ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Biennial Report 2021

Illinois Department of Agriculture

Illinois Environmental Protection Agency

Illinois Extension
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

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Biennial Report 2021

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Cover Photo: Vermilion River at Matthiessen State Park by Layne Knoche

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GLOSSARY
OF ACRONYMS AND ABBREVIATIONS

AFT	*American Farmland Trust*
AISWCD	*Association of Illinois Soil and Water Conservation Districts*
AWQPF	*Agriculture Water Quality Partnership Forum*
BMP	*best management practice*
C@H	*Conservation@Home*
CAFO	*Concentrated Animal Feeding Operation*
CMAP	*Chicago Metropolitan Agency for Planning*
CREP	*Conservation Reserve Enhancement Program*
CRP	*Conservation Reserve Program*
CSC	*Calumet Stormwater Collaborative*
CSP	*Conservation Stewardship Program*
DCSWM	*DuPage County Stormwater Management*
DMR	*discharge monitoring report*
DRSCW	*DuPage River Salt Creek Workgroup*
DRWW	*Des Plaines River Watershed Workgroup*
EPA	*Environmental Protection Agency*
EQIP	*Environmental Quality Incentives Program*
FFA	*Future Farmers of America*
FPDDC	*Forest Preserve District of DuPage County*
FRIP	*Fox River Implementation Plan*
FRSG	*Fox River Study Group*
FSA	*Farm Service Agency*
GIGO	*Green Infrastructure Grant Opportunities Program*
HIPP	*Headwaters Invasive Plant Partnership*
HSPF	*Hydrological Simulation Program – FORTRAN*
IAWA	*Illinois Association of Wastewater Agencies*
ICGA	*Illinois Corn Growers Association*
IDNR	*Illinois Department of Natural Resources*
IDOA	*Illinois Department of Agriculture*
IDOT	*Illinois Department of Transportation*

IFB	*Illinois Farm Bureau*
IFCA	*Illinois Fertilizer & Chemical Association*
IPPA	*Illinois Pork Producers Association*
IPS	*Identification and Prioritization System*
ISA	*Illinois Science Assessment*
ISAP	*Illinois Sustainable Ag Partnership*
ISWS	*Illinois State Water Survey*
IWS	*Integrated Water Science*
LCFPD	*Lake County Forest Preserve District*
LDRWC	*Lower DuPage River Watershed Coalition*
LDWG	*Lower Des Plaines Watershed Group*
LMW	*Leadership for Midwestern Watersheds*
LTA	*Local Technical Assistance Program*
MGD	*million gallons per day*
MIBI	*Macroinvertebrate Index of Biological Integrity*
MRBI	*Mississippi River Basin Initiative*
MRTN	*Maximum Return to Nitrogen*
MS4	*Municipal Separate Storm Sewer System*
MWRDGC	*Metropolitan Water Reclamation District of Greater Chicago*
NARP	*Nutrient Assessment Reduction Plan*
NASS	*National Agricultural Statistics Service*
NBWW	*North Branch Chicago River Watershed Workgroup*
NCSA	*National Center for Supercomputing Applications*
NGICP	*National Green Infrastructure Certification Program*
NLRS	*Nutrient Loss Reduction Strategy*
NMC	*Nutrient Monitoring Council*
NPDES	*National Pollutant Discharge Elimination System*
NRCS	*Natural Resources Conservation Service*
NREC	*Nutrient Research and Education Council*
NWQI	*National Water Quality Initiative*
PBC	*Performance Benchmark Committee*
PCM	*Precision Conservation Management*
PFC	*Partners for Conservation*
POTW	*Publicly Owned Treatment Works*
PWG	*Policy Working Group*

QHEI	*Qualitative Habitat Evaluation Index*
RCPP	*Regional Conservation Partnership Program*
SAFE	*State Acres for Wildlife Enhancement*
STAR	*Saving Tomorrow's Agriculture Resources*
SWAMM	*Spatial Watershed Assessment and Management Model*
SWCD	*Soil and Water Conservation District*
TMDL	*total maximum daily load*
TNC	*The Nature Conservancy*
UMCW	*Upper Macoupin Creek Watershed*
USDA	*United States Department of Agriculture*
USGS	*United States Geological Survey*
USWG	*Urban Stormwater Working Group*
WASCOB	*water and sediment control basin*
WBP	*watershed-based plan*
WEF	*Water Environment Federation*
WPCLP	*Water Pollution Control Loan Program*
WQIP	*Water Quality Improvement Program*
WREP	*Wetland Reserve Enhancement Partnership*
WRP	*water reclamation plant*

West Branch of the DuPage River
Photo courtesy of Michael Firman

Illinois River at Pere Marquette State Park
Photo courtesy of Layne Knoche, Illinois Extension

CHAPTER 1
EXECUTIVE SUMMARY

The Illinois Nutrient Loss Reduction Strategy 2021 Biennial Report is the third report to provide the public with updates on the implementation of the Illinois Nutrient Loss Reduction Strategy, released in 2015. The strategy continues to be guided by Illinois Environmental Protection Agency, Illinois Department of Agriculture, and University of Illinois Extension, with input and feedback from the Policy Working Group and several other stakeholder groups and councils. This biennial report provides a 2019-20 overview of the efforts and investments made in reducing nutrient loss to Illinois waterways from source sectors: agriculture, point sources, and urban stormwater.

The overall objective of the strategy is to improve water quality in Illinois and downstream to reduce the hypoxic zone in the Gulf of Mexico. The strategy sets a long-term goal of reducing loads from Illinois for total phosphorus and total nitrogen by 45%, with interim reduction goals of 15% nitrate-nitrogen and 25% total phosphorus by 2025.

This report is based on the premise that human and capital resources, which fund and support outreach and educational efforts, lead to the implementation of best management practices on the land and in facilities, resulting in water quality improvement. Over the past two years, many partner organizations, working both collaboratively and independently, remained engaged in this process despite unprecedented challenges, including extreme flooding in 2019 and the global pandemic of 2020.

The overall objective of the strategy is to **improve water quality** in Illinois and downstream to reduce the hypoxic zone in the Gulf of Mexico.

Agriculture

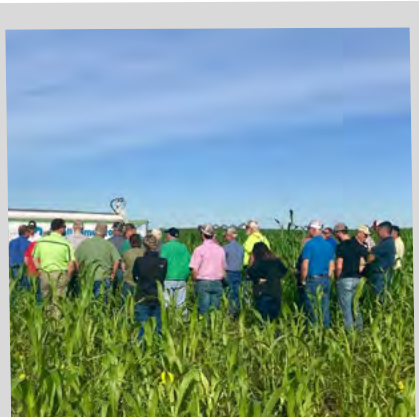
The strategy identified 65 agriculture-related programs, initiatives, and projects developed by agencies and non-governmental organizations to help producers establish practices and strategies to reduce nutrient losses. Agriculture partner organizations reported more than 130 full-time staff members engaged in activities related to implementing the strategy. Between 2019 and 2020, agriculture sector partners reported spending almost $27 million implementing the strategy, outside of state and federal cost-share program funds. The Nutrient Research Education Council, a public-private partnership that ensures a sustainable source of funding for nutrient research and education programs, invested $6.9 million in 59 projects.

The agricultural sector invests in outreach and education to foster voluntary implementation of conservation practices that reduce nutrient loss from farm fields, while balancing production goals. During 2019 and 2020, more than 1,020 outreach events focused on nutrient loss reached over 72,000 attendees. In 2020, most of these events were held online to conform to mandatory social distancing guidelines established by state government. Agriculture and conservation organizations utilized remote technology to reach farmers, Certified Crop Advisers, and others to conveniently provide content on nutrient loss and conservation practices. University of Illinois Extension watershed outreach associates

Photo courtesy of Soils Lab, University of Illinois

NREC invested **$6.9 million** to support **59 research projects**.

Photo courtesy of AISWCD



More than **1,020 outreach events** focused on nutrient loss reached over **72,000 attendees** in person and online.

continued producing the Nutrient Loss Reduction Podcast series. By the end of 2020, 32 episodes had been streamed more than 8,000 times. The podcast covers topics from in-field practices, such as cover crops and reduced tillage, to edge-of-field practices that include constructed wetlands and buffers.

The Nutrient Loss Reduction Podcast series had **32 episodes** that were streamed more than **8,000 times**.

To better understand outreach and education efforts and their correlation to practice implementation, the Illinois Nutrient Loss Reduction Strategy survey conducted by National Agricultural Statistics Service was undertaken for a third time in 2020. It provides the following insights into knowledge and strategy practice implementation: 43% of farmers reported being somewhat to very knowledgeable about the strategy; 66% of farmers reported being somewhat to very knowledgeable about cover crops; 1.4 million acres of cover crops were planted in 2019, representing a 135% increase from 2011. Farmers also reported that 11.2 million acres of cropland received reduced phosphorus fertilizer application rates in 2019 compared to 2011.

In 2019, **1.4 million acres** of cover crops were installed, representing a **135%** increase from 2011.

11.2 million acres of cropland were reported to have **reduced phosphorus** fertilizer application rates compared to 2011.

A large number of prevented plant acres were reported in 2019, which may explain the significant increase in cover crops. To assist farmers after a historical amount of flooding in 2019, Illinois Department of Agriculture redirected funds to implement an additional 93,750 acres of cover crops specifically for prevented planting coverage through its Partners for Conservation cost-share program. Illinois

Department of Agriculture's Fall Covers for Spring Savings program supported an additional 50,000 acres of cover crops in 2019.

Another indication of implementation was sought by the Illinois Fertilizer & Chemical Association, which conducted a 4R survey of agriculture fertilizer retailers to gain an understanding of fertilizer management. This survey found that of those corn acres receiving fall ammonia nitrogen fertilizer, 89% was applied in accordance with the University of Illinois' recommended application date based on soil temperature. Additionally, 87% of the fall ammonia fertilizer was applied with a nitrification inhibitor and 74% of the total nitrogen fertilizer rate was within the recommended range.

Point Sources

The point source sector has directed substantial resources to capital improvements and nutrient reduction studies that identify capital needs. Data provided by the Illinois Association of Wastewater Agencies showed that total spending by the point source sector nearly tripled between 2019 and 2020 — from $65.1 million in 2019 to $185.2 million in 2020. Most of this spending was on capital improvements. Further, Illinois Environmental Protection Agency provides low-interest loans through the Water Pollution Control Loan Program, which funded wastewater treatment plant upgrades to improve nutrient removal, green infrastructure, urban stormwater treatment, and control of combined and sanitary sewer overflows. In 2019 and 2020, over $200.2 million was invested in a dozen projects to reduce nutrient loss through treatment plant improvements.

Photo courtesy of IFCA

Photo courtesy of Kishwaukee Water Reclamation District

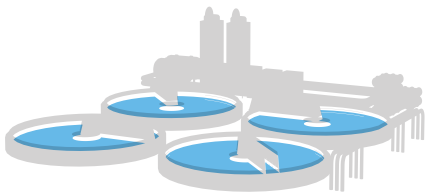
Photo courtesy of CMAP

The point source sector implements the strategy largely through the regulated system administered by Illinois Environmental Protection Agency. The National Pollutant Discharge Elimination System permits contain requirements for publicly owned treatment plants and industrial plants to reduce nutrient loss in their wastewater discharges. Currently, 36% of major municipal wastewater treatment facilities have permits containing total phosphorus limits. Facilities have also developed and submitted 71 nutrient reduction optimization studies and 59 nutrient reduction feasibility studies since 2018.

36% of major municipal wastewater treatment facilities have permits containing total phosphorus limits.

The requirement to develop Nutrient Assessment Reduction Plans is being incorporated in many Illinois permits for major municipal facilities that discharge into a receiving waterbody that has been determined impaired or at risk of eutrophication. Currently, 53 major municipal facilities are developing Nutrient Assessment Reduction Plans. These plans will identify phosphorus input reductions and other measures needed to ensure waterbodies contain adequate amounts of dissolved oxygen and reduced offensive conditions from algae and aquatic plant growth.

53 facilities are developing Nutrient Assessment Reduction Plans.



The 2020 statewide total phosphorus load from the point source sector decreased by 16% compared to 2011 baseline levels. More facilities have reduced their annual average nutrient concentrations during the past two-year period, as well. In 2020, 90 major municipal facilities had an annual average total phosphorus concentration of 1 mg/L or less, while 31 of those averaged 0.5 mg/L or less. Significant total phosphorus load reductions are still anticipated in the long-term, due to large wastewater treatment facilities that are scheduled to become compliant with permit

90 major municipal facilities had an annual average total phosphorus concentration of 1 mg/L or less, while 31 of those averaged 0.5 mg/L or less.

requirements over the next several years. Improvements in the development and successful operation of technology that enhances nutrient removal is also key to achieving nutrient loss reduction goals.

In addition to permit requirements, the point source sector conducted outreach and education activities related to nutrient loss reduction. Data provided by the Illinois Association of Wastewater Agencies showed that in 2019-20, 13 events, consisting of field days, presentations, and workshops, reached a total attendance of over 2,600 stakeholders, including wastewater professionals.

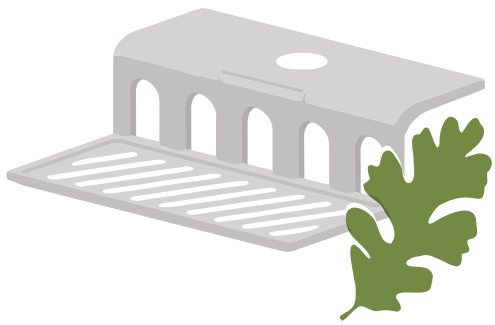
Urban Stormwater

Efforts in the urban stormwater sector continue to expand. In 2020, Illinois Environmental Protection Agency began receiving project applications for the Green Infrastructure Grant Opportunities program. Qualifying projects improve water quality by decreasing the amount of stormwater that enters waterways. Forty-seven applications were received, indicating a keen interest in stormwater projects. Five million dollars, with a local match of $4 million, have been awarded to support 11 green infrastructure projects.

Urban stormwater partners, like the agricultural sector, sponsored numerous events despite the many obstacles posed by the pandemic. They found new ways to reach a wide audience of 14,340 people by shifting to online platforms. Topics focused on educating the public about steps to reduce nutrient losses from their property. Public presentations and webinars encouraged homeowners to install rain gardens and use natural lawncare techniques.

11 green infrastructure projects were awarded **$9 million** in total investment.

Stormwater partners found new ways to reach a wide outreach audience of **14,340 people** by shifting to online platforms.



77% of MS4 communities have implemented street sweeping.

64% of MS4 communities have leaf collection.

Further, the urban stormwater sector engages with industry professionals; state, local, and county officials; and the general public to encourage best management practice implementation. An analysis of the state's Municipal Separate Storm Sewer System communities showed that 61% offered technical assistance to individuals and entities implementing recommended practices.

The analysis also showed that a majority of these communities have implemented street sweeping (77-78%) and leaf collecting (63-65%). A U.S. Geological Survey study shows that such practices are beneficial because leaves on city streets are one of the largest sources of urban phosphorus loads. These actions are important and underscore the role of stormwater managers in meeting the goals of the strategy.

Science Assessment Update

The science assessment, originally published as part of the Illinois Nutrient Loss Reduction Strategy, included an evaluation of Illinois' major river systems and provided implementation scenarios with recommended practices to achieve water quality goals. It is routinely updated with the latest information and research. This update contains new nitrate-nitrogen and total phosphorus river loads, supporting data from U.S. Geological Survey's monitoring network, new implementation scenarios, and additional recommended practices.

Statewide nitrate-nitrogen and total phosphorus loads have been highly correlated with river flow, which in turn is highly correlated with precipitation. For the five-year period of 2015-19, the statewide river flow, nitrate-nitrogen and total phosphorus average loads were estimated at 25%, 13%, and 35%, respectively, above the 1980-96 baseline period (Figure 1.1). The 2015-19 averages were influenced by unusually high precipitation in 2019. Further, five-year average river flows have been greater than the baseline since 2008. Greater runoff and drainage tend to increase nitrate-nitrogen and total phosphorus loads and, therefore, increase the difficulty of meeting the strategy's water quality goals. For some watersheds, how-

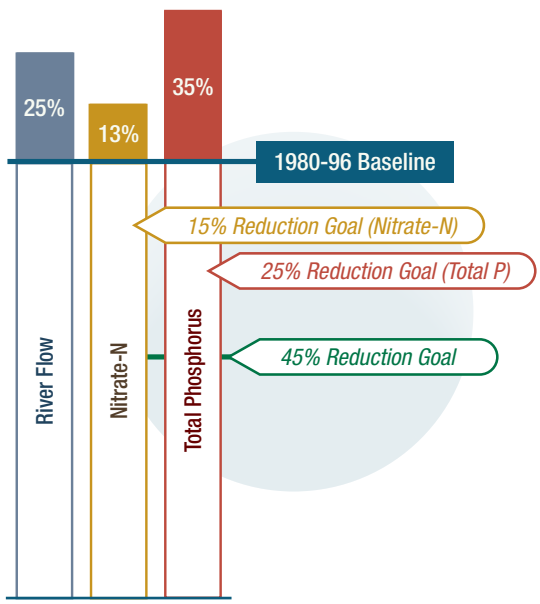


Figure 1.1. *Percent increase from baseline to average 2015–19*

ever, nutrient loads remained constant or even declined despite increases in river flow. This indicates that other factors, such as nutrient management, may influence riverine nutrient loads.

Additional implementation scenarios were developed in 2020. One scenario represents the scale of implementation activities necessary to meet the strategy's interim water quality goals of 25% reduction in total phosphorus and 15% reduction in nitrate-nitrogen. Another scenario provides the implementation activities necessary to meet the final water quality goal of 45% reduction in total phosphorus and nitrate-nitrogen loadings. An interactive spreadsheet was developed and posted to the Illinois Environmental Protection Agency's website that allows citizens to develop their own implementation scenarios for educational purposes.

The University of Illinois Nutrient Loss Reduction Strategy Science Team has an established process for adding new agricultural conservation practices and updating practice performance. In December 2020, two stakeholder organizations submitted proposals recommending several conservation practices. Two of those practices (saturated buffers and terraces) were approved and added to the strategy's recommended agricultural conservation practices to reduce nutrient loss. A saturated buffer consists of subsurface pipe used to divert and spread drainage discharge to a vegetated area to increase soil saturation. The science team estimates this practice has a nitrate-nitrogen loss reduction efficiency value of 40%. A terrace is defined as an earth embankment, channel, or combination of ridge and channel constructed across a slope to intercept runoff. Terraces were given a 40% total phosphorus loss reduction value in non-tiled fields.

Adaptive Management

Adaptive management is a process that promotes flexible decision making, which allows for adjustments based on new data and information with the goal of improving management decisions over time. It allows the Nutrient Loss Reduction Strategy to be a living document focused on both traditional and new technologies and practices.

While the strategy is focused on statewide water quality and best management practice implementation, locally led watershed-based planning remains a priority to help meet water quality goals on a smaller scale. A watershed-based plan provides an integrated, holistic framework to restore water quality effectively and efficiently in impaired waters and to protect water quality in other waters adversely affected or threatened by point source and non-point source pollution.

While watershed-based plans may address a host of water quality concerns and have different water quality goals, they can be useful for meeting statewide nutrient loss reduction goals and are most effective when led locally. Illinois Environmental Protection Agency has provided grant funds for the development of 67 watershed-based plans since 2011.

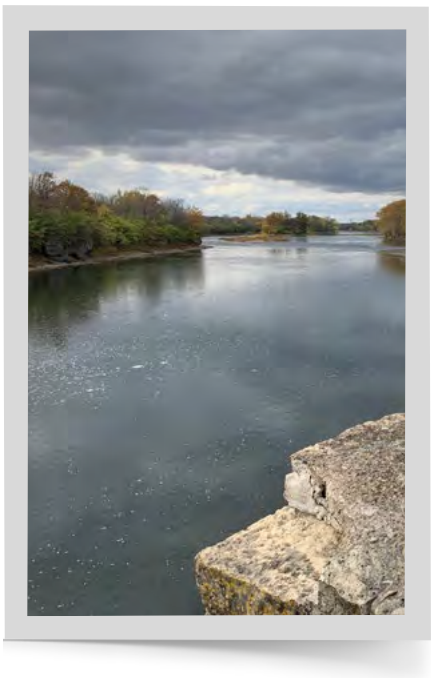
This biennial report demonstrates the continued implementation of the strategy across agriculture, point source, and urban stormwater sectors. Despite these efforts, nutrient loads increased, driven primarily by increases in precipitation and storm events. While progress toward the implementation of certain practices is evident, the scale and pace of adoption of all practices needs to accelerate in order to meet the interim nutrient loss goals by 2025.

Conclusion

The implementation assessments outlined in this biennial report show successes, but also identify areas for improvement. While there were advancements in agricultural conservation practices, municipal and industry efforts, and government support at the community/watershed level, further efforts are required to achieve strategy goals, particularly amid shifting climate conditions. Agriculture, point source, and urban stormwater sectors each have important roles to play in reducing nutrient loss and each sector faces its own set of challenges. Much work remains, but as Illinois strives to achieve nutrient loss goals, these biennial reports continue to provide a valuable resource for influencing decision making and advancing collaboration that drives innovation.

Illinois Environmental Protection Agency has provided grant funds for the development of **67 watershed-based plans** since 2011.

Photo courtesy of Jeff Turner



Point Pleasant Wetland at the Middle Fork River Forest Preserve
Photo courtesy of Champaign County Forest Preserve District

CHAPTER 2
INTRODUCTION

The Illinois Nutrient Loss Reduction Strategy is a statewide collaborative effort to reduce the amount of nutrients, particularly nitrogen and phosphorus, in Illinois' waterways. The strategy, released in 2015, is a framework for using science, technology, and industry experience to assess and reduce nutrient loss to protect and improve the water quality of streams, rivers, and lakes in Illinois and to reduce the state's contribution to the hypoxic zone in the Gulf of Mexico. Excess nutrients in waterways promote excessive algal growth, creating blooms that deplete oxygen when they decompose, posing a risk to aquatic life. Further, specific kinds of algal blooms may be harmful to the health of humans and animals. Excess nutrients can also contribute to degraded water quality for public water supply use.

Strategy development and implementation is coordinated by Illinois Environmental Protection Agency, Illinois Department of Agriculture, University of Illinois Extension, and a multi-stakeholder Policy Working Group with representatives from federal and state agencies, agricultural organizations, wastewater treatment agencies, non-governmental organizations, and industries.

The primary objectives of the strategy are to reduce nutrient loads leaving the state by way of the Mississippi River and to improve local water quality for the benefit of Illinois residents. The strategy's ultimate goal is to achieve 45% loss reductions in both nitrate-nitrogen and total phosphorus with interim loss reduction goals of 15% nitrate-nitrogen and 25% total phosphorus by 2025.

Photo courtesy of Layne Knoche, Illinois Extension

Illinois is one of 12 states that have developed nutrient strategies as members of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, which is charged with addressing hypoxia, or the "dead zone," in the Gulf of Mexico. The 2008 Gulf Hypoxia Action Plan, revised in 2015, calls for a 45% reduction in phosphorus and nitrogen loads to the Gulf of Mexico with a goal of reducing the hypoxic zone's annual average size to 5,000 square kilometers by 2035.

Implementation and Measuring Progress

The strategy describes ways to assess implementation success, as well as plans for communicating progress and challenges to the public via biennial reporting. Implementation relies on the work of stakeholder partners across the state – including agriculture commodity groups and producers; wastewater treatment plants; stormwater managers; and federal, state, county, and municipal governments. Quantifying this work requires a coordinated effort and the cooperation of stakeholder partners who provide content and data.

Working Groups

In addition to the Policy Working Group, other multi-stakeholder groups were created to address implementation and monitor progress toward strategy goals.

The Agriculture Water Quality Partnership Forum focuses on issues related to assisting farmers and the agriculture industry in voluntarily implementing recommended conservation practices that reduce nutrient loads from cropland through outreach, scientific research, and programs that provide technical and financial assistance. The Urban Stormwater Working Group works with stormwater managers to explore funding opportunities, identify legislative initiatives, and coordinate education and tracking of urban stormwater practices. The Nutrient Monitoring Council addresses water quality data collection, analysis, and nutrient loading trends. The Performance Benchmark Committee develops measures and benchmarks for meeting implementation and water quality goals with an emphasis on adaptive management. The Communications Working Group educates elected officials, government staff members, professionals, contractors, business community members, and residents throughout the state about the hypoxic zone in the Gulf of Mexico, the strategy, and opportunities to participate.

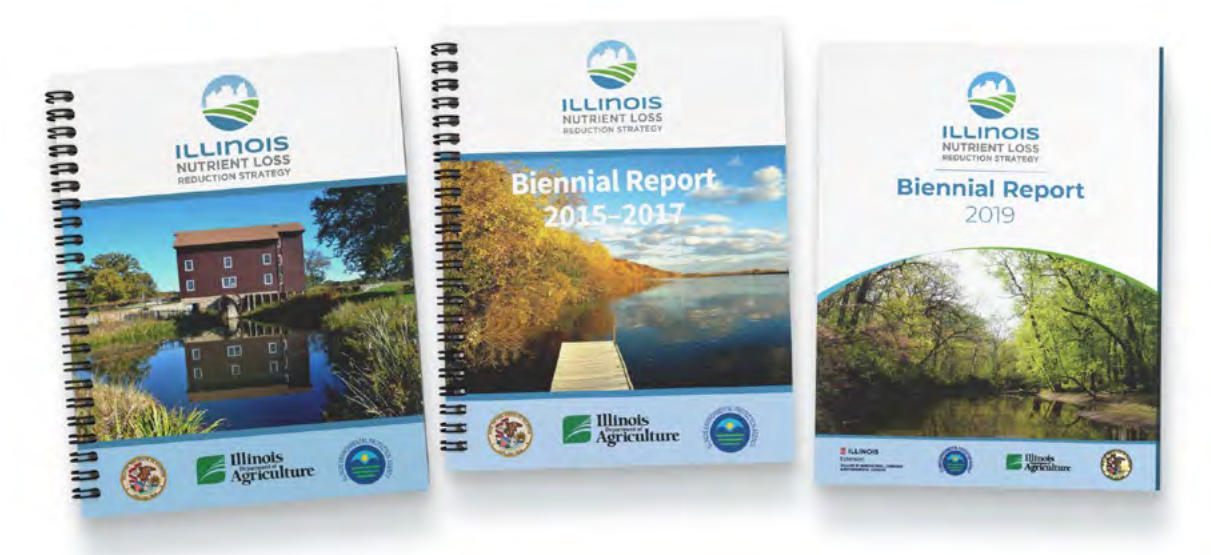
Some of these groups have formed subgroups to address specific tasks like data tracking and education. University of Illinois Extension facilitates and coordinates meetings, conferences, and report writing for the strategy.

Biennial Reports

The strategy calls for the release of biennial reports every other year with updates on progress toward reaching the nutrient loss goals in Illinois. These reports include a science assessment update and information on outreach and education and land and facilities implementation. Biennial reports and other related documents are housed on the Illinois Environmental Protection Agency's website (illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Pages/nutrient-loss-reduction-strategy.aspx).

The first biennial report was released in August 2017. It features data from the 2011 baseline year and reports on 2015–16 implementation activities. The second biennial report was released in November 2019, reporting on 2017–18 implementation activities.

This report — the third biennial report — covers implementation activities in 2019–20.



A logic model (Figure 2.1) establishing measurable indicators of desirable change was adapted from the Iowa Nutrient Reduction Strategy to assess implementation progress. It was introduced and explained in the first biennial report.

Figure 2.1. *The NLRS Logic Model*

RESOURCES

The logic model starts with the category of resources. Resource measures refer to financial investment. These include funding, grants, and the staff who administer them.

OUTREACH

Outreach leads to shifts in people's knowledge, attitudes, behavior, and investment. The outreach measures include field days, presentations, conferences, meetings, print or media, radio or television, social media, newsletters, awards, and surveys.

LAND AND FACILITIES

The land and facilities measures are adoption of best management practices, such as agricultural conservation practices, upgrades to wastewater treatment facilities, and stormwater management practices. These physical changes on the land can affect change in water quality.

WATER

The final measure of change is water. Water measures, which reflect nutrient loads, are presented in the Science Assessment Update chapter.

Data for the resources and outreach measures are obtained primarily through voluntary reporting by strategy partners (individual responses can be found in the appendices). Data for the land and facilities measures are compiled from the most appropriate and best available data sources for each respective sector. The water measure is addressed in the science assessment update. These measurable indicators provide a standardized protocol for evaluating progress by tracking both year-to-year changes and longer trends.

Navigating this Report

This biennial report follows the logic model approach to describe actions and accomplishments toward strategy goals, but it begins with the end in mind.

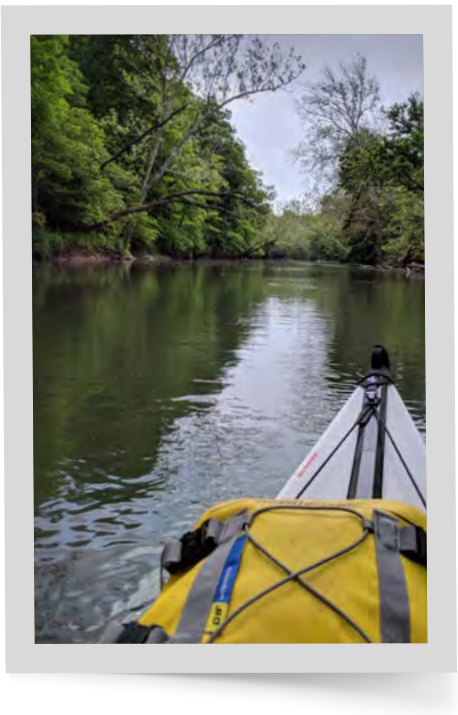
Chapter 3 presents the science assessment update. This chapter contains updated nitrate-nitrogen and total phosphorus river loads and yields and baseline comparisons; supporting data from U.S. Geological Survey's continuous loadings network; the development of additional implementation scenarios; and the addition of recommended conservation practices proposed by stakeholder groups and approved by the Illinois NLRS Science Team.

Chapters 4 through 6 are focused on three sectors (agriculture, point source, and urban stormwater, respectively) which are sources of nutrient loss in Illinois, as identified in the strategy. In each of these chapters, the first three logic model measures — resources, outreach, and land and facilities — are addressed for each sector. Partner programs are also featured in the sector chapters, which highlight considerable work toward strategy goals.

Chapter 7 highlights summaries of working group activities.

Chapter 8 presents an overview of water quality and implementation targets and the state's trajectory toward meeting strategy goals. It discusses using adaptive management to adopt new or revised approaches to overcome implementation barriers and identifies resources needed to support those activities.

Photo courtesy of Gregory McIsaac



Kaskaskia River Monitoring Station
Photo courtesy of USGS

CHAPTER 3
SCIENCE ASSESSMENT UPDATE

The science assessment was originally published as part of the 2015 Illinois Nutrient Loss Reduction Strategy. To present the most accurate picture of Illinois waters, the science assessment is routinely updated with the latest data and published in chapter 3 of the Illinois NLRS biennial reports. This chapter contains new nitrate-N and total phosphorus river loads conducted by Dr. Gregory McIsaac, supporting data from the U.S. Geological Survey's continuous loadings network provided by Paul Terrio, and updated implementation scenarios conducted by Dr. Reid Christianson. The final section is the Illinois NLRS Science Team's proposed practice decisions.

Nitrate-N and Total Phosphorus River Loads

By Gregory F. McIsaac

Nitrate-N and total phosphorus loads in the major rivers draining Illinois were updated through the 2019 water year using the same sites (Table 3.1) and methods used in the 2015 NLRS Science Assessment and subsequent biennial reports. These river systems are depicted on the watershed map in Figure 3.1.

Table 3.1. *Monitoring stations used to estimate the statewide nitrate-N and total phosphorus loads*

River System	Gage Location	Illinois EPA Station	USGS Station Number	Drainage Area (sq. mi)	Drainage Area in Illinois (%)	% of Illinois Represented
Rock	Joslin	P-04	05446500	9,549	43	7.3
Rock	Rockton	P-15	05437500	6,362	13	1.4
Green	Geneseo	PB-04	05447500	1,003	100	1.8
Illinois	Valley City	D-32	05586100	26,743	84	39.9
Kaskaskia	Venedy Station	O-20	05594100	4,393	100	7.8
Big Muddy	Murphysboro	N-12	05599490	2,169	100	3.8
Little Wabash	Carmi	C-23	03381500	3,102	100	5.5
Embarras	Ste. Marie	BE-07	03345500	1,516	100	2.7
Vermilion	Danville	BP-01	03339000	1,290	93	2.1

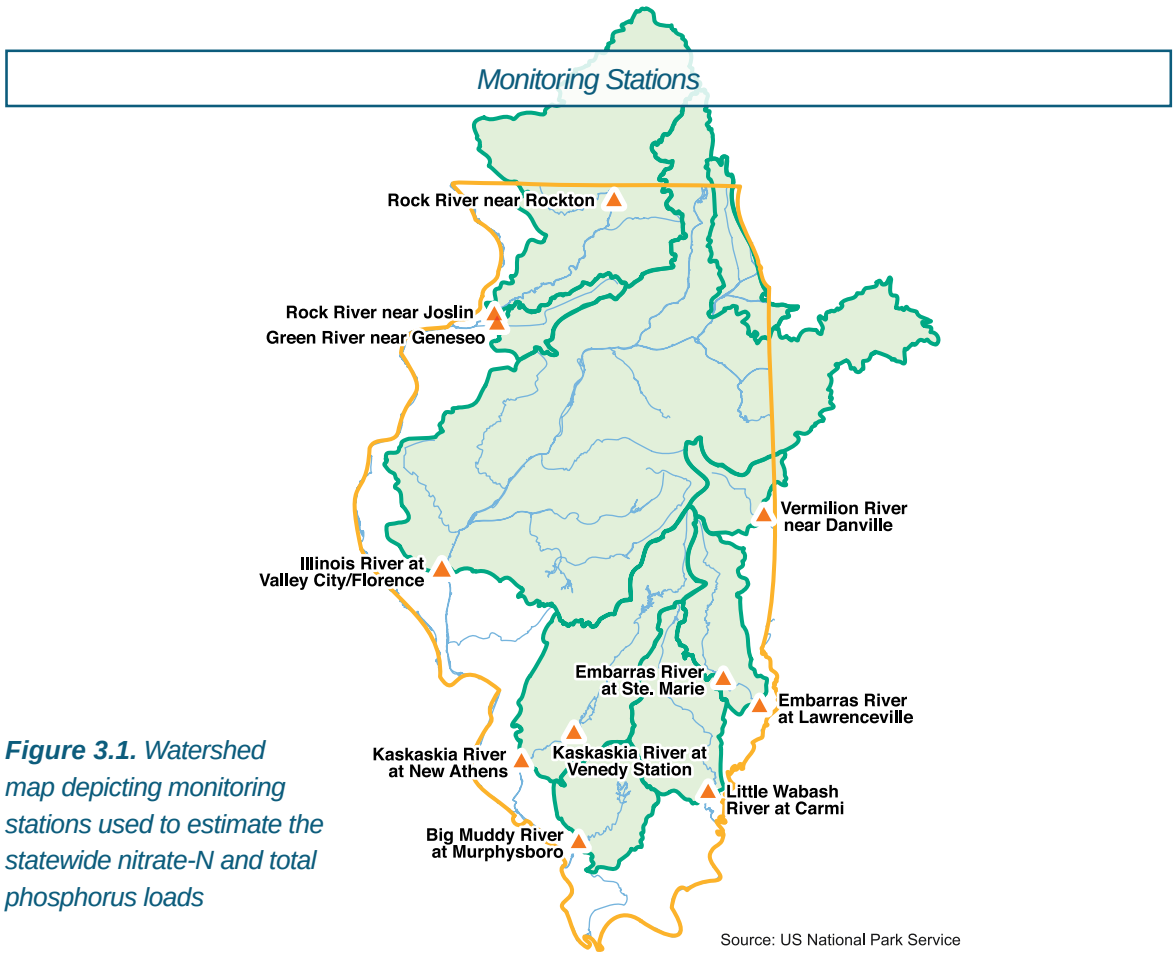


Figure 3.1. *Watershed map depicting monitoring stations used to estimate the statewide nitrate-N and total phosphorus loads*

Methods

Discrete sample concentrations were measured by Illinois EPA and USGS and flow was measured by USGS. Nitrate-N loads were estimated by linear interpolation and total phosphorus loads were estimated using Weighted Regressions on Time, Discharge, and Seasonality. To account for loads coming from neighboring states, the loads in the Illinois and Vermilion rivers were reduced by the percentage of the drainage areas in neighboring states, 16% and 7%, respectively. Additionally, the loads in the Rock River at Rockton, near the Wisconsin border, were subtracted from the load at Joslin to isolate the Illinois portion of the Rock River. The sum of the three adjusted loads and the loads in the other five rivers that lie entirely in Illinois represents the loads draining from 69.7% of the land area in Illinois. To account for the remaining 30.3% of the land area that does not drain past any of these monitoring locations, it was assumed that the loads per unit area (or yield) from the unmonitored 30.3% is the same as the estimated yield from the 69.7% that is monitored. Thus, the final step in estimating the statewide loads was to multiply the sum of the three adjusted loads and the loads in the other five rivers by the ratio of the total state land area to the monitored drainage area (1.435).

Water Measures

Statewide nitrate-N and total phosphorus loads have been highly correlated with water yield (Figures 3.2 and 3.3), which in turn are highly correlated with precipitation. The 2015-19 statewide average nitrate-N load estimate was 448 million pounds N per year, 13% greater than the 1980-96 baseline load (Table 3.2). The 2015-19 statewide total phosphorus load estimate was 46 million pounds P per year, 35% greater than the baseline load. Water yield was 25% greater than the baseline period. The 2015-19 averages were influenced by unusually high precipitation and river flows in 2019. Five-year average water yields have been greater than the baseline water yield since 2008. Greater runoff and drainage tend to increase river loads and, thereby, increase the difficulty of meeting NLRS goals. The 2013-17 total phosphorus load (Table 3.2) is slightly lower than the value reported in the 2019 Biennial Report because weighted regressions on time, discharge, and season estimates concentrations using data over a seven-year window. Adding 2018 and 2019 concentration data to the analysis led to slightly lower estimates for 2013-17.

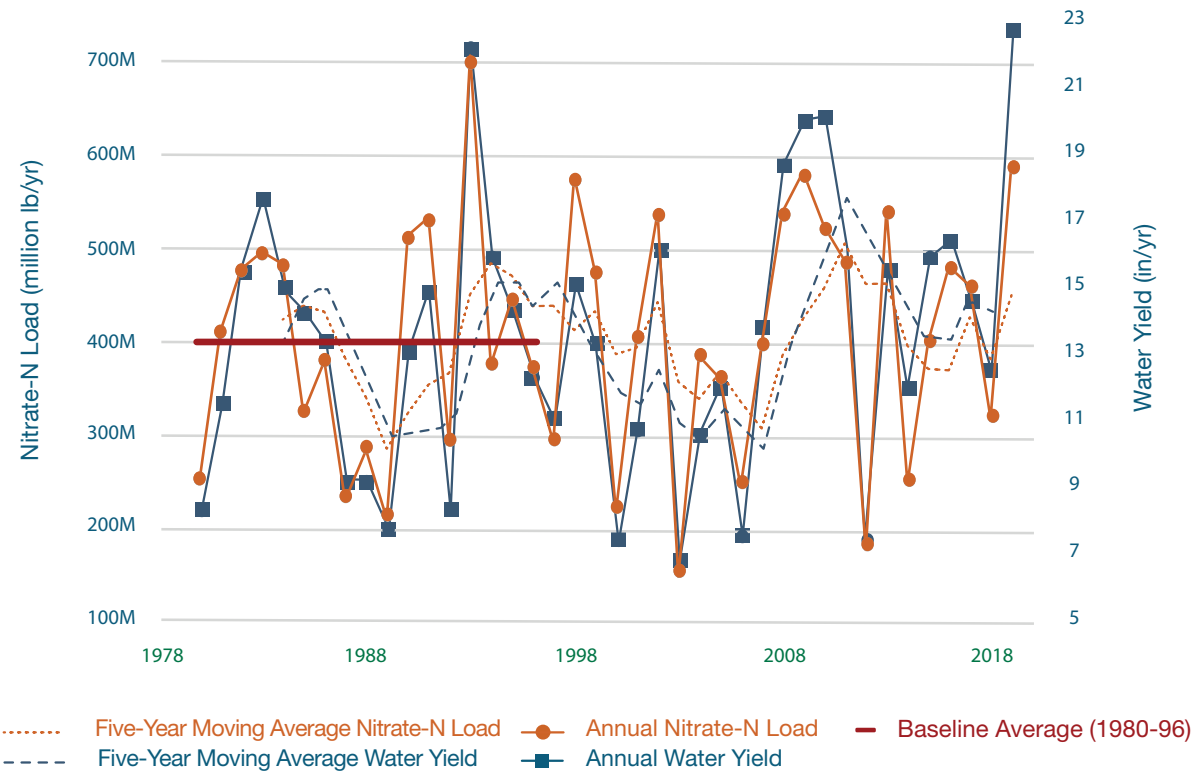


Figure 3.2. *Statewide estimated annual water yields, annual nitrate-N loads, five-year moving averages, and average load for the 1980-96 baseline period*

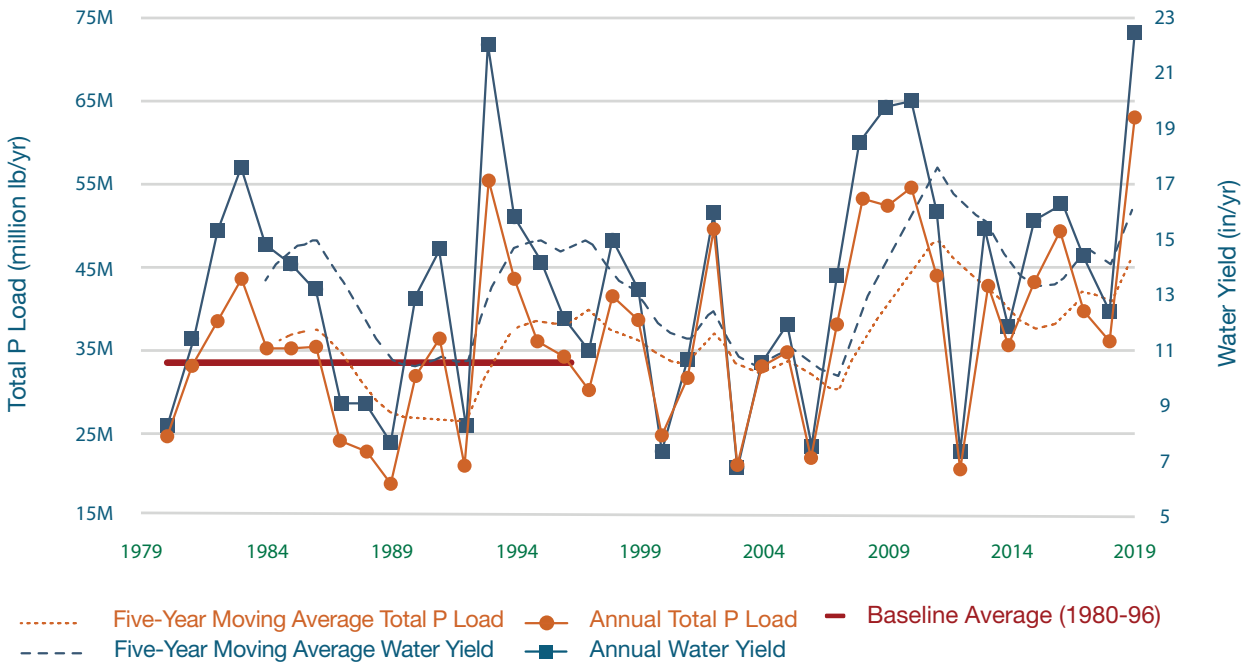


Figure 3.3. *Statewide estimated annual water yields, annual total phosphorus loads, five-year moving averages, and average load for the 1980-96 baseline period*

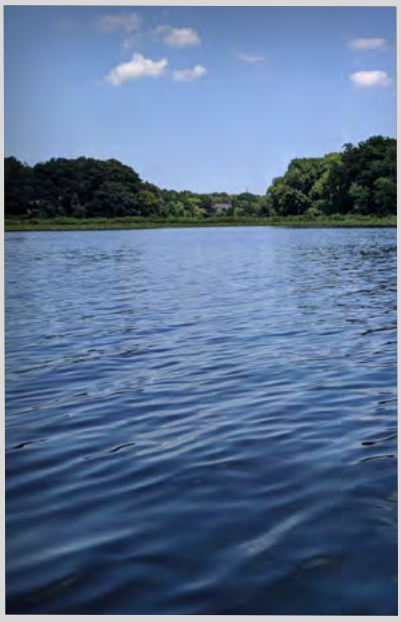
Table 3.2. *Statewide estimated water yield, nitrate-N load, and total phosphorus load for the 1980-96 baseline period and three recent five-year periods*

	1980-96 Baseline	2013-17		2014-18		2015-19	
	Average Value	Average Value	% Change from Baseline	Average Value	% Change from Baseline	Average Value	% Change from Baseline
Water Yield (in/yr)	13.0	14.7	+13%	14.1	+9%	16.3	+25%
Nitrate-N Load (million lb/yr)	397	425	+7%	380	-4.4%	448	+13%
Total Phosphorus Load (million lb/yr)	34	42	+23%	41	+20%	46	+35%

Of the major rivers, the largest nitrate-N loads occurred in the Illinois River, partly because it drains the largest area of all these rivers, including much of the tiled cropland of central Illinois, in addition to receiving considerable discharge of effluent from wastewater treatment in Chicago and Decatur (Figure 3.4). The 2015-19 average nitrate-N loads in the Illinois River were only 3% greater than the baseline period and the 2014-18 loads were 13% less than the baseline.

The largest **increase** in nitrate-N load from the baseline period occurred in the Illinois portion of the Rock River (between Rockton and Joslin) where the 2015-19 nitrate-N load was 135% greater and water yield was 60% greater (Figures 3.5 and 3.6). Increased precipitation is likely one causal factor. Additionally, flow through large groundwater aquifers may have played a role in delaying the appearance of increased nitrate-N concentrations in the lower Rock River. In the baseline period, nitrate-N yield from the portion of the Rock River watershed downstream of Rockton and Perryville was unusually low (4.2 pounds N/acre/year) despite intensive row crop production, irrigation, and tile drainage. In comparison, baseline average nitrate-N yield from the Kishwaukee River was 17 pounds N/acre/year and the neighboring Green River at Geneseo was 12.2 pounds N/acre/year (Table 3.3). In 2015-19, the nitrate-N yield from the Rock River, excluding the Kishwaukee River, was 21.5 pounds N/acre/year, slightly larger than yields from the Kishwaukee River (17.9 pounds N/acre/year) and the Green River (16.5 pounds N/acre/year). Understanding why nitrate-N yields from the lower section of the Rock River were unusually low during the baseline period may shed light on the reasons for the large increase since the baseline period. There is evidence from groundwater wells in the region that nitrate-N has been accumulating in the extensive aquifers below the lower Rock River watershed. Some portion of the increased nitrate-N load in the Rock River may be due to nitrate-N contamination of groundwater in the 1970s, 1980s, and early 1990s that increasingly emerged in the river in the late 1990s and early 2000s.

Photo courtesy of Gregory McIsaac



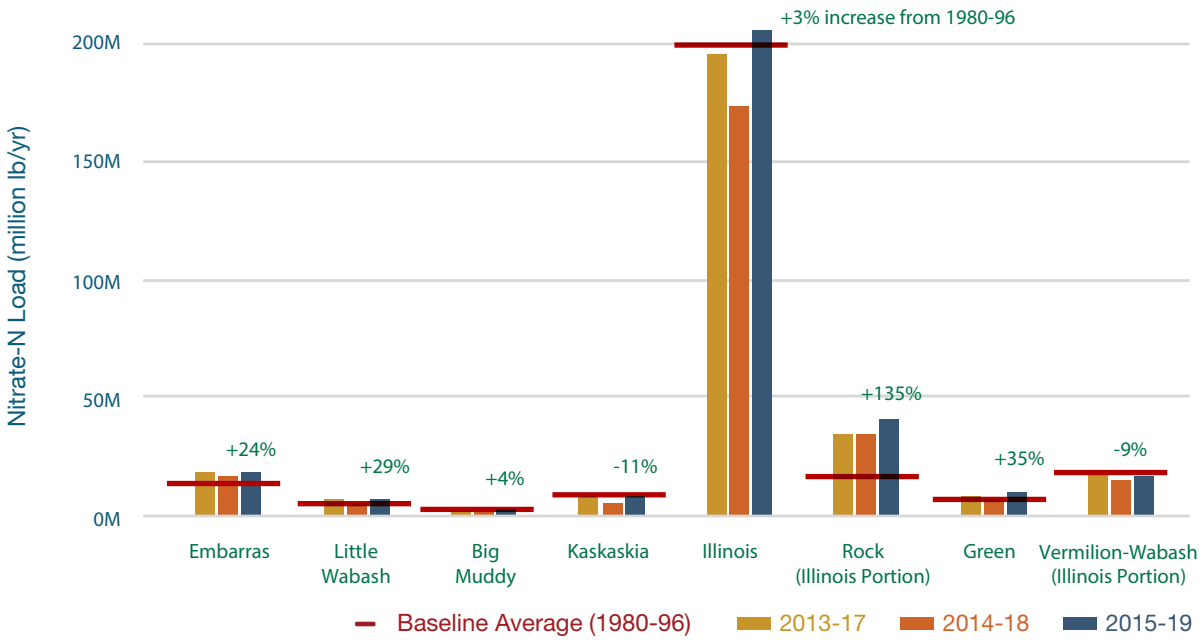


Figure 3.4. *Nitrate-N loads in eight major rivers draining Illinois during the 1980-96 baseline period and three recent five-year periods. The percentage change from the baseline load to 2015-19 for each river system is also indicated.*

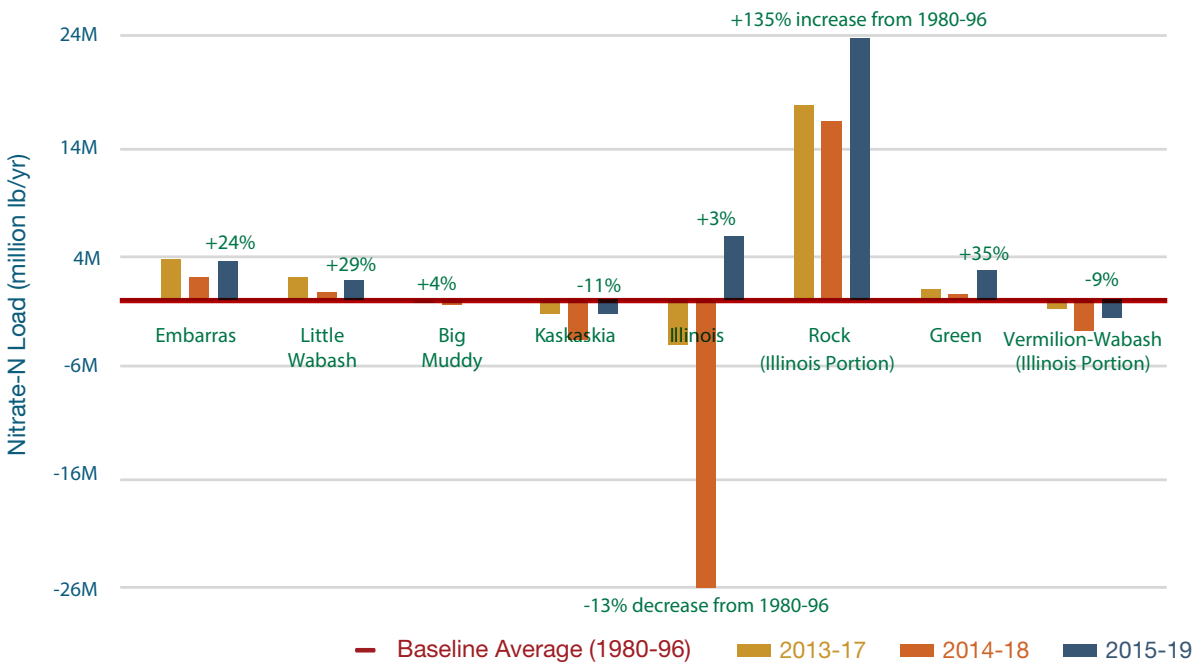


Figure 3.5. *Changes in nitrate-N loads in eight major rivers draining the state for three recent five-year periods relative to the load during the 1980-96 baseline period. The percentage change from the baseline load to 2015-19 for each river system is also indicated.*

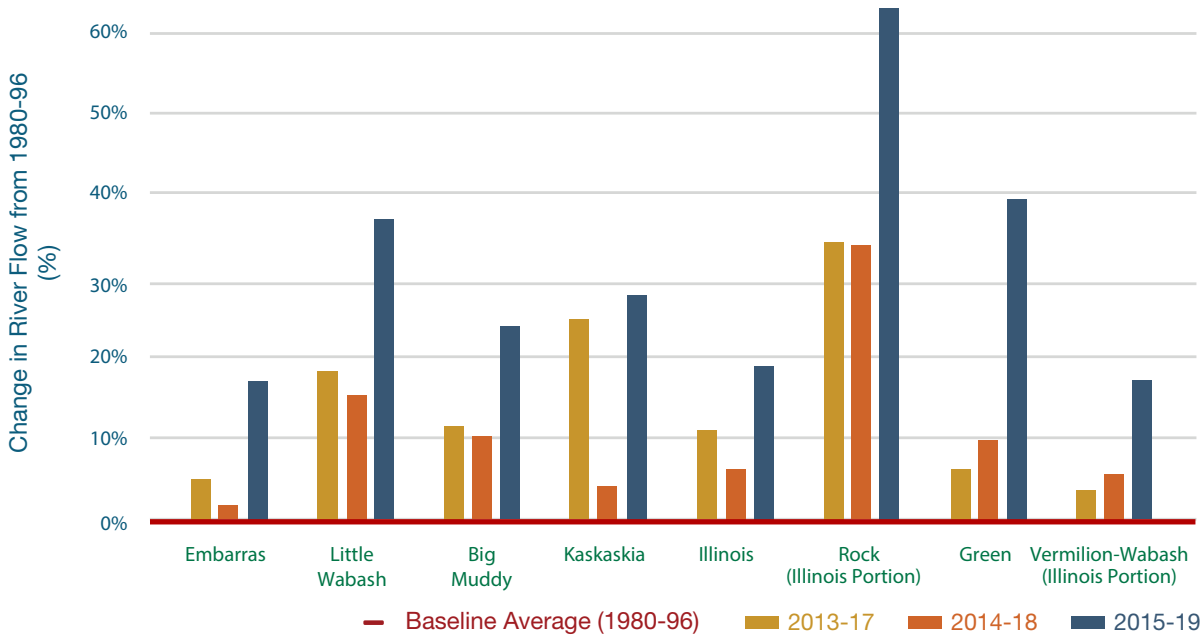


Figure 3.6. *Percent changes in river flow or water yield from the 1980-96 baseline period to three recent five-year periods in eight major rivers draining the state*

Table 3.3. *Monitoring stations used to estimate and evaluate the statewide nitrate-N loads*

River System	Monitoring Locations	1980-96	2013-17	2014-18	2015-19
		pounds of nitrate-N per acre per year			
Big Muddy	Murphysboro	1.5	1.3	1.2	1.5
Embarras	Ste. Marie	15.3	19.5	17.6	19.0
Green	Geneseo	12.2	14.0	13.1	16.5
Illinois	Valley City	13.9	13.6	12.1	14.3
Kaskaskia	Venedy Station	3.6	3.1	2.4	3.2
Little Wabash	Carmi	3.1	4.3	3.6	4.1
Vermilion	Danville	24.3	23.3	20.7	22.2
Rock (Illinois portion)	Joslin-Rockton	8.6	17.3	16.6	20.3
Rock (Illinois portion, excluding the Kishwaukee)	Joslin-Rockton-Kishwaukee	4.2	18.4	17.8	21.4
Kishwaukee	Perryville	17.1	15.4	15.2	17.9
Sangamon	Oakford	15.5	13.4	10.2	13.6

In contrast to the Rock River, nitrate-N loads have declined about 10% in the Vermilion (Wabash Basin) and Kaskaskia rivers, despite increases in water flow of 17% and 28%, respectively (Figure 3.5). A similar reduction also occurred in the Sangamon River at Oakford (Table 3.3). This may be due to increased efficiency of nitrogen

fertilizer use and the absence of significant groundwater retention of nitrate-N. Corn yields have increased substantially since 1996, largely due to improved varieties, while nitrogen fertilizer use has increased only modestly. Increased precipitation and drainage tend to promote increased nitrate-N loss from cropland, but crop management factors can also have a counteracting influence. Another factor to consider is the role of reservoirs, where significant denitrification can occur. Changes in the seasonality of flow and warmer temperatures may be promoting more denitrification in lakes and reservoirs, thereby reducing nitrate-N concentrations and loads downstream.

Total phosphorus loads have also been variable across the state (Figures 3.7 and 3.8). The greatest load occurred in the Illinois River because of the size of the watershed and wastewater discharges from Chicago and Decatur. There was a small (4%) reduction in total phosphorus loads in the Green River, despite a 40% increase in water flow (Figure 3.6). The greatest percentage increases in total phosphorus loads occurred in the Kaskaskia (86%) and Little Wabash (77%) rivers, which were associated with increased river flows of 28% and 37%, respectively. These two watersheds also had the greatest total phosphorus yields of the major rivers during 2015-19 (Table 3.4). In the Illinois section of the Rock River, total phosphorus loads increased 34%, while water flow increased 60%. Total phosphorus loads are influenced by factors other than precipitation and river flow. In the Kaskaskia, legacy phosphorus released from reservoir sediments may be playing a significant role. In the Little Wabash, land slope and greater propensity for surface runoff may be important. Additional research is needed to quantify these and other influences on both phosphorus and nitrate-N loads in rivers.

