Indiana Stream & Wetland Mitigation Program
Final In-Lieu Fee Program Instrument

FEB 16, 2018

Prepared for:

INDIANA DEPARTMENT OF NATURAL RESOURCES
and
INDIANA NATURAL RESOURCES FOUNDATION
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INDIANA STREAM AND WETLAND MITIGATION PROGRAM
IN-LIEU FEE PROGRAM INSTRUMENT
DATE SUBMITTED: February 16, 2018

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I. INTRODUCTION

USACE approval of this Instrument constitutes the regulatory approval required for the Indiana Stream and Wetland Mitigation Program (IN SWMP) to be used to provide compensatory mitigation for Department of the Army permits pursuant to 33 C.F.R. 332.8(a)(1). This Instrument is not a contract between the Sponsor or Property Owner and USACE or any other agency of the federal government. Any dispute arising under this Instrument will not give rise to any claim by the Sponsor or Property Owner for monetary damages. This provision is controlling notwithstanding any other provision or statement in the Instrument to the contrary.

This document shall constitute the instrument (Instrument) that governs the establishment, operation and use of the Indiana Stream and Wetland Mitigation Program (IN SWMP) sponsored by the Indiana Department of Natural Resources (IDNR).

II. PURPOSE

The Indiana Stream and Wetland Mitigation Program (IN SWMP) will be used for compensatory mitigation for unavoidable impacts to waters of the United States (WOUS) and isolated wetlands in the State of Indiana. Permits are required by the U.S. Army Corps of Engineers (Corps) through Section 404 of the Clean Water Act (CWA) for the discharge of dredged or fill materials within WOUS, through Section 10 of the Rivers and Harbors Act for structures or work in or affecting navigable waters of the U.S., and by the Indiana Department of Environmental Management (IDEM) under Section 401 Water Quality Certification of the CWA and, for wetlands that are not WOUS, Indiana's State Isolated Wetlands law (Indiana Code 13-18-22).

The objectives for the IN SWMP are as follows:

- Meet current and expected demand for mitigation credits.
- Achieve ecological success on a watershed basis by providing wetland and stream functions and services that are appropriate to the service area and by integrating IN SWMP projects with other conservation activities whenever possible.
- Provide an alternative to permittee-responsible, project specific, compensatory mitigation that will effectively replace functions and services lost through permitted direct and secondary impacts.
- Provide mitigation credits to resolve Section 401 and 404 of the CWA and Indiana's Isolated Wetland Permit enforcement cases.

This Instrument provides the IDNR with authorization to provide mitigation credits to Corps and IDEM permittees to be used as compensatory mitigation for Corps and IDEM permits, upon approval by the District Engineer (DE), or the Corps' official representative, at the Corps District with jurisdiction over the permitted activity and/or IDEM. Approval shall be in the form of a Corps and/or IDEM permit; the IDNR does not have the written or implied authority to approve Corps or IDEM permits.

III. PROGRAM OPERATION

A. INTERAGENCY REVIEW TEAM

The Corps will form an Interagency Review Team (IRT) comprised of the Corps (Louisville District (Chair), Chicago District, and Detroit District), US Environmental Protection Agency (USEPA), US Fish and Wildlife Service (USFWS), IDEM, US Department of Agriculture Natural Resource Conservation Service (NRCS) and representatives invited by the Corps from other federal, state, tribal, and local resource agencies that would have a substantive interest in the establishment and management of the Indiana Stream and Wetland Mitigation Program (IN SWMP) sponsored by IDNR. The Corps may designate different representatives of the agencies listed above and may invite additional members to serve on the IRT for specific IN SWMP mitigation projects (Mitigation Rule p. 19680 §332.8(b)).

1. Corps of Engineers:

   The Corps is responsible for consulting with the IRT in accordance with the requirements of 33 CFR §332.8, providing oversight of the IN SWMP, and ensuring compliance with the CWA Section 404 and the Rivers and Harbors Act Section 10.

   There are three Corps Districts covered by this Instrument – Louisville, Chicago, and Detroit Districts. Louisville District is the lead District and will serve as the District Engineer (DE) and is responsible under this Instrument for communicating with the IDNR regarding programmatic and instrument decisions and coordinating with the IRT. However, the Chicago and/or Detroit District may request that responsibility be delegated for IN SWMP mitigation projects that are proposed to be located within their respective regulatory program area.

2. IRT Members

   The IRT members are responsible for advising the Corps in assessing monitoring reports, recommending remedial or adaptive management measures, and providing input on credit releases, credit release schedules, and Instrument modifications. The procedures for IRT member review and comment in 33 CFR §332.8 shall apply. IRT members shall recuse themselves from all activities related to a project when their agency has a direct or indirect role in funding, contracting or other financial involvement with that specific project.

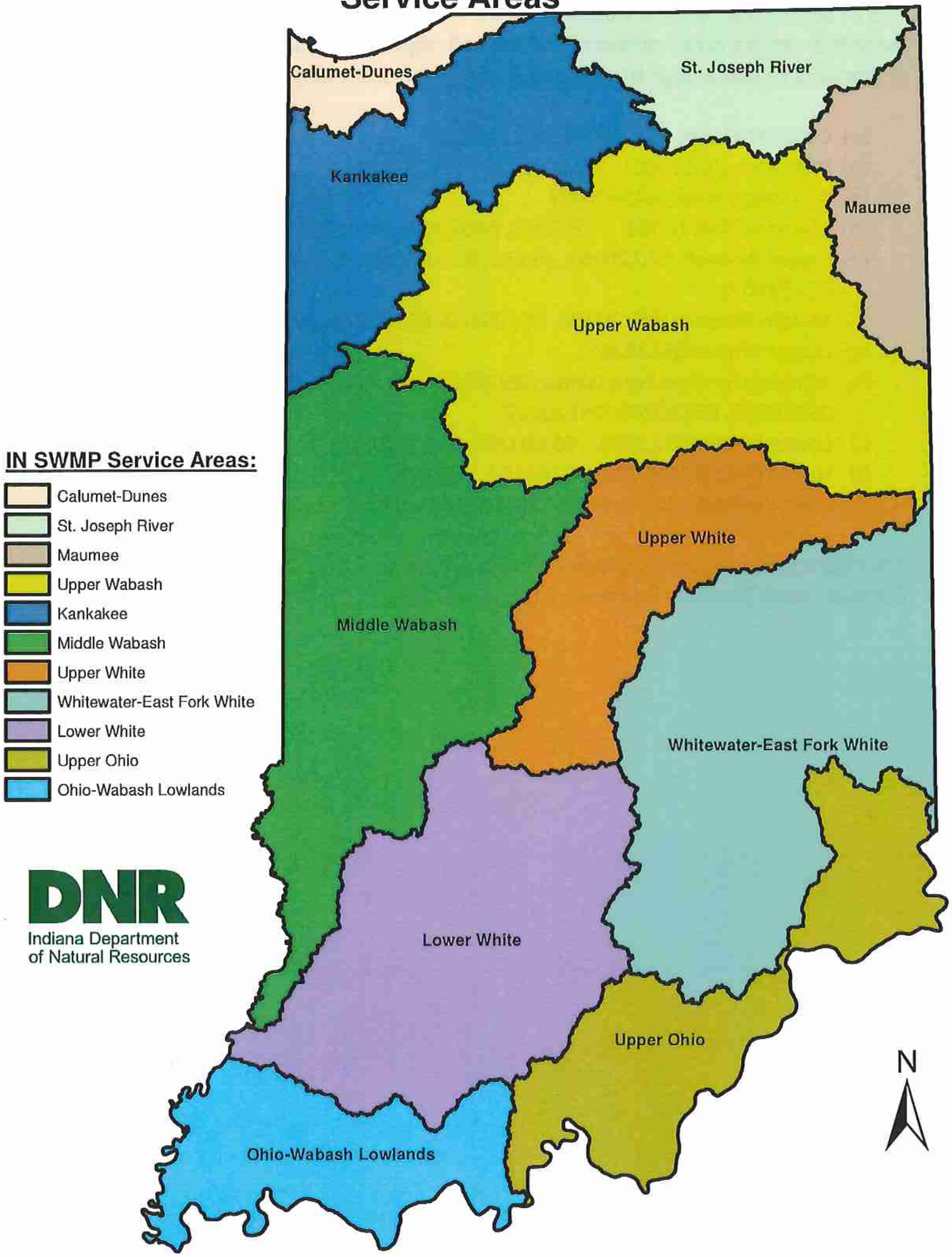
B. SERVICE AREAS

The IN SWMP will operate statewide in the 11 service areas (SA) listed below. The individual service areas consist of the listed 8-digit HUC (hydrologic unit code) watersheds, or portions of said 8-digit HUCs located within the State of Indiana.

(a) Calumet-Dunes (04040001, 07120003)
(b) Kankakee (07120001, 07120002)
(c) St. Joseph River (04050001)
(d) Maumee (04010003, 04010004, 04010005, 04010007)
(e) Upper Wabash (05120101, 05120102, 05120103, 05120104, 05120105, 05120106, 05120107)
(f) Middle Wabash (05120108, 05120109, 05120110, 05120111, 05120113, 05120203)
(g) Upper White (05120201)
(h) Whitewater-East Fork White (05080001, 05080002, 05080003, 05120204, 05120205, 05120206, 05120207)
(i) Lower White (05120202, 05120208, 05120209)
(j) Upper Ohio (05090203, 05140104, 05140101)
(k) Ohio-Wabash Lowlands (05120113, 05140201, 05140202)

The Descriptions of the geographic service area(s) and their basis are provided in the Compensation Planning Framework (Appendix B).

Indiana Stream and Wetland Mitigation Program
Service Areas



C. CREDITS

1. Allocation of Advance Credits

Table 1 below shows the advance credits that will be allocated to the IN SWMP upon approval by service area.

A base allocation of 45,000 stream credits and 90 wetland credits is made for each service area. This allocation is based on an analysis of required mitigation for Corps 404 and IDEM isolated wetland permits in each service area using data from 2009-2015. This analysis indicated that large mitigation requirements, while not the norm, do occur regularly. The base allocation will ensure that the IN SWMP can be a source of compensatory mitigation occasionally for atypical large projects, and still have sufficient credits available for typical impacts, particularly in service areas with fewer impacts in the 2009-2015 timeframe analyzed.

Further analysis of required mitigation indicated that the base allocation would be insufficient to meet projected demand in certain SAs. In these SAs a larger allocation is required.

Large projects that required greater than 20 acres of wetland mitigation and/or 10,000 linear feet of stream mitigation, as well as the cumulative impacts from the construction of I-69 and coal production were excluded from our analysis to determine the estimated demand for advance credits.

Service Area	Wetland Credits	Stream Credits
Calumet-Dunes	90	45,000
St. Joseph River (Lake MI)	90	45,000
Maumee	90	45,000
Kankakee	90	45,000
Upper Wabash	90	45,000
Middle Wabash	90	45,000
Upper White	120	60,000
Whitewater-East Fork White	90	45,000
Lower White	90	45,000
Upper Ohio	90	45,000
Ohio-Wabash Lowlands	115	50,000

Table 1. Advance Credits by Service Area

Additionally, in the event that a large credit purchase was proposed that would exceed the available advance credits at the time of purchase, the IDNR, in consultation with the Corps, may request up to an additional fifty percent (50%) advance credit allocation for the Lower White, Middle Wabash, and Ohio-Wabash Lowlands SAs, and up to an additional thirty-five percent (35%) advance credit allocation in each of the other eight (8) SAs above that listed in Table 1 above without modification of this Instrument; however, this request must be submitted in writing and approved by the Corps after consultation with the IRT. The granting of advance credits would be conditioned upon a three-year credit delivery, unless otherwise extended, in writing, by the Corps. This percentage is very conservatively based upon the 2009-2015 Corps mitigation data that was analyzed by the IDNR.

2. Credit Sales

   The IDNR may sell available Advance or Released credits to Corps and/or IDEM permittees to be used as compensatory mitigation for Corps and/or IDEM Permits, upon approval by the Corps and/or IDEM. 33 CFR §332.3(b)(1) states that the DE shall consider the type and location options for compensatory mitigation in the order presented in 33 CFR §332.3(b)(2)-(6). The approval from the Corps and/or IDEM will be in the form of a Corps and/or IDEM permit.

   Once sold to a permittee, mitigation credits may not be re-funded, re-sold or transferred to other entities except with the approval of the Corps and/or IDEM. Updated credit ledgers shall be submitted to the Corps by the 10th of each month, however if no credits were sold or transferred in the prior month an updated ledger is not required. The Corps will update RIBITS as appropriate.

   The permittee, the Corps, and/or IDEM, shall provide the IDNR with sufficient information to account for impacts and the required mitigation for each Corps and/or IDEM permit in which the permittee is approved to purchase mitigation credits from the IDNR. No credits will be sold until IDNR receives the following documentation from either the permittee, the Corps, and/or IDEM:

   i. Corps District and IDEM project managers
   ii. Corps permit number and date of authorization
   iii. IDEM Water Quality Certification (WQC) and/or isolated wetlands permit number and date of issuance
   iv. Service Area
   v. Project name
   vi. Permittee information (name, address, phone number)
   vii. Project Coordinates (Latitude and Longitude)
   viii. Linear feet and/or acres of impacted WOUS and/or isolated wetland
   ix. Functional or other mitigation units lost
   x. Type of waters impacted
   xi. The number of functional or other mitigation units required of the IDNR to compensate for the impacts, including temporal loss and/or cumulative impacts
   xii. Other information as deemed necessary by the Corps and/or IDEM

3. Credit Cost

Fees for the IN SWMP will be determined solely by IDNR (33 C.F.R. §332.8(o)(5)(i)). The fees shall be subject to change as determined by IDNR at their sole discretion. Changes in fees shall not constitute a modification of this Instrument as long as the maximum percent of each project component does not exceed the value specified in Table 2.

Based on the analysis of the required mitigation for Corps 404 and IDEM isolated wetland permits in each service area using data from 2009-2015, a business model was built to estimate the expected demand for advance credits from the IN SWMP. This was used to estimate the size of the initial IN SWMP project in each service area, how soon additional projects could be expected to be implemented, and the full cost to implement the initial project.

Table 2 gives a percent range for each of the components of a project in order for the program to provide complete compensatory mitigation delivery and accounts for the full cost accounting as required by 33 C.F.R. §332.8. The variability is due to the fact that every service area is different and each project will have its own set of variables and costs. These ranges are not meant to be fixed and will be adjusted by the IDNR as necessary based upon periodic reviews of costs to operate the program.

Project Component	Percent of Credit Cost
Land Acquisition/Protection	up to 50%
Engineering Design/Project Management	up to 20%
Financial Assurances	up to 20%
Construction	up to 60%
Monitoring / Adaptive Management	up to 20%
Long Term Management	up to 20%
Contingencies	up to 15%
IN SWMP Administration Fee	up to 15%

Table 2. IN SWMP Project Component Breakdown

Finally, the estimated costs to implement the initial IN SWMP project in each service areas were divided by the target project size to determine the draft fee schedule for IN SWMP which is included in Appendix C.

As IN SWMP mitigation projects are identified, designed, constructed and operated, the fee schedule will be updated regularly based upon refined estimates of the target project sizes, costs and anticipated credit sales.

4. Credit Types and Units

Credit Class	Credit Unit	Resource Type
Wetland	Acre	Emergent
		Scrub-Shrub
		Forested
Stream	Linear Feet	Perennial
		Intermittent
		Ephemeral

Table 3. IN SMWP Credits

5. Fulfillment and Reallocation

Mitigation credits will be fulfilled and identified by the following in accordance with 33 CFR 332.8(n):

Released Credits are credits associated with an approved mitigation plan for IN SWMP mitigation projects that are available for sale upon achievement of certain performance measures and milestones.

Advance Credits are any credits made available prior to being fulfilled by released credits from an IN SWMP mitigation project.

Credits will be accounted for by service area. Any credits sold for isolated wetland impacts authorized by an IDEM permit will be accounted for within each service area. Additionally, the service area funds (project funds) from credits sold for isolated wetland impacts will be placed in a separate sub-account from those sold for Section 10 and Section 404/401 impacts. Additional details can be found in Appendix A.

Released Credits will first be used to fulfill any Advance Credits that have already been sold to permittees within the service area before any remaining Released Credits can be sold or transferred to permittees.

Once previously provided Advanced Credits have been fulfilled, an equal number of Advance Credits will be re-allocated for sale to fulfill new mitigation requirements consistent with this Instrument.

D. COMPENSATORY MITIGATION PROJECT CREDITS

1. Determination of Credits

Mitigation credits generated by IN SWMP mitigation projects will be determined as part of the mitigation plan approval and credit release process for IN SWMP mitigation projects. Mitigation credits will be determined in accordance with 33 C.F.R. §332.8(o). In order to generate released mitigation credits, all IN SWMP mitigation projects must have an approved Mitigation Plan.

In general credits generated by IN SWMP mitigation projects will be calculated according to the following schedule:

- Restoration (Re-establishment) – 1 to 1
- Restoration (Rehabilitation) – 0.6 to 1 thru 1 to 1
- Establishment – 1 to 1 (at the time all ecological performance standards are met)
- Enhancement – 0.1 to 1 thru 0.6 to 1
- Riparian Habitat Enhancement – up to 0.2 to 1
- Preservation – 0.1 to 1

The Corps and/or IDEM in consultation with the IRT may approve variances from the above ratio for specific IN SWMP projects.

2. Schedule for Credit Release

The Mitigation Plan for each IN SWMP Mitigation project will contain a credit release schedule tied to ecological performance-based milestones. The credit release schedule and mitigation success criteria will require approval from the Corps on a per mitigation project basis to be consistent with the current Corps Mitigation Plan Template. IN SWMP mitigation projects, other than preservation, will utilize the following credit release schedule:

- 15% mitigation credit release after site protection and approved Section 404 permit;
- 5% additional mitigation credit release (20% cumulative) upon DE acceptance of "As Built" Report;
- 60% additional mitigation credit release (80% cumulative), divided equally for each year monitoring performance standards are met, not including final year of monitoring.
- 20% additional mitigation credit release (100 % cumulative) once the final performance standards have been met and when long term management plan and funding is in place and the DE has provided written release from monitoring to the Sponsor.

In the case of preservation, 100% of the mitigation credits will be released upon securing the site, implementing the site protection, and finalizing the long term management plan and funding.

Deviations from the above release schedules may be approved by the Corps on a case-by-case basis after consultation with the IRT and shall be included in the approved

Project Mitigation Plan for the compensatory mitigation project. Approval of deviations from the above release schedule shall be based on past and current performance, specific site characteristics or factors that would affect risk, or other considerations as determined by the Corps.

3. Credit Release

The IDNR shall submit documentation to the Corps demonstrating that the ecological performance-based milestones have been achieved and shall request release of the mitigation credits.

The Corps, in consultation with the IRT, shall approve the release of mitigation credits for a compensatory mitigation site per 33 CFR §332.8(o)(9).

E. CREDIT/DEBIT ACCOUNTING AND REPORTING

The IDNR shall establish and maintain appropriate ledgers and provide an annual report in accordance with 33 CFR §332.8(i)(3) & (q)(1).

Individual ledgers for each service area shall track:

1. Credit Accounting - including allocated advance credits, advance credits sold, advance credits fulfilled, released credits, released credits sold, and current balance of credits available; and

2. Credit Transactions –the permit authorizing the associated impact and its date of issuance, project name, permittee name, impact location, acres and/or linear feet impacted, aquatic resource impacted, functional units lost and required for mitigation, amount paid to the IN SWMP and the date the funds were received.

Each IN SWMP mitigation project shall have a separate ledger that tracks the total credits expected to be generated by the project and the actual Released Credits for that site that have been approved by the Corps and IRT.

Credit ledgers and annual reports shall be provided to the Corps and IRT by February 28 of each year for the previous calendar (January through December) year. The Corps may consider granting an extension of this deadline upon request by the IDNR.

F. IN SWMP COMPENSATORY MITIGATION PROJECTS

1. Mitigation Plan

The IDNR will submit a Project Mitigation Plan for each IN SWMP mitigation project to the Corps. The Project Mitigation Plan must include the information required in 33 CFR

§332.8(j) and shall be supported by the Compensation Planning Framework (CPF). IN SWMP will utilize any/all current Corps mitigation templates, guidance, and/or SOPs as necessary when proposing IN SWMP mitigation projects.

2. General Considerations

   The general considerations for compensatory mitigation set forth in 33 CFR §332.3 shall be the basis for evaluating IN SWMP mitigation projects submitted by the IDNR to the Corps for approval.

   IN SWMP projects shall only involve the restoration, establishment, enhancement and/or preservation of Indiana's aquatic resources. IN SWMP mitigation projects shall not include sanitary sewer projects or other municipal infrastructure projects, even when gains to aquatic resource functions are derived from such projects. IN SWMP funds/projects cannot be used to fulfill any obligations except those required under Sections 404, 10 and 401 of the Clean Water Act and Indiana's isolated wetlands law).

3. Approval

   The Corps must approve all IN SWMP mitigation projects as modifications to this Instrument. IN SWMP mitigation projects will be reviewed and approved in accordance with 33 CFR §332.8. Projects requiring Corps authorization will be approved following current Corps procedure. Upon approval of an IN SWMP mitigation project, each project will be entered into the table contained in Appendix D with the Corps ID number for tracking purposes.

4. Implementation

   The IDNR is responsible for the implementation, long-term management, and any required remediation of IN SWMP mitigation projects, even if those activities are conducted by other parties.

5. Monitoring

   The IDNR is responsible for monitoring IN SWMP mitigation projects. Monitoring shall be in accordance with the approved Mitigation Plan for each IN SWMP mitigation project to ensure performance based milestones are achieved.

   Monitoring reports shall be submitted in accordance with the approved Mitigation Plan.

6. Long Term Management

   IDNR shall be responsible for developing and implementing a long-term protection and management plan for each IN SWMP mitigation project.

Projects shall be designed, to the maximum extent practicable, to require minimal long-term management once ecological performance standards have been achieved.

The long-term management plan for each project will be approved by the Corps. The approved plan shall identify the party responsible for both the long-term protection and management of the project site.

The long-term management responsibilities may be transferred from the IDNR to another party after review and approval of the Corps. The long-term management plan developed for each project will include a description of anticipated management needs with an annual cost estimate and an identified funding mechanism to cover the annual cost estimate. The funding mechanism shall be in place and fully funded prior to the final release of credits. If long-term management obligations will be fulfilled by a party other than the Sponsor, sufficient funds to implement the long-term management plan activities can also be transferred to the party fulfilling the long-term management obligations with the Corps approval.

7. Site Closure

IDNR shall request closure of each IN SWMP mitigation project when the ecological performance standards have been met, all monitoring has been completed and reporting accepted.

Upon establishment of any agreements or arrangements required by the long term management plan and/or site protection, IDNR may request closure of the compensatory mitigation project.

The Corps shall, after consulting with the IRT, issue written notice of closure if all requirements are met.

Upon closure, any remaining released credits would no longer be available to sell, transfer or fulfill advanced credits.

G. ACCEPTANCE OF COMPENSATORY MITIGATION RESPONSIBILITIES

1. The permittee shall retain responsibility for providing the compensatory mitigation until the Corps and/or IDEM has received the appropriate documentation that confirms the IDNR has accepted the permit mitigation responsibilities and received payment.

2. The IDNR assumes responsibility for the mitigation requirements of permittees who are issued Corps and/or IDEM permits for which mitigation credits are purchased from the IDNR as compensatory mitigation for impacts authorized by the Corps and/or IDEM by a permit.

3. The IDNR shall provide the Corps and/or IDEM with documentation confirming the IDNR has accepted responsibility for providing the required compensatory mitigation for a Corps and/or IDEM permit.

   This documentation will consist of a letter to the permittee, signed by the IDNR, identifying the permit number(s) and stating the number and type of mitigation credits that have been secured from the IDNR. The IDNR shall also provide a copy of this letter to the Corps and/or IDEM.

4. The IDNR shall retain the right to refuse to sell credits, temporarily shut down a service area, or suspend credit sales at their discretion. IDNR shall provide notice to the Corps and IDEM 24 hours prior to any such decision.

5. The IDNR, in consultation with the DE and IRT, may purchase mitigation credits from a Corps-approved mitigation bank to fulfill advance credits that have been sold. In these cases, the instrument governing the mitigation bank shall apply, including the transfer of mitigation liability from the IDNR to the bank once the mitigation credits have been purchased.

H. COMPENSATION PLANNING FRAMEWORK (CPF)

1. The CPF for the IN SWMP is attached as Appendix B and will be used to direct the selection and implementation of mitigation projects, and describes the geographic service areas for the IN SWMP and their basis.

2. Modification of the CPF is considered a significant modification to this Instrument and will be made following the procedures in 33 CFR §332.8(d).

I. TIMING OF COMPENSATORY MITIGATION PROJECTS

1. In general, implementation of IN SWMP mitigation projects will occur after sufficient funds are available in a service area to undertake a project. Unless the Corps determines more time is needed to plan and implement an IN SWMP project (33 CFR §332.8(n)(4)), all Advanced Credits sold within a calendar year in each respective SA will accumulate, and the delivery of permanent protection and initial physical and/or biological improvements for the sum of those credit sales shall be due three (3) years from the end of the given calendar year. An approved ILF mitigation project may satisfy credits sold in subsequent calendar years if the specific mitigation project has released credits available.

   Alternative compensatory mitigation, including the purchase of mitigation credits from a Corps-approved mitigation bank, shall be provided when the IDNR does not provide mitigation within three growing seasons after the first Advance Credit is sold in a service area unless the IDNR proposes and the Corps agrees that more time is needed.

2. The IDNR may identify, design, and/or implement IN SWMP mitigation projects in advance of impacts.

IV. PERMANENT PROTECTION

A. Each IN SWMP mitigation project site (the aquatic habitats, riparian areas, buffers and upland areas that comprise the overall compensatory mitigation project) will be protected with a real estate instrument or other mechanism, as appropriate, per 33 CFR §332.7.

B. The approved mitigation plan for each IN SWMP mitigation project will include the required site protection.

C. Unless approved by the Corps, the IDNR shall not implement mitigation on sites where oil, gas, mineral, timber, quarrying (limestone, sand, etc.) or other land use rights or interests are severed from fee ownership or where those rights have been leased to a third party where such rights could threaten the long term success and ecological value of the IN SWMP mitigation project site.

D. Mitigation protection shall maintain the aquatic resources and associated habitats that are preserved, restored, enhanced or created for each IN SWMP mitigation project site. The protection shall be bound on all assigns and successors.

E. Any activity which is inconsistent with the purposes of an IN SWMP mitigation project shall be prohibited on the IN SWMP project site, this includes:
   a. subdivision of the site into two or more parcels, with the exception of any future dedication of all or part of the site as a nature preserve or other such classification;
   b. any residential, commercial, agricultural or industrial use or activity on the site;
   c. the maintenance of any new man-made modifications such as buildings, structures, boat ramps, or other improvements, unless part of the approved mitigation plan;
   d. mining, exploration for, or extraction of oil, gas, or other minerals, hydrocarbons, soils or other materials that disturbs the surface or aquatic resources of the site;
   e. the dumping or storage or disposal of trash, garbage, sewage, debris, or other refuse of any nature;
   f. the cutting or harvesting of trees or wood products, unless approved as part of the approved mitigation plan and/or long term management plan;
   g. earth moving, grading, dredging or filling, unless approved as part of the approved mitigation plan;
   h. the construction, maintenance, or erection of any commercial advertisement, sign or billboard, except for posting of signs depicting the project site, including boundary, interpretive or directional signs;
   i. the construction or extension of roads or utility systems, outside of existing easements or right-of-ways, unless court ordered;

j. use of horses, ponies, bicycles or motorized vehicles, such as cars, trucks, snowmobiles, dune buggies, ATVs or motorcycles, except the use of vehicles necessary to complete the construction or maintenance of improvements in the approved mitigation plan;
k. other activities, actions, or uses that would be detrimental or adverse to soil and water conservation values.

F. The following activities shall be allowed on IN SWMP mitigation project sites:
   a. natural resources inventories or monitoring of species of plants and animals;
   b. installation of signs relating to the mitigation project, depicting designations or classifications, including interpretive signs or directional signs;
   c. non-commercial, non-developed recreational activities including, hunting, fishing, hiking, nature viewing and photography, and other low impact, non-extractive uses not inconsistent with the mitigation project that will not be detrimental to the mitigation project achieving its required ecological performance standards;
   d. installation and maintenance of trails to provide access to the site, as approved in the mitigation plan;
   e. management of the site to restore and /or enhance native plant and animal communities, including control of invasive plant and animal species, considered noxious under state law or considered detrimental to the conservation values on the site according to the approved mitigation plan, invasive plant species control and removal may be by manual or mechanical methods, by the use of herbicides or bio-controls and/or prescribed burning, invasive animal species control may be by trapping or hunting pursuant to applicable laws and regulations;
   f. management of the site to restore and/or enhance aquatic resources and to alter the vegetation and hydrology, including diverting or affecting the natural flow of surface or underground water into, within, or out of the site, or dredging, channeling, filling, pumping, diking, impounding, or other related activities according to the approved mitigation plan;
   g. entry and use, and all other activities not expressly prohibited by the approved mitigation plan or the Instrument that are consistent with the conservation value of the property.

G. No human activities shall occur on an IN SWMP project site that require a Corps and/or IDEM permit for impacts to aquatic resources, except those authorized to implement the mitigation work plan and long term management plan.

   If the Corps and/or IDEM authorize impacts to aquatic resources on an IN SWMP project site, the permit shall require compensatory mitigation by the permittee for the direct loss of the aquatic resource, past impacts being mitigated for by the aquatic resources, and all associated temporal losses.

V. FINANCIAL ASSURANCES

A. The approved mitigation plan for each IN SWMP mitigation project will specify the amount of the IN SWMP Program Account's reserve funds that will provide the required financial assurances for that project site.

B. The long term management funding mechanism for each IN SWMP mitigation project may be transferred to a third party upon written approval from the Corps and/or IDEM.

C. If sufficient reserve funds are not available in the IN SWMP Program Account to provide the required financial assurances for a specific IN SWMP mitigation project, IDNR shall provide acceptable financial assurances in a form according to 33 CFR §332.3(n)(1)-(2).

D. The approved mitigation plan for each IN SWMP mitigation project will have an identified schedule to release the financial assurances as the project site meets its approved ecological performance standards.

E. Appendix A – IN SWMP FINANCIAL ACCOUNTING provides additional financial details for the program.

VI. MODIFICATION OF THIS INSTRUMENT

A. Modification of this Instrument shall follow the procedures set forth in 33 CFR §332.8(g).

   In the event that any items that require modification would fall into the authority of the Sponsor and DE to utilize the streamlined review process, those items for modification, as determined by the DE, and the streamlined process, will follow the procedures set forth in 33 C.F.R. §332.8(g)(2).

B. The Compensation Planning Framework (Appendix B) utilizes various sources of external information/data in its mitigation approach and prioritization. These sources of information/data are expected to be updated or modified over time by the external entities responsible for maintaining these sources of information. The IDNR's use of updated or modified information from these external sources in the application of its CPF is not considered a modification of the CPF or this Instrument.

C. The addition of new projects will follow an approved Mitigation Letter of Permission (LOP) for new mitigation projects associated with approved compensatory mitigation banking and in-lieu fee instruments within the state of Indiana.

VII. DEFAULT, SUSPENSION, AND TERMINATION

A. When the Corps determines that the Indiana Stream and Wetland Program (IN SWMP) is not meeting or complying with the terms of this Instrument, the Corps will take appropriate action. Such actions may include, but are not limited to: suspending IN SWMP credit sales, decreasing the allocation of Advance Credits, requiring adaptive management actions, suspending approval of new mitigation projects, directing funds to alternative mitigation, terminating this Instrument, or other actions as approved by the Corps.

B. Termination

1. Either the Corps or IDNR may terminate this Instrument. Termination procedures shall be commenced upon written notice of either party's intent to terminate this Instrument.

2. Within 90 days of the written notice to terminate, the IDNR shall provide the following:

    a. An accounting of all monies and outstanding obligations by service area and for each mitigation project;

    b. The status of all approved mitigation projects, including the number of credits released, the remaining projected credits to be generated by each project, the extent to which each project is meeting the performance standards and measures that will be taken to ensure the performance standards are met;

    c. The status of the long term management plans and funding, and the measures that will be taken to ensure that the plans can be implemented.

3. The Corps, after consulting with the IRT, will determine if the measures proposed by IDNR are adequate and determine the final closure plan for the IN SWMP.

4. If no released credits from a mitigation project have been generated and subsequently used to fulfill advance credits or otherwise transferred, the site protection instrument may be vacated with written approval of the Corps.

C. Remaining Funds

1. In the case of default or termination by either party, any remaining IN SWMP funds after fulfilling all obligations shall be used as directed by the DE.

VIII. FORCE MAJEURE

A. Responsibility for Repair and Remediation: The Sponsor shall be responsible for repair and remediation of compensatory mitigation projects except under the following circumstances:
   1. A project is released from monitoring by the DE and IRT; and
   2. Damages to the compensatory mitigation project are the result of a human-caused or natural disaster, or a deliberate and unlawful act.

B. The DE, in consultation with the IRT, will determine whether a Force Majeure event has occurred and the Sponsor shall bear the burden of demonstrating to the satisfaction of the DE:
   1. That the disaster was caused by circumstances beyond the control of the Sponsor, and/or any entity controlled by the Sponsor, including its contractors and consultants;
   2. That neither the Sponsor, nor any entity controlled by the Sponsor, including its contractors and consultants, could have reasonably foreseen and prevented such an event or damages from such event; and
   3. The damage was caused by such event.

IX. POINTS OF CONTACT

The points of contact for written communication among the parties are as follows or as otherwise specified in the future by written notice to all parties:

Corps of Engineers

U.S. Army Corps of Engineers
Chief, Regulatory Division
(currently Mr. Michael Ricketts)
U.S. Army Engineer District
Louisville District Corps of Engineers
OP-FN, Room 752
P.O. Box 59
Louisville, KY 40201-0059
PHONE: (502) 315-6685
FAX: (502) 315-6677

U.S. Army Corps of Engineers
Chief, Regulatory Branch
(currently Mr. Charlie Simon)
Construction-Operations Division
Detroit District Corps of Engineers
477 Michigan Avenue
Detroit, MI 48226-2550
PHONE: (313) 226-2218
FAX: (313) 226-6763

U.S. Army Corps of Engineers
Chief, Regulatory Branch
(currently Mr. Keith L. Wozniak)
Technical Services Division
Chicago District Corps of Engineers
231 South LaSalle Street, Suite 1500
Chicago, IL 60604
PHONE: (312) 846-5530
FAX: (312) 353-4110

Sponsor

Indiana Department of Natural Resources
Division of Land Acquisition
Carl Wodrich
Director of Ecological Services
402 W. Washington Street, W261
Indianapolis, IN 46204
317-232-1291
CWodrich@dnr.IN.gov

Sponsor's Fiscal Agent

Indiana Natural Resources Foundation
Jody Kress, Executive Director
402 W. Washington Street, W256
Indianapolis, IN 46204
317-234-5447
JKress@dnr.in.gov

IN SWMP Mitigation Specialists:
Brad Baldwin
David Carr
bbaldwin@dnr.IN.gov / 317-234-9702
dcarr@dnr.IN.gov / 317-234-9703

IRT Members

IDEM, Office of Water Quality
Marty Maupin
100 North Senate Avenue
Indianapolis, Indiana 46204
317-233-2471

USEPA, Region 5, WW-16J
Melanie Burdick
77 West Jackson Boulevard
Chicago, Illinois 60604
312-886-6833

USFWS, Bloomington Indiana Field Office
Marissa Reed
620 South Walker Street
Bloomington, Indiana 47403-2121
812-334-4261

USDA-NRCS
Albert Tinsley
6013 Lakeside Boulevard
Indianapolis, IN 46278-2933
317-295-5856

X. EFFECTIVE DATE:

This agreement shall become effective when signed by the Louisville, Chicago, and Detroit Districts of the U.S. Army Corps of Engineers, IDEM, and the IDNR. IRT members are invited to sign this Instrument as an indication of their agreement to the terms of this Instrument. The decision of an IRT Member not to sign this Instrument does not negate the effectiveness of this Instrument. The Corps retains the final authority for approval of this Instrument.

XI. CORPS OF ENGINEERS AND INDIANA DEPARTMENT OF NATURAL RESOURCES SIGNATURES

Michael S. Ricketts | Date: Φ2 MAY 2Φ18
Michael S. Ricketts
Chief, Regulatory Division
Louisville District

23 April 2018

Keith L. Wozniak
Chief, Regulatory Branch
Chicago District

Date

23 Apr 2018

Charles M. Simon
Regulatory Office
Detroit District

Date

4-12-18

Cameron F. Clark
Director
Indiana Department of Natural Resources

Date

XII. INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT SIGNATURE

April 12, 2018

Bruno L. Pigott   Date
Commissioner
Indiana Department of Environmental Management

XIII. INTERAGENCY REVIEW TEAM SIGNATURES

Scott E. Pruitt — Date
Bloomington Field Office Director
U.S. Fish & Wildlife Service

Wendy L Melgin — 4/13/2018
Wendy L. Melgin, Chief — Date
Wetlands Section
U.S. Environmental Protection Agency, Region 5

Jill Reinhart — Date
Acting Indiana State Conservationist
U. S. Department of Agriculture Natural Resource Conservation Service

XIII. INTERAGENCY REVIEW TEAM SIGNATURES

4/16/18

Scott E. Pruitt | Date
Bloomington Field Office Director
U.S. Fish & Wildlife Service

Wendy L. Melgin, Chief | Date
Wetlands Section
U.S. Environmental Protection Agency, Region 5

Jill Reinhart | Date
Acting Indiana State Conservationist
U. S. Department of Agriculture Natural Resource Conservation Service

XIV. IN SWMP APPENDICES

APPENDIX A. IN SWMP FINANCIAL ACCOUNTING

A.1 FISCAL AGENT

The Indiana Natural Resources Foundation (INRF) will serve as fiscal agent for the Indiana Stream and Wetland Program (IN SWMP). The INRF will receive and safeguard all IN SWMP funds. The INRF will disburse IN SWMP funds only according to the terms of this Instrument. The INRF will maintain all financial records relating to the IN SWMP for a minimum of five years after the termination of the program. The INRF will follow the IDNR's records retention policy.

A.2 FINANCIAL ACCOUNTS

A.2.1 IN SWMP Account

The INRF will establish the IN SWMP Account at an FDIC member financial institution upon approval of the IN SWMP and prior to the sale of any advance credits.

All mitigation payments shall be deposited into the IN SWMP Account held by the INRF and segregated and accounted for in the separate subaccounts noted below. The IN SWMP Account is to be used solely for the purposes and benefit of Indiana stream and wetland mitigation projects. All monies that may be generated from the sale or disposal of property, equipment, materials or other items purchased using in-lieu fee funds shall be reimbursed and deposited in the IN SWMP Account for the sole use and benefit of the IN SWMP and shall not be diverted for other uses. The IN SWMP Account will be used for in-lieu fee mitigation activities, including: land acquisition, project planning and design, construction, plant materials, labor, legal fees, monitoring, remediation and adaptive management activities, long term management, administration, or other costs necessary to complete mitigation projects. The pricing of credits will be set at an amount sufficient to fund all costs associated with operation of the IN SWMP and implementation of mitigation projects.

As stated in Paragraph VII.A., if the DE determines that the Indiana Stream and Wetland Mitigation Program (IN SWMP) is not meeting or complying with the terms of the Instrument, the DE, in consultation with the IRT, may direct IN SWMP Account funds to alternative mitigation or other actions.

Interest and earnings shall remain in the IN SWMP Account for use solely by and for the purposes of the IN SWMP and providing compensatory mitigation for Corps and/or IDEM permits. Funds in the IN SWMP Account will remain in the account at the end of the INRF's and state's fiscal year and will not revert to any other funds.

The IN SWMP Account shall have four sub-accounts that will be tracked and accounted for separately:

(a) Administrative Funds
(b) Service Area Funds (in-lieu fee project funds for Section 10, 404, and 401 permitted impacts)
(c) Service Area Funds (from credits sold for IDEM-permitted isolated wetland impacts)
(d) Reserve Funds

A.2.2 Administrative Funds

The credit costs include an amount to fund the administration of the IN SWMP. Up to fifteen (15) percent of each credit sold shall be used to fund administrative tasks including, but not limited to, tasks completed by IDNR staff, INRF staff, and/or professional services required to carry out operation of the IN SWMP program.

IDNR may withdraw Administrative funds at their discretion without the approval of the Corps or IRT.

Administrative funds shall be tracked separately from the Service Area funds and the Reserve funds.

A.2.3 Service Area Funds

Funds to implement IN SWMP mitigation projects shall be deposited into the IN SWMP Account and tracked by Service Area. Funds from credits sold for isolated impacts will be deposited into a separate account from credits sold for Section 10, 404 and 401 impacts. When funds are moved from the NRF to the IDNR/state accounts, these funds will be co-mingled but will be tracked separately using appropriate, identifying chartfield information to distinguish these funds from one another easily when the state's accounting system is queried for reports to be generated for the program and to fulfill reporting requirements to the DE, IDEM and the IRT.

These funds will be used to implement compensatory mitigation projects including locating and identifying, planning, acquisition, site protection, design, construction, performance monitoring, adaptive management, financial assurances, long term management funding mechanisms, anticipated contingencies and/or other activities. Each individual mitigation project's finances will be tracked within each service area.

The Service Areas are listed below and discussed in detail in Appendix B.

(a) Calumet-Dunes
(b) Kankakee
(c) St. Joseph River (Lake Michigan)
(d) Maumee
(e) Upper Wabash
(f) Middle Wabash
(g) Upper White
(h) Whitewater-East Fork White
(i) Lower White
(j) Upper Ohio
(k) Ohio-Wabash Lowlands

Upon approval of an IN SWMP mitigation project, expenses shall be tracked for each project both in the INRF and the IDNR/State of Indiana accounting system.

Disbursements from the IN SWMP Account may only be made per the approved IN SWMP mitigation project plans and only upon receipt of written authorization from the DE, after IRT consultation. Disbursements made to the IDNR that are deposited into IDNR accounts will be tracked by project and any other identified financial coding in the state accounting system as necessary and/or required by the DE.

IDNR may request written authorization from the DE, in consultation with the IRT, to withdraw funds for locating, identifying, planning and gaining approval of IN SWMP mitigation projects prior to approval of a mitigation plan for said project sites.

A.2.4 RESERVE FUNDS

A "Reserve" will be established in the IN SWMP Accounts. The Reserve will be maintained by the interest that has accrued to the IN SWMP Account and from a percentage of each credit sold.

The Reserve shall be used for contingency actions, to provide program and project-specific financial assurances, long-term management, permanent protection activities (legal fees, encroachment repairs, boundary signage, etc.), and extra mitigation as may be necessary based upon the interest accrued on funds set aside for financial assurances. As financial assurances for IN SWMP projects are released, those funds will remain in the Reserve Fund.

The use of Reserve funds shall be subject to the approval of the DE in consultation with the Sponsor and IRT except for minor actions that do not require a permit, such as long-term

APPENDIX B. COMPENSATION PLANNING FRAMEWORK (CPF)

CPF APPLICABILITY AND MITIGATION RULE COMPONENTS

The compensation planning framework adopts a landscape-watershed approach to selecting and implementing in-lieu fee mitigation projects that restore, enhance, establish and/or preserve aquatic resources under the IN SWMP program. This framework will be used to identify, evaluate, and screen potential IN SWMP mitigation projects and will be referenced in future Project Mitigation Plans.

The compensation planning framework includes the following ten elements required under 33 CFR §332.8 (c):

1. **Service Areas -** The geographic service area(s), including a watershed-based rationale for the delineation of each service area;
2. **Threats to Aquatic Resources -** A description of the threats to aquatic resources in the service area(s), including how the in-lieu fee program will help offset impacts resulting from those threats;
3. **Historic Aquatic Resource Loss -** An analysis of historic aquatic resource loss in the service area(s);
4. **Current Aquatic Resource Conditions -** An analysis of current aquatic resource conditions in the service area(s), supported by an appropriate level of field documentation;
5. **Aquatic Resource Goals and Objectives** - A statement of aquatic resource goals and objectives for each service area, including a description of the general amounts, types and locations of aquatic resources the program will seek to provide;
6. **Prioritization Strategy -** A prioritization strategy for selecting and implementing compensatory mitigation activities;
7. **Preservation Objectives -** An explanation of how any preservation objectives identified in paragraph (c)(2)(v) of this section and addressed in the prioritization strategy in paragraph (c)(2)(vi) satisfy the criteria for use of preservation in §332.3(h);
8. **Public and Private Stakeholder Involvement -** A description of any public and private stakeholder involvement in plan development and implementation, including, where appropriate, coordination with federal, state, tribal and local aquatic resource management and regulatory authorities;
9. **Long-Term Protection and Management -** A description of the long-term protection and management strategies for activities conducted by the in-lieu fee program sponsor;
10. **Periodic Evaluation Strategy -** A strategy for periodic evaluation and reporting on the progress of the program in achieving the goals and objectives in paragraph (c)(2)(v) of this section, including a process for revising the planning framework as necessary

The IN SWMP CPF provides a statewide approach with additional specificity within each of the 11 service areas. Elements nine and ten apply statewide and do not require additional specificity for each service area as they apply to the program as a whole.

STATEWIDE CPF

ELEMENT 1. SERVICE AREAS

1.1 Description

The IN SWMP will operate in 11 service areas listed below. The 8-digit HUC was used as the cataloguing unit for constructing the service areas. Two of the service areas are sized at an 8-digit HUC scale; the remaining service areas were configured by combining multiple 8-digit HUC watersheds. The following service areas were chosen based on a combination of watershed boundaries and the likelihood of future wetland and stream impacts and potential mitigation opportunities to offset those impacts (**Figure 1**). Ecoregions were also considered as a secondary priority in determining service area boundaries as most ecoregions do not coincide with watershed boundaries.

1. Calumet-Dunes
2. St. Joseph River (Lake MI)
3. Maumee
4. Kankakee
5. Upper Wabash
6. Middle Wabash
7. Upper White
8. Whitewater-East Fork White
9. Lower White
10. Upper Ohio
11. Ohio-Wabash Lowlands

The IDNR will provide mitigation credits for aquatic resource loss by completing projects in the same service area where the impact occurred. The threats, permitted impacts and historic loss within each service area will guide the IN SWMP landscape-watershed restoration goals, objectives and priorities in project selection, plan development, and implementation.

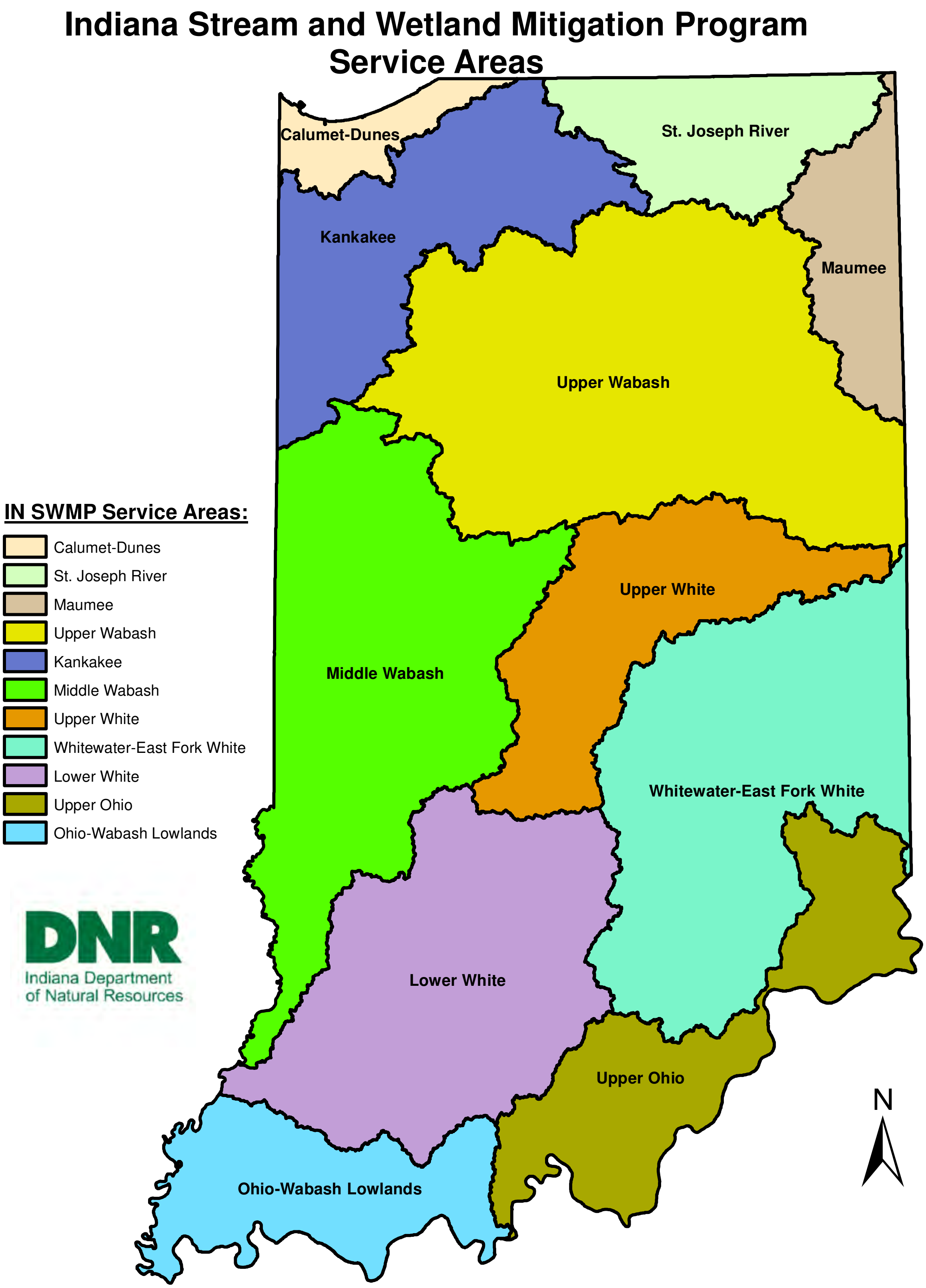


Figure 1. IN SWMP Service Areas

1.2 Rationale

The IN SWMP seeks to establish an option for mitigation that is environmentally preferable to permittee responsible mitigation. This will be accomplished by consolidating mitigation projects and resources, providing financial planning and scientific resource expertise and reducing uncertainty over project success. To achieve these results, the amount of fees collected by the IN SWMP must be sufficient to finance viable mitigation projects in each service area.

The State of Indiana is divided into 39 different 8-digit HUCs. The IDNR believes, based upon historical impact and mitigation data from the Corps and IDEM, that proposing a service area for each 8-digit HUC would result in numerous small service areas that would not experience enough impacts and therefore collect enough fees from the sale of credits over a period of three years to finance the required mitigation projects that would adequately compensate for permitted impacts to aquatic resources.

IDNR believes that the eleven service areas proposed will result in effective compensation for adverse environmental impacts to aquatic resources within each service area. The service areas, except the St. Joseph River and Upper White, are comprised of multiple 8-digit HUCs which IDNR biologists and ecologists believe have similar aquatic habitat systems and similar watershed characteristics.

The Calumet-Dunes Service Area includes two (2) 8-digit HUCs:

- 04040001 - Little Calumet-Galien
- 07120003 - Chicago

This service area is defined by the geologic and natural features associated with Lake Michigan and its origins. This includes morainal forests and prairies, lake plain wetlands, sand savannas, sand prairies, dune and swale habitat, swamps, and the sand dune and beach topography of the lake border. Northern wetland types characterize the entire area, especially associated with the Little and Grand Calumet Rivers. Much of the southern portion of this service area is within the Central Corn Belt Plains with glaciated plains that were historically extensive prairie communities that have been replaced by agriculture. The eastern half of this service area is within the Southern Michigan/Northern Indiana Drift Plains with a wide assortment of landforms, soil types, soil textures and land uses. The eastern half of this service area also has low to medium gradient streams and is home to paleobeach ridges, relict dunes, and morainal hills.

This service area has a relatively dense concentration of impacts, but has limited opportunities for wetland and stream restoration in each HUC compared to the rest of the proposed service areas. The Chicago HUC has a significant amount of impacts, but urbanization has reduced the accessibility to quality restoration opportunities. The Little Calumet-Galien HUC has significantly less historical impacts, but provides for greater opportunity to restore and rehabilitate wetlands and streams.

The St. Joseph River Service Area is a single 8-digit HUC:

- 04050001 - St. Joseph River

This service area has a distinctly different watershed outlet (the eastern shore of Lake Michigan) from the other 8-digit HUCs in Indiana. Complex glacial topography of moraines, kettles, kames characterize the service area which contains many of the highest quality wetland areas in the state, including lakes, peat lands, bogs, swamps, wet prairies as well as rich upland forests and prairies. Due to the large size of this HUC, the distinct drainage outlet, and the largely congruous northern lakes region occurring there, this single 8-digit HUC will be a distinct service area.

The Maumee Service Area includes parts of four (4) 8-digit HUCs (State of Indiana portions):

- 04100003 - St. Joseph (OH)
- 04100004 - St. Marys
- 04100005 - Upper Maumee
- 04100007 - Auglaize

The 8-digit HUCs in this service area all drain to Lake Erie. This service area captures the entire drainage basin of the Maumee River in Indiana: clearly distinguished from all other Indiana drainages by a continental divide. The natural communities are similarly related by headwaters streams draining forested morainal areas surrounding the flat Maumee lake plain (the Black Swamp). The majority of this service area is a transitional area between the Loamy, High Lime Till Plains and the Maumee Lake Plains. Soils are less productive and more artificially drained in this portion of the Eastern Corn Belt Plains ecoregion compared to the western and southern portions of this ecoregion in Indiana. The Maumee Lake Plains ecoregion is poorly-drained and contains clayey lake deposits, water-worked glacial till, and fertile soils. Elm-ash swamp forests and beech forests once were extensive but have been replaced by productive, drained farmland.

Due to the small size and common outlet of the watersheds as well as the similarities of the ecology within this service area, the partial 8-digit HUCs were combined to form this service area. The watersheds included in this service area are all headwater watersheds for the Maumee River.

The Kankakee Service Area includes portions of two (2) 8-digit HUCs:

- 07120001 - Kankakee
- 07120002 - Iroquois

The unifying feature of this service area is the Kankakee River. This area is bordered to the west by the prairie plains and moraines of the Iroquois River, to the east, the northern wetlands and forested moraines of the Plymouth area. The two HUCs of this service area are mostly included in the Central

Corn Belt Plains Ecoregion and both drain into the Illinois River. This ecoregion is characterized by the extensive flat, glaciated plains, wet prairies and bulrush-cattail marshes that were part of the sandy Kankakee drainage that has been converted to farms on the dark and fertile soils of this ecoregion. Additionally, these HUCs were combined to ensure sufficient credit sales within the service area. Individually, these HUCs individually have not had impacts such that they would support a financially viable service area on their own.

<u>The Upper Wabash Service Area</u> is a combination of seven (7) 8-digit HUCs:

- 05120101 - Upper Wabash
- 05120102 - Salamonie
- 05120103 - Mississinewa
- 05120104 - Eel
- 05120105 - Middle Wabash-Deer
- 05120106 - Tippecanoe
- 05120107 - Wildcat

These HUCs are largely rural, experiencing population declines, have had relatively few historical impacts requiring mitigation, and are primarily headwater watersheds. While this is a relatively large geographic area, this service area is characterized throughout by the forested tributaries of the upper Wabash River and Tippecanoe River. These HUCs drain the plains and landscape features that have a Wisconsinan glaciation origin. This service area contains both the Eastern Corn Belt Plains and the Southern Michigan/Northern Indiana Drift Plains Ecoregions; the ecology of the HUCs is similar across the service area. Most of the latter ecoregion within this service area is the Middle Tippecanoe Plains, a Level IV ecoregion that is better to include from an ecological perspective with the other Upper Wabash watersheds of this service area that are part of the Clayey, High Lime Till Plains that were also historically forested. Dividing this service area would create numerous smaller service areas that are not likely to be financially viable for the program when looking at the historical impact data.

<u>The Middle Wabash Service Area</u> includes all or part of six (6) 8-digit HUCs:

- 05120108 - Middle Wabash-Little Vermilion
- 05120109 - Vermilion
- 05120110 - Sugar
- 05120111 - Middle Wabash-Busseron
- 05120113 - Lower Wabash (small portion)
- 05120203 - Eel

This service area, while a relatively large geographic area, it is unified physiographically by the many distinct and highly incised and dendritic tributaries draining into the Central Wabash Valley. It was an area dominated by mixed deciduous forests. This includes streams of the central tillplain, as well as the Wabash lowlands and geologically older plains to the south. The Eel 8-digit HUC was included in the Middle Wabash Service Area due to fewer impacts within the remainder of the service area when compared to the relatively higher number of impacts in the Upper White Service Area and the Lower White Service Area. Also, the lower half of the Eel River watershed is within the Interior River Valleys and Hills ecoregion making it arguably more appropriate from an ecological perspective to be included in this service area rather than either the Upper White or the Lower White. Combining these HUCs into one service area should also ensure that it will remain financially viable for the program long-term.

The Upper White Service Area is defined as a single 8-digit HUC:

- 05120201 - Upper White

This service area includes the city of Indianapolis and the surrounding suburbs which have a relatively high volume of impacts based on the Corps and IDEM data from 2009 to 2015. The service area is a relatively uniform region of forested streams and a poorly drained, formerly forested, level tillplain that has been converted to agriculture and more recently for urban sprawl.

The Whitewater-East Fork White Service Area includes all or parts of seven (7) 8-digit HUCs:

- 05120204 - Driftwood
- 05120205 - Flatrock-Haw
- 05120206 - Upper East Fork White
- 05120207 - Muscatatuck
- 05080001 - Upper Great Miami
- 05080002 - Lower Great Miami
- 05080003 - Whitewater

This service area includes 8-digit HUCs that are nearly entirely within the Eastern Corn Belt Plains Ecoregion. The area is characterized by the deeply incised Whitewater River valley to the east, and the flat, often poorly drained, headwaters of the East Fork White River, including the Muscatatuck River. It was an area of similar types of largely forested plant and animal communities, including many wetlands associated with stream corridors. The Whitewater River watershed was included in this service area with the East Fork White as opposed to the Upper Ohio service area after taking into consideration the ecoregions of this portion of the state.

The Lower White Service Area is a combination of three (3) 8-digit HUCs:

- 05120202 - Lower White
- 05120208 - Lower East Fork White
- 05120209 - Patoka

While large, and being comprised of two different ecoregions fairly equally, this service area is defined by the drainages of the lower stretches of both the East and West Forks of the White River to their confluence with the Wabash River. This includes the rugged topography and bedrock hills of unglaciated south-central Indiana. Large areas of karst plain topography are also present. Further west in the drainages, the land abruptly transitions to the broad level plains of the Wabash River lowlands. The entire service area was forested, with many affinities to southern woodland types. The rugged uplands possess very few wetland soil types outside of those directly associated with stream channels. However, the western lowlands, especially along the lower West Fork White and Patoka River, contain significant areas of hydric soils and existing wetlands. Individually, each of these 8-digit HUCs within this service area has not had historical impacts that required mitigation between 2006 and 2013 for each watershed to serve as an individual service area. Additionally, each of these three watersheds spans two ecoregions. Therefore, combining these three 8-digit HUCs into one service area creates what IDNR believes will be an ecologically and financially viable service area for the lifetime of the program.

The Upper Ohio Service Area includes three (3) 8-digit HUCs:

- 05090203 - Middle Ohio-Laughery
- 05140104 - Blue-Sinking
- 05140101 - Silver-Little Kentucky

These HUCs were combined into this service area since all three watersheds drain through fairly short basins into the Ohio River. While this service area is composed of two ecoregions, these HUCs share some ecologic similarities, primarily being composed of southern forests, including barrens and glades, on hilly to very rugged topography that was primarily unglaciated. Significant areas of karst topography are also present in much of this service area.

Additionally, the Corps and IDEM impact data show a small area of concentrated impacts with relatively few impacts in the remainder of the service area. Therefore, due to the ecological similarities and from studying the historical impact data, IDNR believes that combining these three HUCs into one service area will provide an ecologically and financially viable service area for the lifetime of the program.

The Ohio-Wabash Lowlands Service Area includes all or part of three (3) 8-digit HUCs:

- 05120113 - Lower Wabash
- 05140201 - Lower Ohio-Little Pigeon
- 05140202 - Highland-Pigeon

These HUCs drain into the Wabash and Ohio River and share many natural features. The extensive river bottom lowlands of this service area possess significant wetland resources. Many small streams drain the eastern hills region along short drainages directly into the Ohio River. The majority of this service area is within the Interior River Valleys and Hills ecoregion. While less than half of the Lower Ohio-Little Pigeon watershed is within the Interior Plateau ecoregion, it wasn't ecologically different enough to justify splitting this 8-digit HUC into two separate service areas. While the Corps and IDEM data show fairly evenly distributed impacts across the entire service area, the IDNR does not believe there will be a sufficient number of impacts in each individual 8-digit HUC in a three-year period for them to stand alone as individually as service areas and still remain ecologically and financially viable for the lifetime of the program.

ELEMENT 2. STATEWIDE AQUATIC RESOURCE THREATS

2.1 Threats to Indiana's Aquatic Resources

Many projects and human activities convert land and resources from one type or use into another to achieve a goal with a perceived benefit. The majority of these anthropogenic activities, primarily aquatic system, and upland conversions and modifications, greatly alter in aggregate the natural functions and services of Indiana's aquatic resources and dependent habitats. As a result, there are many common threats to aquatic resources across Indiana; and in conjunction with permitted impact trends, historic loss and current watershed conditions, warrant significant consideration in the statewide foundation of the IN SWMP goals, objectives and prioritization strategies.

In this analysis, threats are catalogued from the perspective of the aquatic resources, botanical resources, and dependent wildlife and habits that experience the impacts of those threats. Threats to Indiana's streams, rivers, lakes and wetlands, and the ecological functions and services they provide, are described and categorized based on the major land and aquatic resource conversion activities which in themselves' are the main sources of direct and indirect threats that contribute to aquatic resource and habitat alteration, fragmentation, impairment and loss. Threats can be residual, current/ongoing or anticipated in the future.

The predominant threats to aquatic resources and habitats throughout Indiana as a result of anthropogenic activities include, but are not limited to, the following:

- Habitat conversion
- Habitat alteration
- Habitat fragmentation
- Habitat degradation
- Aquatic resource loss
- Altered surface and groundwater hydrology
- Increased and accelerated erosion and sedimentation

- Stream channelization
- Stream instability
- Loss and/or impairment of aquatic system functions and services
- Point source pollution
- Non-point source pollution
- Invasive and non-native species

The major anthropogenic categories of activities, both historic and ongoing, that have resulted in the above-listed threats to the chemical, physical and biological integrity of aquatic resources and habitats across Indiana include, but are not limited to the following:

- **Growth and Development:** Residential, commercial and industrial developments and land use, urban areas, suburban areas, towns, waste and drinking water treatment plants, airports, local utilities and easements, local roads, train yards, golf course, parks, campgrounds, landfills.
- **Agricultural Land Use:** Cultivated crops, livestock grazing, hay/pasture lands.
- **Dams, Levees and Non-Levee Embankments:** High head dams (instream dams impounding water such as reservoirs), low head (in-channel) dams, flood control levees and flood walls, non-levee embankments.
- **Energy Production and Mining:** Coal mining, mineral and gravel mining, and oil and gas production.
- **Transportation and Service Corridors:** Interstates, federal and state highways, railroads, bridges, culverts, oil and gas pipelines, electric transmission lines, shipping lanes and regional utility easements.

These categories of major anthropogenic activities and resulting common threats are based greatly on Section 404 Department of the Army permitted impact trends from 2009 to 2015 (Chicago, Detroit and Louisville Corps Districts); the 2015 Indiana State Wildlife Action Plan (SWAP) (SWAP, 2015); the Indiana Wetlands Program Plan (IWPP, 2015); historic loss of aquatic resources determined primarily from land cover changes from pre-settlement to the present; and IDEM's aquatic resource and habitat assessment data (305b Assessments, 303(d) Listing; Impairment Sources) (IDEM-IR, 2016). Similar to the Indiana State Wildlife Action Plan, IN SWMP has adopted the approach to characterizing the threats to Indiana's aquatic resources and their contributing factors that is established in Salafsky, et. al., *A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions* (Salafsky, et al., 2008).

IDNR analyzed the project work type descriptors of the Corps provided Section 404 permit data for stream and wetland impacts requiring mitigation from 2009 to 2015 in order to identify the permitted activities with one of the five broad major anthropogenic categories above. For example, if the purpose of bank stabilization was to protect a state highway, the impact was categorized as "transportation". If a bank stabilization project's purpose was to protect a residential property, the impact was categorized in "growth and development".

IDNR completed this analysis for the 2009-2015 dataset and summarized that analysis in **Figures 2 and 3** below. Energy Production, which includes coal mines, is the dominant category. Transportation and Development are, by comparison, much smaller.

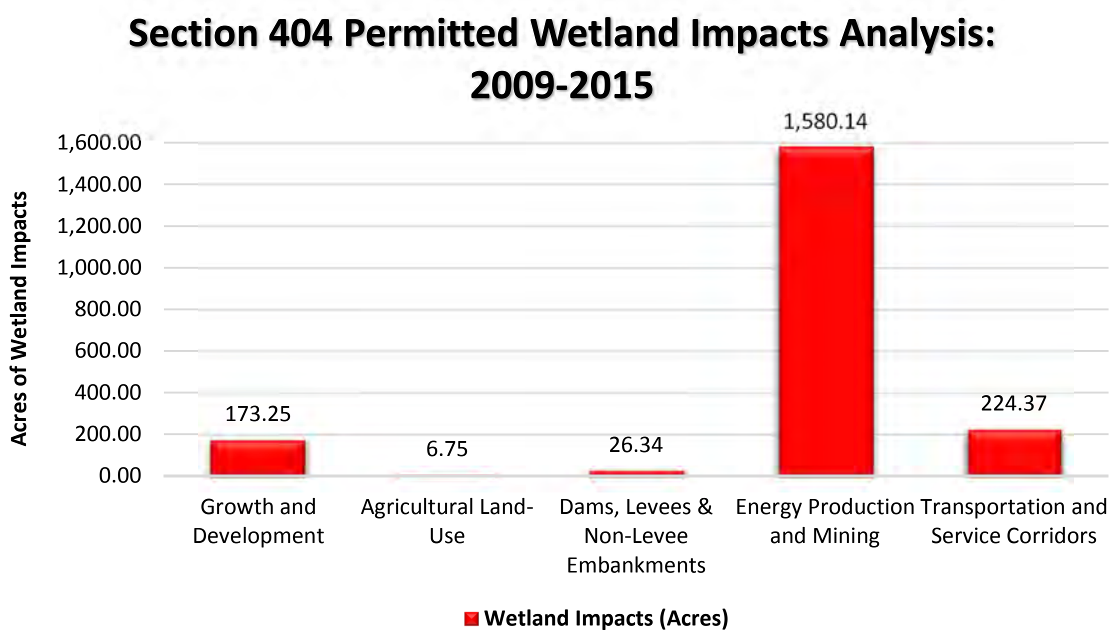


Figure 2. Section 404 permitted wetland impacts that required mitigation from 2009-2015.

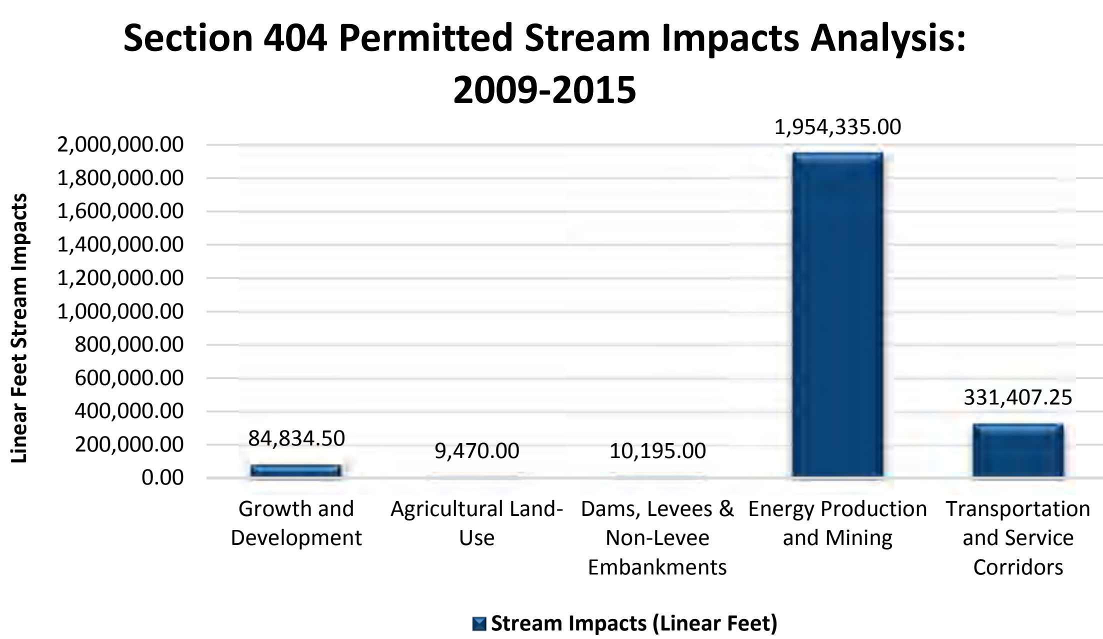


Figure 3. Section 404 permitted stream impacts that required mitigation from 2009-2015.

While the IDNR is not expecting that these large impacts would be mitigated through IN SWMP, it is not out of the realm of possibility that IN SWMP could be utilized at some point in the future to fulfill mitigation requirements for some of these impacts, therefore, IDNR has included all impacts that required mitigation in **Figures 2 and 3**. Additionally, in several service areas, energy production and mining remains the predominant threat to aquatic resources and warrants discussion in this document.

While agriculture and dams have not had a significant number of permitted impacts, mostly due to permitting exemptions and the nature of the aquatic resource impacts predate protection under the Clean Water Act and State regulations; however, their presence on the landscape along with the ongoing and/or potential future threats from historic land and habitat conversions warrants that they be discussed as major categories of anthropogenic impacts to Indiana's aquatic resources.

2.2 Major Anthropogenic Categories of Impacts

Authorized Section 404 and state isolated wetland permitted activities that exceed the impact thresholds of general permits typically require compensatory mitigation to help offset impacts to aquatic resources, which has predominantly been completed by the permittees. Compensatory mitigation carried out by IN SWMP for the authorized sale of advance credits to permittees will be conducted through stream and/or wetland restoration, enhancement and/or preservation activities to help offset threats from the identified major anthropogenic categories that impact aquatic resources while considering historic loss and current conditions. Proposed mitigation acitivties to help offset the identified threats are discussed at the conclusion of each of the five major categories deliberated in this section below. Additionally, a summary of offsets per major anthropogenic category and a general threat-offset activity matrix is provided in **Appendix C.**

2.2.1 Impacts from Growth and Development

Population growth, and residential, commercial and industrial development are major contributors to the alteration, conversion, degradation and loss of aquatic resources statewide. In addition to historical conversion and loss, Indiana's aquatic resources continue to be impacted by population growth, urban and suburban expansion, encroachment, deforestation, industrial effluent, storm water management, channelization, and a resulting decline in water quality (Amlaner & Jackson, 2012). The Indiana SWAP identifies residential, commercial and industrial areas, and haphazard urban sprawl, as some of the top ranked threats to all major habitat types statewide (SWAP, 2015). The Indiana Wetlands Program Plan (IWPP) recognizes increased development, aquatic resource conversion, declining quality and increased quantity of runoff from urban and suburban landscapes, and the fragmentation of habitats as major threats to Indiana's remaining wetlands (IWPP, 2015). Additionally, IDEM identifies urban runoff, construction (site clearing), loss of riparian habitat, streambank modifications, hydromodification, municipal and industrial discharges, and failing septic systems as major sources impairing Indiana streams (IDEM-IR, 2016).

2.2.1(a) Developed Land and Threats to Aquatic Resources

Aquatic resource conversion and loss, in addition to ongoing land uses, have significant impacts on aquatic resources and habitats in developed areas. Urban sprawl, commonly considered dispersed and inefficient urban growth, often results in loss of natural wetlands, core forest and riparian habitats, and an increase in impervious surfaces (Hasse & Lathrop, 2003). As cities expand into rural areas, large tracts of land become developed with varied land uses such as housing, retail stores, offices, industry, recreation facilities and public spaces, and are usually kept separate through zoning (Frumkin, 2002). Until recent history, the majority of existing urban developments were built without much consideration for water quality protection with the objective of using the land to its greatest potential for the planned land use (IDEM-Storm Water, 2007).

Increased impervious surfaces in developed areas intensify storm water runoff carrying pollutants such as oils and grease, sediments, bacteria, pesticides, fertilizers, metals, salts and other pollutants (Tedesco & Salazare, 2006). Additionally, urban snow melt runoff can contain accumulated concentrations of pollutants, particulates, salts and litter that can contribute substantial portions of an annual load of pollutants resulting in a significant threat to water quality (Oberts, 2000). For an example of developed land use impacts to aquatic resources, in Indiana's most developed watershed, a decline in water quality has been well documented in the White River Basin, which includes high turbidity, high bacteria counts, poor chemical quality, degraded habitat and reduced biodiversity, and is largely attributed to the urban centers (Martin, Crawford, Frey, & Hodgkins, 1996). Specifically in the Upper West Fork White River, nutrient concentrations were higher downstream of Muncie, Anderson and Indianapolis than upstream of the cities due to much larger volumes of treated municipal sewage, combined-sewer overflows, and urban runoff (Frey et al, 1996) (Martin, Crawford, Frey, & Hodgkins, 1996).

The changes in land use associated with urban development also affect flooding in many ways. The removal of vegetation and soil, grading the land surface, impervious surfaces, and the construction of drainage networks in urban/suburban areas, results in increased peak discharge volume and frequency in streams (Konrad, 2003). As a result of larger and more frequent discharges correlated with urbanization within a watershed, the geometry and stability of stream channels are altered through widening and down cutting, or a combination of both (Caraco, 2000). The resulted increases in width and depth are roughly proportionate to the increase in peak flows (Booth, 1990). Of the many riverine functions and services impacted by urbanization; stream evolution, riparian succession, erosion, sedimentation and sediment transport processes, instream and riparian habitat, and biological community processes are most likely to be impacted (Shochat, et al., 2010). The accelerated degradation of channel physical integrity often leads to increases in stream bank armoring, which affects stream functions and services such as morphological evolution, riparian succession, hydrologic balance, sediment processes, habitat, and chemical and biological processes (Fischenich, 2003).

The responses of stream biological condition are strongly influenced by localized landform and land use, and urban streams often have degraded habitats and reduced biological diversity as a result of urban stressors (Allan, 2004). A significant amount of documented research indicates that urban fish and invertebrate assemblages are typically species poor due to factors such as flashy hydrographs, low habitat diversity and high contaminant loads (Bernhardt & Palmer, 2007). This reduction in biotic richness typically results in an increased dominance of tolerant species, and a decrease in sensitive species in both fishes and macroinvertebrates (Waslsh, et al., 2005). Transformation of natural land cover to developed use alters vegetation structure, lowers biodiversity, and is responsible for the extirpation of many native plants from urban settings (Shochat, et al., 2010); (Amlaner & Jackson, 2012). Reductions in riparian areas and canopy cover reduce shading, increase stream temperatures, decrease bank stability, increase bank and channel erosion, and cause substantial changes in biological assemblages (Allan, 2004). Additionally, densely populated urban areas are typically hotter than surrounding rural areas, the effect known as “urban heat islands” (U.S. EPA, 2016). The increase in paved surfaces and rooftops, as well as the reduction in tree cover and stream shade in urban areas, increases the temperature of run-off which raises water temperatures of aquatic resources in an urbanized watershed (U.S. EPA, 2016).

Though urbanization in a watershed is highly influential to streams, stream conditions are also strongly influenced by the directly adjacent landscape; therefore, the physical integrity of degraded stream reaches can improve, especially if the riparian area is substantially forested and devoid of road crossings (McBride & Booth, 2005). On the contrary, as floodplain encroachment is typically more intensified in developed areas, the concentrated infrastructure interferes with the streams’ natural meander belts (fluvial erosion hazard areas), which negatively impacts fluvial and floodplain processes as the waterway shifts its position across the landscape over time (Indiana Silver Jackets, 2016). The number and density of stream crossings, either bridges or culverts, are greater in developed areas, and result in negative cumulative impacts of riparian areas, stream flow dynamics and fluvial processes. Bridges and culverts can reduce channel and floodplain cross-sectional flow area; create backwater and increase upstream flood elevations; increase velocities and shear stress increasing scour and stream instability; accumulate debris causing blockage and increase shear stress on the structure and adjacent banks; and create hydraulic jumps and downstream plunges (U.S. DOT, 2012).

The effects of urbanization on hydrology, geomorphology and ecology also cause wetlands in urban areas to function differently than wetlands in less disturbed settings (Ehrenfeld, 2000). A decrease in evapotranspiration, interception, and infiltration in urban landscapes greatly alters the water balance and natural hydrological cycle, resulting in stressed hydrologic budgets for wetlands in urban areas (Tong & Chen, 2002). Other than major wetland loss and fragmentation due to filling and draining; urban wetland degradation is caused by changes in water quality, quantity, surface flow, non-native species, physical disturbances, sedimentation, and the full host of urban and industrial pollutants (U.S. EPA, 2001). Sediment accumulation in wetlands can reduce their capacity to retain storm water and their value to wildlife (IDEM-Storm Water, 2007). Additionally, the quantity and quality of water available for ground water recharge and stream base flow is greatly reduced (Tong & Chen, 2002). These water budget stressors can also affect reaches of urban streams with an intact riparian area when for example an incised channel in combination with piped storm water drainage and increased impervious surfaces results in a lowered water table reducing riparian benefits such as nutrient and pollutant uptake moving through shallow ground water flow (Groffman, et al., 2002).

<u>2.2.1(b) Changes in Land Use for Development</u>

As Indiana's population increased from 2000 to 2010, so did the area of developed land cover. Evaluation of the 2011 National Land Cover Database (Homer, et al., 2015) indicates Indiana's developed land cover increased 4.45 percent from 3,748 square miles (10.29% total cover) in 2001, to 3,922 sq. mi. (10.77% total cover) in 2011 (**Figure 4**), for a total gain of 174.55 sq. mi. (111,712 acres). Not only did developed land cover increase, but the intensity of existing developed land cover increased as the area of impervious surface gained 9.45 percent in the same decade. Agricultural lands gave up the most land cover to developed areas at 134.72 square miles (86,220.8 acres) of cultivated crops and hay/pasture. This trend is continuing from previous decades. From 1950 to 2007, Indiana's agricultural acreage decreased 24 percent and the population increased by 2.4 million (63%) (Hall, 2010). A summary of land cover change for development can be found in **Table 1**.

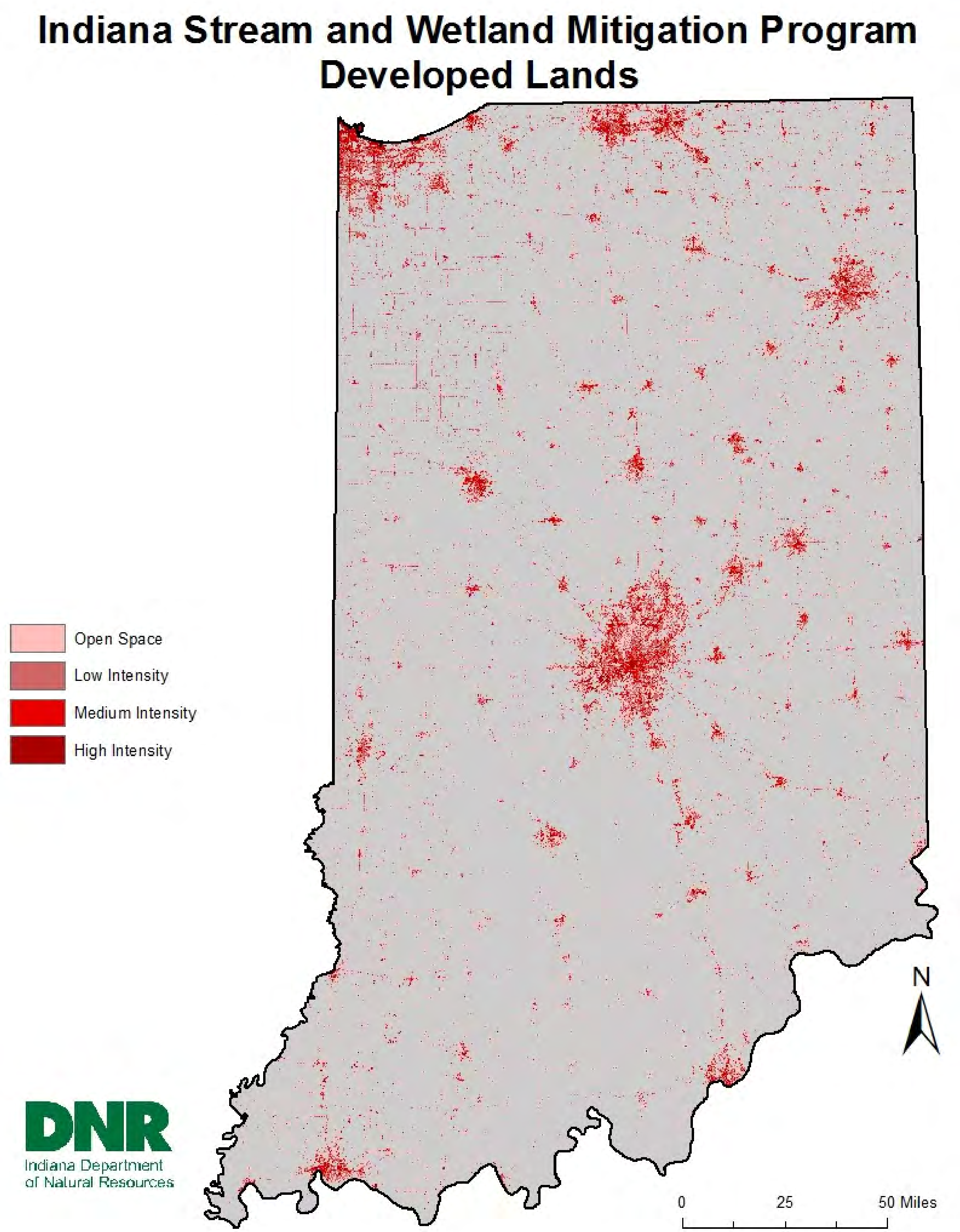


Figure 4. Indiana's Developed Areas as of 2011, 2011 NLCD, (Homer, et al., 2015)

Land Cover	Changed to Developed 2001-2011 (Square Miles)	Changed to Developed 2001-2011 (Acres)
Open Water (WTR)	1.11	710
Barren Land (BAR)	1.18	755
Deciduous Forest (DFS)	17.51	11,206
Evergreen Forest (EFS)	0.49	313.60
Mixed Forest (MFS)	0.29	185
Scrub/Shrub (SCB)	3.09	1,977
Grassland/Herbaceous (GRS)	11.1	7,104
Pasture/Hay (PSH)	18.77	12,012
Cultivated Crops (CLC)	115.95	74,208
Woody Wetlands (WDW)	3.87	2,476
Emergent Herbaceous Wetlands (EMW)	1.19	761.60
Total	174.55	111,712

Table 1. Land cover change to developed areas from 2001 – 2011, NLCD, (Homer, et al., 2015)

2.2.1(c) Population Distribution and Growth Trends

Indiana has experienced population growth through natural increase (i.e., more births than deaths) and net migration into the state since admittance into the Union as the 19th state in December of 1816 (Indiana LTAP, 2011). Indiana's present day population centers were well established and growing communities shortly after the turn of the 20th century, and accounted for the majority of early census figures (Indiana LTAP, 2011). Over the past several decades, metropolitan areas have accounted for the majority of growth through both natural increase and net migration into the state (Kinghorn M. , 2012), while the majority of rural areas consisting of agriculture and smaller towns are experiencing a net emigration (Waldorf, Ayres, & McKendree, 2013). Any net emigration of rural areas has historically been offset by natural increase, though recent trends show that 29 rural and rural/mixed counties have experienced a decline in population (Kinghorn M. , 2011).

The U.S. Office of Management and Budget (OMB) defines a Metropolitan Statistical Area (MSA) as a core urban area with a population of at least 50,000, and any adjacent counties that are highly integrated socially or economically to include commuting ties (25% or more commute) (U.S. OMB, 2013). The Census Bureau defines rural as an area that encompasses all population, housing and territory not included within an urban area of 2,500 or more people, which are defined as a Micropolitan Statistical Area (U.S. Census Bureau, 2010).

Indiana has 15 MSA's (**Table 2**), each within one or more service areas, with the Gary Metro Area being a division of the Chicago MSA since nearly 8.8 million of the 9.5 million people in the Chicago MSA are located outside of Indiana (Manns, 2013).

Based on the U.S. OMB MSA definitions, as of 2010, 44 of Indiana's 92 counties belong to one of 15 MSAs (**Table 2**), accounting for 77.5 percent of Indiana's total population; and 15.5 percent live in one of 25 counties in 24 Micropolitan Statistical Areas (combined at 93 percent), leaving only 7.1 percent of the population not part of a statistical area within one of 23 rural counties (Kinghorn M. , 2016).

The Purdue University Center for Rural Development further classifies Indiana counties, because many counties with a predominantly rural character may be classified as urban if located within an MSA (Ayres, Waldorf, & McKendree, 2013). The center has delineated Indiana counties into three classifications of Rural, Rural/Mixed and Urban, based on the population being either less than 40,000, 40,000 to 100,000, or over 100,000 respectively (Ayres, Waldorf, & McKendree, 2013). Considering Purdue's definition, analysis of the 2010 census indicates of the 42 counties considered to be rural, 24 counties had an increase in population while 18 counties experienced a decline in population. Population declines in Indiana have mainly been experienced in rural areas or historically industrial communities where job losses have been more prevalent (Kinghorn M. , 2011). Though Purdue's Center for Rural Development definition has Indiana's rural population at 14 percent in 42 counties, Urban and Rural/Mixed populations still dominate Indiana with a combined 86 percent under the Purdue University classification system.

Though Indiana has lost manufacturing jobs, the long-term economy is difficult to predict, and there could be a positive shift in this sector as industry diversification, economic growth and tight labor markets could stimulate a greater than expected net immigration in the coming decades (Kinghorn M. , 2012). Indiana has a strong business culture that provides an array of corporate tax incentives and credits, and as such, the corporate income tax is decreasing from the current 6.5% to 4.9%, which will be phased in by 2021 (IEDC, 2016). Furthermore, Indiana provides prospective business, communities and the workforce with economic development programs, regulatory assistance, grants, and resource and technical assistance through the Indiana Economic Development Corporation (IEDC). Additional incentives and resources for economic development in Indiana are offered by the Indiana Office of Community and Rural Affairs; the Indiana Department of Workforce Development's Economic Growth Regions; and the Indiana Association of Regional Councils currently comprised of 15 Regional economic and planning commissions, councils and/or districts across the state.

Metropolitan Statistical Areas	Counties and Service Areas	2010 Population	Percentage of Growth or Decline 2000 – 2010
Chicago* (Gary Metro Division)	Lake, Porter, Newton, Jasper **SA's:** Calumet-Dunes, Kankakee, Upper Wabash	708,070	4%
Michigan City-LaPorte	LaPorte **SA's:** Calumet-Dunes, Kankakee	111,467	1.2%
South Bend-Mishawaka	St. Joseph **SA's:** St. Joseph, Kankakee	319,224	0.8%
Elkhart-Goshen	Elkhart **SA's:** St. Joseph, Kankakee	197,559	8.1%
Fort Wayne	Allen, Whitley, Wells **SA's:** Maumee, Upper Wabash	416,257	6.7%
Lafayette-West Lafayette	Tippecanoe, Benton, Carrol **SA's:** Kankakee, Upper Wabash, Middle Wabash	201,789	13%
Kokomo	Howard **SA:** Upper Wabash	82,752	-2.6%
Muncie	Delaware **SA's:** Upper White, Upper Wabash	117,671	-0.9%
Indianapolis-Carmel-Anderson	Marion, Boone, Hamilton, Madison, Putnam, Hendricks, Hancock, Morgan, Johnson, Shelby, Brown **SA's:** Upper White, Whitewater-EF White, Upper Wabash, Middle Wabash, Lower White	1,887,877	13.8
Terre Haute	Vermillion, Vigo, Clay, Sullivan **SA's:** Middle Wabash, Lower White	172,425	0.9%
Bloomington	Monroe, Owen **SA's:** Lower White, Upper White, Middle Wabash	159,549	12.1%
Columbus	Bartholomew **SA's:** Whitewater-EF White, Lower White	76,794	7.5%
Cincinnati*	Union, Dearborn, Ohio **SA's:** Whitewater-EF White, Upper Ohio	63,691	6%
Louisville-Jefferson County*	Clark, Floyd, Harrison, Scott, Washington **SA's:** Whitewater-EF White, Upper Ohio, Lower White	276,617	10.2%
Evansville	Posey, Vanderburgh, Warrick **SA's:** Ohio Wabash Lowlands, Lower White	265,302	5.2%
Total	44	5,057,044	8.8%

Table 2. Metropolitan Statistical Areas and percent growth from 2000 – 2010 (IDNR combined analysis of Indiana Business Research Center and U.S. Census Bureau data) *Metros with at least one county outside Indiana's boundaries – 2010 Population only for Indiana counties within MSAs. (Manns, 2013)

Though Indiana is a historically predominant agricultural and industrial manufacturing state, the Indiana Career Council, in conjunction with other public and private sector partners, developed a strategic plan to transform Indiana's workforce with post-secondary skills and credentials in a diversity of sectors such as health sciences, information technology, transportation and distribution logistics, energy production and distribution, and advanced manufacturing with the goal of growing the economy (Indiana Career Council, 2014).

2.2.1(d) IN SWMP Offsets for Growth and Development Impacts:

Since urban growth and development continues to increase, helping to offset impacts within and adjacent to developed areas is ecologically important. IN SWMP will help offset impacts from growth and development by targeting compensatory mitigation projects utilizing a watershed approach within and adjacent to developed land uses, in which will help improve the quality and quantity of aquatic resources and dependent habitats unique to the landscape watershed needs within each service area. Those offsets include:

- Restoring wetlands and/or riparian areas upstream of developed areas to help provide floodplain storage, attenuation of peak flow discharges, relieve hydraulic pressures of reduced urban and suburban cross-sectional flow areas, and improve/increase aquatic resource functions, services, water quality and/or habitat quality.
- Conducting stream and river channel restorations that help to provide more natural conditions to improve fluvial processes and facilitate ecological recovery.
- Restoring wetlands, riparian areas and/or stream and river channels within developed areas where reasonably appropriate to help provide floodplain storage, attenuate peak flow discharges and velocities, promote increased channel and floodplain connectivity, establish functional native vegetative buffers from adjacent land use impact sources, connect riparian corridors, improve habitat, and/or improve natural fluvial processes.
- Pursuing wetland, riparian and/or stream/river channel restoration opportunities downstream of developed areas to help improve aquatic resource functions and services, water quality, habitat and/or riparian corridor connectivity to help offset upstream developed land use impacts.

2.2.2 Agricultural Land Use Impacts

Agricultural land uses have made a significant contribution to the conversion, degradation, alteration, and loss of aquatic resources on a statewide scale (**Figure 5**). Indiana ranks fifth in agricultural row-crop production and tenth in all agricultural commodities within the United States (Indiana State Department of Agriculture, 2014). Although Indiana is a top producing agricultural state, the majority of active row-crop production is on farm ground that has been historically converted from wetlands. Approximately 54.8% of Indiana's land use is dominated by agriculture (Homer, et al., 2015), and a majority of wetlands in Indiana have been and continue to be lost as a result of agricultural drainage practices.

Indiana Stream and Wetland Mitigation Program
Present Agriculture

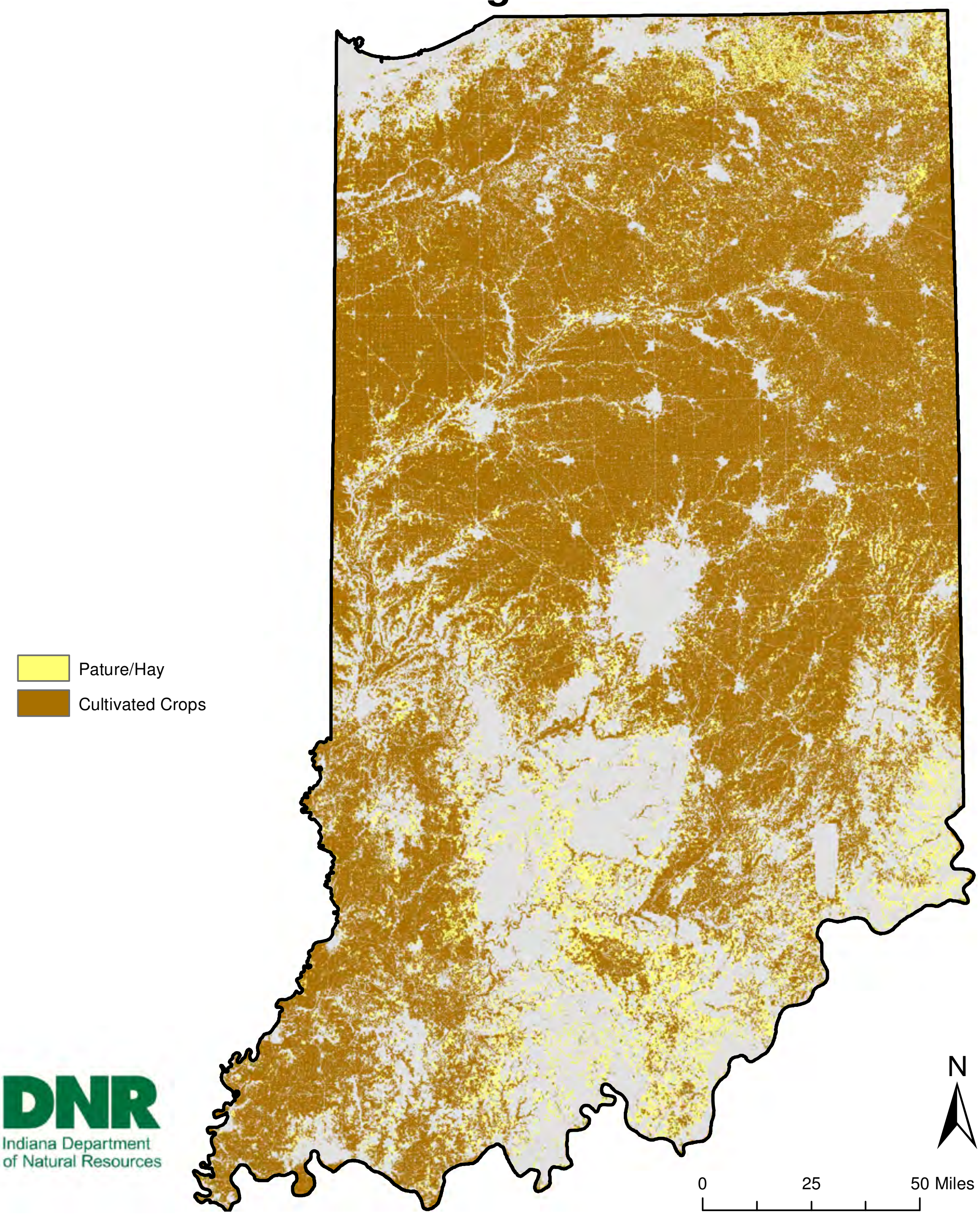


Figure 5. Indiana agricultural land cover; cultivated crops and pasture/hay; 2011 NLCD, (Homer, et al., 2015)

2.2.2 (a) Conversion for Row Crop Production

Indiana has lost approximately 87% of wetlands from pre-settlement, ranking the state as fourth in the United States for acres of wetlands lost (Dahl T. E., 1990). The conversion of wetlands for agricultural production has greatly fragmented and reduced wetland distribution in Indiana.

Although the majority of wetland loss is attributed to early settlement ditching and drainage practices, wetland conversion and manipulation continues to contribute to aquatic resource loss and degradation. Wetlands in Indiana are being lost at a rate of approximately one to three percent each year (Kim, Ritz & Arvin, 2012). Habitat loss associated with stream channelization and wetland conversion to croplands are direct effects of tiling; however, aquatic ecosystems are indirectly affected with increased sediment loads that impair aquatic habitat; elevated phosphorus, nitrogen, and pesticides; and altered volume and timing of runoff due to the hydraulic alterations of these systems (Blann, Anderson, James L., R., & Vondracek, 2009). These tile systems are constructed in patterns to maximize drainage for increased crop yields. This is achieved by controlling inundation frequency and levels by maintaining optimum conditions for planted crops. While manipulated drainage conditions are being maintained, these subsurface tiling systems outlet directly into adjacent streams and impact water quality. Large areas drained by subsurface tile drains in agricultural watersheds generally have higher nitrates, which leads to higher concentrations of nitrate in receiving streams (Blann, Anderson, James L., R., & Vondracek, 2009).

Increased demands and prices for agricultural commodities also contribute to wetland conversion and loss in Indiana. These economic conditions influence the loss of wetlands in Midwestern agricultural areas due to efforts to improve drainage to better support crop production (Dahl T. , 2011). Farm fields are being expanded into wetland areas to increase farmable acres and improve efficiency. Field tile installation in wetland areas is feasible due to the long-term gains in production. Midwestern States, including Indiana, are experiencing wetlands loss due to efforts to improve drainage on agricultural lands as a result of economic conditions (Blann, Anderson, James L., R., & Vondracek, 2009).

In addition to wetland loss and/or conversion, stream manipulations for drainage purposes threaten natural stream systems. Historically, many of Indiana's streams were straightened and channelized in order to increase surface drainage for increased crop production. Maintenance of legal drains continues to be a threat to Indiana's streams. This practice can further degrade the waterway producing negative effects on channel morphology and in-stream habitat for aquatic organisms as well as reducing floodplain and riparian connectivity, altering sediment dynamics and nutrient cycling (Blann, Anderson, James L., R., & Vondracek, 2009). A large proportion of streams in agricultural regions of Indiana are subject to continual maintenance activities. These channelized streams often have their riparian buffers removed to facilitate farming to the top of the stream's bank, resulting in stream instability, increased water temperatures and increased sediment loads. This threatens the aquatic health and habitat of these aquatic systems. In addition, tiles are installed below riparian areas of streams which increase peak and base flows, and contributes to chemical loading (Babbar-Sebens, Barr, Tedesco, & Anderson, 2013). Furthermore, the loss of riparian vegetation disrupts important functions for riverine ecosystems. Riparian areas provide functions for riverine ecosystems by offering an energy source with the input of leaves; provide shading of the stream to maintain more consistent water temperatures for macro invertebrate and fish populations; regulate the growth of macrophytes in streams; and overhanging trees and their roots provide structure and habitat for many types of aquatic life (Vought, Gilles, Fuglsang, & Ruffinoni, 1995). The removal of riparian buffers also fragments important habitats that species rely upon for part of their life-cycle, such as the federally endangered Indiana Bat.

Floodway alterations associated with cropland production disrupt and fragment riparian habitats and their natural processes. The erosion and deposition of sediments from floodplains, along with their depositional patterns and rates, create diverse floodplain wetland communities (King, Twedt, & Wilson, 2006). Levees and non-levee embankment structures are constructed in agricultural areas as an attempt to provide flood protection for crops. These structures are typically constructed parallel to stream systems, restricting the streams ability to have floodway interaction, limiting hydrology needed for wetland formation. Restricted channel migration, due to extensive levee development and channelization, reduces or eliminates the rate of wetland formation; simultaneously, land use alterations that result in increased sedimentation, including channelization and agriculture, accelerate the filling of wetlands (King, Twedt, & Wilson, 2006). This also increase peak flows during rain events and leads to accelerated stream instability. Additionally, restricting floodway interaction also affects soil productivity. Natural productivity of floodplain soils is reduced when rivers become disassociated from their floodplain (Vought, Gilles, Fuglsang, & Ruffinoni, 1995). Cumulatively, these alterations and conversions threaten aquatic habitats and the flora and fauna that are dependent on these natural alluvial processes.

2.2.2(b) Livestock Production

Livestock production and grazing practices also pose a threat to Indiana's aquatic resources and water quality. In order to provide food for livestock, the conversion of natural habitats to hay and pastureland result in the loss and degradation of stream and wetland habitats. Pasture lands that provide livestock direct access to streams can result in riparian loss and geomorphic changes that negatively affect the stream system. The composition of riparian vegetative communities can change due to poor grazing practices, which results in changes in rooting depth, rooting character, surface protection, and aquatic habitat. Moreover, adverse stream channel adjustments such as accelerated bank erosion, increased width/depth ratios, altered channel patterns, induced channel instability, increased sediment supply, decreased sediment transport capacity, and damage fisheries habitats as a result of these changes (Rosgen, 1996). Allowing livestock access to streams has significant implications for streambank erosion. Streambank loss, due to the effect of sloughing from cattle, results in a 77% increase in streambank erosion (Sheffield, Mosaghimi, Vaugh, Collins Jr., & Allen, 1997)

In addition to impacts to riparian areas and stream geomorphic compensation, water quality is negatively affected when livestock have unrestricted access to Indiana's streams. A study conducted on Fishback Creek, located in central Indiana within the Eagle Creek Watershed, revealed that turbidity and ammonium, total Kjeldahl nitrogen, total phosphorus, concentrations of total suspended sediments and E. coli were dramatically affected by unrestricted cattle access to the stream (Vidon, Campbell, & Gray, 2007).

Pastoral land-use can negatively affect natural wetlands, as well. When livestock are not restricted from wetlands they disturb native vegetation, promote compaction and erosion, and excrete their waste directly into the aquatic resource. High levels of fecal contamination in wetlands located in pasturelands without cattle exclusion can transport fecal coliform directly to stream systems during rain events (Vidon, Campbell, & Gray, 2007).

Although the majority of productive agricultural land was gained when early settlers converted and drained a majority of wetlands across the state, there is continued loss of aquatic resources and/or their functions due to the expansion of agriculture and the associated maintenance required for drainage for row crop production in these altered systems which has lasting negative effects on Indiana's aquatic resources. The aggregate of these threats will be a focus for IDNR's IN SWMP. The effects of these impacts to Indiana's waters will be offset with specific goals that will help restore and enhance these aquatic resources.

2.2.2(c) IN SWMP Offsets for Agricultural Impacts:
IDNR's IN SWMP will help offset impacts from agriculture by targeting compensatory mitigation projects, utilizing a watershed approach, which will help improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Restoring degraded and lost wetland values and services in agriculturally dominant watersheds.
- Restoring channelized streams by replacing natural stream geomorphology and floodway interaction.
- Removing subsurface agricultural drainage tiles in order to restore hydrology to drained wetlands and improve water quality.
- Daylighting subsurface drainage tiles in order to re-establish natural stream and wetland systems.
- Establishing native vegetation on restored streams and wetlands located in agricultural areas while reducing habitat fragmentation.
- Restricting livestock from degrading aquatic habitats, by restoring, buffering and protecting, aquatic resources in watersheds that are dominated by livestock grazing.

Protecting high quality wetlands and stream corridors, providing important aquatic functions and services to the watershed.

2.2.3 Dams, Levees, Floodwalls and Non-Levee Embankments

Dams, levees and non-levee embankments are significant threats to aquatic resources and result in habitat alteration, fragmentation, degradation and loss. The Indiana SWAP recognizes impoundment of water, flow regulation and any associated stream channelization as significant threats to aquatic systems and habitats that require conservation actions (SWAP, 2015).

2.2.3(a) Dams

Dams have been constructed in both developed and rural areas in Indiana for human and livestock water supply, industrial and waste water processes, flood control, irrigation, energy production, recreation, economic development, and historically for grist and lumber mills (ASDSO, 2016). Though dams have a lower percentage of permitted impacts requiring mitigation at this point in time, the cumulative footprint and ongoing secondary impacts to water quality, fish, wildlife, and botanical resources are significant. The USFWS recognizes that free-flowing rivers are vital to our nation's aquatic species, and native fish, shellfish, amphibians, waterfowl and plants that depend upon the natural flow variations of rivers at many stages of their lives (USFWS, 2012).

Continuing threats due to dams include, but are not limited to structural integrity and dam failure, diminishing natural system functions and services, reservoir sedimentation and accumulation of contaminants, channel degradation, inundation of critical riverine habitat, flow alteration, a multitude of negative water quality effects, increases in invasive, alien and tolerant species, blockage of fish passage and migrations, hydraulic undertows (rollers), and socioeconomic and cultural effects (services) (Aadland, 2010).

Dams alter two critical elements of a fluvial system: the ability of a river to transport sediment and the amount of sediment available for transport (Grant, Schmidt, & Lewis, 2003). Dams alter the ability of a stream or river to transport a natural sediment load, often causing a downstream sediment deficit that triggers accelerated stream bed and bank degredation, incision, change of bed material distribution, and changes in channel deminsions (Grant, Schmidt, & Lewis, 2003). Dams also obstruct the migration of fish to spawning or feeding areas, fragment and alter physical habitats, and negatively affect species distriubtions within riverine systems (Liermann, Nilsson, Robertson, & NG, 2012).

According to the American Society of Civil Engineers (ASCE), the average age of the approximately 84,000 dams in the U.S. is 55 years old, and dams receive an overall grade of poor (D+) on the *2013 Report Card for America's Infrastructure* (ASCE, 2013). Indiana's dams share the same overall grade, with 57 percent of dams considered conditionally poor or worse due to age, deterioration and/or a lack of maintenance (ASCE, 2013). Though the time of prolific dam construction is in the past, DNR dam records show that the majority of dams are nearing 40 to 60 years in age, with some structures more than 100 years old (IDNR DOW, 2016).

Dams in Indiana are classified as high, significant or low hazard based on the threat they present to downstream property and life upon failure. This classification, however, does not consider the existing structural integrity of the dam, its likelihood of failure and/or the ecological impacts. The ownership type and hazard distribution of currently known regulated dams are shown in **Table 3**, and the statewide distribution of dams is illustrated in **Figure 6**.

Owner Type	High Hazard	Significant Hazard	Low Hazard	Totals
Federal Government	8	1	9	18
State Government	16	27	85	128
Local Government	30	28	86	144
Public Utility	15	13	18	46
Private and/or Unknown	183	213	522	918
Totals	252	282	720	1,254

Table 3. Indiana approximate dam totals and ownership type, (IDNR DOW, 2016)

Approximately 70% of the known regulated dams are in private ownership. These private dams may pose greater downstream ecological risk given that the costs associated with dam maintenance, rehabilitation and/or reconstruction are often prohibitive for typical private owners (IDNR DOW, 2016). Ecological effects due to dam failure can include intense flooding and overbank destruction of vegetation; hydraulic damage such as erosion, channel incision and sedimentation; and sediment inundation of critical habitat and damage to fisheries (Evans, Mackey, Gottgens, & Gill, 2000). Additionally, dam failure can result in damage of infrastructure and utilities, futher compounding the negative chemical, physical and biological impacts to aquatic resources and dependent habitats.

Though significant and high hazard dams receive the most regulatory and funding attention (public and/or private), until recent history, the majority of low head dams have not since they are given a low hazard classification due to minimal downstream risk to life and property upon failure. This classification does not address the ecological impacts associated with the dams' presence in the watershed or the potential for ecological harm should they fail. There are 175 currently known low head dams in Indiana (**Figure 7**). Analysis of the IDNR, Division of Water, *Low Hazard In-Channel Dam Visual Inspection Reports* (IDNR DOW, 2016) and the *Indiana Silver Jackets* (ISJ) low head dam statewide inventory, indicates at least 40 percent of currently known in-channel low head dams do not serve the purpose for which they were constructed. The ownership of approximately 35 percent of existing low head dams is unknown, and approximately 50 percent of low head dams are reported to have a poor (deteriorated) overall condition.

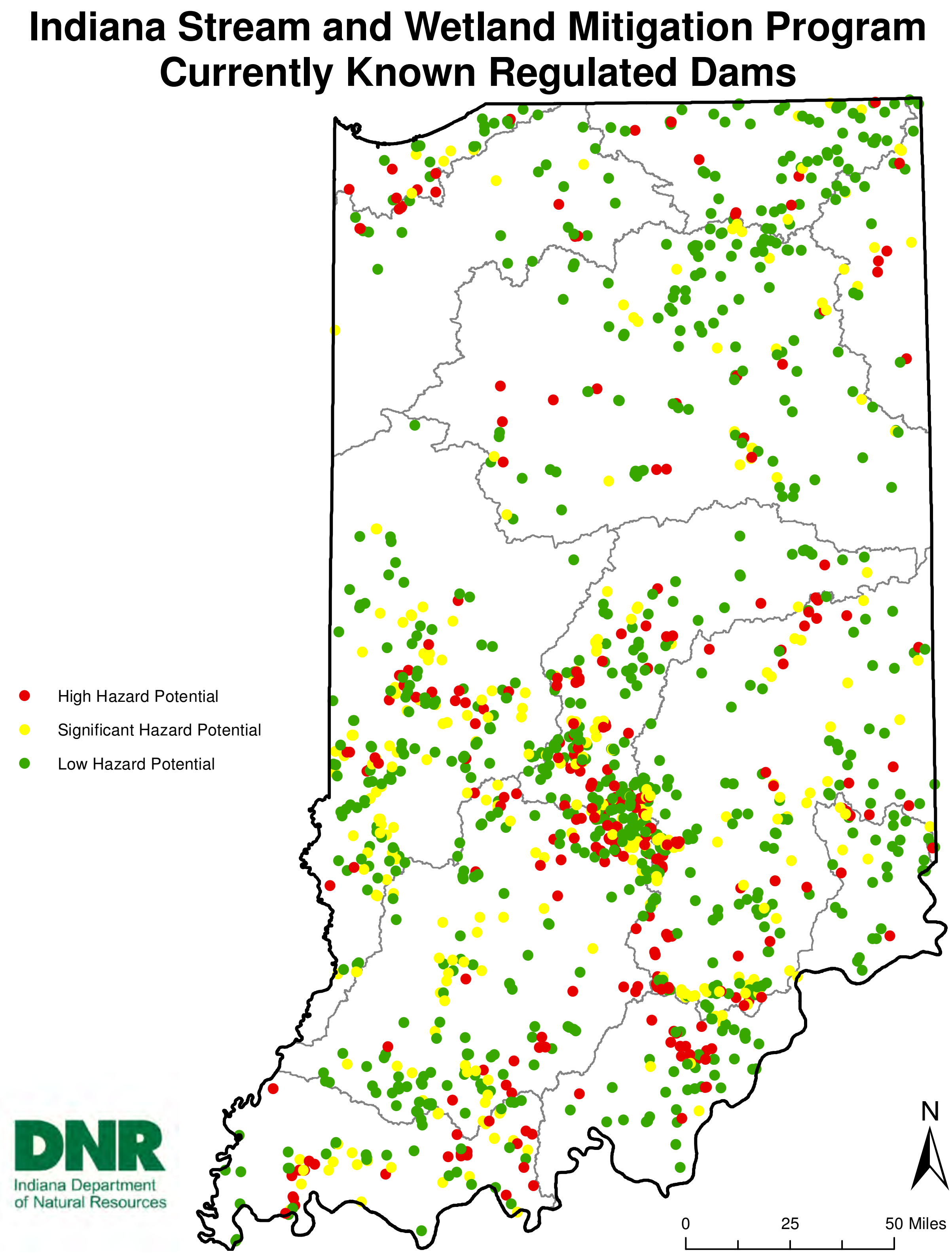


Figure 6. Dams currently regulated by IDNR, (IDNR DOW, 2016)

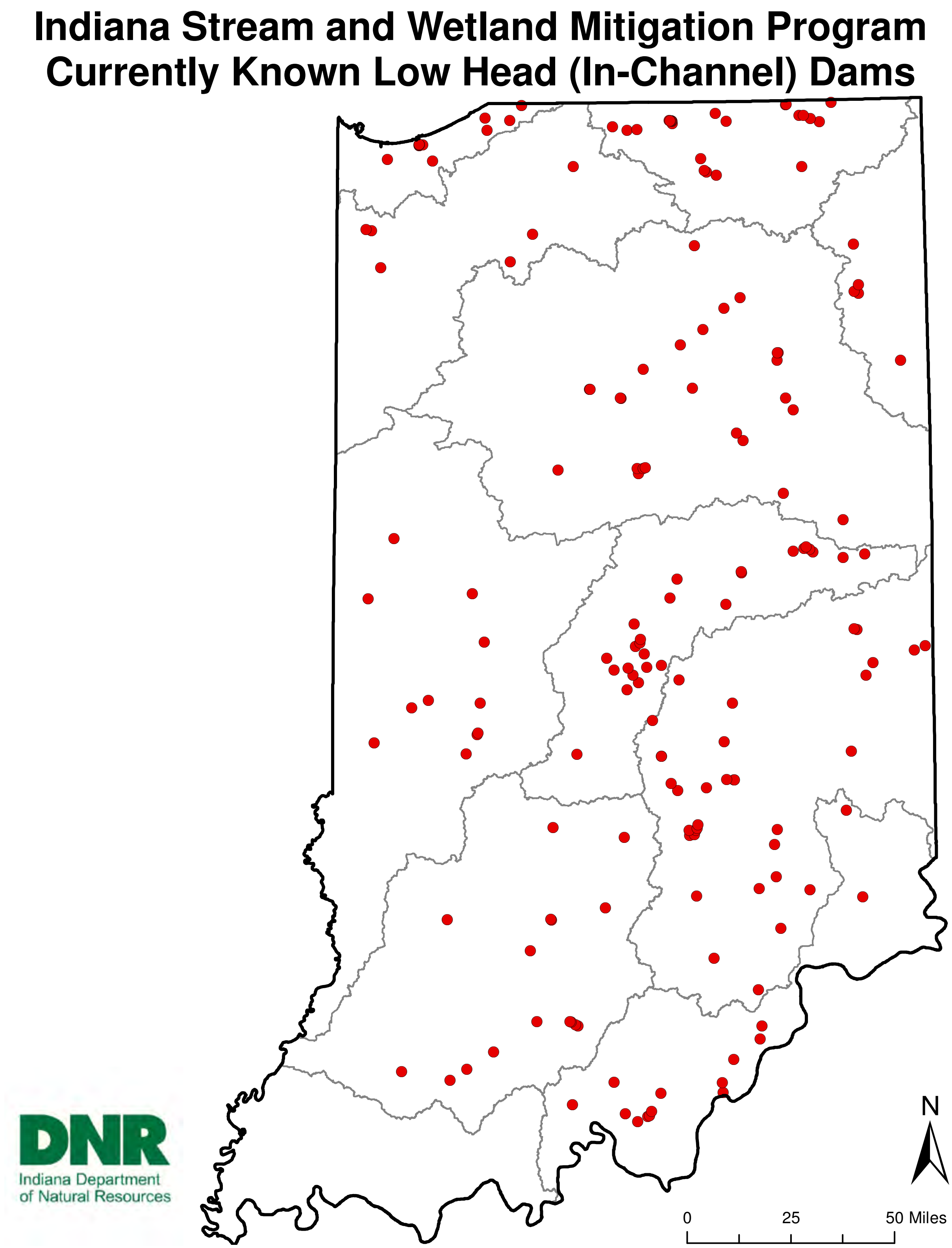


Figure 7. Identified low-head (in-channel) dams in Indiana, (IDNR DOW, 2016)

Due to the known adverse effects of low head dams to aquatic resource functions and services, there has been an increased interest in removing and/or modifying these structures in Indiana to increase aquatic resource functions and/or services within watersheds.

The DNR Division of Fish and Wildlife Aquatic Habitat Unit has ranked low head dams in order of priority for modification or removal using GIS Digital Elevation Models (Lidar), the National Hydrography Dataset, and DFW Game and Non-Game Fisheries Biologists' surveys based on the following physical and biological parameters, and distributed in quartiles per service area below (**Table 4**):

- Inundated pool length (natural channel recovery potential)
- Upstream reconnection reach including perennial tributaries
- Impacts on mussels
- Impacts on non-game fishery
- Impacts on sport fishery
- Aquatic invasive species accessibility
- Conservation Partner priority areas
- State navigable or outstanding river

Service Areas	Low Head Dams	Bottom Quartile	Second Quartile	Third Quartile	Top Quartile
Calumet-Dunes	13	10	1	2	0
Kankakee	6	4	0	1	1
Lower White	16	5	7	2	2
Maumee	5	1	2	1	1
Middle Wabash	11	3	3	3	2
Ohio-Wabash	0	0	0	0	0
St. Joseph	24	1	7	3	13
Upper Ohio	15	1	6	6	2
Upper Wabash	25	3	6	9	7
Upper White	26	9	3	9	5
Whitewater-East Fork White	34	10	9	8	7
Statewide	175	47	44	44	40

Table 4. Quartile ranking of DNR Division of Fish and Wildlife low head dam removal priority per IN SWMP Service Area. IDNR Division of Fish and Wildlife, Aquatic Habitat Unit

Though this IDNR Division of Fish and Wildlife priority ranking was conducted specifically as an assessment of a dam removal's impact to aquatic species, any of these physical and biological factors can be assessed in conjunction with broader stream and/or watershed parameter considerations in order to pursue the most gain in aquatic functions and services. Based on this analysis, there are approximately 22,134 miles of potential perennial channel reconnectivity, and 149 miles of recoverable channel within existing dam pool lengths when considering the cumulative footprint of all 175 known low head dams.

Removal of dams can restore natural flow regimes, improve water quality, restore natural sediment transport and bedload, and restore connectivity for fish and other aquatic organisms promoting the rehabilitation of native species (American Rivers, 2002). All of the above improvements of fluvial system functions and services have recently been demonstrated with the removal of three low head dams within the Eel River in north central Indiana by the efforts of Manchester University with support from the USFWS National Fish Habitat Program. Robust pre and post dam removal monitoring has shown thus far that built up sediment behind the dams has been transported, natural morphology has been restored, QHEI scores have increased by 20 percent upstream of each dam, IBI scores improved from a “Fair/Poor” status to “Good” (USFWS, 2014), and in conjunction with a fish passage project at another dam within the Eel River, the projects have the cumulative potential of 728 perennial stream miles restored for aquatic life migration and connectivity (IWRA, 2015).

2.2.3(b) Levees, Floodwalls and Non-Levee Embankments

Levees, floodwalls and non-levee embankments have been and continue to be constructed, maintained and upgraded in urban and rural settings to contain, control, and/or divert the flow of flood waters in order to reduce risk of threat to life, property and/or agriculture. Levees constructed in urban areas are more likely to be built to higher standards, such as those certified by the USACE, than those in rural areas. Some levee systems accredited by the FEMA National Flood Insurance Program show a 1-percent annual-chance flood risk reduction on respective Flood Insurance Rate Maps (FIRM). Non-levee embankments, which are not Corps certified and/or FEMA accredited levees, tend to be in rural agricultural settings, or related to road or rail transporation routes, and are not designed or constructed to engineering standards of structural integrity or freeboard of the 1-percent chance flood or greater (FEMA, 2016).

Ongoing threats due to levees, floodwalls and non-levee embankments include, but are not limited to: adverse impacts to natural functions and services of a riverine system; the displacement of floodwaters to adjacent, upstream or downstream properties; increased flood frequency and severity; increased depth and velocity of floodwaters; alteration of the natural attenuation of flows; increased channel incision, bank erosion and sedimentation; alteration and/or removal of channel and floodplain interaction; and removal of riparian vegetation, wetland hydrology and critical habitat (ASFPM, 2007).

The USACE maintains the National Levee Database (NLD), which contains reports and locations of the majority of levees within the USACE Levee Program (USACE, 2016), but this dataset only accounts for an estimated 15% of the total levees nationwide (National Committee on Levee Safety, 2016). The National Committee on Levee Safety estimates that the locations of 85% of the nation’s levees are unknown. There is currently no holistic national inventory of levees, and there is not a single centralized data host of levee inventories (National Committee on Levee Safety, 2016). FEMA does not currently maintain a publically available database for the locations for FEMA accredited levees, though they can be identified on respective FIRMs. In response to the 2008 natural disasters that resulted in

Presidential Disaster Declarations for 82 of Indiana's 92 counties (IN OCRA & IHCDA, 2009), a Non-Levee Embankment (NLE) mapping project was conducted as a joint effort between the IDNR Division of Water, Indiana Silver Jackets, The Polis Center, Indianapolis Mapping and Geographic Infrastructure System IMAGIS/Indy GIS, and Southern Illinois University Geography (IDNR, 2016).

The purpose of the project was to identify and map NLE's utilizing LiDAR and other advanced geoprocessing techniques (**Figure 8**). NLE's are elevated linear features adjacent to waterways and within the floodplain typically related to agriculture (flood protection for farm fields) or transportation (elevated road and rail). NLE's located in floodplains have an effect on the movement and expansion of waterways increasing the potential flood risk, and often have a dramatic impact on flood conveyance and flood heights by detaining or directing flood waters. By identifying these features, Indiana can assess and mitigate for the potentially detrimental effects resulting from reduced storage capacity and increased downstream flooding. Only 82 of the 92 counties in the Indiana were eligible for inclusion in the mapping effort. IDNR's goal is to secure funding to map NLE in the remaining 10 counties to complete the statewide dataset. The resources provided by this project enable the private and public sectors to better recognize these embankments and adopt strategies to mitigate NLE related risks and adverse impacts to aquatic resources, life and property (IDNR, 2016).

