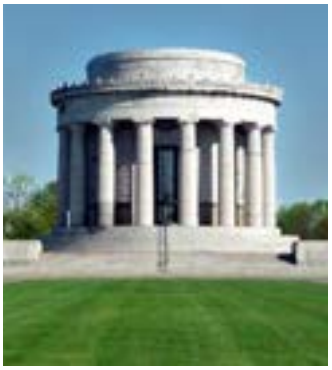
Water Quality Characterization Report

Stormwater Quality Management Plan

Prepared for: City of Vincennes



Indiana Department of Environmental Management
Municipal Separate Storm Sewer System (MS4)
General Permit (INR040034)

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Professional Consulting and Design Services

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CHAPTER 1 - INTRODUCTION

This report presents the Water Quality Characterization Report (WQCR), as required by the Municipal Separate Storm Sewer System General Permit for the City of Vincennes, under the Indiana Department of Environmental Management (IDEM) Permit Number INR040034, effective December 18, 2021. Permit language outlining the requirements for this portion of the MS4 permit are as follows:

GENERAL PERMIT COVERAGE
MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4)

3.0 WATER QUALITY CHARACTERIZATION
A MS4 entity must characterize the water quality of all known waters that receive stormwater outfall discharges from the MS4 area. The characterization must begin with the receiving waters identified in the notice of intent (NOI) submittal, and, as additional receiving waters are identified, the characterization may be expanded to further develop program goals.

3.1 Water Quality Characterization Report

(a) The water quality characterization report (WQCR) shall use the most current data available but may also consider additional data that describes the chemical, biological, and/or physical condition of the receiving waters of the MS4 jurisdictional area.

(b) If monitoring is conducted as part of the characterization, the monitoring of receiving waters shall be either at, or in proximity to stormwater outfalls.

(c) The WQCR must include:

(1) An assessment of land use.

(2) An inventory of MS4 owned/operated structural stormwater management measures that are operated for purpose of stormwater quality, stormwater management, and flood control, including an identification number, geographic coordinate, and structural condition.

(3) Identification of all receiving waters that receive discharges from outfalls within the MS4, including wetlands and lakes.

(4) Any 303d listed impaired waters or TMDLs for receiving waters need to be identified.

(5) Identification of known sensitive areas including, but not limited to public swimming areas, drinking water intakes, habitats associated with threatened or endangered species, and outstanding state and national resource waters.

(6) A review and summary of existing and available monitoring data of the MS4 receiving waters, including, as applicable, data that can be correlated from stream reach characterization and evaluation reports (SRCER).

(7) Identification of areas that have a reasonable potential for or are actually contributing to stormwater quality problems based on available land use and complaint information and relevant chemical, biological, and physical data.

(8) An evaluation of data collected to determine which areas or specific discharge points that may need to be considered for future planning and implementation of new stormwater measures or modification of existing measures. The highest priority should be given to sensitive areas and the prohibition of new or significantly increased MS4 discharges.

The purpose of this report is to provide a baseline “snapshot” of the water quality of the City of Vincennes’ receiving streams and to evaluate the City’s Municipal Separate Storm Sewer System (MS4) area to determine where Best Management Practices (BMPs) may need to be targeted. The evaluation includes an investigation of land use, identification of sensitive areas, potential areas of concern, and a review of existing and available monitoring data.

This report is organized based on the requirements set forth in the MS4 General Permit:

- *Chapter 1: Introduction*
- *Chapter 2: Land Use* – Provides an assessment of land use within the boundaries of the MS4.
- *Chapter 3: MS4 Operated BMP Inventory* – Provides a summary of MS4 owned or operated structural stormwater management measures operated for the purpose of stormwater quality, stormwater management, and flood control.
- *Chapter 4: Receiving Waters* – provides a summary of receiving waters that receive discharge from MS4 owned outfalls.
- *Chapter 5: 303(d) List of Impaired Waterways* – Provides a list of any impaired waterways and regulated Total Maximum Daily Load (TMDLs) for the receiving waters.
- *Chapter 6: Sensitive Areas* – Provides identification of any sensitive areas including swimming areas, drinking water intakes, habitats associated with threatened/endangered species, and outstanding state and national resource waters.
- *Chapter 7: Monitoring Data* – Provides a summary of data sources used in the Baseline Characterization.
- *Chapter 8: Baseline Conclusions* – Identification of areas with a reasonable potential for or are contributing to stormwater quality problems based on land use, complaint information, and monitoring data.
- *Chapter 9: Evaluation* – Provides a discussion of areas or discharge points which may be the focus of future planning and implementation of stormwater measures.

CHAPTER 2 - LAND USE

General Information on the City of Vincennes MS4 Area

The City of Vincennes is located in western Knox County along the Wabash River. The population of Vincennes is 16,631 (2021 Census). Land use in Vincennes is comprised of mostly of single family residential. Major commercial corridors are located along 6th Street, Main Street, Hart Street, and Willow Street. The older downtown area of Vincennes is in the Robeson Pond – Wabash River Watershed, which drains directly to the Wabash River. A large portion of the City (approximately southern half) is located in the headwaters of the England Ditch – Wabash River and Swan Pond Ditch Watersheds. The initial receiving stream in the Swan Pond Ditch Watershed is an intermittent stream named Oliphant Ditch. The northeast portion of Vincennes is drained by Kelso Creek. The majority of the Snapp Creek – Kelso Creek Watershed drains agricultural areas outside of the City of Vincennes. A small portion of Vincennes drains to Snapp Creek, which joins Kelso Creek near the Wabash River.

The City of Vincennes does not have existing land use maps. Therefore, a generalized land use map was created by using the Knox County 2022 aerial imagery. Field reconnaissance was also conducted to verify land use. The following categories of land uses were assigned:

- Residential
- Commercial/Retail
- Institutional (hospital, schools, etc.)
- Industrial
- Parks

The land use classifications were provided for large tracts of contiguous land use. Individual parcels of commercial or institutional land uses that are scattered in residential areas were not identified. Figure 2-1 shows the land use map that was developed and used in the baseline characterization. The areas that are not shaded are primarily residential.

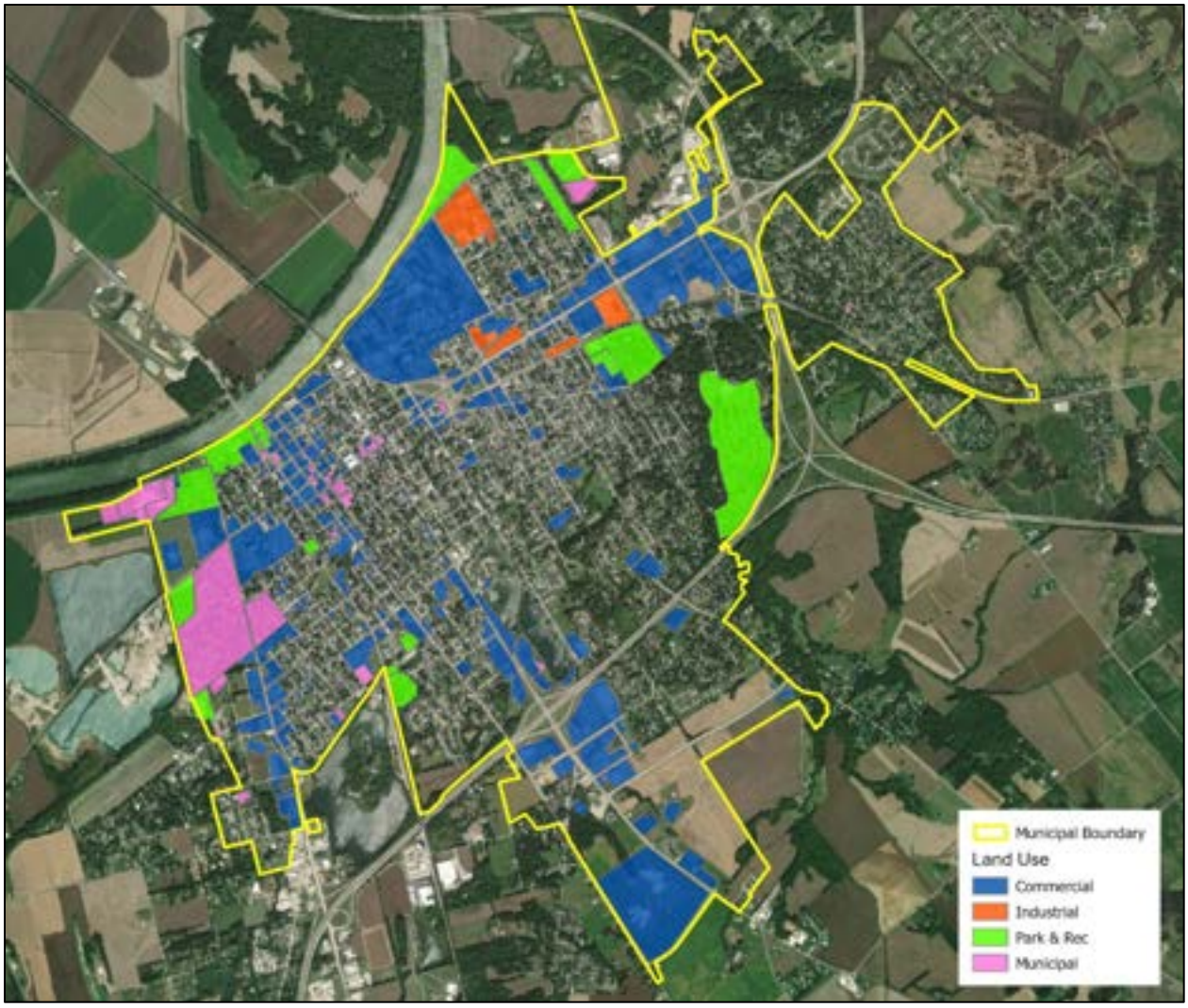

Figure 2-1. Land Use Map

2.1 ROBESON POND – WABASH RIVER WATERSHED

The total drainage area of the Robeson Pond – Wabash River watershed is 11,515.7 acres (18.0 mi.^{2}). The eastern portion of this watershed (approximately 50 percent) contains primarily residential land use. Other land uses in the watershed include Kimmell Park (along the Wabash River), two industrial areas (one across from Kimmell Park and one on 6th Street), Vincennes University (commercial land use on Figure 2-1), and a portion of the downtown commercial/business district. Figure 2-2 shows the portion of the City of Vincennes that contributes to stormwater runoff within the Robeson Pond – Wabash River watershed. The Vincennes municipal boundary is outlined in yellow, the Robeson Pond – Wabash River watershed is outlined in blue, and the portion of the City of Vincennes that is within the Robeson Pond – Wabash River watershed is displayed with a red hatch.

