be found in the *2003 Summary Report of Redwing Marsh* (LCHD 2004a). LCHD conducted a shoreline assessment of Redwing Marsh in 2003. The assessment found that the shoreline is almost entirely classified as wetland, with a small amount classified as shrub. No erosion was observed during the survey (LCHD 2004a).

4.3 FLOODING

This section profiles existing flooding problems in the Sequoit Creek watershed, updates the floodplain map adoption process, and discusses mapping of existing flood hazard areas and opportunities for minimizing losses from flood damage.

4.3.1 Profile of Existing Flooding Problems

The Sequoit Creek watershed suffers from flooding, and the two main sources of the flooding are (1) Sequoit Creek and its tributaries and (2) non-riverine depressional areas. Flooding problems include nuisance ponding in yards, street flooding, sewer backups, and overbank flooding. Table 4-1 summarizes the types of flooding recorded in the watershed. During monthly SCPC meetings, stakeholders identified flooding problem areas. The watershed municipalities and the Townships of Lake Villa and Antioch were

contacted to identify additional flooding problem areas**.** Table 4-1 probably underestimates the actual flooding incidents because not all flooding incidents are reported. Most of the areas that have experienced flood problems are adjacent to the riverine floodplain. Depressional flooding appears to be the cause of flooding for the remaining areas reported.

TABLE 4-1
FLOODING PROFILE FOR SEQUOIT CREEK WATERSHED

Flooding Type[a]	**Primary Cause[b]**	**Number of Sites Affected[c]**
Overbank flooding	2	2
Local drainage problem	4	10
Depressional flooding	6	6
Septic problems	Not Applicable	>200
Sewer backups	1	8

Notes:

a More than one type of flooding may occur at a problem site
b Indicates number of sites for which the flooding type was considered the primary cause.
c A flooding problem site may contain multiple buildings, roads, or other infrastructures

The numbers used in Table 4-1 are different from those reported in the draft County Flood Hazard Mitigation Plan, which utilized the data from the SMC's Flood Problem Area Inventory (FPAI). These numbers have been updated to reflect flooding problems reported during interviews with residents who live in the watershed.

The numbers of structures and facilities affected illustrates the magnitude of the flooding problem in the watershed. According to the updated FPAI,

- Up to 80 buildings have experienced flooding problems.
- An access road to the Antioch WWTP, a critical facility, is subject to flooding.
- Six roads and bridges, including Route 83, have been closed or threatened by flooding.
- The northern and northeastern sides of East Loon Lake suffer from depressional flooding. Approximately 50 homes are affected.

- The Petite Lake Road area on the eastern and western sides of Route 83 and north of Cedar Lake Road suffers from depressional flooding.
- The Oakwood Knolls subdivision north of North Avenue experiences sewer backups.

The Sequoit Creek watershed has a relatively flat slope and mild relief. The watershed has many depressional areas that were formed during the glacial movement; most of these areas now appear as wetlands. Rapid population growth within the watershed, and the resulting residential demand, has resulted in urban development within the natural floodplains, displacing wetlands and depressional areas that traditionally soaked up excess rainfall. Urban development dramatically increases the percentage of impervious area, resulting in a large amount of runoff during storms. Instead of infiltrating into the ground, rainfall is converted quickly to runoff and is then discharged from the sites through sewers and manmade channels. The factors that contribute to flooding include the following:

- Lack of initial multipurpose watershed planning
- Erosion from areas under development, which generates sediment that obstructs drainage paths and reduces the capacity of the creek to convey water
- Channelization, flood encroachment, and piping, which reduce the ability of the creek to convey floods
- Undersized discharge structures of lakes, which may restrict the flow of water and raise water levels
- Poor stream maintenance, which enables heavy vegetative growth and debris accumulation, reducing the ability of streams to convey water
- Increased runoff volume because of additional impervious areas throughout the watershed

Flooding in the Sequoit Creek watershed has occurred either adjacent to the existing floodplain of the creek and its tributaries or in non-riverine depressional areas. The most problematic areas of flooding include (1) the areas on the north and northeast sides of East and West Loon Lakes, where about 50 homes have been affected; (2) the area along Petite Lake Road on the east and west sides of IL-83, north of Cedar Lake; and (3) Oakwood Knolls subdivision and north of North Avenue. The common feature of these areas is their close proximity to the floodplain. Sequoit Creek has very narrow channels, but a wide floodplain. The increased flow raises the water level in the creek and connected lakes. The elevated water level in the stream causes the storm sewer backup and overbank flooding. Flooding problems such as ponding in yards and street flooding are possibly attributed to improper grading and lack of drainage.

Many localized flooding problems are associated with the failure or faulty abandonment of drain tiles. The hydrology of the Sequoit Creek watershed is partially affected by the channelization of streams of drainage ditches and the extensive network of drainage tiles. Subsurface drainage tiles predominantly drain agricultural fields in the region. There are very few records of the actual locations of many of these drainage systems, especially those installed more that 75 years ago. The lack of drainage maps makes it difficult to locate nonfunctioning tile lines, or even determine the position of functional systems in cases where additional drains are to be installed.

4.3.2 Mapping of Existing Flood Hazard Areas

The SMC commenced a detailed floodplain mapping study of the watershed in 2000. The purpose of the study was to update the existing Flood Insurance Rate Map (FIRM) for the watershed. The Federal Emergency Management Agency (FEMA) depends on local municipalities to perform the actual mapping and to submit the revised data; FEMA then creates preliminary map panels to send to the municipality. The municipality is responsible for posting the map panels for public review for a period of 90 days. During this time, the public may submit comments and revisions to the municipality, which then submits the comments to FEMA at the end of the 90-day period. FEMA considers the comments and revisions before producing the final map panels. Because it is expensive to physically print new map panels and the process can take up to 2 years, FEMA frequently issues a Letter of Map Revision (LOMR). The LOMR is valid as the new floodplain for the mapped area.

FIRMs show flood hazard areas, which are defined as the floodplains that have a 1 percent chance of being inundated in any given year. Flood hazard areas that are associated with a flowing stream or river are called riverine floodplains, while those located in depressional areas that are isolated from rivers or streams are called depressional flood hazard areas or depressional floodplains. The floodplain study was limited to the riverine floodplains of Sequoit Creek and its tributaries. Non-riverine, depressional areas were not mapped as regulatory floodplain for flood insurance purposes. Because one of the uses of the FIRM is to set flood insurance rates, future conditions such as the 2020 land use projections are not considered in the floodplain study. That is, the proposed FIRM reflects only existing conditions in the watershed, including land use and any physical changes to the Sequoit Creek main stem and tributaries.

FIRMs are an important tool for planning, zoning, and regulatory purposes such as regulating development in floodplains. The new FIRMs are intended to assist SMC and local municipalities in

making better floodplain management decisions. Figure 4-3 shows the existing, FEMA-approved FIRM. According to the FIRM, the floodplain of Sequoit Creek and its tributaries covers about 1,908 acres, or about 24 percent of the watershed. Since under normal conditions the area of open water including lakes and creeks is about 1,010 acres, the land area that would be inundated during 100-year storms is 898 acres, which represents about 11 percent of the watershed. The existing FIRM shows that the number of properties located within the riverine mapped flood hazard areas alone is about 102. The actual number of properties located in flood hazard areas in the watershed may be significantly greater than 102 because depressional floodplains were not included in FEMA's mapping study. The WDO, however, requires applicants to identify and protect all floodplains with tributary areas exceeding 100 acres or depressional areas exceeding 0.75-acre foot in storage.

The number of properties at risk and the severity of the flooding are likely to increase if the impacts of development are not mitigated. Today's floodplains may continue to expand because development generally creates impervious areas, which increase runoff volumes and runoff peaks. Therefore, properties that today are out of harm's way will be at risk in the future.

The floodplain study indicates that because of the low relief of the watershed, the Sequoit Creek and its associated system of lakes act hydraulically as a lake system rather than a fast river floodplain. This means the Sequoit Creek floodplain is sensitive to both runoff volumes and peak flows. Because the creek has a mild slope for most of its length, any structure across the creek will create a strong backwater effect that will increase the flood risk upstream of the structure. The impoundment will not be localized to a finite channel reach. For this reason, traditional structural solutions for protecting properties from overbank flooding, such as levees, weirs or dams, will not be effective. Thus, any future development activity in the watershed that increases runoff volume, even without increasing flood peaks, will likely result in expansion of the floodplain. An effective strategy for preventing future flood risks and associated damages must focus on the following:

- Preserving existing floodplain storage, including depressional areas
- Providing additional storage to accommodate increased runoff and to reduce flood peaks

Figure 4-3 Existing Flood Problem Areas

Such a strategy will reduce overbank flooding of riverine properties by preventing increases of the water levels. Providing storage to accommodate future additional runoff will prevent flood stages in depressional floodplains from increasing. Section 4.3.4 discusses existing programs and opportunities for preventing existing and future flood damages based on the above findings.

4.3.3 Update on the Map Adoption Process

Although the most recent printing date of the current FIRMs for the Sequoit Creek watershed is September 1997, the studies for the maps were actually performed more than 20 years ago. The floodplain studies for both the Villages of Antioch and Lake Villa were performed by the U.S. Department of Agriculture, Soil Conservation Service. The Antioch study was completed in October 1979, and the Lake Villa study was completed in September 1979.

A draft floodplain study has been completed by CTE Engineers, Inc. under the direction of the SMC. The goal of the study is to update the existing FEMA floodplain maps. This draft study is now undergoing an independent technical review by Christopher B. Burke Engineering, Ltd. Once this independent technical review is completed, any necessary revisions will be made to the hydrologic and hydraulic models, and the resulting floodplain/floodway maps will be produced. This review and revision process is expected to be completed by the end of 2004.

Upon receipt of the revised floodplain study and maps and after review and acceptance by the SMC, a 60-day public comment period will be provided for the local municipalities within the watershed, namely the Village of Lake Villa, the Village of Antioch, and Lake Villa and Antioch Townships. Any legitimate, technical comments regarding the floodplain study will be addressed by the SMC at the conclusion of the public comment period. If necessary, appropriate revisions will be made to the models.

Once the public comment period issues are resolved, the floodplain study will be presented to the SMC Commissioners for formal approval and adoption as “best available information.” If the Commission chooses to adopt the study, it could be used for regulatory enforcement in the cases where the new floodplain elevation is higher than the existing FEMA floodplain elevation. It could not be used in areas where the new floodplain elevation is lower than the existing FEMA elevation until it has been reviewed by IDNR and FEMA. If the Commission chooses not to adopt the study, it could only be used on a voluntary and advisory basis until it is reviewed and adopted by IDNR and FEMA.

At this point, the SMC will submit the floodplain study to IDNR for certification of flows and then to FEMA for a full technical review and eventual adoption by FEMA. This submittal will most likely occur in late 2004 or early 2005. The IDNR/FEMA review process can be rather lengthy and could take 2 to 3 years to complete.

4.3.4 Opportunities for Minimizing Flooding Problems

This section discusses potential causes of flooding in the Sequoit Creek watershed and measures that can be used to address the existing flooding problems and prevent future flooding.

4.3.4.1 Flood Control

The impacts of past actions and future development are now being recognized, and SMC and watershed stakeholders are working together to relieve the flooding problems in the watershed. According to the Draft Framework Plan, the population in the Sequoit Creek watershed will increase dramatically by year 2020, with the Antioch and Lake Villa populations more than doubling. This growth will result in a tremendous loss of pervious land and a corresponding increase in impervious land. As shown in Table 3-3, by year 2020, the commercial, industrial, and residential areas will increase as much as 71 percent, while the agricultural, wetland, and open space areas will decrease. Development will cause more frequent flooding without well-planned flood control measures. It is conceivable that stormwater detention can effectively reduce runoff rates and control localized flooding. However, it does little to control the increased volume of runoff caused by urbanization. While engineered solutions are important tools in flood prevention, the over-reliance on artificial drainage approaches has negative consequences. Simple elimination of excess surface water after a rainfall as quickly as possible through a closed-conduit system has a cumulative effect and results in an increased frequency of downstream flooding.

