CMAP

Ferson-Otter Creek Watershed Plan

December 2011

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Support was also provided by The Conservation Foundation and Tara Neff who served as the local watershed coordinator and outreach manager. The Fox River Ecosystem Partnership and Becky Hoag, Communications Director, provided website and communications support. This plan was prepared for the Ferson – Otter Creek Watershed Coalition that formed as the plan neared completion. The many contributors to this planning process include Trotter and Associates, Campton Township, Village of South Elgin, Village of Campton Hills, Village of Lily Lake, City of Elgin, City of St. Charles, Kane County Planning, Kane-DuPage Soil and Water Conservation District, Natural Resources Conservation Service, Kane County Health Department, Pizzo and Associates, St. Charles Park District, Lake Campton Property Owners Association, Wildrose Subdivision, The Windings of Ferson Creek HOA, Deer Run Creek HOA, Deer Run East Property Owners Association, Black Creek Hydrology, and the Sierra Club.

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1. INTRODUCTION

1.1 WATERSHED PLANNING

Watershed planning is a public process involving local residents, governmental agencies, and other concerned interests. Those participating in the planning process as well as the interests they represent are known as stakeholders since they all have a vested interest, or stake, in the overall health of the place they live or work. Addressing nonpoint-source pollution to protect good water quality or improve poor water quality is the primary purpose for developing a watershed-based plan. Other objectives can be pursued too as they are often related to the health of water resources. The planning process and resultant plan are informed by both local knowledge and science-based information.

The watershed, defined by topography and influential in the movement of surface water, has become the organizing principle for planning and for understanding the interrelationships between the many ways that people view and interact with water resources. When combined with an adaptive management approach to plan implementation, the plan and its stakeholders offer a potentially effective framework for producing and evaluating project and policy recommendations to correct water resource problems.[1] It is through this lens that the Ferson-Otter Creek Watershed Plan was created.

The purpose of the plan that follows is to provide a roadmap for improving local water quality and thus, the quality of life for those that live, work, and play within the Ferson-Otter Creek Watershed. It should be noted that this plan's recommendations are advisory in nature.

1.2 HISTORY OF THE WATERSHED

Ferson Creek was named after two brothers, Dean and Reed Ferson, who traveled to the area in 1833 from Vermont to invest in real estate. The brothers laid claim to land that at the time was known as Charleston, present day St. Charles. Dean settled in what is now known as the LeRoy Oakes Forest Preserve before moving to the northwest side of the city near where his brother Reed built a log cabin in the WildRose area.

Stemming from Ferson Creek is Lake Campton, a man-made lake formed from damming Ferson Creek. The idea to create this lake was that of Bill Fisher, an insurance man who developed a number of properties in the Wasco area in the 1950s, which are now part of the Village of Campton Hills. A dam was built on Ferson Creek, just west and south of the intersection of Burlington and Corron Roads to make a private lake and recreation area for boating, fishing and skating. Originally known as Fisher's Lake, this 40 acre body of water has come to be known as Lake Campton.

Otter Creek winds throughout land once dedicated to the Henry Sherman and Cyrus Larkin farms. The Creek was surrounded with prairie to the west and woodland to the east. The Cyrus Larkin farm was located where the Elgin Larkin High School now stands today. Henry Sherman was a businessman in addition to being a farmer and Sherman Hospital in Elgin carries his name. He was also part owner of the Elgin Watch factory, which employed women during World War II when the factory converted from making watches to making war materials.

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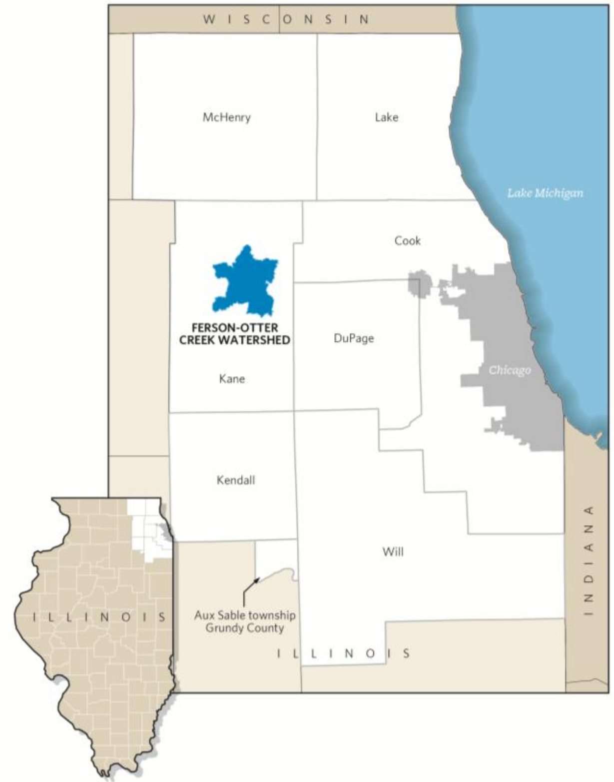
[1] Adaptive management is a natural resource management approach that formulates and implements policies as experiments. If a new policy is found to be successful, hypotheses are confirmed; if policies fail to achieve their objectives, adaptive management learns from the experience and makes informed adjustments accordingly. See, for example, Kai N. Lee. *Compass and Gyroscope: Integrating Science and Politics for the Environment*. Washington, D.C.: Island Press, 2003. Dr. Lee thinks of science and democracy as compass and gyroscope — "navigational aids in the quest for sustainability." Page 6.

1.3 OVERVIEW

The Ferson-Otter Creek Watershed is located within the Lower Fox River Basin (Hydrologic Unit Code [HUC] 07120007) and consists of Ferson Creek (HUC 071200070104) and Otter Creek (HUC 071200070103) subwatersheds. For our planning purposes, the two subwatersheds will be studied together as Otter Creek is a tributary to Ferson Creek. The Ferson-Otter Creek Watershed is located on the urban fringe of the Chicago metropolitan area in Kane County, the 5th most populated county in Illinois with a 27.5% population growth from 2000-2010 (Figure 1). The watershed covers portions of the Cities of Elgin and St. Charles as well as the Villages of Campton Hills, South Elgin, and Lily Lake (Figure 2). The total population in Ferson-Otter Creek Watershed is approximately 50,704.[2] The watershed has experienced a 49% increase in population growth since 2000 and has a drainage area of approximately 54 square miles. Additionally, the watershed has a total of 55.1 miles of streams within the watershed.[3] Ferson Creek is 14.6 miles long while Otter Creek is 6.5 miles long.[4] Table 1 breaks down the number of square miles contained within each municipality as well as unincorporated areas.[5] As of 2005, twenty-nine percent of the land area within the watershed was developed.[6]

Figure 1. **Regional location map of Ferson-Otter Creek Watershed**



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

[3] NIPC, U.S. Fish and Wildlife Service and U.S. EPA. *Advanced Identification (ADID) Study, Kane County, Illinois Final Report*. Chicago, IL: USACE Chicago District, August 2004. http://www.lrc.usace.army.mil/co-r/pdf/KaneADIDReport.pdf (accessed November 7, 2011).

[4] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water*. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011).

[5] CMAP. "Municipality Boundaries." Chicago, IL: CMAP, 2009.

[6] "Kane County, Illinois Flood Information," Kane County, Illinois, last modified January 12, 2005, accessed November 7, 2011, http://www.co.kane.il.us/kcstorm/flood/index.htm.

Figure 2. **Municipalities & Townships in Ferson-Otter Creek Watershed**

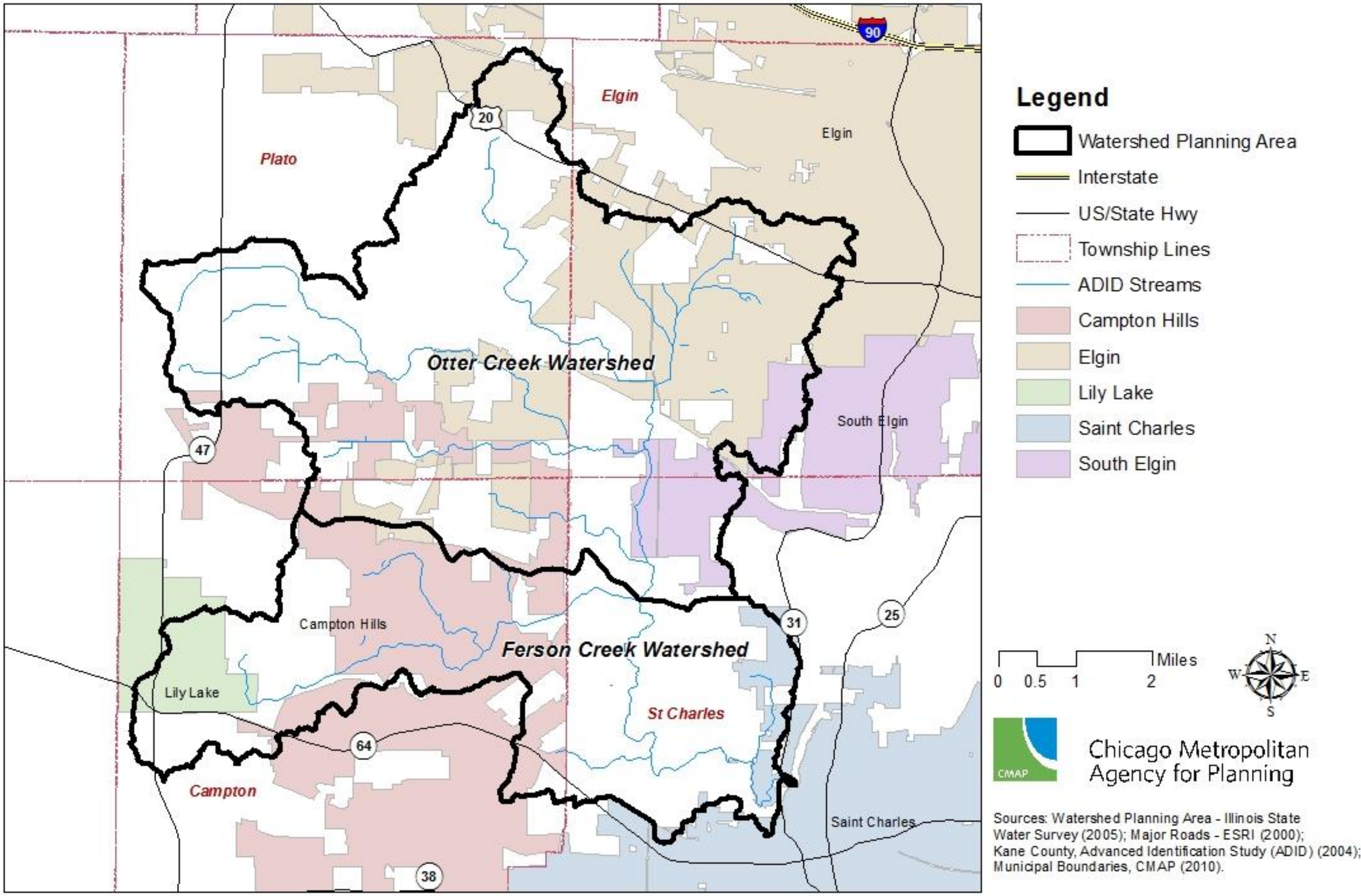

Table 1. Number of square miles for each municipality within Ferson-Otter Creek Watershed

MUNICIPALITY	AREA, IN SQUARE MILES
Campton Hills	8.4
Elgin	10.3
Lily Lake	1.4
South Elgin	2.5
St. Charles	1.0
Unincorporated Kane County	30.4
Total	**54.0**

Presently, fecal coliform is the only cause of impairment that has been identified in the watershed.[7] The primary focus of the plan, therefore, will be on recommendations to eliminate this cause to the extent possible. Currently, a lack of comprehensive monitoring data (i.e., spatial resolution) prevents identification of source locations of this contaminant throughout the watershed. Policy recommendations made in the plan regarding fecal coliform will cover a variety of potential sources (septic system failure, wildlife, pet waste, etc.). Similarly the project recommendations will include various projects that will improve overall water quality in addition to having some fecal coliform reduction benefits. The need for more comprehensive monitoring is addressed in Chapter 7.

Additionally the plan will address water quality concerns facing the Fox River given that the Ferson-Otter Creek is a major tributary. To provide context, a brief discussion of the Fox River Basin will be provided in Chapter 2.

In 2010, the Chicago Metropolitan Agency for Planning (CMAP) entered into an agreement with the Illinois Environmental Protection Agency (IEPA)[8] to complete three watershed-based plans within the Fox River Basin, including the Ferson-Otter Creek Watershed. As the delegated authority for the region's areawide water quality management plan, CMAP works with local partners to outline management strategies for eliminating point- and nonpoint-source pollution, protecting groundwater, and managing wastewater throughout the seven-county region.[9] CMAP, as did the Northeastern Illinois Planning Commission before it, uses a collaborative watershed approach to planning that seeks to protect and/or remediate water quality.[10] Funding for these projects was provided by IEPA through Section 604(b) of the Clean Water Act and must meet certain requirements which are discussed below.

[7] Ferson Creek and Otter Creek were not assessed for all designated uses and potential causes of impairment such as nutrients and other pollutants. Water quality data presented for Ferson Creek were collected at station DTF-01 at its mouth. This station is at Illinois Route 31 in St. Charles in Ferson Creek Park. The soil type at this station is called "Otter silt loam," which is occasionally flooded and has a slope of 0 to 2 percent. For the soil at this station, the hydrological soil group is B and the hydric classification is "all hydric."

[8] "Bureau of Water," IEPA, accessed November 8, 2011, http://www.epa.state.il.us/water/.

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

[10] A watershed planning approach often addresses other related natural resource (e.g. open space, habitat, etc. or built-environment (flooding, stormwater, etc.) management issues in a complementary fashion. In so doing, a watershed plan can be multiobjective.

1.4 PLAN GUIDANCE

The United States Environmental Protection Agency (USEPA) provides guidelines for watershed-based plans produced with Clean Water Act (CWA), Section 319 grant funding aimed at controlling nonpoint-source pollution. Under these guidelines, a watershed-based plan must include at a minimum the following nine components:

1. An identification of the causes and sources that need to be controlled to achieve pollutant load reductions estimated in this plan;
2. An estimate of the load reductions expected for the management measures described under (#3) below;
3. A description of the non-point source management measures that will need to be implemented to achieve the load reductions estimated under (#2) above;
4. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan;
5. An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented;
6. A schedule for implementing the non-point source management measures identified in this plan;
7. A description of interim, measurable milestones for determining whether non-point source management measures or other control actions are being implemented;
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards; and
9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (#8) above.

Three additional regional criteria listed below are being explored for their utility as well:

1. Set target pollutant-load reductions for impaired waters taking into account both point- and nonpoint-source pollution sources;
2. Consider groundwater protection from both water quality and water quantity perspectives;
3. Compare municipal codes and ordinances against the Center for Watershed Protection's Code and Ordinance Worksheet.[11]

Criterion one is addressed in the Water Quality chapter. The second criterion, groundwater protection, was discussed during stakeholder meetings and covered a variety of topics including groundwater quality, population growth, water supply / demand, and conservation and efficiency. Groundwater protection is especially important in the Ferson-Otter Creek Watershed because all of the communities' public water supplies are dependent on groundwater or river water (Table 2). Lastly the Center for Watershed Protection's Code and Ordinance worksheet provides a starting point to evaluate municipal codes and ordinances to guide relevant plan recommendations discussed in more detail in Chapter 5.

[11] Center for Watershed Protection. *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program*. Tool 4: Code and Ordinance Worksheet. Ellicott City, MD: Center for Watershed Protection, 2008. http://www.cwp.org/documents/cat_view/76-stormwater-management-publications/90-managing-stormwater-in-your-community-a-guide-for-building-an-effective-post-construction-program.html (accessed November 8, 2011).

Table 2. Water source by municipality within the Ferson-Otter Creek Watershed

MUNICIPALITY	WATER SOURCE
Campton Hills	**groundwater**
Elgin	**Fox river**[1]
Lily Lake	**groundwater**
South Elgin	**groundwater**
St. Charles	**groundwater**

1 Elgin relies primarily on the Fox River for their water supply; however, a small portion of their supply is provided by groundwater.

1.5 STAKEHOLDER CONCERNS AND GOALS

One of the first tasks for the watershed's diverse set of stakeholders was the discussion and establishment of goals for the Ferson-Otter Creek Watershed Plan. Before developing the goals, stakeholders were asked to communicate their concerns and vision for the watershed. Stakeholder concerns included:

- Fecal coliform, nutrients and sediment and other pollutants.
- Current and future development in the watershed and its effect on stream health.
- Lack of education for land owners along creeks, need to encourage stream corridor best management practices.
- The ecological condition of the lands adjacent to the creek as well as the natural areas throughout the watershed, protecting quality of open space and the need for a healthy stream corridor.
- Stormwater
    - Too much runoff and not enough infiltration and recharge.
    - Non-point source pollution
    - Volume of stormwater channeled into creek leading to stream bank erosion and sedimentation.
- Need for improved recreation and education opportunities on public land in coordination with Kane County.
- Log jams and beaver dams along the creek.
- Tree removal and clearing debris.

Goals were then drafted directly from the concerns expressed by the stakeholders. The final goals were adopted November 23, 2010 and capture the desired outcomes and vision for the watershed. Recommendations throughout the plan will address each of the following goals:

1) Reduce fecal coliform contributions to Ferson and Otter Creek.
2) Reduce nutrients, sediments, and other pollutant contributions to Ferson and Otter Creek.
3) Raise stakeholder (residents, public officials, etc.) awareness about the importance and best management practices of proper watershed stewardship.
4) Promote land use and best management practices that minimize increases in the volume of stormwater runoff and reduce the risk of flood damage.
5) Protect the quality and quantity of our water supplies.
6) Improve the physical condition of our waterways.
7) Develop an effective and lasting Watershed Coalition to foster continuing stewardship efforts in the watershed.

1.6 THE PLANNING PROCESS

The Ferson-Otter Creek Watershed planning process was designed to be stakeholder-driven with assistance from CMAP and other partner agencies. As the project lead, CMAP facilitated monthly meetings (between September 2010 and December 2011) and provided technical assistance for the watershed-based plan. The kick-off meeting was held on September 21, 2010 at the Campton Township Community Center in St. Charles, Illinois. In addition to monthly meetings, one evening Open House meeting was held to better accommodate a wider variety of stakeholders. Several "stream walks" were organized in which stakeholders experienced both healthy landscapes within the watershed as well as areas in need of improvement. Together these meetings directed the development of the watershed-based plan based on stakeholder input, best professional judgment, and the requirements enumerated above.

The Conservation Foundation (TCF)[12] and the Fox River Ecosystem Partnership (FREP)[13] are both partners in the planning process and have received grants from CMAP. In coordination with CMAP and FREP, TCF served as the watershed coordinator, convened local stakeholders, and executed an education and outreach campaign during the planning process.

FREP supported the outreach and education effort by upgrading their website (subwatersheds webpage), highlighting watershed planning activity in their monthly e-newsletter – "Downstream" and hosting a Noon Network in the Ferson-Otter Creek Watershed on October 19, 2011.[14]

[12] "The Conservation Foundation," Conservation Foundation, accessed November 8, 2011, http://www.theconservationfoundation.org/. The Conservation Foundation (TCF) was established in 1972 as a not-for-profit land and watershed protection organization. TCF has been involved in planning coordination and technical assistance for a number of watershed plans including Upper DuPage River, Aux Sable Creek, Lower DuPage River, Salt Creek and Tyler Creek.

[13] "Fox River Ecosystem Partnership," FREP, accessed November 8, 2011, http://foxriverecosystem.org/. The Fox River Ecosystem Partnership (FREP) is a not-for-profit created in 1996, comprised of local governments, private businesses, not-for-profits and landowners in the Fox River Basin. FREP's vision for the *Fox River Basin "is to balance all the uses and demands on our natural resources while preserving and enhancing a healthy environment."*

[14] Ibid. 13.

2. RESOURCE INVENTORY AND ASSESSMENT

The Resource Inventory and Assessment chapter is a summary of publicly available data that have been gathered for the Ferson-Otter Creek Watershed. The compendium of data and information that follows does not claim to be exhaustive, but rather a good-faith effort at organizing as much as could be collected in a timely manner during the construction of this plan. Data were taken from a variety of sources with the purpose of characterizing the watershed and providing stakeholders with information about existing conditions to assist in the formulation of recommendations for the watershed plan.

2.1 FOX RIVER OVERVIEW

This watershed-based plan aims to address the fecal coliform impairment in Ferson Creek; however, the plan can also address some of the Fox River concerns given that the Ferson-Otter Creek is a major tributary. These concerns include nutrients (phosphorus and nitrogen) and sediment or total suspended solids. Sources of these pollutants include both agricultural and urban runoff. To provide context, a brief discussion of the Fox River Basin follows.

The Fox River is the third largest tributary of the Illinois River stretching 185 miles (115 miles in Illinois) from its headwaters near Waukesha, Wisconsin, to its confluence with the Illinois River in Ottawa. The Fox River Basin covers approximately 2,658 square miles of which 1,720 (65%) are in Illinois. The river basin includes portions of eleven Illinois counties including six (Cook, DuPage, Kane, Lake, McHenry, and Will) that are the most populated in the state and six that are among the top ten fastest growing counties in Illinois (#1: Kendall, #2: Will, #3: Grundy, #5: Kane, #7: McHenry, #8: DeKalb)[15]. An attraction for the population growth in the Fox River Basin is the abundance of recreational opportunities and high quality natural resources associated with the river and its tributaries. However, those same high quality resources are being lost or significantly impaired by historic land use change and a type of development that is often inconsistent with sustainable land and water resources stewardship.

The Illinois portion of the Fox River Basin contains about 2,300 river and tributary stream miles and 406 lakes, many of the lakes glacially formed (IDNR, 1998). Perhaps the most noticeable of these lakes are in the Fox Chain-of-Lakes in northwestern Lake County, comprised of fifteen interconnected lakes with more than 7,500 surface acres of water. Four segments of the Fox River and fourteen glacial lakes are considered to be “biologically significant” with more than 150 state-threatened and endangered species found within the basin (IDNR, 1997).

The map below shows Ferson-Otter Creek’s placement within the larger Fox River Basin. The Basin is divided into the Upper and Lower sections with the Lower Fox reaching south into LaSalle County and the Upper Fox River Basin reaching north into Wisconsin. In addition to the Ferson-Otter Creek Watershed Plan, CMAP is simultaneously leading two other watershed planning processes for a total three plans: Sleepy Hollow / Silver Creek in the Upper Fox River Basin and Blackberry Creek along with Ferson-Otter Creek in the Lower Fox River Basin. Figure 3 illustrates where watershed plans exist or are under development within the Fox River Basin, reflecting the need for improving or protecting water quality.

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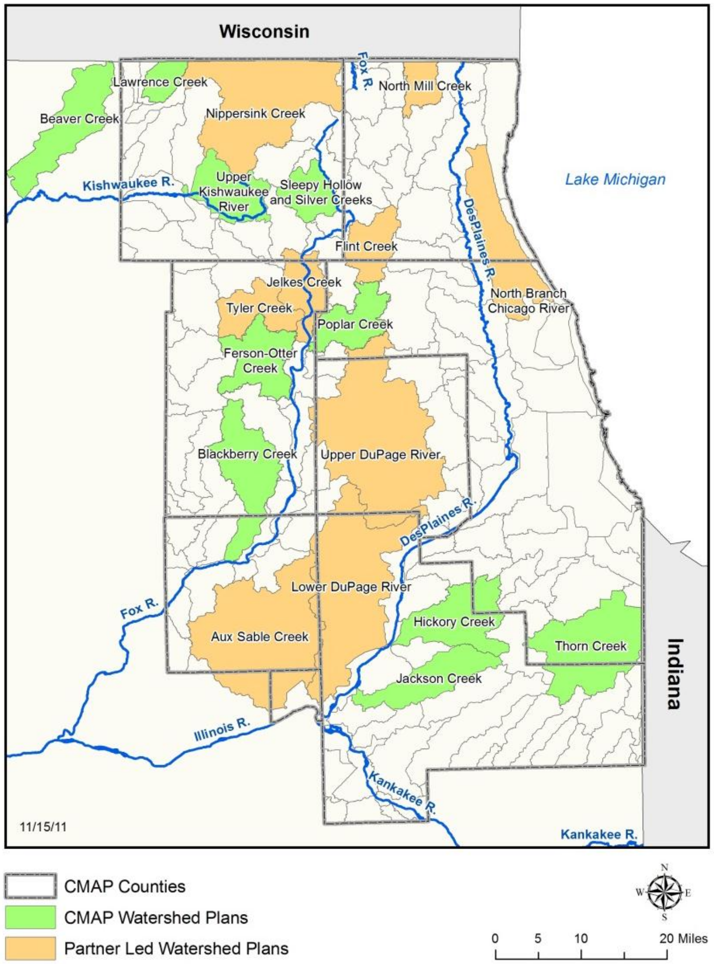
[15] Bureau of the Census, Population Division. “Population Estimates for the 100 Fastest Growing U.S. Counties in 2003: April 1, 2000 to July 1, 2004.” *Population Estimates Program*, Table CO-EST2003-09 (April 14, 2005). http://www.census.gov/popest/counties/CO-EST2004-09.html (accessed November 3,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

Figure 3. **IEPA compliant watershed plans in northeastern Illinois**



Agricultural and urban development throughout the river basin have had negative impacts on the hydrology, aquatic habitat, and water quality of the Fox River and its tributaries. The invasion of nonnative vegetation has compounded the problem. In many areas the absence of deep rooted native riparian vegetation results in little or no filtering of pollutants and sediment in surface or subsurface runoff from the watershed to the streams.

