

INDIANA NUTRIENT REDUCTION STRATEGY

A framework to reduce nutrients entering Indiana's waters

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Summary

The Indiana Nutrient Reduction Strategy represents the state's commitment to assess the quality of its waters and to reduce nutrient runoff into Indiana's waters from point sources and non-point sources alike. This strategy outlines a realistic and attainable set of objectives while considering the EPA's eight "Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution" (Stoner 2011). These objectives include acknowledgment of the obstacles facing the improvement of Indiana's impaired waters, prioritization of HUC-8 watersheds and preliminary HUC-12 watersheds, the inventory and utilization of resources to achieve their highest impact on nutrient reduction, involvement and engaging of stakeholders in the state's efforts to reduce nutrient loads, and in addition to regulatory control of point sources, encouragement of voluntary, incentive based conservation through the many state and federal water quality related programs.

Many of these objectives will be aided by the completion of a science assessment, which will create a comprehensive picture of the state's waters as a whole through a meta-analysis of the state's water quality data and subsequently provide insight as to the direction of Indiana's strategy in the future.

The Indiana Nutrient Reduction Strategy also serves as a renewed effort to encourage outreach and education to conservation partnerships and the public alike 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, environmental pressures, as well as many other complex factors, including the location and nature of rural BMPs such as filter strips, buffers and cover crops as well as measures in urban areas including septic system management, residential fertilizer applications and erosion controls at construction sites. As such, there will always be a need for continued efforts in conservation, education, outreach and research in order to maintain progress.

Existing Water Quality Problems in the State of Indiana

Nutrient Load Effects on Indiana's Water

Indiana's surface and ground waters are negatively impacted by excessive nutrient loads from point sources and nonpoint sources to our rivers, lakes and streams. This reality in Indiana is most evident in harmful algal blooms (HABs) present in increasing numbers on a large number of lakes and reservoirs. This has affected economic and recreational activities by increasing cost for treating public water supplies as well as reducing recreational use of lakes for swimming and boating.

We Hoosiers are called to address the health of our water resources in a comprehensive way. 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, including storm water management. 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). This includes managing agricultural lands to reduce nutrient loads lost to runoff, managing soil health and water-holding capacity as well as utilizing buffers, filters and other best management practices along waterways in both urban and rural areas.

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. As a national leader in use of cover crops, nutrient management and advocating of soil health and productivity, Indiana is perhaps the best 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. These and other initiatives will be described in greater detail in following sections.

National Nutrient Load Priorities and Concerns

Eutrophication, or nutrient enrichment of waters, is not only an issue for the state of Indiana. Across the nation nitrogen and phosphorus loads entering our waterways are a growing concern. Among the most pressing is the Hypoxia Zone in the Gulf of Mexico, where nutrient loads from the Mississippi/Atchafalaya River Basin (Figure 1) are contributing to eutrophication and harmful algal blooms across an area greater than 6700 square miles (http://www.noaaneews.noaa.gov/stories2011/20110804_deadzone.html).

Addressing Problems through Watershed Prioritization and Utilization of Existing Programs

Prioritize 8-digit HUC Watersheds

In order to make the most impact with the tools at our disposal, it is vital that we prioritize our HUC-8 watersheds in the state of Indiana. While the primary goal of this document is to format a plan for

nutrient reduction in Indiana's waters, it is of the utmost importance that Indiana's goals are realistic and attainable to achieve the desired positive effect on our water quality, which is to reduce the nutrient loading estimates in high-priority watersheds across the state.

Selection for prioritization at the HUC 8 level was determined by both the Indiana State Department of Agriculture (ISDA) and the Indiana Department of Environmental Management (IDEM) and was approved by the Indiana Conservation Partnership (ICP). Seven of the watersheds under the Conservation Reserve Enhancement Program (CREP), situated along the Wabash River and White River, will serve as Indiana's prioritized watersheds. This was deemed most appropriate for Indiana, as those impaired watersheds along our largest waterways also happen to have the most active locally led initiatives as well as plentiful conservation resources in water quality and nutrient management or soil health programs and initiatives at the state and federal levels. Furthermore, field staffs from both state and federal agencies in these watersheds are virtually a ubiquitous resource for education, outreach and technical assistance. Due to these favorable circumstances along some of our most impaired and influential waterways, these are the watersheds that also have the greatest potential for positive water quality impact. The Indiana Conservation Partnership determined that, on a practical scale, these watersheds are not only logistically and environmentally sound targets for prioritization, but are also the most economically viable target watersheds for prioritization due to the existing programs and robust infrastructure which exists in the CREP HUC-8 watersheds.

The Conservation Reserve Enhancement Program (CREP) is an enhancement to CRP with a focus on water quality and serves eleven HUC-8 watersheds across Indiana which stand to see the most impact on water quality through best management practices. This program exists as a partnership between the Indiana State Department of Agriculture and the Farm Service Agency with cooperation from the State Soil Conservation Board (SSCB) to provide financial incentives to farmers willing to enroll eligible cropland into the program in order to reduce sediment and nutrient runoff and increase nutrient uptake on agricultural lands. The CREP Permanent Easement Program also serves the function of improving water quality with the Nature Conservancy (TNC) and the Indiana Department of Natural Resources (IDNR) as partners. The formation of CREP for three HUC-8 watersheds in 2005 and its subsequent expansion to eleven HUC-8 watersheds in 2010 marked the earnest effort by the state of Indiana to prioritize its HUC-8 watersheds prior to the initiation of this effort or the state nutrient reduction strategy. As such, the seven HUC-8 CREP watersheds in Indiana along our largest impaired waters continue to serve as the top priority targets for nutrient management and reduction. These watersheds are: Upper Wabash, Middle Wabash-Deer, Middle Wabash-Little Vermillion, Middle Wabash-Busseron, Lower Wabash, Upper White and Lower White (Figure 2).

In order to reduce nutrient loads in these watersheds, a collective and cooperative effort between local, state and federal agencies to increase enrollment in existing conservation and water quality programs in the seven priority CREP watersheds will be the primary focus set forth by this strategy. Outreach in this effort will include education on nutrient loading issues in the watersheds by government field staff as well as efforts such as a cooperative targeted outreach campaign between ISDA and the Farm Service Agency (FSA) for CREP enrollment and permanent easement enrollment along these river systems. The Natural Resource Conservation Service (NRCS) soil health campaign as well as that of the Conservation Cropping Systems Initiative (CCSI) will also be directed toward these watersheds, which are largely agricultural. These and many other programs and initiatives will serve as the groundwork on which future efforts will also be made, including that of a science assessment of Indiana's water quality data. Once this has been completed, a review of our prioritized watersheds and programs will be overlaid with the assessment results to better determine areas of resource strength and weakness in the state in

order to better direct efforts and resources if necessary. The development of a science assessment will be addressed in sections to follow.

Two HUC-12 watersheds within the CREP are of particular focus, as they have significant amounts of water quality data to serve as baselines to allow us to measure changes. These watersheds are:

1. Eagle Creek in central Indiana has a USGS continuous water-quality monitoring sentry 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 is part of the USGS Midwestern Stream Quality Assessment (MSQA), an 11-state, 100 site, intensive water-quality and ecology survey in 2013-2014, coordinated with EPA's National River and Streams Assessment. MSQA at Eagle Creek includes weekly samples analyzed for nearly 300 constituents, including nutrients and pesticides. An autosampler at the site collects daily composite samples. A nutrient processing study at the site includes streambed water samples, periphyton chlorophyll, and a second set of continuous monitoring sensors with added parameters. MSQA includes an ecology survey of habitat, fish, and invertebrates. Eagle Creek has had multiple years of small scale stream monitoring for nutrients by 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.

2. Sugar Creek in south-central Indiana has a USGS gage (USGS 03361650) at New Palestine that is a USGS National Water Quality Assessment (NAWQA) Program long-term trends site. This site is sampled approximately three times per month for a long list of NAWQA constituents including nutrients. This site is an MSQA site with the same daily automated sampler as used at Eagle Creek, along with the weekly water-quality sampling and ecology survey of the MSQA. The Sugar creek watershed was thoroughly characterized during earlier NAWQA studies of agricultural chemicals and nutrients transport and tile drain studies. A USGS sediment source tracking study is underway at the New Palestine site. 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.

Encourage Actions that are Voluntary, Incentive-based, Practical and Cost-effective

Cost-Share Programs - A key aspect of improving our state's waters is providing voluntary, incentive-based, practical and cost effective programs and options to landowners. The collective utilization of all

water quality, soil health and nutrient management programs across the state is something that Indiana already does very well. The cohesion of agencies and programs that exists here has made Indiana a national leader in local, state and federal partnership cooperation as well as conservation farming through cover crop implementation and nutrient management.

State departments like the Indiana State Department of Agriculture (ISDA), the Indiana Department of Environmental Management (IDEM) and the Indiana Department of Natural Resources (IDNR) are all invested in the continued growth and promotion of grants and programs that improve the state's water quality by encouraging actions that are voluntary, incentive-based, practical and cost-effective. Such initiatives include the Conservation Reserve Enhancement Program (CREP), the Lake and River Enhancements Program (LARE), the Healthy Rivers Initiative (HRI) and other programs, practices and grants funded by 319 monies awarded to the State by the US Environmental Protection Agency as well as Indiana's own Clean Water Indiana funds. Farm bill programs are also available through the USDA Natural Resource Conservation Service and the Farm Service Agency 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 and initiatives will be described in the following section.

Agricultural Commodities Efforts – Agricultural commodity groups in Indiana, including those of corn, soybeans, pork, dairy, cattle and poultry, have voluntarily created a Nutrient Management and Soil Health strategy with input and dialogue from the US Environmental Protection Agency (USEPA), NRCS, ISDA, IDEM and the Farm Bureau. This document, which complements Indiana's state nutrient reduction strategy, highlights the challenges posed to agriculture in responsibly managing and reducing nutrient and sediment loss. It also incentivizes improvements along these lines by highlighting the economic and environmental benefits of promoting and building soil health, which reduces nutrient loss and runoff by improving water holding capacity, increases nutrient exchange and uptake by plants and strengthens soil structure resulting in reduced sedimentation.

This effort is also keenly focused on education and outreach of these challenges and goals for the agricultural community. Representatives from the agricultural community in Indiana who are responsible for the development Nutrient Management and Soil Health Strategy are also actively engaged in creating Educational Material Implementation Plans for producers to utilize in these efforts. Similarly, systems approaches to nutrient management and soil health improvement are already highlighted and encouraged within the strategy itself.

Utilize the Tools and Programs We Have: Non-point Source

Indiana already 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 other means. While all these programs and initiatives directly or

indirectly contribute to Indiana's effort to positively impact water quality across the state, those marked with an asterisk (*) are active in one or more of Indiana's priority watersheds.

Conservation Reserve Enhancement Program (CREP)* - The Conservation Reserve Enhancement Program (CREP) is a federal-state natural resources conservation program that addresses agricultural-related environmental concerns at the state and national level. CREP participants receive financial incentives to voluntarily enroll in the Conservation Reserve Program (CRP) in contracts of 14 to 15 years. Participants remove cropland from agricultural production and convert the land to native grasses, trees and other vegetation. The Indiana CREP is a partnership between USDA and the state of Indiana (Figure 2).

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 which will reduce nonpoint sources of water pollution through education, technical assistance, training, and cost sharing programs. The CWI program is responsible for providing local matching funds as well as grants for sediment and nutrient reduction projects through Indiana's Soil and Water Conservation Districts. The State Soil Conservation Board directs the Department in the use of CWI funds (Figure 3).

Healthy Rivers Initiative (HRI)* – Since 2010, the Healthy Rivers Initiative has been the largest land conservation initiative 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 as well as over 26,000 acres of the Muscatatuck River bottomlands in southeast Indiana. 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, as well as the public and surrounding communities by providing flood protection, improved water quality and recreational opportunities for current and future generations who enjoy our water resources (Figure 4).

IDEM Section 205j* - The federal Clean Water Act Section 205(j) provides funding for water quality management planning. Funds are to be used to determine the nature, extent and causes of point and nonpoint source pollution problems and to develop plans to resolve these problems (Figure 5).

IDEM Section 319(h)* - Section 319(h) of the Clean Water Act creates a state-based grant program to address nonpoint source water pollution by 1) conducting statewide assessments of its waters, 2) developing nonpoint source management programs to address impaired or threatened waters that have been identified, and 3) implementing approved, federally-funded nonpoint source management programs to remediate and prevent nonpoint source pollution. The Indiana Department of Environmental Management (IDEM) is charged with the implementation of all aspects of Section 319 of the CWA. IDEM places strong emphasis on watershed planning that ensures that Section 319 funds are directed to on-the-ground projects that reduce, eliminate, or prevent nonpoint source pollution in Indiana's waters. (Figure 5).

Great Lakes Commission Sediment Control Program - Currently there are three active watershed based demonstration projects underway in Indiana utilizing funding from this program. Those include the St. Mary's River Watershed administered by the Adams County SWCD, the Upper Maumee River Watershed Project administered by the Allen County SWCD and the Elkhart River Watershed Project administered by Elkhart River Restoration Association with assistance from the Elkhart County SWCD. Each of these

projects received funding in excess of \$300,000 for three year projects. Recently the DeKalb County SWCD received a small grant from this program to purchase a small seeds no-till drill for seeding cover crops.

Lake and River Enhancement (LARE) Grant Funding Administered by IDNR* - The Lake and River Enhancement (LARE) 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. (Figure 6)

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:

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

Watershed Land Treatment 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.

On-Farm Network (OFN)* - The On-Farm Network (OFN) is a group of crop producers interested in economics, stewardship, and reducing their environmental footprint. Participating farmers use precision

agricultural tools and technologies to conduct research on their own farms. Through the On-Farm Network®, farmers use this data from their own farms and others in their area to evaluate the effectiveness and economic pros and cons of different management practices, such as nutrient application rates, timing, and form. Farmers not only evaluate the effectiveness of different practices on their own farm, but benefit from aggregate data across multiple farms and years (Figure 7).

Conservation Cropping Systems Initiative (CCSI)* - The Indiana Conservation Cropping Systems Initiative (CCSI) promotes a systematic approach to production agriculture focusing on Continuous no-till/strip-till, nutrient and pest management, precision farming, and cover crops. The result is improved soil quality, water quality and profitability on Indiana cropland. The CCSI is a resource for the 92 Indiana Soil and Water Conservation Districts to carry out their conservation cropping systems goals and objectives (Figure 11). Efforts from the CCSI have been closely coordinated with the NRCS Soil Health Campaign and represent a strong partnership in Indiana which serves as a national model and example. CCSI and its cooperative efforts with state and federal initiatives has actively fostered environmental stewardship, conservation farming and dedication to improving soil and water resources since its inception.