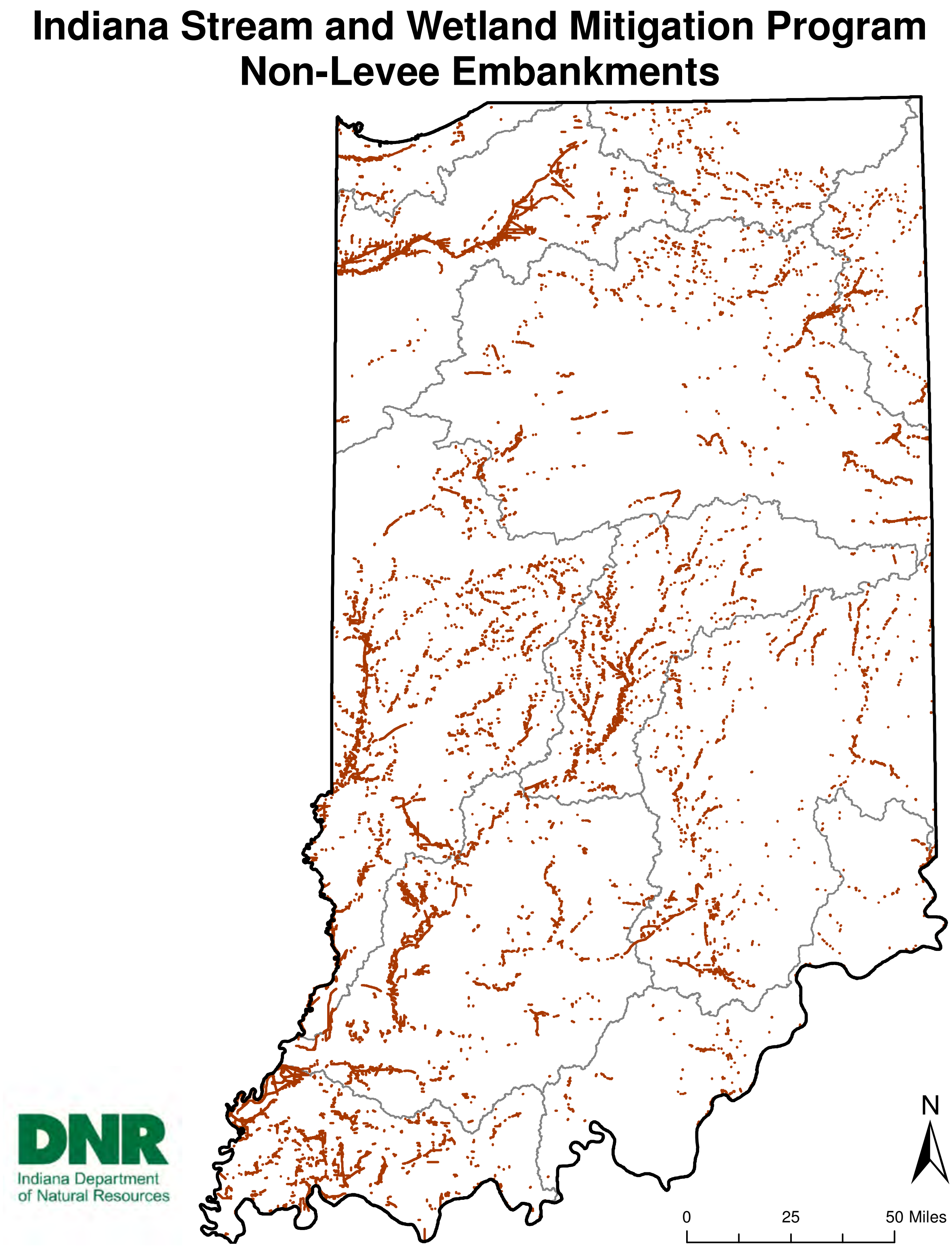


Figure 8. GIS analysis to identify non-levee embankments (completed in 82 of 92 counties), (IDNR, 2016)

2.2.3(c) IN SWMP offsets for threats posed by dams, levees and non-levee embankments:

IDNR's IN SWMP will help offset impacts from dams, levees, and non-levee embankments by targeting compensatory mitigation projects, utilizing a watershed approach, in which will help improve the quality, quantity, and functions and services of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Remove high and low head dams prioritized for removal and conduct in-stream restoration that would help improve the ecological health of the stream by providing an increase in natural functions and services, upstream connectivity, improved water quality, and increased aquatic and/or riparian habitat.
- Modify low head dams that are not eligible for removal in conjunction with broader aquatic resource restoration measures that will help improve natural stream functions, services, water quality, and upstream connectivity.
- Identify and restore degraded stream channels, riparian areas and/or wetlands upstream of impounded waters including public freshwater lakes to address system specific causes of impairment using appropriate functional assessment methodologies and restoration techniques to help improve natural functions and services while contributing to improved water quality and reduced sedimentation of the impounded water.
- Identify and restore wetlands contiguous with public freshwater lakes, public reservoirs or water supply reservoirs that will contribute to improvement of the functions, services, water quality and habitat of the water body and downstream receiving waters.
- Identify non-levee embankments for removal or breach to help reestablish channel and floodplain connectivity, improve degraded channel morphology, and conduct riparian and/or wetland restoration measures to address system specific symptoms caused by the structures.
- Identify degraded channels downstream of dams which are not eligible for removal or modification to address system specific symptoms caused by the dam that have potential for restoration of the natural stream channel and riparian habitats to help influence the system's natural fluvial processes to adjust and function within the existing hydrologic conditions downstream of these dams.

2.2.4 Energy Production and Mining

Indiana is influenced by the reserves of natural resources it contains. Its natural deposits provide energy resources resulting in industries that extract and produce commodities for the national and global scale, as well as supports industries that facilitate and utilize these resources. The state has reserves of coal, oil, natural gas and industrial minerals, which includes clay, shale, limestone, gypsum, sand and gravel. All of these resource deposits support Indiana's mining and aggregates industry. Mining extraction processes require extensive land disturbance, resulting in ecological impacts that threaten the current and long-term health of Indiana's aquatic environment.

2.2.4(a) Coal

Indiana's coal producing region is located in 25 southwestern counties, occupying approximately 6,500 square miles. In 2014, Indiana was ranked the eighth greatest coal-producing state in the country and its surface and underground coal mines produce approximately 39 million tons of coal annually (U.S. Department of Energy, 2014). Coal produced in southwestern Indiana is extracted from the Indiana Coal Field. This geologic formation comprises the eastern portion of the greater Illinois Basin, see illustrated in **Figure 9** below.

Although coal reserves have been mined in this region for over 150 years, the area retains substantial reserves. It's estimated that Indiana has enough coal reserves to supply energy for the next 300 years (Modisett Kemp, 2012). Energy consumption in this region is influenced by proximity and feasibility of the regional coal reserves. Indiana coal consumption is estimated to be 1,200 Trillion BTU per year, which ranks third nationally (U.S. Department of Energy, 2014). With established coal mines and miners in the Indiana coalfield region, and with its ample reserves, surface and underground mining will continue to shape the region's landscape. Until feasible energy alternatives become viable sources for energy, the utilization of coal for industry and energy production will continue to be utilized in Indiana.

According to IN SWMP's analysis of permitted impacts authorized under Section 404 of the Clean Water Act between 2009 and 2015, coal mining projects comprised 81.76% of stream and 78.58% of wetland permitted impacts statewide that required compensatory mitigation. Surface and underground coal mining are the primary mining methods used in coal recovery in southwestern Indiana. Although both mining techniques are actively used, surface mining is the dominant coal mining method, with 98% percent of permitted actions from 2009-2015, resulting in compensatory mitigation.

Both mining methods require surface land disturbances resulting in impacts to aquatic resources. Surface coal mines generally result in greater impacts due to the mining method. Surface mines require larger mining boundaries, where vegetation, top soil, then substantial amounts of rocks and overburden is removed in order to extract the coal (Greb, Eble, Peters, & Papp, 2006). During this process, all unavoidable surface waters within the mining footprint are filled or mined through, impacting all surface water features.

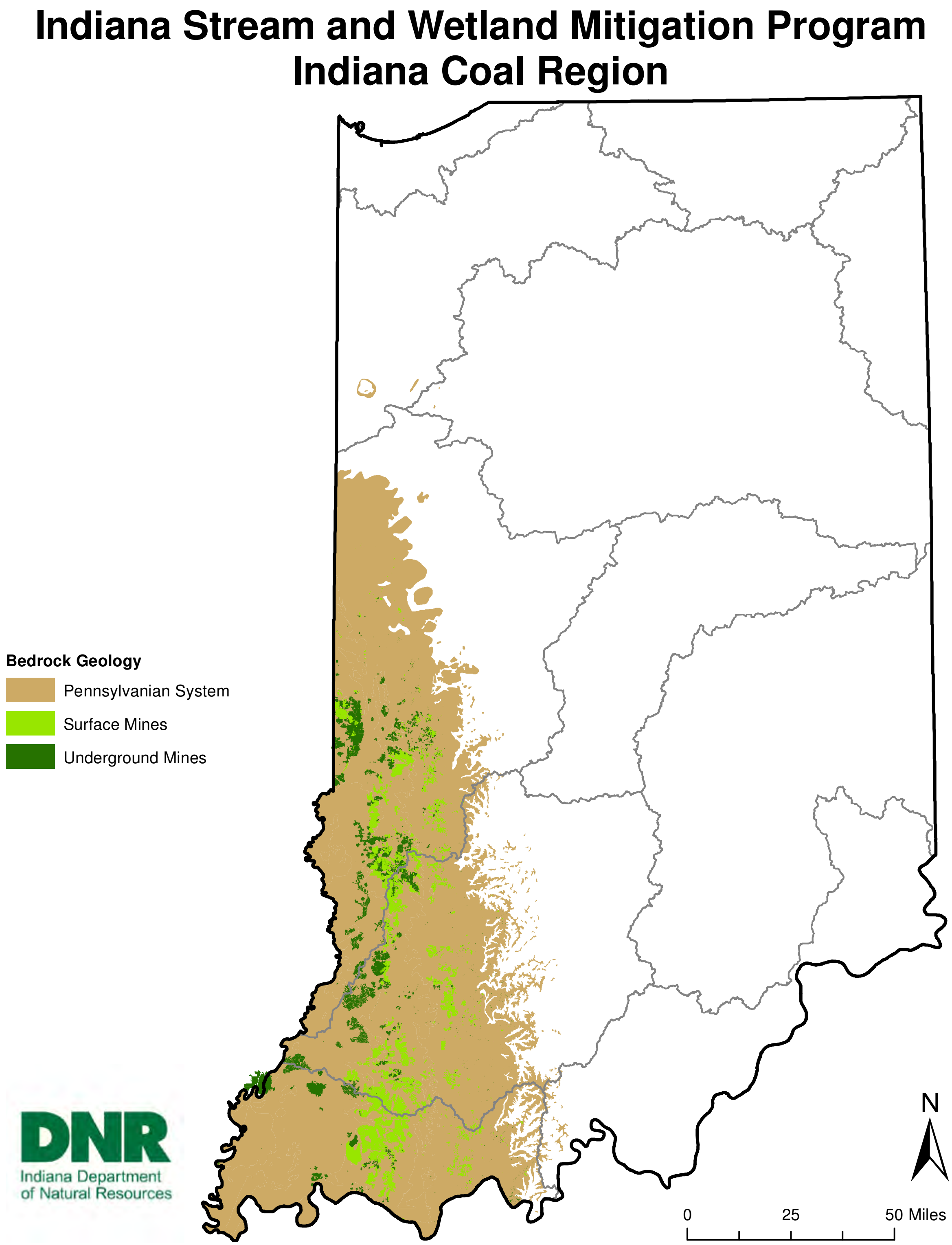


Figure 9. Illinois basin coal field within Indiana

In contrast, underground mines generally require smaller, more concentrated physical disturbances associated with mine access areas (Greb, Eble, Peters, & Papp, 2006). Although the surface footprint is generally smaller with underground mines, surface aquatic resources are often negatively impacted. Underground mines utilize conveyer systems in order to transport mined coal and resulting mine refuse (Greb, Eble, Peters, & Papp, 2006). Once these materials are conveyed to the surface, the processing of recovered coal and resulting refuse require areas for disposal within the mining boundary. This generally results in impacts to aquatic resources within the surface boundary of the underground mining operation.

All active coal mines in Indiana are subject to regulatory requirements when those activities result in impacts to aquatic resources. Sections 404 and 401 of the Clean Water Act of 1972 (CWA) requires compensatory mitigation for permanent impacts to jurisdictional streams, wetlands and lakes resulting from the placement of fill and/or the complete loss of these aquatic resources due to mining-related activities. In addition, the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA) requires active mining operations to reclaim the physical disturbances to the landscape during and following the mining process (U.S. Department of Interior, 2016)

Although active coal mining operations must adhere to current regulatory requirements, prior to SMCRA, mining operations were not required to reclaim mined areas. Pre-SMCRA, coal production was the primary objective and minimal reclamation measures were implemented by mining companies resulting in severe and long lasting environmental consequences (Stevens, 2012).

In response to the environmentally adverse effects of abandoned mine lands, the passage of SMCRA established the Abandoned Mine Lands (AML) program to address environmental degradation associated with past coal mining practices with funding coming from a per-ton tax on coal assessed to coal operators (Stevens, 2012). Although AML projects continue to address the lasting environmental degradation of abandoned mines, it is estimated that Indiana contains a large amount of pre-SMRCA mine lands that still require reclamation. The Indiana Department of Natural Resources-AML Program has approximately $194 million worth of reclamation projects in the current program inventory which covers approximately 3,500 acres throughout 16 counties in southwestern Indiana; however, there is a considerable amount of AML eligible lands that will be inventoried in the future (Stacy, 2016). With multiple program objectives and limited funding for AML projects, the legacy of degradation of AML sites will continue to pollute and depress watersheds, and their aquatic systems, throughout the coal bearing counties (Weber, 2012).

Acid mine drainage (AMD) continues to be a concern for Indiana's wetlands and streams as acidic waters resulting from coal mining leach into the groundwater and downstream surface waters, degrading water quality and preventing the establishment and longevity of aquatic fauna and flora (Amlaner & Jackson, Habitats and Ecological Communities of Indiana: Presettlement to Present, 2012).

AMD is a persistent problem associated with abandoned coal mines because of its negative effects on Indiana's streams, wetlands, lakes, and even entire watersheds (Weber, 2012). In the process of extracting coal, mining and coal processing results in waste material, such as spoil, slurry, and gob. This waste material results in AMD if not reclaimed and has lasting effects to the aquatic environment.

2.2.4(b) Natural Gas and Oil Production

Indiana contains over 13 million acres of oil and natural gas reserves. Indiana ranks in the top 25 for oil and gas production. According to the U. S. Energy Information Administration data, natural gas marketed production totaled 7,250 million cubic feet for 2015; while crude oil production totaled 158 thousand barrels through August 2016, ranking Indiana 24th in both categories nationally (U.S. Department of Energy, 2016). **Figure 10**, provides the statewide distribution of Indiana oil and gas petroleum fields.

The physical alterations associated with the exploration, development, production, recovery and delivery of petroleum products from Indiana's oil and gas fields pose threats to Indiana's aquatic resources. Aquatic habitats are threatened by landscape changes, related to pad development and associated infrastructure, including new and expanded roads, pipelines, compressor stations, and impoundments (Brittingham, Maloney, Farag, Harper, & Brown, 2014). Changes in hydrology, sedimentation, and water quality in response to oil and gas development have been identified as three main stressors to surface waters based on recent studies (Brittingham, Maloney, Farag, Harper, & Brown, 2014). These alterations have compounding effects that expand beyond the footprint of these fields. Habitat loss, wildlife mortality and displacement, and introduction of invasive species result from oil and gas impacts to wildlife and the environment (Ramirez Jr. & Mosley, 2015). In addition, the operation and development of petroleum fields can result in contamination of aquatic resources. Significant environmental impacts and injury to fish, wildlife and their habitats due to oil and gas operation and maintenance activities can occur from accidental releases and spills, brine, and/or chronic leaks in aging infrastructure (Ramirez Jr. & Mosley, 2015). These sources of contamination can negatively affect both surface water and groundwater.

2.2.4(c). Mineral and Aggregate Mining

The Indiana mineral mining industry produces commodities such as crushed stone and dimension stone, which generally have prolonged periods of mining, as well as shale, clay gravel, gypsum, marl and peat (Shaffer, 2012). Some of these commodities have made Indiana a mining leader based upon production. For example, Indiana contains the largest brick facility in the United States which mines Indiana shale to make 120 million bricks per year. Indiana is also a leading producer of dimension limestone (U.S. Department of Interior, May 2015).

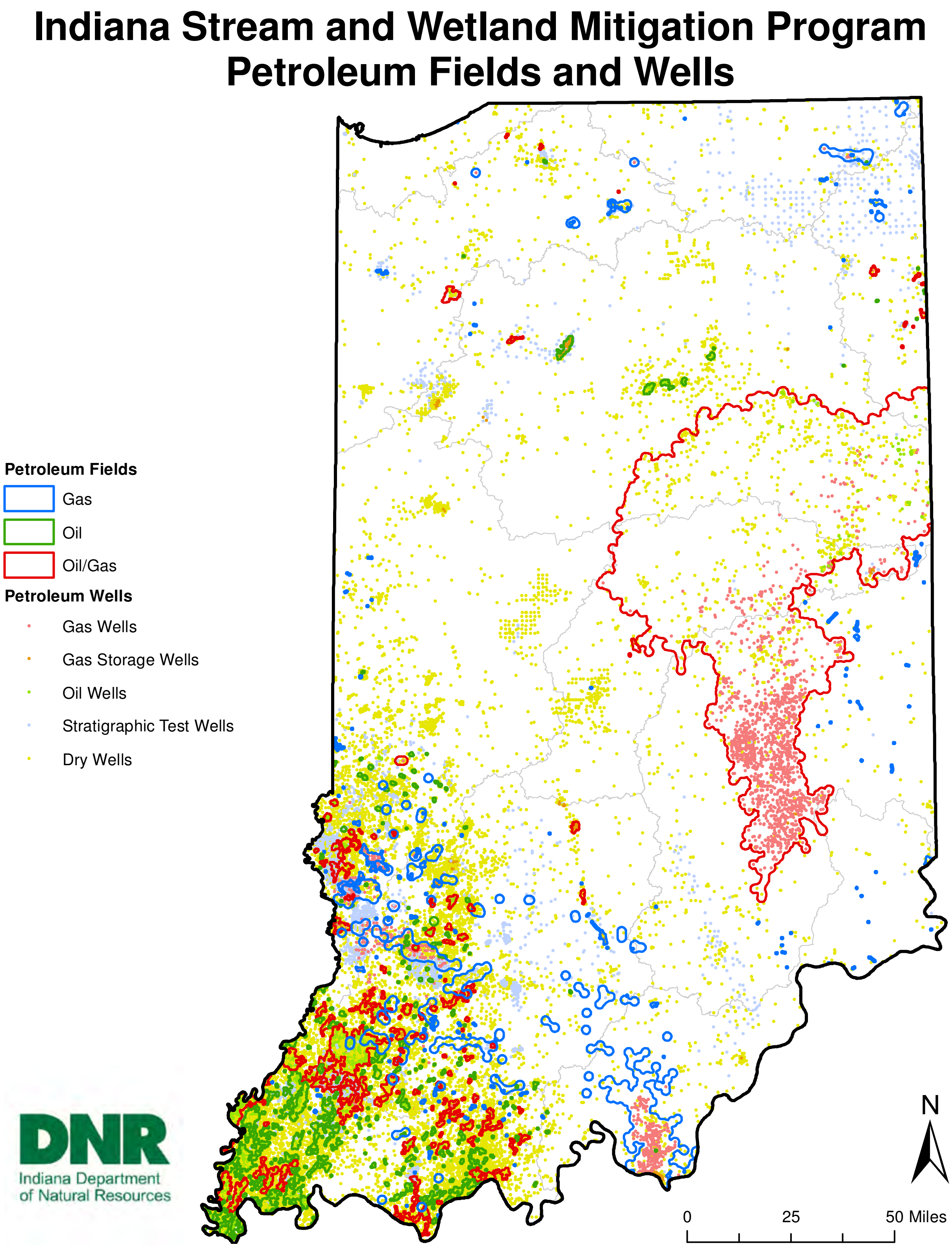


Figure 10. Indiana Oil and Gas Petroleum Fields Map

Although mineral mining's footprint is relatively small when compared to Indiana's coal production, they have similar impacts to aquatic resources. Mineral mine distribution is more widespread across the state than coal mining, which means that the threats to aquatic resources are seen more widely across the state and affect all of the IN SWMP service areas.

Changes in geomorphology and conversion of land use, accompanied by habitat loss, noise, fugitive dust, vibrations, chemical spills, erosion, and sedimentation are associated with quarry impacts (Langer, 2001). Demand for new construction and infrastructure provide the catalyst for aggregates which perpetuates impacts to aquatic resources throughout Indiana. Surface waters are threatened by these activities because mineral mining can intercept surface waters, changing their course; additionally, groundwater pumping from quarries effects streams and nearby surface water features such as wetlands by altering their hydrology. Lastly, water discharges from quarries can result in increased flood recurrence intervals when discharged directly into nearby streams (Langer, 2001).

All mined resources result in impacts to the environment; however, some mineral resources can result in more damaging effects to the aquatic environment based on the deposits' proximity to aquatic resources. One of the top sources of sand and gravel aggregate materials are found in alluvial deposits such as stream channels and terraces, flood plains and alluvial plains (West & Cho, 2006). This is shown in **Figure 11**, which maps the locations of the majority of sand and gravel mine operations being within alluvial deposits. Streams and adjacent wetlands are threatened by aggregate extraction in sensitive areas.

Indiana Stream and Wetland Mitigation Program
Mineral and Aggregate Mining

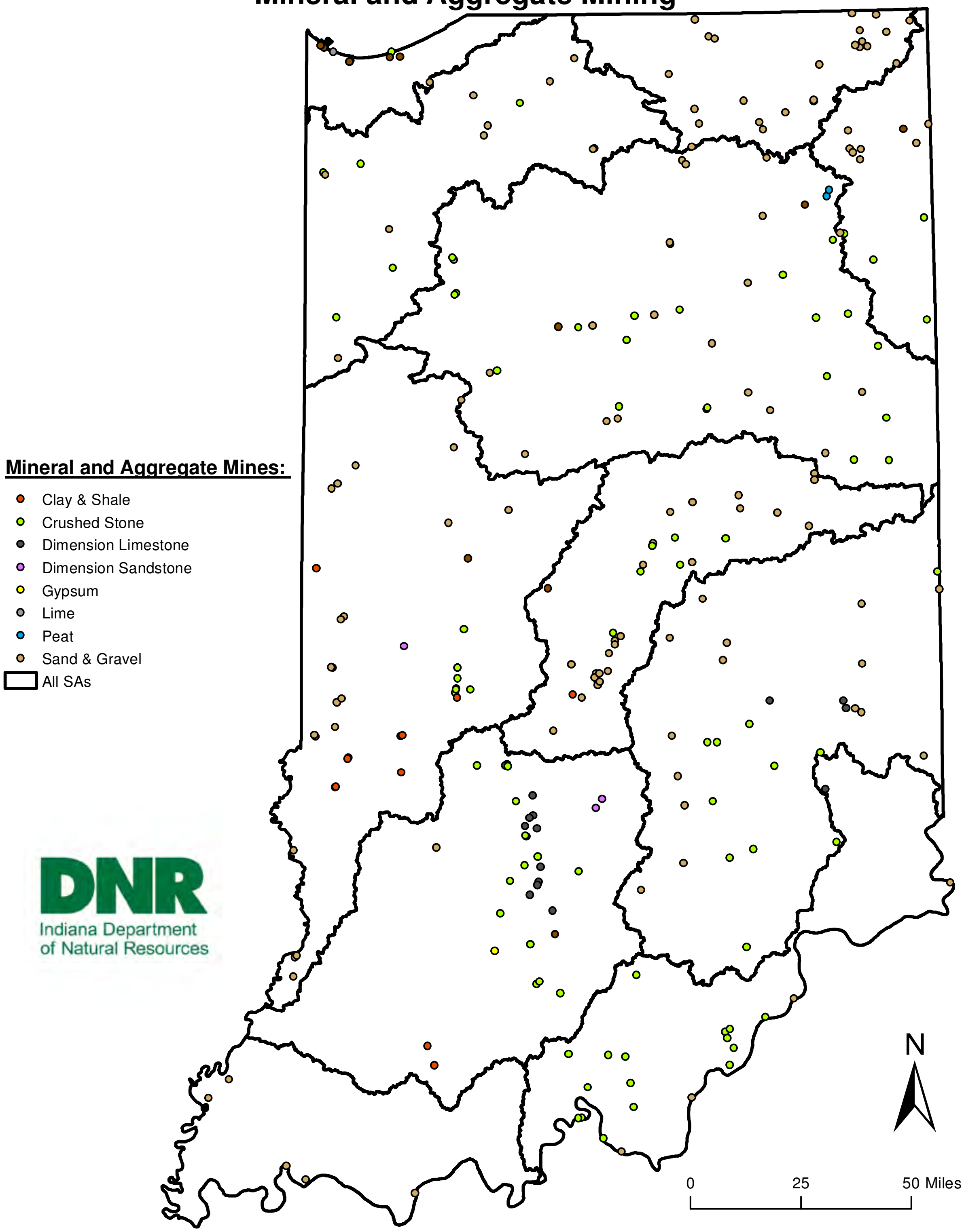


Figure 11. Indiana mineral mining statewide distribution

2.2.4(d) IN SWMP Offsets for Energy Production and Mining Impacts:

IDNR's IN SWMP will help offset impacts from energy production and mining by targeting compensatory mitigation projects, utilizing a watershed approach, which will improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Implement stream and/or wetland restoration projects that supplement IDNR Division of Reclamation's Abandoned Mine Lands Program reclamation projects that will help increase Indiana's aquatic resource functions and services.
- Restore fluvial processes by implementing natural stream restoration projects on streams that have experienced physical degradation from mining, natural gas and oil production activities.
- Implement mitigation projects that connect fragmented habitats that are a result of cumulative effects associated with historic and ongoing mining activities and natural gas and oil production.
- Preserve and enhance high quality wetlands and stream corridors that provide important aquatic functions and services to the watershed that are directly threatened by impacts from mining, natural gas and oil production activities.

2.2.5 Transportation and Service Corridors

Transportation is an integral component to providing national and local mobility, which is necessary for economic vitality and quality of life. Transportation supports Indiana commerce, such as manufacturing, wholesale, and agribusiness, by providing networks for the mobilization of raw materials, produce and finished products (Indiana Department of Transportation, 2015).

2.2.5(a) Roadways

Construction of new roadways and improvements to existing roads can result in negative effects on aquatic resources. The major ecological impacts of road networks (**Figure 12**) at the landscape scale are the loss of bio diversity and disruption of landscape processes; at the local scale, aquatic resources suffer ecological effects due to roadways.

Aquatic and terrestrial ecosystems are affected by roads due to physical alteration of the environment, modified animal behavior, increased mortality from road construction and collision with vehicular traffic, alteration of the chemical environment, and spread of invasive species (Trombulak & Frissell, 2000).

Long-term effects to aquatic resources threaten stream and wetland health, along with the biological communities that depend upon these ecosystems. Road and bridge construction can alter the natural development of stream channels, floodplains, and wetlands. The physical effects of road incursion may extend long distances from the construction site due to the energy associated with moving water; in addition, changes in channels and shorelines many miles away, both up- and down-gradient of a road crossing, are a response to the effective changes in hydrodynamics and sediment deposition (Trombulak & Frissell, 2000).

The most common characteristic of human impacts in riverine systems is associated with alterations to connectivity of the fluvial system (Wohl, 2004) (Blanton & Marcus, 2009). Many roads are constructed along river valleys and intercept rivers and streams. Roads require bridges and culverts as they cross aquatic features. Road placement and stream crossings result in connectivity alterations that fragment riverine systems and processes. These disruptions can have profound impacts to natural stream processes. Fluvial system impacts alter a stream's ability to interact with the river landscape by disrupting the ability to exchange water, sediment and biota, which control the evolution of stream channel and floodplain habitat (Blanton & Marcus, 2009).

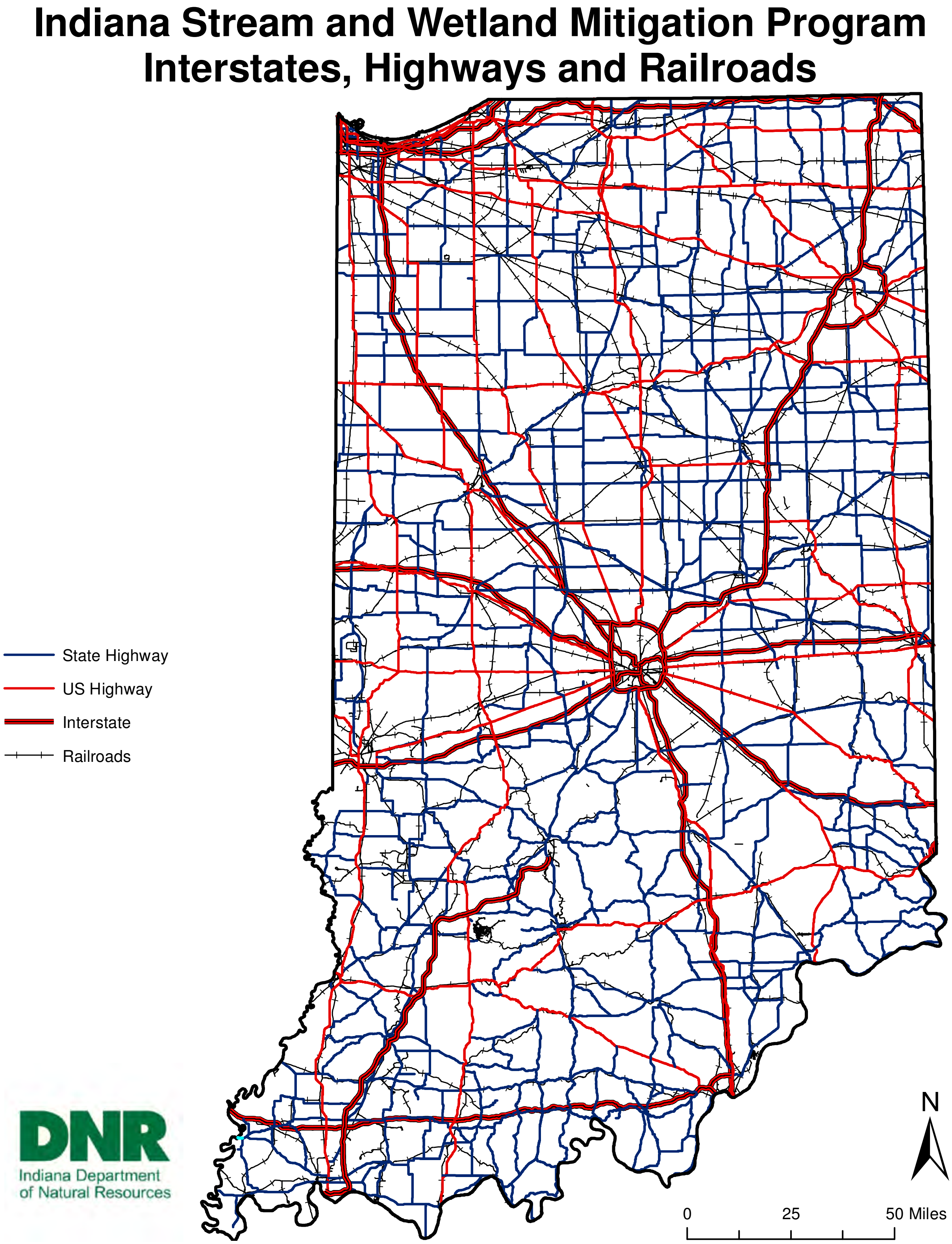


Figure 12. Indiana Railroads and Roadways. (INDOT Road Inventory Section, 2016); (Federal Railroad Administration, 2002)

In addition to disruptions to fluvial processes, transportation networks create barriers that directly impact aquatic community health. Valley-bottom roads can destroy or block access to seasonal floodplain wetlands and small tributaries, that salmonids and riverine fishes seasonally escape stresses of main channel flows; even more, the distribution and productivity of a population can be reduced due to persistent barriers that encourage local selection for behaviors in response to the limitation of natural migration patterns (Trombulak & Frissell, 2000). River and stream crossings can compound long-term negative affects to aquatic communities. Fishes and other aquatic animals are commonly restricted by road crossings that act as barriers (Trombulak & Frissell, 2000). Inadequate culverts disrupt aquatic organism movement, which threatens the overall population health of these aquatic species.

Although efforts are in place to address aquatic passage issues, many existing stream crossings were installed without these considerations. This has resulted in issues that impact aquatic communities and the ecosystem processes they depend upon, such as natural hydrology, sediment transport, fish and wildlife passage, or the movement of woody debris (Jackson, Bowden, & Graber, 2007).

Wildlife populations are affected by habitat fragmentation of natural areas into smaller remnants, reducing the number of species able to move from one area to another (Andrews, 1990). This is especially true for aquatic ecosystems and their associated fauna. Wetland species, including amphibians and turtles, commonly show reduced tendencies to cross roads, creating a barrier effect when moving to adjacent habitats (Forman & Alexander, 1998). In addition, roads create edge effects that promote long-term consequences that extend beyond initial impacts during construction; including altering the physical characteristics of soil density, temperature, soil water content, light, dust, surface-water flow, runoff patterns, and sediments (Trombulak & Frissell, 2000).

When considering a roadway's proximity to aquatic habitats, wetland species can be subject to road mortality impacts. This relationship can result in increased threats for sensitive species. A study was performed in Tippecanoe County, Indiana that involved a multi-species road-kill survey to determine a correlation between roadways and impacted species' habitat characteristics. While developing a species index focused on herpetofauna specific to Indiana, they evaluated landscape characteristics of roads that experienced high vertebrate mortality and associated effects of seasonal weather change. Data obtained was then compared to global decline in amphibian populations. The study provided insight into several potential threats that roads pose for aquatic species. The study found that low flying Chimney Swifts and Tiger Salamanders that were using the bog as a stopover and/or breeding area resulted in ephemeral exposure to vehicle hazards; in addition, the analysis documented significant wildlife mortality to the Northern Leopard Frog where roads bisect wetlands which indicates the potential of significant impacts on populations of threatened or endangered species (Glista, DeVault, & DeWoody, 2008).

2.2.5(b) Railroads

Indiana rail system totals over 8,000 miles, providing transportation options for freight and passenger services. Based on INDOT's Indiana State Rail Plan,

> Indiana's rail system ranks high among other states in a number of rail-related categories. For instance, Indiana ranks among the top 10 states in rail tons originated, total rail tons carried, total rail carloads carried, and rail employment and wages. In terms of commodities, it also ranks in the top 10 among states for coal tonnage originated and terminated, farm products originated, food products originated, primary metals originated and terminated, and petroleum products terminated (Indiana Department of Transportation, November 2011).

With existing rail infrastructure and future transportation needs, aquatic resources face permanent and long term threats.

The construction of new rail corridors can result in a series of environmental impacts to the aquatic environment. Identified impacts associated with rail projects can significantly impact streams, wetlands, water quality, habitat, flora and fauna, including endangered and threatened species, and biologically sensitive areas (Deakin, 2010). The need for new rail sightings and corridors can be in direct response to development and industry. Field crops, bio-fuels, coal, manufacturing and steel are identified as industry developments that could impact major rail commodities within Indiana (Indiana Department of Transportation, November 2011). In addition to potential industry developments, existing industry that utilize rail infrastructure as a means to transport goods contribute to aquatic threats. The coal industry has been identified as an industry that could impact rail commodities; however, Indiana's domestic coal distribution has been dominated by rail. Indiana railroads deliver 25,436 thousand short tons of coal per year, which comprises 74.6% of all modes of domestic coal transport (U.S. Department of Energy, 2016).

Many of the identified aquatic resource threats associated with roadways transcend to railroads. Both the construction disturbances and the fragmentation that linear rail corridors require result in conversion of wetland and stream habitats. The construction and use of railroads contributes to the fragmentation of natural areas, loss of habitat, ecological disturbance, barrier effect and mortality due to collisions (Van Der Grift, 1999).

Railroad corridors can contribute to major disruptions in stream process when located in the floodplain. Railroad beds are constructed at higher grades, creating lateral disconnection of stream systems causing significant ecological damage (Blanton & Marcus, 2009). Although roadbeds can create a similar effect, typical railroad construction results in a more constrained stream system, due to the linear levee effect they create. These floodplain disconnections result in riparian forest loss, loss and/or simplification of stream and floodplain habitat, and terrestrial and aquatic loss of species richness and diversity which disrupts aquatic resource functions (Blanton & Marcus, 2009).

Future passenger transportation needs may be met through high-speed passenger rail, which typically requires dedicated rail lines for frequent, high-speed trips between urban centers. These high-speed rail projects will require new easements and acquisition of linear corridors for new railroad construction.

2.2.5(c) Service Corridors

Pipelines and corridors associated with oil and gas operations pose several threats to Indiana's aquatic resources. Impacts associated with the construction and maintenance of pipeline corridors result in permanent and temporary aquatic resource impacts that can have lasting negative effects to stream and wetland systems. Pipeline construction activities impact wetland functions due to increased soil compaction and erosion; loss of wetland habitat for dependent wildlife species, terrestrial vegetation impacts that result in loss of habitat and species diversity; potential for colonization by non-native and/or invasive species; wildlife mortality, habitat fragmentation; and permanent wetland loss in response to filling activities (Soli, 2015).

Pipeline corridors located through stream and river systems pose a multitude of threats to these aquatic resources. The construction and maintenance of these corridors can result in increased sedimentation, alterations in stream flows during construction, and changes in stream morphology (Soli, 2015). Both construction activities and natural fluvial processes can threaten infrastructure placed within streams and rivers. As stream systems adjust to geomorphic conditions resulting from either anthropogenic or natural changes within the system, they become unstable. Erosion can expose pipelines buried under rivers and streams making them more susceptible to damage or rupture from strong currents (Ramirez Jr. & Mosley, 2015). Responsible parties for these pipelines are tasked with identifying exposed infrastructure and obtaining permits to armor/repair the reach of stream where the pipeline has been exposed due to erosion and stream instability. Many times this is a temporary fix due to the instability in the channel or natural channel migration.

When pipeline corridors are installed within streams and rivers, they are threatened by the dynamic nature of fluvial systems. Similarly, pipeline maintenance poses permanent effects to aquatic resources. Pipeline spills can result in significant damage to the aquatic environment and the leading causes for pipeline releases are punctures or damage from equipment, corrosion, pipe defects, improper installation, and natural hazards such as ground movement, weather, lightning, and stream currents (Ramirez Jr. & Mosley, 2015).

Installing pipeline infrastructure within or adjacent to sensitive aquatic areas increases the potential for degradation of these sensitive habitats. Based on information from the U. S. Fish and Wildlife Service (USFWS), wildlife refuges in the Midwest Region have over 28 liquid pipelines that transport crude oil, and refined petroleum products including gasoline, diesel, and jet fuel; in addition, their refuges are bisected by over 70 gas pipelines that transport natural gas and other gases, when combined they total approximately 150 miles of liquid and gas pipelines (Ramirez Jr. & Mosley, 2015). These pipelines bisect portions of Indiana and directly impact its national wildlife refuges. The Patoka River National Wildlife Refuge, which is a part of the USFWS-Midwest Region and located in southwestern Indiana, has four major pipelines within its boundary (U.S. Fish and Wildlife Service, April 2014). As pipelines bisect these diverse and sensitive natural areas, the fish and wildlife and aquatic ecosystems that comprise these Refuges are threatened by the likelihood of infrastructure failures.

Similar to impacts associated with the construction of any linear project, electric transmission lines pose many of the same threats to aquatic resources. Transmission line construction activities within stream systems impact water quality by increasing water temperatures in response to vegetative removal, impact flow regimes and processes due to improper installation and maintenance of temporary structures, damage stream banks and increase erosion (Public Service Commission of Wisconsin, July 2013).

Wetlands are subject to similar threats, when constructing new corridors for transmission lines. The installation of transmission towers, substations and related infrastructure can result in permanent impacts when constructed or sited through any wetland community. A ten year study conducted on a shrub/bog wetland located within a powerline corridor, revealed its vegetation exhibited poor recovery from disturbance (Andrews, 1990). Forested wetland communities experience poor recovery potential due to tree limitations within transmission line corridors. The resulting right-of-way maintenance activities contribute to habitat fragmentation, dispersion of invasive species, and loss of native plant species diversity (U.S. Fish and Wildlife Service, 2015).

The delivery of liquid and gas products and electricity are transported within each region of the state as shown in **Figure 13**.

As each of these service corridors extend throughout the state, they require rights-of-way that disrupt and fragment native plant communities and aquatic resources. These pipelines can result in aquatic impacts during their installation and ongoing, intermittent impacts due to maintenance activities. Maintenance practices within utility corridors allow vegetation to regrow but, due to cutting, mowing or spraying of herbicides, vegetation is maintained into an early successional stage, which affects plant and animal communities within the easement (Andrews, 1990). Similar to previously mentioned right-of-way maintenance impacts, native plant species experience an overall loss in species diversity and these practices promote the spread of invasive species (U.S. Fish and Wildlife Service, 2015); in addition, these practices impact animal communities by habitat fragmentation, edge effects that disrupt natural communities, and resulting barriers that maintained corridors create for wildlife (Andrews, 1990).

Indiana Stream and Wetland Mitigation Program
Electric Transmission Lines and Energy Pipelines

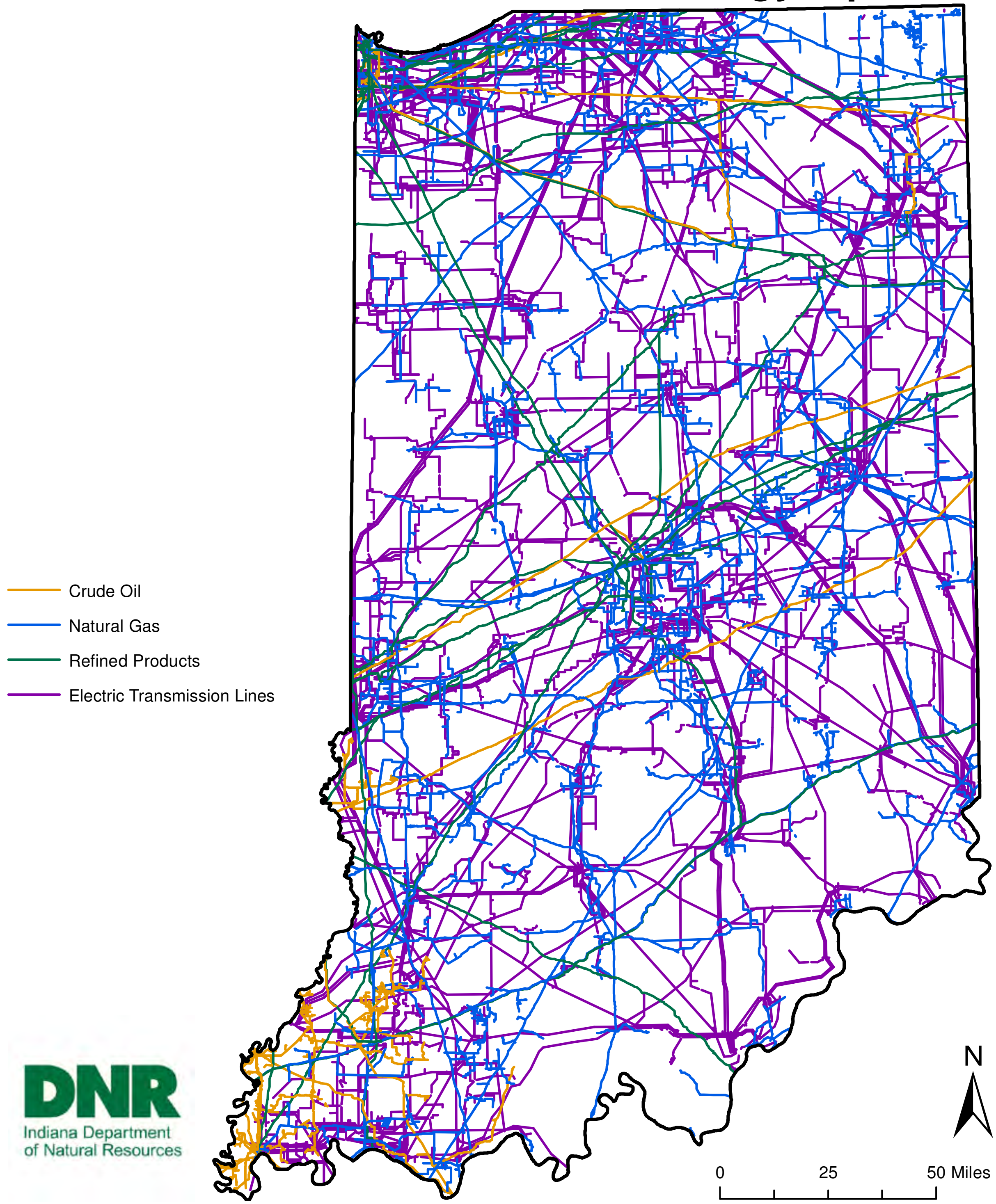


Figure 13. Indiana Pipelines and Transmission Lines. (Indiana Geological Survey , 2015) (Indiana Geological Survey, 2001)

Similarly, electric transmission lines result in permanent linear conversion of natural communities. The installation of a 65 mile 345 kV transmission line project located in southwestern Indiana resulted in permanent impacts to approximately 16 acres of wetlands. The majority of these impacts were due to permanent conversion of forested wetlands within the project right-of-way. The scale and scope of transmission line corridor impacts to aquatic resources is correlated to obtaining better efficiency and higher voltage needs as old infrastructure is updated. New transmission line corridors increase is based on the voltage size. For example, 69 kV transmission line corridor generally require 60 feet wide corridor, 138 kV line require 100 feet, 345 kV require 150 feet and 765 kV line typically require 200 feet (Ginter, 2016). When existing transmission lines are upgraded to a greater voltage, these permanent corridor width requirements resulted in additional impacts to aquatic resources for these upgraded lines. It is expected that as demand for electricity increases, more upgrades to aging energy infrastructure will be required and will result in additional permanent impacts to aquatic resources that will require mitigation.

In summary, these linear corridors fragment habitats which result in threats to aquatic ecosystems. Habitat fragmentation of aquatic ecosystems can affect the dispersal of riverine taxa; when roads and pipelines cross streams, especially via culverts, they often create barriers to dispersal, separating and isolating upstream and downstream populations from one another (Brittingham, Maloney, Farag, Harper, & Brown, 2014).

2.2.5(d) IN SWMP Offsets for Transportation and Service Corridor Impacts:

IDNR's IN SWMP will help offset impacts from transportation and service corridors by targeting compensatory mitigation projects, utilizing a watershed approach, which will improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Increase habitat connectivity by targeting stream and/or wetland mitigation projects that provide critical linkages to existing conservation areas.
- Remove stream culverts within proposed stream mitigation project segments in order to remove barriers to aquatic passage whenever possible.
- Establish native vegetative communities and help eradicate invasive species, associated with vegetative degradation from linear projects.
- Restore fluvial processes by implementing natural stream restoration projects on streams that experience degradation from transportation and service corridor projects.
- Create wetland mitigation projects that provide the greatest ecological lift in functions that are negatively affected by transportation and service corridor projects.
- Protect high quality wetlands and stream corridors that provide important aquatic functions and services to the watershed that have been impacted from transportation and service corridor projects.

ELEMENT 3. Historic Aquatic Resource Loss

Since 1800s European settlement, the state of Indiana's landscape has been influenced by increases in population growth and development of urban areas as well as agriculture. These influences, along with the use of new technologies, have resulted in Indiana's aquatic resources suffering both quantitative and qualitative losses. Indiana's pre-settlement landscape is estimated to have been comprised of roughly 88% forest (20.4 million acres) and 12% non-forest (2.8 million acres) land cover on a statewide scale (Lindsey, Crankshaw, & Qadir, 1965). It's estimated that over 24% (5.6 million acres) of these forested and non-forested communities were wetlands (Amlaner & Jackson, 2012).

Although Indiana's presettlement landscape was predominately forested, the state was comprised of a multitude of natural communities and subsequent aquatic resource types. The understating of these natural communities has been subject to the compilation of information dating back to the early 1800, such as early geological mapping and General Land Office surveyor's notes. Indiana's natural regions have been defined by (Homoya, Abrell, Aldrich, & Post, 1985) in, "The Natural Regions of Indiana." Homoya et al identified Indiana's natural communities by determining distinctive assemblages of features with the integration of soils, glacial history, presettlement vegetation, topography, climate, exposed bedrock, physiography, flora and fauna distribution throughout the state, and details of various aquatic resource types that dominated the state before European settlers permanently transformed its landscape. **Figure 14**, illustrates the Natural Regions of Indiana boundaries and sections, along with the respective IN SWMP Service Areas boundaries. Although this provides a statewide depiction of the regions, the specific makeup of these natural regions will be detailed within each respective Service Area portion of this document. Additionally, each SA's natural regions map is supplemented with historic natural community composition tables that highlight additional research and surveys that assist in the understanding of the historic composition of each SA's aquatic resources. The tables detail GIS analysis of the percent land cover of each natural region and sections; land cover distribution of mapped hydric and partially hydric soils from Soil Survey Geographic (SSURGO) Database; and the estimated percentage of forested land cover which was adapted from (Lindsey, Crankshaw, & Qadir, 1965)'s "Soil Relations and Distribution Map of the Vegetation of Presettlement Indiana," (1965). This publication provides a generalization of Indiana's presettlement vegetation types, circa 1820.

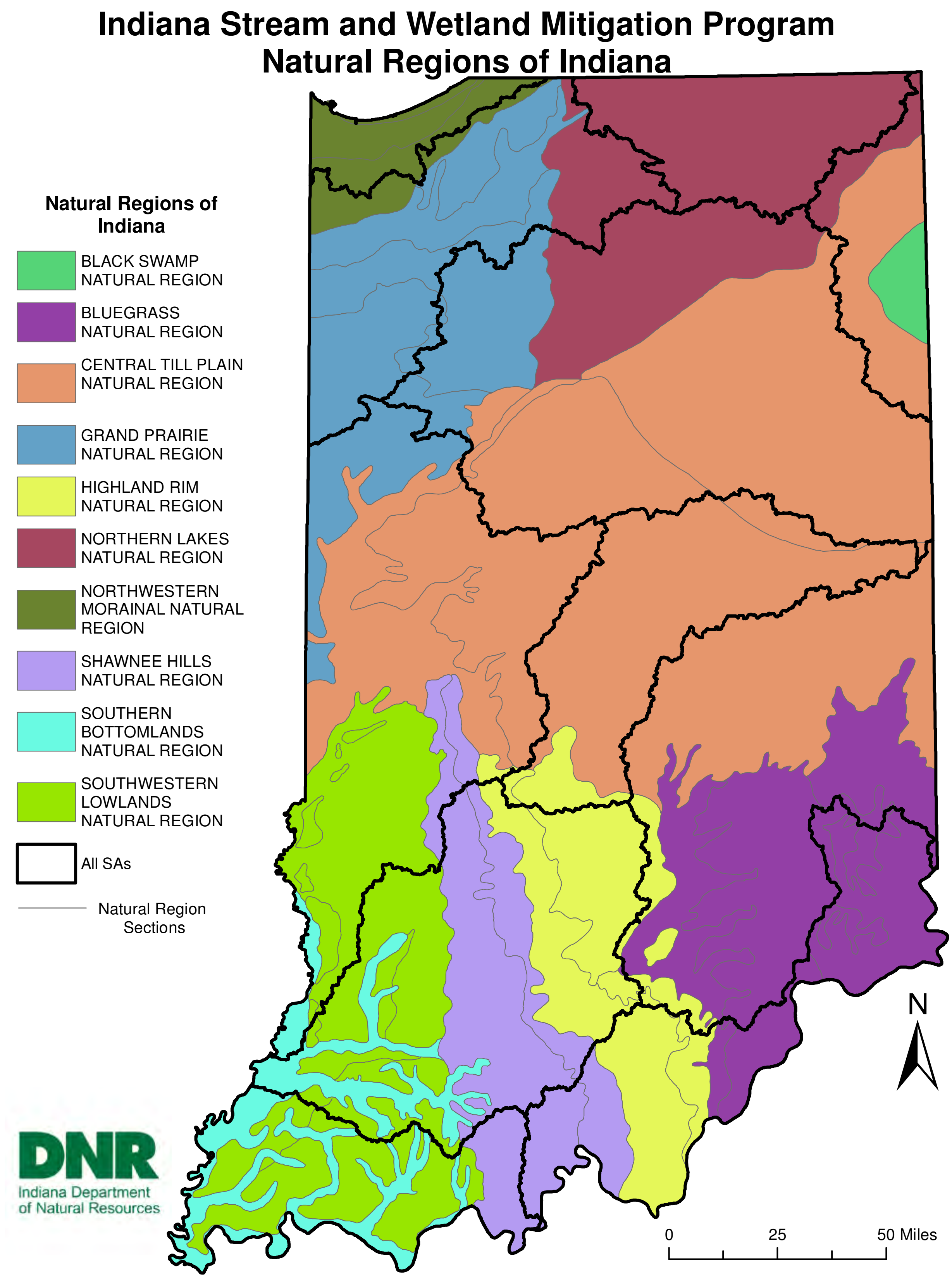


Figure 14. Natural Regions of Indiana (Homoya, et. al. 1985)

Although the state's aquatic resources had experienced relatively minimal disturbance until the 1800's, America's major land acquisitions fueled westward expansion. Population pressure and the lack of productive farmland in the eastern states accelerated full-scale settlement of Indiana and its surrounding states (U.S. Department of Agriculture , 1987). This growth led to the exploitation of its natural resources and natural communities, permanently altering Indiana's landscape. After 1860, forest clearing, wetland draining, and plowing of prairies was wide spread throughout Indiana (Amlaner & Jackson, 2012). Within 20 years, approximately fourteen million acres of the state, which accounts for 61% of the States total acreage, were being farmed (Dahl & Allord, 1996). Once drained, wetlands were transformed into row crops.

Keeping former wetlands from reverting was a major hurdle for early farmers. In order to manipulate hydrology, drainage ditches were constructed in wetlands. Farmers would use teams of oxen and plows to cut two to three feet deep drainage ditches through wetland areas (Jackson M. T., 1997) Although this was the common tool for gaining farmable land; this practice was outpaced by the efficiency of subsurface tile drainage installation. Tiles became a standard practice for wetland conversion by the mid 1800's. Indiana had over 30,000 miles of drain tiles operating by 1882 which converted thousands of acres of wetlands into productive agricultural land (Jackson M. T., 1997).

Forests were timbered to supply raw materials for development, primarily for lumber and fuel. It is estimated that as much as 10 million acres of forestland was cleared across the state (Jackson M. T., 1997). Infrastructure and transportation contributed to the loss of forested wetlands in Indiana. Trees were harvested to construct roads and bridges for infrastructure, provide building supplies, and to construct and fuel railroads. Since early European settlement (circa 1800), Indiana and Ohio have experienced the highest rate of deforestation within the United States (Evans, Donnelly, & Sweeney, September 19, 2009).

The widespread deforestation of Indiana's forests resulted in ancillary impacts to streams and rivers. Dams were constructed to provide water power for the processing of felled timber. There were 1,248 operating sawmills throughout Indiana by 1840; and they were processing up to 1,000 board feet of lumber per day (Jackson M. T., 1997).

Indiana's waterways provided food, power and transportation. Indiana's streams were channelized to facilitate the construction of canals as a means for commerce and transportation. Canals contributed to Indiana's growth with, "agricultural expansion and the export of agricultural surpluses, the import of eastern merchandise, and economic diversification towards manufacturing and commerce" (Indiana Historical Bureau, 1997). Although Indiana's network of canals became obsolete due to the more favorable economics of railroads, their construction negatively impacted wetlands and streams throughout the state. Riparian wetlands were destroyed by clearing and dredging during canal construction (Dahl & Allord, 1996).

Based on societal views during the mid-1800s, draining and converting wetlands was encouraged by State, local and federal governments, and supported by law. Nationwide, wetlands were targeted by the Swamp Land Act of 1850; this increased the states authority to lead the initiative to drain wetlands and construct levees for flood control (Mitsch & Gosselink, 2000). Although this Act relinquished federal control of poorly drained areas to the states, the impetus to drain these aquatic features was established. Indiana was granted authority to drain approximately 1,259,231 acres of swamp lands, as a result of the federal Swamp Land Act of 1850 (Dahl & Allord, 1996).

The southwestern region of Indiana has been altered and influenced by surface and underground coal mines. This region of the state contains unique geological deposits that comprise the Indiana Coalfield, an area that covers approximately 6,500 square miles and constitutes the eastern-most part of the Illinois coal basin (Hatch & Affolter, 2002).

Early 1800's mining techniques utilized pick, shovel and horse-drawn scrapers on the surface and at outcrops; however, the majority of coal production in Indiana during the 1800's to the early 1900's was through underground mining (Powell, 1972). During this time, the primary driver for coal extraction was domestic use. As energy demands increased for industrial uses, efficiencies in coal extraction led to new mining methods and equipment. Open pit strip mining with large steam powered shovels and draglines allowed mines to recover nearly all coal in contiguous cuts and became the dominant mining technique (Powell, 1972).

Surface disturbances for coal extraction not only resulted in stream and wetland losses, but the lack of mine reclamation resulted in long lasting damaging effects to the region's environment. Acid mine drainage was and continues to be a concern for Indiana's wetlands and streams as acidic waters resulting from coal mining leaches into the ground and downstream surface waters degrading water quality and preventing the establishment and longevity of aquatic fauna and flora (Amlaner & Jackson, 2012).

Indiana's natural communities have been and continue to be altered by anthropogenic activities. Early European settlers made major alterations to the landscape as a means of survival. Over the past 200 years, the permanent alterations to Indiana's landscape have resulted in conversion, degradation and fragmentation of native natural communities and degradation of the state's aquatic resources. Despite the changes in Indiana's landscape, high quality remnants remain, many of them preserved by the IDNR, federal government and non-profit conservation organizations over the last century. Finally, many restoration opportunities remain throughout the state to increase and improve the functions and services of Indiana's aquatic resources.

ELEMENT 4. Current Aquatic Resource Conditions

Since the beginning of European settlement, Indiana's aquatic resources have experienced quantitative loss and degradation of the chemical, physical and/or biological integrity of those resources. Aquatic systems continue to be impacted by threats such as habitat loss, conversion, alteration, fragmentation and degradation from urban development, deforestation, agricultural establishment, transportation and utility corridors, point and nonpoint source discharges, and channelization (Amlaner & Jackson, 2012).

The 2016 Indiana Integrated Water Monitoring and Assessment Report (IR or the 305(b) report) prepared by IDEM and submitted to the U.S. EPA is the most comprehensive and up-to-date report on state water quality, and is updated every two years (IDEM-IR, 2016). IDEM's Watershed Assessment and Planning Branch in the Office of Water Quality assesses the chemical, physical, and biological conditions of Indiana's aquatic resources (excluding wetlands) based on Indiana's water quality standards (327 IAC 2), which define the designated uses that the state's waters must support (IDEM-IR, 2016). IDEM assesses state waters for beneficial uses such as aquatic life use support, recreational use support, fish consumption (PCBs and Mercury in fish tissue), and drinking water for surface waters that serve as a public water supply (327 IAC 2). IDEM assesses the most current data for the purposes of compiling the 305(b) report and the 303(d) list of impaired waters using IDEM's consolidated assessment and listing methodology (CALM) (IDEM-IR, 2016). Data collection efforts conducted by IDEM are outlined in Indiana's Water Quality Monitoring Strategy and stored in the Assessment Information Management System (AIMS) database (IDEM-IR, 2016). AIMS contains surface water chemistry data, fish and macroinvertebrate community data, assessments of habitat quality, results from algal monitoring, as well as fish tissue and sediment contaminant data (IDEM-IR, 2016). Reporting tables and figures for Indiana streams, lakes, reservoirs and groundwater are found in the 2016 IR appendices. IDEM has the following water quality monitoring programs that contribute to CWA Section 305(b) assessments:

- Probabilistic Monitoring Program
- Fixed Station Monitoring Program
- Contaminants Monitoring Program
- Performance Measure Monitoring Program
- Special Studies Program
- Watershed Characterization Program

IDNR will rely on IDEM assessment data, among other appropriate statewide and regional sources, to remain up-to-date with the current conditions of Indiana's aquatic resources and will be one of many tools used in the IDNR's prioritization strategy for assessing and selecting compensatory mitigation sites using a watershed approach.

4.1 Streams and Rivers

Based on IDEM's Indiana Reach Index developed for the purposes of mapping Indiana's 305(b) assessments and 303(d) listings, Indiana has approximately 63,130 miles of rivers, streams, ditches and drainage ways (IDEM-IR, 2016); however, streams not included on the USGS National Hydrography Dataset (NHD), such as ephemeral headwaters (USGS, 2016), are not included in the IN Reach Index. A significant portion of Indiana streams are channelized or are man-made ditches, however, records of channel modifications, if they exist, are mostly retained in hard copy within each county and therefore the total reach of these alterations has not been determined.

According to the 2016 IR, approximately 68 percent of the 37,693 stream miles assessed for aquatic life use were found to be fully supporting, leaving approximately 32 percent of assessed miles as impaired. Approximately 74 percent of the 31,683 stream miles assessed for full body contact do not support recreation use. Pathogens are found to be the main source of stream impairments, impacting more than 23,000 miles of streams. More than 4,900 miles of stream contain fish with polychlorinated biphenyls (PCBs) in their tissue and 760 stream miles with mercury in fish tissue. Nearly 8,300 assessed stream miles also have impaired biological communities (IBC) with measurable adverse response to pollutants. Potential sources impacting Indiana waters include nonpoint sources that impact 16,040 miles of streams, while unknown sources impact almost 10,000 miles of streams. A summary of designated use support is provided in **Table 5**.

Designated Beneficial Use	Total (Miles)	Assessed (Miles)	Percent Assessed	Fully Supporting (Miles)	Not Supporting (Miles)
Full Body Contact (Recreational Use)	63,130	31,683	50%	8,122	23,561
Human Health and Wildlife (Fishable Use)	63,130	8,873	14%	3,418	5,455
Public Water Supply	365	25	7%	0	25
Warm Water Aquatic Life (Aquatic Life Use)	63,130	37,693	60%	25,793	11,900

Table 5. Summary of designated use support for streams and rivers from IDEM 2016 Integrated Report and 305(b) assessment database, (IDEM-IR, 2016).

Following are the definitions of Categories 4A and 5 of impaired waters which do not fully support one or more of their designated uses as outlined in U.S. EPA's "Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act" (U.S. EPA, 2003).

Category 4A (**Figure 15**)**:** Segments are placed in Category 4A when all TMDLs needed to result in attainment of all applicable WQSs have been approved or established by EPA.

Category 5 – 303(d) Listing Waters (**Figure 16**)**:** Segments are placed in Category 5 when it is determined, in accordance with the State's assessment and listing methodology, that a pollutant has caused, is suspected of causing, or is projected to cause an impairment or threat; therefore requiring the development of a TMDL.

To gain a better initial understanding of the physical conditions and habitat structure of Indiana's streams, IDNR examined and mapped IDEM's 1991-2014 dataset of Qualitative Habitat Evaluation Index (QHEI) overall scores for stream reaches sampled for fish and/or macroinvertebrate community structure in each service area (IDEM OWQ, 2014). The QHEI is a method developed by the Ohio EPA for assessing habitat in flowing waters, and has been adapted for Indiana to sample streams and rivers regardless of drainage area size (Ohio EPA, 2006), (Rankin, 1995). QHEI reaches are a segment of a stream equal in length to 15 times the average wetted stream width, with a minimum length of 50 meters and a maximum length of 500 meters (IDEM, 2010). The QHEI is not required or used alone to list a stream as impaired for aquatic life use; rather, the QHEI is designed to evaluate the lotic habitat quality important to aquatic communities, and is used in conjunction with macroinvertebrate Index of Biotic Integrity (mIBI, a community assessment score) or fish community IBI data, or both, to evaluate the role that habitat plays in waterbodies where impaired biotic communities (IBC) have been identified (IDEM-IR, 2016). The QHEI, most recently updated for Indiana in 2009, assesses the following major individual metrics, each with individual scoring components: 1) Substrate; 2) Instream Cover; 3) Channel Morphology; 4) Riparian Zone; 5a) Pool Quality; 5b) Riffle Quality; and 6) Gradient. The major metrics are calculated for a total maximum score of 100, with the overall QHEI score rating in the narrative range in **Table 6**. A higher QHEI score represents a more diverse habitat for colonization of aquatic organisms (Ohio EPA, 2006).

QHEI Score	Narrative Rating
>64	Habitat is capable of supporting a balanced warm water community
51 - 64	Habitat is only partially supportive of a stream's aquatic life designation
<51	Poor habitat

Table 6. QHEI narrative ratings and score for QHEI (IDEM, 2008).

The narrative ratings for the 4,217 reaches in which IDEM sampled and collected QHEI data between 1991 and 2014 for Indiana streams is summarized in **Table 7**. These QHEI ratings are mapped for each service area and are located within that service area's discussion later in this document. This data shows that approximately one-third of the stream reaches assessed have poor habitat quality, one-third are only partially supportive and another third are cable of supporting a balanced warm water community.

QHEI Narrative Rating	Total Reaches	Percentage of Total
Poor Habitat	1,451	34%
Partially Supportive	1,325	31%
Supporting	1,441	34%
Total	**4,217**	**100%**

Table 7. Statewide QHEI scores and sampled reaches. (IDEM OWQ, 2014)

Indiana Stream and Wetland Mitigation Program
Category 4A Impaired Waters

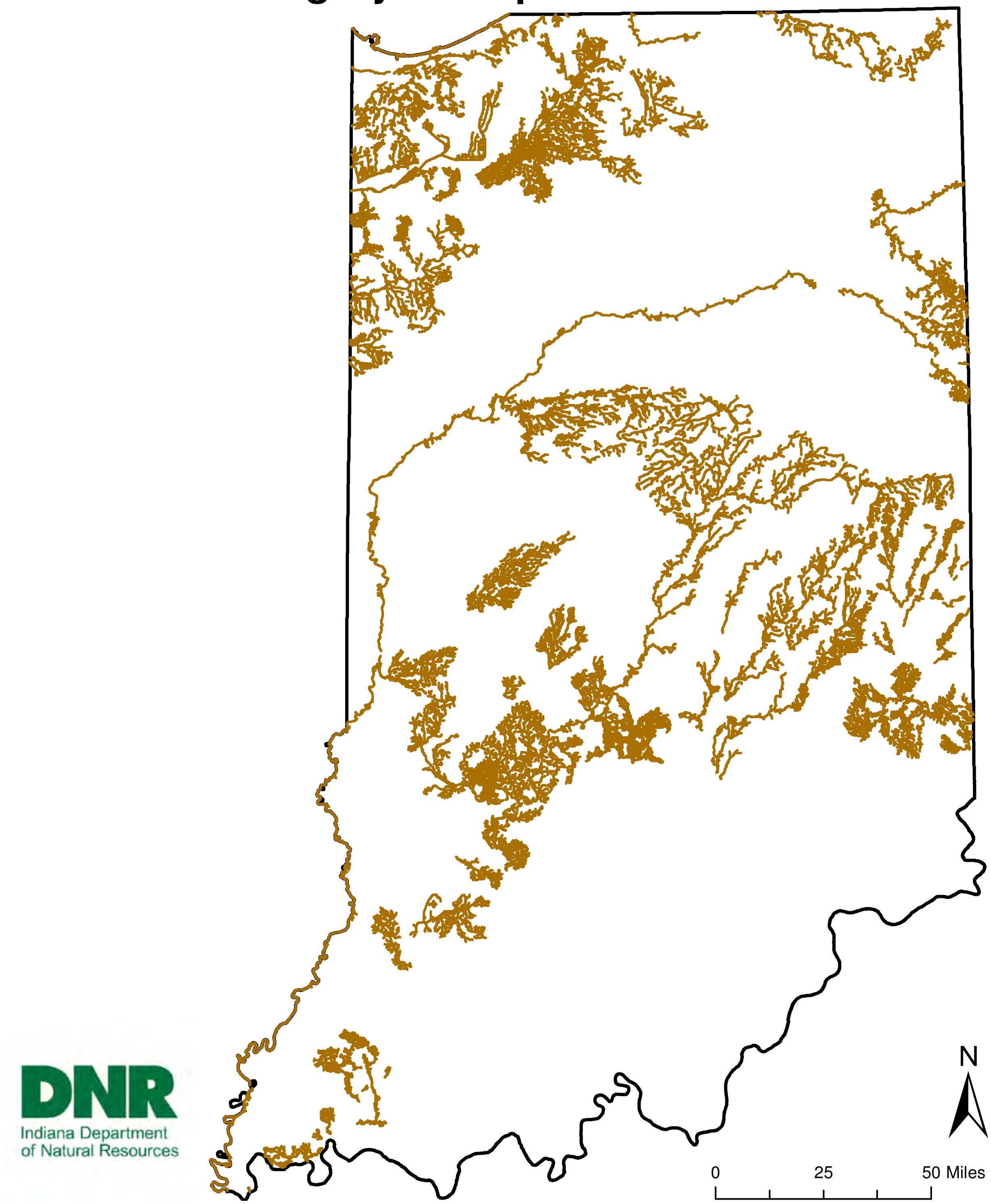


Figure 15. Category 4A impaired waters, (IDEM-IR, 2016)

Indiana Stream and Wetland Mitigation Program
Category 5 Impaired Waters

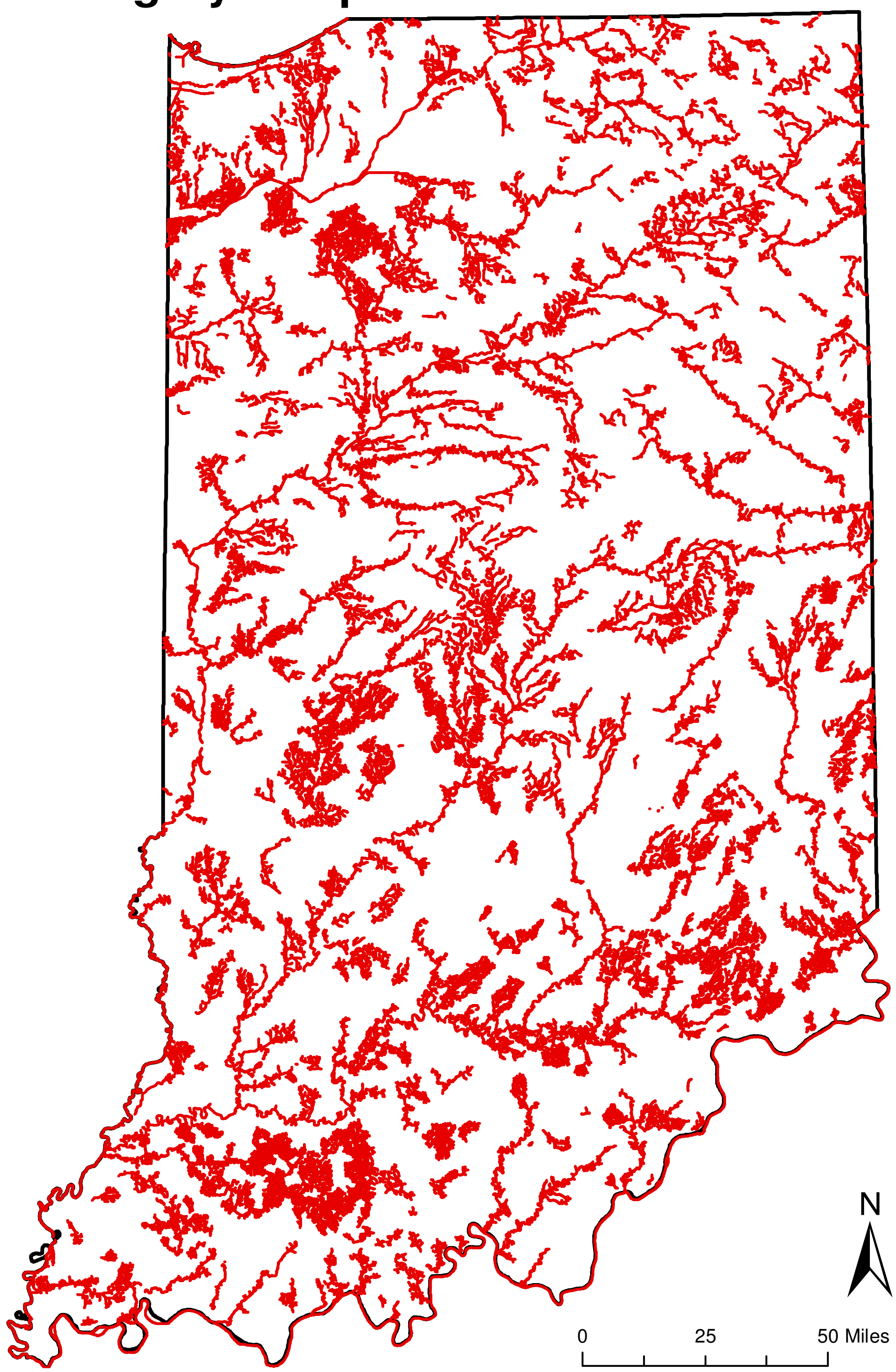


Figure 16. Category 5 impaired waters, (IDEM-IR, 2016)

A component to the QHEI is "bank erosion and riparian zone" which includes metrics for the width of the riparian zone, whether any erosion is present, and composition/land use of the flood plain. Floodplains with forested/swamp/wetland with no erosion and greater than 50 meter wide riparian buffer receiving the highest score for this particular metric. The ecological functions and services provided by forests are extremely important to the chemical, physical, and biological integrity of streams and other aquatic resources. Both forested uplands and aquatic resources such as forested wetlands and riparian areas provide ecological and hydrologic functions and services such as soil stabilization and development, stream bank stabilization, nutrient and contaminant filtering, peak runoff and flow attenuation, infiltration to ground water, ground and stream shading, and critical wildlife habitat (Brauman, Daily, Duarte, & Mooney, 2007). The significant reduction in Indiana's forested cover indicates that the ecological and hydrological functions and services that forests provide have been diminished. A reduction or lack of forested cover is a significant contributor to impaired aquatic resource functions and critical wildlife habitat conditions statewide.

To gain a better understanding of where diminished forest cover may be impacting the functions and services of Indiana's streams, a GIS analysis was completed to identify headwater streams with a forested riparian area width of less than 100 feet located within the agricultural settings of cultivated crops and pasture/hay per the 2011 NLCD (Homer, et al., 2015). Approximately 68,969,843 linear feet (13,062 miles) of headwater streams with a riparian corridor of less than 100 feet in width within an agricultural setting were identified (**Table 8**). This information will be used as an additional tool by IDNR when assessing and prioritizing potential stream mitigation projects.

Service Area Name	Potentially Restorable Headwater Streams (Linear Feet)
Calumet-Dunes	378,082
St. Joseph River (Lake MI)	1,220,086
Maumee	2,779,740
Kankakee	3,231,953
Upper Wabash	12,677,175
Middle Wabash	12,258,927
Upper White	4,122,307
Whitewater-East Fork White	11,818,126
Lower White	9,248,485
Upper Ohio	3,559,241
Ohio-Wabash Lowlands	7,765,720
Total	**68,969,843**

Table 8. Linear feet of potentially restorable headwater streams in Indiana with less than 100ft of riparian buffers within an agricultural setting. These numbers are estimates based on GIS evaluation completed by Ducks Unlimited

4.2 Wetlands

The Indiana Wetlands Program Plan identifies altered hydrology, impaired water quality, isolation and fragmentation of wetland habitats, invasive species, failed mitigation, and unaccounted functional losses as major concerns attributed to current wetland conditions in Indiana (IWPP, 2015). Current wetland degradation is attributed to agricultural activities, residential, commercial and industrial development, road construction, water development projects, groundwater withdrawal, loss of instream flows, water pollution, and vegetation removal (IDNR, 1996). In addition to significant historic loss, wetlands in Indiana continue to be lost at a rate of approximately one to three percent each year (Kim, Ritz, & Arvin, 2012).

IDEM routinely assesses water quality data on streams and lakes throughout the state, but does not collect assessment data for wetlands (IWPP, 2015). Additionally, Indiana does not currently have a fully implemented standardized assessment methodology, or water quality standards specific for wetlands (IWPP, 2015). Approximately 96% of Indiana's land is privately owned (IASWCD, 2016), making it more logistically difficult to conduct on-the-ground conditional assessments of wetlands as compared to streams. According to the Indiana Department of Administration's "State Property Facts at a Glance" dated May 2010, the State of Indiana only owns 1.7% (394,631 acres) of the total land, while the federal government owns approximately 2% (470,000 acres) (IDOA, 2010).

The most extensive database of the extent of wetland resources in Indiana is the National Wetlands Inventory (NWI). It was originally developed by the U.S. Fish and Wildlife Service (USFWS) in the 1980's (IWPP, 2015), updated in Indiana in 2009 by Ducks Unlimited (Ducks Unlimited, 2010), and was officially published for the public within the USFWS NWI Wetland Mapper in September of 2011 (USFWS NWI, 2015) (**Figure 17**). The updated NWI for Indiana utilized quality 2005 aerial photography and improved methodology while maintaining the Cowardin, *et al*. classification scheme (Ducks Unlimited, 2010), (Cowardin, Carter, Golet, & LaRoe, 1979). The updated NWI is more accurate in identifying wetland locations, extent, types and trends than the original 1980's version (IWPP, 2015).

As part of the 2009 NWI update for Indiana, Ducks Unlimited conducted a comparative analysis of the original and the updated NWI (Ducks Unlimited, 2010). The overall accuracy of the updated GIS NWI delineations based on field verifications was 86%. The overall accuracy of the updated wetland Cowardin classifications was 79%. There was a four year period of time between the 2005 aerial photography used for the NWI analysis and the 2009 field verifications, which may account for some of the misclassifications.

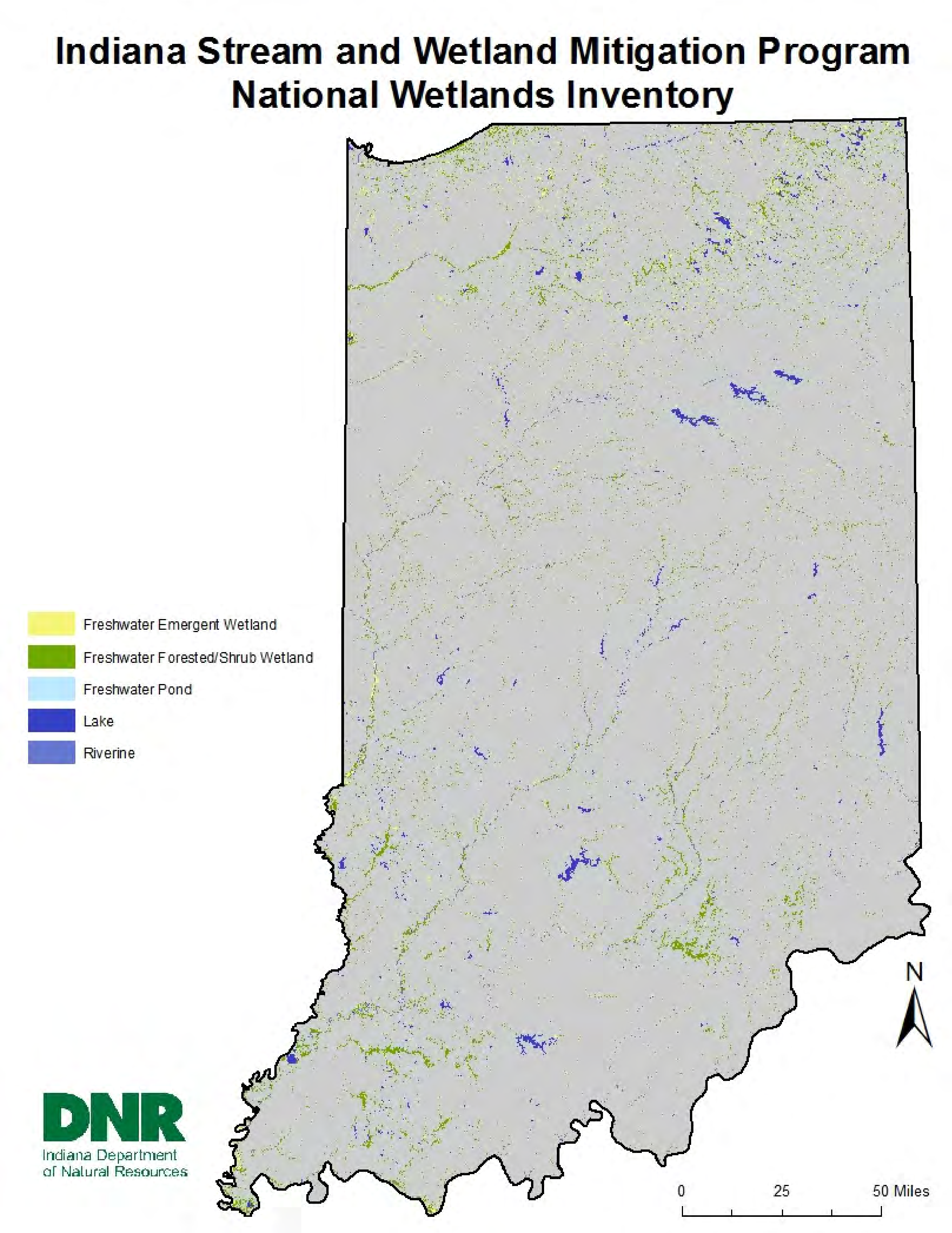


Figure 17. National Wetland Inventory for Indiana (USFWS NWI, 2015)

The total number of individually identified wetlands that were fully converted from the time of the original NWI of the 1980's to the time of the updated NWI in 2005 was 31,952, while 4,991 individual wetlands were partially converted (**Table 9**). The cumulative acreage of fully or partially converted wetlands totaled 45,416 acres (**Table 10**) at an average size of 1.23 acres. Agricultural land use accounted for 72% of wetland conversions and development was the second largest at 24%.

	Agriculture		Development		Recreation		Other		
	Number	%	Number	%	Number	%	Number	%	Total
Fully Converted	24,588	76.95%	6,109	19.12%	210	0.66%	1,045	3.27%	31,952
Partially Converted	2,529	50.67%	1,972	39.51%	144	2.89%	346	6.93%	4,991
Total	**27,117**	**73.4%**	**8,081**	**21.87%**	**354**	**0.96%**	**1,391**	**3.77%**	**36,943**

Table 9. Number of wetlands converted by conversion type (1980-88 to 2005)

	Agriculture		Development		Recreation		Other		
	Acres	%	Acres	%	Acres	%	Acres	%	Total
Fully Converted	25,023	79.2%	5,722	18.11%	369.8	1.17%	477.5	1.51%	31,593
Partially Converted	7,895.24	57.12%	5,090.9	36.83%	527.4	3.82%	309.59	2.24%	13,823
Total	**32,918.3**	**72.48%**	**10,814**	**23.81%**	**897.2**	**1.98%**	**787.03**	**1.73%**	**45,416**

Table 10. Acreage of wetlands converted by conversion type (1980-88 to 2005)

Emergent wetlands accounted for 56% of the total individual wetlands converted, with open water at 25% and forested wetlands at 13% (**Table 11**). Emergent wetlands accounted for 48% of the total converted wetland acreage, while converted forested wetlands accounted for 32% (**Table 12**). The individual size of a converted forested wetland was typically larger than that of a converted emergent wetland.

	Aquatic Bed		Emergent		Forested		Scrub-Shrub		Open Water		Shore		Other		
Converted	#	%	#	%	#	%	#	%	#	%	#	%	#	%	Total
Fully	**222**	**1%**	**19,285**	**60%**	**2,336**	**7%**	**1,094**	**3%**	**8,812**	**28%**	**149**	**0%**	**54**	**0%**	**31,952**
Partially	**30**	**1%**	**1,380**	**28%**	**2,559**	**51%**	**385**	**8%**	**607**	**12%**	**4**	**0%**	**26**	**1%**	**4,991**
Total	252	1%	20,665	56%	4,895	13%	1,479	4%	9,419	25%	153	0%	80	0%	36,943

Table 11: Number of wetlands converted by wetland class (1980-88 to 2005)

	Aquatic Bed		Emergent		Forested		Scrub-Shrub		Open Water		Shore		Other		
Converted	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	**Total**
Fully	**113**	**0%**	**18,392**	**58%**	**6,216**	**20%**	**2,072**	**7%**	**4,294**	**14%**	**177**	**1%**	**330**	**1%**	**31,593**
Partially	**20**	**0%**	**3,319**	**24%**	**8,328**	**60%**	**924**	**7%**	**489**	**4%**	**6**	**0%**	**737**	**5%**	**13,823**
Total	133	0%	21,711	48%	14,543	32%	2,996	7%	4,783	11%	183	0%	1,066	2%	45,416

Table 12. Acres of wetlands converted by wetland class (1980-88 to 2005)

There were a total of 60,346 additional individual wetlands added to the inventory totaling 102,486 acres (**Table 13**). Wetlands identified in the NWI update that were not in the original are not necessarily new wetlands. Rather the scale and quality of the 2005 aerial photography was better than that of the original, accounting for additional wetlands with an average size of 1.7 acres which was below the minimum size of the original NWI mapping scale (Ducks Unlimited, 2010).

	Aquatic Bed		Emergent		Forested		Scrub-Shrub		Open Water		Shore		Other		
Additional	%		%		%		%		%		%		%		Total
Acres	**419**	**0%**	**26,723**	**26%**	**6,450**	**6%**	**1,494**	**1%**	**43,479**	**42%**	**0**	**0%**	**23,922**	**23%**	**102,486**
Number	**387**	**1%**	**9,325**	**15%**	**1,677**	**3%**	**573**	**1%**	**48,124**	**80%**	**0**	**0%**	**260**	**0%**	**60,346**
Avg. Size Acres	**1.08**		**2.87**		**3.85**		**2.61**		**0.9**		**0**		**92.01**		**1.70**

Table 13. Number and acres of additional wetlands by wetland class (1980-88 to 2005)

Though additional individual wetlands were identified, and there was a gain in emergent wetland, aquatic bed and open water acres, there was a documented loss of forested, scrub-shrub, and shore wetlands (**Table 14** and **Table 15**). Open water accounted for the majority of the additional acres, though the individual waterbodies averaged under an acre in size, and were mostly small private pond or retention basins.

	Aquatic Bed		Emergent		Forested		Scrub-Shrub		Open Water		Shore		Other		Total
Number	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	
Converted	252	1%	20,665	56%	4,895	13%	1,479	4%	9,419	25%	153	0%	80	0%	36,943
Additional	387	1%	9,425	15%	1,677	3%	573	1%	48,124	80%	0	0%	260	0%	60,346
Total	**135**		**-11,340**		**-3,218**		**-906**		**38,705**		**-153**		**180**		**23,403**

Table 14. Net change in wetland numbers from 1980-88 to 2005

	Aquatic Bed		Emergent		Forested		Scrub-Shrub		Open Water		Shore		Other		Total
Acres	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	
Converted	133	0	21,711	48%	14,543	0%	2,996	7%	4,783	0%	183	0	1,066	2%	45,416
Additional	419	0	26,723	26%	6,450	6%	1,494	1%	43,479	42%	0	0	23,922	23%	102,486
Total	**285**		**5,012**		**-8,094**		**-1,503**		**38,696**		**-183**		**22,856**		**57,070**

Table 15. Net change in wetland acreage from 1980-88 to 2005

Additionally, regional wetland information is reported in the USFWS's Status and Trends of Wetlands in the Conterminous U.S, 2004 – 2009. The report indicates that Indiana is located within a region with the highest rate of freshwater wetland loss to upland, and also experienced a decline in emergent wetland area (Dahl T. , 2011).

Since there is currently a gap in ground-truthed wetland data in Indiana, it is important to quantify wetlands that have been converted to other land uses by evaluating mapped hydric and partially hydric soils in these areas to further demonstrate that there are major deficiencies in the potential of wetland functions and services in Indiana due to the extent of wetland conversion and loss. An IDNR wetlands analysis from 1991 estimated that Indiana had lost approximately 86 percent of historic wetlands, reduced from approximately 24.1 percent (5.6 million acres) of total land cover circa 1780, to 3.5 percent (813,032 acres) cover as of the 1980's (IDNR, 1996).

In order to determine the approximate amount of converted wetlands that are potentially restorable within the state of Indiana, hydric and partially hydric soils from the Soil Survey Geographic (SSURGO) Database (NRCS-USDA, 2016) within the footprint of the potentially restorable land cover types of cultivated crops and pasture/hay from the 2011 National Land Cover Database (Homer, et al., 2015) were analyzed. Existing PFO, PSS and PEM wetland acres from the NWI (USFWS NWI, 2015) mapped within agricultural land use cover were then removed to obtain a net of potentially restorable wetland acres. Based on this analysis, it is estimated that out of the 23,139,288 acres of Indiana's total land, approximately 4,046,664 acres (17.5%) are hydric and approximately 4,199,550 acres (18.2%) are partially hydric, of which 3,260,944 mapped hydric acres and 3,117,129 partially hydric acres are currently within the footprint of agricultural land use. Per the NWI, there are approximately 552,633 acres of PFO, PSS and PEM wetland types mapped within and/or that interestect the 2011 NLCD agricultural footprint which were then subtracted from the hydric and partially hydric soils total, resulting in a net of 5,825,442 acres of potentially restorable wetlands statewide (**Table 16**). This data analysis is a good starting point for further identifying loss of wetland functions and services, and for locating potential restoration sites. This information will be used as another potential tool when assessing and prioritizing for wetland mitigation projects, and has been analyzed further per each SA's current aquatic resource conditions discussion to identify above average concentrations of wetland loss while also contributing to the program's aquatic resource restoration goals and objectives for prospective wetland restoration opportunities.

	Hydric Soils w/in Ag. Land Use		Partially Hydric Soils w/in Ag. Land Use		PFO, PSS, PEM Wetlands from NWI w/in Ag. Land Use	Net Potentially Restorable Wetlands
Service Area	**Acres**	**% of SA**	**Acres**	**% of SA**	**Acres**	**Acres**
Calumet-Dunes	15,695	4.1%	13,629	3.5%	11,072	18,251
St. Joseph River	69,860	6.4%	171,975	15.8%	63,179	178,657
Maumee	136,627	16.6%	324,658	39.5%	19,979	441,306
Kankakee	549,179	28.7%	305,536	15.9%	45,872	808,844
Upper Wabash	1,038,235	23.5%	1,025,262	23.2%	108,193	1,955,304
Middle Wabash	494,339	14.3%	374,622	10.8%	77,676	791,286
Upper White	291,355	16.7%	382,861	22.0%	25,618	648,599
Whitewater-East Fork White	377,350	11.5%	462,763	14.1%	76,597	763,515
Lower White	146,847	5%	10,986	0.4%	63,334	94,500
Upper Ohio	7,177	0.4%	44,832	2.6%	8,215	43,794
Ohio-Wabash Lowlands	134,281	10%	3.37	0.0%	52,897	81,387
Statewide Total	**3,260,944**	**14.1%**	**3,117,129.09**	**13.5%**	**552,633**	**5,825,442**

Table 16: Potentially restorable wetlands within agricultural land use

4.3 Lakes, Reservoirs and Ponds

Indiana has more than 1,400 natural lakes, reservoirs, and ponds (IDEM-IR, 2016). The Indiana Clean Lakes Program (CLP) was created by IDEM in 1989, and is administered through a CWA Section 319(h) grant to Indiana University's School of Public and Environmental Affairs (SPEA) – IU Bloomington (Indiana Clean Lakes Program, 2016). The CLP is a statewide public lake management program consisting of components of public information and education, technical assistance, volunteer lake monitoring, lake water quality assessment, trophic state trends, aquatic invasive species monitoring (as of 2012), and coordination with other state and federal lake programs (Indiana Clean Lakes Program, 2016). The CLP has sampled over 500 lakes statewide, and all the information and data is available on the CLP website. The CLP provides all lake data to IDEM for use in CWA Section 305(b) assessments, 303(d) listings, and IR biennial reports (IDEM-IR, 2016). In addition, the CLP tracks trends in individual lakes, identifies lakes that need special management, and tracks water quality improvements due to industrial discharge and runoff reduction programs (Indiana Clean Lakes Program, 2016).

Many of Indiana's lakes, reservoirs and ponds have excessive nutrient concentrations, nuisance algae, excessive plant growth, as well as murky water and/or odor (IDEM-IR, 2016). These impairments have been greatly attributed to anthropogenic causes such as poorly managed agriculture, suburbanization of lakeshores, boating impacts and septic system discharges (IDEM-IR, 2016). A summary of designated use support for lakes and reservoirs from the 2016 IR is found in **Table 17**. A summary for Lake Michigan is found in the Calumet-Dunes Service Area.

Designated Beneficial Use	Total Size (acres)	Size Assessed (acres)	Percent Assessed	Size Fully Supporting (acres)	Size Not Supporting (acres)	Size Not Attainable (acres)
Full Body Contact (Recreational Use)	127,539	37,041	29%	29,035	8,006	0
Human Health and Wildlife (Fishable Use)	127,539	77,845	61%	27,290	50,555	0
Public Water Supply[1]	29,541	16,615	56%	230	16,385	0
Warm Water Aquatic Life (Aquatic Life Use)	127,539	10,379	8%	3,754	6,625	0

Table 17. Designated use support for freshwater lakes and reservoirs in Indiana from IDEM's 2016 IR and assessment database (IDEM-IR, 2016). [1]While all waterbodies in Indiana are designated for aquatic life and recreational uses, not all are designated for public water supply. There are a total of 29,541 lake acres designated for drinking water in Indiana

IDEM identifies nutrients as the number one cause of impairment to Indiana lakes and reservoirs. Additionally, pathogens (E.coli), thermal impacts, toxic organics (PCB's), metals (Mercury), mineralization, pH, and algae (chlorophyll-a) are also significant contributors to current lake impairments (IDEM-IR, 2016). The main sources impairing lakes and reservoirs include runoff (nonpoint source) from agriculture and animal feeding operations, industrial permitted discharges, acid mine drainage, combined sewer overflows, and urban-related runoff and storm water discharges (IDEM-IR, 2016). Lake impairment data from the IR and information from the CLP will be valuable prioritization tools utilized by IDNR for assessing and siting potential compensatory mitigation projects.

4.4 Ground Water and Surface Water Interaction

Though ground water is not directly regulated under Section 404 of the CWA, impacts to surface water resources, in addition to many other land use activities, affect the quantity and quality of groundwater (IDEM-IR, 2016). Conversely, groundwater quantity and quality often directly affect surface waters (Winter, Harvey, Frank, & Alley, 1998). Nearly all types of surface water interact with groundwater, either by surface waters recharging groundwater and/or groundwater discharging to surface waters (Winter, Harvey, Frank, & Alley, 1998). This interaction greatly influences both ground water driven hydrology for wetlands and base flow conditions for streams and rivers.

As part of 305(b) ground water assessments, the IDEM Ground Water Section identifies the following as the top ten priority contaminant sources: commercial fertilizer applications, confined animal feeding operations, animal manure applications, underground storage tanks, landfills constructed prior to 1989, septic systems, shallow injection wells (Class V), industrial facilities, materials spills (including during transport), and salt storage and road salting (IDEM-IR, 2016). The type of contaminants most commonly associated with groundwater contamination include inorganic pesticides, organic pesticides, halogenated solvents, petroleum compounds, nitrate, salinity/brine, metals, radionuclides, bacteria, protozoa and viruses (IDEM-IR, 2016).

IDEM identifies an aquifer's hydrogeologic sensitivity as the most significant risk factor when considering the degree of a contaminant's threat to groundwater (IDEM-IR, 2016). In order to estimate groundwater recharge rates in shallow unconsolidated aquifers, the Indiana Geologic Survey (IGS) with support and data from IDEM created a data set to support a statistical analysis and create a mapping tool to spatially represent recharge across Indiana (**Figure 18**) (Letsinger S. L., 2015). In order to support decision making where knowledge of sensitivity to aquifer contamination is desired, the IGS with support and data from IDEM created a data set and mapped near surface aquifer sensitivity in Indiana (**Figure 19**) (Letsinger S. , 2015). In conjunction with other watershed considerations, IN SWMP will consider groundwater recharge rates, especially those that are slow or sensative, when assessing and identifying wetland mitigation needs.

Additionally, significant surface and ground water withdrawal or interception can result in reduced groundwater recharge and base surface flows. Indiana's Water Resource Management Act (IC 14-25-7) requires the owners of significant water withdrawal facilities to register with the DNR and report water use on an annual basis. A "significant water withdrawal facility" (SWWF) is defined in the statute to mean "the water withdrawal facilities of a person that, in the aggregate from all sources and by all methods, has the capability of withdrawing more than 100,000 gallons of ground water, surface water, or ground and surface water combined in one (1) day." The IDNR Division of Water (DOW), Water Rights and Use Section currently maintains records of approximately 4,068 active SWWFs, representing about 7,204 ground-water wells and 1,351 surface water intakes (**Figure 20**) (IDNR DOW, 2016). SWWF's records as of 2015 are presented in each SA. The DOW Resource Assessment Section also has ongoing groundwater quantity assessment data collection and publications that may contribute to the IDNR's assessment and prioritization of compensatory mitigation projects. DOW groundwater assessments include base flow mapping to understand the groundwater-surface water connection for watersheds; groundwater potentiometric surface mapping used to map flow direction, recharge, discharge, and changes in static water levels over time; and consolidated (bedrock) and unconsolidated aquifer mapping used to show geologic materials characteristics, thickness of confining units, aquifer thickness, static water levels, well yield, typical well depths, and depth to aquifer resource.

Indiana Stream and Wetland Mitigation Program
Aquifer Recharge Near Surface

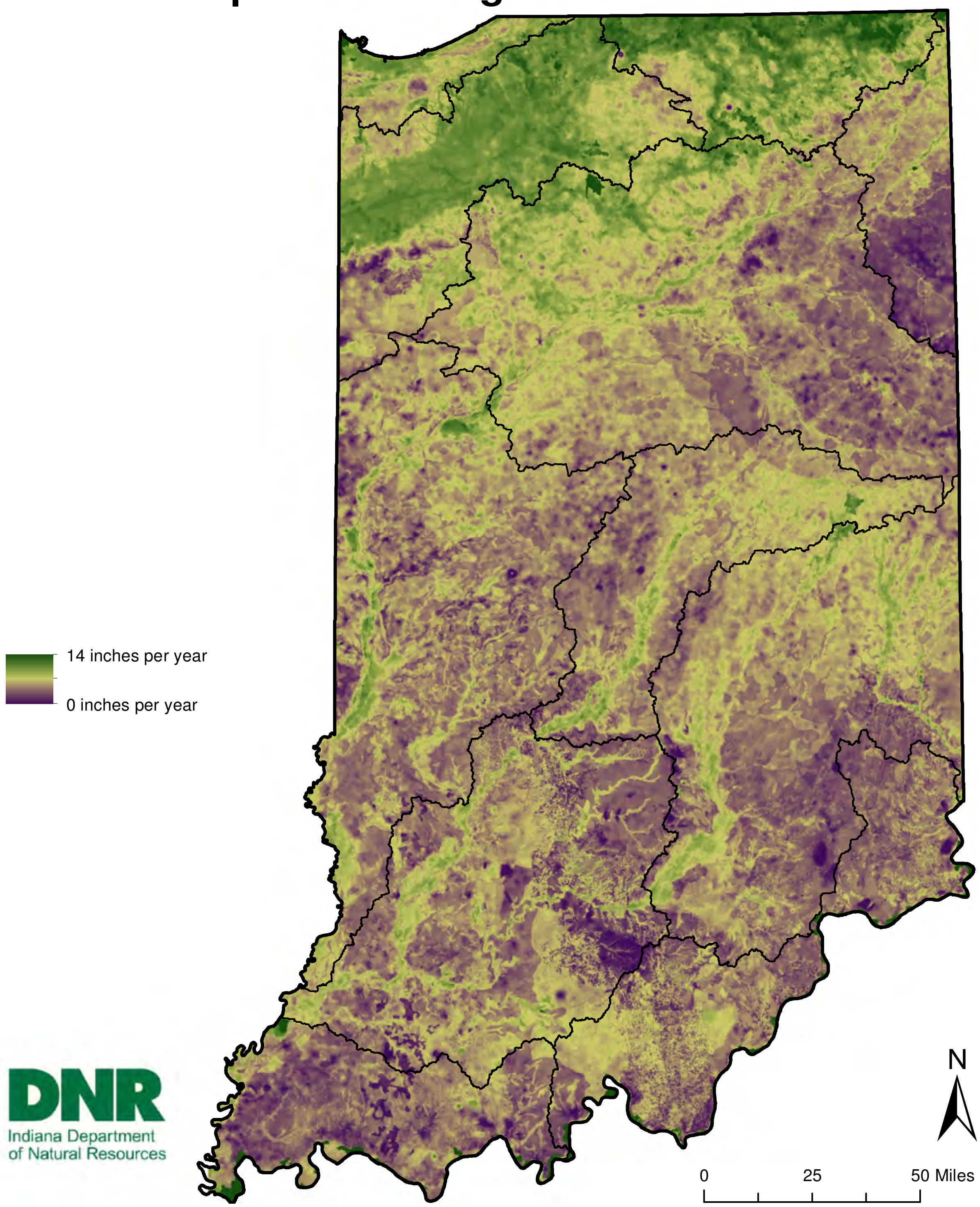


Figure 18. Groundwater recharge rates to shallow aquifers, Indiana Geological Survey (Letsinger S. L., 2015)

Indiana Stream and Wetland Mitigation Program
Aquifer Sensitivity Near Surface

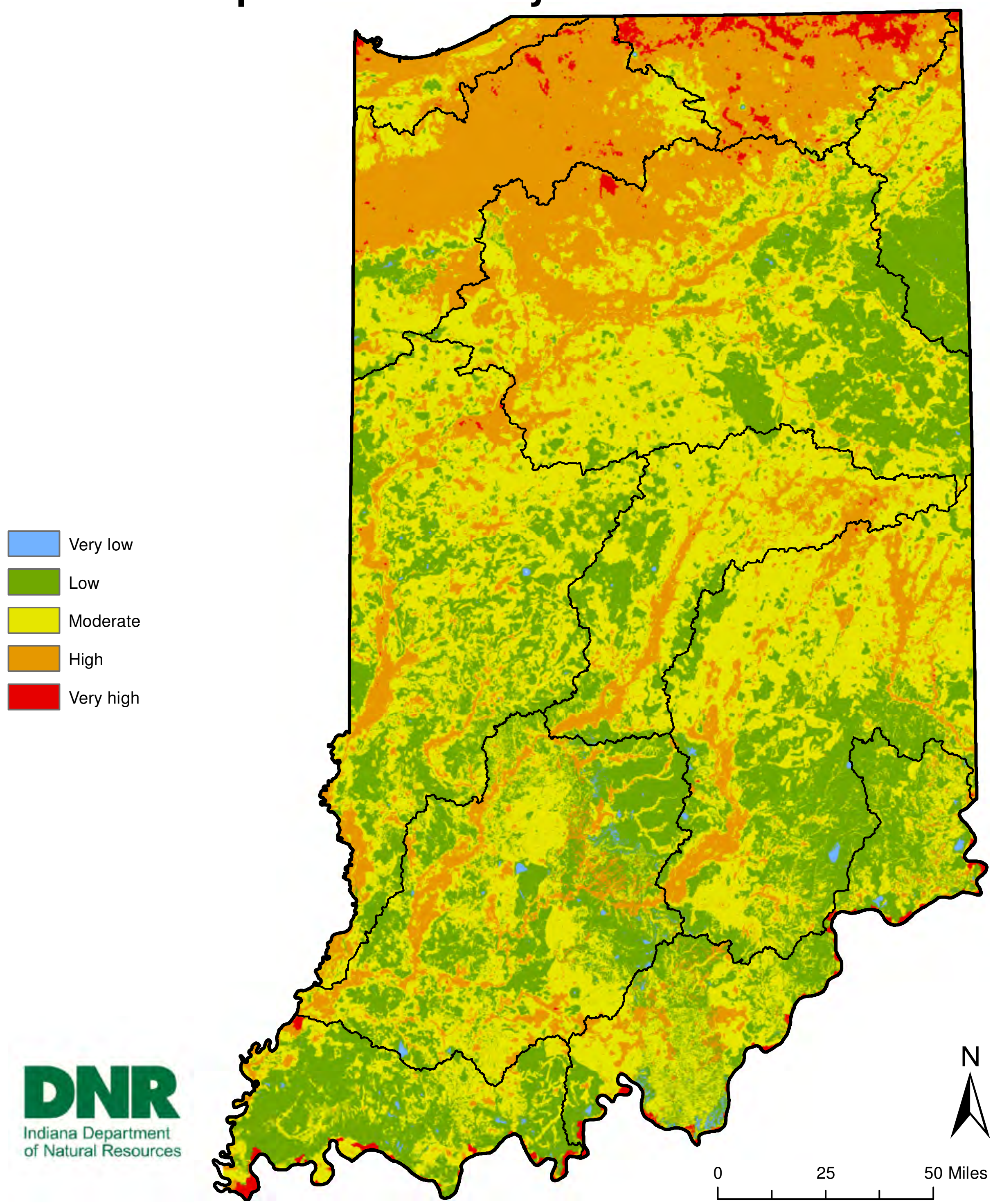


Figure 19. Aquifer sensitivity in shallow aquifers, Indiana Geological Survey (Letsinger S. , 2015)

Indiana Stream and Wetland Mitigation Program
Registered Significant Water Withdrawal Facilities

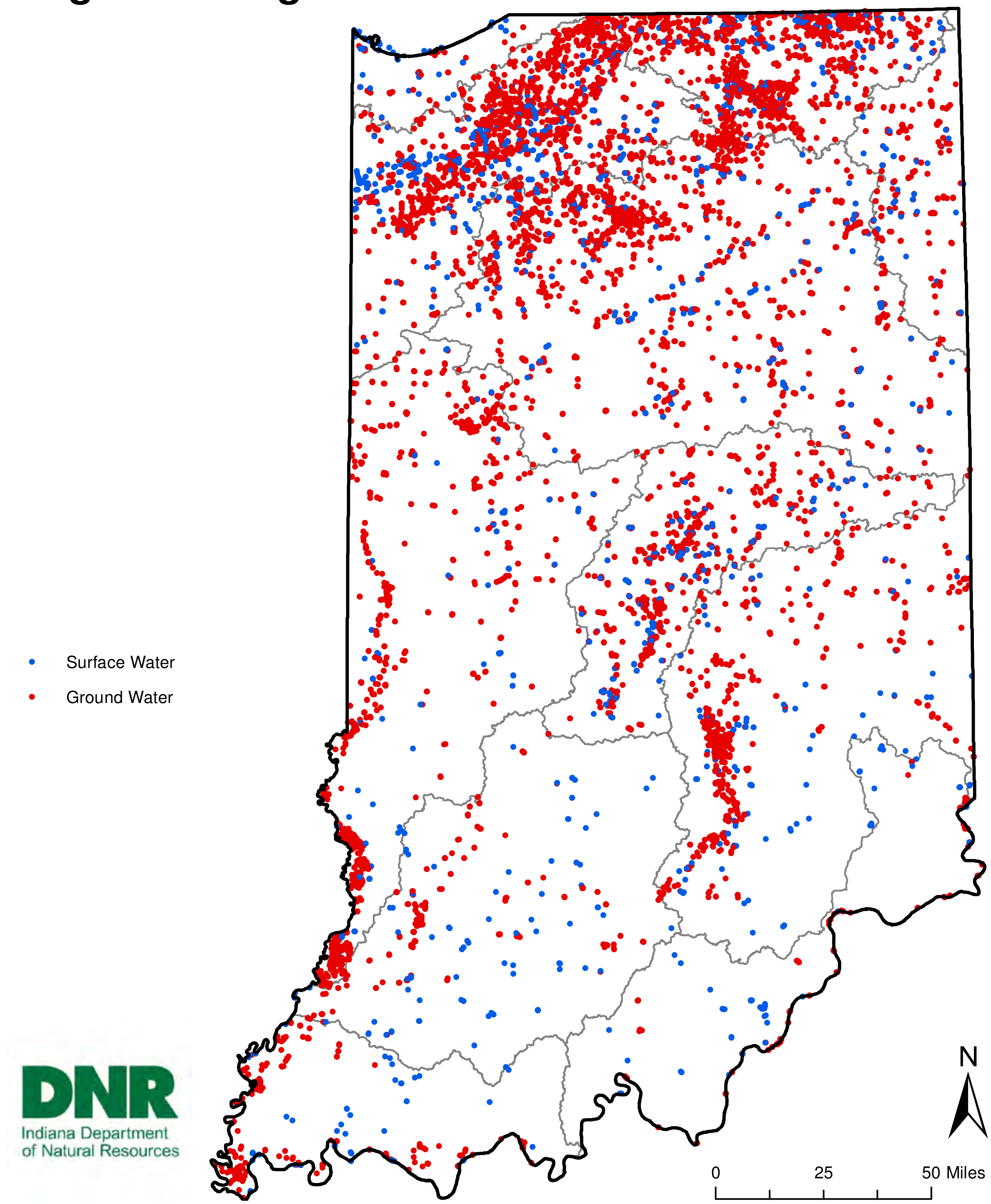


Figure 20: Registered Significant Water Withdrawal Facilities – 2015 (IDNR DOW, 2016). Capacity of 100,000 gallons per day for both ground water and surface water

4.5 Invasive Species

As a result of habitat conversion, fragmentation and degradation of aquatic resources, there has been a decline in the number and diversity of native aquatic/wetland and terrestrial plant species, including many that have been extirpated (Amlaner & Jackson, 2012). Part of this reduction is also due to the introduction of non-native, invasive species such as purple loosestrife, glossy buckthorn, and Eurasian strains of common reed and reed canary grass, among a host of others (Amlaner & Jackson, 2012). In response to this increasing problem, the Legislative Council of the Indiana General Assembly directed the Natural Resources Study Committee to investigate invasive species issues which resulted in the creation of the Invasive Species Task Force (ISTF) in 2007 (Indiana Invasive Species Council, 2008). In 2009, based on the recommendation of the task force, the Indiana General Assembly established the Indiana Invasive Species Council (IISC) within the Purdue University College of Agriculture to enhance the ability of the state agencies to detect, prevent, monitor and manage new and long established invasive species (IC 15-16-10 – Invasive Species Council). Among many other efforts within their mission, the IISC maintains an official invasive plant list which ranks invasiveness and provides current IN legal status (IISC, 2016).

Invasive plants in Indiana are referred to in statutes as exotic weeds, noxious weeds and detrimental plants. Jurisdiction over invasive plant species is divided between the Department of Natural Resources (IC 14-24-2-1), Office of Indiana State Chemist (IC 15-15-1-14, 18, 20, 25, 40, 41), County Weed Boards (IC 15-16-7-2), and township trustees (IC 15-16-8-12). Per the ISTF, though invasive species are well documented and rapidly increasing in the state, little is known on the current locations (exact distributions) since there is currently no agency responsible for tracking invasive plant locations in Indiana; and just as importantly, where they are not (Indiana Invasive Species Council, 2008). In response to this shortfall, the IISC implemented Report IN in 2014, which is a system for reporting invasive species in Indiana to include plants, insects, diseases and wildlife (IISC, 2016). Report IN is managed through the Early Detection and Distribution Mapping System (EDDMaps), a web-based system for reporting and documenting invasive species distribution (IISC, 2016). Reports can be made on a computer and on the Great Lakes Early Detection Network (GLEDN) smartphone application, with all data maintained in the EDDMaps database (Jacquart, 2014). Report IN will be used to map invasive species distribution, track their movement, and to facilitate early detection and appropriate responses (Jacquart, 2014). Report IN will gain value as more users report invasive species over time, and could prove to be a useful tool for IN SWMP.

Invasive species such as *Phragmites australis* (common reed) and *Phalaris arundinacea* (reed canary grass), along with many other species, degrade much of the wetlands left in the state, reducing biodiversity and natural habitats available for fish and wildlife (Indiana Invasive Species Council, 2008). Invasive plants also negatively impact Indiana's forests and riparian areas by outcompeting native flora, reducing tree and understory growth rates, threatening biodiversity, and degrading natural habitats (Indiana Invasive Species Council, 2008). The state's prairie flora is among the most reduced in number, and almost no areas that were formally prairie have reverted (Amlaner & Jackson, 2012). Most prairie species can still be found, but in scattered, very small remnants that are threatened by herbicides and by non-native species (Amlaner & Jackson, 2012). Additionally, Indiana's aquatic resources are generally rich with nutrients, enabling aquatic invasive species to grow quickly and outcompete native species (Indiana Invasive Species Council, 2008).

As of 2005, there were approximately 899 non-native species of flora documented in Indiana (Amlaner & Jackson, 2012). Approximately 400 native plant species are threatened with decline and possible extirpation from the state, and over 50 species are thought to already be extirpated (Amlaner & Jackson, 2012). The conversion of natural habitats due to the major anthropogenic activitiy categories outlined in this CPF has had significant adverse impacts on fish, wildlife and native botanical resources, and the present extent of these land uses strongly influence invasive species ability to expand in Indiana (Amlaner & Jackson, 2012).

4.6 Preservation of Indiana's Aquatic Resources and Natural Communities

Though the chemical, physical and/or biological integrity of the majority of Indiana's aquatic resources, in addition to the functions and services they provide, are impaired in some way, there are still high quality natural aquatic and upland communities (buffers), and waterbodies that are designated for increased protection. Though the precise extent of all wetland types and locations in Indiana is not known, a group of wetland types known as 'Rare and Ecologically Important Wetland Types' receive priority protection in Indiana under IC 13-11-2-25.8(a)(3)(B) and 327 IAC 17-1-3(3)(B). These wetlands are located in an undisturbed or minimally disturbed setting that supports more than minimal wildlife, aquatic habitat, and/or hydrologic function and include acid bog, acid seep, circumneutral bog, circumneutral seep, cypress swamp, dune and swale, fen, forested fen, forested swamp, marl beach, muck flat, panne, sand flat, sedge meadow, shrub swamp, sinkhole pond, sinkhole swamp, wet floodplain forest, wet prairie, and wet sand prairie.

These rare and ecologically important wetland types also coincide with the natural wetland communities documented in the Indiana Natural Heritage Data Center (NHD), which represents a comprehensive attempt to determine the state's most significant natural areas through an extensive statewide inventory. Indiana has an exceptionally diverse selection of natural habitats, which in turn support high species diversity. To assure adequate methods for evaluating this information and setting sound land protection priorities, the program is designed to provide information about:

- Natural ecosystems
- Endangered, threatened, special concern and rare flora and fauna species
- Landscape features

The Heritage database contains the most comprehensive and up-to-date data with more than 1,000 records of federally endangered species; more than 12,000 records of state-listed species, and more than 1,300 records of high-quality natural communities. The NHD also contains records for more than 700 significant natural areas in the state.

With the dedication of Meltzer Woods, the last unprotected old growth forest in Shelby County, as a nature preserve (NP) on May 19, 2016, Indiana has tallied a total of 50,000 acres protected through dedication as state nature preserves. Indiana's system of nature preserves was established in 1967 with the Nature Preserves Act, IC 14-31, passed by the Indiana General Assembly. The act's purpose is to identify, protect and manage an array of nature preserves and natural areas in sufficient numbers and sizes to maintain viable examples of all of Indiana's natural communities. The IDNR Division of Nature Preserves also manages and maintains viable populations of endangered, threatened and rare species.

The Healthy Rivers INitiative (HRI) was launched in 2010 as the largest land conservation initiative undertaken in Indiana. The initiative includes a partnership of resource agencies and organizations who are working with willing landowners with a goal to permanently protect over 43,000 acres located in the floodplain of the Wabash River and Sugar Creek in west-central Indiana, and over 26,000 acres in the Muscatatuck River bottomlands in southeast Indiana.

These projects involve the protection, restoration and/or enhancement of riparian and aquatic habitats and the species that use them, particularly threatened and endangered species, migratory birds and waterfowl. This initiative also helps to reduce nutrient inputs, connect fragmented habitats, provide flood protection to riparian landowners, and provide increased public access for recreational opportunities. As of 2016, through conservation easements and land acquisition, the HRI has permanently protected over 33,000 acres in the three project areas since 2010.

Additionally, Indiana possesses higher quality streams and rivers documented in statute and rule with more stringent protections, such as the following:

- Indiana Designated Salmonid Waters: 327-IAC-2-1.5-5(a)(3)
- Indiana Designated Outstanding State Resource Waters, all or partially: IC-18-3-2(u), 327 IAC 2-1.3-3(3)(d) and 327 IAC 2-1.5-19(b)
- State Designated Scenic Rivers: 312 IAC 7-2
- State Navigable Waterways: IC 14-29-1

ELEMENT 5. Aquatic Resource Goals and Objectives

The principal goal of the IN SWMP is to provide compensatory mitigation to satisfy IDNR's responsibilities taken on by the sale of mitigation credits to fulfill Corps and/or IDEM permit requirements through restoration, establishment, enhancement, and/or preservation of aquatic resources within the state.

Service area specific goals and objectives are tailored to address unique aquatic resource threats within each of the 11 respective boundaries and are detailed within the respective service area section.

The following **aquatic resource goals and objectives** apply to all service areas:

1. Implement compensatory mitigation projects that improve the quality of aquatic resources within each service area, utilizing a watershed approach, to help offset the predominant statewide threats to Indiana's aquatic resources while also helping to offset unique threats identified in each service area.
2. Establish mitigation projects that contribute to high priority conservation objectives for stream and wetland habitats outlined in Indiana's State Wildlife Action Plan, the Indiana Wetland Program Plan, and/or other state or regional conservation initiatives for Indiana's aquatic resources and dependant habitats.
3. Reduce stream and wetland habitat fragmentation by establishing mitigation projects that improve connectivity by providing critical linkages to exiting conservation areas and/or corridors.
4. Replace wetland and stream types that have experienced historic loss within each service area, while recognizing current hydrological and geomorphological conditions, and establish mitigation projects in areas within each service area that have experienced significant losses of function and services due to the identified threats.
5. Implement projects that can address sources of impairment identified in IDEM 305b reports, 303d list, Total Maximum Daily Load (TMDL) reports, watershed management plans, watershed restoration action strategies and other applicable water quality assessment data, when determined to be feasible, non-detrimental to mitigation success, and mutually beneficial to the aquatic resource restoration objectives.
6. Restore and enhance aquatic habitats on existing and/or adjacent to conservation lands while ensuring long-term management, funding and protection in perpetuity fulfills all requirements set forth in the Federal Mitigation Rule under applicable sections of 33 CFR §332.3; and 33 CFR §332.8.
7. Preserve rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
8. Contribute to ongoing water quality initiatives by working closely with public and private stakeholders at the statewide and service area level.

Project specific goals and objectives will be developed for each mitigation project in which will be evaluated by the Corps and IRT for each individual mitigation proposal. The project specific goals and objectives shall be tailored to address the current site conditions, site constraints, and specific objectives that will help offset threats to Indiana's aquatic resources identified in this document and/or watershed plans. Additionally, the individual mitigation proposal will provide for measurable success of project initiatives and have project-specific performance criteria.

ELEMENT 6. Prioritization Strategy

6.1 Statewide Project Prioritization

IN SWMP projects in all service areas will effectively replace lost aquatic resource functions due to permitted physical impacts. The main goal of mitigation projects within each service area is to restore streams and wetlands as compensation for adverse impacts to aquatic resources permitted through Section 10 of the Rivers and Harbors Act, Sections 401 and 404 of the Clean Water Act (CWA), and Indiana's State Isolated Wetlands law (Indiana Code 13-18-22).

IN SWMP's strategy for project prioritization will adhere to all applicable requirements set forth in the Federal Mitigation Rule, *Federal Register 33 CFR §332.3 & 33 CFR §332.8*. Mitigation project site selection in all service areas will utilize a watershed approach in order to achieve IN SWMP's aquatic resource goals and objectives by selecting projects that will help offset the threats to Indiana's aquatic resources, as described in Element 2, historic loss as described in Element 3, and/or current impaired conditions as described in Element 4. Based on a landscape-watershed approach to aquatic resource restoration, if an approved watershed management plan(s) (WMP) and/or TMDL(s) exist within the service area in which the impact occurred, these plans will be consulted when selecting a mitigation project site to determine if the potential project will assist in fulfilling the goals and objectives of those plans. Likewise, any other applicable data may be utilized to assist in site selection decision making and prioritization.

Aquatic resource impact types that are permitted to utilize IN SWMP for compensatory mitigation will be considered in the selection and implementation of mitigation projects. IDNR will consider compatibility of restoration sites for in-kind replacement and historic aquatic resource loss while considering current conditions. This approach will have the greatest likelihood to effectively replace lost aquatic resource functions and services resulting from permitted impacts, historic loss and/or current impaired conditions.

IDNR will target compensatory mitigation projects that will help to improve the quality and quantity of aquatic resources while helping to address the unique needs within each service area. Priority will be given to project sites that have the greatest increase in ecological functions and services with re-establishment providing the highest level of compensation followed by rehabilitation, establishment, enhancement and then preservation.

6.2 General Criteria for Mitigation Site Identification and Selection

Numerous criteria are involved in the identification of mitigation sites including hydric soils and characteristics, topography, land use trends, ecological benefits, population/growth and development trends, wetland inventory data, protected lands, surrounding geography and landscapes, and physiographic regions.

