

# Chapter 5

## *Management of Nonpoint Sources of Pollution*



*This product was financed through a grant from the Ohio Environmental Protection Agency and the United States Environmental Protection Agency with funds from Section 604B of the Clean Water Act.*

# Chapter 5: *Management of Nonpoint Sources of Pollution*

## Introduction and Purpose

Nonpoint sources of pollution are diffuse in nature, and have more than one point of origin. Common nonpoint sources are agriculture, forestry, urban land uses, mining, construction, dams, channels, land disposal and city streets. Nonpoint source pollutants include soil particles, fertilizers, animal manure, pesticides, oil, road salt, fecal material from failing septic systems, pet wastes and debris from paved areas. These pollutants are transported over the landscape by storm runoff, snow melt and wind to eventually enter rivers, streams, wetlands, lakes, ponds or the groundwater. In some cases, the nonpoint source pollution originates at a stream or aquifer because of a disturbance.

Point sources of pollution are stationary locations or fixed facilities from which pollutants are discharged. Though often described as end-of-pipe locations, point sources include any discernible, confined or discrete conveyances from which pollutants can be discharged to surface waters of the state.

The purpose of this chapter is to analyze the significance of nonpoint source pollution to water quality management planning for Butler, Clermont, Hamilton and Warren counties in Southwest Ohio. A significant objective of nonpoint source analysis is to help distinguish areas where wastewater treatment improvements or centralized sewage service may not be effective because most of the water quality degradation in some areas is attributable to nonpoint sources rather than point sources.

Both point source and nonpoint source pollution harm aquatic habitat and life. This chapter focuses on the impact that nonpoint source pollution has on aquatic life. The means for this analysis are twofold:

1. Ohio EPA expertise available through the Watershed Assessment Unit Summaries that are part of the *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report*.
2. local expertise available through the staffs of soil and water conservation districts for Butler, Clermont, Hamilton and Warren counties

This chapter's third section, titled Nonpoint Source Data and Data Sources, explains how OKI combined the expertise of Ohio EPA and the county conservation districts to analyze nonpoint source pollution.

OKI has long recognized the significance of nonpoint source pollution to water quality management planning. In the *Regional Water Quality Management Plan* (OKI, 1977) OKI noted that the Water Pollution Control Act Amendments of 1972 required that the areawide water quality management process should identify nonpoint sources of pollution and develop procedures to control it to the extent possible. OKI's 1977 plan stated "that it may be virtually impossible to economically achieve the required quality of water in the streams without identifying the nonpoint sources and exerting controls and management techniques to reduce them."

In the years since the original 1977 plan was prepared, nonpoint source pollution has taken on added prominence in the OKI Region. Regulatory programs and sewage infrastructure improvements have reduced many point source problems, while urbanization and spreading impervious surfaces have increased nonpoint source problems. Row crops still account for part of the region's nonpoint source pollution, but a growing share of the problem is attributable to developed land.

### **Sources and Causes of Nonpoint Source Pollution**

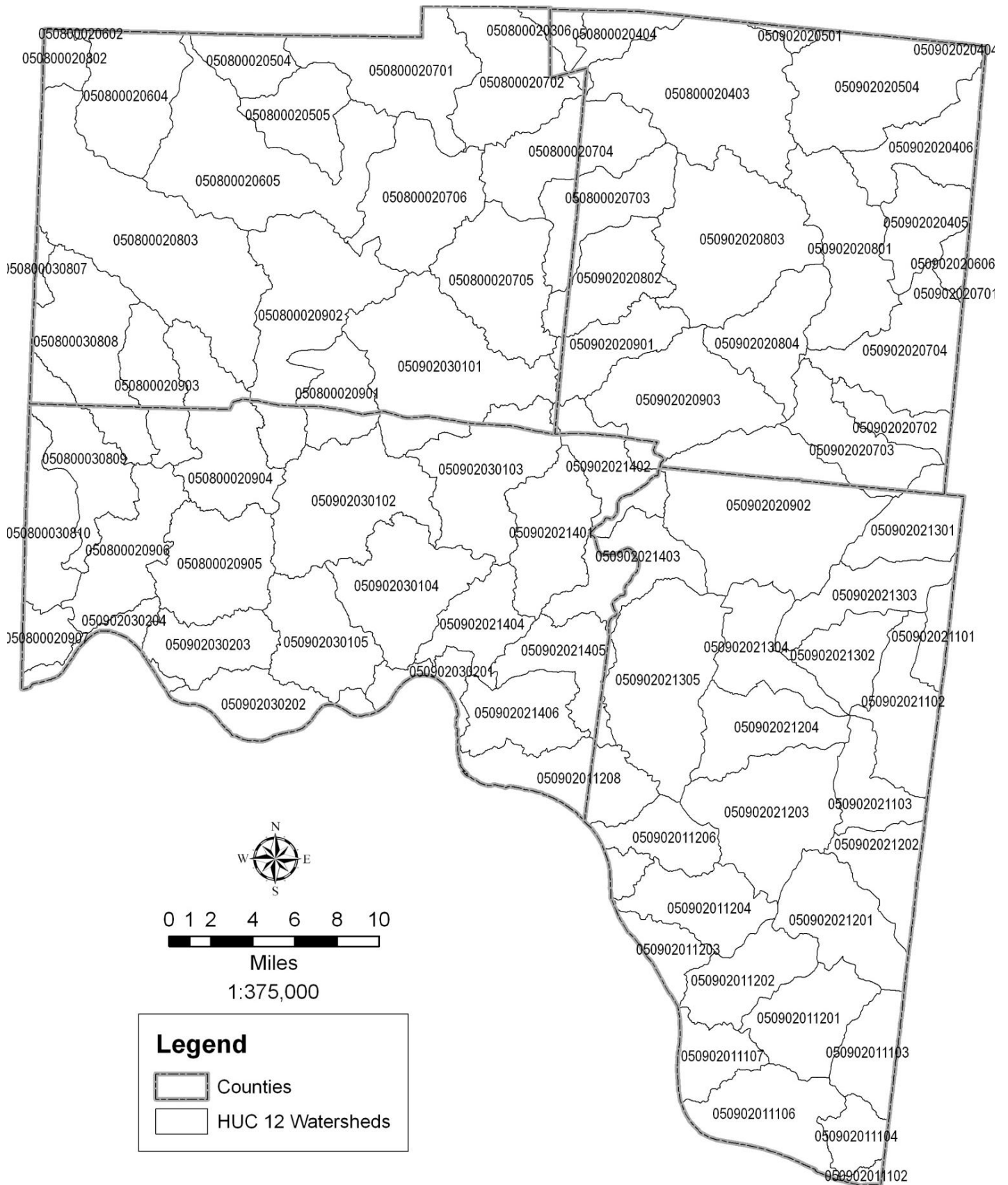
Among the many questions surrounding nonpoint source pollution, two of the most basic questions are: *Where does the nonpoint source pollution come from?* and *How does it express itself in a river or stream?* The Ohio EPA's provides answers to these questions through Watershed Assessment Unit Summaries, which are online at:

<http://wwwapp.epa.ohio.gov/dsw/ir2010/wau.php?hu=> ( *enter 12-digit hydrologic unit code here*).

As indicated in parentheses above, the end of the web address for each Watershed Assessment Unit Summary consists of that watershed's 12-digit hydrologic unit code. Hydrologic Unit Codes (HUCs) are a systematic method of naming watersheds in the United States. HUC watershed boundaries define areas that are drained by streams or rivers, and typically follow topographic features such as ridge lines. There are multiple levels of HUC watersheds based on size. Each large watershed is divided and subdivided into six levels: region, sub-region, basin, sub-basin, watershed, sub-watershed. Each of the six levels has a two-digit code. Watershed Assessment Units are assigned by sub-watersheds, so that each Watershed Assessment Unit Summary is signified by a 12-digit hydrologic unit code (six levels of watershed data with two-digit codes for each level).

Figure 5-1 on the next page shows the Watershed Assessment Units (i.e., sub-watersheds) of Butler, Clermont, Hamilton and Warren counties. For discussion purposes, these sub-watersheds are also referred to as HUC 12 watersheds because they correspond with 12-digit hydrological unit codes. This map shows the geological basis for further discussion on the sources and causes of nonpoint source pollution. Immediately following the map is Table 5-1, which lists the National Hydrography Dataset names for the HUC 12 watersheds shown on the map.

**Figure 5-1: Watersheds in Butler, Clermont, Hamilton and Warren Counties**



**Table 5-1: Names for HUC 12 Watersheds  
in Butler, Clermont, Hamilton and Warren Counties**

12-digit HUC	Watershed Name	12-digit HUC	Watershed Name
050800020306	Town of Germantown-Twin Creek	050902020501	Sugar Creek
050800020403	Clear Creek	050902020504	Newman Run-Little Miami River
050800020404	Dry Run-Great Miami River	050902020606	Little Creek-Todd Fork
050800020504	Rush Run-Sevemile Creek	050902020701	East Fork Todd Fork
050800020505	Ninemile Creek-Sevenmile Creek	050902020702	Second Creek
050800020602	Little Four Mile Creek	050902020703	First Creek
050800020604	Acton Lake Dam-Four Mile Creek	050902020704	Lick Run-Todd Fork
050800020605	Cotton Run-Four Mile Creek	050902020801	Ferris Run-Little Miami River
050800020701	Elk Creek	050902020802	Little Muddy Creek
050800020702	Browns Run-Great Miami River	050902020803	Turtle Creek
050800020703	Shaker Creek	050902020804	Halls Creek-Little Miami River
050800020704	Dicks Creek	050902020901	Muddy Creek
050800020705	Gregory Creek	050902020902	O'Bannon Creek
050800020706	Town of New Miami-Great Miami River	050902020903	Salt Run-Little Miami River
050800020802	Brandywine Creek-Indian Creek	050902021101	Solomon Run-East Fork Little Miami River
050800020803	Beals Run-Indian Creek	050902021102	Fivemile Creek-East Fork Little Miami River
050800020901	Pleasant Run	050902021103	Todd Run-East Fork Little Miami River
050800020902	Banklick Creek-Great Miami River	050902021201	Poplar Creek
050800020903	Paddys Run	050902021202	Cloverlick Creek
050800020904	Dry Run-Great Miami River	050902021203	Lucy Run-East Fork Little Miami River
050800020905	Taylor Creek	050902021204	Backbone Creek-East Fork Little Miami River
050800020906	Jordan Creek-Great Miami River	050902021301	Headwaters Stonelick Creek
050800020907	Doublelick Run-Great Miami River	050902021302	Brushy Fork
050800030807	Headwaters Dry Fork Whitewater River	050902021303	Moores Fork-Stonelick Creek
050800030808	Howard Creek-Dry Fork Whitewater River	050902021304	Lick Fork-Stonelick Creek
050800030809	Lee Creek-Dry Fork Whitewater River	050902021305	Salt Run-East Fork Little Miami River
050800030810	Jameson Creek-Whitewater River	050902021401	Sycamore Creek
050902011102	Turtle Creek-Ohio River	050902021402	Polk Run-Little Miami River
050902011103	West Branch Bullskin Creek	050902021403	Horner Run-Little Miami River
050902011104	Bullskin Creek	050902021404	Duck Creek
050902011106	Bear Creek-Ohio River	050902021405	Dry Run-Little Miami River
050902011107	Little Indian Creek-Ohio River	050902021406	Clough Creek-Little Miami River
050902011201	Headwaters Big Indian Creek	050902030101	East Fork Mill Creek-Mill Creek
050902011202	North Fork Indian Creek-Big Indian Creek	050902030102	West Fork Mill Creek
050902011203	Boat Run-Ohio River	050902030103	Sharon Creek-Mill Creek
050902011204	Ferguson Run-Twelve mile Creek	050902030104	Congress Run-Mill Creek
050902011206	Tenmile Creek	050902030105	West Fork-Mill Creek
050902011208	Ninemile Creek-Ohio River	050902030201	Town of Newport-Ohio River
050902020404	Middle Caesar Creek	050902030202	Dry Creek-Ohio River
050902020405	Flat Fork	050902030203	Muddy Creek
050902020406	Lower Caesar Creek	050902030204	Garrison Creek-Ohio River

Each Watershed Assessment Unit Summary has sections indicating whether that watershed is attaining (i.e., satisfying) its designated beneficial uses for aquatic life and recreation. Beneficial use designations are goals set by the Ohio EPA for specific water bodies.