Great Lakes Restoration Initiative (GLRI) - The President's 2010 Budget provides \$475 million in EPA's budget for a new Environmental Protection Agency-led, interagency Great Lakes Restoration Initiative, which will target the most significant problems in the region, including invasive aquatic species, nonpoint source pollution, and contaminated sediment (Figure 8).

Mississippi River Basin Initiative (MRBI)* - To improve the health of the Mississippi River Basin, including water quality, wetland restoration, and wildlife habitat, the Natural Resources Conservation Service has established the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Through this Initiative, NRCS and its partners will help producers in targeted watersheds within the Mississippi River Basin voluntarily implement conservation practices (Figure 8).

Wetland Restoration Enhancement Program (WREP)* - WREP, a voluntary conservation program, offers both financial and technical assistance to private landowners wishing to restore wetlands and increase wildlife habitat. WREP is a part of the more familiar Wetlands Reserve Program (WRP). Both federal programs are administered by the USDA's Natural Resources Conservation Service (Figure 8).

National Water Quality Initiative (NWQI) and the Environmental Quality Incentive Program (EQIP)* - The USDA's Natural Resource Conservation Service (NRCS) National Water Quality Initiative also has a valuable presence in smaller HUC-12 watersheds within the Eel, Patoka and Upper White (HUC-8) watersheds in Indiana. Farmers and landowners are able to participate in this initiative through enrollment in the Environmental Quality Incentive Program (EQIP), wherein financial and technical assistance are provided to apply conservation and/or management practices through a systems approach in order to control and trap nutrient and manure runoff from agricultural land.

Agricultural Water Enhancement Program (AWEP) – The USDA Agricultural Water Enhancement Program (AWEP) is a voluntary conservation initiative that provides financial and technical assistance to agricultural producers to implement agricultural water enhancement activities on agricultural land for the purposes of conserving surface and ground water and improving water quality (Figure 8).

Healthy Forest Reserve Program (HFRP)- The purpose of the USDA Forest Service's Healthy Forests Reserve Program (HFRP) is to assist landowners, on a voluntary basis, in restoring, enhancing and

protecting forestland resources on private lands through easements, 30-year contracts and 10-year cost-share agreements (Figure 8).

Safe Acres for Wildlife Enhancement (SAFE) and the Conservation Reserve Program (CRP)* – 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. 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.

Cooperative Conservation Partnership Initiative (CCPI) - The USDA Cooperative Conservation Partnership Initiative (CCPI) is a voluntary conservation initiative that enables the use of certain conservation programs along with resource of eligible partners to provide financial and technical assistance to owners and operators of agricultural and nonindustrial private forest lands (Figure 8).

Ohio River Basin Water Quality Trading Project: Pilot Trading Plan by the states of Indiana, Kentucky and Ohio - 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, a pilot program allowing farmers and industrial facilities to trade pollution credits to reduce fertilizer run-off and nutrient discharges. 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. The goal is to establish a private sector trading market that is self sustaining and does not involve government subsidy. Indiana counties participating will include Wayne, Dearborn, Ripley, Ohio, and Switzerland. The program will run through 2015 and received \$1.3 million in federal funding from the US Department of Agriculture and the EPA, as well as support from large investor-owned utilities like AEP and Duke Power. 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.

Utilize the Tools and Programs We Have: Point Source

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.

Commencing in 2013, to further characterize phosphorus loadings from wastewater treatment plants, all major (1 MGD or bigger) municipal facilities will have a monitoring requirement in their permits (if not already in their permits) at renewal. There are approximately 140 major municipal dischargers. To reduce phosphorous loadings, all new sanitary wastewater facilities and those requesting capacity related upgrades are receiving a limit of 1mg/l for total phosphorous. All sanitary wastewater dischargers that discharge to a nutrient impaired stream segment identified in the 2010 303(d) List of Impaired Waters will receive a limit of 1mg/l for total phosphorous upon permit renewal. Additionally, IDEM will implement Total Maximum Daily Load (TMDL) load reductions as written and approved for

total phosphorous upon the renewal of an affected permit, and IDEM will continue to implement phosphorus removal as required by 327 IAC 5-10-2 (Figures 9-19).

Confined Feeding Operations (CFOs)* - In Indiana, an animal feeding operation with 300 or more cattle, 600 or more swine or sheep, 30,000 or more poultry, or 500 horses in confinement is a CFO. A person must request and receive IDEM approval before starting construction of a CFO, or starting expansion of a CFO to increase animal population or manure storage capacity. As of July 1, 2012, the new CFO rules require that farmers apply manure to their fields on the basis of the soil's phosphorus content. Previously, manure was applied to fields based on soil nitrogen content and nitrogen needs for the coming crop. New regulations require that soil phosphorus not exceed 200 parts per million by 2018. That means that over the next six years, farmers will need to continue to monitor soil phosphorus concentrations and work to begin the gradual process of reducing the phosphorus content of their fields. Additionally, there are new rules specific to CFO operators regarding winter manure application and soil phosphorus. Under the new regulations, manure application on frozen and snow-covered ground is no longer permitted; however, there are 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.

Concentrated Animal Feeding Operations (CAFOs)* - The terms CFO and CAFO relate to the size of the CFO. A Concentrated Animal Feeding Operation (CAFO) is a CFO that meets the threshold animal numbers for a large CAFO. Many of the program's requirements apply to CFOs of all sizes. Some requirements apply only to CAFOs. Indiana revised its Confined Feeding Operation Rule, which is found at: 327 IAC 19 and its Concentrated Animal Feeding Operations Rule, 327 IAC 15-16. A fact sheet can be found at: http://www.state.in.us/idem/files/factsheet_animal_feeding_operation.pdf
<http://www.hoosieragtoday.com/index.php/2012/06/26/new-cfo-and-cafo-rules-require-operational-changes/>

Operators with individual CAFO permits will be required to create nutrient management plans accessible to the public. Additional record keeping also will be required. For example, farmers will need to keep records of daily inspections. More information about impending rule changes is available on the IDEM website at <http://www.in.gov/idem>.

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.

MS4s are working with IDEM’s Hoosier Riverwatch Program and the external data framework coordinator to ascertain acceptance criteria (credible data requirements) for their monitoring efforts and to develop in-stream water quality monitoring programs to determine the efficacy of their BMPs. Criteria should be in place by October 1, 2013.

- 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* encourage 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).

Engage Partnerships and Stakeholders

Indiana Conservation Partnership - One of the most important tasks in this effort is that of engaging and utilizing the Indiana Conservation Partnership (ICP) and others invested in Indiana’s water quality. 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’ efforts to do the same. The ICP embodies that reputation.

The ICP is comprised of eight entities, including the State Soil Conservation Board (SSCB), the Indiana Association of Soil and Water Conservation Districts (IASWCD), the USDA Farm Service Agency (FSA), the USDA Natural Resources Conservation Service (NRCS), the Indiana State Department of Agriculture’s Division of Soil Conservation (ISDA or ISDA-DSC), the Indiana Department of Natural Resources (IDNR), the Indiana Department of Environmental Management (IDEM), and the Purdue Cooperative Extension Service. These partners work together to leverage technical, financial and educational assistance to implement environmental 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. This is best illustrated by the Indiana’s national leadership in the promotion and use of cover crops and conservation cropping systems through CCSI and the NRSC soil health initiative.

Indiana’s membership in the Hypoxia Task Force is a direct result of outreach toward these stakeholders, as was the state’s effort to begin developing a nutrient reduction strategy. Dialogue between ISDA, IDEM and members of the ICP initiated this plan’s development as well as its consideration for the overarching principles which guided the Gulf Hypoxia Task Force 2008 Action Plan and the suggested EPA guidelines for state Nutrient Reduction Strategies. In the same fashion, this strategy as well as the

development and execution of a science assessment will be shared and reviewed by the Indiana Conservation Partnership.

State Soil Conservation Board (SSCB) - The Indiana State Soil Conservation Board is another key group of stakeholders in Indiana's water quality. The SSCB appoints supervisors as recommended by Soil and Water Conservation Districts (SWCDs) and sets policy governing programs of the ISDA Division of Soil Conservation 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 to SWCDs through ISDA Division of Soil Conservation employees, and builds district capacity by facilitating information exchange between SWCDs through SWCD Annual Conference, publications, workshops, and the efforts of the Division of Soil Conservation's conservation 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. The State Soil Conservation Board also has legal authority to develop a regulatory program to be used in the event that voluntary erosion and sediment reduction approaches have been exhausted. This entity, too, was consulted in the planning and initiation of the Indiana Nutrient Reduction Strategy.

Soil and Water Conservation Districts (SWCDs) – Indiana's 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 state 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 Indiana's 92 counties.

Agricultural Commodity Groups –Farm Bureau, Indiana Corn, Soybean, Pork, Beef, Dairy and Poultry commodity groups have all been actively engaged in identifying and approaching the challenges of nutrient loading (and subsequently, soil health) in their development of a Nutrient Management and Soil Health Strategy. This effort is the result of comprehensive input and discussion from members of the Indiana Conservation Partnership as well as many members of the agricultural community at large. In an agricultural state rich with steward-farmers, this partnership is invaluable in addressing water quality and soil health related issues.

Setting Nutrient Reduction Goals and Developing a Science Assessment

Real progress toward nutrient reduction in Indiana will be measured qualitatively and quantitatively by the establishment and pursuit of action items and their measurements for success. The prioritization of Indiana's HUC-8 watersheds is to be initially based upon the eleven CREP HUC-8 watersheds in Indiana. These watersheds are: Tippecanoe, Upper Wabash, Middle Wabash-Deer, Middle Wabash-Little Vermillion, Middle Wabash-Busseron, Lower Wabash, Upper White, Lower White, Upper East Fork White, Lower East Fork White and Highland-Pigeon. Currently, two HUC-12 watersheds, Eagle Creek and Sugar Creek, have been identified in the Upper White, with HUC-12s to be prioritized in the remaining ten over the second half of 2013.

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 in place regarding minimal criteria for water quality. The language defining these narrative limits is quoted verbatim below:

"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*

(327 IAC 2-1-6 Minimum surface water quality standards)

Numerical Limits

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, development of Total Maximum Daily Loads (TMDLs), and determination of permit limits. Indiana envisions that the codification of numeric nutrient criteria will 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 (Ohio and Kentucky, the others) 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. Indiana is on the following tentative timelines for numeric water quality criteria development:

Proposal of phosphorus criteria for lakes	June 2013
Adoption of criteria into the state’s WQS	December 2014
Proposal of phosphorus criteria for rivers & streams	December 2013
Adoption of criteria into the state’s WQS	June 2015

Indiana has, in the meantime, adopted the following draft 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

IDEM’s internal nutrient coordination committee is considering re-visiting the nutrient indicator models for determining biologically relevant levels and using that/those threshold(s) for nitrogen when developing TMDLs until numeric criteria are developed.

Developing a Science Assessment

A cooperative effort to develop a science assessment for Indiana is a key, ongoing aspect of the state’s nutrient reduction strategy. As mentioned before, this assessment will not only serve as a tool for more comprehensive watershed prioritization, but also as a means to create a consistent “big picture” overview of the state’s waters. This goal, set forth by IDEM, ISDA, NRCS and the Purdue University water quality community, is currently in its planning stages in cooperation with the Indiana Conservation Partnership. The goals of the science assessment are as follows:

- To complete a meta-analysis of the available water quality data across the state
- To compare the analysis with IDEM's data and maps of impaired waters in order to best address non-point nutrient runoff around those waters
- To evaluate Indiana's prioritization of HUC-8 watersheds in respect to the meta-analysis as well as available resources to best impact those watershed

As a means of utilizing the water quality monitoring data in Indiana, a meta-analysis of the various data and models will serve to provide the state with a look at its water quality needs through a much more sophisticated lens. Meta-analysis is a statistical method of comparing and contrasting results of different studies in order to identify relationships between data sets. A major challenge posed in many states in assessing water quality is forming such a comprehensive view of the "big picture"; water quality data is relatively disparate or fragmented in Indiana, as in other states. There is a wealth of monitoring data available in Indiana from the US Geological Survey (USGS), IDEM, various watershed organizations as well as from university research and environmental consulting groups. The Indiana Water Monitoring Council has adopted the goal of creating a single location where water monitoring data from multiple sources throughout the state can be accessed for more comprehensive analysis of water quality. A science assessment which includes a meta-analysis will take full advantage of these and other existing data as tools for assessing our waters.

Monitoring Indiana's Waters

Revised in the last quarter of 2010, Indiana's Water Quality Monitoring Strategy (WQMS) was implemented in 2011. The previous WQMS had not changed significantly with regards to monitoring approaches since 1995. In the 1990s, Indiana was ahead of the curve in implementing a probabilistic design in its WQMS, which allowed Indiana to efficiently and effectively meet the CWA 305(b) requirement to "assess all waters." The WQMS also included the fixed station network, special studies, and some targeted monitoring including source identification and stressor identification studies.

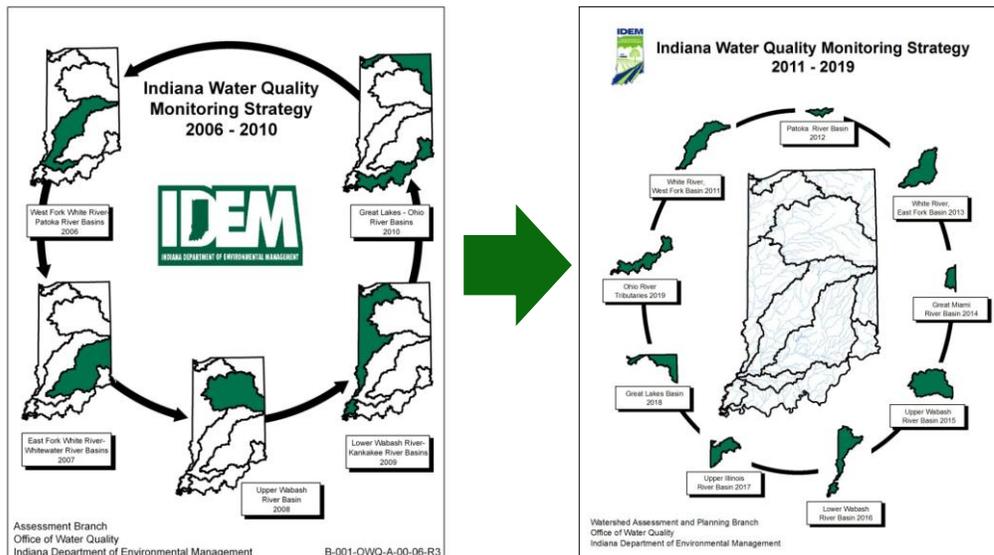
U.S. EPA (NPS program) had identified the lack of monitoring to support NPS watershed planning projects and performance measure (follow-up) monitoring as a significant gap in the WQMS, which jeopardized standing with regards to "satisfactory progress" and threatened 319 funding. More importantly, Indiana was unable to answer the question posed by our governor, elected officials, water professional planners and concerned citizens, "Are our waters getting any better?" The probabilistic design had become an impaired waters listing machine, and the source and stressor ID studies were not particularly coordinated with the NPS program. There was no performance measures monitoring designed to answer that fundamental question and to determine if NPS watershed planning and implementation activities were making a positive difference to improve Indiana's water quality. The guiding criteria for the revision of the WQMS were to:

- Focus on primary monitoring objectives required by the CWA;
- Ensure we were collecting the appropriate data to support Office of Water Quality program needs; and to
- Design our sampling plans to satisfy as many data needs as possible while addressing specific questions.

