Water Resources Strategy Paper – DRAFT – NOT FOR DISTRIBUTION

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Introduction

Abundant and high quality water resources play an essential role in sustaining the economic prosperity, environmental health, and high quality of life within our region. Water supplies from the region's lakes, rivers and aquifers support our region's industry, economy, households, and energy generation. Our aquatic systems support ecologically significant ecosystems and a rich composition of native flora and fauna. Lake Michigan and our waterways also provide one of the great recreational systems in the country, while simultaneously transporting goods, both nationally and globally.

CMAP has started the development of ON TO 2050, the region's next comprehensive plan, scheduled for adoption in October 2018. Plan development includes the creation of strategy papers, which are intended to help shape content for ON TO 2050 by providing the agency with direction on new topics, exploring how GO TO 2040 recommendations can be further refined, and identifying additional research needed to support the plan's development. As a part of this effort, water resources are being explored through four key areas: water quality (including wastewater), water supply, waterways and Lake Michigan, and stormwater and flooding (a separate strategy paper). There are clear areas of overlap between this strategy paper and others, including Green Infrastructure Co-Benefits, Climate Resilience, Lands in Transition, and Stormwater and Flooding. There are less direct, but nonetheless real, overlaps between water topics and others, such as Reinvestment and Infill, Asset Management, Municipal Capacity, and Public Health.

Development of this paper began in fall of 2016 with a staff assessment of past and current water-related initiatives by CMAP, other regional partners, and peer MPOs, followed by collection and analysis of data and other information about past and current conditions and trends. This work led to the identification of issues and challenges, and associated policy and action areas for the region and its partners to consider. Progress was presented to CMAP's Environment and Natural Resources Committee in November 2016, March 2017, and June 2017.

The paper begins with the regulatory context governing water resources, the work that CMAP (and its predecessor NIPC) have engaged in over past two decades, and the activities that CMAP currently undertakes for the region. The second section of the paper presents issues and challenges supported by data, followed by potential policy responses to those issues and challenges, in section three.

Regulatory Context

The Chicago region contains a unique array of natural and modified[1] surface waters—lakes, fens, prairie sloughs, wetlands, rivers, and streams—that connect communities, industries, states and even countries, as well as groundwater resources. Yet these resources are regulated and managed by a variety of agencies and laws, which are not well integrated with one another. This section presents some of that regulatory context in order to help understand the framework in which the policy recommendations are presented. Although this section attempts to give a broad overview of how water resources are regulated via the Clean Water Act (CWA) with the CMAP region, it is not exhaustive. Pieces of legislation other than the CWA—the Endangered Species Act, Safe Drinking Water Act (SDWA), National Environmental Policy Act, and Water Resources Development Act, among others—have an impact on the waterways and water supply in the CMAP region. Clearly, the context for managing our

[1] The reversal of the Chicago River in 1900 through the creation of the Sanitary and Ship Canal has significantly defined the regional waterway system, which was also connected to Lake Calumet through the Cal-Sag Channel that links the Calumet and Little Calumet Rivers. The Chicago River system flows to the Des Plaines River and drains into the Illinois River near Joliet.

water resources is complex and difficult to navigate, and is at least partly responsible for the significant challenges ahead for the region.

Water Quality

Passed by Congress in 1972, the Clean Water Act (CWA) provides the basic structure for protecting the quality of these surface waters here and across the country.[2] The statute uses a combination of regulatory and non-regulatory mechanisms to reduce point and nonpoint source pollution[3] entering U.S. waters with the goal of "restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so they can support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."[4] Although the CWA is federal legislation, it is also the source language for most state and local water regulations.[5] Within the CMAP region, the Illinois Environmental Protection Act designates the Illinois Environmental Protection Agency (IEPA) as the primary "pollution control agency," authorizing it to enforce the CWA for the state. Local authorities rely on these statutes for regulatory guidance, and, in many cases, for funding water quality improvements.

The CWA requires states to establish water quality standards (WQS) for all surface waters within its jurisdiction. Lakes, rivers, and streams are assigned a designated use[6], which establishes water quality criteria that must be attained for each waterbody. Together, these function as the legal basis from which states enforce water quality standards, regulate pollution, and employ programs aimed at preventing water quality from falling below the thresholds needed to support existing uses,[7] and ensuring higher quality waters remain healthy over time.[8] Illinois IEPA sets these standards in cooperation with the Illinois Pollution Control Board (IPCB) and with guidance from the U.S. EPA.

Using the established WQS, IEPA is responsible for ongoing monitoring and biennial reporting of the condition, stressors, and sources of impairment of the state's surface waters every two years. These reports are intended to help states allocate resources for developing and implementing pollution reduction strategies for impaired waters, such as the production of watershed-based plans and Total Maximum Daily Load (TMDL) studies, as well as sustaining those that are healthy.[9]

In addition to monitoring and reporting, the CWA further assists states by creating regulatory and voluntary programs to curb point and nonpoint source pollution as well as implement water quality planning and management activities. The primary mechanism through which the CWA regulates point

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[2] In addition to the elements presented here, the CWA also contains a number of regionally significant provisions that ensure water quality as it pertains to the health of the Great Lakes (Sec. 108, Sec. 118), wastewater (Sec. 301, Sec. 302), and wetlands (Sec. 401, Sec. 404.

[3] Point source pollution is discharged from a pipe and includes wastewater treatment facilities and industry; nonpoint source pollution flows into our rivers and lakes from across the landscape when it rains.

[4] Introduction to the Clean Water Act (EPA's Watershed Academy)

[5] The US EPA is responsible for implementing the Clean Water Act (CWA). The agency fulfills these duties by delegating powers to the states; providing national guidance on water quality standards (WQS); reviewing and approving WQS proposed by states; and overseeing, budgeting for, and providing financial support to point and nonpoint source pollution control programs administered by the states.

[6] Designated uses are specific uses assigned to a water body, whether or not water quality conditions currently support that use. Alternatively, they can be viewed as "desired uses" (e.g. fishing or swimming).

[7] Under the antidegradation policy, 'existing uses' are those attained in the waterbody on or after November 1975; and therefore, must be protected "at a level reflecting the highest use achieved" (EPA's Watershed Academy).

[8] The CWA also requires water quality standards to be established for toxic and water-quality based effluent under Section 307 and 302, respectively.

[9] US EPA has been encouraging states to consolidate the Section 305(b) and Section 303(d) reporting in 2002. Illinois began developing these consolidated integrated water quality reports in 2006.

and nonpoint source pollution is the National Pollution Discharge and Elimination System (NPDES) permit program.[10] Point sources are discrete conveyance systems, such as a pipe or drainage ditch, from which pollutants are directly transferred into nearby surface waters. Unless an NPDES permit is obtained, it is illegal to discharge pollutants into US waters. NPDES permits set limits on the type and amount of pollutants that a point source can discharge into a given waterbody at any point in time.[11] Permits are commonly applicable to private and commercial industries, municipal wastewater facilities[12], and public entities that have stormwater systems that discharge directly to a waterbody. Within Illinois, the IEPA is responsible for reviewing and issuing NPDES permits to these entities.[13]

The CWA attempts to address nonpoint source pollution through two programs – Municipal Separate Storm Sewer Systems (MS4) permits and the Section 319 Nonpoint Source Management program. MS4 permits technically fall under the NPDES program because stormwater runoff ultimately gets discharged to surface waters via a pipe (point source), but the sewer systems collect nonpoint source pollution conveyed via runoff.[14] MS4 permits require dischargers (municipalities) to develop a Stormwater Management Program and implement measures that improve the quality of the stormwater being discharged, such as education and street sweeping programs.[15] Conversely, the Section 319 program is a voluntary program through which the US EPA allocates funds to IEPA to support activities that help prevent and manage nonpoint source pollution. The program, which is administered by IEPA, funds a wide range of activities, including technical and financial assistance, education, watershed and TMDL plan development, as well as the installation and monitoring of best management practice (BMP) demonstration projects.

While state-administered MS4 permits provide some guidance for community stormwater management practices, most municipalities have also adopted or otherwise adhere to county stormwater management ordinances, which are primarily focused on managing the rate and volume of stormwater runoff.[16] County ordinances can go beyond the standards for runoff control set by the state, by requiring stream buffers, green infrastructure practices, impervious surface area, and floodplain protection. County and municipal land use regulations also govern, to some extent, the impact of development on water resources, though local requirements vary greatly in their level of scope and detail.

CMAP receives funding from IEPA under Section 604 of the CWA to help communities and other stakeholders develop EPA-compliant watershed-based plans. CMAP works closely with the IEPA to implement these activities, among others, because CMAP serves as the Designated Areawide Water Quality Planning Agency for northeastern Illinois, as stipulated under Section 208 of the CWA. This statute also requires the designated regional body to develop water quality management plans for their

[10] Section 402 of the Clean Water Act

[11] Limits set by NPDES permits are specific to the waterbody within in which the pollutant is discharged. Types of pollutants permits can limit include: total suspended solids, ammonia nitrogen, fecal coliform, and phosphorus.

[12] The NPDES permit program established effluent- and technology-based effluent limits, requiring wastewater treatment facilities to invest in cost-effective efficient pollution prevention system to ensure that the pollutant load limits for a waterbody are met.

[13] Under the NPDES Permit program, IEPA is responsible for reviewing and issuing general stormwater permit for MS4 and CSO communities, as well as permits for Confined Animal Feeding Operations (CAFOs).

[14] MS4 permits were issued in two phases: In 1990 (Phase I), cities or counties with populations of 100,000 were required to obtain NPDES MS4 permits for their stormwater discharges. In 1999 (Phase II), small urbanized and rural areas with MS4s were required to obtain permits for the discharges as well. (NPDES: Stormwater Discharges from Municipal Sources (EPA, 2017))

[15] Municipal Separate Storm Sewer System (MSW) Storm Water Management Program (SWMP) (EPA, 2017)

[16] County ordinances are the minimum standard to which municipalities must adhere, though they can adopt more stringent stormwater regulations.

jurisdiction. The most recent of these plans, the Areawide Water Quality Management Plan, was developed by the Northeastern Illinois Planning Commission (CMAP's predecessor) in the 1980s.

Two additional pollution control strategies are Total Maximum Daily Loads (TMDLs) and the State Revolving Fund (SRF). If waterbodies become impaired, states (or the relevant entity) are required to develop Total Maximum Daily Loads (TMDLs) that investigate the source of impairing point and nonpoint source pollutants and prepare a corresponding implementation plan for reducing those pollutants.[17] TMDLs can be viewed as "pollution budgets" – if the pollutant loads meet or are below the thresholds set by the TMDLs, the waterbody would be in compliance with its water quality standards.[18] The SRF is comprised of two funds[19] that offer public entities, including wastewater treatment facilities, low interest loans to support projects that reduce point source and nonpoint source pollution, and invest in infrastructure projects, including drinking water projects.[20]

While IEPA regulates water quality, the Illinois Department of Natural Resources (IDNR) is the lead state agency for water resources planning. The Rivers, Lakes, and Streams Act charges IDNR to manage and safeguard the state's surface water resources against encroachment, wrongful seizure, or private use, and provides guidance for construction activities, dam maintenance, floodplain issues including filling and the National Flood Insurance Program, water supply, drought, and navigation. [21] IDNR also oversees the Illinois Coastal Management Program[22] and other local Great Lakes initiatives seeking to restore, manage, and enhance the natural and cultural resources along the Lake Michigan shoreline.[23]

The United States Army Corps of Engineers (USACE) is another major stakeholder in the region. In Illinois, USACE regulates activities in US waters, including wetlands, through various permit programs, and manages Illinois' wetland mitigation banks.[24,25] They also provide expertise across a number of disciplines including restoring degraded ecosystems, constructing sustainable facilities, regulating waterways, managing natural resources, and cleaning up military hazardous waste sites. USACE conducted the Great Lakes and Mississippi River Interbasin Study (GLMRIS) in 2012, and continues to help manage invasive species throughout the CMAP region.[26]

Internationally, there are three major agreements—the Boundary Waters Treaty, EPA's Great Lakes Water Quality Agreement, and the St. Lawrence River Basin Sustainable Water Resources Agreement—that outline responsibilities for Great Lakes stakeholders on topics such as water use, water quality, and air quality. Illinois has been involved in these agreements and has subsequently responded to the provisions via state law. The companion document to the St. Lawrence River Basin Sustainable Water

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[17] A Total Maximum Daily Load (TMDLs) is the maximum loading of all pollutants that a waterbody can receive and be in compliance with its WQS. A TMDL is calculated by measuring a waterbody's existing pollutant loads and determining the total load reduction needed to meet its WQS.

[18] Introduction to the Clean Water Act (EPA's Watershed Academy), p29-30

[19] The Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF)

[20] Since 2000, the region has received approximately $900 million in drinking water loans, and $2.9 billion in wastewater (clean water) loans via the state revolving fund loan program. Gary Bingenheimer, IEPA, personal communication.

[21] The Rivers, Lakes, and Streams Act

[22] Illinois participates in the National Coastal Zone Management Program—one of three programs created by the Coastal Zone Management Act of 1972—to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." (Coastal Zone Management Act of 1972)

[23] IDNR Coastal Management Program

[24] The two major permits needed are for a) construction of structures in US waters required under Section 10 of the Rivers and Harbors Act of 1899, and b) the discharge of dredge or fill material into US waters required under Section 404 of the CWA through the Dredge or Fill Discharge Permit Program.

[25] Mitigation (USACE, Chicago District)

[26] U.S. Army Corps of Engineers: Great Lakes and Mississippi River Interbasin Study

Resources Agreement, the Great Lakes Compact, is a significant and binding agreement between the eight Great Lakes states to protect, conserve, restore, improve, and manage the renewable but finite water resources of the Great Lakes Basin for the use, benefit, and enjoyment of all basin citizens.

Water Supply

The Chicago region obtains its drinking water from three major sources – Lake Michigan, inland surface waters (Fox River and Kankakee River), and groundwater. The majority of the water used in the region comes from Lake Michigan; however, Lake Michigan's water is a shared and finite resource. Since Illinois withdraws, uses, and then diverts Lake Michigan water out of the Great Lakes Basin, the State's access to lake water is governed by a U.S. Supreme Court Consent Decree.[27] This ruling sets a diversion rate (3,200 cubic feet/second (cfs) for Illinois[28], and thereby, limits the amount of water that Illinois can withdraw, which is equivalent to approximately 2.1 billion gallons of water per day.[29] In response to the Decree, Illinois enacted the Level of Lake Michigan Act, which is a compilation of statutes intended to manage and monitor the use of Lake Michigan water through a permit system.[30] Lake Michigan water availability is allocated to the year 2030 with additional potential to serve a limited number of new communities that currently use groundwater. More than half of this withdrawal is used for public drinking water supplies, and the remaining portion is allotted to stormwater runoff, lockage, leakage, navigation, and the maintenance of the Chicago Sanitary and Ship Canal. [31] Although the Level of Lake Michigan Act is Illinois' overarching legislative mandate, the Great Lakes Compact also regulates and manages the region's water resources by banning new diversions of water from the Great Lakes Basin as well as requiring states to develop and implement water conservation and efficiency programs in the Great Lake region.[32]

In addition to the ample surface waters, northeastern Illinois has a complex network of groundwater aquifers that have been vital in sustaining our region's economy, population, and rich ecological resources. Illinois EPA administers the Groundwater Quality Program, which was created through the Illinois Groundwater Protection Act (IGPA). Under this program, IEPA facilitates an interagency coordinating groundwater committee and the Groundwater Advisory Council (GAC), administers a well protection program, defines maximum setback zones, conducts ambient groundwater monitoring including surveying, mapping, and assessments, and manages a regional groundwater protection planning program.[33] Despite the significance of this resource, there is minimal legislation that protects and manages the region's groundwater. The Illinois Water Use Act of 1983 establishes a "reasonable use" rule for groundwater withdrawals and designates the Soil and Water Conservation Districts to receive notice and recommend restrictions on withdrawals.[34] However, there are no statutory remedies for disputes that might arise over groundwater withdrawals and Illinois does not require a permit for

[27] Wisconsin v. Illinois, 388 U.S. 426 (1967); 449 U.S. 48 (1980).
[28] The diversion rate is based on a 40 year accounting period and considers annual variations in flow.
[29] Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan. (CMAP, 2010)
[30] The Illinois Department of Natural Resources, Office of Water Resources, administers the use-permit system that is used to manage the allocation of Lake Michigan water.
[31] Ibid.
[32] Great Lakes Compact One Page Overview (Great Lakes-St. Lawrence River Basin Water Resources Council
[33] EPA's Groundwater Quality Protection Program. Passed under the federal Safe Drinking Water Act, IGPA relies to state and local partners to protect groundwater as a natural and public resource, and enforce special provisions that target drinking water wells
[34] Illinois Water Use Act

groundwater withdrawals beyond the operating permit following construction that is issued by IEPA and is non-expiring.

IDNR has assigned minimum low flow thresholds, known as the "Q7, 10", for the Fox and Kankakee Rivers, which are water supply sources for a number of communities, with potential to serve additional communities.[35] This low flow metric represents an estimate of how much water volume is flowing in a river during drought conditions, and is intended to protect water quality while accommodating inflows of wastewater effluent. These thresholds are updated approximately every 10 years in northeastern Illinois.

Previous Regional Planning Efforts

CMAP and its predecessor (NIPC) have worked in partnership with IEPA, IDNR, and regional partners for many years to plan for protection and management of our water resources. The plans described below provide the most recent and relevant background for developing policies and strategies for ON TO 2050.

Areawide Water Quality Management Plan (NIPC)

Since 2005, CMAP has served as the Designated Areawide Water Quality Planning Agency for northeastern Illinois, as stipulated under Section 208 of the Clean Water Act. As the Designated Agency, CMAP's predecessor (NIPC) developed the Areawide Water Quality Management Plan (AWQMP) in the 1980s.[36,37] CMAP is responsible for helping local governments and stakeholders implement point source and urban and agricultural nonpoint source strategies for achieving the water quality goals of the Clean Water Act. The AWQMP describes the existing conditions of the region (in the 1980's), water quality challenges, and strategies for addressing those challenges. The primary goals of the AWQMP are:

- Restoration and maintenance of the chemical, physical, and biological integrity of regional waters.
- Elimination of waste and pollutant discharges into the region's waterways and Lake Michigan.
- Water quality, which provides for the protection and propagation of fish, shellfish, and wildlife and provides for human recreation wherever attainable.

The AWQMP also establishes CMAP's role in wastewater planning, though this role and relevance to the state's oversight of wastewater requires examination and revision with IEPA to improve the relevance of the process.

Lake Michigan Lakewide Management Plan (NIPC)

NIPC helped develop the *Lake Michigan Lakewide Management Plan (LaMP, 2000)* which outlines steps to restore and protect the Great Lakes region, and thereby, achieve the Great Lakes Water Quality Agreement (GLWQA) between the United States and Canada. This agreement committed the U.S. and Canada to address water quality issues of the Great Lakes in a coordinated, joint fashion. The agreement called for the development of Lakewide Management Plans (LaMP) to identify critical pollutants that affect the beneficial uses of the lake and to develop strategies, recommendations, and policy options to

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[35] http://www.sws.uiuc.edu/docs/maps/lowflow/background.asp

[36] Section 208 of the CWA requires that areawide plans be prepared for controlling water pollution in urban and industrial areas. US EPA, who was initially responsible for implementing this law, delegated responsibility to the states. The State of Illinois then passed these responsibilities to NIPC in 1975, which were carried over to CMAP with the merge of NIPC and CATS in 2005.

[37] The two Areawide Water Quality Management Plan volumes can be downloaded from CMAP water quality planning website.

restore those beneficial uses. The status of Lake Michigan and the LaMP was assessed every two years until 2008, the most recent update.

Strategic Plan for Water Resource Management (NIPC)

Prior to the formation of CMAP, the Northeastern Illinois Planning Commission (NIPC) led a strategic planning process to build regional consensus on complex water resources issues and strategies to influence state policy, improve local and regional management, and enhance public understanding of water issues facing the region. In 2001, NIPC published the Strategic Plan for Water Resource Management, which calls for a "comprehensive, integrated approach to protect water supplies, reduce stormwater and flooding impacts, and protect water quality of our rivers, lakes, and wetlands." The plan identifies 34 water resources issues and 133 associated strategies, as well as the major entities that should take the lead in implementation. Although NIPC folded into CMAP in 2005, many of the issues and strategies presented in Strategic Plan for Water Resource Management are still relevant to the CMAP region, and are reflected in this strategy paper, including water supply, some of which was addressed by Water 2050.