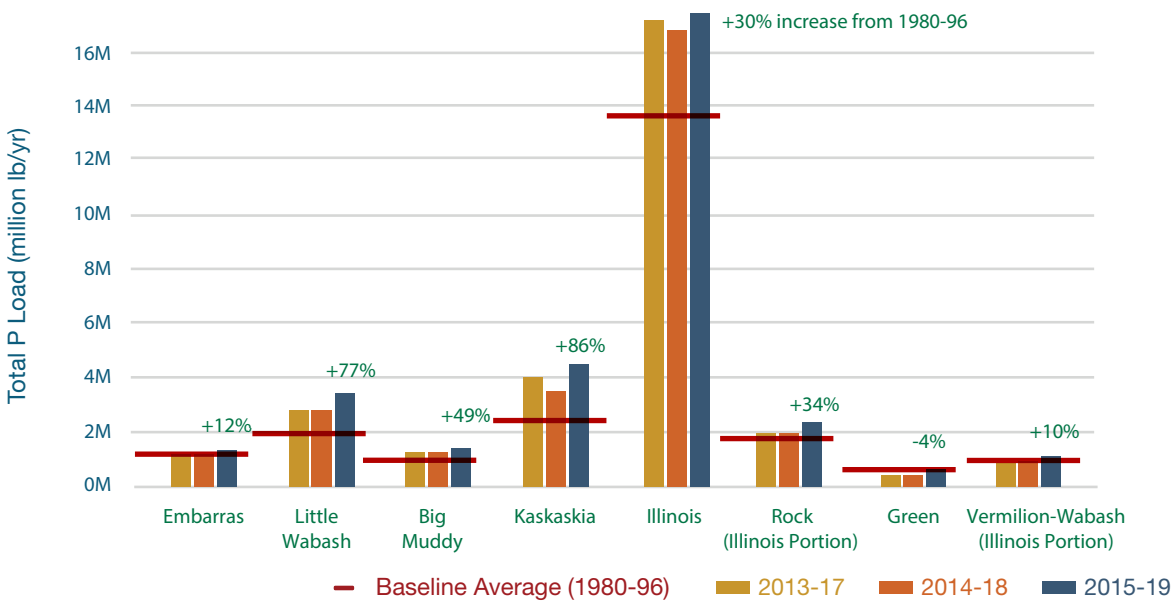


Figure 3.7. *Total phosphorus loads in eight major rivers draining Illinois during the 1980-96 baseline period and three recent five-year periods. The percentage change from the baseline load to 2015-19 for each river system is also indicated. The estimated loads for the Illinois and Vermilion rivers reflect loads attributed to the portion of watershed drainage areas in Illinois.*

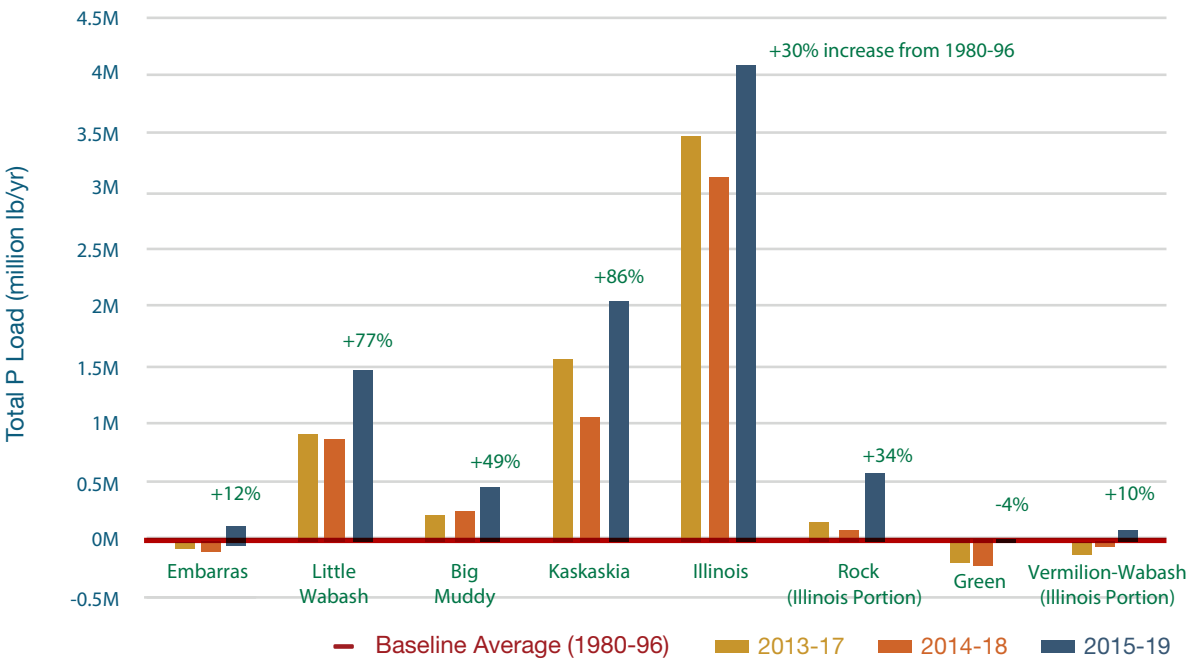


Figure 3.8. *Changes in total phosphorus loads in eight major rivers draining the state for three five-year periods relative to the load during the 1980-96 baseline. The percentage change from the baseline load to 2015-19 for each river system is also indicated.*

Table 3.4. *Total phosphorus yields from major river systems draining Illinois for the 1980-96 baseline period and three recent five-year periods*

River System	Monitoring Locations	1980-96	2013-17	2014-18	2015-19
		annual average pounds of total phosphorus per acre per year			
Big Muddy	Murphysboro	0.69	0.86	0.87	1.02
Embarras	Ste. Marie	1.23	1.18	1.14	1.38
Green	Geneseo	0.97	0.60	0.59	0.93
Illinois	Valley City	0.95	1.19	1.17	1.24
Kaskaskia	Venedy Station	0.86	1.41	1.24	1.59
Little Wabash	Carmi	0.96	1.43	1.40	1.71
Rock (Illinois portion)	Joslin-Rockton	0.86	0.95	0.91	1.15
Vermilion	Danville	1.19	1.06	1.14	1.31

U.S. Geological Survey Continuous Loadings Network

By Paul Terrio

Since 2015, the U.S. Geological Survey, with financial assistance provided by Illinois Environmental Protection Agency, has operated a network comprised of "super gages" that provide real-time continuous monitoring of eight major rivers in the state (Figure 3.9 and Table 3.5). Each super gage continuously measures river discharge, along with nutrient and suspended-sediment concentrations to calculate continuous loadings. Nutrient and suspended-sediment loads were computed for the 2016-20 water year period using a statistical modeling approach. These load estimates represent the riverine loads at the locations of the eight monitoring stations and include parts of the Illinois, Rock, and Vermilion River basins that receive drainage from neighboring states. The loads do not include an estimate of ungaged areas of the state. The cumulative drainage area of these gaging stations covers approximately 74% of the total land area of Illinois, as well as portions of Wisconsin and Indiana. The statistical modeling procedure provides a means to both determine and reduce uncertainties in load estimates computed from continuous data with data gaps. The load estimates are currently under review and awaiting approval; a report describing the modeling procedures and results is scheduled for publication in 2021. A detailed comparison of load estimates using this procedure and load estimates computed from discrete water quality data is forthcoming.

For the 2016-20 water year period, the provisional mean annual nitrate-N load was 426 million pounds N per year; the provisional mean annual total phosphorus load was 30.2 million pounds per year; and the provisional mean annual suspended-sediment load was 8.32 million tons per year.

Photo courtesy of USGS

Drainage Basins and Monitoring Stations

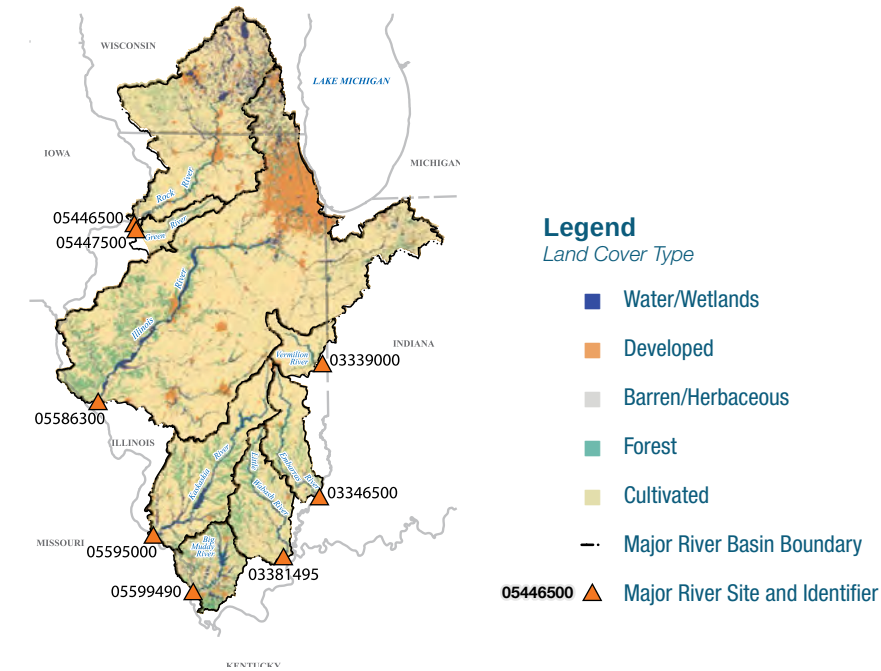


Figure 3.9. *Drainage basins and locations of the eight nutrient monitoring stations*

Table 3.5. *Monitoring station information*

River	USGS ID	Station Drainage Area (km^2)	Station Drainage Area in Illinois (km^2)	Basin Drainage Area in Illinois (km^2)	Percent of Station Drainage Area in Illinois	Areal Percent of Illinois
Vermilion	03339000	3,341	3,105	3,372	93%	2.1%
Embarras	03346500	6,042	6,042	6,307	100%	4.2%
Little Wabash[1]	03381495	7,998	7,998	8,298	100%	5.5%
Rock	05446500	24,732	10,290	13,789	42%	7.1%
Green[2]	05447500	2,598	2,598	2,927	100%	1.8%
Illinois[3]	05586300	69,264	58,666	64,009	84%	40.2%
Kaskaskia	05595000	13,439	13,439	15,045	100%	9.2%
Big Muddy	05599490	5,592	5,592	6,180	100%	3.8%

[1]Drainage area numbers are for Little Wabash River at Carmi, IL (USGS ID 03381500).
[2]The Green River is part of the Rock River drainage basin. The 2,927 km^2 is part of the 13,789 km^2 Rock River drainage area in Illinois.
[3]Drainage area numbers are for the Illinois River at Valley City, IL (USGS ID 05586100).

Implementation Scenarios

By Reid Christianson

This is a summary of a full report published in 2020 (Christianson, 2020a) detailing agricultural conservation practice scenarios developed to meet water quality goals. Please see that report for additional details.

The Illinois NLRS was released in July 2015. The Science Assessment to Support an Illinois Nutrient Loss Reduction Strategy included example implementation scenarios detailing combinations of conservation practices, scales of implementation, and the associated level of nutrient load reductions that may be realized when fully implemented. Two of the example implementation scenarios met the 45% reduction goals set for both nitrogen and phosphorus; however, none of them reflected the interim reduction goals of 15% nitrate-N and 25% total phosphorus. In addition, tracking and reporting on some of the conservation practices, as described in the scenarios, has proven difficult. The purpose of this section is to provide additional implementation scenario examples that meet the interim nutrient reduction goals and provide additional scenario examples that meet the 45% reduction long-term goal, all with conservation practice scales that are more amenable for tracking and reporting.

Photo courtesy of Layne Knoche, Illinois Extension

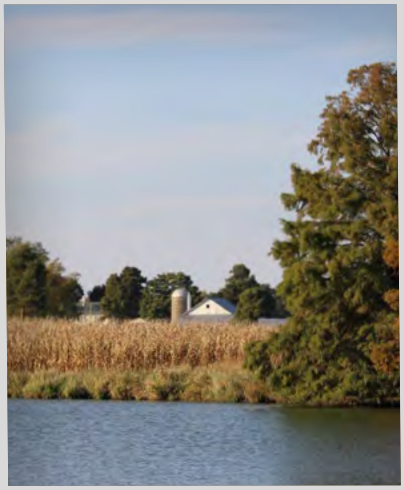


Photo courtesy of Jennifer Jones, Illinois Extension

These additional implementation scenarios were developed by University of Illinois and funded by Illinois Environmental Protection Agency through a grant provided by U.S. Environmental Protection Agency. The intent is to align implementation scenarios with data available for tracking implementation across the state. Previous scenarios were set up without the knowledge of data availability, or how to potentially track progress with available data sources over time, such as conservation

tillage practices on soil eroding greater than the tolerable level (>T). Many of these practices are excellent, though direct measurement of these systems would require data not currently available, or not consistently collected. There are six scenarios focused on nitrogen, phosphorus, or combined scenarios. The first three meet the interim water quality goals, while the last three focus on the 45% long-term reduction goals. Three additional scenarios were developed to highlight the potential use of new conservation practices that have yet to be assessed as part of the strategy.

Interim scenarios have undergone a simple cost optimization. Full scenarios required substantial adoption of practices; cost optimization was not attempted, since 100% adoption was largely required for all conservation practices. Further, the scenario development framework has been designed to allow new or updated costs to be incorporated as they are developed. In the future, new scenarios accommodating new information can be developed easily.

Point source reductions for phosphorus have been included in all scenarios. Urban stormwater was included as a line item, though this was not populated and will likely have little impact on the overall scenario development. Further, each scenario was broken into three distinct land use categories based on a combination of information available in the strategy, the science assessment, and available information on practice implementation. The three groups were general agricultural land consisting of corn and soybeans, tiled land, and non-tiled land. The two drainage categories are important to differentiate due to the applicability of certain conservation practices in the tiled landscape, such as denitrification bioreactors, and because data sources available to track this information make the distinction. Taking advantage of this information provides more detail and control over scenario development.

The science assessment was used to supply the agricultural conservation practice performance values (Table 3.6) for all scenarios. All nitrogen management practices are assumed to apply only to corn acres. The Policy Working Group has recently adopted a process to update or add conservation practice performance values to the strategy. As part of scenario development, a custom spreadsheet was developed to accommodate practice updates as they become available, so scenarios can be quickly modified using the most current scientific information. Potential additional practices may include some of the most highly funded practices by the U.S. Department of Agriculture's Environmental Quality Incentives Program. Between 2008 and 2016, this program provided roughly $4.4 million in funding for water and sediment control basins, $3.9 million for grassed waterways, $2.9 million for heavy use area protection, $2.8 million for grade stabilization structures, and $2.5 million for terraces across Illinois.

Table 3.6. Conservation practice performance values that were part of the Illinois NLRS

Conservation Practice Efficiencies	Nitrogen Reduction (%)	Phosphorus Reduction (%)	Data Source
Cover crops (grass-based) – tiled	30%	30%	NLRS Survey conducted by NASS
Cover crops (grass-based) – non-tiled	30%	30%	NLRS Survey conducted by NASS
Maximum return to nitrogen	10%	0%	NLRS Survey conducted by NASS
Soil test phosphorus (rate reduction)	0%	7%	NLRS Survey conducted by NASS
Wetlands	50%	0%	Wetland Reserve Easement Program, NRCS EQIP, IDNR CREP Easements
Bioreactors	25%	0%	NRCS
Nitrogen management (fall to spring) – tiled	18%	0%	NLRS Survey conducted by NASS
Nitrogen management (50% in fall & 50% spring pre-plant) – tiled	9%	0%	NLRS Survey conducted by NASS
Nitrogen management (40% in fall; 10% spring pre-plant; 50% sidedress) – tiled	18%	0%	NLRS Survey conducted by NASS
Perennial energy crops – generic	90%	70%	Cropland Data Layer
Nitrification inhibitor – tiled	10%	0%	NLRS Survey conducted by NASS
Nitrification inhibitor – non-tiled	10%	0%	NLRS Survey conducted by NASS
Nitrogen management (fall to spring) – non-tiled	18%	0%	NLRS Survey conducted by NASS
Nitrogen management (50% in fall & 50% spring pre-plant) – non-tiled	9%	0%	NLRS Survey conducted by NASS
Nitrogen management (40% in fall; 10% spring pre-plant; 50% sidedress) – non-tiled	18%	0%	NLRS Survey conducted by NASS
Conservation tillage	0%	50%	Tillage Transect Survey
Buffers – non-tiled	90%	50%	None

The science assessment also developed costs associated with the various conservation practices. These costs included the expected life of each practice and the typical area treated by it. Full details can be found in appendix B of the Illinois Nutrient Loss Reduction Strategy. The science assessment noted five issues to consider when developing costs:

1. Costs represent a change from current practice.
2. The initial cost of practice investment (if lasting longer than a year) is amortized over the life of the practice with a discount factor of 6%. A lifespan of 20 years was most common. This is called the equal annualized cost.
3. A yield change due to implementing a practice was determined using the Illinois Agronomy Handbook as a general guide.
4. If per acre net returns on farmland are $55/acre, additional costs due to conservation practice implementation of even $10/acre would represent a substantial reduction in agricultural returns.
5. Some of the practices would require significant capital investment and may expose farmers to additional risk. Similarly, limiting the time available to do field operations (i.e., all field activities to be done in the spring), may also increase risk.

Each of the practices used in the scenarios had additional nuances, as discussed in the strategy. The resulting costs are summarized in Table 3.7. Cost development did not consider the human capacity issues that would be associated with a rapid ramp-up of conservation activities. In other words, the cost assumes the expense required to complete a given practice without competition for design, competition for installation capacity, or other technical skills requiring an expert.

Photo courtesy of Jack Pizzo, The Pizzo Group

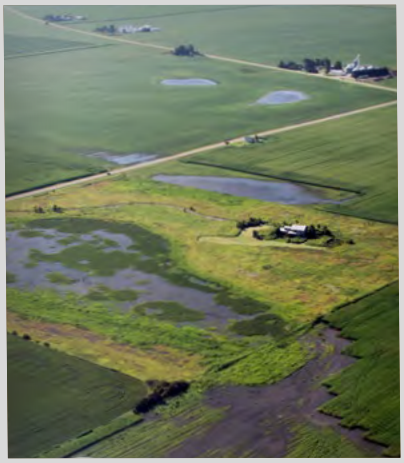


Photo courtesy of Amanda Cole, Illinois Extension

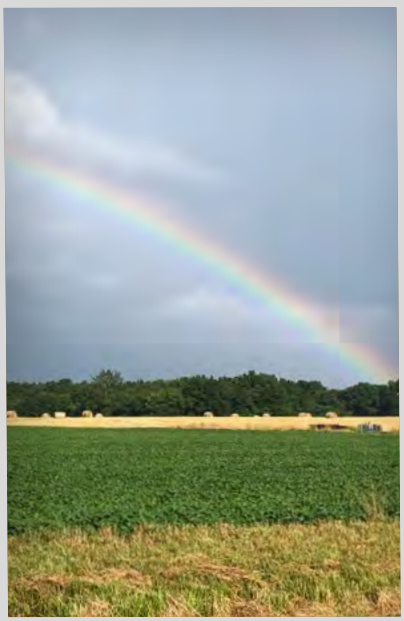


Table 3.7. Conservation practice costs included in the Illinois NLRS

Practice	Cost ($/ac)	Other Economic Concerns, as Noted in Illinois NLRS
Reduced tillage	-$17.00	Potential yield reductions
Phosphorus rate reduction	-$7.50	—
Stream buffer	$294.00	Cost is per acre of buffer; negative impacts on farmland
N rates reduced from background to MRTN	-$8.00	—
N inhibitor with fall-only fertilizer application	$7.00	—
Split N fertilizer application on tiled soils (50% fall and 50% spring)	$17.00	—
Spring-only N fertilizer application on tiled acres	$18.00	Timeliness
Cover crops	$29.00	Planting difficulty; potential impact on yields
Bioreactors	$17.00	Large investment costs; increasing costs with large adoption
Wetlands	$60.63	Large investment costs
Perennial crops	$86.00	Lower forage prices due to large shifts

Scenario Summary

A summary of the six basic scenarios is provided here for quick reference (Table 3.8). Costs were broken into annual cost and cost savings, as well as net annual cost. Cost savings are associated with reduced tillage management, phosphorus rate reductions to lower soil test phosphorus from high to optimum, and using the Maximum Return to Nitrogen application rate. Scenario details for combined interim water quality goals and full water quality goals are listed in the scenario results section. The total impacted area quickly rises above the estimated 22 million acres of row crops, due to the use of multiple practices on a given acre. For example, reducing nitrogen application rates to the MRTN would likely happen in combination with the addition of cover crops, or applying phosphorus based on the Illinois Agronomy Handbook recommendations for soil test phosphorus levels. These scenarios have also been refined based on stakeholder feedback, which was summarized in Christianson (2020a).

The five extended scenarios were included to help answer questions surrounding specific types of activities and were intended to be "what if" scenarios. Extended scenarios added more detail to tillage categories, saturated buffers as a conservation practice, perennials, nutrient management only, and in-field practices only. Since these scenarios did not, necessarily, align with the strategy, they are not discussed in detail here. More information on extended scenarios can be found in the full report (Christianson, 2020a).

The six basic scenarios are as follows:

N7: Interim Nitrogen Reduction Goal of 15% from Benchmark

P7: Interim Phosphorus Reduction Goal of 25% from Benchmark

NP7: Interim Combined Reduction Goal of 15% for N and 25% for P from Benchmark

N8: Nitrogen Reduction Goal of 45% from Benchmark

P8: Phosphorus Reduction Goal of 45% from Benchmark

NP8: Combined Reduction Goal of 45% for N and P from Benchmark

Table 3.8. *Summary of agricultural conservation practices to meet water quality goals from the agricultural sector (estimates assume the point source sector meets goals)*

	Scenario					
	N7	P7	NP7	N8	P8	NP8
Number of Practices Used	5	4	7	8	4	11
P Reduction (%)	4%	13%	13%	14%	23%	24%
N Reduction (%)	13%	7%	13%	35%	22%	35%
Equal Annualized Cost ($/ac/yr)	$16.62	$3.95	$4.39	$25.38	$11.46	$14.03
Area Impacted (million acres)*	15.65M	24.83M	35.3M	35.2M	40.92M	56.23M
Net Equal Annualized Cost (million/yr)	$260M	$98M	$155M	$893M	$469M	$789M
Equal Annualized Cost Savings (million/yr)	-$19M	-$95M	-$125M	-$19M	-$107M	-$126M
Equal Annualized Cost (million/yr)	$279M	$193M	$280M	$912M	$576M	$915M

*Practices may be implemented on the same acreage, though no data sources are available for estimating this.
There are no estimates developed showing combined impact of practices on the same area.
More significant digits available in full report.

Methods

The backdrop for all scenarios was historical land use acreages and nitrogen and phosphorus loads. Background information was compiled accordingly and is shown in Table 3.9 for the 1997-2011 benchmark period. Many of these values were initially included in the strategy, though National Agricultural Statistics Service survey results, Cropland Data Layer, and Census of Agriculture values were also used. The corn to soybean ratio and the tiled to non-tiled ratio were used to proportionally distribute information on implementation potential for certain practices, like cover crops, when needed. Distinctions were made between tiled row crop agriculture and non-tiled row crop agriculture, due to data availability. Specifically, the NLRS Survey conducted by NASS asked questions distinguishing between these land management practices; some conservation practices, such as bioreactors, are only applicable in the tiled landscape.

Parameter	1997-2011
Total Nitrogen Loss (lb)	536,000,000
Nitrate-N Loss (lb)	410,000,000
Phosphorus Loss (lb)	37,500,000
Point Source Total Nitrogen Loss (lb)	87,300,000
Point Source Nitrate-N Loss (lb)	75,200,000
Point Source Phosphorus Loss (lb)	18,100,000
Urban Total Nitrogen Loss (lb)	8,300,000
Urban Nitrate-N Loss (lb)	6,000,000
Urban Phosphorus Loss (lb)	1,500,000
Agricultural Total Nitrogen Loss (lb)	440,400,000
Agricultural Nitrate-N Loss (lb)	328,800,000
Agricultural Phosphorus Loss (lb)	17,900,000
Corn Area (ac)	12,848,492
Soybean Area (ac)	8,520,101
Small Grains Area (ac)	727,714
Total Rowcrop Ag (ac)	22,096,307
Corn to Soybean Ratio	0.60
Pasture/Hay Area (ac)	4,223,842
Tiled Land (ac)	8,900,026
Tiled to Non-Tiled Ratio	0.40
Corn Area Tiled (ac)	5,175,159
Soybean Area Tiled (ac)	3,431,755

Table 3.9. *Background information for the 1997-2011 benchmark period for nutrient load in water and the 2011 benchmark period for agricultural management. These values were largely reported in the strategy; however, some extended calculations were added to facilitate proportionally distributing conservation practices.*

As the scenarios developed here are from the view of the 1997-2011 benchmark period, the land use areas and ratios, along with nitrogen and phosphorus loads from this period were used. Information about conservation practice implementation during the benchmark period was collected from the strategy, where available, and from supplemental sources. For example, the existing cover crop area was not indicated in the strategy; however, the NLRS Survey conducted by NASS provides an estimate of the area using cover crops for 2011.

Maximum potential and practical area available to host specific conservation practices was estimated using a combination of background data and narrative provided in the strategy, the science assessment, literature, and the USDA Cropland Data Layer (USDA, 2018). Maximum potential area was included to add a realistic check against scenario development; however, the developed framework allows these maximum values to be updated with new information.

Photo courtesy of CMAP

The maximum potential for buffers was estimated based on the equivalency of previous scenarios P1 and P2 (Illinois EPA et al., 2015), which were identical with the exception of buffers being used in scenario P1 and cover crops being used in scenario P2. Making this equivalency for phosphorus, assuming all buffers were on non-tiled land with a phosphorus loss reduction efficiency for buffers of 50% and 30% for cover crops, resulted in approximately 12.3 million acres being treated by buffers. Buffers were the one practice included without a suitable data source to allow tracking.

Some effort was made to adjust the maximum potential implementable area by reducing to account for competing practices. For example, increasing perennial land requires a land use change, which was subtracted from applicable corn and soybean acreages. As these adjustments are not necessarily a direct subtraction from a given conservation practice, the initial maximums were divided by the total row crop area to develop

a ratio. Land use changes in a given scenario were subtracted from corn or corn and soybean areas, but the practice maximum ratio was maintained. For example, the Maximum Return to Nitrogen practice could be implemented on an all-corn area, which is roughly 54% of the row crop landscape. A change to perennial would be subtracted from all row crop area, with the result multiplied by 54%, which would be the new maximum for the MRTN practice. Nitrogen management practices were treated in the same manner, though all nitrogen management practices were in direct competition with each other, meaning changing from 100% of nitrogen applied in fall to 100% of nitrogen applied in spring is in direct conflict with applying 50% of nitrogen in fall and 50% of nitrogen in spring.

The addition of cover crops is a major component in all scenarios, due to the relatively high nutrient loss reduction efficiency values for both nitrogen and phosphorus. To date, cover crop adoption across the state has been relatively low, though adoption is accelerating. Historic estimates of cover crop area have included winter wheat, which is technically not defined as a cover crop, but as a commodity and would, thus, factor into the base land use. Since tracking sources for cover crops (the NLRS Survey conducted by NASS) have not split these two apart, no effort was made here to split them. As cover crop adoption increases, this discrepancy will become less important, assuming winter wheat acreage stays relatively constant, as it has over the last five to 10 years.

Cost optimization included implementing the least expensive practice up to the practical maximum before moving to the next least expensive. End results were rounded.

Results

Figures 3.10 and 3.11 summarize acreages and provide a visual of the scenario. All nitrogen reduction results presented are for nitrate-N, as most of the conservation practices assessed focused on nitrate-N, which makes up over 75% of total nitrogen leaving the state (Illinois EPA et al., 2015).

Interim Goal: NP7 — Combined Reduction Nitrogen (15%; 61.5 million pounds) and Phosphorus (25%; 9.4 million pounds)

This scenario includes increasing acres being managed at the Maximum Return to Nitrogen rate to 100% of corn acres, increasing nitrification inhibitors with all fall-applied nitrogen, increasing cover crops, and treating tile water with bioreactors. This scenario also includes increasing acres being managed with conservation

tillage, cover crops, and increased phosphorus management based on soil test information and following the Illinois Agronomy Handbook recommendations for calculating phosphorus application, including limiting application where soil test phosphorus is above optimum. An estimated 59% of fields in 2008 tested above optimum. Note the total acreage needed is larger than the total row crop agriculture acreage. This indicates more than one practice per acre.

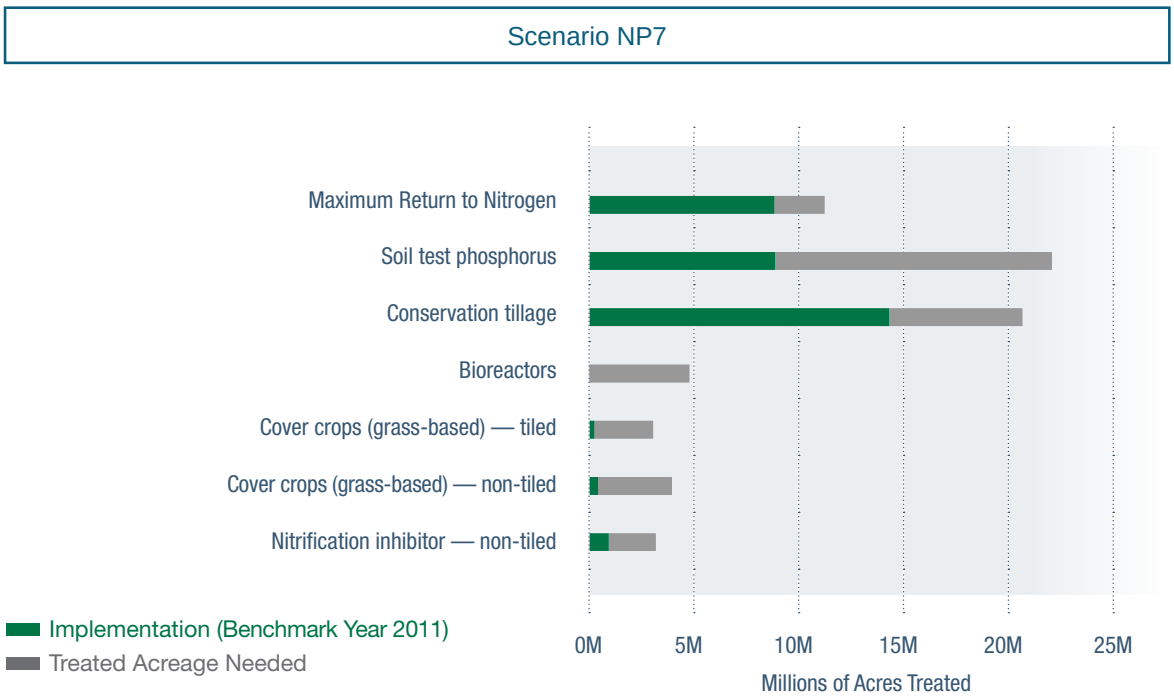


Figure 3.10. *Interim combined nitrogen and phosphorus loss reduction scenario: acreage needed*

Full Goals: NP8 — Combined Reduction Nitrogen (45%; 184.3 million pounds) and Phosphorus (46%; 17.3 million pounds)

This scenario maxes out MRTN, phosphorus management based on soil test phosphorus (as described in scenario P7), conservation tillage, cover crops, split nitrogen application on tiled land, nitrification inhibitors on fall-applied N on tiled land, bioreactors, and wetlands. Also, an increase in land treated with buffers was needed to close the nutrient loss reduction gap. As with the previous scenario, a treated area increased above the row crop area indicates more than one practice per acre.

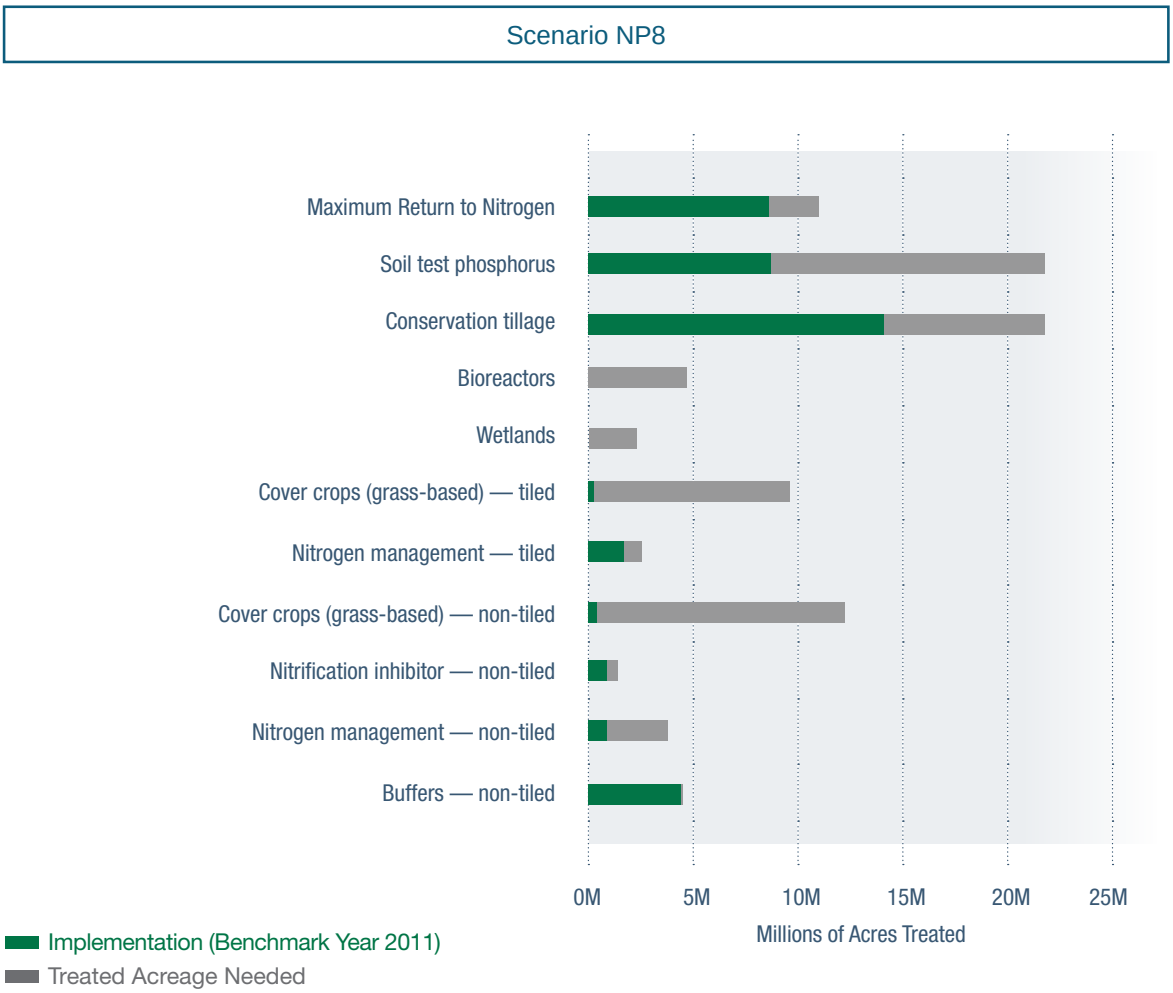


Figure 3.11. *Full combined nitrogen and phosphorus loss reduction scenario: treatment area needed*

Conclusion

This type of planning is important to orient all stakeholders and provide some general guidance on the direction that conservation efforts could and should be going for the purpose of water quality. These scenarios are for information only; they are not prescriptive. All agricultural conservation activities are voluntary, so the numbers here represent hypothetical avenues to meet water quality goals. It is apparent with these scenarios that substantial effort is required to meet our nitrogen and phosphorus reduction goals. The primary benefit of having these scenarios published is to allow for conservation practice tracking to be correlated with associated metrics of accomplishment, so that an accurate story can be told. Since buffers are part of

scenario NP8, a mechanism to track buffer implementation over time would be a helpful addition to overall tracking efforts. Finally, additional details surrounding all scenarios developed can be found in Christianson (2020a) and a presentation given at the 2020 Illinois NLRS Partnership Workshop (Christianson, 2020b), both of which can be found on the Illinois EPA's website at www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Pages/NLRS-Scenario-Development.aspx.

Christianson, R. (2020a). 2020 Illinois Nutrient Loss Reduction Strategy Scenarios. Retrieved from Christianson, R. (Producer). (2020b). 2020 Illinois Nutrient Loss Reduction Strategy Scenarios - Presentation. Retrieved from www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Documents/Agriculture%20Water%20Quality%20Partnership%20Forum/2020/awqpf-presentation-christianson-102020.pdf.

David, M., McIsaac, G., Schnitkey, G., Czapar, G., & Mitchell, C. (2014). Science Assessment to Support an Illinois Nutrient Loss Reduction Strategy. Retrieved from IEPA, IDOA, & University of Illinois Extension (2015). Illinois Nutrient Loss Reduction Strategy. Retrieved from Springfield, IL: www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf.

USDA. (2018). CropScape - NASS CDL Program. Retrieved from nassgeodata.gmu.edu/CropScape/.

Science Team Proposed Practice Decisions

By Illinois NLRS Science Team

The last biennial report included a section that discussed the Illinois NLRS Science Team. It outlined a formal evaluation procedure to adopt new conservation practices and update practice performance numbers, which can also be found at www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Pages/nutrient-loss-reduction-strategy.aspx. One of the science team's duties is to perform these evaluations for proposed additions to the practices listed in the strategy's first science assessment. When proposals are received, this formal procedure is enacted. Note: updates to the proposal process are described in chapter 8 of this report.

In December 2020, stakeholder organizations submitted two proposals: one for saturated buffers and another recommending several practices, including grade stabilization, blind inlets, terraces, and water and sediment control basins. First, the NLRS Steering Committee evaluated the proposals for completeness. They determined that both proposals contained the requested information and

forwarded them to the Illinois NLRS Science Team for full consideration. Table 3.10 is a summary of the team's decisions made during a series of virtual meetings held January through March 2021.

Additional details from the science team's discussions by practice area follow.

Table 3.10. *Summary of NLRS Science Team proposed practice decisions*

Practice	Decision	Efficiency Number	Cost
Saturated buffers	Include as an NLRS practice	40% nitrate-N loss reduction; 0% P loss reduction	$10/ac/yr*
Grade stabilization	Insufficient information	-	-
Blind inlets	Insufficient information	-	-
Terraces	Include as an NLRS practice	40% P loss reduction in non-tiled fields; 0% nitrate-N loss reduction	$40/ac/yr
WASCOBs	Insufficient information	-	-

*Annual operation and maintenance would be less than a bioreactor, so assumed a $2.50 annual operation and maintenance cost. The following formula was used:

$$Equivalent\ Annual\ Cost = \frac{NPV \times r}{1 - (1 \div r)^{-n}}$$

Saturated Buffers

The science team decided that saturated buffers should be included in the list of NLRS practices due to the number of studies submitted, their geographic relevance, and the quality of the work. They decided on a nitrate-N loss reduction efficiency value of 40%, which was the median value of the 27 site-years selected for inclusion in the science team's assessment. No phosphorus loss reductions were associated with saturated buffers. The proposal included a cost estimate for this practice of $10/treated acre/year, factoring in installation costs, expected practice life, and the drainage area treated. These data were converted into an equivalent annual cost by multiplying the installation cost by a 6% discount factor, then dividing by (1-(1+6%)^(-life)). Similar to bioreactors, an assumed annual operation and maintenance cost was added. Little information was available to draw from, though the science team expected that operation and maintenance for saturated buffers would be half of the $5/treated acre/year assumed for bioreactors.

Grade Stabilization

Insufficient information about this practice precluded inclusion at this time.

Blind Inlets

Due to a lack of studies that determine removal efficiency, the team decided not to add blind inlets to the list of NLRS practices. However, looking forward, the team expects to see future studies that will provide this information about blind inlets and encourages resubmission when these studies become available.

Terraces

Because terraces are an established practice that has been used in Illinois for many years, the team decided to include it. The literature has little existing information on terrace phosphorus dynamics; however, the team felt it unlikely that any forthcoming new research would refine nutrient loss reduction efficiencies. Therefore, the following efficiency numbers were decided: 40% P loss reduction in non-tiled fields; 0% N loss reduction. These estimates were based on the lowest reported phosphorus loss reduction in the proposal. Concern regarding total and dissolved phosphorus dynamics, especially when terraces are drained, led the science team to select a conservatively low estimate. A cost estimate of $40/treated acre/year was assumed based on the presented annualized installation costs (rounded to the nearest $10), as well as reported installation, and operations and maintenance costs presented by Yang, et al. (2010), which were inflated to 2021 dollars and rounded.

Yang, Q., Zhao, Z., Benoy, G., Chow, T. L., Rees, H. W., Bourque, C. P. A., & Meng, F. R. (2010). A watershed-scale assessment of cost-effectiveness of sediment abatement with flow diversion terraces. Journal of environmental quality, 39(1), 220-227.

Water and Sediment Control Basins

The science team discussed, but ultimately decided not to include WASCOBs at this time, due to a lack of studies. However, studies are currently underway. They encourage collaboration among NLRS partners and resubmission after more studies are published.

Illinois farm field

Photo courtesy of Dennis Bowman, Illinois Extension

CHAPTER 4
AGRICULTURAL SECTOR

Each of the source sector chapters has two parts: 1) implementation status and 2) current program updates. The first portion of this chapter reports on agricultural implementation while the second portion highlights updates to current programs and projects in the agricultural sector.

Implementation Report

Agricultural implementation follows the tracking measures logic model framework outlined in chapter 2. Data collected from agricultural partners about financial investments and outreach efforts inform the resource measures as analyzed by Illinois Extension and outreach measures as assessed by Dr. Anna Marshall, University of Illinois. Information was submitted by 110 partners, including individual county Soil and Water Conservation Districts (see the appendices). The Nutrient Loss Reduction Strategy Survey conducted by the U.S. Department of Agriculture National Agricultural Statistics Service and data reported through federal and state agencies provide information in the Land and Facilities section of this chapter.

Resource Measures

The first step in tracking the success of the Illinois NLRS is to quantify the resources invested. In this case, that includes staff members and funding that help progress strategy implementation. Appropriate staff and financial resources are essential to implementing the recommendations of the NLRS. The sections below provide a summary of the staff resources and funding measures that were dedicated to implementing the NLRS during the reporting period. Partner organizations, in addition to state and federal agencies, submit spreadsheets detailing their contributions to these resource measures.

Photo courtesy of Jennifer Jones, Illinois Extension

Staff Resources

In 2019, approximately 125 full-time equivalent staff members were engaged in Illinois NLRS outreach, implementation, or research for the agricultural sector. In 2020, the number grew to 132 FTE. This includes existing agency employees and represents multiple organizations working in any capacity on nutrient loss reduction goals.

Estimates of staff time dedicated to strategy implementation are not comprehensive. Many people are involved in strategy implementation across the state, including farmers and private contractors, and tracking these efforts can be difficult. For example, private contractors who implement nutrient management activities contribute significantly to implementation, but currently have no tracking mechanism.

Funding Resources

The agricultural sector partners reported that in 2019, public and private funds totaled $12,913,738. In 2020, they reported public and private funds totaling $13,982,060 (Table 4.1). These numbers do not include state or federal cost-share program funds.

It is difficult to capture all expenditures outside of state and federal cost-share programs, so while some of this information is being tracked, the list is incomplete. As a result, figures reported in this document may significantly underestimate total dollars spent in Illinois.

Table 4.1. *Funding resources in the agricultural sector*

	2019	2020
Grants or Loans Received	$4,685,811	$5,366,883
Grants or Loans Given	$7,753,612	$8,100,700
Funded Programs	$474,315	$514,477
Total	**$12,913,738**	**$13,982,060**

Outreach Measures

Outreach is essential for successful implementation in the agricultural sector. The COVID-19 pandemic in 2020 was an unprecedented event affecting industries around the world and agriculture was no exception. Extensive social distancing policies restricted daily activities and governments advised that people stay safe and stay at home. This course of action had a direct impact on essential NLRS programming dedicated to engaging the Illinois agricultural community to advance conservation practices recommended to achieve NLRS goals. Modest efforts were made to protect the core objectives, while simultaneously seeking to pivot to new opportunities in reaching target audiences with critical information and training to advance the nutrient loss reduction strategies. The following sections highlight key initiatives utilized in 2019 and 2020.

Photo courtesy of Illinois Farm Bureau

Outreach Activities

The extensive and ongoing activities sponsored by agricultural organizations in 2019 and 2020, in the midst of a global pandemic, speak to the agriculture sector's commitment to promoting NLRS. Indeed, while statewide restrictions on face-to-face meetings required cancellation of many field days and workshops, agricultural stakeholders made a quick and effective transition to online presentations and other methods for communicating information about water quality and soil health. This section describes those remarkable efforts in more detail.

Agricultural organizations continued their long-standing tradition of sponsoring hundreds of events to help advance the goals of the NLRS for a wide variety of audiences. Often partnering with SWCDs across Illinois, agricultural organizations and commodity groups shared information and research about the impact of cover crops, effective nutrient management, and edge-of-field practices. Through field days, workshops, and presentations, they shared information with landowners about specific conservation practices and programs to support the adoption of those practices. Table 4.2 summarizes agricultural organization outreach activities and attendance.

In addition to events geared toward encouraging producers to implement conservation practices, the outreach efforts in this reporting period reflected efforts to create a wider culture of conservation in Illinois' agricultural community. Specifically, agricultural partners brought information and guidance about the strategy to watershed planning meetings around the state, providing opportunities for implementation of the strategy across watersheds. In addition, members offered presentations at educational events for students in elementary and high schools, teaching young people about the value of water quality and soil health. These efforts instill values supporting conservation in influential groups that might further spread the message.

***Table 4.2.** Outreach activities and associated attendance*

	2015-16		2017-18		2019-20	
Type of Outreach	**Number of Events**	**Total Attendance**	**Number of Events**	**Total Attendance**	**Number of Events**	**Total Attendance**
Presentations	457	16,000	602	38,155	724	47,375
Field Days	130	3,692	204	18,493	118	11,760
Workshops	607	12,695	423	18,478	132	8,322
Conferences	27	6,935	42	9,355	46	4,623
Total	**1,221**	**39,322**	**1,271**	**84,481**	**1,020**	**72,080**

Despite the social, economic, and logistical challenges presented in 2020, agricultural organizations reported remarkably high rates of event sponsorship. Comparing outreach across all three reporting periods, activities dipped only slightly during the COVID-19 pandemic. Partners maintained a high rate of NLRS outreach activities. Using online platforms, they were able to extend programming to audiences across the state.

In addition to presentations and demonstrations, agricultural organizations continued to provide support for producers who are concerned about the cost or logistics associated with the implementation of conservation practices. Many SWCDs offer a range of technical assistance to farmers, from plant and seed sales to support for pollinators in wetlands, and from equipment rentals for those interested in cover crops and conservation tillage to assessments of soil health. Information provided by partners indicated that Illinois Farm Bureau, Illinois Corn Growers Association, Illinois Fertilizer & Chemical Association, Illinois Soybean Association, Nutrient Research and Education Council, and The Nature Conservancy continue to fund research on the impact of conservation practice implementation. The results are shared with farmers to illustrate the adoption of conservation practices as a cost-effective means to improving water quality.

Finally, agricultural organizations expanded online public engagement – developing websites with NLRS-related material, promoting events and conservation practices on Facebook and Twitter, and publishing posters, printed material, and other tools to help farmers implement conservation practices. University of Illinois Extension's watershed outreach associates introduced the Illinois NLRS podcast series in 2018, addressing the strategy and its implementation. That podcast draws on the experience and expertise of many stakeholders and producers across the state. There is further discussion of the podcast later in this chapter.

Photo courtesy of Jennifer Jones, Illinois Extension

Table 4.3 illustrates a continuing trend in outreach activities. While many partners continue to spread the word about the strategy in general, providing information about specific conservation practices is the greater focus. Thus, an increasing percentage of workshops and presentations specifically describe nutrient management, cover crops, conservation tillage, and edge-of-field practices such as wetlands, buffers, and bioreactors.

***Table 4.3**. Topics of outreach activities 2019-20*

	Topic	Number of Activities	Percent of Activities
General Topics	NLRS	187	22%
	Conservation Practices	135	16%
	Soil Health	93	11%
	Programs	69	8%
Specific BMPs	Nutrient Management	87	10%
	Cover Crops	147	17%
	Edge-of-Field	114	13%
	Tillage	24	3%

Strip till plus fertilizer
Photo courtesy of IFCA

Land and Facilities Measures

Agricultural organization outreach efforts have influenced implementation of NLRS recommended conservation practices. The adoption of these practices on agricultural land remains a key metric in tracking implementation of the NLRS. Since many conservation practices are implemented without utilizing state or federal conservation programs, an NLRS survey was once again conducted by National Agricultural Statistics Service to provide a more holistic view of conservation practice adoption. It should be noted that other types of conservation practices are implemented throughout the state, as well. While these practices are not currently recommended or tracked by the NLRS, they do reduce nutrient loss. Chapter 3 discusses two new conservation practices that have been added for future tracking and reporting. Organizations are encouraged to submit additional conservation practices through the process discussed in chapter 8.

This section provides details on the conservation practices recommended in the NLRS that were implemented with technical and financial assistance from state and federal conservation programs. Section subheads are listed by data source.

Federal Conservation Programs

USDA Farm Service Agency

Conservation Reserve Program

The Farm Service Agency administers the Conservation Reserve Program in Illinois. This voluntary program assists participants in conserving and improving natural resources nationwide. Federal funds provide incentives (if applicable), cost-share, and annual rental payments in exchange for establishing and maintaining grass, wetland, and tree-based practices over a 10 to 15-year contract. While the program is funded through FSA, technical services are provided by the USDA Natural Resources Conservation Service with local assistance from county SWCDs.

To be eligible for CRP enrollment, a producer must have owned or operated the land for at least 12 months prior to the end of the CRP enrollment period, unless certain conditions are met. Producers must file an accurate and timely acreage report for all crops and land uses, including failed acreage and prevented planting acreage.

Since 2018, both acres with CRP wetlands and CRP buffers have held relatively steady (Table 4.4 and Figure 4.1). CRP buffers include acreage enrolled in filter strip (CP21), riparian buffer (CP22), farmable wetland pilot buffer (CP28), marginal pastureland wildlife habitat buffer (CP29), habitat buffer for upland birds (CP33),

and SAFE buffers (CP38A). Wetlands include acres enrolled in shallow water area (CP9), wetland restoration (CP23), farmable wetlands pilot wetland (CP27), marginal pasture – wetland buffer (CP30), bottomland timber establishment on wetlands (CP31), SAFE wetlands (CP38B), and farmable wetland program and constructed wetland (CP39).

Table 4.4. *Acres in CRP wetlands and buffers*

	2011	2015	2016	2017	2018	2019	2020
CRP Wetlands	57,463	45,790	27,616	43,826	55,716	55,536	57,867
CRP Buffers	145,813	279,534	197,442	270,002	265,753	257,047	250,784

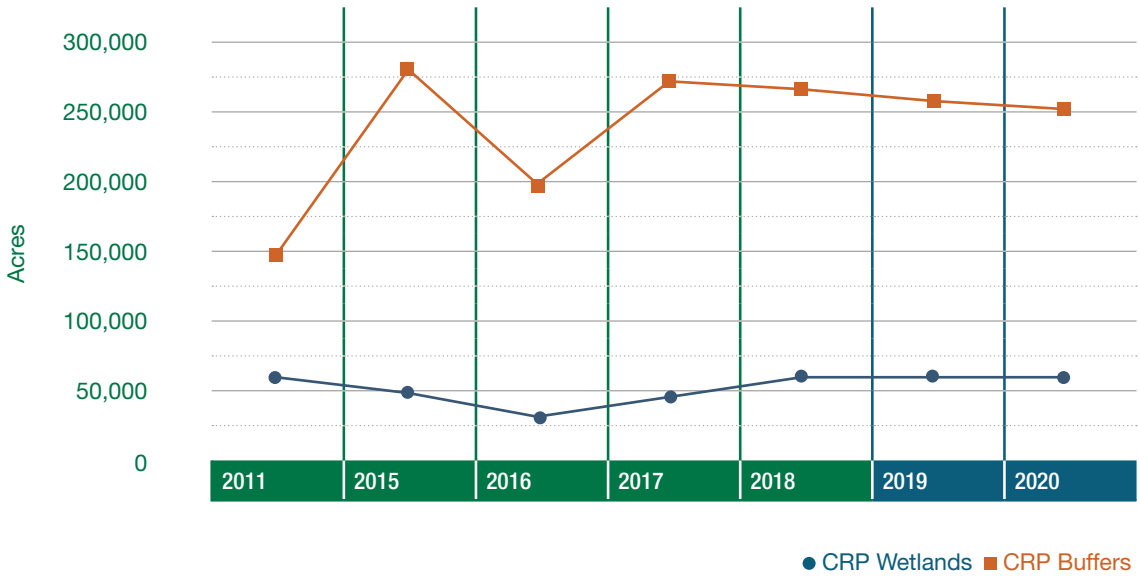


Figure 4.1. *Acres in CRP wetlands and buffers*

The number of acres in CRP perennials, energy, and pasture jumped by more than half a million from 2018 to 2019, with a slight decrease in 2020 (Table 4.5 and Figure 4.2). Included in this number are all acres certified with intended uses of forage, grazing, or left standing, as well as acreage enrolled in the following practices: introduced grasses (CP1), permanent native grasses (CP2), permanent wildlife habitat (CP4D), grassed waterway (CP8A), vegetative cover – grass – already established (CP10), contour grass strips (CP15A), contour grass strips on terraces (CP15B), rare and declining habitat (CP25), SAFE grass (CP38E), tree planting (CP3), hardwood tree planting (CP3A), SAFE trees (CP38C), pollinator habitat (CP42), prairie strip (CP43), and grasslands (CP87, CP87A, CP88, CP88A). More information on FSA conservation practices and land

measures can be found in the appendices. In 2020, there were 1,062,618 acres certified as forage, grazing, or left standing, and 523,645 acres enrolled in the perennial vegetation conservation practices listed above.

Table 4.5. *Acres in CRP perennials/energy/pasture*

	2011	2015	2016	2017	2018	2019	2020
CRP Perennials/ Energy/Pasture	985,531	1,524,379	1,386,378	1,547,612	1,086,474	1,606,621	1,586,263

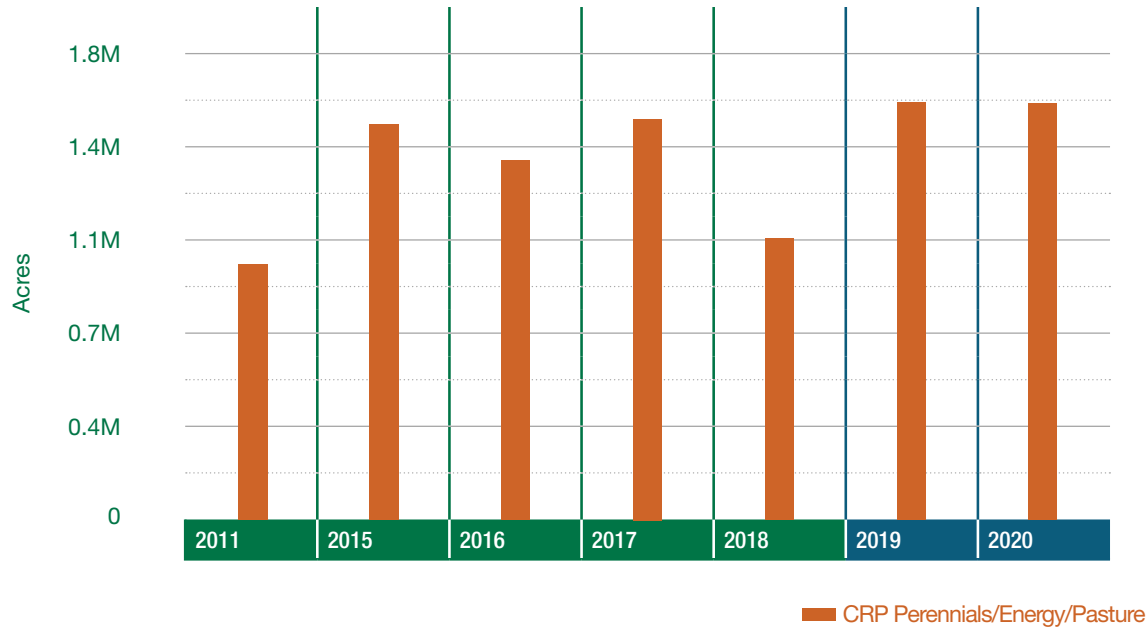


Figure 4.2. *Acres in CRP perennials/energy/pasture*

Cover Crops

Farmers who plant cover crops can report those acres to FSA when reporting their planted cash crop acres. The acres presented here were voluntarily reported and represent cover crops that were planted regardless of whether financial assistance from government conservation programs were used. SWCDs, along with other agricultural organizations, provided outreach during the 2019-20 growing seasons reminding farmers to report their cover crop acres to FSA. Cover crop acres include all farmland planted with a certified cover crop (intended use is "cover only"). For more information on FSA conservation practices and land measures, see the appendices. Cover crop acres saw a spike in 2019, which may be due to a large amount of prevent plant acres in response to widespread flooding (Table 4.6 and Figure 4.3).

Table 4.6. Acres in cover crops reported by producers to FSA

	2011	2015	2016	2017	2018	2019	2020
Cover Crops	768	11,064	27,064	83,980	92,970	427,410	131,757

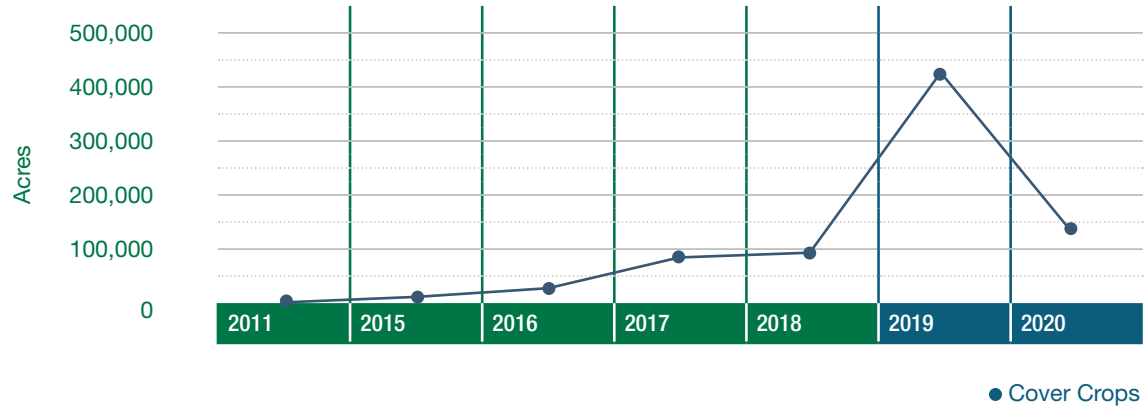


Figure 4.3. Acres in cover crops reported by producers to FSA

USDA Natural Resources Conservation Service

In Illinois, USDA NRCS administers multiple programs, including the Environmental Quality Incentives Program, Conservation Stewardship Program, and Agricultural Conservation Easement Program, which includes the Wetland Reserve Easement Program. These programs address multiple natural resource concerns, including nutrient loss and wetland restoration protection and enhancement.

These voluntary conservation programs support producers in making conservation work for them. Together, NRCS and producers invest in proven conservation practices that safeguard natural resources for the future while enhancing agricultural operations.

For detailed information on NRCS programs, see nrcs.usda.gov/wps/portal/nrcs/il/programs/farmbill/.

Environmental Quality Incentives Program

EQIP provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits, such as improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion and sedimentation, and improved or created wildlife habitat and mitigation against drought and increasing weather volatility.

In federal fiscal years 2019 and 2020, NRCS obligated 835 new EQIP contracts to implement conservation practices on 81,777 acres. This represents a total financial investment of $28,167,439. The totals represented in Table 4.7 and Figure 4.4 include all conservation practices implemented through EQIP.