Non-point Source

Significant Changes to the Water Quality Monitoring Strategy

Probabilistic monitoring was changed from a 5-year rotating basin design (two basins per year for four of the years) to a nine-year rotating basin sampling design (one basin per year).



This change freed approximately 50% of IDEM's resources to conduct targeted monitoring, which was identified as necessary for meeting primary objectives. Targeted monitoring includes baseline monitoring for NPS planning projects and performance measures monitoring to determine change for water quality improvements. Additionally, through a two-year grant, IDEM piloted in 2010 a toxic algae surveillance monitoring program at selected public bathing beaches, which is now incorporated into the WQMS. Dissolved rather than total metals were collected in the probabilistic program and at twelve fixed stations which represent an even geographical spread across the state.

Through Section 319(h) projects to date (recorded as of September 1, 2011) 644,030 lbs/year, 371,902 lbs/year and 230,738 tons/year of total Nitrogen, Phosphorus and sediment load reductions (respectively) have been achieved. In 2011, IDEM also began a baseline study to serve as a foundation for monitoring water quality improvements gained through nonpoint source restorative BMPs in Indiana. (FFY 2011 Annual Report to the U. S. Environmental Protection Agency, pp 36-37).

Total Maximum Daily Load (TMDL) prioritization, monitoring and document development have been revised to ensure the primary goal of making measureable improvements in water quality. To achieve this goal, IDEM has developed a TMDL document that is implementable by stakeholders; is instituting a TMDL development process that supports and augments other water quality and conservation program

objectives; and is developing a TMDL implementation tracking system for following-up to determine effectiveness. These objectives will be achieved through seeking input and program coordination within the Office of Water Quality and, to the extent possible, with external partners. Continuous improvement in program efficiencies and program adaptability within the context of emerging state priorities and/or national trends or mandates will be the key to success.

- To date, nutrient TMDLs have been completed on the Wabash River mainstem, the St. Mary's watershed, and in the Pigeon River watershed, two of which are identified in this strategy as priority HUCs . As a result, National Pollutant Discharge Permits (NPDES) included monitoring for total phosphorous for one permit cycle to determine if limits would be required for the next. Commencing in 2013, a modified geometric design that includes pour points will be employed for TMDL water quality assessments to determine the source and extent of impairments.
- A committee comprised of NPDES permit writers, storm water staff, NPS staff and TMDL staff is working to coordinate activities and to determine the best models for calculation of waste load allocations and load allocations to nutrients.

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 having five components:

1. Public Information and Education
 - Produce and distribute the quarterly Water Column newsletter
 - Sponsor the annual Indiana Lake Management Conference
 - Prepare informational brochures
 - Prepare lake assessment reports
 - Conduct training and informational workshops
2. Technical Assistance
 - Assist lake associations with interpreting water quality data
 - Attend lake association meetings
 - Present programs to lake associations
3. Volunteer Lake Monitoring (the latest report can be found at:
<http://www.indiana.edu/~clp/documents/Vo%20Report%202009-2011.pdf>)
 - Citizen volunteers monitor water transparency on 80 Indiana lakes
 - Volunteers in an expanded program collect monthly samples for total phosphorus and chlorophyll *a* analysis
4. Lake Water Quality Assessment (the latest report can be found at:
<http://www.indiana.edu/~clp/documents/LWQA%202009-2011.pdf>)
 - Conduct routine assessments of water quality on Indiana lakes
 - Identify regional and/or temporal patterns in lake data
 - Identify lake conditions that warrant further attention

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- 5. Coordination with Other State and Federal Lake Programs
 - Work with other state and federal agencies to coordinate efforts and enhance the protection of Indiana lakes

HAB monitoring data

IIDEM’s blue-green algae (cyanobacteria) surveillance program commenced in 2010 with five IDNR public access beaches and has expanded to twelve sites on ten IDNR lakes (Figure 20). For protection of human health from cyanobacteria, the World Health Organization (WHO) uses a guideline level of greater than 100,000 cells/ml and microcystin toxin levels of 20 parts per billion (ppb) for a high risk health alert in recreational waters. Indiana uses 6 ppb of microcystin toxin as a warning level. The WHO has not set a guideline value for the cylindrospermopsin toxin. Indiana uses 5 ppb as a warning level, consistent with the state of Ohio recommendation. Toxin results are 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. Swimming areas will stay on the High Count Alert until the cell counts fall below 100,000.

Over the last three years, there has been a significant increase in cell counts, nearly seven-fold as evidenced by the following table:

Year	# Lakes Sampled	# Samples	Highest Cell Count	% of Samples >100,000	% of Samples >1 million
2010	5	18	260,000	28	0
2011	10	58	798,000	48	0
2012	10	70	1,800,000	76	16

Nutrient Removal Technology

CCSI - As previously described, many of the cost-share programs, 319-funded and 205j-funded projects in Indiana serve reduce nutrient loads and runoff entering Indiana’s waters. These programs are our primary modes of action in removing nutrients from our waters. One particular program which has set Indiana on a national stage in this effort has been the Conservation Cropping Systems Initiative (CCSI). Indiana has the most cover crops planted of any state in the country, due largely in part to CCSI’s championing of soil health and its impacts on improved nutrient uptake and water holding capacity. The success of CCSI has subsequently meant positive effects on the quality of water that comes from farms taking advantage in conservation cropping systems.

In 2012 CCSI assisted ICP partners in securing a \$1.7 Million, 3-year NRCS Conservation Innovation Grant (CIG) which takes the CCSI concept to the farm level and educates ICP members. This project is the next level of CCSI and will establish dedicated regional hub farms that will feature conservation practices that are practical and achievable on varied soils and topography within each region of the state. These hub farms will not only directly engage farmers but will evaluate what the practices mean to farm economics.

NRCS Soil Health Campaign – Mirroring the CCSI’s efforts, 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, as with CCSI, 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).

Bioreactors - The Natural Resource Conservation Service now offers an edge-of-field nutrient removal technology called a bioreactor. This newly cost-shared best management practice provides Nitrogen removal water treatment to waters that may otherwise run from tiles to ditches or streams.

Measuring Nutrient Removal – The Indiana State Department of Agriculture has adopted the Region 5 nutrient reduction model developed and (also utilized) by IDEM. This model estimates load reductions from individual BMPs on the ground and its use has been standardized by the ISDA for all field staff and SWCD staff to measure estimated reductions in pounds of Nitrogen and Phosphorus and tons of sediment per year for all 319 funded projects in Indiana. Figures 25-27 illustrate the Nitrogen, Phosphorus and Sediment load reductions from 319-funded projects reported by Division of Soil Conservation staff upon adoption of this protocol. 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 following table reflects IDEM’s and ISDA’s emphasis shift to implementation projects by showing the estimated total load reductions achieved from 319-funded projects alone over the last two years from best management practices funded through these grants.

Nonpoint Source Pollutant	Estimated Reduction FFY 2011	Estimated Reduction FFY 2012
Sediment	28,880 tons/yr	47,616 tons/yr
Phosphorus	33,434 lbs/yr	94,980 lbs/yr
Nitrogen	70,450 lbs/yr	141,709 lbs/yr
Biological Oxygen Demand	6,628 lbs/yr	29,542 lbs/yr
Chemical Oxygen Demand	1,977 lbs/yr	2,709 lbs/yr
Pesticides	490 lbs/yr	0 lbs/yr
Suspended Solids	5,970 lbs/yr	35,122 lbs/yr
Lead	5 lbs/yr	10 lbs/yr
Zinc	7 lbs/yr	14 lbs/yr

Copper	0 lbs/yr	1 lbs/yr
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Seek Funding for Nonpoint Source Pollution Reduction Projects

While not all of these funding sources are focused directly on the reduction of nutrients to surface waters, there are many that can be used to implement projects that will result in the reduction of nutrients loads.

205 j Grant Funding (Administered by IDEM)

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. IDEM project managers will continue to 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.

319(h) Grant Funding (Administered by IDEM)

The Federal Clean Water Act Section 319(h) provides funding for various types of projects that work to reduce nonpoint source water pollution. 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. 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 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 U.S. 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.

IDEM project managers 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.

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 35 million dollars of its USEPA 319 nonpoint source grant funding to projects related to reducing nutrient loads to Indiana surface water

Lake and River Enhancement (LARE) Grant Funding Administered by IDNR

LARE grants can only be awarded for activities involving public lakes, and to organizations having the resources and ability to properly administer the funds. This would include formally established lake associations, conservancy districts, local units of government, or other similar entities. Participation in the program requires the submittal of an application form for each program element.

Traditional LARE Project Grants

Grants are available on a competitive basis for several actions that can address the ecology and management of public lakes and their watersheds. Depending on your particular lake's needs, you may want to consider applying for funds for any of the following: 1) a preliminary lake study, 2) a comprehensive lake diagnostic study, 3) an engineering feasibility study of possible pollutant control measures, 4) a design study for a specific pollutant control measure, 5) construction of a particular pollutant control measure, 6) a management plan for the lake, or 7) a performance appraisal of a constructed pollutant control measure. A third of the LARE funds is to be used for sediment removal or exotic species control.

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. Having 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 plant management plans or, if such a plan has already been prepared, for actual plant control projects. Having an aquatic plant management plan is a prerequisite to acquisition of grant funds for actual plant control.

USDA, Natural Resources Conservation Service (NRCS), Environmental Quality Incentives Program Funding

The Environmental Quality Incentives Program (EQIP) was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. These contracts provide incentive

payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to an environmental quality incentives program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions. The local conservation district approves the plan.

EQIP may cost-share up to 75 percent of the costs of certain conservation practices. Incentive payments may be provided for up to three years to encourage producers to carry out management practices they may not otherwise use without the incentive. However, limited resource producers and beginning farmers and ranchers may be eligible for cost-shares up to 90 percent. Farmers and ranchers may elect to use a certified third-party provider for technical assistance. An individual or entity may not receive, directly or indirectly, cost-share or incentive payments that, in the aggregate, exceed \$450,000 for all EQIP contracts entered during the term of the Farm Bill.

UDSA, NRCS, Farm Services Agency, 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 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 tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

Clean Water Indiana

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 (IC-14-32-8). The purpose of the Clean Water Indiana 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 initial year the program received no funding. In 2001, Indiana legislators utilized Build Indiana Funds to appropriate \$1 million per year for 2001 and 2002 to the program. Later that year, the \$1 million for 2002 reverted back into the Build Indiana Fund to help address the state's financial situation. During 2003, legislators introduced two bills to fund the Clean Water Indiana Program. Neither House Bill 1976 "Stewardship Fee on Bottled Water" nor House Bill 1875 "Increased Landfill Tipping Fees" passed.

The DNR-Division of Soil Conservation administered the \$1 million dollars appropriated by Indiana legislators from the Build Indiana Fund under the direction of the State Soil Conservation Board. The Board established a policy that all Clean Water Indiana Funds would be used for local projects that had direct benefit to water quality. The Division worked closely with the Indiana Association of Conservation Districts, Inc. to develop a formula for awarding Clean Water Indiana funds to local soil and water conservation districts based on the amount of local match (county funding for district programs) the respective districts received at that time. The districts were required to submit a Clean Water Indiana Project(s) proposal for approval by the State Soil Conservation Board. The average Clean Water Indiana Grant award per district was \$9,500. All 92 soil and water conservation districts received a grant with the minimum being \$7,000 and the maximum being \$20,470.

The SWCDs utilized \$835,007 in Clean Water Indiana Funds to implement local projects. In addition, they committed nearly \$241,000 of their funds and partnered with others for over \$956,600 in cash and in-kind support. For every dollar invested by the State the Clean Water Indiana Program generated \$2.45 to support local projects.

The districts used the grant money in four basic areas; cost-share/incentives for applying conservation practices; purchase of equipment for the purpose of renting it to land users for applying conservation practices; contracting for technical assistance to survey, design, and oversee construction of conservation practices and non-point source pollution prevention related information materials, planning assistance and projects.

If funded, the Clean Water Indiana program will provide funds to share the costs of conservation practices with private landowners and will match, dollar for dollar, local funds provided to Soil and Water Conservation Districts to address polluted run-off concerns.

Reporting and Accountability

To Federal Agencies

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 here in Indiana through various CWA programs at IDEM in the Office of Water Quality (OWQ). Many of these programs reside in OWQ’s Watershed Assessment and Planning Branch, working together to help restore and protect Indiana waters.

Watershed Assessment and Planning Branch Monitoring Programs

IDEM’s surface water monitoring programs are implemented in the Watershed Assessment and Planning Branch and are guided by the OWQ’s Water Quality Monitoring Strategy. The strategy identifies key water quality monitoring objectives and the monitoring approaches used to collect the data necessary to meet them. The Watershed Assessment and Planning Branch has two water monitoring programs, both of which collect a variety of chemical, physical, and bacteriological water quality data and biological community data in conjunction with habitat information.

The Probabilistic Monitoring program conducts monitoring at sites selected based on a stratified random distribution. This statistical method provides data for 38-50 locations within a given basin each year, which can be extrapolated to characterize water quality conditions of the entire basin. In addition, over time, the data may be used to identify emerging trends in basin-wide water quality conditions to meet the CWA 305(b) goal of assessing all waters of the state. These data may also be used to make waterbody-specific CWA 305(b) assessments of water quality.

The Targeted Monitoring program conducts monitoring at sites that are selected based on known impairments, historical information, permitted dischargers, land use, watershed group focus areas, and other factors relevant to the monitoring objective for which the monitoring is to be conducted. Sampling occurs at different sites each year and may be located anywhere in the state depending on the monitoring objective(s). These data are used to support a variety of OWQ programs including waterbody-specific assessments of water quality for CWA 305(b) purposes. Please see the table of IDEM monitoring projects for 2013

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. These assessments are based on Indiana's water quality standards (WQS). Indiana's WQS provide narrative and numeric water quality criteria Indiana waters must meet to ensure that they support their designated beneficial uses – the activities that we as a society want those waters to support and the benefits that we want them to provide. Indiana's WQS may be found online at: www.IN.gov/legislative/iac/T03270/A00020.PDF.