A potential solution is development options involving BMPs in alternative stormwater drainage and land development design approaches that can substantially reduce the impact of development. The selected BMPs reduce the amount of impervious surface area and runoff and utilize the landscape to naturally filter and infiltrate runoff on the site before it discharges into the drainage system. BMPs and their capacities for flood reduction are detailed in a supplement to this plan. Some BMPs that can be used for flood reduction are infiltration practices, porous pavement, and natural landscaping. In many cases, a BMP can be used to not only reduce flooding but also to improve water quality.

4.3.4.2 Regulation and Planning

Currently there is a countywide floodplain management program intended to accomplish these objectives. This management program is incorporated into the countywide WDO and is driven by the requirements of the National Flood Insurance Program (NFIP). The NFIP requirements embody structural and nonstructural measures for managing floodplains to prevent flooding and reduce flood damage. Communities enforcing the WDO NFIP requirements benefit by enjoying lower flood insurance premiums in addition to lower flood risks.

The WDO contains additional measures to minimize flooding problems, such as protection of depressional floodplain areas that have storage exceeding 0.75 acre-feet during 100-year storm events. As explained in Chapter 3, the Sequoit Creek watershed contains numerous depressions that store floodwaters during heavy storms, thus reducing peak flows and stormwater volumes to the main channel. The WDO also contains performance standards for protecting structures located in floodplains and requires stormwater detention storage to reduce peak flows.

However, by itself, the WDO cannot adequately address all of the existing and future problems for the following reasons:

- Some existing or "legacy" problems predate the ordinance. These problems are associated with properties that were located in flood hazard areas prior to publication of the FIRM.
- The flood hazard areas are not known with certainty. FIRMs are created using the best available information but may not show isolated flood hazard areas and may not account for localized conditions that can result in flooding.
- The WDO stormwater provisions mainly address peak flows and not runoff volumes. Peak flows are calculated using statistically derived precipitation events and do not address situations where a series of storms affect an area over a period of time, thus causing flooding.
- The WDO stormwater provisions do not incorporate watershed changes that would increase watershed imperviousness. Higher imperviousness will increase the runoff volumes and will extend the existing floodplain beyond the current boundaries.
- The WDO provides only minimum standards or guidelines for floodplain management. Because each watershed is unique, these minimum standards may not provide the same level of protection for all watersheds in the county.

Based on available information, the areas of the watershed that will experience significant development pressure are shown on Figure 3-5. The uncertainties inherent in future land use projections, such as the 2020 conditions, must be considered, especially as they apply to floodplain management decisions.

Zoning decisions are frequently made based on limited information on riparian areas. Consequently, the particular development scenario shown on Figure 3-5 should be regarded as just one of many possible future outcomes.

Effective strategies for floodplain management must be flexible. They must address existing problems, and at the same time be adaptable for future unpredictable development scenarios. For planning purposes, strategies for reducing flood damages may be classified as remedial or preventive. Remedial strategies aim at reducing or eliminating existing flood damages. Preventive strategies aim at preventing future flooding and flood-related damages. Remedial strategies for reducing existing flooding problems may include the following:

- Buy out structures located in flood hazard areas and convert the land to uses compatible with riparian areas, including recreational open space such as parks
- Flood-proof properties that are at risk
- Survey structures located in flood hazard areas using the new FIRMs to determine options for reducing flood damage; information collected includes first-floor elevations, elevation of low openings, basements, and building type
- Identify causes of storm sewer backups and construct relief storm sewers or install sewer backup protection devices
- Improve local drainage that may cause basement and nuisance flooding; potential areas for drainage improvements are included in the FPAI
- Initiate an outreach campaign to educate the public about the NFIP and to encourage the purchase of flood insurance
- Retrofit existing pre-WDO dry stormwater detention basins to reduce peak flows and provide additional storage

Preventive strategies for mitigating future flood damages must rely on reducing runoff volumes or increasing storage in the headwaters of the tributaries. Generally, this strategy can be achieved by preserving open space, preserving existing depressional areas, and increasing detention storage. Opportunities for preventive strategies to reduce flood damages in the watershed may include the following:

- Continue enforcement of the WDO floodplain management provisions.
- Amend local ordinances to require mapping of drain tiles in all new developments with priority to those located in farmlands. Currently, WDO requires known drain tiles to be tied to maintainable drainage systems

- Delineate drainage easements that would be required under full buildout in each subwatershed. These drainage easements could then be placed on the property before zoning or development to prevent development in areas that could safely channel flooding. The hydrologic models developed as part of the floodplain mapping could be used to accomplish this task.

- Preserve open lands to mitigate future increases in stormwater volumes. Open lands create less runoff by allowing infiltration. Preserving open lands also preserves the existing numerous depressional storage areas that are less than 0.75 acre-foot, but are not protected by the WDO. Preserving open lands has other multiple benefits, including preserving habitat, providing for recreation, and improving water quality. Chapter 5 presents a prioritized list of opportunity sites for preservation as open space.

- Preserve aquifer recharge areas. Lake County's Regional Framework Plan urges county stakeholders to preserve any priority aquifer recharge areas that the ongoing USGS-sponsored mapping identifies in the Antioch quadrangle. Because the Sequoit Creek watershed covers most of the Antioch quadrangle, any recharge areas identified probably will be located in the watershed. Preservation of these recharge areas will achieve the multiple objectives of promoting infiltration, improving water quality, and preserving open space.

- Explore sites for regional water detention facilities that may be used to offset future increases in runoff and to compensate for the loss of depressional storage areas in new developments. Regional detention facilities are discussed in Chapter 5.

- Change zoning requirements to minimize impervious area such as incorporating low impact development concepts, preservation of open space, and low-density development.

4.4 NATURAL RESOURCES AND HABITAT

This section discusses the challenges and opportunities associated with preserving the abundant natural resources in the Sequoit Creek watershed. The discussion provides the framework for action items intended to preserve or enhance these resources and is consistent with the intentions of the Regional Framework Plan for Lake County. Specifically, this section discusses the protection status of Fox River Watershed Biodiversity Inventory Sites (FRWBIS) and wetlands in the Sequoit Creek watershed.

4.4.1 Protection Status of FRWBIS

The Fox River Watershed Biodiversity Inventory (FRWBI) was made possible through a grant agreement with the Illinois Conservation Foundation. Funding for the entire project was made available to the Chicago Wilderness Project Coalition through the U.S. Forest Service and the U.S. Fish and Wildlife Service.

The FRWBI is designed to provide information on areas of significant biodiversity located in the Fox River Watershed region. It is also designed to prioritize sites in the Fox River Watershed for land and

water protection and management action. Information for the inventory was collected about sites and streams that fit under any of the criteria listed below. These criteria are based on the 1998 edition of the McHenry County Natural Areas Inventory.

- All natural areas containing grade C or better examples of natural communities, no minimum size limits
- Any site containing at least one state endangered or threatened species
- All streams classified to date by the IDNR as A or B quality
- All ecologically significant public open space areas actively or potentially restorable to natural communities
- Ecologically "special" areas, as determined by individual participants—examples include outstanding geological features; outstanding archaeological sites; large grasslands, even Eurasian, supporting declining prairie bird communities; heron rookeries; reptile hibernacula; areas with Federal Category 2 species not listed as endangered, threatened, or watch-listed in Illinois (e.g. Blanding's turtle); Illinois watch list species locations
- Biological corridors linking other features entered
- Buffer land for protection or expansion of known natural features

Lake County Forest Preserve District staff prepared the list of FRWBIS in the Seqouit Creek watershed. This list was reviewed by IDNR and the FRWBIS project coordinator. Inventory data for Lake County was drawn from Forest Preserve District files, IDNR's Natural Heritage database, the Lake County ADID (early 1990s), and site-specific field knowledge of FPD and IDNR staff. Lake County Forest Preserve District staff identified the following nine FRWBIS in the Sequoit Creek watershed:

- Beach Grove Road Wetland
- Cedar Lake
- Deep Lake
- Deep Lake Road Low Shrub Bog
- West Loon Lake
- Industrial Park Marsh
- Petite Lake Road Marsh
- Little Silver Lake
- Sun Lake Forest Preserve

Table 4-2 summarizes the size, natural resources (communities, rare plants and animals, and other characteristics), and protection status of each of the nine sites identified during the inventory. Figure 4-4 shows the locations of these nine sites as well as the FRWBIS sites adjacent to the watershed, including

Heron Harbor Marsh, Cross Lake, Antioch Bog, Lindenhurst Marsh, Windance Acres Marsh, Grand Avenue Marsh, and Petite Lake.

4.4.2 Watershed-Scale Greenway

An opportunity exists to protect a watershed-scale greenway that currently connects ecologically significant areas lying southwest of the watershed (the Grant Woods Forest Preserve) to ecologically significant areas lying northeast of the watershed (the State of Illinois Conservation Area) as shown on Figure 4-4. This watershed-scale greenway would be composed of protected and currently unprotected land- and water-based, open land. A significant amount of this open land is unprotected. The water-based sites in the watershed are not protected and are not expected to be removed regardless of their protection status; however, the stakeholders in the watershed should consider protecting land-based sites by such means as conservation easements, platted dedications or acquisition.

4.4.3 Wetlands

Wetlands provide important habitat for aquatic plants and animals, including a number of state threatened and endangered species. Some wetlands also recharge groundwater tables. Wetlands provide a variety of recreational opportunities such as hunting, fishing, and bird-watching.

The Lake County Forest Preserve District estimates that Lake County may have lost about 20 percent of the more than 48,000 acres of wetland that existed prior to the area's settlement. This reflects a high level of protection compared to the national wetland loss average of 90 percent. Unfortunately, LCHD has estimated that only about 5 percent of the remaining wetlands are pristine, having never been plowed, grazed, or otherwise damaged (Dreher and others 1992). Historically, the most significant cause of wetland degradation in the county was likely draining of land for agricultural purposes. In the recent past, wetland degradation has been caused by activities associated with urban development, including filling, excavation, and draining of land; sedimentation from construction site erosion; and discharge of untreated stormwater runoff (Dreher and others 1992).

Figure 4-4 Protection Status of Ecologically Significant Areas

TABLE 4-2

FRWBIS IN THE SEQUOIT CREEK WATERSHED

Size (acres)	Natural Resources				Protection Status
	Communities[a]	Rare Plants	Rare Animals	Other Characteristics	
Beach Grove Road Wetland (ADID Study Site No. 22)					
27	Sedge meadow (B) Basin marsh (B)	None	None	Good sedge meadow community with emergent marsh in center Marsh heavily used by small birds Overall, site provides good variety of habitat Sedge meadow dominated by prairie cord grass and sedges Very high species diversity and very low degree of disturbance	Unprotected
Cedar Lake (ADID Study Site No. 38)					
342	Graminoid bog (B) Basin marsh (C) Kettle lake (B)	State threatened and endangered species present	State threatened and endangered species present	Outstanding example of glacial lake in Illinois Significant declines in the quality of native plant communities and in viable populations of threatened and endangered species resulting from aggressive replacement by exotic species (buckthorn and reed canary grass) Dense residential development of the lakeshore threatens water quality because of nutrients in runoff	Portions protected by IDNR (dedicated nature preserve and formally recognized natural area)
Deep Lake (INAI Site and ADID Study Site No. 29)					
207	Kettle lake (B)	State endangered species present	State threatened and endangered species present	Connected to Sun Lake natural area by wetlands (all ADID) Run-off from residential development on east and south side of lake	INAI site No legal protection
Deep Lake Road Low Shrub Bog (Portions of ADID Study Site No. 17)					
160	Low shrub bog (B, C) Sedge meadow (B, C)	State endangered species present	None	Exotic species (buckthorn and purple loosestrife) present	Unprotected but adjacent to forest preserve and IDNR land

