Coffee Creek Watershed Preserve in Chesterton. Photo by Stephen Sostaric.

Chapter III: Environment & Green Infrastructure

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Overview

The environment is one of the three pillars often recognized at the foundation to building a sustainable and vibrant future. Its importance was recognized by Northwest Indiana residents throughout the public input process NIRPC engaged in to develop this 2040 Comprehensive Regional Plan (2040 CRP). Environmental planning is also one of the core functions assigned to NIRPC by the state in our enabling legislation. The environmental pillar of the 2040 CRP can be best envisioned as an overarching Green Infrastructure Network for the region (Figure III.1).

The Green Infrastructure Network is the convergence of an Ecosystem Approach, Green Infrastructure Approach, and the Urban Revitalization and Livable Communities strategies that are described at length in the Growth and Conservation chapter. Establishing a network of "green infrastructure" that co-exists with urban development and the transportation network, will consist of agricultural and natural areas that merit protection connected by well-buffered streams, trails and recreational open space. The benefits to this combined approach include:

- Cleaner air and water
- Healthier people, land and ecosystems
- Better connectivity for fish and wildlife conservation
- Safer, more cost-effective public infrastructure
- Higher property values and more efficient project development
- Enhanced resilience of communities to climate uncertainty
- Reduced vulnerability to natural disasters
- More sustainable energy, land and resource consumption
- Improved quality of life

An ecosystem approach plans for environmental preservation by focusing on environmental protection at a larger scale within the context of natural systems. An ecosystem approach requires looking beyond project boundaries, specific pollutants or species, regulatory programs and checklists. The ecosystem approach targets conservation efforts to areas that support functional assemblages of species and habitats, provides connectivity between these areas and buffers them from disturbances and negative impacts. This approach also can lead to more cost-effective and efficient ways to avoid and minimize impacts while identifying and seizing conservation and mitigation opportunities that are quickly disappearing with development pressures. An ecosystem approach allows for preservation and enhancement of the rich ecological heritage and globally significant biodiversity Northwest Indiana enjoys.

An ecosystem approach requires looking beyond project boundaries, specific pollutants or species, regulatory programs and checklists.

While the ecosystem approach helps to protect the ecological integrity of our region, a green infrastructure approach focuses on planning to maintain and enhance the many valuable services and functions that the natural environment provides to the economy and the residents of the region. This approach enables the evaluation of land use decisions and conservation opportunities based on their practical value and focus on the cost effectiveness of protecting the environment and using environmentally based approaches to solving human problems.

Finally, the strategies of Urban Revitalization and Livable Centers address long-term land use planning. By directing population growth into established urban areas, cities and towns, development pressure on remaining green spaces can be alleviated.

This section addresses the current condition of the various building blocks of green infrastructure in Northwest Indiana, including water

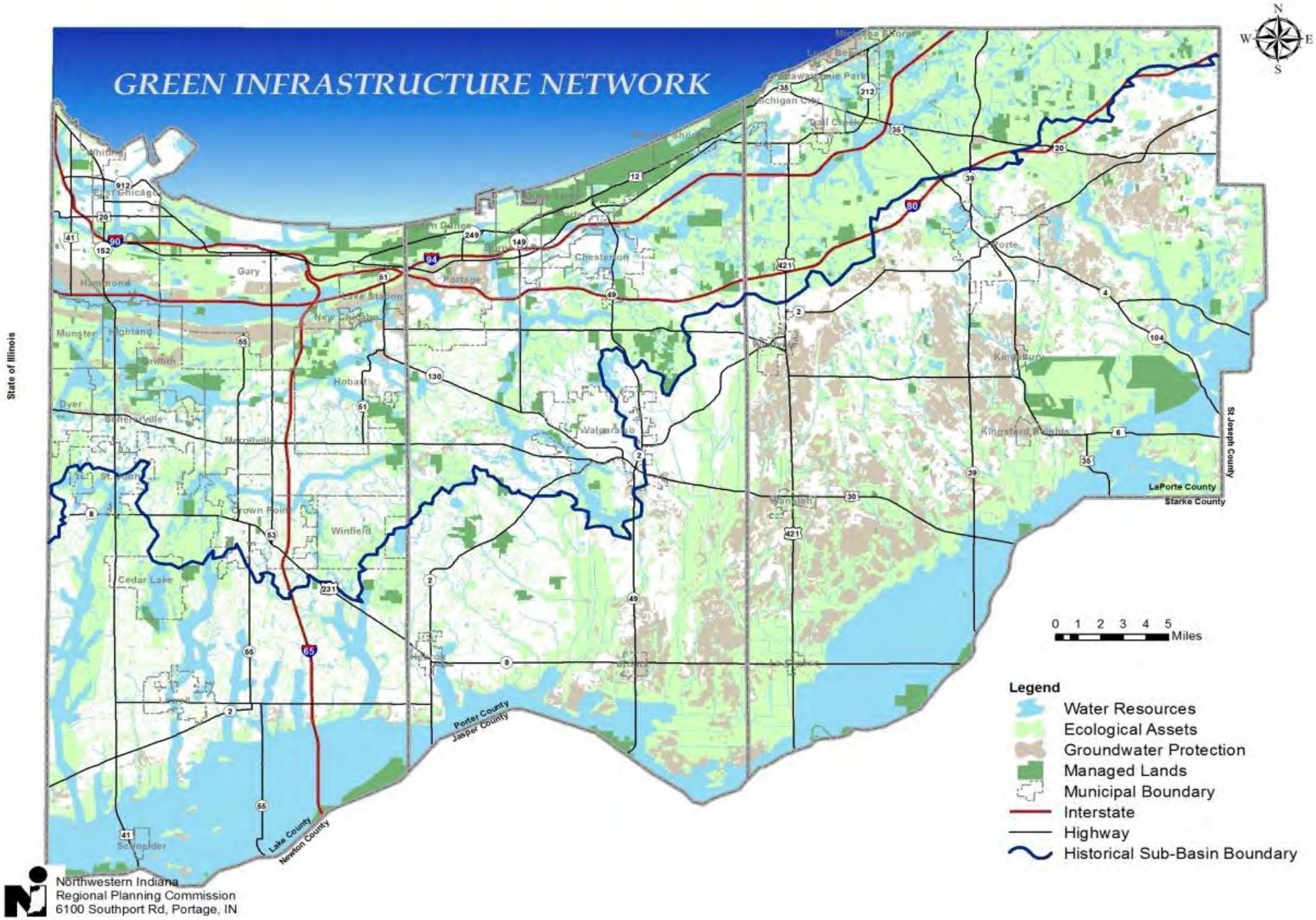


Figure III.1 Green Infrastructure Network, NIRPC Analysis 2011.

resources, forest resources, managed lands and open space, soils and prime agricultural land. Other actors and plans that are actively engaged in maintaining or building our Green Infrastructure Network also are highlighted. A set of strategies including policies, projects and implementation activities for protecting and growing our Green Infrastructure Network by 2040 also are presented.

Recent Planning Efforts

Several existing state and regional conservation and restoration plans provided guidance in identifying critical areas for conservation and/or restoration in Northwest Indiana and developing environmental policies. Those include:

- Indiana Nonpoint Source Management Plan - Indiana Department of Environmental Management (IDEM), 2009
- Local Watershed Management Plans:
  - Deep River / Turkey Creek - City of Hobart, 2002
  - West Branch Little Calumet River / Willow Creek - Gary Storm Water Management District, 2008
  - Galena River, LaPorte County SWCD, 2010
  - Trail Creek, Sanitary District of Michigan City - 2007
  - Dunes Creek, Save the Dunes - 2006
  - Salt Creek, Save the Dunes - 2008
- Indiana Wetlands Conservation Plan – Indiana Department of Natural Resources, 1998
- Indiana Comprehensive Wildlife Strategy - IDNR, 2006
- Indiana Statewide Forest Assessment & Strategy- IDNR, 2010
- Coastal & Estuarine Land Conservation Program (CELCP) Plan - IDNR, 2008
- Northwest Indiana Regional Greenways & Blueways Plan - NIRPC, 2007
- 2006-2010 Statewide Comprehensive Outdoor Recreation Plan - IDNR, 2007
- Lake Michigan Coastal Area Public Recreation Access Inventory - IDNR, 2008
- Needs Assessment of Public Access Recreation Sites within the Indiana Coastal Area - IDNR, 2009
- Chicago Wilderness Green Infrastructure Vision - Chicago Wilderness, 2004

The recommendations included in the 2040 CRP build on the foundation of the opportunities identified during all of these previous planning efforts.

Mt. Baldy in the Indiana Dunes National Lakeshore. Photo by Tom Gill via Flickr.

Environment & Green Infrastructure Goals & Objectives

The 2040 CRP Vision Statement addresses the environment and green infrastructure in its "Vibrant Region" and "Revitalized Region" vision themes: *Growth is planned, natural and rural areas are valued and protected, and our environment is clean.* Four goals and their related objectives provide the framework for further action and initiatives to bring about achieving these vision themes.

Goal: Managed growth that protects farmland, environmentally sensitive areas and important ecosystems

Objectives:

- Promote the development and preservation of regional greenways and blueways (water trails) and establish linkages between them
- Encourage the concentration of development around existing infrastructure
- Encourage redevelopment of infill sites within established centers
- Promote compact development and smart growth through techniques such as transit-oriented development, traditional neighborhood development and conservation design
- Foster the development of local food systems and a local food economy
- Preserve prime agricultural land and rural landscapes
- Encourage and plan for the protection and responsible use of shoreline areas
- Improve access to major regional parks and preserved open lands, including the Indiana Dunes

Goal: Reduced flooding risks and improved water quality

Objectives:

- Achieve water quality standards and designated uses of our lakes and streams
- Complete, improve, and implement watershed management plans
- Promote stormwater best management practices including the development of green infrastructure and the reduction of impervious surfaces
- Facilitate regional planning for adequate collection and treatment of wastewater and the elimination of the inappropriate use of septic systems
- Promote the upgrading of aging water infrastructure
- Facilitate the development of a regional stormwater strategy
- Facilitate regional planning for water supply and demand
- Preserve floodplain and wetlands

Goal: Improved air quality

Objectives:

- Achieve national ambient air quality standards for all pollutants, including carbon monoxide, ozone and particulates
- Reduce air toxics, greenhouse gases and other harmful emissions
- Improve the aesthetics – noise, odor, discoloration – of air
- Reduce the disproportionate impact of industrial and transportation emissions on environmental justice populations
- Coordinate land use and transportation policies to reduce motor vehicle trips

Goal: Clean land

Objectives:

- Maximize the number of brownfields returned to productive use
- Facilitate a regional solid waste and landfill strategy
- Promote the acquisition and protection of green space
- Mitigate transportation and land use impacts

Achieving these goals will require the active buy-in and support of not only NIRPC and other organizations and elected officials, but also involved residents. As with other initiatives, ongoing challenges need funds to expand the capacities of NIRPC and partner organizations. NIRPC and its partners will need to be creative and resourceful in identifying opportunities to coordinate efforts and seek alternative funding sources to support expanded initiatives, increase protection of regional resources and keep encouraging sustainable development techniques.

The sections below outline current conditions and introduce recommended strategies to make more effective use of existing resources and pursue new opportunities. These initiatives will require the commitment and participation of NIRPC and its many partner organizations and member governments to realize.

Mt. Baldy in the Indiana Dunes National Lakeshore. Photo by Stephen Sostaric.

Water Resources

Water continues to play a vital role in the economic, social and environmental well-being of Northwest Indiana. All communities and businesses in the region derive their drinking water directly from Lake Michigan or from groundwater in the Lake Michigan or Kankakee River basins. Major manufacturing processes in the region depend on ready access to water, as does a great deal of recreational activity. Water is used in the agricultural and rural communities for irrigation and livestock watering. Our harbors, ports and navigable waterways connect us with national and international markets for transporting goods. A healthy Lake Michigan provides recreational access to thousands of region residents and visitors, generating economic benefits from tourists and locals through camping, hotel visits, boating and marina spending, fishing and long days at the beach. For these reasons, continued investment in water quality improvements, responsible management of water use and forward planning for water supply and conservation strategies are to be a high priority.

Internationally, the United States and Canada have been engaged in more than a century of commitment to sustainable policies and practices to ensure water quality and quantity within the Great Lakes basin. In 2008, all eight Great Lakes states passed legislation approving the Great Lakes – St. Lawrence River Basin Water Resources Compact[1], which was subsequently approved by Congress and signed by President George W. Bush. The compact serves to secure long-term protection of the water supply for the NIRPC region and the rest of the Great Lakes Basin by outlawing new or increased diversions of Great Lakes water from its natural drainage basin with rare exceptions, while requiring the states to regulate their own large-scale water use. For existing cesignificant water withdrawal facilities, their approved diversion under the compact is based on their total registered withdrawal capacity, rather than current usage. This allows a facility the flexibility to increase future water use up to their full capability before having to consider applying for additional water diversion. Significant increases will be highly restricted and regulated.

[1] http://www.cglg.org/projects/water/docs/12-13-05/Great_Lakes-St_Lawrence_River_Basin_Water_Resources_Compact.pdf

The compact requires water conservation and efficiency programs be developed by each state in order to reduce waste by all users. The Indiana Department of Natural Resources is developing the regulations necessary to implement the compact. In addition, local communities have begun to explore water conservation strategies. For example, Valparaiso City Utilities adopted a Water Conservation Plan in September 2009.

In addition to meeting the regulatory requirements of implementing the compact, it is in the long-term interest of Northwest Indiana to thoughtfully consider the implications of growth and development on the all of the region's water resources. This section describes the vital water assets that are a fundamental consideration in creating a more sustainable and ecologically sensitive approach to growth and development in Northwest Indiana. The sections below address lakes and streams, wetlands, floodplains, aquifers, watershed management, water withdrawals and water use. Figure III.2 provides an overview of these regional water resources.

Kitesurfers on Hammond's Wolf Lake. Photo by Ella Geen.

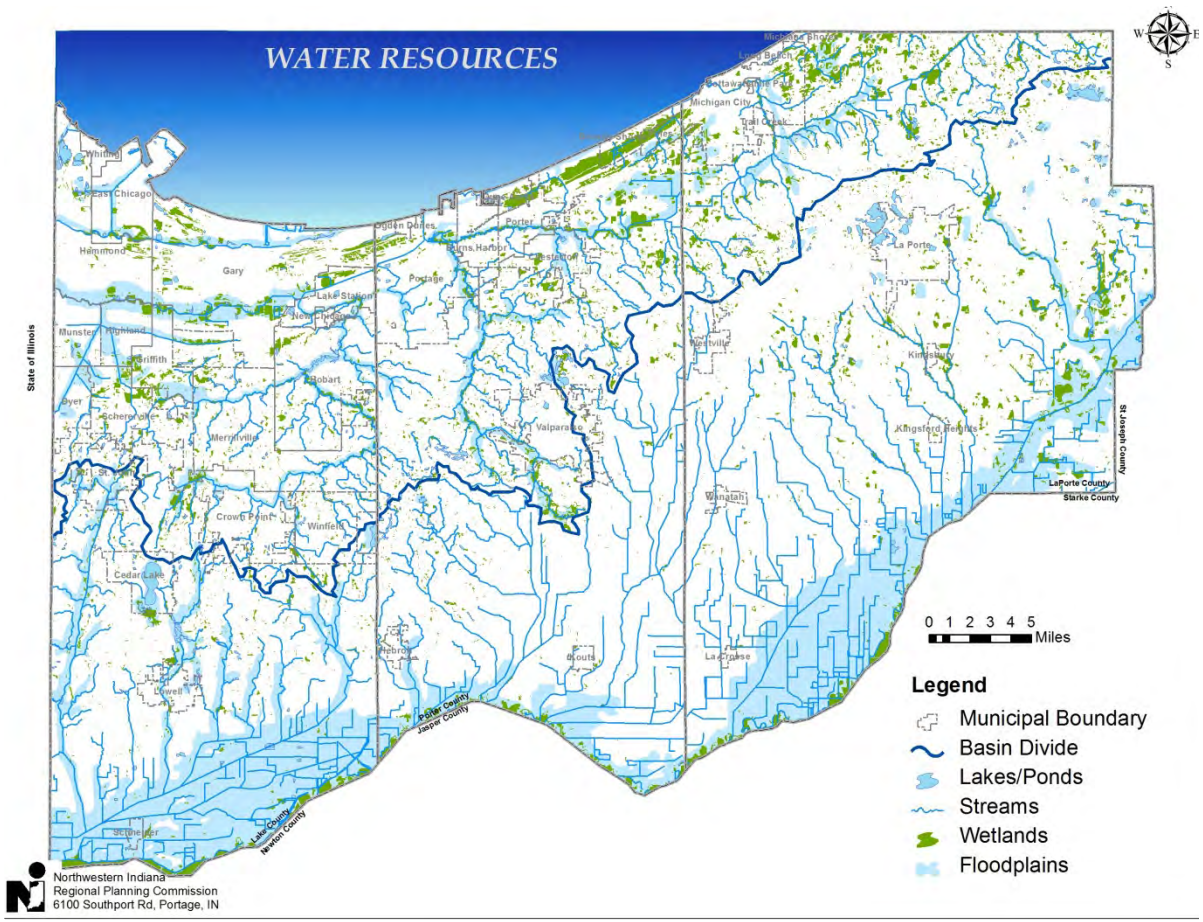


Figure III.2 Surface Water Resources of Northwest Indiana, NIRPC GIS Databases. 2010

Lakes & Streams

Lake Michigan, the second largest of the Great Lakes, always has been an influential factor in the growth and prosperity of Northwest Indiana. The entirety of Indiana's 45-mile coastline lies within Lake, Porter and LaPorte counties. Early development patterns in the region focused around the lakefront because it provided access to a plentiful source of water for industry and a means of transporting goods and materials. Communities that developed around these job centers also had access to a plentiful drinking water supply. Additionally, Lake Michigan and its shoreline provide tremendous recreational opportunities for residents and visitors. Several parks and more than 20 marinas provide direct access to the lake. These recreational opportunities further support local businesses and the regional economy.

Inland from Lake Michigan, more than 1,775 miles of streams and 500 lakes and ponds of various sizes are scattered across Northwest Indiana's landscape. These water bodies support a variety of plant, fish and wildlife species while also providing many recreational opportunities for residents and nonresidents. Nearly 186 miles of waterway are designated as navigable by the state, including the Lake Michigan shoreline, the Kankakee River and the Little Calumet River. Another 193 miles are designated as salmonid streams, supporting trout and salmon runs from Lake Michigan throughout much of the year.

The Indiana Natural Resources Commission lists three reaches of Northwest Indiana waterways on its Outstanding Rivers List for Indiana. The Deep River in Lake and Porter counties, from south of U.S. 30 to the Little Calumet River, is listed as a state-designated canoe route and as having outstanding ecological recreational or scenic importance. The Kankakee River in LaPorte, from the upstream boundary of the Kingsbury Fish and Wildlife Area to the Indiana state line, also is listed as a state-designated canoe route and a State Heritage site. The Little Calumet River East Fork in Porter County, from County Road 600E to Ind. 249, is listed as a having outstanding fishing value and as a state-designated canoe route. In addition, state law designates Lake Michigan and all waters incorporated into the Indiana Dunes National Lakeshore

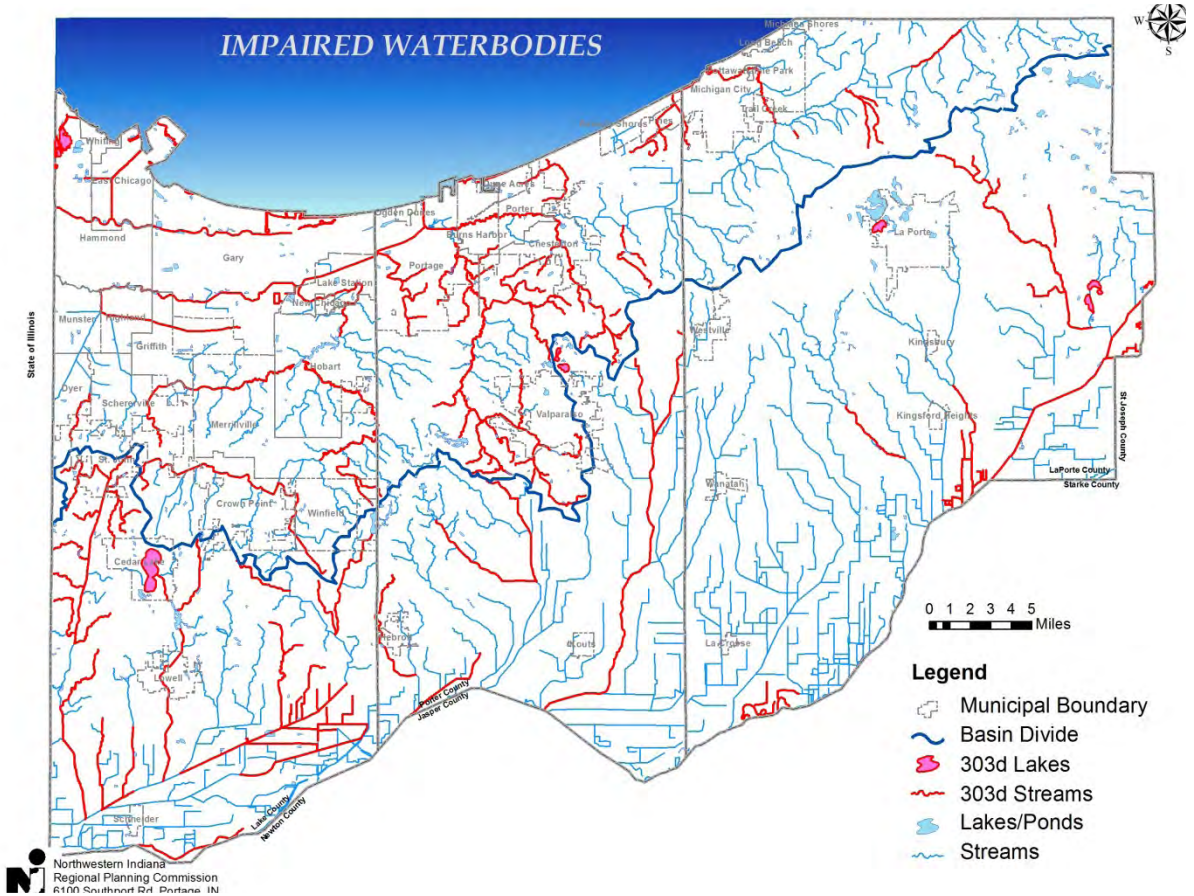


Figure III.3 303 (d) Impaired Waterbodies. Indiana Department of Environmental Management 303(d) List, 2008.

as outstanding state resource waters. Finally, all waters within or flowing through a designated natural area, nature preserve, state or national park are designated as exceptional use waters.

Beyond the recreational and habitat values that these waters provide, many also serve as drainage ways, shipping corridors, sources of water for industrial processing and irrigation for golf courses and agricultural lands.

Lakes and streams largely are defined and influenced by their watersheds and the land uses within those watersheds. Poor land use decisions and practices can have negative impacts on water quality and habitats. For example, impervious surfaces in an urbanized watershed can result in significant levels of heavy metals, pathogens, oil and grease, nutrients and sediment being carried by stormwater runoff to adjacent water bodies. Increased runoff volumes from these areas also contribute to stream bank erosion and flooding.