Water 2050: Northeastern Illinois Regional Water Supply / Demand Plan

In 2006, CMAP was commissioned by the Illinois Department of Natural Resources (IDNR) to form a stakeholder group[38] to prepare a water supply plan for an 11-county northeastern Illinois planning area – the CMAP region along with Boone, DeKalb, Grundy, and Kankakee Counties. The outcome of this stakeholder-driven planning process was the *Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan (Water 2050),* published and adopted by CMAP in 2010. *Water 2050* seeks to ensure that the region's relatively finite water supplies will be available for years to come, even as millions of new residents are expected by mid-century. Water 2050 is intended to inform decisions about water supply and demand throughout the 11-county Northeastern Illinois planning area.[39] Water 2050 provided the region with its first water demand forecast, which was compared against estimates of water supply based on best available science. The resulting forecast highlighted areas of concern where supply may not be able to meet projected demand. Water demand management strategies are the cornerstones of the plan, but Water 2050 also outlines four major land use strategies and recommendations.[40] Water demand targets identified through the *Water 2050* planning process were also incorporated as regional indicators for measuring GO TO 2040 implementation.

GO TO 2040

GO TO 2040, the region's comprehensive regional plan, addresses water resources in two of its chapters – *Expand and Improve Parks and Open Space*, and *Manage and Conserve Water and Energy Resources*. Within the *Parks and Open Space* chapter, one of the major recommendations is to increase open space, particularly targeting preservation efforts within the area outlined in the *Green Infrastructure Vision (GIV).* The GIV is a spatial dataset intended to help the region identify conservation and restoration opportunities within a connected network of land. It also recommends open space and public access along waterway corridors, the framework for which was established in the *Northeastern Illinois Regional*

[38] The Northeastern Illinois Regional Water Supply Planning Group (RWSPG) was comprised of 35 advisory members representing nine distinct stakeholder-interest groups. See Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan.

[39] See CMAP's Water 2050: Northeastern Illinois regional Water Supply/Demand Plan webpage.

[40] CMAP website

Greenways and Trails Plan. GO TO 2040 often refers to waterways as connections between open spaces, or encompasses waterways within the scope and definition of natural areas. Therefore, water resources are indirectly addressed through other recommendations associated with greenways and conservation. GO TO 2040 acknowledges that the region's waterways have a transportation role as well. Although there are no complementary recommendations, the plan states that there is a need for expanding waterway shipping and invasive species control, while also taking advantage of Great Lakes water transportation.

Many of the recommendations within the *Manage and Conserve Water and Energy Resources* chapter were informed by *Water 2050,* which preceded GO TO 2040. Under this chapter, the plan recommends a number of actions to better conserve and manage water resources:

- supporting a variety of water conservation measures such as using more efficient appliances in homes and full cost water pricing by utilities
- shifting groundwater dependent communities to surface water supplies
- consolidating some of the region's water utilities for greater efficiency and operation
- integrating water conservation goals with land use planning, including preservation of open space in aquifer recharge areas and using green infrastructure to manage stormwater

GO TO 2040 also identifies watershed planning as an effective tool for detecting water resource issues—such as poor water quality, habitat loss, or flooding—as well as identifying and evaluating projects to address them.[41]

CMAP's Current Water-related Activities

As summarized above, CMAP and its predecessor (NIPC) have a long history of regional water resources work, including wastewater planning and promoting the adoption of county stormwater ordinances. This work has evolved over the years, but CMAP's role remains important and integral to the region's livability. This section details ongoing work by the agency, which continues to be integrated into CMAP's Local Technical Assistance program in a variety of ways. In addition, there are links between the strategies discussed in this paper and other ON TO 2050 work, including Lands in Transition, Climate Resilience, Green Infrastructure Co-benefits, and the alternative futures

Water quality activities

CMAP works with IEPA and regional partners to fulfill its responsibilities through five broad programmatic areas,[42] which are funded by the IEPA:

- *Wastewater Planning*: As part of the regional water quality strategy outlined in the AWQMP, and as one of the roles of the Designated Agency, CMAP has been involved in reviewing facility planning area (FPA) amendment requests, as needed, in order to help monitor and assess the impact of increasing wastewater discharges on the region's water quality. The IEPA has modified its wastewater planning process to shift focus away from FPAs as the organizing geography for wastewater service, and has signaled its intent to use watersheds instead, though much remains unresolved. CMAP will continue to provide information to stakeholders and review wastewater service change requests until a new process has been established. As part of this responsibility,

[41] CMAP's *Water* project webpage.
[42] CMAP's Water Quality Planning webpage.

CMAP notifies partners of point source permit activities and requests for Clean Water State Revolving Funds.

- *Watershed-based Planning*: Watershed planning is an important framework for addressing today's water resource challenges and opportunities. Using a collaborative and multi-objective planning approach, watershed plans develop strategic recommendations to help restore impaired waters, and protect and maintain the quality of unimpaired or threatened waters. Although water quality is a primary focus, the planning process acknowledges the value of other natural resources, and seeks to improve quality-of-life in the watershed for both current residents and future generations. CMAP is also working to ensure that recommendations will contribute more directly to habitat improvement and flood mitigation.

  As the Areawide Water Quality Planning agency, CMAP will often take on the role of a regional watershed coordinator. The agency frequently leads development of watershed plans in partnership with local stakeholders, assists others with plan development, and provides administrative oversight of plans led by other regional stakeholders on the behalf of IEPA. Many of these activities are realized with the support of the IEPA's 604(b) Water Quality Management Planning grant program. All watershed plans led by CMAP address U.S. EPA's nine key elements to ensure plan implementation can be supported through IEPA's Section 319 grant program. [43]

- *Nonpoint Source Pollution Reduction*: In addition to watershed plan development, CMAP attempts to reduce nonpoint source pollution through plan implementation. This is considered the most critical, and oftentimes most challenging, endeavor in watershed planning. In past years, CMAP has received Section 319(h) funds to help communities implement strategy recommendations—such as the installation of BMPs and demonstration projects and the development of outreach and education programs—that are listed in EPA-compliant plans. The Local Technical Assistance (LTA) program is another avenue through which CMAP helps communities with watershed plan implementation.

- *Illinois Volunteer Lake Monitoring Program (VLMP)*: CMAP contributes to the region's water quality monitoring and data collection through the Illinois Volunteer Lake Monitoring Program (VLMP) for the counties of Cook, DuPage, Kane, Kendall, McHenry, and Will, and in Lake County partners with the Lake County Health Department. [44] This volunteer-based program enables citizens, state agency staff, and municipal staff to monitor and report on the quality of the state's lakes. CMAP provides participants with training, technical assistance, educational materials, and data management and interpretation. Data collected through the VLMP is used by IEPA in its biennial assessment and reporting of the state's waters as required by the federal CWA,[45] as well as by scientists, planners, and consultants to inform local lake and watershed management decision making. Across the state, VLMP has over 300 volunteers that monitor approximately 150 lakes annually.[46]

- *Technical Assistance and Guidance*: In recent years, CMAP produced a guidance document for preparing watershed-based plans (Guidance for Preparing Watershed Action Plans in Illinois), educational materials for promoting water quality and water conservation through the Lawn to Lake program, and other materials, such as guidance for stormwater utilities. CMAP also has begun to

[43] Watershed plans that address the U.S. EPA's nine elements are eligible for the CWA's Section 319(h) grant funding. In Illinois, this funding is administered by IEPA through Illinois' Nonpoint Source Management Program. See Handbook for Development Watershed Plans to Restore and Protect Our Waters for more information on U.S, EPA's nine elements.
[44] Lake County Health Department oversees the VLMP in Lake County.
[45] Section 305(b) and 303(d) of the Clean Water Act.
[46] VLMP Timeline (Illinois EPA, 2015).

integrate watershed planning as well as implementation of planning-related watershed plan recommendations under the Local Technical Assistance program.

Water Supply Activities

After Water 2050 was adopted in 2010, CMAP began work on the plan's implementation, though funding for this work has ebbed and flowed with the state budget. In 2014, CMAP received a two-year grant from IDNR to support water supply planning for the region but in 2015, State of Illinois budget challenges prompted IDNR to halt all activities related to the grant. This was CMAP's only means of supporting Water 2050 and GO TO 2040 implementation actions related to water supply.

CMAP works with IDNR and regional partners to pursue goals of the Water 2050 plan:

- Coordination: For several years, CMAP convened and co-facilitated regional partners to discuss regional water supply planning and management issues. This coordination helped to create Water 2050 and continue the conversations on implementation. CMAP has supported the work of the Northwest Water Planning Alliance (NWPA)—a voluntary coalition of 70 communities and their 5 county governments collaboratively planning for and managing shared groundwater resources in the Fox River Basin. NWPA aims to provide a sustainable water supply that supports the region's people, economy, and environment. In 2013, CMAP helped to develop a three-year strategic plan for the NWPA. Since the development of this plan, CMAP, in partnership with MPC and Illinois-Indiana Sea Grant, have also worked with NWPA to develop outreach materials to help individuals and communities conserve water resources through household appliance repairs as well as water-wise watering and landscaping practices.
- Technical Assistance: CMAP worked with IDNR Office of Water Resources' Lake Michigan Water Allocation Program to improve understanding of water loss control practices and challenges faced by community water suppliers. The project illuminated the level of water loss among Lake Michigan permittees and identified seven recommendations to advance the Lake Michigan Water Allocation Program.[47] Following this report, CMAP began creating guidance on water system improvement plans, model policy language on water loss prevention, and other data collection recommendations before funding was suspended. In addition, CMAP has worked with several municipalities to develop tailored water conservation and efficiency plans and ordinances and has also incorporated water considerations into zoning and subdivision regulations through the Local Technical Assistance (LTA) Program. CMAP also developed a model water conservation ordinance to promote better water use management.
- Education: Following adoption of Water 2050, CMAP produced a number of public education materials to help community water suppliers inform residents on the importance and value of water demand management strategies. In addition, CMAP partnered with IISG to provide guidance on full cost pricing and healthy lawn and landscape practices.

Climate Resilience Activities

CMAP has been addressing water supply and water quality issues through its climate and resilience planning work as well. The most recent National Climate Assessment highlights how the Midwest region will be impacted by extreme precipitation, increased urban and riverine flooding, increased atmospheric pollution, drought, and life-threatening heat waves. These impacts have serious implications on water

[47] http://www.cmap.illinois.gov/livability/water/supply-planning/loss

resource management. Following the completion of GO TO 2040, CMAP developed *the Climate Adaptation Guidebook for Municipalities in the Chicago Region* to aid municipalities interested in adapting their planning and investment decisions to a changing climate.[48] CMAP is currently working with partners to develop an approach to incorporate climate science into local planning efforts to better prepare communities for future extreme events, such as high-precipitation events causing increased urban and riverine flooding.

The Climate Resilience strategy paper addressed water resources in a number of ways, including strategies for updating water infrastructure design standards, protecting critical assets such as water treatment facilities, and adaptive management of water resources, which encourages decision makers to address the range of flood-to-drought conditions anticipated in the future. Through the continued monitoring, evaluation, and learning associated with adaptive management, decision makers can adjust their actions with increasingly better data and understanding.[49]

[48] Climate Adaptation Guidebook for Municipalities in the Chicago Region (CMAP, 2013)

[49] CMAP, 2010, "Water 2050," http://www.cmap.illinois.gov/documents/10180/14452/NE+IL+Regional+Water+Supply+Demand+Plan.pdf/26911cec- 866e-4253-8d99-ef39c5653757.

Water Resource Issues and Challenges

The regulatory context presented in the previous section illustrates the complex nature of water resource management challenges in the region. Some of the more complex and relevant challenges of the regulatory environment, such as the many agencies involved, are described below, along with other issues and challenges that the region faces. Organized into the following five broad categories, these challenges set the context for the Policy Framework, the final section of the strategy paper.

- Water quality
- Water service, infrastructure, and facilities
- Water source availability and quality constraints
- Water withdrawal management and source protection
- Waterways, water bodies, and habitat

Water Quality

Generally, despite the Clean Water Act, other laws and regulations, and the investment of millions of dollars in grants to the region, many the region's water resources are still not meeting the goals of the Clean Water Act, IEPA's Designated Uses or water quality standards, or measures of biological quality (Table 1.) Significant progress has been made controlling point source pollution, which is regulated by the CWA, though 'emerging pollutants' such as pharmaceuticals in point source waste streams, primarily wastewater effluent, are not currently controlled by treatment processes. These emerging pollutants are likely to be handled by wastewater permits and effluent standards set by the state in the future. Nonetheless, there are a significant number of point sources discharging to the region's waterways, including combined sewer outfalls (CSOs) that discharge mixed stormwater and untreated wastewater during heavy rain events. The locations of these point sources and CSO discharge points are illustrated in Figure 1, which also displays CSO service areas and communities that fall under the municipal separate storm sewer systems (MS4s) stormwater permit program. MS4s are discussed in more detail below.

Nonpoint source pollution, on the other hand, including urban stormwater and agricultural runoff, is the major source of water quality impairment today. NPS is not controlled to the same extent as regulated point sources. NPS control, while addressed somewhat by county stormwater ordinances, relies primarily on voluntary approaches, partnerships, grants, and optional programs, which have proven much less effective than regulation. Helping to reduce the flow of nonpoint source pollution into our waterways is an area where CMAP can provide guidance and influence.

Figure 2 displays the watersheds and water bodies that have been identified for the development of Total Maximum Daily Load (TMDL) studies and pollution reduction strategies for specific impairments. The figure displays streams and lakes for which TMDLs have been written and approved by IEPA, those for which TMDL studies are underway, the watersheds of those waters, as well as impaired waters that have yet to be scheduled for TMDL development. The takeaway message is that the majority of the region's waters are impaired to the degree that pollution budgets are needed.

As described in the regulatory context, Illinois water quality standards include a narrative description of their intent for protecting designated uses, and nearly all have associated numerical standards (including biological criteria in some cases.) However, numeric standards have not been established for several water quality parameters (e.g., nutrients in streams), and may not be the best indicators of stream

health.[50] The lack of stream nutrient criteria complicates setting quantitative targets, measuring progress toward meeting water quality goals, and supporting pollution-trading programs. No standards have been established for low flow conditions.[51] Another complicating factor in assessing stream health and progress towards water quality goals is the lack of adequate monitoring data to assess current conditions and track change over time.[52] Less than 50 percent of streams and lakes have been assessed, and over 50 percent of assessed streams fall short of water quality goals (Table 1). More data is especially needed in the region's less densely populated areas, away from wastewater discharges, and in headwater stream habitats.[53]

Table 1. Designated Uses and Attainment Status of the Region's Streams and Lakes

EPA Designated Uses	**Use Attainment Status**													
	Fully Supporting				**Not Supporting (impaired)**				**Not Assessed**				**Totals[54]**	
	Streams		Lakes		Streams		Lakes		Streams		Lakes		Streams	Lakes
	miles	%	acres	%	miles	%	acres	%	miles	%	acres	%	miles	acres
Aesthetic Quality	794	42	2,417	10	110	6	17,026	68	979	52	5,331	21	1,883	25,165
Aquatic Life	528	29	18,636	76	850	47	747	3	418	23	4,800	20	1,796	24,586
Indigenous Aquatic Life	14	16	592	100	73	84	---	0	---	0	---	0	86	592
Fish Consumption	---	0	2,528	10	505	27	10,679	42	1,378	73	11,970	48	1,883	25,178
Secondary Contact	22	1	1,111	4	---	0	---	0	1,861	99	24,067	96	1,883	25,178
Primary Contact Recreation	22	1	1,111	5	573	32	710	3	1,201	67	22,765	93	1,796	24,586
Public & Food Processing Water Supply	25	100	2,417	10	---	0	---	---	---	0	---	---	25	---

[50] Research indicates little if any relationship between WQ parameters and biological health in lightly to moderately urbanized watersheds (Booth, Karr et al, 2004)

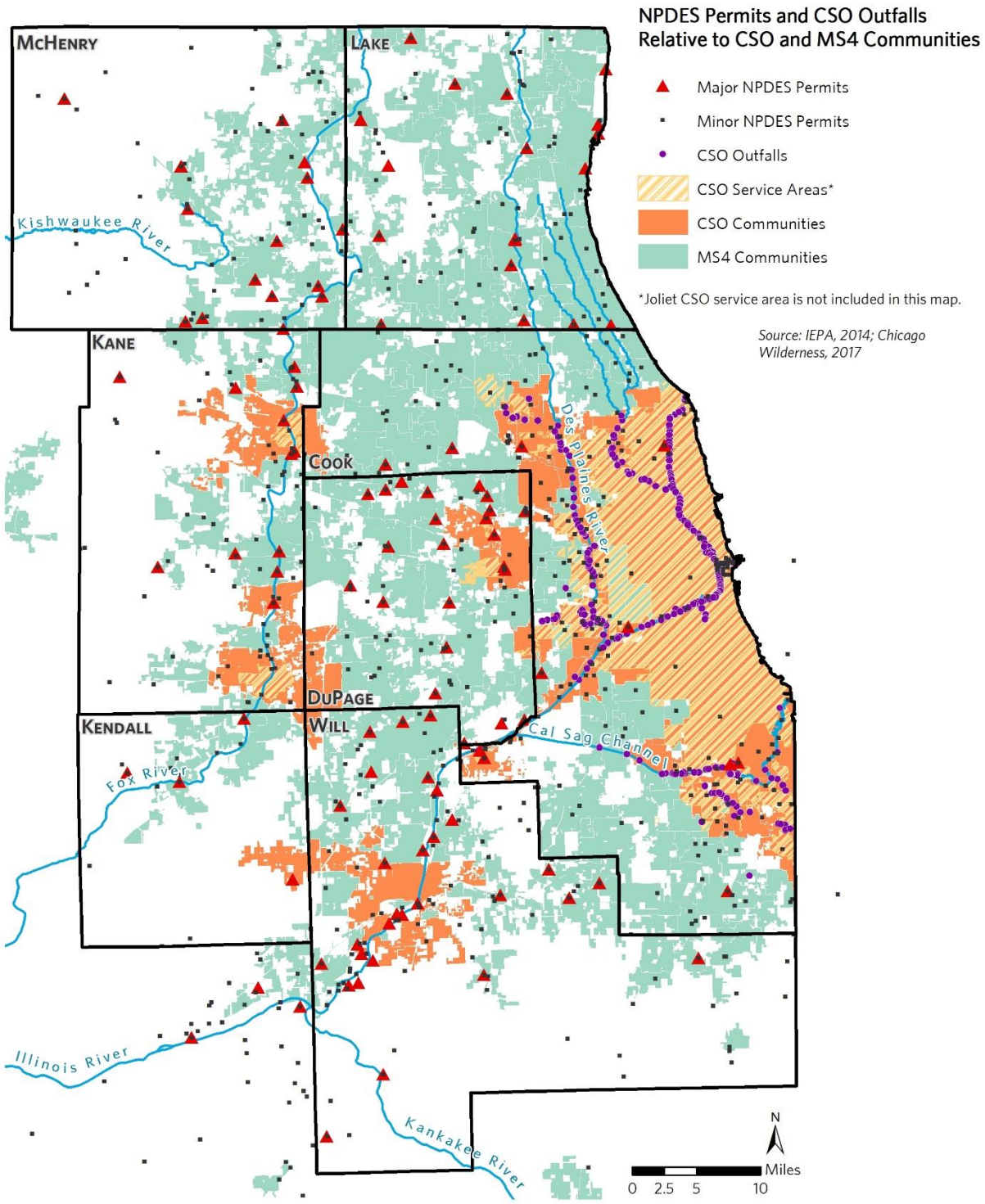
[51] Illinois General Use water quality standards do not apply "during periods when flows are less than the average minimum seven day low flow which occurs once in ten years" from 35 Ill. Adm. Code Part 302, Subpart A, Section 302.103 Stream Flows (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx, accessed 4/24/2017).

[52] http://digitaledition.chicagotribune.com/tribune/article_popover.aspx?guid=5de14248-937f-408a-909d-d2ee7c6c431a

[53] Chicago Wilderness Aquatics Task Force, 2009. Aquatic Needs Assessment. From Aquatic Data Gap Analysis project files of Holly Hudson, CMAP.