TABLE 4-2 (Continued)
FRWBIS IN THE SEQUOIT CREEK WATERSHED

Size (acres)	Natural Resources				Protection Status
	Communities[a]	Rare Plants	Rare Animals	Other Characteristics	
Industrial Park Marsh (ADID Study Site No. 26)					
20	Basin marsh (C)	None	None	Site has good hemimarsh condition Area is a cycling marsh currently being used by muskrats Overall, site provides good wildlife habitat Runoff from industrial park and encroachment of development threaten water quality	Unprotected but adjacent to Sun Lake Forest Preserve and Lake County Forest Preserve District
West Loon Lake INAI Site and Portions of ADID Study Site No. 17)					
468	Kettle lake (B) Sedge meadow (C) Basin marsh (C)	State endangered species present	State threatened and endangered species present	Pollution and siltation from residential development threaten water quality	No legal protection
Petite Lake Road Marsh (ADID Study Site No. 188)					
25	Basin marsh (C)	None	State threatened species present	Exotic species (purple loosestrife and reed canary grass) present Reduction of hemimarsh has occurred Development is causing wetland degradation	Unprotected
Little Silver Lake (ADID Study Site No. 14)					
60	Kettle lake (C)	None	State threatened and endangered species present	Rare fish record from 1992, SIU- Carbondale collection Leachate from landfill, septic system pollution, and runoff from cottage development on northern side of lake threaten water quality	Unprotected
Sun Lake Forest Preserve (ADID Study Sites No. 27 through 29)					
521.5	Kettle lake (B) Basin marsh (C) Sedge meadow (C) Loamy mesic prairie (C)	State threatened and endangered species present	State threatened and endangered species present	Outstanding example of glacial lake in Illinois Adjacent to Deep Lake, which is known for rare fish and aquatic plants Invasive purple loosestrife and broad-leaved cattails displacing conservative species on calcareous floating mat Buckthorn and reed canary grass are serious threats Residential developments will soon surround much of preserve	Owned and managed by the Lake County Forest Preserve District

Notes:

[a] Letter in parentheses indicates Fox River Biodiversity Inventory grade

ADID Advanced identification

The WDO contains an effective program for preserving the wetlands of the county. This program may be supplemented with publicly funded wetland mitigation and enhancement activities to increase the overall quality of wetlands in the Sequoit Creek watershed.

SMC initiated a wetland banking study in 2001 to evaluate the potential for a wetland banking program in Lake County. Wetland banking is a convenient way to replace wetlands drained or filled for agriculture or urban development. Wetland banking allows a person wishing to drain or fill a wetland to purchase wetland credits from someone who has already restored or created a wetland and "deposited" those wetland credits in an approved “Wetland Bank.” Because of the increasing demand for mitigation bank credits throughout Lake County, SMC authorized a wetland banking study in 2001 for the North Branch of the Chicago River basin and the Squaw Creek and Sequoit Creek watersheds. The purpose of the study was to identify potential wetland restoration sites and select the most feasible sites for further evaluation as possible mitigation banks (Hey and Associates, Inc. 2001). SMC should continue its efforts to identify potential wetland restoration sites in the watershed.

CHAPTER 5
ACTION PLAN

This chapter presents the action plan for the Sequoit Creek watershed. Section 5.1 discusses recommended action items and associated responsible parties to achieve the goals and objectives presented in Chapter 2. Sections 5.1 through 5.7 address action plan effectiveness, plan implementation, coordination and cooperation, plan assessment, plan updates, and costs and funding, respectively. In addition, SMC has prepared a document entitled "Watershed Restoration and Management Techniques" that describes various best management practices (BMP) applicable to the Sequoit Creek watershed. The document is included in a supplement to this plan.

SMC, in cooperation with stakeholders, prepared a watershed management plan for the Little Silver Lake watershed, which is located in the northeast corner of the Sequoit Creek watershed as shown on Figure 5-1. The Little Silver Lake management plan (LSLMP) lists specific action items and management measures intended to protect the short- and long-term ecological health of Little Silver Lake. The LSLMP is therefore included as part of the action plan for the Sequoit Creek watershed, which will be implemented after adoption by the Lake County Board. However, the action items in the LSLMP are not explicitly discussed in this Sequoit Creek watershed management plan. Figure 5-1 also illustrates proposed sites for the implementation of action items listed in Table 5-1, including proposed stream and wetland restoration areas, potential floodproofing or buy-out areas, and potential regional detention sites. The restoration activities will consist of removing tree branches and other brush from Sequoit Creek.

5.1 RECOMMENDED ACTION PLAN AND RESPONSIBLE PARTIES

Table 5-1 details the recommended action plan. Each portion of the table identifies the following:

- The party that is best positioned to implement the actions
- The actions recommended
- The status of the actions (ongoing or new)

With regard to action status, ongoing actions may be improved in the future if new regulations or a broader effort is initiated. The recommended time frames for implementing plan actions include a short term of 5 years and a long term of 20 years. The 5-year time frame was chosen because it is the common planning cycle for most local and state governments. The 20-year time frame follows naturally from the time horizon that was used for population and land use projections.