Table 4.7. *Total acres enrolled in EQIP*

	2013	2014	2015	2016	2017	2018	2019	2020
Acres per Year	91,095	41,457	26,424	25,563	31,035	40,989	44,325	37,452

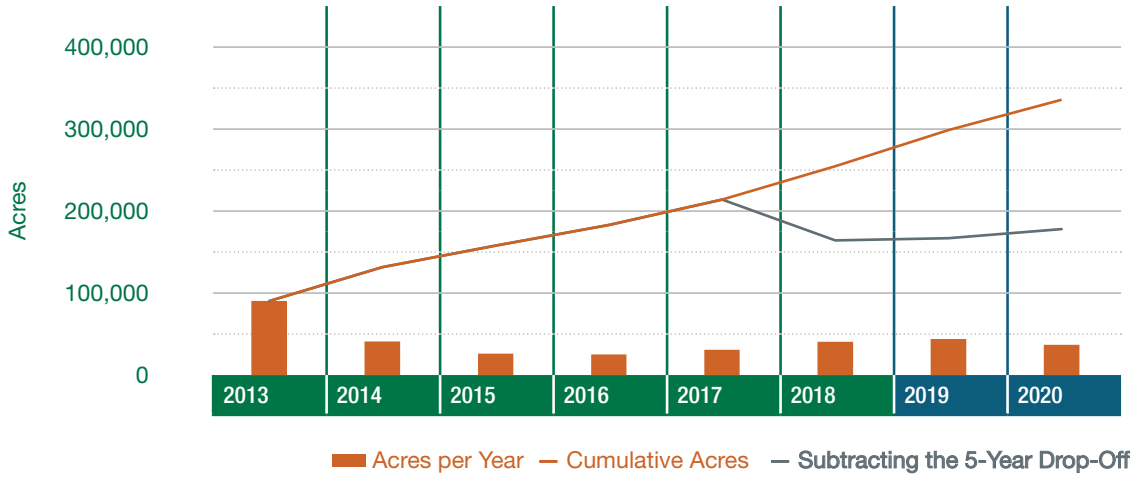


Figure 4.4. *Total acres enrolled in EQIP*

NRCS offers agricultural producers financial assistance and one-on-one support to design and execute NLRS recommended conservation practices. Using these practices can lead to cleaner water and air, healthier soil, and better wildlife habitat, all while enhancing agricultural operations. Through EQIP, producers can voluntarily implement conservation practices, and NRCS co-invests in these practices with them.

Table 4.8 and Figure 4.5 show the number of acres on which nutrient conservation practices were implemented through EQIP. Filter strips were installed on 23 acres in 2019, and on 0.4 acres in 2020. Nutrient management plans were implemented on 997 and 5,931 acres in 2019 and 2020, respectively. In 2019, conservation tillage was implemented on 398 acres, and on 4,418 acres in 2020. Cover crops were planted on 7,147 acres in 2019 and 4,400 acres in 2020. Perennial vegetation was established on 244 and 1,205 acres in 2019 and 2020, respectively. No EQIP wetlands were installed in

2019 or 2020. The table and figure also provide analogous information about dollars invested for each practice under this program.

Table 4.8. *Acres implemented and dollars spent on nutrient conservation practices through EQIP*

	2019 Acres	2019 Dollars	2020 Acres	2020 Dollars
Filter Strips (Buffers)	23.1	$12,718	0.4	$243
Nutrient Management	997	$14,089	5,931	$90,326
Conservation Tillage	398	$6,382	4,418	$75,327
Cover Crops	7,147	$432,242	4,400	$245,247
Perennials	244	$58,373	1,205	$351,273
Wetlands	0	$0	0	$0

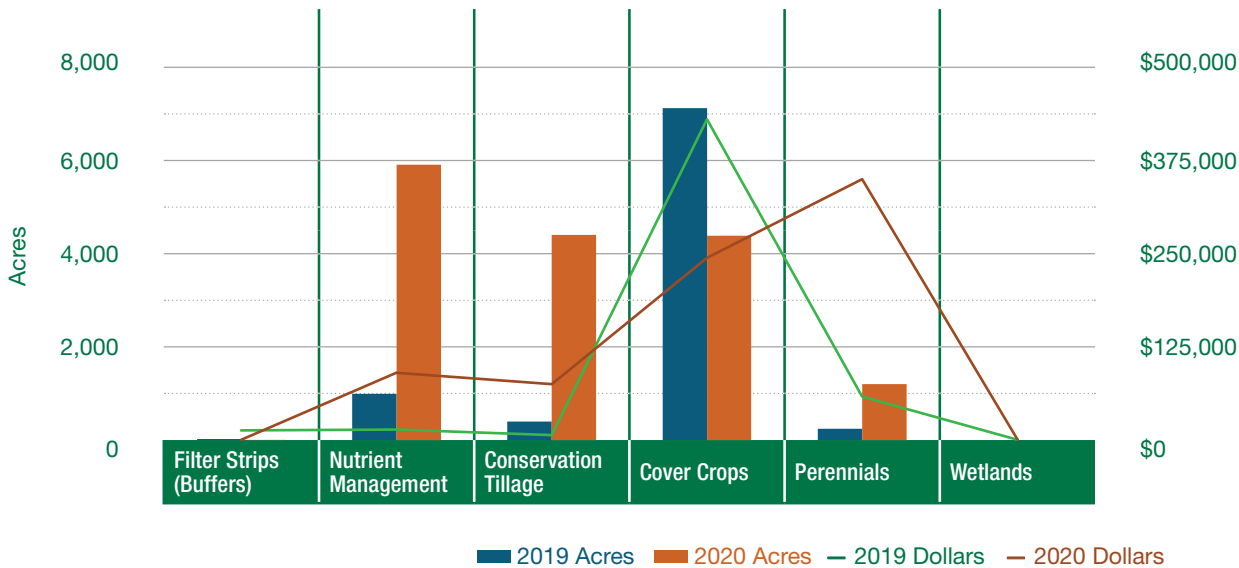


Figure 4.5. *Acres implemented and dollars spent on nutrient conservation practices through EQIP*

Conservation Stewardship Program

The Conservation Stewardship Program provides financial and technical assistance to farmers for maintaining and improving existing conservation systems, as well as adopting additional conservation activities. Participants earn CSP payments for conservation performance — the higher the performance, the higher the payment.

In fiscal years 2019 and 2020, NRCS obligated 671 new CSP contracts on 305,542 acres for a total financial investment of $40,567,006. The totals represented in Table 4.9 and Figure 4.6 include all conservation practices implemented through the CSP.

Table 4.9. *New acres enrolled in CSP*

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Acres per Year	165,416	229,815	188,731	399,024	214,557	160,172	149,844	200,455	122,638	182,904
Subtracting the 5-Year Drop-Off	165,416	395,231	583,962	982,986	1,197,543	1,192,299	1,112,328	1,124,052	847,666	816,013
Cumulative Acres	165,416	395,231	583,962	982,986	1,197,543	1,357,715	1,507,559	1,708,014	1,830,652	2,013,556

Data source: NRCS At a Glance

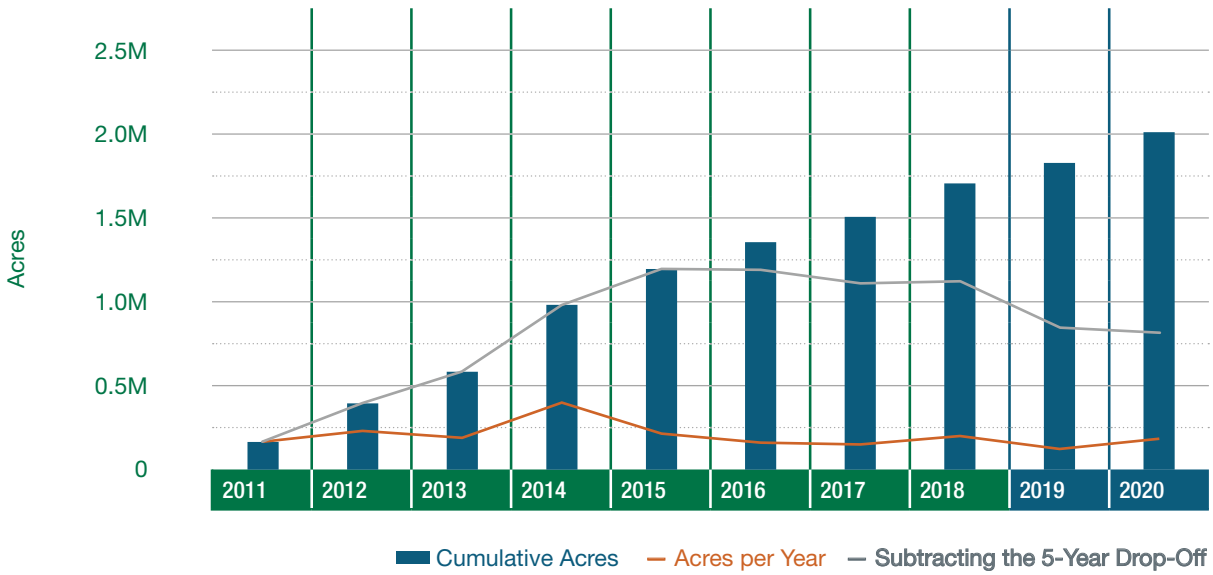


Figure 4.6. *Acres enrolled in CSP, 2011-20*

Table 4.10 and Figure 4.7 show the number of acres on which nutrient conservation practices were implemented through CSP. Filter strips were installed on two acres in 2019 and seven acres in 2020. Nutrient management plans were implemented on 37,895 and 117,558 acres in 2019 and 2020, respectively. In 2019, conservation tillage was implemented on 19,875 acres and on 44,550 acres in 2020. Cover crops were planted on 19,271 acres in 2019 and 37,907 acres in 2020. Perennial vegetation was established on 291.6 and 1,026 acres in 2019 and 2020, respectively. The table and figure also provide analogous information about dollars invested for each practice under this program.

Table 4.10. Acres implemented and dollars spent on nutrient conservation practices through CSP

	2019 Acres	2019 Dollars	2020 Acres	2020 Dollars
Filter Strips (Buffers)	2	$941	7	$4,576
Nutrient Management	37,895	$485,612	117,558	$1,543,252
Conservation Tillage	19,875	$67,604	44,550	$154,643
Cover Crops	19,271	$178,806	37,907	$342,331
Perennials	291.6	$11,857	1,026	$23,194

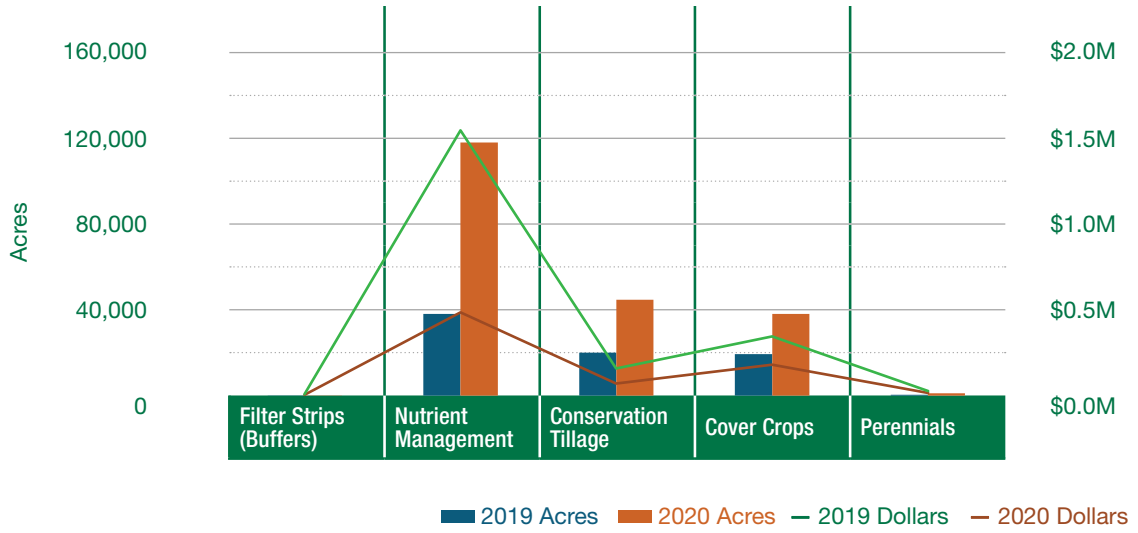


Figure 4.7. Acres implemented and dollars spent on nutrient conservation practices through CSP

Agriculture Conservation Easement Program

The Agriculture Conservation Easement Program helps landowners, land trusts, and other entities protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements. Under the Agricultural Land Easements component, NRCS helps American Indian tribes, state and local governments, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetland Reserve Easements component, NRCS helps to restore, protect, and enhance enrolled wetlands. The Wetland Reserve Enhancement Partnership continues to be a voluntary program through which NRCS signs agreements with eligible partners to leverage resources to carry out high priority wetland protection, restoration and enhancement, and to improve wildlife habitat. Unlike other conservation practices, wetlands are neither seasonal, nor annual contract-based, so acres enrolled in this program in the past remain on the landscape.

In fiscal years 2019 and 2020, NRCS funded 17 new agreements with landowners to purchase easements on 2,912 acres for $12,100,000. Table 4.11 and Figure 4.8 show the new wetland acres enrolled in WREP. In 2019, 1,403 acres were enrolled; 1,509 acres were enrolled in 2020. Cumulatively, 11,487 acres of wetlands have been enrolled in this program since 2011.

Photo courtesy of Ryan Pankau, Illinois Extension

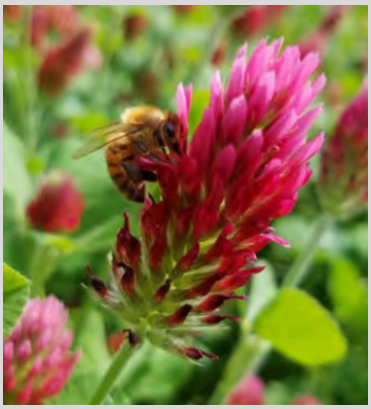


Table 4.11. *New wetland acres enrolled in WREP*

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Acres per Year	1,788	1,420	569	305	396	1,237	2,600	260	1,403	1,509
Cumulative Acres	1,788	3,208	3,777	4,082	4,478	5,715	8,315	8,575	9,978	11,487

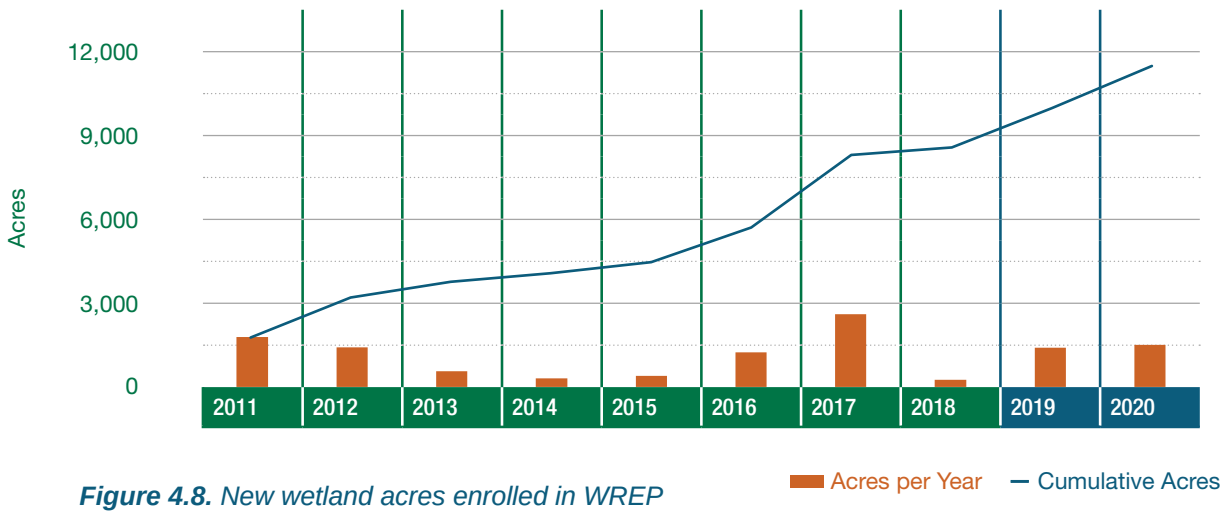


Figure 4.8. *New wetland acres enrolled in WREP*

Mississippi River Basin Healthy Watersheds Initiative

Through the Mississippi River Basin Healthy Watersheds Initiative (Figure 4.9), NRCS and partners work with producers and landowners to implement voluntary conservation practices that improve water quality, restore wetlands, enhance wildlife habitat, and sustain agricultural profitability in the Mississippi River Basin.

In fiscal years 2019 and 2020, NRCS obligated 43 new MRBI contracts to implement conservation practices on 7,331 acres. This represents a total financial investment of $1,030,148.

For more information on MRBI in Illinois, see nrcs.usda.gov/wps/portal/nrcs/il/programs/landscape/NRCSEPRD326423/.

Mississippi River Basin Healthy Watersheds Initiative

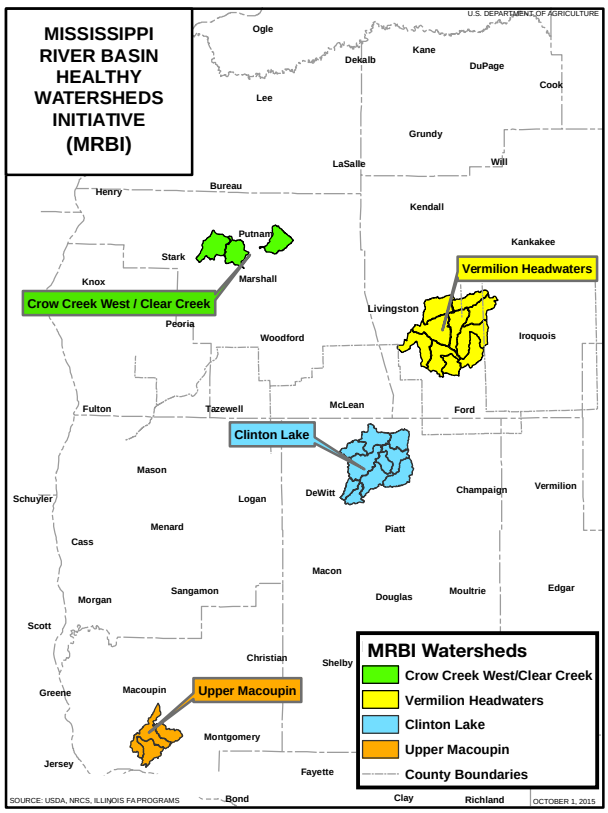


Figure 4.9. *Mississippi River Basin Healthy Watersheds Initiative participating locations*

National Water Quality Initiative

Through the National Water Quality Initiative (Figure 4.10), eligible producers implement voluntary conservation practices to contribute to cleaner water for their neighbors in impaired watersheds where federal investments can improve water quality. Using EQIP funds, NRCS provides financial and technical assistance to producers to implement conservation practices, such as nutrient management, cover crops, no-till, grassed waterways, terraces, and water and sediment control basins.

In fiscal years 2019 and 2020, NRCS obligated 17 new NWQI contracts to implement conservation practices on 1,692 acres. This represents a total financial investment of $558,579.

For more about this initiative, see nrcs.usda.gov/wps/portal/nrcs/il/programs/landscape/NRCS141P2_030483/.

Eligible NWQI Watersheds in Illinois

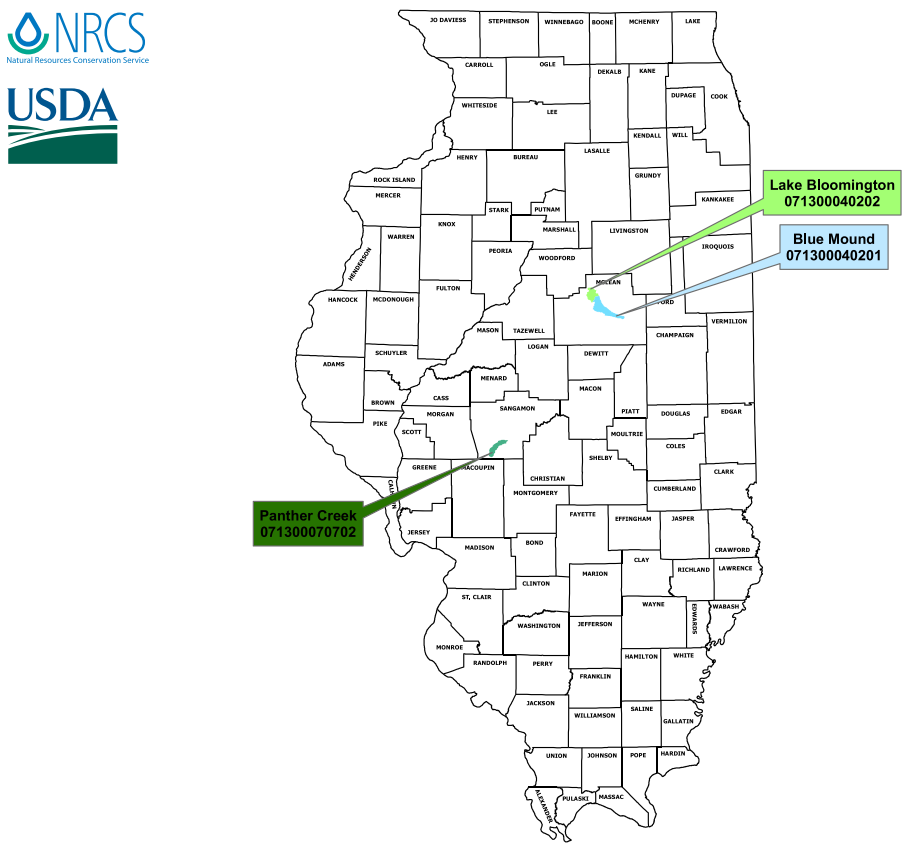


Figure 4.10. *Eligible NWQI watersheds in Illinois*

Regional Conservation Partnership Program

The Regional Conservation Partnership Program (Table 4.12 and Figure 4.11) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and RCPP conservation program contracts. For more information on RCPP projects in Illinois, see nrcs.usda.gov/wps/portal/nrcs/il/programs/farmbill/rcpp/.

RCPP projects include:

- Upper Macoupin Creek Watershed Partnership
- Illinois Headwaters Conservation Partnership
- Otter Lake Source Water Protection
- Precision Conservation Management
- MRB-Big Bend Enhancing Water - Soil - Habitat Quality Project
- Driftless Area Habitat for the Wild and Rare Phase 2

Table 4.12. *Acres implemented and dollars spent on nutrient conservation practices through RCPP*

	Filter Strips (Buffers)	Nutrient Management	Conservation Tillage	Cover Crops	Perennials	Wetlands
2019 Acres	0	3,154.85	198.2	4,743.3	49	0
2019 Dollars	$0	$2,572	$2,571	$211,680	$1,463	$0
2020 Acres	0	384.3	5,150.2	2,974.8	197.9	0
2020 Dollars	$0	$4,415	$33,837	$92,509	$3,477	$0

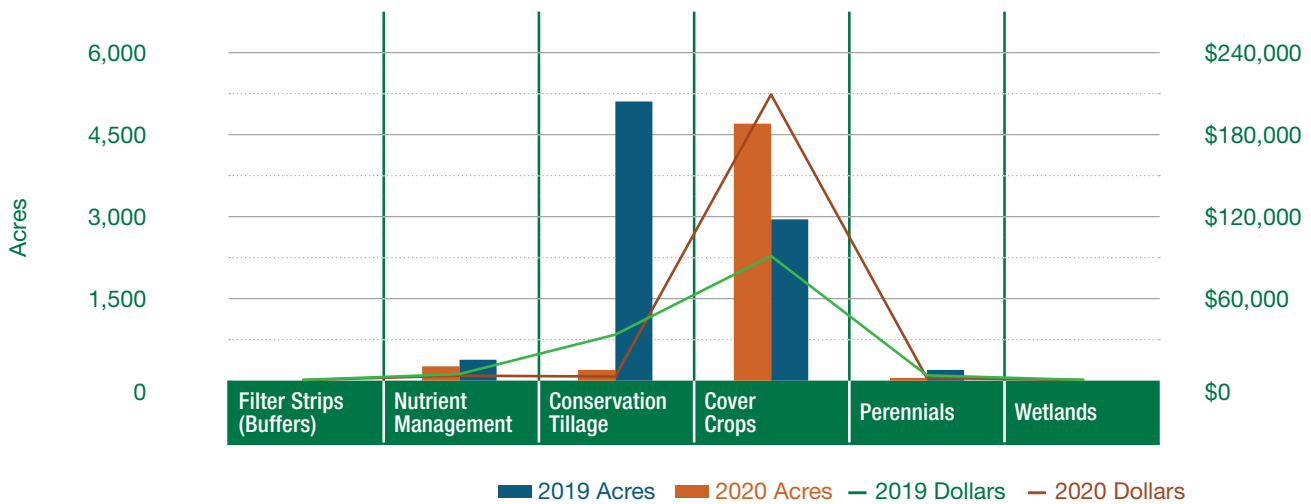


Figure 4.11. *Acres implemented and dollars spent on nutrient conservation practices through RCPP*

Upper Macoupin Creek Watershed Partnership

Through the Upper Macoupin Creek Watershed Partnership (Figure 4.12) with NRCS, the American Farmland Trust and 15 partners continue to advance the adoption of conservation practices that improve soil health, reduce nutrient loads, and provide economic benefits to local farms. Since 2015, the partnership has invested more than $1.6M in conservation practices through RCPP and MRBI funding. In 2019, the partnership completed a nine-element watershed plan, and is currently launching an online interface using the Spatial Watershed Assessment and Management Tool to identify and track implementation of priority practices. See the Current Programs and Projects section later in this chapter for more information.

Upper Macoupin Creek Watershed Partnership

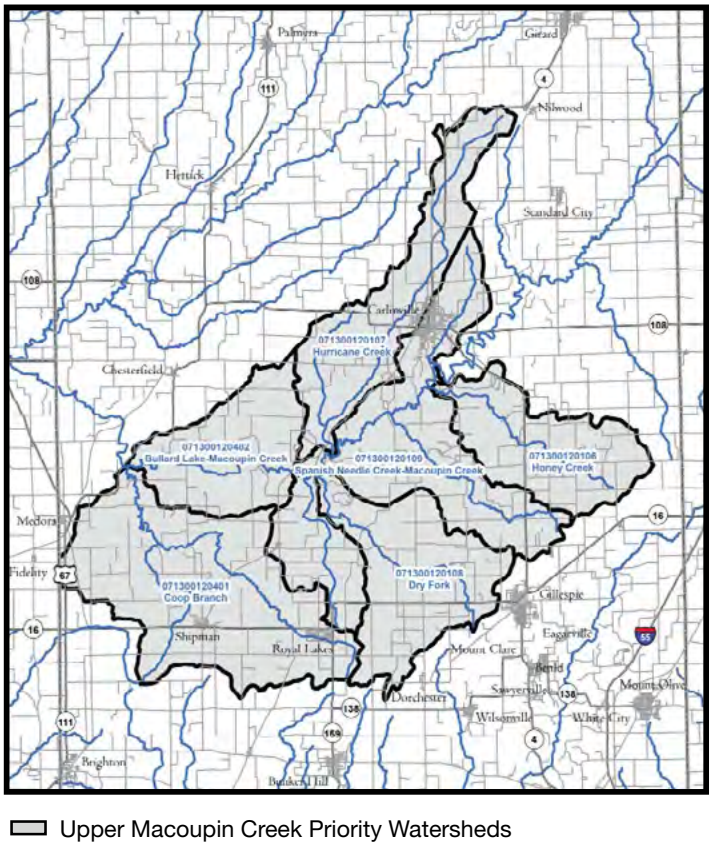


Figure 4.12. *Upper Macoupin Creek Watershed Partnership*

Illinois Headwaters Conservation Partnership

Photo courtesy of Roger Inman, Master Naturalist

The Headwaters Invasive Plant Partnership (Figure 4.13) includes portions of the historically prairie-dominated Grand Prairie Region, as well as the South-Central Region, where forest slightly exceeded prairie acreage. While forest may not be the dominant land cover in the HIPP area, it greatly contributes to the biological diversity of the region. Recreation opportunities in the forest include hunting, hiking, and camping. Healthy forests are essential for reducing soil erosion, protecting water quality, and reversing pollinator decline.

Illinois Headwaters RCPP Area

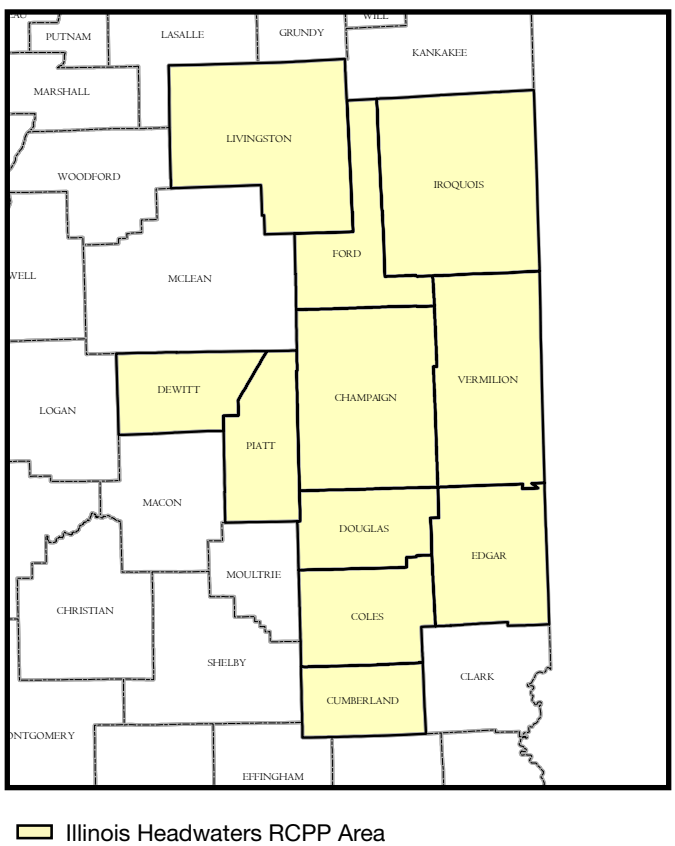


Figure 4.13. *Counties participating in the Illinois Headwaters Forest Improvement Partnership*

Otter Lake Source Water Protection

Photo courtesy of Jennifer Jones, Illinois Extension

Otter Lake (Figure 4.14) is located in the heart of Illinois corn and soybean country and its primary purpose is to provide drinking water for 19,000 rural residents. Every day, the lake provides the water supply for six towns, two villages, and two rural water districts. The Otter Lake Source Water Protection Project will protect Otter Lake by reducing excessive levels of sedimentation and nutrient loading. The project will enable conservation practice to be micro-targeted to areas of greatest resource need.

Otter Lake Watershed

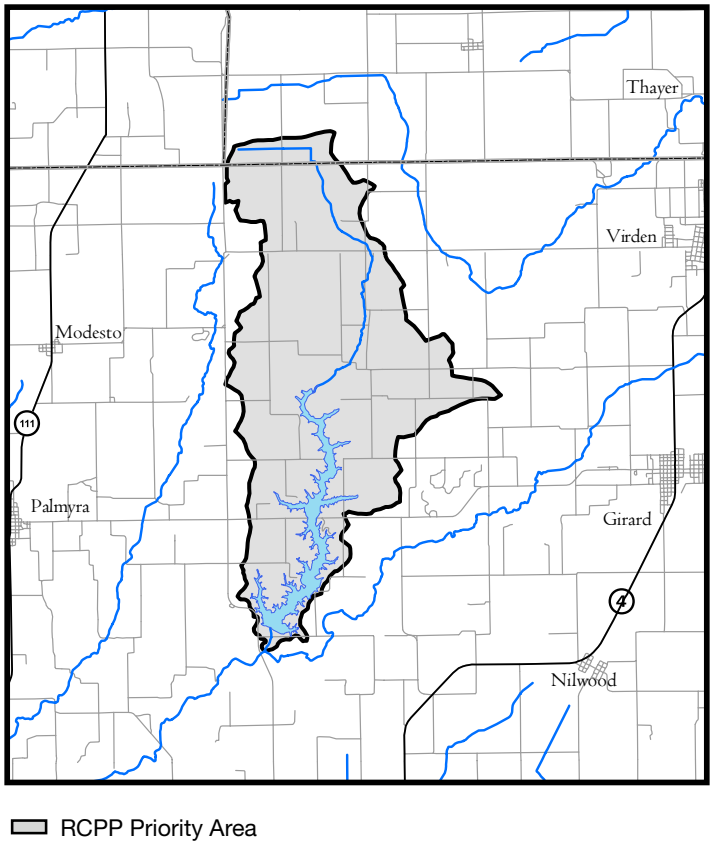


Figure 4.14. *Otter Lake watershed*

Precision Conservation Management

Precision Conservation Management (Figure 4.15) is a program led jointly by ICGA and ISA. PCM was launched in 2016 in response to the Illinois NLRS and has worked with over 300 Illinois farmers and about 50 farmers in Kentucky. PCM's objective is to help farmers adopt and scale the use of conservation practices in a financially responsible way. PCM recognizes that every conservation decision is a business decision for farmers. Through collaborations with more than 30 partners and the development of a farmer-friendly data collection platform, PCM offers one-on-one technical support, confidential yearly reports of each farmer's environmental and financial strengths and weaknesses, data summaries demonstrating financial and environmental outcomes of various management systems, and opportunities to receive financial and technical assistance for adopting new conservation practices. To learn more about PCM, see the program summary and four-year data highlights in the Current Programs and Projects section later in this chapter.

Precision Conservation Management

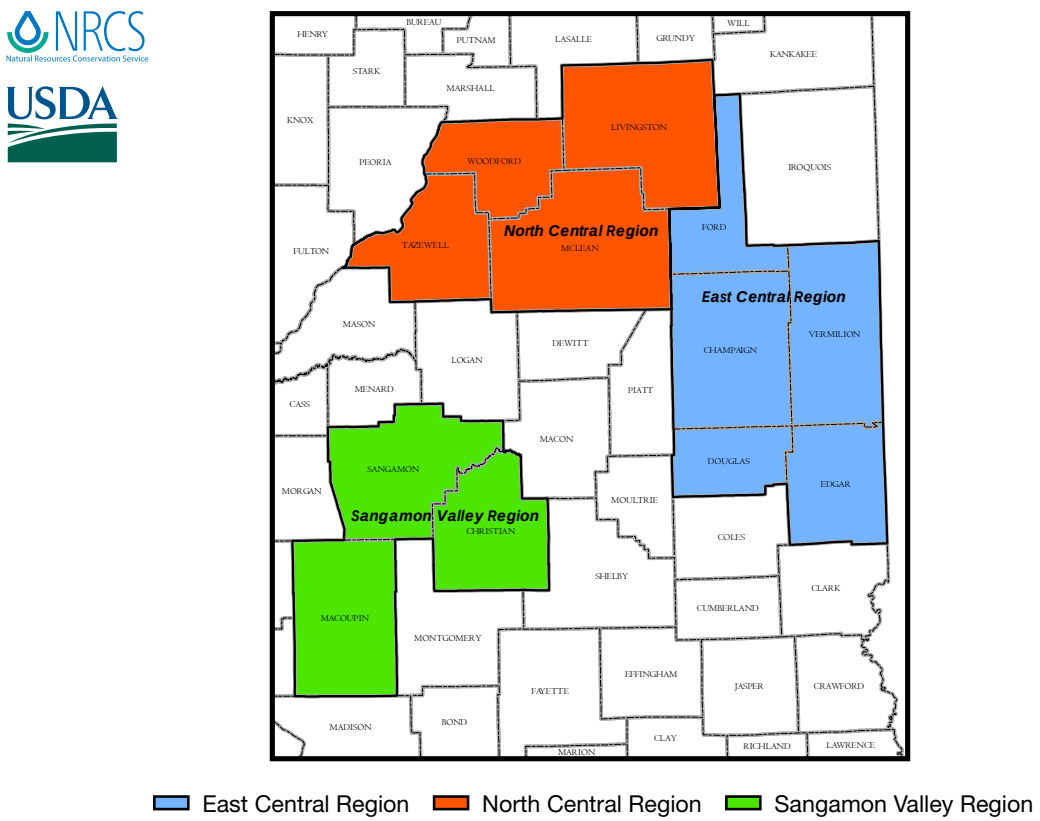


Figure 4.15. *PCM areas*

MRB-Big Bend Enhancing Water - Soil - Habitat Quality Project

The Mississippi River Basin – Big Bend Enhancing Water – Soil – Habitat Quality Project (Figure 4.16) is located in the critical conservation area, Mississippi River Basin. It focuses on the priority/impaired Illinois River basin watershed lying within the boundaries of Marshall and Putnam counties along the big bend of the Illinois River. The project will employ an overarching approach of melding the application of conservation practices that address soil erosion, soil health, and inadequate habitat for fish and wildlife.

The RCPP-EQIP funds for this project are no longer available.

MRB-Big Bend Enhancing Water - Soil - Habitat Quality Project

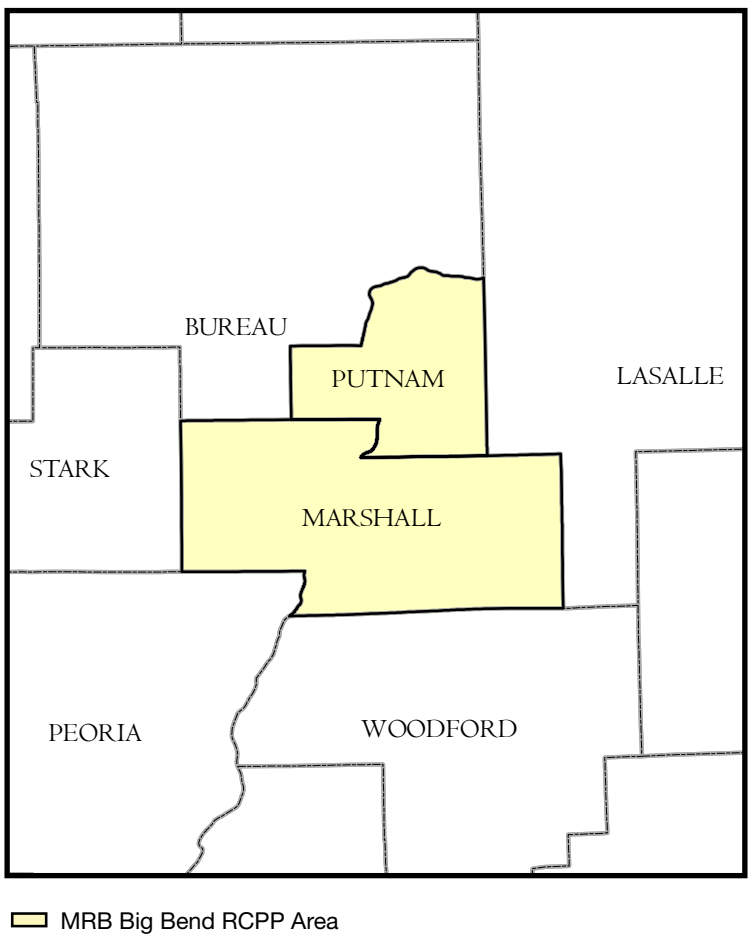
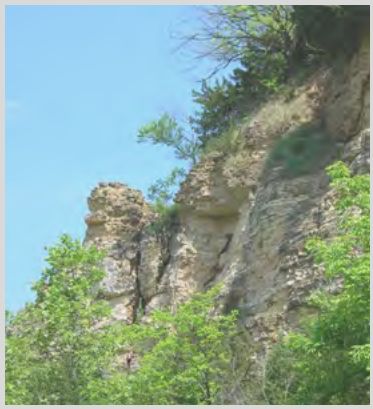


Figure 4.16. *MRB-Big Bend Enhancing Water – Soil – Habitat Quality Project boundaries*

Driftless Area Habitat for the Wild and Rare Phase 2

The Driftless Area (southeast Minnesota, southwest Wisconsin, northeast Iowa, and northwest Illinois) was bypassed by the last continental glacier and features steep valleys, sandstone bluffs, and more than 600 unique spring-fed creeks and ridges once covered in prairie and scattered oaks (Figure 4.17). This ancient landscape supports a variety of plants and animals, including dozens of uncommon species. This diversity provides critical habitat for dozens of species of concern in the State Wildlife Action Plan and has been cited as one of North America's most important resources.

Photo courtesy of Jay Solomon, Illinois Extension



RCPP Driftless Area Habitat for the Wild & Rare Phase 2

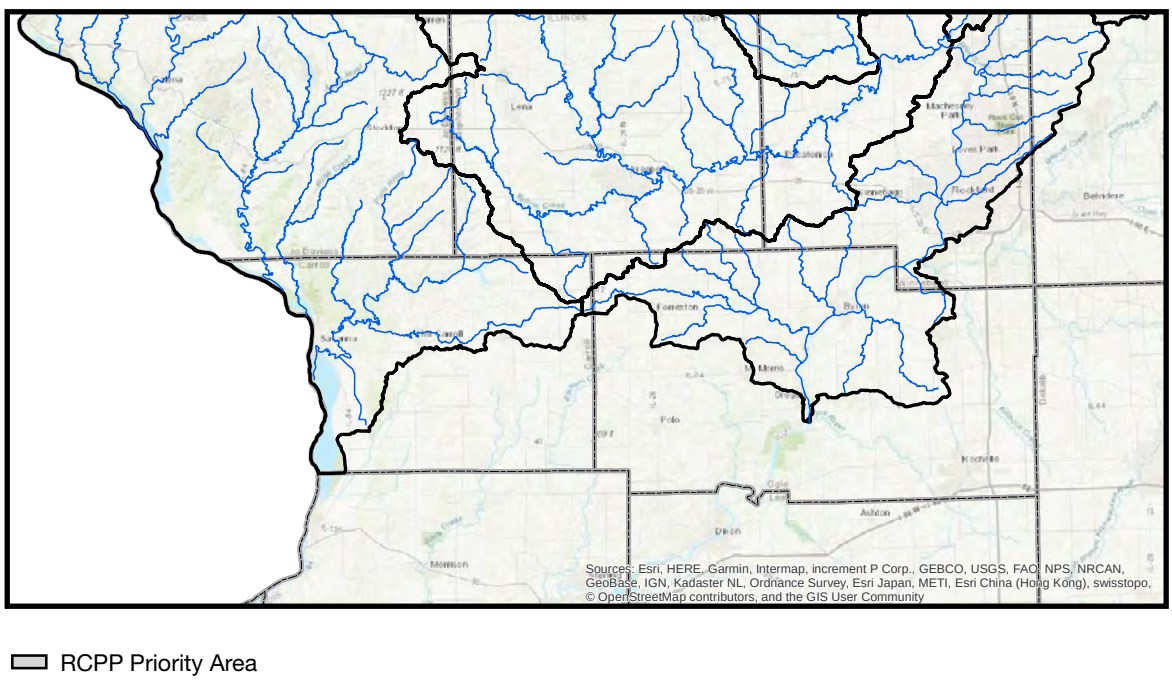


Figure 4.17. *RCPP Driftless Area Habitat for the Wild & Rare Phase 2*

USDA National Agricultural Statistics Service

Illinois NLRS Survey

While it has been a straightforward process to document conservation practices put in place through federal and state programs explained in this report, data on the number of practices implemented by farmers not engaged in incentive programs were not readily available. A statistically significant survey of Illinois farmers conducted by NASS and funded by the Illinois NREC, helped shed some light on farmer knowledge and conservation practice adoption in support of Illinois NLRS goals. The first NLRS Survey conducted by NASS took place in 2017 and covered the 2015 crop year and the benchmark/baseline year of 2011. The current survey covers the 2019 crop year and general knowledge questions reference respondents' understanding at the time of the interview, in early 2020. NASS plans to continue conducting the survey biennially as resources allow.

Nitrogen Management

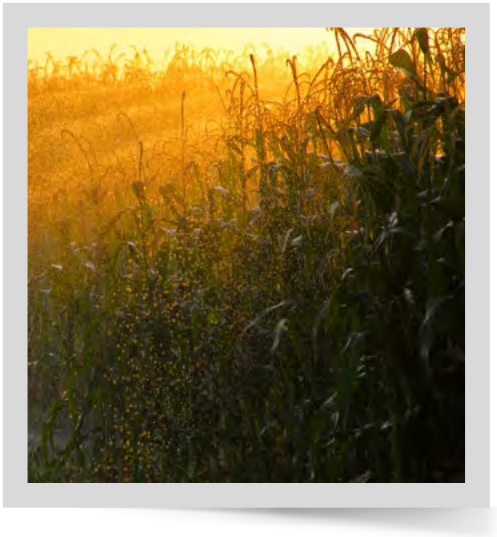
Many producers are using some type of professional recommendation as they decide how much nitrogen to apply on their corn acres. Table 4.13 shows the results of the NLRS Survey conducted by NASS. The results indicate that producers used the Maximum Return to Nitrogen strategy to help determine the amount of nitrogen they would apply to one-third of their 2019 corn acres. In addition to the MRTN strategy, producers used other industry-recommended techniques on 70% of their corn acres.

NOTE: Many producers considered more than one strategy before finalizing their decisions for nitrogen applications. Two or more strategies could have been considered before applying nitrogen to some acres of corn in 2019; therefore, the sum of percentages in the table below is greater than 100%.

Table 4.13. *Acres with a nitrogen management strategy*

	Acres in 2011	Acres in 2015	Acres in 2017	Acres in 2019
Acres of corn planted	12,600,000	11,700,000	11,200,000	10,500,000
Acres where an MRTN strategy was used to determine application rates	8,820,000 or 70% of planted acres	9,430,000 or 81% of planted acres	3,730,000 or 33% of planted acres	3,700,000 or 33% of planted acres
Acres where other industry-approved technique was used to determine application rates	Not asked	Not asked	7,750,000 or 69% of planted acres	7,390,000 or 70% of planted acres

Photo courtesy of Brian Rennecker, IDOA



Fertilizer Application Strategies (Nitrification Inhibitors)

Tables 4.14 and 4.15 reflect questions about nitrification inhibitors. The NLRS Survey conducted by NASS shows that 14% of the 2019 corn acres on tiled ground were fertilized in the fall or winter with a nitrification inhibitor. For non-tiled acres, that percentage was 5%.

Table 4.14. *Fertilizer application strategies for corn on tiled acres*

	Acres in 2011	Acres in 2015	Acres in 2017	Acres in 2019
Acres of corn planted	12,600,000	11,700,000	11,200,000	10,500,000
Fall/winter nitrogen was applied with a nitrification inhibitor	3,240,000 or 26% of planted acres	2,970,000 or 25% of planted acres	3,550,000 or 32% of planted acres	1,460,000 or 14% of planted acres
Spring nitrogen was applied with a nitrification inhibitor	Not asked	Not asked	2,790,000 or 25% of planted acres	2,220,000 or 21% of planted acres

Producers also used nitrification inhibitors when applying fertilizer in the spring. The NLRS Survey conducted by NASS shows that 21% of corn acres on tiled ground were fertilized in the spring with a nitrification inhibitor, and 20% of corn acres on non-tiled ground were fertilized in the spring with a nitrification inhibitor.

Table 4.15. *Fertilizer application strategies for corn on non-tiled acres*

	Acres in 2011	Acres in 2015	Acres in 2017	Acres in 2019
Acres of corn planted	12,600,000	11,700,000	11,200,000	10,500,000
Fall/winter nitrogen was applied with a nitrification inhibitor	Not asked	Not asked	1,040,000 or 9% of planted acres	540,000 or 5% of planted acres
Spring nitrogen was applied with a nitrification inhibitor	Not asked	Not asked	1,040,000 or 9% of planted acres	2,070,000 or 20% of planted acres

Fertilizer Application Strategies (Timing of Applications)

The NLRS recommends several specific strategies for the timing of fertilizer applications. The NLRS Survey conducted by NASS asked producers which of those strategies they used, if any, in preparation for the 2019 corn crop (Table 4.16).

Strategy 1 Fall and winter nitrogen applied was less than 50% of total nitrogen applications.

Strategy 2 Fall and winter nitrogen was 0% of total nitrogen (all spring applications).

Strategy 3 Less than 50% of nitrogen applied in fall and winter, with remaining nitrogen applications split between pre-plant and sidedress applications.

Photo courtesy of IFCA

Table 4.16. *Fertilizer application strategies for corn on tiled acres*

	Acres in 2011	Acres in 2015	Acres in 2017	Acres in 2019
Acres of corn planted	12,600,000	11,700,000	11,200,000	10,500,000
STRATEGY 1 – Fall/winter nitrogen was 50% or less of total nitrogen	940,000 or 7% of planted acres	950,000 or 8% of planted acres	780,000 or 7% of planted acres	330,000 or 3% of planted acres
STRATEGY 2 – Fall/winter nitrogen was 0% of total nitrogen (all spring applications)	2,480,000 or 20% of planted acres	2,660,000 or 23% of planted acres	1,850,000 or 17% of planted acres	1,720,000 or 16% of planted acres
STRATEGY 3 – Less than 50% fall/winter applications, with remaining nitrogen applications split between pre-plant and sidedress applications	1,730,000 or 14% of planted acres	2,220,000 or 19% of planted acres	1,790,000 or 16% of planted acres	1,930,000 or 18% of planted acres

The same questions were asked about corn on non-tiled acres with results presented in Table 4.17.

Table 4.17. *Fertilizer application strategies for corn on non-tiled acres*

	Acres in 2011	Acres in 2015	Acres in 2017	Acres in 2019
Acres of corn planted	12,600,000	11,700,000	11,200,000	10,500,000
STRATEGY 1 – Fall/winter nitrogen was 50% or less of total nitrogen	Not asked	Not asked	340,000 or 3% of planted acres	110,000 or 1% of planted acres
STRATEGY 2 – Fall/ winter nitrogen was 0% of total nitrogen (all spring applications)	Not asked	Not asked	1,250,000 or 11% of planted acres	990,000 or 9% of planted acres
STRATEGY 3 – Less than 50% fall/winter applications, with remaining nitrogen applications split between pre-plant and sidedress applications	Not asked	Not asked	930,000 or 8% of planted acres	740,000 or 7% of planted acres

Phosphorus Management

Since 2011, many producers have reduced the amount of phosphorus they apply on their cropland (Table 4.18). The NLRS Survey conducted by NASS shows that producers made those reductions on 7.4 million acres of tiled cropland and 3.8 million acres of non-tiled cropland. Also, many producers have changed their phosphorus application method from broadcast to subsurface, or banding. The survey shows that those changes were made on 1.44 million tiled acres and 870,000 non-tiled acres.

Table 4.18. *Phosphorus application questions for tiled and non-tiled acres*

		Acres in 2017	Acres in 2019
Tiled Acres	Acres where phosphorus application rates were reduced since 2011	4,440,000	7,410,000
Non-Tiled Acres	Acres where phosphorus application rates were reduced since 2011	2,150,000	3,800,000
Tiled Acres	Acres where placement of phosphorus applications were moved from broadcast to subsurface or banding	1,530,000	1,440,000
Non-Tiled Acres	Acres where placement of phosphorus applications were moved from broadcast to subsurface or banding	280,000	870,000

As Table 4.19 shows, when asked about the reasons for reducing phosphorus applications, producers responded as follows:

- Updated Illinois Agronomy Handbook removal rates were cited as the reason for phosphorus reductions on nearly 4.5 million acres.
- Soil test results were cited as the reason for reductions on nearly 9.5 million acres.
- Other reasons, including cost, were cited as reasons for reductions on just over 5 million acres.

NOTE: The questionnaire allowed producers to cite multiple reasons for reducing phosphorus applications on the same acres.

***Table 4.19.** Reasons cited for reducing phosphorus applications*

	Acres in 2017	Acres in 2019
The Illinois Agronomy Handbook removal rates for phosphorus were updated	2,390,000	4,460,000
Soil test information	4,520,000	9,470,000
Other reasons, including cost	2,420,000	5,030,000

Cover Crops

As Table 4.20 shows, the NLRS Survey conducted by NASS included questions about the seeding of cover crops in 2019, on both tiled and non-tiled acres of corn and soybeans. The questions were phrased to capture cover crops seeded into standing 2019 crops, or after the 2019 crop was harvested. Results show that farmers seeded 930,000 acres of cover crops on tiled acres and 480,000 acres of cover crops on non-tiled acres for a total of 1,410,000 acres.

***Table 4.20.** Cover crop questions for tiled and non-tiled acres*

	Acres
Corn/soybean acres planted to cover crops after the 2019 crop season on tiled ground	930,000
Corn/soybean acres planted to cover crops after the 2019 crop season on non-tiled ground	480,000
Corn/soybean acres planted to cover crops after the 2017 crop season on tiled ground	290,000
Corn/soybean acres planted to cover crops after the 2017 crop season on non-tiled ground	420,000
Corn/soybean acres planted to cover crops after the 2015 crop season on tiled ground	490,000
Corn/soybean acres planted to cover crops after the 2015 crop season on non-tiled ground	630,000
Corn/soybean acres planted to cover crops after the 2011 crop season on tiled ground	220,000
Corn/soybean acres planted to cover crops after the 2011 crop season on non-tiled ground	380,000

General Questions

The NLRS Survey conducted by NASS included a series of general knowledge questions about the NLRS and conservation practices (Table 4.21).

NOTE: While the reference year for the most recent survey was the 2019 crop season, the survey questions were posed to producers in 2020. On the previous survey, the general knowledge questions were posed to producers in early 2019.

Survey results revealed that farmers are most knowledgeable about cover crops, followed by using the MRTN method for determining nitrogen fertilizer rates. Forty-three percent of farmers reported being somewhat to very knowledgeable about the NLRS. They are less knowledgeable about edge-of-field practices, such as bioreactors and constructed wetlands.

Table 4.21. *General knowledge questions (percent reporting)*

		Not at All Knowledgeable	Slightly Knowledgeable	Somewhat Knowledgeable	Knowledgeable	Very Knowledgeable
2020	Nutrient Loss Reduction Strategy	26.9%	29.9%	20.7%	10.7%	11.8%
	MRTN Strategy	30.2%	29.0%	17.6%	14.7%	8.5%
	Woodchip Bioreactors	54.7%	17.2%	14.4%	11.5%	2.2%
	Constructed Wetlands	42.1%	20.5%	16.5%	17.9%	3%
	Cover Crop Management	9.1%	24.7%	27.7%	26.1%	12.4%
2019	Nutrient Loss Reduction Strategy	21%	27%	38.4%	11.6%	2%
	MRTN Strategy	20.3%	33.5%	25.5%	14.1%	6.6%
	Woodchip Bioreactors	53.8%	23%	15%	5.5%	2.7%
	Constructed Wetlands	19.7%	29.6%	38%	10.2%	2.5%
	Cover Crop Management	15.2%	16.7%	35.5%	28.4%	4.2%

Edge-of-Field Questions

The NLRS Survey conducted by NASS included questions on edge-of-field practices like bioreactors, constructed wetlands, and saturated buffers. However, survey results for bioreactors could not be published in the last few reports due to confidentiality constraints and it can be inferred that few tile drainage systems

in Illinois have bioreactors installed. Numbers for constructed wetlands and saturated buffers are similarly limited. Going forward, NASS will not include questions on edge-of-field practice acres in the survey. These practices will be tracked and reported through traditional state and federal cost-share programs and other information channels, provided on a voluntary basis.

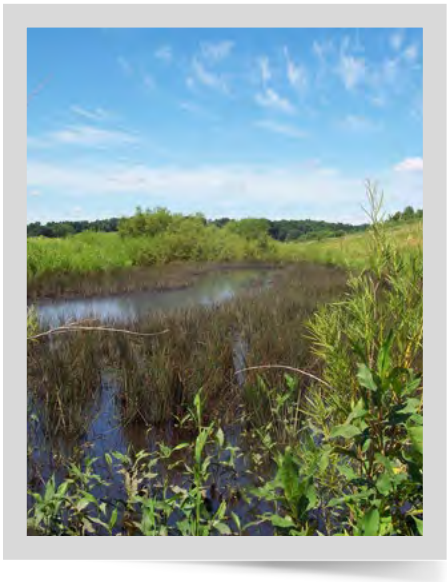
State Conservation Programs

Illinois Department of Natural Resources

Conservation Reserve Enhancement Program

Illinois Department of Natural Resources administers the Conservation Reserve Enhancement Program, a targeted federal and state incentive program that couples enhanced USDA CRP incentives and payments with state payments. Illinois CREP is the second oldest CREP in the nation. Participation is voluntary and is more financially rewarding than other CRP options. Illinois CREP participants may elect to extend the benefits of their CRP contract through a 15-year, 35-year, or permanent CREP state easement, which goes into effect when the federal CRP contract expires, or is terminated. CREP is currently offered in the Illinois River and Kaskaskia River basins (Figure 4.18).

Photo courtesy of IDNR



Several CREP goals correspond with the goals of the Illinois NLRS:

- Goal 1 — Help meet federal goals to reduce nitrogen loading to the Mississippi River and the Gulf of Mexico, thereby helping to reduce hypoxia in the Gulf of Mexico.
- Goal 1a — Reduce the amount of silt and sedimentation entering the main stem of the Illinois and the Kaskaskia rivers by 20%.
- Goal 1b — Reduce the amount of phosphorus and nitrogen in the Illinois and Kaskaskia rivers by 10%.

CREP Eligible Watersheds

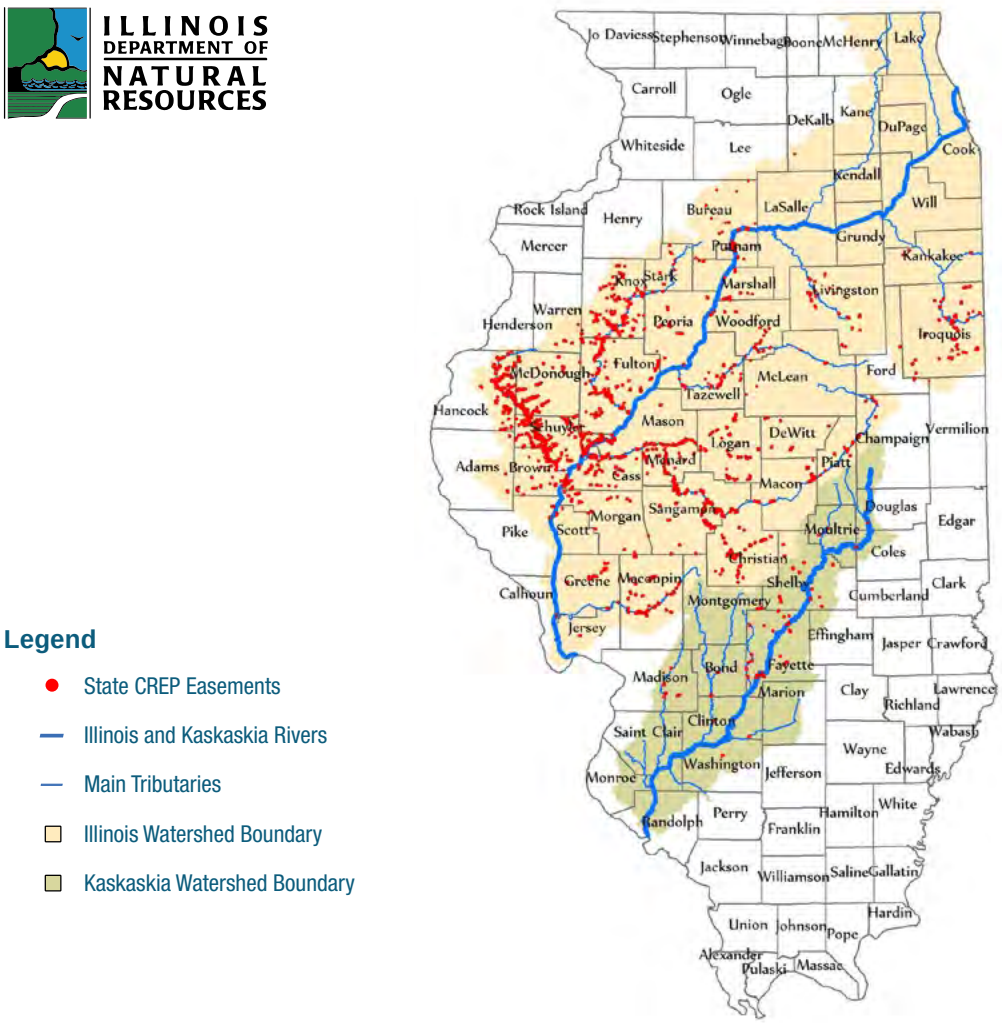


Figure 4.18. *CREP-eligible watersheds*

Conservation practice acres that are under federal CRP contract are not considered part of the state program until that contract expires. Acres of conservation practices implemented with CREP assistance since 2011 are shown in Table 4.22 and Figure 4.19. Due to the lack of a state budget for fiscal years 2016 and 2017, the state of Illinois was unable to offer funding under CREP; therefore, USDA, the Commodity Credit Corporation, and the state of Illinois suspended CREP enrollment. Recently, funding for the state side of CREP has been restored and revisions to the memorandum of agreement between the USDA, the Commodity Credit Corporation, and state of Illinois have begun with the hope of beginning CREP enrollments again in the near future.