Within our region, there are nearly 622 miles of streams and 3 square miles of lakes that are included on the 2008 Indiana 303d List of Impaired Waters (Figure III.3). The IDEM Office of Water Quality updates this list every two years, identifying the waters that do not or are not expected to meet water quality standards as required by the Clean Water Act. The most common impairment for our region's waterways is E. coli, which is an indicator of fecal contamination. Potential sources of E. coli can vary by watershed, but in general include sewer overflows, failing septic systems and pet and livestock waste. Each year, elevated E. coli levels result in swimming advisories and closures along the Lake Michigan shoreline. Another water quality concern is those stream segments in which a fish consumption advisory is in place. This is especially true for low-income areas, such as Environmental Justice zones, where subsistence fishing may be more prevalent.

Accurately attributing these impairments to specific sources is difficult, at best, and is, in many cases, impossible to do with a high degree of certainty, according to the Indiana Integrated Water Monitoring and Assessment Report: 2008. More detailed and resource-intensive sampling

and analysis are needed to do so. This is one reason for developing watershed management plans. Generally speaking, though, water and stream habitat quality tend to be better in areas in which forest, wetland and grassland habitats are maintained or preserved to the greatest extent possible. A prime example is the Galena River watershed located in northeast LaPorte County, where more than 63% of the land cover is still natural and water quality and habitat has been found to be among the best in the region. Conversely, many studies have documented that the greater the percentage of impervious surfaces, such as roofs and roads, in a watershed, the more likely that its waters are not in good shape.

Wetlands

Wetlands have many beneficial functions, including floodwater storage, water quality improvement, fish and wildlife habitat and aesthetics. Historically, wetlands used to be a prevalent feature in Northwest Indiana, covering a little more than 340,000 total acres based on NRCS hydric soils data. Today, only 72,410 acres, or 21%, of these wetlands remain[2] and tend to be smaller and more fragmented than historical wetlands. The average wetland size is now 5.7 acres.[3] Much of the historical wetland loss can be attributed to "land reclamation" (i.e. draining) for development or agricultural purposes.

Macroinvertabrate collection for water quality testing Photo courtesy Joe Exl.

Hydric soils are a good indicator of where wetlands once existed since they developed under sufficiently wet conditions capable of supporting hydrophytic (water loving) plant species. These soils are commonly associated with wetlands and do, in fact, serve as one of the indicators used for wetland delineations for regulatory purposes. Aside from the regulatory standpoint, hydric soils can be used to identify potential wetland habitat restoration areas. These soils also indicate areas of poor natural drainage. Many remaining wetlands are still threatened by encroaching land uses and further habitat fragmentation. Only about 20% of Northwest Indiana's remaining wetland acreage is protected within the boundaries of managed lands such as the Indiana Dunes National Lakeshore or Grand Kankakee Marsh.

While far fewer in number and size than historically existed, wetlands are still an integral part of our region. They can be some of the most productive ecosystems in the world, with an immense variety of plant and animal life. Indeed, a number of the region's endangered, threatened and rare plant and wildlife species depend on wetland habitats to not only prosper, but to even exist. Aside from their wildlife benefits, wetlands also provide flood protection and water quality benefits by storing, slowly releasing and filtering rain, snowmelt and floodwaters. In some areas, wetlands help to maintain stream flows during dry summer months or periods of drought. Some help to replenish ground water supplies. Wetlands also provide a myriad of recreational opportunities including hunting, fishing and nature watching.

[2] Ducks Unlimited National Wetland Inventory Update data, 2010

[3] Ducks Unlimited National Wetland Inventory Update data, 2010

Floodplains

Floodplains are an extremely important, yet often "invisible," natural feature in the region, as they serve their critical purpose only during a flood event. Floodplains provide areas where floodwaters can be stored and flood velocities and peaks can be reduced. They also help protect water quality by filtering out and settling sediment, nutrients and contaminants carried in floodwaters. Floodplains help recharge groundwater supplies, which in turn maintain stream flows during extended dry periods. Additionally, they benefit fish and wildlife resources by providing nesting and feeding areas.

The natural hydrology of the Northwest Indiana region has been considerably altered over time by channelization projects, construction of ditches and urbanization. In the Lake Michigan watershed, most of the natural floodplains have been converted to residential, commercial or industrial use. Historically, this has led to significant property damage and economic loss in our region. As a result, hundreds of millions of dollars have been spent to build levees and elaborate flood control systems in some portions of the most developed floodplains, such as the western branch of the Little Calumet River. Water is retained within levees, or it frequently floods unprotected areas.

In the Kankakee River sub-basin, most of the floodplain has been converted to cropland and is protected by spoil bank levees from the Kankakee River and its various drainage ditches. These levees are in need of constant attention to protect the cropland from flooding. Levee failure often leads to crop loss, soil erosion and disruption of the transportation network.

Floodplains must be preserved from development and used only for compatible, beneficial uses. Protection of cropland must be weighed with the value of floodwater storage. Areas where floodplains can be restored should be a high priority, especially in the Lake Michigan watershed.

Aquifers

For many of our rural communities and residents, groundwater is the sole source of drinking water. Overall, the quality of groundwater in Indiana is very good and the vast majority of those relying on it have access to safe water. Public drinking water supplies in Indiana are regularly tested for a variety of contaminants and are subject to federal health standards under the Safe Drinking Water Act. Private wells, on the other hand, are not monitored by any government agency. Therefore, less information is available for them.

One contaminant that has been found in some Indiana wells is nitrate[4]. Nitrate is a health concern particularly for young infants, causing a sometimes-fatal condition commonly known as "blue baby syndrome." Nitrates in groundwater can be naturally occurring, but levels of nitrate-N above about 3 parts per million (ppm) can indicate contamination from a source such as septic systems, fertilizers (applied to lawns, golf courses or agricultural areas), sewage sludge or animal wastes. The EPA drinking water standard for nitrate-N, above which water should not be used by infants, is 10 ppm. Studies by the United States Geological Survey (1995) and the Indiana Farm Bureau Inc. (1994) in recent years found nitrate concentrations greater than the drinking water standard in 3.5% to 4.5% of private wells in the state. Although this is a serious concern for those households, particularly if an infant is present, more than 95% of private wells had water that is considered safe for nitrates. However, all private wells should be tested regularly to ensure nitrate safety.

The vulnerability potential of an aquifer to groundwater contamination is in large part a function of the susceptibility of its recharge area to infiltration. Areas that are replenished at a high rate are generally more vulnerable to pollution than those replenished at a slower rate. Highly permeable soils, those in hydrologic soil groups A and B, function as important groundwater recharge areas. Unconfined aquifers that do not have a cover of dense material are susceptible to contamination. In Northwest Indiana, many of these areas exist along the Lake Michigan shoreline and in the Kankakee River sub-basin. Because of the slow movement of ground water, the effects of surface activities such as pollutant spills or dumping, or land use and cover, changes (ex. percent impervious cover) on groundwater flow

[4] https://engineering.purdue.edu/SafeWater/drinkinfo/nitrate.html

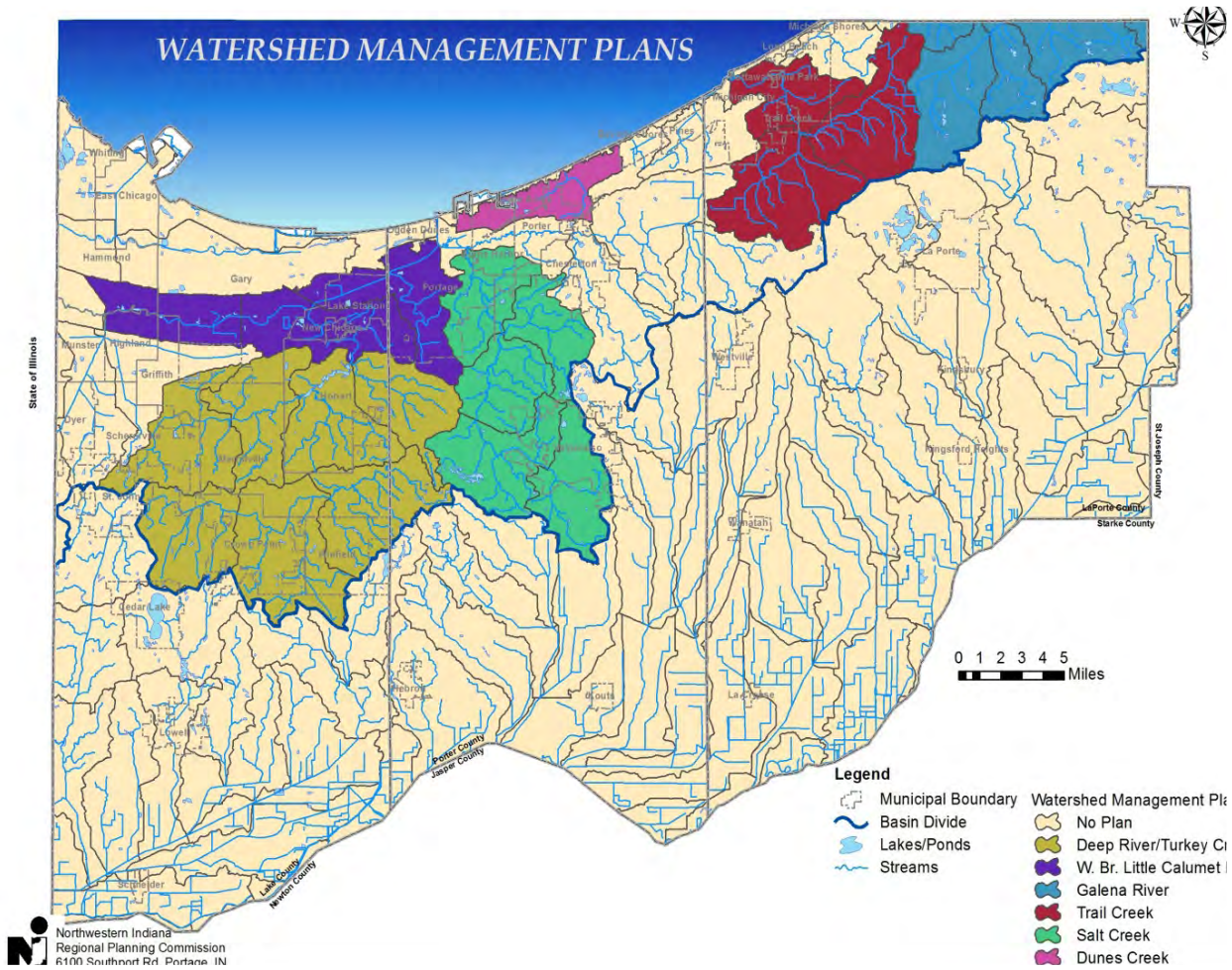


Figure III.4. State Approved Watershed Management Plans, Indiana Department of Environmental Management, 2010

and quality can take years to manifest themselves. As a result, threats to groundwater often are seemingly less dire than issues related to surface water alone. People don't become concerned until pollutants are detected in their tap water, and often by that time, remediation is so time-consuming and costly that alternative water sources must be tapped.

Not only is groundwater important for human use, it also is important to ecosystem health. Groundwater discharge helps maintain surface water body levels and generally provides good quality water that, in turn, promotes habitat for aquatic animals and sustains aquatic plants during periods of low precipitation. It also helps maintain water temperature in the region's cold water trout and salmon streams during the heat of the summer.

In 1990 and 1994, the IDNR produced Water Resource Assessment reports for the Kankakee Basin and Lake Michigan Region, respectively. These reports provide detailed technical analysis of the ground water hydrology of the two basins that comprise Northwest Indiana. The primary aquifer systems serving as potential and active water supplies for our region include the Lacustrine Plain, Calumet, Valparaiso Moraine, the Valparaiso Outwash Apron and the Kankakee. A complete discussion of these aquifers and their relative capacity for development is beyond the scope of this Comprehensive Plan.

Watershed Management

Watershed management is a flexible framework for managing water resource quality and quantity within specified drainage areas, or watersheds. Watershed management occurs at the level of each watershed, or sub-watershed(s) in some cases, through the preparation of watershed management plans, which are used as the basis for allocation of Section 319(h) funding from the United States Environmental Protection Agency

(U.S. EPA). To date, there have been six watershed management plans completed by various stakeholder groups in Northwest Indiana, which together comprise about 25% of the total land area of the region.

To date, most watershed management planning and implementation efforts have been focused in the Little Calumet-Galien sub-basin, which drains to Lake Michigan. Figure III.4 shows the coverage of the six watershed plans developed and currently approved by IDEM under Section 319. Each watershed management plan includes a list of stakeholders involved in the project, a watershed characterization inventory, identification of problems and causes on which the stakeholder groups have chosen to focus, identification of potential pollutant sources and calculated loads, water quality improvement or protection goals, identification of critical areas where implementation projects will need to occur and a list of measures and best management practices (BMPs) needed to achieve plan goals.

To date, there have been six watershed management plans completed by various stakeholder groups in Northwest Indiana, which together comprise about 25% of the total land area of the region.

Demonstration wetland at the Dunes Visitor Center in Chesterton. Photo by Stephen Sostaric.

Water Withdrawal, Consumption & Supply

Although a comprehensive Water Balance study for the NIRPC region could not be performed within the scope of this plan, a general analysis and summary of available state agency data on water withdrawal, water use and public water supply has been pulled together by NIRPC staff. Several topics that would benefit substantially from further study will be discussed in the implementation sections.

The trend in water withdrawals for the NIRPC region has shown a decline over the past eight years. Figure III.5 shows the annual water withdrawals for Lake, Porter and LaPorte counties over that time period. According to IDNR records, total water withdrawal from significant facilities in the region went from 887 billion gallons in 2002 to 798 billion gallons in 2009[5]. This represents an 11% reduction in water withdrawal. Comprehensive analysis of the reason for these declines in water use is not available. Contributing factors likely include, but are not limited to, more efficient use of water in industry to comply with environmental regulations, reduced use of water due to the economic slowdown, water conservation and weather patterns.

In 2008, all of the eight Great Lakes states, with the approval of Congress and the president, entered into the Great Lakes-St. Lawrence River Basin Water Resources Compact. The Great Lakes Compact bans new or increased water diversions with limited and strictly regulates exceptions from Lake Michigan, its tributaries and its contributing groundwater. This means that for all practical intents and purposes, Great Lakes water withdrawals in the region are essentially capped at current rates.

Water withdrawals in some communities, such as Hammond, are calculated as part of the strictly regulated Chicago Diversion. The remainder of our region, our counties and some of our communities straddle the Great Lakes drainage divide. In 2008, 83% of the population of our three counties lived in the Lake Michigan basin. In Lake County, that number is 92%. Access to Lake Michigan surface and groundwater resources becomes complicated in communities outside of that basin. Existing registered water uses in the Great Lakes Basin will be authorized for use at their current withdrawal capability. Employing water conservation practices can enable existing users to create spare capacity to allow for economic growth. All proposals for new or increased water withdrawals must incorporate sound and economically feasible water conservation and efficiency measures in order to minimize the waste of water within the Great Lakes Basin. Indiana's implementation of the Compact establishes that conservation and efficiency programs for the basin are voluntary and have been outlined in IDNR's "Report on Indiana Water Use Efficiency and Conservation." Voluntary water conservation and efficiency programs also will be encouraged statewide by the IDNR.[6]

Visitors at Portage Lakefront Park. Photo by Stephen Sostaric.

[5] Indiana Department of Natural Resources Water Use Section, through their Significant Water Withdrawal Facility Data reports.

[6] Indiana DNR Great Lakes Compact Web Page

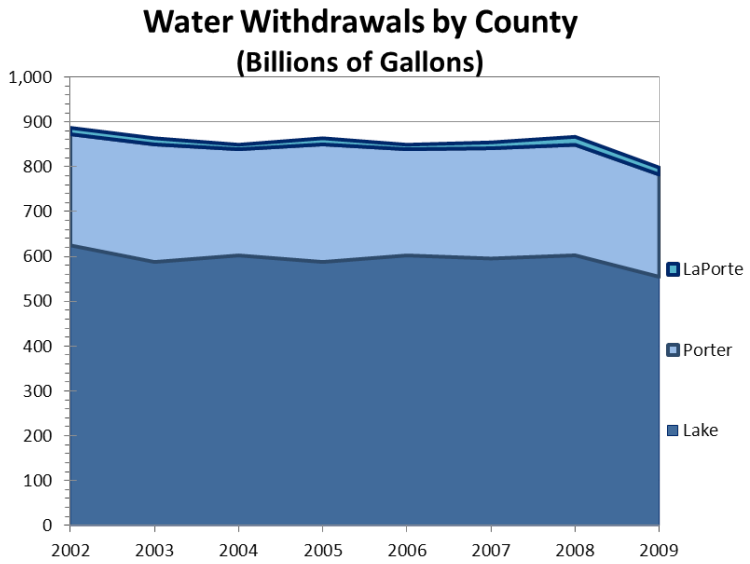


Figure III.5. Annual Region Water Withdrawals, Indiana Department of Natural Resources, 2010.

Water use by various sectors of the economy also can be compared. The category definitions that IDNR uses to identify water withdrawal facilities relevant to the NIRPC region are:

Energy production – Power generation, cooling water, oil recovery
Industry – Process water, cooling water, mineral extraction, quarry dewatering, waste assimilation
Irrigation – Crop and golf course irrigation, farm field drainage, agricultural services
Miscellaneous – Fire protection, amusement parks, construction dewatering, dust control, pollution abatement, hydrostatic testing, recreational field drainage
Public Water Supply – Drinking water, sanitary facilities
Rural use – Livestock, fisheries

Figure III.6 shows that "Industry" uses the largest percentage of the water withdrawn, followed by "Energy production." "Public water supply" is a distant third. The large quantity of noncontact cooling water used daily by the large refinery and integrated steel mills in our region likely sets it apart from other parts of the state in this regard. The figure also shows that the industrial category has been the primary driver of water withdrawal reductions over this time period. The reasons for this may include implementation of water conservation measures to reduce water pollution control costs, to prepare for implementation of the Great Lakes Compact, or reduced production due to recent economic conditions. On average, industrial water withdrawals have decreased by approximately 12% over the past seven years. If we want to maintain or reduce water withdrawals in our region, this data would suggest that our priorities for conservation should be industry and energy production. Public water supply, which includes residential, commercial and institutional use, would be a distant third.

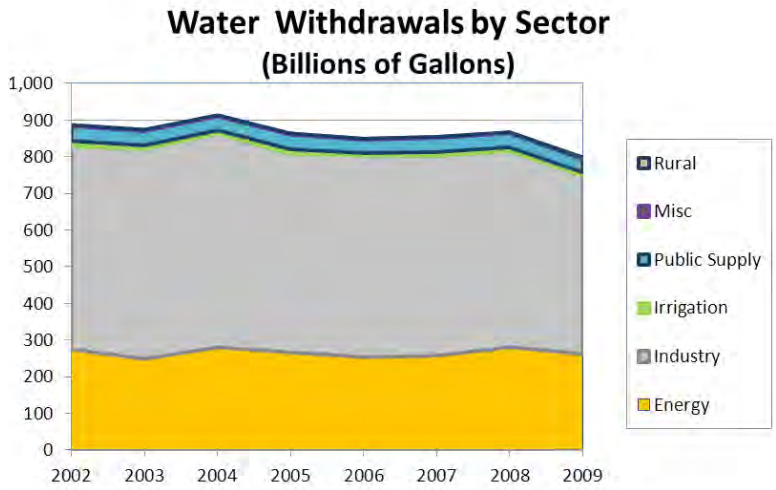


Figure III.6. Water Withdrawals by Sector, Indiana Department of Natural Resources, 2010.

Water withdrawals are important, but perhaps more important to the long-term sustainability of our water supply is the amount of water that is actually removed from the system by its use versus that which is returned to streams, ditches and aquifers. While this sounds simple,

in practice it is a complicated topic that differs by sector and by scale. In 2003, the Great Lakes Commission[7] evaluated different mechanisms and methods used to calculate consumptive use to try and assess the total consumption of Great Lakes Basin water. It found a lack of consistency in approaches between jurisdictions, sectors and water resource types. For example, water pumped from Lake Michigan that evaporates from a cooling water facility might be calculated as a consumptive use by the facility because it is not returned to the water body through a regulated outfall; however, in reality this water may condense and fall back on the lake as rain. Conversely, water loss through leakage from public water supply pipes also would be calculated as a consumptive use, although this water may in effect be recharging valuable groundwater aquifers. Water that is incorporated into products that may then be exported from the basin or sold and used within it also makes this a highly challenging factor to quantify. In general, Indiana uses consumptive use coefficients to calculate water return rates for use categories as follows:

Sector	Water Return Rate
Public supply/domestic use	85%
Irrigation	10%
Livestock	20%
Industry	94%
Thermoelectric	98%
Other*	88%

*Other examples: fish and wildlife, environmental, recreation, navigation and water quality purposes

Applying these factors to the cumulative water withdrawals from 2002 to 2009 presents a different picture in which sectors have the biggest impact on local water resources. Of the 6.9 trillion gallons pumped in the region during this time, the total consumptive use

[7] Great Lakes Commission Report "Measuring and Estimating Consumptive Use of the Great Lakes Water" (2003).

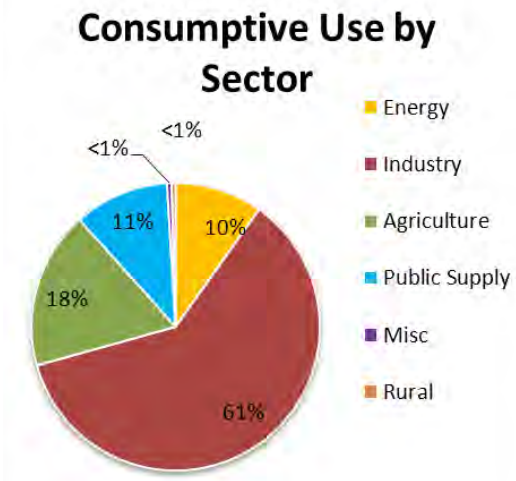


Figure III.7. Percent of Consumptive Water Use by Sector 2002-2009, IDNR Data and Great Lakes Commission Consumptive Rate Factors 2003.

was 430.8 billion gallons, or 6% of the total withdrawn. Of the water pumped from the Lake and the ground, 94% is being returned to the environment – ideally after appropriate treatment. Note that the sectors with the lowest return rate are agriculture uses such as irrigation and livestock. This is because much of the water use in that sector is absorbed by plants and released to the atmosphere in evapotranspiration, or is incorporated into animals and their products, such as milk.

Despite its limitations, applying the consumptive use factors to water withdrawal allows us to evaluate the relative likelihood of different water uses to impact available water supplies. Figure III.7 shows the relative percentage of consumptive use by category. Of the 6% of water volume that is consumed, industry is the largest user, followed by irrigation, public water supply (domestic use) and energy production.

While this information can give us an idea of who the greatest users of water in the region are, there are many questions it can't answer. It cannot tell us how much of the water is being used productively versus being wasted or lost to leakage. It cannot tell us how the use of water is impacting long-term supplies or ecosystem health in our region.

This data shows that industry and agriculture appear to consume the largest portion of the water in our region. These users have very different issues and concerns associated with them. Energy production and public water supply are also significant consumption categories. Water conservation opportunities exist in all of these sectors and, if strategically applied, could have a strong impact on the sustainability of this important resource in our region.

