

2. **Describing the Watershed:** Describe features of the watershed, including land use, soil types, topographic features, hydrology, and any other information needed to understand the plan.

### Highland-Pigeon Watershed in SW Indiana

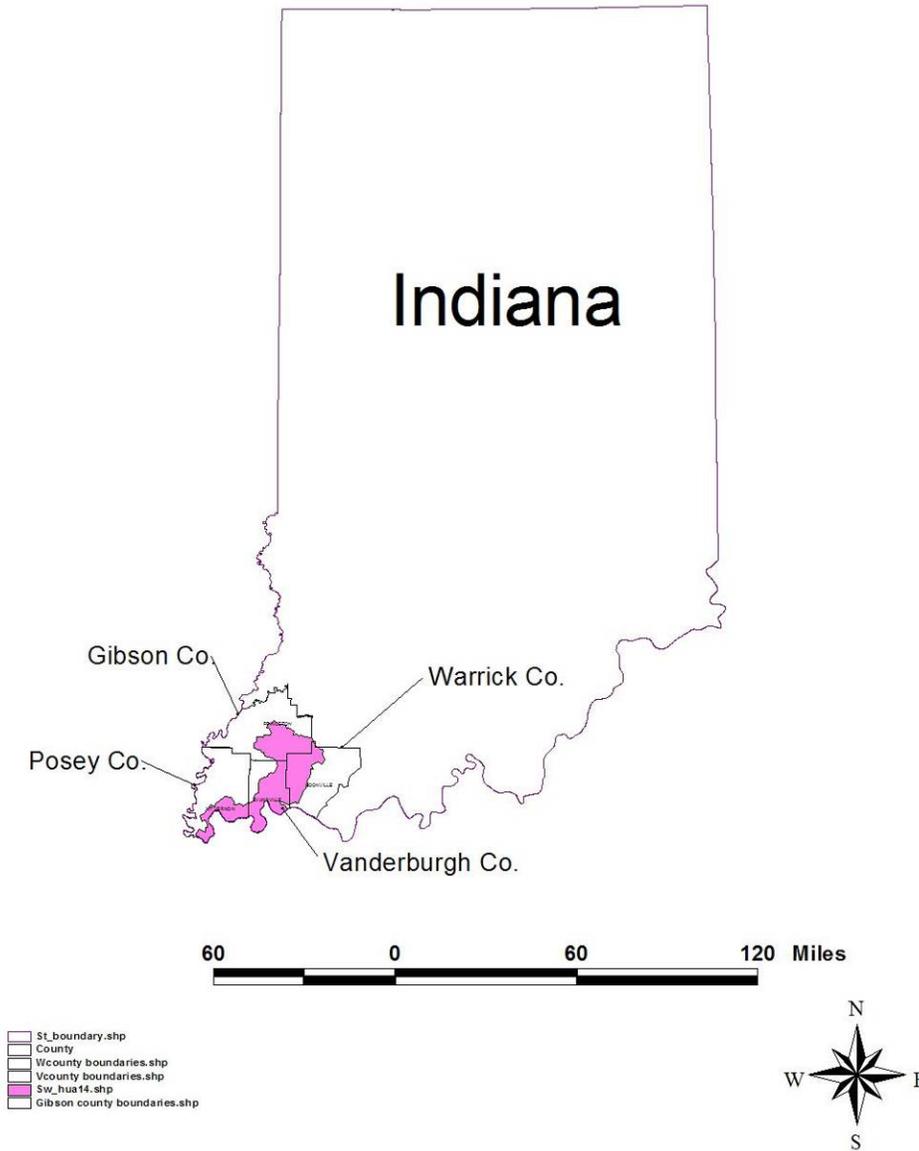


Figure 5: Location of watershed



# Highland-Pigeon Watershed HUC 05140202

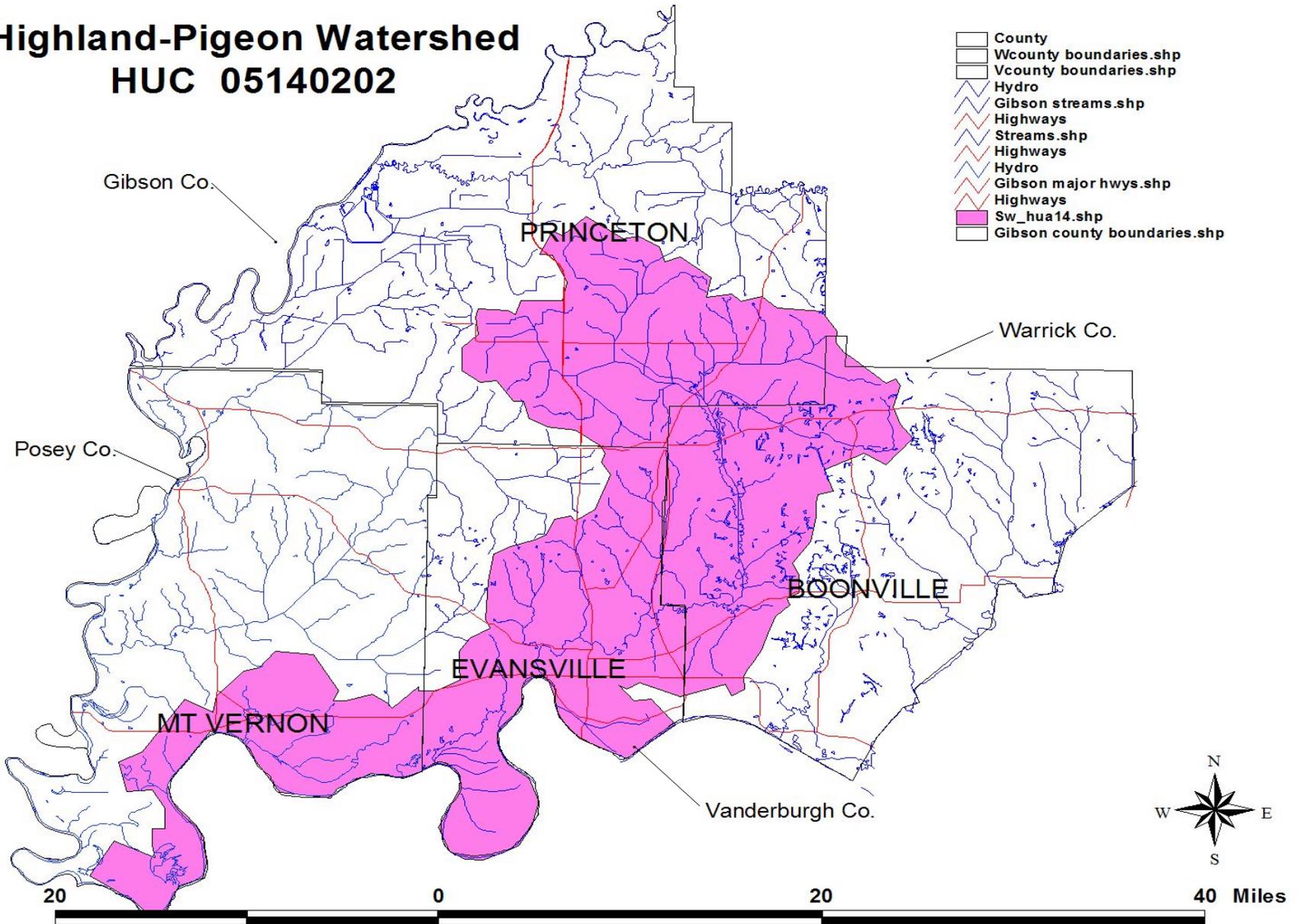


Figure 6: Location of watershed within SW Indiana



**Physical description:**

- **Geologic setting**

The study area is in unglaciated terrain of the Wabash Lowland Region. The watershed is nearly entirely underlain by the McLeansboro Group Patoka and Shelburn bedrock formations of Pennsylvanian age. The outcrop belt of the McLeansboro Group extends from western Warrick County northward to southwestern Vermillion County. The maximum thickness of 770 feet (235 m) is reached in the Mumford Hills in northern Posey County. Shale and sandstone make up more than 90 percent of this sequence, but minor amounts of siltstone, limestone, clay, and coal are present (Wier 1961, 1965).

- **Climate**

While Indiana has warm summers and cold winters, temperatures fluctuates both daily and seasonally as surges of polar air move southward or tropical air masses move northward. Temperature fluctuations are more common in winter than in summer. Severe storms and tornadoes are more frequent in the spring months. Temperature and precipitation data for the area are presented below. Spring is generally the wettest season in southwestern Indiana. The length of the growing season ranges from 166 to 233 days.

- **Natural History**

- Pigeon Creek enters the Ohio River at mile point 792.9 after draining 375 square miles of southwestern Indiana. The drainages of both Pigeon Creek and McFadden Creek are largely rural, and contain a variety of land uses and cover types. Land use/land cover types in the watershed include forests, water and wetlands, prairies, residential and commercial urban areas, industrial and rural areas, active and reclaimed mined lands, and agriculture. These habitats provide for an abundant and diverse fauna. Principal crops include wheat, corn and soybeans. Large tracts of coal mined lands are on the eastern sides of the watershed, in Warrick and Gibson Counties. There are also oilfields in parts of Gibson County and Posey County.

