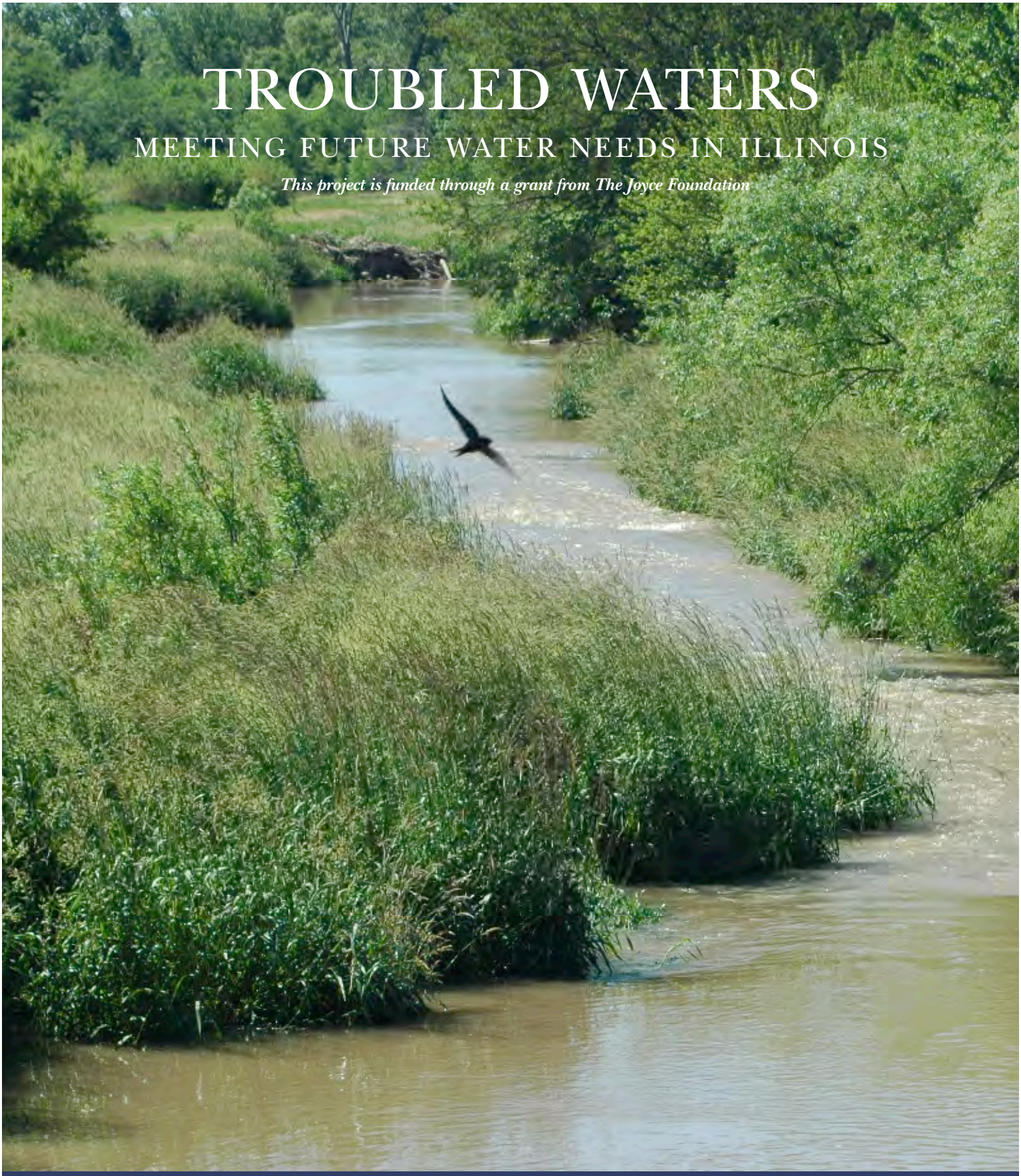

TROUBLED WATERS

MEETING FUTURE WATER NEEDS IN ILLINOIS

This project is funded through a grant from The Joyce Foundation

Campaign for Sensible Growth

Metropolitan Planning Council

Openlands Project

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PHOTO COURTESY OF RICHARD MARINER

Well designed and integrated native landscaping helps protect natural resources and eliminates the need for heavy infrastructure.