Ohio's Water Quality Standards have seven subcategories of aquatic life uses for rivers and streams. The three most commonly assigned aquatic life uses have quantitative biological criteria that express the minimum acceptable level of biological performance based on three biological indices. Those three aquatic life uses are:

- Warmwater: water bodies capable of supporting and maintaining a balanced, integrated, adaptive community of warmwater aquatic organisms
- Exceptional Warmwater: water bodies that have the potential to support and maintain an exceptional or unusual community of warmwater aquatic organisms.
- Modified Warmwater: water bodies that have been the subject of a use attainability analysis and have been found to be incapable of supporting and maintaining a balanced, integrated and adaptive community of warmwater organisms because of irretrievable modifications of the physical habitat.

Recreation use designations are in effect only during the recreation season (May 1 to October 15). They are divided into three main categories:

- Bathing Waters, which are suitable for swimming where a lifeguard or bathhouse are present
- Primary Contact, which are waters suitable for full-body contact recreation such as swimming, canoeing and scuba diving with minimal threat to public health as a result of water quality
- Secondary Contact, which are waters suitable for partial body contact recreation such as, but not limited to, wading, with minimal threat to public health as a result of water quality

Any condition that impedes a water body from attaining its designated beneficial use is an impairment. For those watersheds that are impaired, the Ohio EPA addresses both sources of impairment and causes of impairment.

In brief, a source of impairment is where the most prominent agent of impairment originates. It addresses the question: *Where does nonpoint source pollution come from?* For Butler, Clermont, Hamilton and Warren counties, the Watershed Assessment Unit Summaries listed 32 types of sources of impairment. Of those 32 types, 25 are typically considered to be indicative of nonpoint source pollution. In alphabetical order, they are:

- (1) Agriculture
- (2) Channelization – agriculture
- (3) Channelization – development
- (4) Contaminated sediments
- (5) Dam construction – agriculture
- (6) Dam construction – development
- (7) Dredging – development
- (8) Flow regulation/modification – development
- (9) Land development/suburbanization
- (10) Landfills
- (11) Loss of riparian habitat
- (12) Municipal (urbanized high density area)
- (13) Natural (or Natural sources)

- (14) Nonirrigated crop production
- (15) Onsite wastewater systems (septic tanks)
- (16) Other urban runoff
- (17) Removal of riparian vegetation – agriculture
- (18) Removal of riparian vegetation – development
- (19) Sewer line construction
- (20) Streambank modification/destabilization - agriculture
- (21) Streambank modification/destabilization – development
- (22) Unpermitted discharge (domestic wastes)
- (23) Unrestricted cattle access
- (24) Urban runoff/storm sewers (NPS)
- (25) Upstream impoundment

The source of impairment types that are not typically indicative of nonpoint source pollution are:

- (1) Combined sewer overflows
- (2) Industrial point source (also: Minor industrial point source)
- (3) Major municipal point source
- (4) Minor municipal point source
- (5) Municipal point source discharges
- (6) Sanitary sewer overflows (collection system failures)
- (7) Source unknown

For impaired watersheds, the Watershed Assessment Unit Summaries also list causes of impairment, which addresses the question: *How does the impairment express itself in a river or stream?* The Ohio EPA defines causes of impairment as the most prominent "agents" deemed responsible for the observed aquatic life use impairment in the assessment unit. Causes of impairment are important to Ohio EPA because the *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report* states: “Causes will be the initial focus of restoration activities or TMDL (total maximum daily load) development within the watershed.” A total maximum daily load is a calculation of the highest amount of a pollutant that a water body can receive and safely meet water quality standards set by the Ohio EPA.

For Butler, Clermont, Hamilton and Warren counties, the Watershed Assessment Unit Summaries listed 25 types of impairment causes. Of those 25 types, 14 are typically indicative of nonpoint source pollution. In alphabetical order, they are:

- (1) Direct habitat alterations
- (2) Flow alteration
- (3) Iron
- (4) Natural conditions (flow or habitat)
- (5) Nutrient/eutrophication biological indicators
- (6) Nutrients
- (7) Oil and grease
- (8) Organic enrichment/DO (which in some cases, can be indicative of point source pollution)
- (9) Other flow regime alterations
- (10) Phosphorus (total)
- (11) Salinity/TDS/chlorides (which in some cases, can be indicative of point source pollution)
- (12) Sedimentation/siltation
- (13) Siltation
- (14) Suspended solids

The cause of impairment types that are not typically indicative of nonpoint source pollution are:

- (1) Ammonia
- (2) Barium (which can indicate nonpoint source pollution in cases where it is naturally occurring)
- (3) Cause unknown
- (4) Chlorine
- (5) Copper
- (6) Organic enrichment (sewage) biological indicators
- (7) Oxygen, dissolved
- (8) Priority organics
- (9) Taste and odor
- (10) Unionized ammonia
- (11) Unknown toxicity

Causes and sources of impairment for HUC-12 watershed assessment units were originally assessed by Ohio EPA for the larger 11-digit HUC areas of years past. As Ohio EPA continues converting from the 11- and 14-digit HUC system to the 10- and 12-digit HUC system, the causes and sources of impairment will become more germane to the HUC-12 watersheds.

### **Nonpoint Source Data and Data Sources**

This section reviews data sources that help assess nonpoint source pollution. The review starts with federal data sources, then progresses to state, regional and local data sources. Useful data is printed below in custom tables for the watersheds of Butler, Clermont, Hamilton and Warren counties.

The U.S. Geological Survey performed a National Water Quality Assessment of the Great Miami River, Little Miami River and Mill Creek basins during the period of 1998-2002. This produced several technical reports that delve into nonpoint source pollution, among other issues. Those reports are described in Chapter 2: Water Resources in Southwest Ohio.

In 1997 the U.S. Environmental Protection Agency published a report entitled *The Incidence And Severity of Sediment Contamination In Surface Waters Of the United States; Volume 3: National Sediment Contaminant Point Source Inventory* (EPA-823-R-97-008) Although the report is a point source inventory and was prepared several years ago, the information on sediment contamination is still of interest because while the contaminants may originate from the ends of pipes, the contaminated sediments become nonpoint sources of pollution to rivers and streams, deposited in diffuse patterns which can persist over very long periods. Table 5-2 on the next page summarizes data from this report on contaminated sediment loadings to six watersheds in Southwest Ohio:

**Table 5-2: Contaminated Sediment Loadings to Watersheds in Southwest Ohio**

<b>Hydrologic Unit Code (8-digit)</b>	<b>Watershed Name</b>	<b>Priority Group (scale of 1<sup>st</sup> to 5<sup>th</sup>)</b>	<b>Dominant Chemical Class</b>	<b>Dominant Industrial Class</b>	<b>Data Source</b>
05080001	Upper Great Miami	fourth	divalent metal	sewerage systems	Permit Compliance System
05080002	Lower Great Miami	second	divalent metal	sewerage systems	Permit Compliance System
05080003	Whitewater	fourth	divalent metal	sewerage systems	Permit Compliance System
05090201	Ohio Brush-Whiteoak	fifth	divalent metal	public utilities	Permit Compliance System
05090202	Little Miami	fourth	divalent metal	sewerage systems	Permit Compliance System
05090203	Middle Ohio-Laughery	second	divalent metal	sewerage systems	Permit Compliance System

The U.S. Army Corps of Engineers maintains a database of permits required for anyone who wishes to discharge dredged or fill material into waters of the United States, under Section 404 of the Clean Water Act. The permit application requires a variety of information, including:

- project location
- waterbody to be affected
- nature of activity, such as structures that cause hydromodification, excavations, dredging or filling
- types of materials that may be discharged
- amount of each type of discharged material
- surface area of waters filled

Such information indicates activities that may produce nonpoint source pollution, at least for a measurable time period at a specific location.

Section 404 permits are required by the Clean Water Act, which also requires a Section 401 water quality certification prior to issuance of the Section 404 permit. In Ohio, Section 401 is administered by the Ohio EPA, which also can provide useful information on projects that may produce nonpoint source pollution.

The *Ohio Integrated Water Quality Monitoring and Assessment Report* is becoming increasingly useful for analyzing nonpoint source pollution. It is issued every two years by Ohio EPA's Division of Surface Water in compliance with Section 305(b) of the Clean Water Act. The report became even more useful in 2010 with Ohio EPA's conversion to smaller watershed assessment units with a corresponding increase in level of detail available. As the Ohio EPA continues to monitor on the scale of 12-digit hydrologic unit codes, the assessments and analyses in the biennial *Integrated Reports* should become more localized and specific. Prior reports were based on larger watershed assessment units.

Several sections of the *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report* contain data useful to analyze nonpoint source pollution in Butler, Clermont, Hamilton and Warren counties.

Section E evaluates threats that watersheds may pose to peoples’ health by noting the presence of contaminants in fish tissue. The consumption of fish is recognized in the *Ohio 2010 Integrated Report* as a beneficial use of surface water. Human health is the term used to connote this beneficial use. Ohio has adopted human health water quality standards to protect the public from adverse impacts, both carcinogenic and non-carcinogenic, due to the contaminated flesh of sport fish. The purpose of that criterion is to ensure that levels of a chemical in water do not bioaccumulate in fish to levels harmful to people who catch and eat fish.

The Ohio EPA reviewed fish tissue for six types of contaminants and found the vast majority of problems to be triggered by excessive levels of polychlorinated biphenyls (PCBs).

OKI considers PCBs to be indicative of nonpoint source pollution because their sale was banned in 1979 but they continue to persist in the environment by their presence in contaminated sediments. A table in the *Ohio 2010 Integrated Report* shows “waters impaired because levels of PCBs or mercury in fish tissue exceeded the threshold level upon which the water quality standard criterion is based.” The table included eight assessment units in Butler, Clermont, Hamilton and Warren counties. All eight of the assessment units are classified with health impairments because of PCBs. The eight assessment units are shown below in Table 5-3. The first six water bodies are watershed assessment units, while the seventh and eighth water bodies (Whitewater River and Little Miami River), are large river assessment units.