Table 1

**WATERSHED CLIMATE DATA (1961-1990) TAKEN  
AT EVANSVILLE AIRPORT  
(Source: Midwestern Regional Climate Center, Champaign, IL)**

Month	Temperatures			Precipitation		
	Maximum	Minimum	Mean	Mean	High	Low
January	38.9	21.2	30.1	2.66	14.78	0.51
February	43.7	25	34.4	3.12	7.26	0.27
March	55.9	35.7	45.8	4.71	12.84	0.01
April	67.4	45	56.2	4.02	11.83	0.4
May	76.9	54.2	65.5	4.75	13.51	0.59
June	86.2	63.3	74.8	3.49	11.44	0.38
July	89.1	67.5	78.4	4.04	10.32	0.18
August	87.2	64.9	76.1	3.11	8.43	0.13
September	80.7	57.6	69.2	2.97	9.89	0.25
October	69.6	44.7	57.2	2.87	11.19	0.01
November	55.9	36.5	46.2	3.73	9.24	0.2
December	43.6	26.7	35.2	3.67	8.23	0.56
Annum	66.3	45.2	55.8	43.14	64	25.55

- Stream habitat in the mainstem is generally poor. This poor habitat is attributable to channelization for agricultural development and navigation. In 1853 the Wabash and Erie Canal extension was completed through Evansville, forming, at that time, the longest man-made waterway in the Western Hemisphere. The Wabash and Erie Canal crosses the watershed boundary at Francisco. In 1860, after only a few years of use, the southern part of the canal was abandoned, leaving Pigeon Creek without much of its natural meanders, pools or riffles.
- Today, Pigeon Creek is deemed by the Natural Resources Commission to be a navigable waterway from its mouth at the Ohio River upstream 15.8 river miles. Locust Creek, which enters Pigeon Creek one-half mile downstream of the Illinois Central Gulf Railroad Bridge, is also a navigable waterway for its first 1.5 miles. Portions of Little Pigeon Creek, Clear Creek and Baker Creek are also considered navigable waterways.
- Prior to settlement by European immigrants, much of the study area was wetland. Today, there are very few wetlands. There are 14,216 wetland acres in the watershed or about 6%. Table 2 shows acreage of wetlands in each subwatershed of the study area. Forested wetland is the dominant wetland type remaining in the Pigeon Creek watershed.