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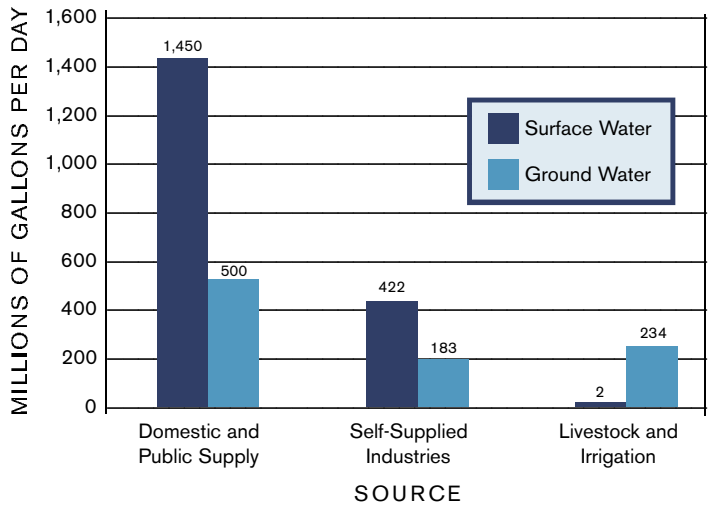
Careful planning and management of our water resources is critical to ensuring supplies of clean water at a reasonable cost in the future.

Illinois lies adjacent to one of the world's largest bodies of fresh water, Lake Michigan, and has seemingly endless groundwater and surface water. However, parts of Illinois face the same dilemma as states in the west and southwest – projected water shortages by the year 2020 because of ever-increasing demands for water, combined with legal and physical constraints.

The amount or quantity of water that exists in Illinois depends on four factors: water availability, water demand, the supply from existing delivery systems, and actual use. While water availability is generally more than adequate to meet future demand, growth in population, the economy and in energy consumption are leading to projected water shortages in some areas. This policy brief advocates for protection of Illinois' water supply through sustainable development practices combined with improved water planning and increased public awareness. It describes current water demands in Illinois and the sources of water supply. It also outlines the considerable challenges to meeting current and future demands, as well as actions to ensure adequate water availability in both quantity and quality for future generations.

Figure 1:
Illinois Consumptive Fresh Water Withdrawals, 1995*



SOURCE: U.S. GEOLOGICAL SURVEY CIRCULAR 1200

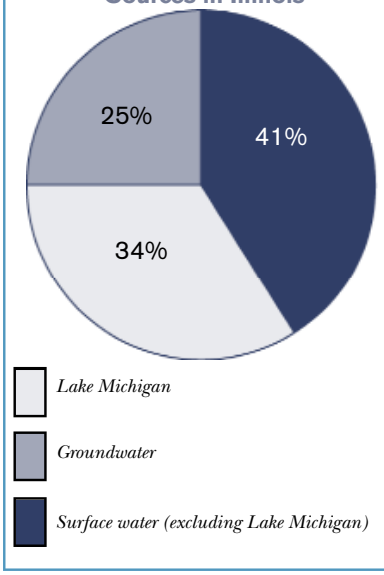
* *Does not include thermo-electric generation*

WATER DEMANDS AND RESOURCES IN ILLINOIS

Close to 20 billion gallons of water are used in Illinois each day for domestic, municipal, commercial, agricultural, industrial, mining, power generation, recreation, navigation, and waste dilution purposes. Large quantities of water also are needed to sustain healthy ecosystems, including habitat for fish and other wildlife.

Researchers from Southern Illinois University's Department of Geography report water use statewide is projected to increase almost 28 percent overall by 2025. They project total

Figure 2:
Relative Utilization of Water Sources in Illinois



SOURCE: ILLINOIS STATE WATER SURVEY

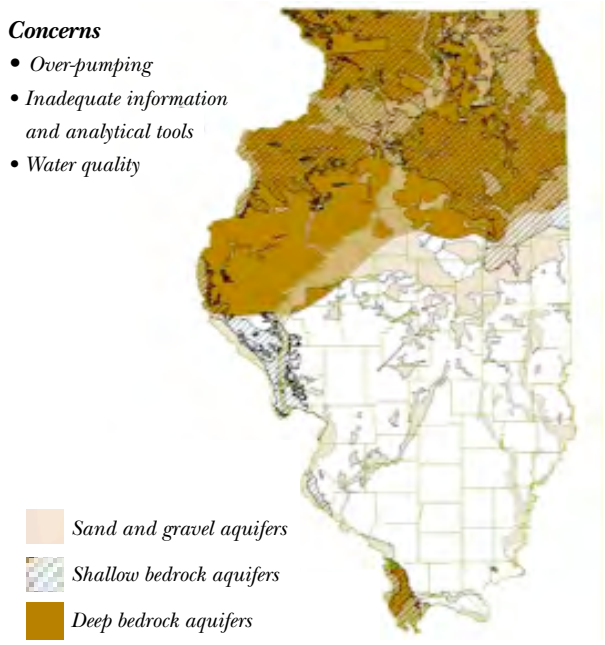
water use will increase in 89 of 102 counties. (*County-Level Forecasts of Water Use in Illinois*: 2005-2025.)

