Indian Creek Watershed Management Plan

Prepared for Harrison County Commissioners

HARRISON COUNTY

July 7, 2008

Acronyms and Abbreviations

AQL	Aquatic Life
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
BIT	Bacterial Indicator Tool
C	Centigrade
CAFO	Confined Animal Feeding Operation
CFO	Confined Feeding Operation
CFS	Cubic Feet per Second
CFU	Colony Forming Unit (Bacteria)
DO	Dissolved Oxygen
FCA	Fish Consumption Advisory
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FMSM	Fuller, Mossbarger, Scott and May Engineers
GIS	Geographic Information System
HMGP	Hazard Mitigation Grant Program
HUC	Hydrologic Unit Code
IAC	Indiana Administrative Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IGS	Indiana Geological Survey
ISDH	Indiana State Department of Health

LIDAR	Light Detection and Ranging
Mg/l	Milligrams per Liter
MIBI	Macroinvertebrate Index of Biotic Integrity
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resource Conservation Service
OWQ	Office of Water Quality (IDEM)
PCBs	Polychlorinated Biphenyls
PDM	Pre-Disaster Mitigation (Grant)
QHEI	Qualitative Habitat Evaluation Index
RSD	(Harrison County) Regional Sewer District
SSO	Sanitary Sewer Overflow
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWA	Unified Watershed Assessment
WQ	Water Quality
WWTP	Wastewater Treatment Plant

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1.0 Introduction and Watershed Description

A watershed is defined as an area of land that drains to a common point. A watershed is like a bowl; it has a ridge that defines its boundary and a valley that collects each drop of water that falls within its boundary. Human impacts as well as natural characteristics within the watershed boundaries affect the quality of water of that system. For this reason watersheds are logical units for water resource management and provide a holistic approach to address water issues.

Section 205(j) of the Federal Clean Water Act provides funding for water quality management planning. Funds are provided for projects that gather and map information on water pollution (point and nonpoint), develop recommendations for increasing involvement of organizations in watershed activities, and develop and implement watershed management plans (IDEM 2006). In January 2004, Harrison County submitted a Clean Water Act Section 205(j) grant application to the Indiana Department of Environmental Management (IDEM) with the intent to develop a watershed management plan (WMP) to address water quality issues in the Indian Creek Watershed.

The following steps were taken under the grant to develop the watershed management plan:

- Hire a watershed coordinator
- Establish an Indian Creek Watershed Subcommittee to the Harrison County Regional Sewer District
- Form watershed mission and approach
- Conduct public outreach
- Compile and assess data
- Conduct water quality monitoring
- Inventory sinkholes
- Develop watershed management plan
- Implement watershed management plan

Stantec Consulting Services, Inc. (formerly Fuller, Mossbarger, Scott, and May Engineers) was retained by the Harrison County Board of Commissioners to act as the watershed coordinator, help lead the development of the watershed management plan, and conduct data collection efforts. Stantec's Steve Hall served as watershed coordinator, assisted by support staff from the Watershed Planning and GIS departments.

1.1 WATERSHED SUBCOMMITTEE

An important element for the development and implementation of a watershed plan is the active participation and buy-in of elected officials and policy makers, as well as broad participation from local governments, agencies and interested individuals. Development of this watershed plan was guided by the *Indian Creek Watershed Subcommittee,* which was established through the Harrison County Regional Sewer District (RSD). The Subcommittee was appointed to provide focus, goals, policy direction and recommendations for the watershed plan.

The Committee met from October 2006 to March 2008 to discuss the progress of the plan, concerns of the group, and strategies for implementation. The RSD Indian Creek Subcommittee members are listed in **Table 1.1**. Additional information regarding the Indian Creek Watershed Subcommittee is provided in **Appendix 1.1**.

Table 1.1. RSD Indian Creek Watershed Plan Subcommittee

Name	Affiliation
Anthony Combs	Harrison County Regional Sewer District & Harrison County Health Department.
Chris Cunningham	Harrison County Health Dept.
Gary Davis	Harrison County Council President
Daniel Lee	Harrison County Regional Sewer District, & Tyson Foods
Don Lopp	Floyd County Planner
Kevin Russel	Harrison County Engineer
Bill Sanders	Heritage Engineering
Dan Schroeder	Harrison County Health Department
Ralph Schoen	Harrison County GIS
Tom Tucker	Harrison County Regional Sewer District
Eric Wise	Harrison County Planning Commission
Bob Woosley	Heritage Engineering
Laura Fribley	Indiana State Department of Agriculture
Donald Jones	Soil and Water Conservation District, Floyd Co Farm Bureau
Virginia Morris	Soil and Water Conservation District
Ken Griffin	City Manager, City of Georgetown

The following personnel from the Indiana Department of Environmental Management assisted with the subcommittee with development of the watershed plan:

Pamela Brown
Alice Rubin
Kathleen Hagan
Crystal Rehder
Bonny Elifritz

1.2 WATERSHED VISION

The following watershed vision statement was developed by the Indian Creek Watershed Plan Subcommittee.

> ***Vision:*** *Foster economic development, preserve environmental quality and enhance the quality of life for all who live and work in the Indian Creek Watershed.*

This vision is supported by the following objectives which were included in the 205(j) grant application:

- Improve quality of life by ensuring clean water and healthy natural resources
- Evaluate and prioritize problems affecting ground and surface waters
- Develop the watershed management plan in advance of IDEM's schedule for the Total Maximum Daily Load (TMDL)
- Reduce pollutants and provide protection in high quality areas

The Indian Creek Watershed Management Plan addresses three major, inter-related water quality issues:

- Water Quality Impairment
- Karst Ecosystem Protection
- Ground Water Protection

1.3 WATERSHED PLAN APPROACH

In 2005, IDEM awarded the County with a $99,930 grant to develop the watershed management plan. The grant was for a two-year project period from April 2006 through March 2008. Representatives from the Harrison County Board of Commissioners and the County Engineer selected Fuller, Mossbarger, Scott, and May Engineers, Inc. (FMSM) from Jeffersonville, Indiana as the watershed consultant for the two-year project period.

The Indian Creek Watershed Management Plan meets the requirements outlined in IDEM's "What needs to be in a Watershed Management Plan" checklist, effective for 2003.

1.4 WATERSHED DESCRIPTION AND HISTORY

1.4.1 Watershed Location

The Indian Creek Watershed is a subwatershed within the Blue Sinking Watershed located in South Central Indiana. **Figure 1.1** depicts the location of the Indian Creek Watershed within Indiana.

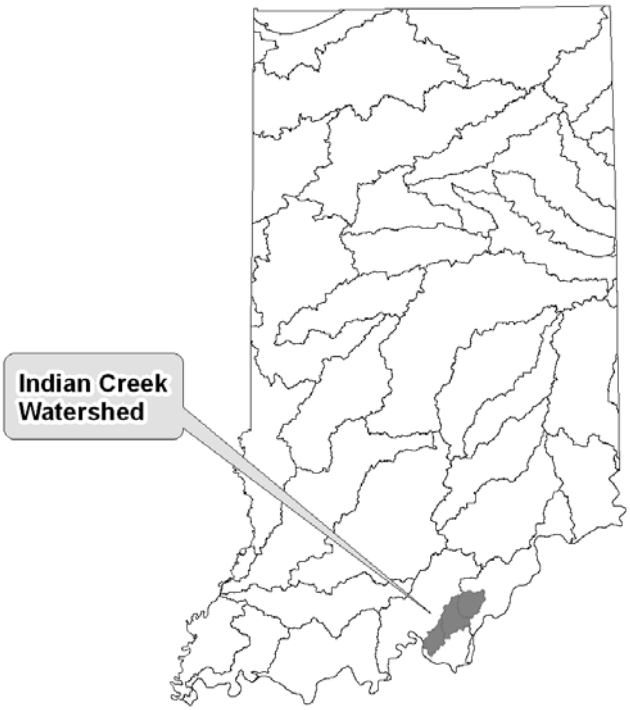

Figure 1.1 Indian Creek Watershed Location

As shown in **Figure 1.2**, the Indian Creek Watershed, one of seventeen subwatersheds in the Blue Sinking Watershed, encompasses three 11-digit hydrologic unit code (HUC) subwatersheds (05140104080, 05140104090, and 05140104100).

