Our Water's Health in the Rockford Region

Regional Water Quality Technical Support Document

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REGION 1 PLANNING COUNCIL | RPC

A3E ENVIRONMENTAL CONSULTANTS

PLACE foundry

Acknowledgements

Report written for Region 1 Planning Council

Written by:

Ella Iaderosa, *Associate Ecologist, A3 Environmental Consultants*

Daisy Orellana, *Associate Ecologist, A3 Environmental Consultants*

Directed and Edited by:

Rebecca Olson, MS, *Lead Ecologist, A3 Environmental Consultants*

Jeff Macke, PE, *Place Director, Place Foundry*

Technical Advisors:

Dan Kane, PG, *Water Resource Specialist, Boone County*

Justin Krohn, PE, MBA, *Engineer, Boone County*

Sean Von Bergen, *Assistant County Engineer, Winnebago County Highway Department*

Dennis Anthony, *Executive Director/Soil Scientist, Winnebago County Soil and Water Conservation District*

Scott Sanders, *Director of Public Works, City of Rockford*

Tim Verbeke, *Director of Planning, Region 1 Planning Council*

Michael Dunn, *Executive Director, Region 1 Planning Council*

Purpose and Intent

Clean water supports our health, economy, recreation, and nature. This Regional Water Quality Technical Support Document compiles studies and data about the interconnected water system within the Rockford Region to serve as a summary to help professionals, planners, and concerned citizens to make informed decisions regarding water use and treatment. This report is meant to provide information related to the quality of our water and direction to other documents for more detail. It is not an action plan, although information regarding recommendations from local literature are included. This document is linked to the Regional Water Quality Overview with the intent of providing more detailed information to interested audiences. The Overview can be accessed using the QR code and link to the right.

Executive Summary

The Region 1 Planning Council (R1) worked with A3 Environmental Consultants and Place Foundry to provide a comprehensive summary of local water quality data within this technical support document. This report discusses known information about our integrated water system, organized by surface water, groundwater, and drinking water topics in a manner that planners, water quality professionals, and interested citizens can use to inform their decisions. This document addresses both natural and human-induced elements of water quality. It is not exhaustive in its reporting of local data or recommendations, however, it briefly summarizes information from local sources throughout the Rockford Region, which extends throughout Winnebago, Ogle, and Boone counties, as shown in Figure 1.

Our Water Cycle

Water is an integrated system that includes surface water, groundwater, and drinking water. Naturally, water cycles between the atmosphere, Earth's surface and underground. Figure 2 provides an illustration of the water cycle, highlighting the difference between natural and human processes. Human processes change the natural water cycle, pumping and treating groundwater for drinking water, blocking natural pathways underground, and disposing of wastewater and stormwater into our streams and lakes. As a result, less of the water that falls as precipitation infiltrates into our aquifers. Our stormwater management systems route rainfall from impervious surfaces within urban and suburban development—such as roads, rooftops, and parking lots—into our surface waterways instead of allowing it to soak into the ground where it falls. Figure 3 provides a helpful graphic comparing infiltration in impervious environments to natural environments.

Changes Over Time

The history of the Rockford Region is based on manufacturing and agricultural production. The land use throughout the region has changed over time, experiencing a significant growth in development between 1985 and 2025, as evidenced by Figure 8 and Figure 9, respectively. Currently, the Rockford Region's landscape, approximately 434,665 acres in size, is dominated by 49% cropland (213,222 acres), 24% developed areas (102,363 acres), 13% pasture and other grassed areas (58,216 acres), and 14% natural areas (60,864 acres). This breakdown is shown graphically in Figure 10 and geographically in Figure 11.

Accompanying these land use changes, precipitation in the region has steadily increased 4.14 inches over the past 100 years, as seen in Figure 5. The combination of these changes promotes stormwater runoff, wastewater discharges, and flashy hydrology during storms, leading to issues like erosion, flooding, aquifer drawdowns, and water pollution. Engineers use precipitation data from Bulletin 75, published in 2019, to design stormwater detention systems to handle the increased precipitation. Prior constructed basins were sized to previous precipitation levels published in Bulletin 70 in 1989. Therefore, our stormwater detention system, comprised of small, interconnected basins, may be undersized to handle the increased precipitation.

Aquifers

Our region sits on top of productive aquifer systems that have reliably supplied water for over 100 years. Aquifers within the Rockford Region exist in three main layers: deep sandstone aquifers are 500 feet below the ground, shallow bedrock aquifers are less than 500 feet below the ground, and shallow sand and gravel aquifers are closest to the Earth's surface, as shown in Figure 14, a Chicago-region geology graphic comparable to that of the Rockford region. The deep Cambrian-Ordovician sandstone aquifers are the source of most public water supplies for both large municipal systems and smaller community water systems. Water flows through these deep sandstone aquifers at consistent rates making them productive and reliable; however, the sustainability of the water supply depends on the recharge capacity, which varies dramatically based on overlying geology throughout the aquifers' recharge areas, which span beyond the Rockford Region into southern Wisconsin. The regional aquifers' locations are provided in Figure 15. Shallow bedrock aquifers present intermediate vulnerability, with rock providing some natural filtration yet fractures and abandoned wells serving as rapid conduits for contaminants to reach the deep sandstone aquifers. Therefore, shallow wells (less than 300 feet deep) face the greatest risk from human activities. Shallow sand and gravel aquifers, which often serve private wells and irrigation, vary in productivity, can rapidly recharge, and are susceptible to contamination from surface sources.

Drawdown

Drawdown occurs when water is not recharged into an aquifer as quickly as it is extracted. Figure 19 depicts differences in drawdown across the northern part of Illinois. Our region's drawdown ranges from 0–200 feet and represents stable water levels relative to other areas of Illinois. In contrast, Joliet has lowered its water levels by more than 900 feet and are in the costly and complex process of switching their drinking water supply from groundwater to Lake Michigan. The Rockford Region sits on the edge of a cone of depression with Joliet in its center. The center of this cone is fundamentally altering regional groundwater flow patterns by creating a hydraulic gradient that draws water from surrounding areas toward the center. Within the cone of depression, wells that originally flowed to the surface by natural pressure now require deep pumping, and the uppermost sandstone layer has become partially desaturated in some areas. Figure 18 illustrates this phenomenon. This regional drawdown threatens the long-term viability of deep sandstone aquifers as a water supply source across northern Illinois. However, a complex and poorly understood geology at local scales complicates the ability to predict the rate at which further drawdown might occur, and improved practices by the region's communities could change or slow the outcome. For example, the City of Rockford's total water pumping has steadily declined from 32 million gallons per day in 1979 to 16 million gallons per day in 2019. Further studies, such as the current efforts by Boone County to prepare detailed geology maps, will aid in our local understanding of the sustainability of the groundwater supply.

Sensitive Aquifer Recharge Areas

Locating and protecting sensitive aquifer recharge areas (SARA), mainly known to be within the Rock River Valley and maintaining hydraulic connections between aquifer layers are critical for long-term sustainability of our groundwater resources. Within sensitive aquifer recharge areas, shallow sand and gravel deposits allow precipitation to percolate rapidly downward into the deep sandstone aquifers. The same characteristics that make these areas excellent for recharge—high permeability and direct hydraulic connections between surface and groundwater—also make them highly vulnerable to contamination from surface sources. Figure 20 provides a SARA map for Boone County.

Contamination

The quality of our water is affected by regulated point source pollutants—those coming from wastewater treatment plants, storm sewer systems, concentrated animal feeding operations, and construction areas—and unregulated nonpoint source pollutants that accumulate in stormwater runoff from all types of land uses. Pollutants can be organic—such as pathogens, nutrients, and sediment—or inorganic, including heavy metals, chlorides (road salts), cyanides, sulphates, mercury, and arsenic. Rising water temperatures due to thermal pollutants—such as hot water effluent and runoff from dark pavement—can provide favorable conditions for decreased dissolved oxygen, growth of algae and pathogens, and other problems. Emerging contaminants, not yet regulated with risks not fully understood, have been detected in the environment. These include microplastics, hormones, pharmaceuticals, flame retardants, industrial additives, and per- and polyfluoroalkyl substances (PFAS).

Contaminants can be carried into our surface waters and groundwater by various methods. Urban and suburban living create high percentages of impervious surfaces, which route precipitation into nearby water bodies rather than letting it soak into the ground or be filtered by vegetation and soil. Therefore, urban land uses are significantly more polluting to our surface waterways when comparing land use types of the same size (e.g. acre per acre), followed by suburban and then agricultural lands according to the Simple Method for runoff volume with local data inputs. Water that is allowed to infiltrate into the soil, such as in agricultural fields, may carry contaminants that can reach shallow wells and aquifers, such as nitrates and road salts. Deep aquifers, although generally protected from surface contamination, face challenges from naturally occurring contaminants like radium. Approximately one in five wells tapping the St. Peter and Ironton-Galesville sandstone aquifers (major units of the Cambrian-Ordovician aquifer) exceed the 5 pCi/L drinking water standard for radium, requiring treatment for public water supplies.

High Quality and Impaired Streams

The river system in the Rockford Region includes both impaired stream segments and streams of high biologic integrity and diversity. There are 26 impaired segments of stream, comprising 269 miles within the watersheds of the Pecatonica, Rock, and Kishwaukee rivers. Most impairments are to primary contact and fish consumption, and the most identified issues were fecal coliform, mercury, and polychlorinated biphenyl (PCB). Figure 23 provides a map of the impairments throughout the region. Total Maximum Daily Load (TMDL) reports and watershed plans provide additional impairment information within the Rockford Region. Lower Beaver Creek was designated as the highest quality stream in our region as Biologically Significant, which supports the life of rare and endangered species with high biological integrity and diversity. Reaches of the Kishwaukee River in the region shared this designation in the early 1990s, but their ratings declined due to water quality degradation. Of 25 streams given biological quality ratings, 18 were rated exceptional to moderate/fair (A-C) for diversity—a measure of the variety of species—and 23 were rated A-C for integrity, a measure of intactness of a stream community. Figure 24 and Figure 25 provide stream locations and ratings for biodiversity and biological integrity.

Protection

Our region benefits from favorable geology and sufficient water resources, but maintaining safe drinking water and clean streams and lakes requires continuous attention to both legacy contamination and emerging challenges. Laws and regulations have been created to protect our waters. For surface waters, our navigation systems are protected by the Rivers and Harbors Act of 1899, while our water quality is protected by the Clean Water Act of 1972. Drinking water health standards were borne from the Safe Drinking Water Act of 1974, which requires regular testing and public reporting for community drinking water sources. Groundwater is protected by the Illinois Groundwater Protection Act and monitoring of major, known aquifers through the Ambient Groundwater Monitoring Network. However, groundwater is difficult to monitor due to access issues and lack of aquifer maps.

Other laws and regulations at the federal, state, and local levels, plus organizations promote water quality protection on a voluntary basis. R1 Planning Council provides the Rockford Region with a One Water approach, treating all water – stormwater, groundwater, surface waterways, and wastewater – as an interconnected system. They promote the sustainable and equitable use of water while coordinating the planning of water, land, and other related resources. Other governments and non-profits often collaborate with R1 and provide complimentary water protection services, including the Soil and Water Conservation District, Natural Resources Conservation Service, Natural Land Institute, forest preserve districts, park districts, conservation districts, and city and county governments. The IEPA offers abundant educational resources and funding opportunities for these organizations and individuals.

Monitoring

Drinking water is monitored by municipalities according to regulations by the IEPA, surface water is monitored by the IEPA, and groundwater is monitored by the U.S. Geological Survey (USGS). Municipal water systems monitor and treat over 80 contaminants including bacteria, inorganic chemicals, volatile organic compounds, and emerging contaminants of concern. Our region's groundwater and drinking water resources consistently meet Maximum Contaminant Levels established by the Illinois Environmental Protection Agency, with detected levels typically well below regulatory limits. Monitoring results are published through annual Consumer Confidence Reports for drinking water and Integrated Water Quality Report for surface water by the IEPA, and the USGS manages the National Groundwater Monitoring Network database.

Gaps in the Data

Data that we have is limited geographically and in depth of content, some resources are aging or being downsized, and some desired information has not been studied. For groundwater and drinking water, sensitive aquifer recharge areas, aquifer locations, and the interconnectedness between aquifers and our drinking water are based on limited studies and low-resolution data and would benefit from analysis of detailed imaging and water well level monitoring. An important regional groundwater study is underway: voluntary mapping of aquifers with high definition data in Boone County.

Regulated municipalities report their drinking water quality and stormwater discharges; however, much of the region consists of unregulated smaller community stormwater systems and private wells serving fewer than 25 connections, which are exempt from regulatory oversight and routine water quality testing. These wells are often associated with private septic fields, which should be monitored at least once every three years by the owner. Private well owners should map and protect the wellhead capture zone of wells, maintain detailed records of well construction, and voluntarily test their wells and septic fields.

Surface water studies are available on a limited basis for quality and peak flow analysis. Watershed plans and TMDL studies have been conducted for the northern portion of the Rockford Region but not the southern portion, as shown in Figure 26. The USGS that monitors stream peak flow and other data have 230 streamgages are experiencing budget cuts, and 35 have been discontinued nationally. A Nutrient Assessment Reduction Plan (NARP), mandated by the IEPA, is being created by local municipal water treatment facilities that discharge effluent into impaired waterways. Furthermore, our stormwater detention basins are designed on a case-by-case basis, and no compilation of information analyzing the water volume capacity and function of system as a whole is publicly available.

Community Effects of Water Quality

Human health, recreation, aesthetics, and economy are affected by the quality of our waters. Water supports industries such as agriculture, manufacturing, and food processing, and clean water can raise the value of a nearby home by up to 25%. Degraded water quality loses out on billions per year in Illinois for recreational tourism such as fishing and boating. Public health concerns of degraded water quality like drinking water treatment and flood management are more costly than protecting the resources, and poor water quality leads to less opportunity and investment in the community. Funding and effort are needed to protect our natural resources that promote healthy water.

The Rockford Region is expecting a housing demand of up to 9,100 units between 2023 and 2033, accompanied by an increase in industrial, commercial, and mixed-use developments. Illinois could require 20% to 50% more water usage in the upcoming decades based on projected growth in the state. Care is being taken to mitigate these additional strains on our groundwater resources and prevent further degradation of our surface waters. Local plans in place include the City of Rockford Comprehensive Plan, R1's Integrated Water Resource Planning initiative and Winnebago County Multi-Hazard Mitigation Plan, North Park's Water Action Plan, Natural Land Institute's Strategic Land Conservation Plan, and several watershed plans, TMDL studies, to name a few.

It is important for our health and economy that planners keep water quality and conservation at the forefront of decision-making to prevent and offset damages. A mindset of water resources instead of nuisances will shift the handling of rainwater from shedding it downstream as a source of flooding and contamination to promoting it as a resource with capture and reuse of water and the nutrients, sediment, and other materials it carries.

Preservation and Mitigation

Preservation of natural land in strategic areas such as sensitive aquifer recharge areas and within the floodplains of rivers and streams is a cost-effective approach in protecting our water resources. Natural land filters most pollutants, stabilizes soils, and promotes infiltration of groundwater, especially wetlands and riparian areas that are vegetated by native plants. However, about 90% of Illinois' wetlands have been filled for development or drained for farming, and many streams have been channelized. For areas that are no longer available for preservation, mitigation is an option. Natural functions on our landscape can be rebuilt in strategic locations to improve the quality of our waters, mitigating the damage of nearby unnatural land uses. In urban and suburban settings, low impact development (LID) and green infrastructure mimic natural processes to manage stormwater while providing ancillary economic, social, and natural benefits to the community. In rural areas, best management practices (BMPs) appropriate for agricultural lands provide the same function. The Illinois Urban Manual provides BMP designs and specifications. Examples of green infrastructure within the Rockford Region on public lands include bioswales, bioretention basins, constructed stormwater wetlands, vegetated filter strips, and floating wetlands at Levings, Ken Rock, and Park-er Woods parks. Examples of BMPs on agricultural lands include no till, cover crops, and filter strips, and producers can participate in programs designed to convert productive farmland to natural land for 10 to 15 years, such as the Conservation Reserve Program (CRP).

Consumer Choices

Consumers have options for drinking water sources, based on personal conclusions about safety, taste, affordability, and trust. Choices include tap water, bottled water, and household-treated tap water (e.g. reverse osmosis, carbon filtration) from private or municipal sources. Water consumption patterns often mirror broader social and economic realities, and violations of drinking water standards have occurred more frequently in rural Latino communities and areas experiencing persistent poverty. It is important to make decisions based on specific circumstances and accurate information, such as Consumer Confidence Reports, rather than marketing claims and misconceptions.

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An Introduction to One Water

Water is one of the world's largest shared resources. Whether it's water from the tap, flowing through a stream, trickling underground, or pouring down from the skies, it is all connected through the water cycle. When considering water as one valuable resource rather than considering it in each of its forms separately, we can begin to understand its complexity, malleability, and interconnectedness. It is this understanding that can help us manage water in a way that benefits the environment and maintains water as a clean and plentiful resource without disrupting the integrity of the natural water cycle.

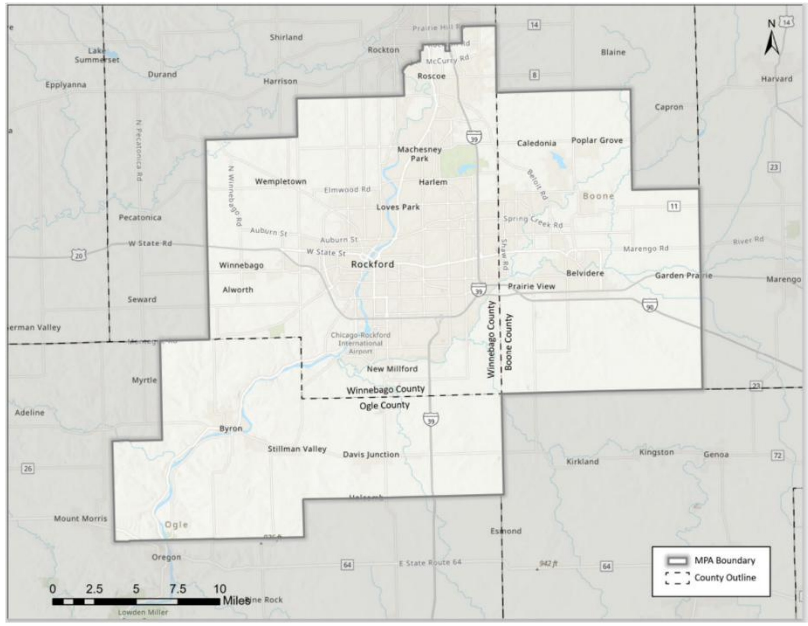

FIGURE 1. ROCKFORD MPA

Region 1 Planning Council (R1) is a local organization that aims to look at water management in the Rockford Metropolitan Planning Area (Rockford MPA) through the lens of *One Water*. Figure 1 displays the extent of the Rockford MPA which comprises parts of Winnebago, Ogle, and Boone counties, generally centered around the city of Rockford and its surrounding sprawl. They are asking questions like: If there is a drinking water issue, what is the state of the aquifer? If a lake is overrun with harmful algae, what is going on upstream? These are just some examples of the types of questions we should be asking when it comes to water quality.

The Rockford Region is unique in its rich system of streams and rivers that connect urban, suburban, and rural communities. The network between small towns and cities is dispersed in a way that does not completely crowd out natural and rural areas, providing access to the local waterbodies within the Rock, Kishwaukee, and Pecatonica watersheds. These vast waterways support recreation, public health, and economic vitality while playing a crucial role in flood control, drought management, and wildlife habitat.

From kayaking on the Rock River to relying on clean groundwater for drinking, residents depend on healthy water systems for both livelihood and quality of life.

Protecting local water quality preserves not only ecological integrity but also the social and cultural values tied to the region's waterways. The Rockford MPA serves a population of 300,000+ people throughout Boone, Winnebago, and Ogle counties. With plans for economic and industrial growth throughout the region, water quality presents itself as an important variable in the success and longevity of such development.

This report serves to provide a technical evaluation of water quality within the Rockford MPA, and includes the causes and effects of water pollution, gaps in local water quality data, and recommendations to existing community priorities to improve surface, drinking, and groundwater quality while supporting the growth and development of those communities. The first two sections below provide an overview of the natural water cycle, history of disturbances, and how the effects on water quality are monitored and regulated in the Rockford Region.

The Water Cycle: Linking Earth's Water Systems

Water systems are thoroughly interconnected, linking together surface water bodies such as rivers and lakes to groundwater aquifers, which supply the majority of the Rockford Region's available drinking water. Water cycles continuously throughout atmospheric, terrestrial, and aquatic systems by natural processes of evaporation, condensation, precipitation, and collection, driven by the gravitational forces and chemistry.[1] Figure 2 provides a graphic illustration showing the flow of the water cycle through arrows interacting with the landscape. It includes condensation, evaporation, and transpiration contributing to moisture in the sky and precipitation sending water back to the lan's surface, either through rain or snow. The graphic highlights human versus natural processes that make up the water cycle with different types of arrows. Human processes include irrigation, runoff, waste water, municipal drinking water, and private and municipal wells. It shows how water can flow through streams and rivers, or seep into the ground to recharge aquifers and the processes in which humans collect, use, and dispose of that water for human needs.

Without human influence, water movement throughout the cycle is characterized by slow and steady transportation of water molecules between different reservoirs. These reservoirs

[1] Fisher, M. R. (2017). *7.1 Water cycle and fresh water supply.* In *Environmental Biology*. Open Oregon Pressbook. https://openoregon.pressbooks.pub/envirobiology/chapter/7-1-water-cycle-and-fresh-water-supply/.

include atmospheric moisture, waterbodies on the surface (lakes, rivers, streams, wetlands, etc.), water trapped in ice and frost, and water trapped underground. Atmospheric moisture returns to the surface through precipitation, and water trapped in ice might become snowmelt when temperatures rise, both contributing to surface flow, or **surface water**. Some of this water finds temporary residence in waterbodies or in ice once again. Remaining water is intercepted by the thick vegetation of prairies, woodlands, and wetlands before flowing into a waterbody or infiltrating the soil.[2] Once underground, **groundwater** recharges underground aquifers, where it is stored to later feed streams, wetlands, and lakes, eventually cycling back to the surface. This water contains differing amounts of nutrients and sediment from natural processes of erosion and decaying biological matter. The degree to which the water is "filtered" by the soil through which it passes is dependent on the physical and chemical properties of the soil and the makeup of the substances clinging to water molecules. Moisture returns to the atmosphere through evaporation from surface waters and transpiration from plants completing the cycle. With the intense global development over the past couple hundred years, humans have altered the landscape and added more variables to the cycle, oftentimes disrupting this self-sustaining system.

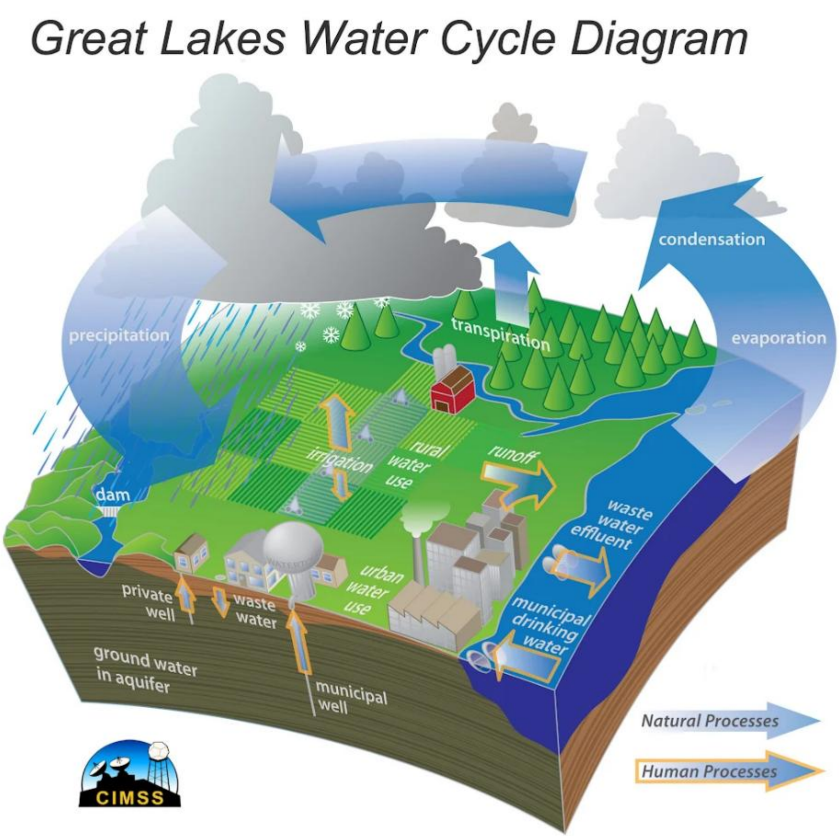

FIGURE 2. WATER CYCLE
Source: Cooperative Institute for Meteorological Satellite Studies. (2014). *Great Lakes modern water cycle diagram [Image]*. University of Wisconsin–Madison.

[2] American Planning Association. (n.d.). *Integrated water resource management (IWRM).* https://www.planning.org/knowledgebase/watermanagement/.

Ecological Disturbance

Much of what used to be natural land, bursting with a broad diversity of native vegetation, has been developed into buildings, parking lots, roads, and crop land. Approximately 90% of Illinois' lush wetlands were filled for development or altered with drain tiles and ditches for agricultural use, removing stored water from the landscape and creating channelized and modified surface water conveyance instead.[3] Headwater streams were eliminated and replaced with agricultural waterways or drainage ditches, removing aquatic habitats completely from natural stream systems. These ditches, crop lands, and paved surfaces do not provide the same "services" that prairies, woodlands, and wetlands do. Natural spaces capture and store water, absorbing the nutrients carried within it, giving it new purpose to sustain life rather than contribute to flood events that carry pollutants across the landscape. Understanding disruptions to the water cycle will be particularly important in supporting community efforts to implement water quality improvement initiatives.

The biggest difference between the pre-urbanized water cycle and the water cycle under which the global ecosystem operates today is the change in land cover. Today, the amount of land available for water infiltration has drastically decreased. In the Chicago region, from 2001-2015, approximately 140,000 acres of agricultural and natural areas were developed.[4] There is not currently a comprehensive statistic for our region, but it has also seen developmental growth in recent years. Because of modern development, there are more **impervious surfaces** like roads, buildings, parking lots, etc. It is this change in infiltration that reduces the ability for water to be filtered by soil and vegetation and recharge groundwater aquifers as shown by Figure 3 which compares water cycle processes in an environment with pervious surfaces - like a grassland or woodland - to an environment with 75-100% impervious land cover - like a densely populated city. It highlights how the natural ground cover allows for more shallow and deep

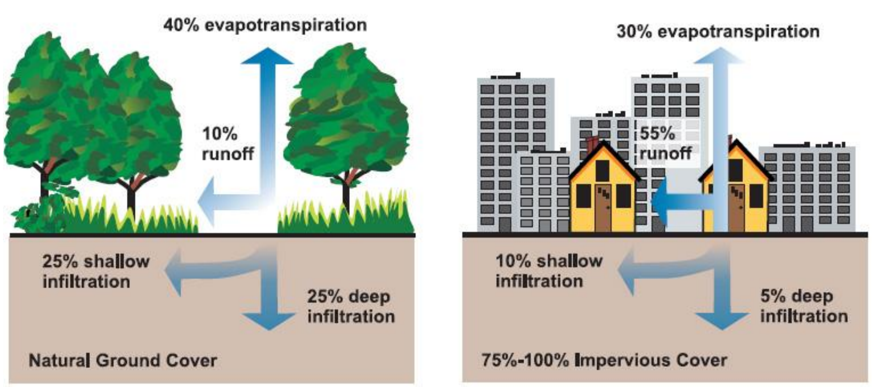

FIGURE 3. WATER INFILTRATION: PERVIOUS VS. IMPERVIOUS
Source: U.S. Environmental Protection Agency

[3] Illinois Environmental Council. (2025). *Protecting Illinois' biodiversity.* https://ilenviro.org/conservation-policy-in-illinois/.
[4] Chicago Metropolitan Agency for Planning. (2018). *Natural resources snapshot: FY18-0062.* https://cmap.illinois.gov/wp-content/uploads/FY18-0062_NATURAL_RESOURCES_SNAPSHOT.pdf.

infiltration of water than the impervious cover environment which in turn experiences far more surface runoff.

Instead, what would have become groundwater becomes urban surface water directed into roadside swales, streams, rivers, and lakes. The excess surface water often overruns these bodies of water, especially those which lack a natural floodplain, making streams and rivers "flashier," creating flash flood events and severe erosion of streambanks. This allows for the mass transportation of pollutants and sediments into the water systems causing a myriad of environmental integrity and health concerns. Figure 4 depicts the difference in flashiness between an urban canal (very flashy) and a natural stream (less flashy) as seen by the rate at which water levels peak after a rain event and fall after the peak. The hydrographs within the figure show that the urban canal peaks much quicker than the natural stream, and that the peak is higher and shorter than that of the natural stream which experiences a more drawn out increase and decrease in water level.

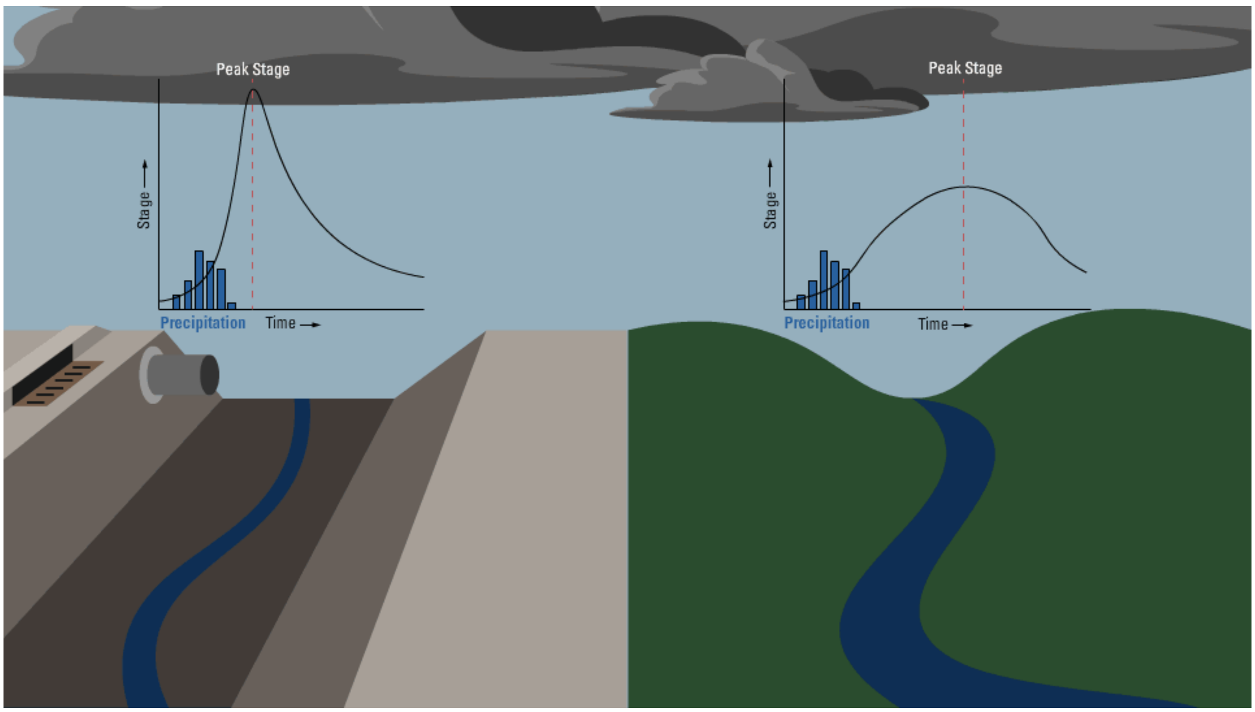

FIGURE 4. FLASHINESS OF AN URBAN CANAL (LEFT) VERSUS A LESS FLASHY NATURAL STREAM (RIGHT)

Source: Johnson, R. (2023). *Flashiness* [gif]. Virginia and West Virginia Water Science Center. U.S. Geological Survey. https://www.usgs.gov/media/images/flashiness.