The **four steps below** present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each service area.

When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the service area, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within that service area and/or watershed utilizing the landscape-watershed approach for site selection.
3. Project proposals will consider how to help offset the anthropogenic threats to aquatic resources, historic loss, and/or current impaired conditions while achieving IN SWMP goals and objectives, within each service area.
4. Other evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value (services), and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

ELEMENT 7. Preservation Objectives

According to the federal mitigation rule (33 CFR §332.3 (h)), preservation is defined as the removal of a threat to, or preventing the decline of, aquatic resources; this includes activities associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms and does not result in a gain of aquatic resource area or functions.

Under the IN SWMP, preservation actions will be consistent with the watershed approach to protecting aquatic resources. The main objective of preservation mitigation projects is to permanently protect existing waters having a significant contribution to conservation needs within a service area.

Reference to Indiana's current SWAP should be made when identifying habitat threats and management goals; these plans will help determine where greatest preservation and conservation efforts are needed in the state. Consultation with local land trust organizations will be conducted to locate preservation opportunities. Preservation strategies will be based on their ability to relieve these threats and the importance of the resource to the watershed and/or State.

Preservation will be used to provide compensatory mitigation when the following criteria are satisfied (33 CFR §332.3 (3) (h)):

1. The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
2. The resources to be preserved contribute significantly to the ecological sustainability of the watershed;
3. Preservation is determined by the District Engineer, in consultation with the IRT, to be appropriate and practicable;
4. The resources are under threat of destruction or adverse modifications;
5. The preserved sites will be permanently protected though an appropriate legal instrument.

ELEMENT 8. Public and Private Stakeholder Involvement

The IDNR will work diligently with private landowners, federal and state agencies, other conservation organizations, non-governmental organizations, academic institutions, local governments, watershed councils and associations, professional societies, universities, and public land agencies to meet the requirements of the Instrument. Individual mitigation projects will be implemented on private and public lands, and IDNR believes stakeholder involvement will be important to the success of the program. The IDNR will work closely with partners to deliver quality mitigation projects. Since the majority of land in Indiana is privately owned, there will need to be a cooperative effort between private land owners and public agencies.

Potential partners and stakeholders include, but are not limited to:

Federal Agencies

- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- U.S. Department of Agriculture (NRCS)
- U.S. National Park Service
- U.S. Forest Service
- U.S. Department of Transportation
- Federal Emergency Management Agency (FEMA)
- National Oceanic and Atmospheric Administration (NOAA)

State Agencies

- Indiana Department of Environmental Management
- Indiana Department of Natural Resources
- Indiana Department of Transportation
- Indiana State Chemist Office
- Indiana Department of Health
- Indiana State Department of Agriculture
- Indiana Geological and Water Survey
- Indiana Natural Resource Commission
- Indiana Department of Homeland Security

- Adjoining state governments (shared watersheds)

<u>Other Organizations</u>

- Conservation organizations (Local land trusts, Ducks Unlimited, The Nature Conservancy and similar conservation organizations)
- Indiana Association of Soil and Water Conservation Districts (SWCDs)
- Indiana Association of Regional Councils (IARC)
- Municipal and county governments
- Municipal Separate Storm Sewer Systems (MS4) Entities
- River Basin Commissions
- Conservancy Districts
- Indiana Silver Jackets
- Indiana Conservation Partnership
- Landscape Conservation Cooperative Network (Eastern Tallgrass Prairie and Big Rivers, Upper Midwest and Great Lakes, and Appalachian LLC's)
- Universities
- Active Watershed Management Groups
- Indiana Water Monitoring Council
- Indiana Water Resource Association
- Indiana Clean Lakes Program
- Indiana Invasive Species Council
- Private landowners

In addition to these agencies and organizations, IDNR will conduct public outreach activities to educate the public regarding the mitigation program and to seek local involvement in identifying mitigation projects. The public will also have an opportunity to comment on IN SWMP projects during the public comment period laid out in 33 CFR §332.8(d)4 when mitigation plans are submitted to the District Engineer; participation by the public in this process will be greatly encouraged by the IDNR during each public comment period.

Partners will be able to provide knowledge of the local area and help locate and identify areas for mitigation projects, assist with the development and implementation of monitoring programs, own mitigation sites and provide long-term management for sites they will own.

Additionally, IN SWMP will utilize appropriate existing and future U.S. regional, statewide, and/or state regional planning and guidance documents that were created with significant stakeholder involvement. For example, as part of IDEM's Indiana Wetland Program Plan, a tool was developed for identifying and mapping high priority wetlands conservation sites (HPWCS) (IWPP, 2015). The intention of this tool is to improve tracking of existing high quality wetland sites and target them for protection (including appropriate buffers). In addition, certain wetlands and geographic areas have been identified as priorities due to ecological significance, high potential benefit, or other needs. IN SWMP provides maps of existing high priority aquatic resource conservation areas within each SA. An additional tool that IDNR can utilize is “Potential Wetland Restoration Sites” which was created by IDEM and included as part of the IWPP.

ELEMENT 9. Long-Term Protection and Management Strategies

IDNR shall be responsible for developing and implementing a long-term protection and management plan for each IN SWMP project. IDNR may utilize existing publicly owned property or secure property for inclusion to the public trust. Projects implemented on publicly owned property or property that will be transferred to public ownership shall be protected and managed through appropriate real estate instruments or other mechanisms approved by the District Engineer (DE) and as required by 33 CFR 332. IDNR may also utilize privately-owned properties and will record real estate instruments to guarantee protection of privately-owned properties. Long term management of privately-owned properties will be transferred to an appropriate natural resource management entity with a plan approved by the DE in consultation with the IRT.

IN SWMP projects will be designed, to the maximum extent practicable, to require minimal long-term management efforts once performance standards have been achieved. IDNR shall be responsible for maintaining IN SWMP program projects consistent with the mitigation plan to ensure long-term viability as functional aquatic resources. IDNR shall retain responsibility, unless and until, the long-term management responsibility is formally transferred to a long-term manager with Corps approval. The long-term management plan developed for each IN SWMP project will include a description of anticipated management needs with annual cost estimates and an identified funding mechanism (such as non-wasting endowments, trusts, contractual arrangements with future responsible parties, or other appropriate financial instruments). Other voluntary management activities may be considered as long as no detrimental effects to the mitigation project are realized. Reference to 33 CFR §332.7 (d) shall be made when determining the long-term management plan for each mitigation project.

The final mechanism for long-term protection and management shall be submitted to the IRT for review, and approval will be made by the DE in consultation with the IRT prior to the release of mitigation project credits.

ELEMENT 10. Periodic Evaluation and Reporting

Every 5 years, the IDNR will submit a program findings/evaluation report to the District Engineer (DE) and the IRT as a supplement to the Annual Program Report; this report will address how the goals and objectives set forth in the Instrument are being met in terms of site selection and project implementation.

The report may also include any proposed changes to the Compensation Planning Framework. A review of the resources used to create the Compensation Planning Framework will be conducted during the evaluation. Requested changes to the Compensation Planning Framework will be submitted as an amendment to the Instrument for approval by the DE in consultation with the IRT.

The following sections provide Service Area specific information, details on the status of the aquatic resources, and the specific compensatory mitigation approach and priorities.

APPENDIX B.1 CALUMET-DUNES SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION

The Calumet-Dunes Service Area (SA) is located in the most northwestern portion of Indiana and borders Lake Michigan. It includes all or portions of the following 8-digit HUCs:

- 04040001 – Little Calumet-Galien
- 07120003 – Chicago

The Calumet-Dunes SA includes portions of the four Indiana counties listed below in the Lake and Northern Moraine physiographic region. A fraction of Lake, Porter, and LaPorte Counties are also split with the Kankakee SA, while the majority St. Joseph County lies within the St. Joseph River SA.

Lake	Porter	LaPorte	St. Joseph

The Calumet-Dunes SA is located in two ecoregions; the western portion is located in the Central Corn Belt Plains; the eastern portion is located in the Northern Indiana Drift Plains. The western portion of the SA is characterized by its beach ridges, marshy swales, and sand dunes; the eastern portion of the SA contains higher dunes, greater woodlands, lower relief, and less urban-industrial activity than the western portion of the SA. In addition, the eastern portion is characterized by its sandy coastal strip with beaches, beach ridges, and swales (U.S. EPA: Ecoregions of Indiana). The Calumet-Dunes SA is located within the SWAP Great Lakes Planning Region (SWAP, 2015).

Little Calumet-Galien Watershed (HUC-04040001) within Indiana drains approximately 512 square miles (327,680 acres) into Lake Michigan (Northwestern Indiana Regional Planning Commission), while the Chicago Watershed (HUC-07120003) drains 90 square miles (57,600 acres) into the Illinois River; in total, the Calumet-Dunes SA spans approximately 602 square miles, or 385,280 acres, and is the smallest of all 11 SA's.

Based on the 2011 NLCD (Homer, et al., 2015), the land cover type with the most area in the Calumet-Dunes SA is developed and impervious land use (42.76%), followed by agricultural land use (20.33%), forest and shrub/scrub (17.98%), and wetlands and open water (12.06%). Woody wetlands are the prominent wetland type and range from approximately 6.3% of the total SA cover per the NWI, up to 10% per the 2011 NLCD. Emergent herbaceous wetlands range from approximately 0.7% per the NWI to 2.7% per the 2011 NLCD.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Calumet-Dunes SA (SA) have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Calumet-Dunes SA from 2009 – 2015 was collected and analyzed (**Table 18**). According to the data, 113 acres of impacted wetlands and 18,579 linear feet of impacted streams required mitigation during the period of analysis.

The transportation and service corridor work type accounted for the most stream impacts (85%), followed by development (15%). There were no documented stream impacts requiring mitigation for agricultural land uses, dam related activities, or energy production and mining for this time period in this SA.

Development accounted for the most wetland impacts (58.34%), followed by transportation and service corridors (41.66%). There were no documented wetland impacts requiring mitigation for agricultural land uses, dam related activities, or energy production and mining for this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 21**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	0	0.00%	0	0.00%
Development	2,707	14.57%	65.98	58.34%
Energy Production	0	0.00%	0	0.00%
Transportation and Service Corridors	15,872.42	85.43%	47.12	41.66%
Grand Total	**18,579.42**	**100.00%**	**113.1**	**100.00%**

Table 18. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015. Source: USACE Louisville, Detroit and Chicago Districts

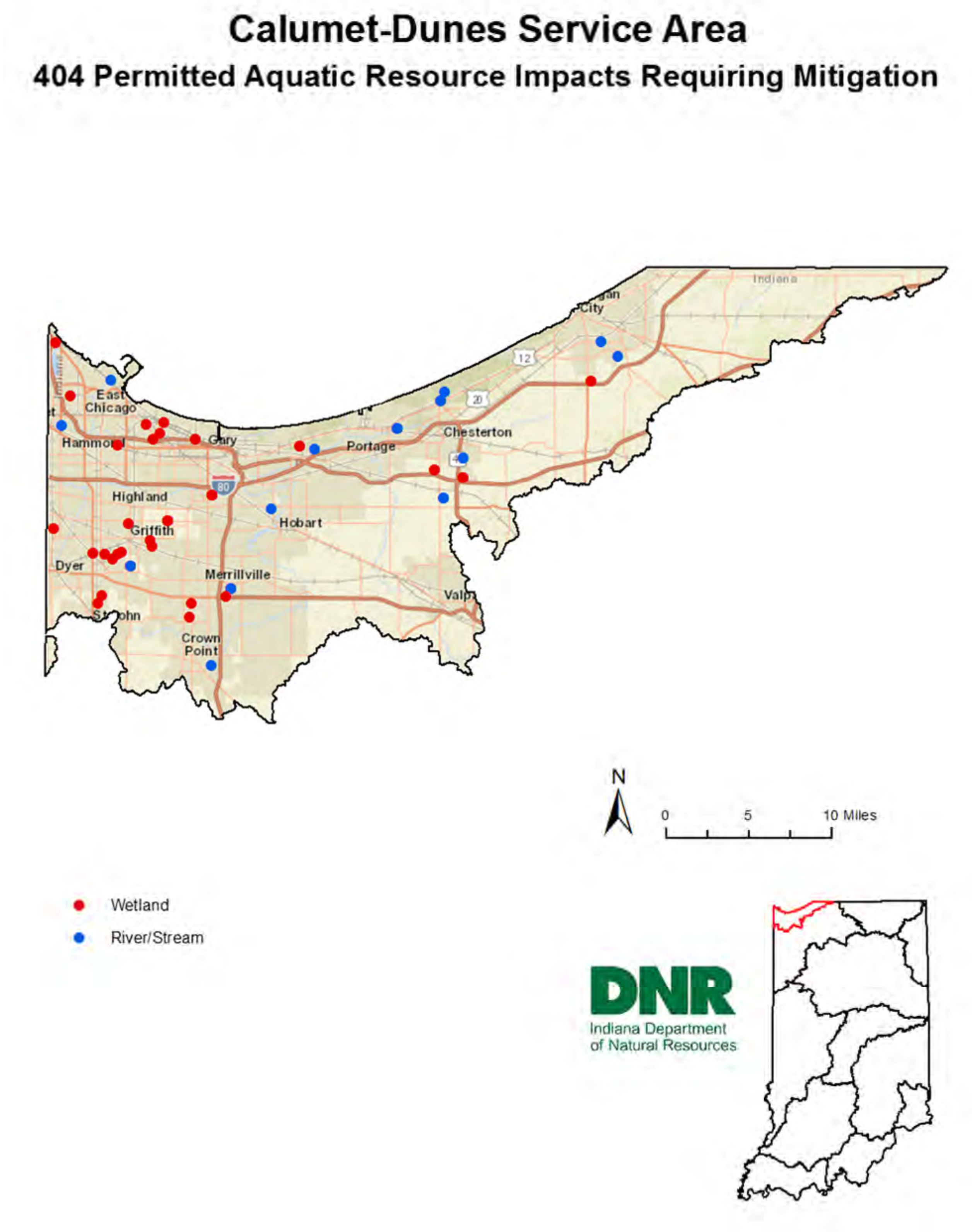


Figure 21. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD (Homer, et al., 2015) to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Calumet-Dunes SA is presented in **Figure 22,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

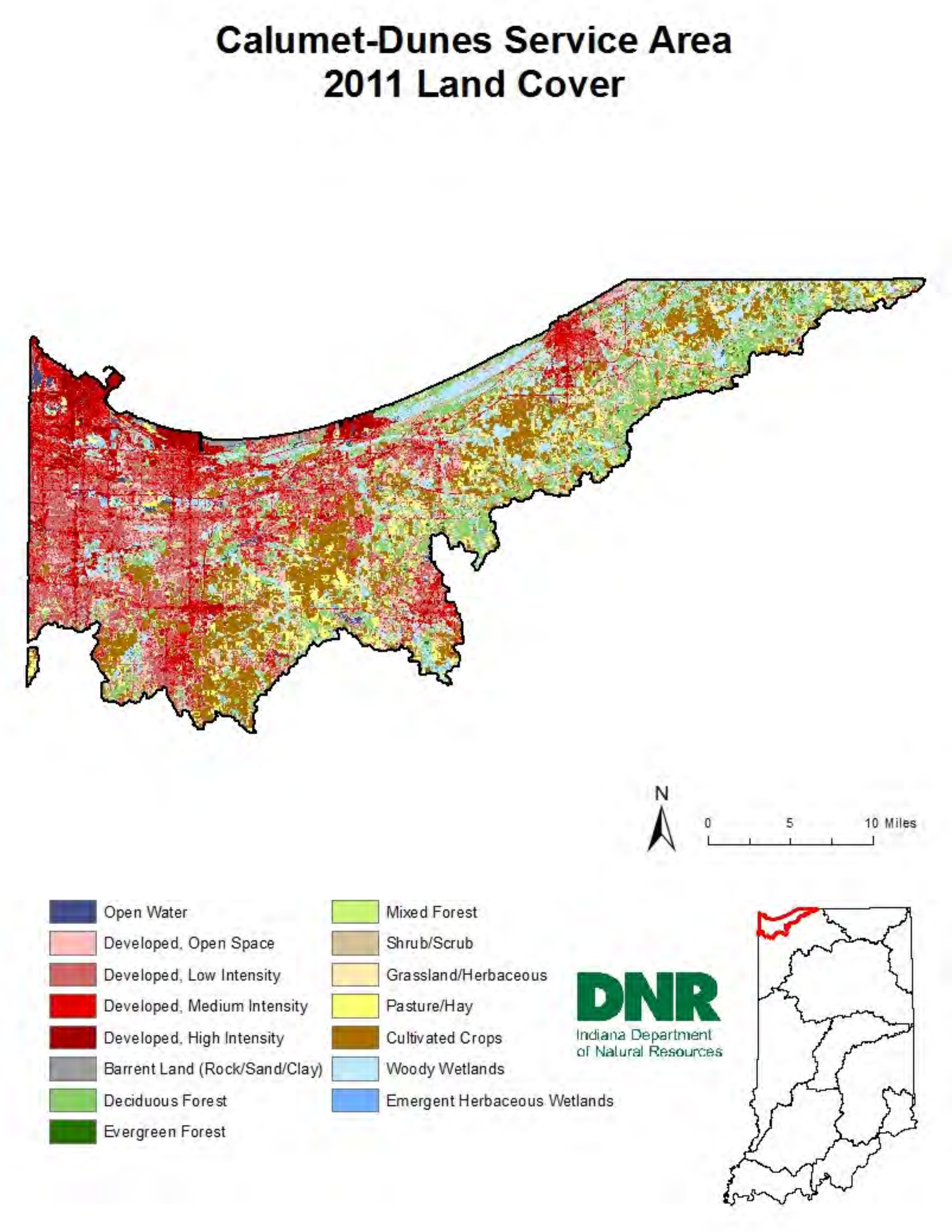


Figure 22. Land cover within the Calumet-Dunes Service Area (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 19)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	4,115	1.07%
Developed	Open Space	34,468	8.96%
Developed	Low Intensity	73,467	19.10%
Developed	Medium Intensity	36,777	9.56%
Developed	High Intensity	19,784	5.14%
Barren Land (Rock/Sand Clay)	*	2,578	0.67%
Forest	Deciduous	54,135	14.08%
Forest	Evergreen	1,402	0.36%
Forest	Mixed	768	0.20%
Shrub/Scrub	*	12,861	3.34%
Grassland/Herbaceous	*	23,802	6.19%
Pasture/Hay (Agriculture)	*	18,462	4.80%
Cultivated Crops (Agriculture)	*	59,718	15.53%
Wetlands	Woody	39,661	10.31%
Wetlands	Emergent Herbaceous	2,613	0.68%
Grand Total		**384,613**	**100.00%**

Table 19. Calumet-Dunes land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 23** below to demonstrate the current overall land cover distribution of the SA.

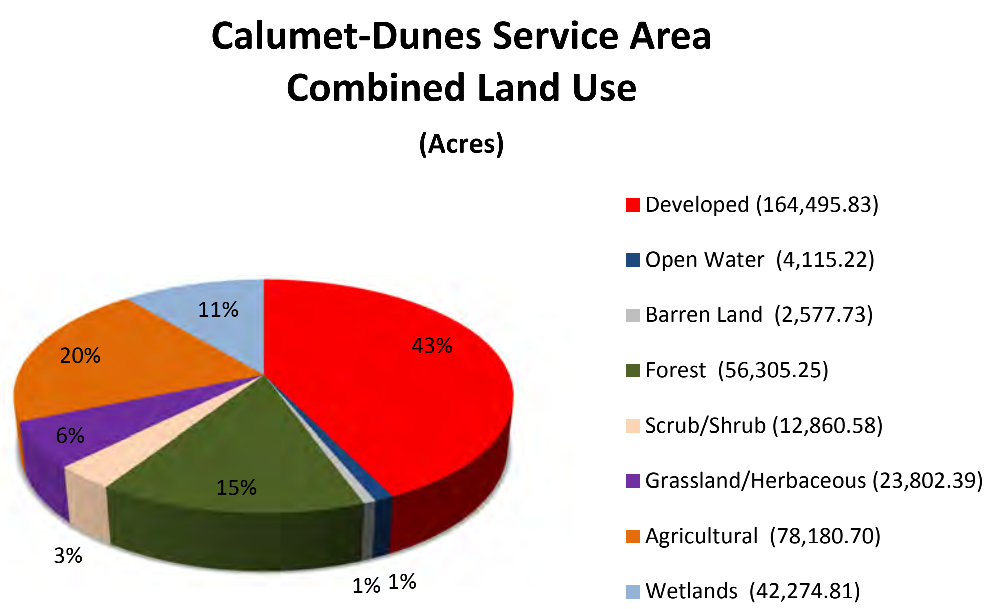


Figure 23. Combined land uses within the Calumet-Dunes service area from the 2011 NLCD (Homer, et al., 2015)

2.3 Growth and Development

The 2011 NLCD (Homer, et al., 2015) demonstrates that the dominant land use in the Calumet-Dunes SA is developed impervious area covering approximately 164,486 (43%) of the 384,613 total acres, which is the highest developed area density of any SA. (**Figure 23** and **Table 19**).

In general, urban/suburban development and land uses and their associated impervious areas are concentrated in the western two-thirds of the SA and along Lake Michigan in the north. The Calumet Dunes SA contains the Gary Metropolitan Area, the second largest metropolitan area in the state with a 2010 population size of 708,070, and part of the larger Chicago-Naperville-Arlington Heights Metropolitan Division that extends from Indiana to the southernmost county in Wisconsin along Lake Michigan with a total 2010 population of 9,461,105. The Calumet-Dunes SA also overlaps with the Michigan City-LaPorte MSA having a 2010 population of 111,476 (Manns, 2013). Analysis of the INDOT cities and towns GIS data (INDOT, 2016) shows the Calumet-Dunes SA contains entirely or in part 47 cities and/or towns, 29 of which are incorporated.

Additionally, analysis of INDOT's local roads GIS data (INDOT Road Inventory Section, 2016) shows there are approximately 4,458 miles of municipal and county roads contributing to the developed impervious land cover within the SA. The Calumet-Dunes SA has the highest local road miles to square mile ratio of all SA's at approximately 7.4 miles of local roads per square mile. This density is almost double that of the next highest SA, further indicating that growth and development, developed land uses, and impervious surfaces are a significant threat to aquatic resources in this SA.

Prior to 1900, the Grand and Little Calumet Rivers of Indiana drained into Lake Michigan and deposited sewage and other contaminants directly into the lake. The Grand Calumet River (GCR) has been significantly altered since the early 1900s from hydromodification activities including channelization, dredging, and damming. Primary impacts to the river included habitat loss and degradation due to these alterations as well as residential and industrial development.

A 1994 report from the IDNR provided information from the mid-1900s on the status and impacts to aquatic ecosystems near the shore of Lake Michigan as well as stream resources in the Calumet-Dunes SA (IDNR Division of Water, 1994). This report noted sources of impacts which affected recreational uses of rivers included oil, grease, floating debris, and odors; sources of impacts which made these waters unfit for body contact included high coliform bacteria counts. Beaches on Lake Michigan were often closed due to high bacteria counts, and water purification facilities reported excessive ammonia concentrations near intake cribs and taste and odor problems. The causes of these impacts resulted from urban sewage disposal, channel dredging, and effluent from oil refineries and steel mills (Indiana NRC, 1996). Additional impacts reported were related to industrial development and urbanization.

The Little Calumet River has also suffered similar impacts from industrial pollution and residential establishment which have reduced the river's ecological functions and services provided to its watershed. Hydromodifications to the Little Calumet River, which include alterations due to a flood control project by the USACE and IDNR, changed flow characteristics of the river which affected the life stages of aquatic organisms and reduced the suitability of stream habitat for fish, wildlife, and botanical resources (Little Calumet River WMP, 2008).

This SA, along the Lake Michigan shoreline and especially in the northwestern portion of this SA, has experienced a long history of growth and development associated with heavy industry such as steel mills, oil refineries, chemical companies, meat packing plants, and numerous other industrial land uses since the late 1800s. Much of this industrial development in northwest Indiana is due to its close proximity to Chicago and Lake Michigan. This heavily industrialized portion of the SA has numerous Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; sites are also known as the Superfund law) sites, state clean-up sites, Resource Conservation and Recovery Act (RCRA) sites, groundwater contamination issues, and contaminated soils and sediments. While many of the sources of these sites have been eliminated and the properties are in clean-up programs, numerous legacy contamination issues do persist and pose a threat to aquatic resources in the SA.

2.4 Agricultural Land Use

Agricultural land use is the second largest land use category in the Calumet-Dunes SA. Total agricultural land use covers 22.33% of the SA's total land area of 384,613 acres (Homer, et al., 2015). Agricultural land uses occur primarily in the southern and eastern portions of the SA.

Within the identified agricultural land use areas, cultivated crops comprise 59,719 acres (15.53%) and pasture/hay lands cover 18,462 acres (4.8%) of the SA. Corn and soybean production are the primary cultivated crops with in the SA, when based on harvested acres (United States Department of Agriculture, 2016 and 2017). The pasture/hay lands support livestock production for small to major livestock farms within the SA. Both dairy cattle and pig farming have active confined feeding operations (CFOs) that have a minimum of 5,000 animal units. These CFOs are considered the predominant livestock industry in the Calumet-Dunes SA (Thompson, 2008). When combining these major agricultural land use activities, the Calumet-Dunes SA ranks last in percentage of total statewide land use (0.34%), but it is a significant land use within the SA.

2.5 Transportation and Service Corridors

2.5.1 Roadways

Based on GIS analysis of INDOT's U.S. interstates and highways, state highways and local roads, there are approximately 567 miles of U.S. interstates and highways, 238 miles of state roads, and 4,458 miles of local roads within the Calumet-Dunes SA. Since this is the smallest of all the SAs, the concentration of road miles per square mile of land within the SA is substantial.

The concentration of U.S. Interstates/highways in the SA is approximately 0.94 miles per square mile, ranking it first of the eleven SAs. Although both U.S. Interstates/highways and local roads have the highest concentrations, the density of state highways is near the bottom, ranking ten of eleven, with 0.40 mile of state highways per square mile.

The Calumet-Dunes SA contains the highest density of roadways of any SA when all three road types are combined. The construction and maintenance of roads and bridges to support the primary means of transportation is in direct response to the significant growth and development throughout the region.

2.5.2 Railroads

As an alternative mode of transportation, the Calumet-Dunes SA has approximately 714 miles of railroad within the SA boundary. These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Calumet-Dunes SA contains the greatest concentration of railroads with a density of 1.19 miles of railroad per square mile. The significant concentration of linear infrastructure throughout this SA has impacts on the aquatic resources that include habitat fragmentation and fire suppression; this has resulted in habitats that have been significantly impacted by the invasion of non-native and invasive vegetation.

2.5.3 Service Corridors

Similar to threats identified with roads and railroads, the Calumet-Dunes SA contains concentrations of service corridors. The SA has over 2,362 miles of service corridors that extend throughout its boundary.

The SA contains a network of large kilovolt (kV) electric transmission lines that includes approximately three hundred seventy one (12 kV) lines, twenty one lines (34 kV), twenty seven (345kV) lines, and one (765 kV) line (Indiana Geological Survey, 2001). These lines extend over 1,226 miles throughout the SA and contains the highest concentration of electric transmission lines relative to its size, resulting in 2.04 miles of electric transmission lines per square mile.

In addition to electric transmission lines, the Calumet-Dunes SA contains over 1,137 miles of pipelines in total; approximately 184 miles of pipeline carry crude oil, 454 miles of pipeline carry natural gas, and 499 miles of pipeline carry refined petroleum products (Indiana Geological Survey, 2002). The SA contains the fourth largest concentration of crude oil pipelines, seventh highest concentration of natural gas pipelines, and the second highest concentration of refined product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 13 known low head dams within the SA (IDNR DOW, 2016), accounting for the highest concentration of any SA at one low head dam per 46 square miles. Additionally, ten of the 13 low head dams are located within state designated salmonid streams. There are currently 16 state regulated high head dams documented within the SA (IDNR DOW, 2016) at a density of one dam per 38 square miles, comprising 2% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 126,625 linear feet (24 miles) of NLE's mapped within the SA, averaging one mile of NLE per 25 square miles, ranking sixth in NLE density among all SAs. Approximately 19 miles of NLE's in this SA are located within predominantly developed areas, indicating that many of the mapped NLE may be road and rail embankments, and/or berms along channelized/maintained waterways. The remaining NLE's are mapped in rural or agricultural settings.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Calumet-Dunes SA contains minimal natural gas and oil production. The Indiana Geological Survey (IGS) identifies one petroleum gas field and a single associated gas well ranking the Calumet-Dunes SA last in producing statewide for natural gas and oil fields (Indiana Geological Survey , 2015). Although the amount of petroleum fields ranks at the bottom, the IGS petroleum wells data identifies 177 exploratory wells, ten stratigraphic wells, tenwaste disposal wells and one observation well within the SA boundary (Indiana Geological Survey, 2015)

2.7.2 Mineral Mining and Aggregates

The Calumet-Dunes SA contains active mineral operations that extract and produce commodities. Based on Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, this SA currently contains one sand & gravel and one crushed stone operation (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes industry byproducts commodities that are used as aggregate. The IGS identifies nine active slag and two active lime producers' within the SA (Indiana Geological Survey, 2016). Northwest Indiana experiences little mining of natural materials, resulting in extensive use of slag generated from Indiana steel mills as aggregate (Indiana Geological Survey, 2016). Relative to the Calumet-Dunes Service Area size, mineral mining in the SA is tied for second to last in the state with 13 active operations.

2.7.3 Coal

The Calumet-Dunes SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Calumet-Dunes SA is located entirely within the Indiana SWAP Great Lakes Planning Region. The SWAP identifies the most significant threats to habitats and SGCN within the Great Lakes Region as:

- Habitat conversion and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

The SWAP Great Lakes Region has experienced loss in the majority of habitat types over the last decade mostly to urban development, which gained 6.2% in land cover (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the developed and agricultural footprints make up 63% of the land cover within the SA and are expected to remain as the top contributors to aquatic resource impairments. This region has grown by more than 4% over the last two decades reaching a record peak population of 771,815 in 2010 (NIRPC, 2011). This growth trend is expected to continue with an additional 170,000 people and 80,000 new jobs targeted by 2040 per the Northwestern Indiana Regional Planning Commission's 2040 Comprehensive Regional Plan (CRP) (NIRPC, 2011).

IDNR expects development and transportation projects to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue. The urban core of this SA has experienced population decline over the past 30 years, shifting population growth centers to relatively undeveloped areas (NIRPC, 2011). The regions expected growth in conjunction with development patterns of the past several decades suggests new residential and commercial construction and road projects as likely to continue into the foreseeable future. With urban cores in population and industry decline, aquatic resource impacts are expected to occur in these high intensity areas as regional economic plans call for residential, commercial and industrial revitalization (NWIEDD, 2016). Additionally, public transportation options are expected to increase (NWIEDD, 2016), which may lead to more passenger rail development and/or added bus lanes within the region to support greater metropolitan area connectivity to Chicago and its suburbs.

Finally, while there have been a number of remediation and/or restoration projects in the more heavily contaminated portions of the SA (especially Hammond, Gary, East Chicago, and Whiting), there are still numerous clean-up activities to be completed on upland sites that could have potential impacts to adjacent aquatic resources as well as remedial actions and restoration activities that could improve existing aquatic resources within the region. Additionally, there is still remedial and restoration work yet to be completed within the Grand Calumet River itself, some of the adjacent wetlands to the river, and throughout this SA.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Calumet-Dunes SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Calumet-Dunes SA historic aquatic resources were comprised of a diverse mix of natural aquatic community types that are a product of Lake Michigan and the surrounding landscape. The biological diversity of the Grand Calumet River Basin is associated to the convergence of three major biomes which includes eastern deciduous forest, boreal forest and tall grasslands, succession over a small area, and the large variations of the hydrological regimes associated with its streams, lakes and wetlands (Nevers, Whitman, & Gerovac, 1999/2000). Diversity of the aquatic resources within this region suffered from European settler's alterations of the landscape. The regions dense forest land was cleared and land was cultivated extensively as European settlement began in 1832 (Nevers, Whitman, & Gerovac, 1999/2000). As settlement increased due to westward expansion, commerce and industry started to dominate the landscape. The natural and wetland ecosystems of the region have been cleared, drained, fragmented and cut by railways and roadways created to facilitate industrial, commercial, municipal and urban development, which led to the introduction of non-native, invasive species which has a cumulative negative effect on regional habitat destruction (Nevers, Whitman, & Gerovac, 1999/2000).

The draining and filling of wetlands to fulfill the development needs of industry, agriculture and other purposes coupled with the suppression of fire within the region has resulted in a few small remnants of the original natural landscape (Bacone & Campbell, 1980). Due to extensive aquatic resource loss within the Calumet-Dunes SA, understanding the region's aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections and their related natural aquatic communities associated within each respective Region and Section. **Figure 24** depicts each Natural Region and Section located within the Calumet-Dunes SA. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources within the region prior to early European settlement. **Table 20** provides a compilation of the best available information and published studies specific to the SA in order to provide insight on aquatic resource loss. The table details the Calumet-Dunes SA estimated land cover percentages for each region and section, and identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover (Homoya, Abrell, Aldrich, & Post, 1985); (General Land Office, 1799-1834); (NRCS-USDA, 2016).

<table>
<tr><th rowspan="2">Natural Region(s)</th><th colspan="2">Natural Region: Section(s)</th><th rowspan="2">Natural Region Community Types</th><th colspan="2">Hydric Soils</th><th colspan="2">Partially Hydric</th><th>Pre-Settlement Forest Cover</th></tr>
<tr><th>Name</th><th>%</th><th>Acres</th><th>%</th><th>Acres</th><th>%</th><th>%</th></tr>
<tr><td rowspan="3">Northwestern Morainal</td><td>Lake Michigan Border</td><td>8.89</td><td>Beach community; the high dunes (mesophytic forest and savanna); pannes</td><td rowspan="4">88,520</td><td rowspan="4">23</td><td rowspan="4">50,419</td><td rowspan="4">13.1</td><td rowspan="4">72.3</td></tr>
<tr><td>Chicago Lake Plain</td><td>45.07</td><td>Marsh, lake, sand savanna, sand prairie, and swamp; along with minor areas of various forest types</td></tr>
<tr><td>Valparaiso</td><td>45.8</td><td>Predominantly forested (eastern); fen, bog, lake, marsh, savanna, seep spring, and swamp</td></tr>
<tr><td>Grand Prairie</td><td>Kankakee Sand</td><td>0.25</td><td>Predominantly prairie and savanna; wet prairie, marsh, swamp, wet sand flat, and wet muck flat; predominantly oak forest (eastern), oak flatwoods (dunal swales)</td></tr>
</table>

Table 20: The historic natural community composition for the Calumet-Dunes Service Area based upon the natural region and section

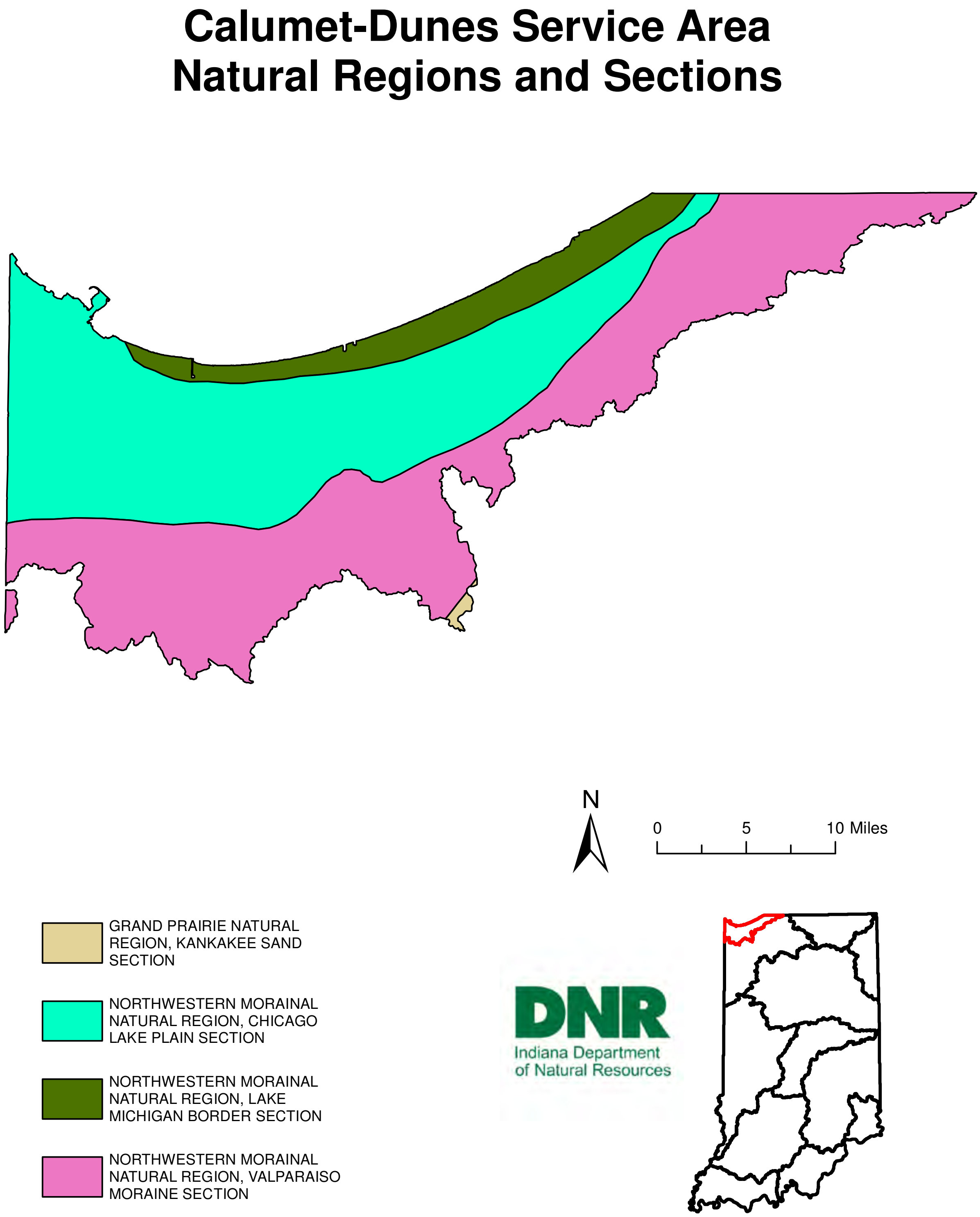


Figure 24. Calumet-Dunes Service Area – Natural Regions and Sections (Homoya, Abrell, Aldrich, & Post, 1985)

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams indicates there are currently 477 miles of category 4A impaired streams and 240 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (416 miles), dissolved oxygen (119 miles), impaired biotic communities (135 miles), nutrients (22 miles), and PCB's in fish tissue (47 miles – Category 5 only) as the leading causes of stream impairments within the service area (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted QHEI assessments of 331 stream reaches within the SA **(Table 21** and **Figure 25**) (IDEM OWQ, 2014). Though QHEI is intended for warm water communities, 156 assessment reaches were conducted within salmonid streams which are also capable of supporting a salmonid fishery (some put-and-take trout fishing) per the Indiana Water Quality Standards, 327 IAC 2-1-.5-5 (a)(3). Of the stream and river habitat reaches assessed, only 9.4% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	199	60.1
51-64	Habitat is partially supportive of a stream's aquatic life design	101	30.5
>64	Habitat is capable of supporting a balanced warm water community	31	9.4
	Total	**331**	**100%**

Table 21. IDEM Overall QHEI scores for Calumet-Dunes SA, 1991 – 2014 (IDEM OWQ, 2014)

As previously discussed, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Calumet-Dunes SA ranks sixth overall in forested cover density of all SA's at 15% of total area with approximately 56,305 acres, and is the SA with the smallest percentage of forested cover with approximately 1.1% of 5,215,169 acres of forest cover statewide.

GIS analysis indicates that there are approximately 378,082 linear feet (72 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Calumet-Dunes SA has the smallest ratio of these potentially restorable stream miles to square miles of SA at approximately 0.12 mile of potential restoration per one square mile, or one mile of potential restoration for every 8.4 square miles of SA.

Calumet-Dunes Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

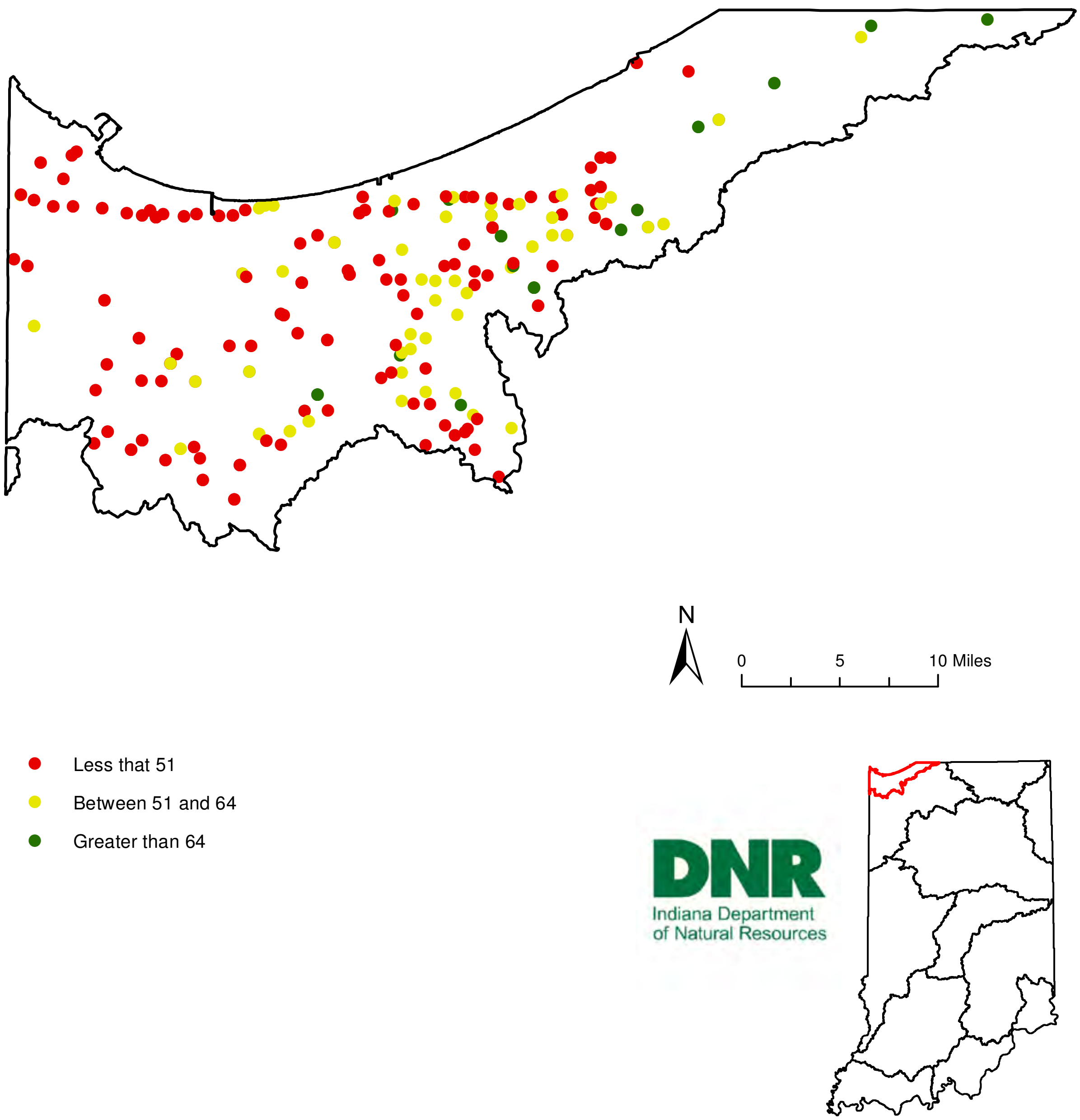


Figure 25. IDEM overall QHEI scores within the Calumet-Dunes service area; 1991-2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI (USFWS NWI, 2015) in the Calumet-Dunes SA shows that there are approximately 10,453 acres of freshwater emergent wetland (PEM) and approximately 24,326 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 9% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 15.4% of the total SA **(Table 22** and **Figure 26)**. In addition to the many high quality natural aquatic community types within this region, the Calumet-Dunes SA contains rare dune and swale ecosystems which provide important habitat for wildlife and is characterized by upland dune ridges and low-relief wetlands along Lake Michigan's 59 miles of Indiana shoreline. Prior to settlement, dune and swale ecosystems covered an area of roughly 10,000 acres; today, only 1,000 acres remain as a result of habitat alteration and contamination by various sources (USFWS, 2001).

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	10,452.63	17.61%	2.71%	0.04%
Freshwater Forested/Shrub Wetland	24,325.48	40.98%	6.31%	0.10%
Freshwater Pond	4,863.60	8.19%	1.26%	0.02%
Lake	18,961.77	31.95%	4.92%	0.08%
Riverine	753.35	1.27%	0.20%	0.00%
Grand Total	**59,356.82**	**100.00%**	**15.41%**	**0.25%**

Table 22. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils (NRCS-USDA, 2016) account for 138,940 acres (**Figure 27**), or 36% land cover within the SA, out of which approximately 18,251 acres have the potential to be restored, accounting for 4.75% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Calumet-Dunes SA has the third least percentage of recoverable wetland acres to total SA size of all SA's, and the least amount of potentially restorable wetland acres of any SA. This is partially due to SA size, but also reflects the high intensity developed land use due to its proximity to Chicago.

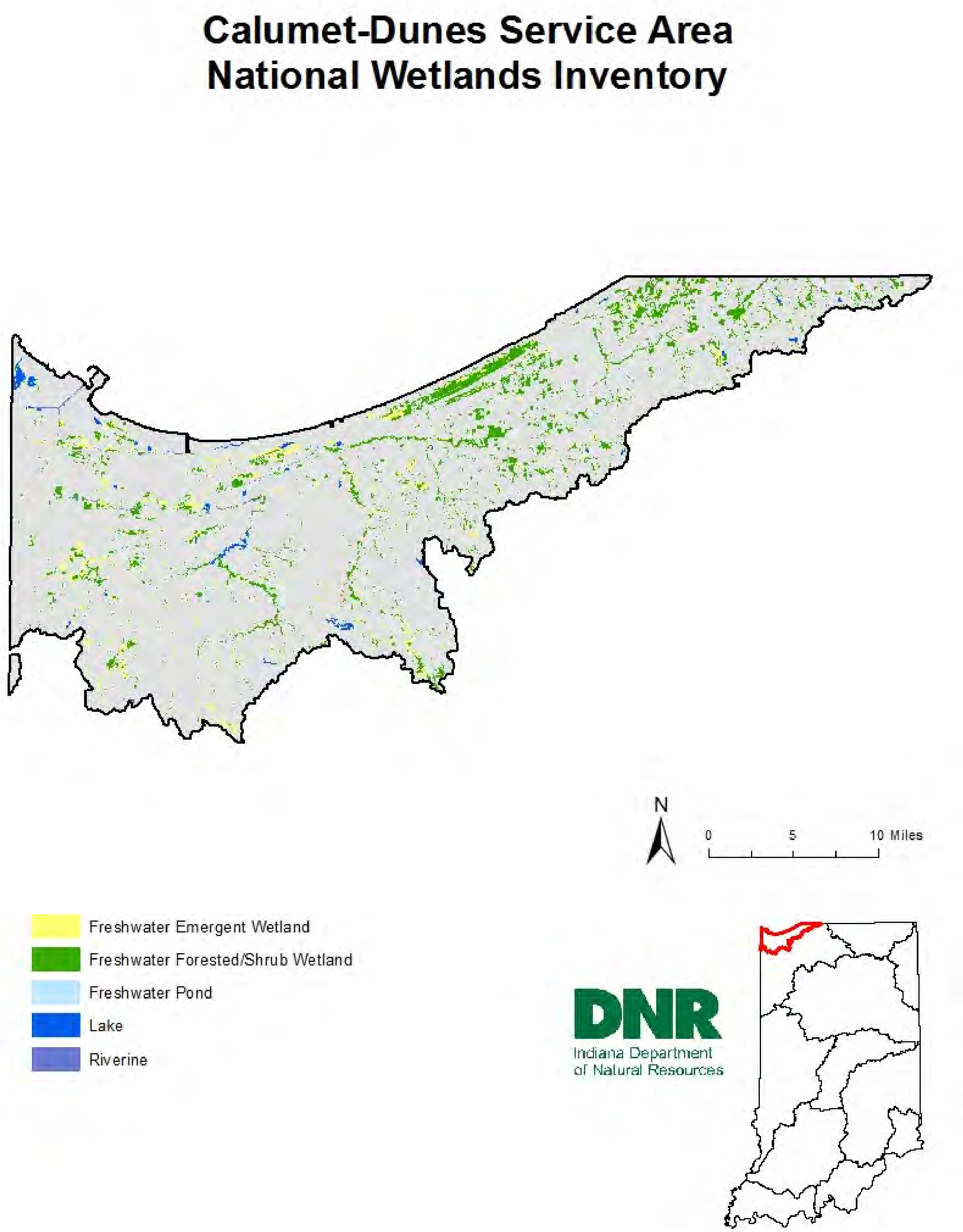


Figure 26. NWI within the Calumet-Dunes service area (USFWS NWI, 2015)

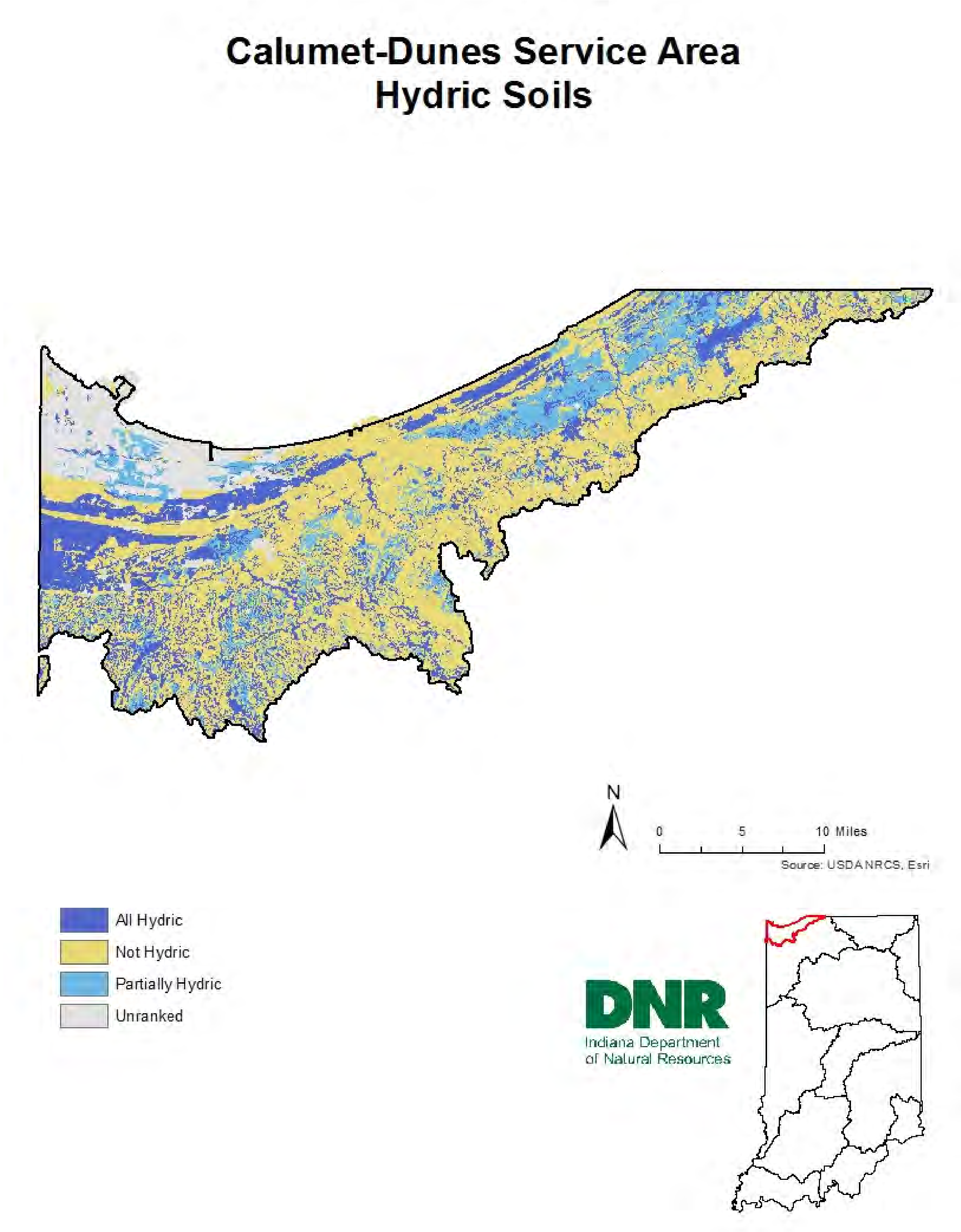


Figure 27: Hydric soils within the Calumet-Dunes service area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 14,905 acres of potentially restorable wetlands within the SA. The watershed with the highest concentration of potentially restorable wetlands is Kemper Ditch-East Arm Little Calumet River (HUC 040400010403; **Table 23**). Hotspots account for 120,766 linear feet of potentially restorable streams within the SA. The watershed with the highest concentration of potentially restorable streams is Duck Creek (HUC 040400010508; **Table 24**). The watersheds with the highest concentrations of potentially restorable streams and wetlands (**Tables 23 and 24**) serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 28** shows where these watersheds are located within the SA.

There are 367 acres of potentially restorable wetlands on IDNR-owned lands within the SA. There are 1,986 acres of hotspots of potentially restorable wetlands adjacent to IDNR-owned lands within the SA. Reynolds Creek Gamebird Habitat Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable wetlands (1,160 acres). The only other IDNR-managed lands adjacent to hotspots of potentially restorable wetlands are Beaver Dam Wetland Conservation Area (687 acres) and Calumet Prairie (139 acres).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
040400010403	Kemper Ditch-East Arm Little Calumet River	2,466
040400010504	Main Beaver Dam Ditch-Deep River	2,003
040400010206	Headwaters South Branch Galien River	1,448
040400010105	East Branch Trail Creek	1,329
040400010502	Headwaters Main Beaver Dam Ditch	1,192

Table 23. Watersheds in the Calumet-Dunes Service Area with the highest concentration of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear ft)
040400010508	Duck Creek	22,328
040400010507	Deer Creek-Deep River	22,208
040400010504	Main Beaver Dam Ditch-Deep River	20,458
040400010206	Headwaters South Branch Galien River	20,028
040400010502	Headwaters Main Beaver Dam Ditch	19,083

Table 24. Watersheds in the Calumet-Dunes Service Area with the highest concentration of potentially restorable streams

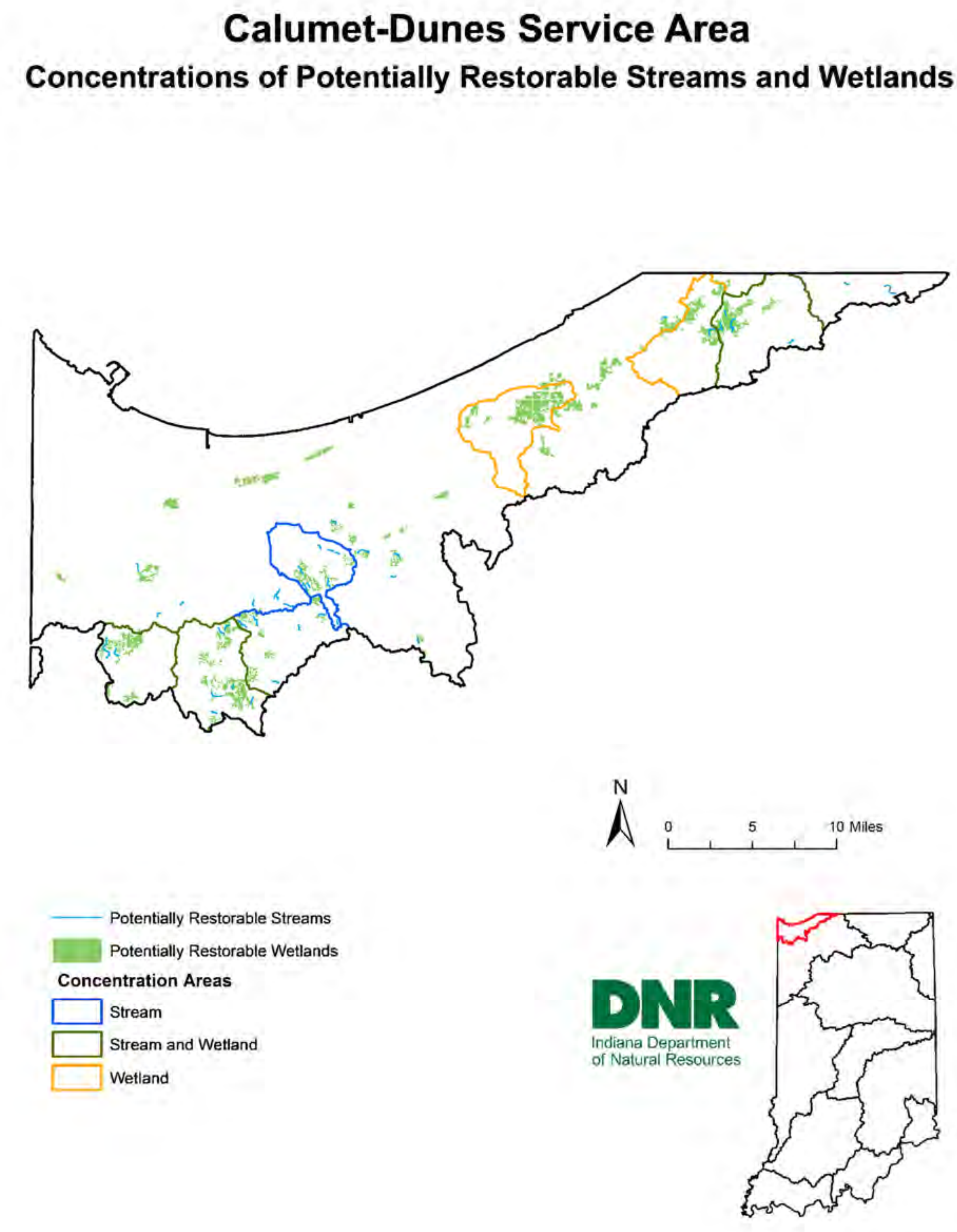


Figure 28. Concentrations of Potentially Restorable Streams and Wetlands in the Calumet-Dunes Service Area

4.4 Lakes, Reservoirs and Ponds

Lake Michigan is assessed as a single unit, and therefore any impairment documented in the lake is applied to all 154,176 acres in Indiana (IDEM-IR, 2016) (**Table 25**). The entirety of Lake Michigan does not support human health and wildlife (fishable use). The majority of Indiana's 59 miles of Lake Michigan shoreline, excluding Indiana Harbor, fully support aquatic life use. Only 7% of Lake Michigan's shoreline waters support full body contact recreation use, and all 59 miles of shoreline were impaired for fish consumption. Impairments along Lake Michigan's shoreline include E. coli as well as PCB's and mercury in fish tissue. These impairments have causes such as septic systems, illicit connections to storm sewer discharges, shorebirds along Indiana beaches, non-point sources, and unknown sources (IDEM-IR, 2016).

Designated Beneficial Use	Total Size	Size Assessed	Percent Assessed	Sized Fully Supporting	Size Not Supporting
Full Body Contact (Recreational Use)	59	59	100%	4	55
Human Health and Wildlife (Fishable Use)	59	59	100%	0	59
Public Water Supply	31	31	100%	31	0
Warm Water Aquatic Life (Aquatic Life Use)	59	59	100%	59	0

Table 25. Summary of Lake Michigan designated use support (IDEM-IR, 2016)

Landward of Lake Michigan there are currently 435 acres of total documented impaired lake waters consisting of Category 5 phosphorous impairments in Wolf Lake and PCB's in fish tissue within Marquette Park Lagoons East and West (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 4,115 acres of open water landward of Lake Michigan which is 1.1% of the SA. This varies from the NWI, which identifies approximately 4,863 acres of freshwater ponds comprising 1.3% of the SA, and 18,962 acres of lakes comprising 4.9% of total SA acres.

Of these open waterbodies, GIS analysis indicates there are seven (7) natural public freshwater lakes (PFL) within the SA (IDNR DOW PD, 2016), which is only 1.6% of the 425 PFL's as identified by the Indiana Natural Resource Commission list of PFLs as of June 2011 (IN NRC, 2011). Furthermore, GIS analysis indicates that approximately 1,754 acres of PFO, PSS and PEM from the NWI are contiguous with the boundary of PFL's within the SA as identified in the DNR DOW's GIS data. IDNR will remain up to date with PFL, reservoir and Lake Michigan condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape-watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

Considerations afforded by the data utilized below include, but are not limited to, helping identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate GIS data from IGS (Letsinger S. L., 2015) for the Calumet-Dunes SA shows that shallow unconsolidated aquifers in this SA are predominantly in the median range of inches of recharge per year (**Table 26).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.92	0.15%
	13	1.71	0.29%
	12	1.63	0.27%
	11	1.59	0.27%
	10	1.83	0.31%
	9	10.62	1.78%
	8	112.10	18.80%
	7	163.51	27.43%
	6	113.04	18.96%
	5	124.90	20.95%
	4	54.35	9.12%
Low	3	7.98	1.34%
	2	1.97	0.33%
	1	0.04	0.01%

Table 26. Approximate ground water recharge rates in the Calumet-Dunes Service Area (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that the majority of the Calumet-Dunes SA near surface aquifers are moderately to highly sensitive to contamination **(Table 27).** The aquifer sensitivity reflects the middle to upper range of aquifer recharge rates in addition to a dominance of developed and agricultural land uses that may contribute to ground water contamination.

Sensitivity	Square Miles	Percent of Total Acre
Very High	12	2%
High	379	63%
Moderate	192	32%
Low	18	3%
Very Low	0	0%

Table 27. Ground water sensitivity in the Calumet-Dunes Service Area (Letsinger S. , 2015)

Analysis of the DNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Calumet-Dunes SA has the most registered capacity of surface water withdrawal of any SA, with a 2015 registered surface water withdrawal capacity of 684,417 million gallons a day (MGD) **(Figure 29)** (IDNR DOW, 2016). The sectors of energy production, industry, and public water supply have the most significant registered withdrawal capacities with a combined total of 99.6% of withdrawal potential, which reflects the developed land uses of the SA.

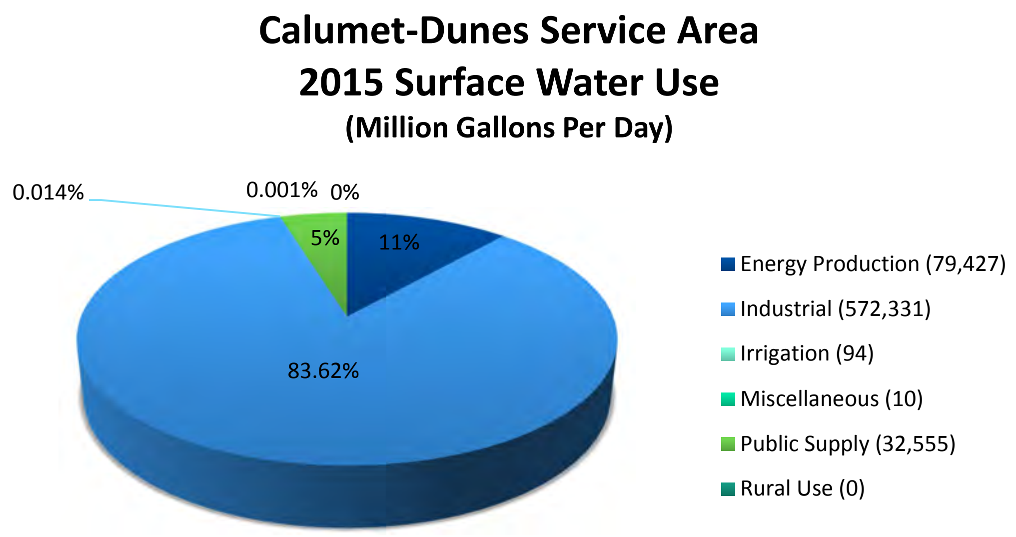


Figure 29. Significant Water Withdrawal Facilities-Surface Water (IDNR DOW, 2016)

On the contrary, significant ground water withdrawal ranks at the bottom among the SA's with approximately 1.7 MGD of registered withdrawal capacity in 2015 **(Figure 30)**.

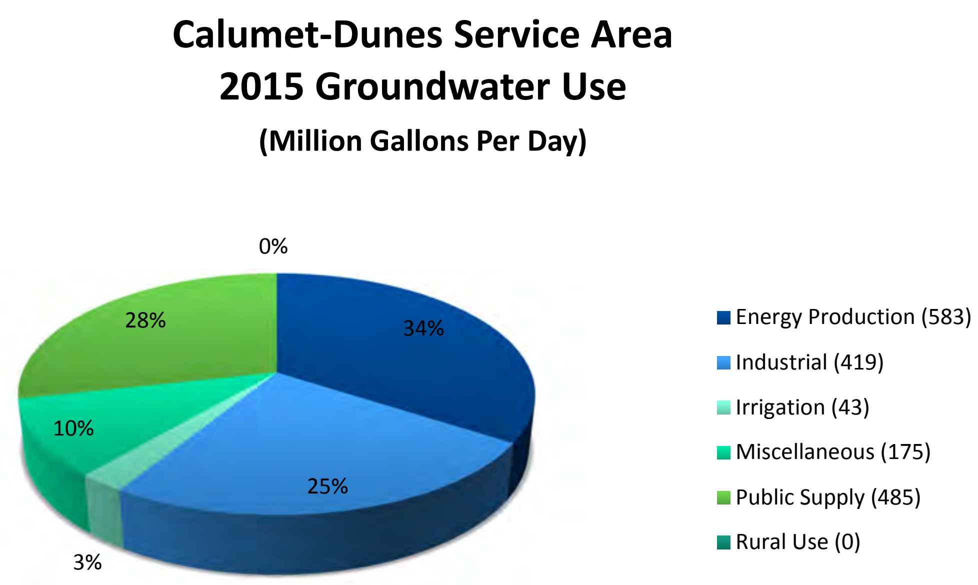


Figure 30. Significant Water Withdrawal Facilities-Groundwater (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

Analysis of the DNR salmonid stream GIS dataset indicates there are approximately 677,345 linear feet (128 miles) of salmonid streams in the Calumet-Dunes SA, approximately double the salmonid stream miles in the St. Joseph River SA.

The Indiana portion of Lake Michigan and all waters incorporated in the Indiana Dunes National Lakeshore are designated as Outstanding State Resource Waters.

High quality natural communities currently documented in the Natural Heritage Database within the SA include, but are not limited to boreal flatwoods, wet prairie, wet sand prairie, fen, marsh, sedge meadow, panne, circumneutral seep, circumneutral bog, forested swamp, scrub-shrub swamp, wet floodplain forest, acid bog, natural lakes, inland coastal plain marsh, and foredune (dune and swale).

There are currently five amphibian species, 47 bird species, 10 fish species, 11 mammal species, eight mollusk species, and nine reptile species listed as SGCN within the Indiana SWAP Great Lakes Planning Region which includes the Calumet-Dunes SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Calumet-Dunes SA. The following aquatic resource goals and objectives apply specifically to the Calumet-Dunes SA based on 404 permitted impact trends, predominant threats, historic loss, impaired and high quality current aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources to help offset the dominant and anticipated threats in the SA.
2. Implement stream and wetland restoration, enhancement and/or preservation projects to support Lake Michigan coastal habitat connectivity, preserve high quality habitats that are not yet protected, and improve coastal aquatic resource functions and services.
3. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
4. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
5. Preservation, enhancement and/or restoration of globally rare dune and swale habitats and other high quality aquatic resource types within this SA will be a priority in accordance with 33 CFR §332.3(h) of the Federal Mitigation Rule.
6. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities.

7. Restoration of in-stream habitat, structural integrity and riparian cover of salmonid streams critical to SGCN and salmonid species to include potential removal or modification of dams.
8. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.
9. Restoration, rehabilitation, enhancement and/or preservation of aquatic resources within the Grand Calumet River watershed.
10. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Great Lakes Planning Region where feasible.
11. Restoration of migratory bird aquatic habitat as identified in the Great Lakes Restoration Initiative and/or other applicable initiatives or studies.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Calumet-Dunes SA, by providing the greatest ecological lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to help offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectiveswithin the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Deep River-Turkey Creek WMP, NIRPC WMP, Dunes Creek WMP, Galena River WMP, Little Calumet WMP, Salt Creek WMP, and Trail Creek WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Calumet-Dunes SA will include rare dune and swale habitats, high quality natural aquatic and riparian communities, and critical habitat for SGCN. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in coincidence with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: the Nature Conservancy of Indiana, the Shirley Heinze Land Trust, Inc. and the Woodland Savanna Land Conservancy. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR intends to partner with land trusts that exist in the SA on compensatory mitigation projects to develop project plans and designs as well as providing long-term management and stewardship of subject properties over the life of the program.

Additional stakeholders' interest and potential conservation partnerships specific to the Calumet-Dunes SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- Indiana Dunes National Lakeshore/National Park Service
- Municipal and County Governmental Entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Lake, Porter, LaPorte and St. Joseph Counties Soil and Water Conservation Districts
- Great Lakes Restoration Initiative (GLRI)
- Great Lakes Environmental Assessment and Mapping Project
- NOAA Great Lakes Environmental Research Laboratory, and Habitat Conservation Restoration Center
- Northwestern Indiana Regional Planning Commission (NIRPC)
- Northwest Indiana Economic Development District
- Northwest Indiana Forum
- Upper Midwest and Great Lakes Landscape Conservation Cooperative (Coastal Wetland Decision Support Tools)
- Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperatives
- Government entities of bordering states
- Local and Great Lakes region academic institutions
- USGS Great Lakes Science Center

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP are shown in **Figure 31** below (IWPP, 2015).

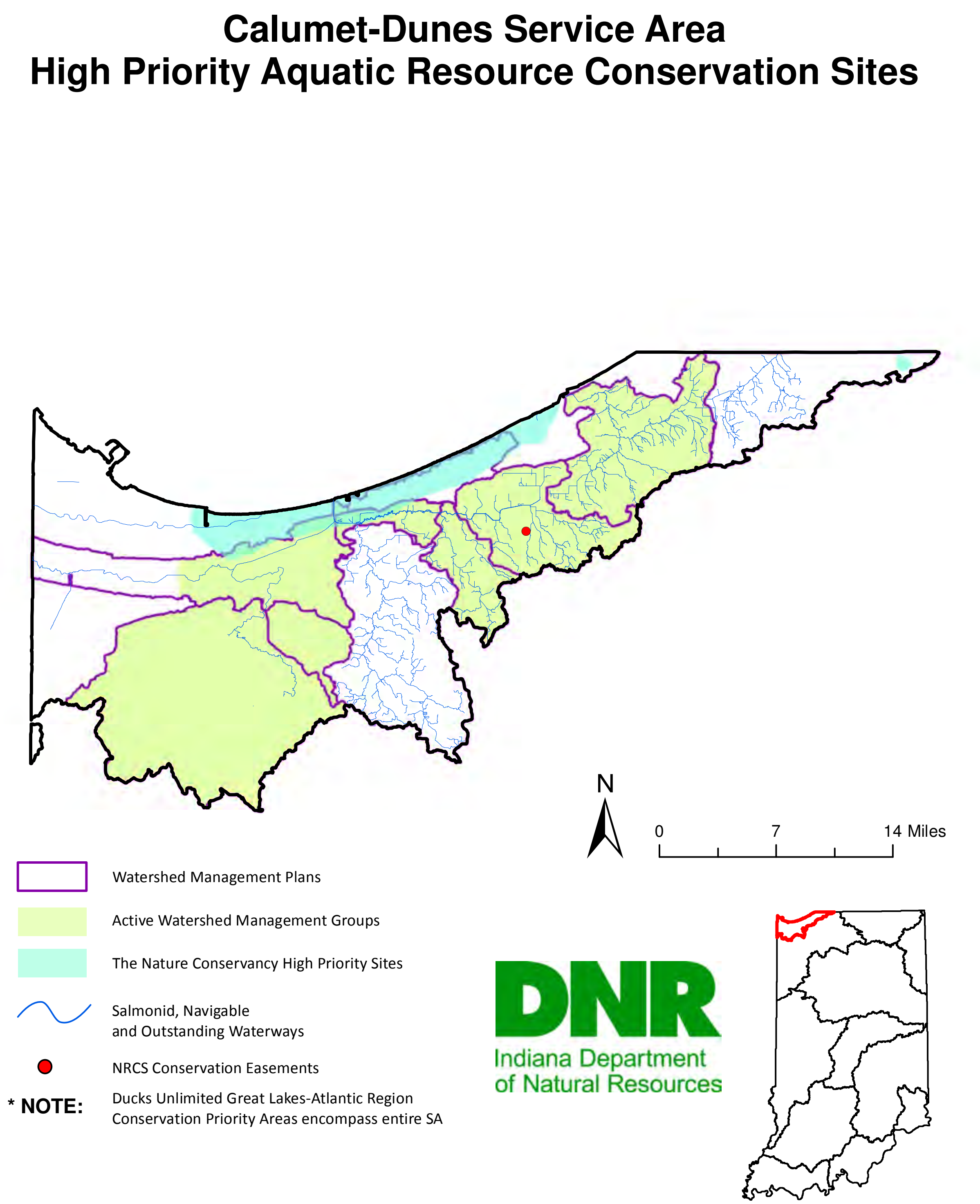


Figure 31. Priority conservation areas and sites; IDEM Wetland Program Plan (IWPP, 2015)

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

APPENDIX B.2 ST. JOSEPH RIVER (LAKE MICHIGAN) SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION

The St. Joseph River Service Area (SA) is located in northeastern Indiana. It includes the following 8-digit HUC watershed:

- 04050001 - St. Joseph River

The St. Joseph River SA includes all or portions of the seven Indiana counties listed below in the Northern Moraine and Lake Region physiographic region.

St. Joseph	Kosciusko	LaGrange	Steuben
Elkhart	Noble	DeKalb	

The St. Joseph River drains to Lake Michigan at St. Joseph, MI. Approximately 42 miles of the 210 mile long St. Joseph River reside within two counties of Indiana, Elkhart and St. Joseph; a majority of the river travels through farmland (FotSJR, 2016). Major tributaries discharging to the St. Joseph River within Indiana include Fawn River, Elkhart River, and Little Elkhart River.

Approximately 1,685 square miles of the 4,685 square mile St. Joseph Watershed is located in northeastern Indiana; the remainder is located in southwestern Michigan. The St. Joseph River SA is located in the Northern Indiana Drift Plains and is characterized by pothole lakes, ponds, marshes, and bogs; land cover is dominated by corn, soybean, wheat, and livestock farming (U.S. EPA: Ecoregions of Indiana). Currently, the St. Joseph River SA is dominated by a mix of agriculture, developed land uses, pasture/hay, and woody wetlands.

Based on the 2011 NLCD, the land cover type with the most area in the St. Joseph River SA is agricultural land use (60.83%), followed by developed and impervious land use (18.82%), wetlands and open water (12.89%), and forest and shrub/scrub (7.61%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 4.77% of the SA cover per the NWI up to 10.13% per the 2011 NLCD. Emergent herbaceous wetlands range from approximately 0.42% per the 2011 NLCD to 2.45% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the St. Joseph River SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are generally presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the St. Joseph River SA from 2009 – 2015 was collected and analyzed **(Table 28)**. According to the data, 2.28 acres of impacted wetlands and 1,430 linear feet of impacted streams required mitigation during the period of analysis.

The transportation and service corridor work type accounted for 100% of permitted stream impacts. There were no documented stream impacts requiring mitigation for agricultural land use, dam related activities, development, or energy production and mining for this time period in this SA.

The development work type accounted for the most wetland impacts (80.96%), followed by dam related activities (16.45%), and transportation and service corridors (2.59%). There were no documented wetland impacts for agricultural land use, or energy production and mining for this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 32**.

Work Type Category	Authorized Stream Impacts Linear Ft	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	0	0.00%	0.375	16.45%
Development	0	0.00%	1.846	80.96%
Energy Production	0	0.00%	0	0.00%
Transportation	1430	100.00%	0.059	2.59%
Grand Total	**1430**	**100.00%**	**2.28**	**100.00%**

Table 28. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015. Source: USACE Louisville, Detroit and Chicago Districts

St. Joseph River Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

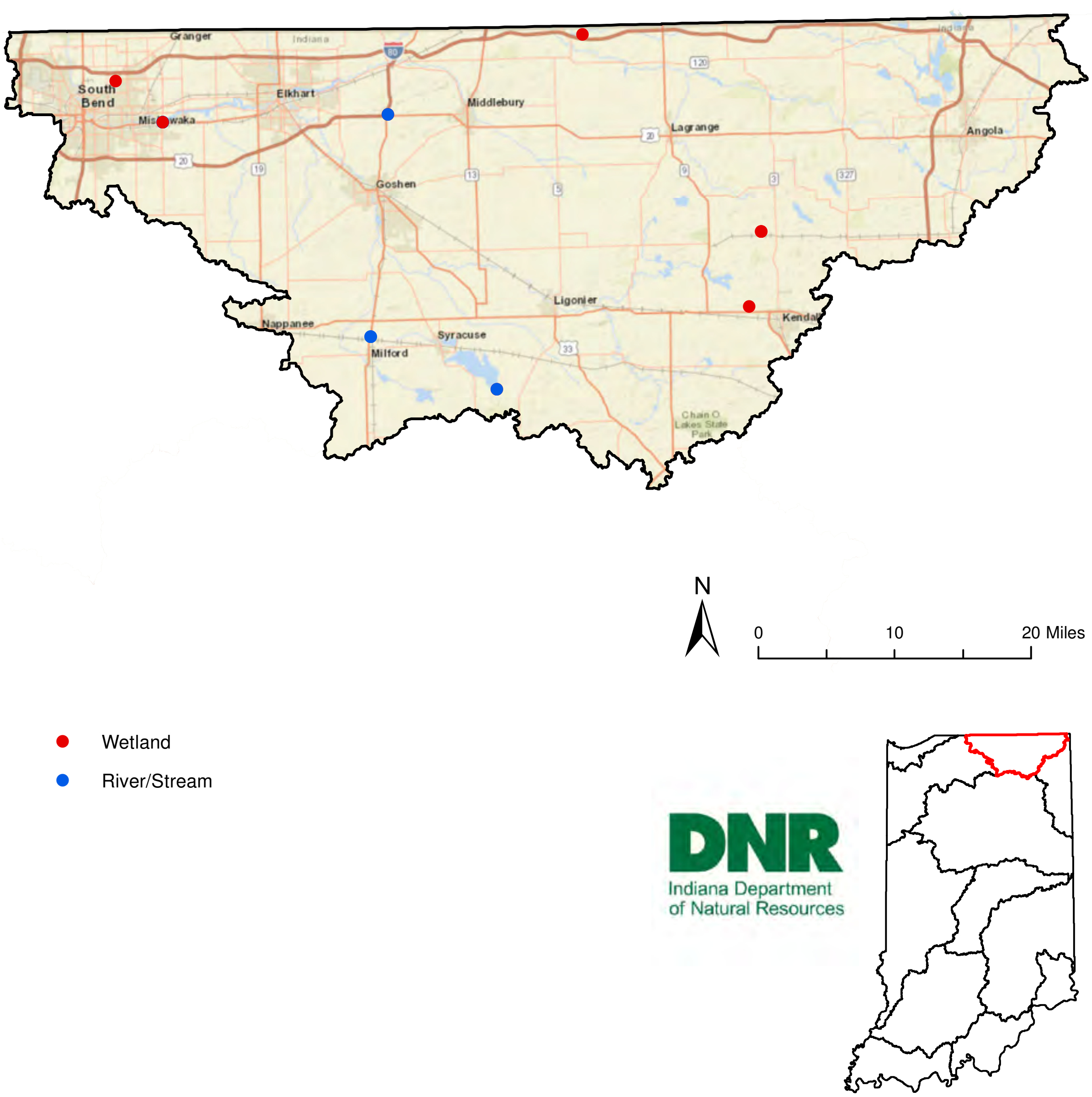


Figure 32. 404 permitted stream and wetland impacts requiring mitigation 2009-2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD (Homer, et al., 2015) to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the St. Joseph River SA is presented in **Figure 33,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

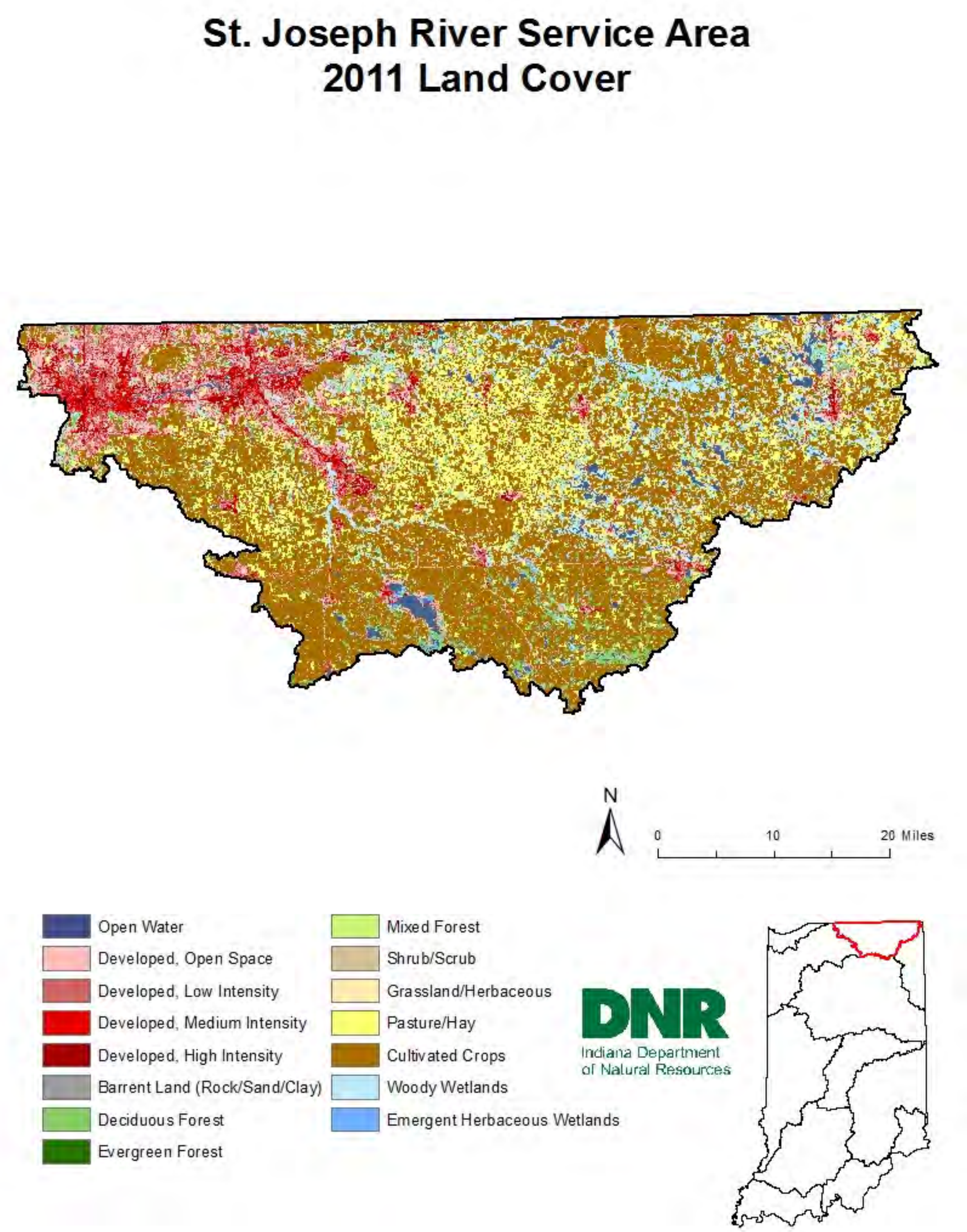


Figure 33. Land cover within the St. Joseph River Service Area from 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 29)**.

St. Joseph River SA Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	25,397	2.34%
Developed	Open Space	91,242	8.39%
Developed	Low Intensity	69,505	6.39%
Developed	Medium Intensity	28,725	2.64%
Developed	High Intensity	15,207	1.40%
Barren Land (Rock/Sand Clay)	*	1,872	0.17%
Forest	Deciduous	63,840	5.87%
Forest	Evergreen	3,603	0.33%
Forest	Mixed	287	0.03%
Shrub/Scrub	*	5,243	0.48%
Grassland/Herbaceous	*	6,186	0.57%
Pasture/Hay (Agriculture)	*	158,855	14.61%
Cultivated Crops (Agriculture)	*	502,648	46.23%
Wetlands	Woody	110,197	10.13%
Wetlands	Emergent Herbaceous	4,570	0.42%
	Grand Total	**1,087,375**	**100.00%**

Table 29: St. Joseph River land classification/value percentages from 2011 National Land Cover Database

* Class does not have additional values. (Homer, et al., 2015)

IDNR combined the values within the same land cover classification in **Figure 34** below to demonstrate the current overall land cover distribution of the SA.

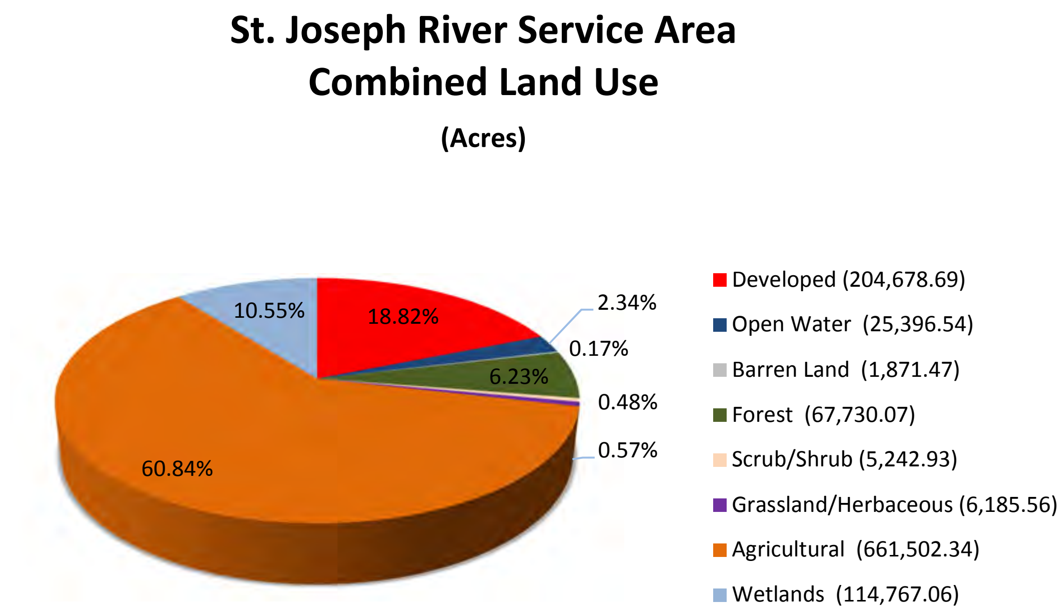


Figure 34. Combined land uses within the St. Joseph River SA from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

The 2011 NLCD demonstrates that the dominant land use in the St. Joseph River SA is agricultural comprising of approximately 661,502 (60.8%) of the SA's 1,087,375 total acres (Homer, et al., 2015). With the exception of the northwestern region that contains the South Bend/Mishawaka region, the St. Joseph River SA agricultural landscape is predominant throughout the remainder of the SA.

Within the agricultural land use areas, cultivated crops comprise 502,647 acres (46.23%) and pasture/hay lands cover 158,855 (14.61%) of the SA. Corn and soybean production are the primary cultivated crops within the SA, based on acres of harvested crops from counties that comprise the majority of the St. Joseph River SA boundary (United States Department of Agriculture, 2016 and 2017).

The pasture/hay lands support livestock production for small to major livestock farming operations within the SA. Both dairy cattle and pig farming have active confined feeding operations (CFOs), which require a minimum of 5,000 animal units, identified within the counties that comprise the SA. These CFOs are considered the predominant livestock industry within the St. Joseph River SA (Thompson, 2008).

When combining these major agricultural land use activities, the St. Joseph River SA ranks eighth in percentage of total statewide land use (2.86%), but it is the most significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the second largest land use category in the St. Joseph River SA covering approximately 204,679 (19%) of the 1,087,375 total acres, which is the third highest developed area density of any SA.

In general, urban/suburban development and their associated impervious areas are most concentrated in the northwestern portion of the SA, consisting of communities such as South Bend, Mishawaka, Elkhart and Goshen; though smaller footprints of high intensity development occur in areas such as Albion, Angola, Kendallville, Syracuse and Middlebury. The SA contains part of the South Bend-Mishawaka MSA, the fourth largest in the state with a 2010 population of 319,224 (Manns, 2013). Approximately 40% (118,016 acres) of St. Joseph County's 295,283 acres fall within the St. Joseph River SA, accounting for approximately 11% of the SA's total acres.

The SA also contains the majority of the Elkhart-Goshen MSA, the eighth largest MSA in the state with a 2010 population of 197,559 (Manns, 2013). Approximately 98% (293,530 acres) of Elkhart County's 299,520 acres fall within the St. Joseph River SA, accounting for approximately 27% of total SA acres. Together, the portions of St. Joseph and Elkhart Counties within the SA account for 38% of total area, and approximately 53% of total developed land.

Three Indiana regional councils overlap with the SA and include the Region III-A Economic Development District and Regional Planning Commission (56%), Michiana Area Council of Governments (44%), and the Northeastern Indiana Regional Coordinating Council (1%) (IARC, 2017). Analysis of the INDOT cities and towns GIS data shows the St. Joseph River SA contains all or part of 85 cities and/or towns, 29 of which are incorporated (INDOT, 2016).

According to the Michiana Area Council of Governments (St. Joseph, Elkhart, and Kosciusko Counties within SA), over a third of this region's employment is in the manufacturing industry with exception of St. Joseph County (16%) where the educational services, health care, and social assistance sectors have the highest number of jobs (MACOG, 2014). This region experienced higher than average job loss as a result of the 2008 economic downturn, but has also been recovering with higher job growth than other areas in Indiana since this time, with an increase of 10% in the region, and 22% within Elkhart County alone (MACOG, 2015).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 6,658 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The St. Joseph River SA has the third highest local road miles to square mile ratio of the SA's at approximately 3.92 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

According to INDOT GIS analysis of U.S. interstates and highways, state highways and local roads, there are approximately 1,052 miles of U.S. interstates and highways, 825 miles of state roads, and 6,658 miles of local roads within the St. Joseph River SA (INDOT Road Inventory Section, 2016). Based on the SA's size and overall concentration of roads per square mile of land, which ranks it in the top three, the overall concentration of roads is considerable.

U.S. Interstates and highways have a concentration of approximately 0.62 miles per square mile and local roads have a concentration of 3.92 miles per square mile, which ranks both categories third of the eleven SAs. The density of state highways is tied for seventh of the eleven SAs with 0.49 miles of state highways per square mile.

The St. Joseph River SA ranks third in the highest density of roadways, when comparing the combination of all three road types from all other SAs. The construction and maintenance of roads and bridges support the predominant mode of transportation and play an integral role in sustaining business and commerce throughout the region.

2.5.2 Railroads

Railroads provide an alternative means of transportation with approximately 375 miles of railroad within the St. Joseph River SA (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers within the SA and state. The concentration of railroads, within the St. Joseph River SA, ranks the sixth greatest with a density of 0.22 miles of railroad per square mile. The concentration of linear infrastructure throughout the SA has resulted in aquatic resource impacts reducing their functions and services due to habitat conversion, fragmentation, and loss associated with the construction and maintenance of railroad rights-of-way.

2.5.3 Service Corridors

Similar to the threats associated with roads and railroads, the St. Joseph River SA contains service corridors, which fragment habitats within the SA. The SA contains over 1,411 miles of service corridors within its boundary.

This SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. There are approximately seventy five (12 kV) lines, fifty four (34 kV) lines, seventeen (69 kV) lines, twenty six (138 kV) lines, and twenty six (345 kV) lines (Indiana Geological Survey, 2001). These lines extend over 635 miles throughout the SA, which is tied for the seventh highest concentration of electric transmission lines relative to the SA size; 0.37 mile of transmission line per square mile.

In addition to electric transmission lines, the St. Joseph River SA contains over 776 miles of pipelines in total (Indiana Geological Survey, 2002). It contains over 50 miles of pipelines that convey crude oil, 599 miles of pipelines that convey natural gas, and 127 miles of pipelines that convey refined petroleum products. When compared to other SAs throughout the state, the St. Joseph River SA contains the tenth greatest concentration of crude oil pipelines, sixth highest concentration of natural gas pipelines, and the seventh greatest concentration of refined product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 24 known low head dams within the SA (IDNR DOW, 2016), the fourth highest statewide total, but the second highest concentration with one low head dam per 71 square miles. Additionally, three of the 24 low head dams are located within state designated salmonid streams. There are currently 19 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 89 square miles, comprising 2% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 142,560 linear feet (27 miles) of NLE's mapped within the SA, averaging one mile of NLE per 63 square miles, the second to least concentration among all SA's. LaGrange and Steuben counties were not included in the NLE identification project since they were not declared disasters resulting from the 2008 severe weather events; therefore, the St. Joseph River SA has additional NLE's that have not yet been mapped as part of this effort. Approximately 22.5 miles of the currently identified NLE's are located within predominantly developed areas, indicating that many of the mapped NLE may be road and railroad beds, and/or berms along channelized/maintained waterways. The remaining NLE's are mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The St. Joseph River SA contains some oil and gas production. The Indiana Geological Survey (IGS) identifies ten petroleum gas fields that include seven active gas wells; twenty-five abandon gas wells; two oil fields that include one oil and gas well and three abandon oil and gas wells within the St. Joseph River SA, with a combined statewide ranking of ninth for productive oil and natural gas fields (Indiana Geological Survey , 2015). Although the petroleum field rankings are near the bottom, the IGS petroleum well data identifies 152 dry wells, 243 stratigraphic wells, two abandon waste disposal wells and eight temporarily abandon wells within the SA boundary (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The St. Joseph River SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains twenty-four sand & gravel mining operations (Indiana Geological Survey, 2016). Relative to the St. Joseph River SA size, mineral mining in the SA ranks seventh in the state with twenty-four active operations.

2.7.3 Coal

The St. Joseph River SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The St. Joseph River SA is located entirely within the Indiana SWAP Great Lakes Planning Region. The SWAP identifies the most significant threats to habitats and SGCN within the Great Lakes Region as:

- Habitat conversion and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

The SWAP Great Lakes Region has experienced loss in the majority of habitat types over the last decade mostly to urban development, which gained 6.2% in land cover (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within agricultural and developed impervious footprints make up 80% of the land use within the SA and are expected to remain as top contributors to aquatic resource impairments. The South Bend-Mishawaka and Elkhart-Goshen MSA's are anticipated to remain the most likely for continued growth and development with the most potential for increases in developed land use impairment sources, which together consist of approximately 53% of the developed acres within the SA.

The MACOG has implemented a transportation plan known as Michiana on the Move: 2040 Transportation Plan, which serves as a roadmap for addressing multimodal transportation needs in this region, both near and long term (MACOG, 2014). Plans for roads, highways and associated infrastructure primarily include road reconstructions, new road constructions, added travel lanes, intersection improvements, grade separations and lane configurations. The plan also identifies mass rail transit, freight, non-motorized transportation, bicycle and pedestrian facilities and intermodal connections, both locally within the region, and for the larger regional cities including Chicago, Indianapolis, Detroit, Toledo and Fort Wayne (MACOG, 2014).

With considerations of growth and economic vitality at the core, the plan models and anticipates growth and development in the region related to improved mobility. This region has continuously grown at varying rates over the last half century, and is projected to grow 10% or more by 2040. Preliminary analysis of considerations in the general framework of NEPA are also integrated into the

MACOG planning approach to identify "red flags" that transportation and development projects have the potential to impact such as infrastructure, mining and mineral exploration, hazardous materials concerns, water resources and historical resources (MACOG, 2014). This analysis will also benefit IN SWMP in identifying potential threats to aquatic resources and habitat, and may help in the landscape-watershed approach in identifying, prioritizing and addressing the most significant water quality problems within the SA.

IDNR anticipates that development along with transportation and service corridor projects, to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to offsetting the predominant threats in the St. Joseph River SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The St. Joseph River SA's historic aquatic resources included a diverse mix of wetlands and natural lakes that was home to a diversity of fish and wildlife species. The predominant land cover throughout the SA was comprised of various deciduous forested communities. The first Europeans entered this region as early as 1675, by using the St. Joseph River as a means of travel to the northern territories; however, fur traders established permanent settlements in South Bend due to the St. Joseph River's rich wildlife (The History Museum, 2016). This as an avenue for passage to western territories, along with transportation routes that extended through the region, cemented European settlement within the region. South Bend was the largest settlement in the SA, which resulted in the conversion and permanent alteration of the landscape and aquatic resources. Growth during this time was correlated to the use of the region's rivers for trade and commerce circa 1800s. The proximity of South Bend settlement on the St. Joseph River provided the shortest portage to the Kankakee River, which ultimately allowed passage for traders to New Orleans via the Mississippi River from the Great Lakes region, or passage west for explorers (The History Museum, 2016).

As European expansion and trade routes were established, settlement continued to grow. This resulted in the exploitation of the region's natural resources. The region's ecosystems were fragmented, drained, cut, and cleared in order to facilitate growth and development that led to cumulative habitat destruction within the region (Nevers, Whitman, & Gerovac, 1999/2000). Forests were harvested to accommodate farmland and the harvested trees provided materials for the region. Deforestation of the area also allowed for the establishment of industry and continued growth. Topeka, located in the central region of the SA, was transformed by this exploitation. Topeka was formally known as Slabtown because of all the sawmills in the region; however, in 1892 the establishment of the Wabash Railroad led to a name change and the establishment of a large stock yard that supported the shipment of livestock to the eastern US (Topeka Area Historical Society).

Shorelines of the natural lakes within the SA have been altered by humans throughout history, resulting in the loss of important lacustrine wetland areas. These alterations were caused by a variety of activities such as road construction and residential development. As a result of these alterations, natural areas have been fragmented and biodiversity has been significantly reduced. This decrease in diversity and productivity has ultimately caused a decrease in the health of aquatic ecosystems existing within lacustrine wetlands; human activities have proven to be primarily responsible for the degradation of plant communities, wildlife habitat, and water quality of these wetlands (Price, 2009).

In order to estimate aquatic resource loss within the SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified natural regions, and their aquatic communities. This SA is unique, when compared to the ten other SA's, because it is comprised of only one natural region, as identified within the Natural Regions of Indiana journal and depicted in **Figure 35**. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed prior to early European settlement **(Table 30)**. The table details the SA's estimated land cover percentage and identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Northern Lakes	Northern Lakes	100	Bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake (Wet sand flats and muck flats), and various deciduous forest types; Typical streams are clear, medium to low-gradient, sandy gravel beds	119,531	10.99	267,905	24.64	94.73

Table 30. The historic natural community composition for the St. Joseph River Service Area based upon the natural region and section

St. Joseph River Service Area
Natural Region

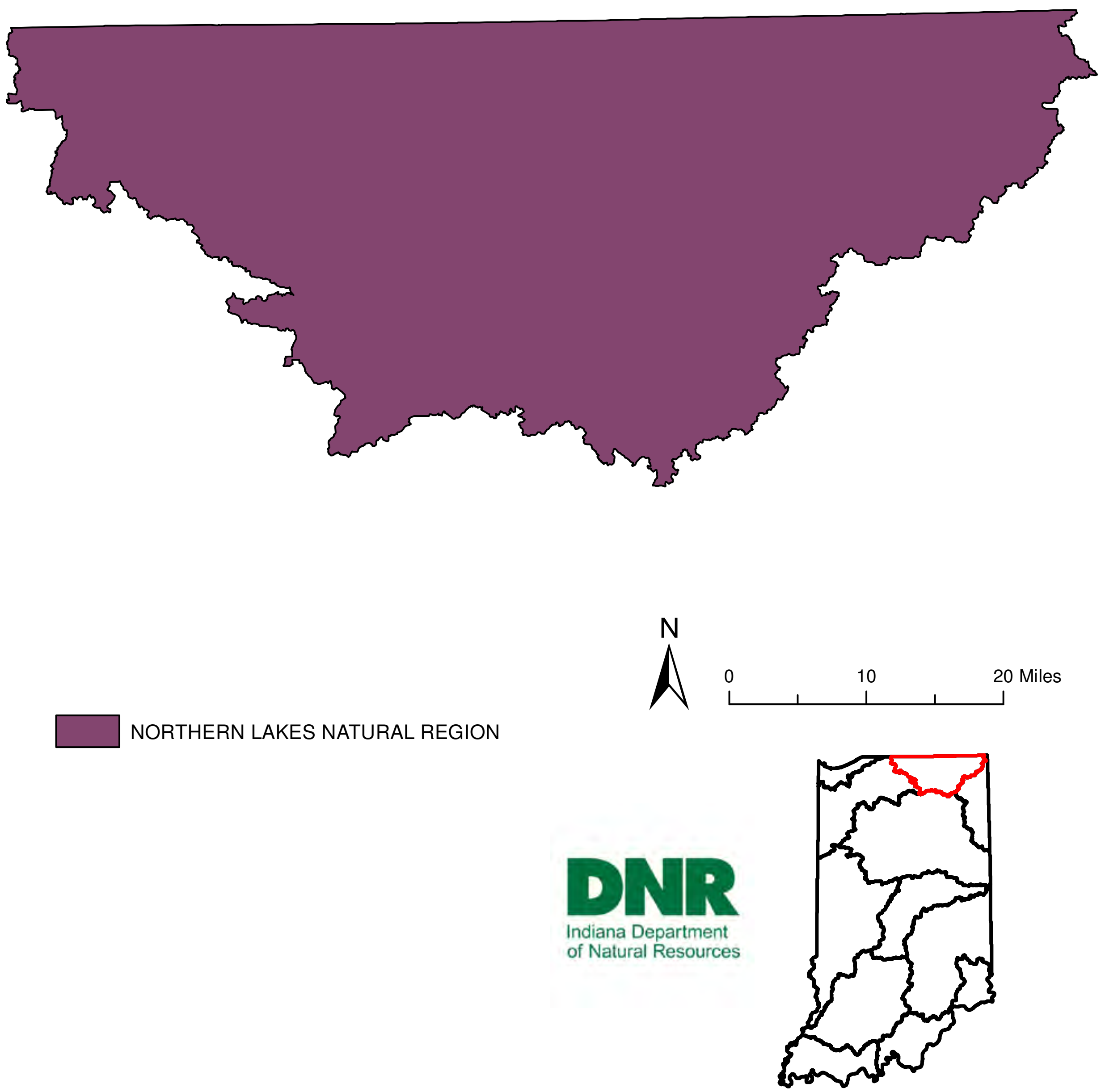


Figure 35. Natural regions and sections within the St. Joseph River Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 318 miles of category 4A impaired streams and 810 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (715 miles), impaired biotic communities (200 miles), dissolved oxygen (87 miles), PCB's in fish tissue (70 miles), nutrients (26 miles), ammonia (25 miles), and chloride (5 miles) as current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted QHEI assessments of 116 stream reaches within the SA **(Table 31 and Figure 36)** (IDEM OWQ, 2014). Though QHEI is intended for warm water communities, four (4) assessment reaches were conducted within salmonid streams which are also capable of supporting a salmonid fishery (such as put-and-take trout fishing) per the Indiana Water Quality Standards, 327 IAC 2-1-.5-5 (a)(3). Of the stream and river habitat reaches assessed, 42.2% are cable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	39	33.6
51-64	Habitat is partially supportive of a stream's aquatic life design	28	24.2
>64	Habitat is capable of supporting a balanced warm water community	49	42.2
	Total	**116**	**100%**

Table 31. IDEM overall QHEI scores for St. Joseph River SA, 1991-2014 (IDEM OWQ, 2014)

As previously discussed, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the St. Joseph River SA ranks last overall in forested cover density of all SA's at 6% of total area with approximately 67,730 acres, and is the SA with the third least percentage of forested cover with approximately 1.3% of 5,215,169 acres of forest cover statewide.

GIS analysis indicates that there are approximately 1,220,086 linear feet (231 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the St. Joseph River SA has the second lowest ratio of these potentially restorable stream miles to square miles of SA at approximately 0.14 mile of potential restoration per one square mile, or one mile of potential restoration for every 7.4 square miles of SA.

St. Joseph River Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

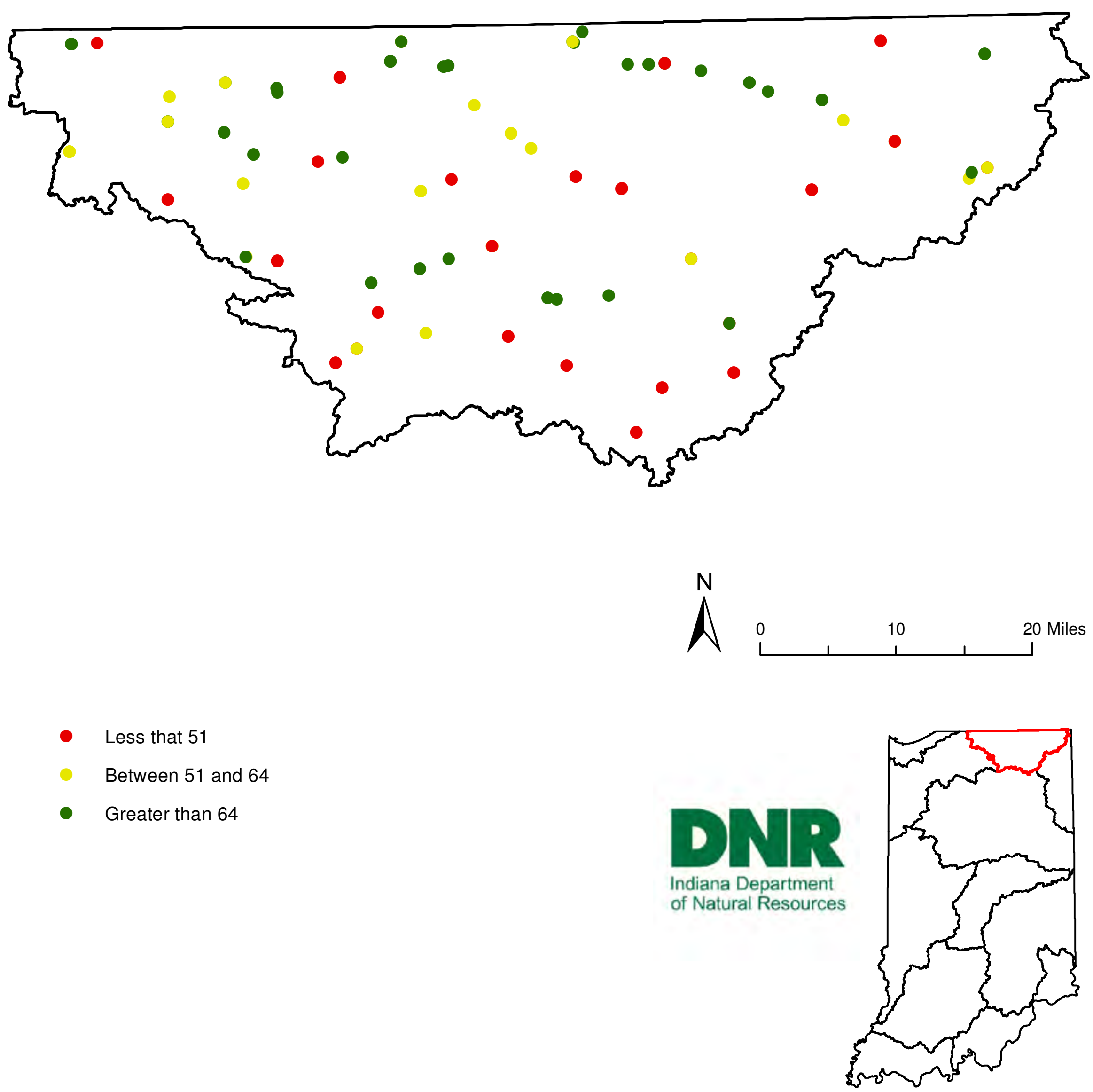


Figure 36. IDEM overall QHEI scores within the St. Joseph River SA; 1991 – 2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI in the St. Joseph River SA shows that there are approximately 26,661 acres of freshwater emergent wetland (PEM) and approximately 51,843 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 7.2% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 10% of the total SA **(Table 32** and **Figure 37)**. The St. Joseph River SA encompasses in part four Indiana counties containing the greatest densities of wetlands within the entire state; these counties are LaGrange, Steuben, Noble, and Kosciusko (IDNR, 1996). Among many wetland dependent wildlife species, the St. Joseph River watershed wetlands are home to many migratory birds and the federally-endangered Indiana Bat (DeGraves, 2005).

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	26,661.41	24.48%	2.45%	0.11%
Freshwater Forested/Shrub Wetland	51,843.16	47.61%	4.77%	0.22%
Freshwater Pond	6,596.40	6.06%	0.61%	0.03%
Lake	22,108.45	20.30%	2.03%	0.09%
Riverine	1,685.06	1.55%	0.15%	0.01%
Grand Total	**108,894.48**	**100.00%**	**10.01%**	**0.47%**

Table 32. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils (NRCS-USDA, 2016) account for 241,835 acres (**Figure 38**), or 22% land cover within the SA, out of which approximately 178,657 acres have the potential to be restored, accounting for 16.4% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The St. Joseph River SA ranks seventh among the SA's for both percentage of potentially recoverable wetland acres to total SA size and for total potentially restorable wetland acreage statewide.

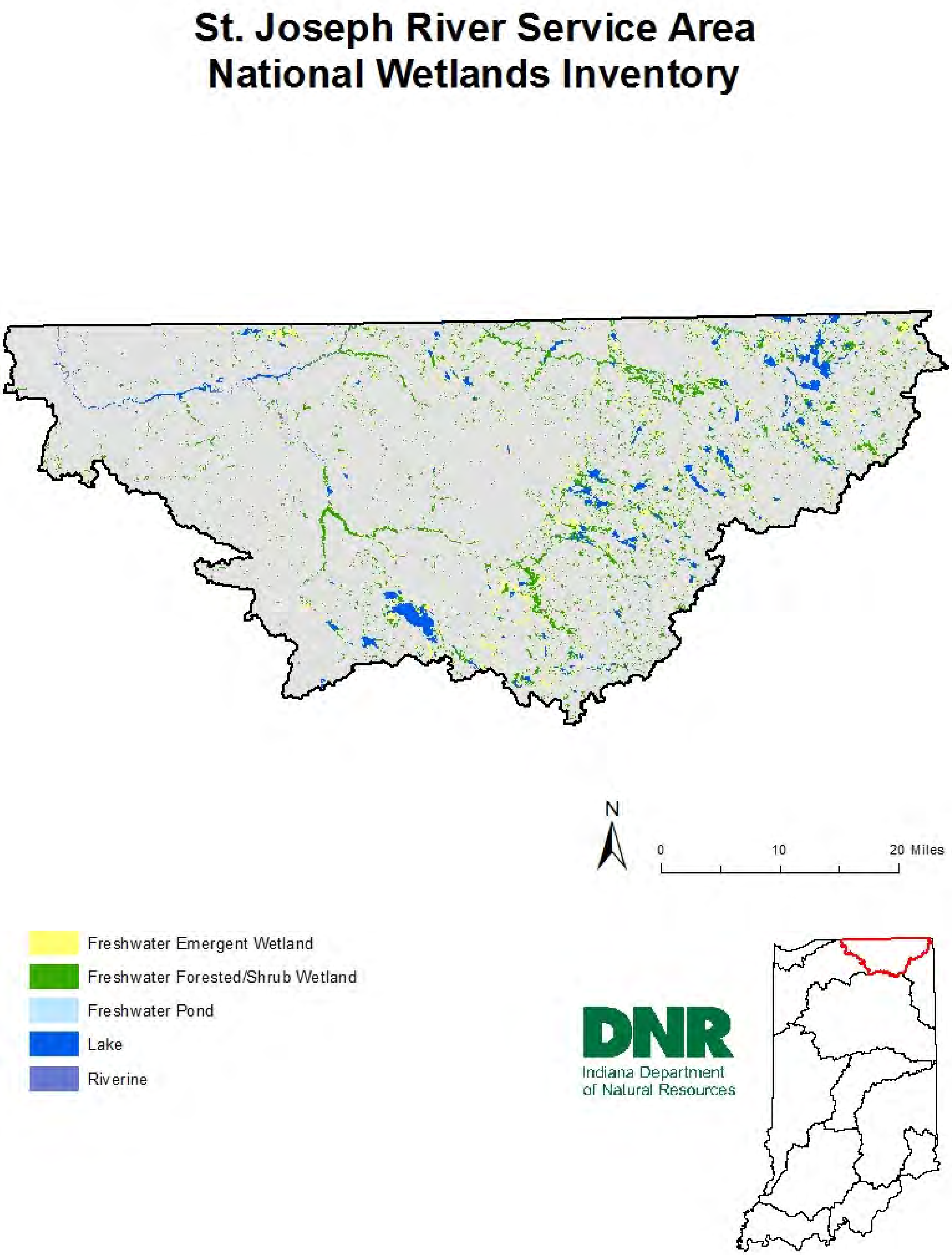


Figure 37. NWI within the St. Joseph River Service Area (USFWS NWI, 2015)

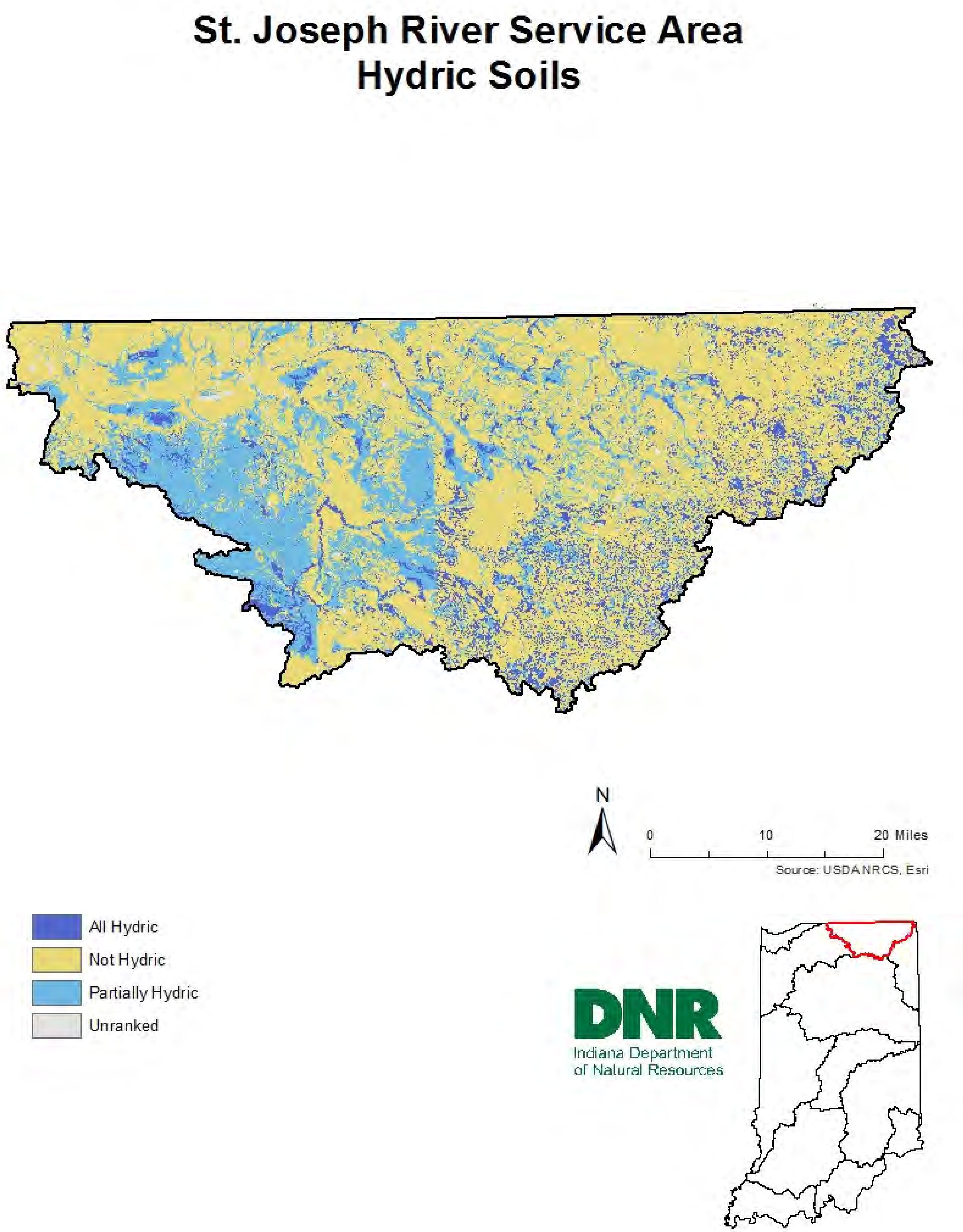


Figure 38. Hydric and partially hydric soils within the St. Joseph River SA (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 109,756 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Wisler Ditch-Baugo Creek (HUC 040500012102 **[Table 33)**.

Hotspots account for 467,444 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Village Lake-Turkey Creek (HUC 040500011701 **[Table 34)**. The watersheds with the highest concentrations of potentially restorable streams and wetlands **(Tables 33 & 34)** serve as the basis for identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 39** shows where these watersheds are located within the SA.

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
040500012102	Wisler Ditch-Baugo Creek	10,585
040500011707	Omar Neff Ditch-Turkey Creek	9,815
040500011708	Dausman Ditch-Turkey Creek	8,555
040500012101	Grimes Ditch	8,216
040500011706	Berlin Court Ditch	7,353

Table 33. Watersheds in the St. Joseph River (Lake Michigan) Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
040500011701	Village Lake-Turkey Creek	32,216
040500011708	Dausman Ditch-Turkey Creek	29,434
040500011901	Hoover Ditch-Rock Run Creek	24,699
040500011803	Headwaters Solomon Creek	24,273
040500011709	Pine Creek	18,295

Table 34. Watersheds in the St. Joseph River (Lake Michigan) Service Area with the most hotspots of potentially restorable streams

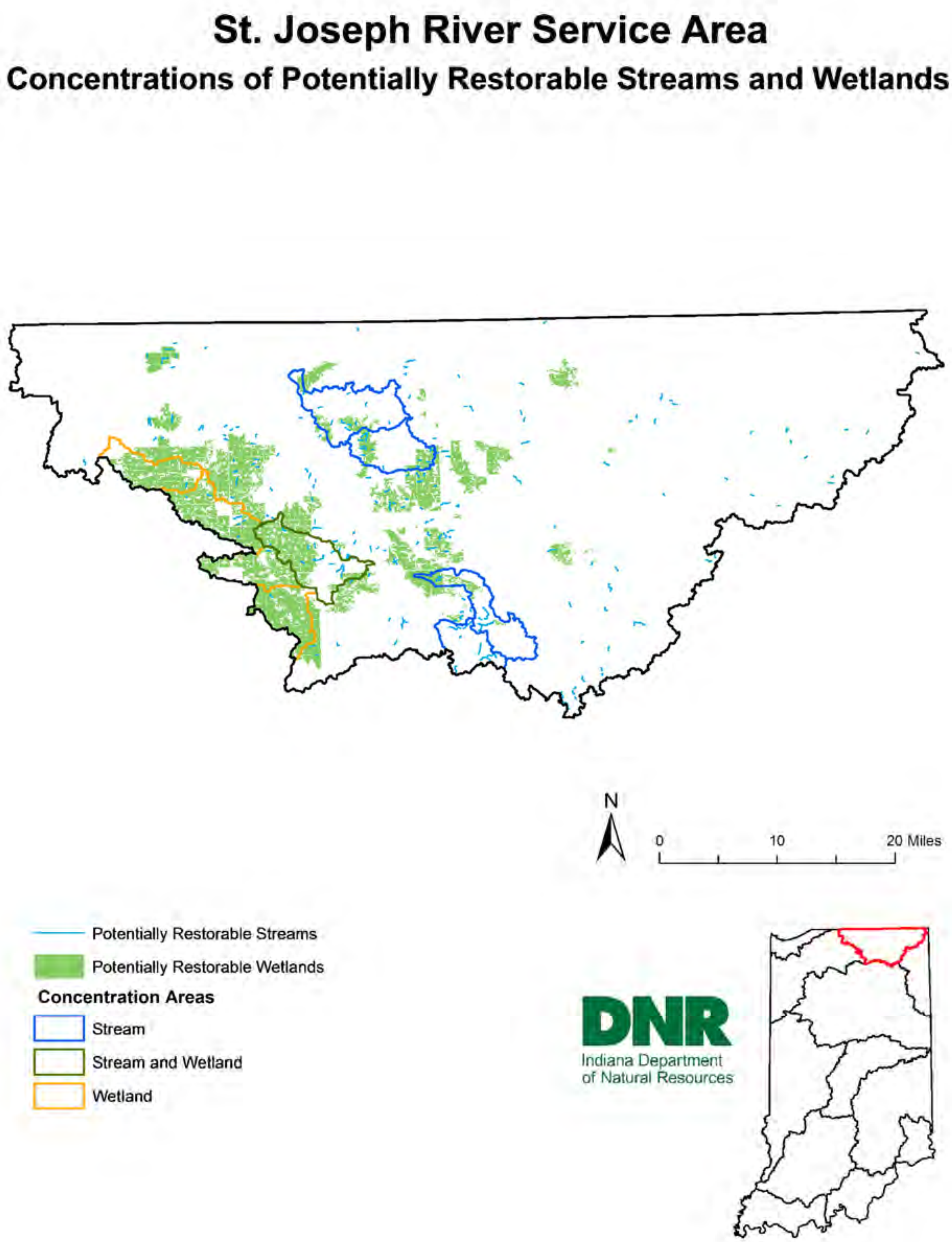


Figure 39. Concentrations of Potentially Restorable Streams and Wetlands in the St. Joseph River Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the SA indicates there are 47 lakes currently documented having category 5 impairments, which measured using the National Hydrography Dataset (NHD), includes 5,266 acres with PCBs in fish tissue, 1,778 acres of impaired biotic communities, 502 acres with phosphorus, and 383 acres total mercury in fish tissue.

