Indiana's State Nutrient Reduction Strategy

A framework to reduce nutrients entering Indiana's waters

Version 5 – November 2018

Prepared by:

Indiana State Department of Agriculture

Indiana Department of Environmental Management

With contributions from the Indiana Conservation Partnership:

Indiana State Soil Conservation Board (SSCB)
USDA Natural Resources Conservation Service (NRCS)
USDA Farm Service Agency (FSA)
Indiana Association of Soil and Water Conservation Districts (IASWCD)
Indiana Department of Natural Resources (IDNR)
Purdue Cooperative Extension

And also by members of the:

Indiana State Nutrient Reduction Strategy Workgroup
Indiana Agriculture Nutrient Alliance

* This state nutrient reduction strategy is a dynamic document and will be reflected upon/reviewed as necessary. A progress report will be provided every two years.

Executive Summary

Eutrophication, or nutrient enrichment of waters, is a concern in many areas of the United States as well as around the world. Nutrients are an essential part of the water system for plant and animal life, however when there is an excess of nutrients, it can cause water quality impairments. When excess nutrients like nitrogen and phosphorus, which can come from many sources including waste water treatment plants (WWTPs), agricultural runoff, urban stormwater runoff, failed septic systems, etc., enter our waterbodies, it stimulates excessive plant or algal growth, often called an algal bloom, which can lead to low oxygen levels in the water as the algae die, sink, and decompose. These areas of very low oxygen cannot support aquatic life and are often called "dead zones", also referred to as hypoxia.

The Gulf of Mexico has been for many years experiencing a large hypoxia zone, so the Mississippi River/Gulf of Mexico Hypoxia Task Force (HTF) in 2008 created a priority action plan that calls for each of the major states that drain in the Mississippi River basin to develop a state nutrient reduction strategy to address the issue of excess nitrogen and phosphorus entering their rivers, lakes, streams, aquifers, wetlands, and drinking water supplies. In 2011, the U.S. Environmental Protection Agency (USEPA) released a memo outlining eight (8) *Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution*, which gave guidance to the 12 states that are a part of the Gulf of Mexico HTF. Indiana is one of those 12 states.
The HTF goal is to reduce the areal extent of the Gulf of Mexico hypoxic zone to less than 5,000 square kilometers by the year 2035, with an agreed upon interim target of a 20% nitrogen and phosphorus load reduction by the year 2025 as a milestone toward reducing the hypoxic zone to less than 5,000 square kilometers by the year 2035.

The Indiana State Nutrient Reduction Strategy represents the state's commitment to reduce nutrient runoff into Indiana's waters from point sources and non-point sources alike. The overall guiding principles of this strategy are:

- **Encourage voluntary, incentive-based, practical, and cost-effective actions**
- **Use and strengthen existing programs**
- **Identify existing and additional funds needed and funding sources**
- **Identify opportunities for innovative, market-based solutions**
- **Follow adaptive management**

More specifically, the main objectives of this strategy include:

- Acknowledgment of the challenges facing the improvement of Indiana's impaired waters;

- Involvement and engaging of stakeholders and partners in the state's efforts to reduce nutrient loads;
- Prioritization of HUC 8 watersheds within Indiana, and further prioritization of smaller HUC 12 watersheds within Indiana's ten major river and lake basins;
- Discussion of the importance of water quality monitoring and regulatory control of point sources;
- The inventory and utilization of resources and practices to achieve their highest impact on nutrient reduction;
- Encouragement of voluntary incentive based conservation through the many local, state and federal water quality related programs;
- Measuring the impacts of urban and rural conservation best management practices and tracking nutrient load reductions; and
- Serve as a strategic document for addressing milestones and action items, and seeking continued funding sources for current and future efforts concerning water quality in Indiana.

The Indiana State Nutrient Reduction Strategy serves as a renewed effort to encourage outreach and education to conservation partnerships and the public regarding stewardship of Indiana's waters. This strategy acknowledges that while the potential to reduce nitrogen and phosphorus entering our waters is great, the achievement of these objectives is dependent upon the cooperation of state, federal and local organizations and initiatives, positively changing individuals' behavior via understanding their motivations, as well as many other complex factors, including the location and nature of conservation practices on productive agricultural ground and other rural best management practices (BMPs) such as filter strips, buffers, nutrient management and managed drainage. Septic system management, appropriate residential fertilizer applications, erosion control at construction sites, and urban BMPs such as green infrastructure will be key to controlling nutrient runoff. As such, there will always be a need for continued efforts in conservation, education, outreach and research in order to maintain progress.

Although the Indiana strategy was originally developed as a result of the HTF 2008 Action Plan for the Gulf of Mexico, this strategy encompasses all waters of the state of Indiana that drain to the Mississippi River and the Gulf of Mexico as well as to the Great Lakes, being Lake Michigan and Lake Erie.

Indiana will continue to evaluate the efficacy of the nutrient reduction policies, programs, and practices outlined in this Strategy. Based on that evaluation and new information/data arising from research and monitoring data, Indiana will modify this Strategy as necessary.

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Foreword

The Indiana State Nutrient Reduction Strategy (SNRS) is the product of an inclusive effort of the Indiana Conservation Partnership (ICP) and the SNRS Workgroup[1] under the leadership of the Indiana State Department of Agriculture (ISDA) and the Indiana Department of Environmental Management (IDEM) to capture statewide, present and future endeavors in Indiana which positively impact the State's waters as well as gauge the progress of conservation, water quality improvement and soil health practice adoption in Indiana. Using the principle of adaptive management, this State Nutrient Reduction Strategy is a dynamic document acknowledging that nitrogen and phosphorus in particular, and nutrient pollution in general, is a very complex problem caused by point and non-point sources across many sectors, which requires a multi-dimensional solution.

Since the release of the 2016 Version of Indiana's State Nutrient Reduction Strategy, the following changes and key refinements have been made.

1) The addition of a Foreword
2) Footnotes have been added throughout the document
3) Section 1 – Introduction
    a. Added a graph showing the Bottom-Water Area of Hypoxia from 1985-2018.
    b. Added the Gulf of Mexico Hypoxia Task Force's overall goal
    c. Is Progress Being Made? – explains that the Gulf of Mexico Hypoxia Task Force added a metric (the USGS WRTDS model) to report progress being made in the Mississippi River Basin, and showed graphs of total nitrogen and total phosphorus loads. Also shows trend analysis in Indiana using the same data and process.
    d. Expanded on the Great Lakes section to explain the Great Lakes Water Quality Agreement (GLWQA) and the development of Indiana's Western Lake Erie Basin (WLEB) Domestic Action Plan.
    e. Added the Guiding Principles that are the foundation and guidance for development of the statewide strategy.
4) Section 2 – Engage Stakeholders and Partners
    a. Added an explanation of the formation of the Indiana Agricultural Nutrient Alliance (IANA) from the nutrient management/soil health strategy workgroup. This is an example of a key refinement of adaptively managing our needs.
5) Section 3 – Watershed Prioritization and Characterization
    a. Added a statement that the SNRS Workgroup will over the next two years reexamine the priority watersheds for the state of Indiana.
    b. Moved Groundwater Vulnerability discussion to this section from Section 4 as a tool for determining priority watersheds.

[1] Members of SNRS Workgroup include the Indiana State Department of Agriculture-Division of Soil Conservation, Indiana Department of Environmental Management-Watershed Assessment and Planning Branch, Indiana Department of Enviromental Management-Drinking Water Branch, USDA-Natural Resources Conservation Service, Soil and Water Conservation Districts, Purdue University, The Nature Conservancy, Indiana Farm Bureau, Indiana Agriculture Nutrient Alliance, Indiana Soybean Alliance and Corn Marketing Council, and Agribusiness Council of Indiana.

6) Section 4 – Water Quality Monitoring in Indiana's Waters
    a. Added text about the Water Quality Standards from the Clean Water Act.
    b. Under the harmful algal bloom discussion, language was added about the testing program that began at Ft. Harrison State Park Dog Park, and added information on exposure thresholds for humans and dogs.
7) The title of Section 5 has been changed to "Nutrient Critera".
8) A new section has been added, Section 6, titled "Practices to Reduce Point Source (PS) and Non-Point Source (NPS) Pollution." It includes language on PS and NPS strategy objectives, as well as a discussion on nitrogen reduction and phosphorus reduction practices in agriculture.
9) Section 6 also includes the discussion on the development of a Science Assessment for Indiana (pg.49).
10) Section 7 – Programs and Projects Supporting Nutrient Reduction
    a. This section has been broken up into four smaller sections by:
        i. Point Source/Regulatory Programs
            1. A table has been added to show the progress being made by facilities within the drainage basins toward the 1mg/l reduction of total phosphorus loads.
        ii. Non-Point Source/Regulated Programs
            1. Added IDEM's Wellhead Protection Program
        iii. Non-Point Source/Non-Regulated (Voluntary) Programs
        iv. Agricultural Initiatives
            1. Added explanation of IANA.
11) Section 8 – Measuring Impacts
    a. Added ways of measuring impacts for urban and point source measures
    b. Under the Region 5 Nutrient Load Reduction model discussion, an explanation was added of how we are going to work toward strengthening our existing method of capturing nutrient load reductions.
    c. Added language on Adaptive Management
12) Section 9 – Milestones and Actions Items Table
    a. Added opening paragraph and a list of the key accomplishment and key progress made.
    b. Updates some of the goals and actions items and added some new goals.
13) A list of acronyms has been added in an appendix.

Section 1 – Introduction

National Nutrient Load Concerns and Priorities

Gulf of Mexico

Eutrophication, or nutrient enrichment of waters, is a concern in many areas of the United States as well as around the world. Nutrients are an essential part of the water system for plant and animal life, however when there is an excess of nutrients, it can cause water quality impairments. When excess nutrients like nitrogen and phosphorus, which can come from waste water treatment plants (WWTPs), agricultural runoff, urban stormwater runoff, failed septic systems, etc., enter our waterbodies, it stimulates excessive plant or algal growth, often called an algal bloom, which can lead to low oxygen levels in the water as the algae die, sink, and decompose. These areas of very low oxygen cannot support aquatic life and are often called "dead zones", also referred to as hypoxia.

The dead zone or Hypoxia Zone in the Gulf of Mexico is among the most pressing, where nutrient loads from the Mississippi/Atchafalaya River Basin (Figure 1) are contributing to eutrophication and harmful algal blooms. Since 1985, the National Oceanic and Atmospheric Administration (NOAA) and the Louisiana Universities Marine Consortium (LUMCON) have conducted an annual research cruise to measure the area of hypoxia in the Gulf of Mexico. In 2017, the dead zone covered an area approximately 22,720 square kilometers (8,776 square miles), about the size of New Jersery, and was the largest measured since dead zone mapping began (Figure 2). In 2018, the dead zone size was reduced and covered an area approximately 7,040 square kilometers (2,720 square miles), about the size of the state of Delaware. (Figure 3) http://water.epa.gov/type/watersheds/named/msbasin/zone.cfm.

Figure 1 – Mississippi/Atchafalaya River Basin
Image source: http://water.epa.gov/type/watersheds/named/msbasin/marb.cfm

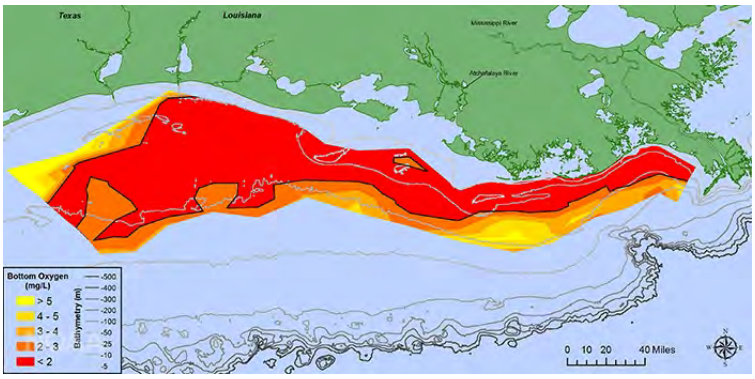


Figure 2 – 2017 Hypoxia Zone in the Gulf of Mexico
Image source: http://water.epa.gov/type/watersheds/named/msbasin/zone.cfm

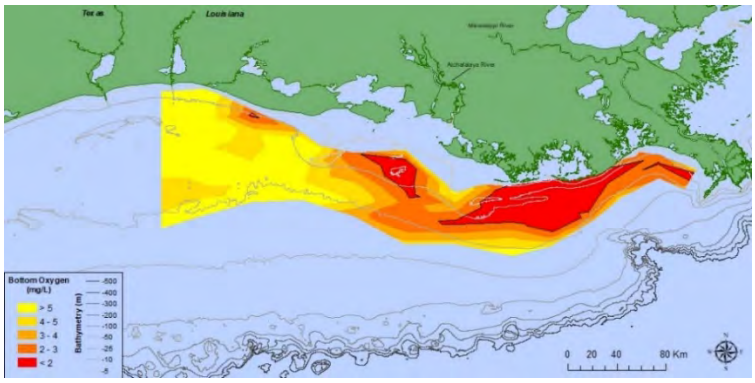
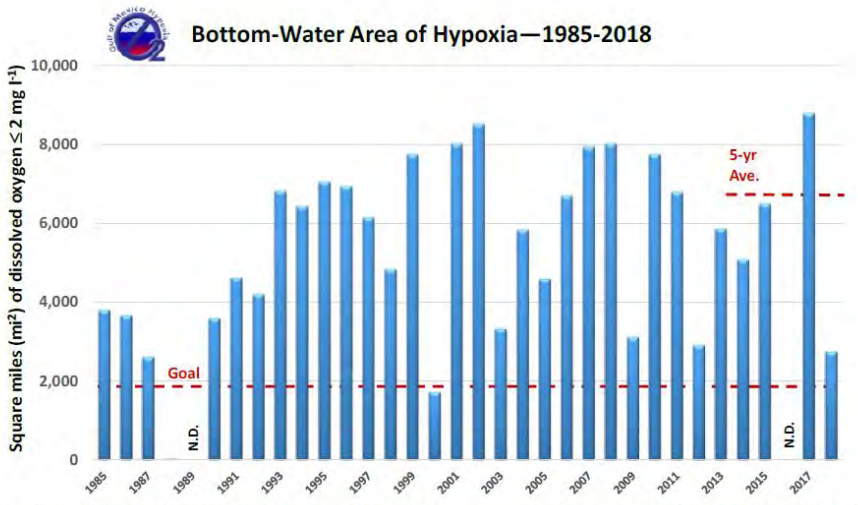


Figure 3 – 2018 Hypoxia Zone in the Gulf of Mexico
Image Source: https://gulfhypoxia.net/research/shelfwide-cruise/?y=2018



Historic size of hypoxia from 1985 to 2018. There are no data (n.d.) for 1989 and 2016. The value for 1988 is 15 square miles and barely visible on the scale.

Figure 4 – https://gulfhypoxia.net/research/shelfwide-cruise/?y=2018&p=press_release
Note: this gragh shows the bottom-water area of hypoxia through 2018 in square miles and not in square kilometers. A square mile is equal to 2.59 square kilometers.

As a result of this issue in the Gulf of Mexico, the Mississippi River/Gulf of Mexico Hypoxia Task Force (HTF) in 2008 created a priority action plan that calls for each of the major states that drain in the basin to develop a state nutrient reduction strategy to address the issue of excess nitrogen and phosphorus entering their rivers, lakes, streams, aquifers, wetlands, and drinking water supplies. In 2011, the U.S. Environmental Protection Agency (USEPA) released a memo outlining eight (8) *Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution*, which gave guidance to the 12 states[2] that are a part of the Gulf of Mexico HTF. Indiana is one of those 12 states.
The HTF goal is to reduce the areal extent of the Gulf of Mexico hypoxic zone to less than 5,000 square kilometers by the year 2035, with an agreed upon interim target of a 20% nitrogen and phosphorus load reduction by the year 2025 as a milestone toward reducing the hypoxic zone to less than 5,000 square kilometers by the year 2035.

Is Progress Being Made (Basinwide)?

The current method that the HTF uses to track progress toward the HTF goal is the 5-year moving average size of the Gulf hypoxic zone, which is influenced by many factors including stream flow and can cause variability in the overall results because of low flow and high flow years. As a result, the HTF agreed in January of 2018 to adopt the United States Geological Survey's (USGS) Weighted Regressions on Time, Discharge, and Season (WRTDS) Model as an additional reporting metric to assess progress being made in the Mississippi River Basin.

This model and method "normalizes" loads to average flow conditions, providing a trend analysis of flow-normalized loads. It more clearly evaluates changes in nutrient load that are caused by factors other than changes in streamflow, such as land-use, management changes, and hydromodification.
The WRTDS method analyzes water quality data from USGS water quality sampling stations and US Army Corp of Engineers streamflow gages in the lower Mississippi River watershed to assess a trend for the basin. Figure 5 on the next page shows the total nitrogen loading to the Gulf of Mexico using the WRTDS model through 2017, and Figure 6 shows the total phosphorus loading to the Gulf. Both of these graphs show the two metrics used by the HTF to assess progress toward the reduction goals – the flow-normalized trend in load and a 5-yr moving average in loads.[3]

Tracking changes in nutrient loads is complex due to many different factors, therefore is it important that more than one method be used to track progress, especially when looking at such a large watershed as the Mississippi River Basin.

[2] Arkansas, Missouri, Iowa, Tennessee, Minnesota, Indiana, Ohio, Louisiana, Illinois, Mississippi, Kentucky, Wisconsin
[3] https://nrtwq.usgs.gov/mississippi_loads/#/GULF

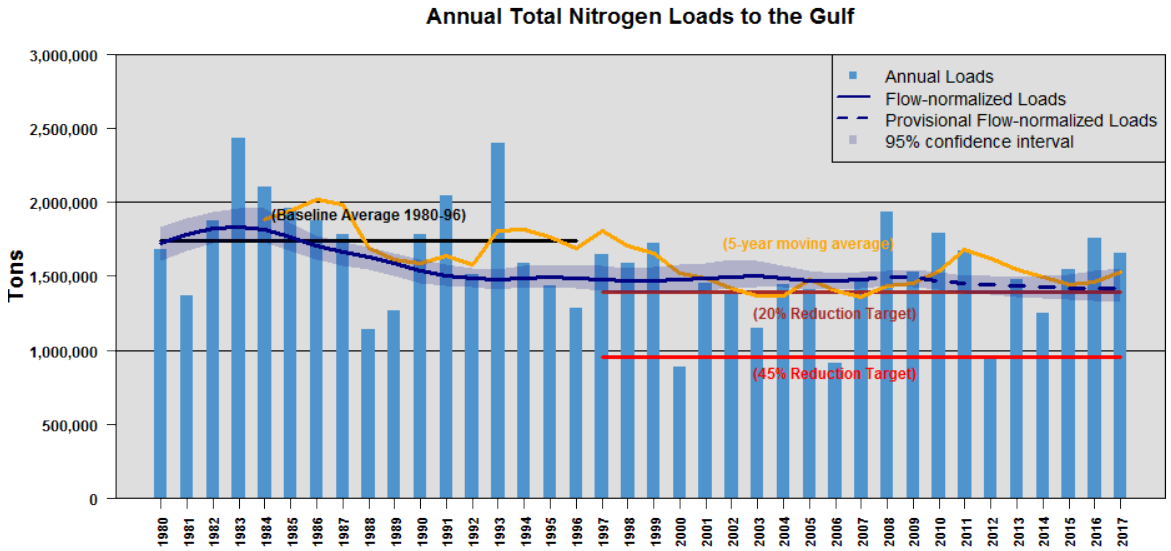


Figure 5 – Annual Total Nitrogen Loads to the Gulf of Mexico from 1980-2017 showing two metrics to assess progress adopted by HTF. https://nrtwq.usgs.gov/mississippi_loads/#/GULF

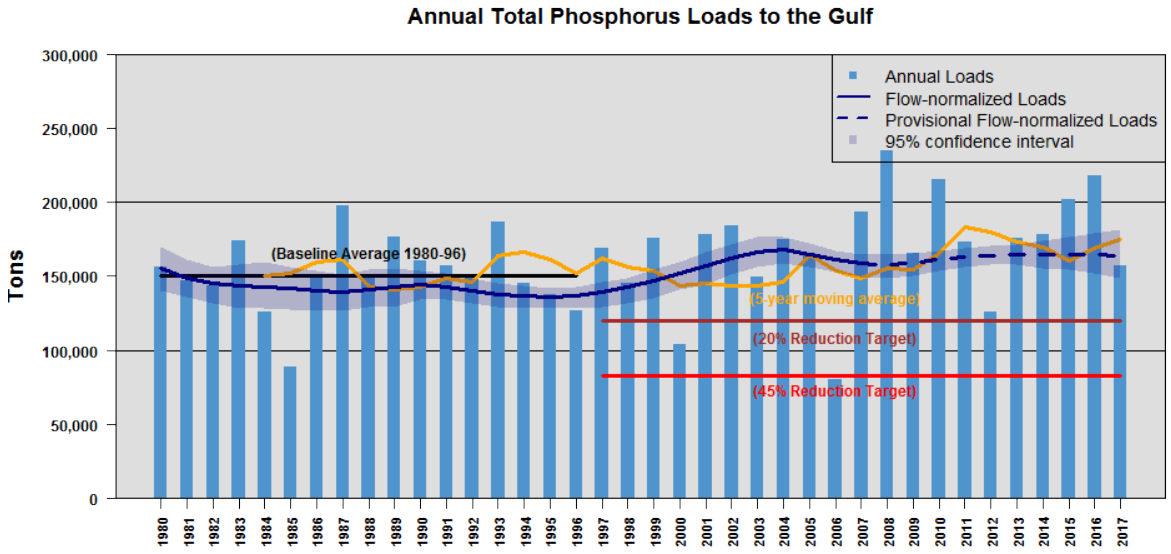


Figure 6 – Annual Total Phosphorus Loads to the Gulf of Mexico from 1980-2017 showing two metrics to assess progress adopted by the HTF. https://nrtwq.usgs.gov/mississippi_loads/#/GULF

What about in Indiana?

Using the same method of "normalizing" loads, WRTDS can provide a trend analysis of flow-normalized loads in Indiana. Water quality data from the USGS water quality sampling station on the Wabash River at New Harmony, IN (Figure 7) was analyzed to assess a trend for Indiana and whether progress is being made in Indiana. The New Harmony USGS location on the Wabash River is the last station on the Wabash River before it flows into the Ohio River, collecting data from the Wabash River watershed as well as the White River Watershed. Figure 8 on the next page shows the total nitrogen loading to the Wabash River from 2002-2012 using the WRTDS model, and Figure 9 shows the total phosphorus loading in the Wabash River from 2002-2012. Based on this data, USGS has identified the watersheds in Indiana as significant contributors of nutrients to the Gulf of Mexico.[4] Note: Data for 2013-2017 from USGS sampling stations will become available in July of 2019.

Figure 7 – Location of the USGS Water Quality Sampling Station on the Wabash River at New Harmony, IN is shown by the red dot on the map. Station is number 03378500. (map made by Trevor Laureys, ISDA)

[4] Information on nutrients and sediment loads from Indiana watersheds can be found in "Loads of nitrate, phosphorus, and total suspended solids from Indiana watersheds", by Aubrey Brunch, USGS. https://pubs.er.usgs.gov/publication/70192934.

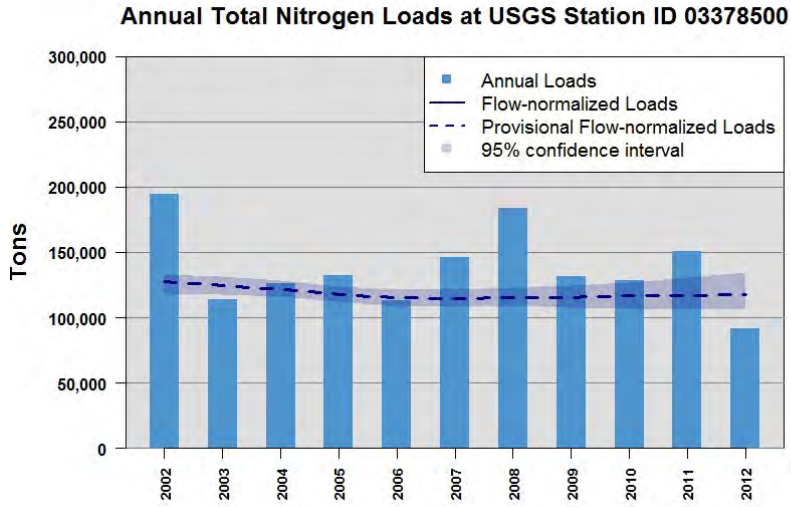


Figure 8 – Annual Total Nitrogen Loads at the New Harmony, IN USGS Station from 2002 – 2012.

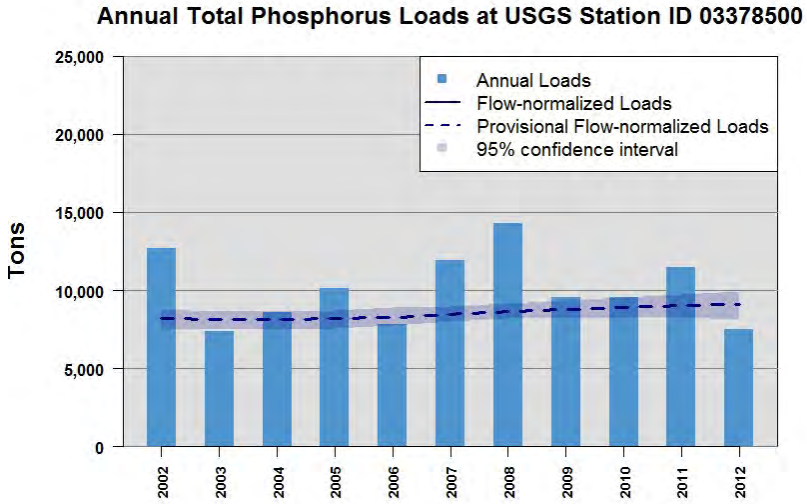


Figure 9 – Annual Total Phosphorus Loads at the New Harmony, IN USGS Station from 2002 – 2012.

While these graphs show a relatively static trend line over the decade between 2002 and 2012, it is important to understand that there is a delay or time-lag, which can be decades, between installation or adoption of conservation practices and positive, statiscally significant changes in water quality.[5] According to Meals and Dressing, 2008, land treatment-water quality monitoring projects – even those designed to be "long-term" – may not show definitive results if the lag time exceeds the monitoring period. This is especially true over a large watershed area. Reductions

[5] Donald W. Meals and Steven A. Dressing. 2008. Lag time in water quality response to land treatment. Tech Notes 4, September 2008. Developed for U.S. Environmental Protection Agency by Tetra Tech, Inc., Fairfax, VA, 16 p. Available online at https://www.epa.gov/sites/production/files/2016-05/documents/tech_notes_4_dec2013_lag.pdf

in pollutant loads to streams, rivers and lakes may be seen sooner on a smaller watershed scale, and through agricultural edge-of-field practices and at point source outfalls.
Also, according to Van Meter and Basu, 2017, "Despite the widespread implementation of conservation measures, nitrogen concentrations in rivers and streams are often remaining steady or continuing to increase. Although many attribute this lack of response to stores of legacy nitrogen in soil and groundwater, it remains unclear how much nitrogen is being stored beneath the surface."[6] VanMeter's and Basu's research shows that nitrogen dynamics in the Mississippi River Basin are dominated by legacy nitrogen in the soil, which can result in the time-lag of the effects of conservation practices, that even if agricultural N use became 100% efficient, it would take decades to meet target N loads. Their results also suggest that both long-term commitment and large-scale changes in agricultural management practices will be necessary to decrease Mississippi N loads to meet current goals for reducing the size of the Gulf hypoxic zone.[7] Their research basically says that nitrogen can be in the system for over 80 years. The next step in their research is to look at the legacy of phosphorus.

Nutrient Load Concerns on Indiana's Waters

Indiana's surface and ground waters are adversely affected by excessive nutrient loads from point sources and nonpoint sources to our rivers, streams, lakes and aquifers. This is evident in increasing occurrences of cyanobacteria (also known as blue-green algae) blooms in Hoosier lakes and reservoirs, which can result in the release of toxins. This is having a negative economic impact by increasing the cost of treating public water supplies as well as reducing the recreational use of lakes for swimming. A number of Indiana's drinking water facilities that use surface water find it necessary to add activated carbon to control taste and odor compounds attributed to algae blooms. Several public water systems apply herbicides to their source waters as a means to control algal blooms. In 2018, the Indiana Department of Natural Resources (IDNR) issued 39 recreational alerts at its public beaches and recreational areas due to algae blooms. These recreational alerts are issued when the cyanobacteria count exceeds 100,000 cells.
In addition, nitrate is one of the most common ground water contaminants found in the State. It represents a threat to drinking water primarily because excess levels can cause methemoglobinemia, or "blue baby" syndrome. Although nitrate levels that affect infants do not pose a direct threat to older children and adults, they do indicate a need for nutrient control.

We must address the health of our water resources in a comprehensive way. Recognizing that what we do on the landscape with urban, rural and agricultural activities and drainage is reflected in our waterways. While regulatory approaches to controlling point sources of nutrients are in place, they remain under continued assessment and improvement, including refining expectations and operations in wastewater treatment facilities and other municipal systems, such as storm water management and the use of green infrastructure for water infiltration and uptake by plants and trees.

[6] "Two centuries of nitrogen dynamics: Legacy sources and sinks in the Mississippi and Susquehanna River Basins", K. J. Van Meter, N. B. Basu, P. Van Cappellen.
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016GB005498
[7] http://science.sciencemag.org/content/early/2018/03/21/science.aar4462

There is also an increased interest in promoting non-regulatory approaches for nonpoint sources such as increased technical and financial assistance for coordinated, effective best management practices (BMPs)[8] on agricultural and urban lands. This includes managing agricultural lands to reduce nutrient loads lost to runoff, optimizing nutrients inputs through enhanced management of the timing, rate, form and placement of fertilizers for crop production, managing soil health and water-holding capacity through a system of practices including never-till and cover crops as well as utilizing buffers, filters and other best management practices along waterways in both urban and rural areas.

Indiana Drainage Overview

The State of Indiana has a surface area of approximately 36,532 square miles. There are about 63,000 miles of rivers, streams, ditches and drainage ways in Indiana. In addition, there are approximately 35,673 miles of surface waterways in Indiana greater than one mile in length.

Indiana is made up of three major drainage basins known as 4-digit HUC[9] watersheds (Figure 10). The blue shaded area on the map shows that the majority of the state drains to the Mississippi River Basin, either to Illinois through the Kankakee River System, into the Ohio River along the southern border of Indiana, or through the Wabash River System.

The main rivers that drain Indiana in the Mississippi River Basin are the Wabash River, the Tippecanoe River, the White River, the Kankakee River, the Whitewater, and several smaller tributaries that drain to the Ohio River. This system drains two-thirds of Indiana's 92 counties and consists of primarily agricultural land with many small towns and some cities located along the rivers.

Figure 10 – Indiana's major drainage basins

The yellow and green shaded areas in Northeast and Northwest Indiana drain to two of the Great Lakes; Lake Michigan and Lake Erie.

[8] Best Mangement Practice (BMP) means a practice, or combination of practices, that is determined to be an effective and practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. http://www.ncforestservice.gov/water_quality/what_are_bmps.htm

[9] Hydrologic unit codes (HUC) are a way of identifying all of the drainage basins in the United States in a nested arrangement from largest (Regions) to smallest (Cataloging Units). The term watershed is often used in place of drainage basin. The smaller the HUC number, the larger the drainage area. For example a HUC 8 watershed is larger than a HUC 12.

The green shaded area in northeast Indiana is known as the Western Lake Erie Basin (WLEB) and covers all or part of 6 counties, covering approximately 812,500 acres. The main rivers that drain the WLEB area are the St. Joseph River, the St. Marys River, and the Upper Maumee River. The St. Joseph River and the St. Marys River come together in Fort Wayne, IN to form the Maumee River that drains to and through Ohio and eventually empties into the western basin of Lake Erie at Toledo, Ohio.

The yellow shaded area along the northern border drains to Lake Michigan and covers all or part of 10 Indiana counties, encompassing approximately 1,416,113 acres. The northwest portion is drained through the Grand Calumet and Little Calumet Rivers, Trail Creek, and Salt Creek and is made up of mostly urban areas. The northeast portion drains to Lake Michigan through the St. Joseph River System (different then the St. Joseph River in the WLEB area), the Elkhart River, the Little Elkhart River, Pigeon River and Pigeon Creek. It consists of primarily agricultural land with small towns and cities located in the watershed.

The Great Lakes

The Great Lakes are also experiencing water quality issues due to excessive amounts of nutrients. The 2012 Great Lakes Water Quality Agreement (GLWQA) amendment established the Nutrients Annex 4 binational subcommittee, which is charged with coordinating binational actions to manage phosphorous loadings and concentrations in the Great Lakes and to commence its work with Lake Erie, which is experiencing excessive phosphorus loading that threatens water quality and ecosystem health by contributing to harmful and nuisance algal blooms. A portion of Indiana drains into Lake Erie and Indiana has been an active member of this subcommittee since its establishment in 2013.

In accordance with the Annex 4 GLWQA Lake Ecosystem Objective to "maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health," Indiana's GLWQA Domestic Action Plan (DAP) to reduce phosphorous to the Western Lake Erie Basin (WLEB) was released Februray 28, 2018. To achieve the above-referenced Lake Ecosystem Objective, a 40 percent reduction in spring-time total phosphorus and soluble reactive phosphorus is needed for the Maumee River. This translates to a flow weighted mean concentration of 0.23 mg/L total phosphorus and 0.05 mg/L soluble reactive phosphorus respectively. Progress toward these target values is being measured on the Maumee River at Antwerp, Ohio, which is 7.6 river miles downstream of the Indiana border and best represents Indiana's phosphorus loading.

The Indiana WLEB DAP is the product of a dedicated Advisory Committee comprised of representatives from different stakeholder sectors and led by the Indiana Department of Environmental Management (IDEM). The Indiana DAP is informed by the intensive planning, research, and steadfast work that is already underway in the WLEB by individuals, non-

governmental organizations, universities, professional associations, for-profit industries, and governmental entities at the town/municipal, county, state, and federal levels. It is in keeping with the principles and approaches within the Indiana State Nutrient Reduction Strategy. It emphasizes using existing programs and optimizing partnerships, effecting the most change with the least cost, prioritizing resources to areas with the most phosphorus export and/or reduction potential, seeking to engage citizens who are not participating in conservation efforts, making use of social indicators to guide actions, and employing adaptive management.

Indiana's DAP for the Western Lake Erie Basin is found at: https://www.in.gov/isda/3432.htm.

Indiana also drains into Lake Michigan for which a plan will be developed in accordance with the GLWQA in the coming years.

The development of Indiana's State Nutrient Reduction Strategy is benefitting our state's local waters resources, which in turn will benefit the Gulf of Mexico and the Great Lakes into which Indiana's waterways drain.

Guiding Principles

The Indiana State Nutrient Reduction Strategy represents the state's commitment to reduce nutrient runoff into Indiana's waters from point sources and non-point sources alike. These five guiding principles are the foundation of this Strategy:

- **Encourage voluntary, incentive-based, practical, and cost-effective actions**
- **Use and strengthen existing programs**
- **Identify existing and additional funds needed and funding sources**
- **Identify opportunities for innovative, market-based solutions**
- **Follow adaptive management**

Specific actions tied to these principles are enumerated in Section 9, the Milestones and Action Table, which will be used to help track progress. As practices, technologies, management systems etc. evolve, those will be added to the Milestone/Action Table. Likewise, if new data and information show that changes are required, adaptations will be made.

Section 2 – Engage Stakeholders and Partners

The State of Indiana recognizes that early involvement of stakeholders provides transparency of the process, allows time for trust to develop, permits incorporating local knowledge, and makes it possible to deal most effectively with misperceptions and manage expectations. All of this helps gain buy-in and cooperation from stakeholders and increases the likelihood of moving toward sustainable solutions. Many agencies and stakeholders were consulted with in the planning and development of the Indiana State Nutrient Reduction Strategy.

Indiana Conservation Partnership (ICP) - One of the most important tasks in this effort is that of engaging and utilizing the Indiana Conservation Partnership. As both a leadership body and as stakeholders in Indiana's water quality, the ICP actively works to address environmental issues across Indiana at local, state and federal levels. Indiana is a national leader in fostering cooperative, progressive and productive state-wide partnerships and has served as a model for other states. The ICP embodies that reputation. http://icp.iaswcd.org/

The ICP is comprised of eight entities, including the:

- State Soil Conservation Board (SSCB)
- USDA Farm Service Agency (FSA)
- USDA Natural Resources Conservation Service (NRCS)
- Indiana Association of Soil and Water Conservation Districts (IASWCD)
- Indiana State Department of Agriculture's Division of Soil Conservation (ISDA-DSC)
- Indiana Department of Natural Resources (IDNR)
- Indiana Department of Environmental Management (IDEM)
- Purdue Cooperative Extension Service (CES)

The mission of the ICP is to provide technical, financial and educational assistance needed to implement economically and environmentally compatible land and water stewardship decisions, practices and technologies. The ICP provides a roadmap for addressing Indiana's conservation issues, and in so doing, functions collectively to touch many other organizations and individuals.

State Soil Conservation Board (SSCB) - The Indiana State Soil Conservation Board is another key group of stakeholders in Indiana's water quality and is a member of the ICP. The SSCB appoints Supervisors as recommended by County Soil and Water Conservation Districts (SWCDs) and sets policy governing programs of the ISDA Division of Soil Conservation (DSC) and the activities of SWCDs. Through ISDA and the policies set by the SSCB, this board serves SWCDs by providing state appropriated funding for SWCD operations, providing technical assistance through ISDA DSC employees, and builds district capacity by facilitating information exchange between the SWCDs through SWCD Annual Conference, publications, workshops, and the efforts of the DSC Resource Specialists.

The SSCB also serves as a body for advice and consultation for ISDA and the SWCDs as well as assists in securing federal and state agency help for district programs. Lastly the board administers Clean Water Indiana, a water quality-related erosion and sediment reduction program.

There are geographical areas within all watersheds of Indiana that have critical natural resource concerns related to soil and water conservation. The SSCB works with the ISDA-DSC, SWCDs and all partners to address these concerns and support Federal initiatives. In a strategic effort to address the top resource concerns identified by the ICP, the SSCB developed goals and strategies within its business plan. These goals and strategies are consistent with the Board's general authority and duties outlined in the District Law as well as its specific authority to provide direction to the ISDA-Division of Soil Conservation on the administration of the Clean Water Indiana (CWI) Program. Several of these goals are outlined in the list of action items under Section 8. http://www.in.gov/isda/2361.htm

Soil and Water Conservation Districts (SWCDs) – Indiana's 92 County Soil and Water Conservation Districts are the grassroots partners in Indiana's effort to improve its waters. Districts not only bring a local environmental perspective to land users and economic developers, but act as local hubs for any and all citizens whom they serve to find information regarding conservation issues and programs available to them. SWCDs most often share residence with local FSA and NRCS offices as well as DSC employees, or are located in close proximity. This not only allows for cooperation and shared resources, but ensures that farmers, landowners and developers can access conservation programs and technical support at local, state and federal levels when they respond to outreach from SWCDs or they themselves reach out to any of these partners.

Partners of the Indiana Conservation Partnership and the State Soil Conservation Board all work closely with SWCDs to ensure that information, technical assistance, funding and programs are made available to landowners and the public in Indiana's 92 counties.
http://www.in.gov/isda/2368.htm

Agricultural Commodity Groups and Interests Groups – Indiana Corn, Soybean, Pork, Beef, Dairy and Poultry commodity groups, as well as the Indiana Farm Bureau (INFB), the Agribusiness Council of Indiana (ACI), Purdue University Extension, and The Nature Conservancy (TNC) have been actively engaged in identifying and approaching the challenges of nutrient loading and soil health, subsequently improving water quality.
These groups with the addition of members from the ICP, worked to develop what was referred to as the nutrient management and soil health strategy. As a result of this effort, a new initiative and group was created called the Indiana Agricultural Nutrient Alliance (IANA)
In an agricultural state rich with steward-farmers, this partnership is invaluable in addressing water quality and soil health related issues. The Indiana Agriculture Nutrient Alliance will be discussed in more detail later in this strategy as an agricultural initiative under section 7.