Figure 2-2. Vincennes Portion of Robeson Pond – Wabash River Watershed

2.2 SNAPP CREEK – KELSO CREEK WATERSHED

The Kelso Creek watershed drains the east/northeast portion of Vincennes (see Figure 2-3). The total drainage area of the Kelso Creek – Snapp Creek watershed is 15,261.2 acres (23.8 mi.^{2}). The City of Vincennes contributes approximately 1.8 mi.^{2} of this watershed (7.6 percent of the total). Most of the watershed is located upstream from Vincennes. Figure 2-3 shows the portion of the City of Vincennes that contributes to stormwater runoff within the Snapp Creek – Kelso Creek watershed. The Vincennes municipal boundary is outlined in yellow, the Snapp Creek – Kelso Creek watershed is outlined in blue, and the portion of the City of Vincennes that is within the Snapp Creek – Kelso Creek watershed is displayed with a red hatch. Figure 2-4 shows the approximate drainage divide between Kelso Creek and Snapp Creek as well as the locations where stream water quality samples were collected by others.

East of U.S. 41, land use in the Vincennes portion of this watershed is residential. West of U.S. 41, north and south of 6th Street, land use is predominately commercial with some industrial. There is a private golf course, Cypress Hill, located between Kelso Creek and U.S. 41. Land use in the watershed upstream from Vincennes is predominantly agricultural with scattered residential areas and a few forested tracts of land.

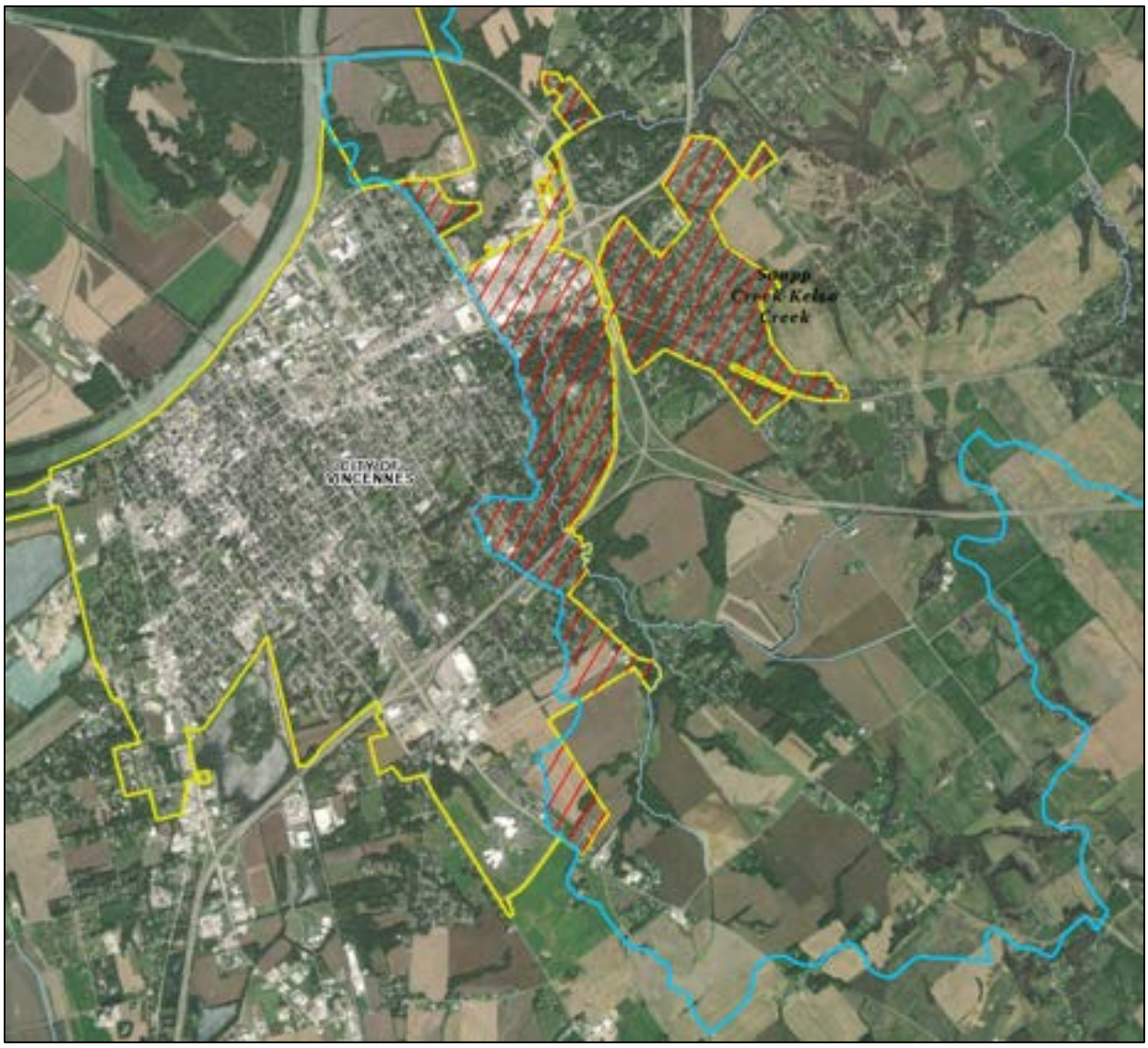

Figure 2-3. Vincennes Portion of Snapp Creek – Kelso Creek Watershed

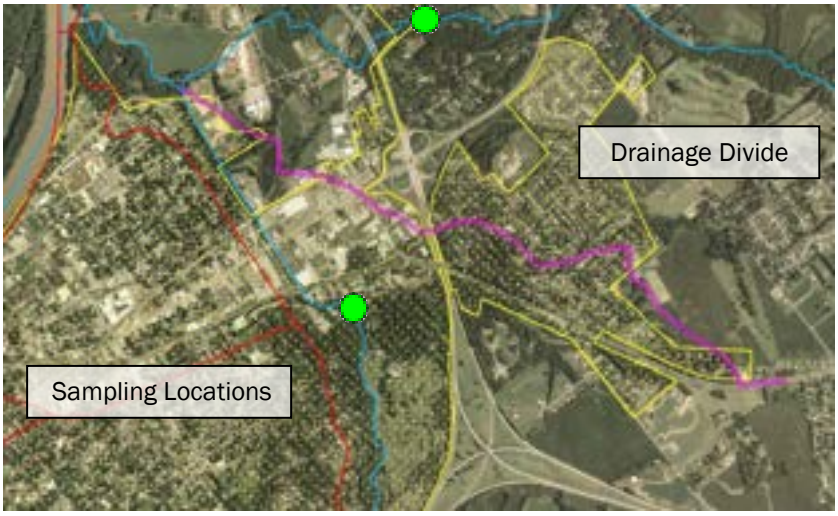

Figure 2-4. Drainage Divide and Sampling Locations – Kelso Creek and Snapp Creek

2.3 SWAN POND DITCH WATERSHED

A large portion of central and southern Vincennes MS4 area is located in the headwaters of the Swan Pond Ditch watershed. The initial receiving stream is Oliphant Ditch. This ditch was not identified in the original NOI because it did not appear in the National Hydrography Database. The ditch serves more as an MS4 conveyance. The ditch flows between Mirror Lake and the adjacent lake to the south and discharges into a third lake (former gravel pit). The discharge from this lake is into Mantle Ditch, which flows south into Swan Pond Ditch. The McKinley Avenue basin was constructed near the headwaters of Swan Pond Ditch and helps to alleviate flooding in this area by increasing the detention time of stormwater runoff prior to entering Swan Pond Ditch. Swan Pond Ditch flows south, discharging into the lower end of River Deshee, which flows into the Wabash River (approximately 19 miles downstream from Vincennes). The total drainage area of the Swan Pond Ditch watershed is 18,749.5 acres (29.3 $mi.^2$). The City of Vincennes MS4 area contributes approximately 2.7 $mi.^2$ of this watershed (9.2 percent of the total). Figure 2-5 shows the portion of the City of Vincennes that contributes to stormwater runoff within the Swan Pond Ditch watershed. The Vincennes municipal boundary is outlined in yellow, the Swan Pond Ditch watershed is outlined in blue, and the portion of the City of Vincennes that is within the Swan Pond Ditch watershed is displayed with a red hatch.