Table 2: wetlands

**WETLANDS (acres) IN THE STUDY AREA**  
(Source: Indiana GAP Project)

	Subwatershed	Wetland Forest	Wetland Woodland	Wetland Shrubland	Wetland Herbaceous	Wetland Sparsely Vegetated	Water	Percent
1	Pigeon - Locust Creek Lower	253	11	26	29	61	50	7%
2	Locust Cr Headwater	62	18	15	0	4.2	86	2.8%
3	Pigeon - Kleymeyer Park	162	9.8	20.9	3.5	19	19	5.6%
4	Harper Ditch	454	0	0	14	17.6	73	8.5%
5	Pigeon - Crawford Brandeis	117	0	2.5	0	0	61	3.1%
6	Weinsheimer Ditch	104	0	0	39	10.3	24	2.0%
7	Pigeon - Barnes Ditch	1,586	3.3	140	139	83	452	18.2%
8	Blue Grass Cr - D Wagner	125	0	0	2.8	0	106	5.5%
9	Firlick Ditch	138	0	0	4.5	0	15	3.8%
10	Stubbs Fruedenberg Ditch	115	0	0	27	8.0	27	4.5%
11	Schlesker Ditch	89	0	0	0	11.6	23	2.7%
12	Little Pigeon Creek	265	7.5	26	15	0	108	3.8%
13	Unnamd Trib to Blue Grass Cr	87	0	0	19	15.7	94	4.1%
14	Blue Grass Cr Headwaters	166	0	8.0	7.3	7.4	34	3.6%
15	Clear Branch	2,527	18	404	113	171	474	25%
16	Squaw Creek	529	3.2	79	92	141	355	14%
17	Big Creek - Little Creek	461	0	53	100	48	615	12%
18	Big Creek Headwaters	792	4.7	84	121	101	439	13%
19	Big Creek - Wye	1,056	3.7	191	50	52	31	19%
20	Smith Fork Headwaters	194	0	0	22	44	125	2.6%
21	Smith Fork - Halfmoon Creek	1,001	0	168	73	17.8	72	12.5%
22	Snake Run	448	0	1.7	10	4.5	6.9	3.3%
23	Hurricane Ditch Creek	102	3.1	0	3.0	0	20	1.2%
24	West Fork Creek	67	5.7	5.5	3.5	0	30	0.6%
25	Clear Fork Ditch	169	0	15	21	0	4.9	1.8%
26	Sand Cr - Muddy Fork Ditch	80	0	3.7	10.0	0	1.4	0.8%
	<b>TOTAL</b>	<b>11,149</b>	<b>88</b>	<b>1,243</b>	<b>920</b>	<b>816</b>	<b>3,347</b>	<b>7.5%</b>

- **Endangered Species**

The threatened and endangered species are protected under the Endangered Species Act (16 USC 1531 et seq.) of 1973. The goal of the act is to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved and to restore all listed species to the point where their numbers make them viable self-sustaining members of their ecological communities.

We contacted the DNR Division of Nature Preserves with a request for information on the presence of threatened or endangered species and high quality natural communities within the study area. Table 3 lists the threatened and endangered species for the Pigeon Creek watershed by county.

The Division of Nature Preserves also provided data on natural areas and communities in the watershed. These are listed below. These data do not include the recently opened 2,500-acre Blue Grass Fish and Wildlife Area near Elberfeld.

Table 3: endangered species

## THREATENED AND ENDANGERED SPECIES IN THE STUDY AREA

Type	Species	Common Name	Fed Status	State Status	County
Amphibian	<i>Cryptobranchus alleganiensis alleganiensis</i>	hellbender	**	SE	V
Bird	<i>Botaurus lentiginosus</i>	American bittern	**	SE	W, G
Bird	<i>Ixobrychus exilis</i>	least bittern	**	SE	W, G
Bird	<i>Ardea herodias</i>	great blue heron	**	**	W
Bird	<i>Nyctanassa violacea</i>	yellow-crowned night-heron	**	SE	W
Bird	<i>Circus cyaneus</i>	northern harrier	**	SE	W
Bird	<i>Buteo lineatus</i>	red-shouldered hawk	**	SSC	W, G
Bird	<i>Rallus elegans</i>	king rail	**	SE	G
Bird	<i>Rallus limicola</i>	Virginia rail	**	SE	W
Bird	<i>Bartramia longicauda</i>	upland sandpiper	**	SE	V
Bird	<i>Tyto alba</i>	barn owl	**	SE	W, G
Bird	<i>Asio flammeus</i>	short-eared owl	**	SE	W
Bird	<i>Thryomanes bewickii</i>	Bewick's wren	**	SE	G
Bird	<i>Cistothorus platensis</i>	sedge wren	**	SE	G
Bird	<i>Lanius ludovicianus</i>	loggerhead shrike	**	SE	V
Bird	<i>Dendroica cerulea</i>	cerulean warbler	**	SSC	W
Bird	<i>Helmitheros vermivorus</i>	worm-eating warbler	**	SSC	W
Mammal	<i>Taxidea taxus</i>	American badger	**	SE	G
Reptile	<i>Nerodia erythrogaster neglecta</i>	copperbelly water snake	LTNL	SE	W, G
Crustacean	<i>Orconectes indianensis</i>	Indiana crayfish	**	SSC	V
Insect	<i>Nicrophorus americanus</i>	American burying beetle	LE	SX	V
Insect	<i>Catocala marmorata</i>	marbled underwing moth	**	**	V
Plant	<i>Perideridia americana</i>	Eastern euphorus	**	SE	W
Plant	<i>Krigia oppositifolia</i>	dwarf dandelion	**	ST	V, W
Plant	<i>Catalpa speciosa</i>	Northern catalpa	**	SR	W
Plant	<i>Phacelia ramunculacea</i>	blue scorpion-weed	**	SE	V
Plant	<i>Juglans cinerea</i>	butternut	**	WL	G
Plant	<i>Rhexia mariana var mariana</i>	Maryland meadow beauty	**	SE	V
Plant	<i>Bacopa rotundifolia</i>	roundleaf water-hyssop	**	SE	W
Plant	<i>Vitis palmata</i>	catbird grape	**	SR	V
Plant	<i>Carex socialis</i>	social sedge	**	SR	W,V
Plant	<i>Nothoscordum bivalve</i>	crow-poison	**	SR	W
Plant	<i>Isoetes melanopoda</i>	blackfoot quillwort	**	SE	V

Notes: SSC=State Special Concern, ST=State Threatened, SE=State Endangered, SR= State Rare, WL= Watch Listed,  
LE=Federal Endangered, LTNL=Federal Threatened  
Counties: V=Vanderburgh, W=Warrick, G=Gibson

Table 4: natural areas

**NATURAL AREAS AND COMMUNITIES IN THE STUDY AREA**  
**(Source: DNR Division of Nature Preserves)**

Community	Counties
Wet-Mesic Floodplain Forest	V, G ,P
Dry-Mesic Upland Forest	W, G
Dry Upland Forest	G
Mesic Upland Forest	V

Notes: V=Vanderburgh, W=Warrick, G=Gibson P-Posey

- **Soils**

Soil associations in the study area are mapped on Figure 7. Most soils are silt loams that range from zero to 18% slopes. Within the Pigeon Creek watershed, there are 64,300 acres of highly erodible land, much of which is eroding well above “T”, the tolerable limit.