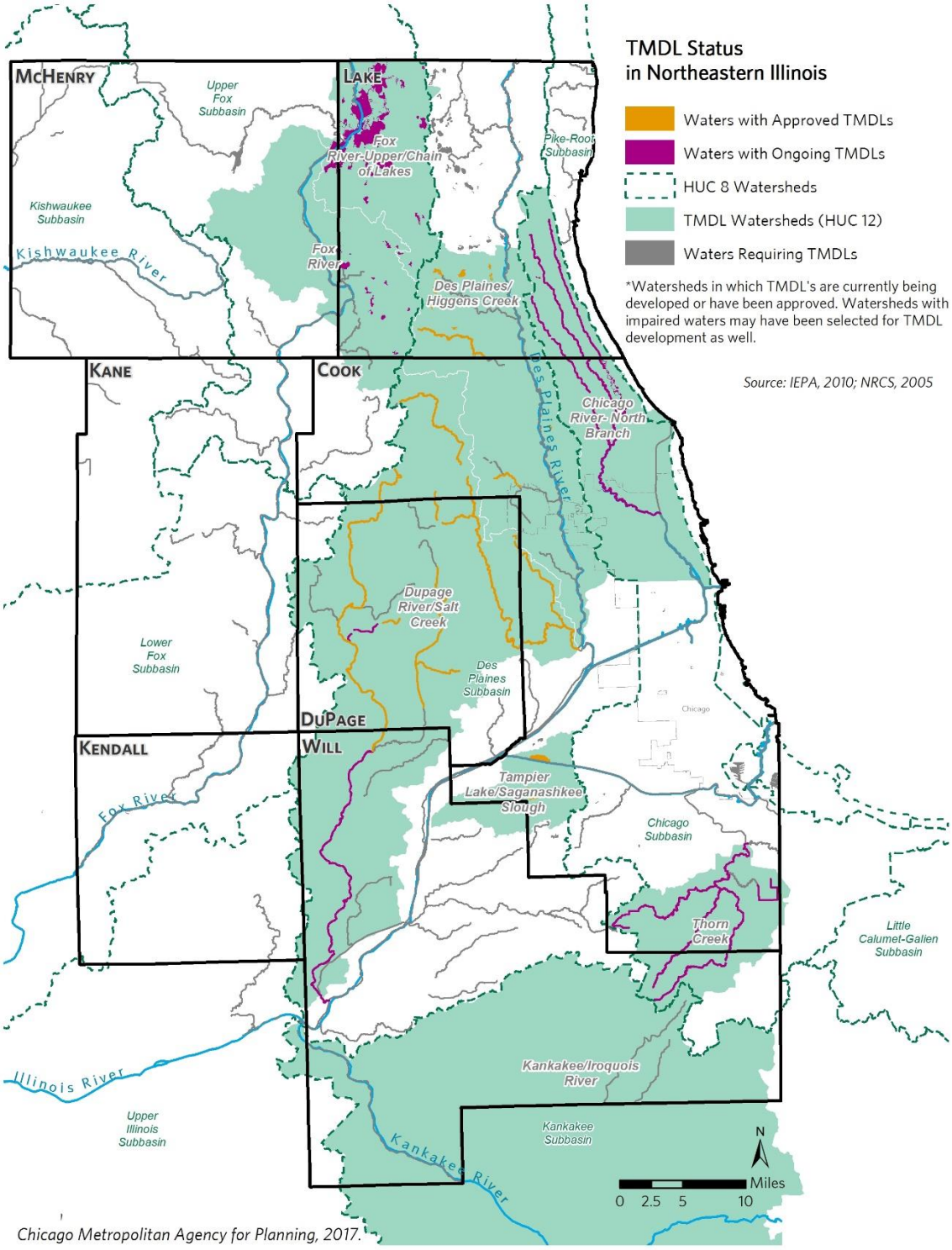
[54] Totals in this column differ because not all streams and lakes are assigned all of the Designated Uses list in the first column.

Figure 1: Point Source Discharge and MS4 Communities



Chicago Metropolitan Agency for Planning, 2017.

Figure 2: Waterbodies and Watersheds with TMDL Status



Source: *Cycle 2016 303(d) data (IEPA, 2017)*

Despite the lack of stream nutrient standards, two current priority pollutants for the state and region include nutrients (phosphorous and nitrogen) and chlorides (salts) from point and nonpoint sources. The challenges are significant, have far-reaching impacts (such as destructive algal blooms and drinking water toxicity), and are not yet adequately addressed by regulation or voluntary measures. However, the Illinois Nutrient Loss Reduction Strategy (NLRS) was released in July 2015 and implementation is underway by the IEPA with assistance from the Illinois Water Resource Center. Many of the region's point sources are monitoring nitrogen and phosphorous, and many also have phosphorous effluent standards (Figure 3.)

Nonpoint sources such as agricultural lands, however, are much more challenging to address. A few of the region's watershed groups are working on nutrient load reduction, including the DuPage River Salt Creek Work Group, Fox River Study Group, Hickory Creek Watershed Planning Group, and the Des Plaines River Watershed Workgroup. The agriculture industry, a significant contributor of nitrogen, has voluntarily embraced the program. Water quality trading was proposed as a strategy to control nutrients in the NLRS, but without a stream-based numeric standard as a goal, it is difficult to create a trading program.[55]

Chloride is being addressed via wastewater NPDES permits, and recent state action allows a watershed approach to meeting chloride standards, including the addition of source control best management practices (BMPs) to municipal MS4 permits (see below.) In addition to these strategies, stakeholders can work collectively to meet chloride and other TMDL requirements for waterbodies.[56]

One of the primary nonpoint source pollution control programs for addressing urban runoff from municipal separate storm sewer systems (MS4s, see Figure 1) are stormwater management plans required under the MS4 permit process. MS4s are technically point sources regulated under the NPDES program, but these systems collect and discharge stormwater runoff and the nonpoint source pollution it carries. The MS4 program is not adequately addressing water quality concerns, however, because the permit requirements are inadequate to reduce nonpoint source pollution enough to achieve water quality goals, and it is difficult and expensive to retrofit the built environment to reduce the runoff of pollutants.[57] Some communities have enacted ordinances and standards that help to manage this runoff, but progress has been slow and sporadic.

As for one of the most promising strategies for addressing water resource challenges broadly, the watershed plan, the Chicago region is fairly well-covered by IEPA-approved watershed-based plans, which meet USEPA's nine minimum elements for addressing nonpoint source pollution (Figure 4.) Presumably, these plans would lead to significant improvement in water quality (and other watershed conditions) if fully implemented. Unfortunately, they have proven to be very difficult to implement due primarily to resource and enforcement limitations[58], and thus have faced challenges in significantly improving water quality in the region. These plans also tend to be fairly narrow in their scope, focusing on water quality, rather than taking a more comprehensive look at a broad set of resources. Monitoring and data constraints, mentioned above, make it difficult to assess whether watershed plans are having an impact.

[55] Missouri has a WQ trading framework in place, up to permittees to figure out how to make it work.

[56] Amy W, personal communication at Calumet Stormwater Collaborative meeting, March 3, 2017. The standard will be 500mg/l for the CAWS (except Bubbly Creek.)

[57] Stormwater is covered in the Stormwater Management, Urban and Riverine Flooding strategy paper.

[58] Since 2000, the region has received an annual average of $2.5 million for nonpoint source pollution control projects via a variety of IEPA programs. Scott Ristau, IEPA, personal communication.

Lack of adequate funding for plan implementation is one challenge that is difficult to overcome, but could be aided by greater coordination of state and regional water resource management efforts, as well as other land use and infrastructure changes and investments. Unfortunately, the disconnected water regulatory and administrative frameworks make it difficult to make meaningful progress. Water is a singular resource, yet no single entity is responsible for managing it, which creates challenges getting on the same page and leveraging opportunities to achieve multiple benefits, efficiencies, and leveraged investments. Better coordination, greater empowerment of local watershed organizations to improve watersheds, and funding could result in efficiencies and synergies.

A lack of resources could be addressed to some extent through the use of appropriate stormwater, planning, and development policies, standards, and regulations that guide development to better protect and improve water quality, habitats, and water supply sources. Unfortunately, these tools also tend to be siloed, with little crossover between them. Stormwater regulations are often focused on preventing flooding; infrastructure design standards fail to include water quality benefits; local development regulations, primarily zoning and subdivision standards, are either inadequate or inadequately implemented or enforced to achieve water quality goals. Land use decisions, which are responsible for the majority of nonpoint source pollution and controlled at the local level, are largely free from concerns about degraded water quality, habitat, or water supply, and there is virtually no process by which the location and intensity of development considers impacts on water resources. One court ruling characterized the challenge by suggesting that some *local governments allow unchecked growth because it increases tax revenue, but these same governments do not sufficiently plan for the resources such unchecked growth will require.*[59] Research conducted as part of the Lands in Transition strategy paper found that from 2001 to 2015, nearly 140,000 acres of agricultural and natural lands were developed, yielding additional impervious acres and the associated runoff of pollutants in stormwater. Eleven percent of new development occurred in areas that were previously wetlands or floodplain, which presumably were accounted for elsewhere due to compensatory storage and wetland mitigation requirements.

One of CMAP's primary responsibilities is to assist local governments with land use planning and development strategies. Some of the guidance for this and other water quality work is contained in the Areawide Water Quality Management Plan, which is severely outdated.[60] One of the implementation strategies of that plan, the wastewater planning and Facility Planning Area function that CMAP continues to serve, requires examination and revision with IEPA to bring the process into the modern era.

Another issue that demands attention is the impact of a changing climate on the region's water resources.[61] Climate change may increase water temperatures in surface water bodies, including Lake Michigan, which could increase pollutant concentrations, lower dissolved oxygen levels, make lakes increasingly vulnerable to toxic and nutrient loadings, increase the probability of toxic cyanobacteria blooms, increase the threat of invasive species, and contribute greater amounts of sediment to these water bodies due to increased storm intensity. Increased storm intensity could also lead to increased risk of water pollution from combined sewer overflows, beach closures, and waterborne diseases. Decreased water quality due to these factors could affect availability of water of sufficient quality needed for uses, most notably public surface water supplies including Lake Michigan and the Fox and

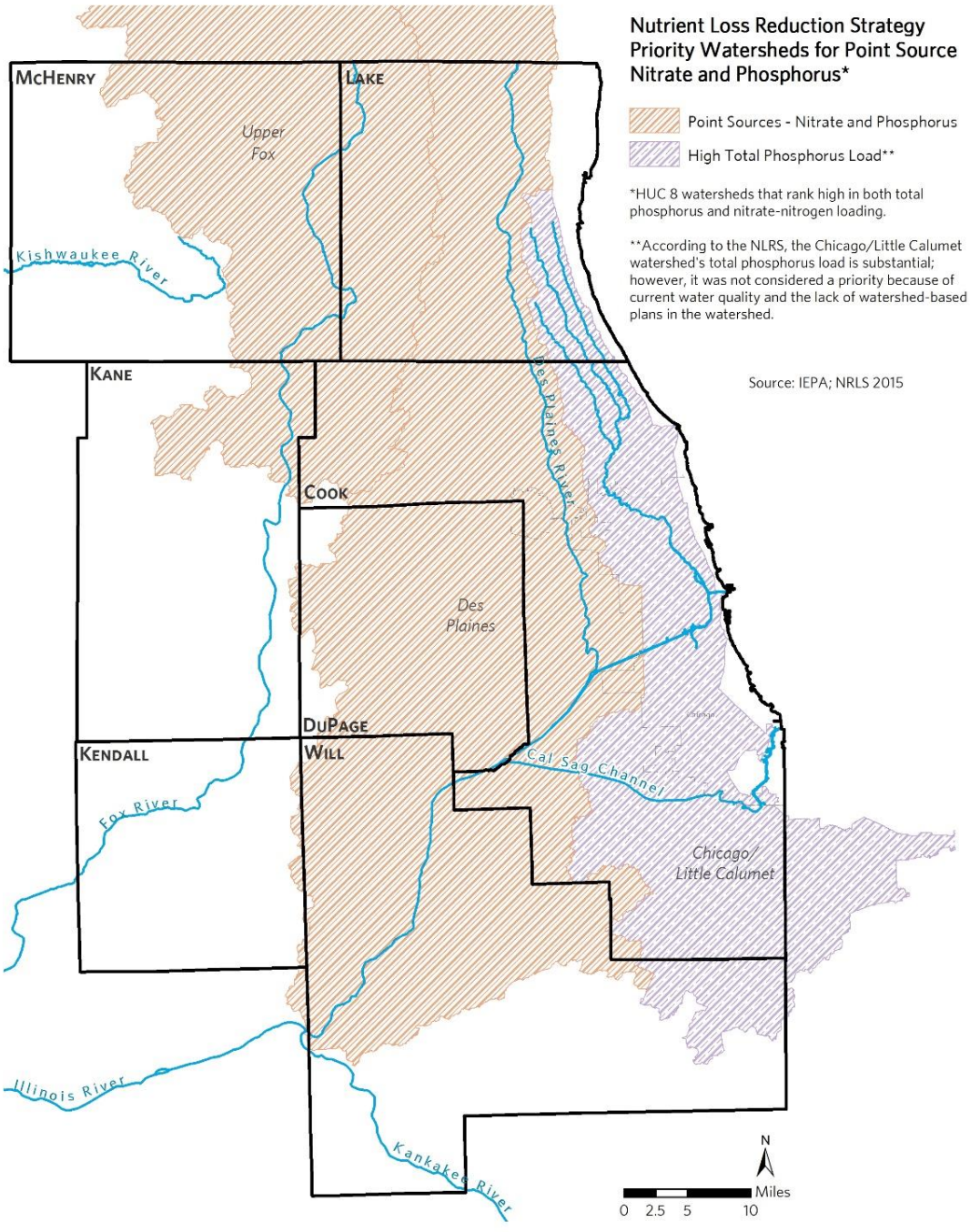
[59] Tri-State Water Rights Litigation 2009, 94-94.
http://www.sam.usace.army.mil/Portals/46/docs/planning_environmental/acf/docs/071709court_ruling.pdf

[60] The AWQMP, certified by the Governor in May 1983 and approved by the U.S. EPA in May 1984, includes over 800 pages of information on existing conditions assessments, water quality standards, water quality problems, models, BMPs, administrative framework, and financing strategies, all of which can be assumed to be somewhat or entirely out of date.

[61] EPA links to a variety of Climate Change and Water Tools

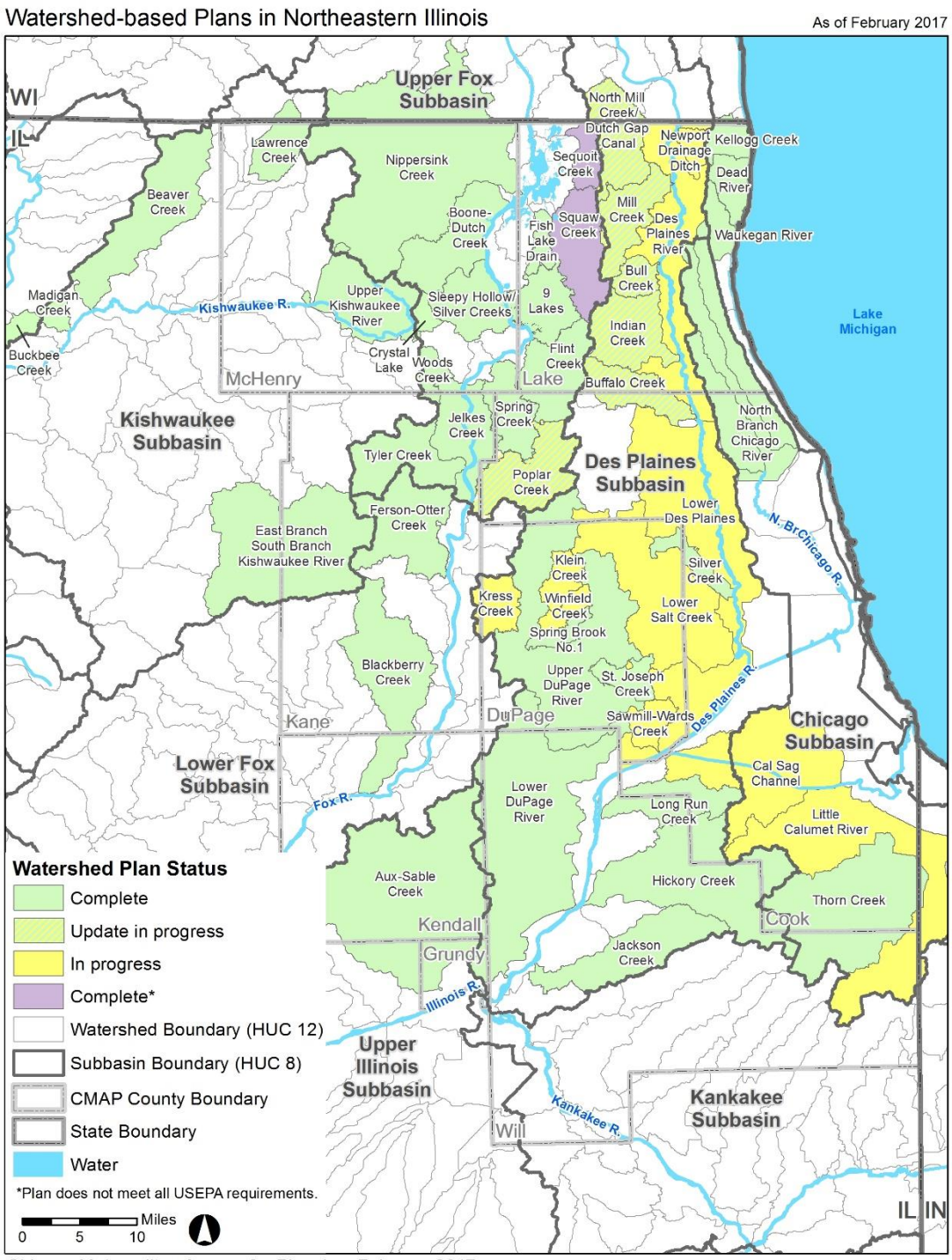
Kankakee Rivers. Flashier storms could decrease groundwater infiltration, and, when combined with projected droughts, could decrease shallow groundwater recharge rates and lower long term supply. In addition, heat waves and periods of drought could increase residential and agricultural demand on existing water supplies.

Figure 3: Priority Watersheds for Point Source Nutrients



Chicago Metropolitan Agency for Planning, 2017.

Figure 4: Watershed-based Plan Status



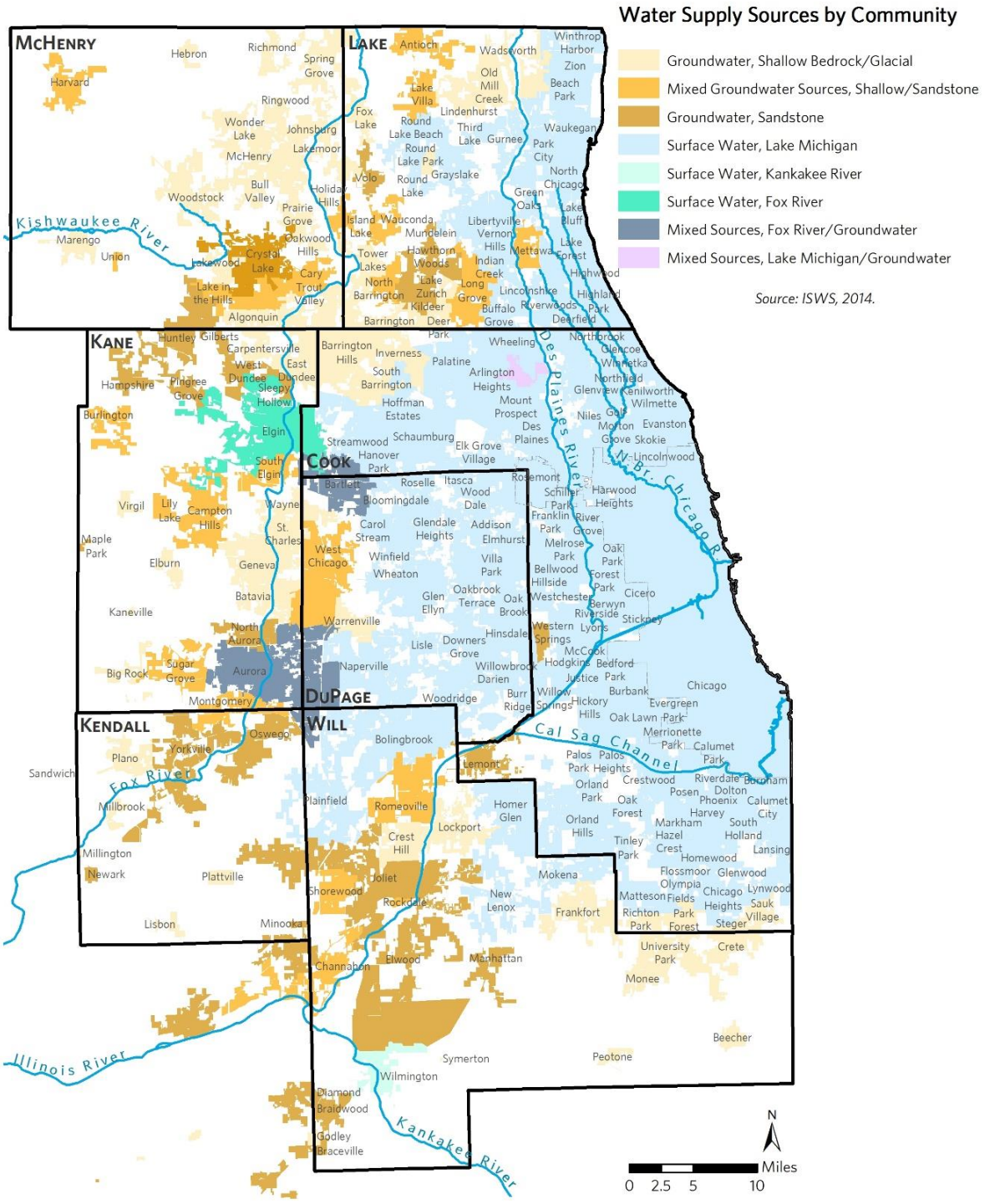
Chicago Metropolitan Agency for Planning, February 2017

Water Source Availability and Quality Constraints

Lake Michigan, groundwater sources, and the third major water source for the region, river water, each face a number of challenges. The Chicago region is water-wealthy compared to other locations in the U.S. and the world. The majority of the region's population and industrial users are supplied by Lake Michigan water, which is often perceived as a limitless resource that supplies the entire region with water. As a result, few residents, businesses, or municipalities consider water supply a concern in the Chicago region. However, Lake Michigan water supply is limited, and parts of the region supplied by groundwater are facing potential water shortages within the next couple of decades. For example, current withdrawals from the deep sandstone aquifers are occurring at twice the estimated sustainable yield rate. Figure 5 displays the water supply sources of the region's communities, and Figure 6 shows the change in population by water source.