Shorelines of the natural lakes within the SA have been altered by humans throughout history, resulting in the loss of important lacustrine wetland areas. These alterations were caused by a variety of activities such as road construction and residential development. As a result of these alterations, natural areas have been fragmented and biodiversity has been significantly reduced. This decrease in diversity and productivity has ultimately caused a decrease in the health of aquatic ecosystems existing within lacustrine wetlands; human activities have proven to be primarily responsible for the degradation of plant communities, wildlife habitat, and water quality of these wetlands (Price, 2009).

The 2011 NLCD identifies approximately 25,397 acres of open water which accounts for 2.34% of the SA. This varies slightly from the NWI, which identifies approximately 6,596 acres of freshwater pond comprising 0.6% of the SA, and 22,108 acres of lakes comprising 2% of total SA acres. Of these open waterbodies, GIS analysis identifies approximately 221 natural public freshwater lakes (PFL) (IC 14-26-2-1.5) within the SA, which is 52% of all PFL's as identified by the Indiana Natural Resource Commission list of public freshwater lakes (IN NRC, 2011). Furthermore, GIS analysis indicates that approximately 8,652 acres of PFO, PSS and/or PEM from the NWI are contiguous with the boundary of PFL's as identified in the DNR DOW's GIS data within the SA. IDNR will remain up to date with PFL and reservoir condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the St. Joseph River SA shows that approximately 99% of shallow unconsolidated aquifers in this SA receive between 4 to 11 inches of recharge per year **(Table 35).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	1.2	0.07%
	13	2.2	0.13%
	12	6.0	0.36%
	11	27.2	1.60%
	10	130.1	7.67%
	9	362.7	21.38%
	8	370.6	21.85%
	7	337.8	19.91%
	6	249.1	14.69%
	5	141.5	8.34%
	4	55.7	3.28%
Low	3	9.7	0.57%
	2	1.0	0.06%
	1>	1.5	0.09%

Table 35. Approximate annual ground water recharge rates in the St. Joseph River Service Area (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that approximately 99% of the St. Joseph River SA near surface aquifers are in the moderate to very high range for sensitivity to contamination **(Table 36)**. This reflects the middle to high aquifer recharge rates in the SA.

Sensitivity	Square Miles	Percent of Total Acres
Very High	253	15.22%
High	1,186	71.27%
Moderate	203	12.22%
Low	20	1.23%
Very Low	1	0.06%

Table 36. Ground water sensitivity distribution in the St. Joseph River Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data (IDNR DOW, 2016) shows the St. Joseph River SA the second least registered capacity of surface water withdrawal of any SA, with a 2015 registered surface water withdrawal capacity of 11,806 million gallons a day (MGD) **(Figure 40)**. The energy production sector accounts for approximately 70% of registered withdrawal capacity followed by industry and agricultural irrigation, both at approximately 11% each of total registered capacity.

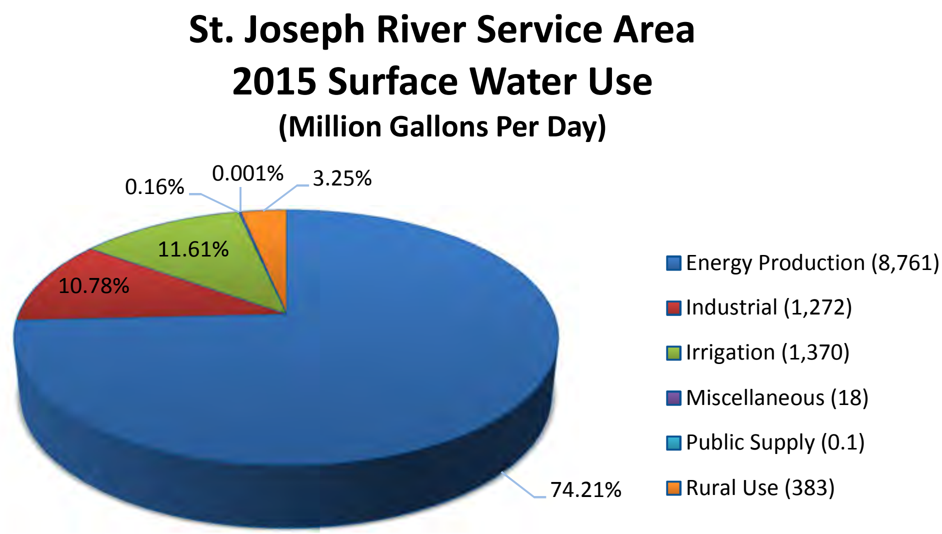


Figure 40. Significant Water Withdrawal Facilities-Surface Water (IDNR DOW, 2016)

Significant ground water withdrawal in the St. Joseph River SA is the fourth most of any SA with 25,978 MGD registered capacity **(Figure 41)** (IDNR DOW, 2016)**.** Public water supply and agricultural irrigation combined account for approximately 83% of registered ground water withdrawal capacity in the SA.

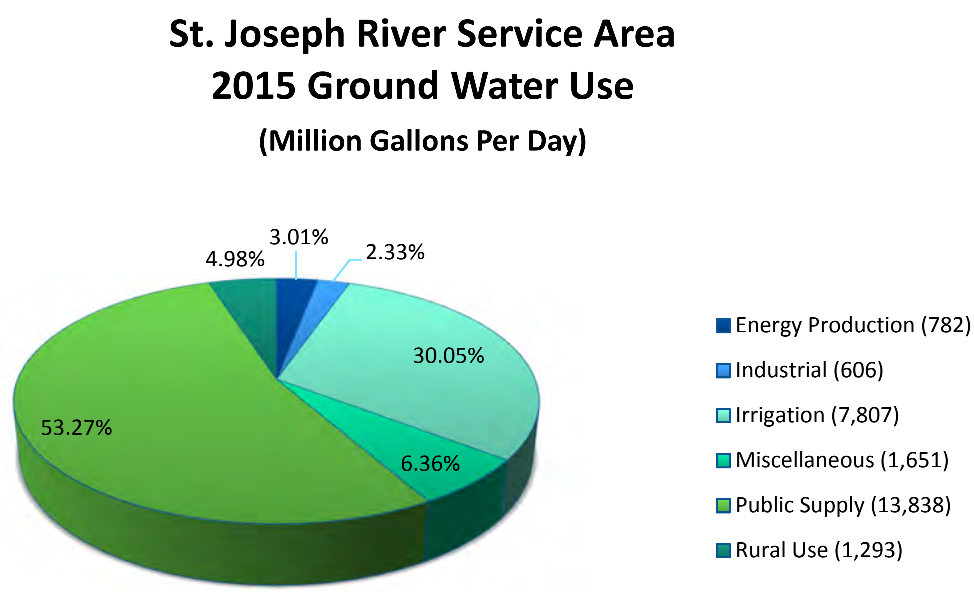


Figure 41. Significant Water Withdrawal Facilities-Ground Water (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

Analysis of the DNR salmonid stream GIS dataset indicates there are approximately 331,990 linear feet (63 miles) of salmonid streams in the St. Joseph River SA.

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the St. Joseph River SA include, but are not limited to acid bog, circumneutral bog, forested swamp, shrub swamp, fen, forested fen, marl beach, muck flat, wet floodplain forest, marsh, and sedge meadow, in addition to quality transitional, mixed and upland communities.

There are currently five amphibian species, 47 bird species, ten fish species, 11 mammal species, eight mollusk species, and nine reptile species listed as SGCN within the Indiana SWAP Great Lakes Planning Region (SWAP, 2015) which also includes the Calumet-Dunes and Maumee SAs.

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the St. Joseph River SA. The following aquatic resource goals and objectives apply specifically to the St. Joseph River SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration of riparian and lacustrine wetlands to help offset threats to, and improve functions and services of, aquatic resources that will improve connectivity of formerly extensive wetland and natural lake complexes throughout the SA that have been degraded by, and/or lost to conversion.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation, and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Restoration of in-stream habitat, structural integrity and riparian cover of salmonid streams critical to SGCN and salmonid species to include potential removal or modification of dams.
5. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying SWAP identified conservation needs and actions in the Great Lakes Planning Region where feasible.
6. Restoration, enhancement and/or preservation of aquatic resources that will offset threats from growth and development, agricultural land use, and transportation and service corridors as well as anticipated threats within the SA.
7. Implement stream and wetland restoration, enhancement and/or preservation projects to help improve watershed functions and services contributing to gains in Lake Michigan water quality, and

preserve and buffer high quality threatened habitats unique to the Great Lakes Region that are not yet protected such as those identified in the Great Lakes Restoration Initiative.
8. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.
9. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
10. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities.
11. Restoration of migratory bird aquatic habitat as identified in the Great Lakes Restoration Initiative and/or other applicable initiatives or studies.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the St. Joseph River SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Baugo Creek WMP, St. Joseph River (MI) WMP, Elkhart River WMP, Elkhart River-Yellow Creek (lower) WMP, Five Lakes Area WMP, Little Elkhart River WMP, Pigeon Creek WMP, and Puterbaugh Creek-Heaton Lake WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the St. Joseph River SA will permanently protect rare aquatic habitats, high quality natural aquatic and riparian communities, and waters having a significant contribution to ecological sustainability and important habitat for SGCN, while addressing the important physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in coincidence with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Trillium Land Conservancy, Wood-Land-Lakes RC&D Council, Clear Lakes Township Land Conservancy, Blue Heron Ministries, Wawasee Area Conservation Fund, and ACRES Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR intends to partner with land trusts that exist in the SA on compensatory mitigation projects to develop project plans and designs as well as providing long-term management and stewardship of subject properties over the life of the program.

Coordination with the St. Joseph River Basin Commission (SJRBC) for mitigation projects within the St. Joseph River SA will also be pursued. The SJRBC has completed the following watershed plans in the SA: Baugo Creek-Wisler Ditch, Elkhart River, Hesston-Stock Ditch Headwaters (including Pleasant and Riddles Lakes), Juday Creek, Little Elkhart River, Pigeon Creek, and Pigeon River.

Additional stakeholders' interest and potential conservation partnerships specific to the St. Joseph SA, and in which IIDNR is an interested party, include, but are not limited to the following organizations and/or initiatives:

- St. Joseph River Basin Commission
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- County Soil and Water Conservation Districts and the Indiana Association of SWCD's (IASWCD)
- Upper Midwest and Great Lakes, and Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperatives
- Michigan state and local level governmental entities
- Local and Great Lakes region academic institutions
- USGS Great Lakes Science Center
- USGS Indiana Water Science Center
- USGS Michigan Water Science Center
- Friends of the St. Joe River (FotSJR), Indiana and Michigan

- Michiana Area Council of Governments
- Region III-A Economic Development District and Regional Planning Commission
- Northeastern Indiana Regional Coordinating Council
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Steuben County Lakes Council
- Lake and/or Property Owner Associations
- Indiana Lakes Management Society
- Wawasee Area Conservancy Foundation

Some currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 42** below.

In order to target wetland protection and restoration efforts in areas with the most significant water quality benefit potential in the St. Joseph River watershed, the Friends of the St. Joe River Association with support from the U.S. EPA and the assistance of the Michigan Department of Environmental Quality (MDEQ) performed a GIS based Landscape Level Wetland Functional Assessment (LLWFA) which classifies existing and historic wetlands based on existing and/or potential functional value. The assessment included water quality functions such as floodwater storage, sediment retention, nutrient transformation and shoreline stabilization. Information about the methodology for the LLWFA and how it can be used to prioritize wetlands for protection and restoration can be found in a related report, *Paw Paw & Black Rivers Wetland Protection & Restoration Project*, for a sub-watershed of the St. Joseph River in Michigan, which was conducted by the Van Buren Conservation District with grant support from the MDEQ (Van Buren CD, 2013).

The 2015 Indiana Wetlands Program Plan recognizes this LLWFA as a robust wetland mapping tool for locating and prioritizing existing and potentially restorable wetlands (IWPP, 2015). The extent of the study is shown in **Figure 43** below illustrating priority wetland restoration (restoration wetland ownership) and existing wetlands (current wetland ownership areas) identified as priority for protection. The study also identified property ownership for all priority restoration locations. This LLWFA will be useful as an additional tool to help identify and prioritize potential wetland restoration, enhancement and/or preservation opportunities in the St. Joseph River SA.

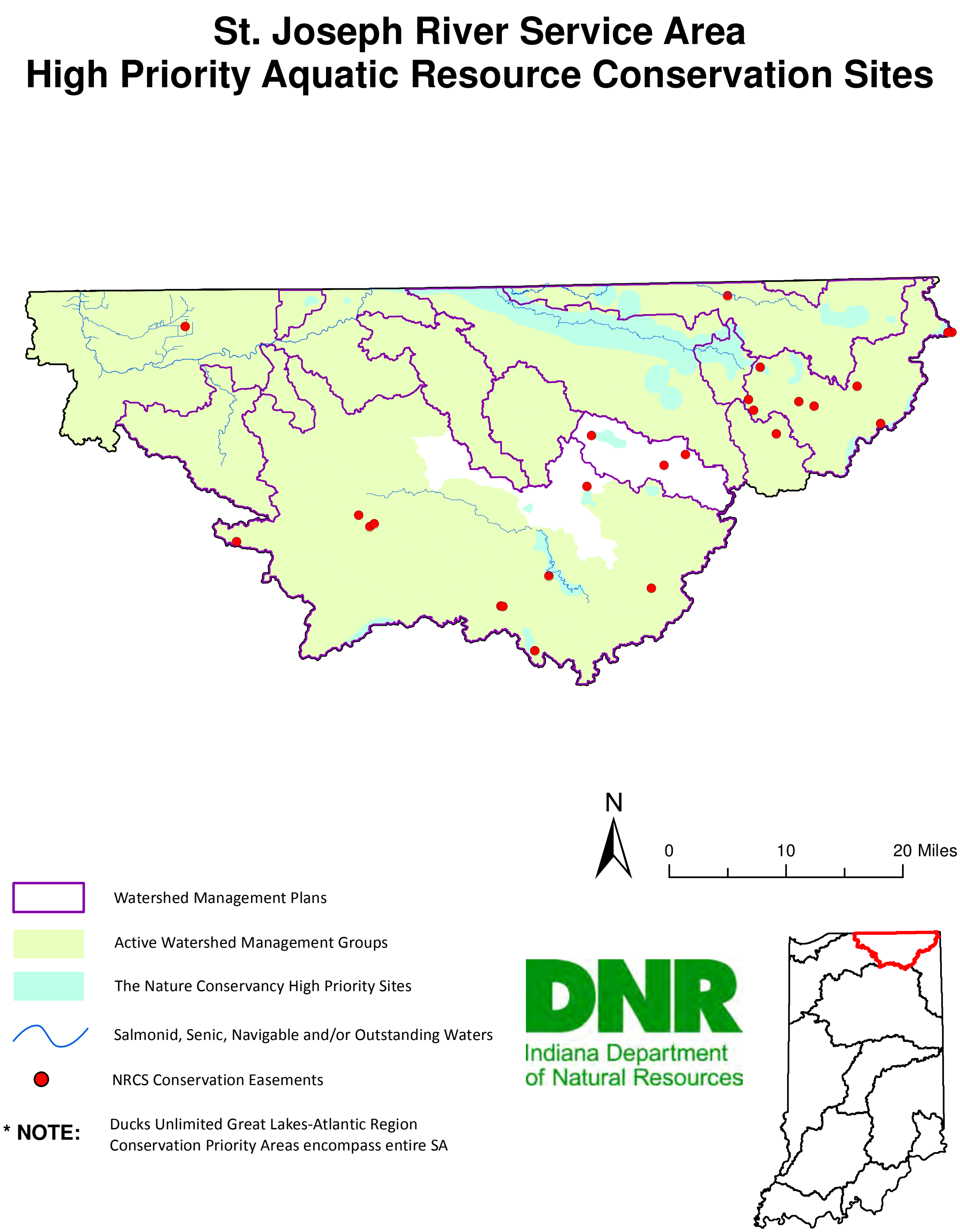


Figure 42. Priority conservation areas and sites within the St. Joseph SA; IDEM Wetland Program Plan (IWPP, 2015)

St. Joseph River Service Area
Functional Assessments and Priorities

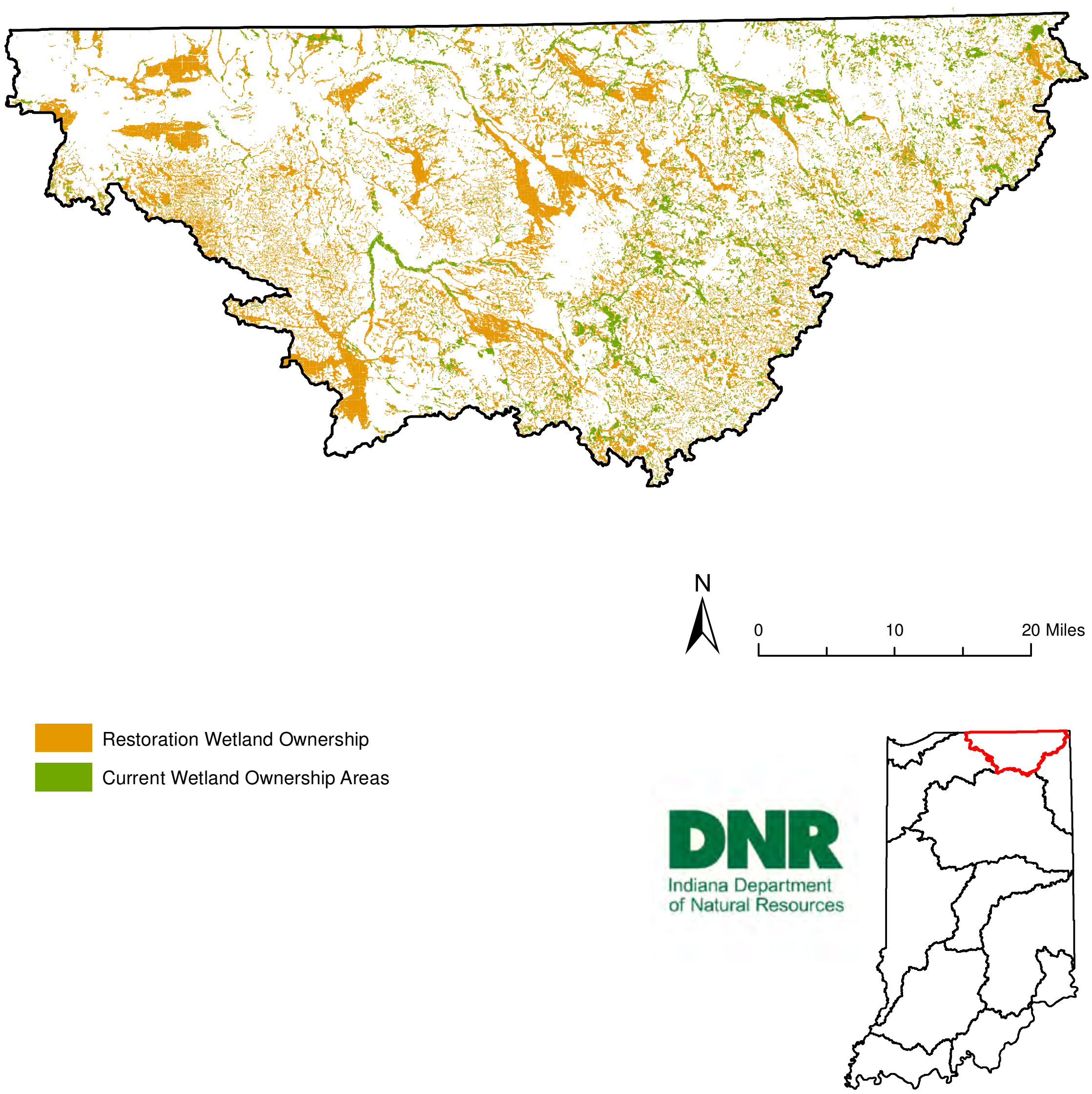


Figure 43. LLWFA priority wetland restoration and existing wetland locations (dataset includes ownership). Friends of the St. Joe, 2013. (IWPP, 2015)

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

APPENDIX B.3 MAUMEE SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION

The Maumee Service Area (SA) is located in northeastern Indiana and is composed of the following four 8-digit HUCs:

- 04100003 - St. Joseph
- 04100005 - Upper Maumee
- 04100007 - Auglaize
- 04100004 - St. Marys

The Maumee SA includes portions of the six Indiana counties listed below in the Maumee Lake Plain Region as well as the Northern Moraine and Lake Region physiographic regions. The Maumee Lake Plain Region is contained within Allen County only.

Steuben	Noble	Wells
DeKalb	Allen	Adams

Major rivers and streams of the Maumee SA include the St. Marys, St. Joseph, and Maumee Rivers. The St. Marys River begins in northwestern Ohio where it flows north to Fort Wayne, Indiana and converges with the St. Joseph River to form the Maumee River; the Maumee River flows 150 miles northeast where it drains to Lake Erie.

Draining approximately 821,671 acres of northeastern Indiana, the Maumee SA is mainly located within the Eastern Corn Belt Plains ecoregion and is characterized by rolling till plains where original beech forests and scattered elm-ash swamp forests have been replaced by farming; soils in this ecoregion are good for cropland. A smaller section of the SA located within Allen County is part of the Huron/Erie Lake Plains ecoregion, more specifically the Maumee Lake Plains sub-region, and is characterized by broad plains interspersed by sand dunes, end moraines, and beach ridges; the Maumee Lake Plains are poorly-drained and contain fertile soil. Elm-ash and beech forests have been replaced by drained farmland, and agricultural activities as well as ditching have greatly degraded the habitats and water quality of the Upper Maumee's aquatic systems (U.S. EPA: Ecoregions of Indiana).

Based on the 2011 NLCD, the land cover type with the greatest area in the Maumee SA is agricultural land use (72%), followed by developed and impervious land use (15%), forest and shrub/scrub (8.4%), and wetlands and open water (3.73%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 2.12% of SA cover per the NWI to 2.41% per the 2011 NLCD. Emergent herbaceous wetlands range from approximately 0.35% per the 2011 NLCD to 0.82% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Maumee SA (SA) have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are generally presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Maumee SA from 2009 – 2015 was collected and analyzed **(Table 37)**. According to the data, 43.8 acres of impacted wetlands and 10,141 linear feet of impacted streams required mitigation in the seven year time period.

The transportation and service corridor work type accounted for the most stream impacts (85.43%), followed by development (14.57%). There were no documented stream impacts requiring mitigation for agricultural land uses, dam related activities, or energy production and mining for this time period.

The transportation and service corridor work type accounted for the most wetland impacts (79.74%), followed by development (18.92%), and dam related activities (1.34%). There were no documented wetland impacts requiring mitigation for energy production and mining, or agricultural land use for this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 44**.

Work Type	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	0	0.00%	0.587	1.34%
Development	1,478	14.57%	8.283	18.92%
Energy Production	0	0.00%	0	0.00%
Transportation	8,663	85.43%	34.912	79.74%
Grand Total	**10,141**	**100.00%**	**43.782**	**100.00%**

Table 37. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015. Source: USACE Louisville and Detroit Districts

Maumee Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

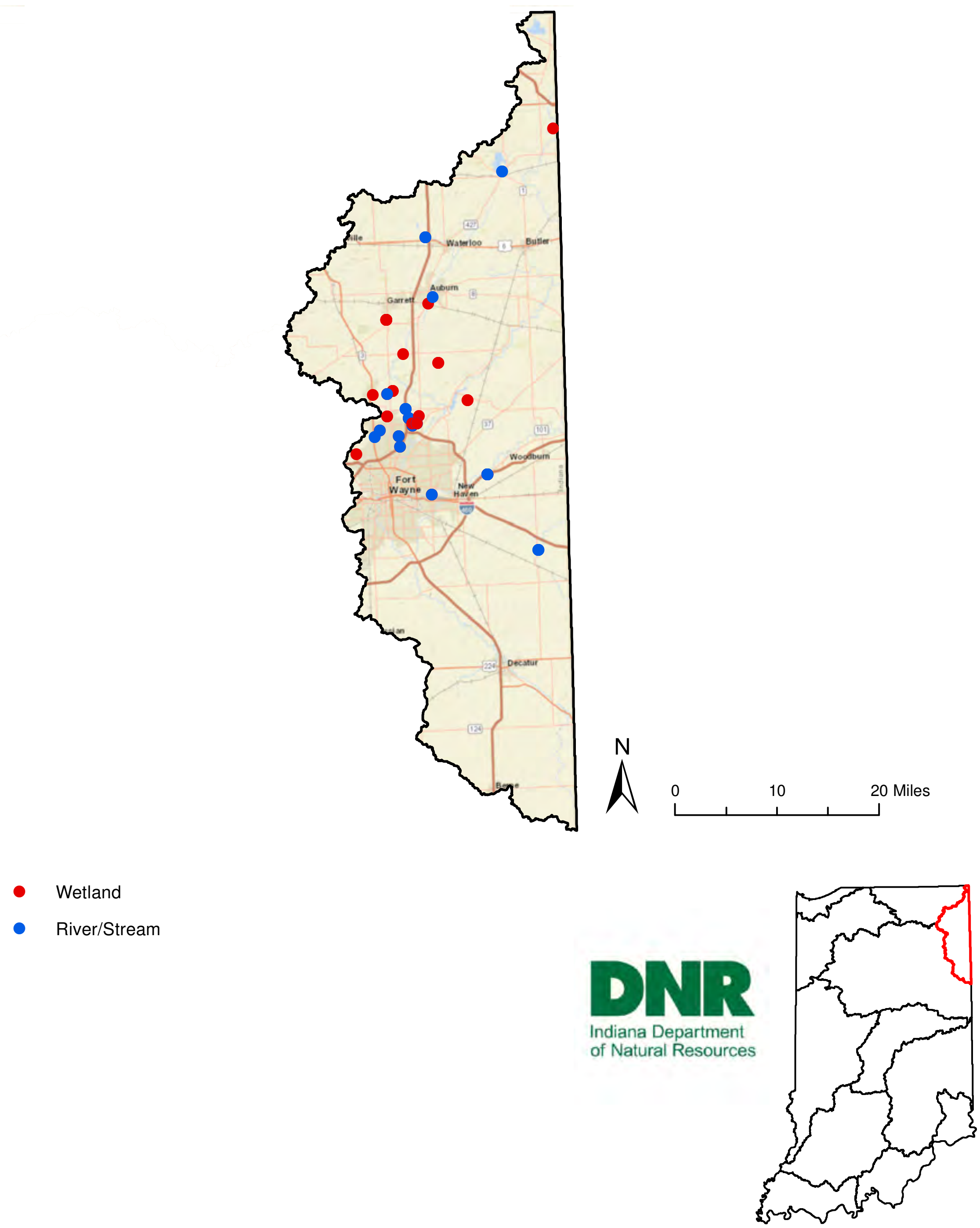


Figure 44. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Maumee SA is presented in **Figure 44,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

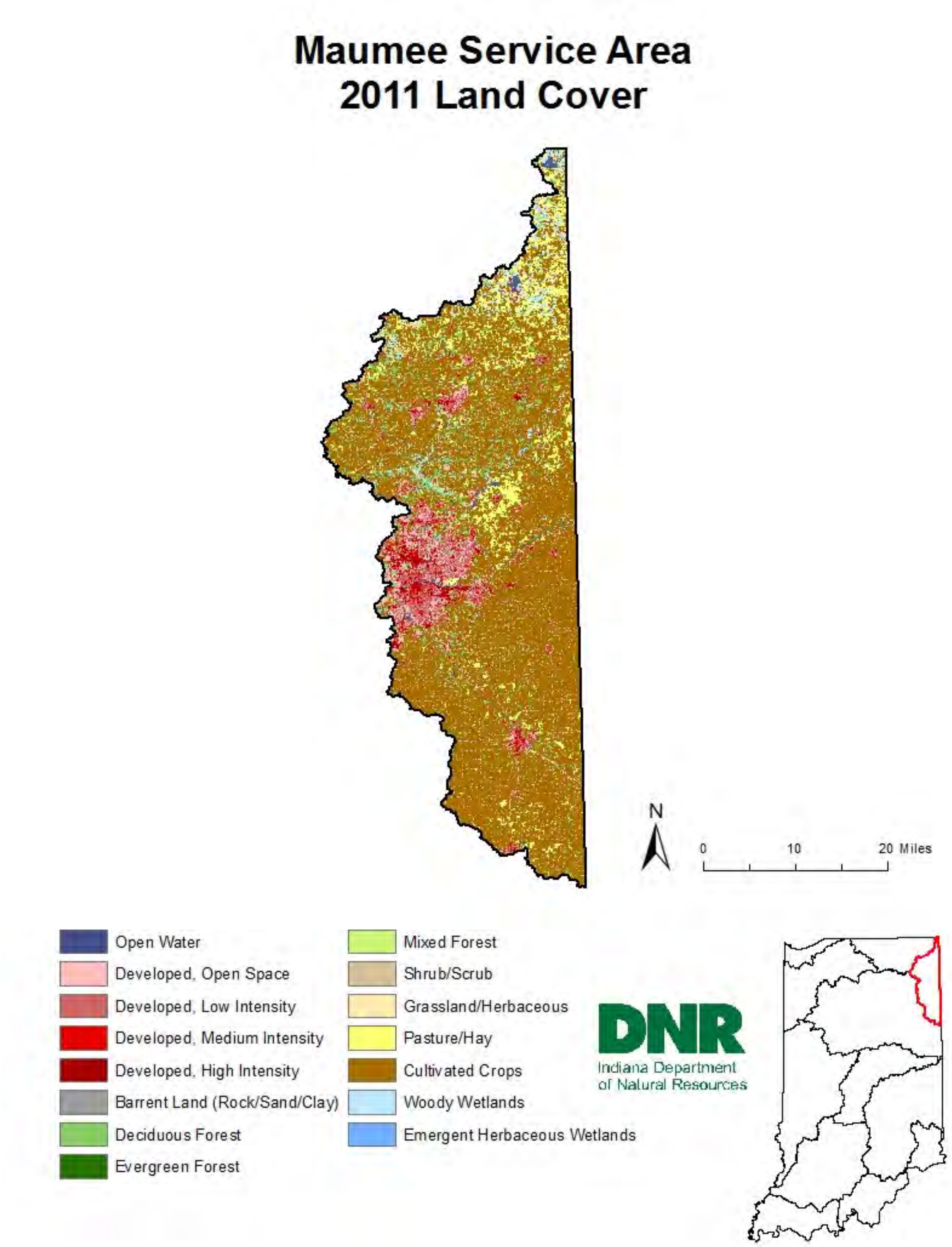


Figure 44. Land Cover in the Maumee Service Area (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 38)**.

Maumee SA Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	7,992	0.97%
Developed	Open Space	58,242	7.09%
Developed	Low Intensity	42,024	5/12%
Developed	Medium Intensity	15,990	1.95%
Developed	High Intensity	7,893	0.96%
Barren Land (Rock/Sand Clay)	*	546	0.07%
Forest	Deciduous	64,542	7.86%
Forest	Evergreen	997	0.12%
Forest	Mixed	64	0.01%
Shrub/Scrub	*	3,488	0.42%
Grassland/Herbaceous	*	5,733	0.70%
Pasture/Hay (Agriculture)	*	56,744	6.91%
Cultivated Crops (Agriculture)	*	534,474	65.07%
Wetlands	Woody	19,8234	2.41%
Wetlands	Emergent Herbaceous	2,872	0.35%
Grand Total		**821,425**	**100%**

Table 38. Maumee SA land cover classification/value percentages from 2011 National Land Cover Database (Homer, et al., 2015)
*** Class does not have additional values**

IDNR combined the values within the same land cover classification in **Figure 45** below to demonstrate the current overall land cover distribution of the SA.

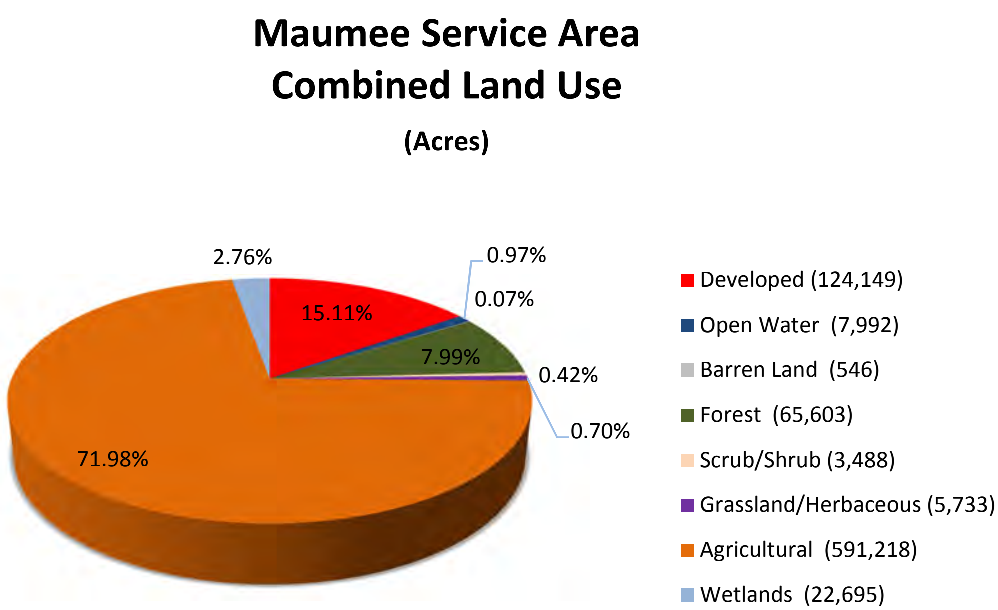


Figure 45. Combined land uses for the Maumee SA from the 2011 NLCD (Homer, et al., 2015)

2.3 Agriculture

The 2011 NLCD demonstrates that the dominant land use in the Maumee SA is agricultural area covering approximately 591,218 (71.97%) of the SAs 821,424 total acres (Homer, et al., 2015). With the exception of the City of Fort Wayne, which is concentrated near the west central region, and other smaller developed footprints, agricultural land cover is the predominant land use throughout the Maumee SA boundary.

Within the identified land use areas, cultivated crops comprise 534,474 acres (60.07%) and pasture/hay lands cover 56,744 acres (6.91%) of the service area. Soybean production is the primary cultivated crop within the SA, followed by corn, based upon acres of harvested crops from counties that comprise the majority of the Maumee SA boundary (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production from small to major livestock farming operations within the SA. Based on identified confined feeding operations (CFOs), which require a 5,000 animal unit minimum, pig farming CFOs are the predominant livestock industry within the Maumee SA (Thompson, 2008).

When combining these major agricultural land use activities, the Maumee SA ranks tenth in percentage of total statewide land use (2.56%), but it is the most significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the second largest land use category in the Maumee SA covering 124,149 (15.11%) of the 821,424 total acres, which is the fifth highest developed area density among all of the SAs.

In general, the most intensely developed impervious areas are most concentrated in the west central portion of the SA in Fort Wayne, with additional smaller footprints of dense development in communities such as Auburn, Decatur, and New Haven. The SA largely encompasses the Fort Wayne MSA, the third largest in the state with a 2010 population of 416,257 (Manns, 2013). Approximately 77% (323,091 acres) of Allen County's 422,400 acres fall within the Maumee SA, accounting for approximately 40% of total SA acres. Analysis of the INDOT cities and towns GIS data shows the Maumee SA contains entirely or in part 73 cities and/or towns, 20 of which are incorporated (INDOT, 2016).

Two Indiana Regional Councils that overlap the Maumee SA include the Northeastern Indiana Regional Coordinating Council (NIRCC) (89%) and Region III-A Economic Development District and Regional Planning Commission (11%) (IARC, 2017). In cooperation, these two regional councils completed a comprehensive economic development strategy for their 10 combined counties encompassing the northeast corner of the state (Region III-A , 2015).

Allen County is the largest county within Region III-A and NIRCC with a population of 363,014, or 53% of this area per the 2013 U.S. Census (Manns, 2013) because it includes the Fort Wayne MSA, impacting growth and development in the more intensely developed portions of the Maumee SA, while also driving growth in the Upper Wabash SA's. Though the Maumee SA does not entirely contain all the counties of these two regional councils, the population in this region has seen a total growth of 73% since 1950 to a 2010 population of 681,728 (Region III-A , 2015). Additionally, Steuben County accounted for 11.8%, and Noble County for 10.3%, of growth over the last decade in this region (Region III-A , 2015).

The largest employment sector in the region is manufacturing with 71,783 (25%) of the workforce. The automotive sector accounts for 21.4% of manufacturing employment in this region, including assembly, components fabrication, recreational vehicles and trailers. Other major manufacturing contributors are the medical devices and defense industries in addition to steady growth in food processing due to significant row crop and livestock operations supported by major grain and processing. These products range from dairy, eggs, poultry, specialty products, and have contributed to growth in agritourism, warehousing and distribution (Region III-A , 2015).

Other major employment sectors in the region are retail/wholesale trade (16%), health/educational services (14%), professional services (8%), financial/insurance and real estate (5%), construction (4%), transportation (3%), with leisure, information, natural resources, utilities, and other services accounting for the remaining 25% of employment. The construction industry is projected to account for 5% of total economic growth by 2020, a 24.1 increase in this sector (Region III-A , 2015).

Additionally, analysis of INDOT's local roads GIS (INDOT Road Inventory Section, 2016) data show there are approximately 4,917 miles of municipal and county roads contributing to the developed impervious land cover within the SA. The Maumee SA has the fourth highest local road miles to square mile ratio of the SA's at approximately 3.83 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

Based on INDOT GIS analysis of U.S. interstates and highways, state highways and local roads, there are approximately 640 miles of U.S. interstates and highways, 488 miles of state roads, and 4,917 miles of local roads within the Maumee SA (INDOT Road Inventory Section, 2016). Since this is the second smallest of all the SAs, the concentration of road miles per square mile of land within the SA is substantial.

U.S. Interstates and highways have a concentration of approximately 0.5 mile per square mile, which ranks sixth when compared to the other eleven service areas. The concentration of both local roads at 3.83 miles per square mile and the combination of all roads at 4.71 miles per square mile, rank fourth compared to all SAs. In contrast, the concentration of state highways 0.38 mile per mile, which places it last when compared to the other SAs.

Although the concentration of state highways is low, when combined with all identified road types within the Maumee SA, the overall concentration of roads ranks near the top. The construction and maintenance of roads and bridges support the predominant mode of transportation and play an integral role in sustaining business and commerce throughout the region.

2.5.2 Railroads

Railroads provide an alternative mode of transportation within the Maumee SA. The SA has approximately 304 miles of railroads within its boundary (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA, state, and region. The Maumee SA contains the fourth greatest concentration of railroads with a density of 0.24 miles of railroad per square mile. The concentration of linear infrastructure throughout the SA poses a significant threat to aquatic resources in the form of habitat fragmentation, disruption to fluvial processes, resource degradation, habitat conversion and resource loss.

2.5.3 Service Corridors

Similar to threats identified with roads and railroads, the Maumee SA contains concentrations of service corridors. The SA has over 1,081 miles of service corridors throughout its boundary.

The SA contains a network of large kilovolt (kV) electric transmission lines that include one (12 kV) line, sixty (34.5 kV) lines, forty-eight (69 kV) lines, sixty-eight (138 kV) lines, twenty (345 kV) lines, and one (765 kV) line (Indiana Geological Survey, 2001). These electric transmission lines extend over 603 miles throughout the SA. When comparing the concentration of transmission lines per mile, the Maumee SA ranks fifth, with 0.47 miles of electric transmission lines per square mile.

In addition to electric transmission lines, the Maumee SA contains over 478 miles of pipelines; approximately 54 miles of pipelines that carry crude oil, 352 miles of pipelines that transport natural gas, and 72 miles of pipelines that carry refined petroleum products (Indiana Geological Survey, 2002). The Maumee SA contains the ninth largest concentration of crude oil and natural gas pipelines, and the tenth highest concentration of refined product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 5 known low head dams within the SA (IDNR DOW, 2016), the lowest statewide total, but the seventh highest concentration at one low head dam per 257 square miles. There are currently 13 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 99 square miles, the third least concentration comprising 1% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 137,280 linear feet (26 miles) of NLE's mapped within the SA, averaging one mile of NLE per 49 square miles, the eighth highest concentration among all SA's. Steuben County, which falls partially within the Maumee SA, was not included in the NLE identification project since it was not a declared disaster resulting from the 2008 severe weather events; therefore, the Maumee SA has additional NLE's that have not yet been mapped as part of this effort. Approximately 13.5 miles of the currently identified NLE's are located within predominantly developed areas with the remaining 12.5 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Maumee SA contains active natural gas and oil production fields. The Indiana Geological Survey (IGS) identifies eight petroleum gas fields that include two active gas wells and forty-six abandon gas wells (Indiana Geological Survey, 2015). In addition, they identify four active oil fields that include four oil wells and sixty-seven abandon oil wells (Indiana Geological Survey , 2015).

Finally, the IGS identifies eight active oil & gas fields that include four oil & gas wells and eleven abandon oil & gas wells. Based upon the combined total of these active fields, the Maumee SA holds a statewide ranking of sixth for productive oil and natural gas fields (IGS-Petroleum Wells in Indiana, 2015). In addition to the Maumee SA oil and gas fields and related wells, the IGS petroleum well data identifies 158 dry wells, 152 stratigraphic wells, two active and one abandon salt water disposal wells and one temporarily abandoned well within the SA boundary (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The Maumee SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains eight sand & gravel mining operations and four crushed stone operations (Indiana Geological Survey, 2016). Relative to the St. Joseph River SA size, mineral mining in the SA ranks seventh in the state with twenty-four active operations. Similar to the Calumet-Dunes SA, the IGS identified one slag operation, which utilizes the byproduct from steel mills as an aggregate (Indiana Geological Survey, 2016).

2.7.3 Coal

The Maumee SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Maumee SA is located entirely within the Indiana SWAP Great Lakes Planning Region. The SWAP identifies the most significant threats to habitats and SGCN within the Great Lakes Region as:

- Habitat conversion and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

The SWAP Great Lakes Region has experienced loss in the majority of habitat types over the last decade, primarily to urban development, which gained 6.2% in land cover (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses with the agricultural and developed impervious footprints make up approximately 87% of land use with the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR anticipates that development, along with transportation and service corridor projects, to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

Northeast Indiana is served by two major interstate highways, I-69 (North/South) and I-80/90 (East/West; the Indiana Toll Road), seven U.S. highways, and over twenty state roads. The interstate, U.S. highway, and state road systems provide connectivity throughout the region to nearly twenty major U.S. and Canadian markets within a 500 mile radius. Businesses in the region have a one-day drive by truck to more than 40% of the U.S. population and over one-fifth of the Canadian population. The roadway infrastructure, in addition to railroad access in the region, allow for significant intermodal transportation of freight in and out of the region. Roadways and associated infrastructure in the region are in need of improvement and regular maintenance. NIRCC's 2035 Transportation Plan addresses needs and plans for the next two decades (NIRCC, 2013).

There has been an emphasis on the development, connectivity and completion of trails and pedestrian facilities throughout the region resulting in many new trails as well as more under development or planned. Public utilities are underfunded and deteriorating, particularly sewer districts, and will require maintenance, upgrades, and expansion for population growth (NIRCC, 2013).

Economic growth goals and objectives for the region include improving and diversifying workforce skill sets to attract more companies across all industries, including expanding the manufacturing core. Other regional planning goals include transportation and infrastructure investments, improved affordable energy, effective public transit, and increased shovel-ready development sites (NIRCC, 2013). Additionally, threats to natural lakes areas within the SA and remaining wetland complexes due to growth and development, and agricultural lands uses are anticipated to continue as well. The Maumee SA has a low 6% forested land cover resulting in the threat of further reduction of forest ecological functions and services due to the ongoing identified major anthropogenic activities.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to offsetting the predominant threats in the Maumee SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Maumee SA's historic aquatic resources were comprised of a diverse mix of natural aquatic communities and was predominately forested. Similar to the majority of the northern section of the state, aquatic resource loss is attributed to the land alteration for European settlement.

The eastern portion of the ancient Lake Maumee, considered the predecessor of Lake Erie, left behind a large forested wetland, named the Black Swamp by early settlers, when the lake receded (Homoya, Abrell, Aldrich, & Post, 1985). It was located in the northeast portion of Indiana and northwestern Ohio and was nearly destroyed due to clear cutting and land clearing. The Maumee watershed is the approximate footprint of the former Black Swamp. This extensive wetland was estimated to equal the size of Connecticut and was eliminated due to the barrier it created for travel and settlement (Dahl & Allord, 1996).

As settlement established within the area, the use of natural resources increased. Although agriculture dominates the landscape, transportation played a vital role for accessing markets and transport. The eastern central portion of the SA, contains Ft. Wayne, which became the regional epicenter of early European settlement. The Wabash and Erie Canal connected Ft. Wayne to Lake Erie, by following the Maumee River and it was considered the most important canal built within the state before the mid-1800s (The History Museum, 2017).

As the primary mode of transportation shifted to railroads, natural resource loss was accelerated. Railroads established transportation routes that provided access to new lands and a means for development; however, the railroad industry were direct consumers of wetland forest products, which fueled intense land clearing and timbering, from 1859 to 1885, resulting in elimination of most of the regions wetlands, including the Black Swamp (Dahl & Allord, 1996). Unfortunately, the majority of wetland complexes throughout the state suffered the same fate. By the beginning of the twentieth century, less than 4% of the Great Black Swamp remained due to drainage practices (Mitsch & Gosselink, 2000).

Due to extensive aquatic resource loss within the Maumee SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 46** below depicts each Natural Region and Section located within the Maumee SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement **(Table 39)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Natural Region(s)	**Natural Region: Section(s)**		**Natural Region Community Types**	**Hydric Soils**		**Partially Hydric**		**Estimated Pre-Settlement Forest Cover**
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Central Till Plain	Bluffton Till Plain	64.0	Predominantly forested, along with minor areas of bog, prairie, fen, marsh and lake	176,777	21.5	452,164	55.1	84.1
Black Swamp	Black Swamp	18.6	Predominantly swamp forest; Typical streams are low-gradient, silty and shallowly entrenched					
Northern Lakes	Norther Lakes	17.4	Bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake (Wet sand flats and muck flats), and various deciduous forest types; Typical streams are clear, medium to low-gradient, sandy gravel beds					

Table 39. The historic natural community composition for the Maumee Service Area based upon the natural region and section

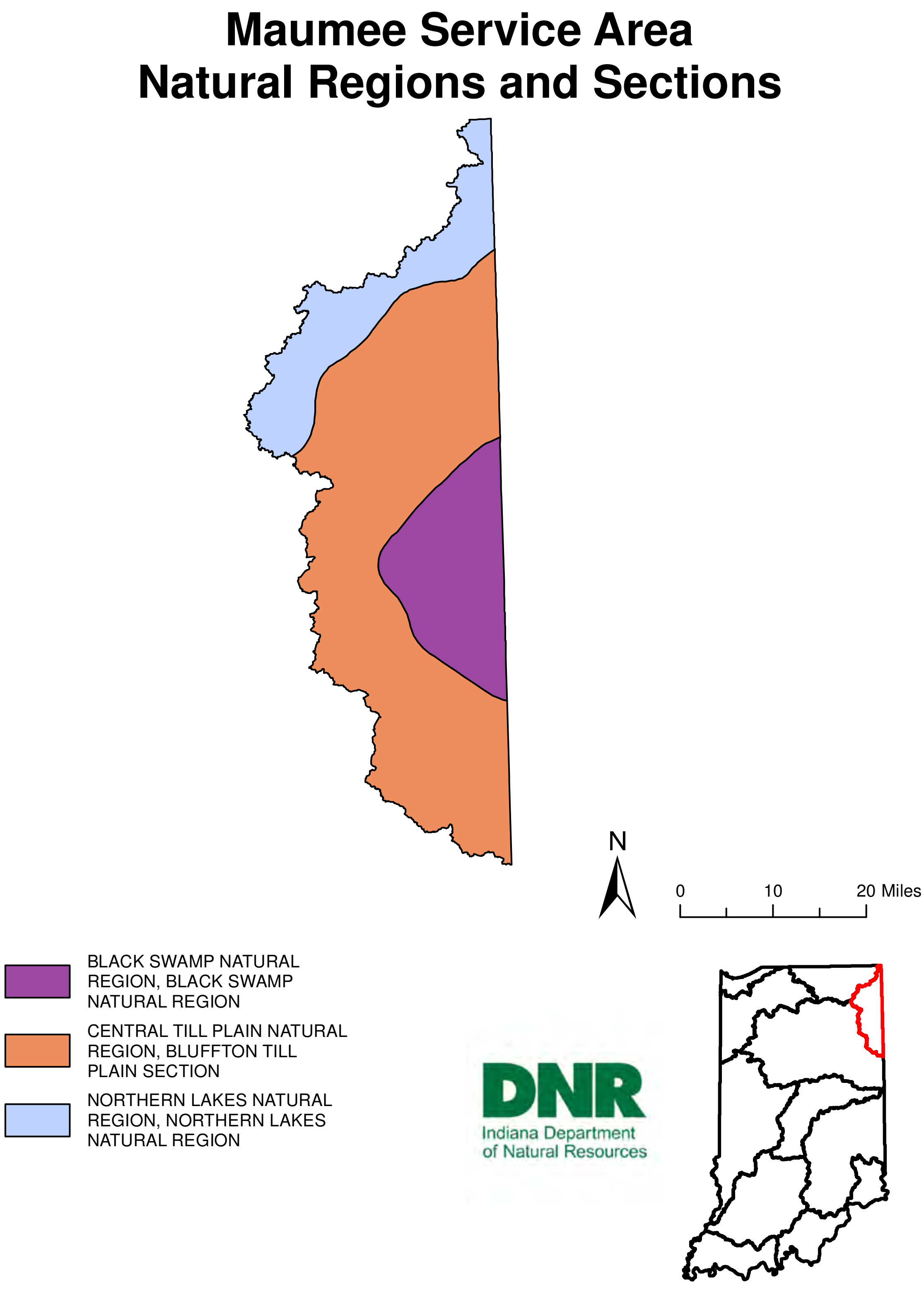


Figure 46. Natural regions and sections within the Maumee SA (Homoya, Abrell, Aldrich, & Post, 1985)

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 412 miles of category 4A impaired streams and 479 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (623 miles), impaired biotic communities (124 miles), nutrients (57 miles), PCBs in fish tissue (53 miles), and dissolved oxygen (35 miles) as current stream impairments within the SA. There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted QHEI assessments of 141 stream reaches within the SA **(Table 40 and Figure 47)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 23.4% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	56	39.7
51-64	Habitat is partially supportive of a stream's aquatic life design	52	36.8
>64	Habitat is capable of supporting a balanced warm water community	33	23.4
	Total	141	100%

Table 40. IDEM overall QHEI scores for Maumee SA, 1991-2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Maumee SA ranks second least overall in forested cover density of all SA's at 8% of total area with approximately 65,603 acres, and is the SA with the second least forested cover of any SA at approximately 1.26% of 5,215,169 acres of forest cover statewide.

GIS analysis indicates that there are approximately 2,779,740 linear feet (526 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Maumee SA has the fourth highest ratio of these potentially restorable stream miles to square miles of SA at approximately 0.41 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.44 square miles of SA.

Maumee Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

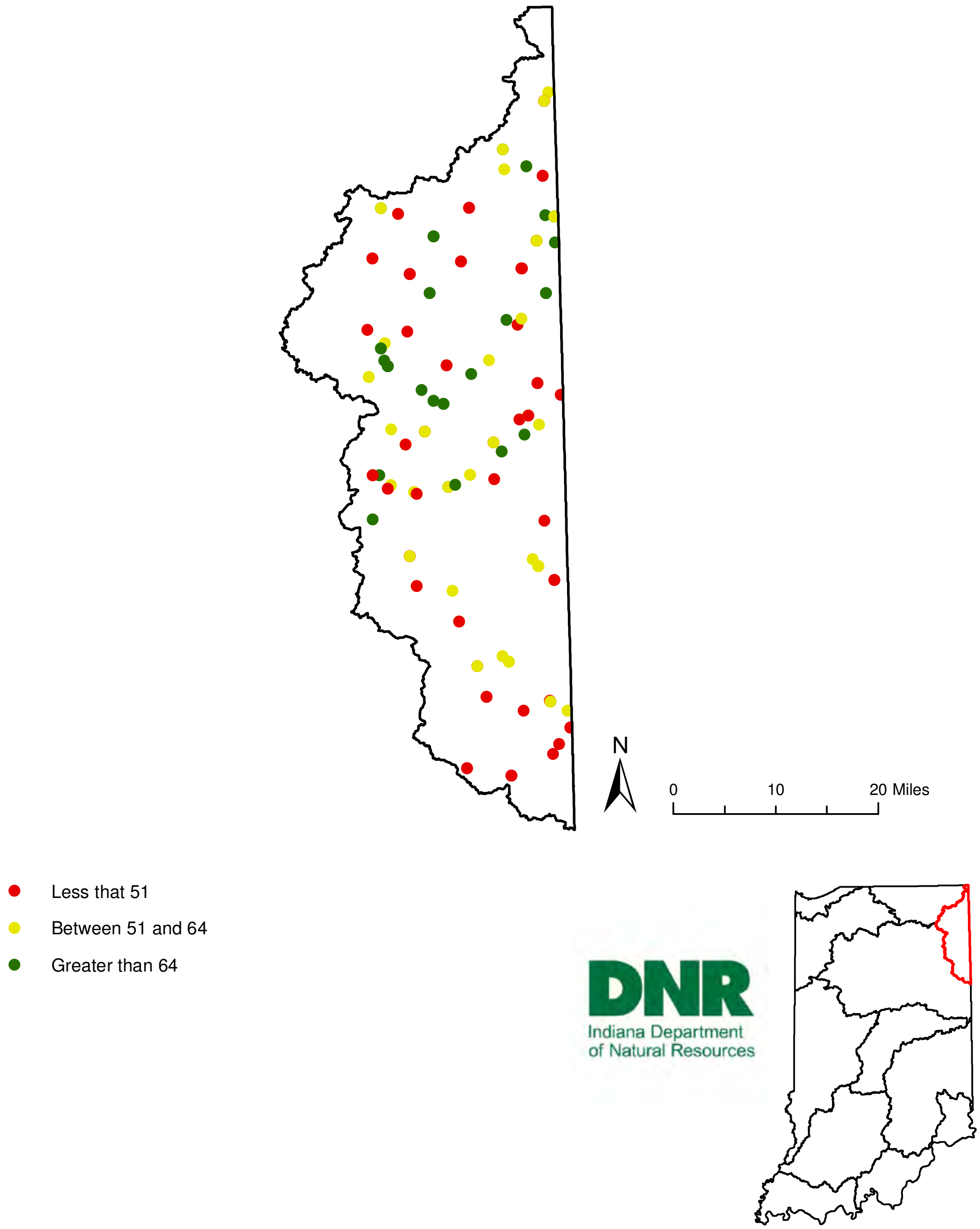


Figure 47. IDEM overall QHEI scores within the Maumee SA; 1991 – 2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI in the Maumee SA shows that there are approximately 6,715 acres of freshwater emergent wetland (PEM) and approximately 17,444 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.9% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5.6% of the total SA **(Table 41** and **Figure 48)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	6,715	14.64%	0.82%	0.03%
Freshwater Forested/Shrub Wetland	17,444	38.04%	2.12%	0.07%
Freshwater Pond	6,047	13.19%	0.07%	0.03%
Lake	3,724	8.12%	0.04%	0.02%
Riverine	11,928	26.01%	1.54%	0.05%
Grand Total	**45,858**	**100.00%**	**5.6%**	**0.20%**

Table 41. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils (NRCS-USDA, 2016) account for 461,284 acres (**Figure 49**), or 56.2% land cover within the SA, out of which approximately 441,306 acres have the potential to be restored, accounting for 53.7% of the total SA.

This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Maumee SA has the highest percentage of recoverable wetland acres to total SA size of all SAs, and the sixth most total acres of potentially restorable wetland acres of any SA.

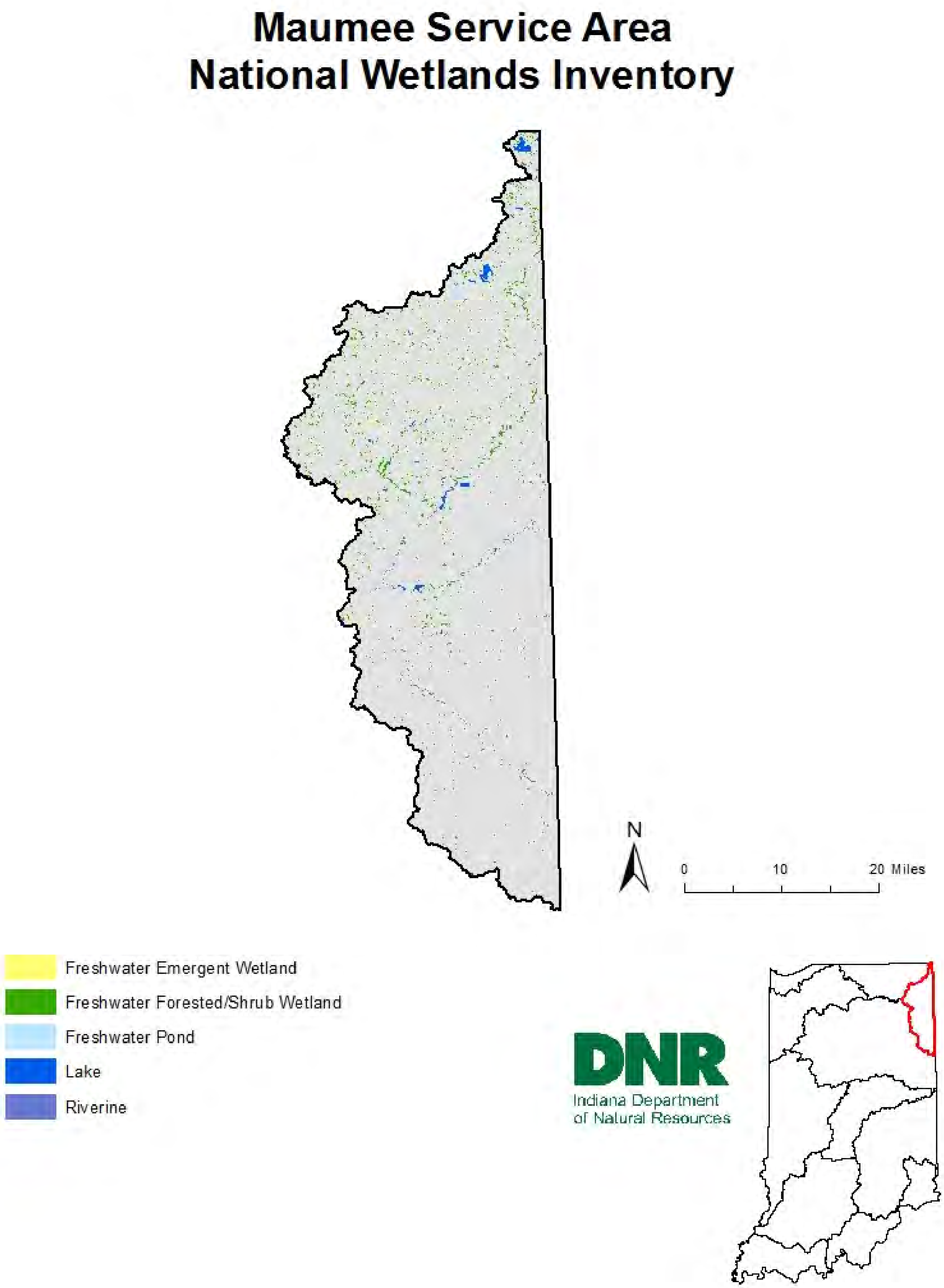


Figure 48. NWI within the Maumee Service Area (USFWS NWI, 2015)

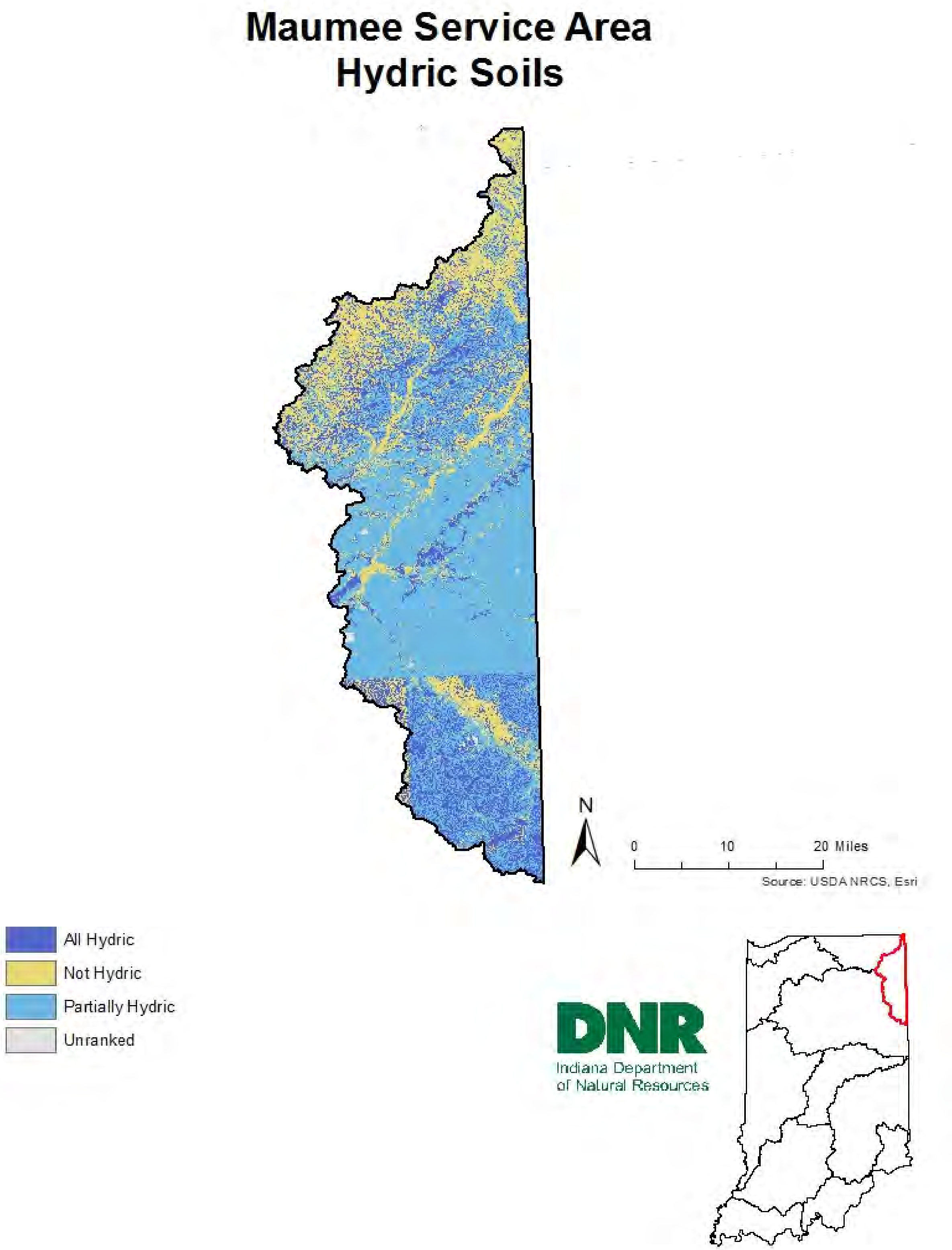


Figure 49. Hydric and partially hydric soils within the Maumee Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 330,730 acres of these potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Holthouse Ditch (HUC 041000040501 **[Table 42]**). There are 5,685 acres of hotspots of potentially restorable wetlands adjacent to the Baltzell-Lenhart Woods Nature Preserve.

Hotspots account for 1,111,924 linear feet of these potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Little Blue Creek (HUC 041000040404 **[Table 43]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 42 & 43)** serve as the basis for identification of areas that have experienced the most recoverable aquatic resource loss with the SA. **Figure 50** shows where these watersheds are located within the SA.

HUC 12 Code	HUC 12 Name	Hotspots of Potential Restorable Wetlands (acres)
041000040501	Holthouse Ditch	17,067
041000050105	Bottern Ditch-Maumee River	17,056
041000040406	Martz Creek	14,747
041000071204	Brown Ditch-Flatrock Creek	13,203
041000040403	Headwaters Blue Creek	13,057

Table 42. Watersheds in the Maumee Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
041000040404	Little Blue Creek	62,304
041000071204	Brown Ditch-Flatrock Creek	61,248
041000040501	Holthouse Ditch	54,912
041000040405	Blue Creek	51,216
041000040408	City of Decatur-St. Mary’s River	49,104

Table 43. Watersheds in the Maumee Service Area with the most hotspots of potentially restorable streams

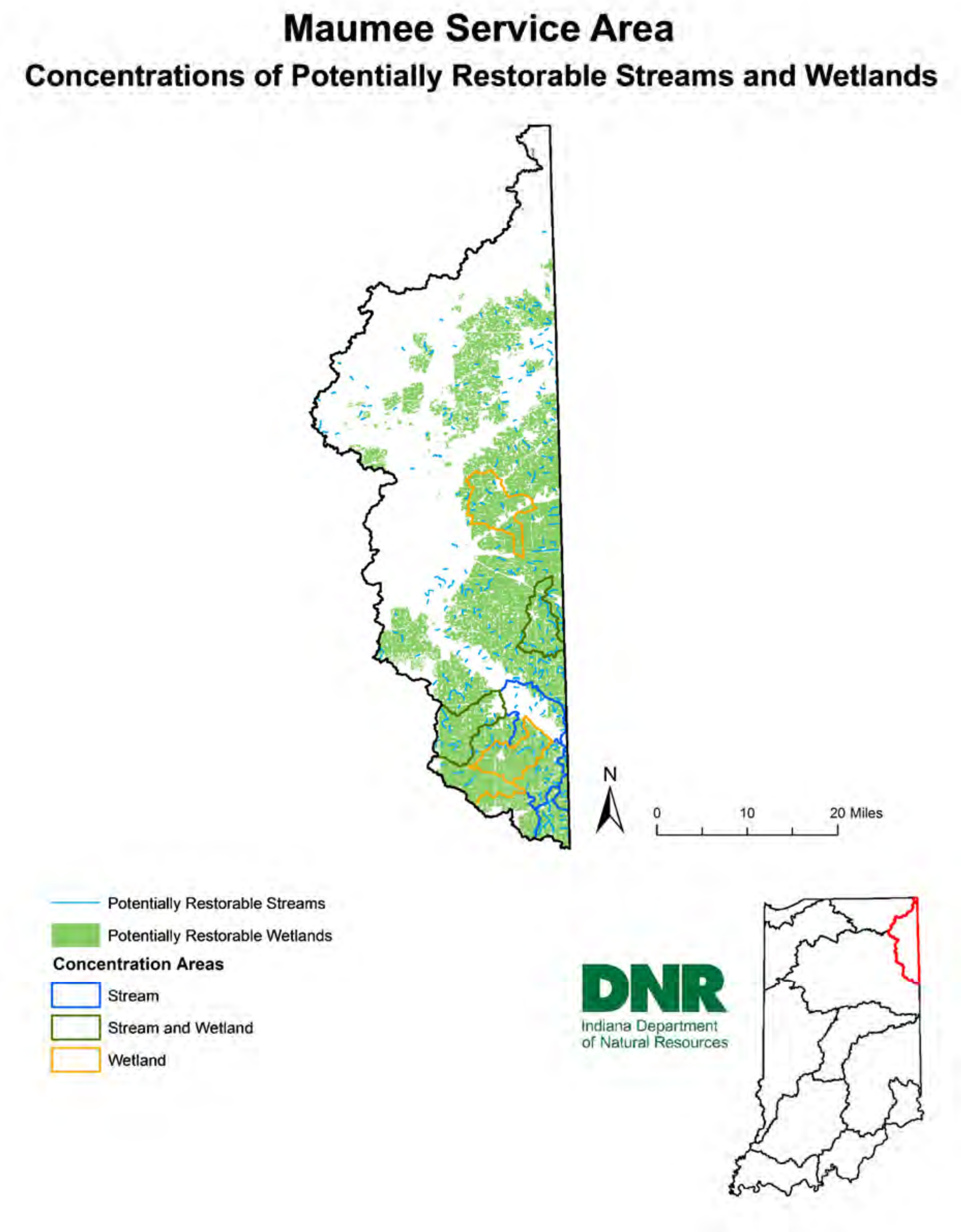


Figure 50. Concentrations of Potentially Restorable Streams and Wetlands in the Maumee Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments in the Maumee SA indicates there are four lakes currently documented having category 5 impairments, which measured using the National Hydrography Dataset (NHD) includes 794 acres with total mercury in fish tissue, 760 acres with PCBs in fish tissue, and 383 acres impaired with E. coli (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 7,922 acres of open water which accounts for 1% of the SA. This varies slightly from the NWI, which identifies approximately 6,047 acres of freshwater ponds comprising 0.7% of the SA, and 3,724 acres of lakes comprising 0.5% of total SA acres. Of these open waterbodies, GIS analysis identifies approximately 21 natural public freshwater lakes (PFL) (IC 14-26-2-1.5) (IDNR DOW PD, 2016) within the SA, which is 5% of the PFL's as identified by the Indiana Natural Resource Commission list of public freshwater lakes as of June 2011 (IN NRC, 2011). Furthermore, GIS analysis indicates that approximately 251 acres of PFO, PSS and/or PEM from the NWI are contiguous with the boundary of PFL's as identified in the DNR DOW's GIS data (IDNR DOW PD, 2016) within the SA. Though Indiana does not directly border Lake Erie, the Maumee River is the largest drainage area contributing to this Great Lake (24% of contributing surface water), and is a significant source of sediment and nutrients that have contributed to the growing blue-green algal blooms and hypoxic zone in the western Lake Erie Basin (Quandt, 2012).

IDNR will remain up to date with PFL and reservoir condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Maumee SA shows that approximately 98% of the shallow unconsolidated aquifers receive seven or less inches of ground water recharge annually **(Table 44).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.6	0.05%
	13	0.4	0.03%
	12	1.6	0.12%
	11	2.5	0.20%
	10	1.5	0.12%
	9	4.9	0.38%
	8	15.6	1.21%
	7	48.1	3.76%
	6	123.2	9.62%
	5	236.0	18.43%
	4	297.4	23.22%
Low	3	260.0	20.30%
	2	247.6	19.33%
	1	41.6	3.25%

Table 44. Approximate groundwater recharge rates in the Maumee Service Area (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that approximately 86% of the Maumee SA's near surface aquifers are in the moderate to low range for sensitivity to contamination **(Table 45)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	8	0.63%
High	174	13.57%
Moderate	487	38.01%
Low	612	47.76%
Very Low	0.3	0.02%

Table 45. Groundwater sensitivity distribution in the Maumee Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Maumee SA has the third least registered capacity of surface water withdrawal of any SA, with a 2015 registered capacity of 14,690 million gallons a day (MGD) **(Figure 51)** (IDNR DOW, 2016). Public water supply accounts for approximately 94% of registered withdrawal capacity with industrial use accounting for the majority of the remaining withdrawal.

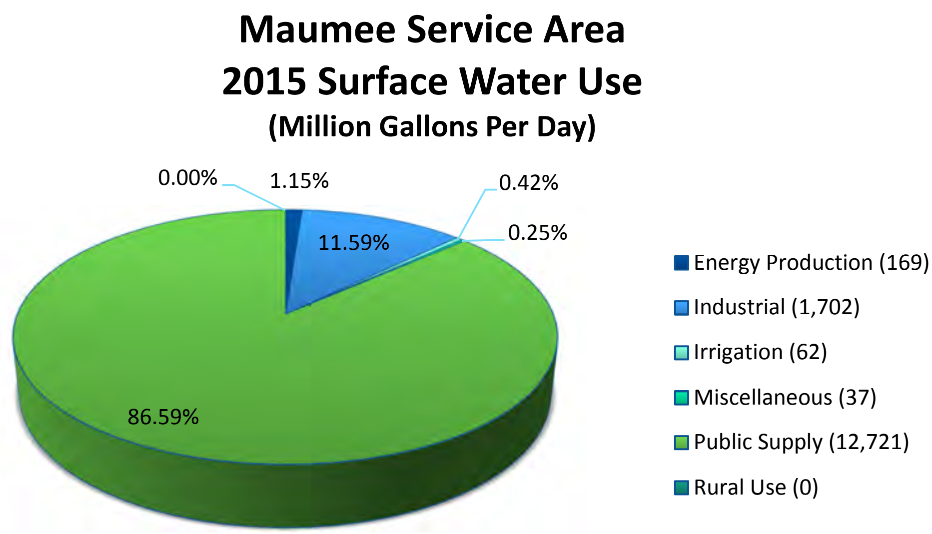


Figure 51. Significant Water Withdrawal Facilities-Surface Water (IDNR DOW, 2016)

Significant ground water withdrawal in the Maumee SA is the second least of any SA with a 4,293 MGD registered capacity **(Figure 52).** Public water supply and agricultural irrigation account for approximately 83% of registered ground water withdrawal capacity in the SA.

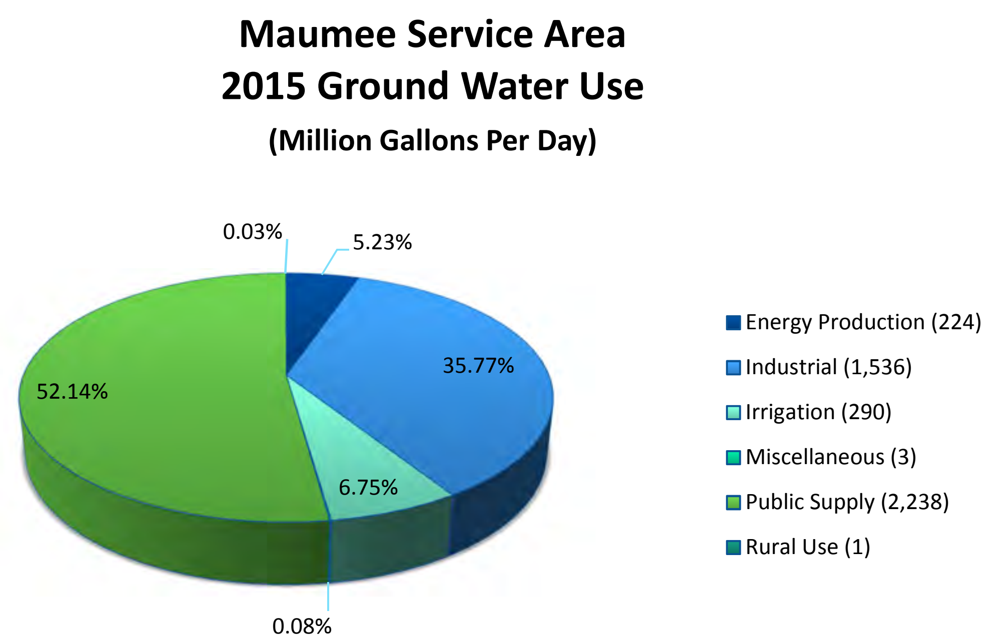


Figure 52. Significant Water Withdrawal Facilities-Ground Water (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities documented in the Natural Heritage Database within the SA include, but are not limited to, black swamp flatwoods, fen, forested fen and shrub swamp, in addition to many other transitional, mixed or upland communities.

There are currently five amphibian species, 47 bird species, 10 fish species, 11 mammal species, eight mollusk species, and nine reptile species listed as SGCN within the Indiana SWAP Great Lakes Planning Region (SWAP, 2015) which includes the Maumee SA.

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Maumee SA. The following aquatic resource goals and objectives apply specifically to the Maumee SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources to help offset the dominant and anticipated threats in the SA.
2. Implement stream and wetland restoration, enhancement and/or preservation projects that contribute to improvements to watershed functions and services as well as Lake Erie water quality; preserve and buffer high quality threatened habitats unique to the Great Lakes Region that are not yet protected such as remnants of the Black Swamp and those identified in the Great Lakes Restoration Initiative.
3. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
4. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
5. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
6. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and potential removal or modification of dams.
7. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.

8. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Great Lakes Planning Region where feasible.
9. Restoration of riparian and lacustrine wetlands to offset threats to, and improve functions and services of, aquatic resources that will improve connectivity of formerly extensive wetland and natural lake complexes throughout the SA that have been degraded by, and/or lost to, conversion.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Maumee SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Cedar Creek WMP, St. Joseph River (Maumee) WMP, Lower St. Joseph River-Bear Creek WMP, St. Joseph River Watershed Initiative WMP, and St. Mary's WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Maumee SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the DE.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Coordination with the Maumee River Basin Commission (MRBC) for projects within this SA will also be pursued. Currently, the MRBC has a voluntary agricultural land-use conversion program that includes wetland restoration. Coordination with this program and their local landowner contacts could provide added value in this SA.

Currently, the following land trusts exist within the SA: Wood-Land-Lakes RC&D Council, Blue Heron Ministries, Steuben County Lakes Council Land Trust, and ACRES Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program.

- Region III-A Economic Development District and Regional Planning Commission
- Northeastern Indiana Regional Coordinating Council
- Maumee River Basin Commission
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Save Maumee
- Upper Maumee Watershed Partnership
- Soil and Water Conservation Districts
- Western Lake Erie Basin Partnership
- USGS Indiana Water Science Center
- USGS Great Lakes Science Center
- USGS Michigan Science Center
- USGS Ohio Water Science Center
- Upper Midwest and Great Lakes, and Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperatives
- Steuben County Lakes Council
- Indiana Lakes Management Society
- Western Lake Erie Basin Initiative-NRCS

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 53** below.

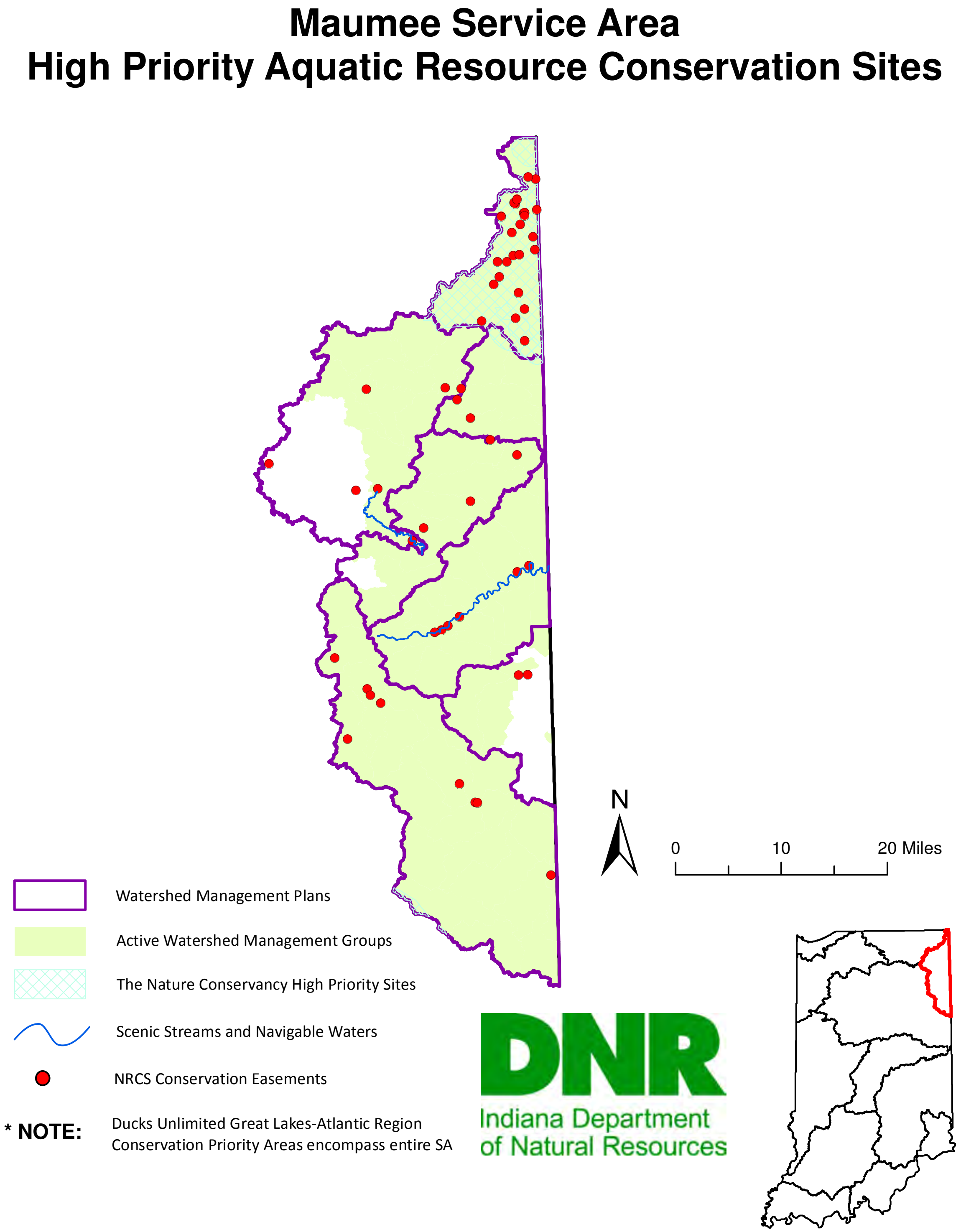


Figure 53. High priority aquatic resource conservation areas and sites within the Maumee Service Area (IWPP, 2015)

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

APPENDIX B.4 KANKAKEE SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION

The Kankakee Service Area (SA) is located in northwestern Indiana and is composed of the following two 8-digit HUCs which form the Kankakee River Basin:

- 07120001 - Kankakee
- 07120002 - Iroquois

The Kankakee SA includes all or portions of thirteen Indiana counties listed below in the Lake Region and Northern Moraine physiographic region.

Lake	Kosciusko	White
Porter	Marshall	Benton
LaPorte	Starke	Newton
St. Joseph	Pulaski	Jasper
Elkhart		

The Kankakee River Basin drains 1,913,059 acres within northwestern Indiana and is located in the Central Corn Belt Plains and Northern Indiana Drift Plains ecoregions. The western portion of the SA is located in the Central Corn Belt Plains and is predominantly rural. The eastern portion is located in the Northern Indiana Drift Plains and is characterized by greater woodlands, lower relief, and less urban-industrial activity than the western portion of the SA (U.S. EPA: Ecoregions of Indiana). The basin as a whole is characterized by its flat to rolling landscape and the channel of the Kankakee River valley which includes man-made drainage ditches and small areas of natural lakes and wetlands (IDNR DOW Assessment, 1990).

The primary major rivers within the SA are the Kankakee, Yellow, and Iroquois Rivers. Originating near South Bend, the Kankakee River flows southwest toward Illinois where it is joined with the Iroquois River, traveling west where it then converges with the Des Plaines River in Illinois to form the Illinois River.

Based on the 2011 NLCD, the land cover type with the most area in the Kankakee SA is agricultural land use (75.8%), followed by forest and shrub/scrub (10.4%), developed and impervious land use (8.13%), and wetlands and open water (3.5%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 2.33% per the NWI to 2.45% per the 2011 NLCD. Emergent herbaceous wetlands range from 0.4% per the 2011 NLCD to 1.23% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Kankakee SA have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Kankakee SA from 2009 – 2015 was collected and analyzed **(Table 46)**. According to the data, 37.5 acres of impacted wetlands and 8,601 linear feet of impacted streams required mitigation in the seven year time period.

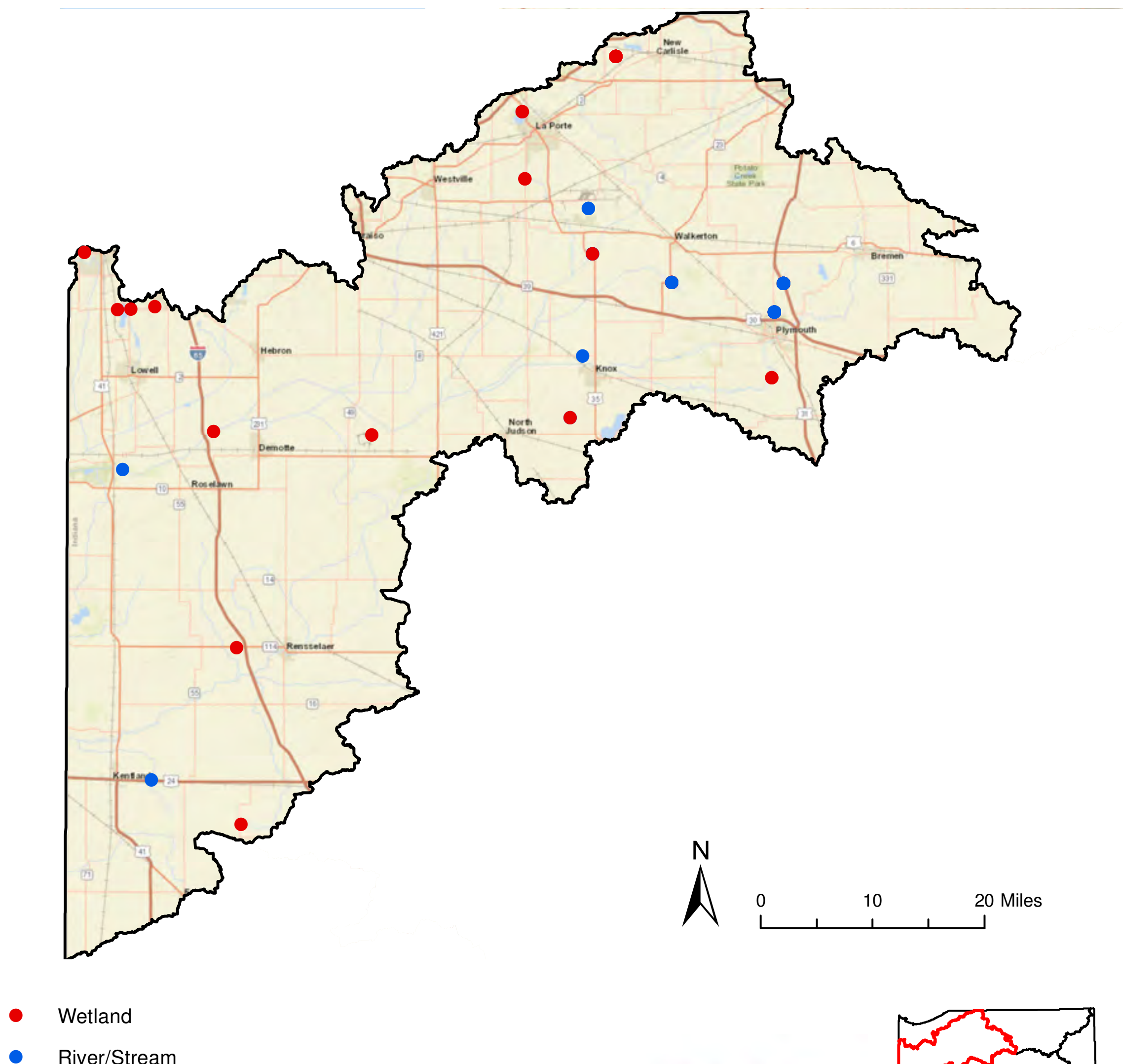
The transportation and service corridor work type accounted for the most stream impacts (72.68%), followed by dam related activities (27.32%). There were no documented stream impacts requiring mitigation for agricultural land uses, development or energy production and mining for this time period.

The transportation and service corridor work type accounted for the most wetland impacts (86.58%), followed by development (8.04%), dam related activities (2.62%), energy production and mining (1.76%), and agricultural land use (0.99%). Locations of the permitted stream and wetland impacts are provided in **Figure 54**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent Wetland Impact per Category
Agriculture	0	0.00%	0.372	0.99%
Dam	2,350	27.32%	0.983	2.62%
Development	0	0.00%	3.016	8.04%
Energy Production	0	0.00%	0.66	1.76%
Transportation	6,251	72.68%	32.47	86.58%
Grand Total	**8,601**	**100.00%**	**37.5**	**100.00%**

Table 46. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville, Detroit and Chicago Districts

Kankakee Service Area
404 Permitted Aquatic Resource Impacts Requiring Mitigation



Indiana Department of Natural Resources

Figure 54. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Kankakee SA is presented in **Figure 55,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

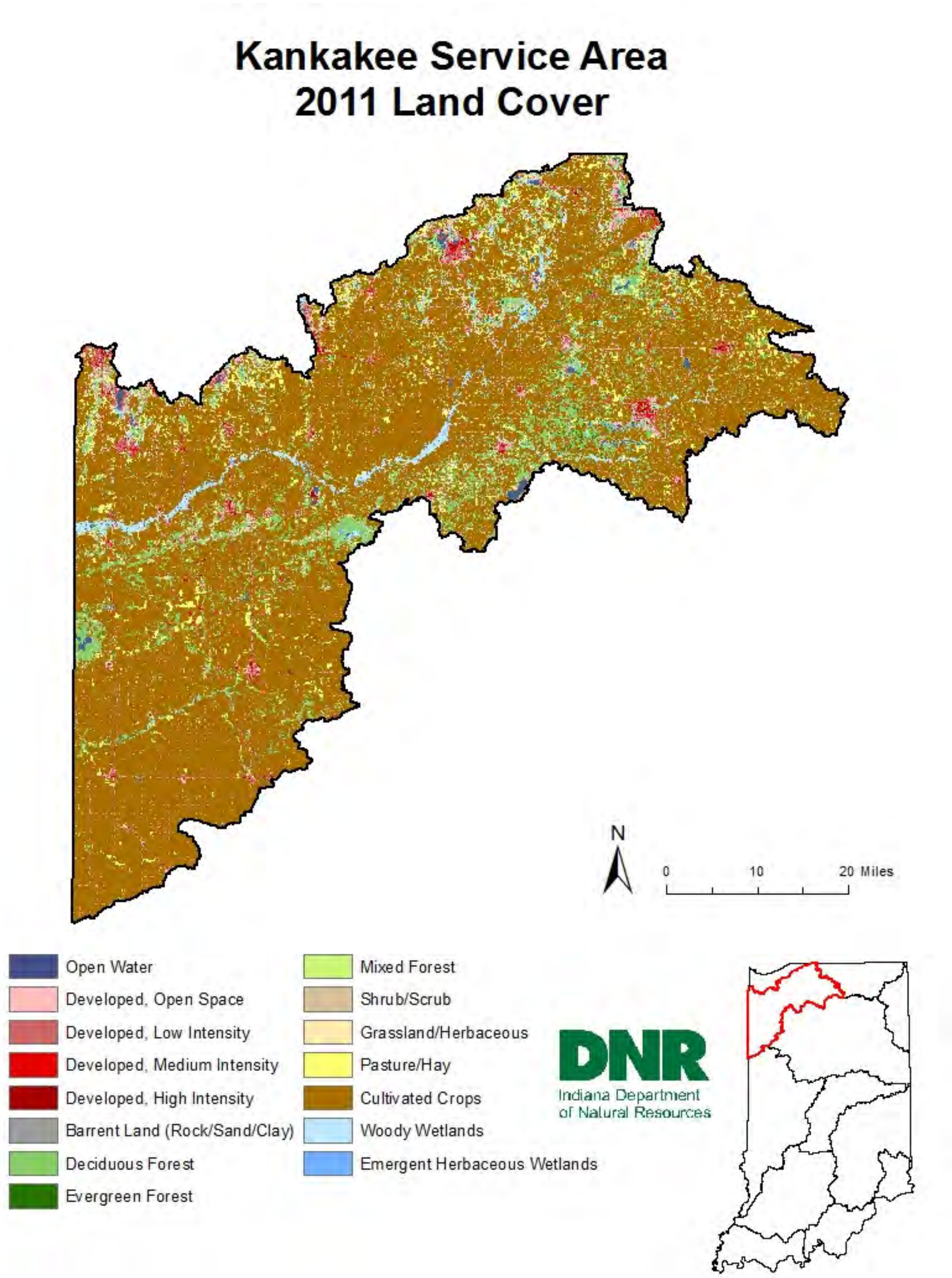


Figure 55. Land cover/use types for the Kankakee Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 47)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	13,110	0.69%
Developed	Open Space	70,543	3.69%
Developed	Low Intensity	68,227	3.57%
Developed	Medium Intensity	12,142	0.64%
Developed	High Intensity	4,417	0.23%
Barren Land (Rock/Sand Clay)	*	2,176	0.11%
Forest	Deciduous	181,059	9.47%
Forest	Evergreen	5,253	0.27%
Forest	Mixed	949	0.05%
Shrub/Scrub	*	11,743	0.61%
Grassland/Herbaceous	*	38,591	2.02%
Pasture/Hay (Agriculture)	*	68,969	3.61%
Cultivated Crops (Agriculture)	*	1,379,811	72.19%
Wetlands	Woody	46,809	2.45%
Wetlands	Emergent Herbaceous	7,642	0.40%
Grand Total		**1,911,442**	**100%**

Table 47. Kankakee land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 56** below to demonstrate the current overall land cover distribution of the SA.

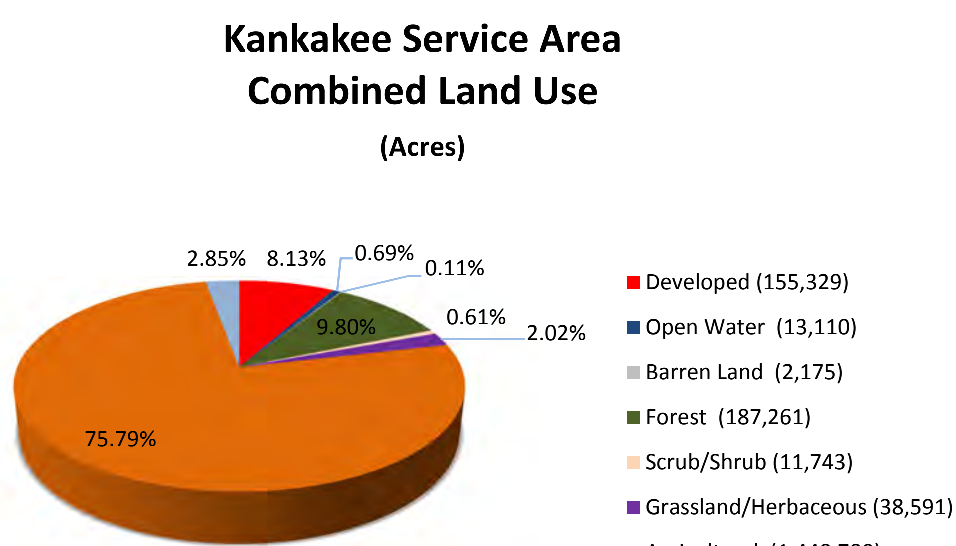


Figure 56. Combined land uses for the Kankakee Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use category in the Kankakee SA. Total agricultural land use covers approximately 76% of the SA's total land area of 1,448,780 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of smaller developed areas.

Within the identified land use areas, cultivated crops comprise 1,379,811 acres (72.2%) and pasture/hay land cover 68,970 acres (3.6%) of the SA. Corn production is the primary cultivated crop, followed by soybeans based on acres of harvested crops from counties that comprise the majority of the Kankakee SA boundary (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. The Kankakee SA contains active CFOs for pig, chicken, dairy cattle and beef cattle which have a minimum of 5,000 animal units with several operations surpassing the 15,000 animal unit threshold. Based on a statewide comparison, both Jasper and Newton County, located in the western portion of the Kankakee SA, contain by far the most dairy cattle CFO permits with more than 30,000 animal units each (Thompson, 2008). When combining these major agricultural land use activities, the Kankakee SA ranks fourth in percentage of total statewide land use (6.26%), but it is the most significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the third largest land use after agricultural and forested cover, covering approximately 155,329 (8.13%) of the 1,911,442 total acres, tied for third least developed area density across SA's. In general, developed impervious areas are most concentrated along the northern border of the SA, consisting of communities in whole or part such as LaPorte, St. John, Cedar Lake, Lowell, Valparaiso and South Bend. Smaller footprints of high intensity development include communities such as Plymouth, Bremen, Knox and Fowler.

The SA contains portions of the Chicago/Gary, Michigan City-LaPorte, South Bend-Mishawaka, Elkhart-Goshen and Lafayette-West Lafayette MSA's, all of which experienced growth in the previous decade (Manns, 2013). In general, the cores of these MSA's are located mostly outside of the Kankakee SA boundary. For example, analysis of INDOT cities and towns GIS data indicates that only 8.4% of the City of South Bend's corporate limits are within the Kankakee SA. Approximately 59% (176,257 acres) of St. Joseph County's 295,156 acres are within the Kankakee SA, accounting for approximately 9% of total SA acres. However, approximately 66% (894,675 acres) of the Chicago/Gary MSA within Indiana is located within the SA, though more intensely developed in the north within the Calumet-Dunes SA. Approximately 76% (298,404 acres) of the Michigan City/LaPorte MSA is located in the SA, accounting for 16% of total SA acres. Analysis of the INDOT cities and towns GIS data shows the Kankakee SA contains all or part of 155 cities and/or towns, 33 of which are incorporated (INDOT, 2016).

Three Indiana regional councils overlap with the Kankakee SA which include the Kankakee-Iroquois Regional Planning Commission (KIRPC) (47%), Northwestern Indiana Regional Planning Commission (NRPC) (31%), and the Michiana Area Council of Governments (22%) (IARC, 2017). The employment sectors with the most workers within the KIRPC are manufacturing (16%), government (14%), and retail/wholesale trade (14%), and agriculture (8%). A major economic development growth factor for the KIRPC region is its geographic location in close proximity to major MSAs such as Chicago (Gary), Michigan City-LaPorte, Lafayette, South Bend-Mishawaka and Indianapolis (KIRPC, 2010).

This proximity is ideal for growth in warehousing, manufacturing and shipping of goods to these sizeable markets. A number of the state and U.S. highways connect the region with important markets and allow for industrial growth. The KIRPC Region contains several industrial parks, ranging from fully developed to shovel-ready and/or informally planned (KIRPC, 2010).

Since 2000, other than Benton County, all counties have experienced population growth in the KIRPC region. According to NIRPC, while many communities in Lake and Porter counties (Calumet-Dunes SA) have experienced population decline in recent years, the southern portions of these counties within the Kankakee SA have seen population gains that include unincorporated areas in Porter County (NIRPC, 2011). NIRPC considers housing to be overbuilt in the south of the region within the Kankakee SA since there is considerable overall housing vacancies, though mostly in the urban core in the north (NIRPC, 2011).

Additionally, analysis of INDOT’s local roads GIS data shows there are approximately 6,948 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Kankakee SA ranks seventh among SA’s in local road miles to square mile ratio with approximately 2.33 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Kankakee SA contains approximately 1,595 miles of U.S. Interstates and highways, 1,324 miles of state highways, and 6,948 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). The concentration of roads per square mile of land and the overall size of the SA ranks near the middle when compared to all SAs; however, analysis of the specific road types reveals various rankings.

U.S. Interstates and highways have a concentration of approximately 0.53 mile per square mile, which ranks fourth when compared to the other ten SAs. Although the concentration of U.S. Interstates and highway miles per square mile fall within the top five, the concentration of state roads ranks ninth at 0.44 mile per square mile, making this the lowest ranking road type within the SA. In contrast, the concentration of local roads is approximately 2.33 miles per square mile, ranking seventh, when compared to all SAs. Similarly, the combined ranking of all roadways, ranks seventh, with concentration of 3.30 miles per square mile.

Although the concentration of state roads and local roads ranks near the middle, and state roads ranking near the bottom, closer analysis reveals the concentration of U.S. interstates and highways ranks near the top. The construction and maintenance of roads and bridges, throughout the Kankakee SA, support the predominant mode of transportation and play an integral role in sustaining business and commerce for the region.

2.5.2 Railroads

As an alternative mode of transportation, the Kankakee SA has 842 mile of railroads within the SA boundary (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Kankakee SA is tied for the second highest concentration of railroads, with in the state, with a density of 0.28 miles of railroad per square mile.

The concentration of linear infrastructure throughout the SA poses a significant threat to aquatic resources in the form of habitat fragmentation, disruption to fluvial processes, resource degradation, habitat conversion and resource loss.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Kankakee SA contains service corridors which contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 3,224 miles of service corridors within its boundary.

The Kankakee SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately 616 (12 kV) lines, sixteen (34.5 kV) lines, forty-three (345 kV), and fifteen (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 2,039 miles throughout the SA which makes it the second highest concentration of electric transmission lines relative to the SA size, resulting in 0.68 mile of transmission line per square mile.

In addition to electric transmission lines, the Kankakee SA contains over 1,185 miles of pipelines in total. It contains over 113 miles of pipelines that convey crude oil, 752 miles of pipelines that transport natural gas, and 320 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Kankakee SA contains the sixth greatest concentration of crude oil pipelines and the fifth greatest concentration of natural gas and refined petroleum products pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 6 known low head dams (IDNR DOW, 2016) within the SA, the third to lowest total in the state, but the lowest concentration at one low head dam per 498 square miles. There are currently 12 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 249 square miles, the lowest concentration of all SA's, comprising 1% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 1,494,240 linear feet (283 miles) of NLE's mapped within the SA, averaging one mile of NLE per 11 square miles, the second highest concentration among all SA's. Approximately 158 miles of the NLE's are located within predominantly developed areas with the remaining 125 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining Threats

2.7.1 Natural Gas and Oil Production

The Kankakee SA contains active oil and natural gas fields within its boundary. The Indiana Geological Survey (IGS) identifies eleven petroleum gas fields with eleven associated gas wells ranking the Kankakee SA fifth statewide for active natural gas and oil fields (Indiana Geological Survey , 2015). In addition, the IGS identifies two oil fields that include two active oil wells. The IGS petroleum well data identifies 45 abandoned gas wells, 170 abandoned oil wells, 614 dry wells, 9 abandoned salt water disposal wells, 3 abandon waste injection wells, 169 stratigraphic wells, 9 observation wells, 3 waste disposal wells, and 58 non-potable water supply wells within the SA boundary (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The Kankakee SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains ten sand & gravel mining operations and five crushed stone operations (Indiana Geological Survey, 2016). Although the Kankakee SA is the fifth largest SA, mineral mining within its boundary ranks seventh in the state with fifteen active operations.

2.7.3 Coal

The Kankakee SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Kankakee SA shares the exact boundary with the Indiana SWAP Kankakee Planning Region. The SWAP identifies the most significant threats to habitats and SGCN with the Kankakee Planning Region as:

- Habitat conversion and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

The SWAP Kankakee Planning Region has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the SA are agricultural and developed impervious footprints which make up approximately 84% of the land use within the SA, and are expected to remain as the top contributors to aquatic resource impairments. Agriculture remains an important economic sector in the region accounting for 9.8% of total earnings with the number of farms noticeably increasing (KIRPC, 2010).

IDNR expects transportation and service corridors along with development projects to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

According to the KIRPC 2010 Comprehensive Economic Development Strategy (CEDS), the region seeks to achieve a modernized road and rail network with condition and connectivity improvements to roads and railways to better serve new and expanding economic sectors in addition to expanded access to surrounding regions. A number of the state and U.S. highways connect the region with important markets and allow for industrial growth. The KIRPC Region contains several industrial parks ranging from fully developed to shovel-ready and informally planned (KIRPC, 2010).

The highest priority short-term development objectives include significant improvements to water, sewer and drainage systems, transportation infrastructure, housing, and community services. Water, sewer and drainage improvements will require the construction of new facilities and systems in addition to upgrades and expansion of existing utilities to industrial sites and future development locations (KIRPC, 2010).

Additionally, this region will continue to pursue growth in wind power and agricultural ventures which the region already supports (KIRPC, 2010). Along with northern portions of the Middle Wabash SA and western portions of the Upper Wabash SA, the region's wind energy farms comprise the world's largest concentration of turbines consisting of the Benton County, Fowler Ridge, Purdue Energy Park, Meadow Lake and Hoosier Wind Farms. The region's goal is to be a global leader in wind energy production (KIRPC, 2010).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Kankakee SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Kankakee SA's historic aquatic resources were comprised of a diverse mix of natural aquatic community types. Although it's estimated that approximately 65% of the SA was forested, Indiana's largest natural prairie communities were found in this SA.

Over 200 years ago, prior to European settlement, the Grand Kankakee Marsh spanned across nearly 500,000 acres and eight counties of Indiana and was one of the largest wetlands in the continental United States (Grand Kankakee Marsh: U.S. FWS Division of Conservation Planning, 2011). Existing within the Kankakee River Basin, the Grand Kankakee Marsh was once home to one of the richest wildlife sources in North America (Everglades of the North- The Story of the Grand Kankakee Marsh, 2013).

Following the Civil War, agriculture was in high demand and the Grand Kankakee Marsh was drained for its fertile soil; ditches were excavated and wetlands were drained to the Kankakee River (Kankakee River: IDNR). By 1923, nearly 250 miles of the Kankakee River were straightened and dredged into what is now a 90 mile long ditch; these draining practices drastically decreased the migratory bird population within the United States (Everglades of the North- The Story of the Grand Kankakee Marsh, 2013). Today, less than 30,000 acres, or 6%, of the Grand Kankakee Marsh exists within the Kankakee Watershed due to human alterations (The Kankakee River Valley: IDNR, 1997).

Due to extensive aquatic resource loss within the Kankakee SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections and their natural aquatic communities within each respective Region and Section. **Figure 57**, depicts each Natural Regions and Sections located within the Kankakee SA as identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed prior to early European settlement **(Table 39)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

<table>
<tr><th rowspan="2">Natural Region(s)</th><th colspan="2">Natural Region: Section(s)</th><th rowspan="2">Natural Region Community Types</th><th colspan="2">Hydric Soils</th><th colspan="2">Partially Hydric</th><th>Pre-Settlement Forest Cover</th></tr>
<tr><th>Name</th><th>% Cover</th><th>Acres</th><th>% Cover</th><th>Acres</th><th>% Cover</th><th>% Forested</th></tr>
<tr><td rowspan="3">Grand Prairie</td><td>Kankakee Sand</td><td>29.17</td><td>Predominantly prairie and savanna; wet prairie, marsh, swamp, wet sand flat, and wet muck flat; predominantly oak forest (eastern), oak flatwoods (dunal swales)</td><td rowspan="5">666,411</td><td rowspan="5">34.86</td><td rowspan="5">383,877</td><td rowspan="5">20.08</td><td rowspan="5">32.85</td></tr>
<tr><td>Kankakee Marsh</td><td>20.03</td><td>Predominance of marsh, lake, and wet prairie communities</td></tr>
<tr><td>Grand Prairie</td><td>22.34</td><td>Dry prairie, wet prairie, savanna, marsh, pond, bog (rare), and forest (riparian and oak groves); Typical streams low-gradient and silty</td></tr>
<tr><td>Northern Lakes</td><td>Northern Lakes</td><td>18.57</td><td>Bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake (Wet sand flats and muck flats), and various deciduous forest types; Typical streams are clear, medium to low-gradient, sandy gravel beds</td></tr>
<tr><td>Northwestern Morainal</td><td>Valparaiso Moraine</td><td>9.9</td><td>Predominantly forested, prairie (western); fen, bog, lake, marsh, savanna, seep spring, and swamp</td></tr>
</table>

Table 48. The historic natural community composition for the Kankakee Service Area based upon the natural region and section

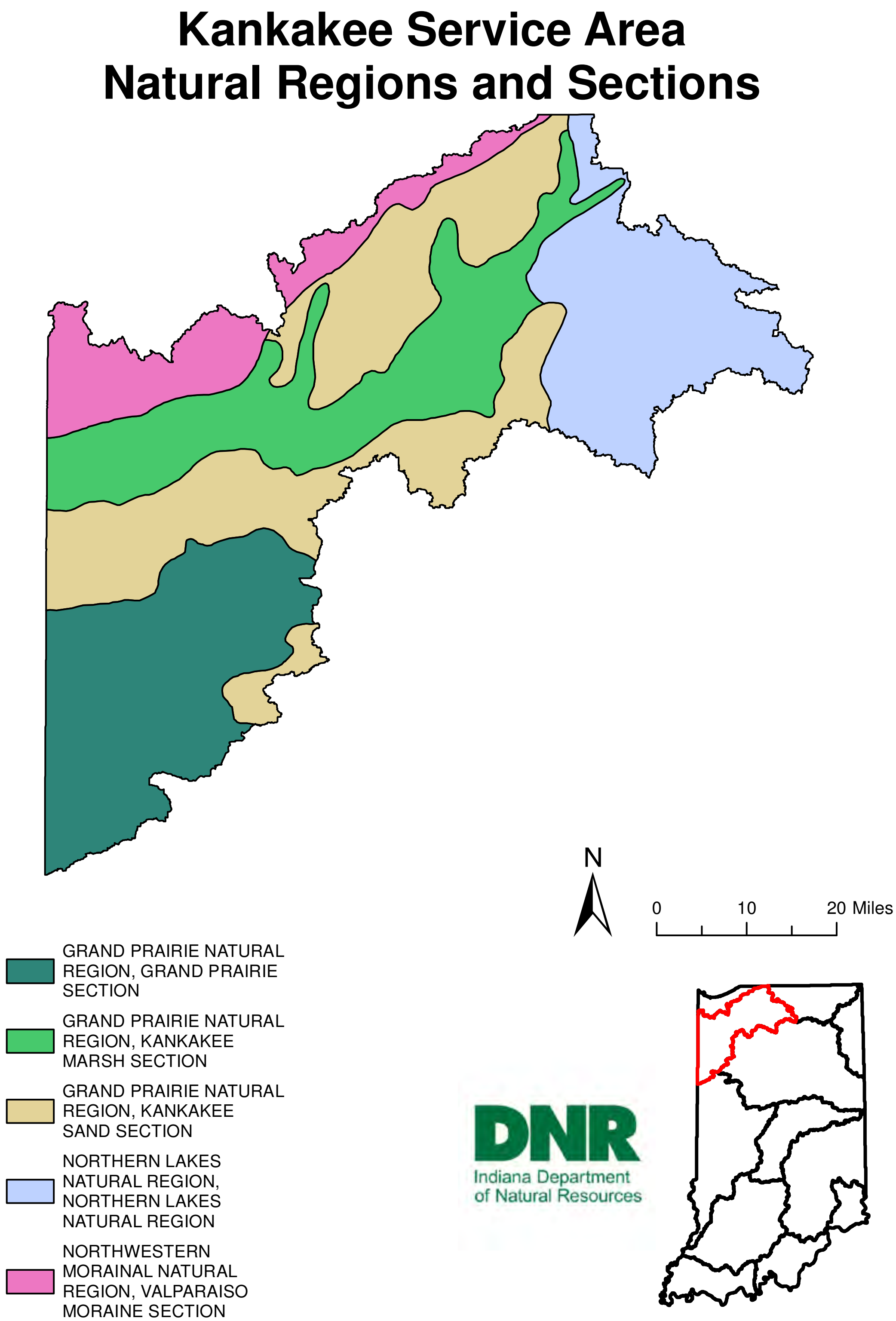


Figure 57. Natural regions and sections for the Kankakee Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 2,759 miles of category 4A impaired streams and 1,476 miles of category 5 impaired streams documented within the SA. IDEM reported E. coli (2,835 miles), impaired biotic communities (653 miles), PCBs in fish tissue (550 miles), dissolved oxygen (139 miles), nutrients (24 miles), chloride (31 miles), and pH (3 miles) as current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted QHEI assessments of 235 stream reaches within the SA **(Table 49 and Figure 58)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, only 4.41% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	192	65.08
51-64	Habitat is partially supportive of a stream's aquatic life design	90	30.51
>64	Habitat is capable of supporting a balanced warm water community	13	4.41
	Total	**295**	**100%**

Table 49. IDEM Overall QHEI scores for Kankakee SA, 1991 – 2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Kankakee SA ranks third least overall in forested cover density of all SA's at 10% of total area with approximately 187,261 acres, and is the SA with the fourth least percentage of forested cover with approximately 3.59% of 5,215,169 acres of forest cover statewide.

GIS analysis indicates that there are approximately 3,231,953 linear feet (612 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Kankakee SA has the third smallest ratio of these potentially restorable stream miles to square miles of SA at approximately 0.2 mile of potential restoration per one square mile, or one mile of potential restoration for every 4.88 square miles of SA.

Kankakee Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

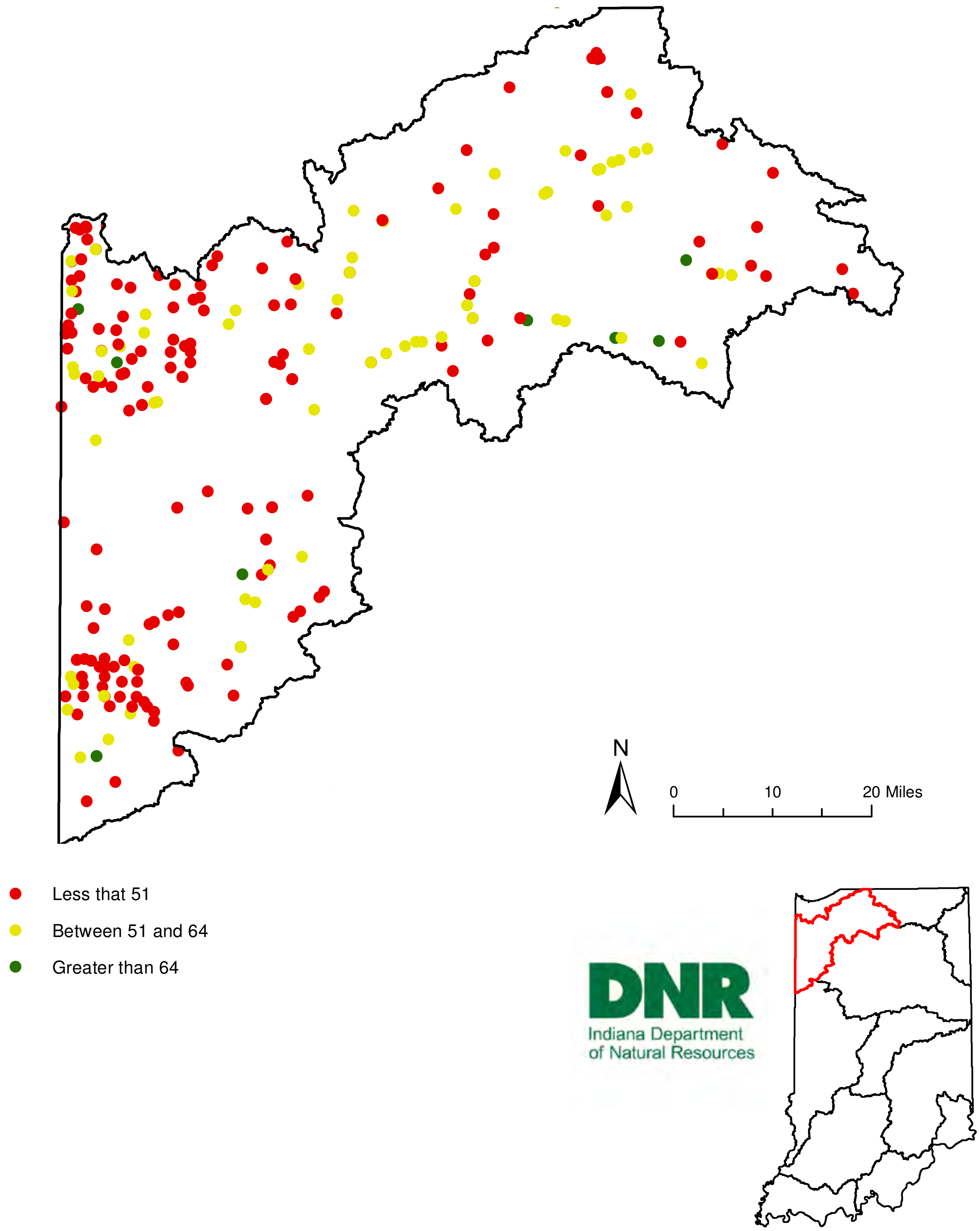


Figure 58. IDEM overall QHEI scores within the Kankakee SA; 1991 – 2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI in the Kankakee SA shows that there are approximately 23,489 acres of freshwater emergent wetland (PEM) and approximately 44,513 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 3.6% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 4.6% of the total SA **(Table 50 and Figure 59)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	23,489	26.61%	1.23%	0.10%
Freshwater Forested/Shrub Wetland	44,513	50.42%	2.33%	0.19%
Freshwater Pond	7,241	8.20%	0.38%	0.03%
Lake	9,776	11.07%	0.51%	0.04%
Riverine	3,266	3.70%	0.17%	0.01%
Grand Total	**88,285**	**100.00%**	**4.62%**	**0.38%**

Table 50. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils account for 854,715 acres (**Figure 60**), or 44.7% of land cover within the SA, of which approximately 808,844 acres have the potential to be restored, accounting for 42.3% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Kankakee SA has the third highest percentage of recoverable wetland acres to total SA size of all SA's, and second overall in potentially restorable wetland acres of any SA. This is due to both a dominance of agricultural land uses and the SA's large size.