Impervious surfaces also decrease the amount of groundwater recharge. Groundwater is where many communities source their **drinking water**. Interruption of groundwater recharge could result in the depletion of aquifers at a faster rate than they are being replenished. Areas where the rate of use is higher than the rate of recharge might experience drinking water insecurity. After drinking water is used for sinks, showers, toilets, and washing machines, it is routed via the underground sanitary sewer system to wastewater treatment plants. After it is processed, it is then discharges back into our rivers and streams, further adding to the increasing amount of surface water flow that we see today.

The depletion of groundwater supply, which is not *yet* an issue in our region, lowers the subsurface water table. This changes the baseline flow of surface waters which, coupled with the increase in flashy behavior of waterways, determines the physical properties of our streams and rivers as well as what kind of aquatic life can survive in these ecosystems.

Climate Change and Water Quality

Climate pressures are further increasing disturbances made to natural infiltration and hydrologic function. Shifting precipitation patterns, increasing global temperatures, and more frequent extreme weather events amplify the impacts already caused by development, agricultural drainage patterns, and the loss of native habitat. [5]

We have seen steadily increased frequency in precipitation events across Illinois since 1895. According to an NOAA study from 2018, the average annual precipitation in Illinois has increased by 4.14 inches since 1895 (Figure 5). As total precipitation rises, so does the frequency of extreme precipitation events. Another NOAA report from 2017 found that the number of days with precipitation over 2 inches within a 5-year period has been generally rising since 1900 (Figure 6). Bulletin 75, published in 2020, replaced Bulletin 70 with a new set of 30 years of rainfall data to be used when planning stormwater retention. The data shows a significant increase in inches of precipitation since 1989 for all time interval events in the northwestern Illinois region, ranging from 0.11 inches to 1.20 inches. The wettest years on record prior to 2020 were 1993, 2008, and 2009 with ~50 inches of precipitation and widespread flooding across Illinois.[6]

[5] The Nature Conservancy. (2021, March 25). *Tackling climate change in Illinois*. https://www.nature.org/en-us/about-us/where-we-work/united-states/illinois/stories-in-illinois/tackling-climate-solutions/

[6] Angel, J. R., Markus, M., *et al.* (2020). *Precipitation Frequency Study for Illinois.* Illinois State Water Survey Bulletin 75. https://www.ideals.illinois.edu/items/114209.

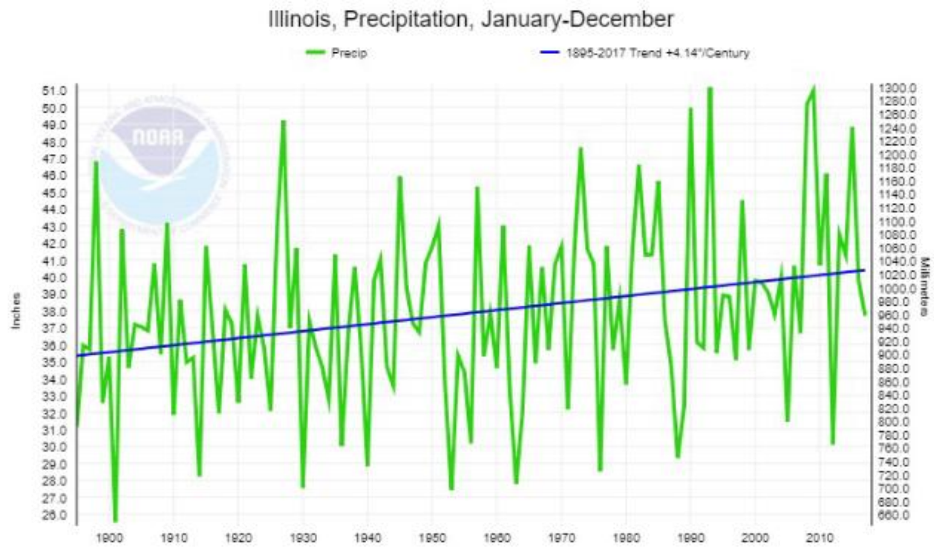

FIGURE 5. STATEWIDE AVERAGE ANNUAL PRECIPITATION FOR ILLINOIS FROM 1895 TO 2017

The green line shows the year-to-year variability. The blue line is a linear trend showing an increase of 4.14 inches over the past century. Source: NOAA, NCEI. (2018). Climate at a Glance [web page]. NOAA National Centers for Environmental Information, Asheville, NC. https://www.ncdc.noaa.gov/cag/divisional/time-series.

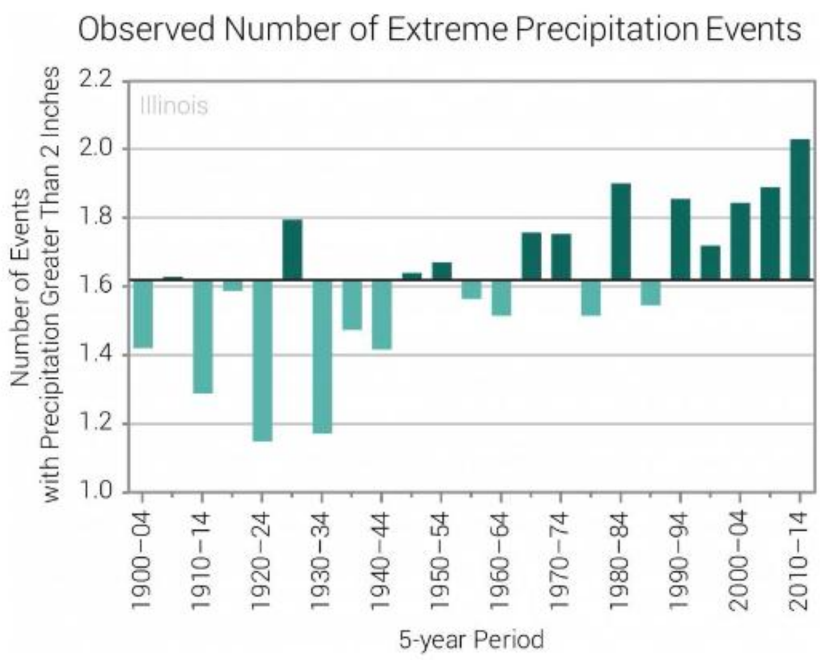

FIGURE 6. OBSERVED NUMBER OF EXTREME PRECIPITATION EVENTS

The observed number of days with precipitation greater than 2 inches for 1900-2014 on average over 5-year periods. Source: Frankson *et al*. (2017). *Illinois State Climate Summary.* NOAA Technical Report NESDIS 149-IL, 4 pp., https://statesummaries.ncics.org/il.

As the region experiences heavier and more intense rainfall events, the consequences of impervious surfaces become more severe. These climate-driven rainfall extremes interact with human-altered landscapes in ways that compound existing vulnerabilities, such as pollutant mobilization and flash flooding. Urban storm sewer systems built for historical rainfall patterns are increasingly overwhelmed. Agricultural drainage tiles and channelized ditches, designed to move water quickly off fields, now convey even greater volumes of stormwater during intense precipitation. [7]

As more intense rainfall events increase for northwestern Illinois, surrounding areas, such as central and south Illinois, have been experiencing the opposite - an increase in drought conditions through the summer of 2025. The U.S. drought monitor showed over 30% of Illinois experiencing at least moderate drought. [8] Figure 7 shows the specific areas of Illinois where differing levels of drought were observed over the summer of 2025. The northern portion of the state only had a couple of small, abnormally dry areas where almost the entirety of the southern two thirds experienced some level of drought, from abnormally dry to severe drought. Water scarcity and insecurity in southern regions of the state could put pressure on ground and surface water sources in the northern part of the state.

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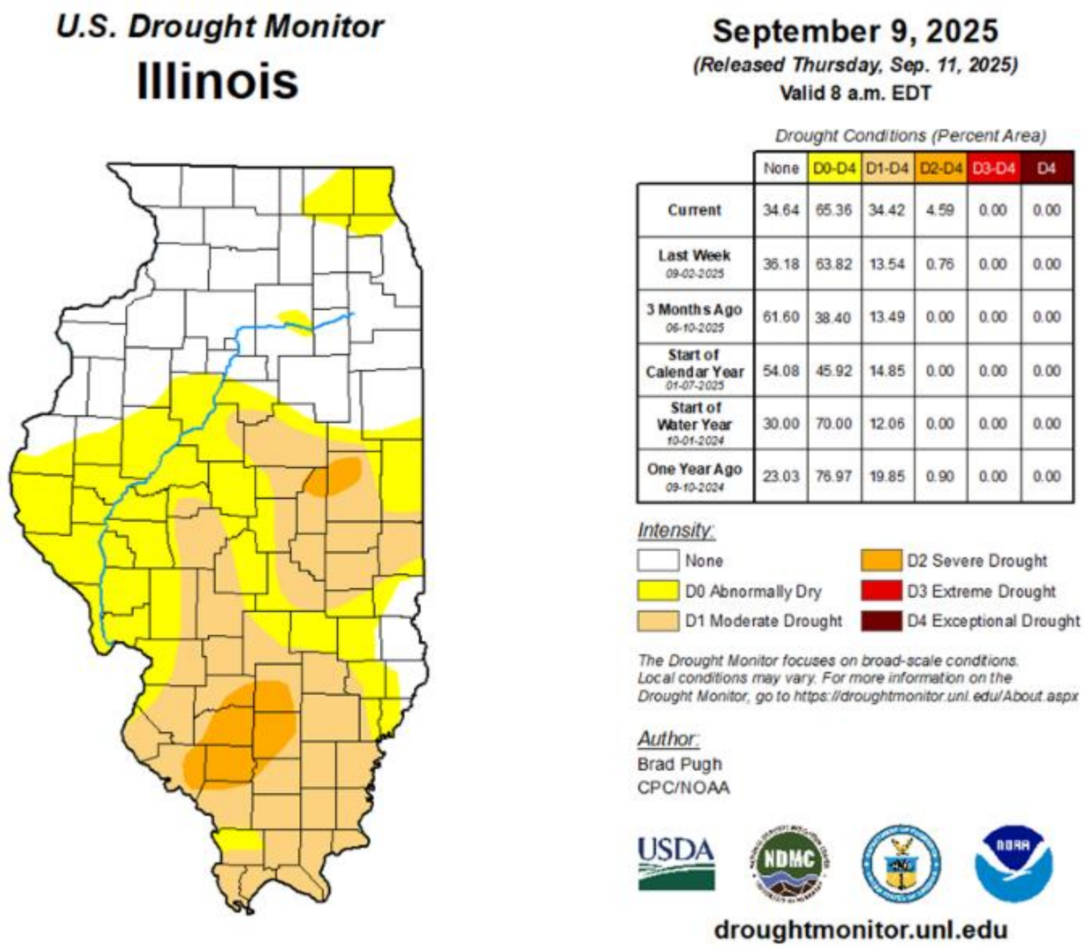
[7] United States Environmental Protection Agency. (2016, August). *What climate change means for Illinois*. EPA 430-F-16-015. https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-il.pdf

[8] Illinois State Climatologist. (2025, September 11). *Drought is intensifying in Illinois.* https://stateclimatologist.web.illinois.edu/2025/09/11/drought-is-intensifying-in-illinois/



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	34.64	65.36	34.42	4.59	0.00	0.00
Last Week 09-02-2025	36.18	63.82	13.54	0.76	0.00	0.00
3 Months Ago 06-10-2025	61.60	38.40	13.49	0.00	0.00	0.00
Start of Calendar Year 01-07-2025	54.08	45.92	14.85	0.00	0.00	0.00
Start of Water Year 10-01-2024	30.00	70.00	12.06	0.00	0.00	0.00
One Year Ago 09-10-2024	23.03	76.97	19.85	0.90	0.00	0.00

FIGURE 7. U.S. DROUGHT MONITOR ILLINOIS CURRENT AS OF SEPT 9, 2025.
Regions of the state that experienced drought conditions through summer 2025 are indicated in shades of yellow, orange, and red, increasing in intensity with darker shade. Source: National Drought Mitigation Center; U.S. Department of Agriculture; National Oceanic and Atmospheric Administration. (n.d.). *U.S. Drought Monitor — Illinois state drought map*. University of Nebraska–Lincoln.

https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?IL.

How did we get here? Rockford Region's agricultural and industrial past

Our region has experienced tremendous economic and developmental changes in just under two centuries.

> *Since its inception as a small, manufacturing-dependent agrarian community to its current highly diversified, resilient metropolitan area, Rockford has been on an economic rebound trajectory, moving from a period of decline to one of revitalization, increasing property values, stronger sectors (manufacturing, logistics, distribution, tourism), and renewed residential demand.*

This renewal comes with major considerations for our surrounding natural environment. With increasing pressures on climate, population growth, and regional development, addressing water resource issues is more important than ever. How did we get here?

It is important to consider that agriculture has always been and continues to be critical to our Region. Rockford made its roots as an agricultural hub in 1834, referred to as "Midway" for its location between two major industrial cities, Chicago and Galena. Early settlers sourced water from private wells, the Rock River, or cisterns that collected rainwater. The small, agrarian community was soon transformed with the arrival of the railroad in 1852, which provided wider transportation networks and shipping routes.

The settlement enjoyed robust waterpower for gristmills due to its convenient location along the Rock River. The area experienced a significant agricultural boom with the invention of the reaper in 1855, which solidified its wheat-based economy. Soon water demand outpaced the supply, and population growth required the development of community water systems. Originally, when the first wells were drilled into the deep sandstone, water pressure was so high that many wells flowed at the surface without pumping, which is referred to as an artesian well. In 1885 the first well was drilled to a depth of 1,520 feet, and it produced 800 gallons per minute or 1.2 million gallons per day. This initial abundance allowed extensive development. This would pave the way for the city's industrial growth from the 1860s-1960s.[9] Decades of pumping have reduced well pressures, and most drilled wells are no longer artesian.

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[9] The Editors of Encyclopedia Britannica. (n.d.). *Rockford*. In *Encyclopedia Britannica*. https://www.britannica.com/place/Rockford.

After the Civil War, Rockford became a furniture manufacturing hotspot due to an influx of Swedish immigration to the area, who merged woodworking skills with growing lumber production. This subsequently increased tool production, encouraging the growth of machine and automobile manufacturing. Prosperity steadily increased during the early 20th century, peaking after World War II.[10]

Like many Rust Belt cities, Rockford faced a decline in industry beginning in the 1970s due to rapid structural changes in manufacturing. It wasn't until the 1990s when the area's dependence on manufacturing shifted to a more diversified economy, introducing thousands of new jobs in healthcare, aerospace, logistics, distribution, and automotive industries, transforming the area into what we know it as today.[11] The difference in land cover between 1985 and 2025 provides evidence of this developmental period. Figure 8 depicts the area between Rockford and Belvidere in 1985, showing a large expanse of agricultural land between them. This drastically contrasts the extensive development we see between the two cities in 2025, as shown in Figure 9. Rockford's agriculture, industry, and community was and is dependent on our water resources. Monitoring and regulation of these shared resources is imperative to our economic, social, and natural health and well-being.

[10] GoRockford. (n.d.). *Rockford IL history.* https://www.gorockford.com/plan-your-trip/about/history/ Go Rockford.
[11] U.S. Bureau of Labor Statistics. (n.d.). *Rockford, IL economy at a glance.* https://www.bls.gov/eag/eag.il_rockford_msa.htm bls.gov.

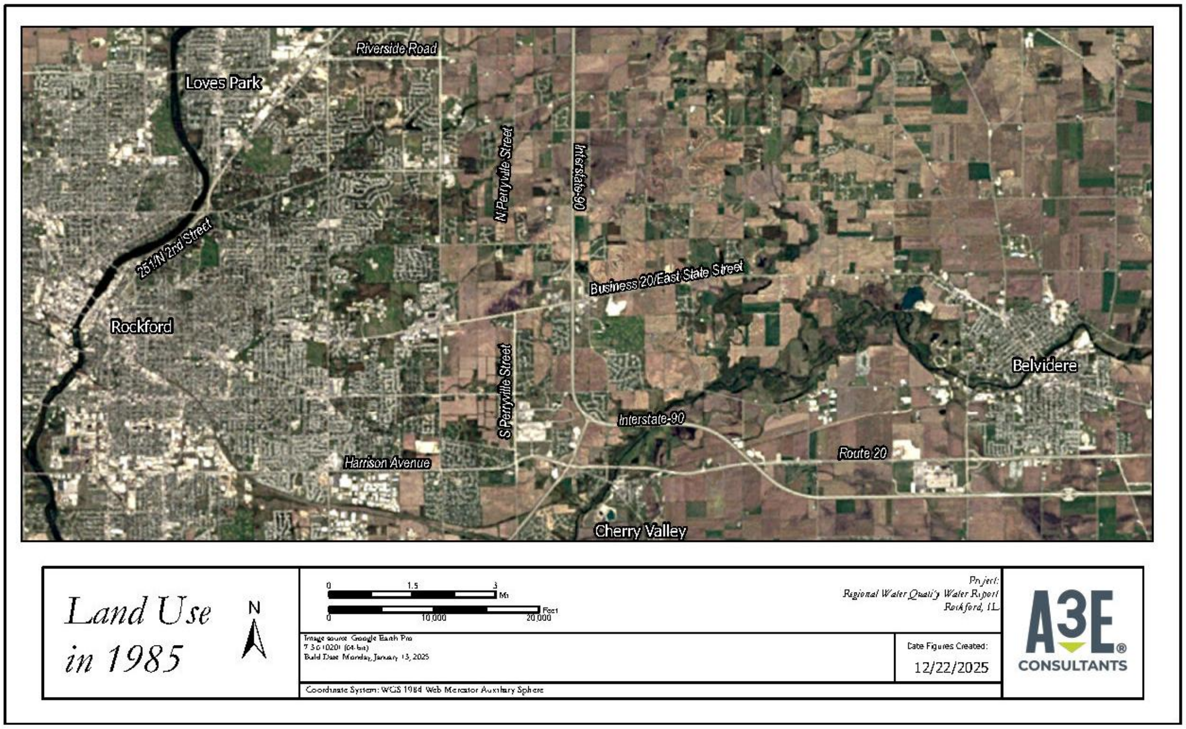

FIGURE 8. LAND USE IN 1985

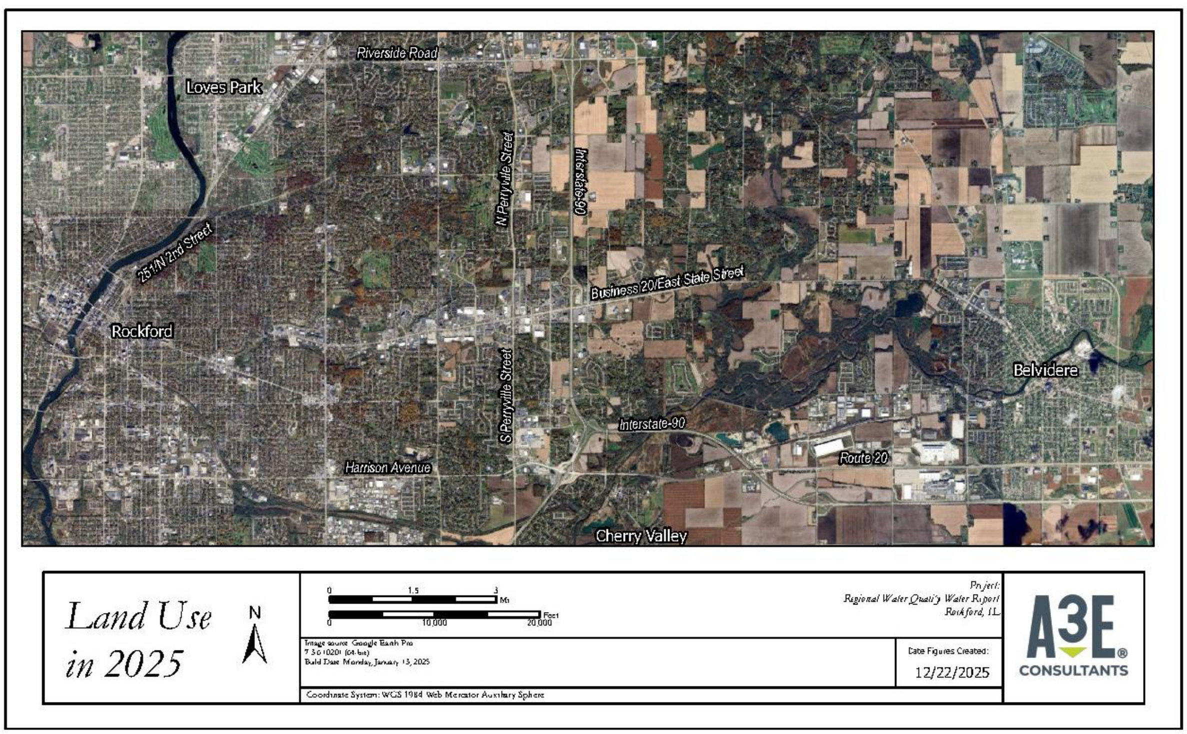

FIGURE 9. LAND USE IN 2025

How is water quality monitored and regulated?

Although human development has resulted in disruption to the natural water cycle, it does not need to impede its functions entirely. Much of global human growth was done with minimal comprehension on its effects on natural processes that we depend on for sustainability and survival. Because of modern science and research, we have a much better understanding of our effects on the planet and how to mitigate detrimental impacts.

Thanks to local, state, and federal efforts to study and improve waterways, we have grown to recognize the difficulties of balancing human development and maintaining the integrity of the systems which serve that development.

History of national water quality regulation

Efforts to manage water quality in the United States began in the early 20th century, largely in response to realizing the harmful effects of increasing industrial development. Early federal laws, such as the **Rivers and Harbors Act of 1899**, focused mainly on protecting navigation rather than water quality.[12] However, typhoid, cholera, and dysentery outbreaks were still common – a result of non-permitted discharge of untreated sewage and industrial waste before the introduction of comprehensive water treatment and sanitation improvements.[13]

At that time, Chicago was a clear example of inefficient water pollution regulation. Lake Michigan was – and still is – the main source of drinking water for the region. Because of sewage discharge into the Chicago River, which flowed directly to the lake, several thousand people were dying from waterborne diseases each year. Instead of regulating the discharge, the city formed the Sanitary District of Chicago and reversed the flow of the Chicago River to protect the lake from sewage discharge in 1900. This meant water pollution continued, but was redirected towards the Des Plains and Illinois Rivers, and eventually, the Mississippi River Basin.[14]

In the early 1900s, chlorine was found to be very effective at reducing bacteria in drinking water and was used in public water supplies to help prevent disease. This water treatment

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[12] U.S. Environmental Protection Agency. (2025). *Section 10 of the Rivers and Harbors Appropriation Act of 1899: Dredging and filling navigable waters, permits, and compliance.* https://www.epa.gov/cwa-404/section-10-rivers-and-harbors-appropriation-act-1899.

[13] Centers for Disease Control and Prevention (CDC). (1999). *Achievements in Public Health, 1900–1999: Control of Infectious Diseases. Morbidity and Mortality Weekly Report*, 48(29), 621–629. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm4829a1.htm.

[14] Baer, G. (2020, March 6). *A remarkable feat of engineering: When Chicago reversed its river.* WTTW Chicago. https://www.wttw.com/chicago-stories/race-to-reverse-the-river/remarkable-feat-of-engineering-when-chicago-reversed-its-river.

technology vastly reduced the number of waterborne disease cases and deaths.[15] This still was not enough to completely eliminate the harmful effects of water pollution, and it wasn't until the **Federal Water Pollution Control Act (FWPCA) of 1948** that the U.S. established its first comprehensive approach to addressing water pollution.[16] The 1948 Act relied heavily on state enforcement and voluntary compliance, which proved ineffective as pollution continued to worsen through the 1950s and 1960s.

Mounting environmental crises — including fish kills, contaminated drinking water supplies, and the 1969 Cuyahoga River fire in Ohio — spurred public demand for stronger national action. In response, Congress passed sweeping amendments to the FWPCA in 1972, now known as the **Clean Water Act (CWA)**.[17]

The CWA established a clear national goal: "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The CWA created the **National Pollutant Discharge Elimination System (NPDES)**, which requires permits for any discharge of pollutants from a **point source** into U.S. waters. It also provided funding for wastewater treatment infrastructure and set up a framework for states and the **U.S. Environmental Protection Agency (EPA)** to establish water quality standards, monitor water bodies, and develop **Total Maximum Daily Loads (TMDLs)** for impaired waters.[18] Subsequent amendments and programs — notably in 1977, 1987, and 2014 — expanded the CWA to address **nonpoint source pollution** and **stormwater discharges** while continuing to strengthen enforcement and public participation.[19]

Separately, the US EPA passed the **Safe Drinking Water Act of 1974** that set national health standards for more than 80 contaminants in drinking water and gave states the opportunity to further enforce their own drinking water standards. These standards included Maximum Contaminant Levels (MCLs) for many pollutants found in public water systems. The act

[15] Centers for Disease Control and Prevention. (2012). *History of drinking water treatment: A century of U.S. water chlorination and treatment: One of the ten greatest public health achievements of the 20th century*. https://archive.cdc.gov/www_cdc_gov/healthywater/drinking/history.html.
[16] U.S. Environmental Protection Agency. (2025). *Summary of the Clean Water Act.* https://www.epa.gov/laws-regulations/summary-clean-water-act.
[17] West Virginia Department of Environmental Protection. (n.d.). *50 Years of the Clean Water Act*. https://dep.wv.gov/WWE/Programs/nonptsource/NPSnews/Documents/50yrsoftheCWA.pdf WVDEP.
[18] U.S. Environmental Protection Agency (EPA). (1972). *Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act),* Public Law 92–500, 33 U.S.C. §1251 et seq.
[19] Singer, S. S. (2023). *Clean Water Act and amendments.* EBSCO Research Starters. https://www.ebsco.com/research-starters/science/clean-water-act-and-amendments/.

required regular testing, public notification of violations, and annual reports that inform customers about water quality.[20] Major amendments in 1986 and 1996 strengthened the law—expanding contaminant monitoring, promoting source-water protection, and creating funding mechanisms like the **Drinking Water State Revolving Fund (DWSRF)** for infrastructure improvements.[21]

Other non-regulative monitoring happens nationwide as well. **United States Geological Survey (USGS)** provides *Water Data for the Nation* which consists of daily stream gauge data for approximately 11,000-12,000 stream gauges across the nation. This data allows anyone to compare a stream against its 30-year average (in most cases) to see how stream behavior has changed over time or the state of a stream compared to normal conditions.[22] The EPA also conducts surveys through the **National Aquatic Resource Surveys (NARS)**.[23]

State Regulations

Early drinking water regulations were managed by the Illinois Sanitation Board and the Illinois Department of Public Health. When the **Illinois Environmental Protection Agency (IEPA)** was created in 1970, just before the federal CWA, drinking water regulation responsibilities shifted to the IEPA.[24] This also marked a major shift from local and voluntary water protection efforts to coordinated statewide regulation.[25] The Illinois EPA, working under delegated authority from the U.S. EPA, administers the state's NPDES permitting, water quality standards, and surface and groundwater monitoring programs. Table 1 shows a very generalized summary of IEPA surface water quality standards. The criteria are much more nuanced than the table might imply because other factors within an ecosystem play a role in the kind of effect a pollutant might have. **Total Suspended Sediment (TSS)** is not listed because it is very site specific. Section 302.203(f) states that water must be "free from sludge or bottom deposits," and often, it is recommended to be under 15 mg/L.[26]

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[20] U.S. Code, Title 42, Chapter 6A, Subchapter XII — Safety of Public Water Systems, §§ 300f–300j-27. (n.d.). https://uscode.house.gov/view.xhtml?req=granuleid%3AUSC-prelim-title42-chapter6A-subchapter12&edition=prelim.

[21] U.S. Environmental Protection Agency. (n.d.). *About the Drinking Water State Revolving Fund (DWSRF)* set-asides. https://www.epa.gov/dwcapacity/about-drinking-water-state-revolving-fund-dwsrf-set-asides epa.gov.

[22] U.S. Geological Survey. (n.d.). *USGS Water Data for the Nation*. https://waterdata.usgs.gov/.

[23] U.S. Environmental Protection Agency (EPA). (2025). National Aquatic Resource Surveys. https://www.epa.gov/national-aquatic-resource-surveys.

[24] Union of Concerned Scientists. (2008). *History and Organization of the EPA. In interference at the EPA: science and politics at the U.S. Environmental Protection Agency* (pp. 11–19). Union of Concerned Scientists. http://www.jstor.org/stable/resrep00048.8.

[25] Illinois Environmental Protection Agency (Illinois EPA). (n.d.). *Enhanced Public Participation Plan.* https://epa.illinois.gov/topics/environmental-justice/ejppp/enhanced-public-participation-plan.html.

[26] Illinois Pollution Control Board. (n.d.). *Title 35: Environmental protection; Subtitle C: Water pollution; Chapter I: Pollution Control Board; Part 302: Water quality standards.* Illinois Pollution Control Board. https://pcb.illinois.gov/documents/dsweb/Get/Document-33354/.

Groundwater is especially difficult to monitor and regulate due to accessibility issues and minimal aquifer map resources. The IEPA has specific practices to ensure ground water quality is not neglected. In 1987, Illinois passed the **Illinois Groundwater Protection Act** which established **groundwater management zones** and **setback zones** to protect groundwater resources.[27] Through the **Ambient Groundwater Monitoring Network**, the IEPA samples **community-water-supply** wells on a rotating basis. This covers most major aquifers and looks at contamination, trends, and baseline conditions. There is also further monitoring for specific areas where discharges or contamination has been noted (e.g., landfills, hazardous waste sites). The IEPA provides forms and requirements for monitoring wells pertaining to their construction, plugging and data submission.[28] The **Illinois Department of Public Health (IDPH)** is responsible for the construction and sealing of private wells for drinking water use but does not regulate or monitor the water quality thereafter. [29]

Pollutant Standards for Surface Water as Determined by Illinois EPA*			
Pollutant	**Unit**	**Standard**	**Condition**
Ammonia Nitrogen (Total)	mg/L	15	~
Barium	mg/L	5	~
Benzene	µg/L	310	~
Chloride	mg/L	500	~
Ethanol	g/L	0.085	Chronic
	g/L	1.1	Acute
Fecal Coliform	cfu/100mL	200	Geometric Mean
	cfu/100mL	400	> 10% of samples within a 30 day period
Gross beta (radioactivity)	pCi/L	100	~
Iron	mg/L	1	~
Mercury**	µg/L	0.012	~
Methoxychlor	µg/L	0.02	Chronic
	µg/L	0.25	Acute
Polychlorinated Biphynels (PCBs)	ng/L	0.056	~
pH	~	6.5-9.0	~
Phenols	mg/L	0.1	~
Phosphorus	mg/L	0.05	~
Radium 226 and 228	pCi/L	3.75	Standard represents combined value
Selenium	mg/L	1	~
Silver	mg/L	5	~
Strontium 90	pCi/L	2	~
Sulfate	mg/L	2000	When hardness is < 100 mg/L or chloride < 5 mg/L
	mg/l	500	When hardness is > 500 mg/L or chloride > 5 mg/L

Table 1. Illinois EPA Pollutant Standards

* The information in this table is very generalized. For more detailed information, please see the report by the EPA[30]
**In reference to human health

[27] Illinois Environmental Protection Agency. (n.d.). *Illinois Groundwater Protection Act.* https://epa.illinois.gov/topics/water-quality/groundwater/wellhead-protection/report.html.
[28] Illinois Environmental Protection Agency. (n.d.). *Ambient Groundwater Monitoring Network.* https://epa.illinois.gov/topics/water-quality/groundwater/ambient-monitoring/ambient-groundwater-monitoring-network.html.
[29] Illinois Environmental Protection Agency. (n.d.). *Private Well Users.* https://epa.illinois.gov/topics/drinking-water/private-well-users.html.
[30] Illinois Environmental Protection Agency. (2019, October 11). *Water Quality Standards.* https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/standards/documents/masterdwqc-nov19.pdf.