# Highland-Pigeon Watershed: Soils Associations (STATSGO)

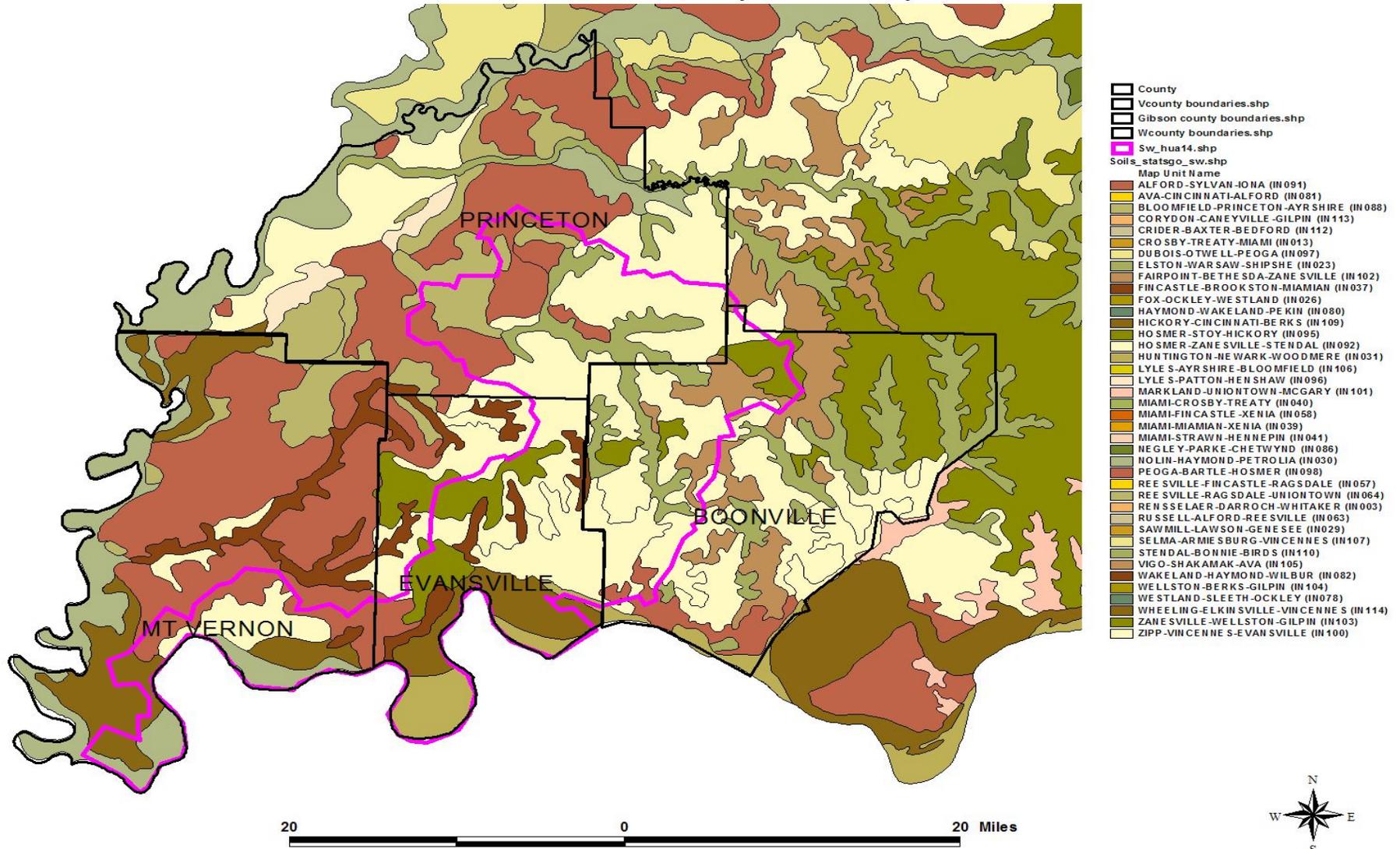


Figure 7: soil associations



- **Topography & Hydrology**

Land elevation in the study area ranges from about 340 feet at the Ohio River to 550 feet in some upper reaches of the watershed. Land is generally level in the Ohio River and Pigeon Creek bottomlands and terraces. While slopes are typically gentle, short lengths of slope may be up to 50% in certain upland areas.

The United States is divided and sub-divided into successively smaller hydrologic units. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to fourteen digits based on the multiple levels of classification in the hydrologic unit system. The fourteen-digit level of classification was available for the study area and supplied to Harza by Rick Obenshain, the watershed coordinator. There are 37 subwatersheds in the Highland-Pigeon watershed, and these are the spatial units of diagnostic study in this report. These subwatersheds are delineated in the map on the following page (Figure 8).