Sources of water in Illinois are groundwater (shallow and deep aquifers), Lake Michigan, and other surface water (rivers, streams, lakes, reservoirs). Relative utilization of these sources is shown in Figure 2. Within the six-county northeastern Illinois region, water sources currently being used are shallow and deep groundwater aquifers, Lake Michigan, and inland surface waters. The deep aquifer system and Lake Michigan are now at or near their sustainable or legally mandated limits and cannot be relied upon as significant sources of additional water for the region.

GROUNDWATER

Although most groundwater in the state is untapped, large amounts of groundwater from shallow and deep aquifers are consumed in northeastern Illinois for public, industrial and commercial purposes, resulting in stresses on water availability and quality. Communities that depend on groundwater in Illinois draw their water from unconsolidated aquifers (local surficial sand and gravel aquifers), the shallow bedrock aquifer, the deep bedrock aquifer, and some even draw from the very deep Elmhurst-Mount Simon bedrock aquifer, which has poor water quality at great depths (Figure 3).
Thousands of private wells tap water in the shallow aquifers. The amount of groundwater that can be withdrawn safely varies tremendously from aquifer to aquifer, as does the quality of the water drawn. Shallow aquifers can be subject to contamination based on the permeability of the soil types. Natural areas such as wetlands and fens are dependent on groundwater discharges to the surface. Excessive pumping may reduce or eliminate those critical flows.

Figure 3:
Illinois Groundwater Resources

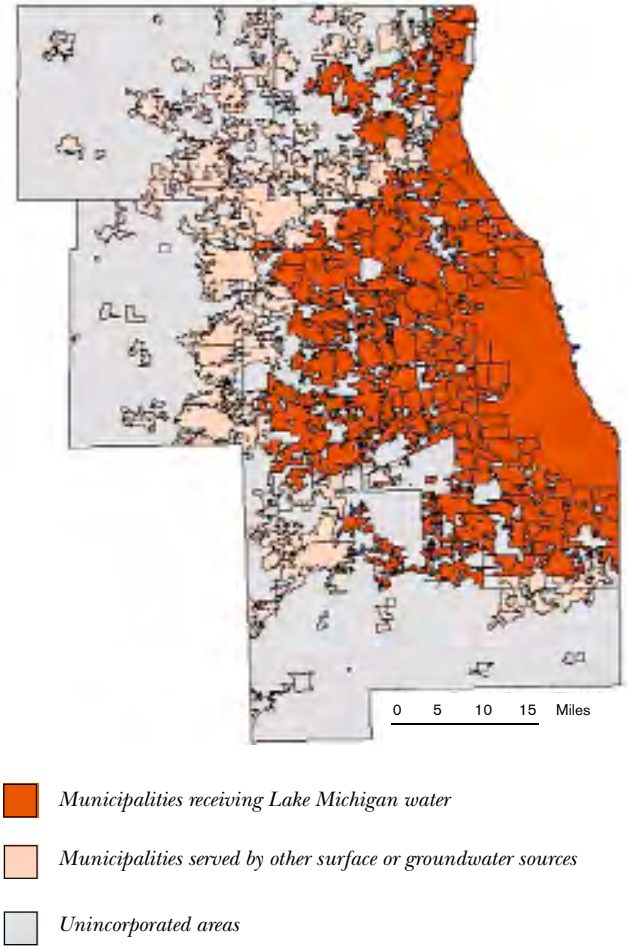


SOURCE: ILLINOIS STATE WATER SURVEY

LAKE MICHIGAN

While Lake Michigan is an abundant source of water, legal constraints limit Illinois' use. After the reversal of the Chicago River in the early 20th Century and a series of lawsuits, the U.S. Supreme Court decreed that Illinois can divert no more than 3,200 cubic feet of water per second from Lake Michigan. Currently, 201 public water supply

Figure 4:
Primary Drinking Water Sources in the Northeastern Illinois Region



INFORMATION PROVIDED BY HARZA ENGINEERING

systems serving approximately 6.8 million northeastern Illinois residents have a permit to use Lake Michigan water (Figure 4).