Municipalities – Primarily those with municipal separate storm sewer systems (MS4S) and major wastewater treatment plants (WWTP) (greater than 1 million gallons design flow per-MGD) were engaged regarding monitoring ambient water quality and/or regarding the non-rule policy document (NPD) setting effluent limits of 1mg/L total phosphorus (TP). In advance of implementing the 1mg/L TP effluent limit for major WWTP dischargers, the affected WWTPs

were e-mailed and phoned prior to the public notice for a 45-day comment period (to which IDEM received no comments). The NPD was presented to the Environmental Rules Board on 11/14/14 and became effective on 12/12/14.

Section 3 – Watershed Prioritization and Characterization

Prioritize 8-digit Hydrologic Unit Code (HUC) Watersheds

Prioritizing watersheds is an important step in the development of a nutrient reduction strategy in order to optimize limited resources in achieving the greatest impact toward sediment and nutrient reduction loads. As a result, in 2011 ISDA and IDEM determined, along with assistance and feedback from the ICP, specific watersheds where it is believed that most of the nutrients are coming from, which was determined by using a number of different resources. It was agreed on by ISDA, IDEM and members of the ICP that prioritization would begin at the 8-digit HUC level with subsequent prioritization at the 12-digit BMP implementation scale.

The resources used to assist in determining the priority HUC 8 watersheds included the USGS SPARROW model (http://water.usgs.gov/nawqa/sparrow/), which is a modeling tool for the regional interpretation of water-quality monitoring data and is used to approximate nutrient loads from major watersheds. There are limitations with the SPARROW model and it should only be used on a regional scale, so the State of Indiana decided to utilize SPARROW only as a screening level tool and general guidance to improve local impacts. Other resources used in the prioritizing of the HUC 8 watersheds included data analyzed by NRCS to prioritize watersheds for the Mississippi River Basin Initiative (MRBI), IDEM's 303d listings, IDEM 319 approved Watershed Management Plans (WMPs), IDNR Lake and River Enhancement Watershed Diagnostic studies, and focus on the Conservation Reserve Enhancement Program (CREP). Also in 2011, NRCS developed a geospatial tool known as the State Resource Assessment (SRA) that complements the prioritization of HUC 8 watersheds in Indiana.

Seven HUC 8 watersheds within the Wabash River System, situated along the Wabash and White Rivers, and the Maumee River watershed in northeast Indiana currently serve as Indiana's eight prioritized watersheds. (Figure 11) These watersheds are:

- Upper Wabash
- Middle Wabash-Deer
- Middle Wabash-Little Vermillion
- Middle Wabash-Busseron
- Lower Wabash
- Upper White
- Lower White
- Maumee

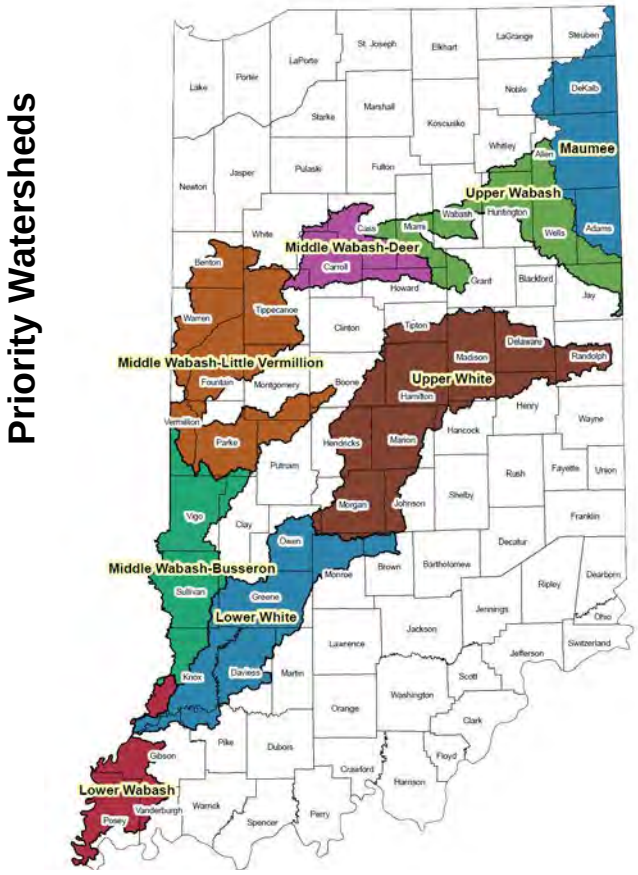


Figure 11 – Indiana's priority HUC 8 watersheds

The ICP determined that, on a practical scale, these watersheds are characterized not only as logistically and environmentally sound targets for prioritization, but are also the most economically viable due to the existing programs and robust infrastructure which exists in these HUC 8 watersheds.

Critical areas defined in approved 9-element WMPs are shared with the ICP and the watershed specialists work with local watershed groups to implement BMPs in these areas in order to reduce nutrient loads. A collective and cooperative effort between local, state and federal agencies to increase enrollment in existing conservation and water quality programs, which are discussed later, in the eight priority watersheds is a primary focus set forth by this strategy.

Within the next two years, the SNRS Workgroup will reexamine the HUC 8 priority watersheds for the state of Indiana. Watersheds with drinking water reservoirs and surface water intakes will be priorities (Figure 12), as well as the areas of aquifer sensitivity. The Indiana Geological Survey (IGS) has compiled data on aquifer sensitivity for the state of Indiana based on estimated ground water recharge rates in shallow aquifers (Figure 13). Using ArcGIS, it is possible to combine the eight HUC 8 priority watershed data from the strategy, and the aquifer sensitivity data from IGS to create a map of the aquifer sensitivity of the identified priority watersheds (Figure 14).

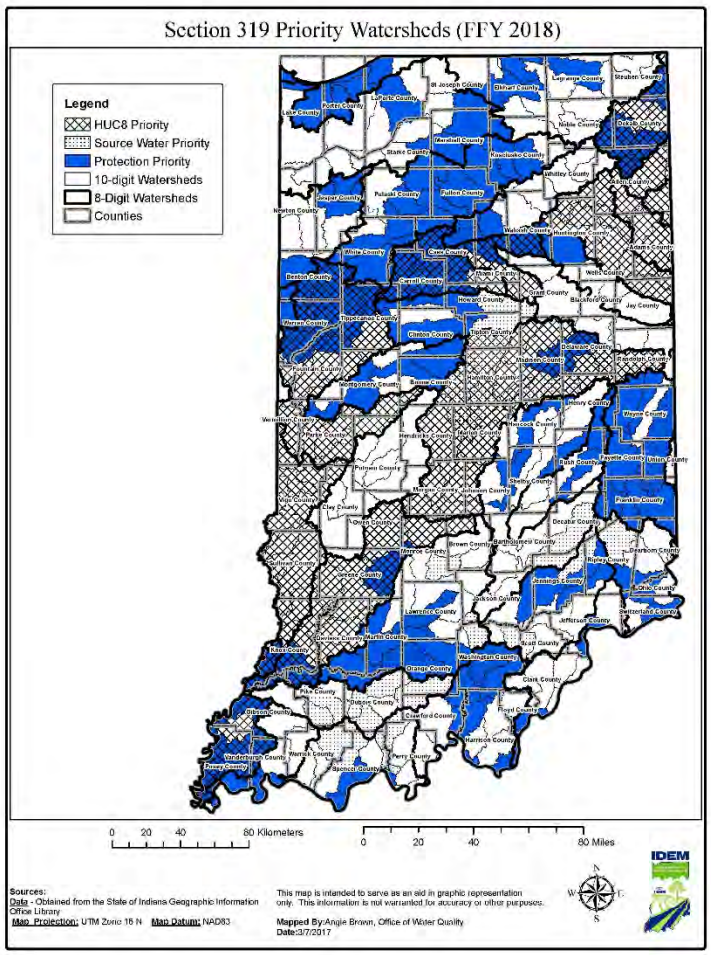


Figure 12 – Source water priority watersheds for drinking water and surface waters

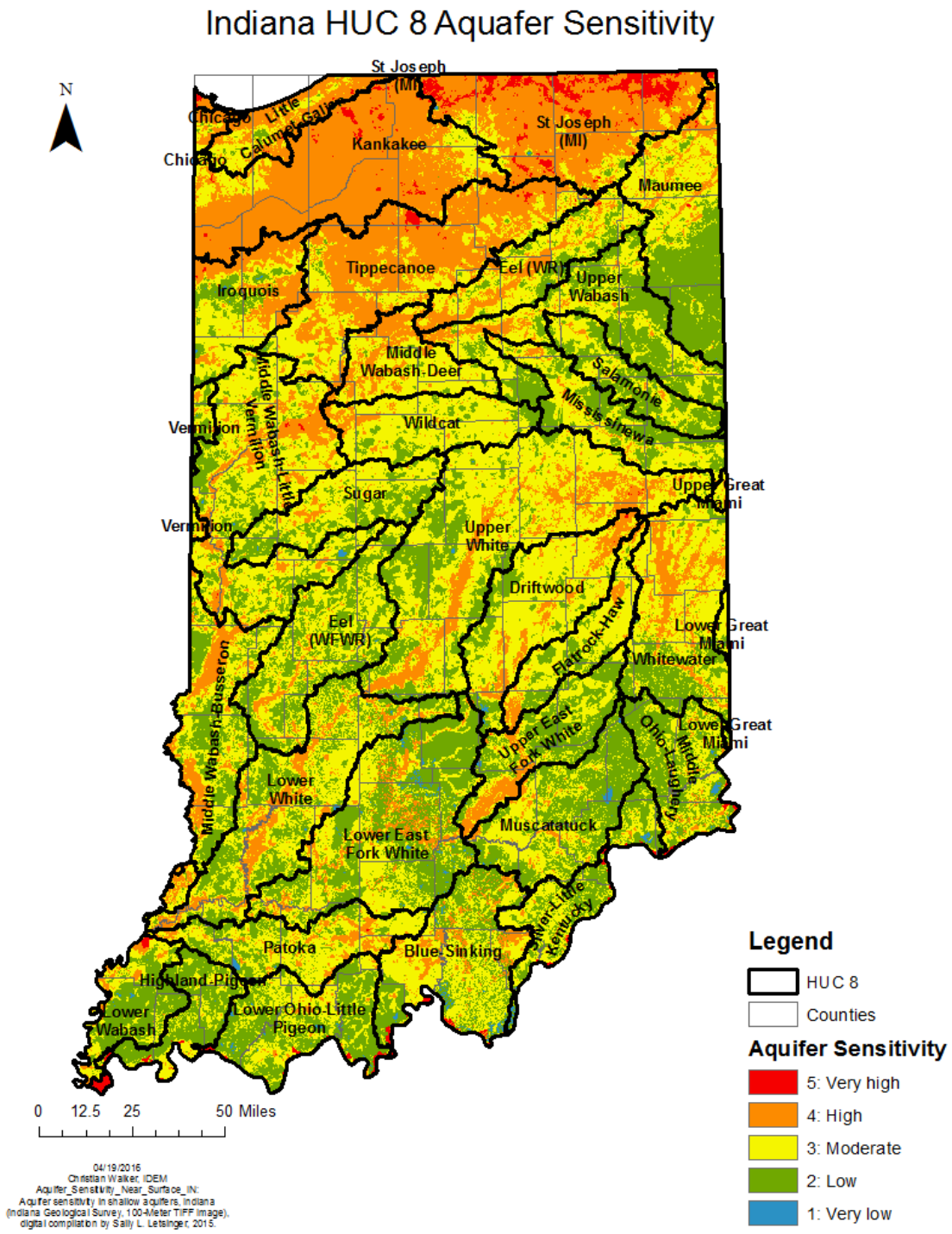


Figure 13 – Aquafer Sensitivity within the state of Indiana

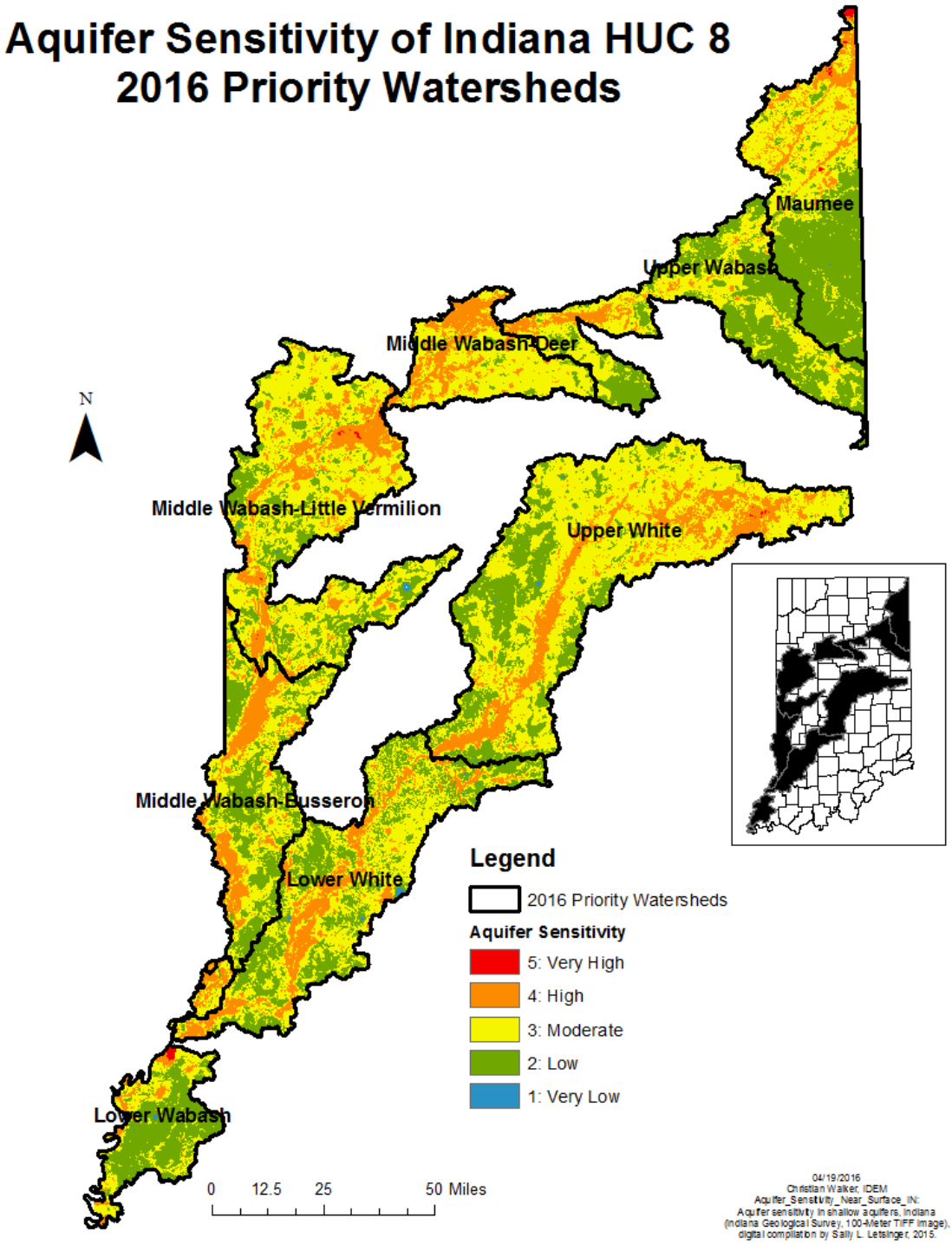


Figure 14 – Aquafer Sensitivity within the Indiana HUC 8 Priority Watersheds

Further Prioritization

Within the HUC 8 prioritized watersheds mentioned above, prioritizing at the 12-digit HUC watershed scale is important because ambient water quality changes occur more quickly at a smaller watershed scale in response to targeted land-based BMPs and reductions in point source discharges. A HUC12 prioritization process was piloted in the Indiana WLEB watershed, and that process will continue throughout the other major watershed basins in Indiana, which are shown on the map below in figure 15.[10] The Great Lakes Basin is furthered divided into the Lake Michigan and Lake Erie watersheds, essentially making 10 river and lake basins. Characterization includes an inventory of land use, analysis of fixed station and other water quality monitoring data, critical areas identified in approved 9-Element WMPs, current social and environmental indicators, as well as current implementation activities.

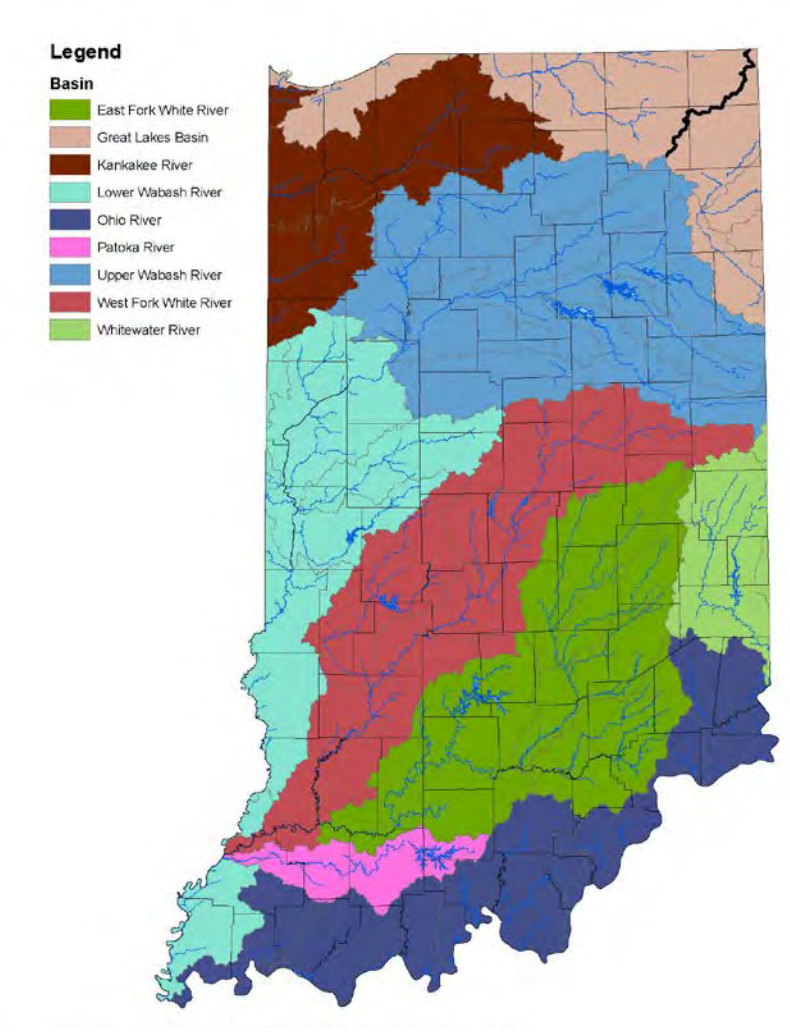


Figure 15 – Nine (Ten) Major River and Lake Basins in Indiana

[10] The major drainage basins are monitored probabilistically and assessed statistically by IDEM on a nine-year rotating basin schedule to determine if waters are meeting their designated uses and/or water quality standards.

Two HUC 12 watersheds are of particular focus as there is significant amounts of water quality data to serve as baselines to allow us to measure changes. Additionally, the first one forms the primary drinking water reservoir for the City of Indianapolis. These watersheds are:

1. Eagle Creek in central Indiana, which is impounded to form a 1,350 acre reservoir that serves Indianapolis, has a USGS continuous water-quality monitoring Super gage at Zionsville (USGS 033532000) that reports nitrate concentrations from an instream sensor. It continuously measures turbidity, which USGS plans to develop into a surrogate for continuously reporting suspended sediment as it has done for a similar gage on the White River at Hazleton. USGS also plans to develop a surrogate for total phosphorus at this gage. Eagle Creek at Zionsville was sampled as part of the USGS Midwestern Stream Quality Assessment (MSQA), an 11-state, 100 site, intensive water-quality and ecology survey in 2013, coordinated with USEPA's National River and Streams Assessment. The MSQA sampling at Eagle Creek included weekly samples analyzed for nearly 300 constituents, including nutrients and pesticides between the first week of May through the first week of August. This site was also sampled as part of a nutrient processing study that included streambed water samples, periphyton chlorophyll, and a second set of continuous monitoring sensors with added parameters. The MSQA study included an ecological survey of habitat, algae, fish, and invertebrates. Eagle Creek has had multiple years of small scale stream monitoring for nutrients by Indiana University-Purdue University Indianapolis (IUPUI), which may also be useful. Eagle Creek is typical of streams in the Tipton till plain physiographic region, with agricultural tile drainage predominant. Eagle Creek drains to the White River which drains to the Wabash River. The upstream drainage area at the Zionsville gage is 106 square miles. Of further interest is the School Branch watershed that is nested inside the Eagle Creek reservoir watershed where there is an ongoing Edge of Field study that is a collaboration of many different agencies, organizations and IUPUI-Center for Earth and Environmental Services (CEES).

School Branch Watershed in Indiana

A unique collaboration of federal, state, local, and academic entities along with dedicated conservation minded farmers is happening in the School Branch watershed near Indianapolis, Indiana. The project is assessing the chemical, physical, and biological impacts of conservation practices at the watershed, sub-watershed, and edge-of- field scales. Water quality is monitored in tile drains, overland flow, stream water, and ground water to assess if soil health management systems in row crop agriculture can decrease the transport of nutrients to streams.

The project builds upon the efforts of the United States Department of Agriculture (USDA) NRCS National Water Quality Initiative, and monitoring and evaluation efforts at different watershed scales from the USGS, IDEM, Marion County Public Health Department (MCPHD), USDA NRCS, IUPUI-CEES, the Indiana Geological and Water Survey (IGWS), and the Office of the Indiana State Chemist (OISC). As with all good collaborations each group brings a different skill or component to improve the overall study.

School Branch is a small (8.4 square miles) watershed located in northeastern Hendricks County, Indiana. Land use in the watershed is predominately corn and soybean agriculture with interspersed residential and populated areas. School Branch eventually drains into Eagle Creek Reservoir, a primary drinking water source for Indianapolis.

There are two USGS Supergages that continuously collect in-stream water quality parameters including nitrate and orthophosphate; automatic edge-of-field water quality sampling of cropland tile drains and overland flow; biology (macro-invertebrates, fish, and algae) monitoring; groundwater monitoring; and soil moisture monitoring (Figure 16). All of these efforts will document the water quality benefits of soil health management systems to other farmers and the public in similar landscapes across the Corn Belt of the United States.

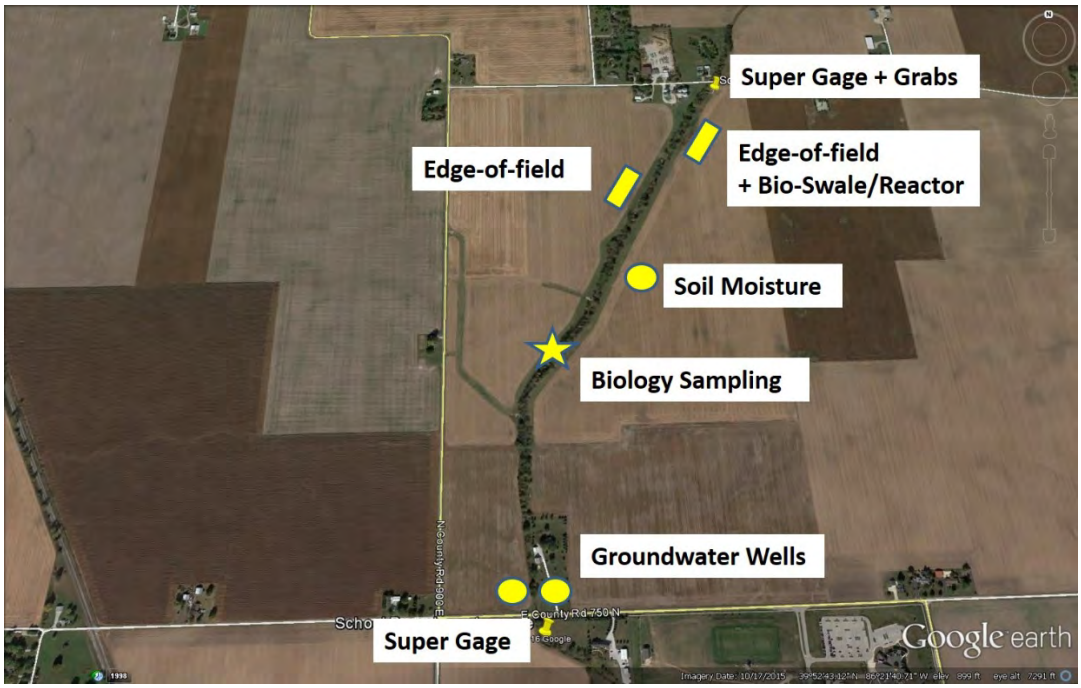


Figure 16 – Aerial view of School Branch projects

2. Sugar Creek in south-central Indiana has a USGS gage (USGS 03361650) at New Palestine that began in 1967. A site just upstream of the gage (USGS 394340085524601), has been a USGS National Water Quality Assessment (NAWQA) Program long-term trends site since 1993. This NAWQA site is sampled approximately 26 times per year for a long list of NAWQA constituents including nutrients and pesticides. Additionally, this site is sampled for biological communities (algae, invertebrates, and fish). This site was also sampled as part of the Midwest Steam Quality Assessment (MSQA), which was sampled approximately weekly between the first week of May and August for nutrients and pesticides in 2013 as a collaboration with the USEPA's National River and Stream Assessment. Sugar Creek and a tributary, Leary Weber Ditch, were intensely sampled as part of the NAWQA Ag Chemical and Transport (ACT) study between 2002-04. The ACT study used autosamplers to collect storm samples from the stream, overland flow, and tile drains to characterize primary pathways of pesticides and nutrients to the stream and ditch. Several wells were sampled at various depths to monitor movement to groundwater. Sugar Creek is typical of streams in the New Castle till plain physiographic province, with agricultural drainage tiles in use. Sugar Creek drains to White River. The upstream drainage area at the New Palestine gage is 94 square miles.

Section 4 – Water Quality Monitoring in Indiana's Waters

The primary goal of the Federal Clean Water Act (CWA) is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Most of the provisions of the CWA are implemented at the state level in Indiana through various CWA programs at IDEM in the Office of Water Quality (OWQ). Over the last few years, IDEM has sought to recognize the nexus between the CWA and the Safe Drinking Water Act in achieving water quality goals; thus, the *Indiana Water Quality Monitoring Strategy 2017-2021* includes the various surface water monitoring programs as well as the ground water monitoring network. Surface water and ground water interactions, including the effects of land use on quantity and quality, are being analyzed to assist with OWQ program decisions and are a factor in prioritizing watersheds for nutrient load reductions. School Branch, the National Water Quality Monitoring project described in Section 3, is an example of coupling at differing scales, surface water and ground water monitoring efforts to characterize a watershed and the effects of different land uses on water quality.

Water Quality Standards

Water Quality Standards (WQS) are the foundation of the water quality based control programs mandated by the Clean Water Act. A standard can consist of either numeric or narrative criteria for a specific physical or chemical parameter and is used as the regulatory target for permitting, compliance, enforcement, and monitoring and assessing the quality of the state's waters. When assessments identify a waterbody as not meeting adopted water quality standards, the assessment may lead to a determination of impairment, initiating further action such as a Total Maximum Daily Load (TMDL) or other regulatory procedure aimed at addressing the impairment.

Water quality standards consist of:

- Designated Uses: identification of how people, aquatic communities and wildlife use our waters (e.g. public water supply, propagation of aquatic life, recreation).
- Water Quality Criteria: numeric or narrative in form and protect the designated uses. Numeric criteria are allowable concentrations of specific pollutants in a water body while narrative criteria are statements of unacceptale conditions in and on the water.
- Antidegradation Policies: protection of existing uses and extra protection for high-quality or unique waters.

IDEM Water Monitoring Programs

Surface Water Monitoring Programs - IDEM's surface water monitoring programs are implemented in the Watershed Assessment and Planning Branch and are guided by the *Indiana Water Quality Monitoring Strategy 2017-2021*, which can be found at https://www.in.gov/idem/cleanwater/2537.htm. IDEM collects surface water quality, biological, and habitat data for the following purposes:

- To fulfill requirements of the CWA §305(b), §303(d) and §314 to assess all waters of the state to determine if they are meeting their designated uses and to identify those waters that are not;

- To support OWQ programs including water quality (WQ) standards development, National Pollutant Discharge Elimination System (NPDES) permitting, and compliance;
- To support public health advisories and address emerging water quality issues;
- To support watershed planning and restoration activities;
- To determine WQ trends and evaluate performance of programs; and
- To engage and support a volunteer citizen scientist monitoring network across the state.

The following monitoring programs are employed to achieve the above objectives:

- Probabilistic monitoring in one basin/year on a 9-year rotating basin cycle;
- Fixed Station monitoring at 165 sites across the state (2 added in 2014 for NRCS National Water Quality Initiative);
- Fish Tissue and sediment contaminants' monitoring on a 5-year rotating basin cycle;
- Targeted monitoring (watershed characterization) for Total Maximum Daily Load (TMDL) reassessments and document development, watershed baseline planning, and performance measures to determine if best management practices implemented in accordance with an approved 9-Element Watershed Management Plan have improved water quality. (To read about restoration success stories, please go to: http://www.in.gov/idem/nps/3360.htm);
- Cyanobacteria monitoring of 15 swimming beaches at 13 IDNR owned or managed sites and one IDNR dog park lake;
- Special studies such as Hydrograph Controlled Release Facilities, Grand Calumet Beneficial Use Delisting project, etc.;
- Thermal verification studies;
- Reference site monitoring to develop Indiana's biological condition gradient; and
- Hoosier River Watch Program. http://www.in.gov/idem/riverwatch/index.htm

Please see the table in Appendix C for IDEM surface water monitoring projects for 2018-2019.

Analyzing data from the Fixed Station monitoring program, albeit on primarily larger rivers, serves as a good first cut in prioritizing sub-watersheds for future program actions; an example of this is the Western Lake Erie Basin (WLEB). An analysis of data from the 12 fixed station sites in the WLEB for total phosphorous (TP) from 2008 to 2015 using both the LOADEST model and load duration curves shows that the larger (8-digit hydrologic unit code or HUC) St. Mary's watershed is the most significant contributor of TP loads to the Maumee River. Hence, this served as the starting point from which to prioritize smaller 12-digit HUC watersheds for targeting efforts and defining next actions to develop Indiana's GLWQA Domestic Action Plan. The State of Indiana intends to continue this process of prioritizing sub-watersheds in the other basins within the state as mentioned on page 25 under "Further Prioritization".[11]

[11] Refer to the "Objectives and Goals" under the Watershed Prioritization section of the Milestones and Actions Items Table, Section 9.

Ground Water Monitoring Programs - In 2008, the Indiana Department of Environmental Management (IDEM) Ground Water Section began collecting untreated water samples from ground water wells statewide as part of a Ground Water Monitoring Network (GWMN). A large percentage of Hoosiers drink residential well water that is not regulated by the Safe Drinking Water Act, and this was the impetus for starting the GWMN in Indiana. With the GWMN, IDEM seeks to:

1. Collect ground water samples from public water supply (PWS) wells and private residential wells within distinct hydrogeologic areas of the state with the overall goal to determine the quality of ground water in the state's aquifers,
2. Identify and expand sampling in areas with notable ground water contamination, and
3. Practice continual improvement adjusting the GWMN as necessary to best fit resources (monetary/field support) and data gap needs.

The GWMN has grown each year with ground water samples being collected from over 240 public water supply wells and approximately 1200 private residential wells. Samples are currently analyzed for approximately 200 parameters which include nitrate-nitrite, pesticides and pesticide degradants at each ground water well sampled. Once statistically-established ambient ground water conditions have been established for Indiana, comparisons between ground water and surface water data may be made and hypotheses concerning ground water/surface water interactions can be formulated and tested. A main goal of the GWMN is to be able to monitor trends in ground water quality which could be used in monitoring nutrient reduction over time with long-term sampling. On the next page (Figure 17) is the map depicting nitrogen results from the water samples collected. The GWMN website also has maps and information for other parameters that are analyzed.

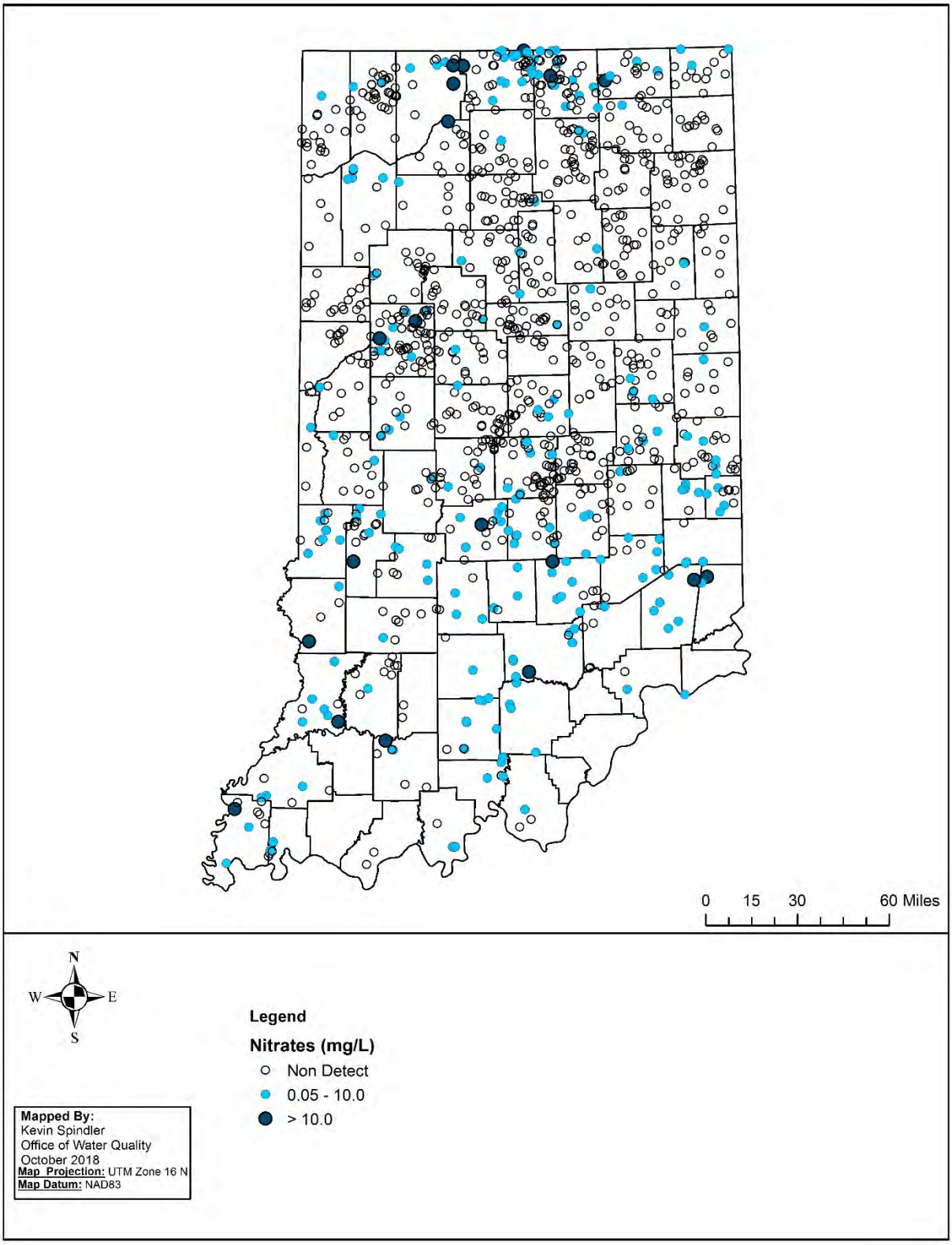


Figure 17 – Nitrogen, Nitrate-Nitrite Concentrations (mg/L) analyzed form wells

Data Sharing and Inventory – There is a wealth of monitoring data available in Indiana from the US Geological Survey (USGS), IDEM, other governmental entities, universities, and non-governmental organizations such as watershed groups, environmental consultants, and conservation organizations. The Indiana Water Monitoring Council (InWMC) was formed to "Maximize resources through improved communication, coordination, data sharing, and collaboration." Specifically, the InWMC:

1) provides a forum for communication among groups that are monitoring water resources,
2) promotes sharing of monitoring information including data, and effective procedures and protocols for sample collection, and
3) facilitates the development of collaborative monitoring strategies.

The InWMC prepared *An Assessment for Optimization of Water-Quality Monitoring in Indiana, 2017* to be used by environmental managers, researchers, and interested citizens who need data from sampling sites that have long periods of record. The goal of this paper is to document existing, ongoing river and stream water quality networks within Indiana, and to identify potential sites of redundancy and where there are gaps in the network of monitoring sites. Indiana strives to optimize its surface water quality monitoring network in order to ensure that all major stream/rivers entering and leaving Indiana borders, as well as major river basins, have water quality monitoring done at co-located stream gages so that nutrient loads and trends can be determined.

Building upon the findings of the InWMC's whitepaper, The Nature Conservancy (TNC) and USGS initiated a study in the Fall of 2018 focused on the Upper White River Watershed. The Upper White River, which drains a large portion of central Indiana (including the cities of Indianapolis, Carmel, Noblesville, Fishers, Muncie, and Anderson) has been identified as a major contributor of nutrients (nitrogen and phosphorus), some of which ultimately reaches the Gulf of Mexico. TNC wants to better understand which parts of the Upper White River watershed contributes the most nutrients, to focus efforts and investments that contribute to nutrient-load reduction. USGS, in cooperation with the TNC, will catalog existing nutrient and streamflow data for the Upper White River, test for temporal trends in streamflow and nutrient concentrations at selected locations, select methods suitable for computing nutrient loads with existing data, estimate nutrient loads where possible, and attempt to evaluate the relative contributions of nutrients from urban and agricultural sources.

Another successful outcome of the InWMC Monitoring whitepaper, is the partnership between the USGS, IDEM, ISDA, and TNC who worked together to provide funding and resources to install a supergage on the Wabash River in New Harmony, IN to better capture the nutrient loads in the Wabash River.

Additionally, IDEM's External Data Framework was launched in the last quarter of 2015 and provides acceptance criteria for three "tiers" of data based on data documentation of quality assurance. This qualification of the abundant data collected by the various monitoring entities listed above will be available to the public for different uses.
http://in.gov/idem/cleanwater/2485.htm

The Indiana Water Summary report is a publication of the InWMC that summarizes important water-related monitoring and research happening in Indiana. The Indiana Water Summary report is intended to help those working to manage water resources in Indiana do so more effectively

and with a fuller understanding of how their efforts fit into the larger picture and to support great communication and collaboration. To read about some of the important work going on in Indiana to better understand, manage, protect, and restore our water resources, you can read the report at: https://www.inwmc.net/resources/indiana-water-report/.

IDEM Lake Monitoring Data

The Indiana Clean Lakes Program was created in 1989 as a program within the Indiana Department of Environmental Management's (IDEM) Office of Water Management. The program is administered through a grant to Indiana University's School of Public and Environmental Affairs (SPEA) in Bloomington. The Indiana Clean Lakes Program is a comprehensive, statewide public lake management program founded on three overall objectives:

1. Lake Water Quality Assessment
    - Lake water quality assessments are conducted annually on 70-80 publicy accessible lakes randomly distributed throughout the state of Indiana.
    - These data are used to update the lake classification system and management plan as well as to update Sections 305(b) and 303(d) listing of impaired waterbodies to the U.S. EPA.

2. Citizen Science – Volunteer Lake Monitoring
    - The Volunteer Lake Monitoring expands upon the water quality assessments of the statewide program by training volunteer citizen scientists to collect data on the lake where they live or most frequently recreate.
    - Data from citizen scientists allow the Indiana Clean Lakes Program to track more long term trends in specific lakes than would be cost effective for the statewide monitoring program.
    - The program has multiple levels of monitoring available depending on the needs of the lake community and the volunteer's time commitment.