Table 4.22. *Acres with Illinois CREP easements*

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Wetlands	20	651	3,681	11,976	17,406	19,467	19,523	19,523	19,523	19,528
Buffers	526	1,324	2,720	5,467	8,768	13,568	13,764	13,850	13,855	13,855
Perennials/ Energy	0	7	84	1,622	2,107	4,395	4,670	4,718	4,726	4,726

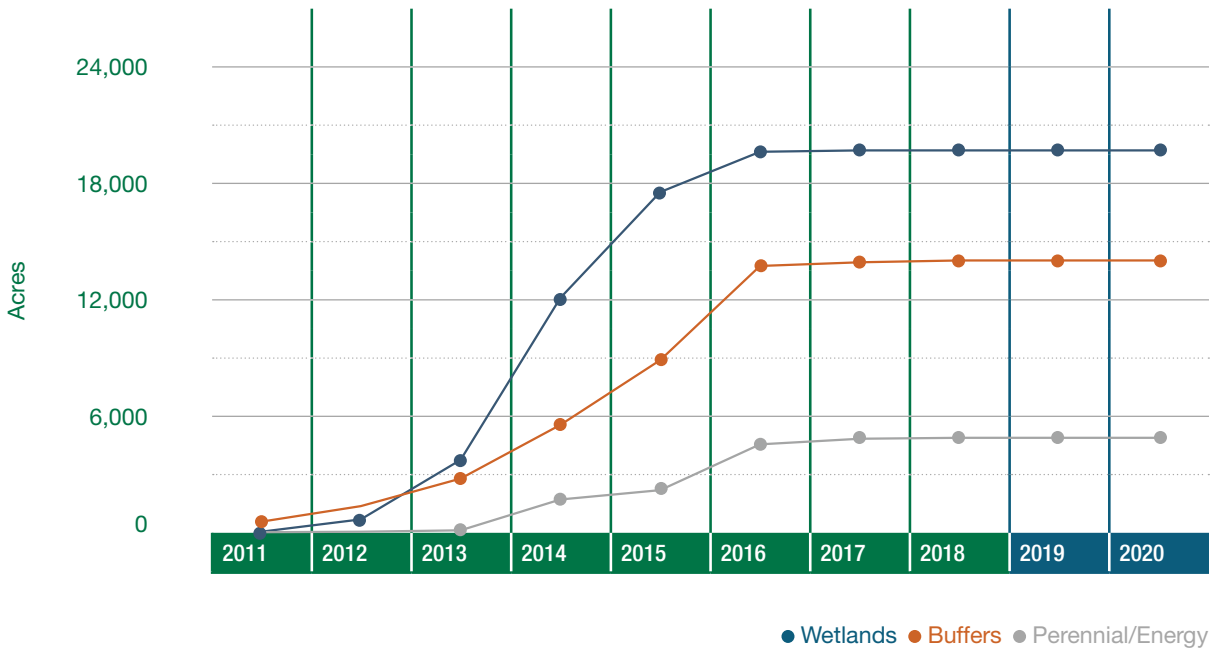


Figure 4.19. *Acres with Illinois CREP easements*

Building Soil Health on Agricultural Leases

Building soil health on state-owned agricultural lands is a priority within the Illinois Department of Natural Resources. By building soil health, IDNR plans to demonstrate regenerative agriculture while assessing the benefits of cover crops to overwintering wildlife, which will aid in the fulfillment of strategy goals.

IDNR is part of a Regional Conservation Partnership Program award, provided by the USDA Natural Resources Conservation Service, that will move 20-25% of the agency's property currently in conventional crop production to a cover crop/reduced tillage (Strip/Vertical: 6,500-9,000 acres) rotation, ultimately building soil health. Also known as regenerative agriculture, the use of different cover crop species mixes not only improves soil health, but creates suitable overwintering habitat for a variety of wildlife species. The primary concern is identifying timing for termination of cover crops that doesn't create a nest sink for early nesting birds in the spring. While considerable research has evaluated the use of cover crops on soil health, research is required to assess the wildlife benefits of this practice. This work is part of a broader statewide partnership under the RCPP program, with 13 partners collaboratively advancing habitat and water quality goals through the Working Lands, Water, and Wildlife Partnership.

Historically, IDNR agricultural leases did not allow for the use of cover crops, but that changed beginning with contracts negotiated in the fall of 2019. Previous agreements with tenant farmers did not require a cover crop/reduced tillage rotation as tenants did not have the financial incentive to use cover crops on state lands. Planting and terminating cover crops requires time and money that many tenants do not have or are not willing to invest on property they do not own. Most of the literature on cover crops shows that it takes three to five years of continuous cover cropping to reap the rewards, such as reduced fertilizer and pesticide costs.

IDNR will use RCPP funds to help tenants plant and terminate cover crops on selected properties throughout the state. Tenants will receive RCPP Land Management funds or NRCS leasing agreements if they agree to implement such a practice. After an RCPP cost-share agreement is completed, it will be written into future IDNR agricultural lease contracts that the tenant is responsible for continuing to use cover crops in their rotation, with the costs offset by the reduced inputs needed to make the soil productive.

The program will allow IDNR to work in a cover crop system that would have minimal impact on the current tenant's operation. The cost-share element will jump-start these efforts, planting and terminating the cover crops through RCPP until the contracts are renewed. It also allows IDNR to build soil health and invest in state-owned lands while setting up demonstration sites that will teach producers how to use such a rotation on their own farms. Many IDNR tenants have farm ground adjacent to or near state parks, which could extend benefits into the parks, as well.

Photo courtesy of Jennifer Jones, Illinois Extension

This effort will begin with eight to 10 sites, with at least one site in each of the five IDNR regions. The focus will be on sites that have agricultural leases and are a priority for grassland birds as identified in the Illinois Wildlife Action Plan Farmland & Prairie Campaign (idnr.maps.arcgis.com/apps/MapJournal/index.html?appid=f3a913ef148f4408830570fa0f5f5fc3). On larger sites where multiple leases exist, half of the leases may be taken into this rotation and the remainder used for comparative studies.

IDNR staff are currently taking soil samples on IDNR lands so the agency can monitor the rotation's progress and success. There are potential opportunities for institutional research projects to be conducted while the RCPP funding is used for practice implementation. IDNR is coordinating with University of Illinois on possible research around soil health benefits and avian use of cover crop fields.

IDNR also plans to establish demonstration sites across Illinois for state agencies, non-governmental organizations, and other partners to show how this style of agriculture can be implemented. These sites will familiarize tenant farmers with the use of cover crops in their rotation and the associated benefits. When producers can see and talk to their neighbor about the use of cover crops, they are far more likely to try the practices themselves. IDNR hopes to create the location for farmers to see regenerative agriculture that is friendly to wildlife and the environment, as well as sustainable into the future.

Contaminant Assessment Section Restoration

The Illinois Department of Natural Resources Contaminant Assessment Section consists of trustees appointed by the governor on behalf of the public to carry out Natural Resource Damage Assessments to protect natural resources and the services they provide. This process, outlined in federal and state law, authorizes trustees to seek compensation for the release of hazardous substances and pollution that harm natural resources, using acquired funds to restore, rehabilitate, replace, or acquire equivalent resources.

Under these authorities, planning for compensatory projects may be directed toward reducing nutrient loads in Illinois' water systems and addressing the goals of the strategy by reducing nutrients, or indirectly by restoring aquatic ecosystems. As the majority of contaminant releases affect water systems, many Contaminant Assessment Section restorations aim to improve the quality of water in Illinois. In 2019-20, progress was made on several projects.

In Jo Daviess County, a cover crop conservation project to benefit Yellow Creek resulted from damages associated with mishandling of livestock waste. Roughly 180-200 acres of the approximately 400 acres surrounding the dairy farm will be available over the next four years for planting cereal rye cover crop prior to soybeans and corn silage plantings. Nitrogen fertilizer application will be monitored based on routine soil testing. The silage storage bunker will also be monitored to ensure no overloading occurs and that leachate is flowing through the gutter system to the waste lagoon.

In Sangamon and Christian counties, aquatic vegetation was planted in Sangchris Lake to increase water quality. Progress will be evaluated by monitoring the fish and aquatic life response.

Plain pocketbook mussels were propagated at the Jake Wolf Memorial Hatchery and placed in Sugar Creek as part of the Logan County plan for wetland and stream restoration at the Bellrose Nature Preserve. As filter feeders, mussels sift through particles and pollution in water as they feed, consequently increasing water quality. The mussels will continue to be tracked and monitored.

Funds were also secured for upcoming, pending projects. An IDNR settlement agreement in Knox County will allow conservation projects designed to enhance and improve habitat conditions and

overall water quality in the North Creek watershed to begin. Another settlement related to the mishandling of livestock waste resulted in funds to implement and monitor progress of restoration projects for Stony Creek and the Salt Fork in the Vermilion River.

More information can be found at www2.illinois.gov/dnr/programs/NRDA/Pages/default.aspx.

Illinois Department of Agriculture

Partners for Conservation Program

The IDOA, in partnership with SWCDs, administers directed programs through the Partners for Conservation cost-share program. PFC encourages increased nutrient management, conservation tillage, and the implementation of cover crops into a crop management regime to slow erosion, improve soil health, enhance water infiltration, smother weeds, control pests and diseases, and increase biodiversity. In 2019, PFC targeted $2.89 million, and in 2020, $2.40 million, in allocations for statewide implementation. Combined PFC resources from 2019 and 2020 covered approximately 56% (up from 52% during 2017-18) of conservation adoption costs, with the balance paid by applicants or landowners.

Conservation practices that are eligible for PFC cost-share assistance include terraces, grassed waterways, water and sediment control basins, grade stabilization structures, crop residue management, cover crops, and nutrient management plans. From 2019 to 2020, landowners completed 1,925 projects. The most common PFC conservation practice during this time was cover crops (Table 4.23 and Figure 4.20).

Through PFC and landowner investments and activities, soil erosion was maintained or reduced at or below tolerable soil loss on 60,283 cropland acres. The Revised Universal Soil Loss Equation indicates that sediment loading was reduced by 20,006 tons — translating to an estimated 1,100 semi-trailer loads of sediment that did not reach Illinois waterways. These conservation practices not only save the sediment from streams, rivers, and waterbodies, they also reduce soil loss in fields via detachment and movement. In the past two years, 67,499 tons of soil were saved.

These practices also reduced nutrient loading to streams throughout the state. Focusing on NLRS practices, this reduction is an estimated 21,535 pounds of nitrate-nitrogen and 10,170 pounds of total phosphorus in 2019-20 (Figures 4.21 and 4.22).

Table 4.23. *Acres treated by and dollars spent on PFC in 2019 and 2020*

	Bioreactors	Wetlands	Filter Strips	Tillage	Perennials	Cover Crops
2019 Acres	0	0	0	535.3	153.81	15,472.48
2019 Cost-Share Dollars	$0	$0	$0	$2,219.20	$14,560.85	$347,678.85
2019 Land Owner Dollars	$0	$0	$0	$1,249.84	$10,927.59	$294,069.77
2020 Acres	0	0	0	4,045.56	443.36	17,945.38
2020 Cost-Share Dollars	$0	$0	$0	$26,253.58	$83,014.78	$426,980.26
2020 Land Owner Dollars	$0	$0	$0	$38,705.83	$46,090.05	$358,703.96

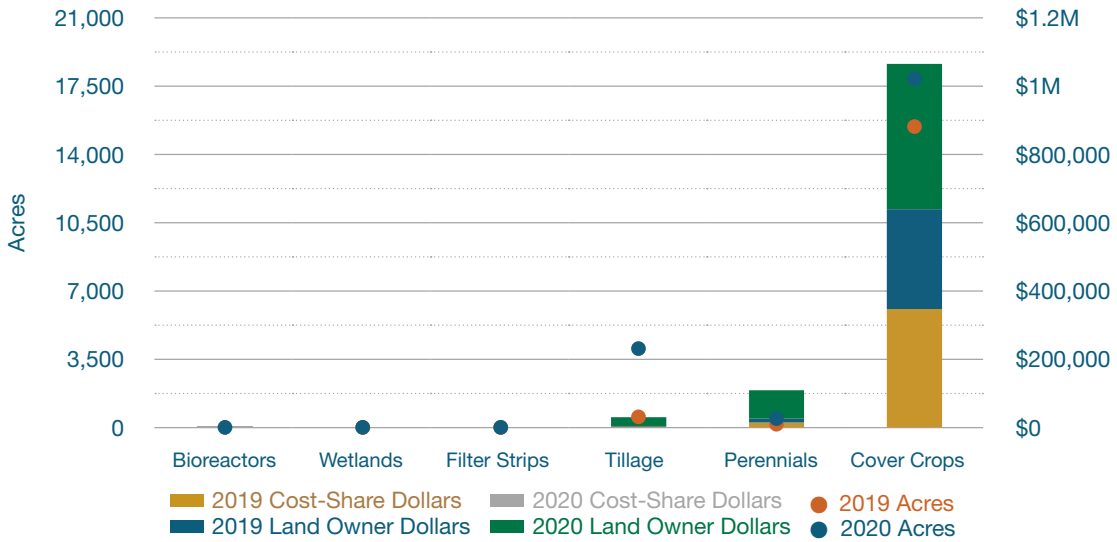


Figure 4.20. *Acres treated by and dollars spent on PFC in 2019 and 2020*

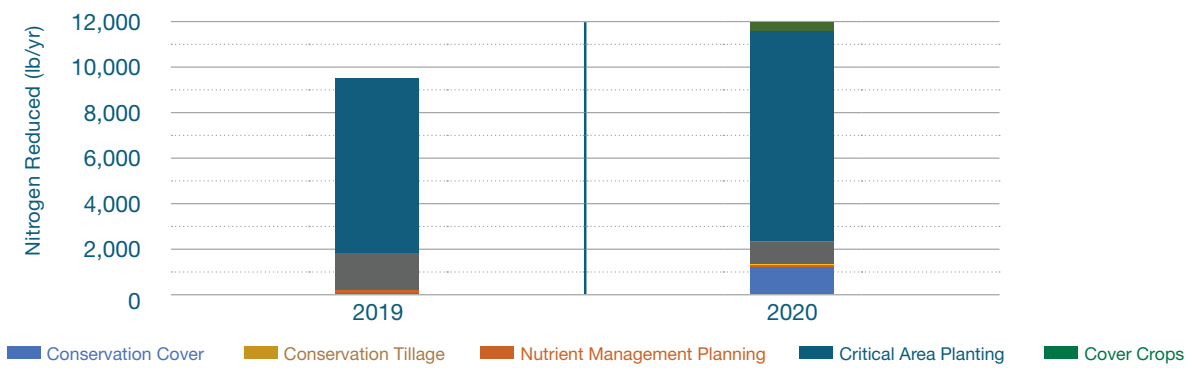


Figure 4.21. *Calculated total nitrogen load reduction (lb/yr) from PFC in 2019 and 2020*

Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of each practice.

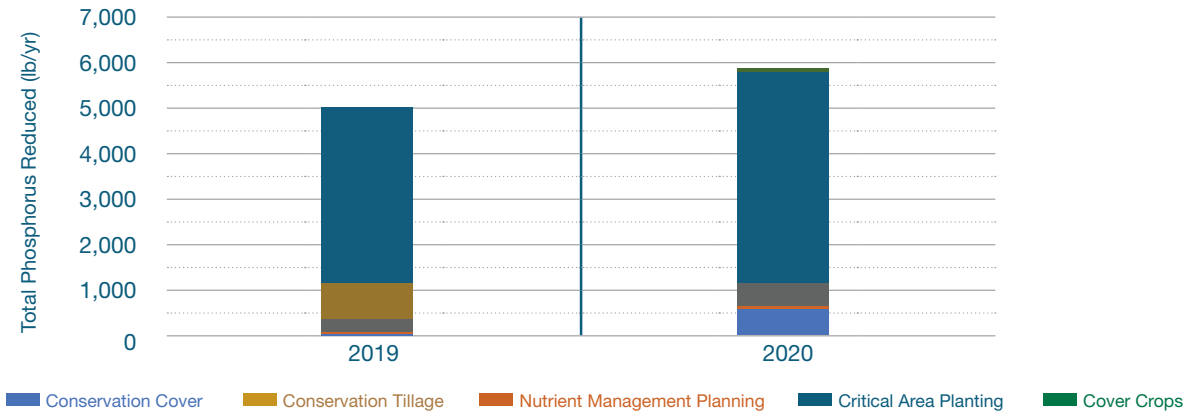


Figure 4.22. *Calculated total phosphorus load reduction (lb/yr) from PFC in 2019 and 2020*

Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of each practice.

Illinois Soil Conservation Transect Survey

Transect surveys for the 2019 growing season were suspended due to the excessive spring rainfall, which led to historic flooding in some parts of the state. This combination led over 1 million cropland acres to be enrolled in the USDA Risk Management Agency's Prevented Planting Program. Then, in March 2020, the COVID-19 pandemic swept the nation and shuttered the department's ability to conduct a safe transect survey for the 2020 growing season. The IDOA and SWCDs intend to resume transect surveys in future years.

Prevented Planting Cover Crop Incentive Program

The 2019 spring flooding was deemed one of the worst floods to hit Illinois in more than a quarter of a century and impacted over 40% of the state's population outside of Cook and the collar counties. IDOA initiated the Prevented Planting Cover Crop Program, which provided a $5 per acre incentive payment to producers for the planting of a cover crop on acres that were enrolled in the USDA Risk Management Agency crop insurance program's prevented planting option for the 2019 growing season. The use of cover crops as weed control on these enrolled acres conserved soil, protected water quality, reduced soil erosion, and reduced the nutrient transport to water bodies. Participation in this program was on a first come, first served basis, and had an overall 100,000-acre statewide participation limit. This program benefited over 400 applicants from across the state.

Streambank Stabilization and Restoration Program

To stabilize and restore streambanks that would otherwise contribute sediment to the state's rivers and tributaries, IDOA, with assistance from SWCDs, administers the Streambank Stabilization and Restoration Program. Funded through PFC, this program provides support for using low-cost techniques to stabilize eroding streambanks, including rock riffles, stone toe protection, and bend weirs (www2.illinois.gov/sites/agr/Resources/Conservation/Pages/default.aspx).

The program is funded at $100,000 per year; it covers approximately 40% of the cost, with the remainder paid by landowners or applicants.

From 2018 to 2021, through 37 projects, 3.68 miles of eroding streambank was stabilized, resulting in a 2,729-ton reduction in sediment loss. These efforts reduced nitrate-nitrogen loading by 5,385 pounds and total phosphorus by 2,629 pounds.

Fall Covers for Spring Savings

The Fall Covers for Spring Savings, also known as the Cover Crop Premium Discount Program, is designed to promote the planting of additional acres of cover crops that are not already covered by other state or federal incentives. This allows eligible applicants to receive a $5 per acre premium discount on the following year's crop insurance invoice for every acre of cover crop enrolled and verified in the program. Funding of the eligible acreage is on a first come, first served basis capped at 50,000 acres. AISWCD, along with conservation partners, advocated for this state appropriation.

The program launched on December 4, 2019. During the 2019-20 growing season, the 50,000-acre cap was met in the first seven days. By the program's January 15th closing date, an additional 113,000 acres had been submitted. In total, 212 applicants, spanning 57 of Illinois' 102 counties, were able to take advantage of the program during its first year.

The 2020-21 growing season led to almost perfect cover crop planting conditions across the state. As the second year of the program opened on December 15, 2020, the allotted 50,000-acre cap was met in just 12 short hours. When the program closed on January 15, 2021, an additional 130,050 acres had been requested, representing an increase of 61% from the previous year. A total of 768 applicants applied for the program, covering 87 counties.

Soybeans planted with annual ryegrass cover crop
Photo courtesy of Jennifer Jones, Illinois Extension

Illinois Environmental Protection Agency

Section 319 Non-Point Source Program

Section 319 of the Clean Water Act (33 U.S.C. 1329) provides grants supporting the implementation of conservation practices that address non-point source pollution in rural and urban areas. Illinois EPA administers this program, which funds the establishment and management of conservation tillage, cover crops, filter strips, wetlands, and other agricultural conservation practices, specifically in watersheds with approved management plans that address reducing nutrient loading to Illinois waters. The number of acres treated by agricultural conservation practices funded through Section 319 had a high point in 2012, due to an influx of conservation tillage acres (Table 4.24 and Figure 4.23). New acres dedicated to wetland restoration have declined considerably since 2015; nonetheless, once a wetland has been restored, it exists until it is deliberately removed.

These shifts in focus are not unusual for the Section 319 program, which offers competitive grants with limited funds. Grant proposals typically focus on local needs and concerns and local approaches to address those concerns. For example, applications received for Section 319 projects in southern Illinois may be more likely to focus on conservation tillage and cover crops, whereas applications received for projects in northern Illinois might focus on nutrient management plan development.

The low number of conservation practices recorded in 2020 can be attributed to a number of items. The Section 319 grant program awards grants on a competitive basis for any type of non-point source pollution control project. Practices such as grassed waterways, grade stabilization structures, water and sediment control basins, and streambank stabilization had more successful applications. While these practices are not currently recommended or tracked by the NLRS, they do reduce nutrient loss. For all agricultural practices implemented using 319 funds, there were 4,672 pounds of total nitrogen and 2,405 pounds of total phosphorus reduced in 2019, and 2,362 pounds of total nitrogen and 1,368 pounds of total phosphorus reduced in 2020. Many of these structural practices have a lifespan between 10-20 years, so load reductions are realized annually during their lifespan.

Weather and program sign-up can play a significant role in the timing of the implementation of the conservation practices. Section 319 grantees might secure all their practice acreage in the first year of a two-year project and, therefore, have a 'zero' for the second year. In addition, practice units are documented upon invoicing after completion, so practices installed in late fall may not be recorded until mid-spring of the following year (e.g., for cover crops, the costs for burn down happen in the spring).

NOTE: Illinois EPA makes an effort to coordinate availability of financial assistance for conservation practices with other state and federal partners within proposed project areas to reduce duplication of services and competition between programs.

Table 4.24. *Acres treated by agricultural practices installed under the Section 319 grant program 2011-20*

	Conservation Tillage	Cover and Green Manure Crop	Filter Strip	Nutrient Management	Wetland Restoration	Total
2011	-	-	-	-	24	24
2012	9,998	-	-	-	255	10,253
2013	-	-	-	-	380	380
2014	-	453	-	-	116	569
2015	-	2,544	8	-	164	2,716
2016	-	2,583	8	3,062	1	5,654
2017	151	3,978	3	-	1	4,133
2018	-	1,570	9	5,713	1	7,293
2019	-	1,151.34	0.5	6,521.5	-	7,673.34
2020	-	15	-	-	-	15

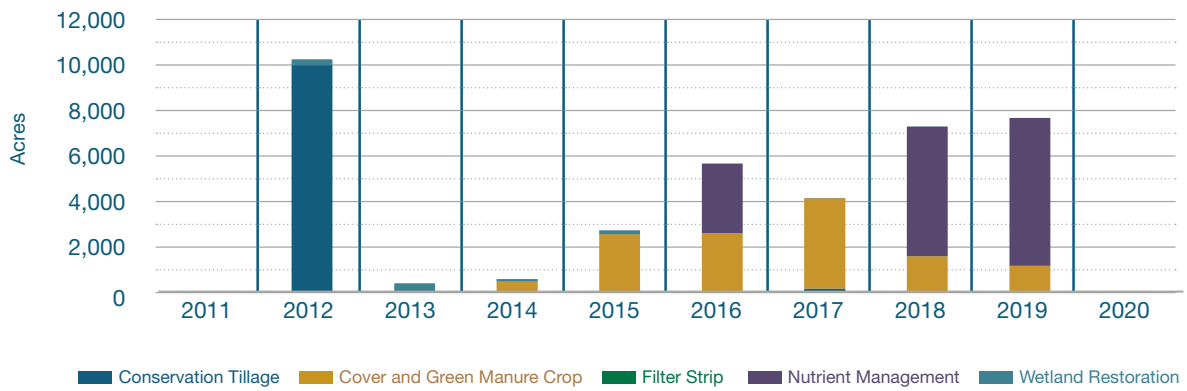


Figure 4.23. *Acres treated by agricultural practices installed under the Section 319 grant program 2011-20*

The Illinois EPA Section 319 grant program is unique in that load reductions associated with conservation practices are calculated using U.S. EPA Region 5 Load Estimation Spreadsheets as part of the process. These calculations indicate that conservation practices have significantly reduced the impact of nutrients in Illinois waters. Since 2011, Section 319 funding led to a reduction in nitrogen loads of over 70,000 pounds. Years with greater nitrogen reduction correspond to years with more acres treated. During the last two years, most of the nitrogen reductions occurred through nutrient management plans implemented in 2019 (Table 4.24 and Figure 4.23).

For phosphorus, since 2011, Section 319 funding led to a reduction in phosphorus loads of just under 30,000 pounds. Similar to nitrogen reductions, years with greater phosphorus reduction correspond to years with more acres treated. During the last two years, most total phosphorus reductions occurred through cover crops implemented in 2019 (Tables 4.25-4.26 and Figures 4.24-4.25).

Table 4.25. *Calculated total nitrogen load reduction (lb/yr) from Section 319 grant program agricultural practices 2011–20*

	Conservation Tillage	Cover Crop	Filter Strip	Nutrient Management	Wetland Restoration	Total
2011	-	-	-	-	94	94
2012	47,200	-	-	-	1,500	48,700
2013	-	-	-	-	1,700	1,700
2014	-	700	-	-	700	1,400
2015	-	600	1,400	-	500	2,500
2016	-	13,700	100	-	600	14,400
2017	300	15,006	100	-	600	16,006
2018	-	1,500	200	-	-	1,700
2019	-	1,051	62	6,521.5	-	7,634.5
2020	-	123	-	-	-	123

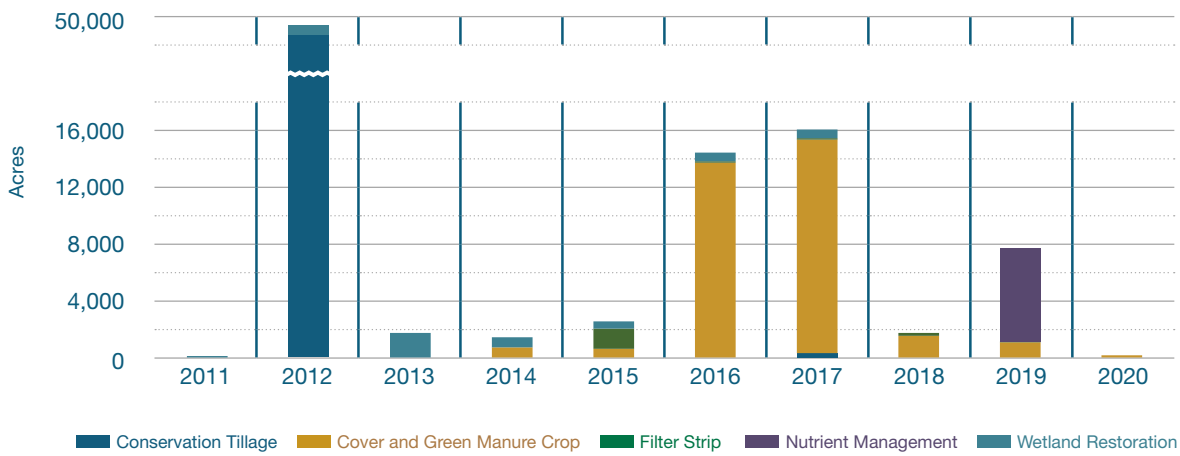


Figure 4.24. *Calculated total nitrogen load reduction (lb/yr) from Section 319 grant program agricultural practices 2011–2020*

Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of each practice.

Table 4.26. *Calculated total phosphorus load reduction (lb/yr) from Section 319 grant program agricultural practices 2011–20*

	Conservation Tillage	Cover Crop	Filter Strip	Nutrient Management	Wetland Restoration	Total
2011	-	-	-	-	47	47
2012	23,700	-	-	-	700	24,400
2013	-	-	-	-	600	600
2014	-	400	-	-	300	700
2015	-	300	700	-	300	1,300
2016	-	600	-	-	200	800
2017	100	500	100	-	100	800
2018	-	700	-	-	-	700
2019	-	525	25	-	-	550
2020	-	62	-	-	-	62

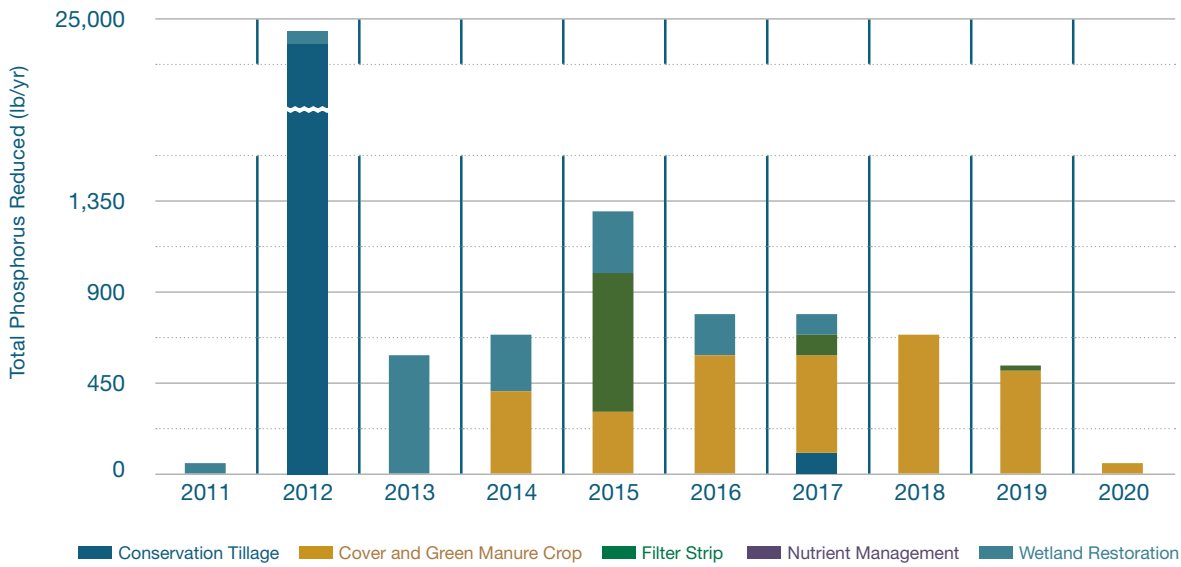


Figure 4.25. *Calculated total phosphorus load reduction (lb/yr) from Section 319 grant program agricultural practices 2011–20*

Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of each practice.

University of Illinois

Woodchip Bioreactors

The implementation of woodchip bioreactors continues to happen at a slower pace than other conservation practices that reduce nitrate loss. Most of the bioreactors were implemented for research and demonstration purposes. For this reporting period, five new woodchip bioreactors were implemented, treating a combined area of 115 acres. In 2016, there were 20 known bioreactors treating approximately 611 acres of tiled cropland. The 2019 Biennial Report showed an increase of 17 bioreactors between 2016 and 2018, treating approximately 1,345 acres. By the end of 2020, there were a total of 42 known woodchip bioreactors treating approximately 1,460 acres.

University of Illinois Extension Watershed Outreach Associates

Since 2018, Illinois EPA has provided financial support to University of Illinois Extension for two watershed outreach associate positions. The work conducted under this grant supports the strategy through the development and delivery of education, outreach, and technical assistance centered in and focused on selected priority watershed basins. They work in the priority watersheds depicted in Figure 4.26.

NLRS Watershed Coordinators Priority Watersheds

ILLINOIS Extension
COLLEGE OF AGRICULTURAL, CONSUMER & ENVIRONMENTAL SCIENCES

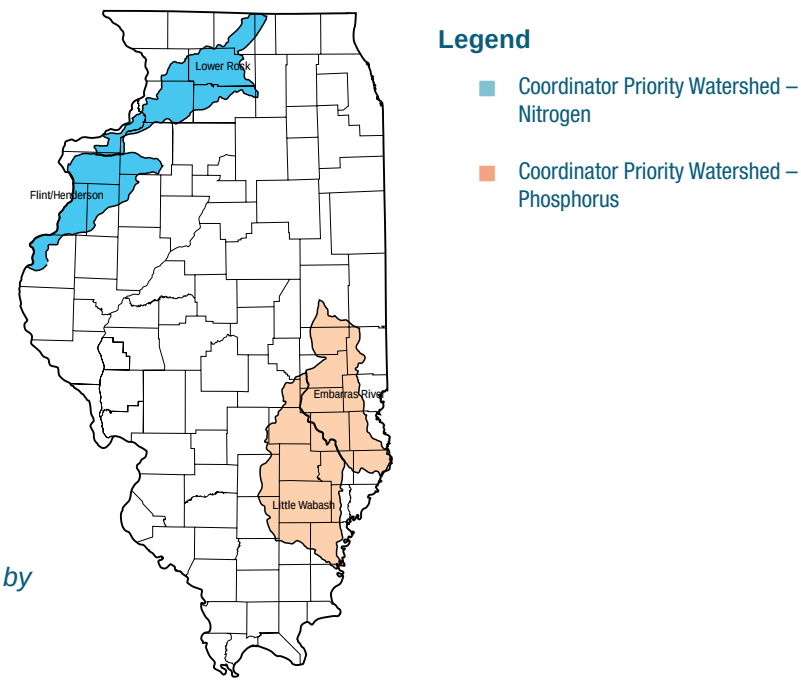


Figure 4.26. *Watersheds served by watershed outreach associates*

Bioreator installation

Photo courtesy of Janith Chandrasoma, University of Illinois

Jennifer Jones is a watershed outreach associate who focuses on phosphorus-priority watersheds — Little Wabash River and Embarras River. She started in April 2018 and is located in the Illinois Extension office in Effingham.

Rachel Curry is a watershed outreach associate who works in the nitrogen-priority watersheds — Mississippi Central/Flint-Henderson Creek and Lower Rock River. She started in November 2020 and is located in the Illinois Extension office in Galva. Haley Haverback-Gruber held this position through July 2020, when she left Extension to pursue a career as a high school agriculture teacher. The position was vacant from August through October 2020, as Extension worked to fill it.

Haverback-Gruber laid much of the groundwork, during her time with Extension, identifying areas to lead watershed planning efforts with SWCDs, IFB, and other stakeholders. She helped stakeholders in Mill Creek, a sub-watershed in the Lower Rock River watershed, secure a Section 604(b) grant through Illinois EPA to develop a watershed management plan. Additionally, she assisted with a Mississippi Central/Flint-Henderson Creek watershed Section 319 grant application that was awarded. Curry has continued and expanded upon Haverback-Gruber's efforts working with IFB, county Farm Bureaus within the Mississippi Central/Flint-Henderson Creek watershed, and SWCDs within the Mississippi Central/Flint-Henderson Creek and Lower Rock River watersheds to identify areas of concern, with the goal of utilizing that information in future watershed management plans.

In the Embarras River watershed, Jones is co-leading ongoing collaborative efforts among SWCDs, IFB, and county Farm Bureaus to update the current watershed management plan. The Coles County SWCD submitted a Section 319 grant application to Illinois EPA in 2019. Multiple stakeholders committed matching funds to support the grant, which would fund the update of the Embarras watershed management plan. While waiting to hear about grant funding decisions, Illinois Extension, IFB, county Farm Bureaus, and SWCDs held a series of nine farmer stakeholder meetings throughout the Embarras watershed in January 2020, attracting nearly 190 farmers and landowners. Participants were asked about their water resource concerns in the Embarras watershed, and the tools desired to help address those concerns. Feedback collected at the farmer meetings will be incorporated into the watershed plan update. Illinois EPA awarded funds to the Coles County SWCD and official efforts to update the Embarras watershed management plan began in January 2021 with work on the update led by a consulting firm.

Watershed outreach associates partnered with a professor of urban and regional planning at University of Illinois and an Illinois Extension community and economic development specialist on

a unique watershed planning collaboration. In the spring of 2020, Jones worked with the professor's watershed planning class on creating a plan for the Salt Creek watershed, a sub-watershed located within the phosphorus-priority Little Wabash River watershed. A graduate student continued developing the plan during summer 2020. The Salt Creek effort was financially supported by a grant from the Lumpkin Family Foundation.

In addition to watershed planning efforts, watershed outreach associates regularly create and deliver NLRS-related educational content to youth and adults, especially focusing on conservation practices farmers can adopt to reduce nutrient loss. For example, watershed outreach associates produce the Illinois Nutrient Loss Reduction Podcast series, in collaboration with Illinois Extension Media Communications Specialist Todd Gleason. Each episode features conservation practices to reduce nutrient loss, such as cover crops, woodchip bioreactors, MRTN Calculator, and manure management. Researchers, Extension educators, agricultural professionals, government employees, and farmers have all been featured guests discussing how and why to implement conservation practices, as well as the related challenges and successes. At the end of 2020, the podcast, which started in 2018, had released 32 episodes. Some episodes have been streamed as many as 600 times. Listen at will.illinois.edu/agriculture/note/illinois-nutrient-loss-reduction-podcast.

Another way in which associates are educating the public is through contributing to annual trainings, like the Certified Livestock Manager Training. In 2020 and 2021, they provided an update on the NLRS to Certified Livestock Manager Training participants. Associates continue to provide educational opportunities related to the NLRS for others based on the most current information and research coming from University of Illinois and other partners around the state.

Current Programs and Projects Supporting Nutrient Loss Reduction Goals

Illinois NLRS identified 65 agriculture-related programs, initiatives, and projects developed by agencies and non-governmental organizations to help producers establish practices and strategies to reduce nutrient losses. Below is a list of all programs referenced in the strategy. The following section highlights programs that are new, have undergone significant changes, or have noteworthy updates.

During a time of restricted state funding, Illinois was able to make substantial progress on these initiatives thanks to numerous partnerships that leveraged resources.

Federal Programs and Projects

State Programs and Projects

Non-Governmental Organization Programs and Projects

(Bold type and page number indicate an update in this report. Details about programs listed in non-bold type and page number can be found in the listed document.)

Non-Governmental Organization Programs and Projects

Edge-of-Field Partnership for Saturated Buffers

The Saturated Buffer Partnership was established in 2019. The Saturated Buffer Partnership is a five-year collaboration between Illinois Farm Bureau, Illinois Land Improvement Contractors Association Inc., Southern Illinois University Carbondale, and NRCS. The purpose of this partnership is to install a saturated buffer each year and to support research into the impact of saturated buffers on water quality at each site for the five-year collaboration period, and beyond. The first saturated buffer was installed in the spring of 2019 in Moultrie County. Plans are in development for the second installation after COVID-related delays.

For more information, see illica.net/2019-saturated-buffer-partnership

Edge-of-Field Partnership for Woodchip Bioreactors

The Woodchip Bioreactor Partnership is a five-year collaboration between Illinois Farm Bureau, Illinois Land Improvement Contractor's Association, Inc., University of Illinois College of Agricultural, Consumer and Environmental Sciences, and NRCS. The purpose of this partnership is to install a woodchip bioreactor each year and to support research into the impact of woodchip bioreactors on water quality at each site for the five-year collaboration period, and beyond. In previous years, the partnership has installed woodchip bioreactors in Bureau and Henry counties. Due to weather-related delays, the 2019 installation was postponed. In 2020, a woodchip bioreactor was installed in Henry County (ilfb.org/ifb-in-action/what-were-working-on/protecting-our-environment/nutrient-stewardship-grant-program/2020-nutrient-stewardship-virtual-field-days/).

Free, Confidential Water Testing Program

The confidential water testing program engages farmers in nutrient and water quality issues by providing specific information on nutrient losses from their operations.

ICGA is partnering with Illinois FFA to provide nitrate water test strips to all ICGA members. A $5 donation is made to any Illinois FFA chapter of the farmer's choosing after they anonymously submit their results online.

Farmers are encouraged to sample water flowing out of tile lines, from surface runoff, or in an adjacent stream or creek. Educational resources and conservation practices are provided to help farmers understand their impact on water quality, evaluate the potential economic loss, and consider management practices that may reduce nitrogen losses.

These test results are just a snapshot of ambient nutrient levels in water from tile drains, surface runoff, or nearby streams. Nutrient levels in runoff water can vary greatly depending on the time of year, temperature, rainfall, and in-field practices. Nevertheless, the test results combined with flow rates (the volume of water leaving a site) can be used to estimate the total nutrient loading into a waterbody. In addition, farmers can estimate the pounds per acre leaving the field. These numbers are a starting point for learning and discussion about practices that are available for farmers to reduce nutrient losses.

For more information, see ilcorn.org/watertesting.

The Franklin Research and Demonstration Farm

The Franklin Research and Demonstration Farm project is a model of sustainable agriculture that demonstrates first-hand how nature and agriculture can coexist to produce benefits for crop production, water quality, scientific research, and habitat preservation.

In 2019, soil scientists from U.S. Army Corps of Engineers published their findings from a 2017 collection of soil samples from the constructed wetlands, floodplain wetlands, and surrounding agricultural fields to evaluate phosphorus sorption capacity of wetland sediments. In 2019, seven tours of the Franklin Farm were conducted for members of the public and other stakeholders.

No tours were conducted in 2020, due to COVID-19 restrictions; however, monitoring of cover crops and constructed wetlands continued. A publication describing experiences drawn from the Franklin Farm and other constructed wetland implementation was produced by The Nature Conservancy and partners.

For more information, see nature.org/en-us/get-involved/how-to-help/places-we-protect/the-mackinaw-river-watershed/.

VanZomeren, C.M., J.F. Berkowitz, A.M. Lemke and K.G. Kirkham. 2019. Soil P storage capacity in agricultural treatment wetlands: can a system designed for N reduction also retain P? Wetlands. doi.org/10.1007/s13157-019-01205-3. Research at Franklin Research and Demonstration Farm.

Lemke, A. M., Kirkham, K. G., Marino, A. L., Wallace, M. P., Kovacic, D. A., Bohnhoff, K. L., Kraft, J. R., Linsenbigler, M., & Noto, T. S. (2020). Accelerating implementation of constructed wetlands on tiled agricultural lands in Illinois, United States. In J. A. Delgado, C. J. Gantzer & G. F. Sassenrath (Eds.), Soil and Water Conservation: A Celebration of 75 Years (pp. 172-178). Ankeny, IA: The Soil and Water Conservation Society.

Illinois Buffer Partnership

The Illinois Buffer Partnership is a statewide Trees Forever program that promotes and showcases the voluntary efforts of farmers, landowners, and communities. Participants install, maintain, and enhance conservation buffers that reduce soil erosion, improve water and soil quality, and provide wildlife and pollinator habitats.

Annually, between 10 and 20 Illinois Buffer Partnership participants are eligible to receive cost-share assistance, on-site technical assistance from Trees Forever, project signs, and the opportunity to host a field day to highlight their projects. Eligible conservation projects include riparian buffers, livestock buffers, streambank stabilization projects, wetland development, pollinator habitat, rain gardens, and agroforestry.

In 2019 and 2020, Trees Forever provided $42,000 in grant funding and technical assistance to 28 projects across Illinois to plant native trees, shrubs, forbs, and grasses to improve water quality, reduce erosion, and provide wildlife and pollinator habitats. Trees Forever provides outreach and education on a wide range of topics, including soil health, riparian buffers, native plants, pollinators, agroforestry, forest and pest management, tree care, improved water and air quality, species diversity, invasive species management, erosion reduction, establishing and maintaining conservation practices, energy efficiency, and plant identification.

Additional information is available at treesforever.org/Illinois_Buffer_Partnership.

Illinois Cover Crop Programs

ICGA provides its members with a variety of opportunities to incorporate cover crops on their farms. The programs facilitate cover crop adoption among farmers who are interested in this practice, but hesitant to get started.

- ☑ First Time Cover Croppers—Through an ICGA and Beck's Hybrids partnership, this cost-share program provides aerial applications of up to 40 acres per farm of a winter terminal (low risk) oats and radish cover crop mixture. It includes technical assistance from Beck's Hybrids cover crop specialists. In 2019, 75 first time cover crop users took advantage of this program and applied cover crops to 3,000 acres. Since its inception, 388 farmers and 15,520 acres have been enrolled.
- ☑ Cover Crop Coupon—Through a partnership among seven Midwest cover crop retailers, this coupon provides ICGA members a discount of $150 - $200 on the purchase of cover crop seed.

ICGA is an ardent supporter of cover crops, developing and leading programs for ICGA members that have resulted in the planting of more than 100,000 cover crop acres over the past five growing seasons in Illinois. Over 52,000 of those acres were from the 2019 and 2020 crop years.

Additional information is available on ICGA's website at ilcorn.org/covercrops.

Illinois Sustainable Ag Partnership

Illinois Sustainable Ag Partnership is comprised of diverse organizations that work collaboratively to accelerate the adoption of conservation practices by serving as a clearinghouse for soil health and conservation drainage education and increasing recognition of the economic value of conservation practices.

ISAP focuses on messaging, outreach, training, and education for farmers and their trusted advisers; it strives to bring together and disseminate new information and lessons learned in plain, practical language. Members work collaboratively to amplify the programs of each organization, share resources to gain efficiencies, and identify synergies in achieving soil health and nutrient goals. ISAP members include Agricultural Drainage Management Coalition, American Farmland Trust, Association of Illinois Soil and Water Conservation Districts, Illinois Central College, Illinois Corn Growers Association, Illinois Land Improvement Contractors Association, Illinois Soybean Association, Pheasants Forever and Quail Forever, Precision Conservation Management, Soil Health Partnership, The Nature Conservancy, The Wetlands Initiative, University of Illinois Extension, and Zea Mays Foundation.

For more information, visit ilsustainableag.org/.

Advanced Conservation Drainage Training

ISAP's Advanced Conservation Drainage Training program highlights practices like saturated buffers, constructed wetlands, controlled drainage, and bioreactors, which are designed to capture and treat high levels of nitrate-nitrogen from tile flow. Workshops provide participants with knowledge and tools to

make conservation drainage practices a standard part of tile installation and farm management, through intensive classroom and hands-on training. A secondary goal of this training is to create a network of drainage designers, contractors, farmers, farm advisers, retailers, and conservation professionals that better understand the implementation and functioning of edge-of-field practices, and to support that network through ongoing communication, resources, and discussion forums. In 2019, three training sessions focusing on saturated buffers, constructed wetlands, and drainage water management were held throughout central Illinois.

The 2020 conservation drainage training was comprised of a three-part webinar series, "On the Leading Edge." The first session provided an overview of hydrology, water quality, and conservation drainage; the second and third sessions examined conservation drainage at the practice and watershed scales. Information and session recordings are available on the ISAP website.

Multiple members of ISAP play a role in these trainings. Special recognition is given to TNC, The Wetlands Initiative, and ILICA for their leadership in planning and delivering conservation drainage training.

For more information, see ilsustainableag.org/programs/advanced-conservation-drainage-training.

Photo courtesy of Vicki Morrical, NRCS

Advanced Soil Health Training

Members of ISAP developed the Advanced Soil Health Training to increase the number of Illinois farmers, retailers, crop advisers, and conservation professionals who understand the science of soil health and related production management changes. Topics include soil structure, chemistry, and biology; cover crop selection, management, and termination; planting and tillage equipment; field day demonstrations and training; and communication and outreach strategies. The intensive classroom and in-field training model spans 18 months and graduates are encouraged to share what they learn through presentations and field days.

Photo courtesy of Jennifer Jones, Illinois Extension

In 2019, the central Illinois cohort, comprised of 25 agricultural professionals from east central Illinois, completed the training. In 2020, the tri-state cohort, a group of 20 individuals from southeast Illinois, southwest Indiana, and northwest Kentucky, completed the training. A new group of 29 trainees from northwest Illinois and eastern Iowa, the bi-state cohort, started training in 2020 and will meet six times over the next 18 months.

Multiple members of ISAP play a role in these trainings. Special recognition is given to University of Illinois Extension and TNC for their role in leading the tri-state training and to Extension, TNC, and ICGA for their role in planning the bi-state program.

For more information, see ilsustainableag.org/programs/advanced-soil-health-training.

Illinois Alphabet Soup Group

The Illinois Alphabet Soup Group is a collection of agriculture professionals, conservation practitioners, farmer advisers, and industry partners who gather quarterly to learn about issues, strategies, programs, and resources that may encourage farmers to implement nutrient reduction and conservation practices. Meetings are hosted at various locations across the state to provide regionally-focused information and networking opportunities. While there were fewer meetings in 2020 than in the past, there are plans to host online discussions until in-person meetings can resume.

ISAP members provide leadership for the Alphabet Soup Group, with special recognition given to AFT, TNC, ISA, and ICGA.

For more information, see ilsustainableag.org/alphabet-soup/.

Photo courtesy of Jean Brokish, AFT

Risk Management Conference

The annual Risk Management Conference highlights the use of land stewardship and soil health management as a tool to mitigate production and market risks. Presentations feature farmers who share their perspectives on productivity, profitability, and changing climate and market forces.

The 2019 conference was held in Sycamore, Illinois and nearly 100 people explored the use of soil health systems to solve the resiliency puzzle. The 2020 conference reached over 200 people through three online webinars looking at the impacts of a changing climate on field work in Illinois, the ways soil health systems can increase working capital, and the consumer demand for sustainably raised crops.

Multiple members of ISAP play a role in the Risk Management Conference, but special recognition is given to AFT and TNC for their leadership in planning and producing the conference.

For more information, see ilsustainableag.org/home-2/risk-management/.

Soil Health and Conservation Drainage Specialist Network (Local Farmer-Led Networks)

The Soil Health and Conservation Drainage Specialist Network builds on the capacity created through ISAP's Soil Health and Conservation Drainage Training programs, which are based on train-the-trainer concepts. More than 40 individuals, including crop consultants, farmers, SWCD employees, and other professionals, are listed as specialists on the ISAP website, and are available to assist farmers and others looking to learn more about conservation cropping systems and edge-of-field practices. Specialists agree to provide technical consultations and are available for field day presentations on soil health and conservation drainage topics. Additionally, ISAP and AFT host a monthly call with farmers, crop consultants, researchers, and field-based staff working with cover crops. Each meeting includes a presentation highlighting recent research on cover crop agronomics, economics, nutrient loss, or related topics. The calls include time for discussion and shared learning among the specialists. Individuals interested in joining cover crop discussions and/or sharing their expertise on soil health and conservation drainage are encouraged to contact ISAP.

For more information, see ilsustainableag.org/specialists.

Crop Grower Satellite Imagery Analysis

Since 2017, ICGA and TNC have measured on-the-ground progress toward the adoption of conservation practices and soil health systems in Illinois. Using analysis of high-resolution satellite imagery, a biannual assessment of buffer, cover crops, and living green plant material coverage across the state is conducted. The imagery is paired with a random sample of ground truthing to further improve upon the technology. A more thorough, aggregated overview of results is planned for the 2023 biennial report.

Keep it 4R Crop

The Illinois Fertilizer & Chemical Association's Keep it 4R Crop program is based on the principles of 4R nutrient stewardship: right source, right rate, right time, and right place. IFCA works closely with its members, including fertilizer manufacturers, distributors, and agricultural retailers, to promote the 4Rs and uphold the IFCA 4R Code of Practice, which promotes education and adoption of specific fertilizer management practices designed to reduce nutrient losses and assure nutrient use by the crop. IFCA also participates in NREC-funded projects, implementing and managing nutrient applications and cover crops at several NREC research sites. In September 2019, IFCA worked with NREC to update the guide entitled "Considering Cover Crops? Research-Based Recommendations, Observations, and Advice to Help Assure Success."

For more information, see ifca.com/4R/Code.

Nitrogen Rate Trials

For nitrate-nitrogen reduction, the strategy presents a scenario in which MRTN adoption for applied nitrogen could reduce losses by 10% per acre. IFCA's program is focused on identifying farmers to place nitrogen rate trials in their fields and ensuring proper implementation of the trials using University of Illinois protocols to ensure quality data for analysis. IFCA and Illinois receive funding from NREC to manage the trials. Nitrogen rates of 0, 50, 100, 150, 200, and 250 pounds per acre are replicated three times in each field, and data collected at harvest determines the corn response to different applied nitrogen rates, timing, and sources.

Photo courtesy of IFCA

The University of Illinois Department of Crop Sciences analyzes harvest data, which is uploaded each year to the MRTN Calculator (cnrc.agron.iastate.edu). These ongoing nitrogen rate trials ensure that the MRTN for corn in Illinois are updated each year, thus ensuring actual on-farm yield response to nitrogen, from all regions of the state, is factoring into the recommendation system. Individual field trial results from 2014–20 are available at ifca.com/4R/Trials. Figure 4.27 illustrates one example of an ongoing nitrogen rate trial.

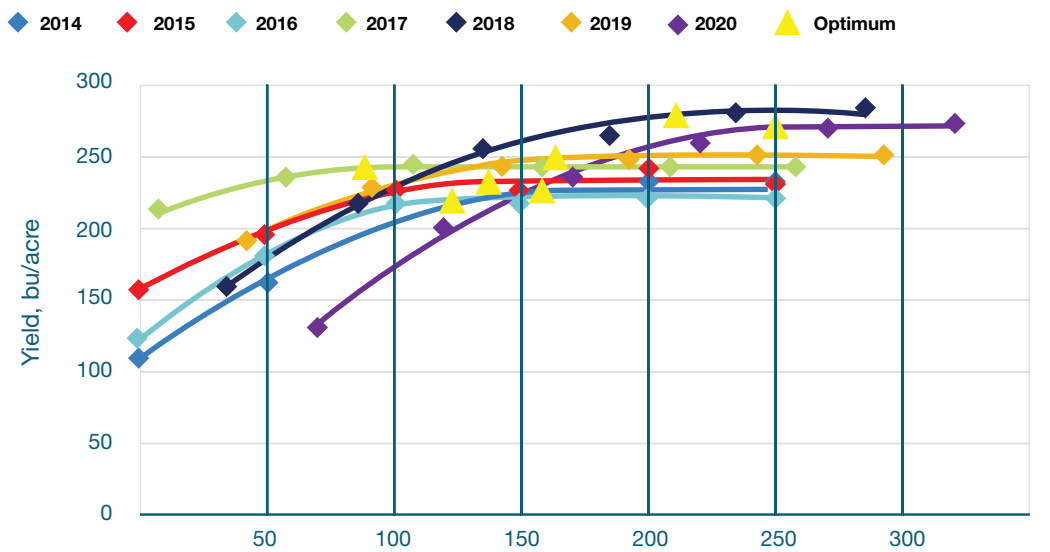


Figure 4.27. *Ongoing N rate trial in Champaign County*

The nitrogen rate trial in Figure 4.27 illustrates how this approach to nitrogen management incorporates the variability that is a universal feature of nitrogen response trials. These trials alternate between two similar fields with corn following soybean each time. While the average optimum nitrogen rate over the seven years was only 162 lb N, the MRTN approach, which maximizes the dollar return using a set of results, shows a best nitrogen rate (for 2021) of 195 lb N per acre.

The map in Figure 4.28 shows the locations of on-farm nitrogen rate trials performed in 2019 and 2020, in all regions of the state. The map also illustrates the north, central, and south climate and soil regions in the land grant university nitrogen rate calculator. The central region includes a rate recommendation for the Lake Springfield watershed. Farmers can access the nitrogen rate calculator online, or as a free app to determine optimum economic and agronomic nitrogen rates.

On-Farm Nitrogen Rate Trials 2019–20

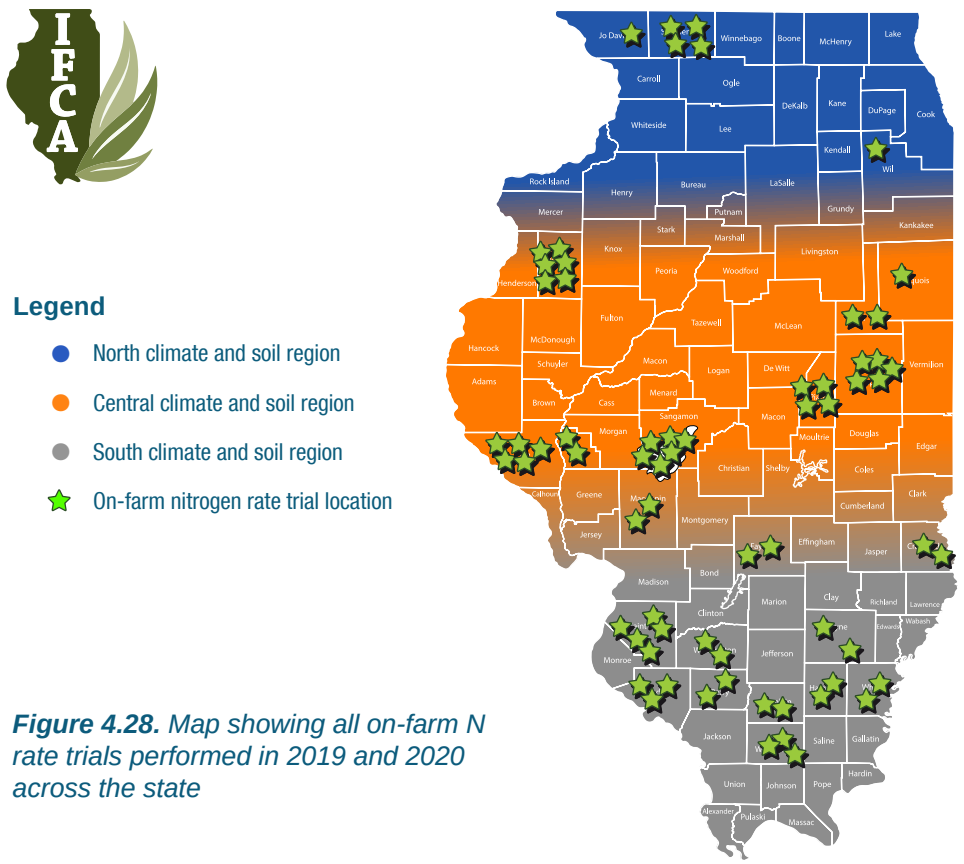


Figure 4.28. *Map showing all on-farm N rate trials performed in 2019 and 2020 across the state*

Water Supply & Industry Partnerships

IFCA works in concert with water supply officials in Lake Springfield, Lake Decatur, Lake Vermilion, and Lake Bloomington/Evergreen to assess nitrate levels on a regular basis and evaluate how nitrogen management practices can help keep levels well below 10 ppm. Along with IFCA, Sangamon County SWCD, and Springfield's City Water, Light, and Power are partners on an Illinois EPA 319 project to conduct nitrogen rate trials, ensuring that the MRTN watershed recommendation is current. IFCA also provides these watershed partners with assistance in organizing educational meetings and providing helpful articles on 4R practices.

4R Metrics Survey

IFCA continues to survey its members each spring and fall about fertilizer application practices based on the 4R Code of Practice. The 4R metric survey results can be combined with results from the survey conducted by NASS for a better understanding of the adoption of voluntary practices over time to reduce nutrient losses. Results shown are from the IFCA 4R survey for the 2020 crop year.