Land use in the Vincennes MS4 area of the Swan Pond Ditch watershed is primarily residential, except for a commercial corridor along Hart Street north and south of the interchange with U.S. 41. There is also a small industrial area and some park areas in this MS4 area as well. Downstream of Vincennes, the Swan Pond Ditch watershed is almost entirely agricultural land use.

Figure 2-5. Vincennes Portion of Swan Pond Ditch Watershed

2.4 ENGLAND DITCH – WABASH RIVER WATERSHED

The western portion of Vincennes MS4 area discharges into the headwaters of the England Ditch – Wabash River Watershed. The initial receiving stream is the City Ditch. Like Oliphant Ditch in the Swan Pond Ditch watershed, City Ditch serves more as an MS4 conveyance. In fact, the open ditch does not begin until the western edge of the City limits. Upstream of that point, the ditch has been enclosed (this is not reflected on USGS or State GIS maps). City Ditch flows southerly, discharging into the Wabash River approximately 9.8 miles downstream from Vincennes. The total drainage area of the England Ditch – Wabash River Watershed is

18,427.7 acres (28.8 mi.^{2}). The City of Vincennes MS4 area contributes approximately 1.2 mi.^{2} of this watershed (4.2 percent of the total). Figure 2-6 shows the portion of the City of Vincennes that contributes to stormwater runoff within the England Ditch – Wabash River watershed. The Vincennes municipal boundary is outlined in yellow, the England Ditch – Wabash River watershed is outlined in blue, and the portion of the City of Vincennes that is within the England Ditch – Wabash River watershed is displayed with a red hatch.

Land use in the Vincennes MS4 area of the England Ditch – Wabash River Watershed includes a large portion of the downtown Vincennes business district (commercial, offices, retail, etc.); a large institutional land use (hospital); commercial areas along Willow Street south of the railroad; and isolated industries (see Figure 2-1 for specific land use locations). The remainder of the Vincennes MS4 area of this watershed is residential except for several cemeteries located north of the commercial area along Willow Street. Immediately downstream of the Vincennes MS4 area are an industry and an automobile junk yard. Further downstream the watershed is almost entirely agricultural land use.

Figure 2-6. Vincennes Portion of England Ditch – Wabash River Watershed

CHAPTER 3 - MS4 OPERATED BMP INVENTORY

Structural BMPs in the Vincennes regulated area are somewhat limited. The existing lakes in Vincennes provide some settling of suspended solids in stormwater that discharges into these lakes. Oliphant Ditch drains into a large lake located outside of the City of Vincennes. The outlet from this lake is Mantle Ditch, which flows south and joins Swan Pond Ditch. This lake, though located outside of the City of Vincennes also provides conditions suitable for settling of suspended solids and associated pollutants from stormwater runoff attached to the solids. Similarly, the new vegetated basin near McKinley Avenue also accomplishes these benefits.

City Ditch is a very flat ditch which acts as a conveyance for stormwater. The ditch flows to a pump station and in high flow conditions, holds water within its banks until the pump can adequately expel the water. Low velocities and minimal slope both promote settling and cause City Ditch to act as a structural BMP.

The City of Vincennes requires vortex units in association with water quality requirements for new development. These structural units remove sediment, oil, and floatables from stormwater and can be found in several locations throughout the City. Non-structural BMPs included buffers located along certain stream segments.

3.1 ROBESON POND – WABASH RIVER WATERSHED

There are no structural stormwater BMPs in the Robeson Pond – Wabash River Watershed within the City of Vincennes. The watershed is mostly river-front and downtown development area as well as a portion of Vincennes University. Vincennes University is now regulated by the IDEM under its own MS4 General Permit. Kimmell Park, previously owned by the City is now under the ownership of Vincennes University (VU). Therefore, the City no longer has control over the vegetation and function of this park. There are several swirl units upstream of the City storm sewer located within the VU campus. These help to settle out pollutants and sediment prior to discharging into the City system. Vincennes University has incorporated pervious pavement throughout their campus to help remove pollutants from stormwater runoff and promote infiltration. Additionally, City MS4 staff communicate frequently with VU staff about street sweeping and winter salt applications. Since the VU campus approaches 50% of the City footprint and maintains their own streets, the City uses this opportunity to encourage the campus to implement BMPs.

3.2 SNAPP CREEK – KELSO CREEK WATERSHED

There are no structural stormwater BMPs in the Snapp Creek – Kelso Creek Watershed. Non-structural BMPs include a tree buffer and forested wetlands located along Kelso Creek, particularly the reach between U.S. 41 and the commercial area along 6th Street and in areas downstream of 6th Street.

3.3 SWAN POND DITCH WATERSHED

One structure that could be considered a BMP is the lake that Oliphant Ditch discharges into. This lake, though located outside of the City of Vincennes, provides conditions suitable for settling of suspended solids and associated pollutants from stormwater runoff attached to the solids. Similarly, the McKinley Avenue basin, located between McKinley Avenue, North 14th Street, and Wheeler Road, at the head of Swan Pond Ditch provides both stormwater quality and quantity benefits.

There is some vegetation along the banks of Oliphant Ditch. Some sections of the ditch appear to have been channelized for drainage purposes.

The City of Vincennes has also begun using green infrastructure practices as the opportunity arises. The Clark Middle School in Vincennes was the first LEED Certified education facility in the state of Indiana. The project incorporated various green infrastructure techniques both inside the building and throughout the site. Additionally, the City has installed and maintains a rain garden at the Rainbow Beach City Pool. The City continues to be receptive to green infrastructure techniques with future development to reduce pollutants, sediment, and quantity of runoff entering adjacent receiving streams.

3.4 ENGLAND DITCH – WABASH RIVER WATERSHED

There are no structural stormwater BMPs in the Vincennes MS4 portion of the England Ditch – Wabash River Watershed.

There is some vegetation along the banks of City Ditch downstream of the Vincennes MS4 area. The ditch appears to have been straightened and channelized, likely for agricultural drainage purposes.

CHAPTER 4 - RECEIVING WATERS

The City's MS4 area covers 7.2 square miles and is drained by five receiving streams located in four watersheds. Table 4-1 lists the 12-digit Hydrologic Unit Code (HUC) watersheds and corresponding receiving streams. Figure 4-1 illustrates this information on an aerial photo of the Vincennes area. The City limits are shown in yellow, watershed boundaries in blue, and receiving streams in purple.

Table 4-1. Vincennes Watersheds and Receiving Streams

Watershed Name	12-digit HUC	Receiving Waterbody
England Ditch – Wabash River	051201130201	Wabash River, City Ditch
Snapp Creek – Kelso Creek	051201111902	Kelso Creek, Snapp Creek
Swan Pond Ditch	051201130202	Mantle Ditch
Robeson Pond – Wabash River	051201111903	Wabash River

Figure 4-1. Watershed and Receiving Stream Locations

4.1 ROBESON POND – WABASH RIVER WATERSHED

Runoff from the Robeson Pond – Wabash River Watershed discharges directly into the Wabash River via the City's MS4.

4.2 SNAPP CREEK – KELSO CREEK WATERSHED

Snapp Creek is mostly located outside of the municipal boundary of Vincennes. Kelso Creek runs along the eastern side of the City. These two receiving streams converge and drain into the Wabash River.

4.3 SWAN POND DITCH WATERSHED

Two man-made lakes (former gravel pits) are located in the Swan Pond Ditch watershed north of U.S. 41 and east of Hart Street. The north lake is approximately 27 acres in surface area and is referred to as Mirror Lake. The south lake is approximately 22.4 acres in surface area and referred to as Indian Lake. Mantle Ditch runs between the two lakes. The lakes are shown in Figure 4-2.

Figure 4-2. Mirror Lake

4.4 ENGLAND DITCH – WABASH RIVER WATERSHED

The England Ditch – Wabash River watershed is mostly located outside of the municipal boundary of the City Vincennes. Runoff from the City's MS4 area discharges into the City Ditch stream. The City Ditch stream converges with the Wabash River approximately 10 miles southwest of Vincennes' City Limits.

CHAPTER 5 - 303(d) LIST OF IMPAIRED WATERWAYS

The Indiana Department of Environmental Management (IDEM) Office of Water Quality (OWQ) develops Indiana's 303(d) List of Impaired Waters as part of the state's Integrated Water Monitoring and Assessment Report (IR). This report is submitted to the U.S. EPA every two years, per the requirements of the Clean Water Act (CWA). CWA Section 305(b) requires states to make water quality assessments and provide water quality reports that identify any waters that do not meet or are not expected to meet applicable state water quality standards. Once a list and ranking of impaired waters is completed, states are required to develop Total Maximum Daily Loads (TMDLs) for these waters to achieve compliance with the water quality standards.

Each watershed within the Vincennes' MS4 boundary has been assessed to determine if any of the receiving waters are on the 2022 303(d) List of Impaired Waters and if any of these waters have developed a TMDL. If so, the water has been identified along with the listed impairment. Each section also includes the relevant impairment definition, per IDEM language.

> *"A Clean Water Act Section 303(d) listed impaired water is a waterbody that is impaired or threatened and needs a TMDL restoration plan. Once a waterbody is placed on the threatened and impaired waters list, it becomes one of many inline for evaluation and development of a plan for solving the problems."*

5.1 ENGLAND DITCH – WABASH RIVER WATERSHED

The England Ditch – Wabash River Watershed (051201130201) contains ten waterbodies, only one of them are within the Vincennes' MS4 Boundary – City Ditch. The City Ditch is not included on the 2022 303(d) List of Impaired Water Bodies. Additionally, there are no waterbodies with an approved TMDL plan within the City's MS4 area of the England Ditch – Wabash River Watershed.