The water quality of surface and groundwater resources is assessed throughout the state and is reported in IEPA's biannual *Illinois Integrated Water Quality Report (Report) and Section 303(d) List (List)*[16]. In the 2010 draft *Report*, designated uses listed for the 17 IEPA-identified segments of the Fox River are Aquatic Life, Primary Contact, secondary contact, fish consumption, and/or public water supply. All 17 segments were assessed for Aquatic Life use, with 14 considered nonsupport (impaired) and three segments (one in the Upper Fox, two in the Lower Fox Basin) yielding full support (not impaired). Causes of impairment include sedimentation/siltation, total suspended solids, total phosphorus, pH, certain organics, and unknown causes. Impairment sources include urban runoff/storm sewers, combined sewer overflows, municipal point source discharges, flow regulation/modification, dams/impoundments, agriculture and crop-related sources, habitat modification, bank modification/destabilization, upstream impoundments, recreational pollution, and contaminated sediments.

All 17 segments also were assessed for fish consumption use, and all were considered nonsupport (impaired) due to polychlorinated biphenyls (PCBs) and in some cases also mercury from unknown sources. Of the ten segments assessed for Primary Contact, three were considered full support (not impaired) and the other seven nonsupport (impaired). Causes of Primary Contact impairment were total fecal coliform bacteria from unknown sources. Two segments are used for public water supply, and one was considered full support (not impaired) and the other nonsupport (due to

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[16] IEPA. Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011).

chloride) for that designated use. Per IEPA's *List* (IEPA, 2010a; Appendices A-2 and A-3), the entire Fox River within Illinois and all 10 lakes within the Fox Chain O'Lakes are 303(d)-listed waters. Additionally, 66 of the other 72 lakes that were assessed within the Fox River Basin are 303(d)-listed (for the aesthetic quality and/or fish consumption designated use), including Silver Lake for fish consumption use due to mercury.

2.2 PHYSICAL AND CULTURAL CHARACTERISTICS

This section characterizes the physical and cultural aspects of the watershed. The physical conditions of Ferson-Otter Creek directly affect water quality and quantity and provide guidance for recommendations so that they may work *with* not against the natural features of the landscape. The cultural watershed characteristics provide information on the effects of cultural decisions such as land use change that also affect water quality and quantity in the watershed.

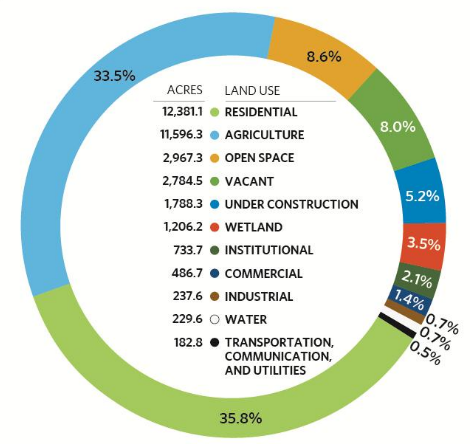
2.2.1 Land Use and Pre-settlement Land Cover

Land use refers to the human use of land. Land use decisions have a significant impact on water quality. For example, an intensely developed area features impervious surfaces,[17] reduced natural vegetation, and causes considerable change to local hydrology. Surface runoff from such an area, picks up contaminants and along with the altered hydrologic regime, impacts Aquatic Life in streams and lakes. Such a scenario can also contribute to local or regional flooding. Additionally, impervious surfaces reduce or prevent the natural infiltration of rainwater and snowmelt into the ground and thus, reduce natural groundwater recharge. Land use, therefore, is an important consideration in watershed planning.

A variety of land uses are present in the Ferson-Otter Creek Watershed. Figure 4 shows the land use breakdown by percentage within the watershed with residential use being the most prominent –covering 35.79% of the total watershed, followed by agricultural use with 33.52%.[18] The remaining land uses are all below 10% each. Figure 5 shows land use within the watershed spatially.

For a qualitative sense of historic land use change, Figure 6 shows the pre-settlement land cover as it existed in the early 1800's and is provided by the Illinois Natural History Survey.[19] The watershed was mostly prairie and forest.

Figure 4. **Land use breakdown within Ferson-Otter Creek Watershed**



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

[18] NIPC. Land Use Inventory. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).

[19] "Land Cover of Illinois in the Early 1800's," Illinois Natural History Survey, accessed October 31, 2011, http://www.inhs.uiuc.edu/resources/gisresources.html.

Figure 5. **Land use in Ferson-Otter Creek Watershed**

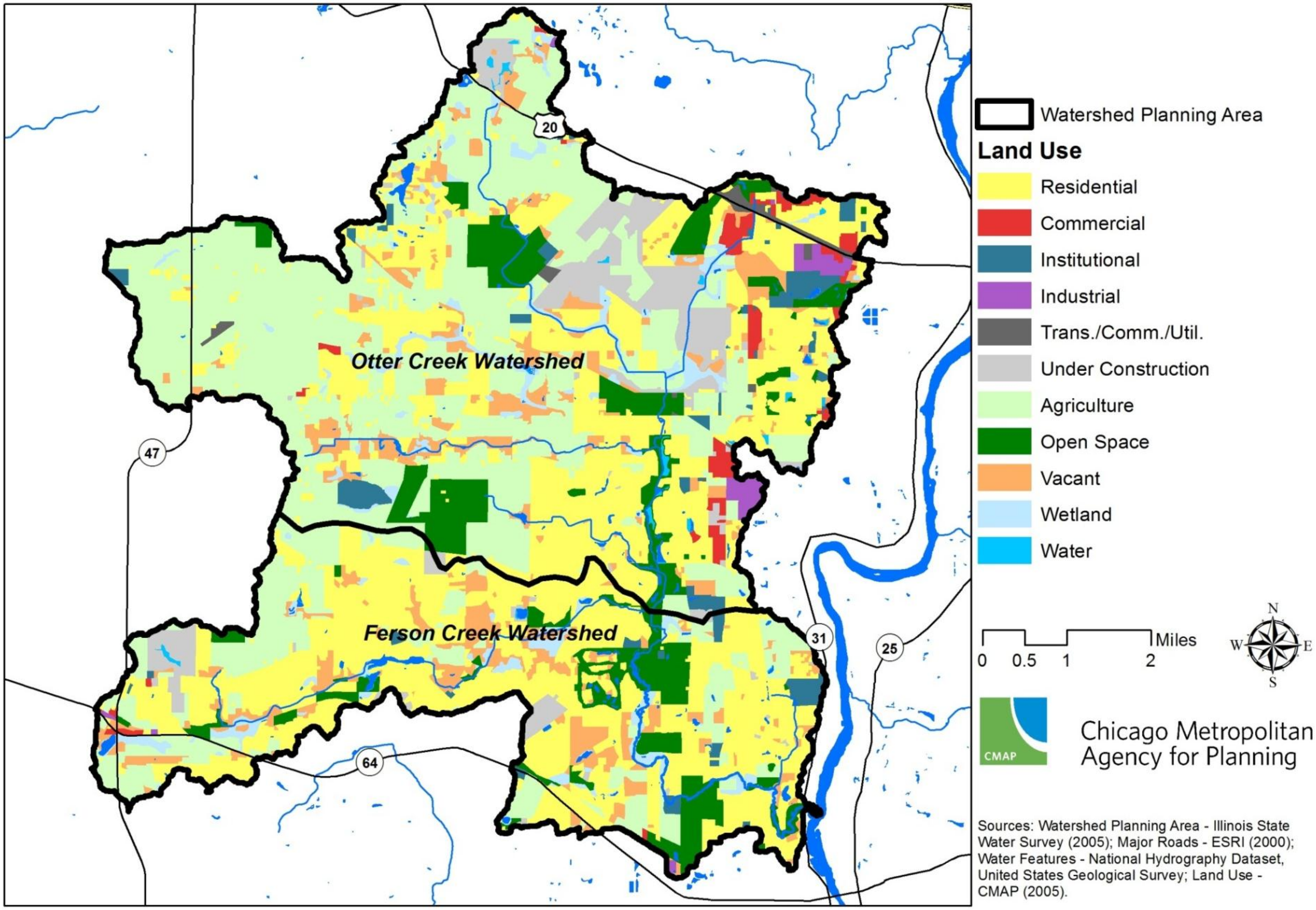
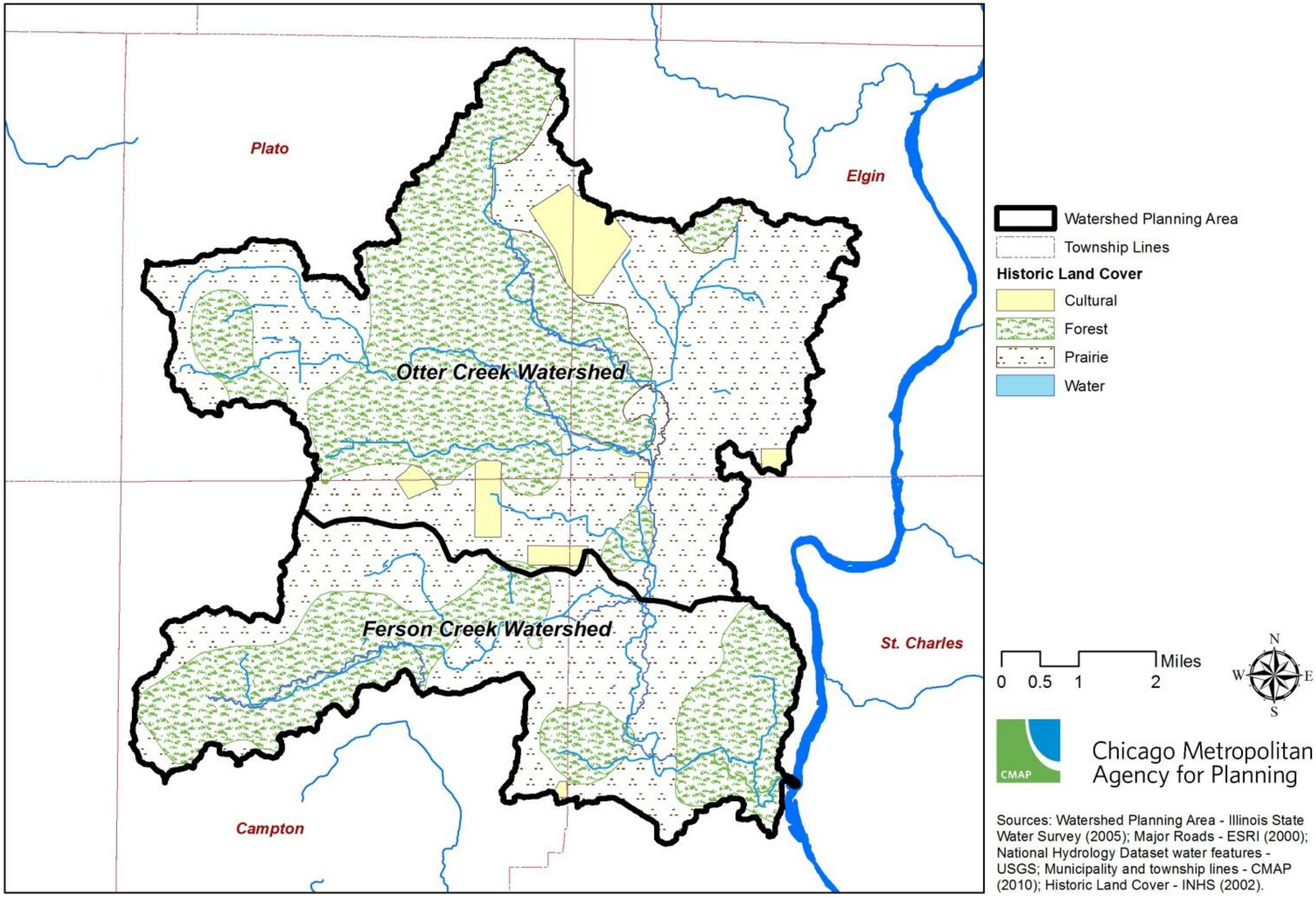


Figure 6. **Pre-settlement land cover for Ferson-Otter Creek Watershed**



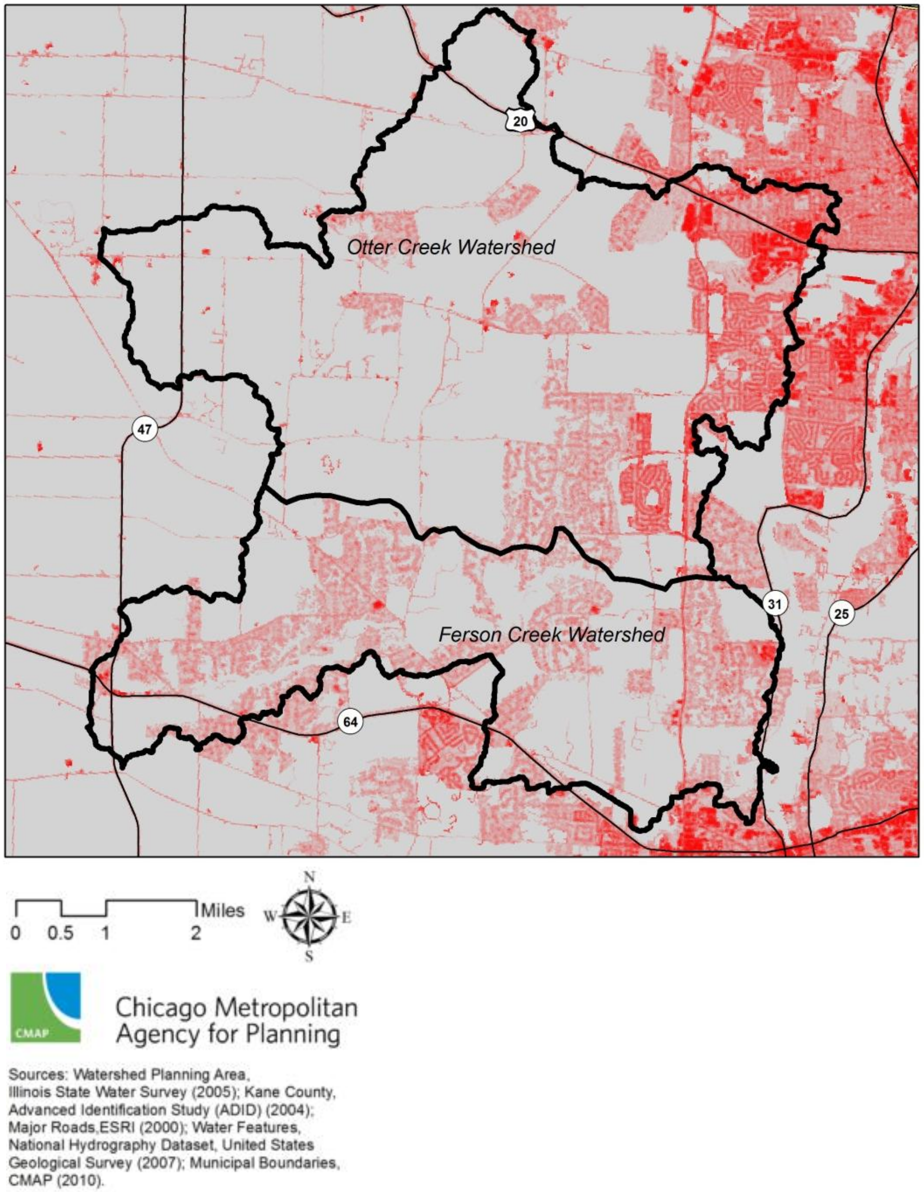
Impervious Surface

Impervious surface cover includes roofs, sidewalks, driveways, roads, parking lots, and other surfaces that restrict water infiltration on site and increase the quantity and decrease the quality of stormwater runoff. As of 2001, impervious surface covered less than 10% of the entire watershed planning area (Figure 7). At the watershed scale, this is encouraging since research indicates that impervious surface cover greater than 10% results in degraded water quality.[20] However, impervious surface in an amount beyond this threshold exists within every municipality, with the most impervious areas found in Elgin and South Elgin and moderate amounts of impervious areas located in unincorporated areas. Given the age of the data from which the analysis was done, it is highly likely that impervious surface cover has increased.
In general imperviousness increases with development, however, these increases of imperviousness can be minimized by using best management practices including low impact development principles. This topic will be covered in more detail in the Green Infrastructure section of Chapter 5.

Protected Open Space

In this plan, protected open space includes publically and privately owned land. Combined, the watershed has approximately 3, 771 acres of protected open space, accounting for 11% of the watershed's land area (Figure 8).[21] Open space is a valuable resource for protecting water quality, among other benefits such as recreation and habitat. More information on open space is available in the Green Infrastructure section of Chapter 5.

Figure 7. **Impervious surface in Ferson-Otter Creek Watershed**



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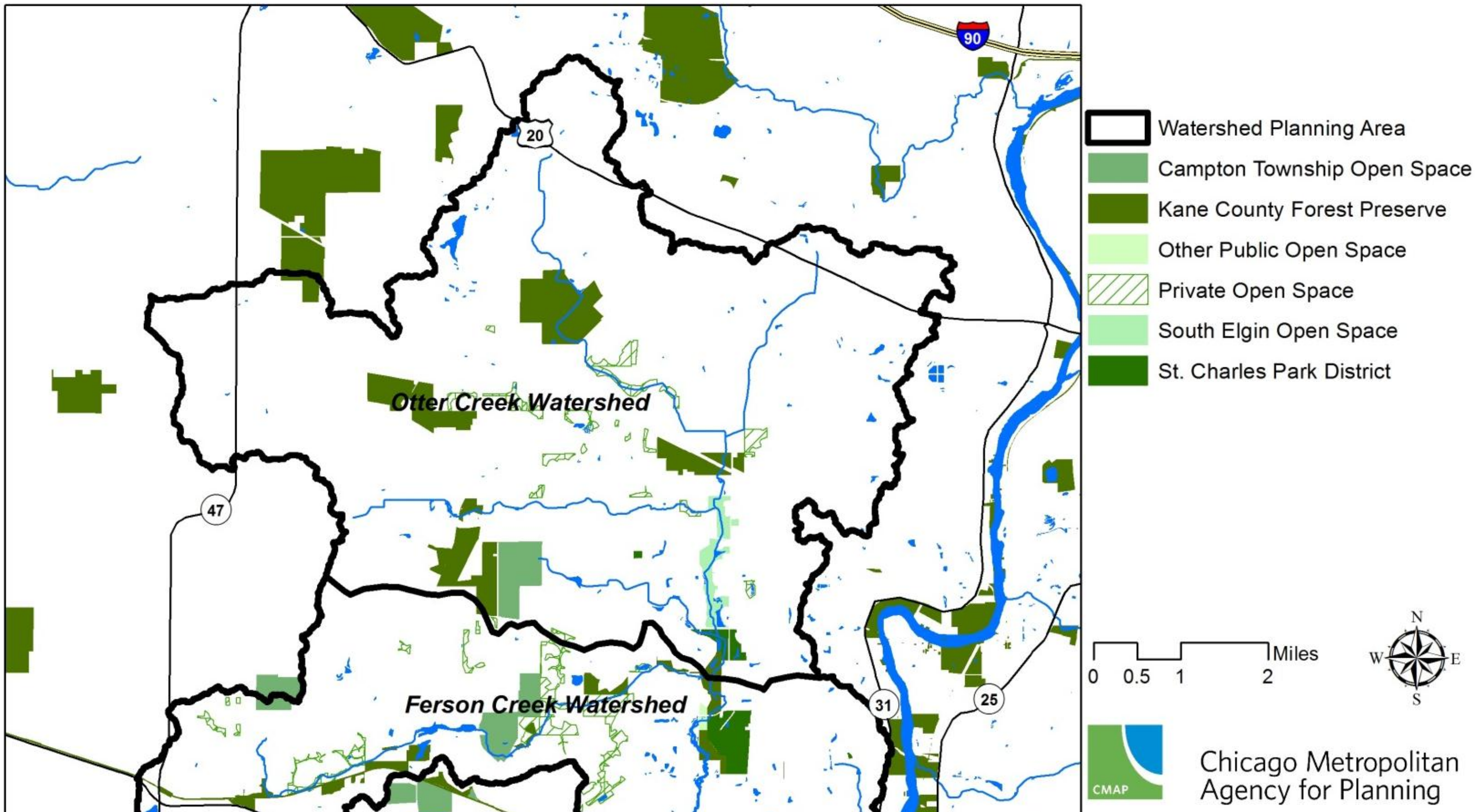
[20] The Center for Watershed Protection. *Impacts of Impervious Cover on Aquatic Systems*. Mansfield, CT: University of Connecticut, 2003. http://clear.uconn.edu/projects/TMDL/library/papers/Schueler_2003.pdf (accessed November 8, 2011).
[21] See Figure 8.

Figure 8. **Protected open space in Ferson-Otter Creek Watershed**



Sources: Watershed Planning Area - Illinois State Water Survey (2005); Major Roads - ESRI (2000); Water Features - National Hydrography Dataset, United States Geological Survey; Kane County Forest Preserve - FPDKC (2009); Campton Township, Other Public Open Space, Private Open Space, South Elgin Open Space and St. Charles Park District - Campton Township Green Infrastructure Plan (2010).

Forest Management Plans

The Illinois Department of Natural Resources (IDNR), Office of Resource Conservation, Division of Forestry, works with private landowners to reforest agricultural land and help with managing private woodlots. The Illinois Forestry Development Act (IFDA; 525 ILCS 15), funded in part by the U.S. Department of Agriculture (USDA) Forest Service, provides for this program. The IFDA created the Illinois Forestry Development Council, the Forestry Development Cost Share Program, and the Forestry Development Fund. Timber harvests in the State of Illinois are subject to a 4% harvest fee which helps to fund the cost-share component of the program.[22]

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

In northeastern Illinois, the program emphasizes exotic species removal and oak regeneration. Within the Ferson-Otter Creek Watershed, there are currently no properties enrolled in the IFDA program.

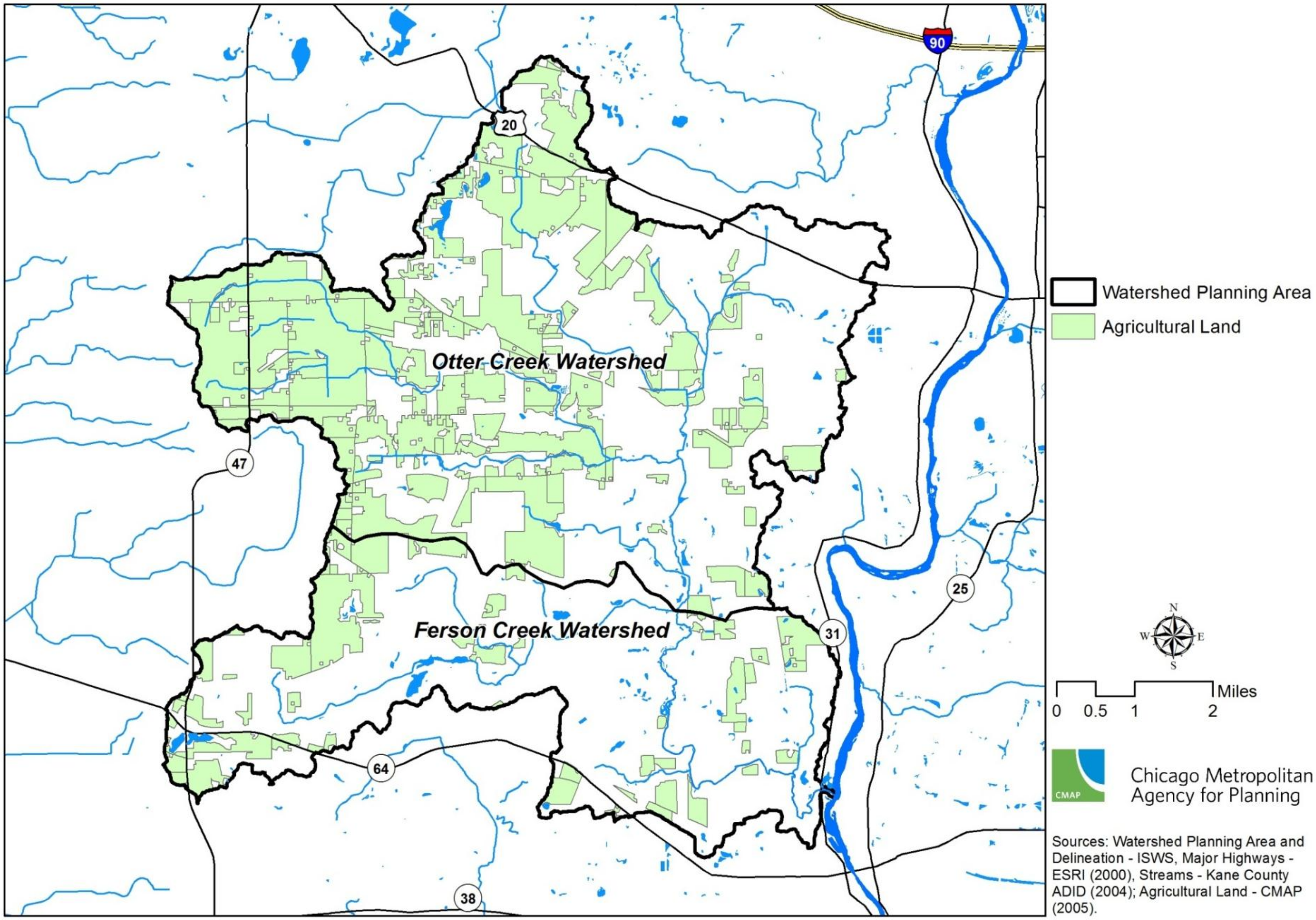
[22] IDNR. *Information Sheet: Illinois Forestry Development Act*. Springfield, IL: IDNR, June 2006. http://dnr.state.il.us/conservation/forestry/IFDA/ (accessed November 2, 2011).