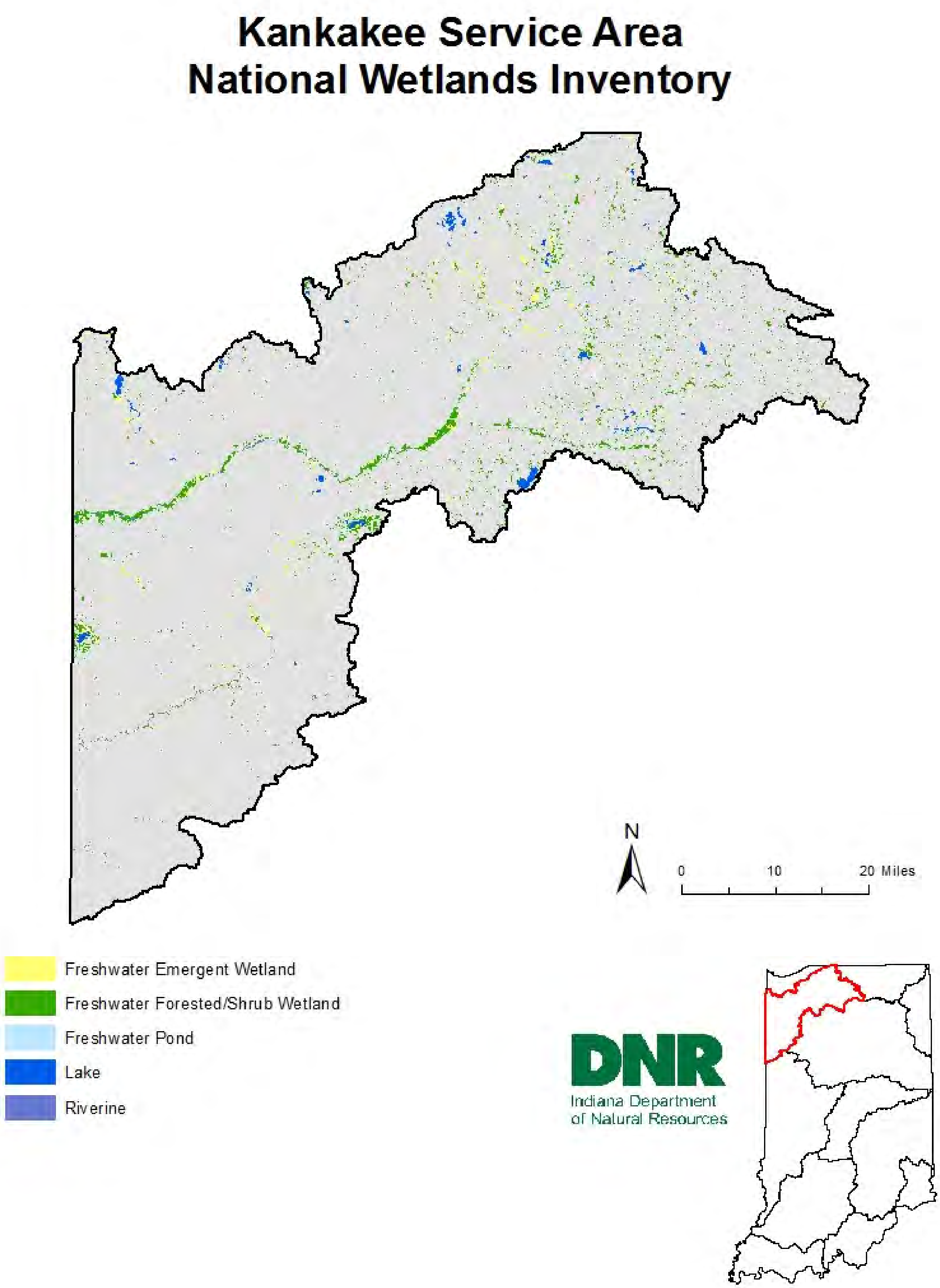


Figure 59. NWI within the Kankakee Service Area (USFWS NWI, 2015)

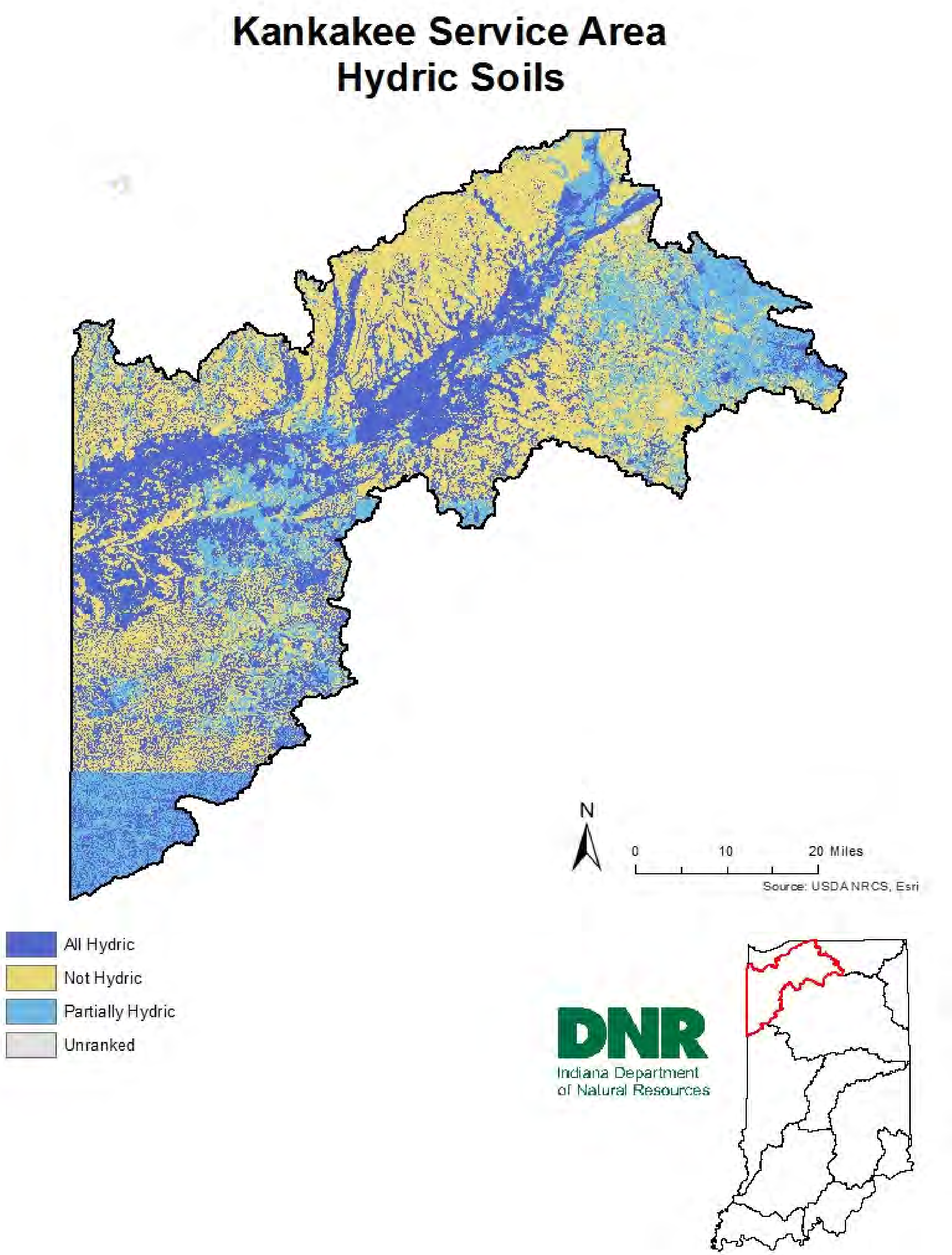


Figure 60. Hydric and partially hydric soils within the Kankakee Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 558,815 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Coon Creek-Mud Creek (HUC 071200020702 **[Table 51]**).

Hotspots account for 1,626,240 linear feet of these potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Brown Ditch (HUC 071200011307 **[Table 52]**). The watersheds with the highest concentrations of potentially restorable streams and wetlands **(Tables 51 & 52)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 61** shows where these watersheds are located within the SA.

Approximately 3,176 acres of these hotspots of potential restorable wetlands are on IDNR-managed lands within the Kankakee SA. Approximately 8,968 linear feet of hotspots of potential restorable streams are on IDNR-managed lands within the Kankakee SA. Approximately 138,899 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands in the SA. Approximately 17,099 linear feet of hotspots of potentially restorable streams are adjacent to IDNR-managed lands in the SA. Kankakee Fish and Wildlife Area is the IDNR-managed land within the Kankakee SA with the most adjacent acres of hotspots of potentially restorable wetlands (39,708 acres). Other IDNR-managed lands within the Kankakee SA with high amounts of adjacent acres of hotspots of potentially restorable wetlands include Jasper-Pulaski Fish and Wildlife Area (34,105 acres) and Willow Slough Fish and Wildlife Area (34,105 acres). The Jefvert Gamebird Habitat Area is the IDNR-managed land within the Kankakee SA with the most adjacent linear feet of hotspots of potentially restorable streams (5,545 linear feet).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
071200020702	Coon Creek-Mud Creek	22,768
071200011102	Wentworth Ditch-Knight Ditch	17,807
071200010302	Kline Rouch Ditch-Yellow River	16,022
071200020705	Yeagers Curve-Sugar Creek	14,621
071200020701	Upper Sugar Creek-Sugar Creek	13,331

Table 51. Watersheds in the Kankakee Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	**HUC 12 Name**	**Hotspots of Potentially Restorable Streams (linear feet)**
071200011307	Brown Ditch	142,959
071200011204	Williams Ditch	133,344
071200020205	Carpenter Creek	105,667
071200020702	Coon Creek-Mud Creek	85,727
071200011103	Brown Levee Ditch-Kankakee River	76,071

Table 52. Watersheds in the Kankakee Service Area with the most hotspots of potentially restorable streams

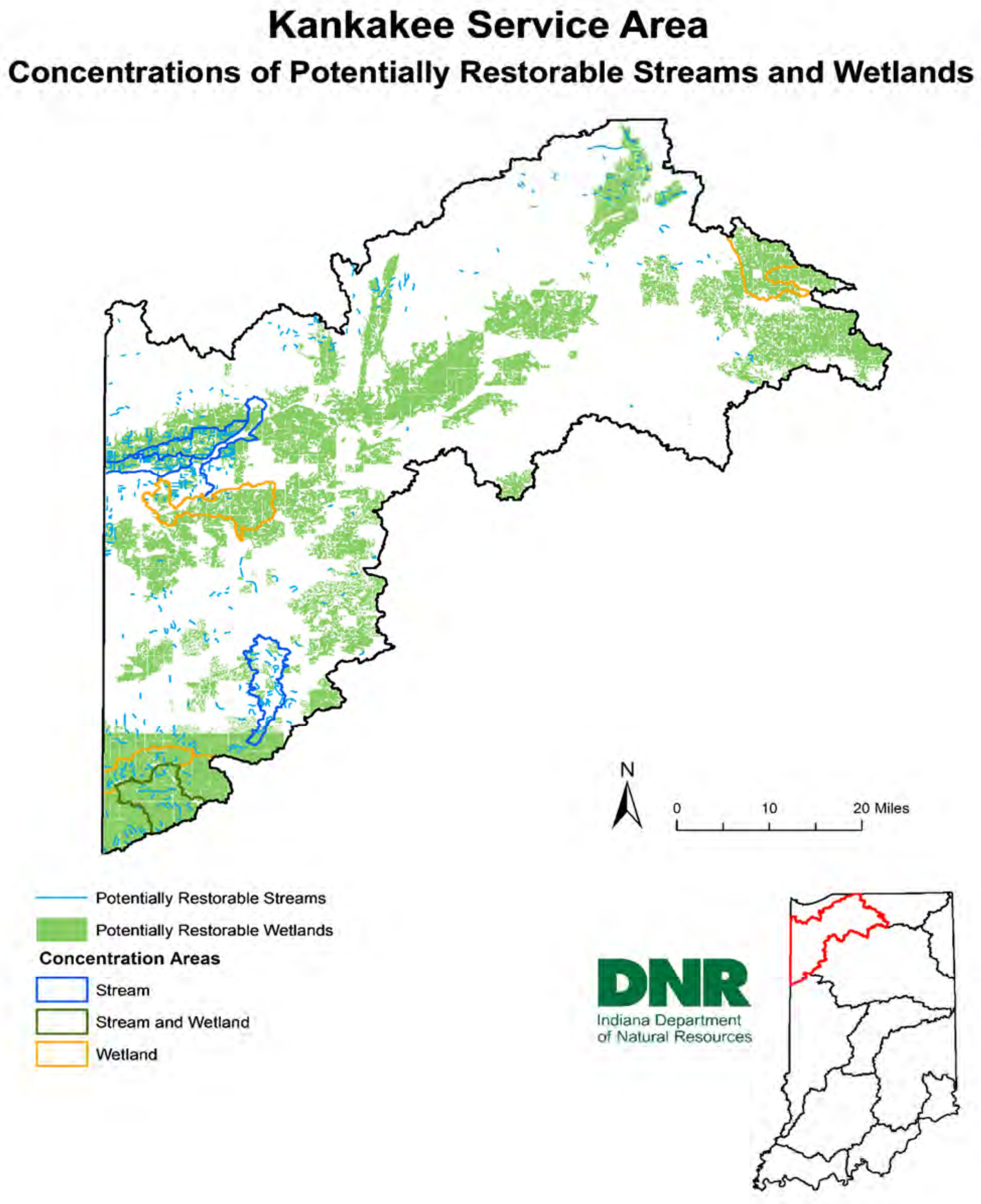


Figure 61. Concentrations of Potentially Restorable Streams and Wetlands in the Kankakee Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments in the Kankakee SA indicates there are 19 lakes currently documented having category 5 impairments, which measured using the National Hydrography Dataset (NHD) includes 3,287 acres with PCBs in fish tissue, 383 acres with phosphorus, and 166 acres with impaired biotic communities (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 13,110 acres of open water which accounts for 0.7% of the SA. This varies slightly from the NWI which identifies approximately 7,241 acres of freshwater pond comprising 0.4% of the SA, and 9,776 acres of lake comprising 0.5% of total SA acres. Of these open waterbodies, GIS analysis identifies 51 natural public freshwater lakes (PFL) (IC 14-26-2-1.5) within the SA which is 12% of the PFL's as identified by the Indiana Natural Resource Commission list of public freshwater lakes as of June 2011 (IN NRC, 2011). Additionally, GIS analysis indicates that approximately 1,567 acres of PFO, PSS and/or PEM from the NWI are contingous with the boundary of PFL's as identified in the IDNR DOW's GIS data within the SA (IDNR DOW PD, 2016). IDNR will remain up to date with PFL and reservoir condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Kankakee SA shows that approximately 75% of the shallow unconsolidated aquifers receive between six to nine inches of ground water recharge annually **(Table 53).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.08	0.003%
	13	0.05	0.002%
	12	0.35	0.01%
	11	2.33	0.08%
	10	19.42	0.65%
	9	252.80	8.48%
	8	1,077.11	36.11%
	7	467.12	15.66%
	6	414.36	13.89%
	5	404.95	13.58%
	4	215.71	7.23%
Low	3	80.16	2.69%
	2	31.87	1.07%
	<2	16.24	0.54%

Table 53. Approximate ground water recharge rates in the Kankakee Service Area (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that approximately 93% of the Kankakee SA near surface aquifers are in the moderate to high range for sensitivity to contamination (**Table 54**). The aquifer sensitivity reflects the middle upper range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	43	1%
High	2,152	72%
Moderate	621	21%
Low	164	5%
Very Low	3	0.1%

Table 54. Ground water sensitivity distribution in the Kankakee Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Kankakee SA is seventh most among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 25,466 MGD **(Figure 62)** (IDNR DOW, 2016). Agricultural irrigation accounts for approximately 42% of registered withdrawal capacity followed by energy production with approximately 32% of total capacity.

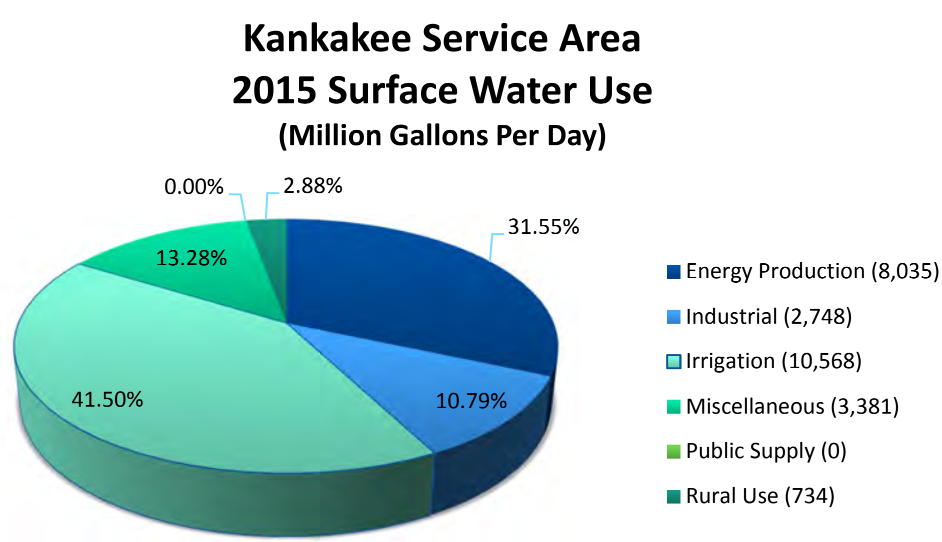


Figure 62. 2015 surface water usage in the Kankakee Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Kankakee SA is the fifth most of any SA with a 20,654 MGD registered capacity **(Figure 63).** Public water supply and agricultural irrigation combined account for approximately 84% of registered ground water withdrawal capacity in the SA.

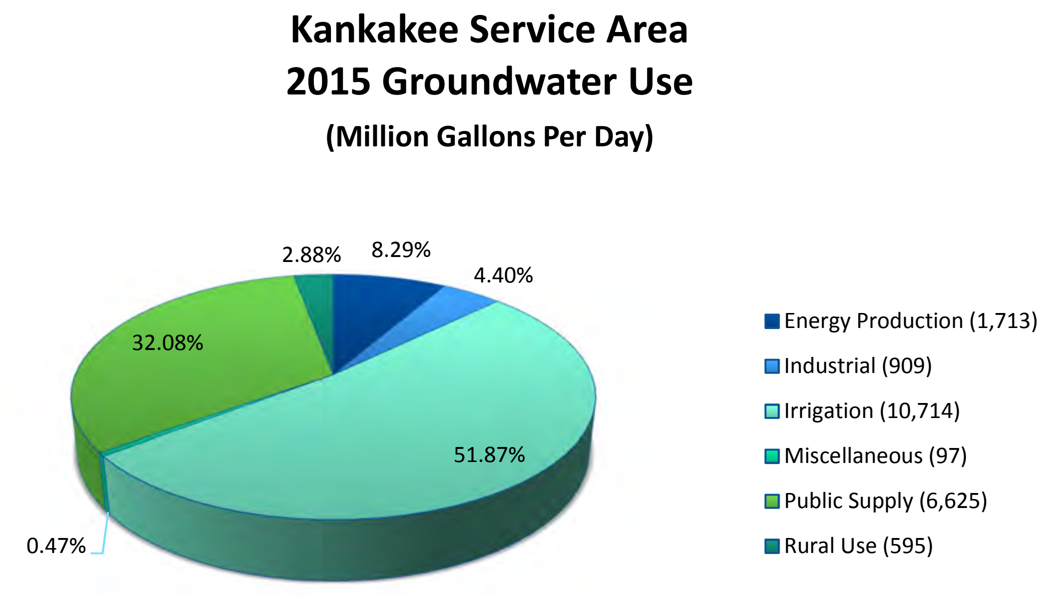


Figure 63. 2015 groundwater usage in the Kankakee Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Kankakee SA include, but are not limited to acid bog, circumneutral bog, fen, forested swamp, shrub swamp, marsh, inland coastal plain marsh, muck flat, sedge meadow, wet prairie, and wet sand prairie in addition to many other transitional, mixed and upland communities.

There are currently six amphibian species, 44 bird species, three fish species, 12 mammal species, three mollusk species, and nine reptile species listed as SGCN within the Indiana SWAP Kankakee Planning Region (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Kankakee SA. The following aquatic resource goals and objectives apply specifically to the Kankakee SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and/or preservation of aquatic resources that will help offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any stream channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Kankakee River Watershed Planning Region where feasible.
7. Restoration of riparian and lacustrine wetlands to help offset threats to, and improve functions and services of, aquatic resources that will improve connectivity of formerly extensive wetland and natural lake complexes throughout the SA that have been degraded by, and/or lost to, conversion.
8. Implement stream and wetland restoration, enhancement and/or preservation projects to restore areas of the Grand Kankakee Marsh and the Kankakee River and tributary channels' natural geomorphology while reducing sediment loading.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Kankakee SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to help offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Flat Lake (subwatershed) WMP, Lake of the Woods (subwatershed) WMP, NIRPC WMP, and Upper Iroquois WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Kankakee SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area.. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Coordination with the Kankakee River Basin Commission may be a beneficial resource since it has a wide range of representation on the Commission from other local agencies and organizations.

Currently, the following land trusts exist within the SA: Woodland Savanna Land Conservancy, Trillium Land Conservancy, Wood-Land-Lakes RC&D Council, LaPorte County Conservation Trust, ACRES Land Trust, and NICHES Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Calumet-Dunes SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- Kankakee River Basin Commission (KRBC)
- Kankakee-Iroquois Regional Planning Commission (KIRPC)
- Michiana Area Council of Governments (MACOG)
- Illinois state and local government entities
- USGS Indiana Water Science Center
- USGS Illinois Water Science Center
- Active Watershed Groups and appropriate Watershed Management Plans

- Upper Midwest and Great Lakes, and Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperatives
- Municipal and County governmental entities
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Indiana Lakes Management Society
- Kankakee River Awareness Program

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 64** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

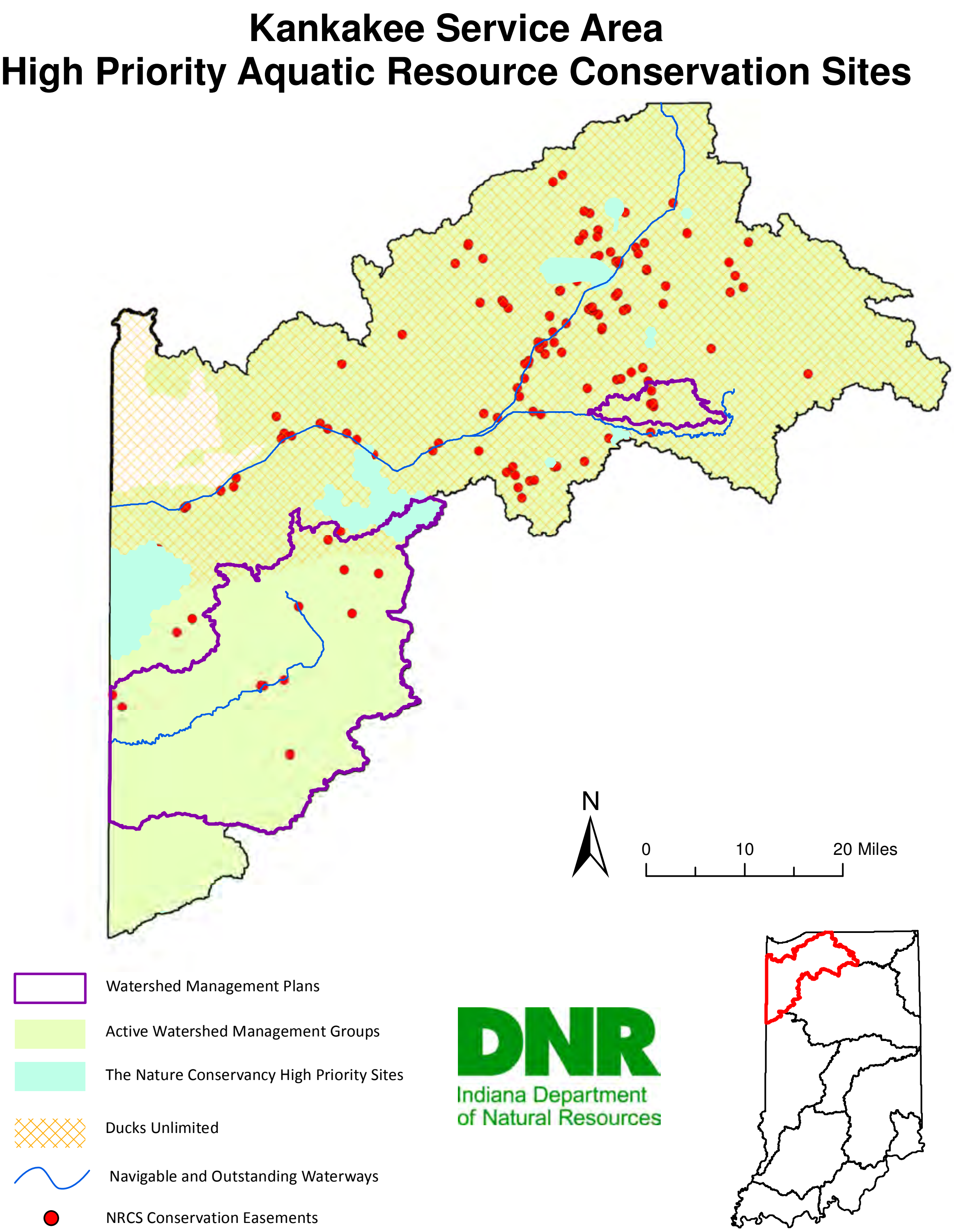


Figure 64. Priority aquatic resource conservation groups and sites within the Kankakee Service Area (IWPP, 2015)

APPENDIX B.5 UPPER WABASH SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Upper Wabash Service Area (SA) is located in northern Indiana and is composed of the following seven 8-digit HUCs:

- 05120106 - Tippecanoe
- 05120105 - Middle Wabash-Deer
- 05120107 - Wildcat
- 05120104 - Eel.
- 05120101 - Upper Wabash
- 05120102 - Salamonie
- 05120103 - Mississinewa

The Upper Wabash SA includes all or portions of twenty-eight Indiana counties listed below and is located primarily in the Central Till Plain physiographic region.

Kosciusko	Tipton	Fulton
Noble	Clinton	Cass
Whitley	Tippecanoe	Carroll
Allen	Benton	Howard
Adams	White	Miami
Jay	Jasper	Wabash
Randolph	Pulaski	Huntington
Blackford	Starke	Grant
Delaware	Marshall	Wells
Madison		

The Upper Wabash SA is the largest of the eleven SAs having an area of 6,915 square miles; this area accounts for over 22% of the entire state of Indiana. The SA is located primarily in the Eastern Corn Belt Plains ecoregion; the eastern portion is within the Clayey, High Lime Till Plains sub-region and is characterized by soils which are less productive and more artificially drained than the western portion of the SA located in the Loamy, High Lime Till Plains sub-region. The Loamy, High Lime Till Plains area is characterized by soils that developed from limy, loamy, glacial deposits. Currently, both sub-regions are dominated by corn, wheat, soybean, and livestock farming. The northwestern-most portion of the SA is located in the Northern Indiana Drift Plains ecoregion; the land is flat to rolling and is characterized by its dunes, end moraines, and lacustrine deposits with its tributaries being fed by a significant amount of groundwater. In addition, the northernmost portion of the SA is characterized by pothole lakes, ponds, marshes, bogs, and clear streams; the area is dominated by corn, soybean, and livestock farming (U.S. EPA: Ecoregions of Indiana).

Primary rivers flowing through the Upper Wabash SA are the Wabash River and its many tributaries, including the Mississinewa, Eel, Tippecanoe, White, and Vermilion Rivers as well as Sugar Creek and Wildcat Creek. The Wabash River originates as a drainage ditch in Ohio and enters Indiana in Jay County. It flows northwest towards the Little Wabash River near Huntington County and continues west and converges with the Eel River in Cass County. An additional confluence of this river occurs in Tippecanoe County with the Tippecanoe River; from here, the Wabash River flows through the Middle Wabash SA in Tippecanoe County and eventually confluences with the Ohio River in the southwestern part of the state.

Based on the 2011 NLCD, the land cover type with the most area in the Upper Wabash SA is agricultural land use (79.8%), followed by developed and impervious land use (8.6%), forest (8.6%), and wetlands and open water (1.84%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 0.64% per the 2011 NLCD to 2.13% per the NWI. Emergent herbaceous wetlands range from 0.32% per the 2011 NLCD to 0.78% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Upper Wabash SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Upper Wabash SA from 2009 – 2015 was collected and analyzed **(Table 55)**. According to the data, 38 acres of impacted wetlands and 29,026 linear feet of impacted streams required mitigation in the seven year time period.

The transportation and service corridor work type accounted for the most stream impacts (86.4%), followed by development (8.26%), dam related activities (3.45%), agricultural land uses (1.72%), and energy production and mining (0.17%).

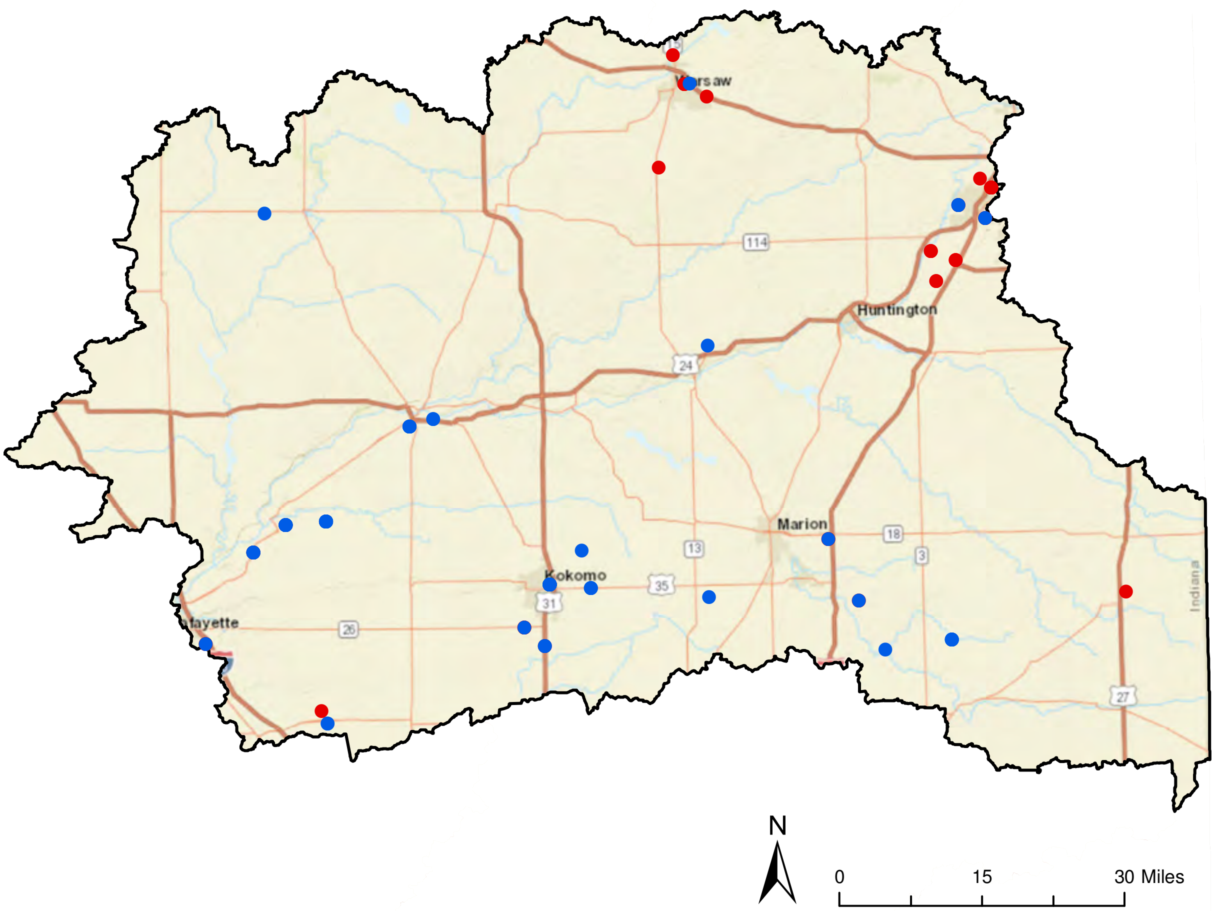
Dam related activities accounted for the most wetland impacts (56.82%), followed by development (28.34%), transportation and service corridors (14.53%), and energy production and mining (0.32%). Based on the 404 permitted impact data provide by the Corps, agricultural land uses had no documented federally jurisdictional impacts requiring mitigation within this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 65**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	500	1.72%	0	0.00%
Dam	1,000	3.45%	21.6	56.82%
Development	2,397	8.26%	10.8	28.34%
Energy Production	50	0.17%	0.12	0.32%
Transportation	25,079	86.40%	5.5	14.53%
Grand Total	**29,026**	**100.00%**	**38**	**100.00%**

Table 55. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville and Detroit Districts

Upper Wabash Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation



Wetland

River/Stream

DNR
Indiana Department of Natural Resources

Figure 65. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Upper Wabash SA is presented in **Figure 66,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

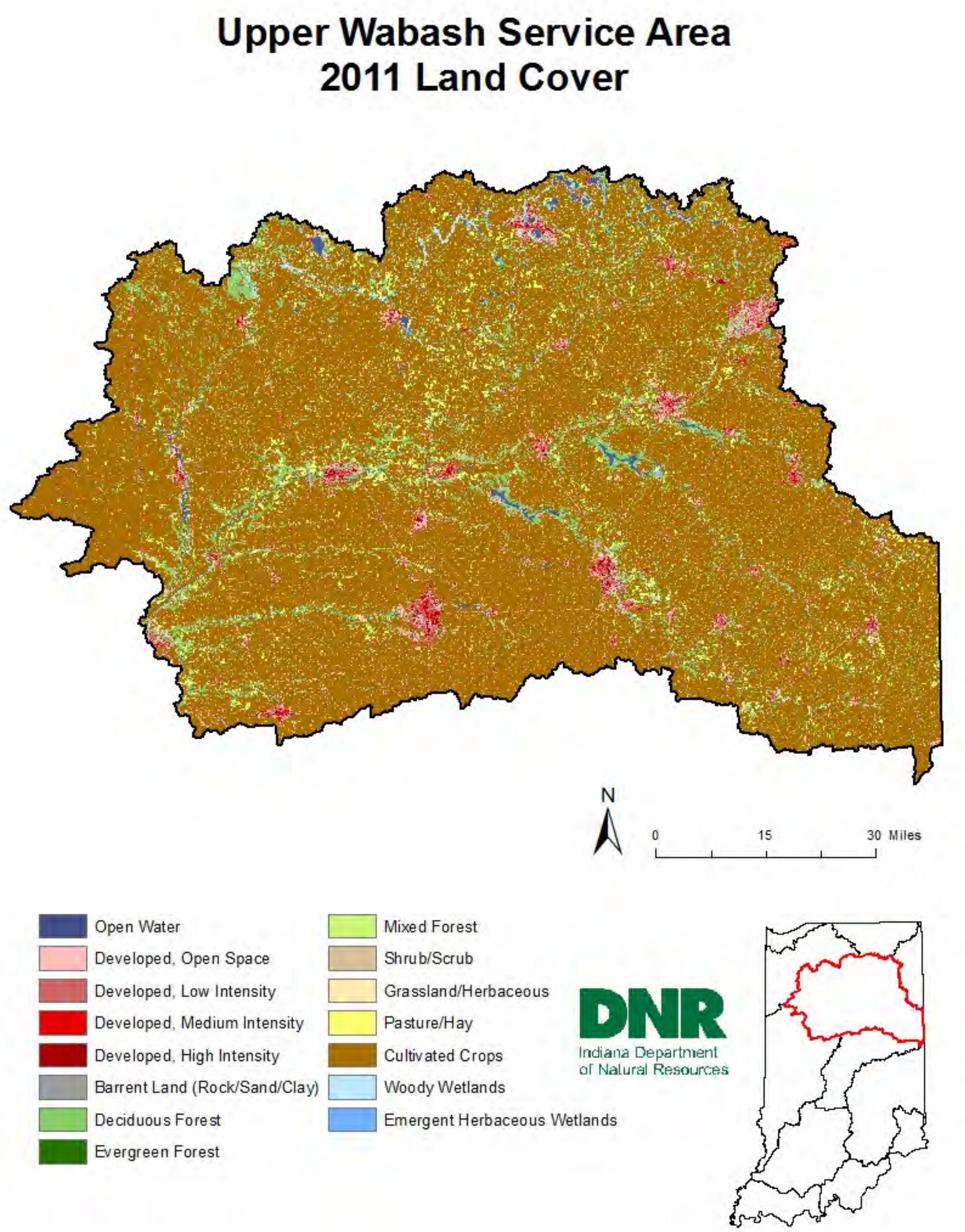


Figure 66. Land cover within the Upper Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 56)**.

Land Cover			
Class	Value	Sum of Acres	Percent of Total Acres
Open Water	*	39,035	0.88%
Developed	Open Space	250,741	5.67%
Developed	Low Intensity	94,193	2.13%
Developed	Medium Intensity	24,516	0.55%
Developed	High Intensity	10,971	0.25%
Barren Land (Rock/Sand Clay)	*	3,349	0.08%
Forest	Deciduous	376,337	8.50%
Forest	Evergreen	3,010	0.07%
Forest	Mixed	8	0.00%
Shrub/Scrub	*	13,414	0.30%
Grassland/Herbaceous	*	36,902	0.83%
Pasture/Hay (Agriculture)	*	111,367	2.52%
Cultivated Crops (Agriculture)	*	3,418,747	77.26%
Wetlands	Woody	28,202	0.64%
Wetlands	Emergent Herbaceous	14,285	0.32%
Grand Total		**4,425,076**	**100.00%**

Table 56. Upper Wabash land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 66** below to demonstrate the current overall land cover distribution of the SA.

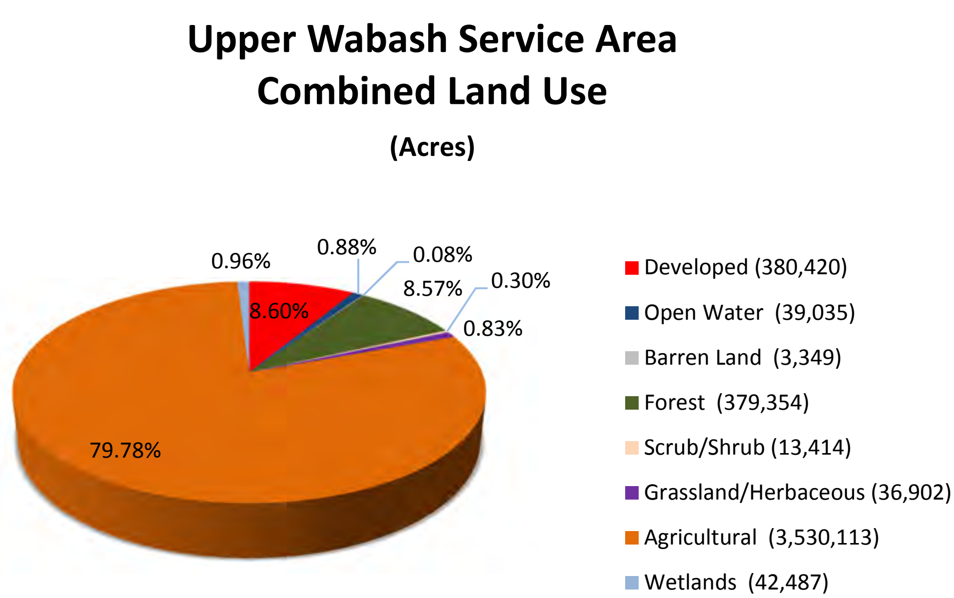


Figure 66. Combined land uses within the Upper Wabash SA from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Upper Wabash SA. Total agricultural land use covers approximately 80% of the SA's total land area of 3,530,114 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of a few developed areas, such as Kokomo, Marion and the western portion of Ft. Wayne.

Within the identified land use areas, cultivated crops cover 3,418,747 acres (77.26%) and pasture/hay lands cover 111,367 acres (2.52%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop followed by soybeans when based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Upper Wabash SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. Since the Upper Wabash SA is the largest with approximately 4,425,075 acres and it contains a multitude of large farming operations. The SA contains active pig, chicken, dairy cattle and beef cattle CFOs which have a minimum of 5,000 animal units with several top producing counties have CFOs that surpass the 15,000 animal unit threshold. The Upper Wabash SA boundary contains top pork and poultry producing CFOs within the state, with Carroll County's combined pig CFOs surpassing 45,000 animal units; and poultry operations in Kosciusko and Wabash counties are two of the top four chicken producers statewide with CFOs that surpass 5,000 animal units (Thompson, 2008).

In addition to dominating pork and poultry production, the Upper Wabash SA includes Carroll, Jay and Wabash Counties which notably contain over 80 CFOs each (Thompson, 2008). The number and concentration of active CFO's within the SA surpasses any other when comparing livestock production. When combining these major agricultural land use activities, the Upper Wabash SA is the top ranking with respect to percentage of total statewide agricultural land use (15.26%), and it's the most significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the second largest land use category in the Upper Wabash SA. Total developed impervious land use covers approximately 380,421 (8.6%) of the 4,425,076 total acres making it the sixth most developed area by density across all of the SAs. Though this SA is sixth in developed density, it contains the second most developed land use acres of all SA's, accounting for 15% of the states approximately 2,484,939 developed acres.

In general, developed impervious areas are located along the U.S. 30 (East and West) corridor in the north consisting of communities such as Columbia City and Warsaw, and the western reaches of Ft. Wayne; along the U.S. 31 (North and South) corridor consisting of communities such as Kokomo, Peru and Rochester; and along the Wabash River and major tributaries consisting of communities such as Huntington, Wabash, Logansport and Marion. Other smaller intensely developed footprints include communities such as Bluffton, Frankfort, Portland and eastern reaches of Lafayette. Many of the communities in the Upper Wabash SA are located adjacent to larger rivers, reservoirs and/or public freshwater lakes.

The SA contains all or part of the the following MSAs: Chicago/Gary, Fort Wayne, Lafayette-West Lafayette, Kokomo, Muncie, and Indianapolis-Carmel-Anderson, and all except the Kokomo and Muncie MSA's experienced growth during the previous decade (Manns, 2013). The core of the Kokomo MSA falls entirely within the Upper Wabash SA, where the core of the other MSA's fall mostly outside of the SA boundary. Analysis of the INDOT cities and towns GIS data shows the Upper Wabash SA contains all or part of 390 cities and/or towns, 101 of which are incorporated (INDOT, 2016). The Fort Wayne/New Haven urbanized areas have expanded into adjacent Huntington and Whitley counties in recent years primarily due to residential growth sprawling out of southwest Allen County. The total number of housing units across the region increased by 23,473 units (8.7%) from 2000 to 2010; with Whitely County accounting for the largest increase of 13.8% (Region III-A , 2015).

Eight Indiana regional councils overlap the SA and include the North Central Indiana Regional Planning Council (NCIRPC) (27%), Kankakee-Iroquois Regional Planning Commission (KIRPC) (19%), Region III-A Economic Development District and Regional Planning Commission (17%), East Central Indiana Regional Planning District (13%), Michiana Area Council of Governments (8%), Northeastern Indiana Regional Coordinating Council (NIRCC) (8%), Eastern Indiana Regional Planning Commission (3%), and Madison County Council of Governments (0.3%) (IARC, 2017).

NIRCC and the Region III-A Economic Development District and Regional Planning Commission completed a joint, comprehensive economic development strategy that addresses future economic and transportation needs for their 10 combined counties encompassing the northeast corner of the state (Region III-A , 2015). Though the City of Ft. Wayne is the dominant driver of growth in this area, the economic development strategy equally addresses the entire region which covers much of the eastern portion of the Upper Wabash SA.

According to the Northeast Indiana CEDS, as of 2013 there were a total of 309,927 people employed in the region, with Allen County accounting for slightly more than half of those jobs and the remaining counties accounting for between 4% and 7% each. The largest employment sector in the region is manufacturing with 71,783 (25%) of the workforce. The automotive sector accounts for 21.4% of manufacturing employment in this region including assembly, components fabrication, recreational vehicles and trailers. Other major manufacturing industries are the medical devices and defense industries in addition to steady growth in food processing due to significant row crop and livestock operations supported by major grain and processing. These products range from dairy, eggs, poultry, to specialty products, and have contributed to growth in agritourism, warehousing and distribution (Region III-A , 2015).

The six counties in the NCIRPC fall mostly within the SA, contributing to developed area with cities such as Kokomo, Frankfort, Logansport, Peru, Mexico and Rochester. Manufacturing is the dominant industry in the region accounting for 19.6% of the workforce with the top manufacturing being primary metals, fabricated metal products and machinery (NCIRPC, 2012). Other predominant work sectors include government (16.3%), retail/wholesale trade (13.7%), healthcare (9.1%), accommodation and food (6.6%) agricultural (4.5%), and transportation and warehousing (3.1%). Sectors with the most growth currently include agribusiness, biomedical, biotechnical and education, with other emerging sectors that include transportation and logistics, business and financial services, defense and security, as well as apparel and textiles (NCIRPC, 2012).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 17,034 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Upper Wabash SA has the sixth greatest density of local road miles to square mile ratio of all SA's at approximately 2.46 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Upper Wabash SA contains approximately 2,834 miles of U.S. Interstates and highways, 4,430 miles of state highways, and 17,034 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the largest SA, the concentration of the road types per square mile of land varies in this SA.

U.S. Interstates and highways have a concentration of approximately 0.41 mile per square mile, which ranks seventh when compared to the other ten SAs making this the lowest ranking road type within the SA. Although the concentration of U.S. Interstates and highway miles per square mile ranks near the middle, the concentration of state roads ranks fourth with 0.64 mile per square mile. The concentration of local roads is approximately 2.46 miles per square mile, ranking sixth. Finally, the concentration of all roadways within the SA is 3.51 miles per square mile which give it an overall ranking of sixth.

Although the concentration of U.S. interstates and highways and local roads rank near the middle, closer analysis reveals the concentration of state highways ranks within the top four when compared to all other SAs. The construction and maintenance of roads and bridges throughout the Upper Wabash SA will play an integral role in sustaining business and commerce for this region of the state.

2.5.2 Railroads

Railroads provide an alternative means of transportation with approximately 1,398 miles of railroad within the Upper Wabash SA (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Upper Wabash SA contains the seventh greatest concentration of railroads when compared to all SAs with a density of 0.2 miles of railroad per square mile. The concentration of linear infrastructure throughout the SA poses a threat to aquatic resources in the form of habitat fragmentation, resource degradation, habitat conversion and resource loss.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Upper Wabash SA contains service corridors that contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 7,419 miles of service corridors within its boundary.

The Upper Wabash SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately 243 (12 kV) lines, fifty (34.5 kV) lines, thirty-two (69 kV) lines, 127 (138 kV) lines, fifty-four (230 kV) lines, thirty-two (345 kV) lines, and thirteen (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 2,506 miles throughout the SA, which ties for the ninth highest concentration of electric transmission lines relative to the SA size, resulting in 0.36 mile of transmission line per square mile.

In addition to electric transmission lines, the Upper Wabash SA contains over 1,784 miles of pipelines. It contains over 114 miles of pipelines that convey crude oil, 1,197 miles of pipelines that transport natural gas, and 473 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Upper Wabash SA contains the greatest concentration of natural gas, fifth greatest concentration of crude oil pipelines, and third greatest concentration of refined petroleum products pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 25 known low head dams (IDNR DOW, 2016) within the SA, the third highest among SA's, but eighth in concentration at one low head dam per 277 square miles. There are currently 46 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 150 square miles, the second lowest concentration of all SA's, but having 5% of all documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 638,880 linear feet (121 miles) of NLE's mapped within the SA, averaging one mile of NLE per 57 square miles, the third lowest concentration among all SA's. Blackford, Clinton, Delaware, Howard, Miami, Tipton and Wells counties within the SA were not included in the NLE identification project since they were not declared disasters resulting from the 2008 severe weather events; therefore, the Upper Wabash SA has additional NLE's that have not yet been mapped as part of this effort. Approximately 62 miles of the currently identified NLE's are located within predominantly developed areas with the remaining 59 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Upper Wabash SA contains a multitude of active oil and gas fields, along with associated wells that are currently supporting, or have supported, the petroleum industry within its boundary. The Indiana Geological Survey (IGS) identifies seven petroleum gas fields with 56 associated gas wells; seven oil fields with 178 oil wells; and three oil & gas fields with two oil & gas wells ranking the Upper Wabash SA eighth statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The Upper Wabash SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 2,482 abandoned gas wells, 7,161 abandoned oil wells, 19 abandoned oil & gas wells, 1,909 dry wells, 67 observation wells, 168 stratigraphic wells, 32 saltwater injection wells, 40 abandon saltwater injection wells, four temporarily abandoned wells, and 26 non-potable water supply wells within the SA boundary (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The Upper Wabash SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains 18 sand & gravel mining operations, two peat mining operations, and 22 crushed stone operations (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one slag operation, which is an industry byproducts commodity that is used as aggregate (Indiana Geological Survey, 2016). In addition to the Upper Wabash SA ranking first based on its size, mineral mining within its boundary ranks first in the state with 44 active operations.

2.7.3 Coal

The Upper Wabash SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Upper Wabash SA is located entirely within the Indiana SWAP Corn Belt Planning Region. The SWAP identifies the most significant threats to habitats and SGCN within the Corn Belt Region as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

The SWAP Corn Belt Region has experienced loss in the majority of habitat types over the last decade mostly to urban development, which gained 4.8% in land cover (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the agricultural and developed impervious footprints make up approximately 88% of the land cover of the SA and are expected to remain as top contributors to aquatic resource impairments.

IDNR expects development along with transportation and service corridor projects to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue. Dam and/or levee activities accounted for the most wetland impacts over the analyzed timeframe, though future dam or levee rehabilitation or maintenance needs are not known at this time.

The NIRCC's 2035 Transportation Plan addresses needs and plans for the next two decades. Northeast Indiana is served by two major interstate highways, I-69 (North/South) and I-80/90 (East/West; Indiana Toll Road). The region is also crossed by seven U.S. highways and over twenty state roads. The interstate, U.S. highway, and state road systems provides connectivity throughout the region to nearly twenty major U.S. and Canadian markets within a 500 mile radius. Businesses in the region have a one-day drive by truck to more than 40% of the U.S. population and over one-fifth of the Canadian population. The roadway infrastructure, in addition to railroad access in the region, allow for significant intermodal transportation of freight in and out of the region. Roadways and associated infrastructure in the region are in need of maintenance to continue to provide the necessary services and connectivity for economic growth (NIRCC, 2013).

The economic goals and objectives for the NIRCC region include improving and diversifying workforce skill sets to attract more companies across all industries to include expanding the manufacturing core. Other regional planning goals include transportation and infrastructure investments, improved affordable energy, effective public transit, and increased shovel-ready development sites. The construction industry is projected to account for 5% of total economic growth by 2020, a 24.1% increase. There has been an emphasis on the development of trails and pedestrian facilities throughout the region. Public utilities are also underfunded and deteriorating, particularly sewer districts, and will require upgrades and ongoing repairs and maintenance (NIRCC, 2013).

The NCIRPC CEDS identifies economic growth and development goals that include: opportunities to expand workforce development; improvements to, and continued development of, cities; maximize the potential of air and highway transportation infrastructure; and provide improved infrastructure and services to residents and businesses (NCIRPC, 2012). This plan includes expansion and/or development of industrial parks, brownfield redevelopment, U.S. 24 and U.S. 31 corridor development and infrastructure improvements, restore and expand housing prospects, attract industry management, create improved pedestrian modes of transportation and recreation, in order to attract families to relocate and stay within the region (NCIRPC, 2012).

The region has several geological resources including petroleum and mineral resources. The Trenton Oil Field is situated at the southeastern part of the region and has been a major petroleum source to the oil and gas industry in Indiana from the late 1800s to the early 1900s. Although most of the natural gas was removed from the field by 1910, only about 10% of the oil was removed with an estimated 900,000,000 barrels still remaining in the ground. The region also has a few places where minerals of commercial importance are mined. Most sand and gravel pits are located in Miami and Howard counties, while cement and crushed stone mines are clustered in the central part of the region. Biofuel crops and production are another significant contributor to the economy with the potential for future growth. Finally, the central and southern parts of the region have wind conditions that are especially favorable for potential wind farm development (NCIRPC, 2012).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Upper Wabash SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Upper Wabash SA historic aquatic resources were comprised of a diverse mix of natural aquatic community types. Presettlement land cover was predominantly comprised of mixed forested communities. With the Upper Wabash SA boundary covering the majority of norther Indiana, the expansive forested communities that dominated the state were represented throughout the region. Similar to the majority of the state, the regions forests and aquatic resources were converted by early settlers in order to harvest timber and farm the land. During the mid-1800s, the land was cleared by immigrants in order to farm (Canal Society of Indiana, 2006).

Similar to the fate of the Black Swamp and the Great Kankakee Marsh, the Upper Wabash SA contained large wetland complexes that were impacted during this era. The Limberlost Swamp was a large wetland complex located near the eastern boundary of the SA. It covered approximately 13,000 acres and was known to be filled with diverse plants and wildlife (Inventorying the Loblolly Marsh, 2009). Unfortunately, the area was drained with a steam powered dredge from 1888 to 1910, creating the

Loblolly Ditch, in order to convert the area to farmland (Indiana Department of Natural Resources, 2017).

The Wabash-Erie Canal extended across the middle of the SA, from east to west, and provided an important transportation route that solidified commerce and settlements rooted in agriculture. Settlements were expanding throughout northern Indiana by 1840, predominantly along the route of the Wabash-Erie Canal (Carman, 2013). The construction of canals allowed settlers a means to get farmed commodities to markets. Eastern markets would pay higher prices for agricultural products and the canals provided transportation routes for these commodities, allowing for the shipping of European imports/exports and goods in and out of Indiana’s interior (Canal Society of Indiana, 2006). Construction of this and other shipping routes led to the region’s aquatic resources to be converted in order to sustain the agricultural and economic needs of the early settlers.

Due to extensive aquatic resource loss within the Upper Wabash SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections and their natural aquatic communities within each respective Region and Section. **Figure 67**, depicts each Natural Region and Section located within the Upper Wabash SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana’s historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss (**Table 57**). The table details the SA’s estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Upper Wabash Service Area
Natural Regions and Sections

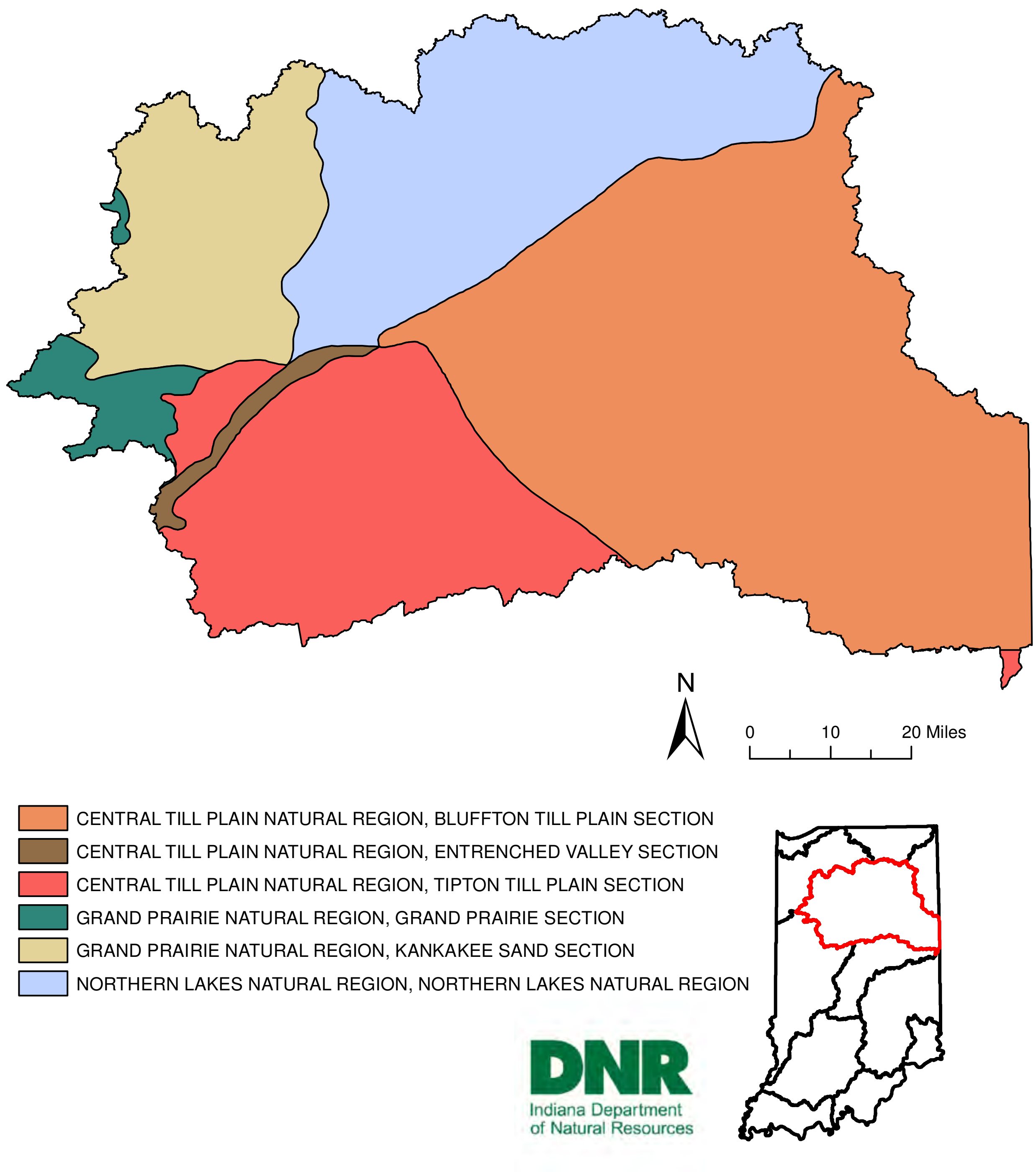


Figure 67. Natural regions and sections within the Upper Wabash Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Central Till Plain	Bluffton Till Pain	44.5	Predominantly forested; minor areas of bog, prairie, fen, marsh and lake	1,206,158	27.26	1,253,152	28.32	88.33
	Tipton Till Plain	18.9	Extensive beech-maple-oak forest (northern flatwoods)					
	Entrenched Valley	1.07	Predominantly upland forests, bottomland forests, and flatwoods; prairie, gravel-hill prairie, fen, marsh, savanna, cliff, seep spring, and pond; Typical streams medium-gradient, relatively clear, and rocky					
Grand Prairie	Kankakee Sand	11.62	Predominantly prairie and savanna; wet prairie, marsh, swamp, wet sand flat, and wet muck flat; predominantly oak forest (eastern), oak flatwoods (dunal swales)					
	Grand Prairie	2.58	Dry prairie, wet prairie, savanna, marsh, pond, bog (rare), and forest (riparian and oak groves); Typical streams low-gradient and silty					
Northern Lakes	Northern Lakes	21.32	Bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake (Wet sand flats and muck flats), and various deciduous forest types; Typical streams are clear, medium to low-gradient, sandy gravel beds					

Table 57. The historic natural community composition for the Upper Wabash Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 958 miles of category 4A impaired streams and 3,381 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,449 miles), PCBs in fish tissue (858 miles), impaired biotic communities (659 miles), nutrients (168 miles), dissolved oxygen (159 miles), and ammonia (66 miles) as current stream impairments with the SA (IR 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 745 QHEI assessments reaches within the SA **(Table 58 and Figure 68)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 39.06% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	280	37.58
51-64	Habitat is partially supportive of a stream's aquatic life design	174	23.36
>64	Habitat is capable of supporting a balanced warm water community	291	39.06
	Total	745	100%

Table 58. IDEM Overall QHEI scores for Upper Wabash SA, 1991 – 2014 (IDEM OWQ, 2014)

Historically, sedimentation by hydromodification and nutrients from agricultural and urban runoff were the main causes of water quality issues within the Upper Wabash Service Area, especially along the Wabash River and its major tributaries. Hydromodification frequently causes streambank erosion, and sedimentation reducing aquatic habitat, spawning, and feeding areas for aquatic organisms. The Upper Wabash has the greatest amount of hydromodification of the SAs due to impoundments such as the Huntington, Salamonie, and Mississinewa Reservoirs as well as impoundments on the Tippecanoe River such as Lake Shafer and Freeman Lake. These impoundments have modified the natural flow regime of streams within the SA, often resulting in the degradation of stream banks and beds in addition to habitat alterations which significantly alteres habitat for aquatic biota and decreases biodiversity.

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Upper Wabash SA ranks third least overall in forested cover density of all SA's at 9% of total SA with approximately 379,354 acres, and ranks sixth in forested cover of any SA at approximately 7.27% of 5,215,169 acres of forest cover statewide.

GIS analysis indicates that there are approximately 12,677,175 linear feet (2,401 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Upper Wabash SA is sixth among SA's in ratio of these potentially restorable stream miles to square miles of SA at approximately 0.35 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.88 square miles of SA.

Upper Wabash Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

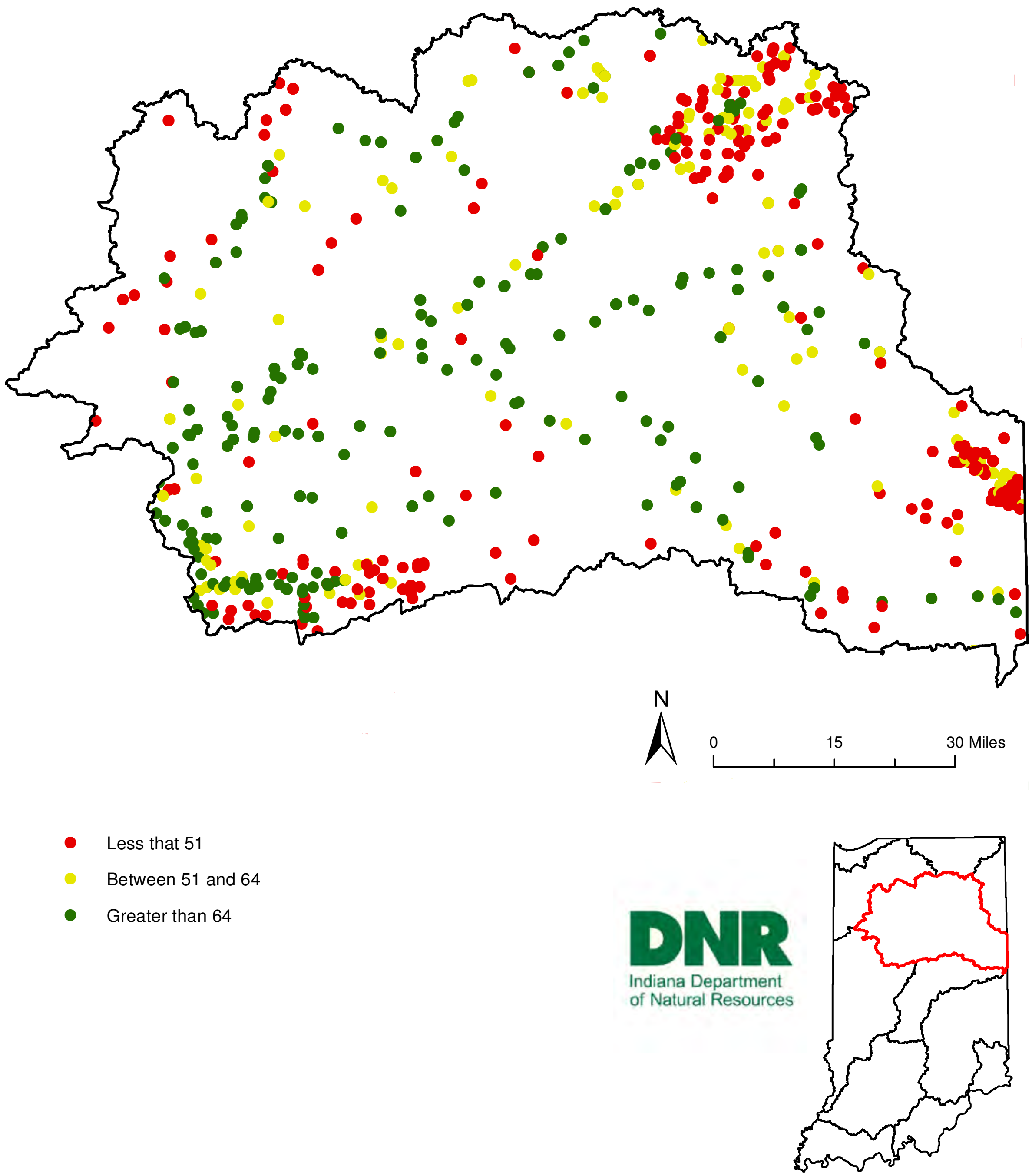


Figure 68. IDEM overall QHEI scores within the Upper Wabash service area; 1991-2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI in the Upper Wabash SA shows that there are approximately 34,575 acres of freshwater emergent wetland (PEM) and approximately 94,167 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.91% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5.22% of the total SA **(Table 59 and Figure 69)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	34,575	15%	0.78%	0.15%
Freshwater Forested/Shrub Wetland	94,167	40.8%	2.13%	0.41%
Freshwater Pond	16,069	7%	0.36%	0.07%
Lake	38,645	16.7%	0.87%	0.17%
Riverine	47,422	20.5%	1.07%	0.20%
Grand Total	**230,877**	**100.00%**	**5.22%**	**1.00%**

Table 59. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils (NRCS-USDA, 2016) account for 2,063,497 acres (**Figure 70**), or 46.63% land cover within the SA, out of which approximately 1,955,304 acres have the potential to be restored, accounting for 44.2% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Upper Wabash SA has the second highest percentage of recoverable wetland acres to total SA size of all SA's, and the most overall potentially restorable wetland acres of any SA. This is both due to a dominance of agricultural land uses and the Upper Wabash being the largest of all of the SA's.

Upper Wabash Service Area
National Wetlands Inventory

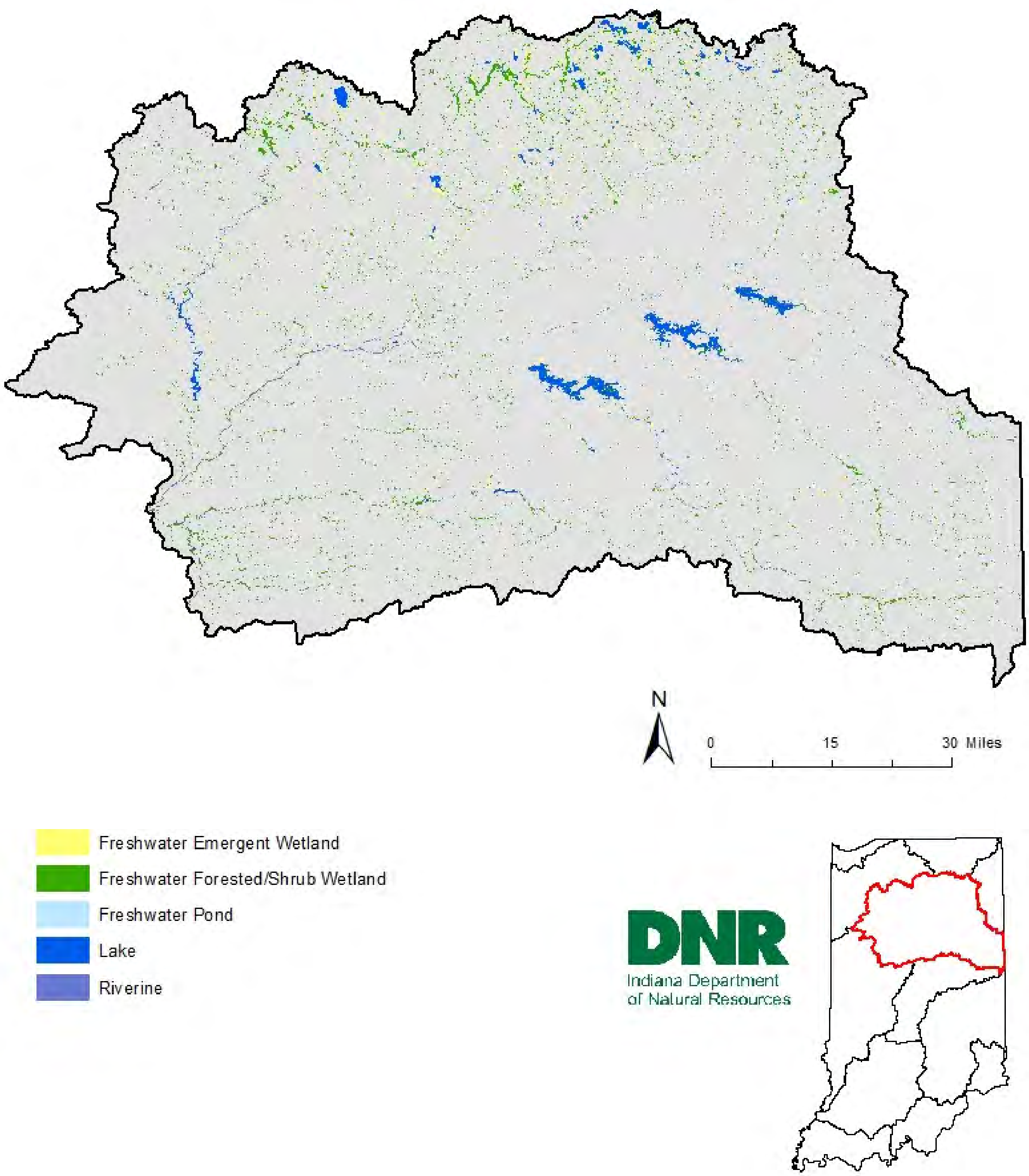


Figure 69. NWI for the Upper Wabash Service Area (USFWS NWI, 2015)

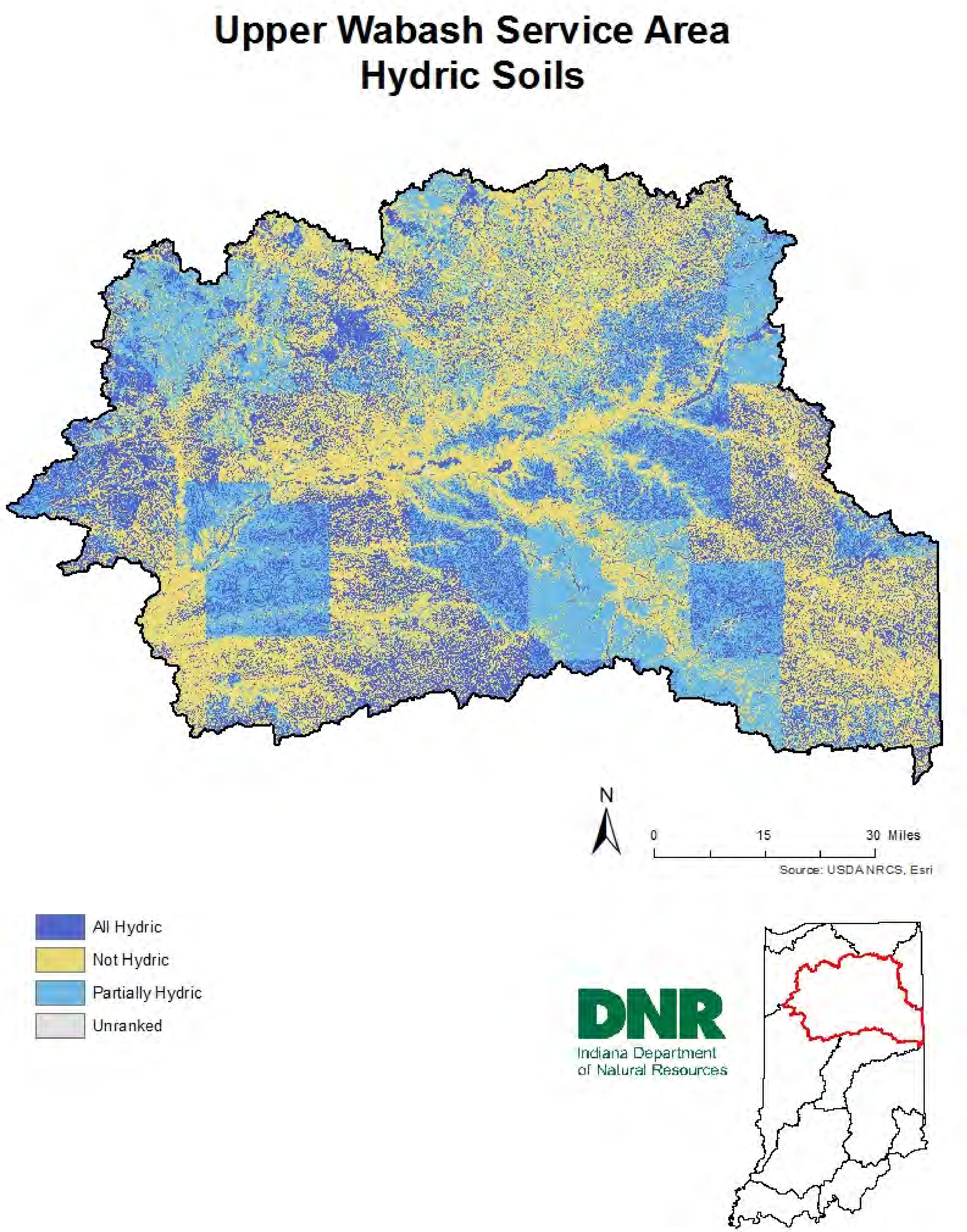


Figure 70. Hydric and partially hydric soils within the Upper Wabash Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 1,391,544 acres of these potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Pipe Creek (HUC 0512010115 **[Table 60]**).

Hotspots account for 5,290,560 linear feet of these potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Black Creek-Salamonie River (HUC 0512010203 **[Table 61]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 60 & 61)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 71** shows where these watersheds are located within the SA.

Approximately 55,455 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands. Howat 80 Wildlife Management Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable wetlands (13,801 acres). Winamac Fish and Wildlife Area is the IDNR-managed land with the Upper Wabash SA with the most adjacent acres identified as hotspots of potential restorable wetlands, followed by Roush Lake Fish and Wildlife Area. There are approximately 6,716 linear feet of potentially restorable streams adjacent to IDNR-managed lands. Randolph County Wildlife Management Area is the IDNR-owned land with the most adjacent hotspots of potentially restorable streams (2,180 linear feet), followed by Loblolly Marsh Nature Preserve (1,401 linear feet).

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Wetlands (acres)
0512010115	Pipe Creek	80,068
0512010505	Deer Creek	74,427
0512010610	Big Monon Ditch	68,384
0512010612	Honey Creek-Tippecanoe River	64,875
0512010701	Kokomo Creek-Wildcat Creek	67,036

Table 60. Watersheds in the Upper Wabash Service Area with the most hotspots of potentially restorable wetlands

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Streams (linear feet)
0512010203	Black Creek-Salamonie River	259,248
0512010201	Brooks Creek-Salamonie River	244,992
0512010104	Loblolly Creek	225,984
0512010405	Paw Paw Creek-Eel River	223,872
0512010305	Massey Creek-Mississinewa River	223,344

Table 61. Watersheds in the Upper Wabash Service Area with the most hotspots of potentially restorable streams

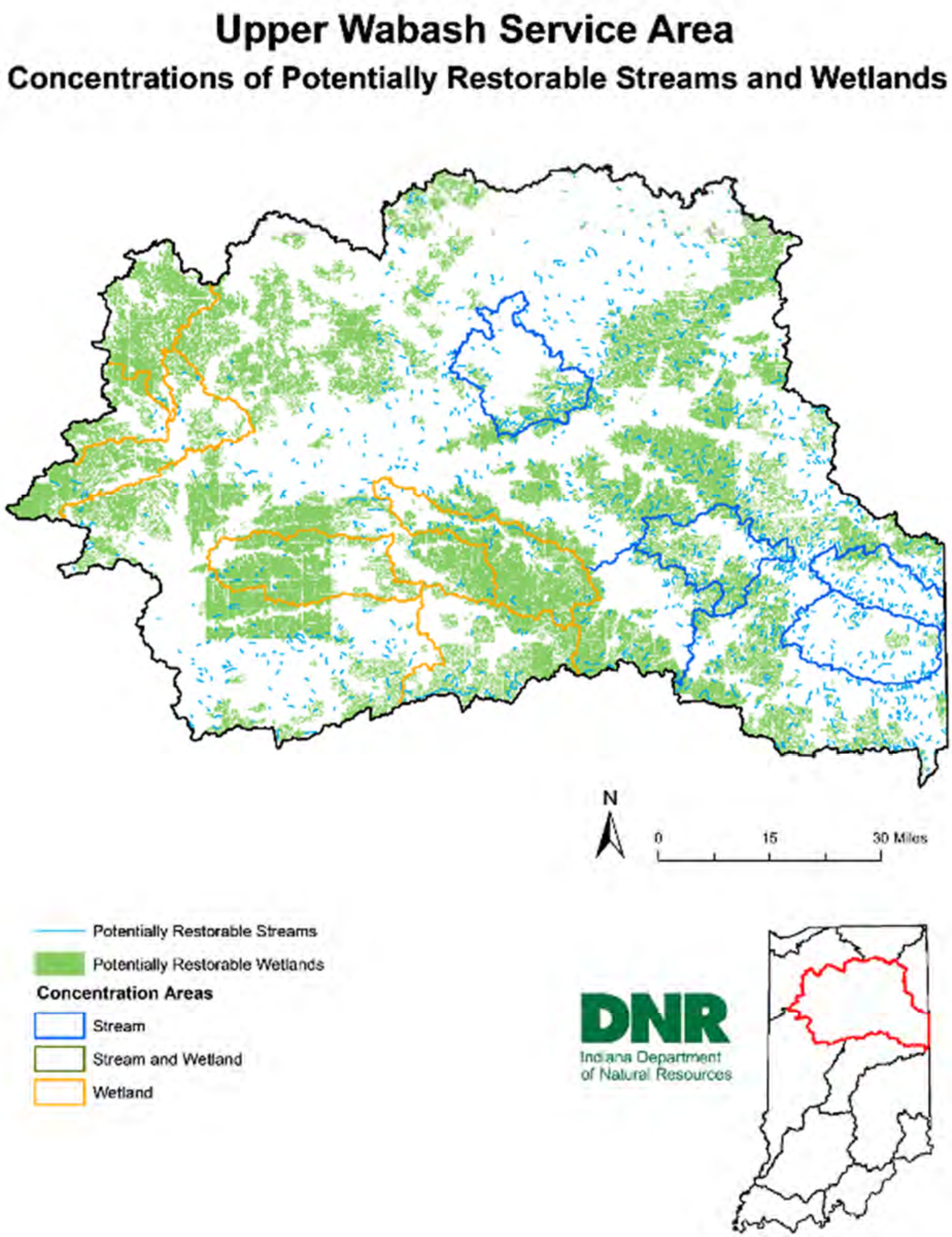


Figure 71. Concentrations of Potentially Restorable Streams and Wetlands in the Upper Wabash Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Upper Wabash SA indicates there are 39 lakes currently documented as having category 5 impairments, which measured using the National Hydrography Dataset (NHD) includes 12,317 acres with PCBs in fish tissue, and 3,064 acres with phosphorus, 709 acres with impaired biotic communities, 698 acres with E. coli, 291 acres with algae, and 77 acres with total mercury in fish tissue (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 39,035 acres of open water which accounts for 0.9% of the SA. This varies slightly from the NWI, which identifies approximately 16,069 acres of freshwater ponds comprising 0.4% of the SA, and 38,645 acres of lakes comprising 0.9% of total SA acres. Of these open waterbodies, GIS analysis identifies approximately 120 natural public freshwater lakes (PFL) (IC 14-26-2-1.5) within the SA, which is 28% of the PFL's as identified by the Indiana Natural Resource Commission list of public freshwater lakes as of June 2011 (IN NRC, 2011). Furthermore, GIS analysis indicates that approximately 3,450 acres of PFO, PSS and/or PEM from the NWI that are contiguous with the boundary of PFL's within the SA as identified in the DNR DOW's GIS data (IDNR DOW PD, 2016).

Shorelines of the natural lakes within the Upper Wabash SA, especially within the Tippecanoe Watershed (HUC-05120106), have been altered by humans resulting in the loss of important lacustrine wetland areas. These alterations were caused by a variety of activities such as road construction and residential development. As a result of these alterations, natural areas have been fragmented and biodiversity has been significantly reduced. This decrease in diversity and productivity has ultimately caused a decrease in the health of aquatic ecosystems existing within lacustrine wetlands; human activities have proven to be primarily responsible for the degradation of plant communities, wildlife habitat, and water quality of these wetlands (Price, 2009).

IDNR will remain up to date with PFL and reservoir condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Upper Wabash SA shows that approximately 97% of the shallow unconsolidated aquifers receive between 3 to 8 inches of ground water recharge annually **(Table 62).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.23	0.003%
	13	0.29	0.004%
	12	1	0.02%
	11	10	0.15%
	10	7	0.10%
	9	37	0.54%
	8	252	3.65%
	7	654	9.46%
	6	1,107	16.01%
	5	1,746	25.26%
	4	1,804	26.09%
Low	3	1,120	16.20%
	2	148	2.14%
	1	26	0.38%

Table 62. Approximate ground water recharge rates in the Upper Wabash SA (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that over 99% of the Upper Wabash SA near surface aquifers fall between low to high sensitivity to contamination, with nearly 50% being moderate **(Table 63)**. The aquifer sensitivity reflects the aquifer recharge rates for the SA.

Sensitivity	Square Miles	Percent of Total Acre
Very High	22	0.32%
High	1,909	28%
Moderate	3,221	47%
Low	1,760	25%
Very Low	3	0.04%

Table 63. Ground water sensitivity distribution in the Upper Wabash Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Upper Wabash SA is eighth among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 22,272 MGD **(Figure 72)** (IDNR DOW, 2016). Industry accounts for approximately 65% of registered withdrawal capacity followed by energy production with 25%, and public water supply with 8%.

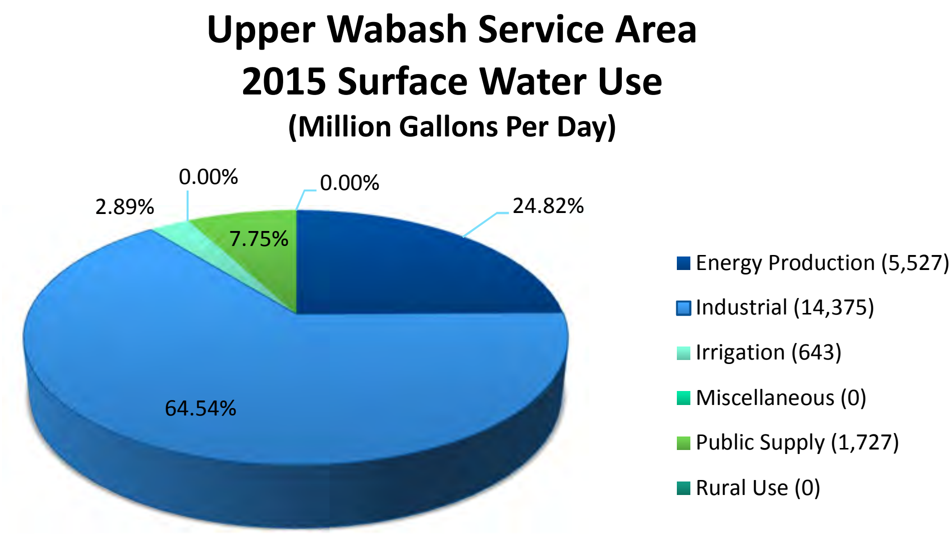


Figure 72. 2015 surface water usage in the Upper Wabash Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Upper Wabash SA is the third most of any SA with a 28,359 MGD registered capacity **(Figure 73).** Public water supply accounts for approximately 56% of registered ground water withdrawal capacity in the SA, followed by agricultural irrigation with 24%, industry with 15% and energy production with 4%.

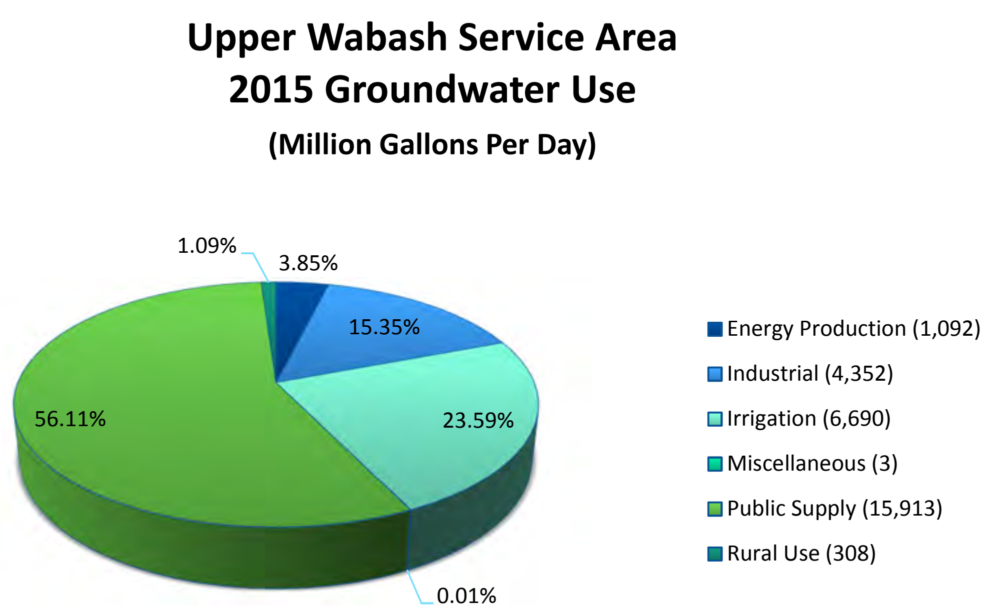


Figure 73. 2015 ground water usage in the Upper Wabash Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Upper Wabash SA include, but are not limited to acid bog, circumneutral bog, circumneutral seep, fen, forested fen, flatwoods, marsh, sedge meadow, shrub swamp, wet-mesic floodplain forest, wet prairie, wet sand prairie, and marl beach, in addition to many other transitional, mixed and upland communities.

There are currently six amphibian species, 47 bird species, seven fish species, 14 mammal species, 15 mollusk species, and seven reptile species listed as SGCN within the Indiana SWAP Corn Belt Planning Region (SWAP, 2015) which includes the Upper Wabash SA.

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Upper Wabash SA. The following aquatic resource goals and objectives apply specifically to the Upper Wabash SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and/or preservation of aquatic resources that will help offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Restoration of riparian and lacustrine wetlands to buffer from threats and improve functions and services in the pursuance of aquatic resource connectivity of formally extensive wetland and natural lake complexes throughout the SA that have been diminished and/or lost to conversion.
5. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
6. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
7. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt Plains Planning Region where feasible.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Upper Wabash SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Eel River-Tick Creek WMP, Eel River (middle) WMP, Limberlost-Loblolly WMP, Upper Wabash River WMP, Mud Creek Headwaters WMP, Pete's Run WMP, Stahl Ditch-Kitty Run WMP, Turkey Creek/Askren/Round Prairie Creek WMP, and Upper Tippecanoe River WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Upper Wabash SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the important physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the DE.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Woodland Savanna Land Conservancy, Trillium Land Conservancy, Wawassee Area Conservation Fund, Little River Wetlands Project, Wood-Land-Lakes RC&D Council, ACRES Land Trust, NICHES Land Trust, Red-tail Conservancy, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Upper Wabash SA, and in which IIDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- Wabash River Heritage Corridor Commission
- Upper Midwest and Great Lakes, and Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperatives
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Region III-A Economic Development District & Regional Planning Commission
- Northeastern Indiana Regional Coordinating Council
- Northcentral Indiana Regional Planning Council (NCIRPC)
- East Central Indiana Regional Planning District
- Eastern Indiana Regional Planning Commission
- Madison County Council of Governments
- Kankakee-Iroquois Regional Planning Commission
- Michiana Area Council of Governments (MACOG)
- Indiana Lakes Management Society
- Wabash River Watershed Section 729 Watershed Assessment – USACE Louisville District
- The Watershed Foundation – Upper Tippecanoe River Watershed
- Little River Wetlands Project
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 74** below.

Upper Wabash River Service Area
High Priority Aquatic Resource Conservation Sites

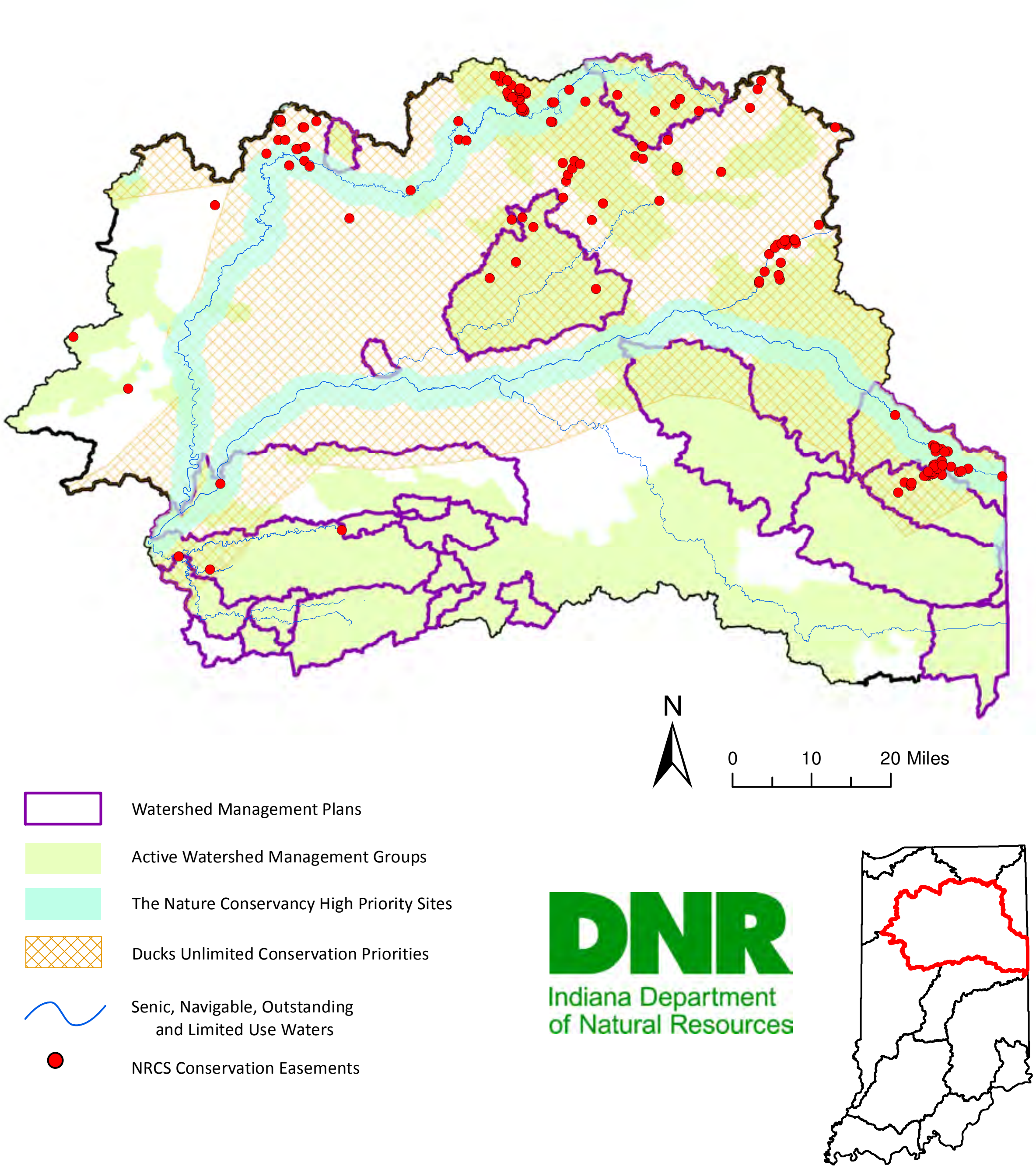


Figure 74. Priority aquatic resource conservation groups and sites within the Upper Wabash Service Area (IWPP, 2015)

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

APPENDIX B.6 MIDDLE WABASH SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Middle Wabash Service Area (SA) is located in western Indiana and is composed of all or part of the following six 8-digit HUC watersheds:

- 05120109 - Vermilion
- 05120108 - Middle Wabash-Little Vermilion
- 05120110 - Sugar
- 05120111 - Middle Wabash-Busseron
- 05120203 - Eel
- 05120113 - Lower Wabash (small portion)

The Middle Wabash SA includes all or portions of twenty Indiana counties listed below and is located primarily within both the Central Till Plain and Southern Hills and Lowlands physiographic regions.

Knox	Putnam	Clinton
Sullivan	Parke	Tipton
Greene	Hendricks	Tippecanoe
Owen	Vermilion	Warren
Clay	Boone	Benton
Vigo	Montgomery	White
Morgan	Fountain	

The Middle Wabash SA drains approximately 5,415 square miles of western Indiana and is located in a variety of ecoregions; the northernmost portion is located in Central Corn Belt Plains; the east-central portion is within the Eastern Corn Belt Plains and Interior Plateau; the south-central portion of the SA is in the Interior River Valleys and Hills. In the north, the land is characterized by dark, fertile soils; the land was once covered by prairie and oak-hickory forests but has been converted to agriculture. The southern area is composed of wide, flat-bottomed terraced valleys and dissected glacial till plains and contain loamy to sandy till deposits. The southern half of the Middle Wabash SA contains a large amount of Indiana's surface and underground mines, mainly in the Lower Wabash and Eel Watersheds. The remainder of the region in the east is primarily a level till-plain with broad bottomlands and is characterized by soils which developed from loamy, limy glacial deposits; the soils are productive for agricultural crops, and a majority of the land use is agricultural (U.S. EPA: Ecoregions of Indiana).

The Wabash River enters the Middle Wabash SA in Tippecanoe County after its confluence with the Tippecanoe River and Wildcat Creek. The Wabash River travels south through Warren and Fountain Counties where it flows along the Indiana/Illinois border beginning in Vigo County; primary tributaries of the Wabash River within this SA include Sugar Creek, the Vermilion and Little Vermilion Rivers, and Big Raccoon Creek.

Based on the 2011 NLCD (Homer, et al., 2015), the land cover type with the most area in the Middle Wabash SA is agricultural land use (69.14%), followed by forest and scrub/shrub (20.1%), developed and impervious land use (7.9%), and wetlands and open water (1.7%). Woody wetlands are the prominent wetland type and range from approximately 0.48% per the 2011 NLCD to 2.22% per the NWI. Emergent herbaceous wetlands range from 0.11% per the 2011 NLCD to 0.47% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Middle Wabash SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Middle Wabash SA from 2009 – 2015 was collected and analyzed **(Table 64)**. According to the data, 564.2 acres of impacted wetlands and 742,293 linear feet of impacted streams required mitigation in the seven year time period.

The energy production and mining work type accounted for the most stream impacts (96.2%), followed by transportation and service corridors (2.53%), development (1.12%), and agricultural land uses (0.19%). There were no documented dam related stream impacts requiring mitigation for this time period.

The energy production and mining work type accounted for the most wetland impacts (95.92%), followed by transportation (3.49%), development (0.31%), agricultural impacts (0.15%), and dam related impacts (0.14%).

Work Type	Authorized Stream Impacts - Linear Ft	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	1,410	0.19%	0.821	0.15%
Dam	0	0.00%	0.77	0.14%
Development	8,298	1.12%	1.745	0.31%
Energy Production	713,804	96.16%	541.13	95.92%
Transportation	18,781.7	2.53%	19.698	3.49%
Grand Total	**742,293.7**	**100.00%**	**564.2**	**100.00%**

Table 64. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville and Detroit Districts

Locations of the permitted stream and wetland impacts are provided in **Figure 75**.

Middle Wabash Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

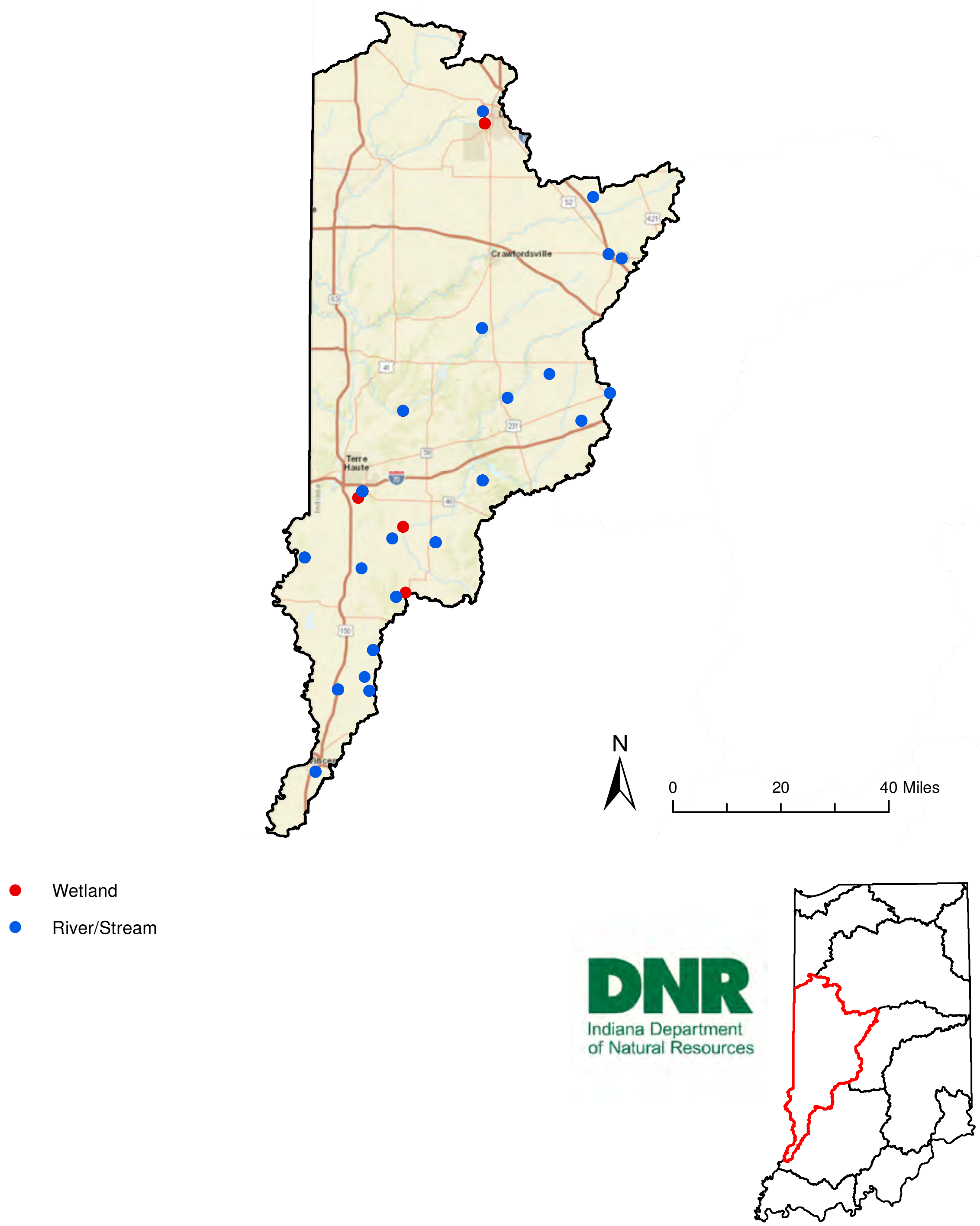


Figure 75. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Middle Wabash SA is presented in **Figure 76,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

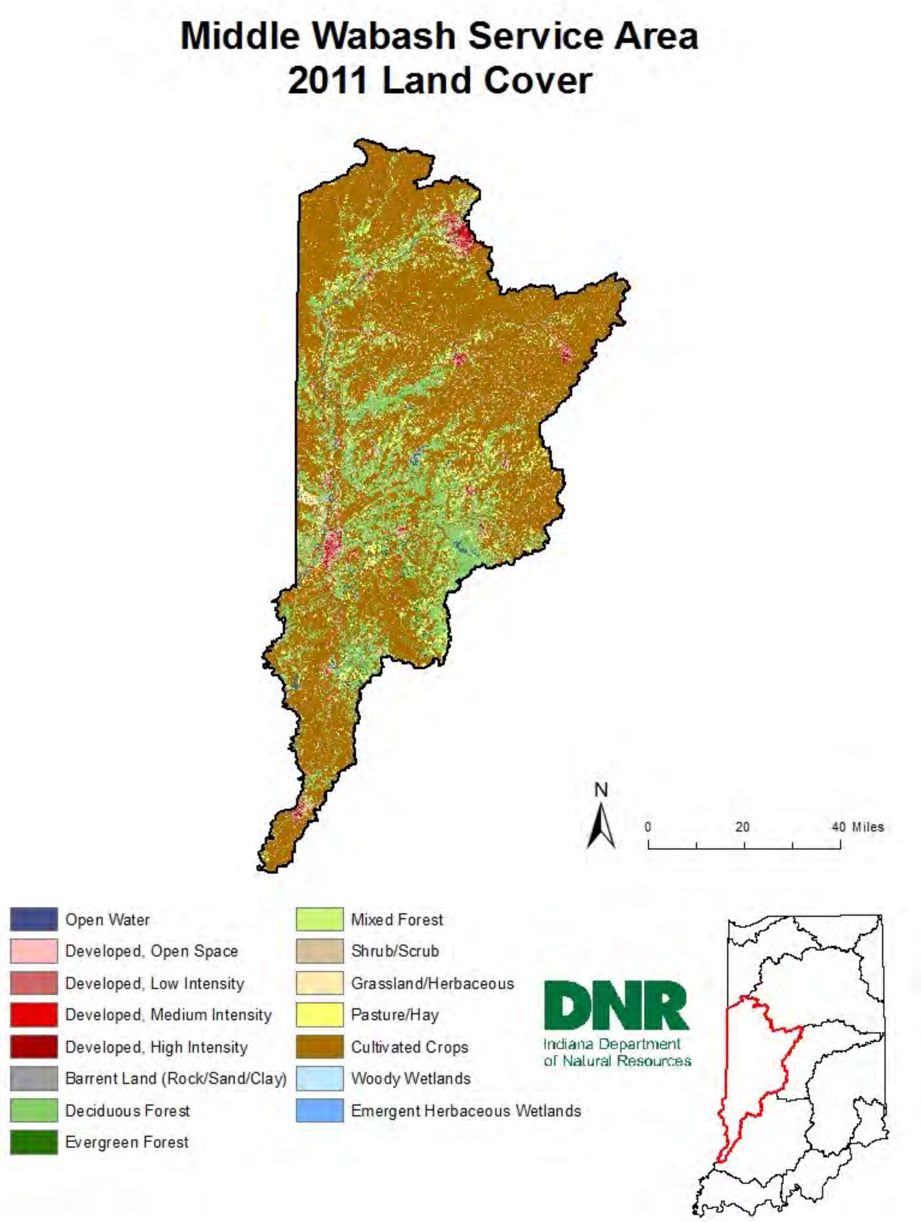


Figure 77. Land cover within the Middle Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 65)**.

Land Cover			
Class	Value	Sum of Acres	Percent of Total Acres
Open Water	*	38,022	1.10%
Developed	Open Space	182,656	5.27%
Developed	Low Intensity	65,138	1.88%
Developed	Medium Intensity	17,474	0.50%
Developed	High Intensity	7,979	0.23%
Barren Land (Rock/Sand Clay)	*	2,374	0.07%
Forest	Deciduous	683,931	19.74%
Forest	Evergreen	10,679	0.31%
Forest	Mixed	315	0.01%
Shrub/Scrub	*	1,047	0.03%
Grassland/Herbaceous	*	39,680	1.15%
Pasture/Hay (Agriculture)	*	190,113	5.49%
Cultivated Crops (Agriculture)	*	2,205,652	63.65%
Wetlands	Woody	16,518	0.48%
Wetlands	Emergent Herbaceous	3,667	0.11%
Grand Total		**3,465,243**	**100.00%**

Table 65. Middle Wabash SA land cover/classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 77** below to demonstrate the current overall land cover distribution of the SA.

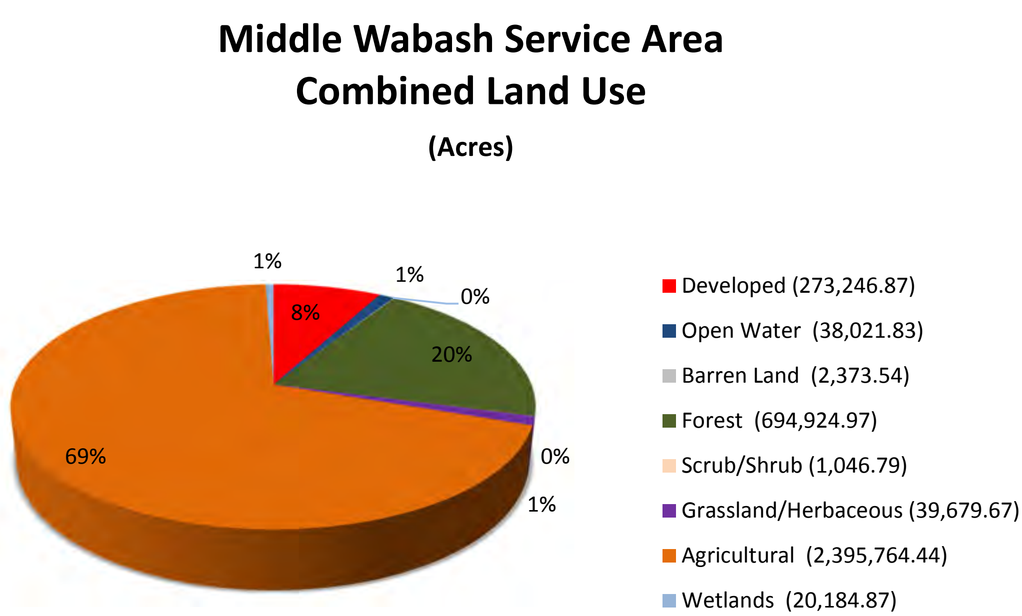


Figure 77. Combined land uses within the Middle Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Middle Wabash SA. Total agricultural land use covers approximately 69% of the SAs total land area of 2,395,764 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of a few pockets of developed areas, such as Terre Haute and West Lafayette.

Within the identified land use areas, cultivated crops cover over 2,205,651 acres (63.65%) and pasture/hay lands cover 190,113 acres (5.49%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Middle Wabash SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. Since the Middle Wabash SA is the second largest SA with a total area of approximately 3,465,243 acres and contains pork, dairy, and beef cattle CFOs, which require a minimum of 5,000 animal units (Thompson, 2008). When combining these major agricultural land use activities, the Middle Wabash SA ranks second in percentage of total statewide land use (10.35%), and it's a significant land use throughout the SA.

2.4 Growth and Development

Developed impervious area is the third largest land use after agricultural and forested cover, covering approximately 273,247 (7.89%) of the 3,465,243 total acres, tied for third least developed area density across all SAs. In general, the two largest developed areas are the communities of Lafayette-West Lafayette and Terre Haute, both along the Wabash River, as well as I-65 and I-70 respectively. Other footprints of high intensity development include communities such as Lebanon, Crawfordsville, Greencastle, Brazil, Sullivan and Vincennes.

The SA contains portions of the Lafayette-West Lafayette, Indianapolis-Carmel-Anderson, Terre Haute and Bloomington MSAs, all of which experienced growth in the previous decade (Manns, 2013). Approximately 98% (931,934 acres) of the Terre Haute MSA is within the Middle Wabash SA which includes all of Vermillion, Vigo and Clay counties, and 94% of Sullivan County, accounting for approximately 27% of total SA acres. The core of the Terre Haute MSA is within Vigo County which accounts for approximately 28% of this MSA, and approximately 8% of total SA acres.

Approximately 24% (670,406 acres) of the Indianapolis-Carmel-Anderson MSA is within the Middle Wabash SA which includes portions of Boone, Hendricks, and Morgan Counties, and the entirety of Putnam County, accounting for approximately 19% of total SA acres. Approximately 46% (381,248 acres) of the Lafayette-West Lafayette MSA is within the Middle Wabash SA which includes portions of Benton and Tippecanoe Counties, and accounts for approximately 11% of total SA acres. The core of the Lafayette-West Lafayette MSA is within Tippecanoe County which accounts for approximately 62%

of this MSA with approximately 74% (238,220 acres) of Tippecanoe County's 321,920 acres within the Middle Wabash SA, accounting for approximately 7% of total SA acres. Approximately 19% (98,404 acres) of the Bloomington MSA is within the Middle Wabash SA which includes only a portion of Owen County, and accounts for approximately 3% of total SA acres. Analysis of the INDOT cities towns GIS data shows the Middle Wabash SA contains all or part of 351 cities and/or towns, 86 of which are incorporated (INDOT, 2016).

Four Indiana regional councils that overlap with the SA include the West Central Indiana Economic Development District (44%), Kankakee-Iroquois Regional Planning Commission (12%), Southern Indiana Development Commission (5%), and the North Central Indiana Regional Planning Commission (2%) (IARC, 2017).

According to the West Central Indiana Economic Development District's 2012 CEDS, this region is served by two interstate highways, I-70 and I-74, in addition to many other major U.S. and state highway routes which allow for a substantial amount of commuters from outside this area. This excellent network of transportation facilities provides business and industry ready access to global and domestic suppliers and markets that include Indianapolis, Chicago, St. Louis and Columbus. The top four business sectors for this region are government, manufacturing, retail/wholesale trade, and health care and social services (WCIEDD, 2012).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 12,054 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Middle Wabash SA ranks ninth among SA's in local road miles to square mile ratio at approximately 2.23 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Middle Wabash SA contains approximately 1,324 miles of U.S. Interstates and highways, 2,936 miles of state highways, and 12,054 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the second largest SA, the concentration of the various road types per square mile of land has varying distribution within the SA.

U.S. Interstates and highways have a concentration of approximately 0.24 mile per square mile, which ranks last among the eleven SAs making this the lowest ranking road type within the state and SA. Although the concentration of U.S. Interstates and highways has the lowest ranking, the concentration of state roads ranks fifth with 0.54 mile per square mile and is the highest ranking road type within the Middle Wabash SA. Similar to the U.S. roadways, the ranking of the concentration of local roads falls near the bottom. The concentration of local roads is approximately 2.23 miles per square mile, which ranks ninth when compared to local roads rankings for the ten other SA. Similarly, the combined ranking of the concentration for all roadways ranks near the bottom with a concentration of 3.01 miles per square mile ranking tenth overall. The construction and maintenance of roads and bridges throughout the Middle Wabash SA will play an integral role in sustaining business and commerce within the region.

2.5.2 Railroads

As an alternative mode of transportation, the Middle Wabash SA has approximately 1,244 miles of railroad within the SA boundary (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Middle Wabash SA contains the fifth largest concentration of railroads with a density of 0.23 mile per square mile. The concentration of linear infrastructure throughout the SA contributes to aquatic resource threats that include habitat fragmentation, disruption to fluvial processes, resource degradation, conversion and loss of aquatic resources.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Middle Wabash SA contains service corridors, which also result in aquatic resource impacts and habitat loss associated with these types of linear infrastructure. The SA contains over 3,911 miles of service corridors within its boundary.

The Middle Wabash SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately fifty-one (12 kV) lines, 154 (34.5 kV) lines, 276 (69 kV) lines, 153 (138 kV) lines, forty-one (230 kV) lines, seventy-two (345 kV) lines, and three (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 2,005 miles throughout the SA, which is tied with the St. Joseph River SA for the seventh highest concentration of electric transmission lines relative to the SA size with 0.37 mile of transmission line per square mile.

In addition to electric transmission lines, the Middle Wabash SA contains over 1,906 miles of pipelines in total. It contains over 226 miles of pipelines that convey crude oil, 1,136 miles of pipelines that transport natural gas, and 544 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Middle Wabash SA contains the second greatest concentration of crude oil pipelines, the third greatest concentration of natural gas lines, and the greatest concentration of refined petroleum product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 11 known low head dams (IDNR DOW, 2016) within the SA, the fourth least among all SAs and second to last in concentration at one low head dam per 492 square miles. There are currently 141 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 38 square miles, the third highest concentration among all SAs with 16% of documented high head dams statewide.

Per the NLE GIS (IDNR, 2016) analysis, there are approximately 1,589,280 linear feet (301 miles) of NLE's mapped within the SA, averaging one mile of NLE per 18 square miles which is tied for the third highest concentration among all SAs. Warren County was not included in the NLE identification project since it was not a declared disaster resulting from the 2008 severe weather events. Approximately 198 miles of the currently identified NLE's are located within predominantly developed areas, with the remaining 103 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Coal

The Middle Wabash SA contains historic and active coal mining operations within its boundary. Based upon IDNR-Division of Reclamation (DOR) surface and underground coal mining dataset, coal mining operations were first documented in 1835 and have effected over 229,685 acres (Gray, Ault, Keller, & Harper, Surface Coal Mines in Indiana, 2010); (Gray, Ault, Keller, & Harper, Underground Coal Mines in Indiana, 2010). However, further analysis of surface and underground mining data operation footprints and permitting history provides insight into coal mining lineage within the SA.

Mining operations, prior to the issuance of the SMRCA of 1977, were not required to implement post mining reclamation. The Middle Wabash SA contained approximately 755 surface coal mines, which totaled approximately 55,015 acres and 1,129 underground coal mines, which totaled 127,726 acres of Pre-SMCRA coal mining operations. These Pre-SMCRA surface mining operations impacted 1.59% of the SA land cover, which ranks last of the three coal bearing SAs. In contrast, Pre-SMRCA underground mining operations impacted 3.69% of the SA land cover, which ranks first, earning the highest concentration.

Permitted surface and underground mining operations that are regulated by SMRCA of 1977 are prevalent throughout the SA. The IDNR-DOR have recorded over 188 surface coal mining operations which total approximately 31,530 acres and over 39 underground mining operations; that total approximately 15,414 acres throughout the Middle Wabash SA. These surface mining operations impact over 0.91% of the SA land cover, which ranks last among the SAs. Similarly, the concentration of underground mining operations ranks last with 0.44% of SA land cover among the coal-producing SAs.

The Middle Wabash SA is the largest SA that contains coal, with approximately 3,465,243 acres, and it has experienced extensive mining impacts. Surface mining has resulted in cumulative impacts to approximately 86,545 acres, altering over 2.5% of the SAs land cover. Similarly, cumulative underground mining impacts have altered over 69,861 acres of the Middle Wabash SA, which ranks last with a concentration of 2.39% of the SA land cover.

2.7.2 Natural Gas and Oil Production

The Middle Wabash SA contains a multitude of active oil and gas fields, along with associated wells that are currently supporting, or have supported, the petroleum industry within the SA. The Indiana Geological Survey (IGS) identifies 42 petroleum gas fields with 272 associated gas wells; 36 oil fields with 371 oil wells; and 18 oil & gas fields with two oil & gas wells ranking the Middle Wabash SA third statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The Middle Wabash SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 184 abandoned gas wells, 1,135 abandoned oil wells, six abandoned oil & gas wells, 3,878 dry wells, 33 observation wells, 753 stratigraphic wells, 43 saltwater disposal wells, 54 abandon saltwater disposal wells, 108 temporarily abandoned wells, 10 potable water supply wells, 10 non-potable water supply wells, 29 water injection wells, 72 gas storage, 32 abandoned gas storage, 15 abandoned observation wells, two abandoned waste disposal wells, 66 abandoned water injection, 35 abandoned oil and water injection, one waste disposal well, within the SA (Indiana Geological Survey, 2015).

2.7.3 Mineral Mining and Aggregates

The Middle Wabash SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, this SA contains 20 sand & gravel mining operations, 10 clay and shale mining operations, seven crushed stone operations, and one dimensional sandstone quarry operation (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one slag operation and cement operation, which are industry byproducts commodities that are used as aggregate (Indiana Geological Survey, 2016). In addition to the Middle Wabash SA ranking second based on its size mineral mining within in this SA ranks it second in the state among all of the SAs with 40 active operations.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Middle Wabash SA contains part of the Indiana SWAP Corn Belt (58.5%), Valleys and Hills (36.5%), and Interior Plateau (5%) Planning Regions. The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the agricultural and developed impervious footprints make up approximately 77% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects energy production and mining, specifically surface coal mines, to remain the foremost permitted activity requiring mitigation followed by transportation and service corridors, and development projects if the 404 permitting trends of the past 7 years continue.

The SA is rich in agricultural and timber resources. The agricultural sector continues to be an important part of the regional economy and has an abundance of natural resources which are important to the national energy supply including large amounts of recoverable coal, natural gas, water supplies and reserves of crude oil (WCIEDD, 2012). Abandoned mines will continue to negatively impact the chemical, physical and biological integrity of aquatic resources. Among the numerous threats to aquatic resource functions and services in these environments, invasive species will continue to thrive unless restoration and enhancement efforts are increased and long term management implemented.

The reserves of industrial minerals such as sand, gravel and clay, while not used to the extent they once were, are still an important factor in the local economy. For instance, after virtually disappearing, the manufacturing of clay brick has made a strong comeback in the past several years with manufacturing facilities being built and operated in Clay, Sullivan, and Vermillion Counties (WCIEDD, 2012).

Inadequate sanitary sewage treatment remains a major obstacle for several counties in the SA. Storm water management has become an important issue over the last 10 years due to the increases in flooding of these communities and the adverse effect storm water can have on existing wastewater systems (WCIEDD, 2012).

The major economic development and growth goals for this region include improvement and expansion to infrastructure such as waste and storm water systems, industrial and business sites, all transportation systems, telecommunications, and housing (WCIEDD, 2012).

It is anticipated that the State Road 641 Terre Haute Bypass will attract new development as the roadway provides access to currently undeveloped land in addition to improved access to and between existing commercial and industrial parks within Vigo County as has been seen with other new road construction/improvement projects across the state.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Middle Wabash SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Middle Wabash SA's historic aquatic resources were comprised of a diverse mix of natural aquatic communities associated with large river systems and bottomlands due to the Wabash River that extends through the northern portion of the SA, before flowing to the southwest along its western boundary. The southern reaches of the Wabash River grew some of the most impressive presettlement forest stands in the Eastern Deciduous Forest Biome (Jackson, 2006); (Petty & Jackson, 1966). Although the SA contained these natural communities and resources, the increase in the number of settlers to the area and their need for resources led to permanent alteration of the landscape.

The Wabash River played an import role in establishing settlements throughout the State and the oldest settlement within the state was located within this SA. Upon settlement, they transformed the region to support their way of life. In 1708, French settlers began clearing the land for orchards, gardens, to construct cabins and churches and eventually established Vincennes which became the territorial capital (The History Museum, 2017). This began the performance of land alterations for timber and agricultural land uses.

The landscape was comprised of impressive stands of hardwood and bottomland forests. The stands of hardwood trees throughout the Lower Wabash Valley were likely the most magnificent that occurred anywhere throughout the Eastern Deciduous Forest Biome (Jackson, 2006). Based on records collected by Robert Ridgeway, who was an early naturalist from the region, he found that virgin forests in the region averaged a canopy height that was 130 feet with some of the tallest tulip and sycamore trees approaching 200 feet (Ridgeway, 1872); (Jackson, 2006). In addition, the southern extent of the SA contained cypress swamps which encompassed the largest northern representation of the species with in the state and North America. Little Cypress Swamp in Knox County contained a bald cypress tree that was recorded at 81.5 inches in diameter and was speculated to be the largest living tree in Indiana at the time (Lindsey, Petty, Sterling, & VanAsdall, 1961); (Jackson, 2006). These impressive stands of forests were cut for timber and converted to agricultural land.

As the region's landscape was converted by settlers, they altered the region's aquatic resources as well as they sought to utilize the forest's resources for economic benefits. The northern region of the SA experienced similar impacts to aquatic resources that were felt throughout the state. Waterways were dammed to power mills to supply grain and lumber. In the 1850's the Pine Hill area had a saw mill added to the Deer and Canine grist mill to facilitate timber cutting within the region (Indiana Department of Natural Resources, 2014). In 1868, Clifty Creek was dammed by the Pine Hill Woolen Mill Company, diverting water to a wooden flume to power the mill by a water wheel (Indiana Department of Natural Resources, 2014). Many of the regions streams, rivers and adjacent wetlands were altered by early settlers for these uses.

Transportation played a major role in transforming the landscape throughout the SA. The Wabash and Erie Canal extended through the SA, following the Wabash River to Terre Haute, then south making its way to Evansville (The History Museum, 2017). The impacts associated with the construction of the Wabash and Erie Canal permanently altered the region's aquatic resources. In addition to alteration of waterways, stream flows, and conversion of wetlands for canal construction, reservoirs were constructed to supplement canal water levels. A critical highpoint in the canal system south of Terre Haute resulted in the construction of the Birch Creek Reservoir that covered 1,000 acres and the Splunge Creek Reservoir that covered 4,000 acres (Canal Society of Indiana, 2006). The construction of these impoundments altered and converted all waterways and natural communities within the 5,000 acre foot print.

Early roads that extended through the SA provided an important transportation network connection to important settlements. One of Indiana's first roads, a former bison trail, connected Vincennes to New Albany and was called the Buffalo Trace (The History Museum, 2017). Roads provided insight into the settlers' land use throughout the region due to the majority of commodities being sold and shipped along these transportation networks. The Buffalo Trace was used during the mid-1700s by early American settlers to facilitate commerce, move livestock between Louisville and Vincennes, and settle the Northwest Territory (Snell, Jackson, & Krieger, 2013). In addition to the Buffalo Trace, the Middle Wabash SA was influenced by another major roadway, the National Road, which reached Indiana by 1829 and extended from Terre Haute to Richmond eventually providing a link from St. Louis to Maryland (The History Museum, 2017).

In addition to canals and roadways, the SA was impacted by the introduction and use of railroads. Similar to other regions of the state, railroads were constructed as a means to travel and transport commodities. In 1897, the Evansville & Terre Haute Railroad constructed railroad tracks in order to transport logs and lumber from the mills and forests of the region (Wright, 1897). The majority of the area's forests were lost and aquatic resources destroyed. The Bison Trail connected Vincennes to other trade routes that sustained settlers within the region. In the 1850s the railroad, constructed north of and parallel to the Buffalo Trace, connected Vincennes regionally from east to west by providing a regional link to St. Louis and Cincinnati (Indiana's Historic Pathways, 2010).

The Middle Wabash SA is one of the three SAs in the southwest portion of the state that contains coal. Both surface and underground coal mining has a deep rooted history within the SA. The first discovery of coal in Indiana was in 1736 along the Wabash River and reports in land surveys and maps have been documented in 1804 (Stevens, 2012). Years of mining impacts have degraded, converted, fragmented and eliminated aquatic resources throughout the region. Historically, the majority of mined land in the western region of the Middle Wabash SA was abandoned without any restoration efforts; acid mine drainage degraded many aquatic systems due to low pH to the point where waterbodies were devoid of local flora and fauna. Historical impacts from coal mining activities in the area included seeping, acidic water and heavy metals contamination (IDNR Division of Reclamation, 2010).

During the early 1900s, the Wabash River within the Middle Wabash SA was characterized as being brown and opaque with suspended sediments from Attica to Vermillion County. Reports from the mid-1990s identified sewage, mill and cannery waste, coal mine drainage, and dairy production wastes as sources of water quality impairments within the middle Wabash River, and increased flooding caused by an inadequate number of runoff channels and man-made landscape alterations; the Wabash River and its tributaries were polluted as a result of flood events. Up until the mid-1980s, the Wabash River continued to be degraded due to agricultural development and urbanization. Since this time, major improvements to water quality have been made, such as point source pollution reductions; however, high nutrient concentrations and PCB and mercury levels in fish tissue continue to exist within areas of the river and its tributaries (Wabash River Enhancement Corporation, 2011).