One of the EPA monitoring programs consists of identifying **impaired water bodies**. The EPA must perform water quality monitoring and assessments of all navigable waters every two years according to Sections 305(b) and 303(d) of the CWA. This assessment is then summarized in a report which features the 303(d) list, a list of all of the surveyed waters and any impairments to **designated uses**. These uses include Aquatic Life Use, Primary Contact Use, Aesthetic Quality use, Public and Food Processing Water Supply, Fish Consumption Use, and Indigenous Aquatic Life Use.[31]

If a waterbody does not meet certain standards, they are considered impaired, and the impaired designated use is defined by the type of contamination or standards that are not met. Data used to compile this list come from various local monitoring programs like the Ambient Water Quality Monitoring Network, volunteer and partner data, NPDES compliance data, and special studies like TMDL Reports.

Regional/Local Regulations

At the regional level, the **Rock River Basin** — spanning northern Illinois and southern Wisconsin — was historically affected by both **industrial point sources** and **agricultural runoff**. Early enforcement actions in the 1970s and 1980s targeted municipal wastewater discharges, leading to significant improvements in the river's oxygen levels and biological health. More recent management efforts, coordinated under the **Rock River Basin Water Quality Management Plan** and **Illinois Nutrient Loss Reduction Strategy (INLRS)**, have shifted focus toward nonpoint source pollution, nutrient reduction, and habitat restoration.[32,33]

Local Ordinances and Water Agencies

Boone County Comprehensive Stormwater Plan

Boone County Public Health Ordinance

Ogle County Stormwater Management Ordinance & Drainage & Storm Sewers

Ogle County Flood Damage Prevention Ordinance

Ogle County Drinking Water Program

Winnebago County Surface Water Management Ordinance

Winnebago County Public Health Ordinance

Winnebago County Multi-Hazard Mitigation Plan

Winnebago County Small Community Water Security Assessment Report (2024)

For more specific local information, explore webpages

The city of Rockford and many of the surrounding cities and towns also have local ordinances and programs that further regulate water quality. These local mandates are usually in relation

[31] Illinois Environmental Protection Agency. (2024, October). *Illinois Integrated Water Quality Report and section 303(d) list, 2024 draft*.https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/303d/2024-IR.pdf.

[32] Illinois Department of Natural Resources (IDNR). (2017). *Rock River Basin Water Quality Management Plan*. Illinois Department of Natural Resources, Office of Water Resources.

[33] Illinois Environmental Protection Agency. (n.d.). *Illinois Nutrient Loss Reduction Strategy Implementation*. https://epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy.html.

to stormwater management and discharges. The city's Illicit Discharge Detection & Elimination website states that any discharge into the storm-sewer system that is not rainwater is prohibited. The city maintains a Stormwater & Environmental Team, with a Stormwater Management Ordinance, Stormwater Master Plan, and programs to monitor stormwater, require sediment/erosion controls on construction sites, and protect waterways from polluted runoff. The city also states that it takes an active role in ground water protection by providing local resources and participating in the **Northern Regional Groundwater Protection Planning Committee**, established by the IEPA. This committee is responsible for identifying and advocating for groundwater protection issues; monitoring and reporting on regional progress regarding protection implementation; maintaining a registry of groundwater contamination hazard advisories; facilitating educational activities; and communicating with the IEPA whether there is need for regional protection.[34] Although there are ordinances, guidelines, and resources available for managing private wells, their *water quality* is not regulated on the federal, state, or regional level. It is the responsibility of the well owner to test the water for possible contaminants.

Local Watershed Plans & TMDLs

Watershed Plans

- Beaver Creek
- Candlewick Lake
- South Fork Kent Creek
- Buckbee Creek
- Madigan Creek
- Keith Creek

TDML Reports

- Rock River/Pierce Lake
- Pecatonica River

Most of our local and regional surface water quality information comes from the TMDL reports and other watershed plans. These projects are usually grant-funded and produce comprehensive documents about the local surface water quality within a certain area.

Together, these national, state, and local efforts illustrate a century-long evolution in U.S. water policy—from basic pollution control toward integrated watershed management aimed at sustaining clean water for ecological and human use.

[34] Illinois Environmental Protection Agency. (n.d.). *Groundwater Protection Planning Regions.* https://epa.illinois.gov/topics/water-quality/groundwater/gw-planning.html.

Pollutants Within the Water Cycle

Water quality is most easily measured, studied, and expressed in terms of pollutant levels. **Pollution** refers to "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water."[35] It should be noted that there are also natural processes which contribute some level of common pollutants to the water cycle. Most harmful pollutants are removed from public drinking water systems during treatment, in compliance with federal and state contamination limits. In order to manage water quality in an informed and efficient way, it's important to understand what pollutants are, where they come from, and what their unique effects are.

Today's contamination landscape includes both persistent legacy issues and emerging challenges.

Depending on their point of origin, chemical constituents, and mechanism of travel within the water cycle, pollutants enter our surface, ground and drinking water sources, both directly and indirectly. Groundwater's vulnerability to contamination varies depending on the local geology. Shallow wells are generally more susceptible to contamination as the soils and underlying materials are more porous and allow water to travel down to groundwater source. Deeper wells are less susceptible to pollution and can be protected by aquitards, or impermeable layers between the surface and the groundwater source. Sensitive recharge areas can be mapped by classifying the underground materials based on their ability to pass water from the surface to the groundwater. Deeper wells can have naturally occurring contaminants from the geological formations themselves.

Point source vs. non-point source pollution

As mentioned briefly above, **point source pollution** is federally regulated under NPDES permits. It is defined by the Clean Water Act as "any discernible, confined and discrete conveyance…from which pollutants are or may be discharged." In other words, point source pollution is any type of pollution that comes directly from a source, like a wastewater treatment plant, straight into a body of water. This type of pollution is often concentrated and traceable, making it somewhat easier to enforce regulations. Some regulated point sources include **Concentrated Animal Feeding Operations (CAFOs)**, **Municipal Separate Storm Sewer Systems (MS4s)**, and **NPDES outfalls**. On the other hand, pollution can also come, and more often does come, from a non-point source. **Non-point source pollution** comes from an accumulation of many diffuse sources, rather than a single point, making it much more difficult to trace and regulate. Because of this, non-point source pollution is of greater

[35] Clean Water Act § 502, 33 U.S.C. § 1251 et seq. (2018).

concern to water quality management agencies. These pollutants are carried by stormwater and runoff from various sources of urban, suburban, and rural land uses.[36]

Pollution can find its way into surface water, groundwater, or drinking water. Due to the interconnectedness of these systems, pollution can also travel between them, often affecting them all if the issue is left untreated. Pollutants enter waterbodies directly from pipe discharges, ditches, and stormwater drains (e.g. industrial facilities), or indirectly from runoff. Pollution within surface water causes environmental issues as well as potential health impacts for recreational uses. Pollutants enter ground water through leaching of contaminated soils from landfills, agricultural and industrial chemicals, septic systems, and underground storage tank leaks. Pollution within groundwater is much more difficult to control and clean up since it is often out of reach. Groundwater contamination often leads to contamination of drinking water sources, as they go hand in hand. Drinking water from municipal sources is water that is treated and deemed suitable for human consumption, which is sourced from both surface and groundwater sources – in our region's case, only groundwater. When pollutants are present in drinking water, it is typically a result of ineffective or outdated treatment systems, cross contamination from sewage systems or industrial lines, or distribution system failures (e.g. pipe corrosion). Drinking water from private wells is more nuanced because they are not regulated federally or by the state. It is the responsibility of the private well owner to monitor stores and treat the water for use. The lack of regulation here allows for a huge data gap in the quantity and quality of groundwater sources and presents challenges in staying informed on local drinking water contamination.

Types of Water Pollutants [37,38]

Organic Pollutants

Organic pollutants consist of oxygen-demanding wastes, synthetic organic compounds and oils. Each of these types of organic pollutants affect water in different ways.

Oxygen-demanding waste is wastewater or sewage from facilities that produce biodegradable organic compounds as a byproduct of their industry. These facilities include food processing industries, breweries, slaughterhouses, etc. They can also enter water systems through runoff from agricultural or urban areas. As the organic material breaks down within a water body, it consumes dissolved oxygen (DO) for aerobic oxidation. Lakes and streams with depleted levels of DO (<5mg/L) cannot adequately support aquatic life. This

[36] U.S. Environmental Protection Agency. (n.d.). NPDES permit basics. https://www.epa.gov/npdes/npdes-permit-basics.

[37] Illinois Environmental Protection Agency. (n.d.). *State and Federal Regulated Contaminants*. https://epa.illinois.gov/content/dam/soi/en/web/epa/documents/compliance-enforcement/drinking-water/sample-collectors-handbook/d-drinking-water-standards.pdf.

[38] Melissa Denchak. (2023, January 11). *Water Pollution: Everything You Need to Know. Natural Resources Defense Council*. https://www.nrdc.org/stories/water-pollution-everything-you-need-know.

leads to biodiversity loss, habitat degradation, altered nutrient and chemical cycles (internal loading of nutrients and metals), and large-scale “dead zones”. Internal loading of nutrients and metals also occurs when there is a lack of oxygen in groundwater which can promote foul odors. The effects on human health are typically indirect as a result of fish kills and excess nutrients, except in the case that the waste also carries pathogens, another issue altogether.

Synthetic organic compounds find their way into our waterways through their production, transportation, and use in different applications. These include pesticides, detergents, food additives, pharmaceuticals, paints, solvents, volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), etc. They can also find their way into our groundwater stores by seeping through the soil, meaning they can end up in our drinking water. Many of these compounds are toxic and resistant to degradation, meaning they remain in the environment for extended periods of time. They disrupt aquatic ecosystems and can have serious impacts on human health when found in drinking water because they can be carcinogenic, neurotoxic, and disrupt other bodily functions.

Oil – petroleum or petroleum-based substances – originates from natural processes and is a mixture of hydrocarbons. Oil can enter waterways and groundwater through oil spills, pipe leaks, and wastewater, and runoff from roads and parking lots. Since it’s lighter than water, it spreads across the surface, reducing the amount of Oxygen that can dissolve into the water system and the amount of light transmission, reducing photosynthetic activity of aquatic plants. Oils can also endanger water birds and aquatic plants. Certain components of these oils like benzene, toluene, and xylene are toxic and carcinogenic when present in drinking water.

Pathogens

Pathogenic microorganisms enter waterways through sewage discharge, wastewater, animal waste runoff, and improperly managed stormwater. These pathways can lead pathogens to streams, lakes, and rivers, as well as groundwater stores that are recharged by contaminated surface water or close to leaking septic systems and other discharges. They can survive for long periods in cool groundwater. These pathogens can consist of viruses and bacteria that cause gastrointestinal diseases in animals and humans that come in contact with them either within streams and lakes or within drinking water.

Nutrients

Nutrients, like phosphorus and nitrogen, in the environment mostly come from agricultural runoff but can also enter our waterways through sewage and fertilizer industry wastewater. Seasonal turnover and decomposition of organic matter can also cause problematic amounts of nitrogen and phosphorus to be released into the water column. High levels of nutrients in waterways stimulate the growth of aquatic algae and weeds which can degrade the value of a water body in terms of aesthetics and biodiversity. It also can reduce DO in the long run and cause **eutrophication**, or a lack of oxygen leading to aquatic life deaths. These events happen most often in the warm summer months when fertilizer use is high and sunlight is plentiful. High amounts of certain algae, like blue-green algae can be harmful to animals and humans using a waterbody for recreation. Nutrients can also soak through the soil into groundwater where nitrates are particularly mobile and persistent, especially in areas lacking living vegetation that might absorb these nutrients from the ground. High nitrate levels in drinking water can cause methemoglobinemia, "baby blue syndrome", and may contribute to thyroid disorders or certain cancers.

Suspended Solids and Sediments

Suspended solids and sediments come from eroded land and are comprised of silt, sand and minerals. They mostly enter waterways through surface runoff that is not always human-induced. Streams can also accumulate natural salts from the weathering of rocks and evaporation that throws off the balance within a system. This is more common in arid or semi-arid regions. Excessive sediment loading reduces the storage capacity of reservoirs, blocks sunlight transmission, can impair aquatic life, and can lead to anaerobic conditions if the solids are organic. The latter of these effects contribute to poor water quality through the loss of biodiversity and natural aquatic processes. Sediment pollution is more common in the late fall-early spring when vegetative cover is at its lowest and there is less soil stabilization, especially on tilled agricultural land. They do not typically affect groundwater much, but they can clog recharge zones and reduce groundwater infiltration. They can also transport pollutants like metals, nutrients, and pathogens into surface water and shallow aquifers. They do not have direct health impacts on humans, but they may affect water treatment processes.

Inorganic Pollutants

Inorganic pollutants are things like heavy metals, mineral acids, inorganic salts, cyanides, sulphates, etc. These also usually enter waterways through sewage and industrial wastes alongside organic matter or from outdated infrastructure of water management. Through these pathways, they can also enter groundwater if not caught up in soil. They are non-biodegradable, meaning they persist in the environment. **Bioaccumulation** of inorganic pollutants has adverse effects on aquatic life, if present in surface water systems, and on human life if the water body is a fishery source.

Heavy metals are also often found in drinking water because of outdated water delivery systems. For example, old lead pipes deliver lead to tap water, even if lead wasn't present in the aquifer from which the water was sourced. Lead can cause developmental problems and neurological damage.

Another inorganic pollutant, arsenic, appears in sand and gravel aquifers, particularly in the southern portion of our region. This arsenic originates from iron-containing minerals deposited during glacial periods and dissolves under specific underground chemical conditions. Long-term exposure to arsenic has been linked to cancer and cardiovascular disease.

Inorganic salts, or chlorides, can also be detrimental to the environment. Chlorides are used during the winter to melt snow and ice on roadways, driveways, and sidewalks. Eventually they dissolve in the meltwater or precipitation and become runoff and flow into our waterways or seep into groundwater. In high amounts, these salts are toxic to aquatic life, and they can disrupt water chemistry by increasing salinity. The impacts of road salts are more pronounced in urban areas where the density of roadways is higher. [39]

Other inorganic pollutants can cause a variety of human health problems: mercury causes neurological and kidney damage; and salts/acids cause corrosion of infrastructure, taste and odor issues, and potential kidney stress.

Thermal Pollution

Thermal pollution is any disruption of a water body's natural temperature. This occurs through discharge of hot water from power plants and industries using water as coolant. It can also occur via the **urban heat island (UHI) effect** where urban areas tend to experience a higher temperature than their surrounding non-urban areas.[40] In areas with higher amounts of energy absorbing materials, like dark pavement, heat is absorbed and radiated into the near surface air or transferred to runoff, causing a warming effect on the localized landscape. The rise in temperature from thermal pollution reduces DO in the water, affecting aquatic life and decreasing water quality. Temperature shifts can favor pathogen growth or algal blooms. It rarely affects groundwater directly but can affect DO in shallow aquifers.

Radioactive Pollution

Radioactive pollutants are toxic to most forms of life. They can originate from processes like mining, research, agriculture, medical/industrial activities, unmonitored discharge from nuclear power plants and reactors, testing of nuclear weapons, and some natural processes. In our region, most radioactive contaminants that have impacted drinking water are naturally occurring. Communities using deep sandstone aquifers, including Rockford, encounter elevated radium levels. Radium can also be found in glacial drift and associated shallow sand-gravel aquifers, with lower levels than the Cambrian-Ordovician aquifer system.[41] This radioactive contaminant is critical to treat at concentrations above 5pCi/L due to its potential

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[39] Evans, M., Frick, C. (2001, August). *The Effects of Road Salts on Aquatic Ecosystems.* https://scec.ca/pdf/the_effects_road_salts.pdf.

[40] Deilami, K., Kamruzzaman, Md., Liu, Y. (2018, May). *Urban heat island effect: A systematic review of spatio-temporal factors, data, methods, and mitigation measures*. https://doi.org/10.1016/j.jag.2017.12.009.

[41] Mathews, M., Gotkowitz, M., & Ginder-Vogel, M. (2018). Effect of geochemical conditions on radium mobility in discrete intervals within the Midwestern Cambrian-Ordovician aquifer system. *Applied Geochemistry, 97*, 238–246. https://doi.org/10.1016/j.apgeochem.2018.08.025.

to cause cancer. Radioactive pollution is invisible and can only be detected through testing. It is usually removed during drinking water treatment processes.

Emerging Contaminants

Emerging Contaminants are substances that have been detected in the environment but are not yet regulated or fully understood in terms of their health or ecological risks.[42] They include microplastics, hormones, pharmaceuticals, personal care products, flame retardants, industrial additives, and Per- and polyfluoroalkyl substances (PFAS).

PFAS

PFAS represent the most significant emerging contaminants, illustrating how our understanding of water quality continues to evolve. PFAS were discovered in the 1930s for their remarkable ability to repel water and oil, making them valuable in everything from non-stick cookware to firefighting foam.

From the 1950s through 2000s, these chemicals saw widespread use before scientists discovered that PFAS persist indefinitely in the environment, and by the 2010s, health impacts became clear.[43] These "forever chemicals" now contaminate ground and surface water through multiple pathways. Industrial facilities and airports used PFAS-containing firefighting foam for decades. Landfills and wastewater treatment plants that received PFAS-containing products became long-term contamination sources. Consumer product manufacturing sites also contributed to widespread environmental release.

PFAS pose significant health risks because they bioaccumulate in human tissues. Exposure has been linked to increased cholesterol, immune system effects, and elevated cancer risk, particularly kidney and testicular cancers. What makes PFAS particularly challenging is that conventional water treatment plants were not designed to remove them, requiring expensive specialized treatment technologies like granular activated carbon or ion exchange systems.[44]

The regulatory response to PFAS illustrates how water quality standards evolve as scientific understanding advances. EPA issued initial health advisories at 70 parts per trillion in 2016,

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[42] U.S. Environmental Protection Agency. (n.d.). *Contaminants of Emerging Concern including Pharmaceuticals and Personal Care Products*. https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products.

[43] Interstate Technology & Regulatory Council (ITRC). (2020, August). *History and use of per- and polyfluoroalkyl substances (PFAS)*. https://pfas-1.itrcweb.org/wp-content/uploads/2020/10/history_and_use_508_2020Aug_Final.pdf.

[44] U.S. Environmental Protection Agency. (2022, September 1). *Our current understanding of the human health and environmental risks of PFAS*. https://www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas.

updated these to near-zero levels in 2022, and proposed national drinking water standards in 2024.[45]

Microplastics

Microplastics are among the most complex and ubiquitous emerging contaminants in modern water systems and waterways. They are defined as synthetic polymer particles measuring one nanometer (nm) to 5 millimeters (mm) in diameter. [46] Their small size renders many of them undetectable by the naked human eye. Microplastics originate from the fragmentation of larger plastic debris and from manufactured primary plastics. Sources include degraded consumer plastics, synthetic textile fibers shed, tire and road wear particles, industrial abrasives, personal care products, stormwater runoff, and atmospheric deposition. These particles are now documented in surface water, groundwater, drinking water, wastewater, and even treated effluent, demonstrating their persistence and mobility throughout the water cycle.[47]

Microplastic particles show significant variability in size, density, and chemistry, influencing how they behave in aquatic environments. Depending on these characteristics, microplastics may remain suspended, settle into sediments, or be transported long distances through stormwater, rivers, and subsurface flow paths.[48] Their high surface-area-to-volume ratio supports the adsorption of chemical contaminants, including heavy metals, organic pollutants, and persistent chemicals such as PCBs.[49]

Despite rapidly growing research, scientific uncertainties remain, including long-term ecological effects and risks to human health. Drinking water treatment can remove a portion of microplastics through filtration and coagulation processes, although the efficiency of removal varies depending on particle size and treatment type.[50]

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[45] U.S. Environmental Protection Agency. (n.d.). *Historical PFOA and PFOS health effects science documents.* https://www.epa.gov/sdwa/historical-pfoa-and-pfos-health-effects-science-documents.
[46] Illinois Environmental Protection Agency. (n.d.). *Microplastics.* https://epa.illinois.gov/topics/water-quality/microplastics.html.
[47] Iwanowicz, D. D., *et al.* (2024). *Integrated science for the study of microplastics in the environment—A strategic science vision for the U.S. Geological Survey* (USGS Circular 1521). U.S. Geological Survey. https://doi.org/10.3133/cir1521.
[48] Österlund, H., *et al.* (2023*). Microplastics in urban catchments: Review of sources, pathways, and entry into stormwater.* Science of the Total Environment, 858 (Part 1), Article 159781. https://doi.org/10.1016/j.scitotenv.2022.159781.
[49] Rafa, N., *et al.* (2024). *Microplastics as carriers of toxic pollutants: Source, transport, and toxicological effects*. Environmental pollution *(Barking, Essex : 1987), 343,* 123190. https://doi.org/10.1016/j.envpol.2023.123190.
[50] World Health Organization. (2019, August 22). *WHO calls for more research into microplastics and a crackdown on plastic pollution* [News release]. https://www.who.int/news/item/22-08-2019-who-calls-for-more-research-into-microplastics-and-a-crackdown-on-plastic-pollution.

Reducing microplastic contamination will require a combination of improvements to drinking water treatment, monitoring technologies, and plastic use reduction strategies. Policies that limit single-use plastics, encourage reusable alternatives, and restrict the manufacture of products containing primary microplastics will help reduce their spread.

Pharmaceuticals

Pharmaceutical pollutants have also entered the sphere of water concerns. Detectable concentrations of pharmaceuticals, including antibiotics, analgesics, antihypertensives, antidepressants, and other common medications have been found in waterways across the U.S. Pharmaceuticals and other bioactive compounds enter the environment via excretion after human consumption, as well as through improper disposal of unused or expired medications. Once these compounds enter wastewater streams, they often pass through conventional wastewater treatment plants or septic systems, because such systems are not designed to eliminate their active ingredients. [51] As a result, treated wastewater is discharged into rivers, lakes, and aquifers.

In a study of waterways in the Chicago metropolitan area, pharmaceuticals originating from treated wastewater were detected in surface waters, establishing that municipal discharge remains a significant source of pharmaceutical contamination even post-treatment.[52] These emerging contaminants present a multi-faceted threat: persistent low-level exposure can have ecological consequences, such as altered behavior, reproductive disruption, or endocrine effects in aquatic organisms, and may complicate the long-term safety of water supplies intended for human use.[53]

Land Use

Land use, and the way it differs from natural land cover (pre-development), is one of the most significant determinants of water quality. It determines how water interacts with the landscape, what pollutants it picks up, how quickly it runs off, and how much infiltrates into the ground. Different types of land use affect the water in different ways. It is critical to keep track of land use composition and management practices in order to track pollutant sources and take steps towards mitigation.

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[51] Illinois Environmental Protection Agency. (n.d.). *Medication disposal*. https://epa.illinois.gov/topics/waste-management/waste-disposal/medication-disposal.html.

[52] Bergman, S. C. (2023). *Pharmaceuticals found in Chicago waterways originating from treated wastewater.* (Master's thesis, University of Illinois Chicago). University of Illinois Chicago INDIGO Repository. https://indigo.uic.edu/articles/thesis/Pharmaceuticals_Found_in_Chicago_Waterways_Originating_From_Treated_Wastewater/23661504.

[53] Glassmeyer, S. T., *et al.* (2009). *Disposal practices for unwanted residential medications in the United States.* Environmental International, 35(3), 566–572. https://doi.org/10.1016/j.envint.2008.10.007.

Most of the Rockford Region is comprised of cropland, mainly for corn and bean production, with developed areas not too far behind. This composition is not unlike other Midwestern metropolitan areas that depend on agriculture for much of the job market. Currently, the Rockford Region's landscape, approximately 434,665 acres in size, is dominated by 49% cropland (213,222 acres), 24% developed areas (102,363 acres), 13% pasture and other grassed areas (58,216 acres), and 14% natural areas (60,864 acres). This breakdown can be seen graphically in Figure 10, where the land use categories are simplified. Figure 11 depicts the same land use data on a more detailed scale, including specialized land use classifications and where those uses are located throughout the Rockford MPA. It shows the extent of urban sprawl from the big cities in our region as well as the magnitude of the agricultural industry which surrounds it.

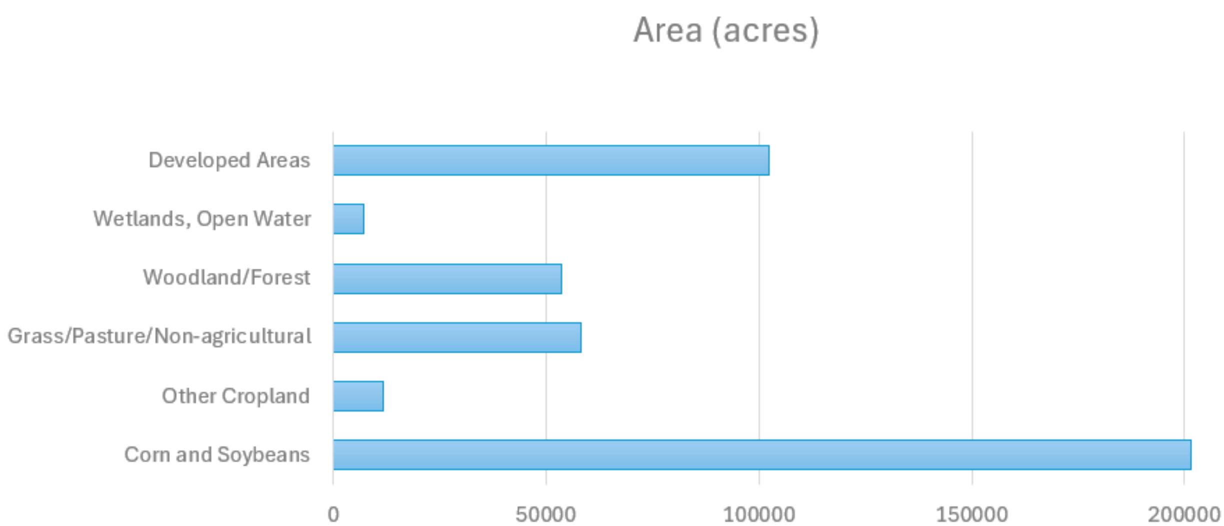

Figure 10. Land Use Breakdown by Area Within the Rockford Region

Rockford Region's 2025 landscape: ~434,665 acres in size; dominated by 49% cropland (213,222 acres), 24% developed areas (102,363 acres), 13% pasture and other grassed areas (58,216 acres), and 14% natural areas (60,864 acres).

Land Use Comparisons

Forests, grasslands, and wetlands contribute varying levels of pollutants to our streams and lakes in small, naturally occurring amounts. Using the Simple Method for annual runoff volume and incorporating local data on precipitation, impervious surfaces, and event mean concentrations of nutrients and solids in the runoff, we estimate that these land covers provide an average of seven pounds of total suspended solids (TSS), 0.06 pounds of total phosphorus (TP), and 0.35 pounds of total nitrogen (TN) to our surface waters each year. Lands that have been developed into urban, suburban, and agricultural uses contribute exponentially more pollutants to our surface waters than the natural lands that once dominated the landscape. Nutrient and sediment contributions to our streams and lakes are highest in our urban and suburban areas.[54, 55]

Urban, suburban, and agricultural lands, if not managed consciously, contribute nutrients, sediment, pathogens, pesticides, and other pollutants to our waters. Natural areas typically improve water quality by filtering nutrients out of runoff, stabilizing soils and sediment, and promoting infiltration, and are usually managed without inputs like fertilizers or pesticides that cause water quality concerns. If non-natural lands are managed consciously, they can contribute less pollutants to our water resources.

***One acre** of commercial development contributes…*

As much total suspended solids as

- 4 ac. of residential development
- 6 ac. of cropland
- 26 ac. of pasture
- 136 ac. of natural land

As much total nitrogen as

- 2 ac. of residential development
- 5 ac. of cropland
- 9 ac. of pasture
- 49 ac. of natural land

As much total phosphorus as

- 3 ac. of residential development
- 8 ac. of cropland
- 13 ac. of pasture
- 42 ac. of natural land

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[54] Stormwater Center. (n.d.). *The Simple Method to Calculate Urban Stormwater Loads.* https://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm.

[55] Stormwater Center (n.d.). *Table 5. Impervious Cover % for Various Land Uses.* https://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple%20imp%20table%205.htm.

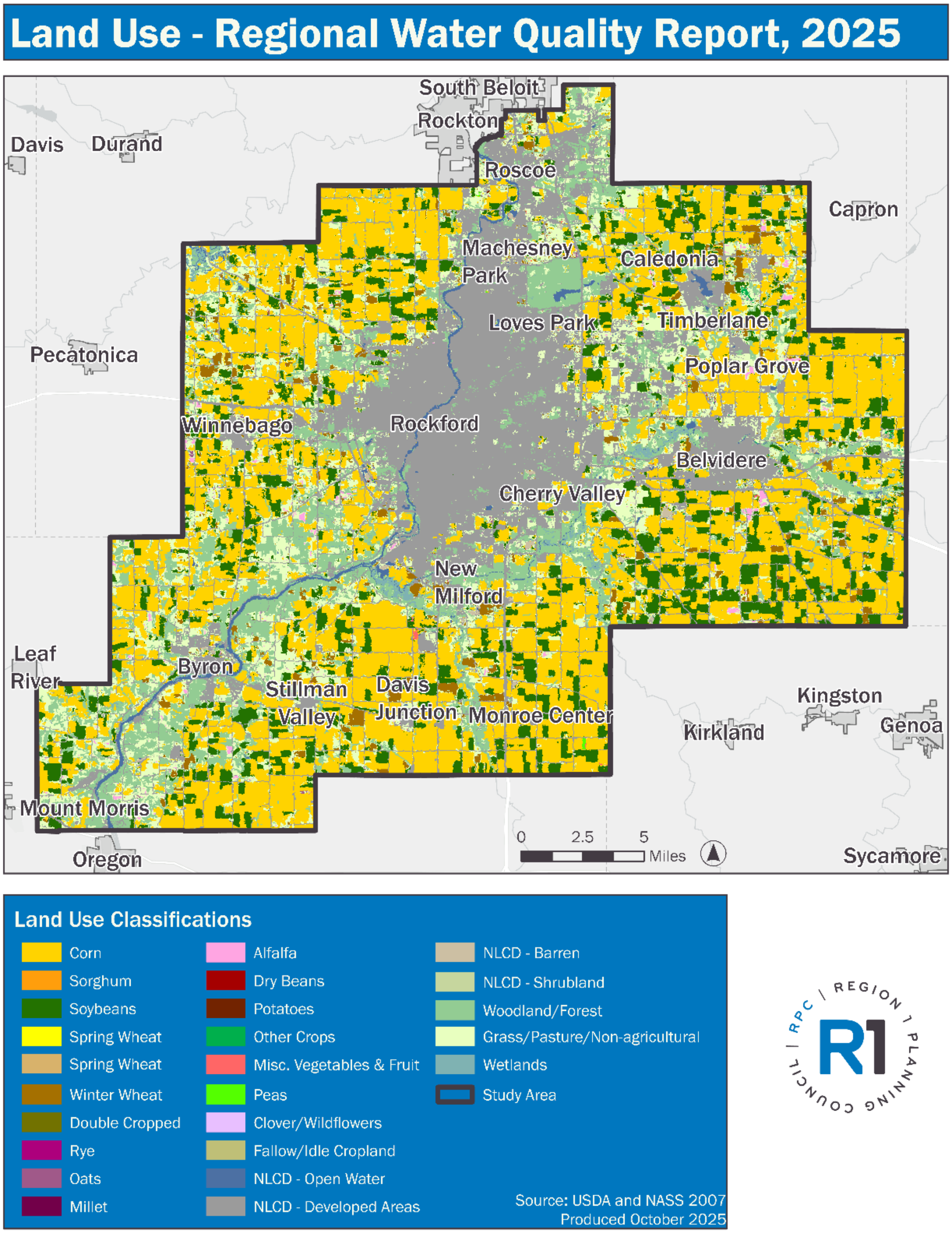

FIGURE 11. OUR REGION'S LAND USE

Urban and Suburban Land Use

Activities associated with urban and suburban land use produce an array of substances that can become water pollutants. The following examples would be considered nonpoint sources, as they are produced in relatively small and untraceable amounts: pesticides used in landscaping and lawn care contribute harmful chemicals; fertilizers and decaying organic matter like grass clippings and leaves lead to nutrient overloads; transportation-related pollutants include particulates and heavy metals from pavement and vehicle wear, salts from deicing practices, oils leaked from vehicles, etc.; wastewater like sewage and greywater from buildings can pollute waterways with inefficient urban planning and water treatment facilities.