Agriculture

The distribution of agricultural land throughout Ferson-Otter Creek Watershed is characterized from the 2005 CMAP Land Use Inventory. See Figure 9 for the distribution of agricultural land throughout these watersheds, a total of 11,596 acres.[23] Beyond the county-level, more detailed watershed-level statistics do not exist for agricultural land use and practices in Ferson-Otter Creek Watershed.[24] County-level statistics are available through the USDA 2007 Census of Agriculture. Kane County is 57% agricultural by land area and of this, 60% is planted in corn and 24% in soy.[25] Although row crop agriculture is the predominant agricultural land use in Kane County, the county also has a small amount of animal agriculture. Kane County accounts for 0.48% of livestock in Illinois, with 124,978 head.[26] Figure 9 shows the distribution of land used for livestock and equestrian purposes for Ferson-Otter Creek Watershed, a total of 694 acres.[27]

[23] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).
[24] Thomas Ryterske, NRCS Illinois District Conservationist, email message to author(s), June 27, 2011.
[25] USDA NASS. "County Summary Highlights: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 1, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011).
[26] Ibid.
[27] Ibid. 23.

Figure 9. **Agricultural land in Ferson-Otter Creek Watershed**



The Census also collects information on selected agricultural practices. Some of these practices are relevant to the discussion of agricultural impacts to water quality. For Kane County, a significant number of farmers employ some form of conservation practice: 33% of farms used some form of conservation method for crop production; 9% of farms practiced rotational or management-intensive grazing; and no farms grazed livestock on an animal unit month (AUM) basis.[28] Conservation practices include any of the several projects or management practices such as conservation tillage or nutrient management planning, described in the National Resource Conservation Service (NRCS) Illinois Field Office Technical Guides (FOTG) that are detailed more thoroughly below.[29] Rotational or management-intensive grazing both involve systematically moving livestock herds throughout available grazing lands according to a plan that is designed to most efficiently encourage forage growth and livestock health. For Kane County specifically, farmers most often use the following conservation practices: residue management (strip-, no- or mulch-tillage); nutrient management planning (monitoring soil nutrient levels and applying fertilizers only in needed amounts); and integrated pest management (using pest-resistant crop varieties, rotating crops and targeting areas for pesticide that exceed defined damage thresholds).[30]

In addition, 0.4% of agricultural land in Kane County is enrolled in the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), Farmable Wetlands, or Conservation Reserve Enhancement Program (CREP) based on the Census.[31] Statewide, 3.3% of agricultural land is enrolled in one of these programs.[32] These are voluntary programs for agricultural landowners that provide assistance and incentives to farmers for conserving natural resources on private lands. CRP offers payments to farmers to establish environmentally beneficial plant cover on eligible croplands. The Wetlands Reserve and Farmable Wetlands programs both focus on wetlands, and in the first case, help farmers to protect or restore wetlands on their property, and in the second, enable farmers to prevent degradation of wetlands on land enrolled in CRP. Finally, CREP combines CRP resources with tribal, state and federal authorities for a community-based approach to conservation issues on private lands locally.

Agricultural irrigation can also have direct consequences for water resources given its consumptive nature. Irrigation in Illinois is used to a more limited extent than in other regions. In Kane County, 1.5% of farmland is irrigated.[33] For comparison, 6.1% of agricultural land is irrigated nationally, while in Illinois, 1.8% of farmland is irrigated.[34] However, a water demand study commissioned by CMAP found that total water withdrawals for agricultural irrigation in northeastern Illinois are not insignificant.[35] Total water

[28] USDA NASS. "County Summary Highlights: 2007." *2007 Census of Agriculture*, Illinois State and County Data, Volume 1, Geographic Area Series, Part 13, Chapter 2, Table 44, Report No. AC-07-A-13. Washington, D.C.: USDA NASS, December 2009. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Illinois/index.asp (accessed August 31, 2011). An *AUM* is the amount of forage necessary to sustain an animal for a month, varying by the type of animal. An AUM accounting system can be used to calculate the required grazing area for a herd, which informs appropriate stocking densities and timing of rotations when farmers are developing grazing patterns.

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

[30] Thomas Ryterske, NRCS Illinois District Conservationist, email message to author(s), June 27, 2011.

[31] Ibid. 28, Table 8.

[32] Ibid.

[33] Ibid. 28, Table 10.

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

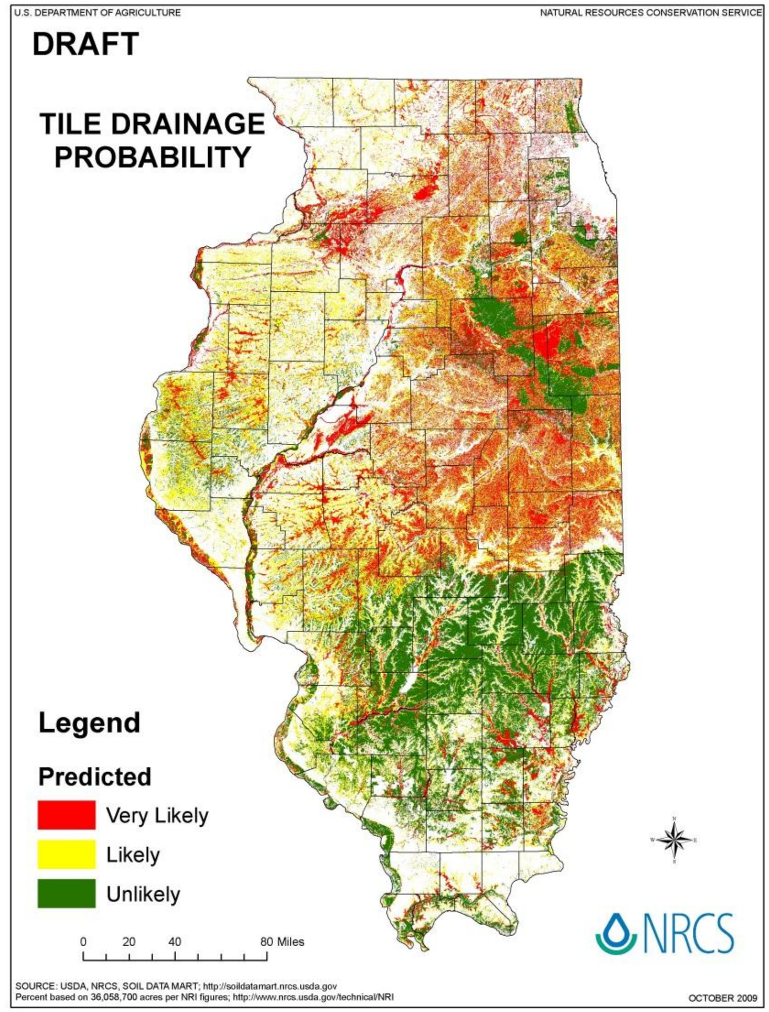
[35] Southern Illinois University, Department of Geography and Environmental Resources. *Regional Water Demand Scenarios for Northeastern Illinois: 2005-2050*, by B. Dziegielewski and F.J. Chowdhury. Chicago, IL: CMAP, 2008.

withdrawal for Kane County in 2005 was 61.5 million gallons per day (MGD).[36] For the same county and year, total water withdrawal for cropland irrigation was 2.47 MGD, while estimated water use for livestock was 0.29 MGD.[37] Cropland irrigation and livestock water use therefore accounted for 4% and 0.04% of total water withdrawals in 2005 in Kane County respectively.

Agriculture in turn is affected by prevalent biophysical conditions in Ferson-Otter Creek Watershed. Soil conditions in particular provide an indication of the hydrological character of land in the watershed, especially with regard to the likely extent of tile drainage on agricultural lands. The location and extent of hydric soils and hydrologic soil groups within this watershed, as well as the definitions of these terms, are discussed further in the Resource Inventory. Such soil characteristics inform the overall drainage ability of agricultural lands. The extent of tile drainage is not well-documented at either national or local levels.[38] Drainage classes determined by NRCS are used to estimate the extent of tile drainage in Ferson-Otter Creek Watershed. At a statewide level, however, NRCS has performed a similar analysis based on the interpretation of soil groups in the Illinois Drainage Guide. Figure 10 features the results of this analysis by NRCS, depicting the probability of tile drainage for agricultural lands throughout the state of Illinois.[39]

Based on this figure, most agricultural lands in Kane County are either "Likely" or "Very Likely" to have tile drainage.

Figure 10. **Tile drainage probability in Illinois**



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http://www.cmap.illinois.gov/regional-water-supply-planning (accessed September 15, 2011).

36 Ibid.

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

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

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

The likely extent of tile drainage in Ferson-Otter Creek Watershed is estimated here based on soil drainage classes. NRCS recognizes seven natural drainage classes describing the frequency and duration of wet periods for various soils. The drainage class for soil features is obtained from the SSURGO dataset (Soil Survey Geographic Database).[40] These classes are Excessively Drained, Somewhat Excessively Drained, Well Drained, Moderately Well Drained, Somewhat Poorly Drained, Poorly Drained and Very Poorly Drained.[41] The last three drainage classes indicate soils which limit or exclude crop growth unless artificially drained. Soils with the Somewhat Poorly Drained, Poorly Drained or Very Poorly Drained drainage class occur on 45% of the agricultural land in Ferson-Otter Creek Watershed. These areas can be taken as an approximation of the likely extent of artificial drainage on currently farmed agricultural lands, given that crop growth on these lands would be impossible or severely impacted without artificial drainage. The extent of soils with these drainage classes is depicted in Figure 11.

Some of these poorly drained areas were likely once wetland areas which are now farmed. There are nine sites identified as "Wetlands Being Farmed" in the CMAP 2005 Land Use Inventory on agricultural lands within Ferson-Otter Creek Watershed (Figure 12).[42] Officially, a Farmed Wetland is a wetland that has been modified to produce agricultural goods that also meets certain hydrologic conditions.[43] The CMAP classification, however, might not meet these criteria. "Wetlands Being Farmed" were identified for the CMAP 2005 Land Use Inventory from any features in the National Wetlands Inventory that are greater than 2.5 acres, on agricultural lands, and verified to be an existing wetland through aerial photography.[44] Farmed wetlands meeting the federal definition are often still wet enough to act as valuable wetland habitats that are subject to Swampbuster, the Wetland Conservation provision in the Farm Bill, and Clean Water Act Section 404, which regulates the management of wetland areas. Consequently, these nine sites with the CMAP "Wetlands Being Farmed" classification might be potential best management practices (BMPs) implementation sites for wetland restoration opportunities given sufficient interest and ability on the part of these private landowners. Additionally, they might require further investigation to determine whether they meet the federal Farmed Wetlands classification.

Finally, the SSURGO dataset from NRCS also includes information about the distribution of highly erodible lands (HEL). Highly erodible lands are those most vulnerable to significant amounts of erosion, and are identified according to a specific set of criteria defined in the Code of Federal Regulations. For Ferson-Otter Creek Watershed, 7% of the total land area is highly erodible, while 18% of all agricultural land is highly erodible. Soil surveys identify HEL soil units based on the erodibility index of the soil.[45] The erodibility index is calculated by dividing the potential average annual rate of erosion for each soil by the maximum annual rate of soil erosion that could occur without causing a decline in long-term productivity (also called the T level).[46] Erosion in turn is calculated according to

[40] USDA NRCS, Soil Survey Staff. *Soil Survey Geographic (SSURGO) Database*. Kane County, Illinois. Washington, D.C. http://soildatamart.nrcs.usda.gov (accessed September 14, 2011).
[41] Soil Conservation Service, Soil Survey Staff. *Soil Survey Manual*. USDA Handbook 18. Washington, D.C.: USDA NRCS, 1993. http://soils.usda.gov/technical/manual/ (accessed September 14, 2011).
[42] NIPC. *Land Use Inventory*. Chicago, IL: CMAP, 2005. http://www.cmap.illinois.gov/land-use-inventory (accessed September 14, 2011).
[43] "Highly Erodible Land and Wetland Conservation." *Code of Federal Regulations*. Title 7, Part 12 (1996). http://edocket.access.gpo.gov/cfr_2011/janqtr/pdf/7cfr12.2.pdf (accessed September 14, 2011).
[44] David Clark, Senior Analyst for CMAP, email message to author(s), September 14, 2011.
[45] "Identification of highly erodible lands criteria." *Code of Federal Regulations*. Title 7, Part 12 (2011). http://frwebgate3.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=pEGmgU/11/2/0&WAISaction=retrieve (accessed October 3, 2011).
[46] Ibid.

the Universal Soil Loss Equation (USLE), which includes factors like rainfall and runoff (R); the degree to which the soil resists erosion (K); and a formula measuring slope length and steepness (LS).[47]

Like wetlands, HEL lands are the focus of specific NRCS conservation efforts. The Highly Erodible Land Conservation Compliance Provisions in the Food Security Act of 1985 requires that under certain circumstances, farmers producing agricultural goods on lands deemed highly erodible lands must use a USDA-approved conservation system.[48] In addition, this Act established a stricter provision called Sodbuster (similar to the Swampbuster provision discussed above) requiring that under certain circumstances, farmers cultivating HEL lands must adopt a conservation system that reduces erosion to the T level.[49] Violations of either provision can result in the loss of some or all USDA program benefits to the farmer. Any HEL lands currently being farmed in the Ferson-Otter Creek Watershed (Figure 13) might be subject to these provisions, if these lands satisfy the criteria used to determine applicability of these provisions to specific properties.

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[47] "Identification of highly erodible lands criteria." *Code of Federal Regulations*. Title 7, Part 12 (2011). http://frwebgate3.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=pEGmgU/11/2/0&WAISaction=retrieve (accessed October 3, 2011).

[48] "Highly Erodible Land Conservation Compliance Provisions," USDA NRCS, accessed October 3, 2011, http://www.nrcs.usda.gov/wps/portal/nrcs/detail/?ss=16&navtype=SUBNAVIGATION&cid=nrcs143_008440&navid=100170150000000&pnavid=100000000000000&position=Welcome.Html&ttype=detail&pname=Highly%20Erodible%20Land%20Conservation%20Compliance%20Provisions%20|%20NRCS.

[49] Ibid.

Figure 11. **Drainage classes in Ferson-Otter Creek Watershed**

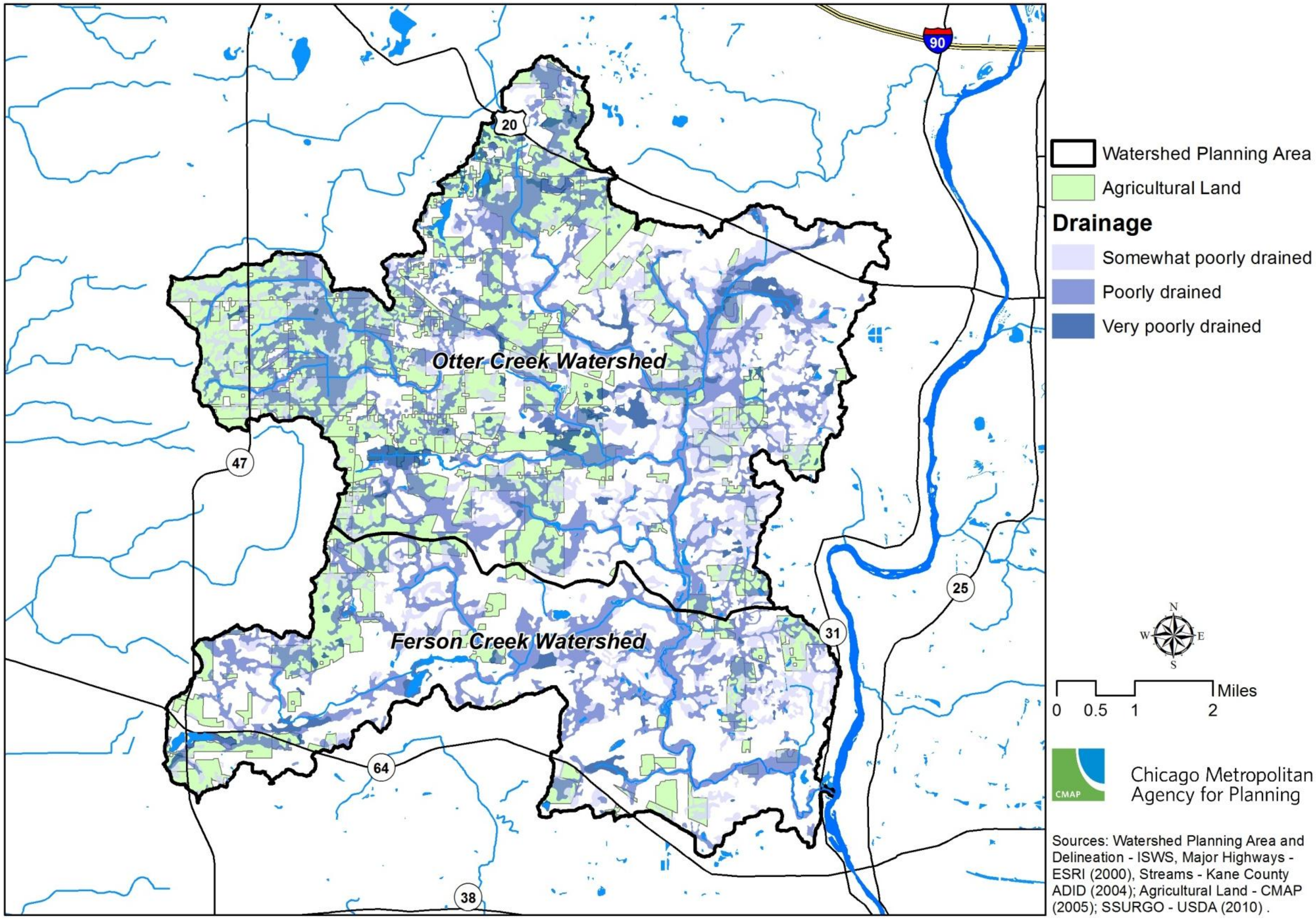


Figure 12. **Farmed wetlands in Ferson-Otter Creek Watershed**

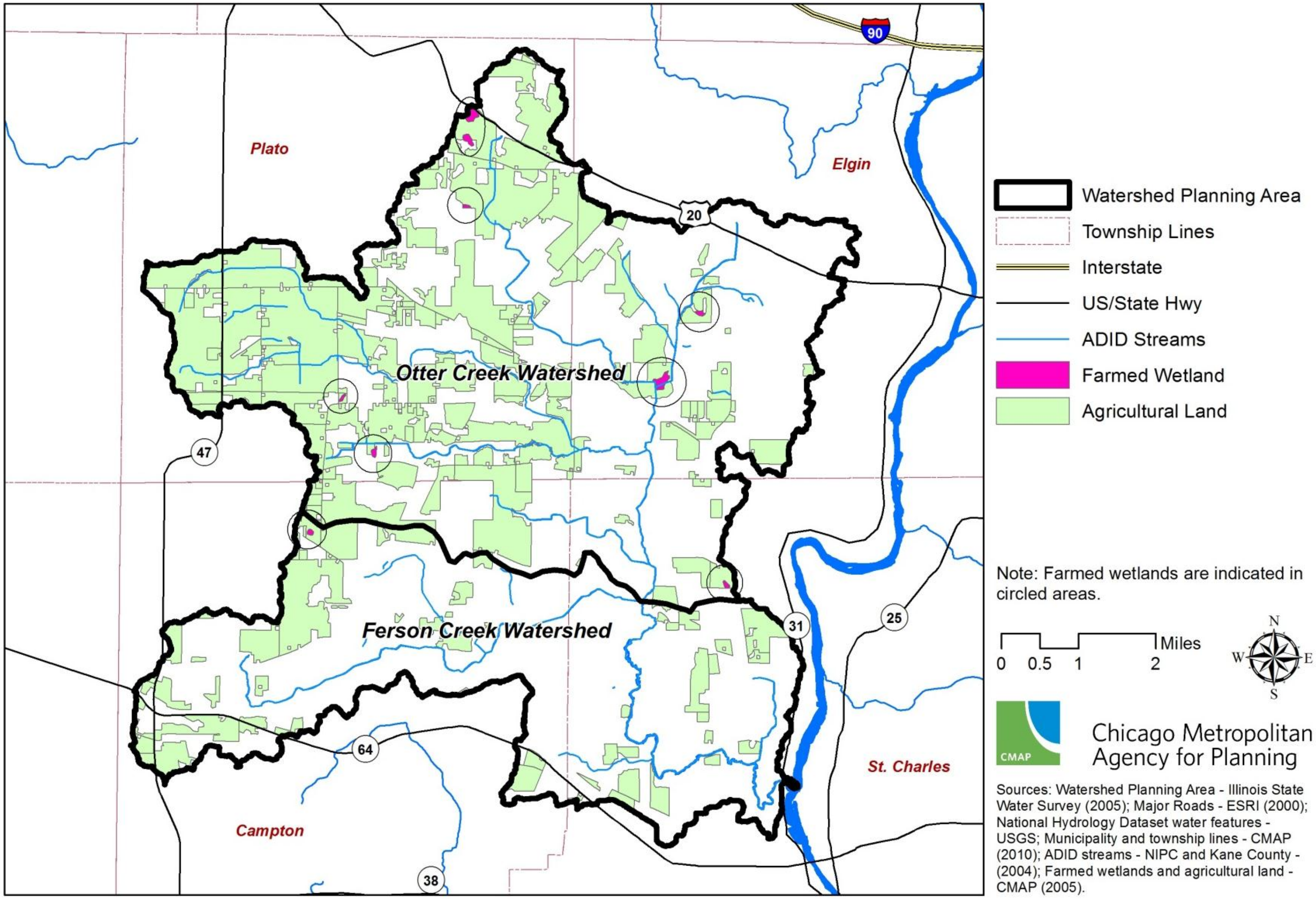
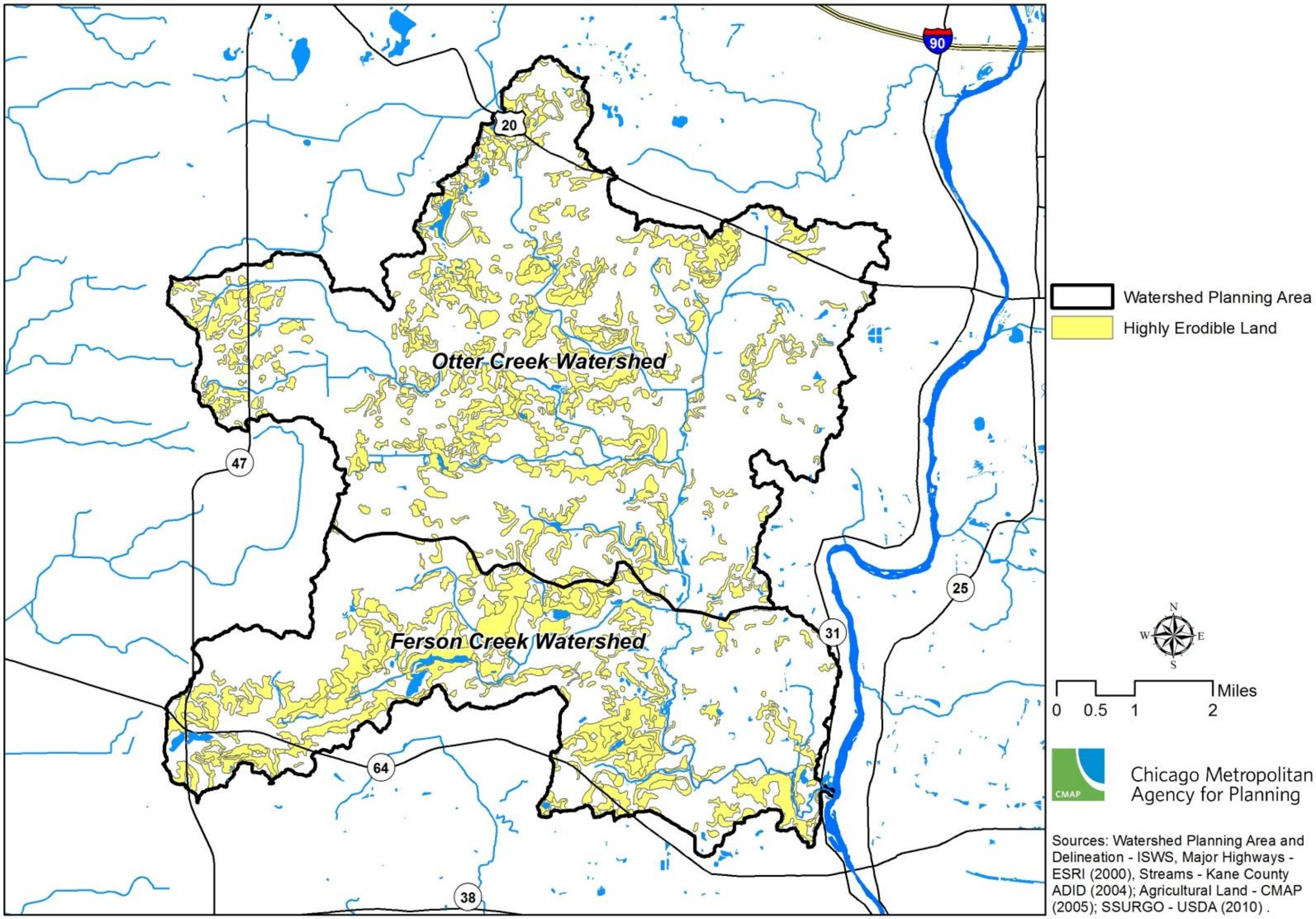