Figure 5-1. Proposed Action Plan Implementation Sites

TABLE 5-1
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
Village of Antioch			
AN1	Amend the local WDO to incorporate the following provisions that will be applied to the Sequoit watershed • Encourage wet-bottom or wetland detention basins • Require mapping of drain tiles for all new developments located in farmlands • Require drainage easements or overland flow paths, and high water elevations for stormwater facilities to be based on full-build out conditions in the tributary watershed	✓	✓
AN2	Implement minimum six National Pollutant Discharge Elimination System (NPDES)-II nonpoint source pollution control measures: • Public education and outreach • Public participation and involvement • Illicit discharge detection and elimination; eliminate residual sanitary-stormsewer cross connections. • Construction site runoff control • Post construction runoff control • Pollution prevention and good housekeeping Complete mapping of the municipal storm sewer including outfalls to Sequoit Creek system within 5 years as planned.	✓	✓ ✓
AN3	Address sewer backups in the problem areas shown on Figures 4-1 and 5-1: • Analyze the sewer system's capacity in order to identify areas susceptible to sewer backups • Select remedial measures, including constructing relief sewers; relining sewers to reduce inflow and infiltration; disconnecting inappropriate connections such as sump pumps; and installing risers, backflow preventors, and storage components		✓
AN4	Identify and remediate infiltration and inflow into sanitary sewers in old parts of the village. Replace leaking sanitary sewers with new sewers with watertight joints to prevent infiltration. Prepare a master plan that identifies priority sewers. Continue to replace collapsed sanitary sewer systems, and add chimney raps to seal manholes starting in June 2003 (Tetra Tech 2002f). Complete village sanitary sewer rehabilitation projects initiated during the past several years (NIPC 1995). Identify potential funding sources, including grants.	✓ ✓ ✓	✓ ✓ ✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
AN5	Expand the WWTP to accommodate projected population growth. The Antioch WWTP flow rate steadily increased from 1997, when it was about 1 million gallons per day (MGD), to 2001, when it was about 1.5 MGD (Gutowski 2000, 2001). The WWTP's average design capacity is 1.6 MGD. The 2001framework plan requires any future expansion to recognize potential impacts to Sequoit Creek. Identifying funding sources (including grants) early will help ensure timely WWTP expansion. Potential funding sources are identified in Section 5.7.		✓
AN6	Incorporate conservation design development techniques into local zoning regulations for new developments where feasible. Conservation design development protects open land while allowing development to continue. In conservation design development, half or more of the buildable land area is designated as permanent open land. This approach allows the same density of development as conventional development; however, developed areas are located on less land through clustering of buildings.		✓
AN7	Implement the county's framework plan recommendation to preserve open space and areas that the ongoing USGS mapping study identifies as aquifer recharge areas.		✓
AN8	Promote infiltration through local landscaping practices. Use of native, deep-rooted vegetation such as prairie grass instead of common turf on lawns can enhance infiltration. Also, nonpoint source pollution control programs should include local landscaping techniques that promote infiltration. Such techniques are included in the supplement to this watershed management plan. Suitable areas for application of these techniques include all new developments.		✓
Village of Lake Villa			
LV1	Amend the local WDO to incorporate the following provisions that will be applied to the Sequoit watershed: • Encourage wet-bottom or wetland detention basins • Require mapping of drain tiles for all new developments located in farmlands • Require drainage easements or overland flow paths, and high water elevations for stormwater facilities to be based on full-buildout conditions in the tributary watershed.	✓	✓
LV2	Implement the minimum six NPDES-II nonpoint source pollution control measures: • Public education and outreach. • Public participation and involvement. • Illicit discharge detection and elimination. Identify all stormwater outfalls to Sequoit Creek. • Construction site runoff control. Priority areas are shown on Figure 4-3. • Post construction runoff control. Priority areas are shown on Figure 4-3. • Pollution prevention and good housekeeping.	✓	✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
LV3	Incorporate conservation design development techniques into local zoning regulations for new developments where feasible. Conservation design development protects open land while allowing development to continue. In conservation design development, half or more of the buildable land area is designated as permanent open land. This approach allows the same density of development as conventional development; however, developed areas are located on less land through clustering of buildings.		✓
LV4	Implement the county's framework plan recommendation to preserve open space and areas that the ongoing USGS mapping study identifies as aquifer recharge areas		✓
LV5	Promote infiltration through local landscaping practices. Use of native, deep-rooted vegetation such as prairie grass instead of common turf on lawns can enhance infiltration. Also, nonpoint source pollution control programs should include local landscaping techniques that promote infiltration. Such techniques are included in the supplement to this watershed management plan. Suitable areas for application of these techniques include all new developments.		✓
Lake County Building and Zoning Department			
LC1	Amend the local WDO to incorporate the following provisions that will be applied to the Sequoit watershed • Encourage wet-bottom or wetland detention basins • Require mapping of drain tiles for all new developments located in farmlands • Require drainage easements or overland flow paths, and high water elevations for stormwater facilities to be based on full-build out conditions in the tributary watershed.	✓	✓
LC2	Implement the minimum six NPDES-II nonpoint source pollution control measures: • Public education and outreach • Public participation and involvement • Illicit discharge detection and elimination. Identify all stormwater outfalls to Sequoit Creek. • Construction site runoff control. Priority areas are shown on Figure 4-3. • Post construction runoff control. Priority areas are shown on Figure 4-3. • Pollution prevention and good housekeeping	✓	✓
LC3	Incorporate conservation design development techniques into local zoning regulations for new developments where feasible. Conservation design development protects open land while allowing development to continue. In conservation design development, half or more of the buildable land area is designated as permanent open land. This approach allows the same density of development as conventional development, but developed areas are located on less land through clustering of buildings.		✓
LC4	Implement the county's framework plan recommendation to preserve open space and areas that the ongoing USGS mapping study identifies as aquifer recharge areas		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
LC5	Promote infiltration through local landscaping practices. Use of native, deep-rooted vegetation such as prairie grass instead of common turf on lawns can enhance infiltration. Also, nonpoint source pollution control programs should include local landscaping techniques that promote infiltration. Such techniques are included in the supplement to this watershed management plan. Suitable areas for application of these techniques include all new developments.		✓
School Districts			
SD1	Incorporate Sequoit Creek watershed studies in school curricula. Elements of such studies could include the following • Organizing a network of teachers in the participating school districts • Assisting the teachers in developing appropriate curricula by drawing on free materials available from the U.S. Environmental Protection Agency (EPA), the Center for Watershed Protection, and others • Conducting a training process to inform teachers of the purpose, needs, and goals of the educational program • Preparing educational materials, including newsletters and pamphlets • Holding conferences involving teachers and stakeholders Putting informational materials on school district web sites as educational resources		✓
SD2	Participate in storm sewer stenciling programs in municipalities of Antioch and Lake Villa.		✓
SD3	Participate in water quality monitoring programs and workshops such as those conducted by VLMP.		✓
Lake County Department of Transportation (LCDOT) and Illinois Department of Transportation (IDOT)			
DT1	Improve road crossings in floodplains at Highway 83 and Route 132 to prevent road closures during storm events of up to the 100-year frequency.	✓	✓
DT2	Conduct a maintenance program to remove debris at culverts and bridges after high flow events.	✓	
DT3	Work with SCPC, the Lake County Forest Preserve District, and other watershed representatives to identify and implement opportunities to connect open space within the watershed to the LCDOT countywide trail. LCDOT's countywide plan to establish a trunk system of trails that local communities can connect to was expected to be completed by spring 2002. Once the plan is completed, feasible opportunities to connect areas within the watershed to these trails could be identified and pursued.		✓
Lake County Forest Preserve District			
FP1	Restore to Grade A the natural communities in ecologically significant areas that are slightly to moderately degraded (Grades B and C). This applies to District-owned lands and is subject to available funding (see Table 5-2).		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
FP2	Develop and implement an exotic and invasive species management plan to prevent significant declines in the quality of native plant communities and in the viable populations of threatened and endangered species. The Fox River Watershed Biodiversity Inventory indicates that some ecologically significant areas in the watershed are already at risk from invasive and exotic species. Data for the Biodiversity Inventory were collected several years ago and may not be representative of current conditions. Priority areas containing invasive and exotic species include the Deep Lake Road low shrub bog, Petit Lake Road marsh, and Sun Lake Forest Preserve. These areas are depicted on Figure 4-4.		✓
FP3	Conduct focused surveys for potential threatened and endangered species to generate a more accurate list of such species in the watershed and possibly to identify new ecologically significant areas that meet the habitat requirements for state-listed and federally listed threatened and endangered species. The number of threatened and endangered species documented by IDNR and USFWS as being present in the watershed may not accurately reflect the total number of such species present. The focused surveys could include the following components: • A literature review for all potential threatened and endangered species in the region • Determination of whether habitats required by potential threatened and endangered species in the region are present in the watershed • Implementation of focused (species-specific) surveys at sites that meet the habitat requirements for potential threatened and endangered species		✓
FP4	Evaluate potential wetland restoration sites within the forest preserve district holdings, such as the locations shown on Figure 5-1. Restore wetlands to provide multiple benefits such as storage, water quality, and habitat.		✓
SMC			
SM1	Buy out frequently flooded properties in floodplains, and restore floodplain functions. Buying out existing developed areas that are frequently flooded would provide opportunities for restoring previously lost floodplains. In addition to the advantages of increased floodplain water storage, buyouts are economical in the long term. Potential buyout areas are depicted on Figure 5-2.		✓
SM2	Assist homeowners in obtaining funding for flood mitigation activities. Methods can be explored for combining funding from the Villages of Lake Villa and Antioch to meet local match requirements for acquisition or relocation of flood-prone buildings or critical facilities.		✓
SM3	Identify demonstration projects in the watershed, submit Section 319 funding applications, provide local match with in-kind assistance.		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
SM4	Identify properties that are suitable candidates for structural flood-proofing, and provide homeowners with information to help them implement flood-proofing measures.		✓
SM5	Initiate a program to construct regional detention facilities. Such facilities are a cost-effective way to reduce flood peaks and improve water quality. Priority locations for these facilities are subbasins in which new developments are expected. Potential locations are shown on Figure 5-1 and are discussed in Table 5-4.		✓
SM6	Coordinate with municipalities to implement NPDES-II public education, outreach, and involvement efforts	✓	✓
SM7	Coordinate with the Lake County Forest Preserve District and private residents to provide technical assistance for restoring channelized portions of Sequoit Creek to their natural condition. This action will improve habitat, floodplain water storage, and water quality. The priority reaches are Reaches 6, 7, 8, 9, and 10 (see Figure 3-1).		✓
SM8	Coordinate with the Lake County Homeowners Association, townships, and SCPC to provide technical and funding assistance for retrofitting detention basins in order to improve water quality and reduce peak flows. The detention basin inventory identified 14 dry detention basins that are good candidates for retrofitting. The locations of these basins are presented on Figure 3-3. In addition, Table 5-5 presents additional problems that will require maintenance or corrective action.		✓
SM9	Promote infiltration through local landscaping practices. Use of native, deep-rooted vegetation such as prairie grass instead of common turf on lawns can enhance infiltration. Also, nonpoint source pollution control programs should include local landscaping techniques that promote infiltration. Such techniques are included in the supplement to this watershed management plan. Suitable areas for application of these techniques include all new developments.		✓
Homeowner Associations, Lake Associations, and Residents			
HA1	Address erosion problems observed along creek and lake shorelines. Priority problem areas are shown on Figure 4-2 and include Reach 23 and the west shore of Cedar Lake. Erosion problems can be remediated through a variety of bioengineering and hard engineering bank stabilization techniques. Priority should be given to low-cost bioengineering techniques such as use of native, deep-rooted vegetation to stabilize soil and improve habitat, but appropriate techniques will vary from site to site. More details on erosion control techniques are provided in SMC's "Watershed Restoration and Management Techniques," which supplements this watershed management plan.		✓
HA2	Establish a program to monitor the condition of creek banks and lake shorelines, and use the monitoring results to assess the effectiveness of the bank stabilization techniques applied and the resulting habitat improvements.		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
HA3	Evaluate and implement control measures for reducing erosion resulting from use of large boat motors in all lakes used for boating, with priority on Cedar and Deep Lakes. Boats with large motors can have a profound effect on lakes and rivers. Research has shown that more damage results from wake turbulence caused by fast-moving boats than from fuel spills or exhaust emissions. The energy stored in the waves of a boat's wake can drastically speed up erosion of shorelines, especially in rivers or lakes where boats can pass very close to the shore. Below the surface, turbulence from propellers resuspends sediment in water less than 6 feet deep, leading to higher turbidity and less light transmission throughout the water body (Asplund 2000). These effects can lead to degradation of habitat. Both Cedar and Deep Lakes are home to threatened and endangered species, and so it is important to preserve the habitat in these lakes.		✓
HA4	Implement a program to control waterfowl around lakes. Waterfowl contribute to fecal coliform, nutrient, and total suspended solid (TSS) loads to lakes in the Sequoit Creek watershed. Priority problem areas include neighborhoods lining Cedar, Deep, West Loon, and East Loon Lakes. Lake waters in these areas have contained fecal coliform concentrations exceeding LCHD's beach closing limit. Some deterrence measures include installing brightly colored flagging or using noisemakers. The most effective long-term method for keeping waterfowl away from lakes is installing a buffer of native vegetation in place of short turf grass. More information can be obtained from the Department of Natural Resources.		✓
HA5	Implement a maintenance program to remove debris from Sequoit Creek after large storm events. Some woody debris should be left in place to provide habitat for microorganisms and fish.		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
HA6	Develop and implement an exotic and invasive species management plan to prevent significant declines in the quality of native plant communities and in the viable populations of threatened and endangered species. Priority areas containing invasive and exotic species include Cedar Lake and the Deep Lake Road low shrub bog. The Fox River Watershed Biodiversity Inventory indicates that some ecologically significant areas in the watershed are already at risk from invasive and exotic species. Data for the biodiversity inventory were collected several years ago and may not be representative of current conditions. An exotic and invasive species management plan could include the following components: • A literature review for all potential invasive exotic species in the region • Determination of whether habitats required by potential invasive exotic species in the region are present in the watershed • Implementation of a focused, watershed-wide inventory of sites that meet the habitat requirements for invasive exotic species • Identification and implementation of practical control measures (mechanical, chemical, and biological) for invasive exotic species • Development and distribution of educational materials for private landowners that provide information on how to identify invasive exotic species, whom to report new observations of invasive exotic species to, and how to get help in controlling invasive exotic species		✓
HA7	Within each Homeowner Association, establish a maintenance program for detention basins to ensure that they function as intended. Stabilize shorelines and buffers, unclog inlets and outlets, and stabilize localized erosion. These actions will improve habitat for local fish and wildlife.	✓	✓
HA8	Coordinate with SMC to establish a program for retrofitting existing detention basins in order to enhance water quality and reduce peak flows. Table 5-5 lists problems that were identified in the assessment.		✓
HA9	Expand fecal coliform monitoring to include privately owned beaches of West Loon, East Loon, Cedar, Deep, and Little Silver Lakes. Homeowners or LCHD could collect samples and LCHD could analyze samples for a fee.	✓	✓
HA10	Initiate a program to reduce septic system failures by improving existing systems and carrying out maintenance and inspections. LCHD can assist associations with educational programs about maintenance, new technologies, existing codes, and enforcement.		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
SCPC and Fox River Watershed Management Board (FRWMB)			
SC1	Promote stewardship of Sequoit Creek and lakes in the watershed by increasing public participation. High-profile demonstration projects such as Section 319 projects can be developed that include hands-on public participation in activities such as shoreline and channel restoration and storm sewer stenciling.		✓
SC2	Facilitate watershed management plan implementation by participating in plan review, monitoring, implementation, and plan updating.		✓
LCHD, IDNR, and IEPA			
EP1	LCHD and IEPA to expand the existing monitoring program to include assessment of fish tissue data. Fish tissue samples are important because they allow the best assessment of toxicity in lakes. All lakes in the watershed should be monitored for fish tissue toxicity. The monitoring should be prioritized based on the severity of existing water quality impairments in the lakes. IDNR may collect the samples, and IEPA will analyze the samples and report the results.		✓
EP2	IEPA to conduct additional facility-related stream survey (FRSS). IEPA is responsible for conducting FRSSs to assess the impacts of point source dischargers on water quality. An FRSS was conducted for the Antioch WWTP in 1990, but no others have been conducted for the Antioch WWTP or for Kay Home Products. FRSSs are needed for both the Antioch WWTP and Kay Home Products to determine whether their discharges are causing the elevated concentrations of nutrients and chlorine observed in Sequoit Creek.		✓
EP3	LCHD to continue LCHD's complaint-response system in areas served by septic systems as a key component of the overall effort to address septic system problems in the Sequoit Creek watershed. LCHD responds to complaints within 7 days, and homeowners have up to 60 days to correct identified problems in accordance with state statutes.	✓	
EP4	LCHD to establish a funding program for maintaining and remediating septic systems around West Loon, East Loon, Cedar, Deep, and Little Silver Lakes. A subdivision in Lake County is currently participating in a pilot program involving establishment of a management district responsible for maintaining and remediating subdivision septic systems. Adopting such a program for the Sequoit Creek watershed would reduce homeowner costs for remediating poorly maintained septic systems. Another option for reducing homeowner costs for new developments is creating septic system utilities in such a way that a cluster of homes relies on one large septic system.	✓	✓
EP5	LCHD to prepare and distribute educational materials on septic systems.	✓	✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
EP6	Coordinate the water quality sampling efforts of IEPA, Volunteer Lake Management Program (VLMP), LCHD, and Lake County Homeowners Association. Tracking and evaluating all the data collected during these efforts would allow a continuous comprehensive assessment of water quality in the watershed. A complete and comprehensive data set is also needed to measure BMP effectiveness.		✓
Interjurisdictional: Local Governments, Private, Land Conservation Foundations, IDNR, Lake County Forest Preserve District, LCHD, SMC, U.S. Army Corps of Engineers (COE), USFWS, NRCS			
JR1	Permanently protect unprotected high-priority open land sites. High-priority open land sites were identified using the Lake County Forest Preserve District's criteria for prioritizing open land parcels for purchase. These sites are listed in Table 5-3 and shown on Figure 5-2. Instruments for protecting these sites may include mutual covenants, leases, management agreements, installment sales, bargain sales, sales with reserved life, outright donations, donations by will, deed restrictions, reverter clauses, easements prior to conveyance, and managed area designations.		✓
JR2	Protect unprotected, land-based sites that provide a watershed-wide greenway. The watershed-wide greenway connects ecologically significant areas southwest of the watershed (the Grant Woods Forest Preserve) to ecologically significant areas northeast of the watershed (the State of Illinois Conservation Area). The recommended unprotected sites are shown on Figure 4-4.		✓
JR3	Develop management plans for the 28 state-listed threatened and endangered species that have been observed in the watershed. Each management plan should address ecologically significant areas previously identified as providing habitat for the threatened or endangered species and any new ecologically significant areas identified during focused (species-specific) surveys. A management plan should include the following components: • The species' physical description, distribution, habitat requirements, and life history as well as the reasons for its decline • Habitat management prescriptions • Monitoring requirements and associated costs • An awareness program, including distribution of species fact sheets to the public		✓
JR4	Promote infiltration through local landscaping practices. Use of native, deep-rooted vegetation such as prairie grass instead of common turf on lawns can enhance infiltration. Also, nonpoint source pollution control programs should include local landscaping techniques that promote infiltration. Such techniques are included in the supplement to this watershed management plan. Suitable areas for application of these techniques include all new developments.		✓

TABLE 5-1 (Continued)
ACTION PLAN

Responsible Party and Action No.	Actions	Action Status	
		Existing	New
JR5	Continue collecting data on macroinvertebrate populations along the downstream end of Sequoit Creek as part of the Critical Trends Assessment Program (CTAP). After 2002, IDNR will evaluate the biological integrity of the downstream end of Sequoit Creek every 5 years. Also, track and evaluate CTAP data along with H.O.D. Landfill long-term monitoring data and potential future sampling data will allow more comprehensive assessment of water quality in Sequoit Creek. Priority data collection locations include Reaches 15 through 23 (see Figure 4-1).	✓	✓
JR6	Implement the county's framework plan recommendation to preserve groundwater recharge areas identified in the ongoing USGS mapping survey.		✓
Lake County Soil and Water Conservation District (LCSWCD), National Resource Conservation Service			
NR1	Provide technical assistance to SMC, local municipalities, and developers in construction and post-construction soil erosion control for compliance with NPDES-II. Conduct training workshops.	✓	✓
NR2	Participate in public awareness campaigns. Produce and distribute educational materials pertinent to NPDES-II compliance.	✓	✓

Figure 5-2. Proposed Open Land Parcels

Table 5-2 lists slightly to moderately degraded natural communities in the Sequoit Creek watershed. Those lands that are LCFPD-owned are associated with Action Item FP2, subject to available funding.