## Highland - Pigeon Watershed: 14 - digit HUC's & Subwatershed Names

1. Locust Cr. Lower 05140202040120
2. Locust Cr. Headwaters 05140202040110
3. Kleymeyer Pk. 05140202040100
4. Harper Ditch 05140202040080
5. Crawford-Brandeis Ditch 05140202040010
6. Weinsheimer Ditch 05140202030060
7. Barnes Dich 05140202030070
8. Wagner Ditch 05140202040060
9. Firlick Cr. 05140202040070
10. Stubbs-Freudenberg Ditch 05140202040040
11. Schensker Dich 05140202040050
12. Little Pigeon Cr. 05140202040090
13. trib. Blue Grass Cr. 05140202040030
14. Blue Grass headwaters 05140202040020
15. Clear Branch 05140202030040
16. Squaw Cr. 05140202030050
17. Big Creek-Little Cr. 05140202030020
18. Big Creek headwaters 05140202030010
19. Big Creek-Wye 05140202030030
20. Smith Fk. headwaters 05140202020060
21. Halfmoon Cr. 05140202020070
22. Snake Run 05140202020050
23. Hurricane Ditch 05140202020030
24. West Fk. Pigeon Cr. 05140202020040
25. Clear Fk. Pigeon Cr. 05140202020020
26. Sand Cr.-Muddy Fk. 05140202020010
27. Eagle Cr. 05140202010020
28. Carpentier Cr. 05140202050010
29. Bayou Cr. 05140202070020
30. Ohio River-Evansville 05140202010030
31. Logsdon-Stroud Ditch 05140202070010
32. Diamond Island 05140202070030
33. Cypress Slough-Dixon Ditch 05140202070040
34. McFadden Cr. 05140202070050
35. Beaverdam Cr. 05140202070060
36. Hovey ILk.-Bayou Drain 05140202070080
37. Little Pitcher Lk. 05140202100040

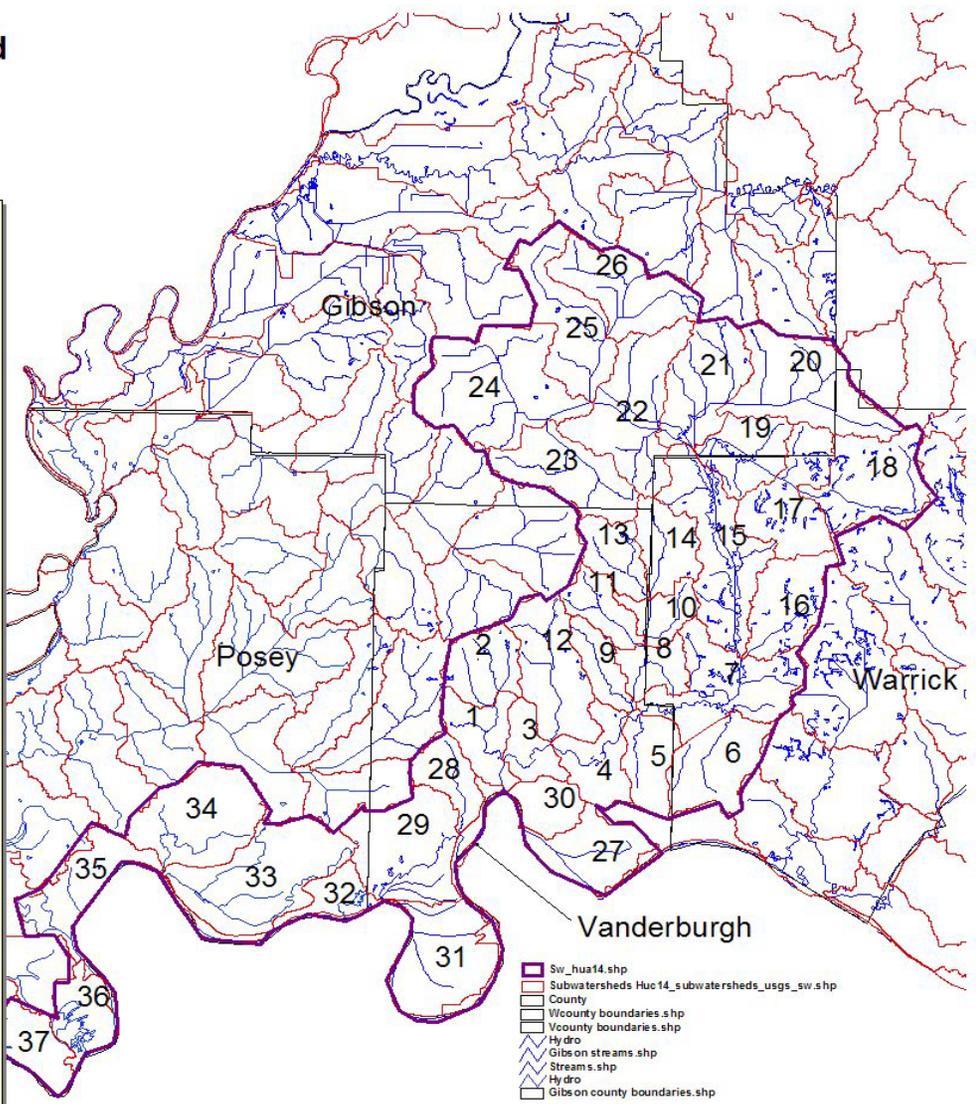


Figure 8: 14-digit subwatersheds

- Drainage

The Indiana statute at IC 36-9-27 contains the County Drainage Code. This law authorizes county drainage boards to regulate certain drains. The intent of this law is to increase the hydraulic efficiency of waterways and control upstream ponding and flooding. The county surveyor is the technical authority on the construction, reconstruction, and maintenance of all regulated drains or proposed regulated drains in the county. The County Drainage Code requires the county surveyor to classify regulated drains in the county as:

1. Drains in need of reconstruction;
2. Drains in need of periodic maintenance; or
3. Drains that should be vacated.

The county drainage boards across the state fund reconstruction and maintenance of regulated drains. Among the board's duties, as defined in the statute, is the reconstruction of regulated drains that do not properly function and may require erosion control or grade stabilization structures. An example project undertaken under this authority is the Gibson County Drainage Board's reshaping of nearly six miles of Pigeon Creek and West Fork in 2000. This project, while justified on the basis of flood control, exemplifies continued single objective management of water courses in the watershed and abuse of ecological consequences.

The County Drainage Code also offers opportunities for financing of watershed projects. We believe this regulatory vehicle is considerably underutilized in the state for environmental change due to the traditional use of these funds for drainage purposes only.