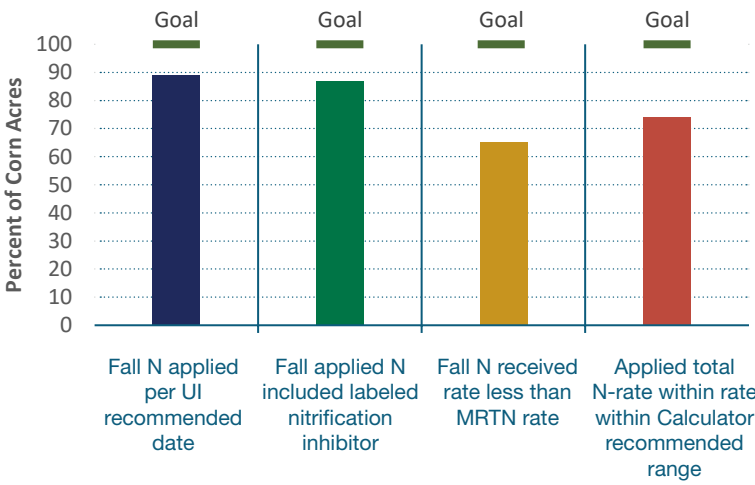


Figure 4.29. *Nitrogen results from the IFCA 4R survey for the 2020 growing season*

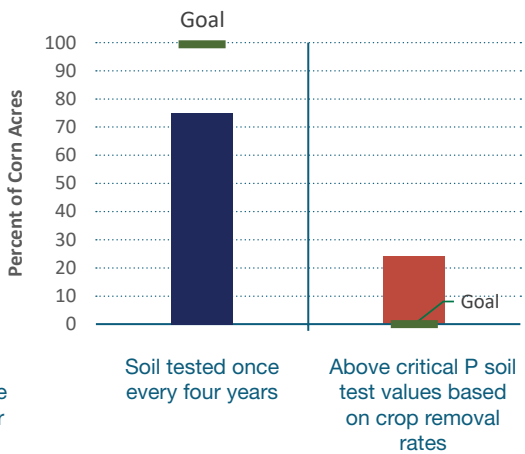


Figure 4.30. *Phosphorus results from the IFCA 4R survey for the 2020 growing season*

For nitrogen loss reduction practices, the survey asked about ammonia application to corn acres. Figure 4.29 indicates that 89% of fall applied corn acres received ammonia in accordance with the University of Illinois' recommended application date and 87% included a labeled nitrification inhibitor. Results

show that 65% of these acres received a rate of applied nitrogen less than the MRTN for corn-corn or corn-soybean rotation, which is an indication of planned split nitrogen application. Seventy-four percent of corn acres had ammonia applied at a total nitrogen rate in the recommended range according to the updated Nitrogen Rate Calculator.

Figure 4.30 shows survey results about phosphorus loss reduction practices. The results indicate that 75% of acres are soil tested at least once every four years and 24% of acres are above critical P soil test values based upon crop removal rates.

Leadership for Midwestern Watersheds

Leadership for Midwestern Watersheds is a popular forum for professionals who lead projects that reduce agricultural runoff in watersheds of the Upper Mississippi River Basin. Led by AFT and other partners, LMW has met 12 times since 2011 to foster the regional cooperation needed to achieve national water quality goals (sandcountyfoundation.org/our-work/soil-and-water-conservation/leadership-for-midwestern-watersheds).

Annual LMW meetings build new connections and explore key agricultural conservation issues with formal presentations and facilitated discussions. The focus has been on engaging farmers, targeting conservation practices for the greatest impact, measuring results, governing projects, and scaling up lessons learned. This annual networking event encourages watershed leaders to share their knowledge and experiences to accelerate measurable water quality improvement outcomes in watersheds across the Midwest.

In 2020, LMW completed a detailed survey of Midwestern watershed leaders to assess their project and professional development needs. LMW is working with partners to develop a web platform and digital forum for user-led information exchange and updates of emerging tools, practices, and funding opportunities with the goal to actively engage hundreds of watershed leaders through ongoing digital dialogue, in addition to convening annual in-person meetings.

At the 2020 virtual conference, AFT facilitated a breakout session and hosted two presentations on estimating water quality and climate outcomes in Illinois, and comparing tools to quantify outcomes. Watershed practitioners from Illinois consistently comprise about 20% of LMW meeting attendees.

For more information, see sandcountyfoundation.org/our-work/soil-and-water-conservation/leadership-for-midwestern-watersheds.

Nutrient Research & Education Council

The Nutrient Research & Education Council was created in 2012 by the state of Illinois and is managed by representatives from farmer organizations, commercial fertilizer retailers, specialty fertilizer retailers, certified crop advisers, and IDOA. NREC is a public-private partnership that assures a sustainable source of funding for nutrient research and education programs (illinoisnrec.org/). The partnership between NREC and IDOA ensures that an assessment of $0.75/ton on all bulk fertilizer sold in Illinois is allocated to research and educational programs focused on nutrient use and water quality. From 2012 to 2020, NREC invested $23 million in nutrient efficiency research. In 2021, an additional $3.75 million will be directed towards applied research, with another $60,000 for outreach and educational activities.

NREC funds research projects in four main categories, with specific issues identified in each of the categories:

- ☑ Applying and understanding the 4Rs — identifying conservation practices and expanding the understanding of these practices related to more efficient fertilizer applications and using those nutrients for crop production.
- ☑ Capturing excess nutrients in the field, primarily using cover crops, with a focus on finding the most economical strategies for adopting these methods on a wide scale.
- ☑ Mitigating the loss of excess nutrients to water supplies through edge-of-field practices — woodchip bioreactors, wetlands, saturated buffers, water and sediment control basins, and other practices designed to capture nutrients before they enter water supplies.
- ☑ Studying other nutrient management issues, including the impact of tile depth and spacing, the use of gypsum and drainage water management, and emerging topics, such as dissimilatory nitrate reduction to ammonium for nitrate retention and the use of biochar to remove phosphorus from drainage water.

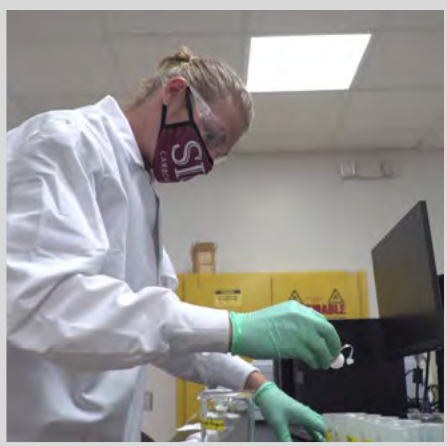
NREC also encourages education-based projects that incorporate research findings and effectively promote conservation practice implementation to farmers and crop advisers. NREC partners with others in the industry to focus on knowledge transfer and usefulness of the generated data. NREC publishes periodic "Investment Insights," which focus on particular research projects and provide a one-page summary of the work and findings. In addition, they post project videos on their YouTube

channel and utilize their other social media platforms to widely distribute research data. In 2020, the group held their first Investment Insight Live event where they brought together academic partners from across the state to share their research, have meaningful dialogue, and share ideas and concepts to move research forward. In addition, many of the 40-plus students who contribute to NREC-funded projects had the opportunity to present their work and interact with stakeholders and other researchers at the event's poster session.

Photo courtesy of NREC

NREC works with industry stakeholders to identify needs and prioritize areas of research. Annually, NREC requests proposals for projects that examine, test, and measure the effectiveness and economic viability of farming practices that reduce nitrogen and phosphorus losses to water and are not detrimental to agricultural production or yield. In addition, NREC funds the biennial NLRS Survey conducted by NASS, which measures adoption and awareness of NLRS practices.

Photo courtesy of NREC



For more information, visit illinoisnrec.org/.

Nutrient Stewardship Grant Program

The Nutrient Stewardship Grant Program is one example of how IFB is making lasting impacts in nutrient stewardship. The program is a cornerstone of the wide range of projects that IFB supports, providing farmers with the opportunity to develop grassroots efforts in their local communities. Since 2015, the IFB Board of Directors has committed over $700,000 to this program, funding 100 projects in 70 counties across Illinois. IFB committed $150,000 to the program in 2019, and once again in 2020. Through this program, IFB takes on an active role to support county Farm Bureaus and local partners to develop projects that address farmer needs for research, education and outreach, and implementation of conservation practices for nutrient loss reduction.

In 2019, IFB worked with 30 county Farm Bureaus and numerous local partners on 18 unique projects across the state. These projects showed active collaboration and action in all categories of the NLRS (education and outreach, research, implementation, and documentation). Through this wide range of unique projects, farmers across Illinois demonstrated that they care about nutrient loss and management.

In 2020, IFB committed over $150,000, with over $88,000 of in-kind matches to the Nutrient Stewardship Grant Program. Twenty-eight counties worked together on 14 projects throughout the state, to help "move the needle" on NLRS implementation. Projects included planting test plots of cover crops, water testing, watershed planning, and hosting education and outreach activities. Farmers across Illinois have once again shown that they actively care about conservation of both land and water. Details on the projects are included in the appendices of this report.

For more information, visit ilfb.org/ifb-in-action/what-were-working-on/protecting-our-environment/nutrient-stewardship-grant-program/.

Partnerships with Drinking Water Suppliers and Wastewater Treatment Plants

IFB has prioritized building relationships and developing cooperative efforts with our state's drinking water suppliers and wastewater treatment plants.

In 2020, IFB was an active supporter of several drinking water supply projects across the state. Additionally, IFB continued to support Springfield City Water, Light, and Power in their efforts to secure IEPA and NRCS funding for the Lake Springfield watershed. Sangamon County Farm Bureau has been a longtime supporter of work in the watershed and is planning to host a field day focused on cover crops in 2021. IFB also worked with the city of Decatur on continued watershed planning and implementation efforts across the seven-county watershed.

IFB has continued to build and strengthen relationships with wastewater treatment plants, including Metropolitan Wastewater Reclamation District of Greater Chicago, in an effort to bridge point and non-point source nutrient loss reduction issues. In 2020, IFB shifted efforts to a virtual workshop that connected farmers to MWRDGC researchers. The workshop provided an opportunity for farmers to learn about work taking place at the Fulton County research site and to share valuable feedback with the MWRDGC research team. IFB plans to strengthen this partnership by involving farm bureaus in Fulton and Cook counties, which will allow them to offer additional education and outreach projects.

For more information, see ilfb.org/ifb-in-action/what-were-working-on/protecting-our-environment/nutrient-stewardship-grant-program/2021-nutrient-stewardship-field-days/ and ilfb.org/ifb-in-action/what-were-working-on/protecting-our-environment/rural-urban-partnerships.

IFB NLRS Priority Watershed Work

Prior to releasing the strategy in 2015, Illinois EPA identified priority watersheds throughout the state, further indicating whether they were nitrogen or phosphorus priorities. IFB has a vested interest in supporting a variety of projects across these watersheds, regularly providing technical, financial, educational, and outreach resources to the efforts, which often involve multiple counties and a variety of point and non-point source stakeholders. In 2020, IFB worked primarily in the Mississippi North Central (Flint/Henderson) watershed and the Embarras River watershed and plan to extend this work into 2021 and beyond.

The Mississippi North Central watershed lies in parts of six counties in northwestern Illinois and covers approximately 1,546,232 acres. The watershed has been identified as an NLRS priority watershed, but currently does not have a watershed plan in place, making this a prime location for IFB and local county Farm Bureaus to be involved in conservation efforts.

In order to help address issues within the watershed, IFB, along with Hancock, Henry, Knox, Warren-Henderson, and Mercer County Farm Bureaus, worked to raise support for an Illinois EPA Section 319 grant application to develop a watershed plan, including specific proposals for implementing conservation practices in one or two high-priority sub-watersheds. Due to COVID-19 restrictions in 2020, the partners shifted their focus from hosting in-person meetings to collecting letters of support for the grant application from county Farm Bureaus, SWCDs, and state and federal lawmakers. The grant application was submitted in August 2020 and the group plans to host meetings to raise awareness and gather feedback from the agricultural community.

The Embarras River watershed, located in southeastern Illinois, covers approximately 1,558,063 acres across 12 counties. In fall 2019, stakeholders within the watershed worked together to support and apply for Illinois EPA Section 319 grant funding to update the Embarras River Watershed Management Plan,

which would expire in 2021. Without a watershed plan in place, stakeholders within the watershed have a decreased chance of receiving funding from certain state and federal programs for implementing conservation practices.

Involving stakeholders in the planning and implementation processes are critical to the success of watershed plans. In order to ensure success in the Embarras River watershed, IFB, alongside 11 county Farm Bureaus (Crawford, Champaign, Clark, Coles, Cumberland, Douglas, Edgar, Effingham, Jasper, Lawrence, and Richland), local SWCDs, and Illinois Extension, hosted nine watershed planning meetings in January 2020 (prior to COVID-19 meeting restrictions). These meetings provided farmers and landowners an opportunity to share their concerns and interests across the entire watershed, as well as the tools they desire to help address those concerns. IFB staff created a summary report of findings from the planning meetings, which provided high-level takeaways from each meeting within the watershed, as well as background information on previous and current watershed update efforts. In addition, IFB and their partners hosted a webinar in April 2020, sharing the report and updating stakeholders on next steps.

Farm Gate

In 2020, IFB, Illinois Pork Producers Association, Illinois Milk Producers' Association, and Illinois Beef Association continued their support of livestock farmers by providing answers to their regulatory questions and sharing educational opportunities and resources to help meet industry regulations and protect the environment.

These organizations continue to share resource guides for swine, beef, and dairy operations. These guides are meant to provide members with a "first step" toward understanding whether and how environmental rules and regulations impact their operations. These resource guides have been distributed widely and help ensure compliance and increase confidence.

This program is offered to livestock farms of all sizes, with a special focus on small and medium-sized operations.

For more information, see ilfb.org/take-actionstar/current-priorities/protecting-our-environment/livestock/.

Paired Watershed Study

Since 2000, Illinois farmers have worked with TNC researchers and their partners in two sub-watersheds of the Upper Mackinaw River watershed in central Illinois to implement conservation practices on private farmland and to monitor their effectiveness for improving water quality, hydrology, and biodiversity at the watershed scale. For the last decade, more focus has been on construction of small tile-treatment wetlands along the edges of fields to reduce the amount of nutrients that enter the river system from agricultural drainage tiles. In the last two years, TNC has added cover crops to test the effectiveness of bundled practices at the watershed scale. Almost 700 acres of cover crops were planted in the treatment watershed in 2020.

Precision Conservation Management

In response to the Illinois NLRS, ICGA and ISA developed PCM, ICGA's premiere nutrient loss reduction program (precisionconservation.org/). PCM is a service program designed to help farmers understand and manage risks associated with adopting new conservation practices, with the objective of helping farmers make sound financial decisions. The program evaluates conservation practices on both their impact to the environment and their impact to family farmer profitability. Through collaborations with more than 30 partners and the development of a farmer-friendly data collection platform, PCM offers one-on-one technical support to over 350 farmers in Illinois and Kentucky. PCM develops confidential yearly reports of each farmer's environmental and financial strengths and weaknesses, offering data summaries demonstrating average financial and environmental metrics for different management systems represented in its database comprising more than 825,000 acres of Illinois cropland from over 10,000 fields, spanning six years. PCM also offers participating farmers opportunities to receive financial and technical assistance for adopting new conservation practices. For the 2019 and 2020 growing seasons alone, PCM farmers have implemented conservation practices resulting in the following nutrient and sediment loss reductions: almost 1.2 million lb nitrate-nitrogen, over 180,000 lb P, and nearly 250,000 tons of sediment loss reductions. These reductions were achieved due to more than 280,000 acres of reduced tillage, 136,000 acres of in-season nitrogen application, and more than 45,000 acres of cover crops for these two years combined. (Figures 4.27 and 4.28 are the results of PCM research). To learn more about PCM and to see the program summary and 5-year data highlights, visit ilcorn.org/pcm.

Table 4.27. *PCM tillage application data and recommendation*

Corn IL, High SPR 2015-19 Avg Values	No-Till	Strip Till	1-Pass Light	2-Pass Light	2-Pass Moderate	2+ Tillage Passes
Number of Fields	310	296	710	139	302	46
Yield per Acre	209	219	220	224	223	216
Gross Revenue	$750	$787	$790	$804	$801	$773
Total Direct Costs*	$388	$395	$382	$384	$396	$422
Field Work	$0	$20	$10	$22	$26	$38
Other Power Costs**	$96	$93	$96	$93	$92	$97
Total Power Costs	$96	$113	$106	$115	$118	$135
Overhead Costs	$37	$37	$37	$37	$37	$37
Total Non-Land Costs	$521	$544	$524	$536	$550	$594
Operator and Land Return	$229	$243	$266	$269	$250	$180

*Direct costs = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance

**Other power costs = fall fertilizer application, spraying, planting, cover crop planting, spring/in-season fertilizer application, harvesting, and grain hauling

No-Till = No-tillage; 1-Pass Light = one pass with low-disturbance tillage; 2-Pass Light = two passes with low-disturbance tillage; 2-Pass Medium = two passes (one low disturbance and one high disturbance); 2+ Pass = more than two tillage passes, any intensity level

Table 4.28. *Nitrogen rates, yields, and returns. This table demonstrates that the greatest net income is generated from the 151 to 175 lb of total nitrogen per acre rate range when averaged over all years and high Soil Productivity Ratings soils. For reference, corn following soybean rate recommended from the MRTN rate calculator would be about 180 lb nitrogen per acre.*

Corn, High SPR, N rate (lb per acre)	Number of fields	SPR	Yield (Bushels per acre)					Average 2015-19	Operator and land return 2015-19
			2015	2016	2017	2018	2019		
Less than 150	41	139	154	222	212	216	198	200	$221
151 to 175	114	140	191	229	212	231	205	213	$270
176 to 200	382	140	205	226	220	232	207	218	$264
201 to 225	574	140	207	223	222	234	211	219	$252
Over 225	336	139	210	233	233	241	217	227	$242

Conservation Lease Addendum Awareness

Through a 2020 grant from Illinois Council on Best Management Practices, ICGA was able to complete a targeted awareness campaign around three conservation lease addendums created with University of Illinois Farmdoc. The conservation addendums for Illinois farm leases serve as a resource for both tenants and landowners navigating discussions about conservation adoption. They cover nutrient management, soil health, and conservation habitat. The addendum templates are fully customizable and can be easily added to any existing farm lease.

Direct mailings, print and social media campaigns, and Farmdoc webinars made possible by the grant reached tens of thousands of farmers, farm managers, and landowners. As a result, the lease addendums received more than 2,000 unique views on the Farmdoc website (farmdoc.illinois.edu).

Soil Health & Cover Crop Workshops

Photo courtesy of AISWCD

The Association of Illinois Soil and Water Conservation Districts hosted a series of Soil Health & Cover Crop workshops in the summer of 2019. A total of 136 attendees participated in four workshops held in Sycamore, Galesburg, Decatur, and Mt. Vernon. The purpose of these regional training sessions was to help foster greater adoption of cover crops and the implementation of the principles leading to increased soil health by agricultural producers across Illinois through a cover crop insurance rewards program.

The workshops were hosted by AISWCD with a combination of Soil and Water Conservation District directors and their staff attending.

STAR Conservation Evaluation Tool

Saving Tomorrow's Agriculture Resources is a free and confidential evaluation tool that provides farm operators and landowners a means to evaluate, measure, and increase their use of conservation practices based on locally identified resource concerns. STAR is used in over 70 Illinois counties and four Indiana counties; three different states are preparing to implement STAR statewide. Using a simple evaluation system, it assigns points for various cropping activities, management decisions, and conservation practices of a field. The total points are used to assign a one to five STAR Rating. The higher the rating, the more on-farm activities are protecting soil and water resources. After the STAR evaluation, farmers receive field signs with their earned STARs, which can increase as they adopt additional practices. The signs provide farmers with recognition of their good work and create awareness in the community. The ratings are based on local resource concerns and vetted by a local technical advisory committee.

Photo courtesy of Champaign County SWCD

In early 2021, STAR finished its third year of enrolling fields and documenting conservation. It has steadily grown reaching more farmers and fields and engaging with new partners (Table 4.29). Through support from its partners, the Association of Illinois Soil and Water Conservation Districts was able to hire a full-time STAR coordinator and kick off the first Pilot Incentive Program, providing payments to farmers that can demonstrate an improved STAR Rating over consecutive years. STAR engages directly with SWCDs and other licensees to help deliver local conservation assistance.

Table 4.29. *Enrollment in the STAR Initiative*

STAR Enrollment	2019	2020	Percent Increase
Acres enrolled	83,592	169,241	102%
Fields enrolled	1,175	2,461	109%
Participants enrolled	214	406	90%

Following are highlights from the 2019 crop year report:

- ☑ Cover Crops — 35% of total fields (411) planted a cover crop; 29% of total fields (341) planted a winter hardy cover crop; and 24% of cover-planting fields (272) planted "green." Cover crops helped keep 1,168 truckloads of sediment out of Illinois waterways and helped keep over 4,000 lb of phosphorus and over 73,000 lb of nitrogen in the field.

- ☑ Tillage — 76% of total fields (893) did not perform any fall tillage; 33% of soy fields (388) are under no-tillage or strip till management; and 24% of corn fields (282) are under no-tillage or strip till management. Use of no-till and strip till helped prevent 3,374 truckloads of sediment from eroding into Illinois waterways and kept 150,000 lb of phosphorus in the fields.

- ☑ Nutrient Management — 51% of fields applying nitrogen (600) used a rate at or below the MRTN suggested rate, avoiding 27,195 lb of nitrogen loss; 35% of fields applying fall nitrogen (411) used a nitrification inhibitor; and 24% of total fields (282) have a nutrient management plan.

For more information, see starfreetool.com.

Tree Buffer Program

The Illinois Pork Producers Association offers a tree buffer cost-share program for swine farmers who implement fresh landscaping on their farms. A buffer is a strategically placed area of trees that provides a windbreak, recycles clean air, and adds curb appeal to a landscape. IPPA matches up to $2,500 of the total cost for each project. Funding can be used to purchase trees, shrubs, and design services. To date, IPPA has invested over $80,000 in the program, allowing swine farmers from across the state to take advantage of this incentive. In 2019 alone, 682 trees were planted.

An environmental engineer for IPPA, funded in part by the Illinois Soybean Association Check-off Program, provides research and planning services to tree buffer cost-share projects. A local Extension educator may also provide support by suggesting the best types of trees for the desired location. Their expertise ensures that each project yields a useful tree buffer that will benefit the farmer.

A map of IPPA-funded tree buffer projects is available at ilpork.com/farmers-care/sustainability/tree-buffers-across-illinois.

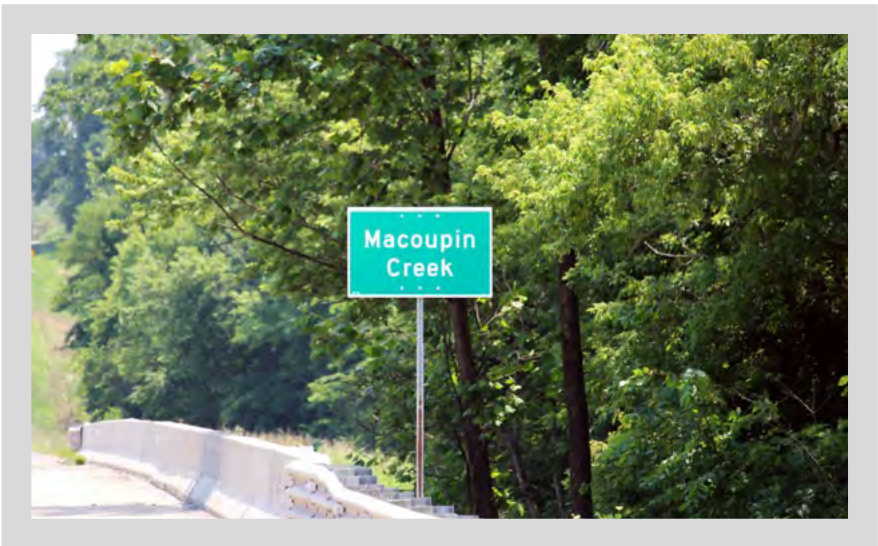
Upper Macoupin Creek Watershed Partnership

The Upper Macoupin Creek watershed is a sub-watershed of the Macoupin Creek basin located in Macoupin County, Illinois. The UMCW project area covers 137,694 acres, about half of the Macoupin Creek Basin. AFT leads this initiative with over 15 federal, state, and local government partners, agricultural trade associations, environmental groups, agricultural retailers, and a local university working to reduce phosphorus losses, improve farm productivity, provide education and outreach, and improve water quality in the creek.

The UMCW partnership includes a 17-member steering committee comprised of eight farmers, two representatives from M&M Service Company, two representatives from CHS Shipman, two representatives from the NRCS office in Macoupin County, one representative

from Macoupin County Soil and Water Conservation District, one representative from Illinois Stewardship Alliance, and one representative from AFT.

Photo courtesy of Layne Knoche, Illinois Extension



In 2019, AFT funded and completed a nine-element watershed plan for the UMCW. The plan outlines the seven goals agreed upon by the watershed steering committee and identifies priority areas and practices, as determined using the Spatial Watershed Assessment and Management Model. Surface runoff is responsible for 61% of phosphorus losses in the watershed, 29% of which are from conventional tillage. Nutrient management, cover crops, and strip till are the three focus practices to reduce erosion and, therefore, phosphorus losses. Structural practices are available to supplement the in-field practices. The 10-year implementation plan predicts that, in order to reach goals laid out in the NLRS, an annual reduction of 41,000 lb of phosphorus is necessary for a 25% reduction across the watershed.

In June 2019, a conservation technician began work in the watershed to promote conservation cropping systems and provide one-on-one conservation planning to all landowners in the project area. The technician helps identify practices based on the SWAMM model.

Twelve farmers in 2019 and 13 farmers in 2020 received funding for improvements in the watershed through contracts with RCPP, including the CSP, EQIP, and MRBI for a total of 25 contracts. Total financial obligations were $295,001.61 in 2019 and $695,154 in 2020 for a total of $990,155.61 over the two-year span. Acres enrolled in 2019 totaled 2,367.1 and 13,508.8 in 2020 for a total of 15,875.9 enrolled acres. Practices supported through cost-share include cover crops, reduced tillage, no-tillage, and nutrient management.

In the winter of 2019, Macoupin County officially became a STAR licensed county. AFT is working to encourage farmers in the UMCW to fill out STAR forms as another way to track progress in the watershed.

For more information, see farmland.org/project/umc.

Table 4.30. *Upper Macoupin Creek watershed*

RCPP-EQIP	Prior Years*	2019	2020	Cumulative
Contracts	3	3	5	**11**
Acres	858	599	886	**2,343**
Obligation	$77,046	$77,939	$115,759	**$270,744**

RCPP-CSP	Prior Years*	2019	2020	Cumulative
Contracts	11	1	6	**18**
Acres	6,559	1,186	11,544	**19,289**
Obligation	$81,326	$53,797	$487,792	**$622,915**

MRBI	Prior Years*	2019	2020	Cumulative
Contracts	24	8	2	**34**
Acres	2,790	582	1,079	**4,451**
Obligation	$490,612.26	$163,270	$91,603	**$745,485.26**

*Previous years include 2018 for RCPP-EQIP and RCPP-CSP, and 2016-18 for MRBI.

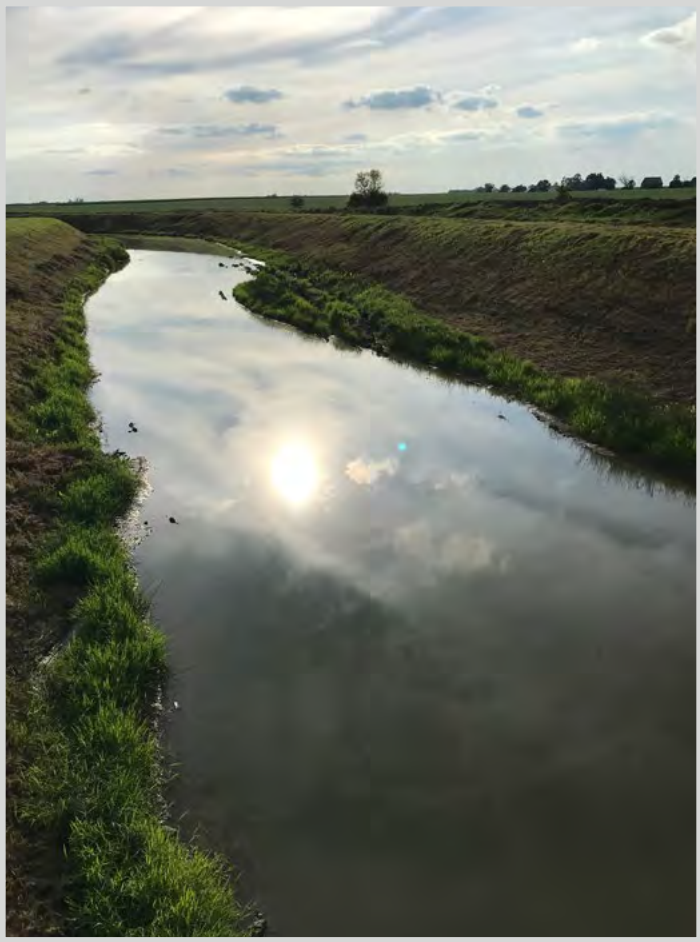
Vermilion Headwaters Watershed Partnership

The Vermilion Headwaters watershed is a 305,426-acre rural watershed encompassing parts of Livingston, Ford, Iroquois, and McLean counties in Illinois. This watershed has been identified as one of the top five, non-point source nitrogen loading watersheds in Illinois and is a major contributor to nitrogen loading in the Mississippi River.

The Vermilion Headwaters Watershed Partnership is a group of stakeholders, including farmers, community leaders, government agencies, research institutions, and nonprofit organizations working to reduce the

loss of nitrogen from farmland in the watershed. The adoption of conservation cropping systems, such as reduced tillage, cover crops, nutrient management, and tile water treatment, can help protect water quality and improve a farmer's bottom line.

Photo courtesy of Jean Brokish, AFT



Funding for priority practices, like cover crops, nutrient management, and reduced tillage is available through the Mississippi River Basin Initiative. In fiscal year 2019, nine contracts were awarded a total of $182,376, spanning 1,785 acres. In fiscal year 2020, six contracts were awarded a total of $187,718, spanning 1,627 acres.

For more information, see farmland.org/project/vhw/.

Table 4.31. *Vermilion Headwaters watershed*

MRBI	2015-18	2019	2020	Cumulative
Contracts	47	9	6	**62**
Acres	6,126	1,785	1,627	**9,538**
Obligation	$1,089,192	$182,376	$187,718	**$1,459,286**

AFT developed case studies of two farmers in the Vermilion Headwaters watershed using partial budget analysis to estimate the net economic benefits from soil health practices, like no-till, strip till, cover crops, and nutrient management. AFT also used USDA's Nutrient Tracking Tool and CarbOn Management & Emissions Tool to quantify the water quality and climate benefits of these practices. Farmer profiles and information on the case studies are available at farmland.org/project/quantifying-economic-and-environmental-benefits-of-soil-health/.

Women for the Land

AFT continues to engage female non-operating landowners through the Women for the Land initiative. In 2020, AFT partnered with Champaign County SWCD to plan and host two virtual learning circles. The project was funded by PepsiCo and presentations were designed to increase the use of cover crops on lands in PepsiCo's supply chain. Evaluation polls at the conclusion of the event assessed learning outcomes. Results reflected significantly increased knowledge of the benefits of cover crops and increased confidence in discussing cover crops with family and tenant farmers. More than half of the participants requested additional information about cover crops and soil health.

AFT also recognizes the role that farm advisers and conservation professionals play in facilitating conversations between farmers and non-operating landowners. AFT collaborated with ICGA and ISA to host an online discussion for agriculture and conservation professionals that emphasized opportunities for conservation on rented lands.

To measure impacts of these "conservation conversations," AFT conducted phone interviews with participants. Fifty percent of participants identified a need for more information on cover crops and soil health practices; 67% requested information on other related topics, ranging from farmland preservation to farm succession planning. Table 4.32 shows a summary of June's conservation conversation outcomes.

Table 4.32. *Summary of June conservation conversation outcomes*

Learning Objectives/Outcomes	Strongly Agree (%)	Agree (%)
Cover crops can improve farm productivity and increase overall profits	42	25
Increased knowledge about on-farm and off-farm benefits of cover crops	33	42
Cover crops can reduce nutrients, sediment, and greenhouse gas emissions	50	50
Confidence in ability to discuss cover crops with family	44	33
Confidence in ability to discuss cover crops with tenant farmer	22	56

Metric Collection

The purpose of this chapter is to showcase the scale of implementation of recommended conservation practices that reduce nutrient loads from agricultural lands. Some of these practices may also contribute to improving soil health, habitat, and carbon sequestration. The agriculture implementation metrics discussed in this chapter are a result of dedicated partner agencies and organizations documenting and submitting their information and data. Reporting this information remains challenging, as there can be multiple organizations working on the same project and some conservation practices are easier to track than others. Creative solutions are necessary to conduct efficient data collection for practices, such as stream buffers and filter strips, along with new practices, such as saturated buffers and terraces.

The success of traditional state and federal cost-share programs is dependent on the level of funding received and the willingness of farmers and landowners to use these programs. It should be noted that most programs receive more requests than can be funded. The growth and maturation of non-governmental programs continues to increase and provide metrics on agriculture implementation. Information can only be included in biennial reports if it is submitted. Omission of programs or activities in this report is not intentional. The inclusion of additional programs and activities that lead to nutrient loss reduction in the agriculture sector is welcomed and encouraged.

Future Strategic Actions

Agricultural Water Quality Partnership Forum

The Agriculture Water Quality Partnership Forum's purpose is to "steer, coordinate, and assign responsibilities for delivering outreach and education required to involve individual farmers in addressing nutrient losses" and to accomplish the objectives listed in the strategy and in chapter 7. Members meet to discuss effective ways to collaborate on agricultural initiatives to meet NLRS goals, work to improve tracking conservation practice implementation, and have a technical subgroup that currently tracks implementation measures. For a discussion of AWQPF and its technical subgroup's activities in 2019–20, see chapter 7.

Point source facility

Photo courtesy of Fox Metro Water Reclamation District

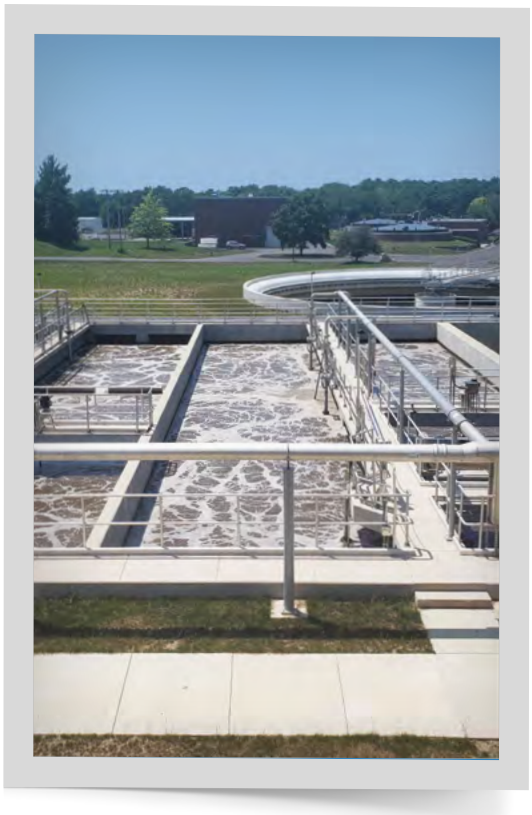
CHAPTER 5
POINT SOURCE SECTOR

This chapter is composed of two parts: 1) implementation status, organized by tracking measures; 2) information about current programs and projects supporting Illinois Nutrient Loss Reduction Strategy goals. Data sources for this chapter include information from the largest wastewater treatment facilities in Illinois, as compiled by Illinois Association of Wastewater Agencies. Further, all National Pollutant Discharge Elimination System permit holders are required to submit monthly discharge data to Illinois Environmental Protection Agency, which provided analysis of this information.

Implementation Report

Point source sector implementation tracking follows the logic model framework outlined in chapter 2. To determine resource and outreach measures, wastewater treatment agencies and watershed groups reported on their staff, financial resources, and outreach efforts via the strategy's tracking spreadsheet. IAWA encouraged its members to complete this spreadsheet during its quarterly technical meetings and compiled the spreadsheets for this report. In 2019, 20 entities responded; 28 responded in 2020, including the 10 largest facilities in the state, representing most of Illinois' effluent flow due to their size.

Photo courtesy of Kishwaukee Water Reclamation District



Completed spreadsheets can be found in the appendix. They were analyzed by University of Illinois Extension and Dr. Anna Marshall, University of Illinois. Land and facility measures data were estimated by Illinois EPA. The computation method is included in this chapter.

Photo courtesy of Fox Metro Water Reclamation District

Resource Measures

The point source sector has directed substantial resources to capital improvements and nutrient reduction feasibility studies. As Figure 5.1 shows, reported total spending nearly tripled between 2019 and 2020 — from $65,132,920 in 2019 to $185,213,223 in 2020. Capital improvements account for most of the spending, with a significant portion contributed by Fox Metro and Kishwaukee water reclamation districts. Facilities continue to invest in feasibility studies, as well. Table 5.1 details granular nutrient-related spending in the point source sector.

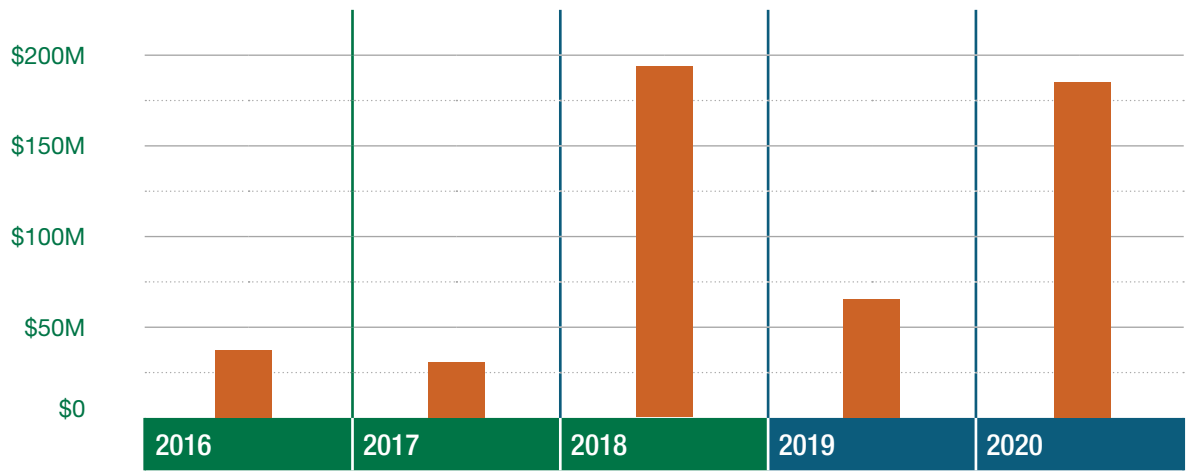


Figure 5.1. *Point source spending comparison for 2016, 2017, 2018, 2019, and 2020*

Table 5.1. *Funds supporting 2019-20 nutrient reduction-related activities in the point source sector for IAWA reporting agencies and watershed groups*

Nutrient Reduction-Related Activity	2019 Totals	2020 Totals
Capital improvement	$60,175,432	$181,581,773
Operations and maintenance	$2,098,370	$665,178
Feasibility studies or permit-required projects	$279,723	$253,056
Staff	$2,357,845	$2,521,000
Other	$221,550	$192,215
Total	**$65,132,920**	**$185,213,223**

Outreach Measures

Although COVID-19 prevented more face-to-face meetings in 2020, Table 5.2 shows that the point source sector, nevertheless, maintained an active agenda of outreach and collaborative engagement to advance the Nutrient Loss Reduction Strategy. Some of these activities included training and workshops aimed at specific strategies, especially phosphorus removal. In addition, the Metropolitan Wastewater Reclamation District of Greater Chicago sponsored virtual events publicizing the benefits of nutrient loss reduction, including the increased population of native fish in Cook County waters.

Table 5.2. *2019-20 point source outreach activities reported by IAWA facilities and watershed groups*

Type of Activity	Number of Events	Attendance
Field Days	2	35
Presentations	9	2,228
Workshops	3	400
Total	**14**	**2,663**

The point source sector's outreach activities in this reporting period reflect enhanced collaboration with stakeholders. Some of that collaboration was inspired by Nutrient Assessment Reduction Plans recently introduced by Illinois EPA. Two working groups, the DuPage River Salt Creek Workgroup and the Salt Fork Watershed Implementation Group, formed to discuss meeting goals set by NARP requirements. In addition, MWRDGC continued meeting with watershed planning councils representing the six major watersheds in Cook County, collaborating with the agricultural sector on field days, and with the stormwater sector on green infrastructure and stormwater treatment.

Finally, MWRDGC conducted extensive public education emphasizing the research and implementation of nutrient loss strategies. Through press releases, its website, and social media campaigns, MWRDGC described advances in technologies for nutrient recovery and energy generation.

Land and Facilities Measures

Progress Across Illinois

Point source sector NLRS implementation focuses on reducing nutrient loads through wastewater treatment facility system upgrades and watershed approaches. Major municipal wastewater treatment facilities (facilities with a design average flow equal to or greater than one million gallons per day) continue to complete and submit optimization and feasibility studies. Since 2018, 71 optimization studies and 59 feasibility studies have been submitted. In addition, 53 individual facilities are currently developing NARPs, while 86 are being developed as part of a watershed group. Statewide nutrient loads from point sources have increased slightly compared to the 2018 loads, which saw a 24% reduction in total phosphorus and 10% reduction in total nitrogen loads, compared to the 2011 baseline period. Reasons for these increases are discussed below; however, reductions compared to the baseline load were still achieved. In 2019, there was an 18% total phosphorus load reduction and in 2020, a 16% reduction, compared to the 2011 baseline load. More facilities have reduced their annual average nutrient concentrations during the past two-year period, as well. Significant total phosphorus load reductions are still anticipated in the long-term, due to large wastewater treatment facilities that are scheduled to become compliant with NPDES permit requirements over the next several years. Improvements in the development and successful operation of technology that enhances nutrient removal is also key to achieving nutrient loss reduction goals.

Statewide Total Phosphorus Load Reductions for 2019-20

Photo courtesy of Kishwaukee Water Reclamation District

Annual total phosphorus loads from point sources were calculated for 2019 and 2020. The last biennial report showed a statewide total phosphorus load reduction of 4.3 million pounds, or 24%, from point sources between 2011 and 2018. Total phosphorus loads in 2019 and 2020 increased, compared to 2018 loads, but were still lower than the estimated 2011 baseline load of 18.1 million pounds.

In 2018, there were 213 major municipal facilities. In 2019, there were 210, due to the closing of three facilities: the Village of Frankfort's North (IL0045403) and West (IL0020532) facilities, and the City of McHenry's (IL0021067) facility. In 2020, the Village of Frankfort's new facility, Frankfort Regional Wastewater Treatment Plant, brought the total to 211 major municipal facilities.

The methods used to calculate point source loads are discussed in detail later in this chapter. Loads for most major municipal facilities, or publicly owned treatment works, were calculated using data from monthly Discharge Monitoring Reports; however, some facilities do not have nutrient monitoring requirements in their current permit. Illinois Association of Wastewater Agencies provided data for the Metropolitan Water Reclamation District of Greater Chicago's Kirie, Egan, Hanover Park, and Lemont facilities, as well as three North Shore Sanitary District facilities. The cities of Decatur and Sauget provided data directly to Illinois EPA. The total phosphorus loads from the past two years are discussed below.

2019 Loads

In 2019, the estimated annual statewide total phosphorus load from point sources was 14.9 million pounds. Nearly all (12.1 million pounds) was attributed to 210 major municipal facilities. It is estimated that minor municipal facilities contributed 2.4 million pounds, while industrial facilities contributed a smaller fraction of 0.4 million pounds (Table 5.3). This results in an 18% reduction from the 2011 baseline load.

Table 5.3. Statewide total phosphorus loads from the point source sector in 2019

Point Source Sector	Total Phosphorus Load (million lb/yr)
2011 Baseline	**18.1**
2019 Total Phosphorus Load › 210 Major Municipals › Minor Municipals › Major and Minor Industrials	**14.9** **12.1** **2.4** **0.4**
Reductions from 2011 Baseline	**3.2 (18%)**

2020 Loads

The 2020 estimated annual statewide total phosphorus load from point sources was 15.2 million pounds. Two hundred eleven major municipal facilities contributed 12.3 million pounds, while it is estimated that minor municipal facilities contributed 2.4 million pounds. Industrial facilities contributed approximately 0.5 million pounds (Table 5.4). This results in a 16% reduction from the 2011 baseline load.

Table 5.4. Statewide total phosphorus loads from the point source sector in 2020

Point Source Sector	Total Phosphorus Load (million lb/yr)
2011 Baseline	**18.1**
2020 Total Phosphorus Load › 211 Major Municipals › Minor Municipals › Major and Minor Industrials	**15.2** **12.3** **2.4** **0.5**
Reductions from 2011 Baseline	**2.9 (16%)**

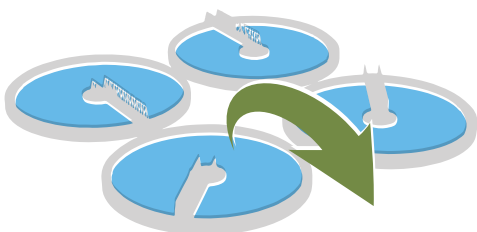
Total Phosphorus Reductions From Individual Dischargers

Total phosphorus loads from many individual major municipal facilities were lower in 2019-20, compared to 2018. In 2019, 111 facilities had decreased loads, ranging from 1-87%, compared to 2018 loads. In 2020, 136 facilities had decreased loads, ranging from one to 1-78%, compared to 2019 loads. Some of these decreases were due to annual variations in flow and concentration, but many were the result of meeting required permit limits of 1 mg/L total phosphorus concentration. These decreases were offset, however, by increased loads from the remaining facilities, with a significant proportion contributed by some of the largest facilities in the state.

The 2019 and 2020 annual average total phosphorus concentrations for the major municipal facilities were also analyzed. In 2019, there were 82 facilities with an annual average total phosphorus concentration of 1 mg/L or less, with 32 of those being 0.5 mg/L or less. In 2020, there were 90 facilities with an annual average total phosphorus concentration of 1 mg/L or less, with 31 of those being 0.5 mg/L or less.

Table 5.5 shows the top 10 major municipal facilities with the highest total phosphorus loads in 2020. The estimated 2011 baseline loads and loads from 2017-20 are also shown. These 10 facilities comprised 59% of the statewide total phosphorus load in 2020. Table 5.6 shows the annual flow and total phosphorus concentration values for 2019 and 2020 for the same 10 facilities.

Photo courtesy of Kishwaukee Water Reclamation District



In 2019,
82 facilities
had an annual average total phosphorus concentration of 1 mg/L or less.

In 2020,
90 facilities
had an annual average total phosphorus concentration of 1 mg/L or less.

Table 5.5. *2020 top 10 major municipal facilities for total phosphorus loads*

NPDES Permit	Facility Name	Baseline 2011 TP Load (lb/yr)	2017 TP Load (lb/yr)	2018 TP Load (lb/yr)	2019 TP Load (lb/yr)	2020 TP Load (lb/yr)	Change from 2011
IL0028061	MWRDGC – Calumet	2,450,714	1,705,544	1,990,902	2,191,160	2,569,259	5%
IL0028053	MWRDGC – Stickney	2,351,312	1,288,296	707,230	2,164,828	2,435,218	4%
IL0028321*	Sanitary District of Decatur	1,562,750	1,770,422	2,022,573	2,011,785	1,897,809	21%
IL0028088	MWRDGC – O'Brien	969,075	916,335	931,333	947,758	978,314	1%
IL0027201	Rock River Water Reclamation District	971,083	232,702	280,051	231,141	223,527	-77%
IL0036340*	MWRDGC – Egan	233,759	206,963	209,074	219,942	210,437	-10%
IL0033481	Granite City, City of	126,431	133,683	330,034	86,593	180,081	42%
IL0028657	Fox River Water Reclamation District	171,050	184,605	171,000	187,850	173,032	1%
IL0034061	Naperville, City of	190,457	163,870	166,060	155,307	162,805	-15%
IL0027731	Bloomington/ Normal Water Reclamation District	139,207	130,866	101,236	132,693	124,924	-10%

**Data provided by facility*

Table 5.6. *2020 top 10 major municipal facilities' flow and total phosphorus concentrations*

NPDES Permit	Facility Name	2019 Avg Flow (MGD)	2019 Avg TP Conc. (mg/L)	2020 Avg Flow (MGD)	2020 Avg TP Conc. (mg/L)
IL0028061	MWRDGC – Calumet	307	2.44	264	3.54
IL0028053	MWRDGC – Stickney	816	0.95	688	1.21
IL0028321*	Sanitary District of Decatur	39	17.18	37	16.96
IL0028088	MWRDGC – O'Brien	257	1.25	207	1.61
IL0027201	Rock River Water Reclamation District	22	1.76	19	2.08
IL0036340*	MWRDGC – Egan	28	2.70	24	3.10
IL0033481	Granite City, City of	19	1.52	15	5.07
IL0028657	Fox River Water Reclamation District	20	3.15	18	3.37
IL0034061	Naperville, City of	22	2.33	20	2.73
IL0027731	Bloomington/ Normal Water Reclamation District	20	2.28	17	2.72

**Data provided by facility*

Metropolitan Water Reclamation District of Greater Chicago

The Metropolitan Water Reclamation District of Greater Chicago provides wastewater treatment and stormwater management services for residents and businesses in the Chicagoland area. Its service area covers 882 square miles, including the city of Chicago and 128 suburban communities in Cook County. MWRDGC serves approximately 10.35 million people each day, including 5.25 million residences.

MWRDGC operates seven facilities: Stickney, Calumet, Terrence J. O'Brien, John E. Egan, Kirie, Lemont, and Hanover Park water reclamation plants. These facilities had a combined discharge of approximately 535 billion gallons of treated water in 2019, and 448 billion gallons in 2020. Due to the large volume of water that is discharged, the nutrient contributions from these facilities comprise a large percentage of the annual statewide loads. MWRDGC facilities contributed 38% and 42% of the annual statewide total phosphorus loads in 2019 and 2020, respectively. These seven water reclamation plants discharged approximately 5.6 million pounds of phosphorus in 2019 and 6.3 million pounds in 2020. The Stickney and Calumet WRPs comprised a majority of these loads.

Most of the statewide reduction in total phosphorus reported in the 2019 biennial report was due to large reductions from the Stickney facility. The implementation of a biological phosphorus removal system in 2014 was optimized in 2018, resulting in a 95% phosphorus removal efficiency. However, problems arose with managing solids content in the aeration tanks in January 2019. The biological phosphorus removal operation was halted and slowly restarted during 2020. To ensure compliance with the permit limit of 1 mg/L that goes into effect in August 2021, a temporary chemical phosphorus removal system is being installed, which will be followed by installation of a permanent chemical phosphorus removal system.

The Calumet WRP discharged the highest statewide total phosphorus load in 2020. A phosphorus removal feasibility study was completed in 2019 and a chemical removal process is currently being designed to work in concert with a biological phosphorus removal system. The Calumet facility's current NPDES permit includes a schedule for achieving compliance with a total phosphorus limit of 1 mg/L by January 1, 2024.

The O'Brien WRP is MWRDGC's third largest facility. A phosphorus removal feasibility study was completed in 2019. A pilot test using algae for nutrient removal is currently underway and a side-stream enhanced biological phosphorus removal system was initiated in 2020. The facility's current NPDES permit includes a schedule for achieving compliance with a total phosphorus limit of 1 mg/L by August 1, 2027.

It is anticipated that significant reductions in total phosphorus loads from point sources will be achieved once these three facilities, along with other large major municipal facilities throughout the state, meet a 1 mg/L total phosphorus concentration. As demonstrated by other facilities, achieving annual average concentrations at or below 0.5 mg/L is possible, which will lead to even further reductions for statewide total phosphorus loads.

Nutrient Reduction Special Conditions

Nutrient Assessment Reduction Plans

The requirement to develop an NARP is being incorporated into many Illinois NPDES permits for major municipal facilities that discharge into a receiving water body that has been determined impaired or at risk of eutrophication. The purpose of the NARP is to identify phosphorus input reductions and other measures that can be implemented by a major municipal facility or group of major municipal facilities via a watershed workgroup to help ensure that dissolved oxygen and offensive aquatic algae and aquatic plant criteria are met throughout a watershed.

A phosphorus-related impairment means that the downstream waterbody or segment is listed by Illinois EPA as impaired due to low dissolved oxygen and/or offensive conditions (algae and/or aquatic plant growth) that is related to elevated phosphorus levels. Illinois EPA will determine if the permittee's treatment plant effluent is located upstream of a waterbody or stream segment that has been determined to have a phosphorus-related impairment. This determination is made upon reviewing available information concerning the characteristics of the relevant waterbody/segment and the relevant facility (e.g., quantity of discharge flow and nutrient load relative to the stream flow).

A waterbody or segment is at risk of eutrophication if there is plant, algal or cyanobacterial growth that may cause a violation of a water quality standard, or if there is pH and dissolved oxygen data that implies excessive plant growth. Illinois EPA will determine if the permittee's treatment plant effluent is located upstream of a waterbody or stream segment that has been determined to be at risk of eutrophication. This determination is made upon reviewing relevant information concerning the characteristics of the relevant waterbody/segment and the relevant facility (e.g., quantity of discharge flow and nutrient load relative to the stream flow).

The permittee shall develop, or be a part of a watershed group that develops, an NARP that will meet the following requirements:

A. The NARP shall be developed and submitted to the Illinois EPA by December 31, 2023 or December 31, 2024 depending on when the permit was issued. This requirement can be accomplished by the permittee, by participation in an existing watershed group or by creating a new group. The NARP shall be supported by data and sound scientific rationale.

B. The permittee shall cooperate with and work with other stakeholders in the watershed to determine the most cost-effective means to address the phosphorus-related impairment. If other stakeholders in the watershed will not cooperate in developing the NARP, the permittee shall develop its own NARP for submittal to the Illinois EPA to comply with this condition.

C. In determining the target levels of various parameters necessary to address the phosphorus-related impairment, the NARP shall either utilize the recommendations by the Nutrient Science Advisory Committee or develop its own watershed-specific target levels.

D. The NARP shall identify phosphorus input reductions by point source discharges and non-point source discharges in addition to other measures necessary to remove phosphorus-related impairments in the watershed. The NARP may determine, based on an assessment of relevant data, that the watershed does not have an impairment related to phosphorus, in which case phosphorus input reductions or other measures would not be necessary. Alternatively, the NARP could determine that phosphorus input reductions from point sources are not necessary, or that phosphorus input reductions from both point and non-point sources are necessary, or that phosphorus input reductions are not necessary and that other measures, besides phosphorus input reductions, are necessary.

E. The NARP shall include a schedule for the implementation of the phosphorus input reductions by point sources, non-point sources and other measures necessary to remove phosphorus-related impairments. The NARP schedule shall be implemented as soon as possible and shall identify specific timelines applicable to the permittee.

F. The NARP can include provisions for water quality trading to address the phosphorus-related impairments in the watershed. Phosphorus/nutrient trading cannot result in violations of water quality standards or applicable antidegradation requirements.

G. The permittee shall request modification of the permit within 90 days after the NARP has been completed to include necessary phosphorus input reductions identified within the NARP. The Illinois EPA will modify the NPDES permit, if necessary.

H. If the permittee does not develop or assist in developing the NARP, and such an NARP is developed for the watershed, the permittee will become subject to effluent limitations necessary to address the phosphorus-related impairments. The Illinois EPA shall calculate these effluent limits by

using the NARP and any applicable data. If no NARP has been developed, the effluent limits shall be determined for the permittee on a case-by-case basis, so as to ensure that the permittee's discharge will not cause or contribute to violations of the dissolved oxygen or narrative water quality standards.

Currently, 53 individual major municipal facilities in Illinois are developing NARPs. It has been determined that 42 facilities do not meet the criteria to develop an NARP, while that requirement is yet to be determined for another 30 facilities. Of the 53 facilities developing an NARP, 14 are required due to discharging to a waterway impaired for nutrients and 39 are required due to discharging to a waterway at risk of impairment due to nutrients.

In addition to these facilities, there are 89 facilities developing NARPs as a part of a watershed group. These watershed groups are: Fox River Study Group, Lower DuPage River Coalition, DuPage River / Salt Creek Workgroup, Des Plaines River Watershed Workgroup, Lower Des Plaines Watershed Workgroup, and North Branch Chicago River Watershed Workgroup.

Illinois EPA has developed an interactive map showing the locations of facilities required to develop an NARP, not required to develop an NARP, and those to be determined. It also specifies facilities that are developing an NARP as part of a watershed group. Figure 5.2 depicts a screenshot of the NARP map website, which can be found at illinois-epa.maps.arcgis.com/home/item.html?id=dd82c86b7325412f823f623b51fe6db9.

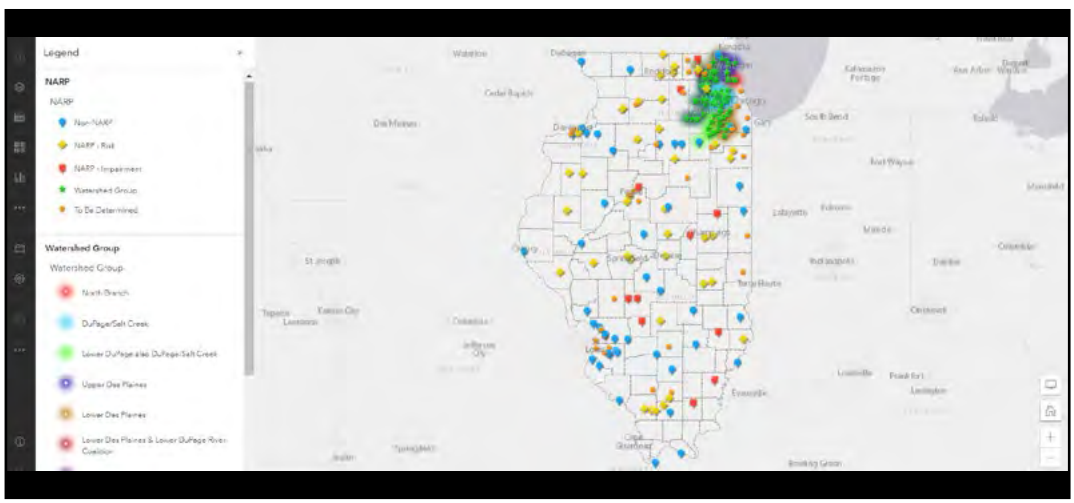


Figure 5.2. *Screenshot of the NARP map website*

Statewide Total Nitrogen Reductions for 2019-20

Annual total nitrogen loads from point sources were estimated for 2019 and 2020 and compared to the 2011 baseline load. The 2019 statewide total nitrogen load from all point sources was estimated to be 85.8 million pounds, which is a 1.7% decrease from the 2011 baseline load (Table 5.7).

Table 5.7. Statewide total nitrogen loads from the point source sector in 2019 and 2020

Point Source Sector	Total Nitrogen Load (million lb/yr)	Reduction From Baseline Load (million lb/yr)
2011 Baseline	**87.3**	
2019 Total Nitrogen Load › 210 Major Municipals › Minor Municipals › Major and Minor Industrials	**85.8** **80.7** **3** **2.1**	**1.5 (1.7%)**
2020 Total Nitrogen Load › 211 Major Municipals › Minor Municipals › Major and Minor Industrials	**83.2** **78** **3** **2.2**	**4.1 (4.7%)**

The 2020 total nitrogen load from all point sources was estimated to be 83.2 million pounds, which is a 4.7% decrease from the 2011 baseline load (Table 5.7).