To make waterbody-specific 305(b) assessments, IDEM follows the processes outlined in its Consolidated Assessment and Listing Methodology (CALM), which describes the designated beneficial 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 beneficial uses. IDEM's most recent CALM is available online in the Notice of Public Comment Period for the 2012 303(d) list: www.watersheds.IN.gov/files/303d_2012_list_notice.pdf.

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: www.watersheds.IN.gov/2639.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 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. The 2012 draft 303(d) list is currently available for public comment until May 8, 2012. IDEM invites any person or organization interested in providing data and information for further development of its 303(d) list to review the materials provided online at: www.watersheds.IN.gov/2647.htm.

Total Maximum Daily Loads

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.

The completion of a TMDL is just the first step in remedying an impairment. Once a TMDL is completed, IDEM will work with local watershed groups wherever possible to implement the recommendations in TMDL document, which are intended to help restore the water body 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: www.watersheds.IN.gov/2652.htm

Conservation Reserve Enhancement Program (ISDA/FSA) - An annual CREP report to the US Farm Service Agency from ISDA is submitted every January. This report includes acreage and practice enrollments, state funds and in-kind contributions the ISDA/FSA CREP partnership, as well as any changes to the program, successes and challenges of the current fiscal year.

Indiana Nutrient Reduction Strategy - A revised draft of this living document to be submitted to the USEPA at the end of 2013.

To Conservation Partners

State Soil Conservation Board update - ISDA's Division of Soil Conservation provides monthly to the State Soil Conservation Board (SSCB) regarding the status of its soil and water quality programs and

initiatives. This includes CREP practice installations and acreage, their subsequent nutrient reduction estimates, and budgetary items. This information is included on the SSCB website and is also available to the public.

Load Reductions and BMP installations - The ISDA reports all conservation practices on SharePoint. This includes Region 5 modeling for Nitrogen, Phosphorus and Sediment reduction for all practices funded by 319 monies. Maps generated from these nutrient and sediment reduction data in 2012 quantitatively illustrate the positive impact that these installed BMPs have on Indiana's waters (refer to figures 21-23).

Indiana Nutrient Reduction Strategy - A revised draft of this living document to be available online to our conservation partners through the ISDA website, IDEM website, SharePoint and through various local entities such as Soil and Water Conservation Districts.

IDEM's Watershed Assessment and Planning Branch Monitoring Activities – The Indian Department of Environmental Management will continue to provide an annual plan highlighting its current and future plans and activities concerning monitoring across the state each year. This document is available to both conservation partners as well as the public (Figure 24-26).

To the Public

All State Agency Monitoring programs - maps, figures and other data are made available on agency websites through <http://IN.gov>.

Indiana Nutrient Reduction Strategy - will be made available online through the ISDA Division of Soil Conservation website, as well as the Division's *Spotlight on Stewardship* blog. This document will also be shared with the Indiana Conservation Partnership as well as the State Soil Conservation Board to be made available to the public through Indiana's soil and water conservation districts.

Also, as part of the final draft of Indiana's nutrient reduction strategy living document (first update to be completed sometime after June, 2013 final draft submission), a catalog process will be initiated for state programs and initiatives pertaining to water quality as well as their means of monitoring and/or reporting, including where to find information which they provide to the public. This measure will be taken in order to provide accountability, transparency and education to the public whose natural resources we strive to conserve.

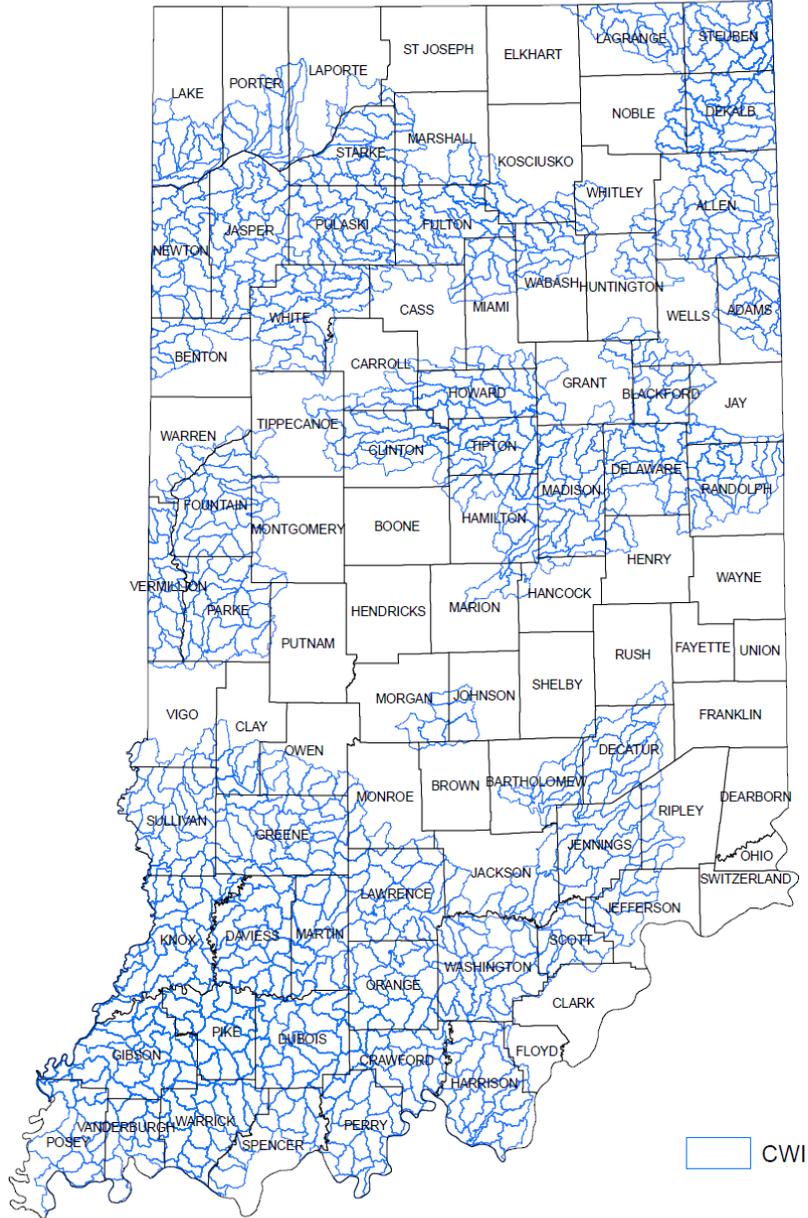
Region 5 Nutrient and Sediment Load Reductions - SharePoint reports as well as news releases and program updates continue to be regularly sent to Soil and Water Conservation Districts as well as ISDA field staff and other Indiana State departments to be shared on the local level.

IDEM's Watershed Assessment and Planning Branch Monitoring Activities – The Indian Department of Environmental Management will continue to provide an annual plan highlighting its current and future plans and activities concerning monitoring across the state each year. This document is available to both conservation partners as well as the public (Figure 24-26).



Figure 1. Mississippi/Atchafalaya River Basin and Gulf of Mexico Hypoxia Zone

Clean Water Indiana Program



November 14, 2012
Deb Fairhurst, ISDA Program Manager

Figure 3.

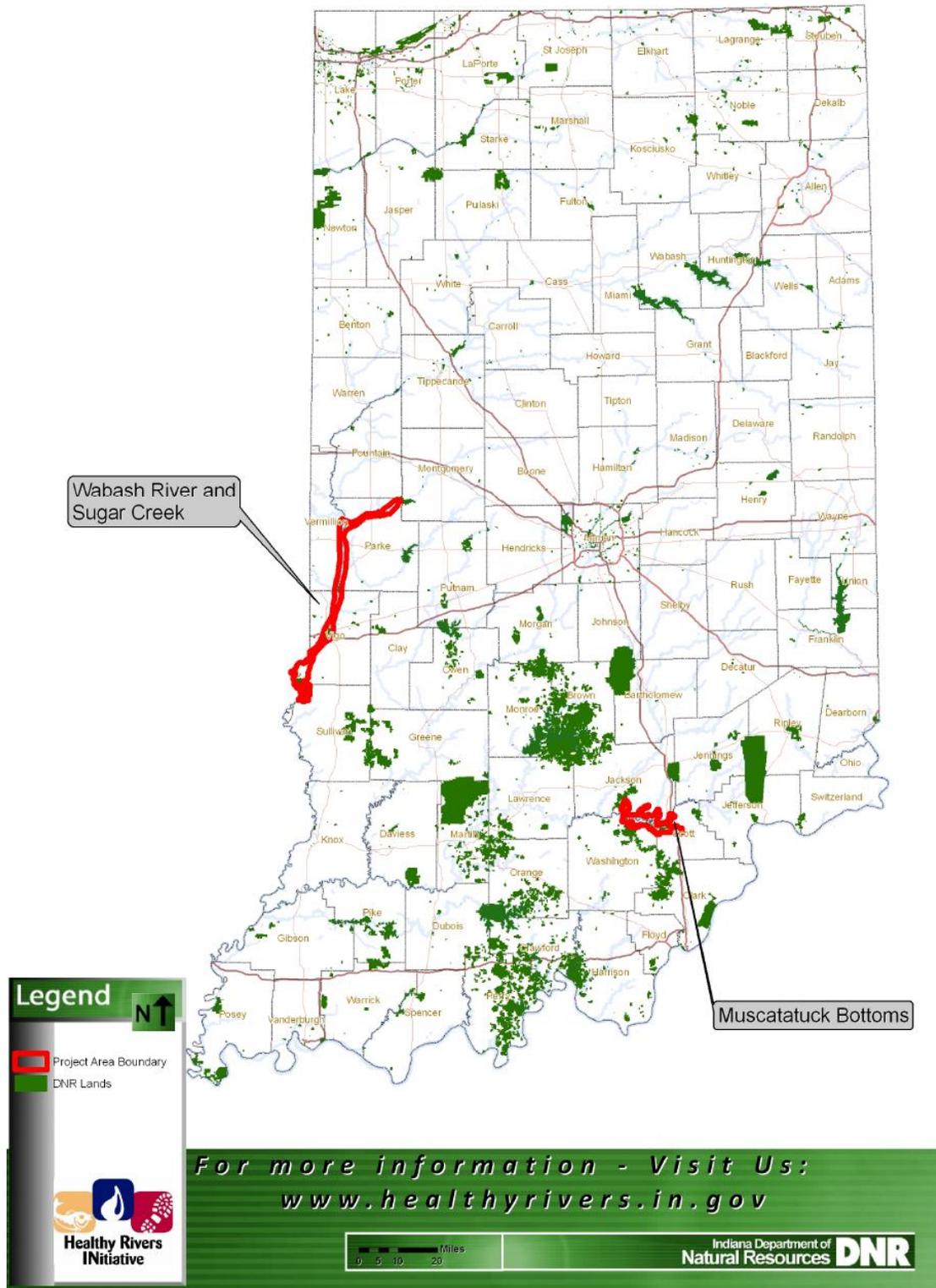
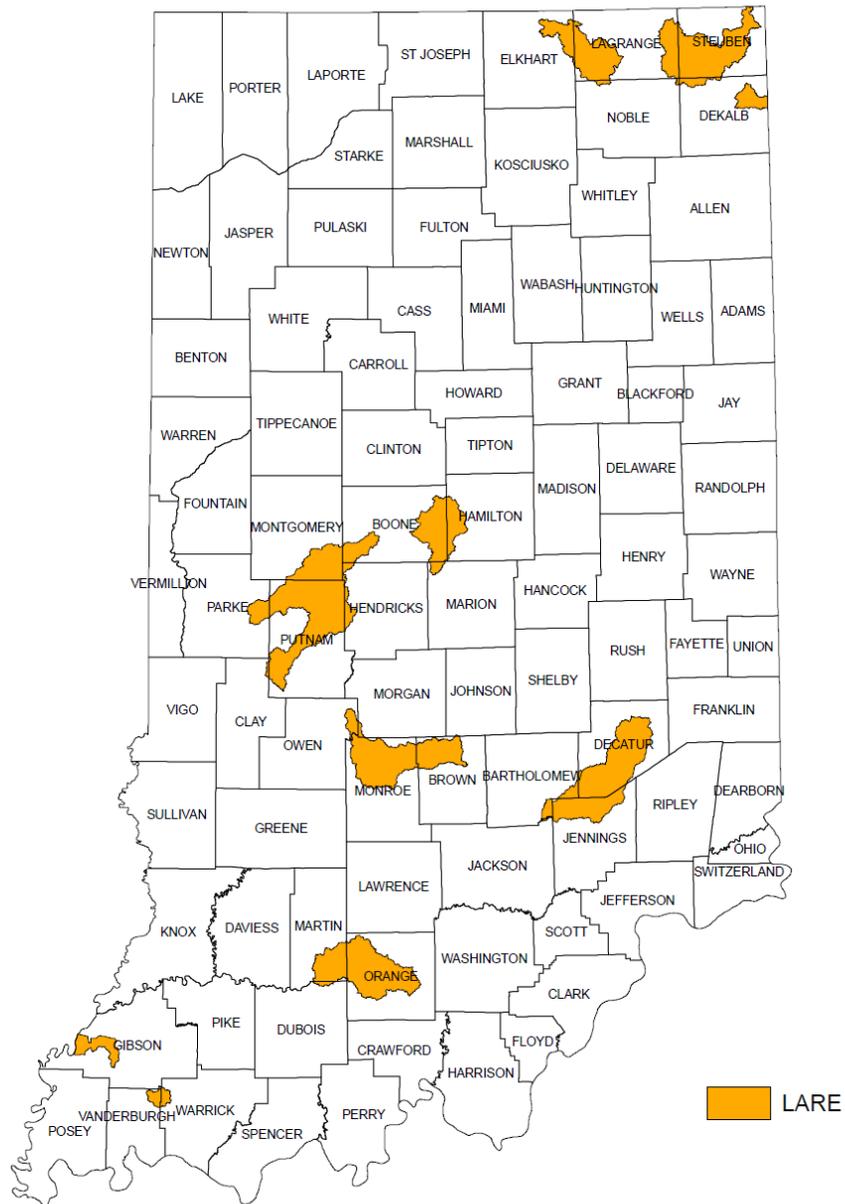


Figure 4.

Lake and River Enhancement Program



November 14, 2012
Deb Fairhurst, ISDA Program Manager

Figure 6.