Since settlement by Europeans, the watershed landscape has been dramatically altered. Over the years, settler activities have changed the dynamic equilibrium of the creek and its upslope systems. The cumulative effect of these changes has been degradation of water quality, loss of floodplain storage, diminished wildlife populations, and decreased aesthetic and recreational values. We have recommended stream corridor restoration efforts in nearly all subwatersheds in the Pigeon Creek watershed. This restoration is a complex endeavor that begins with the recognition that human-induced changes that begun nearly two centuries ago have damaged the structure and function of the ecosystem and prevent the recovery of the watershed to a sustainable condition. These human-induced changes include:

- Creation of the Wabash and Erie Canal
- Channelization of first and second order streams to facilitate agricultural drainage
- Draining of wetlands
- Dredging, clearing and snagging of Pigeon Creek to reduce flooding
- Increased watershed imperviousness
- Mineral extraction and massive landscape alteration
- Loss and/or alteration of vegetative cover across the watershed
- Addition of nutrients and other pollutants to the streams

Among the net results of these alterations are:

- A watershed that is 100% impaired for aquatic life support due to poor physical habitat
- Poor water quality throughout the watershed
- High rates of soil loss
- Near extirpation of nine species of mussels

NRCS (1998) presents guidelines on restoration of stream riparian processes. The massive investment over the last 200+ years in separating the stream from its watershed will require a similar level of investment to reverse, but we believe that will prove economically attractive to do so. The economic benefits of environmental restoration can prove attractive, if the investments are well founded and prudent.

- Land Use

The City of Evansville was founded on March 27, 1812 by Colonel Hugh McGary. On January 7, 1818, Vanderburgh County was created. In 1837, the first cabinet-making shop and steam-powered sawmill opened, in anticipation of the completion of the Wabash and Erie Canal. By 1900, Evansville had over 300 iron, steel and woodworking companies and had become a center for furniture manufacturing. Automobile production and refrigerator manufacturing dominated the local economy by the mid 1920's. The effects of the Great Depression were lessened with the discovery of oil in the area in the early 1930's and the gearing up for World War II. In 1942, the Evansville Shipyard was established and factories were converted to build airplanes for the war effort. After the war the demand for automobiles, household appliances and farm equipment helped to maintain employment and create a network of industrial suppliers and service shops.

During the 1950's, many auto, refrigerator and stove manufacturers closed their doors or were sold, while other industrial concerns relocated to Evansville. Currently, Evansville is home to a large number of plastics related companies. Other notable companies are involved in pharmaceutical, aluminum sheet, food products, and home appliance production.

The Evansville IN-Henderson KY Metropolitan Statistical Area (MSA) consists of Vanderburgh, Posey, Warrick counties in IN and Henderson County, KY. The Evansville MSA ranks 114th in population nationwide. As a city, Evansville ranks 130th in the nation and is the 3rd largest city in the state of Indiana. The MSA has 120,962 households, while the city has 55,144 households. Evansville is a regional economic center, as evidenced by the location of three major hospitals, two full service universities and a vibrant retail and banking community. Evansville has a 1990 population of 126,272 person residing in 53,058 households. Other communities in the watershed include Chandler, Fort Branch, Haubstadt, and portions of Owensville and Princeton.

Evansville supplies its residents with drinking water from collection and treatment of surface water and ground water. Water service is provided to Evansville by the City's Water and Sewer Utility Department. Sources include the Ohio River and an auxiliary deep well. Filtration system capacity is 60.0 million gallons per day (mgd) to meet current peak demands of 35 mgd. The Evansville Water & Sewer Utility also operates two sewage treatment facilities with a capacity 38.6 mgd. Average daily wastewater flows are 28 mgd. EWSU uses a land application system to dispose of its sludge. While EWSU discharges treated wastewater to the Ohio River, many of the smaller upstream communities, as well as some industrial facilities, are permitted to discharge treated wastewater to Pigeon Creek.

Our land use/land cover data were derived from the Indiana GAP Project (1998). The interagency project, led by the U.S. Fish and Wildlife Service, used Landsat Thematic Mapper images to develop the land cover dataset. The images reflect 1994 conditions. About two-thirds of the study area is classified as agricultural lands. Urban land is approximately 4% of the watershed. A more detailed land use analyses was made of McFadden Creek subwatershed, which is 82% agriculture use.

Table 5: land use in Pigeon Creek watershed

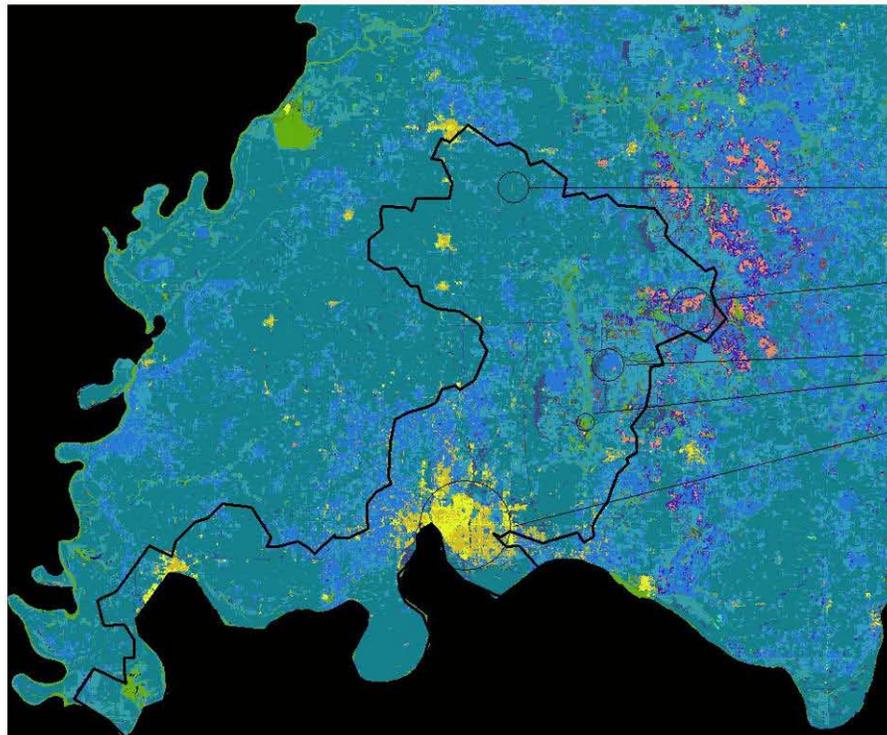
**LAND USE IN THE PIGEON CREEK WATERSHED**  
**(Source: Indiana GAP Project, 1998)**