Source: https://mywaterway.epa.gov/community/051201130201/overview

5.2 ROBESON POND – WABASH RIVER WATERSHED

The portion of the Robeson Pond – Wabash River Watershed (051201111903) within the City of Vincennes' MS4 Boundary includes the Wabash River, which is on the 2022 303(d) List of Impaired Waters. Additionally, the Wabash River has a *TMDL* plan approved in 2006 by the EPA.

Table 5-1. Robeson Pond – Wabash River Watershed 303(d) Listing (2022)

Waterbody	Identified Issue
Wabash River	Bacteria and Other Microbes
Wabash River	Degraded Aquatic Life
Wabash River	Mercury
Wabash River	Metals
Wabash River	PCBs
Wabash River	Pesticides

Source: https://mywaterway.epa.gov/community/051201111903/overview

Definitions

Bacteria and Other Microbes

Bacteria and other microbes (pathogens) are potentially disease-causing organisms from human or animal waste that enter water from faulty septic systems, sewage discharges, farm and feedlot manure runoff, boat discharges, and pet waste. People can become ill by eating contaminated fish or shellfish or swimming in waters with high levels of these microbes.

Degraded Aquatic Life

Degraded aquatic life (impaired biota) means that the biological community normally expected in a lake, stream or other waterway is unhealthy, much reduced, or absent, and the exact pollutant cause is not known.

Mercury

Mercury occurs naturally in rocks and coal. Airborne mercury is converted in water by bacteria into a toxic form called methyl-mercury which accumulates in the food-chain. Mercury can build up in fish, which then poses health risks to people and animals that eat fish. Spills and improper treatment and disposal of mercury containing products or wastes are among other top sources of mercury in water.

Metals

Metals can enter waterways from factories, mining, and runoff from urban areas, as well as from natural processes such as erosion of soil and rocks. At high levels, metals such as arsenic, cadmium, chromium, copper, lead, selenium, and zinc can be toxic to aquatic animals and humans.

PCBs

PCBs, or polychlorinated biphenyls, are a group of man-made organic chemicals with a range of toxicity. Although manufacturing of PCBs was banned in the U.S. in 1979, PCBs are long-lasting in fish tissue and in bottom-sediments of rivers and lakes. PCBs in fish that are eaten by humans and wildlife can build up and may have cancer-causing and other health effects. PCB contamination has caused many fishing bans and warnings.

Pesticides

Pesticides, such as herbicides and insecticides, include a variety of chemicals used to manage unwanted pests or weeds. In water, pesticides can affect the health of aquatic insects, fish, plants, and animals exposed through feeding or contact.

5.3 SWAN POND DITCH

The Swan Pond Ditch Watershed (051201130202) contains eight waterbodies, only one of them is within the Vincennes' MS4 Boundary – Mantle Ditch. The Mantle Ditch is not included on the 2022 303(d) List of Impaired Water Bodies. Additionally, there are no waterbodies with an approved TMDL plan within the City's MS4 area of the Swan Pond Ditch Watershed.

Source: https://mywaterway.epa.gov/community/051201130202/overview

5.4 SNAPP CREEK – KELSO CREEK

Waterbodies within the Snapp Creek – Kelso Creek Watershed (051201111902) within the Vincennes' MS4 Boundary include Kelso Creek and Snapp Creek. Both waterbodies are listed on the 2022 303(d) List of Impaired Waters. Additionally, there are no waterbodies with an approved TMDL plan within the City's MS4 area of the Snapp Creek – Kelso Creek Watershed.

Table 5-2. Snapp Creek – Kelso Creek Watershed 303(d) Listing (2022)

Waterbody	Identified Issue
Kelso Creek	Degraded Aquatic Life
Snapp Creek	Degraded Aquatic Life

Source: https://mywaterway.epa.gov/community/051201111902/overview

Definitions

Degraded Aquatic Life

Degraded aquatic life (impaired biota) means that the biological community normally expected in a lake, stream or other waterway is unhealthy, much reduced, or absent, and the exact pollutant cause is not known.

CHAPTER 6 - SENSITIVE AREAS

Sensitive waters include public swimming areas, surface water drinking intakes, waters containing threatened or endangered species and their habitat, or State outstanding resource and exceptional use waters.

Although there are no specifically designated public swimming areas, the Wabash River offers opportunity for outdoor activities including fishing, boating, swimming, and water skiing. Access to the Wabash River in Vincennes can be made at Vincennes University's Kimmell Park.

Vincennes obtains its drinking water from wells. Hence, there are no surface water intakes used for drinking water.

Threatened or endangered species are listed on the *U.S. Fish & Wildlife Service* and on the *Indiana Department of Natural Resources Endangered, Threatened & Rare Species* websites. Federal Endangered species in Knox County include the Indiana Bat, several Mussel types – including the Fat Pocketbook, the American Burying Beetle, and the Whooping Crane. The State list has numerous Stoneflies, Mussels, Beetles, Mayflies, Insects, Fish, Amphibians, Reptiles, Birds, Mammals, and Plants listed as endangered or threatened. As shown on Figure 6-1, the Eastern Fanshell Pearly Mussel and Fat Pocketbook Mussel are identified in the Wabash River at Vincennes.

The Tier 1 Draft Environmental Impact Statement for the I-69 Evansville-to-Indy Study (*http://www.i69indyevn.org/*) included a review of endangered and threatened species for the Route Alternative 1, which followed the U.S. 41 corridor in Vincennes. Figure 6-1 is an excerpt from this report showing Federal endangered or threatened species in the Vincennes area. Figure 6-2 is an excerpt showing the State listed endangered or threatened species.

State Exceptional Use Water classifications are found in 327 IAC 2-1-11(b). Outstanding State Resource Water classifications (also designated as "high quality waters") are found in 327 IAC 2-1-2(3) and 327 IAC 2-1.5-19(b). None of the receiving streams in Vincennes are listed as Exception Use or Outstanding Resource waters (*verified during 2022 update*).

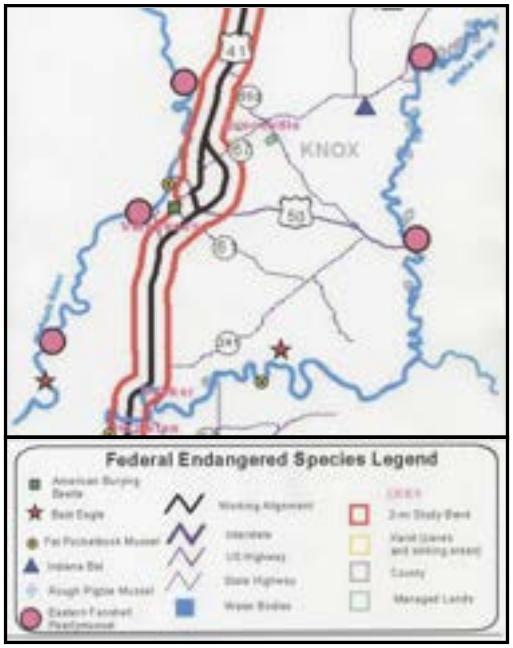

Figure 6-1. Federal Endangered Species

Figure 6-2. Federal/State Listed Species

6.1 ROBESON POND – WABASH RIVER WATERSHED

Kimmell Park is located along the Wabash River, just downstream from the confluence of Kelso Creek / Snapp Creek with the Wabash River (see Figure 6-3, Figure 6-4, and Figure 6-5). Opportunities exist for boating, fishing, water skiing and swimming. There is no specifically designated public swimming area.

As shown in Figure 6-1 of this report, the Wabash River provides habitat for two Federal endangered species, the Eastern Fanshell, Pearl Mussel and Fat Pocketbook Mussel.

Figure 6-3. Kimmell Park Aerial View (2022)

Figure 6-4. Kimmell Park at Wabash River Looking Downstream (2022)

Figure 6-5. Kimmell Park at Wabash River Looking Upstream (2022)

6.2 SNAPP CREEK – KELSO CREEK WATERSHED

There are no sensitive waters in this watershed as defined in the IDEM regulation.

There are several wetlands (mostly forested wetlands) that provide wildlife habitat and help filter stormwater pollutants. Wetland areas in the Snapp Creek – Kelso Creek Watershed are shown as green shaded areas on Figure 6-6. Wetland source was obtained in 2022 from the *National Wetland Inventory (NWI) of the U.S. Fish and Wildlife Service (USFWS)*.

Figure 6-6. Wetland Areas in Snapp Creek – Kelso Creek Watershed

6.3 SWAN POND DITCH WATERSHED

There are no sensitive waters in this watershed as defined in the IDEM regulation.

There are several wetlands in this watershed, most of which are lakes, created as part of area gravel pit operations. Wetland areas in the Vincennes portion of the Swan Pond Ditch watershed are shown as green shaded areas on Figure 6-7. Wetland source was obtained in 2022 from the *National Wetland Inventory (NWI) of the U.S. Fish and Wildlife Service (USFWS)*.

Figure 6-7. Wetland Areas in Swan Pond Ditch Watershed

6.4 ENGLAND DITCH – WABASH RIVER WATERSHED

There are no sensitive waters in the England Ditch – Wabash River Watershed as defined in the IDEM regulation. There are no wetlands in the Vincennes MS4 portion of the England Ditch – Wabash River Watershed.