There currently are strong economic incentives for private industries to conserve water. The costs associated with pumping water for use and treating it to meet regulatory requirements is a strong incentive to conserve and recycle water within facilities. In the 1994 Lake Michigan Basin Water Resources Assessment, IDNR showed that the largest Great Lakes water uses, such as industrial and energy production facilities, were typically withdrawing water at 50 to 60% of their existing pump capacity. Industries also are highly regulated in both the quantity and quality of the water they discharge. The continued implementation of the Great Lakes Compact by the Indiana Department of Natural Resources and the Clean Water Act by the Indiana Department of Environmental Management are likely to continue to hold water consumption by this sector at the current, or decreasing, levels into the forseeable future.

Agriculture, including irrigation and livestock production, presents an entirely different suite of problems. While agriculture, primarily irrigation, consumed 18% of the total water withdrawn in our region, with respect to groundwater it has a larger relative impact. In Lake, LaPorte and Porter counties, the average annual percentage of irrigation water withdrawn from groundwater was 22%, 61% and 37%, respectively.

Use in this sector is highly seasonal and highly influenced by climate. As a result, predictions of future use may be uncertain due to potential increased climate variability. While total annual precipitation in northern Indiana could increase up to 20%, summer precipitation may decline up to 9% and the frequency of hot days also may increase substantially, resulting in higher irrigation demand[8]. An increase in agricultural use in the Kankakee Basin, where groundwater resources are shared by all users, could result in future supply conflicts if population growth in aquifer dependent communities continues.

The Indiana Department of Natural Resources is promoting voluntary water conservation and efficiency efforts in this sector as part of the implementation of the Great Lakes-St. Lawrence River Basin

No. 14 Blast Furnace at U.S. Steel. Photo from web.

[8] Impacts of Climate Change for the State of Indiana, Purdue Climate Change Research Center (February 2008)

Compact. The IDNR has provided a list of 16 suggested Best Management Practices for irrigators to consider and has asked for them to voluntarily provide the state with information as to what practices they currently employ and those they might consider in the future. These measures include creating irrigation system maintenance programs; implementing leak detection and repair programs; developing accurate water measurement systems; tracking pumping plant efficiency to fuel and energy use; tracking seasonal crop water use; maximizing soil infiltration; and many others.

Public Water Supply

Public water supply is an important part of the infrastructure of the region with tremendous impacts on development patterns, cost of living and quality of life. Residents of communities ranging from urban neighborhoods to subdivisions, small rural towns, mobile home parks or unincorporated areas rely on public water supply facilities to provide them with safe drinking water. Many businesses also rely on public water supply to operate their facilities, and the presence of adequate and reliable water supply can play a role in industry location decisions.

Public water supply includes a wide variety of facilities, ranging from large for-profit and municipal systems, to small private systems, to noncommunity, transient and nonresidential systems such as schools, employers and hotels. Essentially, any well or surface water distribution system that provides water beyond a single-family residence is a public water supply. For purposes of this discussion, public water supply data is from systems that are large enough to withdraw more than 100,000 gallons of water per day, and thus be included in the Indiana Department of Natural Resources Significant Water Users database. The few noncommunity or transient suppliers, such as restaurants, employers, or schools that were not included represent less than 0.1% of public water supply withdrawals.

As of 2008, approximately 81% of the region's population was served by a public water supply system, with a high of 97% of the population in Lake County, 68% in Porter County and 44% in the more rural LaPorte County[9]. In addition, the Hammond Water Utility provides drinking water to 10 communities in Illinois, serving approximately 145,000 residents.

Total public water supply use in the region has decreased from 41 billion gallons annually in 2002 to 34 billion gallons annually in 2009, an 18% decline. The reasons for this decline are unclear. The 2010 census shows considerable population reductions in some urban communities, so some of the reduced demand may stem from this shift. Other possible reasons for this decline could include conservation, system infrastructure repairs resulting in reduced waster transmission losses or the economic slowdown.

In 2008, the average daily water use per person in Northwest Indiana was approximately 117 gallons per day, with significant range across the three counties[10]. This equates to a regional demand of approximately 106 million gallons per day (MGD). The total current public water supply capacity of major facilities in the region is 212 MGD. Some excess capacity is a good thing in that it allows for economic and population growth. On the other hand, if capacity and demand are significantly out of line, rate payers may be supporting base operating costs of capacity that is not needed, or lack of revenue may result in water systems delaying needed maintenance and facility upgrades. One likely reason for this large difference between the public supply capacity and the demand in Northwest Indiana may be the shift of population from older urban communities with established water supply infrastructure to new communities and unincorporated areas.

Estimated population growth for the region by 2040 is an additional 170,000 people. At current public use rates, that translates to an additional average water demand of 20 million gallons per day (MGD). These calculations do not reflect the typical 20% higher peak demand rates that occur during summer months. Since the region currently has excess pub-

[9] IDEM PUBLIC WATER SUPPLY SYSTEM FACT SHEETS https://myweb.in.gov/IDEM/DWW/index.jsp

[10] Calculated by dividing public water supply facility withdrawals data from IDNR and facility population served data from IDEM.

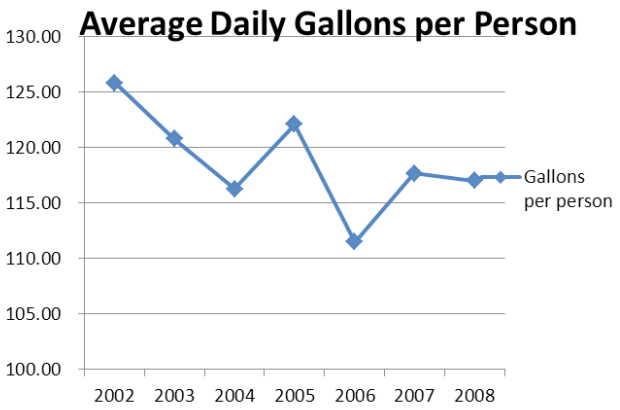


Figure III.8. Per Capita Public Water Use Trends. IDNR Water Withdrawal Data and Census Population Estimates 2008

lic water supply capacity greater than 100 MGD, at first glance it would seem we have no water supply problems. However, that capacity is not well distributed throughout the three counties, nor is it located where increasing population trends are currently the strongest.

The location of the additional demand generated by this projected population growth is crucial to predict future infrastructure needs and costs. Information on the capacity of specific drinking water facilities is not publicly available due to concerns of the Department of Homeland Security. This makes it impossible to relate capacity of systems directly to their service populations. However, Table III.1 provides general capacity information on the current public water supply capacity in different areas of the region. Across the region, sufficient capacity exists to provide public water to the new population growth, but the majority of that excess capacity is in north Lake County. Significant growth in other areas, particularly south Lake County, would require significant investment in additional water treatment capacity. Consideration of the restrictions imposed by the Great Lakes Compact imposes further supply constraints on those areas outside of the Lake Michigan Basin. While the south Lake County area with the most limited public water treatment capacity houses only 8% of the region's population, 89% of those residents are dependent on the public water supplies.

The cost of expanding public water supply infrastructure is not insignificant. The Valparaiso City Utilities Water Conservation Plan estimated the cost of an additional 1 million gallon capacity water storage tank to be $2 million. The cost to build just the 20 tanks needed to store one day's worth of the 20 MGD accompanying estimated population growth between now the 2040 would be $40 million in present worth capital. Valparaiso Utilities also has recently completed a strategic plan that estimates the cost to develop and install new water wells at $300,000 to $400,000 per well.[11] If that population growth is in places where there is not sufficient current treatment capacity, an additional $16 million minimum might be needed for plant expansions.[12]

Our regional per capita water use rate, calculated at 117 gallons per person per day, is 16% higher than the national average.

Regardless of the need to construct new distribution or expand plant capacity to accommodate new growth, the region can anticipate a considerable cost in the future to repair and replace existing drinking water infrastructure in our older, established communities.

Increasing adoption of cost-effective water conservation and water efficiency measures by our utilities, small businesses and residents is one way the region can reduce the need for costly capacity investment without restricting growth and development. Our regional per capita water use rate, calculated at 117 gallons per person per day, is 16% higher than the national average, so we have room for improvement. The Indiana DNR Division of Water maintains a voluntary conservation and efficiency checklist of best management practices for public water suppliers. This list includes recommendations such as: implementation of comprehensive water accounting and loss control programs; incorporation of remote sensing and telemetry for leak detection; creation of system-wide maintenance and repair

[11] Valparaiso City Utilities Strategic Plan 2010-2015, December 2010.

programs; increased use of system-wide pressure management practices; universal metering; creation of rate structures that encourage water efficiency; and many others.

The American Waterworks Association estimates that daily indoor per capita water use is 69.3 gallons. The difference between the average per capita water use of 98 gallons per day and the indoor use of 69 gallons per day is outdoor and landscaping use. Installation of water-efficient fixtures and sprinkling systems and prompt leak repair can reduce that amount by more than 35%.[13] The EPA also has introduced a new water sense product certification program that also can help individuals and small businesses choose plumbing products that use water efficiently.

Area	Current Water Supply Treatment Capacity (Million Gallons per day)
South Lake County (Includes: Cedar Lake, Lowell, St. John, and Twin Lakes Utilities)	5
North Lake County (Includes: Areas served by Indiana American Water, East Chicago, Hammond and Lake Station)	130
North Central Porter County (Includes: Areas served by Indiana American Water and Valparaiso)	32
Northern LaPorte County (Areas served by LaPorte and Michigan City)	45

Table III.1. Current Public Water Supply Capacity in Northwestern Indiana. Indiana Department of Environmental Management. 2011

[12] Water Conservation Plan for Valparaiso City Utilities. Valparaiso City Utilities. 2009.

[13] American Water Works Association, Drinktap.org.

Wastewater Treatment

Wastewater management plays a critical role in land use planning. Properly planned, operated and maintained public sewer and decentralized systems can provide safe and efficient wastewater disposal for residential and business needs, protect public health and water quality and support desired development patterns. Each has its own inherent challenges that must be considered and addressed with future growth.

Every four years, the U.S. Environmental Protection Agency's Office of Wastewater Management, in partnership with the states, conducts the Clean Watersheds Needs Survey. This survey provides a comprehensive assessment of the capital needs to meet the water quality goals set in the Clean Water Act.

Public Treatment Systems

In the 2008 Clean Watershed Needs Survey (CWNS), 21 publicly owned wastewater facilities were identified in Northwest Indiana. Combined, these facilities served 575,672 people, or about 75% of Northwest Indiana's population in 2008. The remaining population is served by on-site septic systems or nonpublicly owned facilities.

While some of the data presented in the CWNS report would seem to indicate that many of these facilities are at or near capacity, personal communications with the EPA Regional CWNS Coordinator revealed that the major sewage treatment plants in Northwest Indiana were designed with several times their actual domestic and industrial flows. Additionally, several major industries also have greatly reduced their flows to these plants. When examining the CWNS data as part of the implementation of the Great Lakes Strategy, EPA came to the conclusion that, in general, design capacity was not a problem in the Northwest Indiana portion of the Lake Michigan Basin.

"Combined sewer systems" are sewers that are designed to collect rainwater runoff, domestic sewage and industrial wastewater in the same pipe, and are often found in older communities. Most of the time, combined

sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers or other water bodies.

These overflows, called combined sewer overflows (CSOs), contain not just stormwater, but also untreated human and industrial waste, toxic materials and debris. More than 40 CSO points within Northwest Indiana are documented on the EPA's EnviroMapper for Water website. The highest concentrations of CSOs exist on the Grand Calumet River and West Branch of the Little Calumet River. In all but a few cases, the CSOs discharge into waters included on the Indiana 303(d) List of Impaired Waterbodies, and therefore is likely one of possibly many contributing factors to their impairment.

CSO communities are required by IDEM to develop Long Term Control Plans (LTCP). In Northwest Indiana, these communities include Chesterton, Crown Point, East Chicago, Gary, Hammond, LaPorte, Lowell, Michigan City and Valparaiso. Based on information from IDEM, each of these communities has submitted their LTCP. Chesterton, East Chicago, Gary and Hammond still are awaiting approval of their respective LTCP. Not surprisingly, the greatest official need identified by facilities in Northwest Indiana was for CSO correction with more than $800 million to prevent or control the periodic discharge of mixed stormwater and untreated wastewater.

Private (On-Site) Treatment Systems

Northwest Indiana is faced with a number of challenges related to on-site wastewater treatment systems, which are more commonly known as septic systems. A review of soils data from the Natural Resources Conservation Service (NRCS) shows that a signification portion of the region is classified as "very limited" for conventional systems, which, in part, rely on absorption fields for treatment. Of greater note, however, is the lack of measures or enforceable policies and mechanisms for the inspection and maintenance of existing on-site wastewater treatment systems.[14] As with centralized wastewater treatment systems, inspection and maintenance of existing on-site systems is needed to ensure their functionality to protect public health and the environment. The Indiana State Department of Health (ISDH) estimates that approximately 25% of all residential wastewater disposal systems are inadequate, and have failed or are failing to protect human and environmental health. A study in the Dunes Creek watershed found that 29% of the septic systems inspected in a critical area showed signs of seasonal malfunction. Additionally, three illegal systems were found in which tanks existed with no absorption field.

The Indiana State Department of Health (ISDH), in partnership with the DNR Lake Michigan Coastal Program, has developed a Web-based tracking tool for onsite sewage systems for use by county health departments called iTOSS (Indiana's Network for Tracking of Onsite Sewage Systems). The ISDH also has developed a model ordinance that can be used by the counties and municipalities for an operation and maintenance program.

Angler in Michigan City's Trail Creek. Photo by Colin Highlands.

[14] Findings for Indiana's Coastal Nonpoint Program document, EPA and NOAA, 2007.

Green Infrastructure

Green infrastructure is strategically planned and managed networks of natural lands, parks, greenways and other open spaces that maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life of people and communities. The foundation of green infrastructure networks are their natural elements (forestlands, wetlands, river, grasslands) that work together as a whole to sustain the natural environment. They complement and augment the services of "gray" infrastructure in a community such as roads, sewers, pipes and power grids. Some special types of "gray" infrastructure such as permeable pavement may also be considered green infrastructure when it is used to help the built urban environment function in a more natural way.

Green infrastructure planning should occur at all scales, from statewide, to the county, city, and parcel/site level. At the regional level, interconnected networks of park systems and wildlife corridors preserve ecological function and create a balance between the built and natural environments. At the urban level, parks and urban forestry are central to reducing energy usage costs and creating clean, temperate air. Green infrastructure retrofits of urbanized areas can help to reduce flooding or other water management problems.

This section describes the existing system of green infrastructure in Northwest Indiana that will form the basis of a more sustainable and ecologically sensitive approach to growth and development in Northwest Indiana in the future, including: managed lands, regional open space, forestlands, biodiversity and habitat areas, and prime agricultural lands.

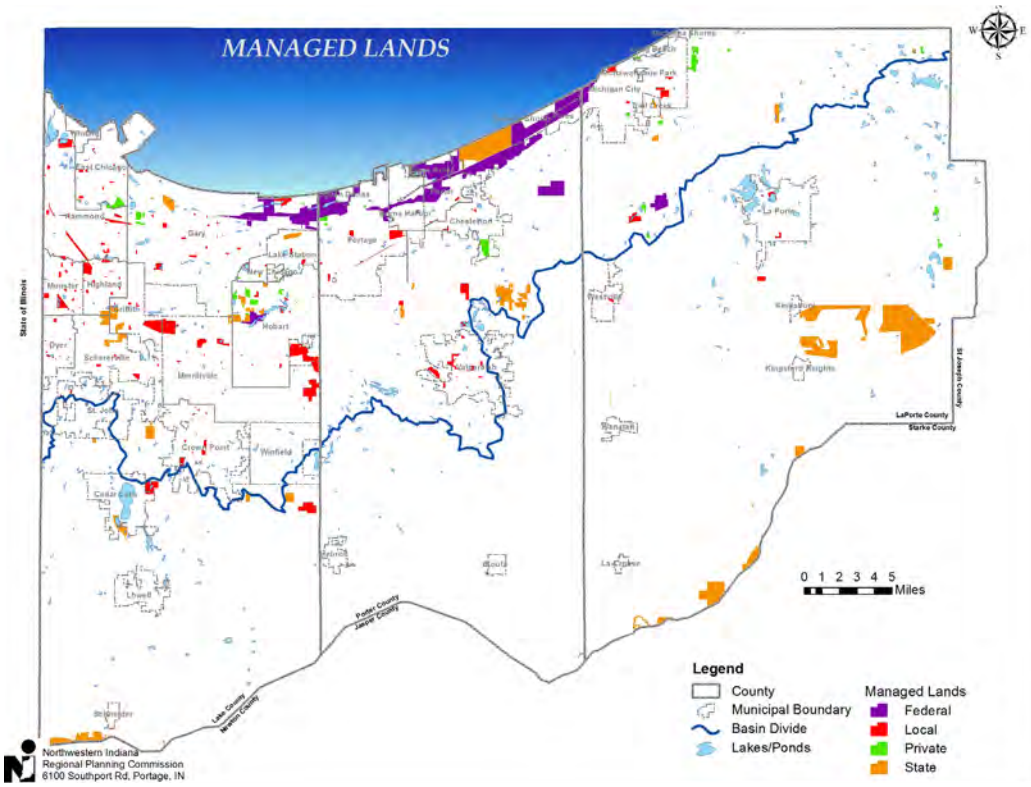


Figure III.9 Managed Lands-Ownership, Indiana Department of Natural Resources, 2010.

Managed Lands

There are approximately 315 natural or recreational areas within Northwest Indiana that are owned or managed by local, state or federal agencies, and non-profit organizations (Figure III.9). Based on data obtained from INDR's managed lands dataset, there are approximately 34,500 public and 1,600 private acres of managed open space in the entire NIRPC three-county region.

Regional Open Space

Northwest Indiana is renowned for its rich environmental diversity, based in large part to the region's proximity to Lake Michigan. Many areas have been opened to public access at every level of government, and through the strong efforts of several nonprofit land trusts. Thus, a unique variety of open space opportunities are afforded to Northwest Indiana residents at both the active and passive scale. From the local level, where active recreation fields are in demand, to the federal level, which has protected thousands of acres of the Indiana Dunes, open space access is vital to the quality of life of those living in the Calumet Region. In addition, a number of protected properties also exist that aim to preserve the delicate natural balance without human interference. The combination of both public and private open spaces forms the backbone of the region's vast ecological diversity, and subsequent enjoyment of these resources.

Types of Open Space

Throughout Northwest Indiana, a range of open spaces exist for both public and private enjoyment. These include:

- Greenways: Greenways are linear corridors of open space. They can vary greatly in scale, from narrow ribbons of open space that run through urban and suburban development to wide corridors that incorporate diverse natural and cultural features. Greenways can be land-based or water-based, and incorporate both public and private property. They always provide greater benefits because of linear continuity than they would if the continuity was broken. Some greenways are primarily recreational corridors, while others focus on environmental protection. Some greenways run along stream corridors, shorelines or wetlands; while others follow old railway tracks or other land-based features. Greenways differ in their location and function, but overall a greenway network will protect natural and cultural resources, provide private or public recreational opportunities, improve and sustain hydrological functions, and enhance the natural beauty and quality of life in neighborhoods and communities.
- Active Open Space: Active recreation involves playing fields and team participation activities such as baseball, soccer, lacrosse, etc. The greater share of facilities for active recreation is found within the management of cities and recreation districts. Open Space funding is allowable for active recreation facilities through a city's attributable share of the sales tax fund, joint venture grants or regional sports facilities grants. Active spaces can include linear corridors such as multiuse trails, and are public and private in nature. However, the vast majority of active open spaces are held by governmental entities.
- Passive Open Space: Passive recreation generally involves trail-based walking or hiking, mountain biking, horseback riding, wildlife viewing, picnicking, or other individual or small group leisure activities. Passive recreation facilities are found primarily within unincorporated areas and are funded with the unincorporated share of the County sales tax fund. Many passive open spaces are set aside for wildlife and plant conservation. They range from public to private in ownership, with land trusts constituting ownership for the latter.

Gazebo at Cedar Lake Parks. NIRPC photo.

Regional Open Space Needs[15]

Although there are many open space opportunities the Northwest Indiana region, significant deficiencies exist, especially in regards to public access and major open space acquisitions. There are also hundreds of acres of prime ecological lands brimming with a variety of native plants and high-quality habitat remnants. A number of these acres have been purchased over the last several years by aggressive non-profit land trusts, but much more progress is necessary, to both protect valuable landscapes and provide enjoyment for the region's residents.

A detailed benchmarking assessment of public accessible facilities in the Lake Michigan Coastal areas was performed by the IDNR and released in 2009, and concluded that the region is:

- below average in the miles of multiuse walking and biking trails;
- below average in the number of public access launch points for personal watercraft;
- above average in miles of public beaches;
- the only region where beach fees are charged for residents;
- far above average in fishing access points;
- above the median in total park acres

In addition to the benchmarking assessment, a "gap analysis" was performed based on current conditions involving acreage and mileage values compared to defined Level of Service (LOS) standards to illustrate the state of public access land in the region. Both qualitative and quantitative measures were used.

The qualitative gap analysis concluded that there is:

- a need for additional public recreation lands and amenities in many communities;
- a need for improved signage and wayfinding to direct users to recreation sites;
- a need to improve trail connections to complete the fragmented trail system;
- a need for connectivity of natural resource lands throughout the region; and
- a need for the creation of "blueways" for non-motorized boats in many areas.

From the local level, where active recreation fields are in demand, to the federal level, which has protected thousands of acres of the Indiana Dunes, open space access is vital to the quality of life of those living in the Calumet Region.

Erie-Lackawanna Trail in Highland. Photo by Stephen Sostaric.

[15] Needs Assessment of Public Access Recreation Sites within the Indiana Coastal Area, Eppley Institute, IDNR 2009.