Common urban point-sources of pollution include Municipal Wastewater Treatment Plants, industrial discharges, power plant cooling water discharges, combined sewer overflows (CSO), MS4s, and construction site dewatering. Point sources of pollution are regulated under various NPDES. Despite their regulation, point sources are still a water quality concern. They can have outdated structures, leading to partially treated discharges. Treated discharge can still contain contaminants. Treatment plants that are fully functioning and regulatory compliant still contain amounts of pollutants that can cause issues downstream. Figure 12 depicts a map of NPDES permit locations throughout our region showing how they are present throughout and mostly concentrated in more populated areas.

The amount of environmentally harmful byproducts of urban and suburban living coupled with high percentages of impervious surfaces makes urban land use the highest contributor of pollution to our waterways when comparing land use types of the same size (e.g. acre per acre).

Suburban land use is close behind, but lawns and green spaces help to promote groundwater infiltration. In either case, without proper stormwater management, impervious surfaces redirect polluted stormwater into our streams and lakes from where it naturally would have soaked into the ground and become groundwater, leaving some of those pollutants behind in less-concentrated amounts, some of which to be used up by other organisms in the case of nutrients and decaying organic matter.[56]

[56] U.S. Environmental Protection Agency. (n.d.). *Nonpoint source pollution from urban areas.* https://www.epa.gov/nps/nonpoint-source-urban-areas#:~:text=Introduction:,such%20as%20streets%20and%20rooftops.

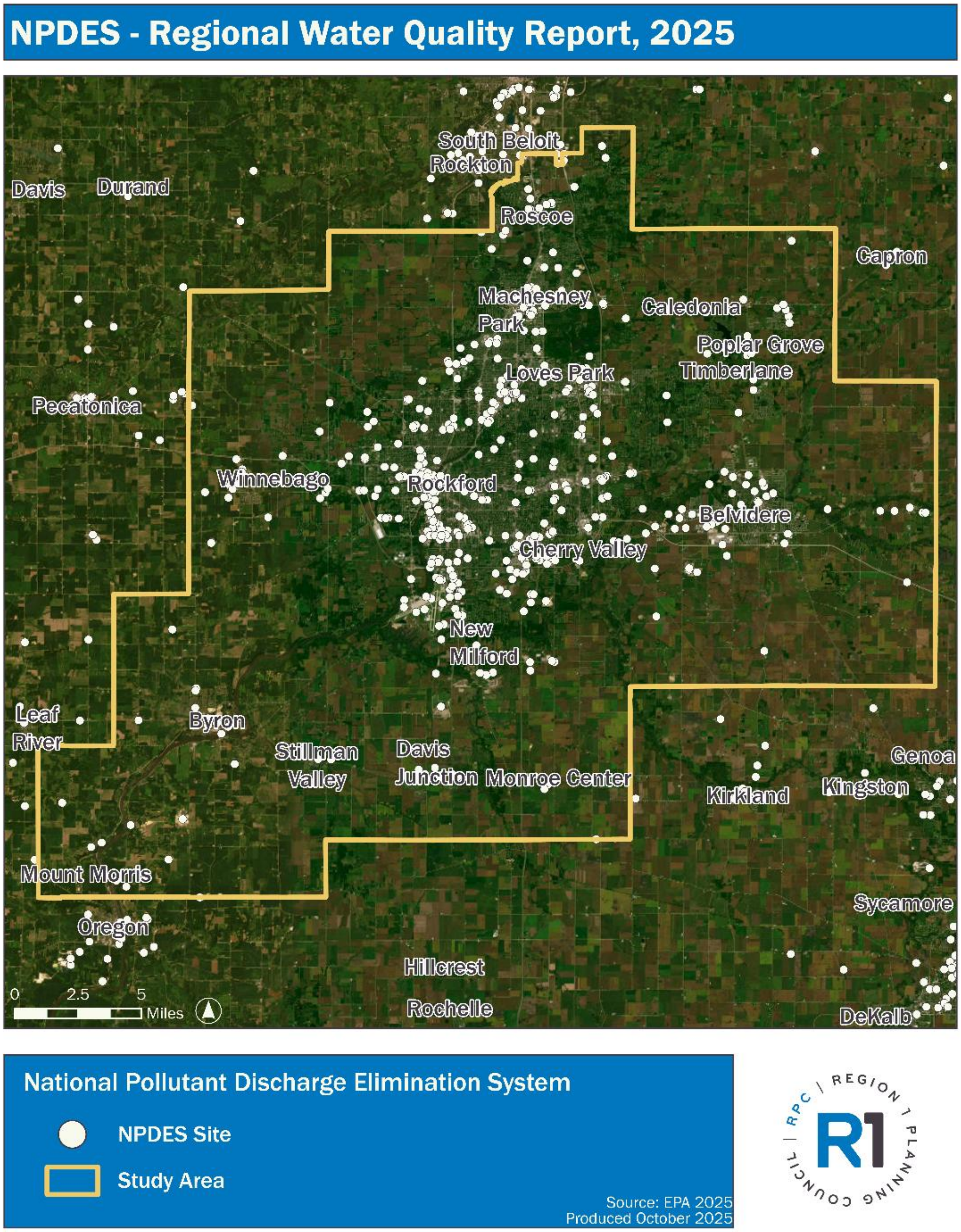

FIGURE 12. NPDES PERMITS IN OUR REGION

Stormwater Management

Urban and suburban areas have stormwater management systems that are meant to capture excess runoff and handle city stormwater. The runoff from urban/suburban spaces contains pollutants like oils, chemicals, pesticides, nutrients, and sediment, which eventually are transported into larger surface water systems. Stormwater drainage is made up of curbs, gutters, combined sewers, roadside swales, water detention/retention basins, culverts, and more. These systems were not always created with water quality as a top priority and often are inadequate at preventing flood events when stormwater overflows these systems or is released too quickly without adequate detention. Flooding not only presents danger to a city's inhabitants, but it also contributes to nonpoint source pollution by exacerbating erosion. Erosion of stream beds allows for sediment and any nutrients within the soil to enter the water system. This also means that more water is remaining in our streams and lakes rather than seeping into the ground to refill aquifers.[57]

Effective stormwater management is becoming more important as climate change affects precipitation patterns. As previously discussed, the region has seen more intense precipitation events which contribute to overloading of the stormwater conveyance systems. As extreme weather events become more common, so will flooding and the associated erosion and spread of pollution that often come with it.

Now that the importance of stormwater management is better understood, urban planners have gotten creative by incorporating more effective strategies into development, farming techniques, and maintenance via stormwater **best management practices (BMPs)** such as **low impact development (LID)** and **green infrastructure**. BMPs are structures or land use practices implemented to manage stormwater runoff and mitigate pollution entering waterways while simultaneously providing economic and social benefits to the community. They control peak stormwater runoff rate, improve water quality, and manage runoff volume to mitigate the adverse environmental effects on surface water quality resulting from development or agriculture. Often, they mimic natural processes such as wetlands and natural areas within the path of stormwater runoff. BMPs such as LID and green infrastructure specifically manage stormwater and mitigate pollution entering waterways, typically in urban or suburban settings. These practices are often recommended by watershed plans after a comprehensive study of an area to choose the most effective BMPs for maximum environmental, economic, and social benefit. The **Illinois Urban Manual** is a technical reference for developers, contractors, planners, engineers, government officials, etc. that provides designs and specifications for BMPs to control non-point source

[57] Barbosa, A. E., Fernandes, J. N., & David, L. M. (2012). *Key issues for sustainable urban stormwater management*. Water Research, 46(20), 6787–6798. https://doi.org/10.1016/j.watres.2012.05.029.

pollution.[58] For structures and practices specific to agricultural lands, designs and specifications are found in the Natural Resource Conservation Service's **Field Office Technical Guide – Illinois**.[59] Within the Rockford Region, they are usually implemented on a voluntary basis to improve environmental conditions, such as when implementing a watershed plan, although it is an option for agencies to mandate them as part of permitting development or land uses.

Local Examples of Stormwater Management

Alpine Dam in Keith Creek Basin

City of Rockford Stormwater & Environmental Team Program

"Adopt-a-Drain" initiative

Winnebago County Highway Department Surface Water Ordinance

The Rockford Region has many local examples of these practices already. For the South Fork Kent Creek and Buckbee Creek watershed plans, R1 partnered with the Rockford Park District, local municipalities, and ecological and engineering firms to build demonstration bioswales and bioretention basins within Park-er Woods and Ken Rock parks while providing education and outreach to residents.[60] From the South Fork Kent Creek Watershed Plan, the Rockford Park District partnered with consulting firms to build constructed stormwater wetlands, bioswales, floating wetlands, and vegetated filter strips of native plantings within and around Levings Lake.[61] The Candlewick Lake Association partnered with experts to treat their stormwater according to the Candlewick Streams and Lakes Conservation Plan by stabilizing streambanks and building constructed stormwater wetlands, floating wetlands, bioswales, and rain gardens. Each aspect of these remediations was designed to soak up excess nutrients, intercept and detain stormwater, and enhance infiltration of surface water.[62] These initiatives, among many more, are great examples of how urban development can occur alongside healthy ecosystems and avoid harming water quality.

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[58] U.S. Department of Agriculture – Natural Resources Conservation Service. (2018). *Illinois Urban Manual: Section 1.* Illinois Urban Manual Partnership. https://illinoisurbanmanual.org/.
[59] Natural Resource Conservation Service. (n.d.). *Field Office Technical Guide.* U.S. Department of Agriculture. https://efotg.sc.egov.usda.gov/#/.
[60] Hey and Associates, Inc. (July 2013*). Winnebago County Watershed Improvement Plan: Buckbee Creek Watershed.* Winnebago County Watershed Improvement Plan Steering Committee. https://wincoil.gov/images/departments/Highway/Plans/11-0174_bcwbp.pdf.
[61] Adams, Olson, et al. *South Fork Kent Creek Watershed Resource Inventory*. Tallgrass Restoration and Olson Ecological Solutions. Dec. 31, 2019. https://wincoil.gov/images/departments/Highway/Plans/sfkc_final_inventory_12.29.2020.pdf.
[62] Illinois Environmental Protection Agency. (n.d.). *Candlewick Watershed-based plan (final report).* https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/watershed-based-planning/documents/candlewickwbp.full.doc.pdf.

Agricultural Land Use

Agricultural land use is an important consideration for water quality because after urban and suburban areas, it is the next largest contributor to water pollution on a per-acre basis, and it makes up most of the Rockford Region by area. Agriculture can create nonpoint and point source pollution. Practices such as tilling, fertilizing, using pesticides, and introducing livestock into the environment can contribute pollutants such as sediment, nutrients, pathogens, and harmful chemicals to the waterways through runoff. Leaving tilled croplands bare for periods of time after harvest can also contribute to sediment load through erosion of these plots when they lack soil stabilization from vegetation or crop residue.[63] Agricultural point sources of pollution can include Concentrated Animal Feeding Operations (CAFOs), processing facilities, irrigation return flows, rural municipal or domestic wastewater discharges, and other agricultural facilities like fish farms. These point sources of pollution are of concern for the same reasons listed above: outdated structure, cumulative impacts, and not strict enough adherence to guidelines.

Aside from point and nonpoint source pollution from agriculture, it can also disrupt the water cycle by way of drainage tiles—piping of plastic or clay used to collect and redirect subsurface water to desaturate the soil to remove water in the crop field's root zone. These practices often facilitate the removal of deep-rooted vegetation associated with wetlands. Removing these habitats from the landscape to expand and improve growing conditions for crops eliminates a host of wetland functions such as filtering pollutants from runoff. Deep-rooted vegetation like old growth forests and prairies also served the function of filtering pollutants and promoting infiltration prior to their conversion to agricultural fields.[64]

Although agricultural land can have implications for the environment surrounding it, participation in sustainable agriculture practices that support soil-health and nutrient-loss reduction are growing. It is often called **regenerative agriculture**

Agricultural Program Links

Winnebago County Soil & Water Conservation District cost-share programs

Illinois Demonstration Farms Partnership

National Resources Conservation Service Programs

Farmer's Rising

Conservation Reserve Program

Farm Service Agency Programs

[63] U.S. Environmental Protection Agency. (n.d.). *Nonpoint source pollution from agriculture.* https://www.epa.gov/nps/nonpoint-source-agriculture#Q2.

[64] Davis, Drew R. (2018). *Effects of Agricultural Tile Drainage on Wetland Habitats and Species.* University of South Dakota ProQuest Dissertations & Theses.

which is a holistic approach to farming that focuses on ecosystem health while farming.[65] There are numerous programs that support agricultural producers making this effort. For example, Winnebago County's Soil & Water Conservation District offers cost-share support for practices such as no-till farming and cover crops through various **Illinois Department of Agriculture (IDOA)** programs, and some local farms are participating in demonstration networks that monitor BMP effectiveness for water quality outcomes. State-wide programs like the Illinois Demonstration Farms Partnership help link individual farms with edge-of-field monitoring, enabling quantification of nutrient reduction under different BMP regimes. **National Resources Conservation Service (NRCS)** has several programs and initiatives geared towards sustainable agriculture and reclaiming agricultural land for natural land, some notable ones include the Conservation/Wetland Reserve Programs and the Agricultural Management Assistance Program. The **Conservation Reserve Program (CRP)** by the **Farm Service Agency** is a voluntary cost-share program that "encourages agricultural producers and landowners to convert highly erodible and other environmentally sensitive acreage to vegetative cover, such as native grasses, trees, and riparian buffers."[66] There are also a variety of other private funding sources that provide cost-share programs for practices such as no-till and cover-crops to help achieve carbon reduction and environmental benefits.

Natural Land Use

Natural land is our best defense against water pollution. It provides a space to allow for infiltration of precipitation and runoff, and it reduces the velocity of moving water to facilitate sediment to settle out of suspension. Our region has natural land that weaves throughout the other land use types, breaking up impervious surfaces and allowing nature to do its job. Wetlands make up some of the most important natural areas. They are often referred to as "nature's kidneys" because of ecosystem services they provide by allowing for water circulation and infiltration.[67]

There are still processes within natural land areas that can cause water pollution at low amounts. Wildlife interaction with streams can introduce nutrients and pathogens into water ways. Natural erosion can contribute sediment. Internal loading of nutrients and sediment within water bodies can lead to pollutant overload within the water column, especially in anerobic conditions. These processes are usually exacerbated in natural areas that have

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[65] The Noble Research Institute. (n.d.). *Regenerative agriculture.* https://www.noble.org/regenerative-agriculture/.

[66] Farm Service Agency. (n.d.) *Conservation Reserve Program (CRP)*. U.S. Department of Agriculture. https://www.fsa.usda.gov/resources/programs/conservation-reserve-program#:~:text=To%20apply%20for%20the%20Conservation%20Reserve%20Program%2C,are%20available%20through%20the%20local%20FSA%20office.

[67] The Nature Conservancy. (2024). *Nature is our strongest ally in ensuring global water security.* https://www.nature.org/en-us/what-we-do/our-insights/perspectives/nature-is-our-strongest-ally-in-ensuring-global-water-security/.

been adversely affected by outside factors like invasive species or soil degradation. Typically, healthy natural systems do not cause health-concerning events like algae bloom, fish kills, or dangerous levels of contaminants because these issues tend to find balance over time through natural processes.[68]

Thus, it is important that we maintain these natural lands to be healthy ecosystems. A "natural" woodland that is dominated by invasive species may not deliver the same ecosystem services as a remnant oak savannah woodland. The difference is that invasive species such as buckthorn or honeysuckle form a dense shrub layer that reduces the amount of sunlight reaching the forest floor. This impedes the growth of herbaceous species that help keep soil intact and promote infiltration of stormwater. Native species have massively complex root systems that range in length, sometimes reaching 15 feet or more in depth, which aids in water infiltration and the filtration process. This deep root system allows for greater storage of stormwater when compared to non-native plants with shallower roots.[69] Figure 13 provides comparisons of root systems and lengths for various prairie plant. Kentucky Bluegrass, the furthest to the left, is a non-native turf grass species that exhibits a very small root system (~4 inches) compared to the native prairie species (up to 15 feet).[70]

[68] Sustainability Directory. (n.d.). *How does land degradation impact water quality?* https://climate.sustainability-directory.com/question/how-does-land-degradation-impact-water-quality/.
[69] MOSS Design. (2017). *Native plants reduce flooding in Illinois*. https://moss-design.com/native-plants-reduce-flooding-in-illinois/.
[70] Natura, Heidi. (1995, Revised 2004). *Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois*. Root Systems of Prairie Plants. Conservation Research Institute in
USDA Natural Resources Conservation Service's Chicago Metro Urban and Community Assistance Office, US EPA Region 5, US Fish and Wildlife Service Chicago Field Office and US Army Corps of Engineers Chicago District. https://www.nrcs.usda.gov/sites/default/files/2022-09/Native%20Plant%20Guide.pdf

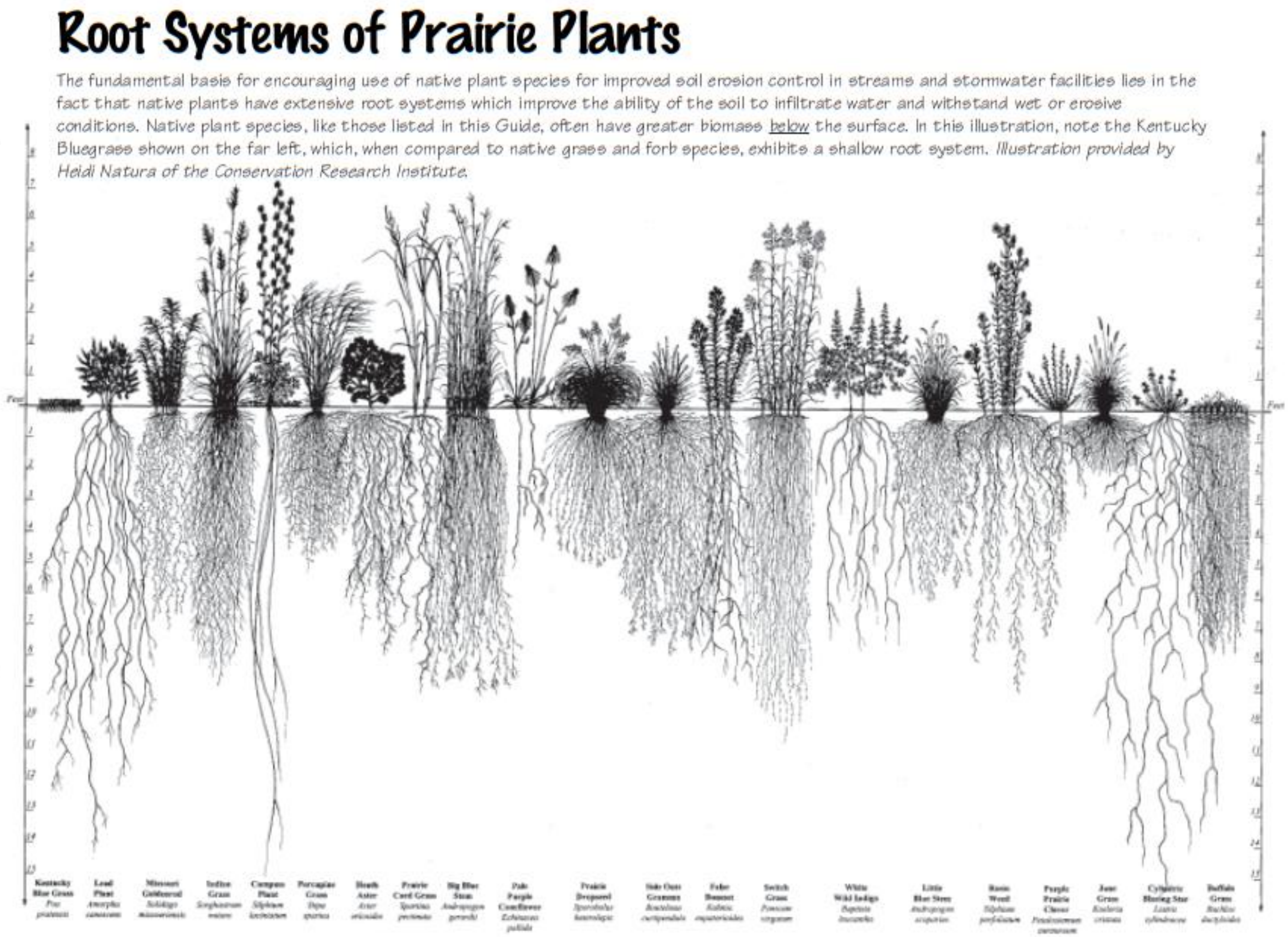

FIGURE 13. ROOT SYSTEMS OF PRAIRIE PLANTS

Geology of Our Region[71]

Geology forms the foundation of groundwater systems. The type of rock and its structure—whether porous sandstone, impermeable clay, or fractured granite—dictates how water moves underground. Permeable layers act as natural reservoirs, while impermeable ones create barriers or confined aquifers. Understanding this underground architecture is key to managing water sustainably, especially since our region sources all drinking water from groundwater.

Three Main Water-Bearing Layers

Our region has three primary sources of groundwater, each of which have distinct characteristics that affect water supply and quality. Figure 14 produced by the Illinois State Water Survey for the Chicago region illustrates these layers, which are the same formations that lie underneath our region. It shows how the different subsurface layers can occur in a variety of shapes, sizes, and locations. The layers depicted in the graphic include:

- **Glacial Deposits - Shallow Sand and Gravel Aquifers:** These aquifers are made up of loose materials like sand and gravel that were left behind by glaciers and rivers. They are found close to the surface. In areas such as Boone and Winnebago Counties, these shallow aquifers are associated with outwash valleys, and can provide water for small households, farms, and some irrigation.
- **Carbonates - Shallow Bedrock Aquifers:** These aquifers form in layers of limestone and dolomite, such as the Galena-Platteville system, which lie a few hundred feet below the surface. Water flow in these aquifers depends on how much the rock is cracked or fractured. In some areas, they can produce a steady supply of water, while in others, the flow may be limited. These aquifers are the source of private wells in upland areas.
- **Sandstones - Deep Sandstone Aquifers (Cambrian-Ordovician System):** These deep sandstone layers are the main source of water for municipal sources in the region. The St. Peter and Ironton-Galesville Sandstones are especially important because their sand grains are well-rounded and have open spaces that allow water to move and be stored efficiently. Most cities in the area, including Rockford, rely heavily on these deep sandstone aquifers for their public water supplies.

Figure 15 depicts the layout of our region's shallow aquifers; almost our entire region sits above major sand and gravel aquifers and major bedrock aquifers. The sand and gravel aquifers sit below the Rock River and Kishwaukee River floodplains. The only areas without shallow aquifers below the surface are found in the eastern part of the MPA in Boone County.

[71] Illinois State Water Survey. (2023). *Water Supply Planning: Assessment Of Water Resources for Water Supply in the Rock River Region* https://www.ideals.illinois.edu/items/127264.

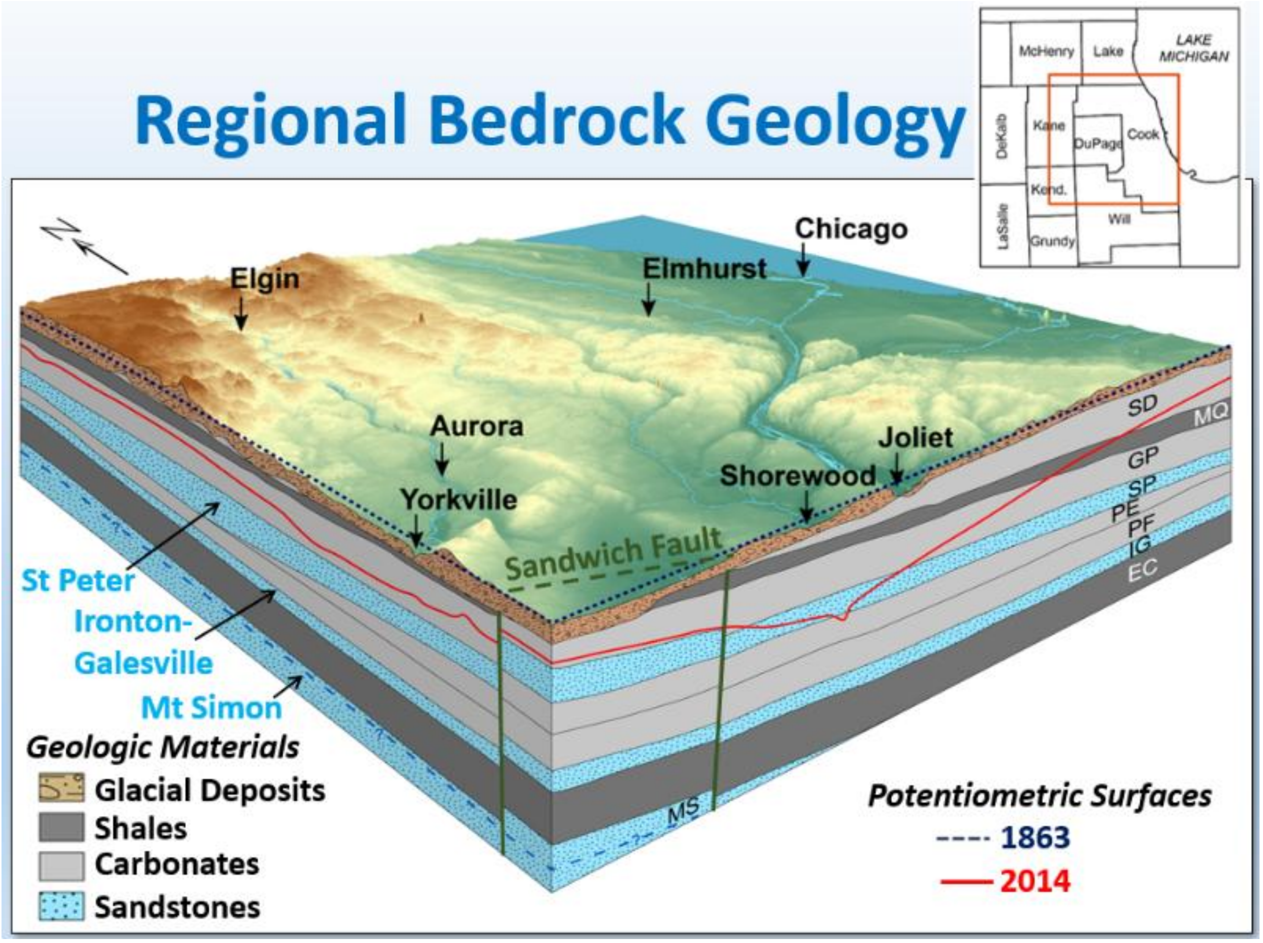

FIGURE 14. REGIONAL BEDROCK GEOLOGY
Source: Illinois State Water Survey - 2021

Shallow Sand and Gravel Aquifers

Formation and Characteristics: Shallow sand and gravel aquifers consist of unconsolidated (loose, uncemented) materials deposited by glaciers and rivers near the surface during glacial periods. These deposits contain rounded quartz particles with pore spaces between grains that store and transmit groundwater.

Geographic Distribution in the Rockford Region: The most productive sand and gravel aquifers occur within the Rock River valley itself. In this area, a shallow alluvial (river-deposited) aquifer sits directly above the deeper Cambrian-Ordovician sandstone, creating excellent hydraulic connectivity. Outside the valley, particularly in the hilly Rock River Hill Country topography of Winnebago and Boone Counties, these shallow aquifers are more limited in extent and productivity.

Water Supply Capacity: Sand and gravel aquifers provide adequate water for smaller uses and some irrigation but vary significantly in productivity depending on location. Their transmissivity (ability to transmit water) can be very high in coarse gravel deposits but drops considerably in areas with more clay-rich sediments.

Vulnerability Characteristics: These aquifers are the most susceptible to contamination of the three major water-bearing layers in the region. Their shallow depth and high permeability—the same characteristics that make them productive—also make them vulnerable to surface contamination. Pollutants from septic systems, road salt, agricultural chemicals, and industrial spills can rapidly infiltrate into these aquifers.

Recharge Dynamics: The high permeability of sand and gravel allows for relatively rapid recharge from precipitation and surface water infiltration. However, this also means contaminants can reach the aquifer quickly. In areas with fine-grained materials (high sand content), recharge potential decreases significantly, making these areas more vulnerable to drawdown during drought periods.

Connection to Deeper Aquifers: Within the Rock River valley, the direct hydraulic connection between the shallow sand and gravel aquifer and the deeper Cambrian-Ordovician sandstone creates a critical pathway for recharge. Precipitation infiltrates easily into the shallow aquifer and then leaks downward to replenish the deeper sandstone.

Shallow Bedrock Aquifers

Formation and Characteristics: Shallow bedrock aquifers in the Rockford region consist primarily of limestone and dolomite formations, most notably the Galena-Platteville system. Unlike sand and gravel aquifers that store water in pore spaces between loose particles, these carbonate bedrock aquifers store and transmit water through fractures, joints, and solution cavities created by chemical weathering of the rock over geological time.

Geographic Distribution in the Rockford Region: The Galena-Platteville limestone system is present throughout the region but lies beneath the surface materials. Critically, east and west of the Rock River valley, this formation directly overlies the deeper Cambrian-Ordovician sandstone aquifers, creating a significant barrier to vertical water movement and recharge.

Water Supply Capacity: The productivity of shallow bedrock aquifers varies dramatically depending on the degree of fracturing in the rock. Highly fractured zones can yield adequate water for small community systems, but productivity is inconsistent and unpredictable compared to sand and gravel or deep sandstone aquifers. Transmissivity in these systems depends entirely on fracture density, orientation, and connectivity rather than the rock's inherent porosity.

Outside the Rock River valley, the Galena-Platteville system acts as a confining layer or aquitard that restricts recharge to the underlying Cambrian-Ordovician sandstone.

Vulnerability Characteristics: Shallow bedrock aquifers present intermediate vulnerability between sand and gravel aquifers and deep sandstone aquifers. While the rock provides some natural filtration, fractures can serve as rapid conduit pathways for contaminants, particularly when vertical fractures connect surface sources to the aquifer. The depth of these formations (typically less than 500 feet for "shallow" bedrock) provides more protection than surface aquifers but less than deep bedrock systems.

Fracture Networks and Contamination Pathways: The Southeast Rockford Groundwater Contamination Superfund site demonstrates the critical role of bedrock fractures in contaminant transport. Poor industrial disposal practices from the 1950s onward contaminated both shallow and deep aquifers, with volatile organic compounds spreading through fractures in the bedrock, sometimes connecting contamination sites as far as half a mile apart. This fracture-controlled transport makes predicting contamination spread particularly difficult.

Recharge Dynamics: In areas where shallow bedrock aquifers are exposed at or near the surface, recharge can occur through infiltration into fractures and solution features. However, where overlain by clay-rich glacial deposits, recharge is significantly limited. The variable nature of fracture systems means recharge rates are highly heterogeneous—some areas may have excellent hydraulic connection to surface water or overlying aquifers, while nearby areas remain isolated.