**Table 5-3: Ohio Water Bodies in the OKI Region Assessed with Human Health Impairments Due to PCBs**

<b>Water Body</b>	<b>County or Counties</b>	<b>Assessment Unit (HUC-12)</b>
Dicks Creek	Butler and Warren	05080002 07 04
Beals Run-Indian Creek	Butler	05080002 08 03
Jameson Creek-Whitewater River	Hamilton	05080003 08 10
Town of New Miami-Great Miami River	Butler	05080002 07 06
Salt Run-Little Miami River	Warren	05090202 09 03
Newman Run-Little Miami River	Warren	05090202 05 04
Whitewater River	Hamilton	05080003 90 01
Little Miami River-Caesar Creek to O’Bannon Creek	Warren	05090202 90 01

Section L-1 of the *Ohio 2010 Integrated Report* shows the status of watershed assessment units in Ohio. In that section, an additional 17 watershed assessment units in Butler, Clermont, Hamilton or Warren counties are listed that have historical data indicating they are impaired for human health. Those 17 watershed assessment units are shown in Table 5-4 below:

**Table 5-4: Ohio Water Bodies in the OKI Region with Historical Data of Human Health Impairments**

<b>Water Body</b>	<b>County or Counties</b>	<b>Assessment Unit (HUC-12)</b>
Elk Creek	Butler	05080002 07 01
Browns Run-Great Miami River	Butler, Warren	05080002 07 02
Shaker Creek	Butler, Warren	05080002 07 03
Gregory Creek	Butler	05080002 07 05
Pleasant Run	Butler, Hamilton	05080002 09 01

Water Body	County or Counties	Assessment Unit
Banklick Creek	Butler, Hamilton	05080002 09 02
Paddys Run	Butler, Hamilton	05080002 09 03
Dry Run-Great Miami River	Butler, Hamilton	05080002 09 04
Taylor Creek	Hamilton	05080002 09 05
Jordan Creek	Hamilton	05080002 09 06
Doublelick Run-Great Miami River	Hamilton	05080002 09 07
Sugar Creek	Warren	05090202 05 01
East Fork Mill Creek-Mill Creek	Butler, Hamilton	05090203 01 01
West Fork Mill Creek	Hamilton	05090203 01 02
Sharon Creek-Mill Creek	Butler, Hamilton	05090203 01 03
Congress Run-Mill Creek	Hamilton	05090203 01 04
West Fork-Mill Creek	Hamilton	05090203 01 05

Section F of the *Ohio 2010 Integrated Report* addresses the designated beneficial use of recreation. Bacteria (*Escherichia coli*) is the criterion for assessing recreation use attainment. High bacteria levels are commonly attributed to point source pollution, such as insufficiently treated effluents discharged from wastewater treatment plants. Nevertheless, bacteria exceedances can also signify nonpoint source pollution, especially in watersheds subject to:

- poorly managed concentrations of onsite wastewater treatment systems (e.g. septic tanks)
- high densities of animal feedlots
- unrestricted cattle access

In some cases, wildlife excrement has been blamed for high bacteria levels.

Table 5-5 below shows which Watershed Assessment Units in Butler, Clermont, Hamilton or Warren counties were impaired for recreation use:

**Table 5-5: Watershed Assessment Units in the OKI Region that are Impaired for Recreation Use**

Watershed Assessment Unit	Assessment Unit Name	County (or Counties)
05080002 06 04	Acton Lake Dam-Four Mile Creek	Butler
05080002 08 03	Beals Run-Indian Creek	Butler
05090202 07 02	Second Creek	Warren
05090202 07 04	Lick Run-Todd Fork	Warren
05090202 09 01	Muddy Creek	Warren and Butler
05090202 13 05	Salt Run-East Fork Little Miami River	Clermont

For informational purposes, Section F of the *Ohio 2010 Integrated Report* also tabulates swimming advisory postings at Ohio's inland lake public beaches from 2004 to 2008. Swimming advisories are posted when bacteria levels are high. Table 5-6 below focuses on swimming advisory postings at the inland lake public beaches of the OKI region.

**Table 5-6: Swimming Advisory Postings at Inland Lake Public Beaches in the OKI Region (2004-2008)**

Park	Beach	County	2004 <sup>a</sup>	2005 <sup>a</sup>	2006 <sup>a</sup>	2007 <sup>a</sup>	2008 <sup>a</sup>	Total
Caesar Creek	north	Warren	0/0	0/7	0/7	0/2	0/7	0
	south	Warren	0/0	1/7	2/10	0/2	0/7	3
East Fork	main	Clermont	0/0	0/15	1/14	0/13	0/12	1
	camp	Clermont	0/0	0/15	1/14	0/13	0/11	1
Stonelick		Clermont	0/0	1/13	1/14	1/11	1/11	4

<sup>a</sup> Indicates the number of advisories posted followed by the number of samples collected.

Section G of the *Ohio 2010 Integrated Report* addresses the designated beneficial use of aquatic life. As previously noted in this chapter, most of the causes and sources of aquatic life impairment are attributable to nonpoint source pollution. The report lists the following as the “top five causes of aquatic life impairment in HUC12 watersheds and large river assessment units based on biological water quality survey data collected from 1999 to 2008:

1. silt/sediment
2. nutrients
3. habitat modification
4. hydromodification
5. organic enrichment/dissolved oxygen

These top five causes are largely synonymous with the nonpoint source priorities stated by the four soil and water conservation districts consulted by OKI staff. The results of those consultations are tabulated later in this section.

Section H of the *Ohio 2010 Integrated Report* addresses the designated beneficial use of public drinking water supply. Only three Watershed Assessment Units of the OKI Region appear in the Section H table (H-3) on public drinking water supply assessment results for the nitrate and pesticide indicators. Nitrates and pesticides typically originate from nonpoint source pollution. These assessment units are summarized below in Table 5-7, along with another relevant unit (Lower Caesar Creek) for which data is insufficient:

**Table 5-7: Summary of Public Drinking Water Supply Assessment Results in the OKI Region for the Nitrate and Pesticide Indicators**

<b>Watershed Assessment Unit</b>	<b>Assessment Unit Name (OKI County)</b>	<b>Public Drinking Water System Zone (Public Water System)</b>	<b>Designated Use Support</b>	<b>Nitrate Indicator</b>	<b>Pesticide Indicator</b>
05090202 04 06	Lower Caesar Creek (Warren)	Caesar Creek Lake (Wilmington)	unknown	insufficient data	insufficient data
05090202 12 03	Lucy Run-East Fork Little Miami River (Clermont)	Harsha Lake – Impounded East Fork Little Miami River (Clermont County)	yes	full support	full support, on Ohio EPA’s Watch List
05090202 07 02	Second Creek (Warren)	Whitacre Run @ RM 1.4 (Blanchester)	no	insufficient data	impaired
05090202 13 01	Headwaters Stonelick Creek (Clermont, Warren)	Stonelick Creek @ RM 23.4 (Blanchester)	no	insufficient data	impaired

Of the four watershed assessment units shown above in Table 5-7, only the Lucy Run-East Fork Little Miami River watershed has a public water system in the OKI Region. With successive *Integrated Reports*, the Ohio EPA can be expected to refine its assessment of nonpoint source pollution that impairs or threatens public drinking water supplies. The *Ohio 2010 Integrated Report* is only the second reporting cycle to assess this beneficial use. Ohio is adopting additional water quality criteria for the protection of public drinking water supply beneficial use and will expand assessments as criteria become finalized.

Section L4 of the *Ohio 2010 Integrated Report* can be an aid to ranking watersheds with nonpoint source pollution problems. Titled the *List of Prioritized Impaired Waters*, Section L4 indicates the order of

importance that Ohio EPA assigns to the various watershed assessment units for total maximum daily load work. Nonpoint source pollution is a major factor in determining a watershed's relative place on the prioritized list. Table 5-8 below selects the impaired watershed assessment units of Butler, Clermont, Hamilton and Warren counties, then lists them in the order they appeared in Section L4, based on the number of priority points assigned by Ohio EPA.

**Table 5-8: List of Prioritized Impaired Waters in Butler, Clermont, Hamilton and Warren Counties, Ohio**

Assessment Unit	Assessment Unit Name (OKI County or Counties)	Sq. Mi. in Ohio	Human Health	Recreation	Aquatic Life	PDW Supply	Priority Points	Next Field Monitoring	Projected TMDL
05090202 07 02	Second Creek (Warren)	20.0	3	5	5	5	10	2022	2010
05080002 06 04	Acton Lake Dam-Four Mile Cr. (Butler)	41.4	1	5	5	0	8	2020	2011
05090202 90 02	Little Miami River Mainstem, O'Bannon Creek to Ohio River (Warren, Hamilton)	1,757.0	5	5	5	0	8	2022	2010
05080002 06 02	Little Four Mile Creek (Butler)	13.7	1h	5	5	0	7	2020	2011
05080002 90 01	Great Miami River Mainstem, Mad River to Four Mile Creek (Warren, Butler)	3,298.0	5	3i	5h	0	7	2010	2013
05080002 07 04	Dicks Creek (Butler, Warren)	27.7	5	3	5x	0	6	2010	2013
05090202 13 01	Headwaters Stonelick Creek (Butler, Warren)	24.3	1h	3	5hx	5	6	2012	2015
05090202 90 01	Little Miami River Mainstem, Caesar Creek to O'Bannon Creek (Warren)	1,086.0	5	5	1	0	6	2022	2010
05080002 07 02	Browns Run-Great Miami River (Butler, Warren)	32.0	5h	3	5x	0	5	2010	2013
05080002 07 03	Shaker Creek (Warren, Butler)	21.4	5h	3	5x	0	5	2010	2013
05080002 07 05	Gregory Creek (Warren, Butler)	29.7	5h	3	5x	0	5	2010	2013
05080002 07 06	Town of New Miami-Great Miami River (Butler)	30.7	5	3	5x	0	5	2010	2013
05080002 90 02	Great Miami River Mainstem, Four Mile Creek to Ohio River (Hamilton, Butler)	5,371.0	5h	3	5h	0	5	2010	2013
05090202 09 01	Muddy Creek (Warren, Butler)	15.9	3	5	5	0	5	2022	2010
05090202 13 05	Salt Run-East Fork Little Miami River (Clermont)	42.5	1h	5	5hx	0	5	2012	2015
05080002 08 03	Beals Run-Indian Creek (Butler)	65.8	5	5	4n	0	4	2019	2011
05090201 12 01	Headwaters Big Indian Creek (Clermont)	21.5	3	3	5hx	0	4	2016	2019
05090201 12 02	North Fork Indian Creek-Big Indian Creek (Clermont)	18.4	3	3	5hx	0	4	2016	2019
05090201 12 03	Boat Run-Ohio River (Clermont)	9.0	3	3	5hx	0	4	2016	2019
05090201 12 04	Ferguson Run-Twelvemile Creek (Clermont)	19.5	3	3	5hx	0	4	2016	2019