3. Outreach and Education
    - *Water Column* Newsletters
    - Sponsor and present at the annual Indiana Lakes Management Society
    - Trainings and workshops: Lake Science 101, Aquatic Macrophyte ID and Mapping, Aquatic Invasive Species Monitoring, etc.
    - Lake Association programs and assistance: technical assistance on their lake and data interpretation, develop programs and workshops for the specific needs of these groups, etc.

Harmful Algae Bloom (HAB) Monitoring Data

IDEM's blue-green algae (cyanobacteria) surveillance program samples fifteen swimming beaches at thirteen IDNR owned or managed sites and analyzes those samples for the type and quantity of blue-green algae present and for the following toxins which may be produced by

certain types of blue-green algae: microcystin, cylindrospermopsin (only done if species that produce it are present), anatoxin-a, and saxitoxin.
In 2017, IDEM commenced sampling at the Ft. Harrison State Park Dog Park Lake. For protection of human health from exposure to the algae and any of the toxins, cyanobacteria will be compared to the World Health Organization (WHO), United States Environmental Protection Agency (EPA) and Ohio Department of Health (ODH) guidelines. WHO guidelines recommend using an action level of 100,000 cells/ml of cyanobacteria to post recreational advisory signs. IDNR's advisory states, *"Swimming and boating permitted. Avoid contact with algae. Avoid swallowing water while swimming. Take a bath or shower with warm soapy water after coming in contact with lake water. Do not use lake water for cooking or bathing. Do not allow your pets to swim or drink water where algae are present."*
For cyanotoxin exposure for dogs, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment has developed action levels for microcystin, anatoxin-a and cylindrospermopsin. The Oregon Health Authority Public Health Division has set an action level for saxitoxin. A warning to dog owners using the Fort Harrison State Park Dog Park lake will occur whenever any cyanotoxins are detected, and the lake will be closed to dogs if levels in the table below are met.

EXPOSURE THRESHOLDS

Exposure Reference Values µg/l	Microcystin	Cylindrospermopsin	Anatoxin a	Saxitioxin
Human Recreation Advisory	**4.0**	**8.0**	**80.0**	**0.8**
Dog Recreation Prohibited	**0.8**	**1.0**	**Any detection**	**Any detection**

Toxin results will be posted if they meet those threshold numbers. Exact cell counts and toxin levels can be found in the Test Results section of the web site at https://www.in.gov/idem/algae/2343.htm. Swimming areas will stay on the High Cell Count Alert until the cell counts fall below 100,000.

The Blue-Green Algae home page is found at: http://www.in.gov/idem/algae/.

Following are the tables showing results of the sampling over the last several years:

Cell Count Summary

Recreation Advisory Issued at 100,000 Cells

Year Sampled	2017	2016	2015	2014	2013	2012*	2011	2010
# Lakes	14	14	14	14	12	10	10	5
# Samples	89	100	86	81	63	70	58	18
Highest Cell Count	1.8 million	1.8 million	810,000	935,000	3.3 million	1.8 million	798,000	260,000
% Over 100,000	52	45	52	37	57	76	48	28
% Over 1 million	4.5	5	0	0	11	16	0	0

*Drought

Microcystin Toxin Summary

Sensitive Population Warning Level *4 ppb

Beach closure at 20 ppb

Year Sampled	2017	2016	2015	2014
% Detections	17	26	37	33
Highest Concentration (ppb)**	1.26	4.15	7.83	1.8
Average Concentration (ppb)	0.51	0.76	0.51	0.24

* New U.S. EPA recommendation of 4 applicable beginning 2017.
** 0.030 Detection Limit in 2017, prior to that 0.150.

Anatoxin-a Summary

Warning Level 80 ppb

Year Sampled	2017	2016
% Detections	8	15
Highest Concentration (ppb)*	3.3	0.62
Average Concentration (ppb)	1.0	.045

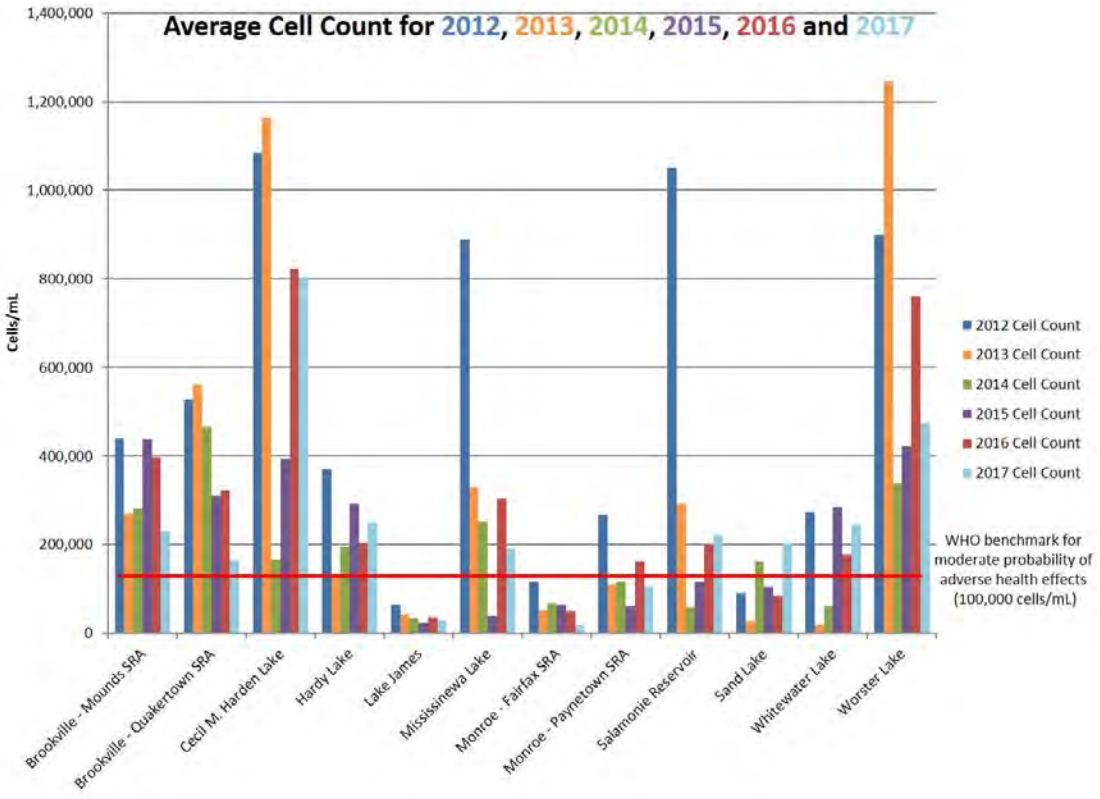
* Reporting limit 0.4

Cylindrospermopsin Summary

Warning Level 8 ppb

Year Sampled	2017	2016	2015	2014
% Detections	14	12	5	8
Highest Concentration (ppb)*	0.29	1.67	2.48	1.17
Average Concentration (ppb)	.17	.48	2.48	.614

* Detection Limit .05



CWA 305(b) Water Quality Assessments

CWA 305(b) requires states to assess water quality conditions of all waters of the state. IDEM conducts two types of CWA 305(b) assessments. Comprehensive basin assessments are based on statistical analyses of data collected by IDEM's Probabilistic Monitoring program and reflect overall water quality conditions throughout a given basin. Waterbody-specific assessments are based on data collected by both the Probabilistic and Targeted Monitoring programs and are representative of conditions in a given waterbody. Both assessment types are based on Indiana's water quality standards (WQS), which provide narrative and numeric water quality criteria that Indiana waters must meet to ensure they support their designated uses – the activities that we as a society want those waters to support and the benefits that we want them to provide (e.g. public water supply, propagation of aquatic life, recreation). Indiana's WQS may be found online at: http://www.in.gov/idem/cleanwater/2329.htm.

To make waterbody-specific 305(b) assessments, IDEM follows the processes outlined in its *Consolidated Assessment and Listing Methodology* (CALM), which describes the designated uses IDEM assesses, types and amount of data needed to make each type of assessment, and the water quality criteria used to make them. The CALM also explains IDEM's Consolidated Listing Process, which places all Indiana waters into one or more of five categories depending on what is known about their water quality and the extent to which they are meeting their designated uses. IDEM's most recent CALM is available online in the Notice of Public Comment Period for the 2018 303(d) list: http://www.in.gov/idem/nps/2647.htm.

Notable as water quality indicators for determining support of public water supply use is IDEM's revised assessment methodology for waters designated for public water-supply, which adds cyanobacterial toxins, cylindrospermopsin and microcystin-LR, for which U.S. EPA has issued drinking water health advisory values.

Public Water Supply Use Support – All Waters		
Chemical Toxicants	Minimum of three measurements collected within the same year at least one month apart	Most recent five consecutive years
Cyanobacterial Toxins	Minimum of one measurement Or One consumption and use notification issued by a water treatment facility based on cyanobacterial toxin concentrations in treated drinking water	Most recent five consecutive years
Conventional Inorganics	Minimum of three measurements collected within the same year at least one month apart	Most recent five consecutive years
Bacteria	All Level 1 and/or Level 2 assessments performed in accordance with the Revised Total Coliform Rule (RTCR)	Most recent five consecutive years

This revision of the public water supply use support reflects Indiana's commitment to prioritize drinking water sources and reduce nutrients to them.

The 303(d) List of Impaired Waters

CWA Section 303(d) requires states to develop a list of impairments identified through IDEM's 305(b) assessments for which a Total Maximum Daily Load (TMDL) must be developed. IDEM's 303(d) program develops the 303(d) List of Impaired Waters as part of its Consolidated List and publishes both in the Indiana Integrated Water Monitoring and Assessment Report every two years. IDEM's most recent Integrated Report can be found online at: http://www.in.gov/idem/nps/2647.htm.

The 303(d) list is a subset of IDEM's Consolidated List. The Consolidated List includes assessment information for all waters of the state while the 303(d) list includes just those water that are known to be impaired.

IDEM relies primarily on data collected by the Watershed Assessment and Planning Branch monitoring programs for its CWA 305(b) assessments, which are how most impairments are identified. However, IDEM also solicits additional data and information from external parties to develop its list, including state and federal agencies, colleges and universities and local organizations, such as county health departments, cities and towns, and watershed management groups, to develop its 303(d) list.

IDEM publishes the draft 303(d) list and the CALM every two years for a 90-day public comment period in order to lend transparency to its assessment and listing processes and to give the public an opportunity to provide input regarding these processes and any additional information that might be useful for developing the 303(d) list. U.S. EPA also provides comments during this time. After the public comment period ends, IDEM reviews all comments

received, makes any necessary revisions, and works with U.S. EPA to get formal approval of the 303(d) list.

Total Maximum Daily Loads (TMDLs)

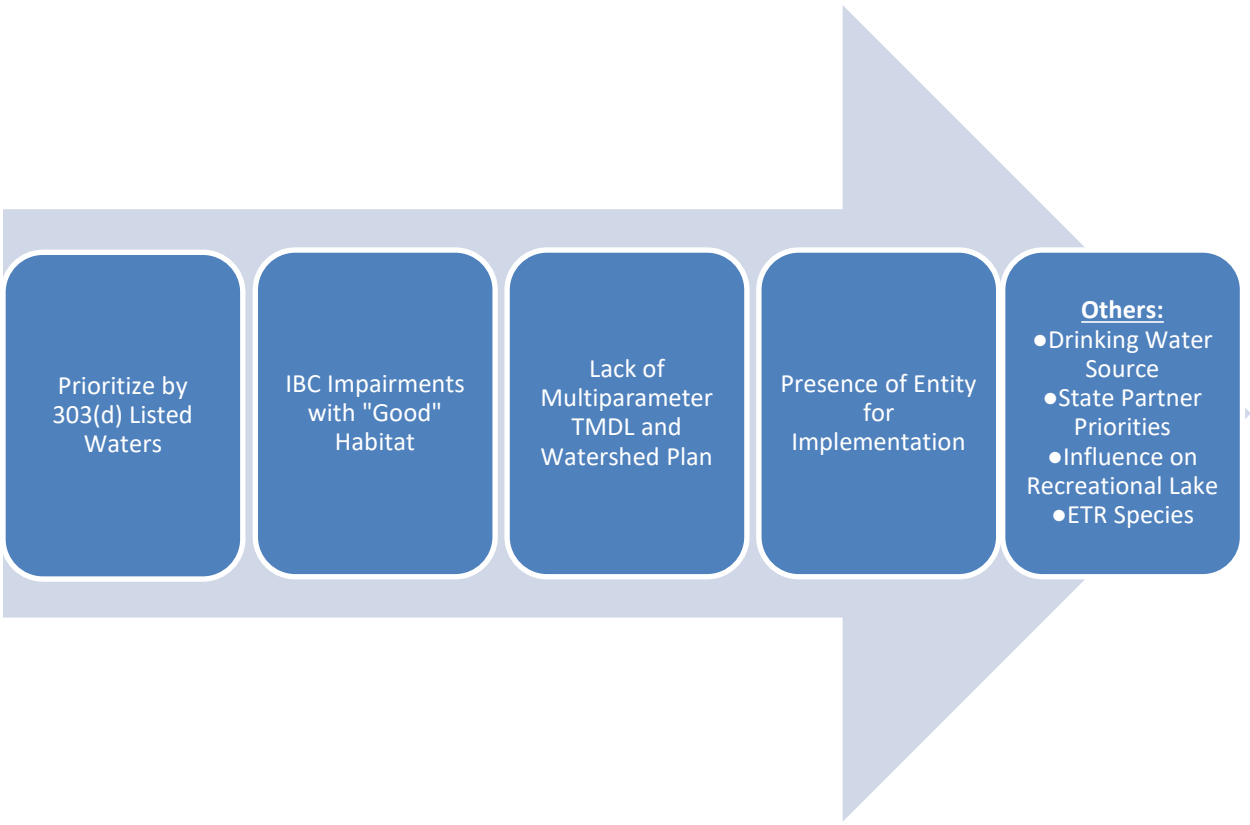
CWA Section 303(d) requires states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting their WQS and have been placed on the state's 303(d) list for one or more impairments. A TMDL is a report that identifies the maximum amount of pollutant that a waterbody can receive and still meet water quality standards, and allocates that amount among the sources of the pollutant in the watershed. The TMDL also provides information that can be used to guide restoration activities in the watershed aimed at mitigating the impairment(s) identified and restoring water quality.

The completion of a TMDL report is just the first step in remedying an impairment. Once a TMDL report is completed, IDEM works with local watershed groups wherever possible to implement the recommendations in the TMDL document, which are intended to help restore the waterbody to the point at which it meets water quality standards. More information on the TMDL program, including completed TMDL reports and those still in progress may be found online at: https://www.in.gov/idem/nps/2652.htm.

IDEM's TMDL Program Priority Framework, which EPA approved in 2016, identifies a prioritization process that addresses nutrient pollution by focusing on impaired biotic communities where the habitat is good. TMDLs will be developed for streams and rivers with impaired biotic communities and *E. Coli* impairments caused by one or more of the following conditions:

- Dissolved oxygen
- Algae
- Total Suspended Solids
- Phosphorus

The following graphic illustrates the secondary filters or considerations for prioritizing TMDLs:


Prioritize by 303(d) Listed Waters
IBC Impairments with "Good" Habitat
Lack of Multiparameter TMDL and Watershed Plan
Presence of Entity for Implementation
Others:
●Drinking Water Source
●State Partner Priorities
●Influence on Recreational Lake
●ETR Species

Section 5 – Nutrient Criteria

The quantitative measure of the state's progress in nutrient reduction will be addressed in sections to follow.

Narrative Limits

The state of Indiana currently has narrative limits found at 327 IAC 2-1-6 regarding minimal criteria for water quality. Those state:

"All surface waters at all times and at all places, including waters within the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:

(A) Will settle to form putrescent or otherwise objectionable deposits.

(B) Are in amounts sufficient to be unsightly or deleterious.

(C) Produce:

(i) color;

(ii) visible oil sheen;

(iii) odor; or

(iv) other conditions;

in such degree as to create a nuisance.

(D) Are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to:

(i) create a nuisance;

(ii) be unsightly; or

(iii) otherwise impair the designated uses

Numeric Criteria

The development of numeric criteria is a requirement of Section 303(c) (33 U.S.C. 1313(c)) of the CWA which directs states to adopt water quality standards for their navigable waters. Section 303(c)(2)(A) and EPA's implementing regulations at 40 CFR part 131 require, among other provisions, that state water quality standards include the designated use or uses to be made of the waters and criteria that protect those uses. Nutrient criteria are also necessary to support 303(d) listing decisions, to develop Total Maximum Daily Loads (TMDLs), and to determine permit limits. Indiana envisions that the codification of numeric nutrient criteria may be a driving force for water quality trading between point sources and agricultural producers, from which ecological benefits beyond just the reduction in nutrients will be realized. Indiana is one of three states, along with Ohio and Kentucky, to participate in the Electrical Power Research Institute's pilot water quality nutrient trading program for the Ohio River, and has been an integral part of helping to develop it. http://wqt.epri.com/

With that said, the development of numeric nutrient criteria for Indiana waters continues to present difficult and complex challenges. How these challenges are addressed has profound effects on the assessment and management of water quality. The precise cause and effect relationships of nutrients in the aquatic environment are not well quantified leading to uncertainties in the development of scientifically sound numeric nutrient criteria.

After analyzing existing total phosphorus data for flowing waters, IDEM identified data gaps that are important in determining relationships between nutrient loads, excessive nutrients and their impact on biological communities. Therefore, IDEM collected additional data in 2017 to clarify the uncertainties and fill the gaps in information regarding the correlation of nutrients and biological integrity. Those data are being analyzed to determine what parameters are critical to determine the potential for a multi-variable criterion. The results will be reported in 2019. Additionally, IDEM will evaluate the U.S. EPA Headquarter's statistical model analysis results of Indiana inland lake data, which will be used to derive draft Indiana-specific total nitrogen and total phosphorus numbers.

Currently, Indiana uses the following nutrient benchmarks, which are monitored by the IDEM and are considered alongside the state's narrative limits in nutrient TMDLs:

Total Phosphorus	Not to exceed 0.3 mg/L
Nitrate+Nitrite	Not to exceed 10 mg/L (current Drinking Water standard)
Dissolved Oxygen	Not to be below 4.0 mg/L or consistently in the range of 4.0 to 5.0 mg/L
pH Values	Not to be above 9.0 or consistently close to the standard (8.7 or above)
Algae Growth	Should not be "excessive" based on field observations by trained staff

Section 6 – Practices to Reduce Point Source and Non-Point Source Pollution

Point Source Pollution

Point Source (PS) pollution is defined as water pollution that comes from a single, discrete place, typically a pipe. The Clean Water Acti specifically defines a "point source" as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture."

It is important to remember that not all pipes create point source pollution. Federal and state laws exist that require permits and place limits on many different types of businesses, cities, and industry that may discharge water containing pollutants to a pipe that, in turn, may flow to a river, stream or lake. These limits are set at levels protective of both the aquatic life in the waters which receive the discharge and protective of human health. These laws require water that comes from point sources be treated in modern facilities called wastewater treatment plants. This technology treats and removes pollutants from wastewater so that when the process is completed, the water is safe enough to put back into nearby rivers and streams.[12] The National Pollution Discharge Elimination System (NPDES) program will be discussed further in the next section on programs.

Point Source (Regulated) Strategy Objectives

Urban/Suburban and Rural

- Wastewater Treatment Plants (WWTPs) and Publicly Owned Treatment Works (POTWs) will seek to employ optimization techniques by analyzing their current operation and maintenance processes to seek better nutrient removal.
- Combined Sewer Overflow (CSO) communities will implement their long term control plans (LTCPs) and associated schedules and track progress. Nutrient load reductions will be quantified via modeling and, where possible, by ambient water quality monitoring as projects and practices are implemented.
- Stormwater management:
    - Municipal Separate Storm Sewer System (MS4)[13] communities will implement their stormwater quality management plans (SWQMPs) and track progress.
    - Construction site sediment runoff controls will be implemented according to the Notice of Intent(NOI) and living stabilization covers will be used that minimize nutrient inputs.

[12] https://www.in.gov/idem/cleanwater/2499.htm

[13] Municipal Separate Storm Sewer Systems (MS4s) are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying storm water. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels and conduits. It does not include combined sewer overflows and publicly owned treatment works. https://www.in.gov/idem/stormwater/2333.htm

    - Industrial site runoff controls will be implemented according to the Notice of Intent (NOI).
- Local health departments and communities will continue to identify failing residential septic systems and seek to put infrastructure in place to replace them or connect them to WWTPs.

Agriculture

- Ensure compliance with the Confined Feeding Operation (CFO) and Fertilizer Certification rules via routine inspections.
- Timely investigate reports of nutrient mismanagement or runoff from regulated farms and spills from unregulated farms.

Non-Point Source Pollution

Non-Point Source (NPS) pollution means that the source of pollution cannot be traced back to a single point or location, and its source is usually unidentifiable. It can come from oil, pet waste, pesticide, herbicide, fertilizer, road salt, bacteria, sediment, and any other contaminant that ends up on the ground naturally or from human activity. Rainwater and snowmelt picks up these contaminants as it washes over yards, sidewalks, driveways, parking lots, and fields and deposits them into Indiana's lakes and streams as nonpoint source pollution. Common sources of nonpoint source pollution in Indiana include:[14]

- Animal production operations and feedlots,
- Agricultural activities,
- Stream bank and shoreline erosion,
- Timber harvesting,
- Land development,
- On-site sewage diposal units,
- Solid waste disposal landfills,
- Transportation-related facilities,
- Coal mining,
- Oil and gas production,
- Non-energy mineral extraction, and
- Atmospheric deposition

Non-Point Source Strategy Objectives

The overall goals are to enhance nutrient managmenet, promote soil health practices, and restore more natural hydrology and ecological functions by promoting drainage water management (rather than moving water off the landscape quickly) and emphasizing the importance of allowing water to infiltrate where it falls.

Hydromodification is the alteration of the natural flow of water through a landscape that reduces precipitation infiltration and changes drainage patterns causing rainfall to discharge into streams

[14] https://www.in.gov/idem/nps/2368.htm

more quickly with higher energy. Large flow events occur more frequently and local drought and flood cycles may be exacerbated. The US EPA indicates that hydromodification is one of the leading sources of water quality degradation in our nation's waters.[15]
Examples of hydromodification include channelization and dredging; streambank denuding; removal of riparian corridors, wetlands and floodplains; stream relocation; dams; streambank and shoreline hardscapes; subsurface drainage (agricultural and residential); and conversion of open landscape to roads, buildings, parking lots, and other impervious surfaces. These changes to flow result in higher sedimentation and nutrient loading to our waterways as well as higher water temperatures, lower dissolved oxygen, degradation of aquatic habitat structure and declines in biological communities.

Opportunities for mitigation include but are not limited to the following approaches:

Urban landscapes: create a green infrastructure (GI) paradigm by seeking incentives and opportunities for it.[16]

- Support practices that promote infiltration, bio-retention, and slow or more natural water release.
- Seek the installation of larger, regional or multipurpose GI practices that are often more cost-effective.
- Ensure that the maintenance of GI practices is included in cost estimates and budgets.
- Provide technical and financial support to install rain gardens, green roofs, rain barrels, and porous pavement in industrial, commercial and residential settings.

Rural landscapes:

- Restore stream sinuosity and riparian buffers.
- Restore and reconnect riparian wetlands and floodplains.
- Employ practices from the *Indiana Drainage Handbook* for the maintenance of legal drains such as retaining native vegetation on one streambank while staging maintenance equipment on the side with easier drain access.
- Install 2-stage ditches where feasible on both regulated and non-regulated drains.
- Install drainage water management BMPs and saturated buffers on working lands.

Agricultural landscapes:

- **Promote nutrient management**:
    - Optimize inputs and uptake by crops through employing the "4 Rs" namely, applying the right nutrient source at the right rate at the right time in the right place.
    - Increase outreach on manure management to livestock farms.
- **Emphasize soil health**: Healthy soil with a higher organic matter content reduces erosion, requires less nutrient inputs, ameliorates the effects of flood and drought, and

[15] National Management Measures to Control Nonpoint Source Pollution from Hydromodification, EPA 841-B-07-002, July 2007.
[16] U.S. EPA's website for Green Infrastructure is a great resource for design and implementation measures as well as funding sources, and Indiana's manual entitled the *Planning and Specification Guide for Effective Erosion and Sediment Control and Post-Construction Water Quality* shows pollutant removal expectations for the various BMPs.

reduces nutrient and sediment loading to streams and rivers. The four key principles to increasing organic matter and building healthy soils are:

- Minimize disturbance through no till or conservation tillage practices.
- Maximize soil cover.
- Keep living roots growing as long as possible.
- Grow a variety of plants.

Practices to Reduce Non-Point Source Pollution

Urban/Suburban practices: below are some examples and recommendations of BMPs that can be used in urban and suburban landscapes to address non-point source pollution.

- Curb Cuts: curb cuts are spaces cut into parking lot curbs to allow storm water to flow onto a pervious surface. In areas with large parking lots, curb cuts are a good option for reducing storm water runoff, and can be especially valuable if combined with the parking islands that contain a rain garden.
- Green Roof: green roofs are where plants and small shrubs are planted on top of buildings. Green roofs lower the temperature of a building, filter pollution and reduce the amount of runoff from rain. They can also reduce the heat island effect in cities.
- Porous pavement: porous pavement refers to any surfacing material that allows storm water to move through it rather than run off.
- Rain Barrel: a rain barrel is a large 40-60 gallon container that collects rainwater from a roof. The barrel is placed at the base of downspout with directs the water into the barrel during rain and a hose attached to the bottom of the barrel can be used to water lawns and gardens.
- Rain Garden: a rain garden is a planted depression that collects rainwater runoff from impervious urban areas, such as roofs, driveways, walkways and compacted lawn areas, and allow the water to absorb into the ground. This reduces rain runoff by diverting rainfall away from storm drains.
- Swale: a swale is very similar to a rain garden. Both are depressions where storm water is allowed to infiltrate deep into the ground. Swales are usually larger and longer that rain gardens, and are able to treat greater amounts of storm water.

Agricultural practices: below are some examples and recommendations of BMPs that can be used on agricultural lands to address non-point source pollution.

An important factor to consider on agricultural lands is sub-surface drainage. The use of sub-surface drainage tile on agricultural lands is important for high production of agricultural crops, however sub-surface drainage is associated with an increase in nitrate loads to streams and rivers that drain to the Gulf of Mexico and the Great Lakes, where it contributes to the low oxygen hypoxic zone. One way to reduce nitrate loads would be to reduce the amount of drained land, but this is unlikely due to the important role of drainage in Midwestern agriculture. Instead focus should be on ways that cropping systems and drainage systems can be managed to reduce nitrate loads, while maintaining high agricultural productivity. [17]

[17] "Ten Ways to Reduce Nitrogen Loads from Drained Cropland in the Midwest", L.E. Christianson, J. Frankenberger, C. Hay, M.J. Helmers, and G. Sands, 2016. Pub. C1400, University of Illinois Extension.

The following ten practices are BMPs that can be used in managing nitrate loads thus improving water quality from agricultural-drained cropland and comes from the University of Illinois, Purdue University, Iowa State University and the University of Minnesota publication titled "Ten Ways to Reduce Nitrogen Loads from Drained Cropland in the Midwest".

Nitrogen Reduction Practices

- Improved nitrogen management – applying nitrogen at the rate needed by the crop and in spring or summer as close as possible to the time it is needed can reduce nitrate loads in subsurface drainage water.
- Winter cover crops – cover crops, such as rye, that are planted in the fall and cover the soil during the winter reduce nitrate losses by taking up water and nitrate from the soil after the main crop is harvested, and cover crops that overwinter can also take up nitrate before the main crop starts growing in the spring.
- Increasing perennials in the cropping system – Perennials are plants that can grow for two or more years without re-planting, such as hayland. They reduce nitrate loads by extending the season during which water and nitrates are removed from the soil, and are the least "leaky" cropping system.
- Controlled Drainage (Drainage Water Management) – Drainage water can be managed through the use of adjustable water control structures placed in the drainage system that allow the outlet level (or water depth) to be adjusted. Water can be held in the field reducing the overall amount of drainage water and nitrogen that moves downstream.
- Reduced Drainage Intensity – Installing drainage pipes either with wider spacing or closer to the soil surface can reduce the total water drained, and thus, result in less nitrate transported from the field.
- Drainage Water Recycling – Capturing and storing drainage water in a pond or reservoir and then returning it to the soil through irrigation can reduce or even potentially eliminate nitrate loss by reducing the water that leaves the site.
- Bioreactors – bioreactors are trenches filled with woodchips through which drainage water is routed, allowing water to be treated by enhancing the natural, biological process of denitrification.[18]
- Constructed Wetlands – Constructed wetlands remove nitrate through denitrification, plant uptake, and reduction in flow due to seepage and evaporation.
- Two-Stage Ditches – this practice consists of a small main channel that accommodates low flow conditions and a second low, grassed floodplain that accommodates high flows within the ditch. This creates a zone of plants and soil that absorbs part of the nitrate load through plant uptake and denitrification, and can also reduce flow, as well as decrease costs of ditch maintenance.
- Saturated Buffers – this is an edge-of-field practice that allows drainage water to be distributed through a riparian buffer via a shallow perforated drain pipe that extends

[18] Denitrification is defined as the part of the nitrogen cycle where nitrate is converted to a gaseous form of nitrogen, typically either dinitrogen gas or nitrous oxide. The soil microbes responsible for this process require a carbon source and anaerobic (low oxygen) conditions in addition to a supply of nitrate.

laterally along the buffer. As the drainage water seeps through the buffer soil, denitrification is increased and the roots take up the drainage water and nitrate.

Phosphorus Reduction Practices: The following BMPs can also be used to reduce phosphorus loads from agricultural lands, and are practices that help keep soil in place to prevent erosion.

- Conservation Tillage Practices – No-till, strip-till, ridge till and mulch till are practices that leave crop residues on the soil surface to reduce soil erosion by water, and can increase organic matter content of the soil allowing for many benefits including increased infiltration.
- Cover Crops – cover crops can hold the soil in place to prevent erosion and the transport of particulate phosphorus attached to sediment. Also, because cover crops increase infiltration of water, this reduces surface water runoff with dissolved phosphorus.
- Conservation Buffers – Strips of land planted with trees and/or grasses help control pollutants by slowing water runoff, preventing erosion, trapping sediment and fertilizers, and enhancing infiltration within the buffer area. Buffers can include riparian areas, grass filter strips, and grassed waterways.
- Perennial Crops – long-term planted crops help keep soil in place to reduce erosion and allow for infiltration of water to reduce runoff.
- Grade Stabilization Structures – these are practices that hold soil in place to prevent excessive erosion in high flow areas.
- Blind Inlets – using blind inlets in place of tile risers in the field can filter excess water and P loss to tile drains.
- Soil Testing – conducting a soil test provides an opportunity to check the nutrient levels in the soil, thereby allowing accurate nutrient recommendations and management to be made for the field.
- Nutrient Management – using the right sources of fertilizers and manures at the right rate at the right time and in the right place allows for good management of nutrients and can improve the efficiency of the plants that are using the nutrients, thus decreasing the amount that is transported off the field.

Development of a Science Assessment

In November of 2018, Indiana held a workshop titled “Nutrient Reduction Estimation Framework”, that invited and convened researchers, conservation agency staff, and others to discuss how Indiana’s framework for establishing nutrient reduction estimates from the implementation of conservation practices could be enhanced, including adding the component of dissolved nutrients. The goal of the workshop was to:

- Determine how we can capture nutrient load reductions from dissolved components;
- Better model our nutrient load reductions from conservation practices, and better determine the impact of various practices on water quality; and
- To use the workshop as one of the tools toward the development of a science assessment for Indiana – to determine the impact of nutrient reductions from various conservation practices on water quality.

It was agreed upon at the workshop that Indiana needs a science assessment to determine a load reduction method based on observed reductions in Indiana and similar regions in the Midwest.

Additional goals to achieve would be determining the current or baseline load which can be used to set goals and provide an additional method for assessing progress, provide agreed-on reduction estimates that could be used beyond the state's Nutrient Reduction Strategy, provide a foundation for speaking with one voice about conservation priorities, and determining the efficiency of various conservation practices on the reduction of nitrogen and phosphorus loads to improve water quality.

Estimating nutrient reduction is critical for tracking water quality improvement but is very challenging. The method that Indiana uses to capture nutrient load reductions from the conservation practices applied is explained in Section 8 – "Measuring Impacts". While this method has worked for Indiana, it has some limitations and we are missing some important components. The Indiana Conservation Partnership would like to strengthen the current method in order to capture more accurate reductions and to better assess the progress being made on improving water quality.

Section 7 – Programs and Projects Supporting Nutrient Reduction

Opportunities exist to reduce nutrient inputs from both urban and rural landscapes, including both point and nonpoint sources. Emphasis is on using existing regulatory and non-regulatory programs, and implementing voluntary BMPs.

Point Source/Regulatory Programs

National Pollutant Discharge Elimination Systems (NPDES) - NPDES permit requirements ensure that, at a minimum, any new or existing point source must comply with technology-based treatment requirements that are contained in 327 IAC 5-5-2. According to 327 IAC 5-2-2, "Any discharge of pollutants into waters of the State as a point source discharge, except for exclusions made in 327 IAC 5-2-4, is prohibited unless in conformity with a valid NPDES permit obtained prior to discharge." This is the most basic principal of the NPDES permit program.

To reduce significantly the discharge of nutrients to surface waters of the state and to protect downstream water uses, IDEM set a practical state treatment standard of 1.0 mg/l of total phosphorus (TP) for sanitary wastewater dischargers with design flows of 1 million gallons/day (MGD) or greater. This policy became effective January 1, 2015.

Applying the 1mg/l TP limit will amount to a nearly 45-50% reduction of TP loads from major sanitary dischargers over the next few permit renewal cycles.[19] The table on the next page shows the reductions of phosphorus made by major municipal wastewater treatment plants within the large basins in Indiana after the implementation of the 1mg/l total phosphorus limit requirement.

Additionally, IDEM will implement TMDL load reductions as written and approved for total phosphorous upon the renewal of any affected permit, and IDEM will continue to implement phosphorus removal as required by 327 IAC 5-10-2. See figures in Appendix B for facilities with water quality monitoring for ammonia and phosphorus, including facilities with permit limit notations.

IDEM's position is that applying the state treatment standard of 1 mg/l total phosphorus to this limiting nutrient sufficiently addresses potential water quality impacts from point sources to fresh water systems; thus, there is no need to interpret Indiana's narrative criteria into water quality-based effluent limits at this time.

The State of Indiana has not yet instituted any statewide monitoring requirements for total nitrogen. To begin the process of total nitrogen data collection, IDEM is proposing that all major sanitary dischargers with average design flow ratings of 1.0 MGD or greater begin monitoring

[19] In the 2016 SNRS, the estimated TP load reduction post NPD implementation was overestimated at 60%. With more monitoring data and actual discharge data,it appears to be closer to 45-50%- still significant.

for total nitrogen as a requirement of their next NPDES permit renewal, commencing with permittees required to submit NPDES renewal applications or applications for modification of an effective NPDES permit after January 1, 2019. IDEM is proposing that total nitrogen be monitored and reported to IDEM on a monthly basis.

The data collected will be used to garner a better understanding of nitrogen loadings in Indiana waters and aid the State of Indiana with future updates of the State of Indiana's nutrient reduction efforts.

Major Municipal Wastewater Treatment Plants with Permit Renewals Implementing the 1 mg/L Total Phosphorus Limit

Major Municipals eligible for Total Phosphorus Limits

Watershed Group Name	2012-2014 Total Calculated Existing Average TP Loading (LBS/2 yrs)	2014-2016 Total Calculated Existing Average TP Loading (LBS/2 yrs)	2016-2018 Total Calculated Existing Average TP Loading (LBS/2 yrs)
Great Lakes Basin(s)	271,537	259,266	278,291
Whitewater River	21,389	16,052	19,189
Upper Wabash River	408,691	452,448	202,645
Lower Wabash River	685,105	526,884	285,860
West Fork White River	1,050,689	835,669	856,063
East Fork White River	275,612	215,704	225,712
Patoka River	26,791	28,236	25,829
Ohio River	485,860	477,028	439,271
Kankakee River	159,050	151,992	118,212
Estimated Total: 1490373	3,384,724	2,963,279	2,451,073
52 % Estimated Reduction		12.5 % Actual reduction from 2012	27.6 % Actual reduction from 2012

All Municipal Major Permits

Watershed Group Name	2012-2014 Total Calculated Existing Average TP Loading (LBS/2 yrs)	2014-2016 Total Calculated Existing Average TP Loading (LBS/2 yrs)	2016-2018 Total Calculated Existing Average TP Loading (LBS/2 yrs)
Great Lakes Basin(s)	271,537	259,266	278,291
Whitewater River	24,542	22,002	33,483
Upper Wabash River	432,595	475,016	216,016
Lower Wabash River	686,091	530,167	289,120
West Fork White River	1,066,833	851,266	874,685
East Fork White River	291,610	244,520	249,031
Patoka River	26,791	28,236	25,829
Ohio River	497,707	493,500	455,911
Kankakee River	159,050	151,992	118,212
Estimated Total: 1833943	3,456,756	3,055,965	2,540,580
47 % Estimated Reduction		11.6 % Actual reduction	26.5 % Actual reduction

Non-Point Source/Regulated Programs

IDEM Wellhead Protection Program - IDEM's Wellhead Protection Program is an essential educational awareness program focusing on source water protection and promoting the resource value of ground water. Community Water Systems (CWS), which utilize ground water as their source of drinking water, are responsible for planning for the prevention of ground water to become contaminated through the implementation of their Wellhead Protection Plan. CWS planning activities include educating the public on pollution prevention, identifying potential sources of contamination within their Wellhead Protection Area, and promoting the value of the ground water resources. As mentioned earlier, IDEM developed the Ground Water Monitoring Network (GWMN) to gather ground water quality information across Indiana to be able to establish a baseline of ground water quality within Indiana's aquifers. Together, Indiana's Wellhead Protection Program and the GWMN are essential steps in Indiana's protection, characterization and improvements of ground water quality.

Confined Feeding Operations (CFOs) – All regulated animal feeding operations in Indiana are considered confined feeding operations (CFO). To be regulated under the Confined Feeding Control Law in Indiana, you must meet the following size of any one livestock group listed below:

- 300 or more cattle
- 600 or more swine or sheep
- 30,000 or more poultry (chicken, turkey or ducks
- 500 horses in confinement

Concentrated Animal Feeding Operations (CAFOs) - The concentrated animal feeding operation (CAFO) designation is strictly a size designation in Indiana. Farms of this size are permitted under the CFO rule, but have a few added requirements under Indiana regulations. A CFO that meets the size classification as a CAFO is a farm that meets or exceeds an animal threshold number in the U.S. Environmental Protection Agency's definition of a large CAFO, which is:

- 700 mature dairy cows
- 1,000 veal calves
- 1,000 cattle other than mature dairy cows
- 2,500 swine above 55 pounds
- 10,000 swine less than 55 pounds
- 500 horses
- 10,000 sheep or lambs
- 55,000 turkeys
- 30,000 laying hens or broilers with a liquid manure handling system
- 125,000 broilers with a solid manure handling system
- 82,000 laying hens with a solid manure handling system
- 30,000 ducks with a solid manure handling system
- 5,000 ducks with a liquid manure handling system

IDEM's Role

Anyone who plans to operate or start construction or expansion of a farm that meets the requirements of Indiana's Confined Feeding Control Law (Indiana Code 13-18-10) must submit an application and receive a permit from IDEM prior to beginning construction or expansion of an operation. No one may operate or start construction or expansion of a CFO without IDEM's prior approval. The laws and rules that govern IDEM's Confined Feeding Operation Program are found in 327 Indiana Administrative Code (IAC) 19 (CFO Rule) and 327 IAC 15-16 (NPDES CAFO Rule). IDEM's permitting, compliance, and enforcement sections implement the rules and the requirements of the laws:

Permitting

The CFO Permits staff reviews applications for CFO permit approvals. IDEM permit managers, engineers and geologists review designs and drawings and conduct inspections prior and during construction of new buildings and manure storage structures. The CFO permit manager is a good point of contact for any question regarding a new permit or modification, renewal, or construction for an existing permit.