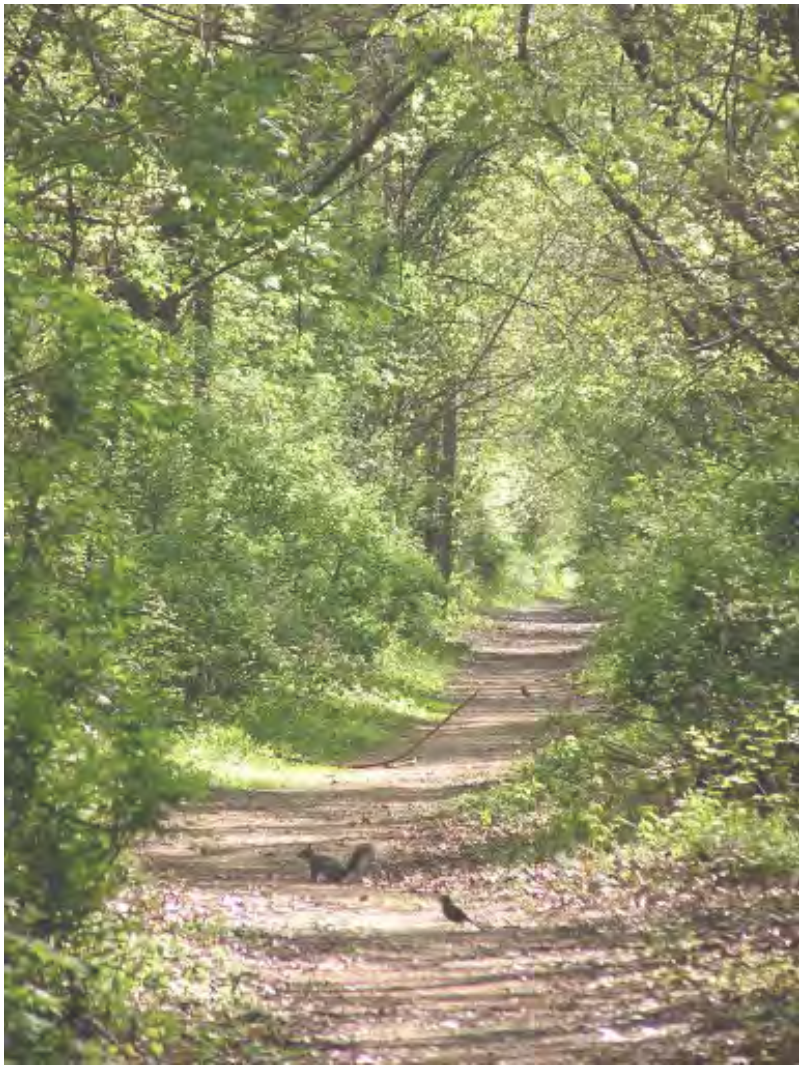
Forestlands

Forests provide many economic, environmental and community benefits. From an environmental perspective, forest cover reduces runoff volume and pollutant loading, improves air quality, provides habitat for terrestrial and aquatic life, reduces stream channel erosion and helps maintain cool stream water temperatures during the heat of the summer. From an economic perspective, forest cover can reduce consumer cooling and heating costs, reduce construction and maintenance costs, and increase property values. From a community perspective, forests increase recreational opportunities, improve health and a sense of well-being and provide aesthetic value.

Much of the region's historic forestland was cleared when the area was being settled for agricultural and development purposes. What remains can primarily be observed as two green swaths following the relatively high relief topography provided the Valparaiso Moraine and the Dunes along southern Lake Michigan. These areas once largely protected because of their unsuitability for agricultural production are under increasing development pressure. Between 1992 and 2009, Lake, Porter and LaPorte counties had some of the highest losses of forestland in the entire state based on data presented in the 2010 Indiana Statewide Forest Assessment by the Indiana Department of Natural Resources. Only 10% of the approximately 101,000 acres of forestland in Northwest Indiana lies within the protective boundaries of managed lands.

While a majority of the region's forest cover is located in unincorporated areas, nearly 20% falls within municipal boundaries. The 2010 Indiana Statewide Forest Assessment shows that a number of the region's urban areas could benefit from increased tree cover. In a number of instances the urban areas identified by the IDNR in the assessment correspond with Environmental Justice (EJ) zones identified by NIRPC. Urban forest and forestry programs align with the strategies that serve the urban core and the EJ populations as described in the Urban Framework section of the 2040 CRP.

While there is value in understanding how much forestland still exists for conservation purposes, it is equally, if not more, important to understand the quality of that remaining forestland and future threats. Forests that share a high proportion of their borders with urbanized areas or agricultural uses are at higher risk of degradation than forests that share a high proportion of their borders with nonforested but natural land cover (wetland, grassland or shrubland). According to the 2010 Indiana Statewide Forest Assessment prepared by IDNR, fragmentation and/or conversion of forests to another land use is the most important



Iron Horse Heritage Trail in Portage. NIRPC photo.

threat to the sustainability of Indiana's forests. Additionally the assessment raises the concern of low species diversity, poor age-class structure, and the threat of emerald ash borer to our urban forests.

The IDNR's 2010 Indiana Statewide Forest Strategy addresses a limited forest base being fragmented or converted to other land uses, like subdivision housing, paved surfaces or row crop agriculture. The strategy seeks to enhance Indiana forests' ability to conserve soil and water resources by protecting existing targeted forest cover in watersheds and promoting reforestation along key streams and rivers. It will guide and improve efforts to control and combat the economically and ecologically disastrous effects of invasive plants in woodlands and make dramatic strides in the preservation of biological diversity by assuring that increasingly simplified and one-dimensional forests become more diverse and connected with one another.

Biodiversity and Wildlife Habitat

According to the U.S. Environmental Protection Agency, no other region in the Midwest has been as greatly impacted by human activity as Northwest Indiana. Prior to European settlement, a series of white pine and jack pine-covered dunes, and swales rich in wetland species, paralleled Lake Michigan. Inland, the dune and swale topography met the Calumet marshes. Further south, the Great Kankakee Marsh was a resting and nesting place for vast numbers of birds of many species. Oak savannas and tall-grass prairies interspersed dune and swale and marshes. East, to the Valparaiso Moraine, a high ridge marking the edge of the last glacier, eastern woodland plant species met western prairie and remnant boreal forest.

The Indiana Dunes National Lakeshore covers nearly 15 miles of Lake Michigan shoreline from Gary to Michigan City. Biodiversity within the national lakeshore is among the highest of all the national parks. More than 1,400 plant species, including 28 species or orchids, and more than 350 bird species have been observed within its boundaries. The national lakeshore is an especially important resting and feeding area for migratory birds.

Within our region, the IDNR's Heritage Database records more than 2,900 endangered, threatened, or rare (ETR) species and high-quality natural community element occurrences (observations). These include a variety of bird, plant, amphibian, reptile, insect, and mammal species as well as globally rare and significant dune and swale habitat. While many of these observations have occurred within the protected boundaries of managed lands (63%), a large number are not afforded such protection. Northwest Indiana remains one of the most, if not the most, biologically diverse area in Indiana and the Great Lakes Basin. However, Northwest Indiana ecosystems are fragmented and under constant, diverse stress from multiple sources. Without the protection and restoration of ecosystem functions and structures, their long-term viability is severely threatened.

Howes Prairie in the Indiana Dunes National Lakeshore. Photo courtesy of the Times of Northwest indiana.

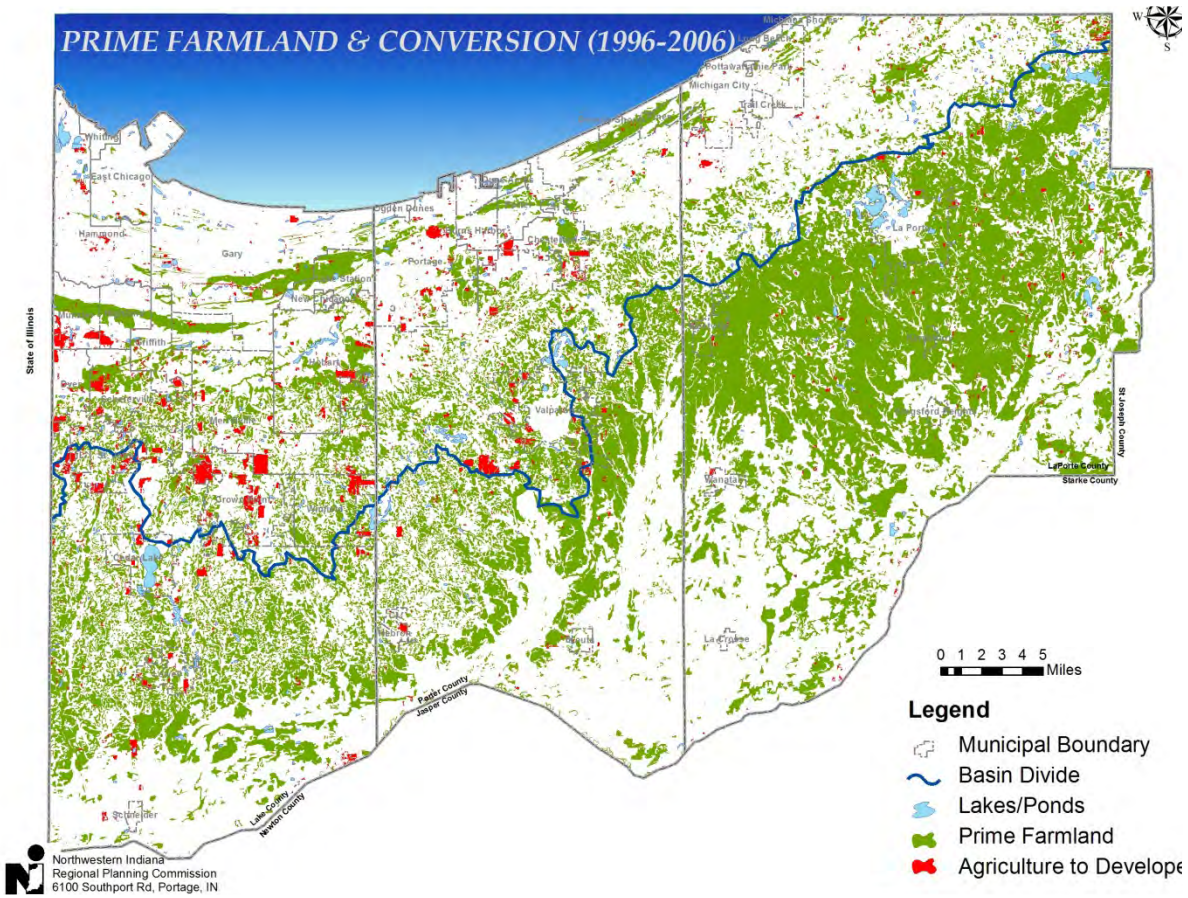


Figure III.10 Prime Farmland Conversion. NIRPC Analysis 2011.

Prime Agricultural Lands

In many areas, agricultural land use can be taken for granted, but there is an increasing recognition that agriculture preservation plans should be included as a component of overall community planning efforts. Agricultural and rural areas are key components of a green infrastructure network, preserving natural and aesthetic qualities that enhance community character and well-being. Nationally, several factors have begun to push back against the loss of economically viable agricultural land, including increased demand for locally produced food; awareness of the historic, cultural and aesthetic value of rural landscapes; and consensus that agricultural land typically requires less in government services than it pays in taxes, thus having a net positive fiscal impact.

There approximately 530 square miles of prime agricultural land within Northwest Indiana based on farmland classified as "all areas are prime farmland" and "farmland of statewide importance" by the NRCS. As can be seen in Figure III.10, the greatest percentage of prime farmland can be found in the Kankakee River sub-basin.

Indiana currently ranks second in the nation in total acreage of prime farmland being lost at the rate of 100,000 acres/year or 10 acres/hour.[16] Between 1996 and 2006, a little more than 13 square miles of agricultural land was converted to developed land uses in Lake, Porter and LaPorte counties. About 20% of this was classified as prime farmland by the NRCS.

Indiana currently ranks second in the nation in total acreage of prime farmland being lost at the rate of 100,000 acres/year or 10 acres/hour.

[16] http://ldm.agriculture.purdue.edu/Pages/P1/EnvNatRes.html

Air Quality

There are many aspects of air quality that are important to the environment, health and quality of life of the region and its residents. Clean air is vital to the productivity of people, land and businesses in Northwest Indiana. Poor air quality can cause a wide variety of health problems, contributing to premature death from cardiovascular and respiratory diseases such as asthma. These problems are often worse in poor urban communities. Air pollution comes from many different sources such as factories, power plants, dry cleaners, cars, buses, trucks, windblown dust, and even fires. It can harm plant life, causing negative impacts on regional natural areas, forests, and farm fields.

Within the context of air quality, it is most relevant to discuss the status of the Lake, Porter, and LaPorte County region with regard to attainment of the National Ambient Air Quality Standards. This section will address the monitoring of Air Toxics in the region, as well as the deposition or pollutants onto land and water. Nuisance problems such as odor and haze, as well as greenhouse gas emissions and climate change, are also addressed.

Air quality has improved in the region substantially over the past decade. Significant investment by local industries in pollution reduction to comply with federal and state regulation of air emissions has contributed to this improvement. Other significant contributors to this progress include implementation of vapor recovery requirements on area gas stations, mandatory vehicle emission testing, and congestion mitigation and air quality improvement in transportation planning.

All of these activities have been achieved through the Indiana Department of Environmental Management State Implementation Plan (SIP) for the Northwest Indiana Non-Attainment Area. A SIP is required for all areas that are in Non-Attainment of National Ambient Air Quality Standards. The SIP details the state approach to reaching air quality standards through regulation of three different types of sources: 1) point sources, which are larger centrally located facilities such as factories and energy plants; 2) smaller and geographically dispersed area sources such as dry cleaners and auto body shops; and 3) mobile sources such as vehicles.

Parachuting over Indiana Dunes National Lakeshore. Photo by Jaro via Flickr.

National Ambient Air Quality Standards

The federal government established the National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants, all of which, in concentrations above certain levels, have adverse effects on human health. These criteria pollutants include: carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), lead (Pb), ozone (O3), particulate matter (PM10), and fine particulate matter (PM2.5).

Pollutant	County		
	Lake	Porter	LaPorte
Carbon Monoxide (CO)	2000	2000	*NL*
Nitrogen Dioxide (NO2)	*NL*	*NL*	*NL*
Sulfur Dioxide(SO2)	2005	*NL*	1997
Lead (Pb)	*NL*	*NL*	*NL*
Ozone 8 Hour Std. (1997)	2010	2010	2007
Ozone Revoked 1 Hour Std.	2008	2008	NL
Particulate Matter (PM10)	2003	*NL*	*NL*
Fine Particulate Matter (PM2.5) 1997 Std.	2009*	2009*	NL
Fine Particulate Matter (PM2.5) 2006 Std.	*NL*	*NL*	*NL*

Table III.2 County NAAQS Attainment Status

NL = Not Listed means that this area was never found to be in non-attainment for this pollutant.

*Although the Final Rule redesignating attainment of the 1997 PM 2.5 Standard for the area that includes Lake and Porter counties was published in the Federal Register November of 2009, the redesignation to maintenance status has not been finalized as of this printing because of uncertainty regarding some of the regulatory mechanisms critical to the SIP. IDEM. 2011

NAAQS attainment status achievements are one of the strongest demonstrations of air quality improvement over time. Table III.2 shows the years in which attainment of ambient air quality standards was achieved in Northwest Indiana counties that were previously designated in non-attainment for each of the various pollutants.

While celebrating the region's achievements, it is important that we continue to strive for continuing improvement in air quality. The United States Environmental Protection Agency (EPA) is mandated to periodically review and update the NAAQS as scientific evidence warrants. As new data and studies reveal new information about health risks from these pollutants, the standards are reviewed and if necessary modified to be more protective of public health. EPA currently has several air quality standards and monitoring requirements in various states of study proposal and promulgation. Some of these could result in Northwest Indiana falling back into nonattainment, based on new data or tighter standards.

Because both Ozone and Fine Particulate Matter have only recently been designated in attainment, this section focuses on them for purposes of understanding the current status of the region's ambient air quality.

Ozone (O3)

Ozone (O3) is an odorless, colorless, highly reactive gas. Ground level ozone forms when its precursors (i.e., nitrogen oxides and volatile organic compounds (VOCs)) mix with high temperatures, bright sunlight and calm winds. This reaction forms smog and can lead to ozone action days, a period when certain pollutant-generating activities should be minimized. Cars, power plants, refineries, chemical plants, gasoline storage, and household paints and solvents emit NO2 and VOCs as a byproduct of their use. O3 can irritate the eyes, nose, throat and respiratory system. It can be especially harmful to individuals with chronic heart or lung disease, as well as the very young and very old. Children, in particular, can be at risk during the summer months due to increased outdoor activity. In addition to public health risks from O3, long-term exposure during the growing

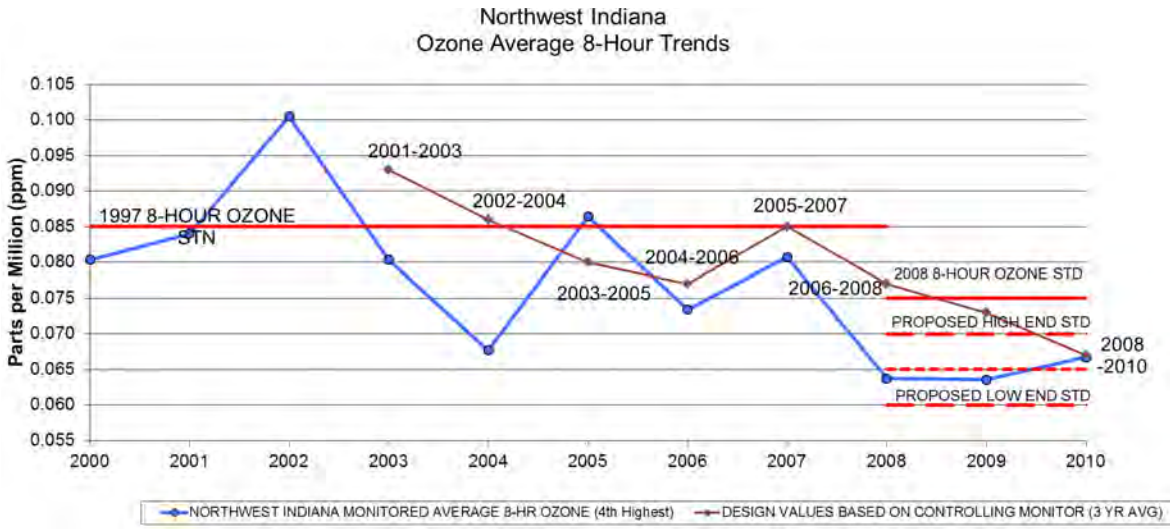


Figure III.11 Regional Ozone Trends, IDEM Air Quality Monitoring Data Website, 2000-2010.

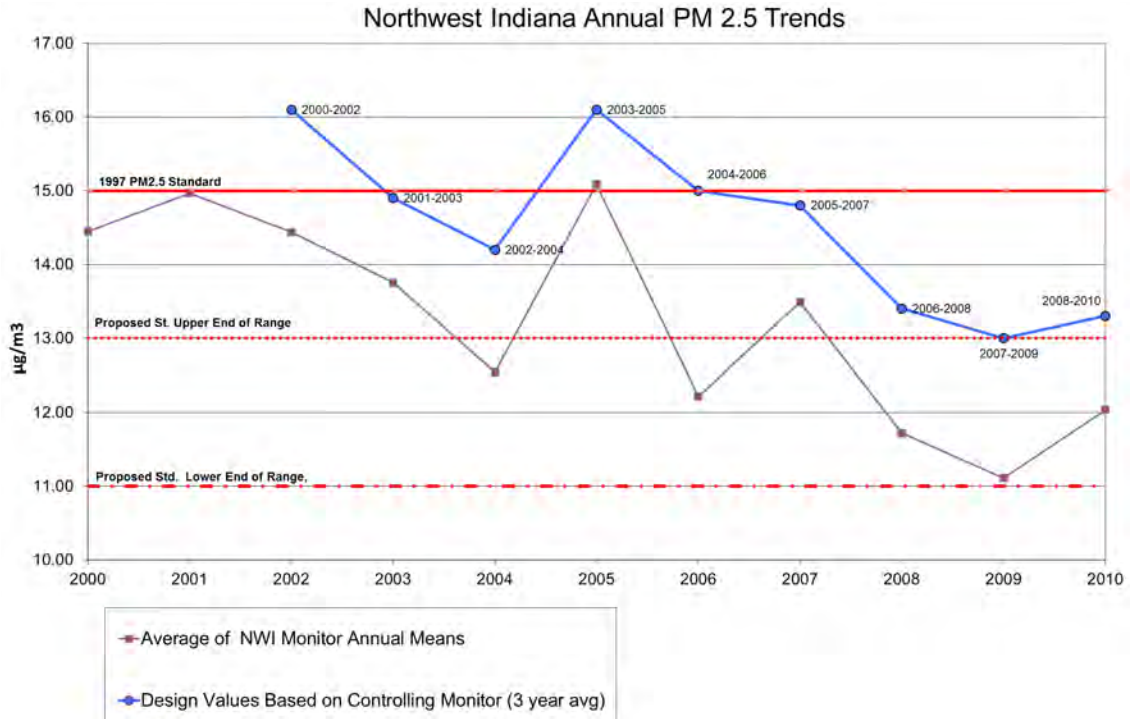


Figure III.12 Annual Std. PM 2.5 Trends, IDEM Air Quality Monitoring Data Website, 2010.

season also damages sensitive vegetation. Cumulative O3 exposure can lead to reduced tree growth; visibly injured leaves; and increased susceptibility to disease, damage from insects and harsh weather. EPA is proposing a new approach to secondary O3 standards to protect important vegetation resources.

There are two NAAQS for O3. The 1-hour O3 NAAQS is exceeded when the day's highest 1-hour average O3 concentration is greater than 0.12 parts per million (ppm). An area does not meet the 1-hour if there are four exceedances in a three calendar year period. The newer 8-hour O3 NAAQS was enacted in 1997 to reflect the health concerns from longer exposure at lower concentrations. As of May 2008, an area does not meet the 8-hour O3 NAAQS if the 3-year average of each year's fourth highest 8-hour average O3 concentration is greater than 0.075 ppm. Because EPA has ruled that Lake and Porter Counties have attained the revoked 1-hour O3 NAAQS and the 8-hour O3 NAAQS is a greater reflection on long-term health concerns; only the 8-hour O3 NAAQS is presented below in Figure III.11.

The O3 NAAQS continues to be a moving target. In 2008 EPA lowered the primary and secondary 8-Hour standard for O3 from 0.08 to 0.075 ppm. Then, in 2010 they proposed further lowering the standard to between 0.060 and 0.070. The modeled design values for Northwest Indiana's air emissions indicate that depending on where the final standard is set, some or all of the counties may return to non-attainment status, requiring a possible revision to the Ozone SIP and additional emission reduction steps to be taken.

Fine Particulate Matter (PM2.5)

Fine particulate matter (PM2.5) is produced by all forms of combustion from engines, wood-burning, open-burning and industrial processes. The annual PM2.5 NAAQS is met when the annual arithmetic mean concentration is less than or equal to 15.0 µg/m3 (parts per billion) The 24-hour PM2.5 NAAQS is met when the three-year average of the 98th percentile of 24-hour concentration is less than 35 µg/m3. The trend of compliance with the annual PM2.5 is a greater indicator of the impact of fine particulate matter on human health.

Like the criteria for Ozone, the standards for Fine Particulate Matter are also in a state of uncertainty. In March 2010, EPA released the announced it would reconsider the Annual PM2.5 standard within a range of 11-13 µg/m3 (parts per billion). Depending on where that final standard is designated, Northwest Indiana again could find itself in nonattainment, as indicated in Table II.2 on page 28.

Air Toxics[18]

Toxics are monitored and regulated differently than National Ambient Air Quality Criteria Pollutants. Northwest Indiana currently has five Air Toxics monitoring sites operated by the Indiana Department of Environmental Management (IDEM). These are located in Whiting, Hammond, East Chicago, Gary and Ogden Dunes. Air Toxic monitoring sites are designed to be located in industrial areas where higher than normal concentrations are expected. Air Toxics are discussed in two groups: noncarcinogenic and carcinogenic. Noncarcinogenic risk is measured using a Hazard Quotient (HQ). Carcinogen risk is evaluated based on the number of cancers likely to occur in one million people; the upper-end carcinogen risk threshold from USEPA is 100-in-1,000,000. According to a 2008 IDEM report, air toxic risk levels in Indiana are comparable to levels normally found in urban areas in the United States. There are three compounds in the state that have been measured at levels of possible concern, including acrolein (noncarinogenic), and benzene and carbon tetrachloride (both carcinogenic). The discussion below focuses, therefore, on these compounds.