Assessment Unit	Assessment Unit Name (OKI County or Counties)	Sq. Mi. in Ohio	Human Health	Recreation	Aquatic Life	PDW Supply	Priority Points	Next Field Monitoring	Projected TMDL
05090201 12 06	Tenmile Creek (Clermont)	13.0	3	3	5hx	0	4	2016	2019
05090201 12 08	Ninemile Creek (Clermont)	26.7	3	3	5hx	0	4	2016	2019
05080002 04 03	Clear Creek (Warren)	53.0	3	3	5hx	0	3	2010	2013
05080002 04 04	Dry Run-Great Miami River (Warren, Butler)	32.5	3	3	5hx	0	3	2010	2013
05080002 04 06	Cotton Run-Four Mile Creek (Butler)	51.3	1	1	5	0	3	2020	2011
05080002 09 01	Pleasant Run (Butler, Hamilton)	15.1	5h	3	5hx	0	3	2010	2013
05080002 09 02	Banklick Creek-Great Miami River (Butler, Hamilton)	44.1	5h	3	5hx	0	3	2010	2013
05080002 09 03	Paddys Run (Butler, Hamilton)	16.3	5h	3	5hx	0	3	2010	2013
05080002 09 04	Dry Run-Great Miami River (Butler, Hamilton)	28.8	5h	3	5hx	0	3	2010	2013
05080002 09 05	Taylor Creek (Hamilton)	26.7	5h	3	5hx	0	3	2010	2013
05080002 09 06	Jordan Creek-Great Miami River (Hamilton)	22.7	5h	3	5hx	0	3	2010	2013
05080002 09 07	Doublelick Run-Great Miami River (Hamilton)	6.7	5h	3	5hx	0	3	2010	2013
05090202 08 02	Little Muddy Creek (Warren, Butler)	20.6	3	3	5	0	3	2022	2010
05090202 14 01	Sycamore Creek (Hamilton)	23.4	3	1	5	0	3	2022	2010
05090203 01 01	East Fork Mill Creek-Mill Creek (Butler, Hamilton)	47.3	5h	3	5x	0	3	2014	2017
05090203 01 02	West Fork Mill Creek-Mill Creek (Butler, Hamilton)	36.2	5h	3	5x	0	3	2014	2017
05090203 01 03	Sharon Creek-Mill Creek (Hamilton, Butler)	31.8	5h	3	5x	0	3	2014	2017
05090203 01 04	Congress Run-Mill Creek (Hamilton)	30.0	5h	3	5x	0	3	2014	2017
05090203 01 05	West Fork-Mill Creek (Hamilton)	23.6	5h	3	5x	0	3	2014	2017
05080003 08 10	Jameson Creek-Whitewater River (Hamilton)	18.0	5	3	1hx	0	2	2010	2013
05080003 90 01	Whitewater River Mainstem, entire length (Hamilton)	1,474.0	5	3	1	0	2	2010	2013
05090202 04 04	Middle Caesar Creek (Warren)	30.1	1h	3	5x	0	2	2011	2014
05090202 04 05	Flat Fork (Warren)	16.8	1h	3	5x	0	2	2011	2014
05090202 04 06	Lower Caesar Creek (Warren)	41.2	1	3	5x	3i	2	2011	2014
05090202 05 01	Sugar Creek (Warren)	33.8	5h	3	4Ax	0	2	2011	2014
05090202 05 04	Newman Run-Little Miami River (Warren)	57.5	5	1	1	0	2	2011	2014
05090202 07 01	East Fork Todd Fork (Warren)	39.6	3	5	4n	0	2	2022	2010
05090202 07 04	Lick Run-Todd Fork (Warren)	35.7	3	5	1	0	2	2022	2010
05090202 09 03	Salt Run-Little Miami River (Warren, Hamilton)	35.3	5	3	3	0	2	2022	2010
05090202 12 03	Lucy Run-East Fork Little Miami River (Clermont)	34.7	1h	3	5hx	1	2	2012	2015
05090202 11 01	Solomon Run-East Fork Little Miami River (Clermont)	43.0	1h	3	5hx	0	1	2012	2015
05090202 11 02	Fivemile Creek-East Fork Little Miami River (Clermont)	42.6	1h	3	5hx	0	1	2012	2015

Assessment Unit	Assessment Unit Name (OKI County or Counties)	Sq. Mi. in Ohio	Human Health	Recreation	Aquatic Life	PDW Supply	Priority Points	Next Field Monitoring	Projected TMDL
05090202 11 03	Todd Run-East Fork Little Miami River (Clermont)	21.0	1	3	5hx	0	1	2012	2015
05090202 12 01	Poplar Creek (Clermont)	24.7	1h	3	5hx	0	1	2012	2015
05090202 12 02	Cloverlick Creek (Clermont)	42.3	1h	3	5hx	0	1	2012	2015
05090202 12 04	Backbone Creek-East Fork Little Miami River (Clermont)	20.8	1h	3	5hx	0	1	2012	2015
05090202 13 02	Brushy Fork (Clermont)	14.9	1h	3	5hx	0	1	2012	2015
05090202 13 03	Moore's Fork-Stonelick Creek (Clermont)	19.4	1h	3	5hx	0	1	2012	2015
05090202 13 04	Lick Fork-Stonelick Creek (Clermont)	18.3	1h	3	5hx	0	1	2012	2015
05090202 14 02	Polk Run-Little Miami River (Hamilton, Warren, Clermont)	17.0	3	3	5hx	0	1	2022	2010
05090202 14 03	Homer Run-Little Miami River (Clermont, Hamilton)	21.5	3i	3	5hx	0	1	2022	2010
05090202 14 04	Duck Creek (Clermont, Hamilton)	15.5	3	3	5	0	1	2022	2010
05090202 14 05	Dry Run-Little Miami River (Hamilton, Clermont)	17.8	3i	3	5hx	0	1	2022	2010
05090202 14 06	Clough Creek-Little Miami River (Hamilton)	18.7	3i	3	5	0	1	2022	2010
05090203 02 01	Town of Newport-Ohio River (Hamilton)	7.5	3	3	5hx	0	1	2016	2019
05090203 02 02	Dry Creek-Ohio River (Hamilton)	17.3	3	3	5hx	0	1	2016	2019
05090203 02 03	Muddy Creek (Hamilton)	16.6	3	3	5hx	0	1	2016	2019
05090203 02 04	Garrison Creek-Ohio River (Hamilton)	6.6	3	3	5hx	0	1	2016	2019

From the perspective of nonpoint source pollution, the most pertinent elements of the Ohio EPA's Watershed Assessment Unit Summaries are:

(1) land use statistics; (2) causes of impairment; and (3) sources of impairment.

The land use statistics are not available for the Large River Assessment Units because they are two-dimensional, linear features; not three dimensional polygon features. For each Watershed Assessment Unit Summary, the land use statistics divide the watershed into five types of land use/land cover: (1) developed; (2) forest; (3) grass/pasture; (4) row crops; and, (5) other.

Developed land uses and row crop land uses are most likely to generate nonpoint source pollution. Developed areas send pollutants from dirty impervious surfaces to nearby rivers and streams. Row crop areas send pollutants from chemically treated farm fields that may be prone to erosion. Tables 5-9, 5-10, 5-11 and 5-12 on the next four pages rank the watersheds of Butler, Clermont, Hamilton and Warren counties by their combined percentages of land that is developed or in row crops.

**Table 5-9: Combined Percentage of Land that is Developed  
or Farmed with Row Crops in Butler County's Watershed Assessment Units**

<b>Rank</b>	<b>Hydrologic Unit Code</b>	<b>Watershed Assessment Unit Name</b>	<b>% Land Area that is Developed</b>	<b>% Land Area Farmed with Row Crops</b>	<b>Combined Percentage</b>
1	05080002 08 02	Brandywine Creek-Indian Creek	8.7	87.1	95.8
2	05080002 09 01	Pleasant Run	91.4	0.9	92.3
3	05090203 01 01	East Fork Mill Creek-Mill Creek	75.1	11.4	86.5
4	05080002 06 02	Little Four Mile Creek	5.5	80.8	86.3
5	05090203 01 03	Sharon Creek-Mill Creek	84.5	0.6	85.1
6	05090202 09 01	Muddy Creek	69.3	10.0	79.3
7	05080002 07 04	Dicks Creek	63.4	14.2	77.6
8	05080002 07 06	Town of New Miami-Great Miami River	39.0	31.8	70.8
9	05090202 14 02	Polk Run-Little Miami River	65.4	1.2	66.6
10	05080002 09 02	Banklick Creek-Great Miami River	56.1	6.7	62.8
11	05090202 08 02	Little Muddy Creek	29.3	33.2	62.5
12	05080002 06 04	Acton Lake Dam-Four Mile Creek	17.4	42.6	60.0
13	05080002 04 04	Dry Run-Great Miami River	40.1	18.1	58.2
14	05080002 07 03	Shaker Creek	30.5	27.3	57.8
15	05080002 07 05	Gregory Creek	51.0	16.3	57.3
16	05080002 07 02	Browns Run-Great Miami River	36.0	16.0	52.0
17	05080002 03 06	Town of Germantown-Twin Creek	12.8	30.3	43.1
18	05080002 06 05	Cotton Run-Four Mile Creek	12.1	28.9	41.0
19	05080002 07 01	Elk Creek	7.1	33.3	40.4
20	05080002 09 03	Paddys Run	13.8	25.5	39.3
21	05080003 08 09	Headwaters (of) Dry Fork Whitewater River	7.9	30.7	38.6
22	05080002 08 03	Beals Run-Indian Creek	9.9	26.5	36.4
23	05080002 05 04	Rush Run-Sevenmile Creek	6.9	27.1	34.0
24	05080003 08 08	Howard Creek-Dry Fork Whitewater River	5.8	28.1	33.9
25	05080003 08 09	Lee Creek-Dry Fork Whitewater River	14.1	16.4	30.5
26	05080002 05 05	Ninemile Creek-Sevenmile Creek	8.2	21.3	29.5

**Table 5-10: Combined Percentage of Land that is Developed  
or Farmed with Row Crops in Clermont County's Watershed Assessment Units**

<b>Rank</b>	<b>Hydrologic Unit Code</b>	<b>Watershed Assessment Unit Name</b>	<b>% Land Area that is Developed</b>	<b>% Land Area Farmed with Row Crops</b>	<b>Combined Percentage</b>
1	05090202 11 02	Fivemile Creek-East Fork Little Miami River	7.0	56.2	63.2
2	05090202 11 01	Solomon Run-East Fork Little Miami River	7.0	53.5	60.5
3	05090202 13 01	Headwaters Stonelick Creek	5.5	54.4	59.9
4	05090202 13 03	Moores Fork-Stonelick Creek	5.9	45.8	51.7
5	05090202 11 03	Todd Run-East Fork Little Miami River	10.0	41.1	51.1
6	05090202 07 03	First Creek	6.8	41.7	48.5
7	05090202 12 02	Cloverlick Creek	5.5	42.1	47.6
8	05090202 13 05	Salt Run-East Fork Little Miami River	42.2	4.0	46.2
9	05090202 13 02	Brushy Fork	5.3	40.4	45.7
10	05090202 14 05	Dry Run-Little Miami River	35.1	5.5	40.6
11	05090202 09 02	O'Bannon Creek	17.1	22.6	39.7
12	05090201 12 08	Ninemile Creek-Ohio River	37.2	1.5	38.7
13	05090202 14 03	Horner Run-Little Miami River	37.3	0.8	38.1
14	05090202 12 04	Backbone Creek-East Fork Little Miami River	17.4	17.1	34.5
15	05090201 11 03	West Branch Bullskin Creek	4.6	28.7	33.3
16	05090202 12 01	Poplar Creek	8.7	23.7	32.4
17	05090201 11 04	Bullskin Creek	3.6	26.7	30.3
18	05090201 12 01	Headwaters Big Indian Creek	4.4	24.8	29.2
19	05090202 13 04	Lick Fork-Stonelick Creek	11.0	14.6	25.6
20	05090202 12 03	Lucy Run-East Fork Little Miami River	16.6	7.6	24.2
21	05090201 12 04	Ferguson Run-Twelvemile Creek	7.1	13.6	20.7
22	05090201 12 06	Tenmile Creek	18.1	1.0	19.1
23	05090201 11 06	Bear Creek-Ohio River	4.1	10.6	14.7
24	05090201 12 03	Boat Run-Ohio River	10.4	4.1	14.5
25	05090201 11 07	Little Indian Creek-Ohio River	5.3	7.8	13.1
26	05090201 11 02	Turtle Creek-Ohio River	4.5	7.1	11.6