Compliance

The CFO Compliance staff conducts routine and complaint-based inspections to assure compliance with operational requirements in the rules. New farms may receive an initial compliance assistance visit and will be inspected at least once in their first year of operation.

Enforcement

The Enforcement Section staff follows up with an enforcement action when a CFO has a serious or unresolved violation.

The CFO rule requires that CFO operations apply manure to their fields on the basis of the nitrogen needs for the crop to be grown or the soil's phosphorus content. Previously, manure was applied to fields based only on nitrogen needs for the coming crop. Fields with soil test phosphorus levels of 0 to 50 parts per million (ppm) may use nitrogen based manure application levels. Current regulations require that manure application on soils with soil test phosphorus levels greater than 50 ppm and not to exceed 200 ppm be based on the phosphorus content of the manure, soil, and on the crop to be grown on the field. If soil test phosphorus levels are greater than 200 ppm, manure from a CFO may not be applied to that land. That means that farmers will need to monitor soil phosphorus concentrations and work to begin the gradual process of reducing the phosphorus content of their fields. Additionally, there are rules specific to CFO operators regarding winter manure application and soil phosphorus. Under these regulations, manure application on frozen or snow-covered ground is not permitted with exceptions for emergency situations. Operators can apply for special permits that allow for winter application if a farm was previously permitted with less than 120 days of manure storage. CAFO sized operations are prohibited from spreading manure on frozen or snow-covered ground uless they get an Individual NPDES permit under 327 IAC15-16. https://www.in.gov/idem/cfo/

Fertilizer and Detergent Regulations - Thirty-five years ago, Indiana became the first state in the nation to protect its lakes and waterways by prohibiting the use of laundry detergents containing phosphorous under IC 13-18-9 and, in 2012, the state legislature extended the phosphorus ban to detergents used in residential automatic dishwashers. On July 28, 2010, the Indiana rule, *Certification for Distributors and Users of Fertilizer Materials,* 355 IAC 7-1.1, went into effect. The date for full compliance with the requirements of this rule was January 1, 2012. The purpose of this rule is to ensure that fertilizer users are competent to apply and handle these materials safely and effectively and in a manner that minimizes negative impacts on water quality and the environment.

Storm Water Runoff Programs

- Municipal Separate Storm Sewer Systems (MS4s)
  MS4s are required to develop Storm Water Quality Management Plans (SWQMPs) as part of their permit requirements. As part of their Public Education component, MS4s have taken an active role to educate the general public and commercial industry on the use of fertilizer, including the use of phosphorous free options. In addition to these education efforts, MS4s are required to address this issue on those facilities that they own and/or operate. The rule specifically states "minimization of pesticide and fertilizer use." While this is a basic non-descriptive requirement, MS4s have incorporated this element into their SWQMPs. As the Storm Water Program re-evaluates future requirements, this topic will continue to be assessed and where appropriate and applicable, provisions and requirements will become part of the regulation.

- Construction Site Run-off
  There are no specific regulatory requirements in the Rule regarding the application of nutrients on active construction sites during the stabilization of the site. However, the technical standards and specifications in the *Indiana Storm Water Quality Manual* encourages utilization of soil tests and lower application rates for fertilizer. Additionally, the premise of the Construction Site Run-off regulation is reducing sediment discharges, which in turn reduce the discharge of nutrients (phosphorous).

- Industrial Site Run-off
  Due to the diversity and uniqueness of industrial facilities, it is problematic to develop a "one size fits all" approach. Therefore, IDEM deals with such facilities on a case-by-case basis. Issues that are considered in such an approach include, but are not limited to, concentration and loading of the discharge, the applicable aspects (flow, impairments, downstream uses, etc.) of the receiving stream, and the facilities' treatment capabilities.

Non-Point Source/Non-Regulated (Voluntary) Programs

Indiana has an impressive infrastructure in place that serves to educate conservation partners and the public. This infrastructure, which exists in the form of state and federal entities, is the most important tool we have in our "toolbox". By organizing educational and outreach events, helping to leverage state and federal funds, offering technical assistance and expertise, and providing cost-share programs to those wishing to put conservation practices on the ground, state and federal employees are directly promoting grass roots solutions to environmental issues by empowering agri-business, educational institutions, farmers, landowners, watershed groups and other environmental organizations to be a part of the solution. While the majority of these programs and initiatives directly improve water quality by reducing sediment and/or nutrient loss or runoff, many others have similar benefits through wildlife habitat improvement and soil health improvements.

The State departments of the ISDA, IDNR and IDEM are all invested in the continued growth and promotion of grants and programs that improve the state's water quality. Such efforts include the Conservation Reserve Enhancement Program (CREP), INField Advantage (INFA), Indiana's own Clean Water Indiana (CWI) funds, the Lake and River Enhancement Program (LARE), and the Healthy Rivers Initiative (HRI). Other programs, practices and grants include those funded by the CWA Sections 106, 319(h) and 205j monies awarded to the State by the US Environmental Protection Agency (EPA).
Farm bill programs are also available through the USDA NRCS and the FSA which offer cost-share of best management practices that reduce runoff, increase nutrient uptake and improve the health of our soils.
These and other grant-funded or cost-share programs are described below.

Indiana State Department of Agriculture (ISDA)

Conservation Reserve Enhancement Program (CREP) - The Conservation Reserve Enhancement Program (CREP) is a voluntary federal and state natural resource conservation program that aims to improve water quality and address wildlife issues by reducing erosion, sedimentation and nutrients, and enhancing wildlife habitats within specified watersheds in the Wabash River System. This program is designed to help alleviate some of the concerns of high nonpoint source sediment, nutrient, pesticide, and herbicide losses from agricultural lands by restoring grass and riparian buffers and wetlands to improve water quality, as well as to protect land from frequent flooding and excessive erosion by planting hardwood trees in floodplain areas along rivers and streams. CREP continues to address a major milestone of the ISDA and the USDA Farm Service Agency (FSA), showcasing Indiana's progressive and meaningful implementation of conservation practices to protect Indiana's soil, water and related natural resources, and to help alleviate hypoxia in the Gulf of Mexico.

CREP in Indiana was first announced in 2005 across three HUC 8 watersheds in the state. The program expanded in 2010 to include eleven HUC 8 watersheds in Indiana, covering a total of 65 Indiana counties. (Figure 18)

As of October 2018, over 14,551 acres of buffers, wetlands and trees have been implemented in floodplains and along bodies of water protecting to date over 698 linear miles of water ways. Over 17,216 acres have been enrolled in the program. The ISDA, and its partners have invested over $6 million in state funds to implement these conservation practices, and for every state dollar that is invested, $5-$13 federal dollars are matched through the Conservation Reserve Program (CRP) incentives available through the FSA. The goal of the program is to enroll 26,250 acres of buffer land, and to protect a minimum of 3,000 linear miles of waterbodies in the Wabash River System.

ISDA employs a CREP Program Manager and has staff in each watershed that focus on expanding the program in order to get more buffers, wetlands and floodplain tree plantings established and to reach the water quality goals of the program. Promotional materials have been developed and are used by ISDA staff and conservation partnership staff in the eligible watersheds. The State Soil Conservation Board supports the CREP by appropriating $660,000 each year to get the remaining acres of buffers installed. In 2017, The Nature Conservancy (TNC) committed $300,000 over the next 5 years in support of expanding the Indiana CREP progam.

Information about the Conservation Reserve Enhancement Program can be found here: http://www.in.gov/isda/2377.htm.

Through CREP, program participants receive financial incentives from the ISDA and the FSA to voluntarily enroll in the program and implement conservation practices on environmentally sensitive land. Eligible practices include:

- Permanent Native Grasses
- Hardwood Tree Planting
- Wildlife Habitat
- Riparian Forest Buffers
- Grassed Filter Strips
- Bottomland Timber Establishment
- Wetland Restoration

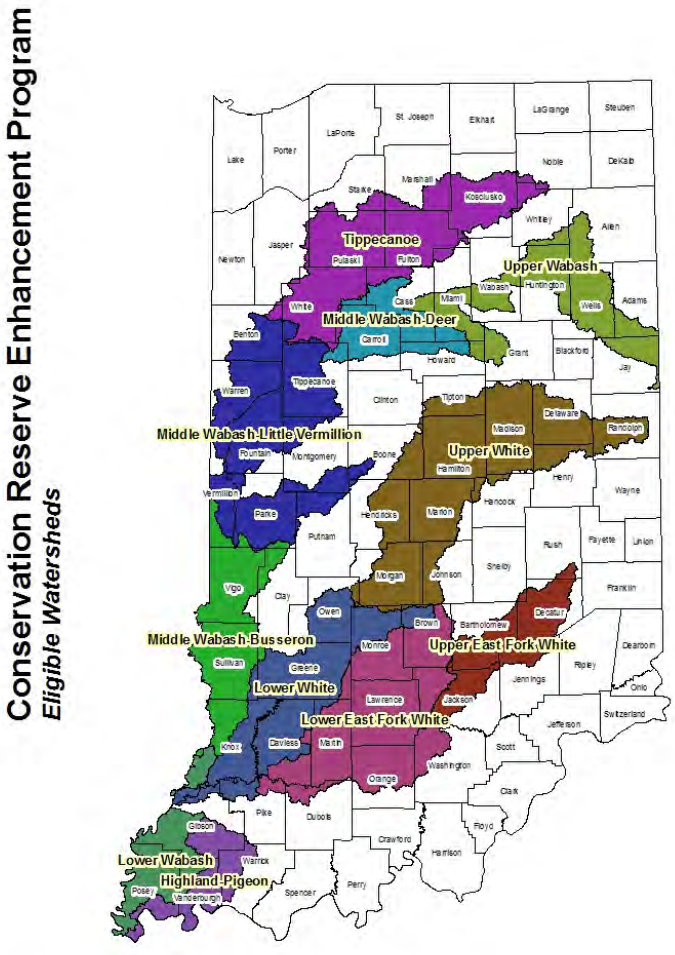


Figure 18 – Indiana CREP Watersheds

INfield Advantage (INFA) - INfield Advantage provides participants access to tools to collect and analyze on-farm, field specific data. Peer to peer group discussions, local aggregated results, and collected data allows participants to make more informed decisions and implement personalized best management practices.

The program started in 2010 as a pilot project in Jasper County in northwest Indiana. It has expanded to include many areas of the state. In 2018 the program enrolled over 1,000 fields in more than 60 counties. (Figure 19)

INFA offers growers the chance to participate in multiple projects depending on their own specific concerns. Many growers will enroll fields in more than one study. Current projects include: nutrient management, for either corn or beans; the impact of cover crops, both late season seeding or inseason interseeding; and manure management.

INFA is available to growers as a resource and a conduit to diverse on-farm research, innovative ideas and technologies. INFA collaborates with local, regional and national partners to help Indiana farmers improve their bottom line, adopt new management practices, protect natural resources, and benefit their surrounding communities.

When surveyed, growers find the program very useful with over 60% of them agreeing that participation is impacting their management practices and nearly half believing participation has increased their profitability.

In the future, INFA will continue to prioritize providing high level services to farmers with support from the Indiana Conservation Partnership, Indiana Corn Marketing Council/Indiana Soybean Alliance and Indiana Pork.

Information about the INfield Advantage program can be found at http://www.infieldadvantage.org/.

Figure 19 - 2018 INField Advantage (INFA) map

Clean Water Indiana (CWI) - The Clean Water Indiana (CWI) Program was established to provide financial assistance to landowners and conservation groups. The financial assistance supports the implementation of conservation practices that reduce nonpoint sources of water pollution through education, technical assistance, training, and cost sharing programs. The program is responsible for providing local matching funds as well as competitive grants for sediment and nutrient reduction projects through Indiana's SWCDs. CWI also contributes critical state matching funds for Indiana's CREP. Furthermore, the (CWI) Program has supported the Conservation Cropping Systems Initiative which focuses on a management systems approach to crop production that results in improved soil and water quality as well as profitability on Indiana cropland.

In 1999, the Clean Water Indiana Program was created by a unanimous vote of the Indiana General Assembly by amending the Indiana District Law to add this program authority (IAC-14-32-8). The purpose of the CWI Program is to provide assistance to help protect and enhance Indiana's streams, rivers and lakes by reducing the amount of polluted storm water runoff from urban and rural areas entering surface and ground water. The CWI program did not receive funding to carry out the program until 2001. The CWI is supported by a portion of the Indiana Cigarette Tax Revenue on a biannual basis.

The ISDA-Division of Soil Conservation administers the CWI dollars appropriated by Indiana legislators under the direction of the SSCB. For the competitive grants, the soil and water conservation districts are required to submit a CWI Project(s) proposal for approval by the SSCB on an annual basis with the intention for the grant money to be used within two years from approval. Each SWCD has an assigned District Support Specialist through ISDA to provide support in developing CWI projects, as well as to aid in district capacity building, including grant writing assistance, developing business plans, and sharing marketing opportunities.

Since the start of the program funding in 2001, millions of CWI dollars have been utilized by the SWCDs to implement local projects, also resulting in thousands of dollars of cash and in-kind support. The districts use the grant money in three areas: Cost Share, Professional Assistance, and Adult Education. Examples of past projects include using the funds for:

1) cost-share/incentives for applying conservation practices, such as cover crops;
2) purchase of equipment for the purpose of renting it to land users for applying conservation practices, such as warm season grasses;
3) contracting for technical assistance to survey, design, and oversee construction of engineered conservation practices, such as grassed waterways and grade stabilization structures; and
4) non-point source pollution prevention related information materials, planning assistance and projects.

Information on past and current CWI projects can be found on the ISDA website at http://www.in.gov/isda/2379.htm. Successful projects such as those listed on the website, and the continued support of current and local CWI projects mean that the goals and objectives of the SSCB Business Plan, as mentioned in Section 9, are being addressed and accomplished.

Indiana Department of Natural Resources (IDNR)

Lake and River Enhancement (LARE) Grant - http://www.in.gov/dnr/fishwild/2364.htm
The Lake and River Enhancement program is part of the Aquatic Habitat Unit of the Fisheries Section in the Division of Fish and Wildlife, Indiana Department of Natural Resources (IDNR). The LARE program goals include operating a scientifically-effective program in a cost-efficient manner to protect and enhance aquatic habitat for fish and wildlife, and to insure the continued viability of Indiana's publicly accessible lakes and streams for multiple uses, including recreational opportunities. This is accomplished through grant projects that reduce non-point sediment and nutrient pollution of surface waters to a level that meets or surpasses state water quality standards.
LARE grants are prioritized towards activities involving publicly accessible lakes and rivers, and involve organizations having the resources and ability to properly administer the funds. This includes non-profit organizations such as formally established lake associations, and governmental entities including cities, counties, conservancy districts, soil and water conservation districts, as well as other local units of government.

Approved grant funding may be used for one or more of the following purposes:

1. Investigations to determine what problems are affecting a lake/lakes or a stream segment.
2. Evaluation of identified problems and effective action recommendations to resolve those problems.
3. Cost-sharing with land users in a watershed above upstream from a project lake or stream for installation or application of sediment and nutrient reducing practices on their land.
4. Matching federal funds for qualifying projects.
5. Feasibility studies to define appropriate lake and stream remediation measures.
6. Engineering designs and construction of remedial measures.
7. Water quality monitoring of public lakes.
8. Management of invasive aquatic vegetation
9. Sediment removal from qualifying lakes.
10. Logjam removal from qualifying rivers.

Participation in the program requires the submittal of an application form for each program element. There are five different kinds of LARE grants awarded annually by the Director of IDNR:

Biological and Engineering Project Grants
These "traditional" LARE grants, awarded since 1989, are available on a competitive basis for several actions that can address the ecology and management of lakes and rivers and their watersheds. Depending on the needs of the waterbody, funds can be granted for:

1) Lake or River Watershed Diagnostic Study,
2) Engineering feasibility study of proposed measures,
3) Design and/or construction projects for specific sediment or nutrient control measures,
4) Bioengineering for bank stability, and
5) Biomonitoring.

Watershed Land Treatment Project Grants
Grants are awarded to Soil and Water Conservation Districts (SWCD's) who work with local landowners to install or adopt various conservation measures directly on the land in targeted watersheds. Technical assistance in the design and installation is provided by personnel of NRCS, ISDA and the SWCD's.

Sediment Removal Plan Development or Sediment Removal Grants
Grant funds may be used to contract for the production of a sediment removal plan or, if such a plan has already been prepared, for funds to be used for a sediment removal project. A sediment removal plan is a prerequisite to acquiring grant funds for actual sediment removal projects.

Exotic Plant or Animal Control Grants
Grant funds may be used for the development of aquatic vegetation management plans or, if such a plan has already been prepared, for actual control of invasive vegetation in lakes or rivers. An aquatic vegetation management plan is a prerequisite to acquisition of grant funds for actual vegetation control. Efforts are limited to management and control of invasive vegetation, not native plants that are considered a nuisance.

Logjam Removal Grants
Grant funds may be used to removal logjam from qualifying rivers.

The funds used to pay costs incurred by the DNR in implementing the LARE projects is paid by Indiana boat owners in their annual registration. The state of Indiana will continue to push for continued funding appropriated to the LARE Program by the State Legislature so that the program grants can be used to target nutrient reduction efforts and to meet IDEM's water quality targets in watersheds throughout Indiana.

Healthy Rivers Initiative (HRI) – Since 2010, the Healthy Rivers Initiative has been one of the largest land conservation initiatives to be undertaken in Indiana. The HRI exists as a partnership of agencies and organizations who work with willing landowners to permanently protect over 43,000 acres in the Wabash River and Sugar Creek floodplains of west-central Indiana, and over 26,000 acres of the Muscatatuck River bottomlands in southeast Indiana (Figure 20). These projects involve the protection, restoration and enhancement of water quality as well as riparian and aquatic habitats. This initiative benefits threatened and migratory species that rely on those habitats, and benefits the public and surrounding communities by providing flood protection, ground water protection and improved water quality. The program also provides recreational opportunities for current and future generations who enjoy our water resources.

Since June of 2010, the HRI program has protected 39,743 acres in the Wabash River and Sugar Creek floodplains and the Muscatatuck River bottomlands in Indiana.

Over 62 river miles have now been protected in the Wabash River and Sugar Creek area, and in the Muscatatuck River area within the HRI project area.

All of these areas are managed by the IN Department of Natural Resources.

Eight key objectives have been identified for the Healthy Rivers Initiative. They are:

- Provide a model that balances forests, farmed lands and natural resources conservation.
- Connect separated parcels of public land to benefit wildlife.
- Restore and enhance areas of land along the Wabash River, Muscatatuck River and Sugar Creek
- Protect important habitat for wildlife
- Open land to the public for recreational activities, such as fishing, hunting, trapping, hiking, canoeing, bird watching and boating
- Protect important rest areas for migratory birds
- Establish areas for nature tourism
- Provide clean water and protection from flooding to landowners downstream

Through reforestation, wetlands restoration and other habitat management efforts, this initiative will reduce nutrient runoff and sediment from erosion that impact downstream waterways. These efforts will also provide better management of the backbone of the agricultural drainage system. The initiative will increase IDNR-owned riparian wetlands by 64%. Wetlands provide habitat for fish and wildlife, including threatened and endangered species; improve water quality by filtering sediments and chemicals; reduce flooding; recharge groundwater; protect biological diversity; and provide opportunities for educational, scientific and limited recreational activities.

For more information on the Healthy Rivers Initiative, visit the website at http://www.in.gov/dnr/6498.htm.

Healthy Rivers INitiative

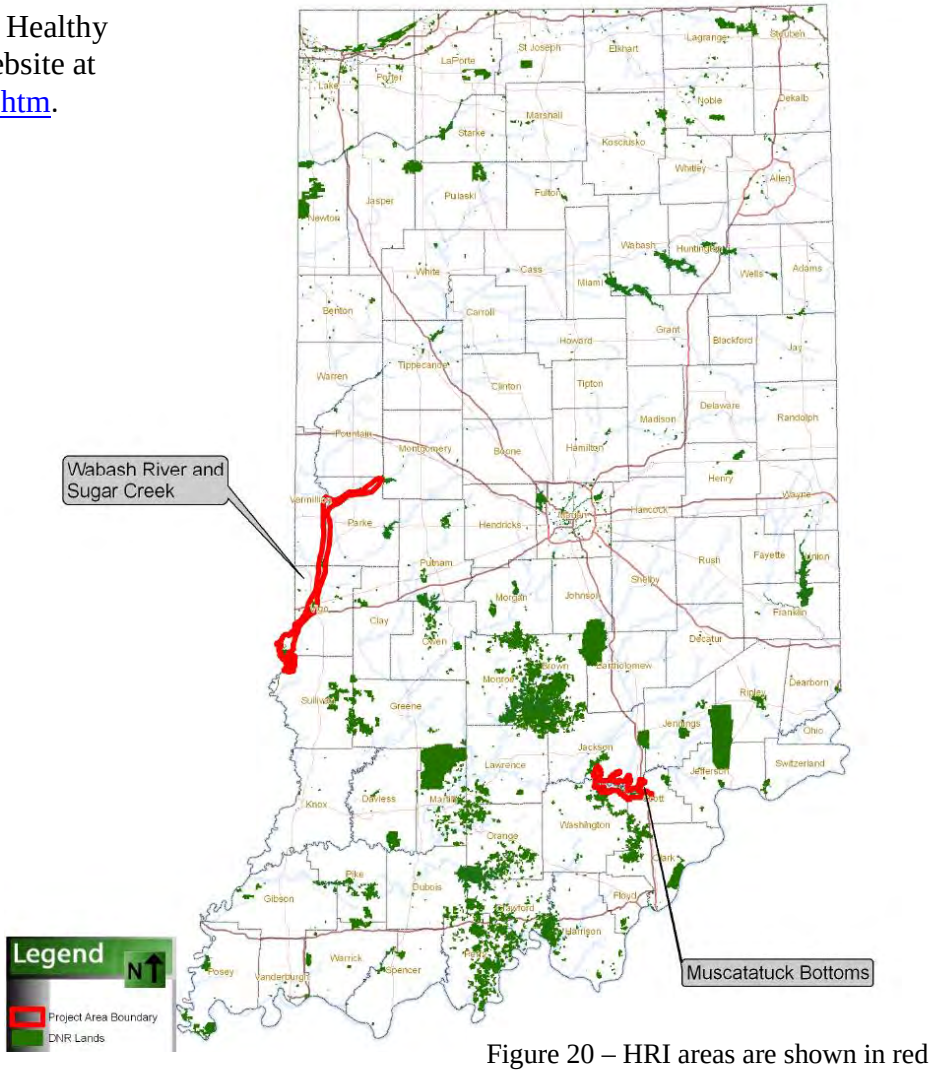


Figure 20 – HRI areas are shown in red

Indiana Department of Environmental Management (IDEM)

IDEM Section 319 (h) Grant Funding **-** The Federal Clean Water Act (CWA) Section 319(h) provides funding for various types of projects that work to reduce nonpoint source water pollution. The Indiana State Nonpoint Source Management Plan guides the usage of the CWA Section 319 funds received by IDEM from the EPA. Funds may be used to conduct assessments, develop and implement TMDLs and watershed management plans, provide technical assistance, demonstrate new technology and provide education and outreach. Organizations eligible for funding include nonprofit organizations, universities, and local, State or Federal government agencies. A 40 percent (non-federal) in-kind or cash match of the total project cost must be provided. (Figure 21)

Projects are administered through grant agreements that spell out the tasks, schedule and budget for the project. Projects are normally two to three years long and work to reduce nonpoint source (NPS) pollution and improve water quality in the watershed primarily through:

- Education and outreach designed to bring about behavioral changes and best management practice (BMP) implementation that leads to reduced nonpoint source pollution;
- The development of watershed management plans that meet EPA's required nine elements; and,
- The implementation of watershed management plans through a cost-share program focusing on BMP implementation that address water quality concerns.

As a requirement of the 319 program, IDEM submits a NPS Program Annual Report to EPA. This is a comprehensive report that includes input from and cooperation with state, federal, local, and private partners, which is critical to Indiana's NPS Program's success. IDEM's NPS Program utilizes multiple partnerships to reach diverse stakeholder groups and further NPS management goals in Indiana. Annual reports including the most recent may be found at http://www.in.gov/idem/nps/3475.htm.

IDEM Section 205j Grant Funding – (http://www.in.gov/idem/nps/2525.htm) The federal Clean Water Act Section 205(j) provides funding for water quality management planning, which is then allocated by each state. The act states that the grants are to be used for water quality management and planning, including, but not limited to:

- Identifying most cost effective and locally acceptable facility and non-point source measures to meet and maintain water quality standards;
- Developing an implementation plan to obtain state and local financial and regulatory commitments to implement measures developed under subparagraph A;
- Determining the nature, extent, and cause of water quality problems in various areas of the state. In previous cycles, grants have been awarded to municipal governments, county governments, regional planning commissions, and other public organizations.

Projects are administered through grant agreements that spell out the tasks, schedule, and budget for the project. For both 205j and 319h projects, IDEM project manager's work closely with the project sponsors to help ensure that the project runs smoothly and the tasks of the grant

agreement are fulfilled. Site visits are conducted at least quarterly to touch base on the project, provide guidance and technical assistance as needed, and to work with the grantee on any issues that arise to ensure a successful project closeout. (Figure 21)

In recent years, Indiana has generally received around three and a half million dollars each year for 319 grant funding. Since 1994, Indiana has directed over 40 million dollars of its USEPA 319 nonpoint source grant funding to projects related to reducing nutrient loads to Indiana's surface waters.

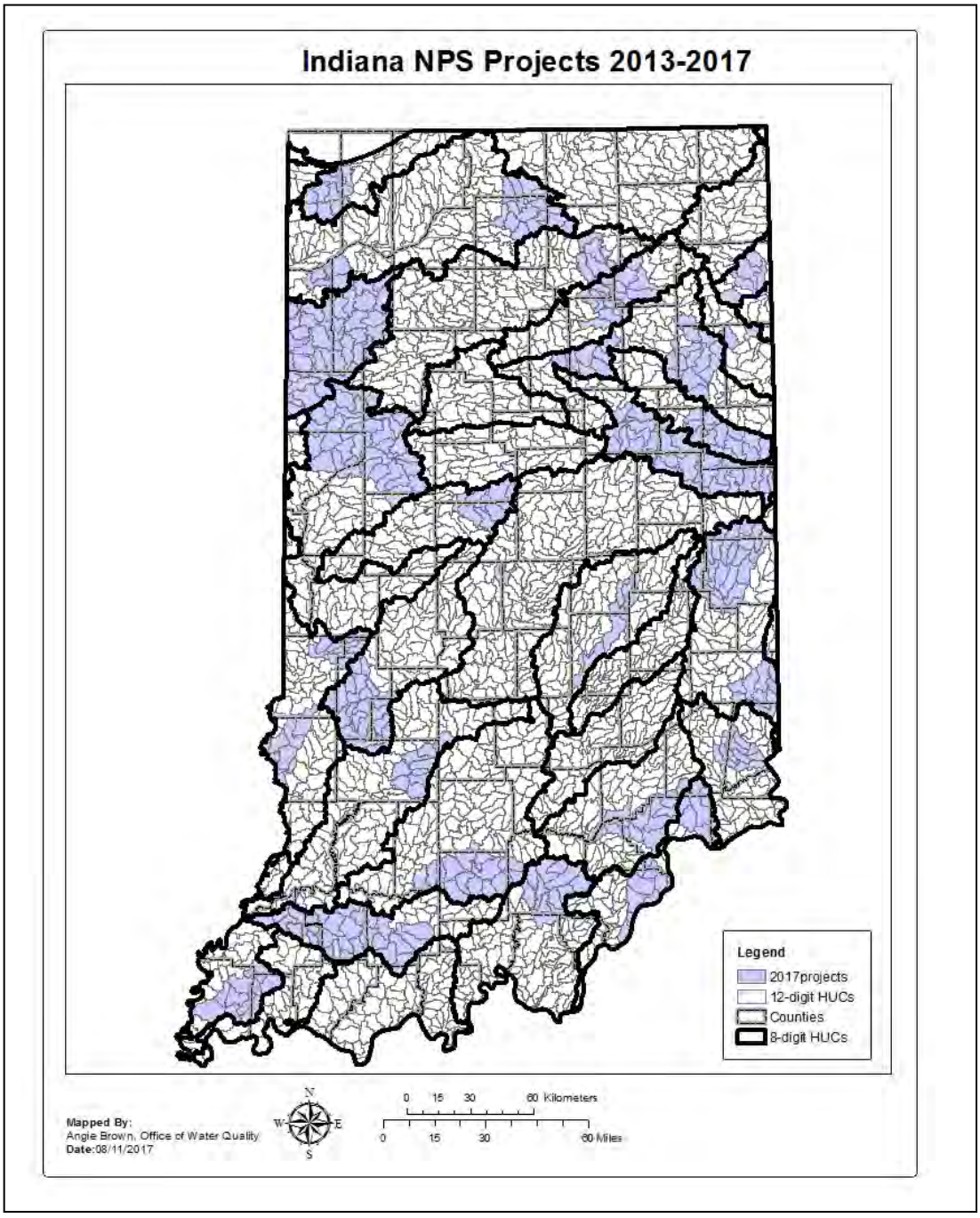


Figure 21 - NPS Water Quality Improvement Projects funded by 319(h) and 205(j) in 2017.

Clean Water Act (CWA) Section 106 Supplemental Funding - The federal Clean Water Act (CWA) Section 106 provides funding for a wide range of water quality activities identified in *Indiana's Water Quality Monitoring Strategy 2017-2021* as representing monitoring needs that have not been met or one that warrants enhancing. These activities may include water quality planning and assessments, ambient monitoring of surface water and wetlands, or monitoring ground water to name a few. IDEM utilizes CWA Section 106 Supplemental funding to support many water quality activities, including the Ground Water Monitoring Network (GWMN), which is first mentioned on page 31, and is managed through IDEM's Drinking Water Branch, Ground Water Section.

The long-term goals of the statewide GWMN include:

- Determining the quality of ground water in the state's 20 aquifer represented hydrogeologic settings;
- Identifying areas of notable contamination, which would include nonpoint source nutrients of concern such as nitrate-nitrite, pesticides and pesticide degradants;
- Determine potential nonpoint source pollution ground water to surface water pathways;
- Work with stakeholder groups to reduce ground water to surface water nonpoint source pollution to below a level of significance, and;
- Monitor ground water quality trends statewide within the state's 20 hydrogeologic settings.

The statewide GWMN will meet these goals through:

- Analysis of the ground water information gathered for the GWMN, which includes analysis for analytes such as nitrate-nitrite, pesticides and pesticide degradants in ground water; and identifying areas where ground water could contribute to nutrient rich surface waters;
- Identification and determining possible migration pathways of nutrient impaired ground water contributing to impaired surface waters;
- Defining appropriate stakeholders to assist in future land management practice decisions to manage nutrients that may infiltrate from the surface down to ground water;
- Begin the conversation with partner stakeholders to find long-term mitigation measures to improve urban and rural nutrient management practices;

Understanding the nutrient contributions of ground water into the overall hydrologic cycle will assist Indiana in addressing the primary goal of the Federal Clean Water Act (CWA) to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The ground water component to this cycle of water plays a fundamental role in this vast effort. The statewide GWMN goals and data collected to date for the statewide GWMN effort can be viewed at http://in.gov/idem/cleanwater/2453.htm.

Other funding activities under CWA Section 106 include:
The following projects were funded prior to 2016:

- Fall Creek Watershed Initiative and the Plummer Creek Baseline studies. This study provided an evaluation of the study design for watershed characterization monitoring, which has been incorporated into IDEM's monitoring programs and budget.

- Cyanobacteria monitoring at public beaches pilot project, which launched IDEM's incorporation of this monitoring into its programs and budget. This also included training on Plankton identification.
- Clean Lakes Program cyanobacteria monitoring.
- IDEM diatom identification and enumeration, which has been adopted into IDEM's probabilistic monitoring program. This also included verification for diatom quality assurance from Georgia College.
- External Data Framework web-based tools and resources. The EDF was launched in 2015.
- Qualitative Habitat Evaluation Index training and data analysis, which is incorporated in IDEM's probabilistic and certain targeted monitoring projects.
- IDEM Fixed Station trend analysis by USGS.
- National Lakes Assessment conducted by Indiana University School of Public and Environmental Affairs.
- Assessment Information Management System data entry module and enhancements, which is the database IDEM uses for all water quality data and uploads to the EPA national database STORET.
- Low-flow statistics and ungaged streams' analysis by USGS.
- Reference sites and index of biotic integrity modernization for IDEM's biological monitoring studies.
- Fish and macroinvertebrate quantitative biological condition gradient and stressor analysis for macroinvertebrate biological response signatures to improve IDEM's assessment capacity.

<u>The following projects were funded in FFY2016 and beyond:</u>

- **Nutrients/Diel Dissolved Oxygen Pilot Study**
  - IDEM is using FFY 2016 Supplemental 106 funding for a pilot study to further trace the steps from nutrients to periphyton (as chlorophyll-a), from periphyton to dissolved oxygen, and from dissolved oxygen to aquatic macroinvertebrates and fish community response measures, with the goal of identifying benchmarks at each step that would help define where a given water body is positioned along a continuum of enrichment. Diel dissolved oxygen concentration swing is being evaluated for the potential as a secondary response indicator to help further refine nutrient thresholds based on biological community response. Time-series dissolved oxygen data loggers were purchased and deployed for the pilot study and are now additionally being deployed at a subset of Probabilistic Monitoring Program sites to further our understanding toward nutrient criteria development for rivers and streams.
- **Phase 1: Implementation of StreamStats for Regional Flow-Duration Curves for Indiana and Illinois**
  - The primary product of phase 1 will be the StreamStats website for Illinois and Indiana. The specific output of the StreamStats website for a site of interest will be a table of the computed streamflow statistics, as well as the basin characteristics used by the regression equations for the selected site. An updated version of SIR 2014-5177 will be published that describes the development of the new flow-duration regression equations for IL region 3 and IN region 2. StreamStats will be released for public use following publication of the final regression equations in the revised

scientific investigations report. The table of flow duration quantiles produced during Phase 1 can be used to manually construct load duration curves (LDC). However, in order to plot discrete water quality samples on this LDC, the user would still need a measure of discharge on the day of sampling.

- **Phase 2: Estimation of Mean Daily Streamflow at Rural, Unregulated Streams in Indiana and Illinois within SteamStats.**
  - The primary product of Phase 2 will be a tool within StreamStats to estimate daily streamflow for a specified period of interest at an ungaged site that is within the limits of the data used to develop the flow-duration regression equations. The primary publication of phase 2 of this project will be a brief SIR to discuss the application of the QPPQ method in Illinois and Indiana and to describe the use and features of the enhanced StreamStats web site. Determination of information from Phase 1 provides daily record automation in phase 2.
- **Index of Biotic Integrity (IBI) for Diatom Communities**
  - IDEM is using FFY 2018 Supplemental 106 funding to enhance Indiana's monitoring strategy by adding another core indicator (diatom community structure) used to assess aquatic life use in IDEM's Integrated Report, thus satisfying 305(b) and 303(d) reporting requirements to U.S. EPA. Creating an additional Index of Biotic Integrity for diatoms provides greater confidence in IDEM's bioassessments. The addition of a diatom IBI will provide a more accurate assessment of ecological effects thus improving IDEM's diagnostic ability to identify causes of degradation in water quality.
- **System enhancements to update the Assessment and Information Management System (AIMS) with Biological Condition Gradient (BCG) calculations**
  - IDEM is using FFY 2018 Supplemental 106 funding to work with a contractor who will provide AIMS system enhancements by adding the BCG calculations for fish and macroinvertebrate community samples. Adding the BCG calculations to the database will set the framework for Tiered Aquatic Life Use investigation and produce another tool to evaluate biological integrity for aquatic life use assessments.
- **Development of Technical Assistance Content for the External Data Framework (EDF)**
  - In 2012, IDEM used CWA Supplemental 106 funds to hire D.J Case Associates to develop technical assistance content for the External Data Framework – materials to help participants as well as Nonpoint Source Program project sponsors better understand the content required in a quality assurance project plan (QAPP) for monitoring projects.
- **Building an Online Tool for the Development of Quality Assurance Project Plans (QAPP) for External Data Framework Participants (EDF) and Nonpoint Source Program (NPS) Projects**
  - IDEM is using FFY 2016 Supplemental 106 funding to make the technical assistance content developed through its 2012 CWA Supplemental 106 project available online to EDF participants and NPS project sponsors through an online tool to help them more easily document the quality of the data they collect. IDEM has developed a template to help NPS projects develop their QAPPs. However, doing so remains a cumbersome and low tech process in which there is a large assumption of knowledge presented to the user. This assumption can lead to incomplete forms, incorrect data, or

frustration by the user who ultimately might not complete the process. All of this discourages EDF participants from providing the data quality documentation IDEM needs to more thoroughly evaluate their data.

- **Statistics Training**
  - IDEM is using FFY 2016 Supplemental 106 funding to provide a three-day statistics training course in December 2018 with a focus on water quality issues, followed by individualized consulting with the instructor to address staff questions regarding the specific analyses they are working on. This training will provide hands-on training and develop expertise for scientists who interpret environmental and ecological data and present their findings to others. In addition to building the capacity for in-house analyses of water quality trends with IDEM data, the training is expected to facilitate the analysis of other datasets received through IDEM's External data Framework and will help to address a number of gaps identified in IDEM's Water Quality Monitoring Strategy resulting from the need for statistical approaches for evaluating data collected.
  - FY2017-2018 Supplemental 106 funding for Indiana's participation in the United States EPA's 2018/19 National Rivers and Streams Assessment (NRSA) in order to characterize the condition of rivers and streams based on chemical, physical and biological data.

USDA, Natural Resources Conservation Service (NRCS)

Private citizens own over 90 percent of the land in Indiana which includes nearly 15 million acres of farmland and about 4 million acres of forestland, making stewardship and conservation absolutely critical to the health of our environment. The following Farm Bill programs available through the USDA, Natural Resources Conservation Service and the USDA, Farm Service Agency offer cost-share assistance for best management practices that reduce runoff, increase nutrient uptake and improve the health of our soils.

USDA
United States Department of Agriculture

Conservation Stewardship Program (CSP) - The Conservation Stewardship Program (CSP) is a voluntary program that encourages agricultural producers to improve conservation systems by improving, maintaining, and managing existing conservation systems and adopting additional conservation activities to address priority resource concerns, including soil, air and habitat quality, water quality and quantity, and energy conservation. The Natural Resources Conservation Service administers this program and provides financial and technical assistance to eligible producers. CSP is available on Tribal and private agricultural lands and non-industrial private forestland on a continuous application basis. Participants can earn CSP payments for conservation performance – the higher the performance, the higher the payment. For more information visit the Indiana NRCS CSP website at:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/in/programs/financial/csp/

Environmental Quality Incentives Program (EQIP) -The EQIP program is a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as national goals. EQIP offers financial and technical assistance to farmers to address natural resource concerns through the development of a conservation plan on their farm(s), and financial assistance to install conservation management practices on eligible agricultural land, such as soil health practices like cover crops and no-till, nutrient management, livestock/animal waste systems, livestock watering facilities, pastureland management, wildlife enhancement and forestry management. For more information visit the Indiana NRCS EQIP website at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/in/programs/financial/eqip/.

NRCS Easement Programs

Agricultural Conservation Easements Program (ACEP) – The Agricultural Conservation Easement Program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect and enhance enrolled wetlands. The ACEP consolidates three former programs – the Wetlands Reserve Program, Grassland Reserve Program, and the Farm and Ranchland Protection Program.
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/in/programs/easements/acep/?cid=stelprdb1248149

- ***Wetland Reserve Program (WRP***) – The Wetland Reserve Program is another voluntary conservation program that allows landowners to enroll sensitive land to help restore, protect and enhance wetland restorations. It is the Nation's premier wetlands restoration program. WRP provides habitat for fish and wildlife, including threatened and endangered species, improves water quality by filtering sediments and chemicals, reduces flooding, recharges groundwater, protects biological diversity and provides opportunities for educational, scientific and limited recreational activities. Through this program landowners can enroll eligible land through Permanent Easements, 30-year Easements, Term Easements or 30-year Contracts. This program is part of the new Agricultural Conservation Easement Program under the new Farm Bill.