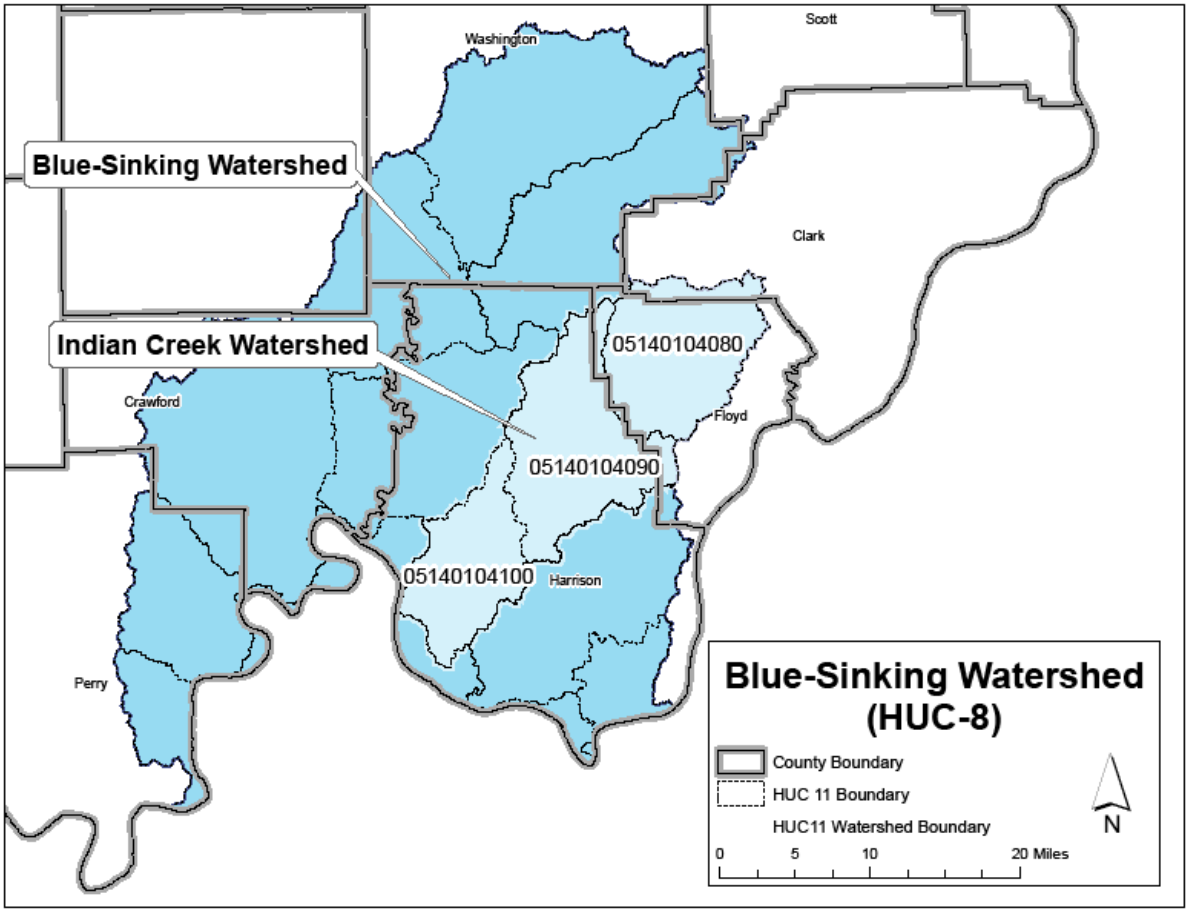

Figure 1.2 Blue Sinking Watershed

The drainage area for the Indian Creek Watershed is 256 square miles. The watershed drains a significant portion of Harrison County and Floyd Counties, as well as a small portion of Clark County. The Indian Creek Watershed has approximately 176.5 miles of streams which flow to the southwest, eventually draining to the Ohio River. The Indian Creek Watershed is approximately 48 miles long and 19 miles wide. The headwaters are located in the knobs of Clark and Floyd Counties.

1.4.2 Physical Setting

The present landscape in Floyd County was formed by the Illinoisan glaciation. Harrison County is an unglaciated area. The Mitchell Plateau, a broad limestone karst plateau is located in Southern Indiana. This plateau extends from the eastern part of Owen County south to the Ohio River in Harrison County (Indiana Geological Survey, 2006). The southern half of the Indian Creek Watershed is underlain with karst geology, including Binkley Cave, the largest cave in Indiana.

Karst features include sinkholes, springs, caves and underground channels. In karst systems surface contaminants can travel quickly into sinkholes, caves and groundwater or can resurface in streams without being filtered and broken down by soils. Therefore, water quality in this area is vulnerable to water quality degradation.

The karst system present in the Indian Creek Watershed is part of a much larger karst system that transcends watershed boundaries, as shown in **Figure 1.3**.

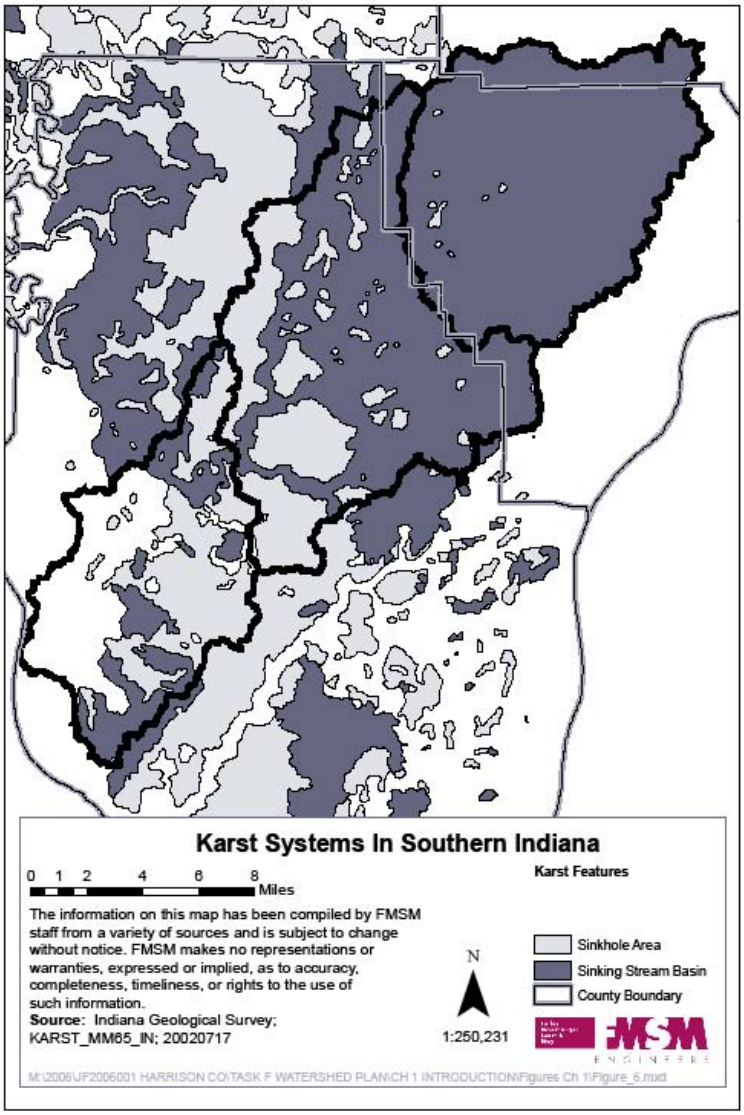

Figure 1.3. Karst Systems in Southern Indiana

This map shows generalized sinkhole areas and sinking stream basins. Prior to the development of this watershed plan, there was a generalized understanding that the karst system was well developed in the watershed. In order to develop more specific data, a sinkhole inventory was conducted as a component of this watershed plan. Over the long term, this inventory, coupled with dye tracing, can be used to improve our understanding of flow volume and flow paths through the karst system. Additional information regarding the sinkhole inventory is provided in **Section 2.8 Sinkhole Inventory**.

The Sinks of Indian Creek are an example of a sinking stream. The Sinks of Indian Creek are located within the channel of Indian Creek approximately 2.5 miles southwest of Corydon. These sinks divert a portion of the flow into subterranean channels. Some of these sinks have historically been dammed to retain flow in Indian Creek. Dye-trace studies have indicated that water from The Sinks of Indian Creek feed into Blowing Hole Cave, cross under the watershed boundary, and resurface in the Blue River Watershed at Harrison Spring. The water then flows into the Blue and Ohio Rivers. The average gradient between the elevation in the Sinks of Indian Creek and Harrison Spring is more than 21 feet per mile. This gradient is far steeper that that of Blue River, which is merely 5 feet per mile for great portion of its length.

Harrison Spring, the spring at which the sinks of Indian Creek resurface, is the largest spring in Indiana. The sub-circular pool of Harrison Spring, where the subterranean water rises, is about 80 feet wide, 110 feet long and 35-feet deep. Flows of 1.7 million gallons per day have been measured in Harrison Spring and an estimate of the drainage area needed to feed Harrison Spring is 200 square miles, which may include a large portion of the Indian Creek Watershed. The spring has been known to give off a violently muddy discharge.