Due to extensive and prolonged aquatic resource loss within the Middle Wabash SA, the understanding of the region's aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 78**, depicts each Natural Region and Section, located within the Middle Wabash SA, and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 66)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

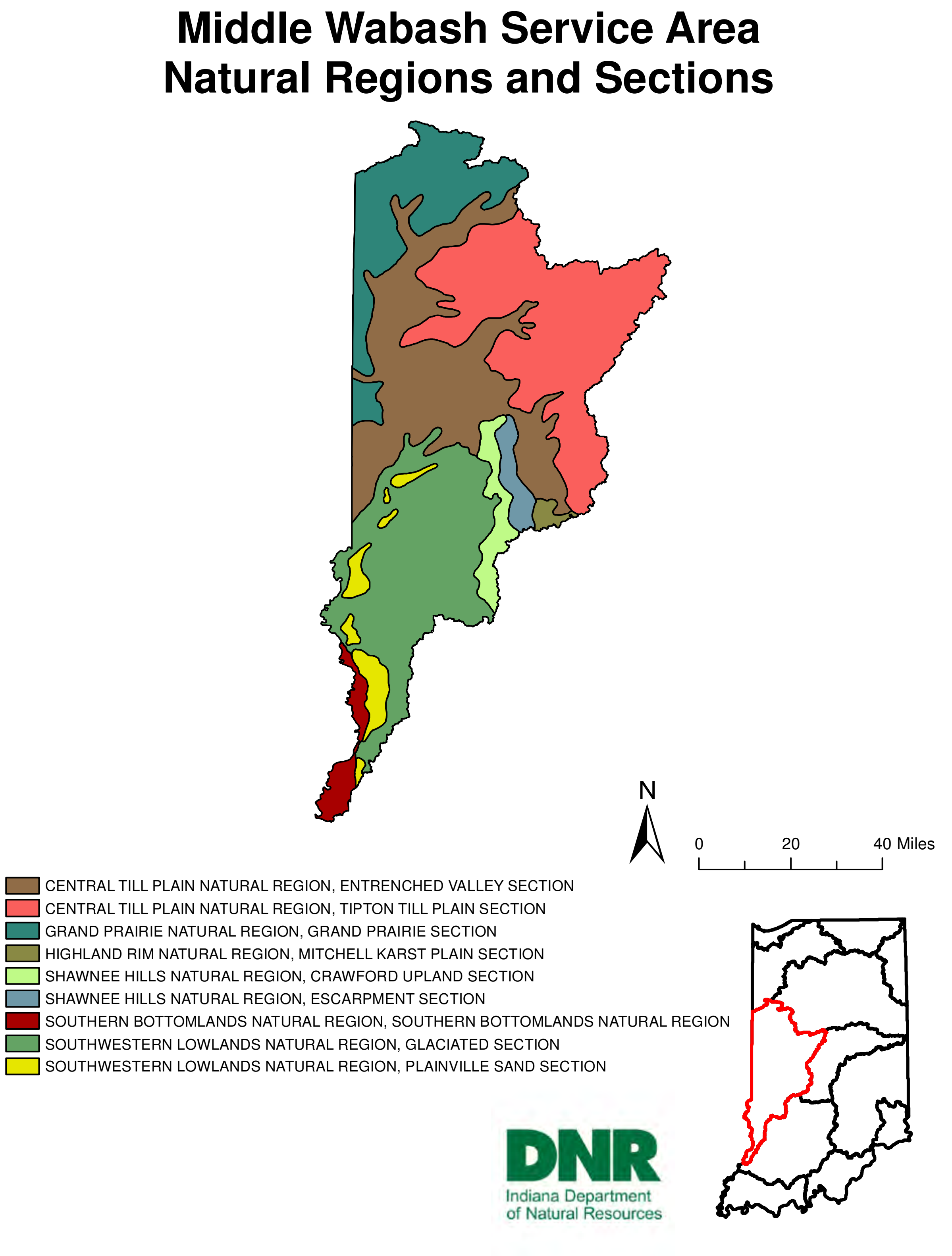


Figure 78. Natural regions and sections within the Middle Wabash Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Central Till Plain	Tipton Till Plain	27.15	Extensive beech-maple-oak forest, northern flatwoods; bog, prairie, marsh, seep spring, and pond	560,783	16.18	425,612	12.28	79.86
	Entrenched Valley	24.81	Predominantly upland forests, bottomland forests, and flatwoods; prairie, gravel-hill prairie, fen, marsh, savanna, cliff, seep spring, and pond; Typical streams medium-gradient, relatively clear, and rocky					
Southwestern Lowlands	Plainville Sand	3.16	Barrens (rare); swamp, marsh, and wet prairie					
	Glaciated	23.04	Predominantly forest types (flatwoods community); prairie, swamp, marsh, pond, and low-gradient streams					
Grand Prairie	Grand Prairie	13.84	Dry prairie, wet prairie, savanna, marsh, pond, bog (rare), and forest (riparian and oak groves); Typical streams low-gradient and silty					
Shawnee Hills	Escarpment	1.02	Various upland forest types (dry-mesic and mesic); aquatic features include normally clear, medium and high-gradient streams, springs, and sinkhole ponds					
	Crawford Upland	3.03	Upland forest types, few sandstone and limestone glades, gravel washes, and barrens; acid seep spring community (rare)					
Highland Rim	Mitchell Karst Plain	0.67	Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)					
Southern Bottomlands	Southern Bottomlands	2.36	Bottomland forest, swamp, pond, slough, and formerly marsh and prairie					

Table 66. The historic natural community composition for the Middle Wabash Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 983 miles of category 4A impaired streams and 2,312 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,126 miles), impaired biotic communities (501 miles), PCBs in fish tissue (484 miles), nutrients (75 miles), dissolved oxygen (65 miles), and pH (43 miles) as current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted QHEI assessments of 445 stream reaches within the SA **(Table 67 and Figure 79)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 36.85% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	116	26.07
51-64	Habitat is partially supportive of a stream's aquatic life design	165	37.08
>64	Habitat is capable of supporting a balanced warm water community	164	36.85
	Total	**445**	**100%**

Table 67. IDEM Overall QHEI scores for Middle Wabash SA, 1991 – 2014 (IDEM OWQ, 2014).

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Middle Wabash SA ranks fifth overall in forested cover density of all SA's at 20% of total area with approximately 694,925 acres and is the SA with the fourth highest percentage of forested cover of any SA at approximately 13.3% of 5,215,169 acres of forest cover statewide.

GIS analysis identifies approximately 12,258,927 linear feet (2,322 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Middle Wabash SA has the third highest ratio of these potentially restorable stream miles to square miles of SA at approximately 0.43 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.33 square miles of SA.

Middle Wabash Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

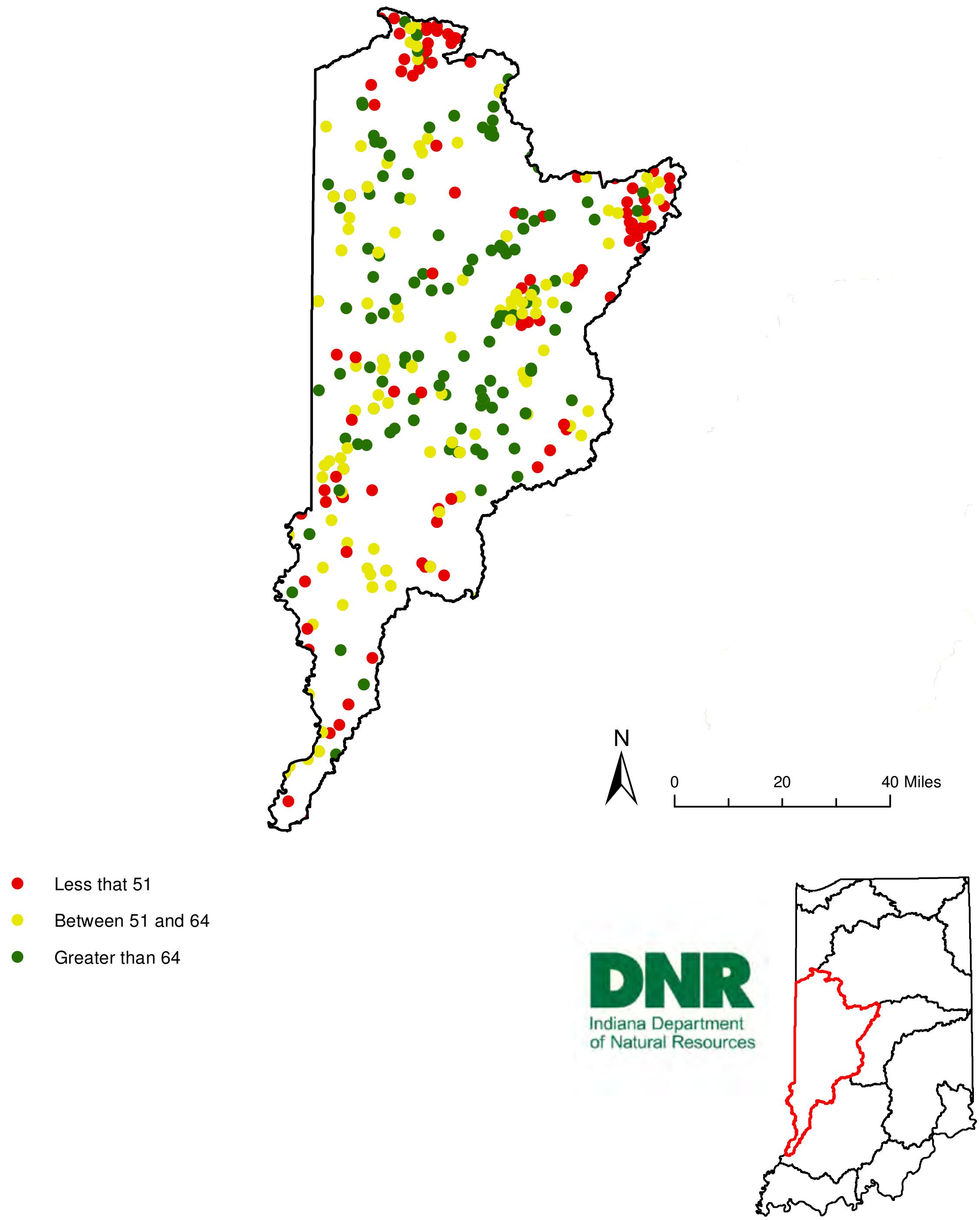


Figure 79. IDEM overall QHEI scores within the Calumet-Dunes service area; 1991-2014 (IDEM OWQ, 2014).

4.2 Wetlands

Analysis of the NWI (USFWS NWI, 2015) in the Upper Wabash SA shows that there are approximately 16,400 acres of freshwater emergent wetland (PEM) and approximately 76,891 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.7% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5% of the total SA **(Table 68 and Figure 80)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	16,400	9.47%	0.47%	0.07%
Freshwater Forested/Shrub Wetland	76,891	44.38%	2.22%	0.33%
Freshwater Pond	21,114	12.19%	0.61%	0.09%
Lake	15,560	8.98%	0.45%	0.07%
Riverine	43,280	24.98%	1.25%	0.19%
Grand Total	**173,247**	**100.00%**	**5.00%**	**0.75%**

Table 68. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015).

Wetlands are most prominent along the Wabash River and its tributaries; wetland densities are most scarce in the Central Corn Belt Plains and Eastern Corn Belt Plains ecoregions in counties such as Montgomery, Putnam, and Warren (IDNR, 1996).

Hydric and partially hydric soils account for 868,962 acres (**Figure 81**), or 25.1% land cover within the SA, out of which approximately 791,286 acres have the potential to be restored accounting for 22.8% of the total SA. This was determined by mapping current hydric and partially hydric soils data (NRCS-USDA, 2016) with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Middle Wabash SA has the 6th highest percentage of recoverable wetland acres to total SA size of all SAs, and the third highest total of potentially restorable wetland acres of any SA. This is partially due to SA size, but also reflective of the dominance of agricultural land use.

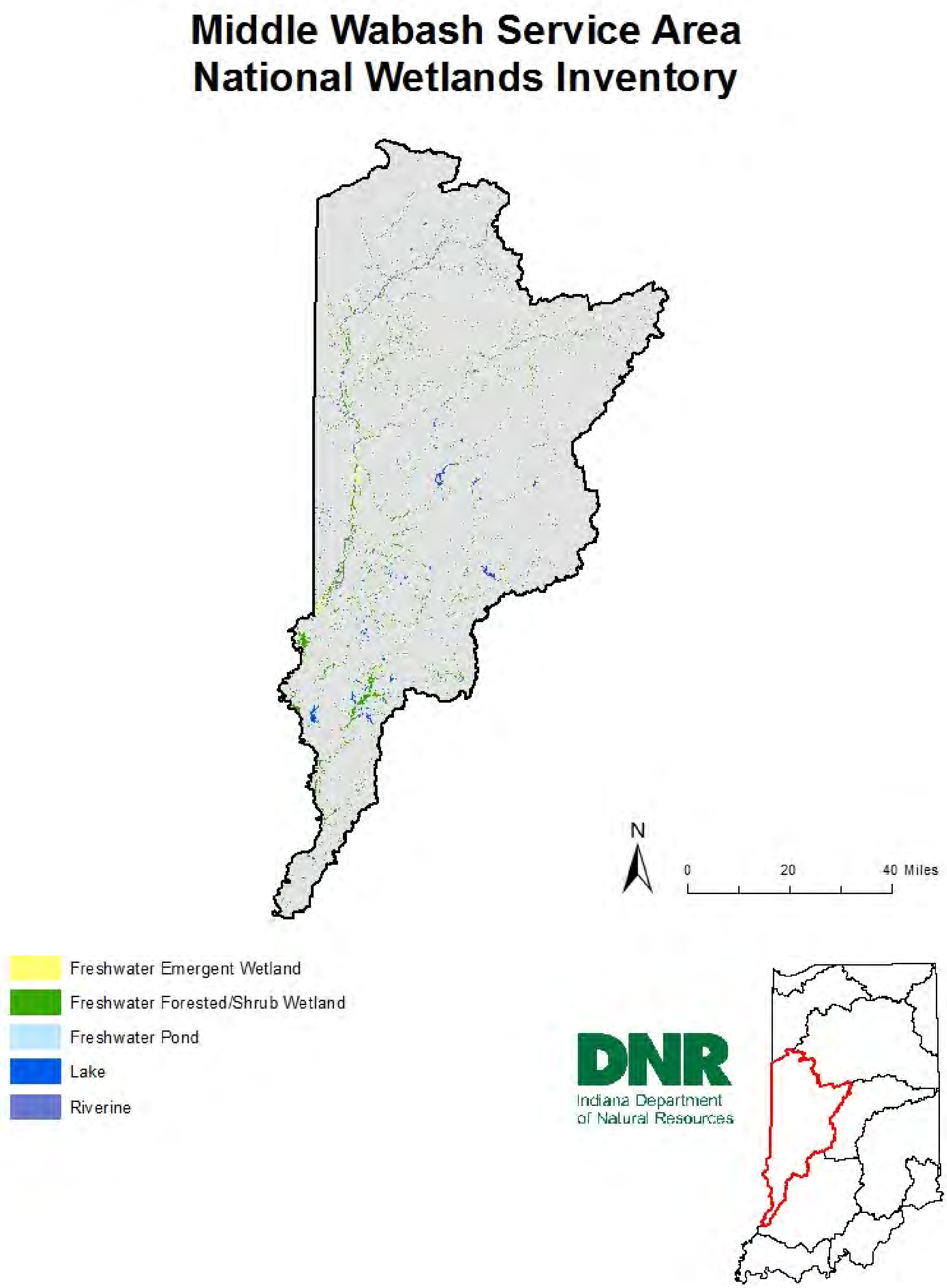


Figure 80. NWI for the Middle Wabash Service Area (USFWS NWI, 2015).

Middle Wabash Service Area
Hydric Soils

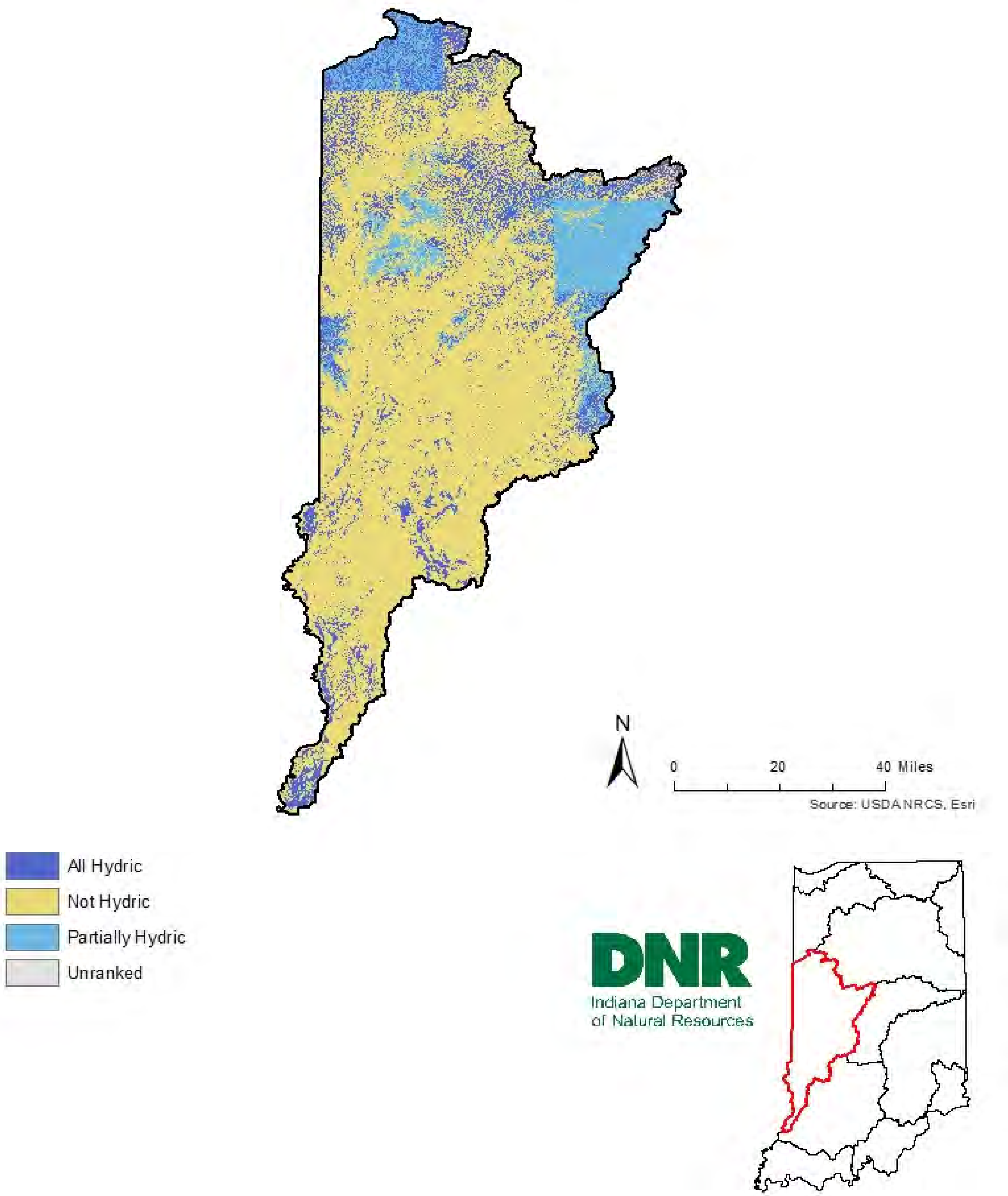


Figure 81. Hydric and partially hydric soils within the Middle Wabash Service Area (NRCS-USDA, 2016).

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 522,766 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Big Pine Creek (HUC 0512010804 **[Table 69]**).

Hotspots account for 4,366,560 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Mill Creek (HUC 0512020305 **[Table 70]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 69 & 70)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 82** shows where these watersheds are located within the SA.

Approximately 1,033 acres of these hotspots of potentially restorable wetlands are on IDNR-owned lands within the Middle Wabash SA. Approximately 62,565 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands within the Middle Wabash SA. Pine Creek Bottoms Gamebird Habitat Area is the IDNR-managed land in the Middle Wabash SA with the most adjacent acres of hotspots of potentially restorable wetlands (42,054 acres). Approximately 13,921 linear feet of hotspots of potentially restorable streams are adjacent to IDNR-managed lands. McClellen Gamebird Habitat Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable streams (4,376 linear feet).

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Wetlands (acres)
0512010804	Big Pine Creek	85,687
0512011001	Browns Wonder Creek-Sugar Creek	63,715
0512011004	Prairie Creek-Sugar Creek	48,015
0512020301	East Fork Big Walnut Creek	41,872
0512010803	Mud Pine Creek	37,146

Table 69. Watersheds in the Middle Wabash Service Area with the most hotspots of potentially restorable wetlands.

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Streams (linear feet)
0512020305	Mill Creek	413,424
0512010804	Big Pine Creek	366,432
0512010812	Cecil M. Harden Lake-Big Raccoon Creek	257,136
0512010803	Mud Pine Creek	230,736
0512011006	Big Shawnee Creek-Wabash River	194,832

Table 70. Watersheds in the Middle Wabash Service Area with the most hotspots of potentially restorable streams

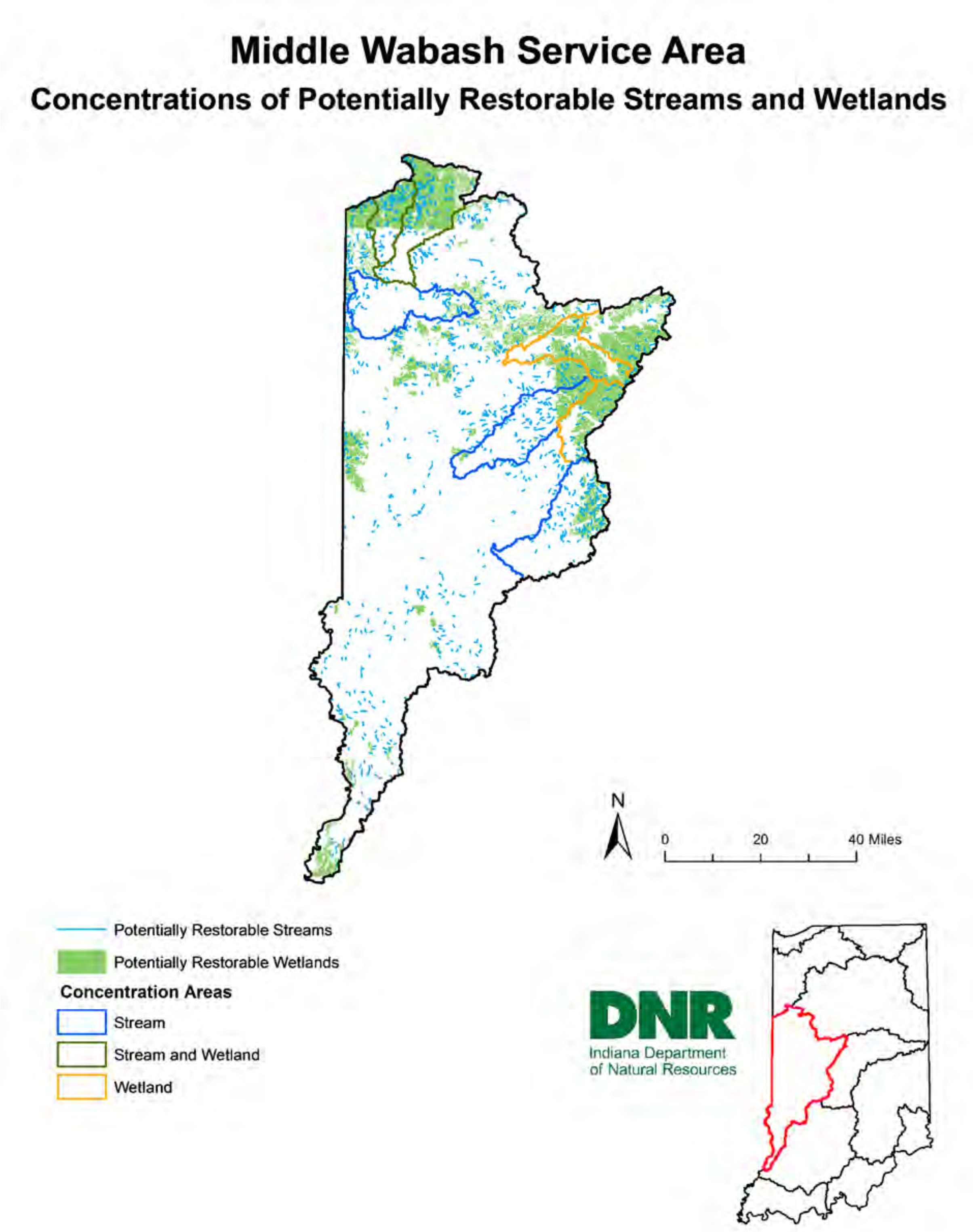


Figure 82. Concentrations of Potentially Restorable Streams and Wetlands in the Middle Wabash Service Area.

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments in the Middle Wabash SA indicates there are two lakes currently documented having category 5 impairments for PCBs in fish tissue, which measured using the National Hydrography Dataset (NHD), accounts for approximately 3,500 acres (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 38,022 acres of open water which accounts for 1.1% of the SA. This varies slightly from the NWI, which identifies approximately 21,114 acres of freshwater ponds comprising of 0.6% of the SA, and 15,560 acres of lakes comprising of 0.5% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Middle Wabash SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Middle Wabash SA shows that approximately 94% of the shallow unconsolidated aquifers receive between three to seven inches of ground water recharge annually **(Table 71).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.02	0.0003%
	13	0.03	0.001%
	12	0.01	0.0002%
	11	0.36	0.01%
	10	2	0.04%
	9	18	0.34%
	8	77	1.42%
	7	209	3.87%
	6	565	10.44%
	5	1,462	27.04%
	4	1,862	34.43%
Low	3	983	18.17%
	2	193	3.56%
	1	38	0.69%

Table 71. Approximate ground water recharge rates in the Middle Wabash Service Area (Letsinger S. L., 2015).

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that nearly 100% of the Middle Wabash SA near surface aquifers are in the high to low range for sensitivity to contamination, with approximately 53% being moderate **(Table 72)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	4	0.08%
High	785	15%
Moderate	2,860	53%
Low	1,754	32%
Very Low	6	0.10%

Table 72. Ground water sensitivity distribution in the Middle Wabash Service Area (Letsinger S. , 2015).

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data (IDNR DOW, 2016) shows the Middle Wabash SA is third among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 491,259 MGD **(Figure 82)**. Energy production accounts for approximately 99.7% of registered withdrawal capacity with industrial and agricultural irrigation accounting for the remainder.

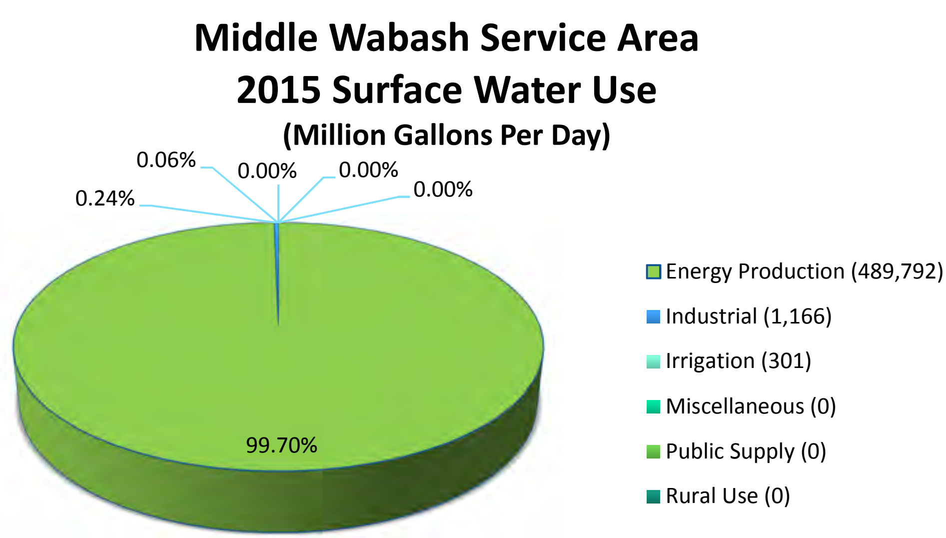


Figure 82. 2015 surface water usage in the Middle Wabash Service Area (IDNR DOW, 2016).

Significant ground water withdrawal in the Middle Wabash SA is the second most of any SA with a 34,897 MGD registered capacity **(Figure 83).** Public water supply accounts for approximately 55% of registered ground water withdrawal capacity in the SA, followed by industrial uses with 22%, agricultural irrigation with 16%, and energy production with 7%.

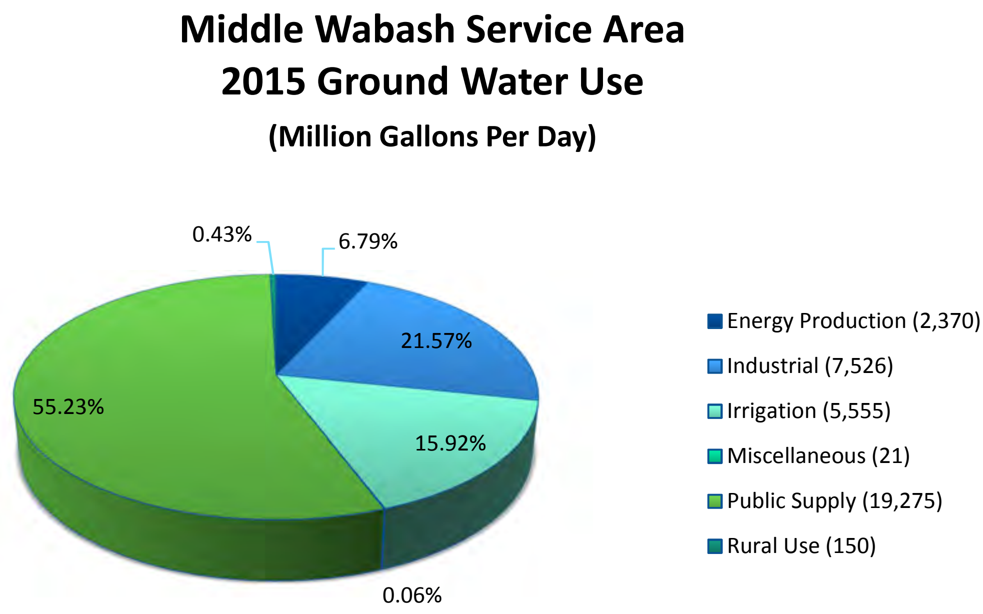


Figure 83. 2015 ground water usage in the Middle Wabash Service Area (IDNR DOW, 2016).

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, high quality natural communities currently documented in the Natural Heritage Database within the Middle Wabash SA include, but are not limited to, acid seep, circumneutral seep, fen, forested swamp, marsh, shrub swamp, and wet floodplain forest, in addition to many other mixed, transitional and upland communities.

There are currently a minimum of seven amphibian species, 47 bird species, 10 fish species, 17 mammal species, 15 mollusk species, and 11 reptile species listed as SGCN within the Corn Belt, Valleys and Hills, and Interior Plateau SWAP Planning Regions within the Middle Wabash SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Middle Wabash SA. The following aquatic resource goals and objectives apply specifically to the Middle Wabash SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources that will help offset current and anticipated threats within the SA.

2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships) including the Healthy Rivers Initiative.
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt, Interior River Valleys and Hills, and Interior Plateau Planning Regions where feasible.
7. Support efforts to offset aquatic resource degradation associated with historic mining activities throughout the service area.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Middle Wabash SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to help offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Middle Wabash SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in coincidence with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Ouabache Land Conservancy, Indiana Karst Conservancy, Four Rivers RC&D, NICHES Land Trust, Sycamore Land Trust, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program.

Currently, the following watershed plans exist within the SA: Big Walnut-Deer Creeks WMP, Busseron Creek WMP, Lake Manitou WMP, Lake Maxinkuckee WMP, Little Sugar Creek WMP, Little Vermillion River WMP, Little Wildcat Creek WMP, Lower Eel River WMP, Region of the Great Bend of the Wabash River WMP, South Fork Wildcat WMP, Lauramie Creek WMP, Spring Creek-Lick Run WMP, and Turtle Creek WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

Additional stakeholders' interest and potential conservation partnerships specific to the Middle Wabash SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Illinois Water Science Center
- Eastern Tallgrass Prairie and Big Rivers, and Appalachian Landscape Conservation Cooperatives
- Friends of Sugar Creek
- Municipal and County governmental entities
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Active Watershed Groups and appropriate Watershed Management Plans
- West Central Indiana Economic Development District
- Southern Indiana Development Commission
- North Central Indiana Regional Planning Council
- Kankakee-Iroquois Regional Planning Commission
- Wabash River Enhancement Corporation Heritage Corridor Commission
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 84** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

Middle Wabash River Service Area
High Priority Aquatic Resource Conservation Sites

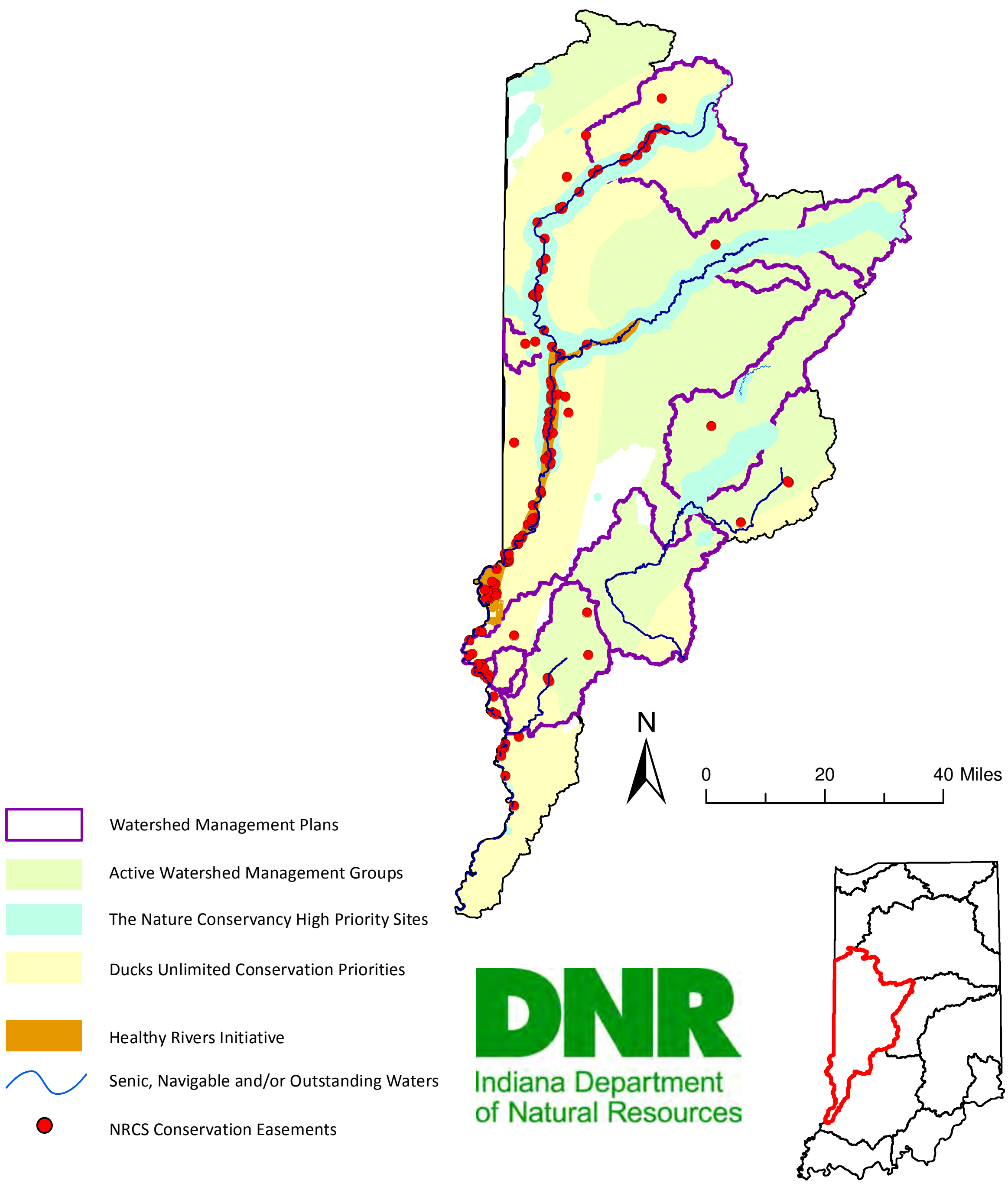


Figure 84. Priority aquatic resource conservation groups and sites within the Middle Wabash Service Area (IWPP, 2015).

APPENDIX B.7 UPPER WHITE SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Upper White Service Area (SA) is located in central Indiana and is composed of the following 8-digit HUC watershed:

- 05120201 - Upper White

The Upper White SA includes all or portions of sixteen Indiana counties listed below and is located primarily within the Central Till Plain physiographic region; the entirety of the Upper White Watershed is within Indiana.

Madison	Johnson	Hendricks
Delaware	Morgan	Boone
Randolph	Brown	Hamilton
Henry	Monroe	Tipton
Hancock	Owen	Clinton
Marion		

The Upper White SA has a drainage area of approximately 2,720 square miles within Indiana and includes over 2,180 miles of streams (Tedesco L. , et al., 2011). The majority of the SA is located in the Eastern Corn Belt Plains ecoregion and Central Till Plain natural region. The till plains are the most extremely farmed regions within the watershed consisting of generally impervious soils; these surfaces limit infiltration and promote surface runoff. The remainder of the watershed lies within the Interior Plateau ecoregion and the Highland Rim natural region; these areas tend to have poorly drained soils and are characterized by both hills and valleys in addition to a karst region in the southwestern most portion of the watershed (U.S. EPA: Ecoregions of Indiana).

Within the Upper White SA flows the West Fork of the White River and its numerous tributaries. Originating in Randolph County and traveling westward through the watershed, the West Fork of the White River passes through the state's capitol of Indianapolis. The river continues to travel southwest through Morgan County until it converges with the East Fork of the White River. From here, the White

River travels southwest until joining the Wabash River at the Indiana/Illinois state border; the Wabash River confluences with the Ohio River and eventually drains to the Mississippi River.

Based on the 2011 NLCD, the land cover type with the most area in the Upper White SA is agricultural land use (58.1%), followed by developed and impervious land use (26.4%), forest and scrub/shrub (12.8%), and wetlands and open water (1.4%) (Homer, et al., 2015). Per the NWI which accounts for more wetland acreage than the 2011 NLCD, woody wetlands are the prominent type covering 1.47% of the SA, while emergent herbaceous wetlands cover 0.26%.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Upper White SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Upper White SA from 2009 – 2015 was collected and analyzed **(Table 73)**. According to the data, 33.7 acres of impacted wetlands and 48,545 linear feet of impacted streams required mitigation in the seven year time period.

The development work type accounted for the most stream impacts (49.5%), followed closely by transportation and service corridors (48.5%), then energy production (1.9%), and dam and/or levee related activities (0.25%). There were no documented stream impacts requiring mitigation for agricultural activities for this time period in the SA.

Development accounted for the most wetland impacts (63.5%), followed by transportation and service corridors (34.2%), and dam and/or levee related activities (2.3%). There were no documented wetland impacts requiring mitigation for agricultural activities or energy production and mining for this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 85**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	120	0.25%	0.784	2.32%
Development	23,958	49.35%	21.399	63.45%
Energy Production	917	1.89%	0	0.00%
Transportation	23,550	48.51%	11.541	34.22%
Grand Total	**48,545**	**100.00%**	**33.724**	**100.00%**

Table 73. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015. Source: USACE Louisville and Detroit Districts.

Upper White Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

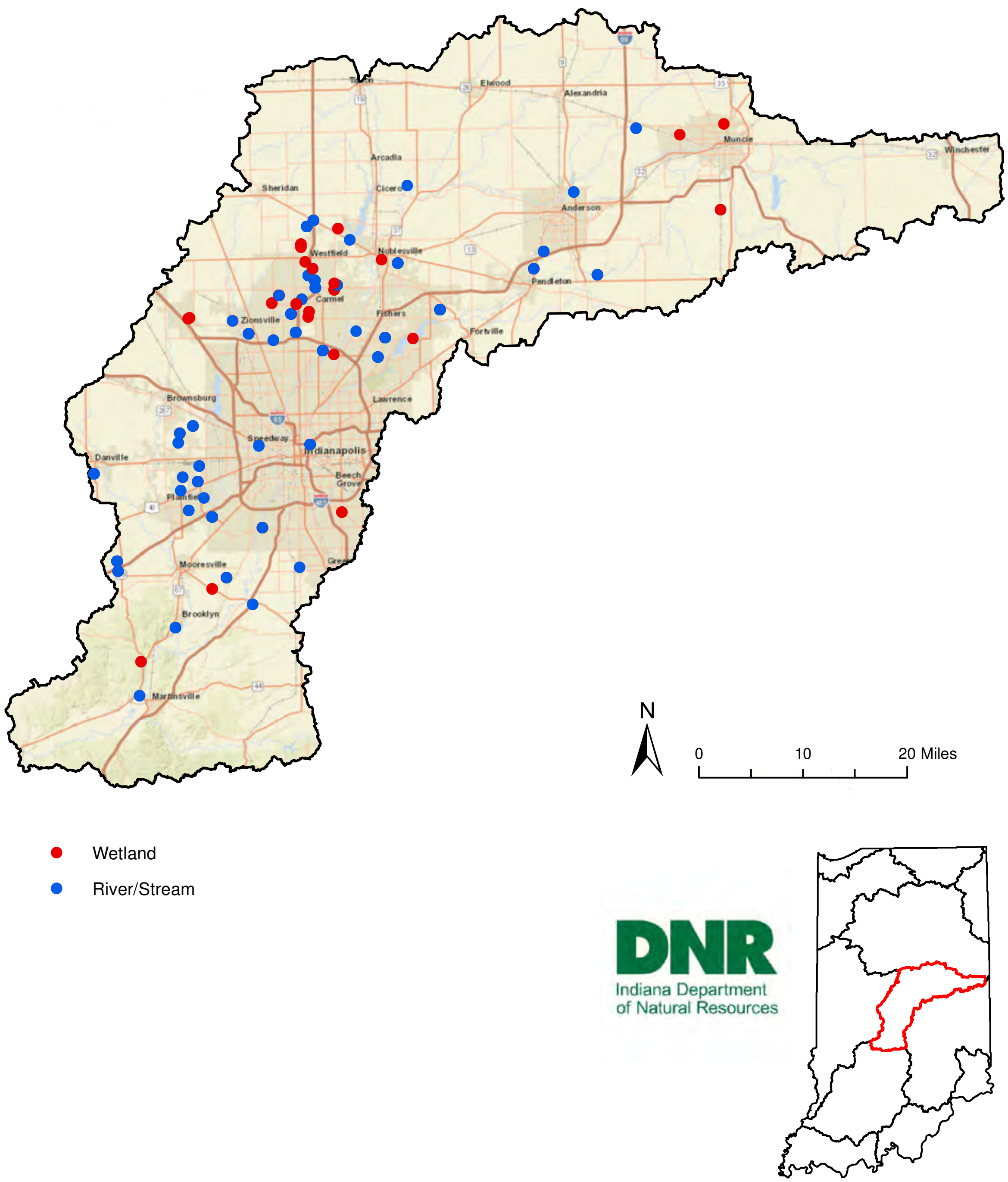


Figure 85. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015.

4.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD (Homer, et al., 2015) to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Upper White SA is presented in **Figure 86,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

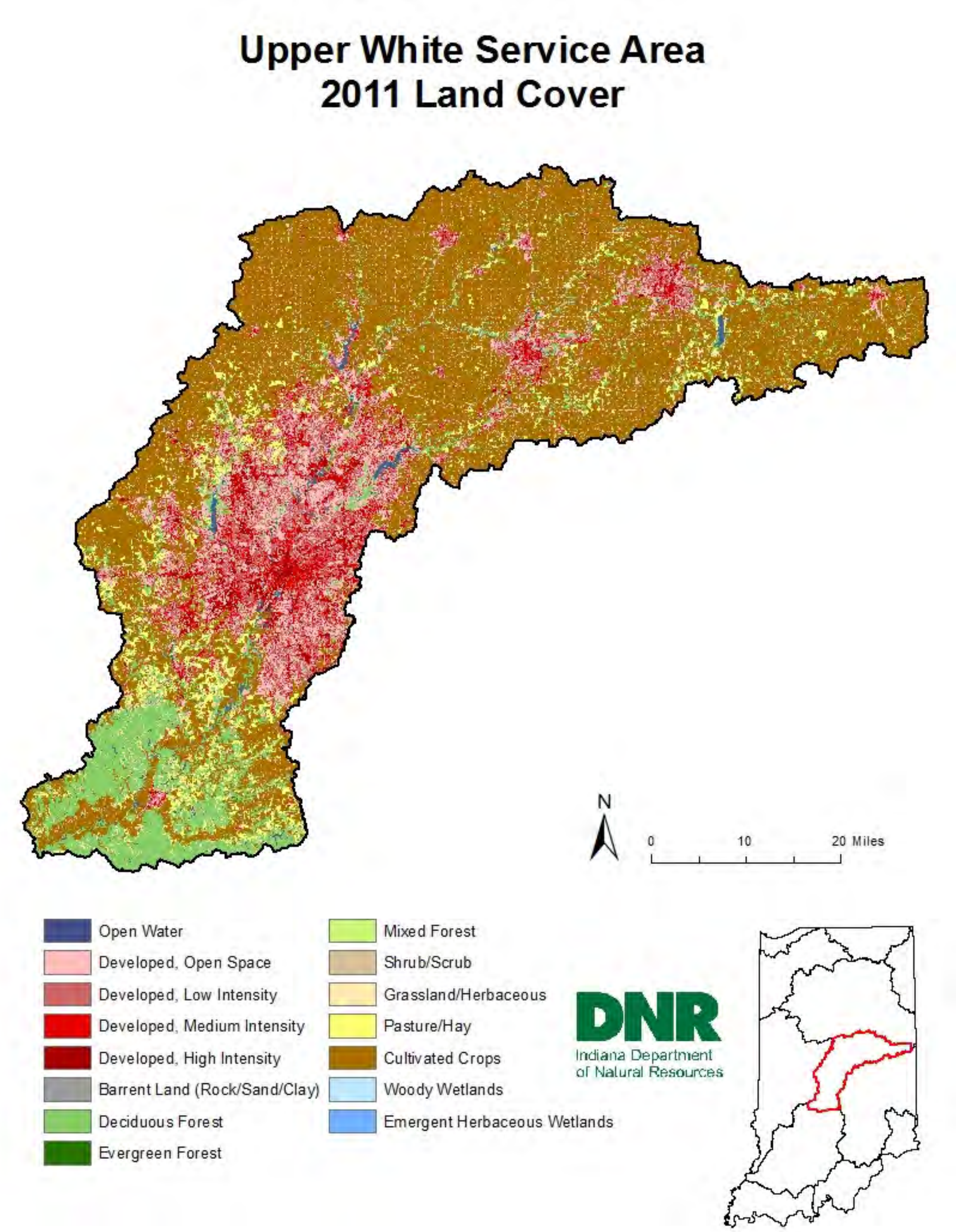


Figure 86. Land cover within the Upper White Service Area from the 2011 NLCD (Homer, et al., 2015).

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 74)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	19,211	1.10%
Developed	Open Space	198,081	11.38%
Developed	Low Intensity	158,552	9.11%
Developed	Medium Intensity	71,871	4.13%
Developed	High Intensity	31,407	1.80%
Barren Land (Rock/Sand Clay)	*	739	0.04%
Forest	Deciduous	217,013	12.47%
Forest	Evergreen	969	0.06%
Forest	Mixed	79	0.00%
Shrub/Scrub	*	4,222	0.24%
Grassland/Herbaceous	*	21,550	1.23%
Pasture/Hay (Agriculture)	*	84,524	4.86%
Cultivated Crops (Agriculture)	*	927,053	53.26%
Wetlands	Woody	2,172	0.12%
Wetlands	Emergent Herbaceous	3,189	0.18%
Grand Total		**1,740,532**	**100.00%**

Table 74. Upper White SA land cover/classification/value percentages from 2011 National Land Cover Database. * Class does not have additional values. (Homer, et al., 2015)

IDNR combined the values within the same land cover classification in **Figure 87** below to demonstrate the current overall land cover distribution of the SA.

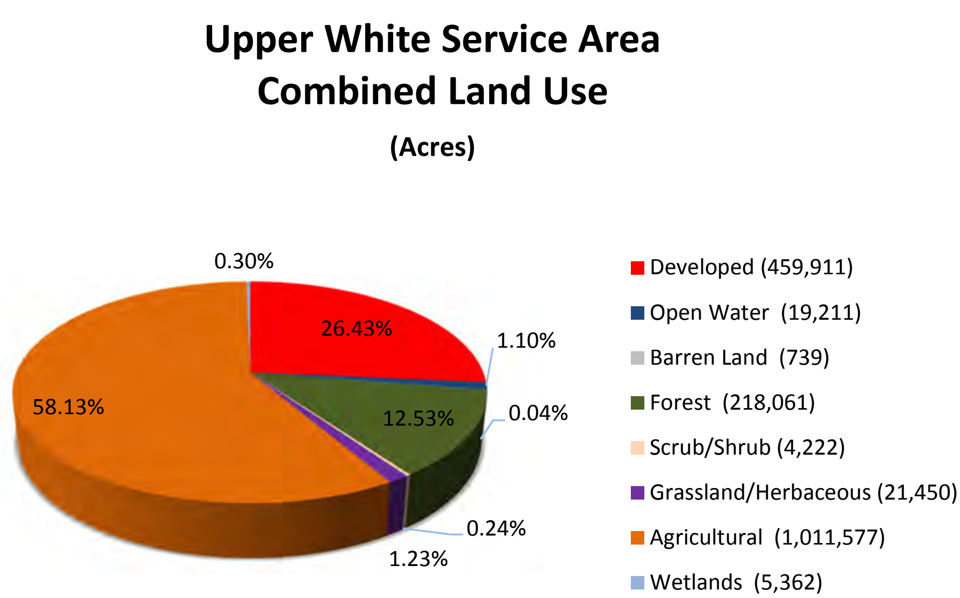


Figure 87. Combined land uses within the Upper White Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Upper White SA. Total agricultural land use covers approximately 58 percent of the SA with a total land area of 1,011,577 acres (Fry, et al., 2011). Although the SA has a significant urban area since it includes much of the Indianapolis metropolitan area, agricultural land use is predominant throughout the northern half of the Upper White SA.

Within the identified land use areas, cultivated crops cover over 927,053 acres (53.3%) and pasture/hay lands cover 84,524 acres (4.86%) of the SA (Fry, et al., 2011). Soybean production is the primary cultivated crop, followed closely by corn, based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Upper White SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. Both dairy cattle and pig farming have active confined feeding operations (CFOs) that have a minimum of 5,000 animal units. These CFOs are considered the predominant livestock industry in the Upper White (Thompson, 2008). When combining these major agricultural land use activities, the Upper White SA ranks sixth in percentage of total statewide land use (4.37%), and it's a significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the second largest land use covering approximately 459,911 (26.4%) of the 1,740,532 total acres, the second most developed area density among SAs, though having the most developed acres of any SA accounting for 18.5% of developed land statewide, and 2% of Indiana's total area. Additionally, the Upper White SA by a large margin has the most high intensity developed area (31,407 acres) and medium intensity developed area (71,871 acres) (Table 74), combining for 103,278 acres or approximately 6% of the SA.

In general, developed impervious areas begin along the White River and Interstate 69 corridors in the north of the SA, which includes large footprint communities such as Muncie, Anderson and Pendleton. The greater Indianapolis metropolitan area then widens beginning in communities such as Noblesville, Westfield, Fishers and Carmel, and continues practically the width of the SA through Indianapolis before narrowing again along the same corridors through communities in the south of the SA such as Greenwood, Mooresville, and Martinsville. Additional communities of densely developed land use located along the SA's many interstates and highways include Zionsville, Tipton, Elwood, Sheridan, Brownsburg, Avon, Plainfield and Danville in addition to many other communities within Marion County.

The SA contains all or part of the Muncie, Indianapolis-Carmel-Anderson and Bloomington MSA's, of which all but the Muncie MSA experienced significant growth in the previous decade (Manns, 2013). The Indianapolis-Carmel-Anderson MSA is the largest in the state with a 2010 population of nearly 1.9

million. Approximately 47% (1,296,950 acres) of the Indianapolis-Carmel-Anderson MSA is within the Upper White SA which includes all or part of Madison, Hancock, Hamilton, Marion, Johnson, Brown, Boone, Hendricks and Morgan Counties, accounting for approximately 74.5% of total SA acres. This central portion of the watershed continues to undergo extensive urban expansion as agricultural areas are converted to developed lands (Tedesco L. , et al., 2011). The majority core of this MSA is the City of Indianapolis and other communities within Marion County. Approximately 87.5% of Marion County is within the Upper White SA, which account for approximately 17.5% of this MSA, and approximately 13% of total SA acres.

The Muncie MSA consists of Delaware County in the northern reach of the SA. Approximately 69% (174,776 acres) of Delaware County's 253,440 acres is within the Upper White SA accounting for approximately 10% of the total SA acres.   As is common for the many large communities throughout the Upper White SA, Muncie contributes significant loads of dissolved and organic pollutants, contaminants and sediments impairing the aquatic functions and services in the upper reaches of the watershed from residential, commercial and/or industrial sources such as CSO's, impervious surfaces, storm water discharges and exposed soils (Tedesco L. , et al., 2011). Similarly, smaller rural areas upstream of Muncie contribute unsewered or failing septic waste contributing to elevated E. coli concentrations in the headwaters of the Upper White, as does the high concentrations of CFO's in Randolph County upstream of CSO related impacts (Tedesco L. , et al., 2011).

The Bloomington MSA consists of minimal areas of northern Monroe and Owen Counties in the southern downstream reach of the SA. Approximately 21,530 (4.2%) of the Bloomington MSA's 511,360 acres are located in the Upper White SA accounting for only 1.25% of total SA acres, with the remainder within the Lower White SA. Analysis of the INDOT cities and towns GIS data shows the Upper White SA contains all or part of 209 cities and/or towns, 70 of which are incorporated (INDOT, 2016).

Four Indiana regional councils that overlap the SA include the Madison County Council of Governments (MCCOG) (16%), the East Central Indiana Regional Planning District (ECIRPD) (14%), the Eastern Indiana Regional Planning Commission (EIRPC) (6%), and the North Central Indiana Regional Planning Council (NCIRPC) (5%) (IARC, 2017). The remaining counties not associated with a regional council are within the Indianapolis MSA and account for the most growth and development statewide. The Eastern Indiana Regional Planning Commission, is a relatively new regional planning district that is in the process of developing a strategic plan to guide the organization with its economic development efforts.

Additionally, analysis of INDOT's local roads GIS data (INDOT Road Inventory Section, 2016) shows there are approximately 13,253 miles of municipal and county roads contributing to the developed impervious land cover within the SA. The Upper White SA ranks second among SA's in local road miles to square mile ratio at approximately 4.87 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Upper White SA contains approximately 1,744 miles of U.S. Interstates and highways, 2,377 miles of state highways, and 17,374 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the seventh largest SA, the concentration of road miles per square mile of land within the SA is substantial.

U.S. Interstates and highways have a concentration of approximately 0.64 mile per square mile, which ranks second among the eleven SAs. The concentration of state highways ranks first with 0.87 mile per square mile and is the highest ranking road type within the Upper White SA. Similar to the U.S. Interstates and highways, the ranking of the concentration of local roads falls in the top tier. The concentration of local roads is approximately 4.87 miles per square mile, which ranks it second, when compared to the ten other SAs. Similarly, the combined ranking of the concentration for all roadways, ranks near the top, with a concentration of 6.39 mile per square mile, which ranks second overall.

2.5.2 Railroads

Railroads provide an alternative means of transportation with approximately 750 miles of railroad within the Upper White SA (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Upper White SA is tied for second with the Kankakee SA for the greatest concentration of railroads with a density of 0.28 miles of railroad per square mile. The concentration of linear infrastructure throughout the SA has resulted in the loss of aquatic resource functions and services due to habitat conversion, fragmentation, and loss associated with their construction and maintenance.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Upper White SA contains service corridors contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 3,144 miles of service corridors within its boundary.

The Upper White SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately twenty-six (12 kV) lines, seventy-three (34.5 kV) lines, 192 (69 kV) lines, 237 (138 kV) lines, eighteen (230 kV) lines, seventy-two (345 kV) lines, and two (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 1,444 miles throughout the SA, which is the third highest concentration of electric transmission lines relative to the SA size, with 0.53 mile of transmission line per square mile.

In addition to electric transmission lines, the Upper White SA contains over 1,700 miles of pipelines in total. It contains over 96 miles of pipelines that convey crude oil, 1,181 miles of pipelines that transport natural gas, and 423 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Upper White SA contains the seventh greatest concentration of crude oil pipelines, the second greatest concentration of natural gas pipelines, and the fourth greatest concentration of refined petroleum products pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 26 known low head dams (IDNR DOW, 2016) within the SA, the second most among SA's, and third most in concentration at one low head dam per 105 square miles. There are currently 104 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 26 square miles, the second highest concentration of all SA's, containing 12% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 633,600 linear feet (120 miles) of NLE's mapped within the SA, averaging one mile of NLE per 23 square miles, the fifth highest concentration among all SA's. Delaware and Tipton Counties, which fall partially within the SA, were not included in the NLE identification project since they were not declared disasters resulting from the 2008 severe weather events; therefore, the Upper White SA has additional NLE's that have not yet been mapped as part of this effort. Approximately 113 miles of the currently identified NLE's are located within rural agricultural land use, with the remaining 7 miles mapped located in developed areas.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Upper White SA contains minimal natural gas and oil production. Although oil and gas production is minimal when compared to many of the other SA, the Upper White SA contains active oil and gas fields along with associated wells that support, or have supported, the petroleum industry within its boundary. The Indiana Geological Survey (IGS) identifies three petroleum gas fields with 102 associated gas wells; and three oil & gas fields with one oil & gas well and 25 oil wells within the boundary (Indiana Geological Survey , 2015). Conversely, there are no identified active oil fields within the Upper White SA according to the IGS dataset. Based on the identified active oil & gas fields within the SA boundary, the Upper White SA ranks tenth statewide.

The Upper White SA, also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 2,123 abandoned gas wells, 324 abandoned oil wells, 16 abandoned oil & gas wells, 28 abandoned gas storage, 19 gas storage wells, 706 dry wells, 10 stratigraphic wells, two observation wells, seven saltwater disposal wells, seven abandon saltwater injection wells, 10 temporarily abandoned wells, and 1 non-potable water supply well within the SA boundary (Indiana Geological Survey, 2015). 2.7.2 Mineral Mining and Aggregates

The Upper White SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the IGS 2016 active Indiana industrial mineral production data, the SA contains 28 sand & gravel mining operations, eight crushed stone operations, and two clay & shale operation

(Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one slag operation, which is an industry byproducts commodities that are used as aggregate (Indiana Geological Survey, 2016). Mineral mining within the Upper White SA boundary ranks fourth in the state with 39 active operations.

2.7.3 Coal

The Upper White SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Upper White SA is located mostly in the Indiana SWAP Corn Belt Planning Region (90.3%) with a small portion in the Interior Plateau Planning Region (9.7%). The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses with the agricultural and developed impervious footprints make up approximately 84.5% of the land use with the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects development, and transportation and service corridor projects to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

Between 2000 and 2010, The Indianapolis-Carmel-Anderson MSA experienced a 15.2% population increase, adding 231,137 people, and accounted for 57% of Indiana’s population growth (Kinghorn M. , 2011). This trend is expected to continue with central Indiana accounting for as much as 70% of Indiana’s projected 15% growth by 2050 (Kinghorn M. , 2011).

According to the MCCOG Anderson/Madison County 2030 Transportation Plan (2005), the areas in the vicinity of Interstate 69 exits 14 and 22 are expected to continue with significant growth that will include residential, commercial and/or industrial developments. As a result of the projected development in these areas, new transportation investments will also be necessary to improve mobility, reduce congestion, and address safety issues that can occur between highway and local road configurations (MCCOG, 2005).

Additionally, an increase in commuting patterns from Madison County and the surrounding areas to Indianapolis have impacted county roads as well as federal, state, and urban networks in the greater Indianapolis area. The increased vehicular volume and commuting trends are overwhelming local road networks that were not designed to accommodate the higher volume of traffic; therefore, road rehabilitation, upgrades and new construction will be required to improve travel (MCCOG, 2005).

As growth in eastern Hamilton County and northern Hancock County continues to move east and northward, growth is projected to continue in the western and southern portions of Madison County. Out-migration from the Anderson urban core is also contributing to growth and development of previously rural areas of the county and SA (MCCOG, 2005).

Madison County has experienced a decline over the last two decades of its two major economic sectors of manufacturing and agriculture, resulting in the focus and encouragement of development within and surrounding the municipalities to promote business revival and recruitment. Agriculture and associated agribusiness are significant economic drivers for the unincorporated areas of Madison County. Local farmers continue to produce and market crops and livestock using modern agricultural practices. There are several major food processors that operate within the region as well as mineral extraction operations within Madison County which are expected to continue and expand (MCCOG, 2005).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Upper White SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Upper White SA's historic aquatic resources were comprised of a diverse forested natural aquatic community types that are indicative of the surrounding landscape and the White River and its tributaries. The regions aquatic and natural communities were heavily impacted due to major land-use changes enacted to facilitate early European settlement throughout the area.

The central and southern half of the SA includes the state capital of Indianapolis that was founded in 1821 based on its central location and proximity to the White River (U.S. Department of the Interior, 2017). During this period, the Indianapolis region relied upon agriculture, especially grain mills, wool mills and pork-packing plants (U.S. Department of the Interior, 2017). Similar to the rest of the SA, the southern region of the SA experienced conversion of the land for settlement and agriculture. From 1816-1853, early pioneer settlers established their homes and communities along the White River and its tributaries, clearing the land for farms and livestock (Morgan County Soil & Water Conservation District, 2005). Reports from 1883, in the "Report of Geological and Topographical Survey of Marion County", indicate Marion County's forests were reduced to small woodlots and the remainder of the land converted to cultivated fields (Brown, 1883); (Barr, et al., 2002). As the land was transformed, many of the wetlands throughout the region were drained. As large farming enterprises were established along the White River bottoms during the mid-late 1800s, marshes were being drained by ditches (Morgan County Soil & Water Conservation District, 2005). The operation of the mills and conversion of the landscape to agriculture resulted in the beginning of the degradation and loss of aquatic resources throughout the area.

Transportation was an integral factor that facilitated growth and development throughout the Upper White SA. In 1829, construction of the National Road began and it extended through Indianapolis, connecting the capital city to Richmond, IN and Terre Haute, IN connecting Indiana and to eastern and western states (The History Museum, 2017). The establishment of a major roadway that allowed travel to the northern and southern portions of the state, also compound land alterations through the region. During the 1830's Indiana constructed a north-south road that ran through Indianapolis, connecting it to Michigan City and Madison, called the Michigan Road (The History Museum, 2017). Michigan Road became the main north-south route during this time, providing a travel corridor from Lake Michigan to the Ohio River.

In addition to the influence of these roads, overland travel via railroads was an important component in the growth and development of the region. The completion of the Indianapolis & Madison Railroad within the region, along with the combining of rail firms resources to build the Union Station, provided development that the failed canal system could not (U.S. Department of the Interior, 2017). Rail also provided a catalyst for increased growth. The discovery of natural gas and railroad access to coal during the 1880's facilitated the growth of industrial foundries, machine shops, and railroad related shops; in addition, the utilization of rail car transportation provided a connection throughout Indianapolis streets and surrounding farms by the 1890's (U.S. Department of the Interior, 2017).

Due to extensive aquatic resource loss within the Upper White SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 88** depicts each Natural Region and Section located within the Upper White SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 75)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

<table>
<tr><th rowspan="2">Natural Region(s)</th><th colspan="2">Natural Region: Section(s)</th><th rowspan="2">Natural Region Community Types</th><th colspan="2">Hydric Soils</th><th colspan="2">Partially Hydric</th><th>Pre-Settlement % Forest Cover</th></tr>
<tr><th>Name</th><th>% Cover</th><th>Acres</th><th>% Cover</th><th>Acres</th><th>% Cover</th><th>% Forested</th></tr>
<tr><td rowspan="2">Central Till Plain</td><td>Bluffton Till Plain</td><td>5.95</td><td>Predominantly forested, minor areas of bog, prairie, fen, marsh and lake communities</td><td rowspan="4">395,828</td><td rowspan="4">22.74</td><td rowspan="4">623,822</td><td rowspan="4">35.84</td><td rowspan="4">100.00</td></tr>
<tr><td>Tipton Till Plain</td><td>85.04</td><td>Extensive beech-maple-oak forest, northern flatwoods; bog, prairie, marsh, seep spring, and pond</td></tr>
<tr><td rowspan="2">Highland Rim</td><td>Brown County Hills</td><td>7.97</td><td>Predominantly forested upland oak-hickory, mesic ravines;, acid seep spring (rare); medium to low-gradient streams</td></tr>
<tr><td>Mitchell Karst Plain</td><td>1.05</td><td>Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)</td></tr>
</table>

Table 75. The historic natural community composition for the Upper White Service Area based upon the natural region and section

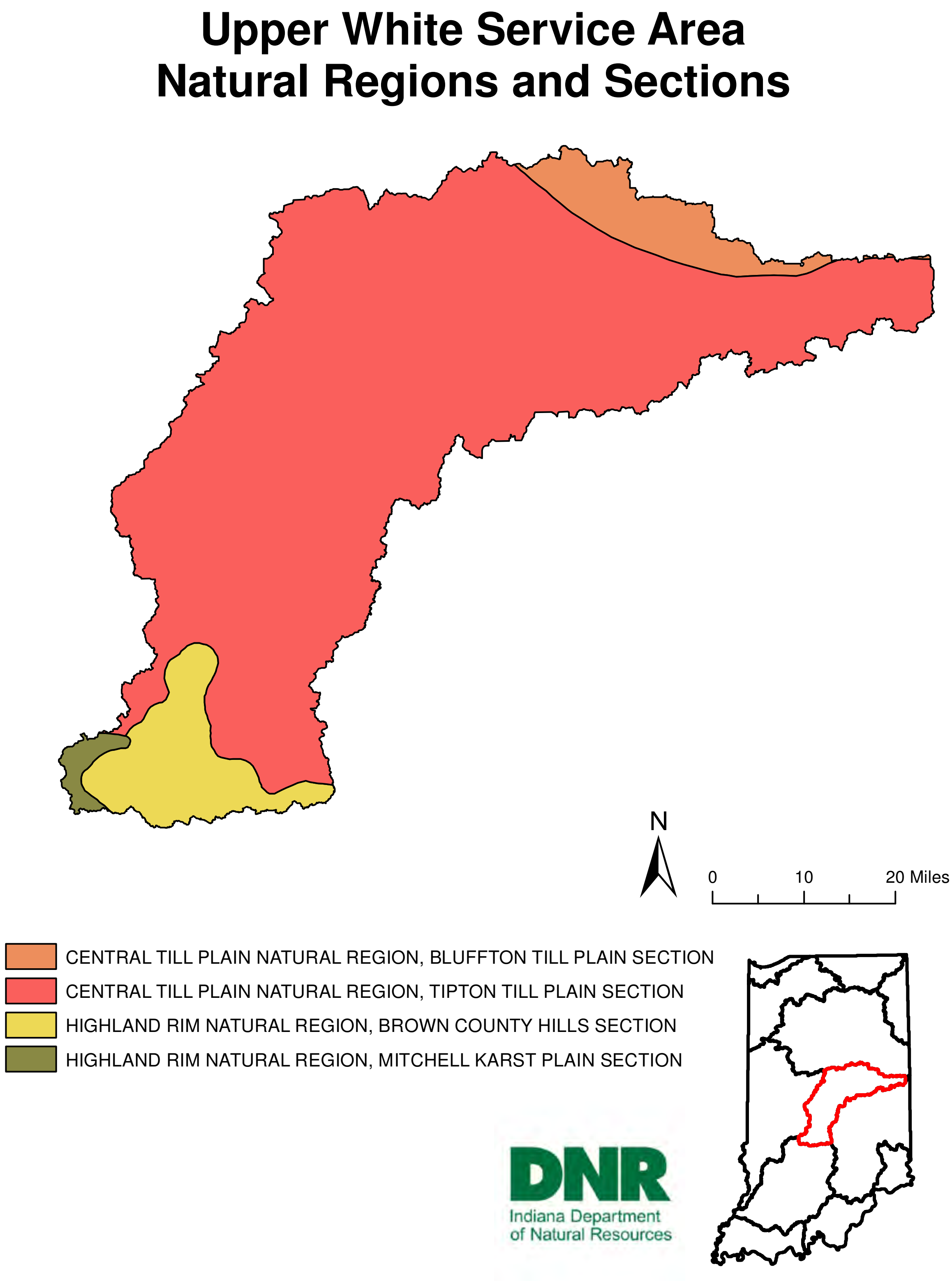


Figure 88. Natural regions and sections within the Upper White Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 1,558 miles of category 4A impaired streams and 1,622 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,598 miles), PCBs in fish tissue (336 miles), impaired biotic communities (158 miles), dissolved oxygen (40 miles), nutrients (36 miles), free cyanide (7 miles), and total mercury (water) (6 miles) are current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 378 QHEI assessment reaches within the SA **(Table 76 and Figure 89)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 59.79% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	76	20.11
51-64	Habitat is partially supportive of a stream's aquatic life design	110	29.10
>64	Habitat is capable of supporting a balanced warm water community	192	50.79
	Total	**378**	**100%**

Table 76. IDEM Overall QHEI scores for Upper White SA, 1991 – 2014 (IDEM OWQ, 2014)

Upper White Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

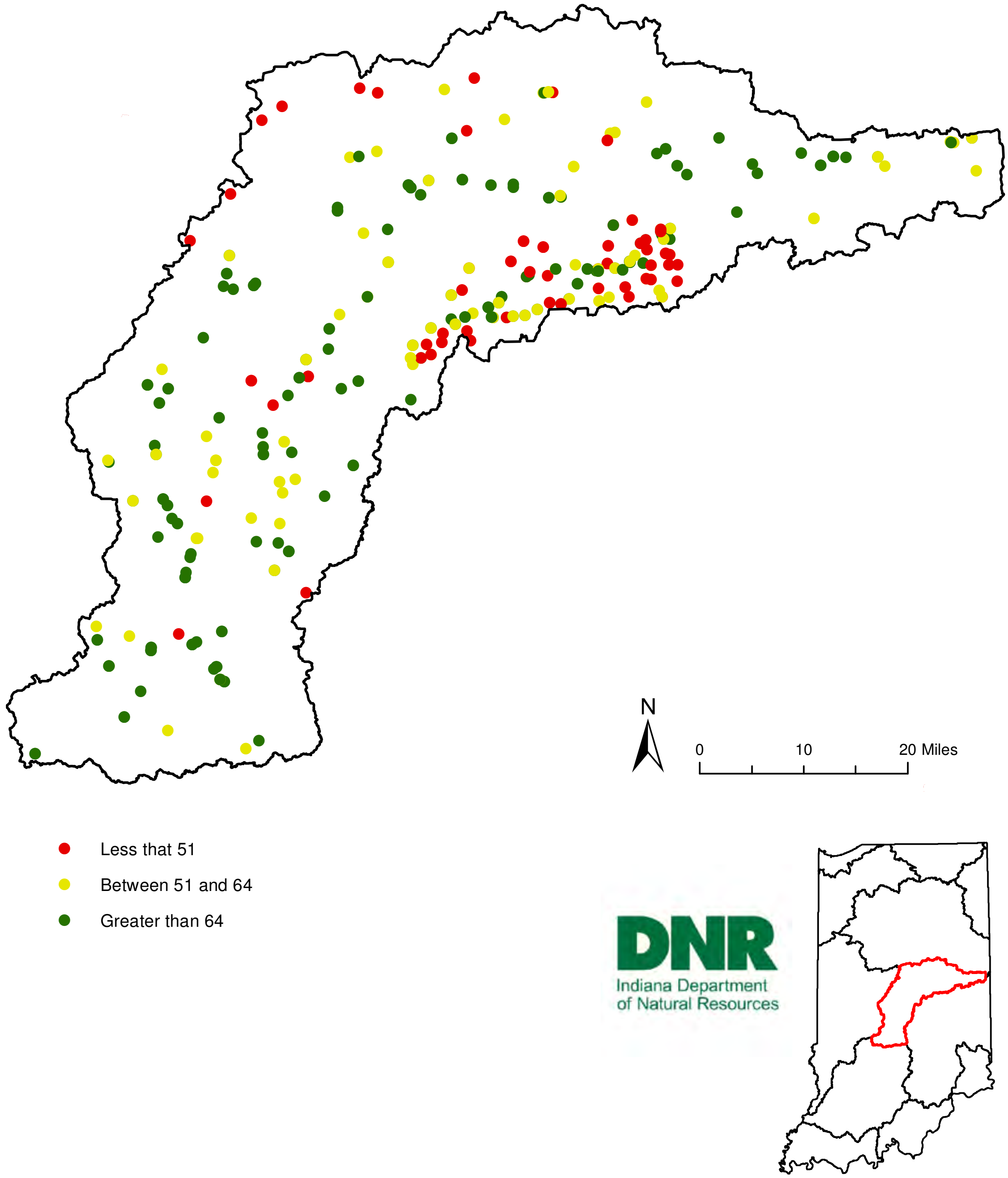


Figure 89. IDEM overall QHEI scores within the Upper White service area; 1991-2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Upper White SA ranks seventh overall in forested cover density of all SA's at 13% of total area with approximately 218,061 acres, and is the SA with the fifth smallest percentage of forested cover with approximately 4.18% of 5,215,169 acres of forest cover statewide.

GIS analysis identifies approximately 4,122,307 linear feet (781 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Upper White SA ranks 7th in ratio of these potentially restorable stream miles to square miles of SA at approximately 0.29 mile of potential restoration per one square mile, or one square mile of potential restoration for every 3.48 square miles of SA.

4.2 Wetlands

Analysis of the NWI in the Upper White SA identifies approximately 4,606 acres of freshwater emergent wetland (PEM) and approximately 25,539 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 1.73% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5.67% of the total SA **(Table 77 and Figure 90)**. Wetland concentrations are greatest in Hamilton, Marion, and Morgan Counties.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	4,606	4.66%	0.26%	0.02%
Freshwater Forested/Shrub Wetland	25,539	25.86%	1.47%	0.11%
Freshwater Pond	13,871	14.04%	0.79%	0.06%
Lake	10,415	10.54%	0.59%	0.05%
Riverine	44,340	44.89%	2.55%	0.19%
Grand Total	**98,772**	**100.00%**	**5.67%**	**0.43%**

Table 77. Acres and percentages of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils account for 674,217 acres (**Figure 91**), or 38.7% land cover within the SA, out of which approximately 648,598 acres have the potential to be restored, accounting for 37.3% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Upper White SA has the 4th highest percentage of recoverable wetland acres to total SA size of all SA's, and the 5th most potentially restorable wetland acres of any SA. Though the Upper White SA has the most developed acres of any SA, the SA size and the dominance of agricultural land use account for the higher than average amount of potentially restorable wetland acres.

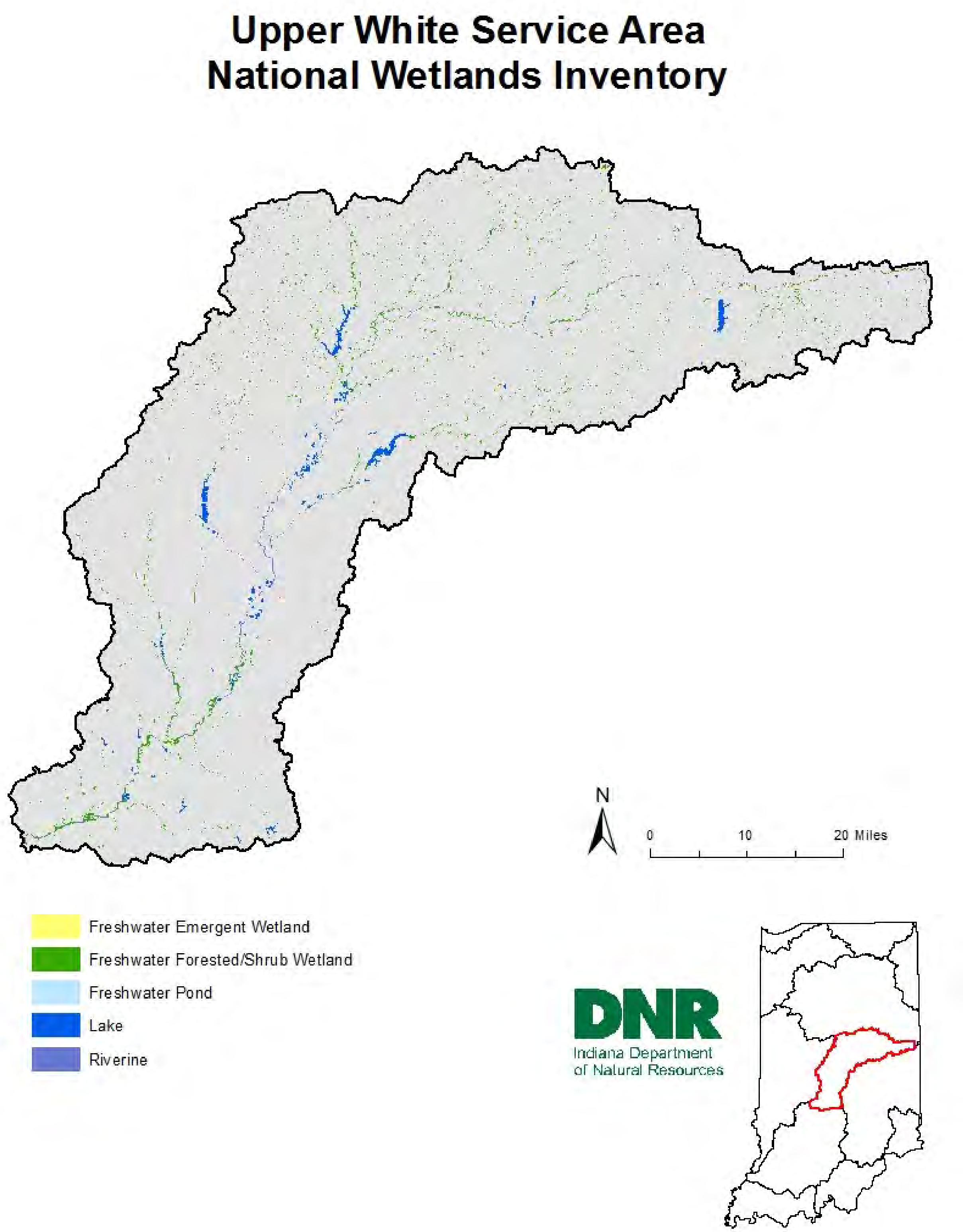


Figure 90. NWI for the Upper White Service Area (USFWS NWI, 2015)

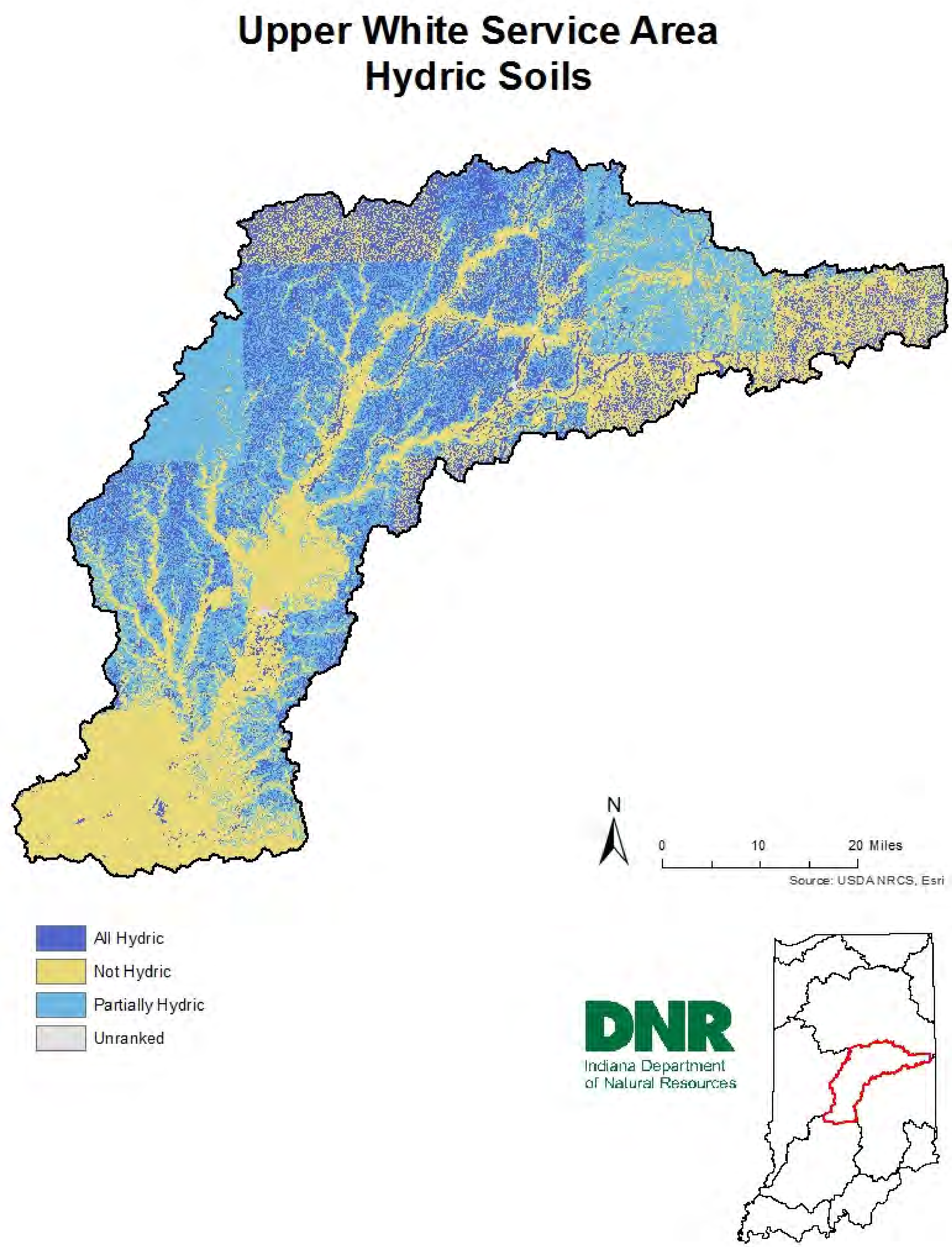


Figure 91. Hydric and partially hydric soils within the Upper White Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 465,532 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Wiley Thompson Ditch-White Lick Creek (HUC 051202011302 **[Table 78]**).

Hotspots account for 1,420,320 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Little Stone Creek-Stoney Creek (HUC 051202010107 **[Table 79]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 78 & 79)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 92** shows where these watersheds are located within the SA.

Boone Pond Public Fishing Area is the only IDNR-managed land with adjacent hotspots of potentially restorable wetlands (1,433 acres).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
051202011302	Wiley Thompson Ditch-White Lick Creek	14,185
051202010405	Lilly Creek-Pipe Creek	12,310
051202010505	Lamberson Ditch-Duck Creek	12,157
051202011304	Headwaters West Fork White Lick Creek	11,661
051202011103	Finley Creek-Eagle Creek	11,343

Table 78. Watersheds in the Upper White Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
051202010107	Little Stone Creek-Stoney Creek	50,160
051202011301	Hughes Branch-West Fork White Lick Creek	49,104
051202010102	Peach Creek-White River	44,352
051202011102	Mounts Run	42,240
051202010803	Deer Creek-Fall Creek	41,712

Table 79. Watersheds in the Upper White Service Area with the most hotspots of potentially restorable streamstreams

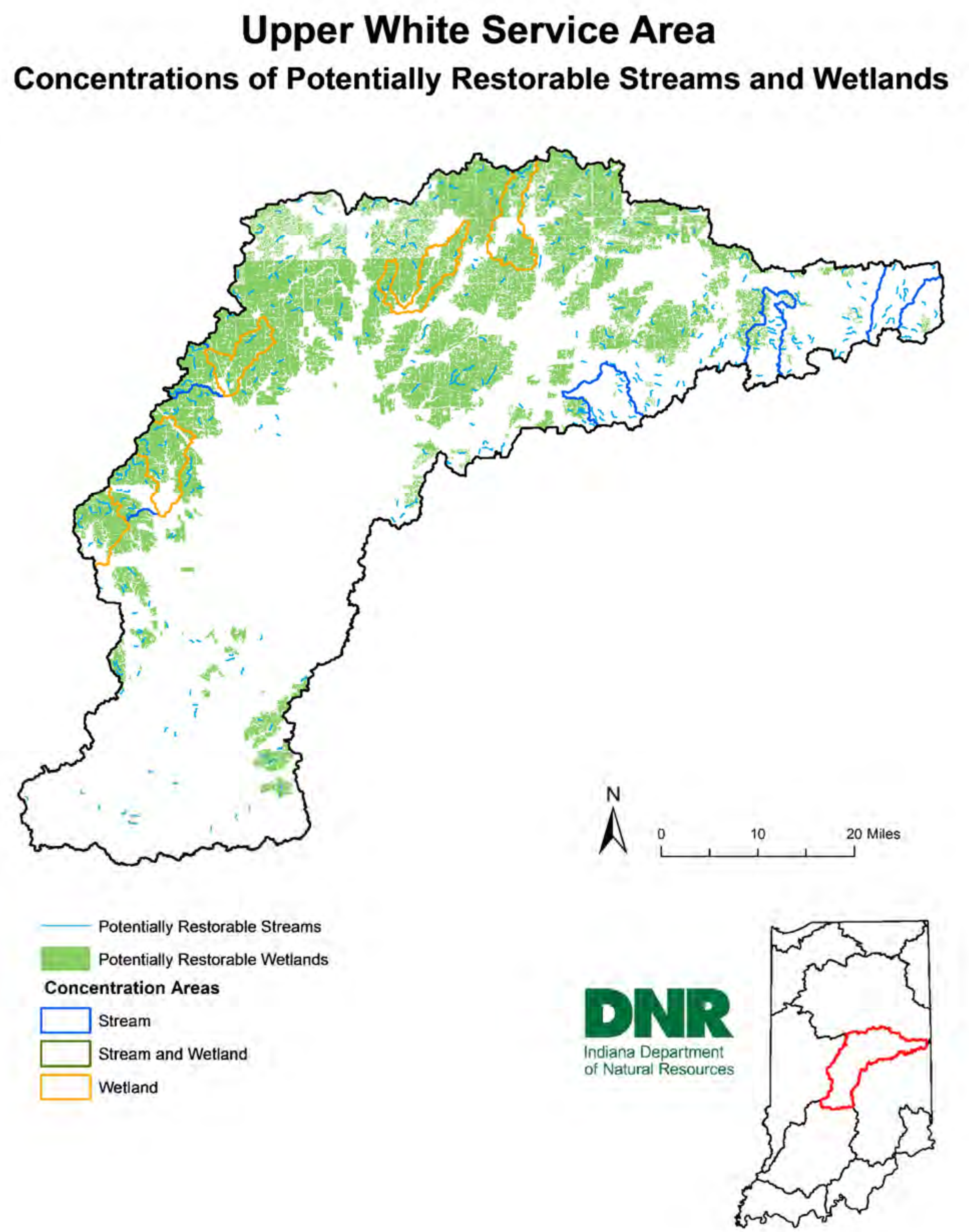


Figure 92. Concentrations of Potentially Restorable Streams and Wetlands in the Upper White Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Upper White SA identifies three lakes currently documented with category 5 impairments, which measured using the National Hydrography Dataset (NHD), accounts for approximately 3,157 acres of PCBs in fish tissue and 1,295 acres with algae (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 19,211 acres of open water which accounts for 1.1% of the SA. This varies slightly from the NWI which identifies approximately 13,870 acres of freshwater ponds comprising of 0.8% of the SA, and 10,415 acres of lakes comprising of 0.6% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Upper White SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Upper White SA shows that approximately 98% of the shallow unconsolidated aquifers receive between 2 and 7 inches of ground water recharge annually **(Table 80).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.1	0.003%
	13	0.1	0.002%
	12	0.004	0.000%
	11	0.1	0.002%
	10	0.6	0.02%
	9	5.5	0.20%
	8	25	0.90%
	7	126	4.63%
	6	383	14.09%
	5	866	31.85%
	4	881	32.39%
Low	3	360	13.25%
	2	61	2.23%
	1	12	0.44%

Table 80. Approximate ground water recharge rates in the Upper White SA (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that nearly 100% of the Upper White SA near surface aquifers are between the low to high range for sensitivity to contamination with approximately 59% as moderate **(Table 81)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	963	0.06%
High	304,928	18%
Moderate	1,018,908	59%
Low	413,703	24%
Very Low	2,028	0.12%

Table 81. Ground water sensitivity distribution in the Upper White Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Upper White SA is sixth among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 114,859 MGD **(Figure 93)** (IDNR DOW, 2016). Energy production and mining accounts for approximately 45% of registered withdrawal capacity, followed by public water supply at 33%, industry at 21%, and agricultural irrigation, rural use and miscellaneous uses accounting for the remaining 1%.

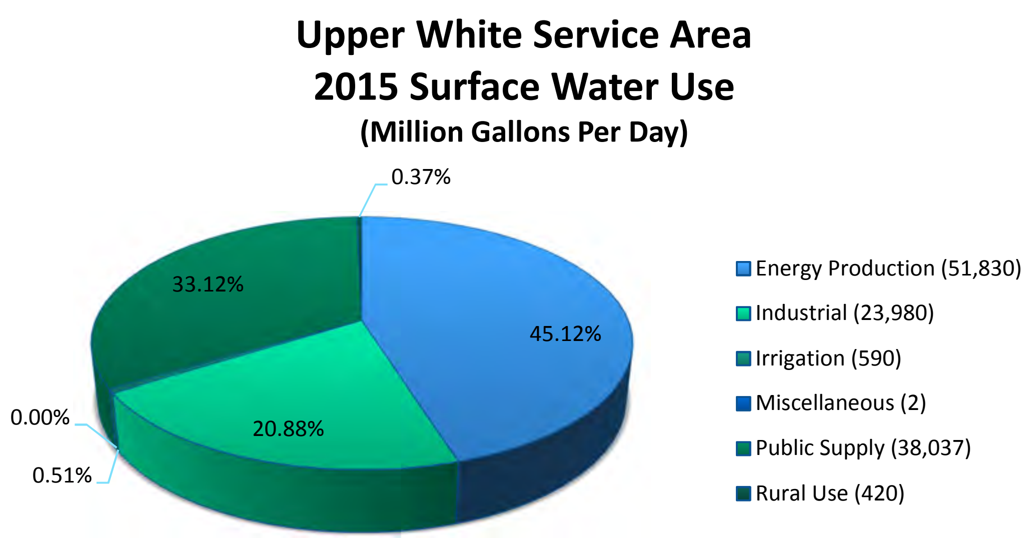


Figure 93. 2015 surface water usage in the Upper White Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Upper White SA is the most of any SA with a 41,953 MGD registered capacity **(Figure 94).** Public water supply accounts for approximately 84% of registered ground water withdrawal capacity in the SA, followed by industry with 6%, energy production and mining with 4%, and agricultural irrigation, miscellaneous uses and rural use accounting for the remaining 6%.

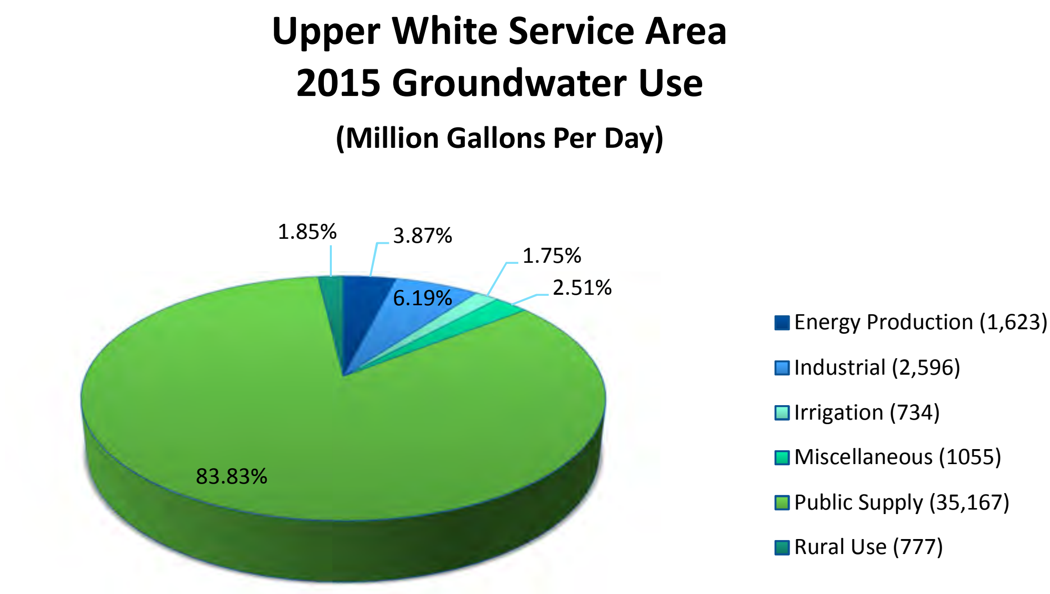


Figure 94. 2015 ground water usage in the Upper White Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Upper White SA include, but are not limited to circumneutral seep, central till plain flatwoods, fen, marsh, and wet floodplain forest, in addition to many other transitional, mixed and upland communities.

There are currently a minimum of seven amphibian species, 47 bird species, eight fish species, 17 mammal species, 15 mollusk species, and 11 reptile species listed as SGCN within the SWAP Planning Regions of the Upper White SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Upper White SA. The following aquatic resource goals and objectives apply specifically to the Upper White SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas.

1. Restoration, enhancement and preservation of aquatic resources that will help offset current and anticipated threats within the SA.

2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.
7. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt Plains and Interior Plateau Planning Regions where feasible.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana’s aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Upper White SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Bacon Prairie Ditch WMP, Morse Reservoir/Cicero Creek WMP, Buck Creek WMP, Cool Creek WMP, Duck Creek WMP, Lilly & Little Duck Creek WMP, Eagle Creek WMP, Geist Reservoir Upper Fall Creek WMP, Indian Creek WMP, Little Cicero Creek WMP, Lower Fall Creek WMP, Lower White Lick Creek WMP, Muncie Creek-Hamilton Ditch and Truitt Ditch-White River WMP, Pleasant Run WMP, Stony Creek WMP, Swanfeld Ditch WMP, Upper White River (Delaware Co.) WMP, and WMP for the White River Watershed in North Central Morgan Co. (Lambs Creek WMP). However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Upper White SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and that provide important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Mud-Creek Conservancy, Red-tail Conservancy, Sycamore Land Trust, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR intends to partner with land trusts that exist in the SA on compensatory mitigation projects to develop project plans and designs as well as providing long-term management and stewardship of subject properties over the life of the program.

Additional stakeholders' interest and potential conservation partnerships specific to the Upper White SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- The Upper White River Alliance, UWRWA
- Geist Fall Creek Watershed Alliance
- Morse Waterways Association
- Eagle Creek Watershed Alliance
- Friends of the White River
- Mud Creek Conservancy

- USGS Indiana Water Science Center
- Eastern Tallgrass Prairie and Big Rivers, and Appalachian Landscape Conservation Cooperatives
- Municipal and County governmental entities
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Madison County Council of Governments
- Active Watershed Groups and appropriate Watershed Management Plans
- East Central Indiana Regional Planning District
- Eastern Indiana Regional Planning Commission
- North Central Indiana Regional Planning Council
- IUPUI Center for Earth and Environmental Science (CEES)
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 95** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

Upper White River Service Area
High Priority Aquatic Resource Conservation Sites

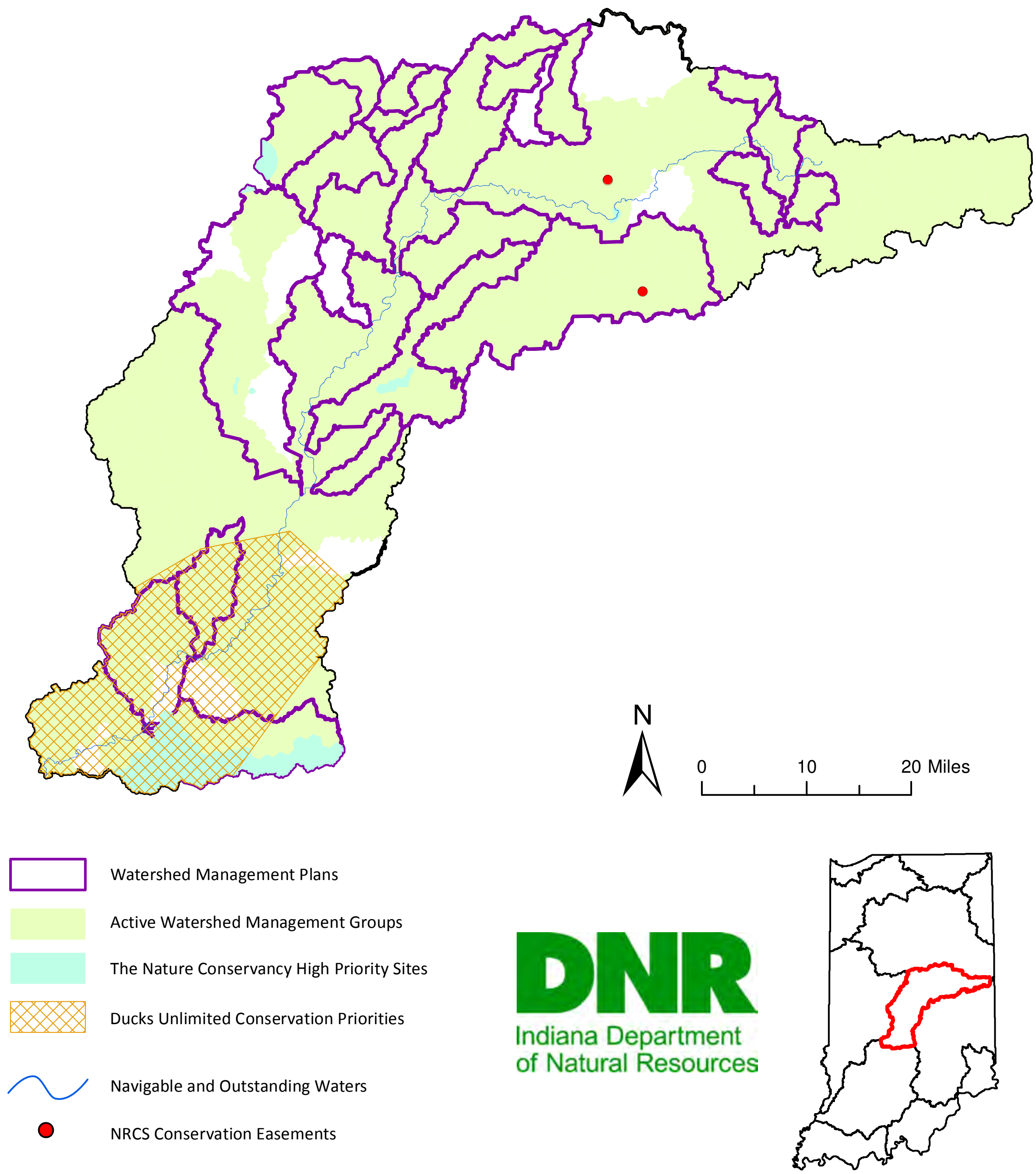


Figure 95. Priority aquatic resource conservation groups and sites within the Upper White Service Area (IWPP, 2015)

APPENDIX B.8 WHITEWATER-EAST FORK WHITE SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Whitewater-East Fork White Service Area (SA) is located in southeastern Indiana and is composed of all or portions of the following seven 8-digit HUC watersheds:

- 05120204 - Driftwood
- 05120205 - Flatrock-Haw
- 05120206 - Upper East Fork White
- 05120207 - Muscatatuck
- 05080001 - Upper Great Miami
- 05080003 - Whitewater
- 05080002 - Lower Great Miami

The Whitewater-East Fork White SA includes all or portions of twenty-three Indiana counties listed below and is located within the Central Till Plain and Southern Hills and Lowlands physiographic regions.

Madison	Rush	Brown
Randolph	Fayette	Jackson
Henry	Union	Jennings
Wayne	Franklin	Jefferson
Hancock	Dearborn	Scott
Marion	Ripley	Washington
Johnson	Decatur	Clark
Shelby	Bartholomew	

The Whitewater-East Fork White SA drains approximately 5,139 square miles of southeastern Indiana and is primarily located in the Eastern Corn Belt Plains ecoregion and its various sub-regions; these regions include the Loamy, High Lime Till Plains in the northwest, the Whitewater Interlobate Area in the northeast, and the Pre-Wisconsin Drift Plains in the south. Glaciers from the Wisconsin Stage over 50,000 years ago formed the northern portion of the Whitewater-East Fork White SA; the soils were developed from loamy, limy glacial deposits. The northeastern portion of the SA is defined by its coarse-bottomed streams fed by an abundance of groundwater and is where the Whitewater River flows. The southern portion of the Whitewater-East Fork White SA is characterized by acidic and extremely leached till and scattered sinkhole areas; prior to a majority of the land being converted to agriculture, beech forests and elm-ash swamp forests dominated the region. The remainder of the eastern portion of the Whitewater-East Fork White SA along the Indiana/Ohio border is part of the Interior Plateau ecoregion and Bluegrass natural region and is characterized by mosaic forests and its rugged terrain underlain by limestone and shale; this region has been extremely dissected by valleys and hills (U.S. EPA: Ecoregions of Indiana).

The Whitewater River is a significant river which flows through the Whitewater-East Fork White SA and is a main tributary of the Big Miami River of Ohio which drains into the Ohio River. The Whitewater River originates as two forks in Randolph and Wayne Counties in Indiana, flowing south toward Ohio and eventually converging in Franklin County; it is known for its steep gradient, falling at an average of six feet per mile (IDNR Outdoor Recreation, 2016).

Based on the 2011 NLCD, the land cover type with the most area in the Whitewater-East Fork White SA is agricultural land use (64.1%), followed by forest and scrub/shrub (25.3%), developed and impervious land use (8.64%), and wetlands and open water (0.89%) (Homer, et al., 2015). Per the NWI, woody wetlands are the prominent wetland type covering approximately 2.69% of the SA, while emergent herbaceous wetlands cover 0.26%.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Whitewater-East Fork White SA have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Whitewater-East Fork White SA from 2009 – 2015 was collected and analyzed **(Table 82)**. According to the data, 32.4 acres of impacted wetlands and 21,342 linear feet of impacted streams required mitigation in the seven year time period. Locations of the permitted stream and wetland impacts are provided in **Figure 96**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	546	2.56%	0.373	1.15%
Development	5,024	23.54%	7.025	21.68%
Energy Production	0	0.00%	0	0.00%
Transportation	15,772	73.90%	25.001	77.17%
Grand Total	**21,342**	**100.00%**	**32.399**	**100.00%**

Table 82. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015

Source: USACE Louisville District

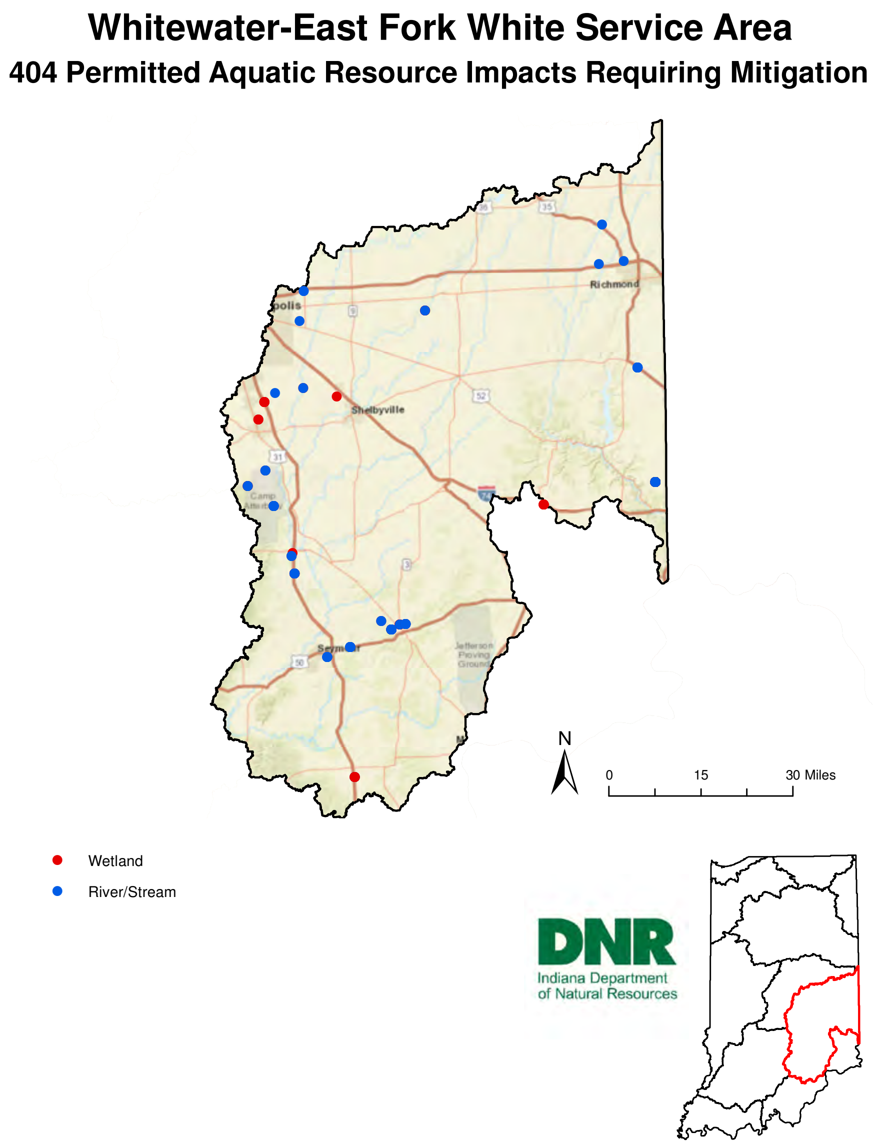


Figure 96. 404 permitted stream and wetland impacts requiring mitigation 20019- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Whitewater-EF White SA is presented in **Figure 97,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

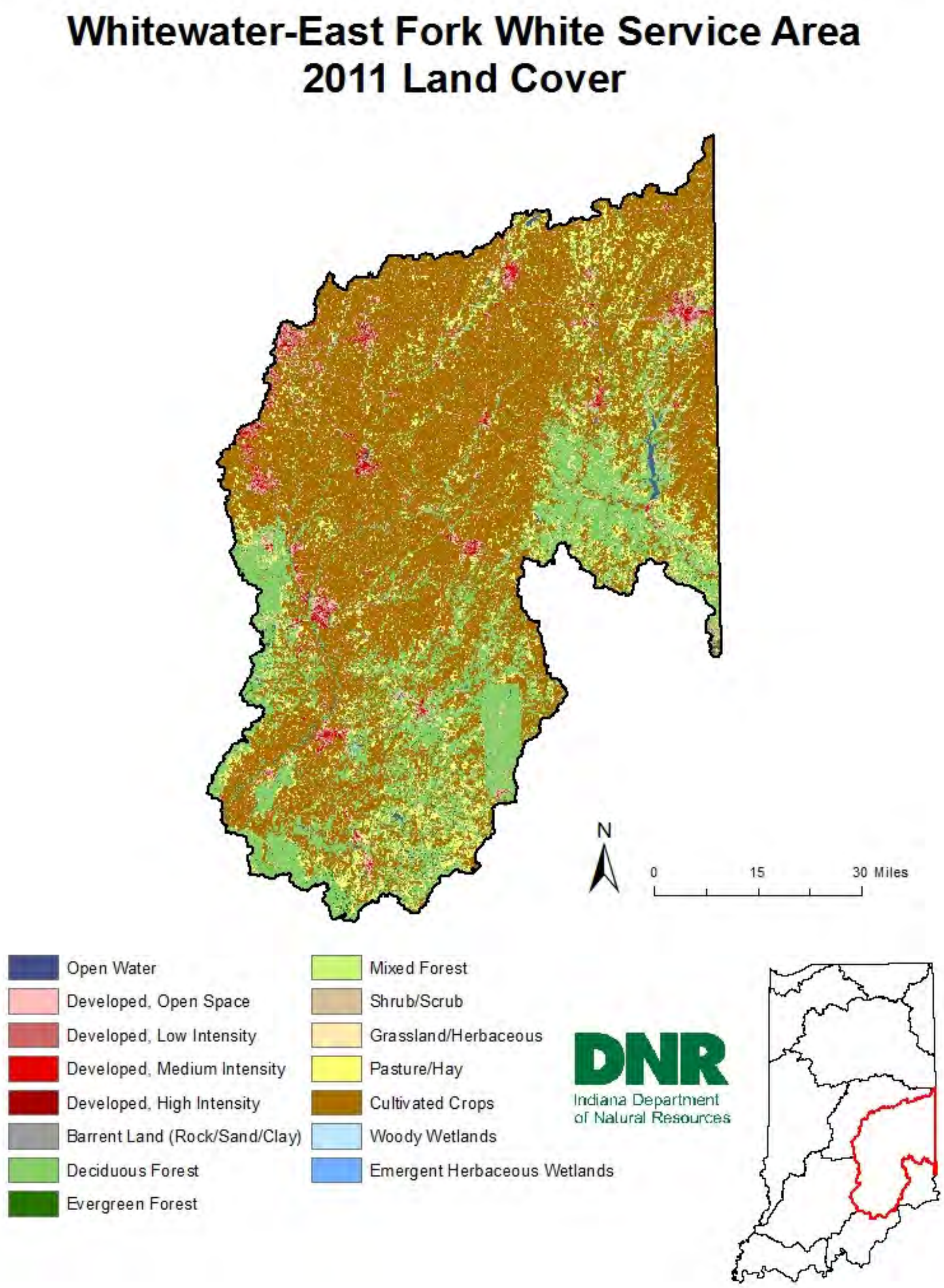


Figure 97. Land cover within the Upper Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses identified within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 83)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	24,345	0.74%
Developed	Open Space	186,649	5.68%
Developed	Low Intensity	65,317	1.99%
Developed	Medium Intensity	23,395	0.71%
Developed	High Intensity	8,528	0.26%
Barren Land (Rock/Sand Clay)	*	1,140	0.03%
Forest	Deciduous	813,990	24.75%
Forest	Evergreen	11,422	0.35%
Forest	Mixed	1,327	0.04%
Shrub/Scrub	*	5,364	0.16%
Grassland/Herbaceous	*	35,064	1.07%
Pasture/Hay (Agriculture)	*	233,470	7.10%
Cultivated Crops (Agriculture)	*	1,873,985	56.98%
Wetlands	Woody	2,680	0.08%
Wetlands	Emergent Herbaceous	2,197	0.07%
Grand Total		**3,288,871**	**100.00%**

Table 83. Whitewater-EF White SA land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 97** below to demonstrate the current overall land cover distribution of the SA.

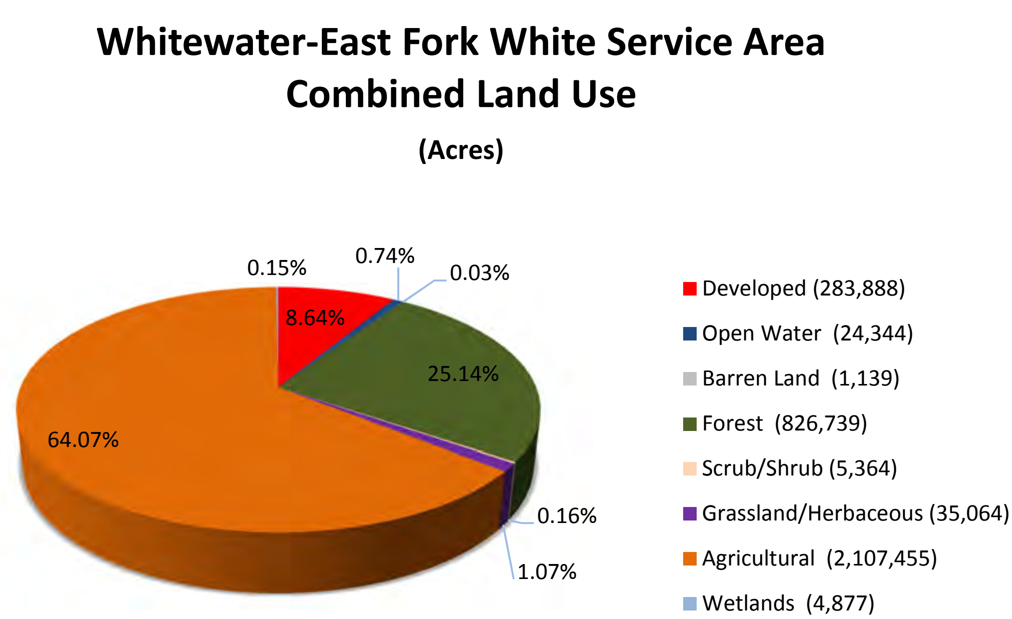


Figure 97. Combined land uses within the Whitewater-East Fork White Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Whitewater-East Fork White SA. Total agricultural land use covers approximately 64% of the SA's total land area of 2,107,455 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of few developed areas.

Within the identified land use areas, cultivated crops cover 1,873,985 acres (56.98%) and pasture/hay lands cover 233,469 acres (7.1%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop when based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Upper Wabash SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the Whitewater East Fork-White SA. Both pig and chicken farming have active confined feeding operations (CFOs) that have a minimum of 5,000 animal units. These CFOs are considered the predominant livestock industry in the SA (Thompson, 2008). When combining these major agricultural land use activities, the Whitewater East Fork-White SA ranks third in percentage of total statewide land use (9.11%), and it's a significant land use within the SA.

2.4 Growth and Development

Developed impervious land use is the third largest land use after forested, covering 283,889 acres (8.6%) of the 3,288,871 total acres which places it tied for the seventh for developed area based upon percentage across SA's. In addition to the areas adjacent to Indianapolis, the majority of developed areas are communities along the interstates of I-70, I-74 and I-65. These areas with densely developed footprints include the communities of Greenfield, New Castle, Richmond, Connersville, Franklin, Columbus, Greensburg, Shelbyville, Seymour and Lawrenceburg.

The SA contains portions of the Indianapolis-Carmel-Anderson, Columbus, Cincinnati and Louisville-Jefferson County MSA's, all of which experienced growth in the previous decade (Manns, 2013). Approximately 22% (607,621 acres) of the Indianapolis-Carmel-Anderson MSA is located within the SA, consisting of portions of Madison, Hancock, Marion, Johnson and Brown counties, and the entirety of Shelby County, accounting for approximately 18.5% of the total SA acres.

Approximately 16.5% (180,250 acres) of the Louisville-Jefferson County MSA within Indiana is located within the SA which includes portions of Scott, Washington and Clark Counties and accounts for approximately 5.5% of the total SA acres. Approximately 138,577 acres of the Cincinnati MSA, which includes all of Union County and 17% of Dearborn County, are within the SA accounting for 4.2% of the SA with the remainder of the MSA located in Ohio and Kentucky. Analysis of the INDOT cities and towns GIS data shows the Whitewater-EF White SA contains entirely or in part 324 cities and/or towns, 74 of which are incorporated (INDOT, 2016).

Five Indiana regional councils that overlap with the SA include the Southeastern Indiana Regional Planning Commission (SIRPC) (38%), the Eastern Indiana Regional Planning Commission (EIRPC) (25%), the East Central Indiana Regional Planning District (ECIRPD) (6%), the River Hills Economic Development District and Regional Planning Commission (5%), and the Madison County Council of Governments (.13%) (IARC, 2017).

According to the SIRPC 2015 CEDS, manufacturing and government institutions are the largest employers throughout the region, as well as significant employment in health care and the retail/wholesale trade. The current top commercial and industrial concentrations in the region include advanced materials, agribusiness, food processing and technology, chemicals and chemical based production, glass and ceramics, forest and wood products, mining, and fabricated metal product manufacturing in addition to transportation and logistics support. Emerging industries in the region include apparel and textiles, biomedical/biotech, energy (fossil and renewable fuels), information technology and telecommunications, and electrical equipment, appliance and component manufacturing (SIRPC, 2015).

Additionally, analysis of INDOT’s local roads GIS data (INDOT Road Inventory Section, 2016) shows there are approximately 11,786 miles of municipal and county roads contributing to the developed impervious land cover within the SA. The Whitewater-EF White SA ranks eighth among SA’s in local road miles to square mile of SA at approximately 2.29 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

Whitewater-East Fork White SA contains approximately 2,701 miles of U.S. Interstates and highways, 2,304 miles of state highways, and 11,786 miles of local roads within its boundary (INDOT Road Inventory Section, 2016). Although this is the third largest SA, the concentration of the various road types per square mile of land have similar rankings throughout.

U.S. Interstates and highways have a concentration of approximately 0.53 mile per square mile which ranks fifth among the eleven SAs making this the highest ranking road type within the SA. Although the concentration of U.S. Interstates and highways has the highest rank in the SA, the concentration of the other road types have identical rankings, which fall in the lower spectrum of the rankings. The concentration of state highways is approximately 0.45 mile per square mile and local roads is approximately 2.29 miles per square mile, which ranks them both at eighth. Similarly, the combined ranking of the concentration for all roadways, ranks eighth, with a concentration of 3.27 miles per square mile.

Although the concentration of U.S. Interstates and highways rank near the middle, closer analysis reveals the concentration of the various road types rank eighth, putting them near the bottom when compared to all other SAs. The construction and maintenance of roads and bridges throughout the

Whitewater-East Fork White SA support the primary mode of transportation and play an integral role in sustaining business and commerce for the region.

2.5.2 Railroads

As an alternative mode of transportation, the Whitewater-East Fork White SA has approximately 852 miles of railroad within the SA boundary which is the tenth largest concentration of railroads with a density of 0.17 mile per square mile (Federal Railroad Administration, 2002). Although active railroads rank near the bottom, they provide an important means of transportation for freight and passengers throughout the SA and state. The concentration of linear infrastructure throughout the SA has resulted in the loss of aquatic resource functions and services due to habitat conversion, disruption to fluvial processes, resource degradation, fragmentation, and loss associated with their construction and maintenance.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Whitewater-East Fork White SA contains service corridors that result in aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 2,310 miles of service corridors within its boundary.

The Whitewater-East Fork White SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately five (12 kV) lines, sixty-three (34.5 kV) lines, 297 (69 kV) lines, 121 (138 kV) lines, fifty-five (230 kV) lines, fifty-six (345 kV) lines, and eleven (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 2,035 miles throughout the SA, which is the sixth highest concentration of electric transmission lines relative to the SA size, with 0.4 mile of transmission line per square mile.

In addition to electric transmission lines, the Whitewater-East Fork White SA contains over 275 miles of pipelines in total. It contains over 79 miles of pipelines that convey crude oil, 79 miles of pipelines that transport natural gas, and 117 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Whitewater-East Fork White SA contains the eighth greatest concentration of crude oil pipelines, eleventh greatest concentration of natural gas and the ninth greatest concentration of refined petroleum products pipelines. While the Whitewater-East Fork White SA is third largest SA, it ranks near the bottom for the concentration of miles of these types of pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 34 known low head dams (IDNR DOW, 2016) within the SA, the most among all SAs and the fourth highest concentration at one low head dam per 151 square miles. There are currently 192 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 27 square miles, the third highest concentration of all SAs which accounts for 22% of all documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 591,360 linear feet (112 miles) of NLE's mapped within the SA averaging one mile of NLE per 46 square miles, the seventh highest concentration among all SA's. Approximately 56 miles of the NLE's are located within predominantly developed areas, with the remaining 56 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Whitewater-East Fork White SA contains active gas fields and associated wells that support, or have supported, the petroleum industry. The Indiana Geological Survey (IGS) identifies 25 petroleum gas fields with 1,428 associated gas wells and one oil & gas field within the SA ranking the Whitewater-East Fork White SA fourth statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The Whitewater-East Fork White SA also contains a series of wells that are supplemental or associated with petroleum industry that are identified within the IGS statewide well dataset. The IGS petroleum well data identifies 2,045 abandoned gas wells, 12 abandoned oil wells, 27 abandoned gas storage wells, 625 dry wells, 67 stratigraphic wells, 34 as storage wells, two temporarily abandoned wells, and one non-potable water supply wells within the SA (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The Whitewater-East Fork White SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains 15 sand & gravel mining operations, three dimension limestone operations and 14 crushed stone operations (Indiana Geological Survey, 2016). The Whitewater-East Fork White SA aggregate and mineral mining sites ranks the SA fifth in the state with 32 active operations.

2.7.3 Coal

The Whitewater-East Fork White SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Whitewater-EF White SA contains both the Indiana SWAP Corn Belt Planning Region (63.5%) as well as the Drift Plans Planning Region (36.5%). The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions have experienced loss in the majority of habitat types over the last decade, mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses with the agricultural and developed impervious footprints make up approximately 73% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects transportation and service corridors, as well as development projects, to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

According to the 2015 SIRPC CEDS, projected growth centers within the SIRPC area include the major highways such as the I-74 business corridor between Cincinnati and Indianapolis, US 50 east of North Vernon and US 62 east and west of Madison in Jefferson County. The Ohio River is expected to remain a significant component of the region as it provides transportation for commerce, creating accessibility and development in the area. Only ten cities within the SIRPC meet the U.S. Census Bureau urban community criteria (population greater than 2,500): Aurora, Batesville, Brookville, Greendale, Greensburg, Hanover, Lawrenceburg, Madison, Norther Vernon and Shelbyville. These cities are most likely to remain the growth centers within the region. This region is projected to see continued moderate population growth over the next 15 years with Dearborn County growing the most (SIRPC, 2015).

Though the number of farms and farmers in the region is in decline, agriculture remains as a significant contributor to employment and the tax base. In addition, the agricultural sector is critical for ethanol, soy diesel, food products and feed materials in this region (SIRPC, 2015).

This region has identified the need for more shovel-ready industrial sites to support economic growth and diversification. To support and attract growth, the region must develop the necessary infrastructure which will need to include residential housing, water storage and distribution, improvements and expansion of sewer systems, and improvement of transportation systems (SIRPC, 2015).