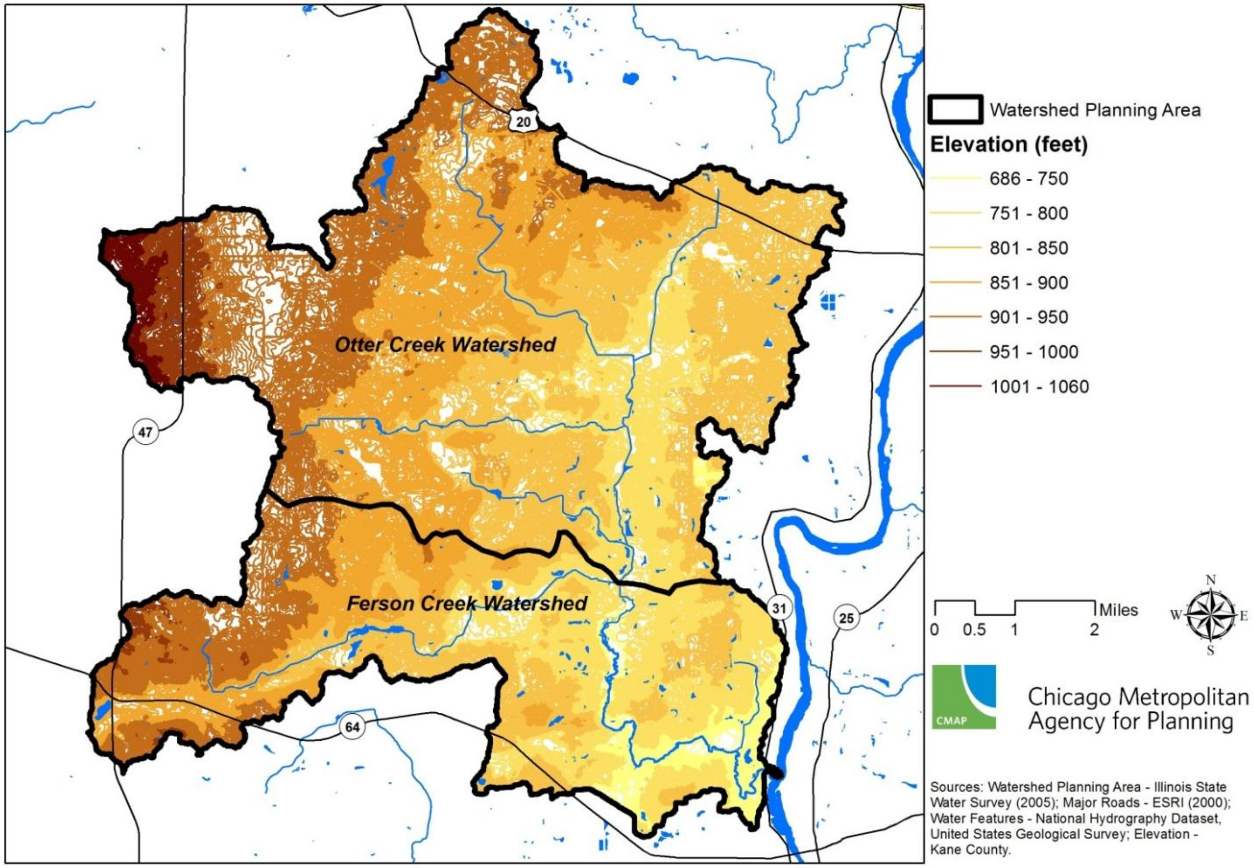
Figure 13. **Highly erodible land in Ferson-Otter Creek Watershed**



2.2.2 Topography

Elevation is highest in the western portion of the watershed and gradually lowers to the east as the land approaches the Fox River. Elevations range from 686 to 1060 feet above mean sea level (AMSL) for a total relief of 374 feet (Figure 14).[50] The majority of the watershed lies under 1000 feet AMSL. Agriculture is the dominant land use in the highest areas of the watershed (900 feet and above).

Figure 14. **Elevation in Ferson-Otter Creek Watershed**



[50] CMAP. "Two Foot Topographic Contours." Geneva, IL: Kane County, Illinois, 2006.

2.2.3 Soils

Hydric Soils

The soils data is sourced from the Soil Survey Geographic (SSURGO) Database produced by the USDA, Natural Resources Conservation Services (NRCS).[51] While NRCS provides a wealth of information about the watershed's soils, this plan will focus on two datasets: Hydric Soils and Hydrologic Soil Groups. Figure 15 shows the range of hydric soils in the watershed from "All hydric" to "unknown." Hydric soils are those that are developed under sufficiently wet conditions such as flooding, ponding, or saturation for a long enough time period to support the growth and regeneration of hydrophytic vegetation, plants that grow partly or wholly in water. Thus, hydric soils are one indicator of the historic presence of wetlands, and among other matters, are useful in guiding wetland restoration efforts.

Partially hydric soils meet some but not all of the criteria and have the potential for hydric inclusion. Hydric soils make up 28.9% of the watershed and are spatially dispersed throughout the land area. Partially hydric soils make up 7.1% of the watershed, 1% of the soils are classified unknown, and 63.2% of the watershed contains nonhydric soils.

Hydrologic Soil Groups

Another way to classify soils is through Hydrologic Soil Groups (HSG) as shown in Figure 16. Soil classification systems, including hydrologic groups, are used by planners, builders, and engineers among others to determine site suitability for projects. The four HSG are defined as Groups A-D, however some soils in our watershed have characteristics of multiple groups depending on site conditions. The following soils are present in the Ferson-Otter Creek Watershed:

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

Over 71% of the watershed planning area contains Group B soils. Both B/D and C soil groups cover about 12% each. Group B and B/D soils are dispersed throughout the watershed. Group C soils, however, are mainly concentrated along the eastern boundary of the watershed in parts of Elgin, South Elgin, St. Charles, and unincorporated Kane County. The location of the Group C soils coincides with the more developed portions of the watershed. Soil Groups A and D cover minimal areas in the watershed.

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[51] USDA NRCS, Soil Survey Staff. *Soil Survey Geographic (SSURGO) Database*. Kane County, Illinois. Washington, D.C. http://soildatamart.nrcs.usda.gov (accessed September 14, 2011).

Figure 15. **Hydric soils in Ferson-Otter Creek Watershed**

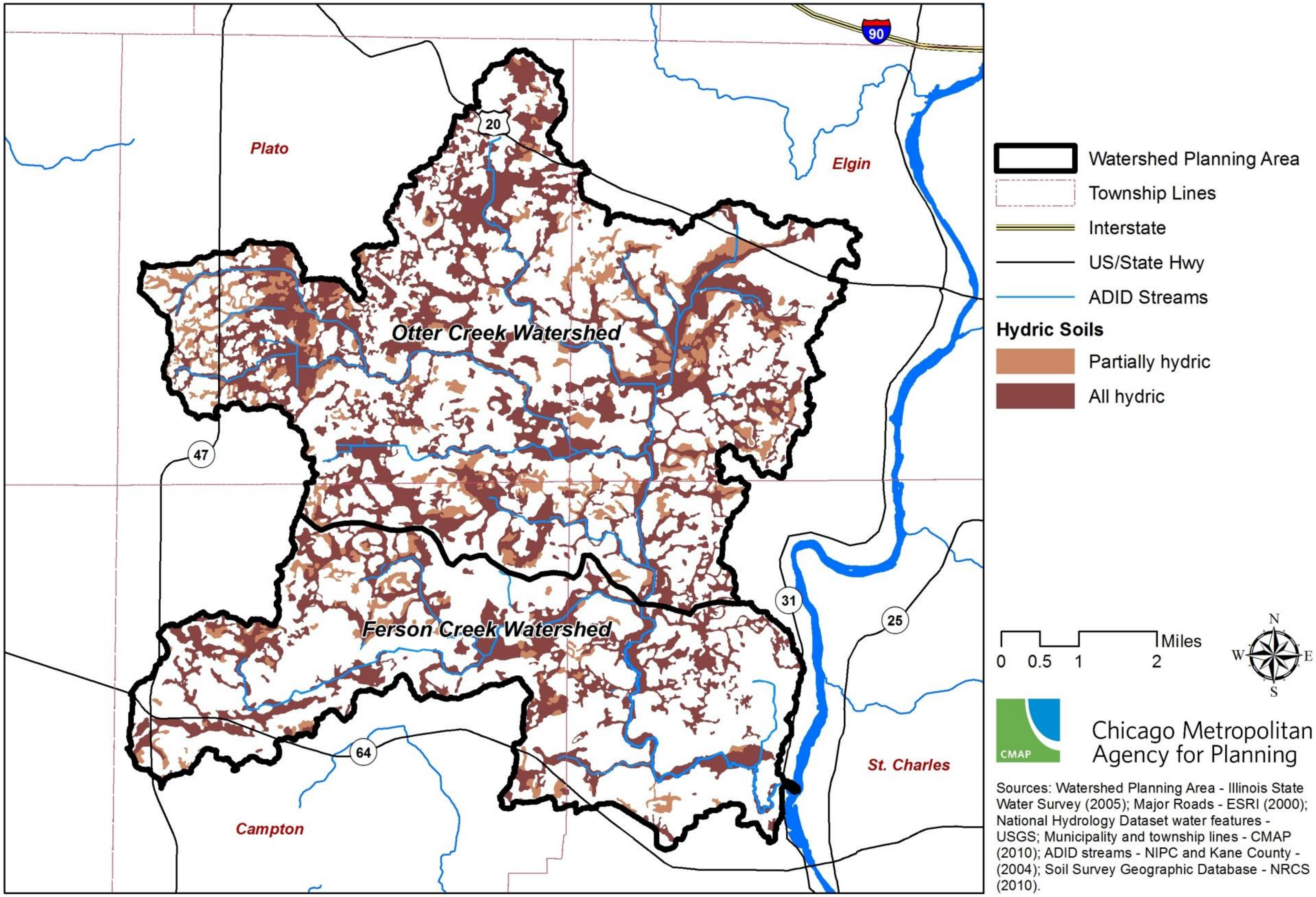
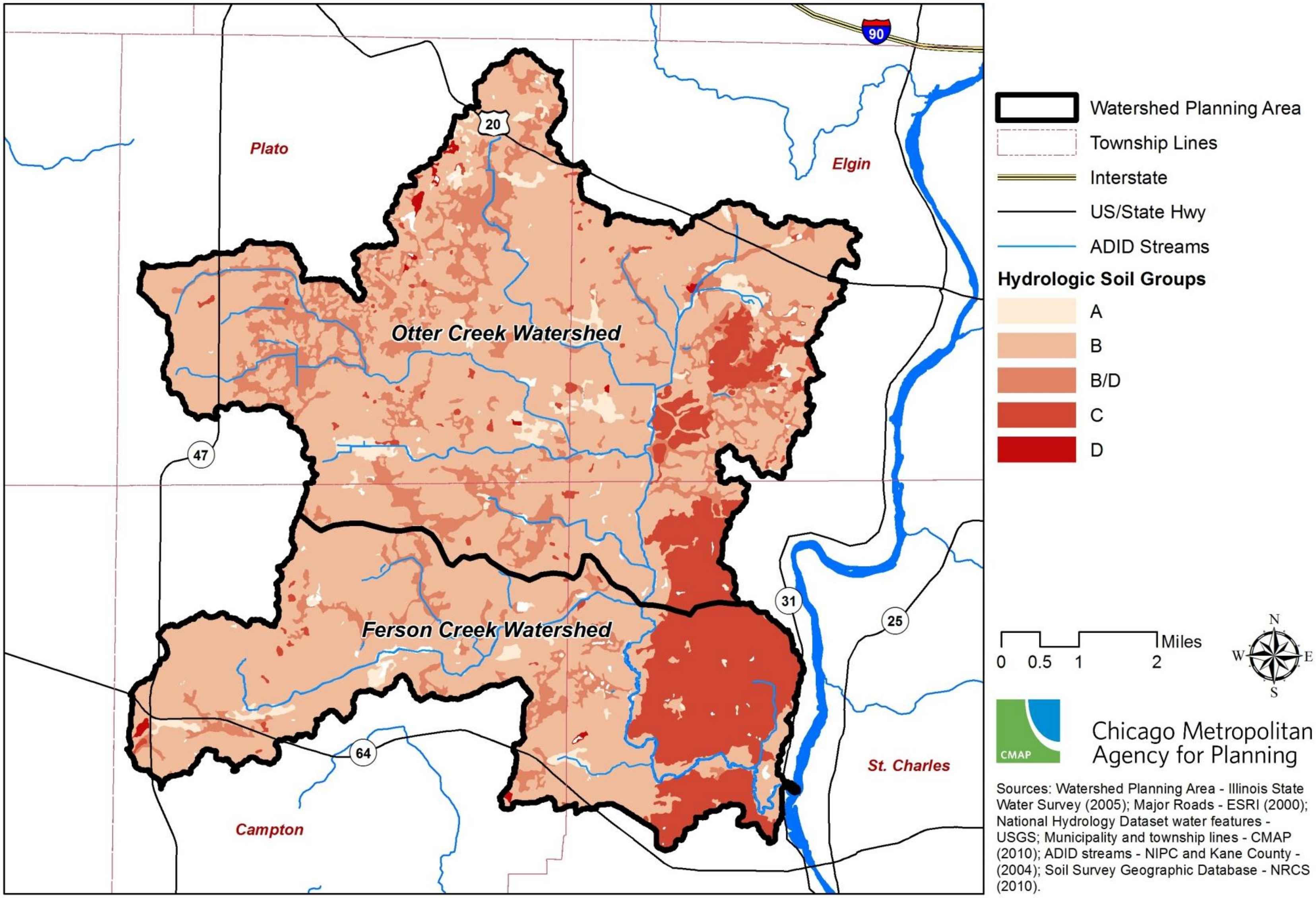


Figure 16. **Hydrologic soil groups in Ferson-Otter Creek Watershed**



2.2.4 Floodplains and Floodways

Floodplain and floodway data are sourced from Federal Emergency Management Agency (FEMA). A floodplain is defined as "any land area susceptible to being inundated by flood waters from any source."[52] However areas that are not directly adjacent to a body of water are often flooded in heavy storms. For example, the 100-year floodplain or base flood encompasses an area of land that has a 1-in-100 chance of being flooded or exceeded within any given year.[53] Whereas the 500-year floodplain has a 1-in-500 chance of being flooded or exceeded within any given year. If a natural floodplain is developed for any other use, such use becomes susceptible to flooding. This results in property and crop damage and degraded water quality. Therefore, floodplains and their relationship to land use should be considered in a watershed plan as well as any other type of land use planning.

Both floodplains and floodways are depicted in Figure 17. Floodways are defined by the National Flood Insurance Program as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." [54] Floodways are a subset of the 100-year floodplain and carry the deeper, faster moving water during a flood event. [55] It should be noted that Kane County's Stormwater Ordinance addresses floodplain requirements that are applicable to all of the county's municipalities.[56]

2.2.5 Wastewater

Wastewater Treatment Plants[57]

Under the National Pollutant Discharge Elimination Systems (NPDES), all facilities that discharge pollutants from any point source into surface waters of the United States are required to obtain a permit. This permit may assign pollutant limits, monitoring and reporting requirements and other provisions to protect surface water quality. In the watershed, only one NPDES permit was issued and is held by the privately owned Ferson Creek Utilities Sewage Treatment Plant (STP) to treat domestic wastewater for the majority of the Windings Subdivision in St. Charles (Figure 18).[58] The STP discharges into a Ferson Creek tributary that ultimately discharges into Lake Campton.[59] The current permit was issued in May of 2007 and is set to expire June 30, 2012 at which time it will need to be renewed. The design average flow (DAF) is 0.095 million gallons per day (MGD) with a design maximum flow (DMF) being 0.238 MGD. This is a relatively small-volume facility. Water quality treatment methods include manually cleaned bar screen, two-stage activated sludge, sedimentation, sand filters, chlorination and dechlorination. The 2007 permit contains water quality standards for the effluent and includes load limits for Carbonaceous BOD_5, Suspended Solids, Dissolved Oxygen, pH, Fecal Coliform, Chlorine Residual, Ammonia Nitrogen, and Phosphorus. The permit for fecal coliform is in line with the statewide standard discussed in the Chapter 3.

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[52] FEMA. Appendix D: Glossary. Washington, D.C. http://www.fema.gov/pdf/floodplain/nfip_sg_appendix_d.pdf (accessed November 8, 2011).

[53] "Flood Zones," FEMA, last modified August 11, 2010, accessed November 8, 2011, http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/flood_zones.shtm.

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

[55] Illinois Association for Floodplain and Stormwater Management. *Regulatory Floodways*. St. Charles, IL: Illinois Association for Floodplain and Stormwater Management, March 2006. http://www.illinoisfloods.org/documents/home_study_course/11%20Regulatory%20Floodways.pdf (accessed November 8, 2011).

[56] *Stormwater Management*. *Kane County, Illinois, County Code*, Chapter 9. http://www.sterlingcodifiers.com/IL/Kane%20County/index.htm (accessed December 19, 2011).

[57] This includes Sewage Treatment Plants (STPs).

[58] "Permit Compliance Systems (PCS)," U.S. EPA, accessed December 19, 2011, http://www.epa.gov/enviro/facts/pcs/search.html. Information found through Envirofacts for NPDES ID number IL0045411.

[59] Ibid. Main discharge number 001.

Figure 17. **Floodplains and floodways in Ferson-Otter Creek Watershed**

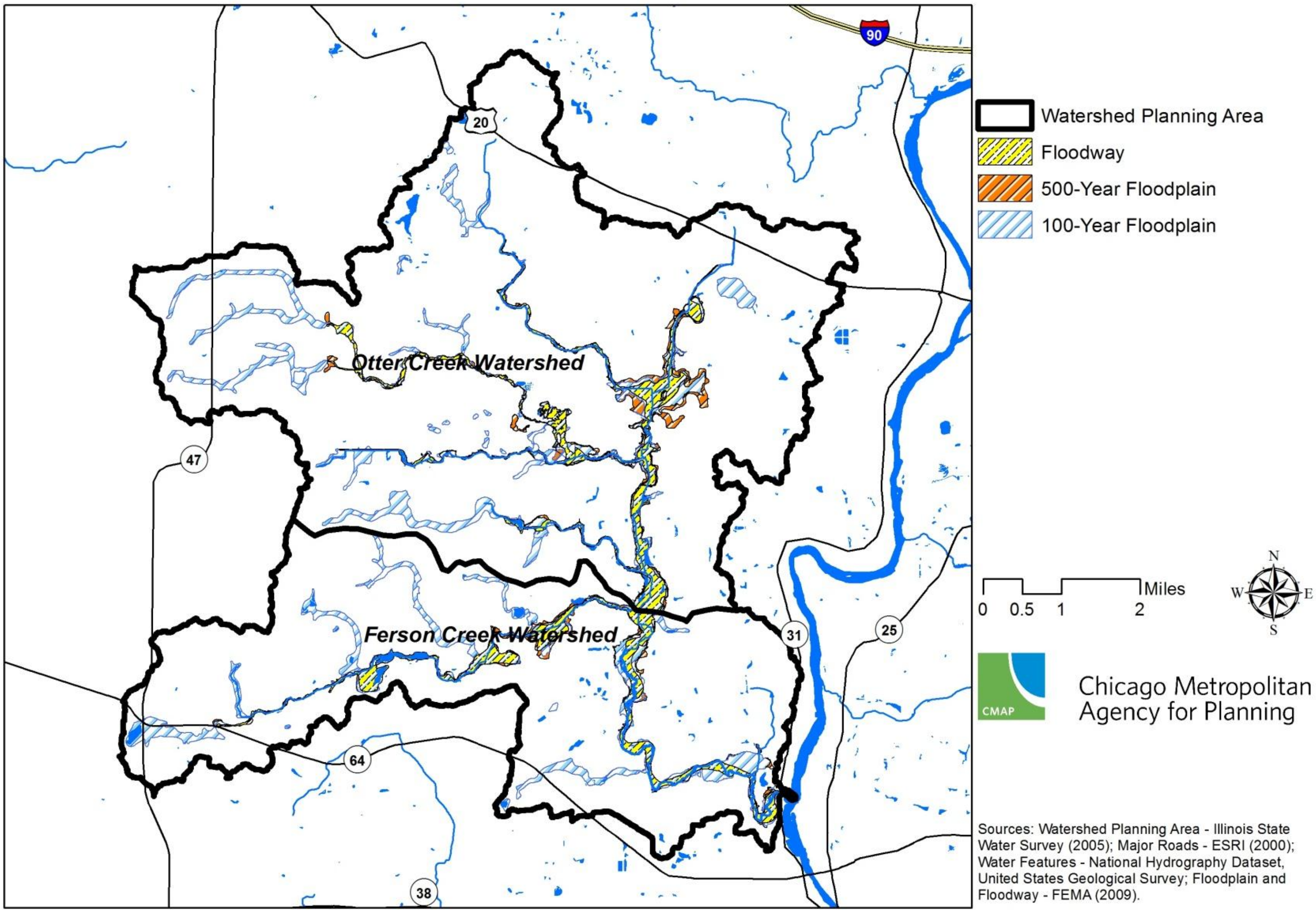
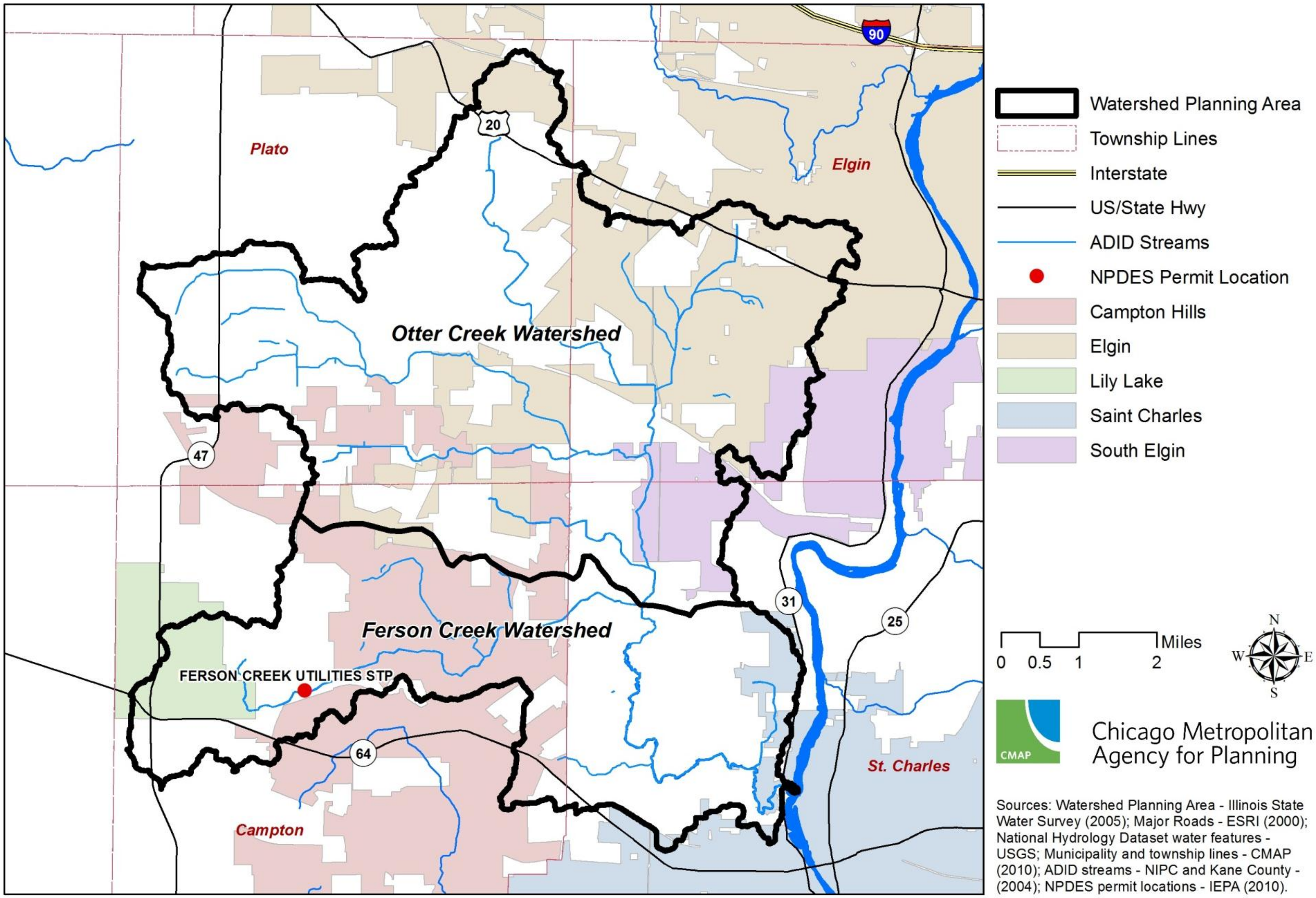