The Indian Creek Watershed is considered to be a major tributary of the Blue River due to this underground connection. The Nature Conservancy operates the Blue River Project Office to protect this system. The Blue River is on the Outstanding Rivers List for Indiana under several categories, including High Water Quality, and it is also a National Wild and Scenic River.

A total of 224 cave entrances have been identified in the Indian Creek Watershed by the Indiana Geological Survey. Cave density is calculated using the number of mapped cave entrances per square kilometer. A map of Indian Creek Watershed cave density is provided in **Appendix 1.2**.

Historically Harrison County has relied on the karst system as a means for stormwater drainage. Presently, Harrison County is proactively working towards the development and adoption of a Stormwater Management Ordinance, which will provide a legal means to address stormwater quantity and quality management, floodplain management, and karst system management.

Climate data were summarized by the Department of Natural Resources (2006). Long-term climatic data for Harrison County were based on the Paoli, Indiana weather station (Midwestern Regional Climate Center, 2005). This weather station is located in Orange County Indiana, near the Indian Creek Watershed. This is the closest operating long term weather station and was considered to be representative of the watershed. Normal monthly maximum, minimum, and mean temperatures for the period 1971-2000 are listed in the following table. Air temperatures

reach a high point in July with a monthly mean of 75.5 °F and dip to a mean of 28.2 °F in January.

Table 1.2. Annual Temperatures (1971-2000)

°F	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Min	18.4	21.9	31	40.4	50.1	59.7	63.8	61.5	52.8	40.1	32	22.7	41.2
Mean	28.2	32.9	42.8	52.9	62.7	71.4	75.5	73.5	66	54.1	43.5	32.7	53
Max	37.9	43.8	54.5	65.4	75.2	83	87.1	85.4	79.2	68.1	54.9	42.7	64.8

Source: Gerald A. Unterreiner, 2006.

Precipitation averages nearly 48 inches per year. Normal monthly and annual precipitation for the period 1971-2000 and precipitation extremes for the period 1901-2001 are listed in the following Table.

Table 1.3. Precipitation

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Min	0.57	0.24	0.5	0.88	0.8	0.45	0.2	0.51	0.48	0.04	0.42	0.35	25.38
Normal	3.29	3.1	4.37	4.84	5.14	4.19	4.46	4.17	3.26	2.9	4.22	3.64	47.58
Max	17.38	8.3	14.29	10.69	12.13	12.72	10.69	8.83	10.92	13.57	9.26	8.19	63.45

Source: Gerald A. Unterreiner, 2006.

1.4.3 Natural History

Native vegetation in the area consisted of hardwood trees (tulip-poplar, oak, hickory, elm, maple, and ash), and swamp grasses and sedges. With a history dating back approximately 4,000 years ago, early Native American cultures prospered in this area.

Floyd County, as it is known today, was organized in 1819. Settlement in Harrison County occurred in the 1800s near the town of Lanesville. As development began to occur in the area, forests were cleared for farmland and agriculture became a major part of the County's economy. In some portions of the County, as a result of clearing performed with disregard for soils and slope steepness, the area is prone to severe erosion (USDA 1975). Although farming is still an important part of the local economy, land uses are transitioning to suburban, commercial and light industrial development. (USDA 1974).

Figure 1.4 depicts natural regions that occur within the Indian Creek watershed. The natural regions have been defined by the US Geological Survey as follows:

- **Knobstone Escarpment:** a steep slope that outlines the eastern boundary of the Norman Upland.
- **Mitchell Karst Plain:** includes extensive areas of rolling hills underlain by limestone and large sections of karst including solution valleys, sinkholes, caves, underground drainage, and springs.

- **Escarpment**: marks the location of steep cliffs, which rise above the Ohio River floodplain.

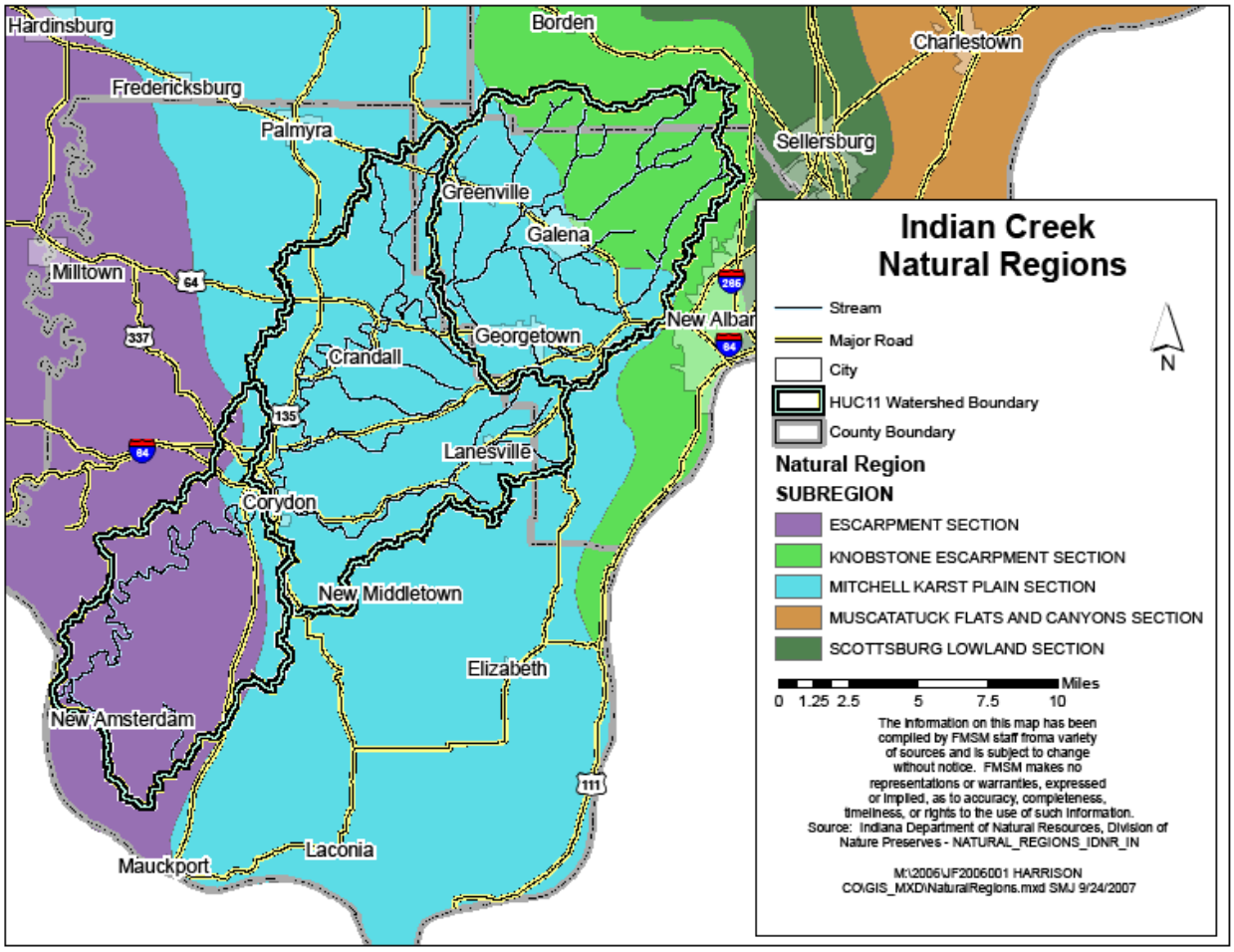

Figure 1.4 Natural Regions

Natural features of Harrison and Floyd Counties including soils, topography, climate, and vegetation are favorable for wildlife (USDA, 1975).

- Open-land wildlife – rabbits, red foxes, skunks, quails, etc.
- Woodland wildlife – deer, squirrels, raccoons, woodpeckers, nuthatches, etc.
- Wetland wildlife – muskrats, wild ducks and geese, kingfishers, red-winged blackbirds, etc.

1.4.4 Rare, Threatened and Endangered Species

Many rare, threatened, and endangered species of flora and fauna have been identified in Harrison and Floyd Counties, mainly because of the unique natural features present in the area (i.e. the extensive cave system due to the karst geology). The 22-mile long Binkley Cave system is home to 74 species, including 6 critically imperiled species (G1- five or fewer locations worldwide), 9 imperiled species (G2 - known from 6-20 locations) and 6 vulnerable species (G3 - known from 21-100 locations). A US Endangered Species, the Indiana Brown Bat, was found in the cave in January 1997, but is thought to be lost due to the March 1997 flood. Eight new species were found in the caves in the Corydon area.