Cambrian-Ordovician Deep Sandstone Aquifers

Formation and Characteristics: The Cambrian-Ordovician sandstone aquifers represent the primary water supply source for the Rockford metropolitan area and most municipalities in northern Illinois. These formations lie hundreds of feet below ground and consist primarily of two major units: the St. Peter Sandstone and the Ironton-Galesville Sandstone. These ancient marine sandstones are composed of well-rounded quartz grains with excellent pore spaces between particles, creating ideal conditions for groundwater storage and transmission.

Geographic Extent and Depth: Unlike the shallow aquifer systems that vary significantly across short distances, the deep sandstone aquifers extend continuously throughout the region at depths typically exceeding 500 feet. This consistent presence and substantial thickness make them the most reliable water source in the Rockford area, capable of supplying large municipal systems as well as smaller community water systems.

Water Supply Capacity: The deep sandstone aquifers are described as the "workhorses of the region's water supply" due to their exceptional productivity and reliability. They possess relatively consistent, moderate transmissivity throughout the region (approximately 2,000 square feet per day), meaning water flows through the formation at predictable rates. This consistency contrasts sharply with shallow materials where transmissivity varies dramatically from very high in coarse gravel deposits to very low in clay-rich areas.

Historical Abundance: When wells were first drilled into the deep sandstone, water pressure was so high that many wells flowed at the surface without pumping—a phenomenon known as artesian flow. This initial abundance allowed extensive development throughout the region, with multiple municipalities and industries developing wells into these formations. However, decades of intensive pumping have reduced these pressures considerably, particularly in areas like Rockford where large volumes are continuously withdrawn.

Vulnerability Characteristics: Deep sandstone aquifers offer the greatest natural protection against contamination of the three major aquifer types in the region. The substantial depth and overlying geological layers provide natural filtration and buffering capacity. However, they are not invulnerable—the Southeast Rockford Superfund site demonstrates that volatile organic compounds can reach these deep formations through fractures in overlying bedrock or improperly constructed or abandoned wells that create direct pathways between aquifer systems.

Natural Contaminant Concerns: While the depth provides excellent protection from surface contamination, the deep sandstone aquifers face challenges from naturally occurring contaminants. Radium presents the most significant natural water quality concern: approximately one in five wells tapping the St. Peter and Ironton-Galesville Sandstones exceed the 5 pCi/L drinking water standard for radium. This naturally occurring radioactive element requires treatment for public water supplies.

Recharge Dynamics and Sustainability: The critical factor determining the sustainability of deep sandstone aquifer use is recharge capacity, which varies dramatically based on overlying geology. The formation also spans a much larger geographic area, gaining recharge from counties in southern Wisconsin as well as local areas.

> *Within the Rock River Valley*: The shallow alluvial sand and gravel aquifer sits directly above the deep sandstone, creating excellent hydraulic connection. Precipitation infiltrates easily into the shallow aquifer and leaks downward to recharge the deeper sandstone.
>
> *Outside the Rock River Valley*: East and west of the valley, the Galena-Platteville limestone system overlies the sandstone and acts as a barrier (aquitard) that severely restricts vertical recharge. Without adequate recharge, even highly productive aquifers cannot sustain intensive pumping indefinitely.

Regional Water Balance: The deep sandstone aquifers function as part of an integrated regional groundwater system. In optimal conditions (like the Rock River valley), surface precipitation recharges shallow aquifers, which then contribute water downward to the sandstone through natural hydraulic gradients. This multi-layer system means that protecting shallow aquifer recharge areas and maintaining hydraulic connections between aquifer layers becomes critical for long-term sustainability of the deep resource.

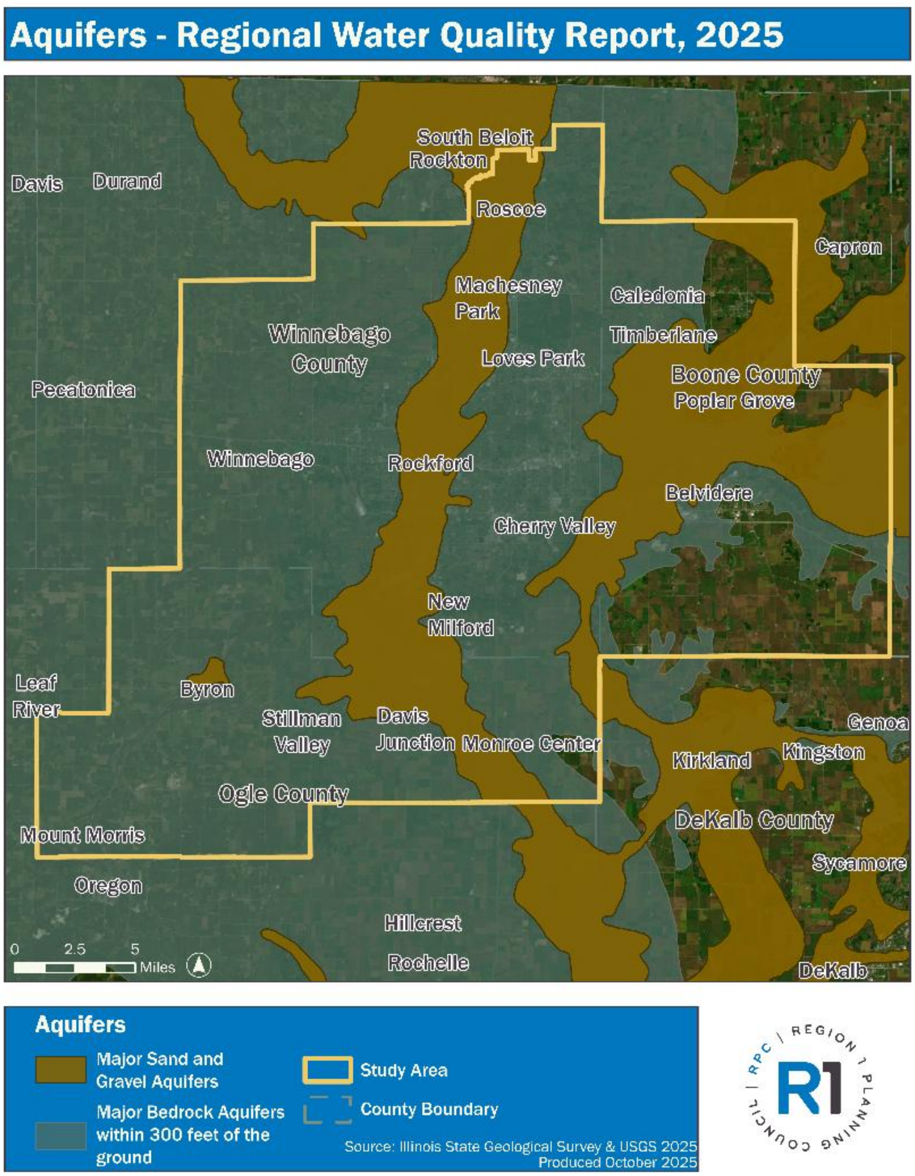

FIGURE 15. AQUIFERS

What Controls Water Availability: Transmissivity

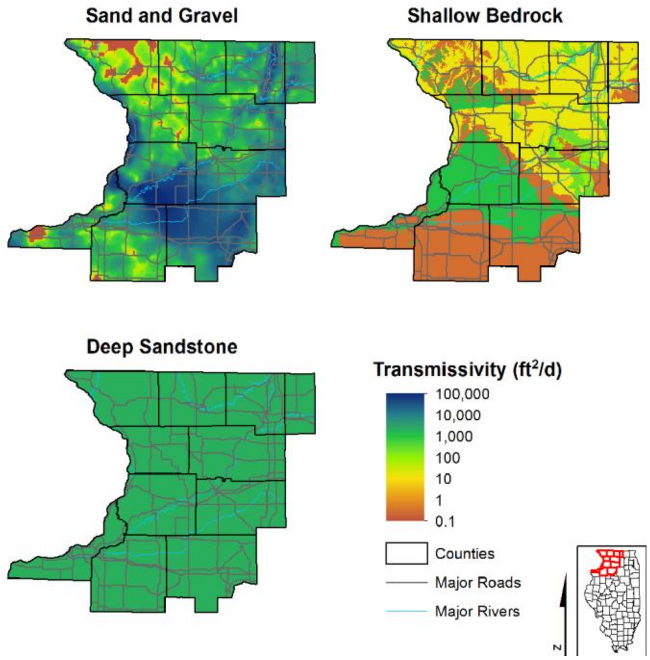

FIGURE 16. TRANSMISSIVITY OF SOIL LAYERS
Source: Illinois State Water Survey – 2023

The ability of underground formations to transmit water is measured by "transmissivity" - essentially how easily water can flow through the rock or sediment. Higher transmissivity means more productive wells. The deep sandstone aquifers have relatively consistent, moderate transmissivity throughout the region (around 2,000 square feet per day), while shallow materials vary dramatically - some sand and gravel deposits have very high transmissivity, while clay-rich areas have very low transmissivity. Figure 16 illustrates how the different water bearing layers vary in transmissivity. Shallow bedrock has the lowest values of transmissivity, while sand and gravel have the highest, meaning that water travels most easily through sand and gravel layers, and bedrock and sandstone aquifers will take longer to recharge. The maps also show how the transmissivity of a specific type of layer can also vary throughout the region.

Our Water Supply[72]

Water Quantity: Tracking Drawdown

Our region currently utilizes groundwater resources. Rockford extracts drinking water from shallow and deep aquifers underground using a network of wells where water is purified at the well site or treated and processed at neighborhood-based treatment plants. [73] Our dependence on these resources makes it critical to track the sustainability of the supply. Drawdown, the reduction in aquifer level over time, is being monitored across the state. Recent analysis shows that most of our region has little drawdown, while other areas have shown some decline in water levels. Proper water supply planning requires detailed

[72] Winnebago County Health Department. (2024 May). *Winnebago County Small Community Water Security Assessment Report.* https://publichealth.wincoil.gov/wp-content/uploads/2025/02/Winn-County-SCW-Security-Assessment-Report_FinalVersion_5.20.2024.pdf.
[73] City of Rockford. (n.d.). *About the water system.* Retrieved October 27, 2025, from https://rockfordil.gov/297/About-the-Water-System.

understanding of the underground aquifer systems. The local geology and impact of well pumping can vary greatly, so a proper understanding of the geology is critical to sustaining our water supply. Well records from two areas of Rockford illustrate how geology impacts drawdown as shown in Figure 17.

Water Supply Status for the Rockford Metropolitan Area

Water Quantity: Current Conditions and Long-Term Stability

Our region sits on top of productive aquifer systems that have reliably supplied water for over 100 years. The deep sandstone aquifers that serve most municipalities, including Rockford, contain substantial water reserves. Some recent trends are encouraging - Rockford's water use has declined from 32 million gallons per day in 1979 to 16 million in 2019, helping stabilize groundwater levels.

Wells located within the Rock River valley benefit from natural recharge and have shown remarkable stability over 70+ years of pumping. Other areas see a down trend in water levels, which will require careful monitoring to ensure supply can keep up with demand.

Wells in the Rock River Valley

The most reliable water sources are found within the Rock River Valley itself, where a shallow alluvial (river-deposited) aquifer sits directly above the deeper Cambrian-Ordovician sandstone. This creates an excellent hydraulic connection - precipitation infiltrates easily into the shallow aquifer and then leaks down to recharge the deeper sandstone. Wells like Rockford's public supply wells #1 and #6, which tap this system, have shown minimal drawdown (less than 50 feet) over more than 70 years of pumping as shown Figure 17.

Wells Outside the Valley

East and west of the Rock River Valley, the situation is quite different. Here, the Galena-Platteville limestone system overlies the deeper sandstone and acts as a barrier, restricting recharge to the sandstone below. Well #30, located east of the valley, experienced much greater drawdown (more than 100 feet) in less than 45 years of operation, demonstrating the impact of local geology on water supply, as shown in Figure 17.

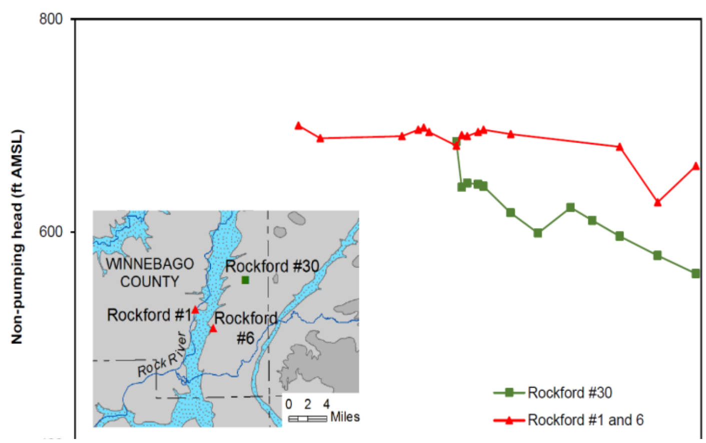

FIGURE 17. GEOLOGY AND DRAWDOWN
Source: Illinois State Water Survey - 2023

Comparing Drawdown Across the State

Recent studies by the Illinois State Water Survey have mapped the drawdown in northern Illinois. The deep sandstone aquifers underlying the area have developed a significant cone of depression—a regional zone where groundwater levels have dropped dramatically due to sustained pumping. This cone, centered in northeastern Illinois near Joliet, has lowered water levels by over 900 feet at its center and by hundreds of feet throughout much of northern Illinois. The cone of depression fundamentally alters regional groundwater flow patterns by creating a large hydraulic gradient that draws water from surrounding areas toward the center of heavy pumping, effectively extending its influence well beyond county and even state boundaries. Wells originally flowing artesian now require deep pumping, and the uppermost sandstone layer has become partially desaturated in some areas, with deeper layers at risk of desaturation in coming decades. Figure 18 provides a helpful graphic depicting the cone of depression phenomenon.

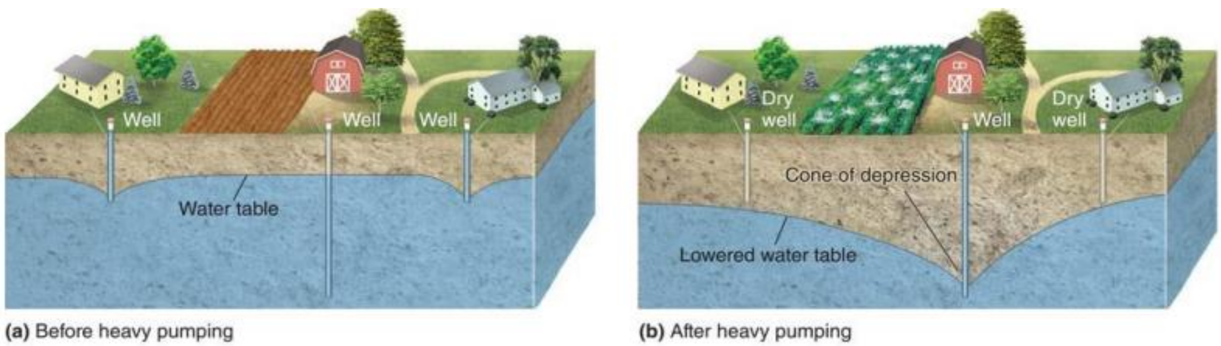

FIGURE 18. CONE OF DEPRESSION
Source: Friedland. (2015). *Environmental Science for AP. 2e.* Freeman and Company.

This regional drawdown threatens the long-term viability of deep sandstone aquifers as a water supply source across northern Illinois. However, significant uncertainties complicate efforts to predict when and how much the cone will continue to widen and impact areas beyond its current footprint. The subsurface geology is complex and poorly understood at local scales, fault zones create unpredictable barriers and conduits for groundwater flow, historical pumping data contains substantial gaps, and the impacts of thousands of multi-aquifer wells that artificially connect different water-bearing layers remain difficult to quantify. This inherent uncertainty, combined with the slow but far-reaching nature of impacts in low-permeability sandstone aquifers, makes it difficult to determine with precision how quickly the cone of depression will expand or when specific communities will experience significant water supply impacts. Further studies, such as the current efforts in Boone County to prepare detailed geology maps, will aid in our local understanding of the sustainability of the groundwater supply.

Our region's drawdown ranges from 0 to 200 feet according to the study and represents stable water levels relative to other areas of the state, like that surrounding Joliet whose drawdown is as much as 900 feet, as seen in Figure 19. Analysis of 23 Rockford wells showed that five had increasing water levels, eight were stable, seven were decreasing, and three showed no clear trend. Again, this illustrates the need to understand geology as the trends are different based on the location of the well.

Recent data shows other positive developments. The City of Rockford's total water pumping has steadily declined from 32 million gallons per day in 1979 to 16 million gallons per day in 2019. This is part of a broader trend in water usage across the country, as public education and newer low-flow plumbing fixtures have reduced the typical household usage. This reduction, combined with the geological advantages in certain areas, has helped stabilize water levels.

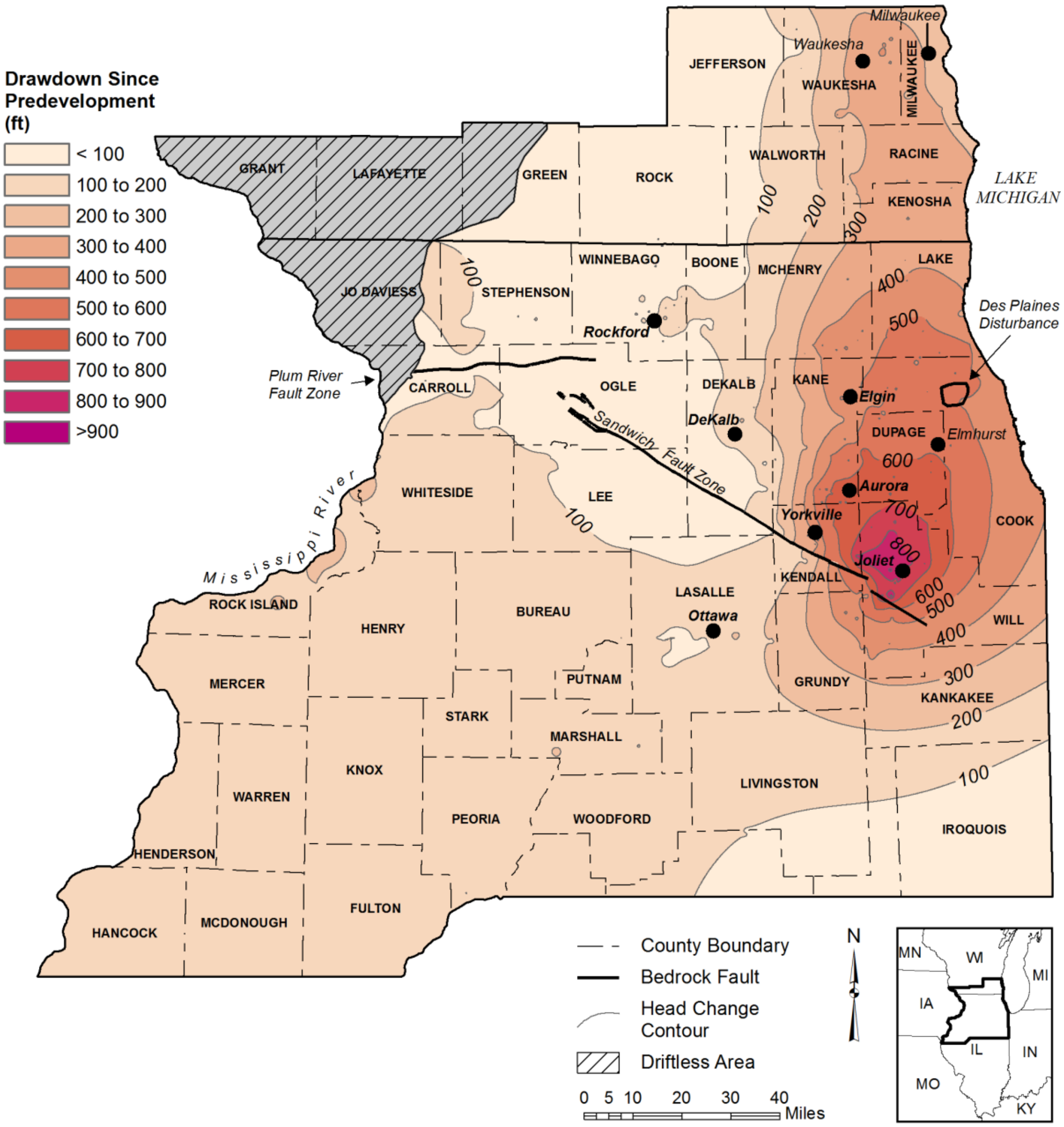

FIGURE 19. COMPARING DRAWDOWN
Source: Illinois State Water Survey, 2023

Groundwater Quality in Our Region[72]

The quality of this groundwater is largely shaped by the area's geology, land use, and the interaction between surface and subsurface systems. Throughout the region, groundwater tends to be hard to very hard, with elevated iron concentrations that, while not health hazards, affect taste and cause staining problems. These minerals dissolve naturally as groundwater moves through limestone, dolomite, and iron-rich formations. Assessing groundwater quality is essential for understanding long-term water security, identifying potential health risks, and supporting sustainable land and water management practices across the Rockford Region.

Sensitive Aquifer Recharge Areas

Sensitive aquifer recharge areas are locations where water infiltrates from the surface to replenish underground aquifers at relatively high rates, making them critical for maintaining long-term groundwater supplies. In the Rockford region, the most sensitive recharge areas occur within the Rock River valley, where shallow sand and gravel deposits allow precipitation to percolate rapidly downward to the deeper Cambrian-Ordovician sandstone aquifers. Outside the valley, recharge becomes increasingly restricted where clay-rich glacial deposits or the Galena-Platteville limestone system create barriers to downward water movement. The same characteristics that make these areas excellent for recharge—high permeability and direct hydraulic connections between surface and groundwater—also make them highly vulnerable to contamination from surface sources like septic systems, road salt, agricultural chemicals, and industrial facilities.

Mapping sensitive recharge areas provides local communities with essential information for land use planning and groundwater protection. By identifying where groundwater is most vulnerable to surface contamination, municipalities can implement targeted protection strategies such as limiting industrial development in recharge zones, requiring enhanced septic system standards, managing road salt application, and establishing setback requirements for potential contamination sources. Recharge area mapping enables communities to balance the competing goals of protecting water quality in vulnerable zones while ensuring adequate recharge occurs to sustain pumping rates. Figure 20 depicts an example of this mapping in Boone County where the most concentrated sensitive recharge areas occur near floodplains.

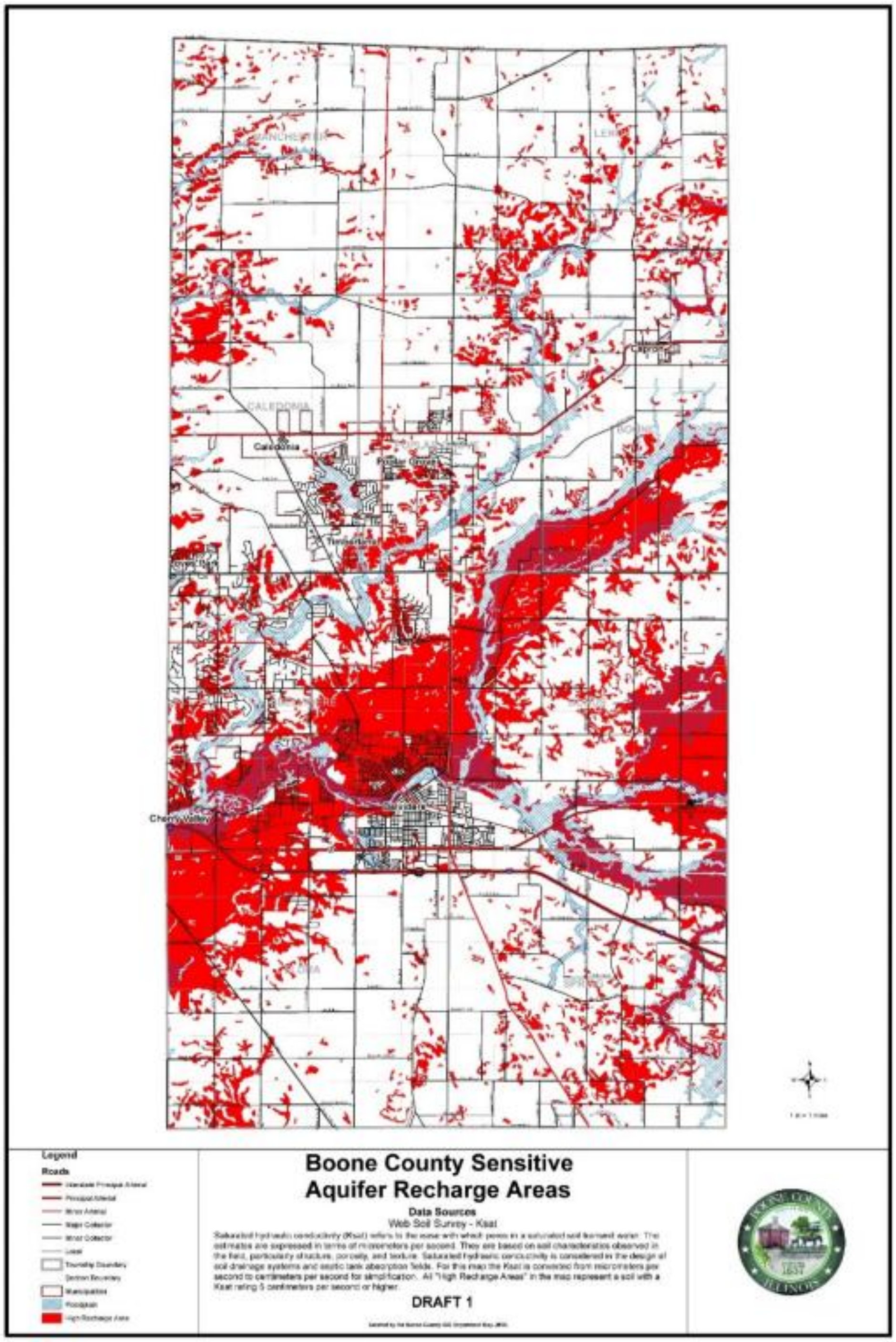

FIGURE 20. BOONE COUNTY SENSITIVE AQUIFER RECHARGE AREAS

Areas highlighted in red depict places considered to be "sensitive" in terms of 1) where contaminants would have an increased chance of soaking into the ground, and thus potentially degrading water quality; and 2) where precipitation is most likely to become groundwater recharge.

Source: Boone County Water Resources.

Human-Caused Contamination: Historical Context

Shallow wells (less than 300 feet deep) face the greatest risk from human activities. The Rock River valley's permeable soils, that make it so productive for water supply, also allow contaminants to move more readily than in areas with dense clay layers. Our region's water quality challenges reflect decades of industrial, agricultural, and urban development. Each contamination source has its own timeline and regulatory response.

Agricultural nitrates contaminate shallow groundwater throughout the region, particularly in northern counties. As fertilizer use intensified following World War II, nitrate levels in groundwater increased correspondingly. Nitrates pose particular risks to infants, causing methemoglobinemia or "blue baby syndrome." Federal nitrate standards established under the Safe Drinking Water Act in 1974 led to improved monitoring, though agricultural sources continue to affect groundwater quality where farming is intensive.

Urban chloride contamination stems from road salt applications that expanded dramatically during the 1970s and 1980s as winter road maintenance became standard practice. Road salt creates chloride contamination in shallow groundwater, particularly problematic in urban areas and along major transportation corridors. While generally an aesthetic concern affecting taste, high chloride levels may pose concerns for individuals on low-sodium diets.

Industrial contaminants have the most storied legacy in the region. One of these examples is the Southeast Rockford Ground Water Contamination Superfund site, created by disposal practices from the 1950s through 1980s, contaminated both shallow and deep aquifers with volatile organic compounds. This contamination forced four municipal wells out of service and spread through bedrock fractures across surprisingly large distances, illustrating how industrial practices considered acceptable at the time created long-lasting environmental consequences that persist today.[74] These areas require extensive remedial plans and will demand ongoing monitoring protocols. For the Southeast Rockford Ground Water Contamination Superfund site, the IEPA and the U.S. EPA divided the possible remedies for each source area into remedies for the soil and remedies for the leachate, a contaminated liquid formed when water seeps through solid waste. Figure 21 shows the Source Area 7 Proposed Plan, which the agencies proposed soil vapor extraction and air sparaging for soil and multi-phase extraction and *leachate* containment for leachate. Source Area 7 refers to a former unregulated disposal area located north and east of Balsam Avenue in southeast Rockford. It now consists of Ekberg Park, fields and open land.[75]

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[74] U.S. Environmental Protection Agency. (n.d.). *Southeast Rockford Ground Water Contamination Rockford, IL.* https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0500955.

[75] Illinois Environmental Protection Agency. (2001, June). *Fact Sheet 10b: Source Area 7 feasibility study and proposed plan.* Southeast Rockford Groundwater Contamination Superfund Project. https://epa.illinois.gov/topics/community-relations/sites/southeast-rockford/fact-sheet-10b.html.

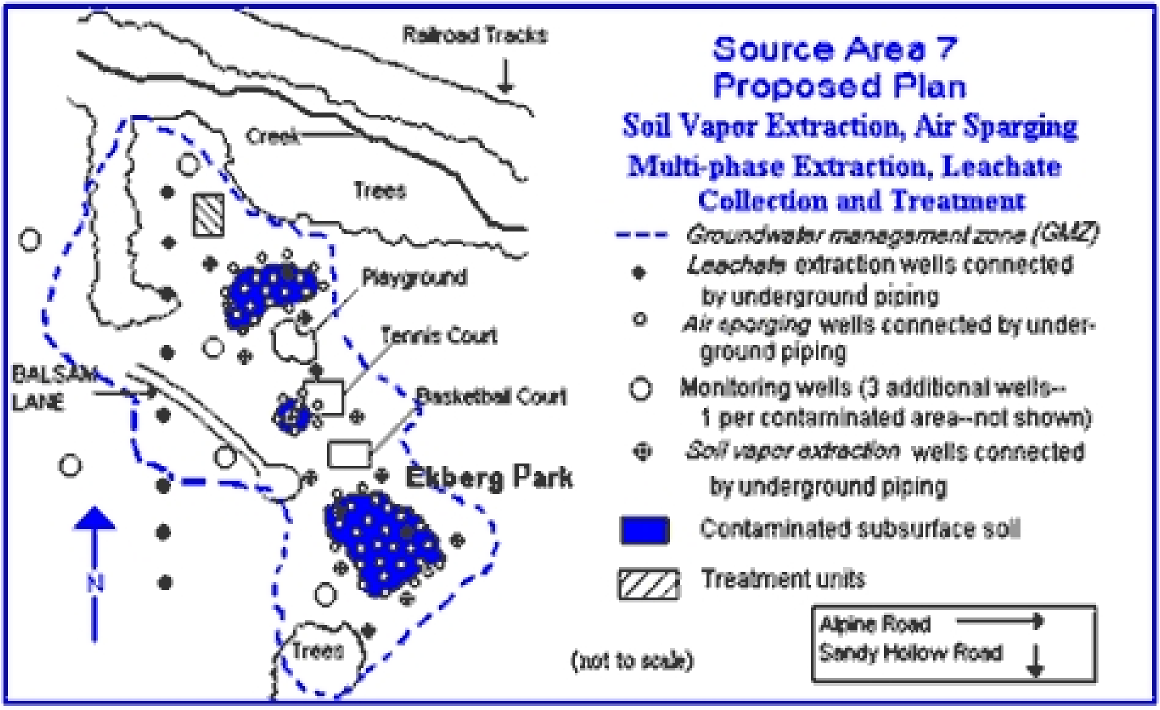

FIGURE 21. SOURCE AREA 7 PROPOSED PLAN- SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION SUPERFUND PROJECT

The figure maps out the groundwater contamination zone boundaries, leachate extraction wells, air sparging wells, monitoring wells, soil vapor extraction wells, areas with contaminated subsurface soil, and treatment units. Source: Illinois Environmental Protection Agency. (2001, June). *Fact Sheet 10b: Source Area 7 feasibility study and proposed plan*. Southeast Rockford Groundwater Contamination Superfund Project. https://epa.illinois.gov/topics/community-relations/sites/southeast-rockford/fact-sheet-10b.html.