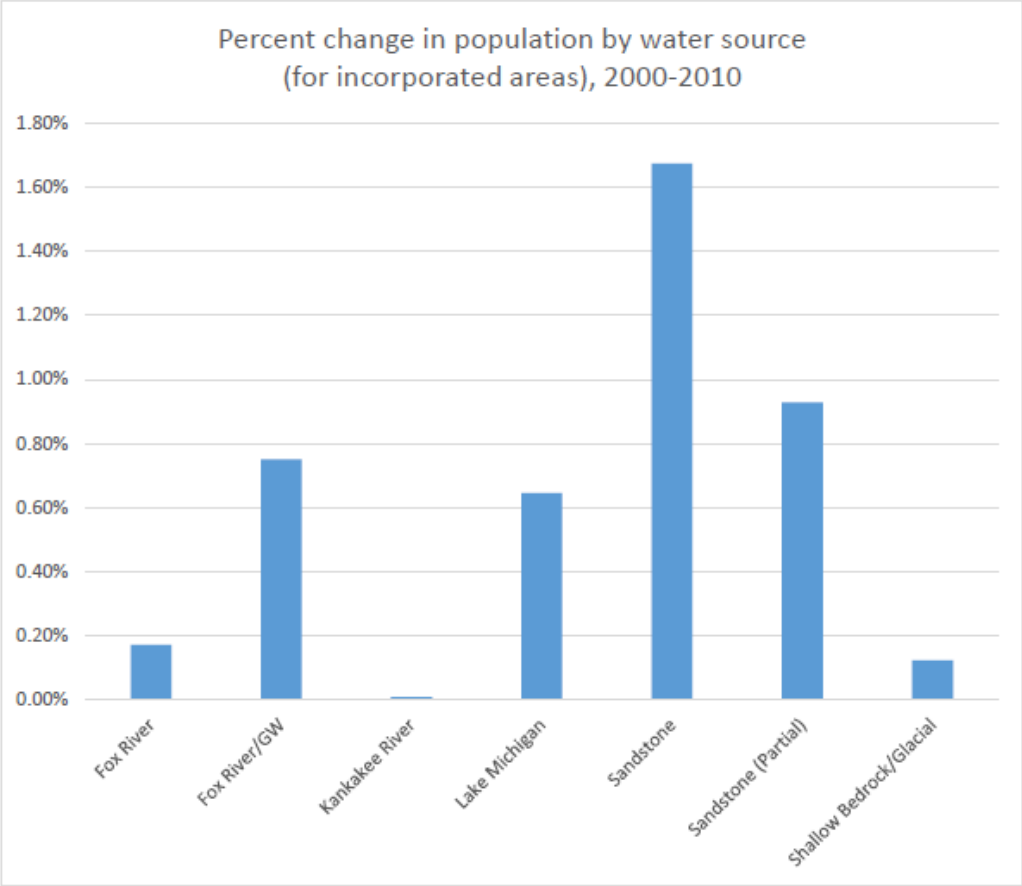
Though the *quality* of our water supply is supported by the Clean Water Act and Drinking Water State Revolving Funds (DWSRF), the *quantity* of our drinking water (including groundwater supplies) was not addressed at all by the CWA, leaving that up to the State of Illinois, which has taken only modest action. Thus, water supply is virtually unmanaged, except for Lake Michigan users, which are regulated by the international Great Lakes Compact and the US Supreme Court decree, which establishes a limit on the volume of water that Illinois can divert from the Lake Michigan basin into other basins via the Illinois River (Figure 8.) Per this court decision, Illinois law governs Lake Michigan water use for those communities receiving an annual allocation through IDNR. Water 2050 determined that only 4 to 6 percent of the allocation could be available in the future to communities not currently served by Lake Michigan water. Figure 9 shows the communities served by Lake Michigan water and the year of access. Climate change, with increasing amounts of precipitation, may increase the amount (percentage) of water that leaves the Lake Michigan basin as runoff, and thereby reduce the amount of the water allocation available for public drinking water supply.

Figure 5: Water Supply Source by Community



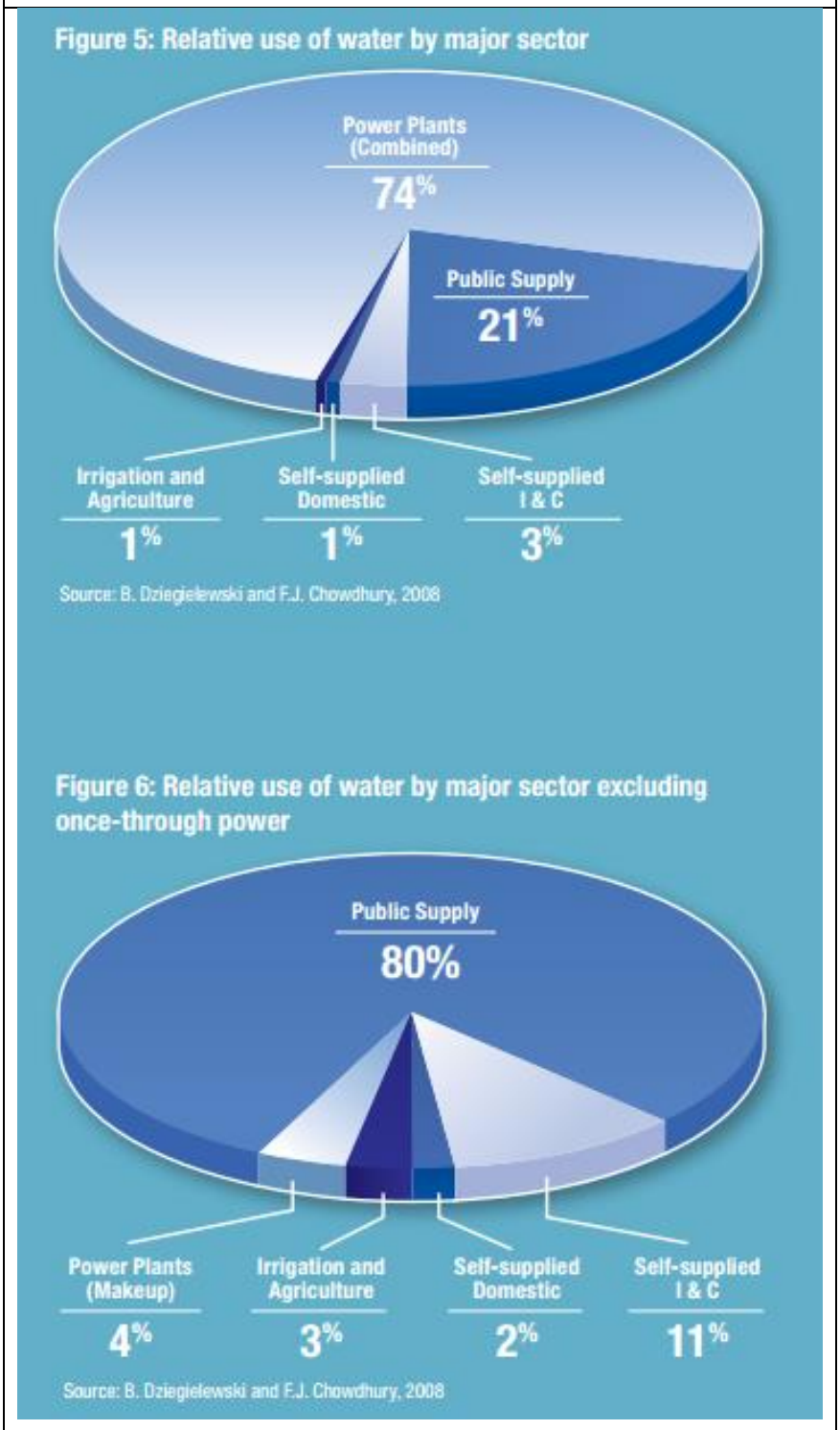
Chicago Metropolitan Agency for Planning, 2017.

Figure 6: Change in Population by Water Source, 2000-2010



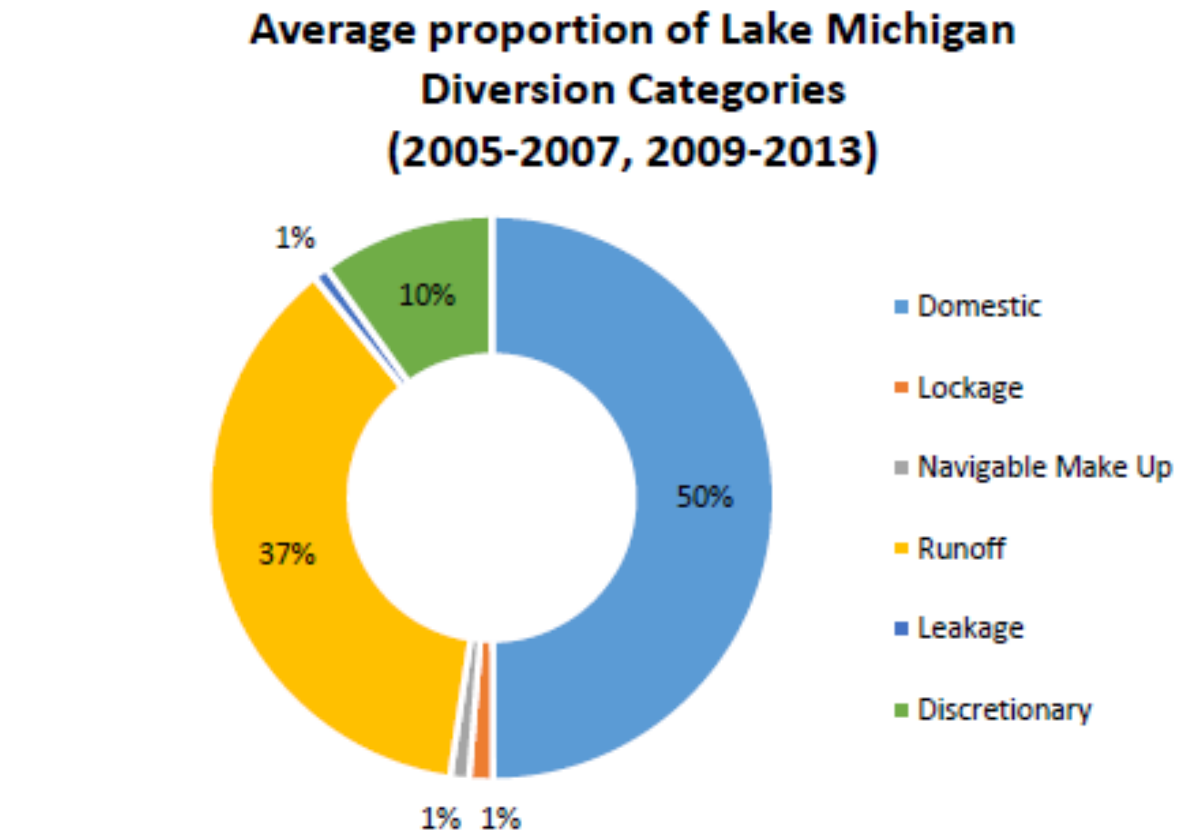
Note: Accounts for changes in water source (from groundwater to Lake Michigan) for the following communities: Bolingbrook, Ford Heights, Homer Glen, Mokena, New Lenox, Plainfield, Riverwoods, and South Chicago Heights.

Figure 7: Water Use



Source: *Water 2050, CMAP, 2010.*

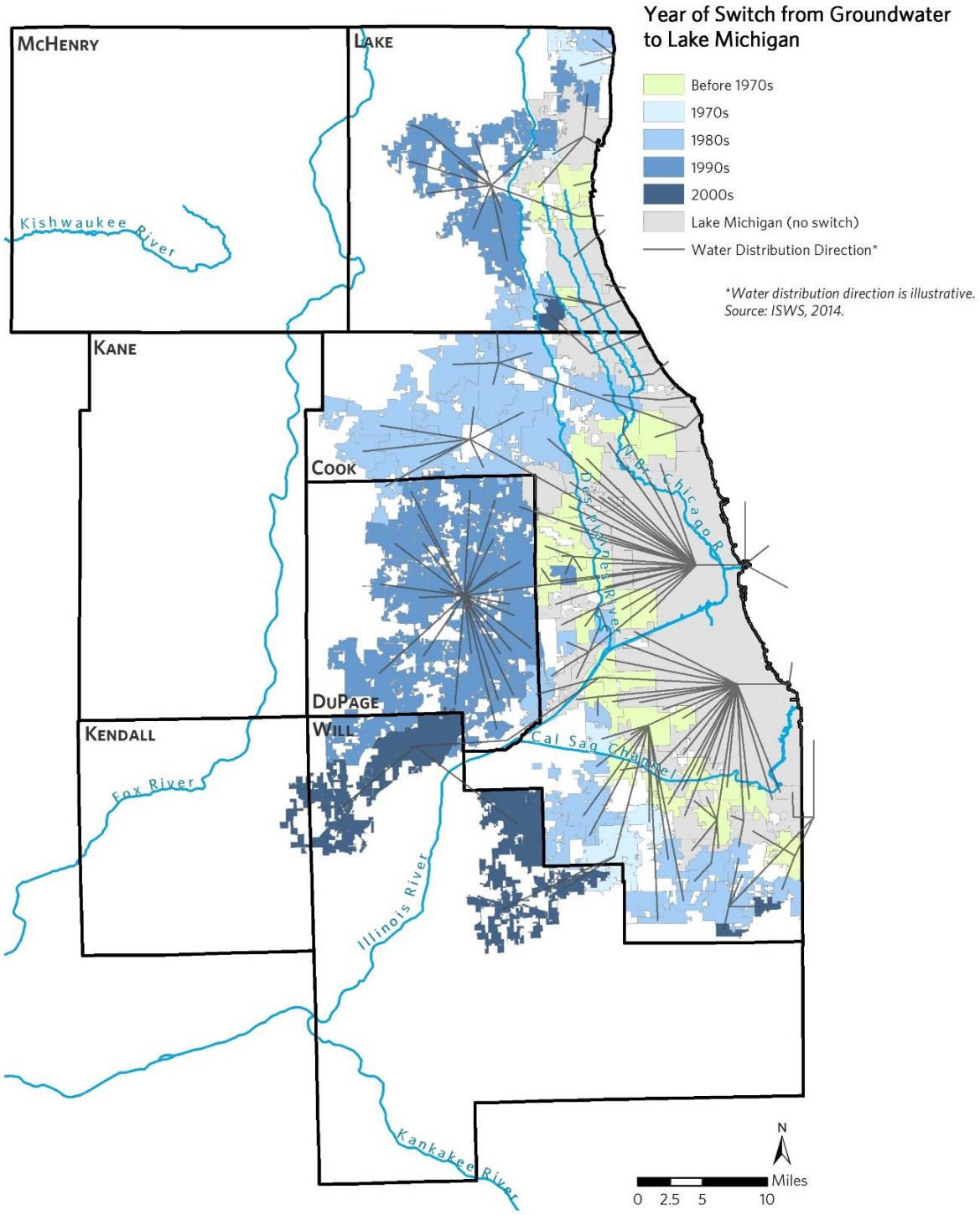
Figure 8: Lake Michigan Water Diversion[62]



Source: USACE, Lake Michigan Diversion Accounting reports
Report unavailable for Water Year 2008, 2014, and 2015.

[62] Diversion categories include: Domestic (household, commercial, and industrial use, including leakage from pipes); Lockage (flow used in locking vessels into and out of the lake); Navigable Make-Up (when large storms are forecast, the canal is drawn down before the storm to prevent flooding; navigational makeup water is used to return to navigation depths. Runoff (rainwater that falls within the historic Lake Michigan watershed but flows away from the region due to stormwater systems); Leakage (water estimated to pass, in an uncontrolled way, through or around the three lakefront structures); Discretionary (flow used to dilute effluent from sewage discharges and improve the water quality in the canal system).

Figure 9: Lake Michigan Water Distribution and Year of Access



Chicago Metropolitan Agency for Planning, 2017.

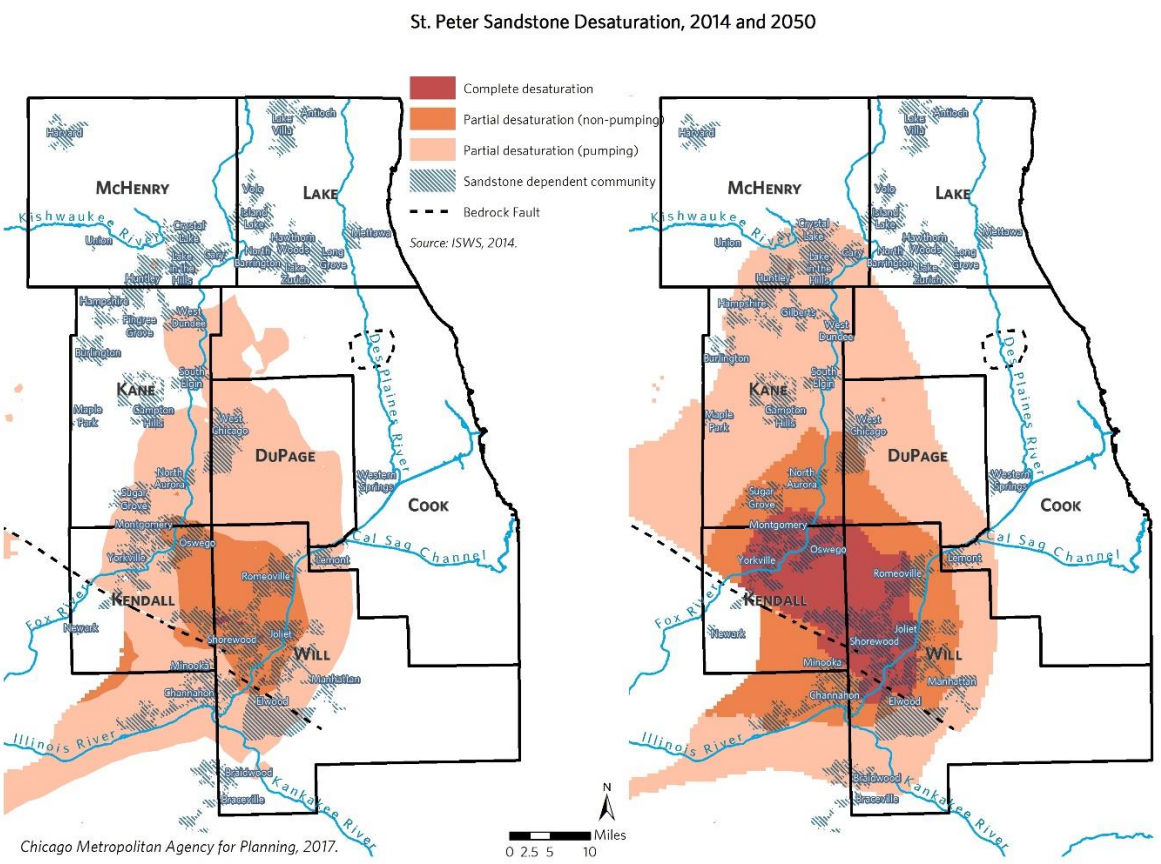
The second major source of water for the region comes from groundwater sources, including deep-bedrock sandstone aquifers, and shallower aquifers. In some areas of the region, groundwater is being withdrawn at a rate that exceeds the recharge rate, resulting in a net drawdown and depletion of these resources (Figure 10.) Drawdown of the deep-bedrock sandstone aquifer can result in decreasing well yields, increasing pumping expenses, increases in salinity, and increased concentrations of radium, barium, and arsenic. A cone of depression is being observed in the Joliet area, where the above impacts could be particularly acute. The deep aquifer is believed to be recharged via infiltration of water in an area west of the Chicago region, around Rockford.[63] Similarly, withdrawals from the shallow aquifer in northeastern Kane County and southeastern McHenry County are exceeding the recharge rate, which can result in greater drawdown interference, additional streamflow capture, and degradation of local surface water quality.