CHAPTER 7 - MONITORING DATA

Several data sources were used to conduct the baseline characterization. Baseline characterization data was requested from several local, State, and Federal agencies. The letters sent to these agencies requested existing available water quality on Vincennes MS4 receiving streams. The agencies and the associated type of data requested are as follows:

- IDEM – Biological Studies (biological data)
- IDEM – Survey (surface water chemical data)
- IDEM – Environmental Toxicology & Chemistry (TMDL sampling)
- IDEM – Environmental Toxicology & Chemistry (biomonitoring toxicity reviews)
- IDEM – Watershed Management (local watershed water quality data)
- Indiana DNR – Division of Fish & Wildlife (fish survey information)
- Indiana DNR – L.A.R.E. Program (water quality data)
- Knox County Soil & Water Conservation Department (KCSWCD) (water quality data)
- Knox County Health Department (water quality and E. coli parameter data)
- IDEM – Rule 6 Coordinator (industrial dischargers list)
- Army Corps of Engineers – Louisville District (water quality or sediment data)
- U.S. Environmental Protection Agency (water quality data)

The Hoosier Riverwatch website (*http://www.HoosierRiverwatch.com*) was queried to retrieve any available stream water quality or habitat quality data from the volunteer monitoring database. The United States Geological Survey (USGS) website (*http://in.water.usgs.gov*) was also reviewed to identify any applicable data.

Receiving stream data was received from the IDEM Assessment Branch (biological studies and survey sections). The following data sets were received:

- Monthly (approximately) sampling results for chemistry, metals, organics, and pesticides for the Wabash River for the period 1990 through 2002;
- Macroinvertebrate data for Snapp Creek (two samples – November 1993 and September 1999);
- Sediment and fish tissue data from the Wabash River in August 1989;
- Fish tissue data from the Wabash River at Vincennes in July 1999; and
- Fish Community Assessment in September 1999 (downstream of Vincennes).

The Hoosier Riverwatch program provided data (chemical, biological, and habitat) for Kelso Creek near Washington Avenue. A total of eight sampling events were conducted over the period of March 2001 through December 2003. The volunteer group that performed the sampling was from Rivet Middle/High School.

Additional monitoring data was obtained from the Knox County Soil and Water Conservation District (KCSWCD) for the Snapp Creek – Kelso Creek watershed. The KCSWCD has obtained grant funding through the Indiana Department of Environmental Management (IDEM) to conduct monthly surface water monitoring throughout the Snap Creek – Kelso Creek watershed and the Smalls Creek watershed. This project began in May of 2022 and will continue for a year and a half. A summary of the of monitoring results have been included in the Snapp Creek – Kelso Creek watershed portion of this section.

Industrial facilities whose stormwater runoff is exposed to manufacturing and processing activities are required to obtain the proper IDEM stormwater discharge permits. Regulated industries must prepare a Stormwater

Pollution Prevention Plan specific to their site and collect grab stormwater samples from qualified rainfall events each year of their permit. Stormwater runoff associated with Industrial activity was previously managed under IDEM Rule 6. While IDEM no longer refers to this program as Rule 6, IDEM is transitioning their resources to an Industrial Stormwater Permitting program. The City will continue to utilize IDEM and City resources to maintain a current list of industrial dischargers within the Vincennes MS4 Boundary. Table 7-1 lists the facilities regulated under the previously known Rule 6 program in the Vincennes area. Figure 7-1 shows a map of the facility locations. As the IDEM Industrial Stormwater Permitting Program is developed, Vincennes will update the City database and map accordingly.

Table 7-1. IDEM Rule 6 Facilities

Permit #	Facility Name	Facility Address
INR140055	Packaging Corporation of America	408 East St. Clair Street
INR210010	Schott Gemtron Corporation	2000 Chestnut Street
INR600035	Dumes Incorporated	1640 North Sixth Street
INR200317	Wabash Steel Corporation	2007 Oliphant Drive
INR220077	Hixson Lumber Sales	700 Fulton Glass Road

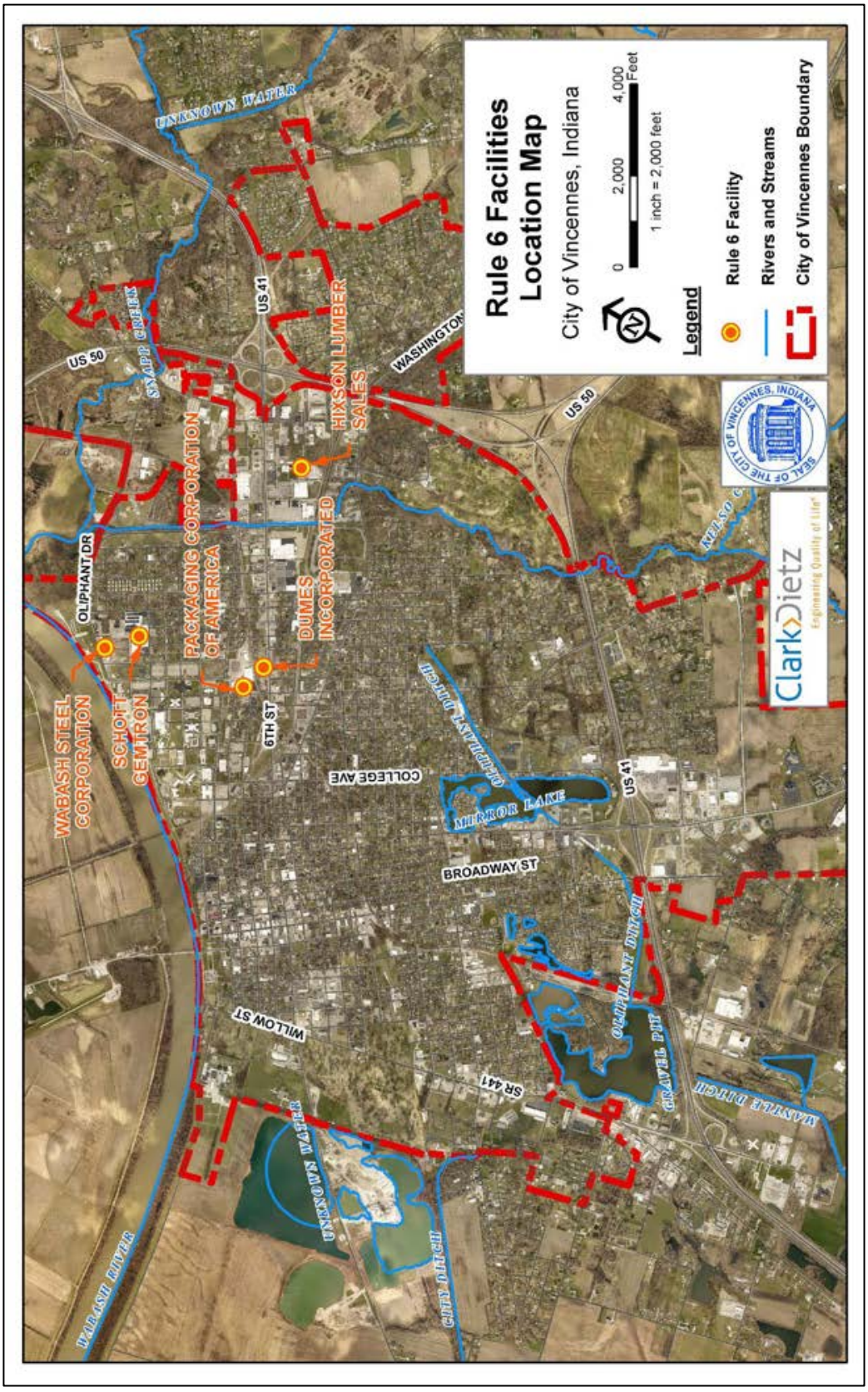

Figure 7-1. Location Map: IDEM Rule 6 Regulated Facilities

A field reconnaissance was performed along Vincennes's receiving streams. Photographs were taken along the stream corridor to visually characterize stream conditions. Aerial photos were also reviewed to identify general land use and assess the condition of the riparian corridor. Land use was also verified through field reconnaissance.

Water quality results were compared to typical values found in various references. Where possible, conclusions were drawn from the data. For streams with no water quality data, visual characterization was performed.

Comparative data was used to assist in the evaluation of existing water quality data on Vincennes receiving streams. Several references were used to identify comparative data:

- Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPS, Metropolitan Washington Council of Governments, July 1987.
- Urbanization and Water Quality: A Guide to Protecting the Urban Environment, Terrene Institute, March 1994.
- Polluted Urban Runoff: A Source of Concern, University of Wisconsin-Extension, 1997.
- Watershed Protection Techniques Vol. 3, No. 1, Microbes and Urban Watersheds: Concentrations, Sources, & Pathways, Center for Watershed Protection, April 1999.
- Stormwater Magazine: The Journal for Surface Water Quality Professionals, The ABCs of Water-Quality Assessment in Georgia, March/April 2002.
- National Management Measures to Control Nonpoint Source Pollution from Urban Areas – Draft, U. S. Environmental Protection Agency, July 2002.
- "Watershed Diagnostic Study and Management Plan: Smalls Creek, Kelso Creek / Snapp Creek and Robertson Pond Watersheds, Knox County, IN" – Study is ongoing, results not currently available. Study being performed by Vincennes University and the KCSWCD.

Table 7-2 summarizes typical values found in the literature for various pollutants found in stormwater runoff. IDEM also publishes guidance for interpreting aquatic life support for various biological tests (Indiana Integrated Water Quality Monitoring and Assessment Report, 2002). Table 7-3 presents these IDEM criteria. This information can be used to identify outliers and target follow up BMPs.