Belvidere, IL also has several past and present environmental concerns, notably the Belvidere Municipal Landfill Superfund Site and the MIG/DeWane Landfill Superfund Site, which contaminated soil and groundwater with VOCs, heavy metals (lead, arsenic), and PCBs, requiring ongoing monitoring and cleanup. While the city's drinking water met federal standards in recent reports, past detections of PFAS (beyond EPA advisory levels in some areas) and VOCs in groundwater near these sites highlight the complex water quality challenges. There lies a similar superfund site in Roscoe, IL at the former Warner Electric Brake and Clutch Company where excessive amounts of VOCs were found in the nearby well water and traced back to the Warner facility in 1983. Ground water and soil investigations were ongoing up until at least 2010, where indoor air pollution or “vapor intrusion” were also a concern. Thanks to significant cleanup and containment practices, the site no longer poses imminent health risks, as VOC levels are low, and local communities source their drinking water from elsewhere[76].

Extreme industrial contamination events such as the Chemtool Inc. fire demonstrate how quickly hazardous chemicals can enter air, soil, and nearby waterways, highlighting the importance of emergency response planning during unforeseen industrial accidents. On June 14, 2021, a major fire and various explosions occurred at the Chemtool grease and lubricant manufacturing plant in Rockton, Illinois. The fire was started by a maintenance accident; a scissor-lift struck a piping valve, allowing hot mineral oil to spill and ignite. The fire prompted a mandatory evacuation of all homes and businesses within a one-mile radius and health advisories for residents within three miles. Because of concerns about chemicals, runoff, and smoke, fire crews allowed parts of the blaze to burn out rather than using large water streams, which might have spread chemical contamination. After the event, investigations looked for air, water and soil contamination (including testing for PFAS) around the plant and nearby Rock River. [77]

Treatment and Monitoring

Municipal water systems have adapted to these diverse contamination challenges through comprehensive monitoring and treatment programs. Water utilities conduct comprehensive testing for over 80 different contaminants including bacteria, inorganic chemicals, volatile organic compounds, and emerging contaminants of concern.

Treatment technologies vary by contaminant type. Volatile organic compounds require activated carbon systems or air stripping. Radium removal uses specialized ion exchange systems or reverse osmosis. PFAS treatment demands the most expensive approaches - granular activated carbon or ion exchange systems specifically designed for these persistent chemicals. Agricultural nitrates can be removed through ion exchange or reverse osmosis systems.

Our region's groundwater sources consistently meet Maximum Contaminant Levels established by the Illinois EPA, with detected levels typically well below regulatory limits. This regulatory compliance, combined with transparent public reporting through annual Consumer Confidence Reports, demonstrates how regional water providers prioritize both water safety and public trust.

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[76] U.S. Environmental Protection Agency. (2010, September). *EPA Proposes Changes to Cleanup Plan – Dana corp. Facility (Warner Electric) Roscoe, IL.* National Service Center for Environmental Publications.
[77] Haas, K. (2021, June 25). *Chemtool fire caused by accident, Rockton Fire Protection District says. WIFR.* https://www.wifr.com/2021/06/25/chemtool-fire-accidental-rockton-fire-protection-district-says/.

Private wells represent a significant but largely unmonitored component of the Rockford region's water supply system. Unlike community water systems that face rigorous monitoring requirements under the Safe Drinking Water Act, private wells serving fewer than 25 individuals or with fewer than 25 connections are exempt from regulatory oversight and routine water quality testing. In Illinois, water quality testing for private wells is required only during real estate transactions, and even then, testing is limited to just two parameters: nitrates and coliform bacteria. This minimal testing framework leaves private well owners potentially unaware of contamination from radium, arsenic, VOCs, PFAS, and numerous other contaminants that could affect their drinking water.

The vulnerability of private wells is compounded by their typical association with on-site septic systems, creating a closed-loop scenario where the same property both withdraws groundwater and discharges wastewater. Septic systems are known sources of nitrate and coliform contamination—the two contaminants that dominate private well testing requirements—yet the regulatory framework provides minimal protection. Under current Illinois regulations, it is only suggested that the septic tank itself undergoes inspection on a three-year cycle, while the drain field, where most treatment and potential failure occurs, receives no routine monitoring. Traditional septic systems have an effective functional life of approximately 25 years, after which drain field failure becomes increasingly likely, potentially contaminating the shallow aquifers that supply both the failing system's well and neighboring properties.

Recommendations for Private Well Users

Given the limited regulatory oversight, private well owners in the Rockford region should implement voluntary testing programs that go beyond the minimal requirements. Testing recommendations vary by well characteristics: shallow wells should be tested annually for nitrate, bacteria, arsenic, pesticides, and VOCs; while deep wells need radium testing every 3-5 years.

Additionally, private well owners should maintain detailed records of well construction, including depth, casing type, and geological formations encountered, as this information proves critical for interpreting water quality results and assessing vulnerability to specific contaminants.

Septic System Management

The three-year tank inspection cycle provides minimal protection against system failure. Property owners should proactively monitor for signs of septic system stress, including slow drains, surfacing effluent, unusually green grass over the drain field, or septic odors. Regular pumping (typically every 3-5 years depending on household size and usage) extends system life, but property owners should recognize that even well-maintained systems approach failure after 25 years of operation. Communities should consider enhanced septic system management programs in sensitive aquifer recharge areas, potentially including mandatory drain field inspections and accelerated replacement requirements in wellhead protection zones.

Source protection represents an equally important strategy alongside treatment. Wellhead protection programs establish zoning restrictions around municipal wells and guide land use planning to prevent contamination. Private wells have setback requirements from private septic fields. Properly abandoning old wells prevents contamination from spreading between aquifer layers. Best management practices range from agricultural nutrient management to improved industrial chemical storage and municipal stormwater management. Even homeowners can take part in maintaining the integrity of these systems through best management practices.

A wellhead capture zone is the surface and subsurface area that contributes water to a pumping well, with 5-year, 10-year, and 15-year zones representing progressively larger areas based on how long it takes groundwater to travel from the land surface to the well. These time-of-travel zones are critical management tools because they provide municipalities with realistic timeframes for detecting and responding to contamination threats—a spill at the edge of the 10-year zone would take approximately a decade to reach the well, allowing time for monitoring and remediation before drinking water is affected.

Establishing these capture zones enables proactive groundwater protection through tiered land use controls. For Rockford-region municipalities, capture zone mapping is particularly important given the hydraulic connection between shallow and deep aquifers within the Rock River valley, where surface contaminants can migrate downward to municipal supply wells. Communities can implement graduated protection strategies: prohibiting high-risk activities within the 5-year zone, requiring enhanced management in the 10-year zone, and promoting groundwater awareness in the 15-year zone.

Water quality management is an ongoing process rather than a solved problem. As our scientific understanding advances and new chemicals enter the environment, monitoring and treatment strategies must evolve. Our region benefits from favorable geology and sufficient water resources, but maintaining safe drinking water requires continuous attention to both legacy contamination and emerging challenges. Municipal water consistently meets all drinking water standards through treatment and monitoring, while the main concerns relate to managing treatment costs and upgrading treatment plants to manage emerging contaminants like PFAS.

Drinking Water Consumer Reporting

Our water utilities work diligently to ensure safe, reliable drinking water reaches every tap in our communities. The recent Consumer Confidence Reports analyzed in this assessment represent a transparent commitment by our local water utilities to keep residents informed about the quality of the water we drink every day. These annual reports are required by federal law and provide detailed information about where our water comes from, how it's treated, and what contaminants, if any, are detected during routine monitoring.

The findings show that our regional water systems are generally performing well, with most utilities meeting federal and state drinking water standards. However, like communities across the nation, we face emerging challenges including PFAS contamination and aging infrastructure that require ongoing attention and investment. Our water providers are actively addressing these issues through enhanced monitoring, treatment upgrades, and coordination with state and federal agencies to ensure we continue delivering safe water to our families and businesses.

The Winnebago County Small Community Water Security (SCWS) Assessment categorized several small community water systems (SCWS) based on water quality violations between 2018 and 2022. High vulnerability systems were based on violations and PFAS detection. **Green Meadows Estates MHP** had the highest vulnerability score (46 points), but has since connected to the City of Rockford's water system. **Rainbow Lane MHP** (13.5 points) and **Bill-Mar Heights MHP** (12.5 points) were also identified as high-priority systems. Both systems had detected PFAS above the guidance level for their respective analytes. Bill-Mar Heights MHP previously had 20 VOC violations. Systems ranked as having high water vulnerability based on proximity to potential contamination sources (such as RCRA sites, USTs, and landfills) include Aqua Illinois Sheridan Grove, Bill-Mar Heights MHP, Cherry Valley, Durand, IL American-South Beloit, Mancuso Village Park MHP, Pecatonica, UTL Inc Coventry Hills UTL Inc, and Winnebago. A large portion of SCWSs, including Durand, Pecatonica, and Winnebago, received the highest score (5 points) for low aquifer recharge potential, indicating high vulnerability in refilling groundwater efficiently after drawdown.[78]

Belvidere (2023 Water Quality Report)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA determined that the Belvidere Community Water Supply's source water is susceptible to contamination.

[78] Winnebago County Health Department. (2024, May 20). *Winnebago County Small Community Water Security Assessment Report*. https://publichealth.wincoil.gov/wp-content/uploads/2025/02/Winn-County-SCW-Security-Assessment-Report_FinalVersion_5.20.2024.pdf

Contaminants:

- PFAS compounds were detected as part of the statewide investigation. Detected PFAS included perfluorooctanoic acid (PFOA), perfluorohexane sulfonic acid (PFHxS), perfluorooctane sulfonic acid (PFOS), and perfluorononanoic acid (PFNA), with levels reported above the Illinois EPA health-based guidance levels in October 2023 and October 2024 in some wells.
- All listed regulated contaminants, such as TTHMs, chlorine, arsenic, barium, and fluoride, were detected but remained within the Maximum Contaminant Level (MCL) or Maximum Residual Disinfectant Level (MRDL) standards.

For the most current information, visit: The City of Belvidere, IL – Water Quality Report

Byron (2024 Drinking Water Quality Report)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA determined that the source water for Well #3 is susceptible to contamination, while the source water for Well #4 is not susceptible.

Contaminants: The 90th percentile results for lead and copper (sampled 08/22/2022) were below the Action Level (AL).

For the most current information, visit: The City of Byron, IL – Public Works

Cherry Valley (2021 Consumer Confidence Report)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA determined that the Cherry Valley Community Water Supply's source water is not susceptible to contamination. However, in the Winnebago County SCWS Assessment, Cherry Valley was listed as having a water system with moderate vulnerability due to radium violations and proximity to pollutant sources.

Contaminants: Also according to the Winnebago County Small Community Water Assessment, the system incurred MCL exceedances for combined radium 226/228 during two periods in 2021 (April–June and July–September). They returned to compliance that same year.

For the most current information, visit: The Village of Cherry Valley, IL – Water Quality Reports

Davis Junction (2024 Consumer Confidence Report)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA determined that the Davis Junction Community Water Supply's source water is not susceptible to contamination.

Contaminants:

- The system received a vulnerability waiver renewal, meaning monitoring for volatile organic contaminants (VOCs) and synthetic organic contaminants (SOCs) is not required between January 1, 2023, and December 31, 2025.
- Lead and copper levels (sampled 09/07/2023) were below the Action Level (AL). Detected contaminants like chlorine, TTHM, and arsenic were within regulated limits.

For the most current information, visit: The Village of Davis, IL – Water Quality Report

Loves Park (2024 Water Quality Report for 2023 Data)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA considers the source water for well #1 of this facility to be susceptible to contamination. The Illinois EPA does not consider the confined bedrock wells #3, #4, and #5 to be susceptible to contamination.

Contaminants:

- The Loves Park Water Department had a monitoring violation for chlorine during April–June 2023, failing to complete all required tests. Compliance was achieved by January 2, 2024.
- In 2023, the Loves Park Water Department supply was sampled for 18 PFAS compounds, and none were detected in their finished drinking water.
- Loves Park also receives water from the North Park Public Water District (NPPWD). Sampling of the NPPWD supply detected PFAS above the Illinois EPA health advisory level.

For the most current information, visit: The City of Loves Park, IL – Water Department

North Park Public Water District (NPPWD) (2023 Water Quality Report for 2022 Data)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The source water assessment identified several potential contamination sources that could hazard groundwater. The source water is susceptible to VOC contamination but not to SOC or IOC contamination.

Contaminants:

- Sampling in 2020 detected seven PFAS contaminants, with one being above the Illinois EPA health advisory level. The report lists sample results for several

PFAS analytes from 2022. The District is evaluating treatment options to reduce PFAS levels.
- NPPWD states there is no lead present in the source water or treated drinking water, and they know of no lead service lines in the service area.

For the most current information, visit: North Park Water – Water Quality

Poplar Grove Systems (North, South, and West-Countryside 2024)

Compliance Status: The system reports showed no regulatory MCL violations, however, all three systems reported a Consumer Confidence Rule violation for failing to provide the annual CCR by the deadline in July 2024 due to a typographical error in the URL link. This has since been resolved.

Source Susceptibility:

Poplar Grove North (IL0070150): Source water for Well #3 is determined to be susceptible to contamination, while Well #2 is not susceptible.

Poplar Grove South (IL0070300): The Illinois EPA does not consider the Poplar Grove South Community Water Supply's source water susceptible to contamination.

Poplar Grove West-Countryside (IL0070350): The Illinois EPA does not consider the Poplar Grove West-Countryside Community Water Supply's source water susceptible to contamination.

Contaminants: The 2024 Lead and Copper results show that Copper had 1 site over the Action Level (AL) in Poplar Grove West-Countryside

Please Note: Poplar Grove South experienced major routine monitoring violations for haloacetic acids (HAA5) and total trihalomethanes (TTHM) for all of 2024 because the sample locations were switched. This means the quality of the drinking water during that time cannot be confirmed.

For the most current information, visit: The Village of Poplar Grove, IL – Consumer Confidence Reports

Rockford (2023 Water Quality Report)

Compliance Status: The system reports showed no regulatory MCL violations, however, there was a monitoring violation for cis-1,2-dichloroethylene at Well #5 due to a clerical error in the laboratory paperwork. Follow-up samples showed results were below the MCL.

Source Susceptibility: The Illinois EPA considers the source water of the Rockford Community Water Supply's facility to be susceptible to contamination based on the proximity of numerous potential contaminant sources (identified within 200, 400, and 1,000-foot setback zones) near many of its wells.

Contaminants:

- Volatile organic contaminants detected include tetrachloroethylene, trichloroethylene, and cis-1,2-dichloroethylene.
- Lead was not detectable in the water delivered to service connections, but high levels of lead are possible due to household plumbing.

For the most current information, visit: The City of Rockford, IL – Consumer Confidence Water Quality Reports

Stillman Valley (2025 Consumer Confidence Report for 2024 Data)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA determined the Stillman Valley Community Water Supply's source water is not susceptible to contamination.

Contaminants:

- All measured regulated contaminants, including combined radium 226/228, gross alpha, and chlorine, were within legal limits.
- The Village of Stillman Valley serves no lead service lines.

For the most current information, visit: The Village of Stillman Valley, IL – Consumer Confidence Reports

Winnebago (2024 Consumer Confidence Report)

Compliance Status: The system reports showed no regulatory violations.

Source Susceptibility: The Illinois EPA determined the Winnebago Community Water Supply's source water is not susceptible to contamination. In the Winnebago County SCWS assessment, Winnebago was ranked as having low vulnerability (0 points) for water quality violations/PFAS detection over the previous five years.

Contaminants:

- All tabulated regulated contaminants, including chlorine, TTHM, HAA5, arsenic, and combined radium 226/228, were detected within legal limits.
- The Village of Winnebago currently serves NO lead service lines.

For the most current information, visit: The Village of Winnebago, IL – Consumer Confidence Reports

Drinking Water Consumer Choice

Recent research provides important insights into the quality and safety of different water options while highlighting why certain communities may reasonably choose alternatives to tap water. Table 2 compares all available drinking water options in terms of source, treatment, regulation, and cost. Comprehensive testing of tap water, bottled water, and household-treated tap water reveals that each option has both benefits and potential concerns. Importantly, research challenges some common assumptions while validating others.[79]

The choice of drinking water is deeply personal and often reflects valid concerns about safety, taste, affordability, and trust.

Table 2. Cost Comparison of Drinking Water Options

Water Source	Where It Comes From	Treatment Prior to Distribution	Regulation	Cost per Gallon	Annual Cost (Family of 4)	% of Food Budget (12,000)
Private Well*	Shallow aquifers	Chlorination	IDPH	$0.00	$750.00	6.25%
Municipal/Community Water System**	Shallow and deep aquifers	Varies, removes solids and contaminants, disinfects	EPA	$0.003	$0.84	<0.01%
Home Carbon Filter	Municipal/Private Wells	Carbon filtration	CPSC		$100	0.80%
Home Reverse Osmosis	Municipal/Private Wells	Reverse osmosis	CPSC		$400	3.30%
Private Label Bottled Water	Varies	Varies, often repackaged private brands	FDA	$1.15	$300	2.50%
Aquafina Bottled Water	Municipal/CWS	Reverse osmosis, carbon filter, additional filtration, UV light	FDA	$1.70	$450	3.80%
Dasani Bottled Water	Municipal/CWS	Reverse osmosis, carbon filter, additional filtration	FDA	$1.70	$450	3.80%
LIFEWTR Bottled Water	Municipal/CWS	Reverse osmosis, carbon filter, add electrolytes, balance pH	FDA	$9.30	$2,400	20%

*Annual cost calculated by dividing the estimated cost of installation (~$15,000) over a 20-year lifespan.[80]
** Cost per gallon estimate based on monthly consumption charge for residential rates in Rockford, IL.[81]

[79] Bear SE, Waxenberg T, Schroeder CR, Goddard JJ. (2024*). Bottled Water, Tap Water and Household-Treated Tap Water–Insight Into Potential Health Risks and Aesthetic Concerns in Drinking Water*. PLOS Water 3(9): e0000272. Https://doi.org/10.1371/journal.pwat.0000272.
[80] Carthan, A. (2025, May 19). *How Much Does Well Installation Cost? https://www.thisoldhouse.com/plumbing/well-installation-cost*.
[81] Rockford, The City of. (2025). *2025 Fee Schedule*. https://rockfordil.gov/DocumentCenter/View/4351/2025-Fee-Schedule-PDF?bidId=.

Options for Drinking Water

Tap Water Quality and Safety

Municipal tap water systems in our region are regulated by the EPA under the Safe Drinking Water Act, which requires comprehensive testing and public reporting of results. Water utilities must immediately notify consumers of any violations and take corrective action. However, research indicates that tap water can contain detectable levels of various contaminants, including disinfection byproducts, trace metals from aging infrastructure, and occasional exceedances of aesthetic standards that affect taste and odor.[82]

The presence of these contaminants doesn't necessarily indicate unsafe water, as many detections occur well below health-protective standards. However, cumulative exposure to multiple contaminants and the disproportionate impact of infrastructure problems on certain communities are legitimate concerns that drive water consumption choices.

Bottled Water: Beyond Marketing

Despite marketing claims of purity, bottled water is not contaminant-free. Testing has revealed that bottled water can contain many of the same substances found in tap water, including disinfection byproducts, heavy metals, industrial chemicals, and even pharmaceutical residues.[79] Additionally, bottled water presents unique concerns including higher microplastic concentrations, potential bacterial contamination during storage, and chemical leaching from plastic packaging.[83, 84]

Importantly, up to two-thirds of bottled water sold in the United States is repackaged municipal tap water that has undergone additional filtration. The regulatory framework for bottled water is different than those for tap water as drinking water. The Food and Drug Administration regulates bottled water federally, while the Illinois Department of Public Health regulates sale of bottled water in Illinois.[85] Standards for water quality are similar, but bottled water companies are not required to publish water quality testing publicly.

Household Water Treatment

Home filtration systems can effectively reduce specific contaminants in tap water. The research indicates that properly maintained household treatment systems often perform comparably to bottled water in terms of overall contaminant reduction, while avoiding some of the unique risks associated with plastic packaging and storage.[79]

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[82] Environmental Working Group. (2008, October 15). *Bottled Water Quality Investigation*. https://www.ewg.org/research/bottled-water-quality-investigation.

[83] Abraham A, Cheema S, Chaabna K, et al. (2024). *Rethinking Bottled Water in Public Health Discourse.* BMJ Glob Health; 0:e015226. doi:10.1136/bmjgh-2024-015226.

[84] Gambino, I.; Bagordo, F.; Grassi, T.; Panico, A.; De Donno, A. (2022). *Occurrence of Microplastics in Tap and Bottled Water: Current Knowledge.* Int. J. Environ. Res. Https://doi.org/10.3390/ijerph19095283.

[85] Parag, Y., Elimelech, E., Opher, T. (2023). *Bottled Water: An Evidence-Based Overview of Economic Viability, Environmental Impact, and Social Equity*. https://www.mdpi.com/2348548.

Understanding Community Perspectives

Water consumption patterns reflect more than individual preferences—they often mirror broader social and economic realities that deserve recognition and respect.

Historical Context and Trust

Some individuals within communities that have experienced water contamination incidents, infrastructure failures, or government neglect have developed skepticism toward public water systems. These concerns are not unfounded fears but reflect real experiences and historical patterns where certain communities have borne disproportionate environmental burdens.

Research shows that violations of drinking water standards occur more frequently in rural Latino communities and areas experiencing persistent poverty. [86] This uneven distribution of water quality problems has created reasonable distrust that extends beyond individual incidents to systemic concerns about equity and environmental justice. Figure 22 shows **Environmental Justice Communities** in our region, found in south Rockford and east Belvidere. Staying informed on where these communities are helps decision-makers ensure equity when analyzing actions that impact the region, either positively or negatively.

Addressing Common Misconceptions

While respecting legitimate concerns and choices, some widespread beliefs about water quality deserve clarification:

"Bottled water is always safer than tap water": Research indicates this is not consistently true. Both options can contain contaminants, and bottled water faces less transparent regulatory oversight with no requirement for public disclosure of testing results.

"All tap water systems are the same": Water quality varies significantly between systems based on source water characteristics, treatment processes, and infrastructure condition. Local water quality reports provide specific information about your community's water.

[86] Jaffee, D. (2024). *Unequal Trust: Bottled Water Consumption, Distrust in Tap Water, and Economic and Racial Inequality in the United States.* WIREs Water, 11(2), e1700. https://doi.org/10.1002/ wat2.1700.

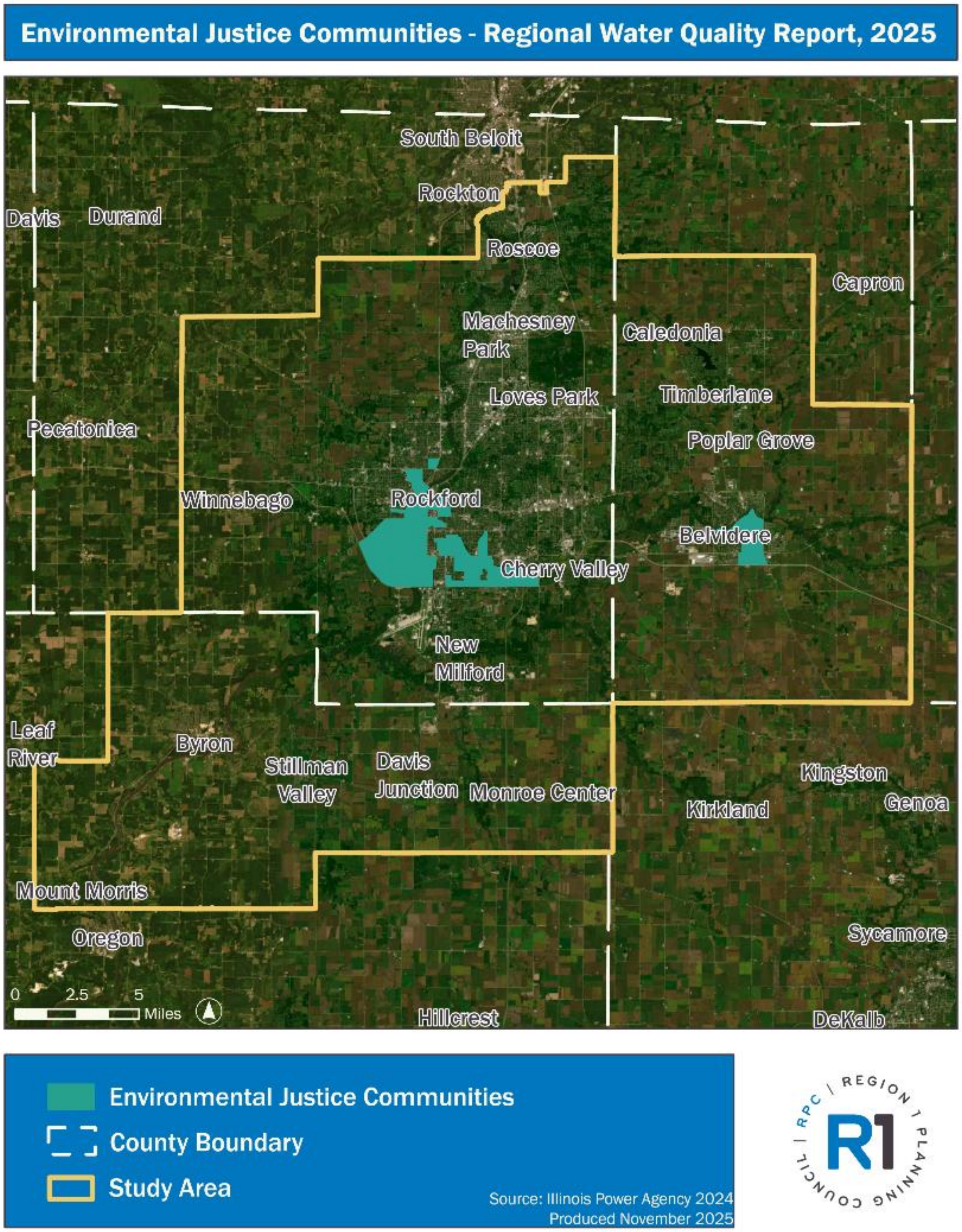

FIGURE 22. ENVIRONMENTAL JUSTICE COMMUNITIES

Regional Commitment to Water Quality

Our regional planning agency and member communities recognize that trust in public water systems must be earned through consistent performance, transparency, and infrastructure investment. Local water utilities are working to:

- Modernize aging infrastructure to reduce contamination from distribution systems
- Enhance treatment processes to address emerging contaminants like PFAS
- Improve public communication about water quality testing and results
- Pursue funding opportunities to support system improvements and affordability programs

Making Informed Choices

Every household must make water consumption decisions based on their specific circumstances, preferences, and concerns. Whether you choose tap water, install home treatment systems, or purchase bottled water, the key is making informed decisions based on accurate information rather than marketing claims or misconceptions.

For those interested in their local tap water quality, annual Consumer Confidence Reports are available from your water utility and provide detailed testing results. Home water testing is also available for households seeking additional information about their specific water quality.

The goal is not to dictate water consumption choices but to ensure all community members have access to accurate information and, ultimately, to safe and affordable drinking water regardless of the source they choose.

The Regional Context

While some areas of Illinois face water scarcity, the Rock River region benefits from favorable geology and climate. The main challenge is maintaining water quality standards cost-effectively while ensuring that groundwater pumping doesn't harm the streams and rivers that support local ecosystems.

Our region's water supply story is fundamentally positive – adequate resources and generally good water quality conditions.

Surface Water Quality in Our Region

Our idea of surface water quality can only be as good as the data we collect. As described earlier, the CWA set up framework for local surface water to be surveyed and assessed periodically. This monitoring is incredibly helpful for informing water quality improvement programs and revealing important information about our impacts on the local environment. Aside from the monitoring required by the CWA, other avenues of water quality research come from local studies, volunteers, grant programs, educational research, and more.