Agricultural Land Easements (ALE) – NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. The program also protects grazing uses and related conservation values by conserving grassland, including rangeland, pastureland and shrubland. Eligible partners include American Indian tribes, state and local governments and non-governmental organizations that have farmland, rangeland or grassland protection programs.

NRCS Program Initiatives

Regional Conservation Partnership Program (RCPP) - The Regional Conservation Partnership Program (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers

through partnership agreements and through program contracts or easement agreements. Assistance is delivered in accordance with the rules of EQIP, CSP, ACEP and HFRP; and in certain areas the Watershed Operations and Flood Prevention Program. (Figure 22 and 23) http://www.nrcs.usda.gov/wps/portal/nrcs/detail/in/programs/farmbill/rcpp/?cid=stelprdb1248173

Mississippi River Basin Initiative (MRBI) - To improve the health of the Mississippi River Basin, including water quality, wetland restoration, and wildlife habitat, the NRCS has established the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Through this Initiative, NRCS and its partners will help producers voluntarily implement conservation practices in targeted watersheds within the Mississippi River Basin. (Figure 22 and 23) http://www.nrcs.usda.gov/wps/portal/nrcs/detail/in/programs/landscape/?cid=nrcs144p2_031031

National Water Quality Initiative (NWQI) - The National Water Quality Initiative has a presence in a small HUC-12 watershed in the Eagle Creek watershed within the Upper White (HUC-8) watershed in Indiana. The designation facilitates a multi-agency partnership monitoring the effectiveness of conservation practices in the watershed. (Figure 22 and 23). http://www.nrcs.usda.gov/wps/portal/nrcs/detail/in/programs/landscape/?cid=nrcs144p2_031016

Great Lakes Restoration Initiative (GLRI) - The Great Lakes Restoration Initiative (GLRI) was launched in 2010 with NRCS as one of a number of federal agency partners. GLRI helps NRCS accelerate conservation efforts on private lands located in targeted watersheds throughout the region. Through GLRI, NRCS works with farmers and landowners to combat invasive species, protect watersheds and shorelines from non-point source pollution, and restore wetlands and other habitat areas. Indiana GLRI funds are targeted in the Western Lake Erie Basin. (Figure 22 and 23)

Joint Chiefs Landscape Restoration Partnership - The goal of this Initiative is to improve the health and resiliency of forest ecosystems where public and private lands meet through a partnership between the Forest Service and NRCS. Indiana NRCS worked closely with the Forest Service and the Indiana Department of Natural Resources, Division of Forestry to select targeted priority forested watersheds to deliver by leveraging technical and financial resources through EQIP and coordinating activities on adjacent lands. (Figure 22 and 23) http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/home/?cid=STELPRDB1246412

Wetland Reserve Enhancement Program (WREP) – WREP is a special enrollment option under the Agricultural Conservation Easement Program's Wetland Reserve Easement component. Through WREP, states, local units of governments, non-governmental organizations and American Indian tribes collaborate with NRCS through cooperative and partnership agreements. These partners work with tribal and private landowners who voluntarily enroll eligible land into easements to protect, restore and enhance wetlands on their properties. (Figure 22 and 23)

Figure 22 – NRCS Special Projects/Initiatives in fiscal year 2018.
* The key to this map is located on the next page.

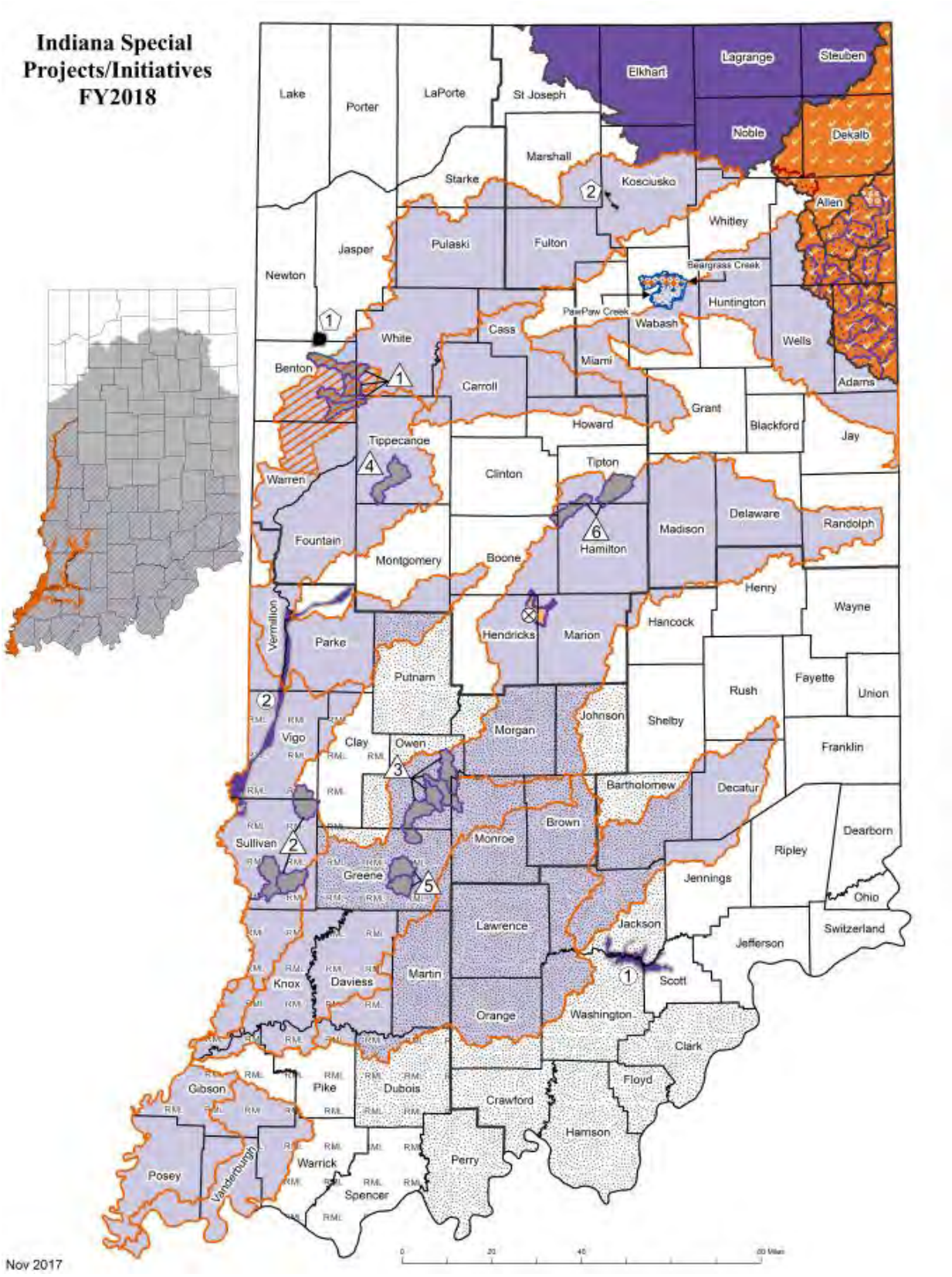


Figure 23 – NRCS Special Projects/Initiatives map key

Indiana Special Projects/Initiatives - FY2018

Initiative Projects

Great Lakes Restoration Initiative (GLRI)
Auglaize, St. Marys, St. Joseph-Maumee and Upper Maumee Watersheds

Mississippi River Basin Initiatives (MRBI)
1 - Big Pine Creek 3 - Fish Creek 5 - Plummer Creek
2 - Busseron Creek 4 - Little Wea Creek 6 - Cicero Creek

National Water Quality Initiative Watersheds (NWQI)
Eagle Creek

Western Lake Erie Basin Initiative
Auglaize, St. Marys, St. Joseph-Maumee and Upper Maumee Watersheds "same area as GLRI"

Wetland Reserve Enhancement Partnership (WREP)
Lower Wabash and Lower White River "see inset map"

USFS & NRCS Joint Chief's Landscape Restoration Partnership
Hoosier Hills & Highlands Oak Community Restoration Partnership

GLRI Phosphorus Initiative
Black Cr, Blue Cr, Bohnke Ditch-Hoffman Cr, Borum Run, Bottern Ditch-Maumee Rv, Buhiman Ditch-St Marys Rv, Bullerman Ditch-Maumee Rv, Blue Cr-St Marys Rv, Fairfield Ditch, Gales Ditch, Headwaters Blue Cr, Headwaters Hoffman Cr, Holthouse Ditch, Houlk Ditch, Marsh Ditch-Maumee Rv, Mariz Cr, Nicklesen Cr, Simmerman Ditch-St Mary Rv, Sixmile Cr-Maumee Rv, Snyder Ditch-St Marys Rv, Trier Ditch and Weber Ditch-St Marys Rv Watersheds

Regional Conservation Partnership Program (RCPP)

FY-14/15 RCPP

ND Cover Crop & 2-Stage Ditch
1 - Kirkpatrick Ditch 2 - Shatto Ditch

St. Joesph River Conservation Partnership

Western Lake Erie Phosphorus Reduction
Auglaize, St. Marys, St. Joseph-Maumee and Upper Maumee Watersheds

FY-16 RCPP

Big Pine Watershed
Big Pine Creek, Mud Pine Creek Watersheds

Soil Health on Reclaimed Mine Lands
RML Clay, Daviess, Dubois, Gibson, Greene, Knox, Pike, Spencer, Sullivan, Vigo and Warrick Counties

FY-17 RCPP

DNR Southern Young Forest
"see inset map"

Monitoring Projects

Agricultural Research Service Study Area
Upper Cedar Creek Watershed

GLRI USGS Edge of Field Monitoring
Black Creek

ICP & CCSI Paired Watershed Study
Beargrass Creek and PawPaw Creek Watersheds

School Branch Watershed Study
School Branch Creek Watershed

Partner Projects

Environmental Defense Fund CIG (EDF)
Beargrass Creek Watershed

Healthy River Initiative Areas (HRI)
1 - Muscatatuck River
2 - Sugar Creek and Wabash River

Ohio River Basin Trading Project
Great Miami, Middle Ohio, Ohio River and Wabash 8 Digit Watersheds "see inset map"

Conservation Reserve Enhancement Program (CREP)
Highland-Pigeon, Lower East Fork White, Lower Wabash, Lower White, Middle Wabash-Busseron, Middle Wabash-Deer, Middle Wabash-Little Vermillion, Tippecanoe, Upper East Fork White, Upper Wabash and Upper White Watersheds

USDA United States Department of Agriculture
Natural Resources Conservation Service
USDA is an equal opportunity provider, employer and lender

USDA, Farm Service Agency (FSA)

Conservation Reserve Program Funding **-** The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and Tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS and other ICP technical staff providing technical land eligibility determinations, Environmental Benefit Index Scoring, and conservation planning.

The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as native grasses, wildlife plantings, trees, filter strips, riparian buffers or wetlands. Farmers receive an annual rental payment for the term of a multi-year, 10-15 year contract. Cost sharing is provided to establish the vegetative cover practices.
http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/in/programs/financial/?cid=stelprdb1119594

Safe Acres for Wildlife Enhancement (SAFE) – This initiative is a voluntary program available under the Conservation Reserve Program (CRP) continuous sign-up, designed to address state and regional high priority wildlife objectives. This program targets habitat restoration for specific wildlife species designated by the U.S. Fish and Wildlife Service as threatened or endangered including the lesser prairie chicken, the New England cottontail, bobwhite quail, and grassland birds. Producers within a SAFE area can submit offers to voluntarily enroll acres in CRP contracts for 10-15 years. In exchange, producers receive annual CRP rental payments, incentives and cost-share assistance to establish, improve, connect or create higher-quality habitat. http://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2015/CRPProgramsandInitiatives/State_Acres_for_Wildlife_Enhancement_SAFE_Initiative.pdf

Agricultural Initiatives

The many programs and initiatives mentioned above are resources that can be used to encourage voluntary use of incentive based conservation by landowners both rural and urban to achieve a positive impact on nutrient reduction. In addition, there are many other agricultural initiatives and efforts taking place in Indiana by the ICP and other conservation organizations, and by non-governmental organizations that are practical and cost-effective.

For example, the NRCS soil health campaign consists of diligent outreach and education concerning the benefits of cover crops paired with no-till or reduced tillage systems to improve tilth and water infiltration as boons to soil health. While this campaign is directed at soil health rather than water quality, the impacts on the latter are both direct and positive through their reduction of surface erosion (through reduced rain impact on exposed soil) and nutrient loss (through improved nutrient uptake from living cover as well as increased infiltration due to greater soil porosity and increased organic matter). There are many efforts by NRCS and the ICP partners to advance this Soil Health Campaign toward addressing Indiana's primary resource concerns such as the ICP Soil Health Philosophy, and the concept of a System's Approach of Conservation Practices, which are methods used by ICP staff to promote and advance the use of soil health, nutrient management and a conservation cropping systems approach to farming.

Indiana's Conservation Partnership Soil Health Philosophy

http://www.in.gov/isda/files/ICP_Soil_Health_Philosophy_final.pdf

The Indiana Conservation Partnership (ICP) includes eight Indiana agencies and organizations that share a common goal of promoting conservation. To accomplish this goal, the ICP members provide technical, financial and educational assistance to support and implement economically and environmentally compatible land and water stewardship decisions, practices and technologies. The ICP and our primary customers – Indiana farmers – are recognized as national leaders in our collaborative efforts to incorporate soil health management systems into conservation planning, education activities and farm management.

Indiana's soil health strategy and priority focus has achieved tremendous success in addressing the state's primary natural resource concerns. The ICP endorses these four key **Soil Health Principles** for all lands:

- Minimize Disturbance
- Optimize Soil Cover
- Optimize Biodiversity
- Provide Continuous Living Roots

Regenerating soil health is a journey. Meeting the **Objectives of Soil Health Improvement** should be part of an overall approach to management decisions and field operations. To fully implement a *conservation cropping system* that improves soil health we will help farmers understand the importance of continually working toward the following objectives:

- Increas**ing** organic matter

- Increas**ing** aggregate stability
- Increas**ing** water infiltration
- Increas**ing** water-holding capacity
- Improv**ing** nutrient use efficiency
- Enhanc**ing** and diversify**ing** soil biology

The ICP works with farmers to help them implement a conservation cropping systems approach to improve the health of their soil. This "system" of practices and management results in improvements to soil health that helps to address Indiana's primary natural resource concerns. Although implementing a single management practice may slow the degradation of soil function, it will rarely achieve the broad improvements of our resource objectives.

The elements of a conservation cropping system go beyond the minimum standards. It is critical to emphasize descriptive adjectives associated with each practice element, such as:

- Quality No-till/Strip till
- Adaptive Nutrient Management
- Integrated Weed and Pest Management
- Diverse and Strategic Cover Crop Integration
- Diverse Conservation Crop Rotations
- Precision Farming Technology
- Prescriptive Conservation Buffers

These practices when incorporated into a profitable and sustainable soil health system can help farmers go beyond simply maintaining the soil to actually improving its health. Since the benefits achieved through this system can begin to degrade if the application of the system stops, soil health is a never-ending journey towards constantly improving the soil over time.

For many farmers, implementing a conservation cropping system may require significant changes in their operations and management. Building a successful conservation cropping system can take time, even years. The ICP commits to providing support for our customers through ongoing education, support and financial and technical assistance so that soil health improvement is possible across all agricultural sectors and becomes the management system of choice.

A System's Approach of Conservation Practices

One of the most wide-scale and effective efforts in Indiana on water quality improvement is the education and promotion of soil health systems and conservation cropping systems in agriculture. ISDA, NRCS, SWCDs and the other members of the ICP are actively promoting a total *conservation cropping systems* approach to farming which focuses on soil health and function. Soil health practices include no-till (never-till), using diverse cover crops, adaptive nutrient management, integrated weed and pest management, diverse crop rotations, precision farming technology and prescriptive buffers. (Figure 24)
https://prod.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_030628.pdf

Conservation Tillage Practices, such as no-till, strip-till, ridge till and mulch till, are practices that leave crop residues on the soil surface to reduce soil erosion by water. Cover Crops are crops grown between regular cash crops like corn and soybeans so that there is a living root growing all year long. Cover crops reduce soil compaction; they cover the soil and protect it from erosion; improve soil structure; increase soil organic matter; fix nitrogen and scavenge nitrogen depending on the species of cover crop used; and can produce forage or pasture.

Figure 24 – "Soil Health is the Goal", an NRCS publication

Conservation Cropping Systems Initiative (CCSI)

The Conservation Cropping Systems Initiative is a program of the ICP with a mission of improving soil health on Indiana cropland. This mission is accomplished primarily through education and outreach efforts that are based on farmer-proven management practices and peer-reviewed agronomic and social science.

Developed in partnership with technical experts from USDA-NRCS, Purdue University, and expert farmers, CCSI's full training curriculum is central to ICP soil health education, including Indiana NRCS's Long-Term Soil Health Strategy (03/2018). Since CCSI's inception in 2009, over 700 unique individuals have attended at least one soil health training event. These trainings have been instrumental in the delivery of consistent soil health information and technical assistance by conservation staff and ag professionals.

CCSI is also a resource for ICP partners, including Indiana's 92 Soil and Water Conservation Districts (SWCDs), in developing and supporting their own soil health outreach and education efforts. Via presentations by CCSI staff, engaging expert speakers, facilitating farmer panels, event promotion, and logistical support, CCSI workshop activities have reached 25,500 attendees.

The unique multi-agency structure of CCSI has enabled the program to facilitate and support partnerships that span geographic, organizational, and expertise boundaries. These types of complex networks have been shown to facilitate the flow of ideas and spur innovative thinking. These networks have also enabled ICP and partner organizations to leverage both financial and human resources to help increase the adoption of soil health practices in Indiana.

CCSI research efforts from 2013-2018 on 17 different field-scale sites have provided insight ino the potential usefulness of commercially-available soil health tests. More importantly, this research has provided guidance to other groups across the nation in development of their own protocols to further much needed soil health research.

More information on the Conservation Cropping Systems Initiative may be found at www.CCSIN.org.

Indiana Agriculture Nutrient Alliance (IANA)

Agricultural commodity groups in Indiana, including those of Corn, Soybean, Pork, Beef, Dairy and Poultry commodity groups, as well as the Indiana Farm Bureau (INFB), the Agribusiness Council of Indiana (ACI), Purdue University Extension, and The Nature Conservancy (TNC) have been actively engaged in identifying and approaching the challenges of nutrient loading and soil health, subsequently improving water quality.
These groups with the addition of members from the ICP, worked to develop what was referred to as the nutrient management and soil health strategy, which complemented Indiana's state nutrient reduction strategy and was used as an agricultural industry implementation plan. As a

result of this effort, a new initiative and group was created called the Indiana Agriculture Nutrient Alliance (IANA). The formation of IANA from the nutrient management/soil health strategy workgroup is an example of a key refinement of adaptively managing our needs.

The IANA is dedicated to keeping Indiana at the forefront of proactive nutrient management and soil health practices that improve farm viability and ultimately reduce nutrient loss to water. Across the state, a large number of public and private sector agencies and organizations are working toward the same goal – reducing nutrient loss and improving water quality. IANA will focus on bridging multi-partner efforts to create practical, cohesive and significant effect across Indiana. www.inagnutrients.org

IANA will focus in 4 main areas:

1. Shared Goals: Establish goals for statewide practice adoption that encourage fertilizer and nutrient loss reductions.
2. Shared opportunities: Communicate IANA partnership organizations' efforts to strengthen synergies and maximize awareness, support and implementation of strategic objectives.
3. Shared information: Develop best management practice educational materials for our farmers and stakeholders to encourage fertilizer and nutrient loss reductions.
4. Shared outcomes: Assist partners with pursuing collaborative nutrient-focused research, identifying synergies and compiling outcomes.

IANA Goals by 2025 are shown in the table below:

Healthy Soil, Clean Water, Viable Farms

	Action	2025*
	Utilization of 4R Principles for Nutrient Management:	Farmer %
Nutrient Management	Farmers Regularly Performing Soil Sampling	100%
	Farmers Planning for Nutrient Management	100%
Application Timing	Farmers Making Frozen or Snow Covered Ground Application of Nutrients Applied Only as Last Resort Option	100%
	Farmers Making Application of Nutrients to Crops at Planting or Post Emergence	75%
	Statewide Soil Health Practices:	Acre %
Soil Health	30% Increase of Green Living Cover Crop Acres	40%
	25% Increase of Minimum Tillage Acres	75%
	10% Increase of No-Till and Strip-Till Acres	35%
	*Base year 2014	

INDIANA AGRICULTURE NUTRIENT ALLIANCE

Figure 25 – Indiana Agriculture Nutrient Alliance Goals

The ISDA-Division of Soil Conservation and the IANA are working together through an EPA approved Great Lakes Restoration Initiative (GLRI)-Domestic Action Plan (DAP) grant in the WLEB watershed in Indiana to expand the adoption of soil sampling and 4R nutrient management in the St. Marys River Watershed in northeast Indiana. The 3-year grant seeks to increase conservation adoption by landowners in the WLEB watershed in Indiana by accelerating the use of phosphorus soil sampling and analysis, manure sampling and analysis, and providing assistance in the development of basis nutrient management plans based on the analysis. The focus is to continue and expand upon the phosphorus soil sampling and manure sampling program that is currently being used in the Indiana WLEB watershed, as well as use this as a systematic approach to working with Certified Crop Advisors (CCAs) and Ag Retailers. The opportunity to collaborate and engage with CCAs is important as they are the consultants that advise many farmers and landowners on a daily basis with many different aspects of farming, including nutrient management.

Increasing the use of soil sampling to determine nutrient management needs on farms is a top goal for IANA, and critical for the development of these kinds of plans is conducting a soil sample that provides an opportunity to check the nutrient levels in the soil. IANA will support ISDA's effort by working jointly in the promotion of the soil sampling and analysis, and nutrient management plan program.

Market-Based Agricultural Initiative

Ohio River Basin Water Quality Trading Project: Pilot Trading Plan by the states of Indiana, Kentucky and Ohio (Figure 26) – In August 2012, representatives from the states of Indiana, Kentucky, and Ohio signed an agreement to create the Ohio River Basin Water Quality Trading Program (http://wqt.epri.com/), a pilot program allowing farmers and industrial facilities to trade pollution credits to reduce fertilizer run-off and nutrient discharges. It is aimed at achieving water quality standards in watersheds along the Ohio River by allowing dischargers to purchase pollution reductions from other sources. The project was conceived by Electric Power Research Institute (EPRI) in conjunction with the states of Indiana, Ohio, Kentucky, the U.S. Department of Agriculture Natural Resources Conservation Service, American Farmland Trust, the Ohio Farm Bureau, and ORSANCO. It was initially funded by a Conservation Innovation Grant (CIG) to the EPRI and is now privately funded and supported by over a dozen organizations and utilities like AEP and Duke Power with technical support from local, state and federal agencies. Indiana counties participating include Wayne, Dearborn, Ripley, Ohio, and Switzerland. The ISDA-DSC District Support Specialist for the region has been serving as an advisor and representative for the project and works with EPRI, American Farmland Trust, DSC Resource Specialists, participating County SWCDs, and USDA-NRCS District Conservationists.

The Electric Power Research Institute's Ohio River Basin Trading Pilot Project is a first-of-its-kind inter-state trading program with participation from Indiana, Ohio and Kentucky. A total of $100,000 in cost-share monies for each of the three partner states were distributed to farmers for implementation of approved water quality Best Management Practices. In Indiana, practices for cover crops, heavy use protection areas for livestock, and cropland to hayland conversion were

approved. Indiana had 12 five year contracts, in five counties that removed 25,530 lbs. total nitrogen (TN) and 6,880 lbs. total phosphorus (TP) per year. All practices that were installed were inspected and verified by DSC staff.
This project has not only gained regional interest, but also international attention, and at this time is the largest water quality trading project in the world. In 2014, the project was featured in many newsletters and articles, including the Wall Street Journal. In the fall of 2017, ISDA-DSC entered into another funding contract with EPRI to provide cost share to forestry practices and conservation practices for the entire Ohio River Basin Watershed in Indiana.

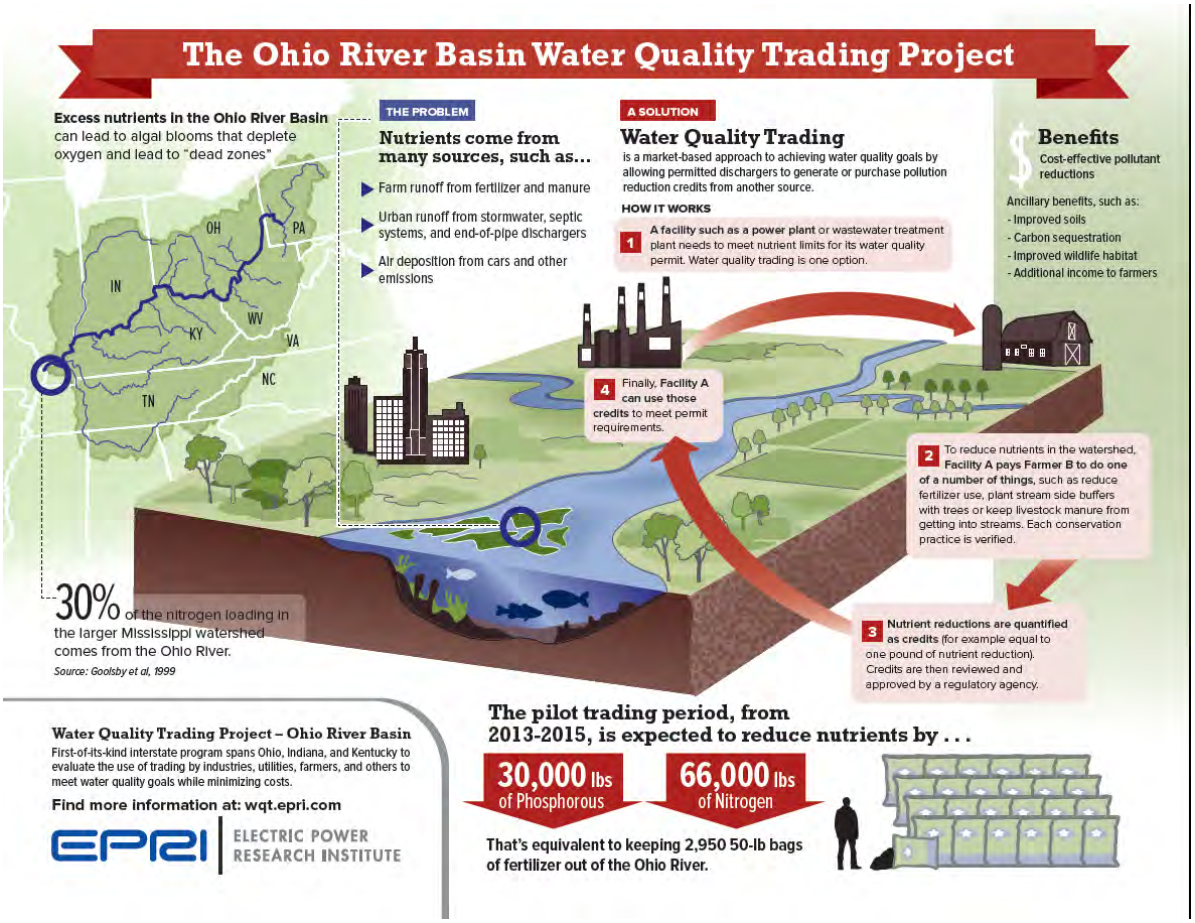


Figure 26 – Ohio River Basin WQ Trading Project Diagram

Agricultural Landowner Educational Resources Available Online

Indiana NRCS has also developed many publications that are available on the website that provide sound advice on many different topics and issues related to phosphorus and nitrogen management, soil health, cover crops, drainage tile and drainage water management, pest management, forage and feed management and many more. There are Guide Sheets and Fact Sheets, Agronomy "Crib" Notes, "Grazing Bites", Soil Health Resources & Publications, among many others.

Section 8 – Measuring Impacts

Best management practices within the regulatory framework and proactive, voluntary conservation measures matter. They matter because of the impact that conservation practices have on water quality both within the state of Indiana and in the water bodies outside of our state. They matter because the impact of the conservation practices results in reductions of nutrient loads. The many state and federal conservation programs, initiatives and actions illustrate the means by which the state can provide reports and accountability of assisted conservation practices reported by staff in the Indiana Conservation Partnership. These impacts are shown in a number of ways:

1. Continuation of the use of the Indiana Tillage and Cover Crop Transects and corresponding reports,
2. The use of the EPA Region 5 Nutrient Load Reduction Model as a means to annually estimate and track sediment, nitrogen and phosphorus load reductions from BMP implementation across Indiana on a watershed-wide scale,
3. An annual preparation of one page load reduction reports for significant waterbodies within Indiana,
4. The use of a GIS Story Map for each of the ten major river and lake basins in Indiana that tell the story of conservation going on in Indiana,
5. Instream water quality monitoring for performance measures to look for watershed improvements and trend analysis of data, and
6. Reviewing Edge-of-Field (EOF) monitoring data.

Regulatory framework nutrient reduction best management practices:

1. Publicly Owned Treatment Works (POTW) discharge monitoring reports are submitted monthly and will be graphed annually,
2. Pertinent information from MS4 annual reports will be compiled and reported annually,
3. Long-Term Control Plans (LTCP) pertinent progress will be reported annually.

Indiana's Tillage and Cover Crop Transects

The tillage transect is a cropland survey conducted each spring following planting in each Indiana county by ICP personnel and Earth Team volunteers. Using a predetermined route, staff look at farm fields in their county collecting data on tillage methods, plant cover, residue, etc. in order to tell the story of conservation efforts in Indiana. The survey uses GPS technology and provides a statistically reliable method for estimating farm management and related annual trends. Transects are usually conducted bi-annually in the spring after crops are planted. ISDA maintains tillage transect reports dating back to 1990 on their website at http://www.in.gov/isda/2383.htm which includes the most recent transect results.

In addition, in the fall of 2014, the first-ever statewide cover crop and fall tillage transect was done in Indiana. This was done as part of a collaborative effort between ISDA, NRCS, Indiana's 92 SWCDs and other members of the ICP. These reports show increases in the adoption of

conservation practices on farm fields by Hoosier farmers.

Due to the efforts through the tillage and cover crop transects, Indiana can track tillage trends back to 1990 and cover crop trends back to 2011.

- Since 1990, Indiana landowners increased no-till acres on corn and soybean fields by 379%, and conservation tillage acres on corn and soybean fields by 297%.
- Since 2011, Indiana landowners increased cover crop acres on corn and soybean fields by 409%.

The ICP will continue the fall and spring cover crop and tillage transects in future years. To review reports and maps from the transect data showing acres, percentages and trends of conservation tillage and cover crops, visit the Cover Crop and Tillage Transect Data page on the ISDA website.

* Refer to Figures 28, 29 and 30 to show trends in usage of no-till and conservation tillage in Indiana, and in cover crop adoption.

As a national leader in use of cover crops, nutrient management and advocating of soil health and productivity, Indiana is a great example in the nation for the benefits that improving soils' nutrient uptake and water-holding capacities can do to reduce nutrient loss and excessive runoff from agricultural and other managed lands. (Figure 27)

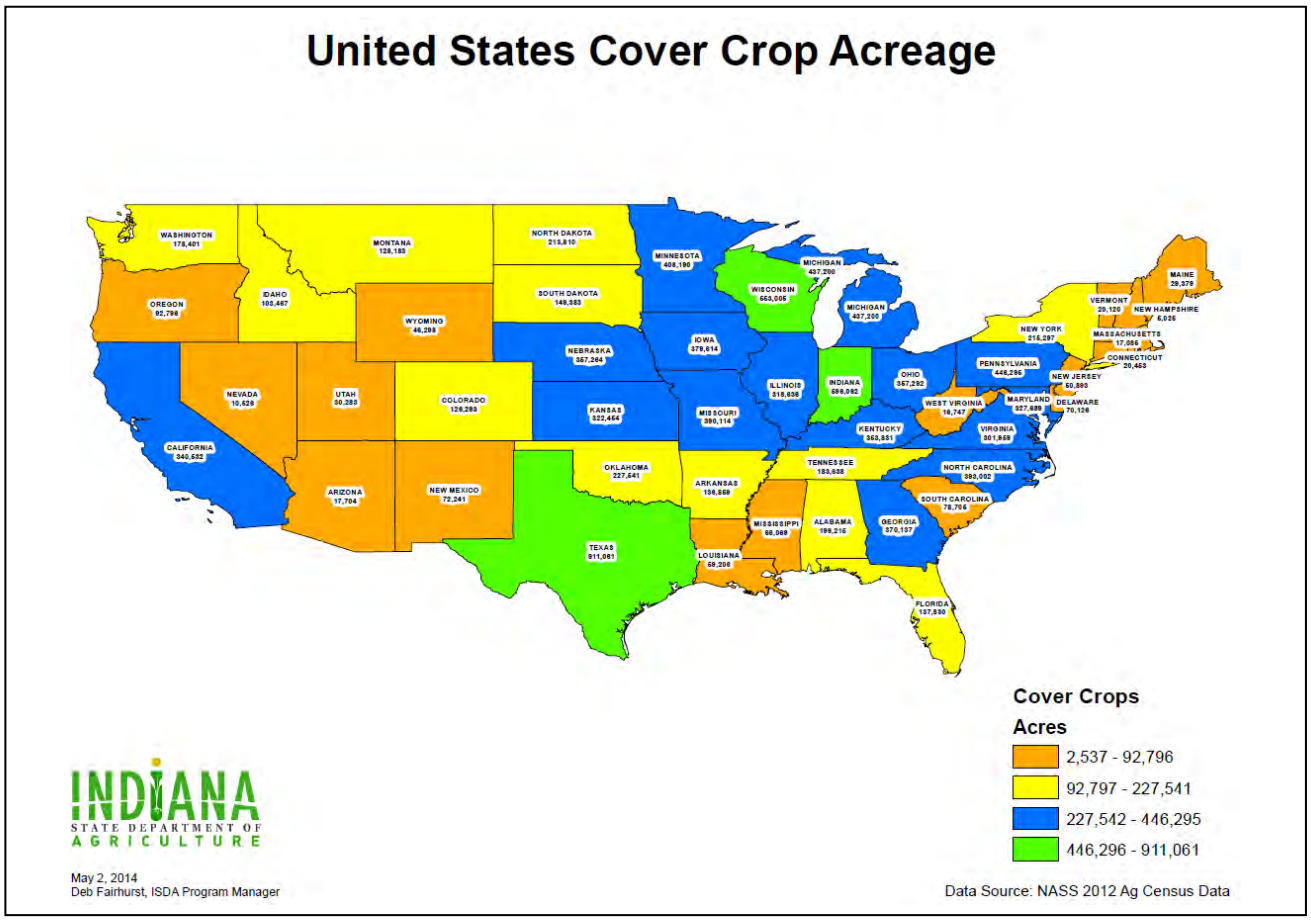
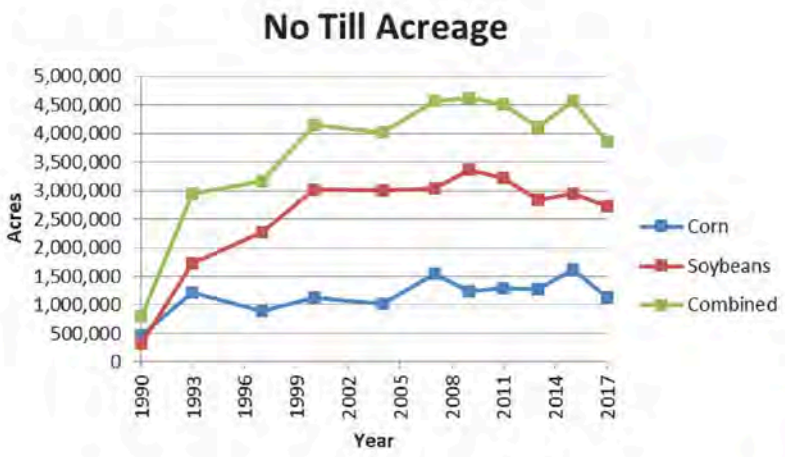
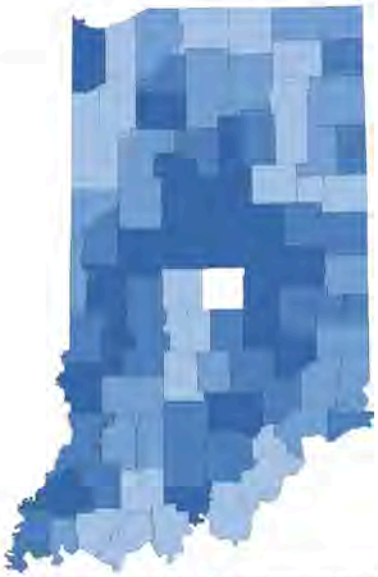


Figure 27 – Cover crops acres by state according to the NASS 2012 Ag Census Data

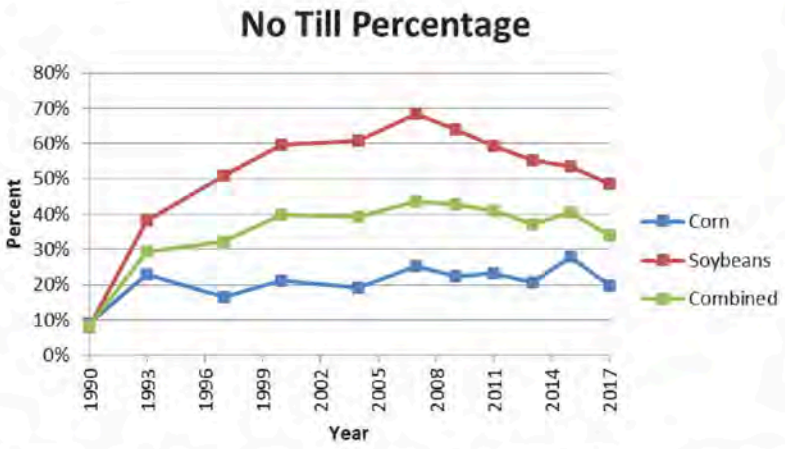
Indiana Statewide Tillage: 1990-2017

No Till: Any direct seeding system, including site preparation, with minimal soil disturbance (includes strip & ridge till).





*Note: Darker colors had a greater percent increase in total no till acres (corn and soybeans) from 1990-2017



* Please note that not all counties have data for all years. No tillage data is collected for Marion county.