A list of endangered, threatened and rare species for Harrison and Floyd Counties is provided in **Appendix 1.3**. It is important to note that the species lists are provided on a county-wide basis so species may or may not be present in the Indian Creek Watershed. Species may be identified as endangered, threatened or rare in an area due to natural conditions or because of potential human impacts on that species natural habitat. The list was compiled over many years based on a combination of isolated observations and systematic species surveys.

1.4.5 Soils

The soils in Harrison County were formed from limestone, sandstone, shale, lacustrine deposits of Wisconsin age, and loess. The bedrock closest to the surface is sedimentary rock from the Mississippian Age. The parent material in Floyd County consists of glacial till and outwash of Illinoisan Age, lacustrine deposits of Illinoisan and Wisconsin age, residuum from limestone, sandstone, shale, and alluvium (USDA 1975: USDA 1974).

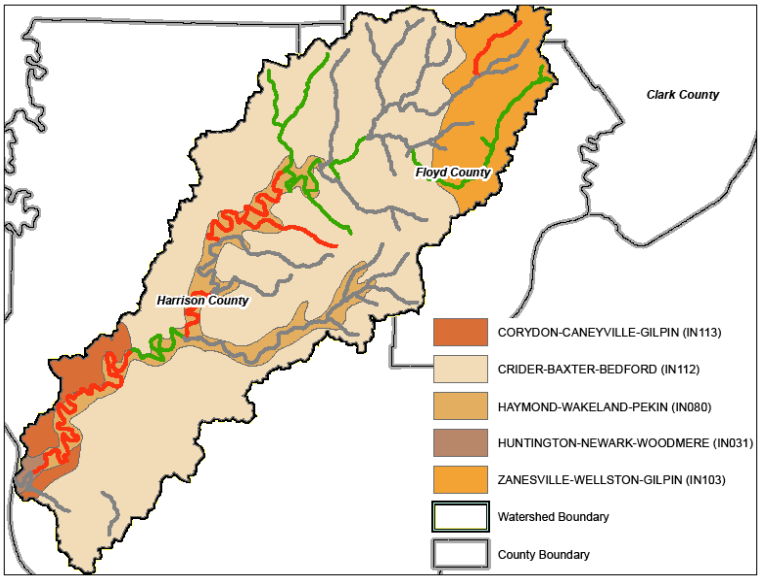

Figure 1.5. Soil Associations

According to the Soil Surveys for Harrison and Floyd County, there are five soil associations in the Indian Creek Watershed, shown in **Figure 1.5**. In Floyd County, the northern section of the watershed, the prevalent Association is the Zanesville-Weston-Gilpin. In Harrison County, which includes the middle and southern sections of the watershed, the Crider-Baxter-Bedford Association is dominant. Present to a lesser extent are the Haymond-Wakeland-Pekin,

Corydon-Caneyville-Gilpin and Huntington-Newark-Woodmere associations. Characteristics of the soil associations are shown in **Table 1.4.**

Table 1.4 Indian Creek Soil Associations

Zanesville-Weston-Gilpin	**Zanesville** - deep, well drained, and slowly permeable, on ridgetops and upper side slopes. **Weston** - sandy loam surface, poorly drained; very slow runoff; moderately slow permeability. **Gilpin** - moderately deep, well drained soil, permeability is moderate.
Crider-Baxter-Bedford	Rolling deep, well-drained, medium textured, cherty soils on uplands. Contains sinkholes that range from 15 feet to ½ mile in width and 3 feet to 90 feet in depth.
Haymond-Wakeland-Pekin	**Haymond** - very deep, well drained soils on flood plains and flood-plain steps, moderate permeability
Corydon-Caneyville-Gilpin	**Corydon** - shallow, well drained, moderately slowly permeable soils, on sloping to very steep hills underlain with limestone **Caneyville** - moderately deep, well-drained soils with moderate permeability, on gently sloping to steep upland ridgetops and hillsides **Gilpin** - moderately deep, well drained soils, on nearly level to very steep uplands
Huntington-Newark-Woodmere	**Huntington** - very deep, well drained, moderately permeable soils, on flood plains **Newark** - very deep, somewhat poorly drained soils, level flood plains and in upland depressions **Woodmere** - very deep, moderately well drained soils on flood plains and flood-plain steps

Source: USDA 1975; USDA 1974

Each soil type has a soil erodibility index assigned by the Natural Resources Conservation Service (NRCS). This value is a numerical expression for a soil's probability to erode based on its physical and chemical properties and the climate conditions of the soil's location. The most recent soils data, published by the NRCS as Soil Survey Geographic (SSURGO) were used for the evaluations that follow.

Indian Creek Erodible Soils were mapped in **Figure 1.6** using the Kf Erosion Factor. The Kf erosion factor indicates the susceptibility of a soil to sheet and rill erosion by water. Areas with high Kf factors are mapped in red. These soils are shown with the 303d assessment of streams which will be further explained in **Section 2.3.2. Water Quality Assessments**.

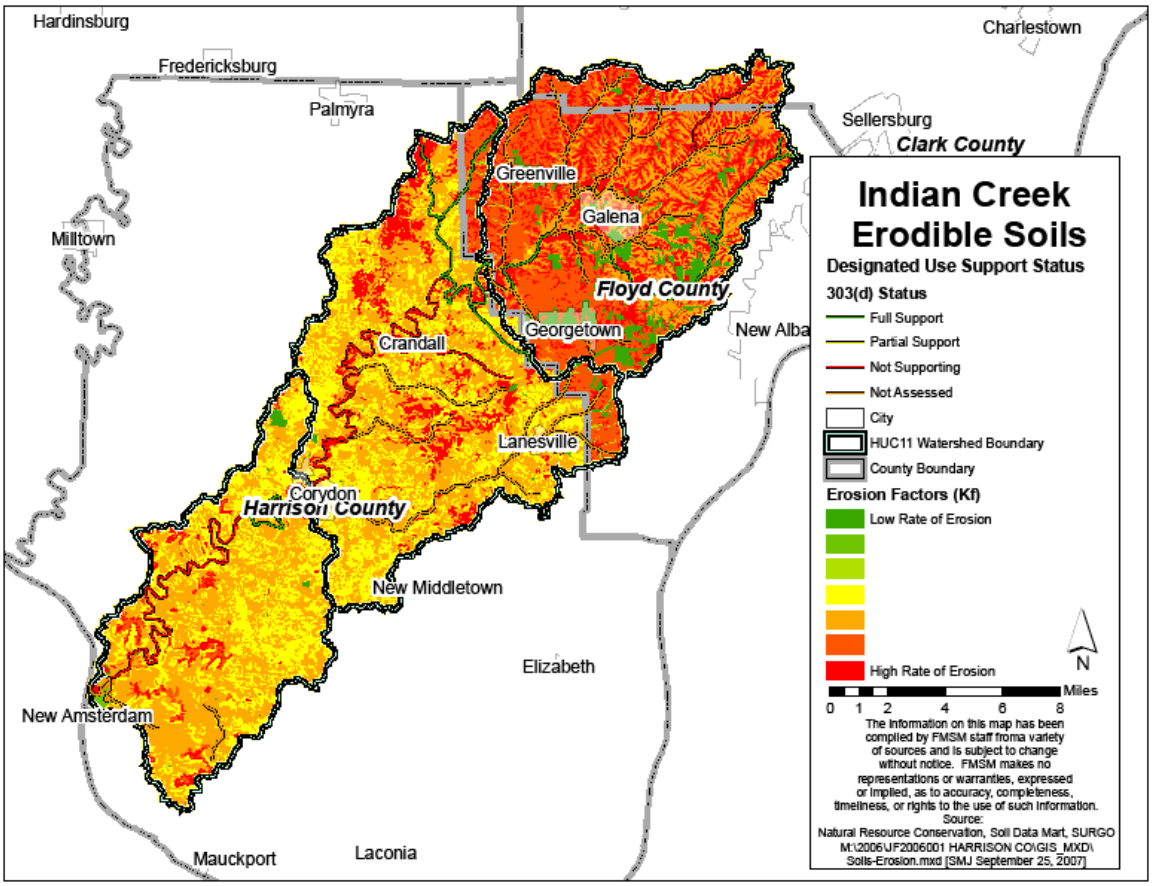

Figure 1.6. Erodible Soils

In order to function properly, septic systems need well-drained soils. The ideal location for a soil absorption field is a large area within a lot which contains deep, well-drained soils. As shown in **Figure 1.7**, the majority of the soils in the Indian Creek Watershed are “somewhat limited”, meaning that the soil has features that are moderately suitable for the septic systems, and “very limited”, implying that the soil has one or more features that are unfavorable for septic systems. It is important to consider that soils data are generalized over large areas and that individual lot suitability is evaluated by the Health Department prior to installation of new systems. Limitations on individual lots may be addressed through siting and design.