2012 On-Farm Network Project Area

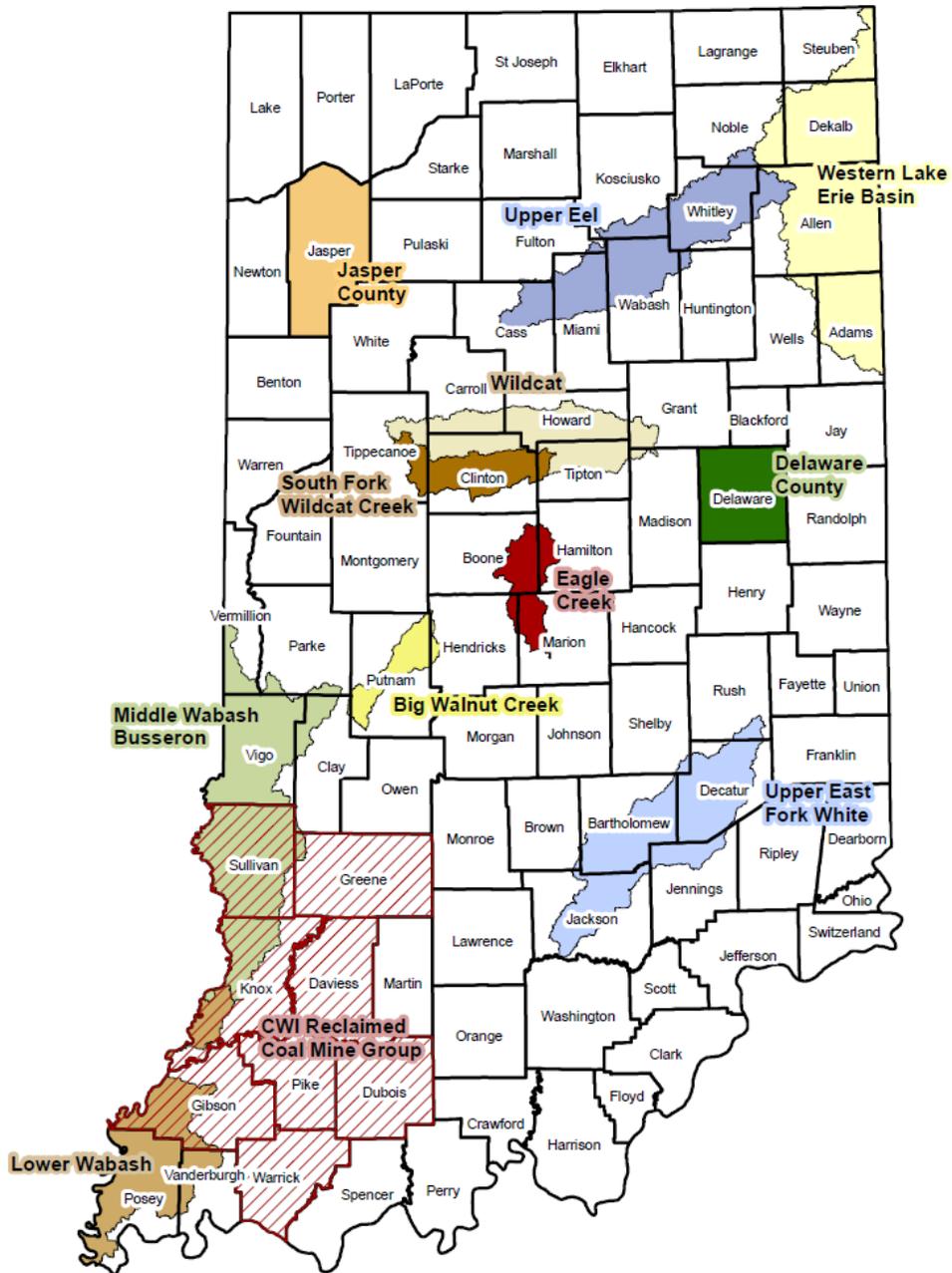


Figure 7. – Indian On Farm Network

Deb Fairhurst, ISDA 2012

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

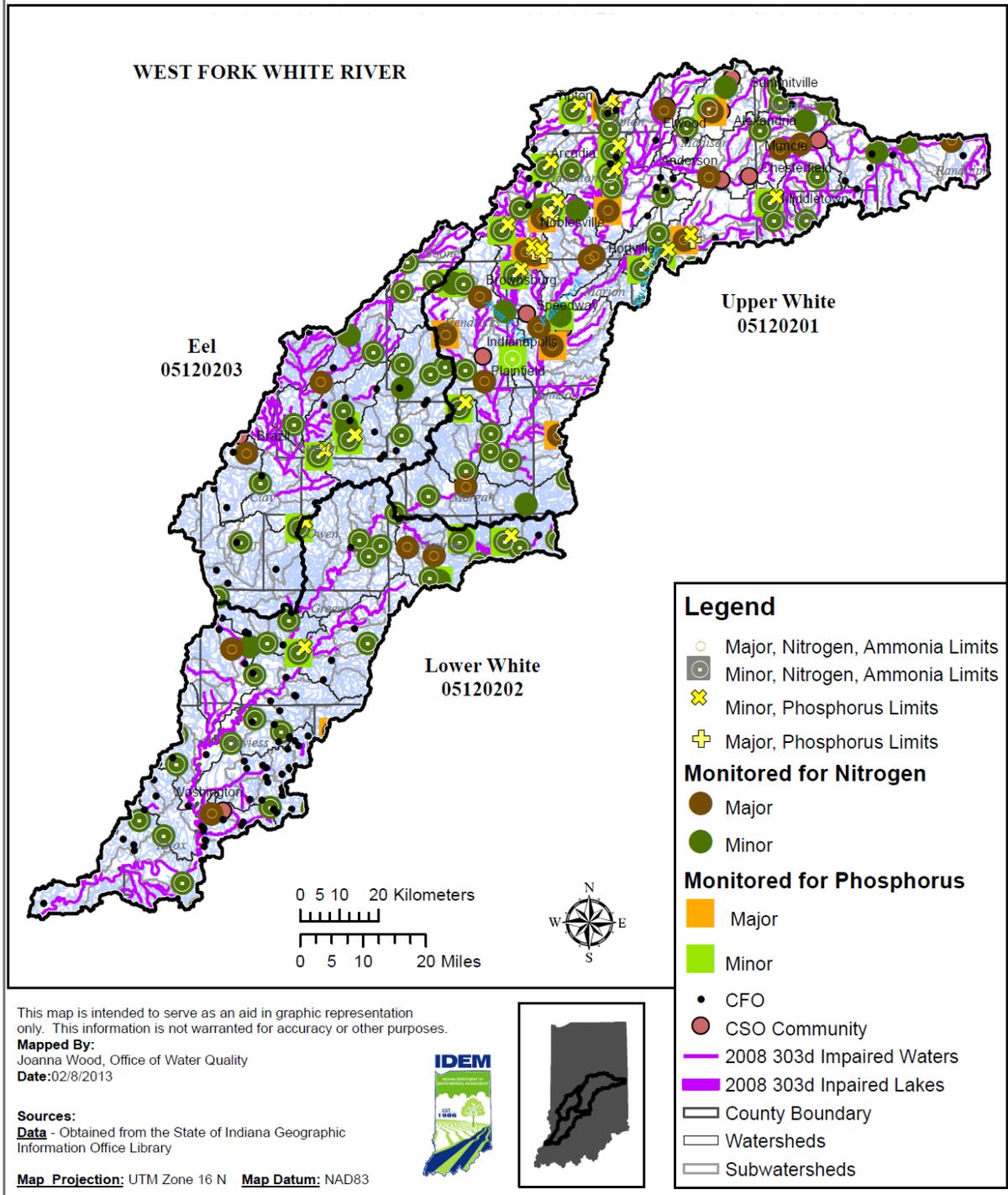


Figure 9.