TABLE 5-2
SLIGHTLY TO MODERATELY DEGRADED
NATURAL COMMUNITIES IN THE WATERSHED

Ecologically Significant Area	Natural Community	Grade	Status
Beach Grove Road Wetland	Sedge meadow	B	Unprotected
	Basin marsh	B	
Cedar Lake	Graminoid bog	B	Portions protected by IDNR
	Basin marsh	C	
	Kettle lake	B	
Deep Lake	Kettle lake	B	Unprotected
Deep Lake Road Low Shrub Bog	Low shrub bog	B, C	Unprotected
	Sedge meadow	B, C	
Industrial Park Marsh	Basin marsh	C	Unprotected
East and West Loon Lakes	Kettle lake	B	Unprotected
	Sedge meadow	C	
	Basin marsh	C	
Petite Lake Road Marsh	Basin marsh	C	Unprotected
Little Silver Lake	Kettle lake	C	Unprotected
Sun Lake Forest Preserve	Kettle lake	B	Owned and managed by the Lake County Forest Preserve District
	Basin marsh	C	
	Sedge meadow	C	
	Loamy mesic prairie	C	

Source: Chicago Wilderness 2000

Table 5-3 lists proposed open land parcels, their potential benefits, and their protection rank. The properties listed in Table 5-3 are recommended by LCSMC and do not reflect the plans of any other unit of government that has jurisdiction within the Sequoit Creek watershed.

TABLE 5-3
PROPOSED OPEN LAND PARCELS

Location (Tax Parcel No.)	Protects Wildlife Habitat	Preserves Wetlands, Prairies, or Forests	Provides Trials, Greenways, or River/Lake Access	Saves Large Refuges	Expands Existing Preserves	Protection Rank
Deep Lake Road Low Shrub Bog	Yes (state endangered plant species present)	Yes (contains portions of ADID Site No. 17)	Yes (provides greenway between East Loon Lake and Redwing Marsh Forest Preserve)	Yes (about 160 acres)	Yes (adjacent to Redwing Marsh Forest Preserve)	1
Petite Lake Road Marsh	Yes (state threatened animal species present)	Yes (contains ADID Site No. 188)	Yes (provides greenway between Cedar Lake and Industrial Park Marsh)	No (about 25 acres)	Yes (adjacent to Sun Lake Forest Preserve)	2
North of Sequoit Creek Forest Preserve and West of Little Silver Lake	Unknown (no threatened or endangered species documented)	Yes (contains portions of ADID Site No. 14)	Yes (provides greenway between Sequoit Creek Forest Preserve and Little Silver Lake)	Yes (about 120 acres)	Yes (adjacent to Sequoit Creek Forest Preserve)	3
South of Cedar Lake Bog Nature Preserve	Unknown (no threatened or endangered species documented)	Yes (contains LCWI wetland)	Yes (provides greenway between Cedar Lake Bog Nature Preserve and Grand Avenue Marsh)	Yes (about 85 acres)	Yes (adjacent to Cedar Lake Bog Nature Preserve)	4
Farm north of Sun Lake Forest Preserve	Unknown (no threatened or endangered species documented)	Yes (contains portions of ADID Site No. 17)	Yes (provides greenway between Sun Lake Forest Preserve and East Loon Lake)	No (about 50 acres)	Yes (adjacent to Sun Lake Forest Preserve)	5
East and adjacent to Sequoit Creek Forest Preserve	Unknown (no threatened or endangered species documented)	Yes (contains portions of ADID Site No. 17)	Yes (provides greenway between Sequoit Creek Forest Preserve and Little Silver Lake)	No (about 20 acres)	Yes (adjacent to Sequoit Creek Forest Preserve)	6
Industrial Park Marsh	Unknown (no threatened or endangered species documented)	Yes (contains ADID Site No. 26)	Yes (provides greenway between Sun Lake Forest Preserve and Petite Lake Road Marsh)	No (about 20 acres)	Yes (adjacent to Sun Lake Forest Preserve)	7
East of Little Silver Lake	Unknown (no threatened or endangered species documented)	Yes (contains portions of ADID Site No. 14)	Yes (extends greenway of Sequoit Creek Forest Preserve to Little Silver Lake)	No (about 20 acres)	No	8
Between Sequoit Creek Forest Preserve and West Loon Lake	Unknown (no threatened or endangered species documented)	Yes (contains portions of ADID Site No. 17)	Yes (provides greenway between Sequoit Creek Forest Preserve and West Loon Lake)	No (about 10 acres)	Yes (adjacent to Sequoit Creek Forest Preserve)	9
Beach Grove Road Wetland	Unknown (no threatened or endangered species documented)	Yes (contains ADID Site No. 22)	No	No (about 27 acres)	No	10

Notes:

ADID = Advanced Identification
LCWI = Lake County Wetland Inventory

Table 5-4 lists potential regional detention basin sites. The table also indicates the approximate area that would be served by each detention basin and its relevance in terms of 2020 land use projections.

TABLE 5-4

POTENTIAL REGIONAL DETENTION BASIN SITES

Subwatershed ID No.	Approximate Area Served by Regional Detention Basin (Acres)	Approximate Storage Volume (acre-feet)	Approximate Percentage of Developed Area	Remarks
22	110	20	20	According to 2020 land use projections, there are no plans for development in this subwatershed.
35	180	60	5	A regional detention basin in this watershed is important because flooding problems exist in the downstream watershed. In addition, this entire area is expected to be developed by 2020.
33 and 13	225	50	10	According to 2020 land use projections, plans for development are limited to the southern part of this subwatershed.
23 and 18	210	110	20	The proposed regional detention basin location is immediately upstream of an ADID wetland.
46	140	90	30	The regional detention basin would only serve the three undeveloped properties north of West Loon Lake, not the entire subwatershed.
48	270	32	25	The regional detention basin would serve only the undeveloped area south of Sequoit Creek, not the entire subwatershed.
48	270	63	75	The regional detention basin would serve only the undeveloped area north of Sequoit Creek, not the entire subwatershed. The proposed location is a non-ADID wetland.
26	110	40	10	The proposed location is a non-ADID wetland. This storage basin has the potential to alleviate the sewer backup in the area of Antioch that appears to have inadequate storm sewer capacity.

Notes:

ADID = Advanced Identification
ft = Foot
ID = Identification

Source: SMC 2002c, d, and e

Table 5-5 presents the results of the detention basin inventory. The table discusses the location and characteristics of each detention basin. It identifies problems or concerns associated with each basin and the potential for retrofit or restoration.

TABLE 5-5

DETENTION BASIN INVENTORY AND RETROFIT OPPORTUNITIES

Detention Basin No.[a]	Name	Location (Municipality: Street)	Basin Type[b]	Pollutant Removal Effectiveness	Identifiable Problems and Concerns	Potential Retrofit and Restoration Opportunities
1	Antioch High School	Antioch Township: West of McMillan Road	Wet	Fair (small storage)	- Rip-rap on 2 shorelines - Some dumping of construction debris on shore - Turbidity or algae	- Improve shoreline buffer - Expand storage
2	Falcon Hill Estates	Antioch Township: Route 59 and Edelweiss	Dry	Poor	-Concrete low-flow channels -Sediment accumulation at outlet	-Remove concrete channels -Create small wetland outlet
3	Heron Harbor	Antioch Township: Edgewater Lane	Wetland	Good	None	None
4	Heron Harbor No. 2	Antioch Township: Edgewater at Hillside	Wetland/dry	Good	- Some erosion from adjacent lots and basin sideslopes	- Occasionally mow or burn wetland to control woody vegetation - Stabilize lots and sideslopes
5	Heron Harbor No. 3	Antioch Township: Heron Drive	Wet	Fair to good	- Some shoreline erosion - Turbidity or algae - Large goose population - Short circuiting between one inlet and outlet	- Improve shoreline buffer and wetland shelf
6	Hidden Creek No. 1	Antioch Township: Hidden Creek Drive	Wet	Good	- Steep shoreline overgrown with reed canary grass - High turbidity	-Revegetate and stabilize shorelines - Contract-controlled outlet
7	Hidden Creek No. 2	Antioch Township: Deep Lake Road	Wetland/dry	Fair (small storage	- Sideslopes overgrown with weeds - Outlet structure unstable - Small storage; little restriction	-Revegetate sideslopes - Stabilize outlet (consider replacing with perforated riser)
8	Pine Hill Lakes No. 1	Antioch Township: Harvest Drive	Wet	Good	- Resident described excess erosion into pond during construction; some sediment at northern inlet - Algae	-Extend shoreline and wetland buffer zone where turf is intruding
9	Pine Hill Lakes No. 2	Antioch Township: Pine Drive	Wet	Good	- Rip-rap on shorelines - Minor sediment accumulation in connecting swale - Some algae	-Widen shoreline and wetland buffer zone

TABLE 5-5 (Continued)

DETENTION BASIN INVENTORY AND RETROFIT OPPORTUNITIES

Detention Basin No.[a]	Name	Location (Municipality: Street)	Basin Type[b]	Pollutant Removal Effectiveness	Identifiable Problems and Concerns	Potential Retrofit and Restoration Opportunities
10	Pine Hill Lakes No. 3	Antioch Township: Pine Drive	Wet	Good	- Rip-rap on shorelines - Some algae - Very little active storage	-Widen shoreline and wetland buffer zone
11	Tiffany Glen No. 1	Antioch Township: Private Road	Dry	Poor	- No vegetation in basin bottom (rip-rap) - Short-circuiting to outlet - Undersized basin	- Replace rip-rap with wetland
12	Tiffany Glen No. 2	Antioch Township: Private Road	Dry	Poor	- No vegetation in basin bottom (rip-rap) - Undersized basin	- Replace rip-rap with wetland
13	Regency Inn Motel	Antioch Township: Route 173	Wetland	Good	- Severe erosion around inlet pipe, concrete channels, and swale - Substantial sediment accumulation, especially on west side	- Stabilize or replace inlet channels - Occasionally mow or burn basin bottom to control woody vegetation - Stabilize vacant lot north of motel
14	Windmill Creek No. 1	Antioch Township: Sequoia and Windmill Creek	Wet (appears to be natural wetland)	Good	- Site still under construction, erosion control inadequate - Embankment at outlet not stabilized	- Stabilize exposed soil - Stabilize embankment
15	Windmill Creek No. 2	Antioch Township: Windmill Creek and Little Silver Lake Road	Wet	Good	- Erosion at upstream storm sewer inlet - Sediment in upstream channel	- Stabilize eroding inlet and channel - Improve shoreline buffer
16	Antioch Township Fire/Police Station	Antioch Township: North of Depot Street	Dry	Poor	None	- Retrofit to wet pond
17	Cedar Point Town Homes (under construction)	Antioch Township: Route 83 South of Joanna Court	Wet	Good	Proposed for construction	None