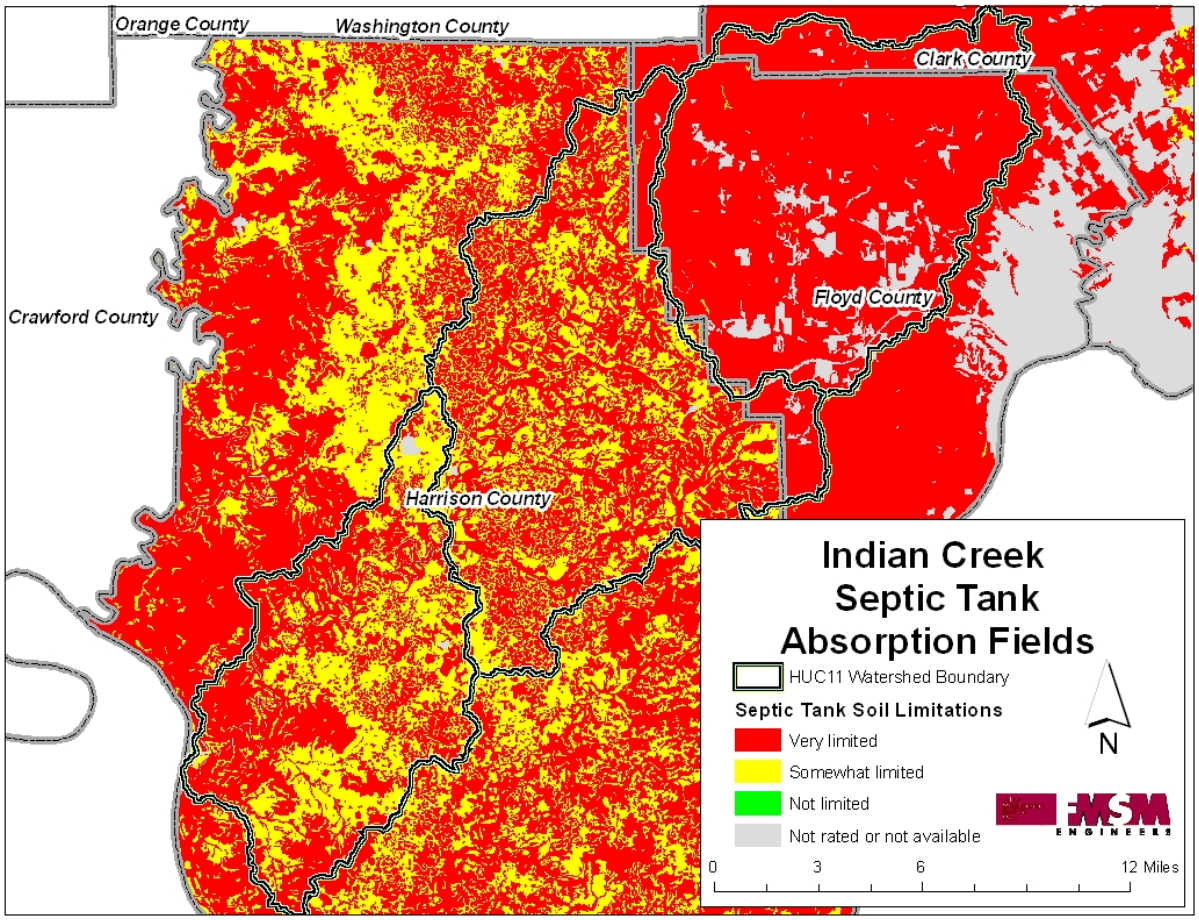

Figure 1.7. Septic Suitability of Soils

Table 1.5 summarizes soil suitability for septic systems in Harrison and Floyd Counties. The percent and number of households with septic systems numbers are from the 1990 Census, the most recent information available. The soil information was derived from SSURGO data.

Table 1.4. Soil Suitability for Septic Systems

Characteristic	Harrison County	Floyd County
Percent of Households with Septic Systems	31%	80%
Number of Households with Septic Systems	7,915	9,214
County Area (acres)	94,288	310,633
Density of Septic Systems (acres per septic system)	11.9	33.7
Percent of Area with Soils Having Severe Limitations for Septic Systems	81%	67%

Source: Hoosier Environmental Council's Watershed Restoration Toolkit: A Citizen's Guide to Improving Water Quality

Because land in the Indian Creek Watershed is predominantly used for agriculture, soil quality is critical. Soils are considered 'prime agricultural soils' when they have the best chemical and physical characteristics for producing food, feed and crops. In the watershed, the majority of the soils are prime farmland soils (Bedford, Crider, Huntington series). However, some soils, such as those found in the Haymond and Wakeland series, require additional measures (i.e. drainage, flooding protection) in order to yield a good crop.

1.4.6 Topography

The highest point of the watershed, located in Floyd County, is 1,020 feet. The lowest point of the watershed, located in Harrison County, goes down as low as 380 feet. Due to the steep gradients in Floyd County, the Indian Creek Watershed is prone to significant flooding. Indian Creek often overflows its banks after heavy precipitation. The Indian Creek tributaries in Floyd County have also overflowed and caused significant damage to nearby roads.

Floyd County is divided from northeast to southwest by Floyds Knobs, a hilly region characterized by sharp elevation changes on the east side and more gradual but still steep changes on the west side.

There are significant floodplains throughout Harrison County located in the ravines along major streams. Currently, the west side of the Knobs in Floyd County is experiencing expanding residential development. It is a significant challenge to design adequate drainage for these new developments, especially on steep slopes. These additional impervious areas associated with existing and new developments may be contributing to flooding issues in the northwestern portion of Floyd County.

1.4.7 Hydrology

There are approximately 176.5 miles of streams in the Indian Creek Watershed. The drainage area for the watershed is 256 square miles. Big Indian Creek flows through the central part of the watershed and drains approximately one-third of Harrison County. In Floyd County, Indian Creek drains the western part of the County. The stream density in this watershed is 0.7 miles of stream per square mile of watershed drainage area. This low stream density is indicative of the extensive karst system in the watershed, and surrounding area.

The headwaters are located in the knobs of Clark and Floyd Counties, the mid and lower watersheds are located in Harrison County. The Indian Creek headwaters flow from the Floyds Knobs (Floyd County) in areas that have undergone significant development in the last few decades. Major tributaries of the watershed include Corn Creek, Crandall Branch, Raccoon Branch, Brush Heap Creek, and Little Indian Creek. See the **Figure 1.8.** Use support is further explained in **Section 2.3.2 Water Quality Assessments**.