The 2019 biennial report showed a 14% and 10% decrease in total nitrogen loads from all point sources in 2017 and 2018, respectively, compared to the 2011 baseline load of 87.3 million pounds. Like total phosphorus, most of the total nitrogen load is discharged by the major municipal facilities, followed by minor municipals, and major and minor industrials. At the end of 2020, there were 20 major municipal facilities with total nitrogen reduction goals included in their permits.

Discussion

Observed differences in annual point source nutrient loads from year to year are the result of changes in flow and nutrient concentrations from each wastewater treatment facility. These fluctuations occur

on a monthly or seasonal basis, as well. To gain a better understanding of the increase in nutrient loads observed for 2019 and 2020, as compared to 2018, the total flow and average nutrient concentrations were analyzed and compared to annual totals for each of the major municipal facilities.

Table 5.8 shows a 13.8% increase in flow from 2018 to 2019. However, there was a 15.8% decrease in flow from 2019 to 2020. Turning to concentrations, the average total phosphorus concentration from all major municipal facilities in 2019 was 1.55 mg/L, which was a 22.5% decrease from 2018. The 2020 average total phosphorus concentration was 1.72 mg/L, an 11% increase from 2019 (Table 5.9). The average total nitrogen concentration in 2019 from all major municipal facilities was 25% higher than in 2018; in 2020, it was 12% higher than in 2019 (Table 5.10). It appears that the 22.5% decrease in total phosphorus concentration in 2019 was overshadowed by the large increase in statewide discharged flow, resulting in increased overall loads. Although discharged flow was markedly lower in 2020 compared to 2019, the slight increase in concentration was enough to increase the 2020 total phosphorus load over 2019. Caution should be used in extrapolating statewide facility average values to explain annual nutrient loading differences, due to the sizeable influence of the largest facilities in the state.

Table 5.8. *Total annual flow for major municipal facilities*

Year	Total Million Gallons	2020 Totals
2018	813,636	—
2019	925,667	13.8%
2020	779,145	-15.8%

Table 5.9. *Average annual total phosphorus concentrations for major municipal facilities*

Year	Total Phosphorus Concentration (mg/L)	Percent Change From Previous Year
2018	2.00	—
2019	1.55	-22.50%
2020	1.72	11.00%

Table 5.10. *Average annual total nitrogen concentrations for major municipal facilities*

Year	Total Nitrogen Concentration (mg/L)	Percent Change From Previous Year
2018	9.34	—
2019	11.6	25.00%
2020	13.07	12.70%

Method for Calculating Point Source Nutrient Loads

Multiple methods were used to calculate annual statewide total phosphorus and nitrogen point source loads for 2019 and 2020. Point sources include major municipal sewage treatment facilities and major and minor industrial wastewater facilities. Load estimates for minor municipal sewage treatment facilities were also used.

In 2019, there were 210 major municipal wastewater treatment facilities, 196 of which were required to monitor for total nitrogen and 198 for total phosphorus. In 2020, there were 211 major municipal wastewater treatment facilities, with 198 required to monitor for total nitrogen and 199 for total phosphorus.

Nutrient loads for major municipal facilities in 2017 and 2018 were previously calculated using the U.S. EPA Water Pollutant Loading Tool. The methodology for calculating point source loads for these years can be found in the 2019 Biennial Report. As mentioned in the report, it was determined that the loading tool did not correctly calculate annual loads for facilities with a main treatment outfall designated as "B01" or "B02." Nutrient loads for these facilities were instead calculated using monthly Discharge Monitoring Report data retrieved from the Integrated Compliance Information System. Due to an increased number of facilities being given a B01 or B02 designation during permit renewals, it was decided that monthly DMR data would be used to calculate the 2019 and 2020 annual loads for all major municipal point sources. Facilities that are not required to submit total nitrogen or total phosphorus DMR data were contacted and voluntarily submitted internal data. While more laborious, this method allows for better quality control checks of the DMR data, ensures the correct outfalls are used, and provides more transparency of how loads were calculated for each individual facility. There is also the possibility that the pollutant loading tool under- or overestimated loads for certain facilities in 2017 and 2018. As methods for calculating point source loads improves moving forward, so will the accuracy of the loads.

To calculate monthly loads for the major municipal facilities, the following formula was used:
Monthly Average Flow Value (MGD) * Monthly Average Nutrient Concentration (mg/L) * 8.34 (conversion factor) * 30.417 (average days in a month).

The U.S. EPA Water Pollutant Loading Tool was used to calculate the 2019 and 2020 annual loads for industrial facilities. The same method was used to calculate these loads in 2017 and 2018. In 2019, there were 17 major and 313 minor industrial facilities with total nitrogen loads. In 2020, there were 18 majors

and 300 minors. For total phosphorus, there were 11 majors and 50 minors with loads in 2019, while there were 13 majors and 49 minors with loads in 2020. Fluctuation in the number of facilities is due to permit terminations and issuance of permits for new facilities. Monthly DMR data was used to serve as a check on some of the higher loading facilities for accuracy. Large fluctuations in loads from year to year were also investigated. Continuing past practice, loads from power plants were not included, as it is difficult to differentiate between nutrients added to process wastewater and nutrients already present in the source water influent.

The annual nutrient loads for minor municipal facilities continue to be based on the estimates used in the original Science Assessment to Support an Illinois Nutrient Loss Reduction Strategy. There are approximately 642 facilities classified as minor municipal. These load estimates will continue to be used until additional resources are available to calculate more accurate loads.

Monthly DMR data is entered into the eDMR system by each facility. While efforts were made to catch and correct outlier values and keying errors, incorrect values may still exist. The accuracy of monthly DMR data depends on the facilities providing correct flow and concentration values. Efforts to improve the accuracy and efficiency of calculating annual point source nutrient loads will continue to be explored.

NPDES Permits Issued with Nutrient Criteria

By the end of 2020, Illinois EPA had issued 77 permits that required each facility to meet a total phosphorus concentration limit of 1 mg/L, representing 36% of major municipal facility permits with this limit (Figure 5.3). Further, 16 facilities are on a compliance schedule to meet future total phosphorus limits of 1 mg/L. Approximately 200 major municipal facilities are now required to monitor for total phosphorus and total nitrogen. Additionally, Illinois EPA has issued 20 NPDES permits with a goal of total nitrogen removal.

Major municipal dischargers are required to submit and implement phosphorus discharge optimization plans for existing facilities, with the following components:

- An evaluation of possible source reduction measures.
- A plan for optimizing operations to achieve the lowest possible total phosphorus effluent levels with existing equipment.
- An evaluation of minor facility modifications to optimize reductions in phosphorus discharges.

- An evaluation of possible levels of reduction.
- A discussion of potential local impacts and the benefits of reduction.
- A timeline for implementation.
- The submittal of annual progress reports.

Major municipal facilities are also required to develop feasibility studies to meet total phosphorus concentrations of 0.5 mg/L and 0.1 mg/L. As Figure 5.4 shows, 143 optimization studies and feasibility studies have been submitted through 2020.

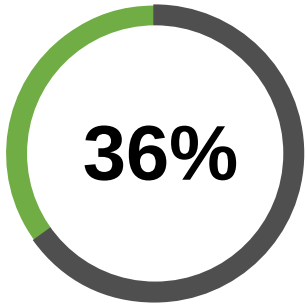


Figure 5.3. *Percentage of major municipal NPDES permits with total phosphorus limits statewide*

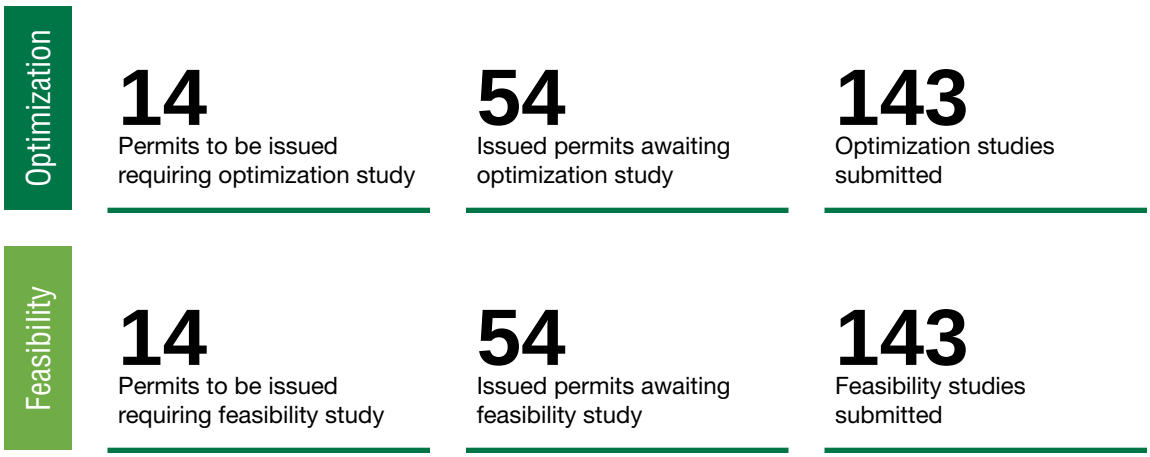


Figure 5.4. *Feasibility studies and optimization studies submitted by major municipal facilities*

Watershed Approach

Illinois EPA continues to encourage and work with local watershed groups to meet the nutrient loss reduction objectives in the strategy, including non-point source, stormwater, and point source nutrient loading. Where practical, as part of this effort, the agency is using permit conditions to require nutrient reduction feasibility reports, cost-effective implementation of control technologies using existing infrastructure, and improved nutrient removal technologies. Facilities will employ improvements to meet Illinois NLRS objectives. Illinois EPA continues to work with the Fox River Study Group, DuPage River Salt Creek Workgroup, Lower Des Plaines Watershed Group, Lower DuPage River Watershed Coalition, North Branch Chicago River Watershed Workgroup, and Des Plaines Watershed Workgroup.

Fox River Study Group

The Fox River Study Group is a diverse coalition of stakeholders who have been working together since 2001 to enhance the health and vitality of the Fox River for the benefit of the nearly 1 million citizens in the Fox River Valley. The study group is using science to guide the region toward a cleaner, safer, and more beautiful Fox River. The group uses research, data, and collaboration to support sustainable policies and development across the Fox River watershed.

In 2015, FRSG completed the Fox River Implementation Plan, which is the community's road map to eliminate water quality impairments due to low dissolved oxygen levels, high total phosphorus levels, and nuisance algae in the Fox River from the Stratton Dam in McHenry County to the mouth of the river in LaSalle County. The group's study area encompasses 1,405 square miles of the Fox River watershed.

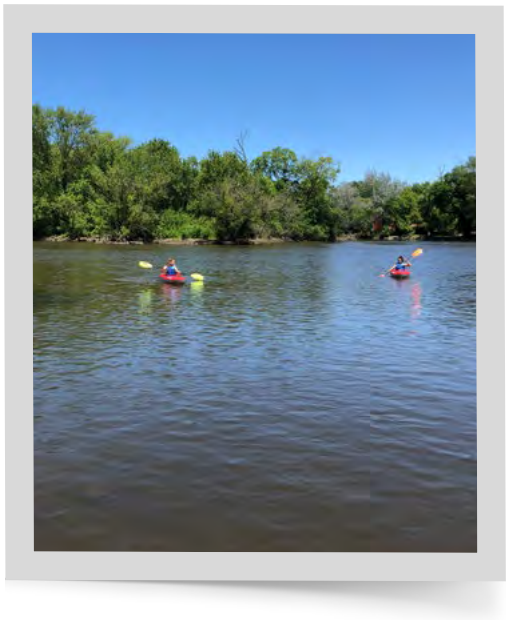
Major wastewater treatment plants that discharge to the Fox River are completing upgrades at their facilities, so that total phosphorus discharges will meet an annual average limit of 1 mg/L. This will result in an approximately 75% reduction in total phosphorus loading to the river during summer months, as compared to the 2010–13 load. These improvements will be adopted through 2022. The Fox River watershed dischargers have also committed in their National Pollutant Discharge Elimination System permits to meet a total phosphorus limit of 0.5 mg/L annual geometric mean by 2030, unless FRSG determines that a greater phosphorus reduction is necessary and achievable before then.

FRSG is now in its 19th year of water quality data collection in the watershed. On a monthly basis, an all-volunteer and in-kind effort by FRSG member groups collects and analyzes samples from seven main stem locations and seven tributary locations along an 80-mile stretch of the Fox River from McHenry to Yorkville. FRSG is also funding the U.S. Geological Survey to collect continuous water quality data on the Fox River during the growing season. USGS is collecting seasonal data during water years 2018–21 at the Stratton Dam (USGS Station #05549501). This is one of the first sites in the nation with continuous monitoring of blue-green algae levels. Blue-green algae can release toxins into the water, so these data are valuable to downstream entities that use the Fox River as the water supply for over 300,000 residents.

The Illinois State Water Survey maintains the FoxDB environmental database, where all available data for the Fox River watershed are compiled and publicly available (ilrdss.sws.uiuc.edu/fox/). The database is

updated biennially. Besides the ongoing monitoring described above, new water quality and biological data were collected in 2020. In anticipation of the planned removal of the Carpenter Dam by the Forest Preserve District of Kane County, the FRSG coordinated pre-removal studies of the pooled and free-flowing reaches near the dam. Illinois EPA studied the macroinvertebrate population and Illinois Department of Natural Resources sampled fish. Consulting firm Deuchler's field staff conducted water quality sampling from July to October in the dam pool and upstream free-flowing reach. These studies will be repeated after the dam removal is completed to document the removal's impacts on water quality and the biological community.

Photo courtesy of Friends of the Fox River



To make informed decisions about how best to maintain and improve the quality of the Fox River in this urbanizing watershed, FRSG has developed two computer models — Hydrological Simulation Program – FORTRAN for watershed loading and QUAL2K for instream. Geosyntec Consultants has completed an update of these models for FRSG. The instream model has been updated to QUAL2Kw, a dynamic version, and recalibrated with data collected since the 2015 FRIP was completed. Geosyntec is currently using the models to assess different management scenarios to address low dissolved oxygen and nuisance algae problems in the Fox River; results will be used to update the FRIP for submission to Illinois EPA by the end of 2022. Scenarios being evaluated include reductions in phosphorus in tributary watersheds the Fox River upstream of the Stratton Dam, and wastewater treatment facilities, as well as removal of the numerous low head dams on the Fox River. In 2021, the models will also be used to evaluate combinations of these different management practices.

FRSG and Chicago Metropolitan Agency for Planning completed an update and recalibration of the HSPF model for the Mill Creek sub-watershed, which was used to complete a new watershed-based plan for that Fox River tributary in 2019. Currently, FRSG and CMAP are collaborating with other watershed stakeholders on the development of a watershed-based plan for the Indian Creek watershed in Kane and DuPage counties. The HSPF model for the Indian Creek watershed is being updated as part of this effort. FRSG continues to work with U.S. Army Corps of Engineers and IDNR to complete the Fox River

Habitat and Connectivity Study. This study, which is half-completed, will evaluate the efficacy and cost-effectiveness of fish passage and riverine function restoration methods at 10 low head, run-of-the-river dams on the Fox River. The FRSG and IDNR are working on an agreement for FRSG to cover the local cost-share needed to complete the study.

FRSG worked with Aileron Communications to conduct a phone survey of residents' attitudes toward the Fox River in February 2020. Findings revealed that 46% think the Fox River is somewhat or very polluted, and 23% think the Fox River is somewhat or very unsafe for paddling, fishing, or recreation. Aileron also helped FRSG refresh its web presence (foxriverstudygroup.org).

In 2019 and 2020, FRSG conducted 14 outreach activities, mostly presentations that informed the public about the Illinois Nutrient Loss Reduction Strategy, the adverse impacts of high algae levels on drinking water from the Fox River, opportunities to improve river conditions, and the efforts the watershed community is undertaking to reduce phosphorus levels and nuisance algae blooms in the river. In addition, the Friends of the Fox River representative on the FRSG board has made presentations on the anticipated benefits of removing more dams from the Fox River.

As Figure 5.5 shows, 23 optimization studies and feasibility studies have been submitted from the Fox River watershed.

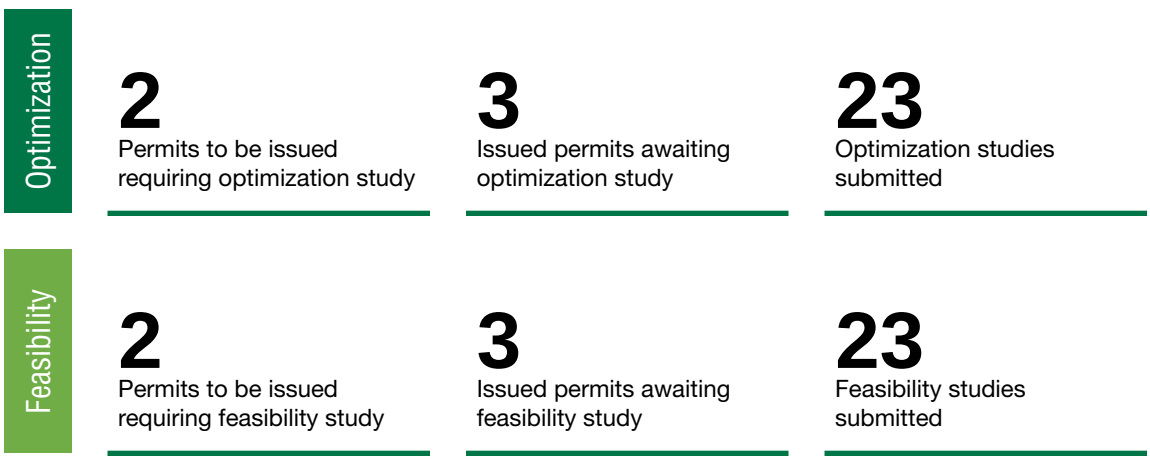


Figure 5.5. *Feasibility studies and optimization studies submitted by major municipal facilities in the Fox River watershed*

DuPage River Salt Creek Workgroup

The DuPage River Salt Creek Workgroup formed in 2005 in response to concerns about Total Maximum Daily Loads set for the east and west branches of the DuPage River and Salt Creek, located in portions of Cook, DuPage, and Will counties in northeastern Illinois. The DRSCW seeks to implement targeted watershed activities that resolve priority waterway problems efficiently and cost-effectively.

In 2015, a special condition was added to DRSCW's NPDES permits that substantially increased financial commitments to restoration efforts focused on improving aquatic life. The special condition includes nine stream restoration projects, two studies, and the development of a nutrient implementation plan.

Physical Projects:

- Post-project monitoring was conducted at the Oak Meadows Golf Course dam removal and stream restoration project along the Salt Creek in Addison, Illinois. Post-project, both the Macroinvertebrate Index of Biological Integrity score and individual species taxa biodiversity improved. The 2019 post-project mean MIBI (40.85 points) increased 17.25 points from the 2013 score, resulting in the sites now meeting the general use standard for aquatic life. Additionally, the post-project Qualitative Habitat Evaluation Index increased at all sites with improvements in substrate, riparian, pool, and riffle scores. Mean QHEI at the project location increased 13.95 points to 71.5 points. All QHEI scores in 2019 were in the range defined as good (>60 QHEI points).
- In cooperation with Forest Preserve District of DuPage County and Illinois State Toll Highway

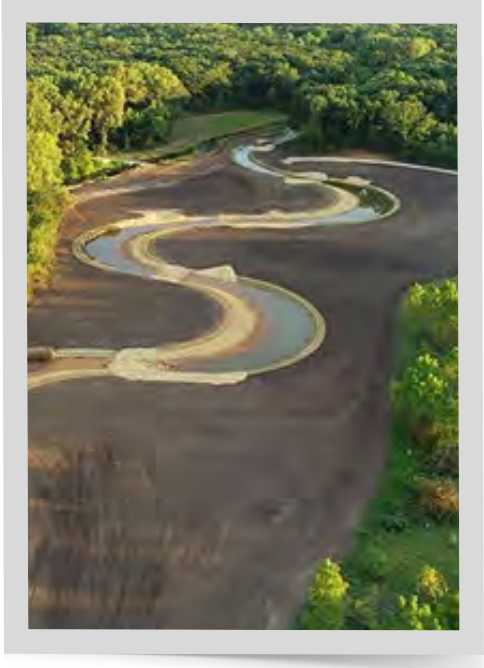


Photo courtesy of Forest Preserve District of DuPage County

Authority, the Spring Brook No. 1 Wetland and Creek Restoration — Phase 2 project in Wheaton was completed in fall 2020. This project included the removal of the Arrow Road Dam and created a new meandering stream channel and restored riparian wetlands and vegetation.

- After a master planning process that included alternatives analysis and an extensive public input process, the DRSCW entered into a license agreement with FPDDC to implement the Master Plan for Salt Creek at Fullersburg Woods. The Master Plan includes the removal of the Fullersburg Woods Dam and one and one-quarter miles of stream restoration within the Fullersburg Woods Forest Preserve. Final design and preparation of contract bid documents is scheduled for 2021.
- In cooperation with FPDDC and DuPage County Stormwater Management, the DRSCW completed preliminary design of a fish ladder system for the Fawell Dam modification. The dam is located on the west branch of the DuPage River in Naperville. The fish ladder is expected to be installed in 2021.

Studies and Nutrient Implementation Plan:

- The DRSCW completed its Identification and Prioritization System model update. The IPS model is an analysis of causal factors influencing aquatic life, including the effects of nutrients. The IPS model also developed watershed-based thresholds for phosphorus, which will be utilized to develop a watershed-based phosphorus goal to be included in the nutrient implementation plan.
- Updates to the QUAL2K models for Salt Creek and the East Branch DuPage River commenced in 2020. These models are being updated to QUAL2Kw; a model is also being developed for the West Branch DuPage River. Calibration and validation for the Salt Creek and East Branch models is complete. These models will be used to evaluate projects and scenarios for the nutrient implementation plan.

As Figure 5.6 shows, 26 optimization studies and feasibility studies have been submitted from the DuPage River Salt Creek watersheds.

Future work for the DRSCW includes preliminary design of the Lower East Branch DuPage River and West Branch DuPage River stream restoration projects, expanding the phosphorus- and nitrogen-trading program to include stream restoration crediting and the development of a best management practices manual for street sweeping, leaf litter removal, and catch basin cleaning.

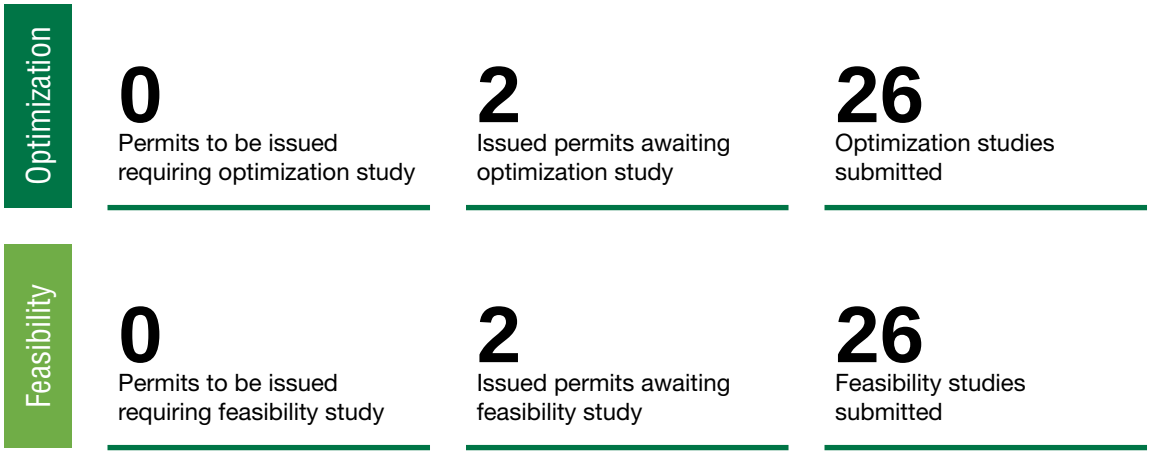


Figure 5.6. *Feasibility studies and optimization studies submitted by major municipal facilities in the DuPage River Salt Creek watersheds*

Hickory Creek Watershed Planning Group

The Hickory Creek Watershed Planning Group disbanded and was absorbed into the Lower Des Plaines Watershed Group.

Lower Des Plaines Watershed Group

The Lower Des Plaines Watershed Group formed in 2017 as a proactive way for municipalities and other dischargers to work together to address water quality issues in the watershed. The watershed encompasses approximately 490 square miles, from Willow Creek, just north of O'Hare Airport in Cook County, to the confluence with the Kankakee River in Will County. All but two municipal dischargers are participating in the LDWG. In 2018, the LDWG worked with Illinois EPA to develop special conditions language for NPDES permits that allow and encourage dischargers to work together to develop an NARP.

Activities:

- In 2019-20, the LDWG implemented the second and third year of the Bioassessment Program, including 22 stations on the upper portion of the Des Plaines River (I-355 to Willow Creek)

and 40 stations in the Hickory Creek watershed. Sampling included water and sediment chemistry, fish, macroinvertebrates, and habitat assessments. Additional dissolved oxygen, nutrient, and chlorophyll a sampling was done at a subset of sites. Reports for the main stem and for Hickory Creek will be available in late 2021.

- The LDWG is working with the DuPage River Salt Creek Workgroup to utilize their IPS model for the tributary watersheds. The IPS model is an analysis of causal factors influencing aquatic life, including the effects of nutrients.

Working with the Lower DuPage River Watershed Coalition, LDWG continues to expand and develop new materials to help members meet Municipal Separate Storm Sewer Systems outreach requirements. Campaigns focus on ways residents can reduce their negative impacts on water quality. Topics include using native plants, rain gardens and rain barrels, detention basin maintenance, pet waste, proper leaf disposal, and reducing chlorides. Outreach materials include social media posts, articles for newsletters and websites, printable handouts, and specialized items for the Salt Smart, Save More winter campaign. All materials are available under the members tab at lowerdesplaineswatershed.org/.

In 2021, the LDWG will continue investigating a framework for the NARP that addresses the differing needs for the Mainstem Des Plaines River and the tributaries.

Lower DuPage River Watershed Coalition

The Lower DuPage River Watershed Coalition was formed in 2012 to identify and address priority water quality issues in the Lower DuPage River and its tributaries, located almost entirely in Will County. The coalition is comprised of municipalities and other public agencies with participation from all six municipal wastewater dischargers.

In 2016, the coalition collaborated with the DRSCW to develop a nutrient implementation plan for the DuPage River watershed. Municipal dischargers are contributing funds to the plan development and two dischargers are contributing funds to implement projects that address contributing factors to low aquatic life scores, including low levels of dissolved oxygen.

Physical Projects:

- The LDRWC has worked in partnership with the Forest Preserve of Will County to design and successfully bid a dam removal project that will result in the removal of the above-grade portion of the Hammel Woods Dam and build an extended riffle in its place. The project will provide passage of fish species to upstream reaches where they are not found currently, as well as improve the instream habitat and dissolved oxygen. The project is awaiting final approvals from permitting agencies and is scheduled for completion in summer 2021.

Studies and Nutrient Implementation Plan:

- The LDRWC partnered with the DuPage River Salt Creek Workgroup to complete its IPS model update. The IPS model is an analysis of causal factors influencing aquatic life, including the effects of nutrients. The IPS model also developed watershed-based thresholds for phosphorus, which will be utilized to develop a watershed-based phosphorus goal to be included in their nutrient implementation plan.
- Development of a QUAL2Kw model for the Lower DuPage River commenced in 2020. Calibration and validation for the model will be complete in 2021. This model will be used to evaluate projects and scenarios for the nutrient implementation plan.

Other Activities:

- Working with the Lower Des Plaines Watershed Group, the LDRWC continues to expand and develop new materials to help members meet MS4 outreach requirements. Campaigns focus on ways residents can reduce their negative impacts on water quality. Topics include using native plants, rain gardens and rain barrels, detention basin maintenance, pet waste, proper leaf disposal, and reducing chlorides. Outreach materials include social media posts, articles for newsletters and websites, printable handouts, and specialized items for the Salt Smart, Save More winter campaign. All materials are available on the website under the members tab.

Future work for the LDRWC includes the design and implementation of an instream restoration project on the main stem DuPage River, upstream of the Hammel Woods Dam. The QUAL2Kw model will be used to run scenarios with differing channel configurations to guide project design. The LDRWC is working closely with the DuPage River Salt Creek Workgroup on expanding the phosphorus- and nitrogen-trading program to include stream restoration crediting and the development of a best management practices manual for street sweeping, leaf litter removal, and catch basin cleaning. More information on this collaboration can be found at lowerdesplaineswatershed.org.

North Branch Chicago River Watershed Workgroup

The North Branch Chicago River Watershed Workgroup was formed in January 2018 to identify and assess water quality issues along the three forks of the North Branch Chicago River. The watershed encompasses over 95 square miles, with northern and southern boundaries roughly extending from Illinois Route 132 in Waukegan, Lake County south to Dempster Street in Morton Grove, Cook County. The work-group membership consists of 42 separate organizations, including 24 MS4 communities and agencies two of which are POTWs.

In 2019 and 2020, NBWW updated the NBWW workplan and progress report to evaluate progress being made toward the workplan. Illinois EPA approved the NBWW Quality Assurance Project Plan in April 2019 and the NBWW continued their water quality monitoring program. The monitoring program included:

- Identifying 25 sites in the watershed for consistent sampling.
- Collecting and analyzing water column chemistry samples from all 25 sites.
- Deploying datasondes at seven sites in 2019 and six sites in 2020 for collecting dissolved oxygen, pH, temperature, and specific conductance.
- Collecting and analyzing fish, macroinvertebrates, habitat, and sediment samples at 14 of the 25 sites, completing the first full cycle of bioassessment data in 2019.
- Collecting and analyzing fish, macroinvertebrates, habitat, and sediment samples at 11 more sites, starting a second cycle of bioassessment data in 2020.
- Receiving a draft comprehensive monitoring report detailing the first full cycle of monitoring data (2018-19). In 2021, the NBWW Monitoring Committee will be reviewing this draft to produce a final version of the comprehensive monitoring report.

The 2018–20 NBWW monitoring program costs were utilized as local project match towards Lake County Stormwater Management Commission's Illinois EPA Section 319 (Clean Water Act) grant program to update the 2008 North Branch Chicago River watershed-based plan.

The NBWW's website can be found at nbwwil.org.

The Des Plaines River Watershed Workgroup

The Des Plaines River Watershed Workgroup was formed in 2015 to fulfill the regulatory requirements of its members. According to Illinois EPA, almost all of the waterways within the DRWW are impaired. To remove the watershed from the Illinois EPA's list of impaired waterways, the Midwest Biodiversity Institute is developing a tool to identify water quality improvement. In anticipation of the Illinois EPA's permit renewal process in 2021, the workgroup is addressing its constituents' regulatory requirements. The DRWW also provides professional development opportunities to members, stakeholders, and constituents. The workgroup membership consists of 36 municipalities, organizations, and business entities.

In 2019, the DRWW worked with Geosyntec to develop a multi-year workplan that will result in a completed NARP by 2023. The NARP will keep both MS4 and NPDES permits compliant; it also meets prerequisites for project funding in the watershed.

Monitoring Projects:

- The DRWW conducted water quality monitoring on the inlets and outlets of Lake Charles, Big Bear Lake, and Little Bear Lake to determine nutrient and pollutant sources. Field data was compared to lake models and to the 2018 study on glacial lakes to determine external and internal phosphorus contributions.
- The DRWW continued water and sediment sampling analysis programs at 73 monitoring locations. Thirty-one monitoring locations were studied for the bioassessment monitoring program.
- The DRWW, with the help of the North Shore Water Reclamation District, began a three-year continuous water quality monitoring program in June 2020. Multiprobe sondes were installed in the Des Plaines River Mainstem at Russell Road, Highway 120, and Half Day Road. The sondes will record specific conductivity, pH, water temperature, dissolved oxygen, chlorophyll a, and turbidity every 30 minutes. This data will be used to support the development of an

NARP for the Des Plaines River watershed, assess watershed impacts from winter road maintenance, and determine sediment transport impacts.

- The DRWW implemented the Hydrilla Rapid Response Plan after hydrilla was found in a stormwater pond in Libertyville in 2019. This will be a long-term treatment and monitoring strategy that will likely occur for the next five to seven years.

Illinois EPA Section 319 Grant Projects:

- The DRWW partnered with Lake County Health Department on the removal of carp to reduce internal nutrient cycling and increase the likelihood of successful aquatic plant establishment in impaired lakes in Lake County. Carp removal began in October 2020 after initial delays due to COVID-19. Carp removal will occur at Crooked, Hastings, McDonald 2, Slough, Des Plaines Lake, St. Mary's Lake, Big Bear Lake, and Little Bear Lake in 2021 and 2022.
- The DRWW partnered with Lake County Forest Preserve District on the Van Patten Woods Hydrologic Restoration and Enhancement Project. Invasive species clearing and drain tile disablement began in December 2019. Since then, LCFPD has retired 94.5 acres of farm field and removed or disabled approximately 11,150 linear feet of drain tile. LCFPD has installed seven check dams, one trail berm, 716 trees and shrubs, and a diverse native seed and cover crop mix to the remaining areas. In spring 2021, LCFPD will be installing native wetland plant plugs in the new wetland basins. The project is expected to be complete by June 2021.
- The DRWW partnered with Village of Libertyville to complete the Charles Brown Park Wetland Detention Project in summer 2020. Two sediment forebays were installed at inlet points to capture sediments and particulate pollutants. A third sediment forebay was installed near the outlet of the basin to capture additional pollutants before discharge through a pump station. The project also included 7.45 acres of wetland enhancement. The wetland enhancement BMPs, in conjunction with the sediment forebay BMPs, have provided significant water quality benefits to downstream waters.

In 2019, the DRWW sponsored and assisted in implementing the Lake County Deicing Workshop, which was attended by 177 people, 46 of whom were from DRWW member communities. DRWW also sponsored a plant identification workshop.

The DRWW's website can be found at drww.org.

Current Programs and Projects Supporting Nutrient Loss Reduction Goals

The following section highlights point source programs and projects that have undergone significant changes or have noteworthy updates since Illinois NLRS and the last biennial report.

Table 5.11. *Point source programs and projects working toward Illinois NLRS Goals*

(Bold type and page number indicate an update in this report. Details about programs listed in non-bold type and page number can be found in the listed document.)

Agriculture and Point Source Sector Partnership: Testing Best Management Practices

MWRDGC established a Nutrient Loss Reduction Research and Demonstration Project on agricultural land at its Fulton County site to foster collaboration with the agricultural sector to develop and expedite nutrient reduction practices. The 13,500-acre property is located between Canton and Cuba, Illinois, about 190 miles southwest of Chicago and 40 miles southwest of Peoria. It was originally purchased in 1970 to restore strip-mined land; approximately 4,000 acres were converted to productive farmland.

Since 2015, research and demonstration projects have been established at the site in collaboration with many partners, such as the University of Illinois at Urbana-Champaign's Department of Crop Sciences, Department of Agricultural and Biological Engineering, and Illinois Sustainable Technology Center; Illinois Central College; Ecosystem Exchange; Illinois Farm Bureau; and Fulton County Farm Bureau. Projects include inter-seeded cover cropping, riparian grass buffer, denitrifying bioreactors, runoff irrigation, subirrigation, drainage water management, designer biochar, and watershed-scale nutrient reduction demonstration.

In 2019, a field day was held at the site in collaboration with IFB, Fulton County Farm Bureau, University of Illinois, and Nutrient Research and Education Council. Participants included the partners' leadership, farmers, representatives from the agriculture sector and communities, and other stakeholders. Highlights of the field day included demonstration of a bioreactor installation and results from cover crop inter-seeding and drainage irrigation research.

In 2020, the partners received a U.S. EPA grant to develop and scale up an innovative bioreactor and treatment system to effectively capture nutrients from subsurface drainage water, recycle nutrient-captured biochars as a slow-release fertilizer, and keep nutrients in the closed agricultural loop. Due to the COVID-19 pandemic, the outreach on this collaboration was moved to a virtual format. MWRDGC, IFB, and Fulton County Farm Bureau worked together to prepare and share a research white paper and video tour of the research site, as well as to host a virtual farmer focus group, providing farmers with an opportunity to share meaningful feedback on continued research at the site.

All involved partners value the collaboration that has stemmed from this project and hope to bring farmers and the MWRDGC research team together at the Fulton County research and demonstration site in 2021.

For more information, visit ilfb.org/ifb-in-action/what-were-working-on/protecting-our-environment/rural-urban-partnerships/.

Total Maximum Daily Loads

Total Maximum Daily Loads developed by Illinois EPA for impaired watersheds include point source waste load allocations for total phosphorus and nitrate-nitrogen when these nutrients are listed as potential causes of impairment. Waste load allocations vary, depending on the magnitude of loadings from point sources in a watershed and the degree to which the water quality standard is exceeded. Point source reduction goals vary for TMDLs with nutrient-related point source contributions. These goals are incorporated into NPDES permits at renewal or modification stages.

MWRDGC staff at Fulton County test site

Photo courtesy of MWRDGC

In 2019–20, U.S. EPA approved a total of 46 total phosphorus TMDLs for the following waterbodies:

- Bonpas Creek Watershed: New West Salem Reservoir.
- Upper Big Muddy River Watershed: Herrin Old Reservoir, Johnson City Reservoir, Arrowhead (Williamson) Reservoir, West Frankfort Old Reservoir, and West Frankfort New Reservoir.
- Upper Fox River — Chain O'Lakes Watershed: Antioch Lake, Bluff Lake, Lake Catherine, Channel Lake, Davis Lake, Deep Lake, Dunn's Lake, Duck Lake, Fish-Duncan Lake, Fischer Lake, Fox Lake, Grass Lake, Hidden Lake, Long Lake, Lake Marie, McGreal Lake, Nippersink Lake, North Churchill Lake, Petite Lake, Pistakee Lake, Redhead Lake, South Churchill Lake, Spring Lake, Summerhill Estates Lake, Lake Tranquility, Turner Lake, and Wooster Lake.
- Upper Fox River — Flint Creek Watershed: Lake Barrington, Drummond Lake, Echo Lake, Grassy Lake, Honey Lake, Island Lake, Lake Fairview, Lake Napa Suwe, Lake Louise, Slocum Lake, Timber Lake (South), Tower Lake, and Woodland (Highland) Lake.

Since 2000, U.S. EPA has approved 139 total phosphorus TMDLs, and eight nitrate-nitrogen TMDLs. Illinois EPA is currently developing total phosphorus TMDLs in Thorn Creek and Lake Lou Yaeger watersheds and nitrate-nitrogen TMDLs in the Vermilion River (Illinois) watershed.

Concentrated Animal Feeding Operations

Concentrated Animal Feeding Operation is a regulatory term used by U.S. EPA pursuant to the Clean Water Act and accompanying regulations at the federal and state levels. In order to be determined as a CAFO, livestock farms have to meet certain species, size, and discharge requirements set forth by regulation. Discharges from CAFOs can be a source of nutrient pollution that impairs local water bodies. Illinois EPA has identified 536 active, large CAFOs (permitted and unpermitted) in Illinois, through its on-site inspection program and internal reviews. Due to increased efforts by Illinois EPA, this number is up from 288 reported in the 2017 Biennial Report, and 249 reported in Illinois NLRS. Illinois EPA's current compliance monitoring strategy has set goals for on-site inspections of 36 unpermitted, large CAFOs and 67 medium animal feeding operations in fiscal year 2020. Since July 1, 2015, Illinois EPA field staff have conducted approximately 351 livestock facility site visits to determine compliance or provide assistance to improve operations. Through these inspections and previous enforcement acts, 14 facilities are currently covered under the general CAFO NPDES permit. Previously, 19 were covered; however, five previously permitted facilities have reached compliance with current CAFO regulations and are now designed, constructed, operated, and maintained such that the facility no longer discharges or proposes to discharge to U.S. waters. Therefore, NPDES permit coverage is unnecessary.

State Livestock Management Facilities Act

In addition to Illinois EPA's CAFO program, Illinois Department of Agriculture also maintains authority over livestock farms in the state. The state's Livestock Management Facilities Act [510 ILCS 77] was enacted in 1996 to "maintain an economically viable livestock industry in the state of Illinois while protecting the environment for the benefit of both the livestock producer and persons who live in the vicinity of a livestock production facility." The act includes design and construction standards for new or modified livestock facilities, waste management planning requirements, facility operator training and testing, anaerobic lagoon financial responsibility demonstration, and facility setback requirements (www2.illinois.gov/sites/agr/Animals/LivestockManagement/Pages/default.aspx).

IDOA annually receives about 100 applications for the siting and construction of new or modified livestock waste handling facilities, as well as numerous facility waste management plans for review and approval. IDOA received and reviewed 72 proposals in 2019 and 65 proposals in 2020.

Approved projects are designed as zero discharge facilities; waste management plans require the agronomic use of generated manure. Livestock waste management plans are required to include appropriate manure application setbacks and other protections to ensure that nutrients in the manure remain at the application site and are appropriately used by growing crops.

State Revolving Fund

The Illinois EPA State Revolving Fund provides low-interest loans for wastewater treatment infrastructure. The Water Pollution Control Loan Program includes wastewater treatment plant upgrades to improve nutrient removal, green infrastructure, urban stormwater treatment, and control of combined and sanitary sewer overflows. The loan program is maintained to ensure adequate resources are available to finance improvements required under NPDES permits. As shown in Table 5.12, in 2019, $187,626,382 was spent on 12 projects that reduced nutrient loss through treatment plant improvements, while $12,650,686 was spent on one such project in 2020. The total funding amount through WPCLP for 2019 was $584,999,350.76 and $214,865,604.19 for 2020. WPCLP funding for state fiscal year 2021 is anticipated to total $700 million.

Table 5.12. *Nutrient removal projects financed by State Revolving Funds*

Facility	Ceiling Amount	Description of Nutrient Removal Component
2019		
Champaign	$6,456,936	Includes green infrastructure features, such as native plants, rain garden/bioretention, and curb cuts that drain into bioswales.
Sycamore	$20,853,989	Installation of new chemical feed equipment for phosphorus removal.
Joliet	$21,542,743	Addition of phosphorus removal equipment that will include one anaerobic zone in the existing aeration tanks for biological removal of phosphorus, plus the addition of new centrifuge-type waste activated sludge thickening units to be installed into the existing thickening building.
Libertyville	$1,717,312	Addition of a chemical phosphorus removal system.
Channahon	$9,508,310	Addition of a chemical phosphorus removal system.
Highland	$11,000,000	Addition of a chemical phosphorus removal system.
Rochelle	$7,000,000	Convert the existing single stage nitrification activated sludge process to biological nutrient removal. A key component of the conversion is the existing anaerobic pre-treatment lagoon, which will be cleaned out and restored. The mechanically-cleaned screen and grit washer are being replaced to improve the removal of screenings and grit to protect the new biological nutrient removal system.
Fox River Water Reclamation District	$26,633,995	Add biological phosphorus removal facilities to the existing activated sludge process.
Fox River Water Reclamation District	$10,502,781	Addition of phosphorus removal improvements at the Albin D. Pagorski Water Reclamation Facility by incorporating struvite removal facilities into the digested sludge handling facilities.
Mount Carroll	$13,303,600	Construction of a new wastewater treatment plant, which will include an activated sludge plant with a Bio-P fermentation zone and a Bio-P selector tank.
Pontiac	$42,774,250	Conversion of the existing activated sludge wastewater treatment plant to a biological nutrient removal process plant.
Algonquin	$16,332,467	Completing upgrades to primary clarifiers and replacement of several probes at the biological nutrient removal tanks. Nitrate and phosphorus monitoring will also be added.
2020		
Fox River Water Reclamation District	$12,650,686	Consists of liquid facilities phosphorus improvements at the Albin D. Pagorski Water Reclamation Facility by incorporating Bio-P facilities into the existing activated sludge process.

Future Strategic Actions

Unsewered Communities Grant Programs

Photo courtesy of Eliana Brown, Illinois Extension

Illinois EPA is aware of more than 200 Illinois communities that have inadequate or nonexistent wastewater collection and treatment facilities. Some communities rely on individual septic tank systems, which often provide inadequate treatment leading to illegal surface discharges. Where wastewater collection facilities are present, these facilities are often patchworks of decades-old underground "wildcat" systems that result in illegal surface discharges.

For unsewered communities, affordability is the biggest hurdle to overcome. While their engineering and consultant costs are State Revolving Fund loan-eligible, the funds are not released until a loan is issued. Thus, communities must initially pay a consulting engineer to design a system and then seek reimbursement when the loan is issued.

To assist in providing solutions to this human health hazard and the adverse environmental impacts these situations harbor, Illinois EPA is making $100 million in construction grants available over five years for wastewater collection and/or treatment facilities through the Rebuild Illinois Capital Plan. Illinois EPA is also making $1 million in planning grants available for the next four years to assist small and disadvantaged communities in developing a project plan that identifies a solution to their wastewater collection and treatment needs. A well-developed project plan would allow communities to apply for a construction grant to implement wastewater collection and/or treat-

ment solutions in areas where they are presently inadequate or nonexistent. Illinois EPA expects to fund four to 10 construction grants and up to 40 planning grants.

Illinois EPA will annually post Notices of Funding Opportunity for the Unsewered Communities Planning Grant Program and the Unsewered Communities Construction Grant Program and accept proposals for projects to plan or construct wastewater collection and treatment systems in unsewered communities. Please check the Illinois EPA's webpage for the latest information (www2.illinois.gov/epa/topics/grants-loans/unsewered-communities).

An entity may not apply for a grant until the entity has registered and pre-qualified through the Grant Accountability and Transparency Act Grantee Portal at grants.illinois.gov/portal. Registration and pre-qualification are required annually.

Applicants may require supplemental funding, in addition to the funds being offered through these grant programs. Applicants may request supplemental funding in the form of a low-interest loan through the Illinois EPA's Water Pollution Control Loan Program.

Stickney phosphorus recovery facility

Photo courtesy of MWRDGC

Red Oak Rain Garden
Photo courtesy of Layne Knoche, Illinois Extension

CHAPTER 6
STORMWATER SECTOR

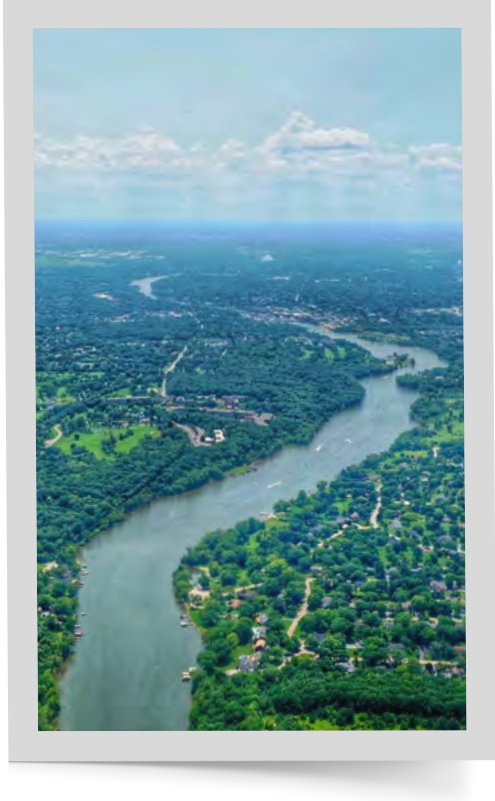
This chapter has two components: 1) a report on urban stormwater implementation and 2) information about stormwater programs and projects that work toward meeting Nutrient Loss Reduction Strategy goals.

Implementation Report

Stormwater runoff is defined as rainfall and snowmelt flowing off impervious surfaces in developed areas. It is a source of numerous pollutants, including phosphorus and nitrogen, that enter waterways. The NLRS Science Assessment determined that the statewide load from the stormwater sector is small compared to the other sectors. However, stormwater runoff can impair local water quality in Illinois lakes and rivers and thus is included as part of the strategy.

Implementation information comes from tracking spreadsheets submitted by NLRS stormwater partners and from state program data sources. In 2018, stormwater partners began reporting their staff and financial resources, as well as their outreach efforts via the strategy's tracking spreadsheet for inclusion in biennial reports. This effort has continued and is slowly expanding. Seven organizations across the state submitted the tracking spreadsheets (see appendices). The data inform the Resource Measures section analyzed by University of Illinois Extension and the Outreach Measures section assessed by Dr. Anna Marshall, University of Illinois. In the Land and Facilities Measures section of this chapter, data sources for stormwater implementation include the Illinois Environmental Protection Agency Section 319 grant program, annual inspection reports from Municipal Separate Storm Sewer System communities, and Metropolitan Water Reclamation District of Greater Chicago's Annual Stormwater Reports. University of Illinois Extension reviewed 524 MS4 reports and leveraged the information to perform analysis summaries in this chapter. Extension also evaluated whether MS4 reports could provide data to track resources and outreach measures. This information was incorporated when it was available.

Photo courtesy of John Bolton Photography



Resource Measures

For 2019 and 2020, the sector reported 46 staff members working on stormwater implementation. MWRDGC reported an additional 57 staff members. It also could be assumed that each of the MS4 reporting communities has at least one staff member, bringing the total to 465.

Table 6.1 shows funding at over $2.25 million in 2019 and more than $1.8 million in 2020. Although more data is available for this year's report, these numbers still underrepresent actual implementation resources in the state. Note that these amounts reflect grants and loans given or received, but does not include other expenditures, such as capital or personnel. These exclusions can make a significant difference in numbers reported. For example, according to the MWRDGC stormwater report, they committed a total of $74,368,591 to stormwater management implementation in 2019 alone. This information may be sought in the future to represent a more complete financial picture.

Following are highlights from the expenditures included in Table 6.1:

- Chicago Metropolitan Agency for Planning dedicated $1,296,817 to comprehensive plans, ordinance updates, and stormwater management plans via their local technical assistance program in 2019 and 2020.
- The City of Champaign awarded residents $1,728 in incentives for rain barrels.
- The City of Urbana awarded residents $2,750 in rebates to purchase rain barrels.
- DuPage County Stormwater Management invested over $700,000 in grants to its municipalities for stormwater projects. These grant projects included a permeable paver parking lot, streambank stabilization in St. Joseph Creek and West Branch DuPage River, detention basin retrofit, and permeable pavers and native plants in a memorial park.
- The Greater Egypt Regional Planning Commission was awarded two Water Quality Management Planning grants from Illinois EPA, totaling $608,464.
- Soil and Water Conservation Districts received approximately $22,000 in grants for stormwater activities in both 2019 and 2020.
- University of Illinois Extension was granted over $37,500 from the Illinois Clean Water Community Foundation and private donors for its work on the Red Oak Rain Garden. Extension also set aside $53,522 for multidisciplinary work on a Green Stormwater Infrastructure Toolkit as part of the Extension Collaboration Grant program.

Table 6.1. *Resources reported by the stormwater sector*

Nutrient Reduction-Related Activity	2019	2020
Grants or Loans Received	$981,932	$1,095,454
Grants Given	$1,266,898	$731,925
Funded Programs	$2,150	$2,328
Total	$2,250,980	$1,829,707

Additionally, the City of Champaign continues to offer Stormwater Utility Fee credits to commercial properties, schools, and churches that provide stormwater education and implement recommended practices. In 2020, credit recipients included 13 private commercial properties and homeowners associations for detention basin management; a public school for stormwater education, rain gardens, bioswales, permeable pavers, and cisterns; a private school for stormwater education and detention basin management; and the city's park district for installing and maintaining stormwater facilities, detention basins, rain gardens, bioswales, permeable pavement, and native plantings around detention basins and stream buffers.

As mentioned, Extension's analysis of MS4 reports included a review of financial information. While the specific grant dollars were unavailable, it is worth noting that out of 524 MS4 communities, 75 reported receiving grants or loans and 32 MS4 communities reported giving grants or loans (Table 6.2). These numbers represent both 2019 and 2020.

Table 6.2. *Number of MS4 communities reporting that they received or gave grants and loans in 2019 and 2020*

Nutrient Reduction-Related Activity	Number of MS4 Communities
Received Grants and Loans	75
Gave Grants and Loans	32

This review also showed that 23 MS4 communities have established stormwater utility fees, which can serve as a funding mechanism for NLRS implementation. A 2020 Western Kentucky University survey of stormwater utility fees found the number in Illinois to be 29, which could indicate that some communities did not include fee information in their MS4 reports.

Outreach Measures

In the 2019-20 reporting period, the stormwater sector sponsored numerous events, reaching a wide audience despite the many obstacles posed by COVID-19. Table 6.3 shows the number of events sponsored by stormwater partners. Adapting to the restrictions on face-to-face meetings necessitated by the pandemic, stormwater partners found new ways to conduct outreach on minimizing nutrient loss. These events allowed the stormwater sector to engage with industry professionals; state, local, and county officials; and the general public, underscoring the role of stormwater managers in meeting the goals of the strategy.

Table 6.3. *Outreach activities reported by the stormwater sector*

Type of Activity	Number of Events	Attendance
Field Days	26	2,535
Presentations	90	7,329
Conferences	14	2,489
Workshops	19	1,987
Total	**149**	**14,340**

Communities in urbanized areas with separate stormwater systems are required to obtain National Pollutant Discharge Elimination System MS4 permits, as discussed later in this chapter. Community outreach is one of the permit requirements. As shown in Table 6.4, the vast majority of MS4 communities reported conducting presentations or workshops on practices. In addition, 61% offered technical assistance to those implementing recommended practices.

Table 6.4. *Scope of stormwater sector outreach as reported by MS4s*

Type of Activity	Number of MS4s	Percent of MS4s
Education and Training Workshops	323	89%
Presentations	300	83%
Conferences	118	33%
Field Days	55	15%
Technical Assistance	220	61%

Another MS4 permit requirement is that communities consider incorporating green infrastructure concepts. The stormwater outreach reported in this period reflected education and training about green infrastructure to generate knowledge among the public and the construction industry, which will increasingly be called on to provide such services. Outreach activities included webinars, trainings, and events promoting green roofing, stormwater basins, and the installation and maintenance of rain gardens. MWRDGC and DuPage County were particularly active. MWRDGC provided project assistance and training for green infrastructure projects. DuPage County made the transition to online activities in the wake of the COVID-19 pandemic and the related restrictions on public gatherings. In addition, University of Illinois Extension has undertaken a project to promote greater inclusion and diversity in the distribution of green infrastructure in Illinois communities.

Photo courtesy of DuPage County

The outreach activities also demonstrated the role that stormwater managers are taking in the wider project of watershed planning. Members of the stormwater sector partnered with other stakeholders in meetings of watershed commissions. For example, MWRDGC works with watershed planning councils on issues of stormwater management and recently extended its agreement to provide administrative assistance to these councils. Effective watershed planning requires the cooperation of those in the area whose activities impact water quality. Stormwater managers' attendance at these planning meetings enhances the cooperative efforts to reduce nutrient loads in watersheds.

Finally, much of the active public engagement in the stormwater sector was focused on educating the public about the steps they could take in their own homes to reduce nutrient losses. Public presentations and webinars encouraged homeowners to install rain gardens, use natural lawncare techniques, and de-ice their sidewalks using environmentally friendly products and practices. In workshops, University of Illinois Extension promoted native plants and pollinators as natural means of reducing nutrient loss. The stormwater sector was also responsible for many public volunteer events that focused on local waterways.

Rain garden build
Photo courtesy of Kane County SWCD

Land and Facilities Measures

Illinois Environmental Protection Agency Section 319 Grant Program

Section 319 is a grant program under the Clean Water Act (33 U.S.C. 1329) that provides funding for states with approved non-point source management plans. These states award sub-grants for both rural and urban sectors to support non-point source pollution control projects that have been identified in an Illinois EPA-approved watershed-based plan. Through technical and financial assistance, Illinois EPA encourages the development of watershed-based plans and the subsequent implementation of plan recommendations to protect and improve water quality. Whether in development or complete, these watershed plans are tracked through the Resource Management Mapping Service (www.rmms.illinois.edu). More information about specific watershed-based plans that address stormwater management can be found later in this chapter.

Participation in and implementation of the Section 319 grant program has varied from year to year (Table 6.5 and Figures 6.1 and 6.2). In the years 2011–20, the cumulative total of urban practices installed through the program was 103. Urban practices cover a cumulative total of 40 acres.

As part of the Section 319 program, on-the-ground practices are converted into pounds of nutrients removed per year using the spreadsheet from the U.S. EPA Region 5 Model for Estimating Pollutant Load Reductions. The model estimates long-term annual reductions in sediment-bound nutrients. Figures 6.3 and 6.4 show calculated nutrient loads removed in pounds per year for 2011–20. Note that the estimated annual load reductions are represented by each practice the year that practice was implemented. Many of these structural practices have a life span of 10-20 years and load reductions are realized annually over the course of that time period. This is represented by the cumulative totals in the graphs.

For urban practices implemented using 319 funds, there were 2,322.5 pounds of total nitrogen and 467.5 pounds of total phosphorus reduced in 2019; 2,703 pounds of total nitrogen and 346 pounds of total phosphorus were reduced in 2020.

Weather and program enrollment can play a significant role in the timing of the implementation of best management practices. Section 319 grantees might secure all their BMP acreage in the first year of a two-year project and, therefore, have a 'zero' for the second year. In addition, BMP units are documented upon invoicing after completion, so practices installed in late fall may not be recorded until mid-spring of the following year.

Note: Illinois EPA makes an effort to coordinate availability of financial assistance for BMPs with other state and federal partners within proposed project areas to reduce duplication of services and competition between programs.