Portions of McHenry, Kane, Kendall, and Will County, home to a growing share of the region's population[64], are increasing withdrawals from these groundwater resources to accommodate new development. Land use and development decision-making processes may not be considering long-term water availability, which is in part due to a lack of detailed information about overall groundwater quantity and current withdrawals, as well as the lack of a mechanism for translating this information to a community's land use planning processes.

[63] Recharge from the southwest may be impeded by the Sandwich Fault, which cuts across Kendall and Will Counties and breaks up the layers of sandstone aquifers (see Figure 9.)

[64] We could cite the demographic snapshot when it's done.

Figure 10: St Peter Sandstone Desaturation



In addition to the increasing withdrawals that come from growing communities, the location and form of development can also affect shallow groundwater quality and recharge. The presence of roads, and conventional road salting practices, are linked to increasing chloride contamination in shallow aquifers, which increases the cost of treating this water before distribution to residents.[65] Sensitive aquifer recharge areas (SARAs) are locations that, if developed, could result in a reduction of the quantity and quality of groundwater recharge. However, the location of SARAs have only been identified for McHenry and Kane Counties and their incorporation into development regulations as important assets to protect is limited. New development continues to occur within natural areas identified in the Green Infrastructure Vision, which can lead to reductions in critical ecosystem services, like groundwater recharge and water purification.

The third primary source of water for the region, considered by some to have significant potential as a water source, are the Fox and Kankakee Rivers, which currently provide water to only a handful of communities. Water is withdrawn from these rivers, used, cleaned, and then returned to the rivers via wastewater discharges. Since these rivers are also natural ecosystems, the IDNR requires that minimum

[65] Illinois State Water Survey. 2016. Shallow Groundwater Sampling in Kane County, 2015. See http://www.isws.illinois.edu/pubdoc/CR/ISWSCR2016-04.pdf

instream flows are maintained, which effectively limits how much water can be withdrawn from these systems. Water flow is typically fed by stormwater runoff, wastewater discharge, and groundwater inflow. Water 2050 estimated the Fox River could support additional new withdrawals of 40-45 million gallons a day, which could provide the residential needs of over 450,000 people, not including commercial or industrial uses, or additional residents and other uses such as commercial and industrial.[66] The Kankakee River currently supplies one community and is also considered to be an underutilized water source. The Illinois State Water Survey is currently completing one of the first studies for this watershed.

These river systems present additional challenges due to potential contamination from various sources, such as chlorides, nutrients, and siltation, all of which make treating the water for human use more costly and difficult. Increasing stormwater runoff and wastewater effluent help to maintain the volume of water in the river, but introduce pollutants and contaminants in the process. Land use and development decision-making processes are largely not considering long-term water impacts on surface drinking water supplies. As the climate changes, more frequent heavy downpours and floods could increase the amount of sediment and contaminants mobilized and transported to surface waters used for drinking water. Warmer surface water temperatures also can create conditions suitable for pathogens and harmful algal blooms, which make water more difficult and costly to treat for domestic use.

Water Withdrawal Management and Source Protection

Water supply resources are managed by nine different state agencies, with different reporting requirements and little coordination. Information gathered by these agencies do not effectively inform decision makers, and what little source protection does exist may not coincide with the resource itself. While much is known about Lake Michigan withdrawals, groundwater withdrawals are largely unknown and unmanaged. Our understanding of the region's shallow and deep sandstone aquifers is improving, however much remains unknown about the overall supply of groundwater, and how much water is withdrawn by public and private users, including agricultural irrigation. The Illinois Water Inventory program (IWIP) is intended to help collect annual data on water withdrawal, water use, and water returns, but it is a voluntary program and its use is not widespread. Groundwater withdrawals are governed under the rule of reasonable use, which allows one to *withdraw groundwater to meet natural needs (e.g., household uses) and a fair share for artificial needs (e.g., irrigation), but not for malicious or wasteful uses*.[67] Illinois does not require a permit for groundwater withdrawals beyond the operating permit following construction that is issued by IEPA, which is non-expiring, though some Illinois communities have created Water Authority districts to help manage water supply.[68] Regardless of where groundwater is withdrawn, after it is used it is nearly always returned to a surface water system, which

[66] Water use is based on 87 gallons per capita per day, the mean value reported in "Residential Water Use in Northeastern Illinois" a research report by Benedykt Dziegielewski, SIUC, 8/25/2009. Available at http://www.cmap.illinois.gov/documents/10180/14452/ NE+IL+Residential+Water+Use.pdf/9a07c0d8-3733-48c3-94f6-abaa5bad1477.

[67] Water Use Act of 1983, 525 ILCS 45

[68] D.L. Uchtmann, 2000. http://www.farmdoc.illinois.edu/legal/pdfs/using_groundwater.pdf. "In addition, the Act requires persons planning to develop new wells expected to withdraw more than 100,000 gallons on any day to notify the local Soil and Water Conservation District before construction of the well begins. The SWCD, either by itself or in concert with other agencies, must (1) notify other local governmental units that may be impacted by the new withdrawals, (2) within thirty days, complete a review of the likely impacts of the proposed new withdrawal on other water users, and (3) make public the findings of the review."

ultimately carries this virtually irreplaceable resource to the Gulf of Mexico. Without critical information about existing supply and current use, as well as a structure to monitor and manage withdrawals, coordinating a sustainable withdrawal rate among different users continues to elude the region. Furthermore, there are no statutory remedies for groundwater disputes and no contingency plans for droughts.

Unlike groundwater and surface water, the Great Lakes Compact provides a framework to coordinate Great Lakes water withdrawals. IDNR is paired with IEPA and the Illinois Pollution Control Board (IPCB) for purposes of the preservation and use of Lake Michigan water. Illinois' Lake Michigan Water Allocation program, administered by IDNR, provides permittees (communities, utilities, and industries) with an annual allocation of water with several conditions.[69] The allocation process itself operates in such a way that if a given permittee is not using their full allocation, their allocation amount could be reduced in subsequent years, providing an incentive to maximize water use and future availability for new population or economic growth rather than conserve. Over half of Illinois' Lake Michigan allocation is typically used for public drinking water supplies, while a significant portion of the diversion (nearly 28 percent) is attributed to the amount of rainwater that previously flowed into Lake Michigan and now is collected by storm sewer systems and sent out of the region via the Illinois and Mississippi Rivers (Figure 8.) [70] This portion of the diversion limits how much of Lake Michigan allocation can be used for domestic use. In other words, if this water was not diverted elsewhere, additional Lake Michigan water could be used for water supply for the region.

It is worth highlighting that Water 2050 promoted water conservation as the most cost-effective means of increasing the effective water supply without creating or tapping additional resources. Unfortunately, conservation practices have not been implemented to a significant degree in the region. While significant technological improvements have been made in plumbing and fixtures in recent years, much of the region's building stock was built before these practices were in place.

The complementary strategy to withdrawal management is protection of water quality and inflows to the sources themselves. Ensuring adequate quantity of water is being recharged to the various sources (groundwater, river water, and Lake Michigan) is important, and ensuring that this water is as clean and usable as possible is equally as important. Dirty water is harder and more expensive to purify to domestic standards than clean water, and it is nearly always cheaper and easier to maintain clean water than to clean it after it has been contaminated. Stormwater runoff, wastewater effluent, and groundwater flow are the primary sources of inflow to our water sources. Maintaining the cleanliness of these inflows should be a priority for the region.

Water Service, Infrastructure, and Facilities

There has been a significant amount of national and regional focus over the past few years on the challenges faced by our aging infrastructure. Water, sanitary and storm sewers, and wastewater treatment systems require significant investment to maintain adequate service levels, protect the health and safety of residents, reduce sewer overflow events, produce high quality effluent, and generally manage our water resources adequately. In addition, new development that requires the extension of new infrastructure may not adequately cover the additional long-term costs of maintaining and upgrading the infrastructure. Meanwhile, previous infrastructure investments in disinvested areas represent 'dollars in the ground' that may be significantly underutilized, wasting the potential of the

[69] The program is authorized by the "Level of Lake Michigan Act" [615 ILCS 50] and is implemented by the IDNR/OWR's Lake Michigan Management Section using its Part 3730 Rules "Allocation of Water from Lake Michigan"
[70] CMAP. 2009. Water 2050

original capital investment, not to mention the ongoing full maintenance costs of these investments. For example, Lake Michigan water continues to be distributed to neighborhoods in Chicago and Cook County that have experienced population loss, but rather than optimizing these flows in areas with sunk costs, suburban communities continue to grow and invest in new infrastructure to access Lake Michigan water.

On the water supply side, increasing capital improvement costs are compounded by high levels of water loss, lack of full cost pricing, and increasing water regulations to maintain safe drinking water. While the levels of water loss are largely unknown among groundwater and surface water suppliers, IDNR's Lake Michigan Allocation program requires annual reporting on water loss and requires loss levels to be below a specific threshold as a condition of receiving a water allocation permit. Twenty-one percent of Lake Michigan permittees face chronic water loss problems.[71] Nonrevenue water, which refers to both water lost through aging and leaky infrastructure as well as apparent losses due to metering and administrative issues, is not only a waste of a valuable resource, but often results in a loss of revenue for the community water supplier, which can hinder the supplier's ability to maintain the water system. Furthermore, water rate revenues rarely recover the full cost of providing water service and the long-term maintenance of the system often suffers as a result. This creates a pricing, or funding gap that communities must address.

The Chicago region has hundreds of community water supply systems, most of which are owned and managed by a municipality and may lack the economies of scale and staff capacity to address needed improvements. This is particularly evident for small facilities and systems, including septic systems and small water suppliers, which can face significant capital constraints for upgrades and even simple maintenance. These small systems and facilities may not perform at a level that adequately protects water quality under all conditions, and septic systems do not appear to be well documented or mapped in an accessible or manageable way. This challenge has roots in resistance to charging full costs for service and system upgrades and maintenance; many communities are reluctant to establish utilities or otherwise charge residents more to help defray the costs of these systems. Furthermore, these systems may not be adequately designed for future conditions that can be expected due to climate and other changes.

A fairly recent trend in the region involves the capture, recovery, and reuse of valuable resources, including grey water recycling and reuse, nutrient and biosolids recovery, and gas and energy capture. Other innovative and sustainable wastewater treatment strategies, such as land application of effluent, show continued promise for smarter water management. Rainwater, greywater, and wastewater reuse are viable sources of additional water supply that could reduce demand on constrained supplies and prioritize higher value potable water for higher value needs. Capturing and using "free" rainwater to flush toilets seems like a good idea, yet we continue to pump valuable, finite groundwater for this purpose. Currently, the process for harnessing these sources is restricted or subject to real or perceived barriers, such as plumbing and building codes, demand uncertainties, and perception of wastewater as unsuitable for reuse.

Finally, some of the region's vulnerable people and places may be disproportionately impacted by degraded infrastructure, poor drinking or stream water quality, and environmental pollution, in addition to climate related impacts such as heat and repetitive flooding. These communities typically experience low reporting of problems, low staff and financial capacity to respond or properly manage municipal assets, and an inability to raise local revenues due to low household income and more pressing

[71] CMAP. 2014. An Assessment of Water Loss among Lake Michigan Permittees in Illinois.

administrative challenges. They also may be more susceptible to ongoing contamination problems, such as the lead challenge experienced by Flint, MI.

Waterways, Waterbodies, and Habitat

Many demands are placed on the region's waterways. They are expected not only to act as receiving waters and conduits for our wastewater and stormwater, but as recreational amenities, commercial transportation routes, and water supply. It is often only after these human needs are met that we consider the habitat and ecosystem functions of these resources. Despite the restoration projects, dam removals, and open space preservation activities over the years, the majority of the region's aquatic, wetland, and riparian ecosystems continue to be in a poor to moderate state of health. Regulatory and conservation approaches have not been effective in preventing continued, large and small-scale losses, direct and indirect (e.g., hydrology) modification, management and restoration challenges, and other impairments such as toxic cyanobacteria, and invasive species[72]. As with water quality impairments, inadequate resources exist to protect and improve habitat quality (primarily IDNR, but also EPA, USFWS, and USACE.)

Most remaining higher quality stream systems and watersheds can be found in the agricultural areas of the collar counties, particularly headwater and low flow streams. Figure 11 shows higher quality streams (Biologically Significant and A/B stream ratings) and headwater streams, juxtaposed with the "developed" landscape shown in Figure 12. Yet these sensitive watersheds and stream systems are not adequately protected by local land use and development regulations from nonpoint source pollution nor habitat degradation. The Clean Water Rule, a federal initiative intended to extend additional protective status on small streams and wetlands, is facing significant opposition from the current administration.[73] Illinois' antidegradation policy, to *protect existing uses of all waters and maintain the quality of waters with higher quality than the minimum water quality standards*[74] accounts only for point source discharges, and not for habitat or hydrologic modifications.

Our region's most well-known aquatic resource, however, is Lake Michigan, which provides drinking water for 12 million residents (not just in Illinois), a relatively clean and abundant resource for industry, and an invaluable aesthetic, recreational, and commercial resource. While protected to a significant degree by international agreements, Lake Michigan is an impaired body of water that deserves greater attention as greater drought and climate change are expected. The Lake Michigan Lakewide Management Plan (LaMP, 2008[75]) outlines steps to achieve the objectives of the Great Lakes Water Quality Agreement between the U.S. and Canada and overseen by the U.S. EPA. However, Illinois' nearshore and shoreline habitat, which is entirely within the Chicago metropolitan region, is degraded and fragmented, despite a few habitat improvements such as artificial reef establishment and some wetland and ravine restoration projects. Native lake species face some challenges, such as a low sturgeon population, and a key food web species, *Diporeia*, has nearly disappeared. Invasive species, both current and potential, are a major threat, and the Asian Carp's presence in the CAWS is cause for alarm due to the destruction it could cause to Great Lakes and its tributaries, i.e., its connected river and other aquatic ecosystems. From a water quality perspective, pathogen exposure from urban runoff and combined sewer overflow events can endanger public health, nutrient runoff can result in widespread

[72] the state lacks an early detection and rapid response plan for aquatic invasive species

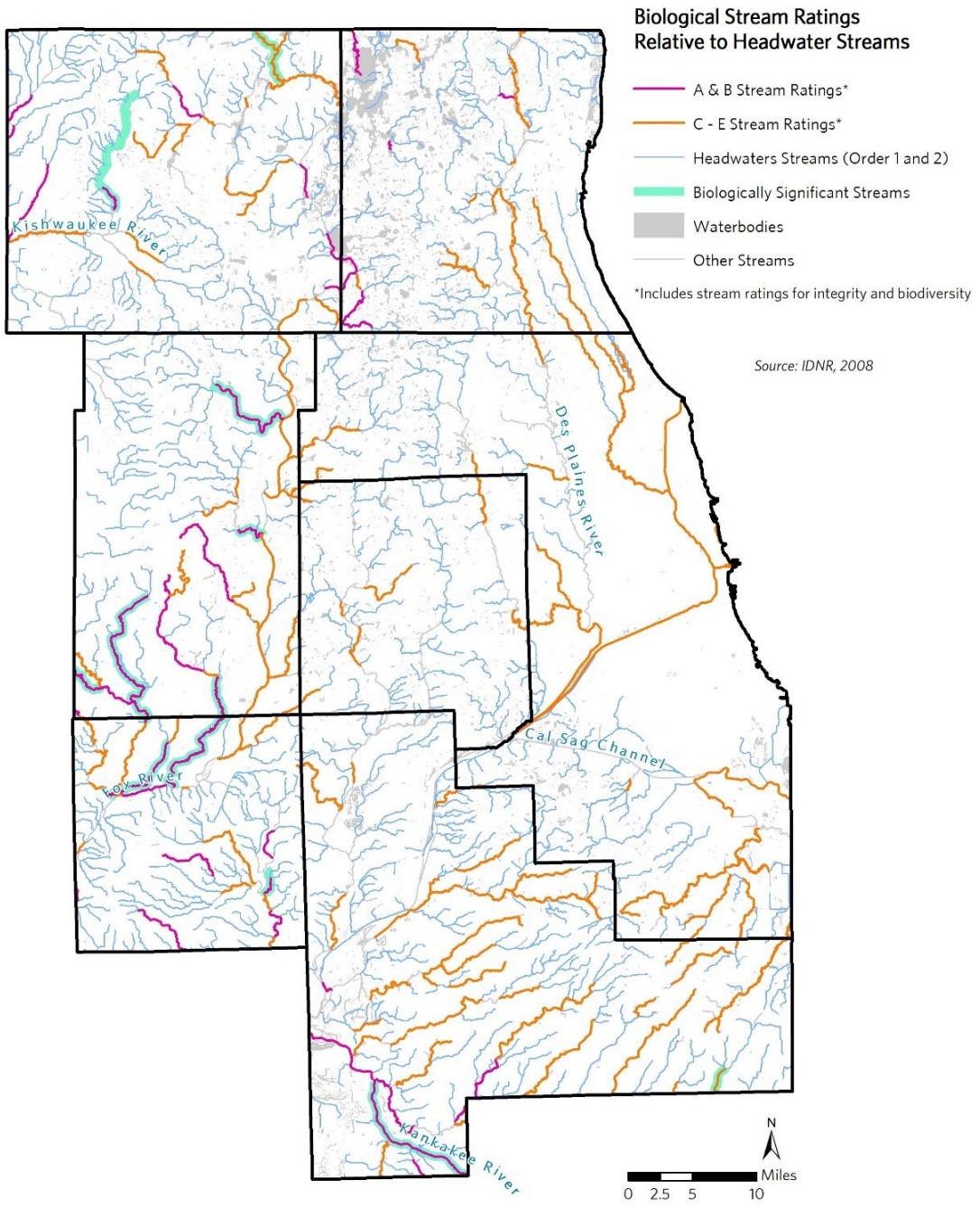
[73] https://www.washingtonpost.com/news/energy-environment/wp/2017/02/27/trump-to-direct-rollback-of-obama-era-water-rule-tuesday/?utm_term=.b9478f16dc3e

[74] https://prairierivers.org/wp-content/uploads/2008/07/PRN_Antidegradation_GuideBook.pdf

[75] *State of the Great Lakes 2011 Highlights*, USEPA, August 2013.

algal growth and associated problems, and a fish consumption advisory for Mercury exists for Lake Michigan.[76] Toxic chemical concentrations, however, are low and decreasing.

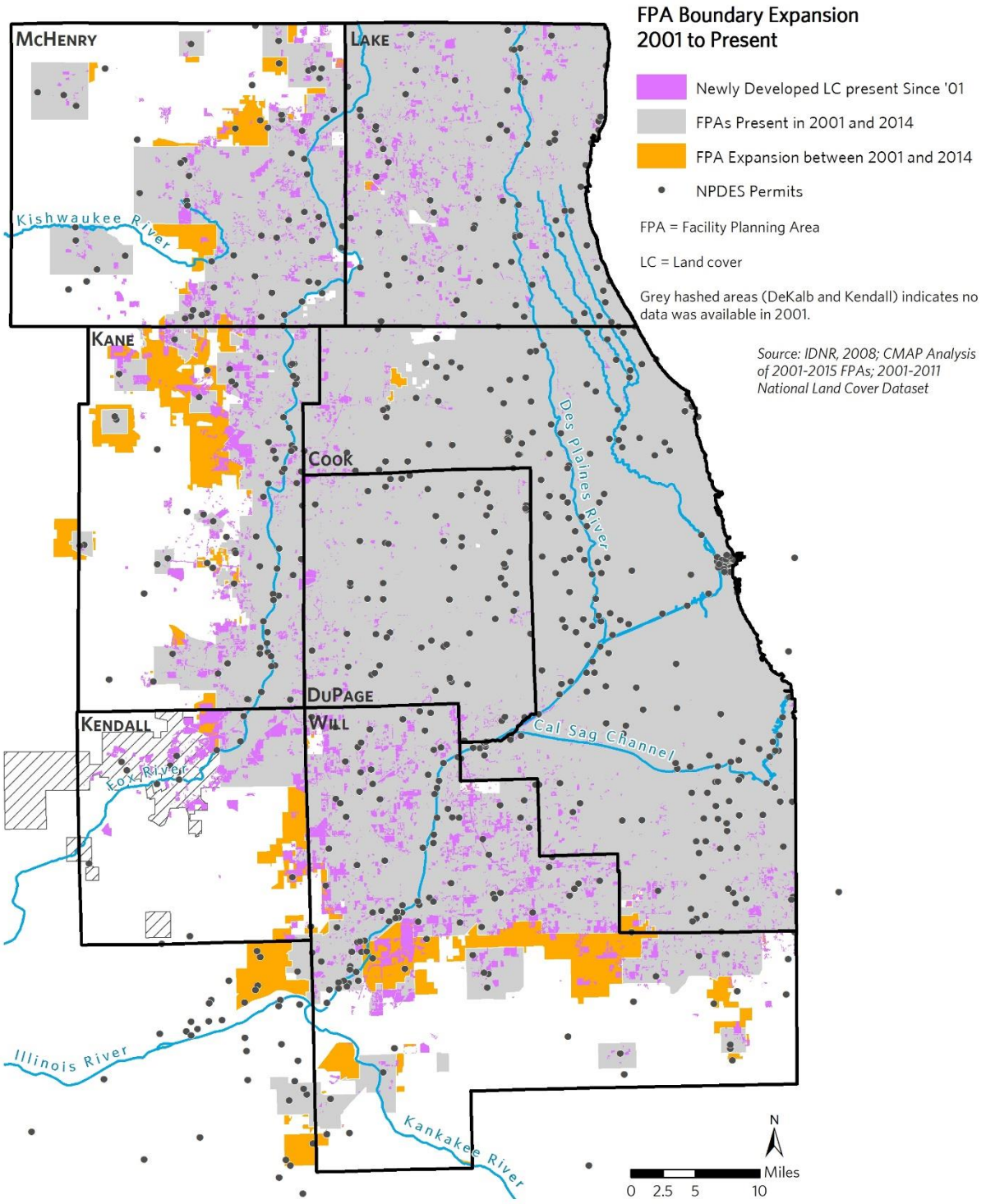
Figure 11: Stream Quality and Headwater Streams



Chicago Metropolitan Agency for Planning, 2017.