Impaired Waterways

In the service area, there were 26 impaired segments of stream that were reported in 2024, 2022, and 2018 by the EPA's 303(d) list. The streams are shown in Figure 22. The impairments by watershed are displayed in Table 3, Table 4, and Table 5. These stream segments add up to 269 miles of impaired stream length. Only nine of them were within the boundaries of a TMDL or LRS report. Some stream segments have more than one impaired designated use. Some streams have more than one impaired designated use. The 26 stream segments list 36 impairments to their six designated uses, of which 10 impairments have plans in place to address them. Of the 36 impairments, 15 are to primary contact, 13 to fish consumption, 7 to aquatic life, and one to aesthetic quality. Fecal coliform was identified as the issue for 15 streams, mercury for 13, PCBs for 11, chemicals such as aldrin, dieldrin, heptachlor, etc. for five, flow regime modification for three, ethanol for two, total phosphorus for one, algae for one, methoxychlor for one, and sedimentation/siltation for one. Six of the impairments did not have an identified issue. It should also be noted that not each designated use is always assessed, so it is possible that there are even more impairments in these streams. None of the streams had a probable source of pollutants identified. One lake was designated as having impaired aesthetic quality due to total phosphorus, and it was addressed in a TMDL report.[31]

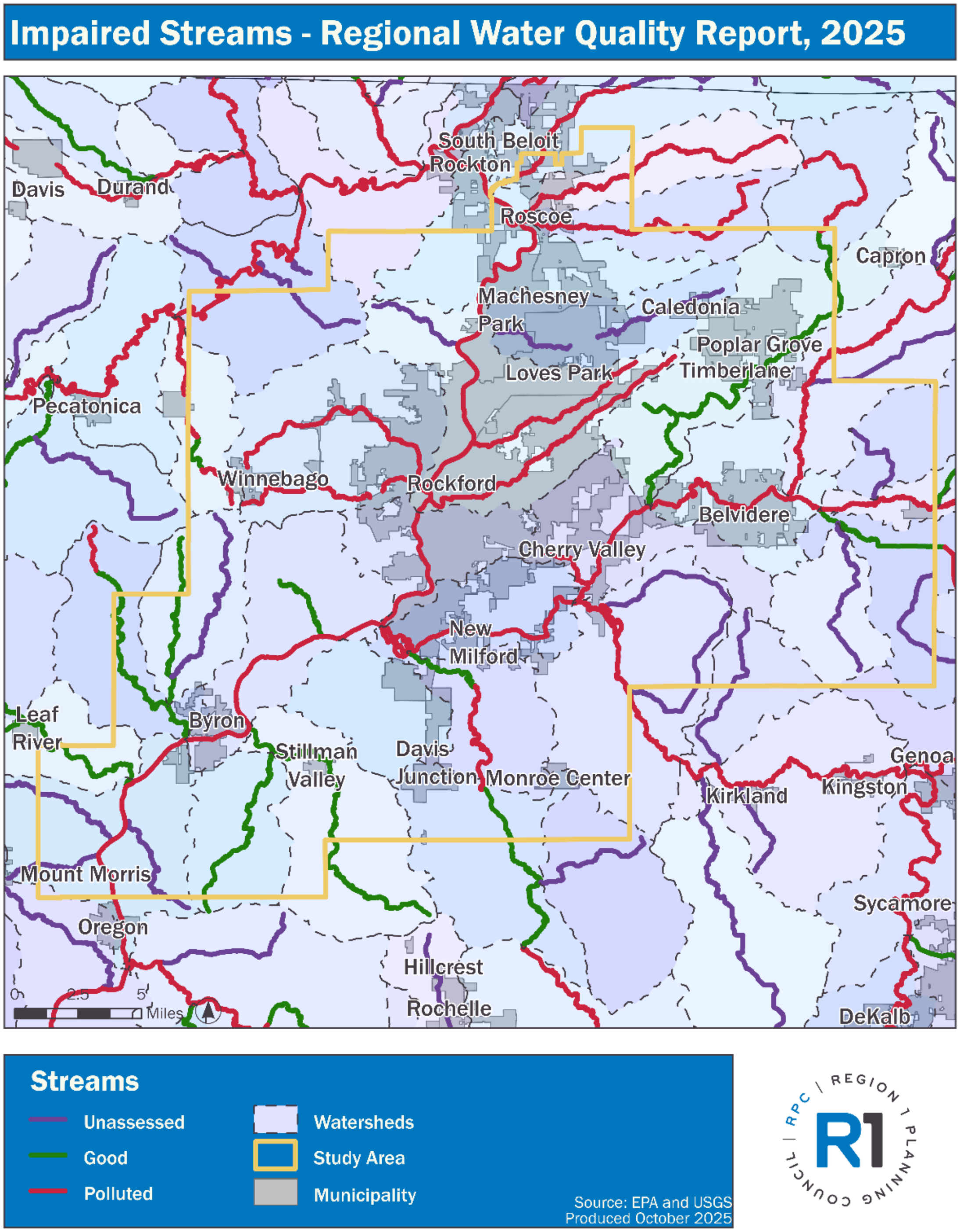

FIGURE 23. IMPAIRED STREAMS

TABLE 3. PECATONICA WATERSHED IMPAIRMENTS

HUC8	Stream AUID	Name	Length (Miles)	Years Reported	Plans	Probable Sources	Designated Uses	Designated Use Status	Identified Issues, if Impaired	Plan?
Pecatonica 07090003	IL_PWF-W-C1	Coolidge Creek	2.56	2018, 2022, 2024	Pecatonica River Watershed LRS	None Identified	Aesthetic Quality	Not Assessed		
							Aquatic Life	Impaired	Unknown, FRM, TP, SS	X
							Fish Consumption	Not Assessed		
							Primary Contact	Not Assessed		
	IL_PWF-L-C1	Coolidge Creek	2.73	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Impaired	Algae, FRM, Unknown	
							Fish Consumption	Not Assessed		
							Primary Contact	Not Assessed		
	IL_PWF-L-C2	Coolidge Creek	4.07	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Impaired	Unknown	
							Fish Consumption	Not Assessed		
							Primary Contact	Not Assessed		
	IL_PW-02	Pecatonica River	18.75	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Impaired	Unknown, FRM	
							Fish Consumption	Impaired	Hg, PCBs	
							Primary Contact	Not Assessed		
	IL_PW-01	Pecatonica River	7.01	2018, 2022, 2024	Pecatonica River Watershed TMDL & LRS	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs	
							Primary Contact	Impaired	Fecal Coliform	X
	IL_PW-13	Pecatonica River	9.4	2018, 2022, 2024	Pecatonica River Watershed TMDL	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCB's	
							Primary Contact	Impaired	Fecal Coliform	X

FRM: Flow Regime Modification
TP: Total Phosphorus
SS: Sedimentation/Siltation

Hg: Mercury
POPs: Persistent Organic Pollutants
PCBs: Polychlorinated biphenyls

TABLE 4. LOWER ROCK WATERSHED IMPAIRMENTS

HUC 8	Stream AUID	Name	Length (Miles)	Years Reported	Plans	Probable Sources	Designated Uses	Designated Use Status	Identified Issues, if Impaired	Plan?
Lower Rock Watershed 07090005	IL_PV-01	Dry Creek	9.38	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Impaired	Unknown	
							Fish Consumption	Not Assessed		
							Primary Contact	Not Assessed		
	IL_PU	North Kinnikinnick Creek	15.28	2018, 2022, 2024	Rock River/Pierce Lake TMDL	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	X
	IL_PT	South Kinnikinnick Creek	14.43	2018, 2022, 2024	Rock River/Pierce Lake TMDL	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	X
	IL_P-15	Rock River	20.43	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs, Various POPs	
							Primary Contact	Impaired	Fecal Coliform	
	IL_P-20	Rock River	25.14	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs, Various POPs	
							Primary Contact	Good		
	IL_PZZG	Spring Creek - North	8.68	2018, 2022, 2024	Rock River/Pierce Lake TMDL	None Identified	Aesthetic Quality	Not Assessed		
							Aquatic Life	Not Assessed		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	X
	IL_PSB-01	North Fork Kent Creek	12.13	2012, 2022, 2024	Rock River/Pierce Lake TMDL	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	X
	IL_PSA	South Fork Kent Creek	9.6	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Not Assessed		
							Aquatic Life	Not Assessed		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	
	IL_P-23	Rock River	7.5	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs	
							Primary Contact	Good		
	IL_PR-01	Keith Creek	10.43	2018, 2022, 2024	Rock River/Pierce Lake TMDL	None Identified	Aesthetic Quality	Not Assessed		
							Aquatic Life	Not Assessed		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	X
	IL_PR-99	Keith Creek	3.34	2018, 2022, 2024	Rock River/Pierce Lake TMDL	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Impaired	Unknown, Methoxychlor	X
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	X
	IL_P-14	Elkhorn Creek	11.01	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs	
							Primary Contact	Impaired	Fecal Coliform	

FRM: Flow Regime Modification
TP: Total Phosphorus
SS: Sedimentation/Siltation
Hg: Mercury
POPs: Persistent Organic Pollutants
PCBs: Polychlorinated biphenyls

TABLE 5. KISHWAUKEE WATERSHED IMPAIRMENTS

HUC 8	Stream AUID	Name	Length (Miles)	Years Reported	Plans	Probable Sources	Designated Uses	Designated Use Status	Identified Issues, if Impaired	Plan?
Kishwaukee Watershed 07090006	IL_PQE-07	Piscasaw Creek	14.6	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg	
							Primary Contact	Not Assessed		
	IL_PQ-10	Kishwaukee River	12.87	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs	
							Primary Contact	Impaired	Fecal Coliform	
	IL_PQ-14	Kishwaukee River	11.6	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs, Various POPs	
							Primary Contact	Not Assessed		
	IL_PQ-02	Kishwaukee River	4.75	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs	
							Primary Contact	Impaired	Fecal Coliform	
	IL_PQZB	U-Trib Kishwaukee River	2.92	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Impaired	Ethanol	
							Aquatic Life	Impaired	Ethanol	
							Fish Consumption	Not Assessed		
							Primary Contact	Not Assessed		
	IL_PQ-12	Kishwaukee River	14.12	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs, Various POPs	
							Primary Contact	Impaired	Fecal Coliform	
	IL_PQC-11	South Branch Kishwaukee River	9.71	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Good		
							Aquatic Life	Good		
							Fish Consumption	Impaired	Hg, PCBs, Various POPs	
							Primary Contact	Not Assessed		
	IL_PQB-02	Killbuck Creek	6.56	2018, 2022, 2024	None	None Identified	Aesthetic Quality	Not Assessed		
							Aquatic Life	Good		
							Fish Consumption	Not Assessed		
							Primary Contact	Impaired	Fecal Coliform	

FRM: Flow Regime Modification
TP: Total Phosphorus
SS: Sedimentation/Siltation
Hg: Mercury
POPs: Persistent Organic Pollutants
PCBs: Polychlorinated biphenyls

Stream Ratings

The Illinois Department of Natural Resources (IDNR) provides the public with an inventory of stream classifications that categorize local streams based on habitat quality, biological integrity and biological diversity. Data is typically taken from fish communities, macroinvertebrates, and mussels. The data is slightly outdated as most of it was collected between 1997-2007, however, it is still informative for us to see the status of these water bodies even if it may not be entirely representative of their current state. Streams are rated on an alphabetical scale of A-E.

Table 6. IDNR Stream Ratings

Stream	Diversity	Integrity
Beaver Creek	A	B
Beaver Creek	B	C
Coon Creek	D	C
Geryune Creek	D	A
Kilbuck Creek	D	E
Kilbuck Creek	B	B
Kishwaukee River	B	C
Kishwaukee River	C	C
Kishwaukee River	C	C
Leaf River	D	C
North Fork Kent Creek	C	C
Piscasaw Creek	D	A
Piscasaw Creek	C	B
Piscasaw Creek	B	A
Rock River	D	C
Rock River	D	B
Rock River	C	A
Rock River	C	C
Rock River	C	C
Silver Creek	C	A
South Branch Kishwaukee River	B	B
South Branch Kishwaukee River	A	A
South Kinnikinnick Creek	C	D
Stillman Creek	C	B
Unknown	A	C

- **A (Unique Aquatic Resource or Exceptional):** Streams of the highest biological quality. They are home to a high diversity of aquatic species and have healthy habitats that are relatively undisturbed.
- **B (Highly Valued or Good):** Streams with good biological quality that support diverse aquatic life.
- **C (Moderate or Fair):** Streams with fair biological quality, but with some signs of degradation.
- **D (Limited or Poor):** Streams with poor biological quality, often with a low diversity of aquatic life and significant habitat degradation.
- **E (Restricted)**: This is the lowest rating and represents a stream with the most severe habitat and water quality problems.

As seen in Table 6, 25 streams within the surface area were given Diversity and Integrity Stream Ratings including one that was designated as Biologically Significant, Lower Beaver Creek. Of these streams, 18 were given a rating of A-C for Diversity and 23 were given a rating of A-C for Integrity. The streams and ratings for biological diversity and biological integrity are depicted in Figure 24 and Figure 25, respectively.[87]

While the Kishwaukee River had previously maintained an A rating in diversity and integrity, it is important to note that the reaches of the Kishwaukee River watershed have since been delisted due to a decline in water quality since the late 1980s. Portions of the Kishwaukee River's main stem were considered a Unique Aquatic Resource in the late 1980s and early 1990s due to their high biological quality and diversity, including 44 documented threatened

[87] Illinois Department of Natural Resources. (n.d.). *Biological Stream Ratings.* https://dnr.illinois.gov/conservation/biologicalstreamratings.html.

or endangered species.[88] This change is despite the Conservation 2000 initiative and the IEPA's more stringent NPDES and improved MS4 standards. This is illustrative of the fact that the watershed, and surrounding watersheds in our region, remain vulnerable to ongoing degradation due to nonpoint-source pollution, urbanization, and land–use change. According to the Upper South Branch Kishwaukee River Watershed Improvement Plan, achieving long-term recovery will require more aggressive implementation of best management practices (BMPs), including streambank stabilization, restored riparian buffers, wetland restoration, stormwater controls, and green infrastructure to slow and filter agricultural and industrial runoff.[89]

[88] Illinois Environmental Protection Agency. (n.d.). *Summary 1972–1996*. Illinois EPA. Retrieved December 6, 2025, from https://epa.illinois.gov/topics/water-quality/watershed-management/resource-assessments/summary-1972-1996.html.
[89] Applied Ecological Services, Inc. (2020). *Upper South Branch Kishwaukee River Watershed Improvement Plan: Executive Summary*. Retrieved from https://irp.cdn-website.com/618477f3/files/uploaded/Watershed%20Plan%20Summary_ohC3bwKiRwKSic4Sj5O3.pdf.

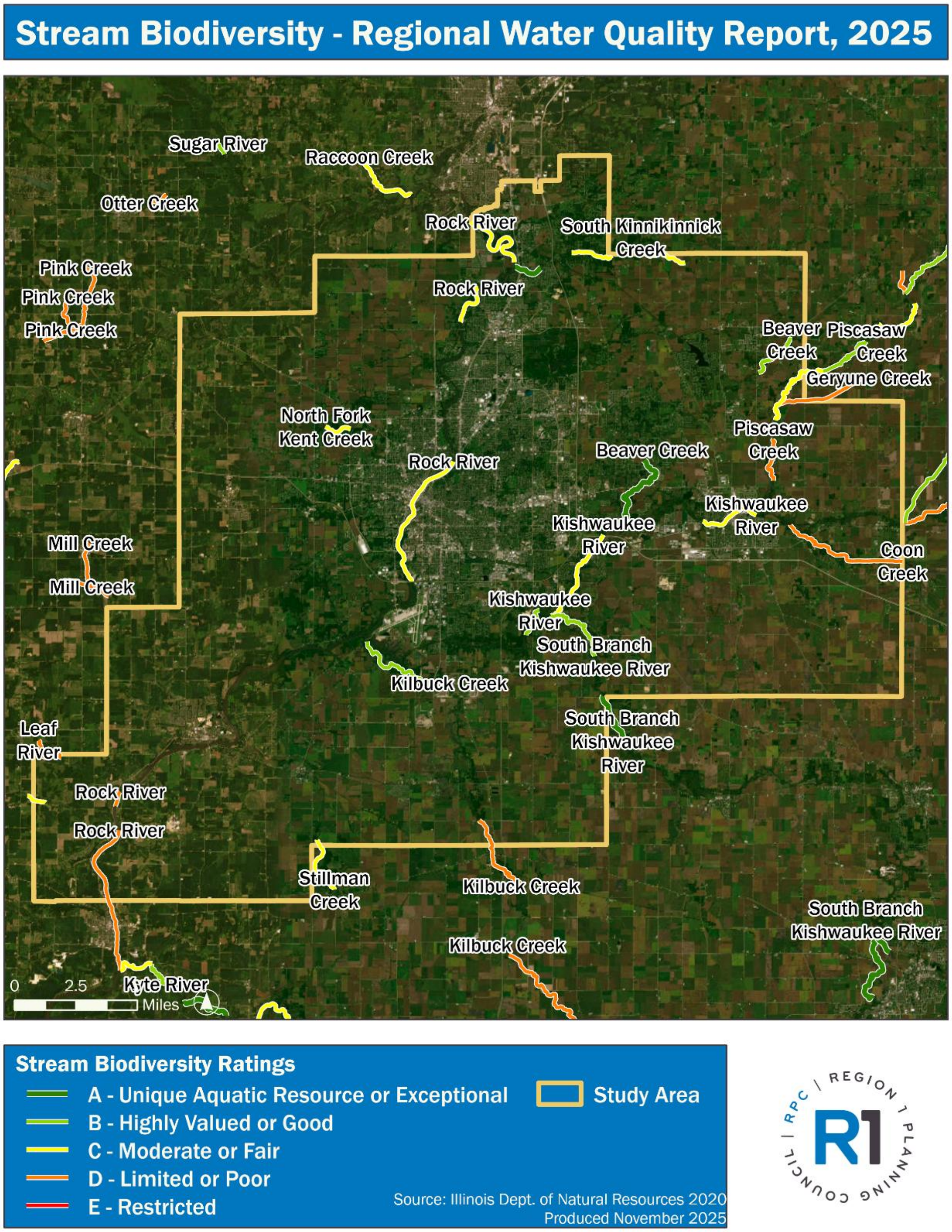

Figure 24. IDNR Stream Biodiversity Ratings

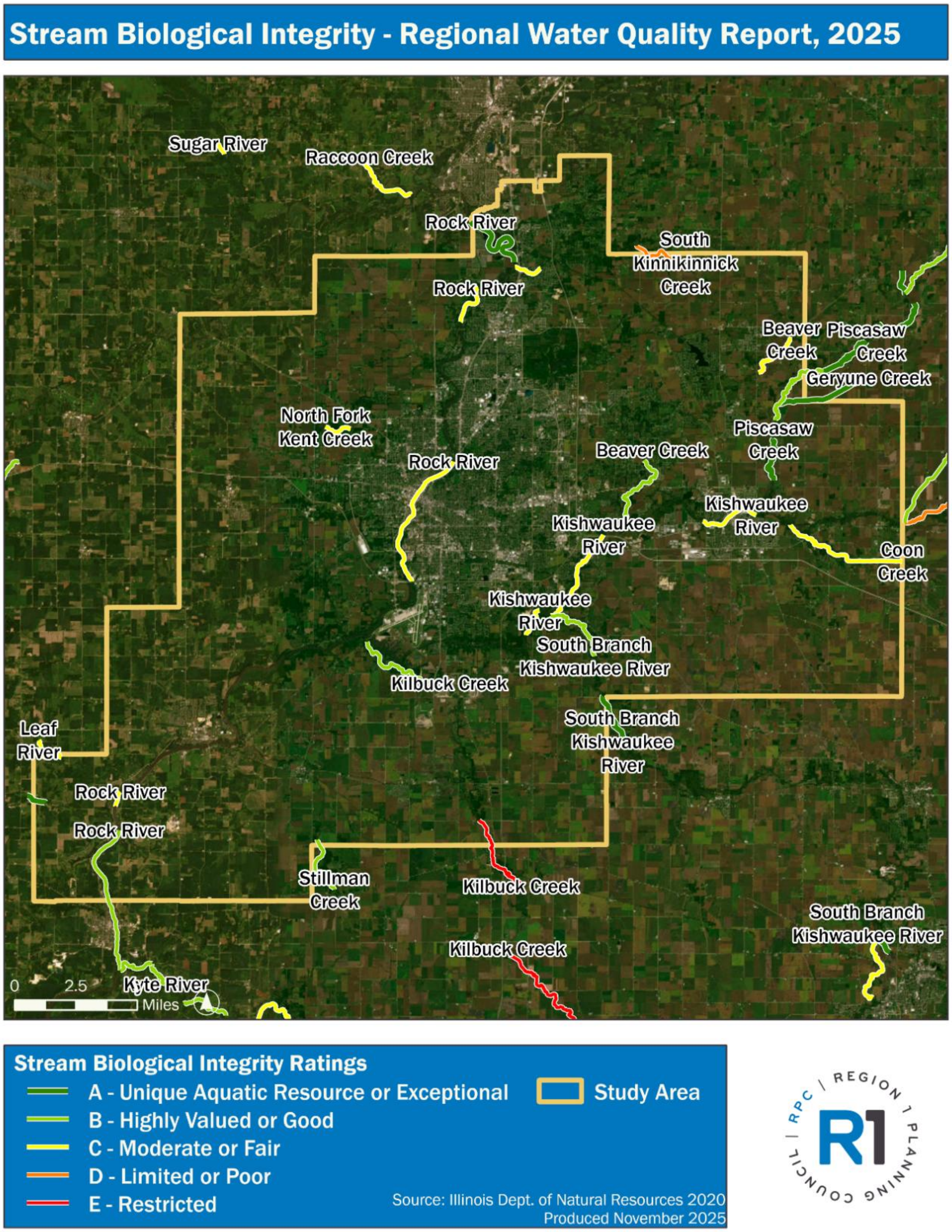

FIGURE 25. IDNR STREAM BIOLOGICAL INTEGRITY RATINGS

Aquatic Life and Water Quality

Aquatic life serves as a direct reflection of a water body's overall health.

Because fish, macroinvertebrates, and algae respond predictably to changes in physical, chemical, and biological conditions, their presence, abundance, and diversity are powerful indicators of water quality. Unlike single water samples, biological communities integrate the effects of multiple stressors over time—such as nutrient loading, sedimentation, temperature changes, and toxic pollutants—providing a more comprehensive measure of ecosystem condition. As described above, aquatic life use attainment is assessed along with other stream impairments and is considered in the IDNR stream ratings. Other types of aquatic life surveys are done for research or educational purposes or in response to a development project to ensure that negative impacts are mitigated properly. It is estimated that nearly 70% of the approximately 300 North American mussel taxa are extinct, federally listed as endangered or threatened, or in need of conservation status.[90,91] This could be an indicator of habitat degradation over time, which has implications for ecosystem health and thus water quality. Continued research on aquatic life assemblages and the sources for their improvement or decline remain important to inform water quality management.

One study, the Coon Creek/Mosquito Creek Natural Communities Assessment, looked at 12 natural communities where one, the marsh/swamp area, was rated high quality while others were rated as C. D, or E due to habitat degradation. These quality ratings came from assessment of the species they found within them. They found 10 avian species that are Illinois state endangered and threatened, which is good news in the sense that those communities are supported, but it also raises concern for prioritizing these areas for restoration and management to maintain those communities.[92]

Another study by the Illinois Natural History Survey looked at mussel, fish, and other macroinvertebrates along I-90 post-construction of new facilities along the highway. They were interested in the condition of aquatic life before and after the construction to ensure they meet environmental requirements for the construction activities. They found that short-distance translocation of freshwater mussels is a viable tool for species conservation, but it does not eliminate all mortality. They discovered significantly altered mussel habitat after the

[90] Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves.1993. *Conservation status of freshwater mussels of the United States and Canada*. Fisheries 18(9):6-22.
[91] Strayer, D.L., J.A. Downing, W.R. Haag, T.L. King, J.B. Layzer, T.J. Newton, and S.J. Nichols.2004. *Changing perspective on pearly mussels, North America's most imperiled animals*. BioScience54(5):429-439.
[92] Weller, Steve. (2002). *Coon Creek/Mosquito Creek Natural Communities Assessment*. Boone County Conservation District.

construction due to increased silt and sand. Fish assemblages did not differ significantly before or after the construction They also saw increases in state threatened species. As reported elsewhere, they also found the biotic integrity of the Kishwaukee River to be "exceptional", while other streams they assessed ranged from fair to good. The IDNR's State Wildlife Action Plan identifies the Kishwaukee River watershed as a Conservation Opportunity Area due to its high-quality aquatic resources, as it supports several state-listed threatened and endangered species. Again, this study reveals that continued protection and restoration are important within this region where threatened species are currently supported. [93,94,95]

Gaps in the Data

It's difficult to know the requirements of improving local water quality when data gaps remain. Despite the amount of data that *is* accessible about the region's water quality, there is much unknown, unreported, unorganized, and still left to be researched. Gaps can lead to misinformation about standards and performance, creating concerns for decision-makers in effective management strategies. Most currently available water quality data is funded by government agencies, either directly or indirectly, and is often done in a piecemeal fashion, leaving gaps along the way. Water quality data within this report comes from TMDLs, watershed plans, IEPA's Section 303(d) list, USGS data, IDNR, Illinois State Water Survey, etc.

TMDLs and watershed plans, while extensive, are focused on very specific watersheds and the water bodies within them. There have been two TMDL reports within the R1 service area, leaving much of the area unresearched. Figure 26 shows the coverage of TMDL and watershed plans within our region and highlights the lack of in-depth research about the southern half of our region. The TMDLs and watershed plans within the region only cover the northern portion. The watershed plans include Beaver Creek, Candlewick Lake, South Fork Kent Creek, Buckbee Creek, Madigan Creek, Keith Creek; the TMDL reports include Rock River/Pierce Lake and Pecatonica River.

There is little available data about NPDES and CAFO outfalls aside from where they are located, shown in Figure 12. It is difficult to determine their current impact on the local water quality without information about their current practices and discharges. The Illinois EPA requires major municipal water facilities that are discharging effluent into impaired

[93] Bilger, E.E., Dreslik, M.J., Phillips, C.A. (2016). *Biotic Integrity of Macroinvertabrate Communities Along the I-90 Corridor*. Illinois Natural History Survey. Prairie Research Institute.
[94] Douglass, S.A., Tiemann, J.S., Baker, S.J., Phillips, C.A., Deslik, M.J. (2016). *I-90 Corridor Post-Construction Monitoring Of Freshwater Mussel Assemblages Along The I-90 Corridor*. Illinois Natural History Survey. Prairie Research Institute.
[95] Stites, A.J., Sherwood, J.L., Tiemann, J.S., Phillips, C.A., Dreslik, M.J. (2016). *I-90 Corridor Post-Construction Monitoring Of Stream Fish Assemblages Along The I-90 Corridor.* Illinois Natural History Survey. Prairie Research Institute.

waterbodies to create Nutrient Assessment Reduction Plans (NARP) through the NDPES program. There is one being developed within the Rockford Region, but it has yet to be submitted.[96]

Investigating stream ratings demonstrates how quickly biological integrity and diversity can degrade despite the conservation measures already put in place. Considering major anthropogenic stresses to streams that continue to increase, more holistic measures beyond just ecological initiatives, such as cross-sector collaboration across municipalities, counties, and private landowners, should be explored.

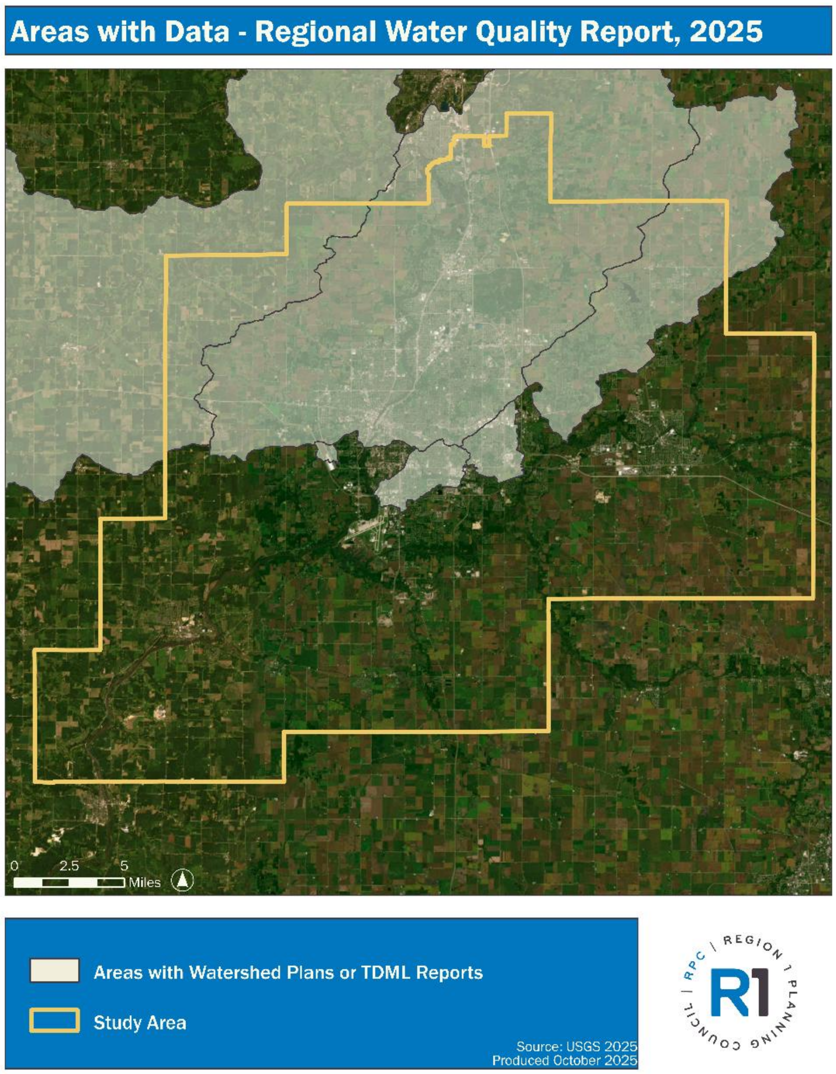

FIGURE 26. AREAS WITH DATA

[96] Illinois Environmental Protection Agency. (n.d.). *Nutrient Assessment Reduction Plans*. Retrieved from https://epa.illinois.gov/topics/water-quality/watershed-management/narps.html.

The IEPA section 303(d) list is one of the single most extensive resources for surface water quality data in Illinois. While it is incredibly informative for the assessments it does produce, it depends on other agencies and programs for attaining the data used for the use assessments. This data only covers navigable waters throughout the state, and they are not all reassessed for each use attainment every cycle. This leaves out a substantial amount of water bodies that could be contributing to local water quality issues, and it can be over 15 years old in some cases. There is a need for more comprehensive and timely surface water quality data, as well as stronger collaboration between already strained agencies.

Ideally, a detailed inventory of detention basins within the service area that includes location, size, type, inlets/outlets, planting plan, and issues/problems with the basin would be a huge step towards progress in filling in these gaps. As part of General NPDES Permit No. ILR40, MS4s are responsible for managing and reporting on stormwater discharges, but most areas outside of an MS4 do not have these requirements.[97] Detention basins and their level of functioning can have a huge impact on local water quality as they promote sediment control, pollutant removal through infiltration, and flood mitigation. Detailed information would allow local agencies to provide upkeep and remediation of these water quality management structures more efficiently. Additionally, detailed assessments of detention basins would further support proper management, as most rural subdivisions place management and maintenance of stormwater conveyance and detention on the local lot owner. This poses an issue as these individuals are typically unaware of the purpose of these basins or how to properly maintain them. As a result, subdivisions bear the cost.

Currently, the USGS streamgages provide important national stream data. This data is important for monitoring change in stream behavior over short and long term periods of time. As federal budgets for environmental programs are being cut, USGS streamgages are becoming endangered and discontinued. Most of these budget cuts occurred in late 2024 and 2025 and are on track to continue through 2026 with 230 endangered streamgages and 35 already discontinued streamgages. There have been and continue to be efforts to rescue endangered and discontinued streamgages by finding new funding sources – 57 of them have been saved this way.[98] The USGS provides a map of these streamgages to pinpoint where funding efforts are needed. This reduction in streamgage data will create even more

[97] Illinois Environmental Protection Agency. (2025, July 8). *General NPDES Permit No. ILR40.* https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/forms/water-permits/storm-water/documents/MS4-general-stormwater-permit-0725.pdf.
[98] United States Geological Survey. (n.d.). *Endangered, Discontinued and Rescued Streamgages Mapper*. Accessed December 3, 2025. https://water.usgs.gov/networks/fundingstability/.

data gaps of concern, especially as we continue to note changes in the behavior of streams and rivers due to increased precipitation and land development.

There is also need for more intensive groundwater data to better understand how our subsurface geology interacts with our water supply, such as where sensitive recharge areas are located. Boone County is currently planning a geologic mapping project to do just that. The information we currently have about our water supply is basic – limited to only a few studies in the area and are usually based on low-resolution data. The current technology, from Web Soil Survey data, is only as detailed as one soil boring per 20-acres of land surface. The new technology will be used to create a detailed picture that profiles the different layers of sediment and rock down to about 1,000 feet below the surface.[99] Sensitive Aquifer Recharge Area maps are not currently available for other counties in our region. However, recharge areas can be estimated by looking at the location of shallow sandstone aquifers, where the underlying ground is porous. Data gaps would be best filled by localized monitoring of well water levels to understand depletion and recharge trends.

There are many plans in place currently to work towards eliminating these gaps in the data and to drive water quality knowledge further. The more information available about water quality, the more action can be spurred to improve, and the more informed the approaches to doing so will be.

Water Quality's Effects on Community

Water quality is much more than just a conservation issue. Water quality affects every aspect of human lives from health to recreation, aesthetic appeal and intrinsic value of natural resources, and the economy. It is intertwined with human quality of life through our use of it, our proximity to it, and our relationships to the natural world around us and beyond us.

Human Health

As discussed in this report, water quality can have huge implications on human health through drinking water and environmental exposure. Contaminants such as nitrates, heavy metals, pathogens, and PFAS can pose serious health risks when present above safe limits within groundwater or surface water. These contaminants can find themselves present within drinking water even in areas where treatment facilities are "up to standard". Heavy metals and PFAS remain in the human body and can accumulate to toxic levels over time, even if the amount in which they are delivered to your home is considered to be safe. Exposure to pathogens and harmful algae outbreaks from pollutant overload in recreational waters can cause gastrointestinal and dermatological illnesses in humans and their pets.

[99] Kane, D. (n.d.). *Geologic Study of Boone County Slated to Begin Soon*. https://cms8.revize.com/revize/boonecountyil/Departments/planning/Three-Dimensional%20Geologic%20Mapping%20Project%20Is%20Being%20Planned%202.pdf?t=202506051027450&t=202506051027450.

Working towards reducing these levels of contaminants in the water and ensuring high water quality thus helps safeguard public health, reduces water treatment costs, and maintains trust in local water utilities.