***Table 6.5**. Urban practices installed under Section 319 grant program 2011–20*

Practice	Number	Acres	Nitrogen Load Reduction (lb/yr)	Phosphorus Load Reduction (lb/yr)
2011				
Oil and grit separator	3	-	24	1
Green roof	-	0.03	-	-
Rain garden	9	-	46	79
Sediment basin	1	-	28	3
Urban stormwater wetlands	13	-	299	80
Bioswale	-	2.5	-	-
Urban filter strip	-	1.48	180	28
Grass-lined channels	-	0.02	3	-
Infiltration trench	11	-	11	4
Porous pavement	-	1	81	8
2012				
Rain garden	12	-	24	4
Urban filter strip	-	0.07	1	-
Infiltration trench	7	-	3	-
Porous pavement	-	1.31	96	9
2013				
Rain garden	1	-	164	43
Urban stormwater wetlands	4	-	1,069	158
Bioswale	-	2.43	1,610	224
Urban filter strip	-	4	56	5
Infiltration trench	6	-	12	22.3
Porous pavement	-	1.51	17	1.7
Rock outlet protection	9	-	-	-
2014				
No Urban Practices Implemented				
2015				
Rain garden	3	-	-	-
Urban stormwater wetlands	2	-	457	73
Bio-retention facility	-	0.1	70	9
Infiltration trench	1	-	1	-
Porous pavement	-	1.66	11	1

2016				
Rain garden	8	-	1	-
Structure for water control	3	-	276	276
Bioswale	-	0.23	582	98
Porous pavement	-	2.32	55	4
2017				
Bioswale	-	1.03	83	13
Urban filter strip	-	2	96	15
2018				
Urban stormwater wetlands	2	-	279	35
Bioswale	-	0.89	21	7
Urban filter strip	-	0.62	36	5
2019				
Bioswale	-	1.2	1,361.5	203.5
Rain garden	3	-	68	11
Urban stormwater wetlands	5	-	357	93
Wetland restoration	-	1.2	536	160
2020				
Urban filter strip	-	13.3	2,685	336
Wetland restoration	-	0.65	18	10

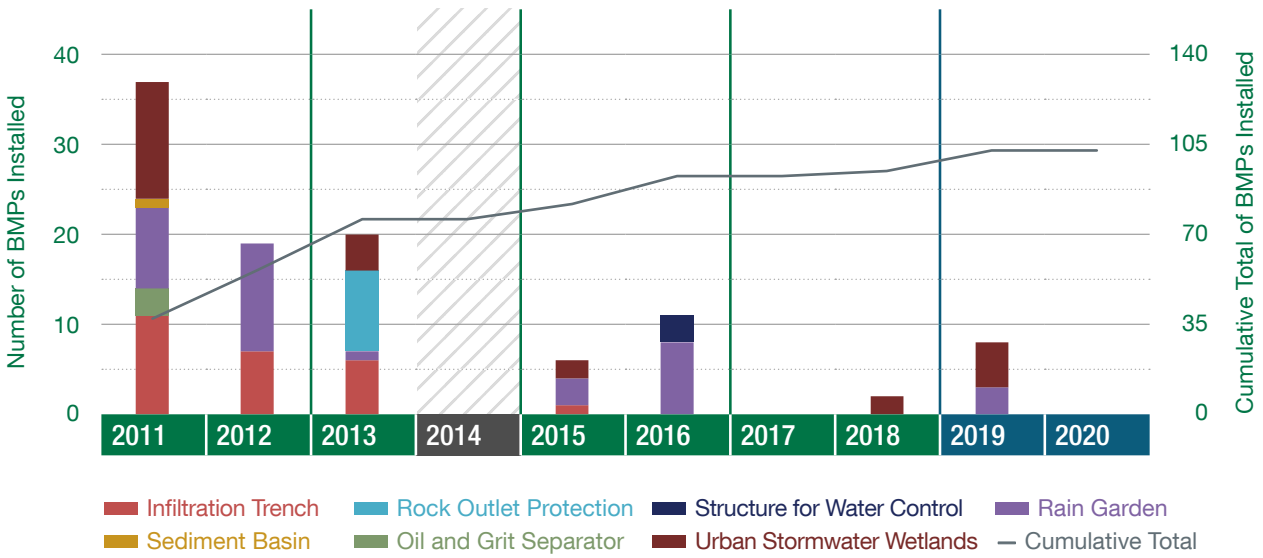


Figure 6.1. *Number of urban practices installed under Section 319 grant program 2011–20*

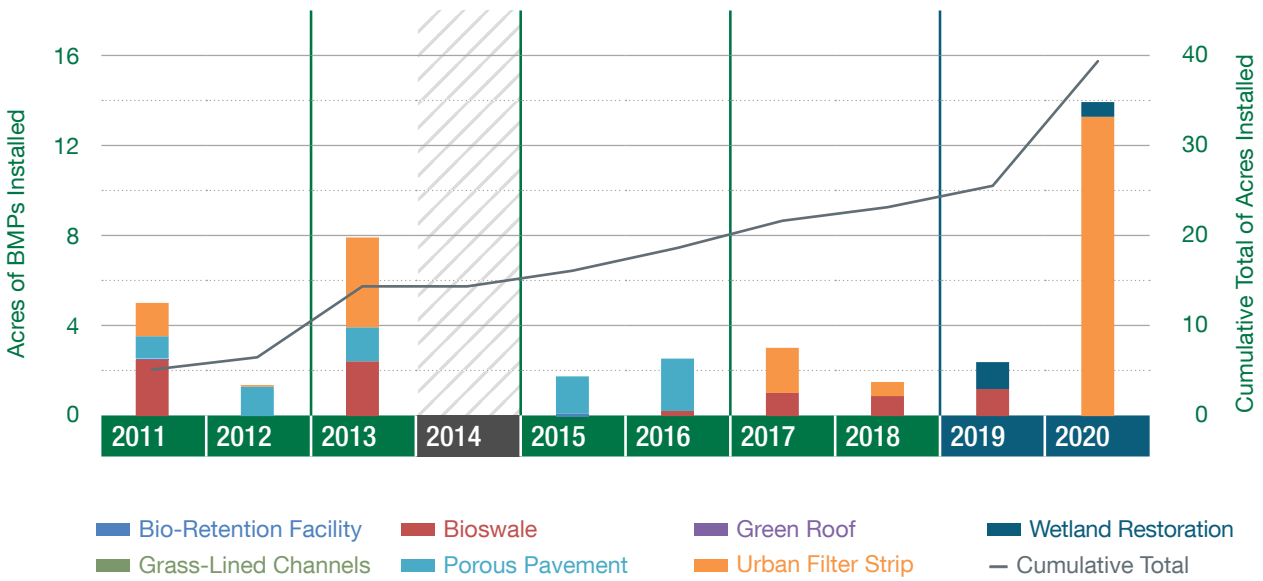


Figure 6.2. *Acres of urban practices installed under Section 319 grant program 2011–20*

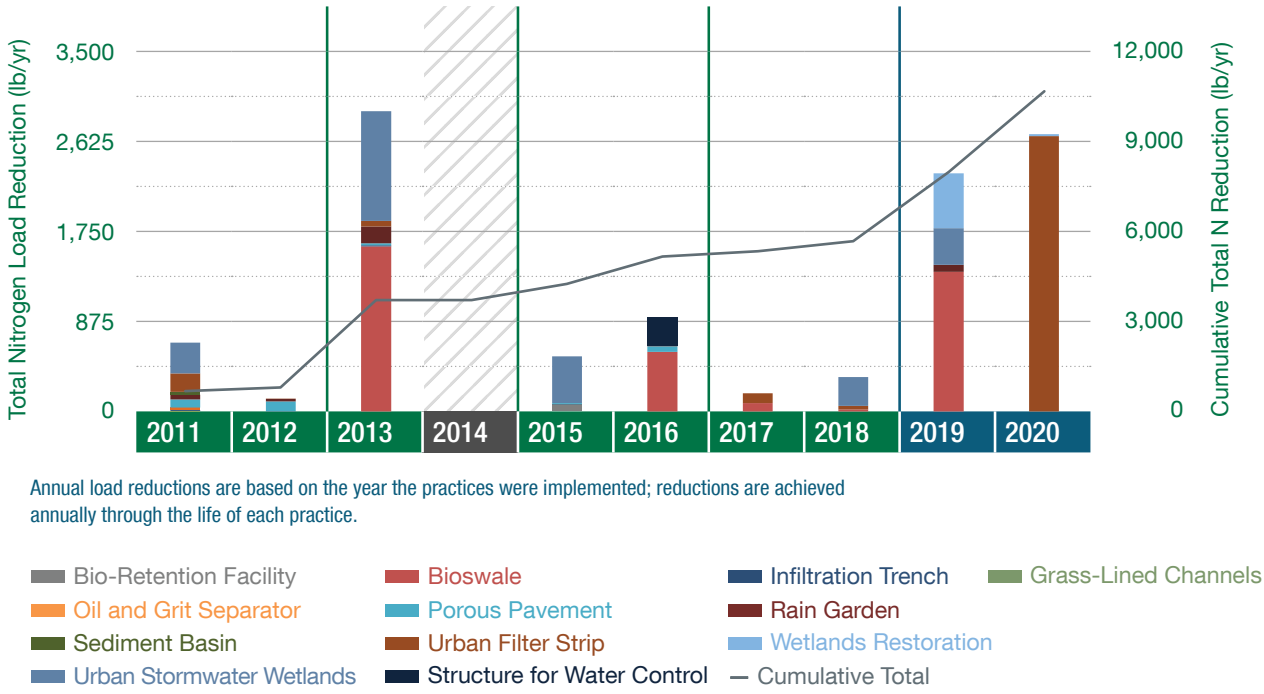


Figure 6.3. *Calculated total nitrogen load reduction (lb/yr) from Section 319 grant program urban practices 2011–20*

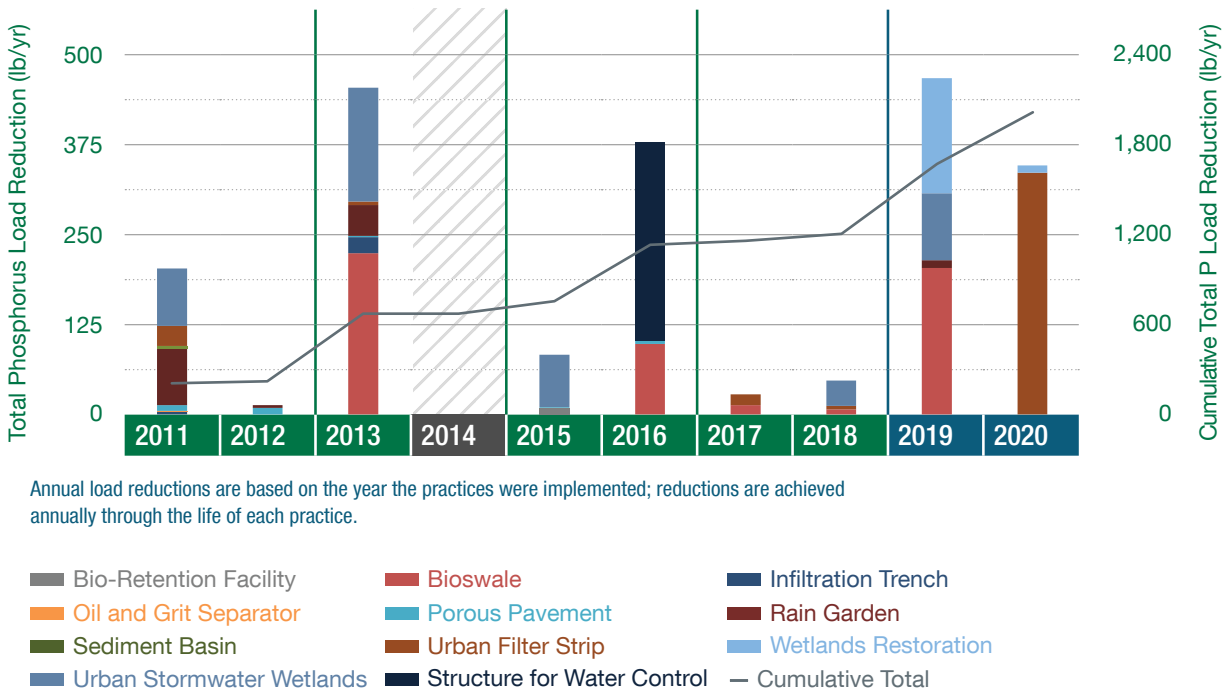


Figure 6.4. *Calculated total phosphorus load reduction (lb/yr) from Section 319 grant program urban practices 2011–20*

Green Infrastructure Grant Opportunities Program

Illinois EPA administers the $25 million Green Infrastructure Grant Opportunities program. GIGO provides grants for projects to construct green infrastructure BMPs that prevent, eliminate, or reduce water quality impairments by decreasing stormwater runoff into Illinois rivers, streams, and lakes. Projects may be located on public or private land.

For the purposes of GIGO, green infrastructure means any stormwater management technique or practice employed with the primary goal to preserve, restore, mimic, or enhance natural hydrology. Green infrastructure includes, but is not limited to, methods of using soil and vegetation to promote soil percolation, evapotranspiration, and filtering or the harvesting and reuse of precipitation.

According to U.S. EPA, localized and riverine flooding will likely become more frequent. Localized flooding happens when rainfall overwhelms the capacity of the urban drainage systems, while riverine flooding happens when river flows exceed the capacity of a river channel. By reducing stormwater runoff in urban areas, diverting water away from impacted areas, and reconnecting streams to their floodplains, GIGO can improve water quality by reducing the number and duration of both localized and riverine flood events.

Eligible GIGO projects provide water quality improvement through the implementation of BMPs to decrease stormwater runoff prior to release into rivers, streams, and lakes and include:

1. Reconnection of a stream with its floodplain (e.g., two-stage ditch, daylighting).
2. Treatment and flow control of stormwater runoff at sites directly upstream or downstream of an impervious area that currently impacts river, stream, or lake water quality through stormwater runoff discharge.
3. Treatment and flow control of water generated from impervious surfaces associated with urban development, such as roads and buildings.

GIGO utilizes funds distributed by the state of Illinois generated under the Build Illinois Bond Fund. Illinois EPA expects to award a total of $5,000,000 per year between 2021 and 2025 and anticipates distributing this amount across two to 10 awards annually. GIGO has a set maximum total grant award of $2,500,000 with a minimum grant award of $75,000.

GIGO funds are available to local watershed groups, land conservancies or trusts, public and private profit and nonprofit organizations and institutions, units of government (county, municipal, township, or state), universities and colleges, park districts and other local land managing agencies, Soil and Water Conservation Districts, and conservation organizations.

A total of 47 GIGO applications were submitted to Illinois EPA in the fall of 2020. These applications requested almost $23 million in GIGO assistance to implement green infrastructure projects totaling more than $35 million. Eleven GIGO grants totaling $5 million were awarded. Local match is estimated to be almost $4 million for an estimated total project implementation cost of $9 million.

The 11 GIGO projects have submitted the following annual estimates:

- 4,973 pounds of nitrogen reduced.
- 1,423 pounds of phosphorus reduced.
- 1,063 tons of sediment reduced.
- 31,414,497 gallons of stormwater retained.

MS4 Report Analysis

The NPDES stormwater program began in 1990 and was expanded in 2003 to include MS4s in U.S. Census Bureau defined urbanized areas and non-traditional MS4s, such as public universities. Illinois EPA manages approximately 380 active MS4 permits for communities around the state. As part of the NPDES stormwater program, permitted communities are required to follow six minimum control measures:

- Public education and outreach on stormwater impacts.
- Public involvement and participation.
- Illicit discharge detection and elimination.
- Construction site stormwater runoff control.
- Post-construction stormwater management in new developments and redevelopments.
- Pollution prevention/good housekeeping for municipal operations.

Starting in 2019, University of Illinois Extension began a comprehensive review of the Annual Facilities Inspection Reports from communities with MS4 permits shown in Figure 6.5 to better understand water quality and green infrastructure practice implementation. This analysis allows a more comprehensive understanding of urban stormwater management practices around the state to better capture progress toward NLRS water quality goals by the urban stormwater sector.

Illinois MS4 Communities 2019 & 2020

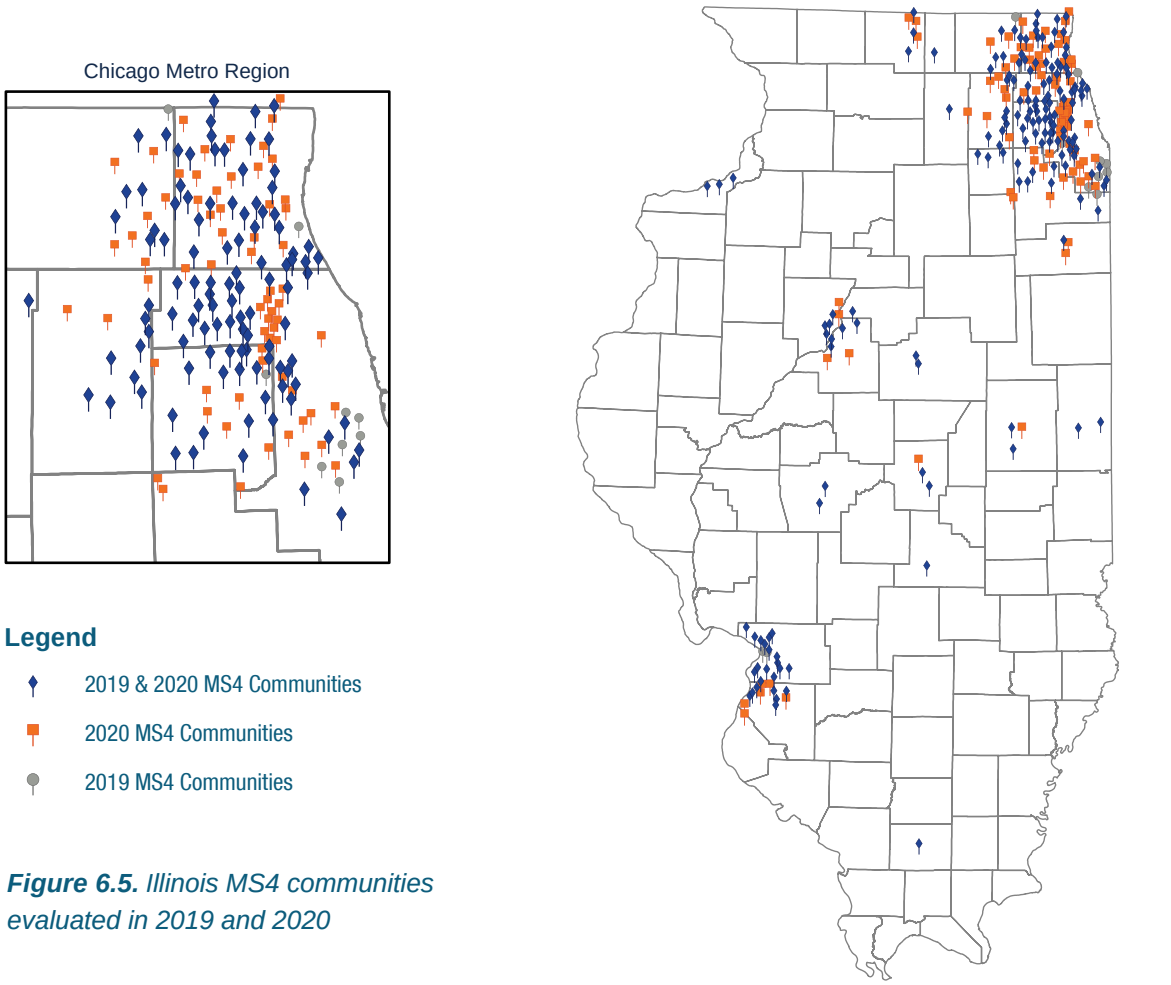


Figure 6.5. *Illinois MS4 communities evaluated in 2019 and 2020*

Findings

Table 6.6 represents the practices in use with the number and percent of communities using them. The table is sorted roughly in order of practice implementation rate, with those practices that are most common listed at the top and those that are less frequently applied at the bottom.

Not surprisingly, some practices, such as outreach and erosion control programs, are almost universal because they are required as a condition of the permit. However, a majority of communities have also implemented street sweeping and leaf collecting, which have been shown to reduce phosphorus loads through storm sewer discharge. Guidance to communities about timing and frequency of such programs could help reduce nutrient loads.

In 2019 and 2020, green infrastructure requirements for new development and redevelopment were also collected. In 2020, 25% of communities reported such requirements. Examples of success stories and lessons learned could help expand green infrastructure implementation.

Only 15% of communities have some form of green infrastructure inventory to monitor location and efficacy of green infrastructure installations. Establishment of a statewide green infrastructure inventory to measure urban stormwater nutrient inputs more accurately is a key recommendation outlined in chapter 8 of this report.

Table 6.6. *Number of MS4 communities reporting practices in 2018-20*

	2018		2019		2020	
Number of Communities Reporting	287		214		314	
Practice	Number of Communities	%	Number of Communities	%	Number of Communities	%
Community outreach	278	97%	212	100%	308	99%
Erosion control programs	Not measured	-	204	96%	299	96%
Electronics recycling programs	40	14%	185	87%	259	83%
Street sweeping programs	114	39%	166	78%	239	77%
Household hazardous waste collections	92	32%	166	78%	227	73%
Litter cleanup events	51	18%	148	70%	213	68%
De-icer management programs	101	35%	132	62%	202	65%
Leaf collection programs	Not measured	-	134	63%	203	65%
Detention basin management/ inspection programs	89	31%	113	53%	154	49%
Green infrastructure grants	32	12%	97	46%	119	38%
Detention pond inventories	Not measured	-	77	36%	102	33%
Green infrastructure requirements in new development and redevelopment	Not measured	-	65	31%	79	25%
Stormwater master plans	27	9%	65	31%	71	23%
Green infrastructure inventories	Not measured	-	49	23%	48	15%
Rain barrel programs	80	27%	25	12%	41	13%
Homeowner rain garden incentives	23	8%	3	1%	41	13%
Stormwater utility fees	24	8%	10	5%	22	7%
Community rain gardens	30	10%	12	7%	12	4%

Data Collection Challenges

While attempts to compare rates of practice implementation in the past three years have value as a measure of NLRS progress, comparison between years and communities is difficult given the nature of MS4 reporting to Illinois EPA.

Reports are narrative and are of varying quality and quantity. Some communities provide easily accessible information about practice implementation, while others are less complete and may not fully reflect the activities utilized. Other comparison challenges include:

- In a narrative report, a community may use different terms to refer to the same practices, making consistency difficult even with trained reviewers.
- Many reports are in a scanned PDF format that is not searchable, which requires additional review time and creates possibility for error.
- Many communities have programs that are listed on their websites, but not in their reports, requiring further research to gather accurate data.
- Different cover pages and report formats make information more difficult to locate and increase the possibility of missed components.

Metropolitan Wastewater Reclamation District of Greater Chicago Green Infrastructure Program

Established in 2014, MWRDGC's Green Infrastructure Program seeks to increase the acceptance and investment of green infrastructure throughout Cook County through numerous partnerships. They introduced the green infrastructure call for projects, which seeks to partner with local communities and public agencies throughout Cook County to fund and build green infrastructure projects. These projects vary in size and scope and can include roadside bioswales and rain gardens, green roofs, permeable pavement alleys, green streetscapes, and eco-orchards. It is available to government organizations within MWRDGC's corporate boundaries. Projects are prioritized on their ability to capture and store water (measured as design retention capacity), flood risk, and structures benefitted by the green infrastructure amongst other criteria. MWRDGC and a partnering agency execute an intergovernmental agreement to facilitate the project, with long term maintenance responsibilities assigned to the partnering agency. Design and construction of each installation are monitored to optimize benefits. After completion, staff inspect the installation, ensuring maintenance is in line with the project's operation and maintenance plan.

In 2017 and 2018, 40 projects were selected. In June of 2019, a third call for projects was held and an additional 20 more projects were selected. The projects selected over the last three years will provide

a total of approximately 6 million gallons of design retention capacity. The Arlington Heights, River Forest, Skokie, and Wheeling Park District projects were completed in 2018, providing 205,453 gallons of design retention capacity for an investment of $694,000. In 2019, the MWRDGC worked with the City of Des Plaines and the Villages of Forest Park, Harwood Heights, La Grange, Maywood, Riverside and Tinley Park to develop GI projects consisting of permeable pavement parking, green alleys, and bio-retention facilities. MWRDGC will contribute up to $2,935,034 to these projects, which provided a combined design retention capacity of 1,109,170 gallons. In June of 2020, another call for projects was issued and an additional 16 were selected.

MWRDGC also helps support Space to Grow, an innovative public-private partnership with a mission of transforming Chicago schoolyards into vibrant green spaces for physical activity, outdoor learning and play. The schoolyards incorporate many green infrastructure design elements to reduce water pollution and neighborhood flooding such as permeable play surfaces, native plantings, and rain gardens. The program is co-managed by the Healthy Schools Campaign and Openlands with capital funding, leadership, and expertise from MWRDGC, Chicago Public Schools, and the City of Chicago Department of Water Management. MWRDGC also provides technical support for green infrastructure elements to ensure that the new schoolyards provide optimal stormwater capture benefits.

Space to Grow schools are prioritized based on flood risk, site suitability, and socioeconomic factors. Numerous community meetings were held to describe project details and benefits. MWRDGC and Chicago Public Schools executed an intergovernmental agreement to facilitate the projects whereby long-term maintenance responsibilities are assigned to Chicago Public Schools.

Since 2014, MWRDGC has invested in 20 schools, providing 3.65 million gallons of design retention capacity. The program was amended to continue through 2022, funding green infrastructure at up to 34 schools for a total investment of approximately $18 million. Construction was completed at five schools in 2020. Another five projects have been designed with construction anticipated in early 2021.

See mwrd.org/sites/default/files/documents/2020_Stormwater_Report_210723.pdf and mwrd.org/services/green-infrastructure for more information.

Current Programs and Projects Supporting Nutrient Loss Reduction Goals

The following section highlights programs and projects that have undergone significant changes, or have noteworthy updates since Illinois NLRS and the last biennial report.

Table 6.7. *Urban non-point source programs and projects working toward Illinois NLRS goals*

(Bold type and page number indicate an update in this report. Details about programs listed in non-bold type and page number can be found in the listed document.)

Calumet Stormwater Collaborative

Since 2014, the Calumet Stormwater Collaborative has been convening stakeholders to solve flooding and water quality problems in the Little Calumet River and Cal-Sag Channel watersheds. More than 40 organizations participate in CSC. During monthly meetings, group members exchange information on water quality and flooding needs, as well as worthwhile projects and initiatives.

CSC has developed free, online green infrastructure design templates for communities, a new data-mapping tool for the region, a repository of stormwater management resources, and a logic model for green infrastructure training and maintenance.

CSC developed four watershed plans: the Little Calumet River, Cal-Sag Channel, Des Plaines River in Cook County, and Poplar Creek. These plans, which were approved by Illinois EPA, recommend BMPs, such as green infrastructure, to reduce nutrient pollution from stormwater. Communities and other stakeholders in the watersheds can apply for Section 319 grants to help support key projects.

Specific items in CSC's work plan include developing a green infrastructure baseline inventory, developing an urban flooding baseline inventory, developing relevant trainings and recommendations for green infrastructure maintenance and service sharing, and assessing municipal capacity to manage stormwater flooding issues. The target geography for these components is the Calumet region of Illinois, but lessons and resources are intended to be applicable to a broader geography.

In 2020, CSC began accepting data for the green infrastructure baseline inventory. More information can be found at metroplanning.org/work/project/23/subpage/6.

The three-year work plan can be found at metroplanning.org/uploads/cms/documents/csc_workplan_2018_2021_final.pdf.

For more information, see metroplanning.org/work/project/23/subpage/1.

Chicago Metropolitan Agency for Planning Local Technical Assistance Program

When the U.S. economy was in the early stages of recovering from the 2008 recession, financial uncertainty was on everyone's mind. Private companies were exploring ways to downsize or shut their doors while maintaining some financial security. The public sector was struggling to address skyrocketing service needs related to the foreclosure crisis with shrinking revenues. Many local governments were striving to understand how to plan for and adapt to a changing economy, as well as the needs of their constituents.

In response, the Chicago Metropolitan Agency for Planning launched the Local Technical Assistance Program to help counties and communities in the region. The LTA program was seeded with $4.25 million received by CMAP through the Sustainable Communities Initiative as part of the agency's efforts to implement the northeastern Illinois region's comprehensive plan at the time. Adopted by the CMAP board in October 2010, it recommended federal and state investments align with the livability principles outlined in the plan and identified immediate actions the region should take in a time of economic uncertainty. Now, CMAP's LTA program aligns with the region's current long-range plan by focusing on inclusive growth.

To establish the LTA program, CMAP put out a call for projects to the 284 municipalities in the region, as well as eligible nonprofits, neighborhood groups, and other groups in need of assistance during the crisis.

Since the program's creation, CMAP has funded over 200 local planning projects, helping to build local capacity, engage marginalized groups, empower local governments to develop solutions for difficult community challenges, make critical decisions, and connect local partners to implementing agencies and capital funding for infrastructure investments.

More information at cmap.illinois.gov/.

Conservation@Home

Initially developed by The Conservation Foundation, Conservation@Home encourages homeowners to establish Earth-friendly landscapes that minimize pollution and negative impacts on the environment, while maximizing habitats for native species. In Cook County, the C@H programs support conservation landscape practices for residential properties, libraries, community centers, faith-based organizations, and schools, such as Kellogg Elementary (pictured right).

This program is a partnership between Forest Preserve of Cook County and University of Illinois Extension staff, who work together to create and refine the C@H checklists specific to the various types of properties listed above. In addition, Extension provides resources and trainings to Master Gardeners and Master Naturalists, schedules property visits, manages website content and registrations, and distributes signs.

Photo courtesy of Conservation@Home

To educate home gardeners with respect to the conservation landscaping best practices outlined in the C@H checklist, Extension staff and volunteers offer unbiased, research-driven programs at nature centers, garden clubs, and libraries. Programming became available via online platforms in 2020. Topics include digging deep with soils, native landscape design, natural lawn care, etc. Each season, a new environmental topic is developed and the program is offered at three locations throughout Cook County. Figure 6.6 shows the number of applications, certified members, and those in consultation for certification in 2020.

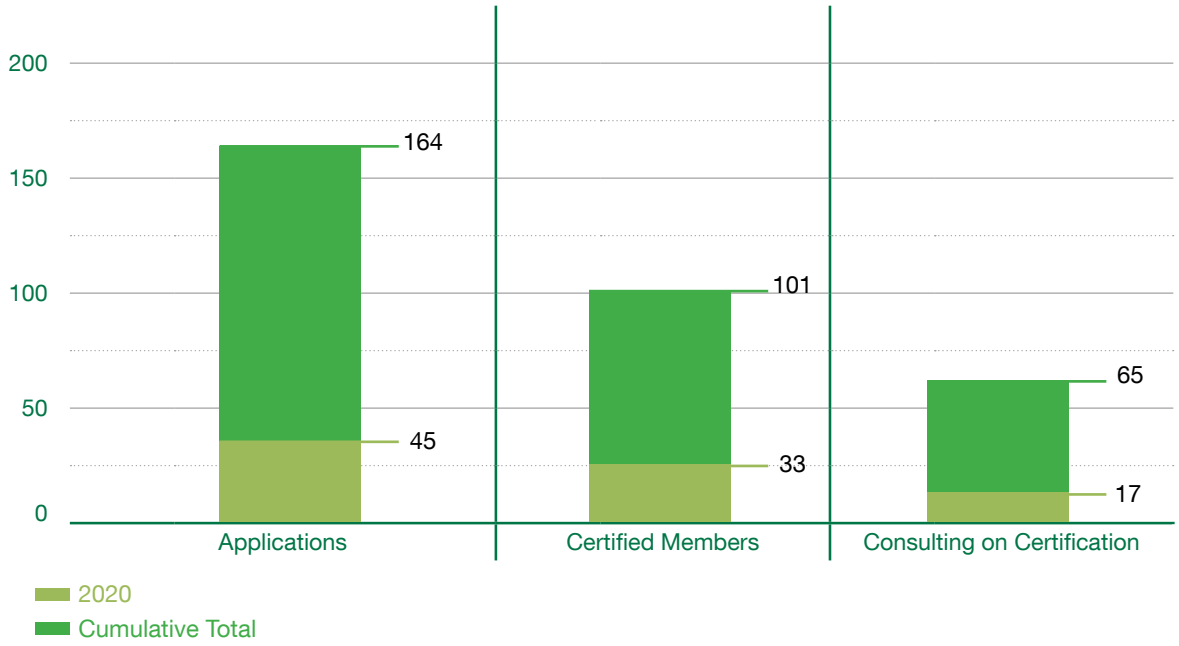


Figure 6.6. *Conservation@Home applications, certified members, and those consulting on certifications*

Staff create and distribute a seasonal C@H newsletter to members and volunteers. The newsletter includes resources and articles by Extension educators, University of Illinois researchers, and other relevant experts, as well as upcoming educational opportunities and plant sales. Staff and volunteers work with schools, libraries, and other community organizations that need assistance in getting started on or meeting the C@H criteria. This assistance mainly involves garden mentorship, but may also involve training, sourcing plant material, and programming.

C@H hosts an annual appreciation event, historically a luncheon, to recognize the members and volunteers of the program. Other partners include Chicago Botanic Garden, Chicago Region Tree Initiative, Field Museum, Openlands, U.S. Forestry, West Cook Wild Ones, and, in the past, MWRDGC.

More information can be found at fpdcc.com/nature/conservationathome/.

DuPage County Green Infrastructure Inventory

DuPage County Stormwater Management is in the process of developing a green infrastructure inventory. The virtual map (see Figure 6.7) shows the location of existing green infrastructure throughout DuPage County and will calculate the acres treated and the volume of runoff treated annually. Photos of the green infrastructure practices can also be included and displayed on the map. DuPage County partners with 41 municipalities and townships in an NPDES permit through Illinois EPA. The map has been presented to these partners and municipal green infrastructure has been requested for inclusion in the map. Once publicly-owned green infrastructure is incorporated, the map will be posted on the DuPage County website, along with educational resources on green infrastructure benefits and implementation. The public will be able to submit information on privately-owned green infrastructure for inclusion in the inventory.

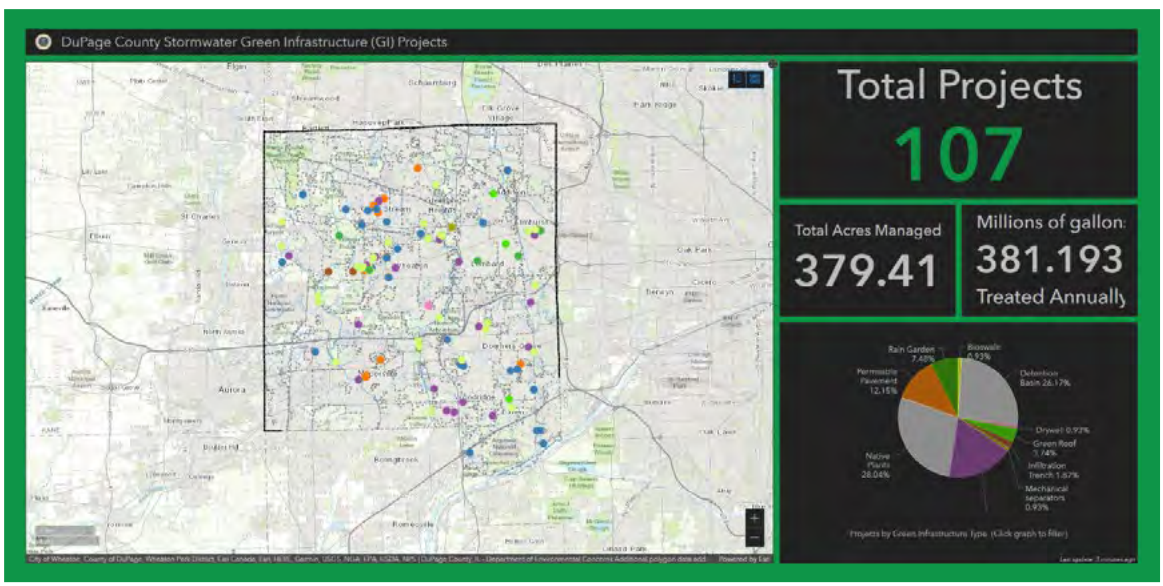


Figure 6.7. *Screenshot of DuPage County green infrastructure dashboard*

DuPage County Water Quality Improvement Program

DuPage County Stormwater Management recognizes the financial burden a property owner may face when undertaking a project that improves regional water quality. DCSWM's Water Quality Improvement Program offers financial assistance to projects providing a regional water quality benefit to local waterways. The grant funds up to 25% of eligible construction costs for water quality improvement projects. DuPage County initiated the grant program in 2000 and has awarded nearly $5 million across 88 projects to date. DuPage County government agencies, organizations, and individuals are eligible to receive funds under the WQIP.

The WQIP story map provides information on the grant and application process, and gives examples of eligible projects, such as rain gardens, green roofs, permeable pavers, and streambank stabilization. The story map also includes animated infographics, photos, project descriptions, and an interactive map showing previously awarded projects.

More information can be found at dupageco.org/WQIPGrant/.

Equitable Green Infrastructure

Changing weather patterns in Illinois are causing increased precipitation, leading to flooded streets, water in basements, and other challenges for cities. Many communities are turning to green infrastructure as part of their solution, which can serve to stop local flooding and provide green space and jobs for marginalized communities. In 2019-20, the North Central Regional Water Network's green infrastructure team conducted a study to see if and how green infrastructure and social justice programs were being connected in Midwestern communities. Green infrastructure practices use plants, permeable surfaces, and landscaping to store, filter, and reduce stormwater flow to sewer systems or to surface waters. Some communities are coupling the two, but most currently think of green infrastructure only as a stormwater management tool. University of Illinois Extension continues to serve as an educational resource for communities that are interested in using green infrastructure to address stormwater management challenges.

More information is available at northcentralwater.org/recently-released-whitepaper-outlines-recommendations-and-barriers-for-equitable-and-just-green-infrastructure-projects/.

Illinois Department of Transportation Stormwater Programs

Illinois Department of Transportation maintains a chartered Stormwater Committee composed of members from a variety of backgrounds and individuals from other state agencies to help inform and guide policy creation, advise IDOT's staff on stormwater issues should they arise, and oversee erosion control training for staff and consultants. The committee also regularly coordinates with other stormwater groups and initiates research through the Illinois Center for Transportation to study aspects of the stormwater management program and determine whether improvements can be made to best management practices.

IDOT has just started researching alternatives to erosion control blankets that use plastic mesh, which is known to entangle wildlife and contribute to microplastics in waterways. IDOT will utilize research and practices generated through other state DOTs, the National Cooperative Highway Research Program, and the Illinois Urban Manual, when applicable.

Lawn to Lake

In 2019, Illinois-Indiana Sea Grant, with input from Lawn to Lake project team members, developed a 50-question natural lawn care survey as part of planned work for an Extension Collaboration Grant. The survey was distributed electronically to residents in Illinois and collected 849 responses. Guided by these survey responses, a soil testing brochure and three versions of a watershed factsheet were drafted and tested in three follow-up focus groups in January 2020. These focus groups took place in Effingham, Milan, and Grayslake, with a total of 18 focus group members from these communities. Based on the informational needs identified and feedback provided through the survey and focus groups, three brochures and three versions of a watershed factsheet are in the final stage of review before being printed and disseminated statewide to county Extension offices and to partners in Illinois and Indiana.

LAWN TO LAKE
midwest

Photo courtesy of Sarah Zack, Illinois-Indiana Sea Grant

In 2020, Illinois-Indiana Sea Grant collaborated with Illinois Extension educators in Cook County and the Conservation@Home program to develop a two-hour natural lawn care workshop for homeowners, which they planned to host three times in April 2020. A train-the-trainer event was held in March 2020 to prepare a team of 20 Master Gardeners to help deliver the program across Cook County. Due to COVID-19,

the workshop was instead delivered virtually via an interactive, two-hour webinar that was attended by 168 people, and again as a two-part program in Extension's Everyday Environment webinar series that was attended by a total of 257 people across the two, one-hour long webinars.

Over this project period, five different Lawn to Lake presentations were given on natural lawn care practices at conferences, community events, and via a podcast episode, reaching a total of 217 people. Illinois-Indiana Sea Grant staffed four pollution prevention and natural lawn care informational booths at conferences, reaching 460 people. One brochure, "Beyond Bluegrass: A Guide to Selecting Low Input Turfgrass in Northeastern Illinois," was completed and disseminated to Lawn to Lake partners in the Chicagoland region.

You can find more information on this program at lawntolakemidwest.org.

National Green Infrastructure Certification Program

The Water Environment Federation and partners, including MWRDGC, created the National Green Infrastructure Certification Program to grow a green workforce. The program trains entry-level workers in the base-level skillset needed to properly construct, inspect, and maintain green infrastructure. With this training, candidates are qualified to enter the field and earn a living wage. Designed to meet international best practice standards, NGICP can meet a wide range of needs, including providing professional development for green infrastructure professionals.

In 2018, Parkland College in Champaign signed a contract with WEF to become the first licensed training center in Illinois, and the first community college in the nation to offer NGICP. This training consists of 35 hours focused on green infrastructure construction, functionality, and maintenance. Parkland offers the course regularly and additional sections are offered in response to the specific needs of organizations and industries.

Since 2018, Parkland has administered three successful trainings and trained over 35 individuals from municipalities, private industry, higher education, nonprofit, and professional organizations. During the COVID-19 pandemic, the training was migrated to fully online; unfortunately, however, the 2020 training was canceled due to lack of enrollment.

A small, but successful one-day green infrastructure workforce development training was held in Chicago in March 2020, thanks to a large group effort. Partners included Calumet Stormwater Collaborative, Chicago Metropolitan Agency for Planning, Coastal Management Program, Illinois Department of Natural Resources, University of Illinois Extension, Illinois Sustainable Technology Center,

Metropolitan Water Reclamation District of Greater Chicago, Parkland College's NGICP Training Center, and University of Illinois at Urbana-Champaign's Prairie Research Institute. Opportunity, Advancement, and Innovation in Workforce Development spearheaded the training, but due to funding losses and complications caused by COVID-19, Chicago Regional Trees Initiative from the Morton Arboretum has assumed the leadership of future offerings.

More information can be found at ngicp.org.

Rainscaping

Illinois-Indiana Sea Grant provides training to communities interested in building rain gardens, using a curriculum developed by Purdue Extension. Rain gardens lead to reduced stormwater runoff and improved water quality. Through workshops, Master Gardeners and other community members learn about rain gardens and other residential-scale green infrastructure techniques. In 2019, University of Illinois Extension piloted a Rainscaping training event at the Jackson County Extension Office in cooperation with the Greater Egypt Regional Planning Commission. The event proved successful, educating eight attendees and building a demonstration rain garden. In 2020, the Purdue Rainscaping Education Program was officially adopted by University of Illinois Extension through a memorandum of agreement to expand it throughout Illinois. Curriculum materials were updated and rebranded by Extension. Due to COVID-19, workshops were also switched to an online format.

Red Oak Rain Garden

In 2019, the Red Oak Rain Garden on the University of Illinois campus was expanded and renovated to improve the garden's functionality. The approximately 9,200-square-foot garden has 9,000 plants, representing 52 species. The garden's design was created with minimal maintenance in mind. This proof of concept was tested by COVID-19 restrictions when volunteers were not allowed to work in the garden.

With no spring volunteers, the low-maintenance garden thrived and set the standard for campus sustainable rainwater management landscapes. By October of 2020, when restrictions were lifted, the garden, which has a capacity of nearly

27,000 gallons, was allowed to serve as a campus education venue once again. About 30 horticulture and landscape architecture students helped plant in the fall, gaining hands-on experience with large-scale installations.

The project team partnered with other researchers and was awarded an Extension Collaboration Grant to create an online Green Stormwater Infrastructure Toolkit.

More information at go.illinois.edu/RORG.

Watershed-Based Planning

Watershed-based plans, as mentioned in chapters 4 and 5, outline current conditions; identify recommended practices; and provide an integrated, holistic framework to protect and improve water quality in a geographic region. They address recommended practices in all three NLRS sectors: agriculture, point sources, and stormwater. Plans are typically developed in partnership with local government agencies, businesses, nonprofits, and residents. As discussed previously, plans are tracked in the Resource Management Mapping Service (www.rmms.illinois.edu).

Below are examples of watershed-based plans developed or being developed by NLRS partners that feature stormwater management BMPs. These plans strive to identify the causes and sources of impairment and propose solutions, such as streambank stabilization, green infrastructure, and educational programs to reduce nutrient and other pollutant loading.

The Chicago Metropolitan Agency for Planning is developing a Mill Creek watershed-based plan for a 31-square-mile area that drains to Mill Creek, a tributary of the Fox River. The area is located in Kane County and includes Batavia, Campton Hills, Geneva, and St. Charles.

Information about this plan can be found at cmap.illinois.gov/programs/lta/mill-creek.

Photo courtesy of CMAP

Greater Egypt Regional Planning Commission has an active role in the development of watershed-based plans in southern Illinois. Two watershed-based plans are currently in development: Western Crab Orchard Creek watershed, a collection of three watersheds encompassing Carbondale and Makanda, and Kinkaid Creek watershed, which includes the area surrounding Kinkaid Lake.

More information is available at greateregypt.org/watershed-based-planning/.

DuPage County Stormwater Management is currently studying the East Branch DuPage River watershed. The East Branch DuPage River watershed covers more than 52,000 acres (81.2 square miles) and is located in central DuPage County with a small portion extending south into Will County. It has been classified as an impaired waterway by Illinois EPA for several pollutants, including total phosphorus, sediment/siltation, dissolved oxygen, and aquatic algae. The plan is expected to be complete by November 2021.

More information can be found at dupageco.org/EDP/Stormwater_Management/Water_Quality/62854/.

Future Strategic Actions

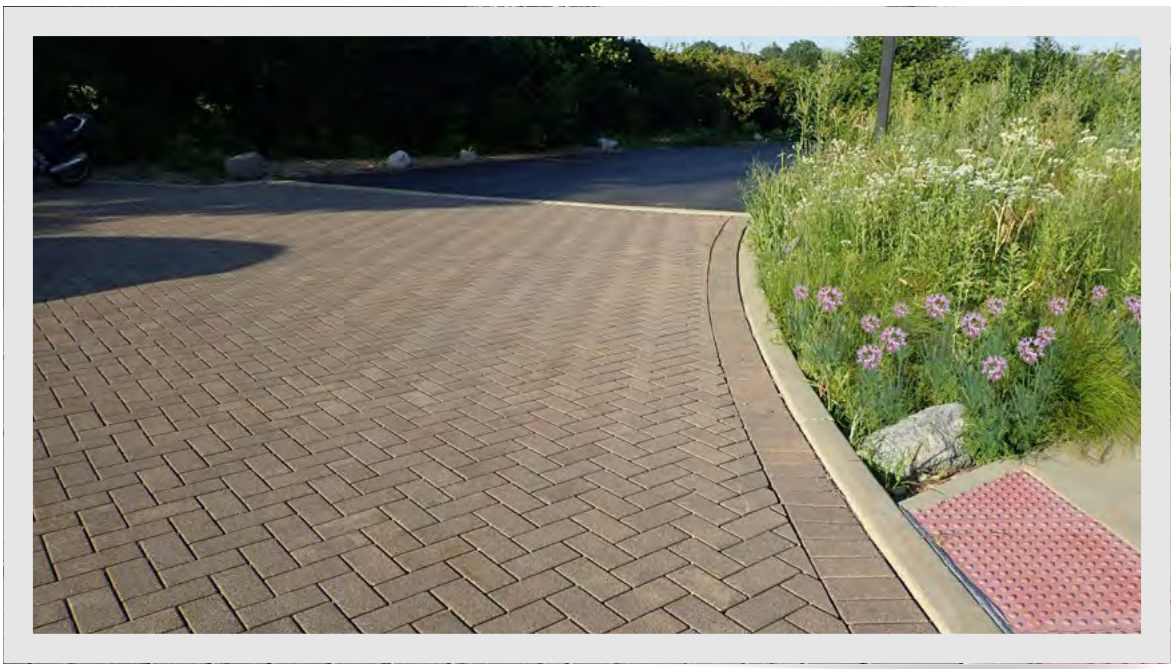
Urban Stormwater Working Group

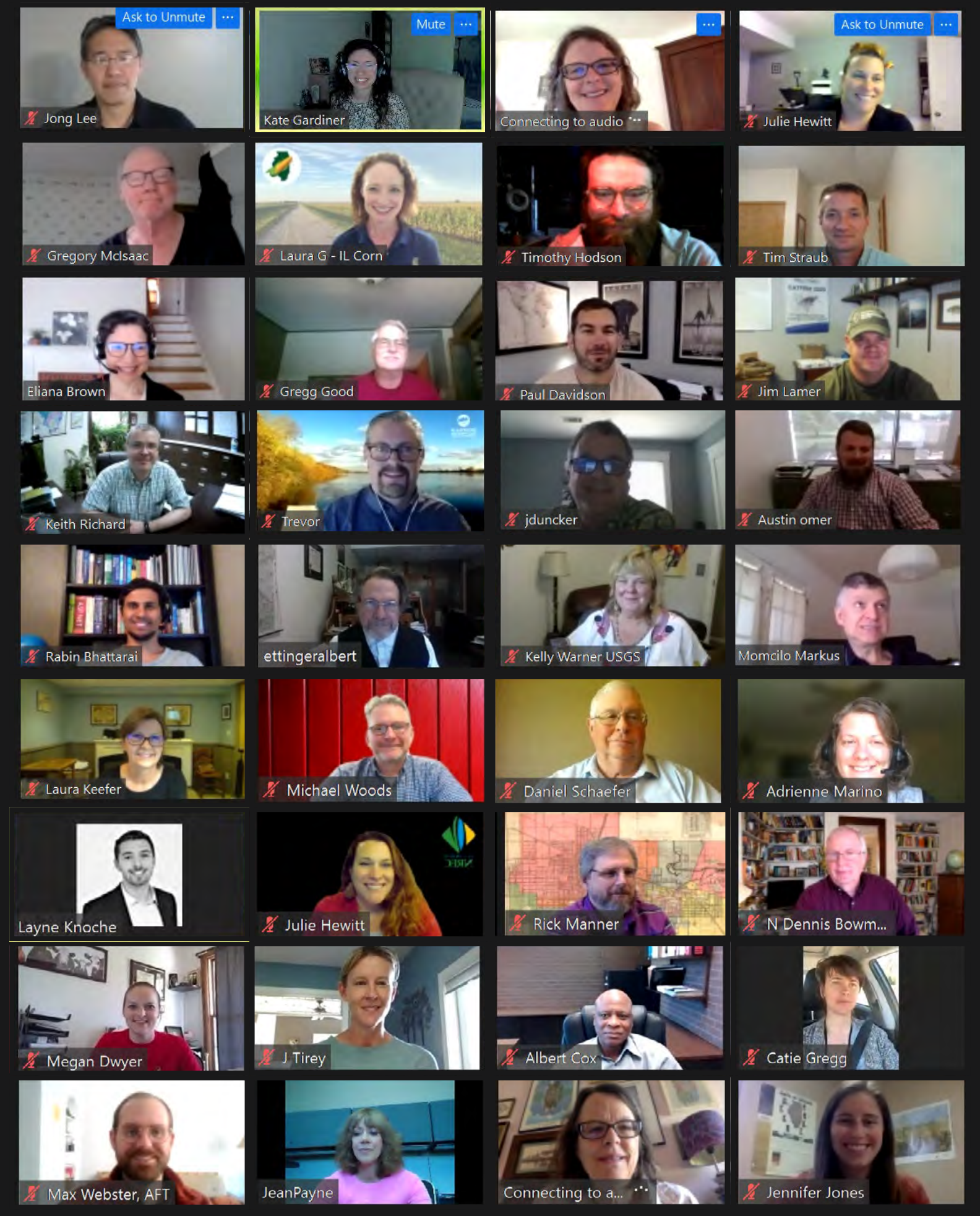
The strategy called for the creation of the Urban Stormwater Working Group to "explore funding, identify legislative initiatives, develop plans" and "coordinate outreach and orchestrate statewide efforts related to green infrastructure expansion and retrofitting, MS4 program training, and urban stream, lake, and stormwater monitoring."

To better quantify stormwater land and facilities implementation, the Urban Stormwater Working Group has recommended establishing a statewide green infrastructure inventory. This work is in alignment with the Calumet Stormwater Collaborative Green Infrastructure Baseline Inventory and DuPage County Green Infrastructure Inventory (discussed elsewhere in this chapter), which could serve as initial data sources for the statewide inventory. Other Illinois communities would need to supply data as part of this effort.

The Urban Stormwater Working Group and its two subgroups — education and tracking — continue to meet. See chapter 7 for a discussion of 2019–20 activities.

Photo courtesy of CMAP

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Tim Straub
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Gregg Good
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Kelly Warner USGS
Momcilo Markus
Laura Keefer
Michael Woods
Daniel Schaefer
Adrienne Marino
Layne Knoche
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Rick Manner
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Megan Dwyer
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Albert Cox
Catie Gregg
Max Webster, AFT
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CHAPTER 7
WORKING GROUP ACCOMPLISHMENTS

One of Illinois' greatest strengths in developing the Illinois Nutrient Loss Reduction Strategy is the vast network of partners and stakeholders involved. For strategy implementation, several working groups have been convened under the Policy Working Group to monitor progress and answer questions raised in the Illinois NLRS. These groups have regular meetings and hold an annual end-of-the-year nutrient workshop that highlights research, in addition to emphasizing other accomplishments. In 2020, two meetings were held before the pandemic restrictions prohibited in-person gatherings. University of Illinois Extension quickly pivoted to an online meeting format that enabled NLRS groups to continue having discussions and sharing information. Since that shift, NLRS groups held 14 meetings and an annual conference online.

This chapter discusses the conclusions and accomplishments of these working groups and their associated subgroups. Specific agendas, presentations, and meeting minutes are all available on the Illinois Environmental Protection Agency's website at www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Pages/nutrient-loss-reduction-strategy.aspx.

Photo courtesy of Kate Gardiner, Illinois Extension

One of Illinois' greatest **strengths** in developing the Illinois Nutrient Loss Reduction Strategy is the **vast network** of **partners** and **stakeholders** involved.

Policy Working Group

The Policy Working Group advises Illinois EPA and Illinois Department of Agriculture on the strategy. It is comprised of representatives from agencies (local, state, and federal), the agricultural industry, and nonprofit organizations, as well as scientists, academics, and wastewater treatment professionals. Members include representatives from American Bottoms Regional Wastewater Treatment Facility; American Farmland Trust; Association of Illinois Soil and Water Conservation Districts; Bloomington & Normal Water Reclamation District; City Water, Light, and Power (Springfield); Downers Grove Sanitary District; Environmental Law & Policy Center; GROWMARK; Illinois Association of Drainage Districts; Illinois Corn Growers Association; Illinois Department of Agriculture; Illinois Department of Natural Resources; Illinois Environmental Protection Agency; Illinois Environmental Regulatory Group; Illinois Farm Bureau; Illinois Fertilizer & Chemical Association; Illinois Pork Producers Association; Metropolitan Water Reclamation District of Greater Chicago; Nutrient Research & Education Council; Prairie Rivers Network; Sierra Club; The Nature Conservancy; University of Illinois Extension; Urbana & Champaign Sanitary District; and U.S. Department of Agriculture Natural Resources Conservation Service.

The objectives of the PWG are to:

- Explore funding opportunities.
- Identify needed legislative initiatives.
- Network with the appropriate people and groups.
- Identify adaptive management adjustments and update the strategy.

Over the last two years, the Policy Working Group met four times: May 22, 2019; December 4, 2019; March 9, 2020; and November 6, 2020.

During the May 2019 meeting, PWG discussed the Nutrient Science Advisory Committee report, the updated science assessment (chapter 3), the results of the NLRS Survey conducted by NASS, and the proposed Upper Mississippi River Water Quality Improvement Act. Members agreed on the structure of subsequent biennial reports and were briefed on the 2019 Hypoxia Task Force meeting in Baton Rouge, Louisiana.

The December 2019 meeting was part of the Illinois NLRS Partnership Conference. At that meeting, members discussed: 1) progress within working groups; 2) collaboration with watershed outreach

Photo courtesy of Kate Gardiner, Illinois Extension

associates; 3) future initiatives, like the Upper Mississippi River Water Quality Improvement Act; 4) the U.S. EPA Nutrient Strategy Grant; and 5) future resource needs. PWG members agreed on the importance of funding the USGS Super Gage Network and Partners for Conservation Program, as well as establishing a consistent monitoring approach among Upper Mississippi River states. Members expressed interest in conducting studies to understand why total phosphorus is increasing, while point source total phosphorus loads have decreased.

At the March 2020 meeting, opening remarks were provided by the Illinois EPA Bureau of Water Chief. Illinois EPA outlined the future of U.S. Geological Survey funding. Illinois Department of Agriculture shared updates on the Hypoxia Task Force meeting, Communications Subgroup, Agriculture Water Quality Partnership Forum meeting, and the development of additional implementation scenarios. Nutrient Research and Education Council shared NREC priority research topics. American Farmland Trust presented on the Fall Covers for Spring Savings program. Sierra Club provided an update on the Partners for Conservation legislation. The State Hydrologist presented on her sedimentation study at the Illinois State Water Survey.

The November 2020 meeting was part of the NLRS Partnership Workshop. PWG members discussed results of the NLRS Survey conducted by NASS, additional implementation scenarios to meet interim and ultimate NLRS goals (which are included in chapter 3 of this report), updates from working groups, and the biennial report production schedule.

The PWG continues to meet one to two times per year to work toward achieving its objectives.

Communication Subgroup

Photo courtesy of Kate Gardiner, Illinois Extension

The Policy Working Group's Communication Subgroup was formed at the 2017 Illinois NLRS Partnership Conference to educate elected officials, government staff members, professionals, contractors, business community members, and residents throughout the state about the hypoxic zone in the Gulf of Mexico, the strategy, and opportunities to participate. Members include representatives from Illinois Association of Drainage Districts, Illinois Department of Agriculture, Illinois Department of Natural Resources, Illinois Environmental Protection Agency, Illinois Environmental Regulatory Group, Illinois Farm Bureau, Illinois Fertilizer & Chemical Association, Metropolitan Water Reclamation District of Greater Chicago, Prairie Rivers Network, and Sierra Club.

The Communication Subgroup met virtually on October 14, 2020. University of Illinois Extension presented its progress on an Illinois NLRS educational resource platform, which will be used by educators to teach students about the strategy. The subgroup agreed on the need for this type of outreach and approved further development of the toolkit.

Going forward, the subgroup will meet on an as-needed basis.

Agriculture Water Quality Partnership Forum

The Agriculture Water Quality Partnership Forum works collaboratively to implement policy and management decisions related to Illinois NLRS in the agricultural sector. AWQPF is comprised of high-level officials from agencies and non-governmental organizations. It includes representatives from American Farmland Trust, Association of Illinois Soil and Water Conservation Districts, Farm Service Agency, Illinois Certified Crop Adviser Board, Illinois Corn Growers Association, Illinois Department of Agriculture, Illinois Department of Natural Resources, Illinois Environmental Protection Agency, Illinois Farm Bureau, Illinois Fertilizer & Chemical Association, Illinois Land Improvement Contractors Association, Illinois Pork Producers Association,

Illinois Society of Professional Farm Managers and Rural Appraisers, Illinois Soybean Association, Illinois Stewardship Alliance, Metropolitan Water Reclamation District of Greater Chicago, The Nature Conservancy, Nutrient Research & Education Council, Prairie Rivers Network, University of Illinois, and U.S. Department of Agriculture Natural Resources Conservation Service.

The objectives of AWQPF are to:

- Steer and coordinate outreach and educational efforts to help farmers address nutrient loss and select the most appropriate agricultural conservation practices.
- Identify needed educational initiatives or training requirements for farmers and technical advisers.
- Strengthen connections between industry initiatives, certified crop adviser continuing education requirements, state initiatives, and other technical services.
- Track conservation practices.
- Coordinate cost-share and targeting.
- Develop other tools, as needed.

The Agriculture Water Quality Partnership Forum met three times: April 30, 2019; February 27, 2020; and October 20, 2020.

Members decided to continue using the NLRS Survey conducted by NASS for tracking agricultural conservation practices and to seek additional sources where possible. They also agreed that the benefits of including details on agricultural implementation progress outweigh the drawbacks of producing a longer report. The AWQPF reviewed additional implementation scenarios that are discussed in chapter 3 of this report. The AWQPF will continue to discuss agricultural conservation practice adoption mapping as a possibility for Illinois. Other AWQPF meeting topics included Illinois Fertilizer & Chemical Association's 4R Metric Survey and how to address the Rock River watershed increases in nitrate load.

The AWQPF continues to meet one to three times per year to make progress on objectives and to stay up to date on the latest nutrient research and programs in Illinois and surrounding states. During these meetings, AWQPF considers and can recommend additional actions to track progress toward implementing the strategy.

Agriculture Water Quality Partnership Forum Technical Subgroup

The Agriculture Water Quality Partnership Forum created a Technical Subgroup to track nutrient loss reduction implementation across Illinois. Members include representatives from American Farmland Trust, Farm Service Agency, Illinois Department of Agriculture, Illinois Department of Natural Resources, Illinois Environmental Protection Agency, Illinois Farm Bureau, Illinois Fertilizer & Chemical Association, Illinois Land Improvement Contractors Association, The Nature Conservancy, University of Illinois, U.S. Department of Agriculture National Agricultural Statistics Service, and U.S. Department of Agriculture Natural Resources Conservation Service.