INLAND SURFACE WATERS

Because of the lack of groundwater sources, inland surface waters are the source of most public water supplies in southern and central Illinois. Withdrawals are either taken directly from streams or, more commonly, taken from reservoirs formed by stream impoundment (i.e., dams). In northeastern Illinois, some rivers, such as the Fox and Kankakee, also supply water for public use.

CURRENT CHALLENGES

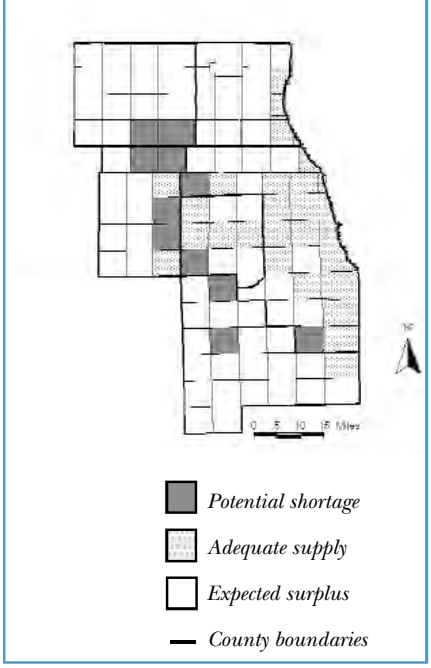
1. Withdrawal of water from *Lake Michigan* is set by decree of the U. S. Supreme Court and by agreement with other states and Canada. The allocation is almost fully used and is unlikely to be increased in the near future.

In 1985, the Great Lakes Governors and the Premiers of the Canadian provinces signed the ***Great Lakes Charter***, which included a set of principles to guide them in developing a regional management system for the Great Lakes. The following year, Congress passed the Water Resources Development Act. Since then, only two new diversions of Lake Michigan water have been approved.

While significant progress has been made since 1985 in restoring and improving the health of the Great Lakes Basin, the ecosystem still remains at considerable risk. In 2001, the Governors and Canadian Premiers signed the ***2001 Great Lakes Charter Annex***, an agreement to update the way the Great Lakes and the waters of the Great Lakes Basin are managed, and provide the Great Lakes with additional protection from pollution and unsustainable practices.

The ***Annex's*** stated goal is to provide a vision for protecting, conserving, restoring, and improving the water and water-dependent natural resources of the Great Lakes. The Great Lakes Governors and Canadian Premiers are currently developing Implementing Agreements for carrying out the princi-

Figure 5:
Potential Water Shortages Predicted in Northeastern Illinois in 2020



SOURCE: ESTIMATES DERIVED USING 1998 CENSUS BUREAU POPULATION ESTIMATES, NIPC'S 2020 POPULATION FORECASTS (SEPT. 2000); GROUNDWATER SUPPLY AVAILABILITY ESTIMATES BY ILLINOIS DEPARTMENT OF NATURAL RESOURCES/STATE WATER SURVEY (SHALLOW AQUIFER GROUNDWATER AVAILABILITY BASED ON SINGH AND ADAMS [1980], DEEP BEDROCK AQUIFER GROUNDWATER AVAILABILITY BASED ON SUTER ET. AL. [1959]); LAKE MICHIGAN AND OTHER SURFACE WATER SUPPLY AVAILABILITY ESTIMATES BY HARZA ENGINEERING (2001), AND PER CAPITA WATER DEMAND ESTIMATES BY HARZA ENGINEERING (2001).

ples of the ***2001 Great Lakes Charter Annex***. The Implementing Agreements will establish a new alliance for the management of the Great Lakes basin and will help the Great Lakes states and provinces retain authority over the water within the basin. Local communities seeking new or increased withdrawls of Great Lakes water will have to comply with the Implementing Agreements.

The Implementing Agreements are comprised of two documents: 1) The Greats Lakes Basin Water Resources Compact and 2) The Great Lakes Basin Sustainable Water Resources Agreement. The Compact would be a legally binding agreement between the eight states that border the Great Lakes; for legal reasons the Canadian Provinces cannot officially join the Compact. The Water Resources Agreement would be a non-binding agreement between the Great Lakes states and the Canadian provinces. The final versions of the Compact and the Water Resources Agreement are expected to be released by the end of 2005. The Implementing Agreements must be ratified by their respective state and provincial legislative bodies and the Compact needs Congressional approval to become effective.