No Till Percentage Change 1990-2017		
	Percentage Point Change	Percent Change
Corn	11	122%
Soybeans	41	513%
Combined	26	325%

No Till Acreage Change 1990-2017		
	Acres	Percent Change
Corn	655,177	136%
Soybeans	2,399,228	733%
Combined	3,054,405	379%

No Till Implementation											
Acreage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017
Corn	479,255	1,211,769	891,962	1,120,174	1,011,467	1,542,152	1,244,400	1,296,300	1,266,700	1,621,000	1,134,432
Soybeans	327,249	1,726,956	2,270,370	3,023,134	3,002,974	3,032,493	3,375,300	3,225,400	2,845,300	2,941,600	2,726,477
Combined	806,504	2,938,725	3,162,332	4,143,308	4,014,441	4,574,645	4,619,700	4,521,700	4,112,000	4,562,600	3,860,909

Percentage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017
Corn	9%	23%	18%	21%	19%	25%	23%	23%	21%	28%	20%
Soybeans	8%	38%	51%	60%	61%	69%	64%	59%	55%	54%	49%
Combined	8%	29%	32%	40%	39%	44%	43%	41%	37%	40%	34%

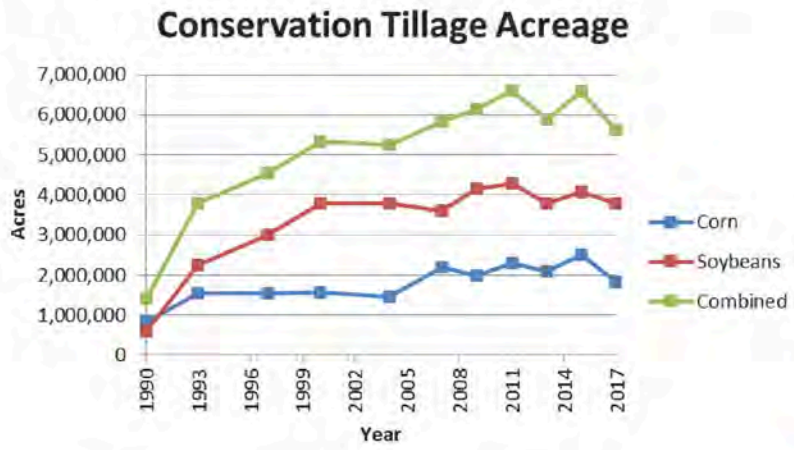
For more information please see: http://www.in.gov/isda/2383.htm

November 15, 2017
Leah Harmon. ISDA CWI Program Manager

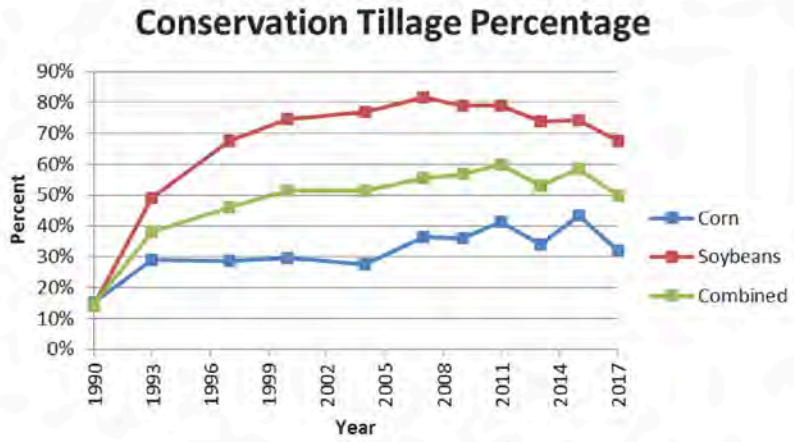
Figure 28 – No-Till Trends from 1990-2017

Indiana Statewide Tillage: 1990-2017

Conservation Tillage: any system that leaves at least 30% residue cover after planting



*Note: Darker colors had a greater percent increase in total conservation tillage acres (corn and soybeans) from 1990-2017



* Please note that not all counties have data for all years. No tillage data is collected for Marion county.

Conservation Tillage Percentage Change 1990-2017		
	Percentage Point Change	Percent Change
Corn	25	170%
Soybeans	65	591%
Combined	43	365%

Conservation Tillage Acreage Change 1990-2017		
	Acres	Percent Change
Corn	991,956	120%
Soybeans	3,209,634	545%
Combined	4,201,590	297%

Conservation Tillage Implementation											
Acreage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017
Corn	824,200	1,536,438	1,528,779	1,558,708	1,455,828	2,202,153	1,988,000	2,304,200	2,086,900	2,507,600	1,816,156
Soybeans	588,159	2,244,690	3,009,387	3,781,933	3,797,671	3,613,545	4,156,160	4,296,000	3,796,600	4,065,500	3,797,793
Combined	1,412,359	3,781,128	4,538,166	5,340,641	5,253,499	5,815,697	6,144,160	6,600,200	5,883,500	6,573,100	5,613,949

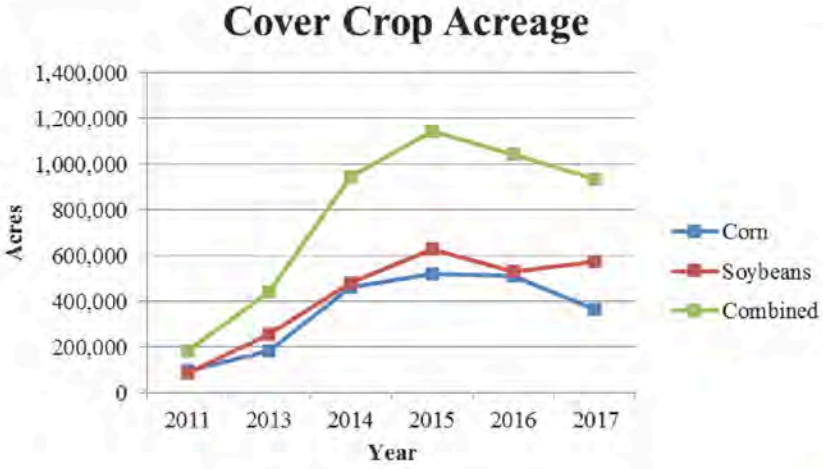
Percentage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017
Corn	15%	29%	29%	29%	28%	36%	36%	41%	34%	40%	32%
Soybeans	14%	49%	67%	75%	77%	82%	79%	79%	74%	79%	58%
Combined	15%	N/A	N/A	52%	52%	55%	57%	60%	52%	58%	50%

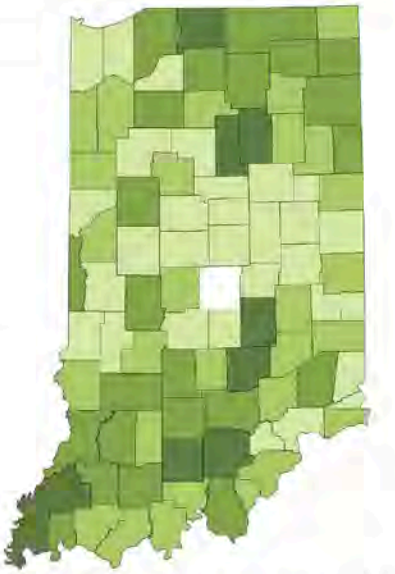
For more information please see: http://www.in.gov/isda/2383.htm

November 15, 2017
Leah Harmon, ISDA CWI Program Manager

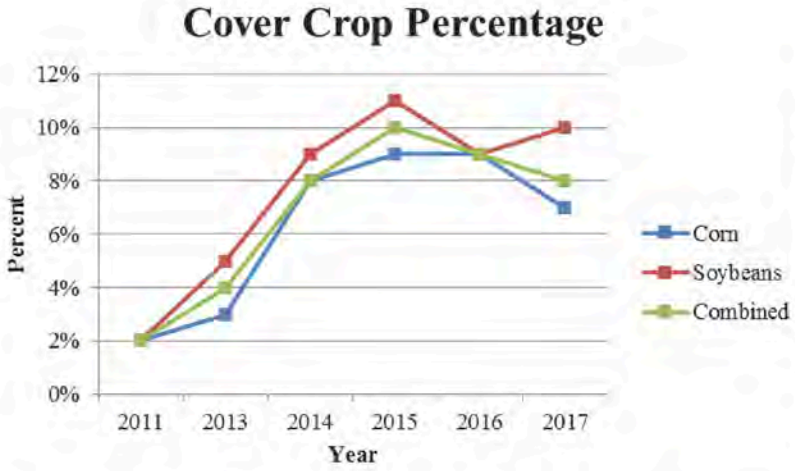
Figure 29 – Conservation Tillage Trends from 1990-2017

Indiana Cover Crops: 2011-2017





*Note: Darker colors indicate counties that reported a greater percentage of combined corn and soybean acres utilizing cover crops in 2017.



Cover Crop Acreage Change 2011-2017		
	Acres	Percent Change
Corn	266,294	276%
Soybeans	485,549	553%
Combined	751,843	409%

Cover Crop Percentage Change 2011-2017		
	Percentage Point Change	Percent Change
Corn	5	250%
Soybeans	8	400%
Combined	6	300%

* Data is not collected for Marion County.
* 2011 and 2013 cover crop data was collected during the spring tillage transect. Figures collected in this manner may not be a true reflection of cover crop implementation because of winter kill and other factors.
* A fall cover crop transect has been completed annually since 2014. Data from these transects are included.

Cover Crop Implementation						
Acreage	**2011**	**2013**	**2014**	**2015**	**2016**	**2017**
Corn	96,200	183,100	461,081	518,808	510,925	362,494
Soybeans	87,800	258,000	483,280	628,722	530,117	573,349
Combined	184,000	441,100	944,361	1,147,530	1,041,042	935,843
Percentage	**2011**	**2013**	**2014**	**2015**	**2016**	**2017**
Corn	2%	3%	8%	9%	9%	7%
Soybeans	2%	5%	9%	11%	9%	10%
Combined	2%	4%	8%	10%	9%	8%

For more information about the transect program, including county level transect data, please see: http://in.gov/isda/2383.htm

April 6, 2017
Leah Harmon, ISDA Program Manager

Figure 30 – Cover Crop Trends from 2011-2017

EPA Region 5 Nutrient Load Reduction Modeling and Mapping: Watershed-Wide

In 2011, ISDA adopted the use of the Region 5 Nutrient Load Reduction Model developed by EPA for three 319 funded watersheds, the Tippecanoe River, Upper Eel River, and the Upper Wabash River watersheds, in which three DSC staff were located to assist with the installation of conservation practices on the ground. IDEM utilizes this Region 5 model for all of its 319 funded projects as required by EPA.

This model estimates sediment, nitrogen and phosphorus load reductions from individual BMPs on the ground. ISDA saw the value of using this model as a means to measure the load reductions coming from all technical assisted projects in Indiana that was being done by all of our staff, not just by the three staff working in the 319 funded watersheds. Its use has been standardized by ISDA, and the Region 5 model was adopted by the Indiana Conservation Partnership in 2013 and is now used statewide to model all the conservation practices that are implemented through assistance of all the ICP partnership staff. Cooperation in this effort by local, state and federal partners in the ICP allows for conservation tracking and load reduction estimation at an order of magnitude greater than any single agency or entity could achieve alone. There is much data that goes into the preparation of the final reports, and Figure 31 shows the methodology by which we work through, and the process is explained in the Methodology report.

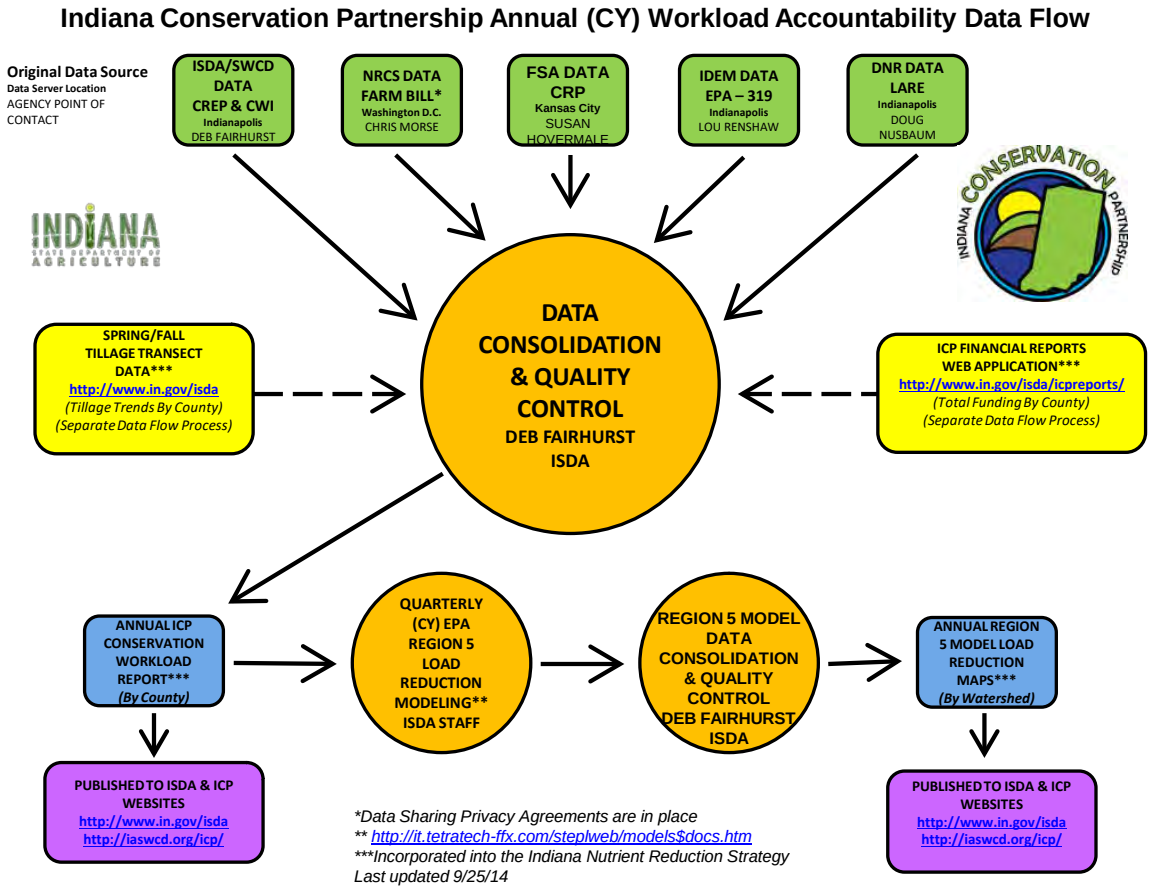


Figure 31 – Methodology Chart

Indiana collects conservation practice data such as type of practice, practice locations, measurements and other necessary parameters from ICP partners for all federal, state and local programs, and through the process of data collection, we can see the impact of the number of conservations practices that are implemented annually. The collected data is then run through the Region 5 model to analyze the sediment, nitrogen and phosphorus load reductions for specific practices. Figures 32-35 illustrate the Nitrogen, Phosphorus and Sediment load reductions from all assisted conservation practices reported by staff in the ICP from 2013-2017. While this model is project-specific, it provides a valuable perspective on a larger scale when showing the collective reductions of practices across several programs. The accountability/verification and annual reporting on implementation are current expectations among Indiana's Conservation Partner's and are regularly being refined and improved. The ICP utilizes the end products of this process to help establish baselines and measure load reduction trends by watershed for each calendar year, and serves as a tangible component of the Indiana State Nutrient Reduction Strategy.
An Annual Accomplishments report is prepared each year and can be found on the ISDA State Nutrient Reduction Strategy webpage: https://www.in.gov/isda/2991.htm.

Strengthening and Improving Our Method

The Region 5 model is used to determine nitrogen and phosphorus load reductions that are tied directly to sediment. As a result, nutrients that are dissolved and carried by runoff waters are not accounted for in the model; therefore we are missing the dissolved nutrients such as nitrate and dissolved phosphorus. Also, there are several practices that can't be run through the model due to the practice not being tied to sediment, such as nutrient management. The ICP would like to strengthen and improve this existing method of capturing nutrient load reductions so that we can capture dissolved nutrients and other practices not tied to sediment.
In November of 2018, Indiana held the Nutrient Reduction Estimation Framework Workshop to coordinate the discussion on improving this method of nutrient load reduction estimation and tracking. This workshop is explained earlier in Section 6 under the discussion on "Development of a Science Assessment". Further work will be done in the next two years among researchers, university studies, Indiana Conservation Partnership staff, and other conservation agencies to help in this challenging effort.

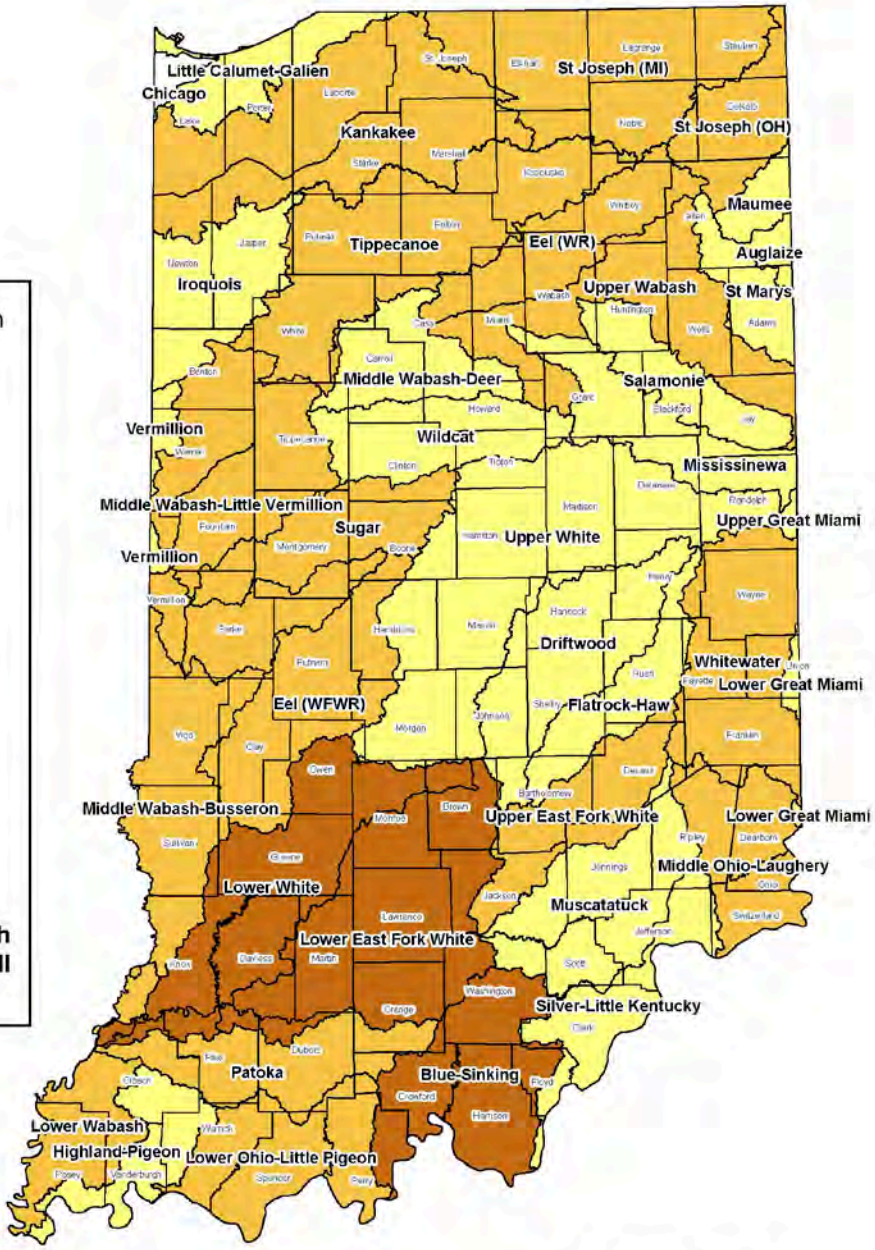
2013-17 Cumulative Sediment Load Reductions

1,372,892 Tons

INDIANA CONSERVATION PARTNERSHIP
icp.iaswcd.org

Since 2013, voluntary conservation efforts from Indiana's private landowners, with support from the ICP, have reduced sediment and nutrients from entering Indiana's waterways.

1,372,892 tons of sediment. A football field covered to a depth of 596 feet, which is almost as tall as the Space Needle.



Sediment (tons)

- No Reported Reductions
- 1 - 25,000
- 25,001 - 100,000
- 100,001 - 225,000

Based on EPA Region 5 Model analyses conducted on 21,957 conservation practices installed by the Indiana Conservation Partnership January 2013 thru December 2017. This effort does not include the many unassisted practices designed and installed solely by a private landowner without ICP assistance.

The cumulative analysis encompassed a breakdown of 2013 thru 2017 conservation practices by lifespan including 1, 5, 10, 15, 20 and 40 years. The map reflects all of the practices minus the 2013 thru 2016 practices with a lifespan of one year and 2013 practices with a lifespan of 5 years.

To learn more about Indiana's Nutrient Reduction Strategy visit http://www.in.gov /isda/2991.htm
For questions and comments email ISDANutrientReduction@isda.in.gov

March 1, 2018
Deb Fairhurst, ISDA Program Manager
Trevor Laureys, ISDA Program Manager

Figure 32 – Cumulative Sediment Load Reductions from 2013-2017

2013-17 Cumulative Nitrogen Load Reductions

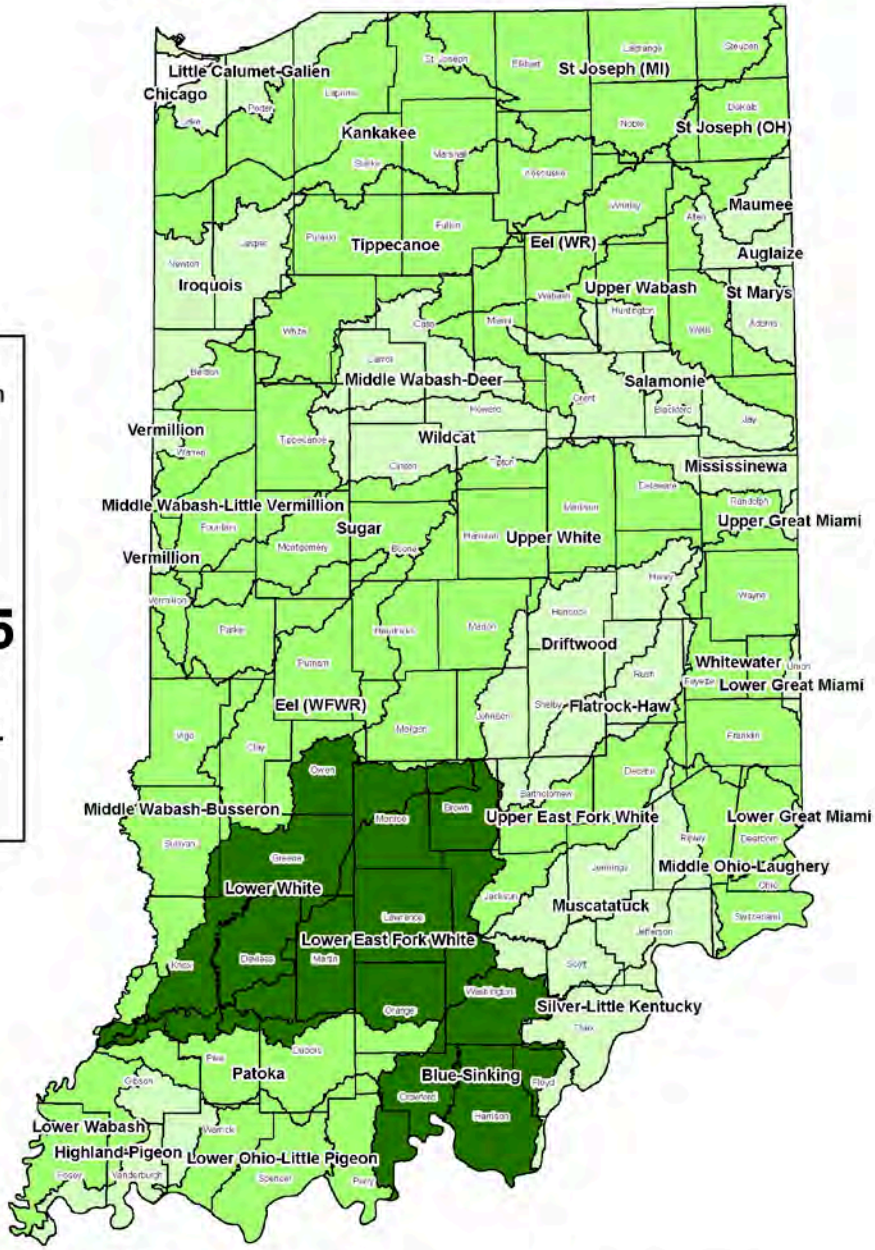
2,841,449 Pounds

INDIANA CONSERVATION PARTNERSHIP
icp.iaswcd.org/

Since 2013, voluntary conservation efforts from Indiana's private landowners, with support from the ICP, have reduced sediment and nutrients from entering Indiana's waterways.

X 14.25

2,841,449 pounds of nitrogen. That's enough to fill 14.25 freight cars.



Based on EPA Region 5 Model analyses conducted on 21,957 conservation practices installed by the Indiana Conservation Partnership January 2013 thru December 2017. This effort does not include the many unassisted practices designed and installed solely by a private landowner without ICP assistance.

The cumulative analysis encompassed a breakdown of 2013 thru 2017 conservation practices by lifespan including 1, 5, 10, 15, 20 and 40 years. The map reflects all of the practices minus the 2013 thru 2016 practices with a lifespan of one year and 2013 practices with a lifespan of five years.

Reductions in dissolved nutrients, such as dissolved reactive phosphorus (DRP) and nitrate (NO3), are not accounted for by the Region 5 Model.

To learn more about Indiana's Nutrient Reduction Strategy visit:http://www.in.gov/isda/2991.htm
For questions and comments email ISDANutrientReduction@isda.in.gov

Nitrogen (pounds)

- No Reported Reduction
- 1 - 50,000
- 50,001 - 200,000
- 200,001 - 425,000

March 1, 2018
Deb Fairhurst, ISDA Program Manager
Trevor Laureys, ISDA Program Manager

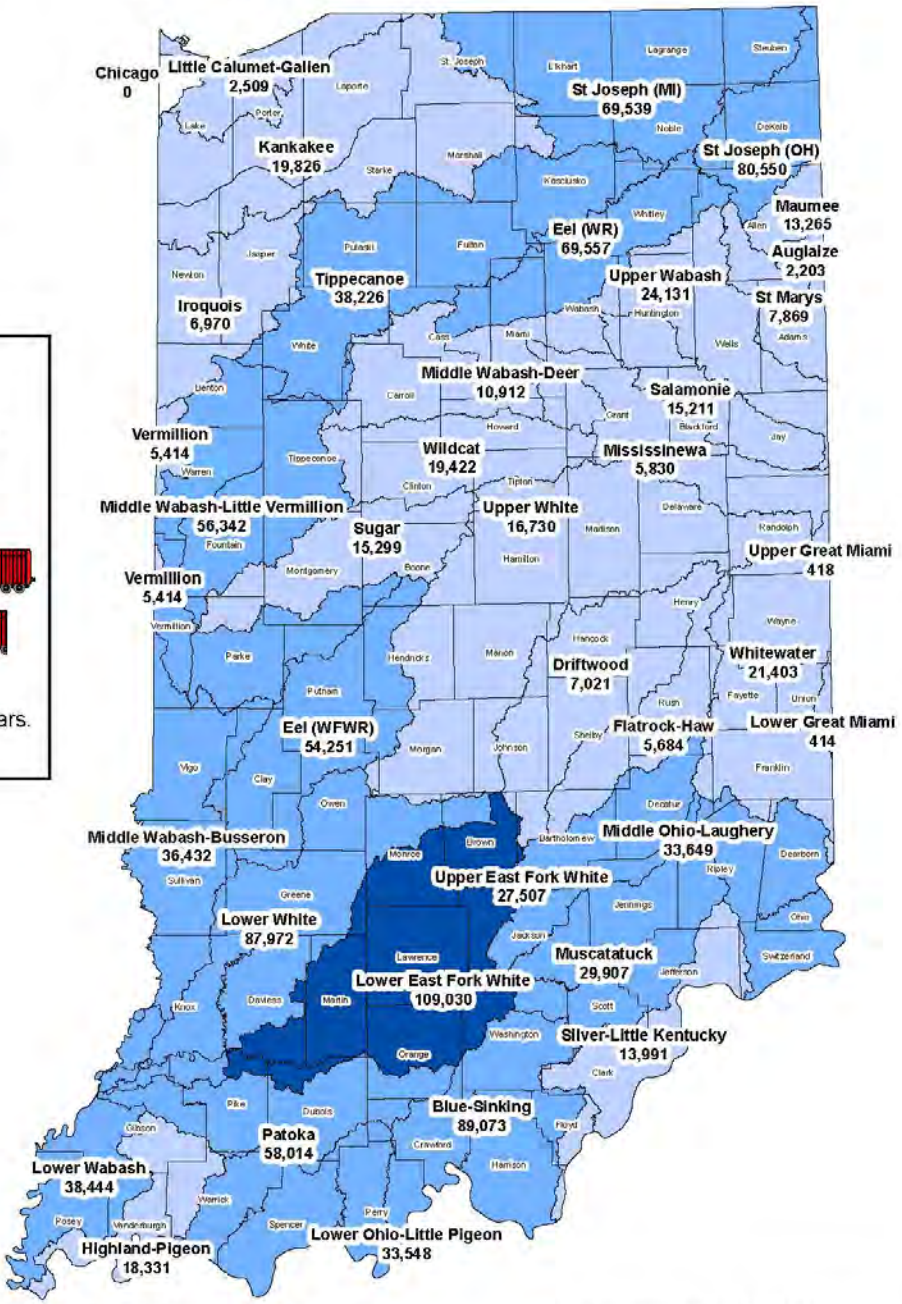
Figure 33 – Cumulative Nitrogen Load Reductions for 2013-2017 Practices

2015 Phosphorus Load Reductions
1,144,892 Pounds

http://icp.iaswcd.org/

In 2015, voluntary conservation efforts from private landowners in Indiana with support from the ICP have reduced sediment and nutrients from entering Indiana's waterways.

1,144,892 pounds of Phosphorus.
That's enough to fill **5.75** 50' freight cars.



Based on EPA Region 5 Model analyses conducted on 12,221 conservation practices installed by the Indiana Conservation Partnership January 2015 thru December 2015. This effort does not include the many unassisted practices designed and installed solely by a private landowner without ICP assistance.

Reductions in dissolved nutrients, such as dissolved reactive phosphorus (DRP) and nitrate (NO3), are not accounted for by the Region 5 Model.

March 2, 2016
Deb Fairhurst, ISDA Program Manager
To learn more about Indiana's Nutrient Reduction Strategy visit: http://www.in.gov/isda/2991.htm.
For questions and comments email ISDANutrientReduction@isda.in.gov

A total reduction of 1,144,892 pounds of phosphorus statewide.

Phosphorus Reduction (lbs./year)

- No Reported Reductions
- 1 - 25,000
- 25,001 - 100,000
- 100,001 - 175,000

Figure 34 – Cumulative Phosphorus Load Reductions for 2013-2017 Practices

Indiana Nutrient and Sediment Load Reductions

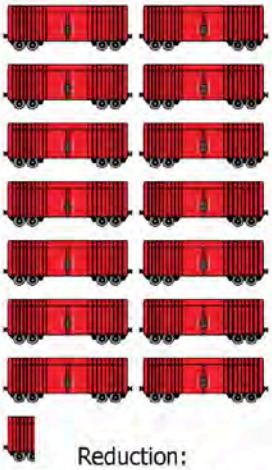
Voluntary conservation efforts from private landowners in Indiana with support from the Indiana Conservation Partnership have reduced nutrients and sediment from entering Indiana's waterways. The figures below represent these efforts in 2017 from conservation practices installed since 2013.*

Load Reductions

Sediment
A football field covered to a depth of 596 feet, which is almost as tall as the Space Needle!

Reduction:
1,372,892 Tons

Nitrogen
14.25 freight cars



Reduction:
2,841,449 Pounds

Phosphorus
7 freight cars

Reduction:
1,407,346 Pounds

Top Conservation Practices

For more information about conservation practices, visit: nrcs.usda.gov

- No Till
- Reduced Tillage
- Cover Crops
- Grassed Waterways
- Wetland Enhancement
- Filter Strips
- Nutrient Management
- Riparian Buffers

Indiana Conservation Partnership

Data is collected by Indiana Conservation Partnership Agencies and aggregated using the USEPA's Region 5 Model to show total nutrient and sediment reductions.

DNR Indiana Department of Natural Resources

USDA NRCS United States Department of Agriculture Natural Resources Conservation Service

Indiana State Department of Agriculture Division of Soil Conservation

Indiana Conservation Partnership icp.iaswcd.org

Indiana Association of Soil and Water Conservation Districts

IDEM Est. 1986

With Support From United States Environmental Protection Agency

This effort does not include the many unassisted practices designed and installed solely by a private landowner without Indiana Conservation Partnership assistance.

Updated: March 1, 2018

For more information about Indiana's Nutrient Reduction Strategy, please see isda.in.gov

Figure 35 – Indiana Nutrient Load Reductions Info-graph

Significant Waterbodies

ISDA currently prepares one page reports for several significant waterbodies in Indiana based on the Region 5 Load Reduction modeling efforts taking place. These reports are available for viewing on the Indiana State Nutrient Reduction Strategy webpage on the ISDA website at http://www.in.gov/isda/2991.htm. Below is an example of one these reports.

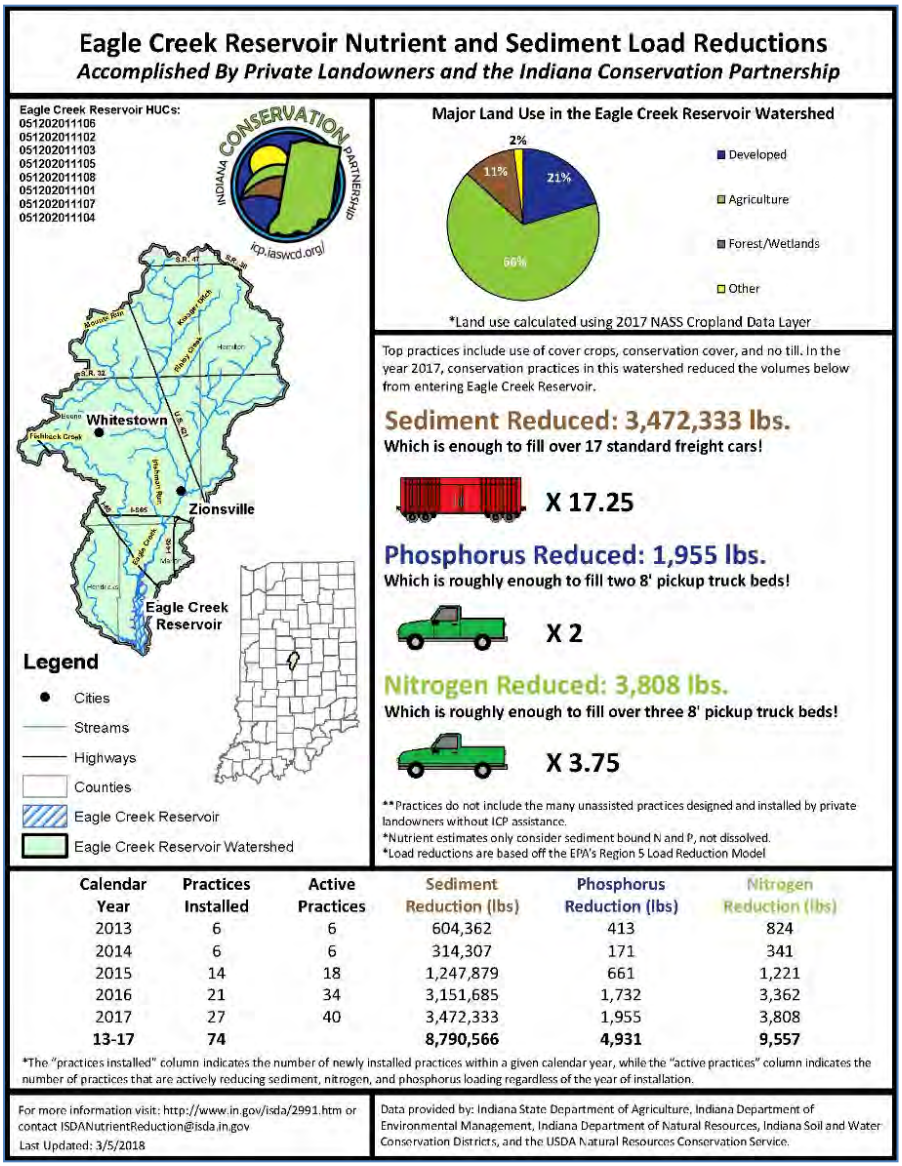


Figure 36 – Eagle Creek Reservoir Sediment and Nutrient Load Reductions

GIS Story Maps for Indiana's Ten Major River and Lake Basins

The purpose of the GIS Basin Story Map applications is to showcase Indiana's efforts to enhance water quality within the ten major river and lake basins in Indiana (Figure 15), as well as educate landowners, both rural and urban, about local, state and federal cost-share programs, educational opportunities, and rural and urban conservation practices. The story maps feature interactive maps which allow users to click on watersheds, water monitoring locations along with links to water quality data, and educational sites to view detailed information about each basin. There is also information about local watershed groups and organizations, the number of conservation practices in specific subwatersheds, nutrient load reductions from BMPs, and links to active grants. The development and purpose of these GIS story maps is making Indiana's nutrient reduction strategy more interactive. http://www.in.gov/isda/2991.htm

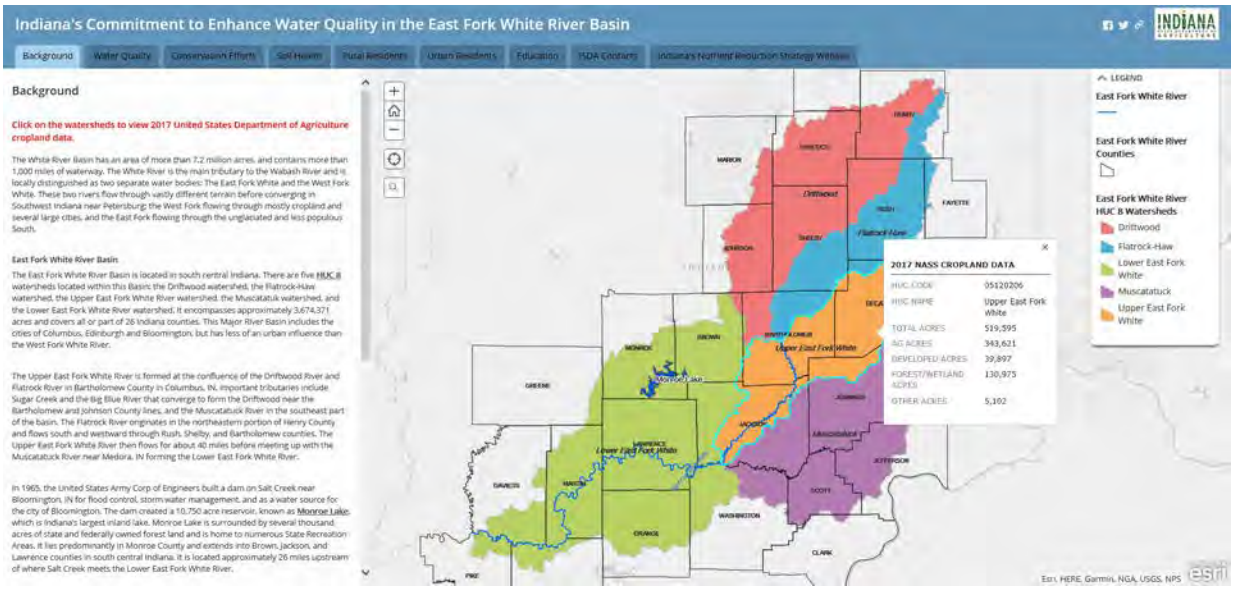


Figure 37 – Image of Background tab on the East Fork White River Basin Story Map

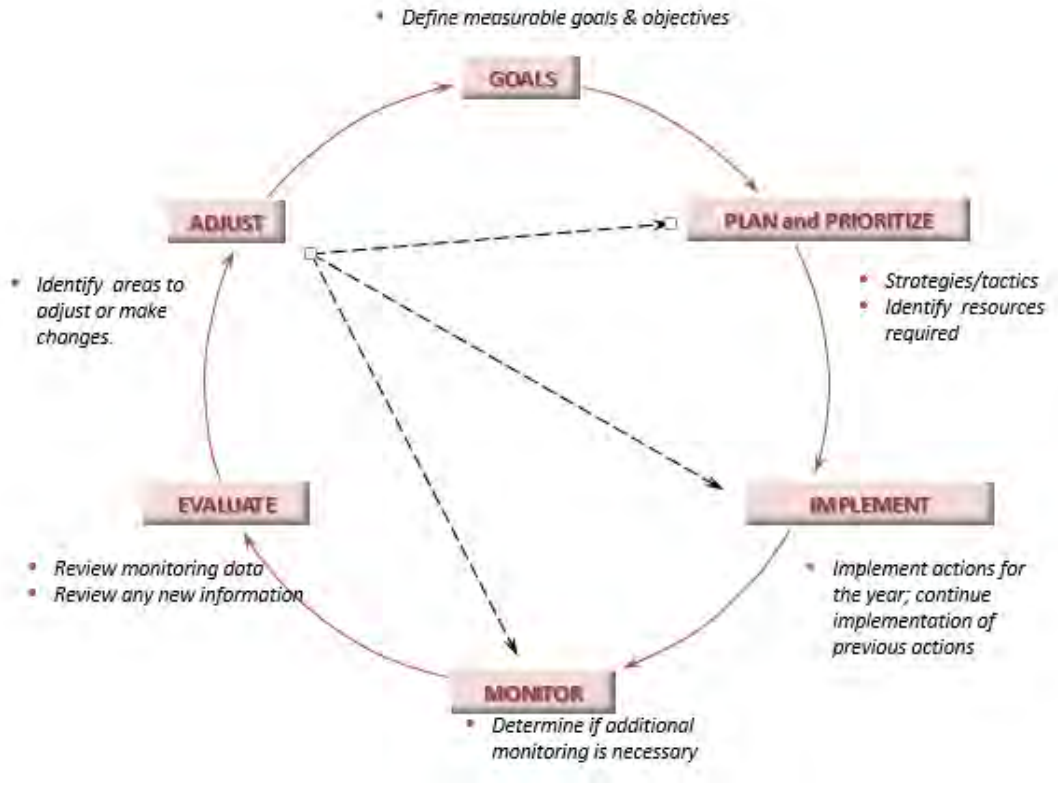
Performance Measures Monitoring

To determine if the BMPs installed are resulting in water quality improvements, IDEM conducts follow-up (performance measures) in-stream ambient water quality monitoring. IDEM consults with other members of the ICP to identify 12-digit HUCs where conservation practices have been in place for a few years. The parameters sampled are based on the water quality impairments for which the stream is listed on the 303(d) List of Impaired Waters. IDEM's monitoring is showing that the watershed approach employed by the ICP is resulting in water quality improvements. Watershed success stories are found at http://www.in.gov/idem/nps/3360.htm.