[18] ToxWatch Data Analysis Report (1999-2008), Indiana Department of Environmental Management.

Noncarcinogens

Acrolein is the leading noncarcinogenic air toxic concern in the state. Acrolein is used as an aquatic herbicide/pesticide as well as in chemical manufacturing. The primary source of acrolein in outdoor air is from the burning of materials such as tobacco, wood, gasoline or oil. Health impacts from chronic long-term exposure to acrolein are primarily congestion and eye, nose and throat irritation. Acrolein is detected in 9 out of 10 samples in Indiana, with a median detection limit 10 times the health protective level. However, it has only been monitored since 2006 so trend data is not available.

The Hazard Quotient (HQ) for noncarcinogens is the ratio of the exposure estimate to effects concentration considered to represent a "safe" environmental concentration or dose. HQs for acrolein ranged from 72 at Ogden Dunes monitor to 130 at the Hammond monitor during the IDEM study. While these levels are high enough to warrant further investigation, the levels are similar to those commonly measured around the country. It should be noted that U.S. EPA is re-evaluating acrolein monitoring and toxicity information across the country to determine if this is a continuing health concern and how it might be addressed. There are concerns about the methods and quality of acrolein monitoring, and about the differences in monitoring site placement nationwide. Indiana also has studied its acrolein data for possible systemic errors in calibration and measurement.

Industry in Whiting. Photo by Stephen Sostaric.

Carcinogens

Benzene is a carcinogen, meaning it is a pollutant suspected of causing cancer in humans. It occurs naturally in the environment and it also is made for use in chemical manufacturing of plastics, resins, nylons, lubricants, dyes and pesticides. Benzene is also a normal part of crude oil, gasoline, coke oven gas, and cigarette smoke. Benzene was found in 9 out of 10 samples taken statewide. While it is not the most potent carcinogen found, its consistent presence in the environment makes it a concern. Trend analysis of benzene shows it is staying the same or decreasing statewide. However, in Northwest Indiana an exception to this trend is found at the Whiting monitoring site.

Carbon Tetrachloride is a carcinogen and a chemical that is used in chemical manufacturing processes. Historically it also had been used in fire extinguishers, refrigerants and cleaning agents. It is also a common indoor air pollutant because of its presence in cleaning products, although it was banned in consumer products in 1970. Carbon tetrachloride was not commonly detected in Indiana's air until 2007 when method detection limits became much more sensitive. It is a global background pollutant, which means that it is ubiquitous in the environment.

In cities or other areas of heavy traffic, localized vehicular air pollution can increase health problems including cancer, heart disease, asthma and emphysema.

EPA Approach to Emissions Reduction

The EPA approach to addressing these compounds has been to establish National Emission Standards for Hazardous Air Pollutants (NESHAPS) and to require Maximum Available Control Technology be used by different categories of point and area sources. The focus of these efforts is to reduce emissions through the application of technology and operational controls.

The EPA also has issued Mobile Source Air Toxics Rules that focus on the four compounds commonly associated with vehicle activity that have the greatest influence on health. Acrolein and Benzene are two of these chemicals that have been found at levels of concern at monitoring stations in Lake and Porter counties. Another pollutant, diesel particulate matter (DPM) was not analyzed in the IDEM ToxWatch report but could reasonably be expected to be present in Northwest Indiana.

The 2007 MSAT Rule focuses on decreasing emissions through cleaner fuels and cleaner engines. FHWA analysis estimates that a 72 percent reduction in priority MSAT emissions will be achieved by 2050 despite predicted increases in vehicle activity.

U.S. 30 traffic. Photo by Stephen Sostaric.

Beyond this technology based approach, MSAT concerns also are applied to transportation projects through the NEPA process. The FHWA Interim Guidance on Air Quality Analysis in NEPA Documents indicates transportation projects can be grouped into a tiered approach to MSAT in NEPA.

Tier 1 projects have no potential for meaningful MSAT effects and include those with categorical exclusions, exceptions from conformity, and projects with no meaningful impacts on traffic volumes or vehicle mix. These include projects such as sign, safety, and landscaping, bike trails, and noncapacity expansion projects.

Tier 2 projects have low potential for MSAT effects but should give the topic a qualitative analysis. These might include minor widening projects, new interchanges, or anticipated annual average daily traffic less than 140,000 and 150,000.

Tier 3 projects have high potential MSAT effects and require a quantitative analysis to allow alternative comparisons. Tier 3 projects create or significantly alter a major intermodal freight facility, or create or expand new urban highway capacity where annual average daily traffic volume of 140,000 to 150,000 or greater, and are located in proximity to populated areas. The only existing transportation facility in Northwest Indiana will traffic volumes approaching these levels is I-80/I-90.

Regional Air Quality Programs

Transportation accounts for 67% of the oil consumed in the United States, with this number projected to reach 72% by 2020. Petroleum's inherently finite and frequently unstable nature makes this reliance a threat to our energy security, bringing with it far-reaching economic and political implications. In cities or other areas of heavy traffic, localized vehicular air pollution can increase health problems including cancer, heart disease, asthma and emphysema. The Air Quality Programs currently implemented by NIRPC and other local partner agencies focus primarily on these transportation sources. Industrial, commercial and other point sources of air emissions are regulated or managed by regulatory programs implemented by the Indiana Department of Environmental Management, the U.S. EPA and, sometimes, local health departments.

Air Quality Public Education and Outreach

NIRPC uses Federal Highway Administration Congestion Mitigation and Air Quality funding and materials from the FHWA and U.S. EPA's It All Adds Up to Cleaner Air Program to conduct annual Public Education and Outreach Programming. This program consists of several components, including an annual comprehensive advertising campaign, a variety of activities and events promoting clean air actions with local and bistate partners and a gas can exchange program to reduce air emissions from poor-quality residential gasoline storage containers.

It All Adds Up to Cleaner Air Program seeks to continuously remind residents of 10 simple steps they can take to improve air quality:

- Trip chain more often
- Take mass transit, share a ride or carpool
- Have fun! Ride a bike
- Use your feet
- Care for your car
- Get fuel when it's cool
- Don't top off the tank
- Telecommute
- Know before you go
- Spread the word

Partners for Clean Air is a voluntary program that encourages individuals, businesses, communities and organizations to be aware of Air Quality Action Days and take action such as those listed above to reduce air emissions on days where the weather conditions exist that are most likely to unhealthy levels of air pollution.

The Air Quality Education Program also partners with South Shore Clean Cities. Clean Cities is a nonprofit organization associated with

the U.S. Department of Energy to promote emission-reducing technology, alternative fuels and anti-idling programs that also save energy and reduce our dependence on foreign oil. South Shore Clean Cities particularly helps NIRPC staff to extend its outreach to fleet owners and operators in our region and across Northern Indiana.

NIRPC works with the Pace Suburban Bus Division of the Chicago Regional Transportation Authority through a memorandum of agreement. The agreement allows NIRPC to promote the online rideshare registration program it has developed. In return, NIRPC funds a portion of its costs for those region residents who utilize its program.

The Gas Can Exchange program is one of the most successful outreach and education programs implemented by NIRPC. Through this program, staff has direct contact with thousands of residents each year. Promoting the events exposes even more residents to NIRPC's action messages, NIRPC encourages residents also to dispose of chemicals that could contribute to air pollution.

Vehicle Emissions Testing, Inspection and Maintenance

Cars and light-duty trucks can contribute more than 30% of the emissions that contribute to ozone, as well as significant amounts of air toxins and particulates that can impact the health of people and the environment. In order to improve air quality in our region, in the State Implementation Plan for Lake and Porter counties, the Indiana Department of Environmental Management requires emission testing of these types of vehicles in Lake and Porter counties. In order for vehicles to be registered in these counties, they must meet emission standards. The emissions testing program in Northwest Indiana is known as Clean Air Car Check. While improvements in our air quality have been made, vehicle emissions testing will continue to be required in Northwest Indiana to prevent backsliding and maintain our progress.

U.S. EPA continually requires motor vehicle manufacturers to meet increasingly stringent pollution control standards. Cars, SUVs and light trucks that are not properly maintained or that have malfunctioning emission control systems often exceed these standards. The vehicle emission testing identifies such cars. Repairs then are required to reduce the emissions that cause pollution. Just more than 17% of the vehicles tested in Northwest Indiana fail the initial vehicle emissions inspection. Identifying and repairing these vehicles has reduced ozone precursor emissions by more than 2 tons per summer day. These repairs also improve the vehicle's performance and fuel economy.

Depending on the year of the vehicle, Clean Air Car Check uses different types of emissions tests. All vehicles receive a Gas Cap Pressure Check, which tests to see if a vehicle's gas cap is effectively keeping fuel vapors from escaping. Fuel evaporation is a major cause of ground-level smog, and a properly functioning gas cap improves gas mileage by preventing fuel waste.

The On-Board Diagnostics (OBD) Test is the most common test procedure and is used in vehicles that are model year 1996 or newer. During this simple test, data is downloaded from the vehicle's on-board computer to check for emissions equipment malfunctions. An OBD scanner is attached to a plug under the vehicle's dashboard.

The Inspection and Maintenance (I/M 93) Test is used for vehicles with model years 1981 through 1995 or newer. During this test, an inspector drives the vehicle on a treadmill device called a dynamometer, which simulates driving on a road. While driving, the car's tailpipe emissions are captured and analyzed to evaluate the effectiveness of the emission control equipment. It is important that a vehicle subject to this type of test has an exhaust system that is intact and leak-free. The vehicle also needs properly functioning brakes and should not have any major fluid leaks.

The Single Idle Speed (BAR 90) Test is used in vehicles from 1976 to 1980. A metal probe is inserted into the vehicle's tailpipe while the vehicle idles to sample the exhaust stream. At the same time, a sensor is placed on the hood of the vehicle to measure the engine speed. The probe measures the vehicle's emissions, and they are analyzed to see whether or not the vehicle's emission control equipment is working properly. The vehicle's exhaust system must be intact and leak-free.

Repair Support

In addition to emissions testing, Clean Air Car Check also provides additional services to drivers whose vehicles are found to have emissions problems. For do-it-yourselfers, a customer service hotline is provided and technical repair advice given by a certified emissions repair technician. For those who need to go to a repair shop, unbiased information is provided about the effectiveness different facilities have had in the past. In addition, technical bulletins, newsletters and support for the regional auto repair industry are provided.

Hardship Repair Grant Program

Since 2009, Clean Air Car Check has locally administered the Hardship Repair Grant Program. This program provides emissions repair grants for qualified low-income motorists and those experiencing financial hardship. The grants have been funded through BP settlement dollars allocated for pollution mitigation. Customers who are determined to meet program eligibility are referred to a participating certified emission repair facility, which then is paid for the repair once the car passes the emissions tests. This program has assisted or funded further testing and repair of 236 vehicles over the course of its first year. It has resulted in a net reduction of slightly more than 20 tons of air pollution during that time at a cost of $50,500. This average cost per ton of approximately $2,500 ranks highly compared to the EPA's cost-effectiveness target of $20,000 per ton.

Diesel Emissions Reduction Programs

In Northwest Indiana and across the country, pollution from diesel engines is a growing concern. The familiar black soot from buses and trucks contaminates our air and dirties our cities. Diesel exhaust is more than just a foul smell or visual nuisance – it is a detriment to public health. Numerous scientific studies have shown that exposure to the pollution from diesel exhaust increases risk for several serious health problems, including respiratory illness and cancer. However, diesel engines are a durable and economical source of power and are important to our economy. NIRPC, along with several state and federal agencies, is part of a number of programs and projects that are working to reduce diesel emissions in our region in sensible ways.

This is important in Northwest Indiana because of the large volume of freight moving through our region, most of it transported by diesel-powered equipment. Truck count volume on the Indiana Toll Road reaches more than 15,000 per day, with volumes on the 80/94 Borman Expressway significantly greater. Trains also run on diesel fuel, and our region boasts seven Class I railroads, plus several regional carriers. Thirty-two million tons of cargo moved through our ports and harbors on diesel-powered ships and were transferred to trains and trucks by diesel-powered equipment. By 2020, Midwest freight is expected to increase by 50%, so it is important that emissions from the engines powering this growth be reduced. Diesel emission reduction is generally approached through three strategies: idle reduction, engine retrofits and alternative fuels.

Photo from web.

Midwest Clean Diesel Initiative

The Midwest Clean Diesel Initiative (MCDI) is a collaboration of federal, state and local agencies, along with communities, nonprofit organizations and private companies working together to reduce emissions from diesel engines in the Midwest. The EPA estimates there are approximately 3.3 million diesel-powered engines in the Midwest that can be affected through voluntary action. MCDI re-

duced emissions through supporting operational changes, technological improvements and use of cleaner fuels in diesel engines across all fleets. The initiative also supports EPA Region 5 state clean diesel coalitions such as DieselWise Indiana and the Indiana Clean Diesel Coalition. As of December 2010, MCDI has impacted more than 1 million engines, including construction equipment, locomotives, municipal vehicles, school buses, transit buses, heavy-duty trucks, cargo-handling equipment, marine vessels and more.

DieselWise Indiana

The Indiana Department of Environmental Management (IDEM) is working to advance cleaner diesel fuel, engine and retrofit technologies so that we can thrive economically while improving air quality through the DieselWise Indiana program. Through DieselWise Indiana, a number of projects to reduce harmful tailpipe emissions from diesel-powered vehicles have been implemented. DieselWise Indiana works with school, municipal and public entities, as well as the private sector, to retrofit diesel vehicles with diesel oxidation catalysts, aftermarket auxiliary heaters and auxiliary power units that dramatically reduce harmful tailpipe emissions. In partnership with the School Transportation Association of Indiana, IDEM introduced a voluntary idle reduction program that can be implemented in school systems statewide.

South Shore Clean Cities Diesel Oxidation Catalyst Retrofit Program

Through use of FHWA Congestion Mitigation and Air Quality funding, NIRPC has partnered with South Shore Clean Cities to support a regional DOC Retrofit Program. This CMAQ funding will cover 100% of the purchase and installation of diesel oxidation catalysts on public school buses, municipal vehicles and private fleets.

Idle Reduction

Reducing the idling time of vehicles saves fuel and money, protects public health and the environment and increases U.S. energy security. Reducing idle time can also reduce engine wear and associated maintenance costs. Idle reduction strategies can dramatically reduce emissions of carbon dioxide, nitrogen oxides, carbon monoxide, particulate matter and other harmful pollutants. Idle reduction strategies also reduce noise pollution. In some areas, heavy-duty trucks and trains are required to limit noise at night. By reducing idle time, drivers can reduce engine idling noise and meet noise standards.

Argonne National Laboratory estimates more than 650,000 long-haul heavy-duty trucks idle during required rest stops. As the trucks idle during those rest periods, they use more than 685 million gallons of fuel per year. At a price of roughly $4 per gallon, that wasted diesel fuel translates into almost $2.5 billion annually, much of which could be saved through the use of idle reduction behavior and technologies.

Behavioral change is one method to achieve idle reduction. Education and driver incentives play an important role in behavioral change. Informing the driver or operator about the fuel consumption, emissions and the potential health risks plays an important part in changing behavior. Another powerful tool in changing driver behavior is offering financial incentives to reduce idling. Many large trucking companies already offer these incentives, and they have reported success in reducing idling times below national averages.

Idle Reduction Technologies

Over the past several years, the EPA has evaluated idle reduction technologies/devices as part of grants, cooperative agreements, emissions testing, engineering analyses, modeling, demonstration projects and external peer-reviewed reports to study the effects of idling on air quality, fuel consumption and driver health. Based on this evaluation and research, EPA has determined that a variety of idle reduction technologies save fuel and reduce emissions when compared to idling the main engine.

Idle reduction technology allows engine operators to refrain from long-duration idling of the main propulsion engine by using an alternative technology. An idle reduction technology is generally defined as the installation of a technology or device that:

- is installed on a vehicle (e.g., bus, truck, locomotive, automobile, marine vessel, equipment, etc.) or at a location .
- reduces unnecessary main engine idling of the vehicle or equipment.
- is designed to provide services (e.g., heat, air conditioning and/or electricity) to the vehicle or equipment that would otherwise require the operation of the main drive engine while the vehicle or equipment is temporarily parked or remains stationary.

Certain idle reduction devices are exempt from the federal excise tax when purchased with a new truck. For a list of idling reduction technologies eligible for the federal excise tax exemption, please see Federal Excise Tax Exemption.

To date, the EPA has verified devices in the following categories of idle reduction technologies: Electrified Parking Spaces (truck stop electrification), Shore Connection Systems and Alternative Maritime Power, Shore Connection Systems for Locomotives, Auxiliary Power Units and Generator Sets, Fuel Operated Heaters, Battery Air Conditioning Systems, Thermal Storage Systems, Automatic Shut-down/Start-up Systems. Each of these categories is described in more detail below.

Electrified Parking Spaces (EPS)

An EPS system operates independently of the truck's engine and allows the truck engine to be turned off as the EPS system supplies heating, cooling and electrical power. The EPS system provides off-board electrical power to operate either:

- an independent heating, cooling and electrical power system, or
- a truck-integrated heating and cooling system.

Tractor trailers plugged in at EPS in San Francisco. Photo from nytimes.com.

In both cases, the EPS system reduces main engine idling by providing an alternative source of energy, which results in lower emissions than the main engine.

Shore Connection Systems and Alternative Maritime Power (SCS/AMP)

An SCS/AMP system allows maritime vessels to plug into an electrical power source instead of using its diesel auxiliary engines while at port. This system also includes various components such as cables, cable management systems, shore power coupler systems, distribution control systems and power distribution.

Shore Connection Systems for Locomotives (SCS)

An SCS system allows locomotives to plug into an electrical power source instead of using its diesel engines while at the rail yard.

Auxiliary Power Units and Generator Sets (APU/GS)

An APU/GS device contains an EPA emission-certified engine (certified under 40 CFR Part 89). APU/GS devices supply cooling, heating and electrical power to Class 8 trucks and other applications. The EPA has determined through its own test program that these devices reduce emissions on long-haul, Class 8 trucks and locomo-

tives when compared to a truck's baseline emissions from the main propulsion engine

Fuel-Operated Heaters (FOH)

A FOH provides heat (only) by combusting fuel drawn from the main engine or other fuel system. The EPA has determined through its test program that these devices reduce emissions on long-haul, Class 8 trucks when compared to the truck's baseline emissions. The EPA also has determined that FOHs provide a similar idle reduction benefit when used on school buses and locomotives. In addition, the California Air Resources Board (CARB) has approved certain FOHs for compliance with applicable California emissions standards.

Battery Air Conditioning Systems (BAC)

A BAC system uses batteries to power an independent electrical cooling system. Typically, these systems integrate a FOH to supply heating. The EPA has evaluated BACs and finds that these systems reduce emissions on long-haul, Class 8 trucks when compared to the truck's baseline emissions.

Thermal Storage Systems (TSS)

A TSS system stores energy in cold storage as the truck is driven, and then provides air conditioning when the truck is turned off. The EPA has evaluated TSS and finds that these systems reduce emissions on long-haul, Class 8 trucks when compared to the truck's baseline emissions.

Automatic Shut-down/Start-up Systems

An automatic engine shut-down/start-up system not only turns off the main engine while idling, but can restart the engine when necessary. Restart of the main engine is typically based on a set time period, engine or ambient temperature and other parameters (e.g., battery charge).

Aerodynamic Technologies

Trailer aerodynamic technologies can minimize aerodynamic drag and maintain smoother airflow over the entire tractor-trailer vehicle. Trailer aerodynamic devices include gap fairings that reduce the gap between the tractor and the trailer to reduce turbulence, trailer side skirts that minimize wind under the trailer and trailer rear fairings that reduce turbulence and pressure drop at the rear of the trailer. The EPA determined that using these trailer aerodynamic fairings in combination with one another (or, in a few cases, when used alone) has the potential to provide an estimated 5% or greater reduction in fuel use relative to the truck's baseline, when used in conjunction with an aerodynamic tractor on long-haul, Class 8 trucks in highway-type operation. This reduces NOx emissions, saves more than 800 gallons of fuel and eliminates over 9 metric tons of greenhouse gas emissions per year. Actual fuel savings depends upon the aerodynamic effectiveness demonstrated by each individual product and truck operation. To reduce NOx, greenhouse gases and improve fuel efficiency, legacy fleets can be retrofitted with aerodynamic trailer fairings, or the fairings can be provided as new equipment options.

Trailer end fairing. Photo from tractorbynet.com.

The EPA has verified the following categories of aerodynamic technologies: Trailer gap reducer and trailer side skirts (used in combination with one another); trailer boat tail and trailer side skirts (used in combination with one another); advanced trailer end fairing; and advanced trailer skirt. In order to be eligible for funding under the DERA, verified aerodynamic technologies must be specifically listed on the EPA's verified technology list:

- Trailer gap reducer (should be used with side skirts) – Estimated fuel savings 1% or greater
- Trailer boat tail (this or the gap reducer should be used with side skirts) – estimated fuel savings 1% or greater
- Trailer side skirts (should be used with gap reducer or boat tail) – estimated fuel savings 4% or greater
- Advanced trailer end fairing (this can be used with or without other fairings) – Estimated fuel savings 5%
- Advanced trailer skirt (this can be used with or without other fairings) – Estimated fuel savings 5%

Low Rolling Resistance Tires

Based upon data provided by tire manufacturers and EPA testing and research, the EPA determined that certain tire models can provide a reduction in NOx emissions and an estimated fuel savings of 3% or greater, relative to the "best-selling" new tires for line-haul trucks when used on all five axles on long-haul, Class 8 trucks. The options offered include both dual tires and single-wide tires (single-wide tires replace the double tire on each end of a drive or trailer axle, in effect turning an 18-wheeler into a 10-wheeler). Low-rolling resistance tires can be used with lower-weight aluminum wheels to further improve fuel savings.

Retrofit Technology

Even with more stringent federal heavy-duty highway and non-road engine standards set to take effect over the next decade, millions of diesel engines already in use will continue to emit large amounts of nitrogen oxides, particulate matter and air toxins, which contribute to serious public health problems. Diesel retrofits can significantly reduce harmful air pollutants, improve the working environment of those working around and operating diesel-powered equipment and reduce smoke and odor from diesel engines. Diesel retrofit devices are common original equipment, but also can be installed on an older vehicle just prior to or after it has been serviced.

Diesel Oxidation Catalysts (DOC)

Diesel oxidation catalysts are devices that use a chemical process to break down pollutants in vehicle exhaust into less harmful components. More specifically, a DOC has a porous, ceramic honeycomb-like structure that is coated with a material that causes a chemical reaction to reduce harmful air pollutants. DOCs rarely require maintenance, come with a 100,000- to 150,000-mile warranty, can last for seven to 15 years and can be installed on a variety of diesel vehicles. Typically, an installed DOC costs between $1,000 and $1,500 and takes one to two hours to install.

Diesel Particulate Filter (DPF)

Diesel particulate filters are ceramic devices that collect particulate matter in the vehicle exhaust stream. The heat produced by the vehicle exhaust heats the ceramic filter and allows the particles to break down (or oxidize) into less harmful components. Unlike diesel oxidation catalysts (DOC), DPFs must be used in conjunction with ultra-low sulfur diesel (ULSD) fuel and work best on diesel engines built after 1995. Therefore, knowing the age and type of each engine in the fleet, as well as the exhaust temperature, is an important part of the retrofit project. Manufacturers recommend that DPFs be cleaned about every 100,000 miles. Most DPFs come with a 100,000- to 150,000-mile warranty. A DPF typically costs between $7,000 and $10,000 and takes about six to eight hours to install.