Table 7-2. Water Quality Comparative Data

Parameter	Units	Typical Wet Weather Values Reported in Literature
BOD	mg/l	12 (1)
COD	mg/l	91 (1)
Nitrogen, Kjelhdahl	mg/l	2.35 (1)
Nitrogen, Nitrate	mg/l	0.96 (1)
Nitrogen, Ammonia	mg/l	0.26 - 1.1 (2)
Nitrogen, Total	mg/l	3.31 (1)
Nitrogen, Organic	mg/l	1.25 (3)
Phosphorus, Dissolved	mg/l	0.16 (1)
Suspended Solids	mg/l	100 (4)
Dissolved Solids	mg/l	N/R
E. coli	/100 ml	11,000 (5)
Fecal Streptococcus	/100 ml	35,000 (5)
Chromium, Hex	mg/l	0.007 (6)
Phenol	mg/l	0.008 - 0.115 (6)
Copper	mg/l	0.047 (1)
Nickel	mg/l	0.012 (6)
Zinc	mg/l	0.176 (1)

Notes:

(1) Nationwide Urban Runoff Program. 2300 monitored storms at 22 sites across the nation. US EPA 1983.

(2) Range is for newer suburban sites and older urban areas, as reported by Metropolitan Washington Council of Governments, 1987.

(3) Newer suburban sites, as reported by Metropolitan Washington Council of Governments, 1987.

(4) U. S. EPA database for general urban runoff.

(5) Center for Watershed Protection database of 34 recent urban stormwater monitoring studies, 1999.

(6) Metro Seattle as reported in Fundamental of Urban Runoff Management: Technical and Institutional Issues, Terrene Institute, 1994.

Table 7-3. IDEM Criteria for Aquatic Life Support

Parameter	Fully Supporting	Partially Supporting	Not Supporting
Benthic aquatic macroinvertebrate Index of Biotic Integrity (mIBI)	mIBI > 4	mIBI < 4 and > 2	mIBI < 2
Qualitative Habitat Use Evaluation (QHEI)	QHEI > 64	QHEI < 64 and > 51	QHEI < 51
Fish Community (IBI) (Lower Wabash)	IBI > 32		IBI < 32

Oxygen Demand (BOD and COD)

BOD and COD are measures of the amount of oxygen used by macroinvertebrates and bacteria in processing organic matter in streams. Organic matter comes from both natural and human sources. Natural sources include riparian vegetation like leaves falling in the stream. Human sources might include sewage, pet wastes, nutrients from fertilizers, and litter. High BOD levels result in low dissolved oxygen in streams, which in turn degrades water quality and lowers diversity of aquatic organisms. Typically, BOD levels from 3 to 5 mg/l are considered moderately clean. Levels below 3 mg/l are considered very clean.

Nutrients (Phosphorus and Nitrogen)

Excess nutrients can cause extensive algal growth which can in turn cause eutrophication, which in turn increases BOD. Phosphorus comes from several sources, including human wastes, animal wastes, industrial wastes, fertilizers, and human disturbance of land. Ammonia nitrogen is often found in areas where duck and geese excretions are high. Human sewage, caused by failing septic systems and illegal sanitary sewer cross-connections, is a source of nitrates. Fertilizers and runoff from animal feedlots and barnyards are also important sources of nitrates (and ammonia). Concentrations of nitrate above 10 mg/l are a concern and may warrant actions to identify and limit inputs into the receiving streams.

Sediment

Typical urban runoff values for total suspended solids (TSS) are around 100 mg/l. High concentrations of suspended sediment in streams cause many adverse impacts. Suspended solids change the color of streams from nearly clear to red-brown. High turbidity causes streams to lose their ability to support diverse aquatic organisms. Suspended solids can also directly impact aquatic life in terms of clogging fish gills, reducing growth rates and decreasing resistance to disease. Excessive sediment deposited in the stream bed can prevent egg and larvae development. The leading sources of sediment in existing urban areas are industrial sites, commercial development and freeways. But by far the highest loads of sediment come from areas under construction. Construction sites have high erosion rates and high delivery rates. Typical erosion rates for construction sites are 35 to 45 tons per acre disturbed per year compared to 1 to 10 tons per acre per year for cropland. The delivery rate of sediment is also much higher in construction sites as compared to cropland because ditches and sewers are typically constructed in the first phase of a site development project. Typically 50% to 100% of soil eroded from a construction site is delivered to a lake or stream, compared to only 3% to 10% of the soil from cropland delivered to lakes or stream.

Bacteria (E. coli and Fecal Streptococcus)

Literature on national averages reports a mean E. coli value of approximately 11,000 counts/100 ml in urban runoff. Bacteria are indicators of the presence of fecal wastes in surface waters. Escherichia coli (E. coli) is in the coliform family of bacteria. Fecal streptococci (also known as Entercocci) are another bacteria group found in feces. Coliform bacteria are only an indicator of a potential public health risk, and not an actual cause of disease. Coliform bacteria are also used by most states as a standard for drinking water, shellfish

consumption or water contact recreation. Indiana uses E. coli as its standard (235 counts/100 ml for water contact recreational use of a stream).

The Center for Watershed Protection (see reference previously listed) developed a database of 34 more recent monitoring studies for bacteria. For E. coli, the group mean was reported to be almost 11,000 counts/100 ml. Nearly every individual stormwater runoff sample exceeded bacteria standards. Bacteria sources in urban watersheds include human sources and non-human sources. Human sources include those caused by combined and sanitary sewer overflows, illegal sanitary connections to storm drains, transient dumping of wastewater, and failing septic systems. Most bacteria present in stormwater runoff are generally assumed to be of non-human origin, unless there are inappropriate human sewage discharges present in an urban watershed. Non-human sources include dogs, cats, raccoons, rats, beaver, geese, ducks, pigeons and other animals. Geese, ducks, and gulls are also speculated to be a major bacterial source in urban areas, particularly at lakes and stormwater ponds where large resident populations become established. Relatively little data is available to quantify whether geese and ducks are a major source. Livestock can also still be a major source of bacteria.

Trace Metals

Trace metals can be a concern because of their toxic effects on aquatic life, and their potential to contaminate drinking water supplies. Sources of metals include roofing materials, downspouts, galvanized pipes, metal plating, paints, wood preservatives, catalytic converters, brake linings, and tires. The most common metals found in urban runoff are lead (has been declining since unleaded gas has been implemented), cadmium, copper, and zinc. The primary source of many metals in urban runoff is vehicle traffic. Concentrations of zinc, cadmium, chromium and lead appear to be directly correlated with the volume of traffic.

Organic Compounds

Like trace metals, organic compounds are also of particular concern because of their potential for toxicity to aquatic life. Phthalate, chlorinated hydrocarbons (found in pesticides and wood preservatives), and polynuclear aromatic hydrocarbons (PNAs) are the most commonly found organics in stormwater runoff. Synthetic organics represent a very large and diverse category of chemicals. They include hundreds of specialized products for industrial and commercial uses and compounds produced incidentally through chemical reactions. Examples of the latter group are the PNAs, by-products of fossil fuel combustion, which appear in vehicle exhausts and lubricants and smoke-stack emissions.

7.1 ROBESON POND – WABASH RIVER WATERSHED

The Indiana Integrated Water Quality Monitoring and Assessment Report – Appendix B: Site Specific Water Body Assessments (IDEM 2002) lists the Wabash River as partial support for fish consumption, and full support for primary contact (recreation). Cause (stressor) ratings are moderate for PCBs and lead and slight for Mercury.

The IDEM Assessment Branch provided data on chemistry, metals, organics, and pesticides for the Wabash River at Vigo Street (Old U.S. 50) Bridge, for the period of 1990 through 2002 (samples taken approximately monthly). This site is identified in the IDEM reports as FSITE WB-130 and *LSITE WBU200-0003*. During the 2022 report update, additional water quality results were obtained for some of the parameters for site WBU200-0003 for an additional time after 2002 until 2022. New water quality results are shown below in bold italics. The following observations were drawn from a review of the data:

E. coli

- A total of 90 E. coli sample results were reported.

- Sample values ranged from 10 to 5900 cfu/100ml (cfu = colony forming units).
- 54 samples were below 235 cfu/100ml (standard for total body contact).
- 10 samples were above 1000 cfu/100ml.

Turbidity

- ***A total of 228 Turbidity sample results were reported.***
- ***Sample values ranged from 5.86 NTU to 729 NTU.***

Total Dissolved Solids

- Sample values ranged from 242 mg/l to 505 mg/l.
- Most of the values were in the 300 to 400 mg/l.
- All sample values were less than the State standard of < 750 mg/l.
- ***A total of 259 Total Dissolved Solids sample results were reported.***
- ***Sample values ranged from 227 mg/L to 505 mg/l.***

Nitrate + Nitrite

- Sample values ranged from 0.1 mg/l to 0.4 mg/l.
- All sample values were less than State standard of < 10 mg/l
- ***A total of 52 Nitrate + Nitrite sample results were reported.***
- ***Sample values ranged from 0.5 mg/L to 5.8 mg/l.***

Biological Oxygen Demand (BOD)

- A total of 64 samples were reported.
- Sample values ranged from 1 mg/l to 11 mg/l.
- 38 of the 64 sample values reported were less than 4 mg/l (a value considered to be good for a receiving stream).
- ***A total of 104 Total Biological Oxygen Demand sample results were reported.***
- ***Sample values ranged from 1 mg/L to 11 mg/l.***

Dissolved Oxygen

- The average of the 171 sample values was 10.3 mg/l.
- One value was reported less than 5 mg/l (State standard). This value was 4.7 mg/l taken on July 14, 1999.
- ***A total of 270 Dissolved Oxygen (DO) sample results were reported.***
- ***Sample values ranged from 4.74 mg/L to 18.5 mg/l.***

pH

- pH generally ran in the 7s and 8s.
- The average pH was in the low 8s.
- All values were within the 6 to 9 range (acceptable range for a receiving stream).
- ***A total of 271 pH sample results were reported.***
- ***Sample values ranged from 6.73 to 9.1.***

Other Parameters

- Pesticides were detected in sampling completed in the spring and summer of 1999. All five pesticides that were tested (Acetochlor, Atrazine, Cyanazine, Metolachlor, and Simazine) were detected at least once. Atrazine was the most commonly detected pesticide.
- Detected metals included arsenic, iron, lead, chromium, copper, manganese, mercury, nickel, selenium, and zinc.