Adaptive Management

Vital to Indiana's success in implementing this State Nutrient Reduction Strategy is an adaptive management approach that tests the hypotheses put forth in the Strategy and applies the lessons learned therefrom to future management decisions.

Figure 38 – Adaptive Management



Indiana will continue to evaluate the efficacy of the nutrient reduction policies, programs, and practices outlined in this Strategy. Based on that evaluation and new information/data arising from research and monitoring data, Indiana will modify this Strategy as necessary.

Section 9 – Milestones and Action Items

The current and on-going actions to address the issue of nutrient pollution and water quality impairment are outlined in the Milestones and Action Items table below. It includes actions or activities associated with certain Objectives/Goals, the responsible parties, along with timeframes and target dates where applicable. This table will be reviewed and amended periodically and the SNRS Workgroup will meet at least once annually for review and discussion.

Some of the key accomplishments and key progress made include:

1) The completion of ten (10) GIS Story Maps, one for each of the major river and lakes basins in Indiana. As mentioned on page 94, the Basin Story Maps help to tell the story of conservation and showcase Indiana's efforts to enhance water quality in Indiana, and is making this SNRS more interactive.
2) IDEM, as part of the Indiana Water Monitoring Council (InWMC) has been working to improve the ambient water quality monitoring network throughout the state in order to determine nutrient loads entering and leaving Indiana. In 2017, the InWMC, the USGS and IDEM completed a Whitepaper titled *An Assessment for Optimization of Water-Quality Monitoring in Indiana, 2017*, which was compiled to document existing, ongoing river and stream water quality networks within Indiana, and to identify potential sites of redundancy and where there are gaps in the network of monitoring sites. This assessment contributes to a better understanding of nutrient sources and loading in the state. An example of an outcome of this whitepaper is a USGS supergage was installed on the Wabash River in New Harmony, IN to better capture the nutrient loads in the Wabash River.
3) Completion of Indiana's GLWQA Domestic Action Plan (DAP) to reduce phosphorous to the Western Lake Erie Basin (WLEB) was released February 28, 2018; WLEB DAP website. A HUC-12 watershed prioritization process was piloted in the WLEB to target efforts and define next actions within the plan, and this successful process will be utilized within the other watershed basins in Indiana.
4) Formation of the Indiana Agriculture Nutrient Alliance (IANA). This formation is an example of a key refinement of adaptively managing our needs. Across the state, a large number of public and private sector agencies and organizations, including the Indiana Conservation Partnership, Ag Commodity groups, and The Nature Conservancy, are actively working toward the same goal – to reduce nutrient loss and improve water quality. IANA will focus on bridging multi-partner efforts to create practical, cohesive and significant effect across Indiana.
5) The Great Lake Restoration Initiative (GLRI)-DAP grant that was awarded to ISDA. ISDA and IANA will work together to expand the phosphorus soil sampling program and 4R nutrient management in the St. Marys River Watershed in northeast Indiana.
6) The Nutrient Reduction Estimation Framework (NREF) Workshop that was held in November of 2018 to bring together researchers, experts, and staff to discuss how to strengthen Indiana's current method of nutrient load reduction estimation and tracking, which will lead to the development of an Indiana Science Assessment.

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Prepare a progress report of the SNRS every two years	SNRS will be updated as necessary; keep track of accomplishments and adaptive management changes	-SNRS -Annual ICP Accomplishment Reports	ISDA, IDEM and SNRS Workgroup	11/2018 - 11/2020	11/2020	In process
Update Milestones and Action Items table	SNRS Workgroup will meet at least annually to review and discuss this table and make necessary changes.	-SNRS -Milestones and Action Items table -Partnership efforts	ISDA, IDEM and SNRS Workgroup	Annually	Dec. 2019 Dec. 2020	In process
Watershed Prioritization						
Watersheds with drinking water reservoirs	Map Drinking water areas	GIS	IDEM	NA	NA	Completed
Groundwater sources	Groundwater Vulnerability Maps	Ground Water Monitoring Network (GWMN); GW staff	IDEM GW staff	NA	NA	Completed -Page 23-24 of SNRS
Watershed Prioritization within the nine major river basins	Analyze fixed station data for the period of the last 10 years for each of the nine basins in this order: 1. Great Lakes a. Lake Erie b. Lake Michigan 2. Upper Wabash 3. White River, West Fork 4. White River, East Fort 5. Lower Wabash 6. Upper Illinois 7. Ohio River Tributaries 8. Great Miami 9. Patoka	- P and N data from AIMS II will be modeled for the period of the last 10 years using Load Duration Curves and LOADEST - WQ monitoring data - Drinking water maps - GW Vulnerability maps - State Resource Assessment (SRA) - WQ Monitoring Data from USGS and other organizations	IDEM WAPB staff; ISDA; USGS; monitoring agencies	December 2020	December 2020	1(a) 100% completed 1(b) in process 2-9: in process
Select critical watersheds at the HUC 12 level within the nine basins.	Identify the intersection of monitoring data, maps of critical areas from WMPs, NRCS modeling, etc. to determine the 12 digit HUC priority areas.	- Monitoring Data - IDEM Watershed Management Plans (WMPs) - Drinking water maps - GW Vulnerability maps - Modeling Data	SNRS Workgroup; Indiana Conservation Partnership (ICP)	On-going	December 2020	In process

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Measuring Impacts						
List what type of management will need to be done in the newly selected HUC12 critical areas/priority watersheds to address issues	Identify BMPs that could be implemented based on type of management needed to address resource issues	- Monitoring Data - IDEM WMPs - Drinking water maps - GW Vulnerability maps - Modeling Data - Indiana Science Assessment	SNRS Workgroup; ICP	On-going	December 2020	In process
Inventory the new BMPs that are implemented in the newly selected critical areas/priority watersheds at the HUC 12 level, and show impacts of this BMP implementation.	Use Region 5 Model to analyze and show sediment and nutrient load reductions	- Performance Measures Monitoring - Region 5 Model	ICP	March 2017-December 2020	December 2020	In process http://www.in.gov/idem/nps/3360.htm
Continue to inventory BMPs implemented through conservation programs and show impacts of the *assisted* BMP implementation statewide.	Use Region 5 Model to analyze and show sediment and nutrient load reductions	- Region 5 Model - Tillage Transects - Cover Crop Transects	ICP	On-going annually	March of every year	ICP Accomplishments Report https://www.in.gov/isda/2991.htm
Continue to conduct the spring tillage transect survey statewide, and to use the data results from these transects.	Partnership staff in each county will conduct this transect in the spring following planting on a bi-annual basis.	Conservation Partnership Staff	ICP	Every two years April-June	NA	https://www.in.gov/isda/2383.htm
Continue to conduct the fall cover crop and tillage transect survey statewide, and to use the data results from these transects.	Partnership staff in each county will conduct this transect in the fall following harvest each year.	Conservation Partnership Staff	ICP	Annually from Oct.-December	NA	https://www.in.gov/isda/2383.htm
Monitoring						
Use monitoring gaps determined by the InWMC Whitepaper titled *An Assessment for Optimization of Water-Quality Monitoring in Indiana, 2017* to prioritize new monitoring sites (statewide)	Determine scale of new monitoring sites: compare the SNRS 12-digit priority HUCs with 8-digit pour points	*Integrated Water Monitoring Network Optimization Taskforce*; *An Assessment for Optimization of Water-Quality Monitoring in Indiana, 2017*; GIS; HUC maps	InWMC, ISDA and IDEM, and USGS	On-going	NA	In process

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Determine funding needs for the new priority monitoring sites	Identify various funding sources	Federal, State and Local funding; Foundation funding; NGO funding	SNRS Workgroup; ICP	On-going	NA	On-going
Add capacity to sample for DRP in the following areas: 1. Laboratory analysis 2. Monitoring resources beginning in the WLEB with Fixed Stations	1. Secure laboratory equipment for the ISDH; 2. Investigate necessary resources for collecting and analyzing for DRP	1. MOU between IDEM & ISDH; IDEM lab account funding 2. Time/travel study	IDEM & ISDH	October 2016 – June 2017	1. 1/2017 2. 3/2017	1. 100%-Funds secured, 100% complete 2. 100% complete
Diurnal Dissolved Oxygen Pilot project planning for development of TP multi-parameter numeric criteria	Develop work plan and secure funding for sampling in 2017	Scientific literature; OH EPA personnel; USGS personnel; equipment manufacturers	IDEM and USGS	April 2016 – December 2016	December 31, 2016	100% complete
Implement Diurnal Oxygen Pilot project	Monitoring of approximately 28 sites	IDEM and USGD staff and equipment	IDEM	March 2017-Oct. 2017	October 2017	100% complete
Plan the project for Performance Measures monitoring for 2017 to determine if BMP implementation has improved water quality	Based on information/data from ICP and the AIMS II database, determine the 12-digit HUC for follow-up sampling	AIMS II database; cost-share information from ICP; Region 5 model outputs	IDEM	October 2016 – Feb. 2017	February 2017	100% complete
Implement performance measures monitoring	Develop work plan, conduct recon	GIS mapping; AIMS II database; field survey	IDEM	April 2017 – Oct. 2017	October 2017	100% complete
Education and Outreach						
Explore opportunities to work with Certified Crop Advisors (CCAs) and private sector to help promote agronomic conservation practices and technologies.	-Support CCA Annual Meeting in December -Hold field days and invite CCAs -Develop possible grant opportunities to work with CCAs	ICP staff	State Soil Conservation Board (SSCB)	On-going	NA	On-going
Promote 4R Nutrient Stewardship Certification Program in the Western Lake Erie Basin working with Indiana Ag Retailers and CCAs	-Certify more Indiana Ag Retailers and CCAs within the Indiana WLEB watershed -ISDA and ICP to support Agribusiness Council (ACI) and Ag retailers in promotion of 4Rs	ICP staff; WLEB Partnership; TNC; Purdue Extension	WLEB Partnership, ISDA	On-going	2020	On-going

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Promote 4R Initiative and Nutrient Stewardship Certification Program across Indiana.	-Work with Indiana ACI, Ag Retailers and CCAs statewide. -Learn from Ohio's statewide program. -Customize Ohio's standards for Indiana's program to include nitrogen	ICP staff; TNC Purdue Extension	Indiana Agribusiness Council; ISDA	On-going	2020	In process
Program Goals						
Enroll 26,250 acres into the Indiana CREP program within all 11 CREP watersheds.	Annually enroll at least 750 acres of new eligible practices within the 11 Indiana CREP watersheds.	CREP promotional materials; CREP staff	ISDA CREP Program Manager and CREP Leaders, FSA, NRCS	August 2005 until acreage enrollment goal is attained	NA	On-going, 65%. Enrollment is 17,183 acres. http://www.in.gov/isda/2377.htm
Annual Nutrient Load Reduction goal within CREP	2,450 tons/yr of sediment 2,400 lbs./yr of phosphorus 4,700 lbs./yr of nitrogen	Use Region 5 Model to analyze reduction numbers	CREP Leaders and CREP Program Manager	Calendar year	December 31, 2018	Sed. - 201% Phos. - 259% Nitr. - 262%
Expand growth of the INfield Advantage (INFA) program with a goal of at least 60,000 acres enrollment each year.	This goal was met in 2018 with 73,220 acre enrollment statewide.	INFA Group Leaders INFA promotional materials	INFA Program Manager, INFA Group Leaders, Indiana Corn and Soy, Purdue Univ.	Calendar year 2018	September 2018	Completed 122% -Page 58 of strategy
ISDA and Soil and Water Conservation Districts (SWCDs) have annual goal to reduce nitrogen from entering waters of the State by	275,000 lbs. of Nitrogen reduced	CREP; Clean Water Indiana (CWI); DNR, Lake and River Enhancement Program; Technical Assistance	ISDA SWCD	Calendar year 2018	December 31, 2018	41%
ISDA and SWCDs have an annual goal to reduce phosphorus from entering waters of the State by	150,000 lbs. of Phosphorus reduced	CREP; Clean Water Indiana; DNR, Lake and River Enhancement Program; Technical Assistance	ISDA SWCD	Calendar year 2018	December 31. 2018	38%
ISDA and SWCDs have an annual goal to see at least 1,000 new conservation BMPs installed.	1,000 new conservation BMPs installed or implemented	CREP; CWI; DNR, LARE Program; Technical Assistance	ISDA SWCD	Calendar year 2018	December 31, 2018	94%

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Indiana NRCS had a goal to write stewardship plans on 57,902 acres through the Conservation Stewardship Program (CSP) in FY2018. The goal for FY2019 will be set when a new farm bill is approved and this table will be updated at that time.	This goal for FY2018 was met and exceeded with CSP stewardship plans written on 98,353 acres.	Conservation Stewardship Program; NRCS Staff	NRCS	Federal Fiscal Year 2018	September 30, 2018	Completed 169% -Page 70 in SNRS
Indiana NRCS: write Conservation Plans for landowners in Indiana in 2018 through technical assistance. The goal for FY2019 will be set when a new farm bill is approved and this table will be updated at that time.	This goal was met as plans were written on 263,909 acres.	Federal Farm Bill Programs; NRCS Staff	NRCS	Federal Fiscal Year 2018	September 30, 2018	Completed -Page 70 in SNRS
Conservation Implementation						
Increase acres of cover crops planted statewide	-Provide continued technical assistance to farmers who have used Cover crops, and new TA to those who have not. -Increase contacts with seed sales/companies -Educate on the benefits of cover crops -Assess results of the Cover Crop Transect done by the ICP	-Cover Crop and Tillage Transect data by ICP -Federal Farm bill programs; State Conservation Programs; Technical assistance	SSCB; ICP	Calendar Year 2018	December 31, 2018	On-going, Link to Transect Data
Increase no-till implementation statewide based on tillage transect results	-Provide technical assistance -Continue to work with those who have a negative opinion of no-till. High residue systems have benefits. -Increase the promotion of strip-till since it has many of the same benefits as no-till and can get nutrients injected below ground, and is better suited for some areas of the state. -Assess results of Tillage Transects done by ICP	-Tillage Transect data by ICP -Federal Farm bill programs; State Conservation Programs; Technical assistance	SSCB; ICP	Calendar Year 2018	December 31, 2018	On-going, Link to Transect Data

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Increase conservation tillage implementation statewide based on tillage transect results	-Provide technical assistance -This practices can be used as a transition to the use of cover crops and not-till. -Use Tillage Transects done by ICP to look at trends and past accomplishments	-Tillage Transect data by ICP -Federal Farm bill programs; State Conservation Programs; Technical assistance	SSCB; ICP	Calendar Year 2018	December 31, 2018	On-going. Link to Transect Data
Increase acres of wetland restorations	-Provide technical assistance -Look at trends and past accomplishments	CREP, HRI, Federal Farm Bill Programs Technical Assistance	ICP	Calendar Year 2018	December 31, 2018	On-going -CREP Annual Report -HRI website
Increase acres of floodplain restorations (tree plantings)	-Provide technical assistance -Look at trends and past accomplishments	CREP, HRI, Federal Farm Bill Programs Technical Assistance	ICP	Calendar Year 2018	December 31, 2018	On-going -CREP Annual report -HRI website
Increase acres of floodplain restorations (tree plantings)	-Provide technical assistance -Look at trends and past accomplishments	CREP, HRI, Federal Farm Bill Programs Technical Assistance	ICP	Calendar Year 2018	December 31, 2018	On-going -CREP Annual report -HRI website
See a measureable increase in the number of joint sediment and nutrient reduction projects among SWCDs funded through CWI.	SWCDs apply for CWI funding; this is a goal of the State Soil Conservation Board (SSCB)	CWI funding; ISDA District Support Specialists; ISDA Resource Specialists	SSCB	On-going	By 2020	On-going CWI website
Planning						
Conduct an Indiana Science Assessment	-Use information gathered from the Nutrient Reduction Estimation Framework Workshop. -Work with newly formed Workgroup for the assessment.	SNRS; NREF Workshop; Monitoring Data; University research; other states studies	ICP, ISDA, Purdue University, and Science Assessment Workgroup	November 2018-December 2020	December 2020	In process
Strengthen current method for tracking nutrient load reductions on conservation practices to include reductions for dissolved nutrients.	-Use information gathered from the Nutrient Reduction Estimation Framework Workshop. -Work with newly formed Workgroup for the assessment.	SNRS; NREF Workshop; Modeling data; Monitoring Data; University research	ISDA, ICP, SNRS Workgroup, and Science Assessment Workgroup	November 2018-December 2020	December 2020	In process

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table

Last updated on December 3rd, 2018

Objectives/Goals	Action/Activity	Tools/Resources	Responsible Party	Timeframe	Target Date	Status & Results (as applicable)
Develop list of most effective Nitrogen reduction practices - Urban vs. Rural - Soil Health - Nutrient Management - Agricultural Drained Lands	-Work with members of the SNRS to develop consistent message on the best practices for nitrogen reduction. -Use Indiana Science Assessment	University publications; NRCS publications; expertise of conservation partnership staff; WQ monitoring data	ICP, SNRS Workgroup, and Science Assessment Workgroup	November 2016 – December 2020	December 2020	In process
Develop list of most effective Phosphorus reduction practices - Urban vs. Rural - Soil Health - Nutrient Management - Erosion Control	-Work with members of the SNRS to develop consistent message on the best practices for phosphorus reduction. -Use Indiana Science Assessment	University publications; NRCS publications; expertise of conservation partnership staff; WQ monitoring data	ICP, SNRS Workgroup, and Science Assessment Workgroup	November 2016 - December 2020	December 2020	In process
Assess the Funding needs and Research needs and gaps within Indiana.	-For monitoring needs and costs, both surface and groundwater; -Edge-of-field Research -Science Assessment	-WQ Monitoring Strategy -Ground Water Monitoring Network (GWMN) -University Research	ICP, SNRS Workgroup	January 2019 – December 2019	December 2019	In process

Section 10 – "What you can do to protect water quality in Indiana"

How can you protect and improve Indiana's water quality? Recall that a watershed is the area of land that drains to a body of water. As a Hoosier, you live in a watershed that drains either to the Gulf of Mexico or to the Great Lakes. It is important to understand that the quality of water coming from your lawn, roof, driveway, neighborhood streets, etc. has an effect on the water quality in the local streams and rivers, as well as on local storm drain systems, which eventually flow to the Gulf of Mexico or the Great Lakes. What you do on a day-to-day basis has an impact on the water quality in your watersheds. You play a role, and you can make a positive difference!

State and local governments, volunteer groups, water quality professionals, and concerned citizens are working together to clean up our lakes, rivers, streams, and wetlands. You can help! Whether you live in a big city or in the country, you can prevent nonpoint source pollution by taking simple actions on your property or in your community. The following are some simple solutions to a big problem (http://www.in.gov/idem/nps/2487.htm):

- **Dispose of oil and household chemicals properly**
  Keep oils and chemicals out of local streams by utilizing and supporting local toxic drop-off sites, maintaining vehicles to reduce leaks and never pouring any materials down a storm drain.

- **Maintain septic tanks**
  Just like any other tool or appliance, a septic tank needs to be maintained to function properly, and a properly working septic system should not release anything that is harmful to you or the environment. Pump it out regularly-at least once every three years-to avoid overload or failure.

- **Create and enhance riparian corridors**
  Riparian corridors are the buffer zones between used land and a stream, most often planted with vegetation. A well-established riparian corridor can help regulate water temperature, protect the bank from erosion, and filter pollutants from storm water. You can start improving your riparian corridor by allowing natural growth, rather than mowing along the stream bank. Allowing native plants to take over the area, as well as adding trees and bushes will help increase the function of your corridor.

- **Pick up pet waste**
  It is simple to reduce nonpoint source pollution from pet waste - just pick up after your pet. Pet waste contributes to nutrient and E. coli nonpoint source pollution. Pet stores and large retail stores carry small plastic bags for picking up pet waste. Biodegradable bags are even available for purchase.

- **Take care of big issues on small farms**
  Depending on the type and number of animals you have, there are many options for reducing the impact of your hobby farm. First, consider isolating animals from water bodies and providing alternative drinking water sources. Animals trample vegetation on stream banks and deposit feces in the water. If you pasture animals, create a rotational grazing system that reduces pasture erosion and allows the vegetation time to grow. For other ideas more specific to your operation, contact your local Soil and Water Conservation District.

- **Read the label – Use lawn and garden fertilizer wisely**
  Fertilizer is composed of nitrogen, phosphorus, and potassium. The content of each is usually listed as a string of three numbers on the fertilizer bag. Although garden plants need varying levels of each chemical to grow properly, Indiana's soil provides plenty of phosphorus for established lawns. Using fertilizer with low or no phosphorous for established lawns will keep it green and minimize the impact on water quality. Starter fertilizer should only be used when growing grass from seeds. When you apply fertilizers, make sure you follow the directions. Over-application and sloppy application leads to fertilizer washing from lawns, sidewalks, and streets into storm drains.

- **Think before you dig**
  Construction sites that disturb one acre or more of land are required to use best management practices (BMPs) to keep sediment out of water bodies. Although it is likely your backyard project will not come close to the one acre size limit, it is still a good idea to avoid leaving bare soil on your property. If you need to disturb the soil for any reason, reseed and replant bare ground as soon as possible to keep soil on your yard and out of streams, rivers, and lakes.

- **Plant a rain garden**
  Rain gardens catch and infiltrate excess storm water as it flows across your yard.

- **Connect your downspouts to rain barrels**
  Rain barrels catch excess water from you rooftops. Use that water to irrigate landscape during dry periods. Make sure the barrel's overflow goes to a pervious surface like a garden or yard instead of your impervious driveway.

- **Use Porous pavement**
  When it's time to replace your driveway, use some type of porous pavement. These materials allow storm water to soak through and infiltrate into the ground. If you cannot afford a whole driveway of porous pavement, consider using it at the driveway's apron where it meets the street.

- **Responsible car washing**
  Use a commercial car washing facility that collects the waste water that can be cleaned through a waste water treatment plant before it gets released to the local streams and rivers.

Interactive online resources

You, Me, and Water Quality - The Indiana Department of Environmental Management (IDEM) has an interactive website that looks at how our activities impact water quality, and how we can change things for the better. Visit the *You, Me, and Water Quality* website to view a graphic with items that the user can move over to learn more about everyday actions that change our water quality.

Clear Choices Clear Water program - *Clear Choices Clean Water* is a campaign to increase public awareness about the choices we make and the impacts they have on our streams, lakes and ground water. Water quality friendly practices such as landscaping with native plants, maintaining septic systems, using less fertilizer on lawns, managing yard and pet wastes, fostering soil health, and using less water all help to protect our precious water resources. By educating individuals on these and other important actions and giving them the tools needed to make behavior changes, *Clear Choices Clean Water* empowers everyone to do their part for water quality and conservation. This program has action-oriented campaigns centered on water quality practices such as those mentioned above. On the *Clear Choices Clean Water* website, citizens can read educational information about the choices they make and can take pledges toward good water quality actions. The focus of this effort began in Indiana but is now spreading across the country.

An electronic version of this strategy can be found on the ISDA website at www.isda.in.gov

If you have questions, comments or feedback about this strategy, please use ISDANutrientReduction@isda.in.gov or call (317) 232-8770.

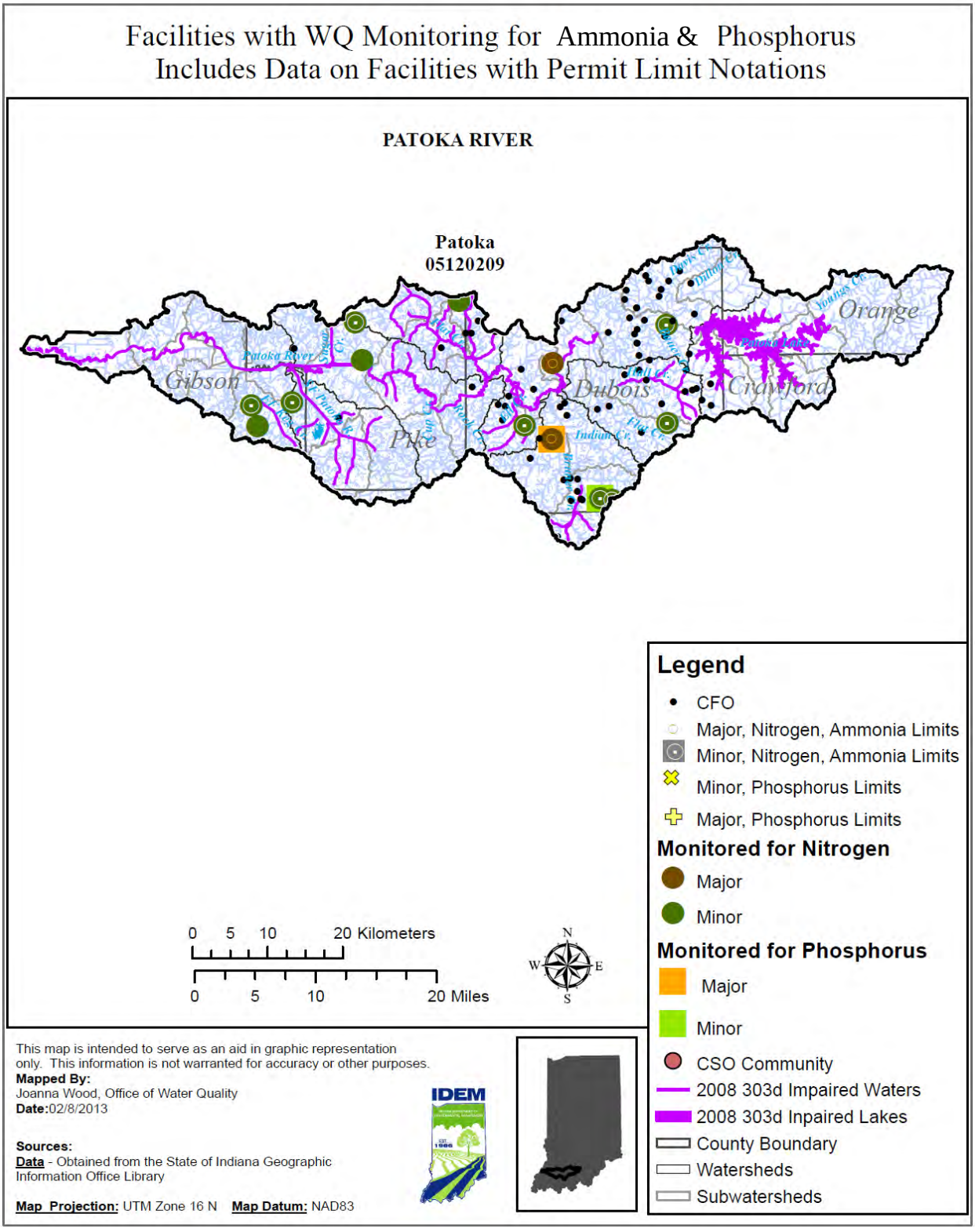
Appendix A – Acronyms

ACEP	Agricultural Conservation Easements Program
ACI	Agribusiness Council of Indiana
ALE	Agricultural Land Easements
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CALM	Consolidated Assessment and Listing Methodology
CC	Cover Crop
CCA	Certified Crop Advisor
CCSI	Conservation Cropping Systems Initiative
CEES	Center for Earth and Environmental Services (IUPUI)
CES	Cooperative Extension Service (Purdue)
CFO	Confined Feeding Operation
CIG	Conservation Innovative Grant
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSO	Combined Sewer Overflow
CSP	Conservation Stewardship Program
CWA	Clean Water Act
CWI	Clean Water Indiana
CWS	Community Water Systems
DAP	Domestic Action Plan
DRP	Dissolved Reactive Phosphorus
DSC	Division of Soil Conservation (ISDA)
DSS	District Support Specialist (ISDA)
EOF	Edge-of-Field
EPA	Environmental Protection Agency
EPRI	Electrical Power Research Institute
EQIP	Environmental Quality Incentive Program
4Rs	Right Source, Right Rate, Right Time, Right Place
FSA	Farm Service Agency (USDA)
GIS	Geographic Information System
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
GWMN	Ground Water Monitoring Network
HAB	Harmful Algae Bloom
HFRP	Healthy Forest Reserve Program
HRI	Healthy Rivers Initiative (IDNR)
HTF	Hypoxia Task Force (Gulf of Mexico)
HUC	Hydrologic Unit Code
IANA	Indiana Agriculture Nutrient Alliance
IASWCD	Indiana Association of Soil and Water Conservation Districts
IAC	Indiana Administrative Code
ICP	Indiana Conservation Partnership
IDEM	Indiana Department of Environmental Management

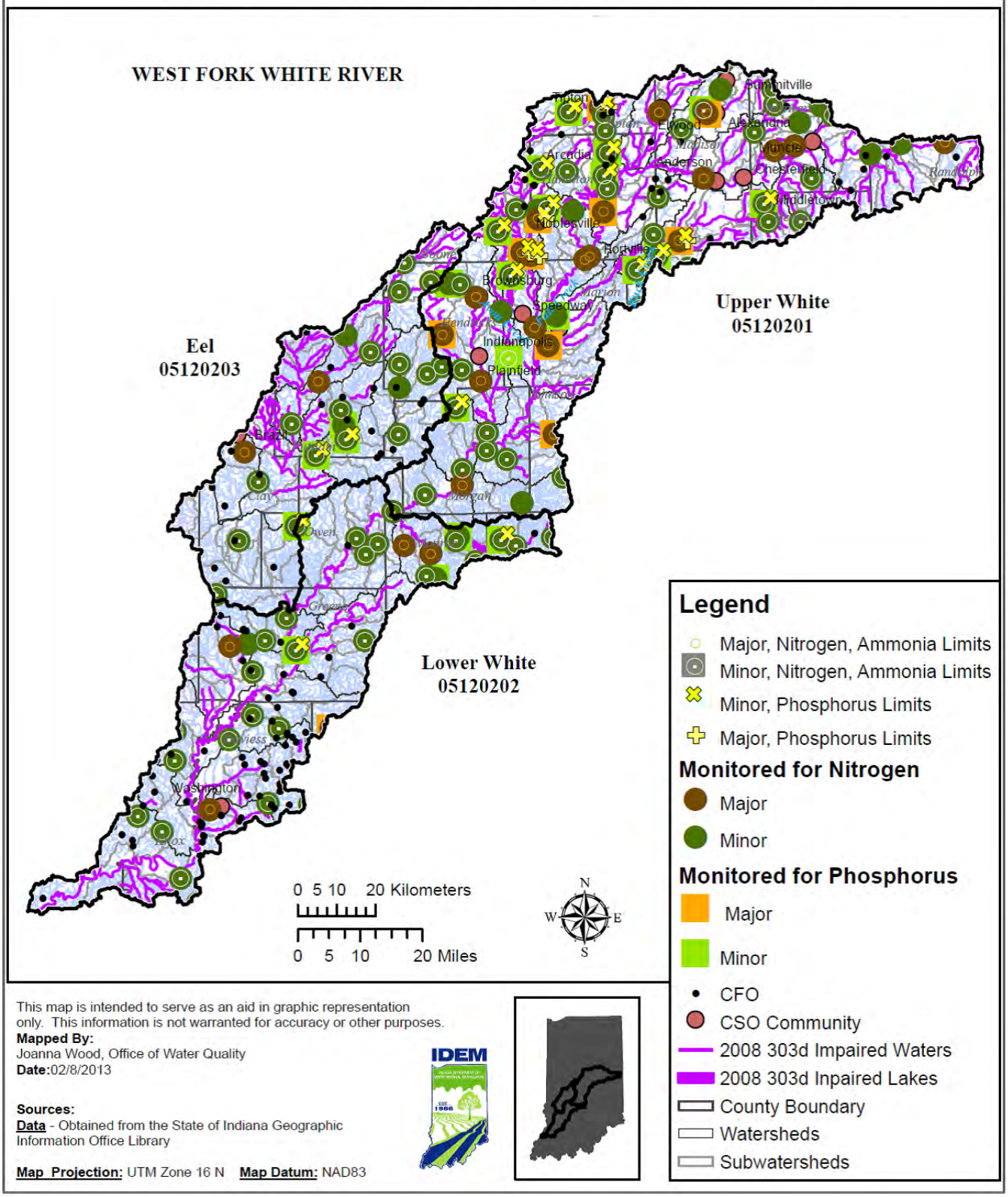
IDNR	Indiana Department of Natural Resources
IGS	Indiana Geological Survey
INFA	INField Advantage
INFB	Indiana Farm Bureau
InWMC	Indiana Water Monitoring Council
ISDA	Indiana State Department of Agriculture
ISDH	Indiana State Department of Health
IUPUI	Indiana University-Purdue University Indianapolis
LARE	Lake and River Enhancement (IDNR)
LOADEST	Load Estimator
LTCP	Long-Term Control Plans
LUMCON	Louisiana Universities Marine Consortium
MARB	Mississippi/Atchafalaya River Basin
MCPHD	Marion County Public Health Department
MGD	Million Gallons/day
MRBI	Mississippi River Basin Initiative
MS4	Municipal Separate Storm Sewer Systems
MSQA	Midwestern Stream Quality Assessment
NASS	National Agricultural Statistics Service
NAWQA	National Water Quality Assessment
NLR	Nutrient Load Reduction
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPD	Non-rule Policy Document
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NRCS	Natural Resources Conservation Service (USDA)
NWQI	National Water Quality Initiative
OISC	Office of Indiana State Chemist
OWQ	Office of Water Quality (IDEM)
POTW	Publicy Owned Treatment Works
PS	Point Source
RCPP	Regional Conservation Partnership Program
RS	Resource Specialist (ISDA)
SAFE	State Acres for Wildlife Enhancement
SNRS	State Nutrient Reduction Strategy
SPARROW	Spatially Referenced Regressions on Watershed Attributes
SPEA	School of Public and Environmental Affairs, (IU)
SRA	State Resource Assessment
SSCB	State Soil Conservation Board
SWCD	Soil and Water Conservation District
SWQMP	Stormwater Quality Management Plan
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TNC	The Nature Conservancy
TP	Total Phosphorus

USDA	United States Department of Agriculture
USGS	United States Geological Survey
WHO	World Health Organization
WLEB	Western Lake Erie Basin
WMP	Watershed Management Plan
WQ	Water Quality
WQS	Water Quality Standards
WREP	Wetland Reserve Enhancement Program
WRP	Wetland Reserve Program
WRTDS	Weighted Regressions on Time, Discharge, and Season
WWTP	Waster Water Treatment Plant

Appendix B – Permitted Facilities with Water Quality Monitoring for Ammonia and Phosphorus



Facilities with WQ Monitoring for Ammonia & Phosphorus
Includes Data on Facilities with Permit Limit Notations



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Joanna Wood, Office of Water Quality
Date:02/8/2013

Sources:
Data - Obtained from the State of Indiana Geographic Information Office Library

Map Projection: UTM Zone 16 N **Map Datum:** NAD83

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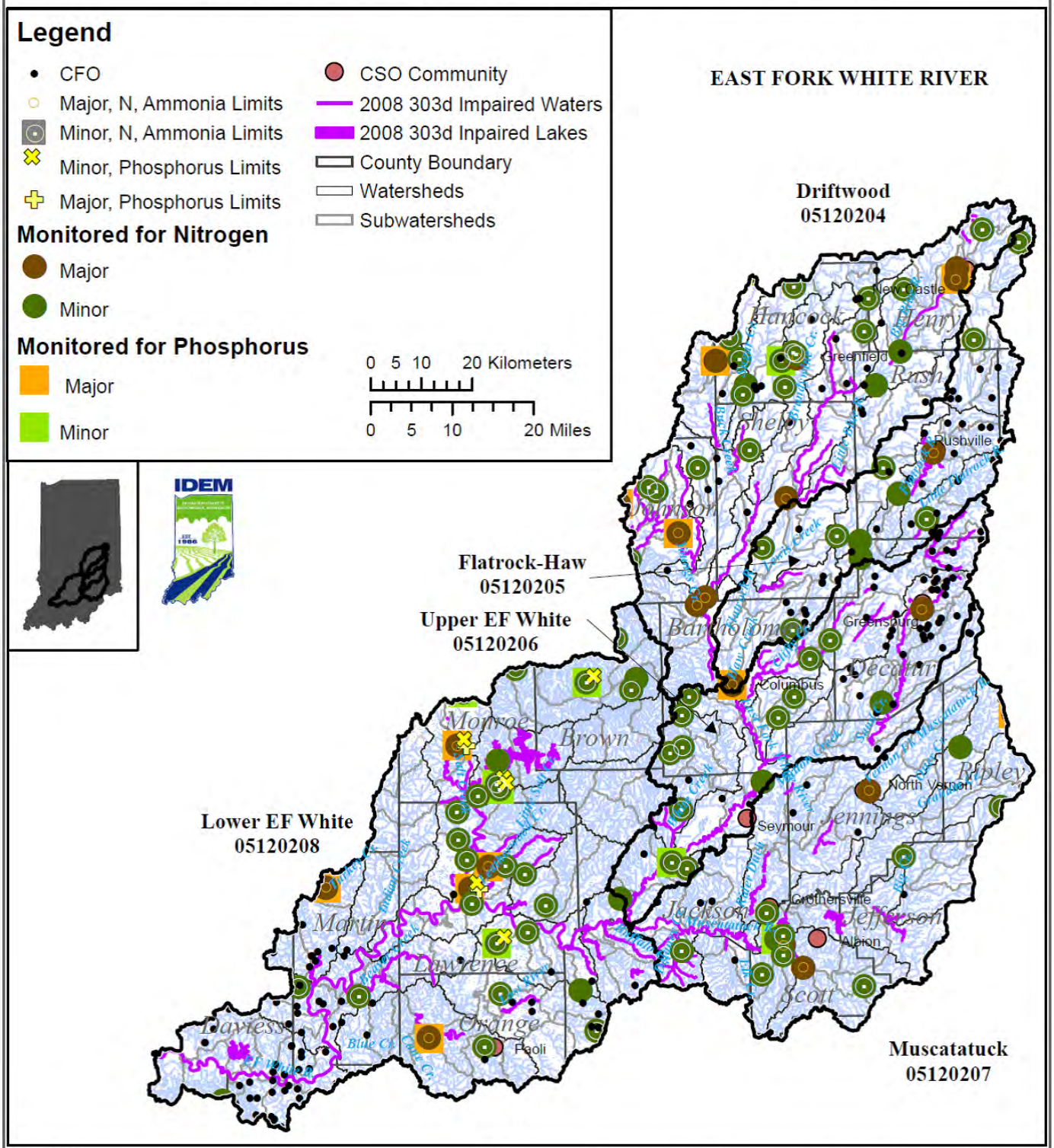