**Facilities with WQ Monitoring for Nitrogen and Phosphorus
Includes Data on Facilities with Permit Limit Notations**

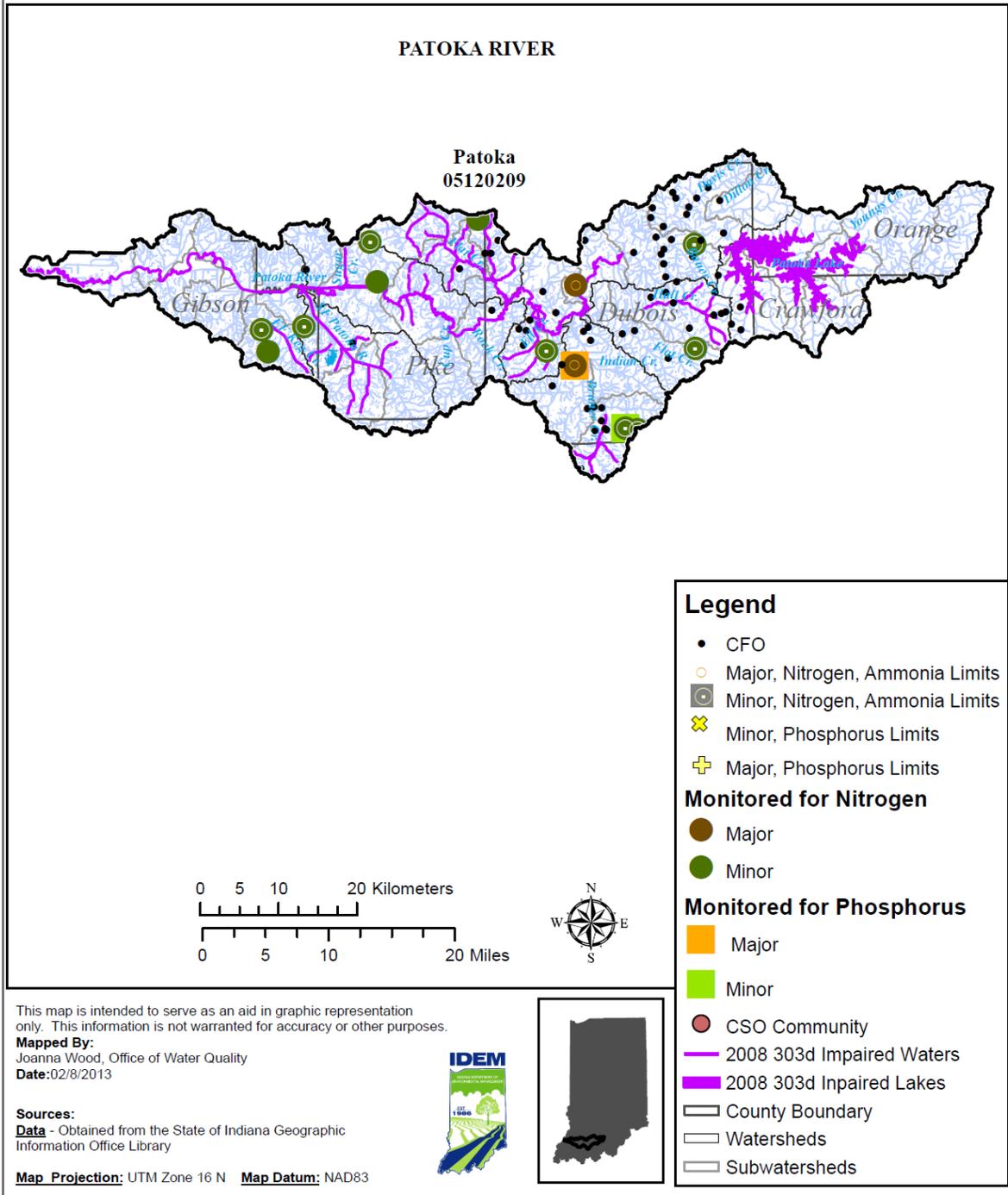


Figure 10.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

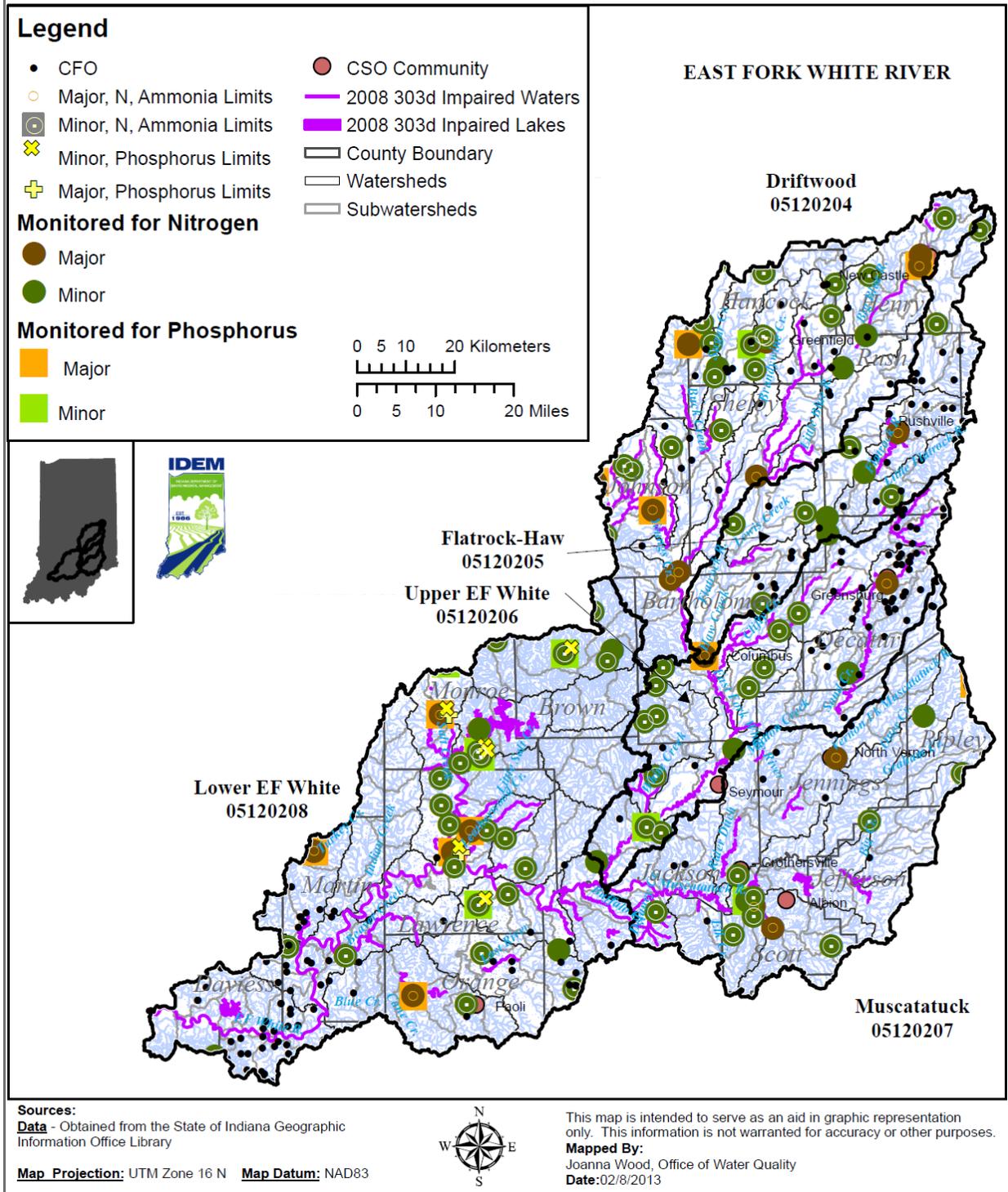
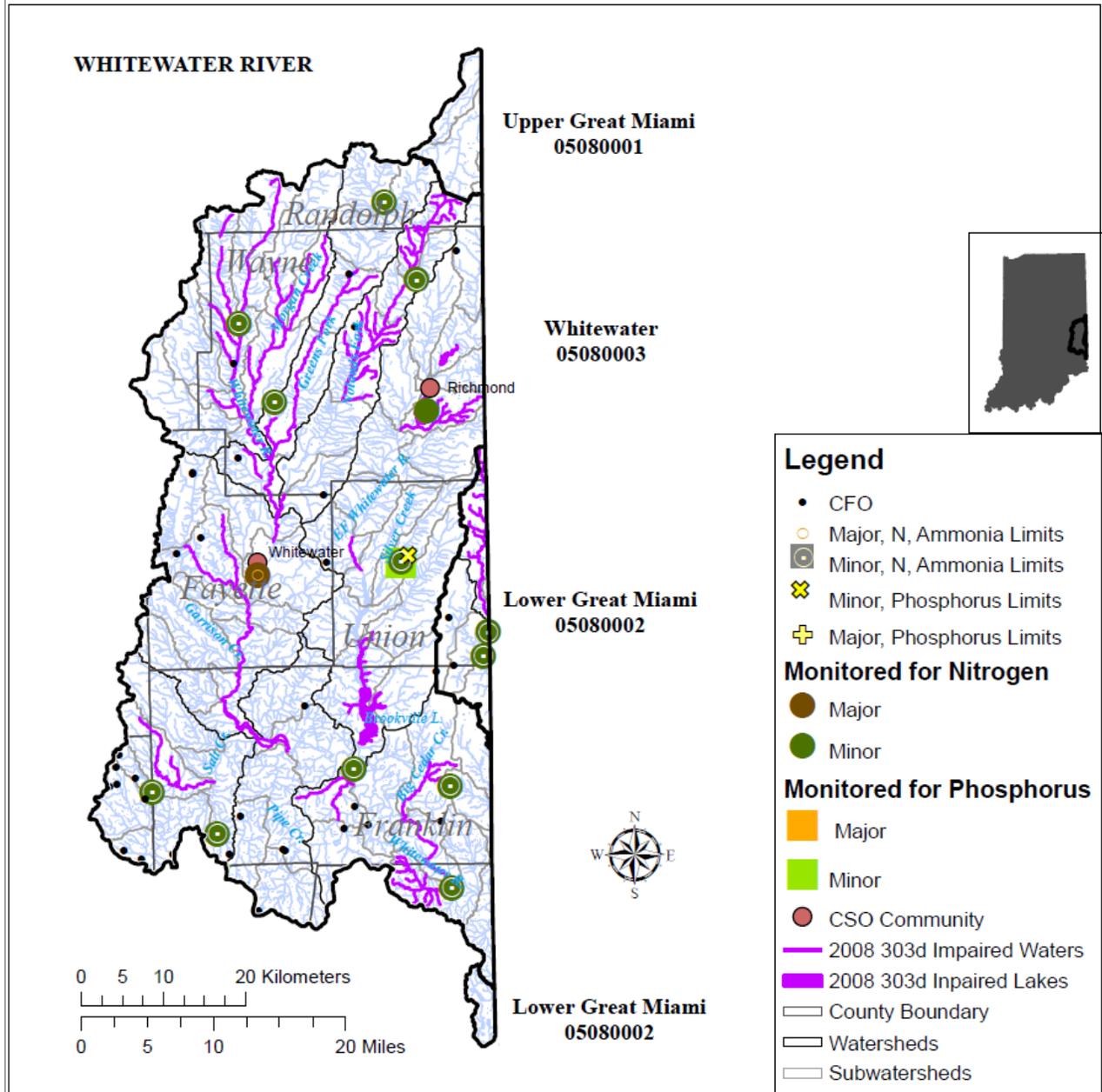


Figure 11.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations



Sources:

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

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



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

Figure 12.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

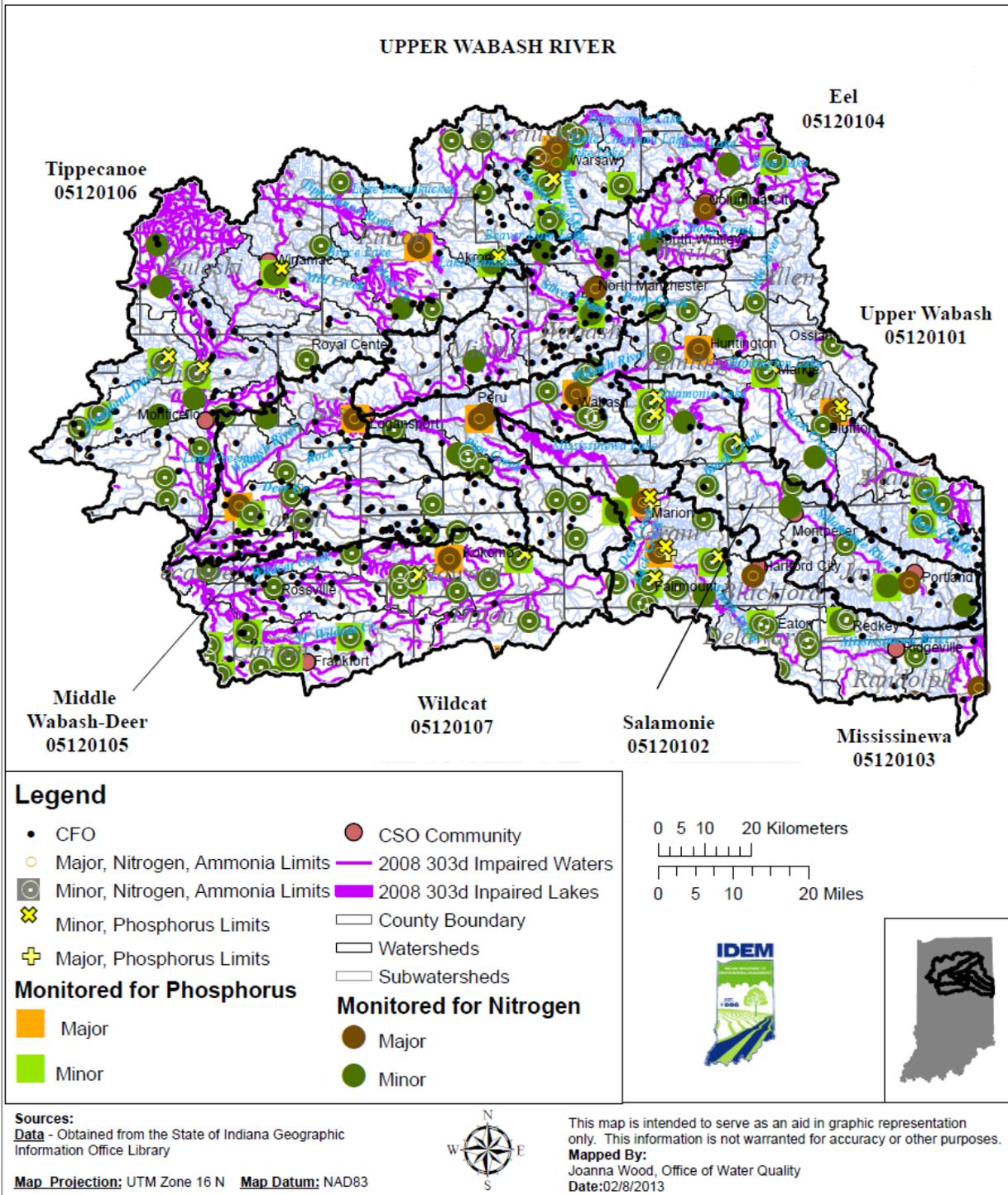


Figure 13.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

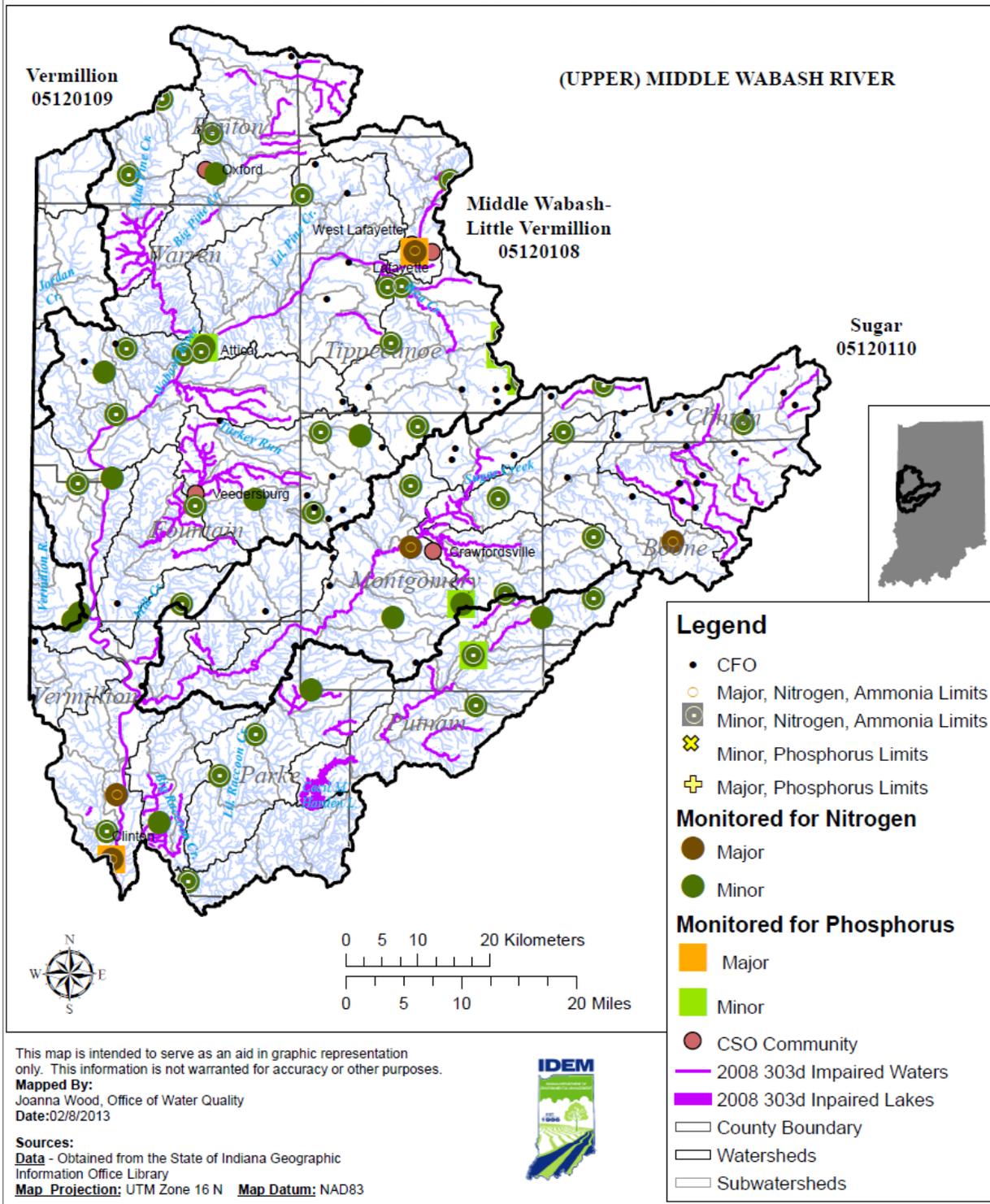


Figure 14.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

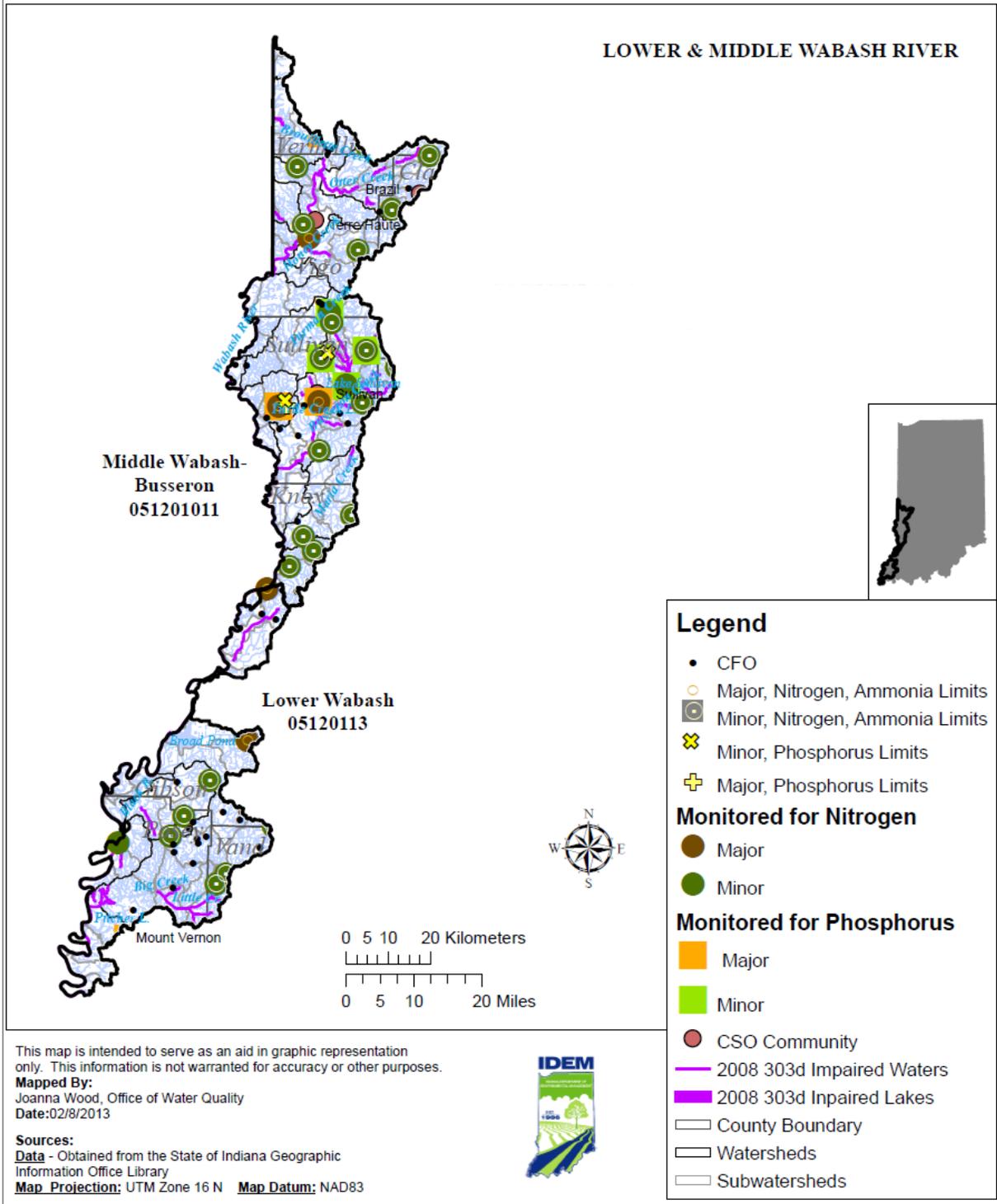


Figure 15.