[76] Updated fish consumption advisory released Feb. 13, 2017: http://dph.illinois.gov/topics-services/environmental-health-protection/toxicology/fish-advisories/map http://dph.illinois.gov/topics-services/environmental-health-protection/toxicology/fish-advisories/map/lake-michigan-multicounty

Figure 12: Development and Point Discharge Locations



Chicago Metropolitan Agency for Planning, 2017.

Water Resources Policy Framework

Our water resources are one of the region's most significant regional natural assets and contribute not only to our economic and community development, but to our high quality of life. The Great Lakes region, and the Chicago metropolitan region specifically, enjoy abundant access to freshwater resources, not only for drinking water but for industrial processes, recreation, and transportation of goods. Our climate currently provides sufficient rainfall to support a strong agricultural sector, and to replenish the Great Lakes and keep our rivers and streams flowing. Our water resources provide value beyond those calculated by typical economic accounting, adding millions of dollars of ecosystem services to the region annually. Yet despite our position as a water-rich region, climatic changes may change the amount and frequency of precipitation in the region, and may drive people and economic activity to the region from those parts of the country that experience devastating drought or impacts from a changing sea level. Fresh water is a globally scarce resource that requires greater and more urgent attention to avoid squandering it for future generations. Water should be recognized as a singular resource that is virtually infinitely reusable if managed properly. Additional strategies for water resources can be found within the recommendation to *Support adaptive management of water resources* in the Climate Strategy paper.

In order to maintain the Chicago region's competitive position as water-rich, CMAP and its partners should:

- Improve regional coordination and information
- Improve land use planning and policy approaches to protect water resources
- Coordinate subregional water withdrawals
- Invest in infrastructure and facilities
- Prevent continued degradation of water quality and aquatic systems

1. Improve regional coordination and information

1.1 Adopt integrated water resource management (*One Water*) as a conceptual framework

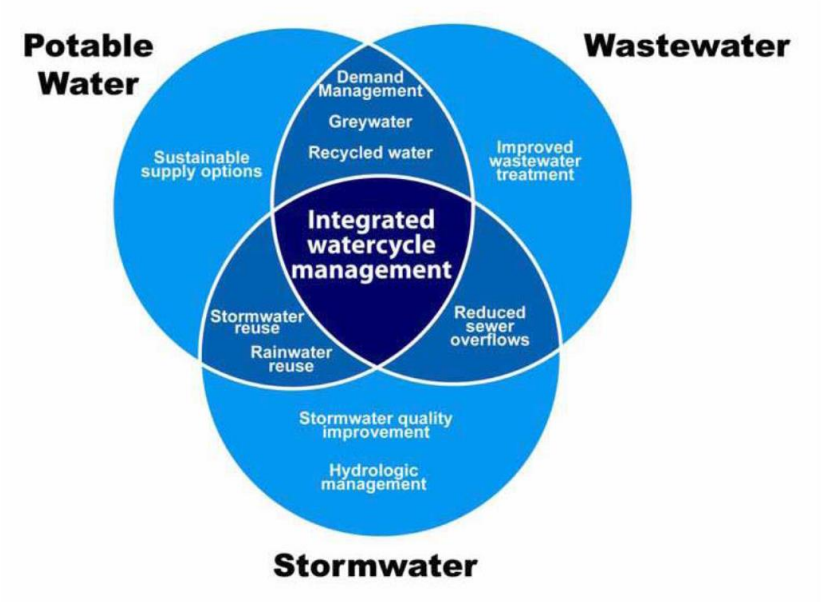
The region should embrace a more inclusive and multi-faceted approach to sensible and prudent management of our water resources. In recent years, *Integrated Water Resource Management* (IWRM), also known as *One Water*, has been gaining traction among water managers and stakeholders. One Water seeks to integrate planning and management of water supply, wastewater, and stormwater in a way that: considers the water cycle as a single integrated system in which all water flows are recognized as potential resources; minimizes the impact on the environment; and maximizes the contribution to social economic vitality. [77,78,79] One Water promotes management and planning at the watershed scale, integrating management with that of other resources, collaborative- and stakeholder-based planning and decision-making, and adaptive management, as well as the use of best practices and innovation backed by sound science. A number of these principles are reflected in the strategies described in this

[77] Understanding Integrated Water Resources Management (IWRM) (USACE, 2014)
[78] AWRA
[79] Within the context of the U.S., there are policies that implicitly reflect IWRM principles; however, the principles are not being used as a foundation for developing policy. Research has also stated that current policy frameworks for water quality are fragmented, and have likely contributed to the increase in nonpoint source pollution over the past 30-40 years.

strategy paper. Adopting One Water approach can bolster the agency's water resource planning framework as many of these principles are already at the core of CMAP's work.[80]

Within the Midwest, other MPOs that have used an integrated water approach to plan and manage water resources at the regional level include Southeast Michigan Council of Government, the Metropolitan Council (Minneapolis – St. Paul), and the Southeastern Wisconsin Regional Planning Commission. While an integrated approach could help the region address threats from aging infrastructure and climate change, and achieve substantial improvements and efficiencies to the region's water quality, ecosystems, and water supply, the greatest challenge will be garnering the support from local stakeholders. CMAP should evaluate how other MPOs are implementing One Water and identify opportunities to update policies and practices.

Figure 13: Placeholder for One Water / IWRM graphic (not critical)



1.2 Improve state and regional coordination

A number of state and federal agencies including FEMA, USACE, IEPA, and IDNR each oversee different aspects of our water resources using separate rules and funding programs, including flood mitigation, water quality, water supply, wetlands, and stream and riparian habitat. Over the years, some progress has been made to coordinate across water sectors and programs, yet better coordination and leveraging of investments could result in more positive, mutually beneficial, and efficient outcomes. A state level comprehensive water planning agenda and funding program that supports CMAP's regional efforts would be a welcome strategy to many in the Chicago region.

CMAP has a long history of working to improve water resources, and while IEPA funding to support the agency's water quality management planning has been stable, funding for other water-related work has been episodic and opportunistic. CMAP should work with the state and regional agencies and organizations to secure a sustainable source of funding for CMAP to provide planning and technical

[80] Understanding Integrated Water Resources Management (IWRM) (USACE, 2014)

assistance for all water resources in the region. In addition to direct grant funding, CMAP can pursue partnerships to provide technical assistance with, e.g., USACE, ISWS/IDNR, MWRD, and county stormwater agencies. Such support can be used to update regional water plans, including Water 2050 and the Areawide Water Quality Management Plan. The region may also consider combining these water plans into a regional, multipurpose, integrated water resources plan that is more closely linked to land use and transportation investments.

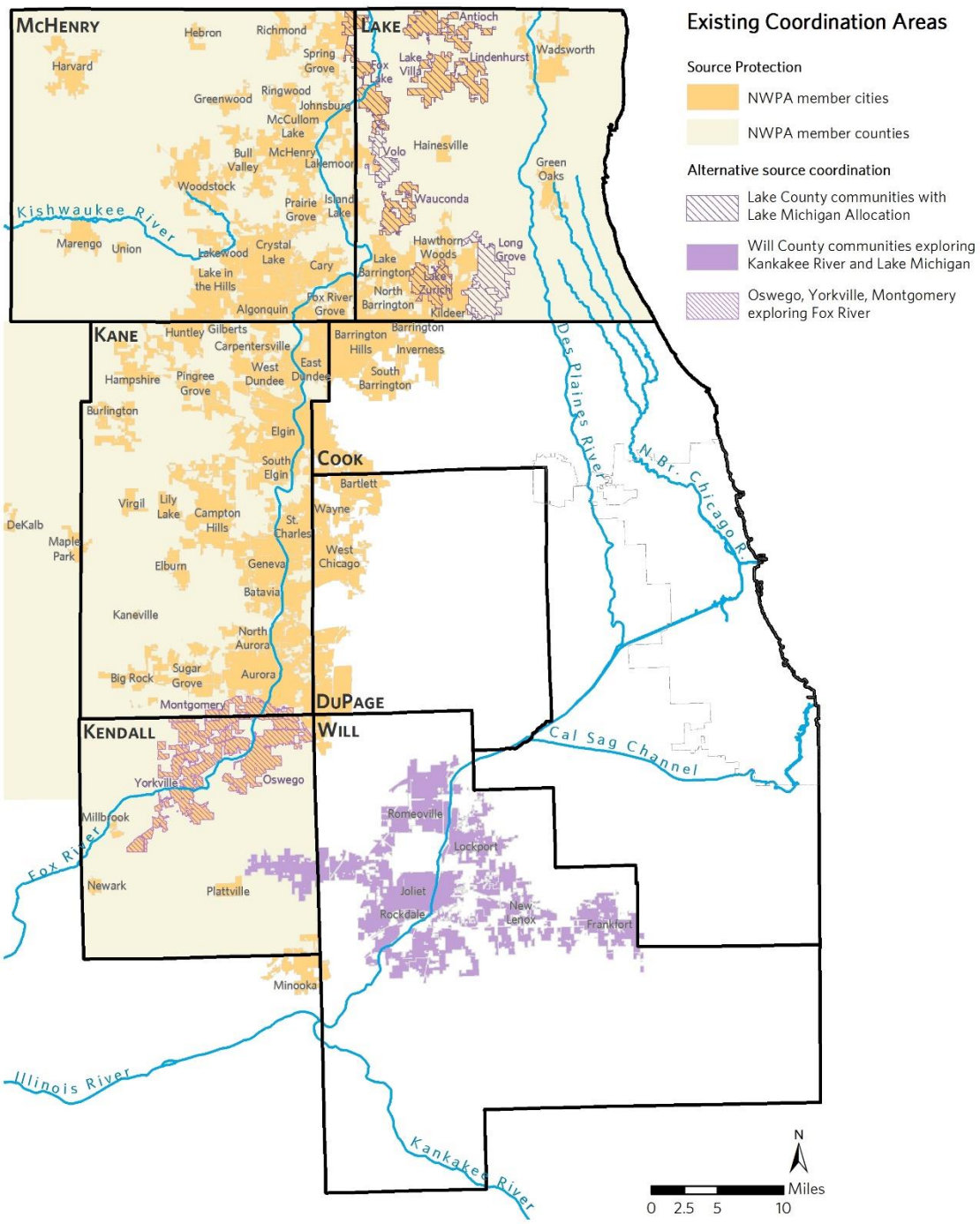
As the designated management agency for implementing the Areawide Water Quality Management Plan (AWQMP), CMAP already has significant responsibility for guiding the region to protect and improve water quality. However, the guiding document for this work is over 30 years old[81] and is in dire need of an update to account for changing water quality conditions, new technologies, new data, and new strategies for water quality management. CMAP should work with IEPA and other stakeholders to update the AWQMP and wastewater planning process so that it better achieves IEPA and CMAP goals for protecting water quality in the region, establishes a new approach to wastewater planning, and accounts for other water resource management goals such as stormwater management and water supply protection. In pursuing this goal, CMAP and the IEPA should pursue a watershed-based approach to wastewater and other natural resources planning efforts.

At the regional scale, CMAP should take a lead role in coordinating the various regional and subregional water management agencies and other stakeholders to foster collaborative relationships that lead to more integrated water resources management across sectors and agencies.[82] CMAP is uniquely positioned to help lead and support regional water supply discussions. CMAP should also connect and support partners who are organizing around shared resources, like the Northwest Water Planning Alliance, and potential future groups organizing around the Fox and Kankakee Rivers, as well as watershed organizations focused on water quality and other improvements. CMAP can provide information, data, and policy guidance to improve decision making at the regional, sub-regional, and local scale, such as the location of sensitive water resources, water supply and demand data, areas where the continued or increased withdrawal of groundwater would negatively impact future supply, and location of groundwater recharge areas.

[81] IWQMP, of which AWQMP is a part, was adopted in November 1982

[82] APA PGW

Figure 14: Water Supply Coordination



Chicago Metropolitan Agency for Planning, 2017.

1.3 Improve data collection and availability

Sound water resource planning and management requires an understanding of water quality and supply characteristics. CMAP has long promoted the importance of collecting and disseminating high quality, accessible, and understandable water resource data, metrics, standards, and information to decision making in the region, and should continue to work to improve data and access for the region. While some data on water quality and water supply exists, it can be incomplete, out of date, difficult to work with, and inaccessible to the broader public and elected officials and staff.

The IEPA provides data on water quality while the Illinois Department of Natural Resources, Illinois State Water Survey, and the Illinois State Geological Survey provide data and research necessary for understanding water availability. However, funding for these programs has been inconsistent and much remains to be known about water quality and availability in the region. Despite funding limitations, these state agencies continue to inform regional decision makers about a variety of key issues, including water quality impairments, the growing risk of desaturation in the St. Peter sandstone aquifer and locations of sensitive aquifer recharge areas, but more information is needed to help guide decision-making throughout the region. CMAP should support the allocation of sufficient funding to IEPA, IDNR, ISWS, and the ISGS to support research and data collection.

In particular, CMAP has identified a number of key projects that are critical for making better land use and development decisions, including water supply/demand forecasting (see Strategy 2.3). These include understanding stream and river quality, groundwater and river water availability, water withdrawals, and the impact of urbanization on water demand. In addition, CMAP should work with partners to continue to improve accessibility of existing data.

Water quality and habitat assessments: CMAP supports increasing the state's efforts to provide more frequent data collection and assessments for the region's water bodies, as well as the development of standards and metrics by the IEPA and others that reflect best available science. The direct measurement of aquatic biota using various indices – combined with physical, chemical, and landscape features – is arguably the best approach to assess and track waterbody health, impairments, and management effectiveness.[83] However, these biotic indices are only applicable to wadeable streams, which means that many streams and rivers remain unassessed. Development of biological and habitat indices and/or other assessment tools for headwater streams and large rivers is still needed. For lakes, Illinois EPA primarily uses an aquatic life use index (ALI), and CMAP supports the exploration of other indices, such as the Floristic Quality Index or other metrics. For Lake Michigan, Illinois EPA assesses aquatic life use impairment for open waters[84] based on several standards. The development of additional biological and habitat indices for Lake Michigan also should be considered.

Groundwater supply research: A number of activities are needed to continue to improve our understanding of groundwater resources, including developing detailed geologic mapping for the entire region[85] and maintaining and continuing to improve the regional groundwater flow model. The model pairs detailed geologic mapping data with water withdrawal data to build an understanding of

[83] Booth, D.B, et. al. 2004. Reviving Urban Streams: Land use, Hydrology, Biology, and Human Behavior. Paper No. 03187 of the Journal of the American Water Resources Assoc.

[84] "The Open waters of Lake Michigan means all of the waters within Lake Michigan in Illinois jurisdiction lakeward from a line drawn across the mouth of tributaries to Lake Michigan, but not including waters enclosed by constructed breakwaters," from 35 Ill. Adm. Code Part 303, Subpart C (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx, accessed 4/24/2017).

[85] ISGS has completed detailed geologic mapping, which identifies sensitive recharge areas among other characteristics, for McHenry, Kane, and Kendall, and Lake, Kendall, and Will counties are underway. Estimated timeframes for DuPage and Cook counties are 2020 and 2025, respectively. (Brandon Curry, ISGS, personal communication, 2015.)

groundwater availability for all aquifers in the region. The flow model can help specific communities understand their water availability and is crucial for development of regional and local water supply/demand forecasts and a better understanding of sustainable withdrawal rates. Expanding groundwater monitoring locations will be essential in building an accurate flow model. In addition, the ISWS should continue to conduct impact analysis for new groundwater wells in order to prevent negative impacts to existing wells.

River water supply research: IDNR provides critical assessments of river water availability, including determining reliable surface water yields, low flow analysis, and instream flow needs. This information is key to assessing the viability of individual withdrawal applications as well as maintaining a regional assessment of how the Fox and Kankakee River systems could accommodate new withdrawals. Given climate change and changing withdrawals and inputs to our waterways, IDNR should continue to perform this important work and update criteria for instream flow protection to reflect best practices.[86] In addition, a number of ecosystems rely on groundwater flow, and a clearer understanding of the interaction between groundwater levels and groundwater fed ecosystems would inform decision-making. Recent cutbacks in river water monitoring by USGS should be restored when possible.

Modernize water withdrawal reporting: Similar to our limited understanding of water availability, data on regional water use is incomplete, is currently reported to a number of different state agencies, and could be streamlined to improve efficiency and accuracy. For example, little is known about agricultural use of groundwater. Continuing to modernize water withdrawal reporting, including transferring to an electronic system and increasing the frequency of reporting, could greatly improve further analysis on availability and supply/demand forecasts.

Study impacts of urbanization and water use: There is a clear connection between urbanization and water use. ISWS and ISGS should continue to investigate the potential impacts urbanization has on groundwater and surface water resources, including changes in hydrology, groundwater infiltration, and recharge areas, the hydrologic interconnection between aquifers and surface waters, and the interconnectivity of water supply quantity and quality.

2. Improve land use planning and policy approaches to protect water resources

Land use and water resources planning lack the coordination and integration required to protect our water supplies and water quality adequately. CMAP is well positioned to help communities integrate water resource considerations into land use planning and policy to minimize the impacts of the developed landscape on water resources. CMAP can prioritize assistance to improve community policies and ordinances in areas of high quality aquatic systems and water supply limitations. These practices, which are well-documented elsewhere, include:

- Green infrastructure and urban retrofit strategies, including reduced imperviousness
- Preservation and stewardship of natural drainage and floodplains
- Stream and riparian restoration, including dam removal and stream crossing design guidelines for transportation projects
- Protection of open space and groundwater recharge areas
- Compact and more water efficient development patterns that minimize runoff, maximize infiltration, reduce water use and wastewater generation
- Reinvestment and infill that utilizes existing water and wastewater infrastructure capacity

[86] Currently IDNR relies on the 1991 Report on Instream Flow Protection.

- Consideration of water source, availability, and consumption patterns in development decisions
- Mitigation of polluted runoff from agricultural and industrial uses
- Enhanced local stormwater requirements

Beyond these tactics and actions, CMAP recommends the following broad strategies be considered.

2.1 Strengthen and update collaborative planning approaches for multiple objectives

At the sub-regional scale, CMAP should continue to refine and pursue multi-jurisdictional, system-based watershed and *source-shed* (i.e., the area that contributes flow to a water source, such as a shallow groundwater table) approaches to water resource planning and management, including adequately addressing the water quality and quantity needs of surface water users,[87] and groundwater recharge areas for groundwater users. The watershed approach can include multiple other goals as well, such as habitat, green infrastructure and open space, cultural and recreational resources, hydrologic modification, and climate resilience. Ideally, the watershed planning mechanism would become more integrated into land use and transportation decision making, as well as broaden that conversation to water supply issues.[88] For example, if transportation investments and land use change would be expected to push impervious surface coverage beyond a threshold for healthy streams, additional water resources management practices would also be encouraged to reduce the impact of such changes. The watershed approach, if adopted and enforced by IEPA, would encourage municipalities to work together to achieve watershed goals, such as through water quality trading, a challenging but not impossible task.