The objectives of the subgroup are to:

- Determine the best way to share and aggregate agricultural conservation practice implementation data across agencies (to track progress in accomplishing strategy goals).
- Determine what agricultural conservation practice implementation parameters will be tracked (e.g., cover crops, wetlands, buffer strips, etc.) and how the data will be aggregated (e.g., per watershed; statewide; practices lumped into categories, such as edge-of-field; etc.). This includes identifying future data parameters required from producer surveys or transect surveys to track progress in accomplishing Illinois NLRS goals.

The Technical Subgroup met on December 20, 2020. Members agreed to share their data and program updates for inclusion in the biennial report.

The subgroup continues to meet annually to reach its objectives.

Urban Stormwater Working Group

While urban runoff due to increased impervious surfaces is a smaller contributor to statewide nutrient loads than point source and agricultural non-point source runoff, it can still have impacts on local water quality. Members of the Urban Stormwater Working Group include representatives from Chicago Metropolitan Agency for Planning, City of Champaign, City of Peoria, City of Urbana, The Conservation Foundation, DuPage County, Greater Egypt Regional Planning and Development Commission, Illinois Department of Natural Resources, Illinois Department of Transportation, Illinois Environmental Protection Agency, Illinois Environmental Regulatory Group, Illinois Farm Bureau, Illinois-Indiana Sea Grant, Illinois State Water Survey, Lake County Stormwater Management Commission, Madison County, Metropolitan Agency for Planning, Metropolitan Water Reclama-

tion District of Greater Chicago, National Great Rivers Research and Education Center, Parkland College, Prairie Rivers Network, Sierra Club, and University of Illinois Extension.

The objectives of USWG are to:

- Explore funding.
- Identify legislative initiatives and develop plans.
- Coordinate outreach and orchestrate statewide efforts related to green infrastructure expansion and retrofitting; Municipal Separate Storm Sewer System program training; and urban stream, lake, and stormwater monitoring.

The USWG met on November 12, 2019, and then significantly increased their efforts in 2020, meeting seven times: April 6, May 12, June 9, July 14, August 11, September 8, and October 13.

The Urban Stormwater Working Group invited several guest speakers to its meetings to increase awareness and facilitate collaborations. These speakers highlighted efforts by Calumet Stormwater Collaborative, Illinois Coastal Management Program, Illinois EPA, Illinois-Indiana Sea Grant, Kane-DuPage Soil and Water Conservation District, National Great Rivers Research and Education Council, Parkland College, University of Illinois, and University of Illinois Extension.

The USWG continues to meet as time allows to fulfill their goals.

Urban Stormwater Working Group Education Subgroup

The Urban Stormwater Working Group created an Education Subgroup to explore ways to provide stormwater education resources and to make audiences aware of stormwater issues. Members include representatives from Chicago Metropolitan Agency for Planning, DuPage County, Greater Egypt Regional Planning and Development Commission, Illinois Department of Natural Resources, Prairie Rivers Network, and University of Illinois Extension.

The subgroup met via conference call on July 23, 2019, and September 28, 2020.

Over the course of these calls, the subgroup brainstormed ways to get vital information to MS4 coordinators. DuPage County shared outreach tips learned from their experience. The subgroup agreed to meet again to review the stormwater resource repository, which they established in 2018.

Urban Stormwater Working Group Tracking Subgroup

The Urban Stormwater Working Group created a Tracking Subgroup to determine metrics appropriate for stormwater best management practices. This can be challenging due to MS4 reporting methods and limited staff resources of both the permitting agency and the permittees. Subgroup members include representatives from The Conservation Foundation, DuPage County, Illinois Department of Natural Resources, Illinois Environmental Protection Agency, Lake County Stormwater Management Commission, Sierra Club, and University of Illinois Extension.

The subgroup met via conference call on August 26, 2020.

Members recalled past tracking efforts and discussed a potential grant to fund a green infrastructure tracking platform. Subgroup members recommended that University of Illinois Extension move forward with the grant application.

Nutrient Monitoring Council

The Nutrient Monitoring Council's overall goal is to coordinate the development and implementation of monitoring activities that provide the information necessary to:

- Generate estimates of five-year running average loads of nitrate-nitrogen and total phosphorus leaving Illinois, compared to 1980-96 baseline conditions.
- Generate estimates of nitrate-nitrogen and total phosphorus loads leaving selected Illinois NLRS-identified priority watersheds, compared to 1997-2011 baseline conditions.
- Identify nutrient load trends, both statewide and in Illinois NLRS priority watersheds over time.

The NMC, chaired by Illinois EPA, has a membership of 16 representatives from agencies and organizations involved in monitoring and assessing nutrient loads and their impacts in Illinois: Illinois Environmental Protection Agency, U.S. Geological Survey, Illinois Department of Natural Resources, Illinois State Water Survey, Illinois Natural History Survey, Metropolitan Water Reclamation District of Greater Chicago, Sierra Club, University of Illinois Department of Agricultural and Biological Engineering, University of Illinois Department of Natural Resources and Environmental Sciences, University of Illinois National Center for Supercomputing Applications, Illinois Corn Growers Association, Illinois Farm Bureau, U.S. Army Corps of Engineers, and Fox River Study Group.

NMC meetings took place on March 19, 2019; September 10, 2019; October 22, 2019; and June 18, 2020.

Over the last two years, the NMC continued to work with NCSA and National Great Rivers Research and Education Council on the Great Lakes to Gulf Virtual Observatory, sought funding for USGS super gage stations, supported the proposed Upper Mississippi River Water Quality Improvement Act, and contributed to the new Hypoxia Task Force Water Quality Monitoring Workgroup. The NMC discussed how to calculate statewide annual nutrient loads most accurately, by accounting for non-monitored areas of Illinois and contributions from Wisconsin and Indiana. The NMC also invited guest speakers to discuss the effect of climate change on reaching NLRS goals and the H2NOW initiative to monitor microbial quality in the Chicago River.

The NMC continues to meet two to three times per year to discuss water quality monitoring issues and activities.

Performance Benchmark Committee

The Performance Benchmark Committee was originally established by the Policy Working Group to address implementation needs defined in the strategy. Their charge is to collaborate with sector work groups identifying on-the-ground steps to meet:

- 2025 interim milestones.
- Ultimate nutrient loss reduction targets.
- In-state strategy waterway cleanup goals.

Members of the PBC include representatives from American Bottoms Regional Wastewater Treatment Facility, American Farmland Trust, Association of Illinois Soil and Water Conservation Districts, Illinois Association of Drainage Districts, Illinois Department of Agriculture, Illinois Environmental Protection Agency, Illinois Environmental Regulatory Group, Illinois Farm Bureau, Illinois Fertilizer & Chemical Association, Illinois Pork Producers Association, Metropolitan Water Reclamation District of Greater Chicago, The Nature Conservancy, Prairie Rivers Network, Sierra Club, U.S. Department of Agriculture Natural Resources Conservation Service, and Village of Deerfield.

The PBC met on April 2, 2019, and October 8, 2020.

During these meetings, PBC members agreed that many combinations of practices and scenarios could be used to reach Illinois NLRS goals. They agreed to develop new implementation scenarios in addition to

those in the strategy's original science assessment, particularly implementation scenarios that meet interim water quality goals. Illinois EPA partnered with University of Illinois Department of Crop Sciences to develop the additional scenarios, as discussed in chapter 3.

The PBC efforts informed the adaptive management discussion in the following chapter.

NLRS Partnership Conferences and Workshops

At the end of each year, NLRS partners hold an annual nutrient conference or workshop that typically includes a research showcase and time for the Policy Working Group to meet. Conferences encompass two days and are hosted in odd-numbered years coinciding with the release of a biennial report. One-day workshops occur in the alternating years.

The 2019 conference was held in Springfield and had 130 attendees. Bill Northey, Under Secretary for Farm Production and Conservation for the U.S. DOA served as keynote speaker. John Kim, Director of Illinois EPA provided opening remarks and John Sullivan, Director of Illinois DOA provided closing remarks. Sessions focused on a review of the 2019 biennial report, partner updates, and a demonstration of the Great Lakes to Gulf virtual monitoring platform. The poster session reception highlighted 14 research projects.

The 2020 NLRS Partnership Workshop was held online and featured an out-of-state panel and an update from NREC. The welcome was provided by Dr. Shelly Nickols-Richardson, Director of University of Illinois Extension. Approximately 200 people attended the conference, representing several diverse stakeholder groups. The out-of-state panel was made up of representatives from Iowa, Ohio, and Minnesota, who discussed the implementation of their respective state strategies. NREC provided an update on their funded research projects.

The Policy Working Group held meetings at the end of both of these events.

2019 NLRS Partnership Conference
Photo courtesy of Kate Gardiner, Illinois Extension

Old Chain of Rocks Bridge over the Mississippi River

Photo courtesy of Layne Knoche, Illinois Extension

CHAPTER 8
ADAPTIVE MANAGEMENT AND MEASURING PROGRESS

Adaptive management as a means to advance nutrient loss reduction in Illinois was first described in the 2019 Biennial Report in alignment with the Gulf Hypoxia Action Plan 2008. It allows the Nutrient Loss Reduction Strategy to be a living document focused on both traditional and new technologies and practices. This chapter summarizes the current state of water quality in Illinois and outlines recommendations for future practice adjustments based on current data and emerging science and policy to achieve goals established in the initial NLRS framework.

The NLRS Performance Benchmark Committee helps to inform NLRS adaptive management goals and has developed interim milestones and ultimate targets. As progress is made toward these goals and new practices and technologies are developed, the mechanisms for reaching these goals may change. Adjustments, such as those outlined in this chapter, will help Illinois' water quality trajectory.

Photo courtesy of Paul Gierhart

Adaptive Management allows the Nutrient Loss Reduction Strategy to be a living document focused on both traditional and **new technologies** and **practices**.

Water Quality Goals

The NLRS was established to improve water quality from local lakes and streams in Illinois to the Gulf of Mexico, as per U.S. Environmental Protection Agency guidelines. To achieve these load reductions, Illinois has set short- and long-term goals to reduce both nitrate-nitrogen and total phosphorus by 45%, with interim reduction goals of 15% and 25%, respectively, by 2025. Figures 8.1 and 8.2 illustrate the state's progress as compared to the baseline years 1980-96. Loads are measured as a range of years because environmental conditions, such as annual precipitation, can greatly impact them. A rolling average is a more reliable measure of progress.

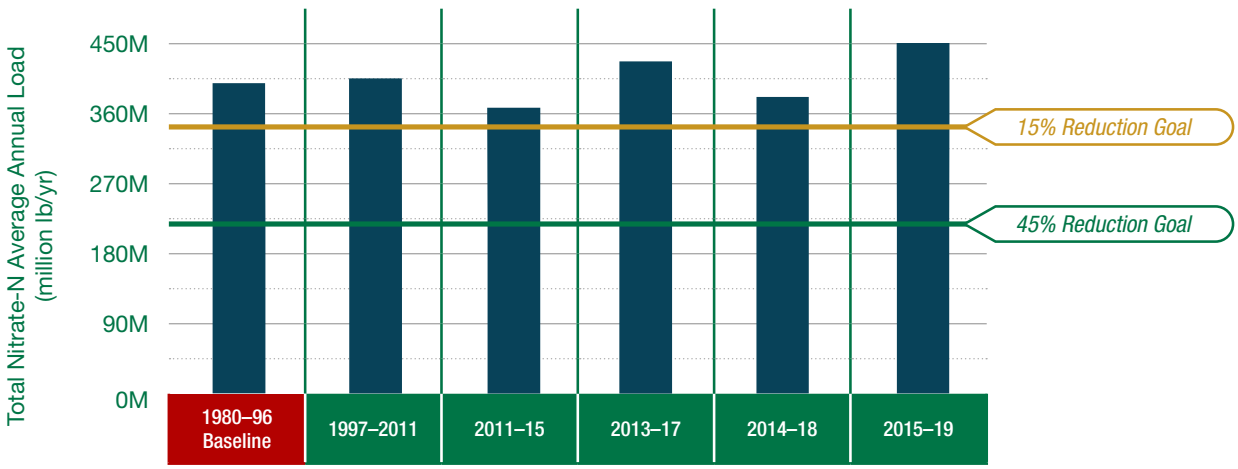


Figure 8.1. *Illinois nitrate-nitrogen loads*

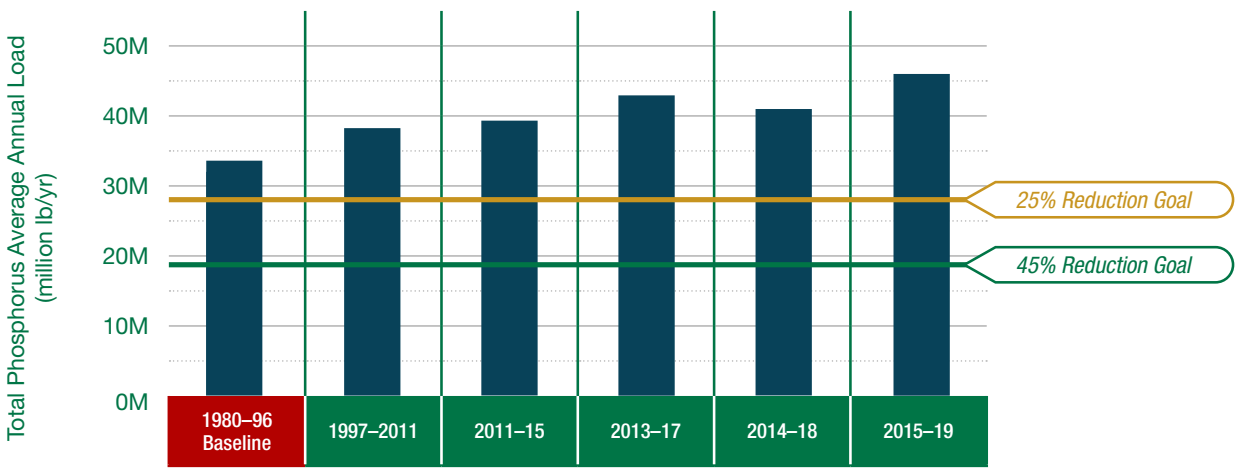


Figure 8.2. *Illinois total phosphorus loads*

Although practices known to reduce nitrogen and phosphorus loads have been implemented widely in both agricultural and point sources, the 2015-19 load average continues to show an upward trend in total nutrient load. As discussed in chapter 3 and illustrated in Figures 8.1 and 8.2 above, the nitrate-nitrogen load is 13% greater than in the 1980-96 baseline years. Total phosphorus has increased 35% over the baseline.

Significant variability of loads by waterway illustrates the need for more research into nutrient load management practices and environmental conditions. Average nitrate-nitrogen loads in the Illinois River for the 2015-19 reporting period were only 3% over the baseline. However, nitrate-nitrogen loads on the Rock River portion of the Illinois River increased by 135%. The Vermilion (Wabash Basin) and Kaskaskia rivers both showed nitrate-nitrogen load declines in this period. Phosphorus loads showed similar variability, with the highest total load coming from the Illinois River, but significant increases over the baseline in all rivers, except the Green River.

Chapter 3 identifies several possible contributing factors. Water yield has increased by 25% over the baseline years, including unusually high precipitation in 2019. Increased water yield causes greater runoff and drainage, which tend to increase river nitrate-nitrogen loads. However, the influence of legacy nitrate loading from groundwater may need to be investigated in certain watersheds, such as the Rock River watershed. In the Kaskaskia River, phosphorus loads may be increasing because of sediment containing legacy phosphorus.

Watersheds that have exhibited recent increases in loads should be further studied to determine if the increases are caused by factors other than increased flow. The Nutrient Research and Education Council has recently funded a study of the increase in total phosphorus loads in the Illinois River and the Illinois Corn Growers Association is studying the increased nitrate loads in the Rock River. The results of this work will provide further guidance for strategy implementation.

Implementation Scenarios

The NLRS includes implementation scenarios by which the state could reach reduction goals. These scenarios include combinations of conservation practices, expected load reductions, and anticipated costs. The initial scenarios proved useful in identifying the scope and scale needed to achieve the goals, but as the strategy has been implemented, some practices have proven difficult to measure expected load reductions and anticipated costs.

As discussed in chapter 3, Illinois EPA provided funding to University of Illinois to develop additional implementation scenarios. Scenarios NP7 and NP8, outlined in chapter 3, use practices for which data is more readily available and that address interim and long-term reduction goals more fully. NP2 and NP3, outlined in the strategy, summarize the initial implementation scenarios. See chapter 3 for detailed information on these scenarios.

The scenarios are meant to guide the process of implementation and are not intended to be formal recommendations. As such, the Policy Working Group has not formally adopted any of the example scenarios. However, many NLRS stakeholder partners are recommending practices put forth in the implementation scenarios. With a few years of implementation data available for analysis, certain trends may become evident.

Agricultural Implementation Progress

Adoption of agricultural conservation practices are measured against the implementation scenarios discussed above to inform progress toward the NLRS implementation goals. Progress has been made with respect to reducing phosphorus fertilizer application rates and adoption of conservation tillage practices. According to the most recent NLRS Survey conducted by NASS, the adoption of cover crops increased 135% from 2011 to 2019 (see chapter 4 for additional detail).

Tables 8.1-8.4 show summaries and data sources for scenarios NP2, NP3, NP7, and NP8 and Figures 8.3-8.6 compare recommended conservation practice adoption levels necessary to meet the interim and 45% reduction goals established in these scenarios. Data representing agricultural practice implementation are collected through the NLRS Survey conducted by NASS. This survey and the data collected are discussed in chapter 4. One of the challenges with measurement of NP2 and NP3 scenarios is alignment with data available through the survey. Scenarios NP7 and NP8 were constructed to better align with available information and thus, provide a better measurement of progress.

The survey response for edge-of-field practices, such as bioreactors, grass buffers, and wetlands, were too low to allow for statistical reporting. For the scenario graphs below, the bioreactor data reflects the number of acres treated by bioreactors, based on data provided by University of Illinois. The acres of constructed wetlands are based on Natural Resources Conservation Service data. No adequate statewide dataset currently exists to measure and report on grass buffers.

Table 8.1. *Scenario NP2 practices, features, and data sources*

Scenario NP2 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
Reducing N rate from background to MRTN	Applies to all corn acres, but reductions only realized on 10%	11.2	3.7	N	NASS
Spring-only N application	50% of corn acres	11.2	3.7	N	NASS
Bioreactors (acres treated)	50% of tiled crop acres	4.45	1.48	N	Illinois EPA-from reported data
Wetlands (acres treated)	10% of tiled crop acres	0.89	0.30	N	NRCS, Illinois EPA
No P fertilizer above STP maintenance	Assumes 12.5M acres are above maintenance	12.5	6.94	P	IDOA, other Assumes that 12.5M acres are above maintenance
Reduced till of conventional eroding>T	Defined as leaving 30% or greater crop residue cover	1.8	1.0	P	Soil Transect Survey
Cover crops on all corn/soybeans	Fall planted	21	7.1 (N) 11.8 (P)	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Point sources (majors only)	1 mg/L TP permit limit	N/A	N/A	P	Illinois EPA
Point sources (majors only)	10 mg/L nitrate permit limit	N/A	N/A	N	Illinois EPA

Table 8.2. *Scenario NP3 practices, features, and data sources*

Scenario NP3 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
Reducing N rate from background to MRTN	Applies to all corn acres, but reductions only realized on 10%	11.2	3.7	N	NASS
Spring-only N application	Tiled corn acres	11.2	3.7	N	NASS
Bioreactors (acres treated)	30% of crop acres	2.7	0.89	N	Illinois EPA-from voluntary reported data
No P fertilizer above STP maintenance	Assumes 12.5M acres are above maintenance	12.5	6.94	P	IDOA tonnage report, other
Reduced till of conventional eroding>T	Defined as leaving 30% or greater crop residue cover	1.8	1.0	P	Soil Transect Survey
Cover crops on all corn/soybeans	87.5% of acres	18.6	2.8 (N) 10.3 (P)	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Buffers on all applicable lands	Estimated 100 feet from stream	0.20	0.07	P	Illinois EPA, FSA, NRCS, GIS analysis
Perennial crops on land eroding>T add perennials	Biofuels, hay, or CRP	2.5	0.83 (N) 1.39 (P)	N, P	FSA (CRP), IDNR (CREP), other

Table 8.3. *Scenario NP7 practices, features, and data sources*

Scenario NP7 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
MRTN	Applies to all corn acres, but reductions only realized on 10%	N/A	3.7	N	NASS
Soil test phosphorus	100% of total acres	N/A	22	P	NASS
Conservation tillage*	94% of total acres	N/A	20.7	P	Soil Transect Survey
Bioreactors (acres treated)	100% of maximum implementation of tiled acres	N/A	4.7	N	NRCS, Illinois EPA-from voluntary reported data
Cover crops (grass-based) — tiled	31% of maximum implementation of tiled acres	N/A	3	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Cover crops (grass-based) — non-tiled	32% of maximum implementation of non-tiled acres	N/A	3.9	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Nitrification inhibitor — non-tiled	100% of maximum implementation of non-tiled acres	N/A	3.1	N	NASS

*Conservation tillage calculated from no-till, mulch till, and reduced till. It includes prevent acres.

Table 8.4. *Scenario NP8 practices, features, and data sources*

Scenario NP8 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
MRTN	Applies to all corn acres	11.2	3.7	N	NASS
Soil test phosphorus	Applies to all acres	22.1	12.3	P	NASS
Conservation tillage*	Applies to all acres	22.1	12.3	P	Soil Transect Survey
Bioreactors (acres treated)	100% of maximum implementation of tiled acres	4.7	1.6	N	Illinois EPA-from voluntary reported data
Wetlands	100% of maximum implementation of tiled acres	2.4	0.8	N	WREP, NRCS EQIP, DNR CREP ease-ments
Cover crops (grass-based) — tiled	100% of maximum implementation of tiled acres	9.7	3.2 (N) 5.4 (P)	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Nitrogen management (40% in fall; 10% spring pre-plant; 50% side-dress) — tiled	100% of maximum implementation of tiled acres	2.6	0.9	N	NASS
Cover crops (grass-based) — non-tiled	100% of maximum implementation of non-tiled acres	12.4	4.1 (N) 6.9 (P)	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Nitrification inhibitor — non-tiled	100% of maximum implementation of non-tiled acres	1.4	0.5	N	NASS
Nitrogen management (40% in fall; 10% spring pre-plant; 50% side-dress) — non-tiled	100% of maximum implementation of non-tiled acres	3.8	1.3	N	NASS
Buffers — non-tiled	36% of maximum implementation of non-tiled acres	4.4	1.5 (N) 2.5 (P)	N, P	None

*Conservation tillage calculated from no-till, mulch till and reduced till. It includes prevent acres.

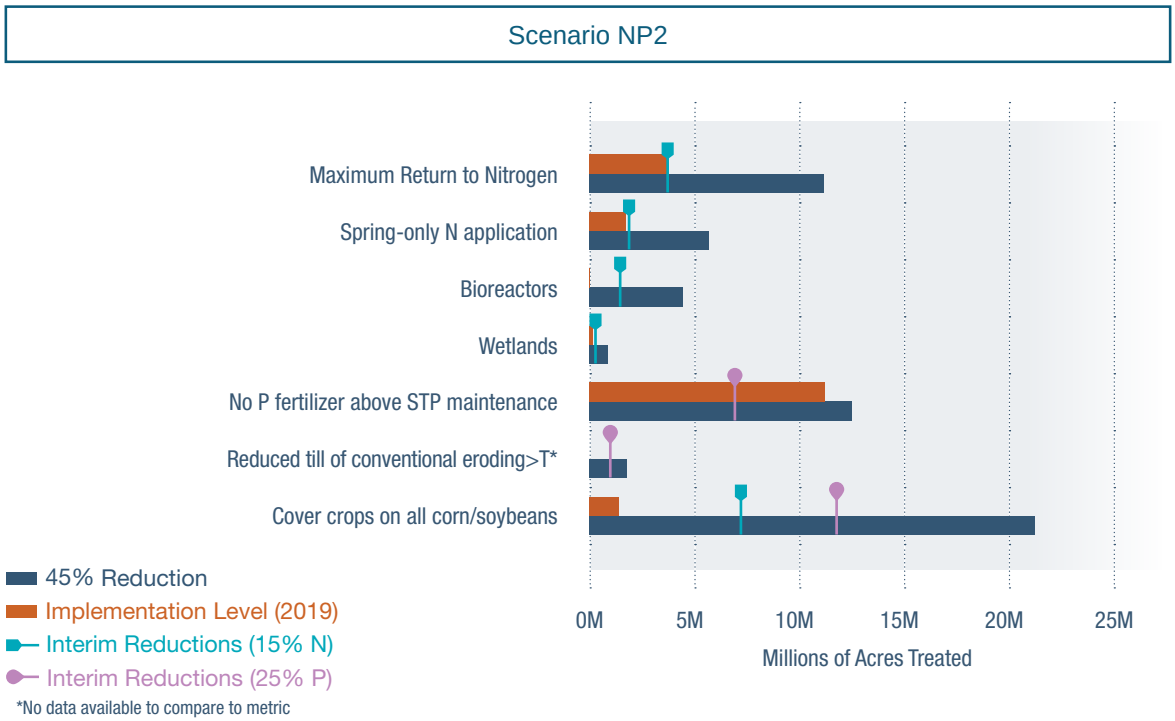


Figure 8.3. *Agricultural implementation as compared with scenario NP2*

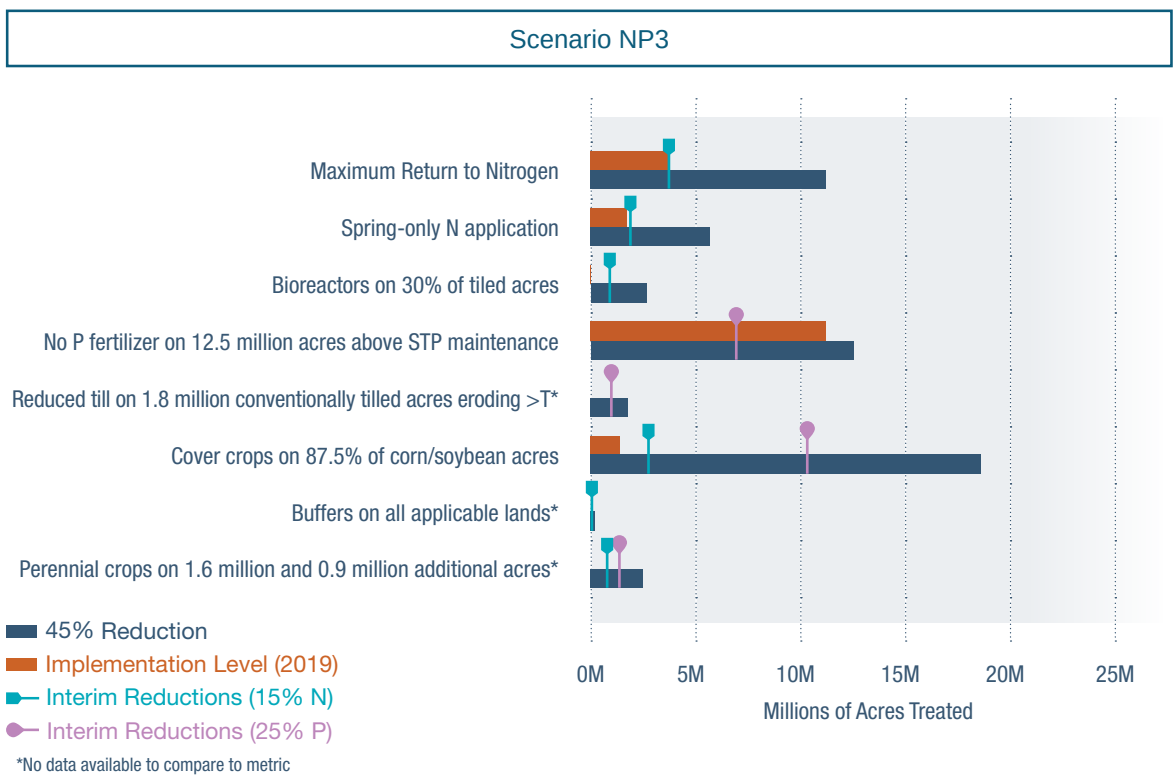


Figure 8.4. *Agricultural implementation as compared with scenario NP3*

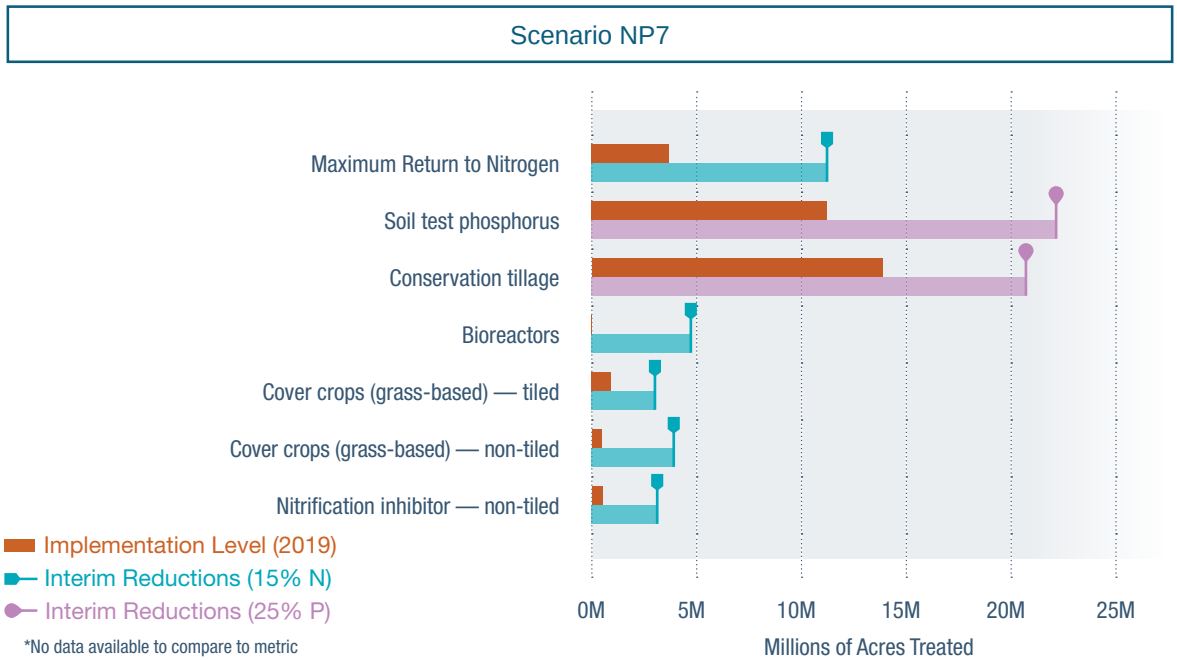


Figure 8.5. *Agricultural implementation as compared with scenario NP7 (which reflects interim goals)*

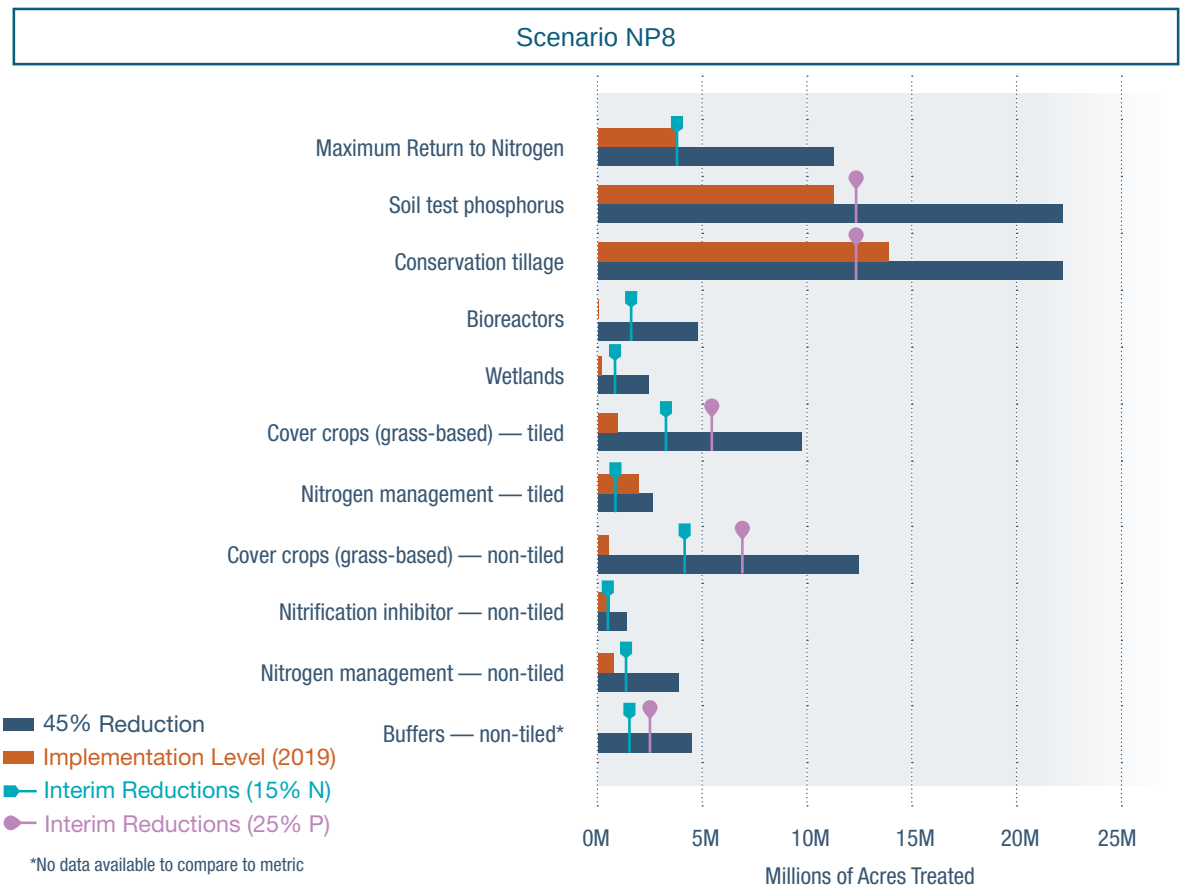


Figure 8.6. *Agricultural implementation as compared with scenario NP8*

Point Source Implementation Progress

As in the agricultural sector, point source contributors are implementing strategies to reduce nutrient loads, primarily total phosphorus. Point source load reductions are achieved primarily through upgrades to wastewater treatment facilities and through watershed-based approaches. In 2020 alone, wastewater treatment plants spent over $185 million on upgraded infrastructure, operations and maintenance, feasibility studies, and other nutrient reduction-related activities. These efforts are discussed in detail in chapter 5.

Figure 8.7 shows the load reduction from point sources over time. During this reporting period, point sources reduced phosphorus loads by 16-18% and nitrogen loads by 1.7-4.7% over the 2011 baseline year. While the load reductions are substantial, they represent a decrease from those reported in the 2019 biennial report. In 2018, nutrient load reductions had almost achieved the 2025 interim reduction goals for the sector. However, as wastewater treatment plants are biological systems requiring complex microbial management, the overall flow from year to year can result in load reduction fluctuation. This is likely a contributing factor in 2019 and 2020. Further, problems with solids management at the Metropolitan Wastewater Reclamation District of Greater Chicago's Stickney Plant required stopping and restarting the biological phosphorus removal operations, which led to an increase in annual total phosphorus concentrations. These decreases in load reductions are likely temporary and as Figure 8.7 shows, the point source sector remains on track to achieve nutrient loss reductions goals.

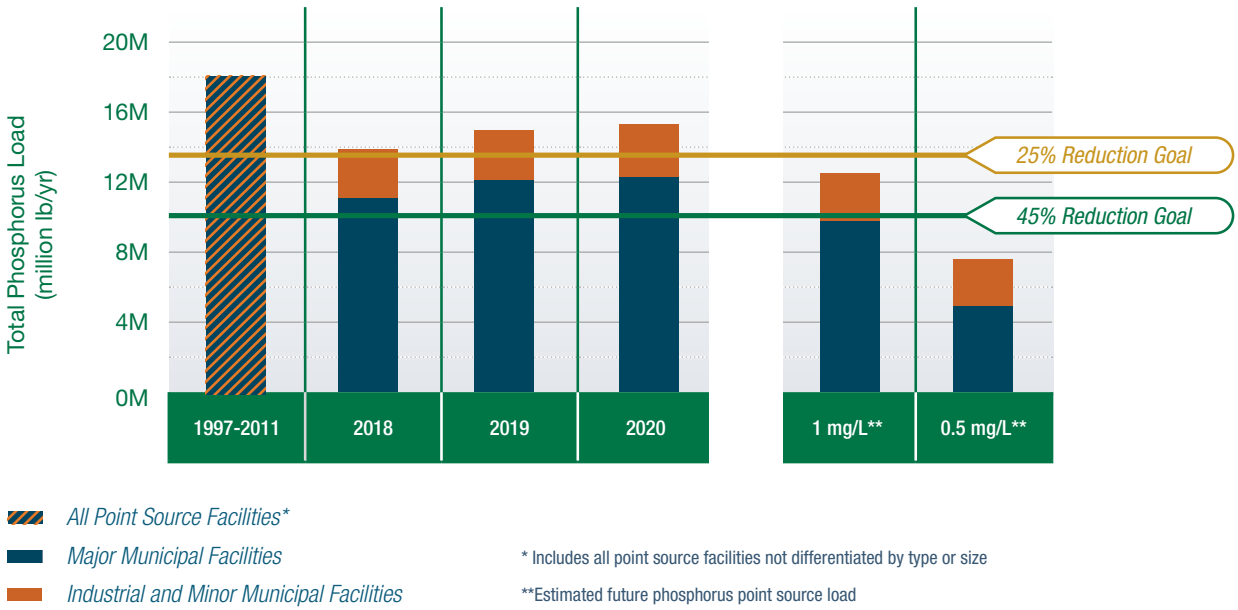


Figure 8.7. *Total phosphorus point source load*

Revision to Conservation Practice Procedure

Photo courtesy of Chifan Belmont

As discussed in chapter 3, the Illinois NLRS Science Team evaluates proposals to adopt new conservation practices and update practice performance numbers. The 2019 Biennial Report includes the formal procedure and this report revises it.

In December 2020, the first two proposals were received for science team consideration. To meet publication deadlines, several science team meetings were held between January and March 2021. Science team decisions are detailed in chapter 3. The initial completion of this process revealed the need for slight changes to ensure enough time for deliberate consideration. Changes to the proposal submission process are as follows:

1. **An update to the proposal due date.** For full consideration, proposals should be submitted by July 31 of the year prior to a biennial report year. More simply, proposals should be submitted by July 31 of even numbered years. That said, proposals may be submitted at any time during the year, and they will be collated and reviewed together in the fall of even numbered years.
2. **A limit to the number of practices submitted per proposal.** One practice per proposal may be submitted. Organizations may submit more than one proposal.
3. **Include the NRCS practice number code, if available**. To ensure clarity, each submission must identify the proposed practice by NRCS practice code, if available.

The revised full proposal submission process to add new conservation practices or to update practice performance is available on the Illinois EPA website at www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Pages/nutrient-loss-reduction-strategy.aspx.

Watershed-Based Plans

Photo courtesy of CMAP

A watershed-based plan is a strategy that provides assessment and management information for a geographically defined watershed, including the analyses, actions, participants, and resources related to developing and implementing the plan (USEPA, 2008). In addition to summarizing the overall condition of a watershed, these plans provide an integrated, holistic framework to restore water quality effectively and efficiently in impaired waters and to protect water quality in other waters adversely affected or threatened by point source and non-point source pollution. While WBPs may address a host of water quality concerns and have different water quality goals, they can be useful for meeting statewide nutrient loss reduction goals.

Illinois EPA's Section 319 and Section 604 grant funds have been used since the mid-1990s to support local watershed planning groups in developing WBPs in Illinois.

In 2013, the U.S. EPA provided an update to the Section 319 program guidance regarding the required elements of a WBP and the increased emphasis on allocating Section 319 grant funds toward the implementation of non-point source pollution control components of approved WBPs. Following the guidelines, non-point source pollution control projects in areas of Illinois not covered by a WBP, or not recommended in an existing WBP, are a lower priority for Section 319 funding.

WBP development and implementation in Illinois is voluntary. It is imperative that local stakeholders are involved in the plan's development so that they will begin implementation as soon as the planning is complete. Most WBPs in Illinois have a 20-year implementation schedule and have identified a vast number of resources required for success.

Since 2004, a total of 129 WBPs have been implemented (pre-2013) and developed. Illinois EPA considers plans that are more than 10 years old to be low priority for implementation, as they are no longer current.

Those plans must be updated to be eligible for Section 319 grant funds; however, the information regarding pollutant load reduction targets is still appropriate for efforts such as the NLRS.

Table 8.5 shows the pollutant load reduction amounts that could be realized, as estimated by the local watershed planning committees. These estimates reflect reductions that could be achieved if all components of the watershed plans reported to Illinois EPA are implemented.

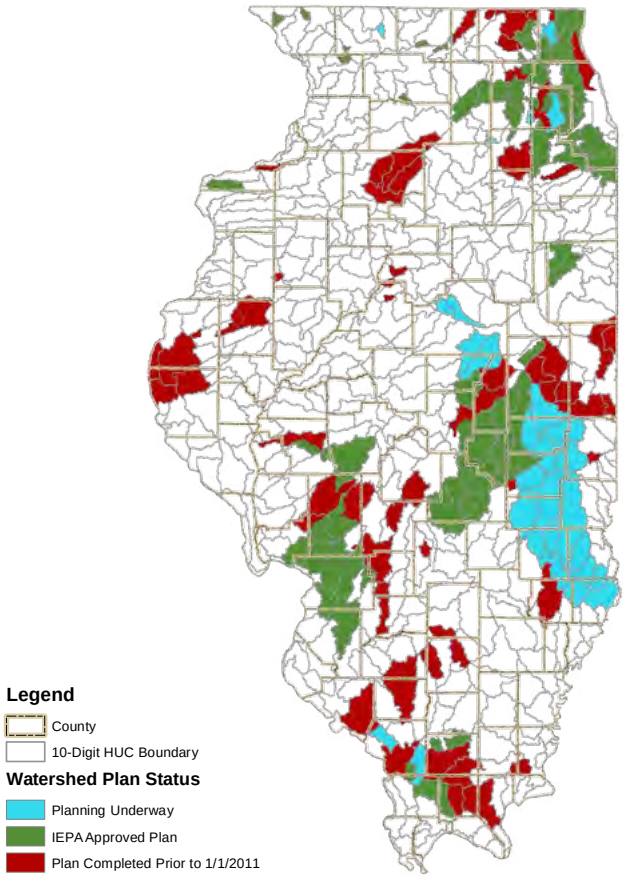
Table 8.5. *Pollutant load reduction if all components of the watershed plans were implemented*

	WBPs Since 2011	WBPs Since 2004	WBPs Under Development	WBPs (Outside Source) Under Illinois EPA Review
Number of Plans	67	128	10	6
Nitrogen (lb/yr)	5,086,760	9,301,246	TBD	TBD
Phosphorus (lb/yr)	1,729,130	2,304,835	TBD	TBD
Sediment (tons/yr)	541,918	986,307	TBD	TBD
TSS (lb/yr)	10,846,448	28,203,523	TBD	TBD

There are 10 additional WBPs currently under development using funds from the Section 319 and Section 604 grant programs. An additional six planning documents, created without Illinois EPA financial assistance, are currently under review by Illinois EPA to determine whether they qualify as approved WBPs. Watershed-based planning is strongly encouraged and is most successful when conducted as a grassroots effort led by local stakeholders addressing local water quality concerns. A WBP not only improves local water quality, but contributes to downstream improvements, as well. For more information about watershed-based planning, go to www2.illinois.gov/epa/topics/water-quality/watershed-management/watershed-based-planning/Pages/default.aspx.

See the appendices for a list of WBPs submitted to Illinois EPA since 2004. Figure 8.8 shows the location of most of the watershed planning efforts that have been reported to Illinois EPA.

Figure 8.8. *Location of watershed planning efforts reported to Illinois EPA*



Looking Ahead

Future Strategy Considerations

The previous chapters in this biennial report demonstrate the continued implementation of the NLRS across agriculture, point source, and urban stormwater sectors. Despite these efforts, the water quality analysis described in chapter 3 confirms that nutrient loads continue to increase. While progress in implementation of certain practices is evident, the scale and pace of adoption of all practices needs to accelerate to meet the interim nutrient loss goals. In the agriculture sector, continued education and outreach is needed to inform farmers and the industry of recommended agricultural conservation practices. Likewise, more technical and financial assistance is needed as farmers adopt conservation practices and methods that main-

tain or increase crop yields, while reducing nutrient loads. For the point source sector, municipal wastewater treatment facilities will need continued access to additional resources to implement nutrient controls that will reduce nutrient loads, particularly total phosphorus. As shown in chapter 5, point source facilities can experience difficulties even after new nutrient removal technologies have been installed. Urban stormwater managers continue to adopt new green infrastructure technologies. A learning curve exists for all sectors as new practices and technologies are adopted, making technical assistance just as important as additional financial resources. Further, the impact of climate change and its influence on water yields and nutrient loads should be considered for future research.

Methods for improving and refining the tracking of agricultural conservation practice implementation outside of traditional government cost-share programs remains a top priority moving forward. There is confidence in the results of the NLRS Survey conducted by NASS, but it is dependent on those taking the survey to fully understand and respond to the questions being asked. Adjustments to some survey questions may be needed to improve confidence in the results. Data sources or methods for quantifying structural conservation practices, such as grass buffers or terraces, should also be investigated. Satellite data and publicly available land use coverages could be used to estimate the number of these practices on the landscape, and potentially, the acres treated by each structure.

Agricultural conservation practices are currently tracked and reported in terms of the number of acres treated. The Illinois EPA 319 grant program and the Illinois Department of Agriculture's Partners for Conservation program estimate the associated nutrient load reductions for each implemented practice. Other state and federal cost-share programs could potentially adopt methods to estimate nutrient load reductions for practices implemented through their respective programs. There is value in documenting environmental outcomes, in addition to reporting total acres of conservation practices implemented. Future reporting could include pounds of nutrients reduced as a counter to increases in nutrient loads observed in water quality data. It provides a means to quantify the amount of nutrients that would have otherwise contributed to an increase in nutrient loads observed in the rivers.

Finally, increased precipitation and stream flow, including extreme weather events caused by climate change, drive variability in nutrient loads from all sources making it more difficult to discern nutrient reductions by implemented practices. More research is needed to gain a better understanding of how climate change will continue to impact nutrient loads from the state. New innovative conservation practices and solutions, as well as changes to the scale of implementation, may be needed to meet nutrient loss reduction goals.

Potential Future Resource Needs

Achieving nutrient loss reduction goals requires significant capital, personnel, and technological investment from all sectors. The Policy Working Group has identified areas for future investment to continue progress toward the 2025 milestones and the long-term 45% reduction goals. The Performance Benchmark Committee members have identified the following sectors and partnerships as those that will advance Illinois' progress.

A formal needs assessment survey is recommended to expand and refine resource needs and associated costs.

Partners for Planning Conservation Funding

Partners for Planning Conservation Funds are used to establish comprehensive programs to protect Illinois' natural resources through cooperative partnerships between State governments and public and private landowners. Legislation to support the program was signed into law in 1999 as the Partners for Planning Conservation 2000 Fund and extended in 2008 under the Partners for Conservation label. The program is set to expire in June 2021.

Extension and expansion of the legislation to include NLRS objectives and funding over the next six years is underway at the writing of this report. The focus on voluntary programs that engage private, public, and corporate landowners would provide much-needed resources to increase conservation practice implementation around the state.

Soil and Water Conservation Districts

A network of 97 Soil and Water Conservation Districts, covering 102 Illinois counties, provides a mechanism for state cost-share funds for nutrient-capture practices to be distributed. SWCDs provide several technical assistance and program administration roles in the state, including administration of the Illinois Department of Agriculture Partners for Conservation Program. Through this program, SWCDs provide technical assistance and financial cost-share incentives to farmers and landowners for installation of conservation practices, such as cover crops, grassed waterways, and filter strips.

Additionally, SWCDs provide ongoing technical and administrative assistance to the U.S. Department of Agriculture to implement federal Farm Bill conservation programs. SWCDs partner with NRCS to help ad-

minister the Environmental Quality Incentives Program, Wildlife Habitat Incentives Program, Conservation Stewardship Program, and Wetland Reserves Enhancement Program. They partner with Farm Service Agency to help administer the Conservation Reserve Program, Conservation Reserve Enhancement Program, and State Acres for Wildlife Enhancement. SWCDs work with U.S. Fish and Wildlife Services to provide the Landowner Incentive Program and Habitat and Forestry Management Program. SWCDs also partner with the U.S. Army Corps of Engineers, U.S. EPA, and numerous grant and landowner payment programs administered by not-for-profit organizations.

Photo courtesy of Maggie Kinnamon

Over 500,000 people benefit from SWCD services each year. The state of Illinois currently invests $7.5 million in SWCDs. Increased funding for this program will allow SWCDs to fulfill their critical role assisting landowners in adopting agricultural and urban conservation practices.

Wastewater Treatment Facility Upgrades

Major municipal wastewater treatment plants continue to make large investments as they strive to reduce total phosphorus loads to meet National Pollutant Discharge Elimination System permit limits. As stated in chapter 5, 77 major municipal wastewater treatment plants now have permit limits of 1 mg/L total phosphorus. This represents 12 additional facilities with total phosphorus permit limits compared to the 2019 Biennial Report. As total phosphorus limits are added to more permits, the need for continued funding is expected to increase.

Local governments require loans or cost-share grants to finance and construct nutrient-capture infrastructure at municipal wastewater facilities to reduce nutrient loads from point sources expediently. The Illinois Association of Wastewater Agencies has compiled information on necessary funding to implement phosphorus removal at major wastewater facilities throughout the state. Seventeen facilities provided actual or estimated design and construction costs, with construction costs totaling over $242 million. This information provides a way to estimate costs for all major wastewater facilities (treating one MGD or more) in the state to install phosphorus removal technologies.

Stormwater Practice Adoption

Communities in Illinois are increasingly turning to Green Stormwater Infrastructure to address evolving stormwater management needs, including to achieve Municipal Separate Storm Sewer System permit requirements. The investment in nature-based solutions at the local and private level can have significant impacts on water quality. Further, the Illinois EPA's Green Infrastructure Grant Opportunity program "funds projects to construct green infrastructure best management practices that prevent, eliminate, or reduce water quality impairments by decreasing stormwater runoff into Illinois' rivers, streams, and lakes" (www2.illinois.gov/epa/topics/grants-loans/water-financial-assistance/Pages/gigo.aspx).

However, Illinois does not have an inventory of green infrastructure best management practices installed throughout the state, making measurement of the long-term impacts on water quality and flooding impossible, and making it difficult for communities to make informed decisions about how to reach statewide and local goals. The NLRS Urban Stormwater Working Group began discussing the creation of a Stormwater Practice Inventory in 2018 as an appropriate way to measure stormwater management practice implementation in the state. Using the Calumet Stormwater Collaborative's inventory as a model, USWG supports a partnership with National Center for Supercomputing Applications, National Great Rivers Research and Education Center, and University of Illinois Extension and faculty to add an urban stormwater practice Esri GIS layer to the existing Great Lakes to the Gulf Virtual Observatory.

Funding of $50,000-$70,000 is required to build this inventory. Maintenance costs are expected to be minimal, with data collected through the biennial report process and uploaded to the platform.

Water Quality Monitoring

USGS Continuous Nutrient Loading Network

Since 2015, Illinois EPA has contracted with U.S. Geological Survey to provide cost-share funding for operation and maintenance of the eight super gages. Each super gage continuously monitors streamflow, nitrate, orthophosphate, turbidity, temperature, specific conductivity, dissolved oxygen, and pH. Summary bulletins regarding the network operation, including annual loading estimates, are developed after each full year of data collection. These super gages also provide direct monitoring and evaluation support for generating estimates of five-year running average loads of nitrate-nitrogen and total phosphorus leaving Illinois. The previous contract with USGS to maintain the super gages was set to expire in September 2020; however,

Illinois EPA extended the contract to continue operation of the gages through September 2021. The Metropolitan Water Reclamation District of Greater Chicago has committed to four years of funding for the ninth gage, which was added in 2018, on the Des Plaines River in Joliet, to capture nutrient loads coming from the urban environment in northeastern Illinois. Continued funding for these nine gages is necessary to provide data for calculating statewide nutrient loads on an annual basis and to determine the five-year running average, so that progress in nutrient reduction can continue to be monitored and reported.

USGS Illinois River Basin Next Generation Water Observing Systems

USGS is planning to intensively study 10 Integrated Water Science basins — medium-sized watersheds (10,000-20,000 square miles) and underlying aquifers — throughout the United States over the coming decade to improve understanding of water availability in a wide range of environmental, hydrologic, and landscape settings. Each IWS basin will be representative of a larger region; high-density monitoring and cutting-edge research will be used to better understand and model factors affecting water availability (quantity, quality, and use) in the basins, the larger regions, and the nation.

In November 2020, USGS selected the Illinois River Basin as the third IWS basin. The Illinois River Basin consists of extensive urban and agricultural land uses that can help improve understanding of how nutrient sources, in combination with climate and land use change, may limit water availability. The USGS Next Generation Water Observing Systems will provide the high temporal and spatial resolution data on streamflow, evapotranspiration, snowpack, soil moisture, water quality, groundwater-surface water connections, stream velocity distribution, sediment transport, and water use that are necessary to advance this understanding.

Over the course of 2021, USGS will begin broad internal and external stakeholder engagement to help develop science and monitoring plans for the Illinois River Basin. The plan will guide USGS IWS activities in the basin over the coming years, depending on appropriations. More information is available at usgs.gov/mission-areas/water-resources/science/next-generation-water-observing-system-illinois-river-basin?qt-science_center_objects=0#qt-science_center_objects.

Data and information obtained from this study could provide additional insights into the changes in nutrient loads, the sources of those loads, and the impact of current and future strategies for reducing nutrient loss.

Illinois Environmental Protection Agency Monitoring Programs

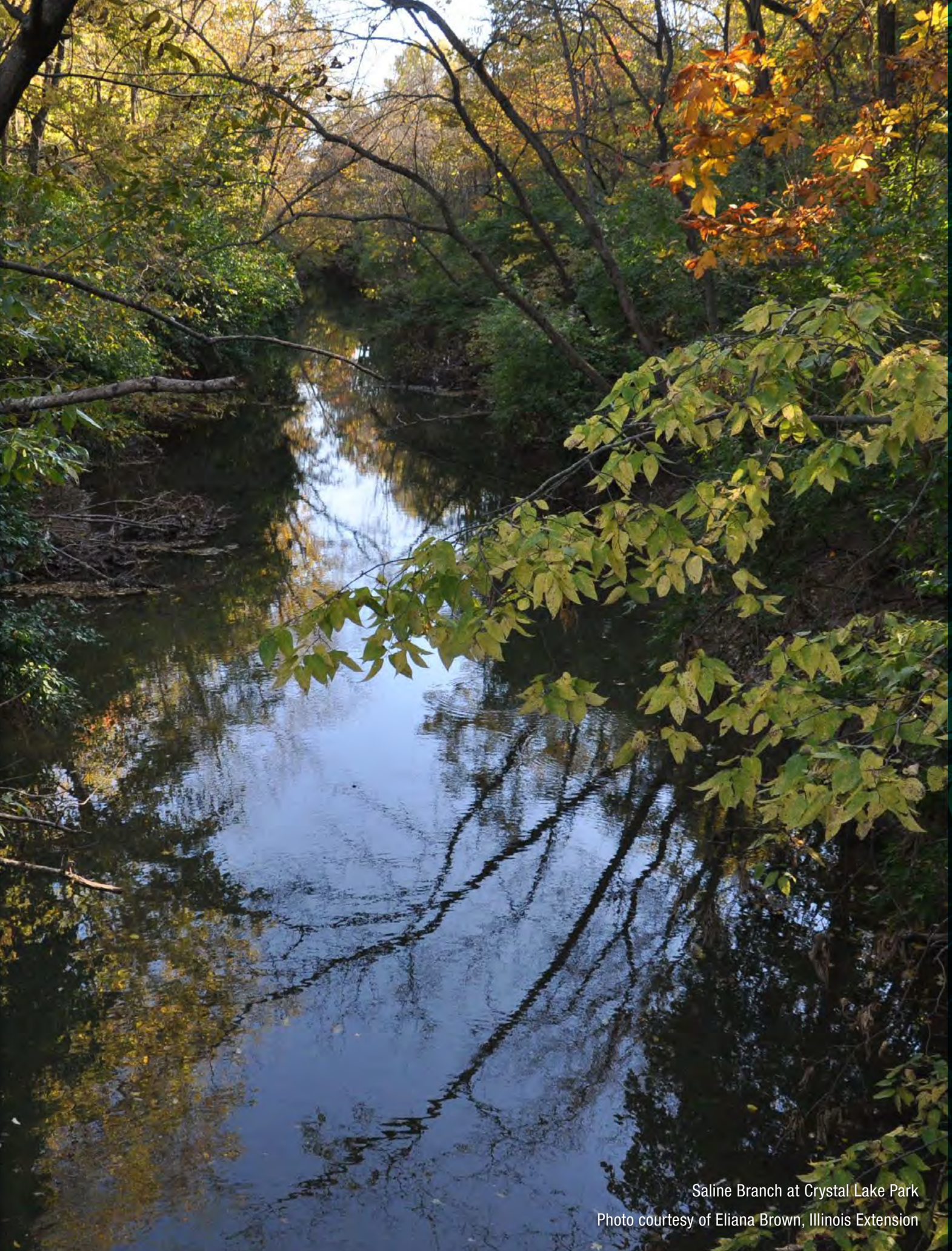
Illinois EPA, with contractual assistance provided by USGS and Illinois State Water Survey, continues to operate an Ambient Water Quality Monitoring Network, consisting of 146 fixed stations, to support surface water chemistry data needs. Integrated water column samples are collected every six weeks and analyzed for a minimum of 55 universal parameters, including nutrients. Data from this network continues to be used to calculate statewide nutrient loads. This monitoring program is crucial, not only to track nutrient load trends over time, but as the foundation for making individual waterbody assessments for the Illinois EPA Integrated Report and 303(d) List.

Illinois EPA's Harmful Algal Bloom Program consists of two primary components — routine monitoring and event response. The primary goal of the overall program is to protect public health and safety for drinking water and recreational uses. For the 2019-20 season, a total of 241 routine algal toxin samples (primarily microcystins) were collected at in-lake beaches, ambient river sites, and in Lake Michigan harbors and near-shores locations. Illinois EPA responded to 138 blooms during that same time period. In addition, a total of 87 routine algal toxin samples (microcystins and cylindrospermopsin) were collected in lakes near a public water supply intake and 94 raw water samples and 49 finished water samples (microcystins and cylindrospermopsin) were also collected.

Allocating resources to continue this program is recommended.

Illinois Nutrient Loss Reduction Strategy Meetings and Reporting

Illinois EPA continues to provide financial support to University of Illinois Extension to facilitate PWG and subgroup meetings, as well as development of the biennial reports. The structure of the PWG, as well as subgroups and committees, provides the collaborative foundation for Illinois NLRS implementation. This work is dependent on ongoing investment in these activities. Likewise, the development of the biennial report is an important process for recognizing implementation successes, providing updates, and noting new challenges and opportunities. Long-term resources that support these activities are necessary to ensure continued implementation of the strategy and water quality improvement in Illinois.



Saline Branch at Crystal Lake Park
Photo courtesy of Eliana Brown, Illinois Extension

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Biennial Report
2021