**Table 5-11: Combined Percentage of Land that is Developed  
or Farmed with Row Crops in Hamilton County's Watershed Assessment Units**

<b>Rank</b>	<b>Hydrologic Unit Code</b>	<b>Watershed Assessment Unit Name</b>	<b>% Land Area that is Developed</b>	<b>% Land Area Farmed with Row Crops</b>	<b>Combined Percentage</b>
1	05080002 09 01	Pleasant Run	91.4	0.9	92.3
2	05090203 01 01	East Fork Mill Creek-Mill Creek	75.1	11.4	85.5
3	05090203 01 03	Sharon Creek-Mill Creek	84.5	0.6	85.1
4	05090202 14 04	Duck Creek	79.8	0.4	80.2
5	05090203 01 04	Congress Run-Mill Creek	79.4	0.1	79.5
6	05090203 02 01	Town of Newport-Ohio River	77.1	0.1	77.2
7	05090203 01 02	West Fork Mill Creek	74.5	0.1	74.6
8	05090203 02 02	Dry Creek-Ohio River	74.4	0.0	74.4
9	05090203 02 03	Muddy Creek	68.3	0.1	68.4
10	05090203 01 05	West Fork-Mill Creek	66.8	0.3	67.1
11	05090202 14 02	Polk Run-Little Miami River	65.4	1.2	66.6
12	05090202 14 01	Sycamore Creek	65.6	0.8	66.4
13	05080002 09 02	Banklick Creek-Great Miami River	56.1	6.7	62.8
14	05090202 14 06	Clough Creek-Little Miami River	54.5	2.1	56.6
15	05090202 09 03	Salt Run-Little Miami River	40.4	13.8	54.2
16	05080002 09 05	Taylor Creek	52.0	0.4	52.4
17	05080003 08 10	Jameson Creek-Whitewater River	24.7	21.7	46.4
18	05080002 09 07	Doublelick Run-Great Miami River	8.9	32.8	41.7
19	05090202 14 05	Dry Run-Little Miami River	35.1	5.5	40.6
20	05090203 02 04	Garrison Creek-Ohio River	35.1	4.6	39.7
21	05080002 09 03	Paddys Run	13.7	25.5	39.2
22	05090201 12 08	Ninemile Creek-Ohio River	37.2	1.5	38.7
23	05080003 08 08	Howard Creek-Dry Fork Whitewater River	5.8	28.1	33.9
24	05080002 09 04	Dry Run-Great Miami River	22.1	10.2	32.3
25	05080003 08 09	Lee Creek-Dry Fork Whitewater River	14.1	16.4	30.5
26	05080002 09 06	Jordan Creek-Great Miami River	20.5	7.7	28.2

**Table 5-12: Combined Percentage of Land that is Developed  
or Farmed with Row Crops in Warren County's Watershed Assessment Units**

<b>Rank</b>	<b>Hydrologic Unit Code</b>	<b>Watershed Assessment Unit Name</b>	<b>% Land Area that is Developed</b>	<b>% Land Area Farmed with Row Crops</b>	<b>Combined Percentage</b>
1	05090202 09 01	Muddy Creek	69.3	10.0	79.3
2	05080002 07 04	Dicks Creek	63.4	14.2	77.6
3	05090202 05 01	Sugar Creek	62.0	12.2	74.2
4	05090202 07 01	East Fork Todd Fork	5.4	67.4	72.8
5	05090202 04 05	Flat Fork	5.7	65.9	71.6
6	05090202 04 04	Middle Caesar Creek	4.9	65.7	70.6
7	05090202 14 02	Polk Run-Little Miami River	65.4	1.2	66.6
8	05090202 08 02	Little Muddy Creek	29.3	33.2	62.5
9	05090202 07 02	Second Creek	9.4	51.3	60.7
10	05090202 13 01	Headwaters Stonelick Creek	5.5	54.4	59.9
11	05080002 04 04	Dry Run-Great Miami River	40.1	18.1	58.2
12	05080002 07 03	Shaker Creek	30.5	27.3	57.8
13	05090202 06 06	Little Creek-Todd Fork	6.3	48.9	55.2
14	05090202 09 03	Salt Run-Little Miami River	40.4	13.8	54.2
15	05080002 04 03	Clear Creek	32.0	21.5	53.5
16	05090202 04 06	Lower Caesar Creek	6.5	45.9	52.4
17	05080002 07 02	Browns Run-Great Miami River	36.0	16.0	52.0
18	05090202 07 03	First Creek	6.8	41.7	48.5
19	05090202 05 04	Newman Run-Little Miami River	9.5	36.5	46.0
20	05090202 08 03	Turtle Creek	28.9	15.1	44.0
21	05080002 03 06	Town of Germantown-Twin Creek	12.8	30.3	43.1
22	05090202 07 04	Lick Run-Todd Fork	5.8	35.4	41.2
23	05090202 09 02	O'Bannon Creek	17.1	22.6	39.7
24	05090202 08 04	Halls Creek-Little Miami River	16.9	12.9	29.8
25	05090202 08 01	Ferris Run-Little Miami River	7.6	18.9	26.6

Although the *Ohio 2008 Integrated Water Quality Monitoring and Assessment Report* has been superseded by the 2010 edition, the 2008 edition still retains value. If a watershed area of interest is more congruent with the larger 11-digit hydrologic unit code (HUC11) boundaries, then the *Ohio 2008 Integrated Report* is worth checking.

Ohio EPA has prepared statewide water quality reports on a two-year schedule for decades. This provides a wealth of information on nonpoint source patterns and trends. Previously termed the *water resources inventory*, the biennial document is now called the *integrated report*. It also is known as the *305(b) report* in reference to that section of the Clean Water Act that requires such reports. Integrated reports dating back to 2000 and water resources inventories dating back to 1994 can be found at [http://www.epa.state.oh.us/dsw/document\\_index/305b.aspx](http://www.epa.state.oh.us/dsw/document_index/305b.aspx).

Through the years, Ohio EPA has developed scientific reports on a variety of rivers and streams in Butler, Clermont, Hamilton and Warren counties. Commonly known as biological and water quality studies, these technical support documents provide additional regional data on nonpoint source pollution:

- Biological and Water Quality Study of the Little Miami River and Selected Tributaries (published 2009)
- Biological and Water Quality Study of the Dry Fork Whitewater River (2006)
- Biological and Water Quality Study of Sevenmile Creek and Select Tributaries (2002)
- Biological and Water Quality Study of Fourmile Creek, Indian Creek, and Select Tributaries (2005)
- Biological and Water Quality Study of Twin Creek and Selected Tributaries (2007)

The Ohio EPA and Ohio Department of Natural Resources (ODNR) are developing geographic information system (GIS) datasets that are useful for analyzing the complexities of nonpoint source pollution.

An Ohio EPA website at <http://www.epa.ohio.gov/dsw/gis/index.aspx> features the following interactive maps relevant to nonpoint source assessment:

- Water Chemistry & Stream Sediment Data
- Biological & Assessment Data
- Fields Approved for Biosolids Application

Among the datasets that can be downloaded from <http://www.epa.ohio.gov/dsw/gis/index.aspx> is a shapefile on Primary Contact Recreation Class “A” Streams. This helps planners prioritize nonpoint source problems by identifying the waterways where humans are most likely to encounter NPS pollutants.

ODNR’s website at <http://www.dnr.state.oh.us/soilandwater/soils/soilsandwatersheds/tabid/9076/Default.aspx> is a gateway to useful maps from the ODNR’s Division of Soil and Water Resources. For nonpoint source assessments, the following maps are particularly promising for the respective reasons:

- Flood Frequency – shows where floodwaters are most likely to aggravate nonpoint source pollution by coming in contact with contaminants that are normally beyond the water’s reach
- Hydrologic Soil Groups – provides baseline data on the suitability of soils for septic tank-leach fields, landfills, liquid waste lagoons and other land uses that can become the origin of nonpoint source pollution
- Highly Erodible Land – shows where erosion is most likely to degrade streams with sedimentation and siltation, which are the common nonpoint source causes of impairment to watersheds in Southwest Ohio
- Slope – shows where developed land or row crops are likely to increase nonpoint source pollution.

Another center for GIS data is the ODNR’s Geographic Information Management System (GIMS), which is online at: <http://www.dnr.state.oh.us/tabid/10528/Default.aspx>. It features 10 categories of digital themes:

- administrative, describes features related to administrative, governmental or regulatory boundaries
- biologic, describes features related to plants, animals and other living entities
- cadastral, describes features related to the land fabric, such as parcel ownership
- demographic, describes information related to human population dynamics and activities
- geologic/soils, describes features related to surface and subsurface terrain features
- hydrologic, describes features related to surface water, ground water and precipitation
- land use/land cover, describe to what extent certain features cover the earth
- recreational, shows parks, boating areas, wildlife areas, nature preserves, etc.
- topographic, shows digital elevation models and contours
- transportation/infrastructure, describes features related to transportation routes and utility systems

The hydrologic digital theme is most relevant to nonpoint source investigations, offering maps of flood hazard zones and floodways where high flows can capture pollutants normally beyond the water’s reach.

A complete nonpoint source assessment requires many clues from different perspectives. These perspectives can be further informed by additional GIS datasets created by Ohio EPA and Ohio Department of Natural Resources. The *Ohio Nonpoint Source Pollution Management Plan – 2005-2010* provides the following GIS-based maps useful to nonpoint source assessment:

- Land Use and Land Cover 2000-2002 (Statewide Land Use Classification and Validation in Ohio)
- NPS Priority Ground Water Areas (based on presence of drinking water protection areas and aquifers)

- NPS Priority Drinking Water Protection Areas for Public Water Systems Using Surface Water
- Pesticide & Nitrate Impacts to Surface Water Sources of Drinking Water
- Maximum Nitrate Concentration Detected in Public Water Systems Using Ground Water
- Community PWS Using Ground Water with High Susceptibility to Contamination and Water Quality Impacts
- Drinking Water Source Protection Areas for Surface Water Systems
- Drinking Water Source Protection Areas for Groundwater Systems

The *Management Plan* is online at <http://wwwapp.epa.ohio.gov/dsw/nps/NPSMP/>.

More information on nonpoint source pollution can also be found in total maximum daily load (TMDL) reports and watershed management plans. The following passage from page C-10 of the *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report* explains the linkage among nonpoint source management, TMDL reports and watershed management plans:

“Ohio’s NPS Management Program relies heavily upon TMDL development and local watershed planning, during which the nature, extent and cause of water quality impairments caused by nonpoint source pollutants are identified. Program strategies are then designed to most effectively address identified NPS causes of impairment of Ohio’s surface waters. An important revision to Ohio’s Nonpoint Source Management Plan is the incorporation of identified local strategies from TMDL studies and state endorsed local watershed plans. Once such strategies are incorporated into Ohio’s NPS Plan, Ohio EPA and other state funding partners mobilize programs and resources designed to result in measurable improvements to water quality throughout Ohio.”