Land Use	Area (ac)	Percentage
Other Non-vegetated	8,920	4%
Urban High Density	3,512	1%
Urban Low Density	7,335	3%
Agriculture Row Crop	113,055	48%
Agriculture Pasture/Grassland	46,728	20%
Shrubland	0	0%
Woodland	2315	1%
Forest Deciduous	32,106	14%
Forest Evergreen	1,354	0.6%
Forest Mixed	2,339	1%
Wetland Forest	11,149	5%
Wetland Woodland	88	0.04%
Wetland Shrubland	1,243	0.5%
Wetland Herbaceous	920	0.4%
Wetland Sparsely Vegetated	816	0.3%
Water	3,347	1%
Total	235,226	100%

Figure 9: land use/land cover



### Highland-Pigeon watershed: Land use/land cover (GAP Project)



Agriculture- grey

Mining- orange

Forest- lt. blue  
Wetlands- lt. green

Urban areas- yellow & tan

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- Evansville has developed into a center for manufacturing, warehousing, wholesaling and retailing, as well as insurance, finance and health services. The Evansville area is known for the production of appliances, nutritional products, pharmaceuticals, prepared foods, aluminum sheet and ingot processing, auto glass, coal and oil production, plastics including finished product, resins and pellets. The surrounding agricultural interests focus on production of corn, soybean and wheat.
- The Evansville area has a diversified economy. Total non-agricultural wage and salaried employment in the Evansville area has risen from 125,200 in 1984 to 138,700 in 1990, an increase of 10.8 percent. Manufacturing employment over the past ten years has decreased, but employment in the service economy has increased, paralleling a national trend.
- Public Lands: Two Indiana Dept. of Natural Resources managed preserves exist in Highland – Pigeon watershed: Hovey Lake, in southwestern Posey Co.; and Bluegrass Fish & Wildlife Area in northwestern Warrick Co., and several tracts of Classified Forest (see map next page- Figure 10)
- Agriculture: The study area depends upon agriculture for much of its well-being. Recent agricultural statistics show local agricultural trends following much of the State and the nation, that is, a trend towards fewer, but larger farms with greater returns. Under this trend, farms offer diminished employment opportunities and greater efficiency.