Older data (hard copy printouts) on sediment and fish tissue were obtained from the IDEM Assessment Branch. In 1989, sediment and fish tissue data were collected both upstream and downstream from Vincennes. Samples were generally tested for metals, pesticides, PCBs and other parameters (selected samples). The concentrations of metals in the sediment samples were significantly higher (more than 50 percent on average) downstream of Vincennes as compared to the sediment samples collected upstream of Vincennes.

For fish tissue, three species (channel catfish, carp, and freshwater drum) were tested for cadmium, lead, mercury and pesticides. Lead levels measured downstream of Vincennes were higher for all three species as compared to samples collected upstream of Vincennes. Mercury was lower for all three species and pesticides were mixed (some higher, some lower).

Fish tissue testing was also conducted in 1999 for catfish and freshwater drum species. Comparing the 1999 data to the 1989 data, the following observations were made:

Catfish

- Lead levels dropped by 75 percent
- Pesticides levels were significantly lower than in 1989.
- Mercury dropped by 36 percent.

Freshwater Drum

- Lead levels dropped by 61 percent.
- Pesticides were generally slightly higher than in 1989.
- Mercury dropped by 13 percent.

A Fish Community Assessment was also performed by the IDEM Assessment Branch in September of 1999. The location was at the Wabash River at Henderson Road (IDEM LSITE WBU200-008), which is approximately 4.5 miles downstream from Vincennes. The total score for habitat was 60 (maximum possible score is 100). According to IDEM habitat criteria, this would indicate Partially Supporting (QHEI < 64 and > 51). The Fish Community Index of Biotic Integrity (IBI) score was 40 (maximum possible score is 60). IDEM criteria list IBI > 32 as Fully Supporting for the Lower Wabash River.

After incorporating 2022 monitoring data, the results appear fairly consistent with those obtained from 2002 and earlier. This indicates that water quality is not degrading at a noticeable rate. Vincennes will continue to monitor any changes and use this information as a guide to help drive future BMPs in the area.

7.2 SNAPP CREEK – KELSO CREEK WATERSHED

In December of 2021, The Indiana Department of Environmental Management (IDEM) approved The Quality Assurance Project Plan as put forth by the Knox County Soil and Water Conservation District (KCSWCD). The grant funding allows the KCSWCD to monitor water quality within the Snapp Creek – Kelso Creek and the Smalls Creek Watersheds. Monthly monitoring began in May of 2022 and will continue for 1.5 years. Sampling parameters include: temperature, dissolved oxygen, pH, flow, turbidity, conductivity, salinity, and total dissolved solids. KCSWCD has partnered with Vincennes University and the Vincennes Water Utility labs to process the collected water samples.

Of the twenty (20) sampling sites throughout the two watersheds, six (6) of them are within the Vincennes MS4 Boundary. See Table 7-4 for a list of KCSWCD monitoring sites with the Vincennes' MS4 boundary. KCSWCD

publishes a map of sampling locations (*https://tinyurl.com/5n88upmx*) and maintains a publicly available Stream Monitoring Data Log (*https://tinyurl.com/y38j9kjv*).

Table 7-4. KCSWCD Monitoring Sites within Vincennes' MS4 Boundary

Site ID	Stream Name	Latitude	Longitude	Location
SK-13	Kelso Creek	38.69852224	-87.5097771	VU sample site by VU baseball field
SK-14	Kelso Creek	38.66290603	-87.4868234	HWY 61 Lift Station
SK-15	Kelso Creek	38.6873565	-87.4879524	Lakewood Subdivision (past Alvis)
SK-16	Kelso Creek	38.69501282	-87.4984524	Vincennes Industrial
SK-17	Kelso Creek	38.68655439	-87.4973414	Washington Ave. @ Harmony Park
SK-18	Snapp Creek	38.70262661	-87.5050594	Lower Ft. Knox by Ford Sawmill & RR tracks

As part of the 2022 update for the Vincennes Water Quality Characterization Report, monitoring data for the KCSWCD Quality Assurance Project Plan was reviewed and has been integrated in the results of the existing water quality parameters listed below. At the time of this report update, the KCSWCD has conducted monthly monitoring from May – November of 2022. Any observations obtained from the 2022 KCSWCD monitoring program that have been added to this report have been summarized in a table under each parameter section. The monitoring results table includes the tested parameter with units and a range of results from each monitoring site for this additional data. If applicable, observations of these results follow the table and can be identified by a bold italicized font.

The Indiana Integrated Water Quality Monitoring and Assessment Report – Appendix B: Site Specific Water Body Assessments (IDEM 2002) lists Kelso Creek – Snapp Creek as full support for aquatic life.

A volunteer group (Rivet Middle/High School) sampled Kelso Creek as part of the *Hoosier Riverwatch program*. The sampling was performed downstream of the private golf course (see Figure 7-2). The sampling was performed three times in 2001, two times in 2002, and three times in 2003. Monitoring occurred once in 2004 and was discovered during the 2010 revisions of this document. It was confirmed during the 2022 report update that no additional monitoring efforts have occurred at this site. Any changes in values are described below in each section. The following observations were drawn from a review of the data:

E. coli

- Sample values ranged from 400 to 5,100 cfu/100ml.
- 2004 sample value was 25 cfu/100ml.

Table 7-5. KCSWCD Monitoring Results for E. coli (May – November 2022)

Parameter	SK-13	SK-14	SK-15	SK-16	SK-17	SK-18
E. coli (MPN/100 mL)	63 - 457	613 - 3255	187 - 1607	144 - 1046	132 - 6131	160 - 350

Note: New results are measured in MPN (Most Probable Number) instead of cfu (colony forming units). While the origin of their results are different, they are thought to be equivalent and both units measure the estimated number of bacteria in a water sample.

Turbidity

- Turbidity ranged from 10 to 83 NTUs (NTU = nephelometric turbidity units).
- Four of the six samples were in the 10.1 – 40 NTU range, which is considered good for a receiving stream.

Table 7-6. KCSWCD Monitoring Results for Turbidity (May – November 2022)

Parameter	SK-13	SK-14	SK-15	SK-16	SK-17	SK-18
Turbidity (NTU)	0.2 - 7.0	1.2 - 8.5	1.0 - 14.3	0.7 - 3.9	1.1 - 5.2	1.6 - 4.9

Nitrate Nitrogen

- Sample values ranged from 0.4 mg/l to 32 mg/l.
- Three samples were greater than 10 mg/l (State standard).
- Samples exceeding 10 mg/l were sampled on 09/30/01, 12/23/01, and 03/30/03.

Table 7-7. KCSWCD Monitoring Results for Nitrate (May – November 2022)

Parameter	SK-13	SK-14	SK-15	SK-16	SK-17	SK-18
Nitrate (mg/L)	0.9 – 1.7	0.3 – 1.8	0.0 – 0.9	0.6 – 1.1	0.8 – 1.5	0.1 – 1.1

Biological Oxygen Demand (BOD)

- Sample values ranged from 2.5 mg/l to 4 mg/l.
- 2004 sample value was 1.17 mg/l.
- Values less than 4 mg/l are considered to be good for a receiving stream.
- ***Parameter not included in KCSWCD 2022 monitoring program***

Dissolved Oxygen

- Sample values ranged from 7 to 14 mg/l.
- 2004 sample value was 12.67 mg/l.
- All values above State water quality standard of 5 mg/l.

Table 7-8. KCSWCD Monitoring Results for Dissolved Oxygen (May – November 2022)

Parameter	SK-13	SK-14	SK-15	SK-16	SK-17	SK-18
Dissolved Oxygen (mg/L)	5.15 – 11.9	5.62 – 11.63	2.14 – 9.8	8.26 – 13.93	7.08 – 13.12	6.26 – 12.26

pH

- Sample values ranged from 7.9 to 9.8 pH units.
- 2004 sample value was 8.3 pH units.
- Two values exceeded 9 (6 to 9 is acceptable range for a receiving stream).

Table 7-9. KCSWCD Monitoring Results for pH (May – November 2022)

Parameter	SK-13	SK-14	SK-15	SK-16	SK-17	SK-18
pH	7.07 – 8.52	7.25 – 8.38	7.09 – 8.83	7.21 – 9.24	7.07 – 8.70	7.16 – 8.87

Total Phosphate

- Sample values ranged from 0.15 to 1 mg/l.
- Most values were in what is considered to be the "fair" range (0.17 to 0.58 mg/l).
- ***Parameter not included in KCSWCD 2022 monitoring program***

Citizens Qualitative Habitat Evaluation Index (CQHEI)

- CQHEI scores ranged from 34 to 50.5 with an average of 45.4.
- 2004 CQHEI score was 45.
- Hoosier Riverwatch does not list criteria as to how the CQHEI scores should be interpreted. For IDEM, a QHEI score of less than 51 is considered not supporting.
- Scores for Substrate (bottom type) measurement varied considerably, from 0 to 14 (maximum score is 24).
- The highest relative score was received for the Stream Forests and Wetlands (Riparian Areas) measurement.
- Figure 7-2 and Figure 7-3 show photographs of the creek in the vicinity of where the CQHEI was completed.