Figure 18. **NPDES permit locations**

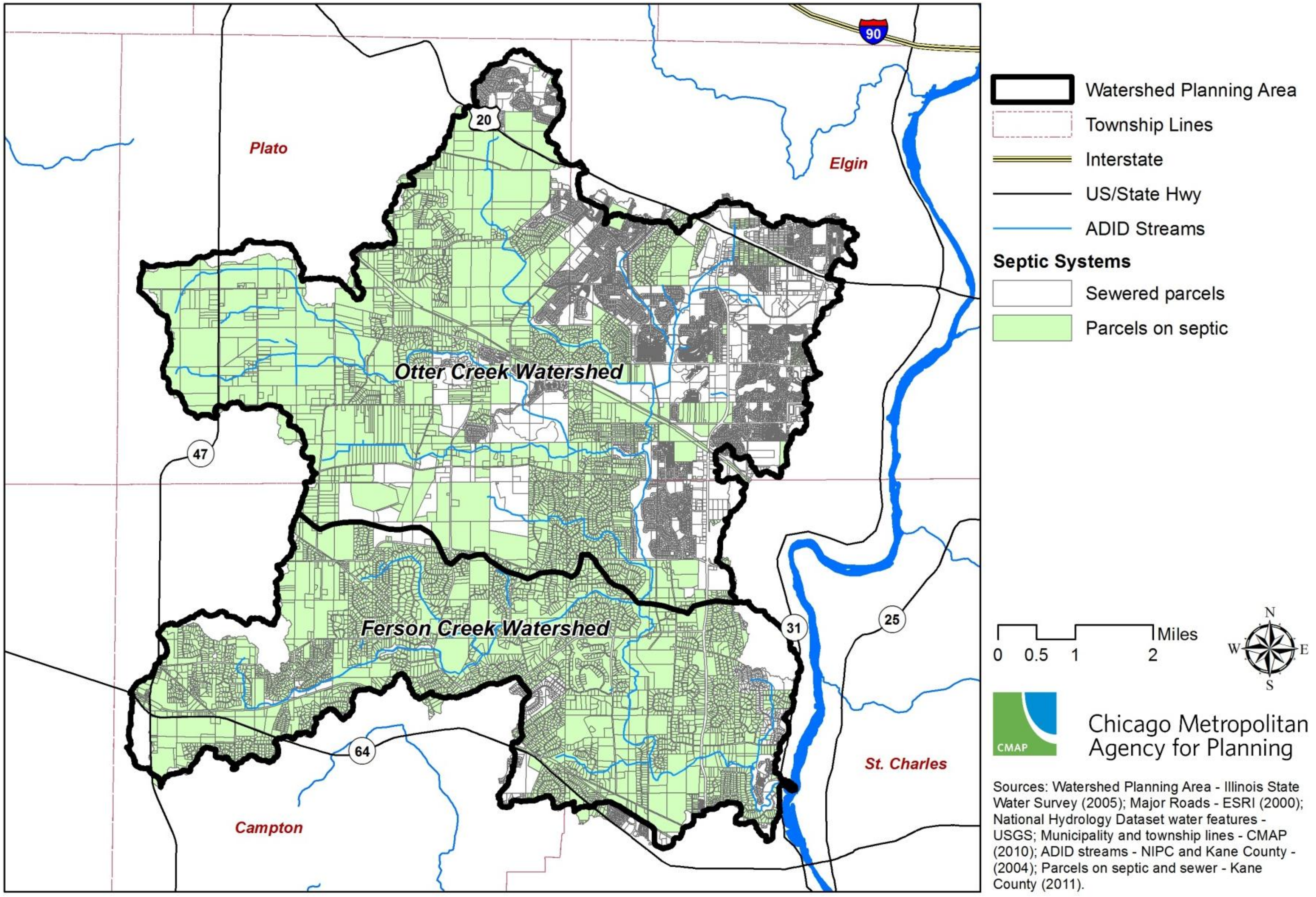


Septic Systems

Kane County provided the data to identify parcels within the watershed that use septic systems (Figure 19). The data were created through the following steps: 1) The Kane County Health Department identified all subdivisions that are on septic within the watershed. 2) All parcels that fell within a sanitary district were deemed to NOT be on septic. 3) All parcels that fall within municipal boundaries that provide sewer service were deemed NOT to be on septic. 4) All remaining parcels were deemed to be on septic. As Figure 19 shows, the large majority - around 70% of the watershed – is likely on septic systems.[60] As stated above, Ferson Creek is impaired by fecal coliform and one potential source that can cause fecal coliform contamination is failing or improperly maintained septic systems.[61] For this reason, septic-related policies at the county level were examined and summarized as follows. Regular maintenance of septic systems is not required for homeowners with traditional septic systems. However those homeowners with aerobic treatment plants are required to have perpetual maintenance contracts on their units necessitating inspections twice a year. Failure rate of septic systems is not known, however the county does track renovation permits which could allude to a certain number of failures. Finally the county does not track or estimate house plumbing tie-ins to agriculture drain tile systems. If such situations are identified, correction is required. Kane County does offer an annual free or low-cost septic system class for residents to learn proper septic system care and provides an online guide.[62]

[60] Sean Glowacz, Land Use Planner for Kane County, email message to CMAP, April 29, 2011.
[61] It should be noted that currently there is no data identifying septic system failure as a source of contamination in Ferson-Otter Creek. Without more specific data, the planning process looked at a wide variety of potential causes include septic system failure. Kane County is aware of very few failed septic systems.
[62] "Kane County Environmental Health Services," Kane County Health Department, accessed December 19, 2011, http://www.kanehealth.com/water_waste.htm. Attendance is generally 25-40 people each year.

Figure 19. **Potential parcels on septic systems in the Ferson-Otter Creek Watershed**



MS4 Permits

In addition to wastewater treatment plants, urban stormwater runoff is also regulated through NPDES.[63] The NPDES Stormwater Program was implemented in two phases. Phase I of this program was implemented in 1990 and applies to medium and large municipal storm sewer systems, as well as certain counties with populations of 100,000 or more; Phase II was implemented in 2003 and expands the scope of storm sewer systems which are subject to NPDES.[64] Unlike Phase I, Phase II applies to small municipal separate storm sewers (MS4's), including smaller construction or industrial sites that are owned and operated in urbanized areas.[65] Industrial sites or construction activities that disturb one or more acres of land must obtain an NPDES permit before construction activities begin.[66]

Under the terms of Phase II permits, industrial, construction, and MS4 Phase II permittees are required to implement certain practices that control pollution in stormwater runoff. To prevent the contamination of stormwater runoff, industrial and construction permittees must develop a stormwater pollution prevention plan (SWPPP), while MS4 permittees must develop a similar stormwater management program (SWMP). Stormwater runoff carrying pollutants from impervious surfaces can degrade water quality when discharged untreated into local rivers and streams, as is often the case. Programs like Phase II that encourage planning and implementation on a watershed basis are therefore vital for protecting water quality from stormwater runoff from both large and small separate stormwater sewer systems, as well as industrial and construction sites.

The following information focuses on the Phase II permit status of municipalities in the watershed planning area. As part of an integrated approach to stormwater pollution prevention, MS4 pollution prevention plans must address the following six minimum control measures: Public education and outreach, Public participation and involvement, Illicit discharge detention and elimination, Construction site runoff control, Post-construction runoff control, and Proper maintenance of pollution prevention controls.[67] The locations of NPDES Phase II permittees that comply with these control measures within Ferson-Otter Creek are shown in Table 3.

Table 3. Municipal MS4 permit status within Ferson-Otter Creek Watershed

MUNICIPALITY	MS4 PERMITTEE	NUMBER
Campton Hills	No	
Elgin	Yes	ILR400333
Lily Lake	No	
South Elgin	Yes	ILR400450
St. Charles	Yes	ILR400454
TOWNSHIP		
Plato Township Hwy. Dept.	Yes	ILR400484
Campton Township Hwy. Dist.	Yes	ILR400483
St. Charles Township	Yes	ILR400131
COUNTY		
Kane County	Yes	ILR400259

[63] "NPDES Permit Program Basics," U.S. EPA, last modified January 4, 2011, accessed October 12, 2011, http://cfpub.epa.gov/npdes/home.cfm?program_id=45.
[64] "NPDES Stormwater Program," U.S. EPA, last modified January 4, 2011, accessed October 13, 2011, http://cfpub.epa.gov/npdes/home.cfm?program_id=6.
[65] Ibid.
[66] U.S. EPA. "Stormwater Phase II Final Rule: An Overview." EPA Report No. 833-F-00-001. Washington, D.C.: U.S. EPA, 2005. http://www.epa.gov/npdes/pubs/fact2-0.pdf (accessed October 12, 2011).
[67] Ibid.

2.2.6 Groundwater Protection

Recharge Areas

This plan considers groundwater protection in addition to surface water quality. Aquifer recharge areas are critical to groundwater protection from both quality (i.e., vulnerable to contamination) and quantity (i.e., infiltration capacity) standpoints. As identified by USGS, the main recharge area is located in and nearby Lily Lake and extends north beyond the watershed. The data are sourced from the 2006 United States Geological Survey (USGS), Campton Township Groundwater Study.[68]

Aquifer Sensitivity to Contamination

Certain areas in the watershed are more vulnerable to aquifer contamination from land use activity than others. Kane County commissioned a study to classify sensitivity ranges from Unit A-D with "A" having the highest potential for contamination and "D" having the lowest.[69] Each classification is qualified by distance to land surface and the degree of aquifer thickness. This plan focuses on Unit A, defined as "areas where the upper surface of the aquifer is within 20 feet of the land surface and with sand and gravel or high-permeability bedrock aquifers greater than 20 feet thick."[70] Table 4 further explains Unit A's 4 subcategories A1-A4.

Table 4. Aquifer sensitivity to contamination

SUBCATEGORY	AQUIFER THICKNESS	LAND (WITHIN) SURFACE DEPTH
A1	**X^1 > 50 feet**	**X^2 < 5 feet**
A2	**X > 50 feet**	**5 < X < 20 feet**
A3	**20 < X < 50 feet**	**X < 5 feet**
A4	**20 < X < 50 feet**	**5 < X < 20 feet**

1 X=the number of feet thick the aquifer is.

2 X=number of feet the aquifer is within the land surface.

Within the county, Unit A areas are common in southern and northwestern sections and along the Fox River (Figure 20). Within the planning area, sensitive-aquifer areas are more common in Otter Creek than in Ferson Creek. These areas have the highest potential for contamination due to the presence of sand and gravel deposits that allow for contaminants to move rapidly through to wells or nearby streams.

Leaking Underground Storage Tank (LUST) Sites

IEPA has identified 30 Leaking Underground Storage Tanks, or LUST sites within the watershed (Figure 20).[71] These sites could be contaminated by gasoline or diesel fuel from leaks, spills, or overfills from when the tanks were in use. In any case, the concern is that LUST sites pose a threat of contamination to soil, groundwater, streams, rivers, and lakes in watersheds, such as this one, that are

68 USGS. *Hydrogeology, Water Use, and Simulated Ground-Water Flow and Availability in Campton Township, Kane County, Illinois*, by Robert T. Kay, Leslie D. Arihood, Terri L. Arnold, and Kathleen K. Fowler. Scientific Investigations Report 2006–5076. Reston, VA: USGS, 2006. http://pubs.usgs.gov/sir/2006/5076/pdf/sir20065076.pdf (accessed November 7, 2011).

69 ISGS. "Kane County Water Resources Investigations: Final Report on Geologic Investigations," by William S. Dey, Alec M. Davis, B. Brandon Curry, Donald A. Keefer and Curt C. Abert. ISGS Open File Series, 2007-7. Champaign, IL: ISGS, 2007. http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2007/ofs2007-07.pdf (accessed November 3, 2011).

70 Ibid. It should be noted that aquifer sensitivity classification rates sequence from Map Unit A to Map Unit E in order of decreasing sensitivity to aquifers becoming contaminated. For this plan, only Map Unit A category (High Potential for Aquifer Contamination) is shown in the resource inventory. However subsequent categories such as Map Unit B (Moderately High Potential for Aquifer Contamination) should be considered for planning purposes when appropriate.

71 "Leaking Underground Storage Tank Program," IEPA, accessed November 2, 2011, http://www.epa.state.il.us/land/lust/index.html. LUST is often interchanged with Underground Storage Tanks (UST).

predominantly dependent on groundwater as a potable water supply source.

Groundwater Geology

In Kane County, materials from the Quaternary geological period (2.6 million years ago to the present) overlie older Paleozoic bedrock, primarily Silurian limestone and dolomite or Ordovician shale.[72] The Cambrian-Ordovician bedrock forms a deep aquifer system, typically 800 to 1,500 feet deep, throughout the entire region that is heavily developed for groundwater pumping.[73] Quaternary materials are also a source of groundwater, forming shallow aquifers from which wells pump water. Quaternary materials include sand, gravel, peat and floodplain alluvium. The sand and gravel in Quaternary materials act as aquifers when they are saturated with water because their porosity and hydraulic conductivity are high, allowing water to flow freely.[74]

Shallow Aquifers

Many of the Quaternary aquifer systems previously described are major, meaning in this region that they yield pumped water at a rate of at least 70 gallons per minute.[75] These major aquifers, mapped for Kane County by the Illinois State Geological survey, are pictured in Figure 21.[76] The St. Charles, Kaneville and some unnamed formations are the predominant major aquifers in the watershed planning area.

Well Setback Zones

Community well systems (CWS) are subject to the Illinois Groundwater Protection Act (IGPA; P.A. 85-0863). Passed in 1987, IGPA emphasizes the comprehensive management of groundwater resources by requiring the implementation of practices and policies that protect groundwater through prevention-oriented approaches.[77] Among these approaches, IGPA guides federal, state and local government in setting groundwater protection policies; assessing the quality and quantity of groundwater resources being utilized; and establishing groundwater quality standards.

One concrete action required by IGPA is that municipalities establish setback zones for CWS wells. Well setback zones help to prevent contamination of groundwater resources with pollution by restricting certain land uses within the setback zone. Industrial, commercial, municipal, agricultural or residential land uses could be restricted by a setback zone given their potential contribution of pollutants and contamination of groundwater. Under IGPA, a 200 or 400 foot minimum setback zone is mandated for CWS wells, depending on the sensitivity of a particular well to possible contamination.[78] The 400 foot setback zone is specified for wells deemed "vulnerable" to contamination based on the depth or character of the aquifer supplying the well. IGPA empowers municipalities to adopt more stringent ordinances to protect groundwater resources. For well setback zones, municipalities can

[72] Edward Mehnert. "Groundwater Flow Modeling as a Tool to Understand Watershed Geology: Blackberry Creek Watershed, Kane and Kendall Counties, Illinois." *Circular 576*, Champaign, IL: ISGS, 2010. http://www.isgs.uiuc.edu/maps-data-pub/publications/monthly/jun-10-pubs.shtml (accessed November 3, 2011).
[73] "Center for Groundwater Science: Northeastern Illinois," ISWS, accessed October 26, 2011, http://www.isws.illinois.edu/gws/neillinois.asp.
[74] ISGS. "Kane County Water Resources Investigations: Final Report on Geologic Investigations," by William S. Dey, Alec M. Davis, B. Brandon Curry, Donald A. Keefer and Curt C. Abert. *ISGS Open File Series,* 2007-7. Champaign, IL: ISGS, 2007. http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2007/ofs2007-07.pdf (accessed November 3, 2011).
[75] Ibid.
[76] Ibid. 74.
[77] *Illinois Groundwater Protection Act*. *Ill. Comp. Stat*. 415 (1987), § 55. http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1595&ChapAct=415%A0ILCS%A055/&ChapterID=36&ChapterName=ENVIRONMENTAL%20SAFETY&ActName=Illinois%20Groundwater%20Protection%20Act (accessed October 12, 2011).
[78] Ibid.

voluntarily adopt ordinances requiring a maximum setback zone of 1,000 feet around certain eligible wells.[79]

Well setback zones have been depicted for CWS wells in Ferson-Otter Creek Watershed (Figure 22). A 400 foot setback is shown for all shallow wells, which are more susceptible to contamination, while a 200 foot setback is shown for the less vulnerable deep wells. Maximum well setback zones are also illustrated in Figure 22. Well location data were obtained from IEPA for CWS wells on both shallow and deep aquifers.[80] For this dataset, Table 5 summarizes the number of wells within the watershed planning area utilized by each municipality.

Table 5. Municipal groundwater well designation

MUNICIPALITY	SHALLOW AQUIFER WELLS	DEEP AQUIFER WELLS
Campton Hills	2	1
Elgin	1	3
Lily Lake	-	-
St. Charles	-	5
South Elgin	-	-

[79] "Maximum Setback Zones," IEPA, accessed October 12, 2011, http://www.epa.state.il.us/water/groundwater/maximum-setback-zones/.
[80] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.

Figure 20. **Recharge areas, aquifer sensitivity to contamination, and LUST sites**

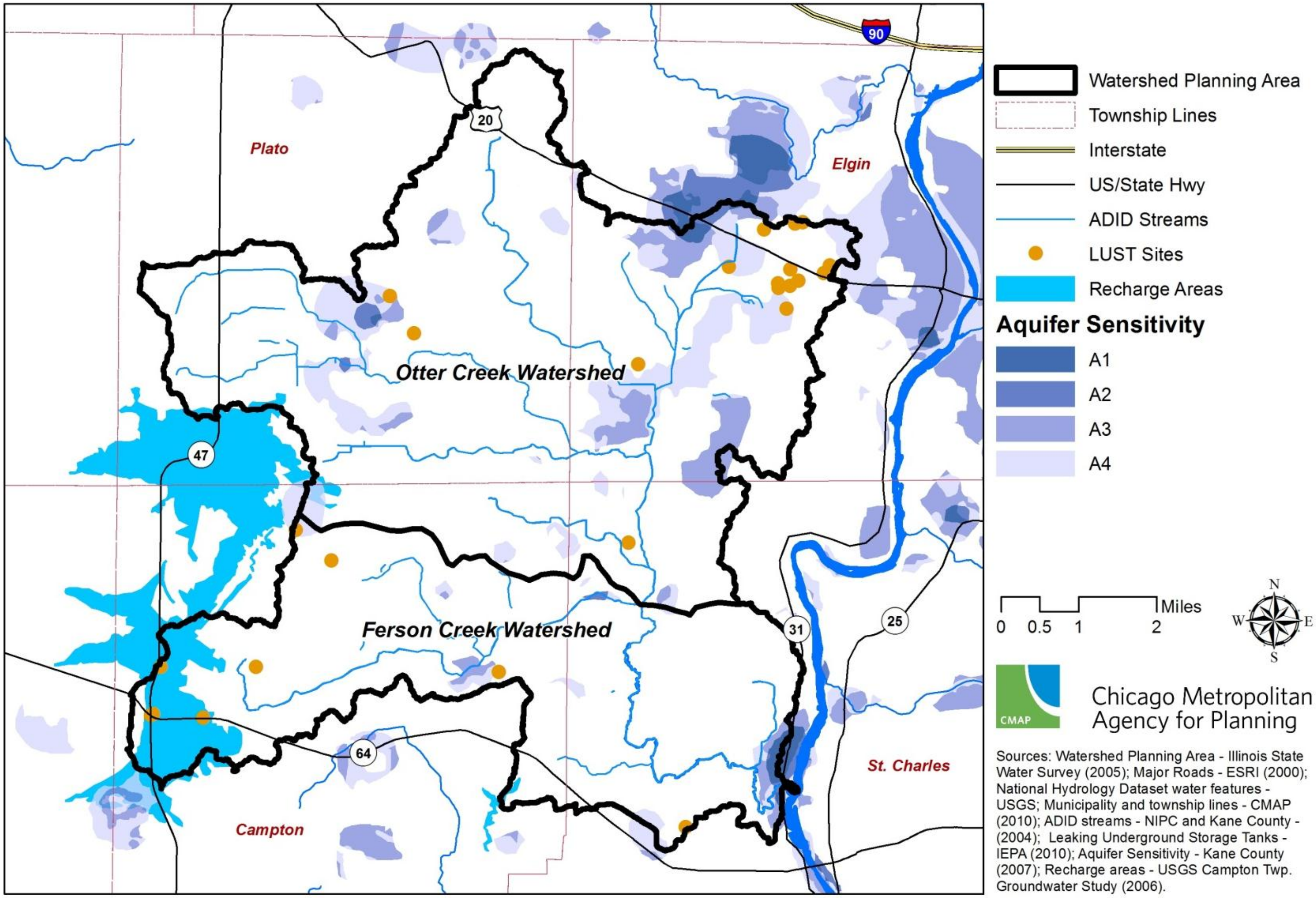


Figure 21. **Major aquifers in Ferson-Otter Creek Watershed**

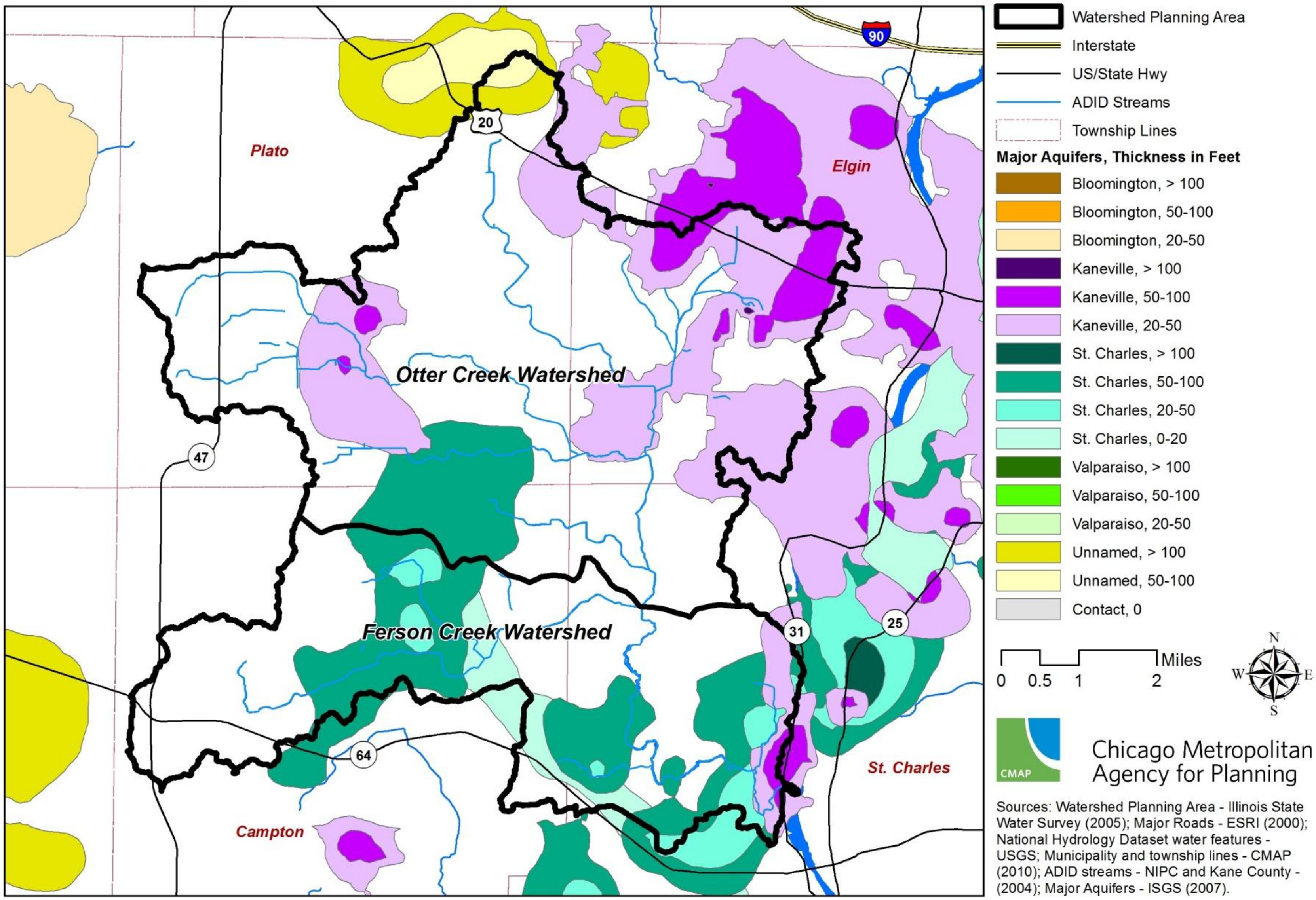
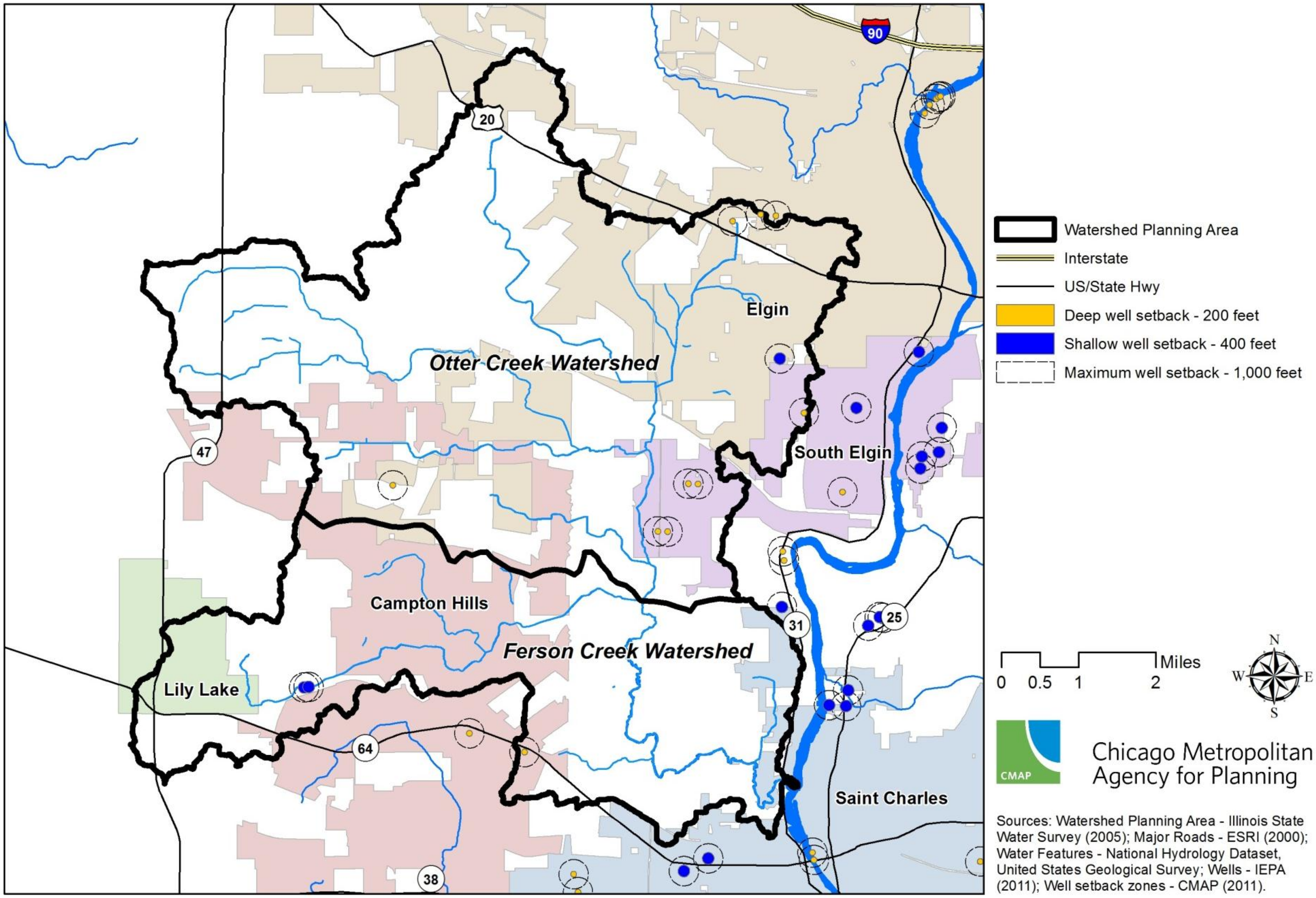