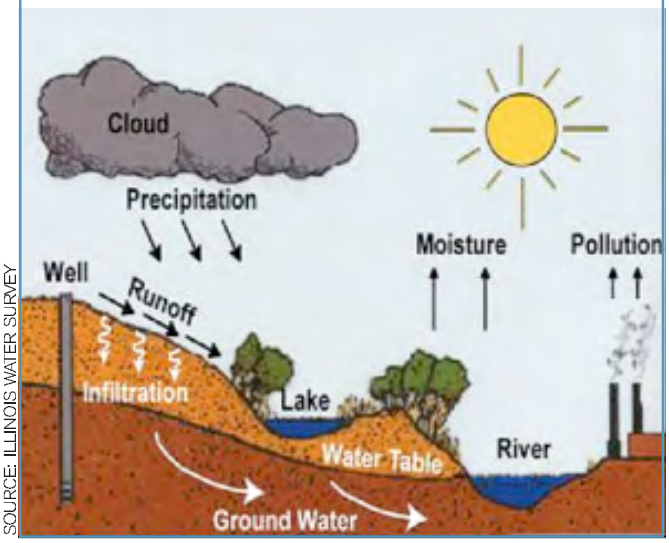
The Northeastern Illinois Planning Commission (NIPC) projects the population served by public water supply systems presently receiving Lake Michigan water will increase by about 12 percent between 1997 and 2020. Improvements in infrastructure and changes in the diversion's accounting procedures may permit Illinois to comply with its diversion limits while accommodating some demand increases within the Lake Michigan service area. If not, other sources of water will be needed to accommodate regional growth in these areas, since it is unlikely that new diversions will be approved.

2. In northeastern Illinois, *new development* is occurring in areas potentially lacking adequate water sources.

The six-county northeastern Illinois region currently uses Lake Michigan water, inland surface waters, and water withdrawn from shallow and deep groundwater aquifers. The deep aquifer system and Lake Michigan are now at or near their sustainable or legally mandated limits. Naturally occurring pollutants, such as arsenic, radium, suspended solids and chloride limit the availability of clean water at reasonable cost in some areas. Human and industrial activities that produce pollutants such as pesticides, metals, sediments and nutrients add to these water-quality problems and treatment costs.

NIPC predicts that the region's overall population will reach over nine million by 2020 and more than 10 million people by 2030, an increase of

Figure 6:
The Hydrologic Cycle



SOURCE: ILLINOIS WATER SURVEY

almost 24 percent over the 2000 population. This continued growth is expected to result in corresponding increases in the demand for water throughout the region even in Cook County.

Significant increases in demand are expected in the far western and southern parts of the Chicago metropolitan region. Because of the cost of infrastructure to transport Lake Michigan water over such a distance and the legal restrictions on withdrawals from the Lake, future increases in demand for water in these areas will have to be met primarily through increased withdrawals from groundwater sources or inland water sources such as the Fox and Kankakee rivers.

In order to facilitate regional water supply and related land-use planning, detailed studies are needed to delineate the location, boundaries, depth, quality, and thickness of the aquifers in northeastern Illinois, as well as the minimum base flow for the inland rivers. Detailed knowledge of the local and regional hydrology is limited. Because of the near-term impacts of dramatic growth, Kane and McHenry counties have committed substantial resources to analyzing their groundwater supply. They are at the forefront of the development of policies for the management and protection of their water resources. The state is involved in a series of hydrological and geological investigations that will provide technical support to the counties for developing policies to help preserve groundwater availability and protect water quality (www.sws.uiuc.edu/gws/neilproj.asp).

3. *Groundwater* and *surface water* have historically been managed separately. A better scientific understanding of their *interconnection* is needed in order to plan and manage the state's resources.

Groundwater interacts with nearly all types of surface waters (streams, lakes, reservoirs, and wetlands) as demonstrated in the hydrologic cycle (Figure 6). Surface water bodies can receive groundwater inflow, lose water by seepage, or both. Therefore, actions upon one part of the hydrologic system can have unintended consequences upon the other parts of the system. As development of land and use of water resources intensifies, it is becoming increasingly important to manage and plan together for groundwater and surface water. The current regulatory system is not set up for this integration.

Currently, there are no comprehensive statewide or regional plans for managing the water supply and no entities charged with the responsibility for water planning and management at the regional level. Water quantity planning on a regional scale is needed because aquifers and watersheds are regional in nature, cutting across political boundaries.