TABLE 5-5 (Continued)

DETENTION BASIN INVENTORY AND RETROFIT OPPORTUNITIES

Detention Basin No.[a]	Name	Location (Municipality: Street)	Basin Type[b]	Pollutant Removal Effectiveness	Identifiable Problems and Concerns	Potential Retrofit and Restoration Opportunities
18	Depot Street Station (not yet constructed)	Antioch Township: Depot Street and North Avenue	Wet	Good	Proposed for construction	None
19	Main Street Car Wash	Antioch Township: Route 83 south of Ainsley Drive	Dry	Poor	-Algae -Sidewalls constructed of landscape blocks -Wood debris and garbage in drainage ditch	- Institute regular maintenance
20	Mc Carty Mini Storage	Antioch Township: Route 83 south of Birchwood Drive	Dry	Poor	-No vegetation in basin bottom -Erosion caused from water seeping over and around concrete footing -Large crack in concrete wall of basin -Algae at outlet location -Sheen present on standing water at outlet location -No erosion control at the location of the 15-inch outlet and connecting drainage ditch	- Stabilize basin slopes with vegetation - Retrofit to convert to wet basin
21	Meyer Machine and Pro Air	Antioch Township: Route 83 south of Birchwood Drive	Dry	Poor	None	- Retrofit outlet to wet basin
22	Saint Ignatius of Antioch Episcopal Church	Antioch Township: Deep Lake Road and Depot Street	Wet	Good	-No inlets to basin -Overland flow appears to be bypassing basin -Outlet discharges to steep hillside and undersized drainage ditch -Emergency overflow could escape portions of northern berm	-Reconfigure emergency outlet -Reconfigure outlet to increase retention time -Conduct regular maintenance -Reconstruct berm to allow containment of emergency overflow

TABLE 5-5 (Continued)

DETENTION BASIN INVENTORY AND RETROFIT OPPORTUNITIES

Detention Basin No.[a]	Name	Location (Municipality: Street)	Basin Type[b]	Pollutant Removal Effectiveness	Identifiable Problems and Concerns	Potential Retrofit and Restoration Opportunities
23	Tiffany Farms Units 1, 2, and 3	Antioch Township: North Avenue and Tiffany Road	**Subbasin No. 2:** Dry **Subbasin No. 3:** Dry **Subbasin No. 4:** Dry	None	-Minor erosion and wood debris at outlet of Subbasin No. 2 -Little vegetation in bottom of Subbasin No. 4 -Minor erosion at outlet of Subbasin No. 4 -Sediment accumulation in outlet of Subbasin No. 4	-Conduct regular maintenance
24	Tiffany Road Senior Apartments	Antioch Township: Tiffany Road and North Lake Street	Wet	Good	-Sediment accumulation in basin bottom -Possible overflow occurrence	-Conduct regular maintenance -Evaluate capacity of discharge sewer system
25	Chain O'Lakes Community Bible Church	Antioch Township: Grass Lake Road	Dry (may be wet much of time; outlet is raised)	Fair	- Inadequate vegetative cover in basin and inlet swale - Sparse weed cover in basin bottom	- Create wetland in basin bottom - Revegetate sideslopes and inlet swale
26	Eagles Nest	Antioch Township: Grass Lake Road and Bald Eagle Road	Wet (may be natural depression)	Good	- Outlet does not provide substantial restriction	- Occasionally mow or burn basin bottom to control woody vegetation
27	Larson Industrial Park	Antioch Township: Route 83 at Apollo Court	Wet	Fair (undersized)	-Inlet pipe undercut and broken -Non-storm discharge observed (apparently illicit connection) - High turbidity	- Investigate illicit connection - Install outlet control - Expand shoreline and wetland buffer zone
28	Regency II No. 1	Antioch Township: South of Gridley Drive	Wet	Good	- Steep shoreline – some areas exposed or overgrown with reed canary grass and loosestrife	- Revegetate shoreline and wetland buffer zone
29	Regency II No. 2	Antioch Township: North of Gridley Drive	Wet	Fair to good	- Very turbid; carp activity - No control outlet	- Establish buffer on turf and bare shoreline
30	Regency II No. 3	Antioch Township: East of Gridley Drive	Wet	Fair to good	- Turbid - No control outlet - Basin appears undersized	- Avoid regular mowing of shoreline
31	Waters Edge Apartments No. 1	Lake Villa: Waters Edge Drive	Wet	Good	- Sediment (sand) accumulation at basin inlet - Some algae	None

TABLE 5-5 (Continued)

DETENTION BASIN INVENTORY AND RETROFIT OPPORTUNITIES

Detention Basin No.[a]	Name	Location (Municipality: Street)	Basin Type[b]	Pollutant Removal Effectiveness	Identifiable Problems and Concerns	Potential Retrofit and Restoration Opportunities
32	Waters Edge Apartments No. 2	Lake Villa: Waters Edge Drive	Wetland	Fair to good	- Some scour along inlet channel - Eroded gravel in basin bottom - Possible short-circuiting into lake	- Stabilize inlet - Prevent short-circuiting
33, 34, and 35	North Shore on Deep Lake	Lake Villa: Deep Lake Road	**Pond No. 1:** Dry **Pond No. 2 (outlot):** Dry **Pond No. 3:** Wetland	None	-Large erosion channel (about 200 feet long) from outlet of Pond No. 3 to Deep Lake -Tree roots exposed where soil has been eroded away within the erosion channel -Fallen trees in erosion channel	-Stabilize outlet channel -Retrofit to wet basin
36 through 39	Oakland Ridge	Lake Villa: Grass Lake Road	**Basin No. 1:** Dry **Pond No. 2:** Wet **Pond No. 3:** Wetland **Pond No. 4:** Wet	None Good Good Good	- Algae in Ponds No. 2, 3, and 4 -Large goose population near Pond No. 2 -Sediment accumulation in outlet of Pond No. 2 -Turbidity in Pond No. 4 -Short-circuiting between two inlets and outlet of Pond No. 3	-Retrofit to wet basin -Reconfigure outlets by reshaping basin to improve wetland functions -Conduct regular maintenance
40 through 50	Painted Lakes	Lake Villa: Grass Lake Road	**Ponds No. 1, 5, 7, 8, 9, and 11:** Wet **Pond No. 2:** Wetland **Ponds No. 3, 4, 6, and 10:** Wetland	Good for all ponds	-Algae in Ponds No. 1 through 11 -No grates on outlets of Ponds No. 1 through 11 to keep dead cattails and other debris from clogging outlets -Turbidity in Pond No. 2 -No erosion control in tilled farm field at outlet of Pond No. 8	-Evaluate quality of wetlands -Reconfigure outlets and ponds to improve water quality and habitat functions -Conduct regular maintenance
51	The Sanctuary Apartments	Lake Villa: Grand Avenue east of Sheehan Drive	**Pond No. 2:** Wet	Good	None	None

TABLE 5-5 (Continued)

DETENTION BASIN INVENTORY AND RETROFIT OPPORTUNITIES

Detention Basin No.[a]	Name	Location (Municipality: Street)	Basin Type[b]	Pollutant Removal Effectiveness	Identifiable Problems and Concerns	Potential Retrofit and Restoration Opportunities
No number	Cedar Village	Lake Villa: Cedar Village Road	Dry	Poor	- Low flow bypass of runoff from strip mall - Minor erosion at inlet from parking lot	- Route strip mall low flow through basin - Create wetland in basin bottom

Notes:

[a] See Figure 3-3 for locations of numbered detention basins.

[b] Basin types are based on the following definitions:

Wet: Manmade basin that is wet year-round.

Dry: Manmade basin that is dry part of the year.

Wetland: Natural depression that is classified as a wetland. Wetlands are assumed to be wet year-round. Wetlands that are dry part of the year are indicated as such.

5.2 ACTION PLAN EFFECTIVENESS

The effectiveness of the action plan depends on the degree to which each of the recommended actions addresses the issues and opportunities raised by SCPC members. Table 5-6 summarizes the potential contribution of each action item to meeting the four primary goals established by SCPC and the stakeholders. Table 5-6 provides a simple means of

- Selecting specific action items that achieve desired goals
- Prioritizing action items at the watershed level
- Monitoring implementation of the action plan
- Updating the action plan

TABLE 5-6
ACTION BENEFITS

Action No.	Action Item	Reduce Runoff and Improve Water Quality	Minimize Flood Damages	Improve Education and Outreach Programs for the Public, Developers, and Community Leaders	Protect and Restore Natural Resources
AN1	Amend the local WDO	[	[	[	[
AN2	Implement NPDES-II	[		[	[
AN3	Address sewer backups	[	[		
AN4	Identify and remediate infiltration and inflow into sanitary sewers	[			
AN5	Expand the WWTP	[			
AN6	Incorporate conservation design development techniques into zoning regulations	[	[		[
AN7	Preserve aquifer recharge areas as protected open spaces	[	[		[
AN8	Promote infiltration through local landscaping practices	[	[	[	
LV1	Amend the local WDO	[	[		[
LV2	Implement NPDES-II	[		[	[
LV3	Incorporate conservation design development techniques into zoning regulations	[	[		[
LV4	Preserve aquifer recharge areas as protected open space	[	[		[
LV5	Promote infiltration through local landscaping practices	[	[	[	
LC1	Amend the local WDO	[	[		[
LC2	Implement NPDES-II	[		[	[
LC3	Incorporate conservation design development techniques into zoning regulations	[	[		[
LC4	Preserve aquifer recharge areas as protected open spaces	[	[		[
LC5	Promote infiltration through local landscaping practices	[	[	[	
SD1	Incorporate Sequoit Creek Watershed Issues studies in school curricula			[	
SD2	Participate in pollution awareness campaigns such as storm sewer stenciling			[	
SD3	Participate in water quality monitoring programs and workshops			[	
DT1	Improve road crossings at Highway 83, Route 132, and Route 173		[		

TABLE 5-6 (Continued)
ACTION BENEFITS

Action No.	Action Item	Reduce Runoff and Improve Water Quality	Minimize Flood Damages	Improve Education and Outreach Programs for the Public, Developers, and Community Leaders	Protect and Restore Natural Resources
DT2	Conduct a maintenance program to remove debris at culverts and bridges	[	[		
DT3	Develop countywide trail plan	[			[
FP1	Restore degraded natural communities in ecologically significant areas	[			[
FP2	Develop and implement an exotic and invasive species management plan			[	
FP3	Conduct focused surveys for potential threatened and endangered species			[	[
FP4	Evaluate potential wetland restoration sites	[	[		[
SM1	Develop a buyout program for frequently flooded properties		[		
SM2	Help homeowners obtain flood mitigation funding		[		
SM3	Identify Section 319 or other demonstration projects in the watershed	[	[	[	[
SM4	Identify properties suitable for structural flood-proofing		[		
SM5	Initiate a program to construct regional detention facilities	[	[		
SM6	Coordinate with municipalities to implement NPDES-II			[	
SM7	Coordinate with the Lake County Forest Preserve District to restore channelized reaches of Sequoit Creek	[	[		[
SM8	Coordinate with the Lake County Homeowners Association to retrofit detention basins	[	[		
SM9	Promote infiltration through local landscaping practices	[	[	[	
HA1	Address erosion problems along shorelines	[			[
HA2	Establish a program to monitor erosion along shorelines	[		[	[
HA3	Evaluate and implement control measures to reduce erosion from motorboat traffic	[		[	[
HA4	Implement a program to control waterfowl	[			[
HA5	Implement a maintenance program to remove debris after large storms	[	[		[
HA6	Develop and implement an exotic and invasive species management plan	[			[
HA7	Establish a maintenance program for detention basins	[	[	[	[
HA8	Coordinate with SMC to retrofit detention basins	[	[		[