For communities using Fox or Kankakee River water for domestic needs, CMAP should support coordination between existing and future river users using a watershed planning and management approach to maintain flows, enhance water quality, and support additional population. This will become increasingly important as communities dependent upon groundwater look for alternative water supplies, where the Fox and Kankakee Rivers may provide a substitute source. Such efforts should engage both potential and existing river water utility managers in watershed planning efforts. The ISWS has recently completed a preliminary assessment of the Kankakee River basin, which could begin a sub-regional water supply and demand plan. CMAP could also take advantage of existing partnerships along the Fox River that are focused on water quality to expand the conversation to water supply.

One strategy for expanding the use of integrated water resources management at the sub-regional scale would be to enable and encourage county stormwater agencies to pursue broad water resource goals that go beyond flood control and include water quality, stormwater management, flood mitigation, green infrastructure, resilience, and the land use approaches that will support these goals. There has been some movement with regard to flooding and water quality by the IEPA, which recognizes flooding as a water quality impairment that, though typically addressed through FEMA and IEMA, may also be addressed through the Section 319 program of the CWA, designed to address nonpoint source pollution. The Lake County Stormwater Management Commission has been working on integrating flood planning into IEPA-approved watershed-based plans, which are typically oriented primarily towards water quality improvement.[89] The USACE, traditionally focused on navigation, flood control, and shoreline stabilization, has a number of programs that relate to environmental restoration and more holistic water resources management.[90] Until fairly recently, MWRD's legislative authority did not allow them

[87] See, e.g., Opportunities to Protect Drinking Water Sources and Advance Watershed Goals through the CWA
[88] David Leopold had some ideas about watershed mgt and coordination, a watershed council governance structure?
[89] Amy W, personal communication at Calumet Stormwater Collaborative meeting, March 3, 2017
[90] Talk to David Bucaro, USACE

to buyout flood prone properties. A number of years ago, greater flexibility was introduced into MWRD legislation to allow such activities.

This movement towards more integrated water resource planning is in early stages, but should be actively encouraged across the region. Additional flexibility in the authority of our stormwater agencies would allow for a broader range of activities to not only protect water resources but address climate adaptation as well. At the federal level, restrictive authorities and funding programs may be working counter to a more holistic approach to integrated water resource management. These efforts should be expanded to include coordinating water supply issues with hazard mitigation in emergency response and preparedness activities, including drought.

Another strategy is to better coordinate municipal stormwater and wastewater management programs into "integrated plans" to achieve water quality goals, which EPA has increasingly embraced as a voluntary approach for water quality improvement.[91] Multi-sector, multi-party coordination is already explicitly supported by the state's general MS4 permit, and such coordination can be written into NPDES permits, such as taking a watershed approach to meeting a chloride standard. The implementing body takes the form of "watershed workgroups" of stakeholders who are collectively investing in watershed improvements in lieu of costly wastewater treatment plant upgrades. Such approaches have the potential to require a lower financial investment while achieving broader watershed goals that go beyond the single pollutant being targeted. For example, watershed-wide best management practice installations can help control a number of nonpoint source pollutants while also providing stormwater management and community greening benefits. These "workgroup" arrangements have been established for the Salt Creek, Des Plaines River, Fox River, and Hickory Creek, yet progress of these initiatives towards water quality goals, particularly nutrient load reduction, is not yet known. This approach requires municipalities put BMPs in their MS4 (stormwater management and discharge) permits, wastewater facilities to put chloride standards in wastewater permits, and all stakeholders to work collectively to meet these and TMDL requirements for waterbodies. [92] Since these are permit requirements that permit holders must implement, the associated activities are not eligible for funding through the Section 319 program. Such plans may also address source water protection efforts that protect surface water supplies, and nonpoint source control through proposed trading approaches or other mechanisms.[93]

On the watershed plan implementation side, the IEPA should empower and fund local stakeholders to take responsibility for broad watershed improvement, with CMAP and other agency (e.g., county stormwater agency) assistance and guidance. Local efforts can be more effective and encourage greater ownership at the local level.

2.2 Incorporate land use strategies that protect water supply and quality into local plans

CMAP's Water 2050, watershed plans, and local planning projects have advocated open space preservation and stewardship to meet water supply and water quality goals. Through the LTA program, CMAP has encouraged adoption of land use strategies that minimize development impacts on natural

[91] Integrated Municipal Stormwater and Wastewater Planning Approach Framework, June 5, 2012 Memorandum from Nancy Stoner Acting Assistant Administrator, Office of Water, and Cynthia Giles, Assistant Administrator, Office of Enforcement and Compliance Assurance, to Regional Administrators.

[92] See the regulatory framework / language of the MS4 permit. Talk to Mike Warner

[93] rated Municipal Stormwater and Wastewater Planning Approach Framework, June 5, 2012 Memorandum from Nancy Stoner Acting Assistant Administrator, Office of Water, and Cynthia Giles, Assistant Administrator, Office of Enforcement and Compliance Assurance, to Regional Administrators.

lands in order to improve water quality and protect shallow groundwater supplies, among other benefits. The CMAP ecosystem services valuation study provided further insights into the importance of water resource protection.

CMAP should continue to explore ways to connect water resource management and open space protection, using a watershed approach to identify key areas and consider impervious cover thresholds. Open space protection in the Fox and Kankakee River watersheds would help to protect and enhance the quality of these resources, not only as sources of domestic water use, but also as important riverine ecosystems. A number of potential avenues exist. In some states, Ohio and Iowa included, state revolving loan funds have been used to acquire natural lands in order to help protect and improve water resources, which could be effective here. In New York, open space preservation in upstream watersheds was considered a more cost-effective strategy than development of new water sources. This connection is understood by regional partners, and recent polling in Kane County for the April 2017 open space referendum showed that voters saw value in open space protection to maintain drinking water supplies.[94] Water quality (e.g. nutrients) and volume control trading is also a rising interest in the region, and land preservation would be one strategy for implementing a trading program.

Development changes the hydrology of an area and can reduce groundwater infiltration and diminish shallow groundwater supply over the long term. Infiltration of rain water, through open space preservation, conservation design, incorporation of site-scale green infrastructure, and other planning and development strategies, can help recharge shallow groundwater tables and reduce stormwater runoff. [95] Directing growth towards infill locations can help protect the infiltration capacity of parts of the region that are groundwater dependent, as well as result in lower per capita water use and lower water infrastructure costs.[96] Water 2050 included a number of references to research studies that demonstrated that higher housing density, smaller lot size, and lower distance from distribution lines correlates with lower per-capita water demand.[97] CMAP should continue to support updating development standards to encourage water-efficient development patterns, as laid out in the recommendations put forth in the *Land and Water* chapter of Water 2050. CMAP could conduct research and compile information on techniques for achieving water neutrality and case studies documenting the reduction of water footprints for individuals, residential developments and the commercial/industrial sector, particularly for areas facing near term water shortages and few good alternatives. These strategies can help achieve other community objectives and have been covered in more detail in various ON TO 2050 strategy papers.[98]

Development can also lead to contamination of shallow groundwater aquifers due to infiltration of road salts, pesticides, and other chemicals, particularly in sensitive aquifer recharge areas (SARAs), which should be identified and preserved. CMAP supports efforts to continue identifying sensitive recharge areas throughout the region and integrating this information into land use and transportation decisions, such as through local plans and ordinances. McHenry County has adopted a number of ordinances that aim to protect their groundwater supply.

Given that groundwater recharge areas cross jurisdictional boundaries, and that communities with recharge areas may not use shallow groundwater as a water source, counties and municipalities should explore approaches that help coordinate protection of these resources, including the use of

[94] Personal communication, The Conservation Foundation.

[95] See Lands in Transition strategy paper.

[96] U.S. EPA. 2006. Growing Toward More Efficient Water Use: Linking Development Infrastructure, and Drinking Water Policies. See https://www.epa.gov/smartgrowth/growing-toward-more-efficient-water-use

[97] Water 2050, CMAP, p61.

[98] Integrating Green Infrastructure Strategy Paper, Stormwater Strategy Paper, Infill and Reinvestment Strategy Paper

intergovernmental agreements. CMAP and partners should continue to promote sensible salting and other best practices to reduce the risk of contamination.

2.3 Incorporate water supply and demand forecasts into local and regional planning

Development trends have continued to increase water demand in areas of the region facing water supply constraints. In order to maintain long-term livability, understanding both the available supply of water and current and future water demand is critical to making informed land use and transportation decisions. Many factors influence water demand: population growth, development patterns, climate dynamics, conservation and efficiency efforts, and population characteristics, to name a few. Assessing forecasted demand scenarios against available water supply can inform local and regional planners on whether there is sufficient water supply and can encourage actions that reduce demand, protect supply, and/or pursue alternative drinking water sources.

Update the regional water supply/demand forecast: In 2010, CMAP released Water 2050, which included a summary of both water supply availability and the potential impact of three water demand scenarios, using 2005 baseline data.[99] Since this data is now nearly 10 years old, the regional water supply and demand forecast should be updated to reflect our improved understanding of water supply availability, climate change projections, and the region's socioeconomic forecast. CMAP can assist IDNR and ISWS in updating the water supply and demand forecast by collecting and maintaining water demand parameters. An update of the water supply/demand forecast should highlight the available water yield and consider future development scenarios that are relevant today. CMAP should work with partners to find funding support for this project on a regular basis. Ideally, the demand forecast could be updated when CMAP updates the socioeconomic forecast, which occurs every four years.

Provide local water supply/demand forecasts: Water 2050 provided critical information at the regional scale about water supply and demand scenarios. However, the data behind the regional forecast are not accessible to local communities, nor are the data downscaled to the municipal scale. Communities could benefit from gaining access to the water demand forecast parameters in order to perform more localized assessments of water demand.[100] Armed with this data, planners and community water supply managers could explore the impacts of different planning and policy approaches, such as different climate scenarios, land use and development patterns, population projections, and conservation and efficiency measures (aka demand management strategies.) The results could then be compared against the available water supply information, including infrastructure capacity as well as water source constraints. This information could inform a range of decision-making processes, including comprehensive planning, review of larger scale developments, and water infrastructure investments.

CMAP, in partnership with IDNR, ISWS, and Illinois-Indiana Sea Grant (IISG), should post relevant data and studies to its water supply webpage that provide information to help communities examine the effects of climate change, current and projected population, land use mix and intensity, water conservation, water pricing, and a number of other factors on future water demand. An accessible location for data and studies would make it easier for state agencies, regional planning agencies, and individual water utilities to explore scenarios of future water demand, and right-size water infrastructure, and identify possible response options. The site should include both updated data from

[99] http://www.cmap.illinois.gov/livability/water/supply-planning/water-2050

[100] For public water supply (population served, climate data (temperature, and precipitation), employment, water price, median household income, conservation trend (from another model regressing water use trend over time); power generation (gross electric generation); industrial and commercial use (cooling degree days, precipitation, employment, self-supplied, conservation trend), Agricultural and irrigation (rainfall deficit, irrigated acres and livestock counts) domestic self-supply))

the regional forecast, as well as customized data to reflect local or regional population projections, development patterns, water uses, energy sources and requirements, and expected savings from conservation and efficiency measures.

CMAP can work with communities to identify water supply programs and policies that can affect the water demand/supply balance, prioritizing those communities and areas that are experiencing more near-term water supply challenges than others.[101] CMAP should work with this target audience to ensure that the data is user-friendly, adaptable to locally-available datasets, and is integrated into planning efforts. CMAP should work with partners, such as IDNR, ISWS, and IISG to provide data and analyses, develop programs and policies, and encourage communities to integrate water demand and supply forecasting into comprehensive planning and local ordinances.

3. Coordinate subregional water withdrawals

3.1 Strengthen groundwater monitoring and withdrawal system

Water 2050 encourages sustainable management of groundwater withdrawals to support future populations. The groundwater supply constraints facing portions of the region will require coordinated management of withdrawals in order to maintain water supplies into the future, support community livability, and mitigate potential conflicts arising from water shortages. The region should also consider a plan of action for droughts, which are projected to increase due to a changing climate. In lieu of significant implementation of conservation and efficiency practices, the region will need to move toward a system where communities commit to specific withdrawal limits based on their existing and future population and available water supplies. However, several interim and substantial steps are needed before this can be accomplished. While the region does not yet have an accurate enough sense of water withdrawals or a sustainable yield, efforts are underway that would move the state and region in this direction. Sound groundwater management cannot wait until these assets are perfectly understood given how decisions continue to negatively impact groundwater resources. Instead, the management systems must evolve and adapt as new information is made available. Communities are already recognizing this and are self-organizing in specific ways to improve coordination amongst themselves, such as the NWPA and Joliet area communities. CMAP has identified a number of activities that can help move this forward.

Water use reporting: As identified in Strategy 1, continuing to enhance the ISWS Illinois Water Inventory Program (IWIP) is critical for a number of different strategies, including maintaining and enhancing the regional flow model and water supply / demand forecasting. The first step in sustainably managing groundwater withdrawals is a robust water use reporting system for all community water suppliers. In the absence of a more streamlined system, the Northwest Water Planning Alliance worked with the ISWS to develop a voluntary monthly withdrawal reporting form. This type of program should be available and encouraged among the region's groundwater dependent communities until a new system can be developed. CMAP and partners can continue to encourage participation in NWPA's monthly reporting form, support for ISWS IWIP, and streamlining efforts between IEPA, ISWS, and IDNR.

Water withdrawal review: CMAP supports updates to how state and local agencies review new groundwater withdrawal applications to thoroughly review potential impacts of additional withdrawals

[101] Whitler, J., Warner, J., 2014. Integrated Urban Water Management for Planners. American Planning Association. PAS Memo d September/October 2014. www. planning.org/pas/about/.

to groundwater supplies and existing wells and improve water use reporting.[102] In 2009, the Water Use Act of 1983 was amended to require ISWS to consider the impacts of proposed wells on neighboring groundwater users. Yet ISWS does not have the funding to conduct impact analyses for new wells, and reporting of new wells to ISWS is inconsistent at best. This information will be important to providing updated well-withdrawal data and impacts to decision-makers.

Coordinated groundwater withdrawal: Communities dependent on groundwater have the potential to self-organize and work to improve the management of shared water resources. In 2010, the Northwest Water Planning Alliance formed to collaboratively plan for their shared groundwater resources. CMAP should continue to disseminate information to groundwater-dependent communities on the potential impacts of continued groundwater withdrawals on water supplies and the effects on future growth. CMAP could assist this process by helping communities understand water supply/demand forecast information and coordinate between communities. Community water suppliers dependent on the deep sandstone aquifers should be a priority given growing water supply concerns. Over the long term, CMAP should work with partners to explore management mechanisms to prevent groundwater overuse and the potential conflicts that groundwater shortage could cause. This could include exploration of how other regions are dealing with similar supply constraints. In the meantime, CMAP can also encourage intergovernmental agreements among counties and community water suppliers to establish water withdrawal standards in accordance with projected growth.[103]

3.2 Strategically manage Lake Michigan allocation

As groundwater-dependent communities become increasingly at risk for water quantity and quality challenges due to over-withdrawal and contamination, some may attempt to pursue transition to Lake Michigan water. However, this option can be very costly, politically challenging, and at times infeasible given that the Lake Michigan allocation is almost fully utilized (Figure 7) and the pipe network has limited capacity. In fact, increases in precipitation due to climate change may mean that stormwater runoff will comprise a larger share of the allocation in the future, because more rainwater will leave the region as stormwater, effectively reducing the number of communities that can access Lake Michigan water.[104] Given future uncertainty of available groundwater and Lake Michigan water in the future, it would benefit the region to take a closer look at managing the Lake Michigan allocation strategically.

CMAP has identified a number of strategies where planning can assist. First, Water 2050 and subsequent policy work highlighted a number of strategies to help existing Lake Michigan permittees reduce water use and meet the conditions of their permits. These strategies, also known as water demand management, are described below. [105,106] Second, CMAP can work with specific communities to explore the feasibility of transitioning from the deep bedrock or shallow aquifer to Lake Michigan water. Ideally, this process would be informed by a localized water supply/demand forecast and integrated with land use planning approaches that can reduce water demand. CMAP could also develop information for

[102] Currently, four counties in Illinois – Iroquis, Kanakee, Tazewell, and McLean have a more comprehensive review process that allows for water use considerations in new well construction.
[103] Communities commit to specific withdrawal limits based on their future populations and with knowledge from ISWS on groundwater supplies for the purpose of water resources management; as provided for in 50 ILCS 805/4, Local Land Resource Management Plans.
[104] Insert reference
[105] CMAP. 2010. Water 2050: Chapter 3: Lake Michigan Service Region Approach
[106] CMAP. 2014. An Assessment of Water Loss among Lake Michigan Permittees in Illinois. See: http://www.cmap.illinois.gov/documents/10180/296743/FY14-0071+IDNR+WATER+LOSS+REPORT/bfda6186-8c79-42b5-80b8-9d97c7c2300d

communities on the cost implications and benefit of different water supply management strategies, such as conservation and efficiency, switching sources (e.g., deeper wells vs river water vs Lake Michigan water), and other options.

CMAP can also promote stormwater infiltration within the Lake Michigan basin, where stormwater that once flowed into Lake Michigan is now sent out of the basin by stormwater infrastructure and the altered river system. This stormwater volume, part of Illinois' allowed diversion of Lake Michigan water, reduces the amount of the Lake Michigan allocation that can be used for domestic purposes. While this is only relevant to the 673 square mile diverted-watershed area, any long-term reduction in the stormwater runoff diversion could make additional lake water available for domestic use. Green infrastructure and other stormwater management best practices that focus on infiltration may help decrease the Illinois diversion volume attributed to stormwater runoff.[107] CMAP already promotes infiltration practices where appropriate to help manage stormwater, and some county stormwater ordinances allow the use of stormwater management practices that promote infiltration. In addition, MWRD is exploring the use of volume control trading, which could encourage stormwater infiltration in key locations.

3.3 Support coordination between existing and future Fox and Kankakee River users

As described in strategy 2.1, existing and potential Fox and Kankakee river water users ought to work together to manage the quantity and quality of these resources into the future. Although these systems are fed to some extent by subsurface groundwater flows that may be recharged outside of the watershed, a multi-jurisdictional watershed-based approach should be used as the organizing framework for maintaining flows, enhancing water quality, and the capacity of these systems to support new development. A number of coalitions have been organized along the Fox River, including watershed groups and the NWPA, which could expand their scope to address water supply as well. The Kankakee River could use a similar set of locally-organized stakeholders to follow up on water supply work being conducted by the ISWS.

3.4 Encourage water demand management strategies

Water 2050 recommended water-demand management as the primary implementation strategy, and provided 13 strategies that can help meet future water demands through reducing water use.[108] Just as water demand is dependent on a variety of factors, demand management strategies depend on local factors and should be tailored for each community based on housing type, land use mix and pattern, median home value and income, utility capacity, and local ordinances. CMAP and partners should focus on regional implementation of the four foundational water-demand management strategies: universal metering, water accounting and loss control, water costing and pricing, and information and education.[109] To identify cost-effective demand management strategies, local governments and water providers can compare the cost per unit of water saved through reduced demand with the cost per unit of newly developed water supply. In recent years, CMAP and partners have promoted water system

[107] It is important to note that stormwater infiltration and the Lake Michigan stormwater-runoff debit do not form a one-for-one relationship. Some of the stormwater infiltrated in the diverted-watershed could return to rivers and streams as baseflow and still be included in the diversion accounting.

[108] Potential region-wide water savings were calculated for nine of the 13 measures, based on two-tiers of implementation, low conservation (10% adoption rate) and high conservation (50% adoption rate) low conservation could meet 23% of demand through 2030, and high conservation, 78%.

[109] https://www3.epa.gov/watersense/docs/part2_508.pdf

audits, leak detection and repair, metering updates, water conservation ordinances, and full cost pricing among community water suppliers. CMAP should also continue to encourage state support of water demand management strategy implementation.

4. Invest in infrastructure and facilities.

4.1 Leverage and achieve more with investments

The nature of our separate federal and state programs for managing water resources, coupled with our strong local government system in Illinois, may not lend itself to achieving efficiencies with our investments. CMAP should encourage our state agencies, and work with local jurisdictions, to think broadly about how we invest public and private resources in our water and other infrastructure to achieve multiple community benefits, to coordinate and leverage limited public resources with other sources of funds both within communities and across jurisdictional boundaries, and to incentivize innovative and resilient infrastructure and design.[110]

This strategy includes recognition by funders and decision makers that investing in green infrastructure practices at multiple scales can help build the resilience of our communities and infrastructure systems, and may be 'tradable' across jurisdictional boundaries. For example, green infrastructure investments in one community with abundant opportunities and capacity may help multiple communities, where opportunities are less available to achieve water quality and MS4 permit goals. Infrastructure investment programs should fund both grey and green strategies to achieve multiple goals and benefits, such as stormwater management and flood reduction, community greening and landscaping, and water quality improvement. *(Also see Green Infrastructure and Climate Resilience strategy papers.)* A common example of efficient improvements is to prioritize those with co-benefits – addressing multiple challenges and upgrades when making a major investment in public infrastructure. Transportation investments can pursue a 'dig once' approach to improve stormwater management and water / sewer infrastructure while the street is being improved.