Figure 22. **Well set back locations**



2.2.7 Wetlands and Streams

The wetland and streams data are taken from Kane County's Advanced Identification (ADID) Study produced in August of 2004.[81] The ADID study was a cooperative effort between federal, state, and local agencies including the Chicago Metropolitan Agency for Planning, U.S. Fish and Wildlife Service, Chicago Illinois Field Office, USEPA, Region 5, and Kane County Department of Environmental Management. This study inventoried, evaluated, and mapped high quality wetland and stream resources in the county with the primary purpose of identifying wetlands and streams unsuitable for dredging and filling because they are of particular high quality. Incorporating this data into planning, zoning, permitting, land acquisition, and related decision making is one intended application of this data. As of 2004, Kane County has 27,368 acres of wetlands covering 8.2% of the total land area. This is a small portion of the wetlands that existed pre-settlement. Most of the wetland acreage has been degraded. In the Ferson-Otter Creek Watershed, there are approximately 3,967 acres of mapped wetlands accounting for 11% of the watershed land area.

Figure 23 illustrates two ADID components, wetlands and streams, of which there are three types. The first type is "High Habitat Value Wetlands and High Quality Streams" which have been identified as having high quality wildlife habitat, high floristic quality, or high quality aquatic habitat. This group is considered "unmitigatable" due to the complex biological systems and functions they provide and it is stated that they cannot be "successfully recreated within a reasonable time frame using existing mitigation methods."[82] The second is "High Functional Value wetlands" which provide water quality and stormwater storage benefits to the county. The third type is simply called "Other Wetlands and Streams." This last type includes all other wetlands and streams not included in the first two types either because they were not thoroughly evaluated or they were evaluated but did not meet the criteria for high habitat value or high functional value. This last type also includes all headwater streams.

It should be noted that there are some natural meander scars and historical floodplain terraces of Ferson Creek in the Leroy Oakes Forest Preserve. These areas depict streams in the watershed prior to European settlement and can create a vision on how to naturalize other stream reaches.

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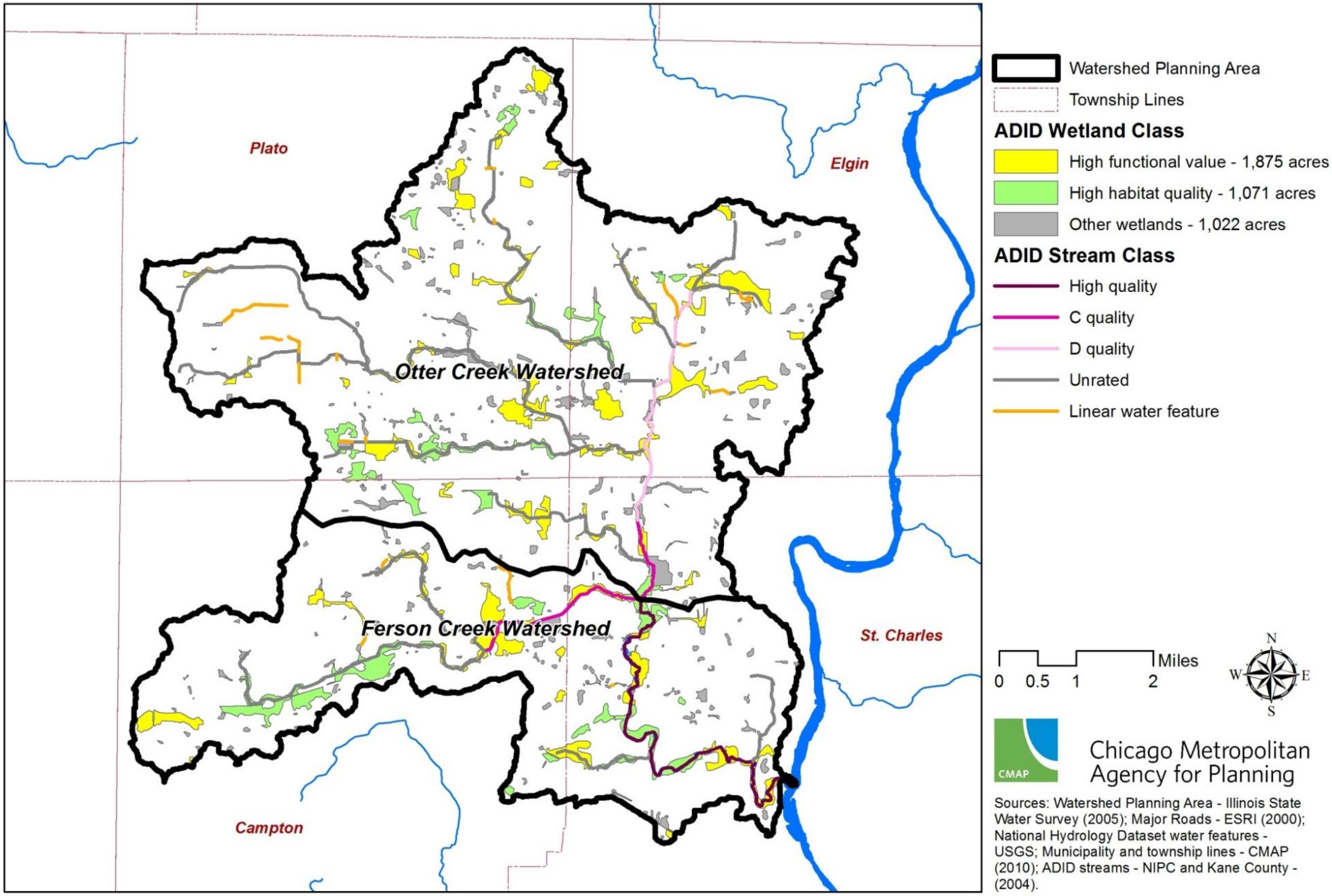
[81] NIPC, U.S. Fish and Wildlife Service and U.S. EPA. *Advanced Identification (ADID) Study, Kane County, Illinois Final Report*. Chicago, IL: USACE Chicago District, August 2004. http://www.lrc.usace.army.mil/co-r/pdf/KaneADIDReport.pdf (accessed November 7, 2011). It should be noted that methodology used to develop this data resulted in an overestimation of the number of acres of wetland in Kane County. Contact Kane County for more information about the data set.

[82] Ibid.

Figure 23. **Wetlands and streams**



2.2.8 Lake Campton

Brief History and Background

Lake Campton is an impoundment lake, created in 1953 by the construction of a 15 foot high earthen dam across Ferson Creek.[83] Two 24-inch valve pipes and one 10-inch pipe[84] were built into the dam to allow the lake level to be drawn down.

The lake is owned and managed by the Lake Campton Property Owners Association (LCPOA), which formed in the mid-1960s.[85] The lake is used recreationally for fishing, nonpower and electric-powered boating, ice skating, and aesthetic enjoyment. Lake access is available to LCPOA members and their guests. Lake management activities have included fish population surveys, fishery rehabilitations, fish stocking, water quality monitoring, and annual nuisance/ invasive aquatic plant control. In years past during dry summer months, the valves in the dam were reportedly opened to provide some water movement and flushing of the lake. This practice has not been conducted for at least 20 years and it is unknown whether the valves are still operable.[86]

Hydrological Description

Lake Campton lies within the Ferson-Otter Creek Watershed of the Fox River Basin, which itself is part of the Illinois River Watershed and subsequently the Upper Mississippi Watershed. The area that drains to Lake Campton is approximately 3,900 acres (6.12 sq. miles).[87]

"Normal" lake elevation is equal to the elevation of the crest of the outlet spillway: 810.3 feet above mean sea level. At this water level, Lake Campton has a surface area of about 27 acres,[88] maximum depth of approximately 9 feet, an estimated average depth of 3 feet,[89] and a calculated volume of about 82 acre-feet (surface area x average depth). Average water residence time was calculated to be roughly 0.03 years using the watershed area, lake volume, and an average annual runoff value of 10 inches/year.[90] Data is summarized in Table 6.

Lake Campton receives its water via surface water flowing in from Ferson Creek at the lake's northwest corner, rain and snowmelt flowing off the land surrounding the lake, and precipitation directly onto the lake surface. The wetlands to the south/southwest of the lake, now owned in part by a local school district and the Forest Preserve District of Kane County, are connected to Lake Campton via a pipe that directs overflow to the lake during wet periods.[91] Outflow from the lake passes over the dam's concrete spillway located at the east end of the lake. Ferson Creek continues approximately 3½ miles downstream to its confluence with Otter Creek and then another 5½ miles down to the Fox River. Water is also lost from Lake Campton via evaporation from the lake's water surface. It is unknown to what degree groundwater infiltration or exfiltration may contribute to the lake's water cycle.

[83] IDOC Division of Fisheries. *Lake Survey for Campton Lake*. Spring Grove, IL: IDOC Division of Fisheries, 1967.
[84] Ibid.
[85] J. Holley, Lake Campton Property Owners Association, personal communication.
[86] Ibid.
[87] "Illinois StreamStats," USGS, accessed December 12, 2011. http://water.usgs.gov/osw/streamstats/illinois.html.
[88] Measurements performed by H. Hudson using 2010 USGS aerial orthophotography.
[89] Based on Volunteer Lake Monitoring Program data collected 2001–2011.
[90] Thomas Price, Principal Civil Engineer/Hydrologist, Conservation Design Forum, personal communication.
[91] Ibid. 85.

Table 6. Lake Campton morphometric data

Surface Area	**27 acres**
Maximum Depth	**9 feet**
Average Depth	**3 feet**
Volume	**82 acres-feet**
Shoreline Length	**1.7 miles**
Maximum Fetch	**2,000 feet E-W**
Lake Elevation (top of weir)	**810.3 feet**
Watershed Area	**3,900 acres**
Average Water Residence Time	**0.03 years**

Aquatic Plant Community

Based on a 1967 Illinois Department of Conservation fisheries survey report along with VLMP observations recorded over the past decade, it appears Lake Campton has experienced extensive nuisance aquatic plant growth (aquatic "weeds") since the lake's creation. Annual aquatic herbicide treatments, accompanied by a weed harvester for a period of years between the mid-1990s and early 2000s, have produced successions of rooted plants, filamentous algae, and phytoplankton. In fact, the 1967 fisheries survey report noted that "Rooted aquatics cover at times up to 75% of the lake area with sago and leafy pondweeds predominating, except in bay area receiving creek where coontail and buttercup and predominated. Filamentous algae is a secondary problem." Similar conditions exist to the present day with the same native aquatic plant species, exacerbated by the addition of an invasive, nonnative aquatic plant, curlyleaf pondweed, which is most abundant in the spring. Small floating plants, duckweed and watermeal, also have become abundant, at times covering more than 50-75% of the lake surface during the summer months.

Fish Community

Lake Campton was first stocked with sport fish, largemouth bass, in 1954—the year after the lake's creation. In 1963, the lake was rehabilitated and restocked with bluegill along with fingerling and breeder largemouth bass. A 1970 fish survey indicated that these populations remained in good condition, as several size groups indicated annual recruitment.[92] A fisheries survey conducted by a private firm in the 1990s indicated that the fish population was in generally good condition at that time.[93]

More recently, a partial fishkill occurred in late July 2001, apparently associated with extremely low oxygen concentrations (CMAP staff measured dissolved oxygen concentrations on August 13, 2001, at the request of the LCPOA). Several factors converging may have contributed to this situation: the lake was nearly covered with duckweed (limiting sunlight penetration and thus photosynthetic oxygen production by phytoplankton and rooted aquatic plants below, and limiting atmospheric oxygen exchange), water temperatures were very warm (the warmer the water, the less oxygen it can hold), and an aquatic herbicide application had recently occurred (decaying plant materials consume oxygen).

Since that time, no formal fish population survey has been conducted to assess the types, numbers, and year classes of fish present. The LCPOA has stocked some 6-8 inch largemouth bass, and discussions with LCPOA members who frequently fish the lake indicate that bluegill are plentiful and that largemouth bass numbers seem fine.[94]

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[92] IDOC Division of Fisheries. *Lake Survey for Campton Lake*. Spring Grove, IL: IDOC Division of Fisheries, 1967.
[93] Wight Consulting Engineers, Inc. *Lake Campton Property Owners Association Engineering Study for Lake Campton Lake Enhancement*. Barrington, IL: Wight Consulting Engineers, Inc., 1994.
[94] J. Holley, Lake Campton Property Owners Association, personal communication.

2.2.9 Dams

Congress authorized the U.S. Army Corps of Engineers (USACE) to create a nation-wide inventory of dams in 1972. Today, the National Inventory of Dams (the Inventory) is a database maintained by USACE that contains information on dams throughout the nation meeting certain criteria. Dams included in the Inventory are those that meet one or more of the following classifications: they are high hazard (i.e., loss of life is likely in the event of dam failure); significant hazard (i.e., loss of life or damage to property or the environment is possible in the event of dam failure); greater than or equal to 25 feet in height and 15 acre-feet in storage; or greater than or equal to 50 acre-feet in storage and 6 feet in height.[95] All dams meeting these criteria are eligible for inclusion in the Inventory, yet in reality, data collection is subject to financial limitations, particularly for those dams unregulated by state or federal agencies.[96]

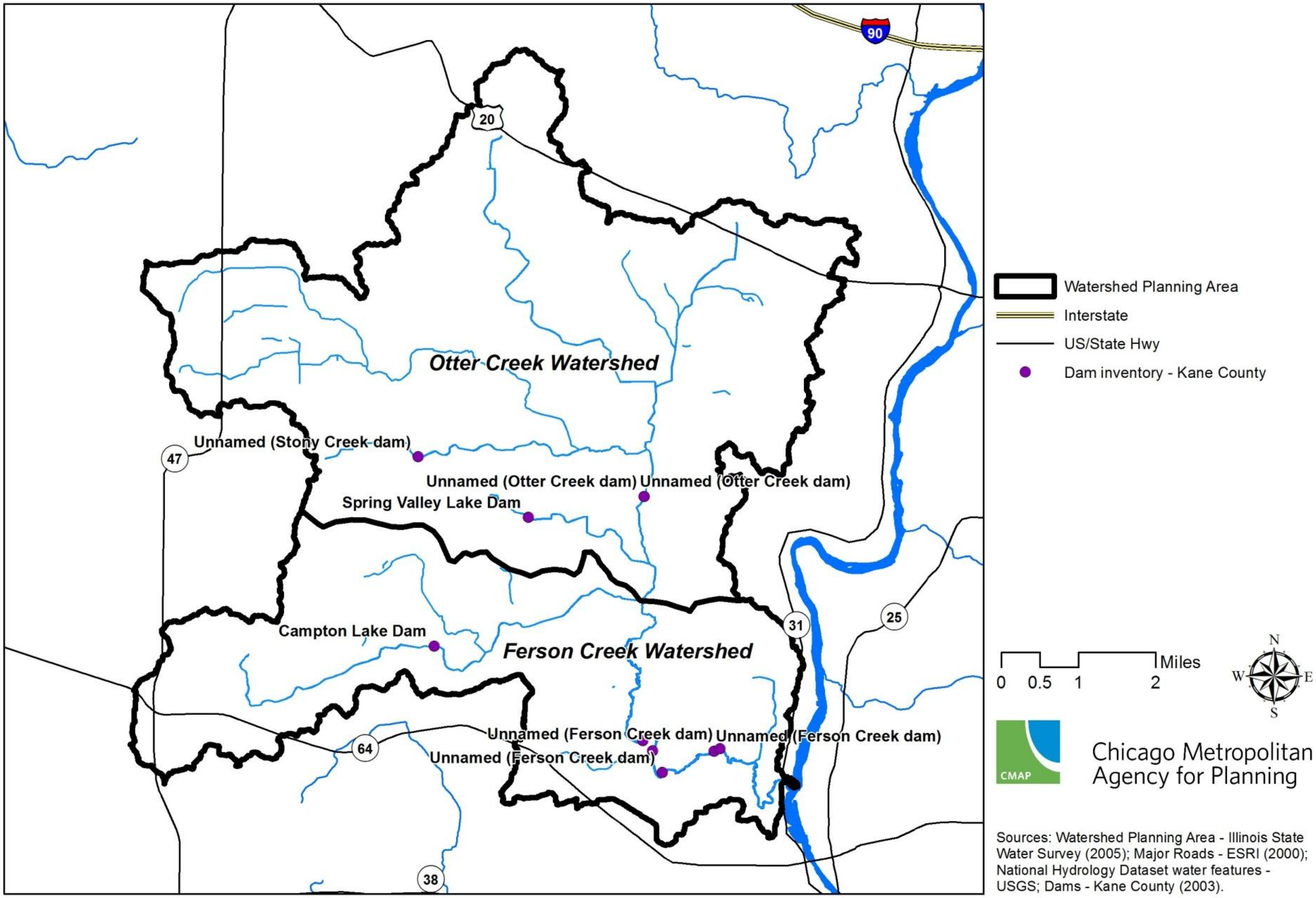
Due to security concerns regarding dam hazard information, the Inventory is not available for download by the general public, but can be acquired by government agencies like CMAP. Although Inventory records for dams in the watershed planning area were obtained, USACE has acknowledged reports of error in the geographic coordinates for dams in the state of Illinois.[97] Dam locations were therefore impossible to map for this watershed planning area. The Illinois Department of Natural Resources, Office of Water Resources, which maintains information on dams in the state, is aware of this problem, but with limited funding available for data collection, is not currently able to correct the error.[98] While mapping was not possible, the dimensions and number of dams in the Inventory for Illinois are correct. For this database, there is one dam listed on Ferson Creek in Kane County. Campton Lake Dam is 13 feet in height and 98 acre-feet in storage.[99] There are no dams listed on Otter Creek.

In addition, Kane County staff provided a spatial data layer of county dams. However, this layer was last maintained in 2003 and may contain dams that have since been removed.[100] Figure 24 illustrates 10 dams in the watershed, including Campton Lake Dam, also listed in the National Inventory of Dams.

[95] "CorpsMaps National Inventory of Dams," USACE, last modified January 15, 2009, accessed October 12, 2011, http://geo.usace.army.mil/pgis/f?p=397:1:8757593860658286::NO.
[96] Ibid. 95.
[97] Rebecca Ragon, USACE staff, email message to author(s), August 4, 2011.
[98] Paul Mauer, IDNR Senior Dam Safety Engineer, email message to author(s), August 24, 2011.

[99] USACE. "National Inventory of Dams." Full dataset obtained through non-disclosure agreement between USACE and CMAP, July 22, 2011.
[100] Jason Vertracht, Kane County GIS Analyst, email message to author(s), July 20, 2011.

Figure 24. **Dam locations in Ferson-Otter Creek Watershed**

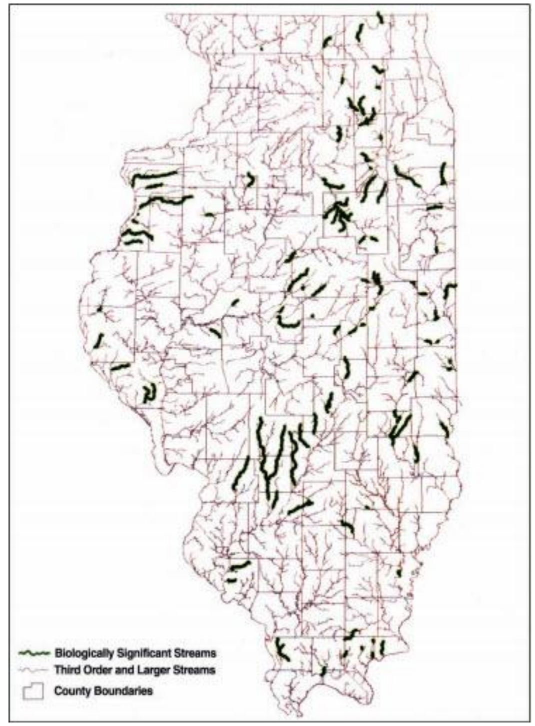


2.2.10 Aquatic Biology

This section focuses on IDNR's Biological Stream Ratings for Diversity, Integrity and Significance. The purpose of these ratings is to assess fish and macroinvertebrate communities, water quality, and habitat throughout the major basins of Illinois and among other objectives identify stream segments that exhibit a high potential for resource management or restoration activities and bring awareness to segments that have uncommon aquatic biotic resources.