TABLE 5-6 (Continued)
ACTION BENEFITS

Action No.	Action Item	Reduce Runoff and Improve Water Quality	Minimize Flood Damages	Improve Education and Outreach Programs for the Public, Developers, and Community Leaders	Protect and Restore Natural Resources
HA9	Expand fecal coliform monitoring	[			
HA10	Initiate a program to reduce septic system failures	[		[	
SC1	Promote stewardship of the watershed			[	
SC2	Facilitate watershed management plan implementation		[	[	
EP1	Expand the existing monitoring program	[			
EP2	Conduct additional FRSSs	[			[
EP3	Continue complaint-response system for septic systems	[		[	
EP5	Establish a funding program to remediate failing septic systems	[			
EP5	Prepare and distribute educational materials on septic systems			[	
EP6	Coordinate IEPA, VLMP, LCHD, and Lake County Homeowners Association water sampling efforts	[		[	
JR1	Permanently protect unprotected high-priority open land sites	[	[		[
JR2	Protect unprotected, land-based sites that provide a watershed-wide greenway	[	[		[
JR3	Develop management plans for state listed threatened and endangered species	[			[
JR4	Promote infiltration through local landscaping practices	[	[	[	
JR5	Continue collecting data on macroinvertebrate populations	[			[
JR6	Preserve aquifer recharge areas as protected open space	[	[		[
NR1	Provide technical assistance to SMC, local municipalities with NPDES-II			[	
NR2	Participate in public awareness campaigns			[	

5.3 PLAN IMPLEMENTATION

Implementation of the watershed action plan will involve performing the recommended action items through projects. The following sections address how action items will be performed by presenting specific coordination and cooperation roles for the partners implementing the plan, discussing assessment of plan performance, and discussing plan updates. The chapter concludes with a discussion of potential funding sources for implementing the action items in the action plan. The list of funding sources presented is not exhaustive because funding sources are driven by a variety of initiatives intended to address watershed problems at the local, state, and federal levels. For this reason, the list may not include the most recent funding opportunities.

5.4 COORDINATION AND COOPERATION

Many stakeholders have a role in implementing the watershed action plan. As a result, a high level of coordination and cooperation will be necessary to implement many of the recommended action items. Coordination will ensure (1) less administrative burden, (2) buy-in by potential project sponsors, (3) that implementation schedules match funding availability, and (4) that resources are available to meet short- and long-term project needs. SMC and SCPC have thus far assumed a lead role in coordinating the development of the action plan. One of SMC's key roles has been interjurisdictional coordination. SCPC can continue supporting SMC's efforts by providing planning guidance for watershed plans and projects. Specific objectives and actions that will maximize coordination and cooperation among stakeholders are outlined in Table 5-7.

TABLE 5-7
COORDINATION AND COOPERATION OBJECTIVES AND ACTIONS

Objective and Action	Lead Agency	Supporting Agency
Objective 1: Coordinate Sequoit Creek Watershed Plan Activities		
Establish criteria for ranking proposed watershed projects to make funding decisions	FRWMB and SCPC	IEPA
Evaluate and update the action plan	SCPC and FRWMB	SMC
Provide technical assistance to watershed stakeholders	SMC and LCHD	SCPC
Objective 2: Promote Coordination of Township, Municipal, County, State, and Federal Watershed Programs and Activities		
Review municipal ordinances for impacts to watershed	SMC and Villages of Antioch and Lake Villa	NIPC and LCHD
Objective 3: Promote Participation of Townships, Municipalities, and County in Flood Mitigation, Construction of Regional Detention Basins, and Retrofitting of Outfalls and Detention Basins		
Coordinate watershed BMP activities	SMC	FRWMB
Objective 4: Promote Watershed Monitoring for Threatened and Endangered Species, Data Gathering, and Data Sharing		
Promote efforts by the Fox River Ecosystem Partnership for volunteer monitoring of natural resources in watershed lakes and Sequoit Creek	Eco Watch Network, Friends of the Fox River, and Fox River Ecosystem Partnership (FREP)	LCHD, Lake County Forest Preserve District, and SMC

5.5 ASSESSMENT OF PLAN PERFORMANCE

Action plan performance will be assessed based on the degree to which the projects implemented achieve the goals and objectives of the watershed management plan. A plan or individual project can be objectively evaluated if measurable indicators of performance are used. The action plan should be evaluated regularly to add or modify individual projects and to assess the performance of completed projects. The purpose of such interim performance evaluation is to allow corrective action to be taken if a project does not meet its intended objectives or to take advantage of improved opportunities such as increased funding or resources. Additional, longer-term evaluations every 5 and 10 years are recommended to assess the overall performance of the action plan based on watershed management plan goals and objectives. SMC, FRWMB, SCPC, townships and municipalities, and project staffs will be responsible for plan performance evaluation. Public involvement through meetings or workshops will be necessary to obtain additional input into the assessment process. Suggested measurable indicators for evaluating plan performance are provided in Table 5-8. These indicators were chosen because of their availability as products of either regular water quality monitoring or plan implementation.

TABLE 5-8
PLAN PERFORMANCE EVALUATION INDICATORS

Goal	Target	Measurable Indicator
Reduce Runoff and Improve Water Quality	Meet federal and state water quality standards or guidelines	• Pollutant concentrations • Number of septic systems improved • Lake water quality indicators • Number of beach closings • Number of reported septic system problems
Minimize Flood Damages	Reduce or eliminate flood damages	• Monetary flood damages • Number of flood problem areas • Number of floodplain buyouts • Number of flood-proofed structures
Improve Education and Outreach Programs for the Public, Developers, and Community Leaders	Make all residents knowledgeable of watershed problems and how to mitigate them	• Opinion survey results • Number of brochures mailed • Attendance at workshops and demonstration projects • School curriculum activities
Protect and Restore Natural Resources	Prevent loss of wetlands, habitat, species, and recreational value	• Percentage of open space remaining • Acreage of open space remaining • Acreage of wetlands • Quality index of wetlands • Fox River Watershed Biodiversity Index

5.6 PLAN UPDATES

After its adoption by the Lake County Board, the Sequoit Creek watershed management plan will become a component of Lake County's "Comprehensive Stormwater Management Plan" (SMC 1992). This watershed management plan for Sequoit Creek is a working document that will need to be updated to reflect changes in stakeholder needs and watershed conditions. SMC staff will have the lead role in reviewing and updating the plan as necessary. SCPC and FRWMB will provide input during plan review and updating. The recommended frequency for updating the plan is once every 5 years, but this period may be shortened depending on the pace of action plan implementation or of development activities in the watershed.

5.7 IMPLEMENTATION COSTS AND FUNDING

The recommended action plan identifies two categories of actions. The first category consists of existing or ongoing actions. Typical examples are street sweeping programs, storm sewer maintenance, construction site inspections, code enforcement, and WDO permit reviews. For funding purposes, it may be assumed that the costs for implementing existing or ongoing actions will be included in the fiscal budgets of the responsible agencies. Additional resources may be needed to provide a higher level of service that meets or exceeds NPDES-II requirements, such as additional personnel to perform regular maintenance activities, administrative duties, enforcement activities over wider areas, more frequent street cleaning, or water quality sampling. For planning purposes, the current costs of ongoing activities are used to provide cost estimates for the increased level of services.

The second category of action items consists of new or proposed actions such as stream restoration, detention basin retrofitting, and wetland restoration. For planning purposes, the estimated unit costs of such action items are presented in Table 5-9. It should be emphasized that actual, site-specific costs may be significantly different from these estimates because of site conditions or economies of scale. The cost estimates are based on a Center for Watershed Protection (CWP) publication, the "2001 Rapid Watershed Planning Handbook." CWP's cost estimates were developed in 1998 based on sample projects in the Chicago metropolitan area. The 1998 cost estimates were developed based on more recent experience to obtain the cost estimates presented in Table 5-9. Itemized cost estimates will be necessary to determine the actual level of funding needed to implement an action item.

TABLE 5-9
ESTIMATED ACTION ITEM COSTS

Action Item	Estimated Unit Cost	Assumptions
Monitoring		
Biomonitoring-Fish	$500 per station	One sampling event per year using basic Index of Biotic Integrity (IBI) methodology; does not include data analysis
Biomonitoring-Macroinvertebrates	$600 per station	One sampling event per year; does not include data analysis
Fecal Coliform Monitoring	$3,000	Sample collection at 10 stations after five storms per year and laboratory analysis; does not include data analyses
Special Surveys for Wetlands, Habitat, and Forests	$20,000 per survey	One subwatershed
Sampling for Toxicity Assessments	$3,500 per test	10 replicate samples collected and analyzed by a laboratory
Watershed Committee Support	$5,000 per year	One committee
Restoration		
Wetland Mitigation and Creation	$15, 000 to $20,000 per acre	Excludes land purchase
Riparian Area Reforestation	$10,000 per acre	Excludes land purchase
Stream Channel Stabilization through Bioengineering	$50 to $60 per linear foot	For severe erosion areas; heavy equipment readily accessible
Stormwater Detention Basin Retrofitting	$5,000 to $10,000 per basin	For installation of new outlet structure
Storm Drain Stenciling	$2,500 per event	For 2 weeks; includes materials; volunteer labor available

Funding is critical in realizing the Sequoit Creek watershed management plan. Generally, funding is the most serious constraint on implementing such a plan. The process of securing funding is not simple and should be considered during the planning phase. Depending on the amount and type of funding sought, the process may involve preparing lengthy in-kind service documentation, may require extensive coordination among the applicants and potential sponsors, and can take months or even years to complete. The timing of funding applications is therefore an important consideration that may affect project implementation. Table 5-10 lists potential funding sources and briefly describes eligibility requirements and the approximate range of funding limits. In addition to the funding sources listed, local governments may provide matching funds.

TABLE 5-10
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
American Greenways Awards Program—Eastman Kodak Company					
This program provides small grants that can be used for all appropriate expenses of completing a greenway or trail project (such as planning, technical, legal, and other costs).	Local units of government and private nonprofit organizations	$500 to $2,500	None	June	Denise Swol (703) 525-6300 dswol@conservationfund.org
Division of Wildlife Resources Special Funds Application—IDNR					
Habitat improvement or land acquisition and protection projects are funded by the Habitat Fund, Furbearer Fund, or Pheasant Fund. Habitat, research, or education projects are considered. Projects must preserve, protect, acquire, or manage wildlife for future generations by benefiting wildlife either directly or indirectly.	Local units of government and private nonprofit organizations	Not available	Cost-sharing preferred but not required	October 31	IDNR Special Funds Coordinator (217) 782-6384
Illinois Wildlife Preservation Fund—IDNR					
Eligible projects involve wildlife management, site inventories, or education.	All eligible organizations	Not available	Matching funds preferred but not required	April 16	IDNR (217) 785-8774
Technical Assistance and Grants Program—Chicago Urban Resources Partnership					
Eligible projects include those in the Chicago metropolitan area that restore or enhance natural ecosystems through local community-based partnerships. The emphasis is on citizen involvement and education.	Local units of government and all eligible organizations	Not available	One-to-one matching funds or in-kind services	Varies	Chicago Urban Resources Partnership (312) 353-2473

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Five-Star Restoration Challenge Grant Program—EPA					
Grant funding is available for community-based wetland and riparian area restoration projects. The program combines environmental enhancement with employment opportunities for economically disadvantaged youth.	Local units of government, all eligible organizations, and private nonprofit organizations	Maximum grant amount of $10,000	Encourages community partnerships that contribute in-kind or matching funds	February	John Pai, EPA (202) 260-8076 pai.John@epa.gov Abigail Friedman, NACo (202) 942-4225 afriedman@naco.org
State Wetlands Protection Grants					
Section 104(b)(3) grants can be used to develop new wetland protection programs or to refine existing protection programs. Priorities include wetland or watershed protection demonstration projects, wetland conservation programs, assessment and monitoring projects, and river corridor and wetland restoration projects.	Generally state and tribal agencies, but eligibility has been expanded to local projects of local governments, conservation districts, nonprofit organizations, and others	Varies	25% matching funds required	December (selection in March)	Sue Elston Water Division (312) 886-6115