Aftermarket Auxiliary Heaters

Aftermarket auxiliary heaters can be used to warm up engines and passenger compartments in colder climates. This equipment runs

off the diesel fuel tank or the vehicle's electrical outlets and includes a timer that can be programmed to automatically start the heating function. There are three types of heaters:

Engine Block Pre-Heaters are used to heat the engine block for a warm start. Engine block pre-heaters cost $1,200 to $1,500 installed. Some of the reported benefits of these heaters are lower emissions and fuel savings, longer engine oil life, less wear and tear on the engine and relatively easy installation and maintenance.

Compartment/Engine Block Heaters warm up the engine block and passenger compartments simultaneously while using an auxiliary heater. These heaters cost approximately $2,300 to $2,500 installed. These heaters are especially useful for nighttime-activity vehicles and buses that transport very young and/or special-needs children. In addition, the radiant heat keeps the windows from frosting or fogging – a safety feature.

Electric Plug-in Block Heaters warm up the engine block by heating the engine coolant or oil. They are powered by electricity and are available in a range of voltages and watts, drawing between 1,000 and 1,500 watts per bus per hour. They include a timer that can automatically start or turn off the heater. A heater is mounted on the engine block of each bus and is plugged in when the bus is parked at the depot. Even in the coldest climates, engines will have a "warm start." Such heaters usually cost less than $100.

Alternative Fuels[19]

Americans are becoming increasingly concerned about the condition of our nation's air quality and our dependence on foreign oil. Yet the vehicles we drive on a daily basis, mostly powered by petroleum-based fossil fuels, are major sources of the problem. The good news is that alternative fuels are readily available. Some businesses, government agencies, individuals and school corporations are choosing to drive alternative-fuel vehicles (AFVs). Most major manufacturers produce AFVs, including cars, light and heavy-duty trucks, shuttle and transit buses and off-road vehicles. Many AFVs are sold as fleet vehicles, but many can be sold to the public, as well. AFVs come in three basic configurations: flexible-fuel, bifuel or dual-fuel, and dedicated-fuel. Flexible-fuel vehicles have one tank and can run on a mixture of petroleum fuel and alternative fuel. Bifuel or dual-fuel vehicles have two fuel tanks for two separate fuels. Dedicated-fuel vehicles use one alternative fuel full time.

Because the majority of the alternative fuels we use are produced domestically, they can be instrumental in our efforts to reduce our nation's dependence on foreign oil. AFVs generally release fewer harmful air pollutants to our environment than petroleum-powered vehicles. Many fleet operators are required by law to purchase AFVs because of the Energy Policy Act of 1992 that requires certain types of vehicle users, including fleets operated by state and federal government agencies, to acquire specific proportions of light-duty AFVs.

Ethanol

E85 (85% ethanol, 15% gasoline) is considered an alternative fuel under the Energy Policy Act of 1992 (EPAct). It is used to fuel E85-capable flexible-fuel vehicles (FFVs), which are available in a variety of models from U.S. and foreign automakers.

The 15% gasoline content in E85 enables FFVs to operate normally under cold conditions. Fueling a vehicle with pure ethanol (E100) creates problems during cold-weather operation. Ethanol also can be mixed with gasoline in lower-level blends, which provide many benefits but are not considered EPAct alternative fuels.

Other than lower gas mileage, motorists will see little difference when using E85 versus gasoline. E85 has about 27% less energy per gallon than gasoline. However, E85 is typically priced lower than gasoline, so that cost per mile is comparable.

[19] http://www.afdc.energy.gov/afdc/

Biodiesel

Biodiesel is a domestically produced renewable fuel that can be manufactured from new and used vegetable oils, animal fats and recycled restaurant grease. Biodiesel's physical properties are similar to those of petroleum diesel, but it is a cleaner-burning alternative. Using biodiesel in place of petroleum diesel significantly reduces emissions of toxic air pollutants. Biodiesel can be blended and used in many different concentrations, including B100 (pure biodiesel), B20 (20% biodiesel, 80% petroleum diesel), B5 (5% biodiesel, 95% petroleum diesel) and B2 (2% biodiesel, 98% petroleum diesel). B20 is a common biodiesel blend in the United States.

For vehicles manufactured after 1993, biodiesel can be used in diesel engines and fuel-injection equipment with little impact on operating performance. But if a vehicle is older than that, the engine could be assembled with incompatible elastomers, which can break down with repetitive high-blend biodiesel use. Most original equipment manufacturers (OEMs) approve blends up to B5 in their vehicles. Some approve blends up to B20, and one manufacturer even approves B100 for use in certain types of its farm equipment. However, some OEMs don't recommend using biodiesel blends above B5 in highway vehicles manufactured in model year 2007 or later. In these vehicles, high levels of fuel may accumulate in the engine lubricant under certain conditions. It is not known whether those high levels of biodiesel might affect lubricant performance.

Biodiesel is available in all 50 states. According to the U.S. Energy Information Administration, annual consumption of biodiesel in the United States totaled 316 million gallons in 2009. 1 As of June 2009, the country had an annual production capacity of more than 2.69 billion gallons. According to the Alternative Fuels and Advanced Vehicles Data Center (AFDC) website, there are more than 600 B20 fueling sites across the country.

Engines operating on B20 exhibit similar fuel consumption, horsepower and torque to engines running on conventional diesel, and biodiesel has a higher cetane number (a measure of the ignition value of diesel fuel) and higher lubricity (the ability to lubricate fuel pumps and fuel injectors) than U.S. diesel fuel. B20's energy content is between those of No. 1 and No. 2 diesel.

Pollutant	Alternative Fueled Vehicle Approximate* Emission Reductions				
	E 85	B 20	Propane	CNG	ULSD
Carbon Monoxide	18 - 20%	11%	20 – 40%	20 – 40%	6%
Hydro Carbons	8 - 18%	21%	>40%		13%
Nitrous Oxides	18 - 54 %	0	0 - 30%	0	3%
Particulate Matter	34%	10%	80 – 100%	80%	13%
Volatile Organic Carbon	15%		10%	10%	

Table III.3 Alternative Fuel Air Emission Reductions. *Actual emissions values vary with engine design.

Natural Gas (CNG)

Natural gas powers more than 100,000 vehicles in the United States and roughly 11.2 million vehicles worldwide.1 Natural gas vehicles (NGVs) are a good choice for high-mileage fleets, such as buses and taxis, that are centrally fueled or operate within a limited area. The advantages of natural gas as an alternative fuel include its domestic availability, widespread distribution infrastructure, low cost compared with gasoline and diesel and clean-burning qualities. NGVs meet the same safety standards as gasoline and diesel vehicles and also meet the National Fire Protection Association's (NFPA) 52 Vehicular Fuel System Code. Natural gas has a narrow flammability range and, because it is lighter than air, dissipates quickly if released. NGV fuel tanks are strong and extremely puncture resistant.

A wide variety of new, heavy-duty NGVs is available. The Honda Civic GX is the only light-duty NGV avail-

able from a U.S. OEM. Consumers and fleets also have the option of economically and reliably converting existing light- or heavy-duty gasoline or diesel vehicles for natural gas operation using certified installers. See the Conversions page in the Vehicles section of the Alternative Fuels and Advanced Vehicles Data Center (AFDC) website at www.afdc.energy.gov. For the latest new vehicle offerings, also see the AFDC's light-duty and heavy-duty vehicle searches.

NGVs operate in one of three modes: dedicated, bifuel or dual-fuel. Dedicated NGVs run on only natural gas. Bifuel NGVs can run on either natural gas or gasoline. Dual-fuel vehicles run on natural gas and use diesel for ignition assist. Light-duty vehicles typically operate in dedicated or bifuel modes, and heavy-duty vehicles operate in dedicated or dual-fuel modes. Natural gas is an odorless, nontoxic, gaseous mixture of hydrocarbons, predominantly methane (CH4). Because it is a gas, it must be stored onboard a vehicle in either a compressed gaseous or liquefied state. Compressed natural gas (CNG) is typically stored in a tank at a pressure of 3,000 to 3,600 pounds per square inch. Liquefied natural gas (LNG) is super-cooled and stored in its liquid phase at -260°F in special insulated tanks. Natural gas is sold in units of gasoline or diesel gallon equivalents based on the energy content of a gallon of gasoline or diesel fuel.

Natural gas is drawn from wells or extracted in conjunction with crude oil production. Biomethane, a renewable form of natural gas, is produced from decaying organic materials such as waste from landfills, wastewater and livestock. In recent years, 80 to 90% of the natural gas used in the United States was produced domestically. The United States has a vast natural gas distribution system, which can quickly and economically distribute natural gas to and from almost any location in the lower 48 states.

A CNG fuel system transfers high pressure natural gas from the storage tank to the engine while reducing the pressure of the gas to the operating pressure of the engine's fuel-management system. The natural gas is injected into the engine intake air the same way gasoline is injected into a gasoline-fueled engine. The engine functions the same way as a gasoline engine. The fuel-air mixture is compressed and ignited by a spark plug and the expanding gases produce rotational forces that propel the vehicle.

Natural gas dispenser for Canadian bus fleet. Photo from hydrogenhighway.ca.

Propane/Liquefied Petroleum Gas

Propane, also known as liquefied petroleum gas (LPG), has been used in vehicles since the 1920s. It is considered an alternative fuel under the Energy Policy Act of 1992 and qualifies for alternative fuel vehicle tax incentives. Today, most propane vehicles are conversions from gasoline vehicles. Dedicated propane vehicles are designed to run only on propane. Bifuel propane vehicles have two separate fueling systems that enable the vehicle to use either propane or gasoline.

Propane vehicle power, acceleration and cruising speed are similar to those of gasoline-powered vehicles. The driving range for bifuel vehicles is comparable to that of gasoline vehicles. The range of dedicated gas-injection propane vehicles is generally less than gasoline vehicles because of the 25% lower energy content of propane and lower efficiency of gas-injection propane fuel systems. Extra storage tanks can increase range, but the additional weight displaces payload capacity. Liquid Propane Injection engines, introduced in 2006, promise to deliver fuel economy more comparable to gasoline systems. Lower maintenance costs are a prime reason behind propane's popularity for use in delivery trucks, taxis and buses. Propane's high octane rating (104 to 112 compared with 87 to 92 for gasoline) and low carbon and oil contamination characteristics have resulted in documented engine life of up to two times that of gasoline engines. Because the fuel mixture (propane and air) is completely gaseous, cold-start problems associated with liquid fuel are eliminated.

Compared with vehicles fueled with conventional diesel and gasoline, propane vehicles can produce significantly lower amounts of harmful emissions. Another benefit of propane vehicles is increasing U.S. energy security.

Ultra-low Sulfur Diesel (ULSD)

Ultra-low sulfur diesel (ULSD) is diesel fuel with 15 parts per million (ppm) or lower sulfur content. This ultra-low sulfur content enables use of advanced emission-control technologies on light-duty and heavy-duty diesel vehicles. Most highway diesel fuel refined in or imported into the United States is required to be ULSD. One hundred percent must be ULSD nationwide by 2010.

Petroleum-based ULSD is not considered an alternative fuel under the Energy Policy Act of 1992 (EPAct), but most ULSD fuels produced from nonpetroleum and renewable sources are considered EPAct alternative fuels.

Photo from tqn.com.

Brownfields

Background

Several cleanup programs have evolved over the years to assess and, where necessary, clean up contaminated sites, facilities and properties.[20] Cleanups may be done by the EPA, other federal agencies, states or municipalities, companies or parties responsible for the contamination, or other organizations. They may be funded by various levels of government, private parties and other organizations. Cleanup requirements, including reporting requirements, vary by program and sometimes even within a program, and not all information is reported to or available to the EPA. In some cases, a particularly piece of property is cleaned by more than one program. In other cases, a spill or other contamination may be cleaned up by an active facility that continues to operate, so that the site has no impact on the health of the people or economy of the surrounding community.

Figure III.6 to the right depicts visually the general concentration of documented brownfield and remediation sites in Northwest Indiana. Some of the highest concentrations occur within Environmental Justice zones. These sites may be in various stages of the remediation process. The map serves to provide an overall view of the legacy of historic industrial operations, and to a lesser extent historic commercial operations, that have resulted in contamination issues that must now be addressed.

It is important to realize that these documented sites represent only those contaminated sites that have been identified, verified, and been enrolled in some type of state or federal regulatory or funded cleanup program.

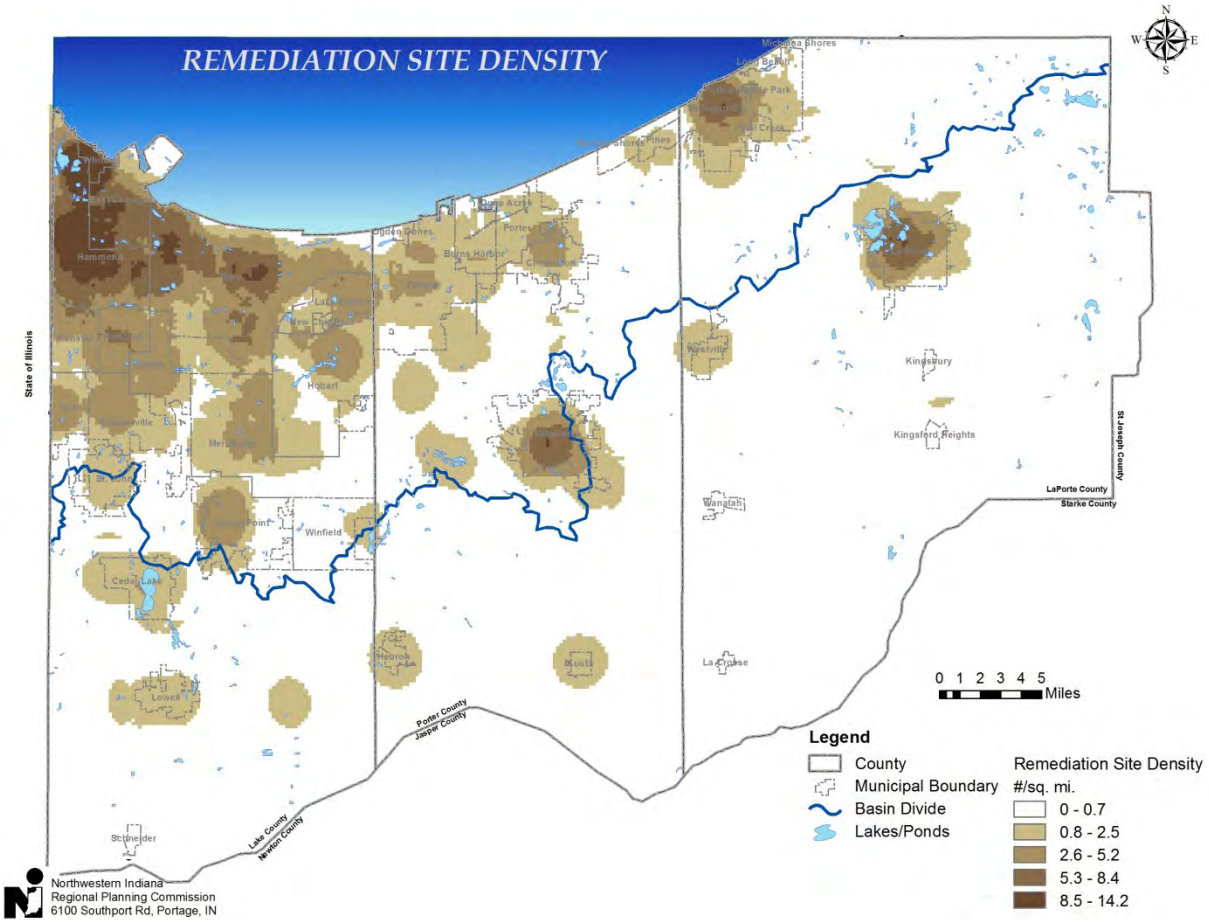


Figure III.13 Remediation Site Density, NIRPC Analysis 2011.

[20] http://www.epa.gov/oswer/cleanup/programs.htm

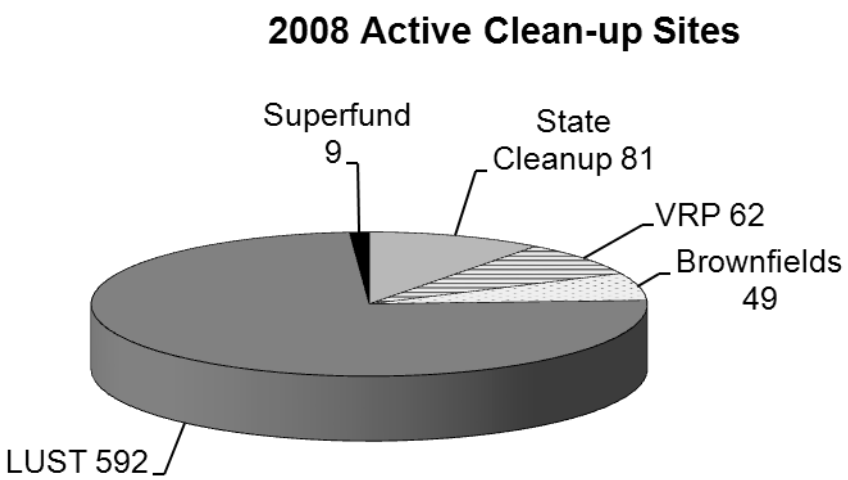


Figure III.14 2008 Active Clean-up Sites.

Many sites may be properties that have been cleaned up and are actually in productive use. Others may have been cleaned up to the extent required under Superfund or other programs, but remain with strict development restrictions that limit their potential future use.

The following profile(s) provide summary information that is available to EPA through mandatory and voluntary reporting under the Superfund, RCRA Corrective Action, and Federal Facilities programs, as well as links to sites that have been made available to the agency.

Superfund: Superfund is a program administered by the EPA to locate, investigate, and clean up the worst hazardous waste sites throughout the United States. EPA administers the Superfund program in cooperation with individual states and tribal governments. These sites include abandoned warehouses, manufacturing facilities, processing plants, and landfills.

RCRA Corrective Action: In addition to addressing other types of waste, the Resources Conservation and Recovery Act (RCRA) tightly regulates all hazardous waste from "cradle to grave." In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. Accidents or other activities at facilities that treat, store or dispose of hazardous wastes have sometimes led to the release of hazardous waste or hazardous constituents into soil, ground water, surface water, or air. EPA refers to cleanup of Treatment, Storage and Disposal (TSD) facilities under RCRA and the Hazardous and Solid Waste Amendments (HWSA) statutory authorities as RCRA Corrective Action.

State Cleanup Program: Sites that do not qualify for the Superfund list remain under Indiana responsibility in this program. The Priority Ranking System (PRS) is the method, by which the State Cleanup Section prioritizes, for state response actions, those sites contaminated with hazardous substances and petroleum that are excluded from the National Priorities List (NPL). The PRS serves as the state's management tool to address those sites that pose a significant threat to human health and the environment, in addition to assuring the department's resources are allocated accordingly. Hazardous substances and petroleum response sites that are evaluated utilizing the PRS are assigned a priority status of low, medium or high depending on site characteristics. Priority ranking is subject to change based upon receipt of additional site information, or other relevant factors.

Only sites designated by IDEM as high or medium priority sites contaminated with hazardous substances will be assigned a project manager. Medium priority sites contaminated with only petroleum will be assigned to a project manager as work load permits. Sites designated as low priorities will be expected to complete site investigation and remediation without direct oversight by the State Cleanup Section through the Independent Closure Process. Regardless of the extent of oversight provided by the State Cleanup Section, responsible parties are required to perform the necessary site characterization and remedial activities. The State Cleanup Section will continue to pursue any actions necessary to ensure the completion of these activities at sites that fail to progress.

Leaking Underground Storage Tank (LUST) Program: In recent years, underground storage tanks for gasoline, fuels, and other

chemicals have become strictly regulated because leaking tanks can easily contaminate ground water. A spill of only three gallons of gasoline can spoil drinking water for a small town. Previously, most tanks were made out of unprotected steel, and would rust and leak after about 10 years (less time under certain conditions). Many tanks and connected piping exposed to ground water have rusted through, allowing the contents to seep out. Since 1998, tank owners and operators are required to use tanks lined with materials that do not rust to help prevent leaks. All LUSTs, whether or not they are regulated tank systems, require an investigation and possible cleanup. Generally, releases from regulated USTs are the responsibility of the LUST Program.

Voluntary Remediation Program (VRP): The VRP provides a mechanism for site owners or operators to voluntarily enter an agreement with IDEM to cleanup contaminated property. When the cleanup is successfully completed, IDEM will issue a Certificate of Completion and the Governor's office will issue a Covenant Not to Sue to the cleaned up property. These documents provide assurance that the remediated areas will not become the subject of future IDEM enforcement action.

Brownfields Program: The Indiana Brownfields Program I operated by the Indiana Finance Authority as a Revolving Loan Fund for the purpose of encouraging and assisting investment in the redevelopment of brownfield properties by helping communities via educational, financial, technical and legal assistance to identify and mitigate environmental barriers that impede local economic growth.

In 2008, there were nearly 800 active cleanup sites in Northwest Indiana, as shown in the chart below, representing a wide variation in scale and risk to public health and the environment. For example, there were nine active Superfund cleanup sites versus nearly 600 leaking underground storage tanks.

During the prior period of 2005 to 2007, the combined state programs of State Cleanup, VRP, Brownfields and LUST remediated 155 contaminated sites in Northwest Indiana. Of those, 86% were LUST sites, and 11% were State Cleanups. At the prevailing rate of approximately 50 cleanups achieved annually, it will take considerable time to address the existing "backlog" of documented contamination at active cleanup sites.

Brownfield clean-up site Portage Lakefront Park. Photo by Stephen Sostaric.

Plan & Policy Recommendations

The 2040 CRP describes a vision and establishes a direction for both cooperative regional actions and local actions with regard to land use and transportation planning. The "third leg of the stool" that will guide the region in realizing its vision for 2040 is protection and stewardship of the natural environment. This section describes the Plan recommendations related to the region's natural resources, framing these recommendations in the context of a "Green Infrastructure Network."

As noted previously, the recommendations included here are informed by a strong foundation of previous studies and planning efforts that address elements of the natural environment, seeking to build on an understanding of current conditions and challenges to establish a shared, sustainable path forward with regard to the natural environment.

What Is the Green Infrastructure Network?

The concept of a Green Infrastructure Network for Northwest Indiana is central to fostering greater awareness of the environmental impacts of land use and transportation planning decisions, and establishing mechanisms at all levels to ensure that impacts are considered and mitigated as the region grows through the implementation of an "ecosystem approach."

The Green Infrastructure Network consists of the following:

- Protection, and responsible and sustainable use and management of the region's existing ecological assets
- Protection, and responsible and sustainable use and management of the region's water resources
- Pursuing opportunities to restore, enhance, expand and better connect existing elements of the region's ecosystem
- Thoughtful design, construction and maintenance of needed "gray infrastructure" to serve the region, such as the transportation network, water conveyance and wastewater treatment systems, and utility systems
- Implementation of "green infrastructure" solutions that lessen the burden on existing, and the need for additional, gray infrastructure
- Sensitivity to the environmental considerations of urban development patterns by accommodating planned population and employment growth in the region in locations and in an urban form that augments the natural environment rather than being at odds with it, including utilizing the Livable Centers concept to guide future urban growth
- A planning mind-set that asks, in every land use and transportation planning decision, whether development or facilities are being sited appropriately to minimize impacts, whether potential negative impacts are being effectively mitigated, and whether potential enhancements to the natural environment are being realized.