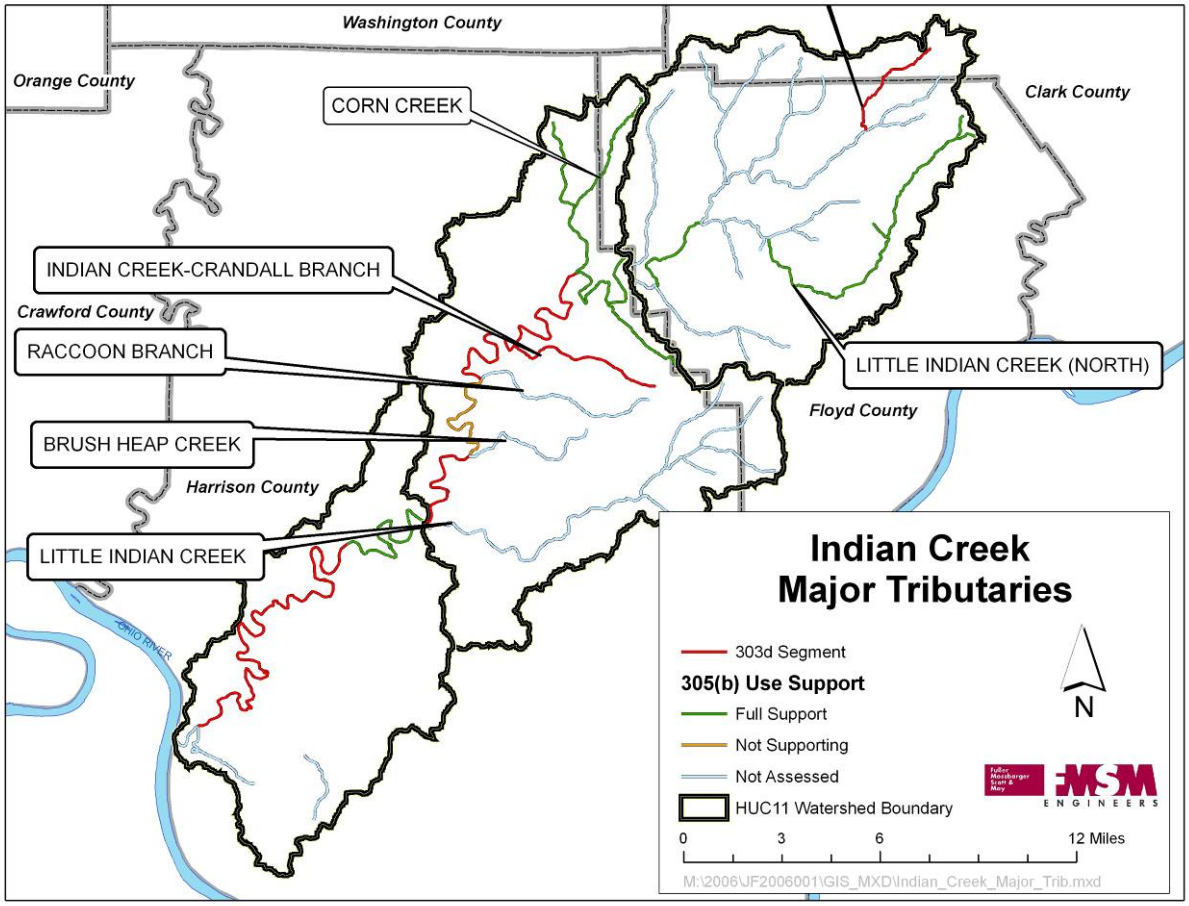

Figure 1.8. Major tributaries in the Indian Creek Watershed

Indian Creek, from the Floyd-Harrison County line to its confluence with the Ohio River in Harrison County, has been designated as an Outstanding River by the Indiana Natural Resources Commission. An Outstanding River designation is applied to streams that are environmentally or aesthetically important. Indian Creek received the designation because it is a State Heritage Program Site, which includes rivers identified by state natural heritage programs or similar state programs as having outstanding ecological importance.

Channel Modifications: Systematic data on channel modifications, such as straightening, were not available. However, much of this watershed is rural, so modifications associated with urbanization are thought to be relatively minimal. Modifications associated with agricultural practices may be more common. Another consideration is the relatively low stream density due to the karst system. Because there are fewer miles of stream per square mile of watershed area, there may be a lower potential for channel modifications.

Monitoring and habitat data have indicated that there are locations in the watershed where channel banks are eroding. This may be attributed to increased volume and velocity of stormwater runoff. Chapter 3 includes a strategy to conduct a habitat and visual assessment to identify locations where erosion is occurring and prioritize these locations for stabilization and restoration projects.

Dams: Sixteen (16) dams were identified in the Indian Creek Watershed by the Indiana Department of Natural Resources and two additional dams were identified through a review of EPA BASINS database, for a total of eighteen (18) dams in the watershed. Dams are characterized by location, storage, hazard potential and height in **Table 1.6**.

Table1.5. Indian Creek Watershed Dams

County	Name	Drainage Area (Square Miles)	Maximum Storage (acre-feet)	Hazard Potential	Height (feet)
Clark	Huber Bros. Lake Dam	0.360	143	Significant	26.00
Clark	Stumler Dam	0.150	129	Low	31.00
Floyd	Brazil Lake	0.170	125	Low	39.00
Floyd	Floyds Knobs Lake Dam	0.320	88	Low	22.00
Floyd	Georgetown Reservoir Dam	0.740	160	High	42.00
Floyd	Krotzki Lake Dam **	0.070	24		
Floyd	Lime Ridge Dam	0.806	293	Low	34.00
Floyd	Mt. St. Francis	0.410	245	Low	40.00
Floyd	Silver Mining Dam	0.169	66	High	30.00
Floyd	Sycamore Ridge Dam	0.113	38	High	28.50
Floyd	Ulrich Lake Dam	0.050	95	Low	28.00
Harrison	Big Indian Bluff Dam	0.030	6	Low	25.50
Harrison	Corydon Water Works Dam #2 (Middle)	154.000	120	Low	23.00
Harrison	Corydon Water Works Dam #3 (North)	148.000	160	Low	23.00
Harrison	Indian Creek (In-Channel) Dam No. 1	0.000	0	Low	11.50
Harrison	Lanesville Reservoir Dam	0.650	192	High	35.00
Harrison	Lutheran Laymens Lake Dam	0.440	73	Low	25.00
Harrison	Pine Springs Lake Dam	0.160	56	Low	28.00

Sources: Indiana Department of Natural Resources
EPA, BASINS

The safety of dams was ranked into three categories as defined below.

- **High:** Loss of human life, major infrastructure damage, homes destroyed
- **Significant:** No loss of human life, but damage may occur to county roads and farm crops, and flooding may occur downstream

- **Low:** No loss of human life, but damage to crops may occur

Four (4) dams were rated as high hazard and one dam was rated as a significant hazard potential by IDNR. Additional watershed planning considerations for dams include their potential to impede fish passage and act as a sink for sediment and associated pollutants within the impoundment.

Drinking Water Sources: Drinking water is supplied by public water systems that rely on the Ohio River as source water. In addition, some residents continue to use wells for potable and agricultural supplies. There are over 250 mapped wells in the Indian Creek Watershed, many within the karst region.

Routine testing of private potable supply wells is not required, so data on well water quality are not available. However, these wells may be vulnerable to contamination due to their location within the vulnerable karst region. In addition, wells are located in areas served by septic systems. The Watershed Restoration Action Strategy for the Blue-Sinking Watershed (WRAS 2002) has identified high septic system densities in the area. Although septic systems can be can be a safe and effective way for treating wastewater, malfunctioning septic systems can pollute groundwater and surface water posing threats to human health and the environment by contaminating nearby wells, drinking water supplies, as well as fishing and swimming areas (WRAS 2002). Strategies to improve management of septic systems are discussed Chapter 3.

Wetlands: Wetland resources are very minimal in this watershed, with land cover data indicating 167.7 acres (0.1%) of woody wetlands and 13.1 acres (0.007%) of emergent herbaceous wetlands. These acreages were estimated from the 2001 Land Cover Data for Indiana published by the United States Geological Survey (USGS). Small local wetlands may not have been mapped through this statewide mapping effort. Wetland habitats are typically diminished in karst areas and in steep terrain.

1.4.8 Land Use

Land use and land cover was evaluated using the 2001 Land Cover Data for Indiana published by USGS. As shown in **Figure 1.9,** farmland dominates the Indian Creek Watershed landscape. Sixty-two percent (159 square miles) of the watershed is utilized for agricultural production. Another ninety square miles (35%), is covered by forested land (deciduous, evergreen, and mixed forests). Approximately 6.4 square miles (3%) consists of developed land. Less than one percent is covered with water and wetland features. Land use and land cover data are summarized in **Table 1.7**.

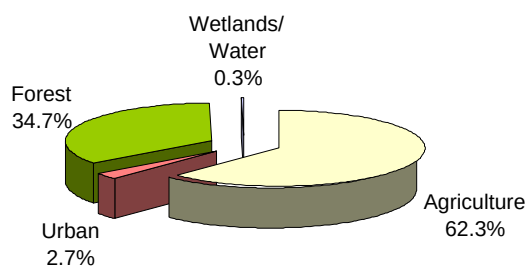

Figure 1.9. Indian Creek Watershed Land Use

Table 1.6. Indian Creek Land Use and Land Cover

Category	Land Use Classification	Acres	Percentage
Agriculture	81-Pasture/Hay	66,552.6	40.5%
	82-Row Crops	35,753.4	21.8%
	SUBTOTAL	**102,306.0**	**62.3%**
Urban	21-Low Intensity Residential	3,413.5	2.1%
	23-Commercial/Industrial/Transportation	815.1	0.5%
	22-High Intensity Residential	145.0	0.1%
	85-Urban/ Recreational Grasses	65.4	0.0%
	33-Transitional	17.3	0.0%
	SUBTOTAL	**4,456.3**	**2.7%**
Forest	41-Deciduous Forest	51,142.4	31.2%
	42-Evergreen Forest	5,475.6	3.3%
	43-Mixed Forest	282.4	0.2%
	SUBTOTAL	**56,900.4**	**34.7%**
Wetlands/Water	91-Woody Wetlands	167.7	0.1%
	92-Emergent Herbaceous Wetlands	13.1	0.0%
	11-Open Water	323.8	0.2%
	SUBTOTAL	**504.6**	**0.3%**
TOTAL		**164,167.3**	**100.0%**

Source: Land Cover for Indiana, USGS (2001)

Using data from Land Cover in Indiana (USGS, 2001), the distribution of land uses spatially in the watershed is shown in **Figure 1.10**. Although urban lands currently comprise a small percentage of the watershed (2.7%), this area is anticipated to increase. According to the 2000 Census, between 1990 and 2000, Harrison County's population growth of 14.8 percent exceeded statewide growth of 9.7 percent. Harrison County's growth rate has also exceeded that of the surrounding areas. Significant residential development has occurred in the area around Corydon, Crandall and Lanesville, which account for 25.7% of the Harrison County population.