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Sustainable Development Challenge Grants					
These grants encourage community groups, businesses, and governmental agencies to work together on sustainable development efforts that protect the environment and conserve resources while supporting a healthy economy and an improved quality of life. Priorities include projects that (1) use proactive, innovative approaches to protect the environment while providing economic benefits, (2) are supported by and involve diverse interests in the communities, and (3) have measurable environmental and economic results.	Local units of government, eligible organizations, incorporated nonprofit organizations, and educational institutions	Up to $200,000	20% matching funds	May	Janette Marsh Office of Strategic Environmental Analysis (312) 886-4856 marsh.janette@epa gov

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Property Tax Incentives for Conservation					
According to the "Real Property Conservation Rights Act" (765 IL-CS 120/1 et seq.), urban land that is environmentally sensitive may qualify for significant property tax reductions under one of the following programs: If land is qualified by having a conservation easement, it may be assessed at 8 to 1/3% of its fair market value. "Illinois Natural Areas Preservation Act" (525 ILCS 30/1 et. seq)/17 Illinois Administrative Code If land is qualified by being designated as an Illinois nature preserve, it may be assessed at $1 per year in perpetuity. "Open Space Assessment" (Illinois Property Tax Code Sections 10-155) A lower use evaluation is used for open space with a 10-acre minimum area (not applicable in Cook County). The purpose of "Preferential Assessment of Common Areas: (Illinois Property Tax Code Sections 10-35) is to encourage open space in residential developments. For qualifying land, the assessment is reduced to $1 per year.	Contact local township or county assessor to determine eligibility under "Open Space Assessment and Preferential Assessment of Common Areas"	Not available	Not available	Not available	IDNR (217) 785-8774

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Hazard Mitigation Grant Program—Federal Emergency Management Agency (FEMA)					
This program helps states and communities implement long-term hazard mitigation measures after a major disaster declaration. The program's objectives are to (1) prevent or reduce loss of life and property as a result of natural hazards, (2) implement state or local hazard mitigation plans, (3) allow mitigation measures to be implemented during the immediate recovery from a disaster, and (4) provide funding for previously identified mitigation measures that benefit a disaster area. Eligible projects include elevation, relocation, acquisition, or demolition of structures to reduce future losses.	State and local governments, certain private nonprofit organizations and institutions, tribes, authorized tribal organizations, Alaskan native villages, and other organizations; project must be in an area declared a disaster area by the President	Depends on disaster declaration	Matching funds or in-kind services required; FEMA can fund up to 75% of total eligible costs	18 months after disaster declaration	FEMA Region 5 (202) 646-4621
Flood Mitigation Assistance Program—FEMA					
This program helps states and communities identify and implement measures to reduce or eliminate the long-term risk of flood damage to homes and other structures insurable under the NFIP. Projects may include (1) elevation, relocation, or demolition of insured structures; (2) acquisition of insured structures and property; (3) dry flood-proofing of insured structures; (4) minor, localized structural activities that are not fundable by state or other federal programs (such as erosion control and drainage improvements); and (5) beach nourishment activities such as planting of dune grass.	State agencies, participating NFIP communities, and qualified local organizations; communities that have been suspended from the NFIP are not eligible	Not available	Cost-sharing preferred but not required	Established by states	FEMA Region 5 (217) 782-6384

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Chicago Wilderness					
Eligible projects include natural area enhancement, education, and research projects that focus on biological diversity in the Chicago region. Projects must include two or more Chicago Wilderness Partners.	Local units of government, all eligible organizations, and individuals	Not available	One-to-one matching funds or in-kind services	January	Chicago Wilderness (312) 346-8166, extension 30
Wetland Restoration Fund—COE					
Eligible projects involve wetland and other aquatic ecosystem restoration or provision of education and technical assistance to further the goals of watershed protection and restoration. Projects must be in the six-county Chicago metropolitan area.	Local units of government, all eligible organizations, and individuals	$5,000 to $100,000	No match required; project site must have a conservation easement	March and October	Corlands (312) 427-4256, extension 238
Wildlife Habitat Incentives Program – U.S. Department of Agriculture (USDA) National Resource Conservation Service (NRCS)					
A voluntary program directed toward the creation of high quality wildlife habitat in upland, wetland, riparian, or aquatic areas. NRCS administers the program and helps the landowner create a wildlife habitat development plan. Landowners agree to limit the use of their land for typically 5 to 10 years, but retain private ownership. Emphasis is placed on habitat for wildlife species with declining or reduced populations, beneficial practices for fish and wildlife that might otherwise go unfunded, and priority areas that have been identified at the state or Tribal level.	Privately owned land, federal land if primary benefit is on private or Tribal land, state and local government land on a limited basis, and Tribal land	Not available	Cost-sharing of up to 75% and technical assistance are provided; greater cost-share is provided if landowner enters program for 15 years or more	Continuous sign-up; no due date	NRCS (815) 338-0444

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Conservation Reserve Program –NRCS					
A program for agricultural landowners designed to improve water quality, control erosion, and enhance wildlife habitat. Contracts last 10 to 15 years, and landowners agree to plant long-term, resource-conserving covers.	Applicants with land in crop production 4 of 6 years between 1996 and 2001, who have owned the land for at least 12 months prior to applying; land must have a weighted average erosion index of 8 or higher, or be expiring CRP land or be located in a national or state CRP priority area	Not available	Cost-sharing of up to 50%; rental payments provided; possible additional $5 per acre per year as a maintenance incentive	Varies	NRCS (815) 338-0444
Habitat Restoration Program for Fox and Kishwaukee River Watersheds – Soil and Water Conservation District of Lake County (SWCD)					
Program is geared toward protection, restoration, and enhancement of aquatic resources, with secondary benefit to wildlife habitat. Landowners are expected to enter into a minimum contract of 10 years.	All landowners in McHenry, Kane, DeKalb, Boone, and the western parts of Lake and North Cook County; no state or federal agencies are available	Not available	Cost-sharing of 75% and technical assistance provided	Varies	SWCD of Lake County (847) 223-1056

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Streambank Stabilization and Restoration Program – SWCD					
Program gives assistance to landowners with severely eroding streambanks and funds demonstration projects statewide. Projects are designed to demonstrate effective, inexpensive vegetative and bio-engineering techniques for limiting streambank erosion.	Not available	Not Available	Cost-sharing of 75%	Varies	SWCD of Lake County (847) 223-1056
Watershed Assistance Grants Program—River Network					
Eligible projects include community-based partnerships that conserve or restore watersheds.	Not available	$4,000 to $30,000	Not available	February 18 and June 15	River Network (503) 241-3506 www.rivernetwork.org
Section 206 Aquatic Ecosystem Restoration—COE					
Clean Water Act Section 206 gives the COE authority to carry out an aquatic ecosystem restoration and protection project if the project will improve the quality of the environment, is in the public interest, and is cost-effective. Federal funds may be used for feasibility studies, planning, engineering, construction, supervision, and administration.	All eligible organizations	Not available	Federal cost-sharing of up to $5 million available; 35% non-federal cost-sharing required	Not available	Planning Division Chief, Chicago District, COE (312) 353-6400
Lake Education Assistance Program—IEPA					
Eligible projects include educational programs on inland lakes and lake watersheds.	Educational institutions and private nonprofit groups	Maximum of $500 reimbursed after project completion	Not available	September 30 and January 31	IEPA (217) 782-3362

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Operator Training Assistance–EPA					
According to the Clean Water Act Section 104(g)(1), the primary use of Section 104(g)(1) funds is to provide on-site technical assistance for operators and municipal employees involved in operation, maintenance, and management of publicly owned treatment works. States may also use these funds to promote energy and water use efficiency and to provide technical assistance for sewer system maintenance to control infiltration and inflow as well as sanitary sewer overflows.	States and interstate agencies, municipalities, educational institutions, and individuals	Typically $30,000 to $50,000	25% state matching funds preferred; 5% matching funds for tribes	Open fund before end of fiscal year; available by January	Russell Martin Water Division (312) 886-0268 martin.russell@epa.gov
Environmental Education–EPA					
The objective of this program is to provide financial support for projects that design, demonstrate, or disseminate environmental education practices, methods, or techniques. Projects must improve environmental education teaching skills; educate teachers, students, or the public about human health; use environmental education to advance education reform; or educate the public through print or other media.	Local, tribal, and state educational agencies; nonprofit organizations; and nonprofit commercial educational broadcasting agencies	Most awards for $5,000; occasional awards up to $25,000	25% matching funds	Announced in August	Suzanne Saric Office of Public Affairs (312) 353-3209 saric.Suzanne@epa.gov
Environmental Monitoring for Public Access to Community Tracking					
Project priorities must include environmental quality measurement, information processing and management, and communication.	Local and tribal governments	Up to $400,000 over life of project	Encouraged but not required	Late winter	Elissa Speizman Office of Public Affairs (312) 353-2072
School Yard Habitat Action Grants—Illinois Resource Center					
Only public schools may serve as sponsors. Projects include developing local habitat areas.	Educational institutions, private organizations, and local units of government	Up to $500	50% matching funds or in-kind services	Mid-April	Illinois Resource Center (847) 803-3535

TABLE 5-10 (Continued)
POTENTIAL FUNDING SOURCES

Funding Source/Purpose and Priorities	Eligible Applicants	Award Amounts	Matching Share	Application Due Date	Contact Information
Science Literacy Grants—Illinois State Board of Education					
Eligible applicants include public schools and nonfederal units of government.	Educational institutions and all eligible organizations	Not available	None	April 15; call to verify	Illinois State Board of Education (217) 782-2826
Grand Victoria Foundation					
Eligible projects include environmental proposals.	Private nonprofit groups, educational institutions, and eligible organizations and individuals	Not available	Not available	April 2, July 8, October 1, and December 31	(847) 289-8575

Sources: SMC 1999 and EPA 2002c

CHAPTER 6
CONCLUSIONS

This watershed management plan was developed to (1) address water quality issues that threaten the resources of the Sequoit Creek watershed, (2) address flooding problems in the watershed, (3) promote watershed-related education and awareness among residents, and (4) preserve the watershed's unique natural resources. To meet these objectives, the current and long-term future conditions of the watershed were assessed in detail. The findings of these assessments formed the basis for the action plan presented in Chapter 5. Following are the main assessment findings:

- The Sequoit Creek watershed is unique in terms of the quality of its lakes and its abundance of natural resources. In their present state, the watershed lakes and streams are in relatively good condition, but concerns exist about future nonpoint source pollution.

- The most immediate concern about the lakes at present is fecal coliform pollution, the primary source of which appears to be failing septic systems.

- The key strategy for preventing future flood damage is through preservation of existing open space and maximization of stormwater storage in the tributaries. Zoning policies that preserve open space are a key recommendation of the 2003 Regional Framework Plan.

- In cooperation with SMC, local governments have established an effective nonpoint source pollution control program that includes many BMPs. However, because the watershed is unique, the program needs to be supplemented with zoning policies that promote open spaces, as recommended in the County's framework plan.

- Public education and involvement are central to the success of the nonpoint source pollution control program. Public education, outreach, and involvement are also key to the implementation of the NPDES-II program.

- Acquiring funding for the action plan may be the most serious constraint on its implementation. For this reason, development of zoning policies that embrace low-impact development concepts, open space preservation, and low-cost stream and wetland restoration alternatives (such as those promoted in Clean Water Act Section 319 pilot projects) may be the most feasible measures for plan implementation in the short term.

- Continued monitoring of the watershed and its streams, lakes, and other natural resources is essential for evaluating the success of the action plan.

Stakeholder comments to this watershed management plan are included in Appendix C.

APPENDIX A

MINUTES OF SCPC MEETINGS

APPENDIX B

LITTLE SILVER LAKE WATERSHED MANAGEMENT PLAN
EXECUTIVE SUMMARY

(Plan Under Separate Cover)

APPENDIX C

COMMENT RESPONSE DOCUMENT