4. Future water availability is highly dependent upon precipitation and temperature. Some projections show that water availability in the Midwest could change dramatically as a result of *climate change*.

In addition to projected increased demands for water throughout Illinois, water supply is uncertain due to climactic extremes such as droughts and floods. Droughts can quickly create water shortages. Floods often damage wastewater treatment facilities and send polluted water into streams and rivers. Some models show annual precipitation in Illinois by the end of the 21st Century as low as 25 inches (current precipitation is approximately 37 inches per year in northeastern Illinois) or as high as 50 inches. The major scientific uncertainties about the type and degree of climate change place additional stress on water supplies (Illinois State Water Survey, www.sws.uiuc.edu/pubdoc/IEM/ISWSIEM2001-03.pdf).

RECOMMENDATIONS

In order to meet the societal demands and those of aquatic ecosystems for water while addressing these many challenges, the following actions are recommended to promote future water availability, in quantity and quality:

1. Carry out a statewide coordinated ground and surface water *inventory*, resource *assessment*, and *modeling* program.

Estimates of water use in Illinois are largely based upon the Illinois Water Inventory Program questionnaires that the Illinois State Water Survey (ISWS) sends annually to municipalities and known self-supplied industrial and commercial facilities. Public water supplies, self-supplied industries, irrigation, fish and wildlife, and conservation uses are inventoried. Completion of the questionnaires is voluntary and the resulting data are provided to the U. S. Geological Survey (USGS) for statewide and regional summary. Estimates of water use often are quite inadequate, however, since many major uses (e.g., irrigation) are not reported. In the absence of full reporting, planning and management cannot be comprehensive.

Funding for the maintenance and expansion of the Water Survey's inventory program needs to be renewed. In addition, technical data and models based on inventory data and additional field investigations are needed for water supply planning and management. Existing models often are outdated, inadequate or nonexistent

Southern Lake Michigan Regional Water Supply Consortium

The Southern Lake Michigan Regional Water Supply Consortium (www.nipc.org/environment/slmrwsc), was created to promote a comprehensive, regional approach to sustainable water supply planning and management in the greater Chicago metropolitan region, southeastern Wisconsin and northwestern Indiana. The consortium includes agencies, communities, and interested parties that collaborate to identify the needs for regional water supply planning and management. In addition to maintaining a Web clearinghouse of information on Lake Michigan and regional water supply sources, the consortium facilitates regional water supply planning by providing a forum for planners, scientists, and water supply providers to exchange ideas and remain informed on current issues and programs. The long-term goal of the consortium is to be a coordinator for funding, data gathering and analysis, as well as related policy development.

The data from USGS and field investigations should be put into detailed ground and surface water models. These models, in turn, can be used to evaluate:

- long-term practical renewable yields from the state's major aquifers;
- impacts of withdrawals on the quality and quantity of the resources;
- interaction between shallow groundwater supplies and streamflows; and
- water use conflicts.

This information will help to establish the scientific basis for the management of the state's water resources.

2. Develop a *statewide framework* for regional water supply planning and management.

Currently, there are no comprehensive statewide or regional plans for managing the water supply and no entities charged with the responsibility for water planning and management at the regional level. Water quantity planning on a regional scale is needed because aquifers and watersheds are regional in nature, cutting across political boundaries. Since aquifers and watersheds overlap geographically and are interdependent, water quantity planning and management must address these resources jointly. Water planning must involve local communities, political entities, and constituents. Planning and communication should occur at several levels and address shared problems and opportunities.

Comprehensive water supply planning at the regional and local levels can increase efficiencies, lower costs, anticipate conflicts, and ensure the future availability of adequate supplies of clean water at a reasonable cost. Based on past legislative experiences and current scientific understanding of appropriate planning scales for water supply, Illinois should encourage the formation of priority water quantity planning areas where existing data suggest future water shortages, such as northeastern Illinois (see box). At this time, the Southern Lake Michigan Regional Water Supply Consortium is purely advisory in nature, but it plays a significant role in bringing together key players from three states to work cooperatively.

To encourage the formation of planning areas and ongoing cooperation within them, the State of Illinois should develop a package of incentives that provides some financial support and dedicated technical assistance. Although each planning area should develop its own regional water resources management plan that describes its unique site-specific problems and proposes solutions, the state should oversee and coordinate the development of regional plans.