Located in LaPorte County, this land is registered in the Wetland Reserve Program (WRP). The WRP is a voluntary program that provides technical and financial assistance to private landowners and tribes to restore, protect and enhance wetlands in exchange for retiring eligible land from agriculture.

Located in the Galena River watershed, this protected forestland is part of the Moraine Forest. The Moraine Forest lies along the southern tip of Lake Michigan and follows the shoreline across LaPorte and Porter Counties. As described by the LaPorte County Conservation Trust, the Moraine Forest is the last forest cover truly large enough to still be called "forest" in LaPorte County.

From a physical planning perspective, the Green Infrastructure Network builds upon the current environmental conditions described earlier in this chapter, seeking to protect the ecological assets, water resources, groundwater, and prime agricultural areas of the region as depicted in Figure III.8.

What Are the Benefits of the Green Infrastructure Network?

As future population and employment growth in Northwest Indiana is accommodated in an environmentally sensitive manner through effective planning and development management at all levels of government, both local municipalities and the broader region will benefit in several ways.

Community Benefits - A Green Infrastructure Network minimizes the physical impacts of urbanization by promoting a compact urban pattern. Doing so enables communities to maintain natural visual amenities, creating a civic identity and becoming a source of community pride. The historical, cultural and archaeological heritage of the region is also protected. A robust network will also include outdoor recreational and educational facilities, both active and passive, promoting community interaction with the environment.

Mobility Benefits - A Green Infrastructure Network seeks to reduce impacts from transportation projects, while still accommodating the region's mobility needs. Roadways are more carefully integrated into the natural system; accommodating public transportation reduces vehicle miles traveled and the resulting environmental degradation, and a well-developed network of nonmotorized transportation, including trails and marked on-street routes, increases mobility alternatives for the region's residents.

Sustainability Benefits - A Green Infrastructure Network focuses on the reuse and upgrading of existing infrastructure, which is more economical and sustainable over the long term. Implementing environmentally sensitive improvements also results in less resource consumption and less required treatment of stormwater and wastewater over time. A land use strategy that focuses on the redevelopment of brownfields (contaminated properties) and grayfields (vacant properties) further reduces demands on the natural environment while still accommodating growth.

Economic Development Benefits - A Green Infrastructure Network can boost the economic potential of tourism, leisure and cultural activities. Access to attractive and usable open spaces also reinforces local community identity and enhances the physical character of an area. This can result in increased property values, thereby aiding urban regeneration and neighborhood renewal efforts. Despite some upfront costs, implementation of green technology options can also provide both the public and private sectors with significant life cycle cost savings, and reduce costs associated with flooding and water quality degradation.

Environmental Benefits - A Green Infrastructure Network promotes improved watershed health and enhanced ecosystem function, by both protecting the natural environment from incursions and mitigating the impacts of incursions where they must occur. Ecological habitats and levels of biodiversity can be protected and enhanced through the ecosystem approach, with the added benefit of improvements in air quality and moderation of temperature extremes. Providing an effective system of environmental infrastructure will also limit the need for "engineered" flood control solutions and moderate the impact of flood events.

Lifestyle Benefits - A Green Infrastructure Network expands the network of recreational amenities available to the region's residents, contributing to health agendas and promoting participation. It also can provide a wide variety of cultural, social and community facilities and activities that promote education and awareness of the environment. Improving physical and social inclusion through these amenities is particularly beneficial for young, disabled and older populations.

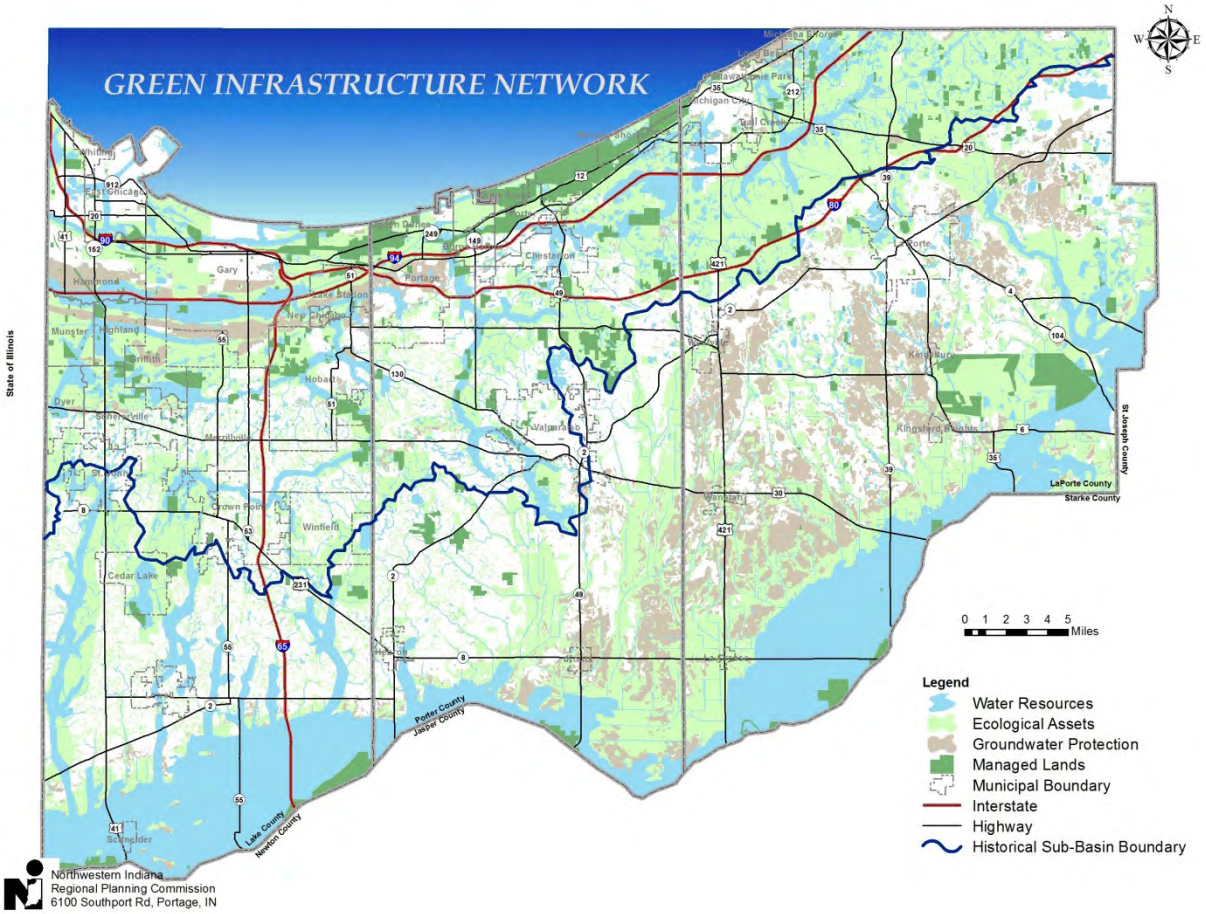


Figure III.15 Green Infrastructure Network, NIRPC Analysis 2011.

How Can Urbanized Areas Contribute to the Green Infrastructure Network?

Man-made elements of the environment that serve community needs with regard to water conveyance, wastewater conveyance and treatment, and stormwater control can be considered "gray infrastructure." Implementing innovative design and construction practices as transportation facilities and utilities are expanded or upgraded is a key element in achieving the objectives of the Green Infrastructure Network. Often referred to as Low Impact Development (LID) practices, these strategies should be an integral part of the region's efforts to "tread lightly" and minimize the physical impacts of urbanization as population and employment growth occurs.

Effective application of these "green" strategies can reduce the burden placed on the region's existing gray infrastructure, and minimize the need for additional gray infrastructure in the future, resulting in the potential for significant capital and maintenance cost savings over time for both the public and private sectors.

Key "green" strategies that can make urbanized areas more environmentally sensitive, and lessen the gray

infrastructure burden, include the following:

Rain gardens: Rain gardens are planted areas that typically consist of deep rooted native plants, and which are designed to collect local stormwater and contain it until it can be absorbed into the soil. Allowing for bio-retention of stormwater aids in recharging groundwater and naturally removes contaminants. Rain gardens also provide wildlife habitat and aesthetic enhancements to property, and are reasonable and achievable projects to implement at the site level and at the neighborhood scale.

Public Rain Garden

Residential Rain Garden

Bioswales: Bioswales are linear stormwater management elements that augment the conventional stormwater management system. Swales along roadway pavement edges that are strategically planted with native plants will slow stormwater runoff, thereby reducing erosion, recharging groundwater and removing pollutants to reduce treatment demands. Bioswales can help reduce peak flows for storm events, and significantly lower capital costs for stormwater infrastructure in both site development and roadway construction projects. As urban streets are reconfigured to better accommodate multiple modes of travel, cost savings can be realized by locating bioswale areas directly above existing catch basins rather than having to relocate them.

Constructed bioswale adjacent to urban street

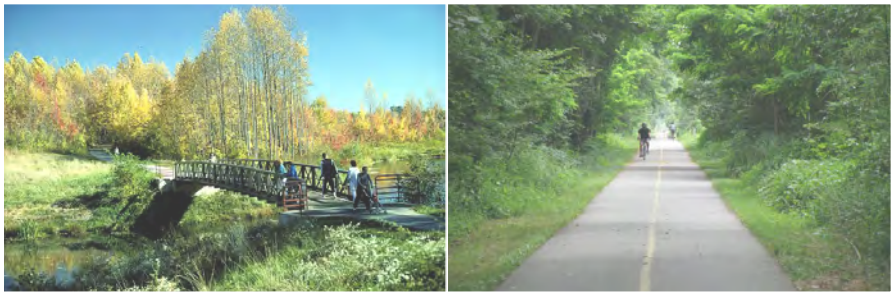
Constructed bioswale in parking lot

Permeable pavements: Permeable pavements are an alternative paving material that allows rainwater to pass through the pavement surface, percolating into the soil below. Much like rain gardens and bioswales, they help recharge groundwater and also remove contaminants that typically gather on pavement surfaces as a result of parked vehicles. The use of permeable pavement can also reduce the overall impermeable footprint of a development that triggers the need for large and expensive detention basins. In addition to parking lot applications, permeable pavement can be a viable solution for public alleys, low-traffic streets and the on-street parking lanes of wider streets.

Permeable pavers

Permeable concrete

Greenways: Greenways are corridors of open space, often located adjacent to streams and other water corridors, which can accommodate multifunctional trails and wildlife habitat connectivity. Greenways help promote an active healthy lifestyle while also providing a vegetated buffer that slows and cleans stormwater before it flows into adjacent water bodies, lessening the need for engineered stormwater infrastructure. In addition to a network of public greenways, developing a network of private greenways in conjunction with new development can be effective in expanding the regional open space framework, reducing everyone's reliance on conventional gray infrastructure.



Photos from web.

Native landscaping: Use of native and drought-tolerant landscaping in development projects, and in open spaces created as a result of public infrastructure projects, aids in maintaining biodiversity and animal habitats, and reduces the demand for artificial irrigation solutions.

Photos from web.

Green design: As both public and private buildings and parcels are designed and developed in the Northwest Indiana region, it will be important to encourage "green design" to minimize the impact of the built environment on water and utility systems. Design elements include such features as green roofs and walls, daylighting strategies, use of rain water to irrigate landscaping, use of gray water to flush toilets, and use of geothermal or solar or wind energy to reduce public utility demands. LEED (Leadership in Energy and Environmental Design)[21] standards developed and monitored by the U.S Green Building Council through their LEED certification process have become the current industry standard for incorporating green features into building and site design, and many municipalities across the country now require LEED certification as a condition of permit approval and/or financial incentives, for public buildings and in some cases for all buildings.

LEED Building, green wall on building façade. Photos from web.

[21] http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

Wind power. Photo from web.

Photovoltaic panels in parking lot. Photo from web.

Achieving the Green Infrastructure Network

The recommendations included below address the many aspects of achieving a Green Infrastructure Network, and are intended to support, and be undertaken in conjunction with, recommendations elsewhere in the 2040 CRP related to growth, conservation, and transportation.

These environmental recommendations dovetail in many ways with those related to supporting Livable Centers, concentrating growth on infill sites in the core communities, and improving transportation choices across the region. Achieving the 2040 CRP vision will require planning "with nature," anticipating dynamic natural processes and managing ecological systems to both minimize the impacts of urban development and be adaptive to changes caused by urban development.

Water Resources

Water is one of the region's most important resources; it is what first attracted residents and commerce to the area. Realizing its importance and protecting it will maintain it as a resource for future generations. It can serve a central role in establishing regional identity and opportunity. Plan recommendations include:

Conservation Measures

1. Making priorities for conserving wetlands based on water quality, flood control and groundwater benefits. These should be made at the watershed or sub-watershed level, using criteria as established in the Indiana Wetlands Conservation Plan. The historical and recreational benefits of wetlands should also be considered in identifying conservation priorities.
2. Promoting source water planning in the Kankakee Basin.
3. Using treated effluent for irrigation and other gray water uses (such as toilet flushing or industrial cooling processes).
4. Developing and advocating for water conservation strategies appropriate to each water user group in the region, including industrial, agricultural and energy production users.

5. Encouraging water conservation strategies for residential and commercial development, including plumbing retrofits in existing buildings, using water-conserving plumbing fixtures in new construction, and using high-efficiency mechanical systems and appliances.
6. Promoting growth in areas with access to Lake Michigan water, rather than in the Kankakee River watershed or in areas without existing water service.

Impact Reduction Measures

1. Restrict development activity within the watershed of "high-quality" streams or lakes, as designated by IDNR
2. Discourage or restrict development activity within designated floodplains and within the recharge area of wetlands
3. Protect aquifer recharge areas with appropriate buffers, rather than just surface water bodies
4. Protect streambank habitat and riparian areas with significant buffering from adjacent urban development, coordinating these efforts with expansion of the regional trail system where appropriate
5. Reduce sediment pollution, in particular from agricultural uses, by restoring stream buffers
6. Work with farm operators to control runoff and pollution (including pesticides and herbicides) and implement innovative irrigation solutions
7. Limit active use of sensitive shoreline and streambank areas that are prone to erosion or other environmental degradation
8. Restore natural hydrology patterns where previous channelization or other engineered solutions have been used, including bioengineering solutions for shoreline and streambank stabilization
9. Establish a model water use conservation ordinance for communities to adopt – addressing all types of water use (commercial, residential, institutional). The model water use conservation ordinance should include incentives such as reduced permit fees, expedited reviews and greater design flexibility, in exchange for incorporating "green" design elements
10. Expand the metering of water use, to both raise awareness regarding water use and enable cost recovery mechanisms
11. Audit water systems to detect leaks and inefficiencies, and target upgrade efforts to systems that are experiencing the most water loss through leakage

Management Measures

1. Fund and pursue studies of critical groundwater recharge areas, to document and enforce necessary recharge area protection buffers
2. Encourage consideration of precipitation as a resource to be used close to where it falls, rather than as a nuisance to be conveyed to another location
3. Minimize impervious surfaces, including consideration of minimizing roadway widths and opportunities to create planted medians
4. Pursue opportunities to restore and expand existing wetlands, thereby reducing stormwater run-off and filtering discharge

Northwest Indiana Paddling Association's Trail Creek Fun Float. Photo courtesy Dan Plath.

5. Target implementation of stormwater management practices toward highly erodible lands, utilizing deep-rooted native vegetation
6. Plan and design any channel modification activities to mitigate negative physical, chemical, and habitat impacts
7. Develop and implement an on-site wastewater operation and maintenance program
8. Study the feasibility of county on-site wastewater districts
9. Document all new and existing on-site wastewater disposal systems in the ISDH iTOSS tracking system
10. Support the installation of water detention systems to maximize on-site pollutant removal, in the context of a regional stormwater strategy
11. Coordinate and assist the nine communities that have combined sewer systems to separate the systems and reduce CSO incidents by working toward their Long Term Control Plans (LTCPs)
12. Develop and implement watershed management plans. Coordinate with adjacent counties and states that share watershed boundaries with Northwest Indiana in watershed management efforts
13. Use waste water and stormwater fees to fund watershed level planning and implementation
14. Pursue strategies to assist property owners in the elimination of the inappropriate use of septic systems

Ecological and Open Space Assets

Ecological and open space assets will form the backbone of a regional Green Infrastructure Network. Realizing their importance and protecting them will provide the organizing strategy for accommodating future population and employment growth. Plan recommendations include:

WATER CONSERVATION PLAN FOR VALPARAISO CITY UTILITIES

When Valparaiso wanted to promote and provide leadership in environmental stewardship, off-set or delay capital expansion costs, and provide customers with means to increase water use efficiency, it created a Water Conservation Plan Task Force with the mission to develop a Water Conservation Plan.

The objectives of the plan are to:

1. implement comprehensive public education for residential, commercial, and industrial users;
2. control and reduce costs;
3. promote and allow for economic development opportunities with limited capital expenditures;
4. develop conservation-friendly water and wastewater rates;
5. demonstrate that water conservation will work in the Great Lakes region; and
6. develop city codes/incentives and policies to achieve these goals.

After months of study and evaluation, the highest priority implementation activity for Valparaiso is a comprehensive public education and information program.

Conservation Measures

Pursue strategic open space acquisition that provides opportunities to expand existing open spaces and improve network connectivity, for the benefit of both the regional trail system and wildlife and biodiversity habitats.

1. Conserve and protect lands identified through Indiana Biodiversity Initiative (IBI) as "high priority" open spaces
2. Conserve and protect existing forests, especially large remnant forests and those in riparian areas
3. Establish preserves in areas with remnant plant and wildlife communities, including upland habitats, allowing for their future viability through expansion
4. Protect or restore connectivity between natural areas and habitat types to support ecosystem function
5. Preserve large contiguous tracts of open space with permeable soils.
6. Preserve open space and natural areas that are ideally suited for scenic resources and recreational opportunities
7. Promote the development and preservation of regional greenways and blueways (water trails) and establish linkages between them

Impact Reduction Measures

1. Protect sensitive areas and forestlands through creation of sufficient buffer zones
2. Seek opportunities to maintain or restore habitat connections through agricultural areas, in conjunction with natural drainage, filtering and irrigation solutions
3. Preserve and enhance strategically sited green areas in developed areas to mitigate their impacts on the region's ecosystem and wastewater system
4. Improve access to major regional parks and preserved open lands, including the Indiana Dunes, in particular via nonmotorized transportation

Management Measures

1. Develop a regional funding strategy for the ongoing maintenance of natural open spaces, including reforestation efforts
2. Encourage habitat protection and restoration on both public and private lands, through appropriate regulation and incentives
3. Encourage cooperative land management agreements that allow for habitat protection and maintenance on private properties
4. Expand the use of best management practices, with special attention to control of exotic and invasive species
5. Encourage the adoption and enforcement of tree preservation ordinances
6. Where deemed beneficial to the region, support artificial habitat creation in areas where natural habitat areas are too degraded or fragmented to restore effectively
7. Coordinate education, training and technical assistance, especially to develop strategic partners in open space management
8. Increase public awareness and access to the open space network, through a coordinated branding and marketing effort the highlights the ecosystem and human health benefits of regional open spaces

Air Quality

Improving air quality will be a vital component of the region's vision for 2040; improvements will be realized through a variety of regulatory initiatives on business and industry at the state and federal level. Additional measures to address air quality improvement through reducing transportation related emissions will be discussed Growth and Conservation and in Transportation Chapters.

Conservation Measures:

1. Educate, promote and develop new opportunities to reduced fuel consumption by residents, businesses and industry
2. Promote Sustainable and Transit Friendly development patterns to reduce dependence on single occupancy vehicles.

Impact Reduction Measures

1. Continue to partner with PACE in Illinois to provide coordinated bistate rideshare and vanpool programs
2. Continue to provide CMAQ funding and technical support to promote retrofitting of long-lived diesel vehicles and engines with emission reduction technology
3. Continue to partner with South Shore Clean Cites and other partners to explore and grow emission reducing alternative fuels and vehicles

Brownfields

Returning contaminated properties to an environmentally safe condition, and to either active or conservation use, will be a vital component of the region's vision for 2040; improvements will be realized through a variety of initiatives discussed here and in the growth and conservation chapter. Plan recommendations include:

1. Facilitating the mitigation and reuse of brownfield sites, in particular in the core communities.
2. Working with the business sector to develop strategies and incentives to encourage voluntary remediation programs (VRPs) for brownfield sites.

Green Development Practices

Demands placed on the natural environment as a result of siting, design and construction practices will have a significant impact on the success of the Green Infrastructure Network strategy. Plan recommendations include:

1. Coordinating urban development and open space planning efforts, per the growth management strategies outlined in the Growth and Conservation section of this Plan.
2. Encouraging redevelopment of infill locations within established Livable Centers, per the growth management strategies outlined in the Growth and Conservation section of this plan.
3. Preserving prime agricultural land and rural landscapes, per the conservation design strategies outlined in the Growth and Conservation section of this plan.
4. Encouraging the concentration of development around existing infrastructure, with a focus on upgrading rather than expanding urbanized areas.
5. Encouraging site planning that both protects high-quality natural features and minimizes the disturbance of natural topography and drainage patterns.
6. Avoiding the fragmentation of existing ecosystems or the introduction of invasive plant types during development.
7. Establishing consistency in local building codes and subdivision regulations, requiring responsible sustainable site planning and building design practices, including LEED-ND certification for site plans and LEED certification for new and renovated buildings.
8. Establishing consistency in local building codes facilitating repurposing and renovation of existing buildings, requiring reclamation and reuse of construction waste, and minimizing the potential environmental effects of building demolition and site preparation.
9. Facilitating and supporting the use of alternatives forms of energy at all viable scales, including wind, solar and geothermal.
10. Requiring erosion and sedimentation control, and protection of existing trees and other vegetation, during construction projects.
11. Encouraging responsible municipal practices with regard to maintenance and service provision, such as the use of low-impact fertilizers and herbicides, natural roadway deicing agents and environmentally friendly municipal vehicle fleets.

Best Practices

There are number of best practice models currently employed that entities in the NIRPC region would be well-served to consider. The following represent a sampling of these approaches as they relate to the environment and green infrastructure initiatives.

Water Resources

Riparian Buffer Preservation - Trail Creek, Michigan City

In 2007, with the input and guidance of many stakeholders, Michigan City completed a two-year effort to update the Trail Creek Watershed Management Plan. The plan was developed in response to Trail Creek, a state designated trout and salmon stream, being included on the 2004 303(d) List of Impaired Waters for E. coli and Impaired Biotic Communities. Like many other watersheds throughout Northwest Indiana, land use practices and other human disturbances in the Trail Creek watershed were found to be negatively impacting water quality and habitat. One of the key implementation goals identified by stakeholders in the watershed plan was the preservation of riparian buffers along Trail Creek.

Overlook on Trail Creek in Michigan City.