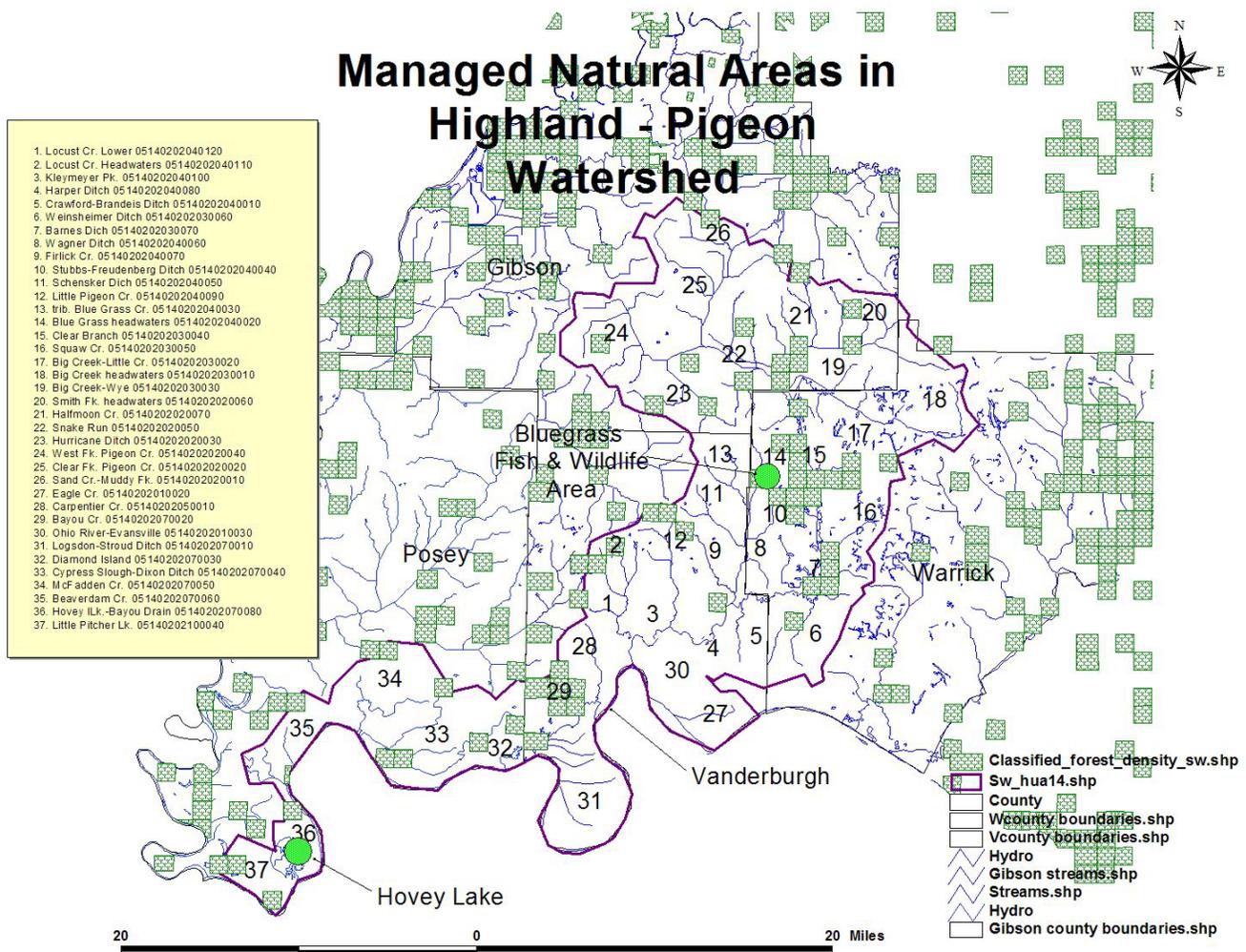


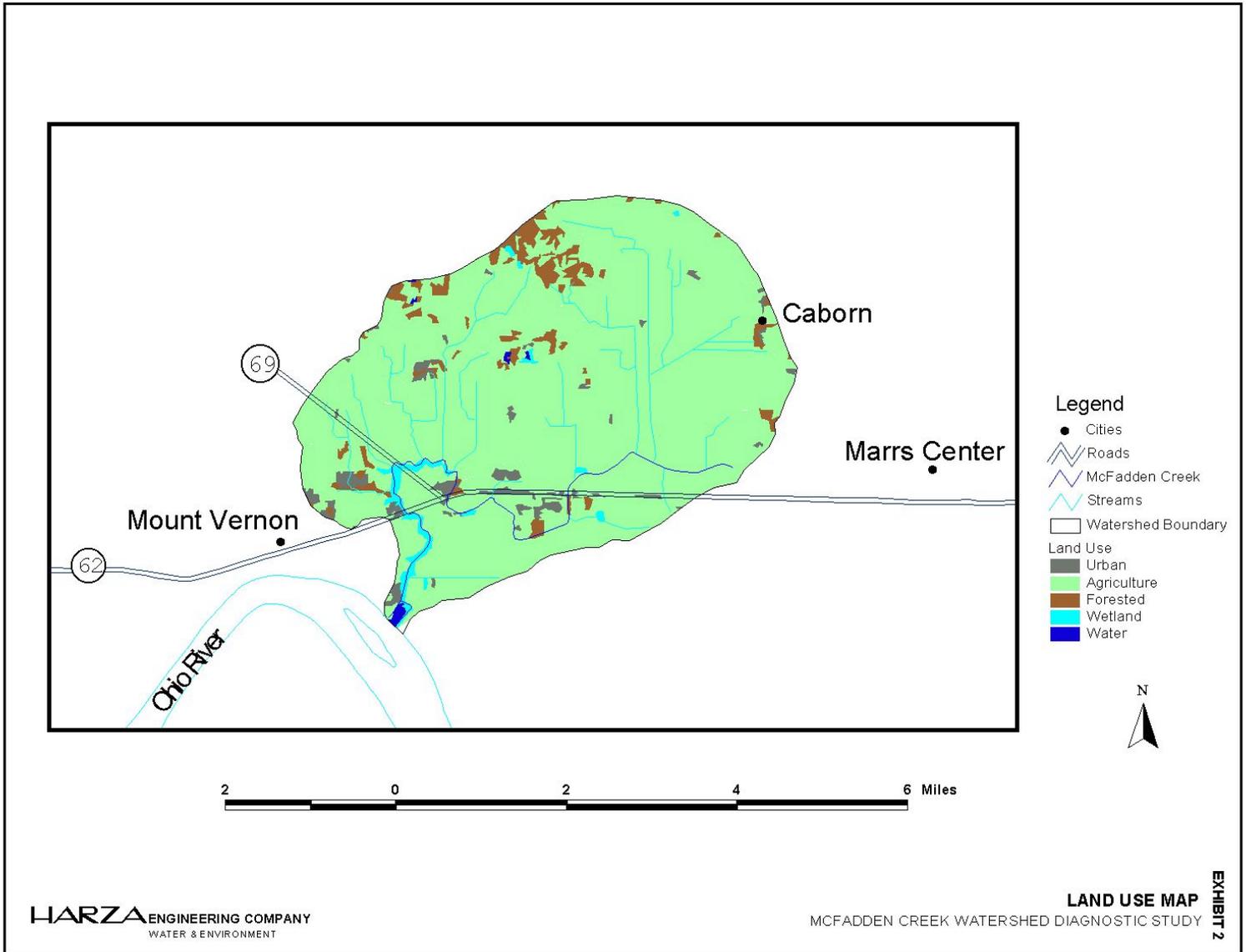
Figure 10: Managed natural areas

Table 6: Watershed Land Use-McFadden Creek

McFadden Creek Watershed

	Area (acres) percentage
Urban	191 1.6%
Agriculture Row Crop	9,815 82%
Agriculture Pasture/Grassland	1,070 8.9%
Upland Forest and Woodlands	534 4.4%
Wetland Forest and Woodlands	157 1.3%
Other Wetlands and Water	70 0.6 %
Other Non-vegetated	137 1.1%
Total	11,974

Figure 11: McFadden Cr. Watershed land use



- Current and Past Conservation Efforts in watershed:

Several conservation efforts are currently in place in the watershed. The USDA programs, including the Conservation Reserve Program (CRP) and Environmental Quality Incentives Program (EQIP), have seen an increase in applicants and practices established in the Highland – Pigeon watershed over the past four years. This increase can be attributed to the efforts of Pigeon-Highland Watershed Steering Committee coordinator, Rick Obenshain. Obenshain was instrumental in contacting agricultural landowners, and encouraging them to install Best Management Practices (BMP's). Cost share was available through an IDEM Section 319 grant for BMP's, with the result being: 41 acres of filter strip, 5.8 ac. field border, 7 grassed waterways, 1.6 ac. of trees, 2275 ft. of fencing, 1 pipe structure, 2 livestock watering systems, 1 compost pad, 7 water & sediment control basins (WASCoB's) and 1.2 acres of wildlife habitat. Many more practices were installed through CRP and EQIP, using USDA cost share. With the end of IDEM Section 319 grant, ARN 00-86, funding will cease for Obenshain's position, leaving no one to "sell" conservation in the watershed. Natural Resource Conservation Service (NRCS) employees, who have the technical responsibility for CRP and EQIP, do not have time to actively solicit participation in these programs. Fortunately, landowners who have had success with BMP's have become the best sales tool, and new participants are signing up due to this peer influence. See Appendix G for "Conservation Practices Installed 1999-2002".

A Lake and River Enhancement (LARE) program is in effect in the McFadden Creek subwatershed (#34). Funded by Indiana Dept. of Natural Resources, using the money generated through boat registrations, the program has been highly successful. See Appendix G for maps.

A previous LARE grant was in effect for Smith Fork-Halfmoon Ditch subwatershed in the mid-1990's. Some work remains to be done there, however, as a large swine operation- the only livestock in the subwatershed- continues to cause water quality problems. The SW Regional Office of IDEM has been attempting to work with the owner to rectify the situation.