The EIRPC is a relatively new regional planning district that is in the process of developing a strategic plan to guide the organization with its economic development efforts.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Whitewater East Fork White SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Whitewater-East Fork White SA historic aquatic resources were predominantly comprised of the deciduous hardwood forest that covered the majority of central and southern portions of the state. In addition, the SA contains the Whitewater River and its tributaries within its eastern portion and the southern portion contains the East Fork of the White River, its headwaters, and the Muscatatuck River and its tributaries near the southern boundary. The region's aquatic and natural communities were permanently altered by major land-use changes by early European settlement.

The influence early European settlers had on the state's landscape and aquatic resources was driven by the consumption of natural resources and converting land for agriculture. The Whitewater-East Fork White SA experienced these same pressures. In the 1800s, the region's forests were cleared for timber and the fertile soil they stood upon while poorly drained areas were eventually tiled in order to cultivate the land for agricultural production (Clifty Creek Watershed Project, 2008). During this time period, early settlement was located on lands along the Whitewater River because it furnished water power for the abundant linseed oil, flax, grist, and saw mills (Friends of the Middle Fork Watershed Steering Committee and Wayne County Soil and Water Conservation District, 2005). All of the major rivers and streams within the SA were affected by the same types of impacts.

The southern portion of the SA experienced similar impacts that resulted in aquatic resource loss. During the mid-1800s, as the state was settled by Europeans, land along the Muscatatuck River was cleared for farming. Between 1830s and 1870s, early settlers established subsistence farming that was reliant upon corn, hogs and wildlife on land that is now the Muscatatuck National Wildlife Refuge; however, extensive deforestation from expanding farms and poor farming practices between 1880 and 1900 resulted in the ditching and channelization of Mutton and Storm Creeks in order to create additional farmland (U.S. Fish and Wildlife Service, 2009). Many of the aquatic resources were degraded and lost by similar practices throughout the SA.

Transportation played an important role in facilitating growth and development, resulting in aquatic resource loss, throughout the SA. Hagerstown provided the northern terminus of the Whitewater Canal which was constructed in 1836 providing transportation near the Ohio River for the regions commodities (West Fork Watershed Steering Committee and Wayne County Soil and Water Conservation District, 2011). In addition, the development of Michigan Road, a major north-south roadway, resulted in direct impacts to aquatic resources and natural communities within the SA. Michigan Road was commissioned in 1826, cutting through the regions dense forests, provided a connection from Madison, located on the Ohio River, extending through Indianapolis and ultimately ending at Michigan City on Lake Michigan (Historic Michigan Road Association, 2017).

The northern region of the SA was effected by the construction of a major east-west roadway, the National Road. In the 1830s, the National Road opened traffic from the eastern seaboard to the western interior, extending through Richmond before extending west towards Indianapolis (The Indiana National Road Association, 1997). Its construction and completion accelerated the influx of immigrants to the region, increasing growth of the Richmond area. Laborers were compensated for cutting trees, grading and hauling stone, sections of the road were planked with wood from the region, and used to construct the Whitewater River Bridge in 1834 (The Indiana National Road Association, 1997).

In addition, growth of the Richmond area was also influenced by the introduction of railroads within the region. During the mid-1800s, the Richmond and Miami Railroad incorporated and the region began to receive railroad service (City of Richmond Indiana , 2006). Each of these transportation routes provide early examples of the linear fragmentation and geomorphic alterations of the region’s hydrologic processes which resulted in permanent aquatic resource degradation.

Due to extensive aquatic resource loss within the Whitewater-East Fork White SA, the understanding of the region’s aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 98** depicts each Natural Region and Section located within the Whitewater-East Fork White SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana’s historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early

European settlement initiated their prolonged loss **(Table 84)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

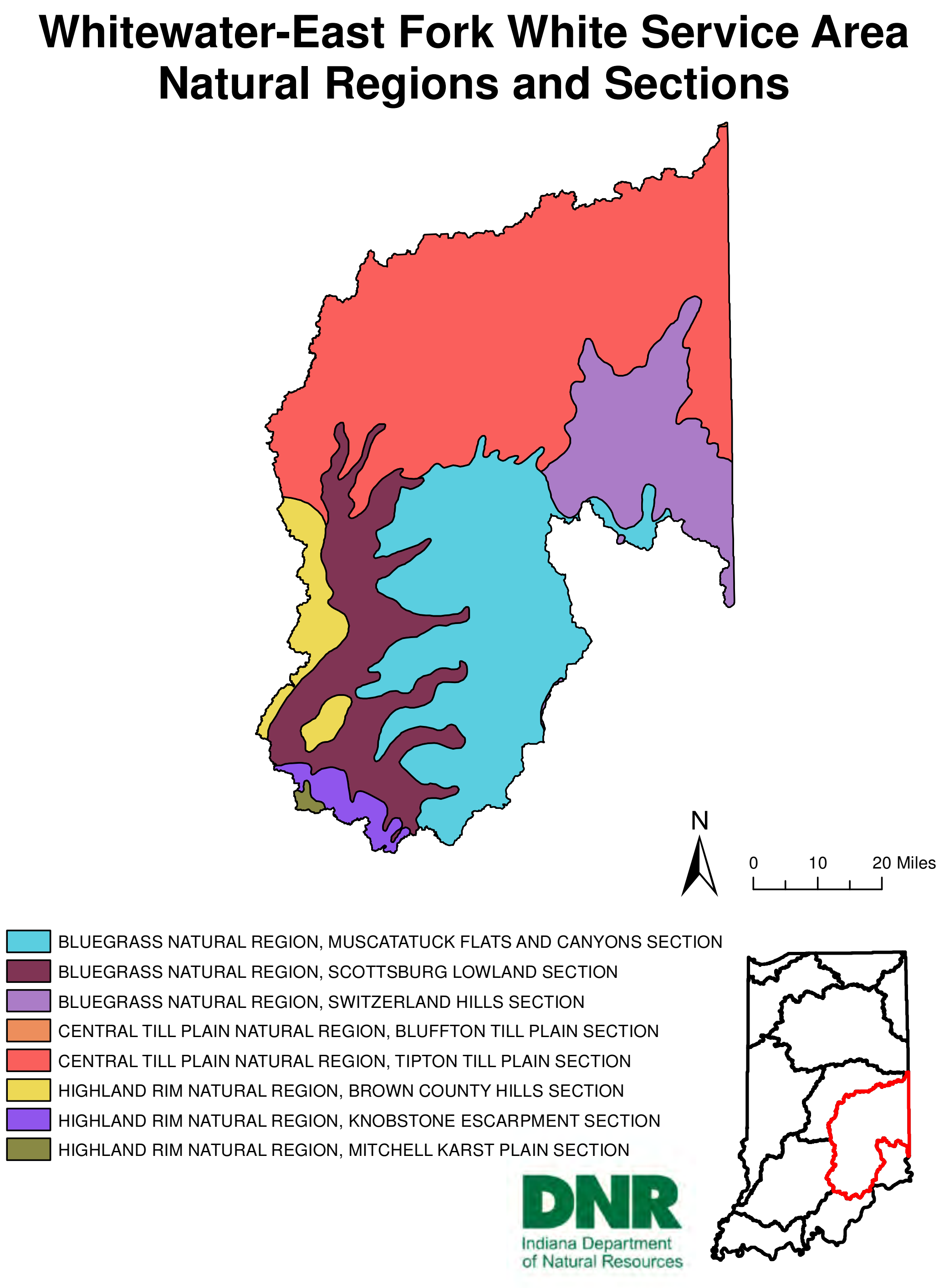


Figure 98. Natural regions and sections within the Whitewater-East Fork White service area (Homoya, Abrell, Aldrich, & Post, 1985)

<table>
<tr><th rowspan="2">Natural Region(s)</th><th colspan="2">Natural Region: Section(s)</th><th rowspan="2">Natural Region Community Types</th><th colspan="2">Hydric Soils</th><th colspan="2">Partially Hydric</th><th>Pre-Settlement % Forest Cover</th></tr>
<tr><th>Name</th><th>% Cover</th><th>Acres</th><th>% Cover</th><th>Acres</th><th>% Cover</th><th>% Forested</th></tr>
<tr><td rowspan="3">Highland Rim</td><td>Brown County Hills</td><td>3.69</td><td>Predominantly forested upland oak-hickory, mesic ravines;, acid seep spring (rare); medium to low-gradient streams</td><td rowspan="8">450,695</td><td rowspan="8">13.7</td><td rowspan="8">655,897</td><td rowspan="8">19.94</td><td rowspan="8">100.00</td></tr>
<tr><td>Mitchell Karst Plain</td><td>0.24</td><td>Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)</td></tr>
<tr><td>Knobstone Escarpment</td><td>1.83</td><td>Predominantly various forest communities, glades (rare); small, and ephemeral high-gradient streams</td></tr>
<tr><td rowspan="2">Central Till Plain</td><td>Bluffton Till Plain</td><td>0.01</td><td>Predominantly forested, minor areas of bog, prairie, fen, marsh and lake communities</td></tr>
<tr><td>Tipton Till Plain</td><td>43.75</td><td>Extensive beech-maple-oak forest, northern flatwoods; bog, prairie, marsh, seep spring, and pond</td></tr>
<tr><td rowspan="3">Bluegrass</td><td>Switzerland Hills</td><td>12.05</td><td>Predominantly forested (mixed mesophytic), barrens (rare); rocky, gravel-bottomed, medium-gradient streams</td></tr>
<tr><td>Scottsburg Lowland</td><td>13.39</td><td>Predominantly floodplain forest and swamp; wetland, swamps, acid seep springs, pond; low-gradient, silty-bottomed streams and rivers</td></tr>
<tr><td>Muscatatuck Flats and Canyons</td><td>25.04</td><td>Predominantly mixed mesophytic forest, southern flatwoods, minor glade and karst; medium-gradient streams with beds of pavement-like limestone</td></tr>
</table>

Table 84. The historic natural community composition for the Whitewater-East Fork White Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1. Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 2,053 miles of category 4A impaired streams and 2,912 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (3,159 miles), impaired biotic communities (618 miles), dissolved oxygen (587 miles), PCBs in fish tissue (259 miles), nutrients (135 miles), total mercury in fish tissue (129 miles), pH (64 miles), and ammonia (14 miles) as current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 827 QHEI assessment reaches within the SA **(Table 85 and Figure 99)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 47.64% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	138	16.69
51-64	Habitat is partially supportive of a stream's aquatic life design	295	35.67
>64	Habitat is capable of supporting a balanced warm water community	394	47.64
	Total	827	100%

Table 85. IDEM Overall QHEI scores for Whitewater-EF White SA, 1991 – 2014 (IDEM OWQ, 2014)

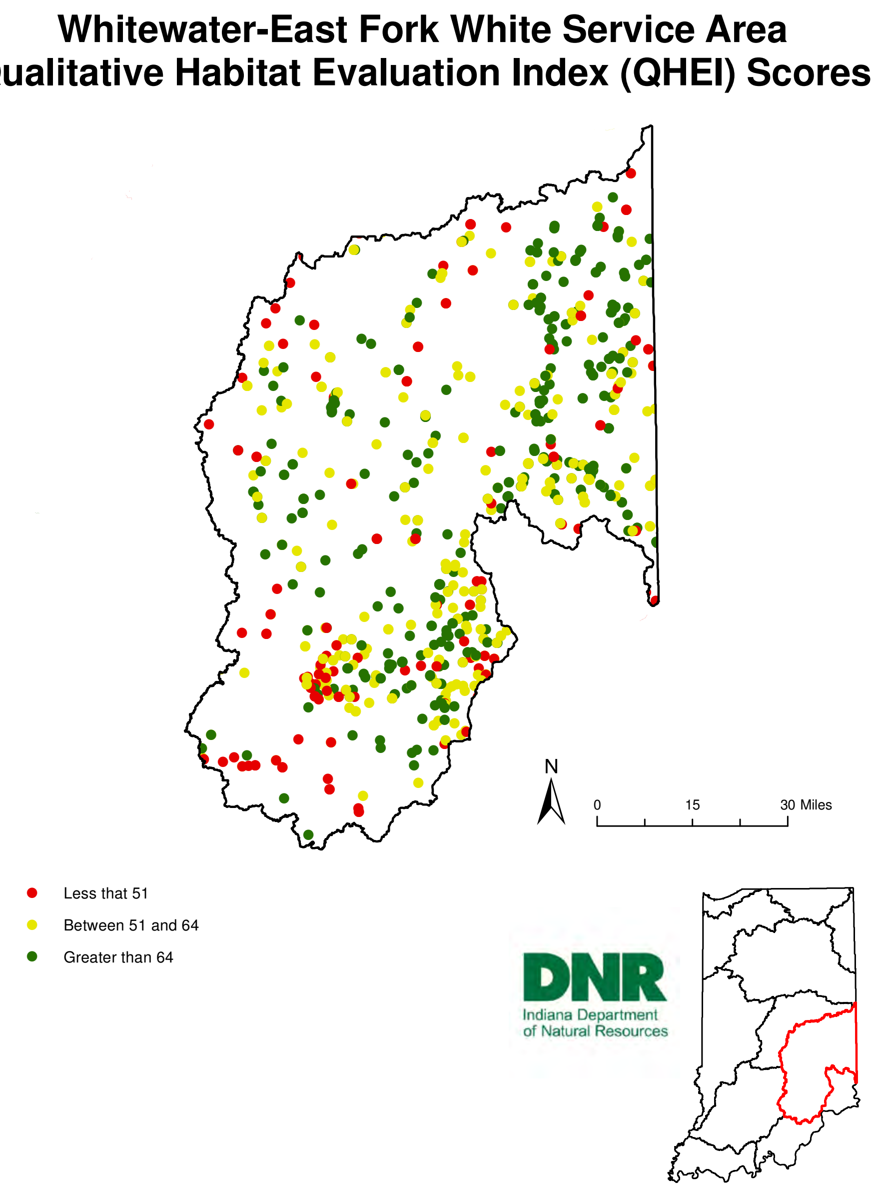


Figure 99. IDEM overall QHEI scores within the Whitewater-East Fork White service area; 1991-2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Whitewater-EF White SA ranks third overall in forested cover density of all SA's at 25% of total area with approximately 826,739 acres, and is the SA with the third highest percentage of forested cover with approximately 15.9% of 5,215,169 acres of forest cover statewide.

GIS analysis identifies approximately 11,818,126 linear feet (2,238 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Whitewater-EF White SA ranks fifth in ratio of these potentially restorable stream miles to square miles of SA at approximately 0.36 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.77 square miles of SA.

4.2 Wetlands

Analysis of the NWI in the Whitewater-EF White SA identifies approximately 5,288 acres of freshwater emergent wetland (PEM) and approximately 88,586 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.85% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 4.19% of the total SA **(Table 86 and Figure 100).**

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	5,288	3.84%	0.16%	0.02%
Freshwater Forested/Shrub Wetland	88,586	64.28%	2.69%	0.38%
Freshwater Pond	17,109	12.42%	0.52%	0.07%
Lake	13,042	9.46%	0.39%	0.06%
Riverine	13,779	10.00%	0.42%	0.06%
Grand Total	**137,804**	**100.00%**	**4.19%**	**0.59%**

Table 86. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils (NRCS-USDA, 2016) account for 840,113 acres (**Figure 101**), or 25.54% land cover within the SA with approximately 763,515 acres having the potential to be restored, accounting for 23.22% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g. cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Whitewater-EF White SA has the fifth highest percentage of recoverable wetland acres to total SA size of all SA's, and the 4th most potentially restorable wetland acres of any SA. This is due to the dominance of agricultural land uses and the SA size.

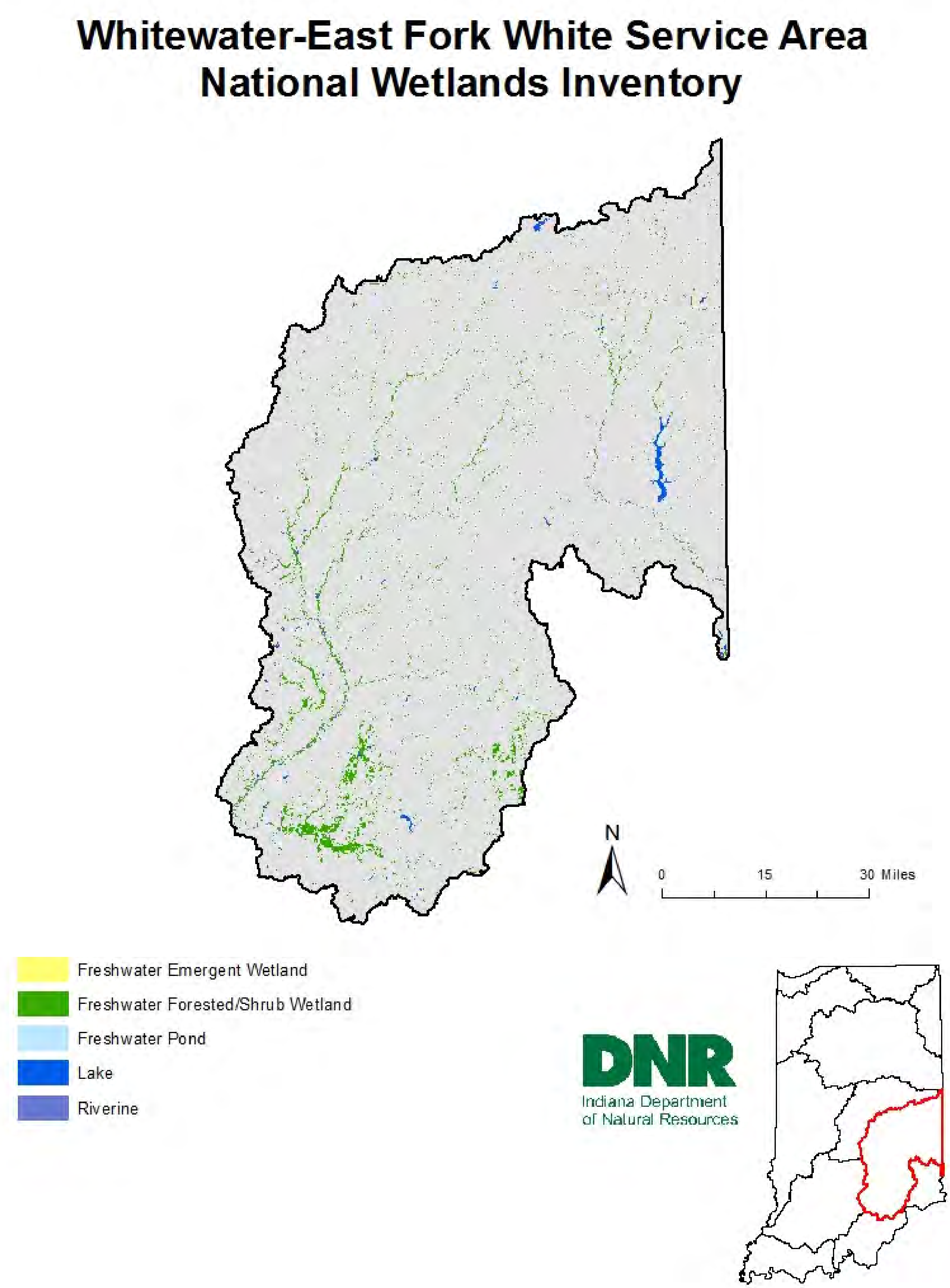


Figure 100. NWI for the Whitewater-East Fork White Service Area (USFWS NWI, 2015)

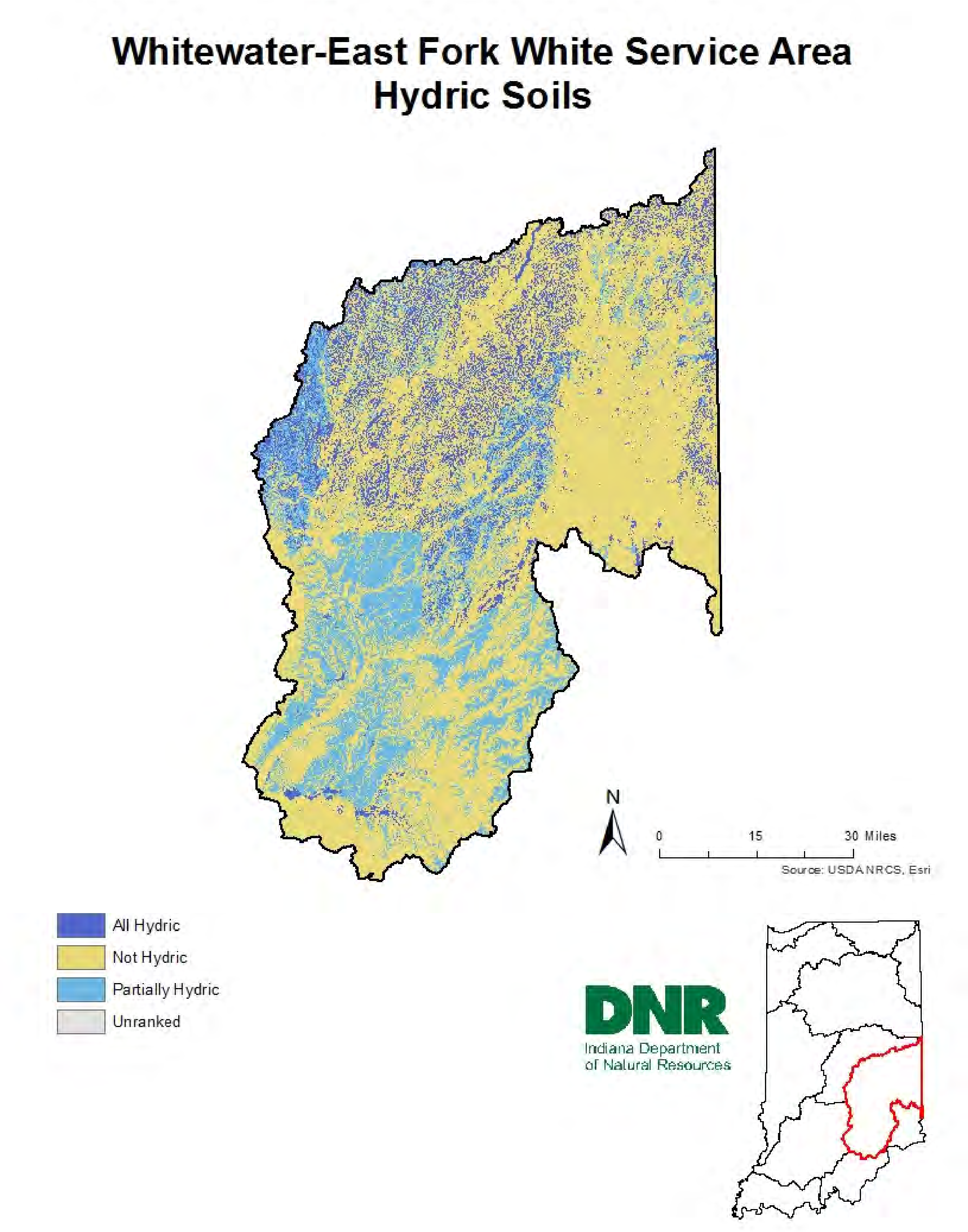


Figure 101. Hydric and partially hydric soils within the Whitewater-East Fork White service area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 490,743 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Clifty Creek (HUC 0512020601 **[Table 87]**).

Hotspots account for 3,954,720 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Clifty Creek (HUC 0512020601 **[Table 88]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 87 & 88)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 102** shows where these watersheds are located within the SA.

Approximately 3,714 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands. Atterbury Fish and Wildlife Area is the IDNR-managed land in the Whitewater-East Fork White SA with the most adjacent hotspots of potentially restorable wetlands (1,235 acres). Approximately 11,423 linear feet of hotspots of potentially restorable streams are adjacent to IDNR-managed lands. Austin Bottoms Conservation Area is the IDNR-managed land with the most hotspots of potentially restorable streams (8,046 linear feet).

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Wetlands (acres)
0512020601	Clifty Creek	55,624
0512020406	Youngs Creek	36,271
0512020603	Sand Creek	34,735
0512020506	Flatrock River	29,143
0512020407	Sugar Creek	25,519

Table 87. Watersheds in the Whitewater-East Fork White Service Area with the most hotspots of potentially restorable wetlands

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Streams (linear feet)
0512020601	Clifty Creek	356,928
0512020501	Shankatank Creek-Flatrock River	239,184
0512020301	Martindale Creek-Whitewater River	216,480
0508000407	Sugar Creek	215,952
0512020504	Mill Creek-Flatrock River	214,368

Table 88. Watersheds in the Whitewater-East Fork White Service Area with the most hotspots of potentially restorable streams

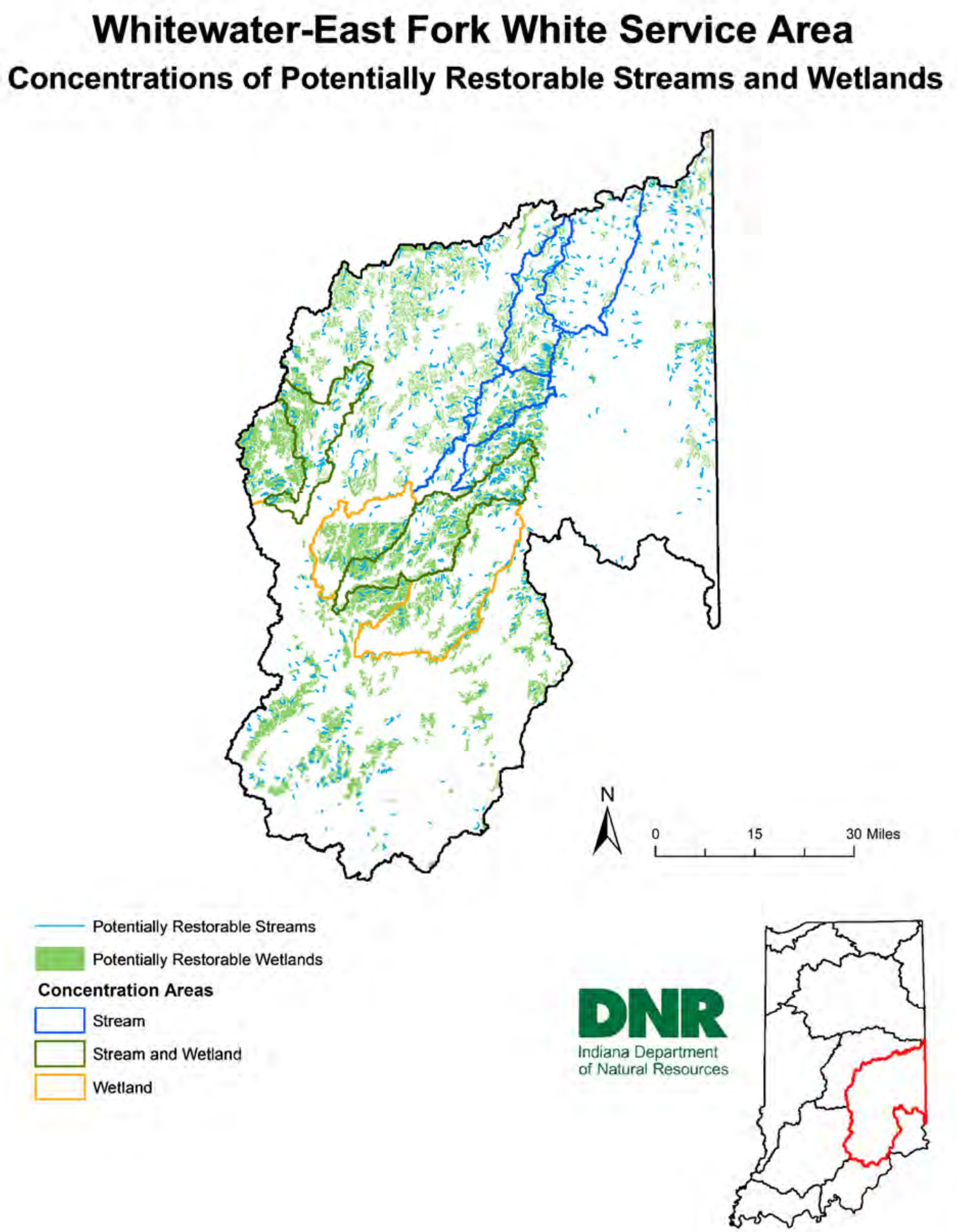


Figure 102. Concentrations of Potentially Restorable Streams and Wetlands in the Whitewater-East Fork White Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Whitewater-East Fork White SA indicates there are four lakes currently documented as having category 5 impairments, which measured using the National Hydrography Dataset (NHD) accounts for approximately 5,960 acres of PCBs in fish tissue and 194 acres with algae (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 24,345 acres of open water which accounts for 0.74% of the SA. This varies from the NWI, which identifies approximately 17,109 acres of freshwater pond comprising of 0.5% of the SA, and 13,042 acres of lake comprising of 0.4% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Whitewater-East Fork SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Whitewater-EF White SA identifies approximately 98% of the shallow unconsolidated aquifers receive between two to seven inches of ground water recharge annually **(Table 89).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0	0.00%
	13	0.01	0.0002%
	12	0.06	0.001%
	11	0.20	0.004%
	10	0.52	0.01%
	9	3.9	0.08%
	8	31	0.60%
	7	220	4.28%
	6	573	11.15%
	5	1,534	29.87%
	4	1,447	28.16%
Low	3	1,032	20.09%
	2	242	4.71%
	1	54	1.06%

Table 89. Approximate ground water recharge rates in the Whitewater-EF White SA (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that nearly 100% of the Whitewater-EF White SA near surface aquifers are in the low to high range for sensitivity to contamination with approximately 51% being moderate **(Table 90)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	1	0.03%
High	732	14%
Moderate	2,633	51%
Low	1,753	34%
Very Low	17	0.33%

Table 90. Ground water sensitivity distribution in the Whitewater-EF White SA (Letsinger S. , 2015)

Analysis of the DNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Whitewater-EF White SA ranks last among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 8,424 MGD **(Figure 103)** (IDNR DOW, 2016). Industrial uses account for approximately 56% of registered withdrawal capacity, followed by public water supply at 40%, with the other categories accounting for the remaining 4%.

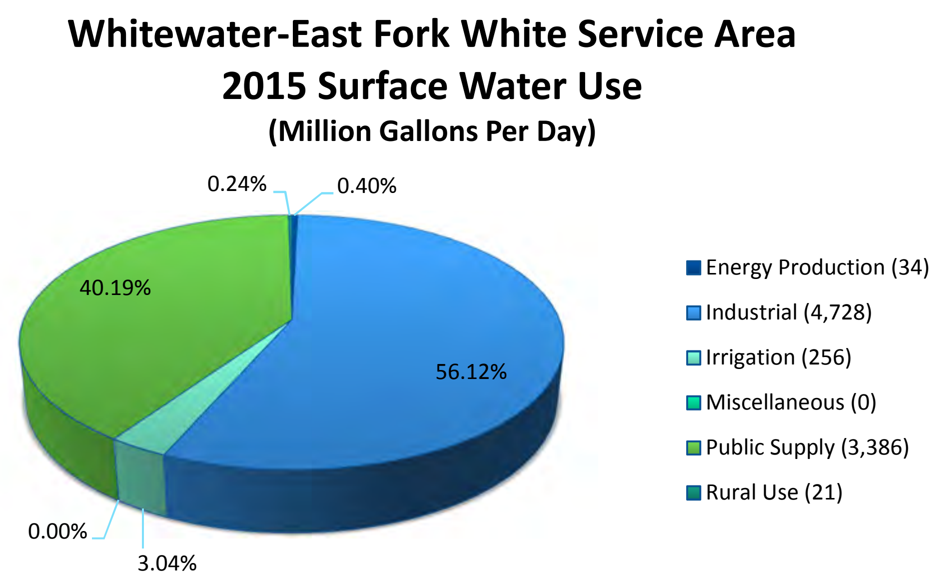


Figure 103. 2015 surface water usage in the Whitewater-East Fork White Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Whitewater-EF White SA is sixth among the SA's with a 19,746 MGD registered capacity **(Figure 104).** Public water supply accounts for approximately 80% of registered ground water withdrawal capacity in the SA, followed by agricultural irrigation with 16%, and the other categories accounting for the remaining 4%.

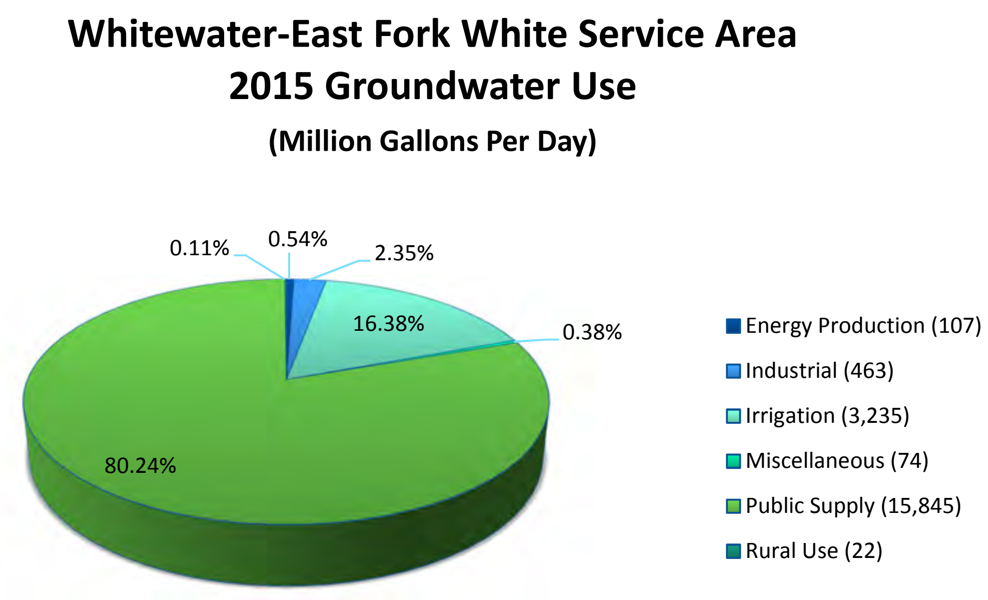


Figure 104. 2015 ground water usage in the Whitewater-East Fork White Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Whitewater-EF White SA include, but are not limited to acid seep, circumneutral seep, fen, and central till plain flatwoods, in addition to many other transitional, mixed and upland communities.

There are currently a minimum of seven amphibian species, 44 bird species, eight fish species, 17 mammal species, nine mollusk species, and 11 reptile species listed as SGCN within the SWAP Planning Regions within the Whitewater-EF White SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Whitewater-EF White SA. The following aquatic resource goals and objectives apply specifically to the Whitewater-EF White SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas.

1. Restoration, enhancement and preservation of aquatic resources that will help offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.

3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships) including the Healthy Rivers Initiative.
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt Plains and Interior Plateau Planning Regions where feasible.
7. Stream and wetland restoration projects to buffer and protect karst features and systems unique to areas in southern Indiana.

ELEMENT 6. PRIORITIZATION STRATEGY

The <u>four steps below</u> present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each service area. When prioritizing sites for mitigation projects, the following **<u>core criteria</u>** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Whitewater-East Fork White SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Brandywine Creek WMP, Central Muscatatuck WMP, Clifty Creek WMP, Conns Creek WMP, Flatrock-Haw WMP, Garrison Creek WMP, Lick Creek WMP, Little Blue River WMP, Middle Fork-East Fork Whitewater WMP, Mud Creek WMP, Sand Creek WMP, Sugar Creek WMP, and Youngs Creek WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Whitewater-EF White SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and critical habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Three Valley Conservation Trust, Whitewater Valley Land Trust, Inc., Oak Heritage Conservancy, Indiana Karst Conservancy, Red-tail Conservancy, Sycamore Land Trust, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Whitewater-EF White SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Kentucky Water Science Center
- USGS Illinois Water Science Center
- U.S. Fish & Wildlife Service Big Oaks National Wildlife Refuge
- U.S. Fish & Wildlife Service Muscatatuck National Wildlife Refuge
- U.S. Forest Service Hoosier National Forest
- Eastern Tallgrass Prairie and Big Rivers, and Appalachian Landscape Conservation Cooperatives
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Southeastern Indiana Regional Planning Commission (SIRPC)
- Eastern Indiana Regional Planning Commission
- River Hills Economic Development District and Regional Planning Commission
- Madison County Council of Governments

- Indiana Karst Conservancy
- Oak Heritage Conservancy
- The Ohio-Kentucky-Indiana Regional Council of Governments (OKI)

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 105** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

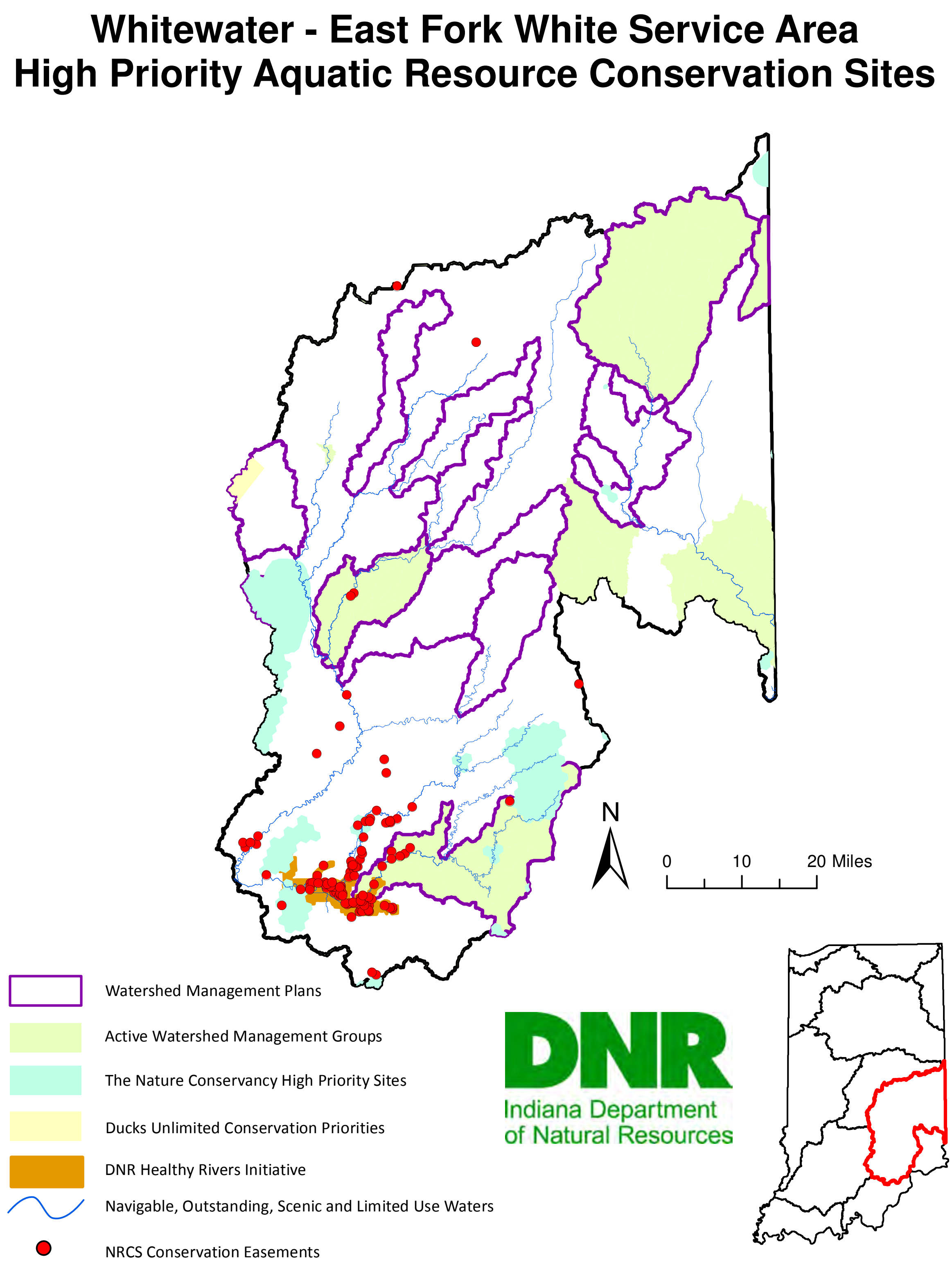


Figure 105. Priority aquatic resource conservation groups and sites within the Whitewater-East Fork White Service Area (IWPP, 2015)

APPENDIX B.9 LOWER WHITE SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Lower White Service Area (SA) is located in southeastern Indiana and is composed of the following three 8-digit HUC watersheds:

- 05120202 - Lower White
- 05120208 - Lower East Fork White
- 05120209 - Patoka

The Lower White SA includes all or portions of nineteen Indiana counties listed below and is located within the Southern Hills and Lowlands physiographic region.

Owen	Lawrence	Gibson
Sullivan	Knox	Pike
Greene	Daviess	Dubois
Monroe	Martin	Crawford
Brown	Washington	Warrick
Bartholomew	Orange	Spencer
Jackson		

Draining approximately 4,564 square miles of Indiana, the Lower White SA is located in both the Interior Plateau and Interior River Valleys and Hills ecoregions. The eastern half of the SA (Interior Plateau) is characterized by karst topography, containing a concentration of sinkhole areas as well as sinking stream basins in the south. The easternmost part of the Lower White SA is mostly forested and is distinguished by its narrow valleys and dissected high hills with silt loam soils. Moving west, sink holes and underground drainage dominate the area, especially within the Lower White Watershed, and the majority of soil here is leached; this area transitions to a more rugged, wooded area moving toward the western half of the SA (Interior River Valleys and Hills) (U.S. EPA: Ecoregions of Indiana).

The western half of the SA is characterized by lowlands formed in sedimentary rock, and till deposits which are common north of the White River. Valleys are widespread within the region, and some of the most distinguishing features are the historical and active mines in the southwest (U.S. EPA:

Ecoregions of Indiana). A number of large-scale wetland impacts have occurred near the surface mines in the Lower White SA bordering the Middle Wabash SA in addition to areas in the Patoka Watershed. Historically, a majority of mined land was abandoned without any restoration efforts; acid mine drainage degraded many aquatic systems in the past due to low pH to the point where the areas were devoid of local flora and fauna. The passing of the Surface Mining Control and Reclamation Act (SMCRA) by the United States government in 1977 has set strict reclamation rules for mining operations; the once degraded aquatic systems are now better able to support aquatic life with their improved water quality (Lower Patoka River WMP, 2008).

The Lower White SA contains many of Indiana's well-known aquatic systems including the White River (both the East Fork and West Fork), Monroe Lake, and the Patoka River. The East Fork of the White River enters the Lower White SA on the border of Washington and Jackson counties; both the East and West Forks of the White River travel southwest until their convergence at the Knox, Daviess, and Pike County borders; the White River joins with the Wabash River at the Indiana/Illinois border which eventually confluences with the Ohio River. Originating in the Hoosier National Forest, the Patoka River travels 138 miles westward and passes through one of Indiana's flood control reservoirs, Patoka Lake; the river confluences with the Wabash River in Gibson County. Formed from the forks of Salt Creek, Monroe Lake is Indiana's largest freshwater lake and is also one of Indiana's flood control reservoirs (USACE Louisville District, 2013).

Based on the 2011 NLCD, the land cover type with the most area in the Lower White SA is forest and scrub/shrub (48.3%), followed by agricultural land use (40.9%), developed and impervious land use (6%), and wetlands and open water (2.12%) (Homer, et al., 2015). Per the NWI, which accounts for more wetlands than does the 2011 NLCD, woody wetlands are the prominent wetland type covering approximately 2.42% of the SA, while emergent herbaceous wetlands cover 0.33%.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Lower White SA have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Lower White SA from 2009 – 2015 was collected and analyzed **(Table 91)**. According to the data, 271.5 acres of impacted wetlands and 946,429 linear feet of impacted streams required mitigation in the seven year time period. Locations of the permitted stream and wetland impacts are provided in **Figure 106**.

The energy production and mining work type account for the most stream impacts (76.8%), followed by transportation and service corridors (21.4%), development (0.79%), agricultural activities (0.67%), and dam and levee related activities (0.26%).

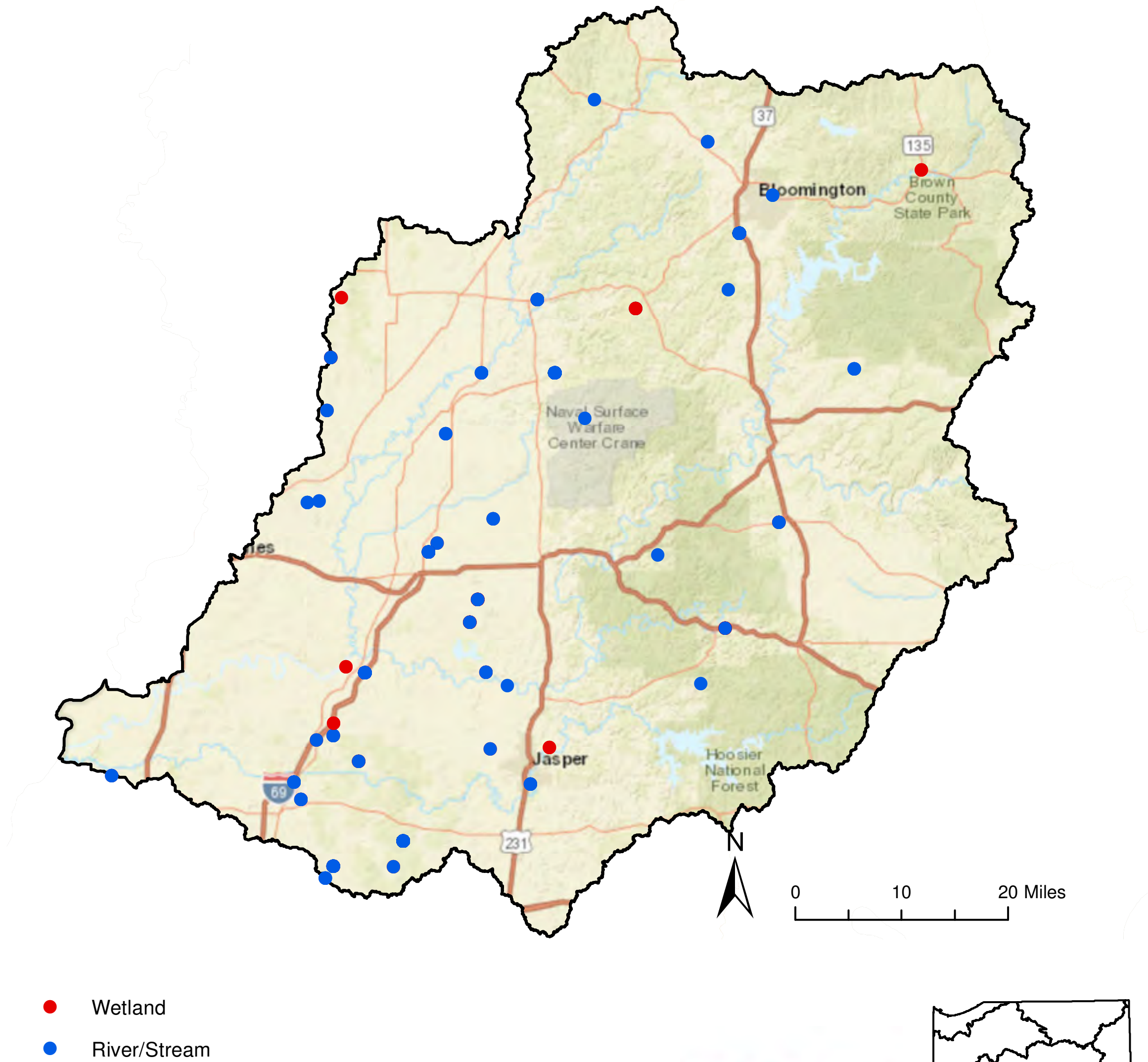
Energy production and mining accounted for the most wetland impacts (81.3%), followed by transportation (15.7%), agricultural activities (2.05%), development (0.78%), and dam and levee related activities (0.13%).

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts – Acres	Percent of Wetland Impact per Category
Agriculture	6,385	0.67%	5.556	2.05%
Dam	2,437	0.26%	0.345	0.13%
Development	7,516	0.79%	2.124	0.78%
Energy Production	727,212	76.84%	220.735	81.30%
Transportation	202,879.12	21.44%	42.739	15.74%
Grand Total	**946,429.12**	**100.00%**	**271.499**	**100.00%**

Table 91. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville District.

Lower White Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation



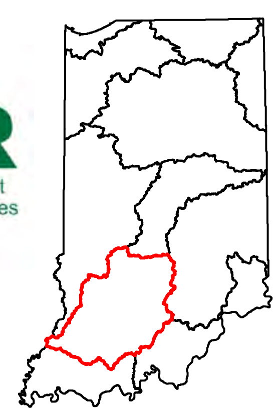


Figure 106. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Lower White SA is presented in **Figure 107,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

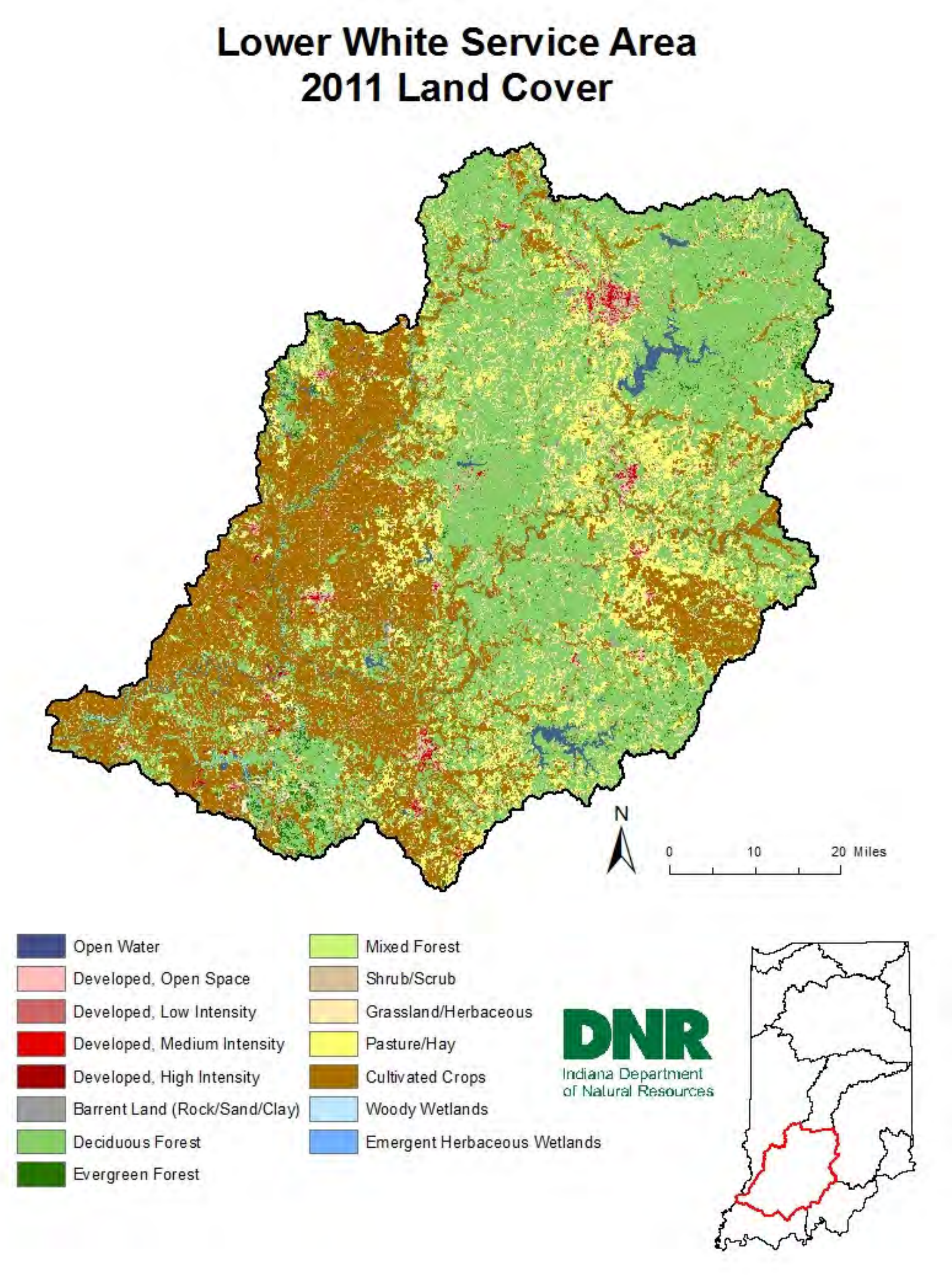


Figure 107. Land cover within the Upper Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 92)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	53,096	1.82%
Developed	Open Space	135,010	4.62%
Developed	Low Intensity	24,643	0.84%
Developed	Medium Intensity	10,125	0.35%
Developed	High Intensity	4,520	0.15%
Barren Land (Rock/Sand Clay)	*	5,343	0.18%
Forest	Deciduous	1,372,249	46.98%
Forest	Evergreen	28,254	0.97%
Forest	Mixed	766	0.03%
Shrub/Scrub	*	9,471	0.32%
Grassland/Herbaceous	*	74,704	6.19%
Pasture/Hay (Agriculture)	*	328,884	11.26%
Cultivated Crops (Agriculture)	*	865,360	29.62%
Wetlands	Woody	4,330	0.15%
Wetlands	Emergent Herbaceous	4,311	0.15%
Grand Total		**2,921,066**	**100.00%**

Table 92. Lower White SA land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 108** below to demonstrate the current overall land cover distribution of the SA.

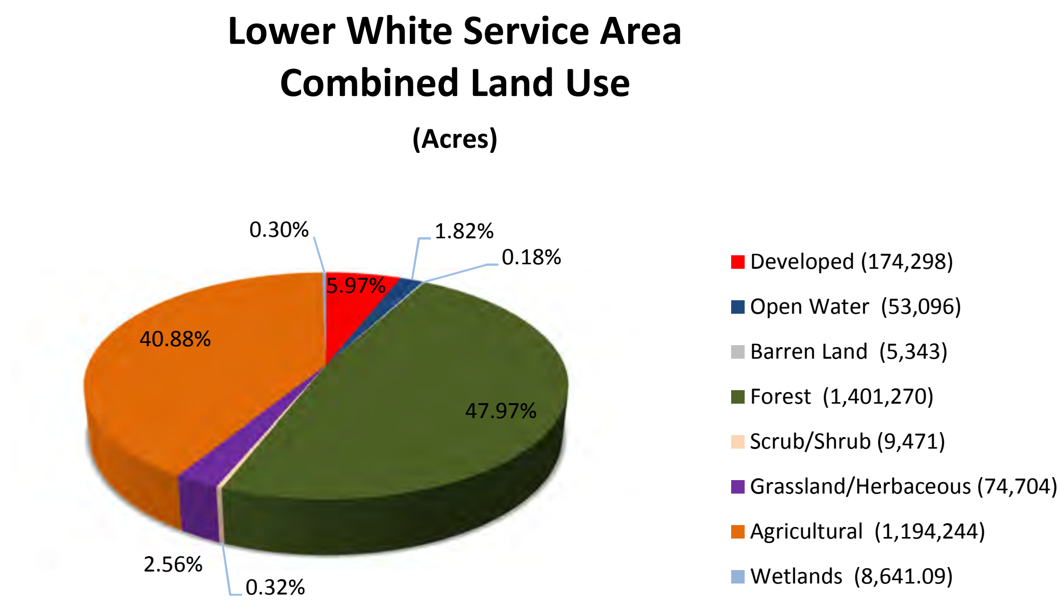


Figure 108. Combined land uses within the Lower White Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest anthropogenic land use in the Lower White SA. Total agricultural land use covers approximately 41% of the SAs total land area of 1,194,244 acres (Homer, et al., 2015). Agricultural land uses are predominantly in the western portion of the SA.

Within the identified land use areas, cultivated crops cover over 865,365 acres (29.62%) and pasture/hay lands cover 328,884 acres (11.26%) of the SA (Homer, et al., 2015). Soybean production, followed closely by corn, is the primary cultivated crop based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Lower White SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. The Lower White SA contains a multitude of large farming operations. The SA contains active turkey, pig, and chicken confined feeding operations (CFOs) which have a minimum of 5,000 animal units including two top producing counties that surpass the 15,000 animal unit threshold. The Lower White SA boundary contains the top turkey producing CFOs within the state. Dubois County has combined turkey CFOs surpassing 28,000 animal units making it easily the largest in the state (Thompson, 2008). When combining these major agricultural land use activities, the Lower White SA ranks fifth of total statewide agricultural land use (5.16%) and it is the most significant anthropogenic land use within the SA.

2.4 Growth and Development

Developed impervious land is the third largest land use after forested cover and agricultural land uses covering 174,298 acres (6%) of the 2,921,066 total acres, having the least developed footprint density of all SAs. The Lower White SA is the most rural of all SAs with agricultural land use and forest combining for approximately 89% of total cover. Communities with densely developed footprints include Bloomington, Bedford, Washington, Linton and Jasper, amongst many other smaller communities scattered across the SA.

The SA contains portions of the Indianapolis-Carmel-Anderson, Columbus, Terre Haute, Bloomington, Louisville-Jefferson County and Evansville MSA's, all of which experienced growth in the previous decade (Manns, 2013). Approximately 76.5% (390,984 acres) of the Bloomington MSA is within the SA which contains portions of Monroe and Owen Counties accounting for 13.4% of total SA acres.

Approximately 6.8% (189,119 acres) of the Indianapolis-Carmel-Anderson MSA is within the SA which contains the majority of Brown County and accounts for approximately 6.5% of total SA acres, though having less developed land cover than the remainder of this MSA to the north. The Terre Haute, Columbus and Evansville MSA's have small portions of them within this SA contributing minimally to the growth and development threat and combined only account for 0.9% (25,689 acres) of total SA acres.

Analysis of the INDOT cities and towns GIS data shows the Lower White SA contains all or part of 275 cities and/or towns, 48 of which are incorporated (INDOT, 2016).

Five Indiana regional councils that overlap the SA include the Southern Indiana Development Commission (44%), the Indiana 15 Regional Planning Commission (26%), the Economic Development Coalition of Southwest Indiana (4%), the River Hills Economic Development District & Regional Planning Commission (3%), and the West Central Indiana Economic Development District (1%) (IARC, 2017).

According to the SIDC 2015 CEDS, more workers commute out of this area for employment to the adjacent MSAs, though approximately 35% of workers in the region commute in from those same MSA's. Major industrial clusters are manufacturing, agri-business, food processing and technology, transportation and logistics, forest and wood products, chemical and chemical based products, biomedical and biotechnical, energy production and mining (fossil and renewable), defense and security, information technology and telecommunications, and glass and ceramics (SIDC, 2015).

According to the Indiana 15 Regional Planning Commission (2016), the leading industries in this region include forest and wood projects, agribusiness and food processing, manufacturing, mining, energy (fossil and renewable), apparel and textiles, chemicals and chemical based products, advanced materials, and transportation and logistics. Primary manufacturing clusters include primary metals, transportation equipment, fabricated metal products, and computer and electronics production. A primary goal for this region is to attract new, and maintain existing, industry and business through support, industrial site expansions, and improvement of infrastructure (Indiana15RPC, 2016).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 9,790 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Lower White SA ranks second to last among SAs in local road miles to square mile ratio at approximately 2.14 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Lower White SA contains approximately 1,189 miles of U.S. Interstates and highways, 2,232 miles of state highways, and 9.790 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although the Lower White SA is the fourth largest SA, the concentration of the various road types per square mile of land rank near the bottom.

U.S. Interstates and highways have a concentration of approximately 0.26 mile per square mile, which ties with the Ohio-Wabash Lowlands SA, ranking ninth among the eleven SAs. The concentration of state highways is approximately 0.49 mile per square mile, which ties with the St. Joseph River SA for the ranking of sixth, and is the highest ranking road type within the Lower White SA. The concentration of local roads is approximately 2.14 miles per square mile, which ranks tenth when compared to local roads rankings for the ten other SA. Similarly, the combined ranking of the concentration for all roadways, ranks at the bottom, with a concentration of 2.89 miles per square mile, which ranks eleventh overall.

2.5.2 Railroads

As an alternative mode of transportation, the Lower White SA has approximately 823 miles of railroad within the SA, which is the ninth largest concentration of railroads with a density of 0.18 mile per square mile (Federal Railroad Administration, 2002). Although active railroads rank near the bottom, they provide an important means of transportation for freight and passengers throughout the SA and state. The concentration of linear infrastructure throughout the SA contributes to aquatic resource threats that includes habitat fragmentation, disruption to fluvial processes, resource degradation, conversion and loss of aquatic resources.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Lower White SA contains service corridors that contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 3,024 miles of service corridors within its boundary.

The Lower White SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately thirty-eight (12 kV) lines, 117 (34.5 kV) lines, 205 (69 kV) lines, 104 (138 kV) lines, four (230 kV) lines, eighty-seven (345 kV) lines, and seven (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 1,444 miles throughout the SA, which is the third highest concentration of electric transmission lines relative to the SA size, with 0.53 mile of transmission line per square mile.

In addition to electric transmission lines, the Lower White SA contains over 1,580 miles of pipelines in total. It contains over 210 miles of pipelines that convey crude oil, 1,100 miles of pipelines that transport natural gas, and 270 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Lower White SA contains the third greatest concentration of crude oil pipelines, fourth greatest concentration of natural gas and the sixth greatest concentration of refined petroleum product pipelines. While the Lower White SA is the fourth largest SA, similarly it ranks fourth for the total combined concentration of miles of pipelines when compared to all SA.

2.6 Dams and Non-Levee Embankments

There are currently 16 known low head dams (IDNR DOW, 2016) within the SA, ranking fourth in total number of dams among all SAs, although the SA has the third least concentration at one low head dam per 285 square miles. There are currently 200 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 23 square miles, the highest concentration of all SA's, containing 23% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 1,320,000 linear feet (250 miles) of NLE's mapped within the SA, averaging one mile of NLE per 18 square miles, tied for third highest concentration among all SAs. Approximately 151 miles of the NLE's are located within predominantly developed areas, the remaining 99 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Coal

The Lower White SA contains historic and active coal mining operations within its boundary. Based upon the IDNR-Division of Reclamation (DOR) surface and underground coal mining dataset, coal mining operations were first recorded in 1848 and have effected over 210,000 acres (Gray, Ault, Keller, & Harper, Surface Coal Mines in Indiana, 2010); (Gray, Ault, Keller, & Harper, Underground Coal Mines in Indiana, 2010). Further analysis of surface and underground mining data, operation footprints and permitting history provides insight into coal mining lineage within the SA.

Mining operations, prior to the enactment of the SMRCA of 1977, were not required to implement post mining reclamation. The Lower White SA contained approximately 515 surface coal mines, approximately 57,924 acres, and 818 underground coal mines, approximately 36,844 acres of Pre-SMCRA coal mining operations. These Pre-SMCRA surface mining operations impacted 1.98% of the SA land cover, which ranks second of the three coal bearing SAs. Pre-SMRCA underground mining operations impacted 1.26% of the SA land cover, which ranks last.

Surface and underground mining operations that fall under regulation of the SMRCA of 1977 are prevalent throughout the SA. The IDNR-DOR has recorded over 699 surface coal mining operations, which total approximately 82,468 acres and over 77 underground mining operations that total approximately 33,016 acres throughout the Lower White SA. These surface mining operations impact over 2.82% of the SA land cover, which ranks it first among the three SAs with coal resources. Similarly, the concentration of underground mining operations ranks first, with 1.13% SA land cover concentration.

Cumulative impacts from coal mining operations have resulted in the alteration of the SA. The Lower White SA is the second largest SA that contains coal with approximately 2,921,056 acres and it has experienced extensive impacts as a result of these activites. Surface mining has resulted in impacts to approximately 140,392 acres, altering over 4.81% of the SAs land cover which ranks it second amongst the coal-mined SAs. Similarly, underground mining impacts have altered over 69,861 acres of the Lower White SA, which ranks last with a concentration of 2.39% of the SA land cover.

2.7.2 Natural Gas and Oil Production

The Lower White SA contains a multitude of active oil and gas fields along with associated wells that support, or have supported, the petroleum industry within its boundary. The Indiana Geological Survey (IGS) identifies 79 petroleum gas fields with 237 associated gas wells; 68 oil fields with 1,754 oil wells; and 60 oil & gas fields with 28 oil & gas wells within the SA ranking the Lower White SA second statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The Lower White SA, also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 442 abandoned gas wells, 3,505 abandoned oil wells, 25 abandoned oil & gas wells, 7,724 dry wells, 101 observation wells, 751 stratigraphic wells, 76 saltwater disposal wells, 108 abandon saltwater disposal wells, 159 temporarily abandoned wells, 10 potable water supply wells, 12 non-potable water supply wells, 408 water injection wells, 330 gas storage, 35 abandoned gas storage, 13 abandoned observation wells, 234 abandoned water injection, 332 abandoned oil and water injection, one gas and water injection well, one abandoned oil & gas and water injection well, and one potable water supply well within the SA (Indiana Geological Survey, 2015).

2.7.3 Mineral Mining and Aggregates

The Lower White SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the service area contains two sand & gravel mining operations, three clay and shale mining operations, 14 crushed stone operations, two dimensional sandstone quarry operations, 14 dimensional limestone quarries, and one gypsum mining operation (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one cement operation, which is an industry byproducts commodity that is used as aggregate (Indiana Geological Survey, 2016). In addition to the Lower White SA ranking fourth based on its size, mineral mining within its boundary ranks fourth in the state with 37 active operations.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats Anticipated Threats

The Lower White SA partially contains the Indiana SWAP Interior Plateau Planning Region (61.5%) as well as the Valleys and Hills Planning Region (38.5%). The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions have experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the developed impervious and agricultural footprints make up approximately 46.8% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects energy production and mining, specifically surface coal mining, to remain the foremost permitted activity requiring mitigation for aquatic resource impacts, followed by transportation and service corridors, and development projects if the 404 permitting trends of the past 7 years continue.

Abandoned mines will continue to negatively impact the chemical, physical and biological integrity of aquatic resources. Among the many impacts to aquatic resource functions and services in this SA, invasive species will also continue to thrive unless restoration and enhancement efforts are increased and ongoing long term management activities are conducted.

Forests cover approximately 48% of the SA, so conversions of forest (deforestation) and timber harvesting have the potential to impact aquatic resources, though modern selective timber harvesting practices have moderated the industries' threat to aquatic resources.

According to the SIDC 2015 CEDS, this region experienced a slight gain in population of approximately 0.4% from 2000 to 2013. The region's population is expected to remain relatively the same through 2040, though Daviess County is expected to grow up to 23.5%, where the remainder of the counties are expected to decline in population. Agricultural drainage issues are also a concern in rural communities resulting in the management of water flow, soil erosion and sediment transport, construction runoff, and aging and failing septic systems. Economic development goals for this region include improved and expanded transportation, storm and waste water improvements, and utility infrastructure to attract residential, industrial, and commercial development. Crane Naval Surface Warfare Center is another major employer of the region contributing to growth and development in both the defense and security, and government service sectors (SIDC, 2015).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to offsetting the predominant threats in the Lower White SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Lower White SA's historic aquatic resources were shaped by the drainages of the lower stretches of both the East and West Forks of the White River as they flow southwest to their confluence with the Wabash River. This includes the rugged topography and bedrock hills of unglaciated south-central Indiana with areas of karst topography. The western region of the SA transitions to the broad level plains of the Wabash River lowlands. The southern boundary of the SA contains the Patoka River as it flows west to its confluence with the Wabash River. The Lower White SA's historic aquatic resources were predominantly comprised of forested communities. The composition of the SA forests, wetlands and river and stream systems were shaped by these three river systems. However, the regions aquatic and natural communities were permanently altered by major land-use changes and conversions by early European settlement.

Agriculture within the Lower White SA has dominated the landscape and resulted in aquatic resource conversion and loss. The southwestern region of the SA is within close proximity to Vincennes, which is one of the earliest settlements within Indiana dating back to the 1700's. The proximity to this early settlement and the convergence of all of these rivers resulted in Europeans establishing settlements within the region. Agriculture has been the dominant land use in the region since early European settlement, which began by clearing forests for farming during the late 1700's, and over 150,000 acres in farmland by 1877 (Knox County Soil and Water Conservation District, 2007). Prior to the late eighteenth century establishment of towns such as Monroe City in 1856 and Wheatland in 1858, the watershed consisted of upland forests, lowland forests and an extensive amount of wetlands and ponds (Knox County Soil and Water Conservation District, 2007).

By the late 1800s, there was a push to increase farm lands resulting in further alterations to, and loss of, aquatic resources. Broad creek and river bottomlands were opened up to agriculture during the 1880s due to the dredging and channelization of streams in order to drain malarial swamps (Knox County Soil and Water Conservation District, 2007). Similar efforts to channelize streams and drain wetlands was a common practice throughout the SA. Within the northwestern portion of the SA, in southwestern Greene County, the Goose Pond area’s aquatic resources were altered by agriculture. Based on early surveys conducted around 1815, this area was comprised of marsh, prairie, forests and brushy ponds; however, the area experienced extensive ditching and draining for agriculture during the late 1800s (Indiana University-Purdue University Indianapolis, 2017).

The Lower White SA has an extensive history of surface and underground mining. Coal mining began in the early nineteenth century and underground mining became the predominant recovery method. Coal was first discovered in Pike County, located along the southern boundary of the Lower White SA, in 1860 and became a major industry to the area (Lower Patoka River WMP, 2008). The development of coal mines during this period became important to the establishment of settlements, towns and industries throughout the SA. The first underground coal mine established in Greene County in 1859, located near the northern boundary of the SA, and led to over 200 active mines within this county (Ksander, 2009). During the late 1800s, the Greene County region experienced an economic boom due to coal mining.

The relationship between transportation and coal became dependent on one another during this period. Trains required coal to power their engines and coal mines needed trains in order to transport the product to the national manufacturing market. In 1869, the Indianapolis and Vincennes Railroads established rail lines across Greene County, which accelerated mining throughout the region (Ksander, The Golden Age of Coal in Greene County, 2009). This network of railroads led to the explosion of urban settlements that supported mining and its associated industries. By the early 1900s, many of the smaller mines throughout the area had been abandoned or consolidated into larger coal companies such as Peabody Coal Company and Fourth Vein (Ksander, Beyond Boom and Bust...Coal's Human Toll, 2009). Throughout the following century the rise of surface coal mines became the predominant method of coal extraction.

Due to extensive aquatic resource loss within the Lower White SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 109** depicts each Natural Region and

Section, located within the Lower White SA, and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 93)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Lower White Service Area
Natural Regions and Sections

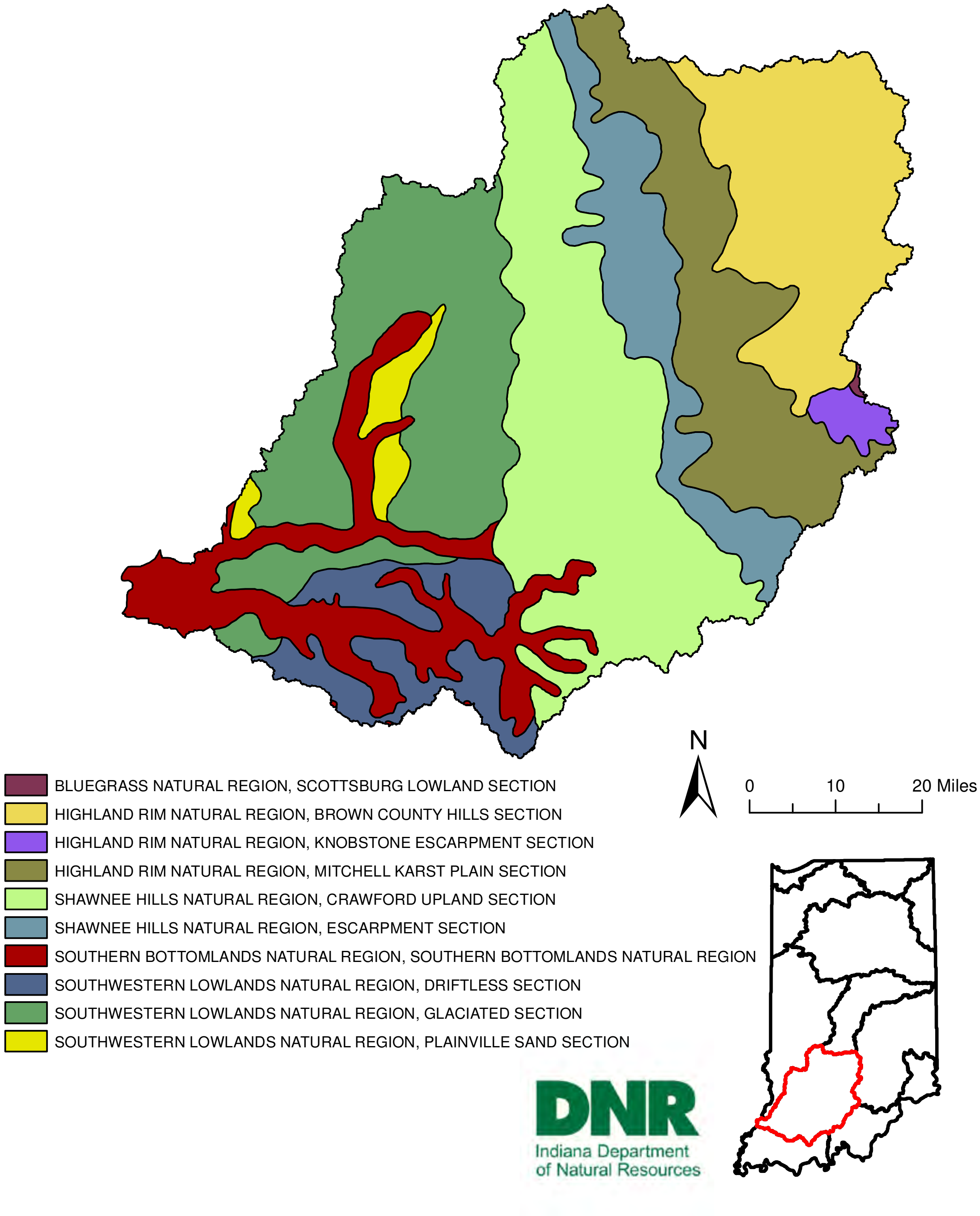


Figure 109. The natural regions and sections within the Lower White Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Highland Rim	Brown County Hills	14.79	Predominantly forested upland oak-hickory, mesic ravines;, acid seep spring (rare); medium to low-gradient streams	188,583	6.46	15,533	0.53	99.9
	Mitchell Karst Plain	13.1	Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)					
	Knobstone Escarpment	1.04	Predominantly various forest communities, glades (rare); small, and ephemeral high-gradient streams					
South-western Lowlands	Plainville Sand	1.97	Predominantly barrens (ridges and well drained), swamp, marsh, and wet prairie swales					
	Glaciated	18.56	Predominantly forested, flatwoods, prairie (several), swamp, marsh, pond; low-gradient streams					
	Driftless	6.04	Predominantly upland forest, southern flatwoods, barrens (xeric, ephemerally wet), acid seep spring (rare), marsh, swamp, sandstone cliff; low to medium-gradient stream					
Shawnee Hills	Escarpment	8.76	Various upland forest types (dry-mesic and mesic); aquatic features include normally clear, medium and high-gradient streams, springs, and sinkhole ponds					
	Crawford Upland	24.15	Upland forest types, few sandstone and limestone glades, gravel washes, and barrens; acid seep spring community (rare)					
Bluegrass	Scottsburg Lowland	0.06	Predominantly floodplain forest and swamp; wetland, swamps, acid seep springs, pond; low-gradient, silty-bottomed streams and rivers					
Southern Bottomlands	Southern Bottomlands	11.52	Bottomland forest, swamp, pond, slough, and formerly marsh and prairie					

Table 93. The historic natural community composition for the Lower White Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 1,389 miles of category 4A impaired streams and 3,298 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,779 miles), impaired biotic communities (866 miles), PCBs in fish tissue (538 miles), nutrients (152 miles), dissolved oxygen (301 miles), total mercury in fish tissue (45 miles), and pH (6 miles) as current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 564 QHEI assessment reaches within the SA **(Table 94 and Figure 110)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 25.89% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	239	42.38
51-64	Habitat is partially supportive of a stream's aquatic life design	179	31.74
>64	Habitat is capable of supporting a balanced warm water community	146	25.89
	Total	**564**	**100%**

Table 94. IDEM Overall QHEI scores for Lower White SA, 1991 – 2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Lower White SA ranks second overall in forested cover density of all SAs at 48% of total area with approximately 1,401,269 acres, and is the SA with the highest percentage of forested cover with approximately 26.9of 5,215,169 acres of forest cover statewide.

GIS analysis identified approximately 9,248,485 linear feet (1,752 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Lower White SA ranks fifth most in the ratio of these potentially restorable stream miles to square miles of SA at approximately 0.38 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.61 square miles of SA.

Lower White Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

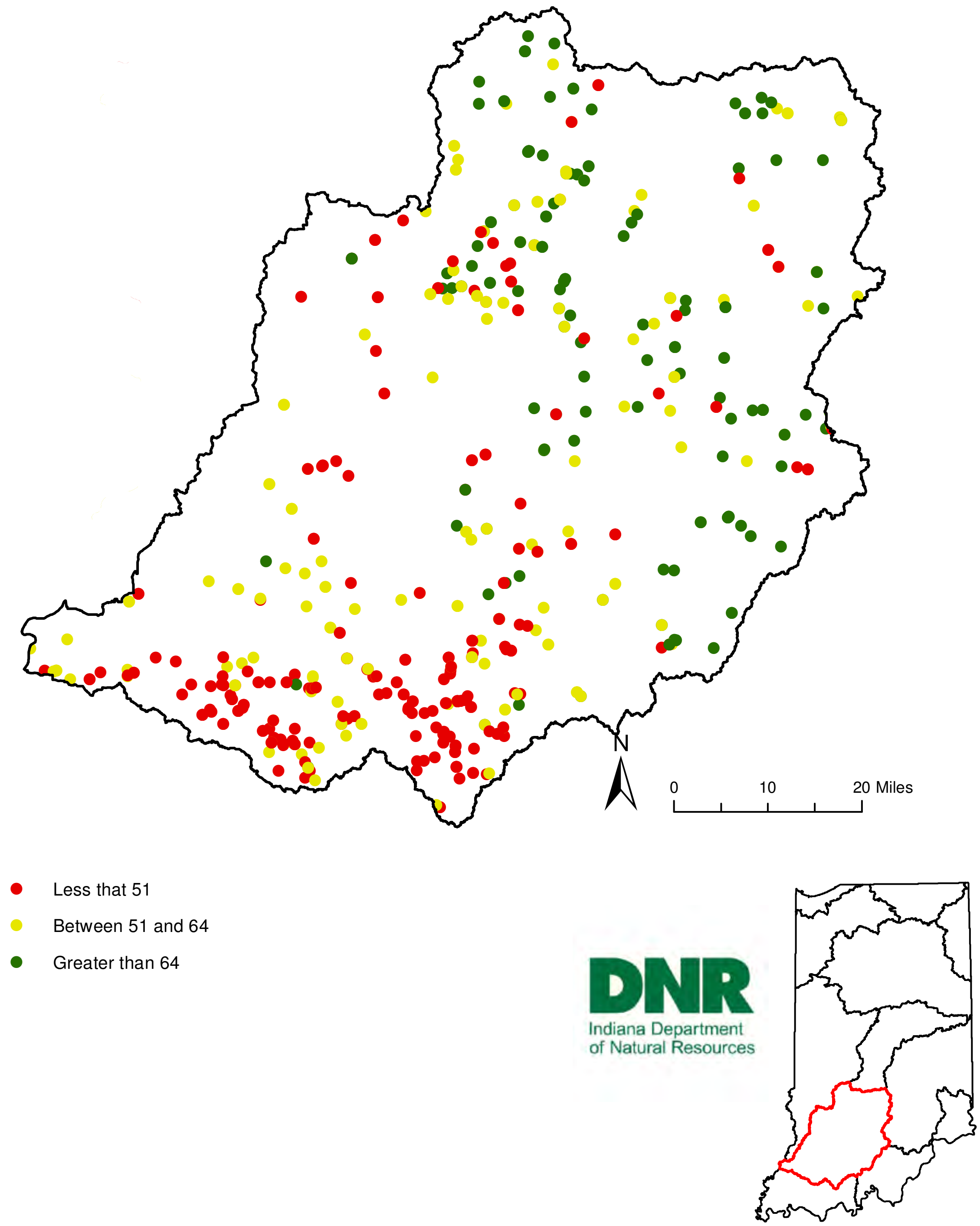


Figure 110. **IDEM overall QHEI scores within the Lower White service area; 1991-2014 (IDEM OWQ, 2014)**

4.2 Wetlands

Analysis of the NWI in the Lower White SA shows that there are approximately 9,495 acres of freshwater emergent wetland (PEM) and approximately 70,609 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.74% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 6.31% of the total SA **(Table 95 and Figure 111)**. Wetlands are greatest in the western portion of the SA in the Interior River Valleys and Hills ecoregion (The Status of Wetlands in Indiana: IDNR, 1996).

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	9,495	5.16%	0.33%	0.04%
Freshwater Forested/Shrub Wetland	70,609	38.38%	2.42%	0.31%
Freshwater Pond	25,543	13.88%	0.87%	0.11%
Lake	30,544	16.60%	1.05%	0.13%
Riverine	47,780	25.97%	1.64%	0.21%
Grand Total	**183,971**	**100.00%**	**6.29%**	**0.80%**

Table 95. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils account for 157,833 acres (**Figure 112**), or 5.4% land cover within the SA, out of which approximately 94,500 acres have the potential to be restored, accounting for 3.24% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Lower White SA has the second to least percentage of recoverable wetland acres to total SA size of all SAs, and the fourth least potentially restorable wetland acres of any SA.

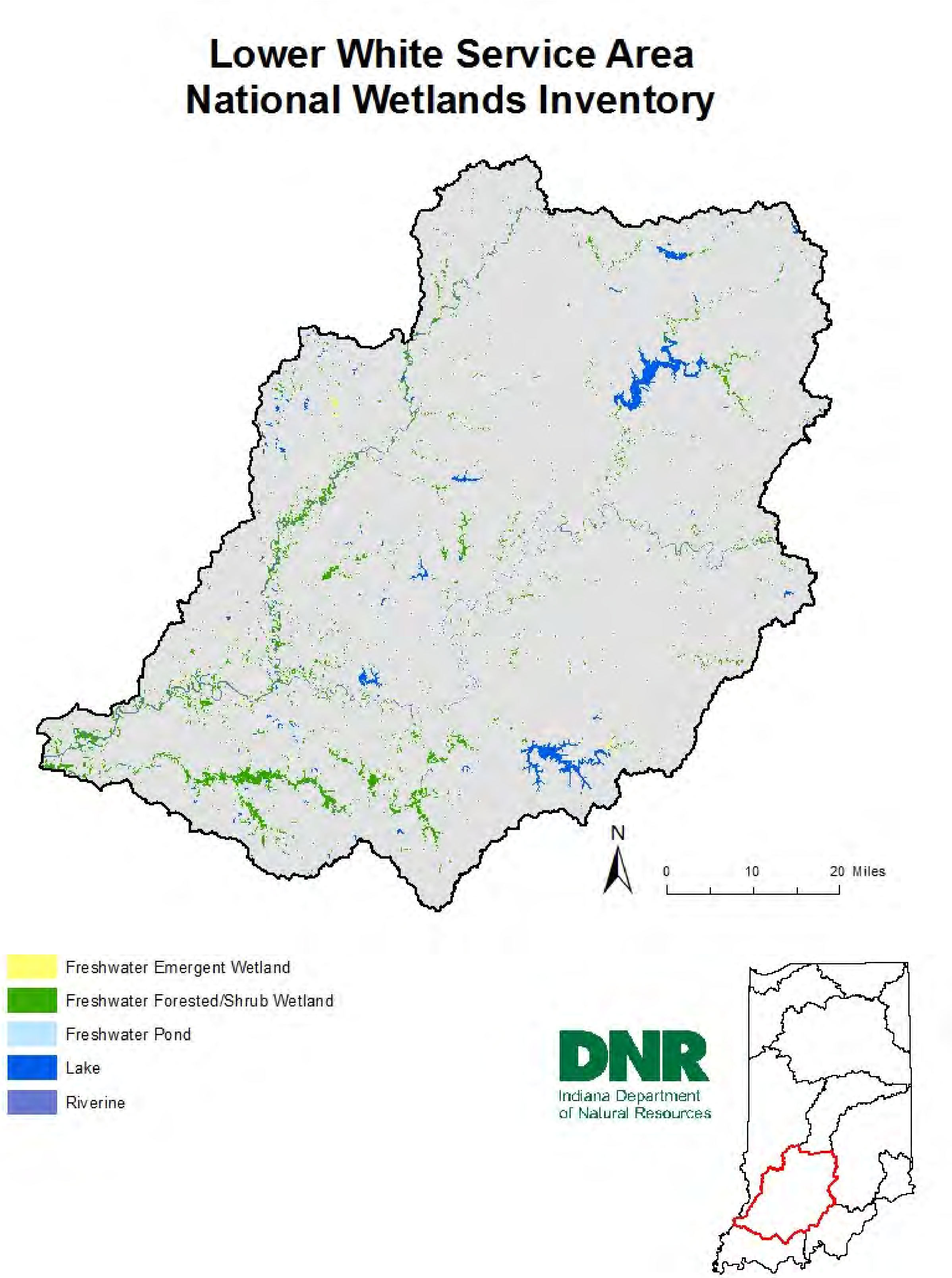


Figure 111. NWI for the Lower White Service Area. (USFWS NWI, 2015)

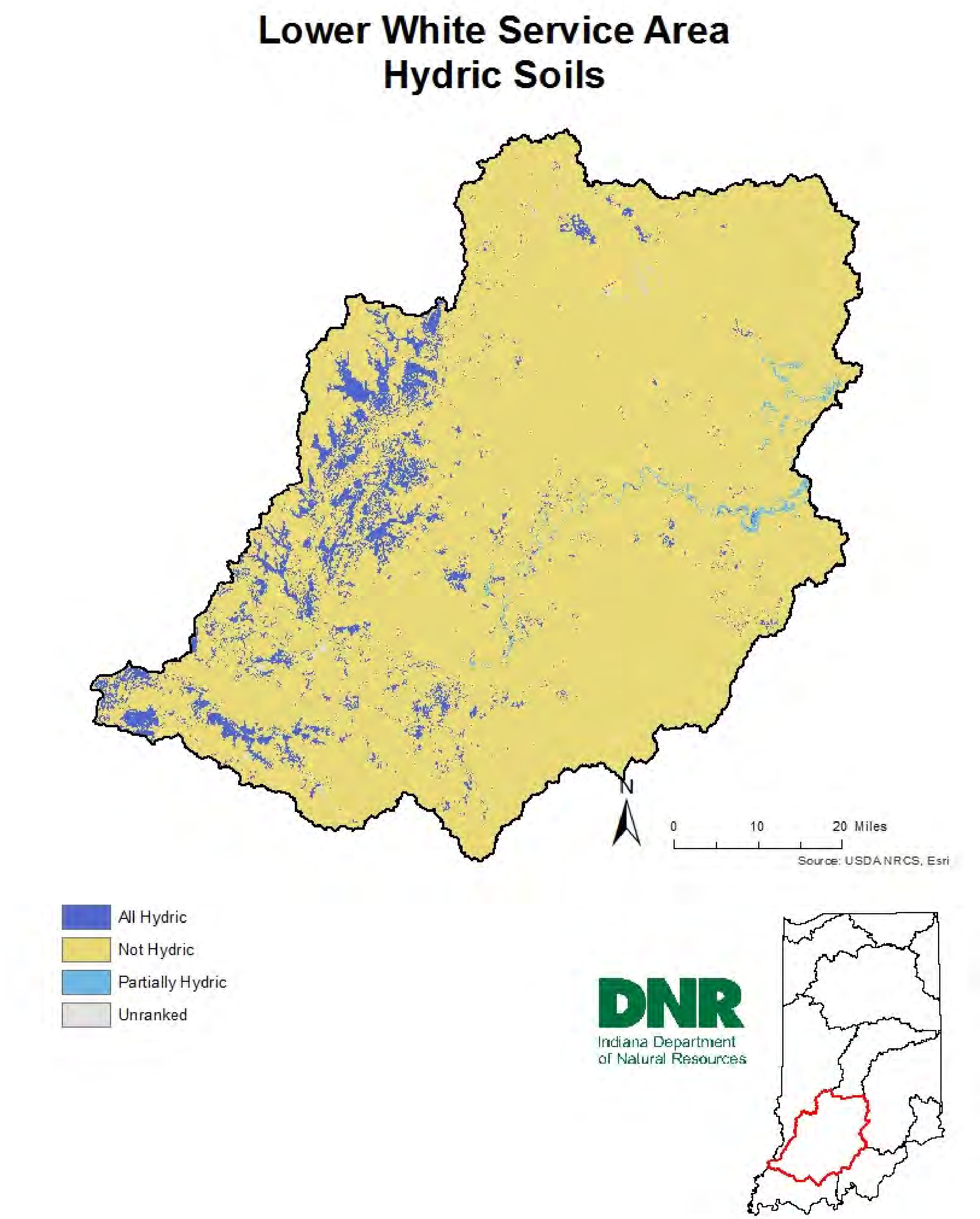


Figure 112. Hydric and partially hydric soils within the Lower White service area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 90,655 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Killion Canal-Prairie Creek (HUC 051202020707 **[Table 96]**).

Hotspots account for 2,882,880 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Kane Ditch-Smothers Creek (HUC 051202020507 **[Table 97]**).The watersheds with the highest concentrations of potentially restorable wetland and streams **(Tables 96 & 97)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA and are shown in **Figure 97**.

Approximately 5,459 acres of these hotspots of potentially restorable wetlands are on IDNR-managed lands within the Lower White SA. Goose Pond Fish and Wildlife Area is the IDNR-managed land in the Lower White SA with the most adjacent hotspots of potentially restorable wetlands (3,141 acres). Other IDNR-managed lands in the Lower White SA with adjacent acres of hotspots of potentially restorable wetlands are White River Bend Wildlife Management Area and Greene-Sullivan State Forest. Approximately 33,524 linear feet of hotspots of potentially restorable streams are adjacent to IDNR-managed lands. Goose Pond Fish and Wildlife Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable streams (19,644 linear feet).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
051202020707	Killion Canal-Prairie Creek	8,283
051202090505	Fourmile Creek	7,279
051202020507	Kane Ditch-Smothers Creek	6,960
051202021005	Upper River DeShee	5,806
051202021005	Claypole Pond-White River	5,732

Table 96. Watersheds in the Lower White Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
051202020507	Kane Ditch-Smothers Creek	159,456
051202021005	Upper River DeShee	155,232
051202020707	Killion Canal-Prairie Creek	121,968
051202090505	Bruner Creek	103,016
051202090302	Fourmile Creek	102,432

Table 97. Watersheds in the Lower White Service Area with the most hotspots of potentially restorable streams

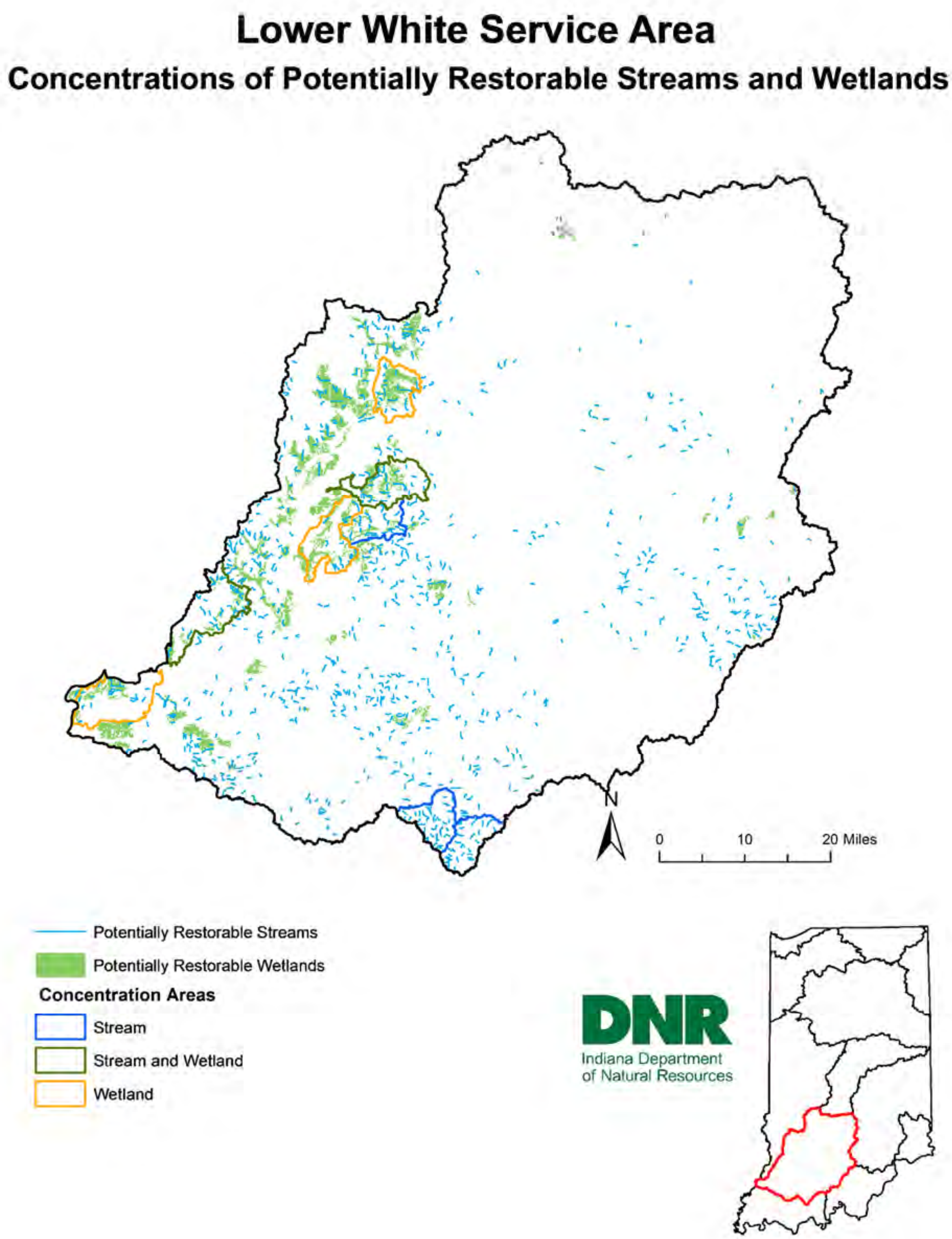


Figure 97. Concentrations of Potentially Restorable Streams and Wetlands in the Lower White Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Lower White SA identifies five lakes currently documented with category 5 impairments, which measured using the National Hydrography Dataset (NHD) accounts for approximately 6,969 acres with algae, 3,887 acres for taste and odor, 114 acres of total mercury in fish tissue, and 100 acres with E. coli (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 53,096 acres of open water which accounts for 1.82% of the SA. This varies slightly from the NWI, which identifies approximately 25,542 acres of freshwater ponds comprising of 0.9% of the SA, and 30,544 acres of lake comprising of 1.1% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Middle Wabash SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Lower White SA shows that nearly 100% of the shallow unconsolidated aquifers receive between seven or less inches of ground water recharge annually **(Table 98).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0	0.00%
	13	0	0.00%
	12	0	0.00%
	11	0.01	0.0002%
	10	0.4	0.01%
	9	1	0.01%
	8	27	0.59%
	7	166	3.65%
	6	552	12.10%
	5	1,150	25.21%
	4	1,085	23.78%
Low	3	992	21.74%
	2	384	8.42%
	1	205	4.49%

Table 98. Approximate ground water recharge rates in the Lower White Service Area (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that nearly 100% of the Lower White SA's near surface aquifers are in the low to high range for sensitivity to contamination with approximately 85% being moderate to low **(Table 99)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates. The near surface aquifer sensitivity mapping shows that aquifers with high sensitivity are generally confined along the major river corridors within the SA.

Sensitivity	Square Miles	Percent of Total Acre
Very High	0.5	0.01%
High	658	14%
Moderate	1,964	43%
Low	1,901	42%
Very Low	40	0.88%

Table 99. Ground water sensitivity distribution in the Lower White Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Lower White SA is fifth among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 152,238 MGD **(Figure 113)** (IDNR DOW, 2016). Energy production accounts for approximately 91% of registered withdrawal capacity and public water supply at 7%.

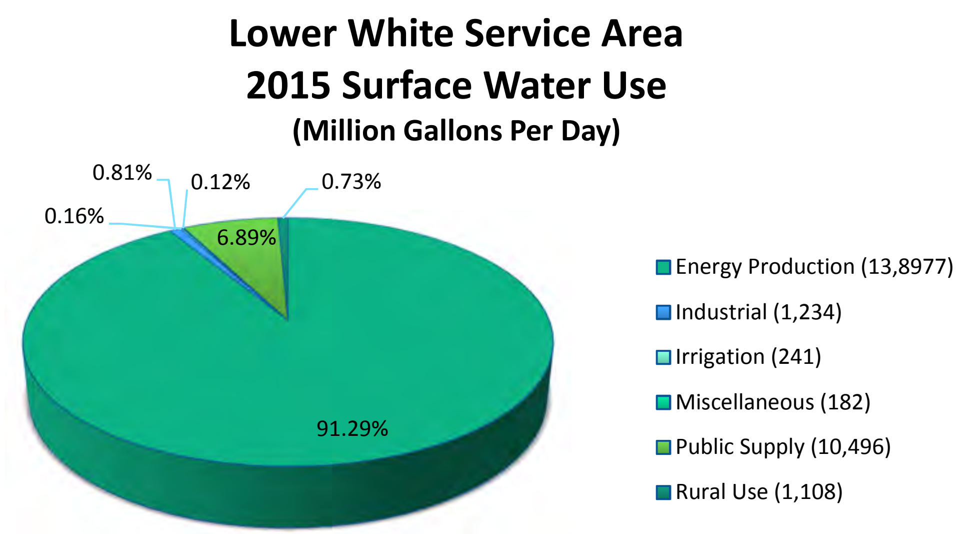


Figure 113. 2015 surface water usage in the Lower White Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Lower White SA is the fourth least of any SA with a 10,571 MGD registered capacity **(Figure 114).** Public water supply accounts for approximately 47% of registered ground water withdrawal capacity in the SA, followed by energy production and mining with 38%, and industrial use with 12%.

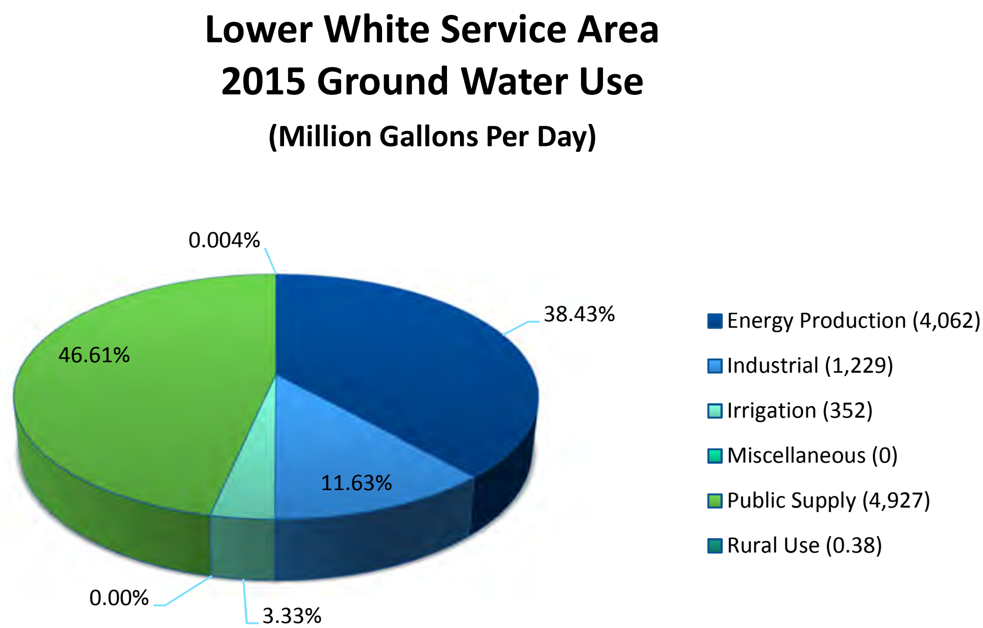


Figure 114. 2015 ground water usage in the Lower White Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database located within the Lower White SA include, but are not limited to, aquatic cave, acid seep, circumneutral seep, forested swamp, shrub swamp, sinkhole swamp, and wet floodplain forest, in addition to many other transitional, mixed and upland communities.

There are currently a minimum of seven amphibian species, 47 bird species, seven fish species, 14 mammal species, 15 mollusk species, and seven reptile species listed as SGCN within the SWAP Planning Regions within the Lower White SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Lower White SA. The following aquatic resource goals and objectives apply specifically to the Lower White SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources that will offset current and anticipated threats within the SA.
2. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include

considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
3. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
4. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
5. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
6. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Interior Plateau, and Interior River Valleys and Hills Planning Regions where feasible.
7. Stream and wetland restoration projects to buffer and protect karst features and systems unique to areas in southern Indiana.
8. Support efforts to offset aquatic resource degradation associated with historic mining activities throughout the service area.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Lower White SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Beanblossom Creek WMP, Kessinger Ditch WMP, Lost River WMP, Lower Patoka River WMP, Middle Patoka River Watershed Source Water Protection Plan, North Fork Salt Creek/Sweetwater Creek WMP, Owen County Watershed Initiative WMP, Patoka Lake Source Water Protection WMP, Patoka River (upper) WMP, Prairie Creek WMP, and Yellowwood Lake WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Lower White SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, as well as important habitat for SGCN while addressing the important physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Ouabache Land Conservancy, Four Rivers RC&D, Oak Heritage Conservancy, Indiana Karst Conservancy, and Sycamore Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Lower White SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Illinois Water Science Center
- U.S. Forest Service Hoosier: National Service and Charles C. Deam Wilderness
- Eastern Tallgrass Prairie and Big Rivers, and Appalachian Landscape Conservation Cooperatives
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Southern Indiana Development Commission
- West Central Indiana Economic Development District
- Economic Development Coalition of Southwest Indiana
- Indiana 15 Regional Planning Commission

- River Hills Economic Development District and Regional Planning Commission
- Friends of Goose Pond
- Friends of the White River
- Indiana Karst Conservancy
- Oak Heritage Conservancy
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 115** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

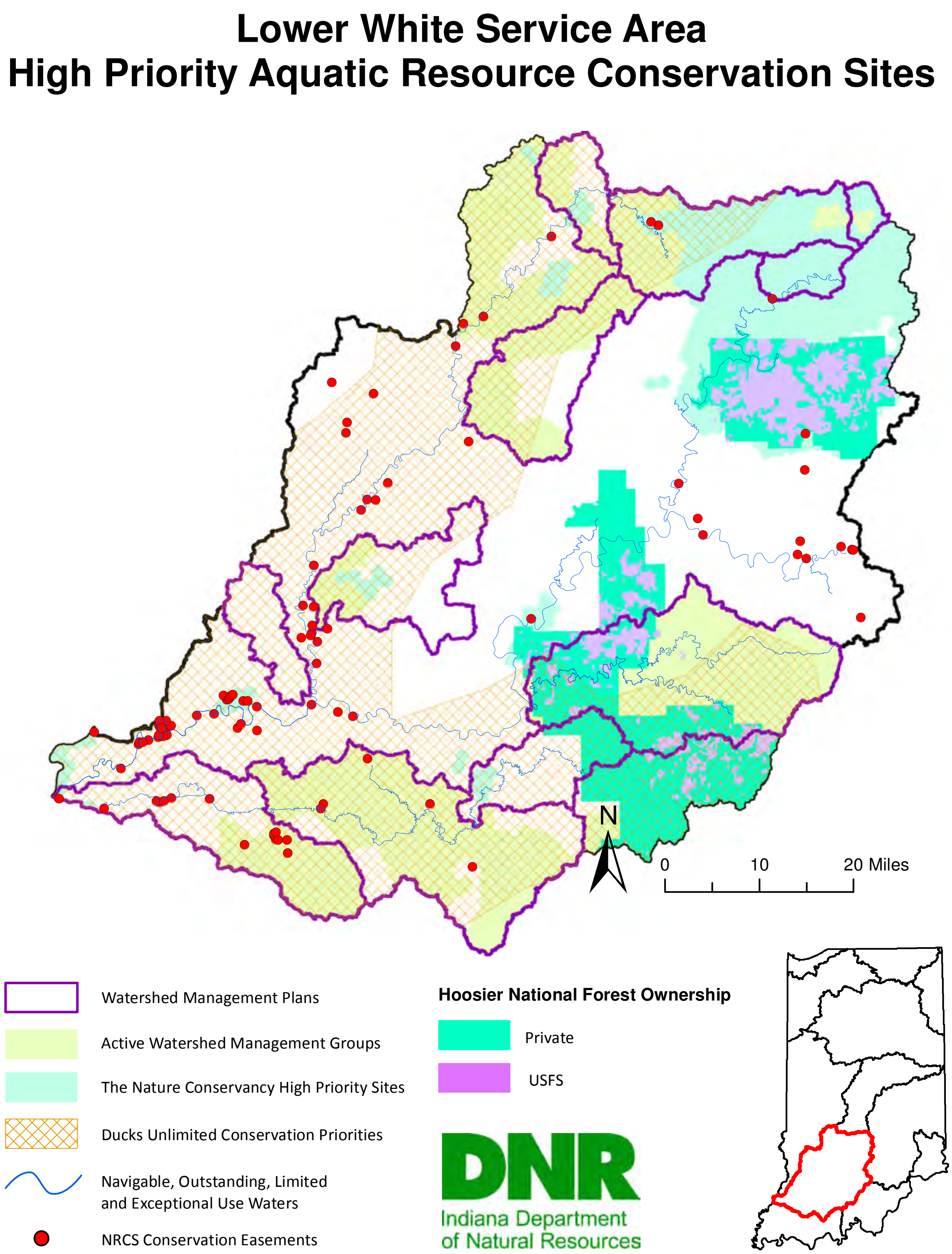


Figure 115. Priority aquatic resource conservation groups and sites within the Lower White Service Area (IWPP, 2015)

APPENDIX B.10 UPPER OHIO SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION

The Upper Ohio Service Area (SA) is located in southern Indiana on the Indiana/Kentucky and Indiana/Ohio borders and is composed of the following three 8-digit HUC watersheds:

- 05140104 - Blue-Sinking
- 05140101 - Silver-Little Kentucky
- 05090203 - Middle Ohio-Laughery

The Upper Ohio SA includes all or portions of fifteen Indiana counties listed below and is located within the Southern Hills and Lowlands physiographic region.

Perry	Jefferson	Ohio
Crawford	Ripley	Switzerland
Orange	Decatur	Clark
Washington	Franklin	Floyd
Scott	Dearborn	Harrison

The Upper Ohio SA drains approximately 2,374 square miles of southern Indiana and is located in both the Interior Plateau and Interior River Valleys and Hills ecoregions. Resting below the Lower White and Whitewater-East Fork White SAs, the southern border of the Upper Ohio SA is the Ohio River. The western portion of the SA is characterized by its rugged terrain and upland forest types; a majority of the area is thinly populated with minor areas of barren land and sandstone and limestone glades. The middle portion of the SA is part of the Southern Bottomlands natural region consisting of neutral to acidic silt loam soils. Bottomland forests, swamps and ponds make up a majority of the natural communities within this region (Homoya, Abrell, Aldrich, & Post, 1985). The remainder of the Upper Ohio SA is within the Bluegrass natural region, characterized by dissected plateaus underlain by limestone and shale (Hill).

The westernmost portion of the Upper Ohio SA and along its border with the Ohio-Wabash Lowlands SA contains a noticeable fraction of Indiana state and federally-owned lands. The Blue-Sinking

Watershed, the westernmost watershed in the SA, also has the greatest karst region in the state and is denoted by its many sinkholes and caves (Hasenmueller, Powell, Buehler, & Sowder, 2011).

The Blue River is a popular river to the region originating in Washington County and traveling south to the Ohio River; it is part of the Indiana Natural, Scenic, and Recreational River System and is managed by the Blue River Commission (Blue River Commission, 2016). The river travels through one of the most scenic and diverse areas in the entire state of Indiana; features along the river include Indian sites, caves, and vast forests, to name a few. The Blue River provides many ecological benefits to its aquatic community, including biodiversity and pristine habitat.

Based on the 2011 NLCD, the land cover type with the most area in the Upper Ohio SA is forest and scrub/shrub (52.9%), followed by agricultural land use (36.2%), developed and impervious land use (7.33%), and wetlands and open water (0.9%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 0.19% per the 2011 NLCD to 0.75% per the NWI. Emergent herbaceous wetlands range from 0.06% per the 2011 NLCD to 0.12% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Upper Ohio SA have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Upper Ohio SA from 2009 – 2015 was collected and analyzed **(Table 100)**. According to the data, 17.7 acres of impacted wetlands and 24,162.5 linear feet of impacted streams required mitigation in the seven year time period. Locations of the permitted stream and wetland impacts are provided in **Figure 116**.

The growth and development work type accounted for the most stream impacts (40.8%), followed closely by transportation and service corridors (40.5%), then dam and/or levee related activities (15.5%), and energy production and mining (3.3%). There were no documented stream impacts requiring mitigation for agricultural activities for this time period in the SA.

Development accounted for the most wetland impacts (74.4%), followed by transportation and service corridors (12.2%), energy production and mining (10.4%), and dam and/or levee related activities (3.02%). There were no documented wetland impacts requiring mitigation for agricultural activities for this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 116**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	0	0.00%	0	0.00%
Dam	3,742	15.49%	0.534	3.02%
Development	9,854	40.78%	13.159	74.44%
Energy Production	790	3.27%	1.834	10.38%
Transportation	9,776.5	40.46%	2.15	12.16%
Grand Total	**24,162.5**	**100.00%**	**17.677**	**100.00%**

Table 100. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville District

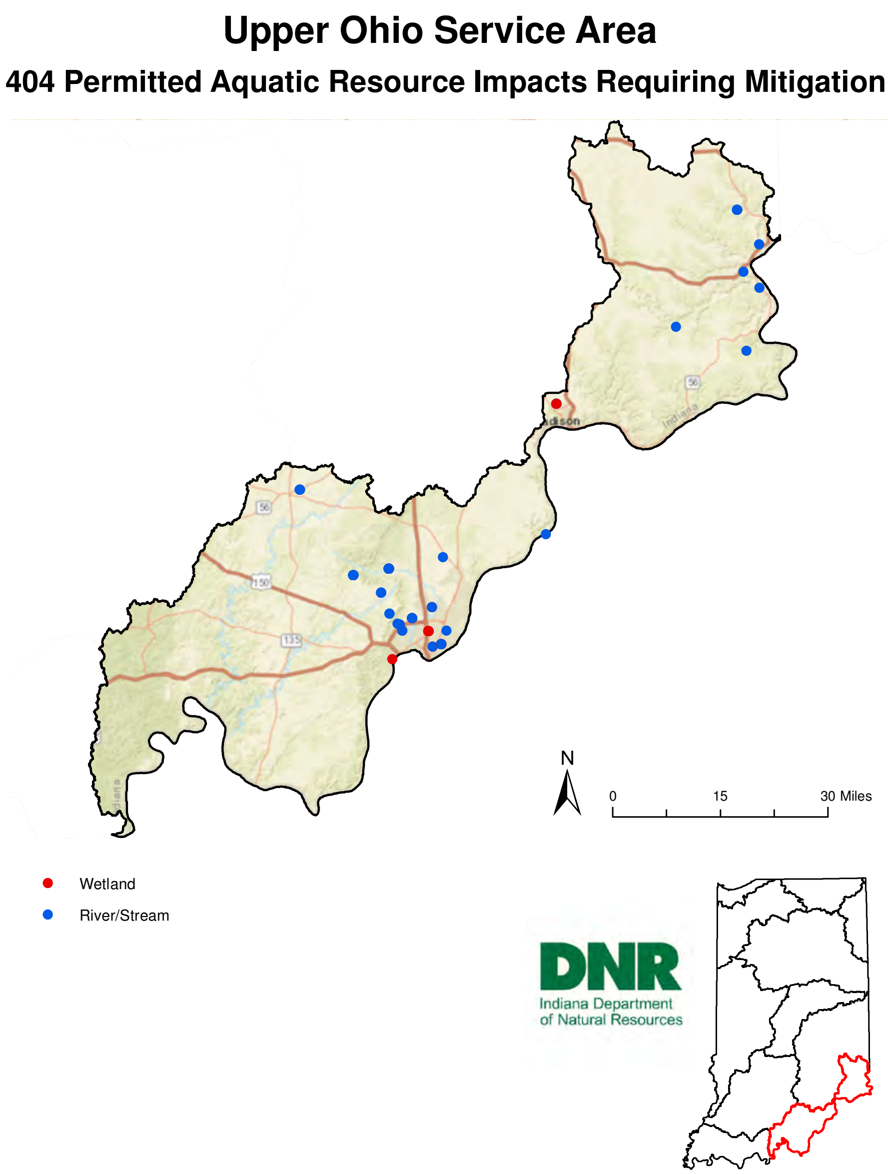


Figure 116. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD (Homer, et al., 2015) to identify land cover and land uses that currently contribute to aquatic resource and habitat impacts. Overall land cover within the Upper Ohio SA is presented in **Figure 117** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

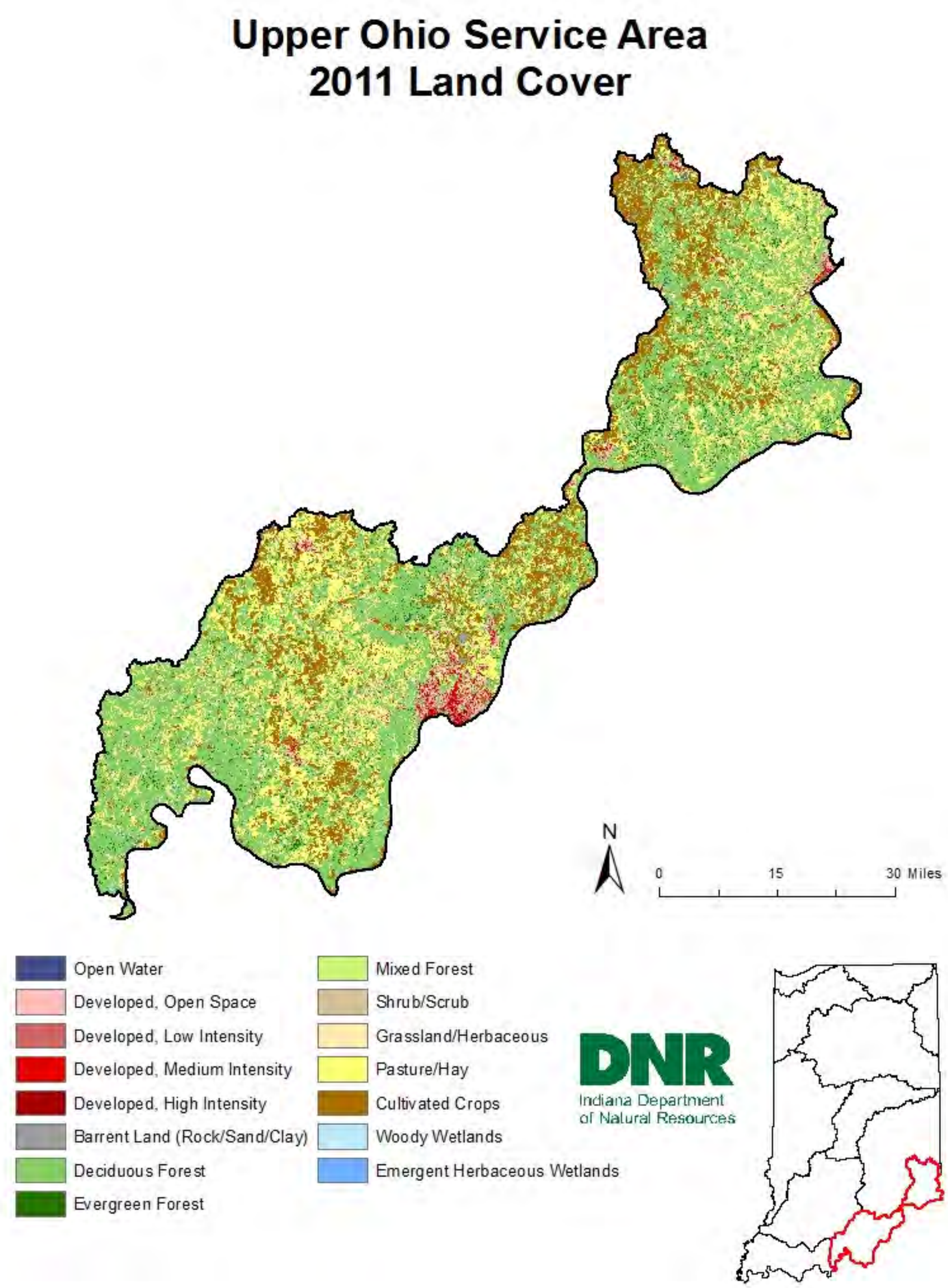


Figure 117. Land cover within the Upper Ohio Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 101)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	11,332	0.65%
Developed	Open Space	88,863	5.08%
Developed	Low Intensity	23,027	1.32%
Developed	Medium Intensity	11,091	0.63%
Developed	High Intensity	5,162	0.30%
Barren Land (Rock/Sand Clay)	*	3,240	0.19%
Forest	Deciduous	874,661	50.00%
Forest	Evergreen	42,112	2.41%
Forest	Mixed	3,053	0.17%
Shrub/Scrub	*	5,346	0.31%
Grassland/Herbaceous	*	43,588	2.49%
Pasture/Hay (Agriculture)	*	363,365	20.77%
Cultivated Crops (Agriculture)	*	269,930	15.43%
Wetlands	Woody	3,349	0.19%
Wetlands	Emergent Herbaceous	1,084	0.06 %
Grand Total		**1,749,206**	**100.00%**

Table 101. Upper Ohio SA land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 117** below to demonstrate the current overall land cover distribution of the SA.

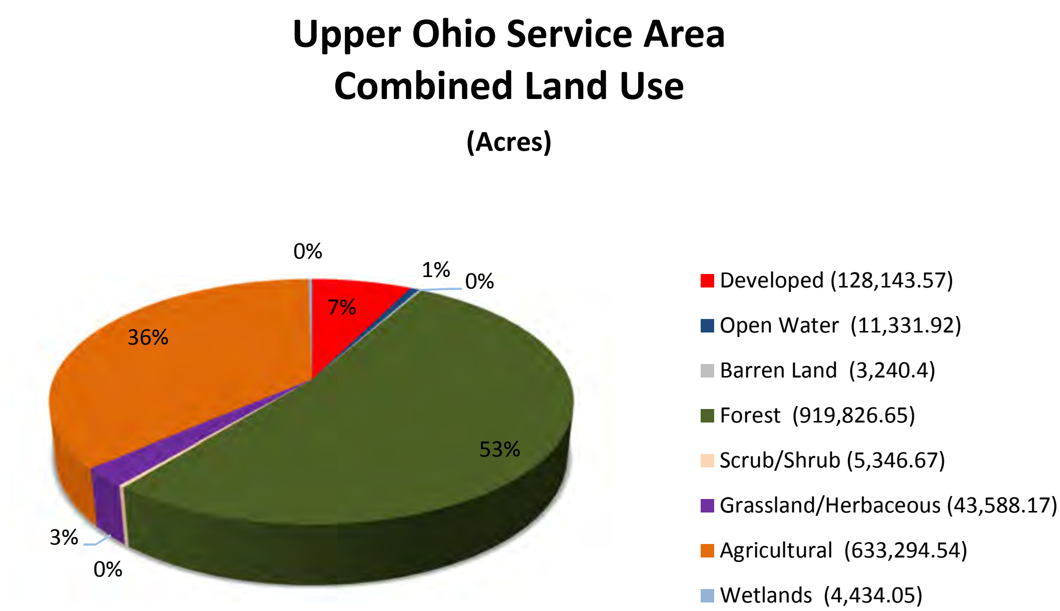


Figure 117. Combined land uses within the Upper Ohio Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest anthropogenic land use in the Upper Ohio SA. Total agricultural land use covers approximately 36% of the SAs total land area of 633,294 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of forested lands and a few developed areas, such as Jeffersonville and Clarksville.

Within the identified land use areas, cultivated crops cover over 269,930 acres (15.43%) and pasture/hay lands cover 363,364 acres (20.77%) of the SA (Homer, et al., 2015). Although corn production is predominant across the SA, soybean production is the primary cultivated crop based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Upper Ohio SA (USDA-NASS, 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. The Lower Ohio SA is the sixth largest SA with approximately 1,749,206 acres, and contains chicken and pork confined feeding operations (CFOs) which have a minimum of 5,000 animal units (Thompson, 2008). When combining these major agricultural land use activities, the Upper Ohio SA ranks ninth in percentage of total statewide land use (2.74%), and it's a significant land use throughout the SA.

2.4 Growth and Development

Developed impervious land use is the second largest land use covering 128,143 acres (7.3%) of the 1,749,206 total SA acres, the second least developed density of all SAs. The Upper Ohio SA is the second most rural of all SAs with agricultural land use and forest combining for approximately 89% of total cover. Communities with densely developed footprints are primarily located along the Ohio River and include Lawrenceburg, Aurora, Madison, Jeffersonville, Clarksville and New Albany, amongst many other smaller communities scattered across the SA.