Facilities with WQ Monitoring for Nitrogen and Phosphorus
Includes Data on Facilities with Permit Limit Notations

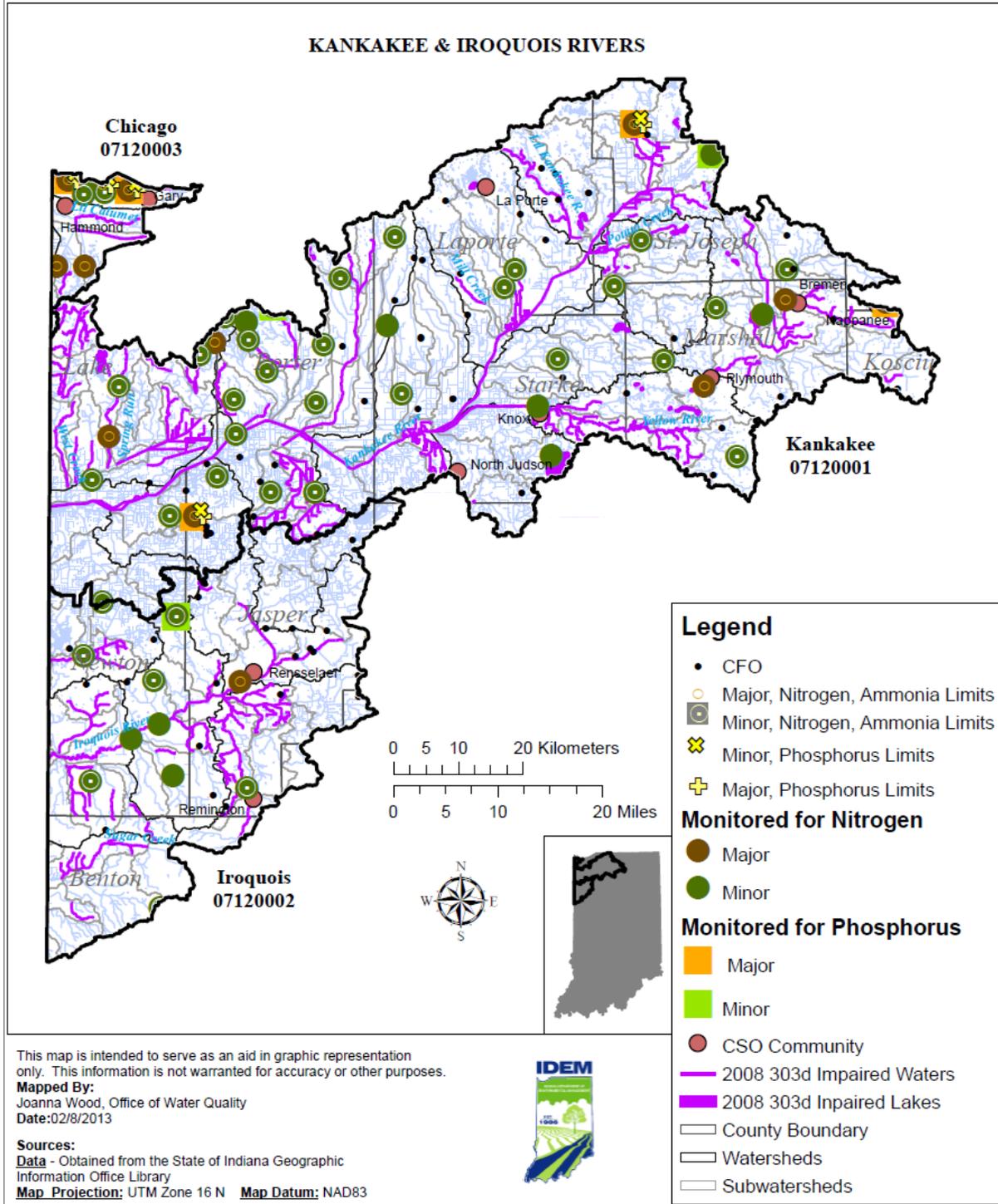


Figure 16.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

ST JOSEPH & MAUMEE RIVERS

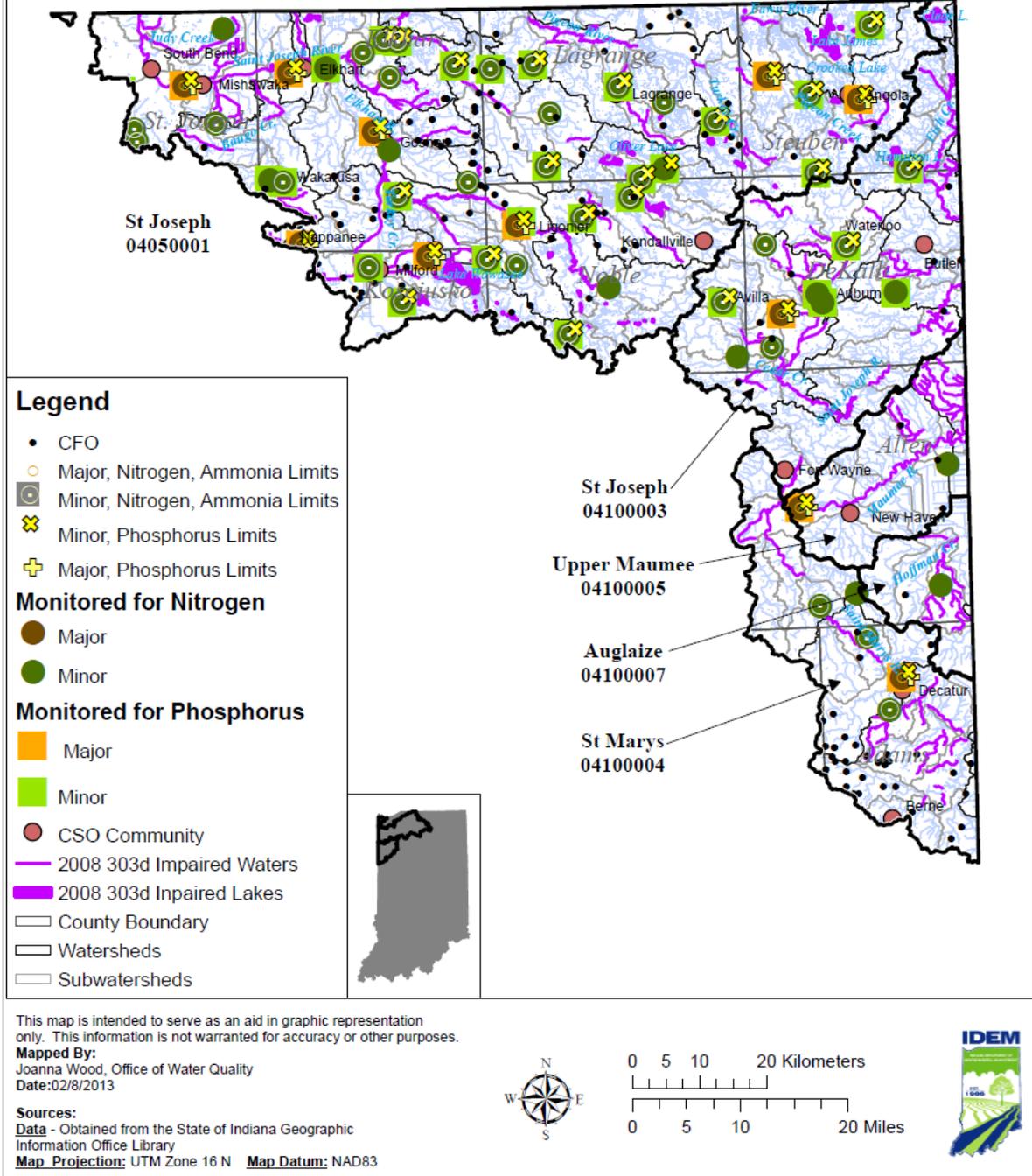


Figure 17.

Facilities with WQ Monitoring for Nitrogen and Phosphorus Includes Data on Facilities with Permit Limit Notations

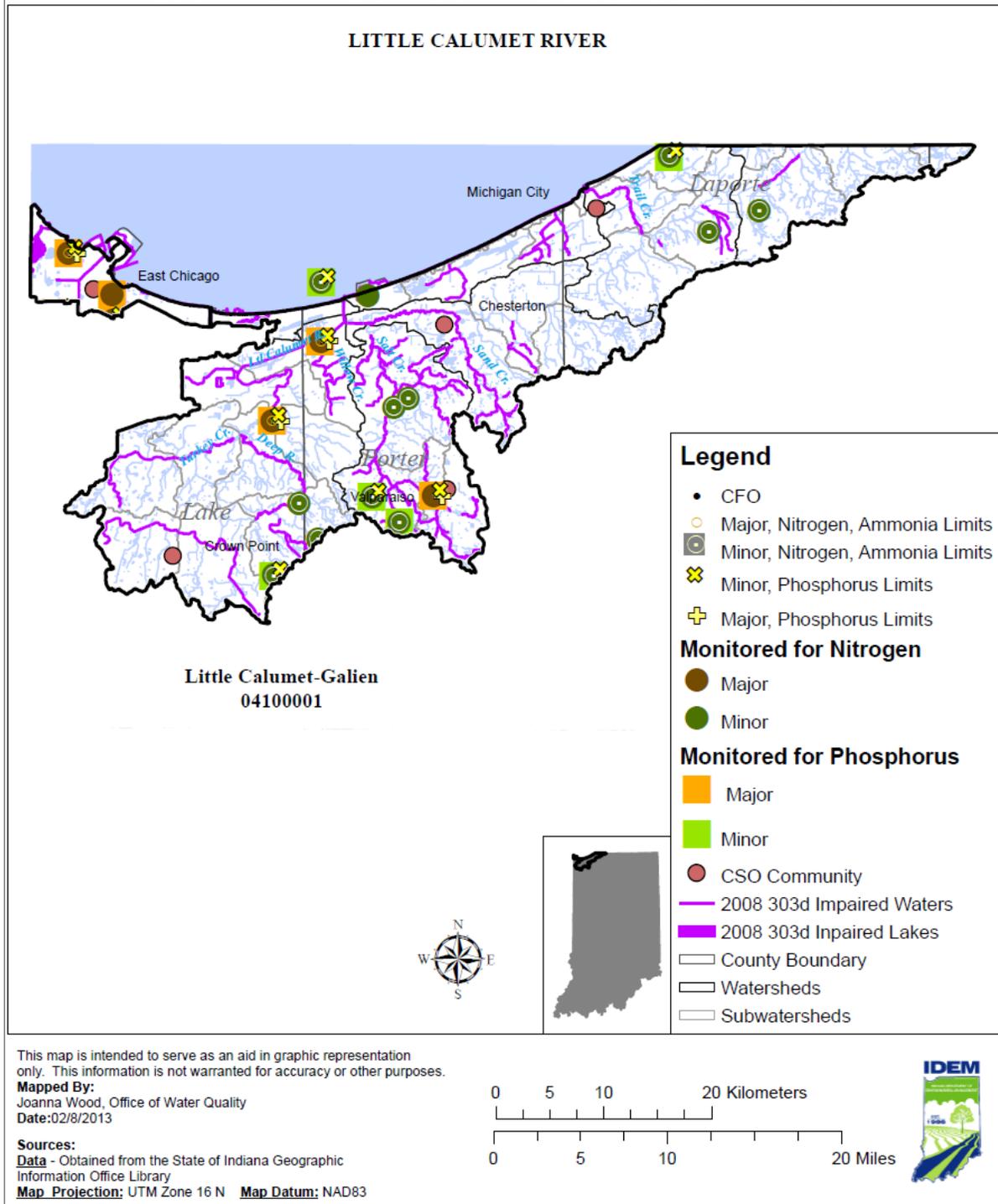


Figure 18.

Facilities with WQ Monitoring for Nitrogen and Phosphorus
Includes Data on Facilities with Permit Limit Notations

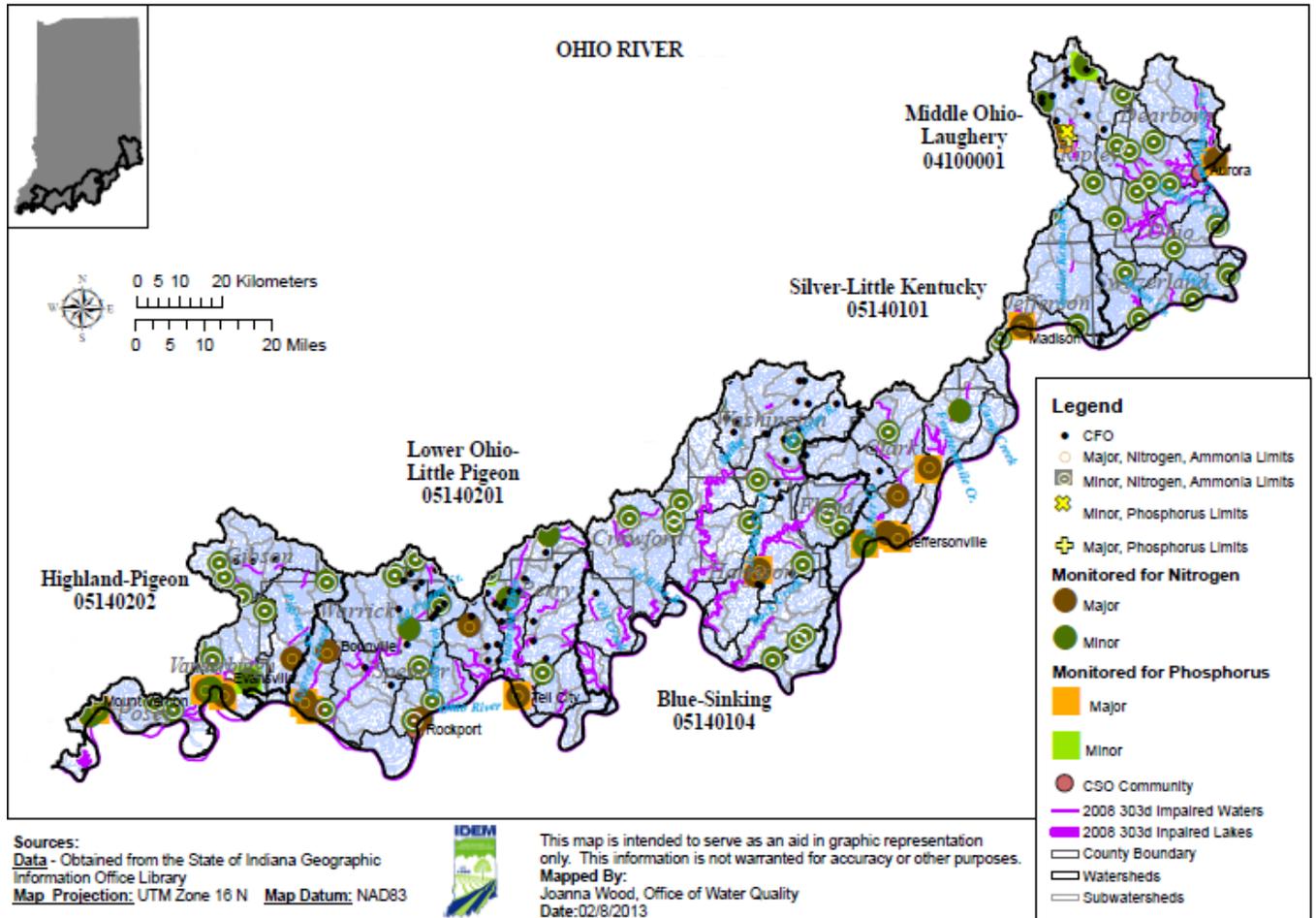


Figure 19.