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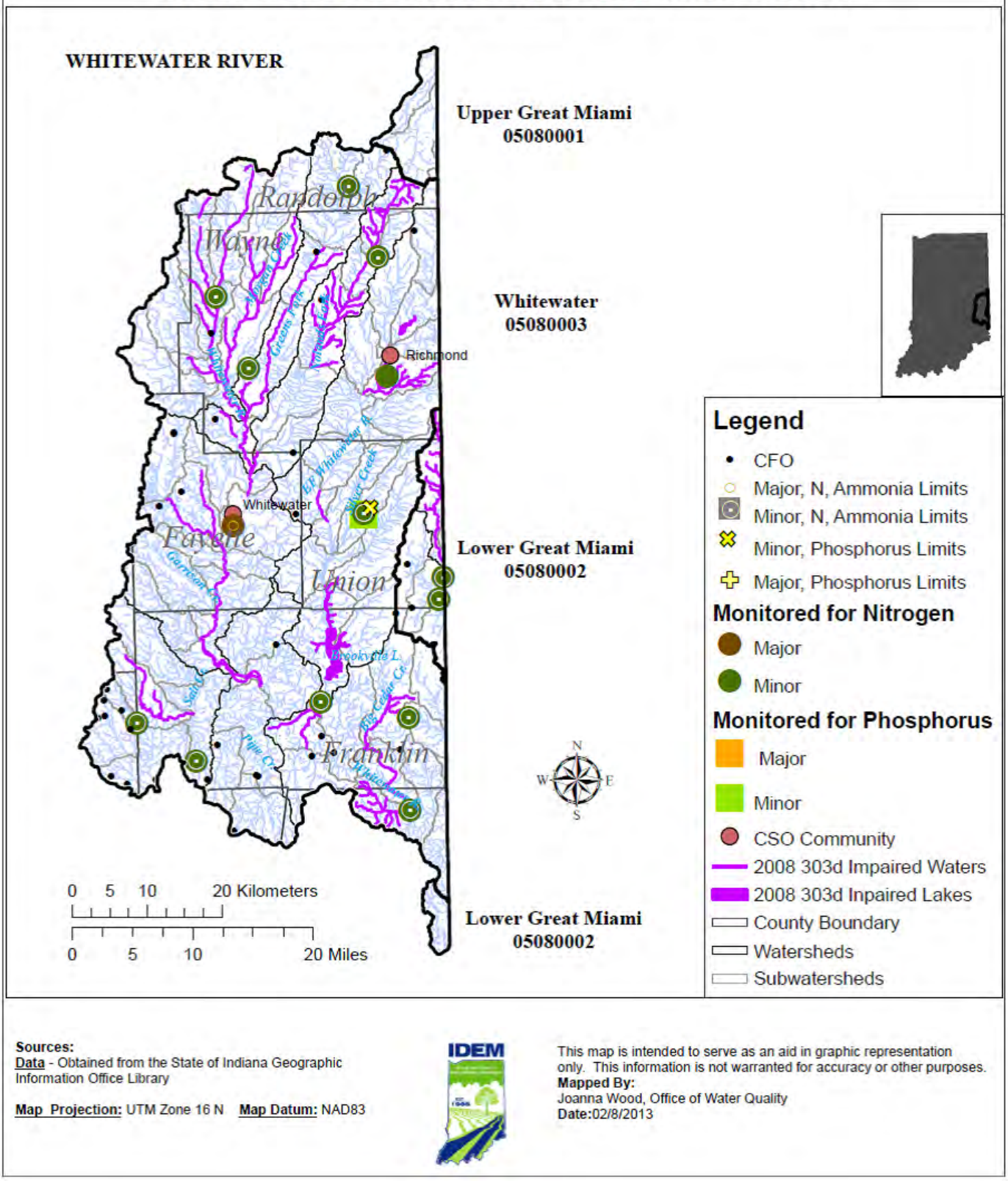

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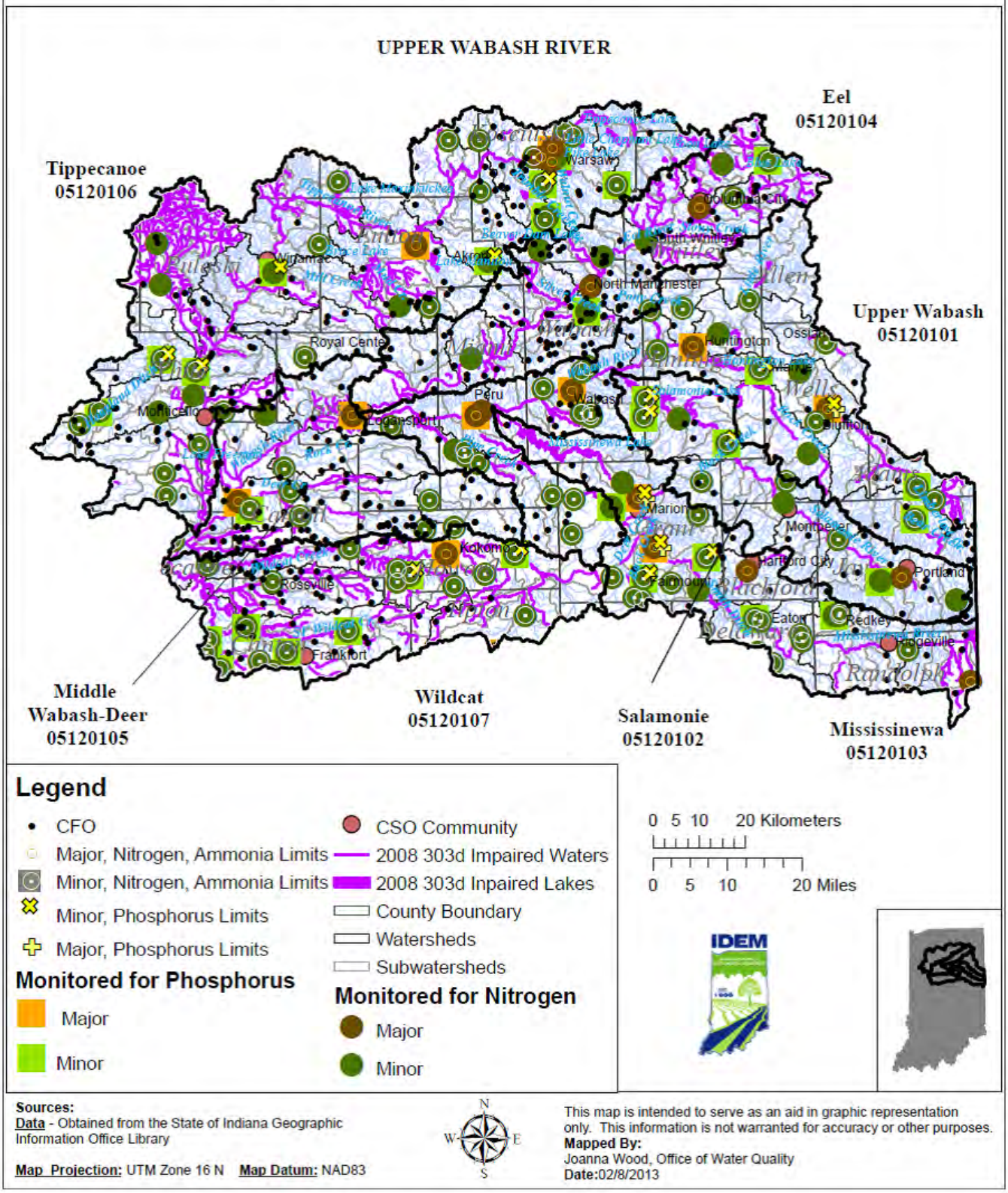

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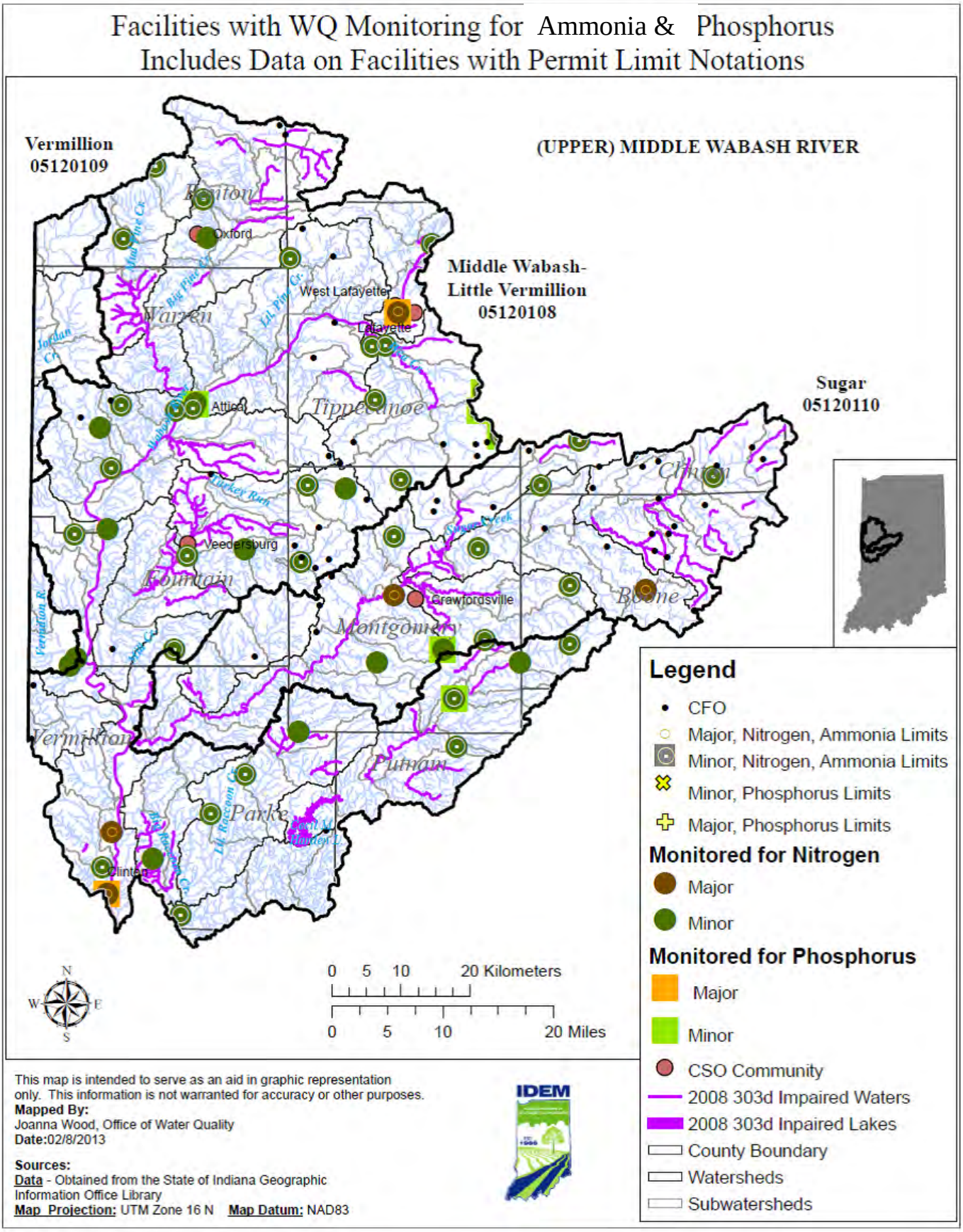

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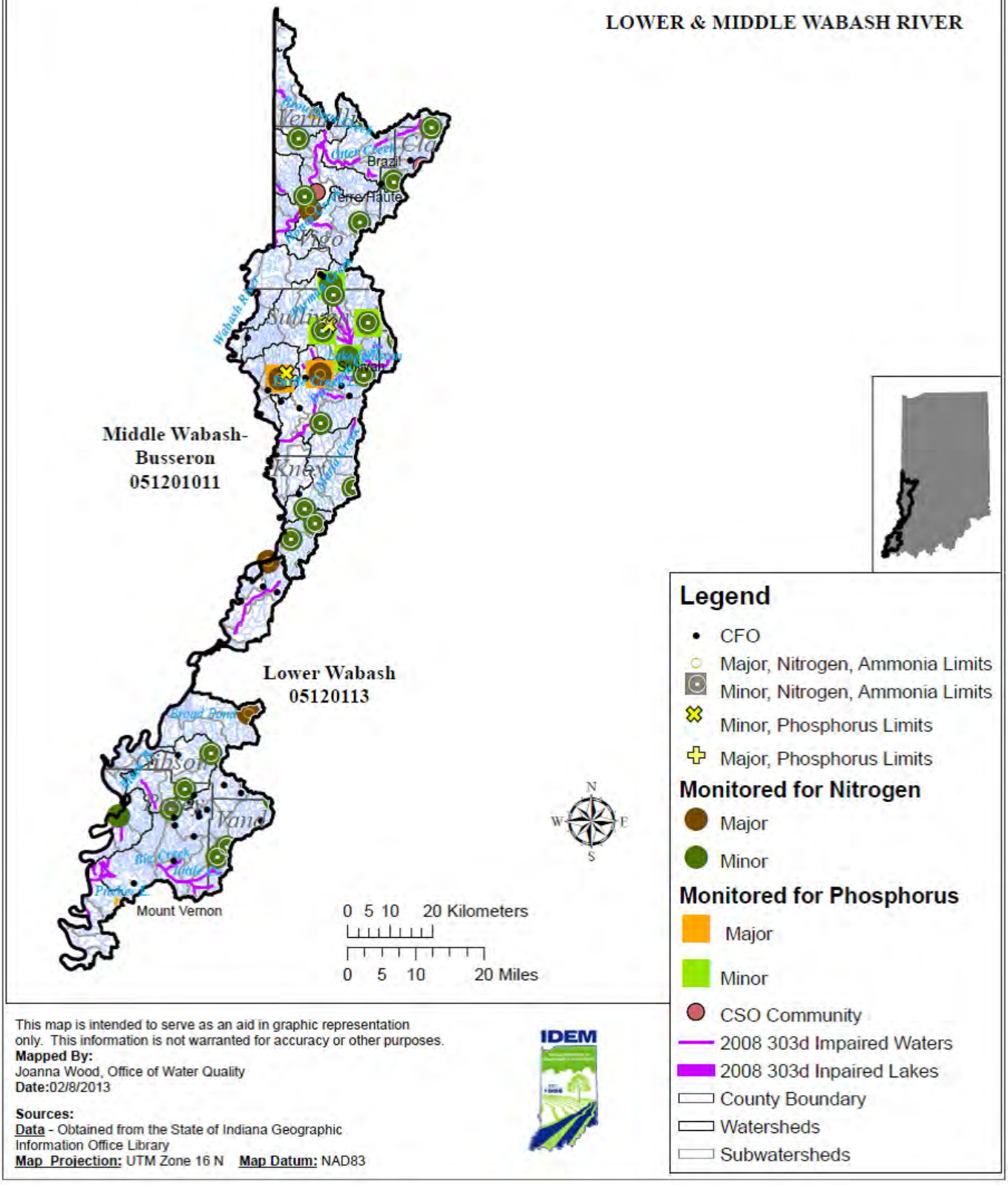

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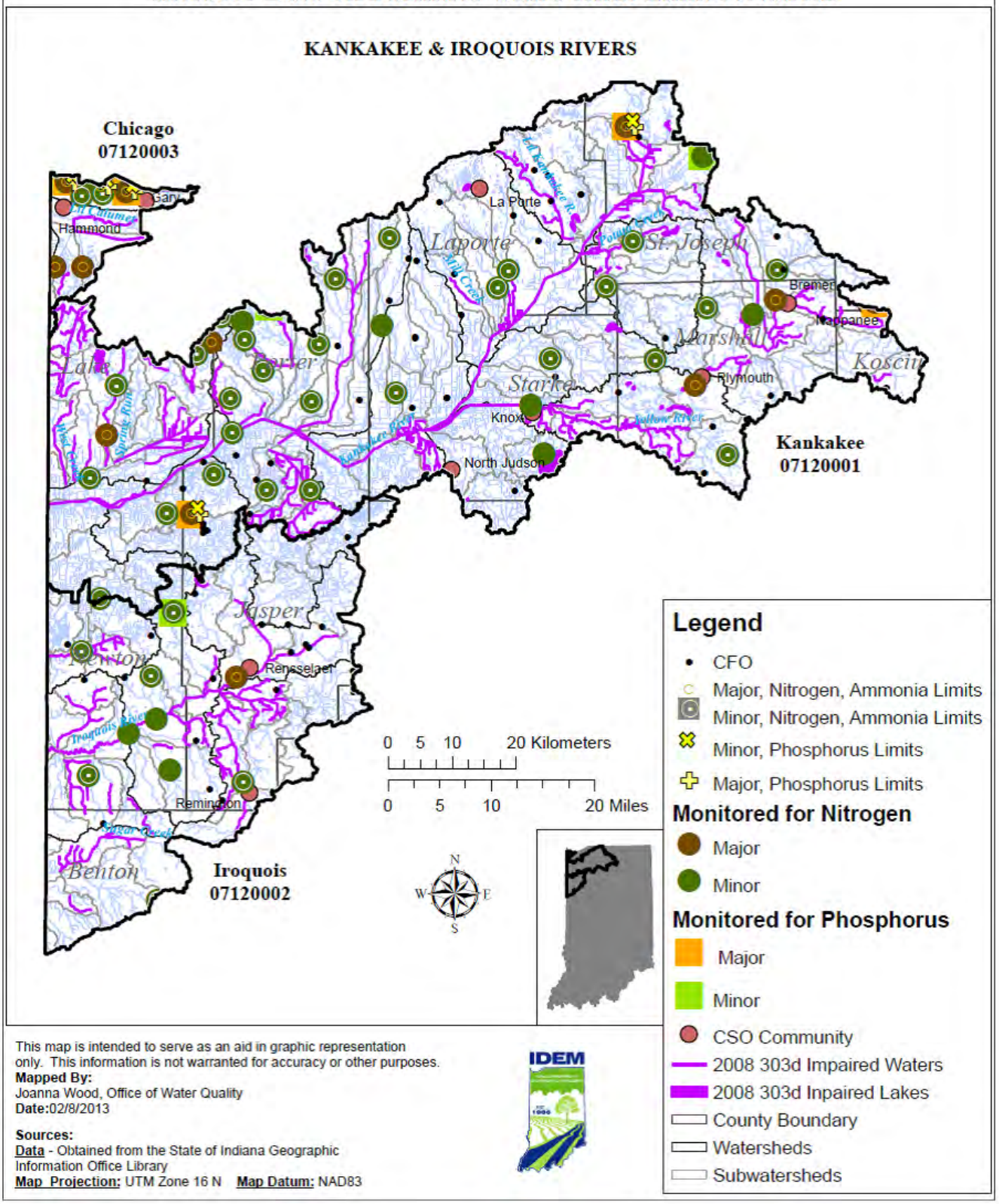

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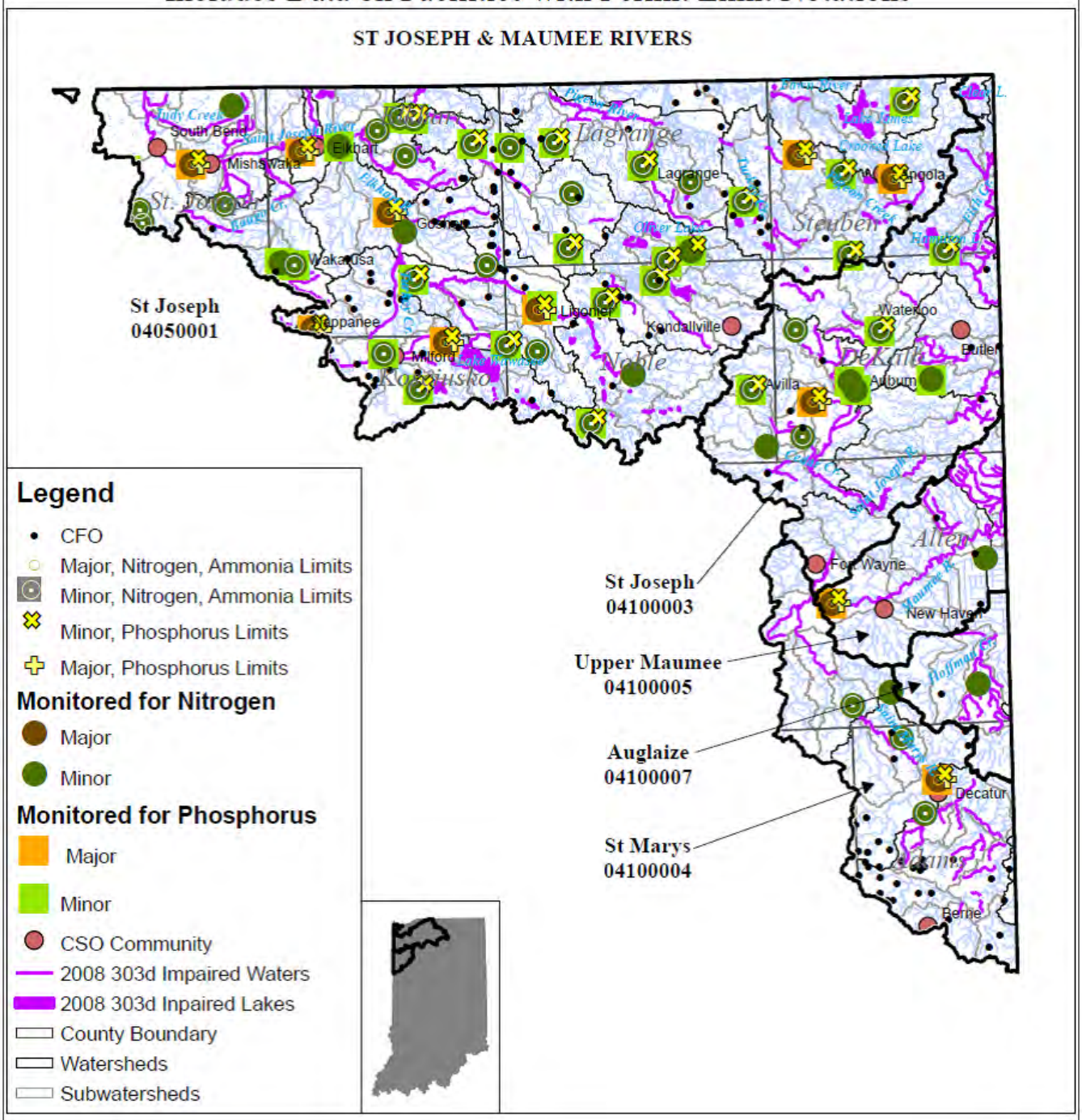

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Facilities with WQ Monitoring for Ammonia & Phosphorus
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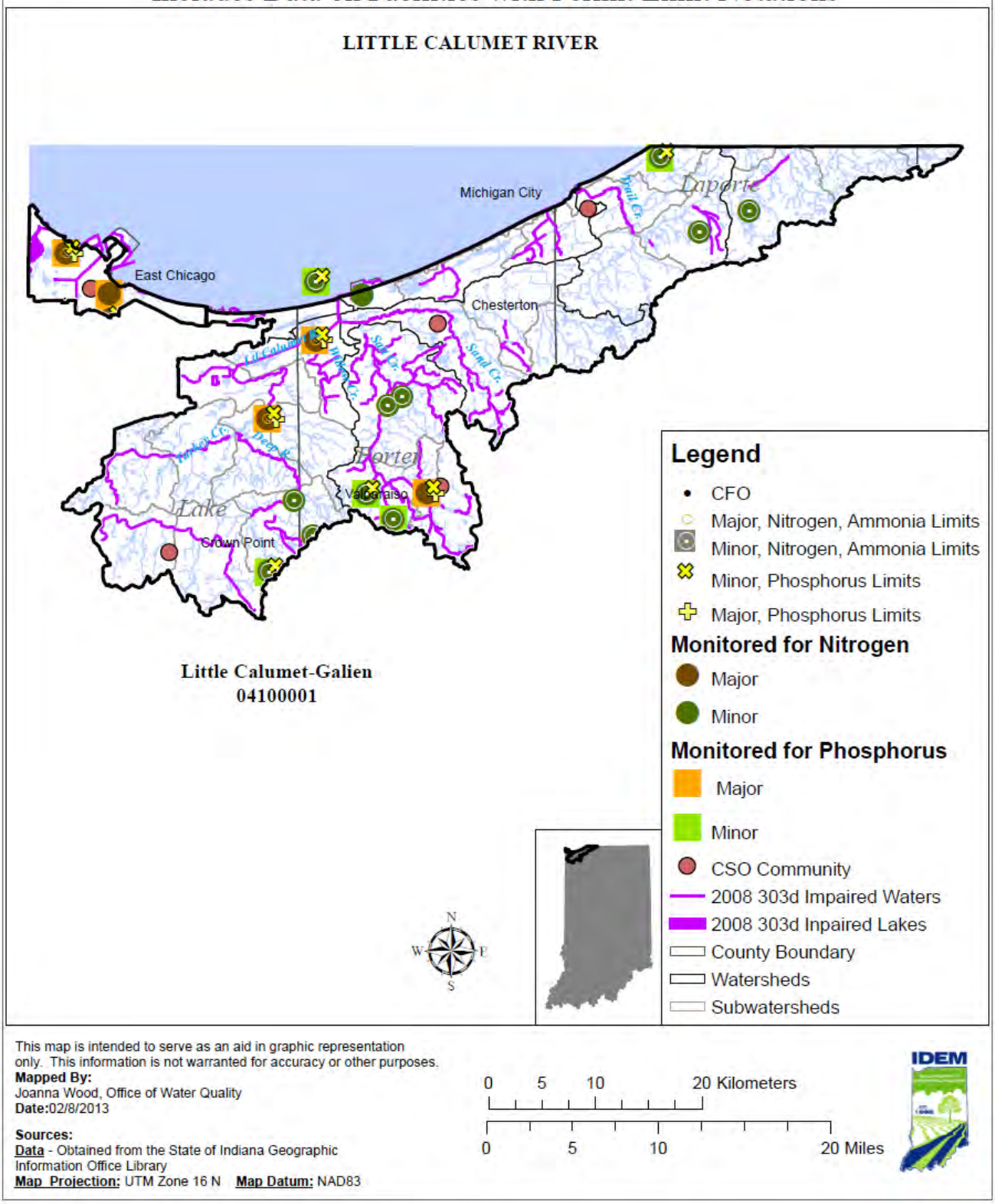

This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Joanna Wood, Office of Water Quality
Date:02/8/2013

Sources:
Data - Obtained from the State of Indiana Geographic Information Office Library
Map Projection: UTM Zone 16 N **Map Datum:** NAD83

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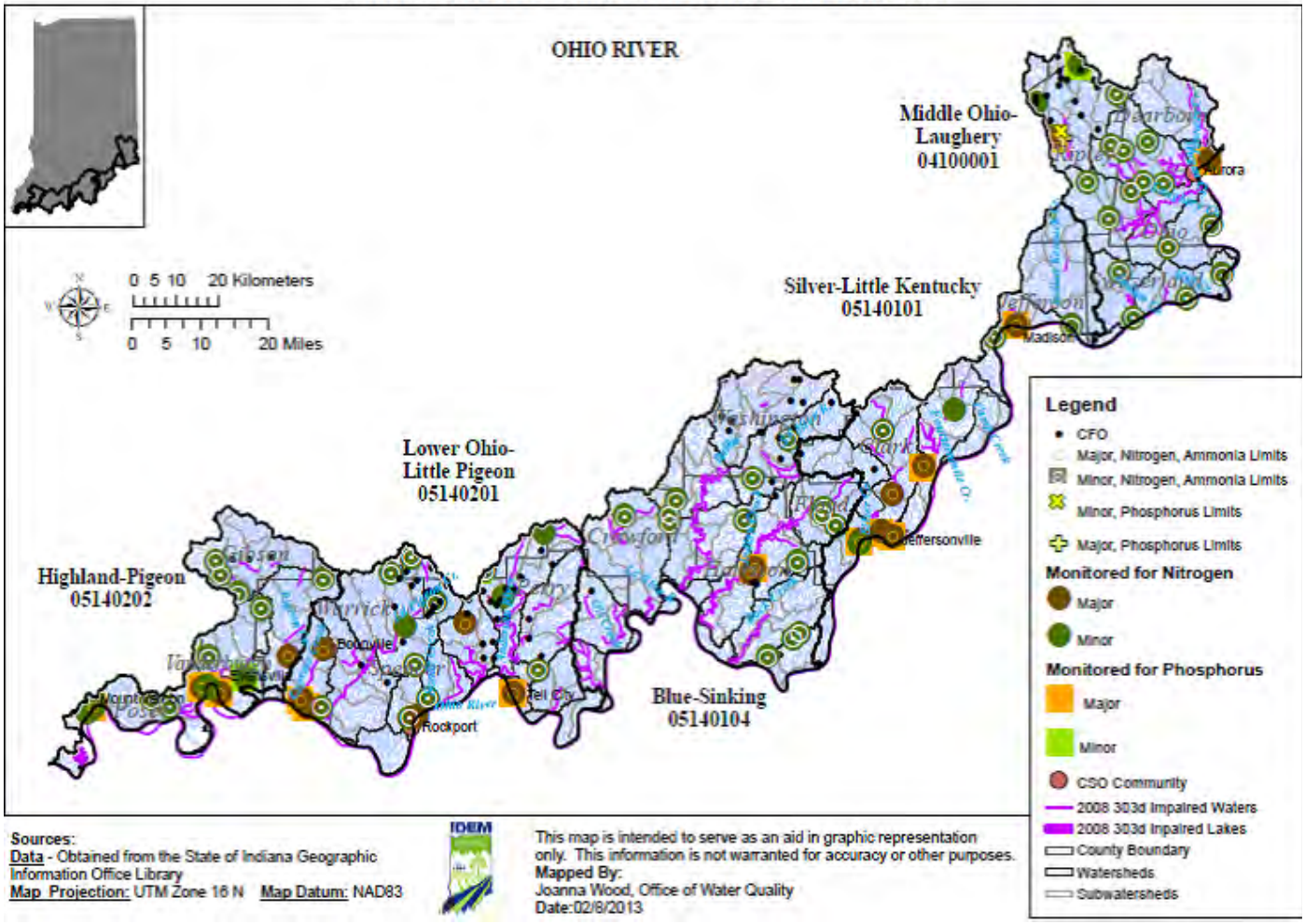

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IDEM

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Watershed Assessment and Planning Branch Monitoring Activities 2018 - 2019

Probabilistic Monitoring	Year: 2018	Parameters	Year: 2019
Watershed Name	Tributaries to the Great Lakes Basin	*E. coli*, Aluminum, Antimony, Arsenic, Calcium, Cadmium, Chromium, Copper, Lead, Magnesium, Nickel, Selenium, Silver, Zinc, Alkalinity, Total Solids, Dissolved Solids, Total Suspended Solids, Sulfate, Chloride, Hardness, TKN, Ammonia- Nitrogen, Nitrate/Nitrite, Total Phosphorous, TOC, Cyanide-Total, Cyanide-Weak Acid Dissociable, Chemical Oxygen Demand, Dissolved Oxygen, D.O. Saturation, pH, Specific Conductance, Temperature, Turbidity, Fish, Macroinvertebrates, Periphyton, Seston, Habitat Dissolved Oxygen and Orthophosphate (@ subset of 14 target sites, minimum 2 week end of August just prior to algae)	Tributaries to the Ohio River
Hydrologic Unit Code(s)	04040001, 04050001, 04100003, 04100004, 04100005 and 04100007 (excludes Lake Michigan shoreline)		05090203, 05140101, 05140104, 05140201, 05140202 (excludes Ohio River mainstem)
Laboratory Analytical Costs/Funding Source	Pace Analytical $69,000 ISDH Environmental Laboratory Division IDEM Mobile *E. coli* Lab $1,100 USGS Algal Biomass Lab $12,500 IDEM Fish, Macroinvertebrate and Algal Lab for Specimen Identification Diatom Verification $1,500 Macroinvertebrate Verification $600 Fish Verification $0		Pace Analytical TBD ISDH Environmental Laboratory Division IDEM Mobile *E. coli* Lab TBD USGS Algal Biomass Lab TBD IDEM Fish, Macroinvertebrate and Algal Lab for Specimen Identification Diatom Verification TBD Macroinvertebrate Verification TBD Fish Verification $0
Reference Site Monitoring	**Year: 2018**	**Parameters**	**Year: 2019**
Stream/River or Watershed(s)	05080003 Whitewater (10), 05090203 Middle Ohio Laughery (3), 05140104 Blue Sinking (13), 05140201 Lower Ohio Little Pigeon (1), and 05120209 Patoka (3)	Aluminum, Antimony, Arsenic, Calcium, Cadmium, Chromium, Copper, Lead, Magnesium, Nickel, Selenium, Silver, Zinc, Alkalinity, Total Solids, Dissolved Solids, Total Suspended Solids, Sulfate, Chloride, Hardness, TKN, Ammonia-Nitrogen, Nitrate/Nitrite, Total Phosphorous, TOC, Chemical Oxygen Demand, Dissolved Oxygen, D.O. Saturation, pH, Specific Conductance, Temperature, Turbidity, Fish, Macroinvertebrates, Periphyton, Seston, Habitat	TBD
Laboratory Analytical Costs/Funding Source	Pace Analytical $43,803 USGS Algal Biomass Lab $5,667 IDEM Fish, Macroinvertebrate and Algal Lab for Specimen Identification Diatom Verification $750 Macroinvertebrate Verification $450 Fish Verification $0		Pace Analytical TBD USGS Algal Biomass Lab TBD IDEM Fish, Macroinvertebrate and Algal Lab for Specimen Identification Diatom Verification TBD Macroinvertebrate Verification TBD Fish Verification $0

Watershed Assessment and Planning Branch Monitoring Activities 2018 - 2019

Fixed Station Monitoring	Parameters		
165 sites throughout all 9 watersheds: Divided into 16 routes sampled monthly (2 added in April 2014 for NWQI) Laboratory Analytical Costs/Funding Source ISDH/106	**CHEMISTRY** (dissolved vs. total metals at 12 selected sites geographically representative): Alkalinity, Hardness, Calcium, Magnesium, Ammonia-N, Nitrate+Nitrite-N, Nitrogen-TKN, Phosphorous-Total, COD, TOC, BOD, Solids-Total, Solids-Suspended, Solids-Dissolved, Fluoride, Chloride, Sulfate, Cyanide-Total, Cyanide-Free, Cyanide-Amenable, Arsenic (µg/l), Cadmium (µg/l), Chromium-Total (µg/l), Copper(µg/l), Iron (µg/l), Lead (µg/l), Manganese (µg/l), Nickel (µg/l), Potassium (µg/l), Sodium (µg/l), Zinc (µg/l), *E. coli*, **RADIOLOGICAL** (select sites, drinking water intakes): Alpha (gross), Beta (gross) **FIELD**: Turbidity, DP, pH, Temperature, Specific Conductance, Weather coding **ORGANICS/PESTICIDES** (select sites, drinking water intakes): Hexachlorocyclopentadiene, Desethylatrazine, Desisipropylatrazine, Hexachlorobenzene, Simazine, Atrazine, Cloazone, Pentachlorophenol, Lindane, Terbufos, Acetochlor, Alachlor, Heptachlor, Metolachlor, Chlorpyrifos, Cyanazine, Penimethalin, Heptachlor Epoxide, Ocychlordane, Gamm-Chlordane, Alpha-Chlordane, Trans-Nonachlor, endrin, Cis-Nonachlor, P,P'-DDT, Bis(2-Ethylhexyl)adipate, Methoxychlor, Bis(-Ethylhexyl)phthalate, Benzoapyrene, Trifluralin, Aldrin, Dieldrin, Propachlor		

Watershed Characterization Studies	Year: 2018	Parameters	Year: 2019
Watershed or Waterbody Name(s)	Lower East Fork White River	**CHEMISTRY** monthly for Alkalinity, Total Solids, Total Suspended Solids, Total Dissolved Solids, Sulfate, Chloride, Hardness, Ammonia-Nitrogen, Total Kjeldahl Nitrogen, Nitrate+Nitrite-Nitrogen, Total Phosphorous, Total Organic Carbon and Chemical Oxygen Demand. **FIELD:** pH, DO, D.O saturation, Temperature, Turbidity, and Specific Conductance. ***E. coli*** will be done 5X **Biological**: Fish, Macroinvertebrates, Habitat	Laughery Creek
Hydrologic Unit Code(s)	05120208, 0512020815		0509020305
Laboratory Analytical Costs/Funding Source	IDEM Mobile *E. coli* Lab, IDEM Fish and Macroinvertebrate Lab for Specimen Identification $33,000 Test America $1,000 *E. coli*		IDEM Mobile *E. coli* Lab, IDEM Fish and Macroinvertebrate Lab for Specimen Identification $39,000 Test America $1,400 *E. coli*

Watershed Assessment and Planning Branch Monitoring Activities 2018 - 2019

Performance Measure Monitoring	Year: 2018	Parameters	Year: 2019
Watershed or Waterbody Name(s)	041000030401 – 2 sites; W Branch Fish Cr 041000030604 – 1 site; W Smith Ditch 041000030702 – 1 site; Peckhart Ditch 041000030705 – 2 sites; Little Cedar Cr 041000030707 – 3 sites; Cedar Creek	**CHEMISTRY** may vary from year to year depending on the impaired listing, BMPs implemented, critical areas, & land use. Ammonia-Nitrogen, Total Phosphorus, Nitrate/Nitrite, Total Kjeldahl Nitrogen, Dissolved Solids, Suspended Solids. **FIELD:** pH, DO, D.O. saturation, temperature, turbidity, and specific conductance. ***E. coli*** will be done 5X if necessary. **Biological**: Fish, Macroinvertebrates, Habitat	TBD
Laboratory Analytical Costs/Funding Source	No sites require an outside lab; therefore, no cost associated with water chemistry. IDEM Fish and Macroinvertebrate Lab for Specimen Identification		TBD IDEM Fish and Macroinvertebrate Lab for Specimen Identification
Fish Tissue Monitoring	**Year: 2018**	**Parameters**	**Year: 2019**
Watershed or Waterbody Name(s)	Upper Wabash River Basin (Lake Michigan - up to 10 samples will be collected by DNR & analyzed by IDEM)	Percent Moisture, Percent Lipid, PCBs, Organochlorine-Pesticides, Cadmium, Selenium, Lead, Total Mercury (and possibly methylmercury)	Kankakee and Lower Wabash River Basins (Lake Michigan - up to 10 samples will be collected by DNR & analyzed by IDEM)
Hydrologic Unit Code(s)	05120101, 05120102, 05120103, 05120104, 05120105, 05120106, and 05120107		05120108, 05120109, 05120110, 05120111, 05120113 07120001, 07120002, 07120003
Laboratory Analytical Costs/Funding Source	Pace/IN Lab Account $120,860		Pace/IN Lab Account TBD
Toxic Algae Monitoring	**Locations**	**Parameters**	
Waterbody Name(s) Laboratory Analytical Costs/Funding Source: IDEM Algal Lab/106	**Designated swimming beaches in the lakes at the following state owned parks or managed recreation areas:** Potato Creek, Pokagon, Chain-o-Lakes, Mississinewa, Salamonie, Raccoon Lake (aka Cecil M. Harden Reservoir), Monroe (2 beaches), Hardy, Whitewater, Brookville (2 beaches), Deam Lake and Starve Hollow	Cyanobacterial Identification and Cell Enumeration, Microcystin, Cylindrospermopsin, Anatoxin a, and Saxotoxin toxin analysis	