While there has been a national movement toward linking surface and groundwater quality protection into watershed planning, there has been little effort to integrate water quantity planning into watershed planning. Water quantity management is impaired because the boundaries of watersheds and aquifers do not coincide, and political boundaries do not coincide with either watersheds or aquifers.

3. Implement a statewide *water withdrawal permitting program.*

The Illinois Water Use Act of 1983 states that it is in the public interest to better manage and conserve water. It provides for public notice of planned substantial (>100,000 gallons per day) withdrawals of groundwater from new points in all areas of the state except the six-county Chicago region. The general purpose and intent of the act was to establish a means of reviewing water conflicts before damage to any person is incurred, and to establish a rule for mitigating water shortage conflicts. The act gives authority to soil and water conservation districts to receive notice of incoming substantial users of water, and establishes a reasonable use rule for groundwater withdrawals.

In order to better plan for future water needs and avoid water-use conflicts, a statewide permitting system should be implemented. The Water Use Act of 1983 should be amended to eliminate the exemption for northeastern Illinois, and funding should be provided for implementation.

4. Evaluate the water demand aspect of *land-use plans.*

Counties and municipalities should evaluate the water demand aspect of land-use plans within their planning areas and identify the source of supply to meet the long-term demand. Currently, most land-use plans and subsequent subdivision and site plans do not include an evaluation of the water demand of the proposed land use, nor is it considered a required element of comprehensive plans under the Illinois Local Planning Technical Assistance Act. If this were required, and if the appropriate water supply scientific studies were conducted, land-use and site plans could be assessed during the review process to ensure the predicted land use will not result in a water-use conflict in the future. Even without full information, an engineering evaluation should be conducted to assess the water demand of the proposed land use and estimate whether the local water resources can sustain that land use.

5. Include water quantity/supply objectives and strategies in *watershed plans.*

While there has been a national movement toward linking surface and groundwater quality protection to watershed planning, there has been little effort to integrate water quantity planning with watershed planning. Water quantity management is impaired because the boundaries of watersheds and aquifers do not coincide, and political boundaries do not coincide with either watersheds or aquifers. As the groundwater/surface water connection is better understood, state, regional and local governments will

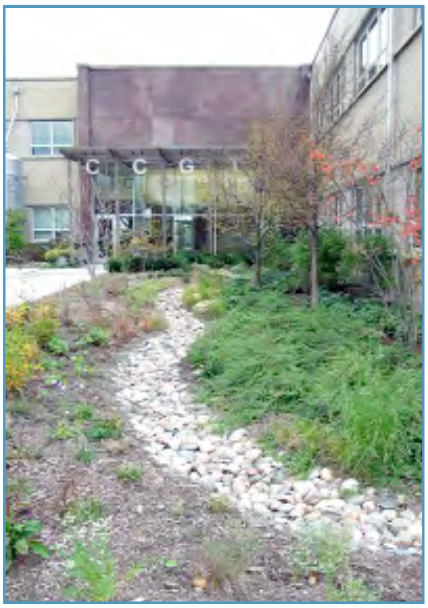


PHOTO COURTESY OF RICHARD MARINER

Using pervious surfaces like this drainage ditch from stones allows for groundwater infiltration and aquifer recharge.

Water conservation best management practices (BMP) are available for different uses and conditions including: agricultural, commercial, industrial, irrigation, landscaping, lawn watering, residential uses, and drought and emergency conditions.

be able to include water quantity/supply issues in watershed planning. Some initial strategies include reduction in paved or impervious coverage and other low-impact development techniques, designation of recharge overlay districts for both water quantity and quality protection, and requiring integration of water reuse scenarios into wastewater planning. (See www.metroplanning.org/cmadocs/changingcourse.pdf for additional ideas.)

6. Implement local *recharge area protection* programs.

The amount of water withdrawn from rivers, streams, springs, lakes, reservoirs and aquifers cannot increase indefinitely. Safe withdrawal is dependent to a large extent on the recharge rate, i.e., the rate at which withdrawn water can be replaced. In general, the faster the recharge rate, the more water can be withdrawn safely. Rivers, streams, lakes and reservoirs can be recharged in a matter of days following heavy precipitation. Aquifers are recharged at a slower rate, ranging from months to thousands of years, depending on their depth and the characteristics of their overlying material.

Local governments have the planning and zoning tools both to protect recharge areas from contamination and minimize impervious coverage to allow for maximum infiltration to the aquifers. Again, state government should create incentives for such actions.