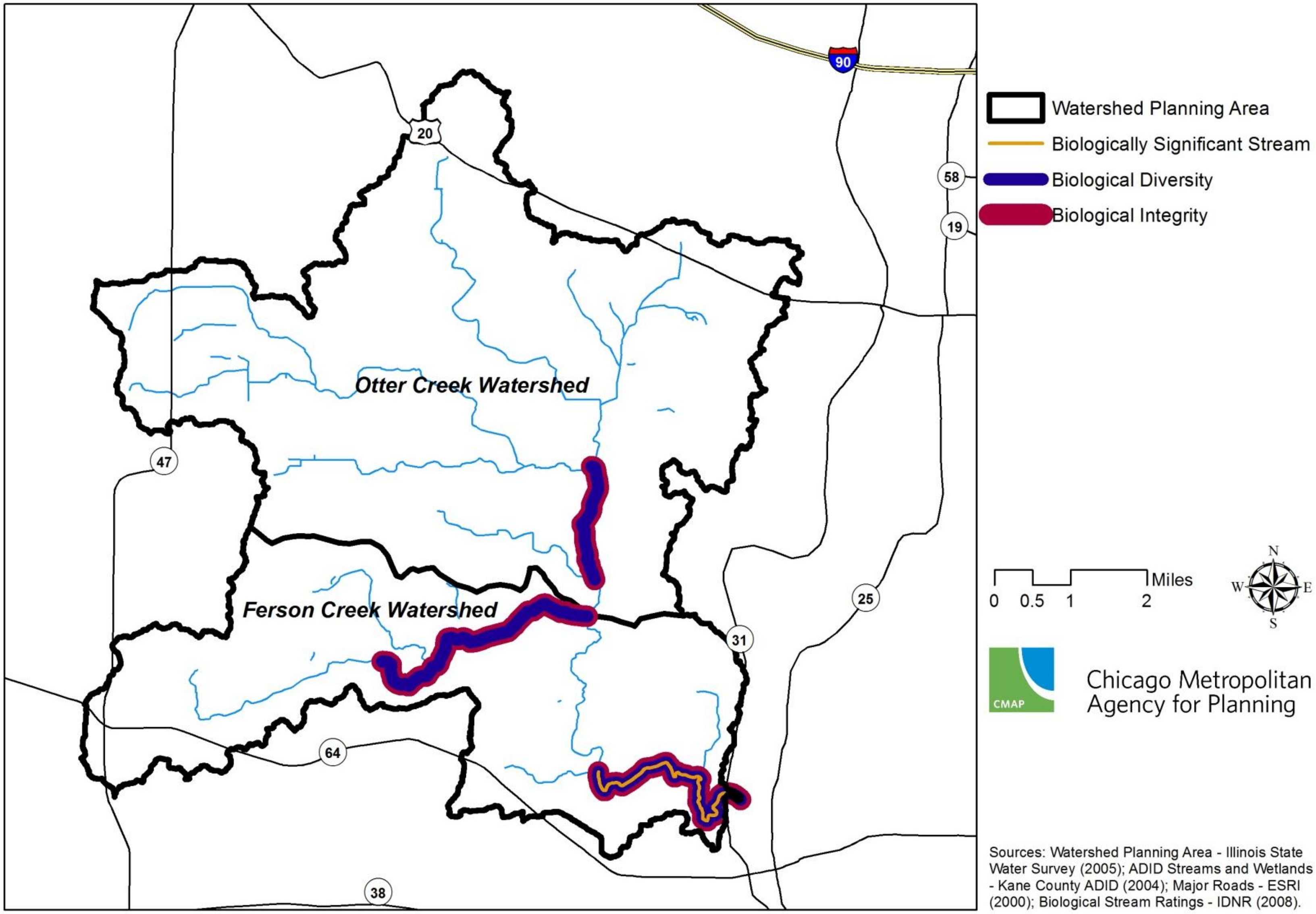
Ratings for Diversity and Integrity are derived from a variety of sources that are then quantified and categorized on a scale from A to E with A being the desired condition. Biologically Significant Streams (BSS) classification is derived from a high rating or score based on data from at least two taxonomic groups. IDNR considers data used to classify both Biotic Diversity and Integrity in the process of identifying BSS. Figure 25 displays all of Illinois' BSS. It should be noted that diversity and integrity are scored separately because it is possible to have a highly intact community (achieve integrity) that is not biological diverse. Data considered for these current ratings were collected from 1997-2006 by IDNR, IEPA, or Illinois Natural History Survey (INHS) monitoring programs.[101] In this watershed, there are three main segments that are identified using these three rating systems- two in Ferson Creek and one in Otter Creek shown in Figure 26. A lengthy stretch of Ferson Creek leading to its mouth at the Fox River is the only stream segment in the planning area that merits a BSS designation. This Ferson Creek BSS is just one of twenty steam segments in the 11-county region that is third order or larger and of this class of highest quality aquatic resource.

Figure 25. Biologically significant streams in Illinois



[101] IDNR. *Integrating Multiple Taxa in a Biological Stream Rating System*. Springfield, IL: IDNR, 2008. http://www.dnr.state.il.us/orc/biostrmratings/images/BiologicalStreamRatingReportSept2008.pdf (accessed November 9, 2011).

Figure 26. **Biological stream ratings within Ferson-Otter Creek Watershed**



Sources: Watershed Planning Area - Illinois State Water Survey (2005); ADID Streams and Wetlands - Kane County ADID (2004); Major Roads - ESRI (2000); Biological Stream Ratings - IDNR (2008).

2.2.11 Fish Surveys

Fish are integral members of the watershed community. Fish surveys can serve as a tool to understand current watershed conditions but also can be an indicator of watershed health when data is collected over time. The Ferson-Otter Creek Watershed has had several surveys completed in the recent past. Below are short summaries of selected surveys.

Ferson/Otter Creek Biological Survey, IDNR, Division of Fisheries, September 1998[102]

Illinois Department of Natural Resources (IDNR) collected these data in 1998 with the purpose of establishing a baseline for evaluating management practices and to provide information for restoration efforts in the Ferson-Otter Creek Watershed. Samples were taken at four locations on the major branches of Ferson and Otter Creek to evaluate fish, macroinverbrates, and habitat quality. The Index of Biotic Integrity (IBI), the Macroinvertebrate Biotic Index (MBI), and the Stream Habitat Assessment Procedure (SHAP) were all used as evaluation tools at each sampling location. A combined total of 716 fish collected represent 31 species from the four locations. While the specific scores of each station vary for a variety of reasons, at the time of the survey water quality did not appear to be a limiting factor (based on MBI scores). However habitat quality and connectivity to the Fox River were more of a concern due to land use and channel manipulation. Specific sampling locations and location scores can be found from the original source.

2002 Fox River Basin Survey Report, IDNR, Division of Fisheries, Region 2, Streams Program, Published September 2004 by Stephen M. Pescitelli and Robert C. Rung.[103]

Both IDNR and IEPA surveyed the Fox River Basin as part of a larger statewide monitoring program to measure the health of Illinois streams. Data were collected from the fish community, macroinvertebrates, habitats, and water and sediment sampling. The conclusions of the report include species composition, distribution, and determination of stream quality based on fish community structure. Overall in the Fox River Basin, 10,317 fish representing 63 species were collected in 2002 from the 18 stations. The 2002 individual, species, and species composition were similar to the comparative 1996 study. All species were native except for the common carp.

For this 2002 report, the only sampling station within the watershed was within the Leroy Oaks Forest Preserve (Ferson Creek) in St. Charles.[104] For Ferson Creek specifically, the total fish count was 282 representing 17 species. The top fish counts were Hornyhead Chub (48 fish), Largescale Stoneroller (43 fish), and the Central Stoneroller (38 fish). The Index of Biotic Integrity (IBI) score dropped 4 points from 48 to 44 from 1996 to 2002 but remained in the good resource quality category as indicated in the Draft 2010 Illinois Integrated Water Quality Report and Section 303(d) List. However the Biological Stream Characterization remained the same, "B."

[102] IDNR. *Ferson/Otter Creek Biological Survey*, by Stephen M. Pescitelli and Robert C. Rung. Plano, IL: IDNR, Division of Fisheries, September 1998. http://www.ifishillinois.org/science/streams/1998%20Ferson%20-%20Otter%20Creek%20Survey%20Report.pdf (accessed November 9, 2011).

[103] IDNR. *2002 Fox River Basin Survey Report*, by Stephen M. Pescitelli and Robert C. Rung. Plano, IL: IDNR, Division of Fisheries, September 2004. http://www.ifishillinois.org/science/streams/2002%20Fox%20Survey.pdf (accessed November 9, 2011).

[104] The Ferson Creek sampling location (DTF-02) is the same for the 1996, 2002, and 2007 Fox River Basin Surveys.

Fish Assemblages and Stream Condition in the Fox River Basin: Spatial and Temporal Trends, 1996-2007, IDNR, Division of Fisheries, Region 2, Streams Program, Published April 2009 by Stephen M. Pescitelli and Robert C. Rung.[105]

This 2007 report builds on the data gathered for the previous Fox River Basin Survey Reports described above. Sixteen stations were added to the 2007 survey when compared to both the 2002 and 1996 surveys, including a station in Otter Creek near Silver Glen Road for a total of 34 stations in the Fox River Basin. Perhaps the additional stations can account for the nearly doubled fish count for the Fox River Basin with a total of 20,285 fish, representing 17 families and 79 species (76 of which are native). For Ferson Creek, the total fish count was 288 representing 18 species. The top fish counts were Hornyhead Chub (71 fish), Central Stoneroller (64 fish), and Bluntnose minnow (57 fish). For Otter Creek, the total fish count was 261 representing 17 species. The top fish counts were Green Sunfish (74 fish), Sand Shiner (47 fish), and Bluntnose minnow (29 fish). The Ferson Creek IBI increased from 44 in 2002 to 48 and Otter Creek reported an IBI of 29.

Overall the IBI scores for the Ferson Creek testing station have been stable throughout the sampling period. More data will need to be collected to track similar trends for Otter Creek. The Table 7 summarizes the Fox River Basin Surveys from 1996-2007. It should be noted that more data is provided in each of these respective full documents.

Table 7. Fish assemblages and stream condition testing stations in Ferson-Otter Creek Watershed

STATION ID AND YEAR	TOTAL FISH COUNT	NUMBER OF SPECIES	IBI SCORE
DTF-02 Ferson Creek-1996	–	–	48
DTF-02 Ferson Creek-2002	282	17	44
DTF-02 Ferson Creek-2007	288	18	48
DTFA-02 Otter Creek-1996	–	–	–
DTFA-02 Otter Creek-2002	–	–	–
DTFA-02 Otter Creek-2007	261	17	29

"-" Indicates no data available.

2.2.12 Stream Assessment

A stream assessment and final report was initiated by the St. Charles Park District and completed in November 2000. The assessment covered four miles of stream channel in various levels of detail and included 24 cross section surveys. The report concluded that Ferson and Otter Creeks "are in a gradual process of channel geometry adjustment in response to changes in flow patterns and volumes." Land use pressures and subsequent alterations to the surface area of the watershed are thought to contribute to these changes. The Ferson-Otter Creek Watershed is experiencing both lateral-changes in channel alignment through bank erosion and vertical migration-changes in the elevation of the longitudinal profile of a given reach or stream. Furthermore the report states that restoration projects should always consider the option of re-connecting the stream system to the adjacent floodplain as a priority. The full report contains additional information including project background,

[105] IDNR, Division of Fisheries. *Fish Assemblages and Stream Condition in the Fox River Basin: Spatial and Temporal Trends, 1996- 2007*, by Stephen M. Pescitelli and Robert C. Rung. Plano, IL: IDNR, Division of Fisheries, 2009. http://www.ifishillinois.org/science/streams/2007%20Fox%20Survey%20Final%20Report.pdf (accessed November 8, 2011).

watershed conditions, data collection methods, cross section installations, photographs and recommendations among others.[106]

2.2.13 Data Availability Status

CMAP and partners worked together to inform the plan with available data that are relevant to watershed planning. Some requests for information could not be fulfilled due to lack of data. Table 8 summaries the unfulfilled requests.

Table 8. Data availability status for resource inventory in Ferson-Otter Creek Watershed Plan

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

[106] Prepared for the St. Charles Park District, St. Charles, Illinois. *Ferson/Otter Creek Stream Assessment Report*, by Steven W. Belz, and H. Lee Silvey. St. Charles, IL: St. Charles Park District, November 2000. Contact the St. Charles Park District for more information.

3. WATER QUALITY AND MODELING RESULTS

3.1 INTEGRATED WATER QUALITY REPORT

The *Illinois Integrated Water Quality Report and Section 303(d) List* (the Report, the List, respectively) comprises a primary source of information on the status of stream, lake, and groundwater health and identifying potential causes and sources of impairment for which watershed planning initiatives can work to address. This document is prepared every two years by the Illinois Environmental Protection Agency (IEPA), with the most recent Report issued in 2010. The basic purpose of the Report is to provide information to the federal government (USEPA) and the citizens of Illinois on the condition of the state's surface and groundwaters. This fulfills requirements of Sections 305(b), 303(d), and 314 of the federal Clean Water Act and the Water Quality Planning and Management regulation at 40 CFR Part 130 for the State of Illinois.[107] The Report seeks to assess the extent to which waterbodies support a set of recognized "designated uses." The designated uses assessed by IEPA for streams and lakes include Aquatic Life, fish consumption, Primary Contact (swimming), secondary contact (boating, fishing), public and food processing water supply, and aesthetic quality. The degree of support of a designated use in a particular stream segment or lake is determined by analyzing various types of information including biological, physiochemical, physical habitat, and toxicity data. For groundwater, the degree of use support is based primarily on chemical monitoring of community water supply wells. The data are compared against specific water quality standards set by the Illinois Pollution Control Board (IPCB) to protect each designated use. IEPA is responsible for developing scientifically based water quality standards and proposing them to the IPCB for adoption into states rules and regulations. While most of Illinois' water quality standards are numeric, some standards (such as temperature) utilize narrative language.

Through their assessment, IEPA determines whether a waterbody falls into one of two use-support levels for each designated use: "Fully Supporting" or "Not Supporting." Fully Supporting means that the designated use is attained; IEPA also refers to this status as "Good" resource quality for that particular designated use. Not Supporting means the designated use is not attained. If a designated use is not attained, the quality of the resource is further determined to be "Fair" or "Poor" depending on the degree to which the use is not attained. Designated uses that are determined to be Not Supporting are called "impaired" uses (Table 9). Any waters found to be not fully supporting of any one of its designated uses are also called impaired and placed on the "303(d) List" of impaired waters. For each impaired use in each assessed waterbody, IEPA attempts to identify potential causes and sources of the impairment.

Table 9. IEPA designated use support levels description

LEVEL OF USE SUPPORT	GENERAL RESOURCE QUALITY	RELATIONSHIP TO WATER QUALITY STANDARD	IMPAIRED?
Fully Supporting	Good	Meets standard	No
Not Supporting	Fair	Does not meet standard	Yes
Not Supporting	Poor	Does not meet standard	Yes

Improving the condition of impaired waters and ultimately removing such waters from the 303(d) List is a main objective of watershed planning efforts like that for the Ferson-Otter Creek Watershed. The following sections summarize the available information from the 2010 Report relevant to these efforts.

[107] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water*. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011). Note: Ferson Creek and Otter Creek are displayed separately in this report.

3.2 ASSESSMENTS AND DESIGNATED USES

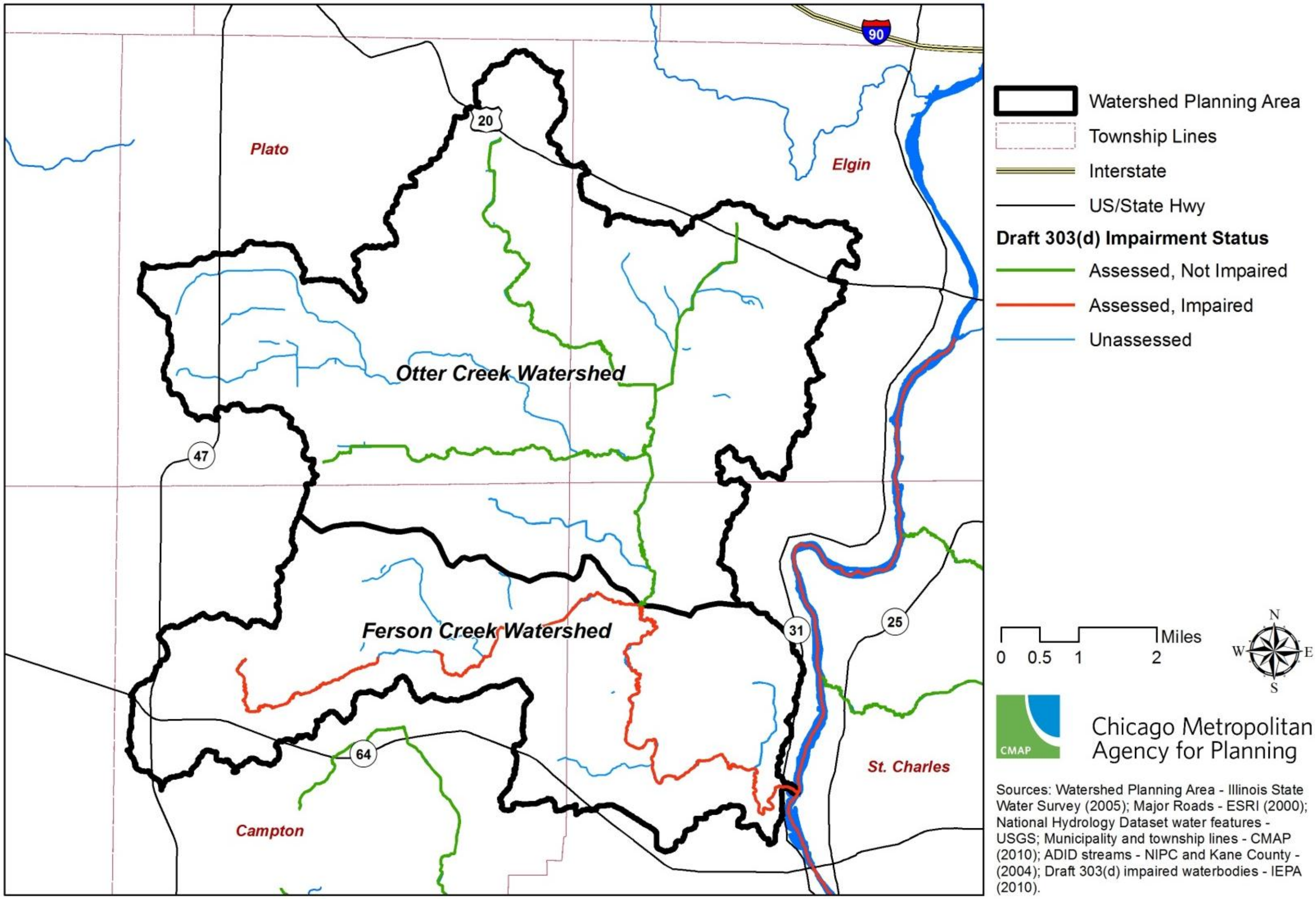
Both Ferson Creek and Otter Creek subwatersheds were assessed in the Report and determined to be Fully Supporting for the Aquatic Life designated use. However, Ferson Creek was also assessed for the Primary Contact designated use, for which it was determined to be Not Supporting. Ferson Creek was not assessed for Secondary Contact, Fish Consumption, or Aesthetic Quality. Otter Creek was not assessed for Primary Contact, Secondary Contact, Fish Consumption or Aesthetic Quality. Therefore, there may be other designated use impairments in the watershed given that assessments have not been performed for all designated uses. See Figure 27 for the water bodies which were assessed and their associated impairment status. Tables 10 summarize the designated uses, assessment status, and impairment status of Ferson and Otter Creek.

Since Ferson Creek and Otter Creek were assessed for Aquatic Life, and also Primary Contact in the case of Ferson Creek, the sections below examine these two designated uses in more detail, including how IEPA defines the designated use, the standard for each and the assessment data with which the impairment determination was made.

Table 10. IEPA designated use status for Ferson-Otter Creek Watershed

DESIGNATED USE: FERSON CREEK	APPLIES TO FERSON CREEK?	ASSESSED IN 2010 IEPA 303(d) LIST?	IMPAIRED?
Aquatic Life	Y	Y	N
Fish Consumption	Y	N	–
Public & Food Processing Water Supplies	N	–	–
Primary Contact	**Y**	**Y**	**Y**
Secondary Contact	Y	N	–
Indigenous Aquatic Life	N	-	–
Aesthetic Quality	Y	N	–
DESIGNATED USE: OTTER CREEK	APPLIES TO OTTER CREEK?	ASSESSED IN 2010 IEPA 303(d) LIST?	IMPAIRED?
Aquatic Life	Y	Y	N
Fish Consumption	Y	N	–
Public & Food Processing Water Supplies	N	–	–
Primary Contact	Y	N	–
Secondary Contact	Y	N	–
Indigenous Aquatic Life	N	–	–
Aesthetic Quality	Y	N	–

Figure 27. **Assessment and Impairment Status for the Ferson-Otter Creek Watershed**



3.2.1 Aquatic Life

IEPA relies on biological, water chemical and stream habitat data to determine the extent to which a stream supports Aquatic Life. These data are used to create two indices used in making this assessment. These indices include (1) the fish Index of Biotic Integrity (fIBI), and (2) the Macroinvertebrate Index of Biotic Integrity (mIBI). Table 11 comprehensively states the standards and interpretation information for these indices.

Table 11. IEPA Aquatic Life standards

BIOLOGICAL INDICATOR[1]			
Fish Index of Biotic Integrity(fIBI)	fIBI < 20	20 < IBI < 41	fIBI > 41
Macroinvertebrate Index of Biotic Integrity (mIBI)	mIBI < 20.9	20.9 < mIBI < 41.8	mIBI > 41.8
Impairment Status	Severe Impairment	Moderate Impairment	No Impairment
Designated Use Support	Not Supporting	Not Supporting	Fully Supporting
Resource Quality	Poor	Fair	Good

The scores for both Ferson Creek and Otter Creek indicate each to be Fully Supporting for the Aquatic Life designated use. Table 12 shows the scores for each watershed from the Report. While Otter Creek shows an fIBI score of 29 indicating a moderate impairment, the combination of these scores still leads to an overall status of Fully Supporting.

Table 12. Aquatic Life Ferson-Otter Creek Watershed data

	FERSON CREEK	OTTER CREEK
Segment ID	IL_DTF-02	IL_DTFA-02
Biological Indicator		
Fish Index of Biotic Integrity (fIBI)	48	29
Macroinvertebrate Index of Biotic Integrity (mIBI)	59.1	56.5
Impairment Status	No Impairment	No Impairment
Designated Use Support	Fully Supporting	Fully Supporting
Resource Quality	Good	Good

3.2.2 Primary Contact

Primary Contact as defined by Illinois Water Quality Standards as "any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing." IEPA primarily uses fecal coliform bacteria data to determine whether or not a stream is supporting this designated use. Fecal coliform is a type of bacteria that is generally found in human and animal feces.[108] The IEPA standard for Fecal Coliform states that "the geometric mean of all fecal coliform bacteria observations (a minimum of five samples over the most recent five year period) collected May through October may not exceed 200 colony forming units per 100 mL OR 10% of all fecal

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

coliform bacteria observed may not exceed 400 colony forming units per 100 mL." Table 13 articulates the standards for the Primary Contact designated use. Fecal coliform data on which the Report's assessment of Ferson Creek and Otter Creek is based was collected by the Illinois State Water Survey (ISWS) at the mouth of Ferson Creek on behalf of the Fox River Study Group over the last 5 years.[109]

Table 13. IEPA Primary Contact support standards

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

Given these results in Table 14, the Report finds that Ferson Creek is Not Supporting (Poor) for the Primary Contact designated use. A 44% reduction in fecal coliform is needed to meet the geometric mean standard of 200 per 100 ml, while a 71% reduction is required to meet the standard for the percentage of samples over 400 (#/100mL). As stated above, Otter Creek was not assessed for Primary Contact. Ferson-Otter Creek stakeholders have therefore chosen the water-quality standard as the threshold for setting the target pollutant-load reduction.

Table 14. ISWS fecal coliform data in reference to state water quality standard

WATER QUALITY STANDARD	FLOW WEIGHTED MEAN CONCENTRATION IN FERSON CREEK	IEPA IMPAIRMENT STANDARD	REDUCTION NEEDED
Geometric Mean	355 (#/100mL)	200 (#/100mL)	44%
% of Samples > 400 (#/100 mL)	35%	10%	71%

3.2.3 Sources of Fecal Coliform Impairment

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

[109] Howard Essig, IEPA, email message to author(s), January 31, 2011. Preliminary monitoring data for the Fox River, collected by Illinois State Water Survey on behalf of Fox River Study Group, 2011.

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

This plan will include recommendations that address runoff generally and aim to increase stormwater infiltration to limit these sources of current and future fecal coliform contamination. Additionally, this plan will include recommendations to address proper septic system and leach field maintenance to limit potential fecal coliform contamination from leaking septic systems.

3.2.4 Water Quality Considerations Beyond Fecal Coliform

In addition to the fecal coliform data used for stream assessment in the Report, ISWS has also collected data in Ferson Creek over the last five years for Total Nitrogen (TN), Total Phosphorus (TP) and Total Suspended Solids (TSS).[110] Data were not collected for the Otter Creek tributary. While total phosphorus, sedimentation/siltation, and total suspended solids are identified causes of impairment in the mainstem Fox River below the mouth of Ferson Creek, neither nutrients nor sediment are implicated as causes of any use impairment within Ferson Creek.[111] Furthermore, the State of Illinois has yet to set water quality standards associated with nutrients in streams and rivers, except for phosphorus at points where streams enter a lake or reservoir greater than twenty surface acres.[112] This particular water quality standard does not apply to Ferson Creek or Otter Creek. However, for water quality parameters for which there are no numeric water quality standards, Illinois does offer statistically-derived guidelines that are used to identify potential use impairment. These guidelines are summarized in Table 15 along with the observed mean concentrations found in Ferson Creek. Given that neither the nutrient concentration nor suspended solids concentration exceeds these guidelines in the watershed, the Ferson-Otter Creek Watershed stakeholders did not set a threshold for acceptable nutrient or sediment concentrations. Establishing target load reductions for nutrients or sediment was, therefore, not necessary at this time. It should be noted that although the Report

[110] Howard Essig, IEPA, email message to author(s), January 31, 2011. Preliminary monitoring data for the Fox River, collected by Illinois State Water Survey on behalf of Fox River Study Group, 2011.
[111] IEPA. *Illinois Integrated Water Quality Report and Section 303(d) List - 2010 DRAFT, Volume I: Surface Water*. Springfield, IL: 2010. http://www.epa.state.il.us/water/tmdl/303d-list.html (accessed November 3, 2011).
[112] *Phosphorus*. *Ill. Adm. Code 35*, Subtitle C, Chapter 1, Part 302 Subpart B, Section 205. http://water.epa.gov/scitech/swguidance/standards/wqslibrary/upload/2006_09_05_standards_wqslibrary_il_il_5_c302.pdf (accessed September 7, 2011).

does not show definitive data pointing to an impairment, nutrients and sediment is still a present stakeholder concern in the watershed, which is affirmed by the plan's short-term project selections in Chapter 4.