Useful information on nonpoint source pollution can be found in the following watershed management plans and TMDL reports for watersheds in Butler, Clermont, Hamilton and Warren counties:

#### Little Miami River Basin

- East Fork Headwaters Watershed Management Plan
- Lower East Fork Watershed Management Plan
- East Fork Lake Tributaries Watershed Management Plan
- Middle East Fork Watershed Action Plan (conditional endorsement by Ohio EPA)
- Todds Fork Watershed Management Plan (full endorsement by Ohio EPA)
- Stonelick Creek Watershed Management Plan

#### Great Miami River basin

- Twin Creek Watershed Action Plan

#### Mill Creek basin

- Upper Mill Creek Watershed Management Plan

#### Total Maximum Daily Load Reports

- TMDLs for the Upper Little Miami River
- TMDLs for the Mill Creek Basin
- Ohio River Bacteria TMDL

Ohio EPA and watershed groups are working on other watershed management plans or TMDL reports that can be informative about nonpoint source pollution. The next chapter, *Watershed Planning in Southwest Ohio*, summarizes the status of watershed management plans and TMDL reports for watersheds in Butler, Clermont, Hamilton and Warren counties.

Regional knowledge of nonpoint source pollution is a responsibility of the Ohio Kentucky Indiana Regional Council of Governments (OKI). As the federally designated water quality management planning agency, OKI works closely with the Ohio EPA on a variety of projects or documents that address nonpoint source pollution.

OKI's *Stream Database*, prepared in 2010, is a comprehensive spreadsheet on the watersheds of Butler, Clermont, Hamilton and Warren counties. It was designed for the needs of water quality management planning and contains data useful for nonpoint source assessment. Listed with each watershed is information on its location, identity, designated beneficial uses, water quality, wastewater treatment plants, and conservation efforts. The database draws upon the *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report* by the Ohio EPA, but also features regional and site specific-information compiled by OKI staff. OKI also prepared the *Stream Database Reference Guide* to facilitate public use of the *Stream Database*. Both the Stream Database and reference guide are available on OKI's website [www.oki.org](http://www.oki.org)

To gain an idea of nonpoint source issues over time, OKI compared its 1999 report entitled *Status of Wastewater Treatment Facilities and Facility Planning Areas in Butler, Clermont, Hamilton and Warren Counties, Ohio* with the Ohio EPA's *Ohio 2008 Integrated Water Quality Monitoring and Assessment Report*. The comparison indicates that changes in watershed classification systems impose obstacles to reliable trend analyses over extended time periods.

Since the publication of OKI's *Regional Water Quality Management Plan* in 1977, the watersheds in Butler, Clermont, Hamilton and Warren counties have been subjected to at least three classification schemes:

1. Drainage patterns, as identified by OKI's *Regional Water Quality Management Plan*, which divides watersheds into major drainage basins, and subdivides them into smaller drainage areas
2. Watershed basins, groups and segments, as identified by Ohio EPA's PEMS (Planning and Engineering Data Management Systems for Ohio) classification scheme
3. Hydrologic units, as identified by the U.S. Geological Survey's hydrologic unit code (HUC) classification system

Comparative trend analyses are further complicated by Ohio EPA's conversion from an 11- and 14-digit HUC classification system for its *Ohio 2008 Integrated Water Quality Monitoring and Assessment Report* to a 10- and 12-digit HUC classification system for its *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report*. The U.S. Geological Survey encouraged the use of 10- and 12-digit HUCs.

A comparison of OKI's 1999 report to the Ohio EPA's 2008 report can also indicate, on a case by case basis, the historical significance of nonpoint source pollution to the contemporary impairment of Southwest Ohio watersheds. This analysis was challenged by the changes in watershed classification systems.

Local expertise on nonpoint source pollution resides with the county soil and water conservation districts. OKI staff conferred closely with conservation district employees in Butler, Clermont, Hamilton and Warren to gain a better understanding of where and how nonpoint source pollution is degrading water quality in Southwest Ohio. As a departure point for local review, OKI staff shared the Watershed Assessment Unit Summaries in the *Ohio 2010 Integrated Water Quality Monitoring and Assessment Report* (Ohio EPA, Division of Surface Water).

As noted above, each Watershed Assessment Unit Summary addresses the sources (origins) and causes (agents) of impairment to the designated aquatic life use for that watershed. Sources and causes of impairment helped the local conservation districts to prioritize watersheds by nonpoint source issues. The conservation district staffs capitalized on their personal knowledge of the watersheds by adding to or subtracting from the lists of causes and sources indicative of nonpoint source pollution, based on what they have observed in the field. This is not scientific modeling, but it does serve as a basic tool for comparative analysis. The comparison indicates areas where nonpoint source pollution is more of a problem than point source pollution.

Results of the consultations with staffs of the conservation districts serving Butler, Clermont, Hamilton and Warren counties are shown in tabular summaries beginning on the next page. In many cases, the Soil and Water Conservation District staff suggested additional sources and causes of nonpoint source impairment which have been reflected in the tables.

Table 5-13 on the next page shows nonpoint source pollution indicators for the watersheds of Butler County. If a cause or source of impairment is shown in **boldface type**, it was added to the list by Butler Soil and Water Conservation District staff.

**Table 5-13: Nonpoint Source Impairments to Butler County Watersheds**

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05080002 09 02	Banklick Creek-Great Miami River	<b>sediments</b> <b>nutrients</b> <b>organics</b> direct habitat alterations flow alteration	<b>gravel mining</b> <b>urban channelization</b> <b>agricultural channelization</b> land development/suburbanization natural removal of riparian vegetation – dev. urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 06 04	Acton Lake Dam-Four Mile Creek	<b>flow alteration</b> barium copper iron natural conditions (flow or habitat) and other flow regime alterations	<b>channelization</b> municipal (urbanized high density area) natural sources urban runoff/storm sewers	Aquatic Life Recreation
05080002 07 02	Browns Run-Great Miami River	<b>sedimentation</b> flow alteration nutrients	<b>channelization</b> <b>nonpoint source pollution</b> contaminated sediments landfills natural non-irrigated crop production	Aquatic Life Human Health
05080002 07 01	Elk Creek	flow alteration nutrients	<b>sedimentation</b> <b>channelization</b> contaminated sediments landfills natural ( <b>deer feces</b> ) non-irrigated crop production	Aquatic Life Human Health
05090203 01 03	Sharon Creek-Mill Creek	<b>sedimentation</b> direct habitat alterations flow alteration nutrients oil and grease	channelization – development streambank modification/destabilization-dev. urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 07 03	Shaker Creek	flow alteration nutrients	<b>sedimentation</b> <b>channelization</b> contaminated sediments landfills natural non-irrigated crop production	Aquatic Life Human Health
05080002 07 04	Dicks Creek	flow alteration nutrients	<b>channelization</b> <b>habitat impairment</b> contaminated sediments landfills natural non-irrigated crop production	Aquatic Life Human Health
05090203 01 01	East Fork Mill Creek-Mill Creek	<b>sedimentation</b> direct habitat alterations flow alteration nutrients oil and grease	channelization – development streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 09 03	Paddys Run	direct habitat alterations flow alteration	<b>channelization – agriculture</b> land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05080002 07 05	Gregory Creek	flow alteration nutrients	<b>channelization- urban</b> contaminated sediments landfills natural non-irrigated crop production	Aquatic Life Human Health
05080002 07 06	Town of New Miami-Great Miami River	flow alteration nutrients	<b>channelization-agriculture</b> contaminated sediments landfills natural non-irrigated crop production	Aquatic Life Human Health
05090202 08 02	Little Muddy Creek	<b>nutrients</b> <b>pesticides</b> <b>flow alteration</b> sedimentation/siltation	<b>suburban development</b> <b>agricultural practices</b> channelization	Aquatic Life
05090202 09 01	Muddy Creek	<b>flow alteration</b> sedimentation/siltation natural conditions (flow or habitat) nutrient eutrophication biological	<b>channelization – urban</b> <b>channelization – agriculture</b> natural sources	Aquatic Life Recreation
05090202 14 02	Polk Run-Little Miami River	siltation direct habitat alterations flow alteration	dredging – development other urban runoff sewer line construction streambank modification/destabilization – dev.	Aquatic Life
05080002 09 01	Pleasant Run	direct habitat flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 08 03	Beals Run-Indian Creek	<b>flow alteration</b> <b>habitat impairment</b> natural conditions	<b>sedimentation</b> <b>channelization</b> natural sources	Aquatic Life (no TMDL needed) Recreation Human Health
05080002 06 05	Cotton Run-Four Mile Creek	<b>Sedimentation</b> <b>flow alteration</b> natural conditions (flow or habitat) phosphorus	<b>channelization</b> natural sources	Aquatic Life
05080002 04 04	Dry Run-Great Miami River	direct habitat alterations flow alteration	channelization – agriculture channelization – development removal of riparian vegetation – agriculture urban runoff/storm sewers (NPS)	Aquatic Life
05080002 06 02	Little Four Mile Creek	<b>ammonia</b> (from field fertilizing) direct habitat alterations sedimentation/siltation	channelization loss or riparian habitat unrestricted cattle access	Aquatic Life Recreation
05080003 08 08	Howard Creek-Dry Fork Whitewater River	natural conditions (flow or habitat)	<b>channelization – agriculture</b> <b>flow alteration</b> natural sources	Aquatic Life (no TMDL needed)

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05080002 08 02	Brandywine Creek-Indian Creek	<b>flow alteration</b> <b>sediment</b> <b>nutrients</b>	<b>channelization – agriculture</b>	(use attainments unknown)
05080003 08 09	Lee Creek-Dry Fork Whitewater River	<b>flow alteration</b> <b>sedimentation</b>	<b>channelization</b>	(Aquatic Life in attainment)
05080003 08 07	Headwaters (of) Dry Fork Whitewater River	<b>flow alteration</b> <b>sedimentation</b>	<b>channelization</b>	(Aquatic Life in attainment)
05080002 05 05	Ninemile Creek-Sevenmile Creek	<b>flow alteration</b>	<b>channelization – agriculture</b>	(Aquatic Life and Human Health in attainment)
05080002 05 04	Rush Run-Sevenmile Creek	<b>flow alteration</b>	<b>channelization – agriculture</b>	(Aquatic Life and Human Health in attainment)
05080002 03 06	Town of Germantown-Twin Creek	(No impairments in Butler County's part of the watershed.)	(No impairments in Butler County's part of the watershed.)	

The staff of the Clermont Soil and Water Conservation District collaborated with the staff of the Clermont County Office of Environmental Quality and the East Fork Watershed Collaborative to produce the information shown below in Table 5-14. If a cause or source of impairment is shown in **boldface type**, it was added by Clermont County personnel. They relied on their local knowledge to say that some of the causes or sources listed by Ohio EPA have ceased to exist.