2012 Nutrient Load Reductions Nitrogen

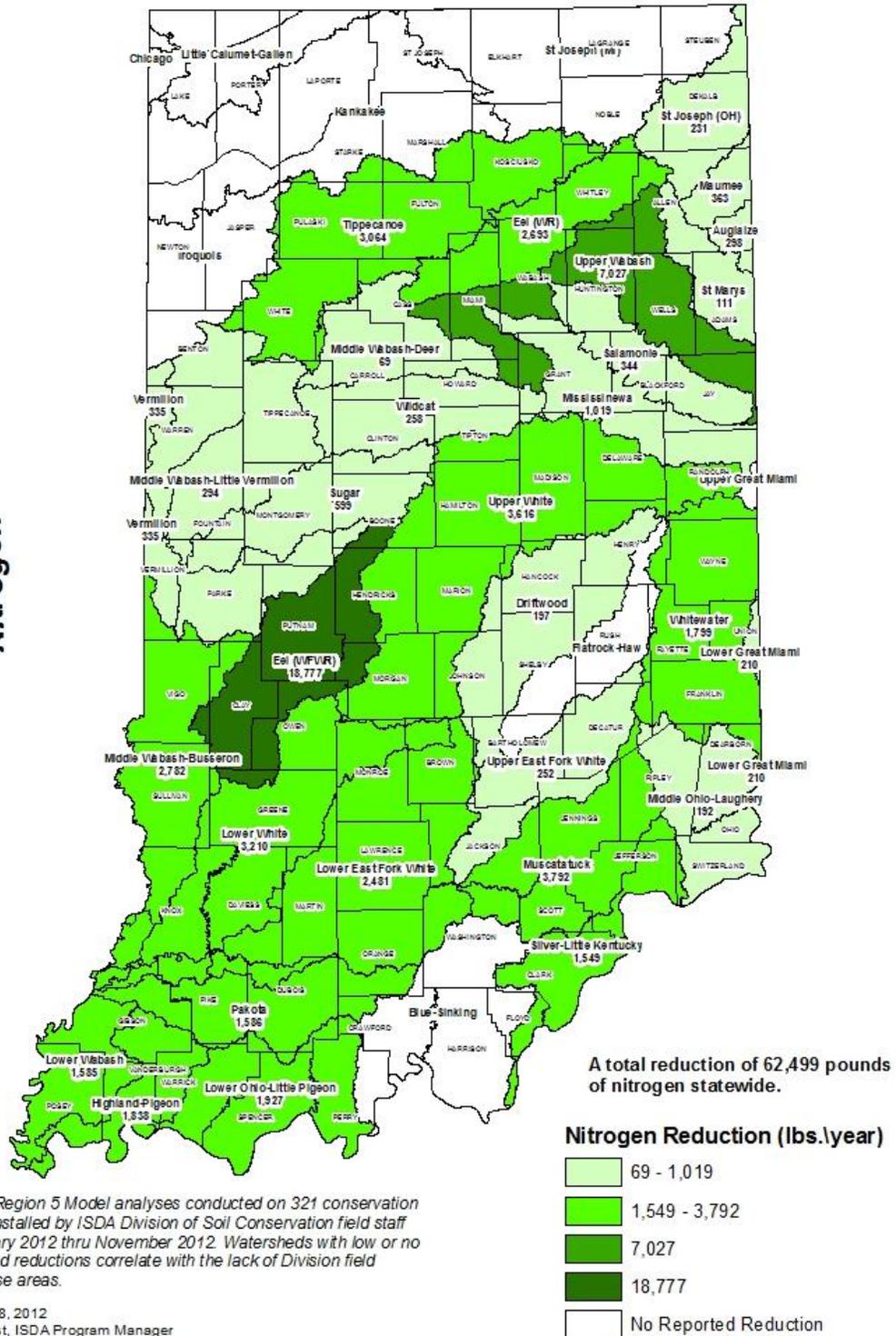


Figure 21.

2012 Nutrient Load Reductions Sediment

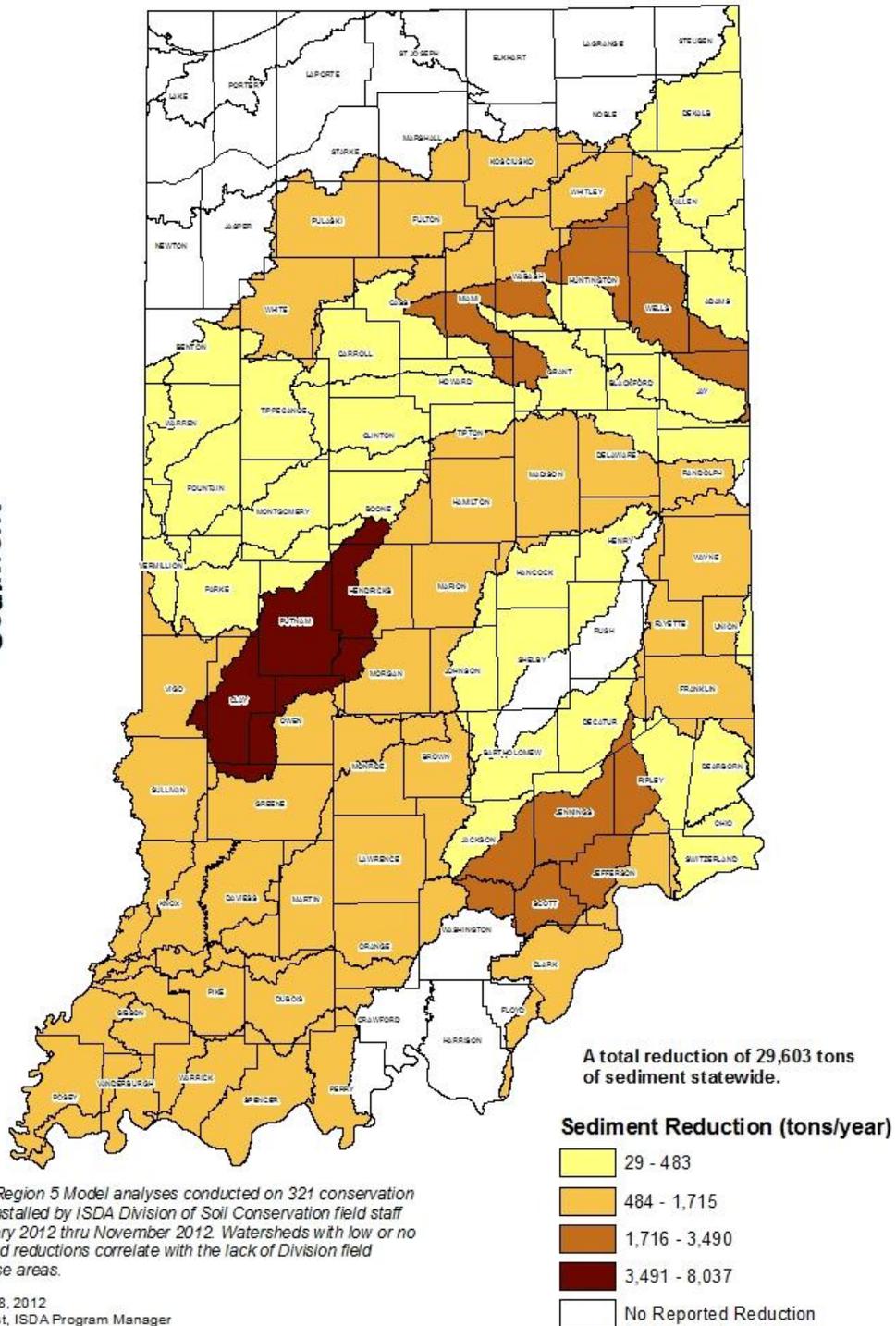


Figure 23.

Watershed Assessment and Planning Branch Monitoring Activities 2013

Fixed Station Monitoring		2013	Parameters
Watershed or Waterbody Name(s)	163 sites throughout all 9 watersheds. Divided into 16 routes sampled monthly		CHEMISTRY (dissolved vs. total metals at 12 selected sites geographically representative): Aluminum, Hardness, Calcium, Magnesium, Ammonia-N, Nitrate-Nitrite-N, Nitrogen-TKN, Phosphorus-Total, COD, TOC, BOD, Solids-Total, Solids-Suspended, Solids-Dissolved, Fluoride, Chloride, Sulfate, Cyanide-Total, Cyanide-Free, Cyanide-Ammoniate, 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 ORGANISMPESTICIDES (select sites, drinking water intakes): Hexachlorocyclopentadiene, Dieldrin/γ-hexachlorocyclopentadiene, Heptachlor Epoxide, Heptachlor, Heptachlor Chlorhydrate, Heptachlor Epoxide, Heptachlor Epoxide, Oxydemeton-Methyl, Aldrin, Dieldrin, Propoxifen, Benzopyrene, Triburan, Aldrin, Dieldrin, Propoxifen
Laboratory Analytical Costs/Funding Source	ISDH/106		Hexachlorocyclopentadiene, Dieldrin/γ-hexachlorocyclopentadiene, Heptachlor Epoxide, Heptachlor, Heptachlor Chlorhydrate, Heptachlor Epoxide, Heptachlor Epoxide, Oxydemeton-Methyl, Aldrin, Dieldrin, Propoxifen, Benzopyrene, Triburan, Aldrin, Dieldrin, Propoxifen
Probabilistic Monitoring	2013		Parameters
Watershed or Waterbody Name(s)	East Fork White River		Upper Wash River Basin
Hydrologic Unit Code(s)	05120204, 05120205, 05120206, 05120207, 05120208		
Laboratory Analytical Costs/Funding Source	Heritage Environmental, IDEM Mobile Lab, IDEM Aqul Biomass Lab/106		
TMQ/Watershed Baseline Studies	2013		2014
Watershed or Waterbody Name(s)	<p>East Fork White River</p> <p>Sage River</p> <p>Southern Whitewater Basin</p>		TBD
			<p>Water sampling monthly for alkalinity, total solids, total suspended solids, total dissolved solids, sulfate, chloride, hardness, ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, total phosphorus, total organic carbon and chemical oxygen demand. Field measurements pH, DO, temperature, turbidity, and specific conductance. E. coli will be done 5X flow monthly. Fish Macroinvertebrates, Habitat</p>

Figure 24

Watershed Assessment and Planning Branch Monitoring Activities 2013

	Hydrologic Unit Code(s)	0609000306, 0609000306, 0609000309	0604000106	Macrobenthos					
	Laboratory Analytical Costs/Funding Source	Heritage Environmental Lab and IDEM Mobile E col lab Chemistry Lab yet to be determined IDEM Mobile E col lab							
	Performance Measure Monitoring		2013	Parameters	May vary from year to year depending on the impaired listing. BAPs implemented; critical areas, & land use; E. coli, Dissolved Oxygen, D.O. Saturation, Turbidity, Specific Conductance, Temperature, pH, Ammonia, Nitrogen, Total Phosphorus, Nitrate/Nitrite, TKN, Dissolved Solids, Suspended Solids, Fish, Macroinvertebrates, Habitat				
	Watershed or Waterbody Name(s)	Blue River Tributaries to Upper Tippecanoe River						2014	
	Hydrologic Unit Code(s)	Blue River: 051401040605, 051401040805, 051401040905 Upper Tippec: 051201080104, 051201080105						TBD	
	Laboratory Analytical Costs /Funding Source	IDEM mobile E col lab							
	Toxic Algae Monitoring		2013	Parameters				2014	
	Watershed or Waterbody Name(s)	Designated swimming beaches in the lakes at the following state owned parks or managed recreation areas: Pottso Creek, Pottsgon, Chain-o-lakes, Mississinewa, Salamonie, Racoon Lake, Morroe (2 beaches), Hardy, Whitewater, Brookville (2 beaches), Deam Lake and Starve Hollow							
	Laboratory Analytical Costs (if/Funding Source	IDEM Algal Biomass Lab/106							
	Fish Tissue Monitoring		2013	Parameters				2014	
	Watershed or Waterbody Name(s)	Upper Wabash							
	Hydrologic Unit Code(s)	(4-5 sam plas will be collected from Lake Michigan by DNR & analyzed by IDEM) 05120101, 05120102, 05120103, 05120104, 05120105, 05120106 and 05120107 (4-5 sam plas will be collected from Lake Michigan by DNR & analyzed by IDEM)							
	Laboratory Analytical Costs /Funding Source	Pacifi/N Lab Account							
	Special Studies	2013		Parameters				2014	
	Hydraulic Controlled Release Facilities	Adams Lake Bryant							

Figure 25.

Watershed Assessment and Planning Branch Monitoring Activities 2013

	Deport Lakeville Atlanta Tri-Lakes RSD Center Point Little Racoon RSD Lyons Morgantown Silver Lake Wakanusa Holton Lakeville Meigsportown		TBD
Laboratory Analytical Costs /Funding Source Grand Calumet/Indiana Harbor	ISDH/106 2013	Fish & Macroinvertebrate Community, Fish Tissue Contaminants, surficial contaminant chemistry & Toxicity Sampling, Habitat & Water Chemistry Analyses	
Laboratory Analytical Costs /Funding Source	Heritage/URL/ Pace		

Figure 26.