The SA contains portions of the Cincinnati and Louisville-Jefferson County MSA's, both of which experienced solid growth in the previous decade (Manns, 2013). Approximately 76% (840,664 acres) of the Louisville-Jefferson County MSA within Indiana is located in the SA accounting for 48% of total SA acres. Approximately 61% (219,605 acres) of the Cincinnati MSA within Indiana is located in the SA accounting for 13% of total SA acres. Analysis of the INDOT cities and towns GIS data shows the Upper Ohio SA contains entirely or in part 193 cities and/or towns, 46 of which are incorporated (INDOT, 2016).

Three Indiana regional councils that overlap with the SA include the River Hills Economic Development District and Regional Planning Commission (EDD & RPC) (48%), the Southeastern Indiana Regional Planning Commission (SIRPC) (38%), and the Indiana 15 Regional Planning Commission (14%) (IARC, 2017).

According to the River Hills EDD & RPC 2015 CEDS, existing and emerging industry sectors in the region include agribusiness, biomedical/biotechnical, advanced materials, chemicals and chemical based products, IT and telecommunications, machinery manufacturing, mining, computer and electronic product manufacturing, forest and wood projects, and primary metal manufacturing. Additional strong industries in the SA, with some decline, are food processing and technology, as well as transportation and logistics. Industrial parks are most heavily concentrated in Clark County, though sites are available in each county of the region. These parks range from fully developed and operating to shovel-ready (River Hills EDD & RPC, 2015).

The River Hills EED & RPC has access to a comprehensive and robust network of roads, highways, railways, airports, and river ports. These assets are invaluable to a number of industries and employers across the area and provide a distinct competitive advantage over other regions (River Hills EDD & RPC, 2015). The Port of Jeffersonville along the Ohio River is one of three ports in the Ports of Indiana system. It has been one of the fastest growing U.S. ports adding more than 20 companies since 1993 with record annual volumes increasing each year. Major cargo includes corn, fertilizer, paper, salt, wire rod, soybeans, steel, liquid asphalt, pig iron, and project cargo (Indiana15RPC, 2016).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 5,800 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Upper Ohio SA ranks last among SAs in local road miles to square mile ratio at approximately 2.12 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Upper Ohio SA contains approximately 863 miles of U.S. Interstates and highways, 1,967 miles of state highways, and 5,800 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the sixth largest SA, the concentration of the various road types per square mile of land has varying distribution throughout its boundary.

U.S. Interstates and highways have a concentration of approximately 0.32 mile per square mile, which ranks eighth among the eleven SAs. Although the concentration of U.S. Interstates and highways ranks in the lower tier, the concentration of state roads ranks third with 0.72 mile per square mile and is the highest ranking road type within the Upper Ohio SA. Similar to the U.S. roadways, the concentration of local roads ranks near the bottom. The concentration of local roads is approximately 2.12 mile per square mile ranking it eleventh and making this the lowest ranking road type within the SA. Although the combined ranking of the concentration for all roadways isn't last, it has a concentration of 3.16 mile per square mile, which places ninth overall.

Although the concentration of state highways ranks within the top three, closer analysis reveals the concentration of the other road types rank near the bottom when compared to all other SAs. The construction and maintenance of roads and bridges throughout the Upper Ohio SA supports the predominant mode of transportation and play an integral role in sustaining business and commerce for the region.

2.5.2 Railroads

As an alternative mode of transportation, the Upper Ohio SA has approximately 331 miles of railroad within the SA (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Upper Ohio SA contains the smallest concentration of railroads in the state with a density of 0.12 mile per square mile. Although the concentration of railroads ranks last in the state, they contribute to aquatic resource threats including habitat fragmentation, disruption to fluvial processes, resource degradation, conversion and loss of aquatic resources.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Upper Ohio SA contains service corridors that contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 1,128 miles of service corridors.

The Upper Ohio SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately sixty-six (34.5 kV) lines, seventy-seven (69 kV) lines, ninety-one (138 kV) lines, fourteen (230 kV) lines, forty-eight (345 kV) lines, and five (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 793 miles throughout the SA, which is the eleventh highest concentration of electric transmission lines relative to the SA size with 0.29 mile of transmission line per square mile.

In addition to electric transmission lines, the Upper Ohio SA contains over 335 miles of pipelines in total that contains over 290 miles of pipelines that transport natural gas and 45 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). Unlike all the other SAs, the Upper Ohio doesn't contain crude oil pipelines which ranks it eleventh. The SA ranks tenth for concentration of natural gas pipelines and last for concentration of refined petroleum product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 15 known low head dams (IDNR DOW, 2016) within the SA, ranking sixth among all SAs for number of low head dams, and the fifth highest in concentration at one low head dam per 182 square miles. There are currently 72 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 38 square miles, tied for the fourth highest concentration of all SA's, containing 8% of documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 132,000 linear feet (25 miles) of NLE's mapped within the SA, averaging one mile of NLE per 109 square miles; the lowest concentration among all SA's. Approximately 18 miles of the NLE's are located within predominantly developed areas with the remaining seven miles mapped in rural agricultural settings.

2.7 Energy Production and Mining Threats

2.7.1 Natural Gas and Oil Production

The Upper Ohio SA contains a multitude of active oil and gas fields, along with associated wells that support, or have supported, the petroleum industry. The Indiana Geological Survey (IGS) identifies 20 petroleum gas fields with 239 associated gas wells; three oil fields with three oil wells; and one oil & gas field ranking the Upper Ohio SA tenth statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The Upper Ohio SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 233 abandoned gas wells, five abandoned oil wells, eight abandoned gas storage wells, two abandoned observation wells, 508 dry wells, 58 gas storage wells, 12 observation wells, 29 stratigraphic wells, two abandoned saltwater disposal wells, 29 temporarily abandoned wells, 11 saltwater disposal wells and one water injection well within the SA (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The Upper Ohio SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains four sand & gravel mining operations, one clay and shale mining operation, 17 crushed stone operations, and one dimensional sandstone quarry operation (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one cement operation, an industry byproduct commodity that is used as an aggregate (Indiana Geological Survey, 2016). In addition to the Upper Ohio SA ranking sixth based on its size, mineral mining within its boundary ranks sixth in the state with 24 active operations.

2.7.3 Coal

The Upper Ohio SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats Anticipated Threats

The Upper Ohio SA contains the Indiana SWAP Interior Plateau (50.1%) and Valleys and Hills (49.9%) Planning Regions. The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions have experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the agricultural and developed impervious footprints make up approximately 43.5% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects development along with transportation and service corridor projects to remain the foremost permitted activities in the SA requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue.

According to the River Hills EDD & RPC 2015 CEDS, continued development of industrial/commerce parks throughout the district, but particularly at River Ridge in Clark County, will continue to be an economic priority for the region. These sites represent a great opportunity for industrial growth and attraction of quality employment opportunities (River Hills EDD & RPC, 2015). According to the Indiana 15 Regional Planning Commission, infrastructure improvements are a priority in this region that include adequate access to affordable water, efficient wastewater treatment, and effective storm water drainage and telecommunication infrastructure. There are a number of issues related to water services in the district requiring infrastructure and capacity improvements due to expanding development and failures in old systems. Infrastructure and public utilities are expected to remain a threat to the karst topography in the region due to sink holes, drainage, and erosion events especially following significant precipitation (Indiana15RPC, 2016).

Major near term priorities to stimulate economic growth and development for this region include, but are not limited to, roadway and other infrastructure improvements to facilitate industrial and business site expansion, relief of congested areas with road expansion projects, residential development opportunities, sewer capacity expansions and line extensions, wastewater treatment expansion, and storm drainage improvements. Transportation goals for this region include strategic development near Interstates I-64 and I-69 as well as state road linkages. Additionally, an expansion of the Ohio River transportation system is a priority (Indiana15RPC, 2016).

The region is well forested with a variety of hardwood species well suited for timber production which is expected to continue to contribute to a number of industries. In addition to forested land, the district also has significant agricultural lands. Counties in the district produce a substantial amount of crops annually such as corn, soybeans, and wheat. Livestock production is also a large contributor to the district’s agricultural output. Hogs, sheep, and especially cattle are all raised in the district. In addition, natural gas production has had a resurgence since the mid-1990s with the development of new extraction technology and is expected to remain a foreseeable threat to aquatic resources (Indiana15RPC, 2016).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to offsetting the predominant threats in the Upper Ohio SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Upper Ohio SA's historic natural communities were predominantly composed of southern forests on hilly to very rugged topography of the relatively unglaciated region. In addition, significant areas of karst topography persist in much of this SA. The unique landscape found along the Ohio River historically consisted of high quality aquatic resources. These aquatic and natural communities were permanently altered by early European settlement throughout the SA.

The SA's natural resources have experienced conversions to agriculture since early European settlement began in the region. The establishment of agriculture within the southwestern portion of the SA resulted in land use changes that led to aquatic resource losses. Settlement of Harrison and Floyd Counties during the early 1800s resulted in the area's forests being cleared for agriculture and farmland, including areas prone to highly erosive conditions (Harrison County Board of Commissioners, 2008). The land-use changes during this period resulted in the clearing of large tracts of land for agriculture, this included the draining of wetlands and the channelization of streams which resulted in early water quality problems (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012). The removal of forests within the watersheds resulted in increased sediment loads to the region's largest rivers, including the Ohio River (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012).

Transportation has played a key role in establishing settlements by facilitating access for early settlers. With the Upper Ohio SA's southern boundary being the Ohio River, this part of the state became important to early settlers because it provided a means for travel and the transport of goods. The predominant means of travel for settlers and their products and crops, during the late 1700s and early 1800s in Indiana was by boat on the Ohio River (The History Museum, 2017).

The ability to ship commodities from the region supported permanent settlements in southwestern Indiana. The northeastern half of the SA began to be settled by European settlers in the late 1790's following the Revolutionary War (Tanners Creek Watershed Steering Committee, 2003). As settlers established in the area and created transportation routes, this region began to see the formation of towns during the 1800s. For example, Dover was known as the "Crossroads" in the 1820s because it was located at the intersection of the trail from Lawrenceburg to Brookville and the trail from Harrison to Napoleon, resulting in a multitude of laborers constructing their headquarters there (Tanners Creek Watershed Steering Committee, 2003).

Near the central region of the SA, similar settlements and towns were established along the Ohio River due to accessibility. Vevay was established in 1813 by early French and Swiss settlers with the attempt to establish viticulture in the region. However, in the mid-1800s, wine making in the region was abandoned due to commercially oriented farming and commerce which established an important trading center and river port for grains, soybeans, tobacco and livestock (Indian Creek Watershed Steering Committee , 2007).

In addition to using waterways for transportation, the SA contained overland transportation routes that led to an increase in settlements in the area. The Buffalo Trace provided an overland route through southern Indiana for early settlers and started near the Falls of the Ohio, connecting current day New Albany to Vincennes, crossing multiple streams and rivers and providing a connection to the Wabash River (Indiana's Historic Pathways, 2010). This route facilitated commerce within southwestern Indiana by providing early American settlers an avenue to move livestock and ultimately settle the Northwest Territory (Snell, Jackson, & Krieger, 2013).

In order to provide overland travel from the Ohio River to Lake Michigan and increase interior travel access, business and commerce, the construction of Michigan Road began in 1832 connecting the southern Indiana town of Madison to the states northern border resulting in the clearing of forests (Carman, 2013). In addition to Michigan Road, the region was affected by the railroads. In 1836, the establishment of the Madison, Indianapolis, and Lafayette Railroad in Madison created the state's first railroad (U.S. Department of Interior, 2017). This transformed Madison which experienced growth and wealth because it contained the only port for river and rail in the state of Indiana (U.S. Department of Interior, 2017).

The present Clark and Floyd County area located on the Ohio River played an important role in the SA because it became a major settlement area for early Europeans due to its proximity to the Falls of the Ohio and the accessibility of the river. The first American settlement in the Northwest Territory was Clarksville in 1784, which led to the formation of Clark County in 1801 and Floyd County in 1873 (The Clark County Soil and Water Conservation District , 2007).

As the region experienced increased population growth, the region's aquatic resources were negatively impacted. Increases in habitat conversion associated with agriculture, urban and industrial development resulted in water quality issues from point source and non-point source pollution, increased siltation and sedimentation, and increased stream temperatures due to the loss of riparian forests (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012).

In response to settlers' needs to process lumber and agricultural commodities, many of the region's streams and rivers were dammed in order to provide water power for mills. In the mid-1800s, Silver Creek was impacted by the installation of several dams for this purpose. One of best known dams constructed within Silver Creek was The Blackison Mill Dam. It was built in 1853 to provide water power for a saw mill that operated a sash saw that cut limber, operated a grist mill that used burros to grind grain, and a cement mill with a lime kiln (The Clark County Soil and Water Conservation District , 2007). As this region experienced further industrial growth, streams and wetlands were lost and degraded. The wetland located at the confluence of Silver Creek and the Ohio River, known as Loop Island, received leather tanning processing waste from a leather company beginning in the early 1860s (The Clark County Soil and Water Conservation District , 2007).

Due to extensive aquatic resource loss within the Upper Ohio SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 118** depicts each Natural Region and Section, located within the Upper Ohio SA, and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 102)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

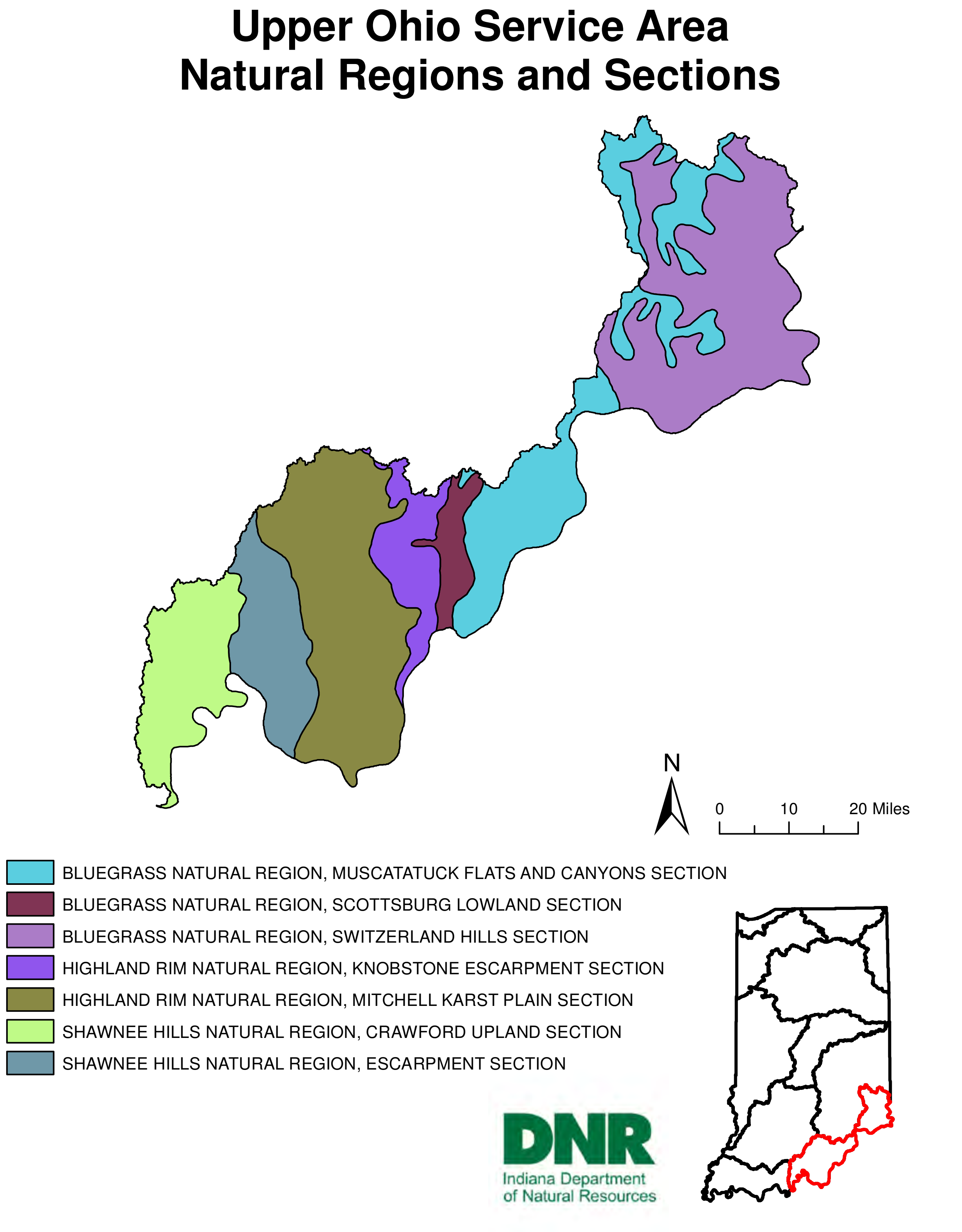


Figure 118. Natural regions and sections within the Upper Ohio Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Bluegrass	Switzerland Hills	26.66	Predominantly forested (mixed mesophytic), barrens (rare); rocky, gravel-bottomed, medium-gradient streams	11,002	0.63	71,129	4.07	99.82
	Scottsburg Lowland	3.2	Predominantly floodplain forest and swamp; wetland, swamps, acid seep springs, pond; low-gradient, silty-bottomed streams and rivers					
	Muscatatuck Flats and Canyons	19.44	Predominantly floodplain forest and swamp; wetland, swamps, acid seep springs, pond; low-gradient, silty-bottomed streams and rivers					
Shawnee Hills	Escarpment	9.44	Various upland forest types (dry-mesic and mesic); aquatic features include normally clear, medium and high-gradient streams, springs, and sinkhole ponds					
	Crawford Upland	11.08	Upland forest types, few sandstone and limestone glades, gravel washes, and barrens; acid seep spring community (rare)					
Highland Rim	Mitchell Karst Plain	23.87	Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)					
	Knobstone Escarpment	6.31	Predominantly various forest communities, glades (rare); small, and ephemeral high-gradient streams					

Table 102. The historic natural community composition for the Upper Ohio Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently zero (0) miles of category 4A impaired streams and 1,269 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (617 miles), impaired biotic communities (261 miles), PCBs in fish tissue (193 miles), dissolved oxygen (139 miles), nutrients (29 miles), total mercury in fish tissue (22 miles), and dioxin (water) (9 miles) are current stream impairments in the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 249 QHEI assessment reaches within the SA **(Table 103 and Figure 119)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 45.38% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	50	20.08
51-64	Habitat is partially supportive of a stream's aquatic life design	86	34.54
>64	Habitat is capable of supporting a balanced warm water community	113	45.38
	Total	**249**	**100%**

Table 103. IDEM Overall QHEI scores for Upper Ohio SA, 1991 – 2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Upper Ohio SA ranks first overall in forested cover density of all SAs at 53% of total area with approximately 919,827 acres, and is the SA with the second most total forest cover of any SA with approximately 17.64% of the of 5,215,169 acres of forest cover statewide.

GIS analysis identified approximately 3,559,241 linear feet (674 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Upper Ohio SA has the fourth lowest ratio of restorable stream miles to square miles of SA at approximately 0.25 mile of potential restoration per one square mile, or one mile of potential restoration for every 4.06 square miles of SA.

Upper Ohio Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

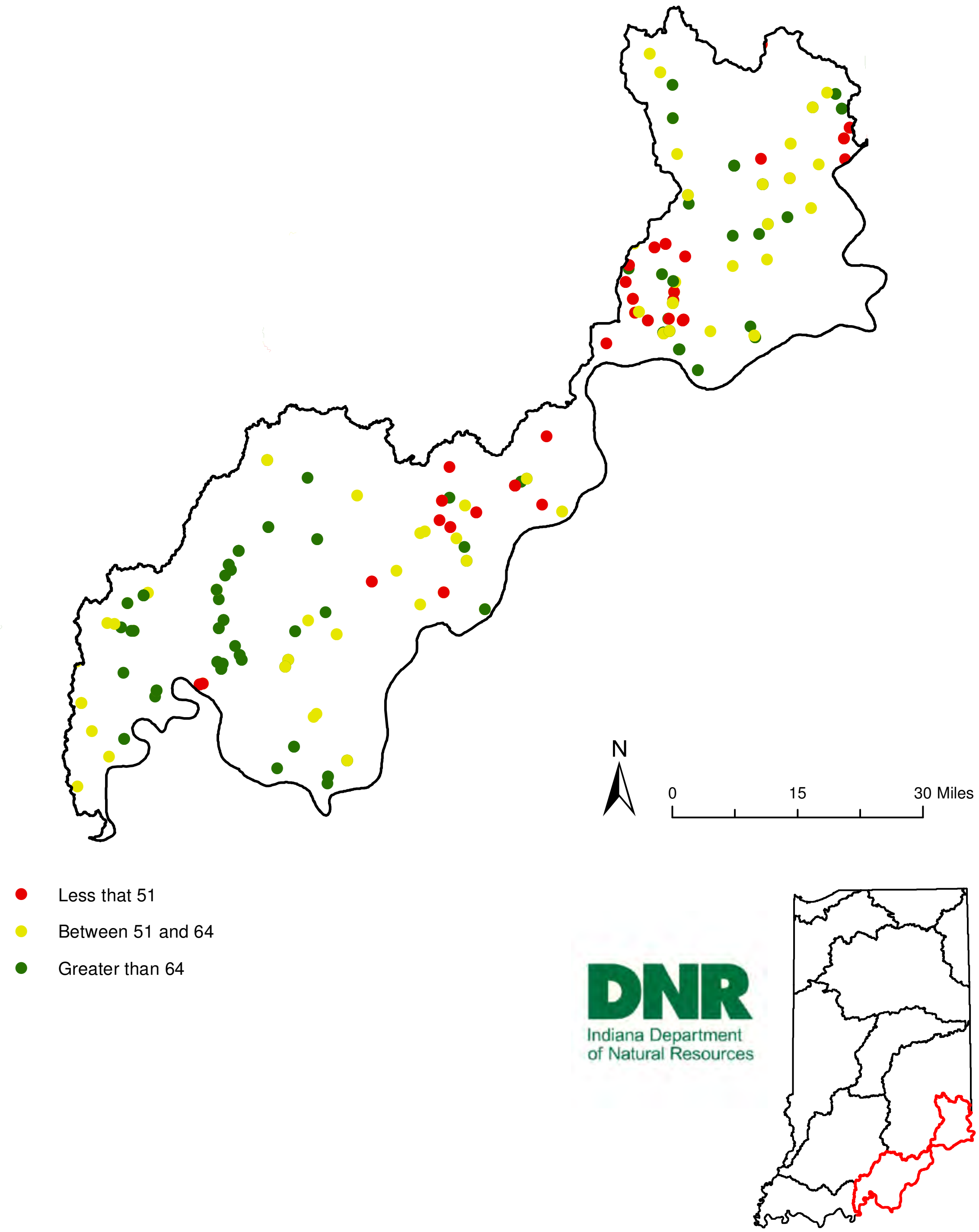


Figure 119. IDEM overall QHEI scores within the Upper Ohio service area; 1991-2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI in the Upper Ohio SA identifies approximately 2,090 acres of freshwater emergent wetland (PEM) and approximately 13,056 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 0.9% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 9.7% of the total SA **(Table 104 and Figure 120)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	2,090	1.24%	0.12%	0.01%
Freshwater Forested/Shrub Wetland	13,056	7.73%	0.75%	0.06%
Freshwater Pond	12,644	7.49%	0.72%	0.05%
Lake	124,777	73.89%	7.13%	0.54%
Riverine	16,302	9.65%	0.92%	0.07%
Grand Total	**168,869**	**100.00%**	**9.65%**	**0.73%**

Table 104. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils account for 52,009 acres (**Figure 121**), or 2.97% land cover within the SA, out of which approximately 43,794 acres have the potential to be restored, accounting for 2.5% of the total SA. This was determined by mapping current hydric and partially hydric soils data (NRCS-USDA, 2016) with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Upper Ohio SA has the lowest percentage of recoverable wetland acres to total SA size of all SAs and the second least amount of potentially restorable wetland acres of any SA.

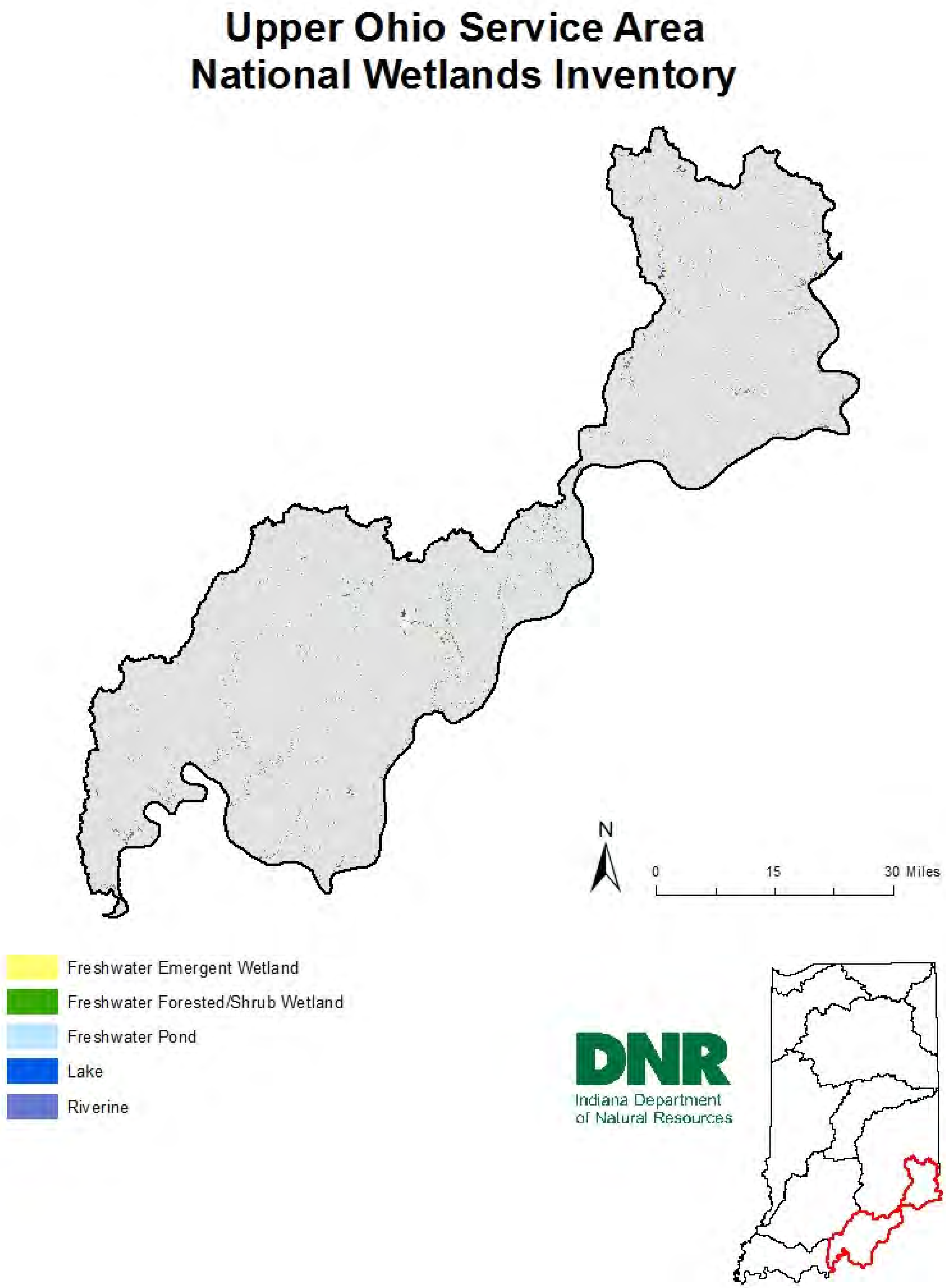


Figure 120. NWI for the Upper Ohio Service Area (USFWS NWI, 2015)

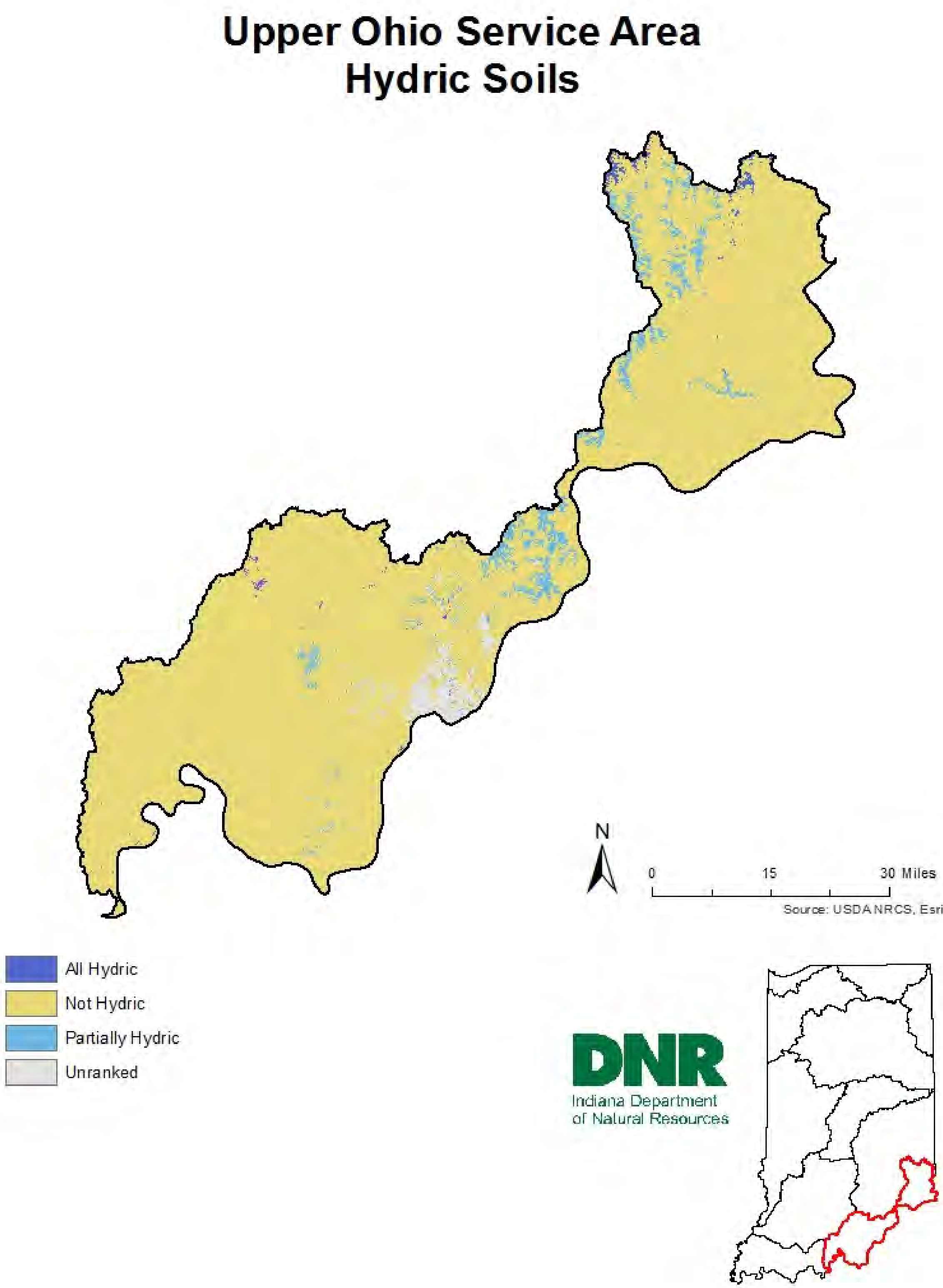


Figure 121. Hydric and partially hydric soils within the Upper Ohio Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 25,328 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Rogers Run-Fourteen Mile Creek (HUC 051401010403 **[Table 105]**).

Hotspots account for 1,098,240 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Highland Creek-West Fork Blue River (HUC 051401040703 **[Table 106]**). The watersheds with the highest concentrations of potentially restorable streams and wetlands **(Tables 4 & 5)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA and are shown in **Figure 122**.

Versailles State Park is the IDNR-managed land with the most adjacent hotspots of potentially restorable wetlands within the Upper Ohio SA (551 acres). Approximately 1,304 linear feet of hotspots of potentially restorable streams are on IDNR-managed lands. Approximately 4,047 linear feet of hotspots of potentially restorable streams are adjacent to IDNR-managed lands. Harrison-Crawford State Forest is the IDNR-managed land with the most adjacent hotspots of potentially restorable streams (2,266 linear feet).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
051401010403	Rogers Run-Fourteen Mile Creek	4,513
050902030501	Tub Creek-Laughery Creek	4,193
050902030507	Henderson Bend-Laughery Creek	3,079
050902030506	Jericho Creek-Laughery Creek	2,573
051401010402	West Fork Fourteen Mile Creek	2,398

Table 105. Watersheds in the Upper Ohio Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
051401040703	Highland Creek-West Fork Blue River	62,832
051401040603	City of Pekin-South Fork Blue River	44,352
050902030501	Tub Creek-Laughery Creek	43,824
051401040604	Dutch Creek-South Fork Blue River	35,904
051401040901	Slick Run-Blue River	35,376

Table 106 Watersheds in the Upper Ohio Service Area with the most hotspots of potentially restorable stream

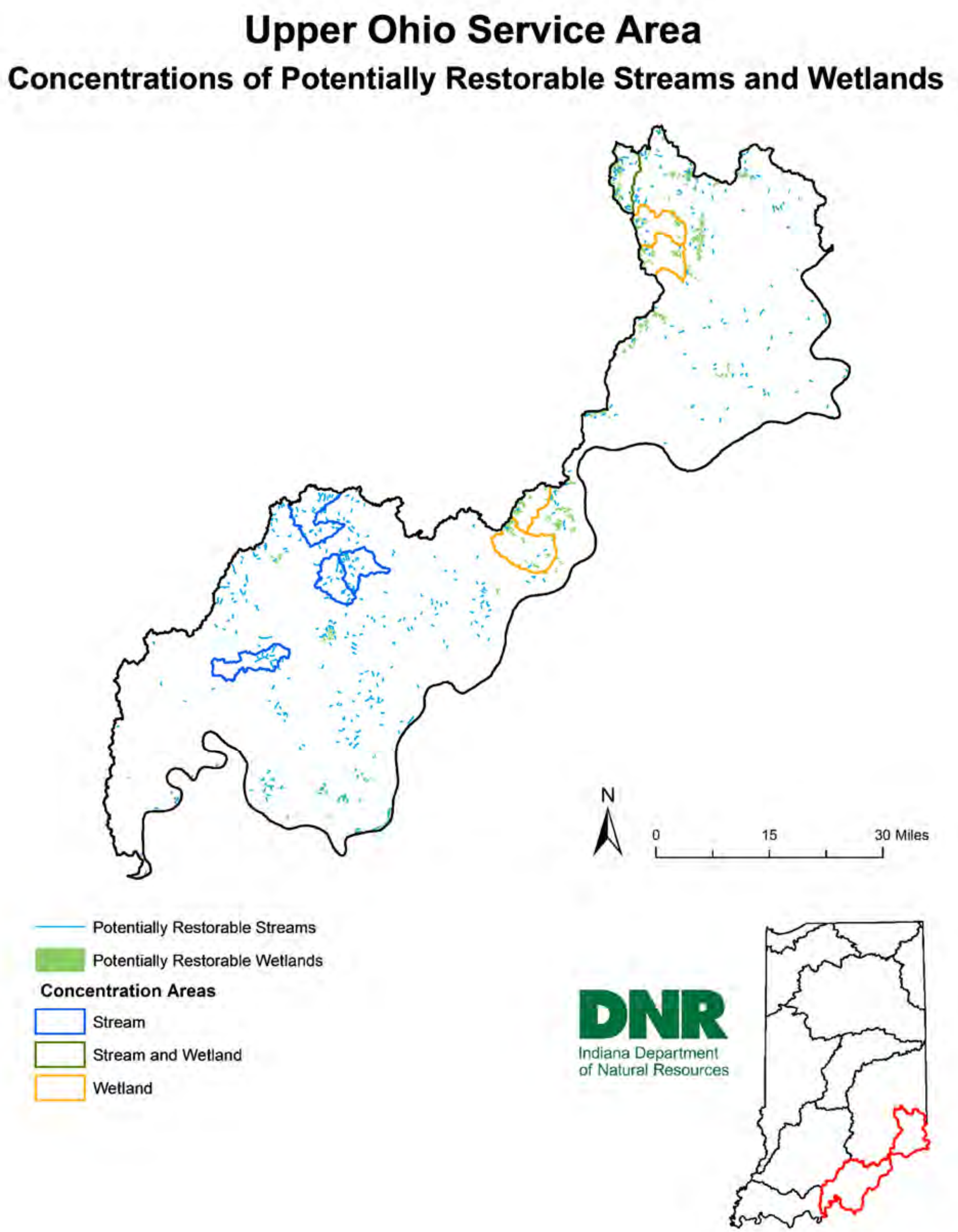


Figure 122. Concentrations of Potentially Restorable Streams and Wetlands in the Upper Ohio Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Upper Ohio SA identified one lake currently documented having the category 5 impairment of algae, which measured using the National Hydrography Dataset (NHD) accounts for approximately 73 acres.

The 2011 NLCD identifies approximately 11,332 acres of open water which accounts for 0.65% of the SA. This varies slightly from the NWI, which identifies approximately 12,644 acres of freshwater pond comprising of 0.9% of the SA, and 2,106 acres of lake comprising of 0.12% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Upper Ohio SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Upper Ohio SA shows that approximately 96% of the shallow unconsolidated aquifers receive 6 or less inches of ground water recharge annually **(Table 107).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	6	0.22%
	13	19	0.68%
	12	20	0.74%
	11	25	0.93%
	10	13	0.48%
	9	5	0.19%
	8	6	0.22%
	7	19	0.70%
	6	270	9.91%
	5	679	24.91%
	4	627	22.98%
Low	3	599	21.97%
	2	305	11.20%
	1	133	4.89%

Table 107. Approximate ground water recharge rates in the Upper Ohio Service Area (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that approximately 96% of the Upper Ohio SA near surface aquifers are in the high to low range for sensitivity to contamination with 87% in the moderate to low range **(Table 108)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	85	3%
High	235	9%
Moderate	1,176	43%
Low	1,198	44%
Very Low	33	1.2%

Table 108. Ground water sensitivity distribution in the Upper Ohio Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Upper Ohio SA as the second most registered capacity of surface water withdrawal among SA's with a 2015 withdrawal capacity of 543,944 MGD **(Figure 123)** (IDNR DOW, 2016). Energy production and mining accounts for approximately 99% of registered surface water withdrawal capacity.

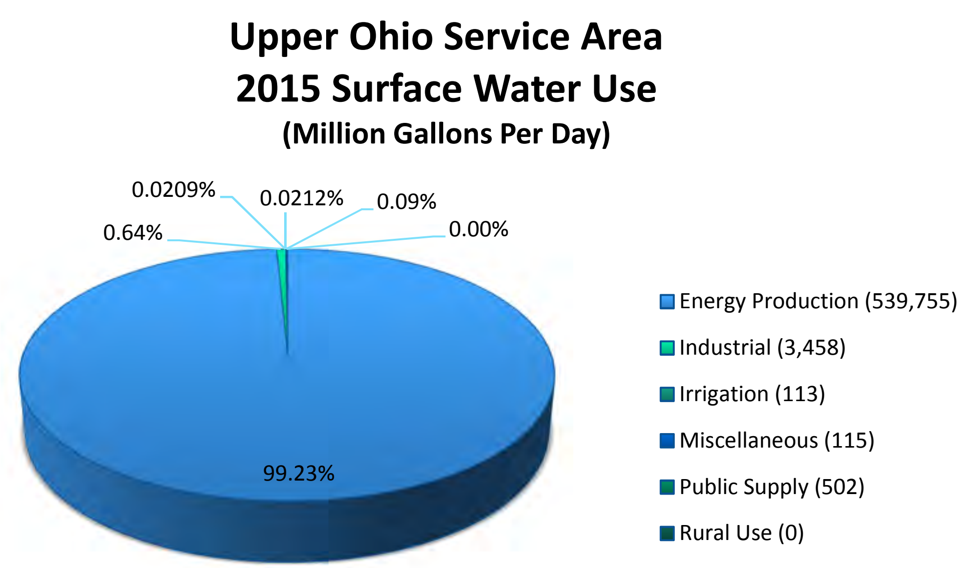


Figure 123. 2015 surface water usage in the Upper Ohio Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Upper Ohio SA is the seventh among SA's with a 13,654 MGD registered withdrawal capacity **(Figure 124).** Public water supply accounts for approximately 58% of registered ground water withdrawal capacity in the SA, followed by industrial uses with 34%, energy production and mining with 8%, and agricultural irrigation accounting for the remainder.

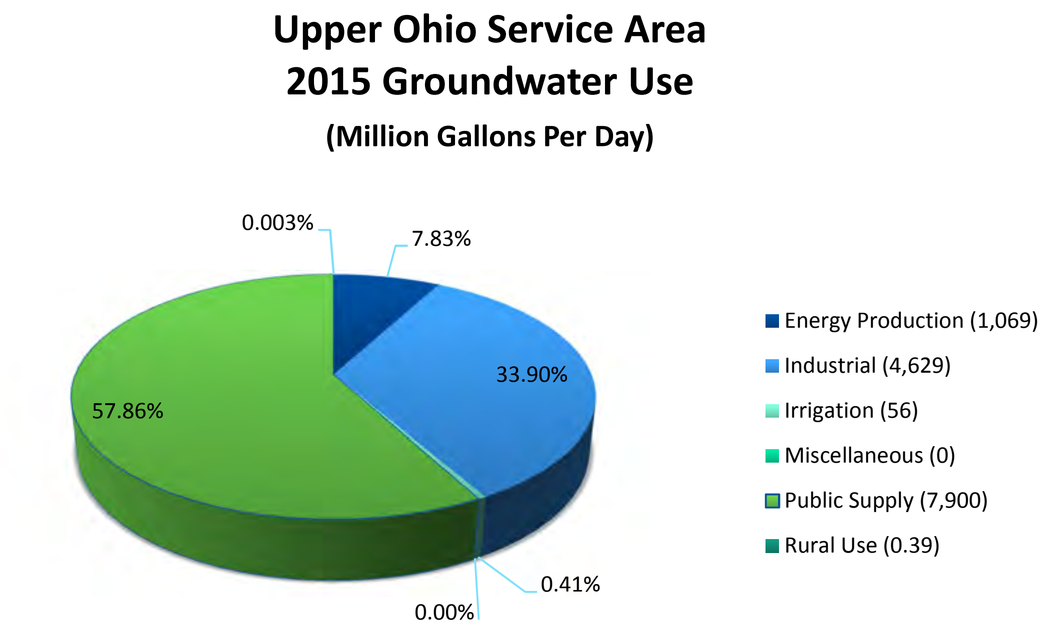


Figure 124. 2015 ground water usage in the Upper Ohio Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Upper Ohio SA include, but are not limited to, aquatic cave, sinkhole swamp, wet floodplain forest, and flatwoods, in addition to many other transitional, mixed and upland communities.

There are currently a minimum of seven amphibian species, 44 bird species, eight fish species, 17 mammal species, nine mollusk species, and 11 reptile species listed as SGCN within the SWAP Planning Regions within the Upper Ohio SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Upper Ohio SA. The following aquatic resource goals and objectives apply specifically to the Upper Ohio SA based on 404 permitted impact trends, predominant threats, historic loss, currently impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources that will offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any stream channel restoration needs.

3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt and Interior Plateau Planning Regions where feasible.
7. Stream and wetland restoration projects to buffer and protect karst features and systems unique to areas in southern Indiana.
8. Implement stream and wetland restoration projects that will improve the water quality and habitat within the Blue River watershed.

ELEMENT 6. PRIORITIZATION STRATEGY

The <u>four steps below</u> present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **<u>core criteria</u>** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Upper Ohio SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Hogan Creek WMP, Indian Creek WMP, Silver Creek WMP, South Laughery Creek WMP, and Tanners Creek WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the DE.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Oak Heritage Conservancy, Indiana Karst Conservancy, George Rogers Clark Land Trust, Oxbow, Inc., and Sycamore Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program.

Additional stakeholders' interest and potential conservation partnerships specific to the Upper Ohio SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Kentucky Water Science Center
- USGS Ohio Water Science Center
- U.S. Forest Service Hoosier National Forest
- Ohio River Valley Water Sanitation Commission (ORSANCO)
- Appalachian Landscape Conservation Cooperative
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- River Hills Economic Development District & Regional Planning Commission
- Indiana 15 Regional Planning Commission
- Southeastern Indiana Regional Planning Commission
- Indiana Karst Conservancy
- Oak Heritage Conservancy
- The Regional Council of Governments (OKI)

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 125** below.

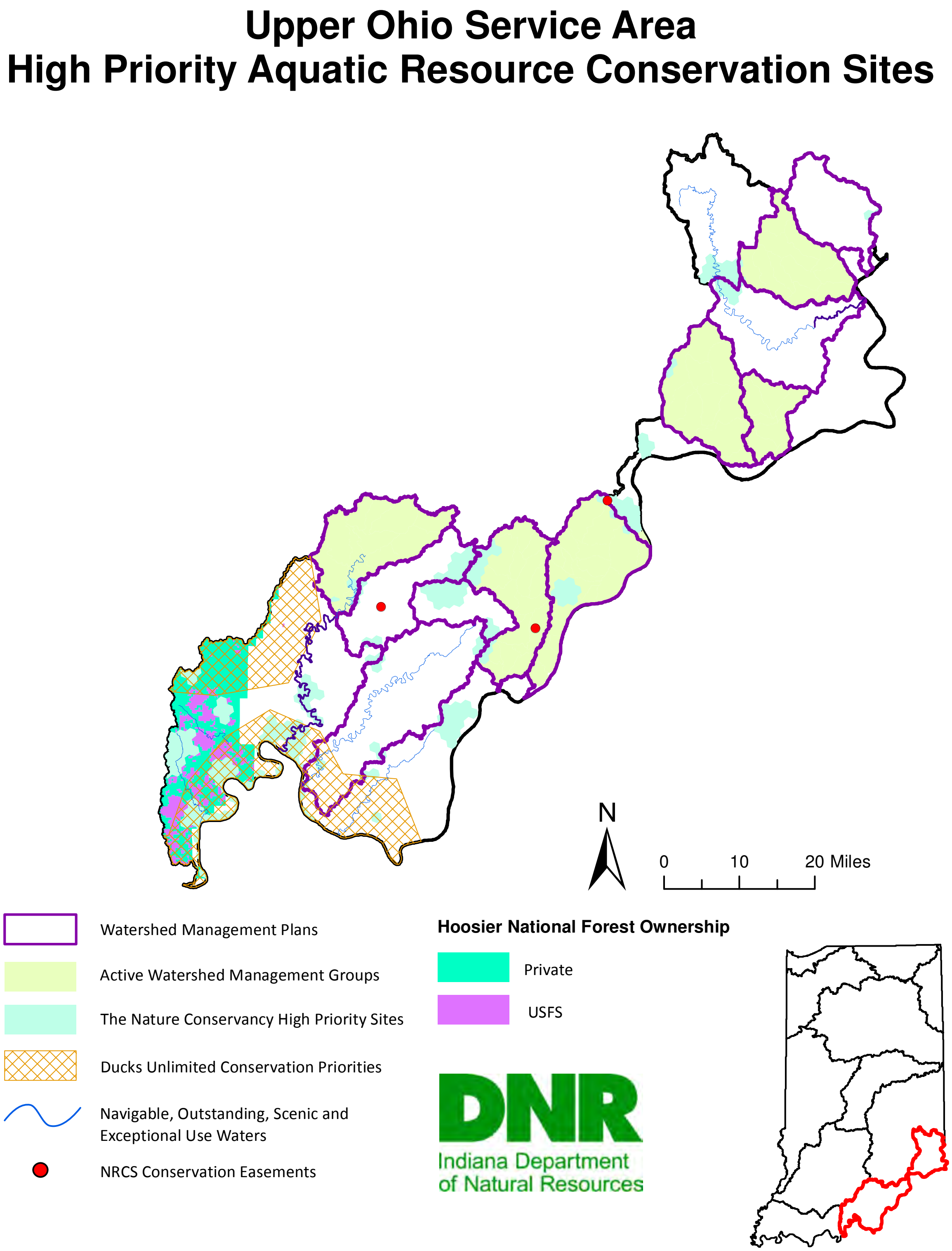


Figure 125. Priority aquatic resource conservation groups and sites within the Upper Ohio Service Area (IWPP, 2015)

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

APPENDIX B.11 OHIO-WABASH LOWLANDS SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION

The Ohio-Wabash Lowlands Service Area (SA) is located in the most southwestern part of Indiana and is composed of all or portions of the following three 8-digit HUC watersheds:

- 05140202 - Highland-Pigeon
- 05140201 - Lower Ohio-Little Pigeon
- 05120113 - Lower Wabash

The Ohio-Wabash Lowlands SA includes all or portions of nine Indiana counties listed below and is located within the Southern Hills and Lowlands physiographic region.

Gibson	Crawford	Warrick
Pike	Perry	Vanderburgh
Dubois	Spencer	Posey

The Ohio-Wabash Lowlands SA drains 2,101 square miles of southwestern Indiana and is located mainly in the Interior River Valleys and Hills, or Interior River Lowland ecoregion; it is bordered on three sides by the Patoka River, Wabash River, and Ohio River. Key features of this region include wide, shallow valleys with wind-blown silt deposits in the west and sandstone bedrock exposure in the east; the soils in this area are neutral to acidic. Prior to the area being cleared for agricultural use and surface mining, mesophytic and oak-hickory forests flourished (U.S. EPA: Ecoregions of Indiana).

A majority of state and federal lands within this SA are located in the easternmost portion of the SA, along its border with the Upper Ohio SA. Popular streams within this SA include Pigeon Creek, Little Pigeon Creek, and the Anderson River, all of which drain to the Ohio River.

Based on the 2011 NLCD, the land cover type with the most area in the Ohio-Wabash Lowlands SA is agricultural land use (54.9%), followed by forest and scrub/shrub (29.6%), developed and impervious land use (10.14%), and wetland and open water (4%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 1.5% per the NLCD to 4% per the NWI. Emergent herbaceous wetlands range from 0.4% per the 2011 NLCD to 0.7% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Ohio-Wabash Lowlands SA have been identified using the same approach as the statewide portion of the CPF. The threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Ohio-Wabash Lowlands SA from 2009 – 2015 was collected and analyzed **(Table 108)**. According to the data, 856.7 acres of impacted wetlands and 539,692 linear feet of impacted streams required mitigation in the seven year time period. Locations of the permitted stream and wetland impacts are provided in **Figure 126**.

Work Type Category	Authorized Stream Impacts – Linear Feet	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impacts per Category
Agriculture	1,175	0.22%	0	0.00%
Dam	0	0.00%	0	0.00%
Development	23,602.5	4.37%	37.905	4.42%
Energy Production	511,562	94.79%	815.663	95.21%
Transportation	3,352.5	0.62%	3.151	0.37%
Grand Total	**539,692**	**100.00%**	**856.719**	**100.00%**

Table 108. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville District

Ohio-Wabash Lowlands Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

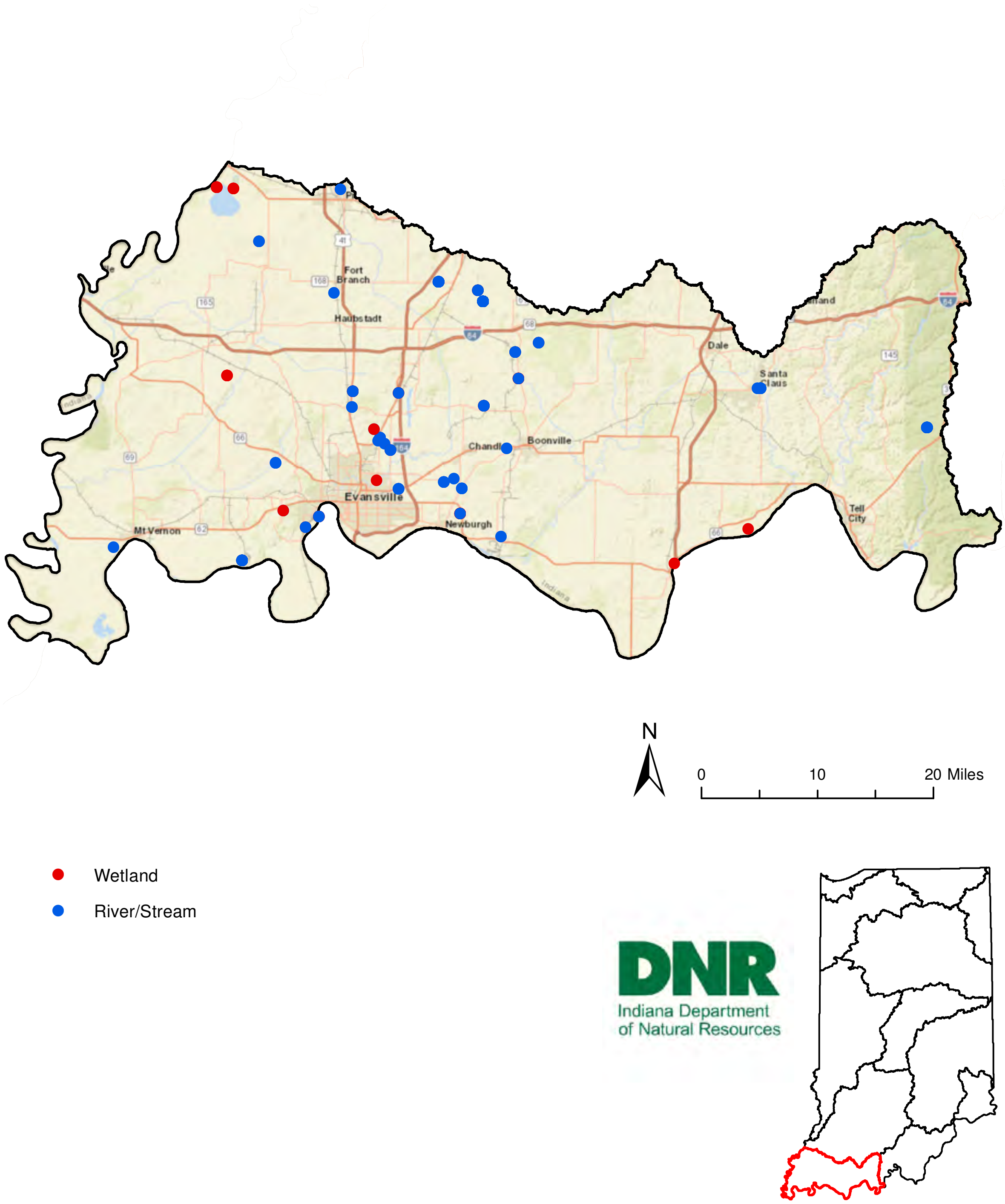


Figure 126. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Ohio-Wabash Lowlands SA is presented in **Figure 127** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

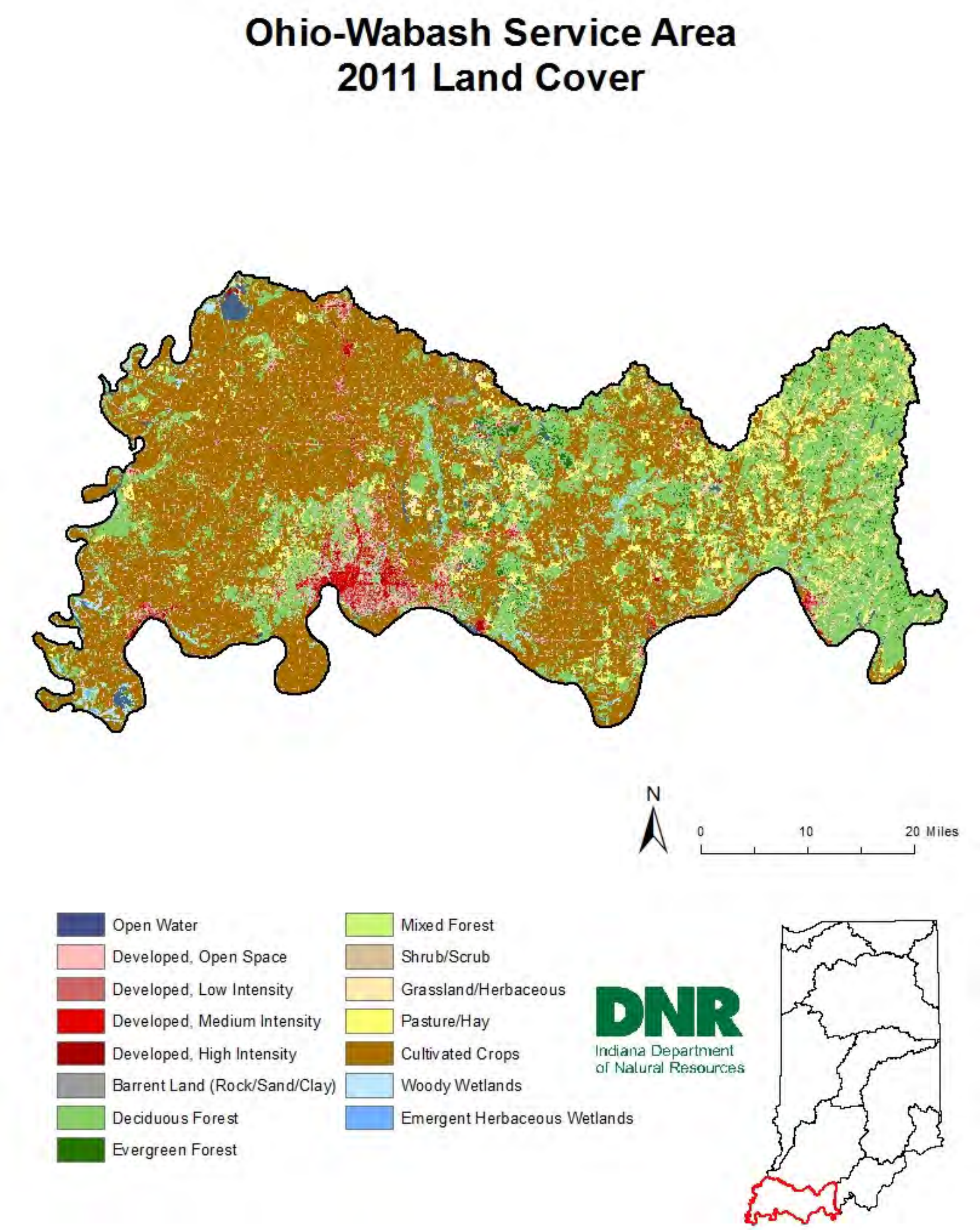


Figure 127. Land cover within the Upper Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 109)**.

Land Cover			
Class	**Value**	**Sum of Acres**	**Percent of Total Acres**
Open Water	*	27,276	2.03%
Developed	Open Space	88,310	6.57%
Developed	Low Intensity	29,117	2.17%
Developed	Medium Intensity	12,902	0.96%
Developed	High Intensity	6,049	0.45%
Barren Land (Rock/Sand Clay)	*	1,864	0.14%
Forest	Deciduous	380,892	28.33%
Forest	Evergreen	16,906	1.26%
Forest	Mixed	298	0.02%
Shrub/Scrub	*	784	0.06%
Grassland/Herbaceous	*	16,462	1.22%
Pasture/Hay (Agriculture)	*	83,025	6.18%
Cultivated Crops (Agriculture)	*	654,711	48.70%
Wetlands	Woody	20,519	1.53%
Wetlands	Emergent Herbaceous	5,264	0.39%
Grand Total		**1,344,382**	**100.00%**

Table 109. Ohio-Wabash Lowlands SA land cover classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 128** below to demonstrate the current overall land cover distribution of the SA.

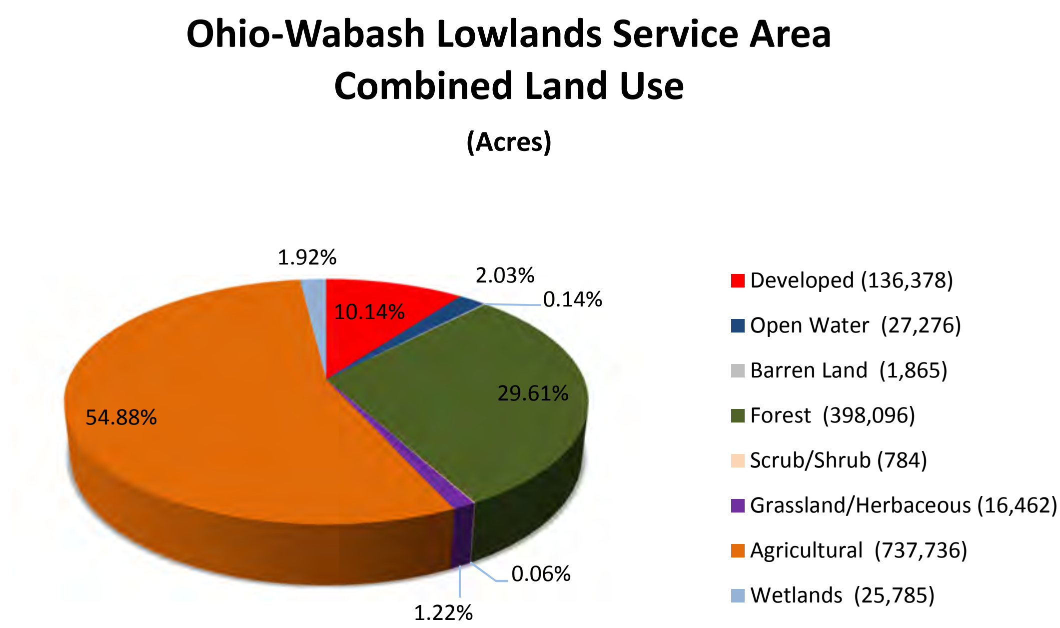


Figure 128. Combined land uses within the Ohio-Wabash Lowlands Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the SA. Total agricultural land use covers approximately 55 percent of the SA's total land area of 737,736 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of developed areas such as Evansville and Mt. Vernon and the predominantly forested region along the eastern boundary of the SA.

Within the identified land use areas, cultivated crops cover over 654,711 acres (48.7%) and pasture/hay lands cover 83,025 acres (6.18%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop followed closely by soybeans based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Ohio-Wabash Lowlands SA (USDA-NASS, 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. The Ohio-Wabash Lowlands SA is the eighth largest SA with approximately 1,344,382 acres and contains pork, turkey, and chicken confined feeding operations (CFOs) having at least 5,000 animal units. When combining these major agricultural land use activities, the Ohio-Wabash Lowlands SA ranks seventh in percentage of total statewide land use (3.19%), and is a significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the third largest land use category after forested cover in the SA covering approximately 136,378 acres (10.14%) of the 1,344,382 total acres and is fifth in developed area intensity among all SAs.

In general, the most densely developed areas consist of communities along the Ohio River and along major transportation routes such as U.S. 41 and U.S. 231. The most densely developed communities include Evansville, Newburgh, Mount Vernon, Princeton and Tell City. The SA contains the Evansville MSA, the sixth most populous MSA in the state (Manns, 2013). Approximately 99% (664,698 acres) of the Evansville MSA is located within the SA accounting for approximately 23% of total SA acres. Analysis of the INDOT cities and towns GIS data shows the SA contains all or part of 130 cities and/or towns, 30 of which are incorporated (INDOT, 2016).

Two Indiana regional councils that overlap the SA include the Economic Development Coalition of Southwest Indiana (65%) and the Indiana 15 Regional Planning Commission (35%) (IARC, 2017). According to the Economic Development Coalition of Southwest Indiana, major industries include bio and life science, advanced manufacturing, advanced logistics, energy, coal mining, agriculture, forestry, transportation, warehousing, distribution, retailing, health care, finance, and business services, with southwest Indiana containing many corporate headquarters. Southwest Indiana provides business with access to five MSA's within 3.5 hours all with a population of over one million. More workers commute into the region than workers commute out, resulting in an economic development strategy focusing on improving housing, education, and public works initiatives to make the region more desirable to live and work within (Economic Development Coalition of Southwest IN, 2010).

Southwest Indiana contains several interstates, as well as U.S. and state highways that include the new construction of Interstate 69 bringing improved and more efficient access to the region. In addition to readily available rail access throughout, southwest Indiana is bordered by the Wabash and Ohio Rivers (Economic Development Coalition of Southwest IN, 2010).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 5,873 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The SA has the fifth highest local road miles to square mile ratio of the SA at approximately 2.8 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The SA contains approximately 555 miles of U.S. Interstates and highways, 1,627 miles of state highways, and 5,837 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the eighth largest SA, the concentration of the various road types per square mile of land has varying distribution throughout its boundary.

U.S. Interstates and highways have a concentration of approximately 0.26 mile per square mile, which ranks ninth among the eleven SAs making this the lowest ranking road type within the SA. Although the concentration of U.S. Interstates and highways has the lowest ranking, the concentration of state highways ranks second with 0.77 mile per square mile and is the highest ranking road type within the

Ohio-Wabash Lowlands SA. The ranking of the concentration of local roads ranks near the middle with approximately 2.80 miles per square mile, which ranks fifth when compared to local roads rankings for the ten other SA. Similarly, the combined ranking of the concentration for all roadways ranks near the middle with a concentration of 3.83 miles per square mile, which ranks fifth overall.

Although the concentration of U.S. Interstates and highways ranks near the bottom, closer analysis reveals the concentration of the state highways places near the top, while local roads and the ranking of all roads combined ranks near the middle when compared to all the other SAs. The construction and maintenance of roads and bridges, throughout the Ohio-Wabash Lowlands SA supports the predominant mode of transportation and plays an integral role in sustaining business and commerce for the region.

2.5.2 Railroads

As an alternative mode of transportation, the Ohio-Wabash Lowlands SA has approximately 407 miles of railroad within the SA boundary (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Ohio-Wabash Lowlands SA contains the eighth largest concentration of railroads with a density of 0.19 mile per square mile. The concentration of linear infrastructure throughout the SA contributes to aquatic resource threats including habitat fragmentation, disruption to fluvial processes, resource degradation, conversion and loss of aquatic resources.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Ohio-Wabash Lowlands SA contains service corridors, which contribute to aquatic resource impacts and habitat loss. The SA contains over 3,146 miles of service corridors.

The Ohio-Wabash Lowlands SA contains an extensive network of large kilovolt (kV) electric transmission lines. The large kV transmission lines identified within the SA include approximately 332 (12 kV) lines, thirteen (69 kV) lines, four (138 kV) lines, eighteen (345 kV) lines, and twelve (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 1,046 miles throughout the SA, which is tied with the St. Joseph River SA for the fourth highest concentration of electric transmission lines relative to the SA size with 0.5 mile of transmission line per square mile.

In addition to electric transmission lines, the SA contains over 2,100 miles of pipelines. This includes over 543 miles of pipelines that convey crude oil, 417 miles of pipelines that transport natural gas, and 124 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Ohio-Wabash Lowlands SA contains the greatest concentration of crude oil pipelines and the eighth greatest concentration of natural gas and refined petroleum product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently no known low head dams (IDNR DOW, 2016) within the SA. There are currently 55 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 38 square miles; tied for the fourth highest concentration across all SAs, containing 6% of documented high head dams statewide.

According to NLE GIS analysis (IDNR, 2016), there are approximately 1,953,600 linear feet (370 miles) of NLE's mapped within the SA, averaging one mile of NLE per 6 square miles, the highest concentration among all SAs. Approximately 275 miles of the NLEs are located within predominantly developed areas with the remaining 95 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining Threats

2.7.1 Coal

The Ohio-Wabash Lowlands SA contains historic and active coal mining operations. Based upon IDNR-Division of Reclamation's (DOR) surface and underground coal mining dataset, coal mining operations were first documented in 1858 and have effected over 128,584 acres (Gray, Ault, Keller, & Harper, Surface Coal Mines in Indiana, 2010); (Gray, Ault, Keller, & Harper, Underground Coal Mines in Indiana, 2010).

Mining operations, prior to the enactment of the SMRCA of 1977, were not required to implement post mining reclamation. The Ohio-Wabash Lowlands SA contained approximately 330 surface coal mines totaling approximately 58,453 acres, and 382 underground coal mines totaling 24,923 acres of Pre-SMCRA coal mining operations. These Pre-SMCRA surface mining operations impacted 4.35% of the SA land cover, which ranks first of the three coal bearing SAs. Pre-SMRCA underground mining operations impacted 1.85% of the SA land cover ranking it second of the three.

Surface and underground mining operations that fall under regulation of the SMRCA of 1977 are prevalent throughout the SA. The IDNR DOR has recorded over 314 surface coal mining operations totaling approximately 37,837 acres and over 27 underground mining operations that total approximately 7,370 acres within the SA. These surface mining operations impact over 2.81% of the SA land cover which ranks it second among the SAs. Similarly, the concentration of underground mining operations ranks second with 0.55% SA land cover concentration. This SA is the smallest of the three that contains coal with approximately 1,344,382 acres. Surface mining has resulted in impacts to approximately 96,291 acres altering over 7.16% of the SA's land cover ranking it first. Underground mining impacts have altered over 32,293 acres of the SA ranking it second with a concentration of 2.4% of the SA land cover.

2.7.2 Natural Gas and Oil Production

The Ohio-Wabash Lowlands SA contains a multitude of active oil and gas fields along with wells that currently support, or have supported, the petroleum industry. The Indiana Geological Survey (IGS) identifies 24 petroleum gas fields with 89 associated gas wells; 166 oil fields with 2,705 oil wells; and 51 oil & gas fields with two oil & gas wells ranking the SA first statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 158 abandoned gas wells, 4,209 abandoned oil wells, 22 abandoned oil & gas wells, 10,104 dry wells, six observation wells, 309 stratigraphic wells, 82 saltwater disposal wells, 137 abandon saltwater disposal wells, 180 temporarily abandoned wells, one potable water supply wells, 38 non-potable water supply wells, 837 water injection wells, 103 gas storage, two abandoned gas storage, one abandoned observation wells, two abandoned waste disposal wells, 587 abandoned water injection wells, 963 abandoned oil and water injection wells, one abandoned oil, gas and water injection well, and three waste disposal wells within the SA (Indiana Geological Survey, 2015).

2.7.3 Mineral Mining and Aggregates

The Ohio-Wabash Lowlands SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains five active sand & gravel mining operations ranking it last in the state (Indiana Geological Survey, 2016).

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Ohio-Wabash Lowlands SA partially contains the Indiana SWAP Valleys and Hills Planning Region (83.4%) and a smaller portion of the Interior Plateau Planning Region (16.6%). The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the agricultural and developed impervious footprints make up approximately 65% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects energy production and mining, specifically surface coal mining, to remain the foremost permitted activities requiring mitigation for aquatic resource impacts followed by development and transportation projects if the 404 permitting trends of the past 7 years continue.

Evansville is the third-largest city in Indiana and the largest in Southern Indiana. Evansville is the regional economic hub for the Illinois-Indiana-Kentucky Tri-State Area, a 24-county economic region with 822,000 residents. The population throughout southwest Indiana is projected to grow by approximately 5% through 2040 (Economic Development Coalition of Southwest IN, 2010).

Infrastructure maintenance and improvements are not keeping pace with the region's growth, and although there are significant transportation and logistics assets, economic development strategies call for increased and improved connectivity to increase efficiency between all modes of travel and transport (Economic Development Coalition of Southwest IN, 2010).

Through the comprehensive economic development process, southwest Indiana community representatives from all sectors have identified business development, urban/downtown revitalization, energy, facilities, housing, parks, road/transportation upgrades, water supply, waste and storm water system improvements, communication infrastructure, and energy production as top growth objectives (Economic Development Coalition of Southwest IN, 2010).

Abandoned mines will continue to negatively impact the chemical, physical and biological integrity of aquatic resources. Among the many impacts to aquatic resource functions and services in the SA, invasive species will continue to thrive unless restoration and enhancement efforts are increased and ongoing long term management is actively conducted.

Forests cover approximately 30% of the SA, so forest conversion (deforestation) and timber harvesting have the potential to impact aquatic resources; though modern selective timber harvesting practices have moderated the industry's threats to, and impacts upon, aquatic resources.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to offsetting the predominant threats in the Ohio-Wabash Lowlands SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Ohio-Wabash Lowlands SA's historic aquatic resources and landscape were shaped by the large rivers and associated forested bottomlands of the Wabash and Ohio Rivers. The extensive river bottom lowlands of this SA were known to possess significant forested wetland communities. Many small streams throughout the eastern region are comprised of short drainages directly into the Ohio River. The streams of the western portion of the SA are comprised of longer reaches extending across the region before their confluence with the Wabash and Ohio Rivers. The composition of the SA's aquatic resources were shaped by this floodplain landscape. These aquatic resources were altered resulting in degradation and loss by the region's early settlers.

The SA's aquatic resources experienced this degradation and loss due to agricultural land use conversion throughout the SA. During the 1800s, settlers rapidly changed the landscape by clearing the forests for agriculture, allowing livestock to roam free, draining wetlands, ultimately impacting the native vegetation and natural communities (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012). In order to facilitate agriculture within this SA, European settlers' channelized first and second order streams to facilitate drainage for crops, which increased nutrients and other pollutants into the streams for over two centuries (Pigeon-Highland Watershed Steering Committee and Four Rivers Resource Conservation & Development Area, Inc., 2003). In addition to using pasture lands to raise cattle and hogs, growing wheat, corn, rice, cotton and tobacco; large settlements, such as Harmony and Vincennes contained horses and sheep during the early 1800s (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012). By 1816, the first and second bottoms of the Wabash River, near New Harmony, contained 700-800 acres of fenced cropland (Whitaker Jr., Amlaner Jr., Jackson, Parker, & Scott, 2012).

As the SA received more settlers, the natural communities of the region felt increased pressures. The City of Evansville and the county in which it resides were established in the early 1800s. Similar to the establishment of other upstream cities, Evansville was situated along the Ohio River. Being situated along an important trade route, business and commerce were important regional growth here. By the late 1800s the increased demand for construction lumber, coal, natural gas, and oil was fueled by the construction of new factories and homes (Carman, 2013). During the end of this period, Evansville had become a center for furniture manufacturing and contained over 300 iron, steel and woodworking companies (Pigeon-Highland Watershed Steering Committee and Four Rivers Resource Conservation & Development Area, Inc., 2003).

The SA contains the southernmost region of the Illinois basin coal field. The existence of coal throughout the region has played a major role in the transformation of the landscape for centuries. Since the first discovery of coal along the Wabash River in 1736, the use of coal provided settlers with an energy source for survival. Indiana coal mining begain in the 1830s, with its predominant uses as fuel for Ohio River steam boats, heating, and blacksmith forges (Stevens, 2012). Recovered coal was shipped throughout the region by utilizing the region's waterways. In 1840, flat boats were being used to ship small quantities of coal from locations along the Ohio, Wabash and White Rivers (Stevens, 2012). During this period, coal mining communities began to develop in order to support the coal mines. In 1850, the first underground mine shaft for deep vein coal mining was constructed in Newburgh, Indiana (Town of Newburgh Indiana, 2017). Less than ten miles to the north, the Chandler Mine was opened in 1875 becoming the town of Chandler's first underground mine (Town of Chandler Indiana, 2017). Coal mining within the SA, became the primary fuel for locomotives and energy production resulting in an influx of companies and mining operations into the town (Town of Chandler Indiana, 2017).

Mineral extraction and massive landscape alteration within the SA have resulted in over two centuries of ecosystem structural and functional damage which limits its ability to recover (Pigeon-Highland Watershed Steering Committee and Four Rivers Resource Conservation & Development Area, Inc., 2003). This resulted in degradation and loss of streams and wetlands. Environmental consequences from historical mining practices were severe and prolonged due to the high demand for coal, lack of regulations, and the absence of methods for successful land reclamation (Stevens, 2012).

Industry and commerce played an important role in the history of aquatic resource loss throughout the SA; however, transportation provided the means for sustaining the region's growth by providing avenues to get commodities to market. By the mid-1880s, Newburgh's Ohio River port grew to become the largest river port between Cincinnati and New Orleans (Town of Newburgh Indiana, 2017). Canals were constructed in order to provide a means of transport but they were slowly replaced by railroads during this period. The Lake Erie, Evansville & South Western Railroad was completed within the SA by 1873; constructed along the creek bed of the failed Central Canal in order to provide a rail line from Evansville to Gentryville (Town of Chandler Indiana, 2017).

Due to extensive aquatic resource loss within the Ohio-Wabash Lowlands SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 129** depicts each Natural Region and Section located within the Ohio-Wabash Lowlands SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 110)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Ohio-Wabash Lowlands Service Area
Natural Regions and Sections

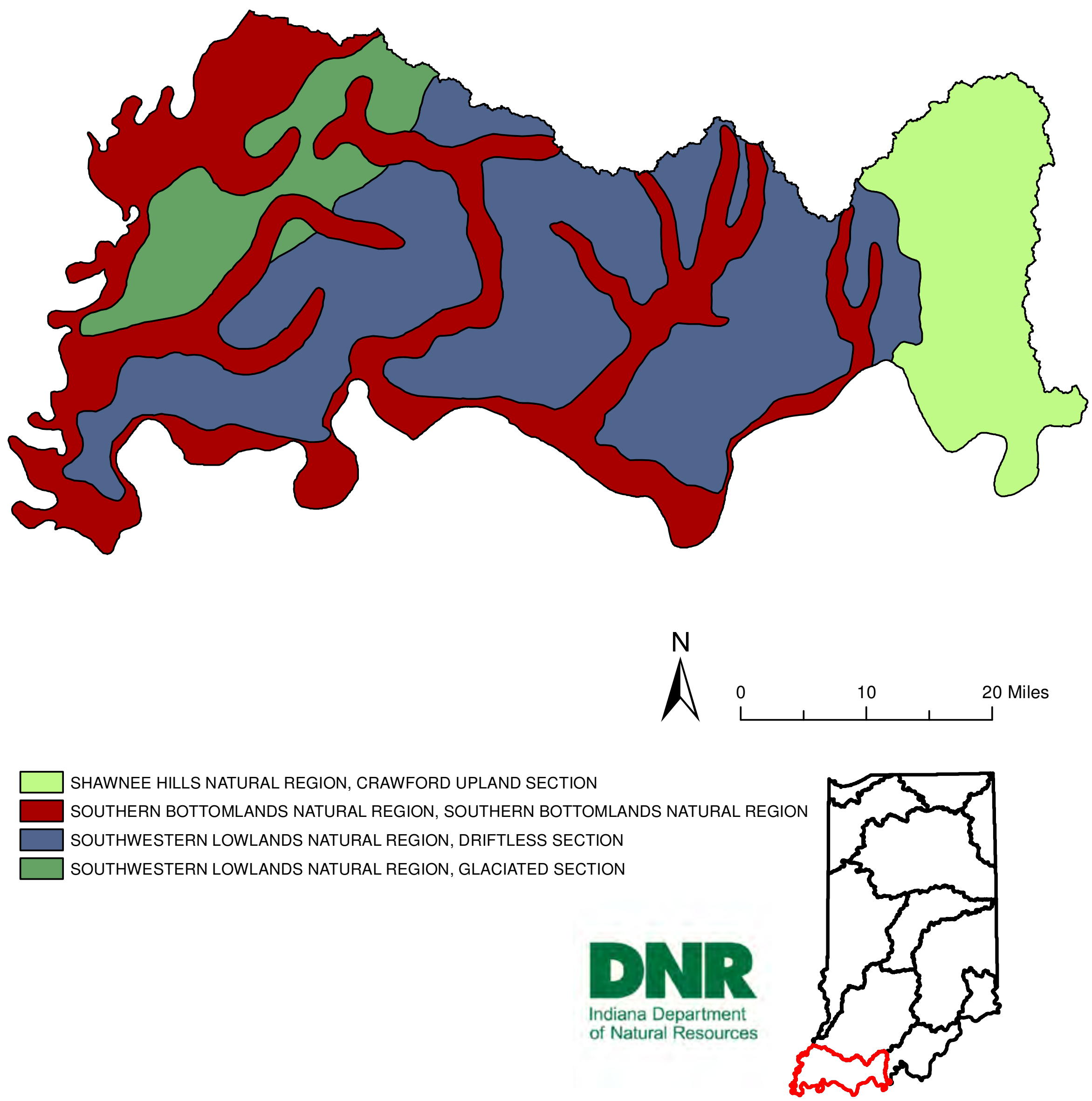


Figure 129. Natural regions and sections within the Ohio-Wabash Lowlands Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Shawnee Hills	Crawford Upland	15.08	Upland forest types, few sandstone and limestone glades, gravel washes, and barrens; acid seep spring community (rare)	182,369	13.57	36	0.001	99.77
Southern Bottomlands	Southern Bottomlands	33.84	Bottomland forest, swamp, pond, slough, and formerly marsh and prairie					
Southwestern Lowlands	Driftless	42.11	Predominantly upland forest, southern flatwoods, barrens (xeric, ephemerally wet), acid seep spring (rare), marsh, swamp, sandstone cliff; low to medium-gradient stream					
	Glaciated	8.97	Predominantly forested, flatwoods, prairie (several), swamp, marsh, pond; low-gradient streams					

Table 110. The historic natural community composition for the Upper White Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are 488 miles of category 4A impaired streams and 997 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (398 miles), impaired biotic communities (294 miles), dissolved oxygen (122 miles), PCBs in fish tissue (121 miles), pH (37 miles), nutrients (10 miles), pesticides (5 miles), total mercury in fish tissue (5 miles), and chloride (4 miles) as existing stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 126 QHEI assessment reaches within the SA **(Table 111 and Figure 130)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, only 11.9% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	66	52.38
51-64	Habitat is partially supportive of a stream's aquatic life design	45	35.71
>64	Habitat is capable of supporting a balanced warm water community	15	11.90
	Total	**126**	**100%**

Table 111. IDEM Overall QHEI scores for Ohio-Wabash Lowlands SA, 1991 – 2014 (IDEM OWQ, 2014)

Ohio-Wabash Lowlands Service Area
Qualitative Habitat Evaluation Index (QHEI) Scores

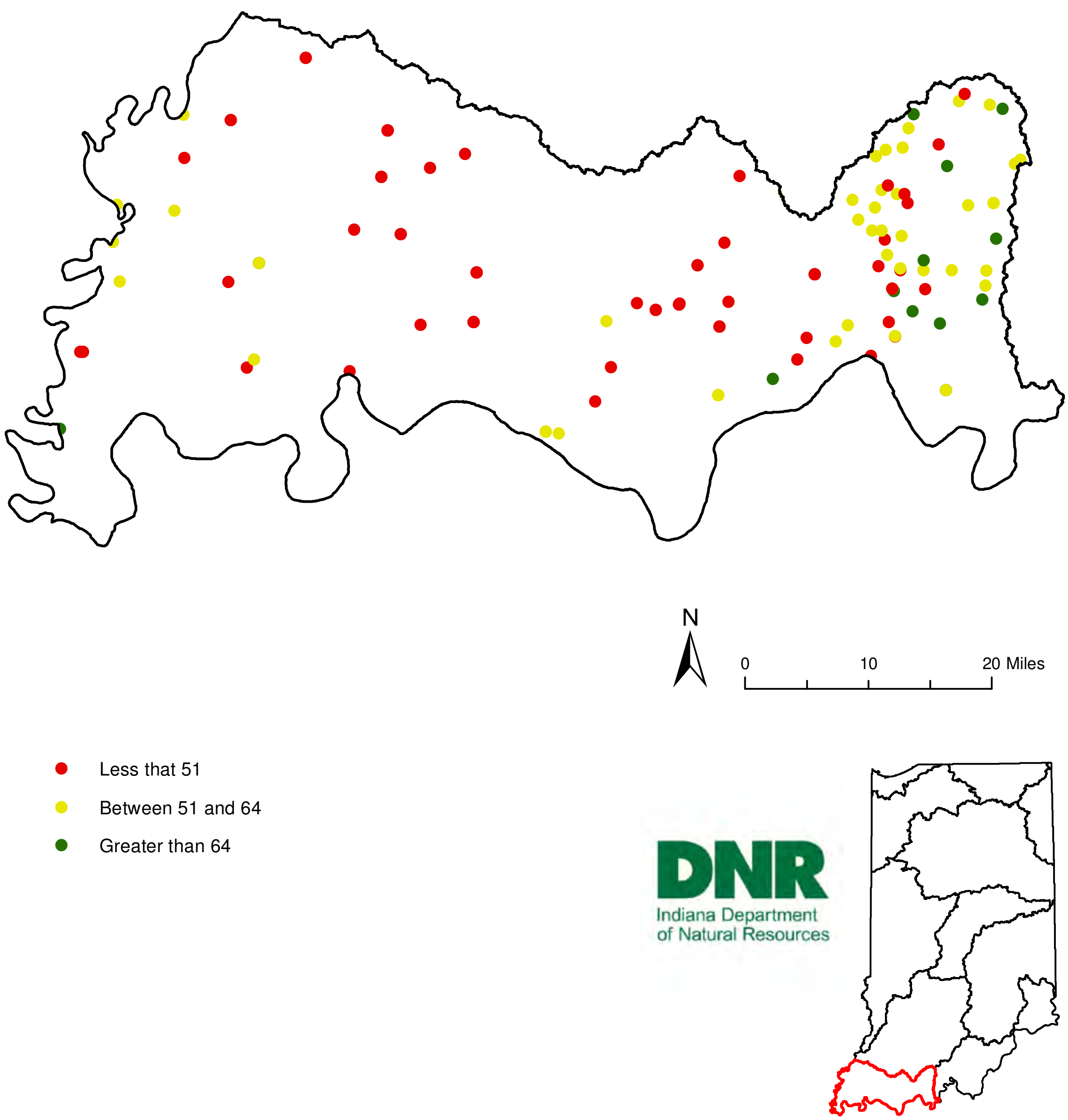


Figure 130. IDEM overall QHEI scores within the Ohio-Wabash Lowlands service area; 1991-2014 (IDEM OWQ, 2014)

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Ohio-Wabash Lowlands SA ranks third overall in forested cover density of all SA's at 30% of total area with approximately 218,061 acres, and contains the third most forested cover of any SA at approximately 7.63% of 5,215,169 acres of forest cover statewide.

GIS analysis identified approximately 7,675,720 linear feet (1,454 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Ohio-Wabash Lowlands SA has the highest ratio of restorable stream miles to square miles of SA at approximately 0.69 mile of potential restoration per one square mile, or one mile of potential restoration for every 1.45 square miles of SA.

4.2 Wetlands

Analysis of the NWI in the Ohio-Wabash Lowlands SA identifies approximately 8,936 acres of freshwater emergent wetland (PEM) and approximately 53,443 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 4.64% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 19.35% of the total SA **(Table 112 and Figure 131)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	8,936	3.44%	0.66%	0.04%
Freshwater Forested/Shrub Wetland	53,443	20.55%	3.97%	0.23%
Freshwater Pond	15,795	6.07%	1.17%	0.07%
Lake	134,038	51.54%	9.97%	0.58%
Riverine	47,857	18.40%	3.56%	0.21%
Grand Total	**260,070**	**100.00%**	**19.35%**	**1.12%**

Table 112. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils account for 134,284 acres (**Figure 132**), or 10% land cover within the SA, out of which approximately 81,387 acres have the potential to be restored, accounting for 6.05% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The SA has the fourth least percentage of recoverable wetland acres to total SA size of all SAs and the third least amount of potentially restorable wetland acres of any SA.

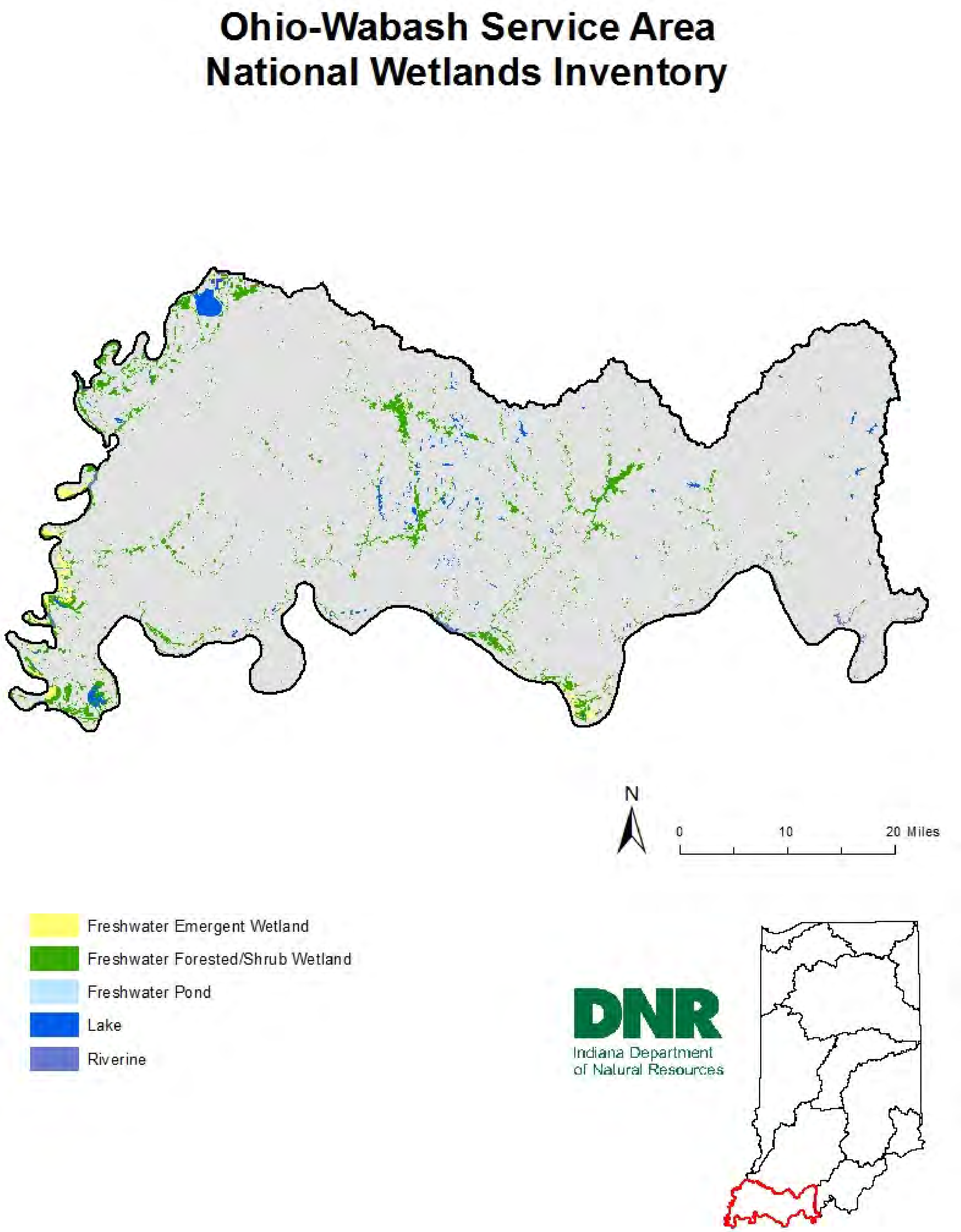


Figure 131. NWI for the Ohio-Wabash Lowlands Service Area (USFWS NWI, 2015)

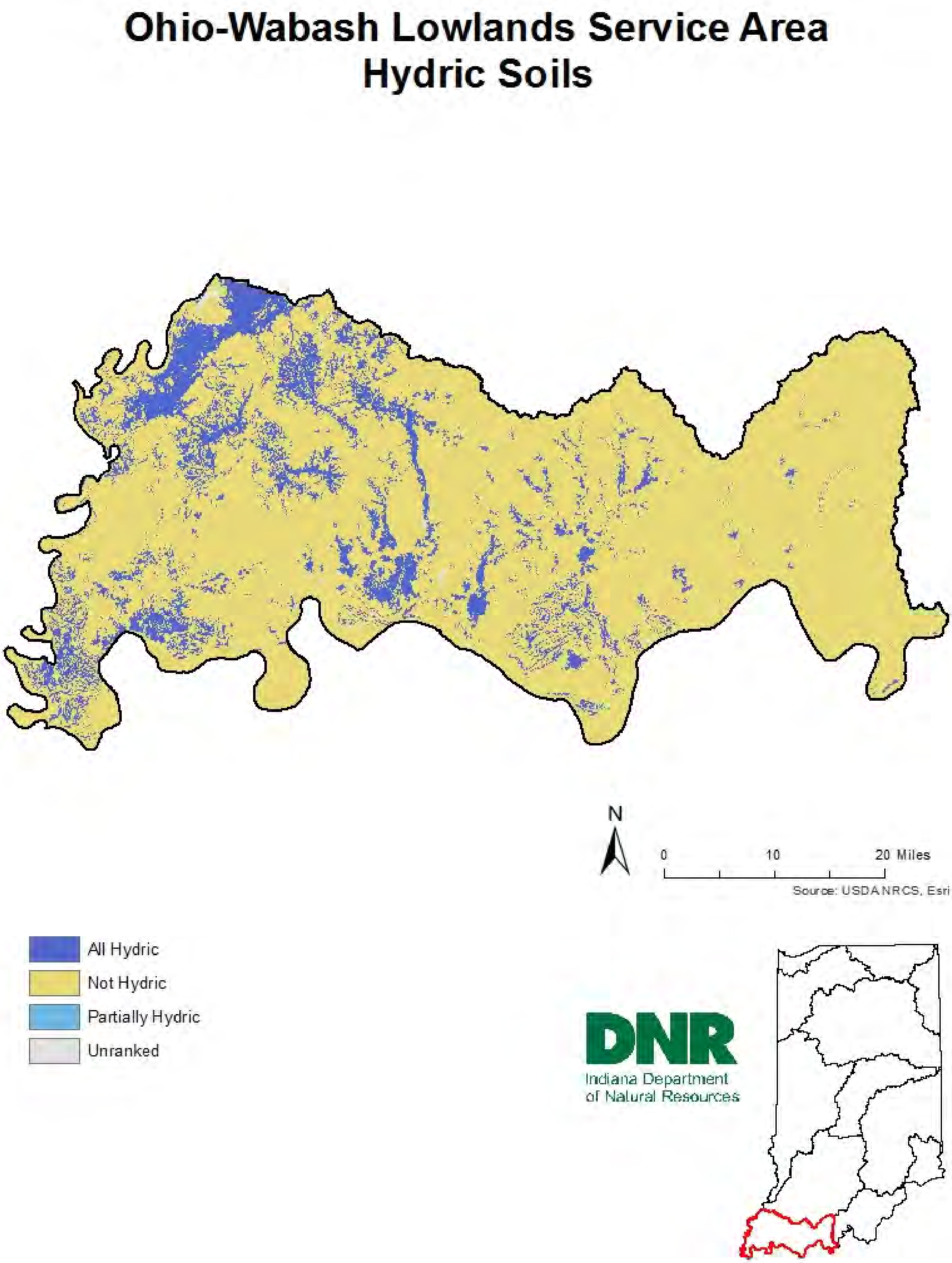


Figure 132. Hydric and partially hydric soils within the Ohio-Wabash Lowlands Service Area (NRCS-USDA, 2016)

4.4 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 73,466 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Scott Ditch-Wabash River (HUC 051201130305 **[Table 113]**).

Hotspots account for 2,222,880 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Pond Flat Ditch (HUC 051201130701 **[Table 114]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 113 and 114)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA and displayed in **Figure 133**.

Approximately 1,478 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands. Bluegrass Fish and Wildlife Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable wetlands (1,056 acres). Approximately 3,865 linear feet of hotspots of potentially restorable stream are on IDNR-managed lands. Approximately 5,370 linear feet of hotspots of potentially restorable stream are adjacent to IDNR-managed lands. Bloomfield Barrens Managed Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable streams (3,131 linear feet).

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Wetlands (acres)
051201130305	Scott Ditch-Wabash River	8,973
051201130502	Headwaters Black River	6,480
051201130302	McCarty Ditch-Coffee Bayou	5,491
051201130501	Barren Creek-Higginbotham Ditch	5,029
051402020103	West Fork Creek	4,459

Table 113. Watersheds in the Ohio-Wabash Lowlands Service Area with the most hotspots of potentially restorable wetlands

HUC 12 Code	HUC 12 Name	Hotspots of Potentially Restorable Streams (linear feet)
051201130701	Pond Flat Ditch	126,720
051201130703	Caney Creek-Big Creek	119,328
051402020103	West Fork Creek	76,032
051402020603	Cypress Slough	64,944
051201130702	Neuman Lateral-Big Creek	64,944

Table 114. Watersheds in the Ohio-Wabash Lowlands Service Area with the most hotspots of potentially restorable streams

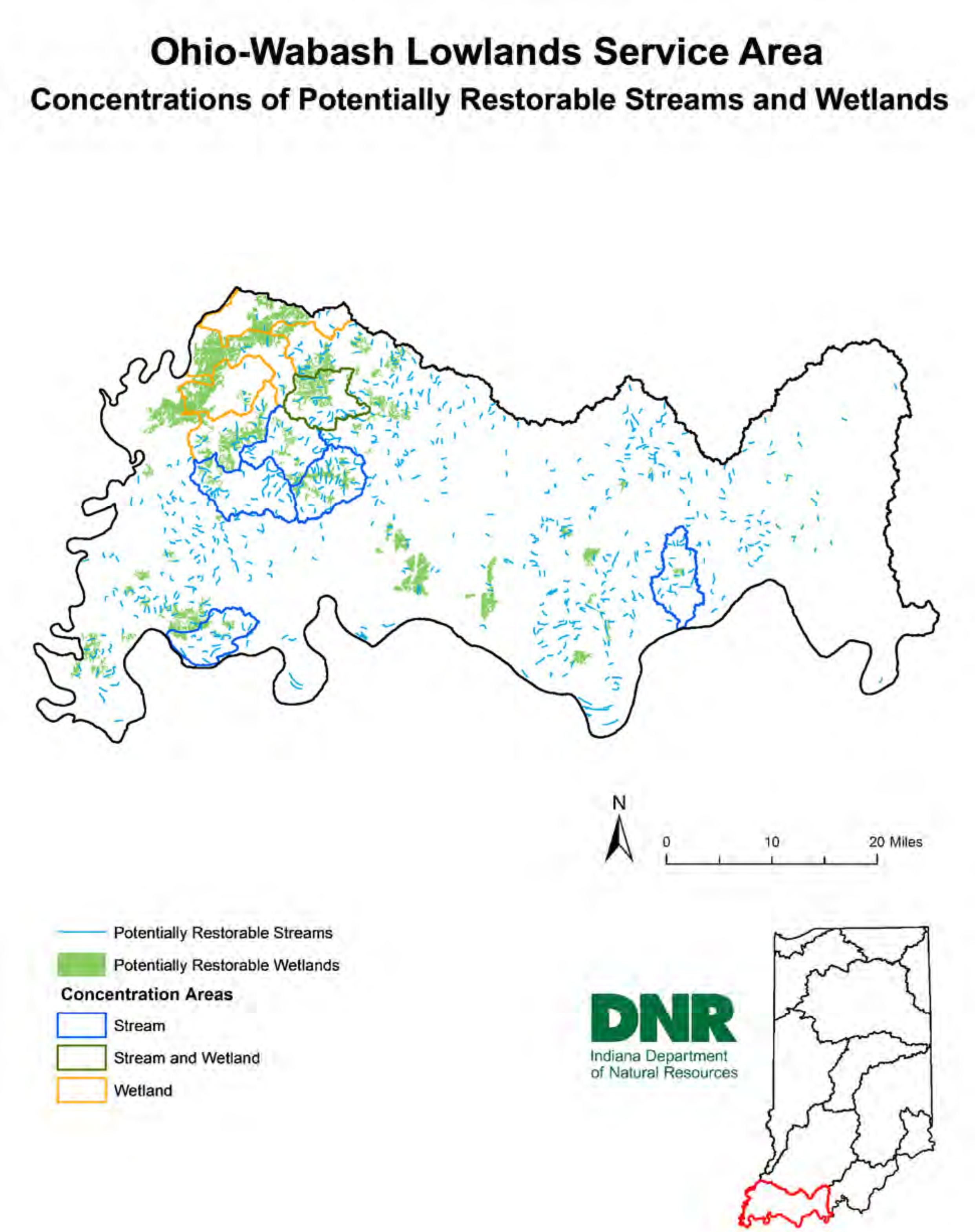


Figure 133. Concentrations of Potentially Restorable Streams and Wetlands in the Ohio-Wabash Lowlands Service Area

4.4 Lakes, Reservoirs, and Ponds

GIS analysis of 303(d) lake impairments in the Ohio-Wabash Lowlands SA identified three lakes currently documented having the category 5 impairments, which measured using the National Hydrography Dataset (NHD), accounts for approximately 1,390 acres for PCBs in fish tissue, and 37.3 acres for taste and odor (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 27,276 acres of open water which accounts for 2% of the SA. This varies slightly from the NWI, which identifies approximately 15,795 acres of freshwater ponds comprising of 1.2% of the SA, and 11,368 acres of lake comprising of 0.85% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Ohio-Wabash Lowlands SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Ohio-Wabash Lowlands SA shows that approximately 95% of the shallow unconsolidated aquifers receive seven or less inches of ground water recharge annually **(Table 115).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	8	0.40%
	13	29	1.37%
	12	21	1.01%
	11	14	0.68%
	10	8	0.37%
	9	5	0.25%
	8	15	0.74%
	7	22	1.05%
	6	65	3.11%
	5	305	14.61%
	4	576	27.61%
Low	3	661	31.71%
	2	264	12.64%
	1	92	4.43%

Table 115. Approximate ground water recharge rates in the Ohio-Wabash Lowlands SA (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that approximately 91% of the Ohio-Wabash Lowlands SA near surface aquifers are in the moderate to low range for sensitivity to contamination **(Table 116)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	81	3.87%
High	93	4.45%
Moderate	704	33.74%
Low	1,197	57.37%
Very Low	12	0.56%

Table 116. Ground water sensitivity distribution in the Ohio-Wabash Lowlands Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Ohio-Wabash Lowlands SA as the fourth most registered capacity of surface water withdrawal among SAs with a 2015 withdrawal capacity of 262,061 MGD **(Figure 134)** (IDNR DOW, 2016). Industrial uses account for approximately 66% of registered surface water withdrawal capacity, followed by energy production at 30%, and public water supply at 4%.

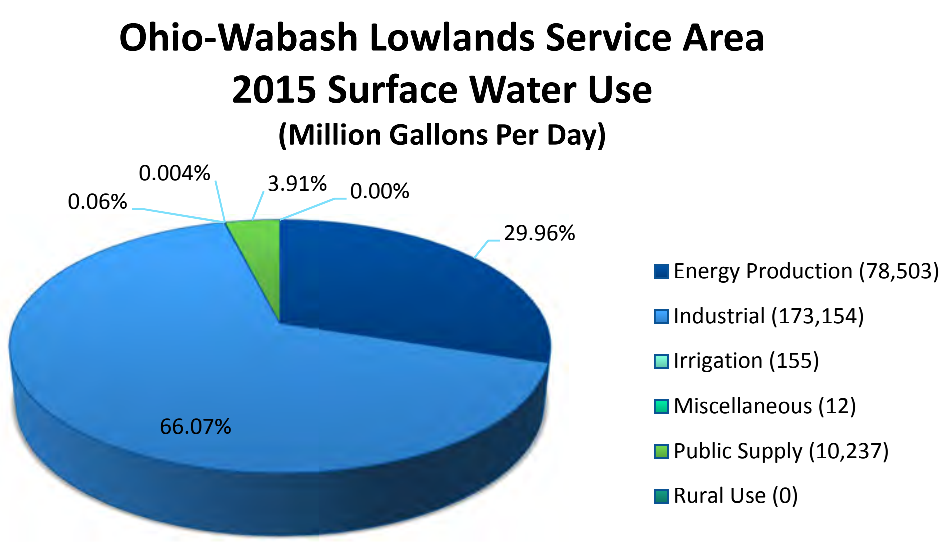


Figure 134. 2015 surface water usage in the Ohio-Wabash Lowlands Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Ohio-Wabash Lowlands SA is the third least among SAs with an 8,131 MGD registered withdrawal capacity **(Figure 135).** Public water supply accounts for approximately 31% of registered ground water withdrawal capacity in the SA, followed by energy production with 30%, industrial uses with 8%, and agricultural irrigation accounting for the remainder.

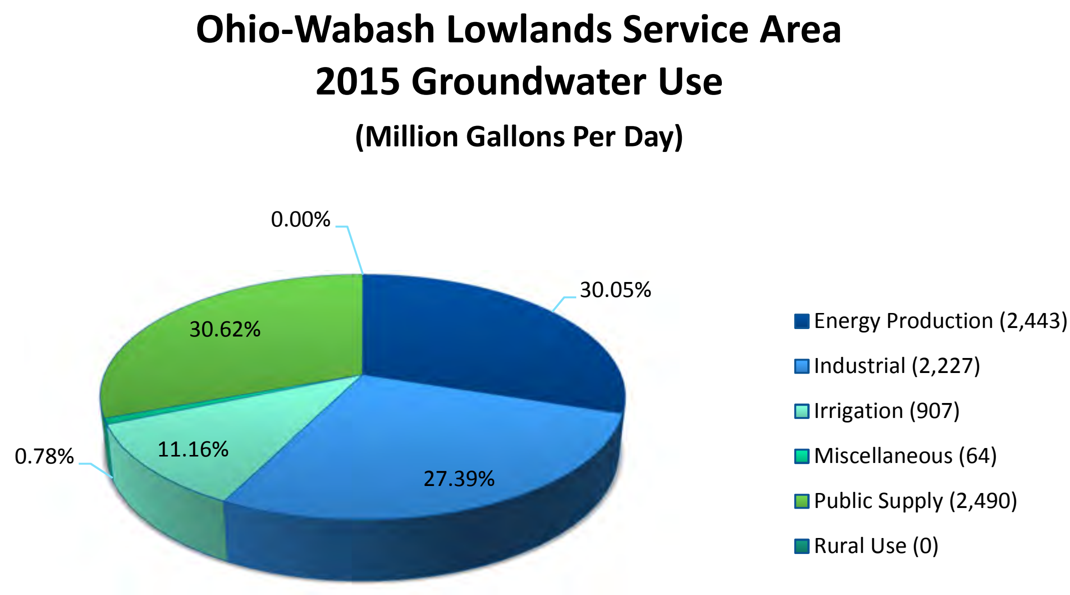


Figure 135. 2015 groundwater usage in the Ohio-Wabash Lowlands Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Ohio-Wabash Lowlands SA include, but are not limited to, forested swamp, shrub swamp, and wet floodplain forest, in addition to many other mixed or upland communities.

There are currently a minimum of seven amphibian species, 46 bird species, 10 fish species, 17 mammal species, nine mollusk species, and 11 reptile species listed as SGCN within the SWAP Planning Regions within the Ohio-Wabash Lowlands SA (SWAP, 2015).

Multiple areas of the Ohio-Wabash Lowlands SA were recognized as focus areas for migration habitat; these areas included the westernmost counties of the SA, Gibson and Posey counties, as well as the Little Pigeon Creek. Gibson Lake and its adjacent wetlands are heavily used during fall and spring migration by waterfowl and various shorebirds and wading birds. Posey County contains numerous oxbow lakes, broad lowlands, and bottomland hardwood forests which are utilized by wood ducks as nesting habitat and is greatly used by migrating waterfowl during spring and fall. Its close proximity to the Ohio River allows large areas of Posey County to be flooded during late winter and spring; these areas provide some of the most productive shorebird habitat in Indiana. The Little Pigeon Creek serves as a valuable nesting habitat for wood ducks and also as important migratory habitat for waterfowl (UMGL JV, 1998).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Ohio-Wabash Lowlands SA. The following aquatic resource goals and objectives apply specifically to the Ohio-Wabash Lowlands SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources that will offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Target stream, riparian and wetland restoration, enhancement and/or preservation projects in urbanized areas acknowledging the challenges and constraints that will likely occur within intensely developed areas in this SA.
7. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Interior River Valleys and Hills, and Interior Plateau Planning Region where feasible.
8. Stream and wetland restoration projects to buffer and protect karst features and systems unique to areas in southern Indiana.
9. Support efforts to offset aquatic resource degradation associated with historic mining activities throughout the service area.

ELEMENT 6. PRIORITIZATION STRATEGY

The <u>four steps below</u> present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA.

When prioritizing sites for mitigation projects, the following **<u>core criteria</u>** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Ohio-Wabash Lowlands SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Big Creek WMP, Highland-Pigeon WMP, Pitcher Lake WMP, and Upper Anderson River WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Ohio-Wabash Lowlands SA will permanently protect rare aquatic habitats,include high quality natural aquatic and riparian communities, and waters having a significant contribution to ecological sustainability and important critical habitat for SGCN, while addressing the important physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in coincidenceconjunction with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Four River RC&D and Sycamore Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Ohio-Wabash Lowlands SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Kentucky Water Science Center
- USGS Illinois Water Science Center
- U.S. Forest Service Hoosier National Forest
- Ohio River Valley Water Sanitation Commission (ORSANCO)
- Appalachian Landscape Conservation Cooperative
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Economic Development Coalition of Southwest Indiana
- Indiana 15 Regional Planning Commission
- Indiana Karst Conservancy
- The Wabash Border Natural Division- Illinois Natural History Survey (INHS)

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 136** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

Ohio - Wabash Lowlands Service Area
High Priority Aquatic Resource Conservation Sites

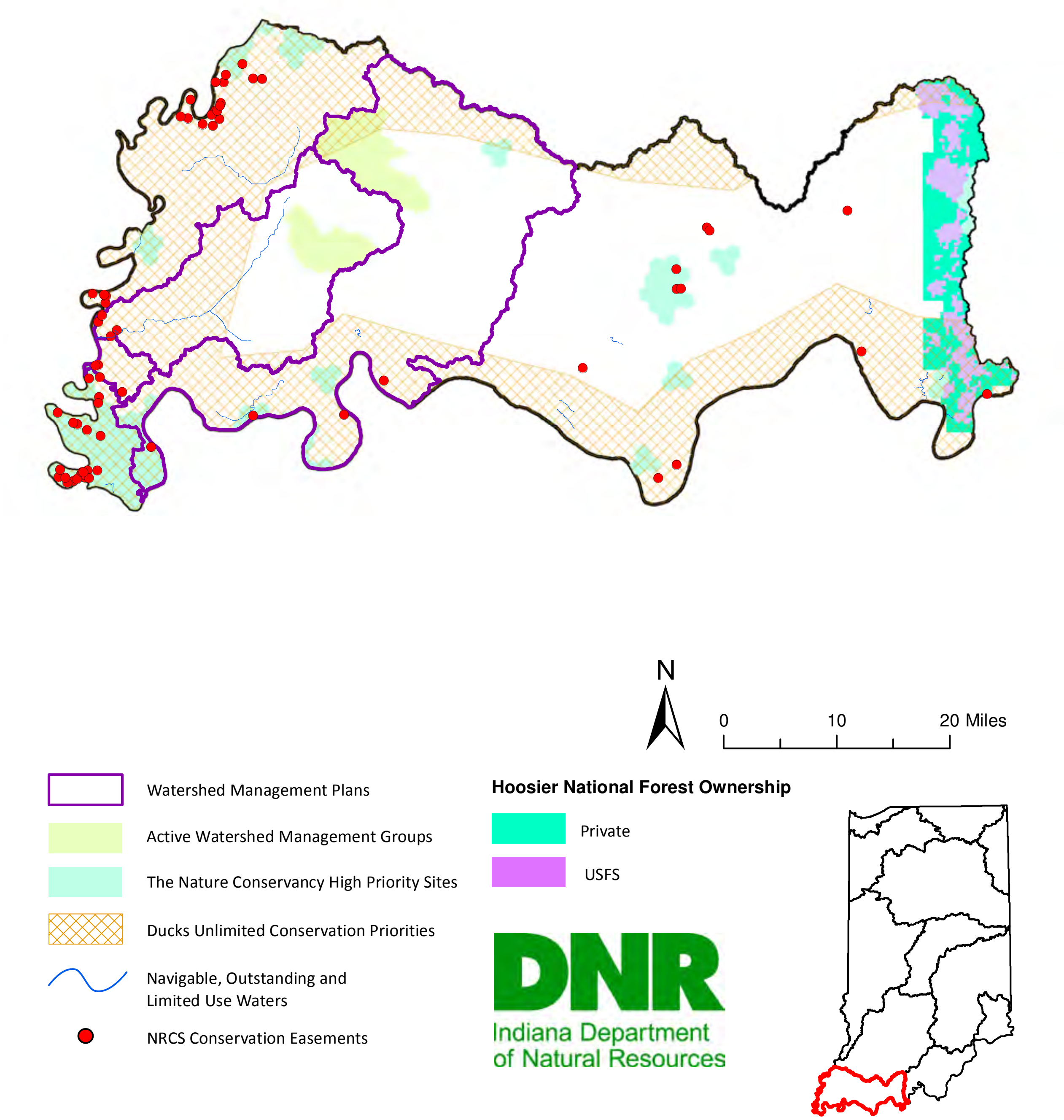


Figure 136. Priority aquatic resource conservation groups and sites within the Ohio-Wabash Lowlands Service Area (IWPP, 2015)

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APPENDIX C. IN SWMP OFFSETS TO AQUATIC RESOURCE THREATS

This appendix provides a summary and general matrix for mitigation actions IN SWMP will pursue to help offset anthropogenic and Section 404 permitted activities that impact aquatic resources in Indiana.

Predominant Statewide Threats to Aquatic Resources

The predominant threats to aquatic resources and habitats throughout Indiana as a result of anthropogenic activities include, but are not limited to the following:

- Habitat conversion
- Habitat alteration
- Habitat fragmentation
- Habitat degradation
- Aquatic resource loss
- Altered surface and groundwater hydrology
- Increased and accelerated erosion and sedimentation
- Stream channelization
- Stream instability
- Loss and/or impairment of aquatic system functions
- Point source pollution
- Non-point source pollution
- Invasive and non-native species

Major Anthropogenic Activities Contributors

The major anthropogenic categories of activities, both historic and ongoing, that have resulted in the above-listed threats to the chemical, physical and biological integrity of aquatic resources and habitats across Indiana include, but are not limited to the following:

- **Growth and Development:** Residential, commercial and industrial developments and land use, urban areas, suburban areas, towns, waste and drinking water treatment plants, airports, local utilities and easements, local roads, train yards, golf courses, parks, campgrounds, landfills.
- **Agricultural Land Use:** Cultivated Crops, livestock grazing, hay/pasture lands.
- **Dams, Levees and Non-Levee Embankments:** High head dams (instream dams impounding water such as reservoirs), low head (in-channel) dams, flood control levees and flood walls, non-levee embankments.
- **Energy Production and Mining:** Coal mining, mineral and gravel mining, and oil and gas production.

- **Transportation and Service Corridors:** Interstates, federal and state highways, railroads, bridges, culverts, oil and gas pipelines, electric transmission lines, shipping lanes and regional utility easements.

Growth and Development (Developed Land Use)

Since urban growth and development continues to increase, helping to offset impacts within and adjacent to developed areas is important. IN SWMP will help offset impacts from growth and development by targeting compensatory mitigation projects, utilizing a watershed approach, which will help improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Restoring wetlands and/or riparian areas upstream of developed areas to help provide floodplain storage, attenuation of peak flow discharges, relieve hydraulic pressures of reduced urban and suburban cross-sectional flow areas, and improve/increase aquatic resource functions, services, water quality and/or habitat quality.
- Conducting stream and river channel restorations that help to provide more natural conditions to improve fluvial processes and facilitate ecological recovery.
- Restoring wetlands, riparian areas and/or stream and river channels within developed areas where reasonably appropriate to help provide floodplain storage, attenuate peak flow discharges and velocities, promote increased channel and floodplain connectivity, establish functional native vegetation buffers from adjacent land use impact sources, connect riparian corridors, improve habitat, and/or improve natural fluvial processes.
- Pursuing wetland, riparian and/or stream/river channel restoration opportunities downstream of developed areas to help improve aquatic resource functions and services, water quality, habitat and/or riparian corridor connectivity to help offset upstream impacts.

Agricultural Land Use

IDNR's IN SWMP will help offset impacts from agriculture by targeting compensatory mitigation projects, utilizing a watershed approach, which will improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Restoring degraded and lost wetland values and services in agriculturally dominant watersheds.
- Restoring channelized streams by replacing natural stream geomorphology and floodway interaction.
- Removing subsurface agricultural drainage tiles in order to restore hydrology to drained wetlands and improve water quality.
- Daylighting subsurface drainage tiles in order to re-establish natural stream and wetland systems.

- Establishing native vegetation on restored streams and wetlands located in agricultural areas while reducing habitat fragmentation.
- Restricting livestock from degrading aquatic habitats, by restoring, buffering and protecting, aquatic resources in watersheds that are dominated by livestock grazing.
- Protecting high quality wetlands and stream corridors, providing important aquatic functions and services to the watershed.

Dams, Levees and Non-Levee Embankments

IDNR's IN SWMP will help offset impacts from dams, levees, and non-levee embankments by targeting compensatory mitigation projects, utilizing a watershed approach, which will improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Remove high and low head dams prioritized for removal and conduct in-stream restoration that would help improve the ecological health of the stream by providing an increase in natural functions and services, upstream connectivity, improved water quality, and increased aquatic and/or riparian habitat.
- Modify low head dams that are not eligible for removal in conjunction with broader aquatic resource restoration measures that will help improve natural stream functions, water quality, and upstream connectivity.
- Identify and restore degraded stream channels, riparian areas and/or wetlands upstream of impounded waters including public freshwater lakes to address system specific causes of impairment using appropriate functional assessment methodologies and restoration techniques to help improve natural functions while contributing to improved water quality and reduced sedimentation of the impounded water.
- Identify and restore wetlands contiguous with public freshwater lakes, public reservoirs or water supply reservoirs that will contribute to improvement of the functions, services, water quality and habitat of the water body and downstream receiving waters.
- Identify non-levee embankments to reestablish channel and floodplain connectivity, improve degraded channel morphology, and conduct riparian and/or wetland restoration to address system specific symptoms caused by the structures.
- Identify degraded channels downstream of dams which are not eligible for removal or modification to address system specific symptoms caused by the dam that have potential for restoration of the natural stream channel and riparian habitats that influence the system's natural fluvial processes to adjust and function within the existing hydrologic conditions downstream of these dams.

Energy Production and Mining

IDNR's IN SWMP will help offset impacts from energy production and mining by targeting compensatory mitigation projects, utilizing a watershed approach, which will improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Implement stream and/or wetland restoration projects that supplement IDNR Division of Reclamation's Abandoned Mine Lands Program reclamation projects that will help increase Indiana's aquatic resource functions and services.
- Restore fluvial process by implementing natural stream restoration projects on streams that have experienced physical degradation from mining activities.
- Implement mitigation projects that connect fragmented habitats that are a result of cumulative effects associated with historic and ongoing mining activities.
- Preserve and enhance high quality wetlands and stream corridors that provide important aquatic functions and services to the watershed that are directly threatened by impacts from mining activities.

Transportation and Service Corridors

IDNR's IN SWMP will help offset impacts from transportation and service corridors by targeting compensatory mitigation projects, utilizing a watershed approach, which will improve the quality and quantity of aquatic resources while addressing the unique needs of each service area. Those offsets include:

- Increase habitat connectivity by targeting stream and/or wetland mitigation projects that provide critical linkages to existing conservation areas.
- Remove stream culverts within proposed stream mitigation project segments in order to remove barriers to aquatic passage whenever possible.
- Establish native vegetative communities and eradicate invasive species, associated with vegetative degradation from linear projects.
- Restore fluvial processes by implementing natural stream restoration projects on streams that experience degradation from transportation and service corridor projects.
- Create wetland mitigation projects that provide the greatest ecological lift in functions that are negatively affected by transportation projects.
- Protect high quality wetlands and stream corridors that provide important aquatic functions and services to the watershed that have been impacted from transportation and service corridor projects

Aquatic Resource Threat Offset Matrix

The following matrix demonstrates the relationship between predominant aquatic resource threats that result in chemical, physical and/or biological impacts to waters of the U.S., and the potential mitigation activities that can be conducted to help offset the impacts resulting from those threats.

	Habitat Conversion	Habiat Alteration	Habitat Fragmentation	Habitat Degradation	Aquatic Resource Loss	Altered Surface and Groundwater Hydrology	Increased and Accelerated Erosion and Sedimentation	Stream Channelization	Stream Instability	Loss and/or Impairment of Aquatic System Functions	Point Source Pollution	Non-Point Source Pollution	Invasive and Non-Native Species	High and Low Head Dams	Levees and Non-Levee Embankments
Wetland Re-establishment															
Wetland Rehabilitation															
Wetland Enhancement															
Wetland Preservation															
Riparain Restoration															
Riparian Enhancement															
Corridor Re-establishment and Connectivity															
Stream Restoration - Natural Channel Design															
Native Vegetative Buffer from Threat															
Dam Removal															
Dam Modification															
Non-Levee Embankment Removal															
Invasive Species Removal															

APPENDIX D. IN SWMP FEE SCHEDULE

Service Area	Stream Credit Price	Wetland Credit Price
Calumet-Dunes	$600	$95,000
St. Joseph River (Lake MI)	$600	$120,000
Maumee	$450	$80,000
Kankakee	$500	$95,000
Upper Wabash	$400	$80,000
Middle Wabash	$400	$80,000
Upper White	$450	$80,000
Whitewater-East Fork White	$400	$80,000
Lower White	$400	$80,000
Upper Ohio	$400	$80,000
Ohio-Wabash Lowlands	$400	$80,000

APPENDIX E. COMPENSATORY MITIGATION PROJECT APPROVALS

ID	Name	Lat/Lon	S. Area	Credit Type	# of Credits	Date Approved	Earmarked Service Area Funds	Earmarked Financial Assurances