Table 15. Pollutant concentration in Ferson Creek

POLLUTANT	FLOW WEIGHTED MEAN CONCENTRATION	STATISTICAL GUIDELINE FOR AQUATIC QUALITY IN ILLINOIS STREAMS
Total Nitrogen	2.64 (mg/L)	7.8 (mg/L)
Total Phosphorus	0.19 (mg/L)	0.61 (mg/L)
Total Suspended Solids	38.68 (mg/L)	116 (mg/L)

3.3 LAKE CAMPTON WATER QUALITY DATA

Lake Campton Property Owners Association (LCPOA) residents began participating in IEPA's Volunteer Lake Monitoring Program (VLMP) in 2001, recording water transparency measurements using a Secchi disk. The volunteer monitors also collected water samples in 2002 and 2004. These samples were analyzed at an IEPA laboratory. A summary of the VLMP data follows.

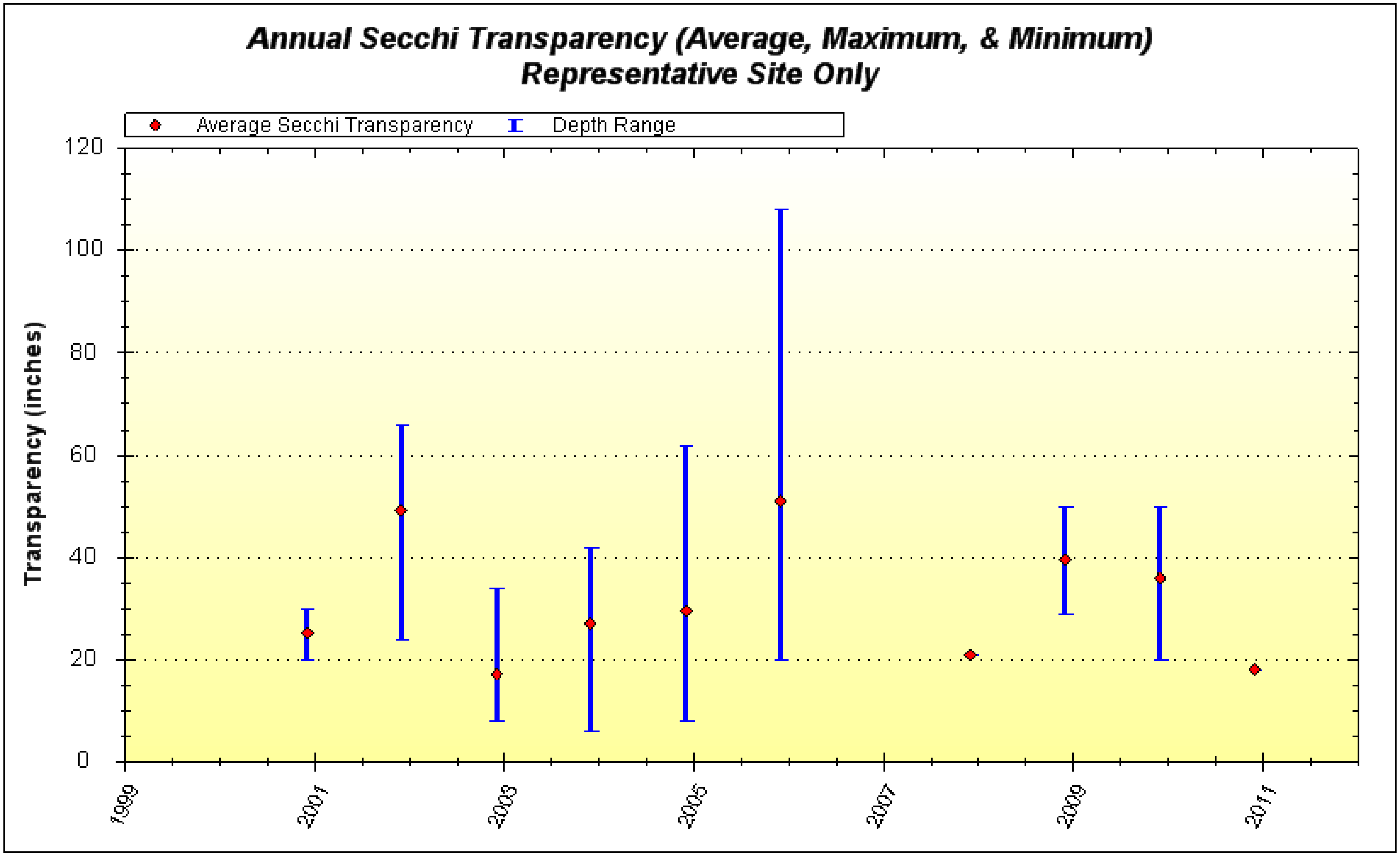
Secchi transparency readings were recorded at three locations in Lake Campton at least four times during the May through October VLMP monitoring season in 2001-2006 and 2010. Table 16 exhibit the average, minimum, and maximum Secchi transparency at Site 1, the lake's representative site, for these years. Water samples also were collected at Site 1 during 2002 and 2004 on a monthly basis, May through October. Figure 28 gives more details on annual Secchi transparency.

Secchi transparency at Site 1 has tended to average between about 2 - 2 ½ feet, although in 2002 and 2006 transparency averaged slightly more than 4 feet, elevated by the increased water clarity during the fall of those years. In fact in 2006, the Secchi disk occasionally could even be seen on the lake bottom at Site 1 in 8½ - 9 feet of water. The lowest transparency readings of around 1 foot and less were recorded after storm events and are associated with high levels of suspended solids carried into the lake from upstream eroding areas and streambanks. The resuspension of soft lake bottom sediments by wind and waves also contributes to the lake's generally low water clarity. Microscopic, planktonic algae further contribute to low Secchi transparency readings, notably in the hotter summer months as supported by the high chlorophyll *a* concentrations.

Table 16. Lake Campton VLMP Secchi transparency (inches), 2001-2006 & 2010

YEAR	MAY I	MAY II	JUN. I	JUN. II	JUL. I	JUL. II	AUG. I	AUG. II	SEP. I	SEP. II	OCT. I	OCT. II	MIN.	MAX.	AVG.
2001	-	-	-	-	-	-	23	30	20	-	28	-	20	30	25
2002	45	38	34	-	42	-	-	24	66	62	66	66	24	66	49
2003	8	34	24	18	14	14	16	16	12	12	14	24	8	34	17
2004	40	6	30	32	18	24	24	36	18	28	-	42	6	42	27
2005	42	38	62	24	26	8	16	12	24	26	38	40	8	62	30
2006	32	26	28	52	26	42	20	40	96	96	46	108	20	108	51
2010	-	33	-	-	27	20	-	-	50	50	-	-	20	50	36

Figure 28. **Lake Campton VLMP monitoring sites**



As summarized in Table 17, Lake Campton is also very nutrient-rich, with plenty of phosphorus and nitrogen available to support nuisance growth of planktonic and filamentous algae. Total phosphorus (TP) concentrations at Lake Campton were high, ranging from 0.086 to 0.704 mg/L, with an average of 0.26 mg/L, over the two sampling years. This is considerably above the 0.05 mg/L General Use Water Quality Standard as well as the 0.03 mg/L level known to contribute to nuisance growth of algae and some aquatic plants.

Inorganic forms of nitrogen (nitrate+nitrite and ammonia nitrogen) may also stimulate algae growth, notably at concentrations in excess of 0.03 mg/L. At Lake Campton, nitrate+nitrite nitrogen ranged from below detection (0.01K) to 3.4 mg/L over the two sampled years, averaging 0.728 mg/L.

Lake Campton is not alone among the many lakes in the state that exceed these phosphorus and nitrogen thresholds. Further, the overall water quality and aquatic plant conditions in Lake Campton are not surprising due to the large watershed above the lake which has and will continue to provide an ongoing source of siltation and nutrients.

Sedimentation

Water depth measurements were conducted throughout Lake Campton by the Illinois Department of Conservation (now Department of Natural Resources) fisheries biologist in 1967 (Figure 29) and by Wight Consulting Engineers in 1993 (Figure 30). Using the three VLMP monitoring sites as reference points and the depths measured at each of these points by the VLMP monitors between 1967 and 2010, it appears that in the vicinity of Site 1, water depths have decreased about 1½ - 2 feet, at Site 2 about 2½ - 3 feet, and at Site 3 about 1-2 feet. The overall surface area of the lake also appears to have declined from 30.6 acres in 1967 to about 27 acres today (Table 18). Sediment accumulation over time is evidenced in the northwestern finger of the lake where an approximately 1-acre marshy area has formed.

Table 17. Lake Campton site 1 summary statistics, 2002 & 2004 water quality data

PARAMETER	UNITS	MEAN	MEDIAN	MINIMUM	MAXIMUM	SD	N
Total Phosphorus	mg/L	0.260	0.191	0.086	0.704	0.190	8
Nitrate+Nitrite Nitrogen	mg/L	0.728	0.085	0.01K	3.400	1.171	10
Total Suspended Solids	mg/L	13.000	9.000	4.000	48.000	12.000	10
Volatile Suspended Solids	mg/L	8.000	7.000	2.000	13.000	3.000	10
Chlorophyll a (uncorrected)	ug/L	28.940	11.400	4.510	66.400	25.300	5
Chlorophyll a (corrected)	ug/L	27.510	12.500	4.650	63.000	23.470	5
Chlorophyll b	ug/L	4.834	1.350	1.000	18.900	7.040	5
Chlorophyll c	ug/L	2.918	1.360	1.000	8.600	2.900	5
Phaeophytin a	ug/L	2.284	1.310	1.000	6.160	1.970	5

Table 18. Lake Campton water depths and surface area, 1967-2010

YEAR	WATER DEPTHS (FEET) SITE 1	SITE 2	SITE 3	SURFACE AREA (ACRES)
1967	10.0 - 11.0	7.0	3.0 - 4.0	30.6
1993	9.0 - 10.0	5.0 - 5.5	3.0 - 4.0	—
2010	8.5 - 9.0	4.0 - 4.5	2.0 - 3.0	27.0

Figure 29. **Lake Campton water depth soundings, 1967**

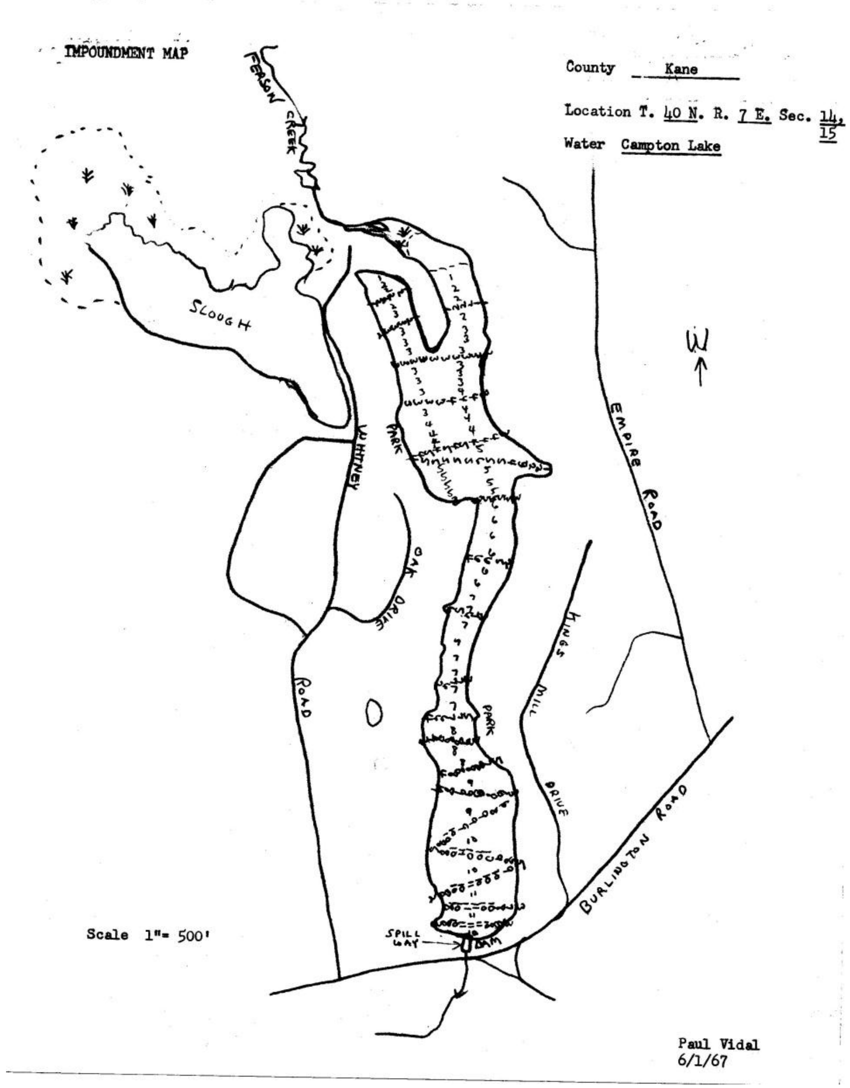
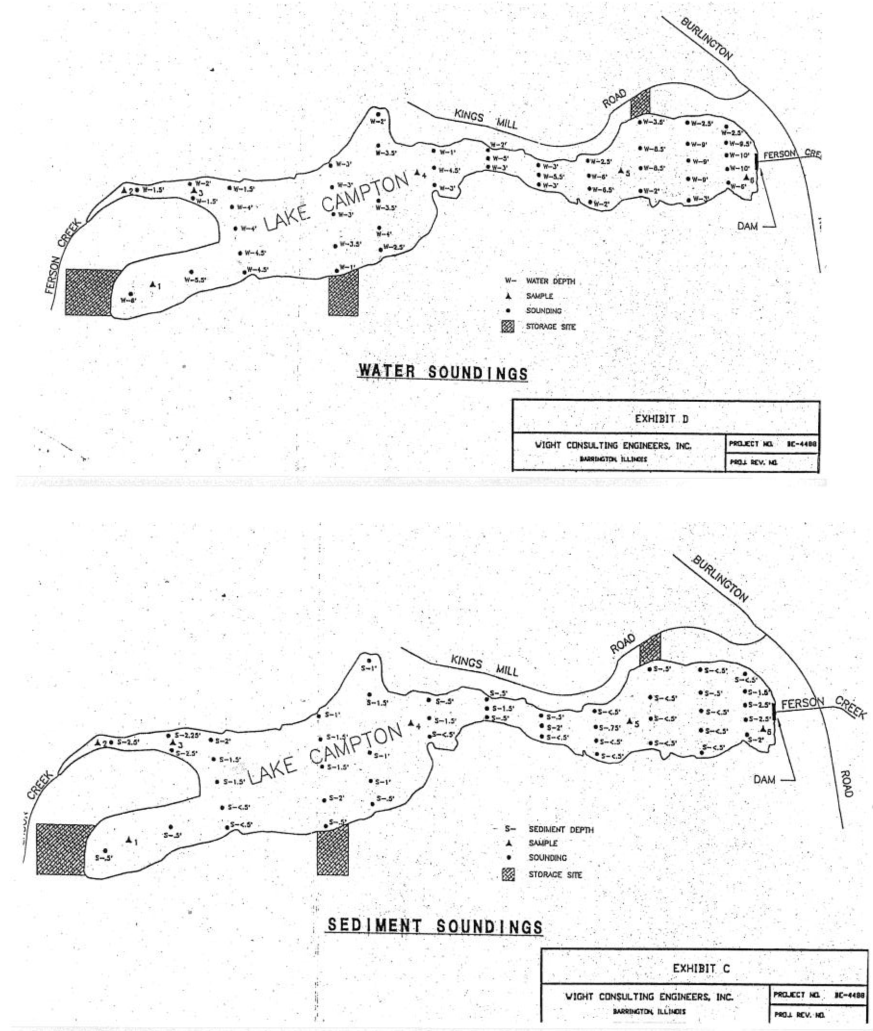


Figure 30. **Lake Campton water and sediment depth sounding, 1993**



3.4 GROUNDWATER QUALITY DATA

Groundwater quality data were obtained from IEPA for community water supply (CWS) wells on both sand & gravel and shallow-bedrock aquifers in the Ferson-Otter Creek Watershed.[113] These data reflect raw water samples, collected prior to treatment/distribution by the water supply operator. (Routine operator sampling is most frequently performed only for treated drinking water.) Since the 1980s, IEPA has sampled all CWS wells at least once for baseline raw water quality data, while a subset of 350 wells are sampled every two years as part of the Ambient Monitoring Network.[114]

Table 19 presents the mean concentration, standard deviation, minimum observed value, maximum observed value and number of observations for each inorganic contaminant among all CWS wells in this watershed. This table also lists the Maximum Contaminant Levels (MCL) or Secondary Maximum Contaminant Levels (SMCL) as applies to each contaminant presented here.[115] MCL standards are enforced drinking water regulations, while SMCL standards are recommended levels for preserving aesthetic characteristics of drinking water like appearance, smell, and taste.

Chlorides in particular have become a groundwater quality concern given a persistent trend of rising chloride concentrations in shallow wells throughout the region.[116] However, chlorides do not pose a threat to human health, although they can impart an undesirable salty taste to drinking water at high levels. Consequently, chloride currently has an SMCL of 250 mg/L (equivalent to parts per million, or ppm).[117] Road salt, septic-system effluent, and water-softener brine waste are major sources of chlorides in urban areas. A recent study found chloride concentrations to be increasing in shallow public wells in the western and southern counties surrounding Chicago. Among shallow public wells in this area, 43% were found to be increasing at a rate greater than 1 mg/L of chloride per year and an additional 15% were found to be increasing at a rate greater than 4 mg/L of chloride per year.[118] Figure 30 from the same study shows mean chloride concentrations for public wells in northeastern Illinois by county for the period 1900 to 2005.[119] The majority of these measurements do not exceed the current SMCL of 250 mg/L, but are much higher than 10 mg/L, the median chloride concentration for Chicago-area wells in 1960.[120,121]

As stated previously, the MCL and SMCL values presented with raw well water sample data in Table 19 are drinking water standards (i.e., finished water for distribution). However, a complex set of water quality standards also apply specifically to in-situ groundwater in Illinois.[122] Groundwater quality data are compared only with drinking water standards in this document (rather than with the more complex groundwater standards) because they are more straightforward, allowing for the abbreviated comparison included here.

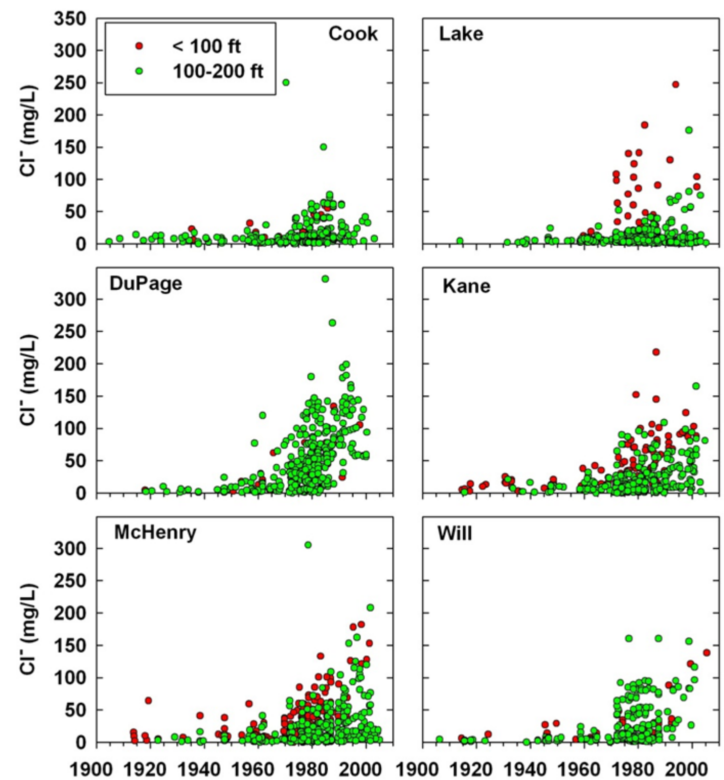
IEPA also collects data on organic contaminants. IEPA detected no synthetic organic contaminants (SOCs) or volatile organic contaminants (VOCs) in any of the wells in this watershed planning

[113] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.
[114] Ibid.
[115] *Primary Drinking Water Standards*. *Ill. Adm. Code* 35, Part 611. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-27419/ (accessed November 14, 2011).
[116] Kelly, Walter R. "Long-Term Trends in Chloride Concentrations in Shallow Aquifers near Chicago." *Ground Water* Vol. 46, No. 5: (September–October 2008): 772–781.
[117] Ibid. 115.
[118] Ibid. 116.
[119] Figure obtained from Walter R. Kelly, Groundwater Geochemist, Illinois State Water Survey (ISWS), email message to author(s), August 25, 2011.
[120] Ibid. 115.
[121] Ibid. 116.
[122] *Groundwater Quality*. *Ill. Adm. Code* 35, Part 620. http://www.ipcb.state.il.us/documents/dsweb/Get/Document-33425/ (accessed November 14, 2011).

area.[123] In particular, there were no detections of a special class of VOCs called carcinogenic VOCs (CVOCs). Data presented here for all VOCs are for raw water samples, as for inorganic contaminants above. Unlike for inorganic contaminants, however, finished drinking water samples are likely to have similar VOC levels as raw water samples because conventional water treatment does nothing to remove them. A new law passed in Illinois in 2010, P.A. 96-1366/ SB 3070 or the MCL Prevention Law, oversees concentrations of CVOC's in finished drinking water.[124]

The six CVOC's affected by this law are benzene, carbon tetrachloride, 1,2-dichlorethane, tetrachloroethylene, trichloroethylene and vinyl chloride. The MCL Prevention Law is designed to prevent concentrations of these CVOCs in public water supplies from reaching regulated MCLs. The law requires that if facilities detect one of the CVOCs regulated by this law at a concentration of 50% or more of that CVOC's MCL in finished drinking water, then under certain circumstances, that facility must submit a response plan to prevent exceedence of the MCL, and to lower the concentration of the CVOC below its detectable limit.[125] Compliance with this law is not explored with regard to the sample data in Table 19 for two reasons. First, raw rather than finished water sample data are presented, and the VOC standards do not apply to these raw water samples. Second, even for finished water samples, there is complexity involved in IEPA's interpretation of standards in making a compliance determination.

Figure 31. **Chloride concentrations for public wells in northeastern Illinois at a county level, 1900 to 2000.**[126]



[123] Wade Boring, Manager Geographic Analysis, Illinois Environmental Protection Agency (IEPA), email message to author(s), July 22, 2011.
[124] *EPA—Carcinogenic Compounds*. *Ill. Comp. Stat*. 810 (2010), § 5/1-101. http://ilga.gov/legislation/BillStatus.asp?DocTypeID=SB&DocNum=3070&GAID=10&SessionID=76&LegID=50631 (accessed September 15, 2011).
[125] Ibid.

[126] Figure obtained from Walter R. Kelly, Groundwater Geochemist, Illinois State Water Survey (ISWS), email message to author(s), August 25, 2011.

Table 19. Groundwater quality statistics for inorganic contaminants for Ferson-Otter Creek Watershed

CONTAMINANT	STANDARD TYPE	STANDARD LEVEL	MEAN	STANDARD DEVIATION	MINIMUM OBSERVATION	MAXIMUM OBSERVATION	NUMBER OF OBSERVATIONS	UNIT
Antimony	MCL	6	0.00	0.00	0.00	0.00	1	ppb
Arsenic	MCL	10	0.00	0.00	0.00	0.00	5	ppb
Barium	MCL	2,000	123.20	50.86	78.00	203.00	5	ppb
Beryllium	MCL	4	0.00	0.00	0.00	0.00	5	ppb
Cadmium	MCL	5	0.00	0.00	0.00	0.00	5	ppb
Chloride	SMCL	250	17.66	21.06	6.80	55.30	5	ppm
Chromium	MCL	100	0.00	0.00	0.00	0.00	5	ppb
Cyanide	MCL	200	0.00	0.00	0.00	0.00	5	ppb
Fluoride	MCL	4,000	390.00	90.00	310.00	530.00	5	ppb
Iron	SMCL	300	1,278.00	360.00	930.00	1,800.00	5	ppb
Manganese	SMCL	50	23.00	15.33	0.00	38.00	5	ppb
Mercury	MCL	2	0.004	0.009	0.00	0.02	5	ppb
Nickel	No MCL or SMCL	–	0.00	0.00	0.00	0.00	1	ppb
Nitrate	MCL	10	0.00	0.00	0.00	0.00	4	ppm
Selenium	MCL	50	0.00	0.00	0.00	0.00	5	ppb
Sodium	No MCL or SMCL	–	12.90	7.16	7.00	23.50	5	ppm
Sulfate	SMCL	250	58.72	38.25	18.60	99.00	5	ppm
Thallium	MCL	2	0.00	0.00	0.00	0.00	1	ppb
Zinc	SMCL	5,000	1.20	2.68	0.00	6.00	5	ppb