Figure 7-2. Kelso Creek Looking Downstream from CQHEI Site

Figure 7-3. Kelso Creek Looking Upstream from CQHEI Site

Table 7-10. KCSWCD Monitoring Results for CQHEI (May – November 2022)

Parameter	SK-13	SK-14	SK-15	SK-16	SK-17	SK-18
CQHEI Score	45	53	49	34	56	54

The IDEM Assessment Branch performed macroinvertebrate sampling on Snapp Creek at an iron bridge upstream of U.S. 50 (see Figure 2-4). The site is listed as IDEM LSITE WBU200-0005. The sampling was performed on November 4, 1993 and September 1, 1999. The November 1993 data showed a Benthic Aquatic Macroinvertebrate Index of Biotic Integrity (mIBI) score of 1.6 and a Qualitative Habitat Evaluation Index (QHEI) score of 43. The September 1999 data showed a mIBI score of 5.4 and a QHEI score of 42.

According to the IDEM criteria shown in Table 7-3 of this report, the stream was not supporting for macroinvertebrate aquatic life in 1993, but was fully supporting in 1999. For habitat use evaluation, the stream was partially supporting in 1993 and not supporting in 1999.

After incorporating 2022 monitoring data from the KCSWCD, the results for many of the parameters appear fairly consistent with those obtained from 2002 and earlier. Results for turbidity and nitrates are drastically decreased in the recent data, which is indicative of an increase in water quality. E coli results are mostly improved; however, some locations have higher levels than previously seen. Vincennes will continue to monitor additional data as it is available and use it as a guide to help drive future BMPs in the area, specifically focused on the locations of elevated levels.

7.3 SWAN POND DITCH WATERSHED

No existing water quality data was received through the data collection process. This was confirmed during the 2022 report update by investigating potential water quality monitoring efforts. No water quality monitoring efforts were found for the Vincennes' MS4 area that resides within the Swan Pond Ditch watershed. A visual inspection of Oliphant Ditch was performed. In general, the water in the ditch is clear to somewhat cloudy. No odors were noted during the reconnaissance. Some reaches of the ditch have a very flat slope with a poorly defined channel and muddy bottom. Figure 7-4 and Figure 7-5 show photographs of the ditch at College Avenue and Main Street, respectively. College Avenue is just upstream from where the ditch flows between Mirror Lake and the adjacent south lake. Main Street is located two roadway crossings downstream from Mirror Lake.

Figure 7-4. Oliphant Ditch at College Avenue

Figure 7-5. Oliphant Ditch at Main Street

7.4 ENGLAND DITCH – WABASH RIVER WATERSHED

No existing water quality data was received through the data collection process. This was confirmed during the 2022 report update by investigating potential water quality monitoring efforts. No water quality monitoring efforts were found for the Vincennes' MS4 area that resides within the England Ditch – Wabash River watershed. A visual inspection of City Ditch was completed, though access to the Ditch is limited due fences

surrounding the ditch. The water in the ditch appeared fairly clear. No odors were noted during the reconnaissance. Figure 7-6 shows photographs of the ditch just downstream of the City limits (note automobile junk yard adjacent to Creek in photo on the right).

Figure 7-6. City Ditch Immediately Downstream of Vincennes City Limits

CHAPTER 8 - BASELINE CONCLUSIONS

Data Evaluation Approach

The following sections summarize the data evaluation approach used to characterize receiving streams and draw conclusions from land use, existing water quality data, sensitive waters, potential areas of concern, and structural and non-structural BMPs.

Potential areas of concern in Vincennes were based on a review of existing land use and thorough field reconnaissance. Areas with higher potential to cause stormwater pollution were identified for follow up activities during the term of the permit.

8.1 ROBESON POND – WABASH RIVER WATERSHED

There are five industrial dischargers in the Robeson Pond – Wabash River Watershed (see Figure 7-1). One of these industries is an auto salvage yard/scrap metal fabricator. IDEM has targeted auto salvage yards with a recent outreach program and has published specific guidance regarding this industrial sector (*https://www.in.gov/idem/partnerships/indiana-clean-yards/*). The concern with auto salvage yards is the number of different waste streams that could be potentially released into the environment.

8.2 SNAPP CREEK – KELSO CREEK WATERSHED

There is one industrial discharger in the Snapp Creek – Kelso Creek Watershed (see Figure 7-1).

The large areas of imperviousness in the commercial area along 6th Street are potential areas of concern. Commercial areas and parking lots typically produce higher loads of stormwater pollutant loads.

8.3 SWAN POND DITCH WATERSHED

There is one industrial discharger in the Swan Pond Ditch watershed (see Figure 7-1). The industry is shown on Figure 7-1.

The commercial areas along Hart Street north and south of the interchange with U.S. 41 have the potential to produce higher loads of stormwater pollutants.

8.4 ENGLAND DITCH – WABASH RIVER WATERSHED

As shown in Figure 7-1, there is one industrial discharger in the England Ditch – Wabash River Watershed (see Figure 7-1).

CHAPTER 9 - EVALUATION

9.1 ROBESON POND – WABASH RIVER WATERSHED

The Wabash River is fully supportive for primary contact recreation and partially supportive of aquatic life (due to presence of mercury, lead, and PCBs). The 1989 sediment and fish tissue sampling provides supporting evidence that Vincennes does contribute to pollutants as metal concentrations were higher downstream of Vincennes as compared to upstream. The 1999 fish tissue sampling showed a drop in metals as compared to 1989.

The sources of metals in urban runoff are wide ranging and include soil erosion, vehicle fuels and fluids, vehicle wear, industrial and household chemicals, industrial processes, paints and preservatives, and pesticides. Because of the wide range of sources, it is not possible to target site specific BMPs. General community-wide BMPs such as public education on topics such as proper disposal of household chemicals and proper maintenance of vehicles; municipal good housekeeping practices; compliance by industrial dischargers; and other practices will be explored as part of Vincennes' SWQMP Part C: Program Implementation.

The Wabash River provides habitat for federal endangered mussel species. Site specific BMPs are not applicable due to the above-mentioned reasons.

Kimmell Park offers access to recreational activities on the Wabash River. Storm sewer mapping is completed, and this area will be reviewed to identify any stormwater outfalls that may impact this area and develop appropriate BMPs if needed in the new permit term as indicated in SWQMP Part C.

9.2 SNAPP CREEK – KELSO CREEK WATERSHED

The existing monitoring data for Kelso Creek indicates elevated levels nitrate nitrogen. Typical sources of excessive nitrates are runoff from fertilized land such as agricultural fields, residential lawns and golf courses. All three of these land uses are located upstream of the sampling point. Public education on appropriate use of fertilizers (and other lawn and crop chemicals) would be an appropriate BMP for this watershed for the residential areas and the golf course. Since the agricultural areas are outside of Vincennes's MS4 area, an appropriate BMP would be to coordinate with the Knox County Soil and Water Conservation District so they can follow up with land owners on potential agricultural BMPs.

E. coli was above 235 cfs/100ml, the standard for full contact recreation. However, unlike the Wabash River, Kelso Creek is quite small and is not used for full contact recreation.

The auto salvage yards in this watershed have the potential to contribute stormwater pollution. These industries are required to developed Stormwater Pollution Prevention Plans and conduct annual sampling. These BMPs should help reduce the runoff impacts from these industries. An appropriate BMP would be to periodically review reports and data submitted to IDEM by these industries.

Lastly, the commercial areas along 6th Street have the potential to produce higher stormwater pollutant loads. However, except for City right-of-way, these commercial areas are on private property. Public education specific to commercial areas would be an appropriate BMP for this area. Typical BMPs targeted for commercial areas include:

- Use smaller quantities of toxic materials or substitute less-toxic materials;

- Modify production processes to reduce waste;
- Minimize outside storage areas;
- Develop a schedule of preventive maintenance;
- Recycle wastes as part of the production process;
- Treat wastes on site to decrease volume and/or toxicity;
- Keep waste containers covered;
- Dispose of wastes properly;
- Implement a spill response plan; and
- Train employees in pollution prevention.

Commercial areas often have medium to large-sized parking lots, making customers potentially the largest contributors of pollution from commercial land use areas due to vehicle traffic and litter. Therefore, effective public education and participation regarding stormwater issues are also important pollution prevention measures for commercial sites. The above BMPs are applicable to other commercial areas throughout Vincennes.

9.3 SWAN POND DITCH WATERSHED

No site-specific BMPs are recommended because there is no existing available water quality data to indicate specific problems. Since most of the watershed is residential, public education would be a good target BMP for this watershed. Typical topics to be included in residential BMP outreach efforts include:

- Automobile Repair and Maintenance
- Automobile Washing
- Automobile Parking
- Home, Lawn, and Garden Care Activities and Product Use
- Disposal of Hazardous Household Chemicals
- Disposal of Pet Waste

The commercial BMPs previously presented would be applicable to the commercial corridor along Hart Street north and south of the U.S. 41 interchange. Lastly, it may be appropriate to periodically review reports and data submitted to IDEM by the industrial dischargers in the Swan Pond Ditch Watershed.

9.4 ENGLAND DITCH – WABASH RIVER WATERSHED

No site-specific BMPs are recommended because there is no water quality data to indicate specific problems. Similar to the other watersheds, appropriate BMPs will be targeted to specific land uses (residential, commercial, industrial). These will be detailed in the City's SWQMP Part C: Program Implementation.

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