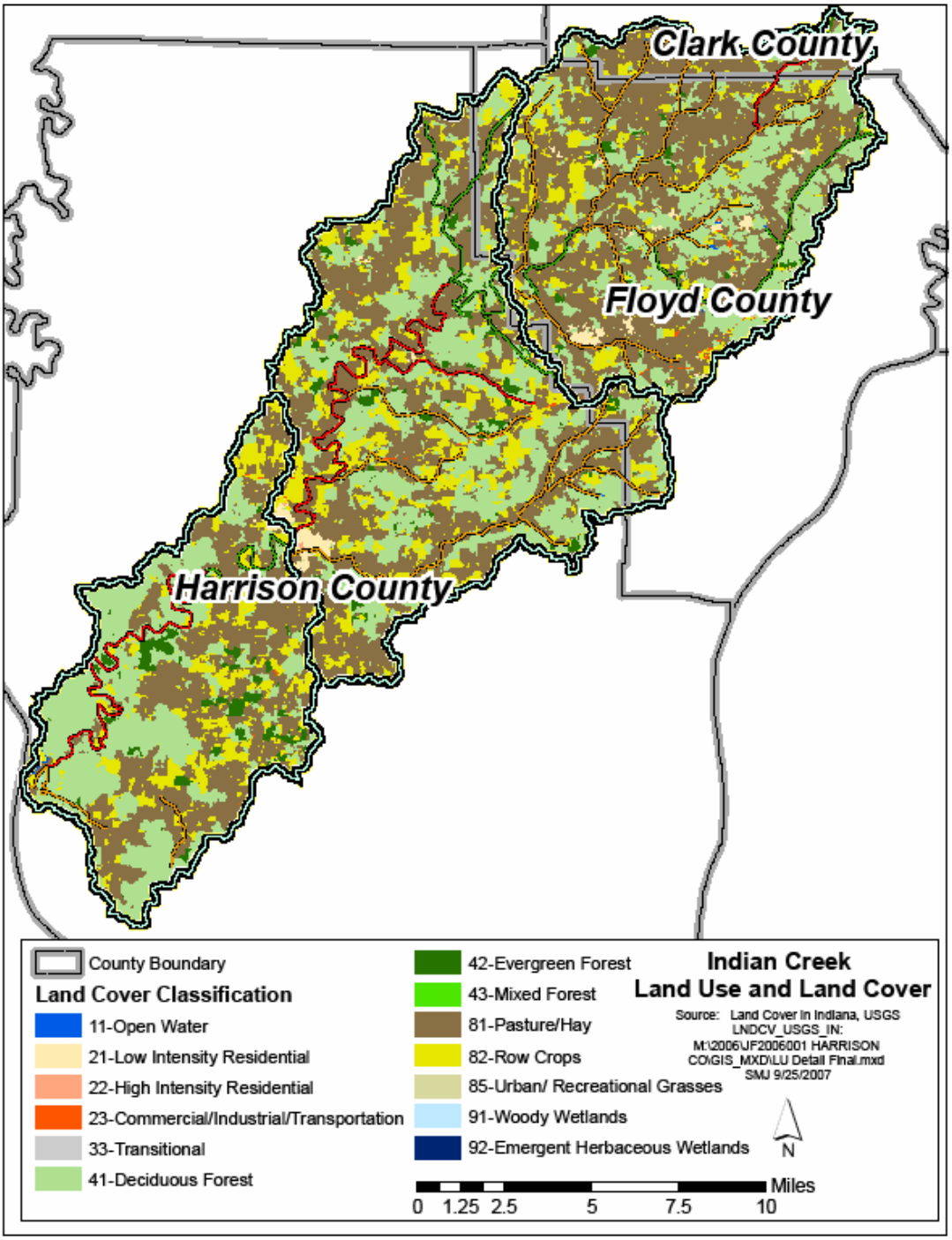

Figure 1.10 Indian Creek Watershed Land Use and Land Cover

The largest town in the Indian Creek Watershed is Corydon with a population of 2,715, according to the 2000 Census. The historical importance of the town is threefold. The state's constitution was drawn up in Corydon. Corydon was also the original state capital, as well as the site of the only Civil War battle fought in Indiana (July 9, 1863). The location of Corydon was an ideal place for trade, as it was surrounded by hills and positioned at the convergence of Indian Creek and Little Indiana. A rail line was later built to add to Corydon's accessibility (Downtown Corydon Revitalization Plan).

The Historic District in the Town of Corydon sits within the natural boundary of Indian Creek to the north and west with Little Indian Creek to the south. Corydon is home to several sites listed in the National Register of Historic Places, including the Corydon Battle Site, Corydon Historic District, Kintner House Hotel, Kintner-Withers House, and the Kintner-McGrain House, the last three of which are listed due to their architectural as well as historical significance (National Register of Historic Places).

According to the 2000 United States Census, the total population of Floyd County has reached 70,823. The County has experienced a 15.7 percent increase in population since 1980. (US Census Bureau).

Without a doubt, the 1998 opening in Harrison County of Caesar's Glory of Rome Riverboat Casino has had a significant impact on Southern Indiana's economy. Caesar's has become Harrison County's largest employer and is also a major tourist attraction and a large source of tax revenue (Lanesville Interchange Master Plan, 2002).

Corydon Interchange on I-64 (#105) is another major employment center in Harrison County. The area south of the interchange includes commercial development (highway service and retail). The area north of the interchange is primarily industrial, with limited highway service uses. The Harrison County Chamber of Commerce owns 43 acres of land at the Corydon interchange available for development. Approximately 160 acres of land zoned industrial is available at the Corydon Interchange. This area has developed because of the availability of public utilities, including water, sewer, electricity and telephone, along with rail service. (Lanesville Interchange Master Plan, 2002). The Tyson poultry processing plant in Corydon has also experienced an expansion in recent years.

In Floyd County, the largest industry in the county is manufacturing. This industry employs 22.3% of the county's workforce, followed by educational, health and social services, which employ 17.1% of the workforce. Retail trade is the third largest industry accounting for 10.2% of the county's employment (US Census Bureau).

In order to further this growth, Harrison County and the Harrison County Economic Development Corporation initiated discussions for two projects – a new county hospital west of Corydon and the Lanesville interchange and road corridor. The hospital is under construction and is anticipated to attract jobs, additional residents and contribute to the economic growth of the area.

The planned Lanesville interchange, seventeen miles west of downtown Louisville, would connect State Road 64 and Interstate 64. In order to plan for development and guide land use decisions in the area, the County developed a supplement to the 1996 Comprehensive Plan for Harrison County entitled the Lanesville Interchange Master Plan, 2002. Although a timeframe for construction has not been established, this project is anticipated to spur additional residential, commercial and light industrial development near the interchange and along the road corridor.

Source: The Nature Conservancy

Figure 1.11. Cedar Farms, Harrison County

The Harrison and Floyd County Comprehensive Plans have similar goals. Both Plans promote and encourage planned community growth in areas best suited for economic development, while preserving and protecting agricultural lands and natural resources. Floyd County is proactively trying to manage growth. Floyd County's Sub-Division Control Ordinance is currently under revision and in the process of being updated to include new requirements for subdivision development. New growth and development, as a result of land use planning, will bring new prosperity to the region. However, these changes will also create new challenges for the region and in turn will affect the water quality in the Indian Creek Watershed.

Recreational Resources: There are numerous recreational resources available in the Indian Creek Watershed. Over 1,900 acres are available for publicly accessible recreational activities, as shown in **Table 1.8**.

Table 1.7. Recreational Acreages by Facility Type

Facility Type	Acreage
Dedicated Nature Preserve	593.5
Fishing/Boating Access	34
For-Profit Facility	68
Golf Course	315
Historic/Cultural	7.3
Non-Profit Facility	452
Other	25.5
Park/ Recreation Area	227
School Grounds	242
Total	**1964.3**

Source: IDNR, 2003. Recreational Facilities IDNR Shapefile.