Infrastructure should also be designed, built, and maintained to protect, conserve, and reuse water resources to support our long-term economic future and overall well-being and resilience. [111] The state's clean water and drinking water revolving loan programs should incorporate climate resilience considerations into funding priorities and encourage drinking and wastewater utilities to incorporate resilience planning into capital improvement plans.

4.2 Connect infrastructure investment to planning goals.

Illinois' State Revolving Fund programs tend to be underutilized, and the IEPA is currently examining ways to make the funds more accessible to communities. CMAP supports the prioritization of these funds for projects that upgrade, rehabilitate, and optimize the use of existing water and wastewater system capacity, before investing in new capacity. The state should also expand the flexibility and coordination of water infrastructure funding and financing strategies, such as the Clean Water SRF, for a broader range of planning, engineering, and capital projects to achieve multiple community objectives. For example, a rule adopted by the IEPA in 2015 allows these SRF funds to be used for stormwater

[110] APA PGW

[111] APA Policy Guide on Water; See Climate Ready Water Utilities and Climate Resilience Evaluation and Awareness Tool (CREAT) (EPA)

management, such as green infrastructure practices, though few if any applications for such use have been proposed.[112] Beyond making such funds more flexible, in the interest of better planning and coordination, these funds could be connected to the preparation of local comprehensive plans that address water, land use, and transportation components, either at the regional, county, or sub-regional scale. Through local planning, better coordination of land use change, infrastructure investment, and water resources could occur. In order to access funds, communities could be required to adequately plan for their own growth and the impacts of such growth on water quality, aquatic ecosystems, and water supply. In areas with sensitive resources, additional considerations might be included, such as water conservation and efficiency standards, and water source protection standards, such as compact development forms that encourage infiltration of rainwater into groundwater tables. The region might also consider using its transportation planning mandate to assess transportation infrastructure investments so that they minimize impacts on sensitive resources. Since these resources also provide ecosystem services (i.e., GIV 2.3), CMAP should also consider using the value of these services in cost-benefit analyses of land-use and transportation investment decisions at the regional and subregional scales.

In some states, revolving loan programs are used to purchase land and conservation easements in strategic locations to protect or improve the quality and quantity of water sources, which can be encouraged through the use of discounted loan interest rates. CMAP can assist with the preparation of local land protection strategies using multi-jurisdictional watershed and source-shed as the planning geographies. Water planning councils, such as the Fox River Study Group or the Northwest Water Planning Alliance, may be set up by watershed/source-shed to include local governments, water users such as agriculture and industry, and other relevant stakeholders to help produce and implement subregional plans.

4.3 Create a Water Safety Net

Some communities with vulnerable populations, such as low income communities, people of color, and older residents, are disproportionately affected by water-related challenges presented in this strategy paper, such as low drinking water quality, an inability to address flooding impacts (see the stormwater strategy paper), and water utility costs for both drinking water and wastewater services. Water affordability is a growing concern in these communities as continuing escalation of water, service, and infrastructure costs translate directly into rising utility bills. Rising water costs disproportionately impact vulnerable populations, and water pricing should be sensitive to the ability of the consumer to pay, a strategy that is known as 'cost-equity'.[113] These communities may suffer from non-revenue water losses that impact the financial health of a community.[114] It is important to improve infrastructure in lower income neighborhoods that would otherwise be overlooked by new private investments. Nationally, an estimated one third of households will find their water bills unaffordable if water rates continue to rise as anticipated.[115] There is a clear connection between this strategy and the inclusive growth and community capacity strategy papers.

[112] Amy W, personal communication at Calumet Stormwater Collaborative meeting, March 3, 2017.
[113] APA Policy Guide on Water
[114] EPA Programmatic Guidance document
[115] Mack, E. A., and Sarah Wrase. (2017) A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States. PLOS OnE.

CMAP's programs can target assistance to disproportionately impacted communities that may be suffering from high adverse impacts on human health and well-being. CMAP can assess the extent to which communities in our region are facing water affordability challenges, as well as identify any highly vulnerable public water supply systems in the region, [116] and identify opportunities, practices, and policies to address these challenges. CMAP should work directly with these communities, connecting them to available resources such as state revolving funds, and helping to establish structures and protocols for improving and managing infrastructure to ensure the delivery of safe drinking water and wastewater service at a reasonable cost to residents. CMAP can also connect these communities to peers and neighbors for shared investment or services projects, or other structures to help manage and administer typical government functions.

4.4 Improve fiscal management and efficiency

Asset management: Reducing water loss is a key way to reduce water use and effectively increase the supply available for use. Nonrevenue water is the volume of water that has been distributed to customers but is not reflected in customer billings. This could be due to a number of reasons, ranging from customer meter inaccuracies (apparent losses) to system leakage (real losses). Either way, the lost water revenue is a financial burden on the community water supplier, customers, and taxpayers. In 2014, CMAP assisted the IDNR OWR Lake Michigan Water Allocation Program in developing a keener understanding of the water-loss practices and challenges of community water suppliers that they regulate under a water-use permit system for allocations of Lake Michigan drinking water.[117] In that process, CMAP identified a number of reforms that could occur at the state and local level to advance asset management, including use of the AWWA M36 water audit method and communication strategies about levels of water loss among decision-makers and the public. Working with partners, such as ILAWWA and MPC, CMAP should continue to advocate for changes to the Lake Michigan Water Allocation Program. Strategies to support these efforts among Lake Michigan permittees are also applicable to groundwater and river water dependent communities and should be encouraged throughout the region. CMAP should continue to shed light on this issue, whether at the regional scale or when assisting communities through local technical assistance projects.

Full cost pricing: Community water rates, while covering the cost of providing water service, do not reflect the full value of water to the region. Water prices in northeastern Illinois are set by municipalities to cover the cost of service. Full cost pricing should consider the full cost of operation and maintenance of water management systems, as well as incorporate life cycle costs. Considering the value of water at the source-shed scale will require community participation in subregional planning efforts to examine long-range water supplies, sustainable withdrawal rates, and appropriate pricing strategies tied to water scarcity.

GO TO 2040 recommended full-cost pricing as fundamental to addressing both the need for investment in water infrastructure and the water efficiency challenge of accommodating millions of additional residents by mid-century with limited water supply. CMAP, in partnership with the University of Illinois Extension Illinois-Indiana Sea Grant program, developed a manual exploring full-cost pricing as a tool for

[116] See, e.g., Source Water Protection and other Sustainable Water Infrastructure practices (USEPA)
[117] CMAP. 2014. An Assessment of Water Loss among Lake Michigan Permittees in Illinois. See: http://www.cmap.illinois.gov/documents/10180/296743/FY14-0071+IDNR+WATER+LOSS+REPORT/bfda6186-8c79-42b5-80b8-9d97c7c2300d

local decision makers interested in sustainably managing community water supply,[118] as well as a water rate benchmarking tool in partnership with the University of North Carolina Environmental Finance Center.[119] Water costs and funding consistently rank at the top of the list in surveys of challenges facing the water industry,[120] and this recommendation remains relevant as the region continues to be challenged by ongoing water infrastructure and water efficiency investment needs.

Shared services: Efficient governance is a critical component of GO TO 2040 and encouraging strategic coordination among municipal governments can ensure the continued delivery of high-quality local services to the region's residents. The costs associated with water and wastewater infrastructure and operations can be an expensive proposition for many communities, particularly for smaller municipalities and utilities. CMAP analysis of water loss among Lake Michigan permittees highlighted that water loss appears to be more severe with smaller water systems.[121] Drinking water and wastewater service provision could benefit from sharing resources across jurisdictional boundaries. This could be particularly true for communities that are conducting long-term water supply planning efforts that may include switching to alternative sources. CMAP worked with Oswego, Montgomery, and Yorkville to explore shared services, and these communities continue to work together to explore potential water supply challenges.

CMAP should continue to work with partners to help community water supplier systems gain efficiencies of scale through collaboration. As CMAP continues to work with communities and multiple jurisdictions on planning efforts, there may be opportunities to pursue efficiencies associated with consolidated water or wastewater systems, or to share services or the cost of services or infrastructure investments. For example, consolidated water supply services and utilities can help achieve efficiencies and aggregate revenues for large-scale investments in infrastructure, or for pursuing large loans through the SRF.

Innovative financing: In light of diminishing state and federal resources for infrastructure investments, particularly grant programs, the region should pursue other innovative and local financing strategies, which may include public private partnerships, value capture strategies such as TIFs, and greater and more flexible / creative application of state revolving loan funds. The Water Infrastructure Finance and Innovation Act (WIFIA) could be pursued to help finance water and wastewater infrastructure of national or regional significance with low interest loans, which could be coordinated with state revolving fund programs.[122] CMAP should work with state and federal agencies to restructure these loan programs to be more flexible for upgrading and rehabilitate existing systems, for investing in both grey and green alternatives, and to incentivize practices that improve their resilience and efficiency, such as conservation policies, development forms that optimize investments, and water source protection strategies. Similar strategies may be applicable for water quality investments as well, such as private capital investment in green infrastructure practices.

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[118] CMAP, IISG, University of Illinois Extension. 2012 Full-Cost Water Pricing Guidebook for Sustainable Community Water Systems. See http://www.cmap.illinois.gov/livability/water/supply-planning/full-cost-pricing

[119] University of North Carolina Environmental Finance Center. 2017. Northeastern Illinois Water and Wastewater Rates Dashboard. See https://efc.sog.unc.edu/reslib/item/northeastern-illinois-water-and-wastewater-rates-dashboard

[120] Black & Veatch 2016. Strategic Directions: Water Industry Report See www.bv.com/docs/reports-studies/sdr-water-industry.pdf?mkt_tok=3RkMMJWWfF9wsRonuKzPZKXonjHpfsXw7OUuXqag38431UFwdcjKPmjr1YIATsF0aPyQAgobGp5I5FEBS7bYVbp2t6MMWg%25253D%25253D

[121] CMAP. 2014. An Assessment of Water Loss among Lake Michigan Permittees in Illinois. See: http://www.cmap.illinois.gov/documents/10180/296743/FY14-0071+IDNR+WATER+LOSS+REPORT/bfda6186-8c79-42b5-80b8-9d97c7c2300d

[122] EPA Programmatic Guidance document

4.5 Continue to advance resource recovery and reuse

Many large and medium-sized wastewater treatment systems are investing in resource capture, recovery, and reuse strategies and technology. Whether driven by regulatory requirements, unrealized revenue streams, or environmental responsibility, water managers are making significant investments to remove nutrients and biosolids from waste streams, direct treated wastewater back into circulation as a water source for process water or landscape irrigation (or even groundwater recharge), and capturing excess heat and natural gas as a source of energy. The region should continue to promote and support these efforts, as well as improving energy efficiency for utilities. [123]

On the water supply side, Water 2050 encouraged the reuse of rainwater and grey water in industrial operations and large scale residential developments. Stakeholders across the region have identified barriers within the Illinois plumbing code that makes it difficult to reuse water in new developments.[124] A significantly untapped potential exists with the capture and use of rainfall locally, which is not only freely available, but would also help to address stormwater management challenges as well. CMAP should support the work of partners, such as the Metropolitan Planning Council and MWRD, to update the state's plumbing code.

4.6 Invest in small and large wastewater systems

Though few combined sewer systems remain in the region, CMAP should work with and encourage communities with combined systems (including Chicago, Aurora, and Elgin) to continue to implement Long Term Control Plans for overflows of combined sewer systems (CSOs), including sewer separation, which may also assist with urban flooding challenges. CMAP can work with these communities to pursue multiple benefits where separation investments are being made. Reducing CSOs will help reduce discharge of pathogens, suspended solids, toxic pollutants, floatables, nutrients, oxygen demanding organic compounds, oil and grease, and other pollutants into Lake Michigan and area waterways.

Small wastewater systems, including individual on-site septic systems, can be problematic as well. While standards do exist for these systems, their decentralized and small scale nature make review and enforcement of these systems more challenging, and failure of these systems can have significant impact on receiving waters, some of which may be small, low flow, and/or high quality and sensitive. In addition, failing septic systems can contaminate not only nearby surface water, but also groundwater resources and nearby water supply wells. CMAP can work with counties to identify relevant geographies and encourage better management practices for areas served by these systems, as well as encourage consolidation of small systems and / or the expansion of larger wastewater treatment systems to serve these areas.

5. Prevent continued degradation of water quality and aquatic systems

5.1 Focus on priority pollutants

Several pollutants have been identified by Illinois EPA as priorities for Illinois' aquatic environments. These include nonpoint and point sources of nutrients (phosphorus, nitrogen), point and nonpoint

[123] See EPA Effective Utility Management doc
[124] Sycamore, IL has incorporated water reuse infrastructure into their system? (Nancy W)

sources of chlorides (which impact both surface water and groundwater), lead in groundwater, and emerging pollutants[125] in point source discharges and nonpoint source runoff.

The State of Illinois should be encouraged to set and enforce numeric nutrient standards and criteria to protect water resources, and to include effluent limits for nutrient pollution in NPDES permits where necessary, notably in low-flow, high quality streams, which is already underway across the country. [126] TMDLs should continue to be prepared and implemented in order to address priority watershed impairments, but alternate approaches to meeting water quality standards should be considered, with watershed based collaborative processes showing much promise. Watershed based water quality permitting should be considered, and could form the basis of a mechanism to facilitate pollution reduction through water quality trading. Water quality trading was included in the IEPA's Nutrient Loss Reduction Strategy, and the agriculture industry has been supportive of the program, but without a nutrient standard, it is difficult to implement a program without a quantifiable goal or target.[127]

More aggressive implementation of nonpoint source reduction strategies of watershed-based plans and TMDL implementation plans is encouraged through technical assistance and grant funding programs, such Section 319 and the revolving loan funds, as well as voluntary approaches such as landowner stewardship and source control programs. The region should invest more broadly in nature-based green infrastructure strategies for stormwater management, and encourage the state to direct a greater portion of revolving loan funds to these and other investments that help control nonpoint source pollution and meet other community goals. Nonpoint source control efforts should focus on priority pollutants: sediment (through better enforcement of construction site soil erosion and sedimentation control practices), nutrients (through urban and agricultural land management practices), and chlorides (through better winter road and parking lot deicing operations and water softening techniques.)[128] Illinois EPA could also consider modifying current guidance to allow Section 319 cost-share funds to be used to retrofit the hundreds if not thousands of single-purpose detention basins in the region to improve their water quality function.[129]

Priority pollutants, particularly nutrients, affect public water supply systems using surface water by contributing to the growth of potentially harmful algal blooms (HABs), which can introduce dangerous cyanobacteria toxins in raw and finished drinking water. USEPA has published guidance and Illinois EPA can provide technical assistance. The development, extent, and persistence of HABs can potentially be reduced through source reduction of nutrients (primarily phosphorus).

[125] "Emerging pollutants" are those not typically monitored in the aquatic environment but that have the potential to adversely impact aquatic organism and/or human health. Such pollutant classes include pharmaceuticals, microplastics, and disinfection by-products.

[126] EPA believes that nitrogen and phosphorus pollution is one of the most serious and pervasive water quality problems. Sources of nutrients present in waterbodies are both natural and anthropogenic (human-influenced). Human-induced nutrient pollution comes from a number of point and nonpointnon-point sources including urban stormwater runoff, municipal and industrial wastewater discharges, row crop agriculture, animal feeding operations (AFOs) and concentrated animal feeding operations (CAFOs), and atmospheric deposition.

[127] Missouri has a WQ trading framework in place, up to permittees to figure out how to make it work.

[128] The general use standard for chloride is 500 mg/L for all waters of the State and Lake Michigan Basin, except in waters where mixing is allowed or where there is a site-specific standard, and 12.0 mg/L for the Open Waters of Lake Michigan.

[129] In *Urban BMPs - Supplement Guidance for Funding Eligibility*, it is indicated that once stormwater enters the municipal storm sewer system, it is considered a point source. Thus, "an end of-pipe device to treat storm water from the municipal storm sewer system before it is discharged to a water body would generally be considered a point source control and would not [be] eligible for Section 319 funding." (http://www.epa.state.il.us/water/watershed/publications/nps-pollution/urban-bmps-supplemental-guidance.pdf, accessed 4/27/29017)

5.2 Renew attention on waterways, waterbodies, habitat, and Lake Michigan

Our waterways and riparian zones should be protected and enhanced for multiple users including recreation, commerce, water supply, and habitat. The region should prioritize waterway preservation and resource protection, planning, and investment efforts in areas where healthy, high quality waters and watersheds may be subject to future development pressure. This may include headwaters streams, low flow streams, and sensitive / high quality / Biologically Significant streams, some of which are dependent on shallow groundwater flow to maintain streamflow and ecological integrity. Protecting, restoring, and expanding riparian buffers should also be promoted as a key component of water quality protection. At the state level, laws should be revised explicitly to protect aquatic habitat and natural conditions in both public and non-public streams and rivers, rather than just the major rivers designated as "public." [130]

The protection, restoration, and improvement of wetlands in the region should be promoted, particularly as the federal government intends to roll back protections. At minimum, the goal should be no net loss of wetlands, and if possible, a net gain in wetlands should be sought through restoration, primarily in areas where suitable soils and hydrology remain or can be easily restored.[131]

For the Chicago metropolitan region, Lake Michigan's importance to the region's economy and high quality of life demands our ongoing attention. Lake Michigan is the single most significant source of water for the people, industries, and economy of the region, and the Illinois water allocation should be better managed to minimize water loss, reduce water use, and reuse water more efficiently, and thereby expand the availability of this source for the region's needs. This may include gaining a better understanding and developing strategies for minimizing the diversion of Lake Michigan water to the Mississippi River system. Lake Michigan as a water source is covered in a separate strategy in this paper.

From a water quality perspective, Lake Michigan receives a variety of point and nonpoint pollutants from urban, agricultural, and industrial sources throughout its drainage basin. Along the Illinois shoreline, combined sewer overflows from Illinois and Wisconsin introduce pathogens that can result in beach closures, and fish contaminated with mercury and PCBs may be unsafe to consume at certain levels by certain populations. As mentioned in the Infrastructure and Facilities section, CMAP should work with partners to reduce the frequency of CSOs to the lake and the frequency of beach closures due to high bacteria / pathogen levels. This will occur primarily via stormwater management strategies outlined in the Stormwater Strategy paper to reduce flows into the storm sewer system. Beyond that, CMAP should continue to encourage separation of combined sewers or implement other strategies to reduce the frequency of overflows.

Aquatic invasive species are already present in significant numbers and have affected the Lake's natural ecology and native species dynamics. Further, the Lake becomes a source from which invasive species can be transported to other inland lakes and waterways. CMAP should continue to follow and support efforts to block new invasive species introductions, curtail the transport of invasive species to inland waterbodies, and strengthen native species populations in the Lake. Discussion continues about the significant ecological damage that could ensue due to the introduction and population growth of the Asian Carp via the CAWS. This challenge may require highly complex and potentially expensive and disruptive solutions, some of which could affect use of the CAWS for transportation of goods and movement, dilution of wastewater, and stormwater flows away from Chicago. CMAP has been only

[130] NICP SPWRM

[131] A number of federal agencies are involved in wetlands (CWA Section 404) including USACE, the principal permitting agency, as well as wetlands restoration programs of the USFWS, USEPA, USDA, USDOI, and NOAA.

modestly involved in discussions of the issue, but there may be additional roles for CMAP as potential solutions are narrowed and a preferred solution emerges.

Much of the Lake Michigan shoreline in Illinois has been hardened or modified to accommodate development, recreation, and safety. Nonetheless, CMAP should work with and encourage coastal communities to protect and restore coastal and near shore habitat including ravines, coastal wetlands, and woodlands, and promote the preservation and restoration of migratory bird flyway habitat along and inland from the coast.

Next Steps

The framework in this strategy paper sets the direction for water resources in ON TO 2050. The recommendations will help integrate the vision for water quality, water supply, and aquatic systems into context with the approaches for other topic areas, such as climate resilience, lands in transition, and stormwater and flooding. CMAP expects these recommendations to inform future strategy papers, snapshots, technical assistance projects, policy updates, research products, and data sharing.

CMAP cannot achieve the strategies outlined in this paper alone. Regional partners are critical to successful implementation of many strategies. Further discussions on the most effective ways to advance regional collaboration will be essential as the agency develops and then implements ON TO 2050. The largest unanswered questions from this paper -- how to address those topics for which CMAP should not take the lead -- will require continued work by staff in partnership with other organizations to hone both the best regional approach and CMAP's role in that approach.