Recreation

Waterways are at the heart of community recreation in the Rockford area. Not only are they important for local communities to enjoy, but they also draw in tourists from surrounding areas which greatly adds to economic benefits for the community. The Rock River Water Trail, for example, supports kayaking, boating, and fishing—activities that depend on clean and safe water. As stated above, certain contaminants can cause human health issues on contact with the water. When pathogens and nutrients get out of hand, we see algae blooms, beach closings, and swimming advisories reducing enjoyment of the pubic and reducing trust in the local government to manage our natural resources properly. Other types of contaminants might not be concerning for direct human with the water but may cause declines in fish populations and/or contribute to higher levels of heavy metal toxicity in fish, making them dangerous to consume. This hurts those who enjoy fishing as a hobby and those who depend on fishing as a career. Conversely, improving water quality enhances public use of rivers and generally increases outdoor activity, thus promoting physical and mental health benefits associated with time spent in natural environments.

Aesthetics

Beyond the health implications and practical uses of local waterways, streams and rivers have aesthetic and cultural value to the region. Clean, flowing water and healthy riparian corridors create visually appealing landscapes that foster community pride and strengthen residents' connections to the Region. Waterways that are visibly polluted diminish public perception of environmental quality and can discourage local engagement and stewardship. Maintaining attractive, ecologically balanced waterways reinforces the identity of Rockford as a river city and enhances property values in neighborhoods adjacent to clean and well-maintained streams.

Economy

Each of the aforementioned topics – human health, recreation, and aesthetics – all relate back to economics. Water quality has extensive direct and indirect affects the local and regional economy. Public health concerns are costly by way of direct clean up. It can cost billions of dollars to clean up polluted water bodies. Consistent public health issues can also lead to decreased funding, decreased tourism, and increased emigration. The EPA states that "the tourism industry loses close to $1 billion each year, mostly through losses in fishing and boating activities, as a result of water bodies that have been affected by nutrient pollution and harmful algal blooms." Degraded water quality increases cost for water treatment, infrastructure maintenance, and flood management. Recreational and aesthetic issues have similar effects on the economy; "clean water can raise the value of a nearby home by up to 25%."[100] Poor water quality leads to less public enjoyment, less local trust, less tourism, and less investment in the community. Water also supports several important industries including agriculture, manufacturing, food processing and fishing, public facilities maintenance, plumbing, wastewater treatment, sewer line construction, hazardous waste site clean-up.

The cost of local conservation is largely borne by local agencies like Boone County Conservation District, Forest Preserves of Winnebago County, and local park systems, which are minimally funded. Private stewardship accounts for the major land holdings of important conservation lands but typically lack management for these functions. Funding is needed to support both private and public conservation efforts. Many traditional funding sources are, or have been, shut off or discontinued.

Moving Forward

Trends & Forecasts

Rockford's population has fluctuated since 1970 with an average yearly growth rate of about 0.2%. Still, the region is expected to experience the addition of 3,400 new jobs, increasing the housing demand over the next ten years by 3,200-9,100 units by 2033.[101] According to the City of Rockford Comprehensive Plan, Rockford is expected to see an increase in industrial, commercial, and mixed-use land uses as well as mixed-use developments.[102] The Rockford Region is not the only area within the state that is expected to see growth. According to the Illinois State Water Survey, Illinois could require 20 to 50 percent more water in the coming decades due to projected population growth.[103] As described above, Rockford's groundwater stores are in good condition for now, but overall population growth and development across the state could put pressure and strain on water resources everywhere. With these growth projections in mind, it's important to keep water quality at the forefront of our planning strategies, to ensure the continued health and prosperity of our communities as they continue to grow.

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[100] U.S. Environmental Protection Agency. (2025, April 11). *Nutrient Pollution. The Effects: Economy.* https://www.epa.gov/nutrientpollution/effects-economy.
[101] City of Rockford. (2023). Housing Needs Assessment and Market Study. https://www.rockfordil.gov/DocumentCenter/View/3619/Housing-Needs-Analysis-and-Market-Study-PDF.
[102] City of Rockford. (2023, October 2). *City of Rockford 2040 Comprehensive Plan.* https://rockfordil.gov/DocumentCenter/View/2817/2040CityofRockfordComprehensivePlan_compressed?bidId=.
[103] Illinois State Water Survey. (2015). Planning for Climate Variability: Illinois State Water Survey and State-Wide Framework for Drought and Water Supply Planning. Illinois Department of Natural Resources & Prairie Research Institute.

Already in Motion

Many individuals and organizations in our region are already taking actions to combat issues with water quality and quantity. Changing water quality standards and regulations on a federal level is incredibly difficult, but many local governments attempt to make up for these shortfalls with their own ordinances and management plans that are more easily updated in reaction to new research and specific environmental events.

As previously mentioned, there are agricultural programs within federal and local government that benefit producers who incorporate BMPs into their process.

The City of Rockford Comprehensive Plan includes many implementation strategies that highlight the importance of water quality and local natural resources. They also plan to continue environmental assessment and remediation, and they acknowledge water and wetlands as critical resources to be considered during development.[102]

There are a multitude of grant opportunities for funding projects that aim to protect and improve the local environment. Some of these by the EPA include the Section 319 grant, the Green Infrastructure Grant Opportunity, and many more. Grants are also offered through state and private funding agencies.

There are also many local efforts outside of government. R1 is the creator of and supporter of many environmental initiatives including local funding, research, and education. Notably, they run an Integrated Water Resource Planning (IWRM) initiative where they promote coordination among local governments and water-related agencies to manage water quality, supply, and land use. Their tool kit is a great resource for municipalities who would like to tie water quality to development planning.

North Park has taken the initiative to instate a Water Action Plan where they investigated local PFAS contamination, sources, and solutions. They have plans to construct a PFAS treatment plant to ensure the health and sustainability of their drinking water. Their webpage houses valuable information about PFAS and treatment of PFAS in water.

Other Water Conservation Programs:

The Illinois Nutrient Loss Reduction Strategy (NLRS)

Four Rivers

Conservation@Home

Conservation@Work

Regional planning documents:

Stormwater Master Plan, City of Rockford (Draft)

Winnebago County Multi-Hazard Mitigation Plan

Winnebago, Ogle, and Boone Counties Greenways Plan

Boone County Stormwater Plan

Ogle County Drinking Water Program

Nutrient Assessment Reduction Plan for the Rock River Watershed

Natural Land Institute Strategic Land Conservation Plan

Boone County Comprehensive Plan

Watershed plans and TMDL reports as listed before

Recommendations to maintain future prosperity

One of the most important factors in working towards a healthier future is keeping water quality at the forefront of our mind when making decisions that impact the environment. Decision-makers can cultivate a conservation mindset to identify, preserve, restore, and sustainably manage natural and working lands; promote sustainable waste management practices and water resource management; and protect and enhance groundwater recharge. Within a conservation mindset, sustainable resource management will allow for issues to be preemptively and preventatively addressed, instead of reacting or resolving an issue as it emerges.

An example of an effective conservation mindset is to shift our thinking about stormwater and nutrients from *nuisances* to *resources*. When handled properly, stormwater evolves from a nuisance (source of flooding and contamination) to a resource (capture and reuse) and can bring benefits to the community at large. Nutrients are necessary when they are not excessive in the environment; they are useful for any industry that relies on plant growth. If excess nutrients in the environment could be efficiently redirected as a resource through capture and reuse, it would solve more issues than just pollution. Soil, for example, is more useful to farmers and landowners when it remains within a system and is not lost to erosion as loose sediment. It's these changes in framework that can help solve water quality issues in a way that is economically feasible, attainable, and sustainable.

This document is not meant to serve as an action plan for the region, and it is not exhaustive. Rather, it is intended to provide a compilation of recommendations from existing resources pertinent to our region to create a comprehensive reference tool to encourage further dedication to the preservation and improvement of our water resources.

Preservation & Restoration

Preservation and restoration are also important factors in maintaining water quality. These often can be attained by incorporating more green infrastructure and BMPs into urban planning to create buffers between nonpoint pollution sources and water resources. BMPs and green infrastructure can also create corridors for wildlife to use as habitat, feeding, and mating areas. Corridors create connections from one natural area to another and allow for a more developed area to support more wildlife, which is especially important for threatened and endangered species. Healthy, balanced ecosystems support healthy water quality and raise the value of surrounding land.

Putting more land under protection to remain as natural land is another way to defend our natural resources from development. Doing so by way of public forest preserves, parks, or conservation districts simultaneously creates public spaces for the community, which improve mental and physical health, strengthen social connections, further promote environmental awareness and stewardship, and enhance economic value of an area. The Greenways Plan for Boone, Ogle, and Winnebago Counties outline tools to "promote a regional greenway network that protects natural and cultural resources in a manner which supports equal access to green space; provides alternative forms of transportation and recreational benefits; enhances environmental and scenic qualities; and stimulates sustainable, equitable economic development." [104]

Another method of land preservation includes conservation easements where private natural land and agricultural land can be put under legal protection. Aside from the ecological benefit this has, it also might protect an important familial or cultural resource to remain in its remnant or current naturalized state into perpetuity. Land preservation also encourages a less conventional method of protecting water supply. Choosing to preserve land in ecologically important areas like floodplains and highly erodible lands makes these investments even more effective at protecting water quality. Local organizations such as Natural Land Institute, Boone County Conservation District, and Forest Preserves of Winnebago County can be productive partnerships for putting land under protection. Additionally, **Agricultural Conservation Easement Program (ACEP)** is another helpful resource for putting land under protection. The program helps landowners protect, restore, and enhance wetlands or working farms and ranches by placing them under a conservation easement in which future uses of the land are limited[105]. Figure 27 highlights the areas throughout our region that are already under protection, either as municipal parks, nature preserves, easements or other protected areas. Conservation areas comprise 25,774 acres or approximately 6% of our region's land surface.

[104] Region 1 Planning Council. (2021, April). *Greenways: A Green Infrastructure Plan for Boone, Ogle, and Winnebago Counties.* https://drive.google.com/file/d/1U-eT1RqGWa9yjN-jw0Ydgoi165qa1j3V/view.
[105] U.S. Department of Agriculture. (n.d.). *Agricultural Conservation Easement Program.* Natural Resource Conservation Service. https://www.nrcs.usda.gov/programs-initiatives/agricultural-conservation-easement-program

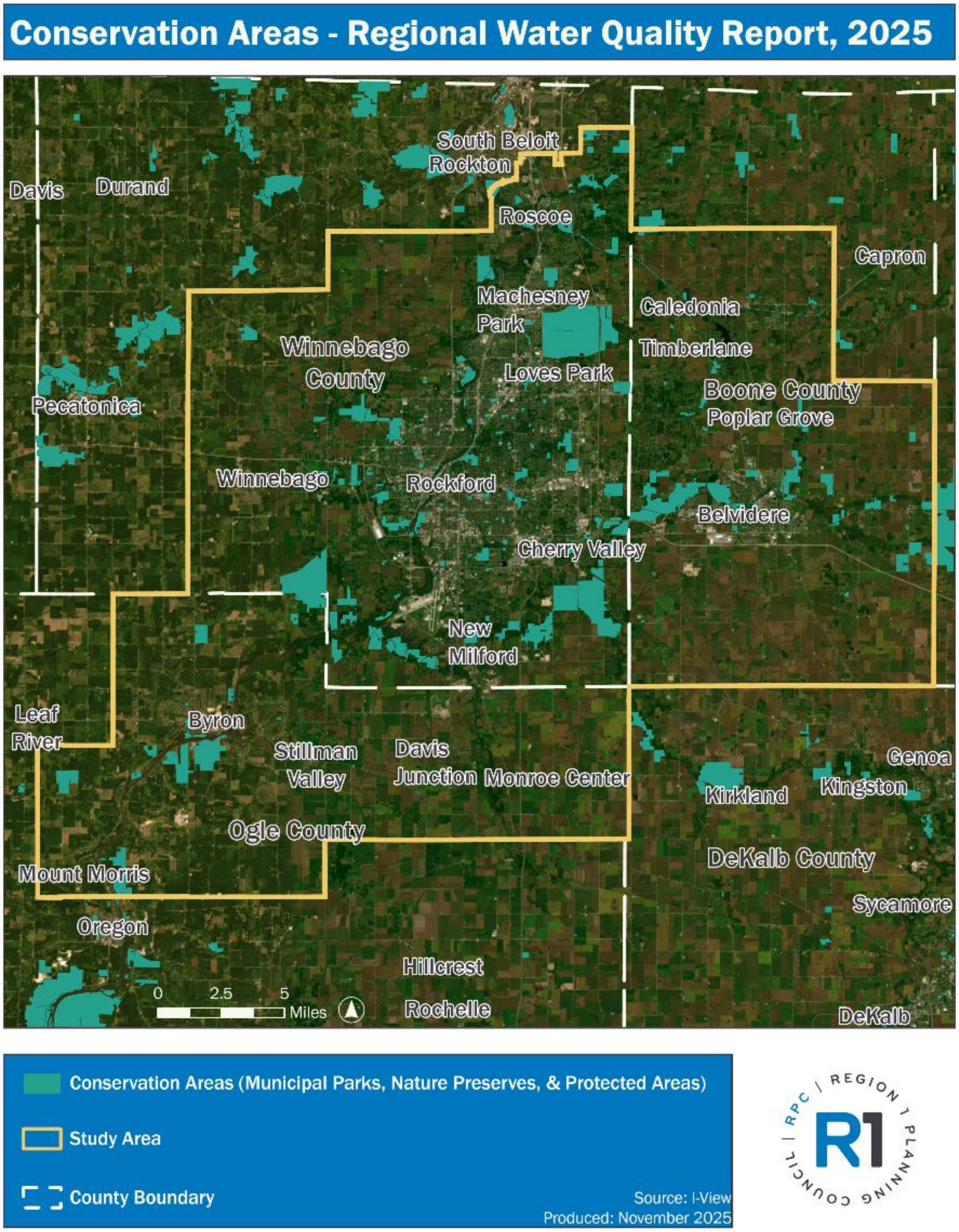

FIGURE 27. CONSERVATION AREAS

Mitigating impacts of impervious surfaces

As previously discussed, impervious surfaces are one of the greatest contributors to, and catalysts of, surface water pollution and groundwater depletion. There are ways to minimize their effect on local waterways and aquifers, which is typically done through green infrastructure. Green infrastructure is more effective when considered as a priority design element during development rather than trying to be retrofitted between driveways – although, this is still effective. Increased community effort is necessary to combatting Generally, we want to prioritize projects that address pollutants at the impervious surface, then immediately next to the impervious surface, then between the impervious surface and the stream or lake. These projects can occur anywhere, in city planning designs and on public and private properties. When replacing impervious surfaces, consider alternative materials and design techniques to create spaces for water to infiltrate, making the surface more porous and permeable, like green roofs or more porous materials for roads, driveways, sidewalks, and parking lots. If structures and driveways have already been developed without water quality in mind, then adding rain barrels, filter strips, rain gardens, bioswales, constructed wetlands, and other infiltration techniques wherever possible is the next best step. Placing filter strips is also especially important just upstream from a waterbody, to avoid contaminated runoff from being directed straight into streams and rivers.

Mitigating impacts of agricultural runoff

The environmental impacts associated with agriculture can be significantly reduced through effective management practices. As previously discussed, producers within the Rockford Region have already taken the leap towards a healthier future with the environment as a priority. Regenerative and sustainable agriculture is crucial to honoring Rockford's history and planning for Rockford's future.

Even more can be done to address sediment and nutrient loss from cropland such as incorporating filter strips to act as buffers along field edges and grassed waterways and sediment basins to address concentrated runoff and gully erosion. The last line of defense would be to strengthen riparian buffers of any nearby streams or rivers to catch any remaining pollution coming from agricultural land.

The more local support these farms can garner, the better. Continuing to support city/county programs and non-profits will ensure that regenerative agriculture only gets more common and more accessible.

Agricultural BMPs that target pollution at the source

- Cover cropping
- Crop rotation
- Diverse planting
- Reduced or no tillage
- Composting rather than fertilizers
- Managed grazing
- Agroforestry
- Nutrient Management Plans

Groundwater Quantity and Quality Improvement Recommendations

Our region's water future depends more on managing existing contamination and preventing new contamination than on finding additional water sources. Key priorities include:

- Protecting recharge areas from new contamination sources
- Monitoring groundwater levels to ensure pumping doesn't harm stream ecosystems
- Continued investment in water treatment infrastructure

Collecting detailed groundwater data is imperative to informing the most effective protection and improvement practices. Studies like the Boone County Geologic Mapping Project will help us to understand our subsurface geology in the most detailed way yet. Projects like these in each of the counties will provide a high-resolution picture of how water interacts with local geology and present illuminated solutions to mitigate drawdown and conserve our water supply.

Monitoring of the MPA aquifers' water levels would also highlight areas of concern to aim our focus for sustaining quality groundwater recharge. A monitoring program to track changes in aquifer water levels will provide short- and long-term trends over time so that we can develop informed strategies to preserve our supply for generations.

Although we currently have not seen significant reductions in water supply, taking appropriate actions now can ensure that we avoid scarcity in the future. Joliet, IL is in the process of searching for alternative water supply since a recent study showed significant drawdown of their groundwater sources.[106] Currently, they are working to improve their water system to meet requirements for sourcing Lake Michigan water. In the meantime, the mayor urges and incentivizes residents to manage water resources more consciously, and have instated a Water Conservation Program with various conservation measures from tips to infrastructure updates. Our region can begin taking conservation measures now to mitigate drawdown of our water resources and ensure a sustainable future.

IEPA Specific Recommendations

The IEPA recommends certain actions in response to a waterway being added to the impaired waters or Section 303(d) list:[31]

- Identify causes and sources of pollution
- Estimate pollutant load reductions
- Describe non-point source BMPs that will need to be implemented
- Identify critical areas
- Create a public information/education product

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[106] Abrams, *et al.* (2015). *Changing Groundwater Levels in the Sandstone Aquifers of Northern Illinois and Southern Wisconsin: Impacts on Available Water Supply, Illinois State Water Survey Contract Report 2015-02*. https://www.isws.illinois.edu/pubdoc/CR/ISWSCR2015-02.pdf.

- Develop implementation schedule
- Identify indicators for monitoring progress over time

The IEPA created six minimum control measures for stormwater within MS4 areas:[107]

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management in New Development and Redevelopment
- Municipal Pollution Prevention and Good Housekeeping

Recommendations for local government

While the regional governments and local agencies do have many programs and plans in place for improving water quality, there are always ways to take it further. Some things that municipalities and other organizations can do are:

- Instate rules minimizing the use of pollutants - like fertilizers, pesticides, detergents, and road salts
- Invest in more sustainable initiatives
- Give tax breaks/subsidies for sustainable development and strategic ground water recharge areas
- Create a farmer-to-farmer network to provide the agricultural community with updates and examples of restorative and effective farming techniques
- Create a network connecting business leaders, government officials, and professionals to stay informed about how to make sustainable development choices that benefit local economics and tourism
- Provide local water workforce training to stimulate education and create local jobs
- Keep inventories of local sources of pollution (MS4s, NPDES outfalls, CAFOs) as well as local green infrastructure projects to ensure that we keep track of where new projects would be the most effective
- Provide educational programs for the public to stay informed about existing conditions and protective practices.
- Utilize existing watershed plans and identify funding sources to implement recommended actions.
- Facilitate proper disposal of environmentally harmful pollutants like pharmaceuticals, plastic waste, technological waste, etc.

A more connected and educated society is the first step towards progress in maintaining the integrity of our natural systems.

[107] U.S. Environmental Protection Agency. (n.d.). *Compendium of Ms4 Permitting Approaches. Part 1: Six Minimum Control Measures.* https://www.epa.gov/sites/default/files/2017-01/documents/part1-epa_compendium_of_ms4_general_permit_requirements_508.pdf.

Planning

Watershed plans, regional stormwater management plans, and TMDL reports give us some of the best information about the state of local waterways along with ideas for improvement based on scientific research. Watershed planning involves entire drainage areas, or watersheds, leading to a particular stream. Urban, suburban, rural, and natural land uses can be addressed within a single watershed plan. Promoting more funding for these projects or taking the time and resources to apply for grants to fund these projects would help to fill in data gaps and create a more informed community. It's also important to use the resources we already have and ensure that watershed plans are being put to good use.

The Rockford Region has plans for growth and development in a way that will benefit the local economy and the community. By adding water quality as a priority to these development plans, we can work where investment is already being expended, promoting healthy waterways and thus, healthy communities, without relying solely on initiatives of local nonprofits and environmental organizations.

Sustaining Rockford Region's Water for the Future

The Rockford Region has made a variety of efforts to embrace recent scientific research and dive deeper into the importance of water quality. Treating water in every form as One Water is an important pathway towards ensuring plentiful groundwater, vivacious surface water, and clean drinking water. Every part of the water system is connected and is pivotal to human health, joy, and prosperity. We must honor what regulations are in place already and recognize that we will always be learning about how to best protect our natural resources and our communities. Some pollutants may last forever in our water systems, and some are yet to be discovered. The continued support of research and action is critical.

Rockford's geology has ensured our source of drinking water for over a hundred years. Rockford's agricultural history has allowed the region to produce and prosper. The vast network of rivers and streams has created a culture that is one with water. Let these truths remain and let our values spread so that every region and every generation may know clean water.

Glossary

Agricultural Conservation Easement Program (ACEP): helps landowners, land trusts, and other entities protect, restore, and enhance wetlands or protect working farms and ranches through conservation easements[105].

Ambient Groundwater Monitoring Network: Long-term statewide program designed to track the natural, or "ambient," quality of groundwater, managed by Illinois EPA and Illinois State Water Survey.[28]

Best Management Practice (BMP): devices, practices, or methods that are used to manage stormwater runoff and mitigate pollution entering waterways by controlling peak runoff rate, improving water quality, and managing runoff volume.[57]

Bioaccumulation: the uptake of chemicals by aquatic life from both water and diet to levels higher (potentially toxicologically significant) than those found in the ambient environment through accumulation in the fatty tissues of exposed organisms.[108]

Clean Water Act: Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.[35]

Community-water-supply (CWS): A public water system that provides water to the same population year-round.[27]

Concentrated Animal Feeding operation (CAFO): An industrial animal agriculture facility that house large numbers of animals in confined spaces. They are regulated under the Clean Water Act by the U.S. Environmental Protection Agency.[109]

Conservation Reserve Program (CRP): administered by the Farm Service Agency (FSA), is a voluntary program that encourages agricultural producers and landowners to convert highly erodible and other environmentally sensitive acreage to vegetative cover, such as native grasses, trees, and riparian buffers.[66]

Designated Uses: Illinois waters are designated for various uses including aquatic life, wildlife, agricultural use, primary contact (e.g., swimming, water skiing), secondary contact (e.g., boating, fishing), industrial use, public and food-processing water supply, and aesthetic quality.[31]

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[108] American Petroleum Institute. (1997). *Ground-water quality modelling for petroleum industry sites (API Publ. 4656-1997)*. https://www.api.org/-/media/files/ehs/clean_water/ground_water_quality/4656-1997.pdf.
[109] U.S. Environmental Protection Agency. (n.d.) *Animal feeding operations (AFOs)*. https://www.epa.gov/npdes/animal-feeding-operations-afos.

Drinking water: Water that is treated and deemed suitable for human consumption. It can be sourced from both surface bodies of water, like Lake Michigan, and groundwater stores, like aquifers and wells, far beneath the surface.

Drinking Water State Revolving Fund (DWSRF): A partnership program to help public water systems finance infrastructure improvements that ensure safe drinking water and compliance with federal standards.[21]

Emerging contaminants: AKA contaminants of emerging concern (CECs), are chemicals or substances that have been detected in the environment but are not yet regulated or fully understood in terms of their health or ecological risks.[42]

Environmental Justice Communities: an area that suffers disproportionately from environmental hazards that can cause long-term negative health effects.[110]

Farm Service Agency: A federal organization overseen by the Secretary of Agriculture that works to achieve an economically and environmentally sound future for American Agriculture.[111]

Federal Water Pollution Control Act (FWPCA) of 1948: The first major U.S. law to address water pollution on a national scale; several amendments to strengthen its provisions transformed it into what is now known as the Clean Water Act.[16]

Field Office Technical Guide: By NRCS, the guides are localized and contain technical information about the conservation of soil, water, air, and related plant and animal resources.[59]

Green Infrastructure: The management of wet weather flows that use infiltration/ evapotranspiration, and the patchwork of natural areas that provide habitat, flood protection, cleaner air and cleaner water. [56]

Ground water: The water located beneath the Earth's surface in the fractures of rock formations and soil pore spaces. They are very slowly refilled by surface water sources or through infiltration of runoff through the soil.

Groundwater Management Zones: an area around a known or potential source of groundwater contamination that is being actively managed or remediated.[27]

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[110] Collins, M. B. *et al.* (2016). *Linking 'Toxic Outliers' to Environmental Justice Communities*. Environ. Res. Lett. 11 015004. DOI 10.1088/1748-9326/11/1/015004. https://iopscience.iop.org/article/10.1088/1748-9326/11/1/015004/meta.

[111] Farm Service Agency. (n.d.). *History and Mission*. U.S. Department of Agriculture. https://www.fsa.usda.gov/about-fsa/history-mission.

Illinois Department of Agriculture (IDOA): a regulatory and promotional agency for Illinois' agriculture industry aimed at encouraging farming and agribusiness while protecting consumers and natural resources.[112]

Illinois Department of Public Health (IDPH): State-level government agency responsible for protecting and improving the health of Illinois residents. As discussed in this report, they are responsible for regulating private well construction and sealing among other responsibilities.[29]

Illinois Groundwater Protection Act: Manages groundwater as a resource that must be protected and establishes a framework for coordinated, preventative management among state and local agencies (IEPA).[27]

Illinois Nutrient Loss Reduction Strategy (INLRS): Guides state efforts to improve water quality at home and downstream by reducing nitrogen and phosphorus levels in our lakes, streams, and rivers. The strategy lays out a comprehensive suite of best management practices for reducing nutrient loads from wastewater treatment plants and urban and agricultural runoff. [33]

Illinois Urban Manual: a technical reference for developers, contractors, planners, engineers, government officials, etc. that provides standards for BMPs to control non-point source pollution.[58]

Impaired Waterways: The Clean Water Act Sections 303(d), 305(b), and 314 requires that the EPA collect and report water quality data. In Illinois, they create the 303(d) list that lists impaired waterways, their impaired use, and their pollutants.[31]

Infiltration: The process by which water seeps from the land surface into the soil, replenishing groundwater and reducing surface runoff.[113]

Low Impact Development (LID): systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.56[56]

Municipal Separate Storm Sewer System (MS4): A network of pipes, ditches, and other stormwater conveyances that carry runoff from urban areas directly to local

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[112] Illinois Department of Agriculture. (n.d.). *About Us.* https://agr.illinois.gov/about.html.
[113] U.S. Geological Survey. (n.d.). *Infiltration and the water cycle.* https://www.usgs.gov/water-science-school/science/infiltration-and-water-cycle#overview.

waterways without treatment. They are regulated under the NPDES permit program which requires that they implement six (6) minimum control measures.[114]

National Aquatic Resource Surveys (NARS): A series of scientifically consistent, nationwide monitoring programs conducted by the U.S. Environmental Protection Agency (EPA) in partnership with states, tribes, and other organizations. Their purpose is to assess the condition of the nation's water resources.[23]

National Pollutant Discharge Elimination System (NPDES): A permitting program established under the Clean Water Act, Section 402 that regulated the discharge of pollutants from point sources into water of the United States. It requires facilities to obtain permits specifying the types and quantities of pollutants that may be discharged, and ensures that those discharges meet water quality standards.[115]

National Resources Conservation Service (NRCS): U.S. federal agency within the Department of Agriculture that provides technical and financial assistance to private landowners, such as farmers, ranchers, and foresters.[116]

Non-point source pollution: The diffuse contamination of water that originates from multiple, widespread sources across a landscape rather than from a single, identifiable discharge point. It occurs when rainfall, snowmelt, or irrigation water runs over land or through the ground, picking up and carrying natural and human-made pollutants into rivers, lakes, wetlands, and coastal waters.[35]

Northern Regional Groundwater Protection Planning Committee: A regional committee established by the IEPA for protecting priority groundwater recharge areas identified by the DNR. Responsibilities include "Identification of and advocacy for region-specific groundwater protection matters; Monitoring and reporting the progress made within the region regarding implementation of protection for groundwaters; Maintaining a registry of instances where the Agency has issued an advisory of groundwater contamination hazard within the region; Facilitating informational and educational activities relating to groundwater protection within the region; and Recommending to the Agency whether there is a need for regional protection pursuant to regulated recharge area."[34]

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[114] Illinois Environmental Protection Agency. (n.d.). *MS4 (Municipal Separate Storm Sewer System) stormwater permits*. https://epa.illinois.gov/topics/forms/water-permits/storm-water/ms4.html.
[115] Clean Water Act § 402, 33 U.S.C. § 1362 (2018).
[116] U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). *About NRCS.* https://www.nrcs.usda.gov/about.

One Water: Treats all water - stormwater, groundwater, surface waterways, and wastewater - as an interconnected system.

Point source pollution: Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.[35]

Pollutants: Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.[35]

Pollution: The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.[35]

Region 1 Planning Council (R1): A special-purpose, regional government agency providing cross-jurisdictional, government-to-government collaborative planning across Northern Illinois.

Regenerative Agriculture: A holistic approach to farming that focuses on restoring and enhancing the health of ecosystems—particularly soil, water, and biodiversity—while producing food and other agricultural products.[65]

Rivers and Harbors Act of 1899: One of the oldest federal environmental laws in the United States, its primary purpose was to prevent obstructions and unauthorized alterations to navigable waters.[12]

Rockford MPA: Rockford Metropolitan Planning Area, R1's service area.

Rockford Region: R1's study area that covers portions of Boone, Ogle, and Winnebago counties (see Figure 1 for boundaries).

Safe Drinking Water Act of 1974: The Safe Drinking Water Act (SDWA) is a landmark federal law enacted in 1974 to protect the quality of drinking water in the United States. It authorizes the U.S. Environmental Protection Agency (EPA) to set and enforce national standards for public water systems to ensure that drinking water is safe for human consumption.[20]

Setback zones: a protective buffer area surrounding a public water supply well, designed to limit activities that could contaminate groundwater (IEPA).[27]

Stormwater: Rainfall or melted snow that flows over land surfaces.[117]

Surface water: Water that collects on the surface of the earth by means of stormwater (precipitation), runoff from land surfaces, and inflows from tributaries and ground discharge. It refers to any body of water on Earth's surface from the oceans to ponds.

Total Maximum Daily Loads (TMDLs): A regulatory tool under Section 303(d) of the Clean Water Act (CWA) that defines the maximum amount of a specific pollutant that a waterbody can receive and still meet water quality standards; it represents a science-based plan to restore and protect impaired waters.[118]

Total Suspended Solids (TSS): solid particles suspended in water – can include silt, clay, organic matter, algae, and industrial or urban debris.[30]

Urban Heat Island (UHI) Effect: a phenomenon when urban areas experience a higher temperature than their surrounding non-urban areas.[40]

U.S. / Illinois Environmental Protection Agency (USEPA/IEPA): The federal agency responsible for protecting human health and the environment. Each state also has their own EPA to handle regulations at the state level.[119]

U.S. Geological Survey: An agency of the U.S. Department of the Interior dedicated to studying the natural resources and physical landscape of the United States.[120]

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[117] U.S. Environmental Protection Agency. (n.d.). *EPA Facility Stormwater Management*. *https://www.epa.gov/greeningepa/epa-facility-stormwater-management*.
[118] U.S. Environmental Protection Agency. (n.d.). *Overview of total maximum daily loads (TMDLs)*. https://www.epa.gov/tmdl/overview-total-maximum-daily-loads-tmdls.
[119] Wisman, Phil. (1985 November). EPA History (1970-1985). U.S. Environmental Protection Agency. https://www.epa.gov/archive/epa/aboutepa/epa-history-1970-1985.html.
[120] U.S. Geological Survey. (n.d.). *Who we are.* https://www.usgs.gov/about/about-us/who-we-are.