Land Ownership: Although land in the Indian Creek Watershed is mainly privately owned, the watershed does include some County-owned land. Within the watershed, Harrison County owns and maintains Hayswood Nature Preserve and Indian Creek Woods (410 acres). Harrison

County participated on the Watershed Subcommittee, involving this land owner. The Nature Conservancy owns the Dewey Hickman Nature Preserve (125 acres) and Flint Hills Barrens Nature Preserve (58.53 acres). The Nature Conservancy participated on the Stakeholder Committee, representing this landowner. The 24,000 acre Harrison- Crawford State Forest is located in western Harrison County and eastern Crawford County. Approximately 4,000 acres of the Harrison Crawford State Forest are located in the Indian Creek Watershed. This forest is not a dedicated nature preserve.

1.5 PUBLIC EDUCATION AND OUTREACH

1.5.1 Public Meetings

Three public meetings were held to inform community members about the project's progress, gather information, raise awareness and support for the watershed plan. All public meetings were advertised with press releases to local newspapers, flyers and on the watershed website.

The first meeting was held on October 18, 2006 at the Harrison County Annex Building and focused on presenting an overview of watershed management planning and approach. The discussion focused on the creeks critical areas, as well as flooding and septic systems.

The second public meeting was held on July 24, 2007 at the Lanesville Jaycees Building. A presentation was given by FMSM that detailed the draft of the watershed management plan, sample collection efforts to date, and information on sinkhole inventory. Citizens made recommendations in reference to flooding, septic system education efforts, and storm water quality. The following priorities were identified: storm water quantity / flooding (1st), septic systems (2nd), water quality (3rd), and karst issues (4th). While this is not a comprehensive list of issues discussed, these broad issue categories cover the major interest areas and topics of discussion. **Appendix 1.4** includes meeting summaries for additional detail.

The third public meeting was held on February 5, 2008 at the Harrison County Annex Building and focused on presenting monitoring results, an overview of the watershed plan and gathering input on watershed strategies from a wide range of engaged citizens. Citizen recommendations were discussed and utilized in Chapter 4 of the watershed plan. Additional information regarding public meetings is provided in **Appendix 1.4**.

1.5.2 Events

A booth was set up at the Harrison County Fair to provide citizens with information about the watershed management plan. Project brochures were dispersed. Input was gained regarding citizen's views of waters quality. Many citizens were displeased with current water quality conditions. They complained of unclear well/tap water, past unawareness of straight pipes, and wastewater disposal issues. A health department nurse also expressed concern regarding the proper disposal of unused medicines, which can potentially accumulate in and contaminate natural water sources.

1.5.3 Website, Publications, and Brochure

An Indian Creek Watershed website was launched at the start of the project to raise public awareness, provide basic information regarding watersheds and to provide a publicly accessible calendar of events. The website also included a password protected page allowing subcommittee members to exchange draft information for review prior to public release. The homepage is shown in **Figure 1.12.** The web address is:

http://www.indiancreekwatershed.com/index.htm

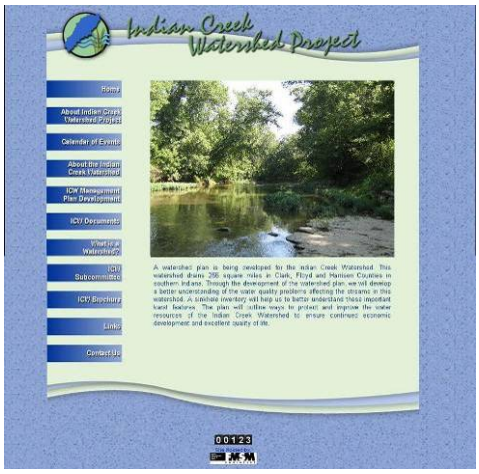

Figure 1.12. Indian Creek Watershed Website

Quarterly public outreach publications were released and watershed information was distributed to raise awareness of watershed issues. Over 400 copies of the Indian Creek Watershed brochure were distributed, and the brochure is included in **Appendix 1.4.**

1.6 PRIORITIZATION OF WATER QUALITY PROBLEMS

The following priorities were discussed at the Indian Creek Watershed Plan Public Meeting held on October 18, 2006. These considerations were integrated into Chapter 3. Goals and Decisions for the Indian Creek Watershed Plan.

1.6.1 Flooding

While flooding is not necessarily a water quality problem, it is related to the increasing impervious land cover from land development. Unmanaged stormwater runoff from existing and new development often contributes to both water quality and flooding issues. Flooding causes a more rapid transport of surface pollutant to streams. Some points to consider when discussing the impact of flooding are as follows:

- Buffers benefit aquatic life, water quality, and provide flood protection.
- Impacts of flooding on facilities and production.
- Low head dams: The ford bridge and Little Indian Creek backwater are likely contributors and the problem is anticipated to worsen as the area develops.
- Flash Floods: The system is very flashy, with floodwaters rising and receding very quickly. This may be attributed to high velocity runoff from local impervious surfaces and rapid runoff from steep sloped in the Floyd Knobs headwater area.
- Funding for agricultural buffers and stabilization In the Blue River, agricultural buffers and stabilization projects have been implemented to mitigate flooding. Agricultural funding sources typically require significant match (up to 50%). Grants can be sought to offset the farmers match requirement.
- Contour practices can reduce agricultural runoff and soil erosion. These practices are common where rainfall is scarcer, but could be useful locally.
- The Federal Emergency Management Agency (FEMA) provides Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grants. These grants are available to study natural hazard problems and build solutions. Data and documentation of the nature and extent of the flooding problem are critical to a successful grant application. Regional solutions can incorporate recreational uses such as linear parks along rivers. Lanesville has a series of parks that provide flood storage and recreational use.
- FEMA buy-outs for repetitive loss structures are also available. This has been used on 1-2 structures in Harrison County. Buy-outs compliment regional solutions by providing land.
- Floyd County involvement is very important since drainage from the knobs and developing areas is increasing. Floyd County is developing a storm water utility that will provide a funding source for storm water/drainage projects that could benefit Harrison County.
- Flood Control Structures: The watershed plan should include a recommendation to identify possible flood control structures and locations.

1.6.2 Failing / Inadequate Septic Systems

Failing septic systems are considered a potentially significant source of E. coli and bacteria.

- Failing septic systems are a problem, but are difficult to quantify. Additional work is needed to study the problem further. Infrared photography can potentially be used to identify failing septic systems. If funding is provided a study could be done in the watershed locate potential problems.
- The existing data is complaint driven and typically arises from lack of percolation. Systems that are failing into karst features don't have percolation issues and are not

being detected. Repairs can be triggered by failures or changes to the system such as expansions to handle home additions.

- New Salisbury and Laconia have more repair needs than Lanesville and Corydon.
- Projects to address this issue in other communities have included using GIS to analyze repair, failure and soils data and have resulted in identification of issues such as clay lenses and perched water tables that limit infiltration. Soil testing requirements were changed as a result.
- Help bring solutions to homeowners with failing septic systems. If septic systems failures are to be highlighted, it is important to bring solutions to homeowners. Some are not likely to have the financial means to repair failing systems.
- Some communities have implemented septic system districts that require routine inspections and pump-outs and repairs for failing systems. Fees are charged for the services, but are typically much lower than tie-on fees for sewage collection and monthly sewer bills. The RSD has the authority to address septic systems and septic education is a major charge for the RSD.

1.6.3 Water Quality

- A water quality problem – foaming – was identified in a Corn Creek cave stream near the Floyd County boundary. There is development in the area, served by septic systems that may be contributing. Existing data did not include these northern Harrison County karst features. This area could be examined further in the Sinkhole Inventory.
- Preservation and protection: The discussion so far has focused on problems, but preservation and protection are often less expensive and less onerous than remediation. Additional discussion on protection measures is needed.
- Citizen stakeholders recommended the following measures to protect and improve water quality: Buffers for runoff; stabilize creek crossing areas with grasses; cows should be kept out of the creeks.
- Straightening of Indian Creek for rapid stormwater conveyance, which leads to further water quality and flooding problems.
- Erosion problems in the headwaters of Floyd County portion of the watershed effect Harrison County downstream.

1.6.4 Karst

- Septic systems that are failing into karst features typically don't have visible surface percolation issues and are not being detected.
- State Department of Health does not approve mound septic systems although they may be a better option for a highly karst area
- Foaming was identified in a stream emanating from a cave on Corn Creek near the Floyd County boundary.
- Some retention ponds may open up into karst.
- Not all parcels are suitable for development in Harrison County due to the high intensity of the karst system.
- Stormwater Best Management Practices (BMPs) that are suited to karst should be identified and tested