**Table 5-14: Nonpoint Source Impairments to Clermont County Watersheds**

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090202 12 03	Lucy Run-East Fork Little Miami River	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>agriculture</b> <b>dam impoundment</b> <b>riparian removal – agriculture</b> <b>streambank</b> <b>modification/destabilization</b> channelization – development flow regulation/modification – development land development/suburbanization onsite wastewater systems (septic tanks) urban runoff/storm sewers (NPS)	Aquatic Life
05090202 12 04	Backbone Creek-East Fork Little Miami River	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>dam impoundment</b> <b>non-irrigated crop production</b> <b>streambank</b> <b>modification/destabilization</b> <b>mining</b> channelization –development flow regulation/modification – development land development/suburbanization onsite wastewater systems (septic tanks) urban runoff/storm sewers (NPS)	Aquatic Life

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090202 13 05	Salt Run-East Fork Little Miami River	<b>sedimentation/siltation</b> nutrients direct habitat alterations flow alteration organic enrichment/DO	<b>land development/suburbanization</b> <b>flow regulation/modification – dev.</b> <b>loss of riparian habitat</b> <b>onsite wastewater systems (septic tanks)</b> urban runoff/storm sewers (NPS) dredging – development sewer line construction streambank modification/destabilization – dev	Aquatic Life  Recreation
05090202 12 02	Cloverlick Creek	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>agriculture</b> <b>dam/impoundment</b> <b>streambank</b> <b>modification/destabilization – ag.</b> channelization – development flow regulation/modification – development land development/suburbanization onsite wastewater systems (septic tanks) urban runoff/storm sewers (NPS)	Aquatic Life
05090202 13 02	Brushy Fork	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>onsite wastewater systems (septic tanks)</b> <b>golf course</b> dredging – development non-irrigated crop production streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life
05090202 12 01	Poplar Creek	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>agriculture</b> channelization – development flow regulation/modification – development land development/suburbanization onsite wastewater systems (septic tanks) urban runoff/storm sewers (NPS)	Aquatic Life
05090202 13 04	Lick Fork-Stonelick Creek	<b>metals</b> flow alteration nutrients siltation organic enrichment/DO	<b>gun club - metals</b> <b>onsite wastewater systems (septic tanks)</b> <b>loss of riparian habitat</b> non-irrigated crop production streambank modification/destabilization – dev.	Aquatic Life
05090202 13 01	Headwaters Stonelick Creek	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>onsite wastewater systems (septic tanks)</b> dam construction – agriculture dredging – development non-irrigated crop production streambank modification/destabilization – dev.	Aquatic Life  Public Drinking Water Supply (pesticide found at upstream withdrawal site in Clinton County)
05090202 13 03	Moore's Fork-Stonelick Creek	direct habitat alterations flow alteration nutrients siltation organic enrichment/DO	<b>onsite wastewater systems (septic tanks)</b> <b>loss of riparian habitat</b> dredging – development non-irrigated crop production streambank modification/destabilization – dev.	Aquatic Life

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090202 14 03	Horner Run-Little Miami River	direct habitat alterations flow alteration siltation organic enrichment/DO	<b>urban runoff/storm sewers (NPS)</b> <b>onsite wastewater systems (septic tanks)</b> dredging – development other urban runoff sewer line construction streambank modification/destabilization – dev.	Aquatic Life
05090202 11 03	Todd Run-East Fork Little Miami River	<b>loss of riparian habitat</b> <b>flow alteration</b> nutrients siltation organic enrichment/DO	<b>loss of riparian habitat</b> non-irrigated crop production onsite wastewater systems (septic tanks)	Aquatic Life
05090201 12 04	Ferguson Run-Twelvemile Creek	<b>nutrients</b> <b>sedimentation</b> <b>flow alteration</b> <b>organic enrichment/DO</b>	<b>agricultural runoff</b> <b>onsite wastewater systems (septic tanks)</b> <b>loss of riparian habitat</b> <b>dam construction - agriculture</b>	Aquatic Life
05090202 09 02	O'Bannon Creek	<b>nutrients</b> <b>sediments</b> <b>organic enrichment/DO</b> natural conditions (flow or habitat)	<b>agricultural runoff</b> <b>urban runoff</b> <b>onsite wastewater systems (septic tanks)</b> <b>streambank modification/destabilization</b>	Aquatic Life (no TMDL needed)
05090202 14 05	Dry Run-Little Miami River	direct habitat alterations flow alteration siltation	dredging – development other urban runoff sewer line construction streambank modification/destabilization – dev.	Aquatic Life
05090201 12 08	Ninemile Creek-Ohio River	<b>nutrients</b> <b>sediments</b> <b>flow alteration</b> <b>organic enrichment/DO</b>	<b>urban runoff</b> <b>onsite wastewater systems (septic tanks)</b> <b>dam construction - development</b>	Aquatic Life
05090201 12 06	Tenmile Creek	<b>nutrients</b> <b>sediments</b> <b>flow alteration</b> <b>organic enrichment/DO</b>	<b>urban runoff</b> <b>onsite wastewater systems (septic tanks)</b> <b>dam construction - development</b>	Aquatic Life
05090201 12 03	Boat Run-Ohio River	<b>nutrients</b> <b>flow alteration</b> <b>organic enrichment/DO</b>	<b>urban runoff</b> <b>agricultural runoff</b> <b>onsite wastewater systems (septic tanks)</b> <b>dam construction – development</b>	Aquatic Life
05090201 11 07	Little Indian Creek-Ohio River	<b>nutrients</b> <b>flow alteration</b> <b>organic enrichment/DO</b>	<b>agricultural runoff</b> <b>onsite wastewater systems (septic tanks)</b> <b>dam construction – development</b> <b>channelization – development</b>	( use attainment unknown)
05090201 11 04	Bullskin Creek	<b>nutrients</b> <b>flow alteration</b> <b>organic enrichment/DO</b>	<b>non-irrigated crop production</b> <b>onsite wastewater systems (septic tanks)</b> <b>dam construction – development</b> <b>dredging – development</b>	( use attainment unknown)
05090202 11 02	Fivemile Creek-East Fork Little Miami River	<b>direct habitat alterations</b> nutrients siltation organic enrichment/DO	<b>loss of riparian habitat</b> non-irrigated crop production onsite wastewater systems (septic tanks)	Aquatic Life

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090202 11 01	Solomon Run-East Fork Little Miami River	<b>flow alteration</b> nutrients siltation organic enrichment/DO	non-irrigated crop production onsite wastewater systems (septic tanks)	Aquatic Life
05090201 11 06	Bear Creek-Ohio River	<b>nutrients</b> <b>flow alteration</b> organic enrichment/DO	<b>agricultural runoff</b> <b>dam construction – development</b> <b>onsite wastewater systems (septic tanks)</b>	( use attainment unknown)
05090201 12 01	Headwaters Big Indian Creek	<b>nutrients</b> <b>sediments</b> <b>organic enrichment/DO</b>	<b>agricultural runoff</b> <b>onsite wastewater systems (septic tanks)</b>	Aquatic Life
05090202 07 03	First Creek	<b>nutrients</b> <b>sediments</b>	<b>agricultural runoff</b> <b>onsite wastewater systems</b>	Aquatic Life
05090201 11 03	West Branch Bullskin Creek	<b>nutrients</b> <b>organic enrichment/DO</b>	<b>agriculture – row crop, livestock</b> <b>onsite wastewater systems</b>	( use attainment unknown)
05090201 11 02	Turtle Creek-Ohio River	<b>nutrients</b> <b>organic enrichment/DO</b>	<b>removal of riparian habitat –</b> <b>agriculture</b> <b>onsite wastewater systems</b>	( use attainment unknown)

Table 5-15 below shows the nonpoint source pollution indicators in the watersheds of Hamilton County. **Boldface** causes or sources of impairment were added by the Hamilton County Soil and Water Conservation District.

**Table 5-15: Nonpoint Source Impairments to Hamilton County Watersheds**

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090203 01 03	Sharon Creek-Mill Creek	direct habitat alterations flow alteration nutrients oil and grease organic enrichment/DO	channelization – development streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090203 01 04	Congress Run-Mill Creek	direct habitat alterations flow alteration oil and grease organic enrichment/DO	channelization – development streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 09 05	Taylor Creek	direct habitat alterations flow alteration	land development/suburbanization removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090203 01 02	West Fork Mill Creek	direct habitat alterations flow alteration nutrients oil and grease organic enrichment/DO	channelization – development streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090202 14 06	Clough Creek-Little Miami River	<b>direct habitat alterations</b> sedimentation/siltation	<b>channelization</b> <b>land development (along Clough Creek)</b>	Aquatic Life
05090203 01 05	West Fork-Mill Creek	direct habitat alterations flow alteration nutrients oil and grease organic enrichment/DO	channelization – development streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090203 01 01	East Fork Mill Creek-Mill Creek	direct habitat alterations flow alteration nutrients oil and grease organic enrichment/DO	channelization – development streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life Human Health

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090202 14 02	Polk Run-Little Miami River	direct habitat alterations flow alteration nutrients siltation	dredging - development other urban runoff sewer line construction streambank modification/destabilization – dev	Aquatic Life
05090202 14 05	Dry Run-Little Miami River	direct habitat alterations flow alteration organic enrichment/DO siltation	dredging - development other urban runoff sewer line construction streambank modification/destabilization – dev	Aquatic Life
05080002 09 01	Pleasant Run	direct habitat alterations flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090203 02 01	Town of Newport-Ohio River	direct habitat alterations flow alteration organic enrichment/DO	dredging - development natural streambank modification/destabilization – dev	Aquatic Life
05080002 09 02	Banklick Creek-Great Miami River	direct habitat alterations flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090203 02 04	Garrison Creek-Ohio River	direct habitat alterations flow alteration organic enrichment/DO	dredging - development natural streambank destabilization – development	Aquatic Life
05090203 02 02	Dry Creek-Ohio River	direct habitat alterations flow alteration organic enrichment/DO	dredging - development natural streambank destabilization – development	Aquatic Life
05080002 09 07	Doublelick Run-Great Miami River	direct habitat alterations flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 09 03	Paddys Run	direct habitat alterations flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 09 04	Dry Run-Great Miami River	direct habitat alterations flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05080002 09 06	Jordan Creek-Great Miami River	direct habitat alterations flow alteration	land development/suburbanization natural removal of riparian vegetation – development urban runoff/storm sewers (NPS)	Aquatic Life Human Health
05090202 14 04	Duck Creek	direct habitat alterations organic enrichment/DO sedimentation/siltation	Channelization urban runoff/storm sewers	Aquatic Life
05090202 14 01	Sycamore Creek	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	Aquatic Life
05090202 09 03	Salt Run-Little Miami River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	Human Health

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05080003 08 10	Jameson Creek-Whitewater River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	Human Health
05090201 12 08	Ninemile Creek-Ohio River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	Aquatic Life
05080003 08 08	Howard Creek-Dry Fork Whitewater River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	Aquatic Life (no TMDL needed)
05080003 08 09	Lee Creek-Dry Fork Whitewater River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	(use attainment unknown)

\*NOTE: Although the Clough Creek-Little Miami watershed has fewer sources and causes of impairment than watersheds that follow it on the table, Hamilton SWCD staff believes it has a higher degree of impairment.

Table 5-16 below summarizes the results of consultations with Warren County Soil and Water Conservation District staff, who added the causes or sources of impairment shown in **boldface**.