It is difficult to maintain the water quality and quantity of shallow aquifers as their recharge areas urbanize. Studies have shown that approximately 79 percent of recharge area acres that support unconfined (without a protective clay layer) aquifer wells are threatened by potential contamination sources. This problem is exacerbated by commercial and industrial land uses, and inadequate identification, preservation and protection of recharge areas.

7. Develop guidelines for local *water conservation* practices.

All Illinois communities using Lake Michigan water and/or groundwater must adopt water conservation measures to promote the efficient use of their Lake Michigan water allocation. Voluntary water conservation initiatives have not been adopted widely, in many communities.

A single home or business that withdraws water does not usually impact the water source significantly. But taken together, unlimited residential, commercial and industrial water withdrawals can weaken a community's ability

While individuals and communities can adopt water conservation measures, ensuring an adequate water supply for future generations requires a systematic approach to planning and managing the state's water supply.

to meet demand. Local officials have the opportunity to be leaders in ensuring water resources are available for current residents and future generations through innovative planning. For residential users, there are many conservation options, including higher efficiency systems like low-flow toilets, showerheads and clothes washers. A typical residence could reduce daily water use from 147.2 gallons per day to 56.7 gallons per day, for a savings of about 60 percent. Illinois should explore requiring local governments to adopt water conservation measures in areas that are likely to experience water supply shortages within the next 20 years.

8. Encourage *alternative wastewater treatment systems.*

Land application systems that reclaim or reuse wastewater can provide reliable treatment. Alternative wastewater treatment technologies, such as land treatment and wastewater reuse, eliminate or reduce the direct surface discharge of treated wastewater into waterbodies and increase recharge of shallow aquifers.

PHOTO COURTESY OF RICHARD MARINER

Naturalized detention aids aquifer recharge.

CONCLUSION

Illinois currently uses close to 20 billion gallons of water per day but consumption is expected to increase over the next 25 years. Although Illinois is considered to be a water-rich state, water shortages are forecast for at least 22 townships in the Chicago metropolitan area by 2020 and many more shortages are expected in years beyond 2025. Moreover, the lack of rain in the spring and summer of 2005 caused temporary shortages in many communities around the state.

Economic growth, as well as population growth, depends upon a reliable supply of water for public use, thermoelectric generation, and commercial and industrial use. While individuals and communities can adopt water conservation measures, ensuring an adequate water supply for future generations requires a systematic approach to planning and managing the state's water supply. The Illinois Water Survey's research and leadership provides the starting point for establishing a framework for developing a comprehensive approach to water supply planning and management. Counties and municipalities need to work together to develop regional plans.

PHOTO COURTESY OF SUSTAIN

DEFINITIONS

Aquifer: An underground bed or layer that can yield useful amounts of groundwater to wells, springs, wetlands or streams.

Consumptive use: Any use of water that reduces the supply from which it is drawn or diverted.

Hydrologic cycle: The continuous movement of water from ocean, lakes, rivers, and other water bodies to air and land then back to these water bodies through rain and snow in a cyclic pattern as water is used and reused. Some water infiltrates into the ground or evaporates back into the atmosphere.

Impervious surface: Surfaces such as concrete, asphalt and hard roofs that resist penetration by water or plant roots, causing stormwater runoff and nonpoint source pollution. In some instances, soil compacted from construction or agricultural activity may be considered impervious.

Inland surface waters: Rivers, streams, lakes and reservoirs

Practical renewable yield: The maximum amount of water that can be continuously withdrawn from a water source without exceeding recharge or causing water levels to decline below critical levels.

Recharge: The increase in groundwater storage from precipitation, infiltration from streams, or human activity (artificial recharge).

Runoff: Stormwater that is not absorbed into the ground, but instead flows over various surfaces (e.g., lawns, driveways, roads, parking lots, earth) before draining into a river, stream, lake or detention facility.

Water availability: The amount of water that can be obtained from rivers, streams, springs, lakes, reservoirs and aquifers.

Water conservation: Practices that promote the efficient use of water, such as minimizing losses, reducing wasteful use, and protecting availability for future use.

Water demand: The amount of water that is desired for domestic, municipal, commercial, agricultural, industrial, mining, power generation, waste dilution, navigation, recreation, and environmental (e.g., fish and wildlife) purposes.

Water use: The amount of water either withdrawn from groundwater or surface water sources or utilized in stream to meet water demand.

Watershed: The land area that directly drains to a common stream, river or lake.

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