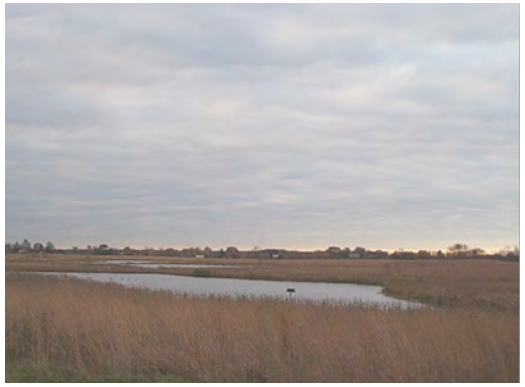
Riparian buffers serve as a natural boundary between waterbodies and existing development. The plants, trees, soils and biological processes occurring in these buffers help to filter out pollutants, provide flood control, reduce erosion, and provide shade, while allowing for lateral movement of the stream channel. Over the past several years Michigan City has been slowly but actively acquiring riparian land from willing sellers along the Trail Creek corridor for preservation. Coupled with a number of adjacent parcels owned by the DNR, what exists today is a greenway totaling nearly two miles along Trail Creek, which provides recreational, educational and water quality benefits to the community and its visitors.

Wetland Restoration - Grand Kankakee Marsh

Wetland restoration in Grand Kankakee Marsh.

The Indiana Grand Kankakee Marsh Restoration Project (IGKMRP) is dedicated to the recovery and perpetuation of waterfowl and other wetland wildlife populations by protecting, enhancing, and restoring the wetlands and associated ecosystems of the Indiana Grand Kankakee Marsh. A coalition of conservationists, with many different reasons for wanting the grandness to return to the Kankakee River Basin, have joined in an effort that has resulted in an impressive set of accomplishments in the first years of its existence.

Individuals, corporations, conservation groups, and government agencies have banded together and taken the first steps in a long-term program to re-establish the Grand Kankakee Marsh. The IGKMRP is working toward the goal by acquiring restorable wetlands



Wetland restoration in Grand Kankakee Marsh.

with associated upland from willing sellers or through donations, and restoring the original, natural wetland and upland conditions to the extent practical. Accomplishments in the first three phases of the project include restoration of 5,774 acres, acquisition of 8,932 acres, and enhancement of 3,700 acres. Additionally the most recent phase (Phase IV) has produced 531 acres of acquisition, 1,793 acres of enhancement, and 817 acres of restoration. The ownership of these parcels is transferred to government agencies or nonprofit organizations.

More information about the Indiana Grand Kankakee Marsh Restoration Project is available at: http://www.igkmrp.org/default.htm.

Stream Daylighting - Dunes Creek, Indiana Dunes State Park

Dunes Creek before daylighting.

In the late 1920s, the Civilian Conservation Corps (CCC) rerouted nearly 1,300 lineal feet of Dunes Creek through an 84-inch diameter culvert to construct a parking lot and temporary barracks in Indiana Dunes State Park. In 2005, as part of the Dunes Creek stream restoration project, approximately 480 lineal feet of culvert was removed to daylight the stream. Nearly three acres of parking lot and 3,775 cubic yards of fill were removed to restore the floodplain within the project limits. The 700 feet of restored stream channel was designed slightly wider than the natural channel conditions immediately upstream of the project site. By taking this approach, Dunes Creek was able to self-form within the restored channel and its floodplain. The restored floodplain and upland slopes were planted with native species to stabilize the highly erodible sandy soils and to also reduce the influx of aggressive invasive plant species.

Dunes Creek after daylighting.

The Dunes Creek daylighting project primary benefits were two-fold. First and foremost, the daylighting project was an in-stream and riparian habitat restoration project. Healthy aquatic communities require intact in-stream and riparian habitat for spawning habitat, nursery areas, food sources, and refuge. Additionally, culverts are known to act as a barrier to fish movement and migration patterns. A 1978 DNR fisheries survey conducted immediately upstream of the restoration site documented ten species of fish. These species would have historically utilized the segment of Dunes Creek that was destroyed when it was rerouted into the culvert. Soon after construction was completed several of these fish species were observed in the restoration area. Secondly, the daylighting project was a water quality improvement project. Floodplains act as a natural sink for sediment and nutrients.

Watershed Management - Save the Dunes, Porter County

The Save the Dunes is currently coordinating the implementation of watershed management plans in the Dunes Creek and Salt Creek watersheds. Both of these watersheds are located in Porter County within the Lake Michigan basin. The watershed management process uses a series of cooperative, iterative steps to characterize existing conditions, identify and prioritize problems, define management objectives, and develop and implement protection or remediation strategies as necessary.

Effective watershed management includes both planning and implementation components. While the development of a watershed plan is a critical step in the process, the plan must be successfully implemented before results can be seen. Save the Dunes is currently coordinating the implementation of the Salt Creek watershed management plan through several projects including a cost-share program for urban and agricultural best management practices, demonstrating low impact development (LID) practices, water quality monitoring, and education and outreach. Implementation projects have included a rain barrel program, rain gardens, bioswales, a green roof, pervious pavement, tree planter boxes, storm drain marking and a volunteer water quality monitoring program.

For more information about Save the Dunes' Water Program, please visit: http://savedunes.org/water_program/water_program/.

Additional information and resources for watershed management, nonpoint source pollution and funding can be found at:

Indiana Department of Environmental Management http://www.in.gov/idem/nps/

Indiana Department of Natural Resources http://www.in.gov/dnr/fishwild/2364.htm

U.S. Environmental Protection Agency http://water.epa.gov/type/watersheds/index.cfm

Agricultural Land - Trail Creek Watershed, LaPorte County

Working with the LaPorte County Natural Resources Conservation Service (NRCS) and Soil and Water Conservation District (SWCD), a farmer in the Trail Creek watershed has installed a number of conservation practices to provide water quality and habitat benefits. A few of these practices in twenty-five acres of filter strips, eight acres of wildlife water facilities, and ten acres of upland wildlife habitat.

Filter strip in agricultural field.

A filter strip is an area of vegetation established for the purpose of removing sediment, organic material and other pollutants from runoff and waste water before they can enter nearby waterbodies. Filter strips are generally located at the lower edge(s) of a field. This will vary somewhat with land use, topography and objectives. They also serve as a setback buffer between water and the fields above the water so that pesticides and other chemicals are not applied directly adjacent or into the water body.

In addition to the above functions, filter strips can be designed to provide one or more of the following secondary benefits:

- Improved fish and wildlife habitat
- Improved aesthetics
- Improved equipment operations, such as field access and turn rows or head lands

- Improved recreation opportunities
- Improved livestock forage source

Shallow wildlife watering facilty.

Shallow wildlife watering facilities not only provide valuable open water and vegetated areas for waterfowl resting and feeding, but they help farmers solve the problem of having areas that are too wet to farm. Proper management can increase and maintain desirable foods for waterfowl, shorebirds and other wildlife species.

Upland wildlife habitat management is creating, maintaining, or enhancing areas of food and cover for upland wildlife. The population dynamics of wildlife are highly dependent on food, water, and cover. The purpose of this practice is to enhance the wildlife habitat and maintain or increase populations of wildlife species. The practice applies to all areas where wildlife need improvements in food, cover, and management.

Guidance and Technical Documents

There are a number of existing state and federal guidance and technical documents that can be used to identify potential practices appropriate for a variety of water resource protection activities.

[22] www.nrcs.usda.gov/technical/efotg/

eFOTG

The electronic Field Office Technical Guides[22] are the primary scientific references for the Natural Resources Conservation Service (NRCS). Section IV of eFOTG provides practice standards and specifications. Following are a few examples from the eFOTG.

- Wetland Restoration (657): The purpose of this practice is to restore wetland function, value, habitat, diversity and capacity to a close approximation of pre-disturbance levels. It applies to sites with hydric soils, or sites that exhibit hydrology and hydrophytic (water loving) vegetation, which were natural wetlands that have been hydrologically and/or vegetatively degraded. Included are criteria for hydric soils, hydrology, and vegetation restoration as well as plans and specification needs.
- Upland Wildlife Habitat Management (645): The purpose of this practice is to treat upland wildlife habitat concerns identified during the conservation planning process that enable movement, or provide shelter, cover, and food in proper amounts, locations and times to sustain wild animals that inhabit uplands during a portion of their life cycle. It applies to land where the objective is conserving wildlife species or ecosystems. Included are criteria to provide a variety of cover types for the target wildlife species such as pollinators or song birds.

Indiana Storm Water Quality Manual

The Indiana Storm Water Quality Manual[23] provides guidelines and specific storm water quality measures for controlling soil erosion; controlling and treating the nonpoint source pollution associated with sediment-laden runoff; and the management and treatment of pollutants associated with post-construction land uses. Adhering to these guidelines and properly applying appropriate storm water quality measures will help minimize the adverse impacts that land disturbance, construction activity, and development can have on soil and water resources, and ultimately, the cost of

[23] www.in.gov/idem/4899.htm

those impacts to society as a whole. In addition to a variety of storm water quality measures, the manual also discusses the philosophy and planning procedures critical to developing an effective storm water pollution prevention plan. Following are a few examples from the Indiana Storm Water Quality Manual.

Wetland serving as green infrastructure.

- **Riparian Buffer Zones:** Riparian buffer zones can take many forms, but usually a mixture of native grasses and tree species is recommended. The general layout of constructed riparian buffers follows a three zone system, each distinguished by their vegetative component, width, and use restrictions. This scheme is highly effective at removing various unwanted pollutants often carried by storm water, although results vary between sites. Included are performance measures (pollutant removal rates), design specifications, and general information on costs.
- **Bioretention Systems:** Bioretention systems are designed to treat storm water runoff from impervious surfaces. They can be easily incorporated into the design of several filtration and infiltration storm water management systems. They are commonly used in parking lot islands, median strips, and drainage swales. Included are advantages and disadvantages of the systems, design specifications, performance measures, maintenance needs, and general cost information.
- **Constructed Storm Water Wetlands:** Constructed storm water wetlands are designed to maximize the removal of pollutants from storm water runoff. This is accomplished through several processes: microbial breakdown of pollutants, settling and adsorption, retention, and plant uptake. Constructed storm water wetlands temporarily store storm water runoff in shallow pools designed to promote the processes discussed above. They offer many advantages over other storm water attenuation measures. Included are performance measures (pollutant removal rates), design specifications, maintenance needs, and general information on costs.
- **Subsurface Detention/Retention:** Underground detention/retention systems are well suited to new development and redevelopment areas. These systems are often selected due to the availability and cost of land. Most systems are installed under parking lots or paved surfaces. They can also be installed under grassed areas. The overall benefit of these systems is to make land available for other uses that would have normally been used for a retention/detention pond. Typical locations of this measure are associated with commercial, industrial, and residential development. Systems designed to infiltrate runoff into the underlying soil are not well suited to storm water hotspots or wellhead protection areas. Pretreatment of storm water runoff that targets the pollutants in the drainage area and those associated with the land use may be used to mitigate the surface water and ground water resource concerns associated with this measure. Included are performance measures (pollutant removal rates), design specifications, maintenance needs, and general information on costs.

Subsurface detention/retention system.

National Management Measures to Control Nonpoint Source Pollution

The U.S. EPA has issued several guidance documents on measures to control nonpoint source pollution in several categories. The measures can be implemented in either a preventative or restorative

mode depending on needs. Of specific relevance will be the documents issued for urban areas, hydromodification, and wetlands and riparian areas. Links to these U.S. EPA documents can are provided by IDEM in the Indiana Nonpoint Source Management plan.[24]

Ecological & Open Space Assets

Shirley Heinze Land Trust

The Shirley Heinze Land Trust works to protect and restore ecologically significant natural areas in Northwest Indiana. Since its inception in 1981, it has acquired more than 1,100 acres of natural land surrounding southern Lake Michigan for preservation. This includes 900 acres that it owns and manages, 100 acres held as conservation easements, and roughly 30 acres transferred to the National Park Service and Indiana Department of Natural Resources.

The Shirley Heinze Land Trust also works in conjunction with other land protection and preservation entities, such as government agencies, nonprofit groups and businesses. Its current holdings cover almost the entire range of habitat communities in Northwest Indiana, including dune and swale, wetland, forestland, prairie, and oak savanna. The trust has developed a number of successful conservation planning projects using geographic information systems (GIS) technology to identify and prioritize areas for preservation. Alongside its efforts to preserve and restore ecologically significant natural areas in the southern Lake Michigan watershed, its community education program raises awareness of the scientific and cultural relevance of preserving our unique ecosystems.

For more information about the Shirley Heinze Land Trust, please visit http://heinzetrust.org/.

[24] www.in.gov/idem/5984.htm

Chicago Wilderness

Chicago Wilderness is a regional alliance that connects people and nature. More than 250 organizations work together to restore local nature and improve the quality of life for all who live in the greater Chicagoland Region (including the NIRPC region), by protecting the lands and waters on which we all depend. Its key initiatives[25] — to restore the health of local nature, green infrastructure, combat climate change and leave no child inside — reflect a commitment to using science and emerging knowledge, as well as a collaborative approach to conservation, to benefit all the region's residents.[26]

The members of Chicago Wilderness include local, state and federal agencies, large conservation organizations, cultural and education institutions, volunteer groups, municipalities, corporations, and faith-based groups.

Resource Conservation & Development Program – USDA NRCS

The purpose of the Resource Conservation and Development (RC&D) program is to accelerate the conservation, development and utilization of natural resources, improve the general level of economic activity, and to enhance the environment and standard of living in designated RC&D areas. It improves the capability of State, tribal and local units of government and local nonprofit organizations in rural areas to plan, develop and carry out programs for resource conservation and development. The program also establishes or improves coordination systems in rural areas. Current

[25] http://www.chicagowilderness.org/initiatives.php

[26] http://www.chicagowilderness.org/memberlist.php

program objectives focus on improvement of quality of life achieved through natural resources conservation and community development that lead to sustainable communities, prudent use (development) and the management and conservation of natural resources. RC&D areas are locally sponsored areas designated by the Secretary of Agriculture for RC&D technical and financial assistance program funds.

For more information, contact Dan Fleming, coordinator, at dan.fleming@in.usda.gov.

Open Space Standards - Unified Development Ordinance, Porter County

Porter County, as part of its Unified Development Ordinance, has adopted an open space standard that requires all proposed developments to provide open space. The open space protection standard provides a framework to encourage wise use and management of natural resources, preserve the integrity and value of land, preserve environmentally sensitive areas, and provide recreational opportunities. Developers are required to set aside at minimum 15% of the site for open space where sites do not have existing environmental features. Where environmental features do exist such as floodplains, a minimum of 20% up to a maximum of 40% must be set aside. The requirements of the Watershed Overlay District count toward the minimum open space requirements of the project site. Since 2005, all proposed projects before the Porter County Plan Commission contain the open space standard. Some projects have preserved nearly 60% of the site in open space.

For more information about the Porter County open space standard, please visit http://www.porterco.org/index.php?id=1106.

Midpeninsula Regional Open Space District- San Mateo & Santa Cruz Counties, California

Created by voter initiative in 1972, the Midpeninsula Regional Open Space District's (MROSD's) purpose is to purchase, permanently protect, and restore lands forming a regional open space greenbelt, preserve unspoiled wilderness, wildlife habitat, watershed, viewshed, and fragile ecosystems, and provide opportunities for low-intensity recreation and environmental education. The district has permanently preserved more than 58,000 acres of mountainous, foothill, and bayland open space, creating 26 open space preserves (24 of which are open to the public).

The district's primary revenue source is a share of the annual total property tax collected within the district. In fiscal year 2008-2009, this amounted to $26.4 million in tax revenue. Other revenue sources may include federal and state grants, interest and rental income, donations, land gifts and note issues.

Tree City USA

The Tree City USA program, sponsored by the Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters, provides direction, technical assistance, public attention, and national recognition for urban and community forestry programs in thousands of towns and cities that more than 135 million Americans call home.

To qualify as a Tree City USA community, a town or city must meet four standards established by The Arbor Day Foundation and the National Association of State Foresters. These standards were established to ensure that every qualifying community would have a viable tree management plan and program.

- A Tree Board or Department
- A Tree Care Ordinance
- A Community Forestry Program With an Annual Budget of at Least $2 Per Capita
- An Arbor Day Observance and Proclamation

Within Northwest Indiana the following communities have been designated Tree Cities: Chesterton, Crown Point, Dyer, East Chicago, LaPorte, Michigan City, Munster and Valparaiso.

For more information about Tree City USA, please visit http://www.arborday.org/programs/treeCityUSA/index.cfm.

Urban Agriculture - Englewood Neighborhood, Chicago

Englewood, a South Side neighborhood of Chicago, is considered a "food desert." Researchers coined the term food desert in the mid-1990s to describe areas where residents lack access to healthy food due to economic, geographic or other barriers. As a result, health and quality-of-life are negatively impacted: residents suffer from elevated rates of heart disease, obesity and asthma which in turn undermine performance both in school and on the job.

Recognizing the important role of community gardens and urban agricultural systems in a community's food environment, the Center for Urban Transformation is working through advocacy to establish urban agriculture, farmers markets, and local produce stands in the community. Utilization of vacant lots and even backyard gardens all play a part in Englewood's Quality-of-Life Plan strategy to "Promote healthy lifestyles that include physical fitness, good nutrition and better use of healthcare services." The common element in the development of this food environment niche is the safety of community residents and the environment in any application. Examples of this include soil testing, the construction of raised garden beds, and the use of safe materials for the construction of the garden beds.

For larger operations such as greenhouses and hydroponic facilities, the focus will be on worker health and safety as well as environmental protection, through the use of ecological and organic agricultural practices adapted for urban applications. This particular niche has great potential for widespread application within the realm of brownfields redevelopment and the recycling of commercial facilities in several south side communities. Hydroponics and greenhouses also offer options for the residential grower to extend growing seasons and/or to grow a portion of their food year-round.

Further details about the Center for Urban Transformation are available at http://www.cutchicago.org/TFPE.html.

Portland (OR) Community Gardens

The Community Garden program has provided gardening opportunities for the physical and social benefit of the people and neighborhoods of Portland since 1975. There are 35 community gardens located throughout the city, developed and operated by volunteers and PP&R staff, offering a variety of activities.

Performance Measures

There are a variety of ways to measure the success of increased efforts to improve the environment and create a Green Infrastructure Network as defined by the 2040 CRP goals and objectives. Selecting the preferred measurements must be based on availability of data and NIRPC's capacity to staff detailed analyses. The following performance measures meet these criteria:

- Miles of stream and acres of lake included on the Indiana 303(d) List of Impaired Waterbodies (IDEM)
- Acres of wetland loss/gain (NOAA)
- Number of active watershed management plans and Section 319 or LARE funding leveraged (IDEM & DNR).
- Public water supply daily per capita use.
- Number and quantity of CSO events (IDEM)
- Total acres of public and private managed or conservation lands (DNR & Land Trusts)
- Natural land cover loss/gain (NOAA)
- Forest Fragmentation- acres of core, edge, perforated, and patch forest (NOAA)
- Number of Tree Cities (Arbor Day Foundation)
- Number of Indiana CLEAN Communities (IDEM)
- Acres of agricultural land loss/gain (NOAA)

Ice angling at Fish Lake in LaPorte County. Photo by Tom Gill.

Implementation

Protecting, restoring and expanding the Green Infrastructure Network will require an ecosystem and watershed approach to fully realize the region's vision. Paramount to implementing this approach is open dialogue, coordination, and flexibility among stakeholders as this approach looks beyond the political boundaries that we have become so accustomed to working within. The approach reflects how natural systems function and how we fit into the system, rather than viewing human and natural elements as opposing forces.

Strategies to implement related to the environment and green infrastructure includes the following:

NIRPC actions:

1. Encourage, review and comment on proposed open space acquisitions as requested, in particular as they relate to the Greenway Infrastructure Network
2. Maximize all opportunities to protect the environment in the transportation planning program
3. Provide technical assistance to revise codes and develop standards/guidelines
4. Collect and maintain current "best practices" information, including economic benefits and local successful examples of open space protection, private sector "green" development, and "green" municipal practices (hybrid fleet vehicles, natural de-icing agents, etc.). Encourage use of the information through easily available distribution.
5. Develop "model" code and development regulation concepts to address the following:
   - Maintaining and protecting natural features during site development
   - Reducing impervious surfaces and stormwater runoff impacts

Erie - Lackawanna Trail. Photo by Stephen Sostaric.

   - Restricting development that would impact high-quality waterways, floodplains, etc.
   - Maintaining appropriate buffers at wetlands, riparian areas, etc.
   - Preserving trees
   - Facilitating use of alternative energy sources- wind, solar, geothermal, etc.
   - Encouraging water conservation- "green" elements to incorporate, incentives to offer, etc.
6. Implement the Greenways & Blueways Plan components of the Green Infrastructure Network, in particular improving north-south linkages for species mobility and linking the trail network to local parks and recreation facilities
7. Engage in watershed scale planning initiatives, in particular for the watersheds that do not yet have a watershed management plan in place, including:
   - Continue multistate planning efforts with the Chicago Metro-

politan Agency for Planning and the Southwest Michigan Planning Commission Work with partners to develop regional, watershed based approach to flood control and management strategies

- Support communities in educating, promoting, and providing technical support to the public and decision makers to implement the post construction development practices required in their municipal stormwater permits to protect water quality
- Support communities in educating and providing technical support for implementation of the erosion control practices required in their municipal stormwater permits to protect water quality
- Pursue wetland priorities per the Indiana Wetland Conservation Plan
- Support communities in educating and providing technical support to the public and decision makers for implementation of the water conservation strategies required in their municipal stormwater permits
- Promote and encourage community utilities to conduct water and wastewater system audits
- Provide technical assistance to communities/groups interested in developing watershed management plans (ex. data, mapping, project coordination)
- Provide easy access to environmental data including GIS layers and mapping on NIRPC website
- Maintain and update Northwest Indiana Watershed Framework document

8. To the extent possible, track local codes and regulations with the 2040 CRP to support the Green Infrastructure Network in both land use pattern and site development practices.
9. Maintain and update the Green Infrastructure Network map and encourage partners to assist with updates.

Regional Partnership:

1. Align and seek compatibility in county land use regulations with the 2040 CRP to limit isolated and inefficient development and ensure open space preservation (counties)
2. Pursue coordinated open space acquisition to expand the Green Infrastructure Network according to 2040 CRP priorities
3. Facilitate effective management and maintenance of privately held open space assets that are critical to the overall Green Infrastructure Network for regional biodiversity and habitat connectivity, including connections through active agricultural areas
4. Promote and educate the public and decision makers in the nine remaining CSO communities to incorporate green infrastructure into their required Long-Term Control Plans (state)
5. Generate methods to encourage replication of successful sustainability innovations throughout small and large, public and private institutions in Northwest Indiana
6. Support local and regional strategies to reduce solid waste, increase recycling and dispose of household hazardous

Photo from web.

7. Establish incentives and/or a differential assessment structure to support permanent land conservation efforts (counties, state)
8. Work with elected officials, county health departments and ISDH to implement septic system operation and maintenance program across region
9. Work with local governments and nonprofit/advocacy groups to fill in gaps for watershed management coverage
10. Work with partners to increase capacity for watershed management including but not limited to staffing, secure funding, data gathering and analysis
11. Support academic institutions in long-term monitoring programs for habitat and water quality

Partners include:

- Local governments
- Private property owners
- Corporate property owners
- Land trust/advocacy groups
- Linear corridor owners
- Land developers
- Federal and state agencies
- Institutions of education

Coffee Creek Watershed Preserve. Photo by Stephen Sostaric.