**Table 5-16: Nonpoint Source Impairments to Warren County Watersheds**

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05090202 13 01	Headwaters Stonelick Creek	direct habitat alterations flow alteration nutrients organic enrichment/DO siltation	dredging – development non-irrigated crop production sewer line construction streambank modification/destabilization – dev urban runoff/storm sewers (NPS)	Aquatic Life  Public Drinking Water Supply Public Drinking Water Supply (pesticide found at upstream site in Clinton County)
05080002 04 03	Clear Creek	<b>suspended solids</b> direct habitat alterations flow alteration organic enrichment/DO	<b>onsite wastewater systems (septic tanks)</b> <b>urban development</b> channelization – agriculture channelization – development removal of riparian vegetation – ag urban runoff/storm sewers (NPS)	Aquatic Life
05090202 14 02	Polk Run-Little Miami River	direct habitat alterations flow alteration organic enrichment/DO siltation	dredging – development other urban runoff sewer line construction streambank modification/destabilization – dev	Aquatic Life
05080002 04 04	Dry Run-Great Miami River	direct habitat alterations flow alteration organic enrichment/DO	channelization – agriculture channelization – development removal of riparian vegetation – agriculture urban runoff/storm sewers (NPS)	Aquatic Life
05080002 07 02	Browns Run-Great Miami River	flow alteration nutrients salinity/TDS/chlorides	contaminated sediments landfills natural non-irrigated crop production	Aquatic Life  Human Health
05090202 05 01	Sugar Creek	flow alteration nutrients organic enrichment/DO suspended solids	<b>non-irrigated crop production</b> natural	Aquatic Life (no TMDL needed)  Human Health

<i>Hydrologic Unit Code</i>	<i>Watershed Assessment Unit Name</i>	<i>Causes of Impairment</i>	<i>Sources of Impairment</i>	<i>Impaired Uses</i>
05080002 07 03	Shaker Creek	flow alteration nutrients	<b>residential and commercial development</b> contaminated sediments natural non-irrigated crop production	Aquatic Life  Human Health
05090202 04 05	Flat Fork	nutrients organic enrichment/DO siltation	land development/suburbanization non-irrigated crop production	Aquatic Life
05090202 04 04	Middle Caesar Creek	nutrients organic enrichment/DO siltation	land development/suburbanization non-irrigated crop production	Aquatic Life
05090202 04 06	Lower Caesar Creek	nutrients organic enrichment/DO siltation	land development/suburbanization non-irrigated crop production	Aquatic Life
05090202 07 02	Second Creek	nutrient/eutrophication bio indicators sedimentation/siltation	<b>onsite wastewater systems (septic tanks)</b> unpermitted discharge (domestic wastes) agriculture	Aquatic Life  Recreation  Public Drinking Water Supply
05080002 07 04	Dicks Creek	nutrients flow alteration	contaminated sediments natural non-irrigated crop production	Aquatic Life  Human Health
05090202 07 04	Lick Run-Todd Fork	<b>nutrients sediment</b>	<b>onsite wastewater systems (septic tanks)</b> <b>non-irrigated crop production</b> <b>urban stormwater runoff</b>	Recreation
05090202 08 03	Turtle Creek	<b>sedimentation</b> natural conditions (flow or habitat)	<b>channelization</b> <b>urban development</b> natural sources	Aquatic Life (no TMDL needed)
05090202 07 03	First Creek	<b>suspended solids</b> <b>nutrient enrichment</b>	<b>non-irrigated crop production</b> <b>onsite wastewater systems (septic tanks)</b>	Aquatic Life
05090202 09 01	Muddy Creek	natural conditions (flow or habitat) sedimentation/siltation	natural sources	Aquatic Life  Recreation
05090202 07 01	East Fork Todd Fork	natural conditions	natural sources	Aquatic Life (no TMDL needed) Recreation
05090202 09 03	Salt Run-Little Miami River	<b>sediment</b>	<b>urban development</b>	Human Health
05090202 08 02	Little Muddy Creek	sedimentation/siltation	channelization	Aquatic Life
05090202 05 04	Newman Run-Little Miami River	<b>sedimentation</b>	<b>non-irrigated crop production</b>	Human Health
05090202 09 02	O'Bannon Creek	natural conditions (flow or habitat)	natural sources	Aquatic Life (no TMDL needed)
05090202 08 01	Ferris Run-Little Miami River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	(use attainment unknown)
05090202 08 04	Halls Creek-Little Miami River	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	(use attainment unknown)
05090202 06 06	Little Creek-Todd Fork	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	(no impairments)
05080002 03 06	Town of Germantown-Twin Creek	(no NPS causes listed by O EPA)	(no NPS sources listed by OEPA)	(no impairments)

University research also provides information on nonpoint source pollution. A prime example is *Report on a Reexamination of the Mussels of the Little Miami River and Its Major Tributaries: Final Report* (Hoggarth & Goodman, Otterbein College, 2007). This study confirmed the findings of a 1992 study that one-third of the mussel species in the Little Miami watershed were in danger of being extirpated and one-third were represented by non-viable populations. Mussels are sensitive to habitat quality and sedimentation, making them good biological indicators of nonpoint source pollution.

## **Conclusions and Recommendations**

Nonpoint source pollution is hard to manage because it follows multiple flow paths, becomes difficult to track, occurs in many different areas, and manifests itself in many different ways. Unlike point source pollution, it can defy regulation by site-specific permits. Management of nonpoint source pollution requires voluntary actions with a variety of best management practices. Solutions lie in collaborative actions by the property owners, land managers, environmental organizations, watershed groups and government agencies confronting the issue. This generates a need to identify nonpoint source priority areas and nonpoint source priority issues.

Cumulatively, the nonpoint source priority areas cover much of Butler, Clermont, Hamilton and Warren counties. Specifically, a nonpoint priority area can be identified by the nonpoint source priority issue prevalent in the watershed. The watershed impairment maps and tables presented in this chapter illustrate where to find priority areas in connection with priority issues.

A useful classification of nonpoint source priority areas is offered by *Getting the Point about Nonpoint: Ohio Nonpoint Source Pollution Management Plan – 2005-2010*, which divides nonpoint sources into two categories: (1) polluted runoff, and (2) physical alterations. Polluted runoff is rain and snowmelt flowing across the land surface or within the groundwater that picks up contaminants and carries them to the stream or into the aquifer. Physical alterations are changes to the stream channel or its corridor, including straightening, deepening, widening or changes in flow patterns. Those seeking solutions are well advised to determine whether a nonpoint source problem results from polluted runoff, physical alterations or both.

Nonpoint source priority areas also can be classified by land use. Sources of impairment to the watersheds of Butler, Clermont, Hamilton and Warren counties fit into two broad land-use categories:

1. urban, which generally corresponds to each Watershed Assessment Unit Summary's land use statistic on developed land
2. agricultural, which generally corresponds to each Watershed Assessment Unit Summary's land use statistic for row crop land

Suburban (or mixed) could be considered a third land-use category, but does not correlate well with land-use statistics provided in the Watershed Assessment Unit Summaries.

Four nonpoint source **priority issues** are common for Butler, Clermont, Hamilton and Warren counties:

1. nutrient loading
2. sediment loading
3. habitat modification
4. organic enrichment (resulting in low dissolved oxygen)

These four issues are congruent with causes of impairment. Nutrient loading and organic enrichment indicate polluted runoff from land-use activities. Habitat modification, by definition, indicates physical

alterations to stream channel, floodplain or riparian corridor. Sediment loading can indicate polluted runoff or physical alterations.

Nonpoint source pollution is a challenge to the scope of state and federal regulatory programs. It compels voluntary actions and coordinated efforts by a broad range of stakeholders. Among the many agencies and organizations dealing with the management of nonpoint source pollution in Southwest Ohio, those that have been the most clearly involved are:

- U.S. EPA
- Ohio EPA
- Ohio Department of Natural Resources
- OKI Regional Council of Governments
- county soil and water conservation districts for Butler, Clermont, Hamilton and Warren counties
- watershed groups, which are addressed in the next chapter

The OKI Regional Conservation Council is a collaborative organization of conservation districts in the tri-state formed by OKI to take the lead in nonpoint pollution management as recommended in the original 1977 Regional Water Quality Management Plan. More recently, county and municipal stormwater districts have become vital to the management of nonpoint source pollution. Butler County, Hamilton County and Warren County each have a county stormwater district under the auspices of the county engineer's office. Clermont County has a stormwater department under the auspices of county government.

Butler County Storm Water District is developing an extensive monitoring project for these objectives:

- predicting the frequency and severity of floods
- establishing quantity and quality of water for aquatic life and recreation
- managing water use
- developing watershed policies, procedures, and action plans for land use and development

The monitoring network will consist of eight rain gages throughout Butler County and a pilot water quality site in the Four Mile Creek watershed. Ultimately, the Butler County Storm Water District intends to collect information countywide. OKI agrees with the District that its monitoring network will serve as the "backbone for facilitating good decision making toward comprehensive water resource management." If the monitoring leads to better nonpoint source pollution management in Butler County, OKI recommends that other storm water districts develop similar monitoring projects.

The management of nonpoint source pollution calls not only for managerial directives and best management practices, but also for assessments and education. This adds the following to the overall list of potential entities for nonpoint source pollution management:

- U.S. Geological Survey
- The Miami Conservancy District
- Natural Resources Conservation Service
- The Ohio State University Extension Service
- universities and colleges
- public school districts
- garden clubs and others promoting rain gardens and other stormwater management practices

To the extent that nonpoint source pollution problems can trigger regulatory vigilance, these entities may also deal with nonpoint source management matters:

- U.S. Army Corps of Engineers
- county sewer districts and municipal sewer departments
- county, township or municipal departments of development, planning and zoning
- county health departments

- solid waste districts
- county and local floodplain managers
- public water systems with drinking water source protection areas
- environmental advocacy groups that assume watchdog functions

Finally, property owners and property managers should be added to the list of stakeholders who can play a role in nonpoint source pollution management. These include the land trusts and conservancy districts that help prevent nonpoint source pollution by setting aside sensitive areas through property purchases, conservation easements, flooding easements, transfer of development rights, deed restrictions and other land title instruments.

The best management practices (BMPs) to manage nonpoint source pollution are as varied as the entities involved. OKI asked the soil and water conservation districts of Butler, Clermont, Hamilton and Warren counties to identify what they consider to be the most effective BMPs for managing nonpoint source pollution in Southwest Ohio. Their responses are listed below, with obvious duplications eliminated but slight variations or subcategories of other entries included:

- Sediment basins
- Extended detention and treatment with forebays
- Water quality basin that involves a detention basin retrofit and serves as a wetland
- Streambank stabilization with bio-engineering techniques
- Riparian buffers (also known as filter strips)
- Stream setbacks, both agricultural and urban
- Grassed waterways
- Bio-swales
- Bio-retention cell with a grease separator
- Bio-retention ponds converted from traditional stormwater detention basins
- Rain gardens
- Storm drain labeling
- Watershed signage
- Public education
- Phased clearing
- Infiltration basins
- Temporary and permanent stabilization of idle ground
- Development community training
- In-line water level control structures
- Any kind of cover vegetation to hold back soil particles and encourage the uptake of nutrients
- Conservation tillage in combination with cover crops and biomass management
- No-till
- Livestock exclusion fencing
- Animal waste storage facilities
- Wetlands (construction, enhancement or preservation)

Although the utilization of these BMPs needs to occur on a site-specific basis, the identification of nonpoint source priority areas contained within this chapter should serve as an aid to directing state and federal cost-sharing dollars for maximum impact.